



A rapid update of CPUE for jack mackerels in JMA 7 to 2024

New Zealand Fisheries Assessment Report 2026/08

D.A.J. Middleton

ISSN 1179-5352 (online)

ISBN 978-1-997309-15-4 (online)

March 2026



Disclaimer

This document is published by Fisheries New Zealand, a business unit of the Ministry for Primary Industries (MPI). The information in this publication is not government policy. While every effort has been made to ensure the information is accurate, the Ministry for Primary Industries does not accept any responsibility or liability for error of fact, omission, interpretation, or opinion that may be present, nor for the consequence of any decisions based on this information. Any view or opinion expressed does not necessarily represent the view of Fisheries New Zealand or the Ministry for Primary Industries.

Requests for further copies should be directed to:

Fisheries Science Editor
Fisheries New Zealand
Ministry for Primary Industries
PO Box 2526
Wellington 6140
NEW ZEALAND

Email: Fisheries-Science.Editor@mpi.govt.nz
Telephone: 0800 00 83 33

This publication is also available on the Ministry for Primary Industries websites at:
<http://www.mpi.govt.nz/news-and-resources/publications>
<http://fs.fish.govt.nz> go to Document library/Research reports

© Crown Copyright – Fisheries New Zealand

Please cite this report as:

Middleton, D.A.J. (2026). A rapid update of CPUE for jack mackerels in JMA 7 to 2024. *New Zealand Fisheries Assessment Report 2026/08*. 63 p.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1 INTRODUCTION	2
2 METHODS	3
3 FISHERY CHARACTERISATION	3
4 CATCH-PER-UNIT-EFFORT	7
4.1 CPUE models	7
5 CATCH COMPOSITION	8
6 DISCUSSION	11
7 ACKNOWLEDGEMENTS	14
8 REFERENCES	14
APPENDIX A DATA GROOMING	15
A.1 Landings	15
A.2 Effort	18
APPENDIX B TABULATED FISHERIES CHARACTERISATION DATA	21
APPENDIX C CPUE SERIES DIAGNOSTICS	29
C.1 JMD7 MW observer	29
C.2 JMN7 MW observer	43
APPENDIX D COMPARISON WITH PREVIOUS SERIES	60
APPENDIX E GLOSSARY	61

PLAIN LANGUAGE SUMMARY

New Zealand's jack mackerel fisheries comprise three closely related species of pelagic fish, two native species (yellowtail and greenback jack mackerels), and the Chilean jack mackerel that periodically arrives in New Zealand waters from the wider South Pacific. Although catch limits are set for the species group, the abundance of each species must be monitored separately.

Off the west of New Zealand (JMA 7), jack mackerels are caught by a midwater trawl fishery with target fishing focussed in the Taranaki Bight. Observer sampling information allows the catches of the three species to be separated. Greenback jack mackerel currently make up about 80% of the catch, with yellowtail jack mackerels most of the remainder.

As part of its management within the Quota Management System, jack mackerel abundance in JMA 7 is monitored using catch-per-unit-effort (CPUE) from the midwater trawl fishery. In this report, this information is given for 1990 to 2024.

Both greenback and yellowtail jack mackerels were likely to be at or above target levels in 2024. In the case of greenback jack mackerels, the assessment is considered to apply to the species in both the JMA 3 and JMA 7 areas as there are indications they are a single population.

EXECUTIVE SUMMARY

Middleton, D.A.J.¹ (2026). A rapid update of CPUE for jack mackerels in JMA 7 to 2024.

New Zealand Fisheries Assessment Report 2026/08. 63 p.

The JMA 7 Total Allowable Commercial Catch (TACC) was exceeded in both 2023 and 2024. A rapid update of the fishery characterisation for JMA 7, adding data from the 2023 and 2024 fishing years, was undertaken. Catch-per-unit-effort (CPUE) analyses for *Trachurus declivis* (greenback jack mackerel, JMD) and *T. novaezelandiae* (yellowtail jack mackerel, JMN) were also updated, using observer data. In addition, bootstrapping of observed tows with species composition sampling was used to estimate catch by species in the JMA 7 area.

T. declivis was estimated to make up around 80% of the JMA 7 catch in recent years, with *T. novaezelandiae* making up most of the remainder; recent catches of *T. murphyi* (Chilean jack mackerel, JMM) have dropped to negligible levels.

The CPUE indices suggested that the abundance of *T. declivis* increased from 2010 to 2017, then fluctuated without trend to 2024. Abundance of *T. novaezelandiae* followed a similar pattern, but with more variation in the period from 2017 to 2024.

Updated partial quantitative assessments were carried out for JMD 7 and JMN 7. Both stocks were assessed as Likely (> 60%) to be at or above the target level in 2023–24, with relative exploitation rates below the overfishing threshold.

The assessment for JMD 7 included catches of *T. declivis* from JMA 3 because the latter is unlikely to be an independent population and, as a working hypothesis, is considered to be part of the JMD 7 stock.

¹Pisces Research, Wellington, New Zealand

1. INTRODUCTION

The fishery for jack mackerels in JMA 7 (Figure 1) was characterised using data to the end of the 2022 fishing year² by Middleton et al. (2024). Standardised catch-per-unit-effort (CPUE) series were prepared for the two native jack mackerels (greenback jack mackerel, JMD, *Trachurus declivis*, and yellowtail jack mackerel, JMN, *T. novaezelandiae*) using observer data from tows where sampling allowed the jack mackerel catch to be separated by species. Partial quantitative stock assessments were carried out using these CPUE series. Middleton et al. (2024) also provided a CPUE series for the non-native Chilean jack mackerel (JMM, *T. murphyi*), but this is not considered to be a separate biological stock and is not assessed in JMA 7.

Recently, a similar characterisation and assessment was undertaken for jack mackerels in JMA 3 (Middleton & Neubauer 2025). During that project, it became clear that *T. declivis* in JMA 3 was probably not a separate biological stock, because catches comprised only larger fish.

To assist in the investigation of stock relationships for jack mackerels in JMA 3, the fishery characterisation and CPUE indices for JMA 7 were updated. These are reported here, and this report provides updated assessments for JMD 7 and JMN 7 using data to the end of the 2024 fishing year. The CPUE series for *T. murphyi* was not updated. This report also extends the characterisation of Middleton et al. (2024) by using observer data to estimate catch by species for the JMA 7 fishery.

An updated assessment for JMA 7 is also of interest due to recent catch trends. In 2022, the commercial catch of JMA 7 was almost 5000 t below the Total Allowable Commercial Catch (TACC; Table 1), but the TACC was exceeded in both 2023 and 2024 (Figure 2, Table B.1).

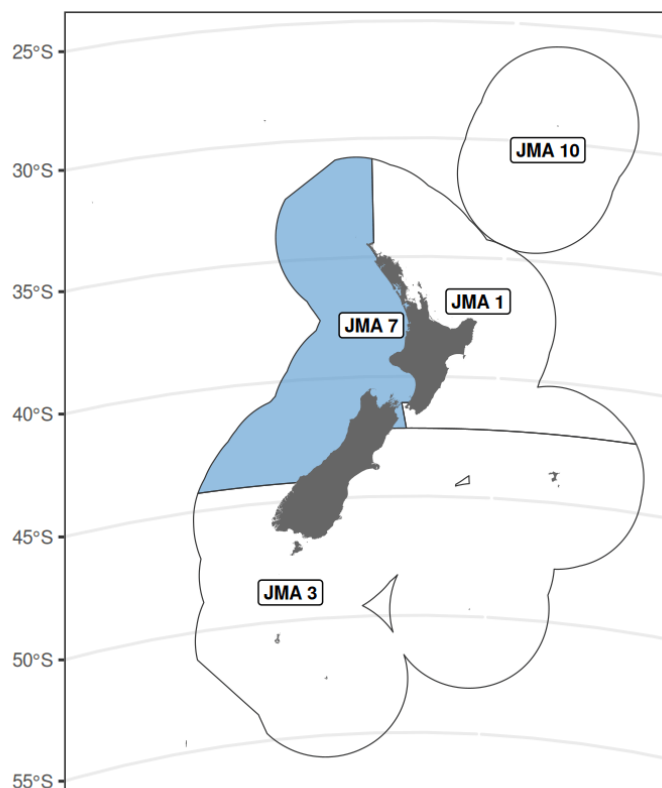


Figure 1: Quota Management Areas for jack mackerels with JMA 7 highlighted.

²where the 2022 fishing year was 1 October 2021 to 30 September 2022

Table 1: Total Allowable Catch (TAC), Total Allowable Commercial Catch (TACC), and allowances (all tonnes) for JMA 7, as at 1 October 2025.

Stock	TAC	TACC	Allowances		
			Customary	Recreational	Other mortality
JMA 7	35 907	35 537	5	10	355

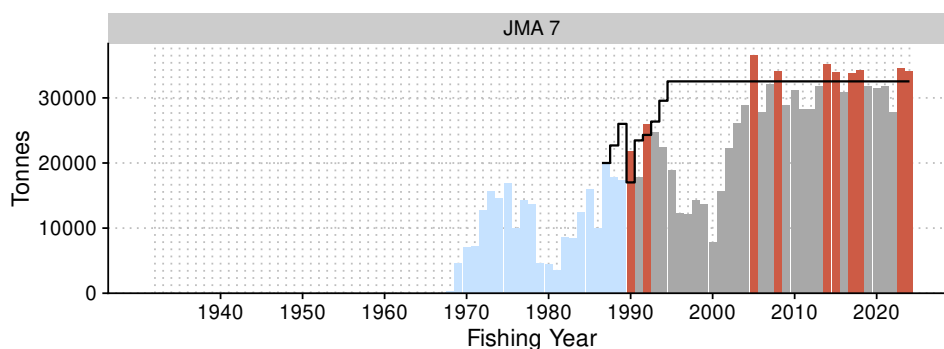


Figure 2: Total Allowable Commercial Catch (TACC; black line) and Monthly Harvest Return/Quota Management Report annual totals (bars) for JMA 7 from 1990 to 2024. Years where the TACC was exceeded are highlighted in red. Catches prior to 1990 are shown in blue using the information compiled in the Fisheries Assessment Plenary Report (Fisheries New Zealand 2024). Tabulated data are provided in Table B.1.

2. METHODS

Extracts (report logs 13159, 17183) of statutory commercial catch, effort, and landings data were provided by Fisheries New Zealand and processed using standardised grooming routines (Appendix A). Methods used for the characterisation and CPUE analyses were as described by Middleton et al. (2024).

3. FISHERY CHARACTERISATION

Since the late 1990s there has been a good correspondence between aggregated catches from the groomed landings data and MHR/QMR totals, with the majority of the catch landed directly to a Licensed Fish Receiver (although transhipments were common in the 1990s; Figure 3). An increasing proportion of the catch has been landed in an unprocessed (green) state, with this change especially notable in 2023 and 2024 (Figure 4). There have been no recent changes in conversion factors applicable to jack mackerels. Total catches also correspond closely with catches that are allocated to fishing events in the characterisation dataset (Figure 5).

Midwater trawling has continued to be responsible for the majority of the jack mackerel catch (Figure 6), with most catch taken on events where jack mackerels were targeted (Figure 7).

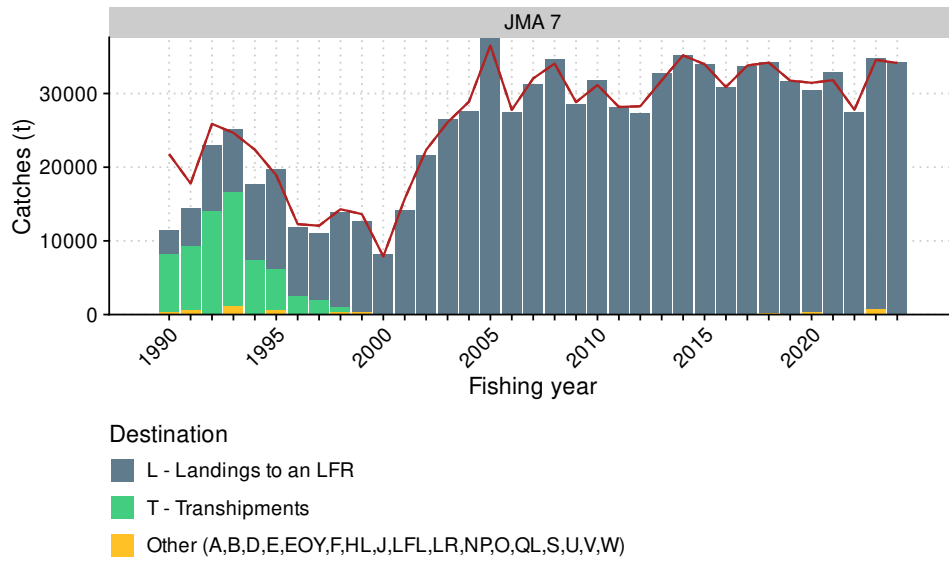


Figure 3: Catches of jack mackerels by destination (bars), compared with Monthly Harvest Return / Quota Management Report (MHR/QMR) annual totals (line), for Quota Management Area JMA 7. Destination codes are defined in Table E.5 and tabulated catches are given in Appendix B.

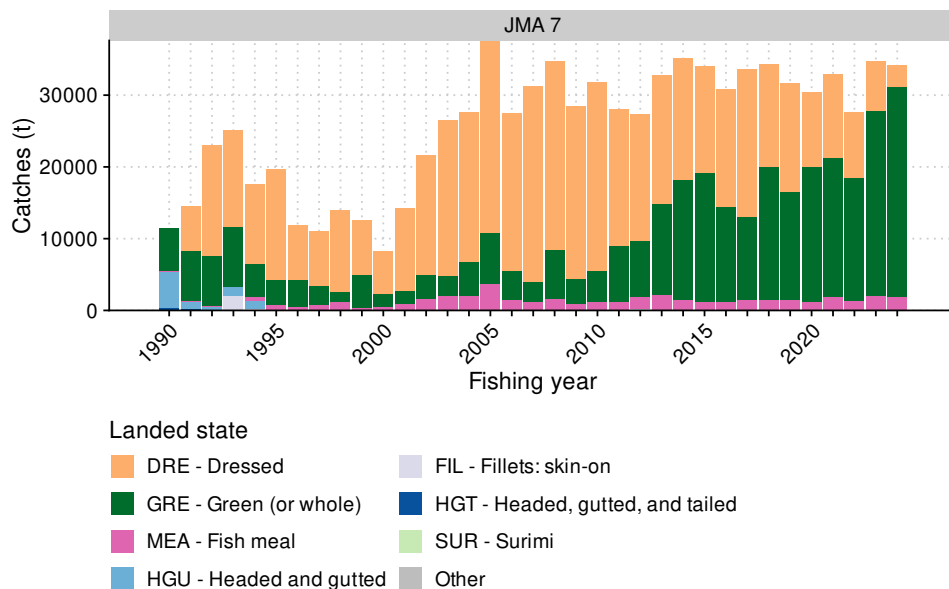


Figure 4: Product state of jack mackerels landings from Quota Management Area JMA 7. Catches are tabulated in Appendix B.

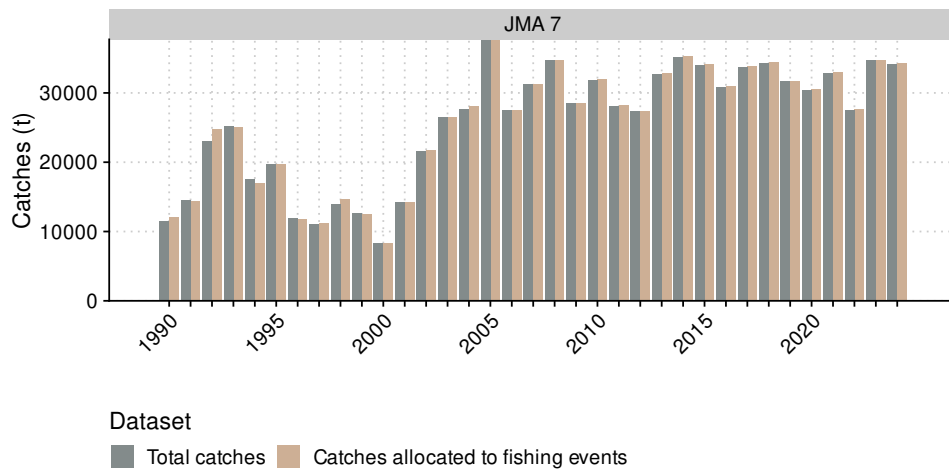


Figure 5: Total catches (t) of jack mackerels from JMA 7 in comparison with catches allocated to fishing events in the characterisation dataset.

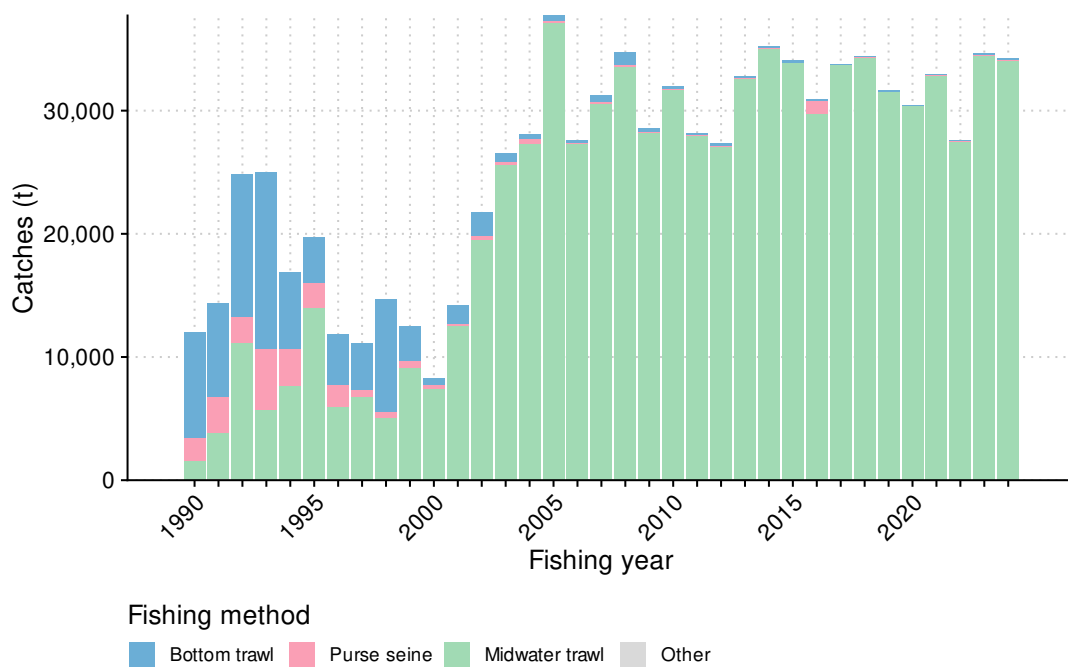


Figure 6: Catches of jack mackerels by fishing method, for events within the JMA 7 Quota Management Area. Methods grouped as Other include: BLL, BPT, BS, CP, CRP, D, DL, DN, DS, DV, FN, FP, HL, OCP, PL, PRB, PRM, PSH, PSN, RLP, RN, SJ, SN, T, TL. Tabulated results are provided in Appendix B, and a list of the main fishing method codes is included in the glossary Table E.3.

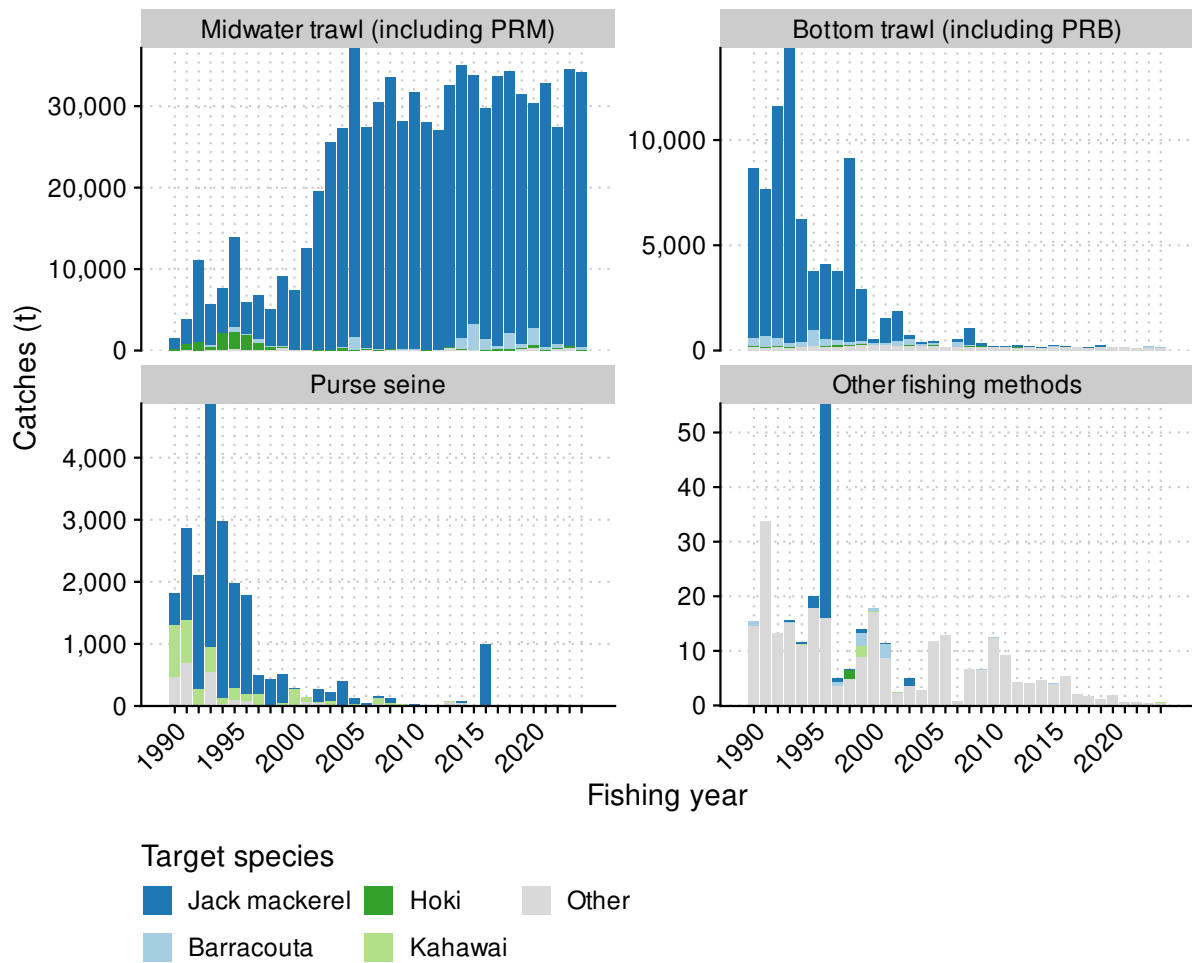


Figure 7: Catches of jack mackerels by fishing method and declared target species, for events within the JMA 7 Quota Management Area. Precision bottom trawl (PRB) catches are included with conventional bottom trawl (BT) catches, and precision midwater trawl (PRM) catches are included with conventional midwater trawl (MW) catches. Fishing methods grouped as Other include: BLL, BPT, BS, CP, CRP, D, DL, DN, DS, DV, FN, FP, HL, OCP, PL, PSH, PSN, RLP, RN, SJ, SN, T, TL. Species grouped as Other include target species with less than 5% of the jack mackerels catch within the JMA 7 Quota Management Area in a fishing year.

4. CATCH-PER-UNIT-EFFORT

4.1 CPUE models

Updated event resolution CPUE series for *Trachurus declivis* and *T. novaezelandiae* in JMA 7 (here referred to as JMD 7 and JMN 7, respectively) were fitted to observer data from 1999 to 2024 (Table 2). Standard diagnostics for these series are provided in Appendix C, and the resulting series are compared with those provided by Middleton et al. (2024), using data to 2022, in Appendix D.

One additional vessel met the core fleet criteria in the updated series (Figure C.2, Figure C.16). In the positive model for JMN 7, tow start time replaced headline height as the final explanatory variable to enter the model (Table C.10). Otherwise, the effects of standardisation were similar in the previous and updated series.

Table 2: Summary of models constructed for CPUE standardisation.

Series name	Data resolution	Response variable	Explanatory variable selection process	Core fleet years	Core fleet trips	Assumed error distribution
JMD7 MW observer	observer	jmdkg	Stepwise	4	1	Weibull
JMN7 MW observer	observer	jmnkg	Stepwise	4	1	Weibull

The updated series for JMD 7 (positive series only) and JMN 7 (combined binomial/positive series) have both fluctuated without trend since 2017 (Figure 8). The JMD 7 series is generally less variable than that for JMN 7. The JMD 7 series showed a notable dip to the series average in 2022 and 2023, before returning to a higher level, consistent with the 2017 to 2021 period, in 2024.

The JMN 7 series shows peaks in 2018 and 2023, and dips in 2020 and 2024, that are unlikely to be solely driven by abundance; it is possible that there has been variable availability of JMN 7 to the midwater trawl fleet in this period.

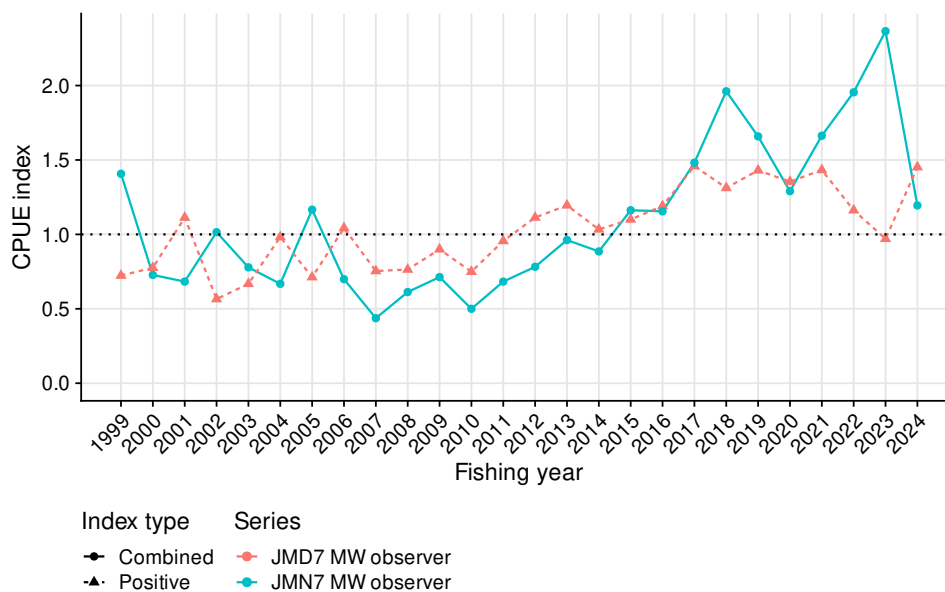


Figure 8: The updated indices for JMD 7 and JMN 7. Indices are scaled to a geometric mean of one for the years in common.

