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Tini a Tangaroa

A rapid update of CPUE for the snapper fishery in SNA 2 to 2024

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Plain language summary

The snapper fishery in Fisheries Management Area 2 (SNA 2) occurs on the east coast of the North Island, primarily from Hawke Bay to East Cape. Snapper in this area is mainly taken as bycatch in trawling that targets tarakihi or gurnard.

Snapper in the north of the SNA 2 area (north of the Māhia Peninsula) and southern part of the area (mainly Hawke Bay) are separate biological stocks. As part of its management within the Quota Management System, snapper abundance in the north and south of SNA 2 is monitored using catch-per-unit-effort (CPUE) from bottom trawl fisheries and, in this report, CPUE series are provided for the period 2002 to 2024, a one-year update from the previous analysis.

Snapper abundance in both the north and south of SNA 2 has increased between 2016 and 2024: by more than three times in the north and by almost eight times in the south. Snapper in the southern area was assessed as Very Likely (> 90%) to be at or above the target level in 2023–24.

EXECUTIVE SUMMARY

Middleton, D.A.J.[1] **(2025). A rapid update of CPUE for the snapper fishery in SNA 2 to 2024.**

***New Zealand Fisheries Assessment Report 2025/32*. 116 p.**

A rapid update of the fishery characterisation and CPUE analysis was undertaken for snapper in SNA 2, adding data from the 2024 fishing year. There were no significant changes in the fishery, but catches from the gurnard target bottom trawl fishery increased. Catches for the fishing year to 30 September 2024 were just below the increased TACC that came into effect on 1 October 2024.

The updated CPUE analyses indicated that abundance in both SNA 2N and SNA 2S is likely to have increased, but was not significantly higher than abundance in 2023. The SNA 2S stock was assessed as Very Likely (> 90%) to be at or above the target level in 2023–24.

[1] Pisces Research, Wellington, New Zealand

1. INTRODUCTION

The snapper fishery in SNA 2 (Figure 1) was characterised using data to the end of the 2023 fishing year[2] by Middleton (2024). Standardised catch-per-unit-effort (CPUE) series were updated for the northern (SNA 2N) and southern (SNA 2S) sub-stocks, and a revised partial quantitative assessment was undertaken.

This report provides an updated assessment using data to the end of the 2024 fishing year. In 2024, the commercial catch of SNA 2 exceeded the Total Allowable Commercial Catch by more than 25% (Figure 2, Table B.1). Given the evidence of an increasing stock size (Middleton 2024), the TACC was increased from 315 t to 409 t, within a Total Allowable Catch (TAC) of 585 t, from 1 October 2024 (Table 1).

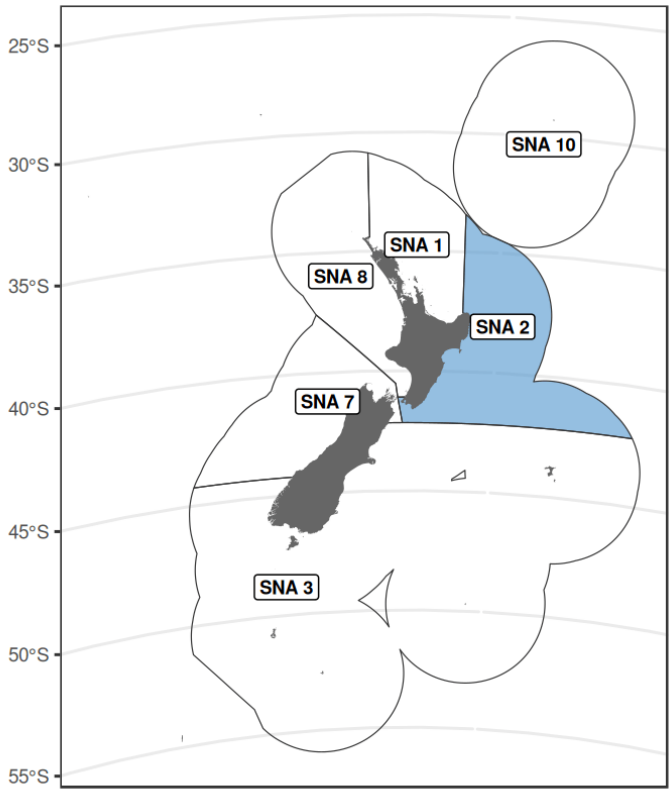

Figure 1: Quota Management Areas for snapper with SNA 2 highlighted.

Table 1: Total Allowable Catch (TAC), Total Allowable Commercial Catch (TACC), and allowances (all tonnes) for SNA 2, as at 1 October 2024.

			Allowances		
Stock	TAC	TACC	Customary	Recreational	Other mortality
SNA 2	585	409	14	122	40

[2] where the 2023 fishing year was 1 October 2022 to 30 September 2023

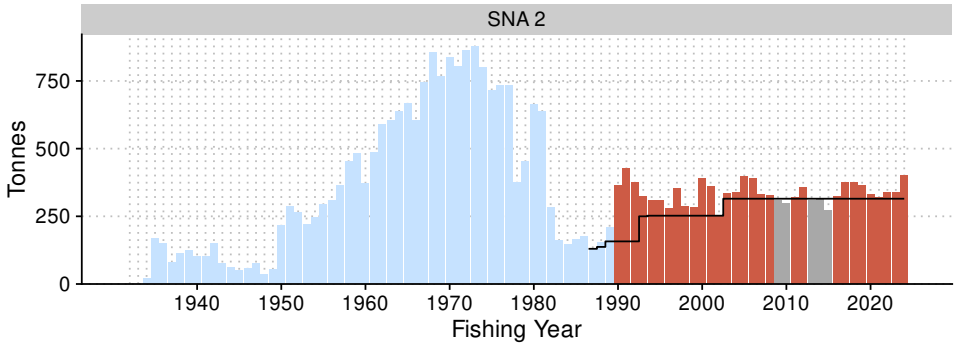

Figure 2: Total Allowable Commercial Catch (TACC; black line) and Monthly Harvest Return/Quota Management Report totals (bars) for SNA 2 from 1990 to 2024. Years where the TACC was exceeded are highlighted in red. Catches prior to 1990 are shown in blue using the information compiled in the Fisheries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

2. METHODS

Extracts (report logs 13159, 16453) 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 (2024).

3. FISHERY CHARACTERISATION

The SNA 2 fishery in 2024 showed no significant change from that described by Middleton (2024). There was a good correspondence between aggregated catches from the groomed landings data and MHR/QMR totals (Figure 3), and a good correspondence between total catches and catches that are allocated to fishing events in the characterisation dataset (Figure 4).

The increased catch in 2024 was primarily taken by bottom trawling, although an increase in the catches from set netting and other methods was also apparent (Figure 5). Within the bottom trawl fishery, the increased catch of snapper was mostly from gurnard target effort; some snapper target trawling was also undertaken after a notable absence of snapper target trawling in 2023 (Figure 6).

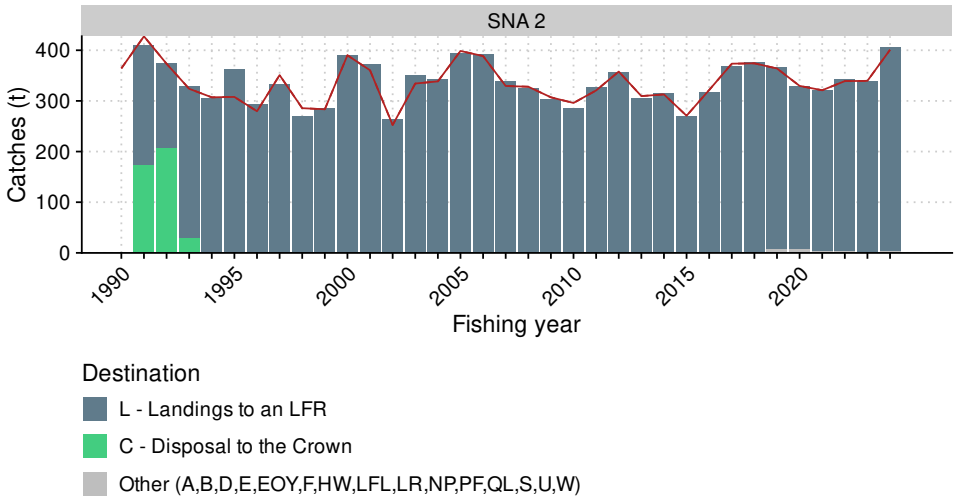

Figure 3: Catches of snapper by destination (bars), compared with Monthly Harvest Return / Quota Management Report (MHR/QMR) totals (line), for Quota Management Area SNA 2. Destination codes are defined in Table E.5 and tabulated catches are given in Appendix B.

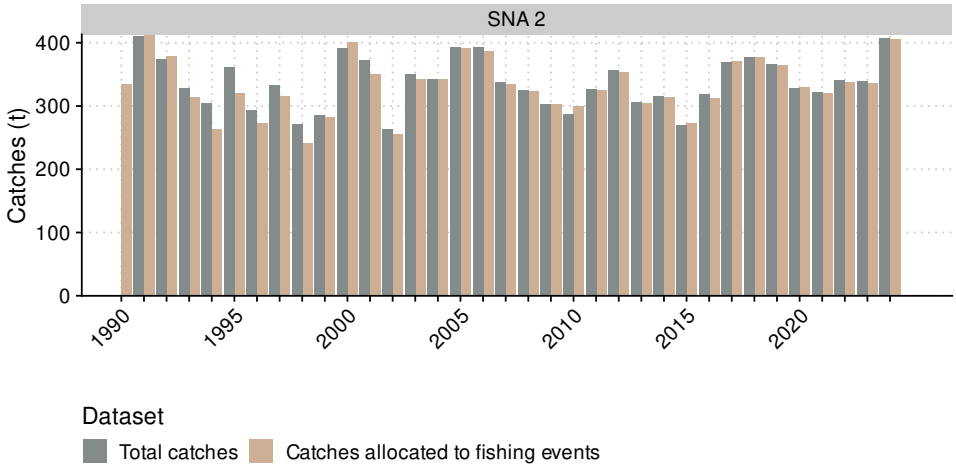

Figure 4: Total catches (t) of snapper from SNA 2 in comparison with catches allocated to fishing events in the characterisation dataset.

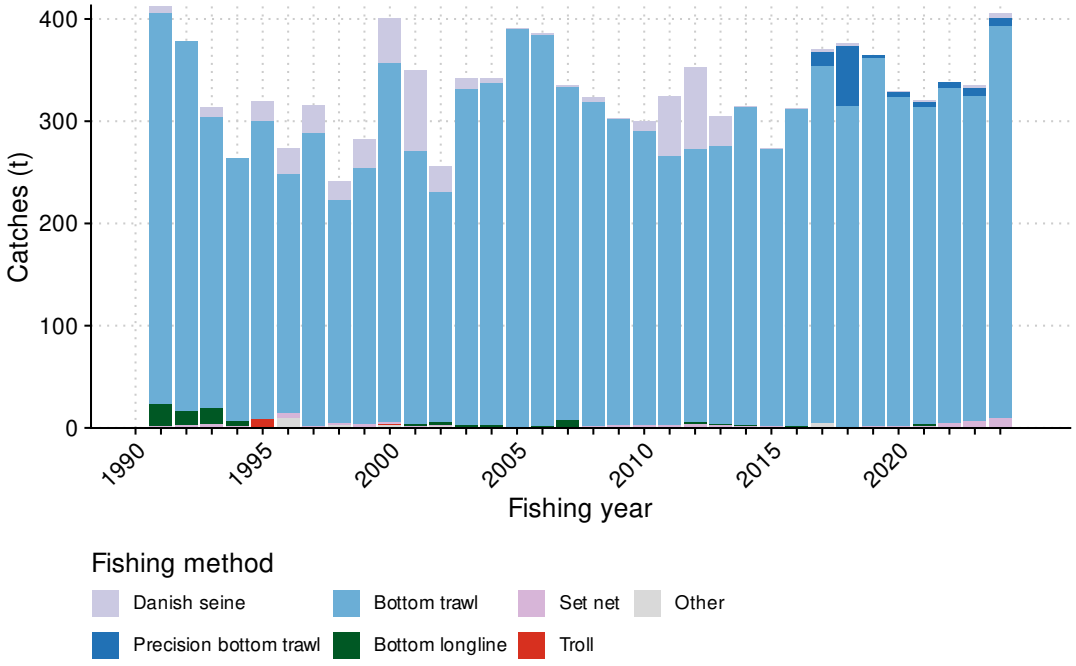

Figure 5: Catches of snapper by fishing method, for events within the SNA 2 Quota Management Area. Methods grouped as Other include: BPT, BS, CP, CRP, DL, DV, FN, FP, H, HL, MW, PL, POT, PS, RLP, SLL, TL. Tabulated results are provided in Appendix B, and a list of the main fishing method codes is included in the glossary Table E.3.

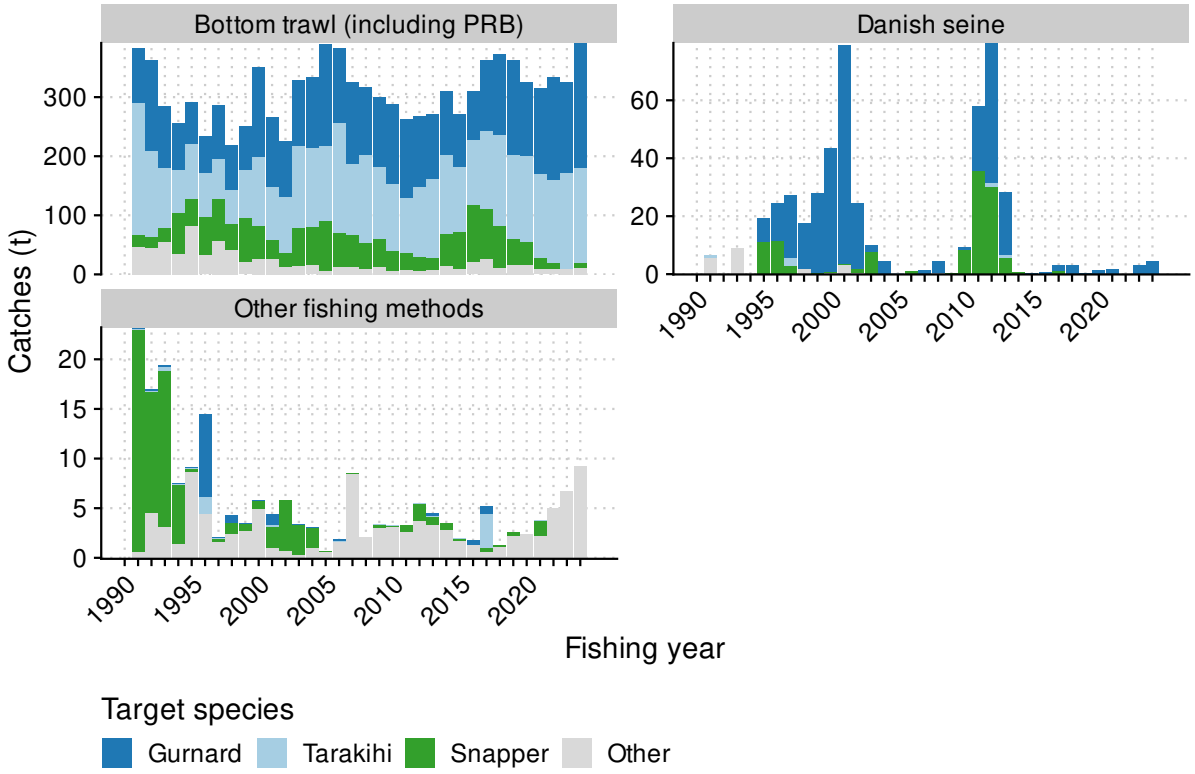

Figure 6: Catches of snapper by fishing method and declared target species, for events within the SNA 2 Quota Management Area. Precision bottom trawl (PRB) catches are included with conventional bottom trawl (BT) catches. Fishing methods grouped as Other include: BLL, BPT, BS, CP, CRP, DL, DV, FN, FP, H, HL, MW-PRM, PL, POT, PS, PSH, RLP, SLL, SN, T, TL. Species grouped as Other include target species with less than 20% of the snapper catch within the SNA 2 Quota Management Area in a fishing year.

3.1 The bottom trawl (including PRB) fishery

The increased catches in the bottom trawl fishery were primarily taken in Statistical Areas 013 and 014 (i.e., Hawke Bay), although there was also increased catch from Statistical Area 016 (the south coast of the North Island) (Figure 7).

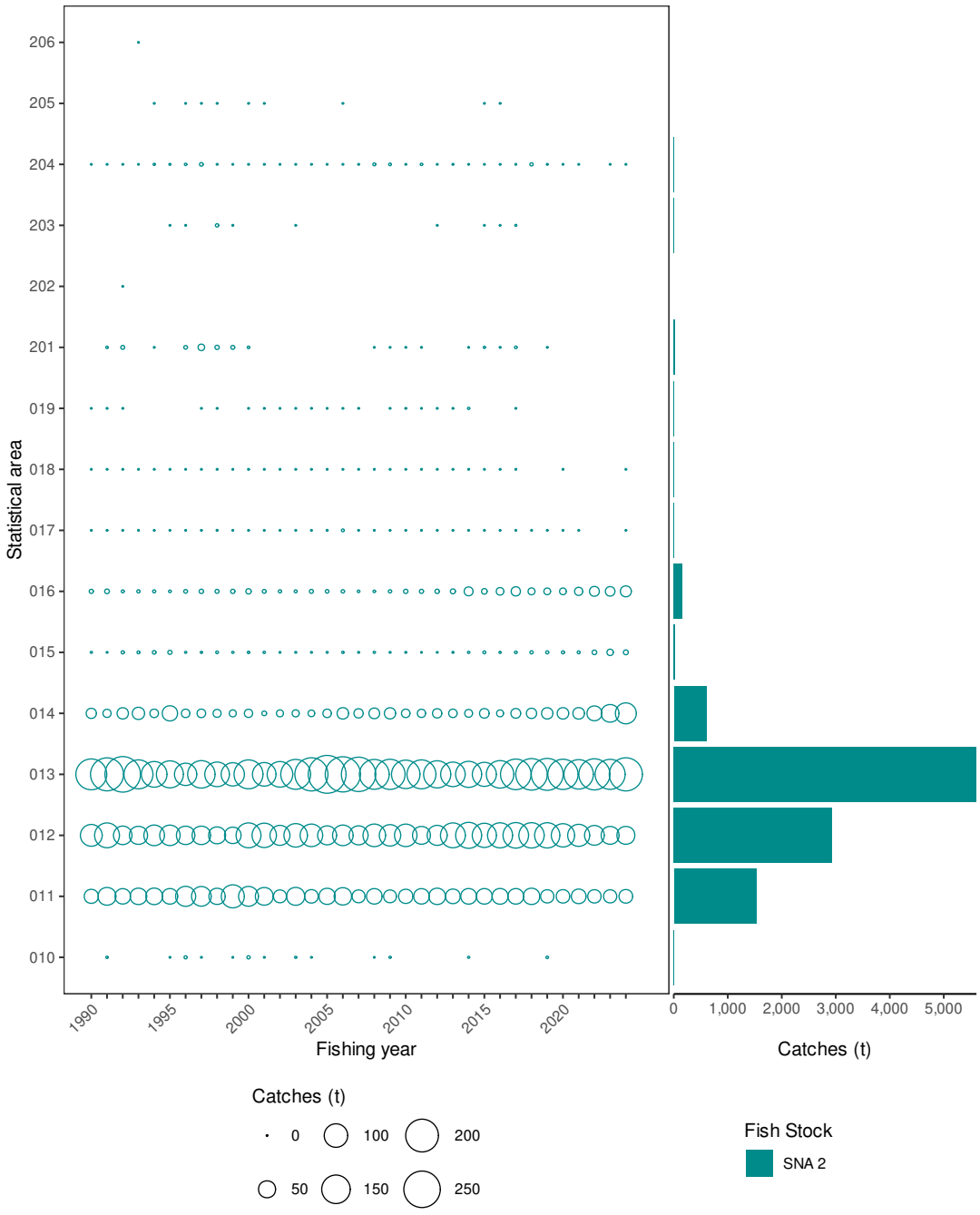

Figure 7: Annual SNA 2 catches (t) by statistical area for the bottom trawl (including PRB) fishery. The circle size scales with the catches by statistical area. The bar plot (right) shows the total catches of SNA 2 for each statistical area.

3.2 Catch history by sub-area

Commercial catch histories for SNA 2N and SNA 2S were compiled using the approach documented by Middleton (2024); the results are illustrated in Figure 8 and tabulated in Table B.8. In 2024, catches increased from both the northern and southern areas.

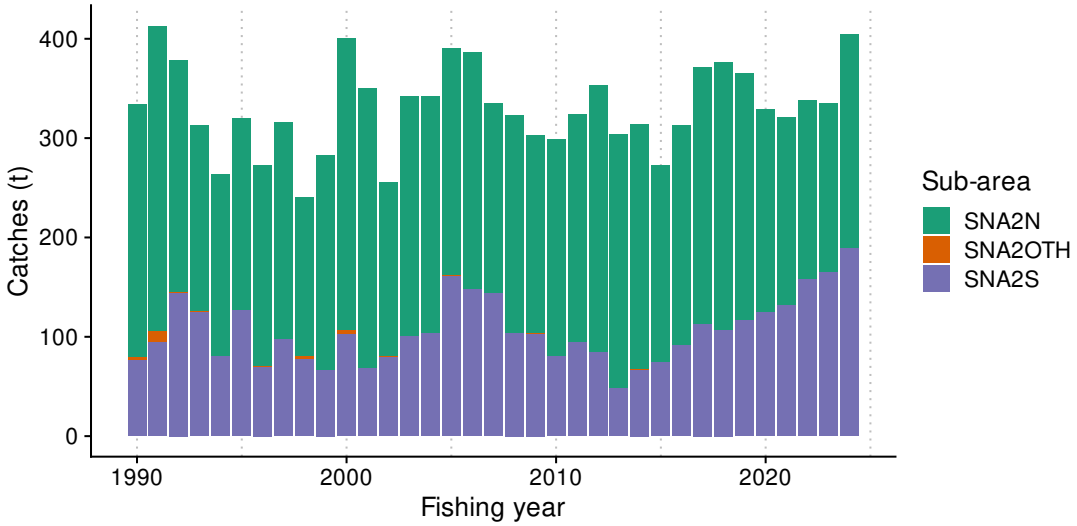

Figure 8: Catches for the northern and southern areas of SNA 2. Catches were allocated to the northern or southern areas based on statistical area, except for those from Statistical Area 013 which were considered to be from the northern area if taken east of 177.87°E, or if the trip landed in Auckland, Gisborne or Tauranga, or targeted tarakihi. Data are tabulated in Table B.8.

4. CATCH-PER-UNIT-EFFORT

Updated daily (pseudo-CELR) resolution CPUE series for SNA 2N and SNA 2S were fitted to data from 2002 to 2024, and event-resolution series were fitted for both areas from 2008 to 2024 (Table 2). In addition, the preferred series for monitoring the abundance of the SNA 2S stock, the SNA2S BT.MIX event (Hawke Bay) series, was also updated to 2024.

Standard diagnostics for all five series are provided in Appendix C, and the resulting series are compared with those provided by Middleton (2024) using data to 2023 in Appendix D. Model fits were similar to those reported by Middleton (2024). The only change in explanatory variables selected was in the SNA 2N daily model where the number of tows was selected as the effort variable in place of total towing duration in the positive catch model (Table C.5); despite this change, the effect of standardisation was similar.

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
SNA2N BT.MIX day	daily	allockg	Stepwise	5	5	lognormal
SNA2N BT.MIX event	event	allockg_top5	Stepwise	4	5	Weibull
SNA2S BT.MIX day	daily	allockg	Stepwise	5	5	lognormal
SNA2S BT.MIX event	event	allockg_top5	Stepwise	5	5	lognormal
SNA2S BT.MIX event (Hawke Bay)	event	allockg_top5	Stepwise	5	5	Weibull

4.1 Comparison of indices

In SNA 2N, there was more divergence between the daily and event resolution indices in 2024 than had been observed previously (Figure 9). In the daily-resolution series there were reduced catch rates when targeting tarakihi (Figure C.19), and in Statistical Areas 011 and 012 (Figure C.20). For the event resolution model there is some evidence of lower catch rates in Areas 011 and 012 (Figure C.44), but no particular difference between target species (Figure C.43).

In SNA 2S, the event resolution series increased more than the daily resolution series from 2022 to 2023; in 2024, however, the event resolution dropped slightly, while the daily resolution index continued to increase (Figure 10).

The event-resolution model for SNA 2S with data restricted to Hawke Bay also increased from 2023 to 2024 (Figure 11), although the rate of increase was reduced.

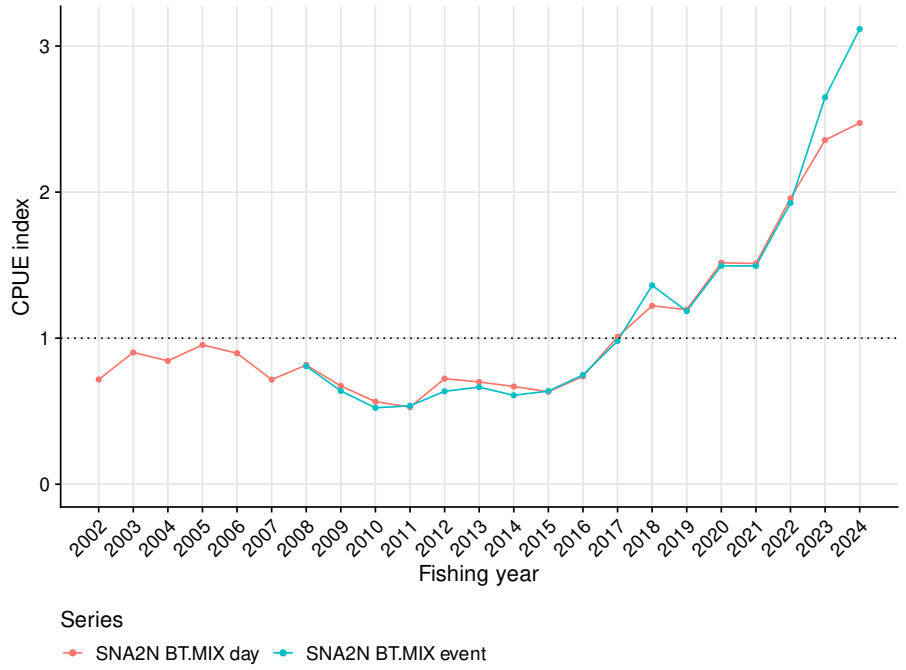

Figure 9: Comparison between the SNA 2N CPUE series for daily and event resolution datasets. Indices are scaled to a geometric mean of one for the years in common.

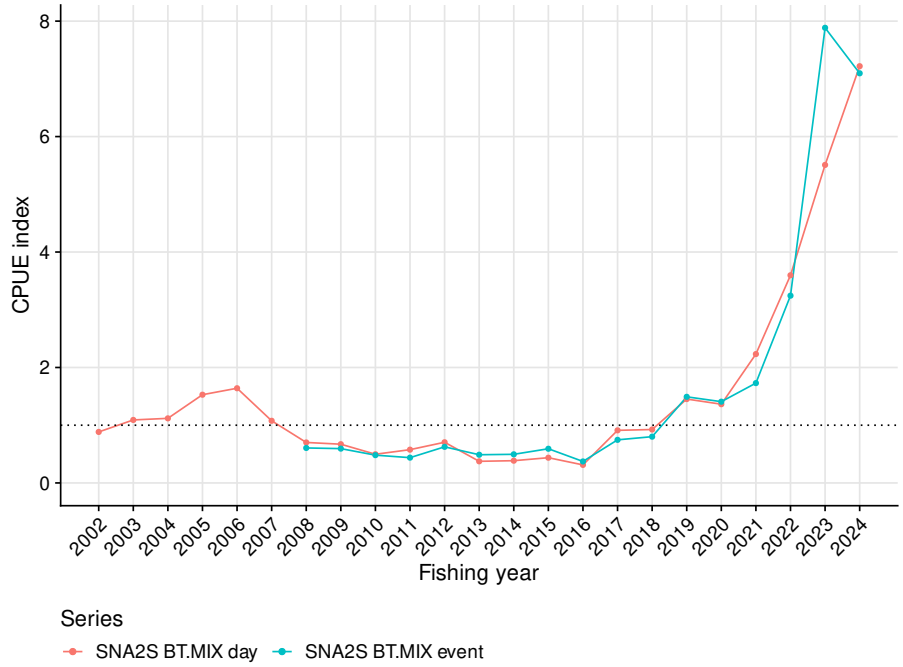

Figure 10: Comparison between the SNA 2S CPUE series for daily and event resolution datasets. Indices are scaled to a geometric mean of one for the years in common.

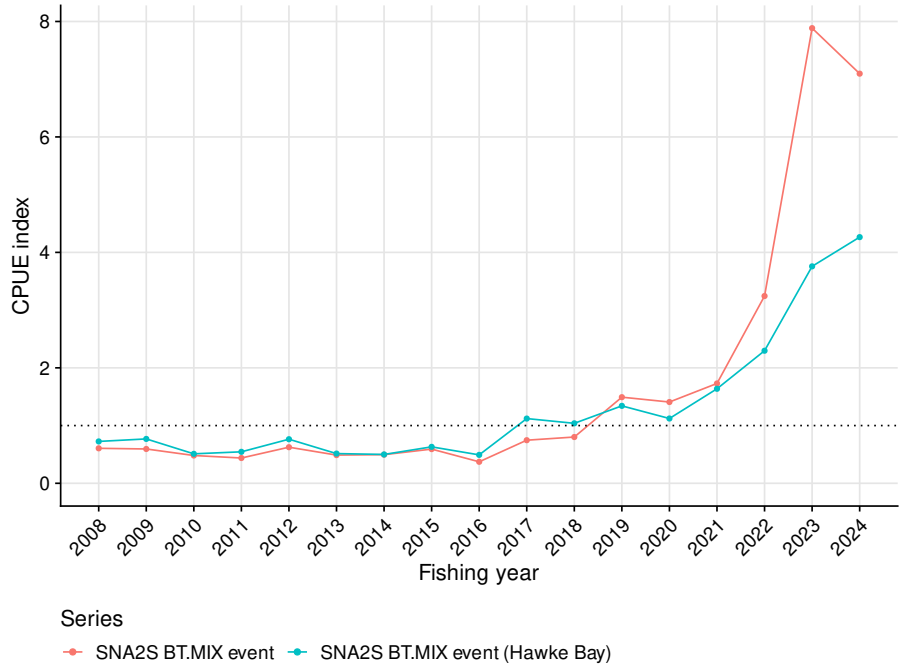

Figure 11: Comparison between the SNA 2S event CPUE series for different model regions. Indices are scaled to a geometric mean of one for the years in common.

4.1.1 Spatial residuals

Spatial residuals from the SNA2S BT.MIX event series (Figure 12) suggest that snapper abundance off the coast south of Hawke Bay continued to be disproportionately high in 2024, with lower relative abundance in inshore areas of Hawke Bay.

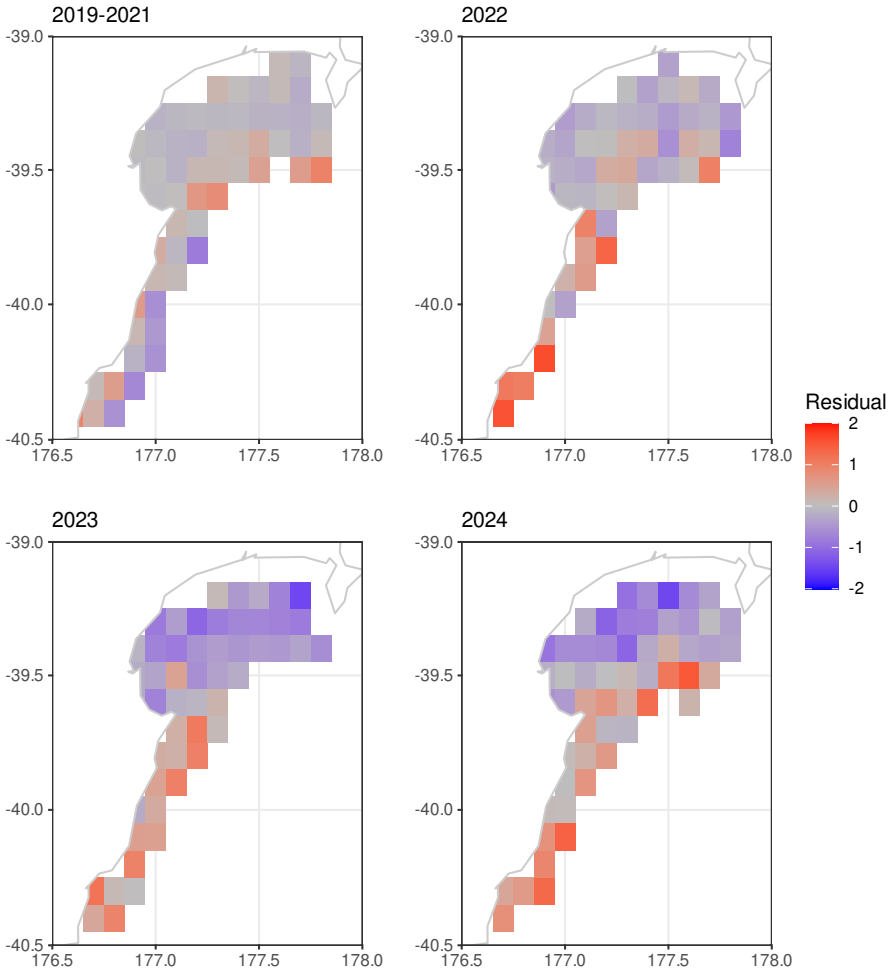

Figure 12: Mean residuals from the positive catch model of the SNA2S BT.MIX event series plotted using a 0.1 degree grid. For 2019–2021 grid cells were included if they contained at least 10 tow start positions; for 2022 to 2024 this threshold was reduced to three tows.

5. DISCUSSION

The updated CPUE indices indicate that abundance in SNA 2N and SNA 2S continued to increase in 2024, although this was at a somewhat reduced rate than that seen from 2021 to 2023 when the increase was especially substantial. Differences between daily- and event-resolution indices were more apparent in 2024.

5.1 Stock status

5.1.1 SNA 2S

The accepted index for monitoring the southern sub-stock (SNA 2S) abundance is the event resolution model with data from Hawke Bay only. Abundance appears to have increased somewhat from 2023 to 2024, but the overlapping confidence intervals indicate that the stock could also be interpreted as remaining at a similar abundance to that seen in 2023. No change in the assessed status is required and the SNA 2S stock is considered Very Likely (> 90%) to be at or above the target in 2023–24 (Figure 13). In the absence of information on recreational harvests in 2024, the change in relative exploitation rate cannot be assessed.

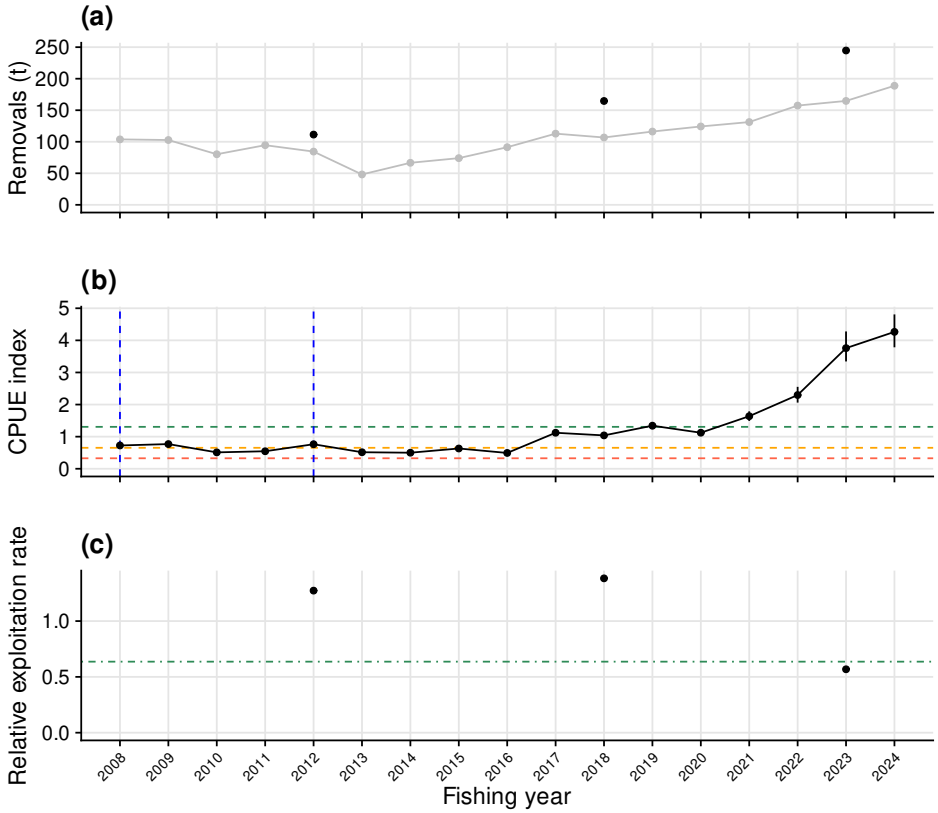

Figure 13: (a) Commercial removals (grey line) and total removals (black points, in years with NPS estimates of recreational harvest); (b) stock status; and (c) relative exploitation rate of SNA 2S relative to the reference period (2008-2012, indicated by dashed vertical lines in panel b), with geometric mean CPUE from the Hawke Bay event-resolution model (black line) in this period considered to represent the soft limit and indicated by the horizontal orange dashed line. The target and hard limit are represented by horizontal dashed green and red lines, respectively.

5.1.2 SNA 2N

Abundance of the SNA 2N sub-stock is assessed based on the daily-resolution CPUE index; as was the case for SNA 2S, there is evidence that the stock abundance has increased further from 2023 to 2024, but not significantly (Figure 14). A target reference level has not been set for the SNA 2N sub-stock and, as was the case for SNA 2S, there is no information on recreational harvests that would be required to update the relative exploitation rate.

