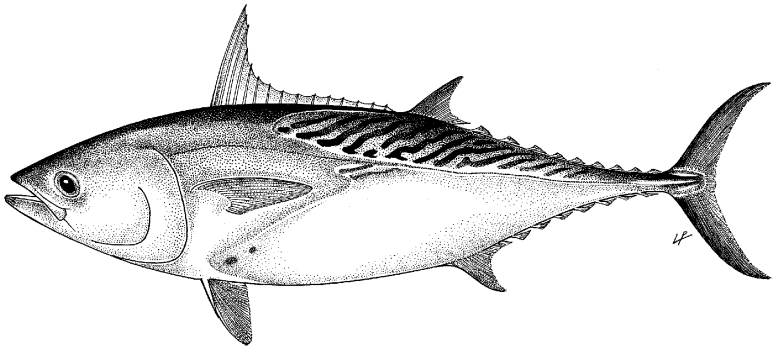
# REVIEW OF FISHERIES STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN KAWAKAWA

Author: IOTC Secretariat



## Introduction

The overarching objective of the paper is to provide participants at the 13th Session of the IOTC Working Party on Neritic Tunas (WPNT13) with a review of the status of fisheries information available on kawakawa (*Euthynnus affinis*) (Risso 1810) occurring in the Indian Ocean. The document describes the temporal and spatial trends in retained catches at global and ocean-basin scale and the main characteristics of the fisheries catching kawakawa in the Indian Ocean, as well as providing an assessment of the reporting quality of the data sets available at the IOTC Secretariat. A full description of the data sources, processing steps to generate the data sets, and key for reporting quality scores is available in IOTC (2023).

## Global catches

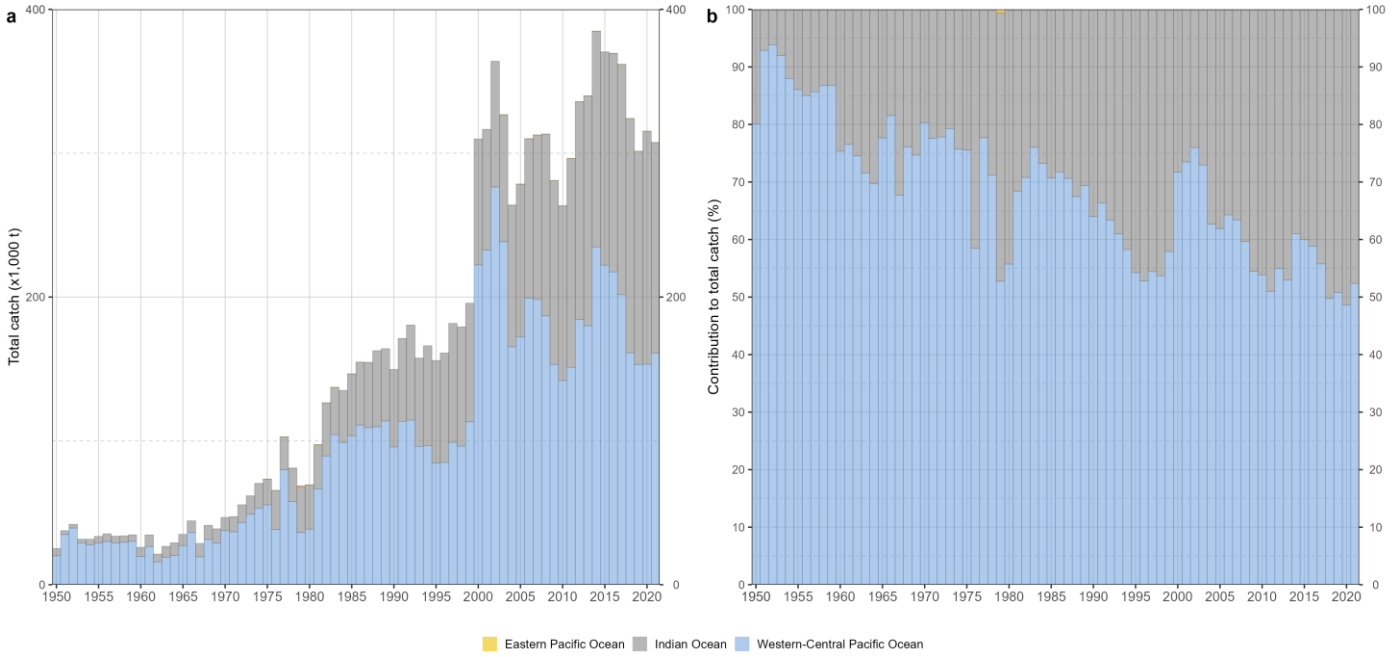



Figure 1: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) contribution to the total retained catches (percentage; %) of kawakawa by ocean basin for the period 1950-2021. Source: FAO global capture production database

# Indian Ocean catches & discards

## Historical trends (1950-2021)

Table 1: Mean annual retained catches (metric tonnes; t) of kawakawa by decade and fishery for the period 1950-2019. The background intensity colour of each cell is directly proportional to the catch level. Data source: best scientific estimates of retained catches

| Fishery | 1950s | 1960s | 1970s | 1980s | 1990s | 2000s | 2010s |
|---|---|---|---|---|---|---|---|
| **Purse seine \| Other** | 111 | 385 | 2,616 | 12,071 | 21,400 | 28,613 | 43,453 |
| **Longline \| Other** | 0 | 0 | 0 | 24 | 706 | 1,106 | 549 |
| **Longline \| Fresh** | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| **Longline \| Deep-freezing** | 0 | 0 | 0 | 37 | 0 | 0 | 105 |
| **Line \| Coastal longline** | 88 | 182 | 543 | 877 | 1,453 | 2,217 | 4,117 |
| **Line \| Trolling** | 1,418 | 2,811 | 5,090 | 7,356 | 11,307 | 11,625 | 11,825 |
| **Line \| Handline** | 204 | 266 | 1,009 | 1,621 | 2,503 | 5,991 | 10,019 |
| **Baitboat** | 88 | 297 | 579 | 1,094 | 2,005 | 1,790 | 1,195 |
| **Gillnet** | 2,564 | 4,486 | 9,691 | 18,001 | 28,426 | 47,161 | 71,961 |
| **Other** | 207 | 422 | 778 | 1,534 | 2,444 | 4,961 | 6,753 |
| **Total** | 4,680 | 8,848 | 20,306 | 42,615 | 70,244 | 103,465 | 150,000 |

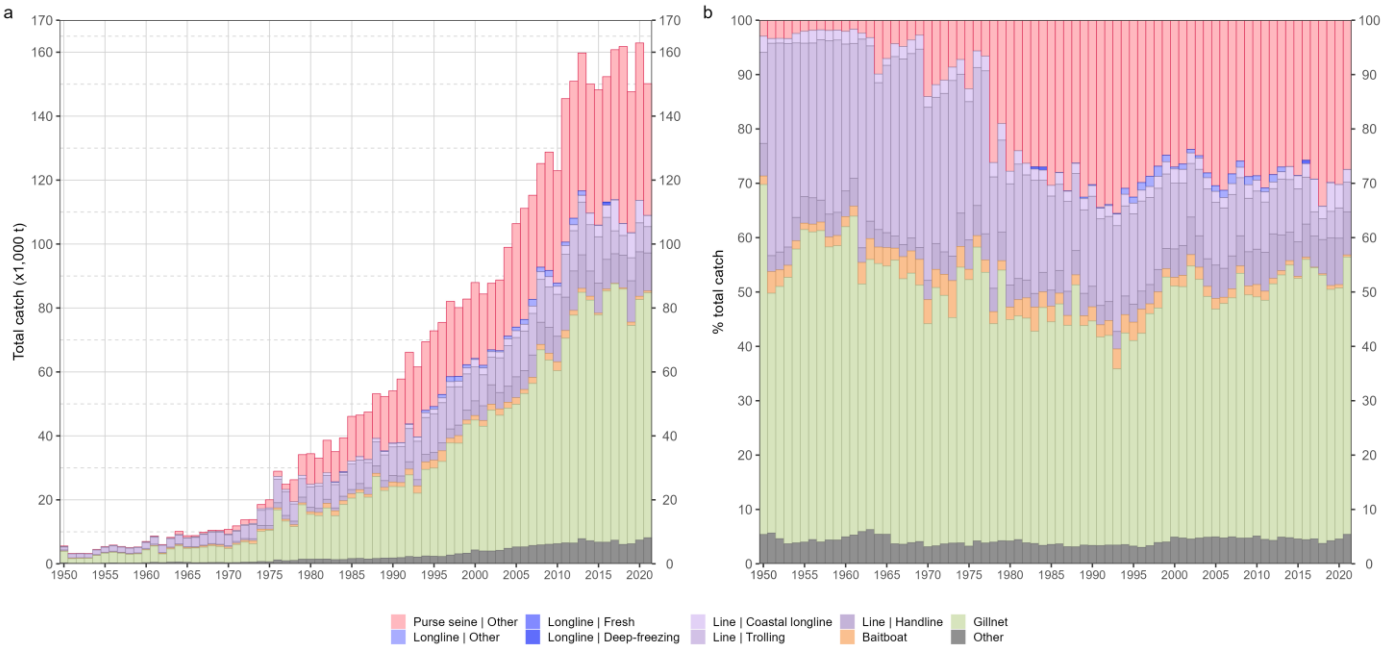



Figure 2: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) cumulative contribution to the total retained catches (percentage; %) of kawakawa by fishery for the period 1950-2021. Data source: best scientific estimates of retained catches

Table 2: Annual retained catches (metric tonnes; t) of kawakawa by fishery for the period 2012-2021. The background intensity colour of each cell is directly proportional to the catch level. Data source: best scientific estimates of retained catches

| Fishery | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|
| Purse seine \| Other | 42,874 | 43,146 | 40,406 | 42,348 | 39,235 | 46,968 | 55,378 | 44,104 | 49,230 | 41,253 |
| Longline \| Other | 2,038 | 1,403 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Longline \| Fresh | 5 | 3 | 24 | 51 | 37 | 31 | 27 | 57 | 21 | 14 |
| Longline \| Deep-freezing | 0 | 0 | 0 | 41 | 954 | 34 | 6 | 15 | 8 | 8 |
| Line \| Coastal longline | 1,856 | 2,123 | 3,563 | 3,566 | 3,791 | 9,615 | 3,717 | 7,748 | 7,017 | 3,464 |
| Line \| Trolling | 12,583 | 16,448 | 14,504 | 14,461 | 13,123 | 7,179 | 6,151 | 7,209 | 9,043 | 8,231 |
| Line \| Handline | 12,346 | 10,514 | 7,876 | 9,388 | 9,280 | 9,230 | 10,206 | 12,933 | 13,908 | 11,868 |
| Baitboat | 1,498 | 1,234 | 1,214 | 565 | 624 | 145 | 394 | 1,050 | 1,031 | 586 |
| Gillnet | 71,246 | 77,056 | 75,266 | 71,054 | 78,566 | 80,215 | 79,843 | 68,270 | 75,215 | 76,611 |
| Other | 6,489 | 7,835 | 7,197 | 6,773 | 6,745 | 7,367 | 6,064 | 6,259 | 7,414 | 8,135 |
| Total | 150,934 | 159,761 | 150,050 | 148,247 | 152,355 | 160,786 | 161,785 | 147,645 | 162,887 | 150,170 |

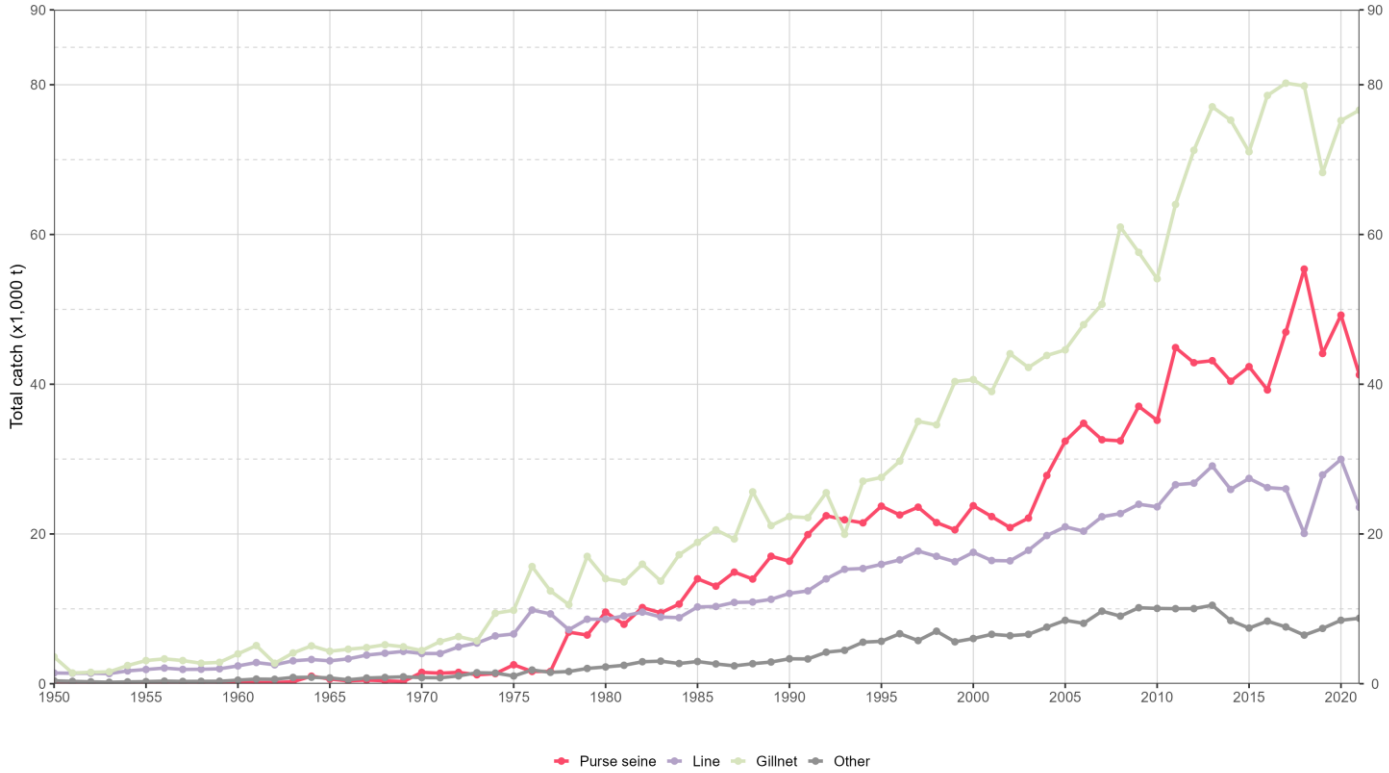



Figure 3: Annual time series of retained catches (metric tonnes; t) of kawakawa by fishery group for the period 1950-2021. Data source: best scientific estimates of retained catches