5. CATCH COMPOSITION

While Middleton et al. (2024) provided species-specific CPUE series for JMD 7 and JMN 7, the separation of catch by species was limited to those tows where observers had undertaken species-specific length-frequency sampling. Separation of the full annual JMA 7 catch by species is, however, desirable. An initial analysis of catch composition was therefore undertaken as part of this update.

For the two native jack mackerel species, *Trachurus declivis* and *T. novaezelandiae*, Middleton et al. (2024, figure 73) illustrated that there was a reasonably clear pattern of spatial separation: *T. declivis* dominated off the north-west coast of the South Island and in the offshore areas of the Taranaki Bight, while *T. novaezelandiae* was more common in the inshore areas of the Taranaki Bight. Separating the fishery into two strata at approximately 173°E provides a reasonably parsimonious division. This is well aligned with statistical area boundaries, and estimation strata were therefore defined as groups of statistical areas (Table 3, Figure 9). In order to include the majority of the JMA 7 catch, the statistical areas included in the two strata were expanded to include statistical areas adjacent to those where the main midwater trawl fishery (and catch sampling by observers) was carried out. The occurrence of *T. murphyi* in the area was considered to be less spatially consistent, and therefore not included in decisions around stratification.

Annual catches by stratum were estimated by bootstrapping the observed tows where species composition estimates were available. A two stage bootstrapping approach was employed, first bootstrapping the observed trips, then the tows within these trips where species composition sampling data were available. The proportion by species for each bootstrap replicate was then applied to the total jack mackerel catch for the stratum-year.

The bootstrap estimates of catch by species (Figure 10) were generally more variable in the 1990s when observer coverage was lower (Middleton et al. 2024). Catches of both *T. declivis* and *T. novaezelandiae* have been greatest in the north-eastern region, with the catch of *T. declivis*, in particular, increasing as the midwater fishery developed in the Taranaki Bight from the late 1990s.

Catches of *T. murphyi* were greatest in the south-western region, but persisted longer in the north-eastern region (Figure 10). Catches of *T. murphyi* were notably lower from 2021 to 2024.

An overall catch series for JMA 7, based on means of the bootstrap estimates of catch by species, demonstrates that the fishery predominantly catches *T. declivis*, but that larger catches of *T. novaezelandiae* have occurred in some years (notably 2005 and 2023; Figure 11). These catch peaks may be related to variation in the availability of *T. novaezelandiae* to the midwater fleet.

Table 3: Statistical area based strata used for estimation of JMA 7 species composition.

Stratum label	Statistical Areas
NE	016, 017, 018, 037, 038, 039, 040, 041, 042, 043, 044, 045, 046, 047, 048
SW	032, 033, 034, 035, 036, 101, 701, 702, 703, 704, 705, 706, 801

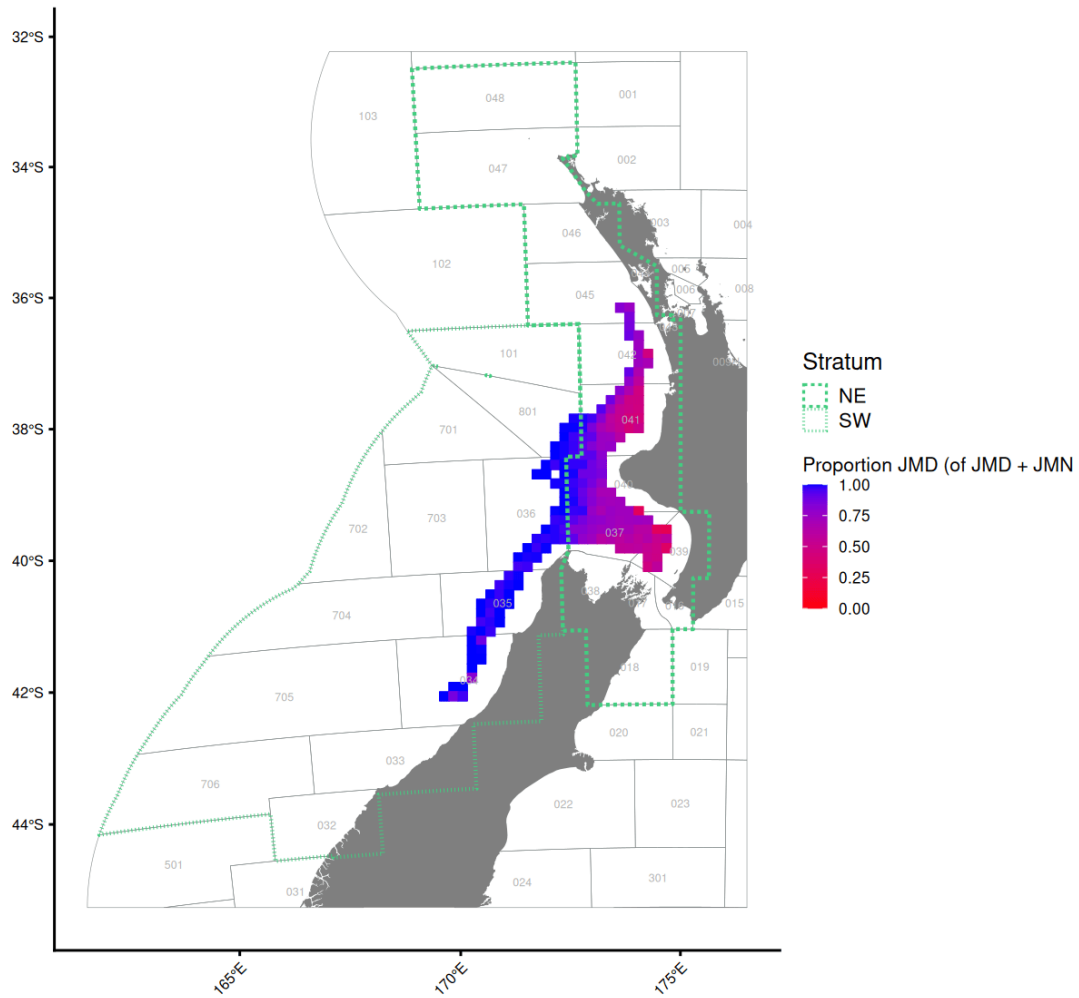


Figure 9: Proportion of *T. declivis*, of the total observed catch of the native jack mackerels (*T. novaezelandiae* and *T. declivis*), on observed tows from the 1987 to 2024 fishing years. This updates Middleton et al. (2024, figure 73) with additional observer data, but does not exclude data from trips where species misidentification was thought to have taken place. The strata defined for estimating overall JMA 7 species composition are outlined using green lines.

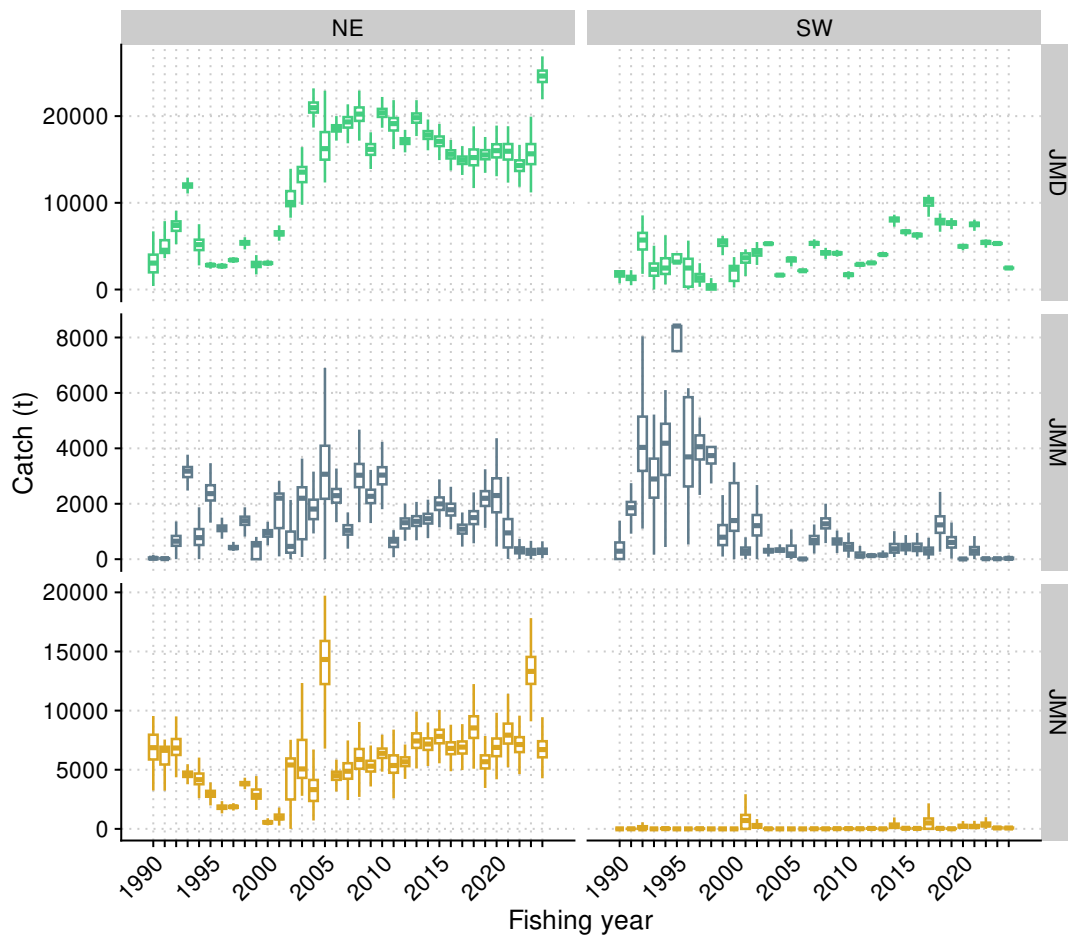


Figure 10: Box-plots of bootstrap estimated catches of jack mackerel species in JMA 7 by species and year. For each stratum and year, 1000 bootstrap replicates were carried out. Outliers are omitted from the boxplots. JMD = *T. declivis*, JMM = *T. murphyi*, JMN = *T. novaezelandiae*.

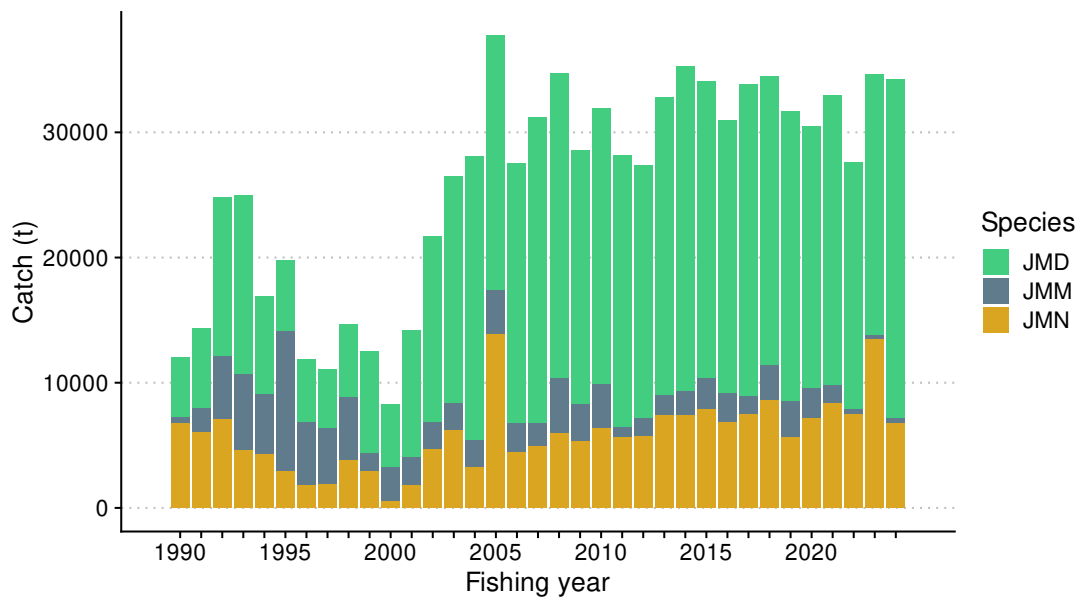


Figure 11: Estimated catches of jack mackerel species in JMA 7 by species and year, with annual totals calculated as the mean of the bootstrap estimates summed over the strata. JMD = *T. declivis*, JMM = *T. murphyi*, JMN = *T. novaezelandiae*.

6. DISCUSSION

Following the development of species-specific CPUE series for *Trachurus declivis* and *T. novaezelandiae* in JMA 7 in 2023 (Middleton et al. 2024), a similar approach was attempted for the JMA 3 fishery in 2025. It was found that observer sampling of jack mackerels in JMA 3 was inadequate to support the development of CPUE series based on observed tows where the jack mackerel catch was separated by species; however, Middleton & Neubauer (2025) constructed a model-based approach for estimating the proportions of *T. declivis* and *T. murphyi* in the JMA 3 catch, having concluded that *T. novaezelandiae* was largely absent (or, at least, unfished) in the JMA 3 area.

In addition, a review of information on stock structure suggested that *T. declivis* in JMA 3 was not a separate biological stock; as a working hypothesis, a stock assessment plenary meeting agreed that JMD 3 and JMD 7 could be assessed as a single stock, using the JMD 7 observer CPUE series to index abundance for the whole population.

The combined catch history for *T. declivis* in JMA 3 and JMA 7 is illustrated in Figure 12; the JMD 7 catches are based on the stratified bootstrap analysis reported above, while the JMD 3 estimates use the model-based approach developed by Middleton & Neubauer (2025).

Partial quantitative assessments for JMD 7 and JMN 7 have been updated, incorporating the observer CPUE analyses extended to 2024, and the new estimates of catch by species. The latter allows relative exploitation rates to be reported for the first time.

In the case of JMD 7, which now includes JMD 3, stock status in 2024 was the same as that assessed in 2022, specifically Likely (> 60%) to be at or above the target (Figure 13). Furthermore, relative exploitation rate has been below the overfishing threshold since 2011.

In 2022, it was considered that JMN 7 was Very Likely to be at or above the target; however, the drop in the CPUE index in 2024 suggested that it was now appropriate to report that this stock was Likely (> 60%) to be at or above the target (Figure 14). Relative exploitation rate for JMN 7 has been below the overfishing threshold since 2011.

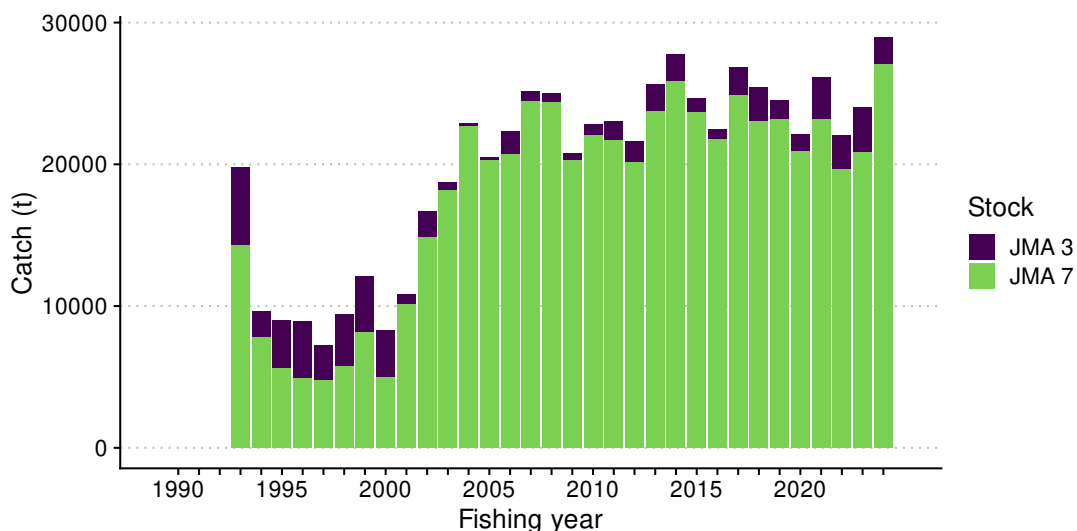


Figure 12: Estimated catches of *Trachurus declivis* from JMA 7 and JMA 3. Catches from JMA 7 are based on the stratified bootstrap of observed tows with species composition sampling, while the JMA 3 catches are estimated using the model-based approach developed by Middleton & Neubauer (2025).

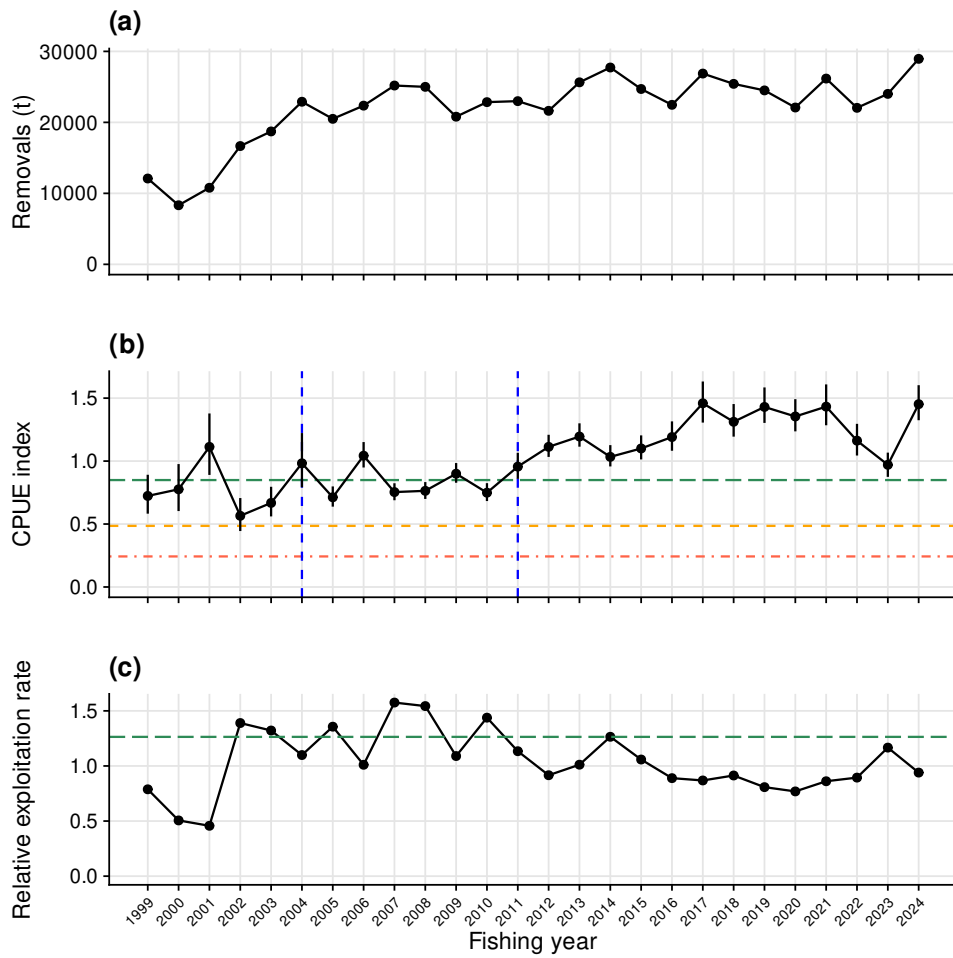


Figure 13: Stock status of *T. declivis* (JMD) in JMD 3 and JMD 7 relative to the reference period (2004–2011, indicated by dashed vertical lines), with geometric mean CPUE in this period considered to represent the target and indicated by the horizontal green dashed line. The hard and soft limits are represented by horizontal dashed red and orange lines, respectively.

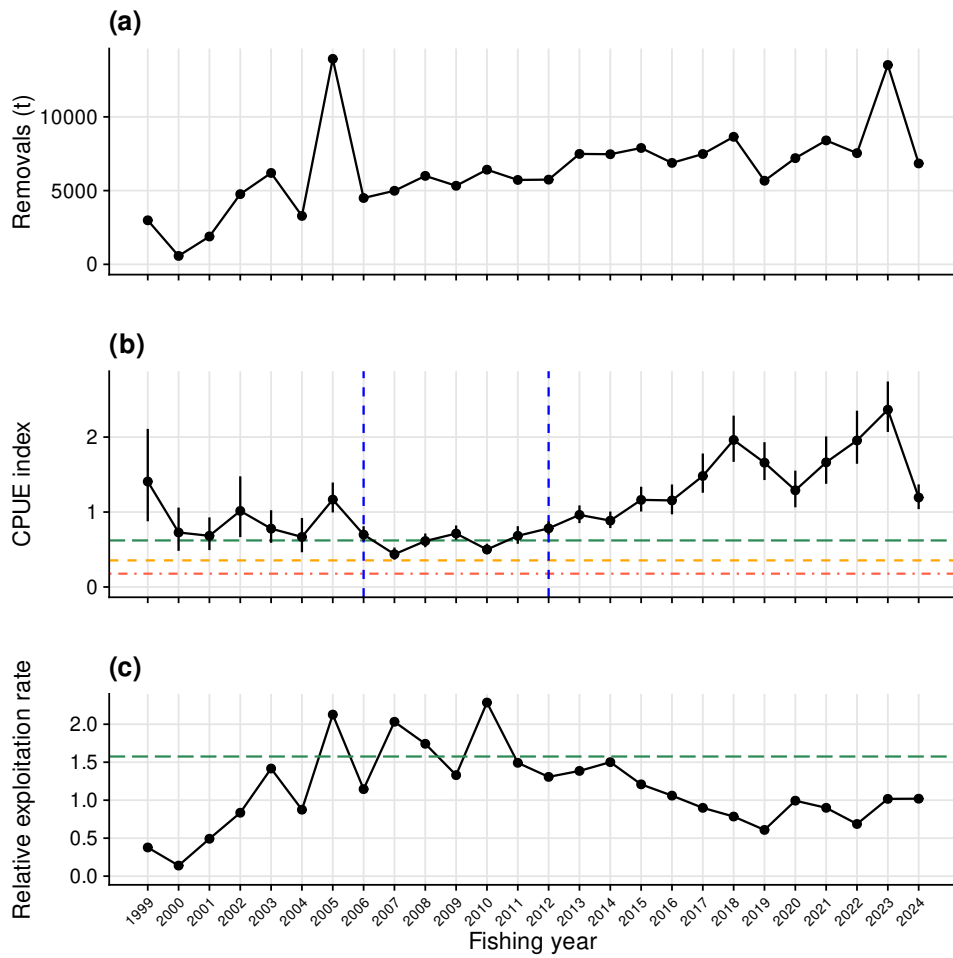


Figure 14: Stock status of *T. novaezelandiae* (JMN) in JMN 7 relative to the reference period (2006–2012, indicated by dashed vertical lines), with geometric mean CPUE in this period considered to represent the target and indicated by the horizontal green dashed line. The hard and soft limits are represented by horizontal dashed red and orange lines, respectively.

7. ACKNOWLEDGEMENTS

The work reported here was carried out as part of Fisheries New Zealand project JMA2024-01, and updates analyses originally developed in Fisheries New Zealand project JMA2021-01. Access to the required data was granted by Fisheries New Zealand. Analyses were carried out using the Kahawai Collective's reproducible research platform. Review and constructive suggestions made by the Deepwater Fisheries Assessment Working Group and Stock Assessment Plenary meeting participants are gratefully acknowledged.

8. REFERENCES

- Bentley, N. (2012). Groomer: grooming and other things for New Zealand fishstocks.
<https://github.com/trophia/groomer>
- Fisheries New Zealand (2024). *Fisheries Assessment Plenary, May 2024: stock assessments and stock status*. Compiled by the Fisheries Science Team, Fisheries New Zealand, Wellington, New Zealand. 1941 p.
- Middleton, D.A.J.; Neubauer, P. (2025). Characterisation and CPUE analyses for jack mackerels in the JMA 3 fishery up to 2024. *New Zealand Fisheries Assessment Report 2025/40*. 431 p.
- Middleton, D.A.J.; Neubauer, P.; Wells, R.H.; Starr, P.J. (2024). Characterisation and CPUE analyses for jack mackerels in the JMA 7 fishery up to 2022. *New Zealand Fisheries Assessment Report 2024/41*. 380 p.
- Starr, P.J. (2007). Procedure for merging Ministry of Fisheries landing and effort data, version 2.0. (Report to the Adaptive Management Programme Fishery Assessment Working Group, document 2007/4).

APPENDIX A: DATA GROOMING

Grooming of the statutory commercial catch, effort and landings data followed the approach of Starr (2007), with a set of rules defined for each of the different types of data (Bentley 2012).

A.1 Landings

Table A.1: Grooming rules applied to landings data.

Rule	Effect	Description
LADTI	Flag	Invalid landing destination
LADTH	Drop	Retained (non-final) landings
LADTT	Flag	Vessel received transhipments
LASCF	Fix	Correct some state codes
LASCD	Drop	Drop landings of secondary product states
LADUP	Drop	Duplicate landings
LACFM	Fix	Replace missing conversion factors with the median over all years
LAGWI	Fix	Estimate missing greenweights
LAGWM	Drop	Missing greenweights that cannot be estimated
LAGWO	Fix	Identify and fix order of magnitude errors in landings

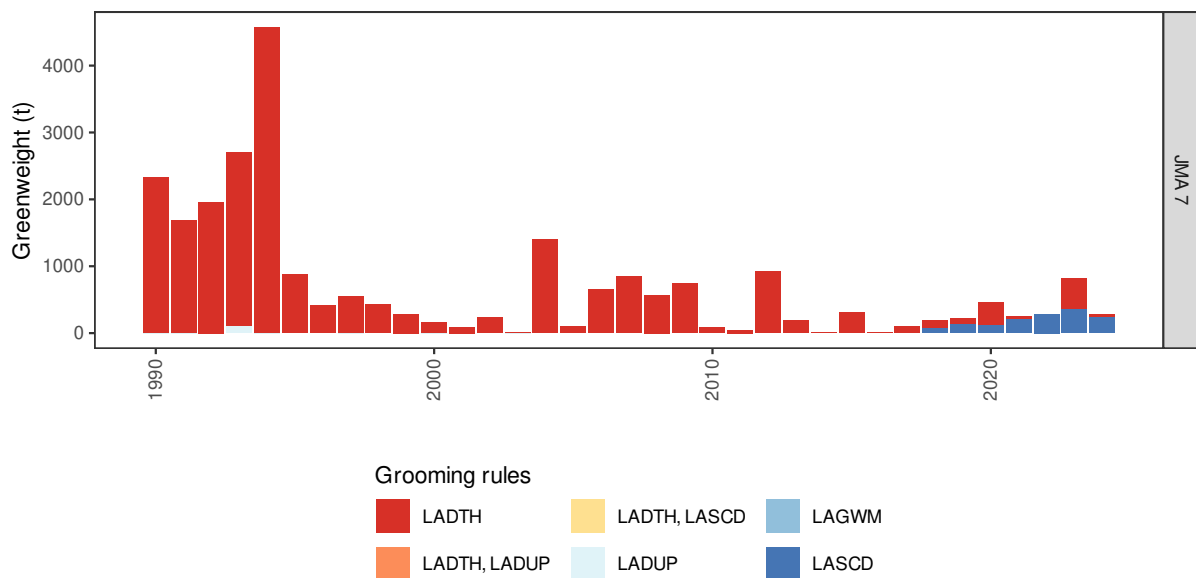


Figure A.1: The quantity of landings dropped, with the relevant grooming rules (Table A.1) indicated, by stock and fishing year.

