REPORT ON THE REVIEW OF RE-ESTIMATION METHODOLOGY OF INDONESIA'S ANNUAL TUNA CATCH DATA IN IOTC FOR 2010-2021

Indonesia

Prepared for the Indian Ocean Tuna Commission (IOTC) 19th Session of Working Party on Data Collection and Statistics (WPDCS19)

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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. However, such method often creates a distinguishable discrepancy between national catch data presented in the country's national report and those presented in the IOTC datasets. Similar to what happened in Indonesia, in particular affecting the yellowfin tuna catch. The re-estimation process by IOTC Secretariat produced 40% less catch than what Indonesia's initially reported and currently under scrutiny.

Since the yellowfin tuna stock in IOTC was under pressure in the last five years, catch reduction was an inevitable solution for guiding it back into recovery. Nevertheless, if the new re-estimated data were to be used as the basis for catch reductions this would not reflect the real situation bearing in mind that the Indonesia waters is the largest ocean area and fishing capacity among IOTC members. Indonesia appreciates the effort taken by IOTC Secretariat to work with Indonesia on developing a new methodology based on the best data available from the robust logbook to produce data catch for the period of 2010-2021. Both parties agreed that the current re-estimation methodology was somewhat confusing and based on obsolete study, thus an updated version with more recent and robust datasets is imminent.

Seven-sessions assistance meeting (virtual and physical) with the IOTC staffs were held during 2021-2023 to follow up the WPDCS recommendation and the SC. This report provided an in-depth study on how to conduct recalculation on the Indonesian tuna 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 catches for the 2010–2021 periods.

1. Purpose of this paper

To provide the re-estimation methodology of Indonesia's annual tuna catch data for 2010-2021 and to present the re-estimation results.

2. Background and the impact of data discrepancies on Indonesian tuna and tuna-like fisheries

2.1. Background

Relevant information related to the background of the development of re-estimation methodology of Indonesia's annual tuna catch data for 2010-2021 quoted from the reports below:

The report of 20th Working Party on Tropical Tunas (WPTT20)

1. The WPTT **NOTED** the large increase in the Indonesian yellowfin tuna catch and queried whether this may be a result of error in data entry or reporting. Indonesia clarified that data verification was needed and an update on this would be included in their national report to SC21.
2. The WPTT **NOTED** that it may be beneficial to include a sensitivity run in the yellowfin tuna stock assessment that investigates the potential bias due to the uncertainties in the catch estimates, which would enable comparison of results with the standard approach that uses the reconstructed catch histories estimated by the IOTC Secretariat. The WPTT further **NOTED** that this approach was not undertaken during the 2018 yellowfin tuna assessment. The WPTT **NOTED** that such an approach may require additional calculations.

The report of 14th Working Party on Data Collection and Statistics (WPDCS14)

1. The WPDCS **NOTED** the changes to the IOTC Secretariat's methodology in terms of revisions to the estimation of average catches and the species composition of Indonesia's fresh longline catches, and the range of data sources used to validate the new estimates, including:
   a. The 2013 Fishing Capacity report, published by the IOTC Secretariat;
   b. Comparisons with the species composition of catches from port sampling conducted by the Research Institute of Tuna Fisheries in Benoa, one of the main landing sites for Indonesia's fresh longline fleets.
   c. Validation of longline observer trips reports submitted by Indonesia.
   d. Comparisons of average catches of vessels unloading in Benoa.
2. The WPDCS **ACKNOWLEDGED** the work of the IOTC Secretariat to develop and improve current estimates of catches of Indonesia's fresh longline fleet. **RECOGNIZING** the need for the Secretariat to report a single nominal catch series for each CPC prior to the IOTC Working Parties, the WPDCS **AGREED** that the catch series provided by the Secretariat is likely the best available information on Indonesian fresh longline catches at present and **REQUESTED** that the possibility of revisions for years prior to 2014 be explored in order to ensure consistency in the catch trends over the longer time period.

3. The WPDCS **ENDORSED** the current methodology developed by the Secretariat to produce the new catch series for scientific use and **REQUESTED** that this methodology be subject to frequent review so as to provide the best available information, given the ongoing uncertainties with the quality of Indonesia's official statistics.

The report of the 21st Session of the IOTC Scientific Committee (SC21)

1. The SC noted that a recent update to official figures for Indonesia nominal catches for 2017 has been received in November 2018 and is in the process of being assessed by the Secretariat. Also, the SC noted that time-area information are included by Indonesia in its national report, but that these same data is not yet submitted to the Secretariat in accordance with Resolution 15/02. Indonesia noted that it is making efforts to comply with Resolution 15/02 and that these data will be provided as soon as possible. The SC **NOTED** that the significant decline in catches reported at the Port of Benoa in 2017 could be explained by a reduction in effort due to an issue with allocating fishing permits to fishers. In response to a query around the large increase in swordfish catches since 2012, the SC noted that the Secretariat has revised its catch reconstruction for the Indonesian fresh longline fishery, and that the detected increase has been corrected resulting in higher confidence around the data in recent years (while ongoing uncertainties still remain with historical catches).
2. The SC noted that there are apparent discrepancies in the IOTC database (as this is disseminated through the IOTC website) and the catch levels in 2017 and previous years for tropical tuna species as reported during the WPTT20. The SC **ACKNOWLEDGED** that this difference was due to the need to provide two distinct nominal catch series to account for the ongoing re-estimation of Indonesian fresh-tuna longline catches, that the method to produce these revised best scientific estimates for the time series has been endorsed during the last WPDCS and that therefore these apparent discrepancies will soon disappear.
3. The SC noted the IOTC Secretariat has re-estimated the catches for Indonesia's fresh longline fleet and provided the WPB16 meeting with an alternative catch series (IOTC–2018–WPB16–DATA03b). The total catches mostly affect catches of swordfish, blue marlin, and striped marlin to a lesser extent, which have been revised downwards by as much as 30%. The SC further noted that these estimates have been reviewed by WPDCS14.

The report of 25th Session of the Indian Ocean Tuna Commission

Indonesia's concerns in the 25th Session of the Indian Ocean Tuna Commission and Associated Meetings are as follow:

- There were two proposals on the Interim Plan for Rebuilding Yellowfin Tuna in the IOTC Area of Competence submitted by the EU and Maldives, respectively. The Commission agreed that the Maldives proposal was used as a basis for discussion.
- The proposal used the IOTC data set which is a catch re-estimation carried out by the IOTC Secretariat.
- Regardless of the data source, the proposal proposed reducing YFT catches for developing coastal states that catch YFT >5,000 tons (in 2014) including Indonesia by 12%.

- The data re-estimation process carried out by the IOTC Secretariat on YFT catch data reported by Indonesia reduced the catch in 2014 by 45,122 tons to 25,275 tons. So that the catch limit obtained by Indonesia when using the IOTC data set will decrease by 44% from 39,707 tons to 22,242 tons.
- Indonesia in principle supports the yellowfin tuna re-building measure, as stated at S25. However, the use of catch re-estimation caused Indonesia to raise an objection.

The report of 1st Indonesian tuna fisheries data workshop

1. An ad-hoc technical workshop on the status of Indonesian tuna fisheries data at IOTC was held online on the 25th, 27th and 28th of May 2021, to provide update and ongoing work on data collection an d improvement and how they may use in revising the re-estimation of Indonesia's official catches (performed in agreement with the IOTC Scientific Committee) and the current rationale for continuing to estimate the species composition of Indonesia's total catches, in particular related to the use of re-estimated data by the IOTC will consequently reduce Indonesia's YFT catch limit significantly by more than 40% compared to Resolution 19/01. This workshop was attended by the IOTC Secretariat, the Ministry of Marine Affairs of Indonesia along with support of the International Pole and line Foundation (IPNLF)
2. Indonesia (IDN) **INDICATED** that they currently lack of understanding of the methodology used to re-estimate Indonesia's official catches by the IOTC Secretariat and that they would like to understand the current discrepancies observed between the reported information (through Forms 1-RC) and the published information (IOTC best scientific estimates) since this among other things may affect the catch limit of YFT for Indonesian fisheries (IOTC Res. 19/01), with potentially major negative consequences on Indonesian fishers and livelihoods.
3. IPNLF **STATED** that it is essential to understand the current methodology used for species and gear assignment to reconcile the catch data sources and address the gap between the position of IDN and the Secretariat with regards to catches of YFT, the extent to which the current estimation methodology was reviewed over time and when, and focus the discussions on the period 2018-2019.
4. The IOTC Secretariat **NOTED** that a key question of the workshop is in first place to understand why the IOTC Scientific Committee requested the Secretariat to re-estimate IDN catch data, **RECALLING** that the estimation procedure has been developed from the early 2000s and revised through time in collaboration with IDN, and that it also concerns fisheries from other CPCs.
5. The IOTC Secretariat **INDICATED** their interest in better understanding the data collection and validation systems in place for IDN tuna fisheries data, and provide IDN with more clarity on the origins and methods applied for the catch data re-estimation, with the objective of helping IDN clarify whether a revision of the estimation process should be discussed and presented at the next WPDCS and SC.
6. The IOTC Secretariat **RECALLED** that the methodology used for validating and re-estimating the IDN's official data has been periodically reviewed, and was last refined in 2018 (specifically, for the component relating to IDN fresh longline fisheries) as a consequence of the issues emerging from the re-estimated catch trends due to the uncertainty in the number of IDN's active fishing vessels, sampling coverage, and species composition in the catch.

7. FAO **INDICATED** that they also expected this meeting to clarify some of the inconsistencies and sharp fluctuations in IDN's official capture fisheries statistics submitted via FAO's NS-1 questionnaire, particularly since 2017 and the implementation of the One Data, and agree with IDN on the way forward to ensure transparency and a common understanding of the main data issues.
8. Conclusions and future activities
   - The Workshop **NOTED** the recent progress accomplished by IDN through the One Data program, with accurate information now acquired through Electronic Reporting Systems (ERS) and fishing positions validated with VMS, **ACKNOWLEDGING** that delays in data submission for the reference year 2020 are expected to occur due to the COVID-19 pandemic.
   - The Workshop **AGREED** on the need for the IOTC Secretariat to improve information and feedback provided to the CPCs, especially when some re-estimation of the data is performed.
   - The Workshop **AGREED** that new technical workshops specifically dealing with IDN tuna fisheries catch data should be conveyed to review and assess the available information and update the methodology used for generating the best scientific estimates to be used for stock assessment and management purposes.

The report of 2nd Indonesian tuna fisheries data workshop

1. The 2nd Indonesian tuna fisheries data workshop was held online on the 20th and 21st September 2021 as a follow up one of the recommendations of the first workshop. It discussed the re-estimation methodology of Indonesia's annual tuna catch for 2017-2019 proposed by Indonesia.
2. The IOTC Secretariat **INDICATED** their acknowledgement on the proposed re-estimation methodology of Indonesia's annual tuna catch for 2017-2019 with some corrections and **SUGGESTED** Indonesia to present the paper of re-estimation methodology in the 17th working party on data collection and statistics (WPDCS).
3. The chair of Scientific Committee **SUGGESTED** to Indonesia to add some additional information regarding the data sources that is used in the proposed re-estimation methodology, such as coverage level of logbook.

The report of the 17th Session of Working Party on Data Collection and Statistics (WPDCS17)

1. The 17th Session of Working Party on Data Collection and Statistics (WPDCS17) was held virtually from 29th November to 3rd December 2021.
2. Therefore **NOTING** the unusual variabilities in some of Indonesia's official catch statistics prior to the implementation of One Data in 2017, particularly in the case of neritic and tropical tuna species, the WPDCS **REQUESTED** that Indonesia undertake work – in collaboration with the IOTC Secretariat – to reassess their official catches (for the period 2010-2016) to ensure consistency and coherence in the longer-term catch series available for management and stock assessment purposes and **RECOMMENDED** that the Scientific Committee endorse this process.
3. The WPDCS therefore **RECOMMENDED** that work is undertaken to test an alternative, more flexible, matrix-based approach developed by FAO, to help refine the

characterization of fisheries in IOTC at the national and regional level, and **NOTED** that a number of CPCs (including Indonesia, Kenya, Maldives, Pakistan and Sri Lanka) expressed their interest in participating in these studies.

The report of 3rd Indonesian tuna fisheries data workshop

1. The 3rd Workshop of Indonesian Tuna Fisheries Catch Data was held from Monday to Wednesday, July 11 - 13, 2022 at Directorate General of Capture Fisheries - Jakarta and on Thursdays to Saturday, July 14-16, 2022 in the Meeting Room of the Tuna Fisheries Research Center - Bali. The meeting was a follow-up to the recommendations of the 17th Working Party Data Collection and Statistics (WPDCS17) meeting, namely Indonesia undertook work – in collaboration with the IOTC Secretariat – to reassess their official catches (for the period 2010-2016) to ensure consistency and coherence in the longer-term catch series available for management and stock assessment purposes.
2. Recommendations from the workshop as follow:

   FAO and IOTC Secretariat

   1) That the reasons for high fluctuations in Indonesia's official catches for selected species/gears highlighted by FAO and IOTC in years *post* OneData, including for tuna and tuna-like species as well as non-tuna species, are further analysed and discussed intersessionally.
   2) Similarly, that major changes in Indonesia's official data (1-RC- and NS-1) pre- and post-One Data are further analysed in order to better understand the reason for the abrupt changes in the species and gear composition reported to FAO and IOTC.
   3) That FAO and IOTC continue to estimate or adjust the official catches (2010-2021+) of Indonesia for selected gears and species (IOTC) and /or species/ISSCAP groups (FAO), in order to moderate the impact of unexplained fluctuations in the catches - particularly since 2017 - subject to the findings of the additional verification and clarification requested of Indonesian scientists by FAO and IOTC.
   4) Given the uncertainty of catches in 2017, due to the transition of One Data, FAO, the IOTC Secretariat and Indonesia agree that official catches for 2017 should not be used and instead estimated until further notice.

   IOTC Secretariat

   5) That Indonesia categorises all relevant fishery information according to the criteria that define the limits of applicability of most IOTC resolutions, i.e., vessels LoA and area of operation.
   6) That Indonesia re-assigns all information currently collected / reported for the LLTU fishery code to either LLFR (fresh tuna longliners) or LL (deep-freezing longliners), considering that LLCO is a fishery code that shall be used only for vessels of LoA <24m exclusively fishing in the EEZ;
   7) That in the ad-interim period, 85 GT and 78 GT be considered as the equivalent (from a tonnage point of view) of 24m LoA for longline and purse seine vessels, respectively;
   8) That Indonesia re-assigns all information currently collected and reported for the PS and PSSS fishery in agreement to points 5) and 7).

   Re-estimation of tuna and tuna-like species

   9) Considering the importance of logbook data have in the proposed re-estimation procedure of IDN catches for 2010-2021+:

a. That further clarification is made on the levels of logbook coverage data for vessels of less than 5 GT by gear type (e.g., number of trips/vessels covered by logbooks; total number of fishing trips or vessels);
b. That the coverage (or the absolute number of data points available) is expressed not only in relative, but also in absolute form (e.g., number of vessels, or trips covered by logbooks);
c. That coverage is also calculated as the fraction of trips for which logbook data are available;
d. That the logbook data for 2019-2020-2021 used by the new re-estimation procedure better reflect the nature of the fisheries considered (in particular, the high proportion of vessels of <5 GT that is currently missing);
e. That in the intersessional period the IOTC Secretariat continues to provide advice and technical assistance to Indonesian scientists as necessary regarding the development and appraisal of options/scenarios of the new re-estimation procedure and how these are presented to the WPDCS;
f. That any re-estimation produced by Indonesia for catches by species and gears in the period 2010-2021+ is documented and also assessed in the context of all Indian Ocean fisheries, to better understand the changes introduced to the global time series of sensitive species;

10) That a follow-up IOTC Data Compliance and Support mission is organised in advance of the 2022 WPDCS meeting (29 Nov - 3 Dec) to continue discussions on the re-estimation methodology and address any other related issues that remain outstanding.

Indonesia

11) That before submitting data to FAO and IOTC according to the respective deadlines, workshops are organized with both institutions to improve the level of reporting and resolve any outstanding issues that might be encountered; [Timeline: before next reporting cycle (2023)].
12) That capacity delivery activities continue being implemented in Indonesia, on topics of relevance to this forum and with support from FAO, IOTC, and any other concerned stakeholder (OFCF and similar agencies) [Timeline: N/A].

The report of IOTC Data Compliance and Support Mission

1. The IOTC Data Compliance and Support Mission was held on the 1-3 November 2022 as a follow up one of the recommendations of the 3rd Indonesian tuna fisheries data workshop. It discussed the re-estimation methodology and address any other related issues that remain outstanding.
2. The recommendations:
   a. Recommendations 1: The manuscript would benefit for more detailed information on the logbook and landing coverage, i.e., the sampling design including year, month, area, gear, vessel size, and landing sites, as well as proportion of vessel-days covered through the logbooks.
   b. Recommendations 2: The current classification of Indonesian fisheries is solely based on vessel size and restricted to longline and purse seine vessels and should be revised to comply with IOTC standard gear classification and better represent the species composition of the catches which is expected to differ between coastal and offshore

components. Information is available from logbooks for the period 2019- 2021 and assumptions have to be made for the period 2010-2018.

c. Recommendations 3: Review scenario 3 with species-specific values of contribution of each gear from IOTC approach for comparison with the revised methodology proposed by Indonesia.
d. Recommendations 4: (i) Correct the number of active industrial longliners used for estimating the total catch of the industrial longline component, by removing the small vessels, accounting for the proportion of small longliners that may operate in ABNJ, and splitting the large vessels between fresh and deep-freezing longliners as derived from logbooks for the period 2019-2021. (ii) Explore an alternative method to derive the mean annual productivity of industrial longliners and purse seiners based on daily catch rates derived from landing and/or logbooks and assumptions about the numbers of days of activity in the year if available. (iii) Apply the method used for artisanal fisheries to the industrial fisheries (i.e., allocation of total catches by industrial gear and use of species composition for each gear based on logbooks and/or landing data) as an alternative scenario.
e. Recommendations 5: (i) Estimate logbook and landing coverage by fishing gear to assess the level of representativeness of the samples, (ii) Describe species composition of the catch in the logbooks, including variability between years (similar to Figure 11 used for landing data) and months to assess seasonal effects, and (iii) Compare species composition between logbook and landing data based on a set of common fishing trips and (iv) Assess the interest of landing data for deriving the species composition of the catch.

The report of the 18th Session of Working Party on Data Collection and Statistics (WPDCS18)

1. The 18th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Data Collection and Statistics (WPDCS18) was held virtually (through the Zoom collaborative platform) from the 28th of November to the 2nd of December 2022.
2. ***Overview of data processing procedures and proposed revisions of historical data.*** Rec. WPDCS18.05 (para 103): The WPDCS **REQUESTED** that Indonesia continue – in collaboration with the IOTC Secretariat – to reassess their official catches and **RECOMMENDED** that the Scientific Committee ENDORSE this activity.

The IOTC Technical Support Mission

1. The IOTC Technical Support Mission was held physically in Jakarta on 27 February – 3 March 2023 as a follow up the recommendation of the 18th Session of Working Party on Data Collection and Statistics (WPDCS18).
2. <u>Classification of fishing vessels</u>: 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.
3. That details of the re-estimation process for industrial fisheries (longline, purse seine, handline, and any other relevant fishery identified from the logbook data) are formalized in a separate document (**for internal use**, and **NOT yet to be shared outside the context of this IDN - IOTC collaboration**) which shall clearly detail:
    a. The overall rationale for the process;

   b. The assumptions made;
   c. All input data sources involved in the process;
   d. The produced output data;
   e. The R scripts and accompanying data frames (or the Excel spreadsheets) that implement the process, to allow for better reproducibility of its results.

4. Training sessions: Support training sessions in species identification in Indonesia in 2023-2024, with a focus on juveniles of tropical tunas, neritic tunas, seerfish, billfish, and pelagic sharks. The training could be developed in collaboration with SEAFDEC.
5. Considering that the information required to proceed with the re-estimation is partially held by **Pusdatin** (licensing, total annual catch estimates, etc.) and partially by **DGCF** (logbook data, landing data, etc.) the group recommends that:
   - Communication between the two groups (Pusdatin / DGCF) is further strengthened so that access to each source of information is streamlined and simplified.
   - Representatives from both groups actively participate to the re-estimation exercise.
6. That **additional work** is still required to identify a proper strategy for the re-estimation of IDN catches from **industrial longliners** (including their categorization as FLL / LL).
7. That **additional work** is still required to identify a proper strategy for the re-estimation of IDN catches from **all artisanal fisheries**, and particularly those operating with vessels < 5 GT for which no information is available through logbooks, although partial information can be extracted from landing data (PIPP).

The 4th Indonesian tuna fisheries data workshop

1. The 4th Indonesian tuna fisheries data workshop was held online on the 19 - 21 July 2023. It discussed the updated of re-estimation methodology of Indonesia's annual tuna catch for 2010--2021 proposed by Indonesia.
2. Recommendations from IOTC Secretariat :
   a. To separate the catch in the 1RC between vessel above 5 GT and vessel up to 5 GT for each fishery;
   b. The reestimation only apply for those species that in 2010-2021 1RC appeared with a significant amount of catches overall (above 100t in total), besides the sixteenth IOTC mandatory species and shark species.

The 5th Indonesian tuna fisheries data workshop

1. The 5th Indonesian tuna fisheries data workshop was held online on the 11 - 13 October 2023. It discussed the updated of re-estimation methodology of Indonesia's annual tuna catch for 2010--2021 from the previous workshop.
2. Recommendations from IOTC Secretariat :
   a. Check the estimates of proportions of catches estimated for vessels below and above 5 GT against the proportions of numbers of vessels by class category reported through forms 1RC
   b. Estimate logbook coverage for each fishing gear, year, and species before and after the filtering process to assess their representativeness for deriving the species composition of the catch

c. To compare the species reported in the logbooks with information available from landing and observer data when available
d. To provide more information on port samples made by enumerators in fishing ports (e.g., numbers of samples, frequency, protocol)
e. To describe which data will be used to estimate the species composition of the catch for coastal vessels <5GT for which logbooks are not available.

2.2. The impact of data discrepancies on Indonesian tuna and tuna-like fisheries

The yellowfin tuna stock in IOTC was under pressure in the last five years, catch reduction was an inevitable solution for guiding it back into recovery. Nevertheless, if the re-estimated data by the IOTC was to be used as the basis for catch reductions this would not reflect the real situation bearing in mind that the Indonesia waters is the largest ocean area, number of fishers, and fishing capacity among IOTC members, as reflected by Table 1.

Table 1. The number of fishers for each fleet category from 2019-2021 in the IOTC area of competence.

FLEET	NUMBER OF FISHERS		
	2019	2020	2021
TOTAL	**682326**	**652276**	**611649**
ARTISANAL (< 30 GT)	**644542**	**622136**	**576032**
Pole and Line (PL)	7202	3863	1340
Gill Net (GI)	228273	279652	225772
Purse Seine (PSSS)	37385	22169	27571
Hand line (HL)	82190	89015	111986
Longline (LLCO)	8736	7067	6375
Troll Line (TL)	20793	16064	20862
Danish Seine (DS)	32694	19967	25227
Lift Net (LN)	51531	23873	23348
Others (OTH)	175738	160466	133551
INDUSTRIAL (> 30 GT)	**37784**	**30140**	**35617**
Pole and Line (PL)			
Gill Net (GI)	78	2024	525
Purse Seine (PS)	35403	15851	19322
Hand line (HL)	27	220	254
Longline (LLTU)	400	1940	4434
Troll Line (TL)	1	1	1
Lift Net (LN)	1839	504	1653
Others (OTH)	36	9600	9428

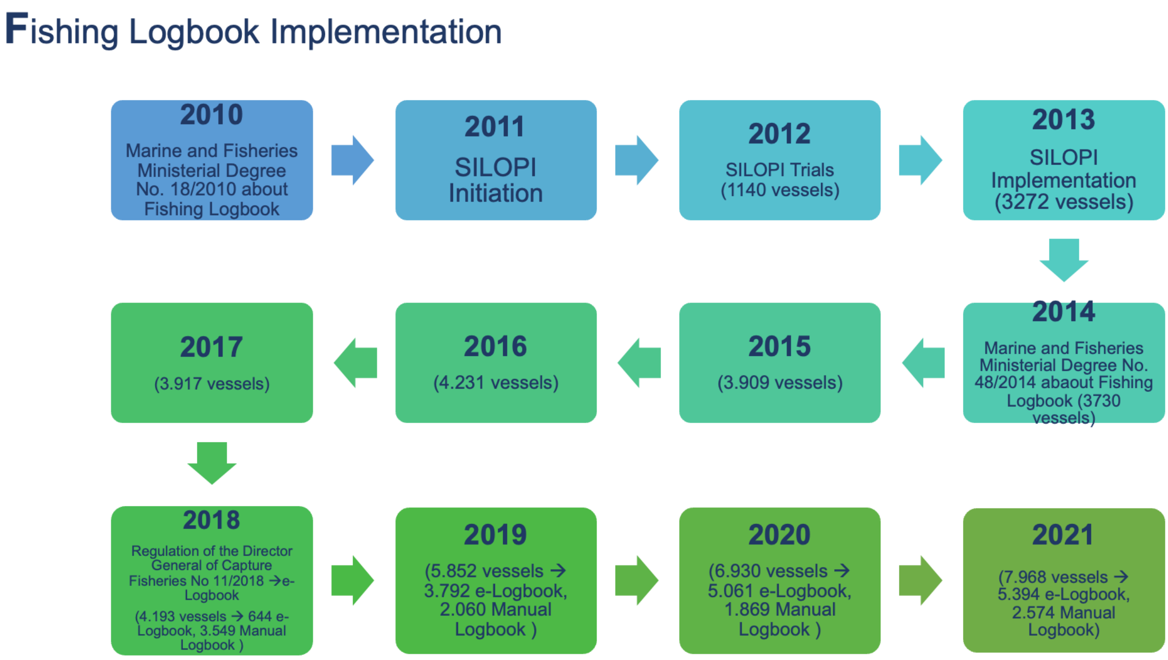
3. New re-estimation methodology

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 logbook and port landing data that provides more appropriate information of catch composition among the data sources. The catch composition of logbook 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), PS (Tuna purse seine), PSSS (Small purse seines), GI (Gillnet), HL (Handline) and HLOF (Offshore handline), while the catch composition of port landing is used to re-estimate the catch composition for DS (Danish seine), LN (Liftnet), PL (Pole and line) and TL (Trolling).

3.1.1. Fishing logbook

Fishing logbook provides information of fishing coordinate to identify the portion of catch for each fishing area. The logbook information used for this study available from 2012-2021. Logbook reporting was mandatory since the issuance of Marine Affairs and Fisheries Ministerial Regulation No.18/2010. In order to elevate the efficiency and optimization of data reporting, a logbook information system (SILOPI) was initiated in 2011. The number of vessels reporting logbook in national scale are increasing, from only 1,140 in 2012 to relatively stable number since 2019 between 5,852 vessels to almost 8,000 vessels in 2021 (Figure 1). The same trend also occurred in the IOTC area of competence, where the reporting rose from less than 500 into almost sixfold in 2021 (Figure 2). Thus, we consider logbook data was one of the best tools available as the base for recalculating the catch composition, because it contained a large documentation of high-resolution fisheries data across gears and species. The data itself was well-maintained by the Directorate General of Capture Fisheries (DGCF), in particular since 2018, when e-logbook program was initiated.



SILOPI: Fishing Logbook Information System (App)

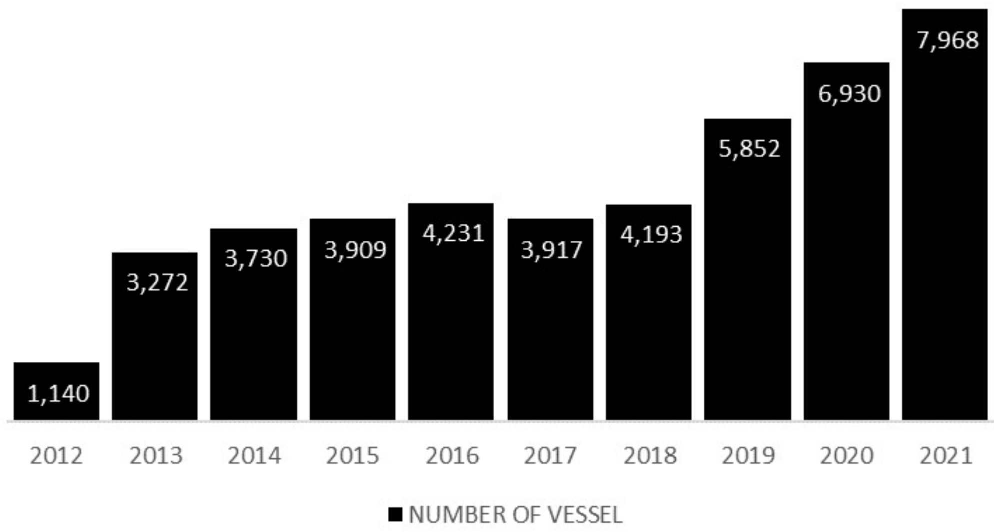


Figure 1. The development of mandatory logbook reporting at national level

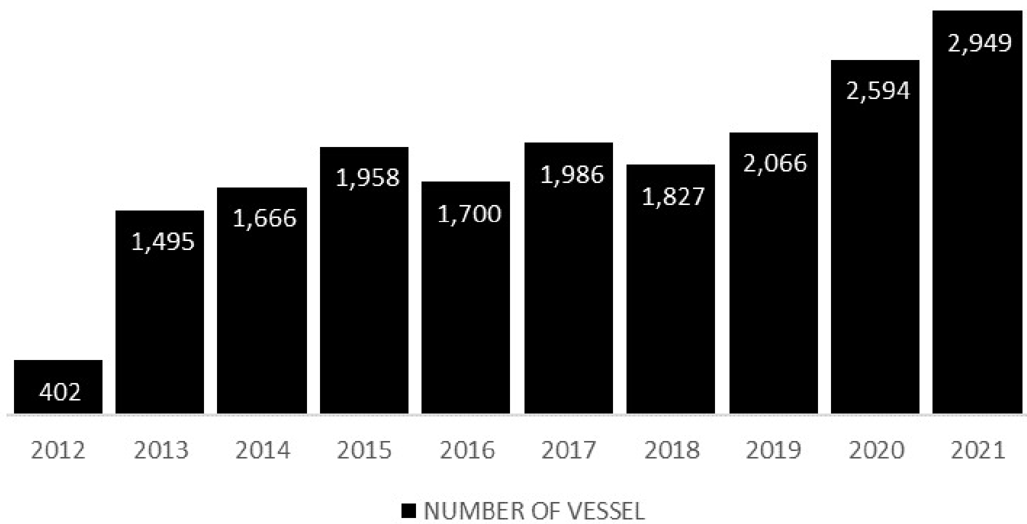
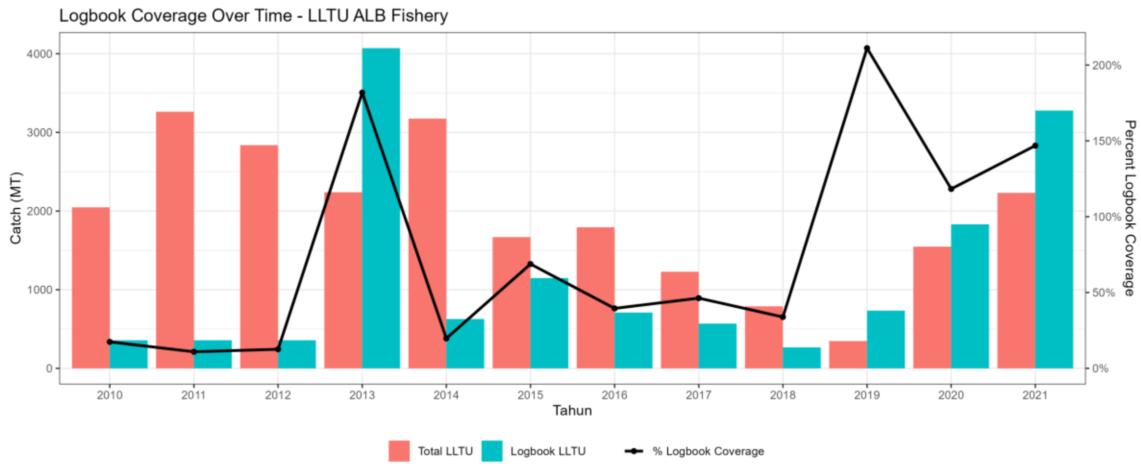
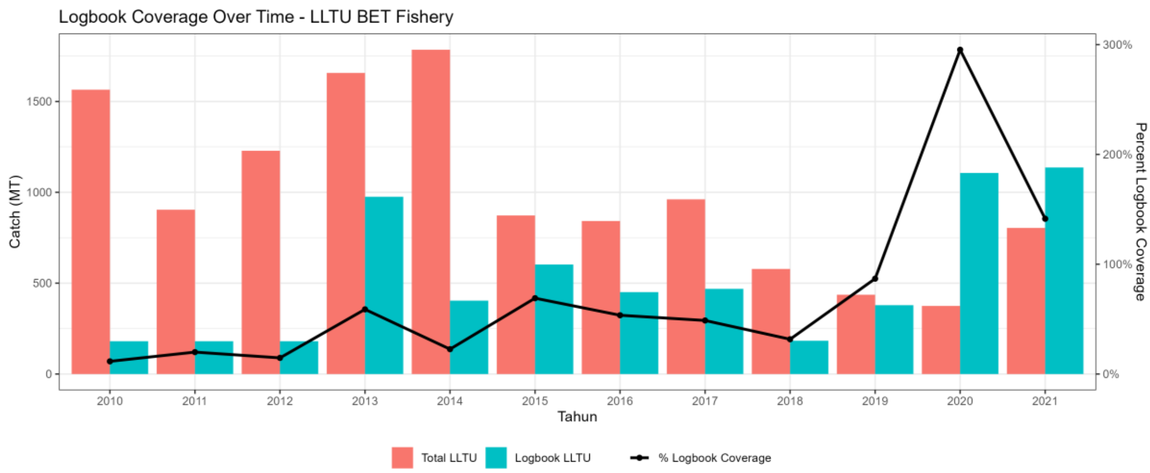


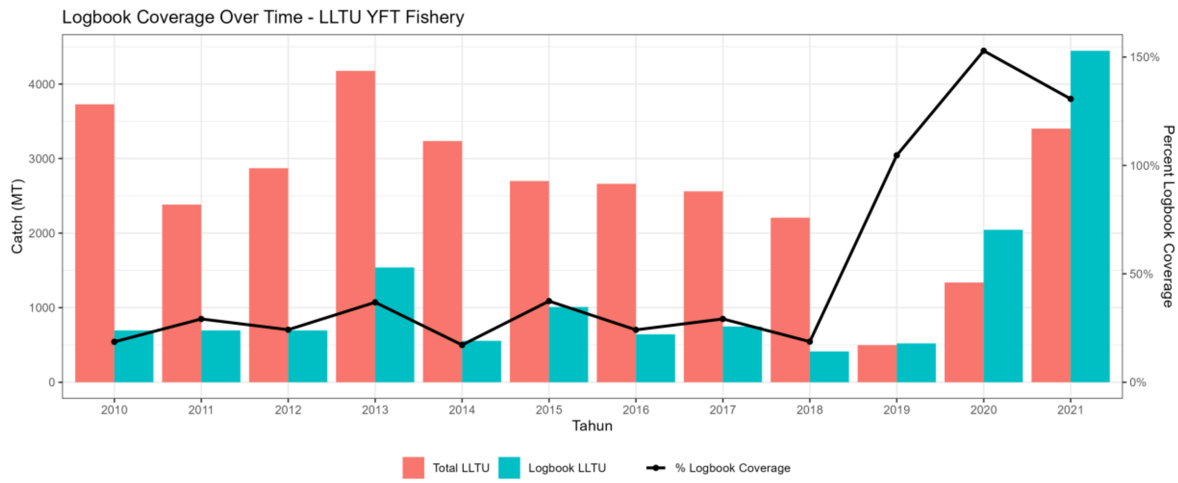
Figure 2. The development of mandatory logbook reporting within IOTC area of competence

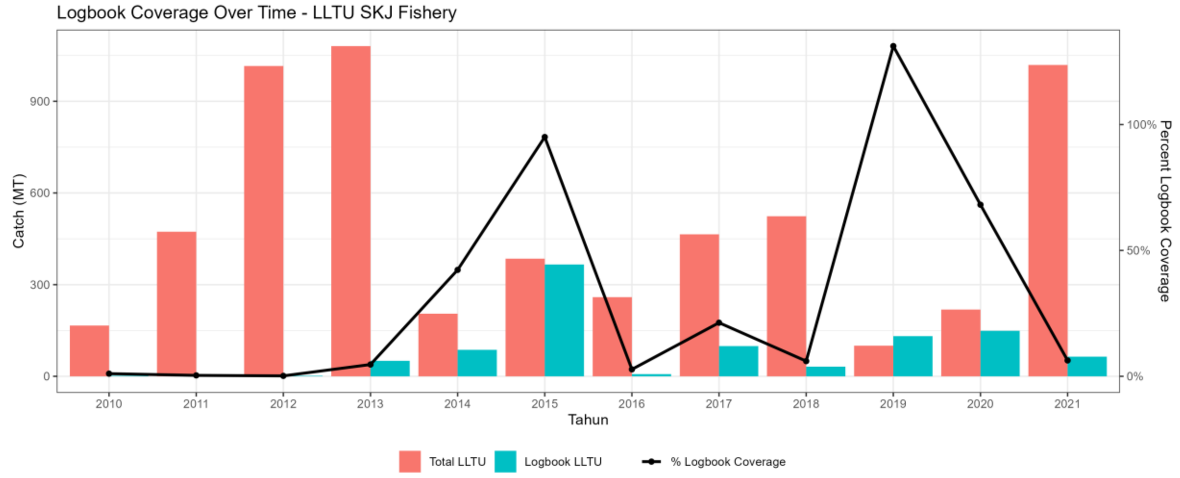
The Coverage of Logbook

LLTU (Tuna longline)

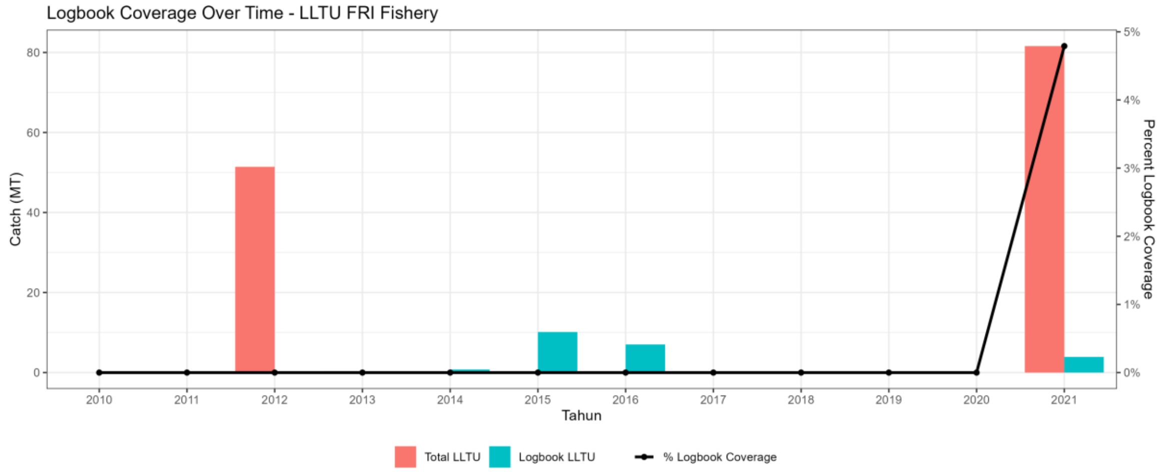




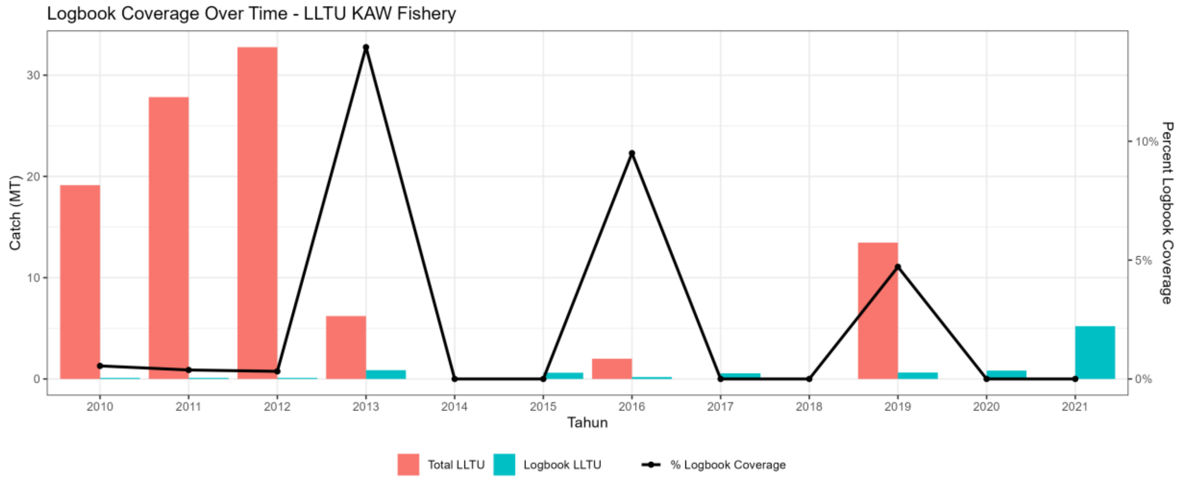




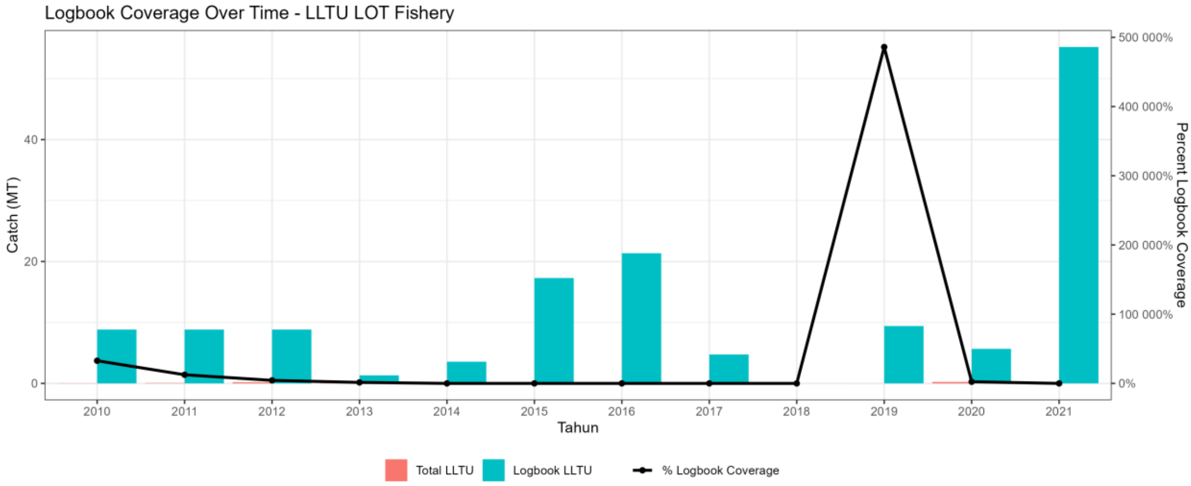
Logbook Coverage Over Time - LLTU SKJ Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage



Logbook Coverage Over Time - LLTU FRI Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage



Logbook Coverage Over Time - LLTU KAW Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage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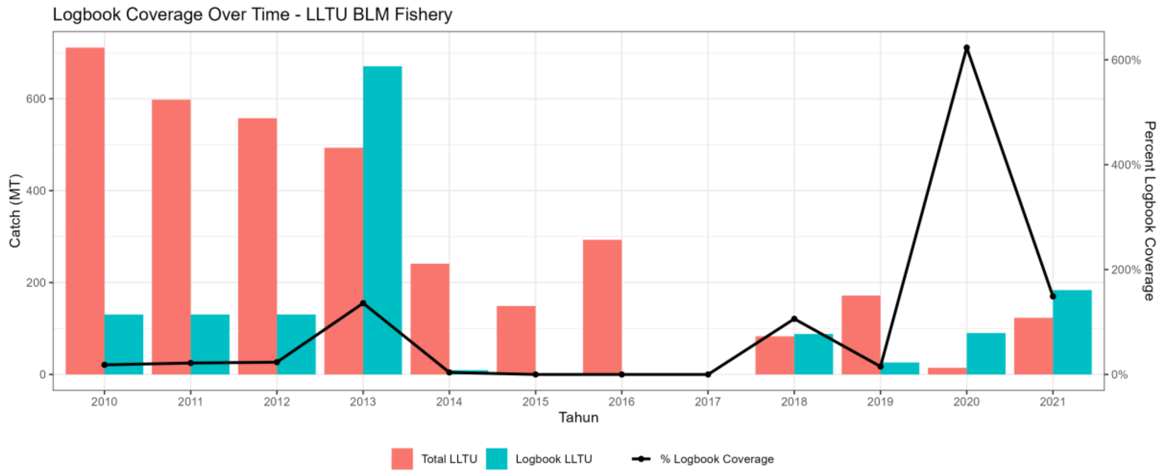
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage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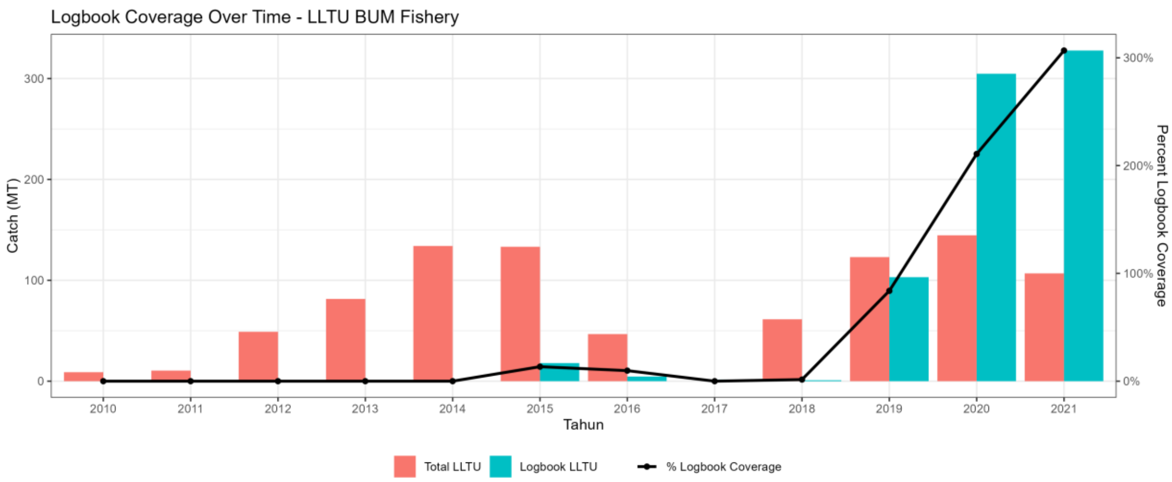
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage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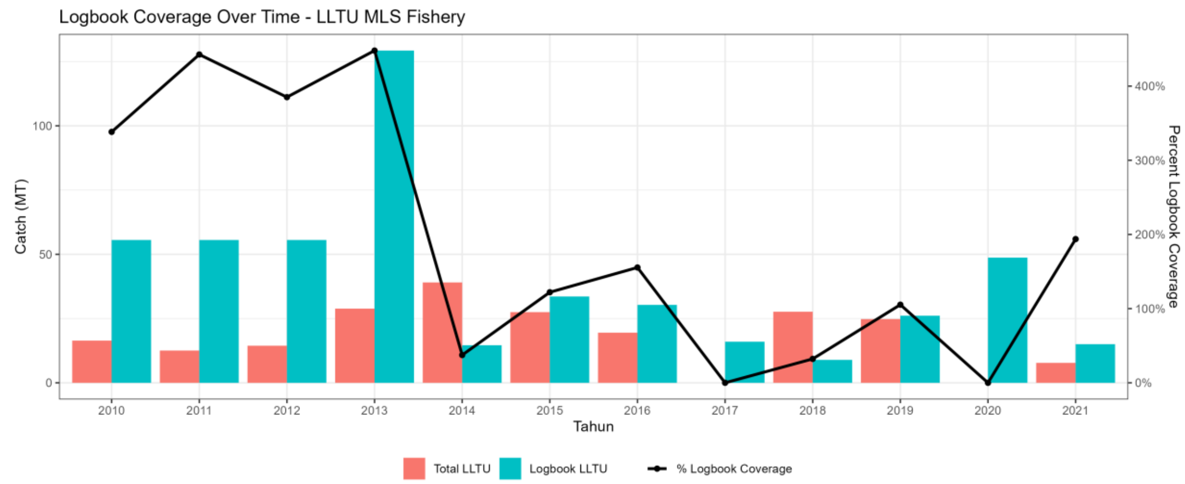
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage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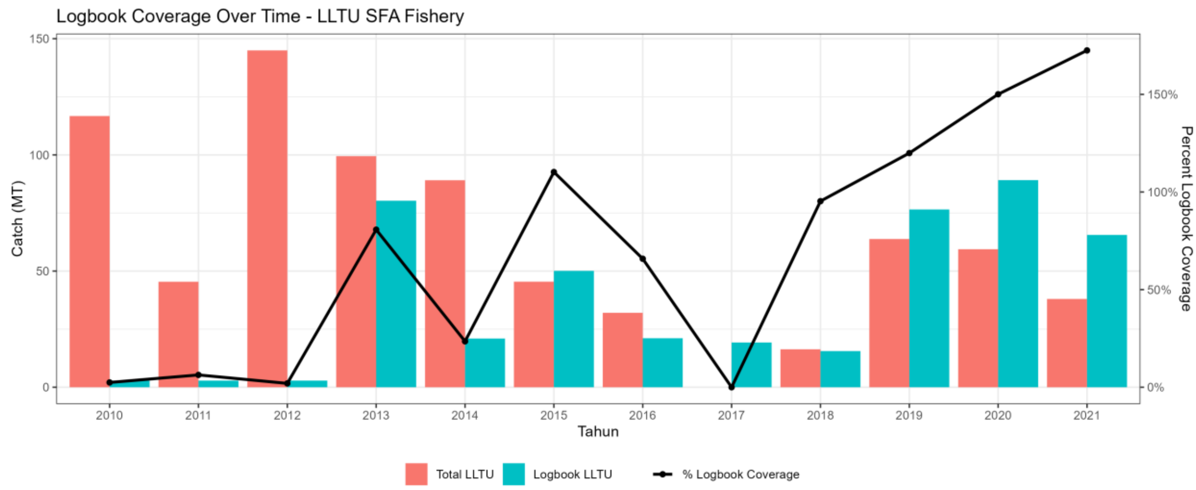
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage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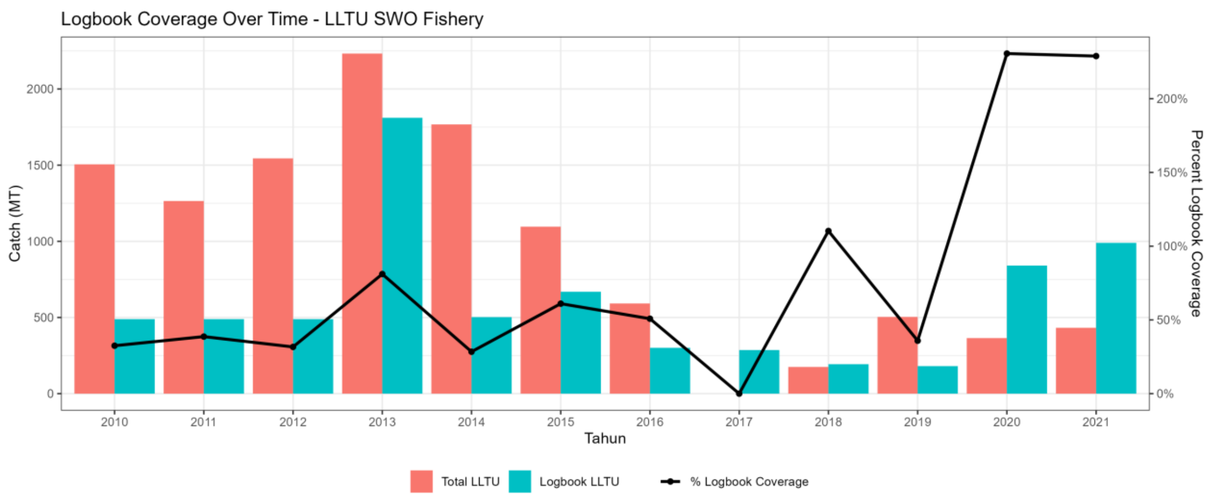
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage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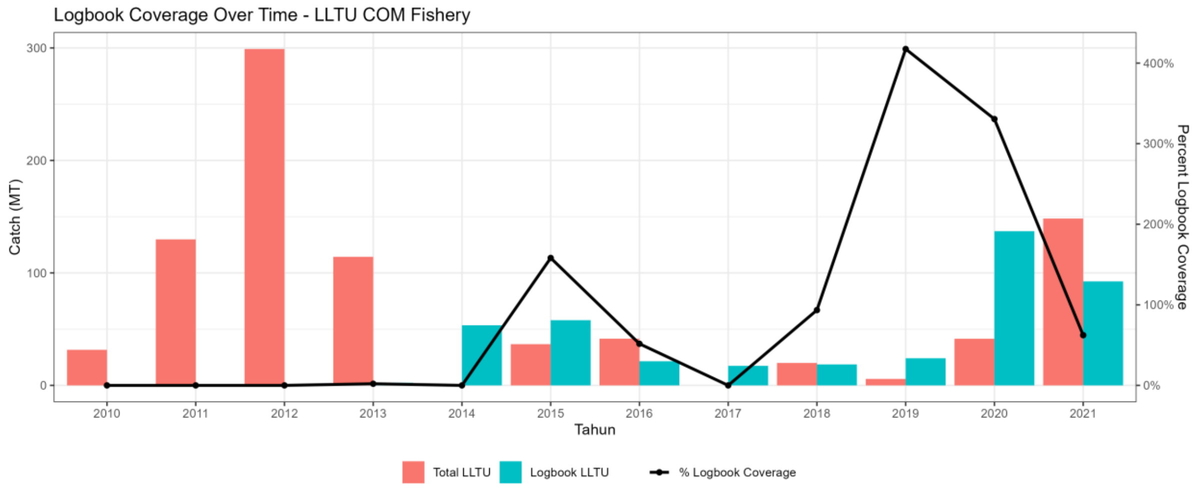
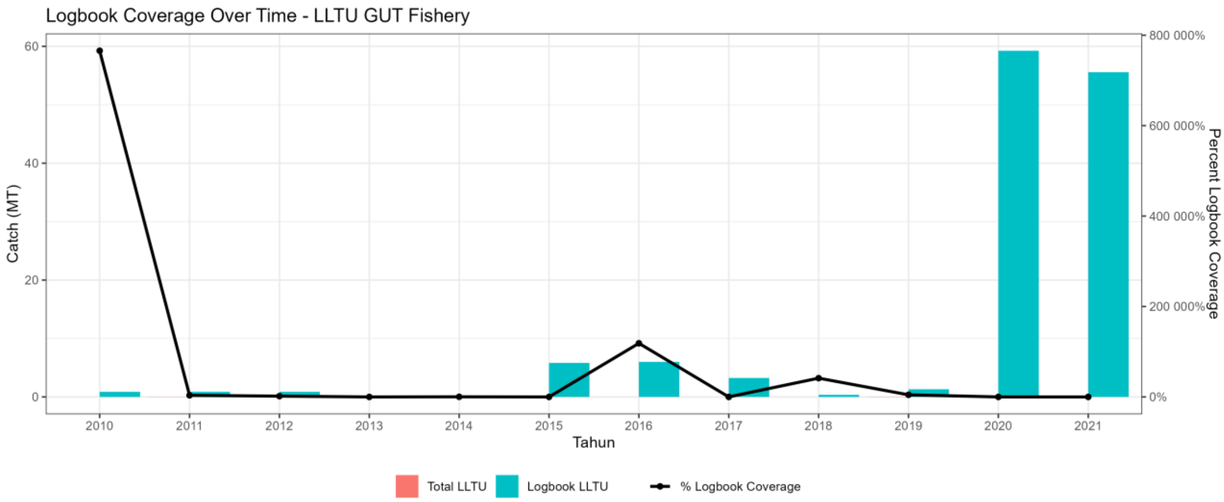
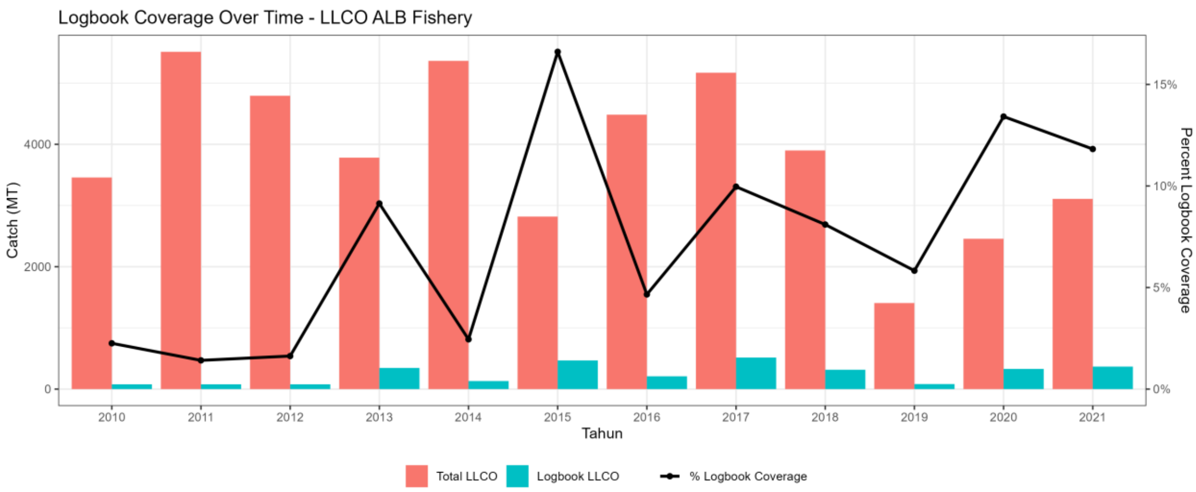
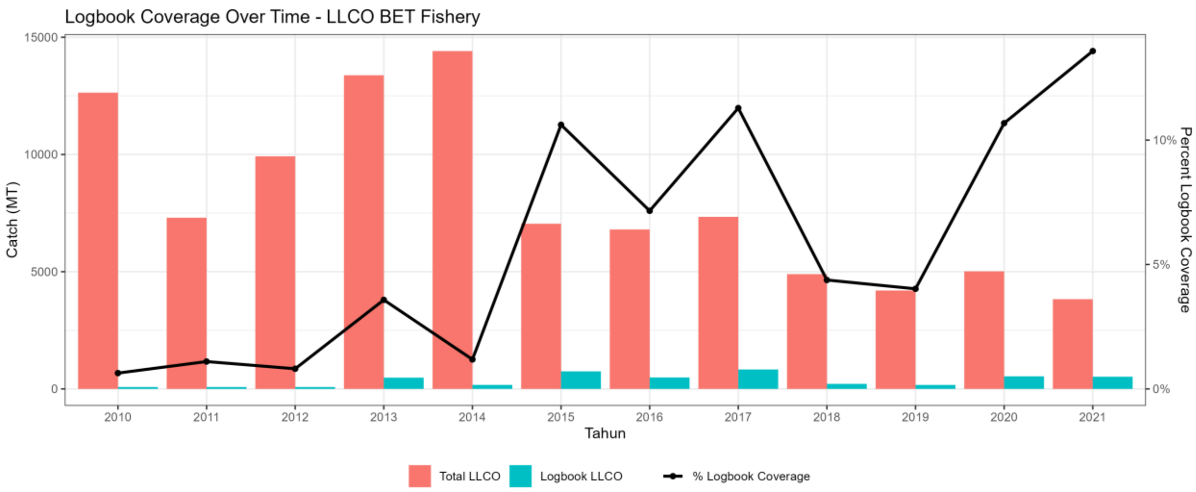
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLTU
Logbook LLTU
% Logbook Coverage