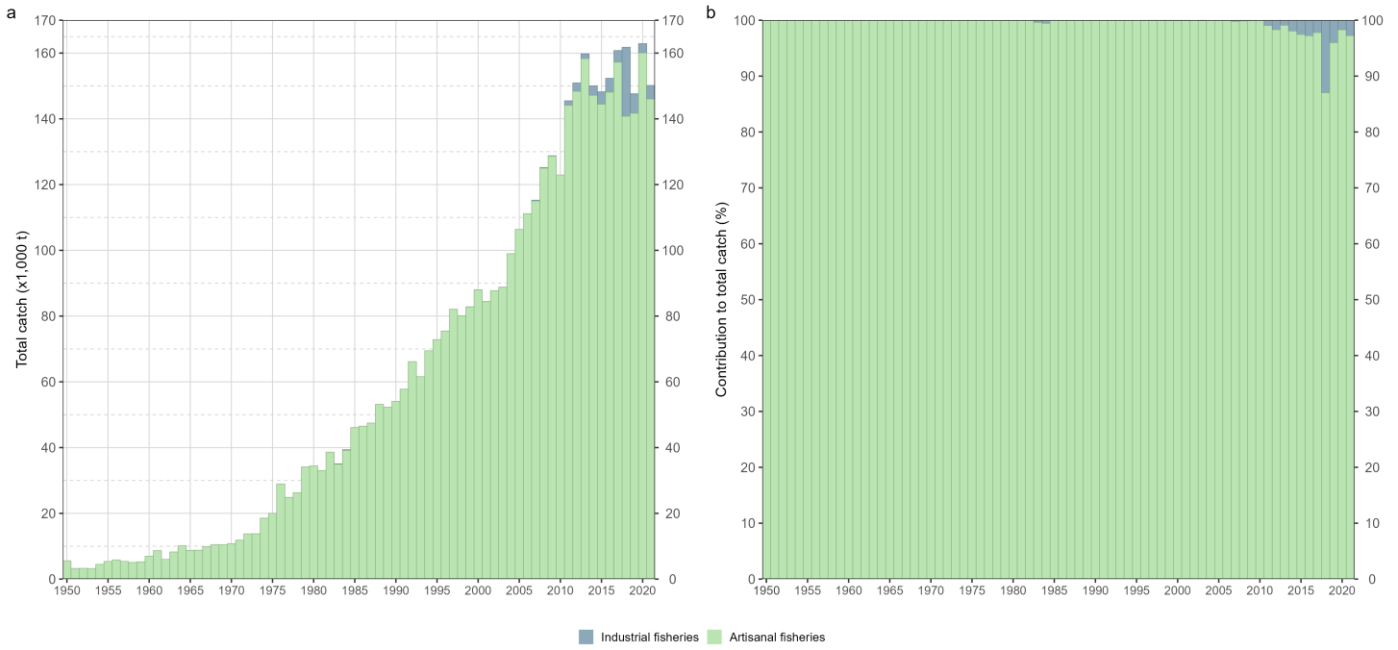



Figure 4: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) cumulative contribution to the total retained catches (percentage; %) of kawakawa by type of fishery for the period 1950-2021. Data source: best scientific estimates of retained catches

## Recent fishery features (2017-2021)

Table 3: Mean annual retained catches (metric tonnes; t) of kawakawa by fishery between 2017 and 2021. Data source: best scientific estimates of retained catches

| Fishery | Fishery code | Catch | Percentage |
|---|---|---|---|
| Gillnet | GN | 76,031 | 48.5 |
| Purse seine \| Other | PSOT | 47,386 | 30.2 |
| Line \| Handline | LIH | 11,629 | 7.4 |
| Line \| Trolling | LIT | 7,563 | 4.8 |
| Other | OT | 7,048 | 4.5 |
| Line \| Coastal longline | LIC | 6,312 | 4.0 |
| Baitboat | BB | 641 | 0.4 |
| Longline \| Fresh | LLF | 30 | 0.0 |
| Longline \| Deep-freezing | LLD | 14 | 0.0 |

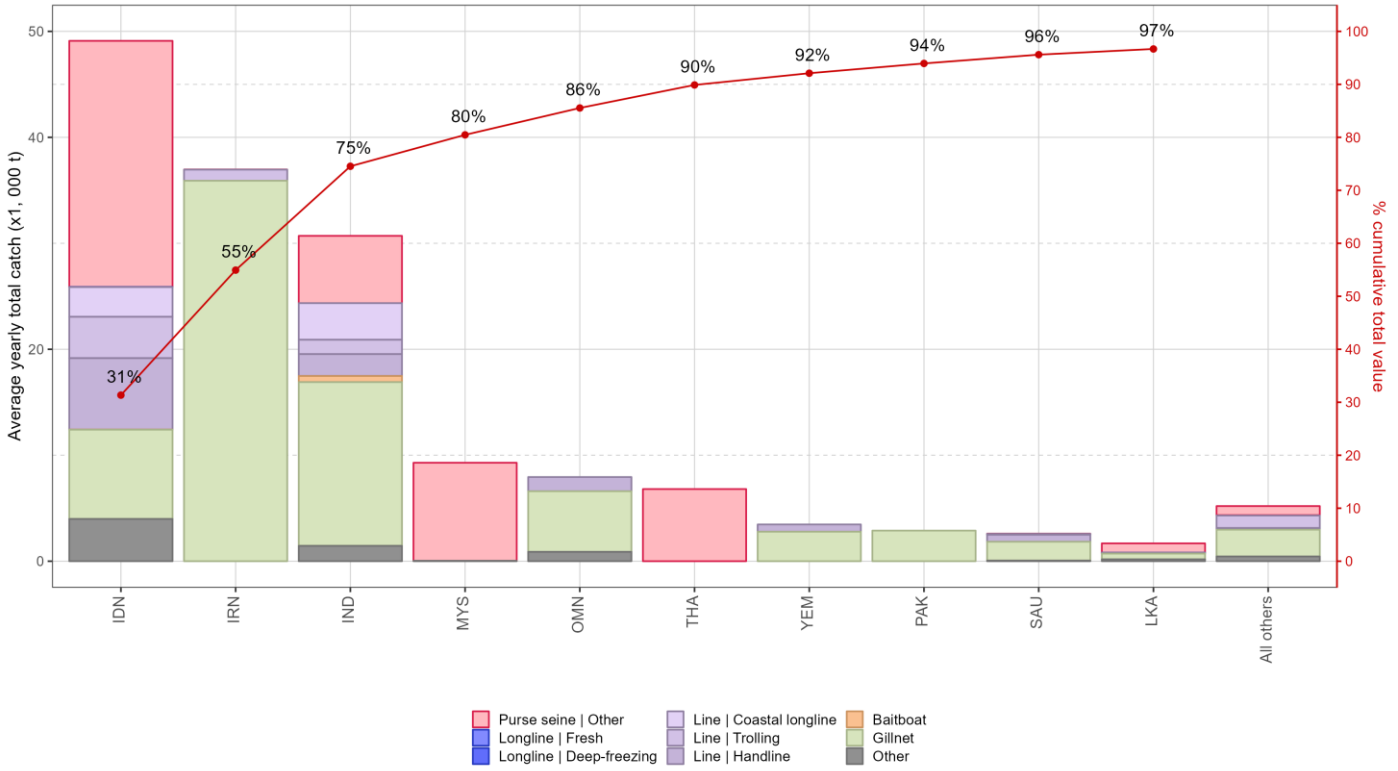



Figure 5: Mean annual retained catches (metric tonnes; t) of kawakawa by fleet and fishery between 2017 and 2021, with indication of cumulative contribution (percentage; %) of catches by fleet. Data source: best scientific estimates of retained catches

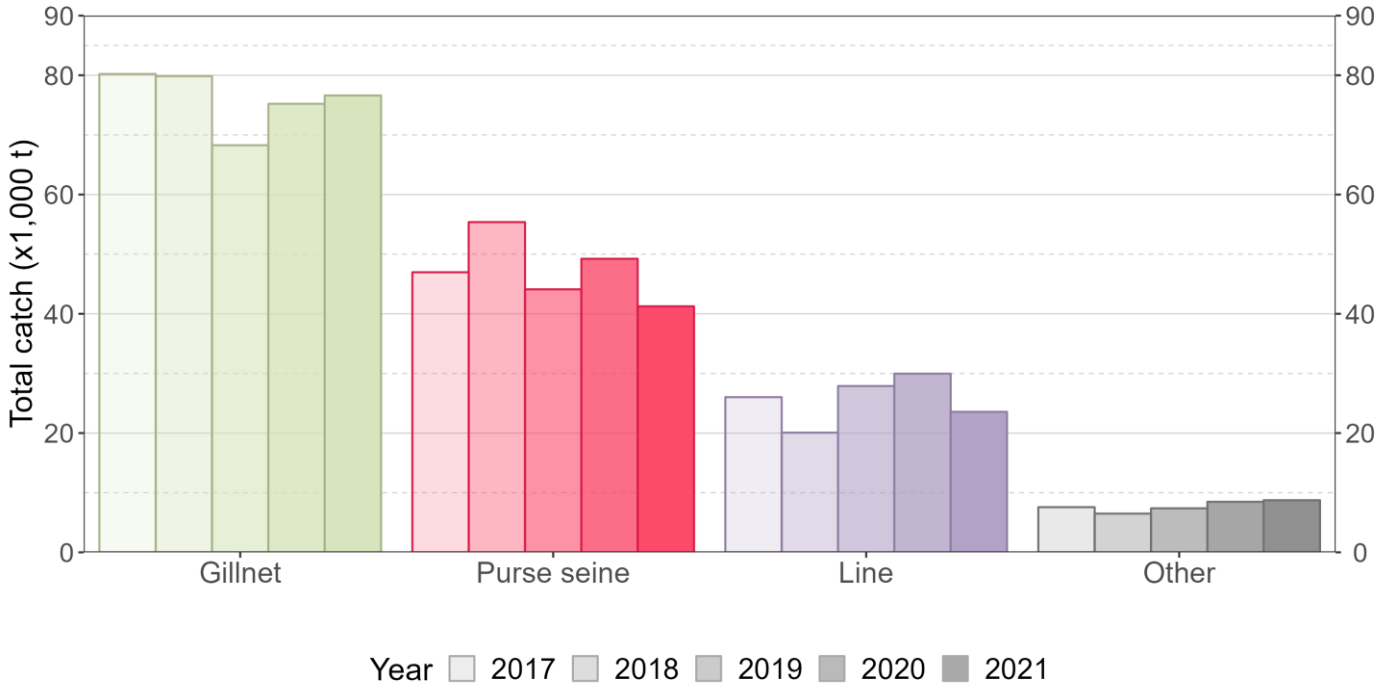



Figure 6: Annual trends in retained catch (metric tonnes; t) of kawakawa by fishery group between 2017 and 2021. Data source: best scientific estimates of retained catches

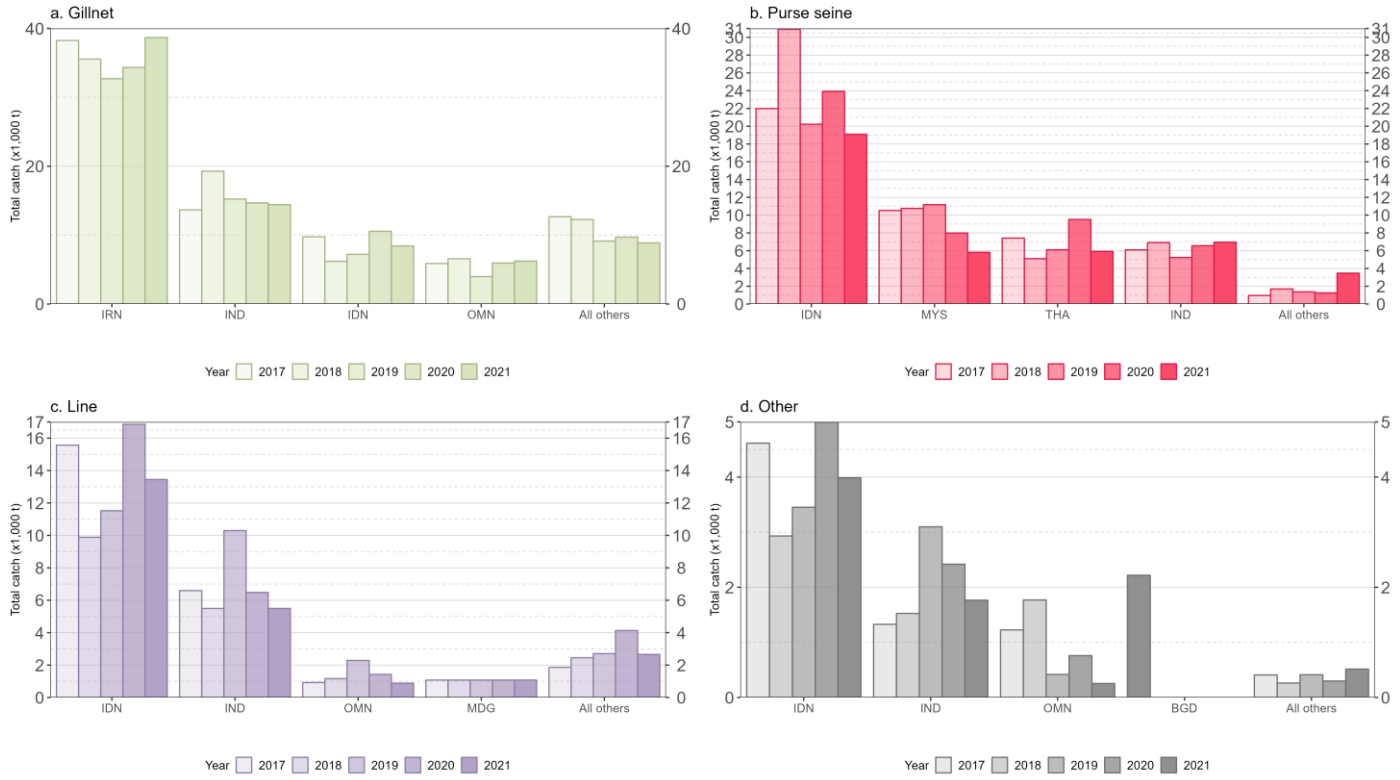



Figure 7: Annual trends in retained catch (metric tonnes; t) of kawakawa by fishery group and fleet between 2017 and 2021. Data source: best scientific estimates of retained catches