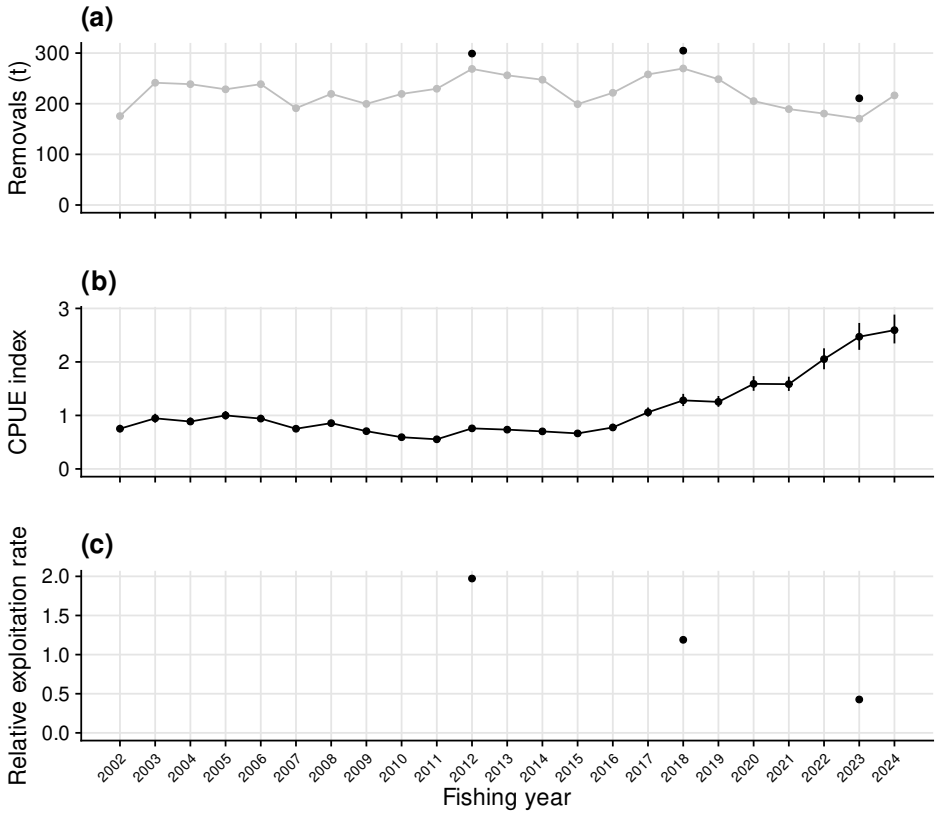

Figure 14: (a) Commercial removals (grey line) and total removals (black points, in years with NPS estimates of recreational harvest); (b) stock status; and (c) relative exploitation rate of SNA 2N using the daily-resolution CPUE model.

6. ACKNOWLEDGEMENTS

This work was funded by the Seafood New Zealand Inshore Council. Access to the required data was granted by Fisheries New Zealand. Analyses were carried out using the Kahawai Collective's reproducible research platform. Constructive review by the Inshore Fisheries Assessment Working Group is gratefully acknowledged.

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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
FLKIN	Fix	Update landed species to SUR when KIN is landed from trips with diving events and no MHR support
LADAM	Flag	Landings where the landing date is missing
LADAF	Flag	Landings where the landing date is in the future
LADTI	Flag	Invalid landing destination
LAFLA	Fix	Correct landings using a flatfish species code to FLA
LAHPB	Fix	Correct landings using a groper species code to HPB
LASQU	Fix	Recode SQU1J and SQU1T landings to SQU1
LATUN	Fix	Correct stock code for non-QMS tunas
LASEC	Fix	Landings to Crown or experimental stock codes
LAQMS	Fix	Replace pre-QMS pseudo-stock with the post-QMS stock code
LADMR	Drop	Mandatory returns (e.g. sub-MLS)
LADTH	Drop	Retained (non-final) landings
LADTT	Flag	Vessel received transhipments
LASCF	Fix	Correct some state codes
LASCI	Flag	Landings to invalid state code
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

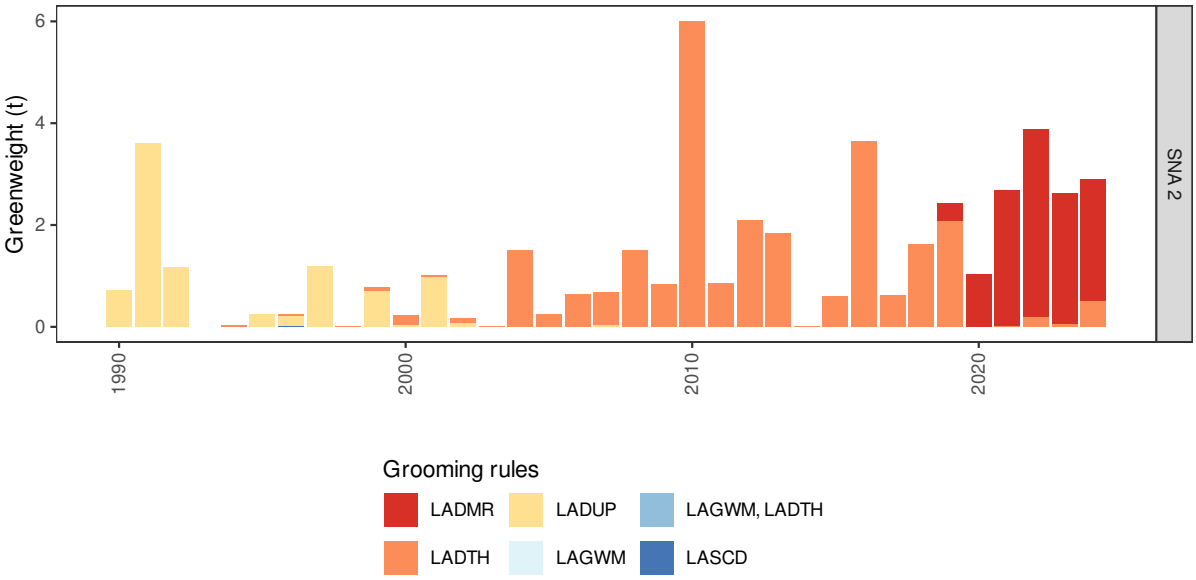

Figure A.1: The quantity of landings dropped, with the relevant grooming rules indicated, by stock and fishing year.

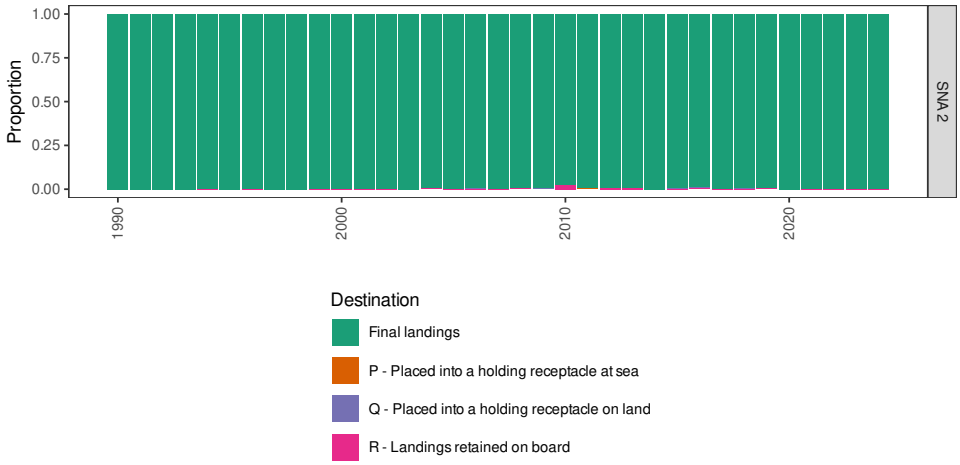

Figure A.2: The proportion of total (final and non-final) landings that are initially to non-final destinations, by stock and fishing year.

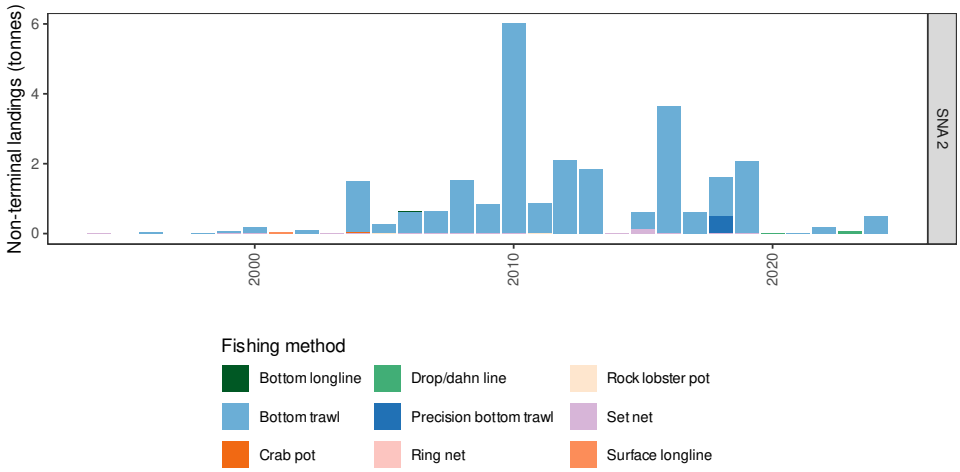

Figure A.3: The quantity of non-final landings, by stock, fishing year, and the modal fishing method used on the trip.

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.

			Greenweight (kg)	
QMA	Fishing year	Trips	Original	Adjusted
SNA 2	1991	1	2 390.0	23.900
SNA 2	2003	1	278.8	2.788
SNA 2	2004	1	296.0	2.960
SNA 2	2005	1	350.0	3.500
SNA 2	2006	1	370.0	3.700
SNA 2	2024	1	292.0	2.920

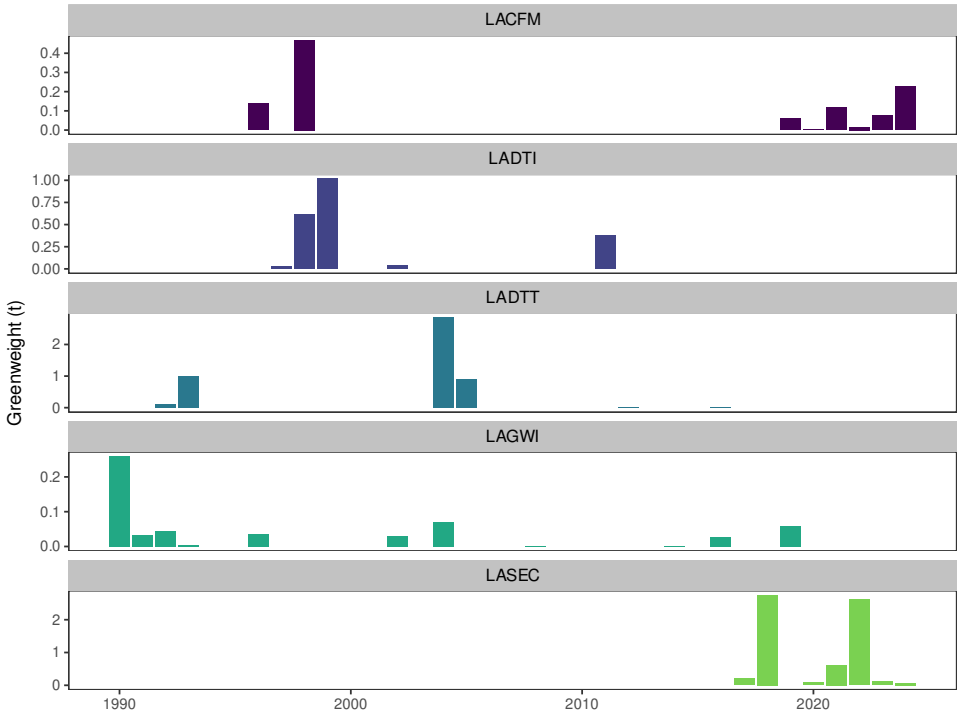

Figure A.4: The quantity of landings flagged by the grooming rules, or where fixes were applied to fields other than the landed greenweight. Note that some landing events may be affected by multiple rules.

A.2 Effort

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

Rule	Effect	Description
FLKIN	Fix	Update target species to SUR when KIN is reported from diving events with no MHR support
FEMDV	Fix	Update historical diving method codes to DV
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
FESAS	Fix	For BCO 4 only correct RL statistical areas to general areas
FESAF	Flag	Flag non RLP events using RL statistical area codes
FESDF	Flag	Flag events in the future
FESDM	Flag	Flag events with missing start date/time
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
FEEHN	Fix	Fix transposed effort numbers for lining methods on CELR forms
FEEMU	Fix	Fix SN mesh sizes recorded in inches
FEFMA	Flag	Mark trips which landed to more than one fishstock for straddling statistical areas
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
FLKIN	Fix	Update estimated catch species to SUR when KIN is reported from diving events with no MHR support
ESTGT	Fix	Create estimated catch records for events with a total catch weight only
ESCWN	Fix	Correct cases where estimated catch is recorded in weight but number of fish is expected

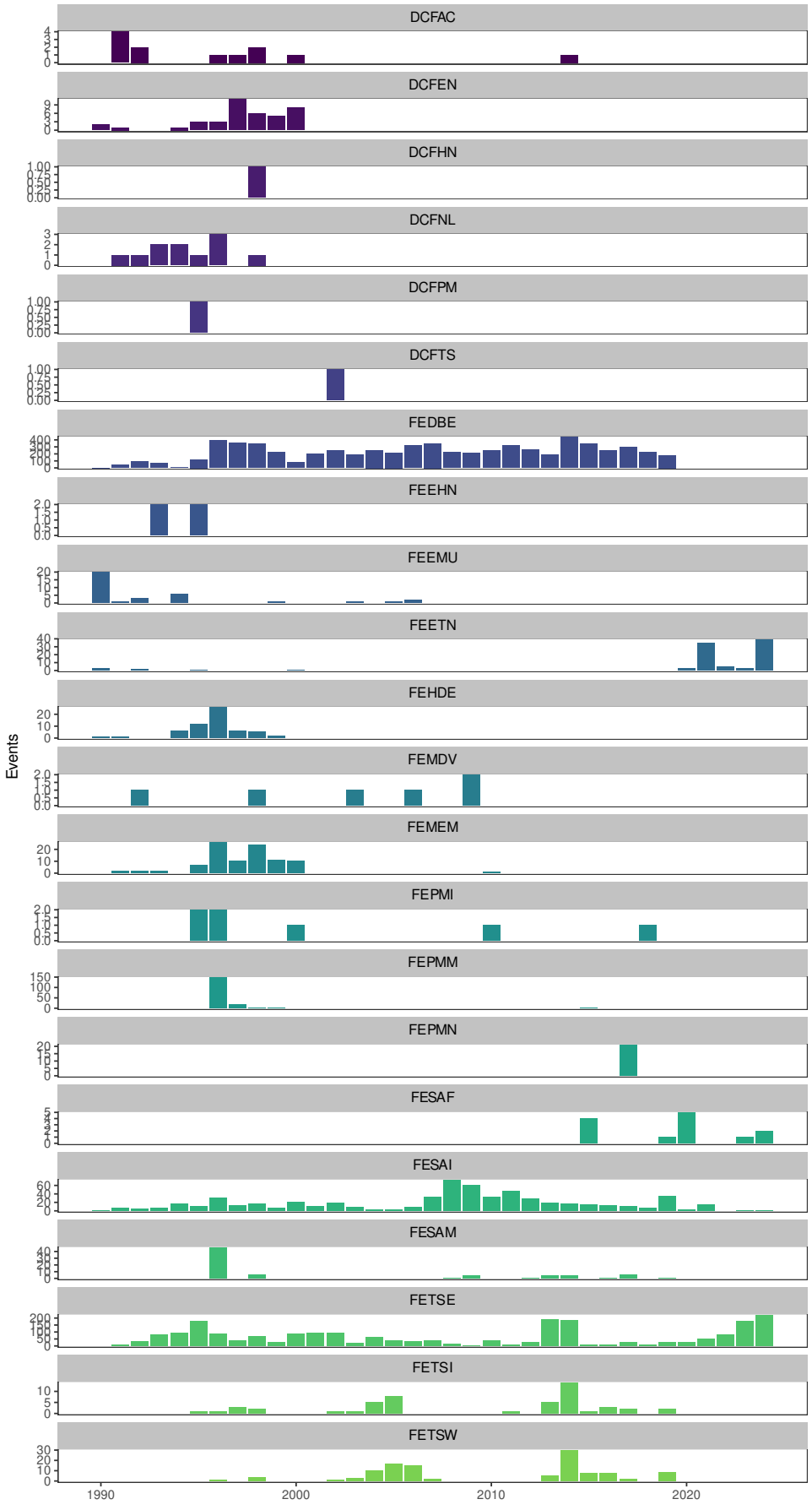

Figure A.5: The number of fishing events flagged or fixed by the grooming rules. Note that some events may be affected by multiple rules.

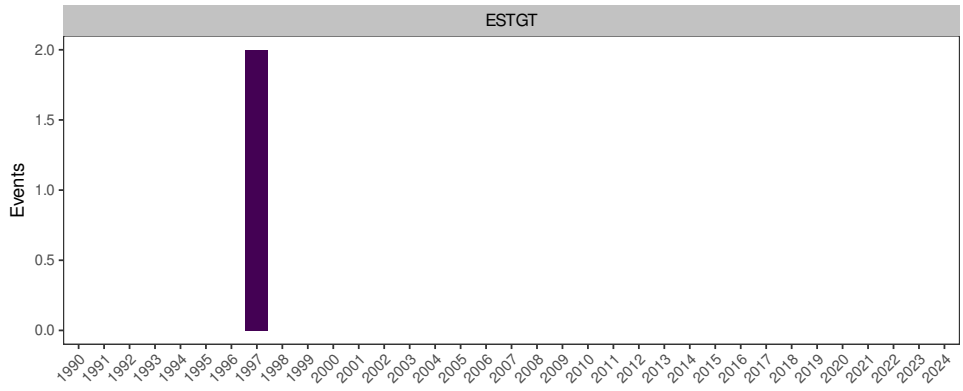

Figure A.6: The number of fishing events where the estimated catch of snapper was flagged or fixed by the grooming rules. Note that some events may be affected by multiple rules.

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 SNA 2 from 1990 to 2024.

Fishing year	SNA 2	
	TACC	MHR/QMR
1990	157.40	364.14
1991	157.40	427.51
1992	157.40	373.30
1993	250.00	323.92
1994	252.30	307.06
1995	252.30	307.85
1996	252.30	279.58
1997	252.30	350.92
1998	252.30	285.66
1999	252.30	283.45
2000	252.30	390.11
2001	252.30	360.44
2002	252.30	252.45
2003	315.00	334.26
2004	315.00	338.57
2005	315.00	398.58
2006	315.00	388.57
2007	315.00	329.43
2008	315.00	327.98
2009	315.00	307.08
2010	315.00	295.95
2011	315.00	320.67
2012	315.00	357.91
2013	315.00	309.51
2014	315.00	312.82
2015	315.00	270.71
2016	315.00	321.50
2017	315.00	373.49
2018	315.00	374.18
2019	315.00	364.01
2020	315.00	329.63
2021	315.00	321.07
2022	315.00	339.06
2023	315.00	339.60
2024	315.00	400.88

Table B.2: Annual SNA 2 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 snapper was targeted. – : no observations.

Fishing year	QMR/MHR (t)	Catches (t)	Allocated catches			Target catches	
			Total (t)	BT-PRB (%)	DS (%)	tonnes	%
1990	364.14	361.04	334.57	93.55	-	55.00	16.44
1991	427.51	410.87	413.07	92.80	1.61	43.62	10.56
1992	373.30	374.54	378.69	95.51	-	32.20	8.50
1993	323.92	328.44	313.30	91.00	2.82	40.73	13.00
1994	307.06	304.55	263.88	97.15	-	76.13	28.85
1995	307.85	361.94	319.98	91.11	6.03	57.93	18.11
1996	279.58	293.25	273.00	85.74	8.98	77.55	28.41
1997	350.92	332.52	315.87	90.71	8.65	76.64	24.26
1998	285.66	270.50	240.91	90.88	7.36	46.45	19.28
1999	283.45	285.84	282.20	88.83	9.94	76.04	26.95
2000	390.11	390.72	401.08	87.66	10.89	57.35	14.30
2001	360.44	372.64	350.20	76.26	22.50	35.11	10.02
2002	252.45	263.11	255.65	88.10	9.61	30.96	12.11
2003	334.26	349.68	342.00	96.08	2.95	74.81	21.88
2004	338.57	342.73	342.06	97.79	1.31	67.97	19.87
2005	398.58	393.30	390.99	99.75	0.09	84.42	21.59
2006	388.57	392.87	386.26	99.24	0.29	59.00	15.27
2007	329.43	337.85	335.12	97.05	0.42	55.66	16.61
2008	327.98	324.76	323.14	97.95	1.40	47.12	14.58
2009	307.08	303.05	302.69	98.83	0.06	48.60	16.06
2010	295.95	286.21	299.55	95.82	3.10	43.16	14.41
2011	320.67	327.02	324.14	81.13	17.87	65.65	20.25
2012	357.91	356.99	353.10	75.89	22.56	57.59	16.31
2013	309.51	306.65	304.24	89.20	9.34	28.84	9.48
2014	312.82	314.63	314.16	98.75	0.16	56.71	18.05
2015	270.71	270.02	273.21	99.19	0.07	64.81	23.72
2016	321.50	318.07	312.90	99.25	0.19	97.70	31.23
2017	373.49	368.66	370.70	97.70	0.88	86.53	23.34
2018	374.18	377.57	376.34	98.88	0.78	72.39	19.23
2019	364.01	366.27	364.95	99.19	0.10	45.50	12.47
2020	329.63	328.28	329.51	98.89	0.40	38.11	11.57
2021	321.07	321.03	320.59	98.26	0.57	21.12	6.59
2022	339.06	341.42	337.90	98.53	0.00	11.59	3.43
2023	339.60	338.96	335.19	97.09	0.91	0.40	0.12
2024	400.88	406.31	405.19	96.63	1.11	9.51	2.35

Table B.3: Annual snapper catches (t) by destination code for the SNA 2 Quota Management Area. C = Disposal to the Crown, L = Landings to an LFR. A complete list of destination codes is provided in Table E.5. – : no observations.

Fishing year	L	C	Other	Total
1990	208.81	151.82	0.41	361.04
1991	238.12	172.52	0.23	410.87
1992	168.41	205.15	0.98	374.54
1993	299.78	28.34	0.32	328.44
1994	302.72	1.10	0.73	304.55
1995	360.48	-	1.46	361.94
1996	292.50	-	0.75	293.25
1997	332.13	0.01	0.38	332.52
1998	269.85	-	0.65	270.50
1999	284.62	-	1.22	285.84
2000	390.67	-	0.05	390.72
2001	372.63	0.01	0.01	372.64
2002	262.78	-	0.34	263.11
2003	349.57	-	0.11	349.68
2004	342.19	-	0.54	342.73
2005	393.13	-	0.17	393.30
2006	392.38	-	0.49	392.87
2007	336.55	-	1.30	337.85
2008	324.08	-	0.68	324.76
2009	302.17	-	0.88	303.05
2010	285.22	-	0.99	286.21
2011	325.29	-	1.73	327.02
2012	356.04	-	0.95	356.99
2013	305.97	-	0.68	306.65
2014	314.03	-	0.59	314.63
2015	269.46	-	0.57	270.02
2016	317.09	-	0.98	318.07
2017	368.09	-	0.57	368.66
2018	376.70	-	0.87	377.57
2019	360.13	-	6.14	366.27
2020	322.19	-	6.09	328.28
2021	317.68	-	3.34	321.03
2022	337.69	-	3.72	341.42
2023	337.10	-	1.86	338.96
2024	402.88	-	3.42	406.31

Table B.4: Annual catches by landed state of snapper from the SNA 2 Quota Management Area. DRE = Dressed, DVC = Dressed-V cut (stargazer), GRE = Green (or whole), GUT = Gutted, HDS = Heads, HGU = Headed and gutted. 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	GRE	DRE	HGU	GUT	DVC	HDS	Other	Total
1990	359.90	-	0.25	0.89	-	-	-	361.04
1991	406.63	0.91	3.06	0.27	-	-	-	410.87
1992	371.70	0.34	2.03	0.47	-	-	-	374.54
1993	325.01	0.73	2.15	0.55	-	-	-	328.44
1994	301.38	1.03	0.85	1.28	-	-	-	304.55
1995	359.42	0.97	0.89	0.57	-	-	0.10	361.94
1996	291.77	0.62	0.28	0.56	-	-	-	293.23
1997	329.91	1.09	0.21	0.81	0.49	-	-	332.52
1998	266.15	0.16	2.79	0.85	-	0.47	-	270.42
1999	282.81	2.65	0.24	0.15	-	-	-	285.84
2000	389.96	0.32	0.08	0.37	-	-	-	390.72
2001	371.67	0.61	-	0.35	-	-	0.01	372.64
2002	261.17	1.31	0.53	0.10	-	-	0.00	263.11
2003	349.10	0.56	-	0.01	-	-	0.01	349.68
2004	340.74	0.64	-	1.35	-	-	0.00	342.73
2005	392.94	0.32	0.02	0.02	-	-	0.01	393.30
2006	390.72	2.04	-	0.08	-	-	0.03	392.87
2007	327.13	10.55	0.02	0.13	-	-	0.02	337.85
2008	323.72	0.90	0.10	0.01	-	-	0.03	324.76
2009	301.62	1.19	0.03	0.05	-	-	0.16	303.05
2010	285.78	0.03	-	0.31	-	-	0.08	286.21
2011	326.31	0.43	0.07	0.19	-	-	0.03	327.02
2012	356.47	0.15	-	0.30	-	-	0.08	356.99
2013	306.18	0.27	-	0.11	-	-	0.08	306.65
2014	313.73	0.80	-	0.03	-	-	0.07	314.63
2015	269.93	0.00	-	0.02	-	-	0.07	270.02
2016	317.63	0.04	-	0.30	-	-	0.10	318.07
2017	364.69	3.82	-	0.05	-	-	0.10	368.66
2018	377.27	0.11	-	0.08	-	-	0.12	377.57
2019	364.49	1.78	-	0.00	-	-	0.00	366.27
2020	328.28	-	-	0.00	-	-	-	328.28
2021	320.93	-	-	-	-	-	0.09	321.03
2022	341.36	-	0.04	-	-	-	0.02	341.42
2023	338.88	-	0.07	0.00	-	-	0.00	338.96
2024	406.06	-	0.11	0.00	-	-	0.14	406.31

Table B.5: Annual modal conversion factor reported for product state codes of snapper from the SNA 2 Quota Management Areas. DRE = Dressed, FIL = Fillets: skin-on, GRE = Green (or whole), GUT = Gutted, HDS = Heads, HGU = Headed and gutted, SKF = Fillets: skin-off. – : no observations.

Fishing year	GRE	GUT	HGU	DRE	FIL	HDS	SKF
1990	1.00	1.10	1.60	-	-	-	-
1991	1.00	1.10	1.60	1.80	-	-	-
1992	1.00	1.10	1.60	1.80	-	-	-
1993	1.00	1.10	1.60	1.80	-	-	-
1994	1.00	1.10	1.60	1.80	-	-	-
1995	1.00	1.10	1.60	1.80	2.40	-	-
1996	1.00	1.10	1.60	1.80	-	-	-
1997	1.00	1.10	1.60	1.80	-	-	-
1998	1.00	1.10	1.60	1.80	-	0.00	-
1999	1.00	1.10	1.60	1.80	-	-	-
2000	1.00	1.10	1.60	1.80	-	-	-
2001	1.00	1.10	-	1.80	2.40	-	-
2002	1.00	1.10	1.60	1.80	-	-	2.70
2003	1.00	1.10	-	1.80	2.40	-	-
2004	1.00	1.10	-	1.80	-	-	-
2005	1.00	1.10	1.60	1.80	2.40	-	-
2006	1.00	1.10	-	1.80	2.40	-	-
2007	1.00	1.10	1.60	1.80	2.40	-	2.70
2008	1.00	1.10	1.60	1.80	2.40	-	2.70
2009	1.00	1.10	1.60	1.80	2.40	-	2.70
2010	1.00	1.10	-	1.80	2.40	-	2.70
2011	1.00	1.10	1.60	1.80	-	-	2.70
2012	1.00	1.10	-	1.80	2.40	-	2.70
2013	1.00	1.10	-	1.80	2.40	-	2.70
2014	1.00	1.10	-	1.80	-	-	2.70
2015	1.00	1.10	-	1.80	2.40	-	2.70
2016	1.00	1.10	-	1.80	-	-	2.70
2017	1.00	1.10	-	1.80	2.40	-	2.70
2018	1.00	1.10	-	1.80	-	-	2.70
2019	1.00	1.10	-	1.80	2.40	-	-
2020	1.00	1.10	-	-	-	-	-
2021	1.00	-	-	-	2.40	-	-
2022	1.00	-	1.60	-	2.40	-	2.70
2023	1.00	1.10	1.60	-	-	-	2.70
2024	1.00	1.10	1.60	-	-	-	2.70

Table B.6: Reporting forms used for effort on trips landing snapper from the SNA 2 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.

	Records (N)							Allocated catches (t)						
Fishing year	CEL	TCP	Other	TCE	ERS - Trawl	ERS - Netting	Total	CEL	TCP	Other	TCE	ERS - Trawl	ERS - Netting	Total
1990	2 174	64	-	-	-	-	2 238	334.57	0.00	-	-	-	-	334.57
1991	2 631	502	-	-	-	-	3 133	394.02	19.04	-	-	-	-	413.07
1992	3 337	571	-	-	-	-	3 908	347.05	31.64	-	-	-	-	378.69
1993	3 282	638	-	-	-	-	3 920	302.52	10.78	-	-	-	-	313.30
1994	3 070	1 177	-	-	-	-	4 247	227.79	36.09	-	-	-	-	263.88
1995	2 857	1 186	-	-	-	-	4 043	266.92	53.06	-	-	-	-	319.98
1996	2 349	1 956	-	-	-	-	4 305	166.08	106.92	-	-	-	-	273.00
1997	2 411	1 729	-	-	-	-	4 140	233.95	81.92	-	-	-	-	315.87
1998	2 457	1 383	-	-	-	-	3 840	183.24	57.66	-	-	-	-	240.91
1999	2 648	1 484	-	-	-	-	4 132	222.68	59.52	-	-	-	-	282.20
2000	3 032	1 189	-	-	-	-	4 221	357.78	43.31	-	-	-	-	401.08
2001	2 719	1 302	-	-	-	-	4 021	259.93	90.28	-	-	-	-	350.20
2002	2 698	1 707	-	-	-	-	4 405	197.40	58.25	-	-	-	-	255.65
2003	2 780	1 661	-	-	-	-	4 441	269.97	72.03	-	-	-	-	342.00
2004	2 291	1 766	28	-	-	-	4 085	240.20	101.86	0.00	-	-	-	342.06
2005	2 560	1 991	4	-	-	-	4 555	278.42	112.57	0.00	-	-	-	390.99
2006	2 778	1 863	172	-	-	-	4 813	303.23	83.02	0.00	-	-	-	386.26
2007	2 748	2 107	227	-	-	-	5 082	254.75	72.31	8.06	-	-	-	335.12
2008	64	1 521	286	6 892	-	-	8 763	8.18	69.33	1.65	243.99	-	-	323.14
2009	46	1 708	523	6 800	-	-	9 077	0.29	72.73	3.24	226.43	-	-	302.69
2010	82	1 870	491	7 309	-	-	9 752	9.48	66.31	3.02	220.74	-	-	299.55
2011	110	1 521	369	7 398	-	-	9 398	58.11	44.45	3.05	218.52	-	-	324.14
2012	211	991	415	6 694	-	-	8 311	79.80	41.53	5.33	226.44	-	-	353.10
2013	108	365	418	7 234	-	-	8 125	28.52	20.86	4.31	250.55	-	-	304.24
2014	44	1 185	308	7 045	-	-	8 582	0.54	66.07	3.38	244.17	-	-	314.16
2015	41	1 098	257	5 637	-	-	7 033	0.52	72.19	1.65	198.85	-	-	273.21
2016	69	767	253	5 890	-	-	6 979	0.64	62.98	1.68	247.61	-	-	312.90
2017	79	1 061	125	5 848	-	-	7 113	3.40	78.91	0.92	287.46	-	-	370.70
2018	75	468	194	5 641	241	-	6 619	2.98	41.25	1.24	302.25	28.62	-	376.34
2019	46	155	339	4 028	1 707	30	6 305	0.42	11.22	2.42	214.78	135.98	0.13	364.95
2020	-	-	346	195	4 740	294	5 575	-	-	2.08	10.12	315.74	1.58	329.51
2021	-	-	320	-	4 515	314	5 149	-	-	3.98	-	315.02	1.59	320.59
2022	-	-	185	-	4 333	377	4 895	-	-	0.44	-	332.93	4.54	337.90
2023	-	-	399	-	3 449	985	4 833	-	-	3.56	-	325.44	6.19	335.19
2024	-	-	407	-	3 752	901	5 060	-	-	5.17	-	391.56	8.47	405.19

Table B.7: Allocated catches (t) of snapper in SNA 2 by method of capture and fishing year. A complete list of fishing method codes is provided in Table E.3. – : no observations.

Fishing year	BLL	BT	SN	T	DS	PRB	PSH	Other	Total
1990	19.20	312.99	1.89	0.02	-	-	-	0.48	334.57
1991	21.56	383.31	0.92	0.02	6.64	-	-	0.62	413.07
1992	14.90	361.68	2.00	0.07	-	-	-	0.04	378.69
1993	16.03	285.11	3.06	0.03	8.85	-	-	0.23	313.30
1994	6.09	256.36	1.39	0.03	-	-	-	0.02	263.88
1995	0.31	291.55	0.77	7.96	19.31	-	-	0.07	319.98
1996	0.09	234.07	4.66	0.09	24.51	-	-	9.58	273.00
1997	0.38	286.53	1.23	0.03	27.33	-	-	0.36	315.87
1998	0.14	218.93	1.96	0.07	17.72	-	-	2.09	240.91
1999	0.23	250.68	2.43	0.00	28.05	-	-	0.81	282.20
2000	0.90	351.59	1.97	0.01	43.70	-	-	2.92	401.08
2001	2.94	267.07	0.78	0.50	78.78	-	-	0.12	350.20
2002	3.56	225.24	0.44	0.01	24.56	-	-	1.84	255.65
2003	3.01	328.57	0.20	0.00	10.10	-	-	0.11	342.00
2004	1.95	334.51	0.84	0.00	4.48	-	-	0.28	342.06
2005	0.03	390.03	0.38	-	0.36	-	-	0.19	390.99
2006	1.08	383.31	0.46	-	1.12	-	-	0.29	386.26
2007	7.69	325.23	0.55	0.00	1.42	-	-	0.23	335.12
2008	0.35	316.51	1.31	0.00	4.53	-	-	0.42	323.14
2009	0.85	299.15	2.39	0.00	0.19	-	-	0.11	302.69
2010	0.35	287.04	2.70	0.00	9.28	-	-	0.18	299.55
2011	0.60	262.97	2.48	0.00	57.93	-	-	0.15	324.14
2012	2.03	267.97	3.35	0.00	79.67	-	-	0.09	353.10
2013	1.56	271.38	2.77	-	28.41	-	-	0.12	304.24
2014	1.56	310.24	1.82	-	0.49	-	-	0.04	314.16
2015	0.04	270.99	1.62	0.00	0.19	-	-	0.37	273.21
2016	0.78	310.54	0.92	0.00	0.59	-	-	0.07	312.90
2017	0.75	349.01	0.22	0.00	3.26	13.18	4.19	0.09	370.70
2018	0.92	314.11	0.33	0.00	2.92	58.01	-	0.05	376.34
2019	1.09	359.32	1.38	0.00	0.36	2.66	-	0.14	364.95
2020	0.66	320.98	1.58	0.00	1.30	4.87	-	0.11	329.51
2021	1.83	310.71	1.59	0.00	1.82	4.32	-	0.33	320.59
2022	0.07	327.59	4.54	0.00	0.00	5.34	-	0.37	337.90
2023	0.00	318.47	6.19	0.00	3.05	6.96	-	0.51	335.19
2024	0.03	384.03	8.47	0.00	4.48	7.53	-	0.67	405.19

Table B.8: Catches (tonnes) from the northern and southern areas of SNA 2. Catches were allocated to the northern or southern areas based on statistical area, except for those from Statistical Area 013 which were considered to be from the northern area if taken east of 177.87°E, or if the trip landed in Auckland, Gisborne or Tauranga, or targeted tarakihi. Catches that were unable to be allocated are listed under SNA 2OTH.

	Sub-area catches (t)		
Fishing year	SNA 2N	SNA 2OTH	SNA 2S
1990	255.18	3.13	76.27
1991	306.90	11.93	94.24
1992	233.89	0.73	144.07
1993	187.04	1.78	124.48
1994	183.80	0.27	79.82
1995	193.08	0.27	126.63
1996	202.54	0.94	69.51
1997	217.99	0.69	97.19
1998	160.66	3.05	77.19
1999	215.70	0.06	66.44
2000	294.60	4.16	102.32
2001	281.99	0.11	68.10
2002	175.56	0.67	79.42
2003	241.39	0.18	100.43
2004	238.58	0.42	103.06
2005	228.46	1.74	160.79
2006	238.59	0.36	147.30
2007	191.13	0.05	143.93
2008	219.35	0.01	103.78
2009	199.67	0.26	102.76
2010	219.34	-	80.21
2011	229.56	0.00	94.58
2012	268.68	0.00	84.42
2013	256.10	-	48.14
2014	247.34	0.18	66.64
2015	199.17	-	74.03
2016	221.55	-	91.35
2017	257.85	-	112.86
2018	269.58	0.00	106.76
2019	248.40	0.37	116.18
2020	205.27	-	124.24
2021	189.36	-	131.23
2022	180.52	-	157.39
2023	170.43	-	164.75
2024	216.41	-	188.78

APPENDIX C: CPUE SERIES DIAGNOSTICS

C.1 SNA2N BT.MIX day

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 SNA2N BT.MIX day CPUE series.

Series	SNA2N BT.MIX day
QMS stock	SNA 2
Reporting forms	CEL, TCP, TCE, ERS - Trawl
Fishing methods	BT
Target species	GUR, TRE, TAR, SNA
Statistical Areas	011, 012, 013
Period	2001-10-01, 2024-09-30
Resolution	Day
Core fleet years	5
Core fleet trips	5
Default model	allockg ~ fyear + vessel_key + target_species + ns(log(fishing_duration), 3) + ns(log(effort_num), 3) + stat_area + month
Stepwise selection	Yes
Positive catch distribution	Lognormal

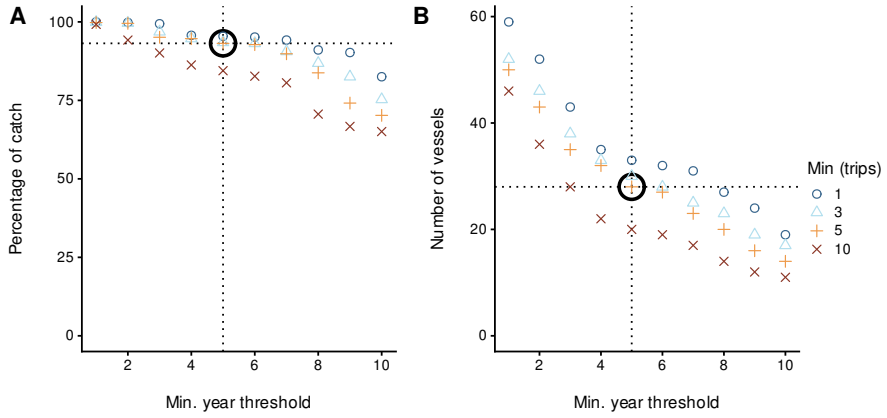

Figure C.1: Percentage of catch and number of vessels for different core vessel selection criteria for the SNA2N BT.MIX day CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel participated in the fishery and the number of trips per year.