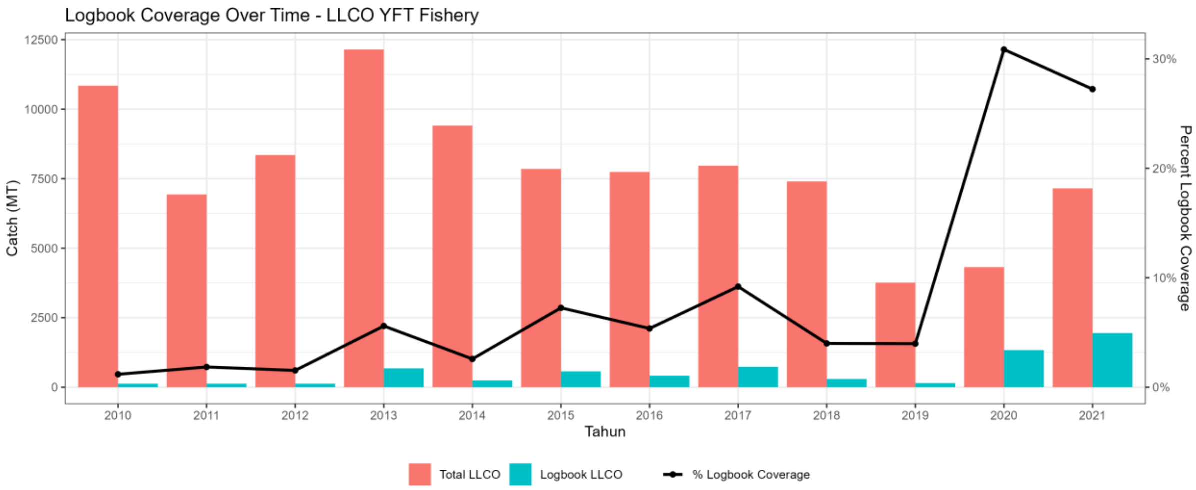


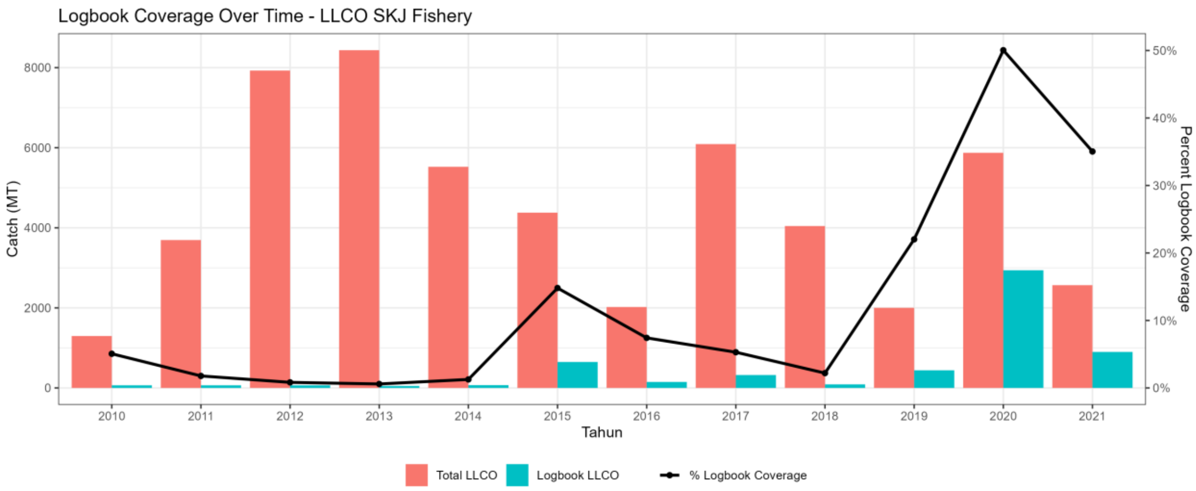


LLCO (Small longline)

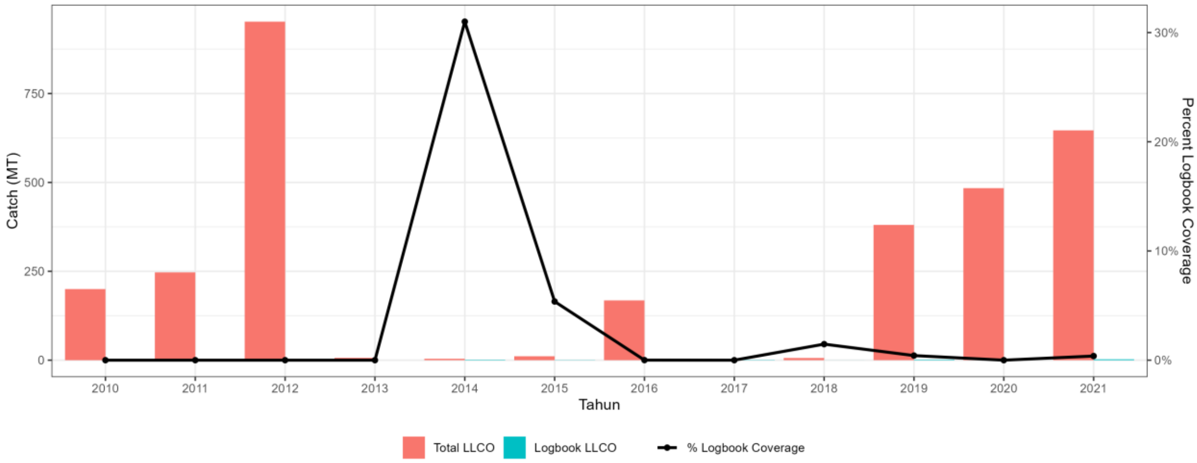



Logbook Coverage Over Time - LLCO BET Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage


Logbook Coverage Over Time - LLCO YFT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage


Logbook Coverage Over Time - LLCO SKJ Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage

Logbook Coverage Over Time - LLCO FRI Fishery



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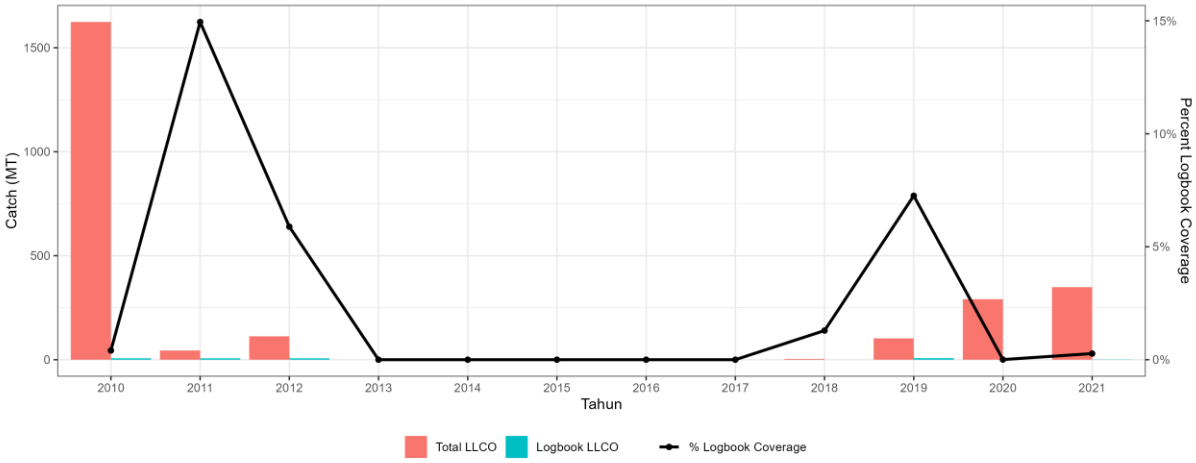
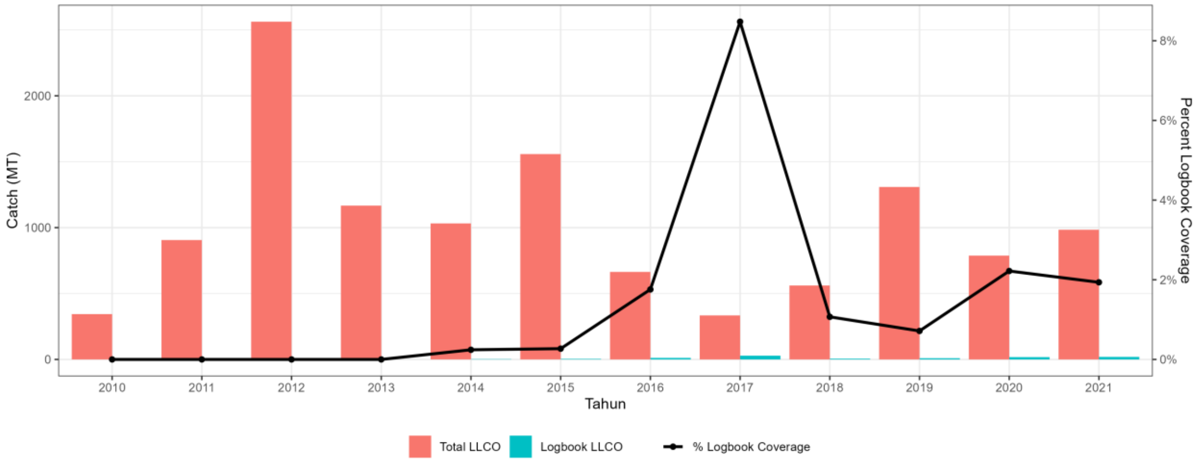
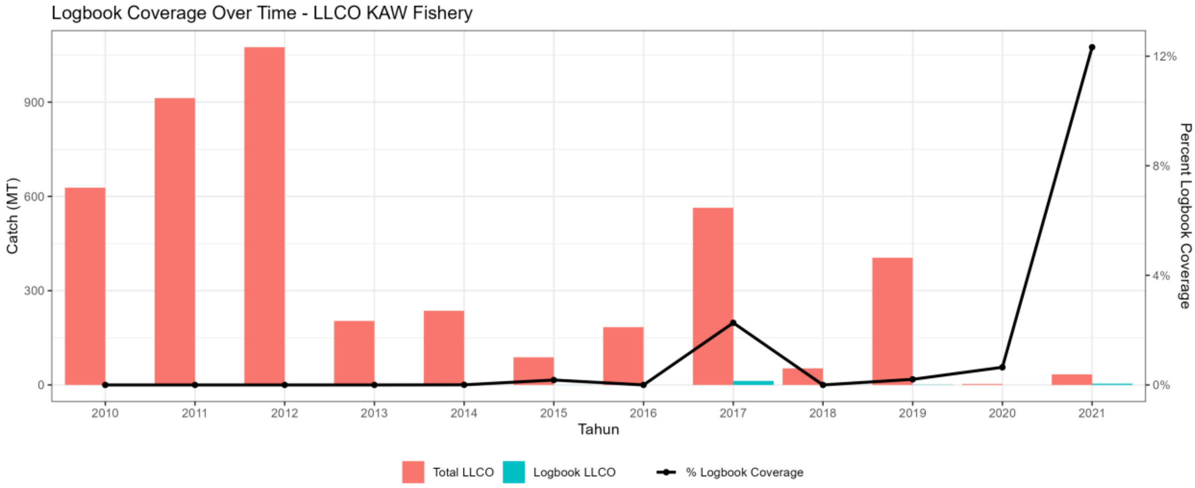
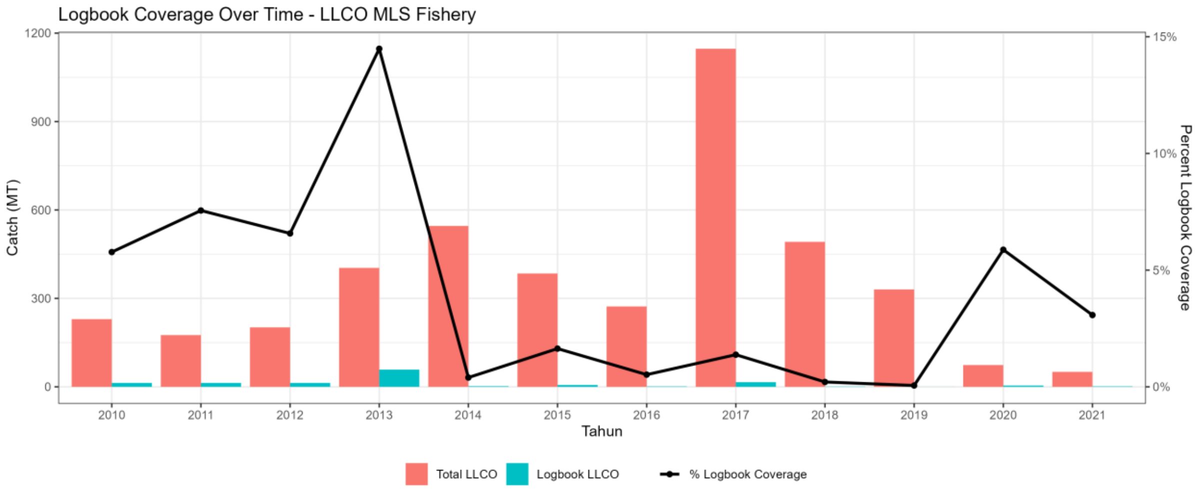


Logbook Coverage Over Time - LLCO LOT Fishery




Logbook Coverage Over Time - LLCO KAW Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage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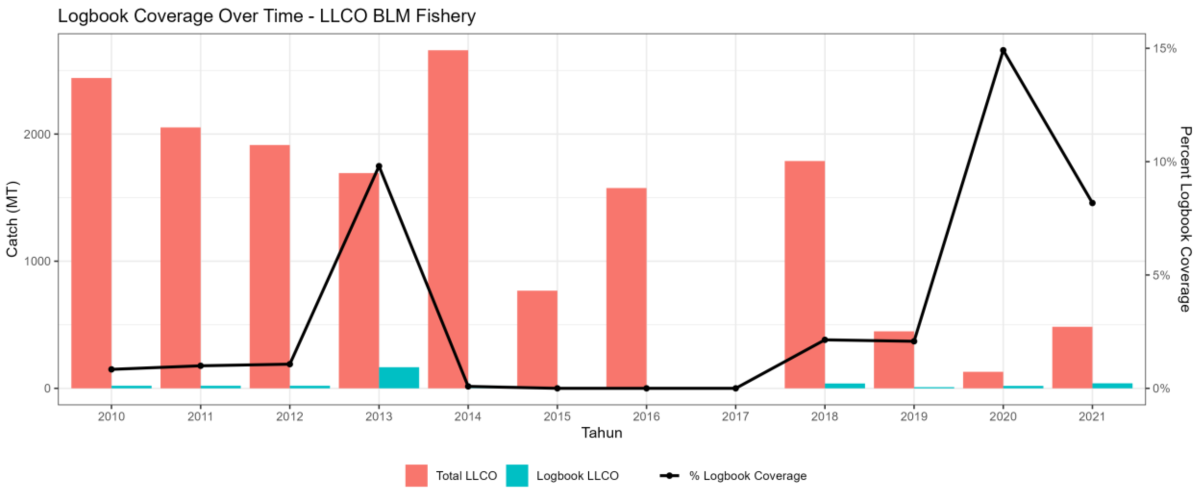
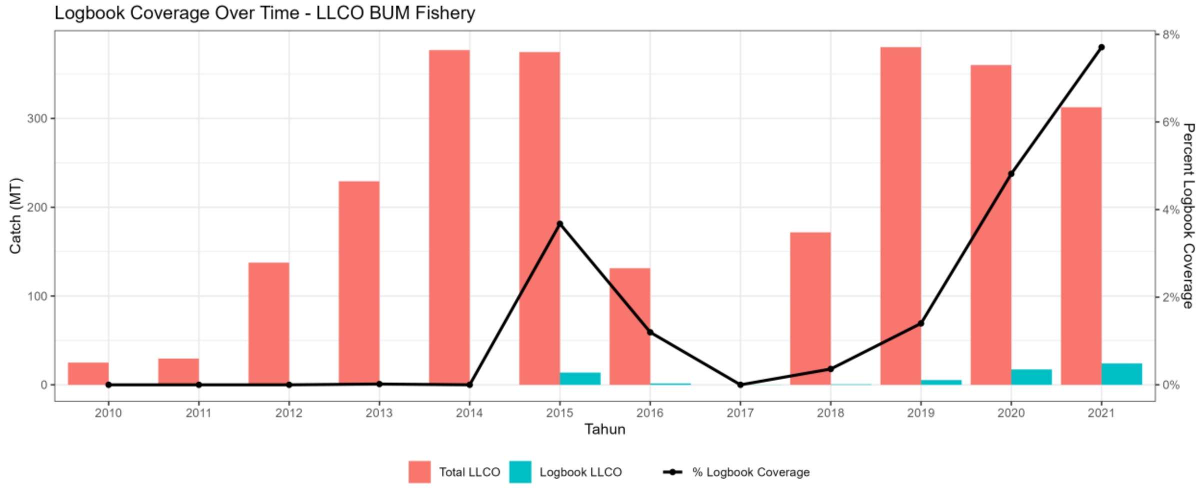
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage


Logbook Coverage Over Time - LLCO BLM Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage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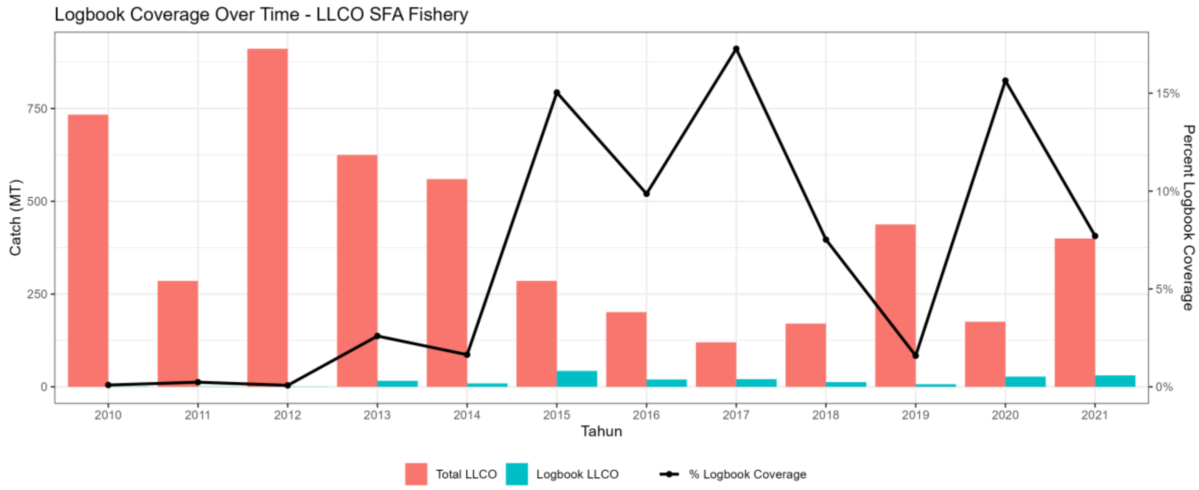
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage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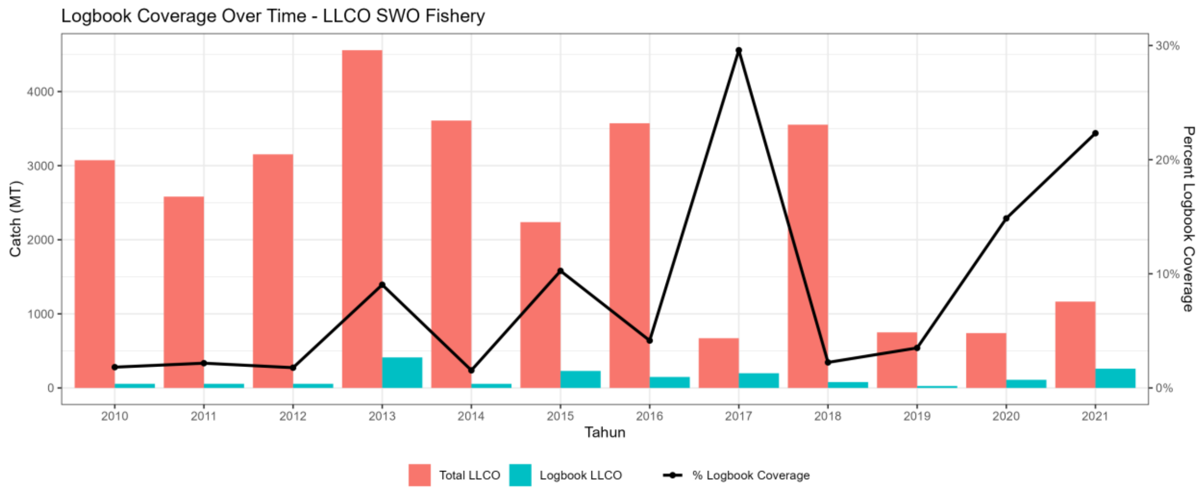
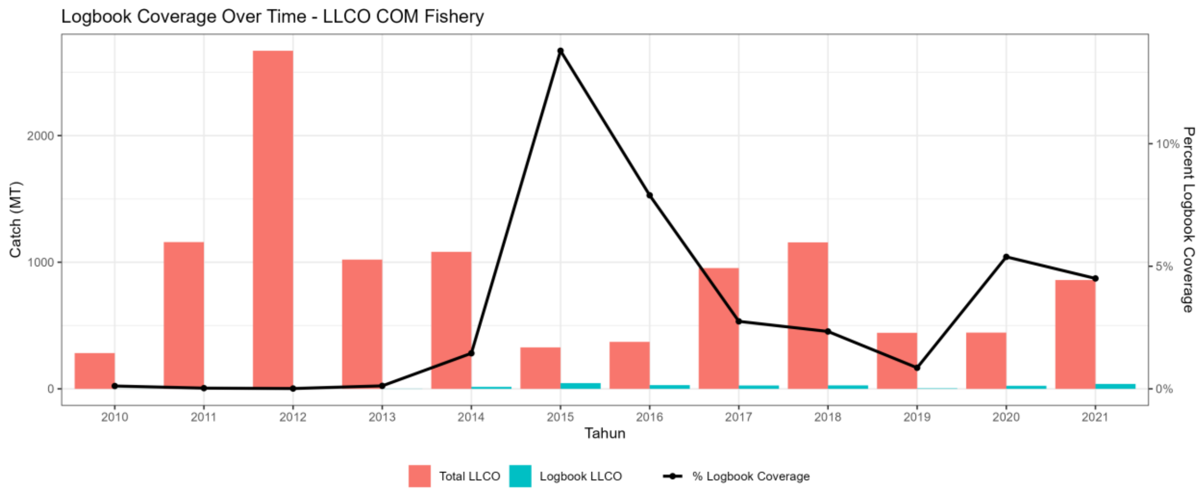
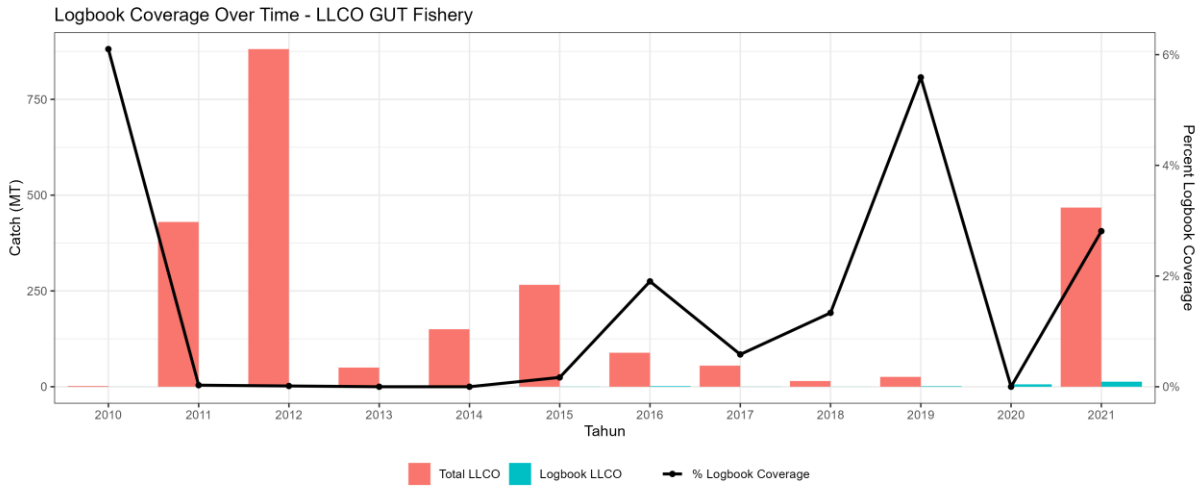
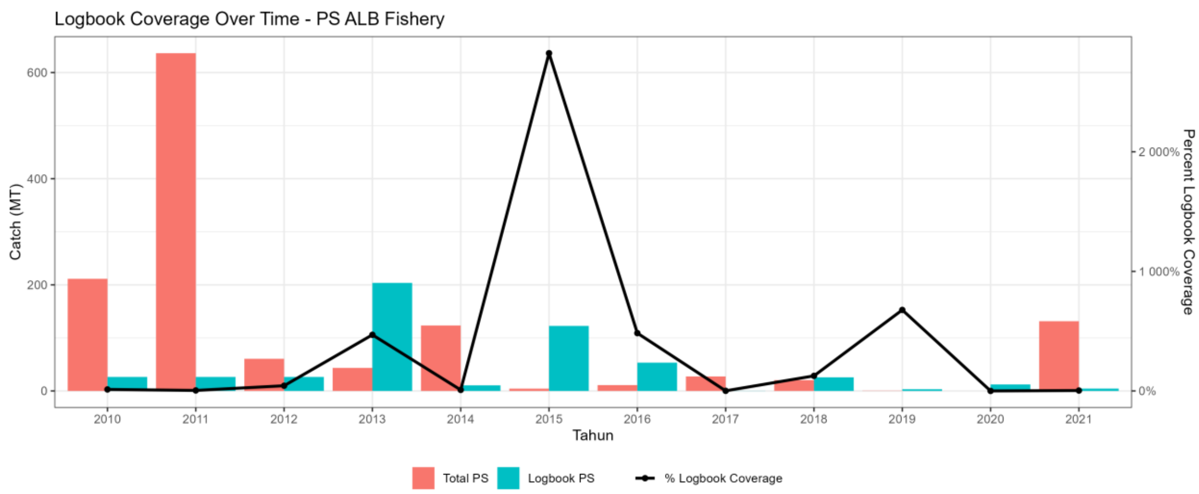
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage

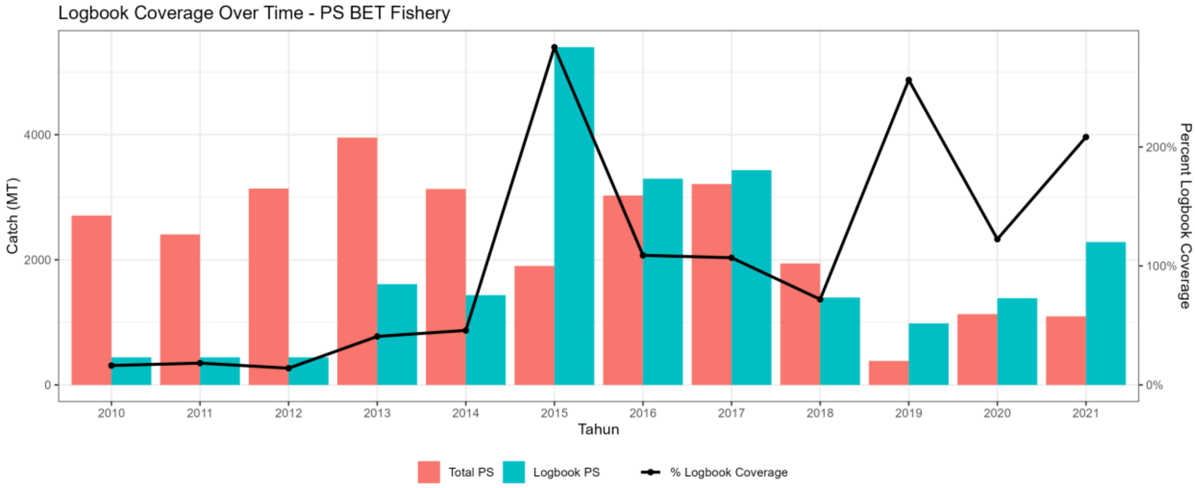

Logbook Coverage Over Time - LLCO SWO Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total LLCO
Logbook LLCO
% Logbook Coverage

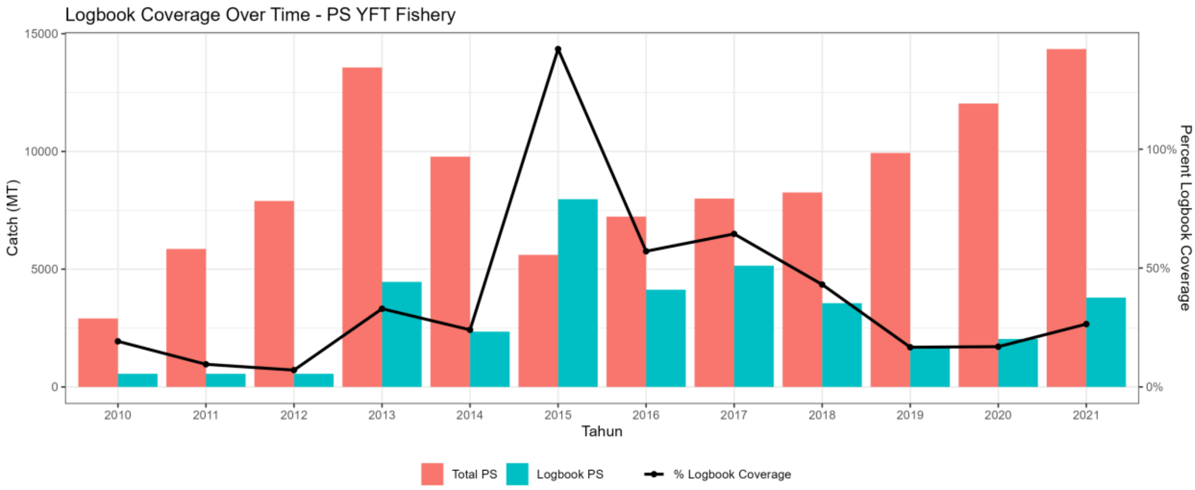




PS (Tuna purse seine)




Logbook Coverage Over Time - PS BET Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total PS
Logbook PS
% Logbook Coverage


Logbook Coverage Over Time - PS YFT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total PS
Logbook PS
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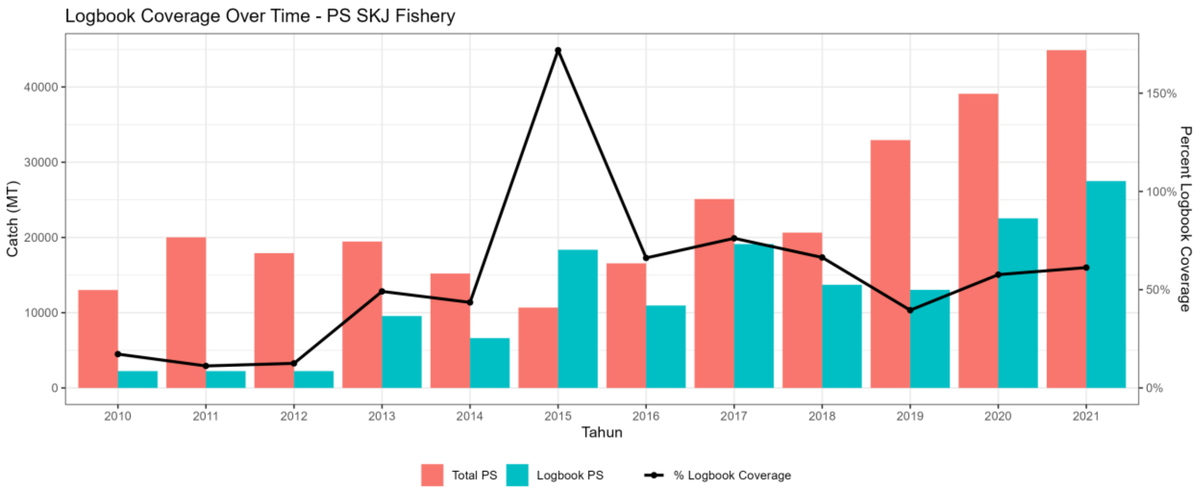
Logbook Coverage Over Time - PS SKJ Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
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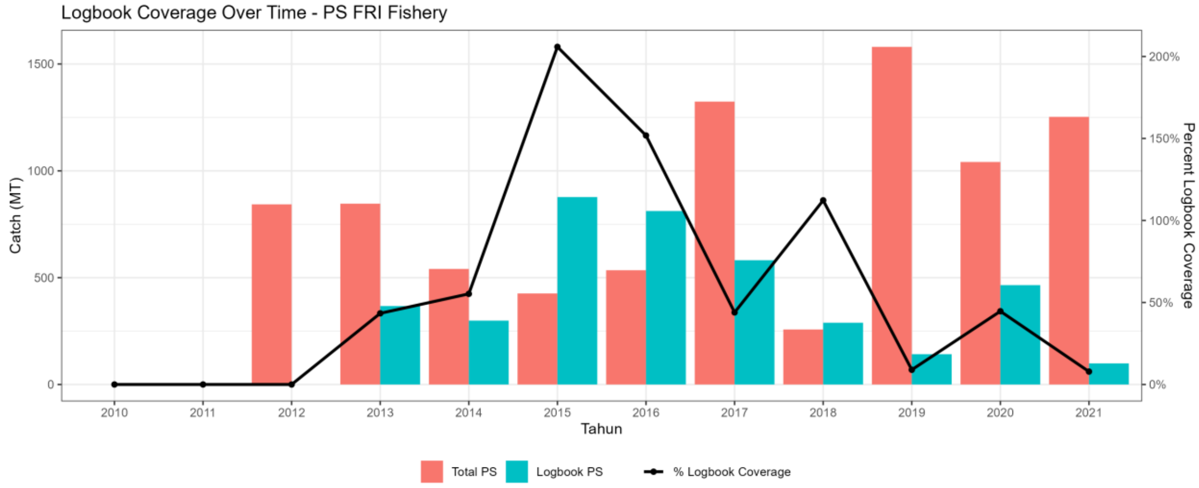
Logbook PS
% Logbook Coverage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Catch (MT)
Percent Logbook Coverage
Tahun
Total PS
Logbook PS
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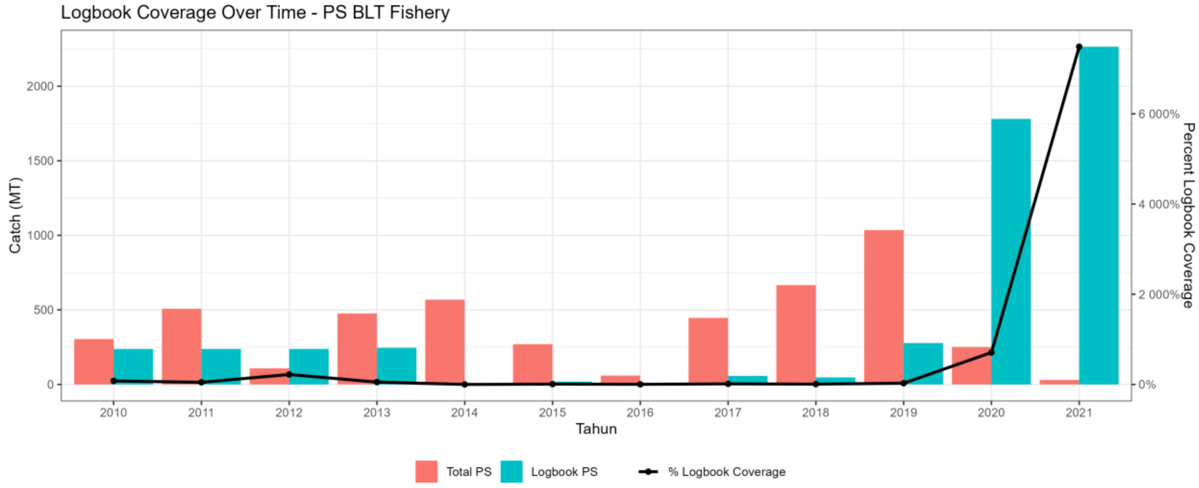
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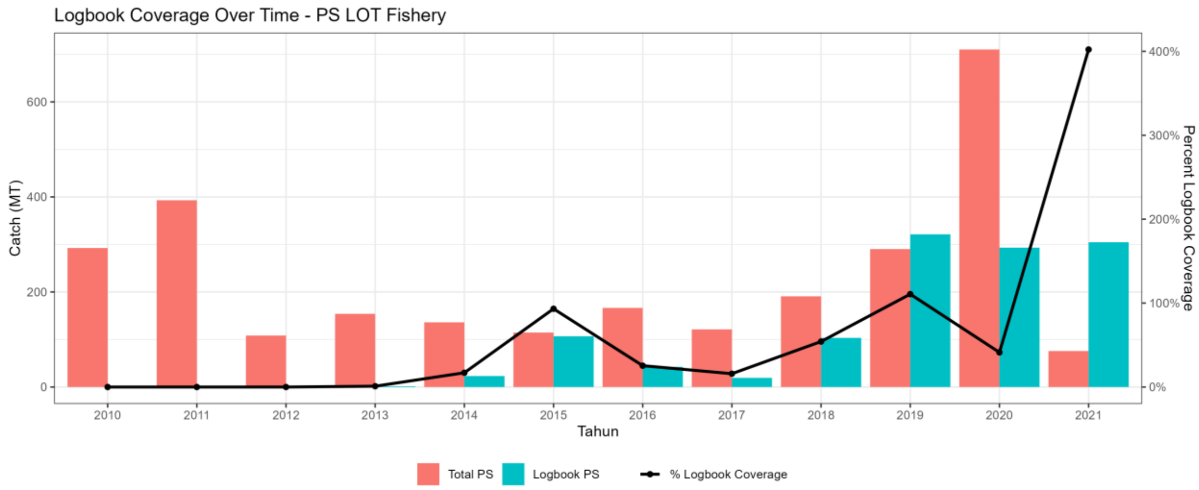
Catch (MT)
Percent Logbook Coverage
Tahun
Total PS
Logbook PS
% Logbook Coverage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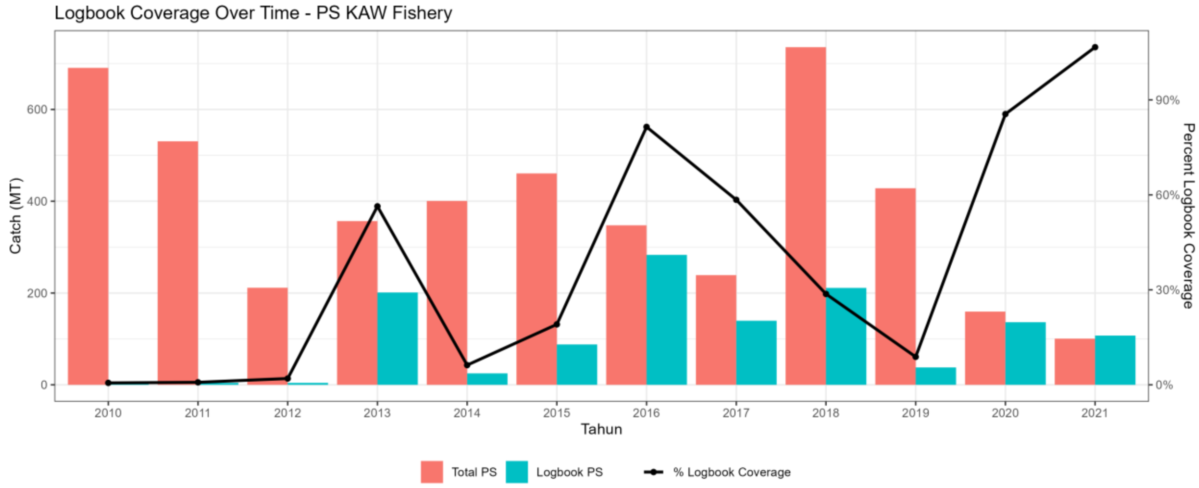
Catch (MT)
Percent Logbook Coverage
Tahun
Total PS
Logbook PS
% Logbook Coverage


