Observed and Estimated Bycatch of Salmon in U.S. West Coast Fisheries, 2002–2025

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Background

This report summarizes the observed and estimated bycatch of all salmon species recorded in the U.S. West Coast groundfish fisheries as monitored by the West Coast Groundfish Observer Program (WCGOP), the At-Sea Hake Observer Program (A-SHOP), the Electronic Monitoring (EM) Program, and the Catch Monitor (CM) Program. The A-SHOP and WCGOP comprise the Fisheries Observation Science Program (FOS) at the NOAA Fisheries Northwest Fisheries Science Center (NWFSC). The EM program is jointly administered by FOS and NOAA Fisheries West Coast Regional Office Sustainable Fisheries Division. We present salmon bycatch in terms of both weight and numbers of individuals, by species. Methods used in this report are similar to the methods presented in an earlier version of this report (Somers et al. 2015) and the most recent groundfish mortality report (Somers et al. 2026). This report does not include data from recreational or tribal fisheries, except for the tribal at-sea mothership sector, which is included with the non-tribal mothership sector. The WCGOP ceased deploying observers into state-permitted fisheries (pink shrimp, California halibut, and nearshore) after 2024; therefore, we only report estimates for these fisheries through 2024. For more information on observer coverage, see Somers et al (2025).

The A-SHOP observes vessels that catch and process Pacific hake at sea. The WCGOP observes a number of fleets that deliver catch shoreside for processing, including sectors that target and incidentally catch groundfish. In the Trawl Catch Share Program, landings are sampled by the CM program; for vessels fishing under maximized retention[1] and/or using EM, this sampling recirds nearly all of their salmon bycatch. Landed salmon counts and weights are recorded in the fish ticket landings data stored in the Pacific Fishery Information Network (PacFIN). For the maximized retention fisheries, the small amount of at-sea salmon discard that may happen due to safety or operational reasons is estimated based on the composition of landings, but is typically negligible.

[1] Typically, shoreside midwater hake and midwater rockfish

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Starting in 2024, the level of review of EM video on trips operating under optimized retention[2] was reduced to a minimum of 10% of hauls on every trip, while the level of review for hauls operating under maximized retention remained at 100%. However, as salmon must be retained on EM trips, we considered the shoreside landings to be a complete account of discards.

Every year this report is updated to include the newest year of data, the most current data from previous years, and the most recent data processing procedures. Data processing updates are described in the annual groundfish mortality report (Somers et al. 2026), which is available in draft form annually in the Pacific Fishery Management Council's (PFMC) September Briefing Book and published later in final form as a NOAA Technical Memorandum.

Trends 2002-2025

We focus on Chinook and coho salmon bycatch trends, because observed fisheries catch these species in the greatest amounts. Additionally, these species are targeted by ocean troll fisheries, and both species include multiple populations that are listed under the Endangered Species Act. Accounting for salmon bycatch in groundfish fisheries is important in balancing the needs of different stakeholders in the groundfish and salmon fisheries, as well as conserving salmon and the ecosystems of which they are an essential component. Bycatch estimates for all observed salmon species and summaries of biological data can be found in the supplementary tables.

We present data from 2002 to 2025. Chinook bycatch in the hake fishery[3] as a whole has been variable, with a high of 13,554 fish in 2014 (Figures 1, 3, 4). In 2025, total bycatch in this fishery was lower than the long-term median (2,571 fish in 2025 vs a long term median of 5,190 from 2002 to 2025; Figure 1). In the shoreside (SS) non-hake groundfish trawl sectors[4], most Chinook bycatch was attributed to the LE, and later CS, bottom trawl fishery (Figures 1, 2). SS non-hake trawl bycatch was high in 2002 and 2003 (>15,000 fish), but has been <1,000 since 2006 other than in 2014, 2015, and 2024. Bycatch has generally been increasing in these sectors in recent years, though in 2025, estimated bycatch was 907 fish (lower than 2023 and 2024), compared to the long-term median of 593 fish. In non-catch shares (NCS)[5] sectors, Chinook bycatch has been below 550 fish across all years (Figure 5), and none was estimated in 2025. However, as noted above, WCGOP stopped covering several NCS fisheries in 2025, and we therefore do not estimate bycatch in those fisheries for 2025, and the 2025 NCS total is not directly comparable to earlier NCS totals.

Over the time period examined, coho bycatch varied considerably across years while generally remaining an order of magnitude lower than Chinook bycatch (Figure 1). Bycatch in the

[2] Typically, bottom trawl and fixed gear

[3] Includes at-sea and non-tribal shoreside hake sectors.

[4] Includes shoreside limited entry (LE) and catch shares (CS) bottom trawl, CS fixed gear, CS midwater rockfish, and LE California halibut.

[5] Includes non-catch shares exempted fishing permits, sablefish primary, nearshore, open access (OA) California halibut, pink shrimp, and OA hook & line sectors.

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hake fishery in 2025 was below the median value (21 vs. 57 fish, Figures 1, 3, 4). Bycatch in the NCS and SS non-hake catch shares fisheries has remained at low or moderate levels across all years, and SS non-hake bycatch was close to the long-term median in 2025 (7 fish vs a long-term median of 8 fish; Figures 2, 3, 5). Non-catch shares bycatch was 40 fish, but as noted above this is not directly comparable to other years.

A-SHOP, WCGOP, and the CM Program collect biological data on salmon, including length, weight, sex, tissue samples, and other information. Figures 6-8 summarize the number of biological samples collected over time.

Figures 9-20 summarize the distribution of bycatch over latitude, depth, and season, relative to overall effort in the catch shares bottom trawl, midwater rockfish, shoreside midwater hake, and at-sea hake fisheries. These boxplots show the quartiles of all haul latitudes, depths, and days of year, as well as those of hauls that encountered Chinook and coho, excluding outliers. EM data for the catch shares bottom trawl fishery for 2024 includes logbook data for hauls with unreviewed video.

In the catch shares bottom trawl fishery and at-sea hake fishery, hauls with Chinook generally appeared to occur at more southern latitudes than overall effort in recent years, while the opposite appeared in the shoreside midwater hake fishery in recent years (Figures 9, 11, 12). There was not a clear latitudinal pattern of bycatch in the midwater rockfish fishery (Figure 10).

In earlier years in the catch shares bottom trawl fishery, the median depth of hauls with Chinook typically appeared to be shallower than overall effort, while in some recent years (2018-2022), the opposite pattern appears (Figure 13). In the midwater rockfish, shoreside midwater hake, and at-sea hake fisheries, median depth of hauls with Chinook often appeared to be shallower than overall effort (Figures 14, 15, 16).

In the catch shares bottom trawl fishery, hauls with Chinook often appeared to occur earlier in the season (Figure 17). In the shoreside midwater hake fishery, hauls with Chinook often appeared later in the season (Figure 19). In the midwater rockfish and at-sea hake fishery, seasonal patterns were less obvious (Figures 18, 20).

Overall, patterns in coho bycatch were more difficult to discern due to smaller and less frequent observations.

Acknowledgements

We thank fisheries observers, catch monitors, and EM reviewers for collecting the data this report relies on.

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Figures

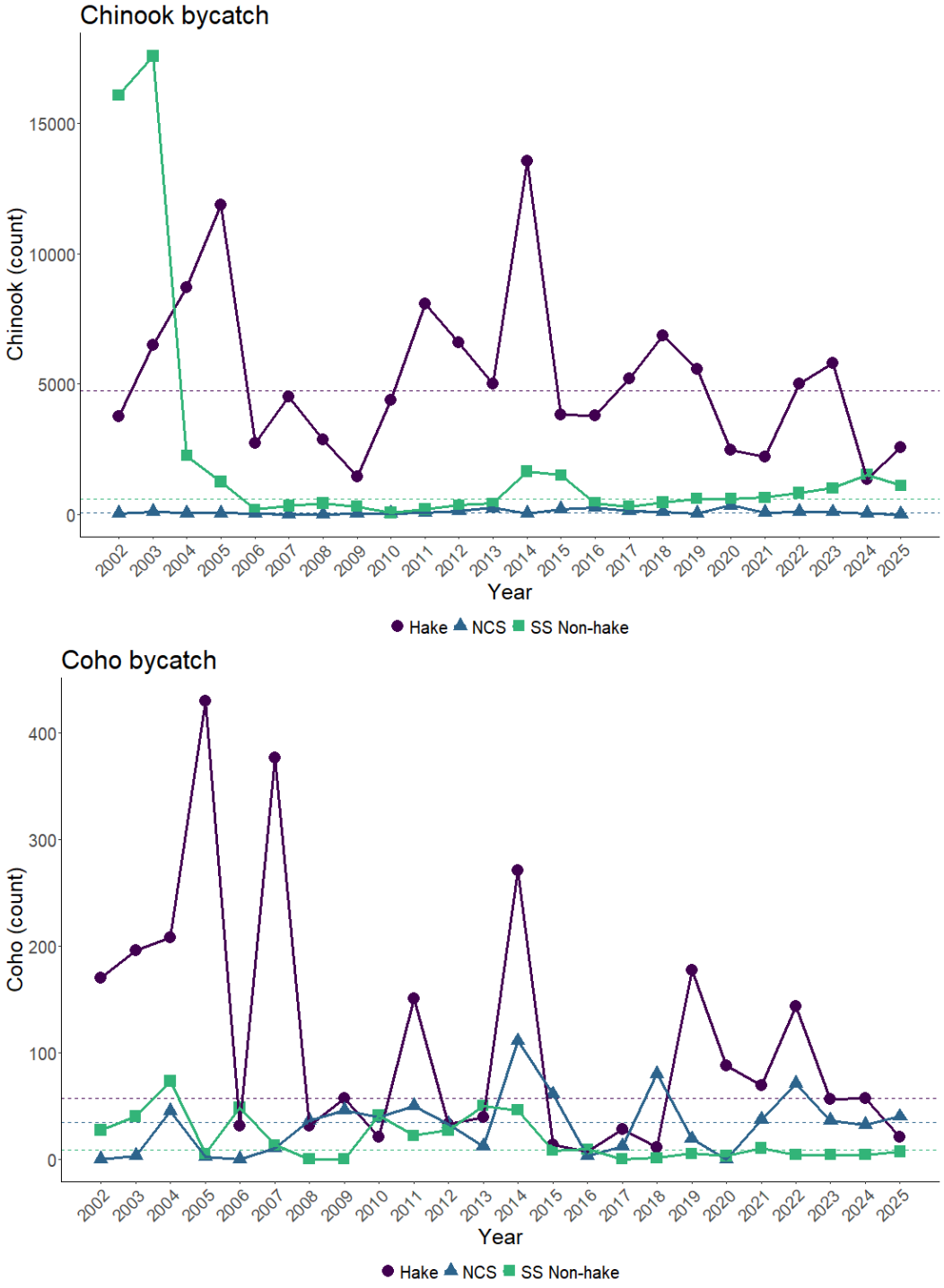


Figure 1. Chinook (upper panel) and coho (lower panel) salmon bycatch in fisheries monitored by the A-SHOP, CM, EM, and WCGOP, 2002-2025. Hake includes at-sea catcher processors, at-sea mothership catcher-vessels, and non-tribal shoreside. Non-catch shares (NCS) includes non-catch shares exempted

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fishing permits, sablefish primary, nearshore (2003-2024 only), open access (OA) California halibut (2002-2024 only), pink shrimp (2004-2024 only), and OA hook & line. Shoreside (SS) non-hake includes shoreside limited entry (LE) and catch shares (CS) bottom trawl, CS fixed gear, CS midwater rockfish, and LE California halibut. Horizontal dashed lines show long-term medians.