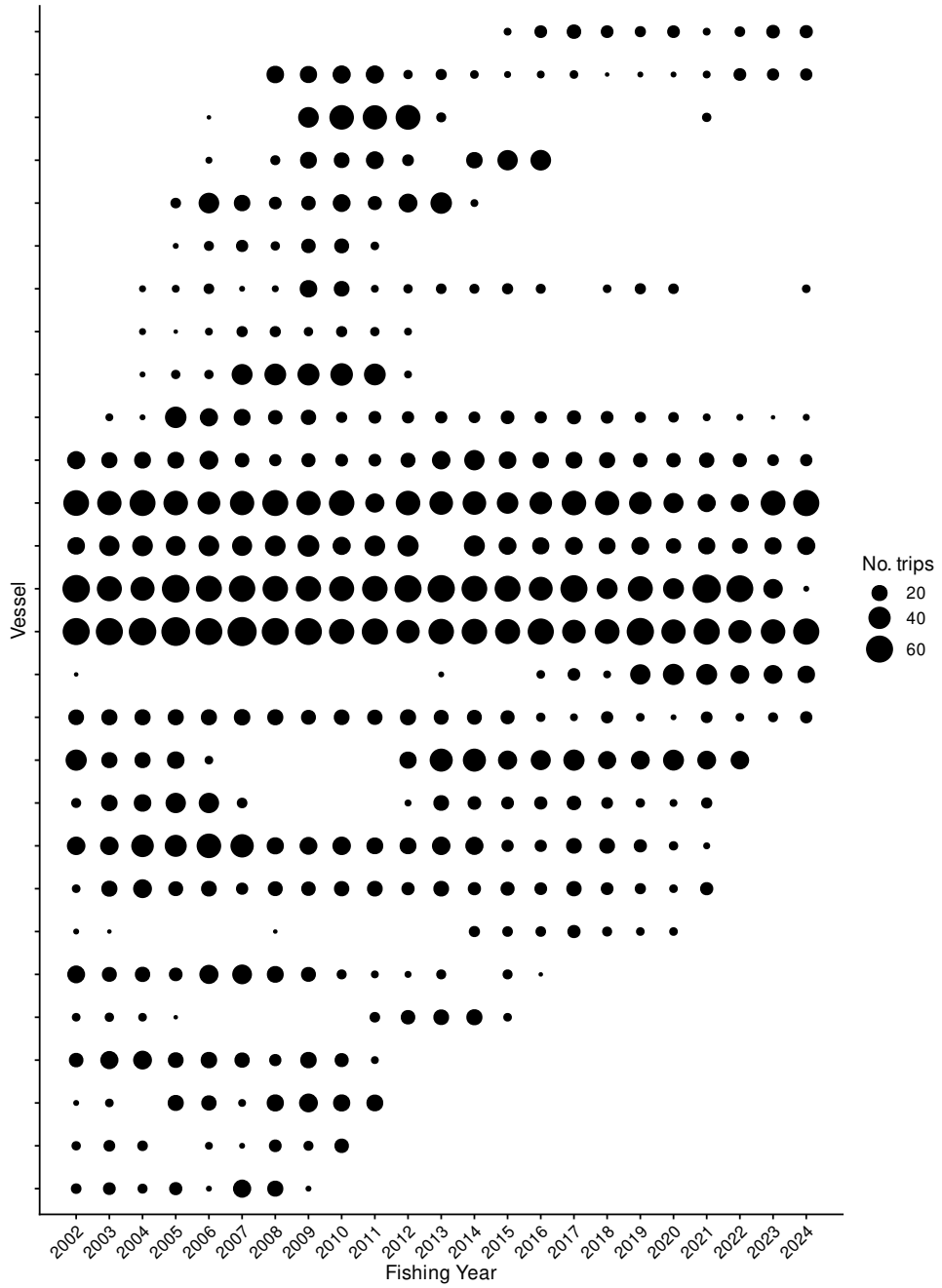

Figure C.2: Number of trips by fishing year for core vessels in the SNA2N BT.MIX day series. The area of the circles is proportional to the number of trips undertaken by a vessel in a fishing year.

Table C.2: Summary of the SNA2N BT.MIX day 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. (Continued on next page)

Filter	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ungroomed data	207 (100%) n: 2572	305 (100%) n: 2457	314 (100%) n: 2239	368 (100%) n: 2491	345 (100%) n: 2478	304 (100%) n: 2445	292 (100%) n: 2281	272 (100%) n: 2320	263 (100%) n: 2686
Fishing duration is not NA	207 (100%) n: 2572	305 (100%) n: 2457	314 (100%) n: 2239	368 (100%) n: 2491	345 (100%) n: 2478	304 (100%) n: 2445	292 (100%) n: 2281	272 (100%) n: 2320	263 (100%) n: 2686
Positive fishing duration	207 (100%) n: 2572	305 (100%) n: 2457	314 (100%) n: 2239	368 (100%) n: 2491	345 (100%) n: 2478	304 (100%) n: 2445	292 (100%) n: 2281	272 (100%) n: 2320	263 (100%) n: 2686
Tows is not NA	207 (100%) n: 2572	305 (100%) n: 2457	314 (100%) n: 2239	368 (100%) n: 2491	345 (100%) n: 2478	304 (100%) n: 2445	292 (100%) n: 2281	272 (100%) n: 2320	263 (100%) n: 2686
Fishing duration under 24hrs	207 (100%) n: 2567	303 (99%) n: 2453	312 (99%) n: 2232	367 (100%) n: 2486	345 (100%) n: 2476	303 (100%) n: 2435	292 (100%) n: 2278	271 (100%) n: 2318	262 (100%) n: 2679
Less than 6 tows per day	206 (99%) n: 2560	303 (99%) n: 2450	310 (99%) n: 2220	366 (99%) n: 2480	342 (99%) n: 2469	299 (98%) n: 2419	290 (99%) n: 2270	270 (99%) n: 2311	257 (98%) n: 2667
Assigned to 013E	142 (68%) n: 1159	215 (71%) n: 1226	219 (70%) n: 1290	220 (60%) n: 1284	227 (66%) n: 1461	179 (59%) n: 1455	210 (72%) n: 1495	187 (69%) n: 1601	192 (73%) n: 1774
Core fleet selection	127 (61%) n: 930	188 (62%) n: 978	183 (58%) n: 1107	177 (48%) n: 1180	192 (56%) n: 1345	168 (55%) n: 1385	196 (67%) n: 1409	183 (67%) n: 1542	182 (69%) n: 1650

Filter	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ungroomed data	225 (100%) n: 2393	244 (100%) n: 2173	250 (100%) n: 2081	277 (100%) n: 2145	244 (100%) n: 1866	286 (100%) n: 1765	300 (100%) n: 1651	283 (100%) n: 1516	320 (100%) n: 1536
Fishing duration is not NA	225 (100%) n: 2393	244 (100%) n: 2173	250 (100%) n: 2081	277 (100%) n: 2145	244 (100%) n: 1865	286 (100%) n: 1765	300 (100%) n: 1651	283 (100%) n: 1516	320 (100%) n: 1536
Positive fishing duration	225 (100%) n: 2393	244 (100%) n: 2173	250 (100%) n: 2081	277 (100%) n: 2145	244 (100%) n: 1865	286 (100%) n: 1765	300 (100%) n: 1651	283 (100%) n: 1516	320 (100%) n: 1536
Tows is not NA	225 (100%) n: 2393	244 (100%) n: 2173	250 (100%) n: 2081	277 (100%) n: 2145	244 (100%) n: 1865	286 (100%) n: 1765	300 (100%) n: 1651	283 (100%) n: 1516	320 (100%) n: 1536
Fishing duration under 24hrs	224 (100%) n: 2386	244 (100%) n: 2170	250 (100%) n: 2079	276 (100%) n: 2143	243 (100%) n: 1863	283 (99%) n: 1756	299 (100%) n: 1645	283 (100%) n: 1515	320 (100%) n: 1532
Less than 6 tows per day	221 (99%) n: 2362	239 (98%) n: 2149	250 (100%) n: 2073	275 (99%) n: 2134	242 (99%) n: 1855	282 (99%) n: 1751	298 (99%) n: 1637	283 (100%) n: 1512	318 (100%) n: 1530
Assigned to 013E	146 (65%) n: 1486	178 (73%) n: 1378	218 (87%) n: 1424	235 (85%) n: 1393	187 (77%) n: 1114	211 (74%) n: 1022	224 (75%) n: 1052	206 (73%) n: 822	235 (74%) n: 863
Core fleet selection	141 (63%) n: 1375	176 (72%) n: 1300	195 (78%) n: 1330	219 (79%) n: 1291	187 (77%) n: 1109	211 (74%) n: 1019	213 (71%) n: 1027	205 (72%) n: 819	216 (68%) n: 845

Filter	2020	2021	2022	2023	2024
Ungroomed data	287 (100%) n: 1320	276 (100%) n: 1249	274 (100%) n: 1238	254 (100%) n: 807	290 (100%) n: 778
Fishing duration is not NA	287 (100%) n: 1320	276 (100%) n: 1249	274 (100%) n: 1238	254 (100%) n: 807	290 (100%) n: 778
Positive fishing duration	287 (100%) n: 1319	276 (100%) n: 1248	274 (100%) n: 1238	254 (100%) n: 807	290 (100%) n: 778
Tows is not NA	287 (100%) n: 1319	276 (100%) n: 1248	274 (100%) n: 1238	254 (100%) n: 807	290 (100%) n: 778
Fishing duration under 24hrs	285 (99%) n: 1313	276 (100%) n: 1247	274 (100%) n: 1237	254 (100%) n: 806	290 (100%) n: 778
Less than 6 tows per day	285 (99%) n: 1313	276 (100%) n: 1247	274 (100%) n: 1234	254 (100%) n: 804	288 (99%) n: 768
Assigned to 013E	195 (68%) n: 683	181 (65%) n: 691	173 (63%) n: 565	167 (66%) n: 470	203 (70%) n: 470
Core fleet selection	195 (68%) n: 678	175 (64%) n: 682	163 (60%) n: 526	162 (64%) n: 451	186 (64%) n: 436

Table C.3: Summary of the SNA2N BT.MIX day dataset after core fleet selection. 'Records' indicates the number of rows (days) in the dataset, and 'Records caught' indicates the percentage of days with catches of snapper.

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
2002	18	385	930	8 240.73	127.27	63.55
2003	18	401	978	8 824.42	187.67	69.43
2004	19	429	1 107	10 180.63	182.55	68.02
2005	21	491	1 180	11 411.57	177.22	65.00
2006	23	507	1 345	13 636.10	191.82	67.88
2007	20	488	1 385	14 071.02	168.33	62.45
2008	22	477	1 409	13 901.08	195.58	69.20
2009	22	543	1 542	15 423.02	182.75	63.10
2010	21	533	1 650	16 528.37	182.03	62.79
2011	21	460	1 375	13 960.78	141.08	58.47
2012	20	425	1 300	13 776.88	176.36	64.31
2013	17	411	1 330	14 337.85	194.64	67.52
2014	17	409	1 291	14 228.43	218.64	64.99
2015	18	357	1 109	12 211.16	186.73	63.21
2016	18	343	1 019	11 438.13	211.06	65.65
2017	15	355	1 027	11 301.52	213.36	67.38
2018	16	294	819	8 923.68	205.42	70.82
2019	16	322	845	9 126.02	215.69	78.82
2020	16	272	678	7 453.10	194.65	77.58
2021	15	305	682	6 708.68	175.45	81.09
2022	11	245	526	5 176.13	163.13	85.17
2023	10	223	451	4 114.47	161.93	81.15
2024	11	218	436	4 094.58	185.63	87.61

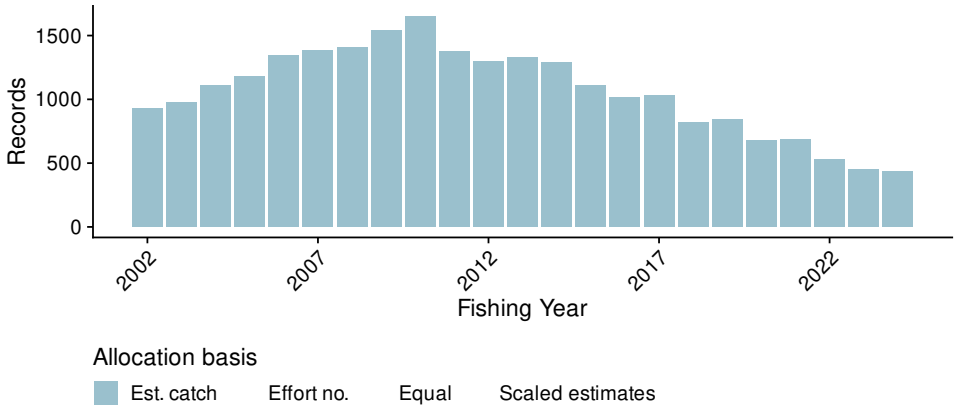

Figure C.3: Allocation basis for attributing landings to records in the SNA2N BT.MIX day catch-per-unit-effort dataset. Allocation basis is in terms of estimated catch, effort number, and/or equal.

Table C.4: Summary of stepwise selection for occurrence of positive catch in the SNA2N BT.MIX day 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	21	30 283	1.6	1.6	*
+ target_species	3	28 842	6.4	4.7	*
+ month	11	27 860	9.6	3.3	*
+ vessel_key	27	26 816	13.2	3.6	*
+ stat_area	2	26 218	15.1	2.0	*
+ ns(log(effort_num), 3)	3	26 079	15.6	0.5	
+ ns(log(fishing_duration), 3)	3	26 076	15.6	0.0	

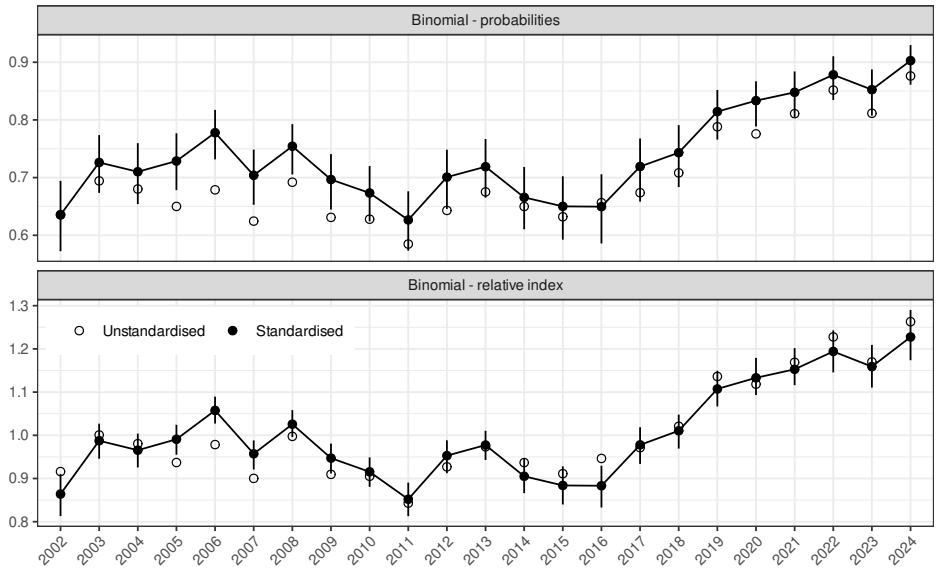

Figure C.4: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for occurrence of catch in the SNA2N BT.MIX day dataset, plotted as both probability of occurrence and as a relative index standardised to the geometric mean.

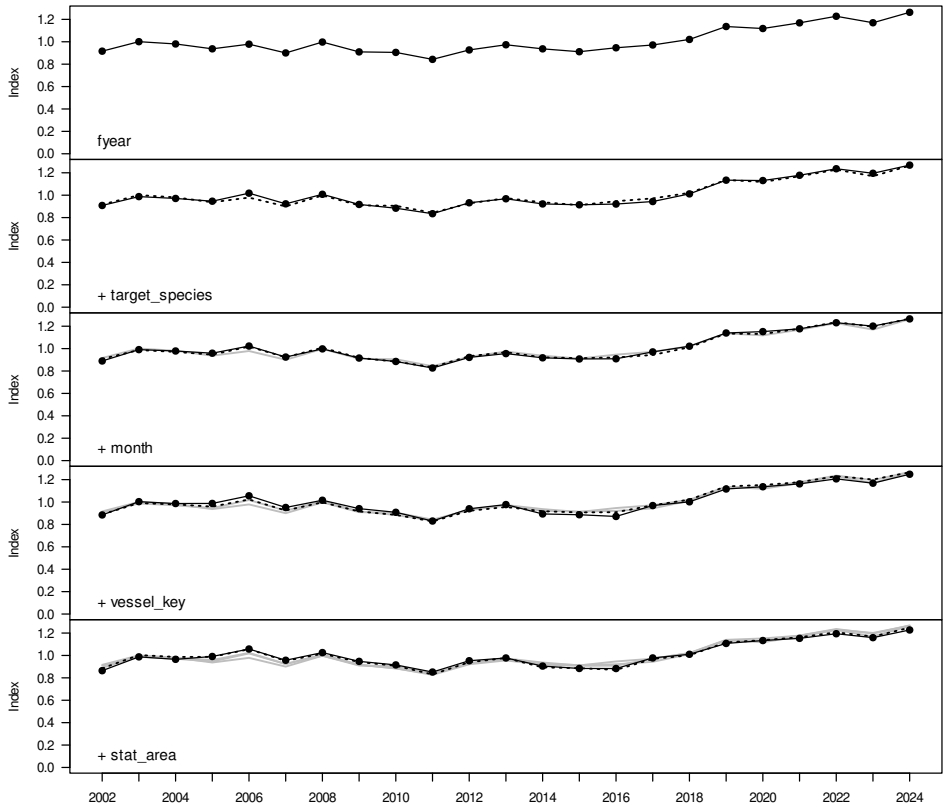

Figure C.5: Step plot for occurrence of catch in the SNA2N BT.MIX day dataset.

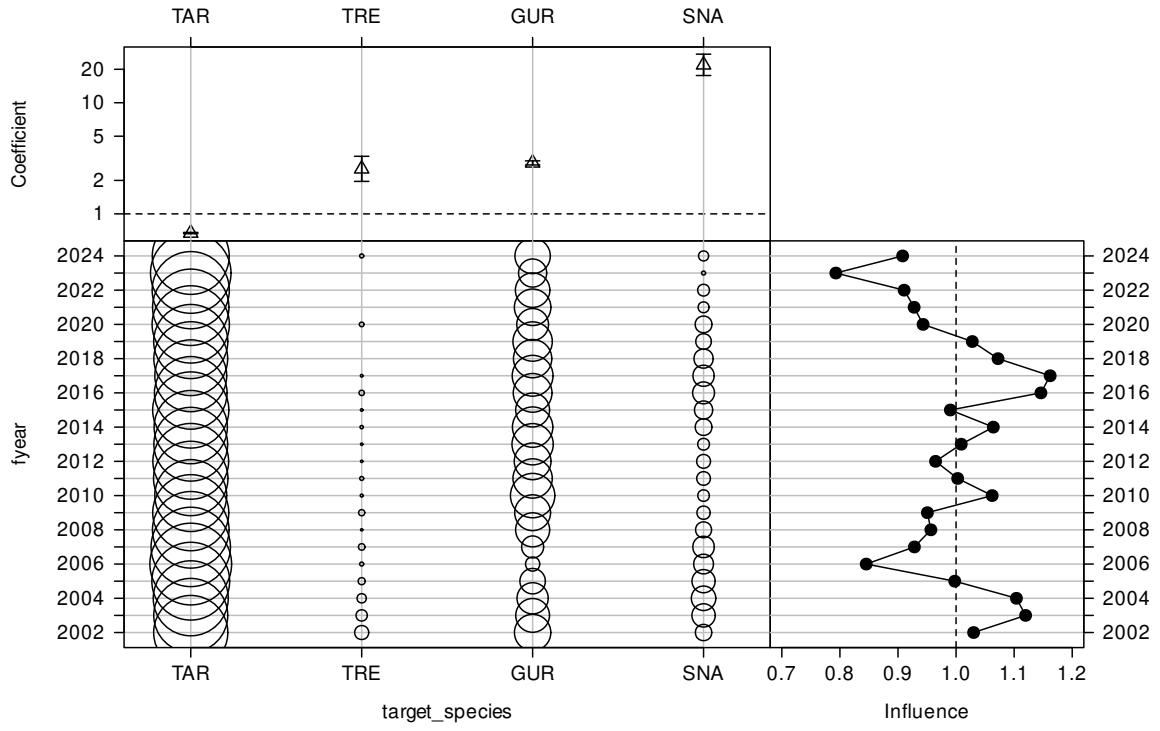

Figure C.6: CDI plot for target species for the occurrence of positive catch in the SNA2N BT.MIX day catch-per-unit-effort dataset.

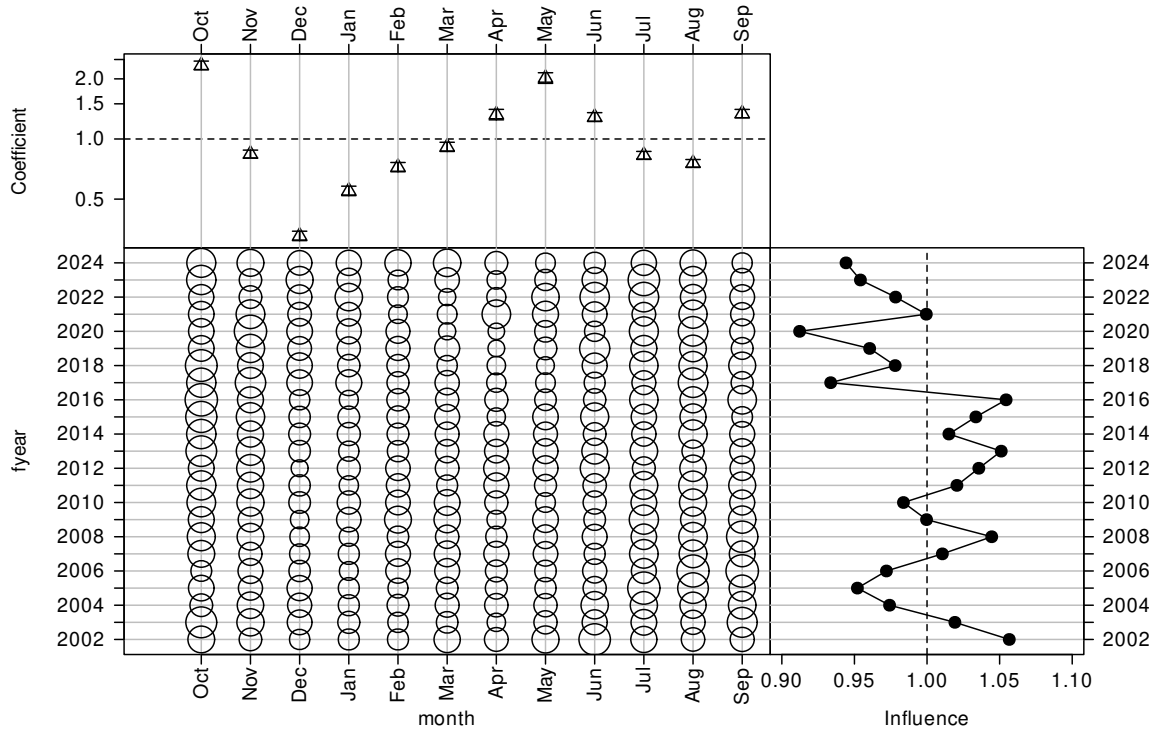

Figure C.7: CDI plot for month for the occurrence of positive catch in the SNA2N BT.MIX day catch-per-unit-effort dataset.

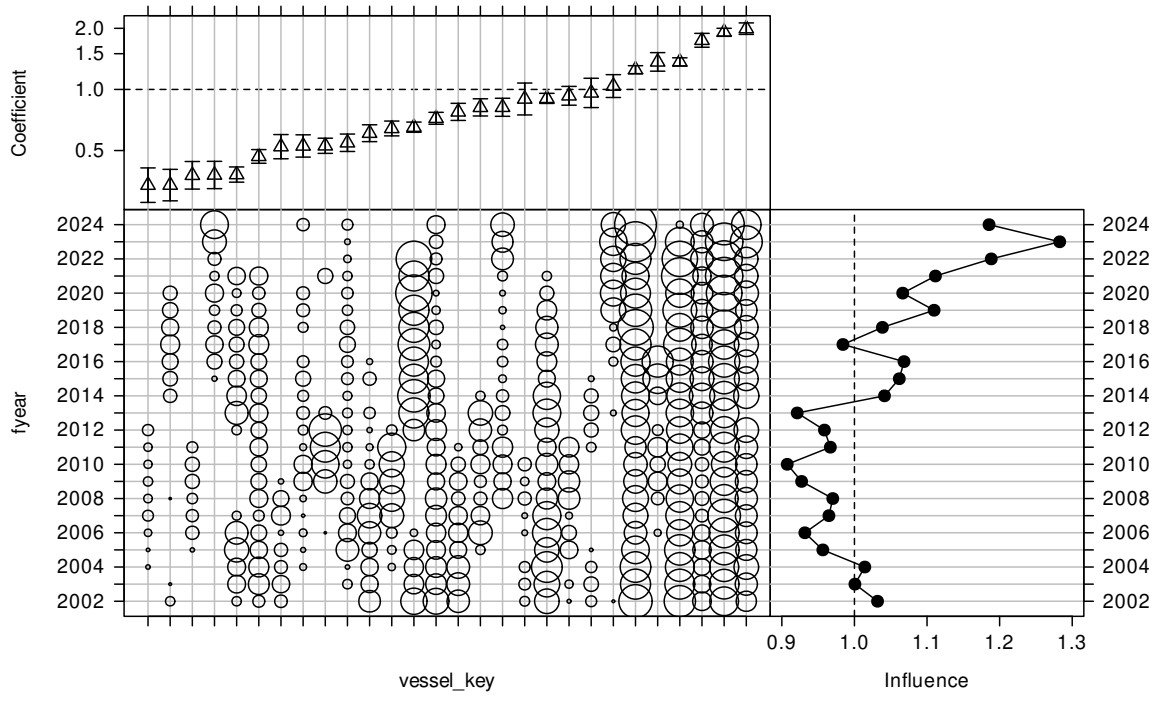

Figure C.8: CDI plot for vessel key for the occurrence of positive catch in the SNA2N BT.MIX day catch-per-unit-effort dataset.

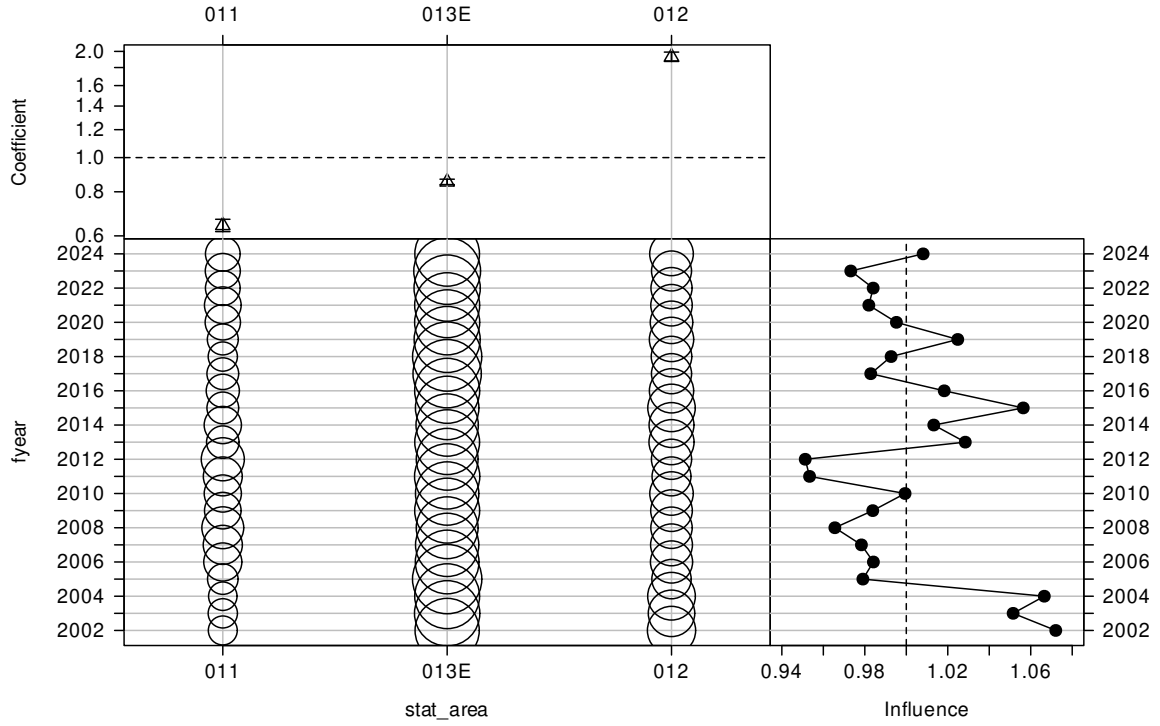

Figure C.9: CDI plot for statistical area for the occurrence of positive catch in the SNA2N BT.MIX day catch-per-unit-effort dataset.

Table C.5: Summary of stepwise selection for the lognormal model for positive catches in the SNA2N BT.MIX day 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	21	51 239	6.1	6.1	*
+ vessel_key	27	48 198	22.1	16.1	*
+ ns(log(effort_num), 3)	3	46 856	28.2	6.1	*
+ target_species	3	45 160	35.3	7.0	*
+ month	11	44 719	37.1	1.8	*
+ stat_area	2	44 295	38.7	1.6	*
+ ns(log(fishing_duration), 3)	3	44 194	39.1	0.4	

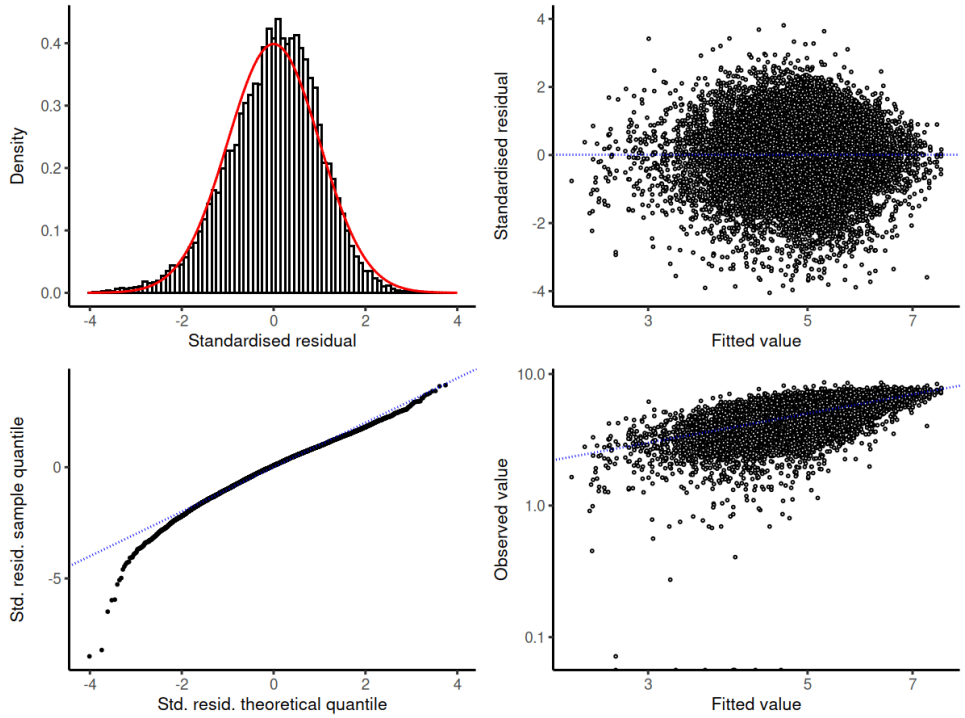

Figure C.10: Diagnostic plots for the selected lognormal model for positive catches in the SNA2N BT.MIX day dataset.

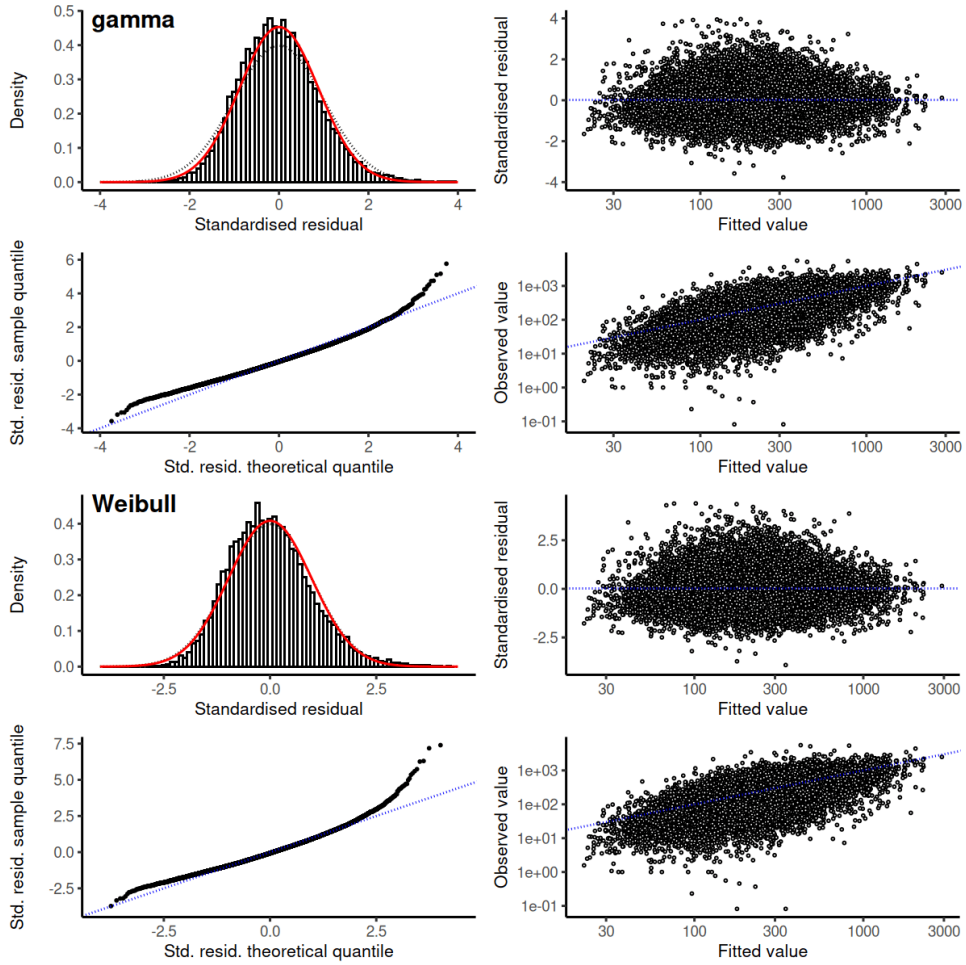

Figure C.11: Diagnostic plots for the alternative gamma and Weibull models considered for positive catches in the SNA2N BT.MIX day dataset.

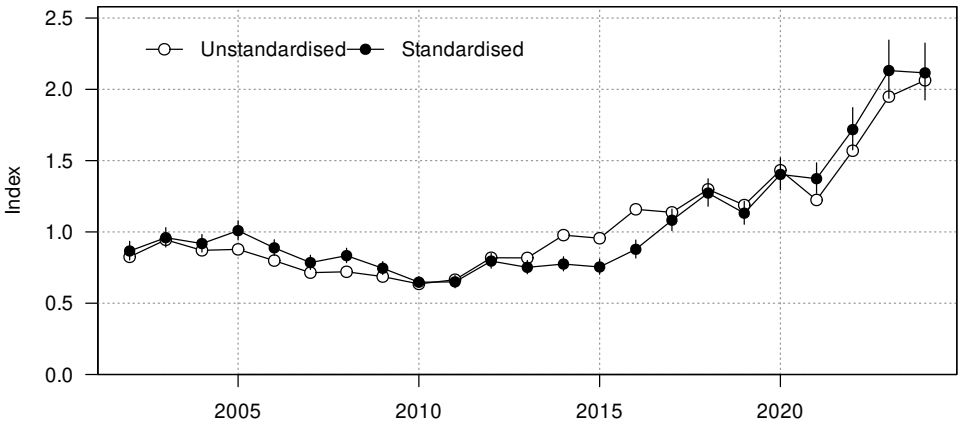

Figure C.12: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the lognormal model for the SNA2N BT.MIX day dataset.

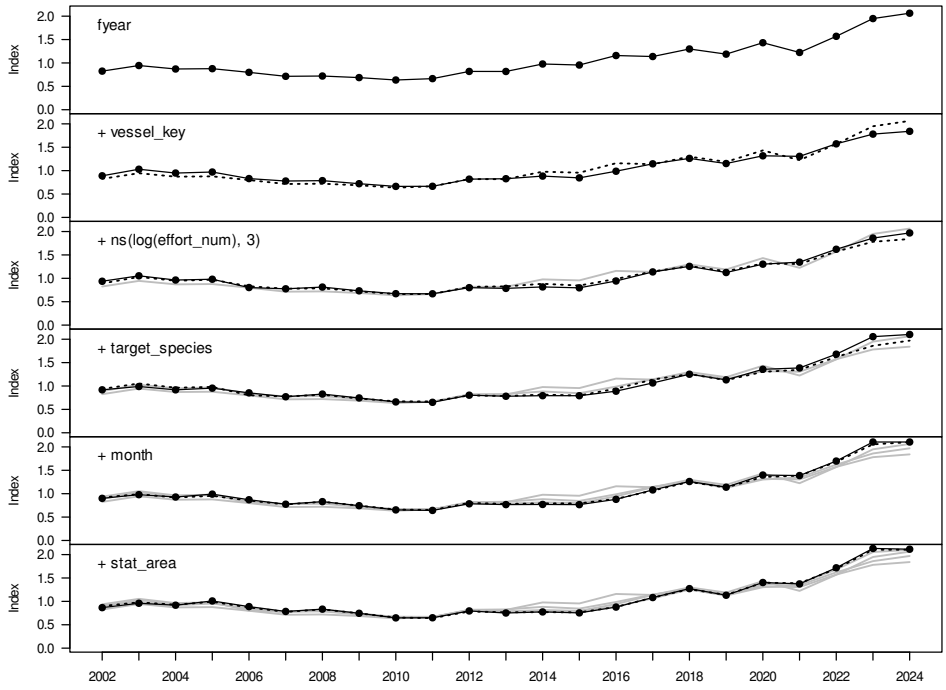

Figure C.13: Changes to the SNA2N BT.MIX day positive catch index as terms are successively entered into the lognormal model.