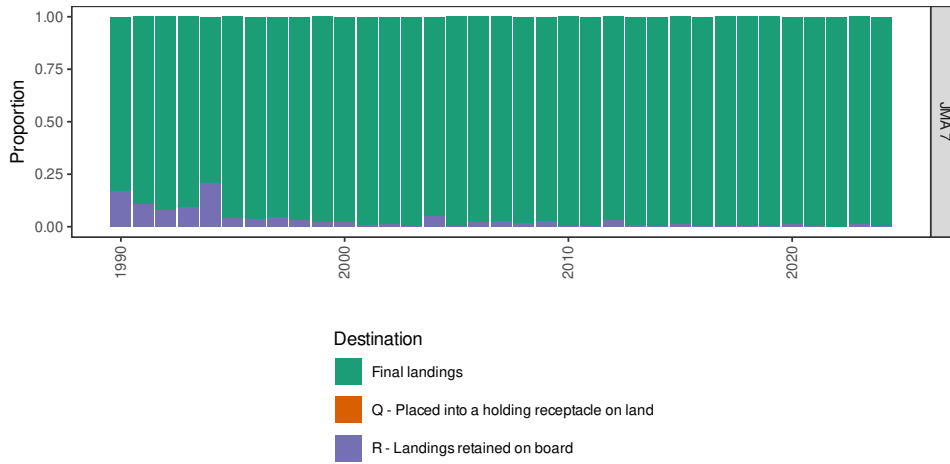


Figure A.2: The proportion of total (final and non-final) landings that are initially to non-final destinations, by stock and fishing year.

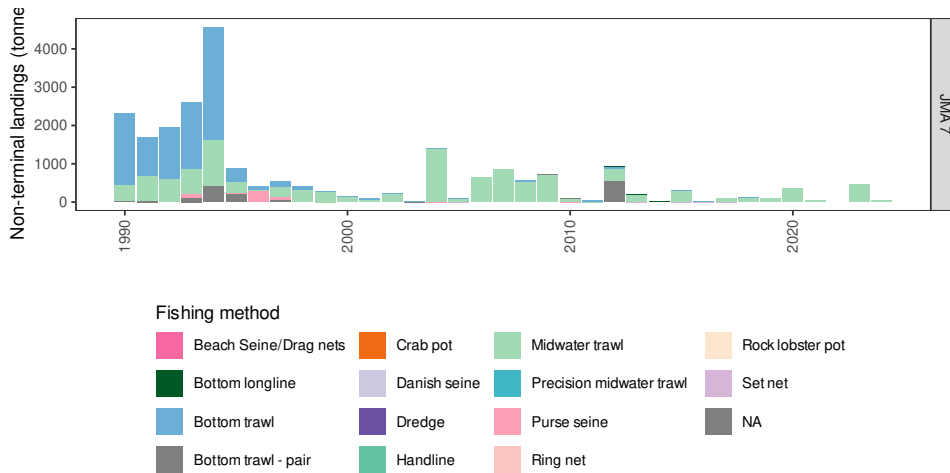


Figure A.3: The quantity of non-final landings, by stock, fishing year, and the modal fishing method used on the trip.

Table A.2: Annual number of trips, and affected greenweight quantity, where the LAGWO rule indicated an order of magnitude error in the landing weight and this was adjusted.

QMA	Fishing year	Trips	Greenweight (kg)	
			Original	Adjusted
JMA 7	1991	1	941 314.0	941.314
JMA 7	1992	3	5 622 753.0	2 577.441
JMA 7	1994	3	2 164 790.0	2 164.790
JMA 7	1995	1	219 247.0	219.247
JMA 7	2004	2	137.0	1.370
JMA 7	2007	1	56.0	0.560
JMA 7	2008	1	142.0	1.420
JMA 7	2011	1	76.0	0.760
JMA 7	2012	1	52.0	0.520
JMA 7	2013	1	44.0	0.440
JMA 7	2015	2	1 192.0	11.920
JMA 7	2019	1	94 819.0	94.819
JMA 7	2020	1	37.0	0.370
JMA 7	2024	1	90.2	0.902

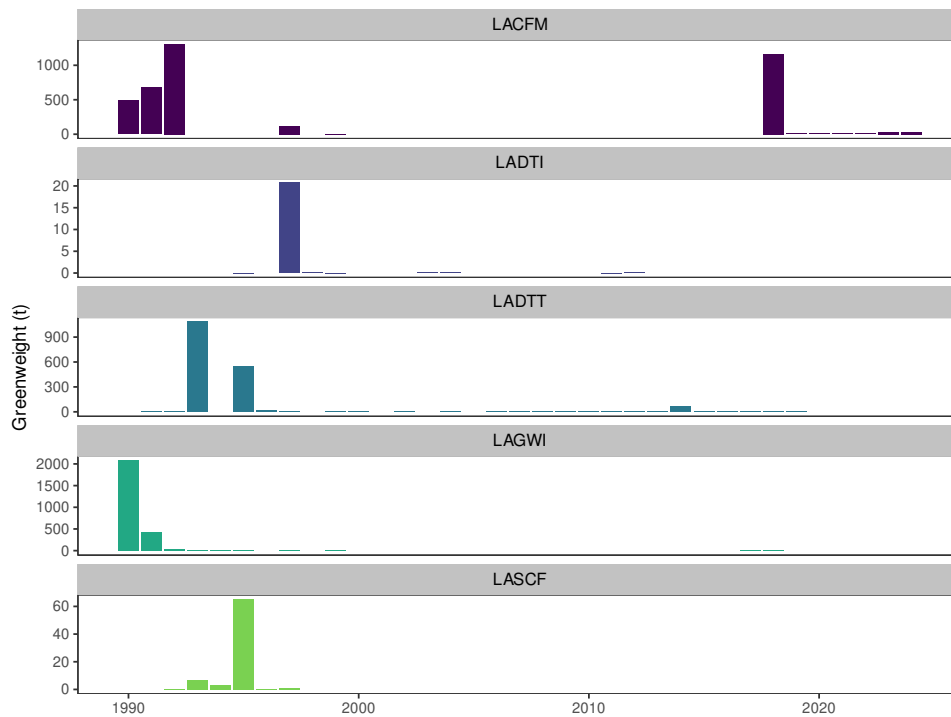


Figure A.4: The quantity of landings flagged by the grooming rules, or where fixes were applied to fields other than the landed greenweight. Note that some landing events may be affected by multiple rules.

A.2 Effort

Table A.3: Grooming rules applied to effort data.

Rule	Effect	Description
FEPMN	Fix	Add PSH as a method code for certain vessels if method is null
FEPMI	Fix	Replace missing methods if there is only one method used on the trip (by form type)
FEPMM	Flag	Flag trips if any events have a missing method
FESAI	Fix	Substitute the modal statistical area from a trip for missing areas
FESAM	Flag	Flag events with missing statistical areas
FESAF	Flag	Flag non RLP events using RL statistical area codes
FETSE	Fix	Set target species to group code for HPB and FLA species
FETSW	Fix	Flag and set target species to null if target species is not a valid species code
FETSI	Fix	Replace missing target species with the modal value for a trip
FEETN	Fix	Flag and fix some CP effort errors
FEEMU	Fix	Fix SN mesh sizes recorded in inches
FEMEM	Flag	Flag events where the primary effort measure is missing
FEHDE	Flag	Flag records where the maximum daily effort is out of range
FEDBE	Fix	Transpose bottom and effort depths if reported effort depth > bottom depth

Table A.4: Grooming rules applied to estimated catch data.

Rule	Effect	Description
ESTGT	Fix	Create estimated catch records for events with a total catch weight only

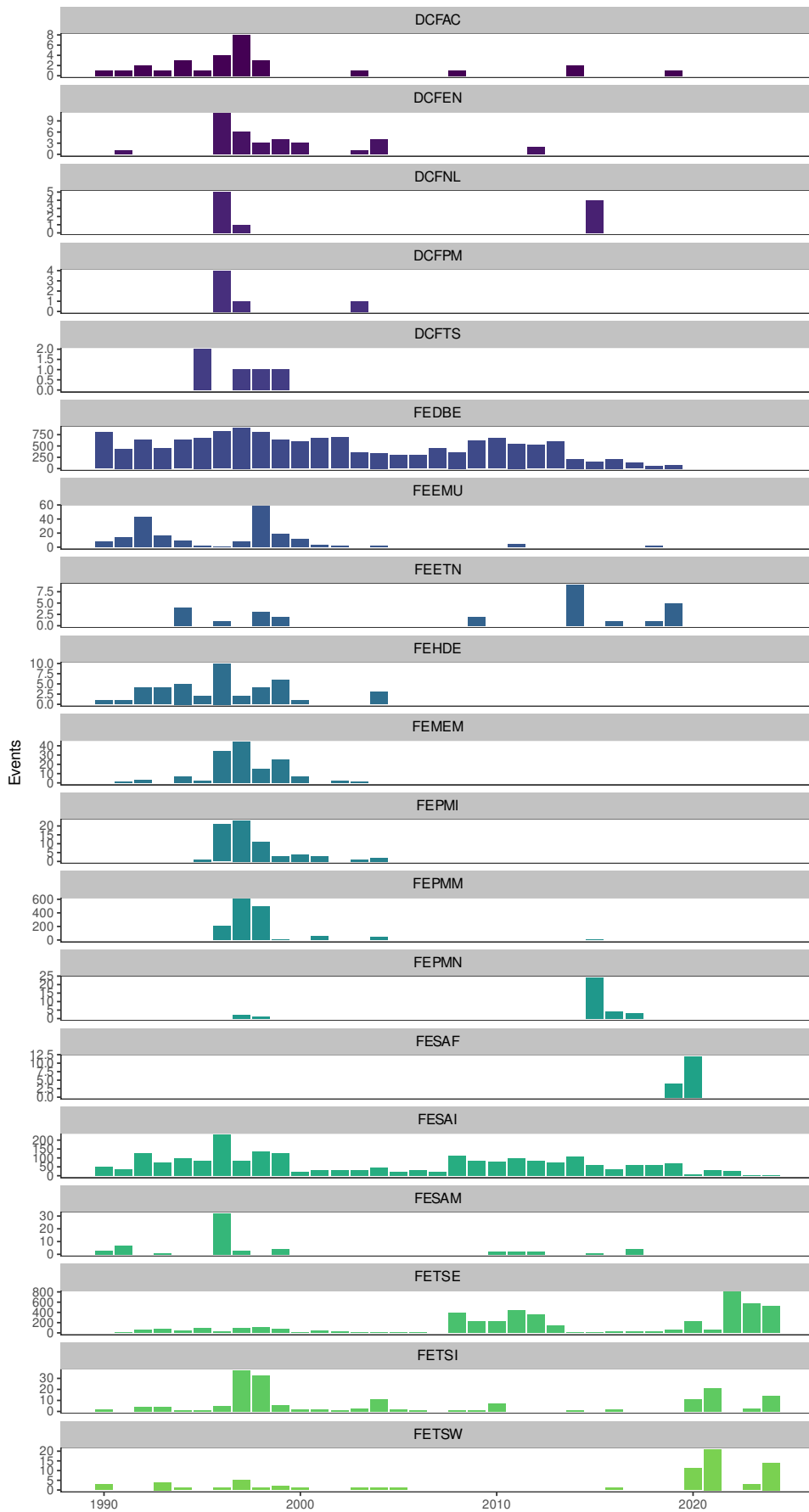


Figure A.5: The number of fishing events flagged or fixed by the grooming rules (Table A.3). Note that some events may be affected by multiple rules.

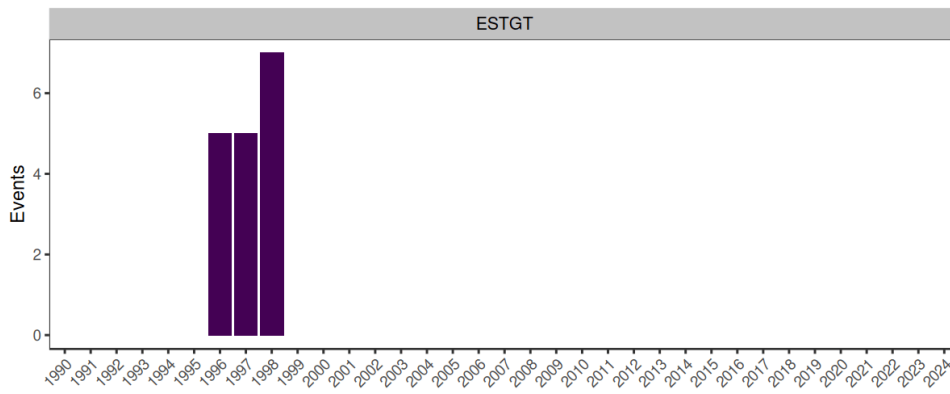


Figure A.6: The number of fishing events where the estimated catch of jack mackerels was flagged or fixed by the grooming rules (Table A.4). Note that some events may be affected by multiple rules.

APPENDIX B: TABULATED FISHERIES CHARACTERISATION DATA

Table B.1: Annual Total Allowable Commercial Catch (TACC; t) and Monthly Harvest Return/Quota Management Report totals (t) for JMA 7 from 1990 to 2024.

Fishing year	JMA 7	
	TACC	MHR/QMR
1990	17020.30	21 776.12
1991	23468.06	17 786.20
1992	24310.93	25 879.74
1993	26362.65	24 659.42
1994	29563.07	22 376.76
1995	32536.50	18 912.49
1996	32536.50	12 270.39
1997	32536.50	12 055.94
1998	32536.50	14 292.76
1999	32536.50	13 628.56
2000	32536.50	7 889.42
2001	32536.50	15 702.87
2002	32536.76	22 337.91
2003	32536.76	26 083.78
2004	32536.76	28 888.33
2005	32536.76	36 507.32
2006	32536.76	27 781.80
2007	32536.76	32 039.47
2008	32536.76	34 059.24
2009	32536.76	28 827.76
2010	32536.76	31 152.31
2011	32536.76	28 176.51
2012	32536.76	28 266.15
2013	32536.76	31 776.15
2014	32536.76	35 174.91
2015	32536.76	33 969.77
2016	32536.76	30 875.41
2017	32536.76	33 801.51
2018	32536.76	34 189.99
2019	32536.76	31 751.74
2020	32536.76	31 450.72
2021	32536.76	31 809.55
2022	32536.76	27 782.46
2023	32536.76	34 549.35
2024	32536.76	34 149.32

Table B.2: Annual JMA 7 catches (t) from the different sources of data used in the fishery characterisation. QMR = Quota Management Reports; MHR = Monthly Harvest Returns. Catches represent groomed (Appendix A) landings/discards data summed by stock (see Table E.5 for destination codes included). Allocated catch represents catches allocated to fishing events in the characterisation dataset, with the percentage taken by key fishing methods indicated. Target catch is the allocated catch taken on fishing events where jack mackerels was targeted. – : no observations.

Fishing year	QMR/MHR (t)	Catches (t)	Allocated catches				Target catches	
			Total (t)	MW-PRM (%)	BT-PRB (%)	PS (%)	tonnes	%
1990	21 776.12	11 486.62	12 057.72	12.85	71.96	15.06	9 838.45	81.59
1991	17 786.20	14 462.22	14 375.22	26.71	53.22	19.84	11 466.35	79.76
1992	25 879.74	22 982.05	24 819.38	44.69	46.80	8.46	22 774.59	91.76
1993	24 659.42	25 121.97	24 987.83	22.91	57.52	19.50	22 926.22	91.75
1994	22 376.76	17 586.13	16 906.04	45.39	36.89	17.65	14 119.59	83.52
1995	18 912.49	19 670.13	19 757.40	70.71	19.15	10.03	15 509.36	78.50
1996	12 270.39	11 871.07	11 826.54	49.82	34.67	15.04	9 088.26	76.85
1997	12 055.94	11 027.32	11 124.90	61.34	34.13	4.48	8 918.71	80.17
1998	14 292.76	13 932.97	14 646.80	34.74	62.29	2.92	13 631.94	93.07
1999	13 628.56	12 596.33	12 530.42	72.71	23.17	4.00	11 395.86	90.95
2000	7 889.42	8 241.74	8 286.91	89.69	6.70	3.40	7 495.89	90.45
2001	15 702.87	14 179.63	14 189.24	88.14	10.75	1.03	13 566.24	95.61
2002	22 337.91	21 612.91	21 719.69	90.03	8.67	1.28	21 038.90	96.87
2003	26 083.78	26 503.71	26 531.05	96.50	2.64	0.85	25 768.13	97.12
2004	28 888.33	27 671.94	28 078.25	97.17	1.41	1.42	27 280.79	97.16
2005	36 507.32	37 613.37	37 721.77	98.46	1.20	0.30	35 592.13	94.35
2006	27 781.80	27 515.20	27 556.99	99.20	0.59	0.16	27 073.99	98.25
2007	32 039.47	31 226.31	31 241.78	97.79	1.72	0.49	30 424.66	97.38
2008	34 059.24	34 726.19	34 731.23	96.64	2.99	0.35	34 175.37	98.40
2009	28 827.76	28 532.86	28 560.45	98.65	1.25	0.07	28 041.06	98.18
2010	31 152.31	31 833.16	31 957.13	99.21	0.67	0.08	31 492.51	98.55
2011	28 176.51	28 113.61	28 194.05	99.24	0.68	0.04	27 964.81	99.19
2012	28 266.15	27 359.59	27 373.19	99.02	0.95	0.02	27 015.58	98.69
2013	31 776.15	32 751.82	32 818.40	99.18	0.60	0.20	32 085.36	97.77
2014	35 174.91	35 142.88	35 242.02	99.32	0.44	0.23	33 471.82	94.98
2015	33 969.77	33 954.82	34 089.81	99.30	0.69	0.00	30 531.28	89.56
2016	30 875.41	30 876.68	30 945.12	96.07	0.68	3.23	29 319.65	94.75
2017	33 801.51	33 701.23	33 811.51	99.56	0.44	0.00	33 127.46	97.98
2018	34 189.99	34 265.51	34 454.50	99.57	0.42	0.00	32 109.86	93.19
2019	31 751.74	31 680.42	31 701.40	99.28	0.72	0.00	30 708.52	96.87
2020	31 450.72	30 363.20	30 474.90	99.49	0.50	0.00	27 612.73	90.61
2021	31 809.55	32 896.73	33 002.62	99.51	0.49	0.00	32 408.51	98.20
2022	27 782.46	27 554.98	27 580.61	99.49	0.40	0.11	26 634.37	96.57
2023	34 549.35	34 774.96	34 663.67	99.47	0.52	0.00	33 965.62	97.99
2024	34 149.32	34 146.91	34 225.08	99.61	0.38	0.01	33 671.72	98.38

Table B.3: Annual jack mackerels catches (t) by destination code for the JMA 7 Quota Management Area. L = Landings to an LFR, T = Transhipments. A complete list of destination codes is provided in Table E.5. – : no observations.

Fishing year	L	T	Other	Total
1990	3 328.85	7 842.90	314.87	11 486.62
1991	5 175.09	8 622.11	665.03	14 462.22
1992	8 933.61	13 914.83	133.61	22 982.05
1993	8 494.22	15 454.73	1 173.02	25 121.97
1994	10 184.12	7 379.98	22.04	17 586.13
1995	13 488.52	5 547.46	634.15	19 670.13
1996	9 357.64	2 384.01	129.42	11 871.07
1997	9 139.21	1 770.04	118.07	11 027.32
1998	12 939.45	642.29	351.23	13 932.97
1999	12 266.02	7.45	322.86	12 596.33
2000	8 239.90	0.81	1.04	8 241.74
2001	14 169.86	0.29	9.48	14 179.63
2002	21 603.62	-	9.29	21 612.91
2003	26 499.20	-	4.51	26 503.71
2004	27 667.17	-	4.77	27 671.94
2005	37 598.10	-	15.26	37 613.37
2006	27 507.29	-	7.91	27 515.20
2007	31 218.22	-	8.09	31 226.31
2008	34 718.96	-	7.24	34 726.19
2009	28 524.57	0.01	8.29	28 532.86
2010	31 818.28	-	14.88	31 833.16
2011	28 103.20	-	10.41	28 113.61
2012	27 338.85	-	20.75	27 359.59
2013	32 727.76	-	24.07	32 751.82
2014	35 109.33	-	33.55	35 142.88
2015	33 940.80	-	14.02	33 954.82
2016	30 858.15	-	18.54	30 876.68
2017	33 685.57	-	15.66	33 701.23
2018	34 128.04	-	137.47	34 265.51
2019	31 642.73	-	37.69	31 680.42
2020	29 999.51	-	363.69	30 363.20
2021	32 888.47	-	8.26	32 896.73
2022	27 545.35	-	9.63	27 554.98
2023	34 051.61	-	723.35	34 774.96
2024	34 071.80	-	75.11	34 146.91

Table B.4: Annual catches (t) by landed state of jack mackerels from the JMA 7 Quota Management Area. DRE = Dressed, FIL = Fillets: skin-on, GRE = Green (or whole), HGT = Headed, gutted, and tailed, HGU = Headed and gutted, MEA = Fish meal, SUR = Surimi. A complete list of product state codes is provided in Table E.1. – : no observations. Records where the landed state was missing were excluded.

Fishing year	DRE	GRE	MEA	HGU	FIL	HGT	SUR	Other	Total
1990	-	6 082.98	155.28	4 892.46	-	336.38	19.44	0.09	11 486.62
1991	6 307.55	6 831.05	119.16	1 073.08	1.16	120.85	9.37	-	14 462.22
1992	15 422.70	6 959.24	141.06	445.01	13.77	-	0.17	0.09	22 982.05
1993	13 564.41	8 283.76	116.61	1 176.42	1 980.55	-	-	0.23	25 121.97
1994	11 158.08	4 622.58	505.53	1 151.59	148.09	-	-	0.27	17 586.13
1995	15 422.16	3 542.49	679.52	0.69	6.38	-	13.51	5.39	19 670.13
1996	7 672.30	3 750.00	447.82	0.41	-	-	-	0.53	11 871.05
1997	7 648.02	2 682.13	690.21	1.27	-	-	5.33	0.01	11 026.97
1998	11 429.15	1 314.28	1 187.92	1.10	0.03	-	-	0.45	13 932.92
1999	7 784.35	4 462.21	348.67	0.17	0.04	-	-	0.89	12 596.33
2000	5 959.16	1 821.08	460.66	0.01	0.04	-	-	0.80	8 241.74
2001	11 448.28	1 796.62	934.20	0.53	-	-	-	0.01	14 179.63
2002	16 632.82	3 442.07	1 532.37	0.01	-	-	-	5.64	21 612.91
2003	21 785.09	2 731.48	1 987.15	-	-	-	-	-	26 503.71
2004	20 980.38	4 687.71	2 003.77	-	0.07	-	-	0.02	27 671.94
2005	26 853.43	7 136.36	3 622.64	-	0.88	-	-	0.06	37 613.37
2006	22 132.55	3 935.31	1 447.20	0.00	-	-	-	0.13	27 515.20
2007	27 270.84	2 804.48	1 150.93	0.03	0.01	-	-	0.03	31 226.31
2008	26 363.36	6 772.87	1 589.71	-	-	-	-	0.25	34 726.19
2009	24 222.97	3 463.84	845.88	-	-	-	-	0.17	28 532.86
2010	26 316.31	4 291.37	1 223.23	0.11	-	-	-	2.14	31 833.16
2011	19 184.00	7 774.05	1 155.16	0.38	-	-	-	0.01	28 113.61
2012	17 664.85	7 845.78	1 676.21	0.01	172.72	-	-	0.03	27 359.59
2013	17 909.40	12 736.21	2 105.95	0.03	0.00	-	-	0.05	32 751.65
2014	16 942.64	16 831.30	1 351.68	-	17.18	-	-	0.08	35 142.88
2015	14 794.87	18 045.92	1 113.64	-	-	-	-	0.40	33 954.82
2016	16 491.33	13 322.62	1 006.62	0.00	54.56	-	-	1.55	30 876.68
2017	20 764.65	11 594.38	1 307.31	0.07	34.82	-	-	0.01	33 701.23
2018	14 364.07	18 541.31	1 315.64	0.08	44.12	-	-	0.29	34 265.51
2019	15 227.62	15 037.58	1 382.28	-	32.64	-	-	0.29	31 680.41
2020	10 362.99	18 877.95	1 122.26	-	-	-	-	-	30 363.20
2021	11 731.50	19 308.45	1 801.94	-	54.80	-	-	0.04	32 896.73
2022	9 065.46	17 259.28	1 224.12	-	5.00	-	-	1.11	27 554.98
2023	7 043.39	25 808.99	1 905.53	0.04	17.01	-	-	-	34 774.96
2024	3 076.71	29 247.56	1 822.12	-	0.52	-	-	-	34 146.91

Table B.5: Annual modal conversion factor reported for product state codes of jack mackerels from the JMA 7 Quota Management Areas. DRE = Dressed, FIL = Fillets: skin-on, GRE = Green (or whole), GUT = Gutted, HGT = Headed, gutted, and tailed, HGU = Headed and gutted, MEA = Fish meal, SKF = Fillets: skin-off, SUR = Surimi. – : no observations.

Fishing year	GRE	GUT	HGT	HGU	MEA	SUR	DRE	FIL	SKF
1990	1.00	1.10	1.60	1.50	5.56	4.30	-	-	-
1991	1.00	-	1.60	1.50	5.60	4.30	1.60	2.50	-
1992	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
1993	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
1994	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
1995	1.00	1.10	-	1.50	5.60	4.30	1.60	2.50	-
1996	1.00	1.10	-	1.50	5.60	-	1.60	-	-
1997	1.00	1.10	-	1.50	5.60	4.30	1.60	-	-
1998	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
1999	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2000	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2001	1.00	1.10	-	1.50	5.60	-	1.60	-	-
2002	1.00	1.10	-	1.50	5.60	-	1.60	-	-
2003	1.00	-	-	-	5.60	-	1.60	-	-
2004	1.00	-	-	-	5.60	-	1.60	2.50	3.10
2005	1.00	1.10	-	-	5.60	-	1.60	2.50	-
2006	1.00	1.10	-	1.50	5.60	-	1.60	-	-
2007	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2008	1.00	1.10	-	-	5.60	-	1.60	-	-
2009	1.00	1.10	-	-	5.60	-	1.60	-	-
2010	1.00	1.10	-	1.50	5.60	-	1.60	-	-
2011	1.00	1.10	-	1.50	5.60	-	1.60	-	-
2012	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2013	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2014	1.00	1.10	-	-	5.60	-	1.60	2.50	-
2015	1.00	1.10	-	-	5.60	-	1.60	-	-
2016	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2017	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2018	1.00	1.10	-	1.50	5.60	-	1.60	2.50	-
2019	1.00	1.10	-	-	5.60	-	1.60	2.50	-
2020	1.00	-	-	-	-	-	1.60	-	-
2021	1.00	1.10	-	-	-	-	1.60	2.50	-
2022	1.00	1.10	-	-	-	-	1.60	2.50	-
2023	1.00	-	-	1.50	-	-	1.60	2.50	-
2024	1.00	-	-	-	-	-	1.60	2.50	-

Table B.6: Reporting forms used for effort on trips landing jack mackerels from the JMA 7 Quota Management Area in terms of data records and their allocated catches. A complete list of form type codes is provided in Table E.2. – : no observations.