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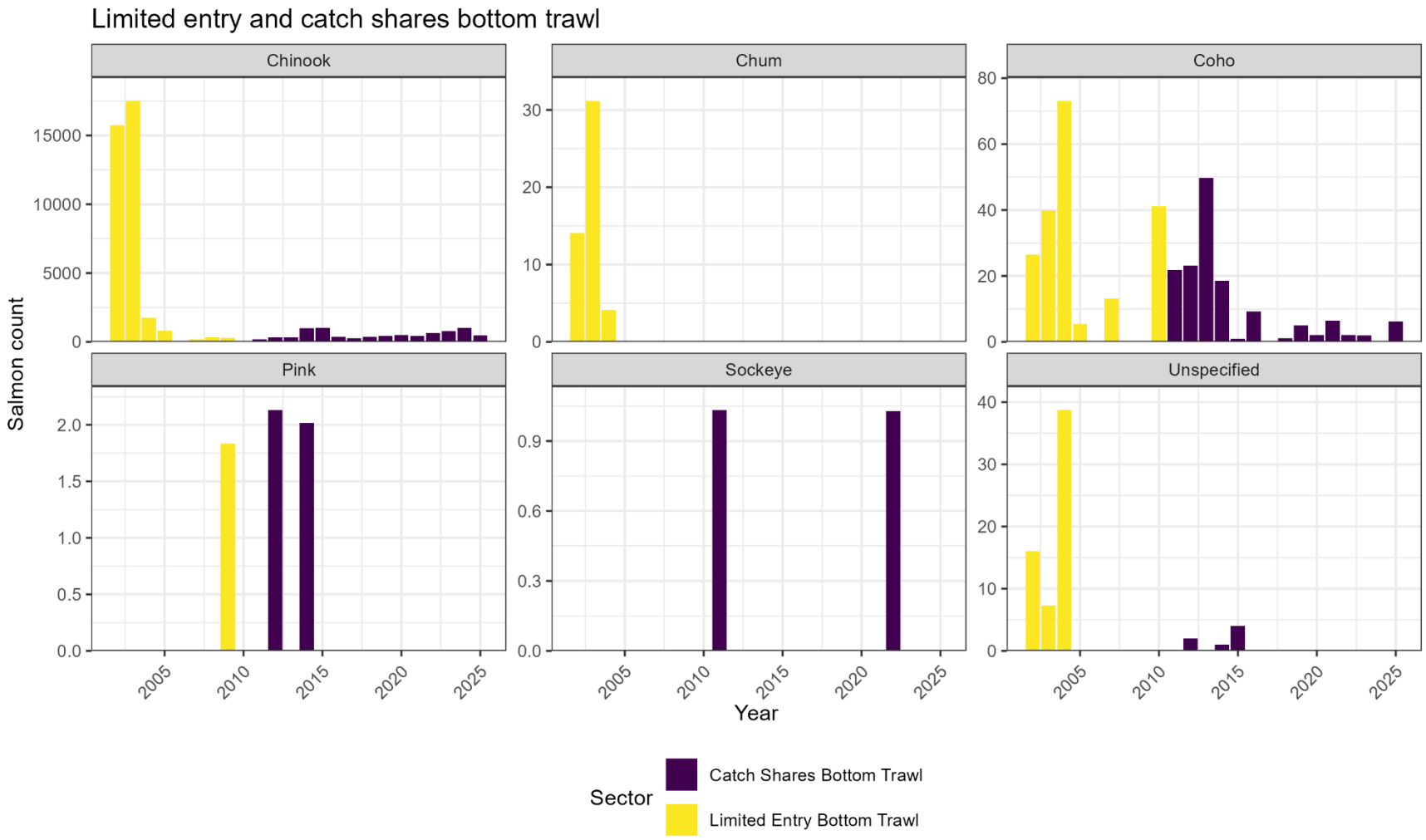


Figure 2. Salmon bycatch in the limited entry (2002-2010) and catch shares (2011-2025) bottom trawl fishery, including vessels using EM. Note that the limited entry bottom trawl fishery counts represent estimates based on partial observer coverage, while the catch

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shares bottom trawl fishery has full observer or electronic monitoring coverage (EM) including dockside monitoring. In years with partial EM video review (2024 forward), EM estimates are derived from landed counts. In order to maintain data confidentiality, non-hake midwater trawl in 2011 and LE California halibut in 2011-2013 are combined with catch shares bottom trawl.

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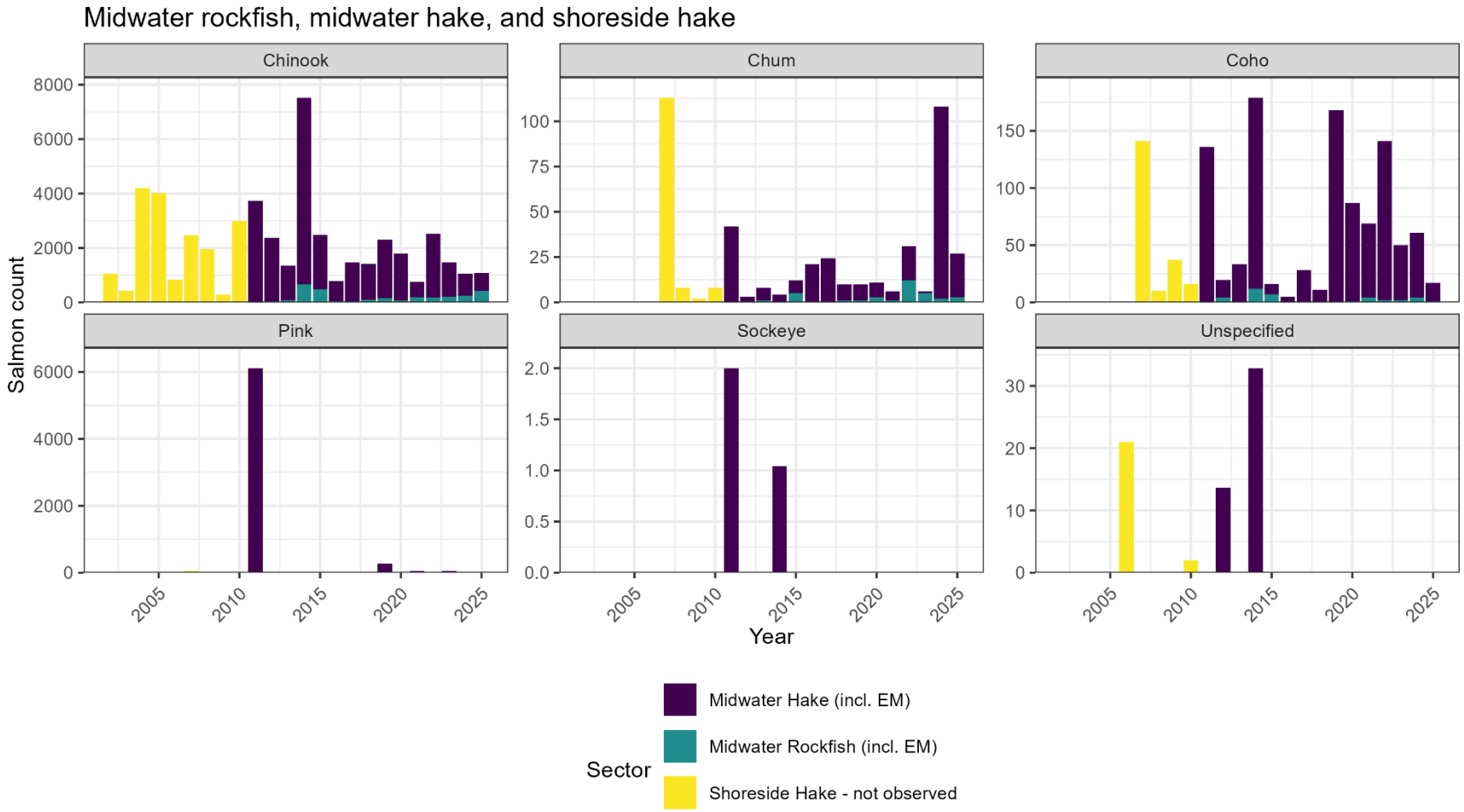


Figure 3. Salmon bycatch in shoreside midwater trawl sectors, including EM vessels, for 2002-2025. Shoreside midwater hake was not observed prior to 2011, and the counts presented here come from shoreside monitoring data housed in PacFIN. From 2011 on, these

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sectors have full observer or electronic monitoring coverage. In order to maintain data confidentiality, midwater rockfish in 2011 is shown combined with catch shares bottom trawl in Figure 2.

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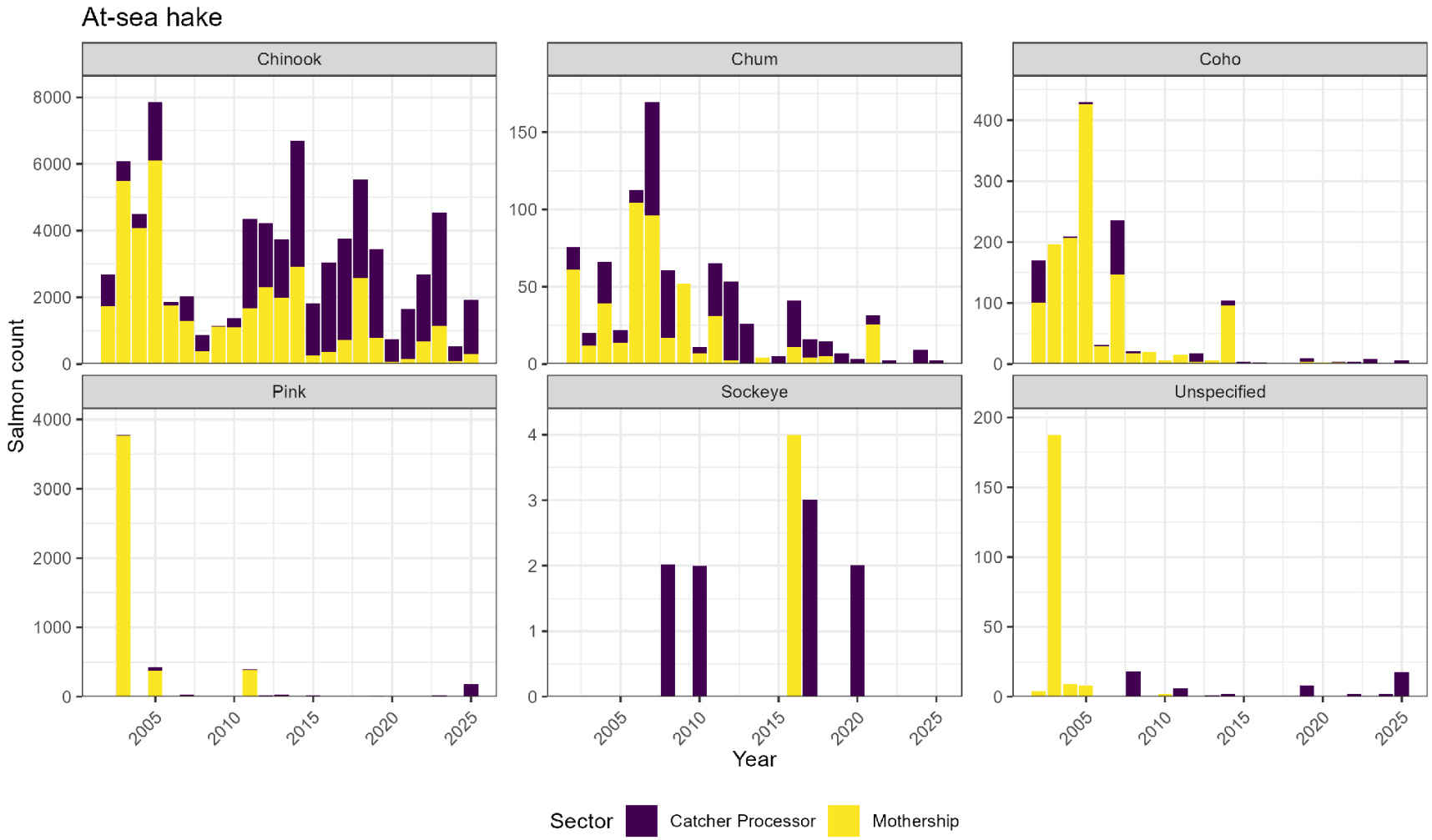


Figure 4. Salmon bycatch in the at-sea hake fishery 2002-2025. This sector has census observer coverage on motherships and catcher-processors and electronic monitoring or observers on mothership catcher vessels. Data from the tribal mothership sector (active prior to 2013) are included here, excepting 2012 for confidentiality reasons.