Logbook Coverage Over Time - PS KAW Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
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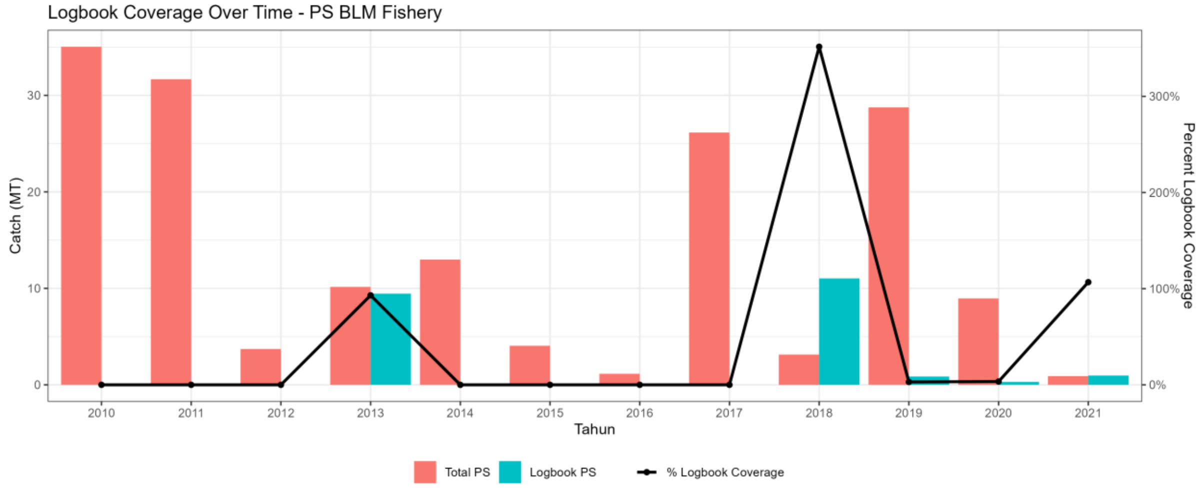
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Catch (MT)
Percent Logbook Coverage
Tahun
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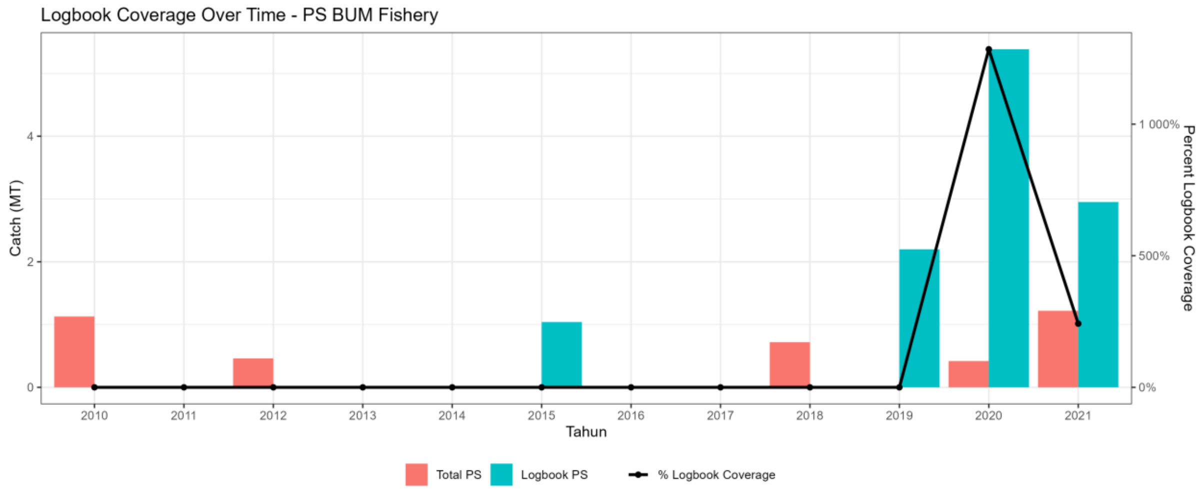
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Catch (MT)
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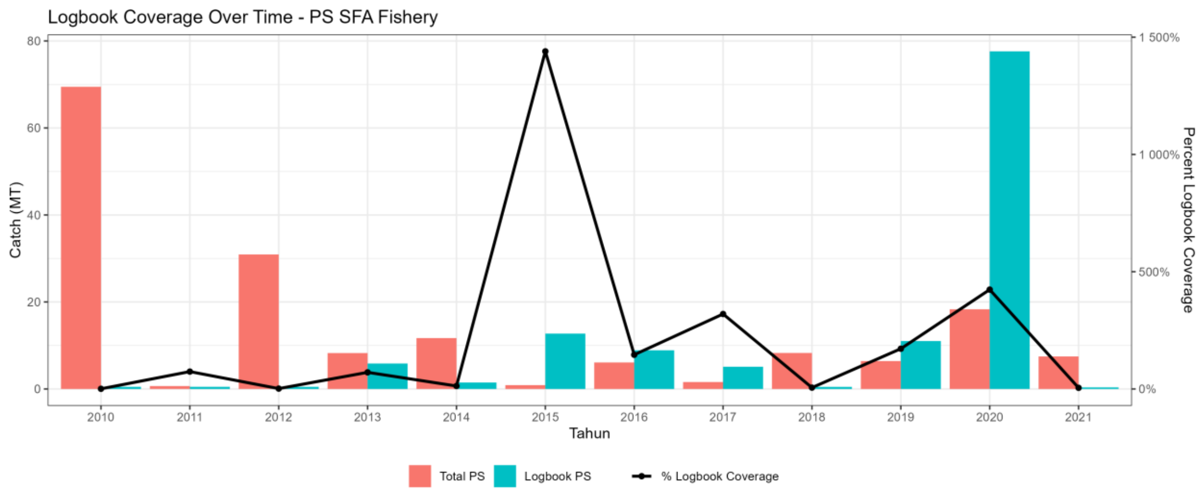
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Catch (MT)
Percent Logbook Coverage
Tahun
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Logbook PS
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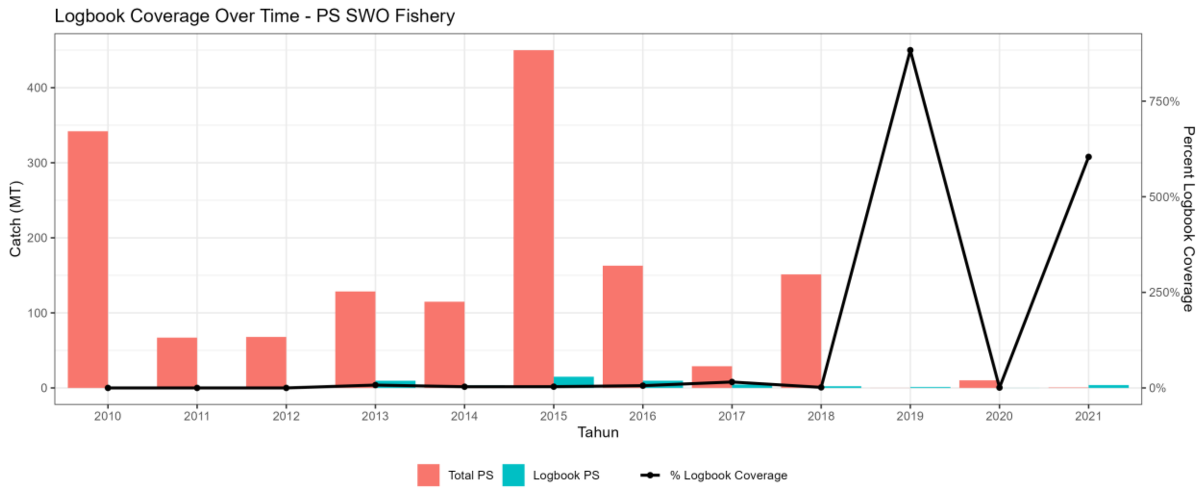
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Catch (MT)
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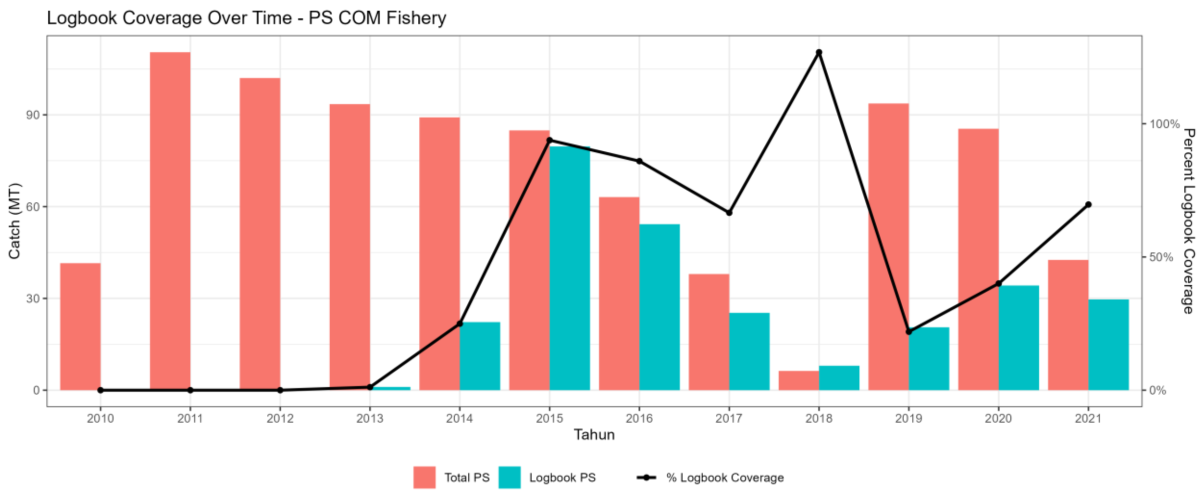
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Catch (MT)
Percent Logbook Coverage
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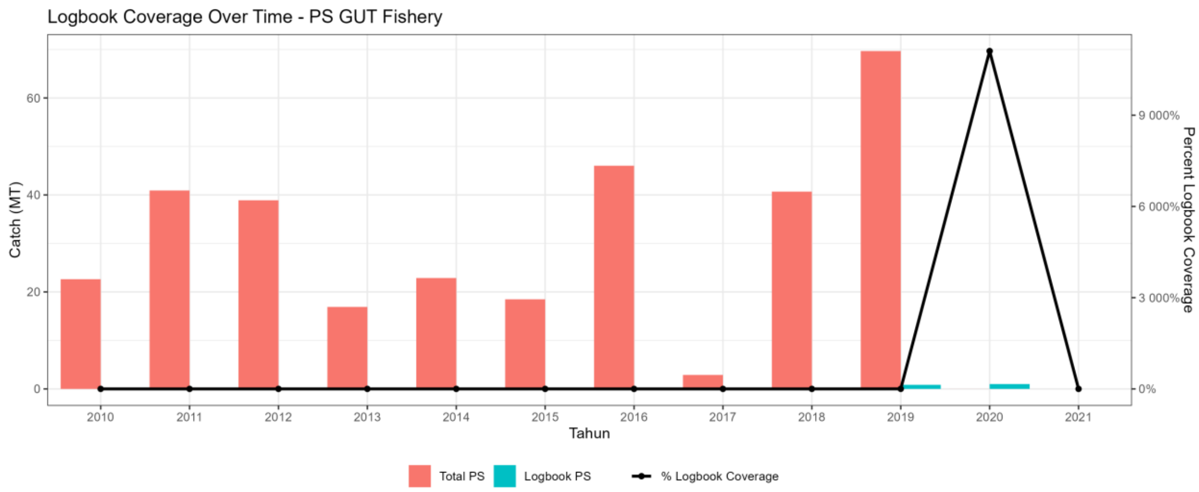
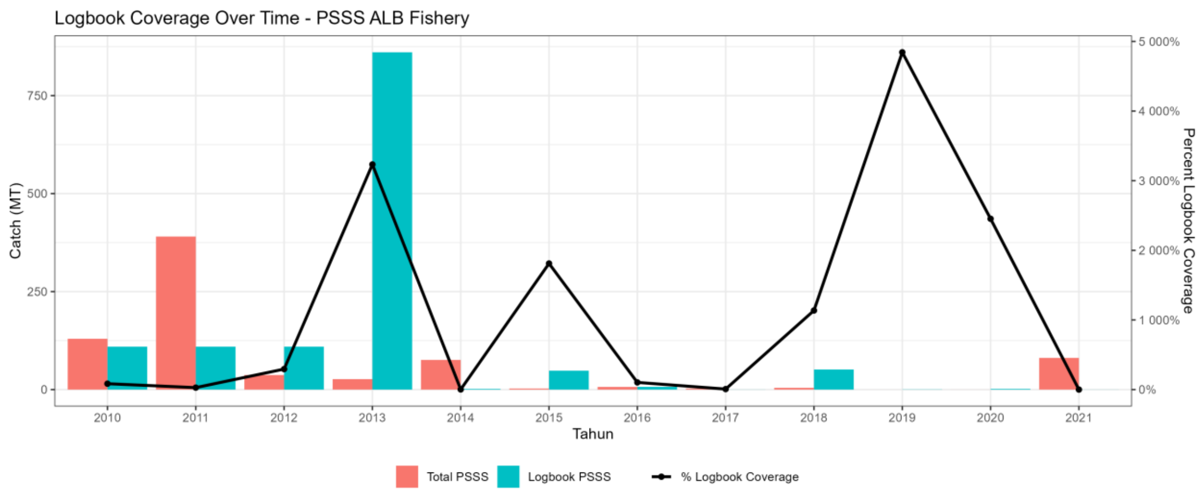
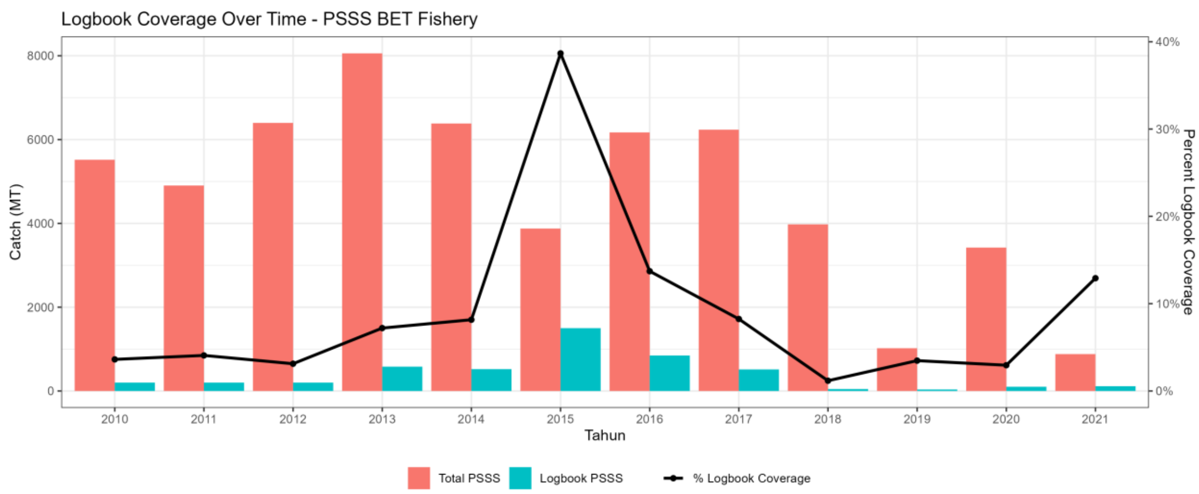
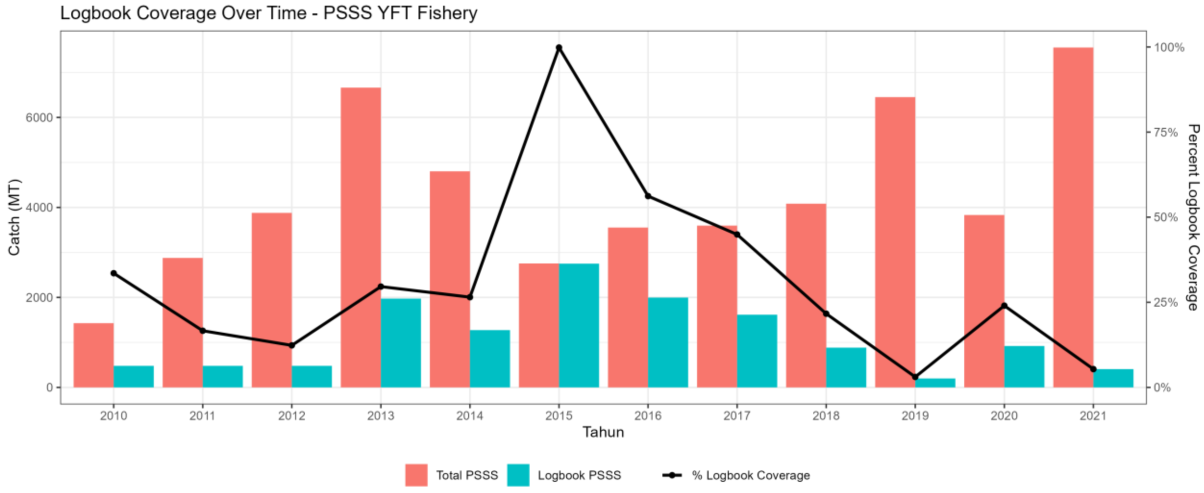
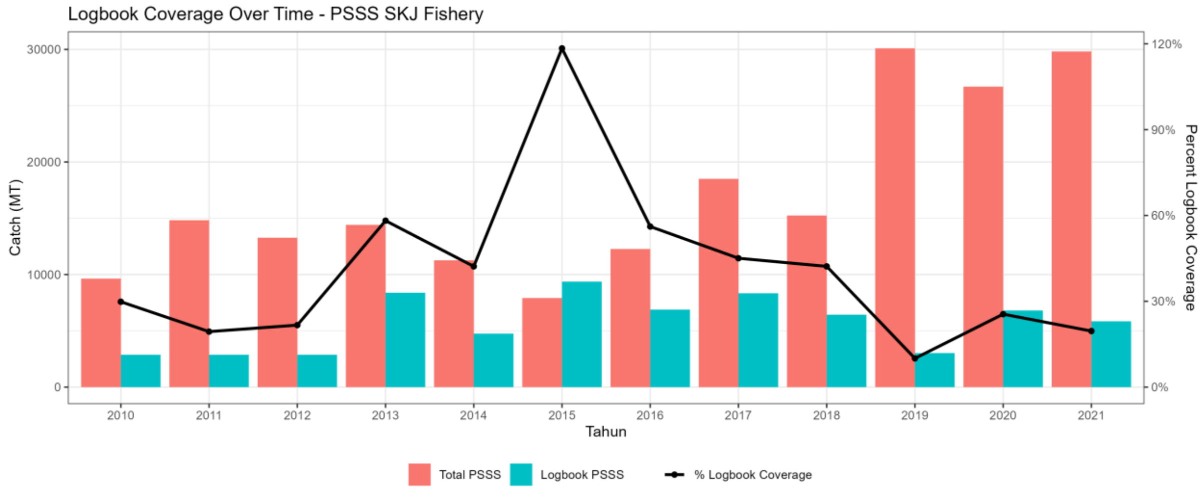


PSSS (Small purse seines)






Logbook Coverage Over Time - PSSS YFT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total PSSS
Logbook PSSS
% Logbook Coverage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Catch (MT)
Percent Logbook Coverage
Tahun
Total PSSS
Logbook PSSS
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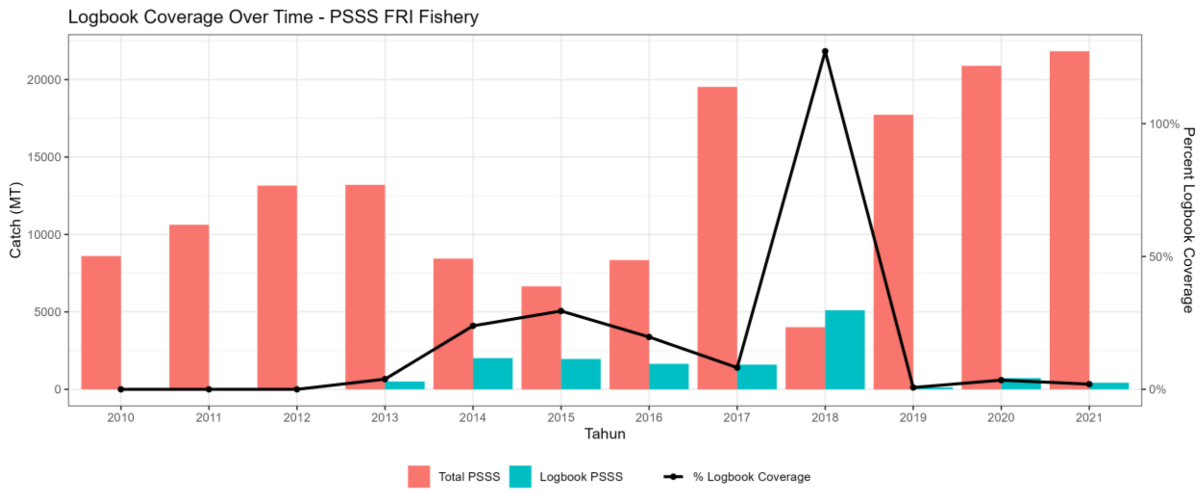
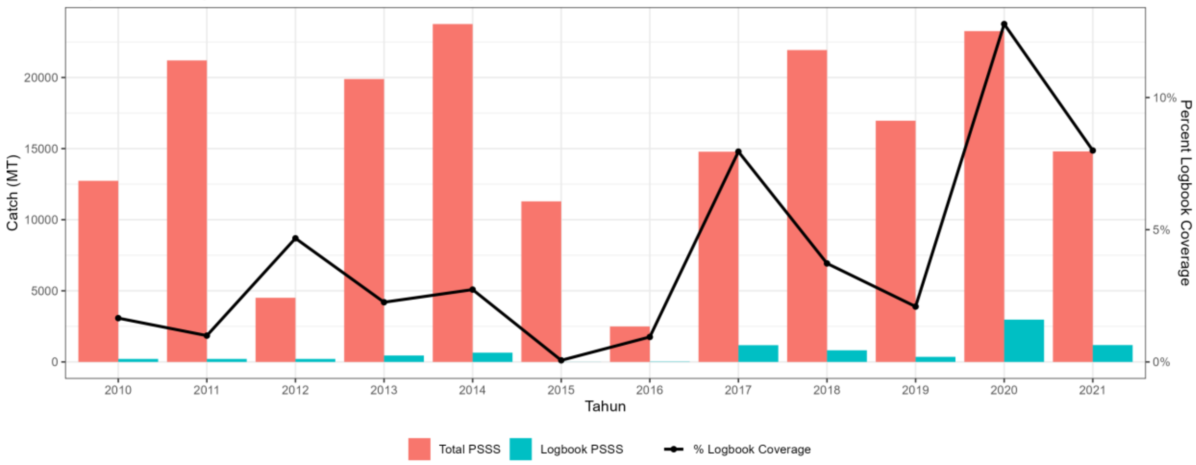
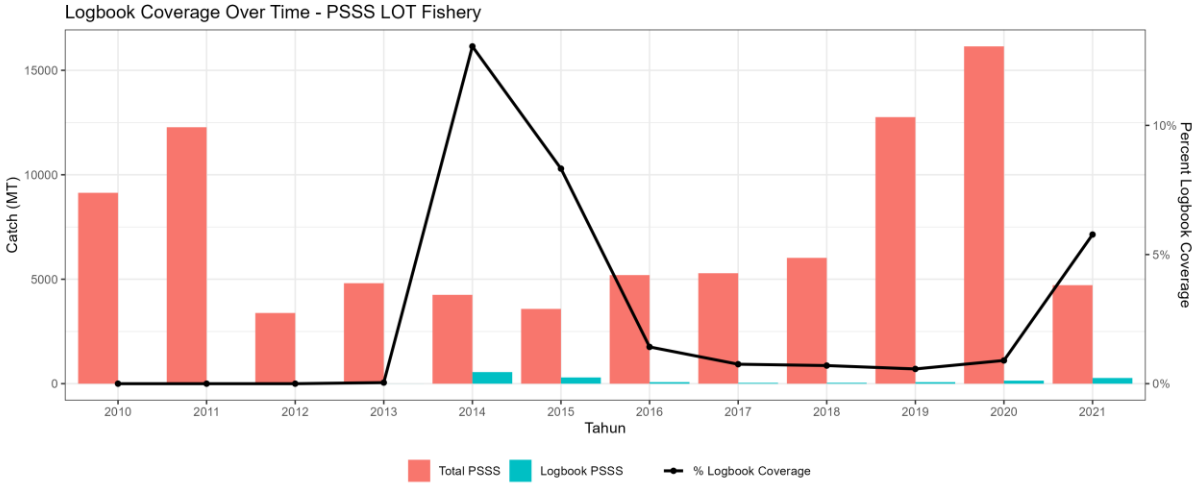

Logbook Coverage Over Time - PSSS FRI Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total PSSS
Logbook PSSS
% Logbook Coverage

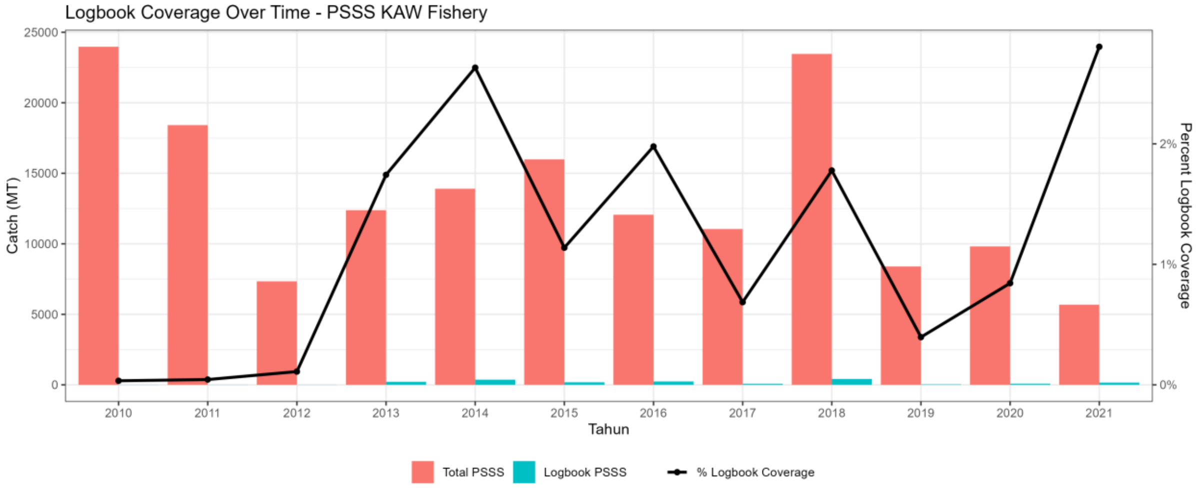
Logbook Coverage Over Time - PSSS BLT Fishery

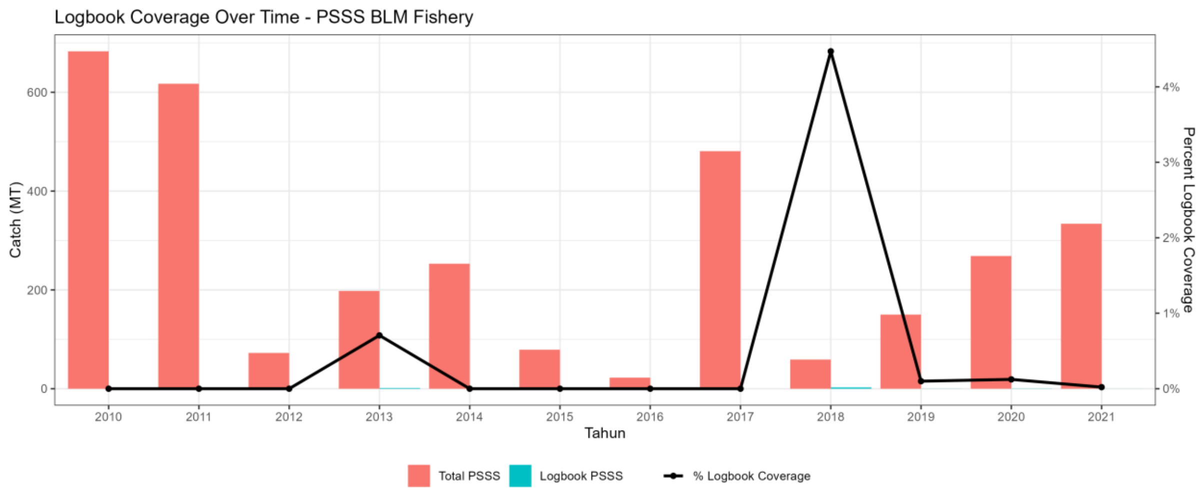


Logbook Coverage Over Time - PSSS LOT Fishery



Logbook Coverage Over Time - PSSS KAW Fishery

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Catch (MT)
Percent Logbook Coverage
Tahun
Total PSSS
Logbook PSSS
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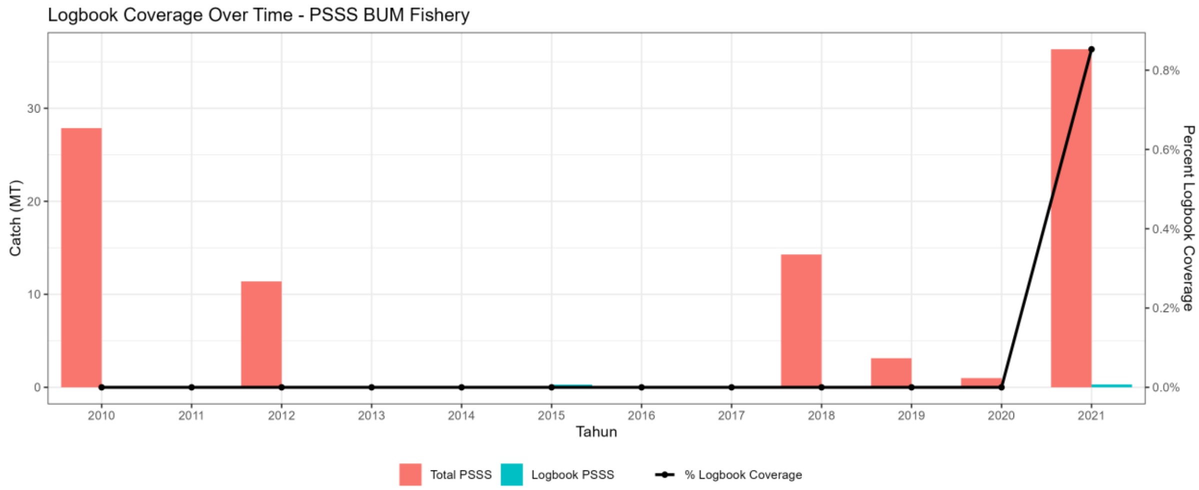
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Catch (MT)
Percent Logbook Coverage
Tahun
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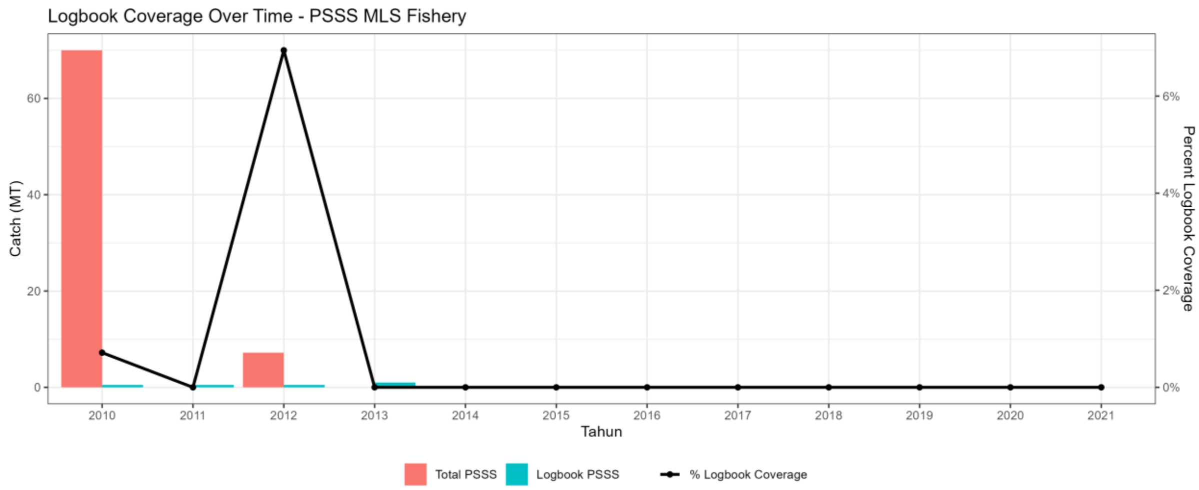
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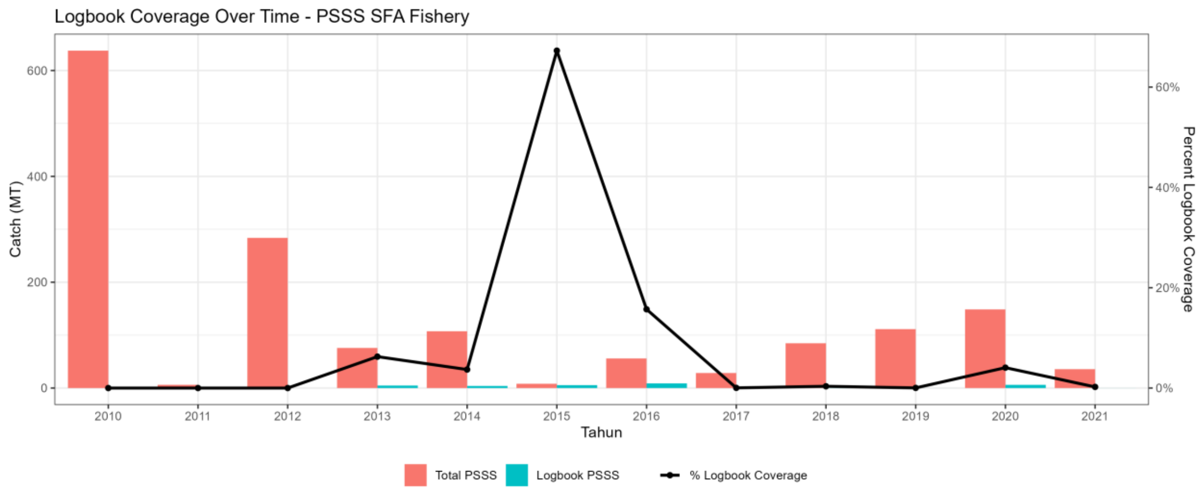
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Catch (MT)
Percent Logbook Coverage
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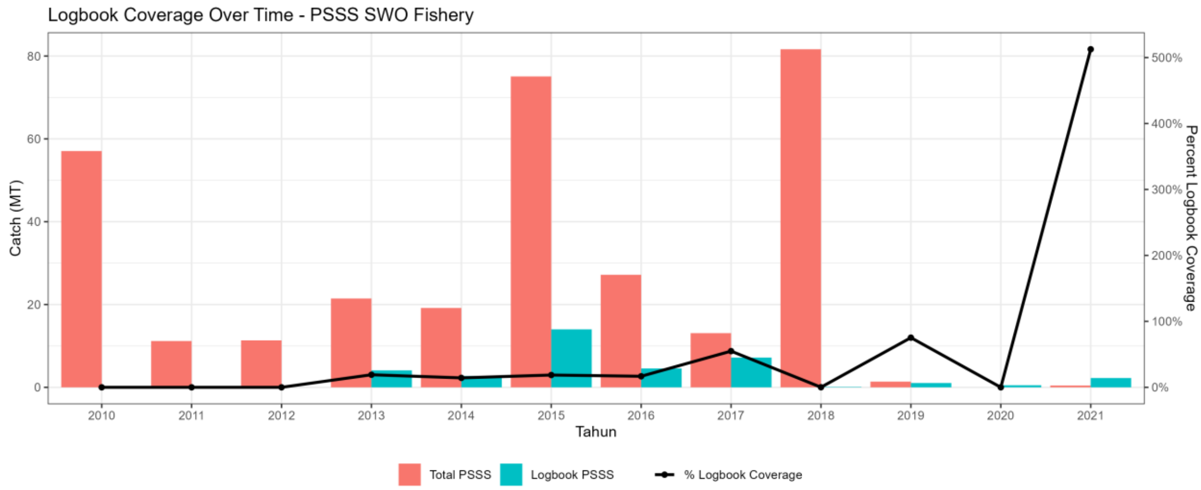
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Catch (MT)
Percent Logbook Coverage
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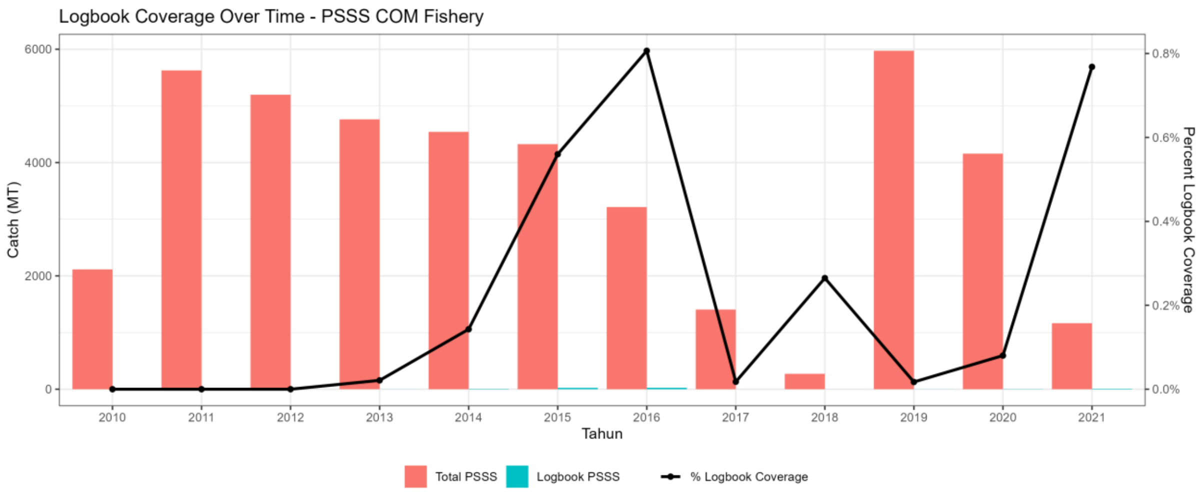
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Catch (MT)
Percent Logbook Coverage
Tahun
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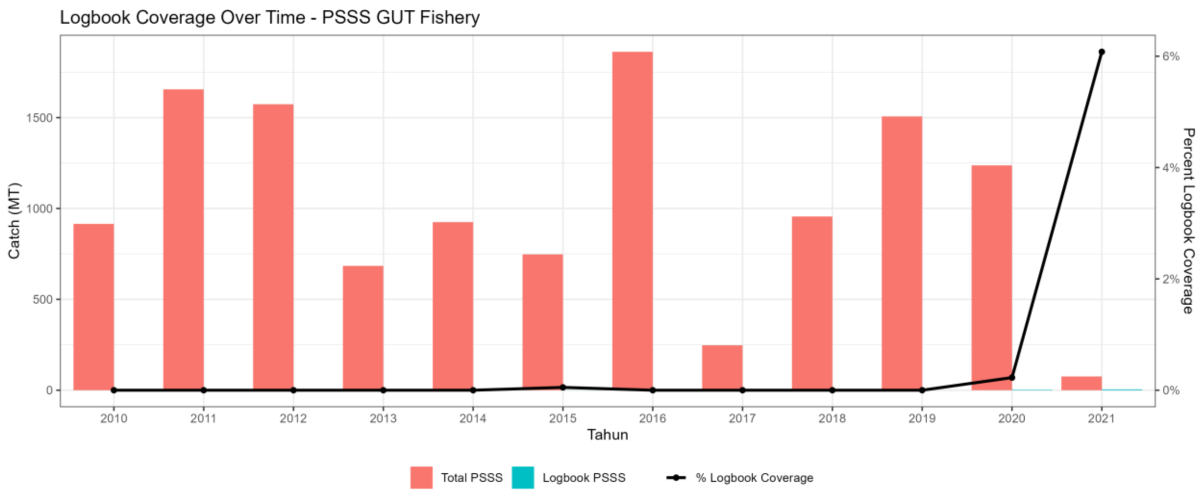
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Catch (MT)
Percent Logbook Coverage
Tahun
Total PSSS
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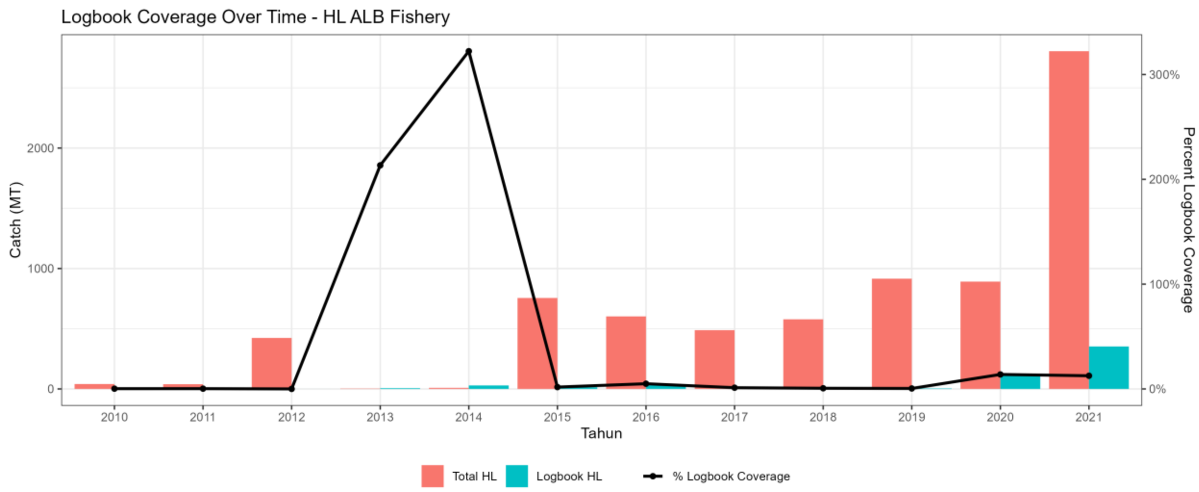
HL (Handline)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Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
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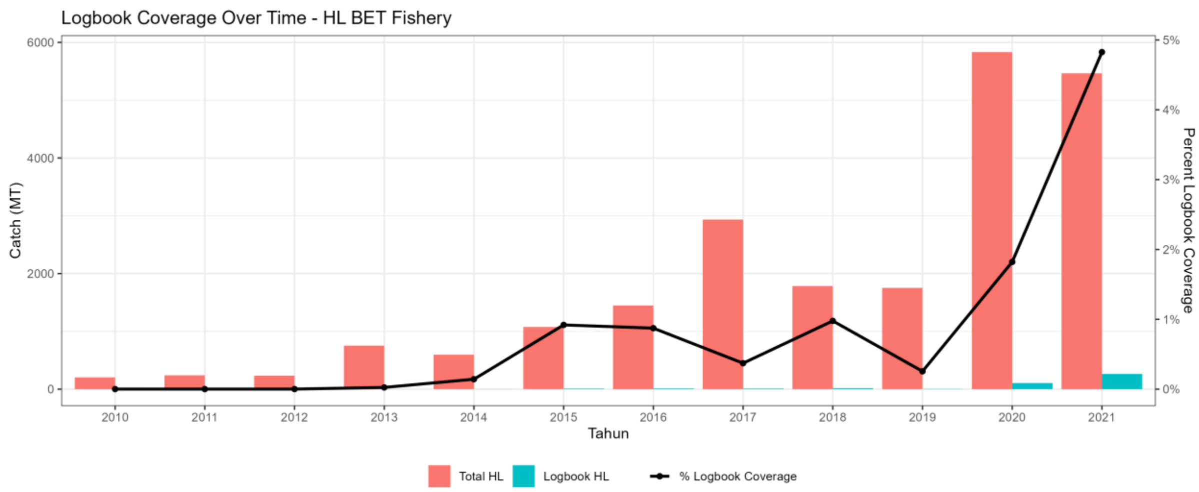
Logbook Coverage Over Time - HL BET Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
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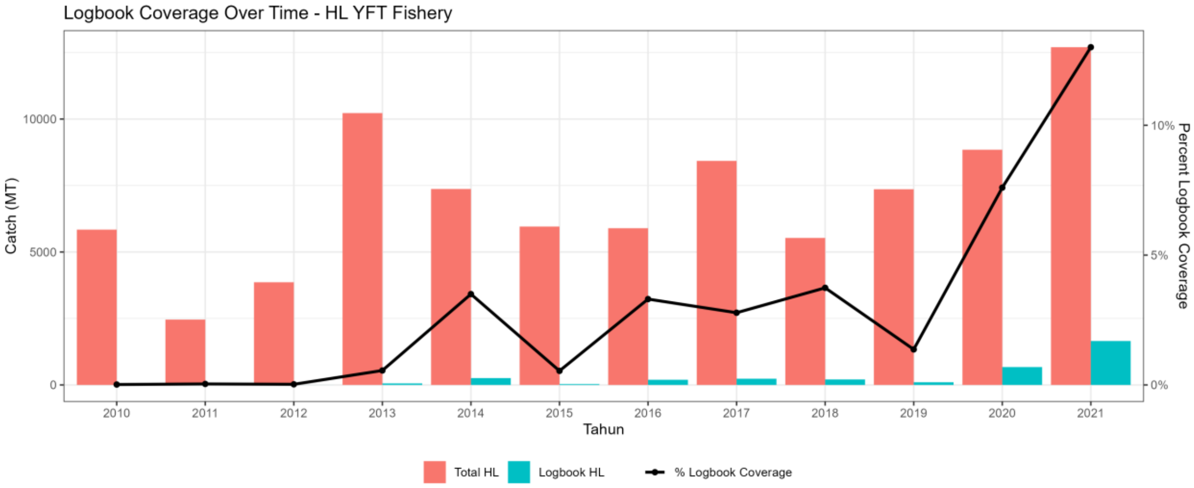
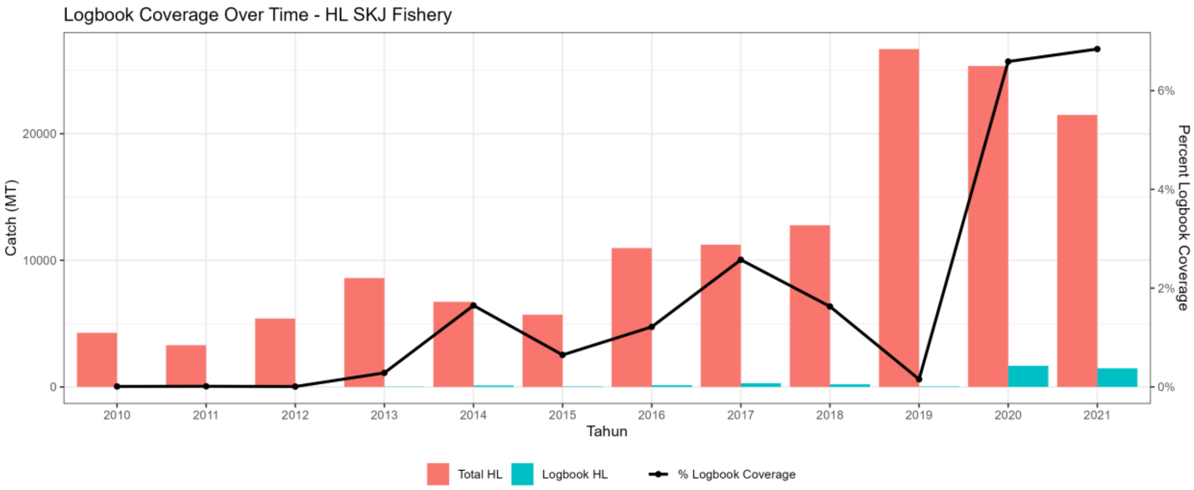
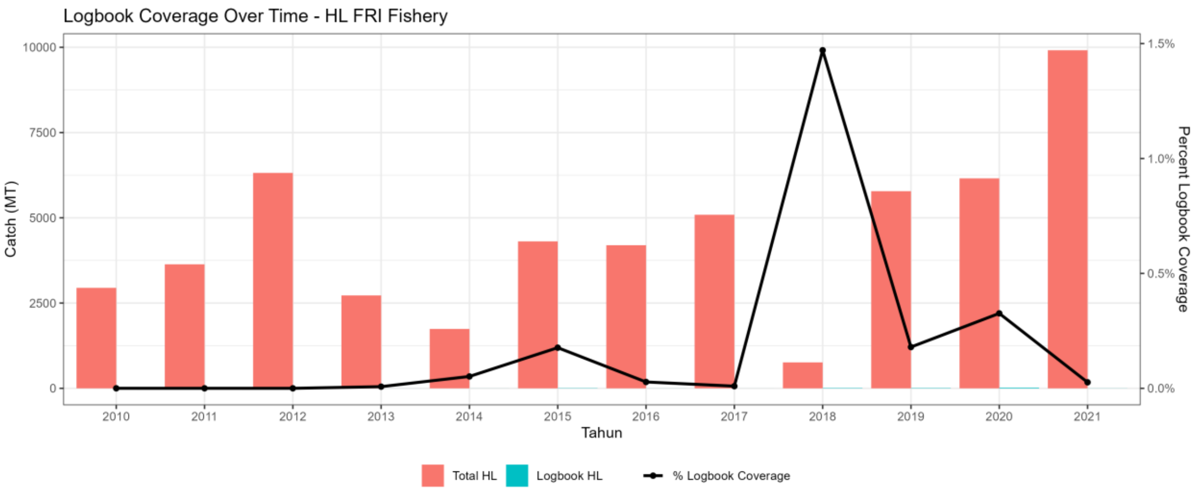
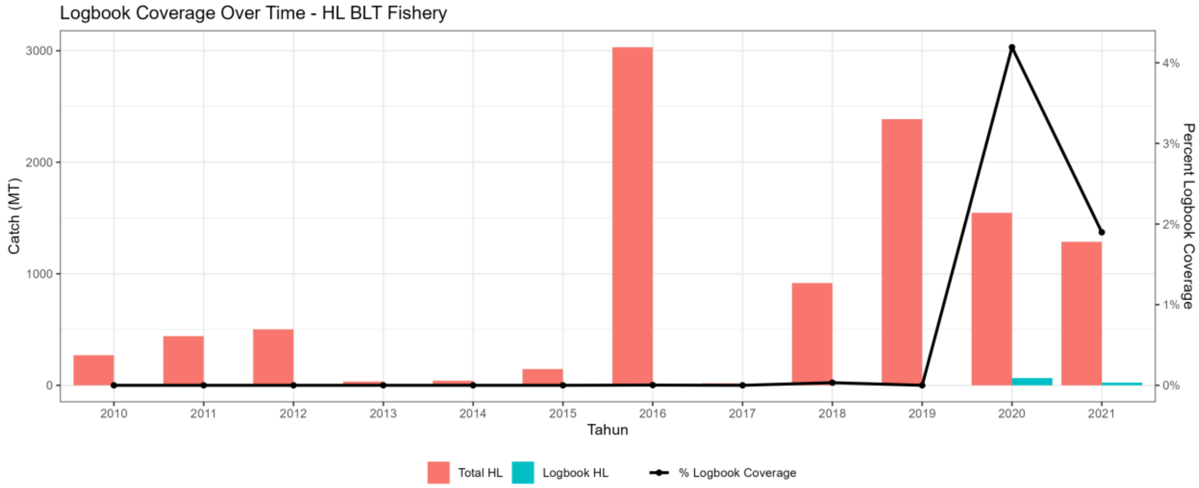
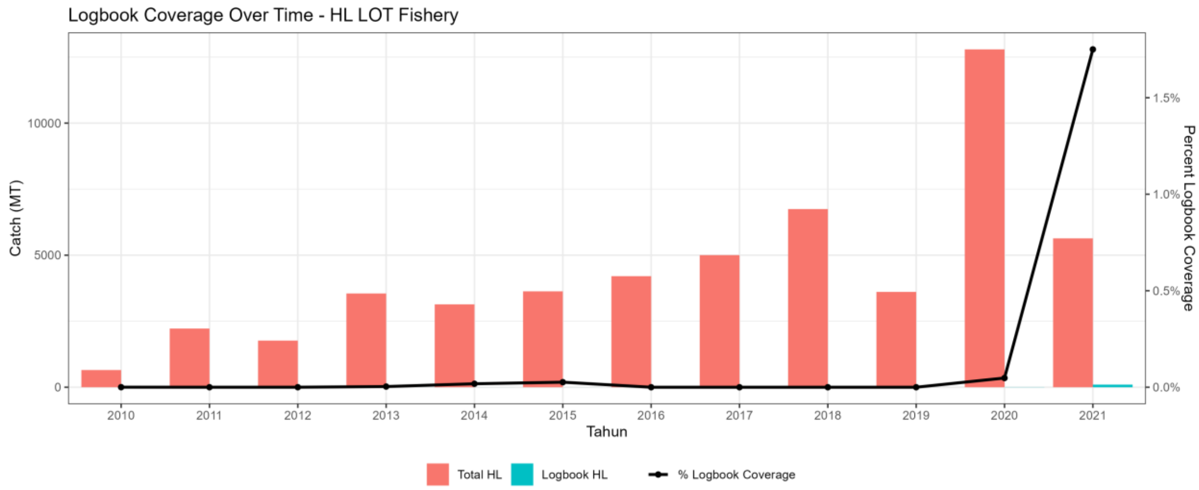
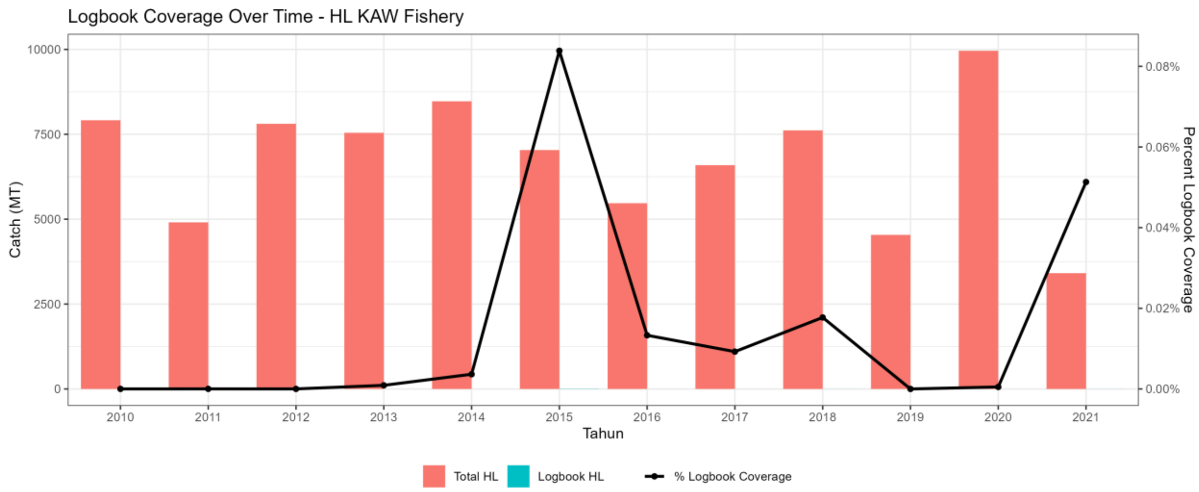

Logbook Coverage Over Time - HL YFT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

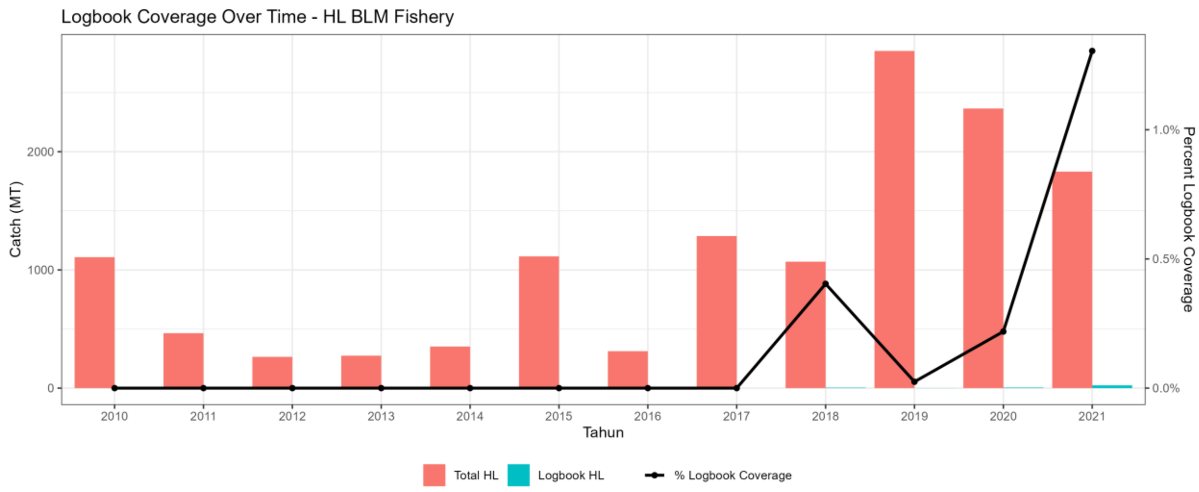

Logbook Coverage Over Time - HL SKJ Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

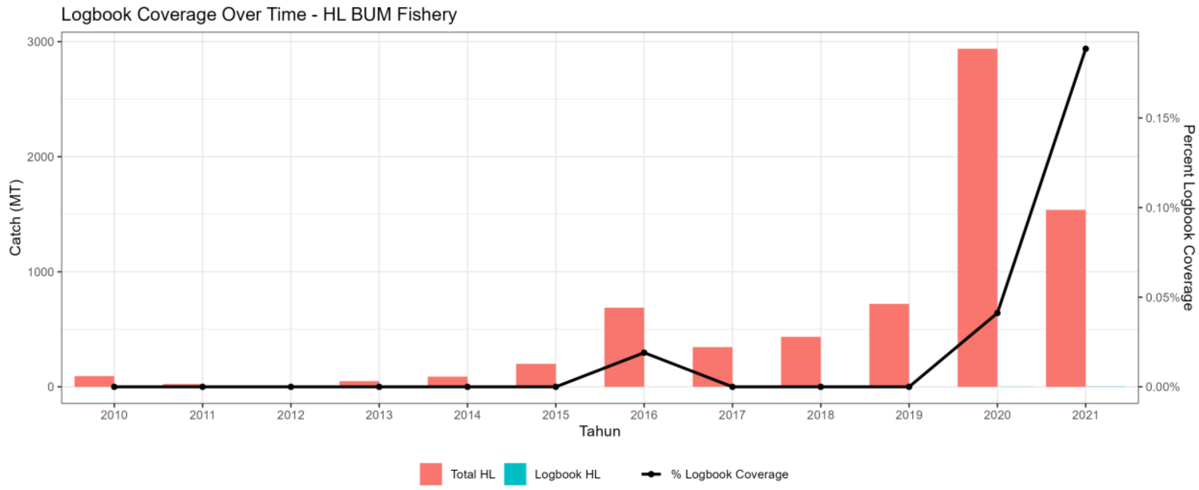

Logbook Coverage Over Time - HL FRI Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

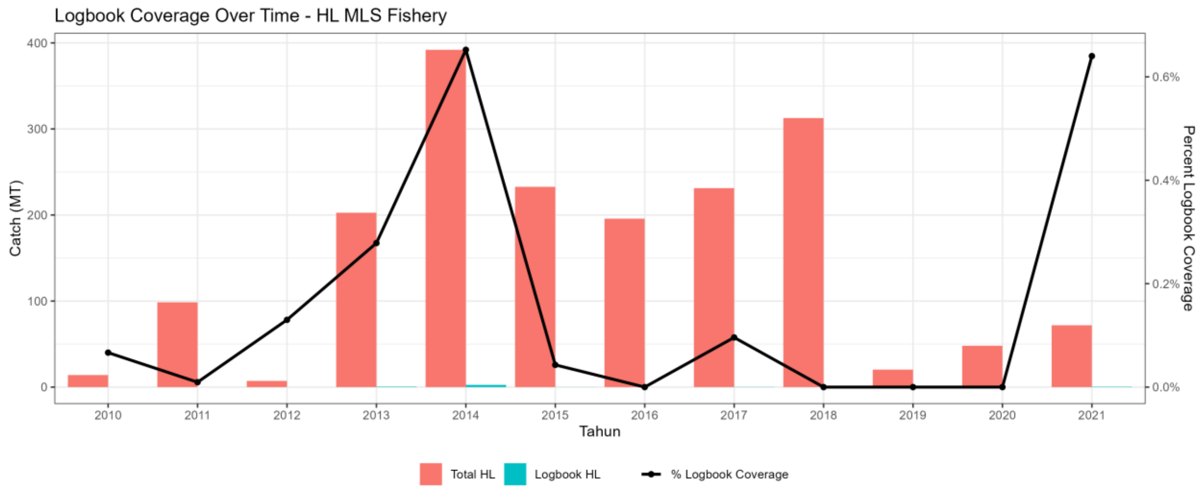

Logbook Coverage Over Time - HL BLT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