Fishing year	Records (N)						Allocated catches (t)					
	TCP	CEL	Other	TCE	ERS - Trawl	Total	TCP	CEL	Other	TCE	ERS - Trawl	Total
1990	8358	1676	-	-	-	10034	10168.40	1889.32	-	-	-	12057.72
1991	8492	2394	-	-	-	10886	11359.84	3015.38	-	-	-	14375.22
1992	8349	2429	-	-	-	10778	22584.87	2234.51	-	-	-	24819.38
1993	8747	3080	-	-	-	11827	19951.07	5036.76	-	-	-	24987.83
1994	10932	2874	2	-	-	13808	13790.57	3115.47	0.00	-	-	16906.04
1995	13372	3061	-	-	-	16433	17612.77	2144.63	-	-	-	19757.40
1996	12366	2492	-	-	-	14858	9914.69	1911.85	-	-	-	11826.54
1997	13268	2872	-	-	-	16140	10421.28	703.62	-	-	-	11124.90
1998	13340	2166	-	-	-	15506	14118.39	528.41	-	-	-	14646.80
1999	12758	2952	-	-	-	15710	11794.05	736.37	-	-	-	12530.42
2000	11180	2825	-	-	-	14005	7824.06	462.85	-	-	-	8286.91
2001	11361	3025	-	-	-	14386	13869.35	319.89	-	-	-	14189.24
2002	11120	2937	3	-	-	14060	21238.57	481.10	0.02	-	-	21719.69
2003	11677	2895	4	-	-	14576	26089.30	441.75	0.00	-	-	26531.05
2004	11921	2737	-	-	-	14658	27519.57	558.68	-	-	-	28078.25
2005	11079	2562	-	-	-	13641	37461.13	260.63	-	-	-	37721.77
2006	7999	1467	-	-	-	9466	27478.01	78.98	-	-	-	27556.99
2007	8764	2116	143	-	-	11023	31039.77	201.38	0.63	-	-	31241.78
2008	7197	174	134	7957	-	15462	34536.79	123.39	1.11	69.94	-	34731.23
2009	5699	324	362	9067	-	15452	28424.02	25.24	1.18	110.00	-	28560.45
2010	5410	253	269	10399	-	16331	31801.00	26.79	1.34	128.01	-	31957.13
2011	4949	291	316	10562	-	16118	28048.71	12.22	2.06	131.06	-	28194.05
2012	5750	415	317	9952	-	16434	27254.09	4.51	3.80	110.79	-	27373.19
2013	5641	278	385	9836	-	16140	32599.10	67.30	3.58	148.41	-	32818.40
2014	6607	336	413	8621	-	15977	35031.74	79.83	4.30	126.16	-	35242.02
2015	7212	253	366	8667	-	16498	33956.77	0.36	2.62	130.06	-	34089.81
2016	6469	261	243	8201	-	15174	29789.08	1000.11	4.80	151.12	-	30945.12
2017	6694	209	223	8590	-	15716	33701.65	0.27	1.76	107.83	-	33811.51
2018	415	227	261	8698	6411	16012	3907.24	0.59	1.46	97.62	30447.60	34454.50
2019	-	249	283	6178	7617	14327	-	0.27	0.76	78.18	31622.20	31701.40
2020	-	11	709	-	12823	13543	-	0.01	1.86	-	30473.04	30474.90
2021	-	-	676	-	12008	12684	-	-	1.26	-	33001.36	33002.62
2022	-	-	528	-	11676	12204	-	-	32.07	-	27548.54	27580.61
2023	-	-	447	-	11160	11607	-	-	0.95	-	34662.71	34663.67
2024	-	-	698	-	11547	12245	-	-	3.80	-	34221.28	34225.08

Table B.7: Allocated catches (t) of jack mackerels in JMA 7 by method of capture and fishing year. A complete list of fishing method codes is provided in Table E.3. – : no observations.

Fishing year	BT	MW	PS	Other	Total
1990	8676.51	1549.90	1815.95	15.36	12057.72
1991	7650.80	3839.13	2851.56	33.72	14375.22
1992	11614.24	11091.04	2100.84	13.26	24819.38
1993	14373.31	5725.70	4873.29	15.53	24987.83
1994	6236.09	7673.88	2984.51	11.57	16906.04
1995	3784.03	13971.14	1982.12	20.12	19757.40
1996	4100.43	5891.85	1779.04	55.22	11826.54
1997	3797.32	6823.75	498.90	4.92	11124.90
1998	9123.53	5088.31	428.39	6.57	14646.80
1999	2903.52	9111.23	501.77	13.90	12530.42
2000	554.87	7432.29	282.00	17.76	8286.91
2001	1525.71	12506.03	146.12	11.37	14189.24
2002	1884.07	19555.13	278.16	2.34	21719.69
2003	700.05	25601.47	224.55	4.98	26531.05
2004	395.17	27282.63	397.65	2.81	28078.25
2005	453.85	37141.57	114.59	11.76	37721.77
2006	163.19	27336.43	44.58	12.79	27556.99
2007	537.18	30550.35	153.46	0.79	31241.78
2008	1038.42	33563.76	122.38	6.67	34731.23
2009	356.97	28175.97	20.98	6.53	28560.45
2010	214.07	31704.24	26.41	12.41	31957.13
2011	192.40	27980.50	12.00	9.15	28194.05
2012	260.93	27103.95	4.13	4.18	27373.19
2013	196.64	32550.87	66.85	4.03	32818.40
2014	155.55	35002.34	79.62	4.51	35242.02
2015	233.81	33851.80	0.11	4.09	34089.81
2016	205.16	29728.43	999.90	11.63	30945.12
2017	141.81	33655.70	0.05	13.95	33811.51
2018	128.36	34306.57	0.39	19.19	34454.50
2019	221.43	31472.66	0.01	7.30	31701.40
2020	152.00	30319.25	0.05	3.59	30474.90
2021	158.83	32840.24	0.69	2.86	33002.62
2022	100.26	27439.42	31.60	9.33	27580.61
2023	175.57	34481.14	0.58	6.38	34663.67
2024	115.78	34091.16	3.20	14.94	34225.08

Table B.8: Bootstrap mean estimates of catches (tonnes) of jack mackerel species by stratum and year. Catches that were reported from outside the two estimation strata were not separated by species.

Fishing year	NE stratum			SW stratum			Other areas
	JMD	JMM	JMN	JMD	JMM	JMN	JMA
1990	3 082.63	37.85	6 830.15	1 718.89	388.18	0.00	17.95
1991	5 038.70	31.10	6 120.58	1 366.97	1 809.98	7.83	48.51
1992	7 285.92	684.70	6 955.43	5 436.87	4 325.80	130.66	-
1993	12 025.15	3 062.90	4 680.69	2 278.91	2 940.18	0.00	-
1994	5 138.73	808.69	4 259.16	2 712.25	3 951.74	35.46	4.72
1995	2 817.96	2 395.87	2 968.39	2 822.65	8 752.53	0.00	-
1996	2 709.95	1 113.69	1 831.18	2 259.30	3 911.98	0.00	437.64
1997	3 389.66	445.67	1 864.81	1 399.80	4 000.22	24.65	85.12
1998	5 382.64	1 382.11	3 832.19	410.72	3 639.11	0.00	25.00
1999	2 890.10	384.70	2 985.84	5 270.85	998.90	0.00	16.27
2000	3 042.26	933.70	569.61	2 005.18	1 736.10	0.00	59.05
2001	6 567.20	1 856.77	1 127.46	3 574.23	303.16	760.42	-
2002	10 635.72	801.13	4 462.91	4 228.53	1 292.84	298.57	-
2003	12 910.72	1 836.46	6 181.30	5 282.98	304.02	15.58	-
2004	21 001.56	1 805.91	3 282.38	1 698.48	289.92	0.00	-
2005	16 874.09	3 180.58	13 934.35	3 428.16	304.31	0.00	289.20
2006	18 596.26	2 287.22	4 498.42	2 163.45	11.62	0.00	18.52
2007	19 193.56	1 054.12	4 977.37	5 295.47	710.10	11.15	15.88
2008	20 191.68	3 017.29	5 969.67	4 210.33	1 312.98	29.27	16.13
2009	16 136.40	2 275.25	5 310.51	4 181.11	640.44	16.74	-
2010	20 397.35	2 989.30	6 393.37	1 699.02	452.57	25.52	-
2011	18 859.51	592.62	5 708.80	2 860.36	158.93	13.82	-
2012	17 127.79	1 301.53	5 706.94	3 069.43	130.58	36.91	-
2013	19 769.09	1 382.31	7 481.97	4 021.10	158.14	5.78	8.16
2014	17 832.18	1 466.16	7 167.61	8 054.44	422.52	299.09	27.00
2015	17 099.58	2 012.43	7 835.34	6 633.06	454.62	54.79	0.80
2016	15 552.09	1 806.59	6 842.87	6 257.77	449.74	36.06	-
2017	14 894.89	1 089.24	6 913.66	10 032.90	311.53	569.29	-
2018	15 229.99	1 499.66	8 602.91	7 811.95	1 265.93	44.07	-
2019	15 567.35	2 189.96	5 652.42	7 656.89	617.62	17.17	-
2020	15 987.17	2 326.63	6 958.65	4 948.08	11.06	243.31	-
2021	15 739.48	1 043.51	8 180.03	7 477.98	338.08	223.54	-
2022	14 296.47	329.40	7 141.77	5 394.19	19.15	399.64	-
2023	15 567.46	270.53	13 418.45	5 289.55	18.63	99.06	-
2024	24 571.20	298.77	6 764.90	2 477.34	36.02	76.85	-

APPENDIX C: CPUE SERIES DIAGNOSTICS

C.1 JMD7 MW observer

Table C.1: Definition for the dataset, core fleet criteria, and Generalised Linear Modelling approach used in the catch-per-unit-effort (CPUE) standardisation for the JMD7 MW observer CPUE series.

Series	JMD7 MW observer
QMS stock	JMA 7
Reporting forms	Observer data collection
Fishing methods	MW
Target species	JMA, JMD, JMM, JMN
Statistical Areas	034, 035, 036, 037, 039, 040, 041, 042, 045, 801
Period	1998-10-01, 2024-09-30
Resolution	Observed event
Core fleet years	4
Core fleet trips	1
Default model	$\text{jmdkg} \sim \text{fyear} + \text{vessel_key} + \text{month} + \text{stat_area} + \text{ns}(\log(\text{fishing_duration}), 3) + \text{ns}(\log(\text{start_time}), 3) + \text{ns}(\log(\text{start_seabed_depth}), 3) + \text{ns}(\log(\text{headline_height}), 3) + \text{ns}(\text{fishing_speed}, 3)$
Stepwise selection	Yes
Positive catch distribution	Weibull

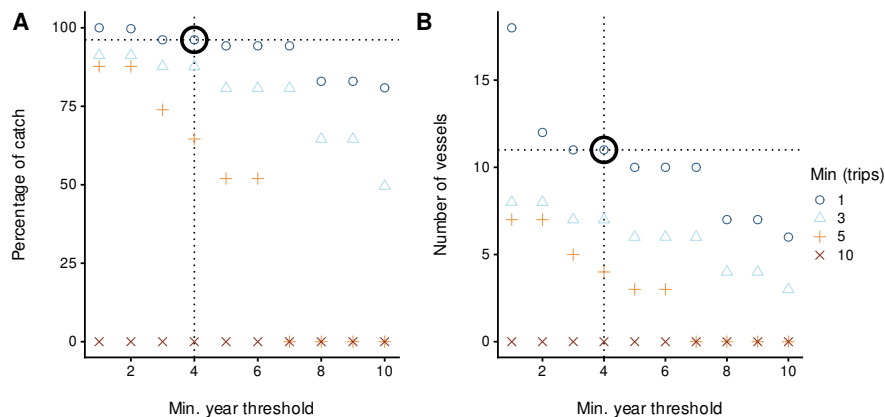


Figure C.1: Percentage of catch and number of vessels for different core vessel selection criteria for the JMD7 MW observer CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel was observed in the fishery and the number of observed trips per year.

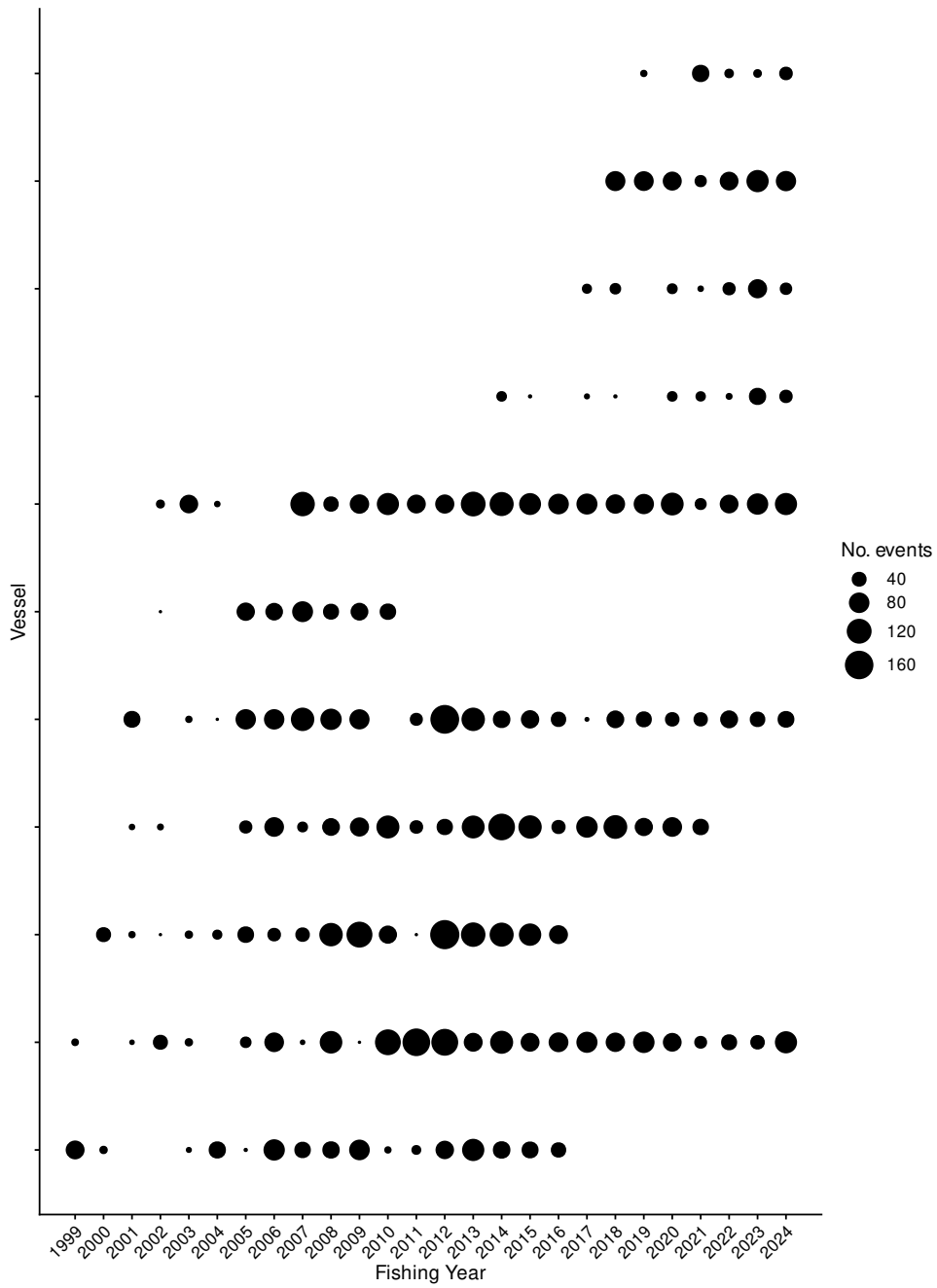


Figure C.2: Number of events by fishing year for core vessels in the JMD7 MW observer series. The area of the circles is proportional to the number of events undertaken by a vessel in a fishing year.

Table C.2: Summary of the JMD7 MW observer dataset total catch (tonnes) and number of records (n), by fishing year after the application of various filters. The first row gives the catch and number of records before filters were applied (ungroomed data). Subsequent rows display the remaining catch (and percent of catch), and the number of records, after the specified filter was applied. Catch data for years with less than three vessels are omitted (indicated by x). (Continued on next 3 pages)

Filter	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ungroomed data	x (100%) n: 116	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	686 (100%) n: 102	1171 (100%) n: 79	2467 (100%) n: 258	4706 (100%) n: 409	4262 (100%) n: 429
Fishing speed not null	x (95%) n: 112	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	686 (100%) n: 102	1171 (100%) n: 79	2435 (99%) n: 256	4706 (100%) n: 409	4262 (100%) n: 429
Start date not null	x (95%) n: 112	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	686 (100%) n: 102	1171 (100%) n: 79	2435 (99%) n: 256	4706 (100%) n: 409	4262 (100%) n: 429
End date not null	x (95%) n: 112	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	686 (100%) n: 102	1171 (100%) n: 79	2435 (99%) n: 256	4706 (100%) n: 409	4262 (100%) n: 429
Start depth not null	x (95%) n: 112	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	686 (100%) n: 102	1171 (100%) n: 79	2435 (99%) n: 256	4706 (100%) n: 409	4262 (100%) n: 429
Headline height not null	x (94%) n: 111	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	678 (99%) n: 101	1171 (100%) n: 79	2435 (99%) n: 256	4706 (100%) n: 409	4262 (100%) n: 429
Fishing speed >3.5kn	x (94%) n: 111	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	678 (99%) n: 101	1171 (100%) n: 79	2435 (99%) n: 256	4706 (100%) n: 409	4262 (100%) n: 428
Headline height >15m	x (94%) n: 111	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	674 (98%) n: 100	1171 (100%) n: 79	2434 (99%) n: 255	4697 (100%) n: 408	4227 (99%) n: 424
Headline height <90m	x (94%) n: 111	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	674 (98%) n: 100	1171 (100%) n: 79	2434 (99%) n: 255	4697 (100%) n: 408	4227 (99%) n: 424
Fishing duration >15mins	x (92%) n: 109	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	674 (98%) n: 100	1171 (100%) n: 79	2433 (99%) n: 254	4628 (98%) n: 407	4174 (98%) n: 423
Seabed depth >50m	x (92%) n: 109	x (100%) n: 54	841 (100%) n: 76	472 (100%) n: 66	674 (98%) n: 100	1171 (100%) n: 79	2433 (99%) n: 254	4628 (98%) n: 407	4174 (98%) n: 423
Seabed depth <400m	x (91%) n: 108	x (97%) n: 53	841 (100%) n: 76	472 (100%) n: 66	674 (98%) n: 100	1171 (100%) n: 79	2423 (98%) n: 252	4628 (98%) n: 407	4174 (98%) n: 423
Start time >0	x (91%) n: 107	x (96%) n: 52	841 (100%) n: 76	436 (92%) n: 63	674 (98%) n: 100	1171 (100%) n: 79	2399 (97%) n: 249	4613 (98%) n: 403	4087 (96%) n: 417
Core fleet selection	x (73%) n: 76	x (96%) n: 52	837 (100%) n: 71	436 (92%) n: 63	674 (98%) n: 100	1171 (100%) n: 79	2399 (97%) n: 249	4613 (98%) n: 403	4087 (96%) n: 417

Filter	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ungroomed data	4943 (100%) n: 512	5881 (100%) n: 524	4443 (100%) n: 487	4202 (100%) n: 309	9693 (100%) n: 715	9843 (100%) n: 641	11383 (100%) n: 669	9856 (100%) n: 593	6348 (100%) n: 389
Fishing speed not null	4884 (99%) n: 511	5881 (100%) n: 524	4423 (100%) n: 486	4202 (100%) n: 309	9693 (100%) n: 715	9805 (100%) n: 640	11383 (100%) n: 669	9856 (100%) n: 593	6333 (100%) n: 388
Start date not null	4884 (99%) n: 511	5881 (100%) n: 524	4423 (100%) n: 486	4202 (100%) n: 309	9693 (100%) n: 715	9805 (100%) n: 640	11383 (100%) n: 669	9856 (100%) n: 593	6333 (100%) n: 388
End date not null	4884 (99%) n: 511	5881 (100%) n: 524	4423 (100%) n: 486	4202 (100%) n: 309	9693 (100%) n: 715	9805 (100%) n: 640	11383 (100%) n: 669	9856 (100%) n: 593	6333 (100%) n: 388
Start depth not null	4873 (99%) n: 509	5625 (96%) n: 499	4375 (98%) n: 483	4129 (98%) n: 305	9151 (94%) n: 679	9317 (95%) n: 619	11338 (100%) n: 666	9786 (99%) n: 577	6333 (100%) n: 388
Headline height not null	4873 (99%) n: 509	5602 (95%) n: 497	4286 (96%) n: 475	4086 (97%) n: 304	9047 (93%) n: 672	9262 (94%) n: 615	11249 (99%) n: 663	9786 (99%) n: 576	6333 (100%) n: 388
Fishing speed >3.5kn	4873 (99%) n: 509	5602 (95%) n: 497	4286 (96%) n: 475	4086 (97%) n: 304	9047 (93%) n: 672	9262 (94%) n: 615	11249 (99%) n: 663	9786 (99%) n: 576	6331 (100%) n: 387
Headline height >15m	4873 (99%) n: 509	5583 (95%) n: 495	4250 (96%) n: 474	4086 (97%) n: 304	8983 (93%) n: 671	9187 (93%) n: 612	11249 (99%) n: 663	9786 (99%) n: 576	6331 (100%) n: 387
Headline height <90m	4873 (99%) n: 509	5583 (95%) n: 495	4250 (96%) n: 474	4076 (97%) n: 303	8972 (93%) n: 670	9187 (93%) n: 612	11231 (99%) n: 662	9771 (99%) n: 575	6331 (100%) n: 387
Fishing duration >15mins	4873 (99%) n: 508	5583 (95%) n: 495	4250 (96%) n: 474	3999 (95%) n: 300	8951 (92%) n: 669	9148 (93%) n: 610	11226 (99%) n: 660	9771 (99%) n: 575	6328 (100%) n: 386
Seabed depth >50m	4873 (99%) n: 508	5569 (95%) n: 493	4243 (96%) n: 473	3999 (95%) n: 300	8951 (92%) n: 668	9130 (93%) n: 609	11226 (99%) n: 660	9755 (99%) n: 574	6328 (100%) n: 386
Seabed depth <400m	4854 (98%) n: 505	5569 (95%) n: 493	4234 (95%) n: 472	3999 (95%) n: 300	8838 (91%) n: 661	9105 (93%) n: 607	11222 (99%) n: 659	9675 (98%) n: 571	6328 (100%) n: 386
Start time >0	4664 (94%) n: 496	5546 (94%) n: 490	4155 (94%) n: 468	3985 (95%) n: 297	8807 (91%) n: 654	9046 (92%) n: 604	11067 (97%) n: 649	9618 (98%) n: 568	6287 (99%) n: 383
Core fleet selection	4664 (94%) n: 496	5546 (94%) n: 489	3954 (89%) n: 446	3985 (95%) n: 297	8807 (91%) n: 654	9046 (92%) n: 604	8856 (78%) n: 598	7232 (73%) n: 478	5407 (85%) n: 344

Filter	2017	2018	2019	2020	2021	2022	2023	2024
Ungroomed data	5899 (100%) n: 309	8658 (100%) n: 433	8557 (100%) n: 380	6557 (100%) n: 397	5650 (100%) n: 259	5534 (100%) n: 331	5505 (100%) n: 410	9558 (100%) n: 418
Fishing speed not null	5820 (99%) n: 307	8658 (100%) n: 433	8557 (100%) n: 380	6477 (99%) n: 395	5497 (97%) n: 255	5534 (100%) n: 330	5500 (100%) n: 409	9558 (100%) n: 418
Start date not null	5820 (99%) n: 307	8658 (100%) n: 433	8557 (100%) n: 380	6477 (99%) n: 395	5497 (97%) n: 255	5534 (100%) n: 330	5500 (100%) n: 409	9558 (100%) n: 418
End date not null	5820 (99%) n: 307	8658 (100%) n: 433	8557 (100%) n: 380	6477 (99%) n: 395	5497 (97%) n: 255	5534 (100%) n: 330	5500 (100%) n: 409	9558 (100%) n: 418
Start depth not null	5764 (98%) n: 304	8646 (100%) n: 432	8557 (100%) n: 380	6477 (99%) n: 389	5438 (96%) n: 249	4615 (83%) n: 292	5500 (100%) n: 409	9558 (100%) n: 418
Headline height not null	5646 (96%) n: 300	8618 (100%) n: 430	8557 (100%) n: 380	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5444 (99%) n: 404	9536 (100%) n: 417
Fishing speed >3.5kn	5646 (96%) n: 300	8618 (100%) n: 430	8557 (100%) n: 380	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5444 (99%) n: 404	9536 (100%) n: 417
Headline height >15m	5636 (96%) n: 299	8618 (100%) n: 430	8557 (100%) n: 380	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5444 (99%) n: 404	9536 (100%) n: 417
Headline height <90m	5636 (96%) n: 299	8577 (99%) n: 428	8557 (100%) n: 380	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5373 (98%) n: 400	9536 (100%) n: 417
Fishing duration >15mins	5624 (95%) n: 298	8577 (99%) n: 428	8522 (100%) n: 379	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5373 (98%) n: 400	9536 (100%) n: 417
Seabed depth >50m	5624 (95%) n: 298	8532 (99%) n: 427	8522 (100%) n: 379	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5373 (98%) n: 400	9536 (100%) n: 417
Seabed depth <400m	5624 (95%) n: 298	8510 (98%) n: 425	8406 (98%) n: 377	6447 (98%) n: 387	5438 (96%) n: 249	4615 (83%) n: 292	5373 (98%) n: 400	9536 (100%) n: 417
Start time >0	5546 (94%) n: 296	8505 (98%) n: 424	8366 (98%) n: 376	6401 (98%) n: 384	5374 (95%) n: 247	4615 (83%) n: 292	5373 (98%) n: 400	9536 (100%) n: 417
Core fleet selection	5421 (92%) n: 282	7749 (90%) n: 411	7855 (92%) n: 357	6401 (98%) n: 384	5374 (95%) n: 247	4615 (83%) n: 292	5373 (98%) n: 400	9536 (100%) n: 410

Table C.3: Summary of the JMD7 MW observer dataset after core fleet selection. ‘Records’ indicates the number of rows (events) in the dataset, and ‘Records caught’ indicates the percentage of events with catches of jack mackerels. Catch and effort data for years with less than three vessels are omitted (indicated by x).