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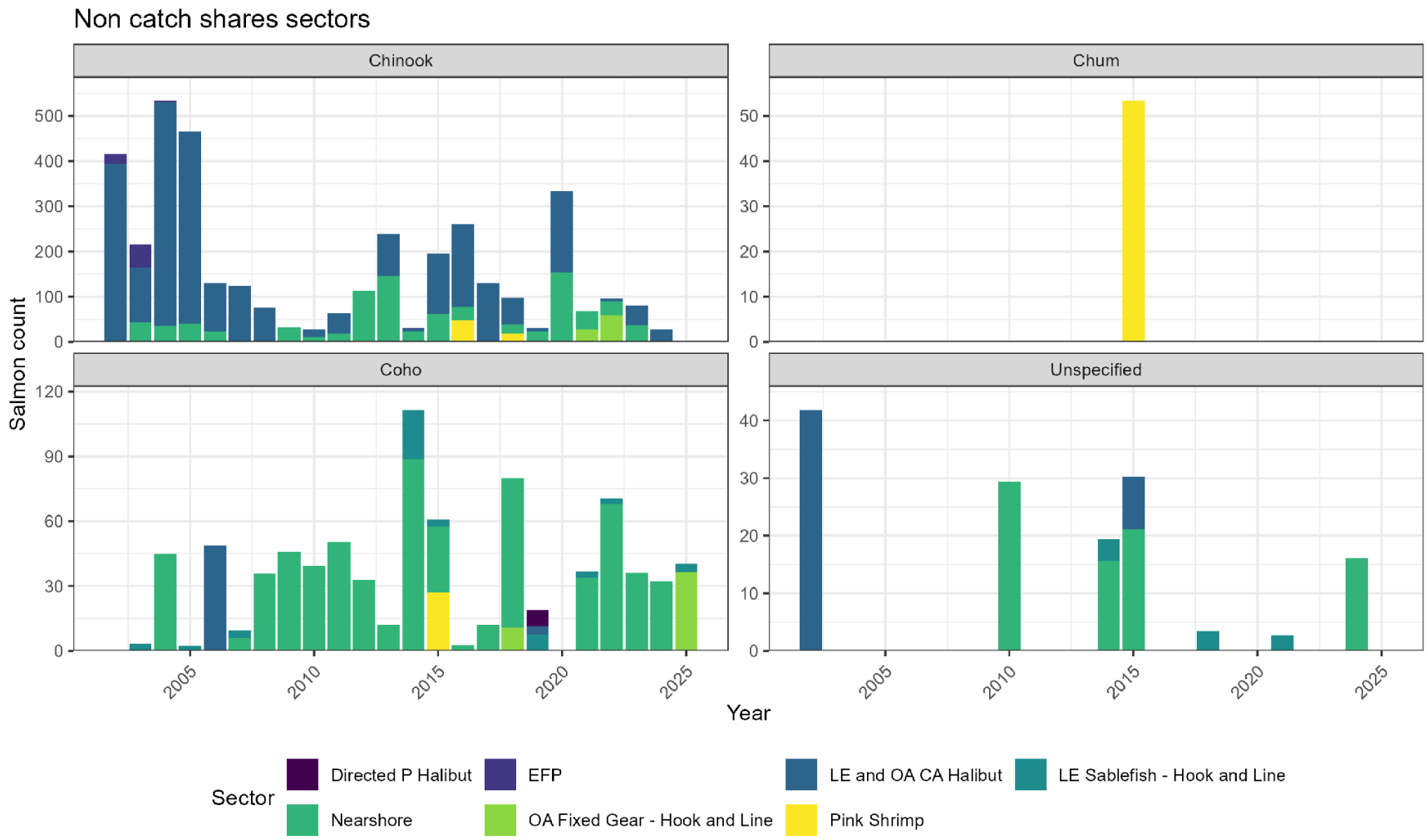


Figure 5. Estimated salmon bycatch in observed non catch shares sectors (excluding limited entry trawl), 2002-2025. Note that we only include estimates for sectors in years where they were observed (see text for details).

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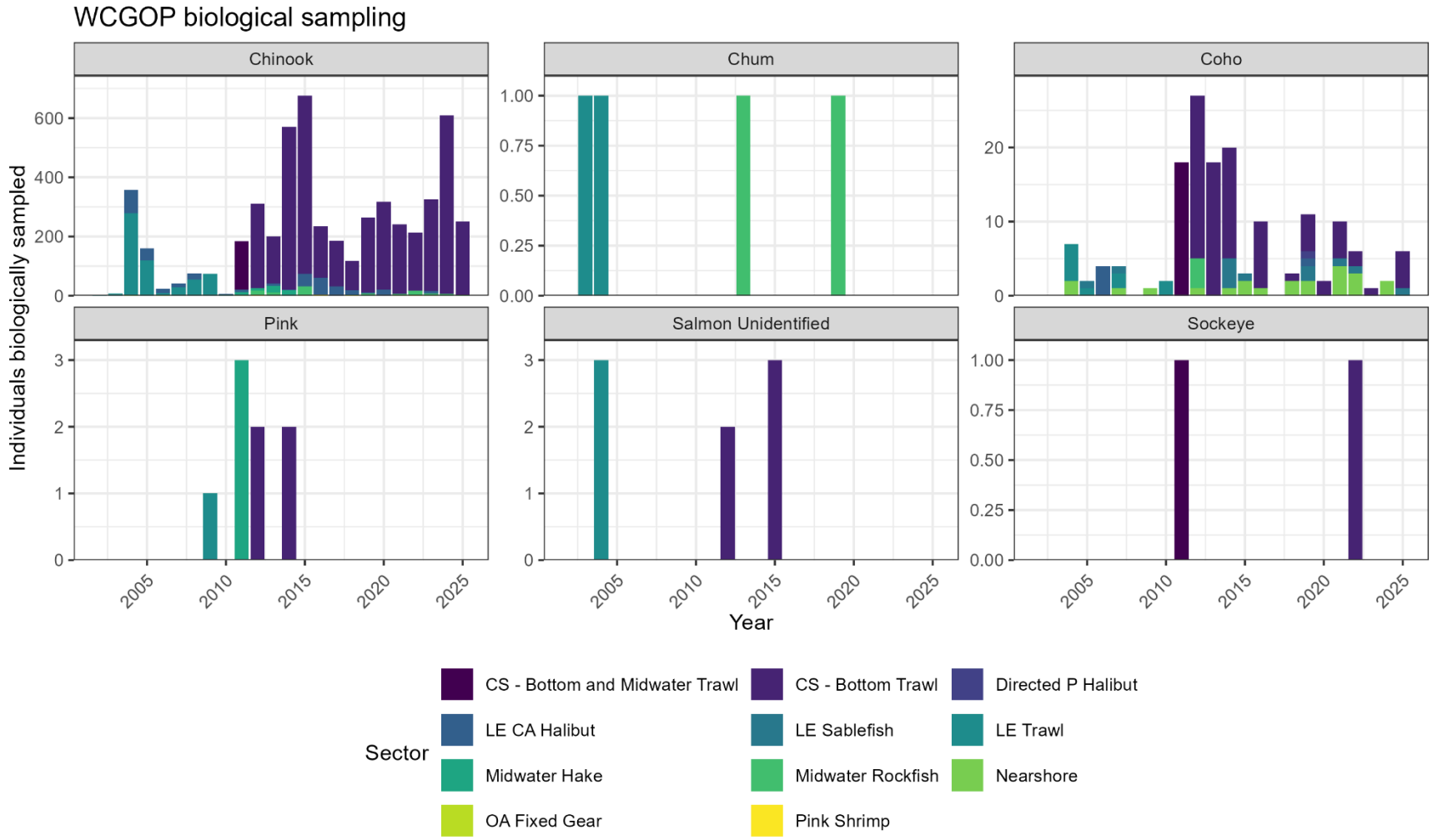


Figure 6. Number of salmon biologically sampled by WCGOP observers 2002-2025.

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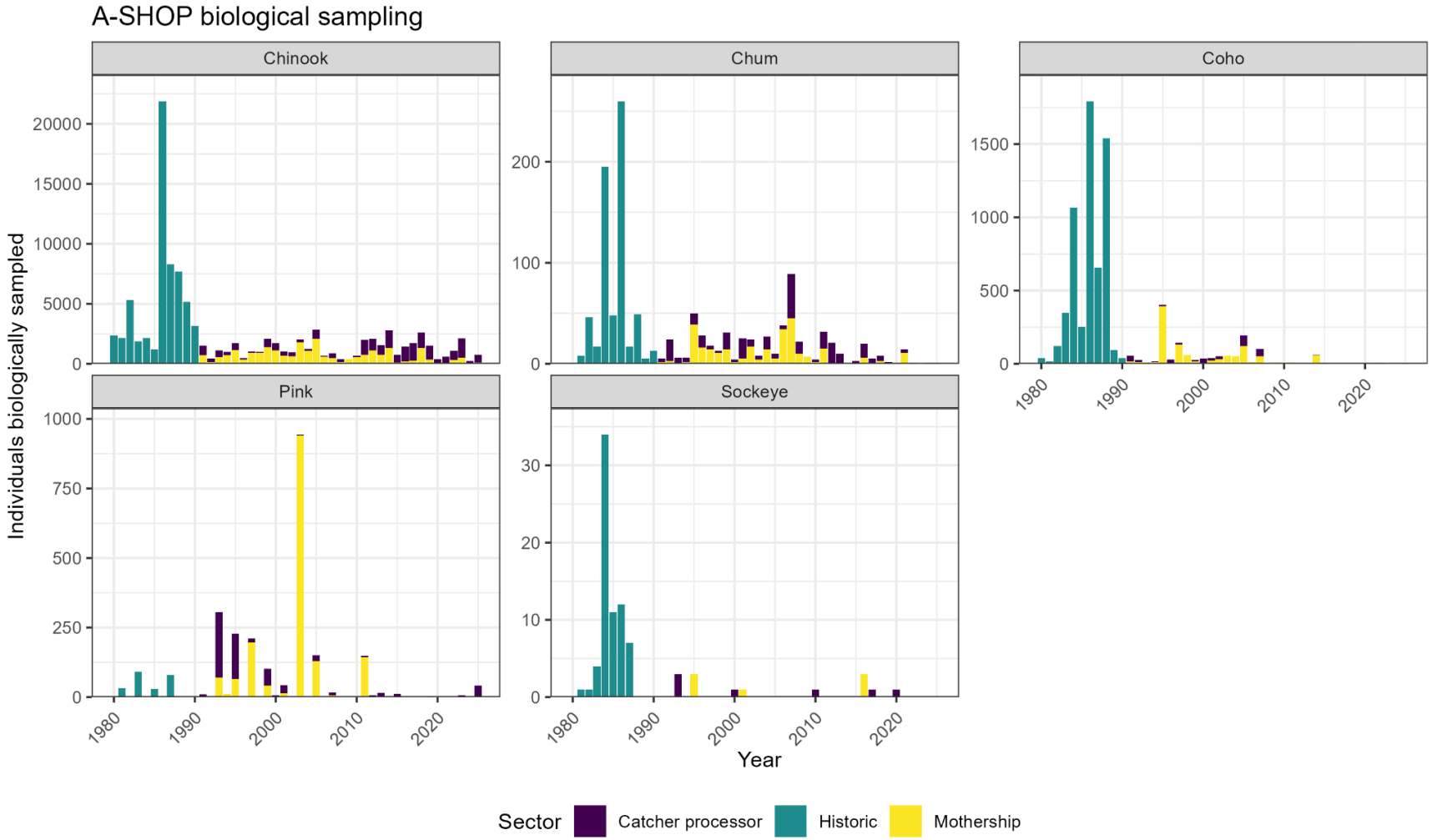


Figure 7. Number of salmon biologically sampled by A-SHOP observers, 1980-2025. Note that while fewer salmon have been sampled in recent years, more samples are taken per individual fish, so the total number of samples is larger than the number of individuals sampled.