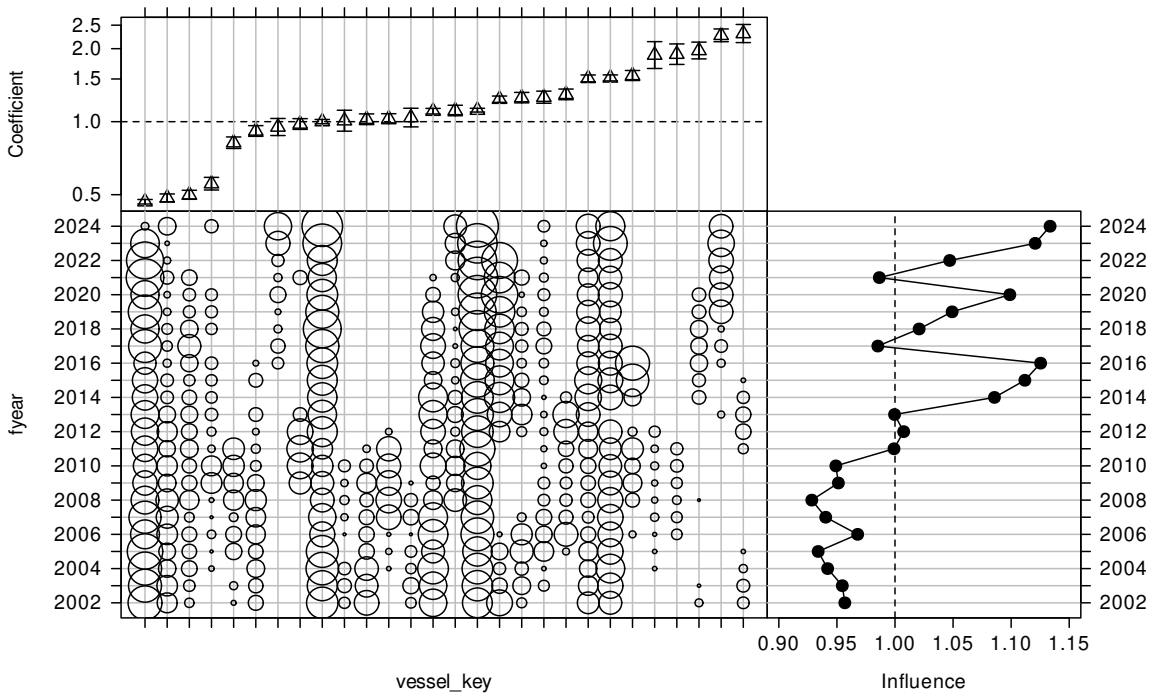

Figure C.14: CDI plot for vessel key for the lognormal model of positive catches in the SNA2N BT.MIX day catch-per-unit-effort dataset.

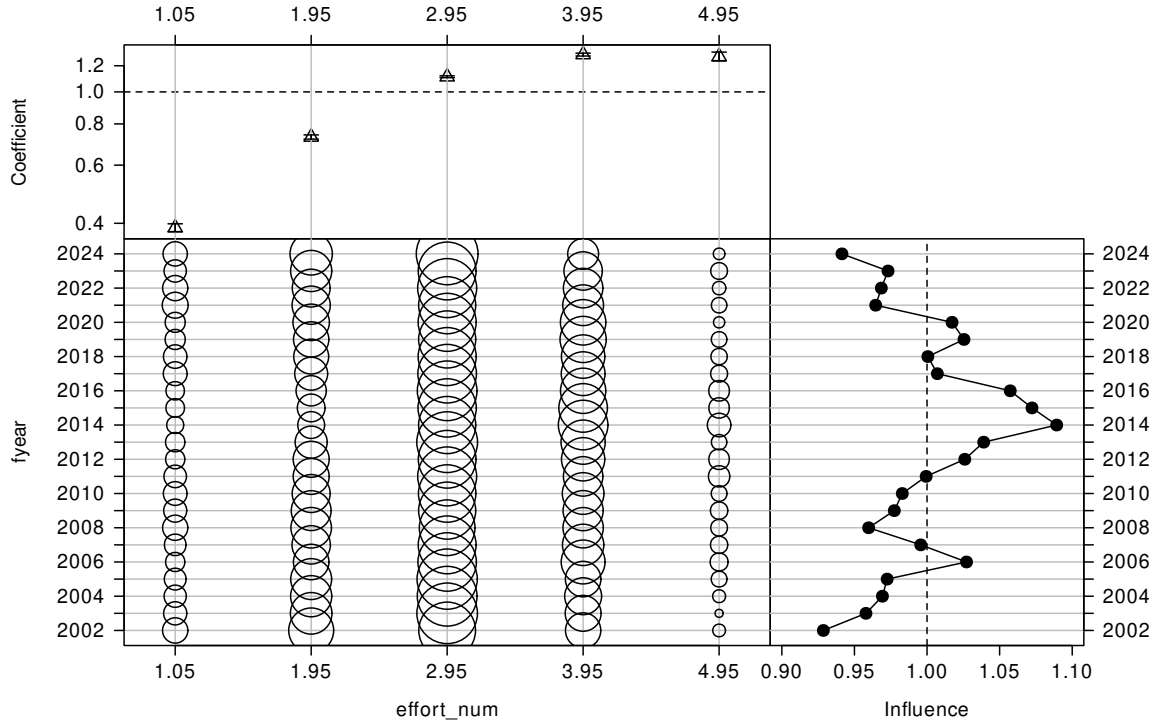

Figure C.15: CDI plot for effort num for the lognormal model of positive catches in the SNA2N BT.MIX day catch-per-unit-effort dataset.

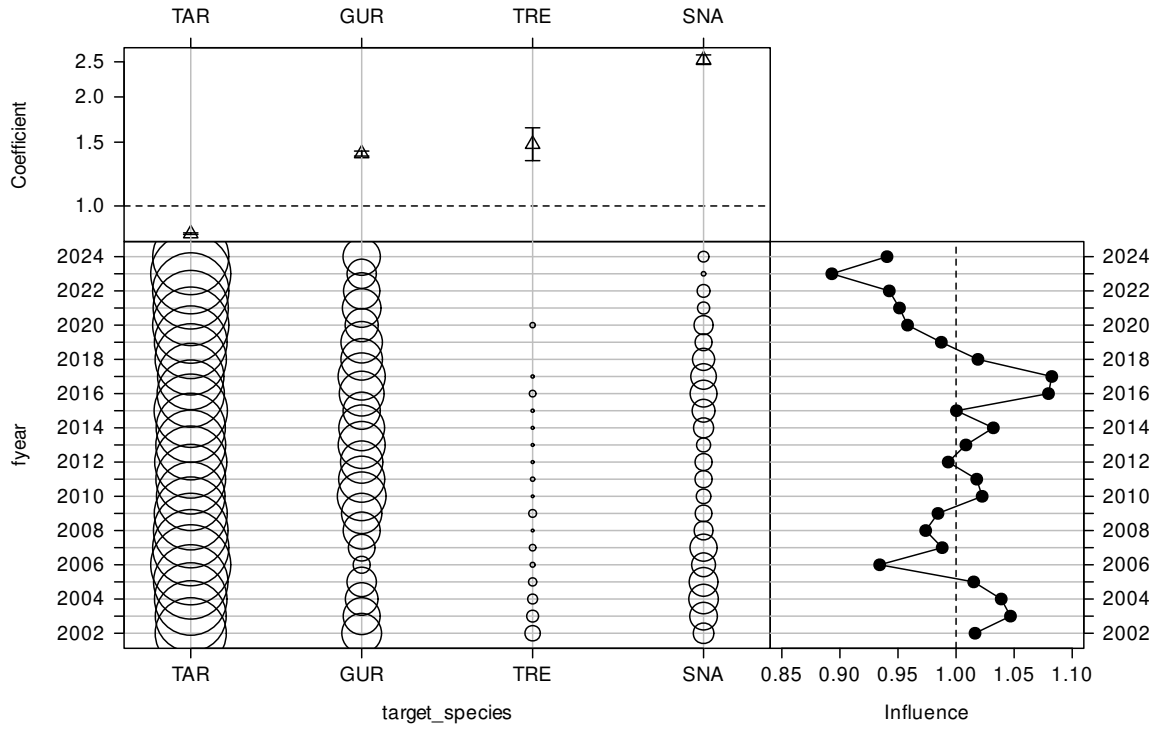

Figure C.16: CDI plot for target species for the lognormal model of positive catches in the SNA2N BT.MIX day catch-per-unit-effort dataset.

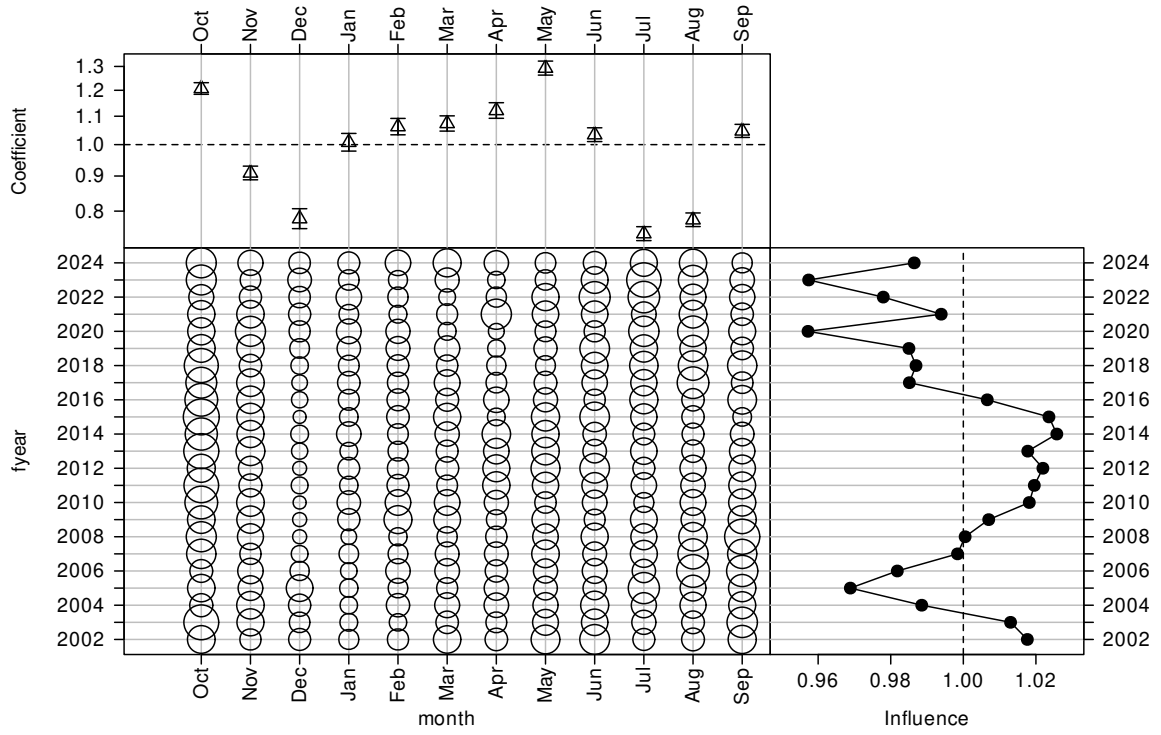

Figure C.17: CDI plot for month for the lognormal model of positive catches in the SNA2N BT.MIX day catch-per-unit-effort dataset.

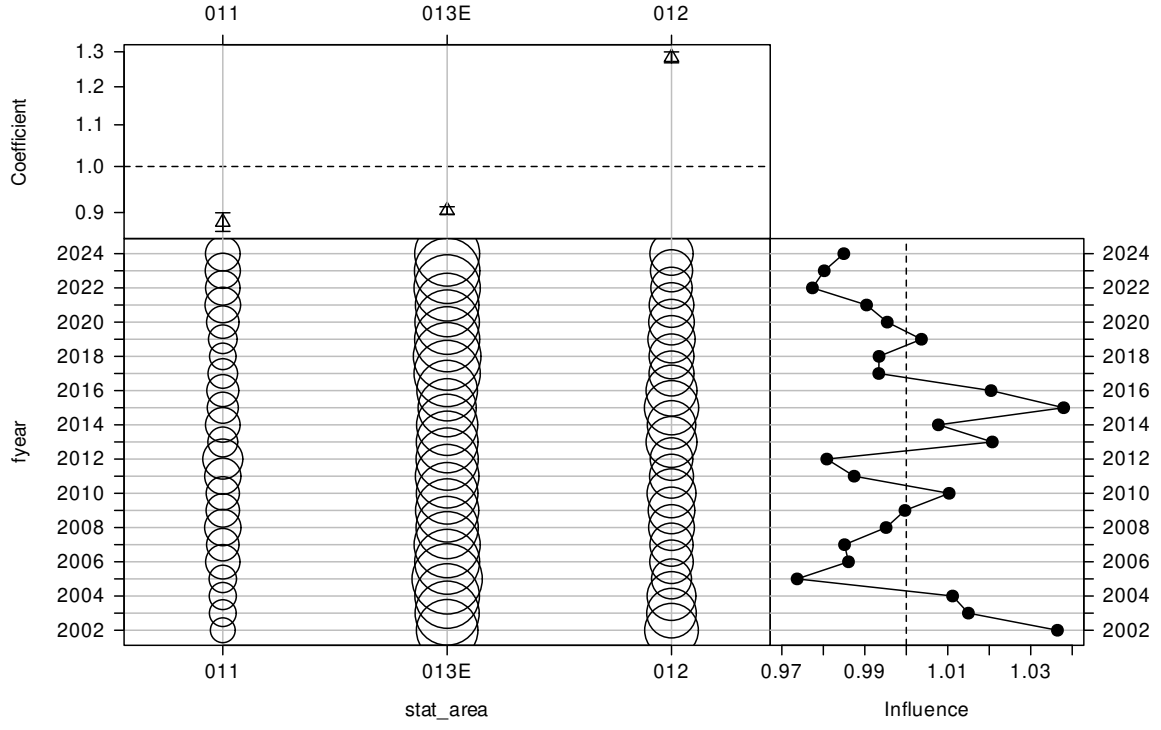

Figure C.18: CDI plot for statistical area for the lognormal model of positive catches in the SNA2N BT.MIX day catch-per-unit-effort dataset.

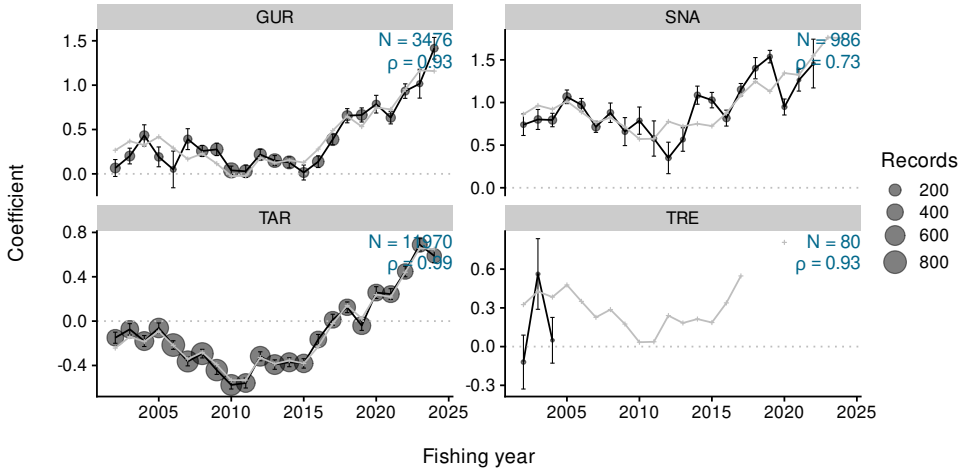

Figure C.19: Residual implied coefficients for target-year in the lognormal positive catch model for the SNA2N BT.MIX day dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in a target-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

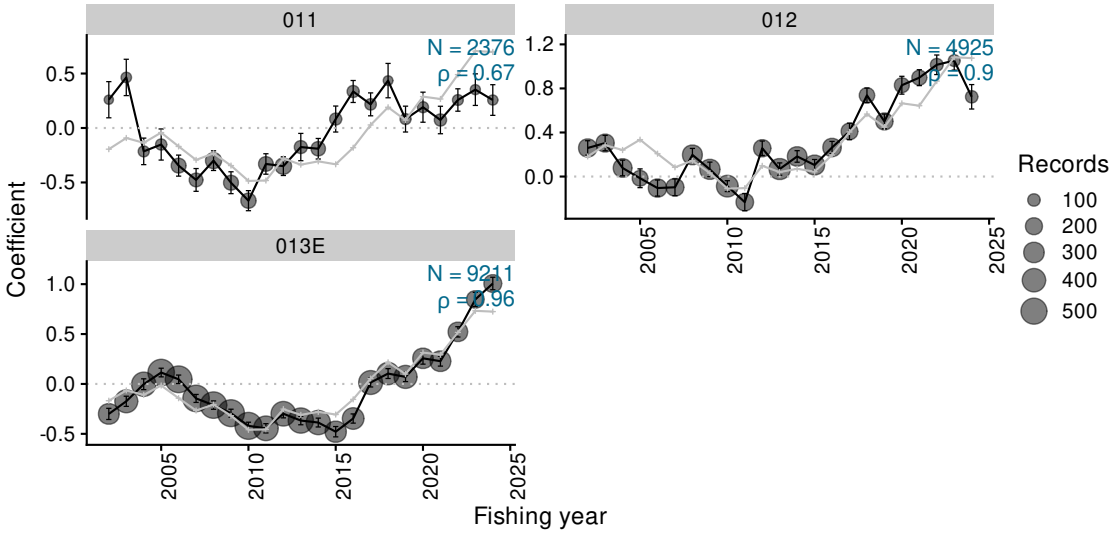

Figure C.20: Residual implied coefficients for area-year in the lognormal positive catch model for the SNA2N BT.MIX day dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data 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.

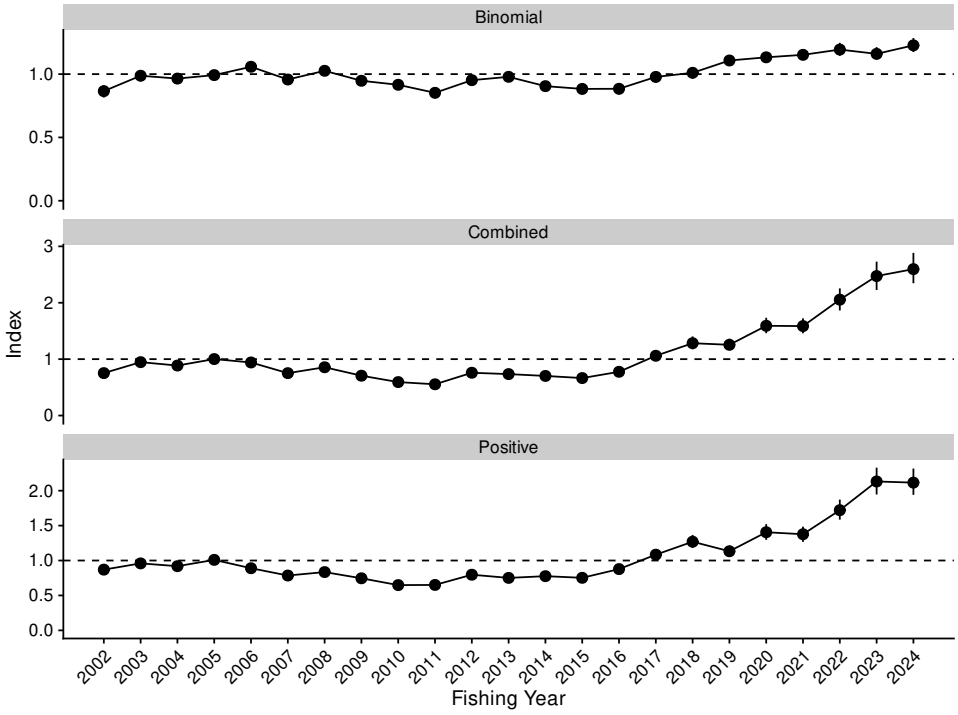

Figure C.21: Standardised indices and 95% confidence intervals for the SNA2N BT.MIX day dataset.

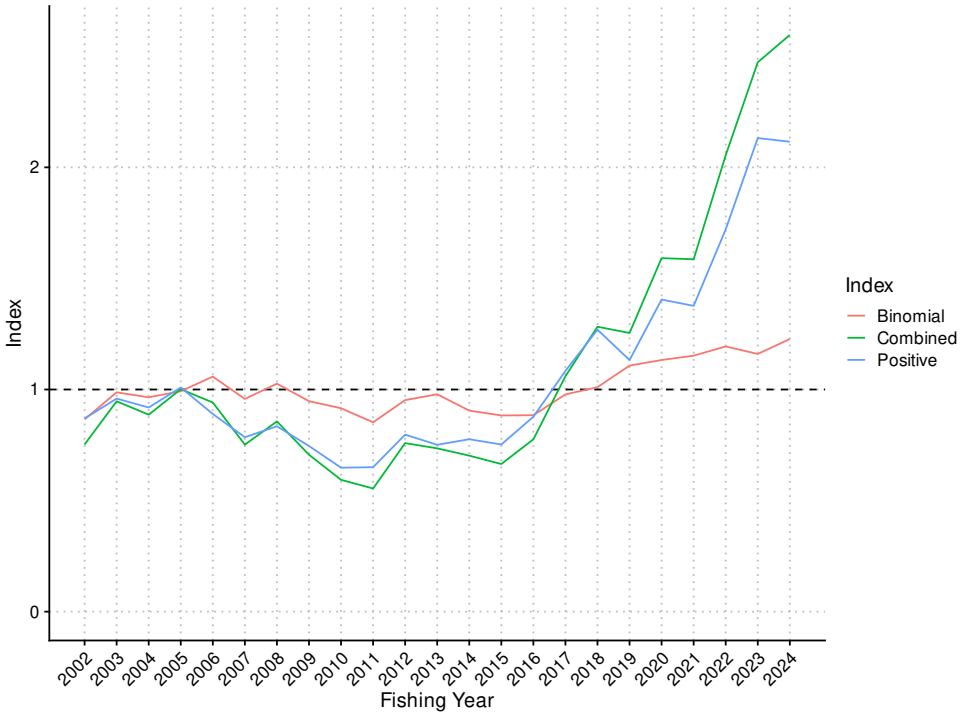

Figure C.22: Standardised indices for the SNA2N BT.MIX day dataset.

Table C.6: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for each model in SNA2N BT.MIX day.

	Binomial				Combined				Positive			
Fishing year	index	SE	LCI	UCI	index	SE	LCI	UCI	index	SE	LCI	UCI
2002	0.866	0.025	0.815	0.911	0.753	0.035	0.686	0.825	0.869	0.030	0.812	0.931
2003	0.987	0.022	0.942	1.028	0.947	0.042	0.864	1.030	0.959	0.036	0.892	1.034
2004	0.965	0.021	0.921	1.002	0.887	0.035	0.823	0.961	0.919	0.031	0.861	0.983
2005	0.992	0.018	0.954	1.026	1.001	0.040	0.924	1.083	1.009	0.034	0.944	1.079
2006	1.058	0.015	1.029	1.088	0.941	0.034	0.879	1.012	0.890	0.029	0.837	0.949
2007	0.957	0.018	0.922	0.993	0.752	0.028	0.698	0.809	0.785	0.025	0.740	0.836
2008	1.026	0.016	0.994	1.058	0.856	0.030	0.796	0.912	0.834	0.026	0.784	0.885
2009	0.947	0.017	0.914	0.979	0.706	0.025	0.659	0.757	0.746	0.022	0.703	0.791
2010	0.916	0.018	0.879	0.949	0.593	0.020	0.553	0.631	0.648	0.019	0.611	0.684
2011	0.852	0.021	0.809	0.892	0.554	0.024	0.509	0.603	0.650	0.022	0.607	0.693
2012	0.952	0.018	0.914	0.986	0.759	0.028	0.706	0.815	0.797	0.025	0.748	0.845
2013	0.979	0.018	0.943	1.013	0.735	0.027	0.684	0.791	0.751	0.024	0.706	0.801
2014	0.905	0.020	0.865	0.943	0.702	0.029	0.648	0.761	0.776	0.026	0.727	0.830
2015	0.883	0.022	0.839	0.925	0.664	0.028	0.611	0.720	0.752	0.026	0.704	0.805
2016	0.884	0.022	0.839	0.926	0.776	0.034	0.711	0.842	0.877	0.031	0.819	0.940
2017	0.978	0.022	0.933	1.018	1.060	0.043	0.979	1.149	1.084	0.039	1.012	1.163
2018	1.010	0.023	0.964	1.052	1.283	0.058	1.176	1.403	1.269	0.048	1.179	1.366
2019	1.108	0.021	1.067	1.150	1.254	0.052	1.160	1.363	1.133	0.040	1.059	1.214
2020	1.133	0.021	1.092	1.175	1.591	0.070	1.460	1.734	1.405	0.057	1.296	1.521
2021	1.152	0.022	1.110	1.197	1.586	0.068	1.458	1.724	1.376	0.056	1.267	1.485
2022	1.194	0.026	1.144	1.247	2.054	0.100	1.863	2.254	1.721	0.073	1.585	1.872
2023	1.160	0.025	1.115	1.213	2.473	0.128	2.226	2.728	2.132	0.098	1.946	2.329
2024	1.227	0.028	1.174	1.285	2.596	0.137	2.346	2.885	2.115	0.096	1.940	2.317

C.2 SNA2N BT.MIX event

Table C.7: Definition for the dataset, core fleet criteria, and Generalised Linear Modelling approach used in the catch-per-unit-effort (CPUE) standardisation for the SNA2N BT.MIX event CPUE series.

Series	SNA2N BT.MIX event
QMS stock	SNA 2
Reporting forms	TCP, TCE, ERS - Trawl
Fishing methods	BT
Target species	GUR, TRE, TAR, SNA
Statistical Areas	011, 012, 013
Period	2007-10-01, 2024-09-30
Resolution	Fishing event
Core fleet years	4
Core fleet trips	5
Default model	allockg_top5 ~ fyear + vessel_key + target_species + month + ns(log(fishing_duration), 3) + ns(bottom_depth, 3) + ns(effort_width, 3) + ns(effort_height, 3) + ns(start_latitude, 3)
Stepwise selection	Yes
Positive catch distribution	Weibull

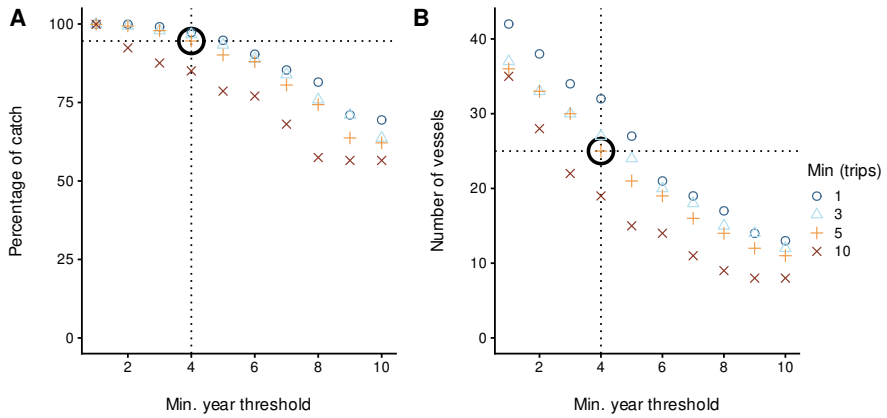

Figure C.23: Percentage of catch and number of vessels for different core vessel selection criteria for the SNA2N BT.MIX event CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel participated in the fishery and the number of trips per year.

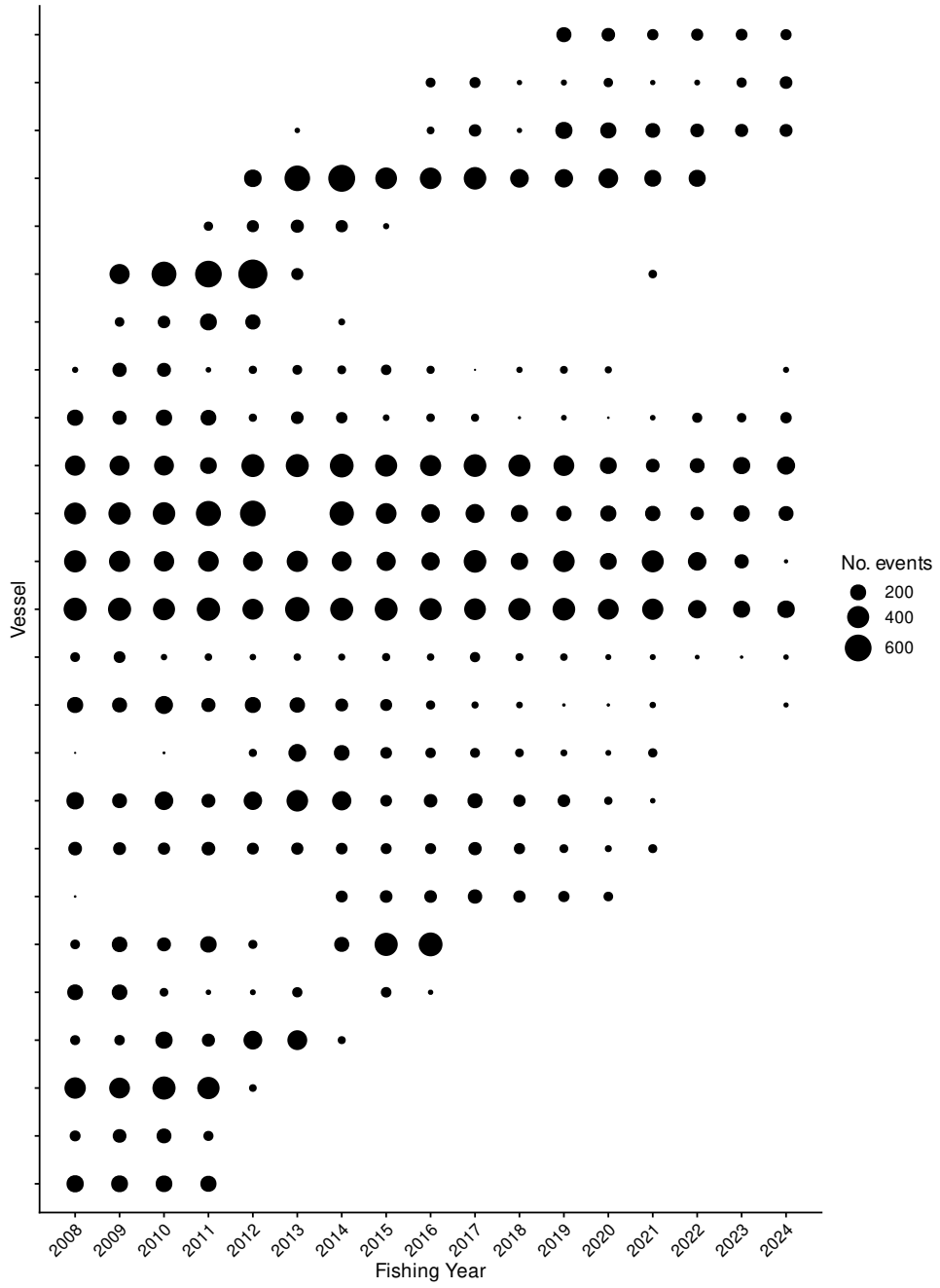

Figure C.24: Number of events by fishing year for core vessels in the SNA2N BT.MIX event series. The area of the circles is proportional to the number of events undertaken by a vessel in a fishing year.

Table C.8: Summary of the SNA2N BT.MIX event 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. (Continued on next page)

Filter	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ungroomed data	292 (100%) n: 6158	276 (100%) n: 6446	281 (100%) n: 7393	242 (100%) n: 6866	251 (100%) n: 6258	259 (100%) n: 6074	286 (100%) n: 6368	249 (100%) n: 5371	295 (100%) n: 4944
Fishing duration is not NA	292 (100%) n: 6157	275 (100%) n: 6441	281 (100%) n: 7392	242 (100%) n: 6865	251 (100%) n: 6258	259 (100%) n: 6074	286 (100%) n: 6367	249 (100%) n: 5370	295 (100%) n: 4944
Positive fishing duration	292 (100%) n: 6157	275 (100%) n: 6441	281 (100%) n: 7392	242 (100%) n: 6865	251 (100%) n: 6258	259 (100%) n: 6074	286 (100%) n: 6367	249 (100%) n: 5370	295 (100%) n: 4944
Fishing duration under 10hrs	292 (100%) n: 6146	275 (100%) n: 6436	281 (100%) n: 7380	241 (100%) n: 6856	251 (100%) n: 6255	258 (100%) n: 6067	286 (100%) n: 6364	249 (100%) n: 5366	295 (100%) n: 4938
Bottom depth shallower than 200m	291 (100%) n: 6024	275 (100%) n: 6364	280 (100%) n: 7307	241 (100%) n: 6790	251 (100%) n: 6216	258 (100%) n: 5996	286 (100%) n: 6311	248 (99%) n: 5307	295 (100%) n: 4892
Assigned to 013E	211 (72%) n: 4031	191 (69%) n: 4443	210 (75%) n: 4959	159 (66%) n: 4426	187 (74%) n: 4328	222 (86%) n: 4315	238 (83%) n: 4408	191 (77%) n: 3371	220 (75%) n: 3120
Latitude in range	211 (72%) n: 4031	191 (69%) n: 4442	210 (75%) n: 4958	159 (66%) n: 4425	187 (74%) n: 4328	222 (86%) n: 4315	238 (83%) n: 4408	191 (77%) n: 3371	220 (75%) n: 3120
Core fleet selection	184 (63%) n: 3491	165 (60%) n: 4004	177 (63%) n: 4416	144 (60%) n: 4165	165 (66%) n: 4043	179 (69%) n: 3656	200 (70%) n: 3691	170 (68%) n: 3083	205 (70%) n: 2903

Filter	2017	2018	2019	2020	2021	2022	2023	2024
Ungroomed data	312 (100%) n: 4602	288 (100%) n: 3987	322 (100%) n: 4036	291 (100%) n: 3361	282 (100%) n: 3068	277 (100%) n: 2965	249 (100%) n: 1998	290 (100%) n: 1930
Fishing duration is not NA	312 (100%) n: 4601	288 (100%) n: 3987	322 (100%) n: 4035	291 (100%) n: 3360	282 (100%) n: 3068	277 (100%) n: 2965	249 (100%) n: 1998	290 (100%) n: 1930
Positive fishing duration	312 (100%) n: 4600	288 (100%) n: 3987	322 (100%) n: 4035	291 (100%) n: 3359	282 (100%) n: 3066	277 (100%) n: 2964	249 (100%) n: 1997	290 (100%) n: 1928
Fishing duration under 10hrs	312 (100%) n: 4596	287 (100%) n: 3984	321 (100%) n: 4029	291 (100%) n: 3356	282 (100%) n: 3062	277 (100%) n: 2961	249 (100%) n: 1997	290 (100%) n: 1928
Bottom depth shallower than 200m	312 (100%) n: 4530	287 (100%) n: 3959	321 (100%) n: 4003	290 (100%) n: 3323	282 (100%) n: 3040	277 (100%) n: 2944	248 (100%) n: 1975	290 (100%) n: 1915
Assigned to 013E	230 (74%) n: 3096	207 (72%) n: 2254	234 (73%) n: 2527	197 (68%) n: 1965	186 (66%) n: 1872	172 (62%) n: 1539	163 (65%) n: 1257	208 (72%) n: 1252
Latitude in range	230 (74%) n: 3095	207 (72%) n: 2253	234 (73%) n: 2527	197 (68%) n: 1965	186 (66%) n: 1871	172 (62%) n: 1539	163 (65%) n: 1257	208 (72%) n: 1252
Core fleet selection	203 (65%) n: 2840	188 (65%) n: 2062	213 (66%) n: 2443	197 (68%) n: 1953	180 (64%) n: 1847	162 (58%) n: 1446	157 (63%) n: 1212	191 (66%) n: 1176

Table C.9: Summary of the SNA2N BT.MIX event 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 snapper.

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
2008	18	412	3 491	11 729.35	183.92	65.20
2009	18	493	4 004	13 487.93	164.54	59.19
2010	19	487	4 416	14 837.67	176.55	60.28
2011	19	468	4 165	13 604.75	144.11	51.55
2012	19	434	4 043	13 467.22	164.85	52.86
2013	16	382	3 656	12 729.58	178.60	64.20
2014	17	382	3 691	12 431.17	200.27	57.63
2015	16	324	3 083	10 568.41	169.60	58.58
2016	17	318	2 903	10 372.13	205.05	61.18
2017	15	330	2 840	10 120.92	202.77	62.08
2018	15	255	2 062	7 437.25	187.93	66.20
2019	16	315	2 443	8 591.90	212.96	69.50
2020	16	269	1 953	7 036.20	197.00	72.40
2021	15	292	1 847	6 221.63	180.44	76.45
2022	10	240	1 446	4 855.38	162.20	78.01
2023	9	217	1 212	3 869.12	157.17	78.96
2024	11	216	1 176	3 928.97	190.53	77.30

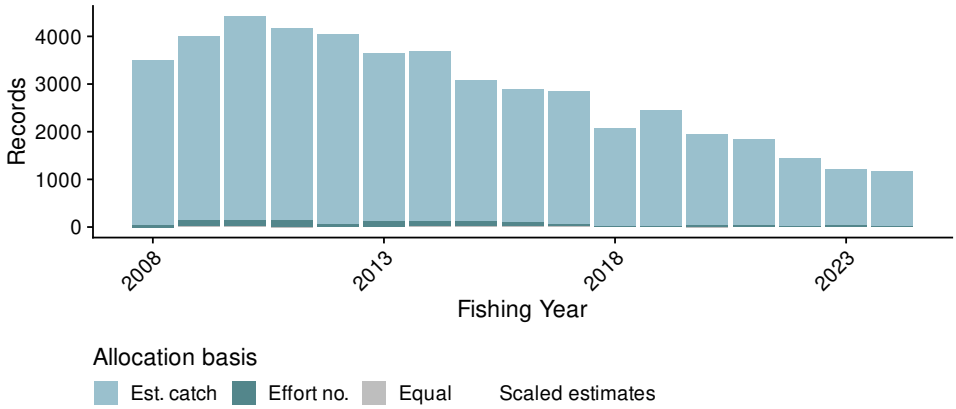

Figure C.25: Allocation basis for attributing landings to records in the SNA2N BT.MIX event catch-per-unit-effort dataset. Allocation basis is in terms of estimated catch, effort number, and/or equal.