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
1999	2	x	76	x	x	100.00
2000	2	x	52	x	x	98.08
2001	4	6	71	186.82	837.16	100.00
2002	5	5	63	222.12	435.58	100.00
2003	5	5	100	362.33	674.22	98.00
2004	4	4	79	333.28	1 171.09	96.20
2005	6	9	249	847.98	2 399.42	98.80
2006	6	8	403	1 479.25	4 613.02	97.52
2007	7	15	417	1 513.20	4 087.29	96.40
2008	7	17	496	1 929.95	4 664.44	94.56
2009	7	15	489	2 034.32	5 545.87	96.11
2010	6	11	446	1 961.88	3 954.47	97.53
2011	6	8	297	1 364.08	3 984.70	96.97
2012	6	20	654	3 379.40	8 806.85	96.18
2013	6	31	604	2 900.57	9 045.85	94.87
2014	7	32	598	2 795.87	8 856.25	93.65
2015	7	32	478	2 361.98	7 232.21	93.93
2016	6	29	344	1 611.68	5 406.64	92.73
2017	6	25	282	1 483.97	5 420.54	95.04
2018	7	30	411	2 455.30	7 749.00	89.78
2019	6	24	357	1 915.25	7 854.84	97.76
2020	7	30	384	1 995.42	6 401.29	87.50
2021	8	21	247	1 353.33	5 373.98	97.17
2022	7	19	292	1 360.50	4 615.19	92.12
2023	7	17	400	2 435.18	5 372.99	88.25
2024	7	19	410	2 558.72	9 535.69	98.78

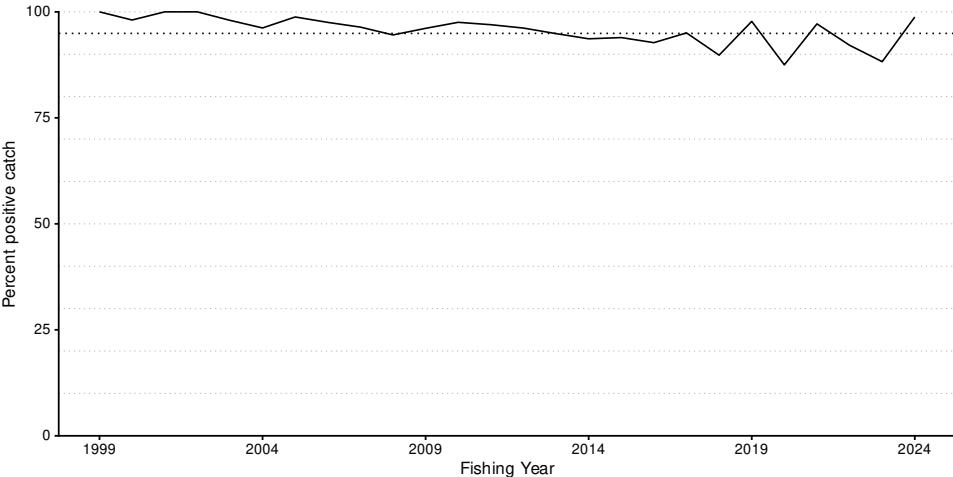


Figure C.3: Percentage of positive catch records in the JMD7 MW observer catch-per-unit-effort dataset.

Table C.4: Summary of stepwise selection for the Weibull model for positive catches in the JMD7 MW observer series. Model terms are listed in the order of acceptance to the model. AIC: Akaike Information Criterion; *: Term included in final model.

Predictor	df	AIC	% deviance	addl. % deviance	Included
fyear	27	174797	7.4	7.4	*
+ ns(log(start_seabed_depth), 3)	3	174198	13.7	6.3	*
+ ns(log(fishing_duration), 3)	3	174021	15.6	1.9	*
+ month	11	173862	17.5	1.9	*
+ ns(log(headline_height), 3)	3	173704	19.2	1.7	*
+ stat_area	9	173597	20.5	1.3	*
+ vessel_key	10	173557	21.1	0.6	
+ ns(log(start_time), 3)	3	173549	21.2	0.1	
+ ns(fishing_speed, 3)	3	173548	21.3	0.1	

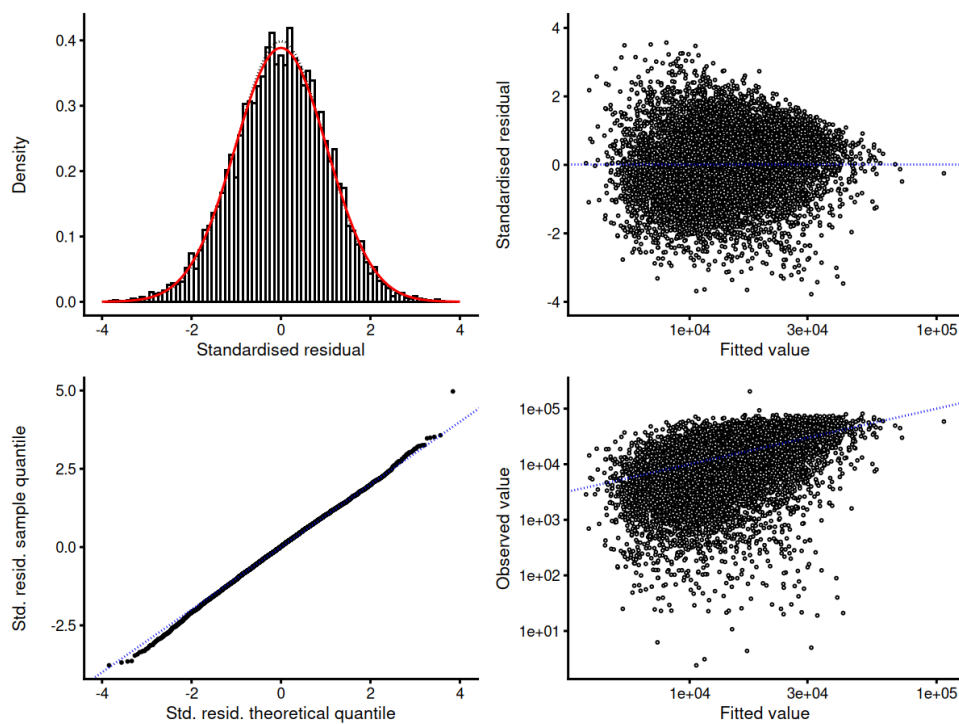


Figure C.4: Diagnostic plots for the selected Weibull model for positive catches in the JMD7 MW observer dataset.

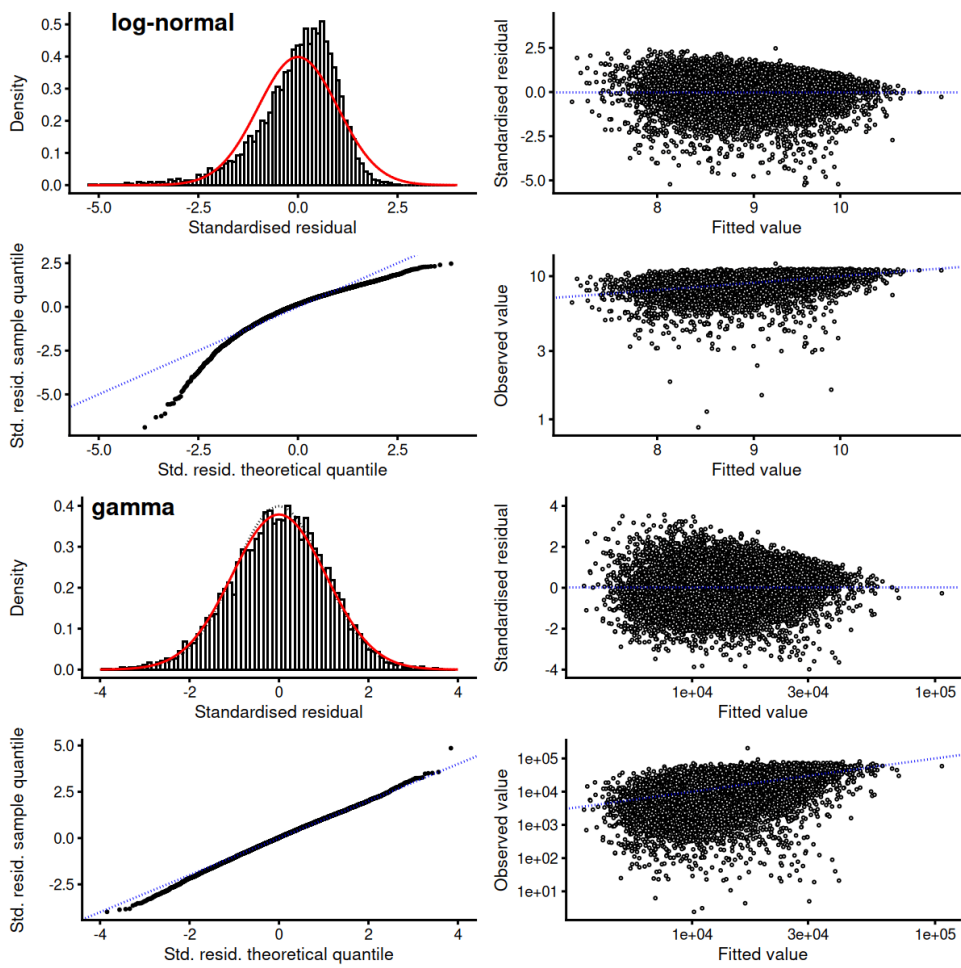


Figure C.5: Diagnostic plots for the alternative log-normal and gamma models considered for positive catches in the JMD7 MW observer dataset.

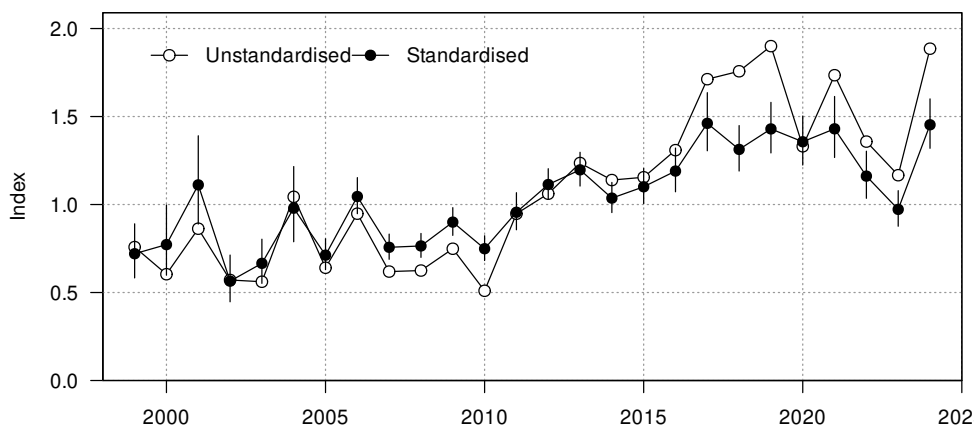


Figure C.6: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the Weibull model for the JMD7 MW observer dataset.

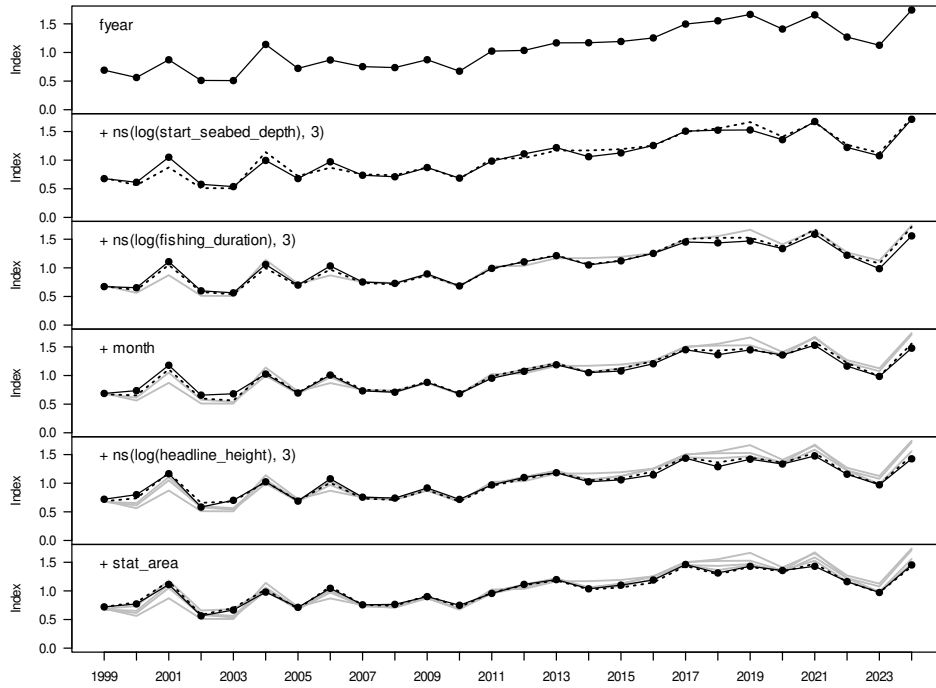


Figure C.7: Changes to the JMD7 MW observer positive catch index as terms are successively entered into the Weibull model.

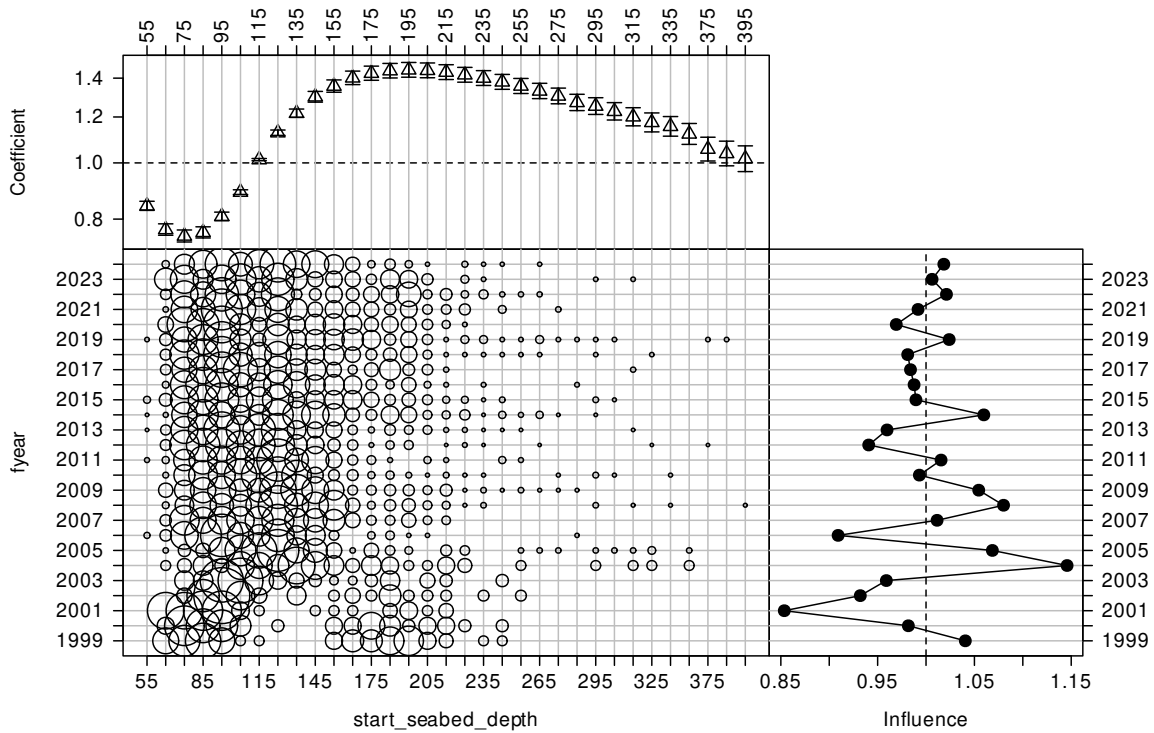


Figure C.8: CDI plot for start seabed depth (m) for the Weibull model of positive catches in the JMD7 MW observer catch-per-unit-effort dataset.

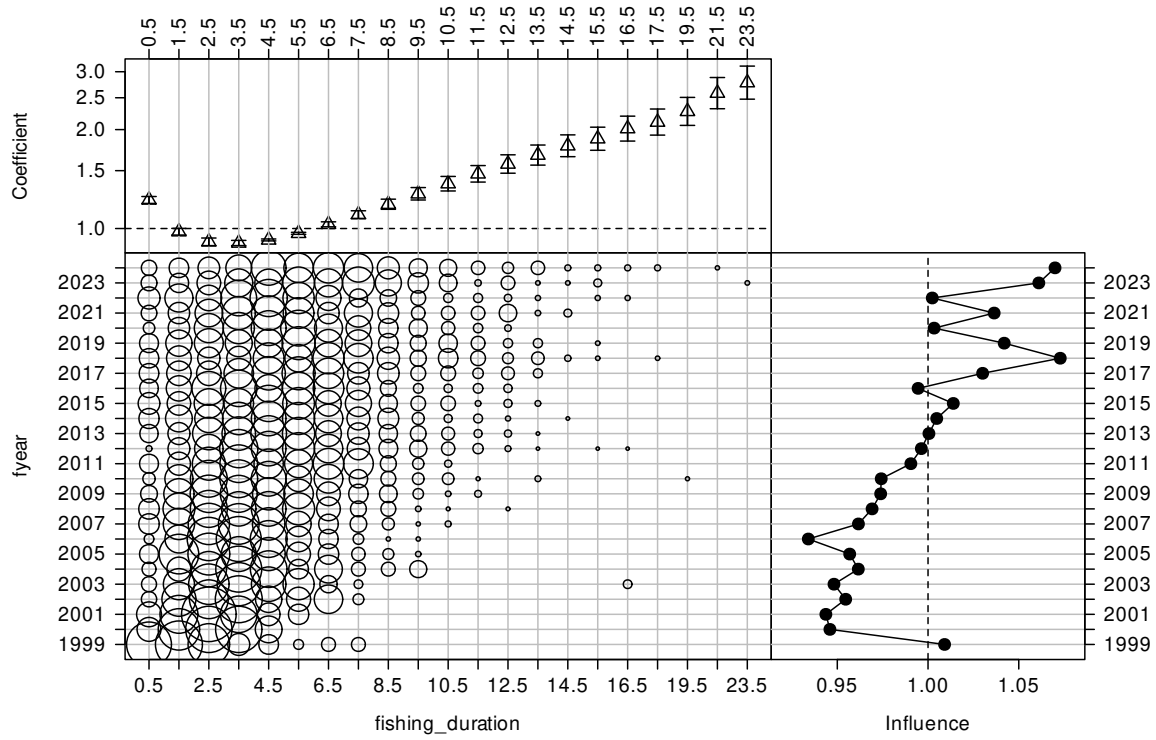


Figure C.9: CDI plot for fishing duration (h) for the Weibull model of positive catches in the JMD7 MW observer catch-per-unit-effort dataset.

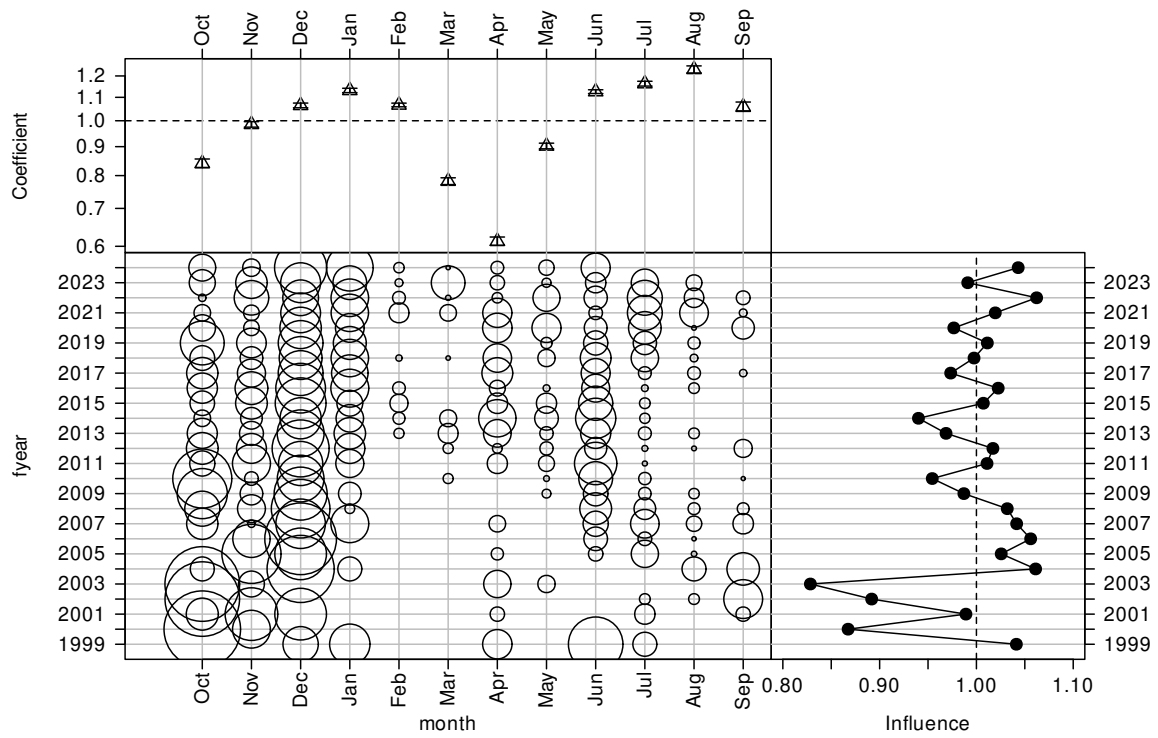


Figure C.10: CDI plot for month for the Weibull model of positive catches in the JMD7 MW observer catch-per-unit-effort dataset.

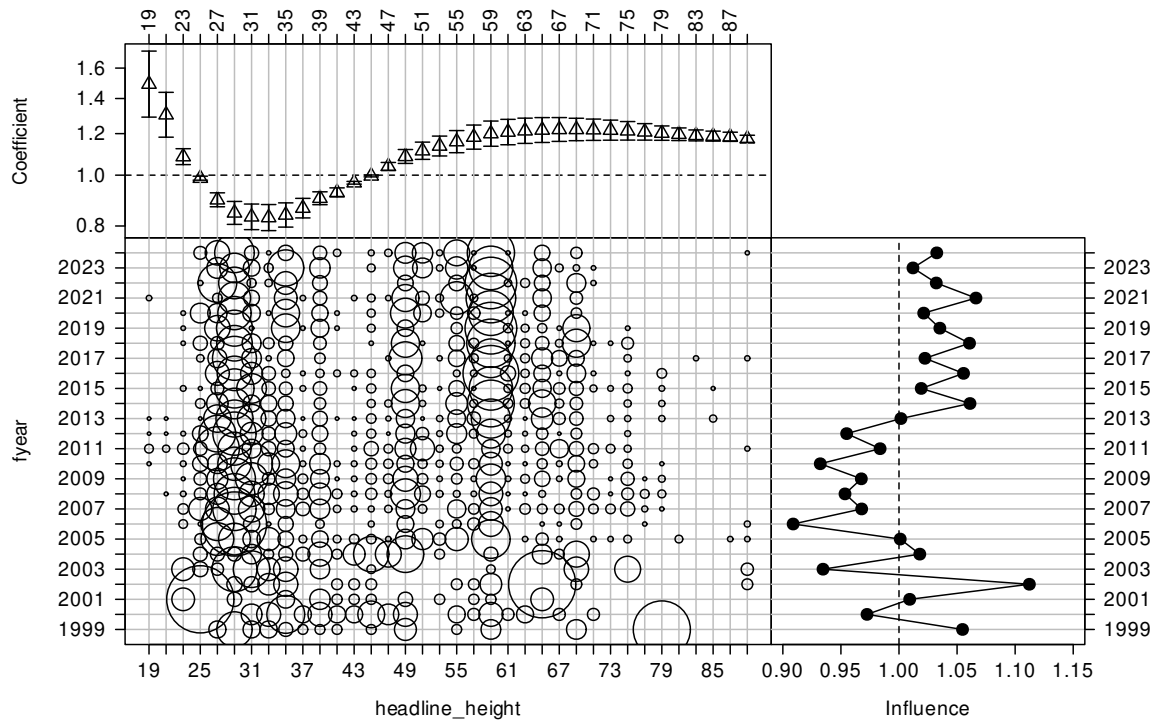


Figure C.11: CDI plot for headline height (m) for the Weibull model of positive catches in the JMD7 MW observer catch-per-unit-effort dataset.

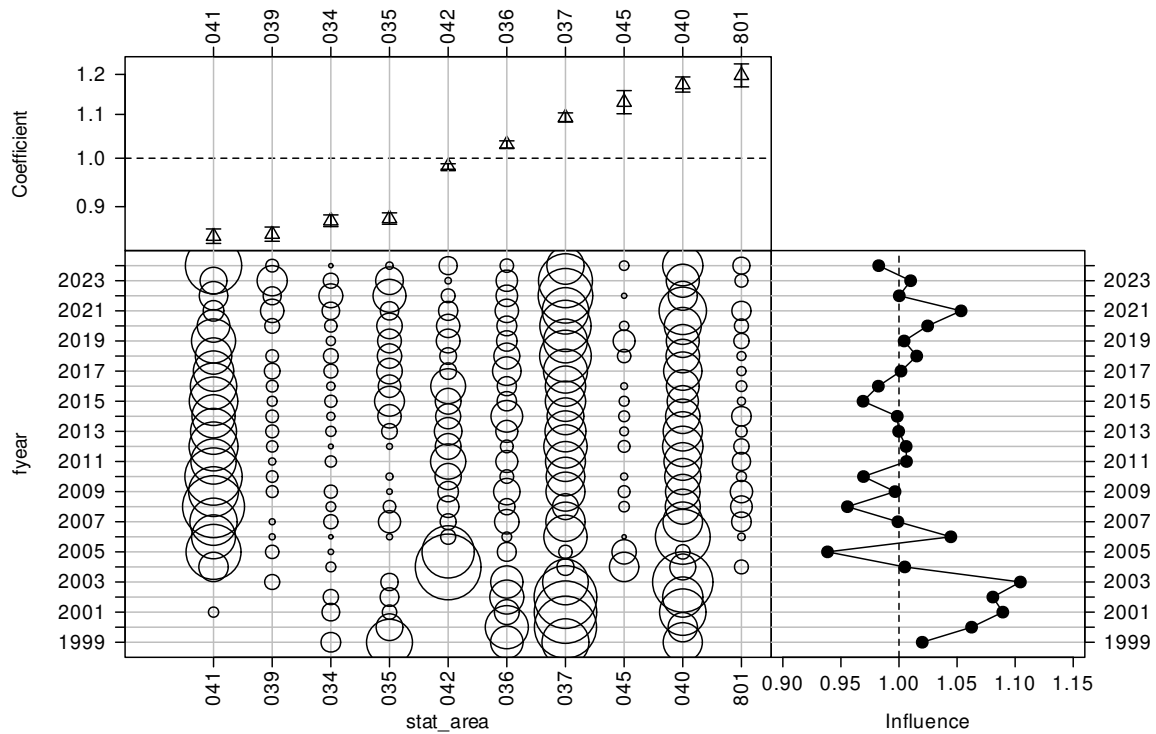


Figure C.12: CDI plot for statistical area for the Weibull model of positive catches in the JMD7 MW observer catch-per-unit-effort dataset.