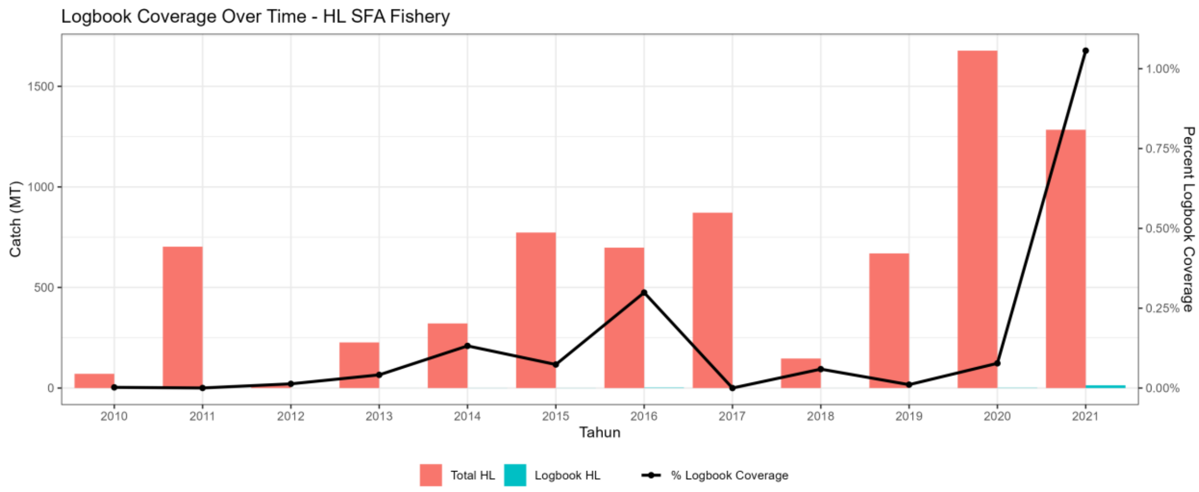

Logbook Coverage Over Time - HL LOT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage


Logbook Coverage Over Time - HL KAW Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

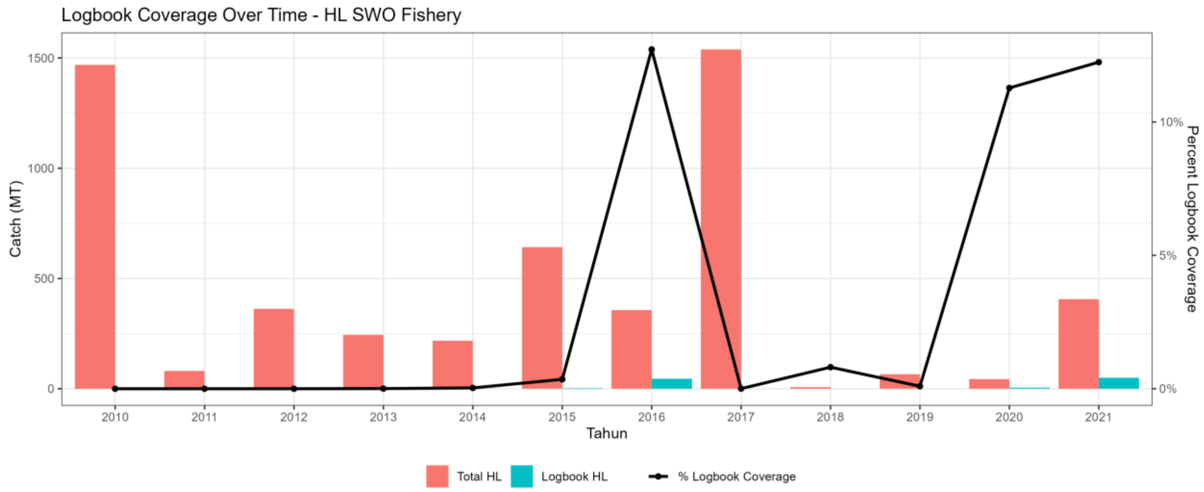

Logbook Coverage Over Time - HL BLM Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage


Logbook Coverage Over Time - HL BUM Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

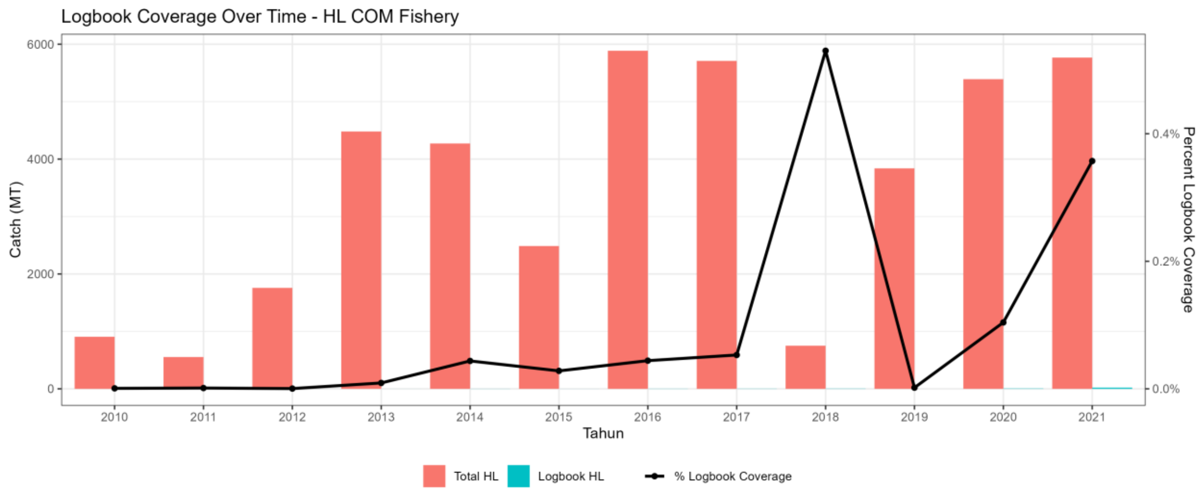

Logbook Coverage Over Time - HL MLS Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage



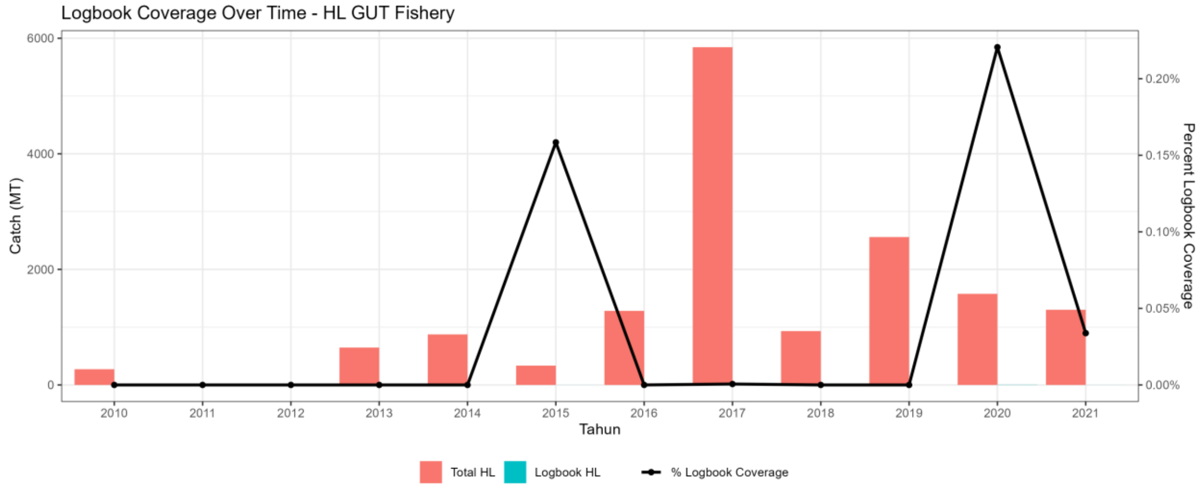
Logbook Coverage Over Time - HL SFA Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage



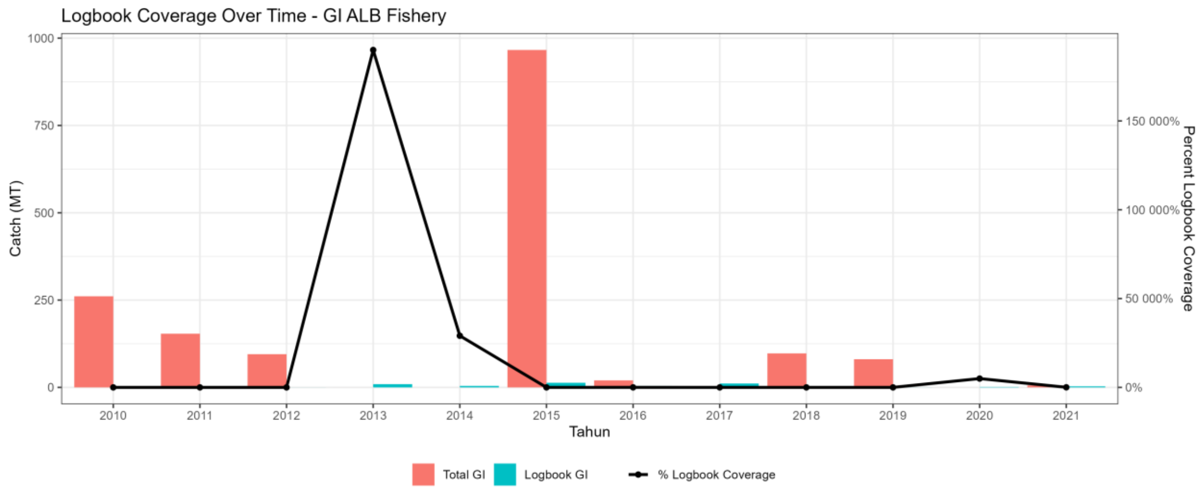
Logbook Coverage Over Time - HL SWO Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

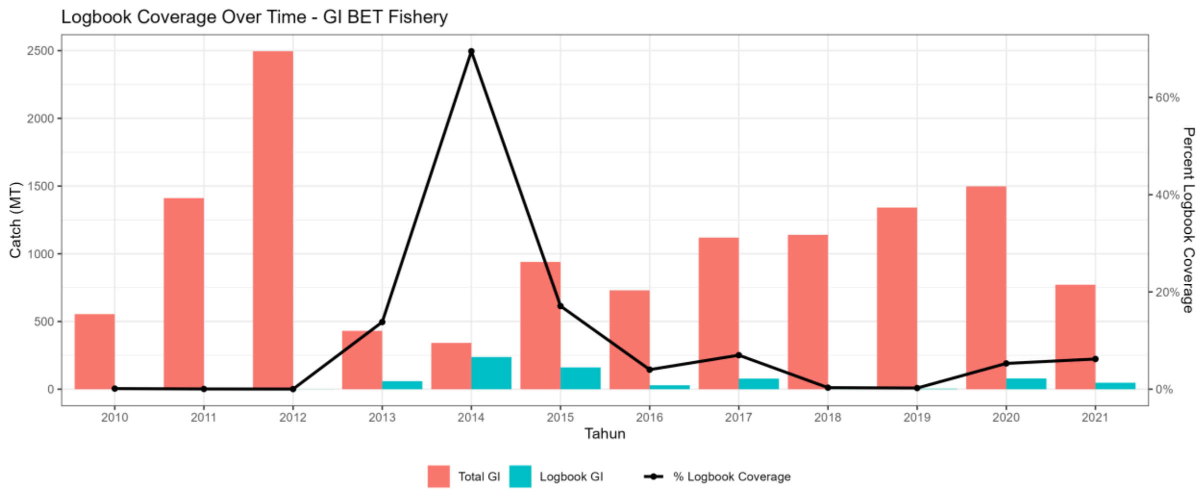


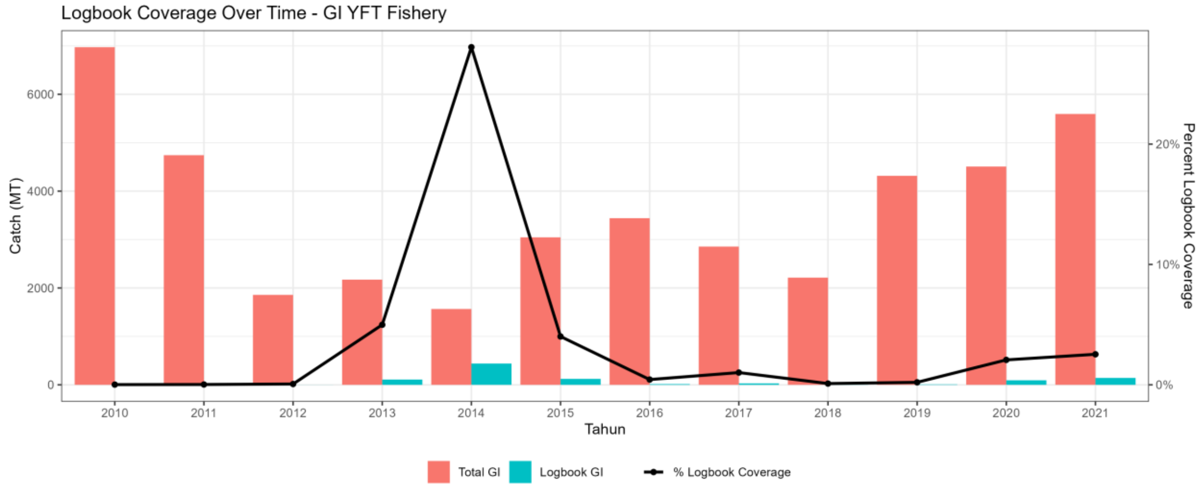
Logbook Coverage Over Time - HL COM Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

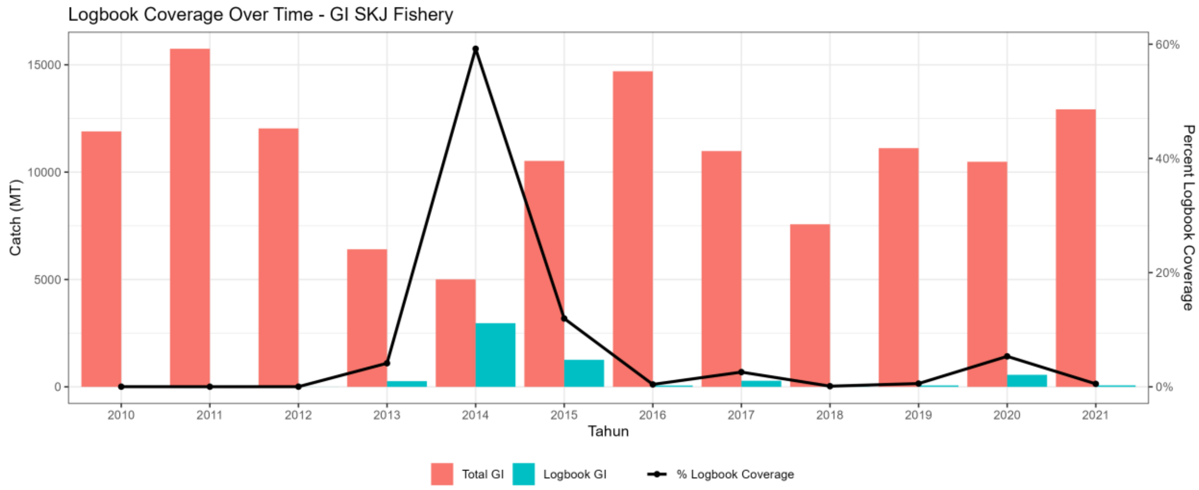

Logbook Coverage Over Time - HL GUT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total HL
Logbook HL
% Logbook Coverage

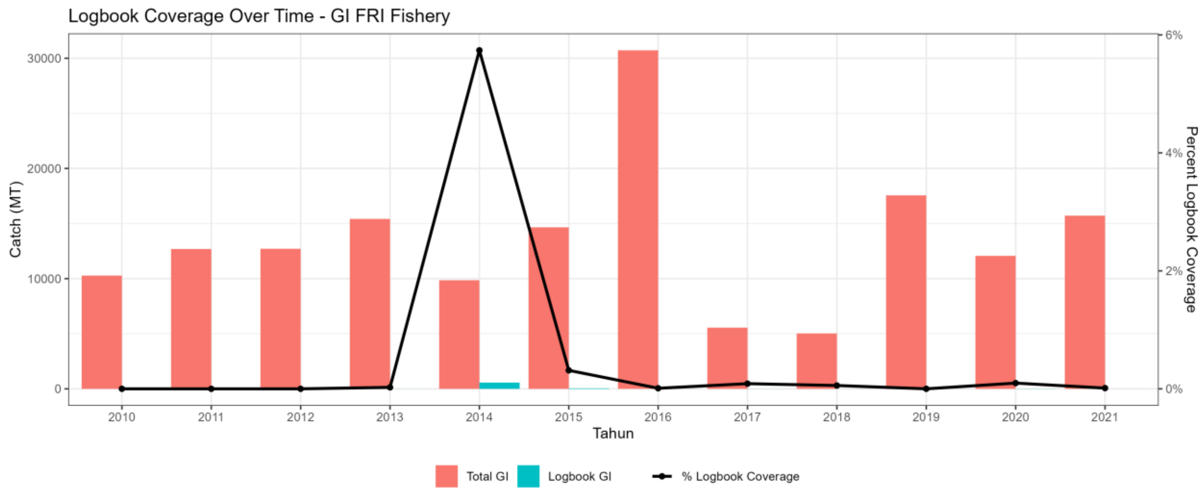
GI (Gillnet)

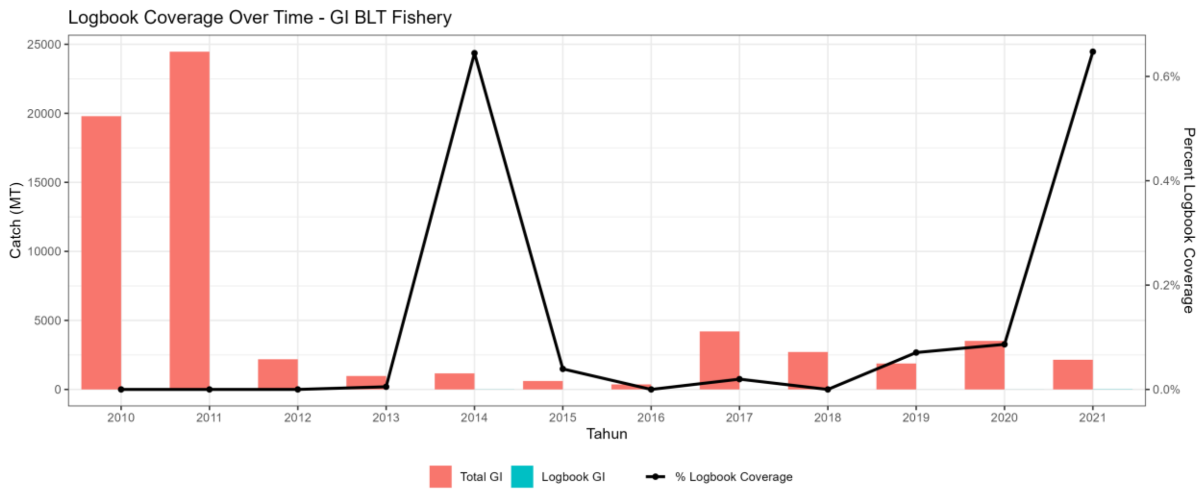

Logbook Coverage Over Time - GI ALB Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

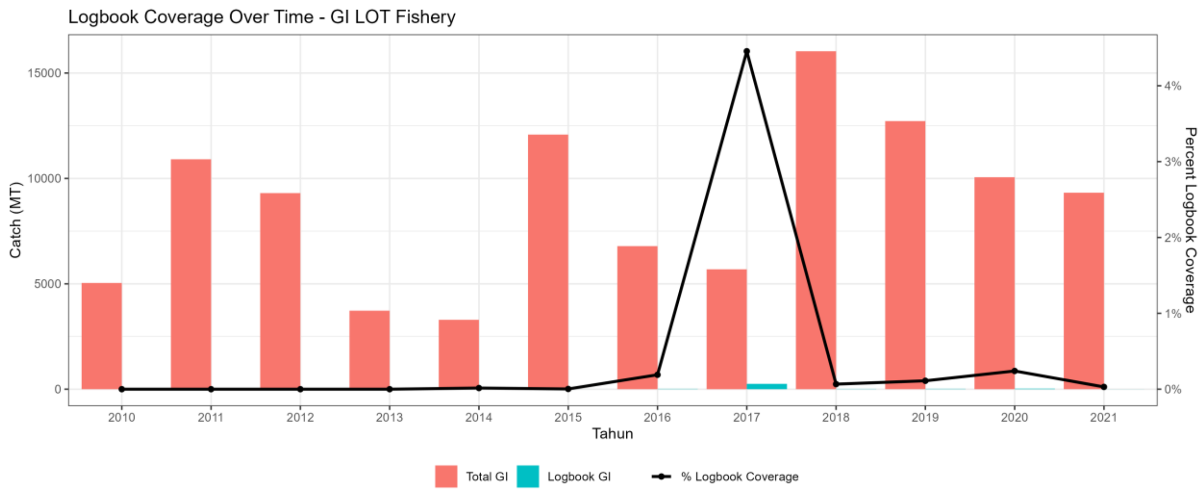

Logbook Coverage Over Time - GI BET Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

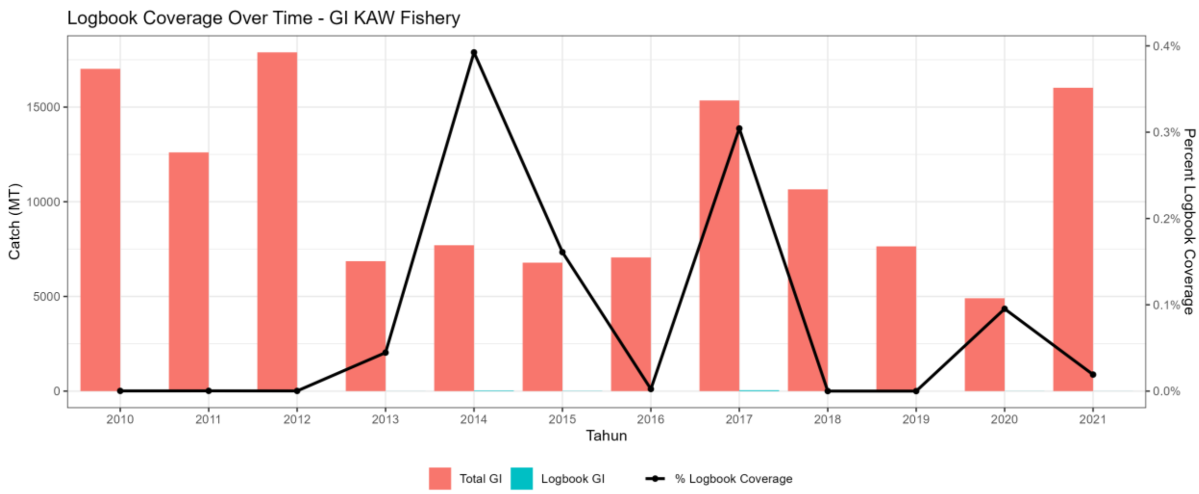

Logbook Coverage Over Time - GI YFT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

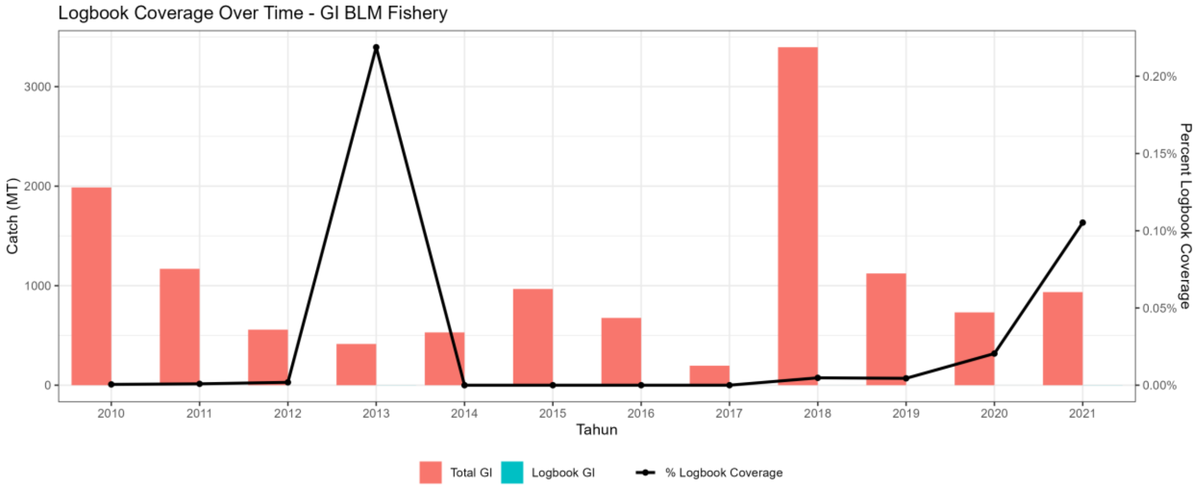

Logbook Coverage Over Time - GI SKJ Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

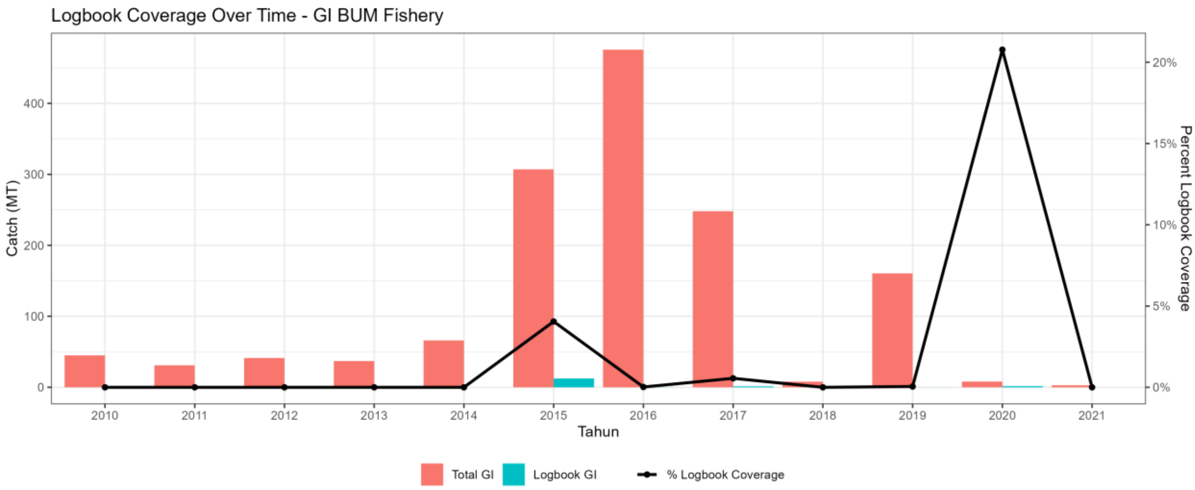

Logbook Coverage Over Time - GI FRI Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

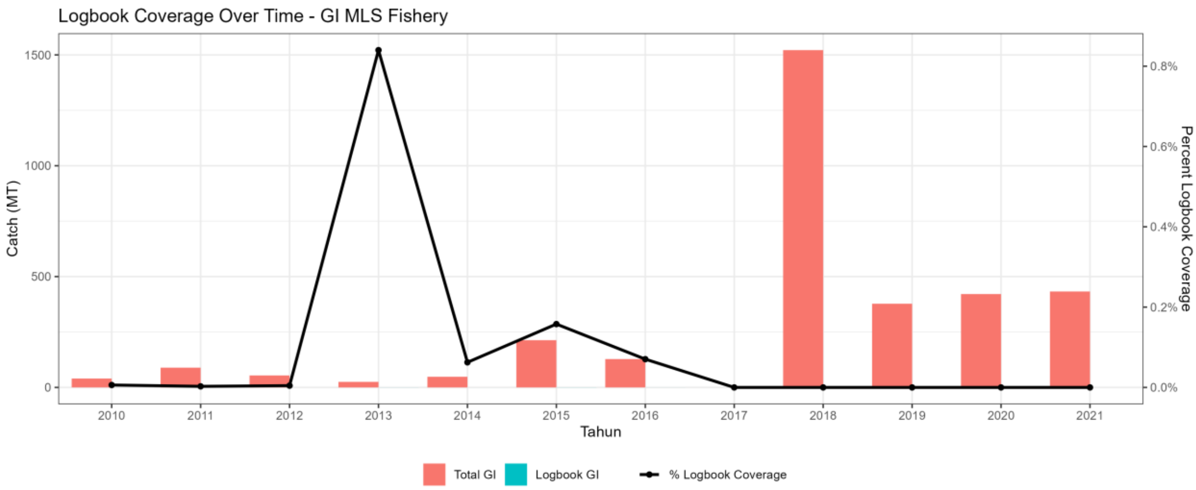

Logbook Coverage Over Time - GI BLT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

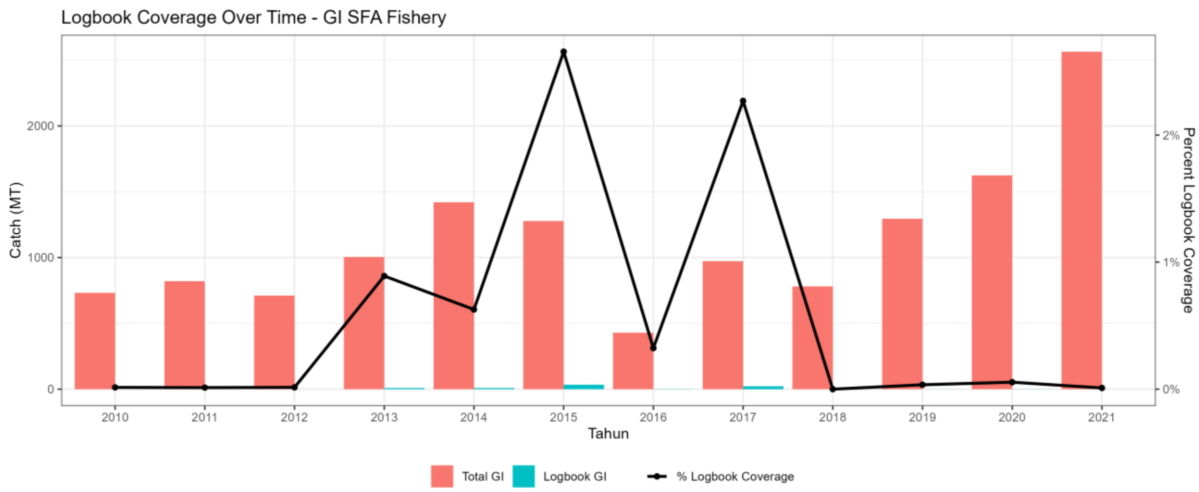

Logbook Coverage Over Time - GI LOT Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

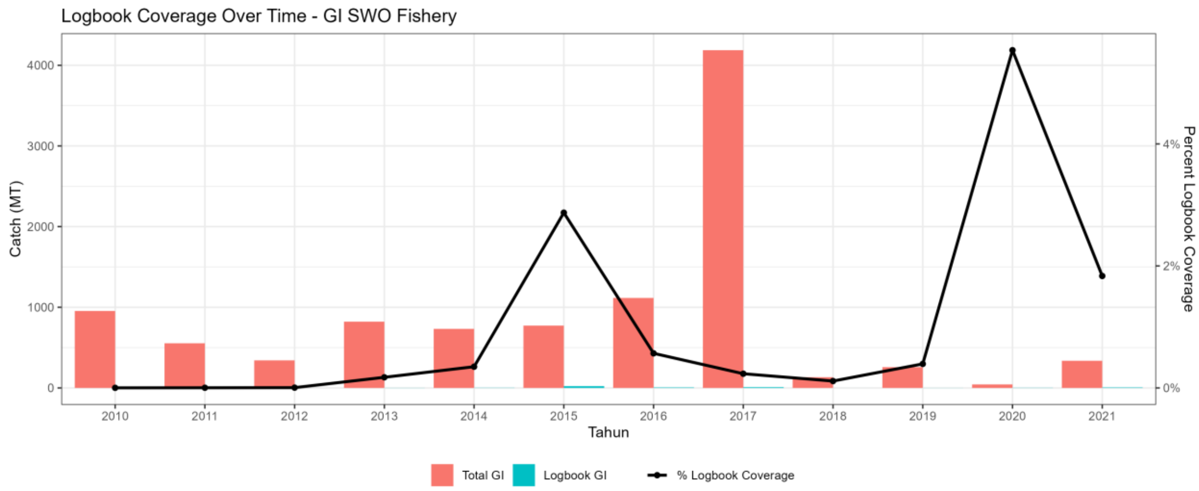

Logbook Coverage Over Time - GI KAW Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

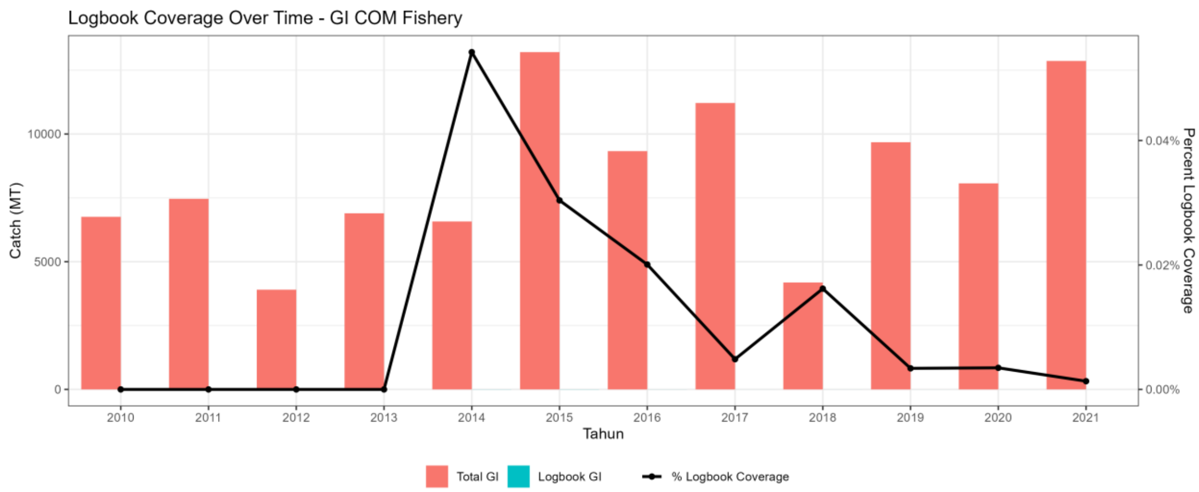

Logbook Coverage Over Time - GI BLM Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage

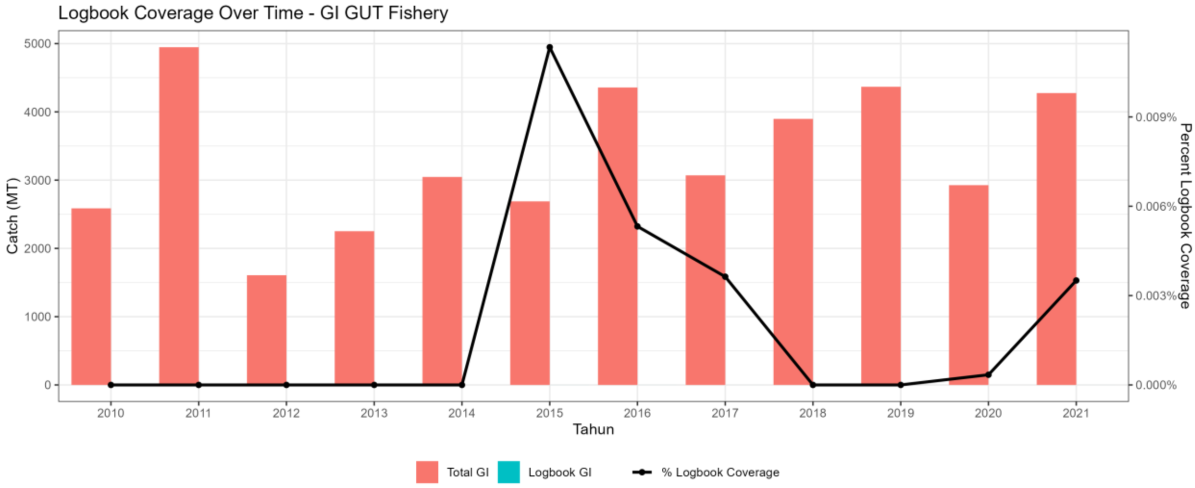

Logbook Coverage Over Time - GI BUM Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage


Logbook Coverage Over Time - GI MLS Fishery
Catch (MT)
Percent Logbook Coverage
Tahun
Total GI
Logbook GI
% Logbook Coverage


Logbook Coverage Over Time - GI SFA Fishery
Catch (MT)
Percent Logbook Coverage
2000
1000
0
2%
1%
0%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total GI
Logbook GI
% Logbook Coverage


Logbook Coverage Over Time - GI SWO Fishery
Catch (MT)
Percent Logbook Coverage
4000
3000
2000
1000
0
4%
2%
0%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total GI
Logbook GI
% Logbook Coverage


Logbook Coverage Over Time - GI COM Fishery
Catch (MT)
Percent Logbook Coverage
10000
5000
0
0.04%
0.02%
0.00%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total GI
Logbook GI
% Logbook Coverage



3.1.2. Port Landing (PIPP)

In the ease 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).

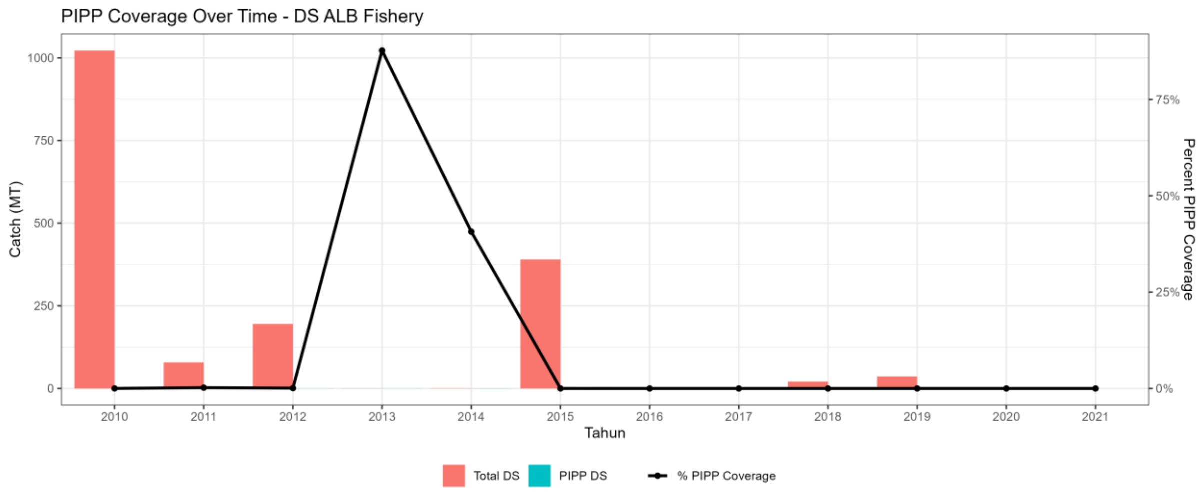
The fishing port information center is an information system that includes the collection, management, analysis, storage, presentation, and dissemination of fishing port data and information. It was built in 2019. Data and information on fishing ports are used to support the operations of fishing ports,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

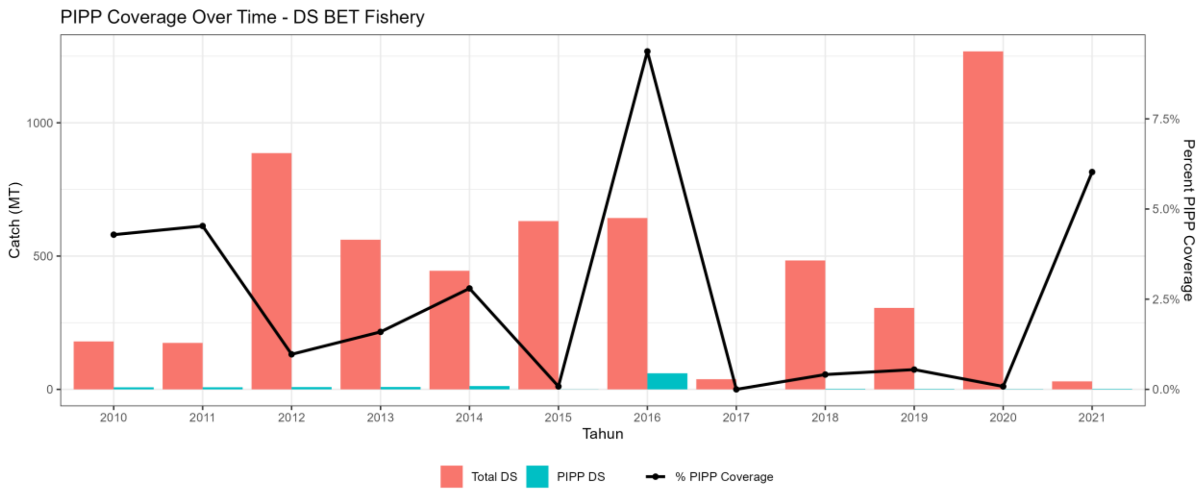
PIPP covers data and information of fishing port facilities, daily, monthly, and annual operational data of fishing ports, which contain the frequency of vessel's arrival, fish production and prices, fishing gear, logistics, marketing, and labor in the form of daily data that can be accumulated in the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

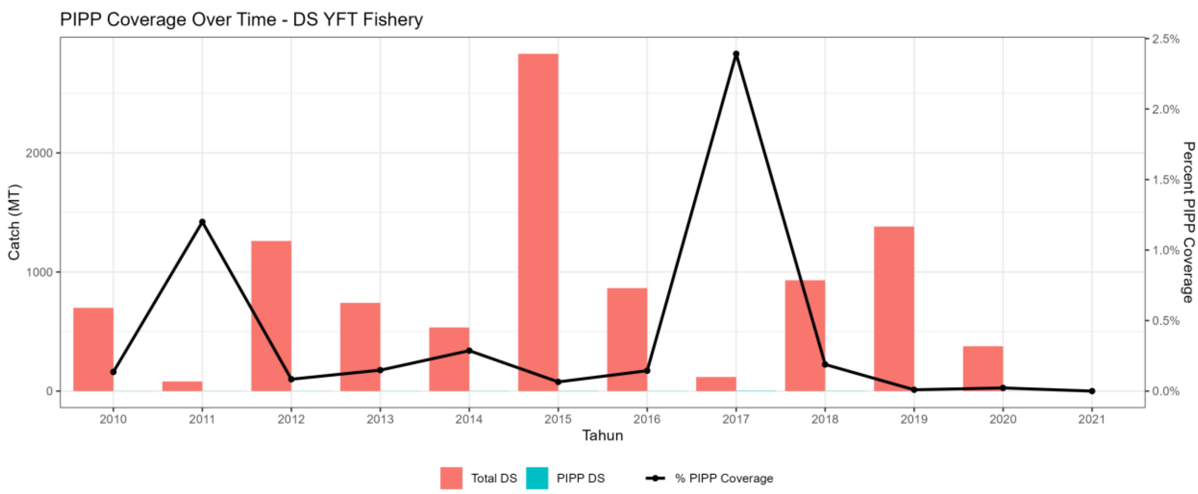
Based on the Decree of the Minister of Marine Affairs and Fisheries Number 6 of 2018 concerning the National Fishing Port Master Plan, there are 538 fishing ports in Indonesia whose operational data and facilities are expected to be entered in the Fishing Port Information Center (PIPP) digitally that can be easily accessed and processed into the update and valid information for the development of capture fisheries, especially in fishing ports. There are 205 fishing ports which joined in the PIPP. The PIPP website can be accessed on the www.pipp.djpt.kkp.go.id page.
In 2019, the number of fishing ports which applied PIPP was 149 fishing ports, while in 2020 was 192 fishing ports and it continues increasing in 2021 as many as 205 fishing ports. The number of fishing vessels recorded in 2019 was 13,698 with size less than 30 GT and 2,944 with size above 30 GT. In 2020 , there were 14,679 vessels with size less than 30 GT and 3,218 vessels with size above 30 GT, while in 2021, there were 17,181 vessels with size less than 30 GT and 4,109 vessels with size above 30 GT.

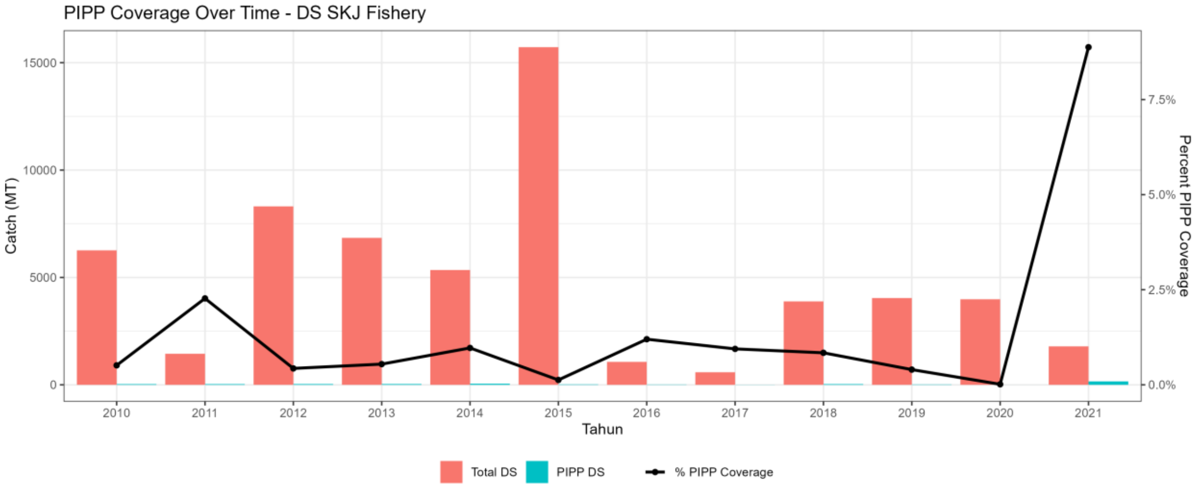
The coverage of port landing (PIPP)

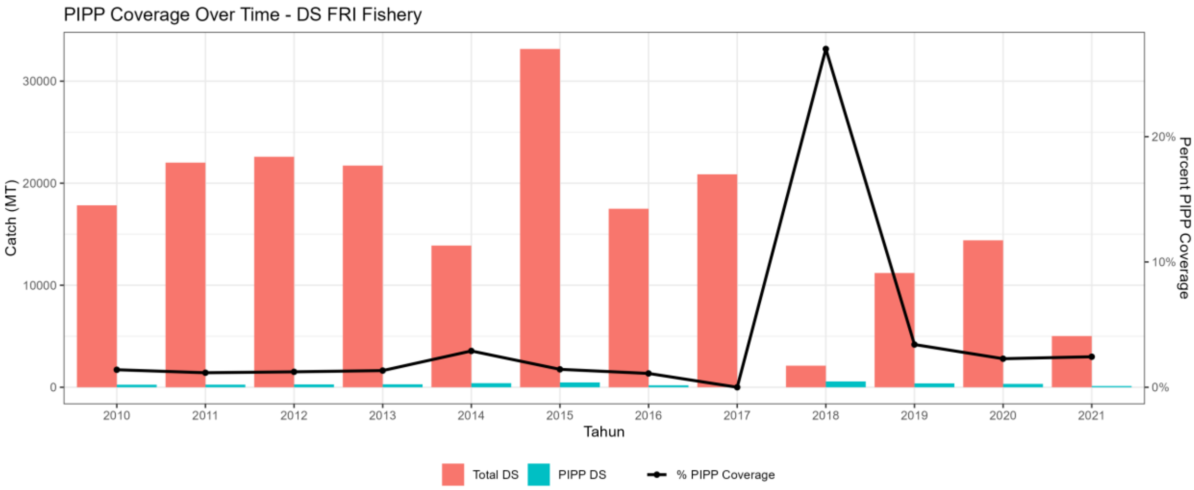
DS (Danish seine)

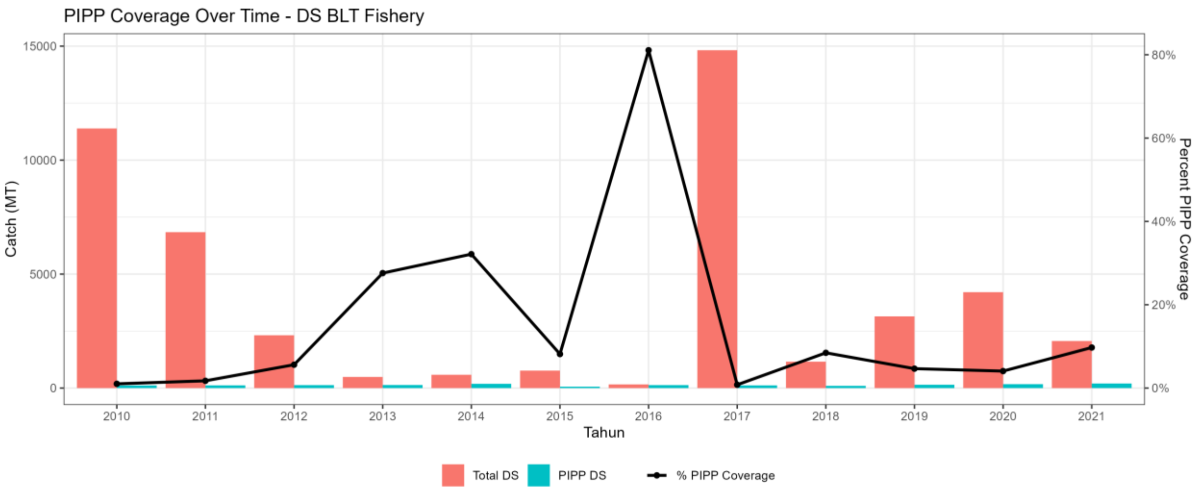


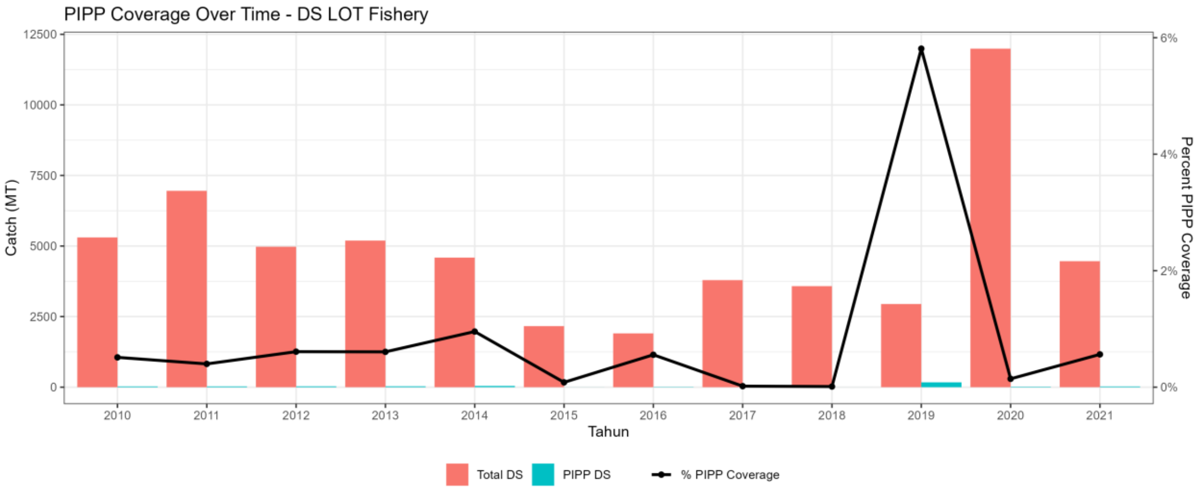


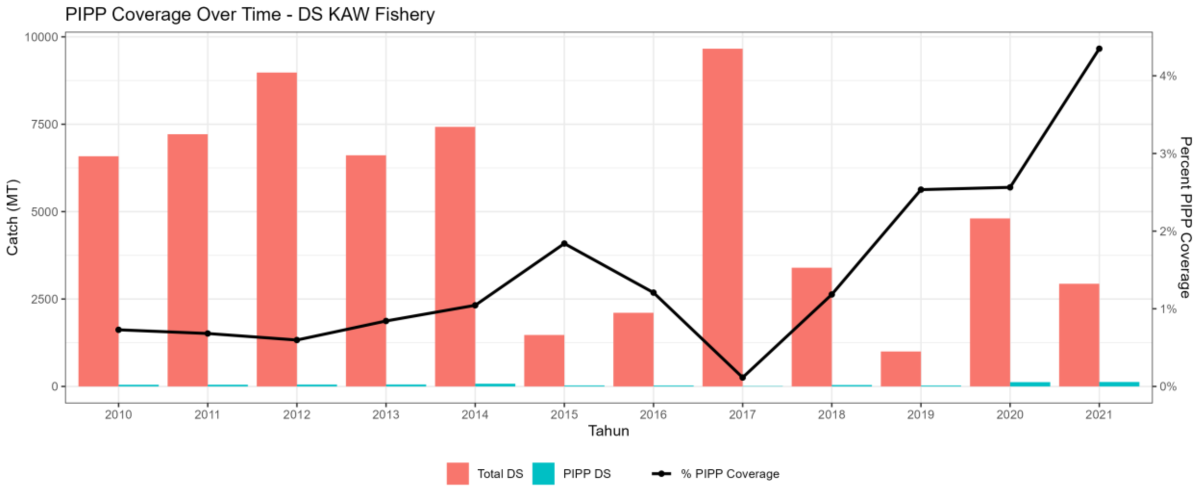


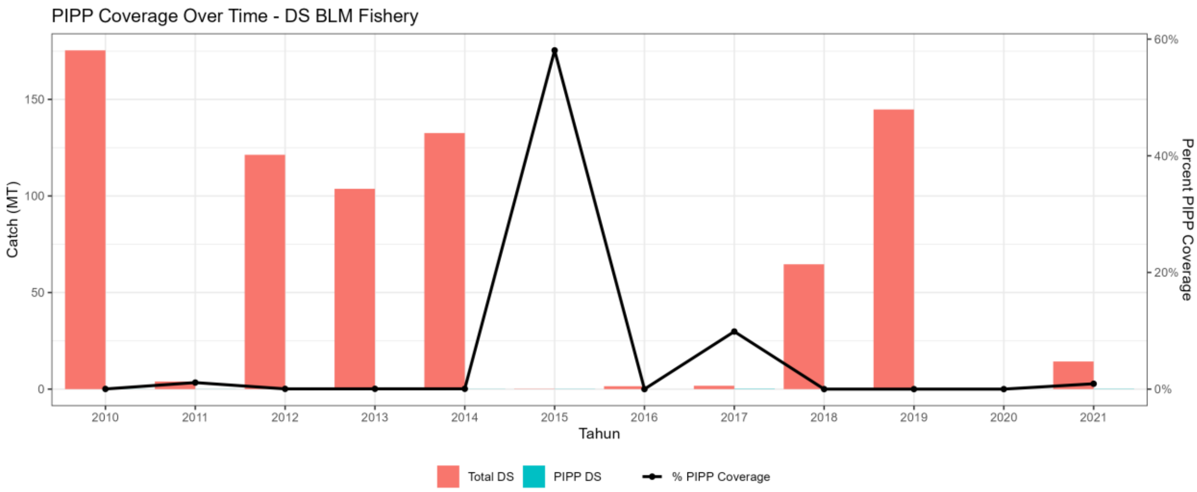

PIPP Coverage Over Time - DS SKJ Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

