Fisheries New Zealand
Tini a Tangaroa

New Zealand Annual Report to the Extended Scientific Committee

New Zealand

Prepared for the 30th Meeting of the Extended Scientific Committee (ESC30) of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

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New Zealand Government

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1 Introduction

1.1 BACKGROUND

1. This review report provides scientific information on the New Zealand southern bluefin tuna (SBT) fishery, including historical data and information, but focusing on the 2024 calendar year and the most recent complete fishing year, which was from 1 October 2023 to 30 September 2024.

1.2 SUMMARY OF HISTORICAL DEVELOPMENTS IN THE FISHERY

2. Historically, juvenile and adult SBT have been widely distributed around New Zealand. During the 1960s and 1970s, juvenile SBT were encountered on both the east and west coasts of the North and South Islands during summer months. Domestically, several tonnes were taken in pole and line and troll fisheries.

3. In the early 1980s, a concerted effort to develop a domestic SBT fishery was undertaken to export to the Japanese market. By 1982, a handline fishery was established with the catch frozen on board a former Japanese longline vessel. Following the relatively high catches of the 1982 season (305 tonnes landed), the handline fishery continued into the late 1980s, albeit at a reduced level (below 100 tonnes until 1989). Around this time, longlining became the dominant fishing method for SBT, and remains so to this day.

4. In 1989, New Zealand implemented a national catch limit of 420 tonnes per year, which remained until 2008/09. In 2009, the 16th Commission Meeting of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) agreed to reduce the global total allowable catch (TAC) by 20% and apply revised national allocations for 2010 and 2011. New Zealand's national allocation increased to 1,000 tonnes between 2015 and 2017 and to 1,088 tonnes for the 2018 to 2020 quota block, which was implemented domestically during the 2017/18 fishing year. In 2020 New Zealand's national allocation was increased to 1,102.5 tonnes for the 2021 to 2023 quota block, and in 2022 it was increased again to 1,288 tonnes for the 2024 to 2026 quota block. On the few occasions when the New Zealand allocation has been exceeded, the domestic catch limit has been reduced in the following year by an equivalent amount.

5. Since 1 October 2004, SBT has been managed under the New Zealand quota management system. The introduction to the quota management system saw a change from the "Olympic" race for fish, to fishing spread throughout the season, and was associated with a consolidation of the fleet.

6. Starting in 2017, there was a significant increase in recreational fishing activity and catch rates on the east coast of the North Island. This established a consistent winter recreational fishery, accessible by trailer boats, which continued to grow. As a result of this, a limit of one fish per angler was implemented in the recreational fishery in 2019. Subsequently, an additional 14 tonnes of quota was allocated to the recreational allowance in 2020, and in 2023, a further 35 tonnes was added to the recreational allowance.

1.3 OVERVIEW OF THE MOST RECENT FISHING SEASON

7. As of January 2024, New Zealand successfully placed cameras onboard all surface longline fishing vessels and data collection for commercial fisheries is now primarily occurring from electronic monitoring (onboard cameras and ER/GPR).

8. For the 2024 calendar year, New Zealand's national allocation was 1,288 tonnes - however, New Zealand held a carry-forward from the previous year's under-catch of 136.1 tonnes, so the effective total allowable catch in 2024 was 1,424.1 tonnes. Within New Zealand's national allocation of 1,288

tonnes, there were the following allowances: a domestic total allowable commercial catch (TACC, which is the commercial allocation) of 1,197 tonnes; a recreational allowance of 69 tonnes; a customary non-commercial allowance of two tonnes; and an allowance for other sources of fishing mortality caused by fishing of 20 tonnes.

9. For the 2023/24 fishing year, commercial removals of SBT were 895.1 tonnes, and for the 2024 calendar year commercial removals were 890.9 tonnes (**Table 1**). Given no foreign charter vessels have fished for southern bluefin tuna in New Zealand since 2015, the entire commercial catch was taken by the domestic fleet. The total commercial catch was within the domestic allowance set by Fisheries New Zealand (1,197 tonnes).

10. Discarding of dead SBT can only lawfully occur when authorised by Fisheries New Zealand observers, or when predation has occurred such that the fish is no longer fit for human consumption (verified by onboard cameras). Previously Fisheries New Zealand scaled observed discards of dead fish across total fishing effort assuming a similar rate on unobserved vessels despite the requirement for SBT discards to be authorised. However, the rollout of onboard cameras provides a high degree of confidence in fisher reported data, noting that 92%[1] of surface longline hooks were covered by camera monitoring in 2024. Therefore, discard mortality for the domestic commercial fleet was 9 tonnes based on 260 fisher-reported discards of dead SBT (**Table 14**). Fishers must account for dead SBT discards with ACE and therefore discards are included in the calculation of commercial removals.

11. In May 2024, an existing exception was reviewed and agreed which continues to allow for SBT to be returned to the sea if caught by SLL or troll, and is alive and likely to survive. Based on fisher reports, 5,625 SBT were released alive (70.93 tonnes) in the 2024 calendar year. Life status of discards are monitored by onboard cameras.

12. Recreational removals were estimated at 69.9 tonnes, and there were no customary removals reported.

2 Catch and effort

13. Total commercial catch for the New Zealand fishery is provided in **Table 1** and **Figure 1**, while catch and effort by fleet and region are provided in **Table 2, Table 3, Table 4, Table 5, Figure 2** and **Figure 3.**

2.2 TRENDS BY GEAR TYPE

14. Prior to the early 1990s, small vessels handlining and trolling dominated the domestic SBT fishery. Since 1991, surface longlining has been the predominant method for both the domestic (ongoing) and foreign charter fleets (ceased in 2016), while handlining and trolling have made up around 4% of the vessel days combined. Since 2008, there has only been a handful of days handlining and trolling for SBT. This represents a major change from the 1980s when most fishing was by handline.

2.3 TRENDS BY AREA AND FLEET

15. Total commercial SBT catch steadily increased from the early 1990s, reaching the highest level to date in the 2023 calendar year at 1,102.8 tonnes (**Table 1** and **Figure 1**). No foreign charter vessels have fished from 2016 onwards so current catches are taken entirely by the domestic fleet. Total effort has fluctuated since the early 1990s, and was at its highest between 1999 and 2004, peaking in 2003 before declining back to similar levels as the 1990s (**Table 3** and **Table 5**). Catch

[1] Note that 92% of hooks were covered by camera monitoring in 2024 due to the cameras going live at the end of January, as well as some temporary technical issues.

data shows most SBT are caught off the west coast of the South Island (CCSBT Region 6) and the east coast of the North Island (CCSBT Region 5) from April to July, and catch has been expanding off the east coast of the South Island in recent years and continued to expand in 2024.

16. For the foreign charter fleet, catch fluctuated around 200 tonnes from the early 1990s to 2015 (**Table 2**). Effort gradually declined from the early 1990s to 2015 after which, due to changes in legislation, the vessels left the fishery (**Figure 2**). Catch and effort predominantly occurred in Region 6, with under 10% of total charter catch and effort occurring in Region 5 (**Table 2**).

17. For the domestic fleet, catch has fluctuated in recent years due in part to the COVID-19 pandemic and the economic upheaval that followed. Rising fuel prices, market variability, and consolidation of the fleet are all likely contributors to the fluctuations in catch. SBT catch by the domestic fleet peaked in 2023 at 1,102.8 tonnes, and declined in 2024 to 890.9 (**Table 4** and **Figure 1**). Effort increased substantially in both regions from 1994 to 2003, which was followed by a decline to a low level in 2007 and 2008, particularly in Region 6 (**Table 5** and **Figure 3**). This decline is associated with a decrease in the number of vessels in the surface longline fleet (**Table 6**), and the removal from the fleet of a domestically owned freezer vessel that fished in Region 6. Since 2008, domestic vessels have increased effort in Region 6, and this has been reflected in increased catch in that region, which reached 545 tonnes in 2019, exceeding the catch in Region 5 (415 tonnes) for the first time since 2012. In 2024, effort remained relatively consistent with 2023 but catch reduced to 370.3 tonnes in region 5 and 520.5 tonnes in Region 6 (**Table 4**).

3 Catch Per Unit of Effort (CPUE)

3.1 NOMINAL CPUE - TRENDS BY FLEET AND AREA

14. From 2008 to 2015, the foreign charter fleet experienced an increase in CPUE, from around one fish per 1,000 hooks to around seven fish per 1,000 hooks, peaking in 2010 at nearer eight fish per 1,000 hooks (**Table 7** and **Figure 4**).

15. Nominal CPUE was calculated for the charter fleet in Region 6 for fish thought to be of spawning age (SBT greater than 10 years of age). This was done based on both approximate ageing from observer-derived lengths and on a smaller dataset of SBT that were directly aged. Both series agree closely with each other. CPUE of SBT greater than 10 years has varied around one fish per 1000 hooks, with an historical low of near-zero fish in 2003 to the highest level of just over two fish in 2015 (**Figure 6**).

16. For the domestic fleet, CPUE was calculated for effort from sets that either caught or targeted SBT. Due to the large changes in the structure of the domestic fleet and the nature of the “Olympic system” under which the New Zealand fishery operated prior to 2004, the trends in the CPUE for the domestic fishery may not provide reliable information on trends in vulnerable biomass, although the CPUE does exhibit similar trends to that of the charter fleet.

17. CPUE dropped in both areas 5 and 6 in 2019 by about 50% (likely due to COVID-19 impacts) but recovered to an all-time high in 2023 to approximately 17 fish per 1000 hooks, before declining in 2024 to around 14 fish per 1000 hooks (**Table 8** and **Figure 4**).

3.2 STANDARDISED CPUE – TRENDS BY FLEET AND AREA

18. Due to the exit of the foreign charter fleet in 2016 and substantial changes in the relative amount of fishing effort in both Regions 5 and 6, New Zealand conducted a standardised CPUE analysis for the first time in 2019 and has repeated it every year to date. Details of this analysis are reported in **Appendix 3** and are summarised here. The standardised CPUE index is used in the CCSBT Indicators Report for the evaluation of the Cape Town Management Procedure.

19. The analysis conducted was a forward stepwise GLM assuming a negative binomial distribution using both the additional percent of deviance explained and AIC criteria to select or reject variables. Variables offered to the analysis were year (forced to be the first variable accepted), month, area, vessel, fleet, target, hooks set (as a polynomial distribution) and length of set (also polynomial).

20. The variables accepted were year, vessel, month, and area.

21. **Figure 5** shows both the standardised and unstandardised CPUE as well as a three-year running average based on the standardised index. The unstandardised index shows a very small decline in CPUE in 2017 and 2018 with a marked decline in 2019 to a level that was sustained in 2020. The standardised index shows a more exaggerated decline beginning in 2017, one that is particularly large in 2019, and then a marked increase in 2020 to near 2018 levels. In 2024 the standardised index remained relatively consistent with that in 2023, and the unstandardized index declined sharply compared to 2023.

4 Size composition

22. Length frequency distributions of SBT catches from the foreign charter and domestic fleets by year are provided in **Figure 7** and **Figure 8.** Proportions of catches under 120 and 140 centimetres for the foreign charter and domestic fleets are provided in **Figure 9** and **Figure 10.** Length frequency distributions for the foreign charter and domestic fleets for each 10-year period are provided in **Figure 11** and **Figure 12.** For the foreign charter fleet, length frequency distributions for each 10-centimetre interval are provided in **Table 9**, and the same is provided for the domestic fleet in **Table 10**. Proportion-at-age distributions, determined from direct aging are provided in **Figure 13** for the foreign charter fleet (but includes information from the domestic fishery from 2016). Proportion-at-length information from the catch documentation scheme and from observers is provided in **Figure 14** for the domestic fleet and **Figure 15** for the foreign charter fleet**.**

4.1 TRENDS BY FLEET

23. Historically, observer coverage was low in the domestic fishery; therefore observer-reported length composition data are not as well estimated for this fleet relative to the foreign charter fleet. Nevertheless, length composition data for both fleets show similar patterns (**Figure 7** and **Figure 8**). These distributions are now better described by data from the catch documentation scheme, which provides a complete census of fish lengths for the fishery since 2011 (**Figure 14** and **Figure 15**).

24. Since 2000, the proportion of the domestic fleet catch under 140 centimetres has varied from less than about 20% from 2003 to 2008 to over 60% from 2016 to 2019, with the proportion declining since 2020 – noting the pattern of proportion of catch under 120cm and under 140cm appears to be closely related in recent years, a trend which continued into 2024 (**Table 10** and **Figure 10**).

25. From 1989 to 2015, the proportion of the charter fleet catch under 140 centimetres varied from less than 10% in 2001– 2004 to over 60% in 2010 (**Table 9** and **Figure 9**). In 2013, the proportion dropped to less than 30% presumably as a result of growth (progression of the main length mode). Overall, the proportions fluctuate in a manner consistent with periods of above and below average recruitment (for example, in two to three-year cycles).

4.2 TRENDS BY AREA AND SEASON

26. In the 2000s, there was a reduction in the range of sizes of SBT taken in the New Zealand fishery (**Figure 11** and **Figure 12**). There is evidence of growth (shown by progression of modes) over this period, but little evidence of recruitment of smaller fish to the New Zealand fishery. However, more recent data appears to show a change, with smaller recruits appearing in the fishery in recent years – noting that data for 2024 is derived from the catch documentation scheme due to the primary verification method moving from observers to electronic monitoring (**Figure 8**).

5 Fleet size and distribution

27. Maps of historical catch and effort by gear type for the fishery are provided in **Figure 16, Figure 17, Figure 18** and **Figure 19.** The number of domestic commercial vessels catching SBT in New Zealand fisheries waters by year are provided in **Table 6.**

5.1 TRENDS BY SEASON

28. Up until 1991, foreign charter vessels dominated the New Zealand SBT fishery. In 1991, the first domestic longline vessel began fishing for SBT, and then throughout the 1990s and early 2000s the domestic fleet expanded. Since around the time that SBT was introduced into the quota management system in 2004, the number of vessels operating in the New Zealand fishery has been declining. Twenty vessels operated in the fishery during the 2023/24 fishing year, all of them domestic (**Table 6**), consistent with the number of vessels operating in 2023.

5.2 TRENDS BY AREA

29. Historically, the charter fleet, which was primarily composed of the larger -60° freezer vessels, dominated the west coast South Island (Region 6) fishery; however, in 2016, changes in legislation resulted in the charter vessels leaving the fishery.

30. The domestic fleet is primarily composed of smaller vessels, which historically have operated mainly in the longline fishery off east coast North Island (Region 5); however, in recent years, domestic vessels have increased effort off the west and east coast South Island (Region 6), replacing some of the effort previously made by the foreign charter fleet (**Figure 18** and **Figure 19**). The domestic vessels are typically at sea for only a few days, and land SBT both as a target and as a bycatch of bigeye and yellowfin target sets.

6 Research and monitoring to improve estimates of attributable catch

6.1 RELEASES AND/OR DISCARDS

6.1.1 Describe the various sources of information and data used in calculating the estimates

31. As of May 2025, an amended landing exception was implemented which allows fishers to return SBT to the sea, when caught by surface longline and troll, subject to the following conditions:

> *A commercial fisher may return a southern bluefin tuna to the waters from which it was taken if that person:*
> - *Determines that the southern bluefin tuna is alive immediately prior to the return, and*
> - *Determines that the southern bluefin tuna is without obvious major external injuries, and*
> - *Returns the southern bluefin tuna as soon as practicable after it is taken.*

The exception for SBT is published in the 'Fisheries (Landing and Discard Exceptions) Notice 2025.[2]

[2] Fisheries (Landing and Discards Exception) Notice 2025

32. Under the Fisheries Act 1996, dead southern bluefin tuna can only be discarded when authorised by an observer and are required to be reported against the annual catch entitlement (i.e. counted within the total allowable commercial catch). However, as of June 2024 a landing exception for seven highly migratory species taken by surface longline (including SBT) was implemented that allows for fish that have been predated such that they are no longer fit for human consumption to be returned to the sea (verified by onboard cameras). These predated fish are not required to be balanced with annual catch entitlement but are accounted for under the 20-tonne allowance for 'other sources of fishing related mortality.'

33. The Resolution on Reporting of all Sources of Mortality of Southern Bluefin Tuna requires that members report the fate of discards. New Zealand does not currently have a moribund category when reporting fate of captures. Moribund fish are included in the 'dead' category, reflecting the domestic requirements that only discarded fish that are 'likely to survive' can be considered 'alive'.

34. Estimates of non-retained catches are required for the CCSBT Data Exchange and have been provided to the Commission for the charter and domestic fleets from 1989 to 2024 (**Table 13** and **Table 14**). Up until 2021, estimates of dead discards and live releases were scaled from observed discards and releases to total effort, assuming a similar rate on unobserved vessels (noting that discarding dead SBT would not be in compliance with regulations if not authorised by an observer, and scaling observed/authorised discards to the whole fleet overestimated total dead discards). In 2022 and 2023, due to low levels of observer coverage across the fleet (as a result of non-compliant watchkeeping practices), observed discards were not scaled as scaling would have significantly over-estimated the level of discards. For 2024, fisher-reported discards are provided - the rollout of onboard cameras in January 2024 provides a high degree of confidence in fisher reported data, noting that 92%[3] of surface longline hooks were covered by camera monitoring in 2024.

6.3.1 Describe the method applied for estimating the catch

35. Monitoring of catch is conducted through electronic monitoring (camera monitoring, and electronic reporting/global position reporting (ER/GPR)). This can be supplemented by observer coverage where necessary. Compliance with these requirements is overseen by aerial flights, at-sea inspections and in-port inspections. These procedures check fishing activity and include checking the use of seabird mitigation, hold checks and adherence to the catch documentation scheme.

36. Observer coverage in 2024 is reported as catch and effort of vessels targeting SBT which had an active camera on board. On average across the two areas, 90% of catch and 89% of effort was monitored by cameras during the 2024 calendar year (**Table 15** and **Table 17**). There were also 13 inspections of New Zealand domestic surface longline vessels to monitor compliance with domestic seabird regulatory requirements and 52 inspections of vessels targeting highly migratory species, including SBT, during the 2023/24 fishing year (from 1 October 2023 to 30 September 2024).

37. Discrepancy analysis between observer data and information reported by commercial fishers is determined on a case-by-case basis when necessary. Fisheries Observer Supervisors also conduct observer briefings and debriefings prior to and after trips. During these discussions any compliance related issues are raised, in accordance with priorities and/or risk assessments. Routine debrief documentation is completed by the observer programme, and in the event of potential serious breaches, a formal debrief is carried out by a Fishery Officer.

38. Electronic catch and position reporting has allowed for increased visibility of vessel movements, processing practices and discards, and has also expedited access to fishing reports. The ability to receive electronic catch and disposal reports within a 24-hour period allows for the early identification of any discrepancies between reports and has the additional benefit of highlighting areas of attention to be addressed by Fishery Compliance Officers. Camera monitoring of fishing

[3] Note that 92% of hooks were covered by camera monitoring in 2024 due to the cameras going live at the end of January, as well as some temporary technical issues.

activities also allows for verification of fisher-reported landings, as well as other fisher reports such as discards and seabird mitigation measure use.

6.3.2 Provide the resulting estimated catch

39. Authorised dead discards of SBT from the commercial fleet in 2024 was 260 fish estimated at 8.7 tonnes – noting 100% of dead discards was predated fish that was unfit for human consumption as no observers were deployed in 2024.

6.2 RECREATIONAL FISHING

40. Reporting of recreational SBT catch is provided in **Table 19, Table 20,** and **Table 21.**

41. A recreational allowance for SBT was introduced when SBT entered New Zealand's Quota Management System on 1 October 2004. In the past, New Zealand based its national catch reporting and carry-forward calculations on the full recreational allowance even though estimates of actual recreational catch were consistently well below the levels set under that allowance.

42. Historically (since the 1970s), a small summer recreational fishery occurred out of Fiordland on the west coast of the South Island. A recreational fishery for Pacific bluefin tuna developed in 2005 out of Greymouth and Westport, on the west coast of the South Island, in which SBT are also occasionally taken as bycatch in August and September. At present, there are two distinct recreational fisheries; the west coast of the South Island from January to July, and the east coast of the North Island in June through August, primarily in the eastern Bay of Plenty. The North Island recreational fishery grew rapidly starting in 2017 when SBT catches increased dramatically, and since then SBT catches have continued to grow in this area, although recent data indicates it may be slowing as of 2024.