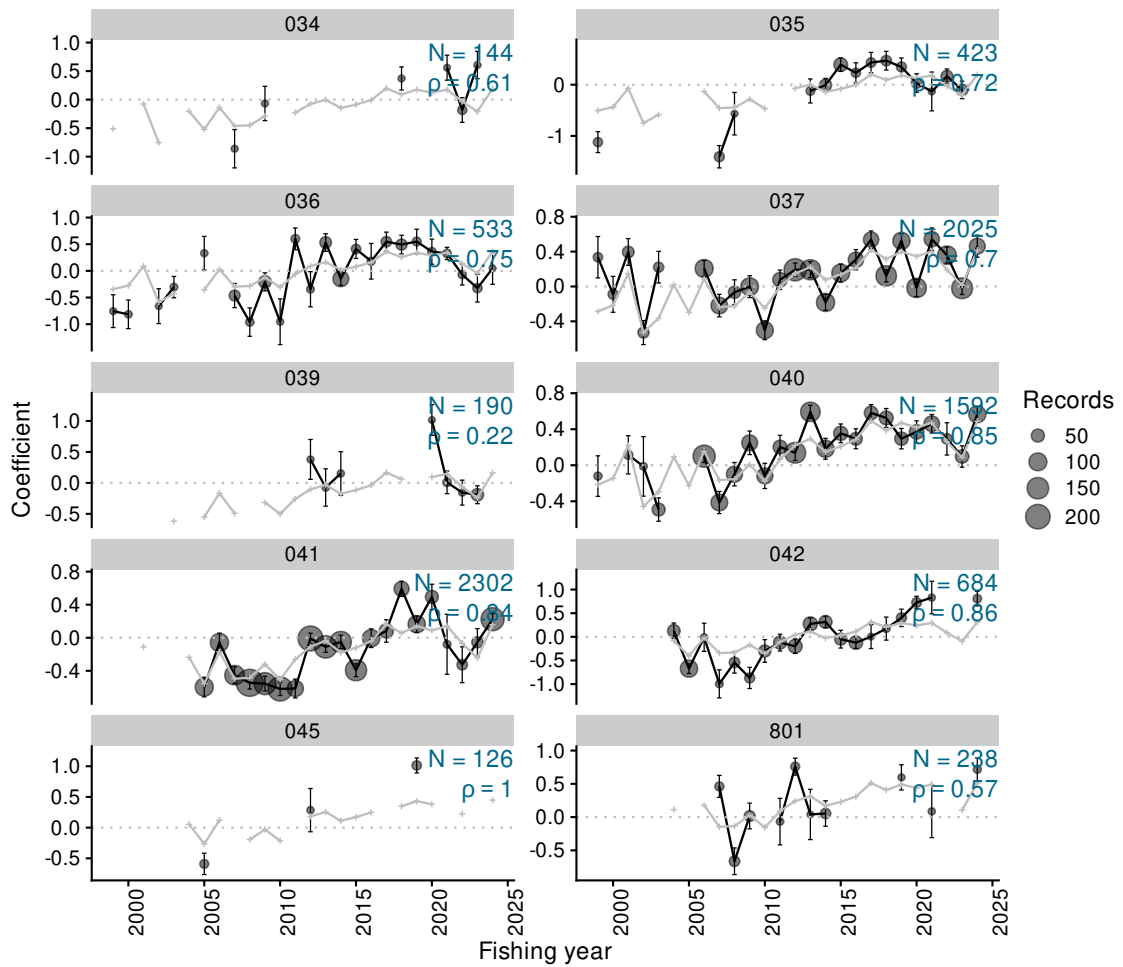


Figure C.13: Residual implied coefficients for area-year in the Weibull positive catch model for the JMD7 MW observer dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in an area-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

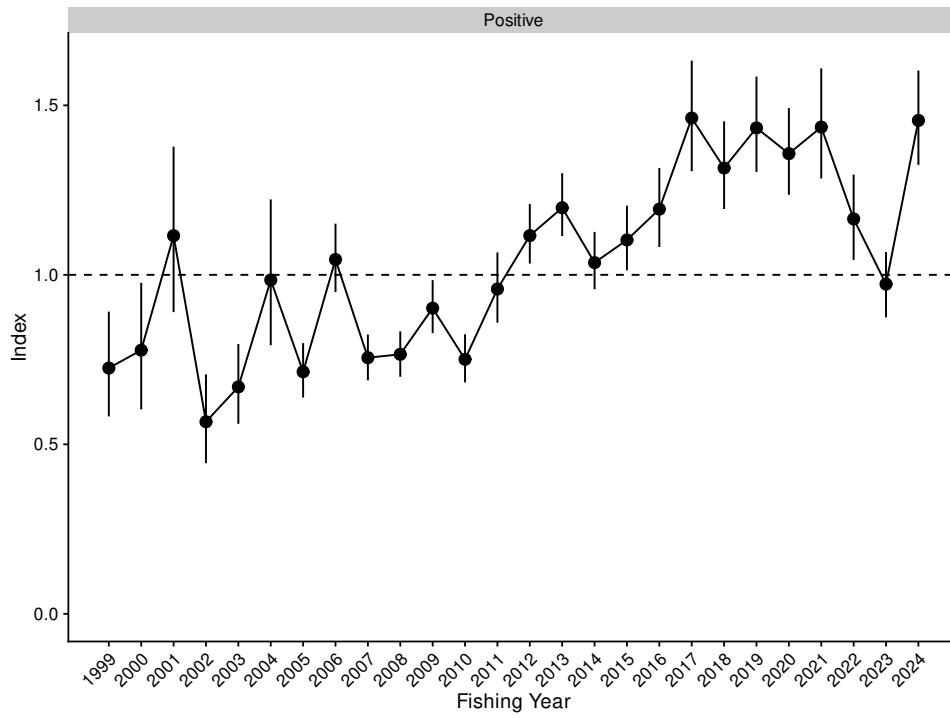


Figure C.14: Standardised indices and 95% confidence intervals for the JMD7 MW observer dataset.

Table C.5: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for the JMD7 MW observer series.

Fishing year	index	SE	Positive	
			LCI	UCI
1999	0.725	0.079	0.582	0.891
2000	0.778	0.095	0.603	0.976
2001	1.115	0.124	0.890	1.378
2002	0.567	0.067	0.444	0.706
2003	0.669	0.060	0.561	0.796
2004	0.985	0.110	0.792	1.222
2005	0.714	0.041	0.638	0.799
2006	1.045	0.051	0.949	1.151
2007	0.756	0.034	0.689	0.824
2008	0.766	0.034	0.699	0.833
2009	0.902	0.040	0.828	0.984
2010	0.751	0.036	0.683	0.825
2011	0.958	0.053	0.859	1.066
2012	1.116	0.045	1.033	1.209
2013	1.198	0.047	1.114	1.300
2014	1.036	0.043	0.958	1.127
2015	1.103	0.049	1.013	1.204
2016	1.194	0.059	1.082	1.315
2017	1.463	0.083	1.306	1.632
2018	1.315	0.066	1.194	1.453
2019	1.433	0.072	1.303	1.585
2020	1.358	0.065	1.236	1.492
2021	1.436	0.083	1.284	1.609
2022	1.165	0.064	1.044	1.296
2023	0.973	0.049	0.875	1.067
2024	1.456	0.071	1.325	1.603

C.2 JMN7 MW observer

Table C.6: Definition for the dataset, core fleet criteria, and Generalised Linear Modelling approach used in the catch-per-unit-effort (CPUE) standardisation for the JMN7 MW observer CPUE series.

Series	JMN7 MW observer
QMS stock	JMA 7
Reporting forms	Observer data collection
Fishing methods	MW
Target species	JMA, JMD, JMM, JMN
Statistical Areas	037, 039, 040, 041, 042, 045
Period	1998-10-01, 2024-09-30
Resolution	Observed event
Core fleet years	4
Core fleet trips	1
Default model	$\text{jmnkg} \sim \text{fyear} + \text{vessel_key} + \text{month} + \text{stat_area} + \text{ns}(\log(\text{fishing_duration}), 3) + \text{ns}(\log(\text{start_time}), 3) + \text{ns}(\log(\text{start_seabed_depth}), 3) + \text{ns}(\log(\text{headline_height}), 3) + \text{ns}(\text{fishing_speed}, 3)$
Stepwise selection	Yes
Positive catch distribution	Weibull

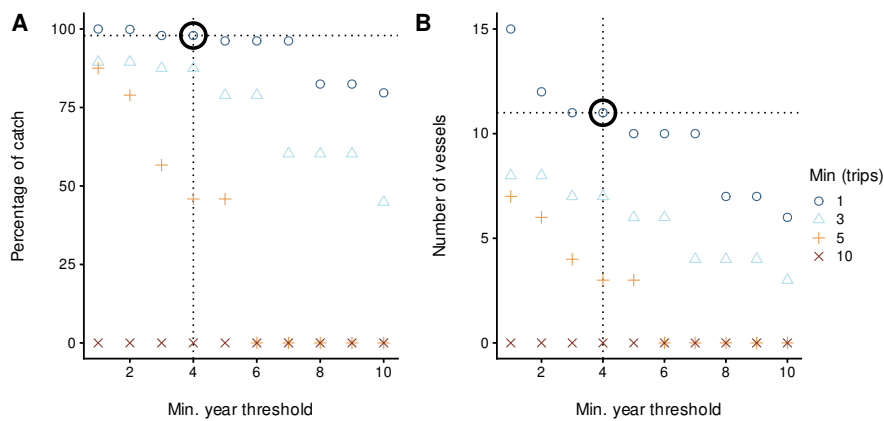


Figure C.15: Percentage of catch and number of vessels for different core vessel selection criteria for the JMN7 MW observer CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel was observed in the fishery and the number of observed trips per year.

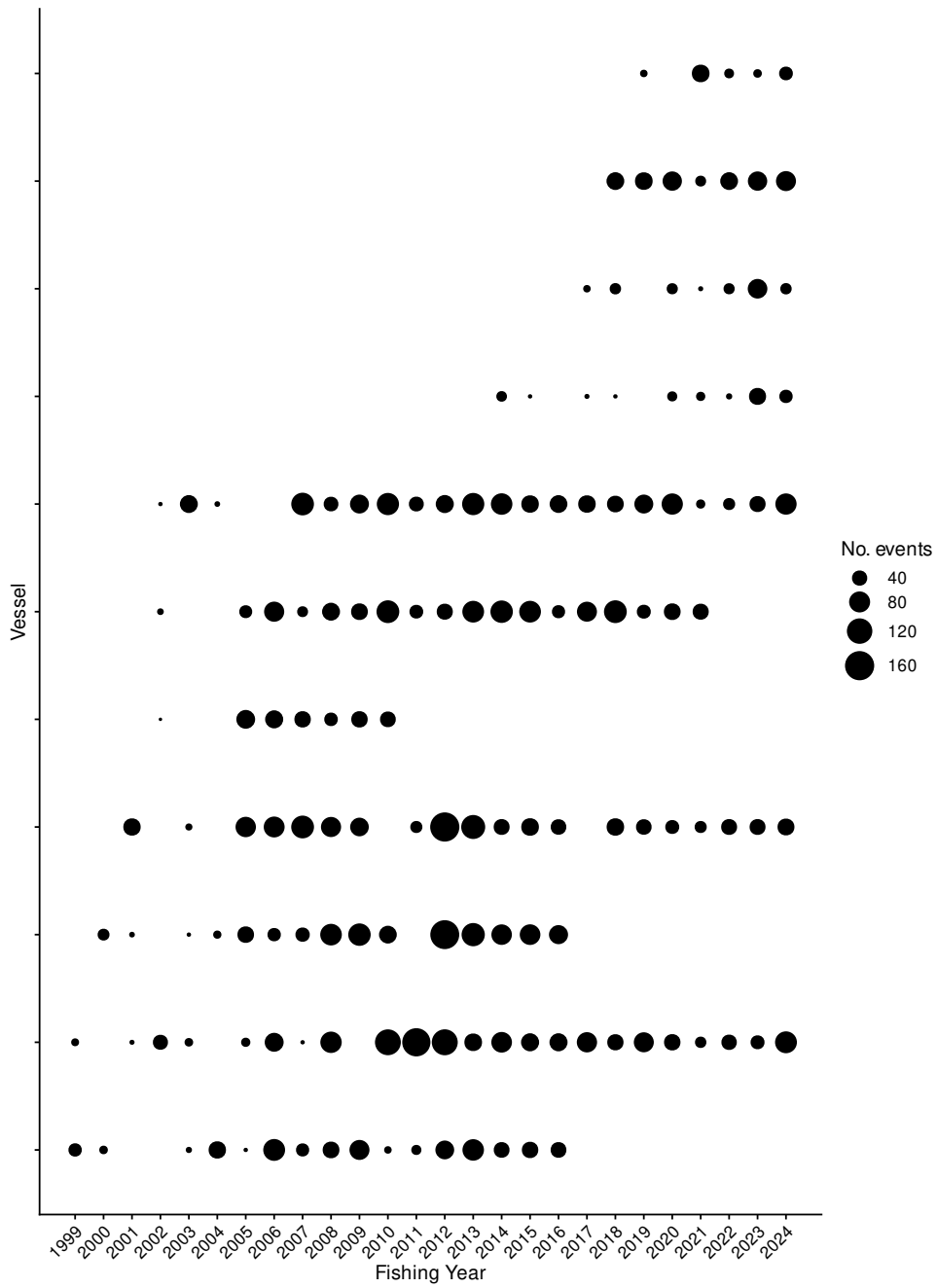


Figure C.16: Number of events by fishing year for core vessels in the JMN7 MW observer series. The area of the circles is proportional to the number of events undertaken by a vessel in a fishing year.

Table C.7: Summary of the JMN7 MW observer dataset total catch (tonnes) and number of records (n), by fishing year after the application of various filters. The first row gives the catch and number of records before filters were applied (ungroomed data). Subsequent rows display the remaining catch (and percent of catch), and the number of records, after the specified filter was applied. Catch data for years with less than three vessels are omitted (indicated by x). (Continued on next 3 pages)

Filter	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ungroomed data	x (100%) n: 45	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 84	403 (100%) n: 76	2571 (100%) n: 243	1541 (100%) n: 397	1353 (100%) n: 329
Fishing speed not null	x (100%) n: 44	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 84	403 (100%) n: 76	2568 (100%) n: 241	1541 (100%) n: 397	1353 (100%) n: 329
Start date not null	x (100%) n: 44	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 84	403 (100%) n: 76	2568 (100%) n: 241	1541 (100%) n: 397	1353 (100%) n: 329
End date not null	x (100%) n: 44	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 84	403 (100%) n: 76	2568 (100%) n: 241	1541 (100%) n: 397	1353 (100%) n: 329
Start depth not null	x (100%) n: 44	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 84	403 (100%) n: 76	2568 (100%) n: 241	1541 (100%) n: 397	1353 (100%) n: 329
Headline height not null	x (96%) n: 43	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 83	403 (100%) n: 76	2568 (100%) n: 241	1541 (100%) n: 397	1353 (100%) n: 329
Fishing speed >3.5kn	x (96%) n: 43	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	389 (100%) n: 83	403 (100%) n: 76	2568 (100%) n: 241	1541 (100%) n: 397	1352 (100%) n: 328
Headline height >15m	x (96%) n: 43	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	386 (99%) n: 82	403 (100%) n: 76	2566 (100%) n: 240	1539 (100%) n: 396	1329 (98%) n: 324
Headline height <90m	x (96%) n: 43	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	386 (99%) n: 82	403 (100%) n: 76	2566 (100%) n: 240	1539 (100%) n: 396	1329 (98%) n: 324
Fishing duration >15mins	x (95%) n: 42	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	386 (99%) n: 82	403 (100%) n: 76	2566 (100%) n: 239	1539 (100%) n: 396	1329 (98%) n: 324
Seabed depth >50m	x (95%) n: 42	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	386 (99%) n: 82	403 (100%) n: 76	2566 (100%) n: 239	1539 (100%) n: 396	1329 (98%) n: 324
Seabed depth <200m	x (95%) n: 42	x (100%) n: 35	178 (100%) n: 60	260 (100%) n: 51	386 (99%) n: 82	394 (98%) n: 67	2417 (94%) n: 230	1539 (100%) n: 395	1329 (98%) n: 324
Start time >0	x (95%) n: 42	x (100%) n: 34	178 (100%) n: 60	228 (88%) n: 48	386 (99%) n: 82	394 (98%) n: 67	2400 (93%) n: 229	1519 (99%) n: 391	1282 (95%) n: 321
Core fleet selection	x (88%) n: 39	x (100%) n: 34	178 (100%) n: 60	228 (88%) n: 48	386 (99%) n: 82	394 (98%) n: 67	2400 (93%) n: 229	1519 (99%) n: 391	1282 (95%) n: 321

Filter	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ungroomed data	2346 (100%) n: 436	2168 (100%) n: 425	2177 (100%) n: 464	1501 (100%) n: 271	4655 (100%) n: 671	4969 (100%) n: 561	3725 (100%) n: 480	5772 (100%) n: 485	3096 (100%) n: 312
Fishing speed not null	2345 (100%) n: 435	2168 (100%) n: 425	2176 (100%) n: 463	1501 (100%) n: 271	4655 (100%) n: 671	4969 (100%) n: 560	3725 (100%) n: 480	5772 (100%) n: 485	3096 (100%) n: 311
Start date not null	2345 (100%) n: 435	2168 (100%) n: 425	2176 (100%) n: 463	1501 (100%) n: 271	4655 (100%) n: 671	4969 (100%) n: 560	3725 (100%) n: 480	5772 (100%) n: 485	3096 (100%) n: 311
End date not null	2345 (100%) n: 435	2168 (100%) n: 425	2176 (100%) n: 463	1501 (100%) n: 271	4655 (100%) n: 671	4969 (100%) n: 560	3725 (100%) n: 480	5772 (100%) n: 485	3096 (100%) n: 311
Start depth not null	2345 (100%) n: 434	2043 (94%) n: 402	2171 (100%) n: 460	1476 (98%) n: 267	4295 (92%) n: 636	4870 (98%) n: 540	3705 (99%) n: 478	5512 (95%) n: 469	3096 (100%) n: 311
Headline height not null	2345 (100%) n: 434	2004 (92%) n: 401	2114 (97%) n: 452	1476 (98%) n: 266	4274 (92%) n: 629	4838 (97%) n: 536	3705 (99%) n: 477	5508 (95%) n: 468	3096 (100%) n: 311
Fishing speed >3.5kn	2345 (100%) n: 434	2004 (92%) n: 401	2114 (97%) n: 452	1476 (98%) n: 266	4274 (92%) n: 629	4838 (97%) n: 536	3705 (99%) n: 477	5508 (95%) n: 468	3076 (99%) n: 310
Headline height >15m	2345 (100%) n: 434	2004 (92%) n: 400	2111 (97%) n: 451	1476 (98%) n: 266	4274 (92%) n: 629	4836 (97%) n: 533	3705 (99%) n: 477	5508 (95%) n: 468	3076 (99%) n: 310
Headline height <90m	2345 (100%) n: 434	2004 (92%) n: 400	2111 (97%) n: 451	1454 (97%) n: 265	4274 (92%) n: 628	4836 (97%) n: 533	3705 (99%) n: 477	5508 (95%) n: 468	3076 (99%) n: 310
Fishing duration >15mins	2345 (100%) n: 433	2004 (92%) n: 400	2111 (97%) n: 451	1425 (95%) n: 263	4274 (92%) n: 628	4826 (97%) n: 531	3704 (99%) n: 475	5508 (95%) n: 468	3076 (99%) n: 309
Seabed depth >50m	2345 (100%) n: 433	2003 (92%) n: 398	2086 (96%) n: 450	1425 (95%) n: 263	4273 (92%) n: 627	4826 (97%) n: 530	3704 (99%) n: 475	5504 (95%) n: 467	3076 (99%) n: 309
Seabed depth <200m	2329 (99%) n: 420	1934 (89%) n: 387	2074 (95%) n: 438	1425 (95%) n: 262	4260 (91%) n: 614	4810 (97%) n: 522	3690 (99%) n: 472	5474 (95%) n: 457	3000 (97%) n: 305
Start time >0	2313 (99%) n: 415	1933 (89%) n: 386	2074 (95%) n: 435	1416 (94%) n: 259	4169 (90%) n: 608	4791 (96%) n: 520	3630 (97%) n: 465	5427 (94%) n: 454	2931 (95%) n: 302
Core fleet selection	2313 (99%) n: 415	1933 (89%) n: 386	2023 (93%) n: 416	1416 (94%) n: 259	4169 (90%) n: 608	4791 (96%) n: 520	3465 (93%) n: 434	4420 (77%) n: 379	2925 (94%) n: 293

Filter	2017	2018	2019	2020	2021	2022	2023	2024
Ungroomed data	2640 (100%) n: 238	4601 (100%) n: 346	2822 (100%) n: 302	2942 (100%) n: 329	2320 (100%) n: 205	2368 (100%) n: 244	4766 (100%) n: 330	3403 (100%) n: 387
Fishing speed not null	2638 (100%) n: 236	4601 (100%) n: 346	2822 (100%) n: 302	2942 (100%) n: 328	2299 (99%) n: 201	2368 (100%) n: 243	4716 (99%) n: 329	3403 (100%) n: 387
Start date not null	2638 (100%) n: 236	4601 (100%) n: 346	2822 (100%) n: 302	2942 (100%) n: 328	2299 (99%) n: 201	2368 (100%) n: 243	4716 (99%) n: 329	3403 (100%) n: 387
End date not null	2638 (100%) n: 236	4601 (100%) n: 346	2822 (100%) n: 302	2942 (100%) n: 328	2299 (99%) n: 201	2368 (100%) n: 243	4716 (99%) n: 329	3403 (100%) n: 387
Start depth not null	2605 (99%) n: 234	4587 (100%) n: 345	2822 (100%) n: 302	2879 (98%) n: 323	2177 (94%) n: 195	2035 (86%) n: 207	4716 (99%) n: 329	3403 (100%) n: 387
Headline height not null	2605 (99%) n: 230	4582 (100%) n: 343	2822 (100%) n: 302	2879 (98%) n: 322	2177 (94%) n: 195	2035 (86%) n: 207	4700 (99%) n: 324	3403 (100%) n: 387
Fishing speed >3.5kn	2605 (99%) n: 230	4582 (100%) n: 343	2822 (100%) n: 302	2879 (98%) n: 322	2177 (94%) n: 195	2035 (86%) n: 207	4700 (99%) n: 324	3403 (100%) n: 387
Headline height >15m	2582 (98%) n: 229	4582 (100%) n: 343	2822 (100%) n: 302	2879 (98%) n: 322	2177 (94%) n: 195	2035 (86%) n: 207	4700 (99%) n: 324	3403 (100%) n: 387
Headline height <90m	2582 (98%) n: 229	4582 (100%) n: 343	2822 (100%) n: 302	2879 (98%) n: 322	2177 (94%) n: 195	2035 (86%) n: 207	4652 (98%) n: 321	3403 (100%) n: 387
Fishing duration >15mins	2564 (97%) n: 228	4582 (100%) n: 343	2822 (100%) n: 302	2879 (98%) n: 322	2177 (94%) n: 195	2035 (86%) n: 207	4652 (98%) n: 321	3403 (100%) n: 387
Seabed depth >50m	2564 (97%) n: 228	4573 (99%) n: 342	2822 (100%) n: 302	2879 (98%) n: 322	2177 (94%) n: 195	2035 (86%) n: 207	4652 (98%) n: 321	3403 (100%) n: 387
Seabed depth <200m	2564 (97%) n: 226	4403 (96%) n: 332	2758 (98%) n: 279	2878 (98%) n: 317	2176 (94%) n: 194	2029 (86%) n: 205	4619 (97%) n: 320	3401 (100%) n: 381
Start time >0	2558 (97%) n: 225	4393 (95%) n: 331	2758 (98%) n: 279	2823 (96%) n: 314	2114 (91%) n: 193	2029 (86%) n: 205	4619 (97%) n: 320	3401 (100%) n: 381
Core fleet selection	2428 (92%) n: 211	4393 (95%) n: 323	2733 (97%) n: 274	2823 (96%) n: 314	2114 (91%) n: 193	2029 (86%) n: 205	4619 (97%) n: 320	3294 (97%) n: 374

Table C.8: Summary of the JMN7 MW observer dataset after core fleet selection. ‘Records’ indicates the number of rows (events) in the dataset, and ‘Records caught’ indicates the percentage of events with catches of jack mackerels. Catch and effort data for years with less than three vessels are omitted (indicated by x).

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
1999	2	x	39	x	x	76.92
2000	2	x	34	x	x	88.24
2001	3	4	60	156.45	178.19	85.00
2002	4	4	48	181.12	228.40	79.17
2003	5	5	82	285.33	386.14	87.80
2004	3	3	67	277.55	393.81	73.13
2005	6	8	229	778.45	2400.03	89.52
2006	6	8	391	1430.92	1519.19	89.26
2007	7	15	321	1208.12	1281.97	72.59
2008	7	16	415	1652.90	2312.74	69.64
2009	6	11	386	1632.37	1932.97	84.20
2010	6	10	416	1848.45	2023.50	83.17
2011	5	7	259	1220.35	1416.43	71.81
2012	6	18	608	3099.03	4169.02	81.58
2013	6	28	520	2608.42	4791.47	82.50
2014	7	32	434	2213.28	3464.87	82.03
2015	7	26	379	1987.15	4419.83	82.85
2016	6	23	293	1480.42	2925.40	79.52
2017	5	19	211	1236.70	2427.90	89.10
2018	7	23	323	2120.23	4392.70	76.78
2019	6	19	274	1615.12	2733.26	81.75
2020	7	29	314	1637.30	2823.50	71.02
2021	8	19	193	1113.40	2114.48	88.08
2022	7	17	205	1045.82	2028.73	81.95
2023	7	16	320	2018.67	4619.06	88.12
2024	7	19	374	2345.17	3293.61	76.47

Table C.9: Summary of stepwise selection for occurrence of positive catch in the JMN7 MW observer series. Model terms are listed in the order of acceptance to the model. AIC: Akaike Information Criterion; *: Term included in final model.