Table C.10: Summary of stepwise selection for occurrence of positive catch in the SNA2N BT.MIX event 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	15	62 878	1.9	1.9	*
+ ns(bottom_depth, 3)	3	53 023	17.3	15.4	*
+ ns(start_latitude, 3)	3	49 939	22.1	4.8	*
+ month	11	48 547	24.3	2.2	*
+ vessel_key	24	47 773	25.6	1.3	*
+ target_species	3	47 068	26.7	1.1	*
+ ns(log(fishing_duration), 3)	3	46 916	27.0	0.2	
+ ns(effort_height, 3)	3	46 874	27.0	0.1	

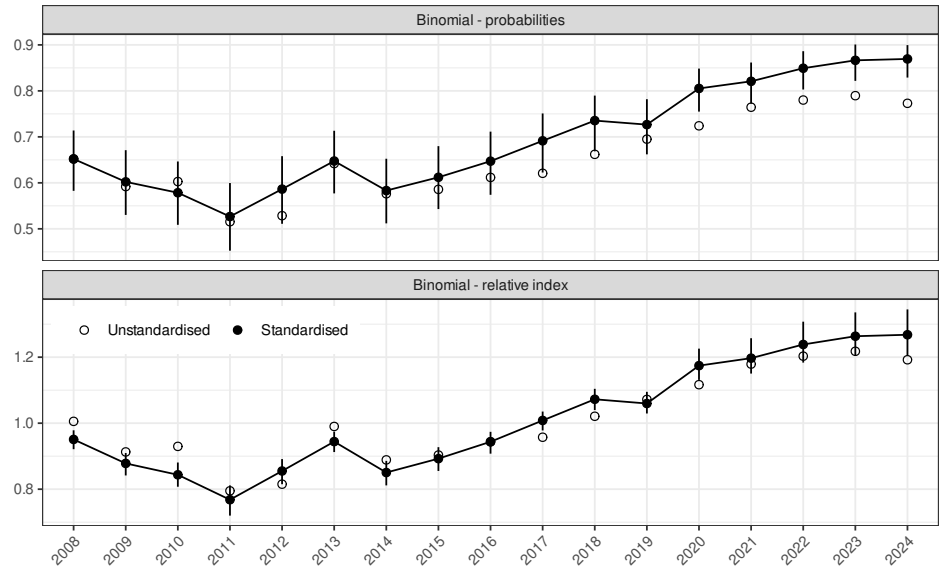

Figure C.26: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for occurrence of catch in the SNA2N BT.MIX event dataset, plotted as both probability of occurrence and as a relative index standardised to the geometric mean.

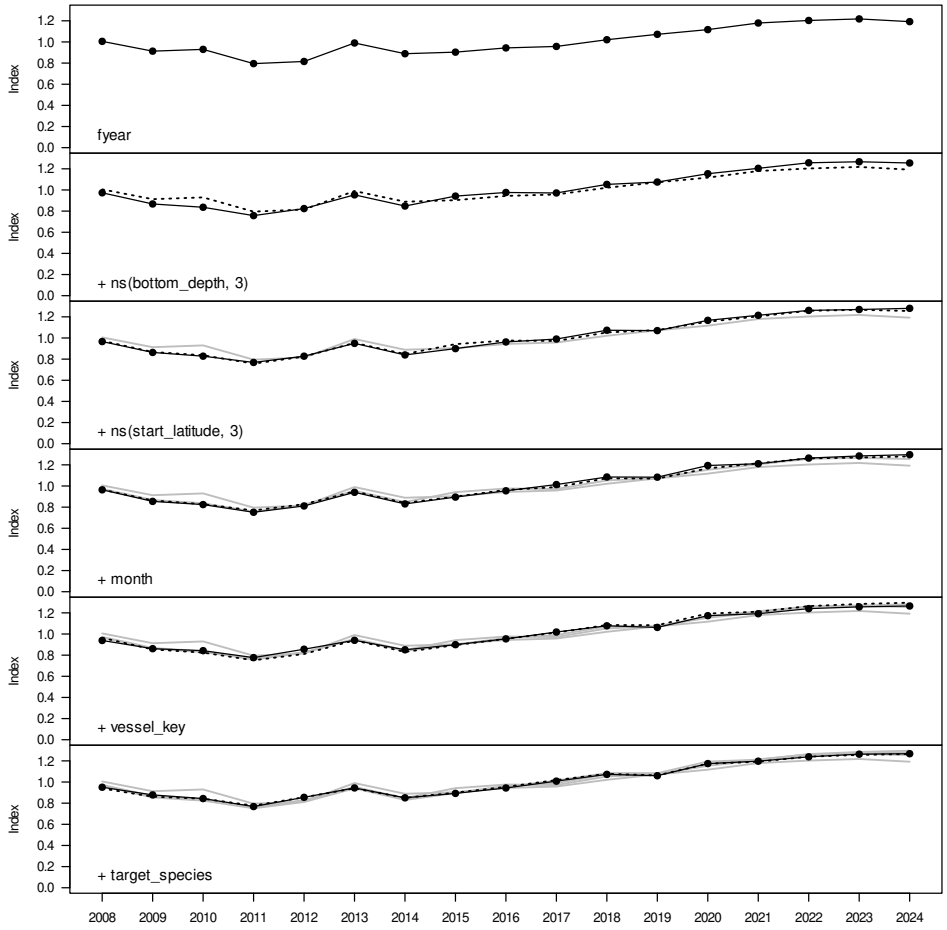

Figure C.27: Step plot for occurrence of catch in the SNA2N BT.MIX event dataset.

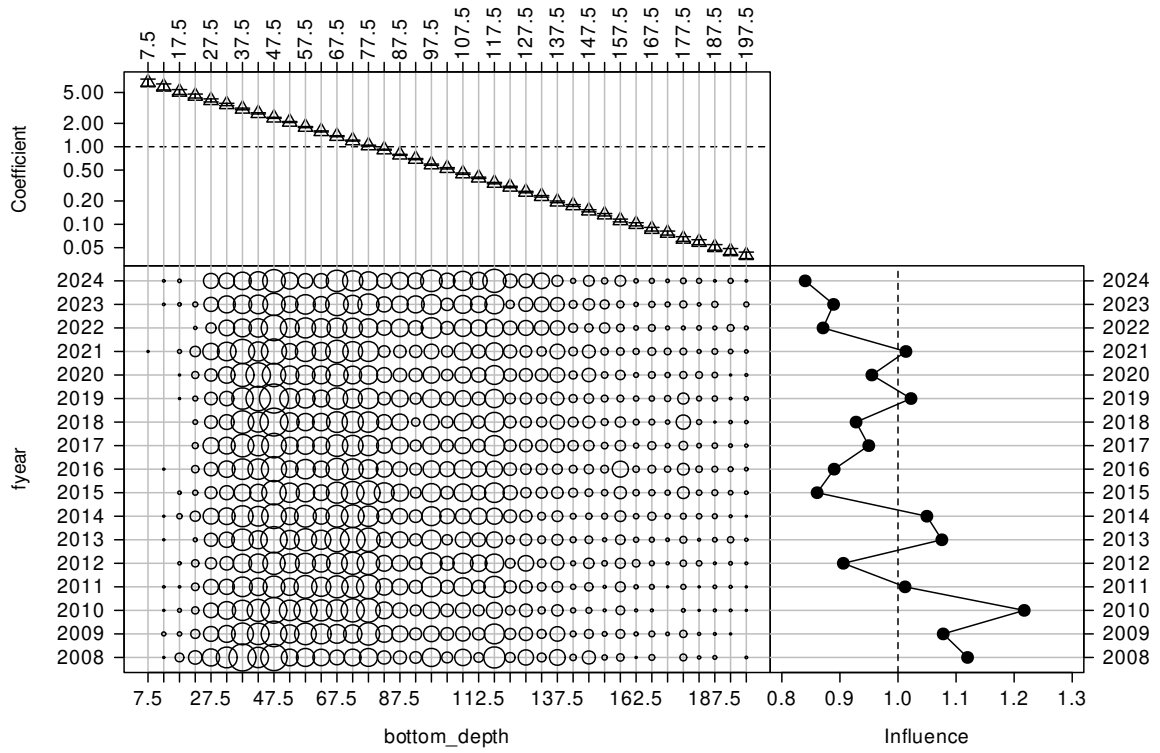

Figure C.28: CDI plot for bottom depth (m) for the occurrence of positive catch in the SNA2N BT.MIX event catch-per-unit-effort dataset.

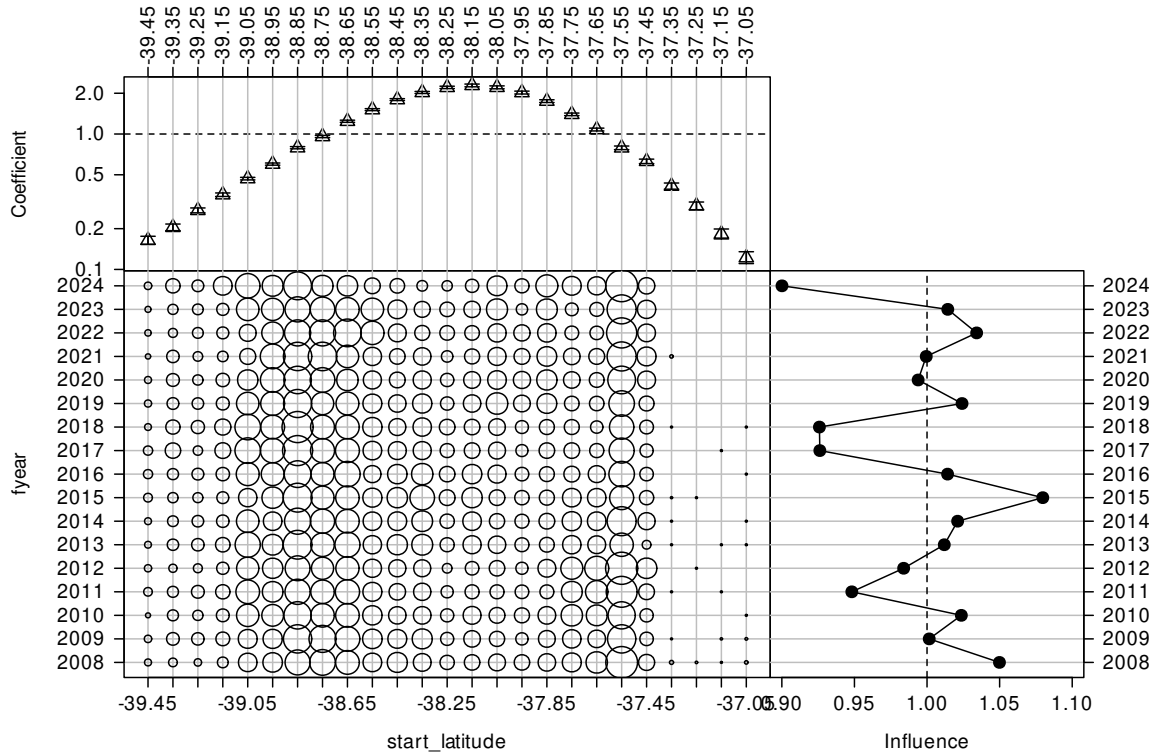

Figure C.29: CDI plot for start latitude for the occurrence of positive catch in the SNA2N BT.MIX event catch-per-unit-effort dataset.

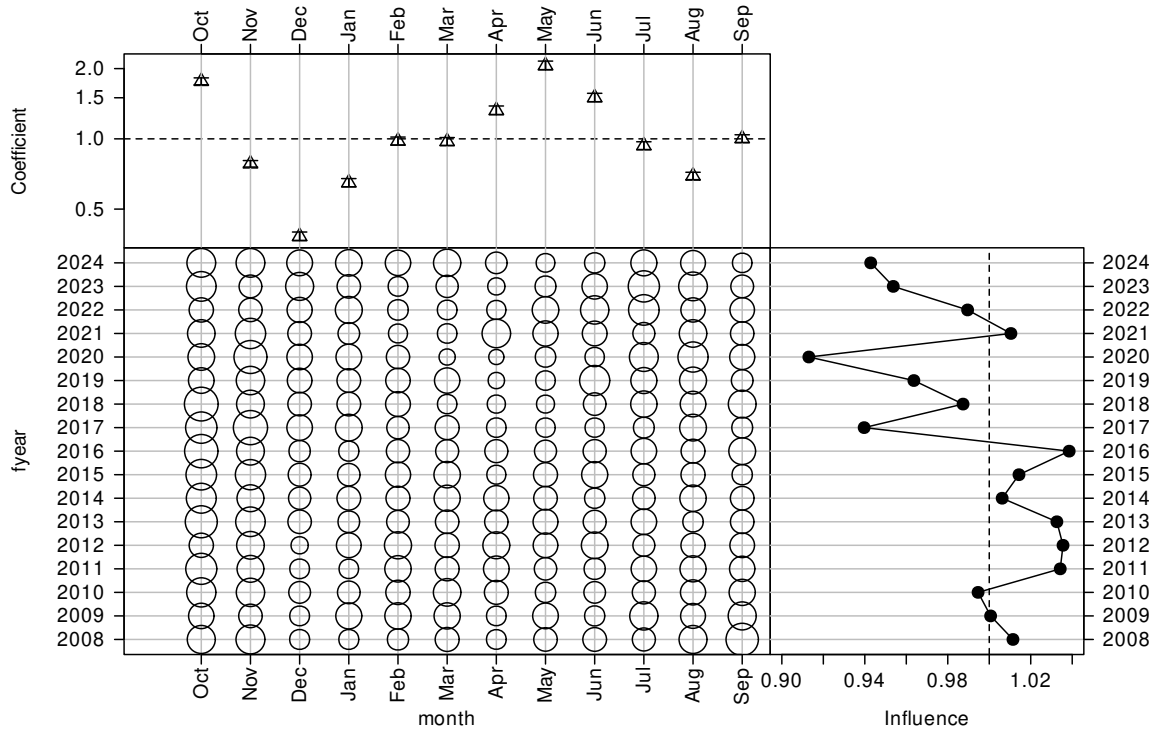

Figure C.30: CDI plot for month for the occurrence of positive catch in the SNA2N BT.MIX event catch-per-unit-effort dataset.

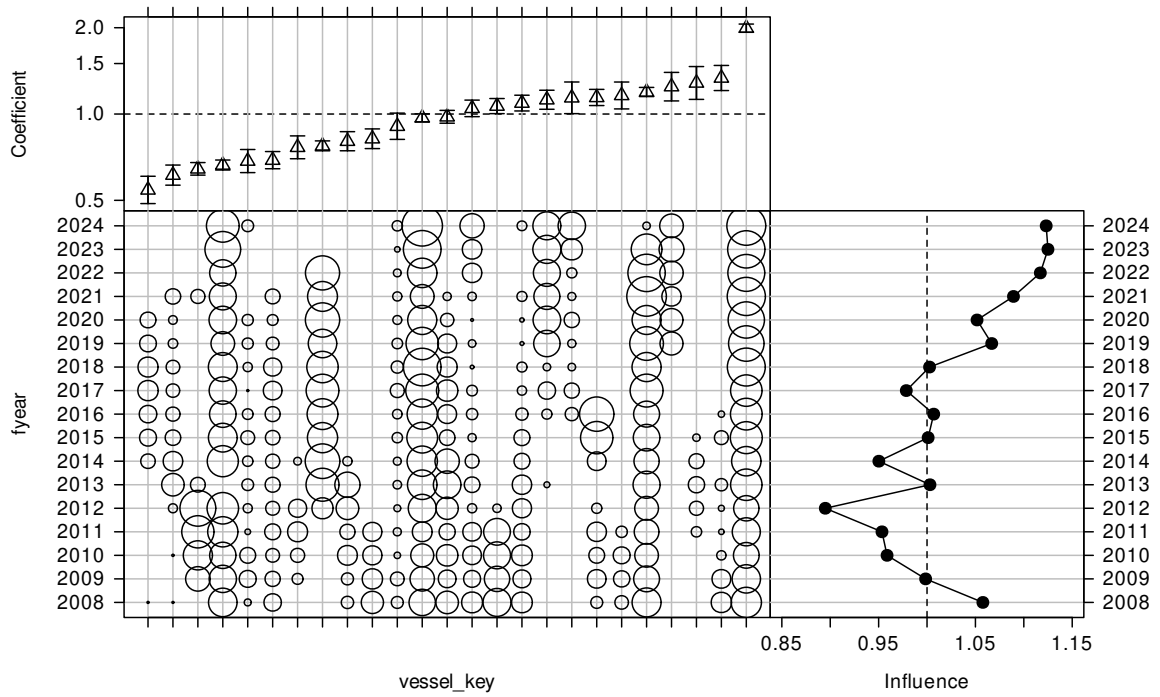

Figure C.31: CDI plot for vessel key for the occurrence of positive catch in the SNA2N BT.MIX event catch-per-unit-effort dataset.

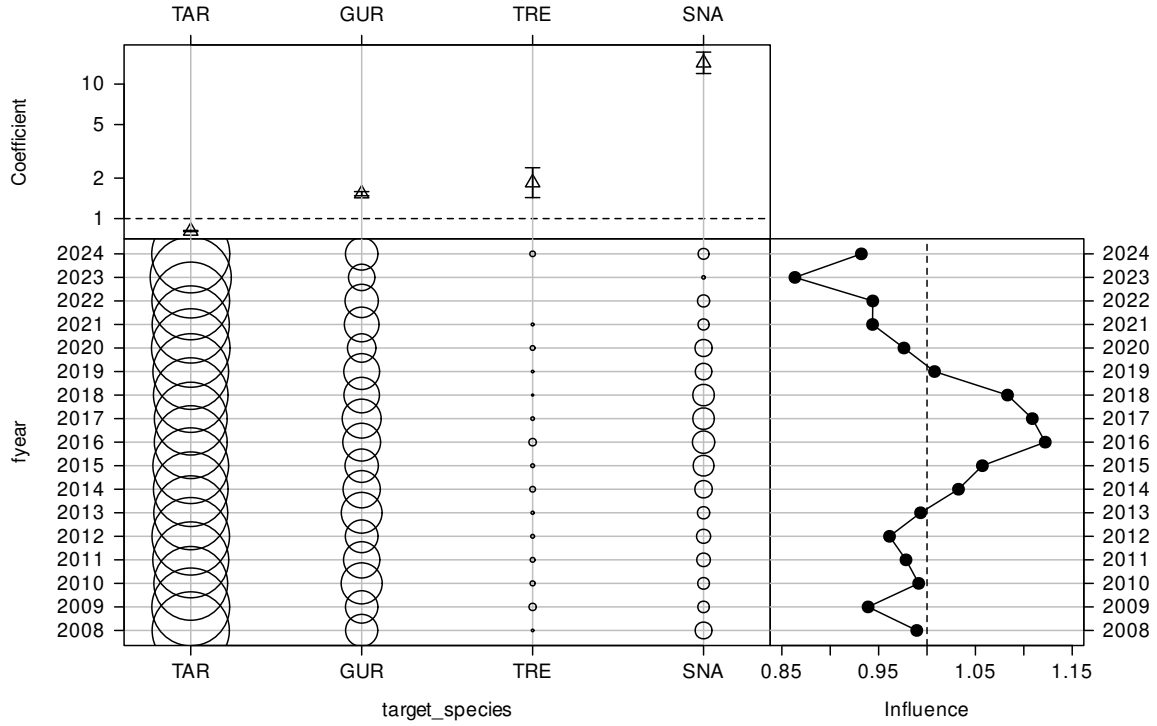

Figure C.32: CDI plot for target species for the occurrence of positive catch in the SNA2N BT.MIX event catch-per-unit-effort dataset.

Table C.11: Summary of stepwise selection for the Weibull model for positive catches in the SNA2N BT.MIX event 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	18	336 216	6.8	6.8	*
+ vessel_key	24	331 255	22.1	15.2	*
+ ns(bottom_depth, 3)	3	327 369	33.9	11.8	*
+ target_species	3	325 368	40.0	6.1	*
+ ns(start_latitude, 3)	3	323 644	45.3	5.3	*
+ month	11	322 573	48.6	3.3	*
+ ns(log(fishing_duration), 3)	3	322 099	50.0	1.5	*
+ ns(effort_width, 3)	3	322 048	50.2	0.2	
+ ns(effort_height, 3)	3	322 045	50.2	0.0	

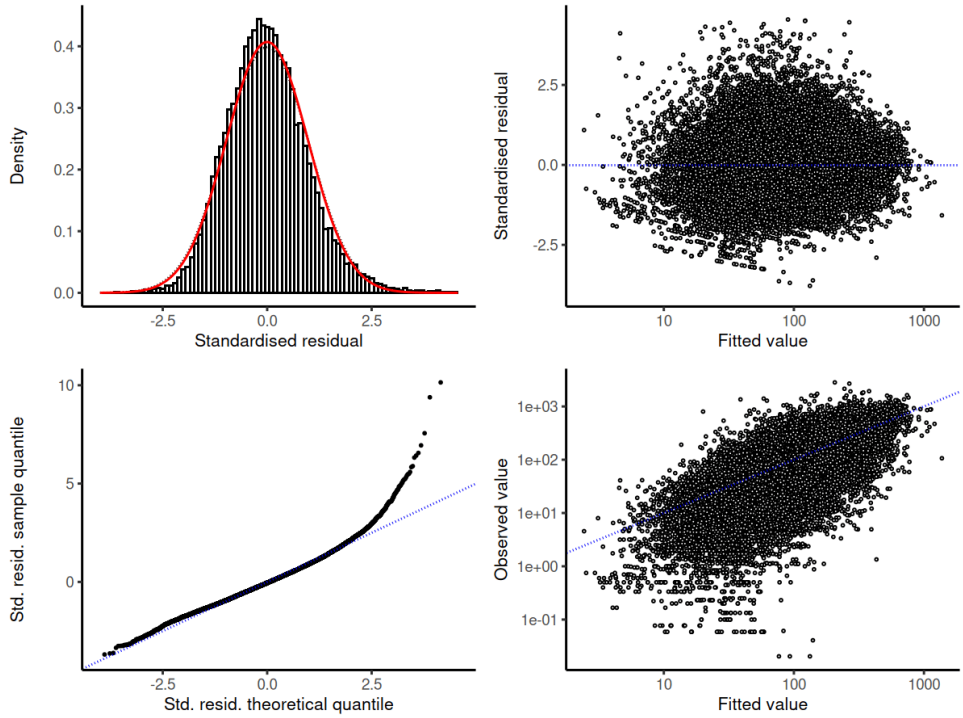

Figure C.33: Diagnostic plots for the selected Weibull model for positive catches in the SNA2N BT.MIX event dataset.

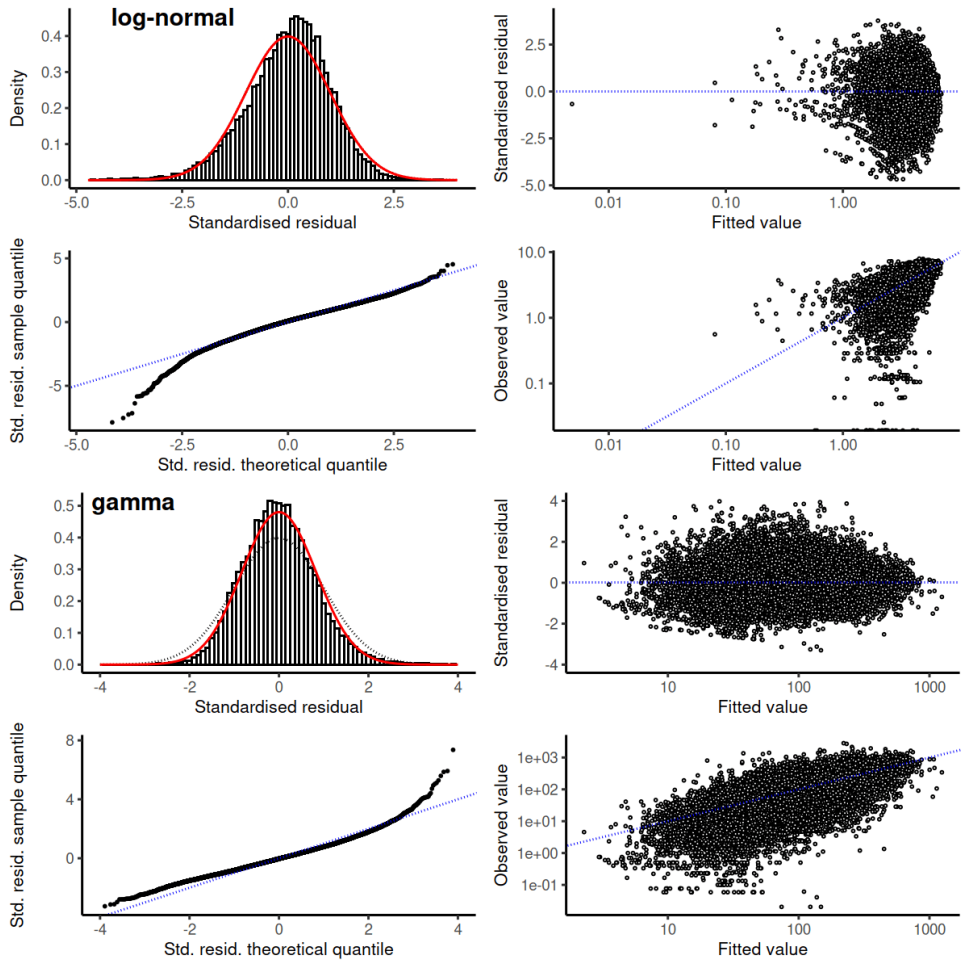

Figure C.34: Diagnostic plots for the alternative log-normal and gamma models considered for positive catches in the SNA2N BT.MIX event dataset.

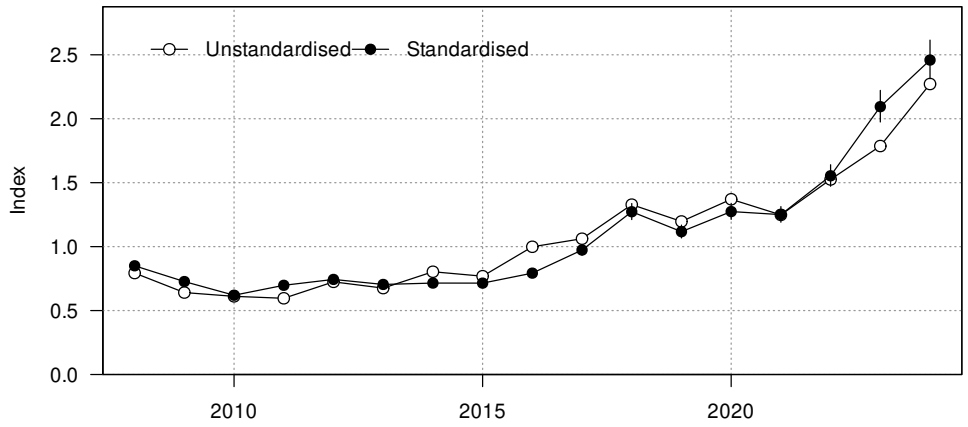

Figure C.35: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the Weibull model for the SNA2N BT.MIX event dataset.

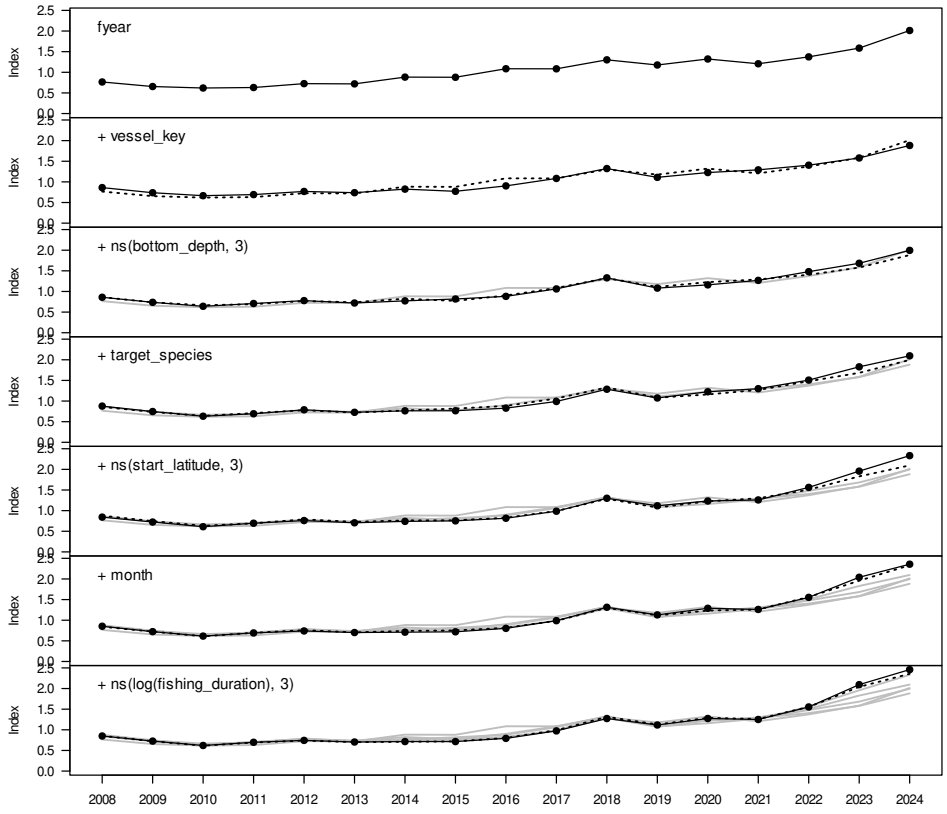

Figure C.36: Changes to the SNA2N BT.MIX event positive catch index as terms are successively entered into the Weibull model.

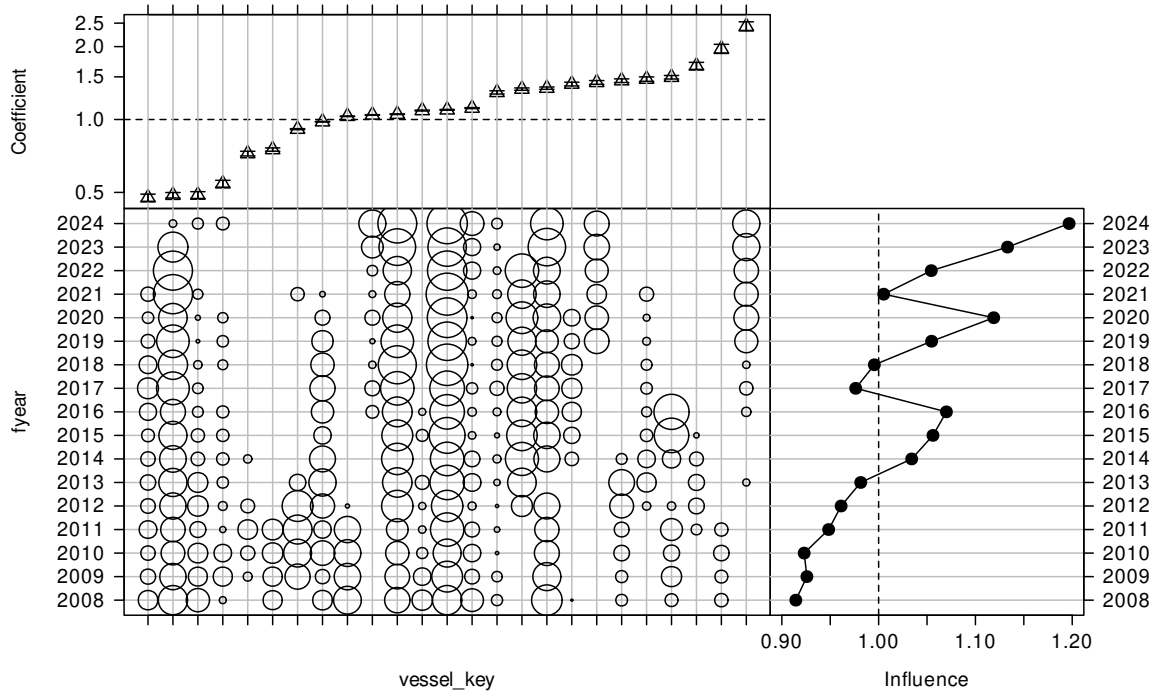

Figure C.37: CDI plot for vessel key for the Weibull model of positive catches in the SNA2N BT.MIX event catch-per-unit-effort dataset.

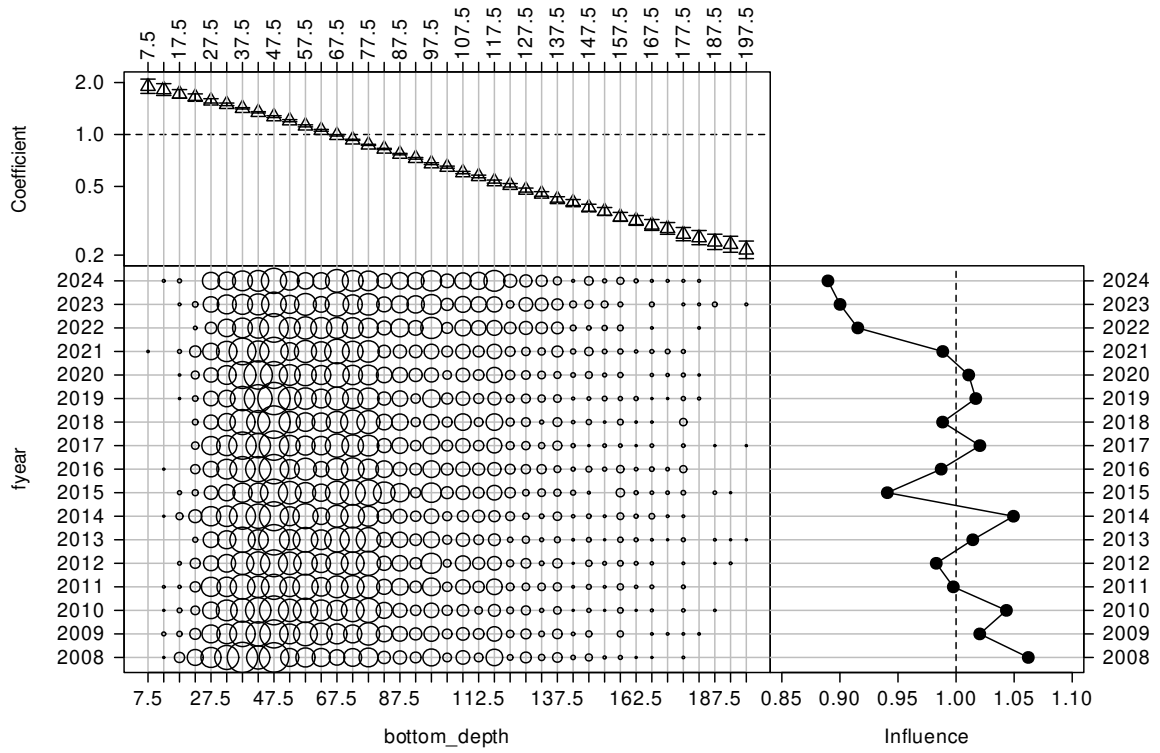

Figure C.38: CDI plot for bottom depth (m) for the Weibull model of positive catches in the SNA2N BT.MIX event catch-per-unit-effort dataset.

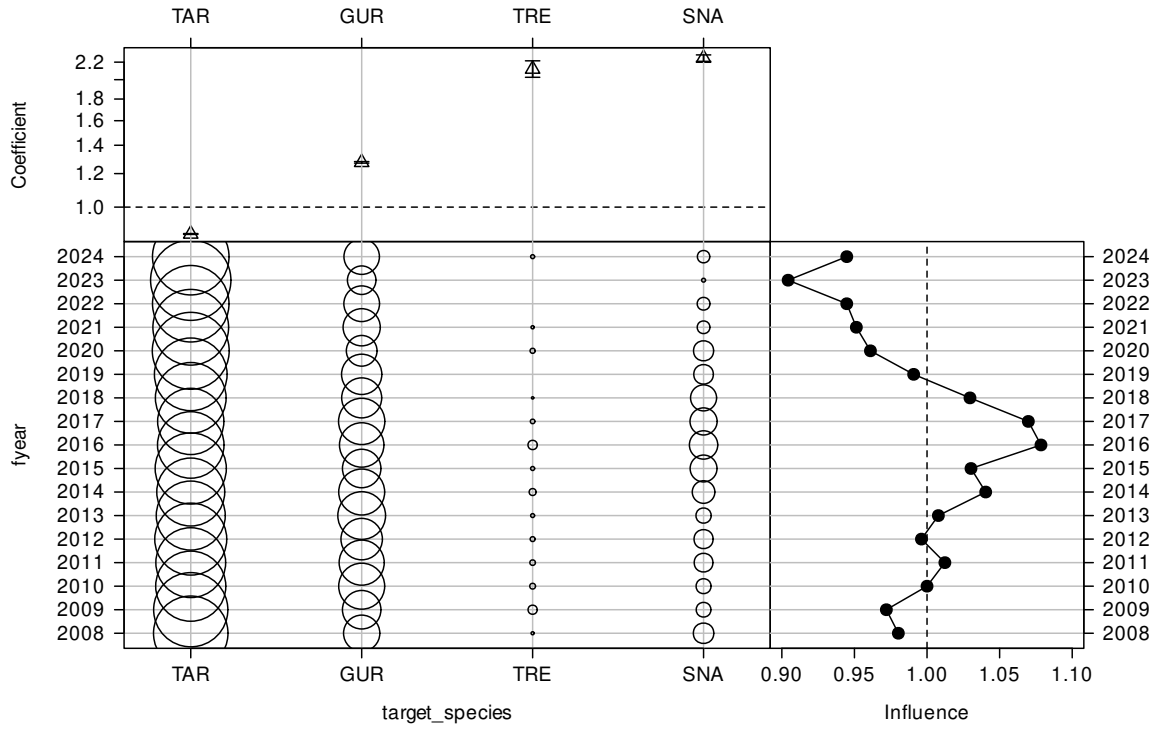

Figure C.39: CDI plot for target species for the Weibull model of positive catches in the SNA2N BT.MIX event catch-per-unit-effort dataset.