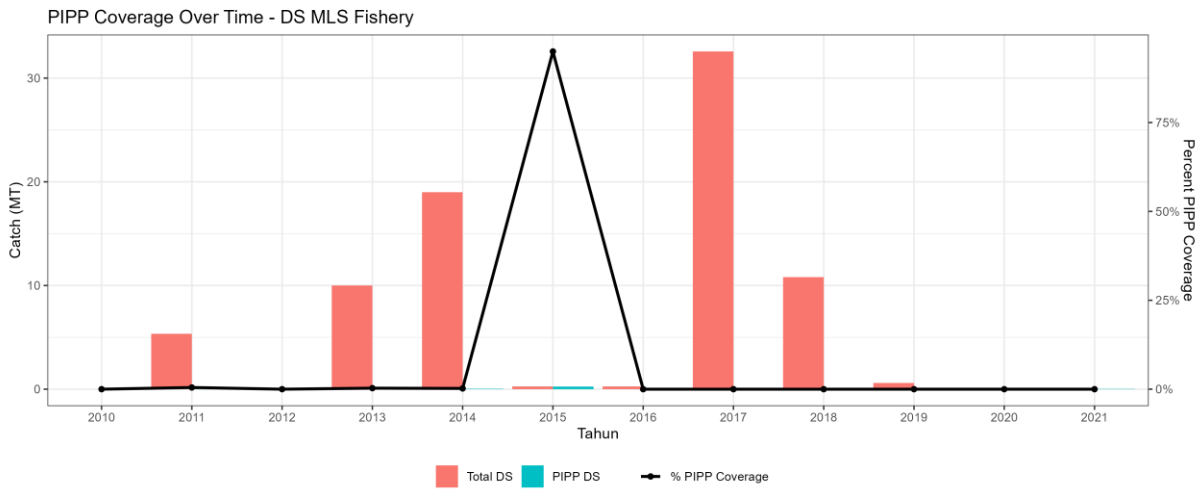

PIPP Coverage Over Time - DS FRI Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

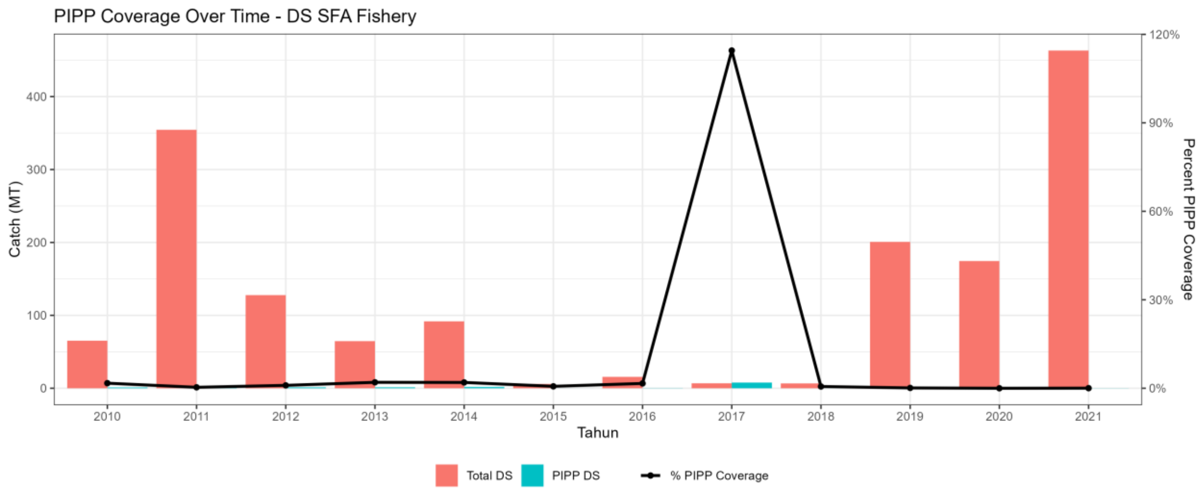

PIPP Coverage Over Time - DS BLT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

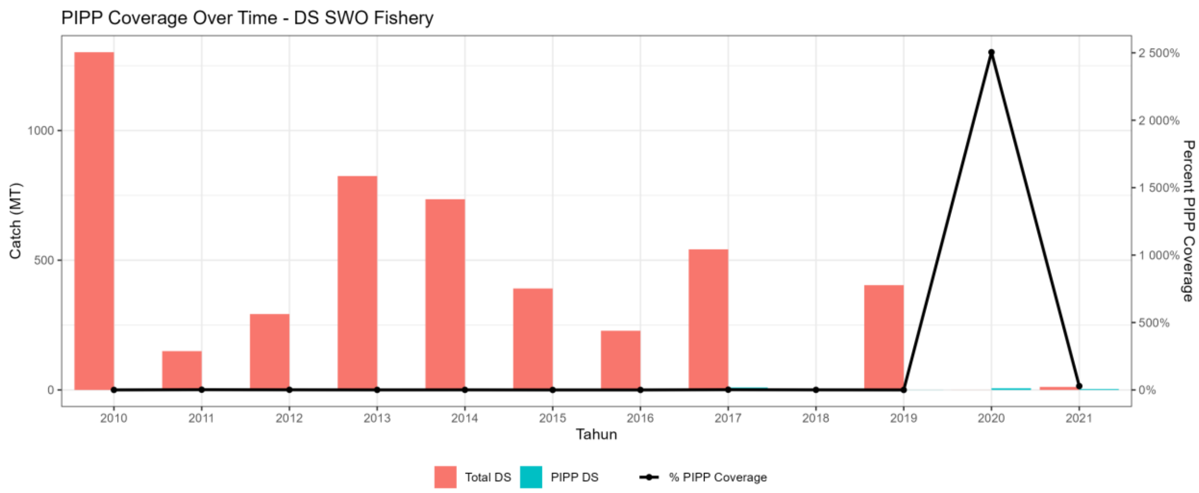

PIPP Coverage Over Time - DS LOT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

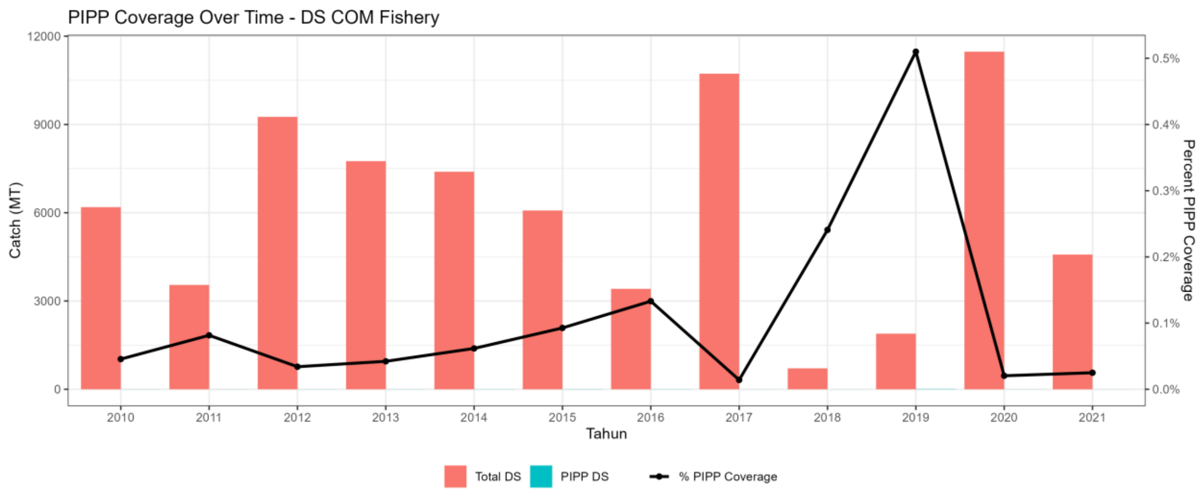

PIPP Coverage Over Time - DS KAW Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

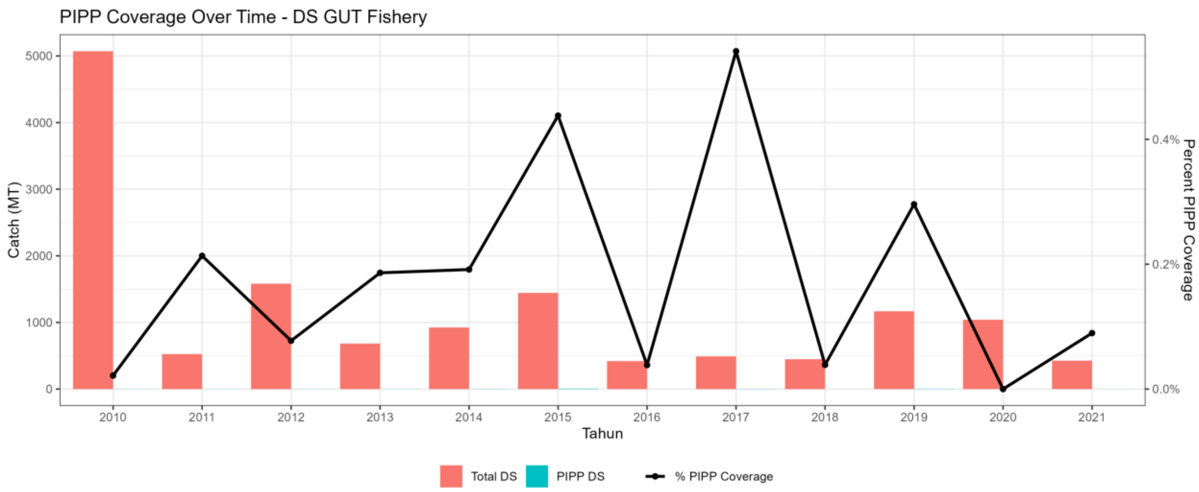

PIPP Coverage Over Time - DS BLM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage


PIPP Coverage Over Time - DS MLS Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

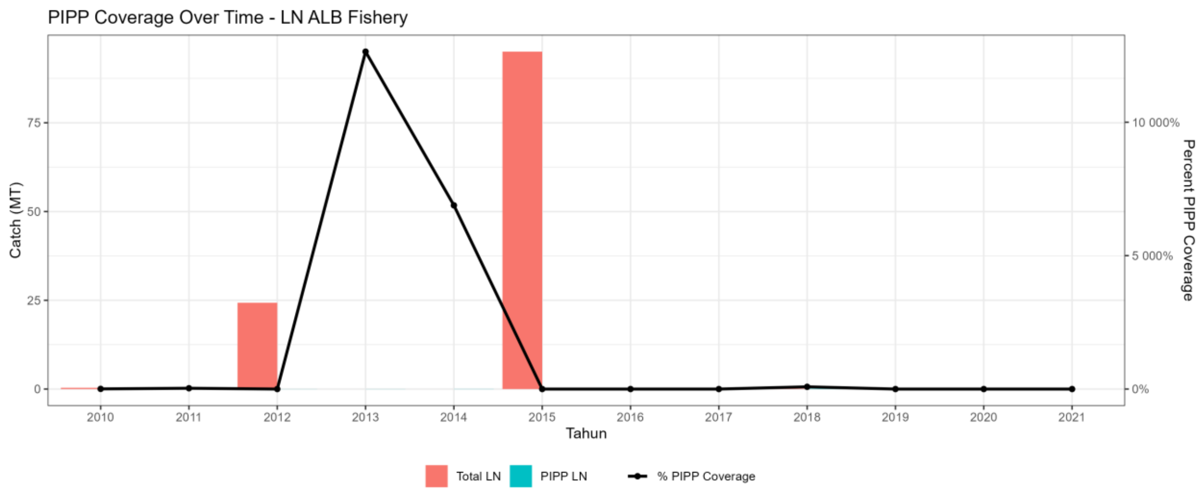

PIPP Coverage Over Time - DS SFA Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

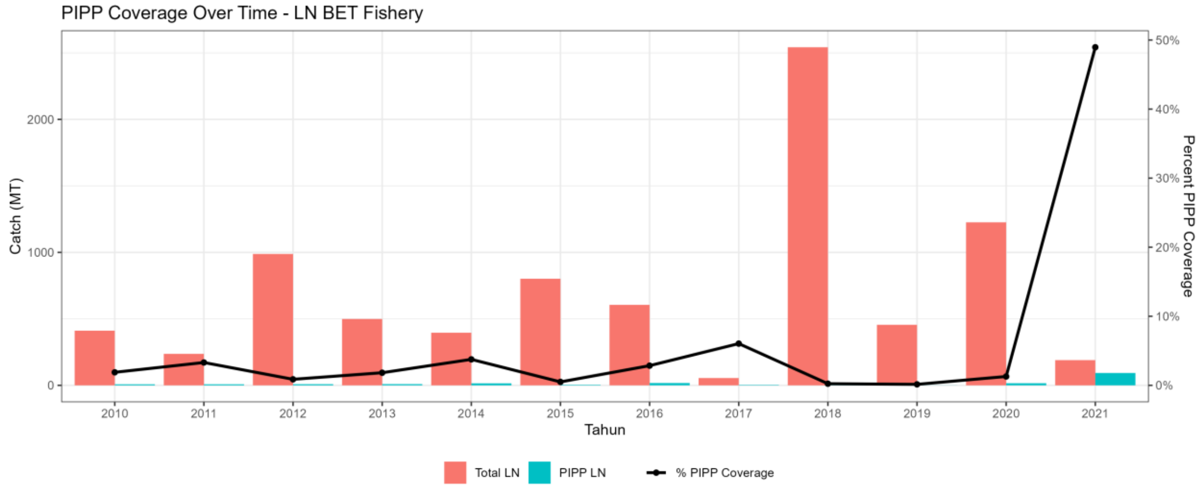

PIPP Coverage Over Time - DS SWO Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

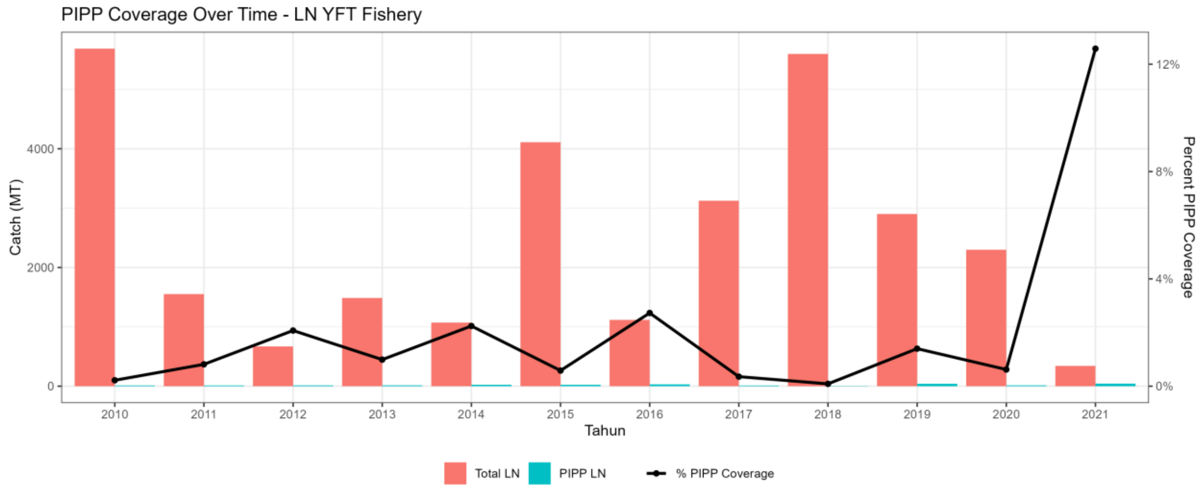

PIPP Coverage Over Time - DS COM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

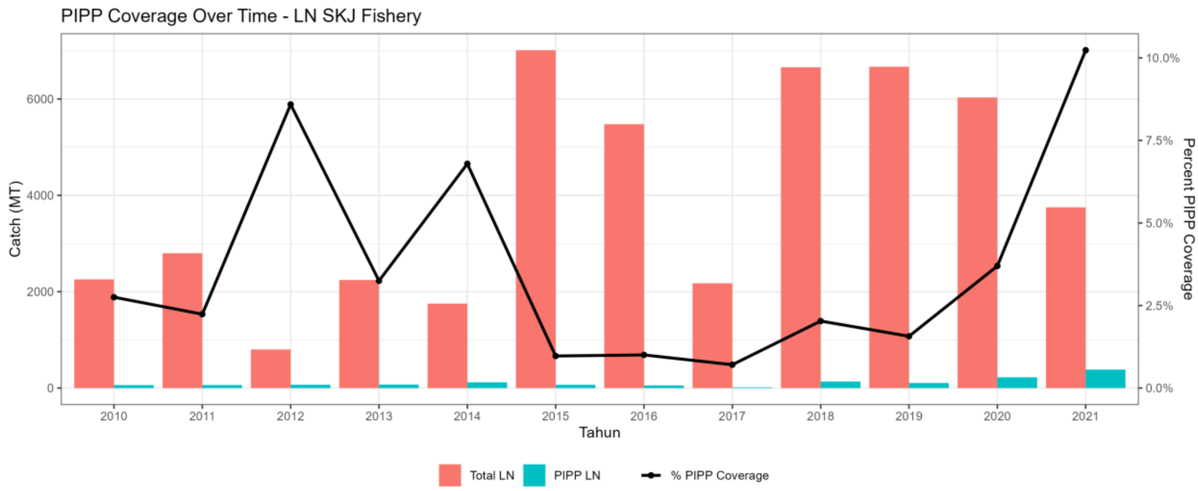

PIPP Coverage Over Time - DS GUT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total DS
PIPP DS
% PIPP Coverage

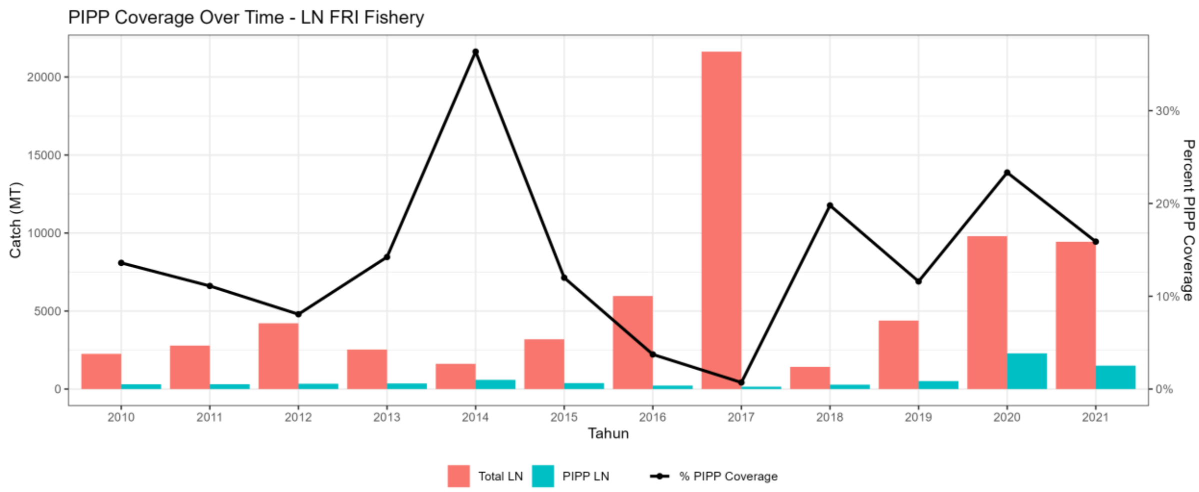
LN (Liftnet)

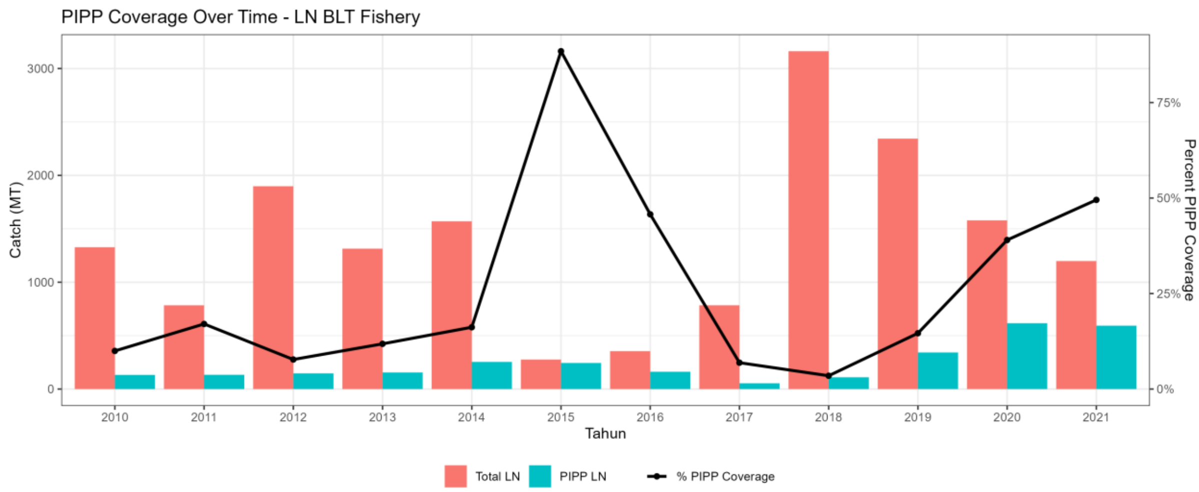

PIPP Coverage Over Time - LN ALB Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

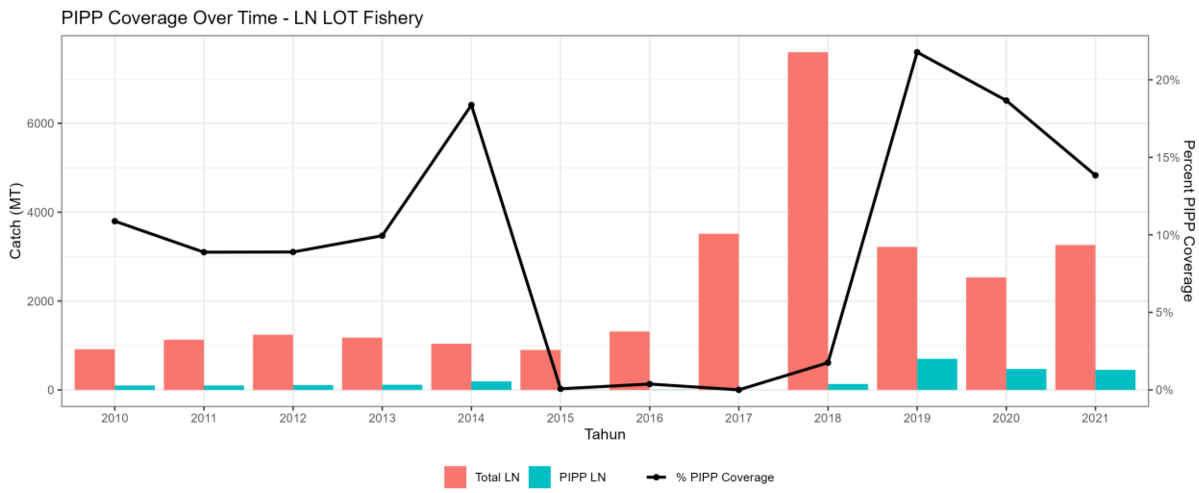

PIPP Coverage Over Time - LN BET Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

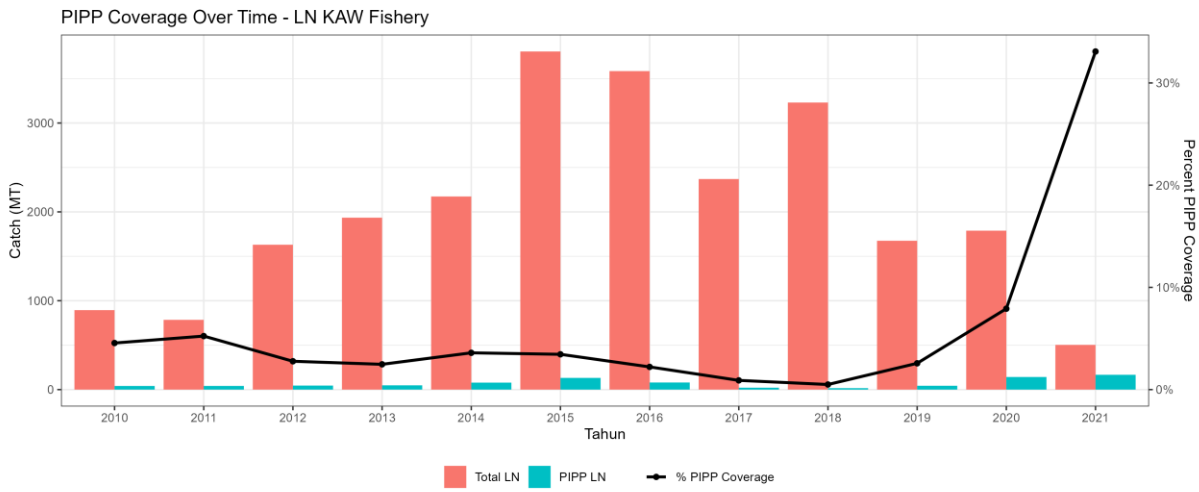

PIPP Coverage Over Time - LN YFT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

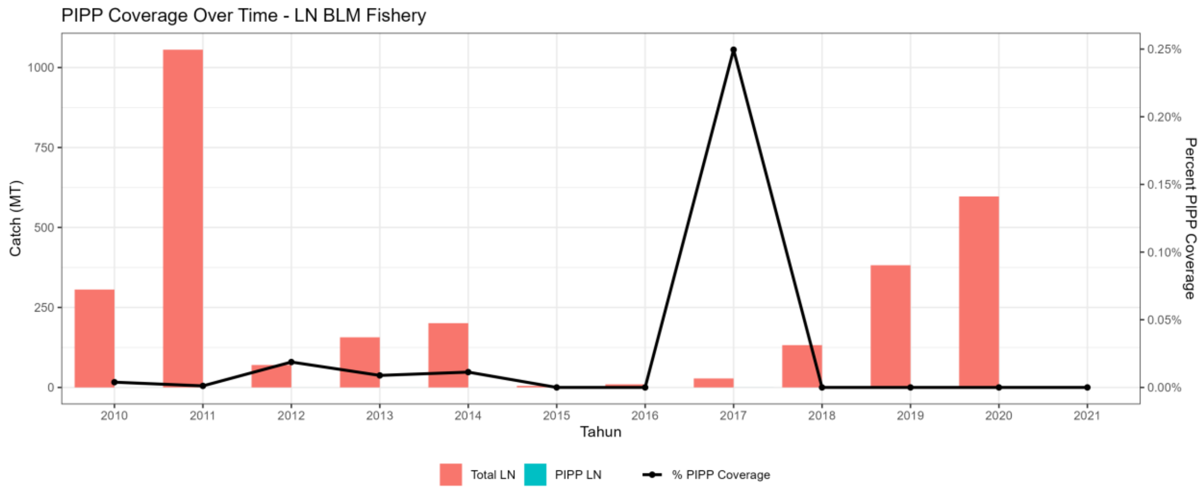

PIPP Coverage Over Time - LN SKJ Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

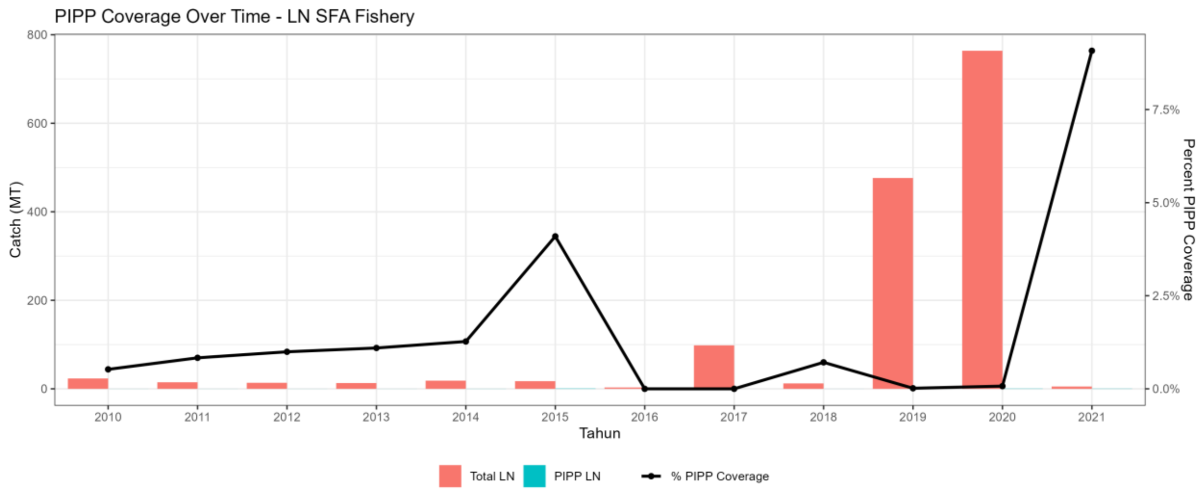

PIPP Coverage Over Time - LN FRI Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

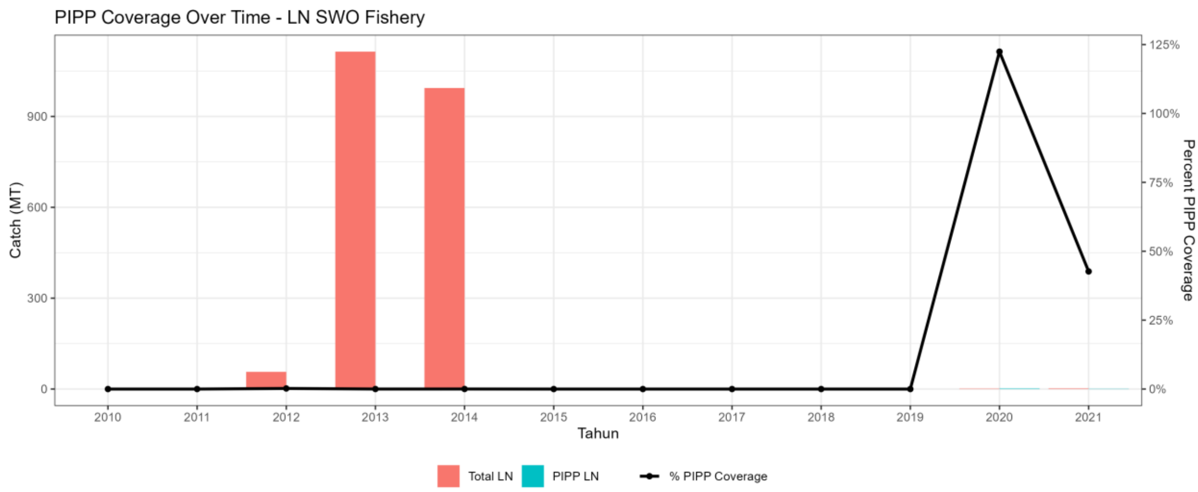

PIPP Coverage Over Time - LN BLT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

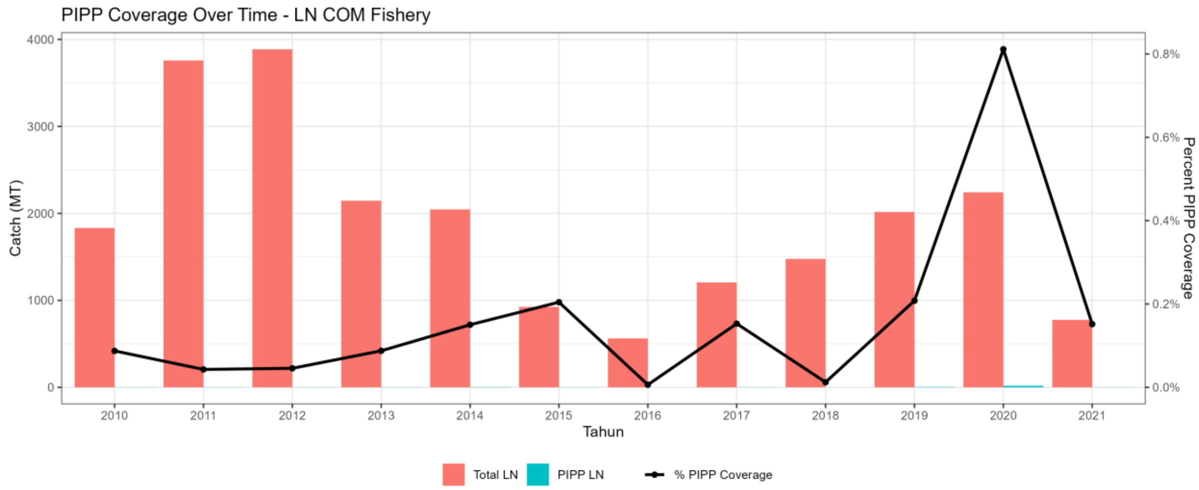

PIPP Coverage Over Time - LN LOT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

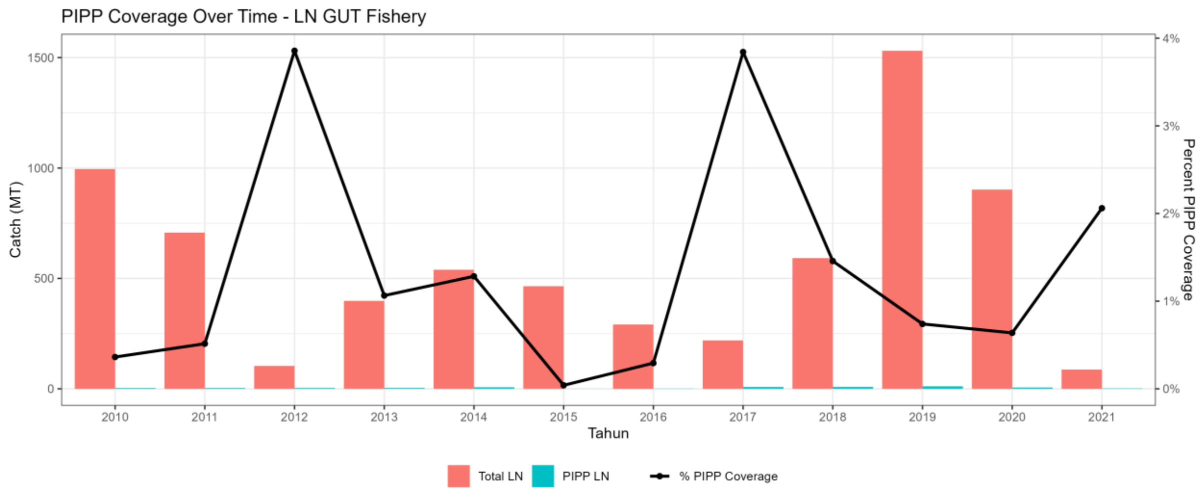

PIPP Coverage Over Time - LN KAW Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage


PIPP Coverage Over Time - LN BLM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

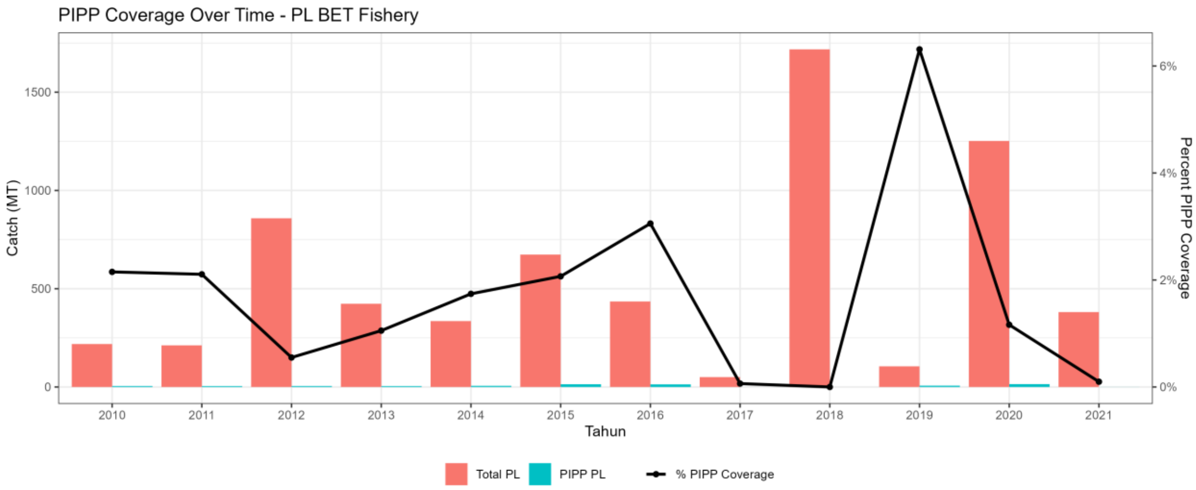

PIPP Coverage Over Time - LN SFA Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total LN
PIPP LN
% PIPP Coverage

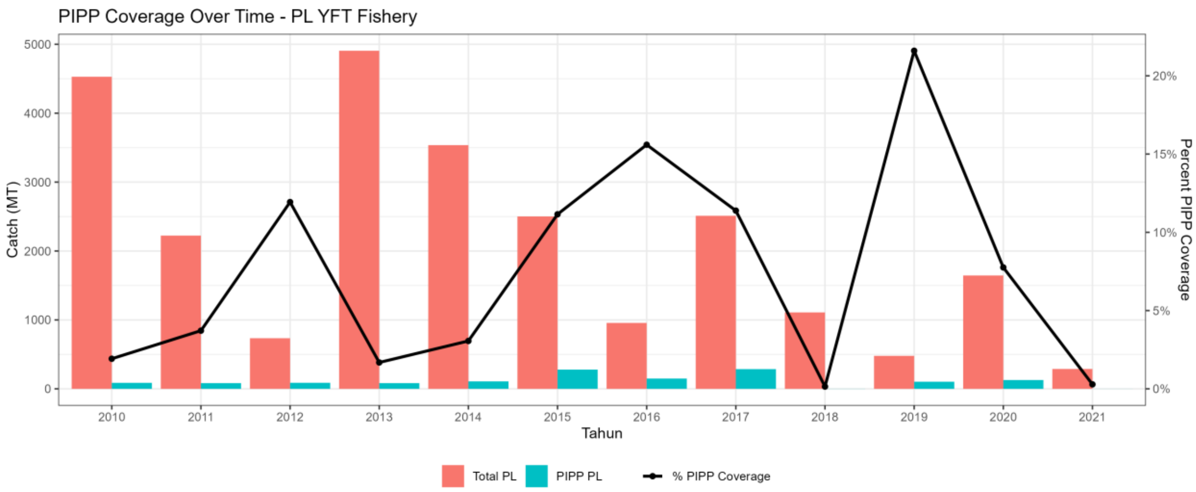

PIPP Coverage Over Time - LN SWO Fishery
Catch (MT)
0
300
600
900
Percent PIPP Coverage
0%
25%
50%
75%
100%
125%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total LN
PIPP LN
% PIPP Coverage

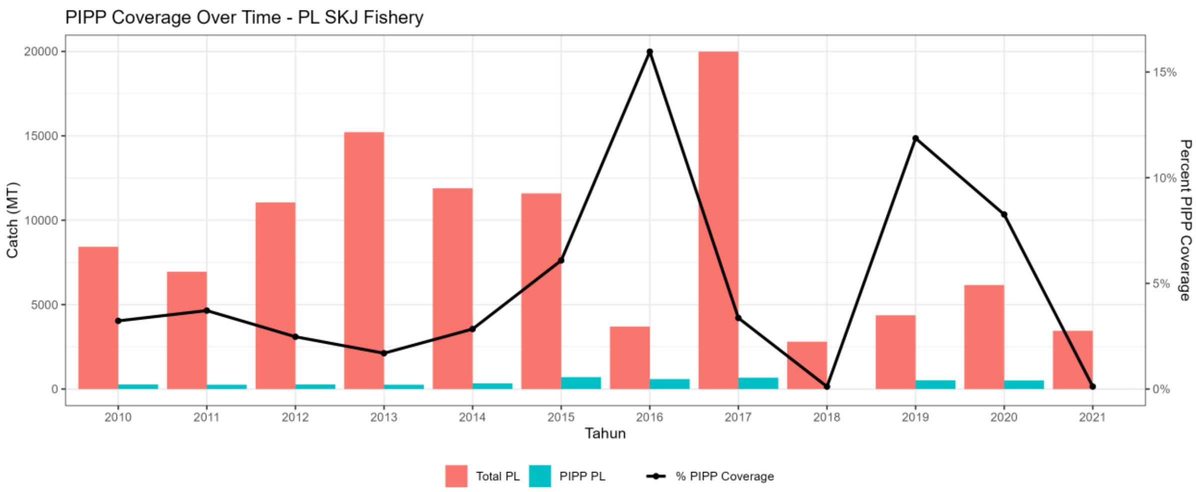

PIPP Coverage Over Time - LN COM Fishery
Catch (MT)
0
1000
2000
3000
4000
Percent PIPP Coverage
0.0%
0.2%
0.4%
0.6%
0.8%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total LN
PIPP LN
% PIPP Coverage

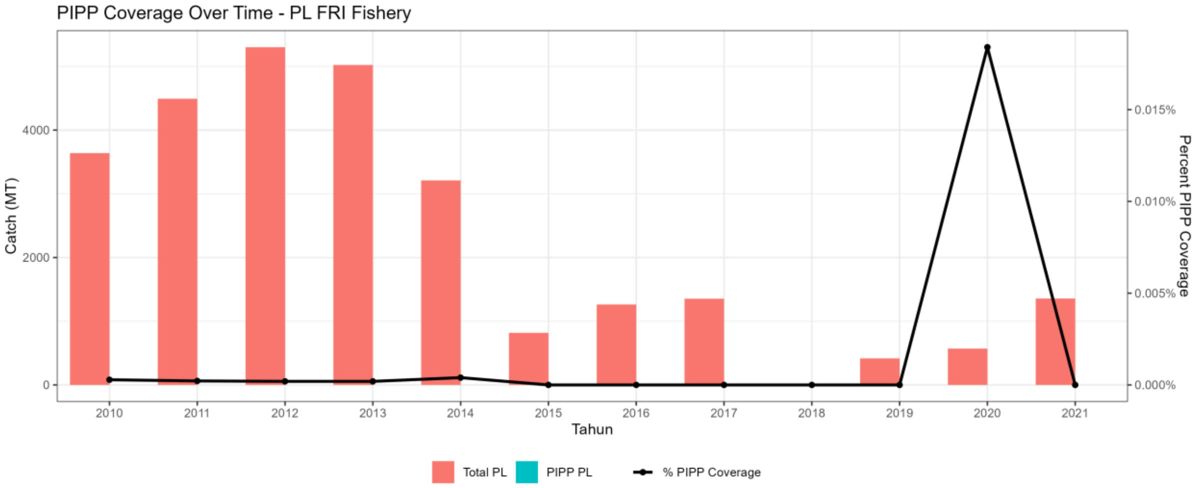

PIPP Coverage Over Time - LN GUT Fishery
Catch (MT)
0
500
1000
1500
Percent PIPP Coverage
0%
1%
2%
3%
4%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total LN
PIPP LN
% PIPP Coverage

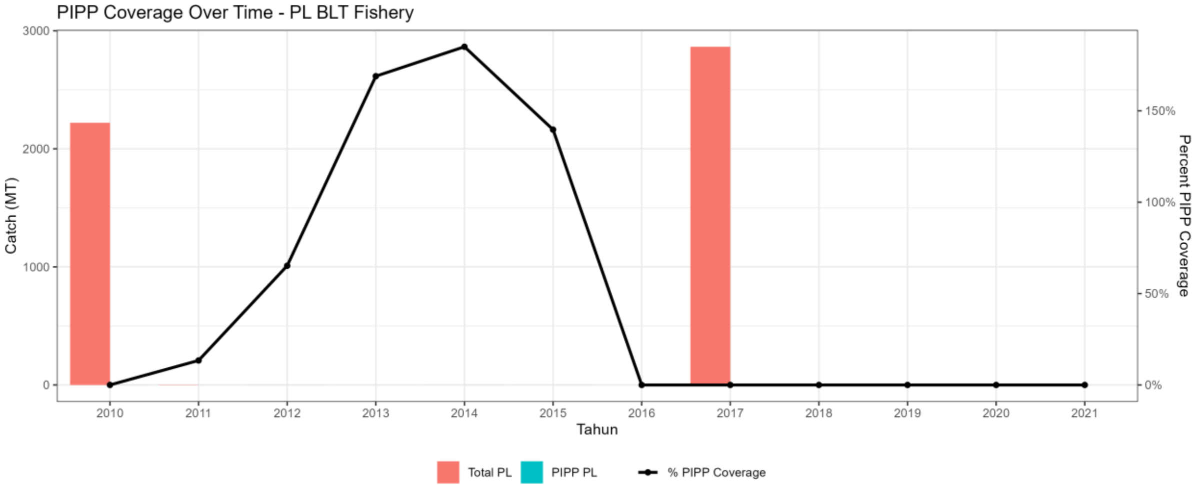
PL (Pole and line)

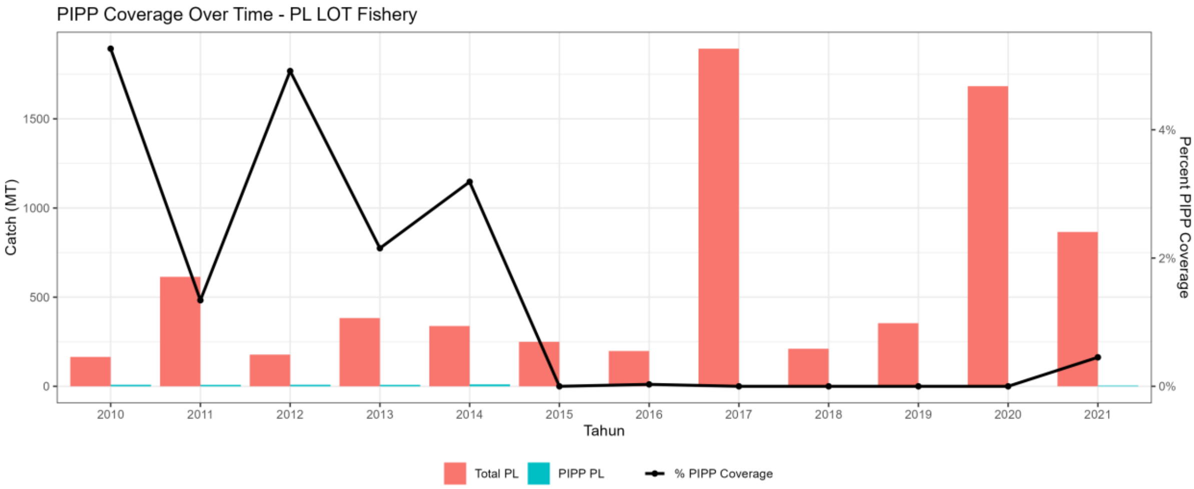


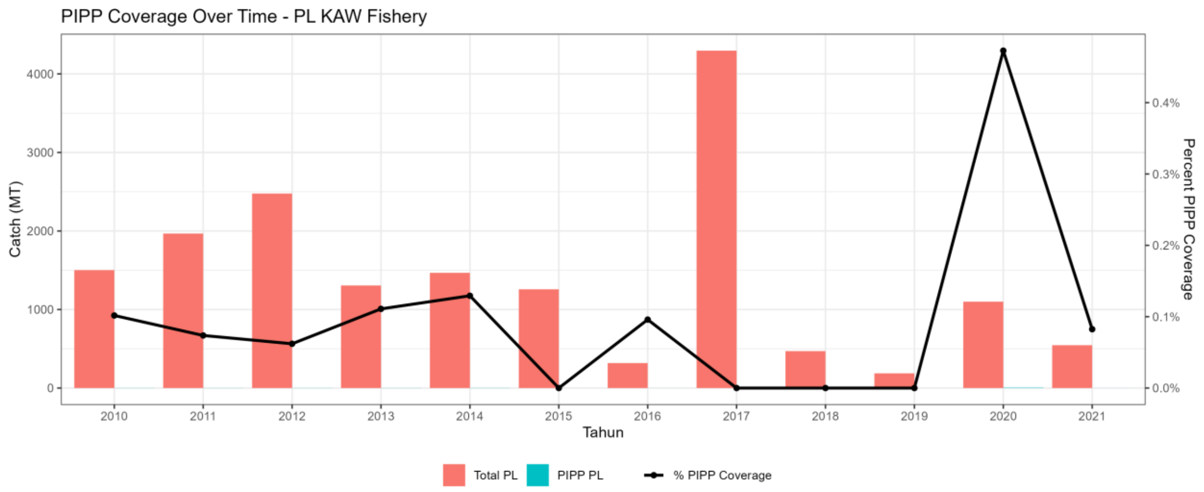


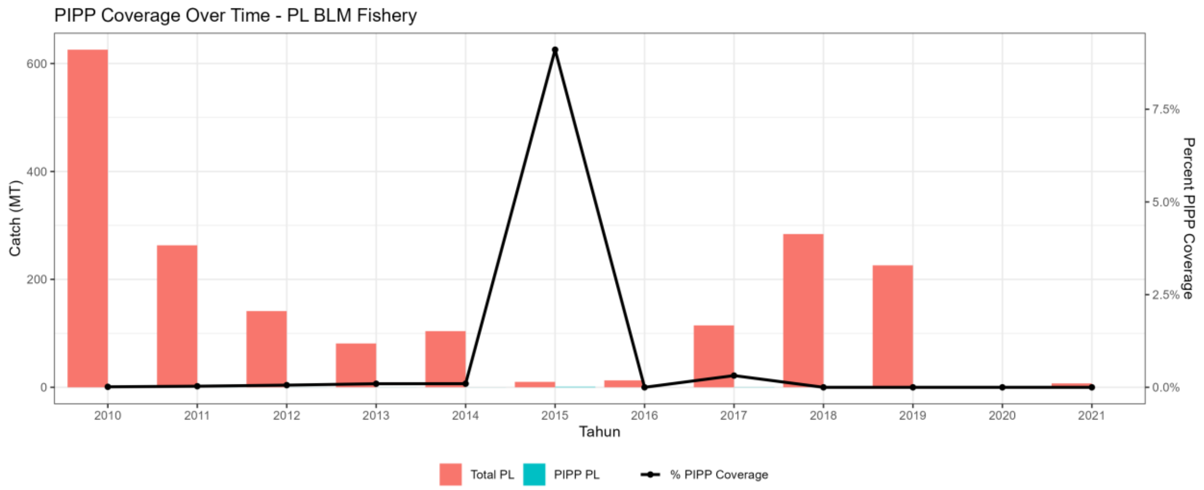


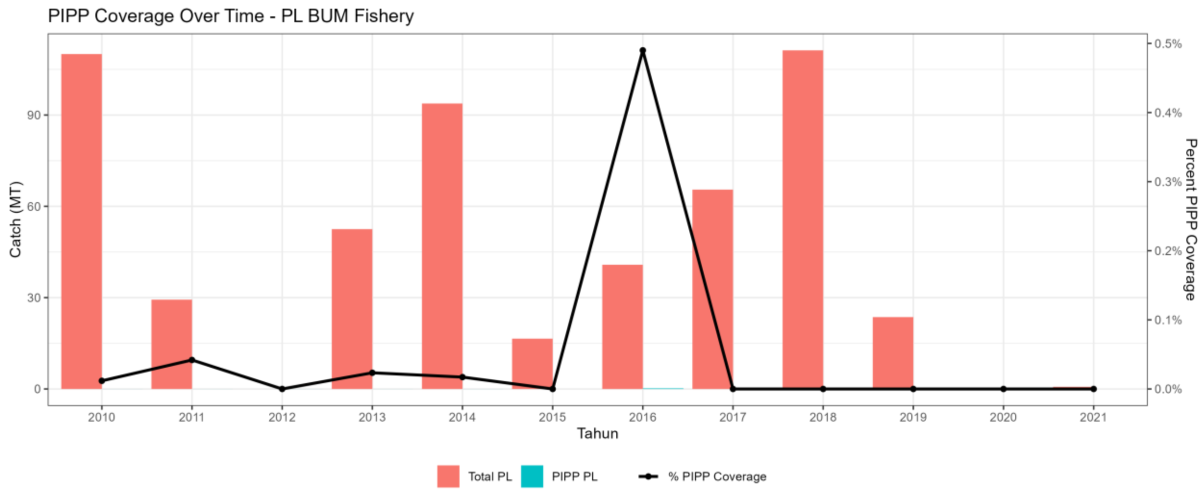

PIPP Coverage Over Time - PL FRI Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