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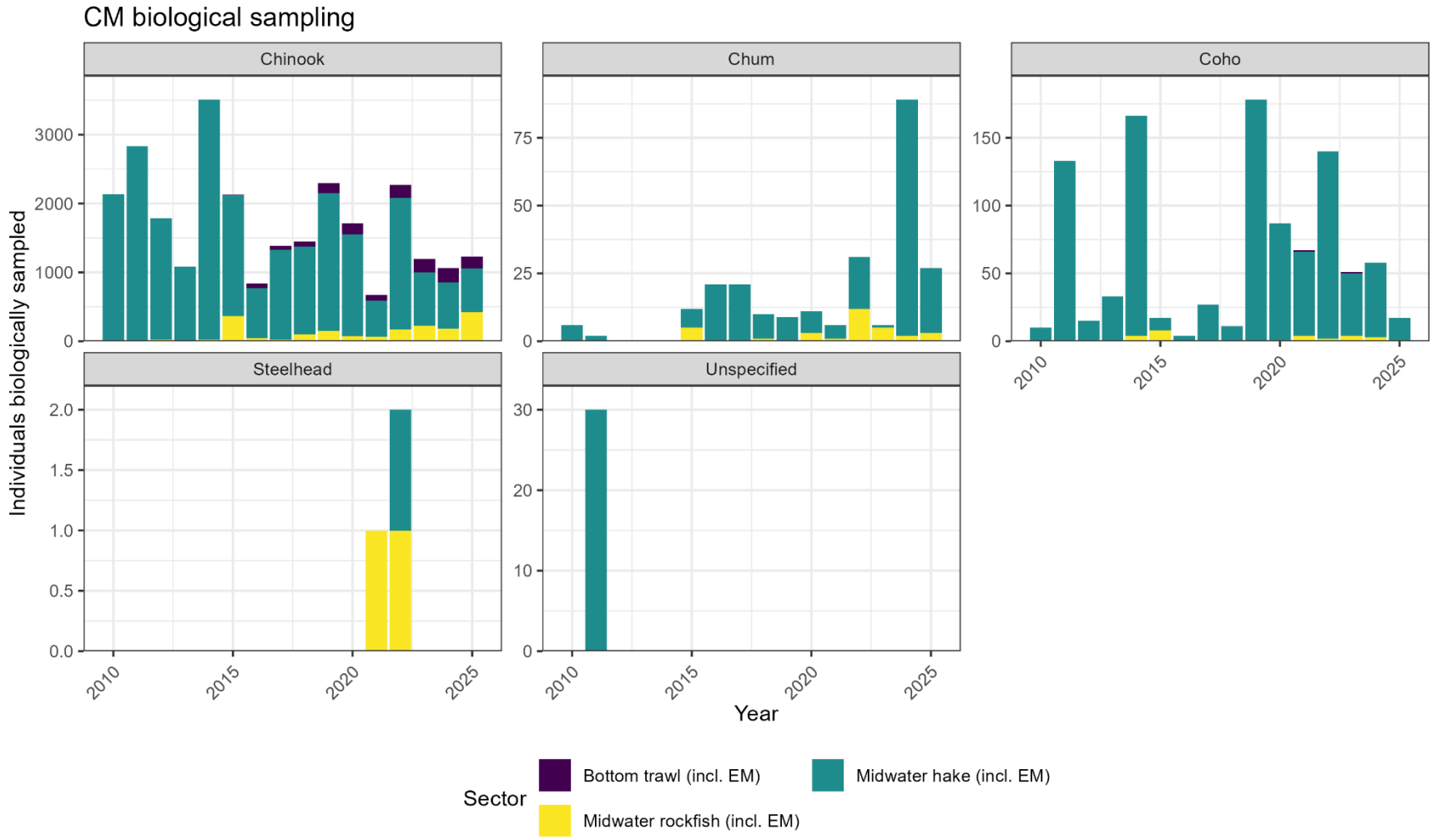


Figure 8. Number of salmon biologically sampled by the Catch Monitor program, 2010-2025.

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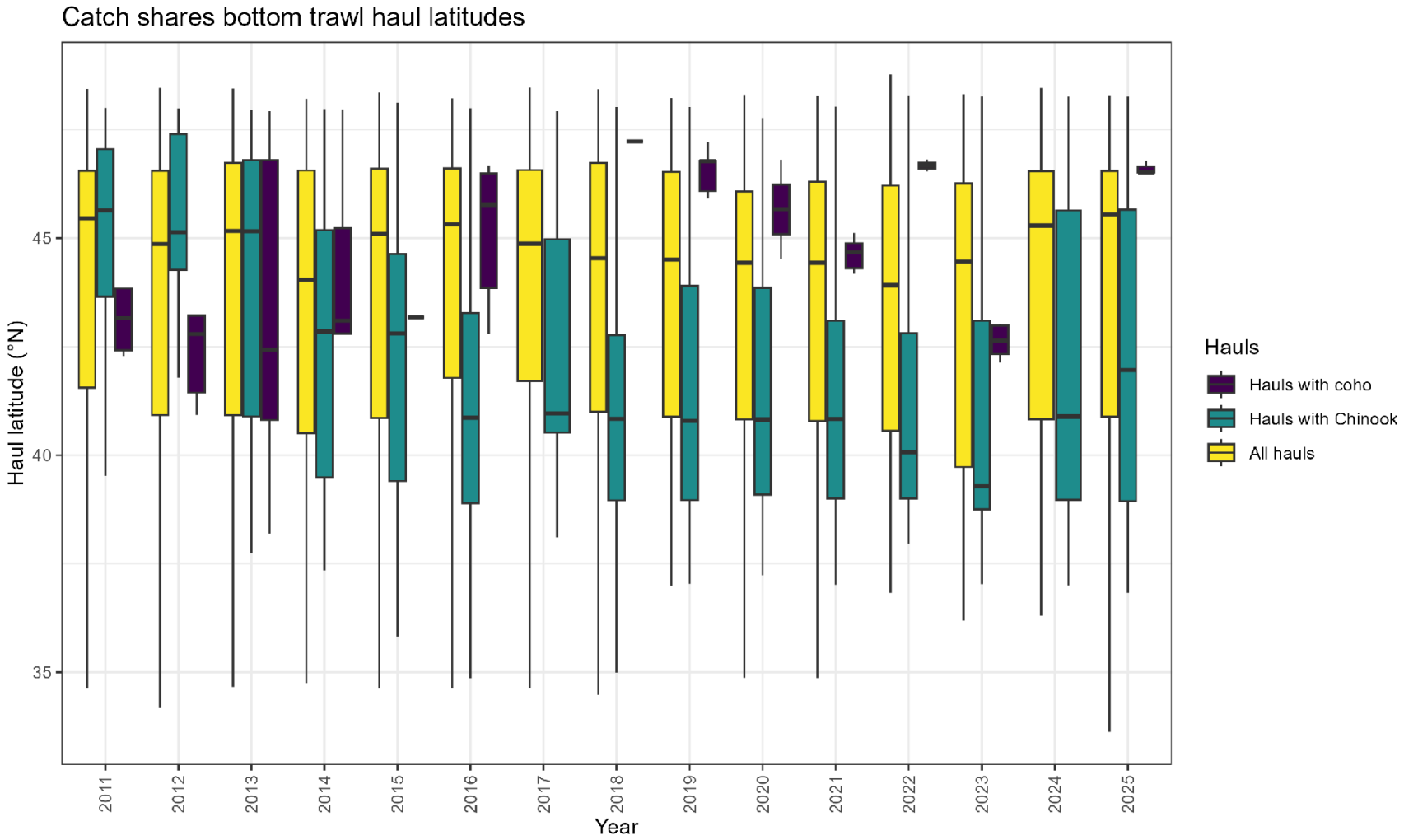


Figure 9. Boxplot of haul latitudes in the catch share bottom trawl fishery. Outliers are not shown.

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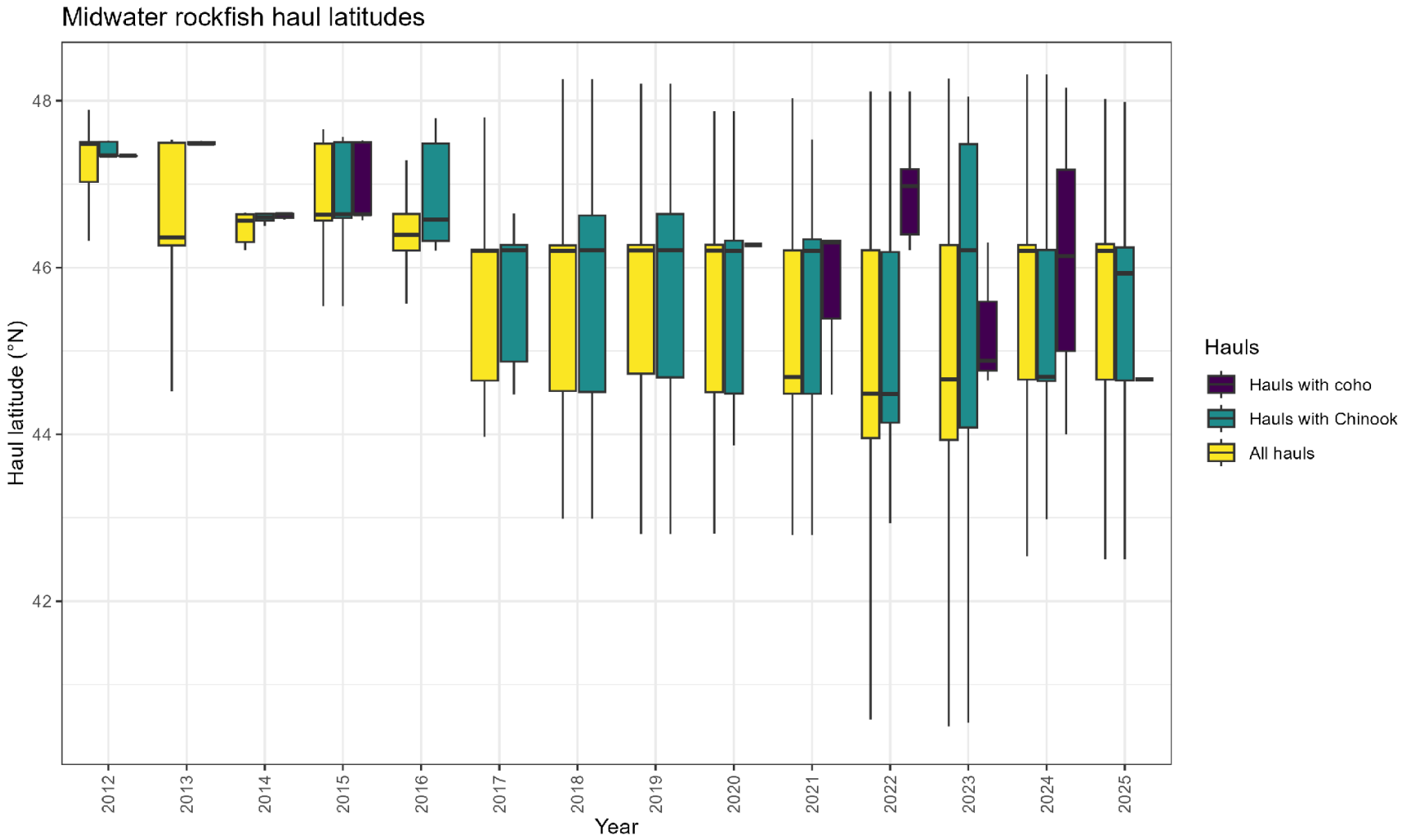


Figure 10. Boxplot of haul latitudes in the midwater rockfish trawl fishery. Outliers are not shown.