## Changes from previous Working Party

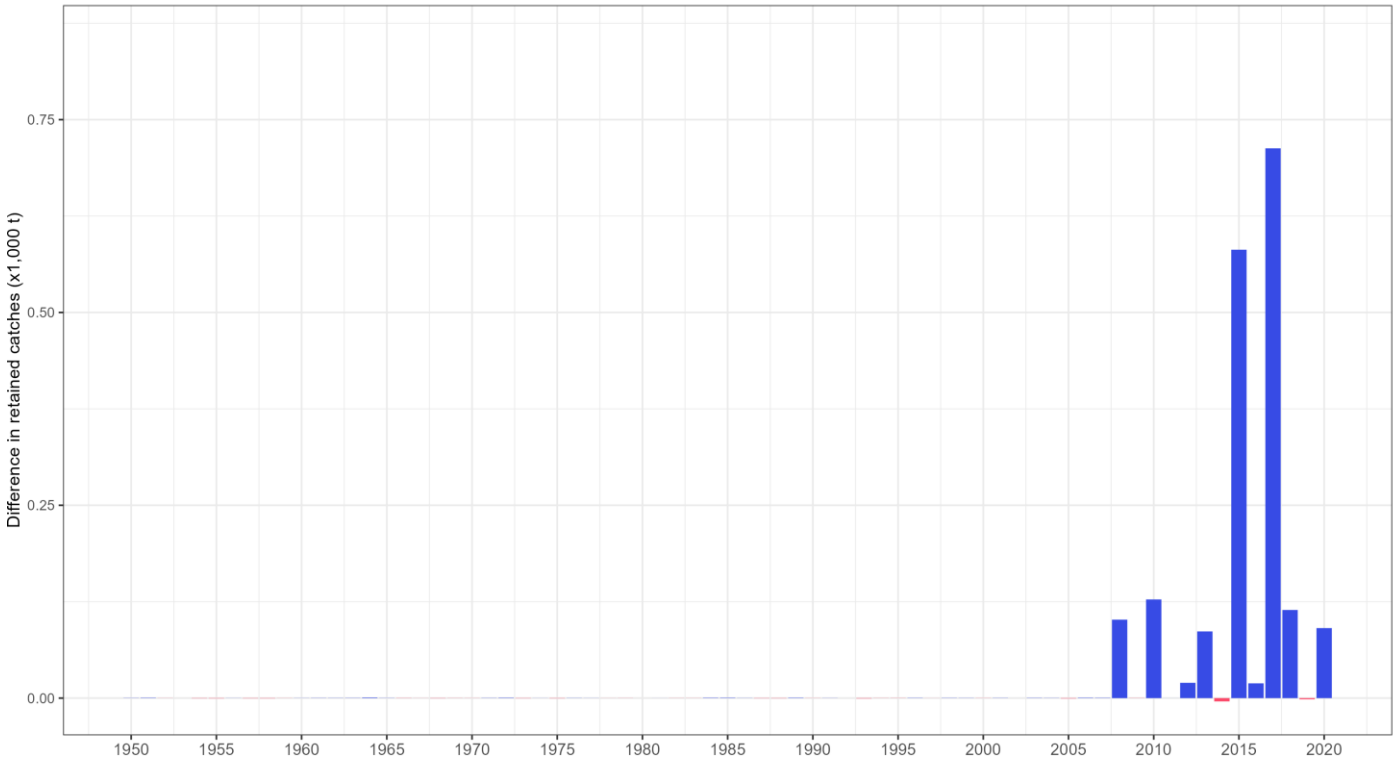



Figure 8: Differences in the annual retained catches (metric tonnes; t) of bullet tuna available at this WPNT and its previous session (WPNT12 meeting held in July 2022). Details by year, fleet, fishery group, and Indian Ocean major area given in Appendix II

## Uncertainties in retained catch data

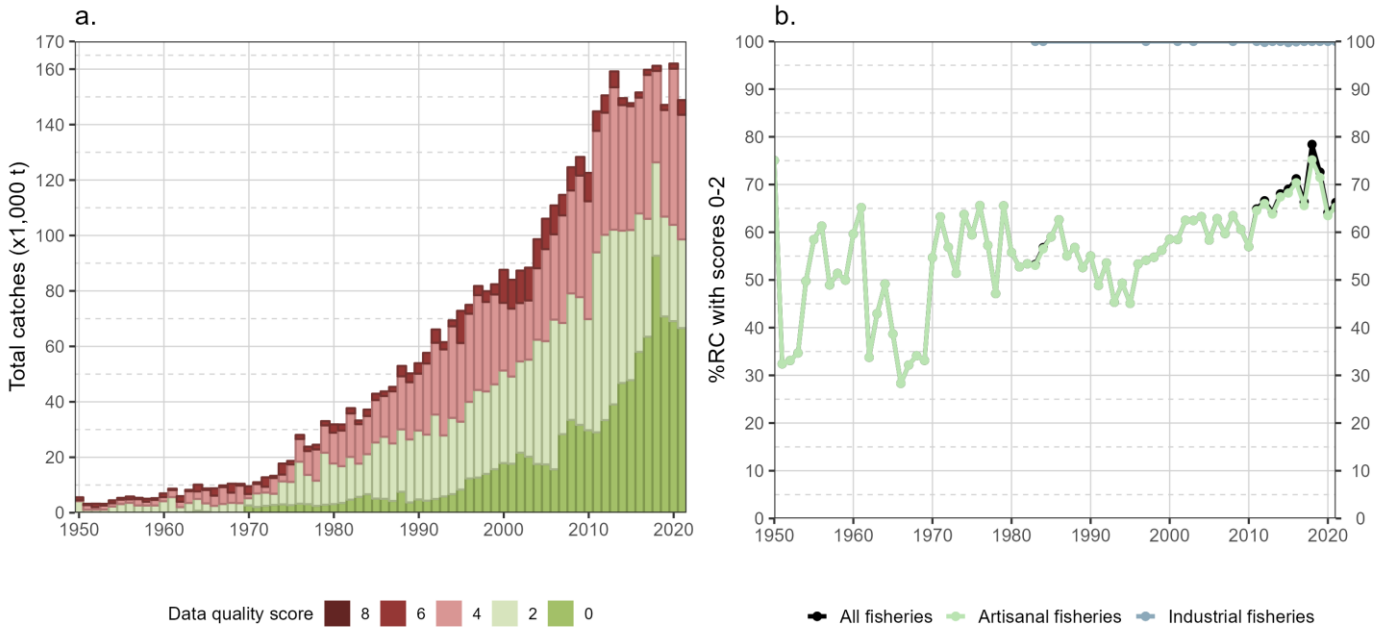



Figure 9: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches fully or partially reported to the IOTC Secretariat to all retained catches (percentage; %) of kawakawa for all fisheries and by type of fishery, for the period 1950-2021

## Discards

Very little information is available on discards of neritic tunas in coastal and semi-industrial fisheries of the Indian Ocean. Discarding of neritic tunas has been shown to occur in large-scale longline and purse seine fisheries that target tropical tunas and billfish but the quantities are considered to be small (Huang & Liu 2010, Ruiz et al. 2018). The implementation of IOTC Res. 19/05 on the retention of bycatch onboard purse seiners since late 2019 is assumed to have resulted in a reduction of the discards of kawakawa in this fishery.

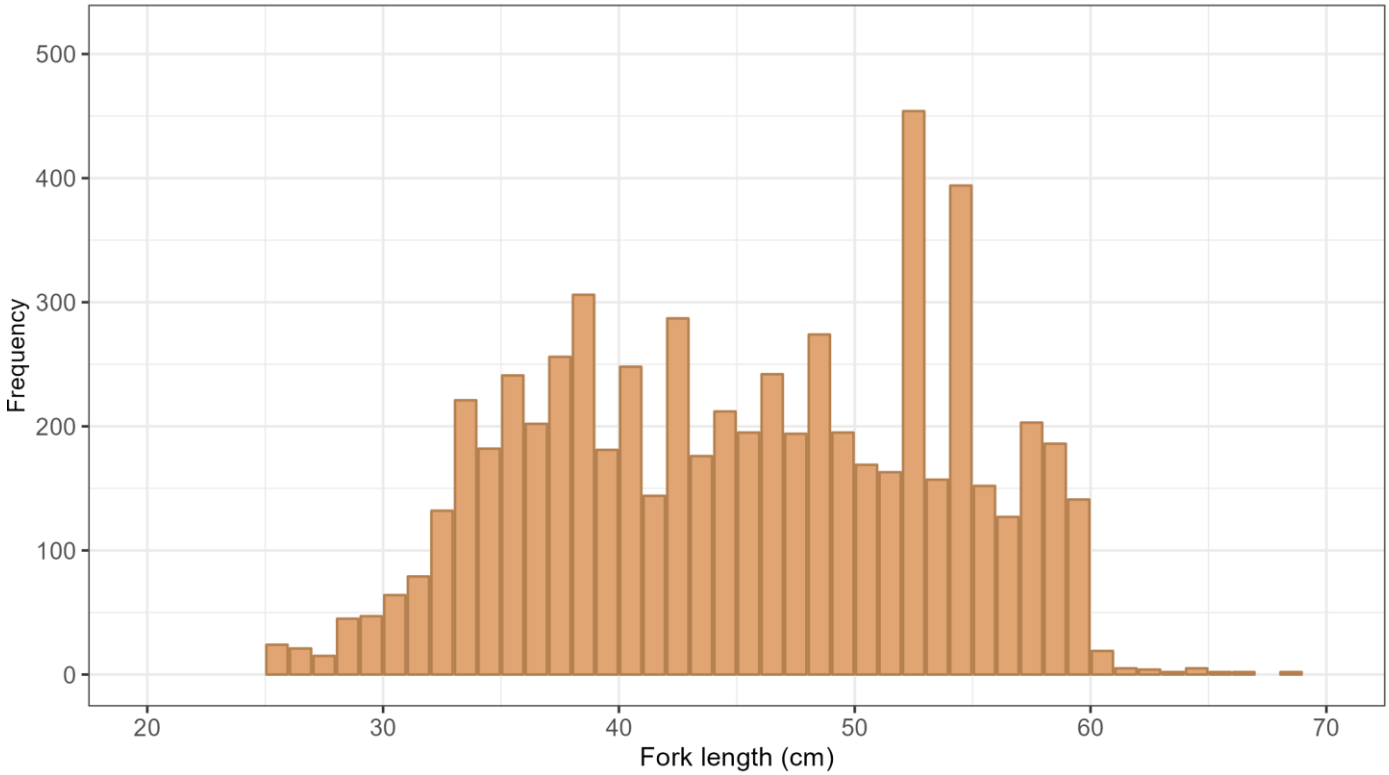



Figure 10: Size-frequency distribution of kawakawa discarded at sea in purse seine fisheries as available in the ROS regional database

# Spatial distribution of catch

## Geo-references catches

### Geo-referenced catches by fishery and decade (1950-2009)

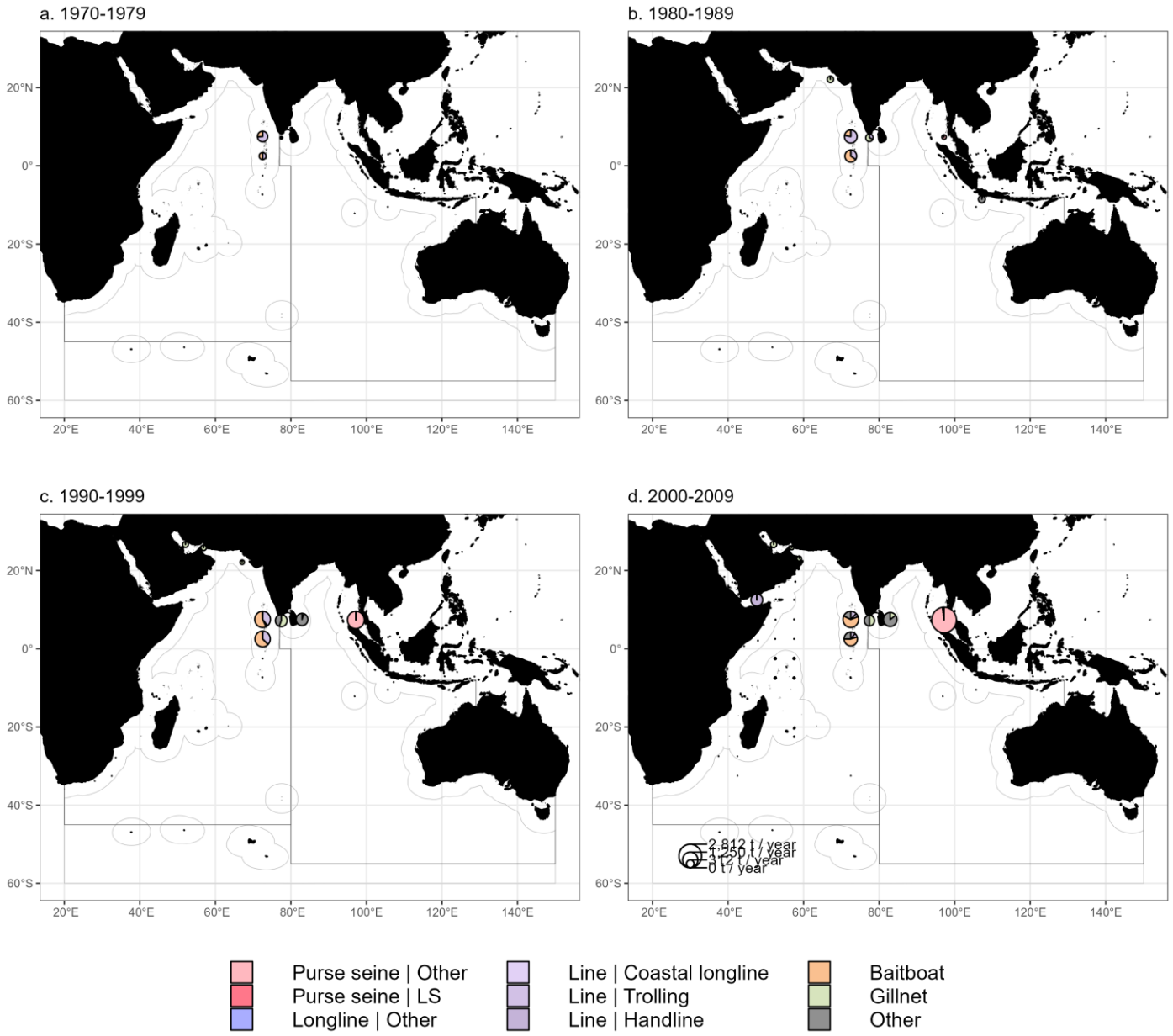



Figure 11: Mean annual time-area catches (metic tonnes; t) of kawakawa, by decade, 5-degree grid area, and fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: time-area catches