Predictor	df	AIC	% deviance	addl. % deviance	Included
fyear	24	6913	2.3	2.3	*
+ ns(log(start_seabed_depth), 3)	3	6490	8.4	6.1	*
+ stat_area	5	6213	12.5	4.1	*
+ month	11	6139	13.8	1.4	*
+ ns(log(fishing_duration), 3)	3	6107	14.4	0.5	
+ vessel_key	10	6099	14.8	0.4	
+ ns(log(headline_height), 3)	3	6094	14.9	0.2	
+ ns(fishing_speed, 3)	3	6089	15.1	0.2	

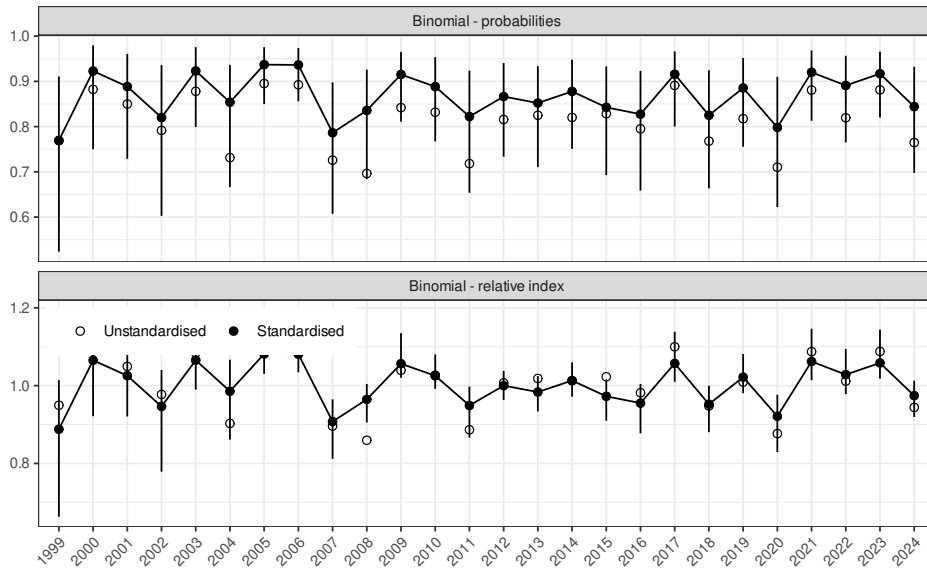


Figure C.17: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for occurrence of catch in the JMN7 MW observer dataset, plotted as both probability of occurrence and as a relative index standardised to the geometric mean.

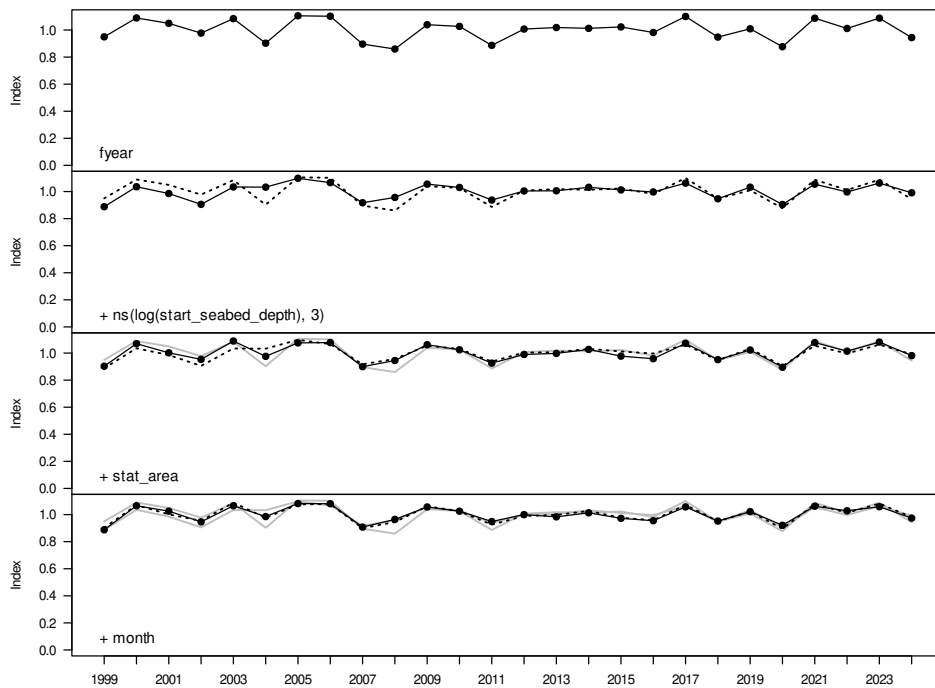


Figure C.18: Step plot for occurrence of catch in the JMN7 MW observer dataset.

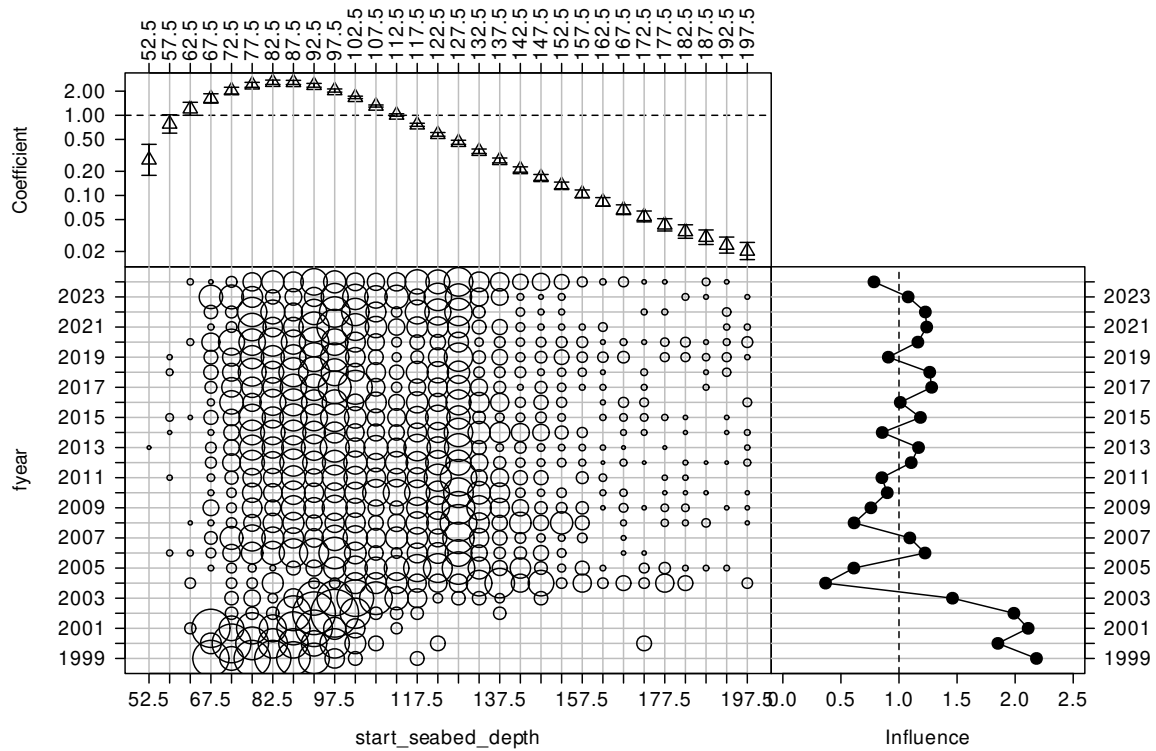


Figure C.19: CDI plot for start seabed depth (m) for the occurrence of positive catch in the JMN7 MW observer catch-per-unit-effort dataset.

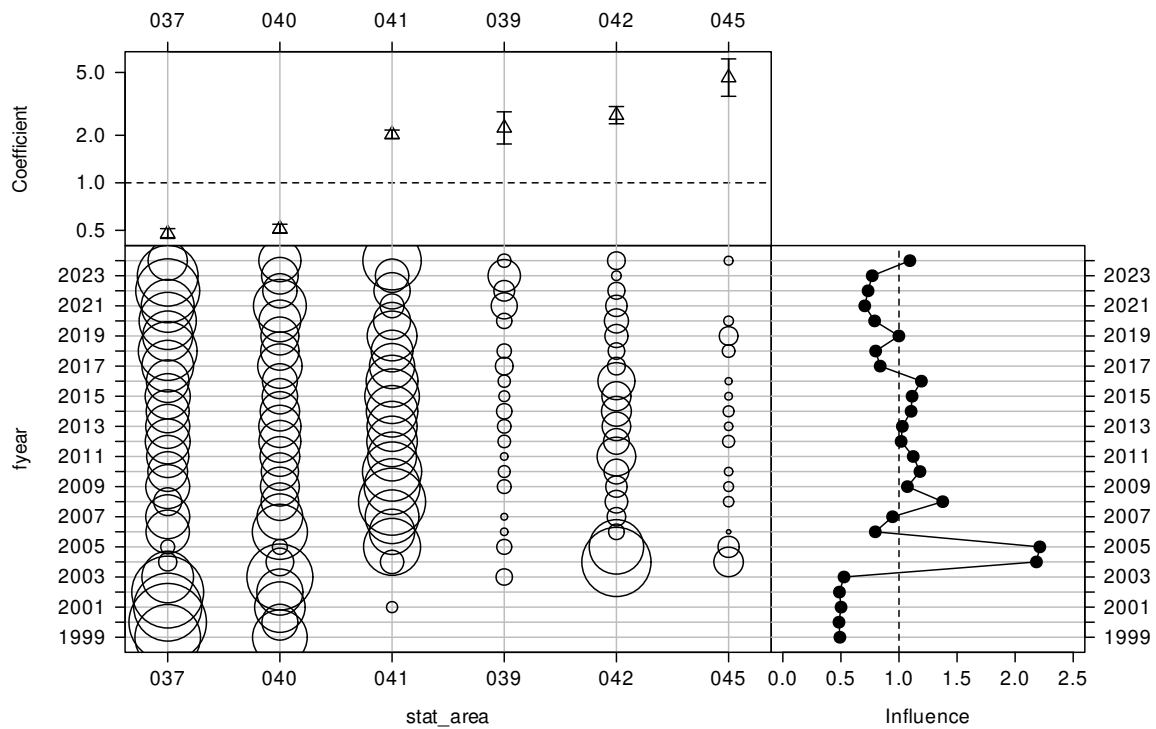


Figure C.20: CDI plot for statistical area for the occurrence of positive catch in the JMN7 MW observer catch-per-unit-effort dataset.

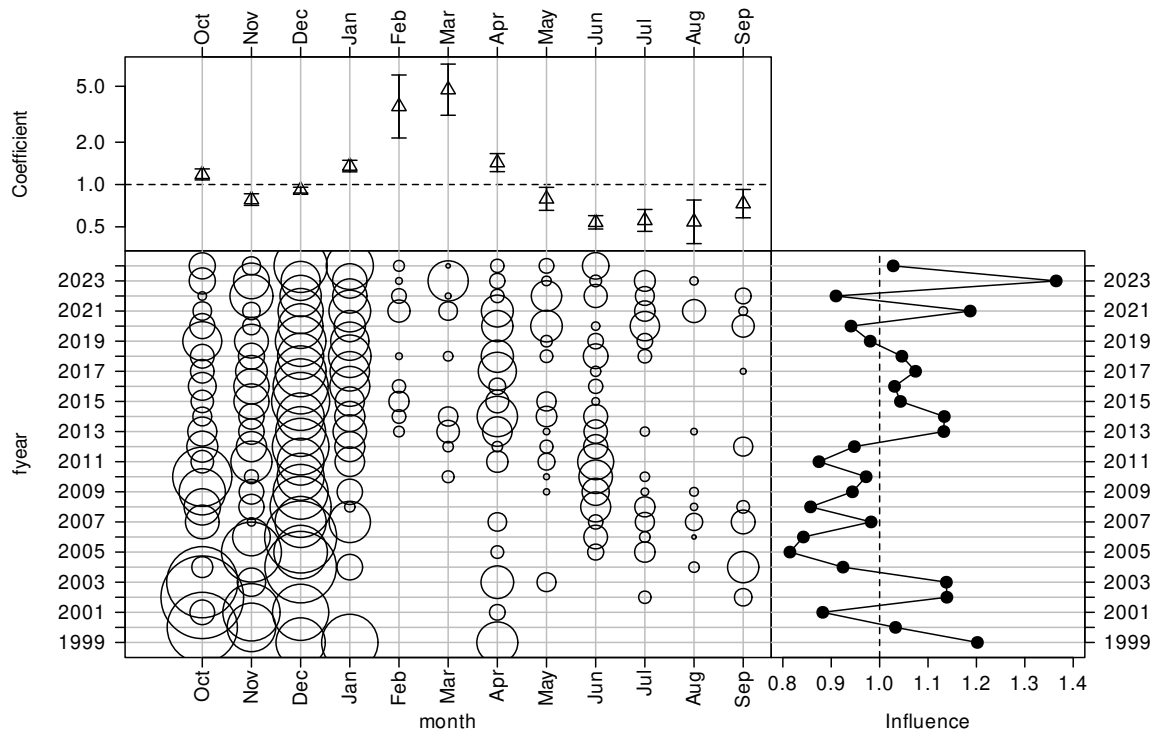


Figure C.21: CDI plot for month for the occurrence of positive catch in the JMN7 MW observer catch-per-unit-effort dataset.

Table C.10: Summary of stepwise selection for the Weibull model for positive catches in the JMN7 MW observer series. Model terms are listed in the order of acceptance to the model. AIC: Akaike Information Criterion; *: Term included in final model.

Predictor	df	AIC	% deviance	addl. % deviance	Included
fyear	27	117844	9.5	9.5	*
+ stat_area	5	117564	13.7	4.1	*
+ month	11	117377	16.6	3.0	*
+ ns(log(start_seabed_depth), 3)	3	117263	18.3	1.7	*
+ ns(log(fishing_duration), 3)	3	117166	19.8	1.5	*
+ ns(log(start_time), 3)	3	117101	20.8	1.0	*
+ vessel_key	10	117080	21.4	0.6	
+ ns(log(headline_height), 3)	3	117075	21.5	0.2	
+ ns(fishing_speed, 3)	3	117072	21.7	0.1	

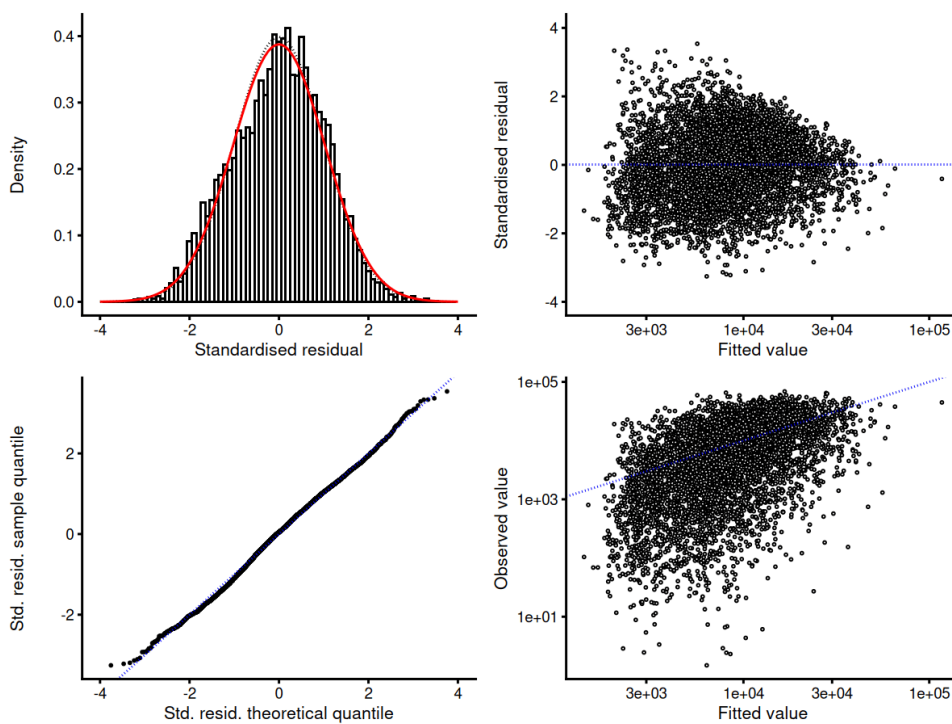


Figure C.22: Diagnostic plots for the selected Weibull model for positive catches in the JMN7 MW observer dataset.

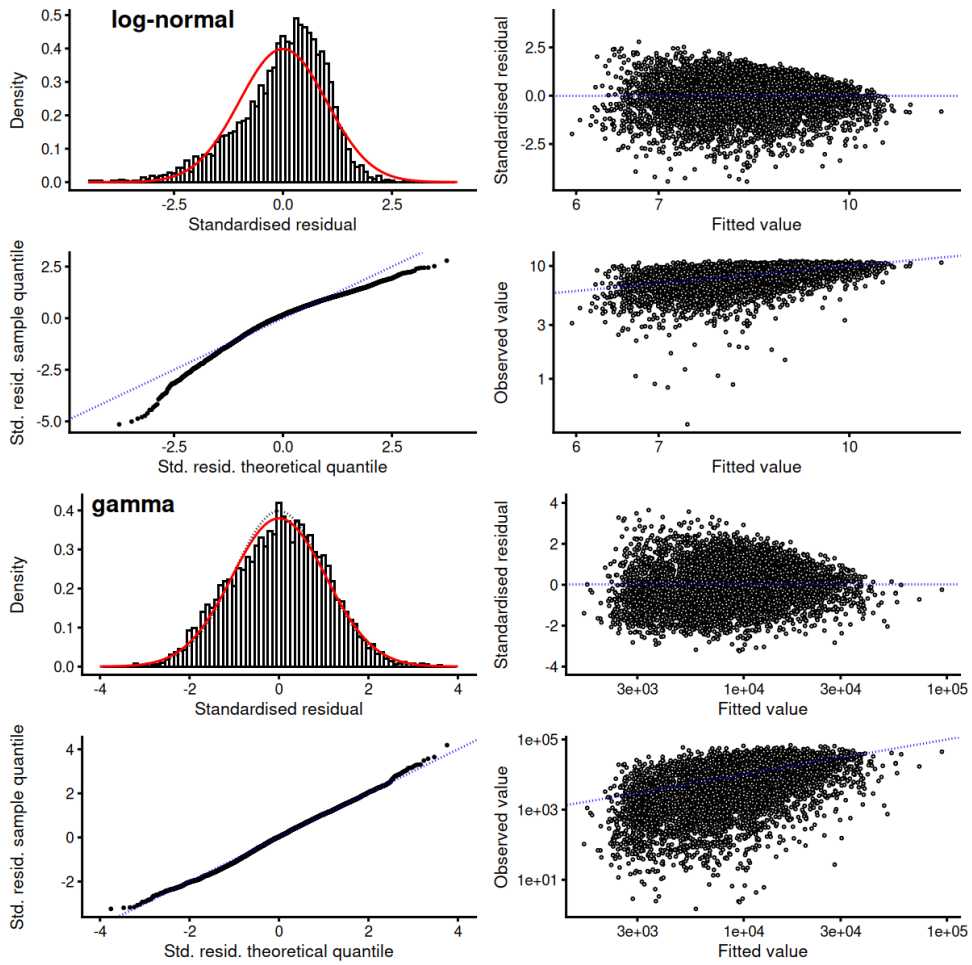


Figure C.23: Diagnostic plots for the alternative log-normal and gamma models considered for positive catches in the JMN7 MW observer dataset.

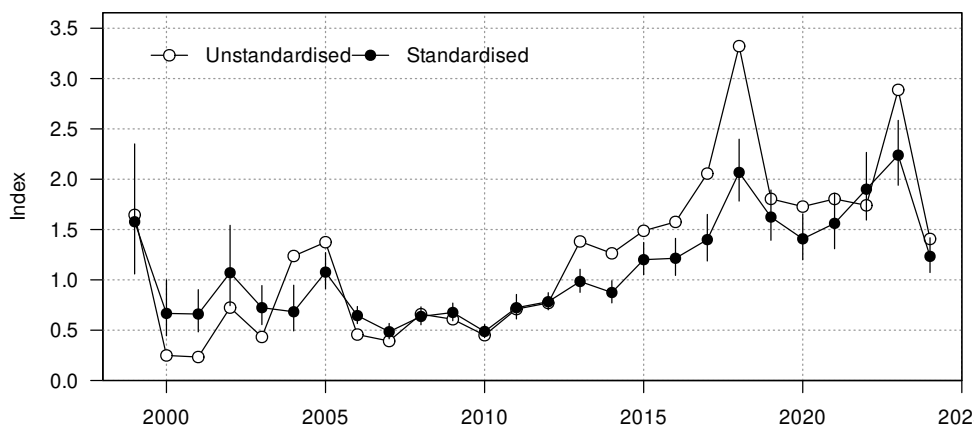


Figure C.24: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the Weibull model for the JMN7 MW observer dataset.

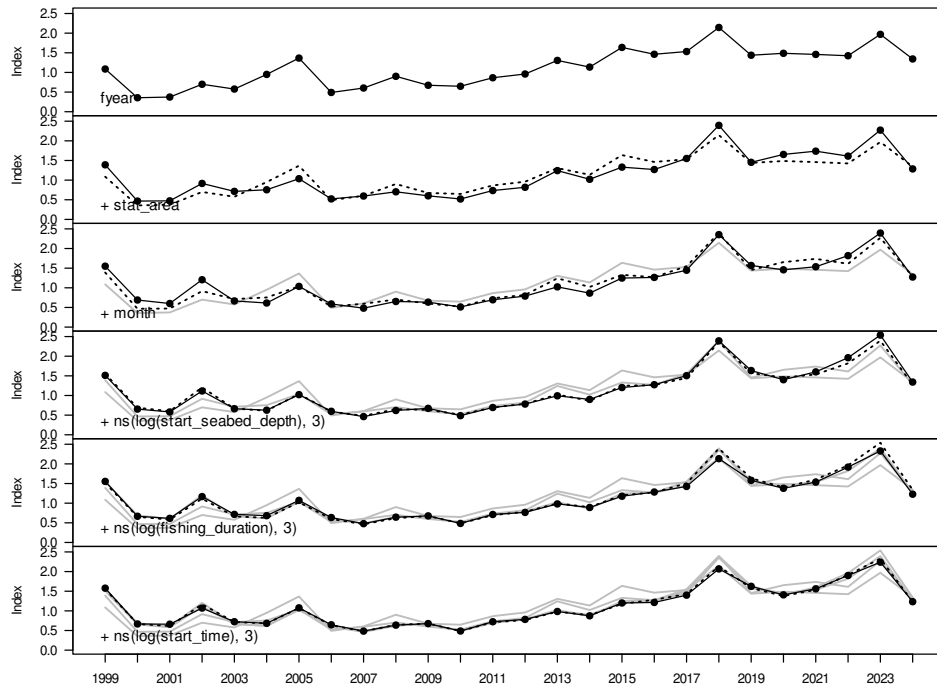


Figure C.25: Changes to the JMN7 MW observer positive catch index as terms are successively entered into the Weibull model.

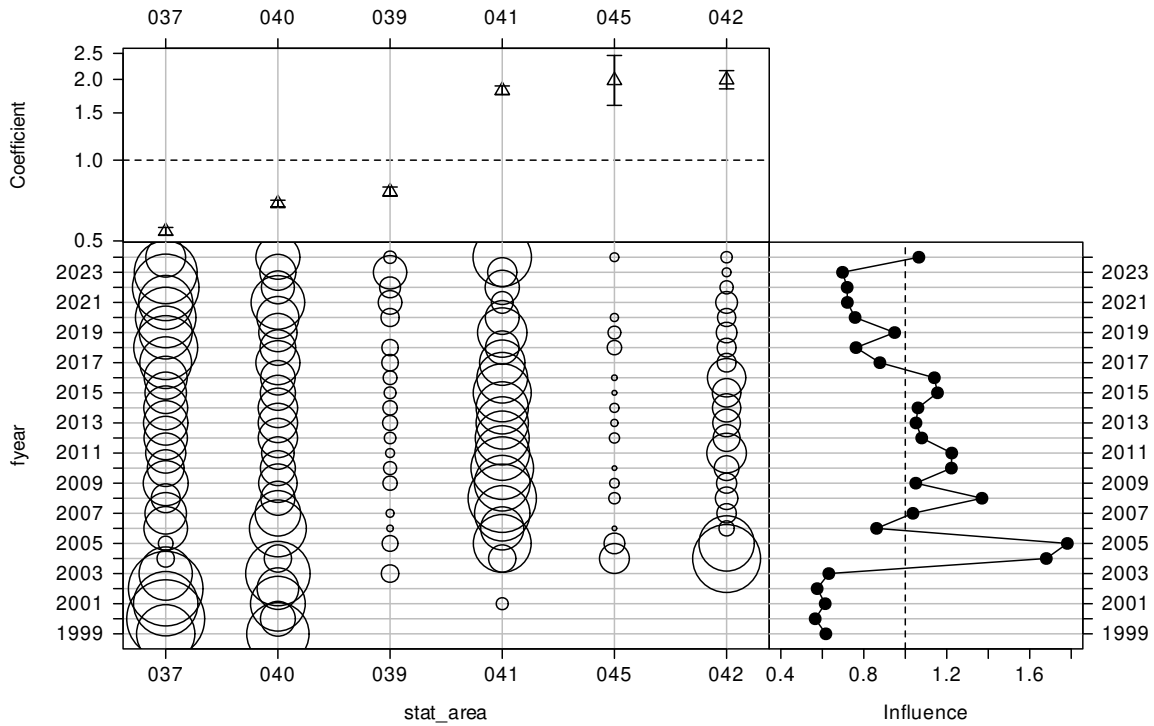


Figure C.26: CDI plot for statistical area for the Weibull model of positive catches in the JMN7 MW observer catch-per-unit-effort dataset.