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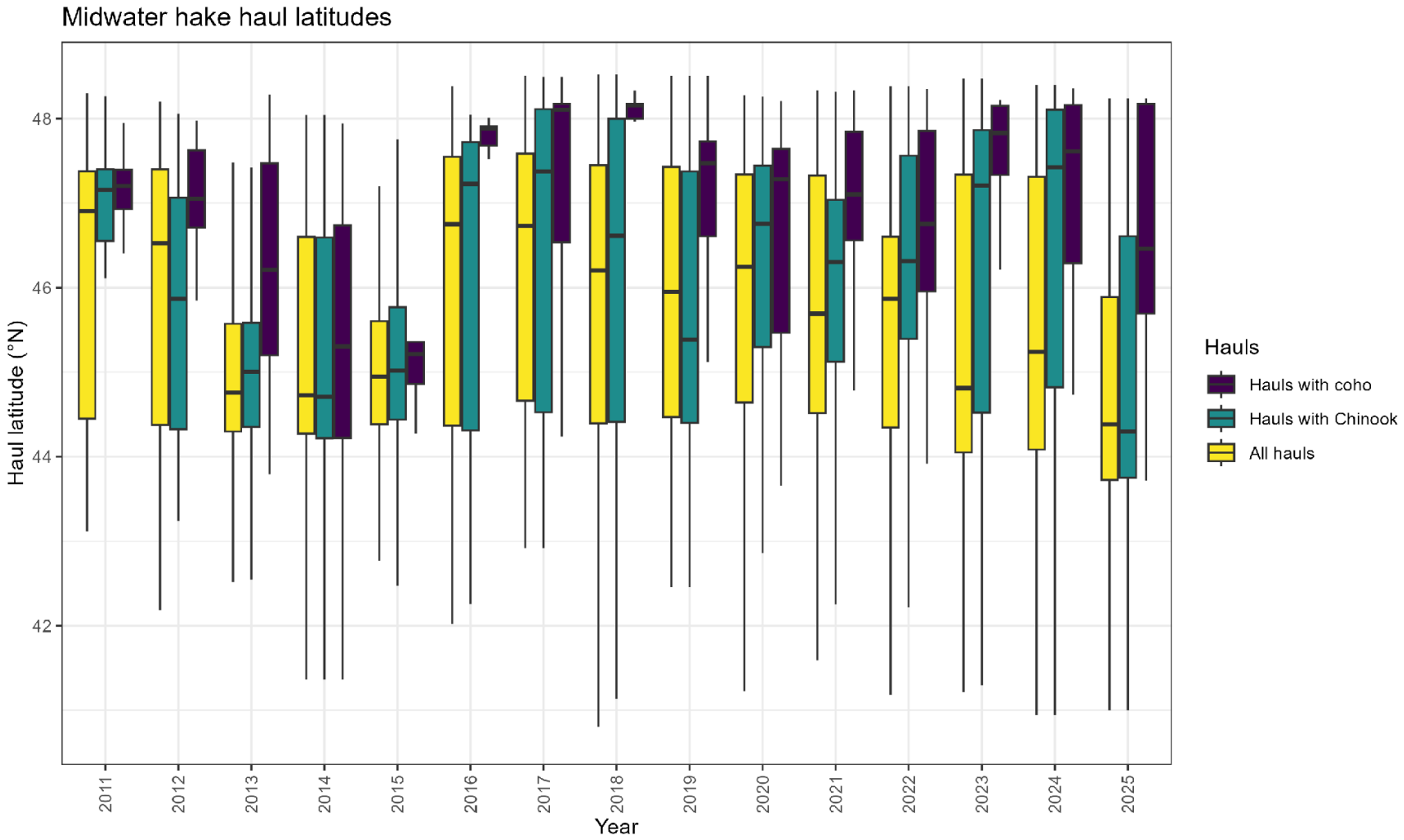


Figure 11. Boxplot of haul latitudes in the shoreside midwater hake trawl fishery. Outliers are not shown.

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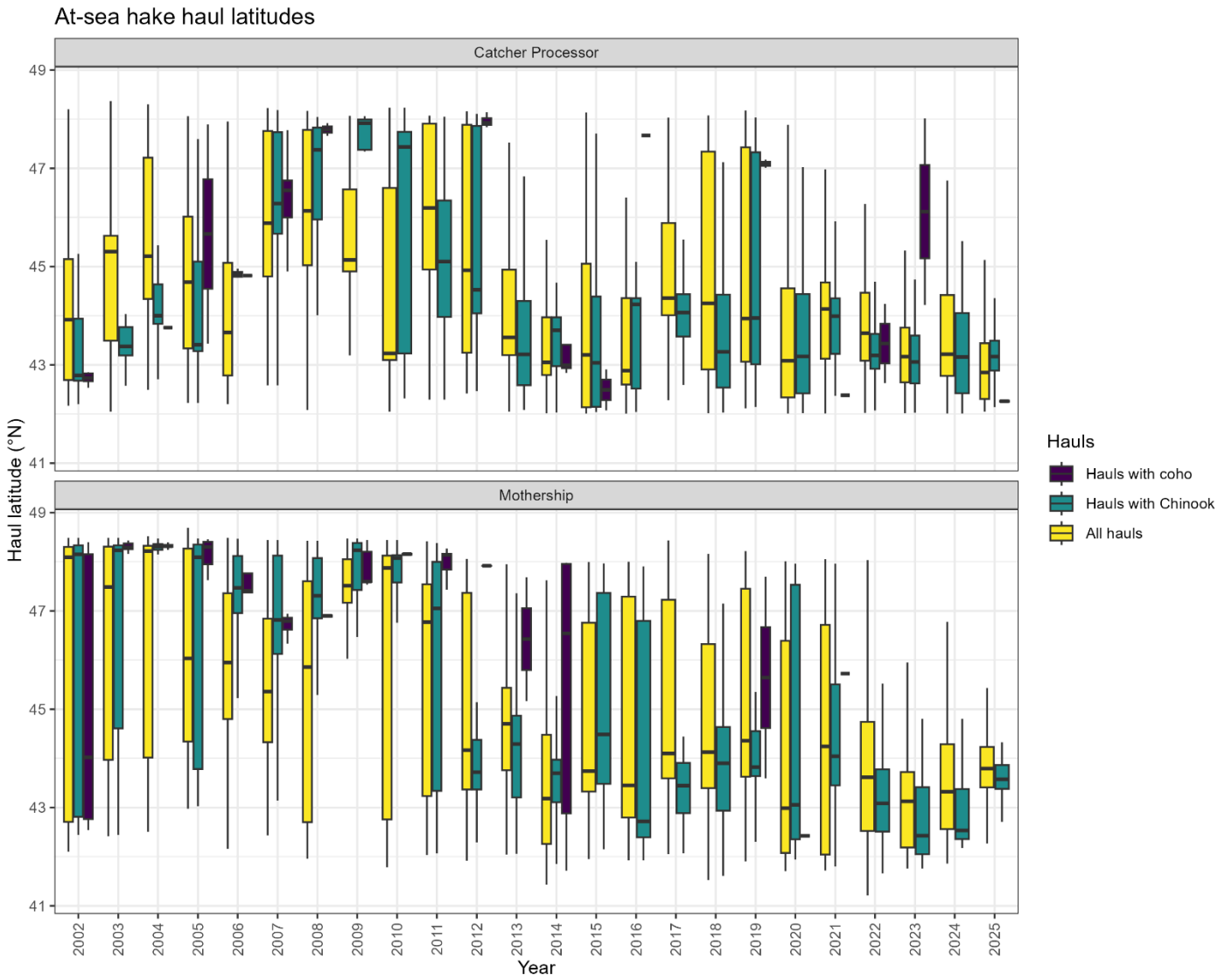


Figure 12. Boxplot of haul latitudes in the at-sea hake fishery. Outliers are not shown.

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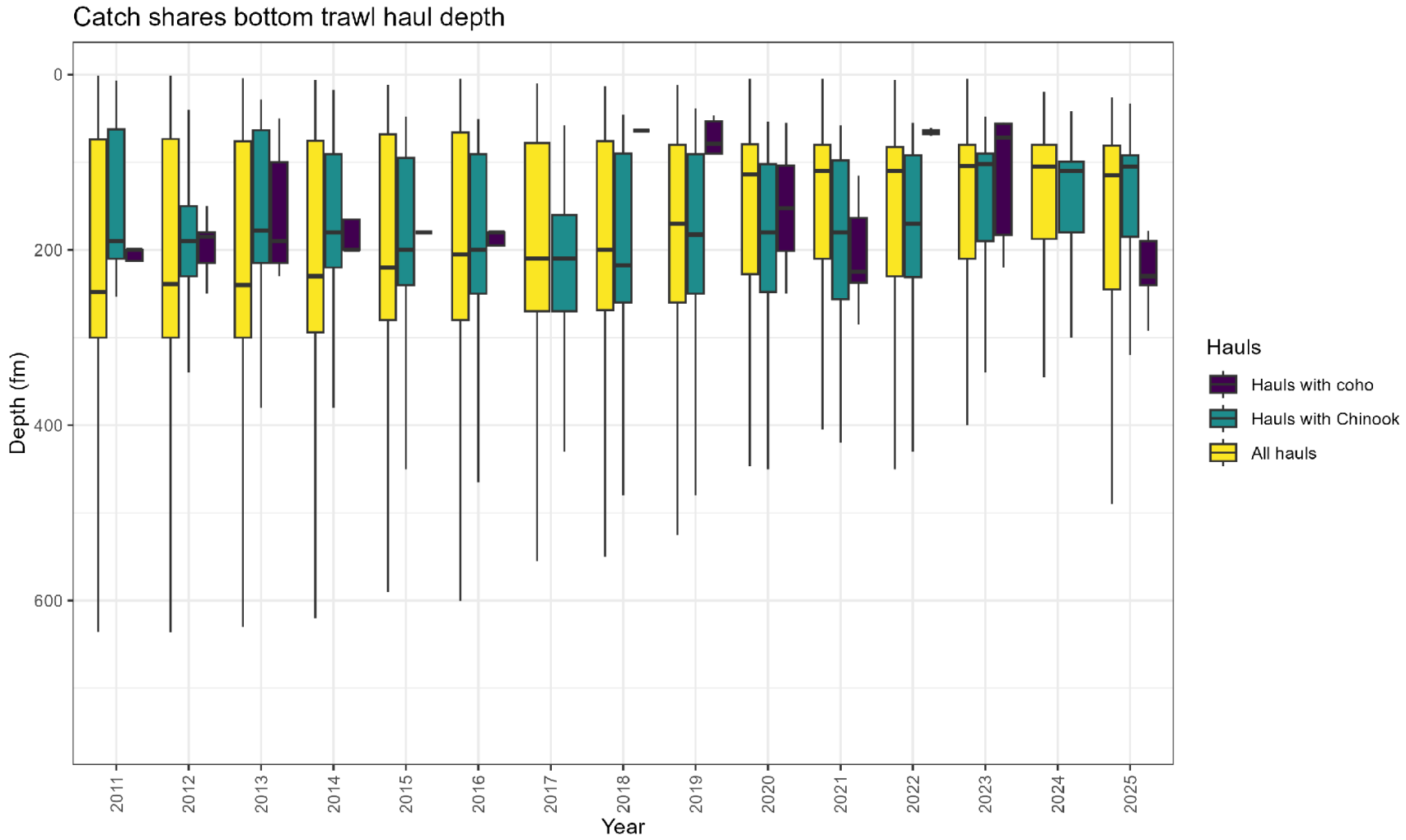


Figure 13. Boxplot of haul bottom depths in the catch share bottom trawl fishery. Outliers are not shown.