6.2.1 Describe the various sources of information and data used in calculating the estimates

43. Fisheries New Zealand monitors recreational catch of southern bluefin tuna in a variety of ways. These include amateur charter vessel records, reporting of recreational activity from commercial vessels, New Zealand sport fishing club records, a boat ramp survey, the New Zealand gamefish tagging programme, and social media. Further information on the different ways New Zealand monitors SBT recreational catch are outlined below.

Amateur charter vessel records

44. Amateur charter vessel records are an important source of information when estimating recreational catch of SBT. Anyone in New Zealand who takes someone fishing where payment is made for the vessel and guide services is required to be registered as an amateur-fishing charter vessel operator under the Fisheries Act 1996. Fish caught on these types of fishing trips are not entitled to be sold or traded, and the catch is regarded as recreational catch.

45. Compulsory reporting for recreational charter vessel operators was introduced by regulation in November 2010 and continues under the provisions of the consolidated Fisheries (Amateur Fishing) Regulations 2013. This requires amateur charter vessel operators to report catch to Fisheries New Zealand on a number of shared species of interest, including compulsory reporting for southern bluefin tuna and Pacific bluefin tuna.

46. In 2024 there were 63 SBT retained by amateur fishing charter vessels (**Table 19**). The number of days fished and the retained weight of SBT in 2024 was significantly less than in the previous four years.[4] Based on the recorded estimated weights, the combined SBT harvest weight by charter vessels was 3.1 tonnes - the mean weight of fish from charter vessels in the South Island was approximately 32.63 kg, while mean weights in the North Island ranged from 25 to 120 kg, with an average of 59.9 kg.

[4] Recreational harvest of southern bluefin tuna in New Zealand, 2023–24

Section 111 reporting

47. Section 111 of the Fisheries Act 1996 stipulates that all fish that is on board, landed from, or transhipped from, any registered commercial fishing vessel or fish carrier is deemed to have been taken or possessed for the purpose of sale. However, commercial fishers can apply for an exemption to this provision that allows fish to be retained for recreational consumption subject to conditions requiring the use of recreational gear. Data on this type of recreational catch is captured as part of commercial reporting requirements.

48. In the 2023/24 fishing year, fish reported as Section 111 landings weighed 1,646 kg. This is an increase from the previous year but still a reduction from the maximum reported in 2021/22 (2,709 tonnes) (**Table 21**).

Estimates of the recreational catch and size composition of SBT research project

49. Following the rapid development of a recreational fishery off the east coast of the North Island in 2017, Fisheries New Zealand approved a research project in 2018 with an overall objective to improve estimates of the recreational SBT catch and size composition in New Zealand.

50. Specific objectives of this research were to: design and implement an on-site creel survey to estimate recreational SBT harvest in the eastern Bay of Plenty in Waihau Bay; and estimate the recreational SBT harvest for the fishing year using a variety of inputs (the creel survey results, data from amateur charter vessel records, a telephone survey, Section 111 landing reports and sport fishing club records). This survey has been repeated every year since 2018.

51. In 2024 a record number of 1,801 trailers were counted over the 85 day fishing season and 777 boat crews were interviewed. The total survey estimate of landed catch using average catch from surveyed boats and total trailer counts was 701 SBT. Additionally, otolith pairs are collected annually as part of this survey and in 2024 15 otolith pairs were extracted from fish with an average weight of 54.5 kg.

52. Additionally, as part of this project, a respondent-driven off-site telephone survey estimated SBT harvest from private vessels off the South Island. There were 118 SBT reported landed from December to August with an overall average weight of 48.8 kg and a total harvest estimate of 5.8 tonnes.

New Zealand sport fishing club records

53. The New Zealand Sport Fishing Council has 55 affiliated clubs across New Zealand. Sport fishing club records provide an important source of information on tagging, landings and weights of highly migratory species caught by recreational fishers in New Zealand waters. Records of SBT landings from various sport fishing clubs are provided to Fisheries New Zealand.

54. In the 2023/24 fishing year, 55 SBT were recorded by North Island sport fishing clubs besides the club at Waihau Bay in the Bay of Plenty where the SBT creel survey is conducted. The average weight of fish recorded at fishing clubs was 61.1 kg.

The New Zealand gamefish tagging programme

55. The New Zealand gamefish tagging programme is a cooperative project between Fisheries New Zealand, the New Zealand Sport Fishing Council, its affiliated clubs, and anglers. The New Zealand Gamefish Tagging Programme was introduced as a multi species gamefish tagging programme to study the seasonal and short-term movements of gamefish species of importance to recreational New Zealand fisheries. Recaptures from the programme provide information on distance and direction of movement, time at liberty, and in some circumstances the average migration rate of the fish involved.

56. The resulting report, ‘Synthesis of New Zealand gamefish tagging data, 1975 to 2014’ can be found at: https://fs.fish.govt.nz/Doc/24040/FAR-2016-24-Gamefish-tagging-synthesis.pdf.ashx. An updated assessment published in October 2019, ‘New Zealand Billfish and Gamefish Tagging, 2016-17 to 2018-19’ can be found at: https://www.mpi.govt.nz/dmsdocument/37811/direct

57. Most southern bluefin tuna tagged under this programme are less than 30 kg and are tagged off the west coast of the South Island. Recaptures of SBT have been recorded in South Australia and Hokitika. The development of a recreational SBT fishery off the east coast North Island has resulted in larger southern bluefin tuna being tagged and released, or released without tags. The New Zealand Sport Fishing Council is encouraging tag and release of SBT. Southern bluefin tagged and released are not counted against the recreational allowance.

National Panel Survey of Marine Recreational Fishers

58. Nationwide panel surveys are conducted to generate harvest estimates of recreational catch in New Zealand waters. Features of the survey include meshblock-based face-to-face recruitment, a frequent and adaptable contact regime with a SMS texting option, and a structured questionnaire administered by telephone to record fishing details.

59. The most recent survey conducted included over 5,000 fishers who reported their fishing activity throughout New Zealand during the fishing year from 1 October 2022 to 30 September 2023. The survey includes information on recreational harvest of highly migratory species, such as skipjack tuna and albacore tuna, but did not capture any information on SBT. The next iteration of the National Panel Survey is scheduled for the 2027/28 fishing year.

Management measures

60. Following a significant surge in recreational catch in 2017 on the east coast of the North Island, the national recreational SBT catch allowance was increased for the 2017/18 fishing year from eight to twenty tonnes. In 2018, Fisheries New Zealand undertook a public consultation to introduce new management measures for the recreational fishery. In response to this consultation, a recreational bag limit of one SBT per person per day was put into effect for 2019.

61. The recreational allowance was increased again in the 2023/24 fishing year from 34 tonnes to 69 tonnes to continue to account for continuously increasing recreational catch.

Social media

62. Social media provides a platform for New Zealand's commercial and recreational fishers alike to share information on SBT. Noted in the past few years, fishers have been seen to share information through "fishing forums" on SBT landings and locations, as well as sharing information about where SBT are congregating in New Zealand waters. A number of New Zealand's sport fishing clubs also share information on social media. Information from social media has been used to substantiate information received through official channels and can provide insight into the behaviour of the recreational sector.

6.2.2 Describe the method applied for estimating the catch

63. The total landed catch from on-site creel surveys and all other available data sources is 992 SBT weighing 57.6 tonnes for 2023/24. Allowing an additional 15% to 30% for unaccounted catch gives a range of 65.5 tonnes to 73.5 tonnes SBT.

64. The mean weight for SBT recorded by North Island fishing clubs was multiplied by the estimate of North Island landed catch and the estimated number of SBT landed in the South Island was multiplied by the overall estimated mean weight. The reported weight of SBT retained under Section 111 was added to the recreational harvest estimates.

6.2.3 Provide the resulting estimated catch

65. The total harvest weight for recreational SBT in 2023/24 is estimated to be 69.5 tonnes.

6.3 CUSTOMARY AND/OR TRADITIONAL FISHING

6.3.1 Describe the various sources of information and data used in calculating the estimates

66. One of the allowances made under the New Zealand quota management system is to allow for the customary take of species. This customary allowance provides for catches of southern bluefin tuna that are governed by customary fishing regulations. There is no evidence to date that catches of southern bluefin tuna are made in this way. Most, if not all, non-commercial catches are taken subject to general provisions for amateur fishing (rather than under the customary fishing regulations). However, in recognition that the introduction of recreational management constraints in 2019 could result in an increased use of customary provisions, the customary allowance was increased from 1 tonne to 2 tonnes.

6.3.2 Describe the method applied for estimating the catch

67. Fisheries New Zealand monitors customary permits; however, no permits have been used to take southern bluefin tuna to date. No additional research or consultation on customary catch was conducted in 2024.

6.3.3 Provide the resulting estimated catch

68. There were no customary permits issued for SBT, therefore the estimated customary catch is zero.

6.4 ARTISANAL

6.4.1 Describe the various sources of information and data used in calculating the estimates

69. New Zealand does not have an artisanal fleet, therefore, there are no sources of information and data for calculating estimates.

6.4.2 Describe the method applied for estimating the catch

70. New Zealand does not have an artisanal fleet, therefore, there is no method applied for estimating catch.

6.4.3 Provide the resulting estimated catch

71. New Zealand does not have an artisanal fleet, therefore the estimated catch is zero.

7 Development and implementation of scientific observer programme

72. Historically, New Zealand's Observer Programme had a target coverage level for fisheries targeting SBT of 10% of catch and effort, as specified in the CCSBT Scientific Observer Program Standards. However, the rollout of onboard cameras in the surface longline fleet in 2024 means that monitoring is now occurring primarily through review of camera footage. All surface longline vessels are operating cameras meaning that 100% of catch of effort is able to be monitored. Coverage is measured in two ways, the proportion of catch (in numbers of fish) observed, and proportion of hooks observed where relevant effort is hooks from sets that either targeted or caught SBT (unraised).

7.1 OBSERVER TRAINING

7.1.1 Overview of the training programme provided to scientific observers

73. Fisheries New Zealand's Observer Services Unit is responsible for the recruitment and training of Fisheries Observers. The recruitment process includes a half day assessment, online physiological testing, drug and alcohol testing, a criminal record check, seafarers medical, and referee checks. Successfully shortlisted candidates then undergo a comprehensive four-week online training course which covers a mixture of New Zealand Qualification Authority (NZQA) unit standards, Fisheries New Zealand task-specific units, other relevant government agency training modules, and industry representation. This is followed by a 10-day residential program including practical courses such as firefighting, safety at sea and first aid. Candidates are assessed throughout the training course against the NZQA unit standards. Candidates must complete the entire four-week course and 10-day residential and pass an exam at the end. Those that successfully pass the training course are deployed on at least one training trip at sea with an experienced observer to train and mentor the new observers. Regular audits are undertaken by the trainer to ensure competency is obtained. Training trips last between 3-7 weeks depending on the vessel type and fishery deployed. Additional SBT specific training is provided during briefing for relevant fishery deployments.

74. The four-week online training and 10-day residential observer training course covers:
    - State Services Code of conduct
    - Maritime New Zealand training
    - Data collection and report writing
    - Safety at sea modules, including firefighting, emergency evacuations, communications, first aid
    - De-escalation training
    - Overview of NZ's Quota Management System
    - Common parts of a vessel
    - Commercial fishing methods
    - Information display systems
    - Catch quantification and species identification
    - Biological sampling
    - Protected species interaction and monitoring
    - Computer training
    - Vessel monitoring and compliance
    - A day in the life of an observer role play

7.1.2 Number of observers trained

75. There are currently 63 observers in Fisheries New Zealand's Observer Programme. All observers deployed by Fisheries New Zealand have successfully completed the full training programme. There were no new observers recruited and trained in 2024.

7.2 SCIENTIFIC OBSERVER PROGRAMME DESIGN AND COVERAGE

76. The fisheries Observer Programme is managed and coordinated by Fisheries New Zealand's Observer Services Unit. The camera program is managed by the Electronic Monitoring team. Fishing industry quota holders are levied or direct charged for observer coverage, while funding for the camera program comes from a combination of levies and government funding. Observer coverage and footage review for the year is determined by consultation with industry and the requirements of fisheries managers and the Department of Conservation.

77. Observer deployment is managed by shore-based staff in Wellington, New Zealand. Observers are deployed throughout New Zealand to cover vessels operating within New Zealand's Exclusive Economic Zone and in international waters as appropriate.

Which fleets, fleet components, or fishery components are covered by the programme:

78. In relation to CCSBT, Fisheries New Zealand observers are typically deployed to the surface longline fleet targeting southern bluefin tuna, bigeye tuna, and swordfish, where possible. Monitoring of video footage of these vessels is prioritised similarly.

How vessels were selected to carry observers within the above fleets or components:

79. Observer placements are prioritised based on vessel level of effort and catch, new entrants to the fishery, length of time since previous observation, and compliance risk assessment. One hundred percent of surface longline vessels are outfitted with onboard cameras.

How was observer coverage stratified: By fleets, fisheries components, vessel types, vessel sizes, vessel ages, fishing areas and seasons.

80. The New Zealand domestic SBT fishery currently consists of a largely uniform fleet of smaller longline vessels. New Zealand has previously stratified its observer coverage reporting based on domestic vs foreign charter vessels however this stratification is no longer relevant with the exit of the large foreign vessels from the fishery.

Details of observer coverage of the above fleets:

81. During the 2024 calendar year, there were no observers deployed on vessels targeting SBT. However, 100% of vessels targeting SBT were outfitted with onboard cameras.

82. On average across Region 5 and Region 6, 90% of the catch and 89% of the effort was monitored by onboard cameras during the 2024 calendar year (**Table 15** and **Table 17**).

83. Raised length composition data for longline is provided at an aggregation level of year, month, fleet, gear, and 5x5 degree stratum. Reduced observer coverage of commercial longline vessels has resulted in some strata where commercial fishing took place, with no corresponding observer length frequency data collected. The process for raising length frequency data to the commercial catch only includes cases where a stratum had observer coverage. A process to raise observer length frequency data to the commercial catch for a stratum with no observer coverage is not documented by CCSBT and therefore not included for the figures supplied as part of New Zealand's 2023 CCSBT data submission. In 2024 the lack of observer coverage in the longline fishery meant that length data from the Catch Documentation Scheme (CDS) was used instead. This data does not include accurate positional data beyond CCSBT stat areas. Therefore the length composition data could only be raised to these stat areas, and then distributed over the 5x5 stratum, based on catch numbers.

84. For the 2023 calendar year this resulted in around 36% of the raised catch data being excluded from the raised length frequency process.

7.3 OBSERVER DATA COLLECTED

85. The list of observer data collected against the agreed range of data is set out in the tables in **Appendix 1**.

Catch data: Amount of catch monitored of SBT and other species (if collected), by area and season, and % monitored out of total estimated SBT catch by area and seasons

86. In 2024, camera monitoring coverage in terms of catch (i.e. the proportion of individual SBT observed) was 98.9% in CCSBT area 5, and 85.6% in area 6 (**Table 15**). Coverage in terms of estimated catch (i.e. the proportion of total estimated weight) was 99% in area 5, and 81.7% in area 6 (**Table 16**).

Effort data: Amount of effort monitored (vessel days, sets, hooks, etc), by area and season and % monitored out of total by area and seasons

87. In 2024, camera monitoring coverage in terms of effort (i.e. the proportion of hooks monitored) was 98.4% for CCSBT area 5, and 83.2% for area 6 (**Table 17**).

Length frequency data: Number of fish measured per species, by area and season.

88. In 2024, there were no biological samples, including lengths, taken as there were no observers deployed to vessels targeting SBT. However, length frequency data collected for the CDS was utilised for determining length frequencies of SBT catch. (**Figure 8**).

Biological data: Type and quantity of other biological data or samples (otoliths, sex, maturity, Gonosomatic index, etc) collected per species.

89. In 2024 there were 147 otolith pairs collected from the commercial fleet, and 15 collected from recreational fishers (**Table 11**). There were no biological specimens collected by observers in 2024 (**Table 12**).

7.4 TAG RETURN MONITORING

90. There have been no dart tags returned since 2021.

7.5 PROBLEMS EXPERIENCED

91. N/A

8 Other relevant information

92. New Zealand has implemented its Digital Monitoring Programme, which requires vessels to electronically report and use geospatial position reporting. Additionally, onboard cameras were rolled out for the SLL fleet in January 2024.

9 Acknowledgements

93. Fisheries New Zealand acknowledges Terese Kendrick for assistance with the standardized CPUE analysis.

Appendix 1 – Tables

Table 1: Commercial catches of SBT in New Zealand fisheries waters (tonnes, whole weight) by calendar year and New Zealand fishing year (1 October to 30 September).

Year	Calendar year catches	Fishing year Catches
1980	130.0	130.0
1981	173.0	173.0
1982	305.0	305.0
1983	132.0	132.0
1984	93.0	93.0
1985	94.0	94.0
1986	82.0	82.0
1987	59.0	59.0
1988	94.0	94.0
1989	437.2	437.1
1990	529.2	529.3
1991	164.5	164.5
1992	279.2	279.2
1993	216.6	216.3
1994	277.0	277.2
1995	436.4	434.7
1996	139.3	140.4
1997	333.7	333.4
1998	337.1	333.0
1999	460.6	457.5
2000	380.3	381.7
2001	358.5	359.2
2002	450.3	453.6
2003	389.6	391.7
2004	393.3	394.0
2005	264.4	264.0
2006	238.2	238.2
2007	382.6	383.1
2008	319.0	318.8
2009	418.5	417.3
2010	500.8	500.0
2011	547.1	547.2
2012	775.5	775.4
2013	756.4	758.2
2014	825.6	825.8
2015	922.3	922.2
2016	950.8	949.4
2017	913.3	913.5
2018	1008.0	1008.1
2019	959.4	956.9
2020	853.0	856.6
2021	787.9	787.5
2022	875.4	875.9
2023	1102.8	1097.6
2024	890.9	895.1

Table 2: Catch (tonnes) for the foreign charter fleet by year and CCSBT region. Based on raised catches. (No foreign charter vessels fished in 1996, nor since 2016).

Calendar Year	Region 5	Region 6	Other*
1989		296.3	0.3
1990	66.7	174.9	
1991	23.0	102.6	
1992	4.8	214.5	0.5
1993	20.2	120.5	9.5
1994		234.1	
1995	1.6	228.7	0.2
1996			
1997	52.3	186.2	
1998	83.9	117.3	
1999	9.8	190.7	
2000	2.5	132.5	
2001		139.3	
2002		148.4	
2003		82.1	
2004		126.4	
2005	34.4	53.0	
2006	9.9	95.3	
2007	53.0	161.0	
2008		200.0	
2009	17.0	201.2	
2010		207.8	
2011		199.1	
2012		240.1	0.1
2013		183.9	
2014		223.9	
2015		256.8	
2016	No foreign charter fleet fishing from 2016 onwards		

*Most often erroneous position data

Table 3: Effort (1000s of hooks) for the foreign charter fleet by year and CCSBT region based on raised hooks. Note that this includes some non-SBT target effort in Region 5. (No foreign charter vessels fished in 1996, nor since 2015).

Calendar Year	Region 5	Region 6	Other*
1989		1596	3.5
1990	259	1490.6	
1991	306	1056.5	
1992	47.6	1386.8	3
1993	174.1	1125.7	101.4
1994		799.1	
1995	27.1	1198.7	13.5
1996			
1997	135.2	1098.7	
1998	225	616	
1999	57.2	955.1	
2000	30.3	757.9	
2001		639.4	
2002		726.4	
2003	3	866.6	
2004		1113.5	
2005	137	498.9	
2006	39.4	562.5	
2007	271.6	1136.1	
2008		568.3	
2009	66.8	731.0	
2010		484.9	
2011		495.9	
2012		548.4	3.4
2013	13.2	450.8	
2014		655.8	
2015		625.9	
2016	No foreign charter fleet fishing from 2016 onwards		

*Most often erroneous position data

Table 4: Catch (tonnes) for the domestic commercial fleet by year and CCSBT region based on raised catches.