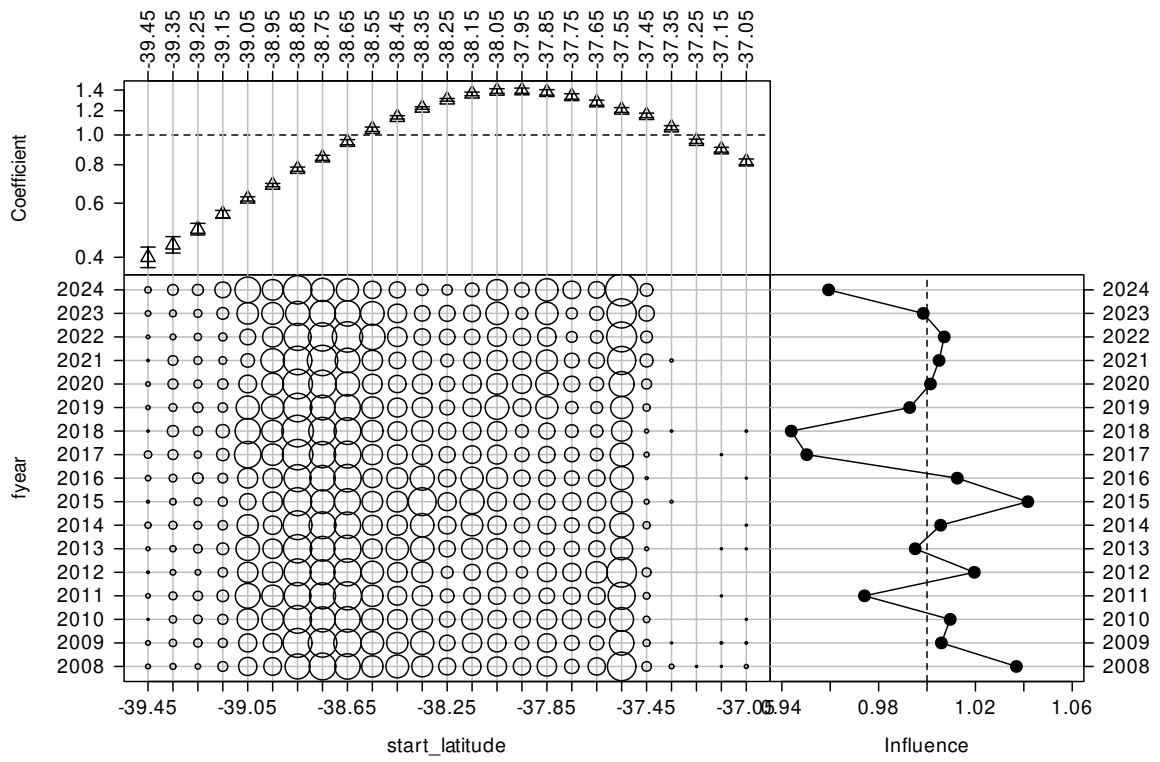

Figure C.40: CDI plot for start latitude for the Weibull model of positive catches in the SNA2N BT.MIX event catch-per-unit-effort dataset.

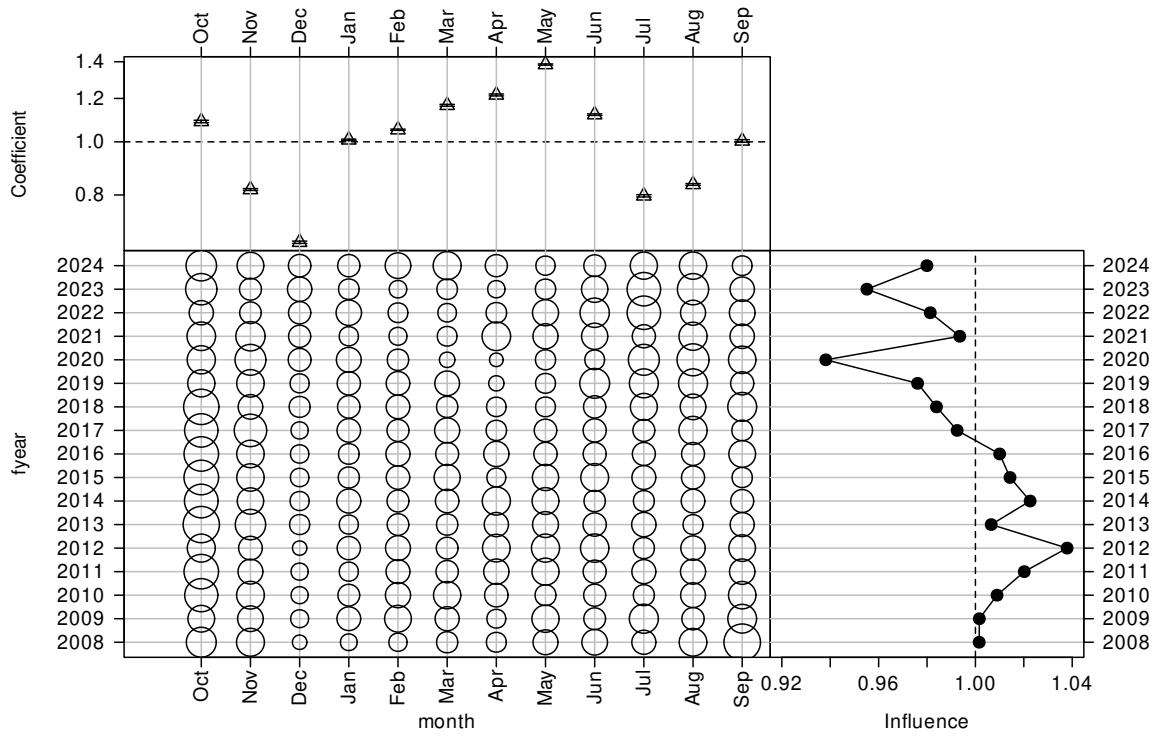

Figure C.41: CDI plot for month for the Weibull model of positive catches in the SNA2N BT.MIX event catch-per-unit-effort dataset.

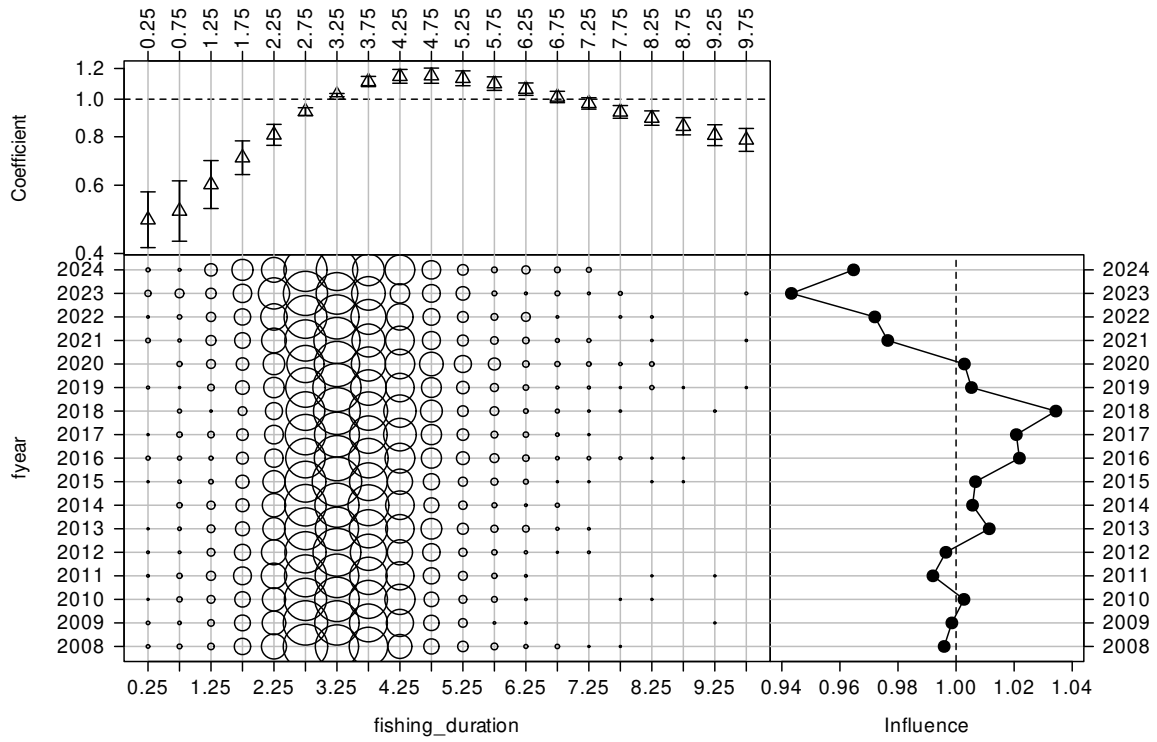

Figure C.42: CDI plot for fishing duration (h) for the Weibull model of positive catches in the SNA2N BT.MIX event catch-per-unit-effort dataset.

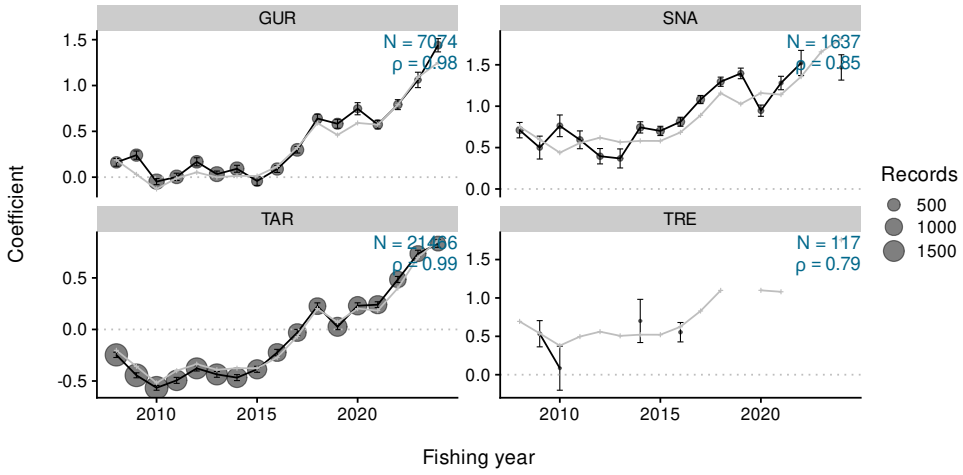

Figure C.43: Residual implied coefficients for target-year in the Weibull positive catch model for the SNA2N BT.MIX event dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in a target-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

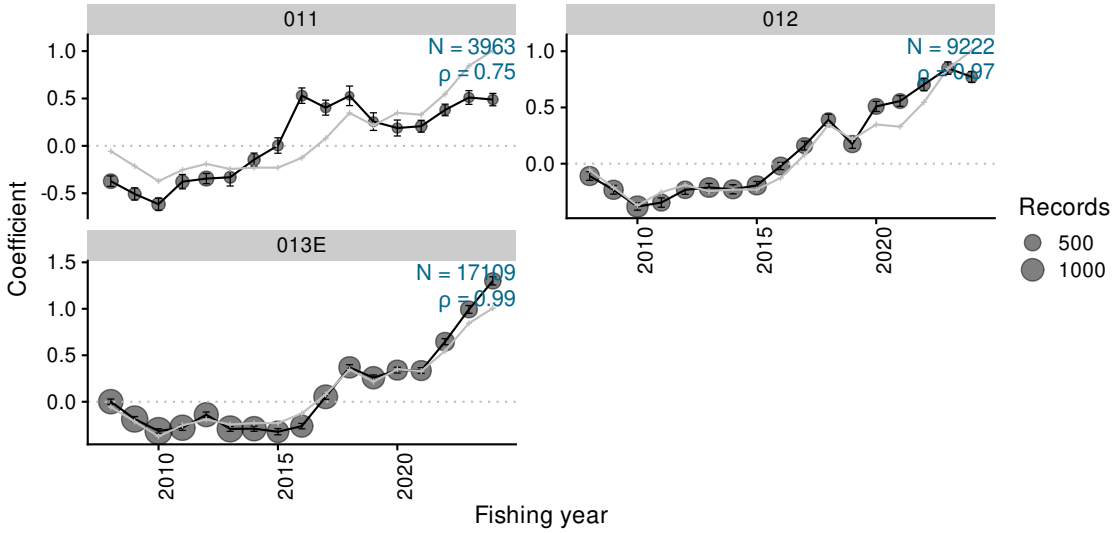

Figure C.44: Residual implied coefficients for area-year in the Weibull positive catch model for the SNA2N BT.MIX event dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data 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.

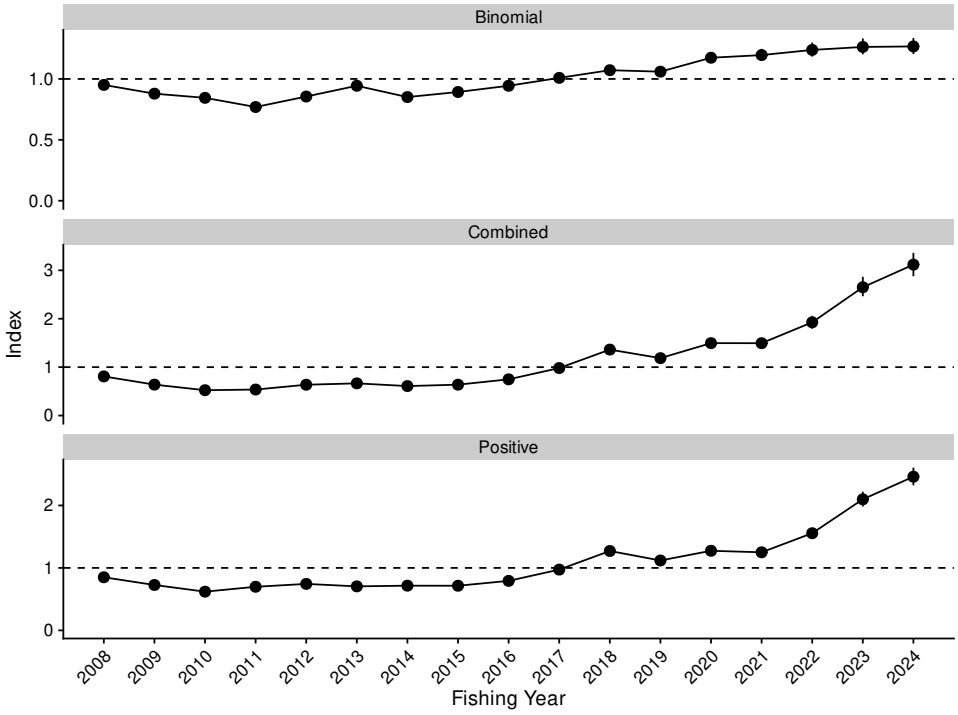

Figure C.45: Standardised indices and 95% confidence intervals for the SNA2N BT.MIX event dataset.

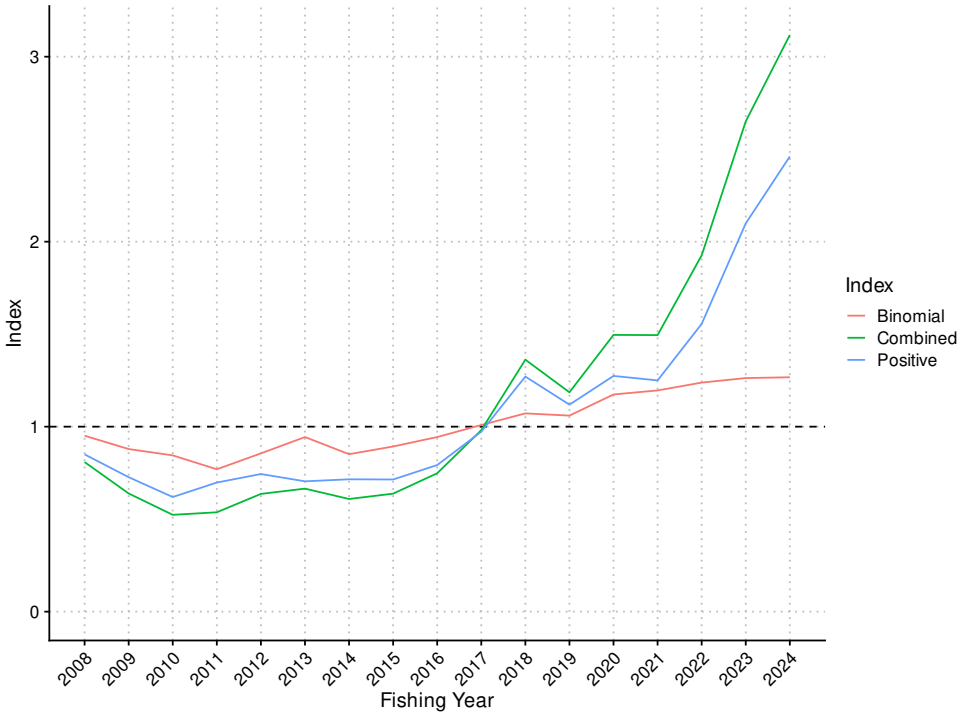

Figure C.46: Standardised indices for the SNA2N BT.MIX event dataset.

Table C.12: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for each model in SNA2N BT.MIX event.

	Binomial				Combined				Positive			
Fishing year	index	SE	LCI	UCI	index	SE	LCI	UCI	index	SE	LCI	UCI
2008	0.951	0.015	0.918	0.979	0.809	0.021	0.768	0.849	0.850	0.017	0.819	0.885
2009	0.879	0.017	0.846	0.912	0.639	0.018	0.604	0.674	0.727	0.014	0.699	0.755
2010	0.845	0.019	0.807	0.880	0.523	0.015	0.493	0.553	0.620	0.012	0.596	0.643
2011	0.770	0.021	0.727	0.810	0.537	0.019	0.500	0.574	0.698	0.015	0.669	0.727
2012	0.856	0.019	0.816	0.890	0.637	0.018	0.602	0.672	0.744	0.015	0.713	0.773
2013	0.944	0.016	0.912	0.973	0.665	0.017	0.630	0.698	0.705	0.014	0.679	0.733
2014	0.851	0.019	0.815	0.891	0.609	0.018	0.574	0.646	0.715	0.014	0.688	0.743
2015	0.893	0.019	0.854	0.928	0.638	0.020	0.599	0.676	0.714	0.016	0.683	0.745
2016	0.944	0.017	0.909	0.975	0.748	0.021	0.707	0.789	0.793	0.018	0.759	0.829
2017	1.009	0.015	0.979	1.040	0.981	0.025	0.932	1.032	0.973	0.021	0.933	1.016
2018	1.072	0.018	1.038	1.107	1.362	0.041	1.285	1.445	1.271	0.031	1.212	1.333
2019	1.060	0.016	1.028	1.091	1.186	0.032	1.124	1.248	1.119	0.025	1.068	1.166
2020	1.174	0.023	1.131	1.221	1.496	0.046	1.409	1.590	1.274	0.031	1.216	1.336
2021	1.196	0.025	1.150	1.247	1.495	0.048	1.404	1.592	1.250	0.030	1.192	1.309
2022	1.238	0.030	1.183	1.299	1.926	0.067	1.795	2.060	1.556	0.042	1.472	1.636
2023	1.263	0.033	1.202	1.333	2.650	0.102	2.465	2.866	2.099	0.060	1.984	2.220
2024	1.267	0.033	1.205	1.336	3.118	0.123	2.878	3.361	2.461	0.072	2.323	2.605

C.3 SNA2S BT.MIX day

Table C.13: Definition for the dataset, core fleet criteria, and Generalised Linear Modelling approach used in the catch-per-unit-effort (CPUE) standardisation for the SNA2S BT.MIX day CPUE series.

Series	SNA2S BT.MIX day
QMS stock	SNA 2
Reporting forms	CEL, TCP, TCE, ERS - Trawl
Fishing methods	BT
Target species	GUR, TRE, TAR, SNA
Statistical Areas	013, 014, 015, 016
Period	2001-10-01, 2024-09-30
Resolution	Day
Core fleet years	5
Core fleet trips	5
Default model	allockg ~ fyear + vessel_key + target_species + ns(log(fishing_duration), 3) + ns(log(effort_num), 3) + stat_area + month
Stepwise selection	Yes
Positive catch distribution	Lognormal

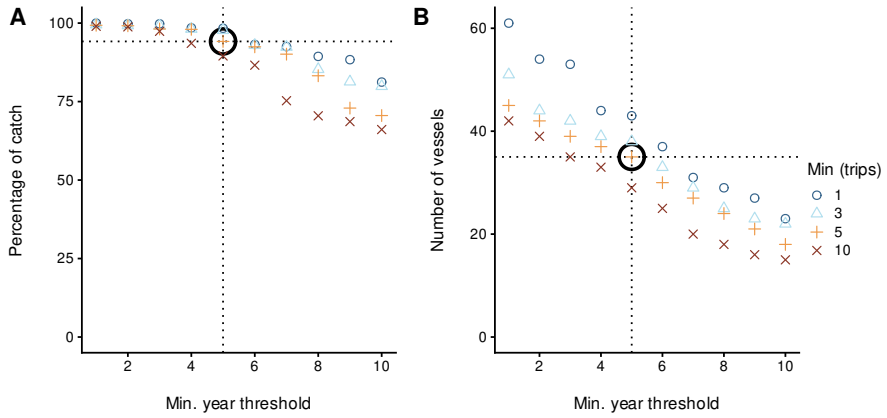

Figure C.47: Percentage of catch and number of vessels for different core vessel selection criteria for the SNA2S BT.MIX day CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel participated in the fishery and the number of trips per year.

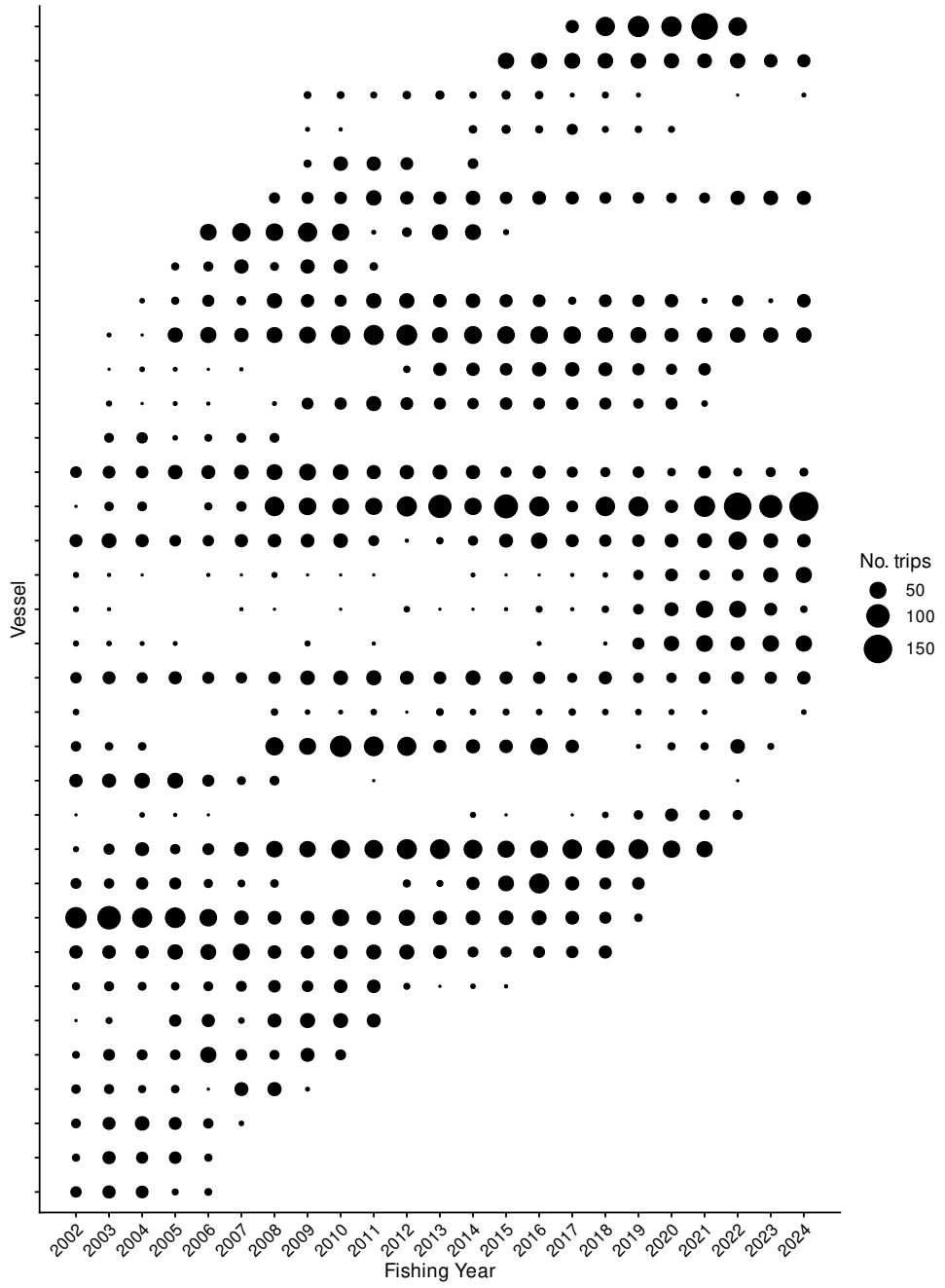

Figure C.48: Number of trips by fishing year for core vessels in the SNA2S BT.MIX day series. The area of the circles is proportional to the number of trips undertaken by a vessel in a fishing year.

Table C.14: Summary of the SNA2S BT.MIX day 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. (Continued on next page)

Filter	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ungroomed data	114 (100%) n: 2677	160 (100%) n: 2683	200 (100%) n: 2313	272 (100%) n: 2762	239 (100%) n: 2688	224 (100%) n: 2614	165 (100%) n: 2322	172 (100%) n: 2413	145 (100%) n: 2590
Fishing duration is not NA	114 (100%) n: 2677	160 (100%) n: 2683	200 (100%) n: 2313	272 (100%) n: 2762	239 (100%) n: 2688	224 (100%) n: 2614	165 (100%) n: 2322	172 (100%) n: 2413	145 (100%) n: 2590
Positive fishing duration	114 (100%) n: 2677	160 (100%) n: 2683	200 (100%) n: 2313	272 (100%) n: 2762	239 (100%) n: 2688	224 (100%) n: 2613	165 (100%) n: 2322	172 (100%) n: 2413	145 (100%) n: 2590
Tows is not NA	114 (100%) n: 2677	160 (100%) n: 2683	200 (100%) n: 2313	272 (100%) n: 2762	239 (100%) n: 2688	224 (100%) n: 2613	165 (100%) n: 2322	172 (100%) n: 2413	145 (100%) n: 2590
Fishing duration under 24hrs	113 (100%) n: 2672	159 (99%) n: 2679	198 (99%) n: 2305	272 (100%) n: 2758	238 (100%) n: 2682	223 (100%) n: 2608	164 (99%) n: 2316	172 (100%) n: 2408	145 (100%) n: 2588
Less than 6 tows per day	113 (99%) n: 2666	159 (99%) n: 2677	197 (99%) n: 2295	271 (100%) n: 2752	238 (100%) n: 2679	223 (100%) n: 2602	163 (99%) n: 2312	171 (99%) n: 2404	144 (99%) n: 2580
Assigned to 013W	11 (10%) n: 788	31 (19%) n: 1090	35 (18%) n: 940	50 (18%) n: 1106	50 (21%) n: 1229	38 (17%) n: 1168	100 (61%) n: 1775	103 (60%) n: 1784	85 (59%) n: 1876
Core fleet selection	9.2 (8%) n: 634	29 (18%) n: 956	35 (17%) n: 900	50 (18%) n: 1072	48 (20%) n: 1117	35 (16%) n: 1027	83 (50%) n: 1607	102 (59%) n: 1694	85 (59%) n: 1788

Filter	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ungroomed data	148 (100%) n: 2418	134 (100%) n: 2033	109 (100%) n: 1966	121 (100%) n: 2109	108 (100%) n: 2063	133 (100%) n: 1940	173 (100%) n: 1828	178 (100%) n: 1826	189 (100%) n: 1725
Fishing duration is not NA	148 (100%) n: 2418	134 (100%) n: 2033	109 (100%) n: 1966	121 (100%) n: 2109	108 (100%) n: 2062	133 (100%) n: 1940	173 (100%) n: 1828	178 (100%) n: 1826	189 (100%) n: 1725
Positive fishing duration	148 (100%) n: 2418	134 (100%) n: 2033	109 (100%) n: 1966	121 (100%) n: 2109	108 (100%) n: 2062	133 (100%) n: 1940	173 (100%) n: 1828	178 (100%) n: 1826	189 (100%) n: 1725
Tows is not NA	148 (100%) n: 2418	134 (100%) n: 2033	109 (100%) n: 1966	121 (100%) n: 2109	108 (100%) n: 2062	133 (100%) n: 1940	173 (100%) n: 1828	178 (100%) n: 1826	189 (100%) n: 1725
Fishing duration under 24hrs	148 (100%) n: 2410	134 (100%) n: 2031	109 (100%) n: 1963	121 (100%) n: 2098	108 (100%) n: 2060	133 (99%) n: 1927	173 (100%) n: 1822	178 (100%) n: 1823	189 (100%) n: 1719
Less than 6 tows per day	147 (100%) n: 2400	133 (99%) n: 2024	109 (100%) n: 1957	119 (99%) n: 2094	108 (100%) n: 2059	133 (99%) n: 1922	171 (99%) n: 1815	178 (100%) n: 1818	189 (100%) n: 1718
Assigned to 013W	92 (62%) n: 1764	76 (57%) n: 1473	48 (44%) n: 1357	55 (46%) n: 1539	70 (65%) n: 1605	82 (62%) n: 1453	93 (54%) n: 1289	96 (54%) n: 1421	117 (62%) n: 1412
Core fleet selection	89 (60%) n: 1694	75 (56%) n: 1427	48 (44%) n: 1341	55 (46%) n: 1484	69 (64%) n: 1573	81 (61%) n: 1419	91 (53%) n: 1262	91 (51%) n: 1331	115 (61%) n: 1382

Filter	2020	2021	2022	2023	2024
Ungroomed data	171 (100%) n: 1482	173 (100%) n: 1483	212 (100%) n: 1459	214 (100%) n: 1065	277 (100%) n: 1216
Fishing duration is not NA	171 (100%) n: 1482	173 (100%) n: 1483	212 (100%) n: 1459	214 (100%) n: 1065	277 (100%) n: 1216
Positive fishing duration	171 (100%) n: 1481	173 (100%) n: 1482	212 (100%) n: 1459	214 (100%) n: 1065	277 (100%) n: 1216
Tows is not NA	171 (100%) n: 1481	173 (100%) n: 1482	212 (100%) n: 1459	214 (100%) n: 1065	277 (100%) n: 1216
Fishing duration under 24hrs	171 (100%) n: 1477	173 (100%) n: 1477	212 (100%) n: 1458	214 (100%) n: 1064	277 (100%) n: 1216
Less than 6 tows per day	171 (100%) n: 1477	173 (100%) n: 1477	212 (100%) n: 1456	214 (100%) n: 1061	277 (100%) n: 1206
Assigned to 013W	144 (84%) n: 1384	150 (87%) n: 1370	180 (85%) n: 1349	193 (91%) n: 1002	218 (79%) n: 1103
Core fleet selection	142 (83%) n: 1349	146 (84%) n: 1339	152 (72%) n: 1157	163 (76%) n: 883	201 (72%) n: 959

Table C.15: Summary of the SNA2S BT.MIX day dataset after core fleet selection. 'Records' indicates the number of rows (days) in the dataset, and 'Records caught' indicates the percentage of days with catches of snapper.

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
2002	22	357	634	6 338.22	9.18	14.98
2003	24	500	956	10 025.82	28.83	20.50
2004	24	470	900	9 354.57	34.86	22.44
2005	23	488	1 072	11 973.93	49.74	25.47
2006	25	519	1 117	12 610.60	48.45	27.57
2007	22	495	1 027	10 420.17	35.48	26.68
2008	24	675	1 607	15 914.38	83.12	34.72
2009	24	687	1 694	17 218.65	101.66	34.71
2010	23	761	1 788	18 168.07	85.28	32.27
2011	22	671	1 694	17 625.08	89.27	35.12
2012	20	624	1 427	14 251.42	75.43	36.51
2013	19	567	1 341	13 706.02	47.70	28.34
2014	23	602	1 484	15 063.60	55.15	28.30
2015	23	619	1 573	16 190.52	69.22	25.68
2016	21	665	1 419	13 834.55	80.67	22.34
2017	22	538	1 262	13 017.90	91.20	32.65
2018	22	574	1 331	13 259.10	91.18	37.34
2019	22	593	1 382	13 506.81	115.07	43.70
2020	19	532	1 349	13 414.75	142.35	49.00
2021	18	629	1 339	12 215.22	146.09	48.02
2022	16	599	1 157	9 927.77	151.94	62.92
2023	12	405	883	8 127.57	162.92	61.27
2024	13	470	959	8 229.45	200.58	64.55

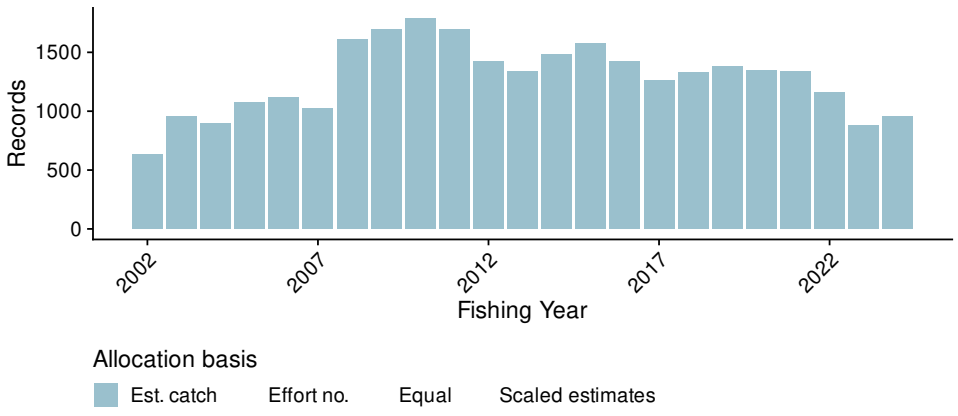

Figure C.49: Allocation basis for attributing landings to records in the SNA2S BT.MIX day catch-per-unit-effort dataset. Allocation basis is in terms of estimated catch, effort number, and/or equal.

Table C.16: Summary of stepwise selection for occurrence of positive catch in the SNA2S BT.MIX day 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	21	36 404	4.9	4.9	*
+ stat_area	3	30 798	19.5	14.7	*
+ vessel_key	34	29 366	23.5	3.9	*
+ target_species	3	27 884	27.4	3.9	*
+ month	11	26 899	30.0	2.6	*
+ ns(log(fishing_duration), 3)	3	26 759	30.4	0.4	
+ ns(log(effort_num), 3)	3	26 750	30.4	0.0	

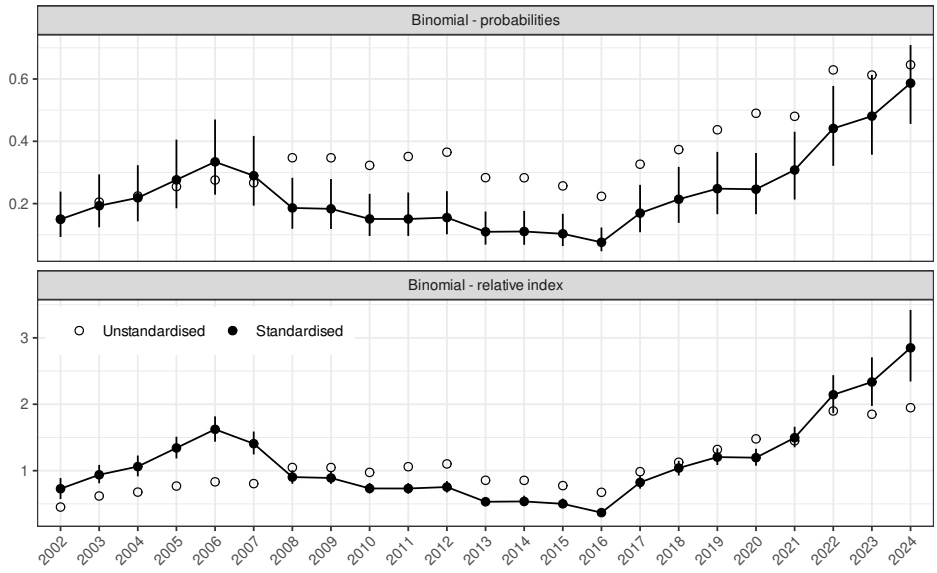

Figure C.50: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for occurrence of catch in the SNA2S BT.MIX day dataset, plotted as both probability of occurrence and as a relative index standardised to the geometric mean.

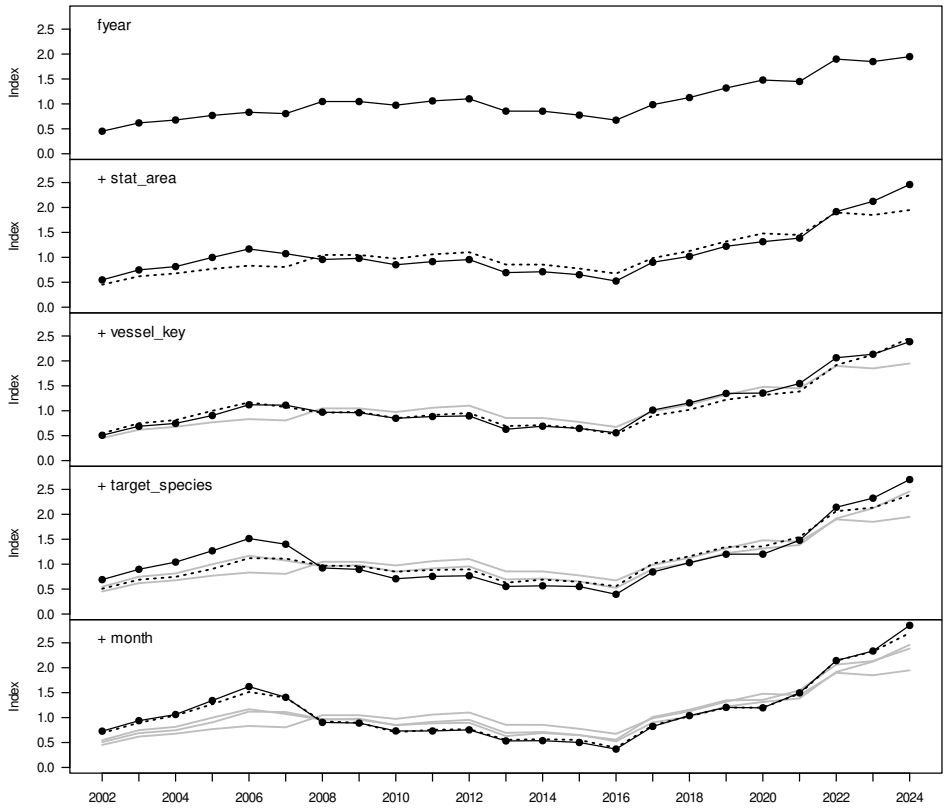

Figure C.51: Step plot for occurrence of catch in the SNA2S BT.MIX day dataset.