**Geo-referenced catches by fishery, last years (2017-2021) and decade (2010-2019)**

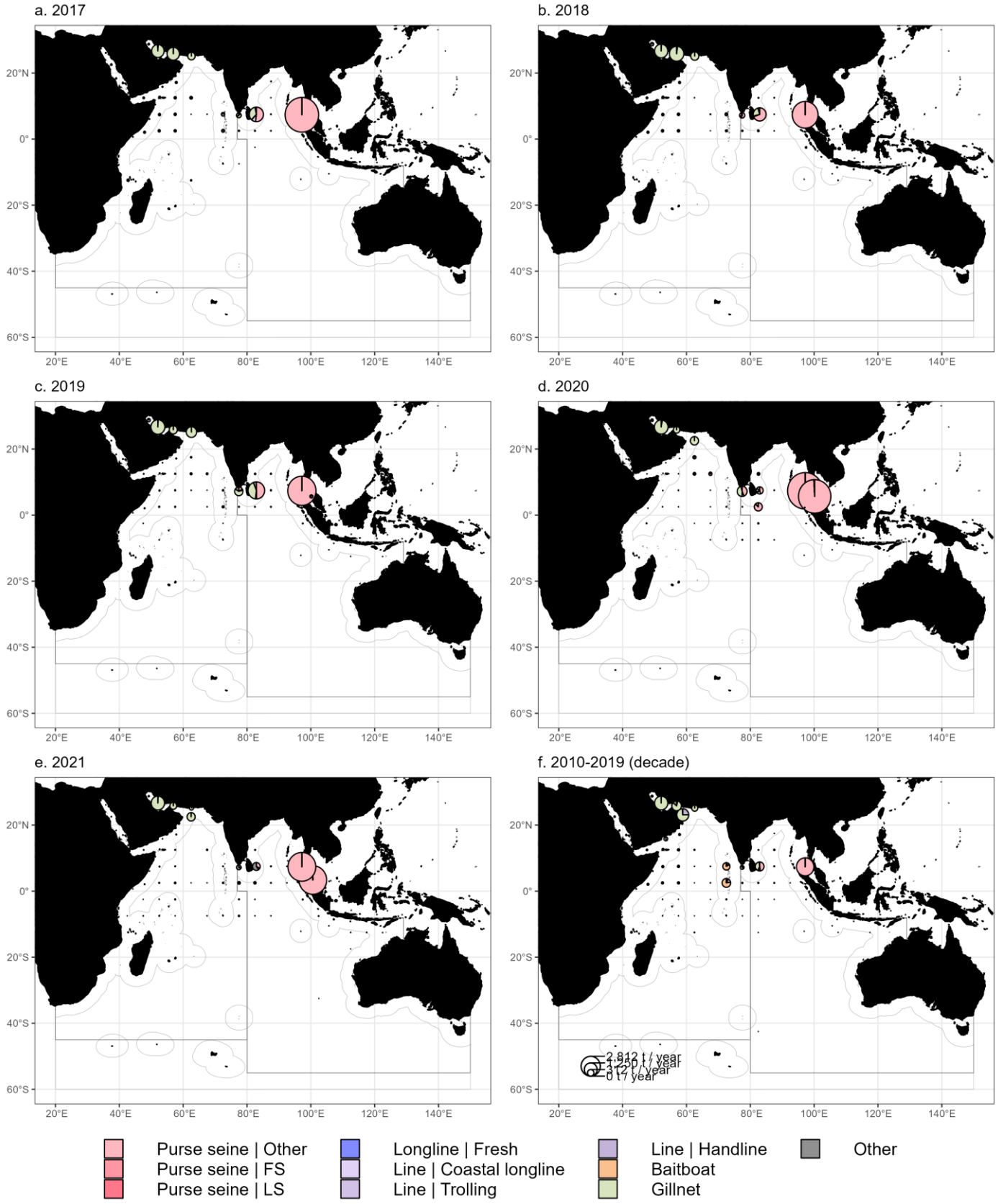



Figure 12: Mean annual time-area catches (metric tonnes; t) of kawakawa, by year and decade, 5-degree grid area, and fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: time-area catches

## Domestic catches within areas under national jurisdiction (2017-2021)

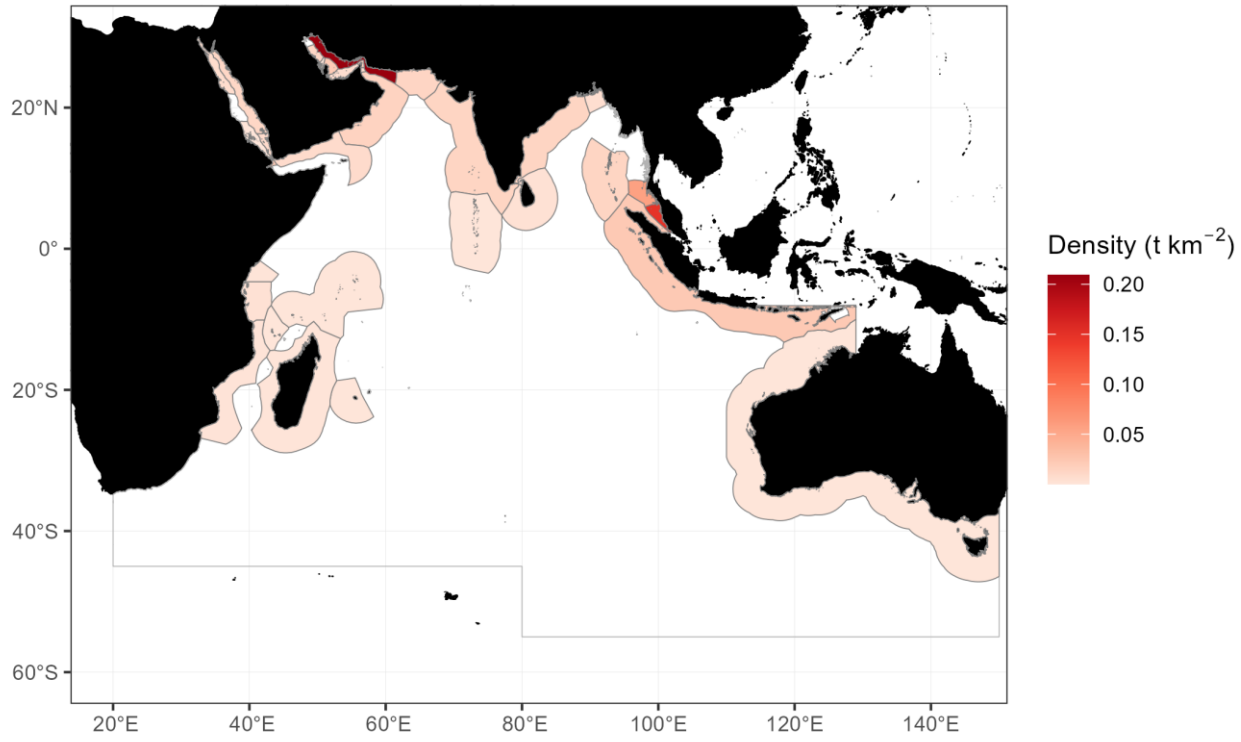



Figure 13: Mean annual density of catch (t km$^{-2}$) of kawakawa reported for domestic fisheries operating in areas under national jurisdiction of IOTC coastal states between 2017 and 2021. Data source: best scientific estimates of retained catches

## Uncertainties in geo-referenced catch and effort data

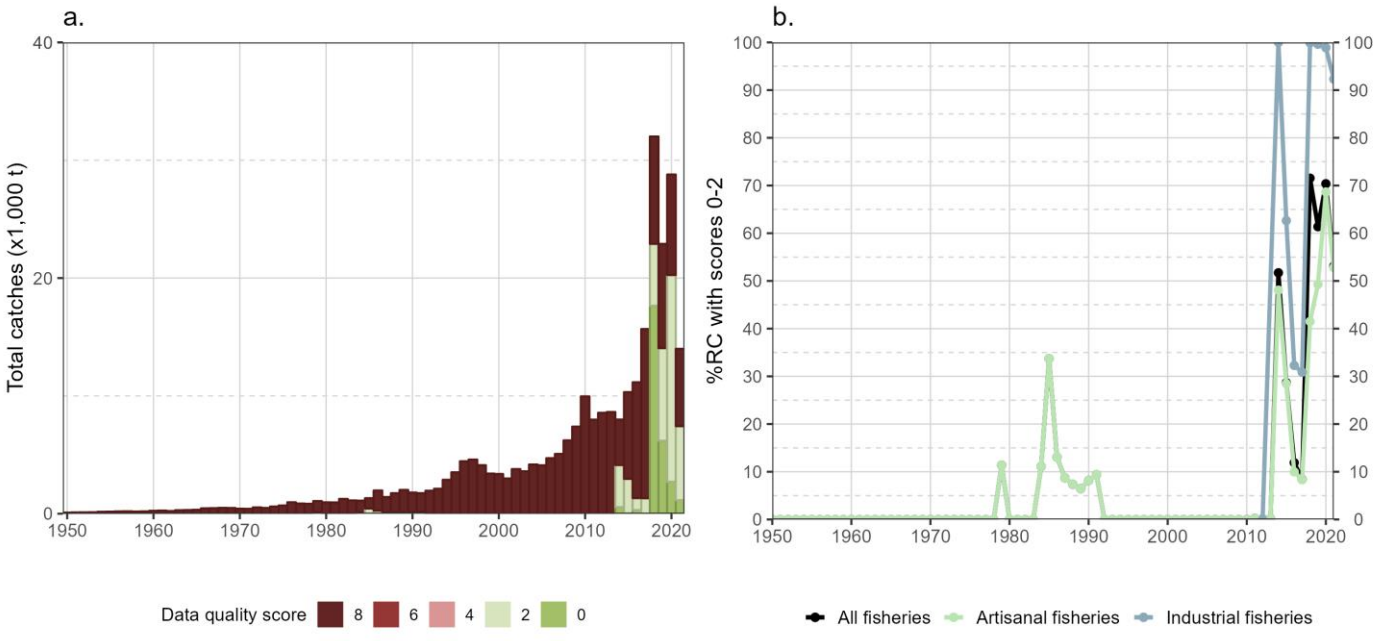



Figure 14: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches (percentage; %) with corresponding geo-referenced catch and effort data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02) to all retained catches of kawakawa for all fisheries and by type of fishery, for the period 1950-2021

# Size composition of the catch

## Samples availability

### By fishery group

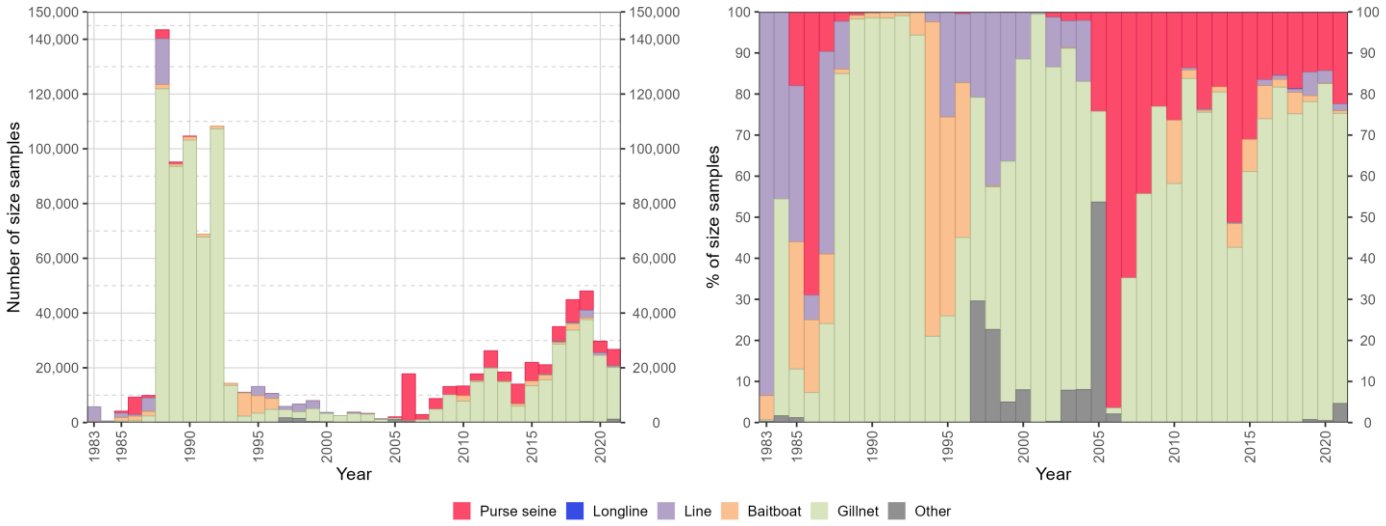



Figure 15: Availability of size-frequency data for kawakawa as (left) absolute and (right) relative number of samples per year and fishery group. Data source: standardized size-frequency dataset

### Purse seine fisheries

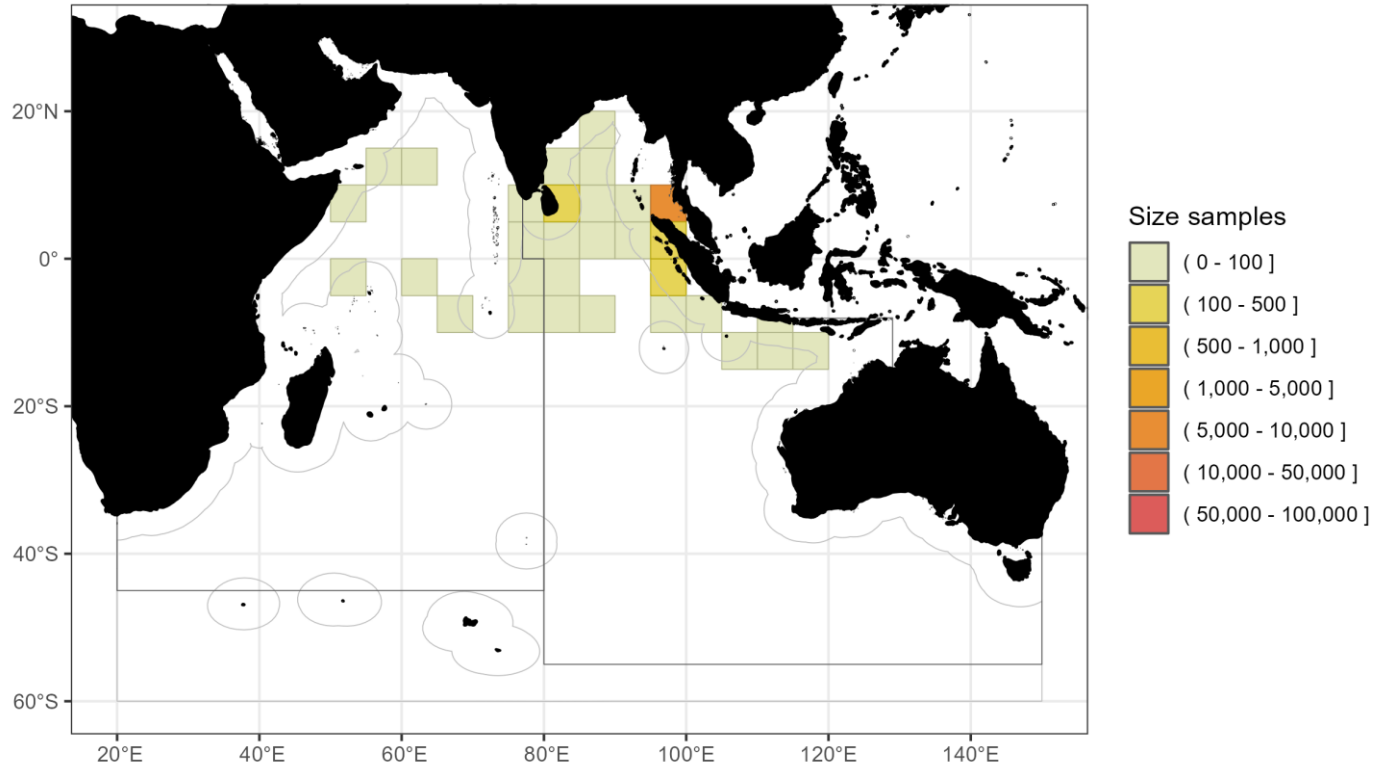



Figure 16: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in purse seine fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