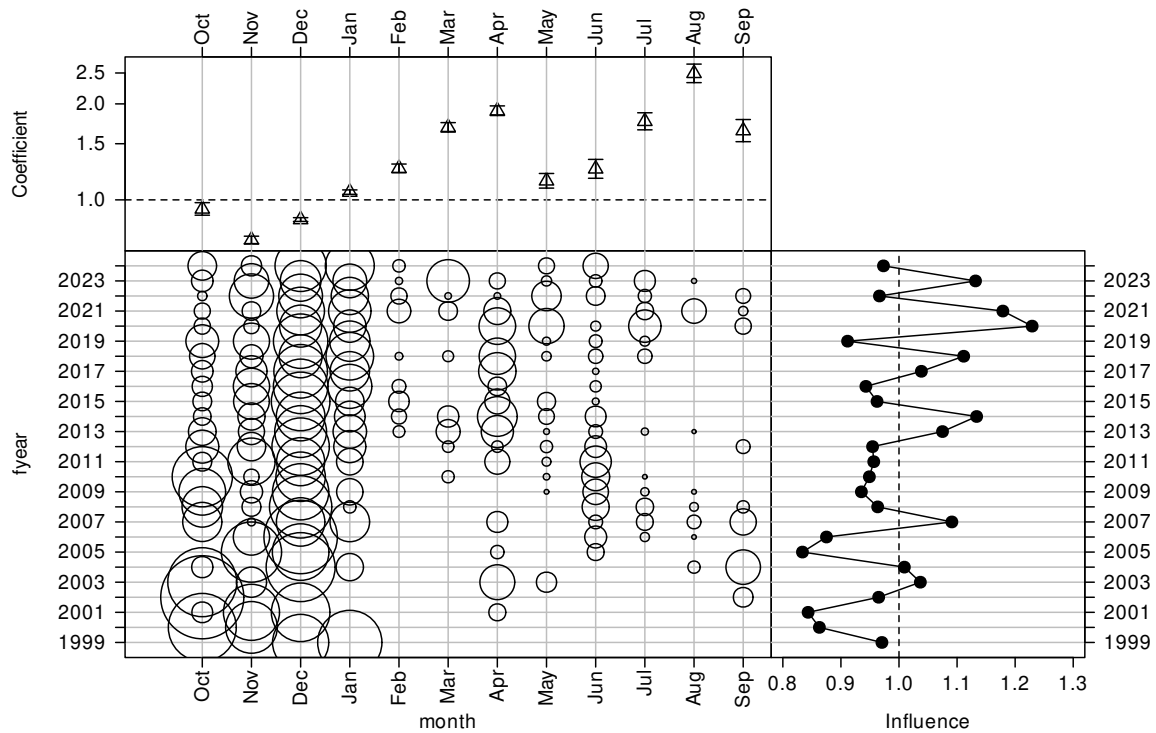


Figure C.27: CDI plot for month for the Weibull model of positive catches in the JMN7 MW observer catch-per-unit-effort dataset.

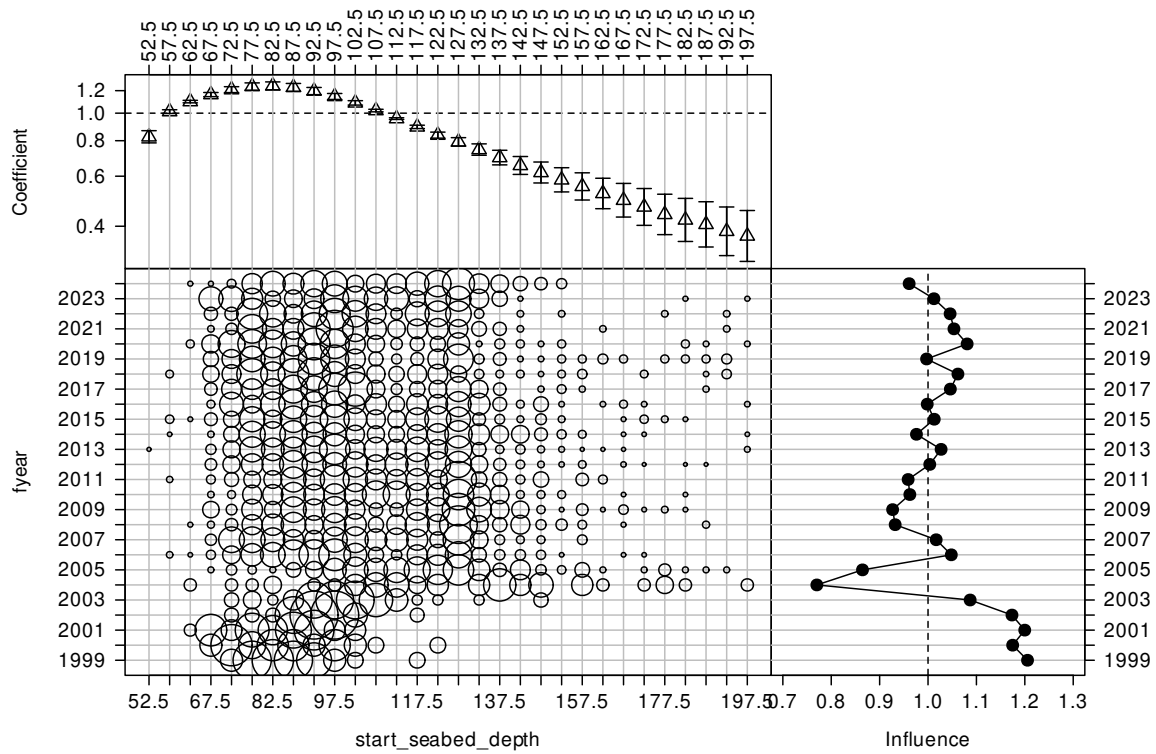


Figure C.28: CDI plot for start seabed depth (m) for the Weibull model of positive catches in the JMN7 MW observer catch-per-unit-effort dataset.

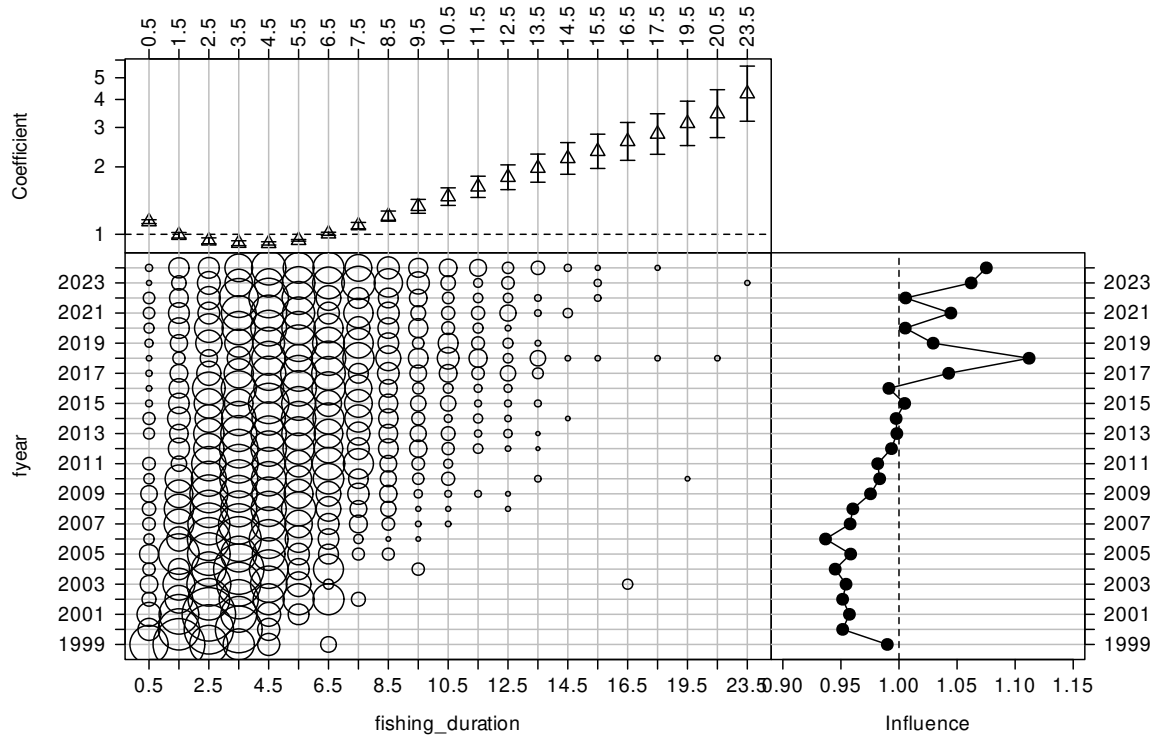


Figure C.29: CDI plot for fishing duration (h) for the Weibull model of positive catches in the JMN7 MW observer catch-per-unit-effort dataset.

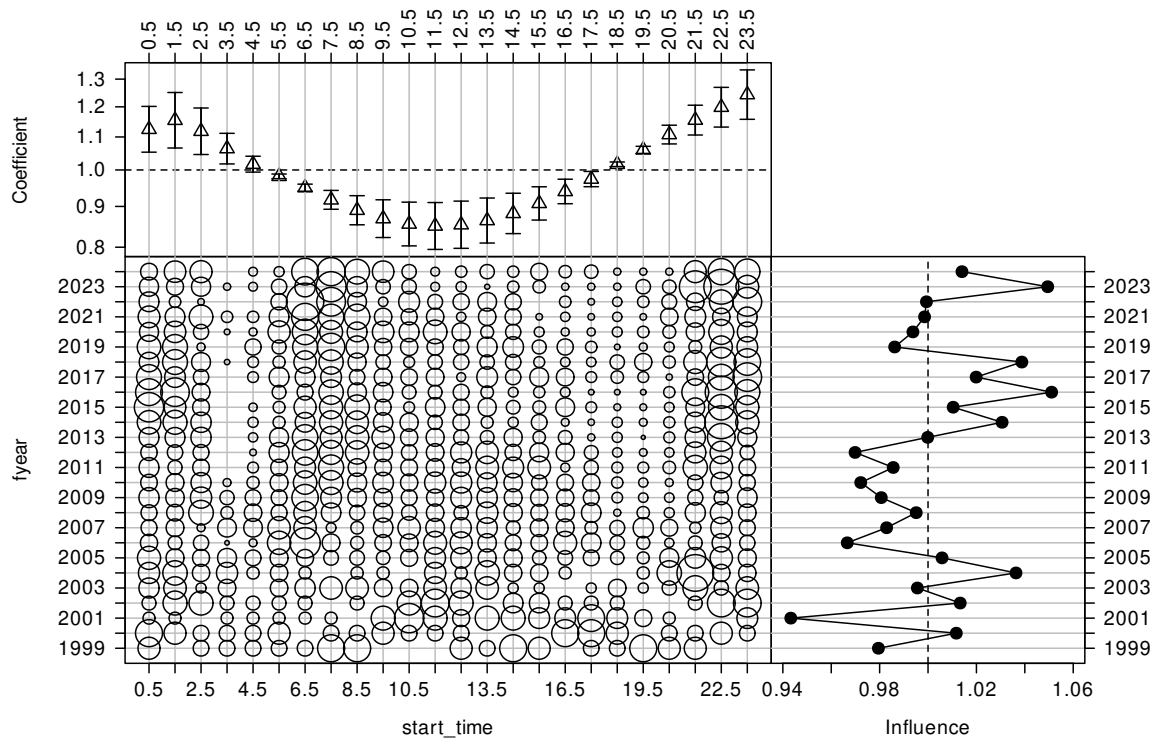


Figure C.30: CDI plot for start time for the Weibull model of positive catches in the JMN7 MW observer catch-per-unit-effort dataset.

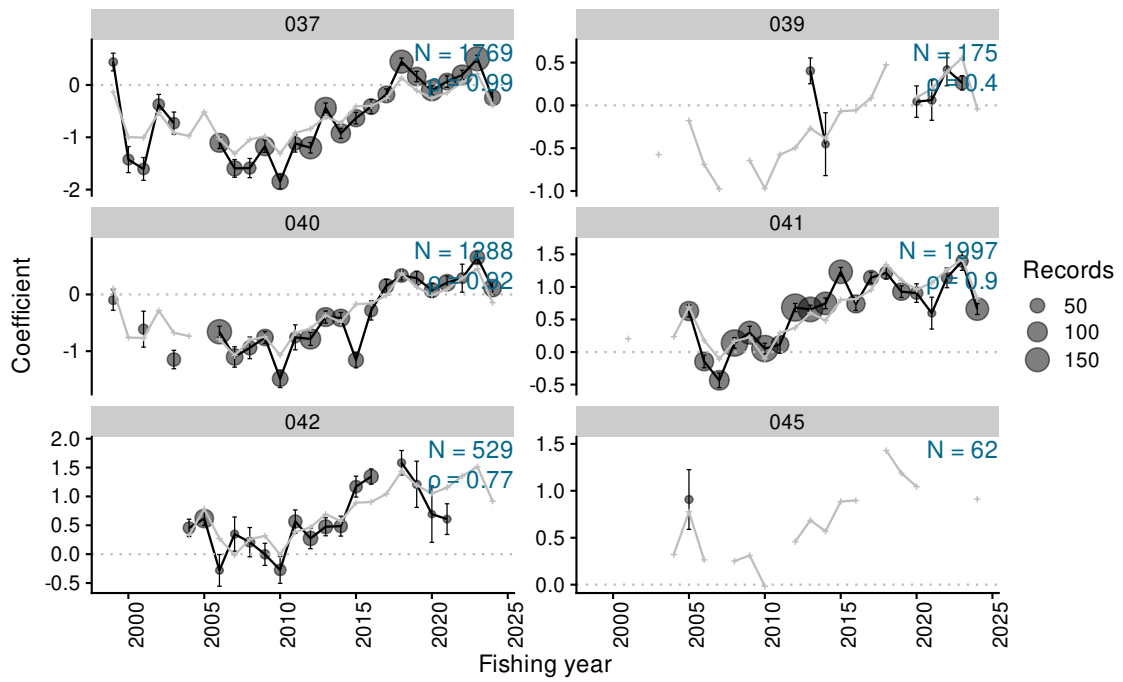


Figure C.31: Residual implied coefficients for area-year in the Weibull positive catch model for the JMN7 MW observer dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in an area-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

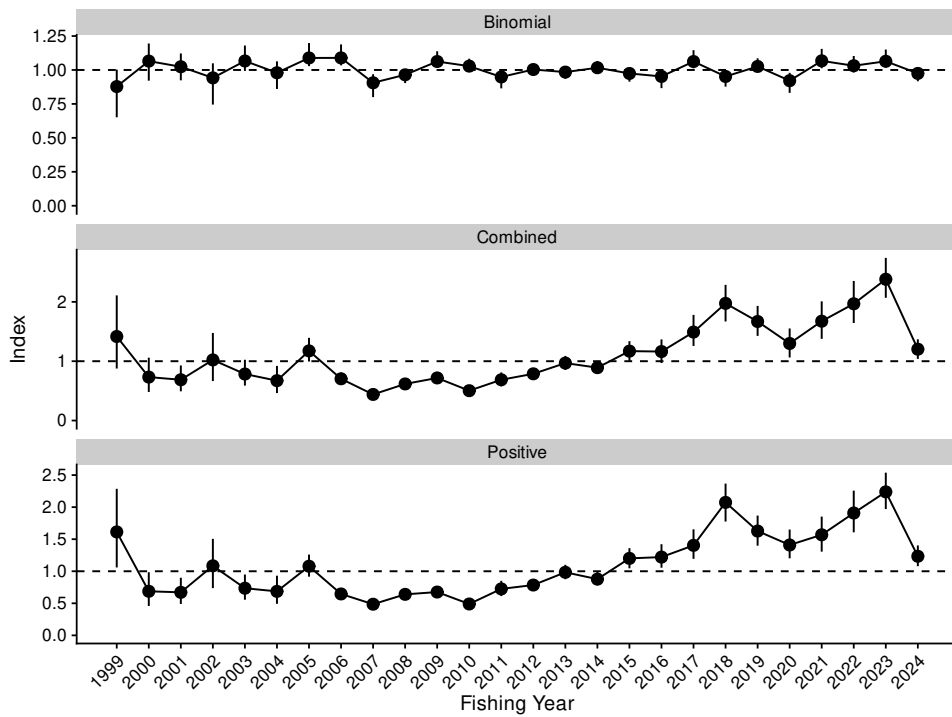


Figure C.32: Standardised indices and 95% confidence intervals for the JMN7 MW observer dataset.



Figure C.33: Standardised indices for the JMN7 MW observer dataset.

Table C.11: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for each model in the JMN7 MW observer series.

Fishing year	Binomial				Combined				Positive			
	index	SE	LCI	UCI	index	SE	LCI	UCI	index	SE	LCI	UCI
1999	0.878	0.090	0.651	1.002	1.416	0.314	0.877	2.109	1.614	0.313	1.059	2.286
2000	1.065	0.070	0.921	1.195	0.732	0.147	0.482	1.059	0.687	0.134	0.458	0.985
2001	1.024	0.050	0.924	1.122	0.687	0.111	0.493	0.928	0.671	0.104	0.490	0.899
2002	0.942	0.077	0.745	1.049	1.022	0.207	0.665	1.476	1.085	0.196	0.737	1.505
2003	1.066	0.048	0.993	1.180	0.784	0.111	0.589	1.024	0.735	0.100	0.556	0.949
2004	0.979	0.052	0.860	1.063	0.672	0.117	0.463	0.921	0.686	0.112	0.492	0.931
2005	1.089	0.043	1.028	1.198	1.174	0.102	0.994	1.394	1.078	0.088	0.916	1.260
2006	1.089	0.039	1.034	1.188	0.703	0.050	0.614	0.811	0.646	0.041	0.570	0.732
2007	0.906	0.043	0.800	0.969	0.440	0.041	0.364	0.526	0.486	0.039	0.413	0.566
2008	0.964	0.026	0.903	1.003	0.617	0.047	0.531	0.713	0.640	0.046	0.558	0.738
2009	1.062	0.030	1.020	1.138	0.718	0.049	0.629	0.821	0.676	0.044	0.595	0.766
2010	1.028	0.023	0.991	1.083	0.503	0.036	0.437	0.578	0.489	0.033	0.427	0.555
2011	0.948	0.034	0.865	0.997	0.687	0.060	0.576	0.811	0.725	0.061	0.613	0.851
2012	1.003	0.020	0.961	1.041	0.788	0.045	0.699	0.876	0.785	0.042	0.703	0.867
2013	0.984	0.023	0.934	1.025	0.968	0.060	0.853	1.088	0.984	0.057	0.876	1.101
2014	1.016	0.022	0.979	1.066	0.891	0.056	0.786	1.007	0.877	0.054	0.781	0.992
2015	0.974	0.027	0.914	1.018	1.170	0.085	1.006	1.338	1.201	0.080	1.046	1.360
2016	0.952	0.035	0.866	1.004	1.163	0.101	0.969	1.367	1.221	0.094	1.055	1.422
2017	1.062	0.034	1.012	1.146	1.491	0.134	1.257	1.781	1.404	0.117	1.194	1.654
2018	0.952	0.031	0.877	0.999	1.974	0.157	1.669	2.286	2.074	0.151	1.776	2.367
2019	1.026	0.026	0.985	1.086	1.669	0.129	1.427	1.932	1.627	0.120	1.399	1.868
2020	0.921	0.038	0.831	0.979	1.299	0.125	1.063	1.552	1.410	0.114	1.202	1.651
2021	1.067	0.036	1.013	1.155	1.674	0.161	1.377	2.009	1.569	0.139	1.306	1.852
2022	1.031	0.031	0.981	1.103	1.968	0.181	1.644	2.352	1.908	0.166	1.607	2.257
2023	1.064	0.034	1.017	1.150	2.381	0.172	2.069	2.742	2.238	0.145	1.970	2.538
2024	0.975	0.025	0.917	1.013	1.202	0.084	1.039	1.369	1.234	0.083	1.079	1.403

APPENDIX D: COMPARISON WITH PREVIOUS SERIES

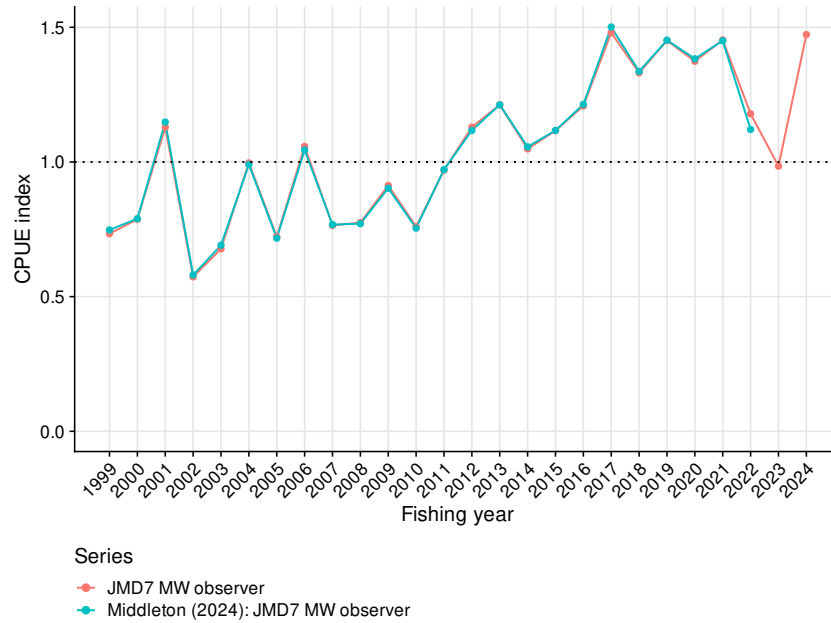


Figure D.1: Comparison between the JMD7 MW observer series and the previous update to 2022 (Middleton et al. 2024). All series are scaled to a geometric mean of one for the years in common.



Figure D.2: Comparison between the JMN7 MW observer series and the previous update to 2022 (Middleton et al. 2024). All series are scaled to a geometric mean of one for the years in common.

APPENDIX E: GLOSSARY

Table E.1: Product state codes used in this report.

Code	Description
DRE	Dressed
FIL	Fillets: skin-on
GRE	Green (or whole)
GUT	Gutted
HGT	Headed, gutted, and tailed
HGU	Headed and gutted
MEA	Fish meal
SKF	Fillets: skin-off
SUR	Surimi

Table E.2: Form type codes used in this report.

Code	Description
CEL	Catch, Effort and Landing Return (CELR)
ERS - Diving	Electronic Reporting System - Diving
ERS - Lining	Electronic Reporting System - Lining
ERS - Netting	Electronic Reporting System - Netting
ERS - Potting	Electronic Reporting System - Potting
ERS - Seining	Electronic Reporting System - Seining
ERS - Trawl	Electronic Reporting System - Trawl
HTC	High Seas Trawl Catch Effort Return (HS TCER)
LCE	Lining Catch Effort Return (LCER)
LTC	Lining Trip Catch Effort Return (LTCER)
NCE	Netting Catch, Effort and Landing Return (NCELR)
SJC	Squid Jigging Catch and Effort Return (SJCER)
TCE	Trawl Catch Effort Return (TCER)
TCP	Trawl Catch, Effort and Processing Return (TCEPR)
TUN	Tuna Longlining Catch Effort Return (TLCER)

Table E.3: Fishing method codes used in this report.

Code	Description
BT	Bottom trawl
MW	Midwater trawl
PRB	Precision bottom trawl
PRM	Precision midwater trawl
PS	Purse seine

Table E.4: Species codes used in this report.

Code	Common name	Scientific name
BAR	Barracouta	<i>Thyrsites atun</i>
HOK	Hoki	<i>Macruronus novaezelandiae</i>
JMA	Jack mackerel	<i>Trachurus declivis</i> , <i>Trachurus murphyi</i> , <i>Trachurus novaezelandiae</i>
JMD	Greenback jack mackerel	<i>Trachurus declivis</i>
JMM	Slender jack mackerel	<i>Trachurus murphyi</i>
JMN	Yellowtail jack mackerel	<i>Trachurus novaezelandiae</i>
KAH	Kahawai	<i>Arripis trutta</i> , <i>Arripis xylabion</i>
SQU	Arrow squid	<i>Nototodarus sloanii</i> , <i>Nototodarus gouldi</i>

Table E.5: Destination codes used in reporting of landings and disposals, with introduction date for codes that were not defined in the original Fisheries (Reporting) Regulations 1990. The inclusion of the landing/disposal in subsequent MHR returns is indicated in circulars issued under the Fisheries (Reporting) Regulations 2017. Only categories that are legally retainable, and considered final, are included in the catches and removals for a stock. LFR = Licensed Fish Receiver.

Code	Description	Date		Final	Retainable	Included in		
		Introduced	Revoked			MHR	Catches	Removals
A	Accidental losses	-	-	Y	Y	Y	Y	Y
B	Retained for use as bait	-	-	Y	Y	Y	Y	Y
E	Catch eaten on board	-	-	Y	Y	Y	Y	Y
EOY	End of year landings	2017-10-01	-	Y	Y	Y	Y	Y
H	Losses from holding receptacles	-	2018-06-30	Y	Y	Y	Y	Y
HL	Losses from holding receptacles on land	2018-07-01	-	Y	Y	Y	Y	Y
HW	Losses from holding receptacles in the water	2018-07-01	-	Y	Y	Y	Y	Y
J	Observer or Fishery Officer authorised returns	2013-10-01	-	Y	Y	Y	Y	Y
L	Landings to an LFR	-	-	Y	Y	Y	Y	Y
LFL	Fish landed after being held live on land	2019-01-10	-	Y	Y	Y	Y	Y
LP	Final landing of fish from holding receptacles at sea	2018-07-01	2019-01-09	Y	Y	Y	Y	Y
LR	Final landing of retained fish	2017-10-01	-	Y	Y	Y	Y	Y
M	Sixth schedule returns (spiny dogfish)	2004-10-01	-	Y	Y	Y	Y	Y
O	Catch transported outside the EEZ	-	-	Y	Y	Y	Y	Y
PF	Predated fish	2018-07-01	-	Y	Y	Y	Y	Y
QL	Landings to an LFR after storing in a holding receptacle on land	2018-07-01	-	Y	Y	Y	Y	Y
S	Catch taken by a Fishery Officer or observer	-	-	Y	Y	Y	Y	Y
T	Transhipments	-	2018-06-30	Y	Y	Y	Y	Y
TL	Transhipments, reported as landed by the catching vessel	2018-07-01	-	Y	Y	Y	Y	Y
U	Used as bait	-	-	Y	Y	Y	Y	Y
W	Wharf sales	-	-	Y	Y	Y	Y	Y
Z	Returns to the sea (certain sharks, dead or near-dead)	2014-10-01	-	Y	Y	Y	Y	Y
BS	Biotoxin samples	2019-11-26	-	Y	Y	N	Y	Y
CS	Customary catch	2017-10-01	2019-11-25	Y	Y	N	Y	Y
D	Non-QMS returns	-	-	Y	Y	N	Y	Y
F	Landings as recreational entitlement	2002-07-11	-	Y	Y	N	Y	Y
I	Returns for safety of protected species	2022-11-01	-	Y	Y	N	Y	Y
V	Observer samples	2017-10-01	-	Y	Y	N	Y	Y
X	Permitted returns	2006-10-01	-	Y	Y	N	Y	N
C	Disposal to the Crown	-	2001-09-30	Y	Y	-	Y	Y
G	Returns above legal size	2018-07-01	-	Y	N	N	N	N
K	Lobster required returns (not sub-MLS)	2018-07-01	-	Y	N	N	N	N
Y	Sub-MLS returns	2017-10-01	-	Y	N	N	N	N
LF	Live fish held on land	2019-01-10	-	N	Y	N	N	N
N	Removals from holding receptacles at sea	2018-07-01	-	N	Y	N	N	N
P	Placed into a holding receptacle at sea	-	-	N	Y	N	N	N
Q	Placed into a holding receptacle on land	-	2018-06-30	N	Y	N	N	N
R	Landings retained on board	-	-	N	Y	N	N	N
TT	Transhipments, reported as landed by the receiving vessel	2017-10-01	-	N	Y	N	N	N