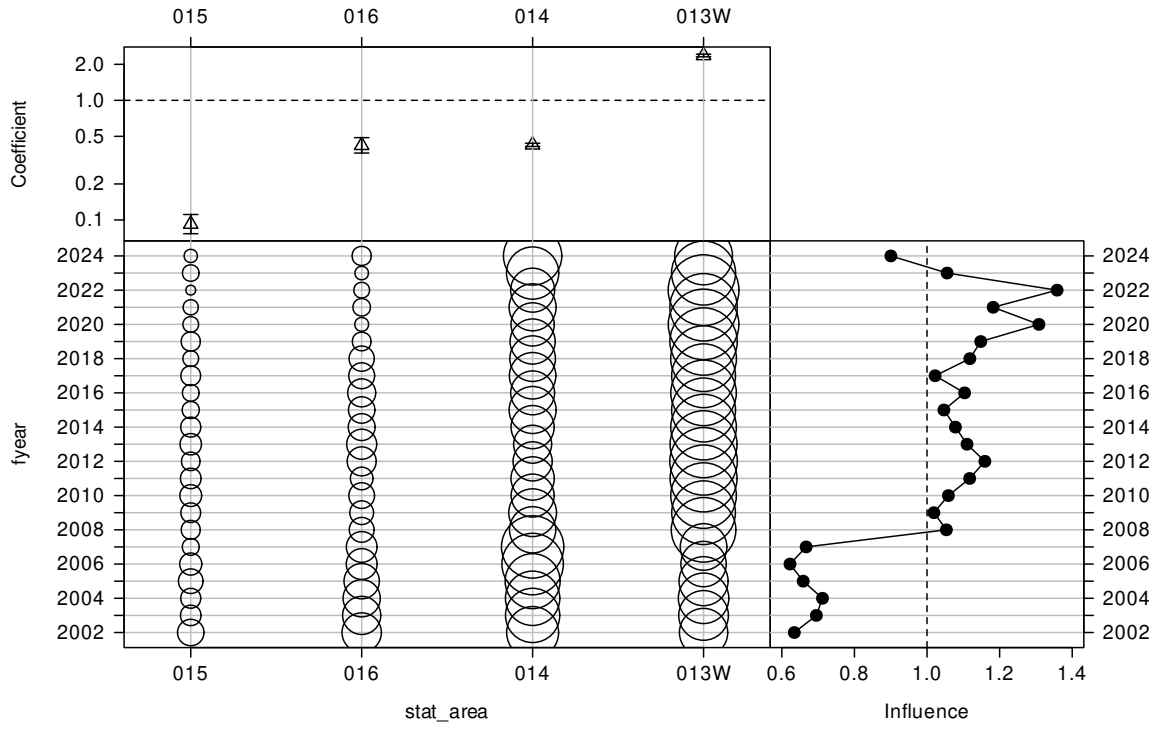

Figure C.52: CDI plot for statistical area for the occurrence of positive catch in the SNA2S BT.MIX day catch-per-unit-effort dataset.

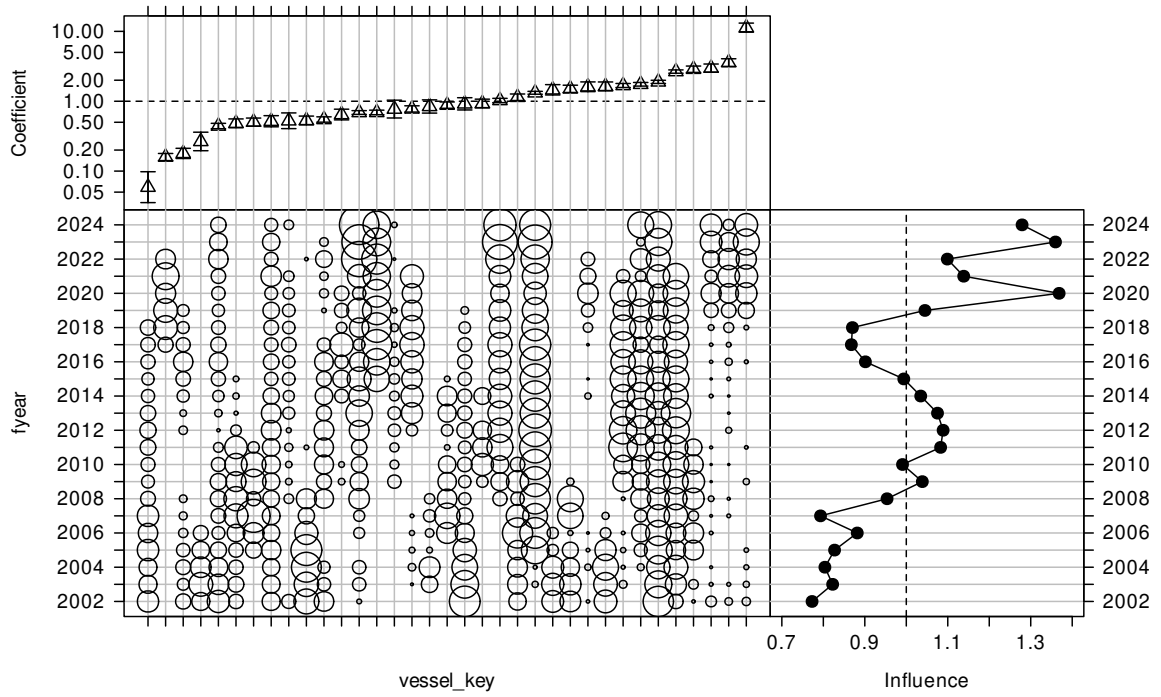

Figure C.53: CDI plot for vessel key for the occurrence of positive catch in the SNA2S BT.MIX day catch-per-unit-effort dataset.

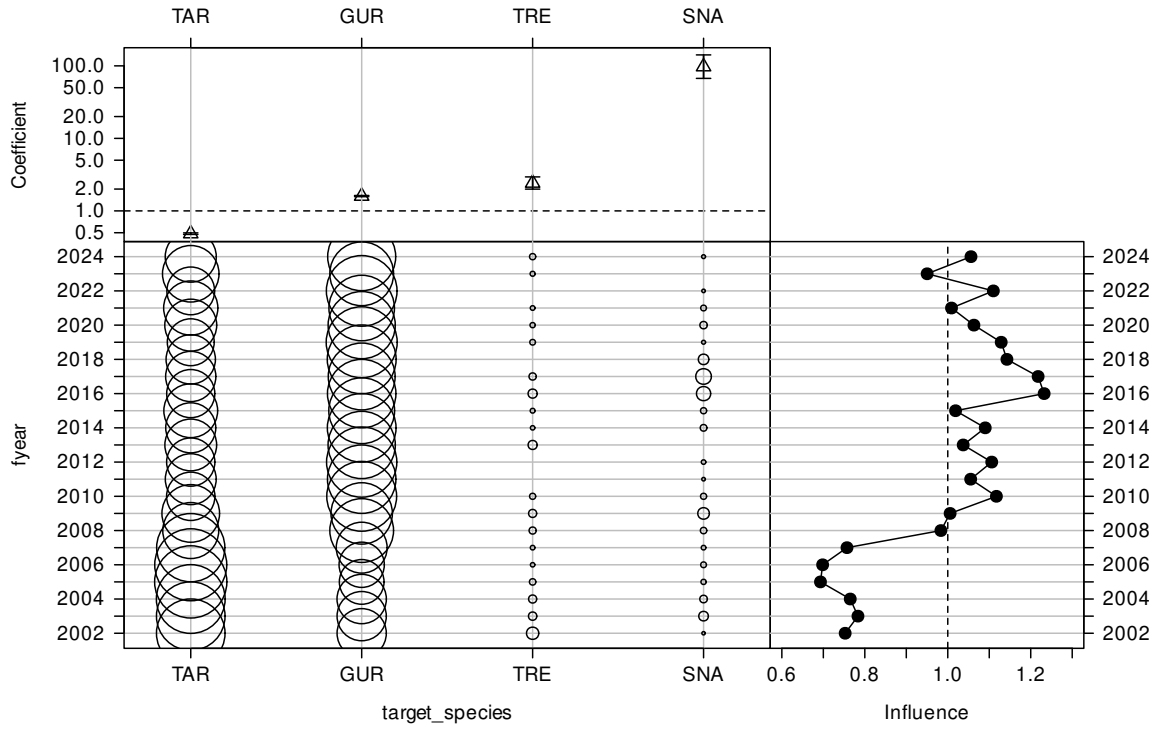

Figure C.54: CDI plot for target species for the occurrence of positive catch in the SNA2S BT.MIX day catch-per-unit-effort dataset.

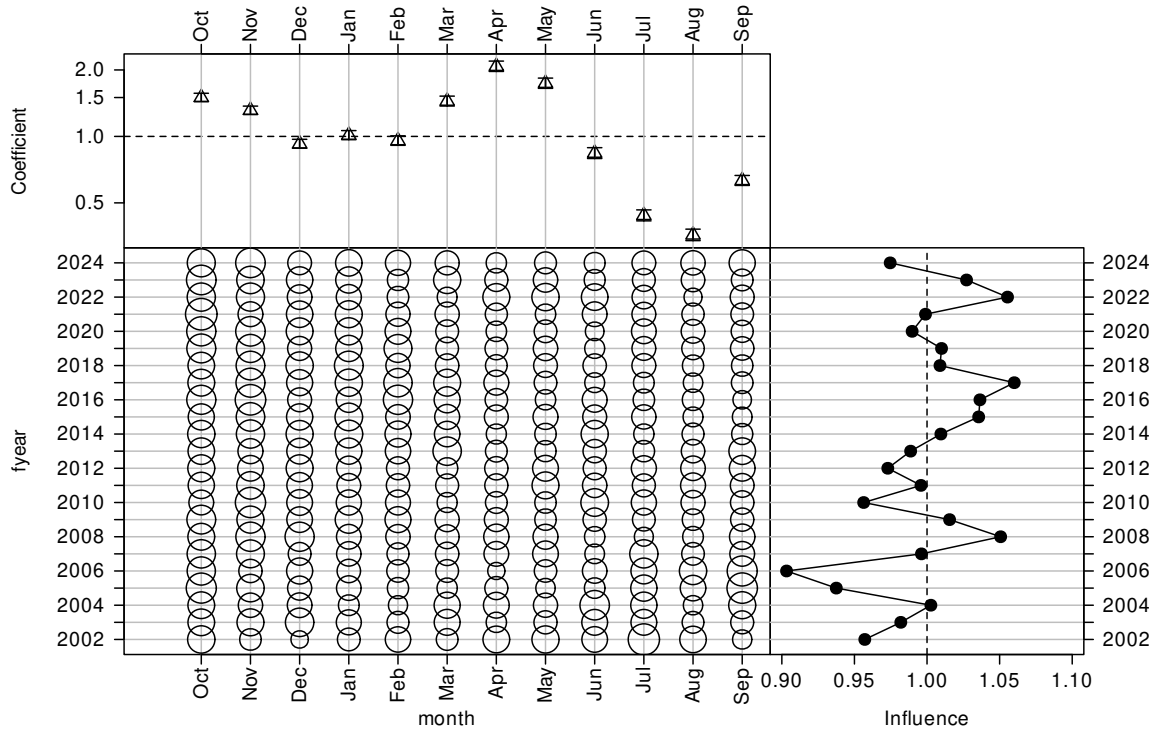

Figure C.55: CDI plot for month for the occurrence of positive catch in the SNA2S BT.MIX day catch-per-unit-effort dataset.

Table C.17: Summary of stepwise selection for the lognormal model for positive catches in the SNA2S BT.MIX day 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	21	35 370	4.7	4.7	*
+ vessel_key	34	30 929	38.2	33.5	*
+ ns(log(fishing_duration), 3)	3	29 595	45.7	7.5	*
+ target_species	3	29 201	47.7	2.1	*
+ month	11	28 933	49.1	1.4	*
+ stat_area	3	28 856	49.5	0.4	
+ ns(log(effort_num), 3)	3	28 796	49.9	0.3	

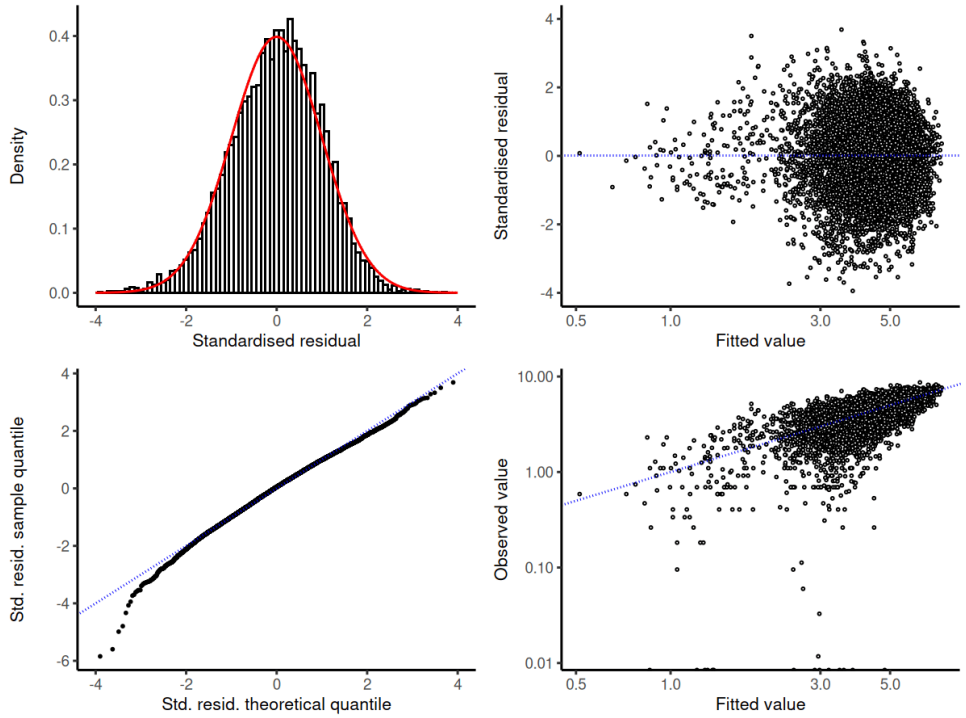

Figure C.56: Diagnostic plots for the selected lognormal model for positive catches in the SNA2S BT.MIX day dataset.

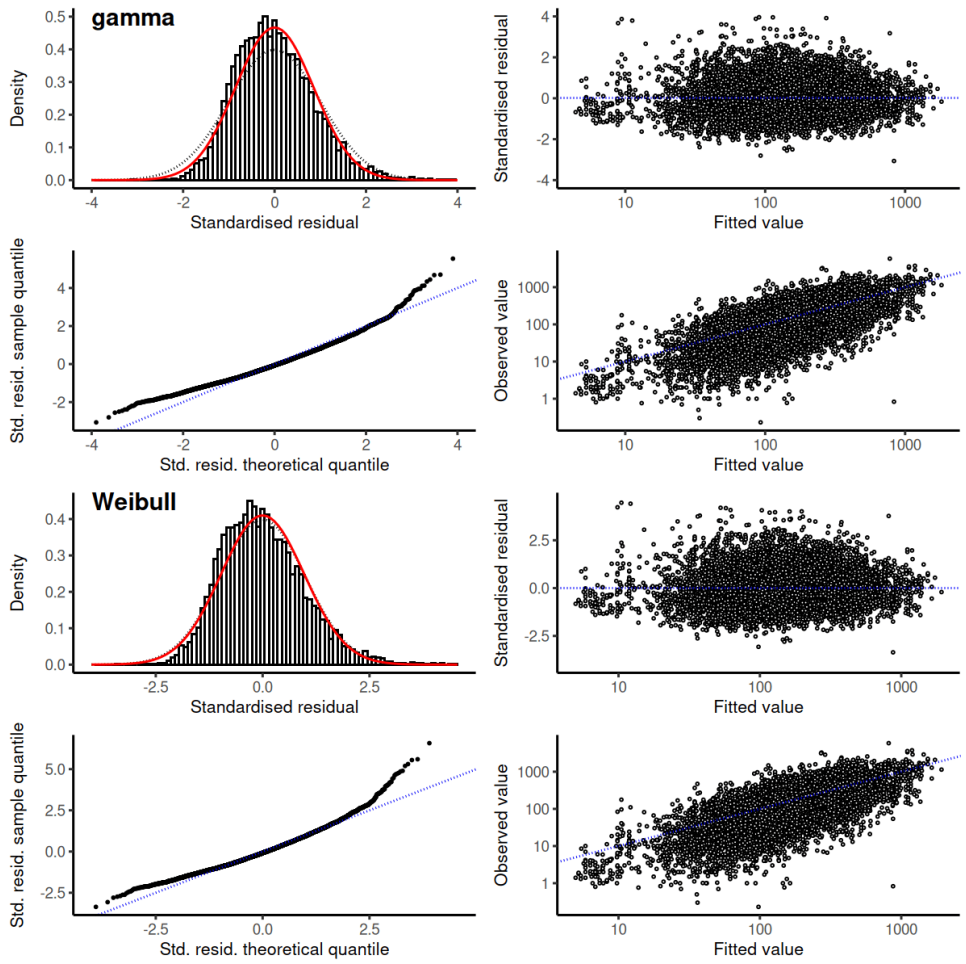

Figure C.57: Diagnostic plots for the alternative gamma and Weibull models considered for positive catches in the SNA2S BT.MIX day dataset.

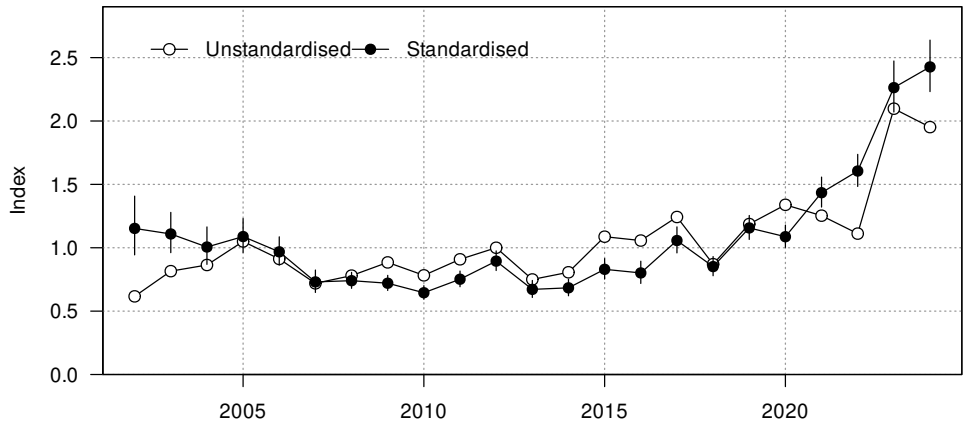

Figure C.58: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the lognormal model for the SNA2S BT.MIX day dataset.

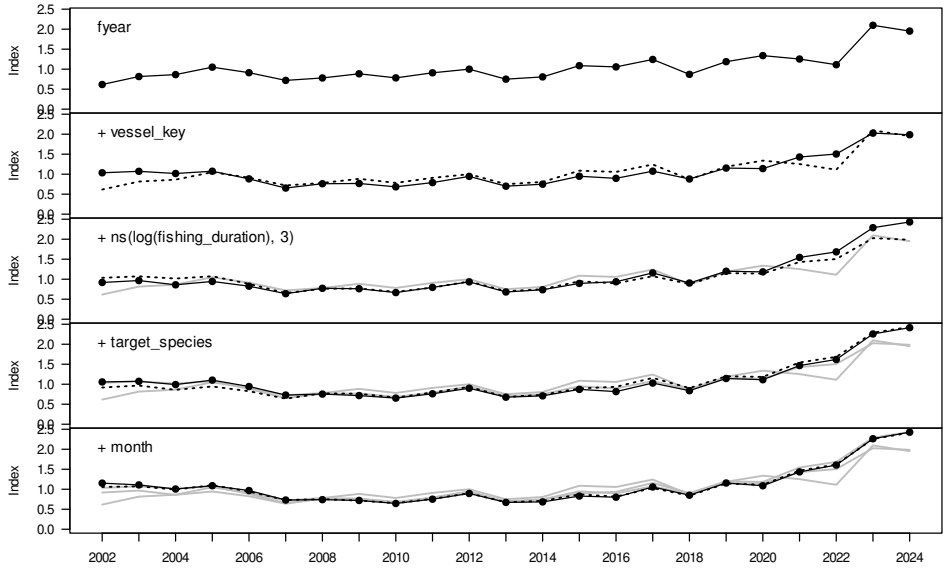

Figure C.59: Changes to the SNA2S BT.MIX day positive catch index as terms are successively entered into the lognormal model.

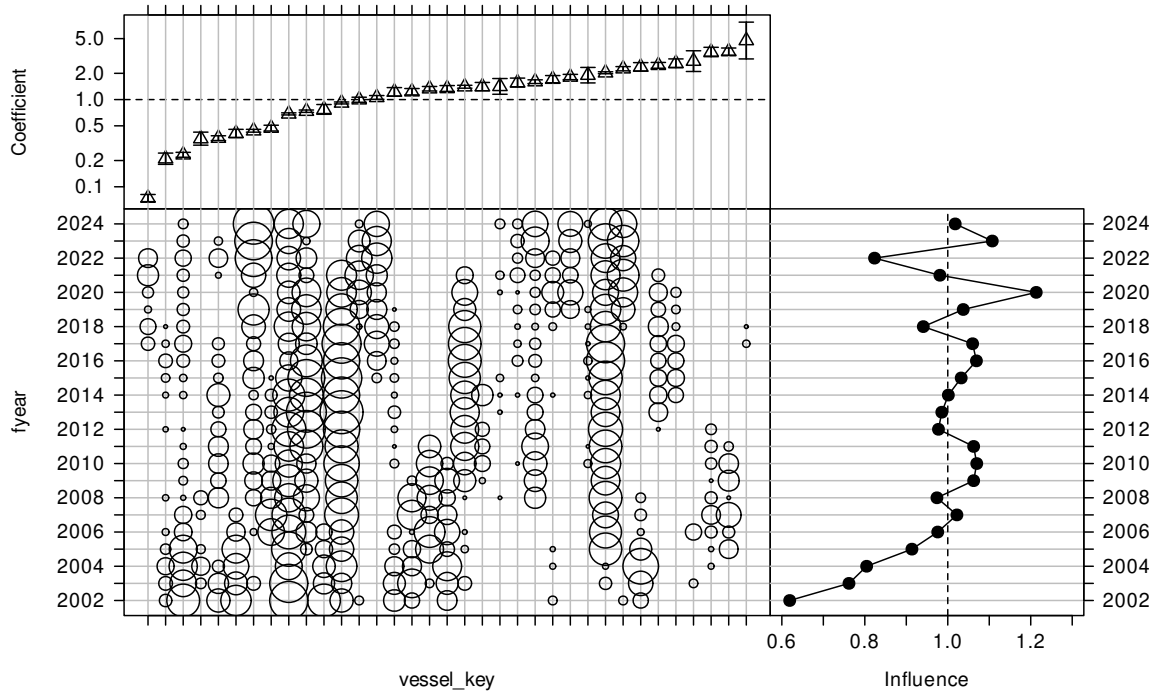

Figure C.60: CDI plot for vessel key for the lognormal model of positive catches in the SNA2S BT.MIX day catch-per-unit-effort dataset.

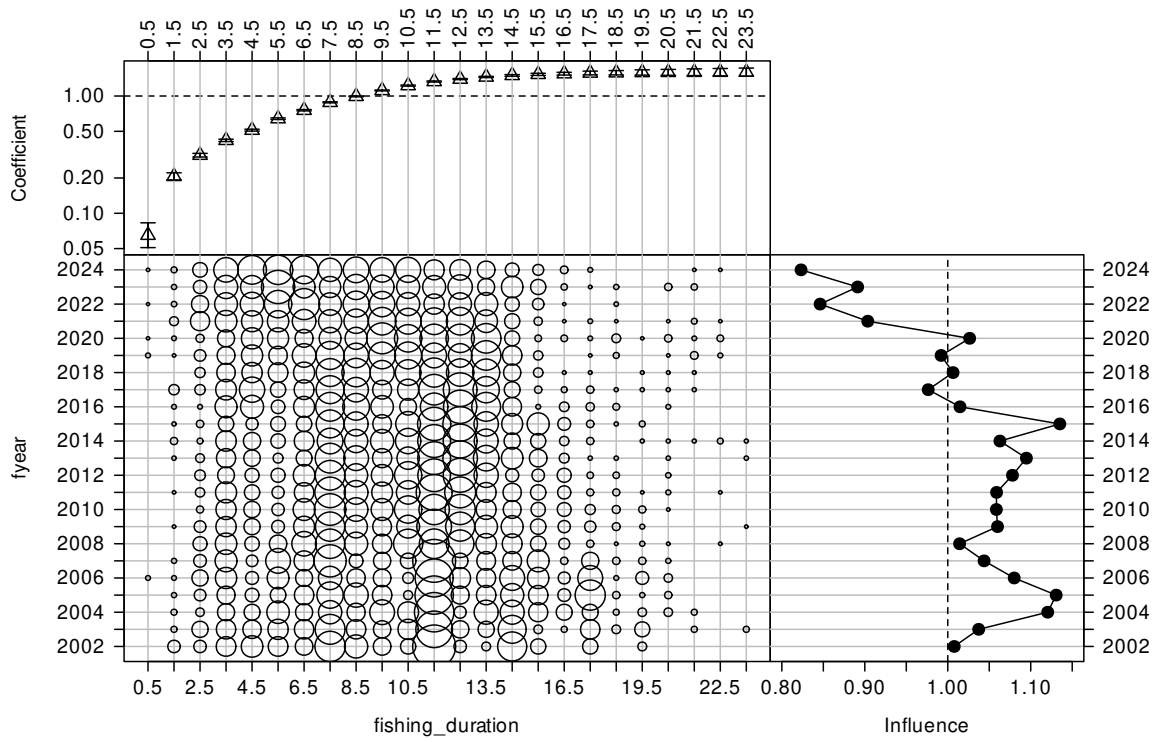

Figure C.61: CDI plot for fishing duration (h) for the lognormal model of positive catches in the SNA2S BT.MIX day catch-per-unit-effort dataset.

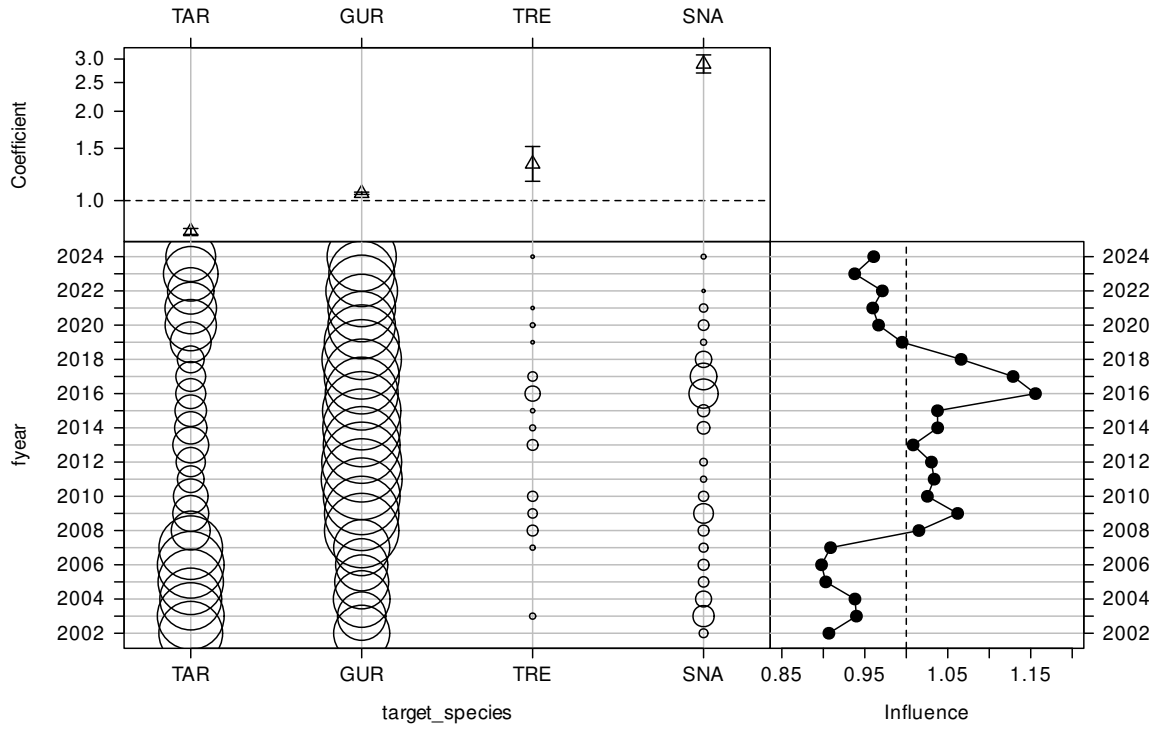

Figure C.62: CDI plot for target species for the lognormal model of positive catches in the SNA2S BT.MIX day catch-per-unit-effort dataset.

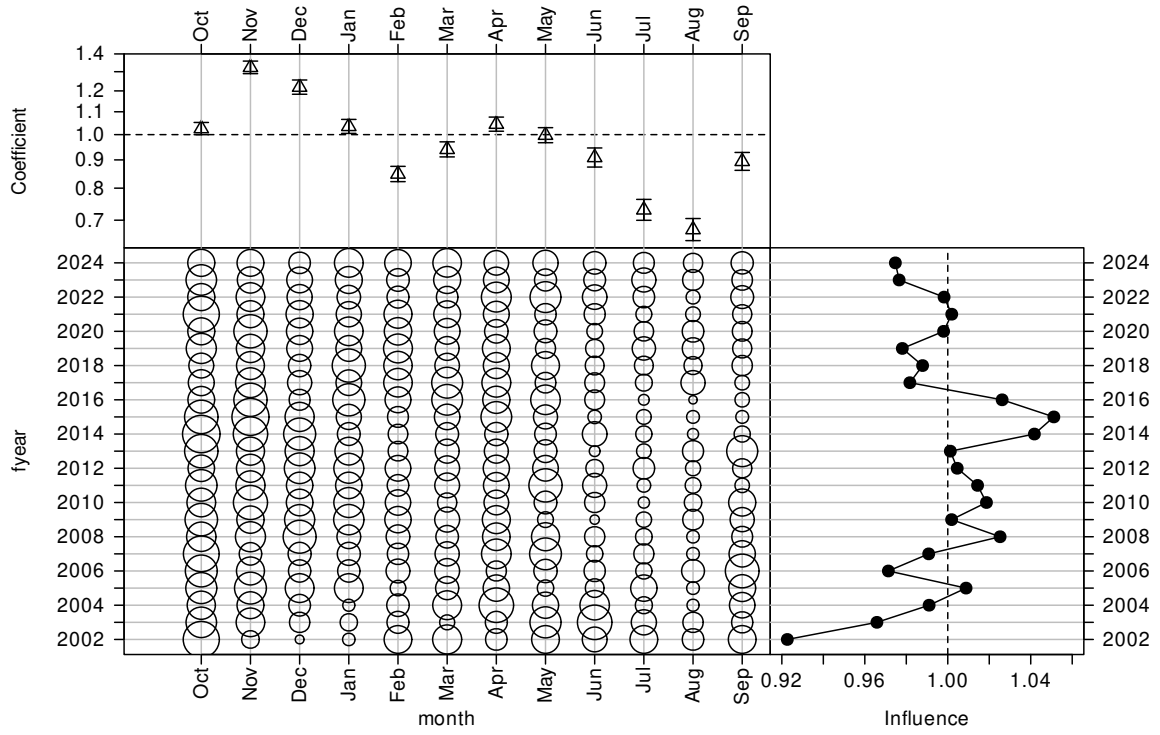

Figure C.63: CDI plot for month for the lognormal model of positive catches in the SNA2S BT.MIX day catch-per-unit-effort dataset.

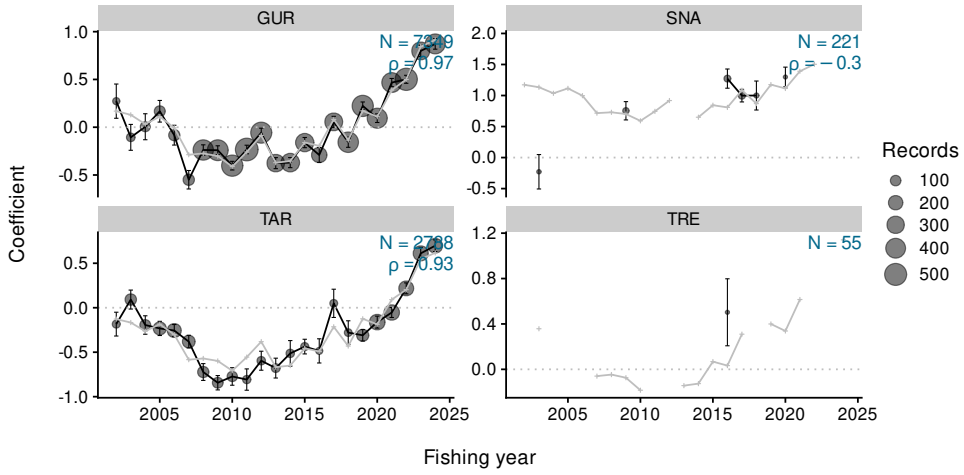

Figure C.64: Residual implied coefficients for target-year in the lognormal positive catch model for the SNA2S BT.MIX day dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in a target-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

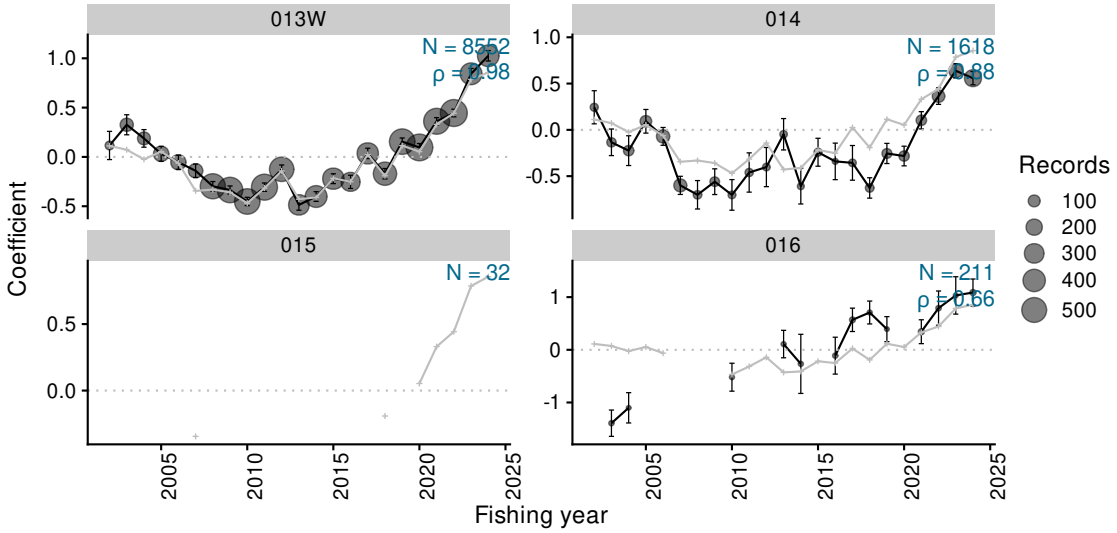

Figure C.65: Residual implied coefficients for area-year in the lognormal positive catch model for the SNA2S BT.MIX day dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data 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.

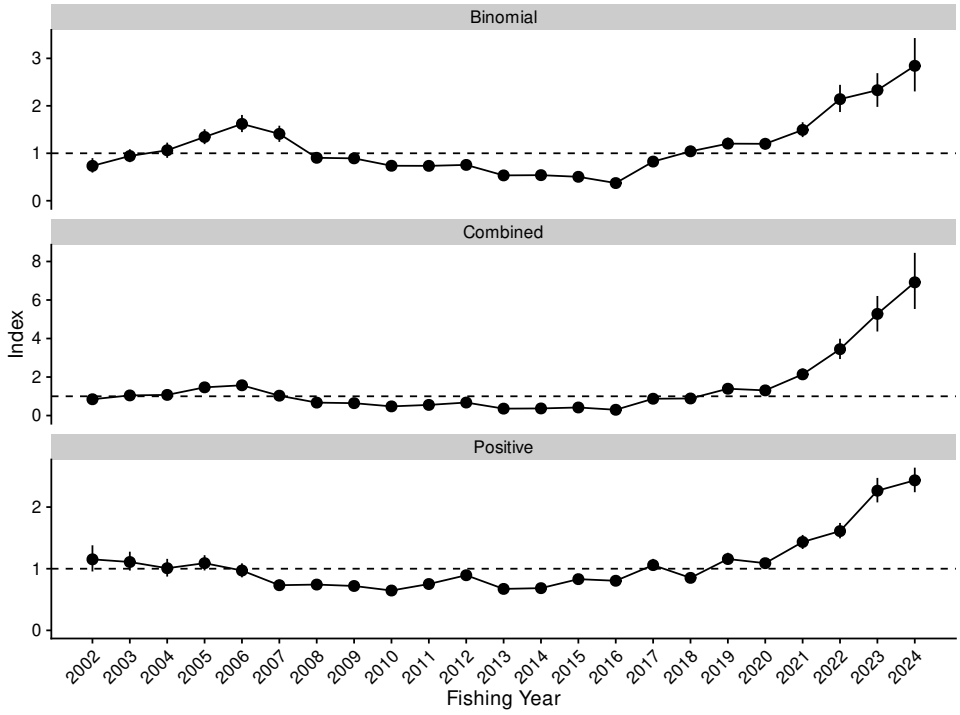

Figure C.66: Standardised indices and 95% confidence intervals for the SNA2S BT.MIX day dataset.