Calendar Year	Region 5	Region 6	Other*
1980			130.0
1981			173.0
1982			305.0
1983			132.0
1984			93.0
1985			94.0
1986			82.0
1987			59.0
1988			94.0
1989	0.1	140.5	
1990	6.9	278.7	2.0
1991	0.9	37.8	0.1
1992	6.2	53.2	
1993	49.4	16.3	0.8
1994	6.5	35.6	0.8
1995	15.0	184.9	6.1
1996	34.2	103.8	1.3
1997	57.9	36.2	1.1
1998	83.4	52.2	0.4
1999	194.7	64.8	0.6
2000	184.0	60.9	0.4
2001	113.1	105.7	0.4
2002	135.7	162.9	3.2
2003	216.7	89.7	0.1
2004	101.0	165.9	
2005	165.2	11.6	0.3
2006	122.8	10.2	
2007	162.5	2.1	
2008	80.5	38.1	
2009	133.5	66.7	0.2
2010	204.8	88.2	
2011	237.2	110.8	
2012	249.1	285.8	
2013	344.1	227.2	
2014	334.0	267.6	
2015	406.1	259.3	0.1
2016	563.5	386.3	1.1
2017	483.6	428.6	1.1
2018	652.5	355.2	0.3
2019	414.7	544.7	0.0
2020	491.9	361.1	
2021	395.1	392.8	
2022	418.6	456.8	
2023	409.4	693.0	0.4
2024	370.3	520,5	

* Includes erroneous position data and data without positions.

Table 5: Effort (1000s hooks that caught or targeted SBT) for the domestic commercial fleet by year and CCSBT region based on raised hooks.

Calendar Year	Region 5	Region 6	Other*
1989			
1990	41.7		
1991	31.5	49.2	
1992	71.7	12.1	
1993	644.0	108.1	7.7
1994	122.6	143.3	5.8
1995	221.5	760.4	26.7
1996	417.9	564.3	11.5
1997	736.4	8.9	17.3
1998	633.6	314.5	1.2
1999	1221.4	382.9	5.5
2000	1164.0	454.4	8.5
2001	1027.6	751.5	1.9
2002	1358.6	1246.8	13.5
2003	1868.7	1569.1	4.3
2004	1154.1	1431.9	1.2
2005	1133.0	153.6	2.4
2006	1036.4	122.4	0.9
2007	681.2	19.0	
2008	527.8	94.0	
2009	733.9	165.4	1.3
2010	1116.7	294.3	
2011	955.7	197.8	
2012	858.9	629.3	
2013	905.3	565.0	1.2
2014	595.0	540.2	
2015	716.0	524.1	0.7
2016	883.8	565.9	12.6
2017	867.1	589.6	7.9
2018	1203.9	485.0	3.7
2019	1356.5	1499.9	0.0
2020	775.0	683.7	
2021	505.4	488	0.9
2022	365.7	557.3	0.5
2023	429.1	714.6	3.9
2024	469.9	746.7	0.7

* Includes erroneous position data and data without positions.

Table 6: Number of commercial longline vessels catching SBT in New Zealand fisheries waters by calendar year and New Zealand fishing year (1 October to 30 September).

Year	Calendar year vessel numbers	Fishing year vessel numbers
2001	132	132
2002	151	155
2003	132	132
2004	99	101
2005	57	58
2006	56	57
2007	44	45
2008	35	36
2009	40	39
2010	44	42
2011	42	42
2012	43	44
2013	39	39
2014	37	38
2015	34	33
2016	32	32
2017	32	32
2018	34	34
2019	28	30
2020	28	28
2021	29	28
2022	22	25
2023	20	20
2024	[5]20	20

[5] The total number of vessels is 27, which includes all commercial vessels catching SBT in New Zealand fisheries waters, as per the CDS.

Table 7: CPUE (number of fish per 1000 target hooks) for the foreign charter fleet by year and Region, based on raised catches and effort. (No foreign charter vessels fished in 1996, nor since 2015.)

Calendar Year	Region 5	Region 6	Other*
1989		2.24	1
1990	2.98	1.61	
1991	0.91	1.43	
1992	1.32	2.48	2.52
1993	1.72	1.69	2.35
1994		4.51	
1995	0.65	2.60	0.24
1996			
1997	4.68	2.25	
1998	5.48	2.94	
1999	2.50	2.78	
2000	1.04	2.78	
2001		3.77	
2002		3.33	
2003	0.00	1.34	
2004		1.37	
2005	2.65	1.18	
2006	2.91	1.95	
2007	1.93	1.70	
2008		4.88	
2009	2.42	4.55	
2010		7.80	
2011		6.39	
2012		7.33	0.29
2013	0.08	6.49	
2014		6.10	
2015		6.74	
		No foreign charter fleet fishing from 2016 onwards	

Table 8: CPUE (number of fish per 1000 target hooks) for the domestic commercial fleet by year and Region, based on raised catches and effort.

Calendar Year	Region 5	Region 6	Other*
1989			
1990	1.32		
1991	0.40	0.74	
1992	1.00	1.35	
1993	0.9	1.83	1.60
1994	0.69	3.62	2.38
1995	0.72	4.63	4.26
1996	1.17	2.68	2.37
1997	1.11	1.52	0.52
1998	2.22	1.82	7.00
1999	2.58	2.13	1.70
2000	2.37	1.99	0.75
2001	1.84	2.63	3.63
2002	1.55	2.20	3.53
2003	1.54	0.82	0.52
2004	1.16	1.46	0.0
2005	1.79	0.70	1.43
2006	1.44	0.88	0.0
2007	2.65	0.43	
2008	1.84	5.99	
2009	2.50	7.85	2.50
2010	2.75	7.29	
2011	3.98	11.12	
2012	4.84	9.78	
2013	6.15	8.11	2.00
2014	8.93	10.14	
2015	9.35	10.19	1.67
2016	12.34	16.48	1.83
2017	10.74	17.43	1.46
2018	11.08	16.81	1.17
2019	5.53	7.82	
2020	11.27	11.52	
2021	13.28	18.98	1.00
2022	20.08	13.97	
2023	16.53	17.09	1.50
2024	14.7	13.6	

* Includes erroneous position data and data without positions.

Table 9: Frequency of catch from the foreign charter fleet under 110, 120, 130, and 140 centimeters (cm) since 1989. (No charter vessels fished in 1996, nor since 2015.)

Year	< 110 cm	< 120 cm	< 130 cm	< 140 cm
1989	0.006	0.026	0.045	0.071
1990	0.041	0.101	0.131	0.164
1991	0.114	0.158	0.274	0.317
1992	0.052	0.237	0.392	0.556
1993	0.217	0.316	0.472	0.594
1994	0.028	0.122	0.229	0.380
1995	0.019	0.05	0.161	0.326
1996	NA	NA	NA	NA
1997	0.038	0.057	0.098	0.162
1998	0.094	0.209	0.247	0.321
1999	0.033	0.082	0.157	0.216
2000	0.067	0.194	0.279	0.370
2001	0.093	0.196	0.378	0.519
2002	0.037	0.135	0.245	0.398
2003	0.002	0.009	0.094	0.241
2004	0.001	0.001	0.004	0.042
2005	0.000	0.000	0.002	0.008
2006	0.035	0.041	0.051	0.059
2007	0.042	0.058	0.087	0.109
2008	0.080	0.181	0.230	0.289
2009	0.033	0.196	0.384	0.485
2010	0.062	0.106	0.366	0.633
2011	0.035	0.073	0.135	0.403
2012	0.062	0.142	0.212	0.328
2013	0.039	0.089	0.175	0.258
2014	0.050	0.177	0.321	0.438
2015	0.044	0.077	0.159	0.284
2016	No foreign charter fleet fishing from 2016 onwards			

Table 10. Frequency of catch from the domestic fleet under 110, 120, 130, and 140 centimeters (cm) for 1989 to 2024.

Year	< 110 cm	< 120 cm	< 130 cm	< 140 cm
1990	0.000	0.011	0.159	0.445
1991	0.000	0.264	0.264	0.264
1992	0.000	0.000	0.102	0.333
1993	0.108	0.160	0.183	0.301
1994	0.038	0.164	0.315	0.515
1995	0.056	0.205	0.406	0.667
1996	0.028	0.094	0.181	0.365
1997	0.028	0.029	0.066	0.257
1998	0.024	0.144	0.205	0.331
1999	0.018	0.060	0.140	0.322
2000	0.013	0.069	0.120	0.277
2001	0.022	0.086	0.187	0.396
2002	0.025	0.082	0.151	0.318
2003	0.000	0.020	0.099	0.186
2004	0.011	0.019	0.019	0.037
2005	0.000	0.006	0.006	0.006
2006	0.091	0.161	0.166	0.190
2007	0.004	0.004	0.004	0.007
2008	0.04	0.046	0.133	0.221
2009	0.005	0.031	0.129	0.289
2010	0.087	0.125	0.230	0.486
2011	0.028	0.098	0.161	0.328
2012	0.055	0.133	0.246	0.352
2013	0.002	0.006	0.036	0.084
2014	0.027	0.126	0.250	0.353
2015	0.011	0.040	0.131	0.266
2016	0.156	0.390	0.492	0.610
2017	0.072	0.307	0.525	0.625
2018	0.041	0.155	0.41	0.634
2019	0.089	0.177	0.349	0.603
2020	0.056	0.162	0.283	0.421
2021	0.044	0.147	0.283	0.400
2022*	0.087	0.218	0.351	0.434
2023*	0.135	0.192	0.316	0.452
2024	0.258	0.366	0.532	0.732

*The calculation of frequency of catch by size relies on length frequency data collected by Fisheries New Zealand observers from commercial vessels. Up to 2023 this data comes from observers, but from 2024 the length data comes from the Catch Documentation Scheme.

Table 11. Number of otoliths collected and aged from the foreign charter and domestic fleet catch since 2000, and from the recreational catch since 2018.

	Foreign charter fleet		Domestic fleet		Recreational fleet	
Year	**Otoliths**	**Number aged**	**Otoliths**	**Number aged**	**Otoliths**	**Number aged**
2000	149	0				
2001	777	198				
2002	1199	197				
2003	838	197				
2004	1141	196	120	23		
2005	417	252	3	3		
2006	443	249				
2007	714	254				
2008	745	253				
2009	1066	268				
2010	875	258				
2011	604	270				
2012	1252	255				
2013	1019	252				
2014	1241	257				
2015	1231	380				
2016			101	89		
2017			119	108		
2018			6	5	32	32
2019			0	0	80	79
2020			26	25	92	91
2021			0	0	45	43
2022			35 (91)	26 (82)	91	44
2023			150	150	49	49
2024			147	147	15	15

Table 12. Biological specimens taken by observers (note that from 2024 no observers were deployed on surface longline vessels targeting SBT so there is no biological data sampling to record).

Calendar Year	2021		2022		2023		2024
Region	**5**	**6**	**5**	**6**	**5**	**6**	No biological samples collected from 2024 due to lack of observer deployment.
LF #	313	1807	83	449	218	708	
Sexed	185	1230	67	233	122	579	
Head	1	0	0	0	0	0	
Viscera	0	0	0	0	0	0	
Stomach (stomach log)	260	549	66	377	121	650	
Otolith	0	0	0	35	0	0	
Tail	0	0	0	0	0	0	
Anal fin	0	0	0	0	0	0	
Entire specimen	0	0	0	0	0	0	
White muscle	243	1477	66	369	120	575	
Photo	1	2	0	0	0	0	
Gillraker	0	0	0	0	0	0	
Stomach contents - kept	0	0	0	0	0	0	
Gonads	0	0	0	0	0	0	
Tag retained	0	0	0	0	0	0	
Eye	0	0	0	0	0	0	

Table 13: Number of releases and discards observed and the estimated total number of discards (separated by life status - alive and dead) based on observer coverage and the life status of the observed discards for the foreign charter fleet. Note that numbers are rounded to the nearest whole fish. (No foreign charter vessels fishing in 1996, nor since 2015).

	Observed numbers		Scaled estimate		
Year	Alive	Dead	Alive (released)	Dead	Total
1989	0	0	0	0	0
1990	0	0	0	0	0
1991	0	0	0	0	0
1992	0	0	0	0	
1993	18	4	55	13	68
1994	27	9	40	13	53
1995	2	3	4	9	13
1996	0	0			
1997	0	23	0	38	38
1998	0	20	0	20	20
1999	18	15	18	15	33
2000	0	3	0	4	4
2001	3	3	3	4	6
2002	2	3	2	3	5
2003	0	2	0	2	2
2004	0	2	0	2	2
2005	0	0	0	0	0
2006	2	2	2	2	5
2007	2	1	4	2	5
2008	0	0	0	0	0
2009	5	0	6	0	6
2010	10	2	12	3	15
2011	10	0	14	0	14
2012	36	0	43	0	43
2013	64	4	82	5	87
2014	65	0	78	0	78
2015	16	0	20	0	20
2016	No foreign charter fleet fishing from 2016 onwards				

Table 14 Actual number of releases and discards observed and the estimated total number of discards (separated by life status - alive and dead) based on observer coverage and/or electronic monitoring, and the life status of the observed discards for the domestic commercial fleet. Note that numbers are rounded to the nearest whole fish.

	Observed numbers		Scaled estimate		
Year	Alive	Dead	Alive (released)	Dead*	Total
1989	0	0			
1990	0	0			
1991	0	0			
1992	0	0	0	0	0
1993	0	0			
1994	0	0	0	0	0
1995	1	3	10	20	30
1996	4	1	25	6	31
1997	0	1	0	4	4
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	0	0	0	0	0
2001	2	3	8	10	18
2002	2	2	24	30	53
2003	0	0	0	0	0
2004	0	1	0	7	7
2005	4	1	33	8	42
2006	1	0	16	0	16
2007	1	1	8	8	15
2008	2	0	13	0	13
2009	1	1	12	12	24
2010	24	2	282	25	307
2011	37	7	442	84	526
2012	61	5	745	65	810
2013	50	0	1180	0	1180
2014	48	19	710	276	986
2015	62	15	913	214	1127
2016	534	66	2770	342	3113
2017	193	31	975	159	1133
2018	70	48	404	280	684
2019	47	9	512	98	610
2020	244	37	2486	381	2858
2021	269	21	2736	206	2942
2022	373	124	8123	-†	8123
2023	343	70	8018	-†	8018
2024**	-	-	5625	260	5885

*Dead discards can legally only occur when authorised by Fisheries New Zealand observers, so the scaled estimates should be treated with caution.

†No scaled estimate of dead discards across total fishing effort have been provided for 2022 and 2023 due to low levels of observer coverage across the fleet (as a result of non-compliant watchkeeping practices).

** As of 2024, the figures reported here are from camera-monitored fisher reports – 'alive' discards being those SBT released under the 2024 exemption allowing for release of those fish that are 'alive and likely to survive,' and dead discards being those fish deemed unfit for human consumption due to predation under the 2024 exemption – note there were no 'observed numbers' in 2024 since there were no observers deployed.

Table 15. Levels of monitoring in terms of catch (proportion of individual SBT observed) for the domestic surface longline commercial fleet for 2023 and 2024 calendar years (2023 shows observer coverage, and 2024 shows coverage in terms of catch with an active camera on board).

Country/ Fishing Entity	Calendar Year	Fishery		CCSBT statistical area	Total SBT catch numbers	Observed SBT catch numbers	Observer coverage (%)
		Gear Code	Fleet Code				
NZ	2023	SLL	NZD	5	9,619	238	2.5%
				6	15,688	1055	6.7%
NZ	2024	SLL	NZD	5	7,326	7,248	98.9%
				6	12,645	10,818	85.6%

Table 16. Levels of monitoring in terms of estimated catch (proportion of total estimated weight) for the domestic surface longline commercial fleet for 2023 and 2024 calendar years (2023 shows observer coverage, and 2024 shows coverage in terms of catch with an active camera on board).

Country/ Fishing Entity	Calendar Year	Fishery		CCSBT statistical area	Total SBT Catch (kg)	Observed SBT Catch (kg)	Observer coverage (%)
		Gear Code	Fleet Code				
NZ	2023	SLL	NZD	5	350,794	7,359	2.1%
				6	616,892	34,935	5.7%
NZ	2024	SLL	NZD	5	341,175	337,868	99.0%
				6	470,802	384,848	81.7%

Table 17. Levels of monitoring in terms of effort (proportion of hooks monitored) for the domestic commercial fleet for 2023 and 2024 calendar years (2023 shows observer coverage, and 2024 shows coverage in terms of hooks set with an active camera on board).

Country/ Fishing Entity	Calendar year	Fishery		CCSBT statistical area	Total Effort (no. of hooks)	Observed Effort (no. of hooks)	Observer coverage (%)
		Gear code	Fleet code				
NZ	2023	SLL	NZD	5	447,149	3,718	0.8%
				6	735,371	47,165	6.4%
NZ	2024	SLL	NZD	5	494,197	486,197	98.4%
				6	785,372	653,430	83.2%

Table 18. Levels of monitoring in terms of days for the domestic commercial fleet for the 2023 and 2024 calendar years (2023 shows observer coverage, and 2024 shows coverage in terms of days fished with an active camera on board).

Country/ Fishing Entity	Calendar Year	Fishery		CCSBT statistical area	Total Effort (vessel days)	Observed Effort (vessel days)	Observer coverage (%)
		Gear Code	Fleet Code				
NZ	2023	SLL	NZD	5	917	4	0.4%
				6	852	51	6.0%
NZ	2024	SLL	NZD	5	498	490	98.4%
				6	747	619	82.8%

Table 19. Number of landed SBT recorded through amateur charter vessel reporting for 2016/17 to 2023/24 fishing years.

Calendar year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Amateur charter vessel reporting SBT landed (number)	52	12	42	153	149	249	108	63

Table 20. Number of landed SBT reported through New Zealand sport fishing clubs for 2016/17 to 2023/24 fishing years.[6]

Calendar year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
New Zealand sport fishing clubs landed SBT (number)	266	171	293	434	563	700	965	756

Table 21. Recreational catch (greenweight, kg) retained by fishers on commercial vessels under a Section 111 approval for 2016/17 to 2023/24 fishing years.

Fishing year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Section 111 landed green weight (kg)	1038	507	454	671	880	2,744	1,099	1,646

[6] Report from Waihau Bay plus from other recreational fishing club records.

Appendix 2 – Figures

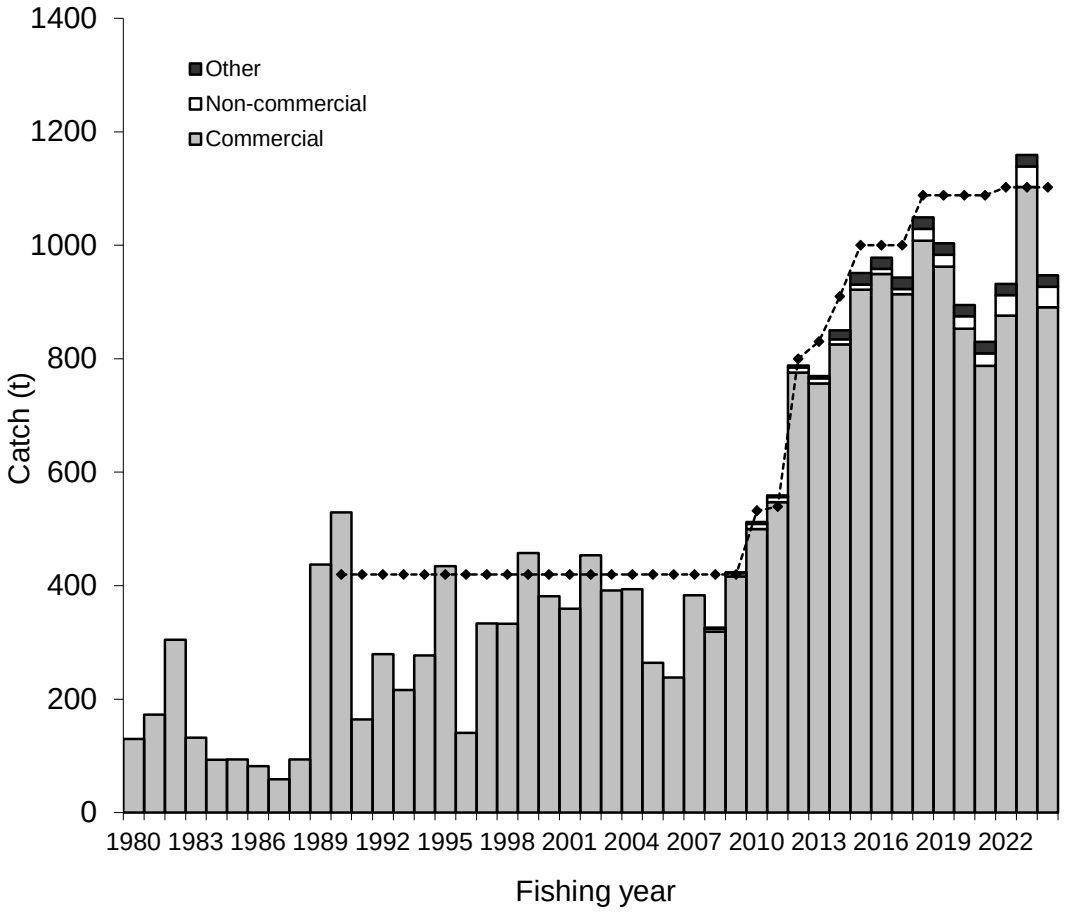

Figure 1: Commercial catches of SBT (tonnes, whole weight) by New Zealand fishing year. From 1998/99 to 2000/01, commercial catch information is from Licensed Fish Receivers, and from 2001/02, commercial catch information is from Monthly Harvest Returns from permit holders. The dashed horizontal line refers to the catch limit for New Zealand. From the 2007/08 fishing year, estimates of non-commercial catch and discard mortality (included as 'other') are provided.