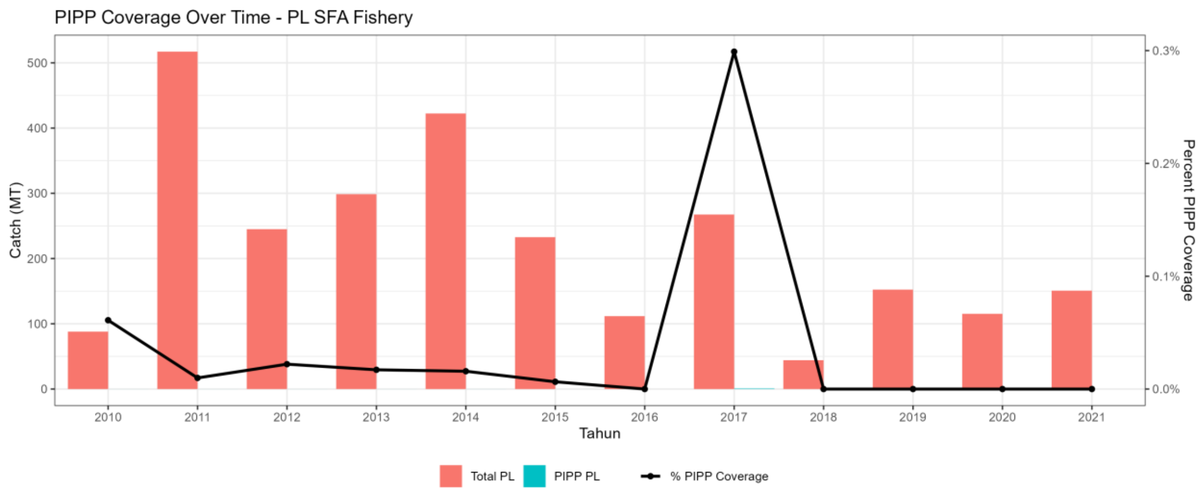

PIPP Coverage Over Time - PL BLT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

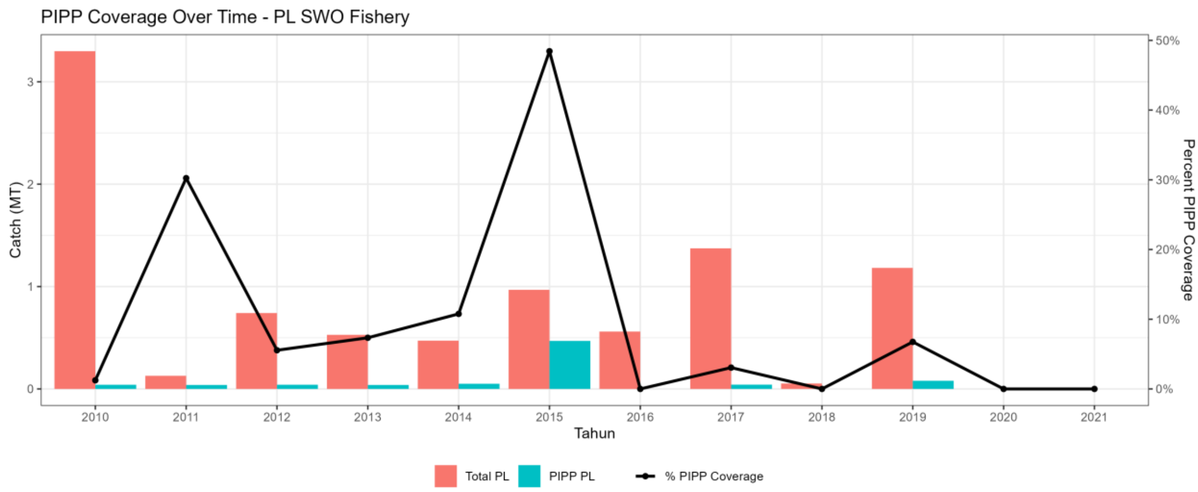

PIPP Coverage Over Time - PL LOT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

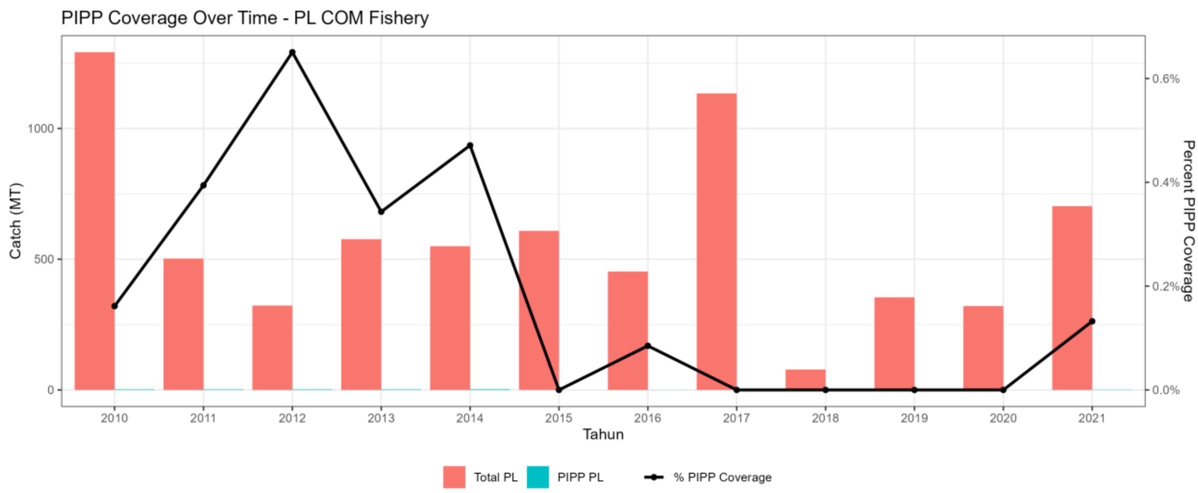

PIPP Coverage Over Time - PL KAW Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage


PIPP Coverage Over Time - PL BLM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

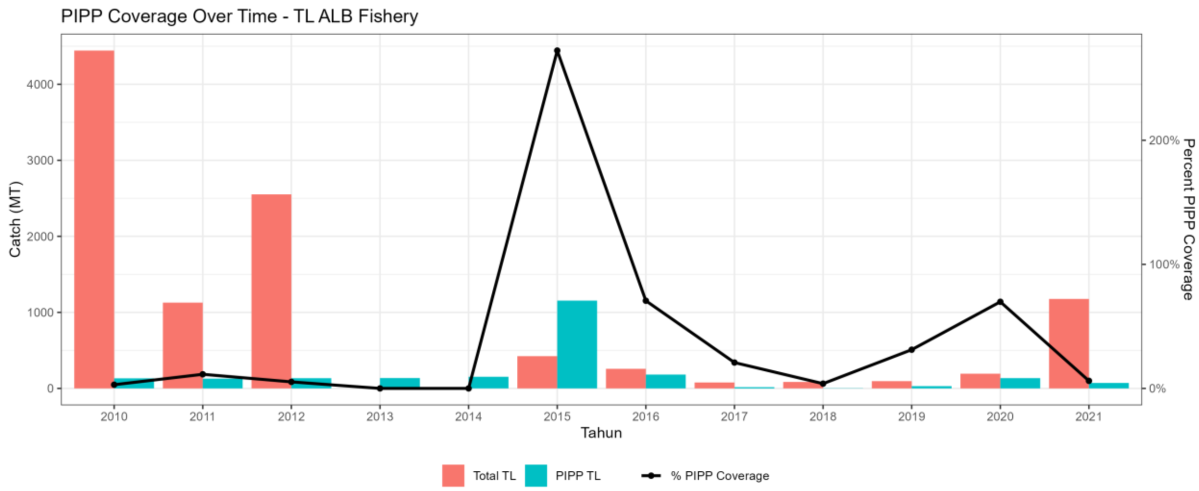

PIPP Coverage Over Time - PL BUM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

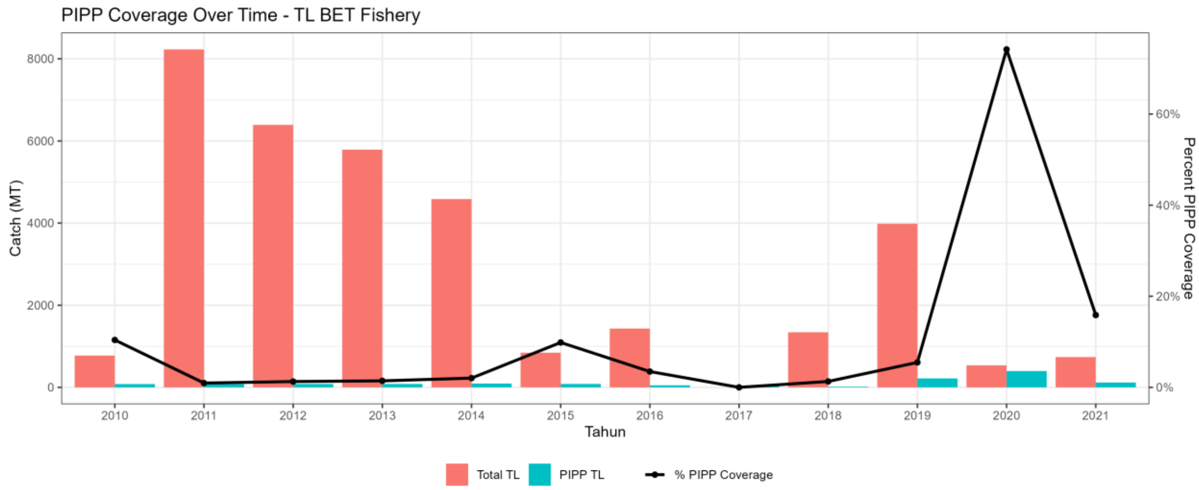

PIPP Coverage Over Time - PL SFA Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

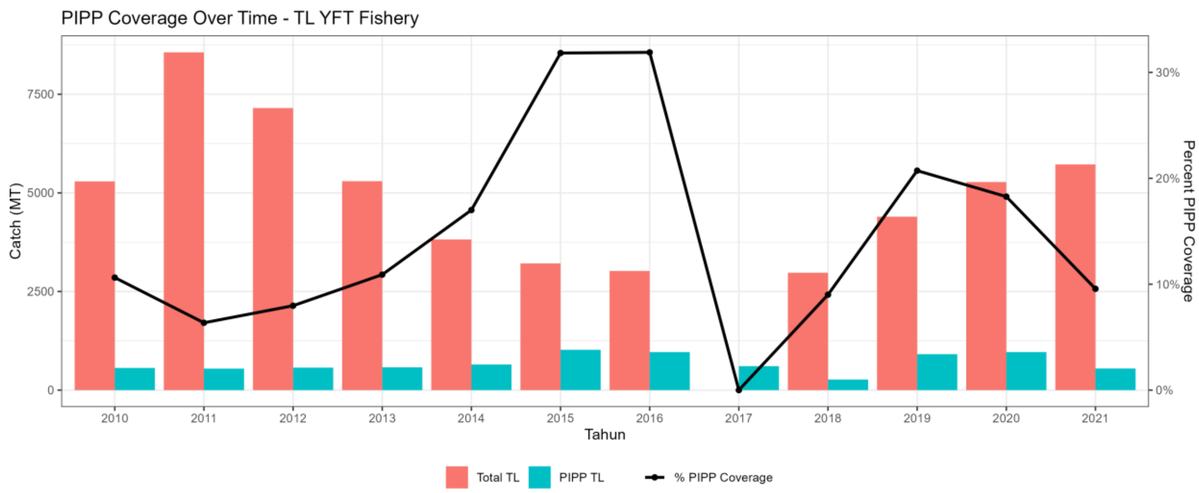

PIPP Coverage Over Time - PL SWO Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

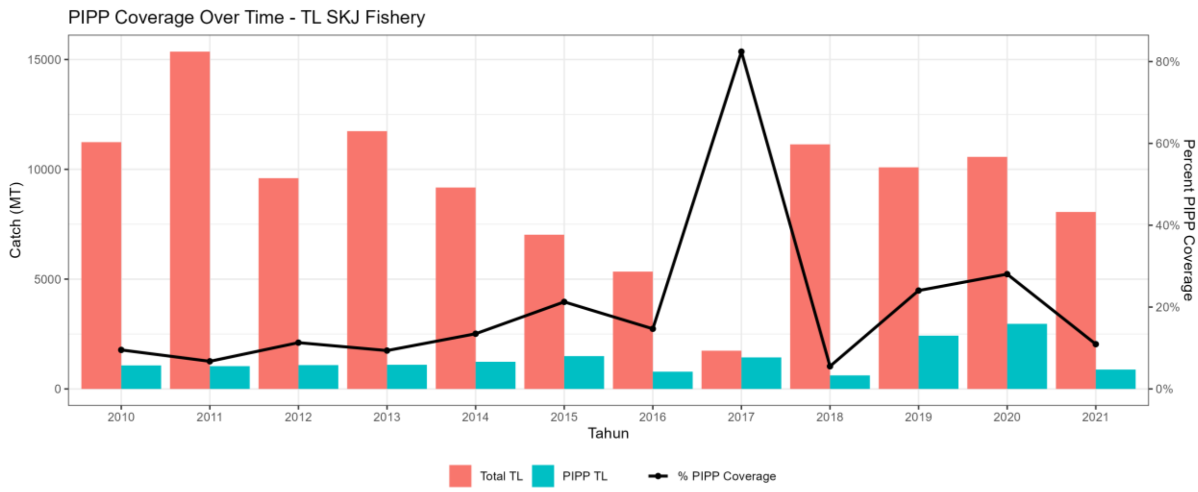

PIPP Coverage Over Time - PL COM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total PL
PIPP PL
% PIPP Coverage

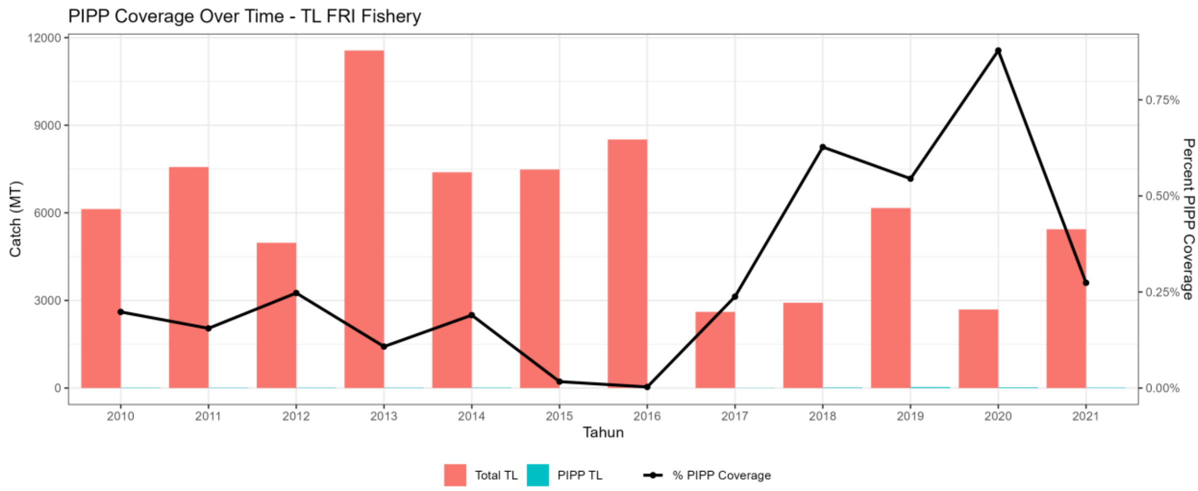
TL (Trolling)

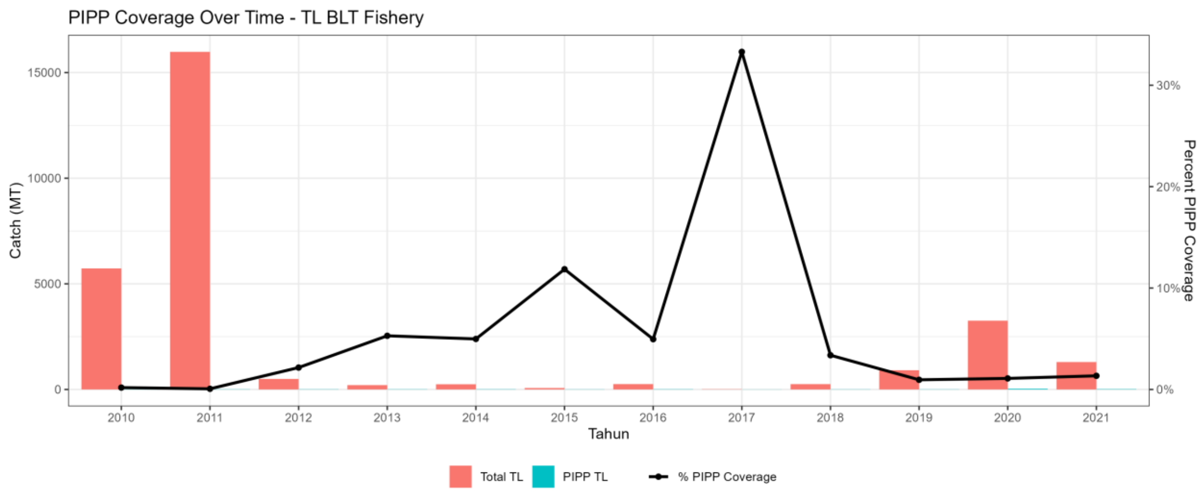

PIPP Coverage Over Time - TL ALB Fishery
Catch (MT)
4000
3000
2000
1000
0
200%
100%
0%
Percent PIPP Coverage
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total TL
PIPP TL
% PIPP Coverage

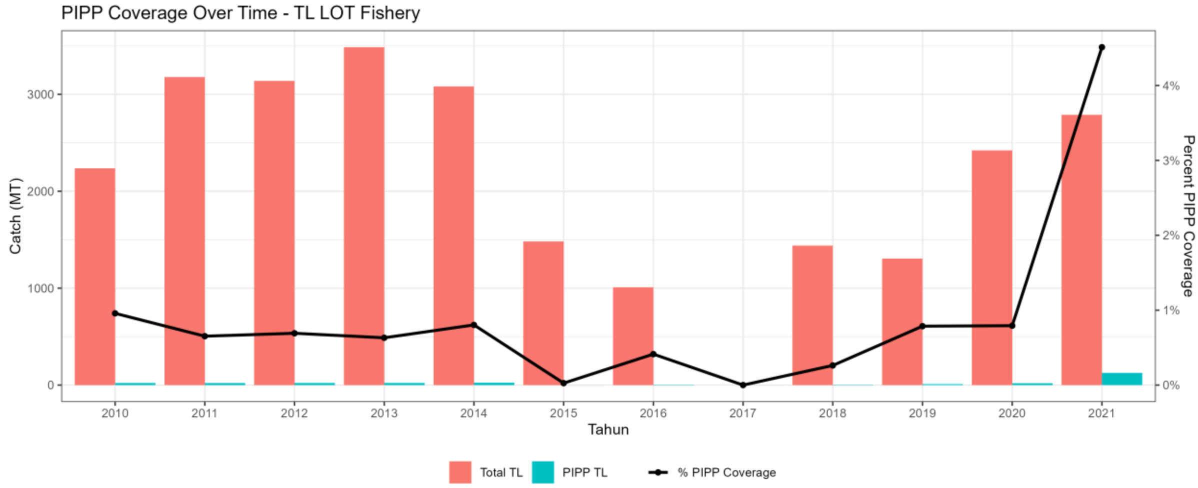

PIPP Coverage Over Time - TL BET Fishery
Catch (MT)
8000
6000
4000
2000
0
60%
40%
20%
0%
Percent PIPP Coverage
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total TL
PIPP TL
% PIPP Coverage

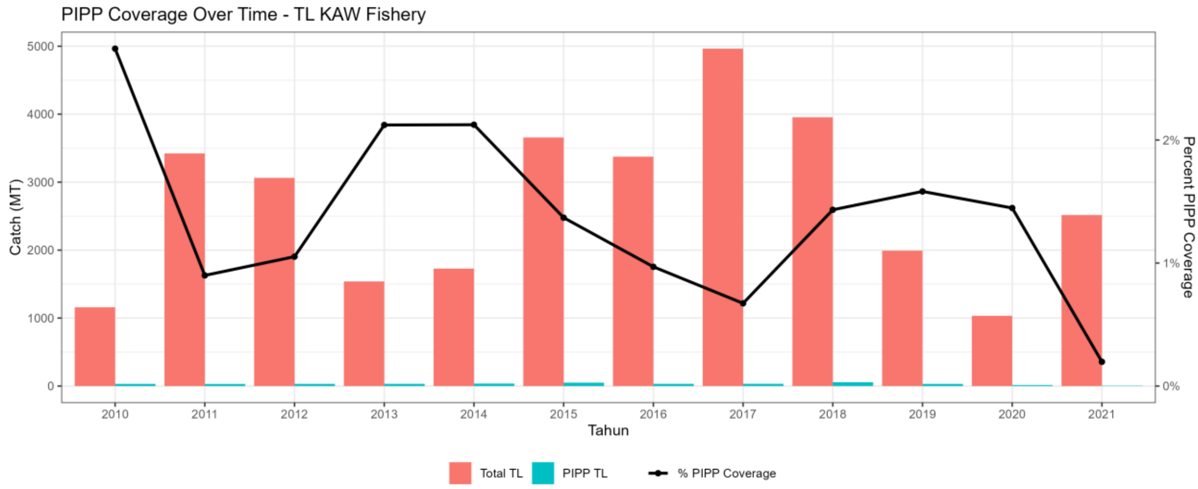

PIPP Coverage Over Time - TL YFT Fishery
Catch (MT)
7500
5000
2500
0
30%
20%
10%
0%
Percent PIPP Coverage
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Tahun
Total TL
PIPP TL
% PIPP Coverage

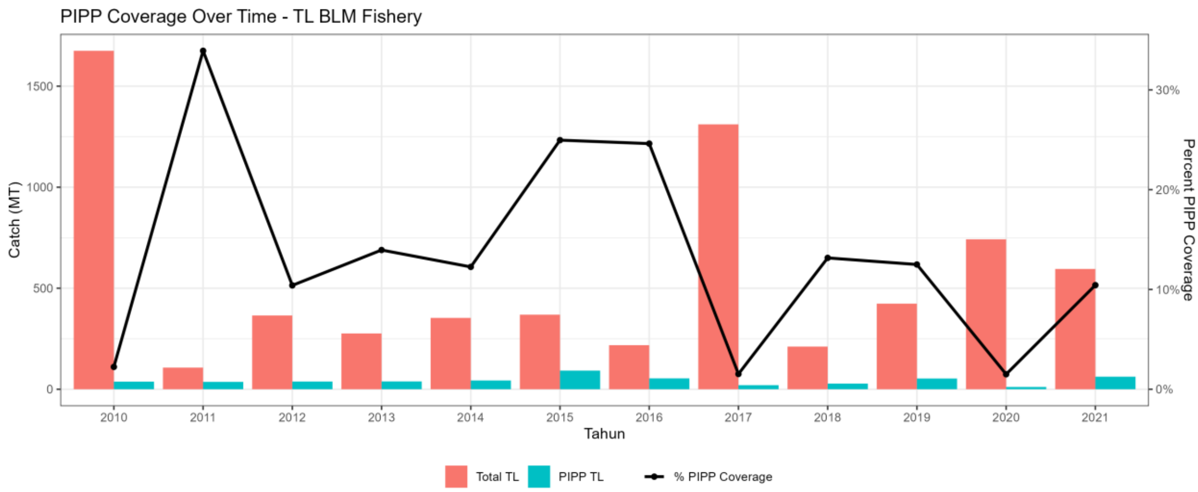

PIPP Coverage Over Time - TL SKJ Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

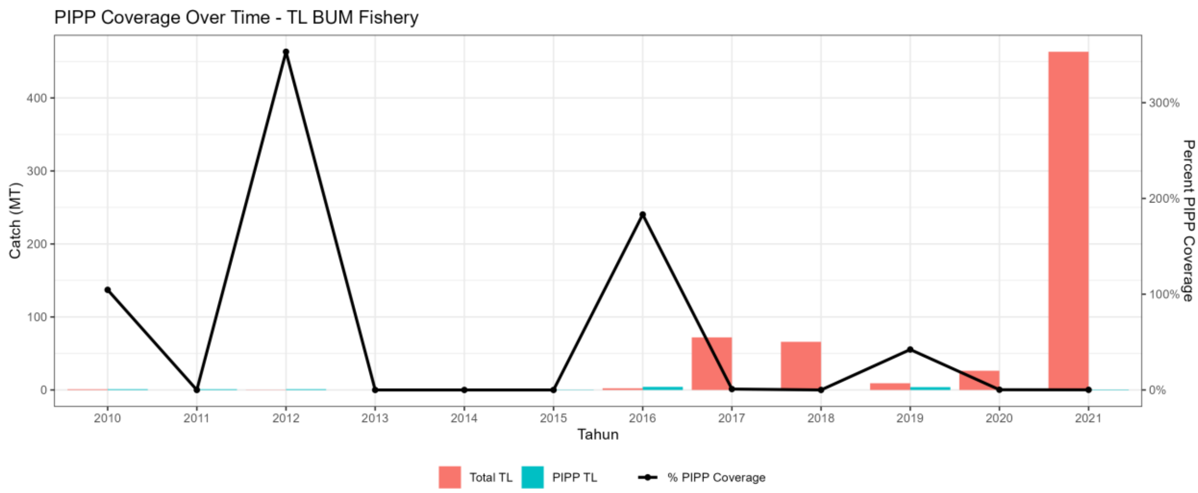

PIPP Coverage Over Time - TL FRI Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

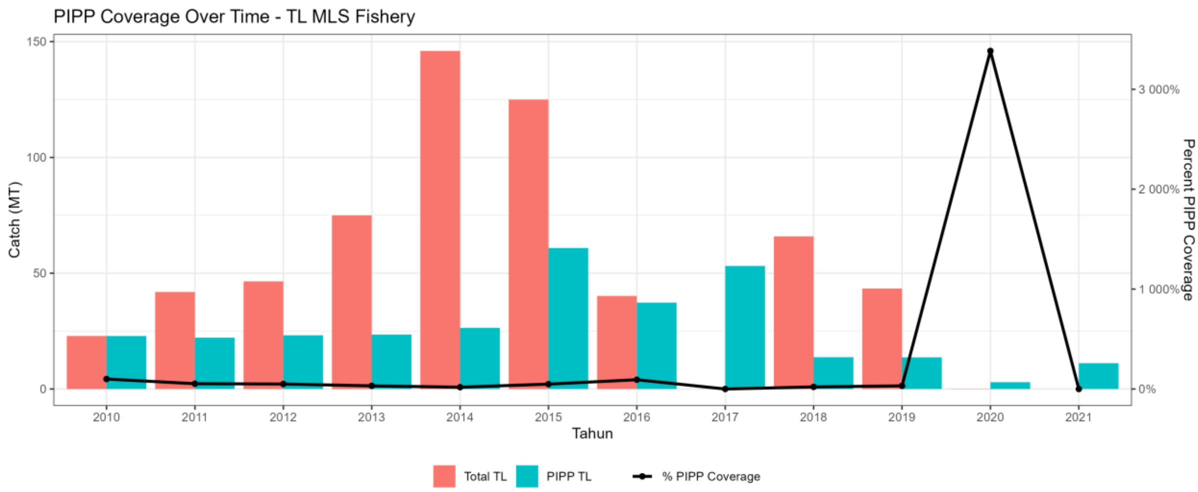

PIPP Coverage Over Time - TL BLT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

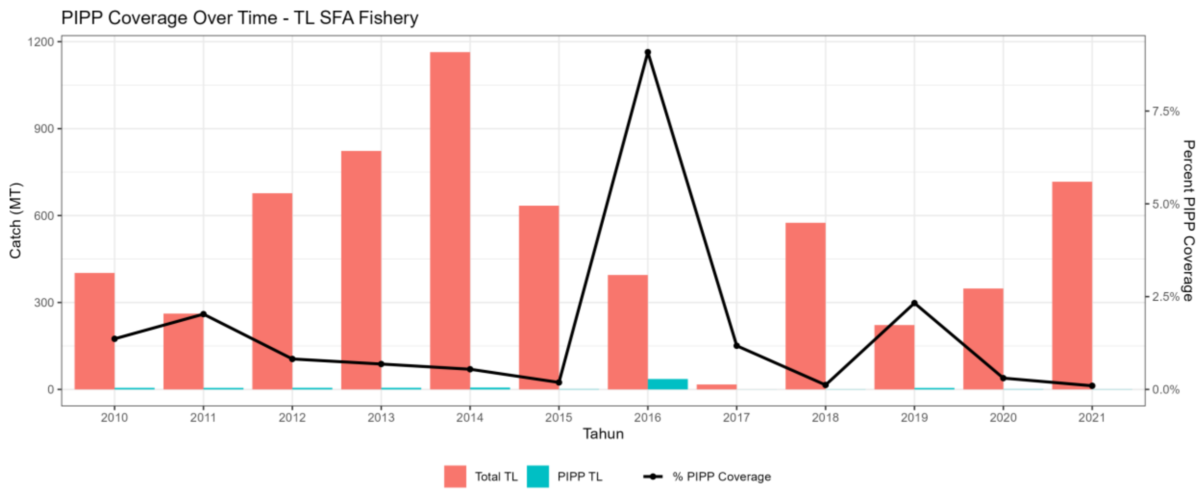

PIPP Coverage Over Time - TL LOT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

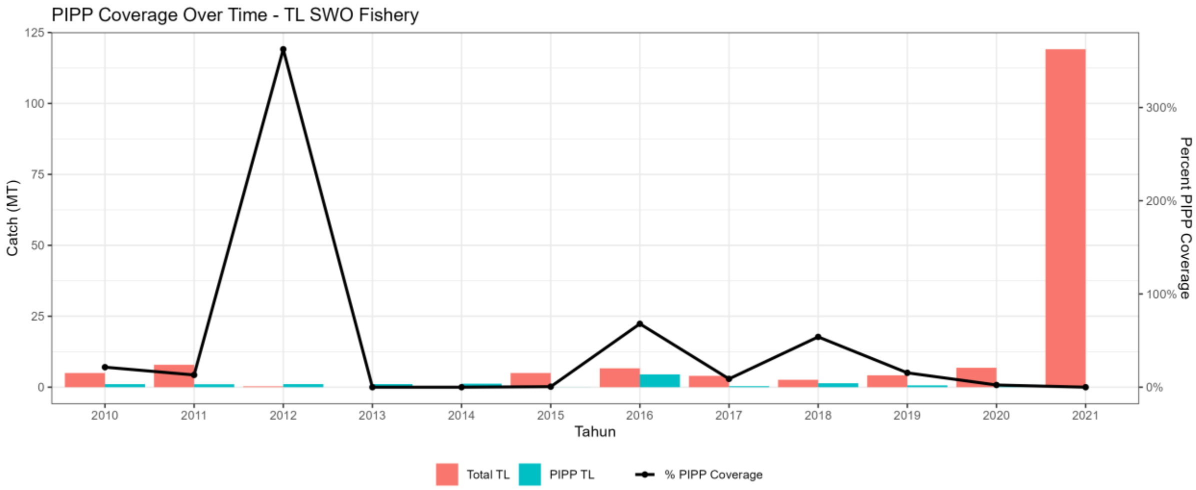

PIPP Coverage Over Time - TL KAW Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

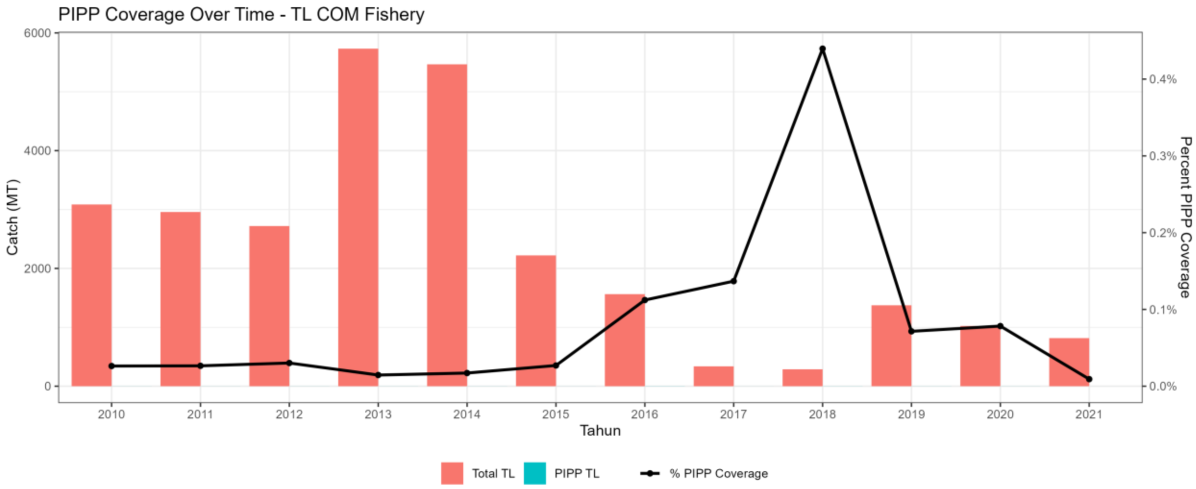

PIPP Coverage Over Time - TL BLM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

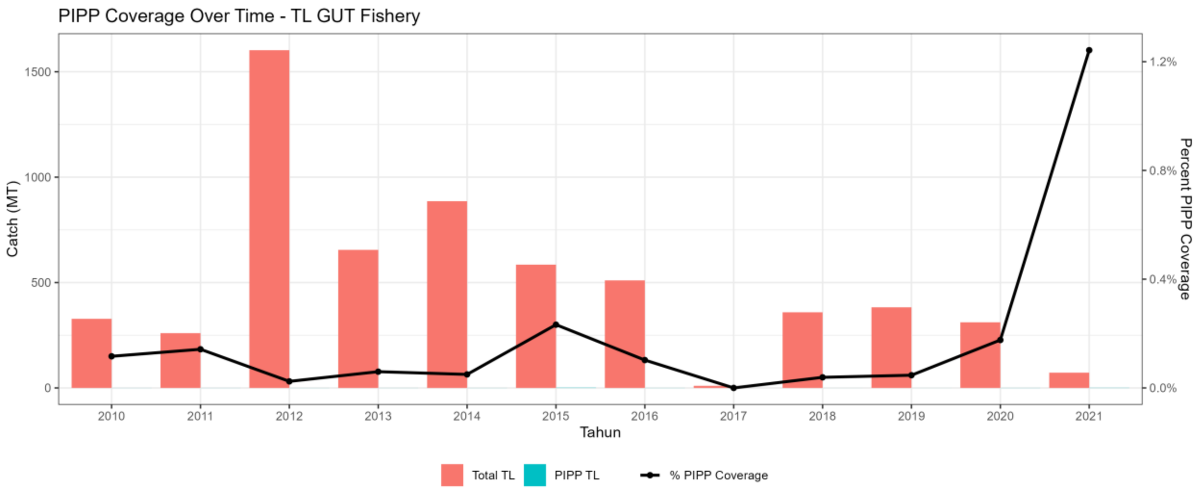

PIPP Coverage Over Time - TL BUM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage


PIPP Coverage Over Time - TL MLS Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage


PIPP Coverage Over Time - TL SFA Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage


PIPP Coverage Over Time - TL SWO Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage


PIPP Coverage Over Time - TL COM Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage


PIPP Coverage Over Time - TL GUT Fishery
Catch (MT)
Percent PIPP Coverage
Tahun
Total TL
PIPP TL
% PIPP Coverage

3.2. Data Processing and Analysis

3.2.1. Fishing Logbook

Prior to use the logbook data, it was scrutinized by the port officers by consider following rules:

1. Suitability between the fishing gear used and the catch
2. Suitability of fishing days with the number of settings
3. Compliance the fishing area with permits

The adjusted fishing log book is input/submitted into SILOPI for verification. The verification process as in the following :

1. Conformity of capture coordinate points (setting points) with Vessel Monitoring System (VMS) coordinate points
2. Correspondence of the number of settings to the number of days at sea. The number of settings during the trip period is at least 50% or more of the number of days at sea for fishing (settings) taking into account the operating characteristics of the fishing gear
3. Correspondence of the number and type of fish landed with those reported
4. Suitability of the number of catches with the size of the vessel (hold capacity)
5. Compatibility of fishing areas with permits
6. Compliance of base port with permits
7. Suitability of fishing gear and catch composition

Processing and analysis of fishing logbook data:

a. Data preparation is as follows:
1) Synchronize setting coordinates
2) Data filtering

For form 3CE, there are additional steps as follows: (Raup S A *et al,* 2021)

- Setting must be commenced between the departure and the arrival date
- The number of day-at-sea should be the differential between the arrival and the departure date
- Total sets per landing should be at least 50% of the total day-at-sea
- Georeferenced points should not intersect with the land nor excess the boundaries from the area of interest

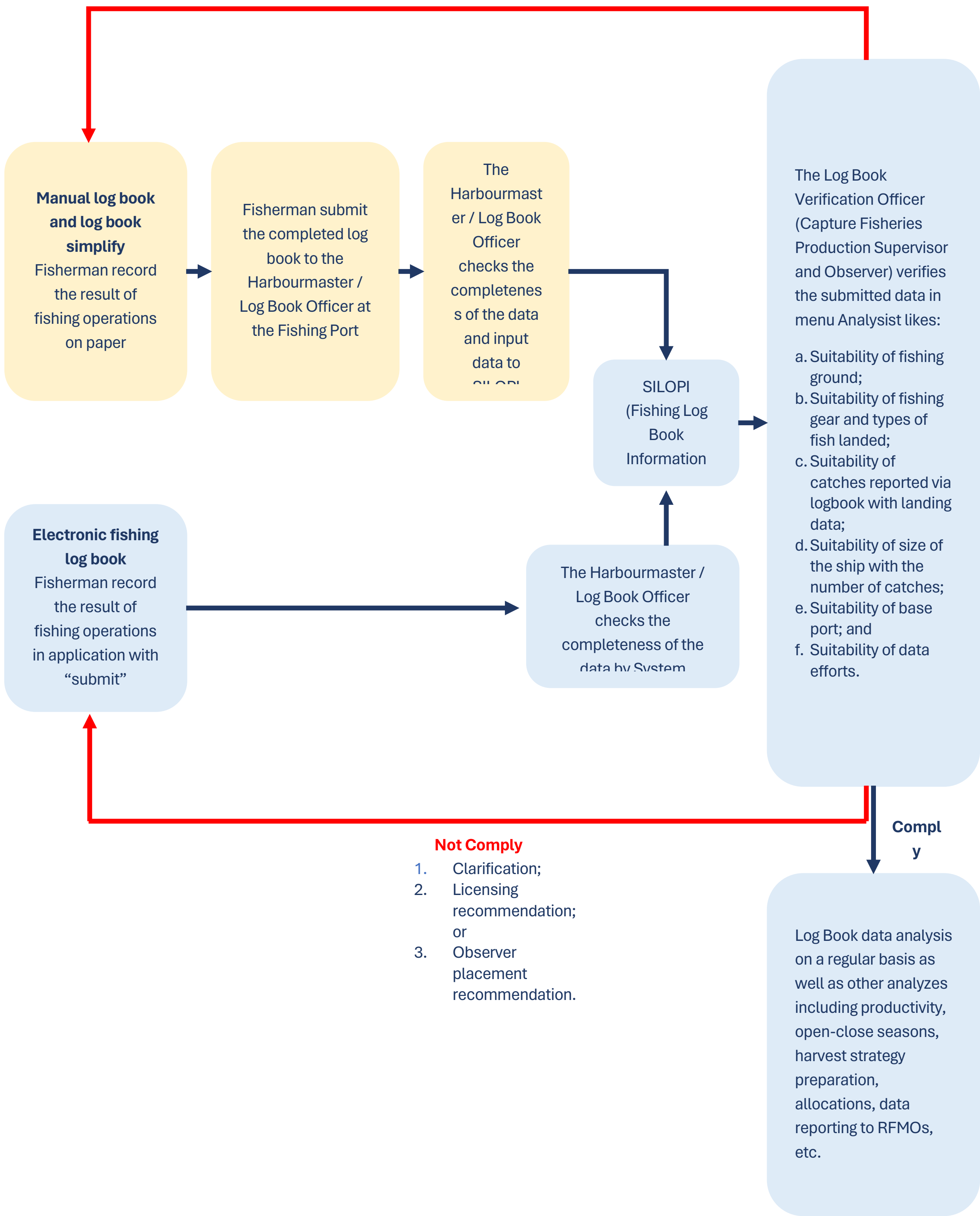
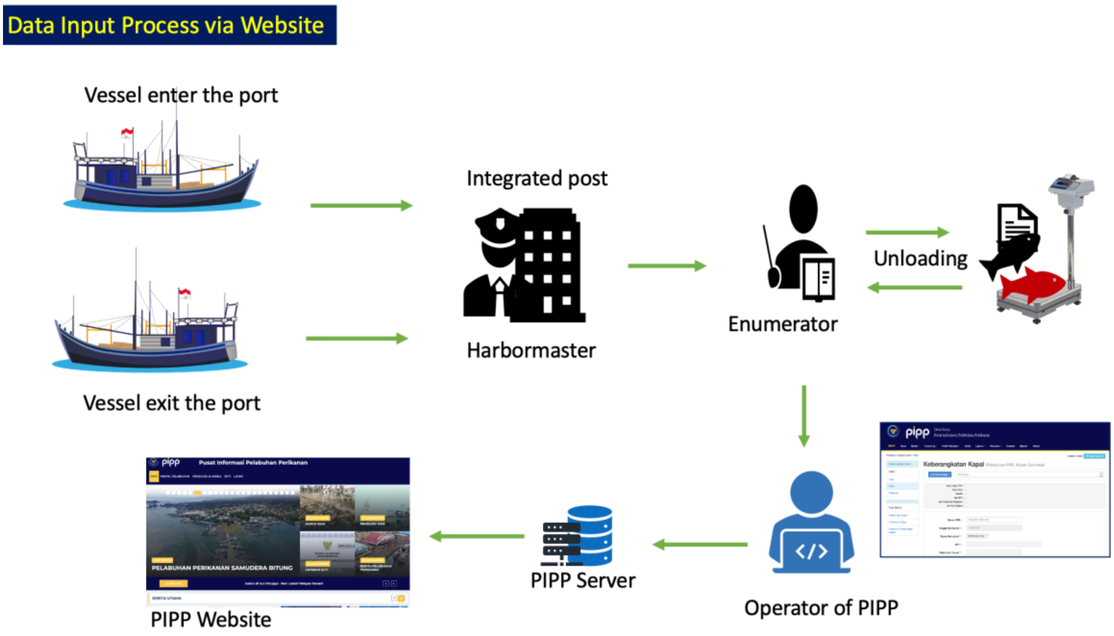
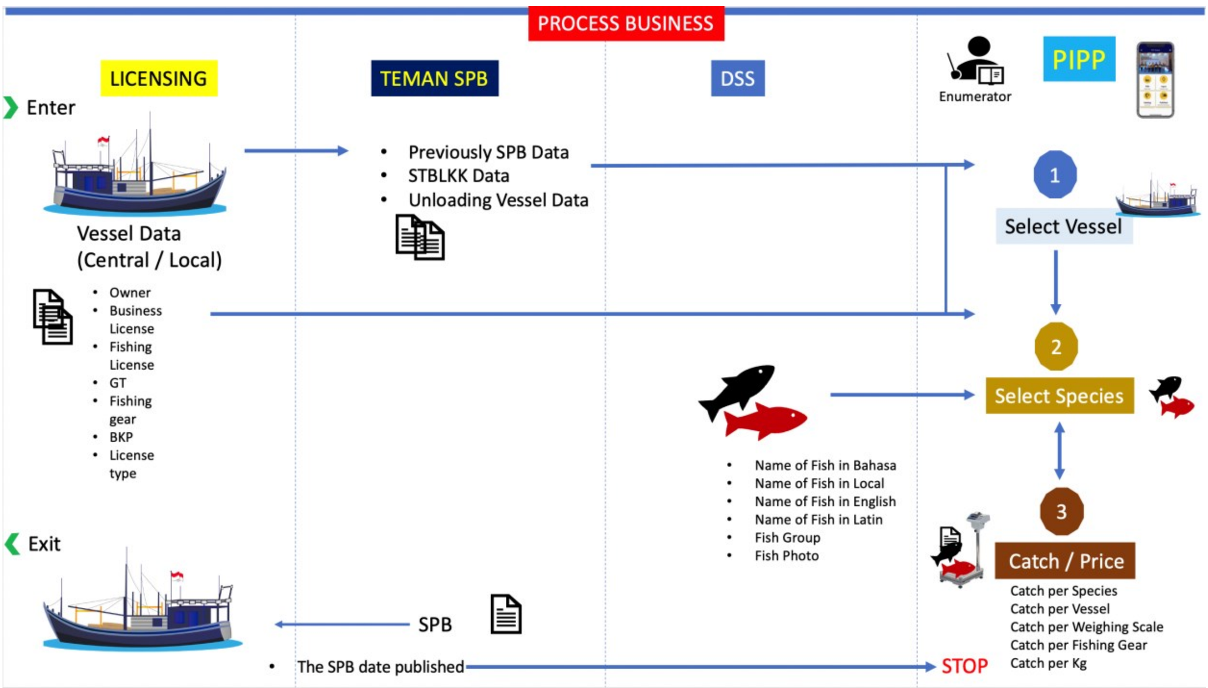


Figure 3. The Flow Chart of Logbook Data Processing and Analysis

3.2.2. Port Landing/PIPP





3.3. Re-estimation methodology

3.3.1. Previously definition of artisanal and industrial fisheries

Indonesia defined the term artisanal and industrial fisheries by how their fishing license categorized. Artisanal fleets are justified as vessels under or equal with 30 GT which the license is issued by local government, whereas industrial fleet refers to those above 30 GT and under management of central government. Both terms became the basis for determining the separation between artisanal (LLCO) and industrial (LLTU) longline as well as artisanal (PSSS) and industrial (PS) purse seine fleets according to types of fisheries for IOTC species (IOTC Secretariat, 2014) as mentioned in Appendix 1.

3.3.2. New 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 (IOTC Secretariat, 2014) as mentioned in Appendix 1 and classification and dimensions of fisheries (IOTC Secretariat, 2014) as mentioned in Appendix 2.

3.3.3. New re-estimation methodology

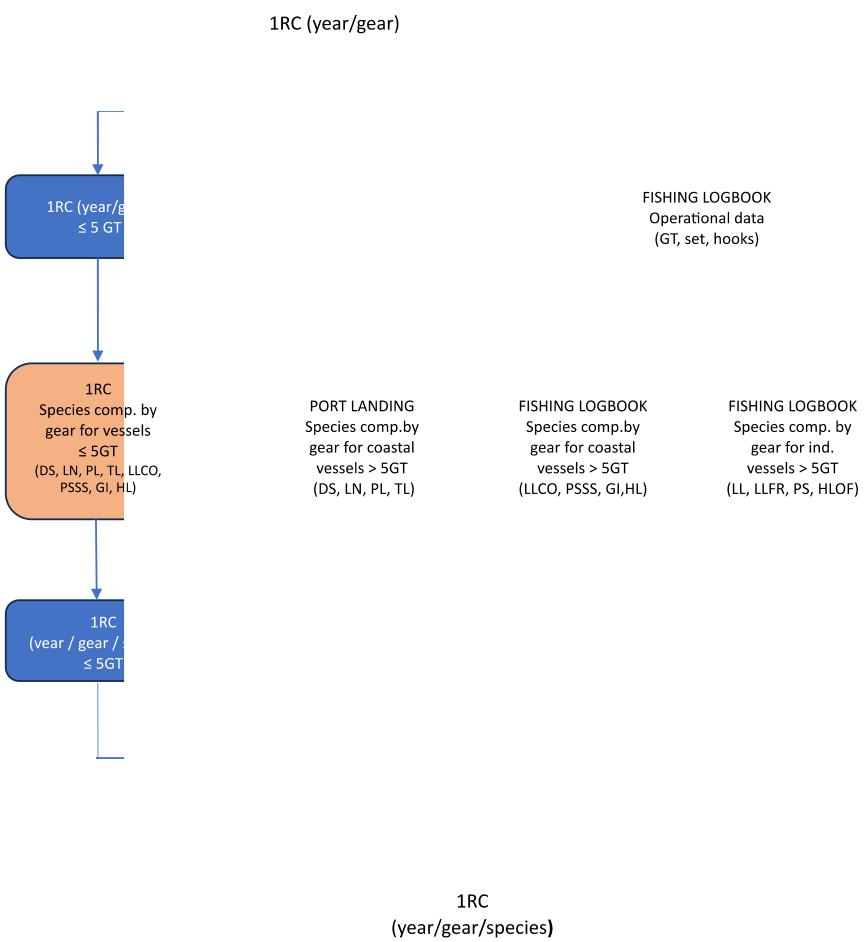


Figure 4. The Flow Chart of The Re-estimation Methodology

The fishing logbook provides information for vessels above 5 GT, therefore, the catch in the 1RC is divided into two categories, which are the catch for vessels above 5 GT and vessels up to 5 GT for each fishery as reflected in the table 2 and table 3 :

Table 2. The catch of vessels above 5 GT

Row Labels	DS	GI	HL	LLCO	LLTU	LN	PL	PS	PSSS	TL	HLOF
2010	12.353	4.735	6.169	18.274	30.493	4.866	3.834	22.494	75.373	22.840	
2011	5.884	5.596	3.615	18.076	13.906	7.933	2.573	27.648	92.642	32.461	
2012	22.247	4.169	10.095	25.398	15.792	11.732	11.716	30.529	53.673	20.712	
2013	20.365	3.233	13.879	25.254	24.890	11.167	16.124	39.514	77.780	23.500	
2014	16.140	2.878	12.348	23.227	14.633	10.029	12.725	30.461	72.042	19.183	
2015	23.919	4.597	14.006	16.077	8.725	16.308	11.079	20.043	52.708	13.823	
2016	10.756	5.309	17.140	15.468	7.381	15.389	4.397	28.424	50.295	12.834	
2017	22.419	3.978	20.000	15.489	5.521	26.414	19.522	38.805	74.126	5.608	
2018	6.227	3.618	15.029	15.017	5.128	23.822	4.269	33.235	72.446	12.451	
2019	10.129	4.502	23.263	8.961	3.205	19.404	4.441	47.327	92.820	15.359	14
2020	20.116	3.682	30.871	11.620	5.062	22.264	7.769	54.886	99.486	13.984	14
2021	8.624	5.096	27.159	12.124	9.465	14.462	4.542	62.187	78.777	14.704	72
2022	4.605	16.704	28.252	228	32.145	14.956	2.537	106.502	95.315	25.269	6.019

Table 3. The catch of vessels up to 5 GT

Row Labels	DS	GI	HL	LLCO	LLTU	LN	PL	PS	PSSS	TL	HLOF
2010	21.768	75.164	11.683	18.825		1.763	3.144		8.368	25.017	
2011	10.368	88.837	6.846	18.620		2.874	2.110		10.285	35.555	
2012	39.203	66.185	19.116	26.163		4.250	9.608		5.959	22.687	
2013	35.887	51.331	26.282	26.015		4.045	13.223		8.636	25.739	
2014	28.441	45.691	23.383	23.927		3.633	10.436		7.998	21.011	
2015	42.150	72.971	26.524	16.561		5.908	9.086		5.852	15.141	
2016	18.954	84.282	32.458	15.934		5.575	3.606		5.584	14.058	
2017	39.506	63.154	37.873	15.956		9.569	16.010		8.230	6.143	
2018	10.973	57.430	28.460	15.469		8.630	3.501		8.043	13.637	
2019	17.850	71.470	44.094	9.231		7.029	3.642		10.305	16.823	
2020	35.448	58.455	58.502	11.970		8.066	6.371		11.045	15.317	
2021	15.197	80.902	51.845	12.490		5.239	3.725		8.746	16.105	
2022	21.504	73.825	47.352	9.835		3.382	1.260		9.458	15.508	

The re-estimation will keep the total annual catches (2010-2021) remain the same as what originally reported by IDN through forms 1-RC. The re-estimation of catch composition for vessels above 5 GT is conducted by multiplying the catch in the table 2 with the catch composition from logbook for LL, LLFR, LLCO, HL, HLOF, GI and multiplying the catch in the table 2 with the catch composition from port landing (PIPP) for DS, LN, PL, TL. The catch composition for vessels up to 5 GT is using catch composition in the 1RC. The template form of catch composition from each source can be seen in the table 4 :

Table 4. The template form of catch composition

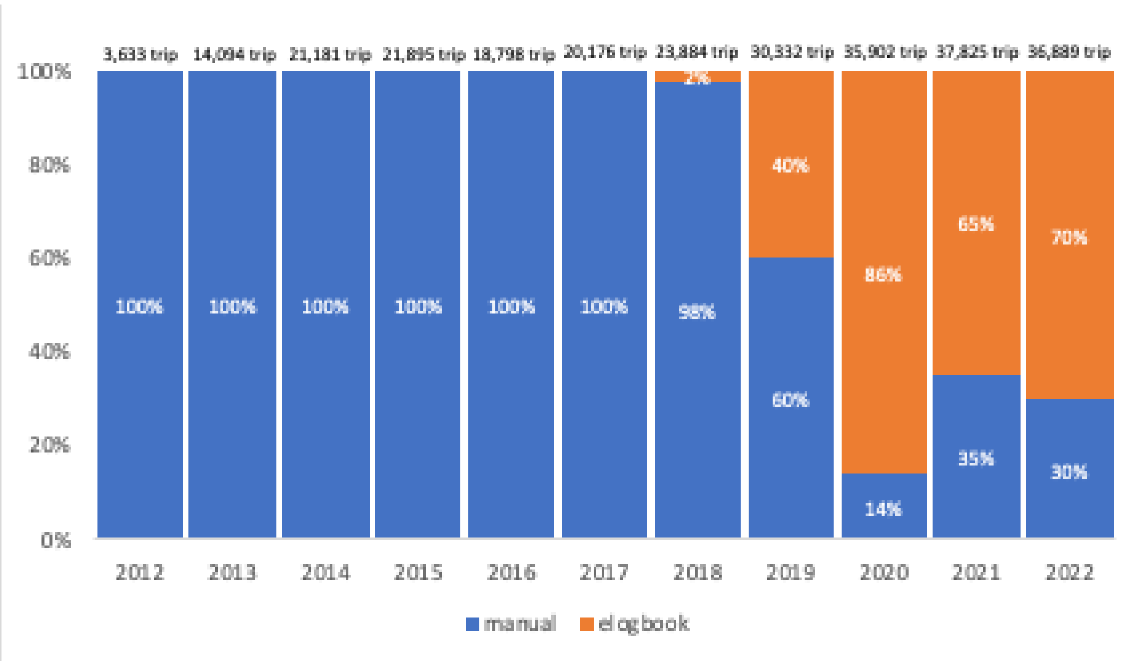
Kode FAO	DS_ton	DS_pct	GI_ton	GI_pct	HL_ton	HL_pct	HLOF_ton	HLOF_pct	LL_ton	LL_pct	LLCO_ton	LLCO_pct	LLFR_ton	LLFR_pct	LN_ton	LN_pct	PL_ton	PL_pct	PS_ton	PS_pct	PSSS_ton	PSSS_pct	TL_ton	TL_pct
ALB																								
BAR																								
BET																								
BIP																								
BLM																								
BLT																								
BSH																								
BUM																								
CCL																								
COM																								
DOL																								
DOT																								
FAL																								
FRI																								
GUT																								
KAW																								
LMA																								
LOT																								
MAK																								
MAR																								
MLS																								
OCS																								
OIL																								
OTH																								
PSK																								
SBF																								
SFA																								
SKH																								
SKJ																								
SMA																								
SPY																								
SSP																								
SWO																								
THR																								
TIG																								
WAH																								
YFT																								

The procedure to estimate the logbook catch composition are in the following :

Calculation of catch composition based on fishing log book data using the data range for 2012-2021, taking into account:

a. Spatial and temporal fishing log book data available as well as catches since 2012 even though though e-logbooks are not yet used
b. The reason why not using average data for 2019-2021, because the time gap is too large, there are concerns that it will not represent the conditions of the year.
c. Recap of years of use of manual and electronic fishing log books

Year	Manual Logbook	e-Logbook
2012	V	
2013	V	
2014	V	
2015	V	
2016	V	
2017	V	
2018		V
2019		V
2020		V
2021		V
2022		V



The preparation of the catch composition of fishing log book data is carried out in the following stages:

1. Categorization of fishing vessel as follows:

IOTC Gear Code	Category	Description
DS	<24 m inside IEEZ	24 m = 85 GT
GI	<24 m inside IEEZ	24 m = 85 GT
GIOF	>=24 m and <24 m outside IEEZ	24 m = 85 GT
HL	<24 m inside IEEZ	24 m = 85 GT
HLOF	>=24 m and <24 m outside IEEZ	24 m = 85 GT
LLCO	<24 m inside IEEZ	24 m = 85 GT
LLFR (<1800 hooks)	>=24 m and <24 m outside IEEZ	24 m = 85 GT
LL (>=1800 hooks)	>=24 m and <24 m outside IEEZ	24 m = 85 GT
LN	<24 m inside IEEZ	24 m = 85 GT
PL	<24 m inside IEEZ	24 m = 85 GT
PS	>=24 m and <24 m outside IEEZ	24 m = 115 GT
PSSS	<24 m inside IEEZ	24 m = 115 GT
TL	<24 m inside IEEZ	24 m = 85 GT

With the following procedure:

a. Create a Fishing Gear Code according to the fishing gear category in IOTC by considering the LoA based on the size of the vessel and fishing waters area.

b. For Longline, apart from point (a), also consider the number of hooks used for each setting.