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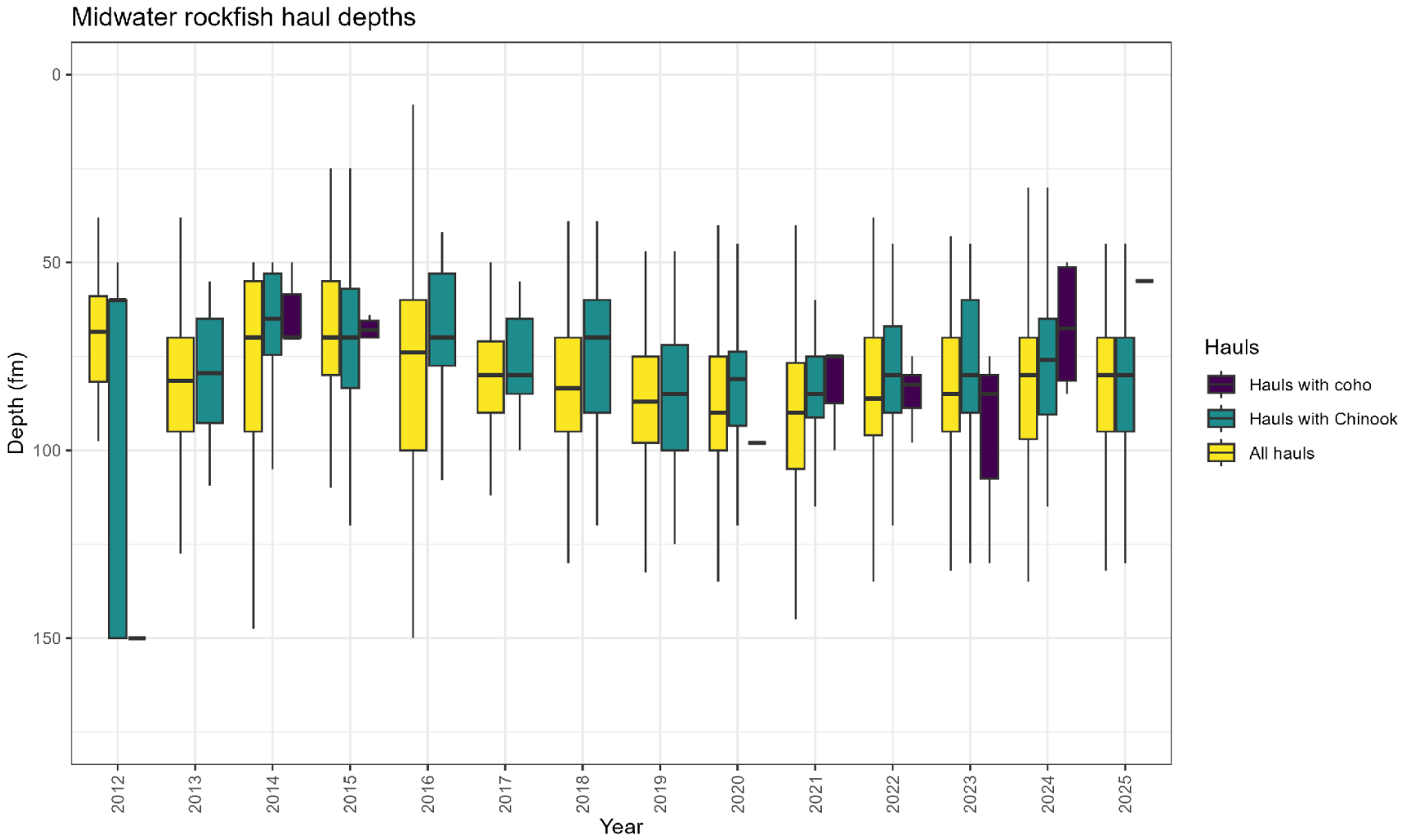


Figure 14. Boxplot of haul depths in the midwater rockfish trawl fishery. Outliers are not shown.

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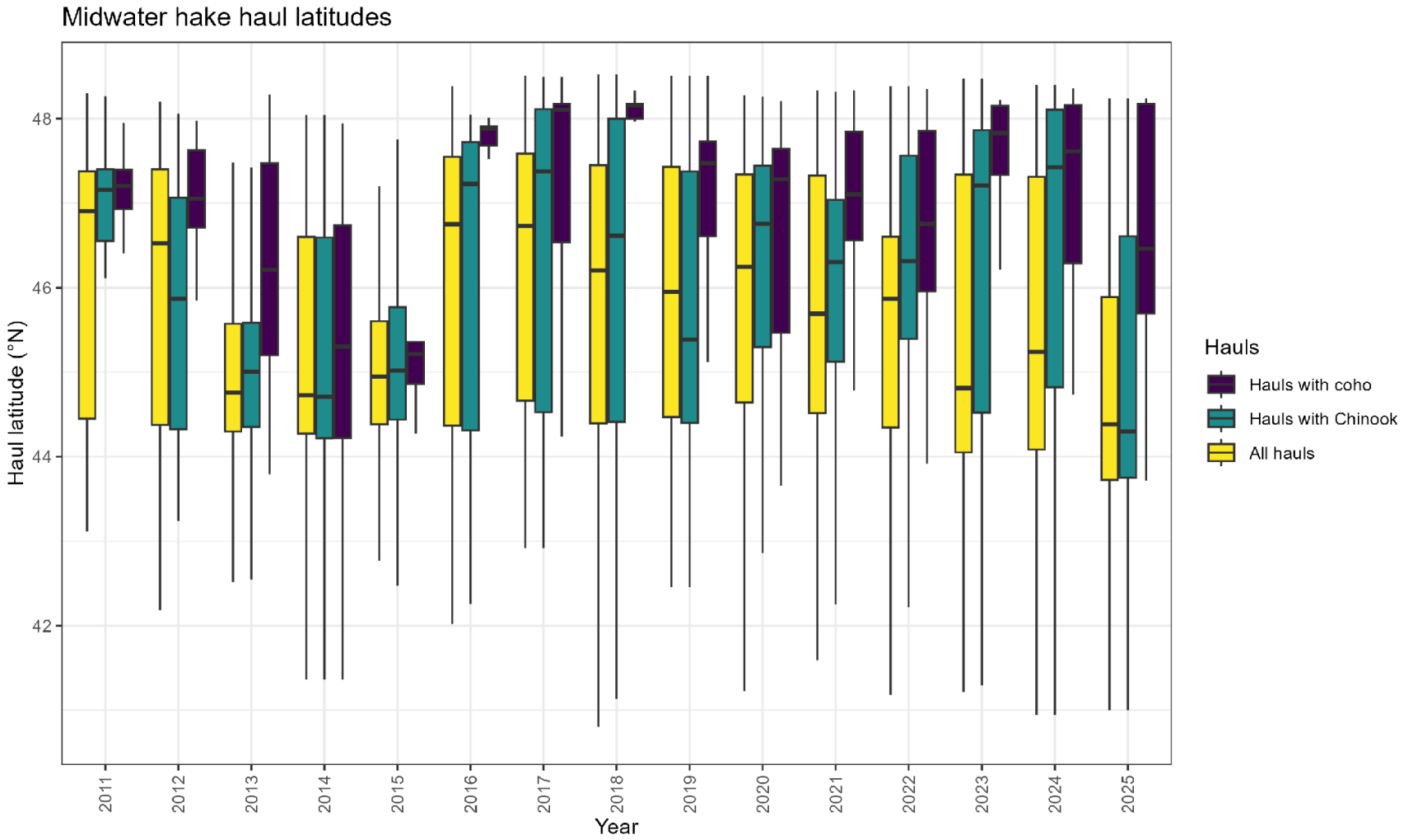


Figure 15. Boxplot of haul depths in the midwater hake trawl fishery. Outliers are not shown.

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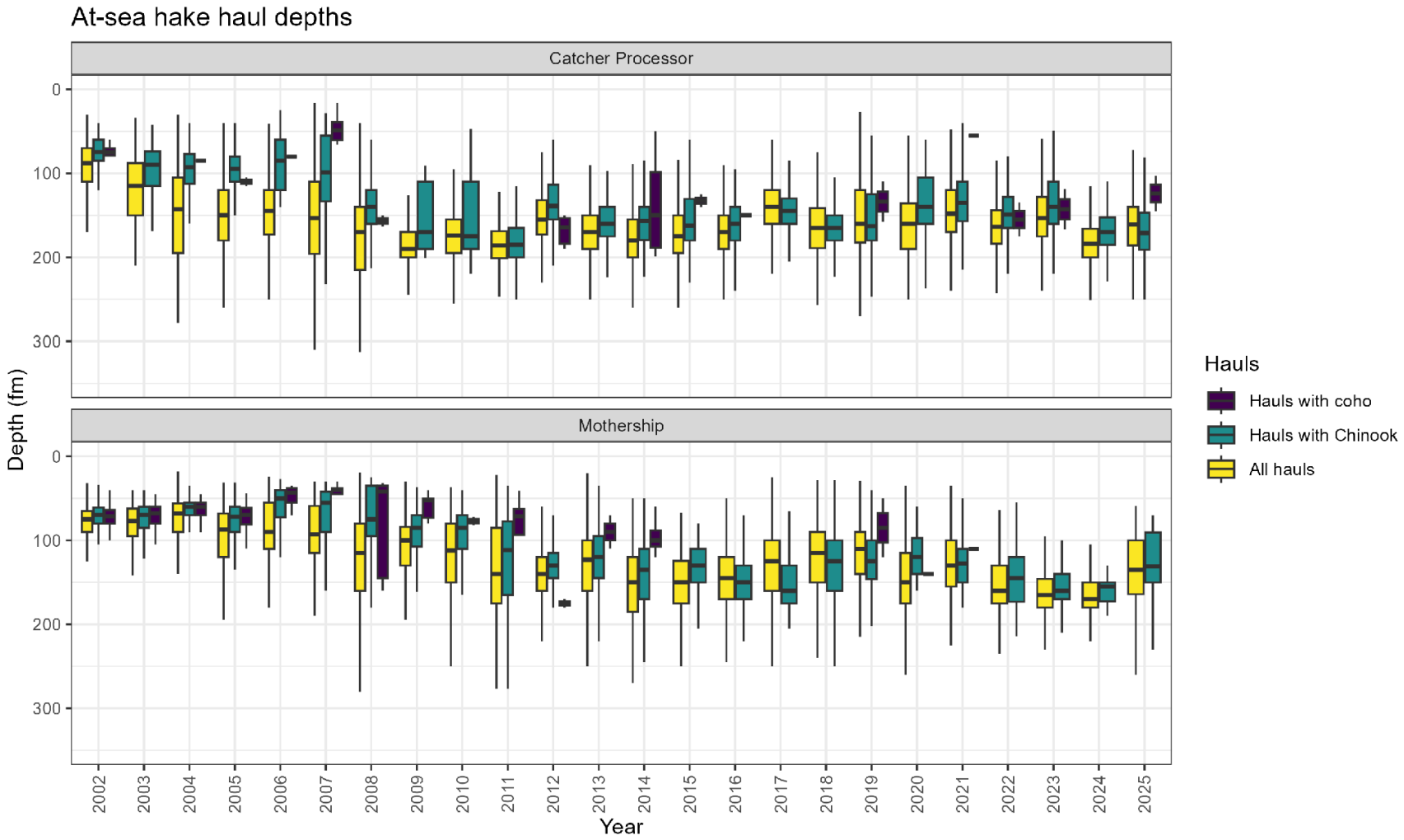


Figure 16. Boxplot of haul depths in the at-sea hake fishery. Outliers are not shown.