## Gillnet fisheries

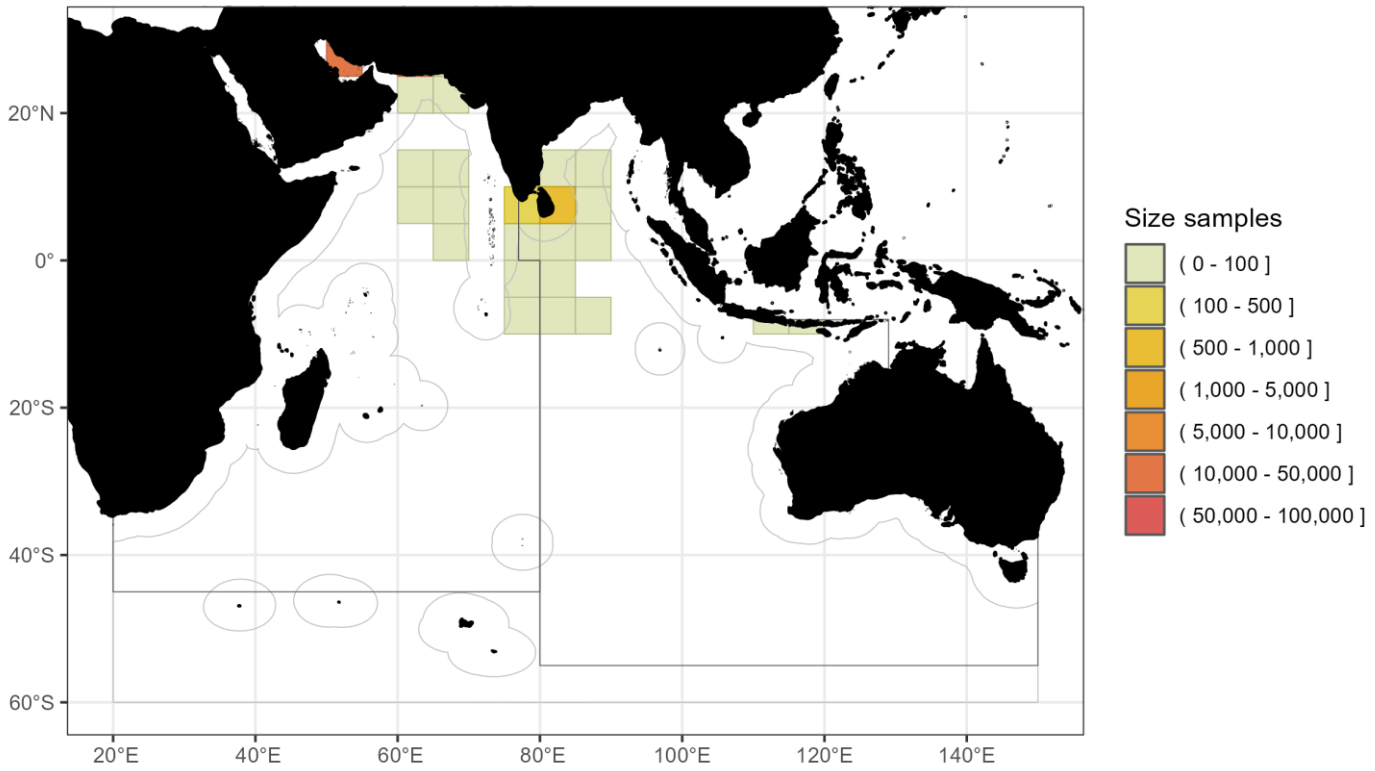



Figure 17: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in gillnet fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

## Line fisheries

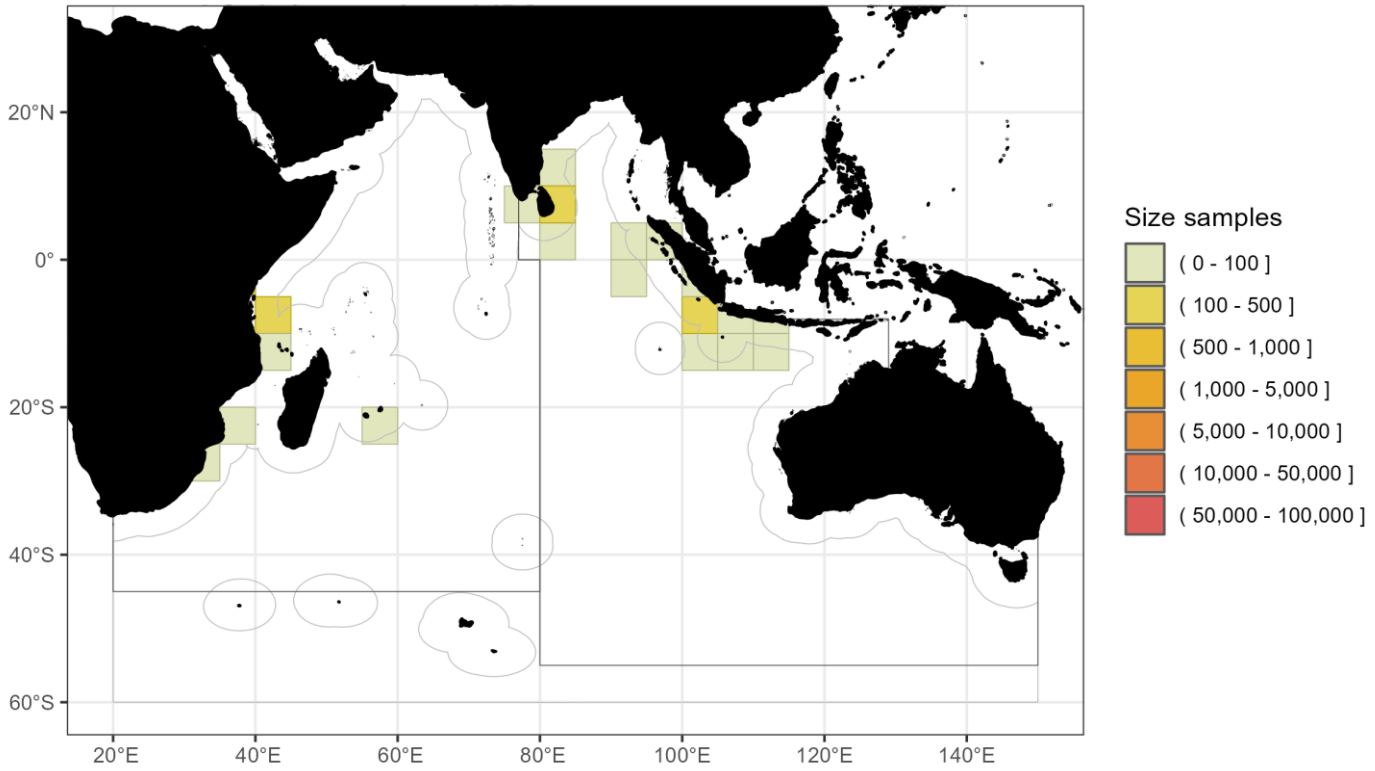



Figure 18: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in line fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

## Other fisheries

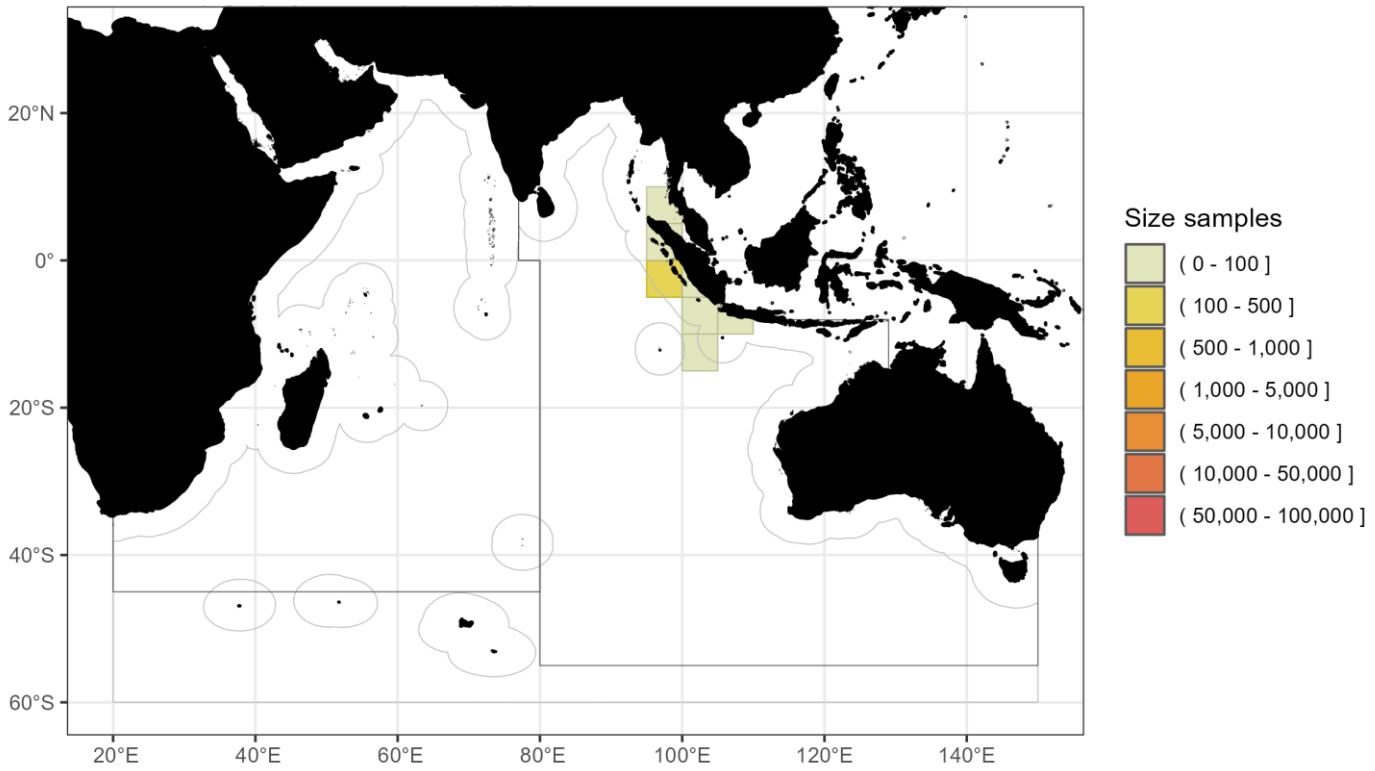



Figure 19: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in 'other' fisheries (beach seine, liftnet, unclassified) during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

## By fishery

### Purse seine fisheries

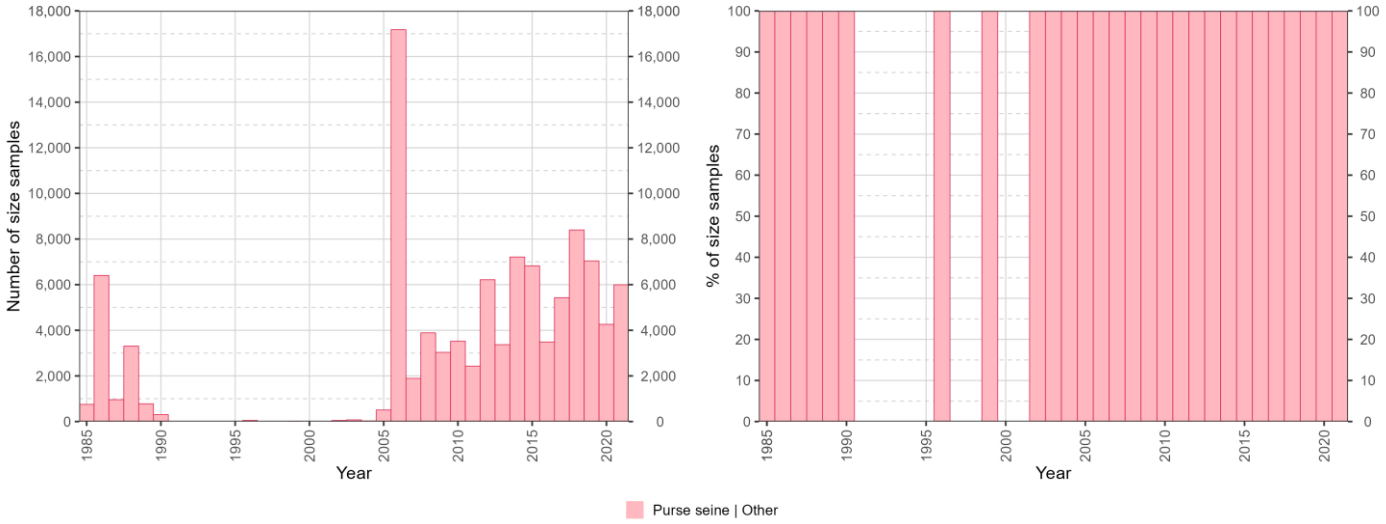



Figure 20: Availability of size-frequency data for kawakawa as (left) absolute and (b) relative number of samples per year and type of purse seine fishery. Data source: standardized size-frequency dataset