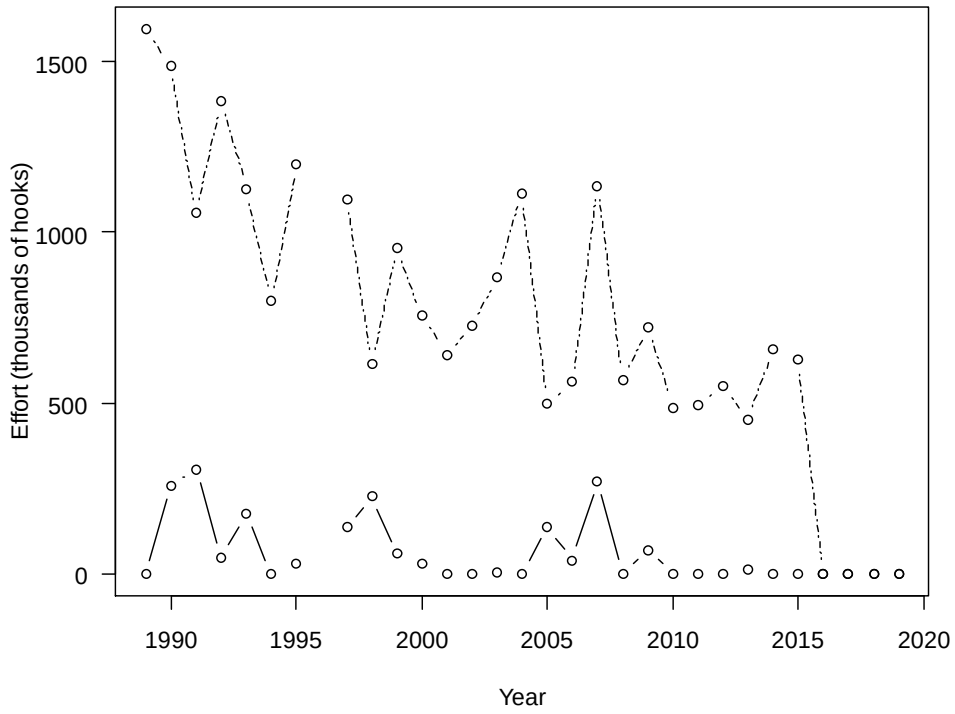

Figure 2: Effort (1000s of hooks) for the foreign charter fleet in Region 5 (solid line) and Region 6 (dashed line). Note that this includes some non-SBT target effort in Region 5 and that no foreign charter vessels fished in 1996, and from 2016 onwards.

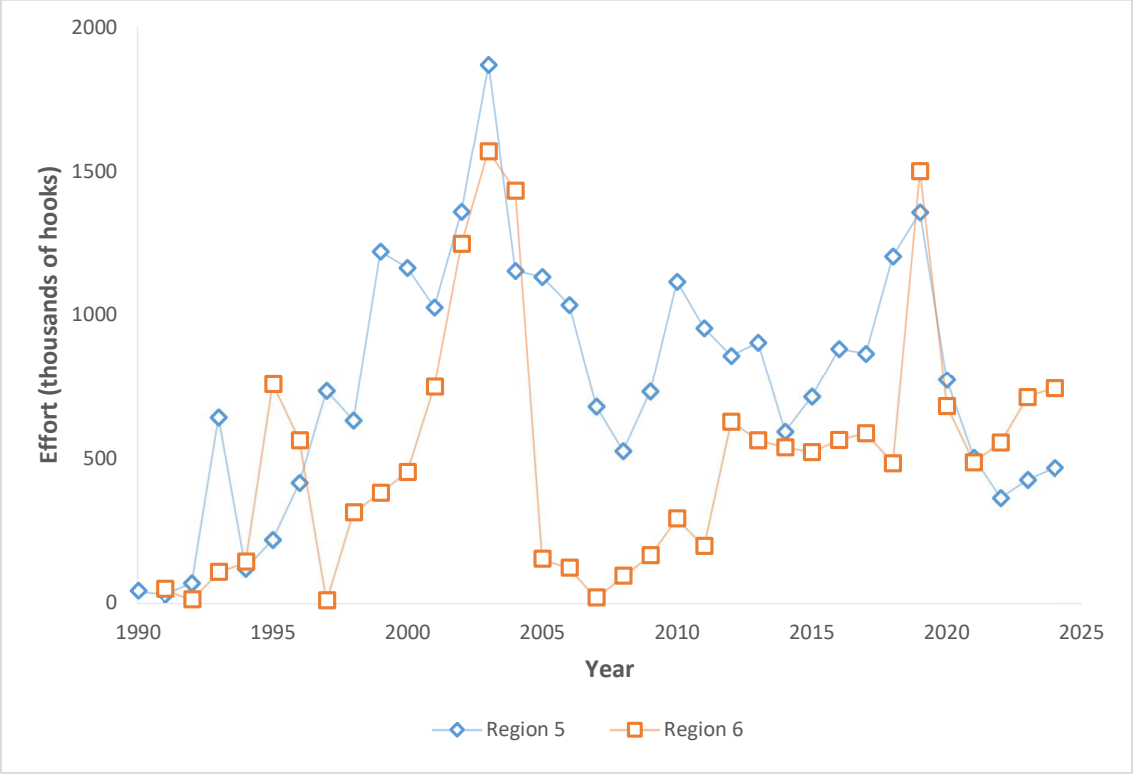

Figure 3: Target effort (1000s of hooks, hooks from sets that either targeted or caught SBT) by the domestic commercial fleet for Region 5 (blue diamond) and Region 6 (orange square).

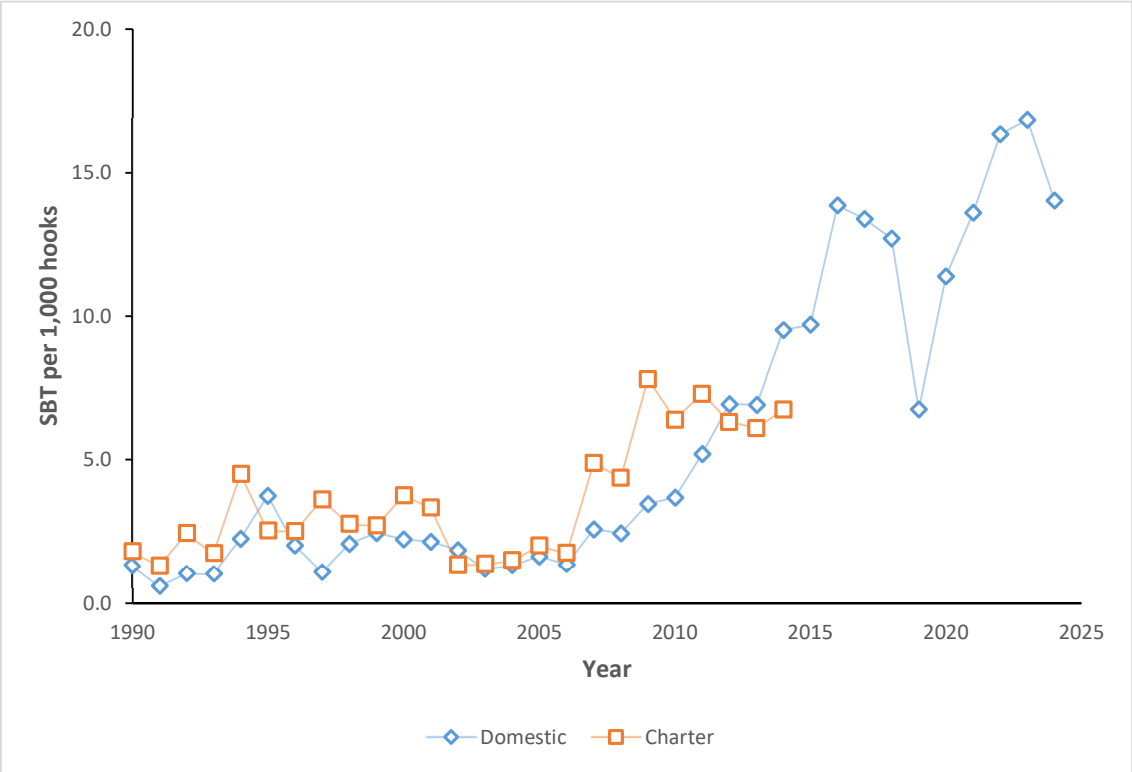

Figure 4: Nominal CPUE (number of SBT per 1000 hooks) by calendar year for the charter (orange square) and domestic (blue diamond) longline fleets based only on effort from sets that either targeted or caught SBT. Note that no charter vessels fished in 1996, and from 2016 onwards.

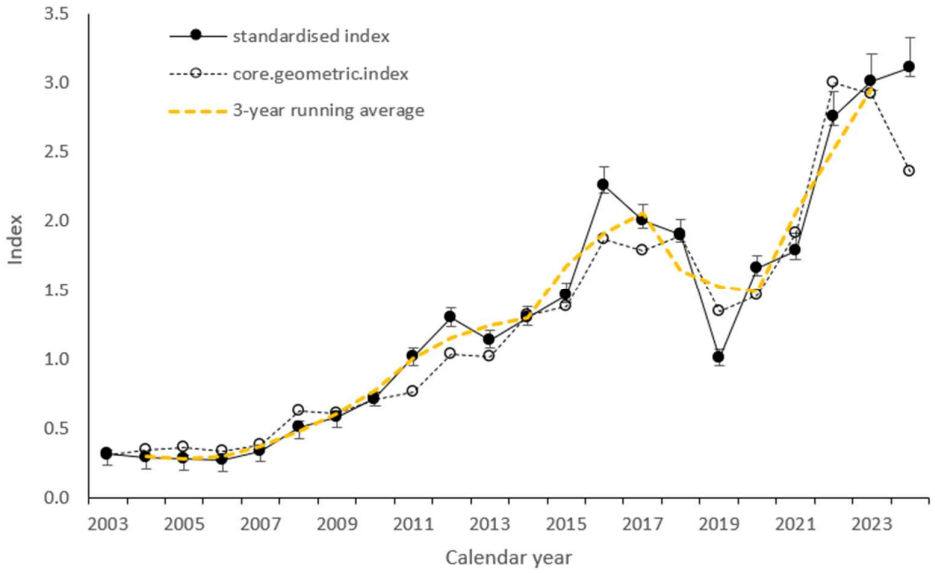

Figure 5: Standardised and unstandardised CPUE indices from unraised catch and effort reported on TLCERs for 2003 to 2023, and a three-year moving average based on the standardised index. Catch per unit of effort for the period 2003 to 2021 was standardised for changes in the core fleet, month and area of fishing, assuming a negative binomial error structure. The index was the number of fish per longline set with year, vessel month and area included in the GLM and the number of hooks and length of longline not being accepted into the model. The three-year running average is plotted at the midpoint of the year range.

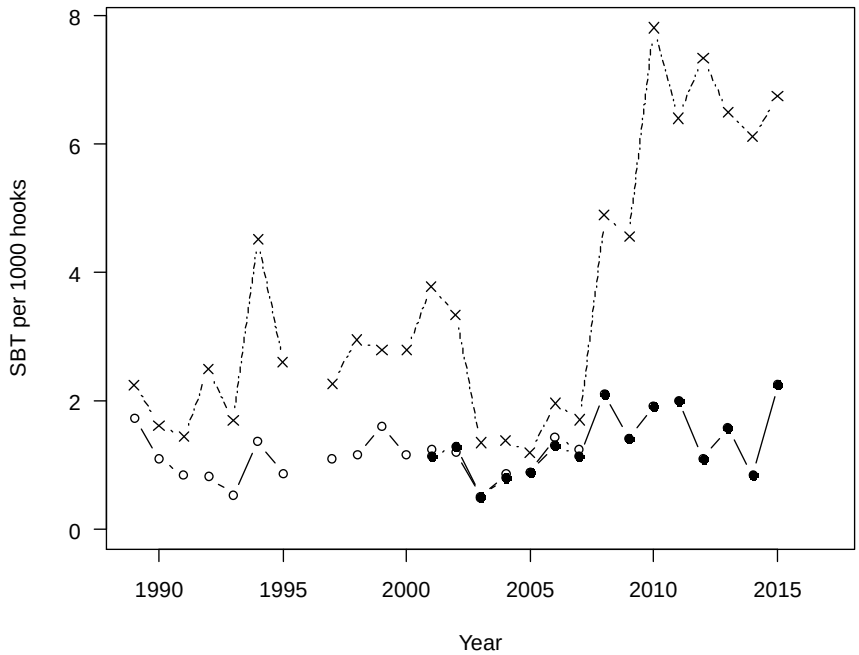

Figure 6: CPUE (number of SBT per 1000 hooks) from the foreign charter fleet in Region 6 (west coast South Island) for all southern bluefin tuna (dashed line) and for fish greater than 10 years of age based on approximate ageing from length frequency data (solid line, open symbols) and based on direct ageing data (solid line, solid symbols). Note that no foreign charter vessels fished in 1996, nor since 2015.

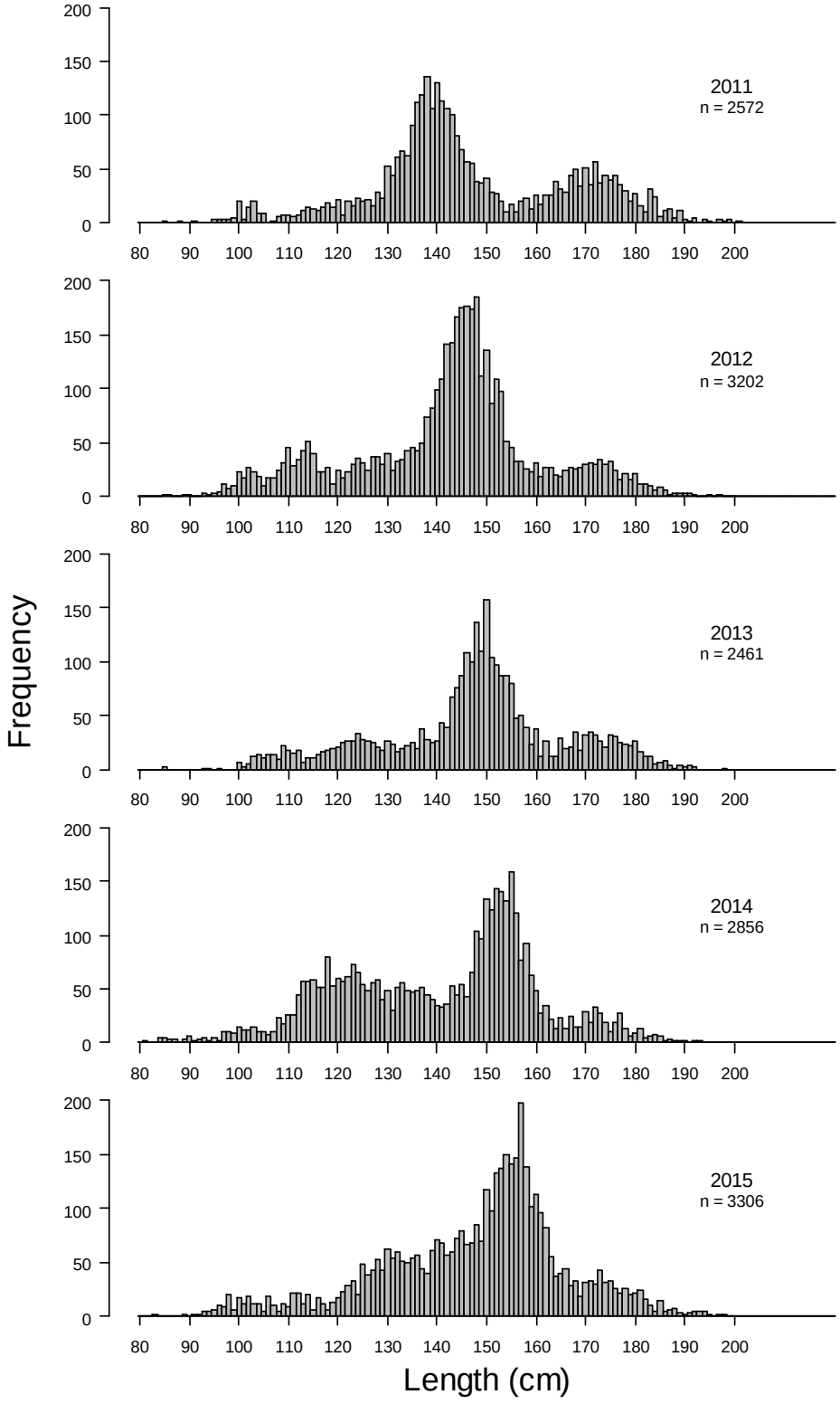

Figure 7: Length frequency of SBT catch (raised) by the foreign charter fleet for the most recent five calendar years (no foreign charter vessels have fished since 2015).