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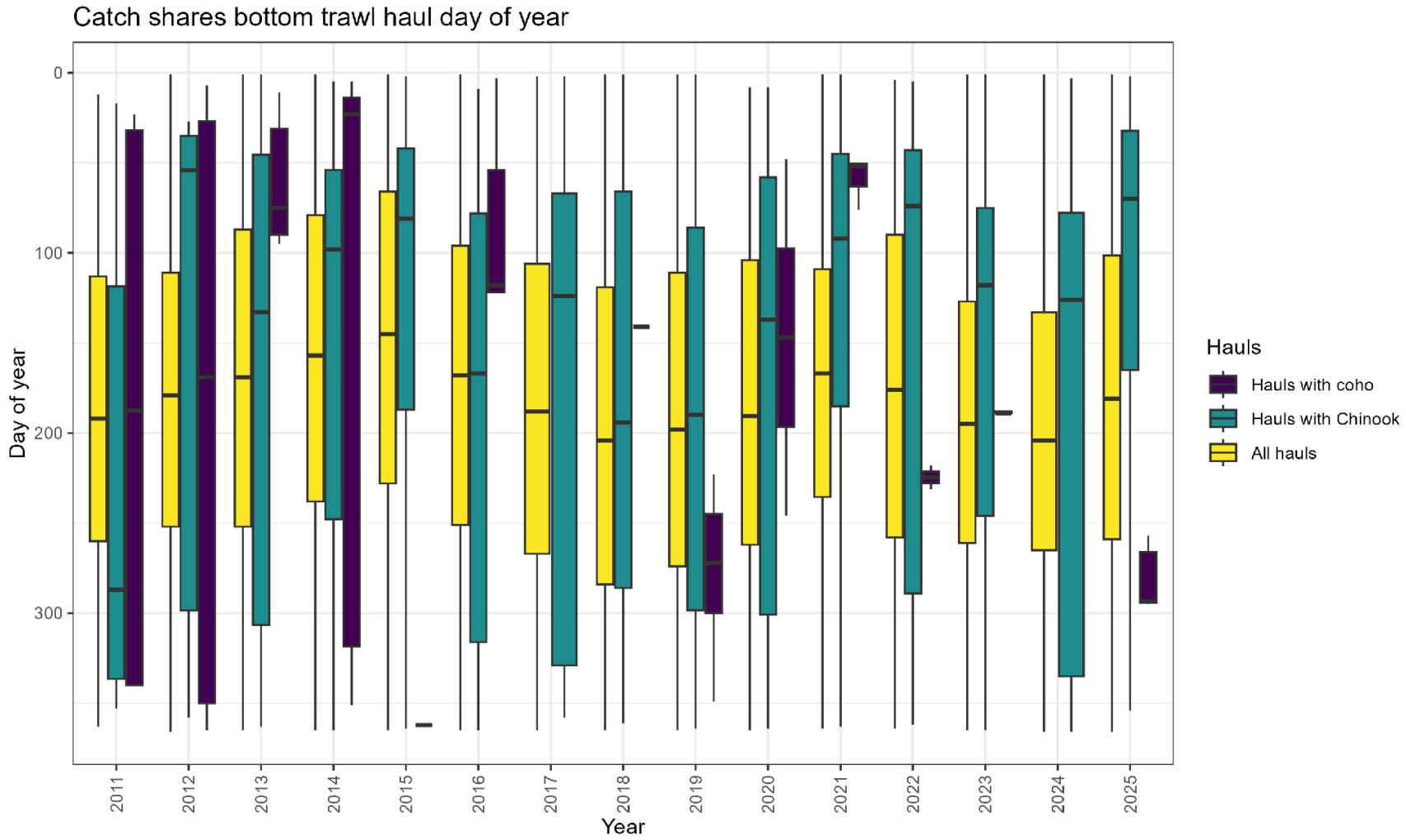


Figure 17. Boxplot of haul day of year in the catch share bottom trawl fishery. Outliers are not shown.

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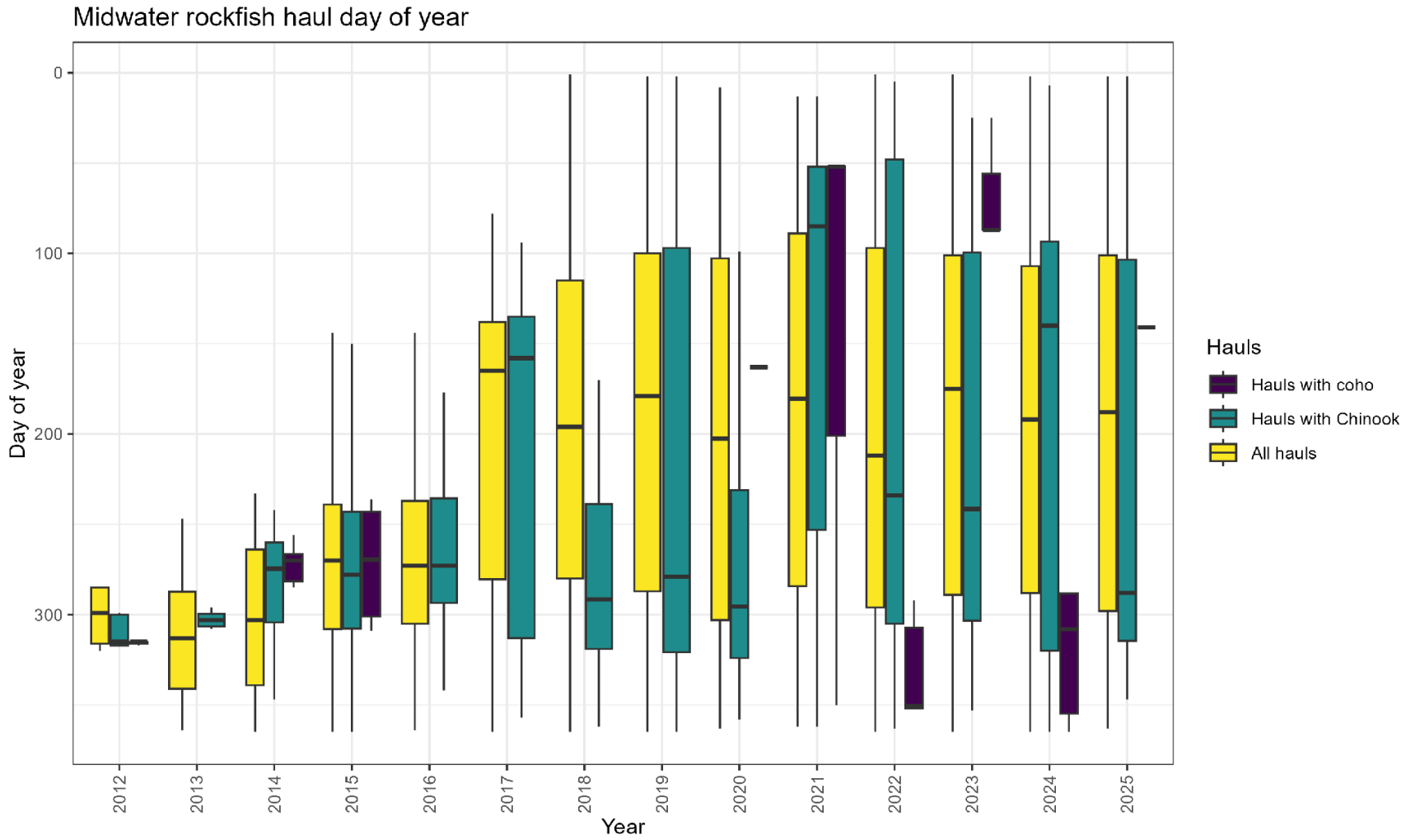


Figure 18. Boxplot of haul day of year in the midwater rockfish trawl fishery. Outliers are not shown.

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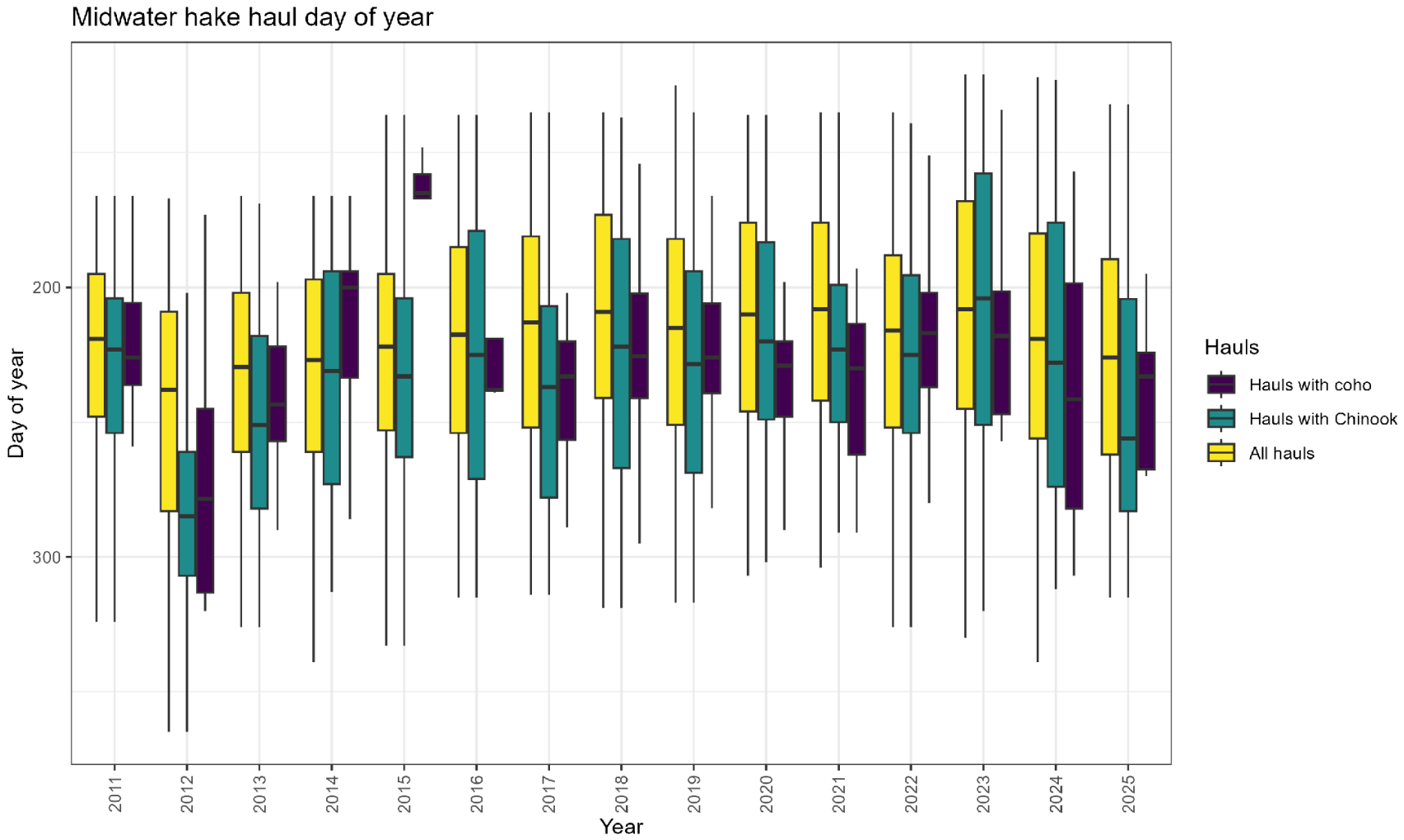


Figure 19. Boxplot of haul day of year in the shoreside midwater hake trawl fishery. Outliers are not shown.