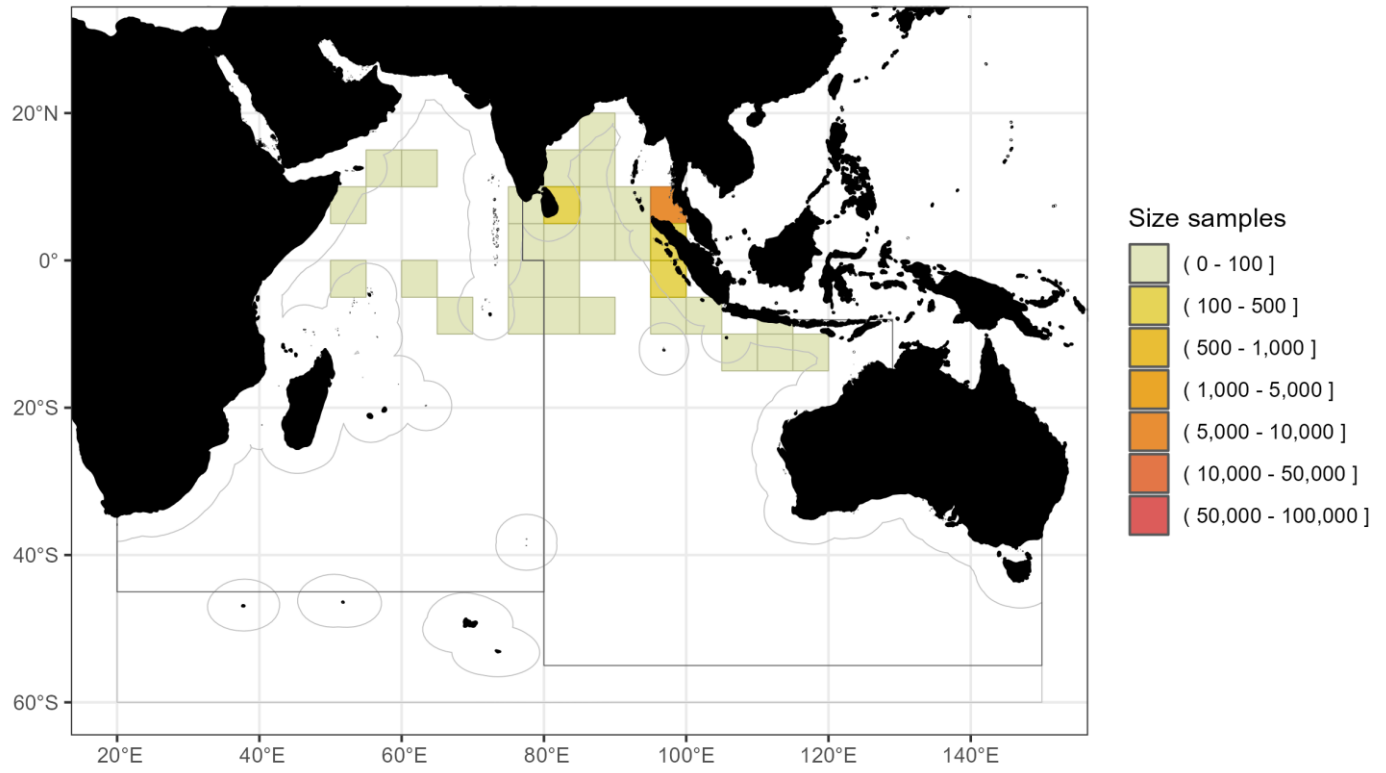



Figure 21: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in coastal and ringnet purse seine fisheries (Purse seine|Other) during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

## Gillnet fisheries

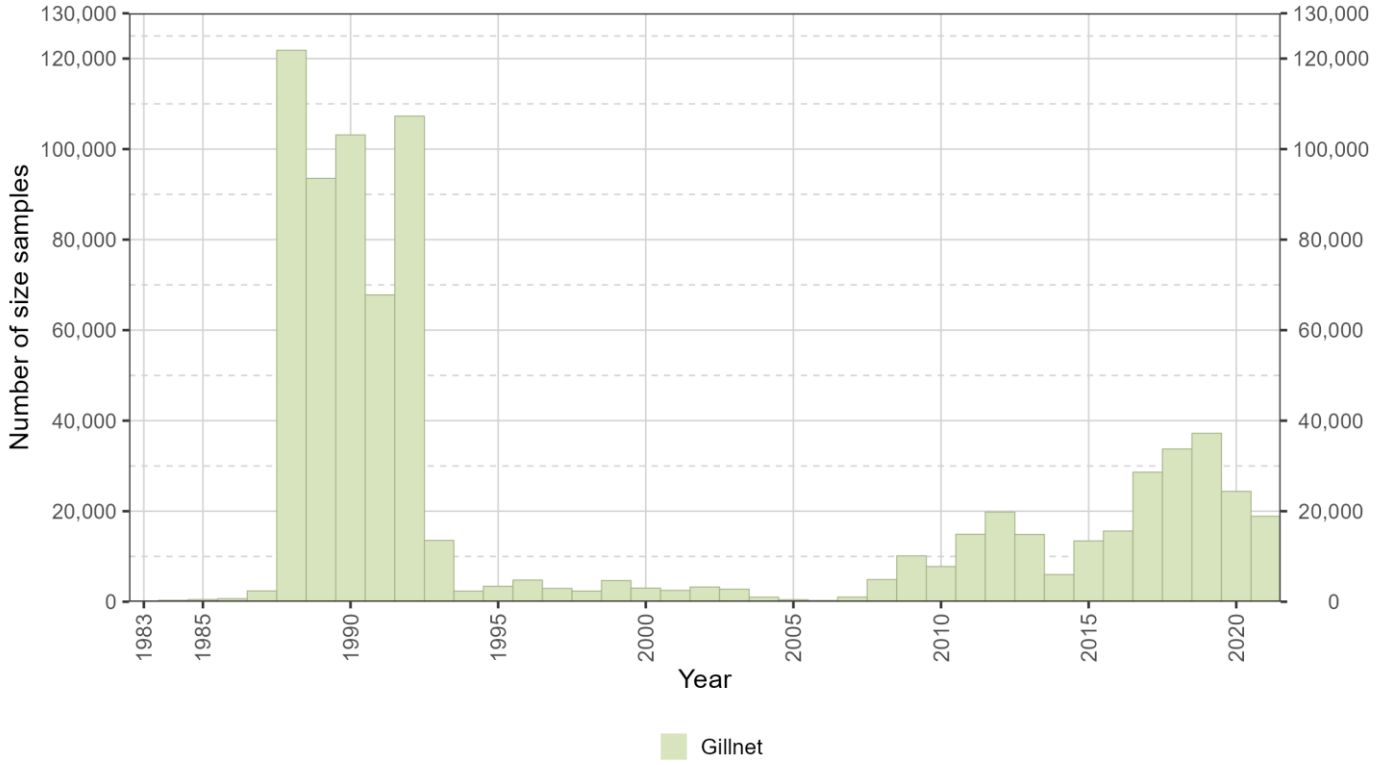



Figure 22: Availability of size-frequency data for kawakawa as absolute number of samples per year in gillnet fisheries. Data source: standardized size-frequency dataset

## Line fisheries

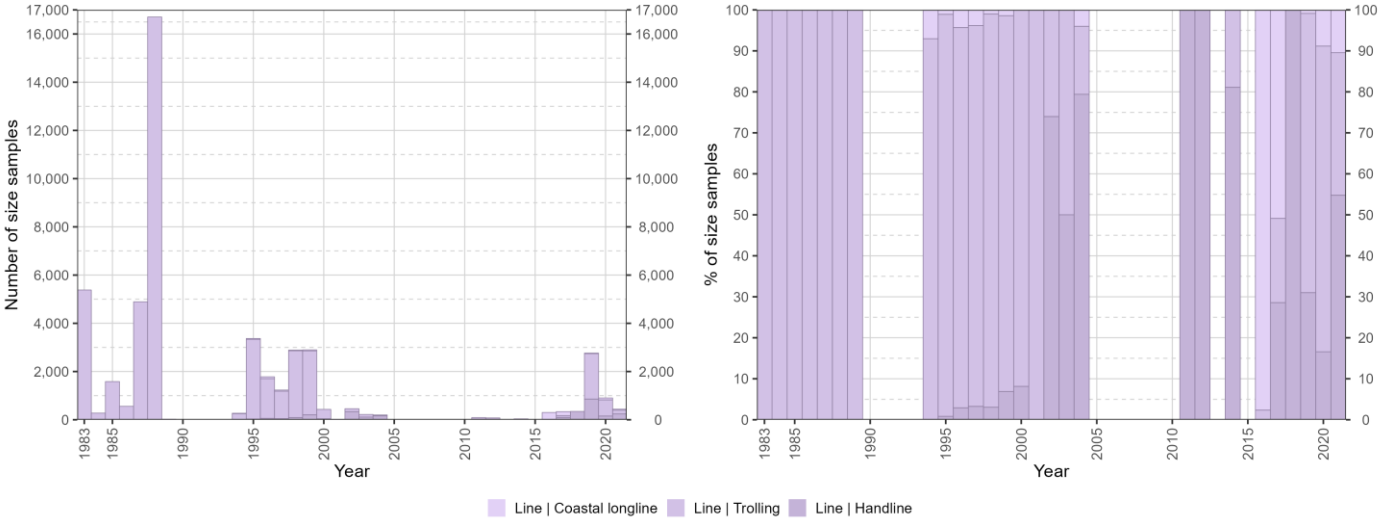



Figure 23: Availability of size-frequency data for kawakawa as (left) absolute and (right) relative number of samples per year and line fishery type. Data source: standardized size-frequency dataset

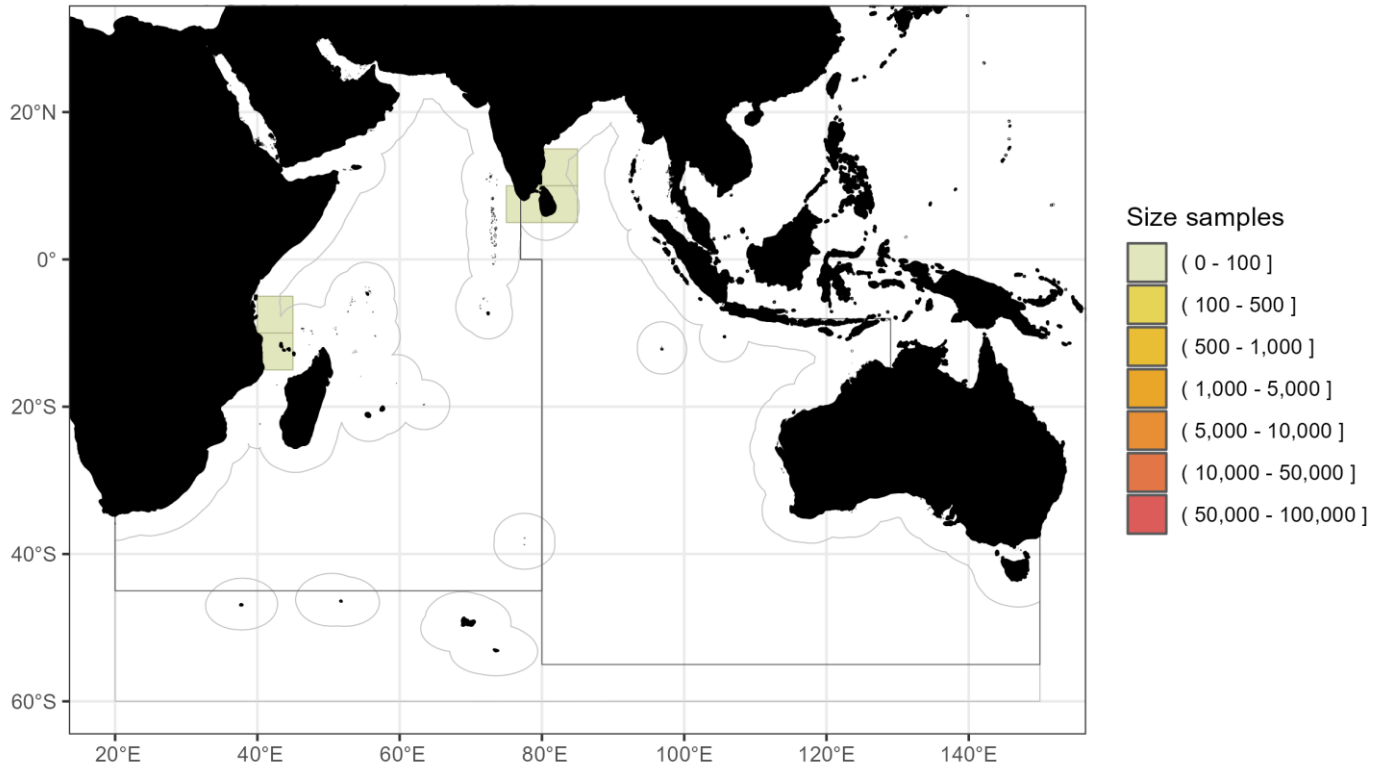



Figure 24: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in coastal longline fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

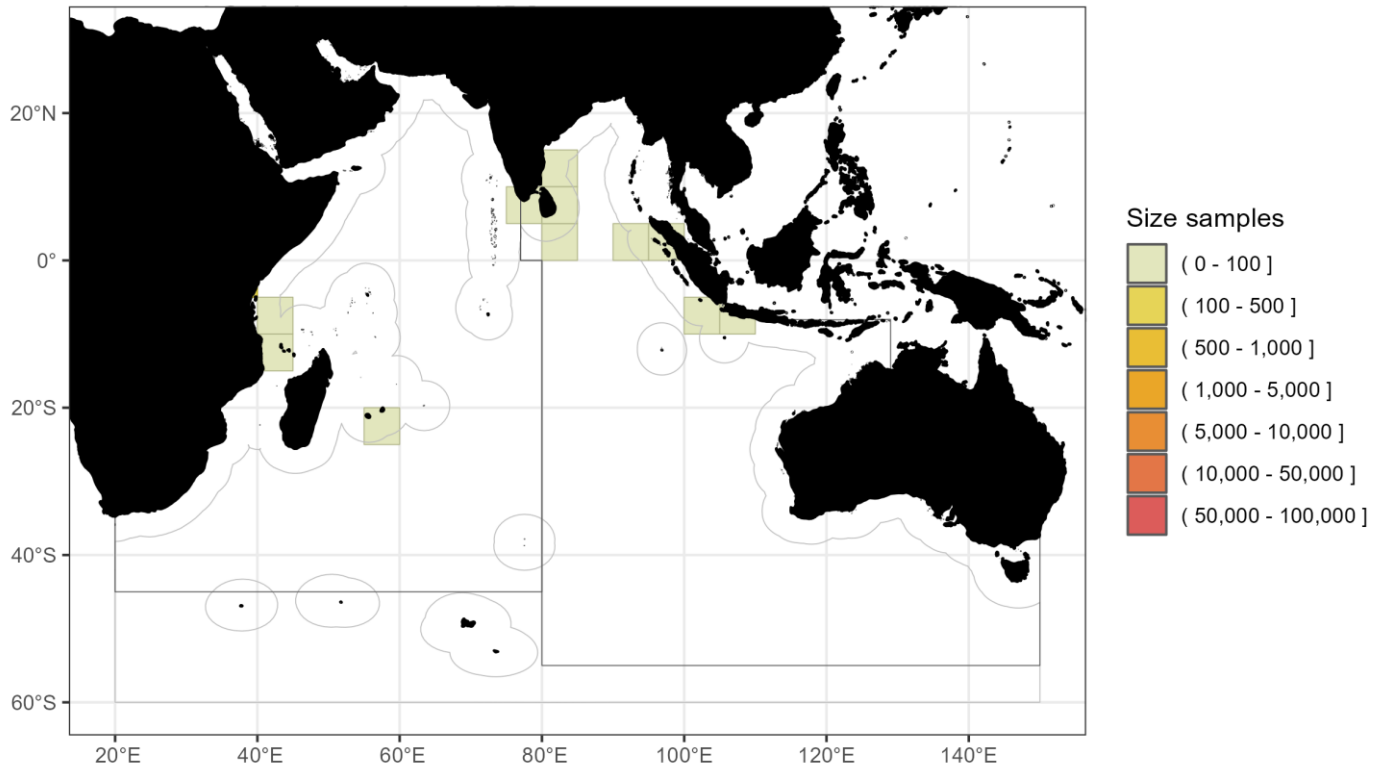



Figure 25: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in handline fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