2. Data filtering, based on:
   a. vessel size above 5 GT
   b. year of capture according to what will be reconstructed
   c. fishing gear according to the IOTC code
   d. types of species according to those managed by IOTC

3. Taking into account the composition of fish species per fishing gear per year.

Kode FAO	DS_ton	DS_ton_pct	GI_ton	GI_ton_pct	HL_ton	HL_ton_pct	LLCO_ton	LLCO_ton_pct	LLTU_ton	LLTU_ton_pct	LN_ton	LN_ton_pct	PL_ton	PL_ton_pct	PS_ton	PS_ton_pct	PSSS_ton	PSSS_ton_pct	TL_ton	TL_ton_pct
ALB	-	-	0.41	0.00	21.77	0.02	126.03	0.05	1,083.30	0.21	-	-	-	-	15.46	0.00	114.25	0.00	2.18	0.00
BAR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BET	-	-	13.75	0.01	12.42	0.01	301.66	0.12	620.43	0.12	0.20	0.00	2.60	0.00	1,536.41	0.05	64.31	0.00	6.41	0.01
BIP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BLM	-	-	0.15	0.00	0.83	0.00	18.06	0.01	45.27	0.01	-	-	-	-	1.07	0.00	0.15	0.00	3.98	0.00
BLT	-	-	2.98	0.00	7.25	0.01	8.54	0.00	3.06	0.00	149.80	0.01	-	-	1,097.82	0.03	1,687.75	0.06	5.40	0.01
BSH	-	-	0.00	0.00	-	-	5.52	0.00	108.63	0.02	-	-	-	-	-	-	-	-	-	-
BUM	-	-	0.13	0.00	-	-	6.92	0.00	151.98	0.03	-	-	-	-	3.12	0.00	-	-	0.07	0.00
CCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COM	-	-	0.54	0.00	1.10	0.00	10.68	0.00	45.74	0.01	1.16	0.00	-	-	27.52	0.00	2.19	0.00	-	-
DOL	-	-	7.58	0.01	7.60	0.01	93.52	0.04	35.03	0.01	0.50	0.00	-	-	68.00	0.00	12.67	0.00	11.31	0.01
DOT	-	-	-	-	-	-	-	-	-	-	1.45	0.00	-	-	-	-	3.50	0.00	-	-
FAL	-	-	2.50	0.00	-	-	1.74	0.00	-	-	-	-	-	-	-	-	-	-	-	-
FRI	-	-	1.04	0.00	21.25	0.02	1.60	0.00	0.44	0.00	235.83	0.02	-	-	211.32	0.01	468.58	0.02	0.52	0.00
GUT	-	-	0.08	0.00	2.91	0.00	11.02	0.00	10.61	0.00	0.08	0.00	-	-	1.46	0.00	0.18	0.00	-	-
KAW	-	-	0.54	0.00	0.20	0.00	0.83	0.00	6.18	0.00	12.93	0.00	-	-	149.25	0.00	80.12	0.00	-	-
LMA	-	-	0.04	0.00	-	-	0.09	0.00	0.39	0.00	-	-	-	-	-	-	-	-	-	-
LOT	-	-	20.76	0.02	3.86	0.00	41.04	0.02	11.57	0.00	319.43	0.03	-	-	618.90	0.02	320.78	0.01	0.49	0.00
MAK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLS	-	-	-	-	-	-	5.93	0.00	44.80	0.01	-	-	-	-	-	-	-	-	14.03	0.01
OCS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OIL	-	-	-	-	-	-	13.63	0.01	95.44	0.02	-	-	-	-	-	-	-	-	-	-
OTH	-	-	789.42	0.81	375.59	0.35	566.09	0.23	906.30	0.18	10,572.45	0.93	-	-	3,710.49	0.11	18,750.31	0.65	77.36	0.08
PSK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SBF	-	-	-	-	-	-	6.79	0.00	487.45	0.09	-	-	0.50	0.00	1.50	0.00	0.20	0.00	-	-
SFA	-	-	0.61	0.00	0.20	0.00	10.03	0.00	101.30	0.02	1.00	0.00	-	-	90.72	0.00	104.63	0.00	0.49	0.00
SKH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SKJ	-	-	106.75	0.11	350.96	0.33	842.62	0.34	186.88	0.04	70.10	0.01	523.74	0.87	22,999.93	0.69	6,753.21	0.23	622.07	0.65
SMA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SSP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SWO	-	-	1.27	0.00	0.29	0.00	53.59	0.02	311.92	0.06	-	-	-	-	2.81	0.00	1.49	0.00	0.24	0.00
THR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WAH	-	-	-	-	-	-	0.07	0.00	2.17	0.00	-	-	-	-	-	-	-	-	-	-
YFT	-	-	23.45	0.02	255.14	0.24	344.39	0.14	900.79	0.17	3.66	0.00	73.69	0.12	2,756.02	0.08	377.88	0.01	205.51	0.22

The procedure to estimate the port landing catch composition are in the following :

The PIPP catch composition is used only for vessels > 5 GT, LoA < 24m but operates inside EEZ, since the coverage in the fishing logbook data is low for liftnet, pole and line, danish seine and trolling. The PIPP data is available for period 2015- 2021.

Using PIPP data in re-estimation requires the coverage of PIPP catch data on 1RC data, with the following calculation stages:

1. Calculate the weight of fish caught per type of fish per fishing gear based on PIPP data
2. Calculate the weight of fish caught per type of fish per fishing gear based on 1RC data
3. Calculate the amount of coverage by comparing PIPP catch weight data with 1RC catch weight data per type of fish per fishing gear per year.

The PIPP catch composition data preparation is carried out in the following stages:

a. Create an IOTC fishing gear code by vlookup the list of fishing gear codes resulting from the agreement.
b. Determine the weight of catch by adjusting the reconstruction form by PIPP data pivot table as in the following:
    1) Filter Column:
        • the year of capture corresponds to the year of the reconstructed data
        • fishing gear based on classification in number 1 (new code 2)
    2) Row column:
        • FAO code
    3) Value column:
        • weight of catch in tons
c. The results of the pivot table are carried out for each fishing gear and input into the reconstruction form per fishing gear per year.

Kode FAO	DS_ton	DS_ton_pct	GI_ton	GI_ton_pct
ALB	0	0	0	0
BAR	0	0	0	0
BET	7.962	0.00750636	0	0
BIP	0	0	0	0
BLM	0	0	0	0
BLT	0	0	0	0
BSH	0	0	0	0
BUM	0	0	0	0
CCL	0	0	0	0
COM	0	0	0	0
DOL	6.76	0.00637315	0	0
DOT	0	0	0	0
FAL	0	0	0	0
FRI	0	0	0	0
GUT	0	0	0	0
KAW	0	0	0	0
LMA	0	0	0	0
LOT	0	0	0	0

d. The reconstruction form produces catch composition per fishing gear per year
e. Input the catch composition from the PIPP reconstruction form into the processing form by multiplying the total number of catches from 1RC by the percentage of PIPP catch composition, the formula is as follows:

=Total number of catches from 1RC*VLOOKUP(fish code,recon form,column order,FALSE))

Kode FAO	2012	2013	2014	2015
ALB	286.255283	8668.51073	6504.38553	2810.96225
BAR	0	0	0	0
BET	314.392955	1920.97043	1159.85488	218.056592
BIP	0	0	0	0
BLM	970.766837	1262.95589	0	0
BLT	0	4.15413219	0	0
BSH	0	0	0	0
BUM	0	0	0	0
CCL	0	0	0	0
COM	0	0	51.6611082	101.44904
DOL	0	154.23462	161.28346	96.7414283
DOT	0	0	0	0
FAL	0	0	0	0
FRI	0	0	73.0815678	0
GUT	0	0	0	0
KAW	0	0	0	0
LMA	0	0	99.5421354	0
LOT	0	0	0	0

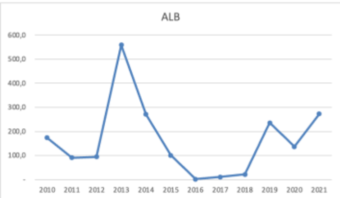
Information:
If the catch composition data is 0% for a particular fishing gear but the data from 1RC contains the total catch, then the catch composition is calculated based on the percentage composition of the species to the total catch on that fishing gear.

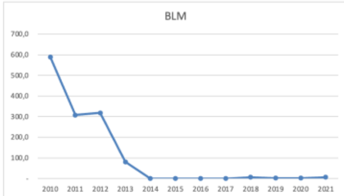
Example :
In the LL-TU fishing gear, the PIPP composition for the SKJ was 0%, while the 1RC data contained SKJ catches, so the percentage of skipjack for LL-TU was calculated based on the percentage of skipjack in LL-TU to the total LL-TU catch.

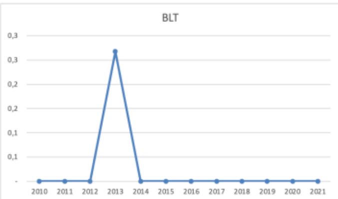
3.3.4. The final results of re-estimation

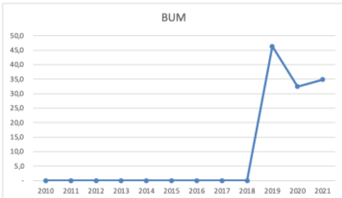
LL (Drifting longline; over 1800 hooks)

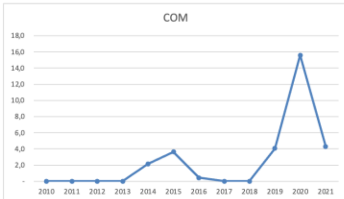
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	173,9	191,0	589,7	-	-	-	-	-	-	-	123,1	-	-	1.336,0	3.601,7
2011	90,7	99,6	307,6	-	-	-	-	-	-	-	64,2	-	-	696,8	1.878,5
2012	93,9	103,2	318,5	-	-	-	-	-	-	-	66,5	-	-	721,7	1.945,5
2013	558,6	123,8	81,4	0,3	-	-	-	-	-	-	20,6	5,7	23,3	163,1	270,6
2014	270,8	48,3	-	-	-	2,2	3,0	-	-	-	-	8,9	1,0	35,2	131,6
2015	100,9	7,8	-	-	-	3,6	-	-	-	-	0,2	2,6	0,6	81,6	56,5
2016	1,3	1,3	-	-	-	0,4	-	-	-	-	0,4	-	-	1,0	0,2
2017	10,4	6,7	-	-	-	-	-	-	-	-	-	-	0,5	14,0	25,0
2018	21,7	9,6	6,2	-	-	-	-	0,4	-	-	0,6	-	-	26,5	37,6
2019	235,9	36,2	2,2	-	46,4	4,1	-	0,0	-	-	9,1	38,9	1,0	45,5	142,0
2020	136,9	37,5	2,3	-	32,4	15,6	-	-	-	-	15,8	8,9	0,9	92,3	65,7
2021	272,1	52,0	6,9	-	34,8	4,3	-	0,1	0,0	0,0	2,2	5,5	1,3	101,0	54,4

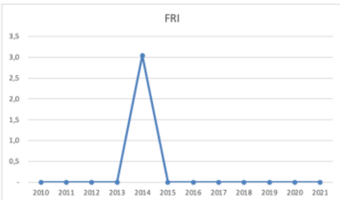


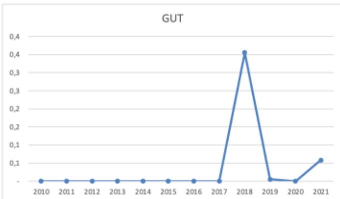


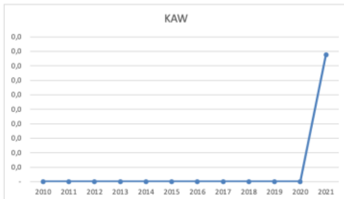


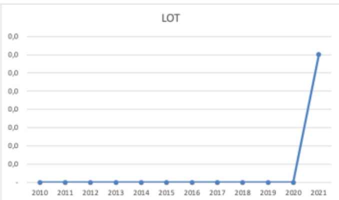


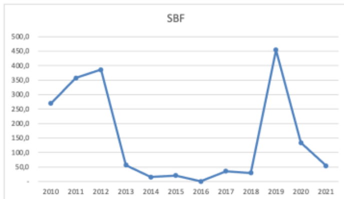


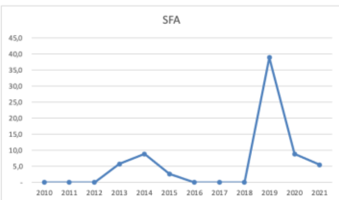


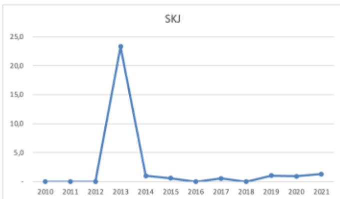






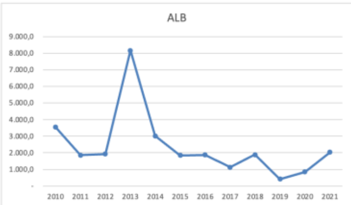


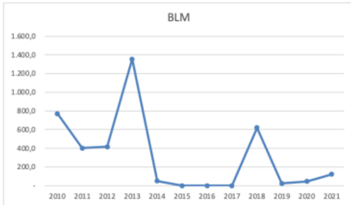


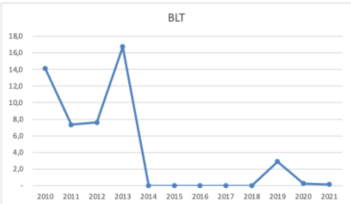


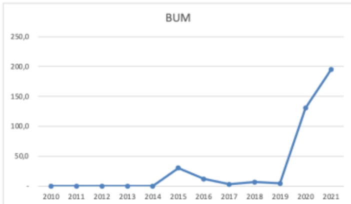
LLFR (Drifting longline; up to 1800 hooks)

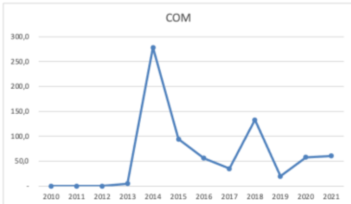
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	3.558,0	1.691,3	771,4	14,1	-	-	-	9,1	1,1	92,2	456,8	29,9	18,3	3.768,6	3.653,2
2011	1.855,7	882,1	402,4	7,4	-	-	-	4,8	0,6	48,1	238,2	15,6	9,6	1.965,5	1.905,3
2012	1.921,9	913,6	416,7	7,6	-	-	-	4,9	0,6	49,8	246,7	16,1	9,9	2.035,6	1.973,3
2013	8.159,5	1.965,2	1.354,8	16,8	-	5,0	-	-	1,9	2,8	256,3	166,2	85,3	3.714,5	3.026,1
2014	3.020,0	2.070,2	49,5	-	-	278,3	1,0	0,1	-	18,7	76,7	101,1	453,7	2.600,2	2.786,8
2015	1.839,1	1.010,2	-	-	30,3	94,3	17,1	9,8	1,0	29,2	56,6	82,0	617,7	1.048,5	1.649,6
2016	1.866,1	1.184,6	-	-	12,0	56,0	18,5	15,8	0,5	56,2	79,4	55,5	18,8	790,2	1.692,0
2017	1.130,9	932,9	-	-	3,0	34,9	-	6,5	1,1	9,5	32,1	38,6	197,8	559,7	1.473,8
2018	1.878,8	1.292,4	620,5	-	6,5	132,6	0,9	2,2	-	-	62,8	110,7	225,2	1.348,6	2.903,9
2019	418,0	333,6	23,3	2,9	4,3	19,5	0,3	1,3	0,6	9,2	16,4	35,8	127,4	130,9	366,9
2020	842,1	553,9	45,8	0,3	130,5	57,7	-	31,7	0,4	3,0	10,3	38,8	78,7	357,2	1.027,1
2021	2.025,5	744,7	121,8	0,2	194,9	60,5	2,7	38,9	3,6	38,7	8,3	40,5	43,8	592,8	3.061,9

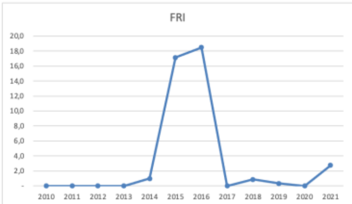


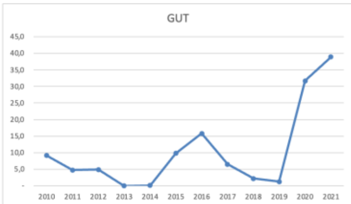


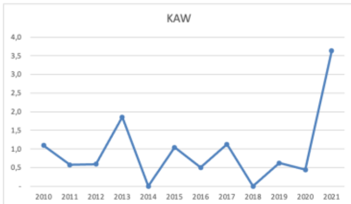


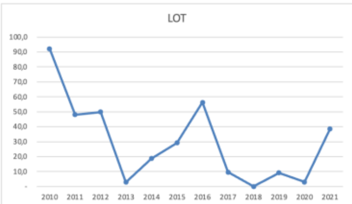


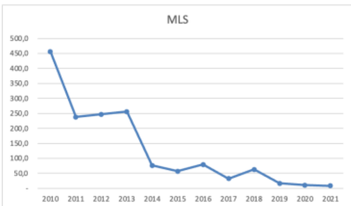


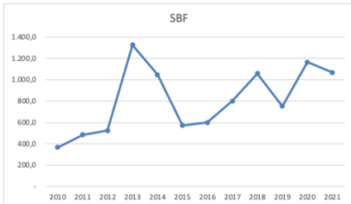


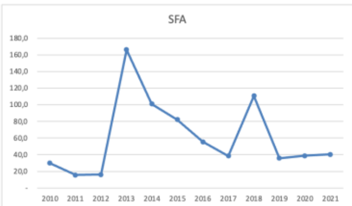


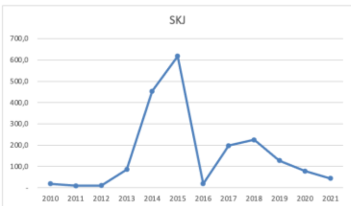


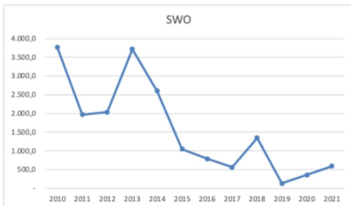


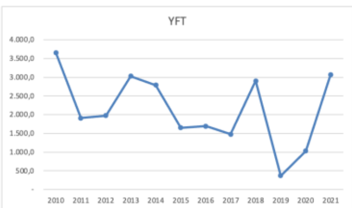






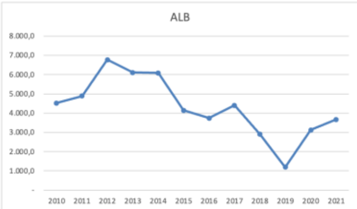


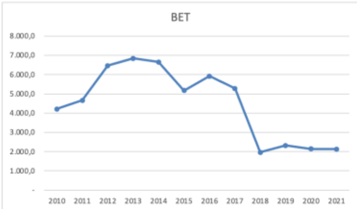


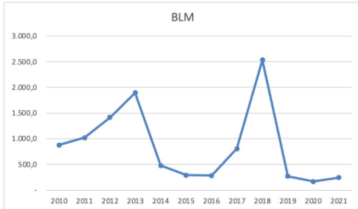


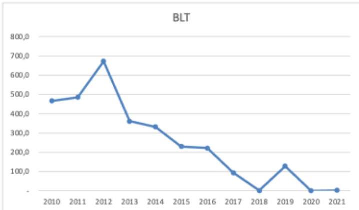
LLCO (Small longline)

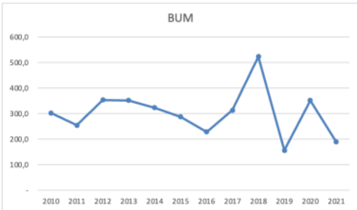
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	4.518,8	4.209,6	876,5	466,9	303,3	717,3	824,8	423,1	1.247,6	1.235,3	389,1	292,3	3.748,8	2.219,0	8.036,4
2011	4.887,0	4.659,4	1.021,5	485,0	255,2	608,0	694,0	357,7	1.049,7	1.039,3	511,9	255,3	4.068,4	2.646,0	8.542,1
2012	6.775,5	6.459,9	1.416,2	672,4	353,8	843,0	962,1	495,9	1.455,3	1.441,0	709,8	354,0	5.640,5	3.668,4	11.843,0
2013	6.107,4	6.839,1	1.897,5	360,8	352,1	833,8	956,7	487,4	1.447,0	1.432,8	595,7	461,2	2.986,0	4.617,2	11.716,5
2014	6.079,9	6.653,9	478,9	331,8	323,6	1.141,3	910,2	448,3	1.331,1	1.379,0	135,4	519,9	4.055,5	2.324,6	11.309,2
2015	4.144,4	5.168,5	292,7	229,7	287,6	732,5	611,7	312,4	921,9	931,6	86,0	402,5	4.620,8	1.726,0	6.340,9
2016	3.742,2	5.922,7	281,6	221,0	229,3	761,3	586,0	313,4	886,3	980,0	67,2	370,8	2.882,2	1.943,0	7.217,5
2017	4.398,6	5.281,8	805,2	93,7	313,5	1.203,6	373,8	182,4	433,8	689,7	224,5	303,3	2.825,5	2.266,2	7.177,7
2018	2.903,2	1.968,8	2.534,3	0,5	523,5	2.773,4	0,8	211,4	-	55,1	451,3	278,1	816,1	3.796,3	2.719,0
2019	1.197,2	2.318,1	269,4	128,1	156,3	519,7	697,8	196,7	858,3	994,2	85,1	188,4	4.676,5	404,0	3.258,9
2020	3.120,6	2.142,3	168,3	0,0	351,8	364,5	-	10,1	0,0	30,3	7,0	249,8	5.533,6	982,9	5.657,6
2021	3.670,0	2.124,7	242,3	2,0	189,4	273,1	112,0	27,2	8,6	39,5	13,7	113,4	3.191,3	1.101,8	8.469,8

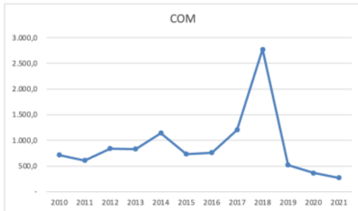


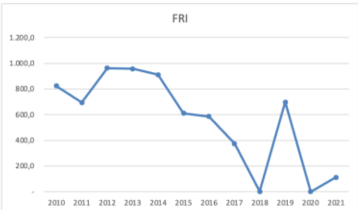


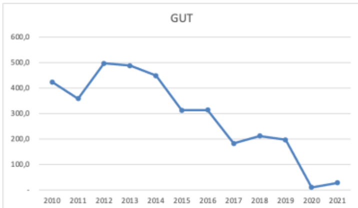


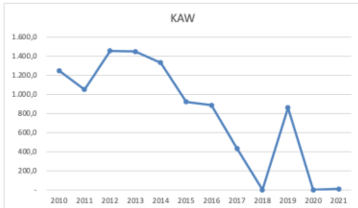


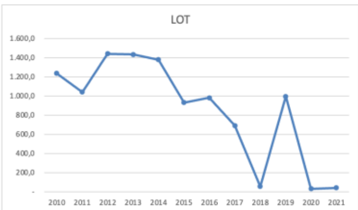


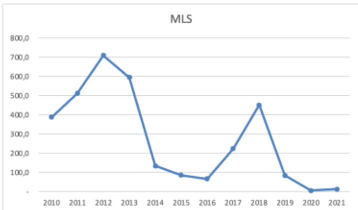


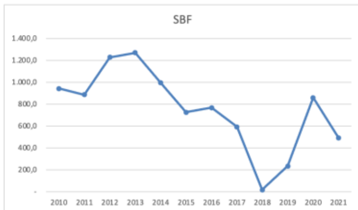


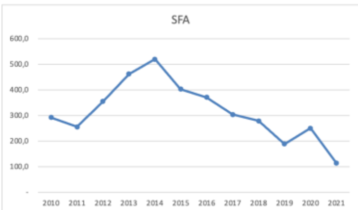


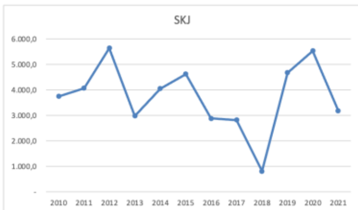


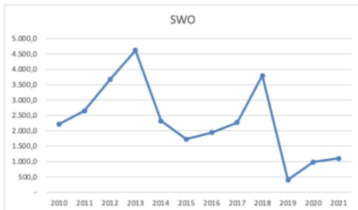


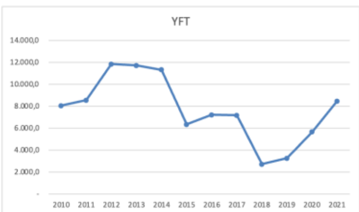






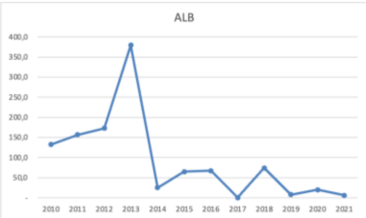


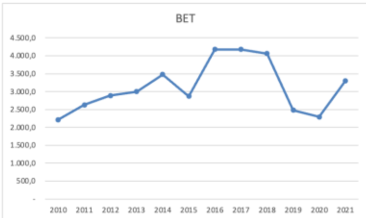


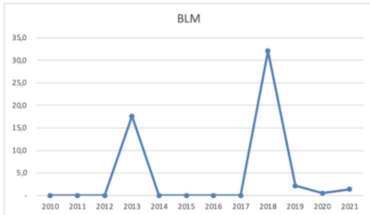


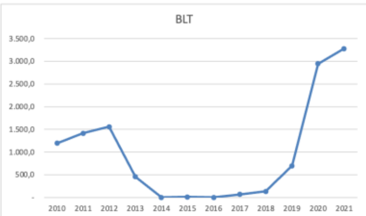
PS (Tuna purse seine)

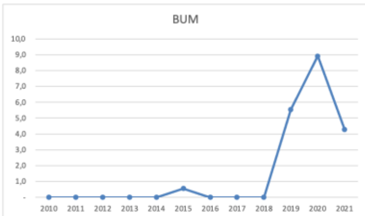
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	132,3	2.214,6	-	1.194,5	-	-	-	-	21,1	-	-	2,5	11.243,4	-	2.798,2
2011	156,9	2.626,3	-	1.416,5	-	-	-	-	25,0	-	-	2,9	13.333,5	-	3.318,3
2012	172,7	2.889,6	-	1.558,6	-	-	-	-	27,5	-	-	3,2	14.670,6	-	3.651,1
2013	379,2	2.999,2	17,6	457,7	-	2,0	683,5	-	374,5	2,8	0,1	10,9	17.798,5	17,8	8.307,3
2014	25,5	3.475,8	-	-	-	53,9	723,9	0,0	60,3	56,0	-	3,6	16.031,0	8,8	5.686,0
2015	65,2	2.871,4	-	10,1	0,6	42,4	466,6	0,0	46,8	56,8	-	6,8	9.766,2	7,9	4.240,2
2016	67,6	4.176,2	-	2,1	-	68,7	1.028,4	-	358,5	53,6	-	11,3	13.877,3	12,2	5.229,5
2017	0,3	4.180,9	-	69,7	-	30,8	708,3	-	170,1	23,4	-	6,2	23.286,1	5,5	6.271,2
2018	74,6	4.061,5	32,1	137,0	-	23,2	840,1	-	613,7	300,6	-	1,4	39.851,9	6,5	10.339,7
2019	8,0	2.479,2	2,2	700,3	5,5	51,9	357,3	2,1	95,4	810,5	-	27,8	32.873,8	3,1	4.185,3
2020	20,2	2.295,4	0,5	2.948,3	8,9	56,7	769,9	1,7	225,9	485,5	-	128,5	37.323,6	0,2	3.371,8
2021	6,4	3.305,9	1,4	3.278,8	4,3	42,9	142,8	-	155,3	441,0	-	0,5	39.798,1	5,5	5.490,2

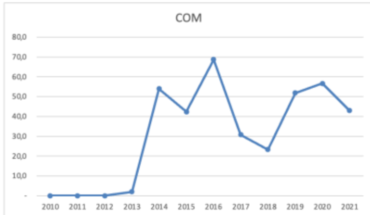


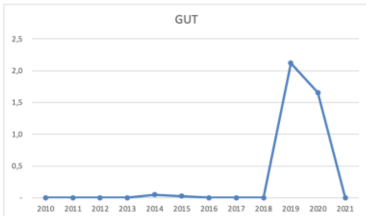


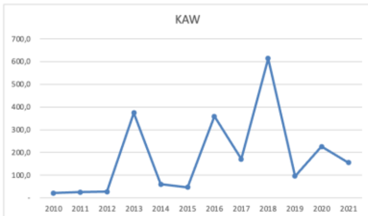


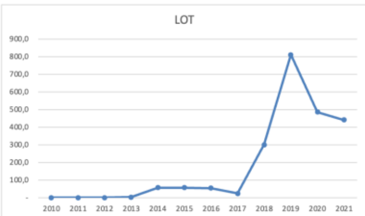


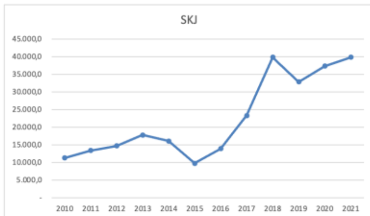


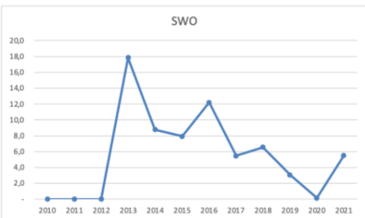


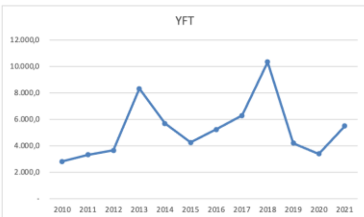


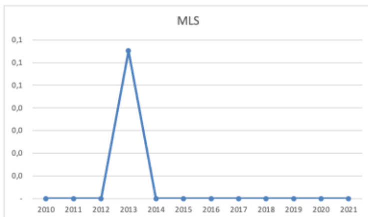






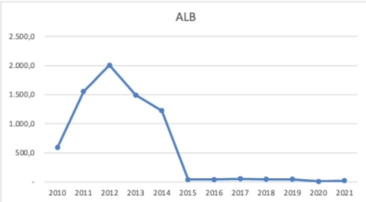


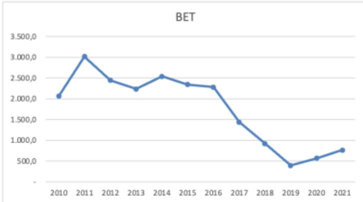


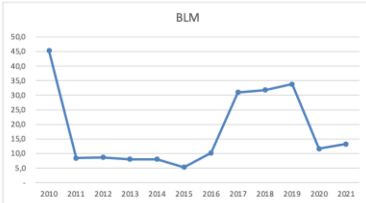


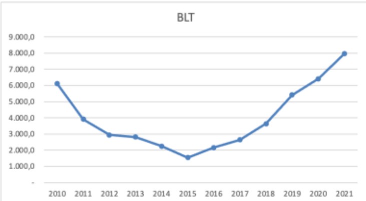
PSSS (Small purse seines)

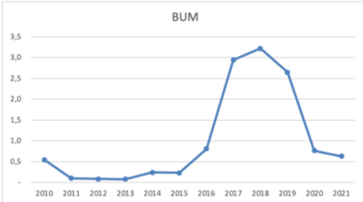
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	593,1	2.061,9	45,3	6.130,4	0,5	777,2	5.585,1	378,2	2.261,9	3.505,1	35,1	54,5	40.707,7	14,1	10.446,2
2011	1.554,9	3.018,1	8,4	3.920,2	0,1	144,2	1.036,6	70,2	526,4	650,6	13,1	10,1	45.504,2	2,6	8.257,0
2012	2.008,7	2.445,4	8,7	2.946,0	0,1	117,4	1.534,1	56,5	689,6	526,2	10,0	14,7	36.891,1	7,8	7.486,7
2013	1.496,3	2.240,0	8,1	2.817,2	0,1	115,9	4.352,1	51,2	1.145,9	1.274,2	7,2	19,6	29.834,1	11,5	6.952,2
2014	1.226,6	2.541,4	8,0	2.246,3	0,2	129,1	5.451,4	51,2	1.225,0	1.439,5	5,8	22,6	27.294,8	19,4	7.196,5
2015	42,9	2.344,7	5,3	1.550,3	0,2	132,6	5.863,2	44,3	1.062,5	1.427,3	3,8	21,6	20.311,5	16,8	5.797,2
2016	40,2	2.284,3	10,2	2.170,5	0,8	255,9	5.084,3	94,3	623,6	658,8	2,6	44,3	24.553,2	163,1	6.098,3
2017	51,9	1.439,8	31,0	2.645,8	2,9	747,1	7.905,3	299,1	779,9	402,3	2,2	150,7	23.523,4	697,3	4.977,9
2018	46,0	925,7	31,8	3.645,1	3,2	708,0	6.982,4	306,7	675,0	474,9	1,7	144,2	29.383,7	696,7	4.619,2
2019	44,6	397,3	33,8	5.411,7	2,6	676,7	5.962,9	281,5	880,2	941,7	1,9	123,7	24.384,1	546,3	3.107,5
2020	9,7	569,8	11,6	6.407,1	0,8	159,1	2.497,2	69,6	770,9	1.291,4	1,8	12,9	29.457,7	6,9	3.633,6
2021	20,2	765,6	13,2	7.957,3	0,6	266,6	3.735,0	63,1	1.171,0	2.473,6	3,0	17,6	27.574,5	8,5	3.919,7

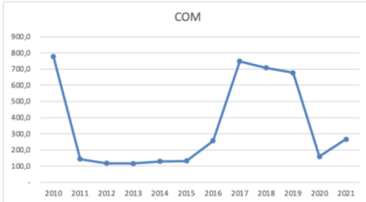


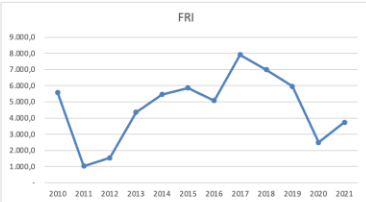


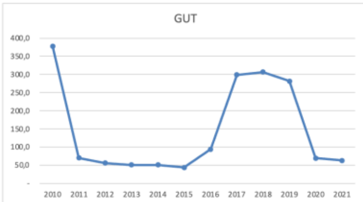


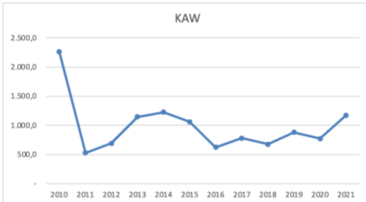


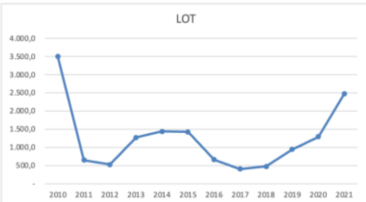


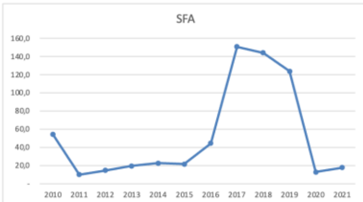


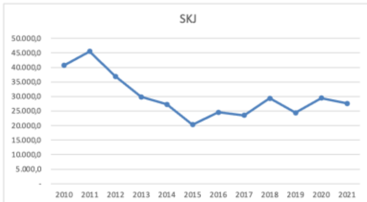


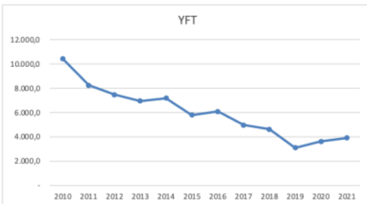


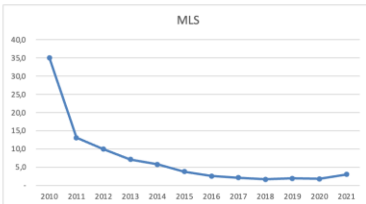






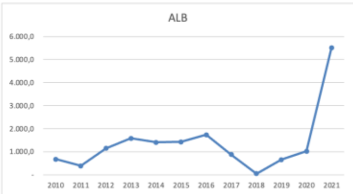


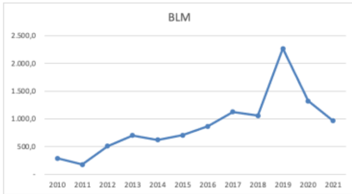


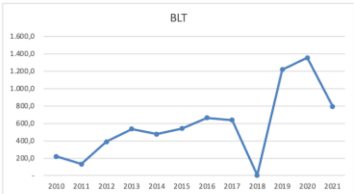


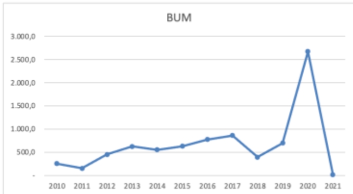
HL (Handline)

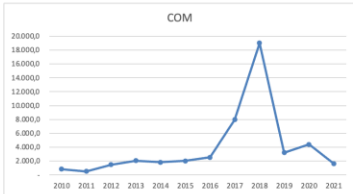
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	680,9	602,3	287,1	220,1	256,5	839,9	1.138,6	277,3	927,8	1.158,9	46,5	167,4	4.036,7	15,4	5.169,0
2011	392,9	363,0	173,3	132,9	154,8	505,8	686,7	167,4	559,8	699,1	26,5	100,8	2.367,6	9,3	2.959,8
2012	1.153,0	1.065,2	508,5	389,8	454,2	1.484,1	2.014,9	491,2	1.642,6	2.051,4	77,6	295,6	6.947,3	27,2	8.684,8
2013	1.585,2	1.464,5	699,1	536,0	624,5	2.040,5	2.770,2	675,3	2.258,4	2.820,4	106,7	406,5	9.551,7	37,4	11.940,5
2014	1.410,3	1.302,9	622,0	476,8	555,6	1.815,4	2.464,6	600,8	2.009,2	2.509,2	94,9	361,6	8.497,9	33,3	10.623,1
2015	1.426,3	2.048,3	705,5	540,9	630,2	2.038,2	3.226,1	713,5	2.625,6	2.884,7	27,0	430,3	8.117,0	172,8	5.258,7
2016	1.736,5	2.188,5	863,4	664,7	775,5	2.527,8	3.421,8	834,0	2.800,2	3.459,7	25,7	552,9	11.573,9	1.532,8	10.442,2
2017	876,9	2.009,9	1.127,9	639,1	863,0	7.973,2	3.272,4	1.296,0	2.721,0	3.358,8	106,1	550,3	15.101,2	46,9	10.394,3
2018	53,9	253,4	1.057,6	4,4	397,1	18.997,5	162,5	1.668,5	19,6	-	257,3	292,7	3.021,8	12,8	3.003,4
2019	663,2	1.858,5	2.270,3	1.219,1	701,3	3.206,6	5.365,5	2.128,8	7.229,0	5.796,4	33,0	339,4	10.817,7	36,4	13.199,4
2020	1.021,5	5.091,5	1.321,3	1.355,4	2.672,6	4.390,3	5.092,9	972,4	7.316,9	10.712,1	-	753,7	25.499,9	43,1	9.739,8
2021	5.500,9	6.461,2	966,3	794,3	18,1	1.643,0	4.239,1	1.130,9	1.546,2	1.783,5	119,0	853,3	22.334,2	373,5	18.335,9

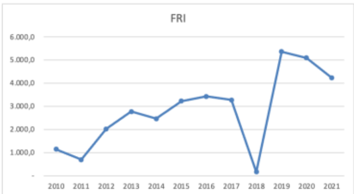


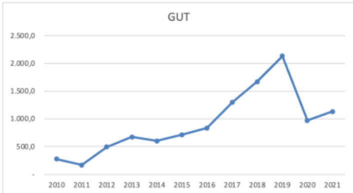


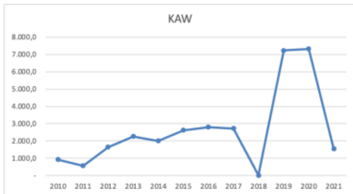


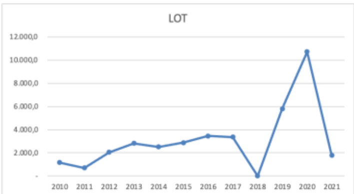


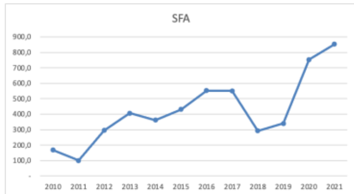


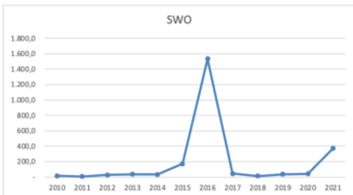


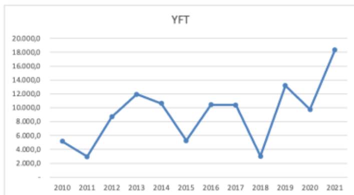






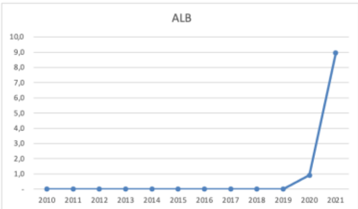


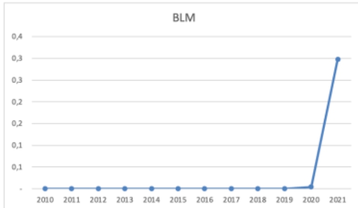


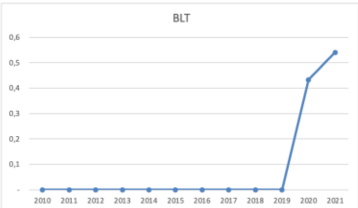


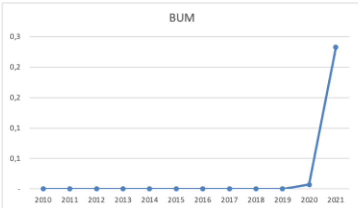
HLOF (Offshore handline)

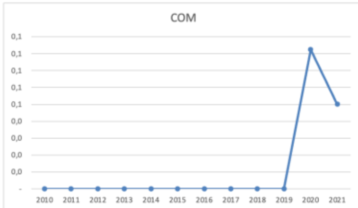
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2019	-	0,2	-	-	-	-	0,0	-	-	-	-	-	9,7	-	3,7
2020	0,9	0,3	0,0	0,4	0,0	0,1	-	0,0	-	-	-	-	4,4	0,0	1,6
2021	9,0	2,2	0,3	0,5	0,2	0,1	-	-	-	0,4	-	-	27,7	0,9	11,6

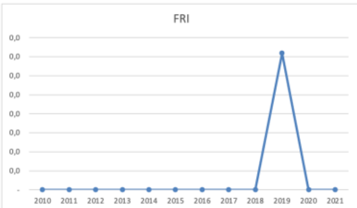


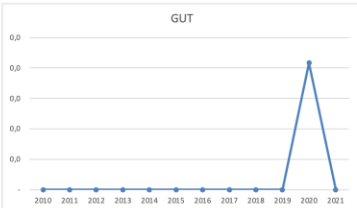


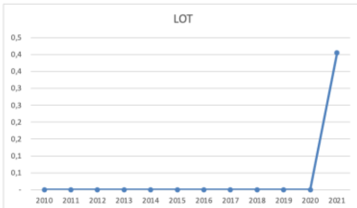






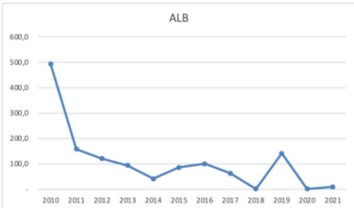


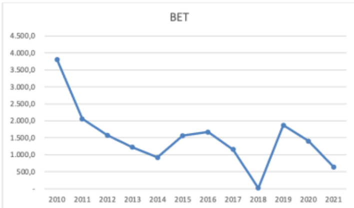


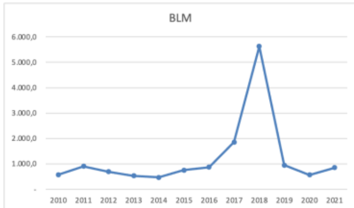


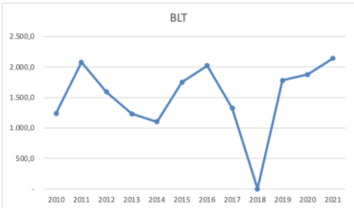
GI (Gillnet)

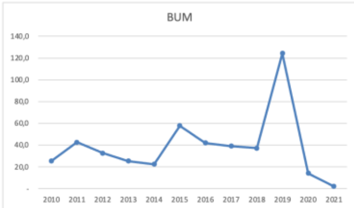
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	494,5	3.809,9	577,9	1.239,4	25,4	6.571,7	11.958,2	1.996,3	5.546,7	6.672,1	301,1	1.545,1	19.686,4	130,2	8.023,3
2011	158,6	2.060,7	904,3	2.077,3	42,6	11.034,1	19.793,8	3.351,9	9.090,3	11.202,6	490,2	1.942,9	13.780,6	114,2	5.578,5
2012	121,3	1.576,6	691,8	1.589,3	32,6	8.442,0	15.144,0	2.564,5	6.954,8	8.571,0	375,1	1.486,5	10.543,3	87,3	4.268,0
2013	94,1	1.222,8	536,6	1.232,6	25,3	6.547,3	11.745,2	1.988,9	5.393,9	6.647,4	290,9	1.152,9	8.177,0	67,7	3.310,1
2014	41,5	920,3	473,3	1.100,7	22,5	5.829,7	10.716,5	1.770,4	4.801,6	5.917,2	257,9	987,6	7.477,7	54,7	2.643,7
2015	86,2	1.563,7	755,8	1.752,3	57,8	9.314,7	16.747,6	2.828,0	7.663,7	9.450,5	412,5	1.629,9	11.804,6	124,3	4.088,9
2016	100,5	1.671,5	873,0	2.023,4	42,1	10.762,6	19.269,8	3.267,2	8.830,5	10.998,7	476,4	1.822,7	11.485,6	139,8	4.572,4
2017	63,5	1.157,7	1.859,1	1.323,3	39,1	14.135,7	12.615,7	3.920,3	5.914,8	7.758,3	900,4	1.652,2	7.965,9	97,8	3.013,7
2018	2,0	18,0	5.630,7	-	37,3	31.135,7	14,1	7.792,4	0,0	53,3	2.572,6	1.789,6	42,7	38,0	11,5
2019	141,3	1.871,9	952,0	1.779,2	124,3	9.351,2	14.321,3	3.532,8	5.835,9	11.479,4	348,9	1.092,5	13.906,1	216,3	6.284,1
2020	1,7	1.400,5	569,5	1.877,7	14,2	8.512,2	14.981,2	2.264,5	4.611,0	10.743,9	373,9	1.313,0	7.843,1	4,7	3.678,5
2021	9,9	644,9	850,7	2.142,2	2,2	9.984,4	14.182,3	3.660,6	16.373,9	8.924,9	477,8	2.710,8	13.331,8	154,9	6.187,6