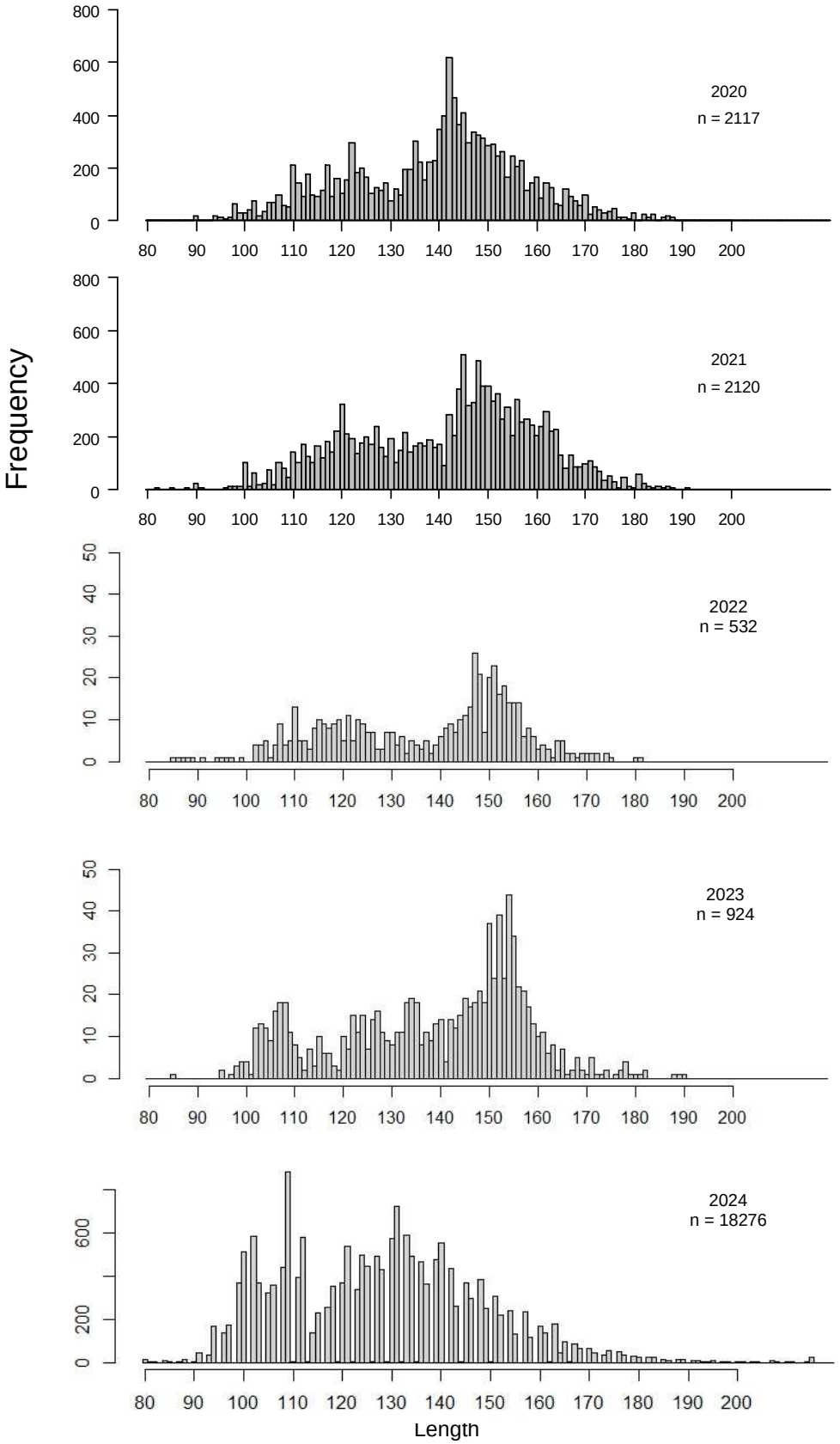

Figure 8: Length frequency of SBT catch by domestic commercial fleet for the five most recent calendar years. For 2024 CDS data was used while all previous years are observer data.

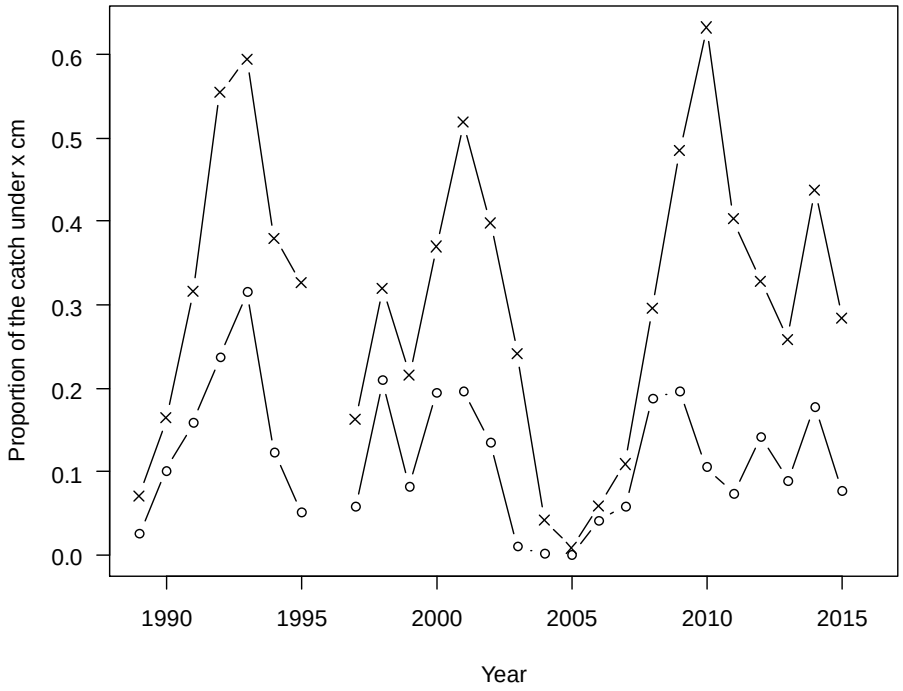

Figure 9: Proportion of the catch from the foreign charter fleet under 120 cm (o) and 140 cm (x) since 1989 (no foreign charter vessels fishing in 1996, nor since 2015).

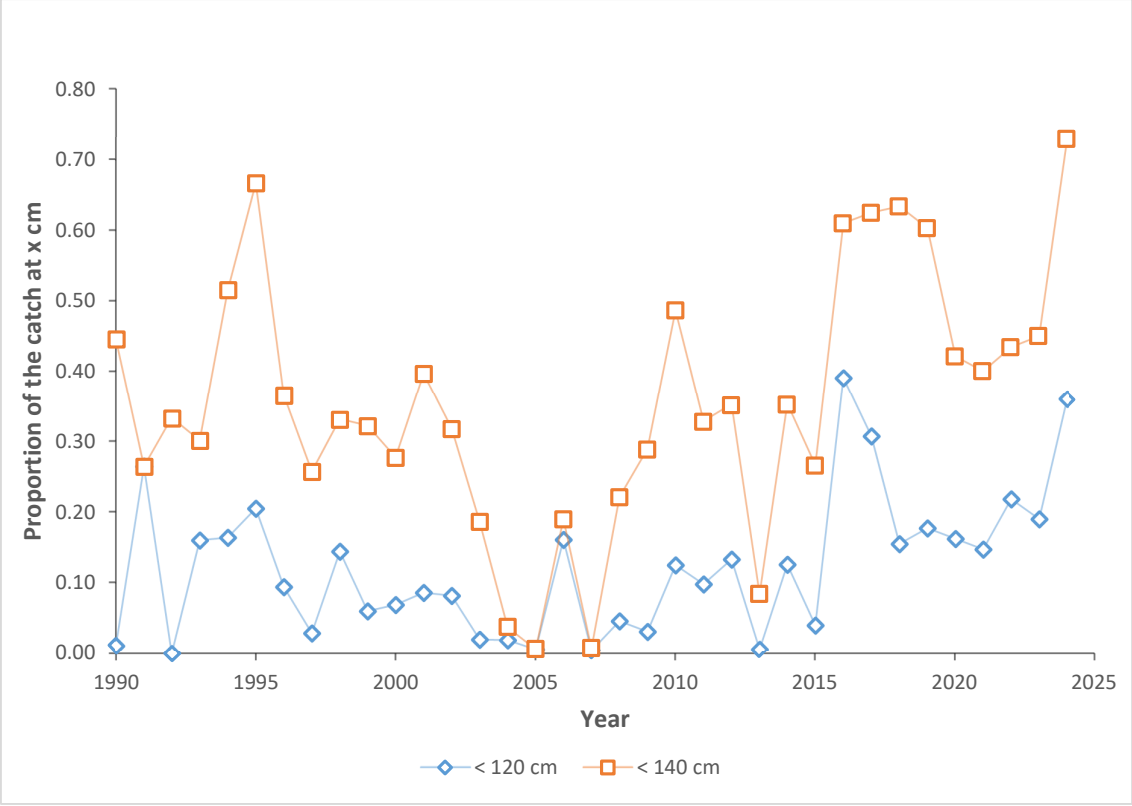

Figure 10: Proportion of the catch from the domestic commercial fleet under 120 cm ( ) and 140 cm ( ) for 1990 to 2024.

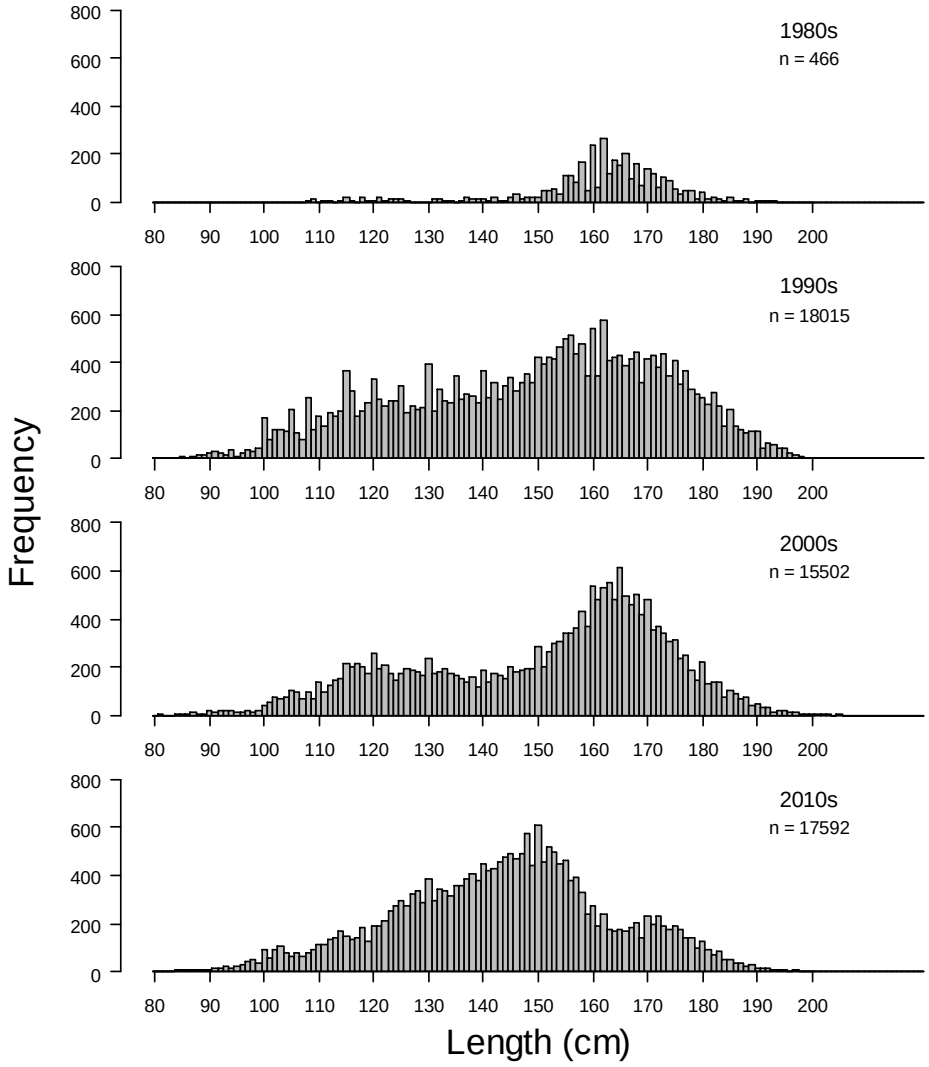

Figure 11: Length frequencies (raised) for the foreign charter fleet in the 10-year periods 1990-99, 2000-09, and 2010-2015. (No foreign charter vessel fished in 1996, nor since 2015.) n= number of fish measured

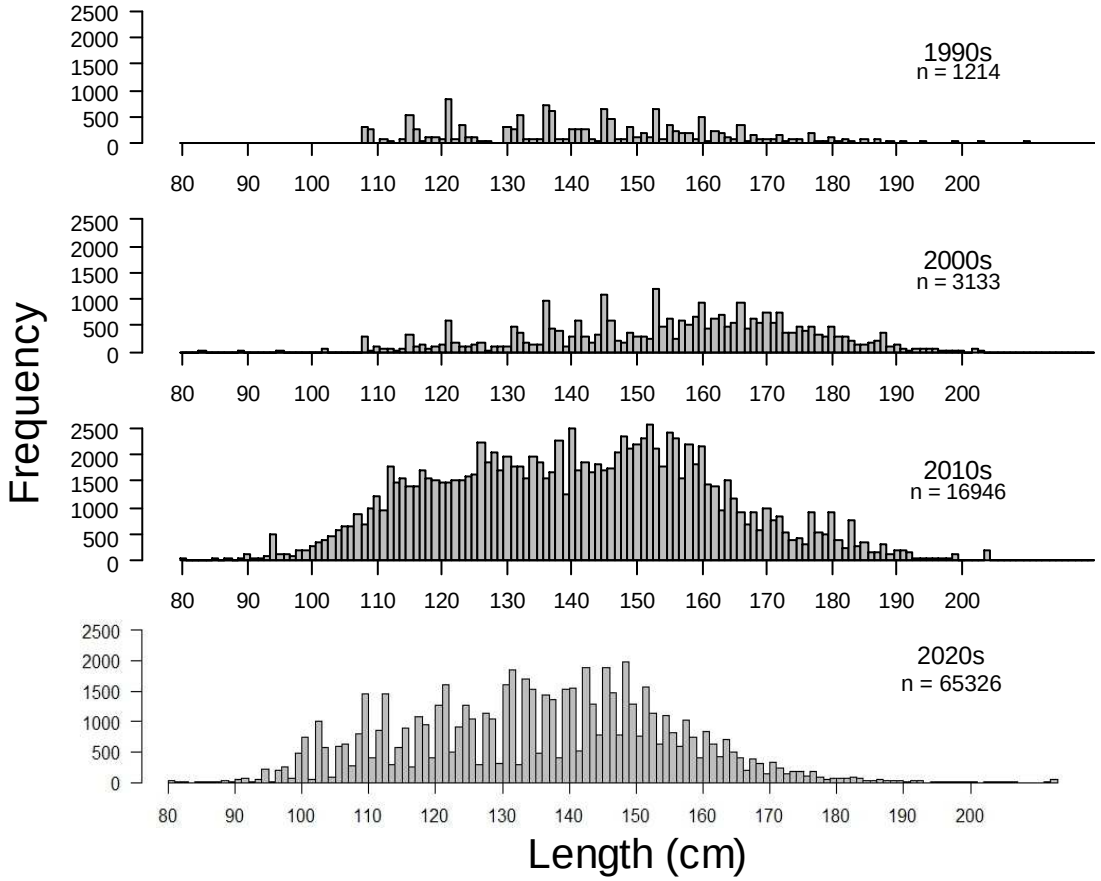

Figure 12: Length frequencies (raised) for the domestic commercial fleet in the 10-year periods 1990-99, 2000-09, 2010-2019, and 2020 -present n= number of fish measured. Note that 2024 length frequencies were raised from CDS length data, while for all previous years, they were raised from observer data.

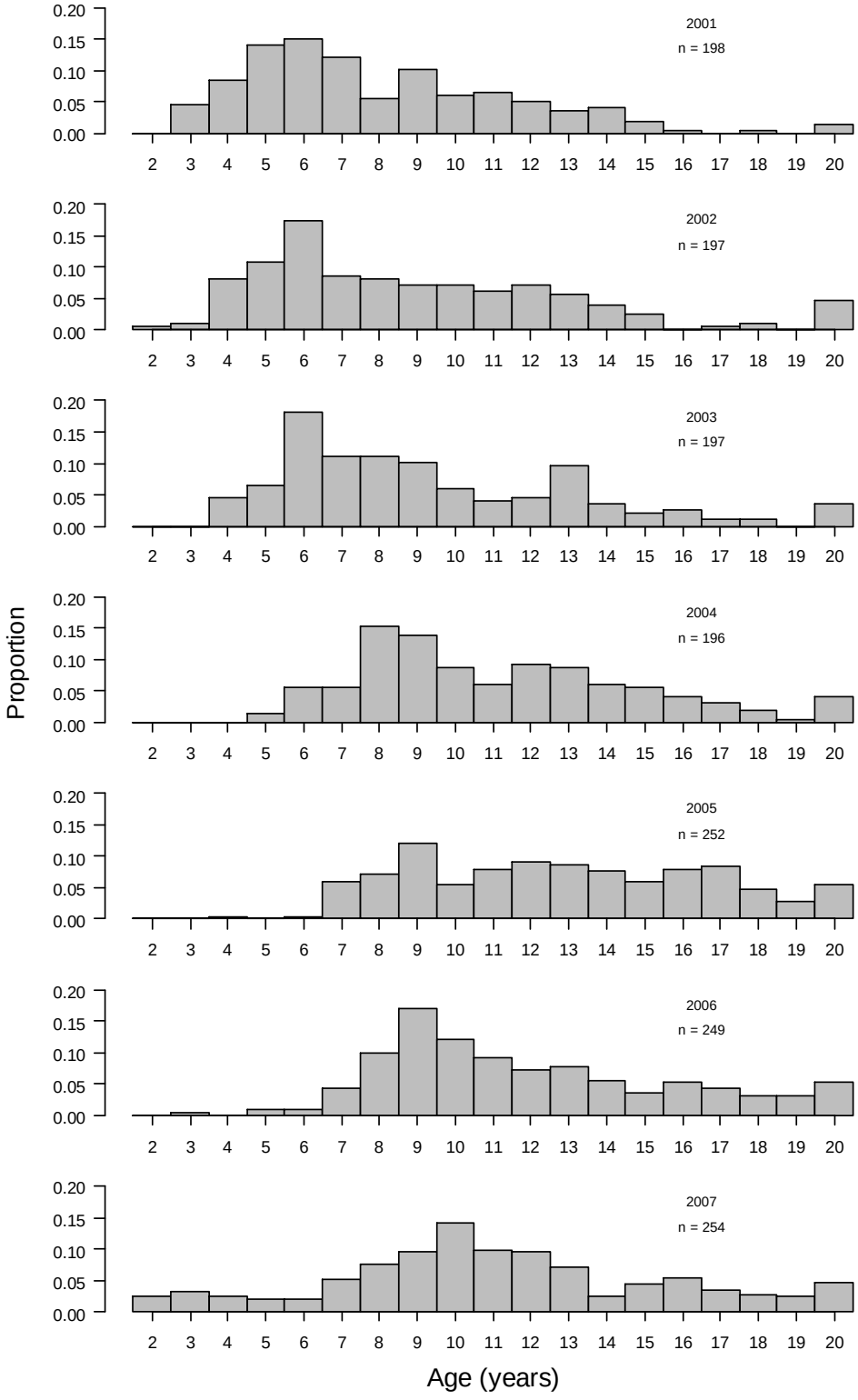

Figure 13: Proportion-at-age for the foreign charter fleet for 2001 to 2015, and for the domestic commercial fleet for 2016 to 2024, based on direct ageing. Age 20 is a plus group.