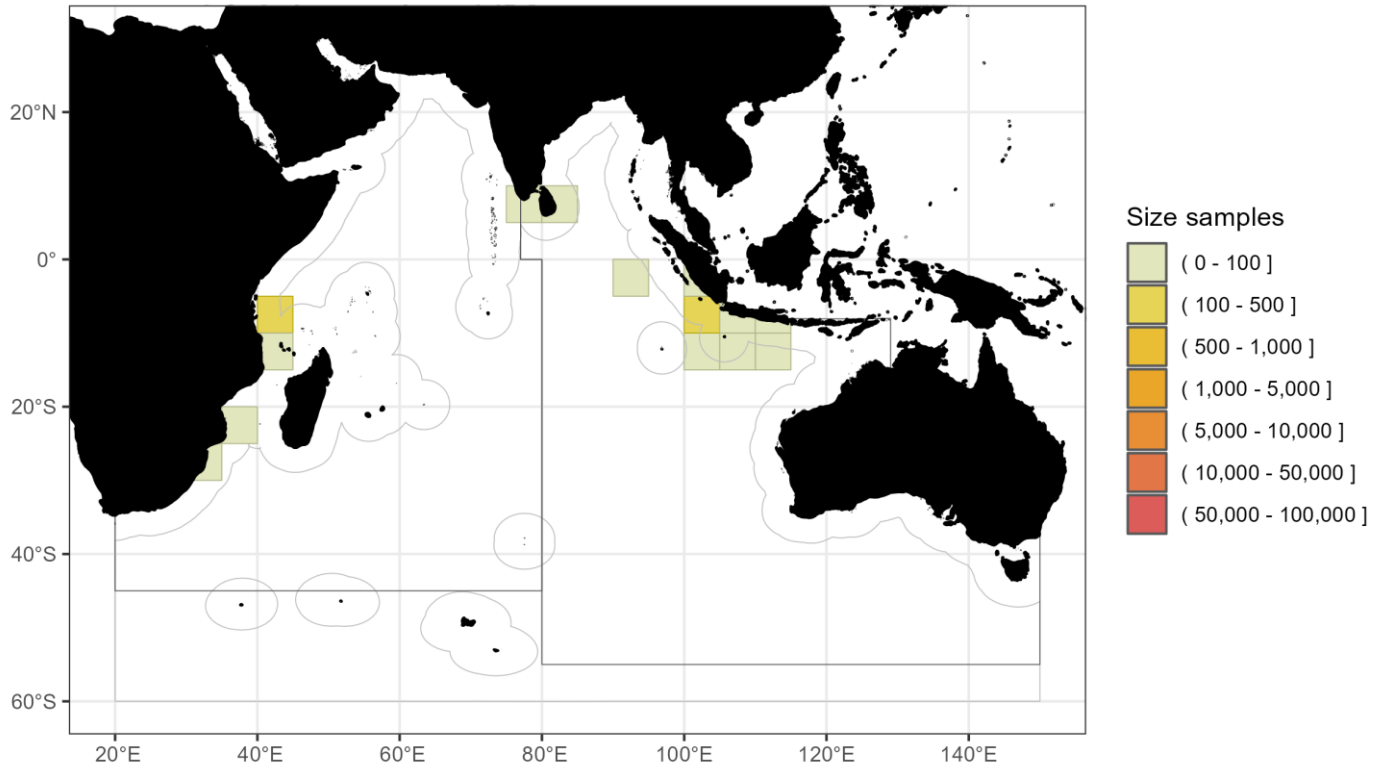



Figure 26: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for kawakawa caught in trolling fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: standardized size-frequency dataset

## Other fisheries

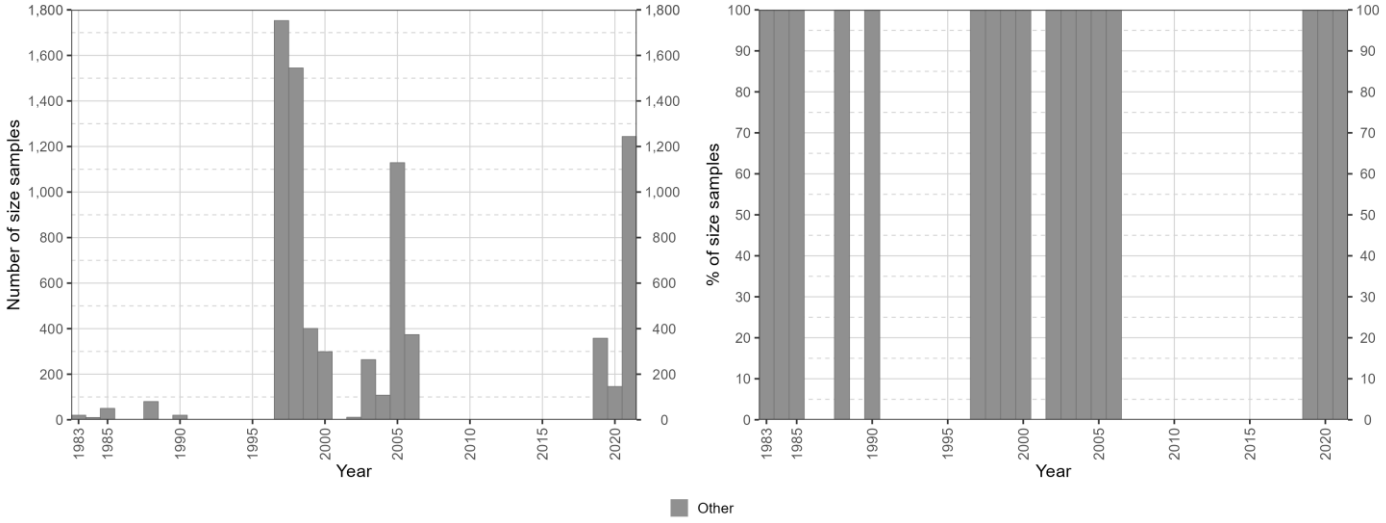



Figure 27: Availability of size-frequency data for kawakawa as (left) absolute and (right) relative number of samples per year for 'other' fishery types (beach seine, liftnet, unclassified). Data source: standardized size-frequency dataset

## Temporal patterns and trends in size distributions

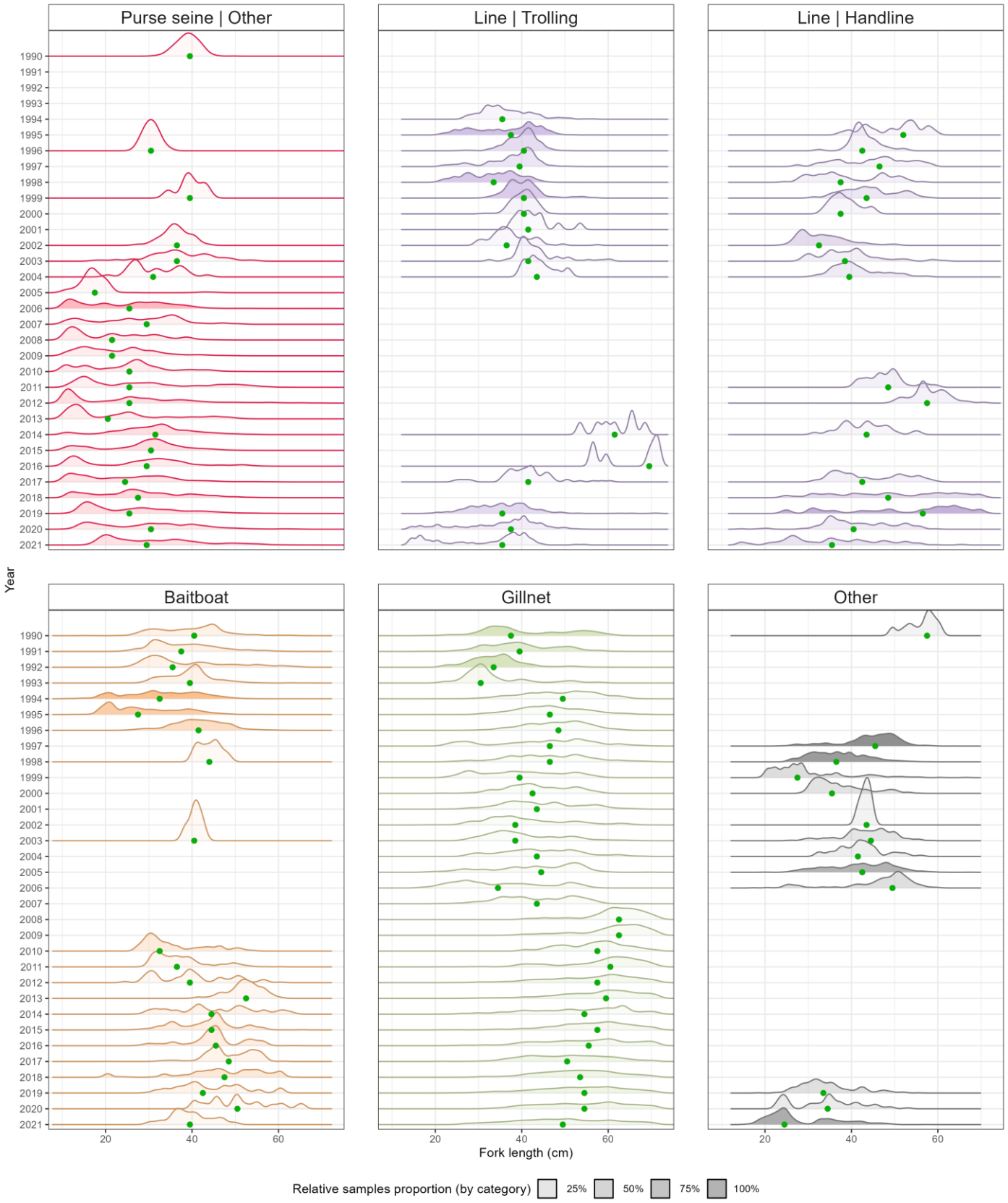



Figure 28: Relative size distribution (fork length; cm) of kawakawa caught in coastal and ringnet purse seine fisheries (Purse seine|Other), gillnet fisheries, and 'other' fisheries (beach seine, liftnet, unclassified). Fill intensity is proportional to the number of samples recorded for the year, while the green dot corresponds to the median value. Data source: standardized size-frequency dataset

## Size distribution by fishery and fleet

Purse seine fisheries (other)

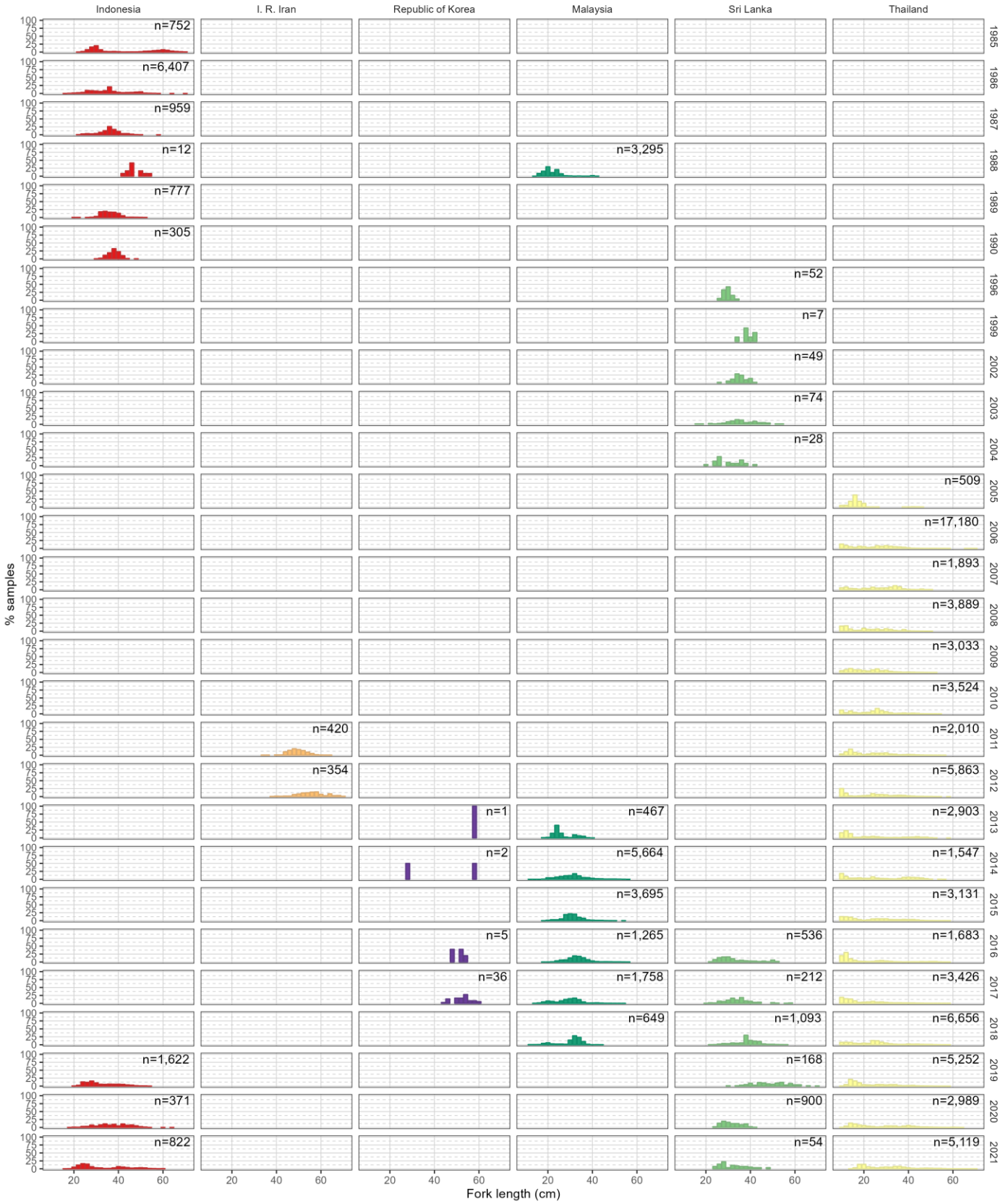



Figure 29: Relative size distribution of kawakawa (fork length; cm) caught in coastal purse seine and ringnet fisheries (Purse seine|Other) by year and main fleet. Data source: standardized size-frequency dataset