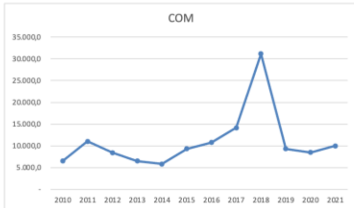


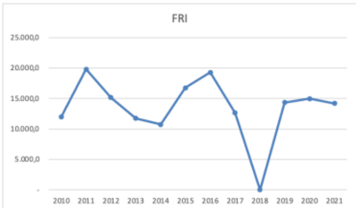


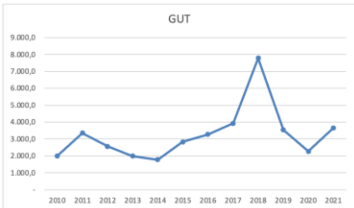


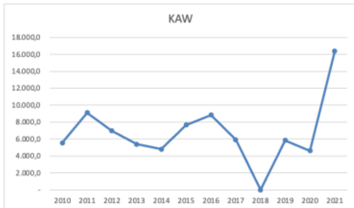


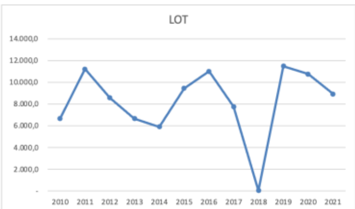


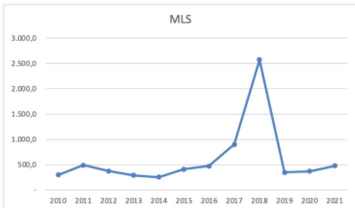


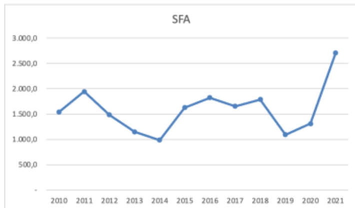


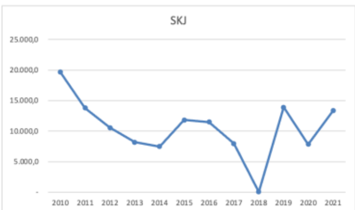


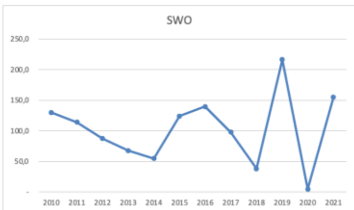


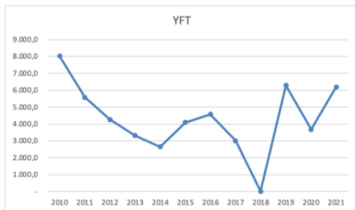






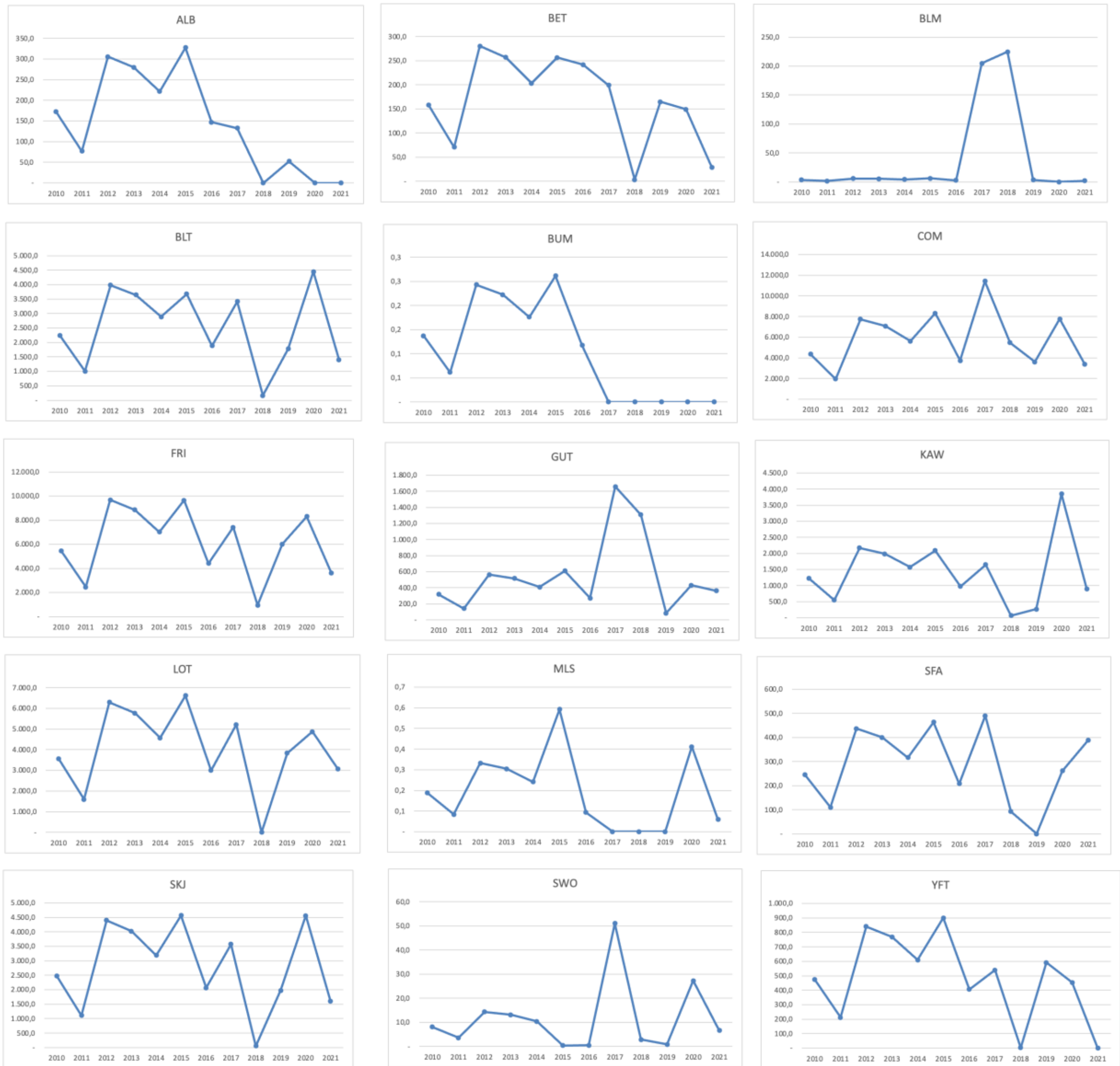






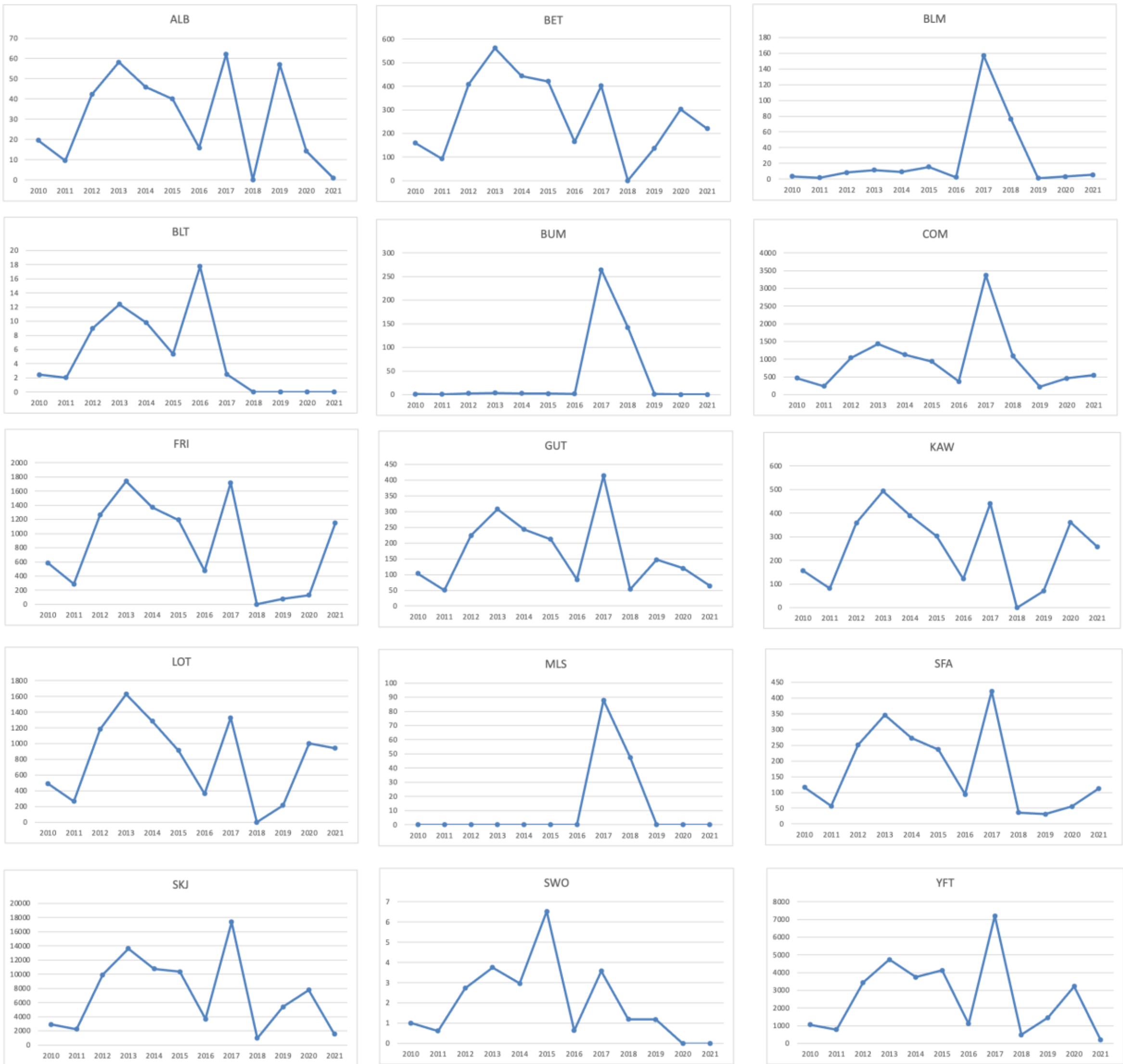
DS (Danish seine)

Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	172,2	158,2	3,3	2.241,7	0,1	4.360,4	5.458,9	317,2	1.224,1	3.550,5	0,2	246,6	2.479,1	8,1	473,6
2011	77,1	70,9	1,5	1.004,0	0,1	1.952,9	2.444,9	142,1	548,2	1.590,2	0,1	110,4	1.110,3	3,6	212,1
2012	305,5	280,6	5,8	3.976,0	0,2	7.733,6	9.682,0	562,5	2.171,1	6.297,2	0,3	437,4	4.396,9	14,3	840,0
2013	279,7	256,9	5,3	3.639,6	0,2	7.079,4	8.863,0	514,9	1.987,4	5.764,5	0,3	400,4	4.025,0	13,1	769,0
2014	221,6	203,6	4,2	2.884,5	0,2	5.610,6	7.024,1	408,1	1.575,1	4.568,5	0,2	317,3	3.189,9	10,4	609,4
2015	327,5	256,5	6,1	3.677,2	0,3	8.306,6	9.650,6	608,0	2.089,2	6.611,3	0,6	463,6	4.566,7	0,4	900,3
2016	147,3	241,8	2,7	1.885,1	0,1	3.741,0	4.418,9	269,4	974,4	2.994,1	0,1	209,0	2.066,7	0,5	406,2
2017	132,8	199,2	204,8	3.411,7	-	11.429,3	7.416,6	1.658,9	1.647,1	5.216,9	-	490,8	3.572,9	51,1	539,9
2018	-	3,3	224,7	161,9	-	5.469,8	943,4	1.309,4	66,4	0,6	-	92,8	54,0	2,8	2,9
2019	52,0	164,7	3,4	1.778,6	-	3.614,0	6.006,7	83,6	269,7	3.829,8	-	0,5	1.973,9	0,8	591,3
2020	-	149,3	-	4.448,4	-	7.758,7	8.297,9	430,9	3.850,7	4.874,5	0,4	261,9	4.555,0	27,3	454,2
2021	-	29,1	2,0	1.400,1	-	3.381,9	3.616,9	362,7	897,9	3.076,3	0,1	388,6	1.602,9	6,7	0,1



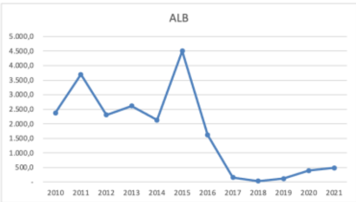
PL (Pole and line)

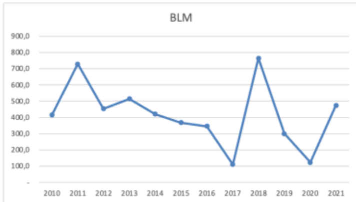
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	19,6	159,9	3,4	2,4	1,0	468,2	584,4	103,6	156,6	493,7	-	116,0	2.907,1	1,0	1.057,3
2011	9,6	92,5	1,9	2,0	0,6	235,5	286,1	50,7	81,2	267,8	-	56,9	2.242,9	0,6	780,1
2012	42,3	408,2	8,4	9,0	2,4	1.039,6	1.263,0	223,9	358,7	1.182,6	-	251,3	9.902,6	2,7	3.444,3
2013	58,2	561,8	11,6	12,4	3,4	1.430,6	1.738,1	308,2	493,6	1.627,4	-	345,8	13.627,5	3,8	4.740,0
2014	45,9	443,4	9,1	9,8	2,6	1.129,1	1.371,8	243,2	389,6	1.284,4	-	272,9	10.755,3	3,0	3.740,9
2015	40,0	421,2	15,6	5,4	2,0	933,8	1.194,1	211,8	303,2	913,5	-	236,5	10.343,9	6,5	4.127,0
2016	15,9	165,7	2,4	17,7	1,6	372,2	473,9	84,0	121,6	362,8	-	93,8	3.681,1	0,6	1.111,2
2017	62,2	401,8	157,1	2,5	264,0	3.369,8	1.717,2	413,4	441,2	1.327,6	87,9	421,5	17.371,3	3,6	7.198,5
2018	-	-	76,2	-	142,0	1.090,1	-	53,5	-	-	47,5	35,9	984,3	1,2	492,1
2019	56,9	137,8	1,3	-	1,3	217,3	78,0	147,0	70,3	214,1	-	30,7	5.389,1	1,2	1.451,4
2020	14,2	302,7	3,2	-	-	458,0	132,3	120,0	360,7	1.002,9	-	55,3	7.777,1	-	3.222,5
2021	0,9	220,4	5,6	-	-	548,5	1.147,4	64,0	257,7	941,7	-	112,2	1.559,5	-	191,3

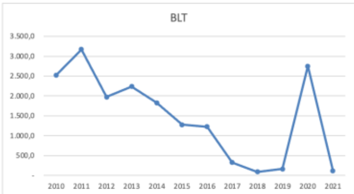


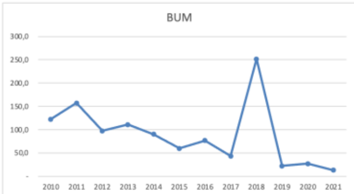
TL (Trolling)

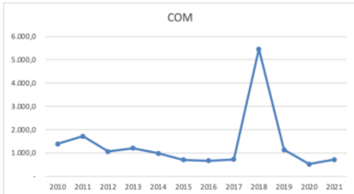
Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	2.375,1	1.517,5	414,0	2.525,7	122,6	1.391,5	5.802,7	35,5	2.683,7	2.724,3	178,7	734,4	13.595,3	125,7	7.173,6
2011	3.698,3	2.338,8	728,7	3.170,6	157,1	1.717,3	7.212,6	45,9	3.489,0	3.478,2	353,8	935,9	22.996,2	161,0	12.117,3
2012	2.302,4	1.456,0	453,7	1.973,9	97,8	1.069,1	4.490,3	28,6	2.172,1	2.165,4	220,3	582,6	14.316,7	100,2	7.543,8
2013	2.612,2	1.652,0	514,7	2.239,5	110,9	1.213,0	5.094,5	32,4	2.464,4	2.456,8	249,9	661,0	16.243,1	113,7	8.558,9
2014	2.132,4	1.348,5	420,2	1.828,1	90,6	990,2	4.158,7	26,4	2.011,7	2.005,5	204,0	539,6	13.259,4	92,8	6.986,7
2015	4.506,5	729,8	367,0	1.276,3	59,8	710,3	2.922,9	21,1	1.411,1	1.308,8	201,6	357,6	7.621,5	60,1	4.807,8
2016	1.613,2	689,0	345,5	1.227,5	77,0	667,0	2.711,2	18,2	1.331,9	1.236,4	200,2	520,9	6.698,3	80,0	6.491,3
2017	153,5	229,7	110,6	326,0	43,8	728,0	1.141,7	448,7	499,2	441,0	140,2	223,9	4.517,3	16,6	2.163,9
2018	35,7	191,2	764,7	93,6	251,6	5.461,6	201,0	4.920,7	622,0	41,4	280,4	1.163,1	6.761,8	21,3	2.942,0
2019	119,5	2.294,5	299,8	162,6	22,5	1.144,7	4.667,5	11,7	1.740,0	711,6	53,1	212,4	13.651,9	22,8	5.819,6
2020	391,4	1.201,1	123,3	2.748,7	27,4	524,8	2.630,4	15,2	264,3	1.953,8	8,5	187,3	12.618,1	0,5	5.331,8
2021	485,3	992,7	473,4	118,3	13,3	716,2	3.604,7	49,1	2.556,8	2.839,8	75,4	722,5	8.446,0	124,7	5.987,4

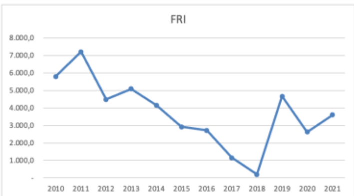


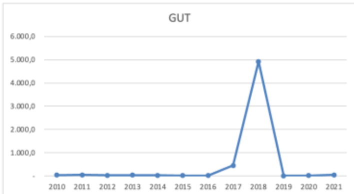


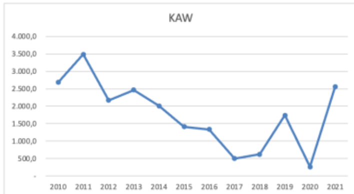


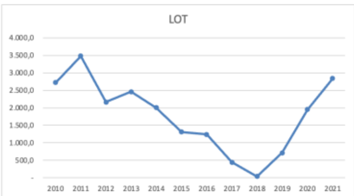


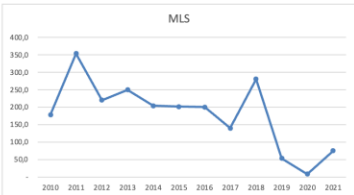


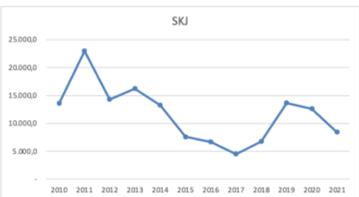


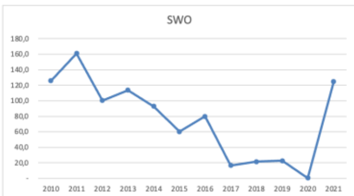


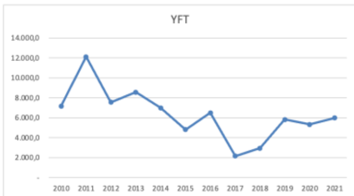






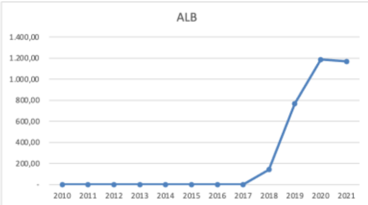


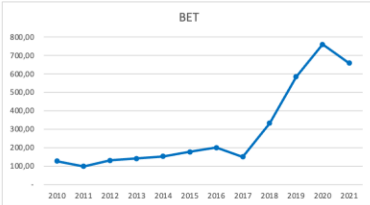


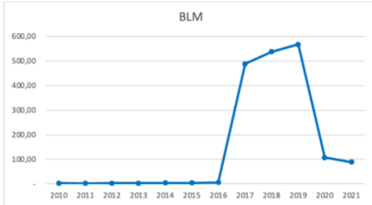


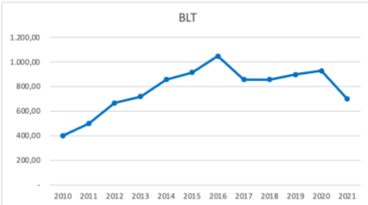
LN (Liftnet)

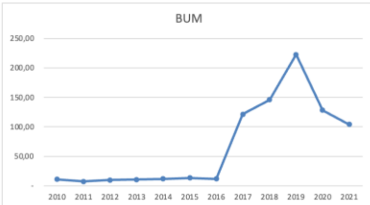
Year	ALB	BET	BLM	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	0,0	127,2	3,2	10,9	44,7	2372,3	10,7	218,3	556,9	9,0	7,10	281,35	0,07	223,18
2011	0,1	98,5	2,2	7,3	32,7	2119,5	13,5	216,9	545,9	6,0	4,95	296,32	0,24	170,89
2012	0,1	131,5	2,9	9,7	43,6	2829,9	18,0	289,6	728,8	8,0	6,61	395,63	0,32	228,16
2013	0,1	141,9	3,1	10,5	47,0	3053,3	19,4	312,5	786,3	8,6	7,13	426,86	0,35	246,17
2014	0,1	153,4	3,5	11,9	53,0	3380,8	16,6	423,9	739,9	9,8	8,64	457,17	0,34	284,75
2015	0,1	177,4	3,9	13,3	56,7	3542,0	14,6	483,7	698,2	10,9	9,38	475,23	0,33	328,40
2016	0,2	201,0	6,3	11,8	613,0	4494,1	99,4	568,9	763,1	10,9	13,26	537,78	0,35	418,49
2017	0,4	149,9	488,1	121,2	1149,7	3592,0	157,5	375,5	773,0	104,4	44,87	602,28	679,19	301,04
2018	142,3	332,2	537,5	145,9	1260,6	2996,5	210,4	466,6	1369,7	122,1	76,35	832,86	729,79	745,47
2019	768,5	584,4	567,3	222,6	780,4	2577,9	123,4	376,7	1368,2	137,1	120,38	971,89	925,62	1437,39
2020	1187,7	760,8	107,1	128,1	249,3	2666,5	61,9	412,5	1301,1	40,8	92,05	1066,70	328,21	2084,93
2021	1169,5	658,8	88,6	104,1	171,2	2435,2	26,8	191,2	616,3	20,1	75,31	1076,90	314,22	1888,33

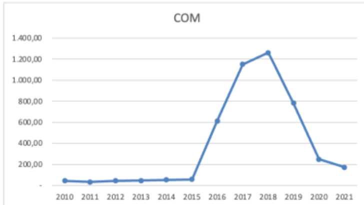


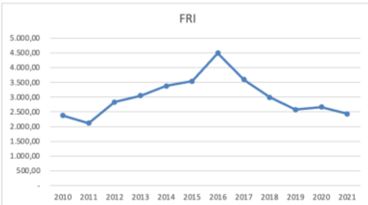


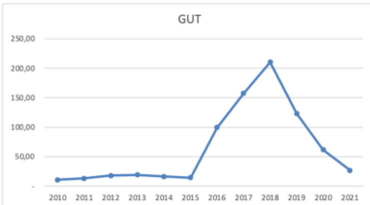


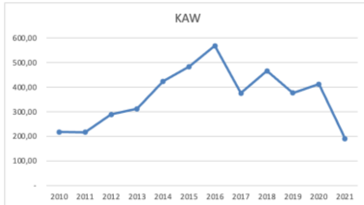


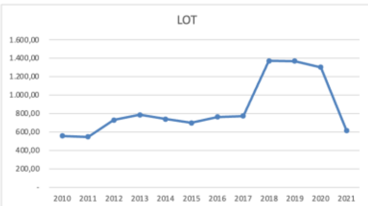


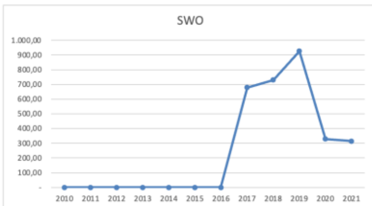


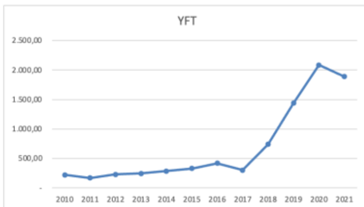






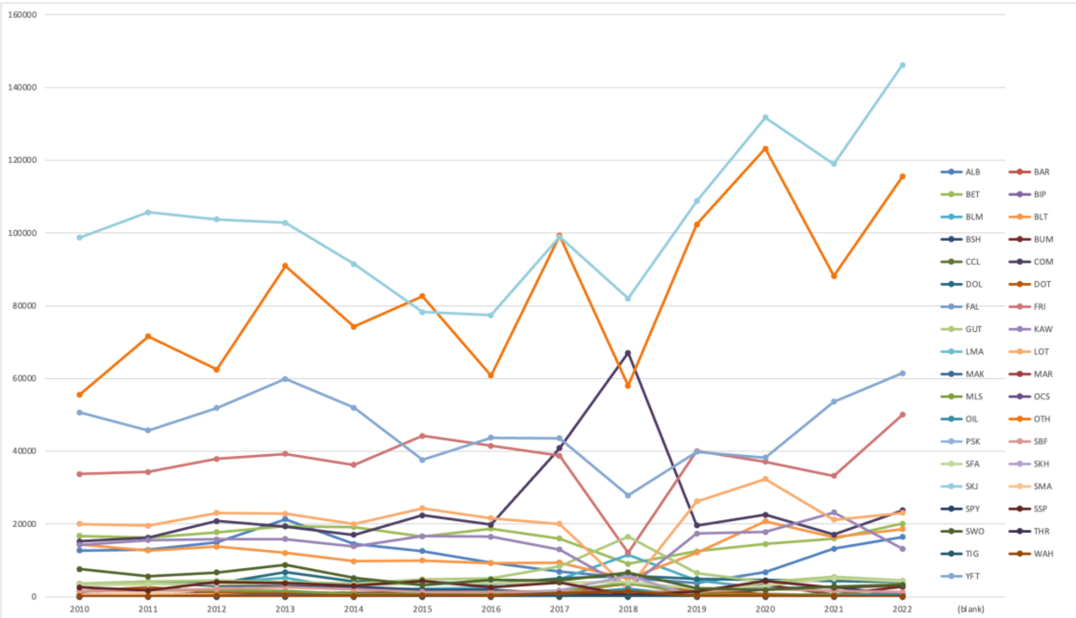






All gears

Year	ALB	BET	BLM	BLT	BUM	COM	FRI	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010	12.718,4	16.743,4	3.571,8	14.436,4	720,4	15.170,8	33.725,0	3.551,0	14.288,9	19.988,9	1.539,6	3.195,7	98.704,2	7.618,2	50.655,6
2011	12.881,8	16.309,7	3.551,6	12.715,2	617,6	16.230,4	34.274,2	4.204,0	15.587,1	19.521,8	1.704,1	3.435,8	105.709,5	5.599,9	45.719,9
2012	14.897,2	17.729,8	3.831,2	13.789,2	950,9	20.772,4	37.920,2	4.445,9	15.762,0	23.013,3	1.714,3	3.448,1	103.714,5	6.665,7	51.908,7
2013	21.330,4	19.467,0	5.129,7	12.032,1	1.127,0	19.314,5	39.256,6	4.077,8	15.879,6	22.815,4	1.536,3	3.637,2	102.778,4	8.760,2	59.837,3
2014	14.474,8	19.161,7	2.068,6	9.734,7	1.007,2	17.032,5	36.206,0	3.565,2	13.827,5	19.917,8	784,8	3.143,8	91.473,2	5.182,6	51.998,7
2015	12.579,0	16.599,4	2.151,9	9.958,0	1.081,9	22.365,7	44.242,0	4.763,5	16.608,8	24.311,8	799,2	3.642,7	78.245,7	3.245,3	37.595,5
2016	9.330,7	18.726,4	2.385,0	9.261,0	1.150,2	19.826,0	41.507,0	4.995,7	16.496,5	21.563,3	862,8	3.694,3	77.374,9	4.663,3	43.679,3
2017	6.881,4	15.990,3	4.783,9	9.368,3	1.650,6	40.802,1	38.742,9	8.382,7	12.983,7	20.000,5	1.597,7	3.882,4	98.964,1	4.437,8	43.537,0
2018	5.158,1	9.056,1	11.516,3	4.898,6	1.507,1	67.052,5	12.141,7	16.475,6	2.463,4	2.295,7	3.796,4	3.985,0	81.974,4	6.680,7	27.816,8
2019	3.705,2	12.476,5	4.424,8	12.080,9	1.287,1	19.586,0	40.035,3	6.508,9	17.356,1	26.155,1	684,7	2.210,5	108.783,1	2.332,9	39.847,4
2020	6.747,0	14.505,0	2.352,9	20.715,5	3.366,6	22.546,9	37.068,4	3.978,0	17.813,5	32.398,7	458,4	3.102,1	131.758,8	1.843,2	38.269,2
2021	13.169,7	16.002,2	2.772,4	16.392,5	562,1	17.092,7	33.218,2	5.423,2	23.162,2	21.175,6	719,6	5.040,3	118.987,7	2.784,4	53.598,4



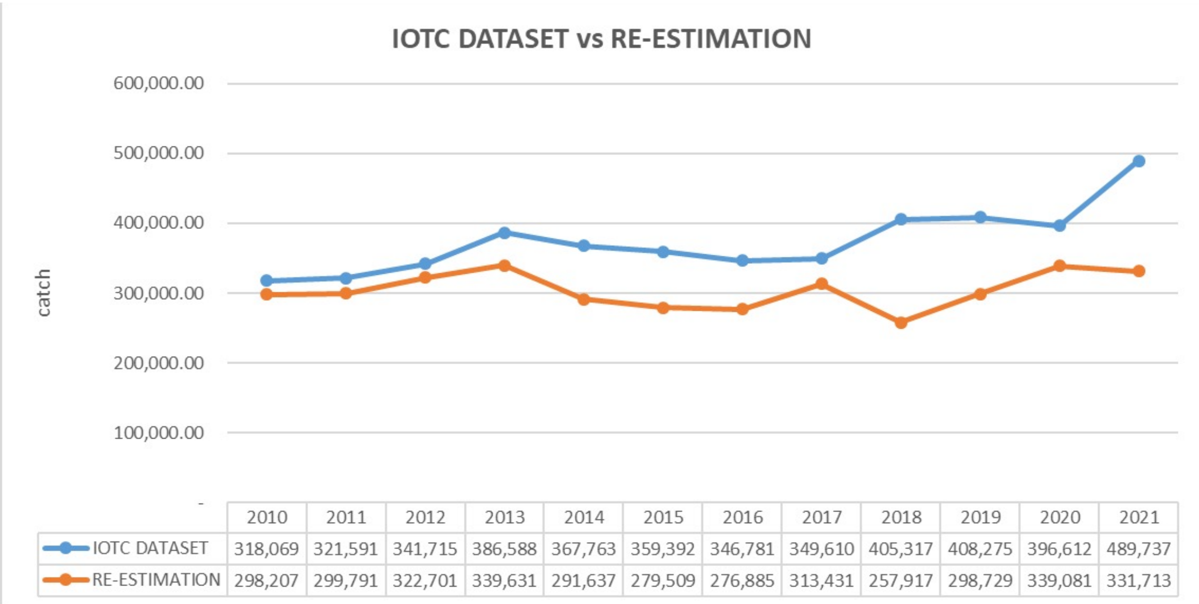
The total of re-estimation

Year	DS	GI	HL	HLOF	LL	LLCO	LLFR	LN	PL	PS	PSSS	TL	GIOF	Grand Total
2010	34.647	80.755	16.919		9.593	35.235	19.643	6.485	6.975	23.397	87.104	46.409		**367.161**
2011	15.518	91.955	9.955		5.003	37.190	10.245	10.380	4.830	27.747	103.297	69.710		**385.829**
2012	61.450	70.354	29.211		5.182	51.561	10.610	15.982	21.325	30.529	59.632	43.399		**399.236**
2013	56.252	54.564	40.161		1.604	51.270	23.286	15.212	29.346	39.514	86.416	49.239		**446.864**
2014	44.581	48.569	35.730		609	47.154	14.023	13.662	23.161	30.461	80.041	40.194		**378.185**
2015	66.069	77.568	40.530		313	32.638	8.412	22.216	20.165	20.043	58.560	28.964		**375.477**
2016	29.710	89.591	49.598		6	31.402	7.375	20.964	8.003	28.424	55.879	26.892		**347.844**
2017	61.925	67.132	57.641		100	31.444	5.421	35.203	35.466	39.884	82.356	11.750		**428.322**
2018	13.809	58.617	39.482		129	24.094	11.391	30.590	3.833	65.863	63.489	26.088		**337.385**
2019	27.979	75.972	67.338	14	894	18.116	2.310	26.388	8.060	47.327	103.273	32.182		**409.855**
2020	55.561	62.138	89.359	14	606	23.514	4.456	30.329	14.140	54.886	110.611	29.302		**474.916**
2021	23.818	85.998	78.933	72	763	24.614	8.702	19.700	8.267	62.187	87.526	30.809		**431.390**

The total of annual catch in the 1RC

Year	DS	GI	HL	LLCO	LLTU	LN	PL	PS	PSSS	TL	HLOF	GIOF	Grand Total
2.010	34.647	80.755	16.919	35.235	29.236	6.485	6.975	23.397	87.104	46.409	-		**367.162**
2.011	15.518	91.956	9.955	37.190	15.248	10.380	4.830	27.747	103.297	69.710	-		**385.830**
2.012	61.450	70.354	29.211	51.561	15.792	15.982	21.325	30.529	59.632	43.399	-		**399.236**
2.013	56.252	54.564	40.161	51.270	24.890	15.212	29.346	39.514	86.416	49.239	-		**446.865**
2.014	44.581	48.569	35.730	47.154	14.633	13.662	23.161	30.461	80.041	40.194	-		**378.185**
2.015	66.069	77.568	40.530	32.638	8.725	22.216	20.165	20.043	58.560	28.964	-		**375.477**
2.016	29.710	89.591	49.598	31.402	7.381	20.964	8.003	28.424	55.879	26.892	-		**347.844**
2.017	61.925	67.132	57.641	31.444	5.521	35.203	35.466	39.884	82.356	11.750	-		**428.322**
2.018	13.809	58.617	39.482	24.094	11.520	30.590	3.833	65.863	63.489	26.088	-		**337.385**
2.019	27.979	75.972	67.338	18.116	3.205	26.388	8.060	47.327	103.273	32.182	14		**409.855**
2.020	55.561	62.138	89.359	23.514	5.062	30.329	14.140	54.886	110.611	29.302	14		**474.916**
2.021	23.818	85.998	78.933	24.614	9.465	19.700	8.267	62.187	87.526	30.809	72		**431.390**

Comparison of Re-estimation Results for Indonesia’s Annual Tuna Catch Data 2010 -2021 with the IOTC datasets



Row Labels	FRI	ALB	BET	BLM	BLT	BUM	COM	GUT	KAW	LOT	MLS	SFA	SKJ	SWO	YFT
2010															
Reestimation	33.725	12.718	16.743	3.572	14.436	720	15.171	3.551	14.289	19.989	1.540	3.196	98.704	7.618	50.656
IOTC Dataset	60.246	13.062	22.930	2.150	2.317	2.092	42.784	13.258	42.186	24.852	870	1.043	81.130	2.908	29.415
2011															
Reestimation	34.274	12.882	16.310	3.552	12.715	618	16.230	4.204	15.587	19.522	1.704	3.436	105.710	5.600	45.720
IOTC Dataset	62.096	11.474	28.089	2.479	2.388	2.744	44.098	13.665	43.481	25.615	1.209	1.068	83.627	3.109	33.550
2012															
Reestimation	37.920	14.897	17.730	3.831	13.789	951	20.772	4.446	15.762	23.013	1.714	3.448	103.714	6.666	51.909
IOTC Dataset	61.848	11.050	34.648	2.086	2.385	1.643	43.921	13.611	43.313	25.513	864	1.452	88.824	4.231	31.465
2013															
Reestimation	39.257	21.330	19.467	5.130	12.032	1.127	19.315	4.078	15.880	22.815	1.536	3.637	102.778	8.760	59.837
IOTC Dataset	72.255	6.205	34.179	2.293	2.779	1.647	51.312	15.901	50.595	29.806	1.126	1.589	99.272	4.375	33.558
2014															
Reestimation	36.206	14.475	19.162	2.069	9.735	1.007	17.032	3.565	13.828	19.918	785	3.144	91.473	5.183	51.999
IOTC Dataset	63.648	7.654	26.409	2.055	2.448	818	45.200	14.042	44.568	26.255	722	1.202	85.799	2.489	25.239
2015															
Reestimation	44.242	12.579	16.599	2.152	9.958	1.082	22.366	4.763	16.609	24.312	799	3.643	78.246	3.245	37.596
IOTC Dataset	62.555	8.687	25.218	1.906	2.406	670	44.585	13.766	43.807	25.811	843	1.225	84.589	4.177	25.942
2016															
Reestimation	41.507	9.331	18.726	2.385	9.261	1.150	19.826	4.996	16.497	21.563	863	3.694	77.375	4.663	43.679
IOTC Dataset	59.445	7.026	21.914	1.836	2.290	556	42.309	13.093	41.626	24.522	530	1.088	80.330	1.773	22.654
2017															
Reestimation	38.743	6.881	15.990	4.784	9.368	1.651	40.802	8.383	12.984	20.000	1.598	3.882	98.964	4.438	43.537
IOTC Dataset	74.138	7.472	25.684	2.211	2.856	614	52.686	16.318	51.913	30.583	650	1.319	100.291	1.962	27.081
2018															
Reestimation	12.142	5.158	9.056	11.516	4.899	1.507	67.052	16.476	2.463	2.296	3.796	3.985	81.974	6.674	27.817
IOTC Dataset	48.669	5.605	20.185	1.426	18.202	220	33.664	10.886	49.920	24.451	370	840	78.926	982	22.636
2019															
Reestimation	40.035	3.521	12.477	4.425	12.081	1.287	19.586	6.509	17.356	26.155	685	2.210	108.783	2.333	39.847
IOTC Dataset	60.574	6.478	18.316	2.106	7.486	597	40.322	12.648	42.415	25.860	577	1.286	128.987	1.876	35.553
2020															
Reestimation	37.068	6.747	14.505	2.353	20.715	3.367	22.547	3.978	17.813	32.399	458	3.102	131.759	1.843	38.269
IOTC Dataset	82.000	10.569	24.106	2.355	4.444	804	57.383	17.724	56.326	33.295	603	1.582	116.119	2.150	31.155
2021															
Reestimation	33.218	13.170	16.002	2.772	16.392	562	17.093	5.423	23.162	21.176	720	5.040	118.988	2.784	53.598
IOTC Dataset	65.389	8.896	19.591	1.917	2.494	408	45.679	14.096	44.953	26.499	432	1.147	132.165	1.411	39.117

4. Conclusion

We have introduced a new methodology to re-estimate Indonesian data, incorporating relatively recent information from both manual and electronic logbooks and port landing data (PIPP).

Compared to the existing estimate based on outdated (2012) fishing patterns, our new estimate aligns with more recent reference patterns and stock conditions in Indian Ocean. The total of re-estimation is significantly lower than the IOTC database, and the catch trend for 2010-2021 is declining.

Despite challenges in the catch data collection system, the new re-estimate demonstrates reduced fluctuations and greater year-to-year consistency.

5. Recommendation

The new proposed re-estimation method proven to be robust and effective in dealing with highly fluctuated datasets and brought more consistency across gears and species. We are confident that this new methodology correctly adjust the Indonesian datasets period 2010-2021.

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

References

IOTC Secretariat. (2014). *Guidelines for the reporting of fisheries statistics to the IOTC* (p. 70pp). Indian Ocean Tuna Commission (IOTC).

IOTC Secretariat (2010-2021). Official Indonesia's Annual Tuna Catch for 2010-2021. Indian Ocean Tuna Commission (IOTC).

Appendix 1. Types of fisheries for IOTC species

IOTC Code	Type of Operation	English name
BS	Artisanal	Beach seine
CN	Artisanal	Cast net
DS	Artisanal	Danish seine
DSD	Artisanal	Demersal Danish seine
GI	Artisanal	Gillnet
GIDR	Industrial	Driftnet
GIOF	Semi-industrial	Offshore gillnet
HL	Artisanal	Handline
HLPA	Artisanal	Handline on anchored-FAD
DL	Artisanal	Dropline (vertical handline)
DLLS	Artisanal	Dropline on anchored-FAD
HR	Artisanal	Harpoon
LL	Industrial	Drifting longline (over 1800 hooks)
LLCO	Artisanal	Smalll longline
LLEX	Industrial	Drifting longline (exploratory)
LLFR	Industrial	Drifting longline (up to 1800 hooks)
LLGI	Semi-industrial	Gillnet/longline
LLSI	Semi-industrial	Swordfish longline (semi-industrial)
LLSK	Industrial	Shark longline
LLSW	Industrial	Swordfish longline (Florida longline)
LLTU	Industrial	Tuna longline
LN	Artisanal	Liftnet
LNPA	Artisanal	Liftnet on anchored-FAD
PL	Artisanal	Pole and line
PLIN	Industrial	Industrial pole and line
PLPA	Artisanal	Pole-and-line on anchored-FAD
PLFS	Artisanal	Free-school pole-and-line
PLDF	Artisanal	Dolphin associated school pole-and-line
PLME	Artisanal	Pole and line (mechanized boats)
PLNM	Artisanal	Pole and line (non-mechanized boats)
PLOF	Semi-industrial	Offshore pole and line
PS	Industrial	Tuna purse seine
PSFS	Industrial	Free-school tuna purse seine
PSLS	Industrial	Log-school tuna purse seine
PSSA	Semi-industrial	Coastal purse seine on anchored-FAD
PSSF	Semi-industrial	Free-school coastal purse seine
PSRN	Artisanal	Ringnet
PSRP	Artisanal	Ringnet with anchored-FAD
PSSP	Industrial	Support vessel industrial purse seiner
PSSS	Semi-industrial	Small purse seines
SN	Artisanal	Setnet
SP	Artisanal	Sport fishing
TL	Artisanal	Trolling
TLME	Artisanal	Trolling (mechanized boats)
TLNM	Artisanal	Trolling (non-mechanized boats)
TP	Artisanal	Trap
TR	Semi-industrial	Trawl

Appendix 2. Classification and dimensions of fisheries (Modified from Moreno & Herrera (2013))

Type of boat	Boat size	Area of Operation	Fleet
Non-motorised	All	Flag state EEZ only	Artisanal
Motorised outboard	All	Flag state EEZ only	Artisanal
Motorised inboard	<15 m	Flag state EEZ only	Artisanal
Motorised inboard	15-24 m	Flag state EEZ only	Semi-industrial
Motorised inboard	<15 m	Includes other EEZ areas and/or high seas	Semi-industrial
Motorised inboard	15-24 m	Includes other EEZ areas and/or high seas	Industrial
Motorised inboard	≥ 24 m	Anywhere	Industrial

Appendix 3. Catch estimation methodology prior 2017

Since 2010, Indonesia has been submitting the official annual tuna catch to the IOTC Secretariat through form 1RC. The 2010-2016 data was accepted as official data, and it was published by FAO. It has been used for various purposes by public as well as other institutions. Based on the IOTC Secretariat's presentation in the 1st Indonesian tuna fisheries data workshop, there were some collaborating activities between the IOTC Secretariat, relevant institutions and Indonesia Government on the review of Indonesia data collection and reporting procedures have been conducted, as the following:

1. 2011: (1) Review of fisheries data collection systems for BOBLME countries, (2) CSIRO-led project on "Capacity development to monitor, analyse and report on Indonesian tuna fisheries" (ACIAR).
2. 2012: Pilot project to improve data collection from IO artisanal fisheries (IOTC), involving (1) Several data sources from 1950-1991 e.g., IPTP, IOTC, etc., (2) Catch data reports and sheets from ports and provinces from 2003-2011 e.g., DGCF, DINAS, etc., (3) Exclusion of unlikely gear-species combinations. The project output was time series of artisanal catches by gear and species 1950-2011, using fixed gear / species ratios for Artisanal (ART) fisheries.
3. 2013: Workshop on evaluating the procedure developed by the IOTC secretariat to estimate IDN albacore catches for 2002-2012 (methodology potentially applicable to other species). For this purpose, several datasets were considered, such as:
   - Different data sources: WCPFC, DGCF, ISSF, IOTC
   - Time series of artisanal catches derived from Revision II
   - Fishing craft data on the number of deep-freezing longliners (LL)
   - TWN LL fishery: proxy for the annual catch rate and composition of IDN LL

   The final outputs were as follows:
   - Time series of IDN deep-freezing longliners, 2002-2011
   - Time series of catches of LL fisheries by species/gear, 2002-2011
   - Time series of catches of FLL fisheries by species/gear, 2002-2011

Based on the paper prepared by IOTC Secretariat in the WPDCS10, there were some capacity building activities implemented by the IOTC and its partners during 2014, in particular Indonesia, as the following:
1. Review of data collection and management systems artisanal fisheries of West Sumatra, Indonesia
2. Data collection Workshop West Sumatra Indonesia
3. Review of data collection and management systems artisanal fisheries of Bali and East Java, Indonesia
4. Pilot sampling activities in the North and West Sumatra, Indonesia

Based on the paper prepared by IOTC Secretariat in the WPDCS11, there were some capacity building activities implemented by the IOTC and its partners during 2015 in Indonesia, as the following:
1. Indonesia pilot sampling monitoring activities (North and West Sumatra)
2. Technical assistance mission: reporting of catch-and-effort, size data and Regional Observer data (Jakarta)

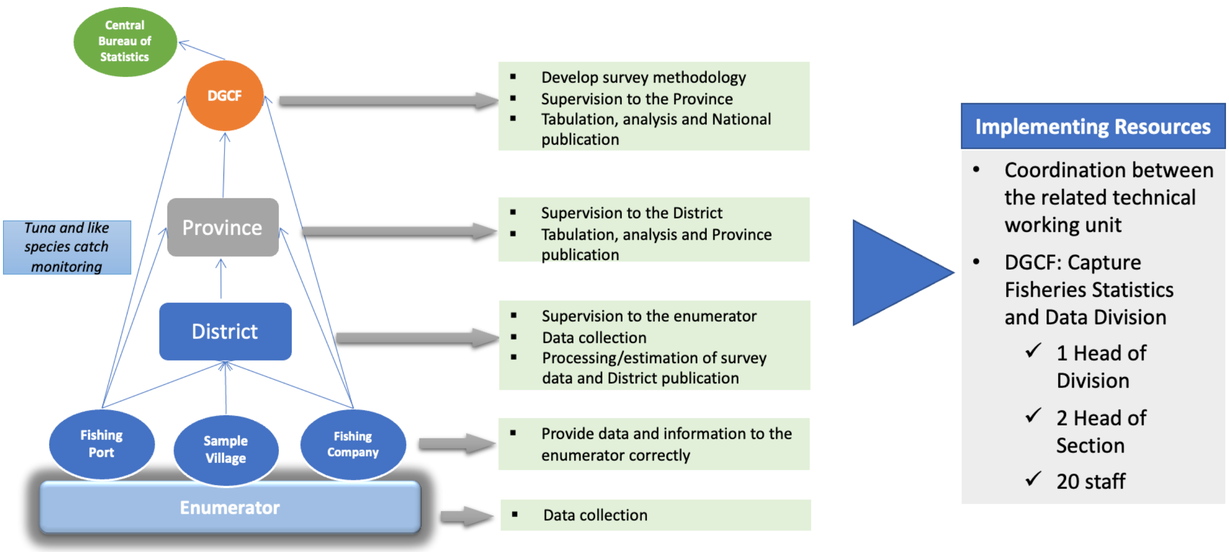
3. Indonesia pilot sampling: project evaluation and catch estimation workshop (Jakarta)

Based on the paper prepared by IOTC Secretariat in the WPDCS12, there were some capacity building activities implemented by the IOTC and its partners during 2016 in Indonesia, as the following:

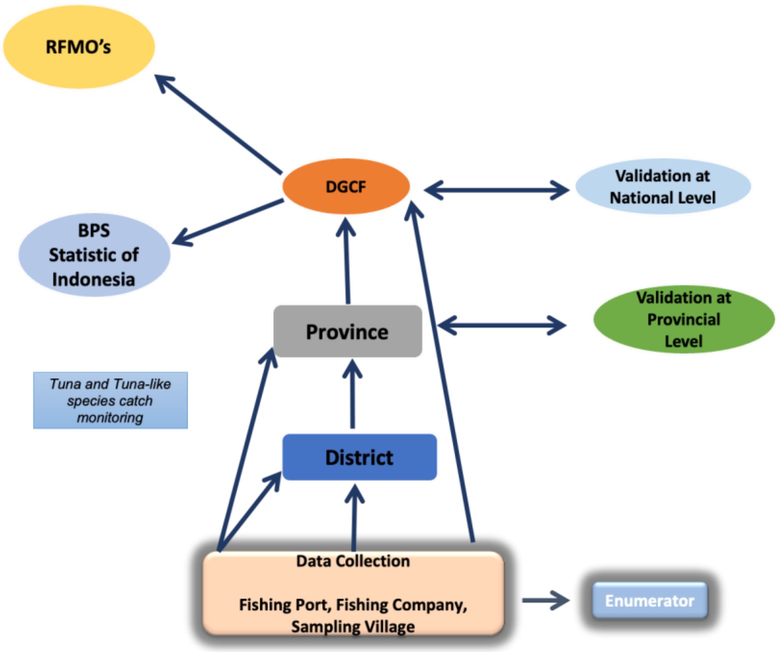
1. Continuation of support for the IOTC/OFCF/BOBLME pilot sampling of artisanal fisheries.
2. Data compliance mission to facilitate the reporting of catch-and-effort and size data from industrial longline fleet.

As the follow up of the coordination activities above, Indonesia has submitted revised annual catch data for the concern years to the IOTC Secretariat and been acknowledged receipt as a final of Indonesia official catch data.

The data collection prior 2017 was conducted based on Yamamoto method as specified below:

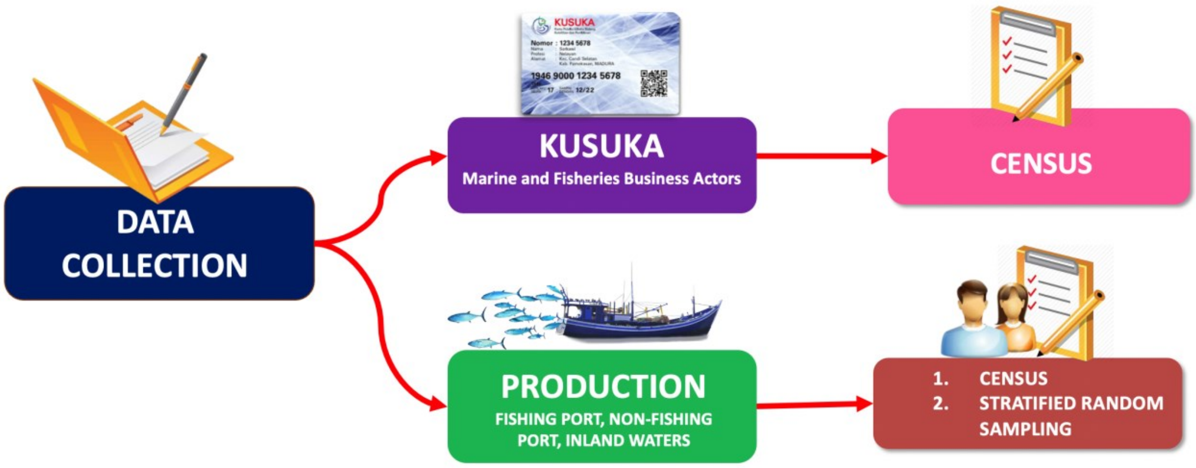


Prior to submission, the official catch data of 2010-2016 has been verified and scrutinized through validation scheme as described below:


RFMO's
DGCF
Validation at National Level
BPS Statistic of Indonesia
Province
Validation at Provincial Level
Tuna and Tuna-like species catch monitoring
District
Data Collection
Fishing Port, Fishing Company, Sampling Village
Enumerator

Appendix 4. Catch estimation methodology for 2017-2021

One Data is a National Program, aimed to provide an integrated data for a more cohesive national planning process. In the beginning of 2017, the MMAF implemented One Data of Marine and Fisheries for the very first time. By late of 2019, the Presidential Decree No. 39 about the National One Data was finally signed, and One Data became a nation-wide Program. The type and method of data collection under the One Data program described as below:



The objective of KUSUKA data collection is collecting/updating data on marine and fishery business actors (fishermen, fish farmers, fish traders/marketers and fish processors and salt farmers), including data on Fisheries households, facilities and types of activities of all marine and fisheries business actors according to their domicile by census.

Meanwhile, the objectives of production data collection are 1) Collecting production data at the fishing port; 2) Collecting sampling data on marine and inland capture fisheries production, aquaculture production, fish processing production and salt production; 3) As a basis for estimating district / city level to aggregate production figures.

The methodology of production data collection is described below:

1. Census for fishing port (daily)
2. Sampling, randomly selected from each population stratification in each district / city (monthly)
3. Recall where the respondent was interviewed regarding fishing activities carried out in the last month (t-1)

Respondents:

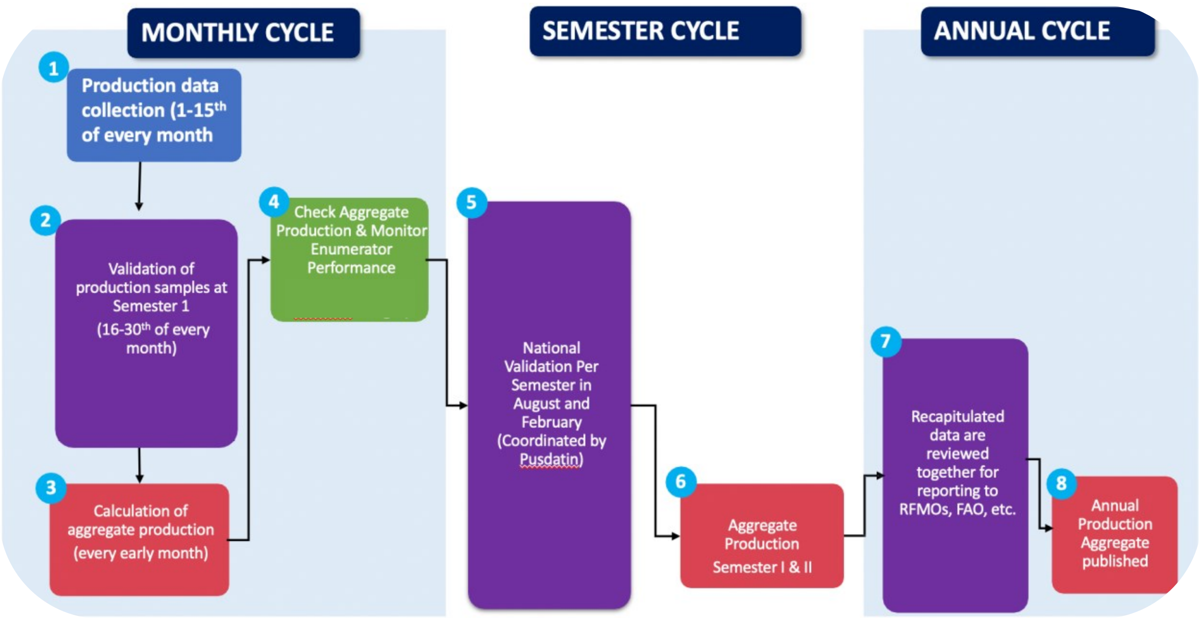
1. All vessels / units that land their catch at the fishing port
2. Fisheries household sample selected in the district / city (non-fishing port)

Data Collection Instruments:
Capture fisheries production questionnaire

Data Collection Periods:
1. Daily for fishing port
2. Monthly for non-fishing port capture fisheries production in marine and inland waters.

Aggregated Number Formulation

Sampling taken (According to the rules)	Aggregated number (A) (Representing districts)
$A = Nx\frac{p}{n}$ Where: A : Production calculation result (aggregated) N : Sum of gear population unit n : Sum of gear sampling unit p : Sum of sampling production	• The sample must derived from stratified population of gears • Sample taken from each gear



The process of annual statistical fisheries data publication by One Data