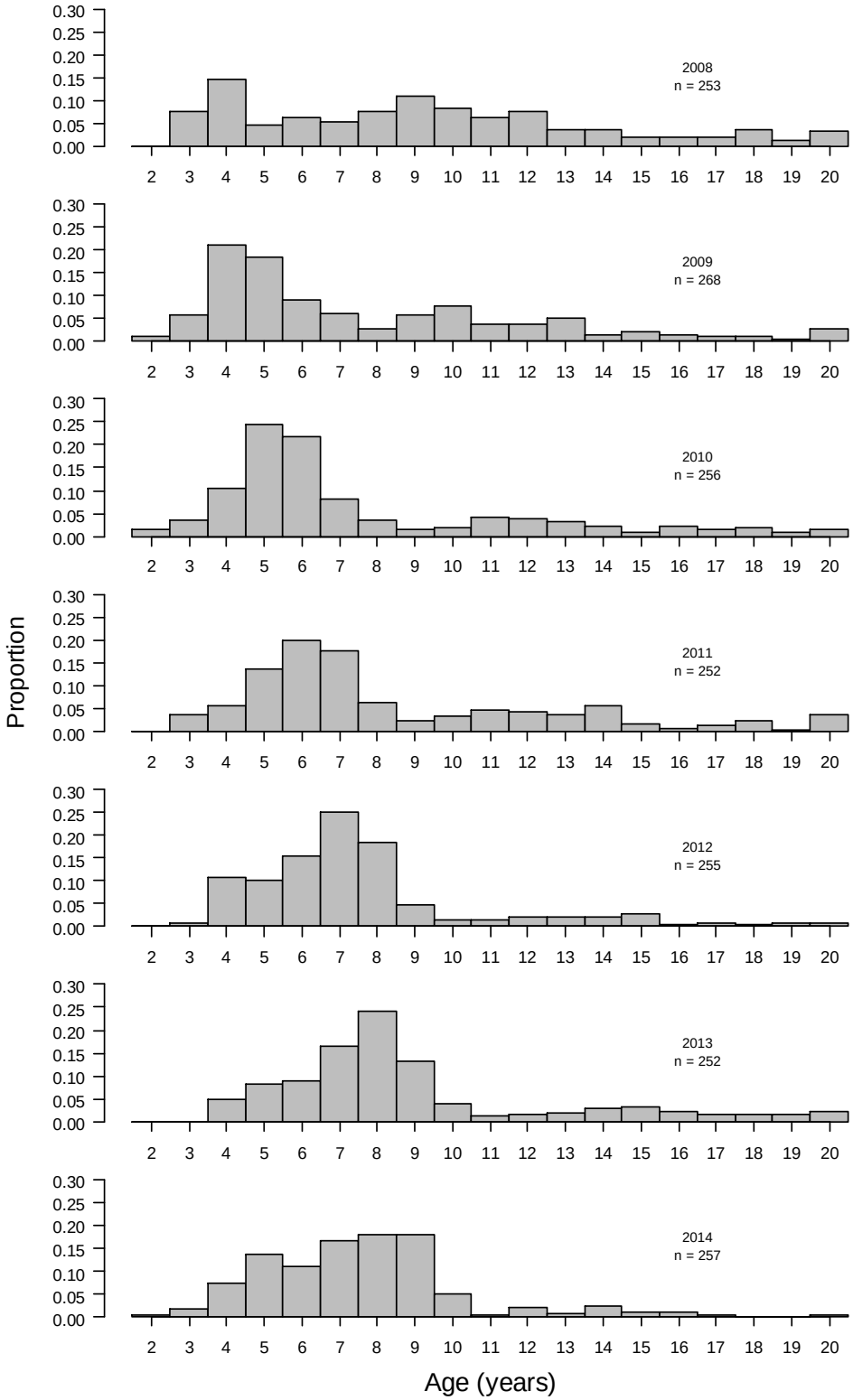

Figure 13 (continued): Proportion-at-age for foreign charter fleet for 2001 to 2015, and for the domestic commercial fleet for 2016 to 2024, based on direct ageing. Age 20 is a plus group.

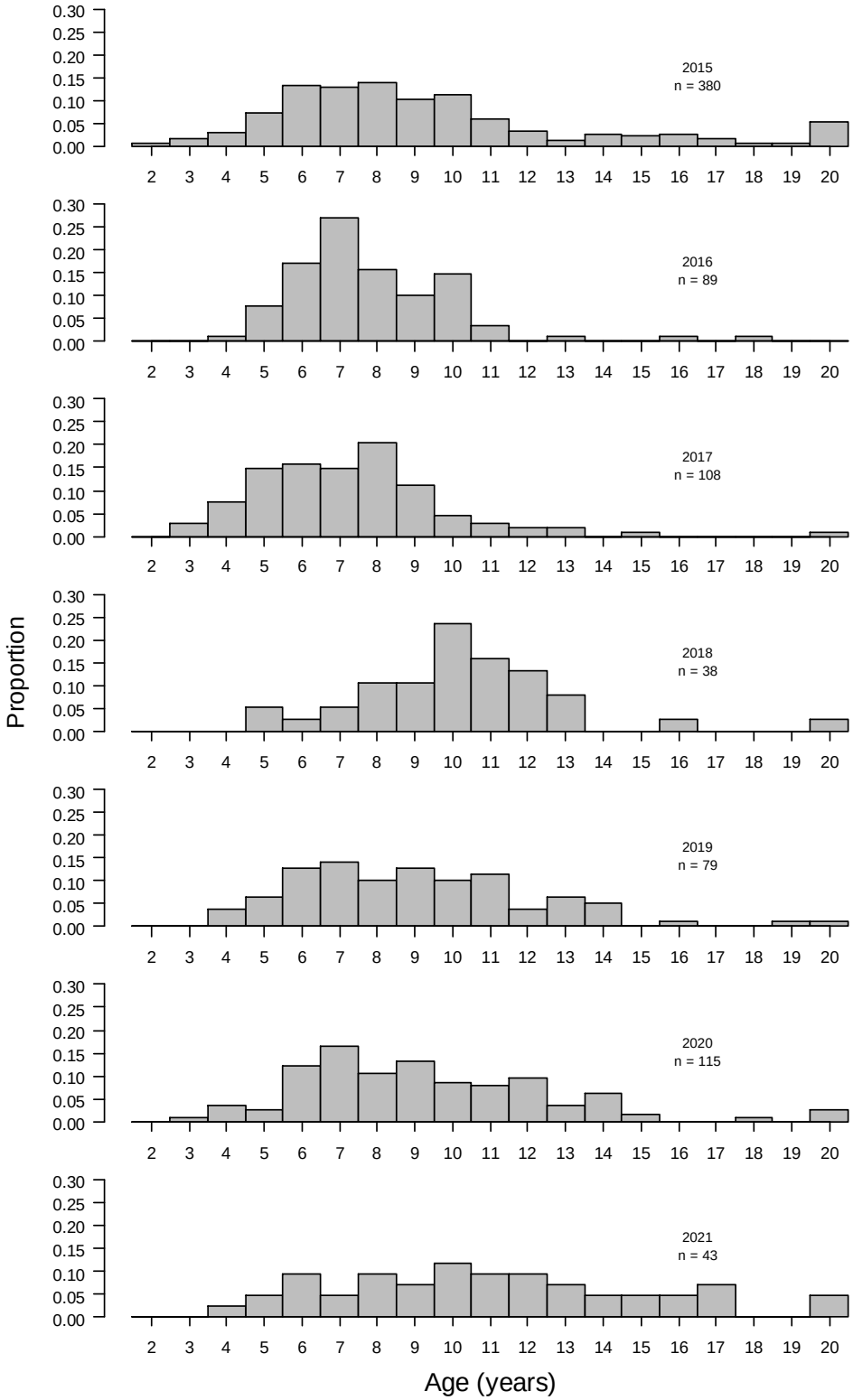

Figure 13 (continued): Proportion-at-age for the foreign charter fleet for 2001 to 2015, and for the domestic commercial fleet for 2016 to 2024 based on direct ageing. Age 20 is a plus group.

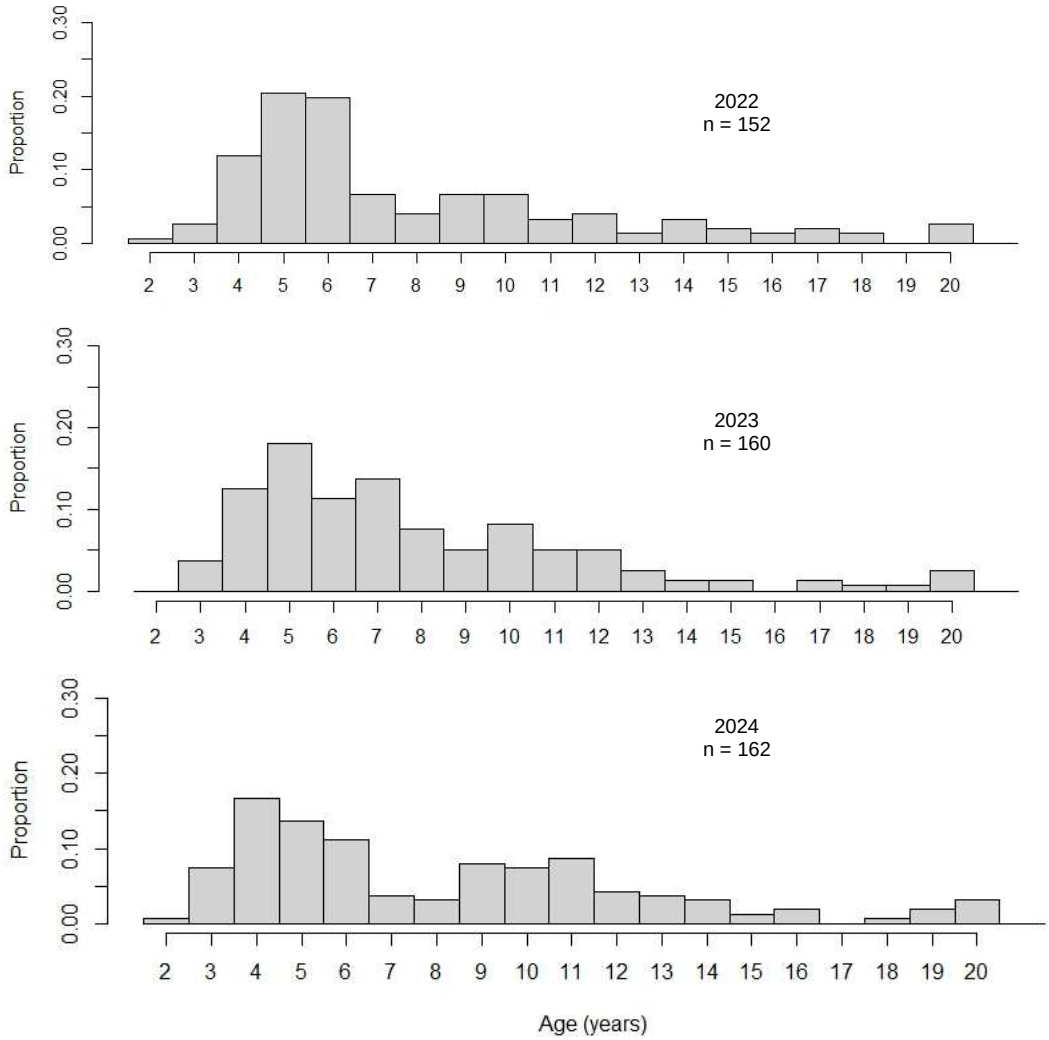

Figure 13 (continued): Proportion-at-age for the foreign charter fleet for 2001 to 2015, and for the domestic commercial fleet for 2016 to 2024 based on direct ageing. Age 20 is a plus group.

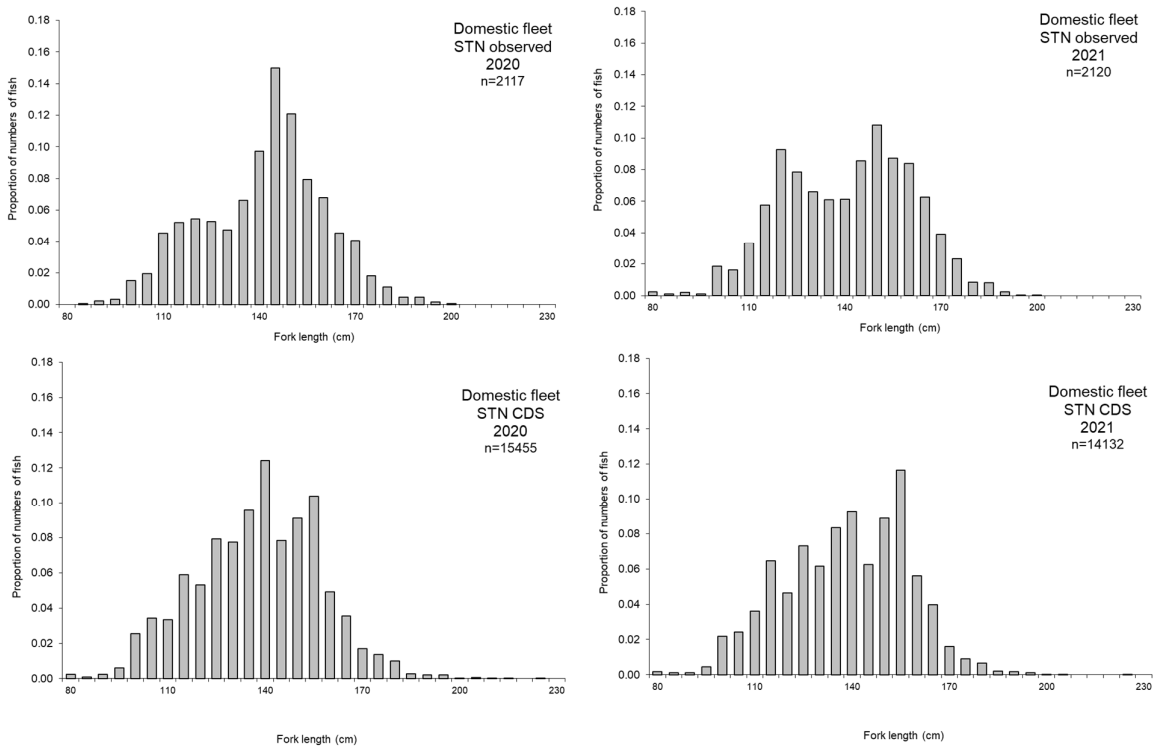

Figure 14: Proportion-at-length for SBT catches from 2020, and 2021 for the domestic commercial fleet measured by observers (upper) and reported on CDS forms (lower).

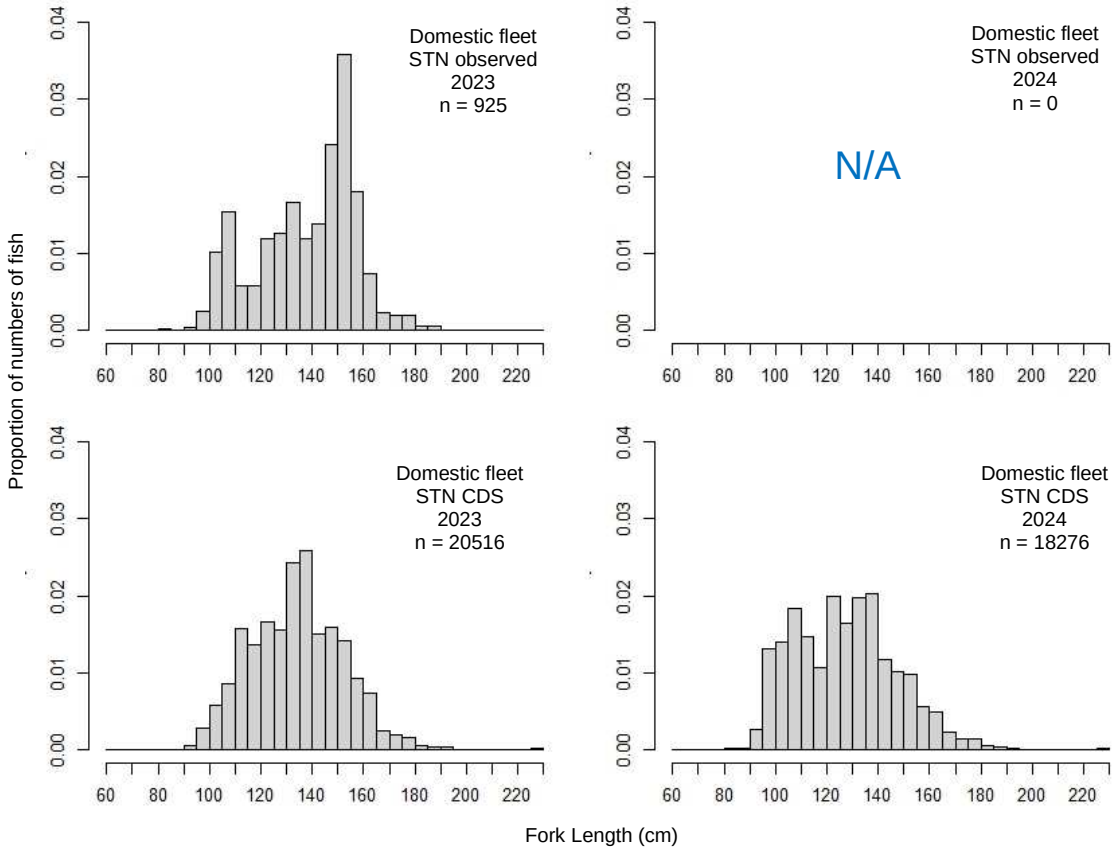

Figure 14 (continued): Proportion-at-length for SBT catches from 2023 – 2024 for the domestic commercial fleet measured by observers (upper) and reported on CDS forms (lower).

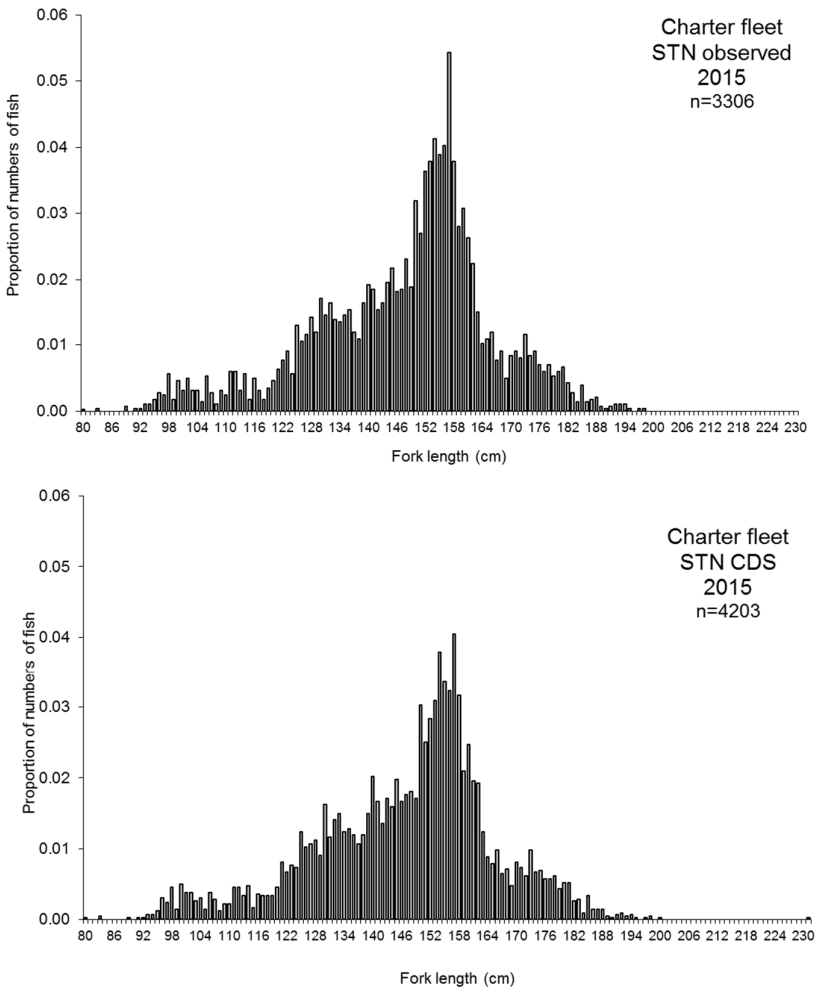

Figure 15: Proportion-at-length for the SBT catches for 2015 for the foreign charter fleet measured by observers and reported on CDS forms.

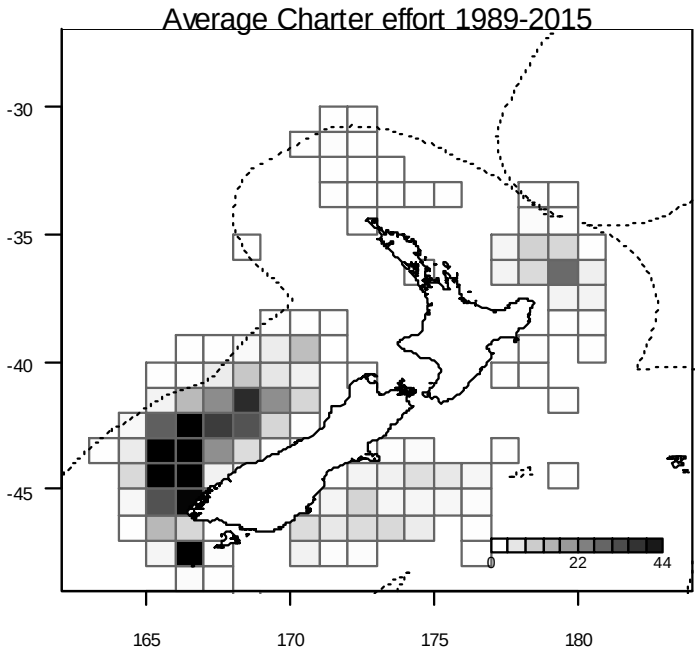

Figure 16: Distribution of longline effort (1,000s of hooks per one degree square) for the foreign charter fleet: average for the time series (1989 to 2015). No foreign charter vessels fished since 2015.