## Gillnet fisheries

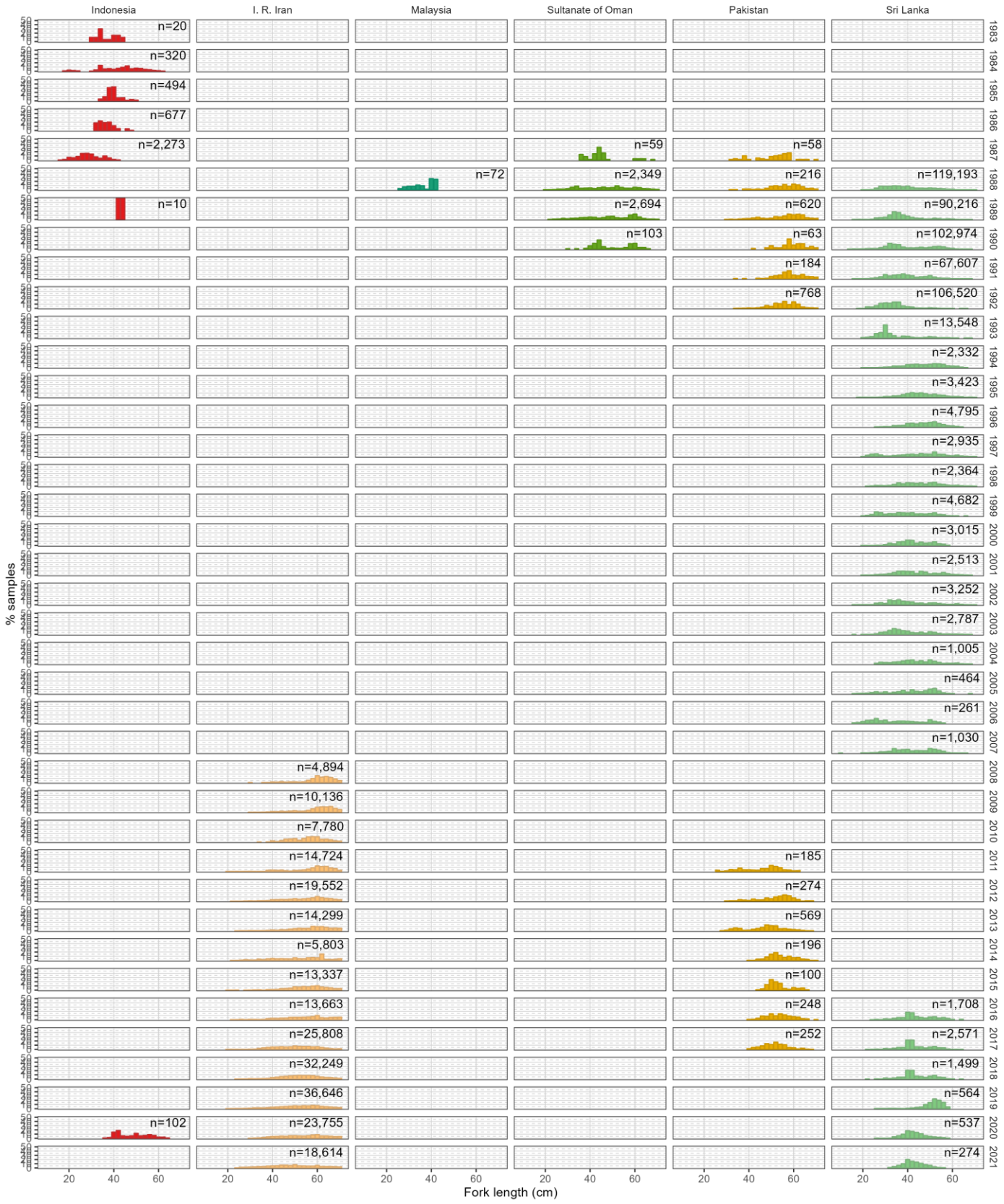



Figure 30: Relative size distribution of kawakawa (fork length; cm) caught in gillnet fisheries by year and main fleet. Data source: standardized size-frequency dataset

## Uncertainties in geo-referenced size-frequency data

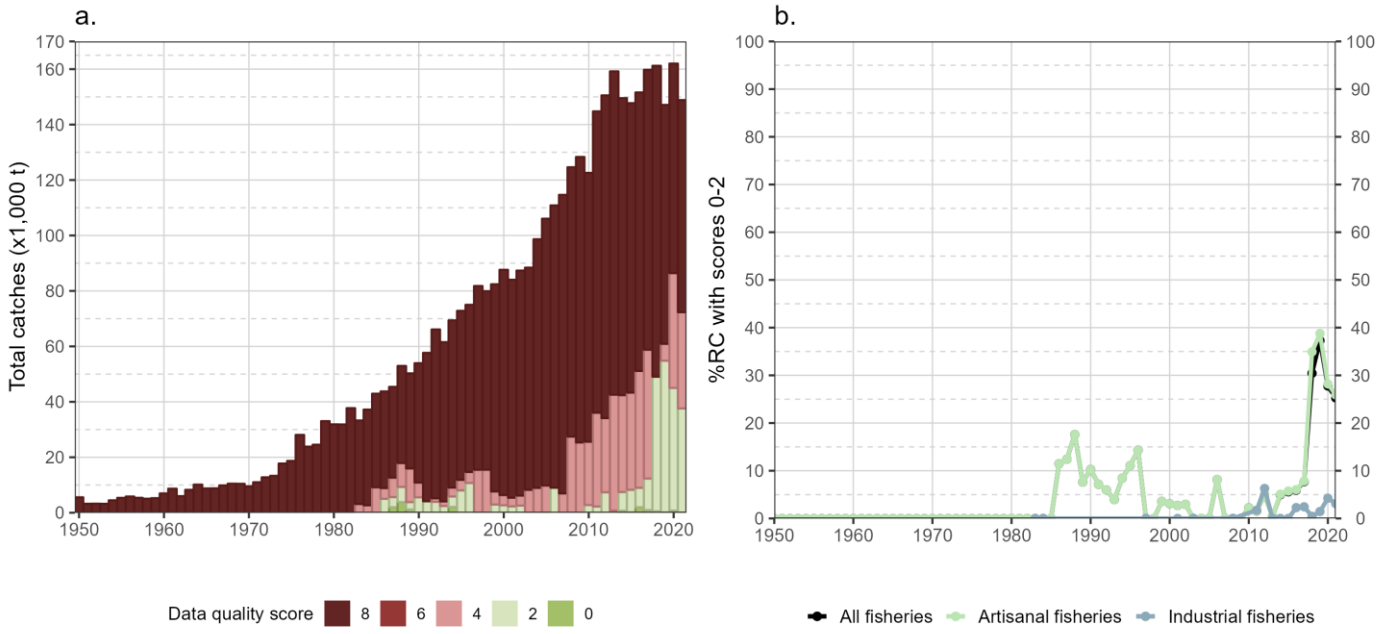



Figure 31: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches with corresponding geo-referenced size-frequency data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 to all retained caches (percentage; %) of kawakawa for all fisheries and by type of fishery, for the period 1950-2021

# References

Huang H-W, Liu K-M (2010) Bycatch and Discards by Taiwanese Large-Scale Tuna Longline Fleets in the Indian Ocean. Fisheries Research 106:261–270.

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Risso A (1810) Ichthyologie de Nice, ou, Histoire naturelle des poissons du département des Alpes Maritimes. F. Schoell, Paris.

Ruiz J, Abascal F, Bach P, Baez J-C, Cauquil P, Grande M, Krug I, Lucas J, Murua H, Lourdes Alonso ML, Sabarros PS (2018) Bycatch of the European, and associated flag, purse seine tuna fishery in the Indian Ocean for the period 2008-2017. IOTC, Cape Town, South Africa, 10-17 September 2018, p 15

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# Appendix

## Appendix I: Taxonomy

| Rank | Taxon |
|---|---|
| Kingdom | *Animalia* |
| Subkingdom | *Bilateria* |
| Infrakingdom | *Deuterostomia* |
| Phylum | *Chordata* |
| Subphylum | *Vertebrata* |
| Infraphylum | *Gnathostomata* |
| Superclass | *Actinopterygii* |
| Class | *Teleostei* |
| Superorder | *Acanthopterygii* |
| Order | *Perciformes* |
| Suborder | *Scombroidei* |
| Family | *Scombridae* |
| Subfamily | *Scombrinae* |
| Tribe | *Thunnini* |
| Genus | *Euthynnus* |
| Species | *Euthynnus affinis* |

## Appendix II: Changes in best scientific estimates of retained catches from previous WPNT

Table 4: Changes in best scientific estimates of annual retained catches (metric tonnes; t) of kawakawa by fleet, fishery group, and main Indian Ocean area, limited to absolute values higher than 10 t

| Year | Fleet | Fishery group | Area | Current (t) | Previous (t) | Difference (t) |
|---|---|---|---|---|---|---|
| **2020** | ARE | Gillnet | Western Indian Ocean | 280 | 255 | 25 |
| | EGY | Gillnet | Western Indian Ocean | 990 | 1,017 | -27 |
| | | Line | Western Indian Ocean | 106 | 78 | 28 |
| | IRN | Gillnet | Western Indian Ocean | 34,341 | 34,549 | -208 |
| | | Line | Western Indian Ocean | 2,215 | 1,108 | 1,107 |
| | KEN | Gillnet | Western Indian Ocean | 51 | 0 | 51 |
| | | Line | Western Indian Ocean | 24 | 0 | 24 |
| | | Purse seine | Western Indian Ocean | 51 | 0 | 51 |
| | MOZ | Gillnet | Western Indian Ocean | 18 | 59 | -41 |
| | | Purse seine | Western Indian Ocean | 3 | 100 | -97 |
| | SAU | Gillnet | Western Indian Ocean | 1,713 | 1,446 | 268 |
| | | Line | Western Indian Ocean | 705 | 604 | 101 |
| **2019** | IDN | Purse seine | Eastern Indian Ocean | 20,222 | 20,234 | -12 |
| | IRN | Gillnet | Western Indian Ocean | 32,706 | 32,822 | -116 |
| | | Line | Western Indian Ocean | 554 | 428 | 126 |
| | SAU | Gillnet | Western Indian Ocean | 1,412 | 1,486 | -73 |
| | | Line | Western Indian Ocean | 586 | 621 | -34 |
| **2018** | IRN | Gillnet | Western Indian Ocean | 35,551 | 36,006 | -456 |
| | SAU | Gillnet | Western Indian Ocean | 1,916 | 1,514 | 403 |
| | | Line | Western Indian Ocean | 794 | 632 | 162 |
| | | Other | Western Indian Ocean | 64 | 52 | 11 |
| **2017** | IDN | Gillnet | Eastern Indian Ocean | 9,746 | 7,807 | 1,939 |
| | | Line | Eastern Indian Ocean | 15,565 | 12,469 | 3,096 |
| | | Other | Eastern Indian Ocean | 4,613 | 3,696 | 918 |
| | | Purse seine | Eastern Indian Ocean | 21,987 | 17,614 | 4,374 |
| | IRN | Gillnet | Western Indian Ocean | 38,253 | 38,311 | -57 |
| | SAU | Gillnet | Western Indian Ocean | 1,766 | 1,383 | 384 |
| | | Line | Western Indian Ocean | 730 | 577 | 152 |

| Year | Fleet | Fishery group | Area | Current (t) | Previous (t) | Difference (t) |
|---|---|---|---|---|---|---|
| **2016** | IDN | Line | Eastern Indian Ocean | 12,480 | 12,469 | 11 |
| | | Purse seine | Eastern Indian Ocean | 17,630 | 17,614 | 16 |
| | IRN | Gillnet | Western Indian Ocean | 33,640 | 33,677 | -37 |
| | KEN | Line | Western Indian Ocean | 43 | 27 | 16 |
| | | Purse seine | Western Indian Ocean | 89 | 0 | 89 |
| | QAT | Gillnet | Western Indian Ocean | 434 | 0 | 434 |
| | SAU | Gillnet | Western Indian Ocean | 1,984 | 1,383 | 601 |
| | | Line | Western Indian Ocean | 820 | 577 | 242 |
| | | Other | Western Indian Ocean | 65 | 48 | 17 |
| **2015** | IRN | Gillnet | Western Indian Ocean | 27,805 | 27,877 | -72 |
| | QAT | Gillnet | Western Indian Ocean | 441 | 0 | 441 |
| **2014** | IDN | Gillnet | Eastern Indian Ocean | 8,367 | 8,381 | -14 |
| | | Line | Eastern Indian Ocean | 13,363 | 13,386 | -23 |
| | | Purse seine | Eastern Indian Ocean | 18,876 | 18,909 | -32 |
| | IRN | Gillnet | Western Indian Ocean | 28,885 | 28,936 | -51 |
| | QAT | Gillnet | Western Indian Ocean | 356 | 0 | 356 |
| **2013** | IDN | Gillnet | Eastern Indian Ocean | 9,499 | 9,203 | 296 |
| | | Line | Eastern Indian Ocean | 15,170 | 14,697 | 473 |
| | | Other | Eastern Indian Ocean | 4,496 | 4,356 | 140 |
| | | Purse seine | Eastern Indian Ocean | 21,429 | 20,761 | 668 |
| | IRN | Gillnet | Western Indian Ocean | 28,131 | 28,377 | -246 |
| **2012** | IDN | Gillnet | Eastern Indian Ocean | 8,130 | 8,063 | 68 |
| | | Line | Eastern Indian Ocean | 12,985 | 12,877 | 108 |
| | | Other | Eastern Indian Ocean | 3,849 | 3,817 | 32 |
| | | Purse seine | Eastern Indian Ocean | 18,342 | 18,190 | 152 |
| | IRN | Gillnet | Western Indian Ocean | 25,719 | 25,984 | -265 |
| **2011** | | Gillnet | Western Indian Ocean | 21,924 | 22,091 | -167 |
| **2010** | IDN | Gillnet | Eastern Indian Ocean | 7,920 | 7,870 | 50 |
| | | Line | Eastern Indian Ocean | 12,648 | 12,569 | 79 |
| | | Other | Eastern Indian Ocean | 3,749 | 3,725 | 23 |

| Year | Fleet | Fishery group | Area | Current (t) | Previous (t) | Difference (t) |
|---|---|---|---|---|---|---|
| | | Purse seine | Eastern Indian Ocean | 17,867 | 17,755 | 112 |