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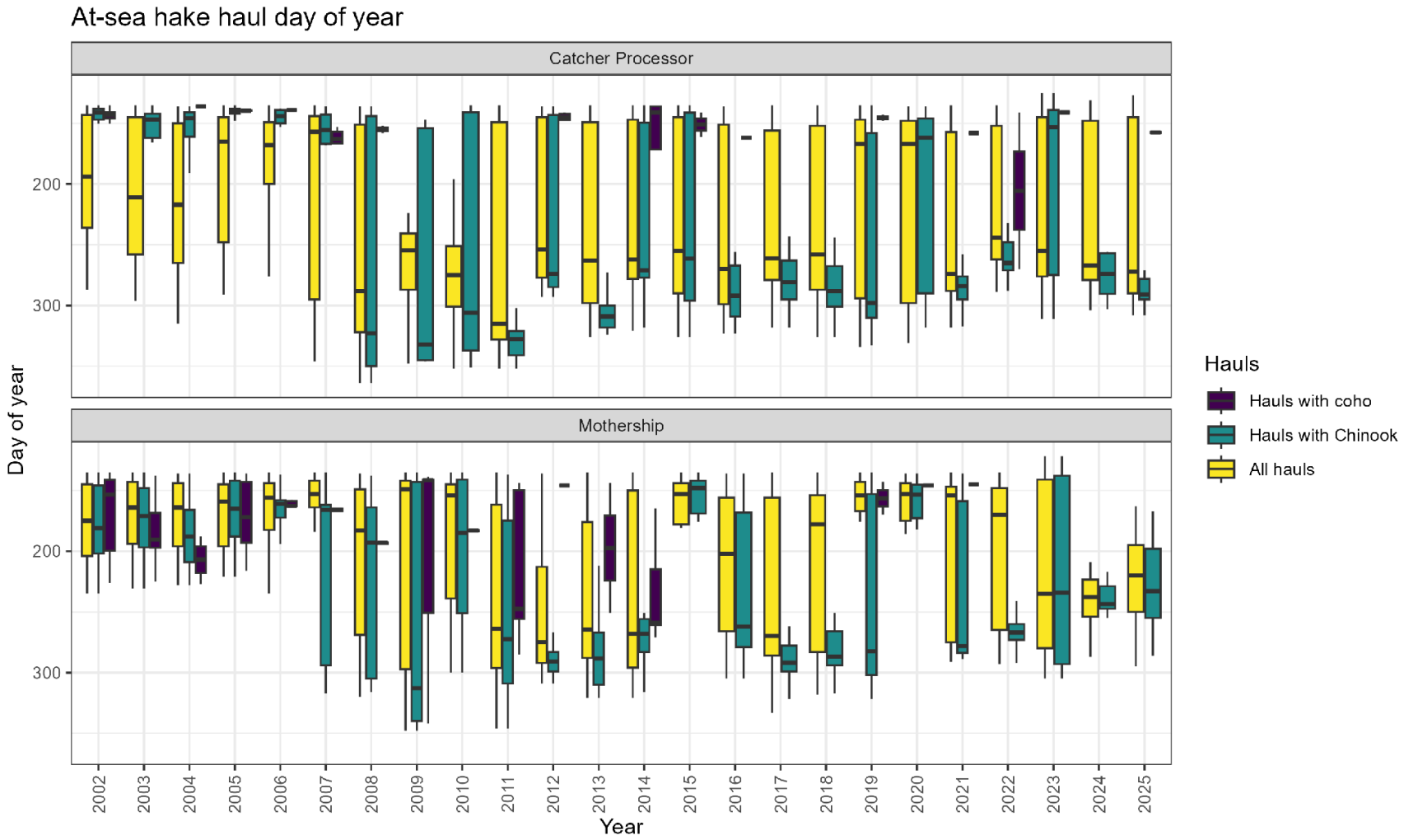


Figure 20. Boxplot of haul day of year in the at-sea hake fishery. Outliers are not shown.

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APPENDIX. Chinook salmon bycatch Genetic Stock Identification – 2025

Overview

Chinook salmon genetic samples collected from the At-Sea Hake Observer Program (A-SHOP), the West Coast Groundfish Observer Program (WCGOP), and the Shoreside Catch Monitoring (CM) Program were processed for genetic stock identification (GSI). This report covers samples collected in 2025.

Summary of methods & results

Genetic samples received from each program were randomly subsampled from across the dates collected, except in cases where sample size was less than 380, in which case all samples received were generally used. DNA was extracted, and DNA samples were used to prepare GT-seq (genotyping in thousands; Campbell et al. (2013)) libraries for high throughput sequencing, a standard approach used to interrogate single nucleotide polymorphisms (SNP) for genotyping and subsequent genetic stock identification (GSI) and parent based tagging (PBT) methods. Libraries were prepared using a panel of >300 SNP loci, and individuals were barcoded according to well and plate. Only a subset of these loci are represented in coastwide chinook salmon genetic baselines, at present. GT-seq libraries were sequenced on the Illumina MiSeq. Individuals were genotyped for all loci using GTscore (https://github.com/gjmckinney/GTscore); filters were applied to remove individuals with <80% genotyping rate, those that appeared to be contaminated (either in the field or the laboratory), or those that appeared to be different species based on multilocus genotypes. Mixture analysis was performed using rubias (Moran & Anderson, 2019) with a subset of loci represented in a compiled coastwide SNP baseline for Chinook salmon (Clemento et al. 2014, Meek et al. 2014), and which was previously used for 2023 in-season bycatch analysis (see G.8.a, Supplemental NMFS Presentation 1: Spring 2023 in-season Chinook bycatch: Evaluation of predicted ESU impacts), and subsequent analysis for additional samples collected in 2023 and 2024 (Richerson et al. (2026)).

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Table A1. Sample numbers received, genotyped and filtered for GSI. Shoreside catch monitor (CM) samples come from landed salmon in the shoreside midwater hake, midwater rockfish, and catch shares bottom trawl fisheries, with the majority coming from shoreside midwater hake.

Collection name	Year	Total samples received	Samples genotyped	Filtered samples genotyped
A-SHOP	2025	696	397	370
Shoreside - CMP	2025	1224	570	506
WCGOP	2025	231	229	194

GSI mixture proportions by collection & year

Mixture proportions of each collection are presented below, including for each collection overall (Figure A1) and the Shoreside - Catch Monitoring sector subdivided by the target of the trip (Figure A2).

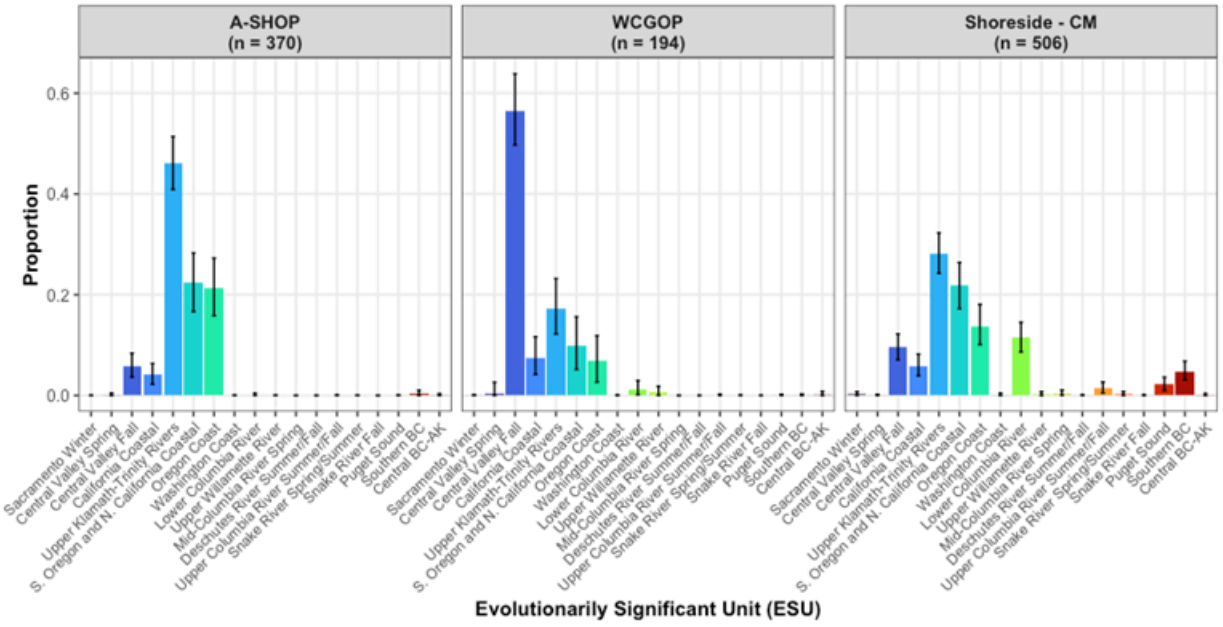


Figure A1. GSI mixture proportions of Chinook salmon bycatch by Evolutionarily Significant Unit (ESU) across the three collections in 2025. Error bars represent 95% confidence intervals.

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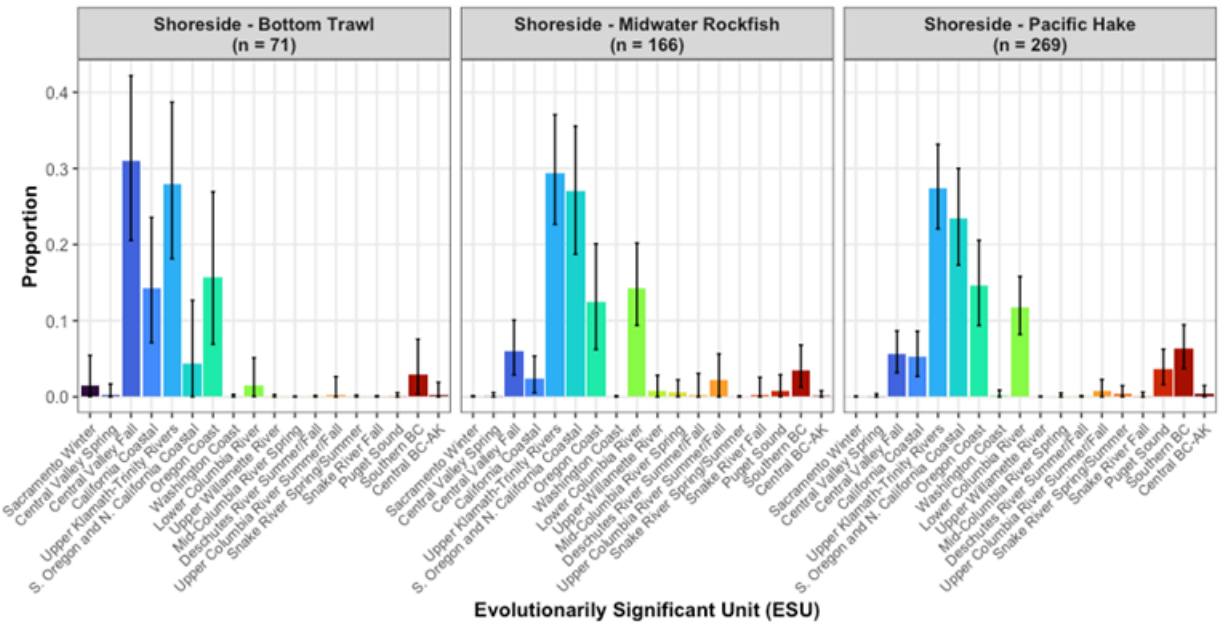


Figure A2. GSI mixture proportions of Chinook salmon bycatch by Evolutionarily Significant Unit (ESU) across Shoreside Catch Monitoring Program fisheries (Bottom Trawl, Pacific Hake, and Midwater Rockfish) in 2025. Error bars represent 95% confidence intervals.

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