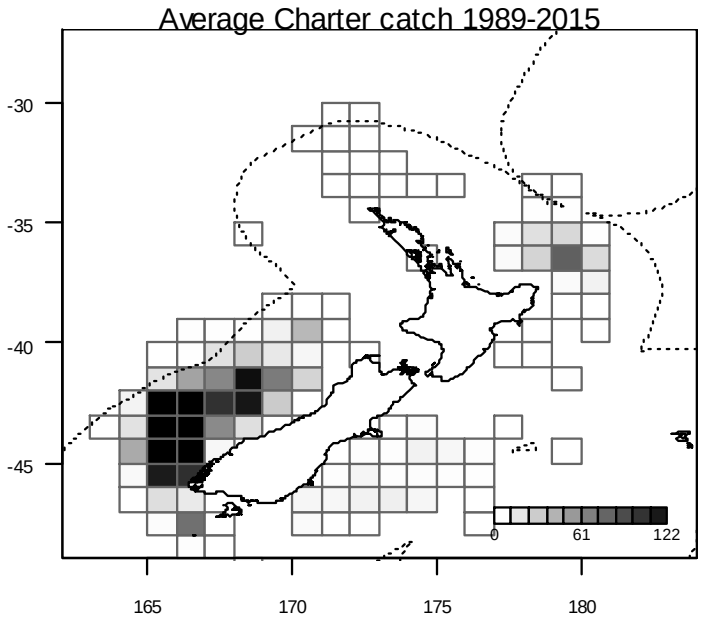

Figure 17: Distribution of longline catches (number of fish per one degree square) for the foreign charter fleet: average for the time series (1989 to 2015). No foreign charter vessels fished since 2015.

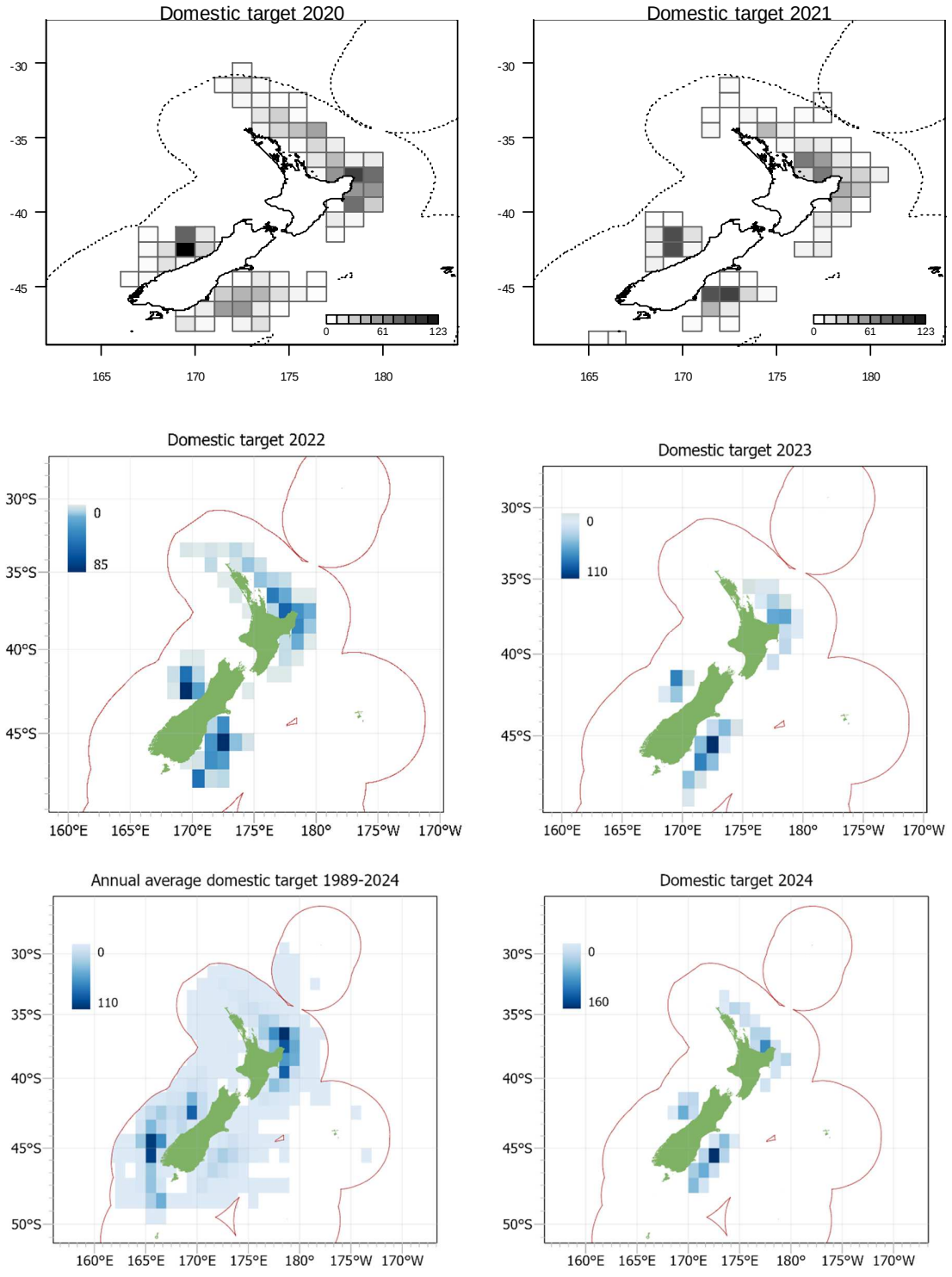

Figure 18: Distribution of longline effort (1,000s of hooks per one degree square) for the domestic commercial fleet that was targeted at SBT: average for the time series (1989 to 2024), and annually for 2020 to 2024.

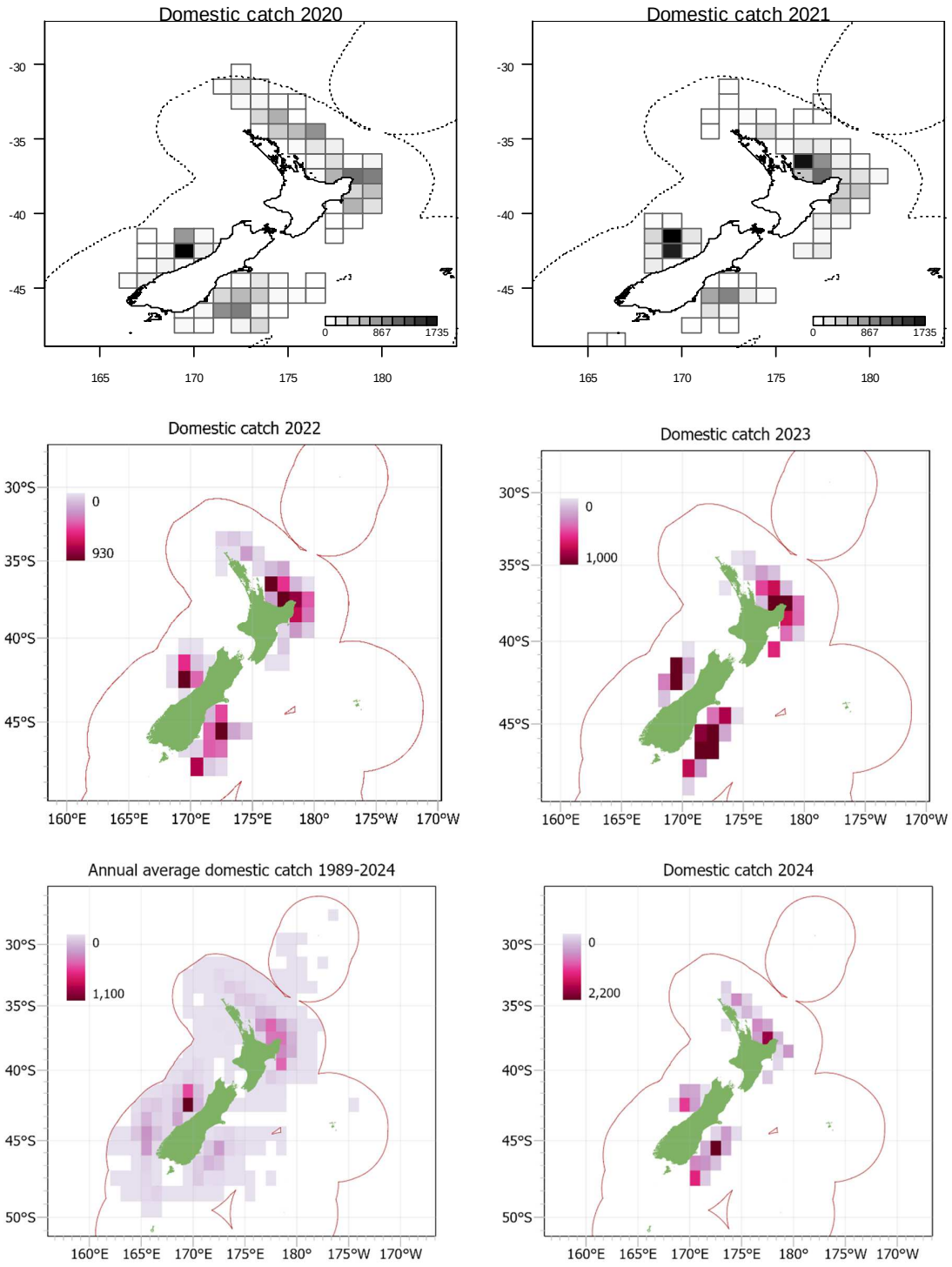

Figure 19: Distribution of longline catches (number of fish per one degree square) for the domestic commercial fleet: average for the time series (1989 to 2024), and annually for 2020 to 2024.

Appendix 3 – Standardised CPUE for southern bluefin tuna in New Zealand

Terese Kendrick
1 July 2025

1. Data subsetting and processing

Tuna Surface Longline effort data as submitted to CCSBT. These data include sets that targeted or that caught southern bluefin tuna. Table 1 summarises the number of fishing vessels, sets, effort and catch in the resultant dataset. The minimum number of vessels was 20 in 2023 and 2024. The percentage of trips with reported landed catch ranged from 53 % to 97 %.

Table 1: Summary of data subset by calendar year.

Year	Vessels	Sets	Effort (hooks)	Catch (t)	Sets with catch (landed,%)
2003	120	2 721	3 959 495	4.9	53.47
2004	89	2 085	3 362 763	4.6	62.01
2005	50	1 195	1 764 341	2.8	63.60
2006	49	1 070	1 586 188	2.6	67.48
2007	37	991	1 978 741	4.0	81.53
2008	33	775	1 152 575	4.3	72.52
2009	38	1 082	1 645 274	6.5	86.97
2010	39	1 445	1 724 815	8.5	78.89
2011	39	1 253	1 584 735	9.2	86.27
2012	43	1 526	1 887 204	14.2	92.14
2013	38	1 455	1 706 112	12.1	92.78
2014	34	1 317	1 656 421	14.0	90.51
2015	33	1 392	1 721 229	15.3	93.89
2016	32	1 567	1 393 552	20.7	94.89
2017	32	1 563	1 402 499	19.3	94.75
2018	33	1 674	1 557 266	20.0	86.44
2019	28	1 762	1 629 829	10.8	59.36
2020	28	1 620	1 474 055	17.3	92.35
2021	26	1 212	1 077 860	15.4	90.51
2022	22	1 127	970 722	21.7	92.90
2023	20	1 275	1 154 527	25.1	93.10
2024	20	1 380	1 273 666	24.6	97.03

2. Core vessel selection

Alternative core vessel selection criteria were investigated by considering the reduction in the number of vessels and percentage of catch (Figure 1). The most appropriate combination of criteria was considered to be to define the core fleet as those vessels that had fished for at least 10 trips in each of at least 4 years. To qualify, trips were required to have recorded at least 0kg of catch. These criteria resulted in a core fleet size of 64 vessels which took 92% of the catch (Figure 1). A plot of the degree of overlap of data among core vessels is provided (Figure 2). A comparison between all vessels and core vessels for key indicators of catch rates is also given (Figure 3).

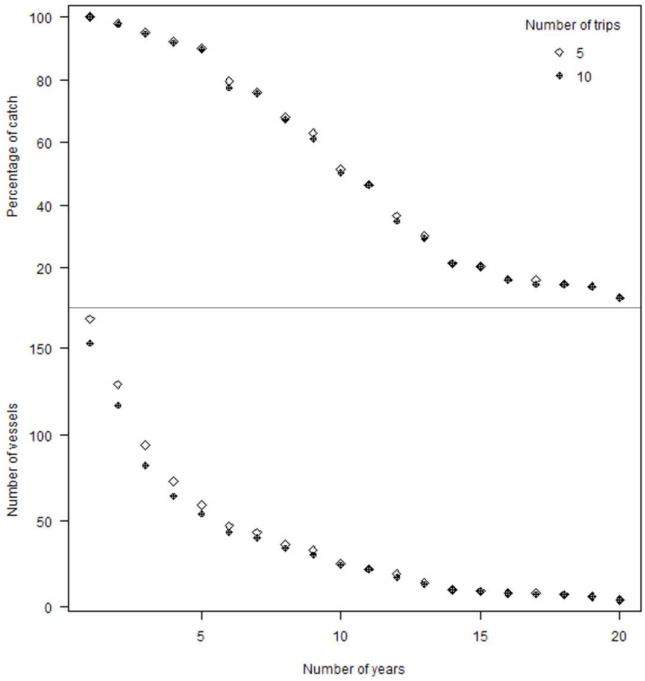

Figure 1: Examination of parameters for defining core vessels. The upper panel indicates how the percentage of catch represented by core vessels changes with alternative criteria. The lower panel indicates how the number of vessels changes with alternative criteria.

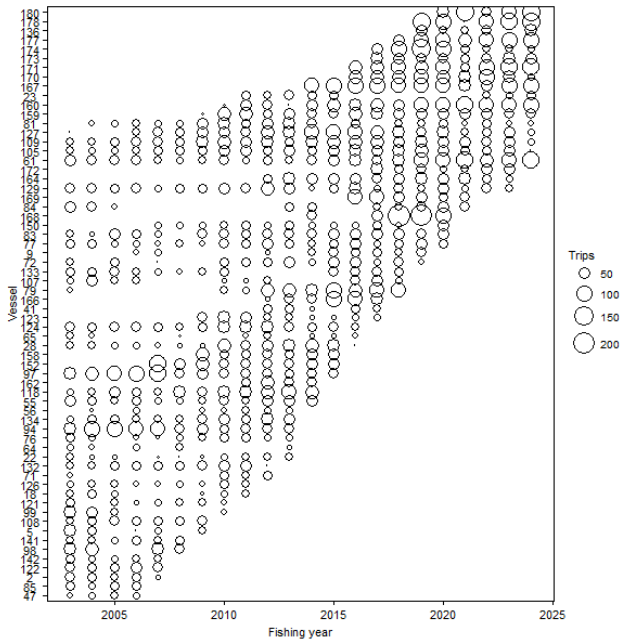

Figure 2: Number of sets by year for core vessels. The area of circles is proportional to the number of sets for a vessel in a year.

Table 2: Summary of core vessel data by year.

Year	Vessels	Sets	Effort (hooks)	Catch (t)	Sets with catch (%)
2003	38	1 193	1 883 879	2.6	57.42
2004	35	1 048	1 789 604	2.9	68.03
2005	31	972	1 530 983	2.5	64.20
2006	32	920	1 451 473	2.4	69.02
2007	32	959	1 948 041	3.9	81.65
2008	27	671	1 046 550	4.1	74.22
2009	30	944	1 505 725	6.2	87.29
2010	34	1 347	1 641 543	8.3	79.88
2011	34	1 182	1 516 741	9.0	86.13
2012	36	1 399	1 766 944	13.5	92.14
2013	33	1 319	1 575 352	11.3	92.87
2014	31	1 266	1 493 836	13.1	90.13
2015	25	1 259	1 508 909	14.0	93.80
2016	27	1 432	1 279 657	19.1	94.55
2017	28	1 432	1 293 479	18.1	94.83
2018	27	1 521	1 424 364	18.6	86.00
2019	25	1 710	1 589 129	10.7	60.35
2020	25	1 531	1 402 059	16.6	92.29
2021	21	1 040	918 790	13.8	89.23
2022	20	1 052	904 872	20.6	92.59
2023	19	1 175	1 069 507	23.3	93.28
2024	17	1 082	1 017 309	20.2	97.13

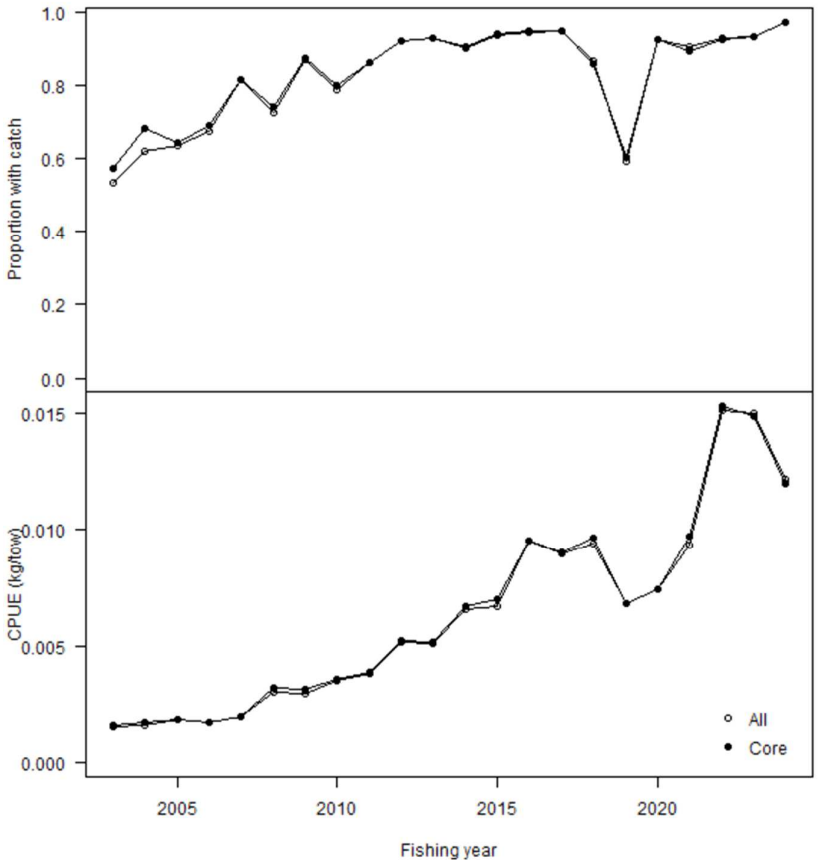

Figure 3: Comparison of the proportion of sets with positive catch (upper) and unstandardised CPUE (geometric mean of catch divided by effort where catch was positive; lower) for all and for core vessels

3. Stepwise selection of model terms

A negative binomial distribution was used. Forward stepwise selection of model terms was done on the basis of the Akaike Information Criterion (AIC). The maximal set of model terms offered to the stepwise selection algorithm was ~ *. year + month + area + vessel + target + poly(log(hooks), 3) + poly(log(length), 3)* with the term *year* forced into the model. Terms were only added to the model if they increased the percent deviance explained by 1 %. Stepper. Table 3 provides a summary of the changes in the deviance explained and in AIC as each term was added to the model. The final model formula was ~ *year + vessel + month + area*

Table 3: Summary of stepwise selection. Model terms are listed in the order of acceptance to the model. AIC: Akaike Information Criterion; *: Term included in final model.

Term	DF	Log likelihood	AIC	Nagelkerke pseudo-R^2 (%)	Final Model
year	22	-83 359	166 761	18.94	*
vessel	85	-81 078	162 326	31.81	*
month	96	-79 775	159 741	38.22	*
area	97	-79 517	159 228	39.41	*
target	104	-79 363	158 935	40.11	
poly(log(hooks), 3)	107	-79 287	158 789	40.46	
poly(log(length), 3)	110	-79 272	158 764	40.53	

4. Influence of model terms on annual CPUE indices

Table 4: Summary of the explanatory power and influence of each term in the standardisation model. Coefficients is the number of coefficients associated with the term added. Log likelihood and AIC values are for the fit as each term is successively added. Coefficient of determination (R^2) values represent the change in R^2 from the previous model. R^2: square of the correlation coefficient between log(observed) and log(fitted).

Term	Coefficients	Log likelihood	AIC	Negelkerke pseudo-R^2 (%)	Overall influence (%)
intercept	1	-86 132	172 266	-	-
year	21	-83 359	166 761	18.94	-
vessel	63	-81 078	162 326	12.86	8.40
month	11	-79 775	159 741	6.41	8.88
area	1	-79 517	159 228	1.19	4.90

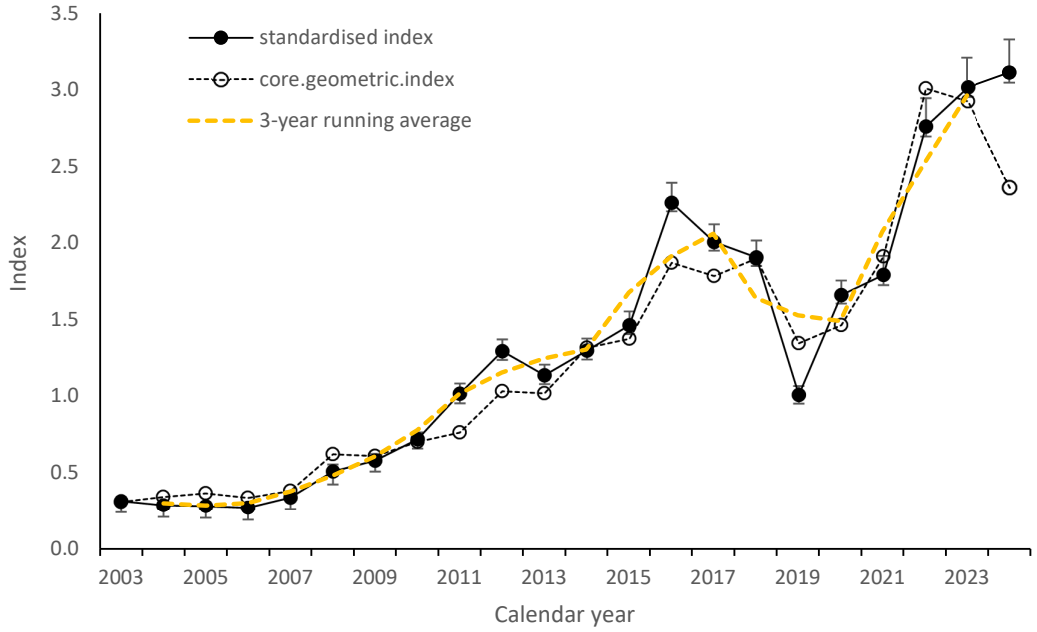

Figure 4: Overall standardization effect of the model. The unstandardised index is based on the geometric mean of the catch per set. A 3-year running average smoother is calculated from the standardised index and plotted in the middle year of the 3-year range.

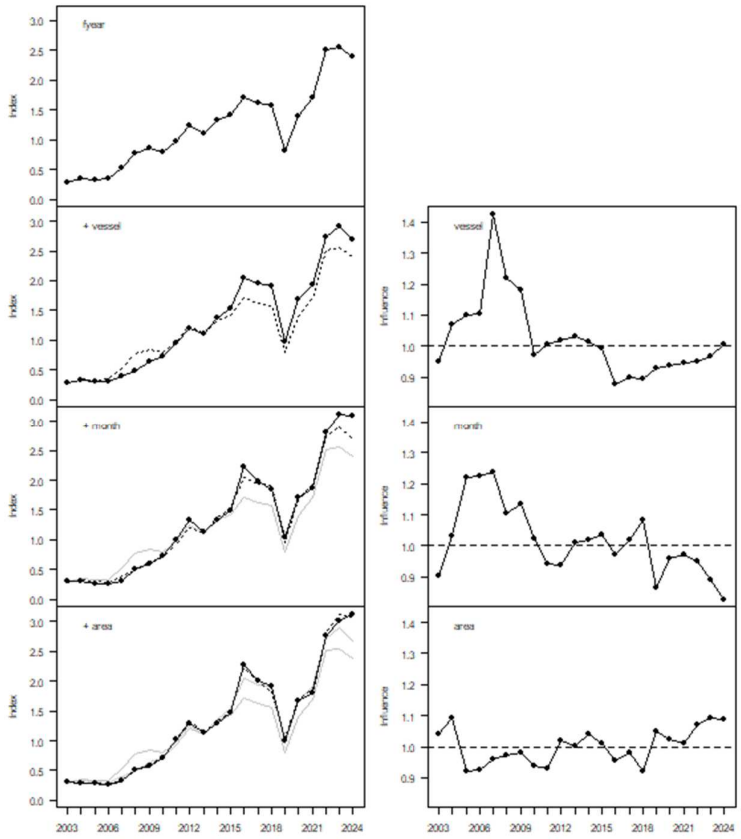

Figure 5: Step and influence plot. The new variable being added is a solid black line, the immediately previous line is dashed, and older lines are in grey.

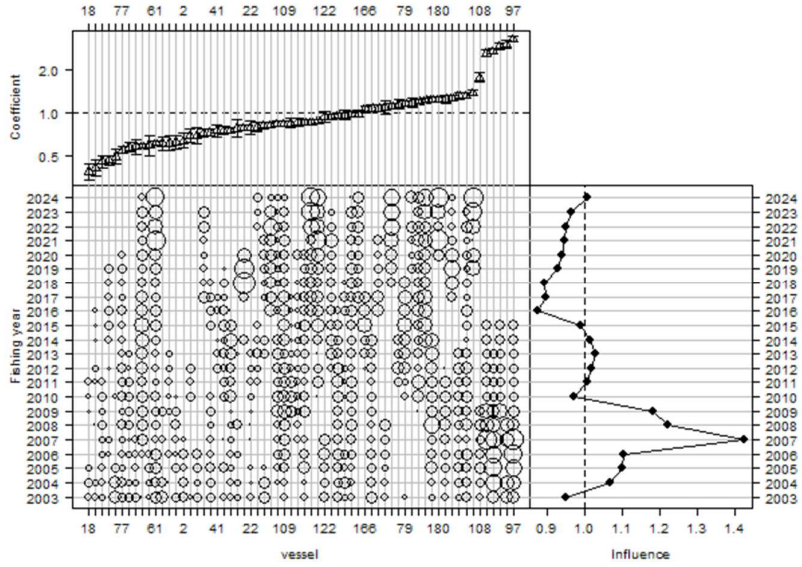

Figure 6: Coefficient-distribution-influence plot for *vessel*.

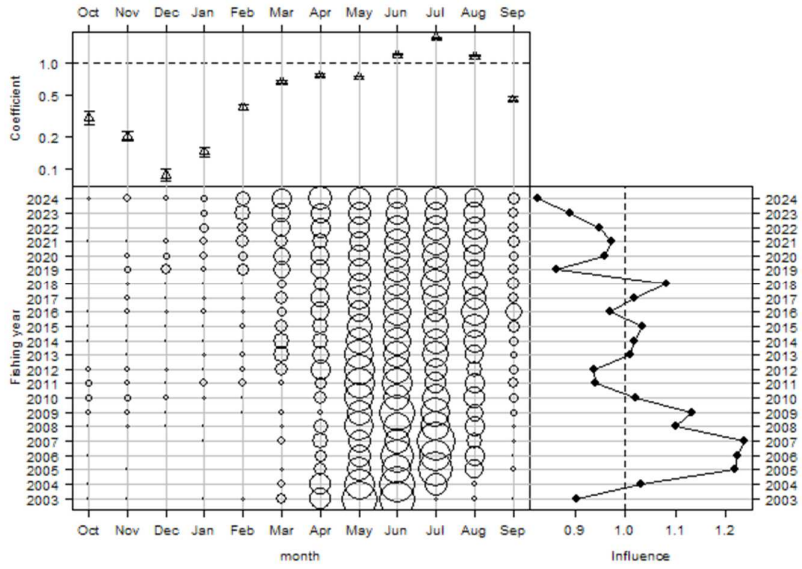

Figure 7: Coefficient-distribution-influence plot for *month*.

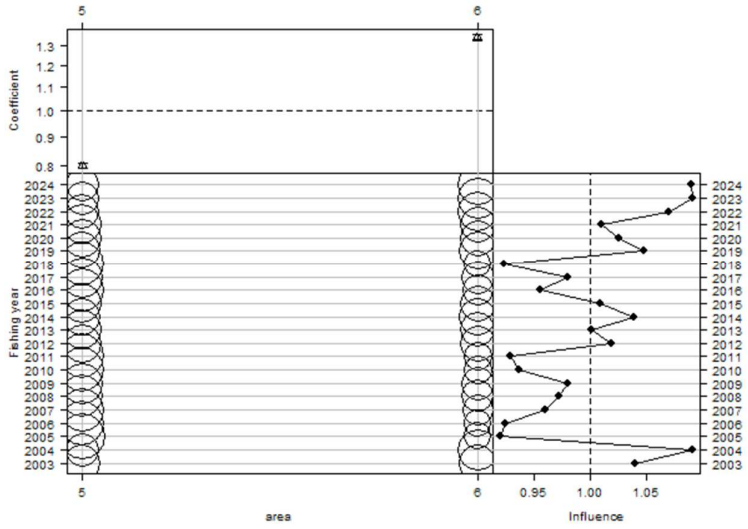

Figure 8: Coefficient-distribution-influence plot for *area*.

4.1. Residual diagnostics

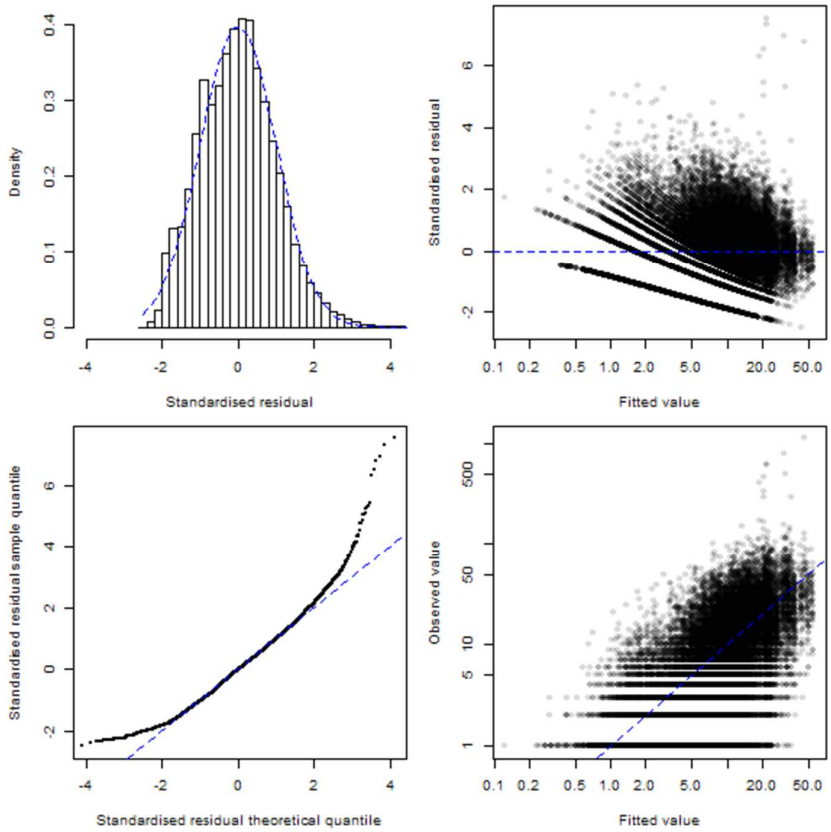

Figure 10: Residual diagnostics. Top left: histogram of standardised residuals compared to standard normal distribution.', Bottom left: quantile-quantile plot of standardised residuals. Top right: fitted values versus standardised residuals. Bottom right: observed values versus fitted values.

4.2. Area x year diagnostics

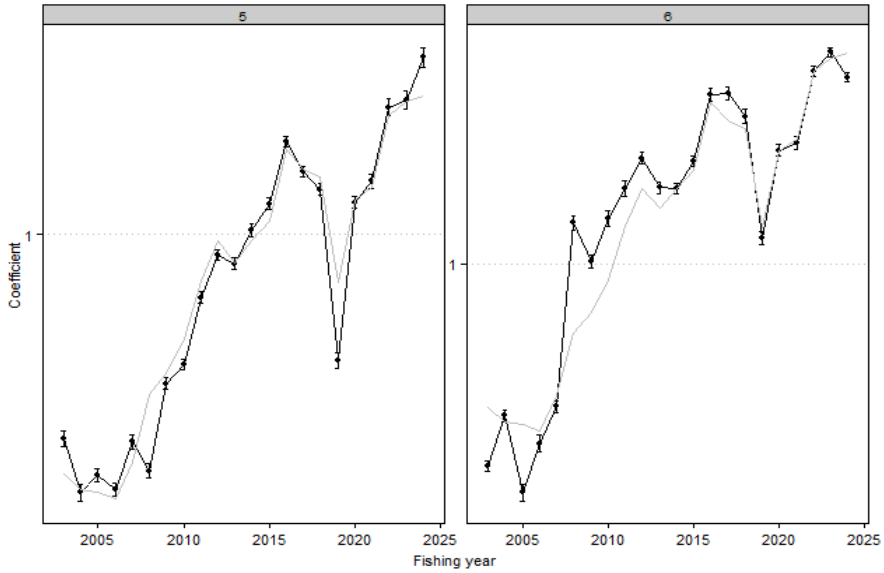

Figure 11: Residual implied coefficients for area x fishing year interactions. Implied coefficients (black points) are calculated as the normalised fishing year coefficient (grey line) plus the mean of the standardised residuals in each fishing year and area. These values approximate the coefficients obtained when an area x year interaction term is fitted, particularly for those area x year combinations which have a substantial proportion of the records. The error bars indicate one standard error of the standardised residuals.

4.3. Area x month diagnostics

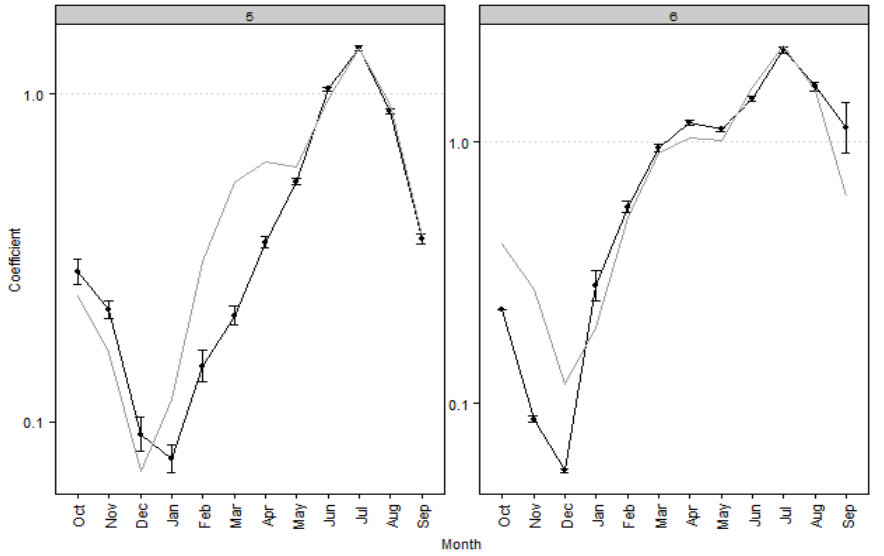

Figure 12: Residual implied coefficients for area x month interactions. Implied coefficients (black points) are calculated as the normalised month coefficients (grey line) plus the mean of the standaridised residuals in each month and area. These values approximate the coefficients obtained when an area x month interaction term is fitted, particularly for those area x month combinations which have a substantial proportion of the records. The error bars indicate one standard error of standardised residuals.

5. Summary of CPUE indices

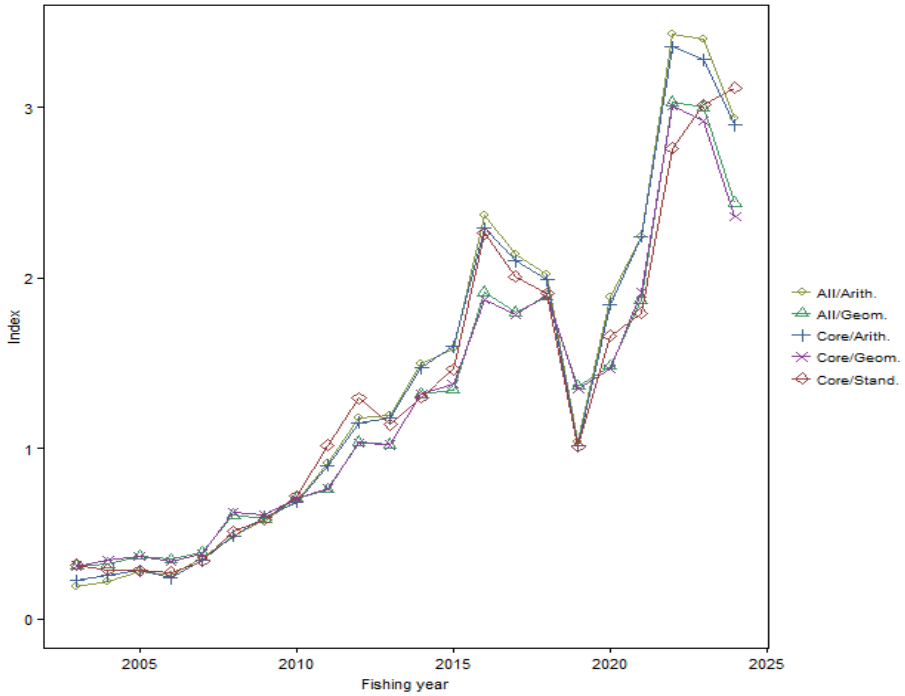

Figure 13: Standardised and unstandardised CPUE indices. All: all vessels, Core: core vessels, Geom.: geometric mean, Arith: arithmetic mean, Stand.: standardised using GLM

Table 5: Standardised and unstandardised CPUE indices. All: all vessels, Core: core vessels, Geom.: geometric mean, Arith: arithmetic mean, Stand.: standardised using GLM, SE: standard error.

Year	All/Arith.	Core/Arith.	Core/Geom.	Core/Stand.	Core/Stand. SE
2 003	0.1937	0.2236	0.3117	0.3171	0.03827
2 004	0.2194	0.2544	0.3434	0.2891	0.03913
2 005	0.2824	0.2835	0.3681	0.2834	0.03969
2 006	0.2560	0.2409	0.3377	0.2729	0.04067
2 007	0.3586	0.3459	0.3839	0.3401	0.03816
2 008	0.4821	0.4878	0.6235	0.5113	0.04302
2 009	0.5807	0.5975	0.6123	0.5822	0.03621
2 010	0.6909	0.6870	0.7046	0.7208	0.03067
2 011	0.9099	0.9022	0.7647	1.0186	0.03183
2 012	1.1810	1.1529	1.0333	1.2961	0.02893
2 013	1.1966	1.1818	1.0206	1.1394	0.02945
2 014	1.4992	1.4726	1.3173	1.2995	0.02956
2 015	1.5853	1.5963	1.3766	1.4654	0.02983
2 016	2.3657	2.2910	1.8722	2.2632	0.02826
2 017	2.1381	2.0994	1.7843	2.0068	0.02831
2 018	2.0211	1.9873	1.8992	1.9071	0.02829
2 019	1.0368	1.0191	1.3468	1.0098	0.02845
2 020	1.8867	1.8459	1.4656	1.6613	0.02802
2 021	2.2420	2.2433	1.9135	1.7930	0.03365
2 022	3.4290	3.3559	3.0078	2.7597	0.03280
2 023	3.4015	3.2794	2.9229	3.0151	0.03164
2 024	2.9366	2.8977	2.3612	3.1128	0.03385