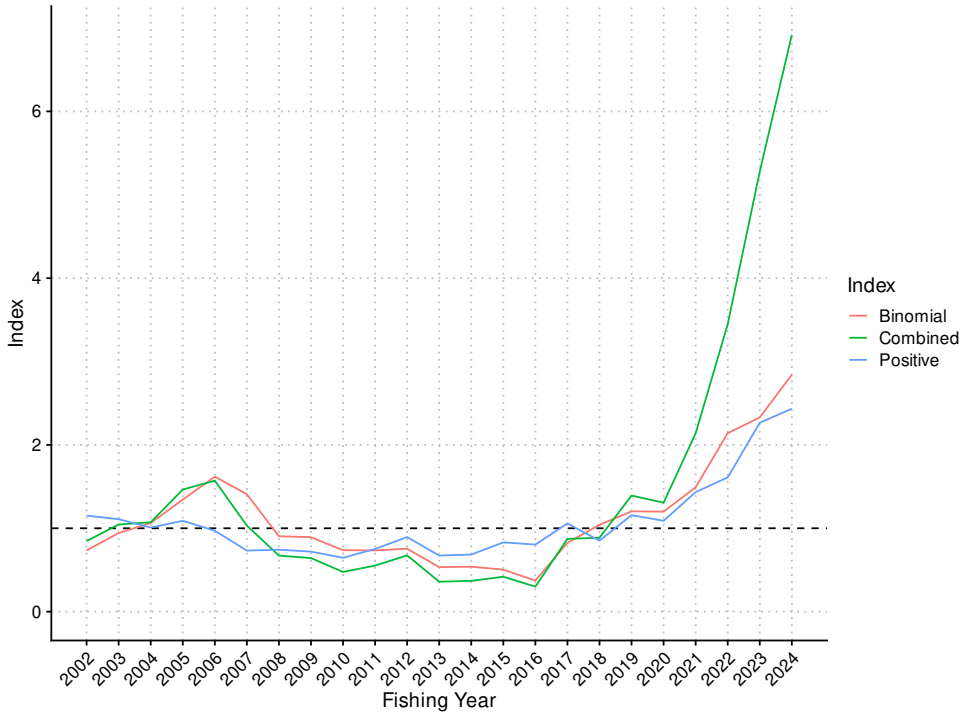

Figure C.67: Standardised indices for the SNA2S BT.MIX day dataset.

Table C.18: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for each model in SNA2S BT.MIX day.

	Binomial				Combined				Positive			
Fishing year	index	SE	LCI	UCI	index	SE	LCI	UCI	index	SE	LCI	UCI
2002	0.735	0.078	0.593	0.898	0.846	0.124	0.632	1.119	1.152	0.108	0.956	1.380
2003	0.943	0.069	0.813	1.085	1.046	0.108	0.845	1.268	1.109	0.078	0.970	1.276
2004	1.063	0.082	0.904	1.224	1.072	0.111	0.868	1.305	1.008	0.073	0.872	1.160
2005	1.343	0.080	1.192	1.506	1.464	0.122	1.238	1.715	1.090	0.063	0.972	1.219
2006	1.619	0.092	1.446	1.807	1.572	0.132	1.326	1.842	0.971	0.058	0.860	1.087
2007	1.409	0.087	1.240	1.581	1.032	0.089	0.870	1.217	0.733	0.044	0.649	0.823
2008	0.905	0.048	0.808	0.998	0.672	0.045	0.585	0.761	0.743	0.030	0.686	0.803
2009	0.893	0.048	0.800	0.989	0.643	0.043	0.564	0.731	0.720	0.030	0.665	0.780
2010	0.737	0.041	0.657	0.819	0.476	0.034	0.414	0.547	0.646	0.027	0.592	0.697
2011	0.735	0.041	0.659	0.820	0.552	0.038	0.480	0.630	0.752	0.032	0.689	0.813
2012	0.755	0.044	0.671	0.844	0.675	0.050	0.584	0.780	0.894	0.038	0.821	0.970
2013	0.534	0.038	0.462	0.610	0.359	0.031	0.304	0.424	0.673	0.033	0.613	0.742
2014	0.539	0.038	0.470	0.618	0.369	0.032	0.309	0.436	0.685	0.033	0.625	0.753
2015	0.504	0.035	0.439	0.575	0.419	0.036	0.353	0.494	0.831	0.038	0.756	0.906
2016	0.372	0.031	0.318	0.440	0.299	0.030	0.247	0.365	0.804	0.042	0.725	0.890
2017	0.825	0.055	0.719	0.935	0.873	0.073	0.740	1.027	1.058	0.050	0.963	1.160
2018	1.041	0.057	0.934	1.159	0.887	0.060	0.774	1.008	0.852	0.038	0.781	0.929
2019	1.203	0.060	1.094	1.330	1.392	0.090	1.229	1.583	1.157	0.049	1.067	1.258
2020	1.199	0.062	1.080	1.324	1.307	0.082	1.150	1.473	1.090	0.042	1.004	1.170
2021	1.492	0.080	1.341	1.654	2.139	0.145	1.875	2.442	1.434	0.058	1.320	1.548
2022	2.141	0.146	1.869	2.442	3.447	0.269	2.934	3.988	1.610	0.064	1.493	1.743
2023	2.329	0.181	1.978	2.688	5.278	0.471	4.364	6.209	2.266	0.101	2.076	2.473
2024	2.843	0.287	2.303	3.428	6.917	0.743	5.533	8.448	2.434	0.102	2.241	2.639

C.4 SNA2S BT.MIX event

Table C.19: Definition for the dataset, core fleet criteria, and Generalised Linear Modelling approach used in the catch-per-unit-effort (CPUE) standardisation for the SNA2S BT.MIX event CPUE series.

Series	SNA2S BT.MIX event
QMS stock	SNA 2
Reporting forms	TCP, TCE, ERS - Trawl
Fishing methods	BT
Target species	GUR, TRE, TAR, SNA
Statistical Areas	013, 014, 015, 016
Period	2007-10-01, 2024-09-30
Resolution	Fishing event
Core fleet years	5
Core fleet trips	5
Default model	allockg_top5 ~ fyear + vessel_key + target_species + month + ns(log(fishing_duration), 3) + ns(bottom_depth, 3) + ns(effort_width, 3) + ns(effort_height, 3) + ns(start_latitude, 3)
Stepwise selection	Yes
Positive catch distribution	Lognormal

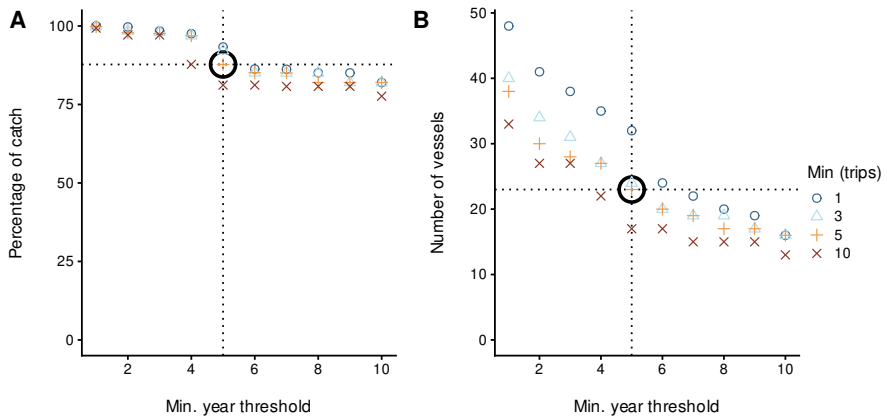

Figure C.68: Percentage of catch and number of vessels for different core vessel selection criteria for the SNA2S BT.MIX event CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel participated in the fishery and the number of trips per year.

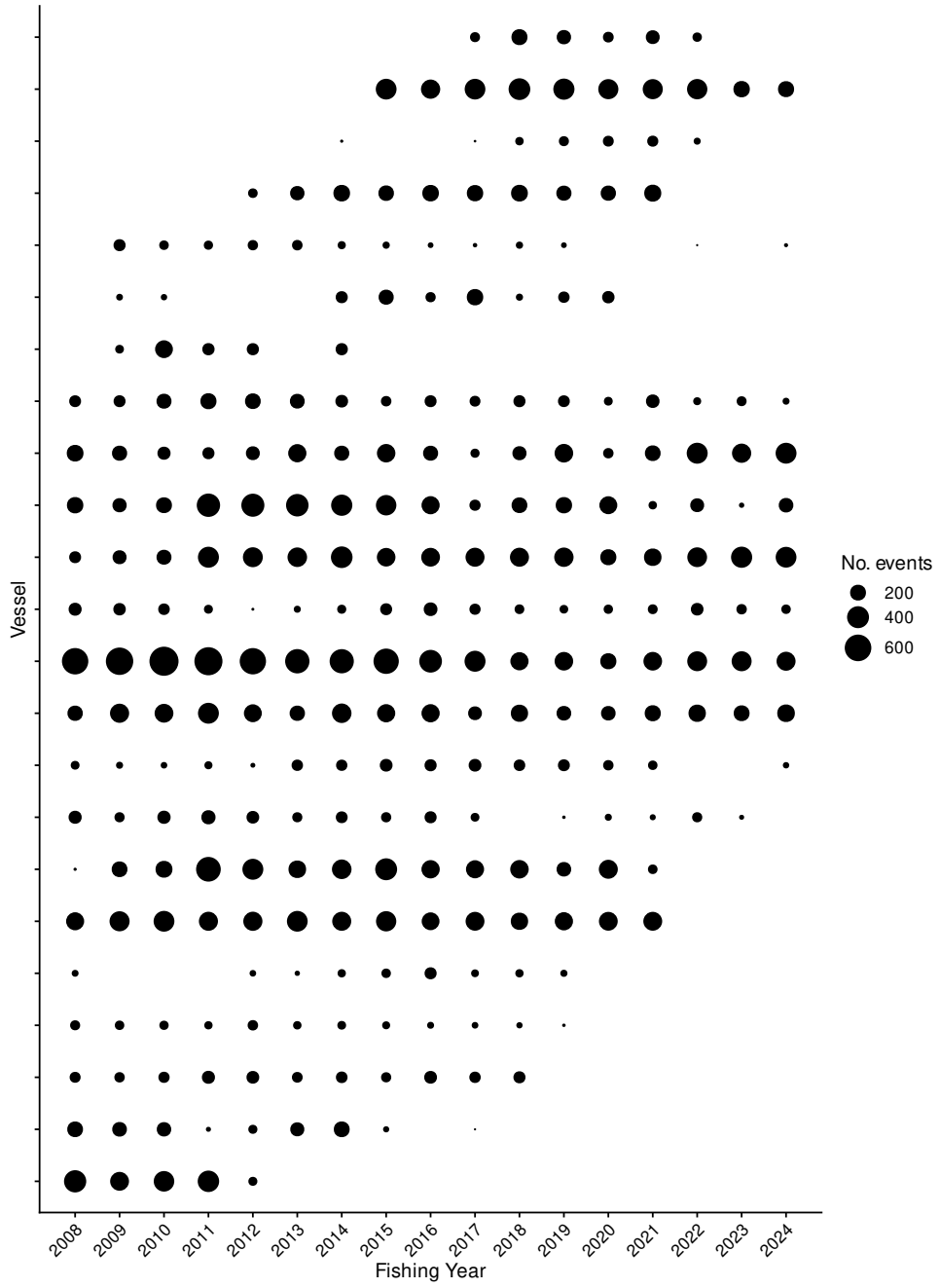

Figure C.69: Number of events by fishing year for core vessels in the SNA2S BT.MIX event series. The area of the circles is proportional to the number of events undertaken by a vessel in a fishing year.

Table C.20: Summary of the SNA2S BT.MIX event 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. (Continued on next page)

Filter	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ungroomed data	176 (100%) n: 6341	187 (100%) n: 6794	163 (100%) n: 7108	162 (100%) n: 6771	147 (100%) n: 5511	123 (100%) n: 5582	135 (100%) n: 5860	118 (100%) n: 5638	145 (100%) n: 5118
Fishing duration is not NA	176 (100%) n: 6340	187 (100%) n: 6790	163 (100%) n: 7108	162 (100%) n: 6770	147 (100%) n: 5511	123 (100%) n: 5582	135 (100%) n: 5859	118 (100%) n: 5637	145 (100%) n: 5118
Positive fishing duration	176 (100%) n: 6340	187 (100%) n: 6790	163 (100%) n: 7108	162 (100%) n: 6770	147 (100%) n: 5511	123 (100%) n: 5582	135 (100%) n: 5859	118 (100%) n: 5637	145 (100%) n: 5118
Fishing duration under 10hrs	176 (100%) n: 6315	187 (100%) n: 6781	163 (100%) n: 7101	162 (100%) n: 6763	147 (100%) n: 5507	123 (100%) n: 5573	135 (100%) n: 5853	118 (100%) n: 5629	145 (100%) n: 5110
Bottom depth shallower than 200m	175 (100%) n: 6207	187 (100%) n: 6723	162 (100%) n: 7042	161 (100%) n: 6701	147 (100%) n: 5479	123 (100%) n: 5516	135 (100%) n: 5806	118 (100%) n: 5583	145 (100%) n: 5055
Assigned to 013W	97 (55%) n: 4288	105 (56%) n: 4276	83 (51%) n: 4577	92 (57%) n: 4390	78 (53%) n: 3476	50 (40%) n: 3249	61 (46%) n: 3775	73 (62%) n: 3905	84 (58%) n: 3387
Latitude in range	97 (55%) n: 4287	105 (56%) n: 4276	83 (51%) n: 4574	92 (57%) n: 4390	78 (53%) n: 3476	50 (40%) n: 3246	61 (46%) n: 3775	73 (62%) n: 3905	84 (58%) n: 3387
Core fleet selection	63 (36%) n: 2811	61 (33%) n: 3082	59 (36%) n: 3557	80 (49%) n: 3980	77 (53%) n: 3364	49 (40%) n: 3215	61 (46%) n: 3627	72 (61%) n: 3804	83 (57%) n: 3319

Filter	2017	2018	2019	2020	2021	2022	2023	2024
Ungroomed data	183 (100%) n: 4833	189 (100%) n: 4704	203 (100%) n: 4403	184 (100%) n: 3751	181 (100%) n: 3564	221 (100%) n: 3462	226 (100%) n: 2609	292 (100%) n: 2860
Fishing duration is not NA	183 (100%) n: 4833	189 (100%) n: 4704	203 (100%) n: 4402	184 (100%) n: 3750	181 (100%) n: 3564	221 (100%) n: 3462	226 (100%) n: 2608	292 (100%) n: 2860
Positive fishing duration	183 (100%) n: 4833	189 (100%) n: 4704	203 (100%) n: 4402	184 (100%) n: 3746	181 (100%) n: 3561	221 (100%) n: 3459	226 (100%) n: 2607	292 (100%) n: 2858
Fishing duration under 10hrs	183 (100%) n: 4824	188 (100%) n: 4695	203 (100%) n: 4389	184 (100%) n: 3737	181 (100%) n: 3557	221 (100%) n: 3457	226 (100%) n: 2603	292 (100%) n: 2856
Bottom depth shallower than 200m	183 (100%) n: 4791	188 (99%) n: 4672	202 (100%) n: 4372	183 (99%) n: 3725	181 (100%) n: 3539	221 (100%) n: 3454	226 (100%) n: 2598	292 (100%) n: 2848
Assigned to 013W	97 (53%) n: 2964	97 (51%) n: 3345	108 (53%) n: 3005	112 (61%) n: 2661	118 (65%) n: 2519	147 (67%) n: 2552	145 (64%) n: 1882	169 (58%) n: 2152
Latitude in range	96 (53%) n: 2962	97 (51%) n: 3345	108 (53%) n: 2997	112 (61%) n: 2658	117 (65%) n: 2515	147 (67%) n: 2552	145 (64%) n: 1882	169 (58%) n: 2152
Core fleet selection	95 (52%) n: 2908	91 (48%) n: 3072	106 (52%) n: 2897	109 (59%) n: 2533	114 (63%) n: 2443	120 (54%) n: 2077	114 (51%) n: 1595	148 (51%) n: 1763

Table C.21: Summary of the SNA2S BT.MIX event 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 snapper.

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
2008	16	578	2 811	10 031.40	63.02	42.83
2009	18	593	3 082	11 437.83	61.40	43.77
2010	18	683	3 557	13 164.13	58.93	42.48
2011	17	642	3 980	14 810.30	79.71	39.37
2012	19	648	3 364	12 763.19	77.42	47.18
2013	17	580	3 215	12 172.22	49.45	41.68
2014	20	632	3 627	13 918.17	61.43	41.19
2015	19	630	3 804	14 762.78	72.23	36.72
2016	18	666	3 319	12 968.92	82.85	41.31
2017	21	548	2 908	11 586.27	94.93	54.99
2018	19	598	3 072	12 277.58	90.57	47.53
2019	19	553	2 897	11 849.23	105.98	50.47
2020	16	433	2 533	10 636.25	109.02	48.60
2021	15	517	2 443	9 853.02	114.49	52.07
2022	12	485	2 077	7 924.42	119.62	63.89
2023	9	300	1 595	6 647.92	114.50	57.49
2024	10	375	1 763	6 790.38	147.80	64.32

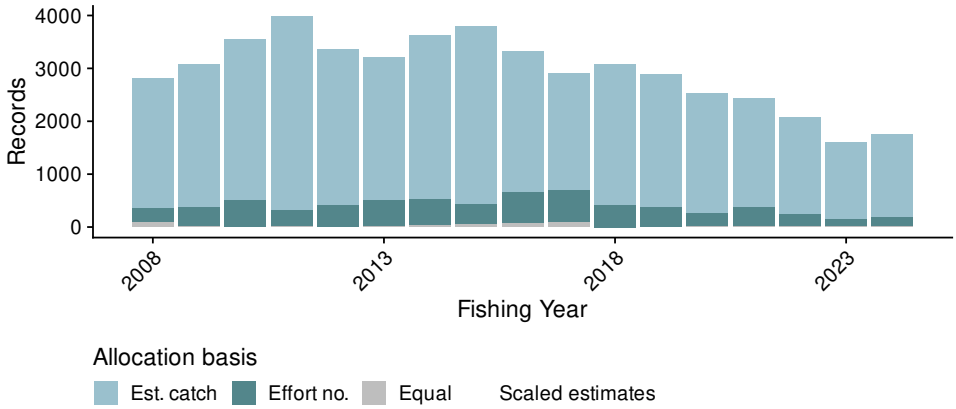

Figure C.70: Allocation basis for attributing landings to records in the SNA2S BT.MIX event catch-per-unit-effort dataset. Allocation basis is in terms of estimated catch, effort number, and/or equal.

Table C.22: Summary of stepwise selection for occurrence of positive catch in the SNA2S BT.MIX event 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	15	68 072	1.6	1.6	*
+ ns(start_latitude, 3)	3	63 782	7.8	6.2	*
+ vessel_key	22	62 165	10.2	2.4	*
+ ns(bottom_depth, 3)	3	60 590	12.5	2.3	*
+ month	11	60 011	13.3	0.9	
+ ns(effort_height, 3)	3	59 805	13.6	0.3	
+ target_species	3	59 634	13.9	0.3	
+ ns(log(fishing_duration), 3)	3	59 504	14.1	0.2	
+ ns(effort_width, 3)	3	59 479	14.1	0.0	

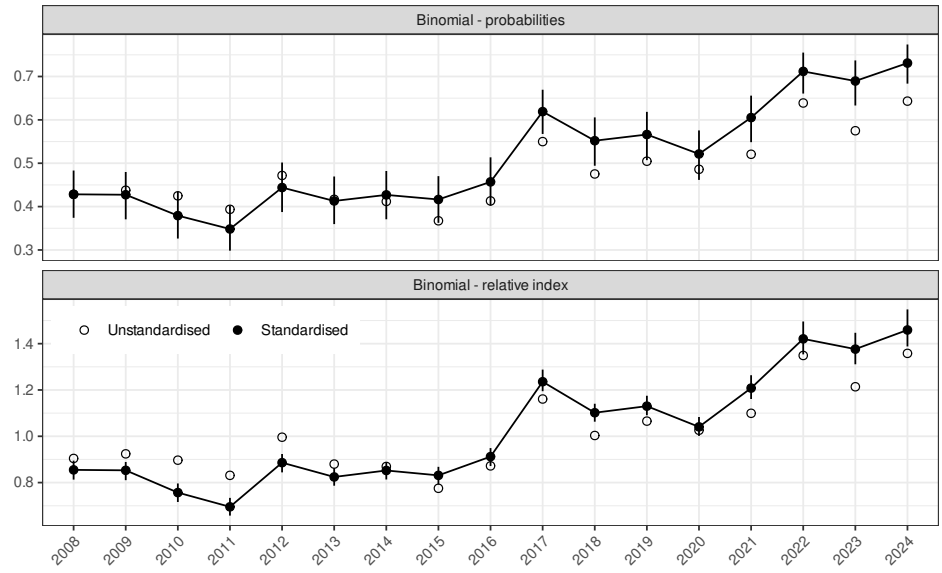

Figure C.71: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for occurrence of catch in the SNA2S BT.MIX event dataset, plotted as both probability of occurrence and as a relative index standardised to the geometric mean.

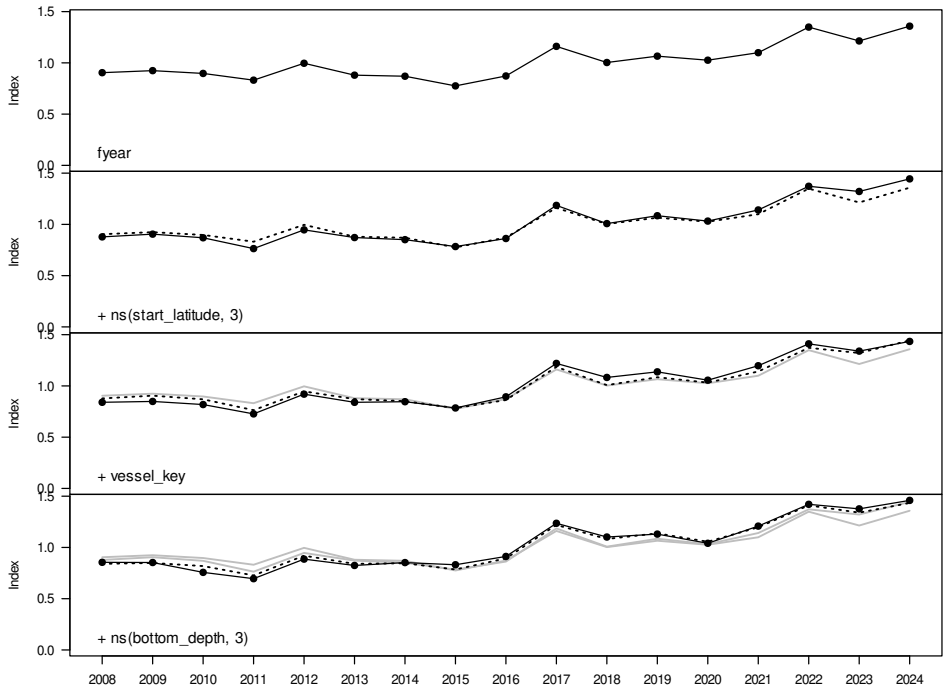

Figure C.72: Step plot for occurrence of catch in the SNA2S BT.MIX event dataset.

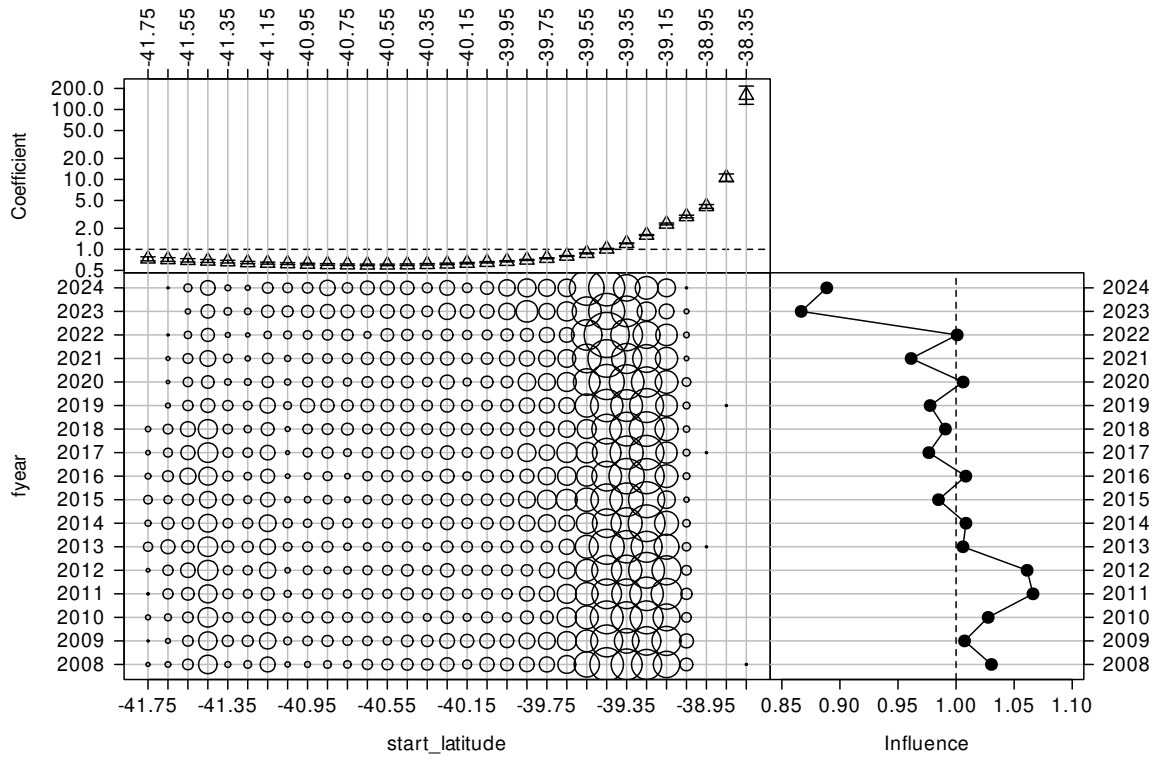

Figure C.73: CDI plot for start latitude for the occurrence of positive catch in the SNA2S BT.MIX event catch-per-unit-effort dataset.

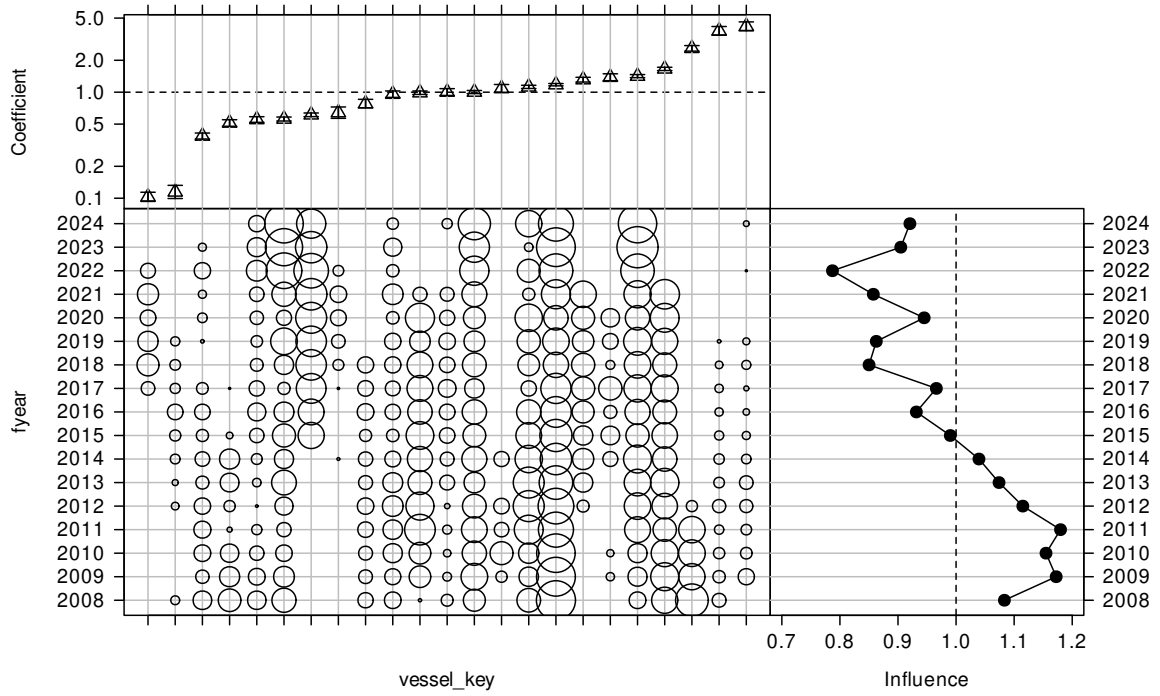

Figure C.74: CDI plot for vessel key for the occurrence of positive catch in the SNA2S BT.MIX event catch-per-unit-effort dataset.

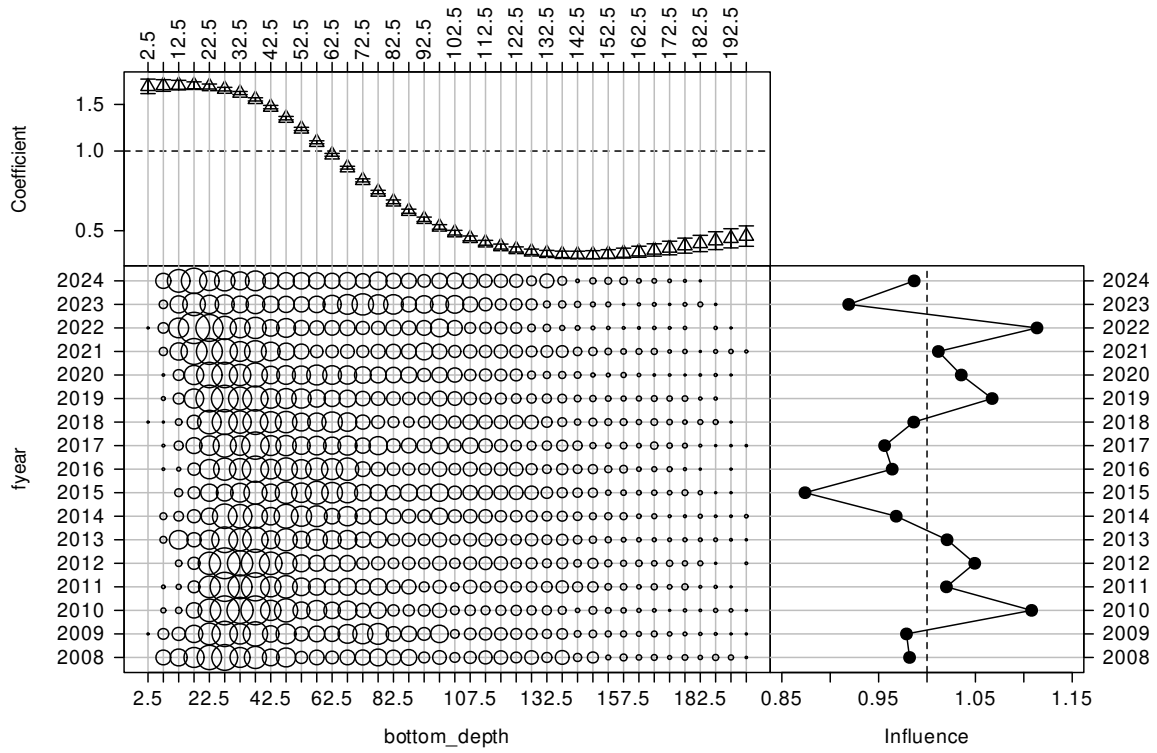

Figure C.75: CDI plot for bottom depth (m) for the occurrence of positive catch in the SNA2S BT.MIX event catch-per-unit-effort dataset.

Table C.23: Summary of stepwise selection for the lognormal model for positive catches in the SNA2S BT.MIX event 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	15	100 001	6.1	6.1	*
+ ns(start_latitude, 3)	3	92 592	31.8	25.7	*
+ vessel_key	22	89 117	41.4	9.6	*
+ target_species	3	87 404	45.6	4.2	*
+ month	11	86 159	48.5	2.9	*
+ ns(bottom_depth, 3)	3	85 541	49.8	1.4	*
+ ns(effort_width, 3)	3	85 439	50.1	0.2	
+ ns(log(fishing_duration), 3)	3	85 368	50.2	0.2	
+ ns(effort_height, 3)	3	85 335	50.3	0.1	

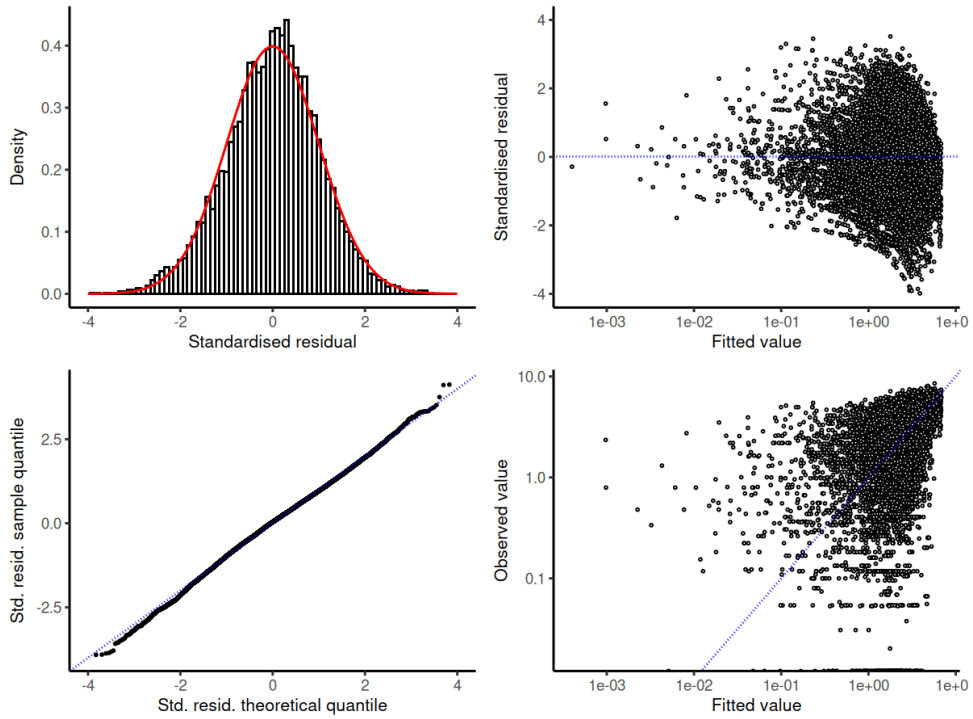

Figure C.76: Diagnostic plots for the selected lognormal model for positive catches in the SNA2S BT.MIX event dataset.

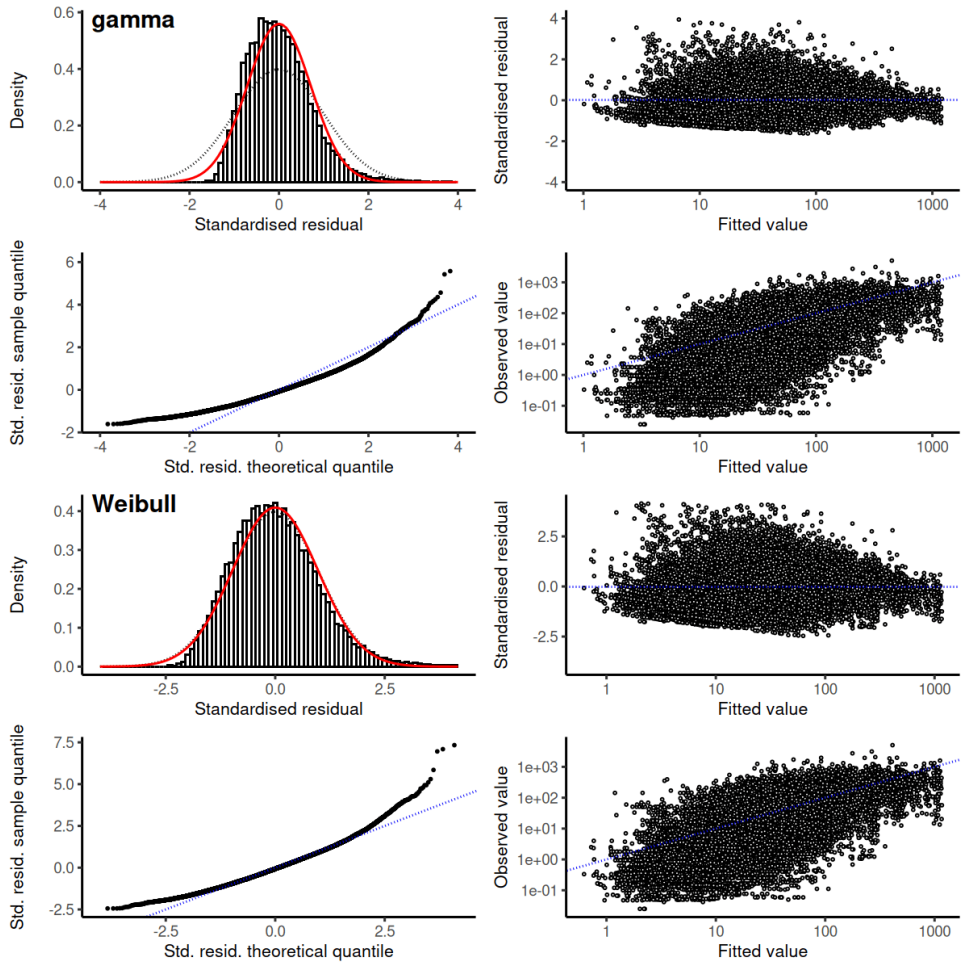

Figure C.77: Diagnostic plots for the alternative gamma and Weibull models considered for positive catches in the SNA2S BT.MIX event dataset.

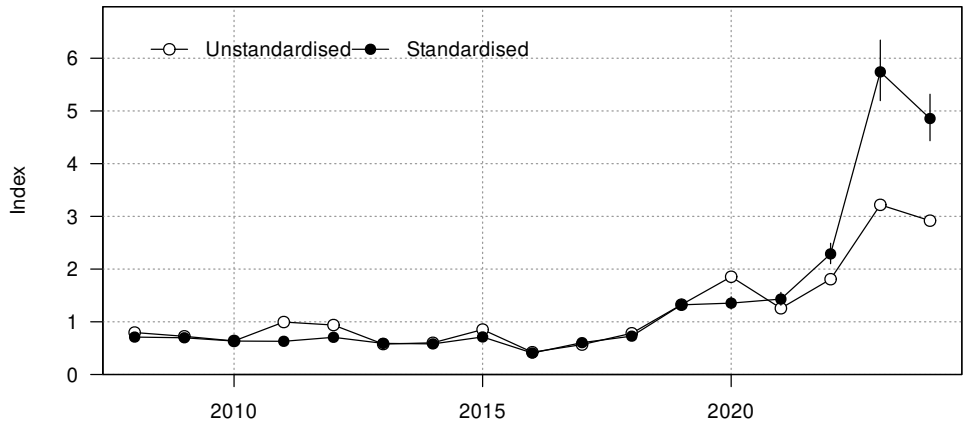

Figure C.78: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the lognormal model for the SNA2S BT.MIX event dataset.

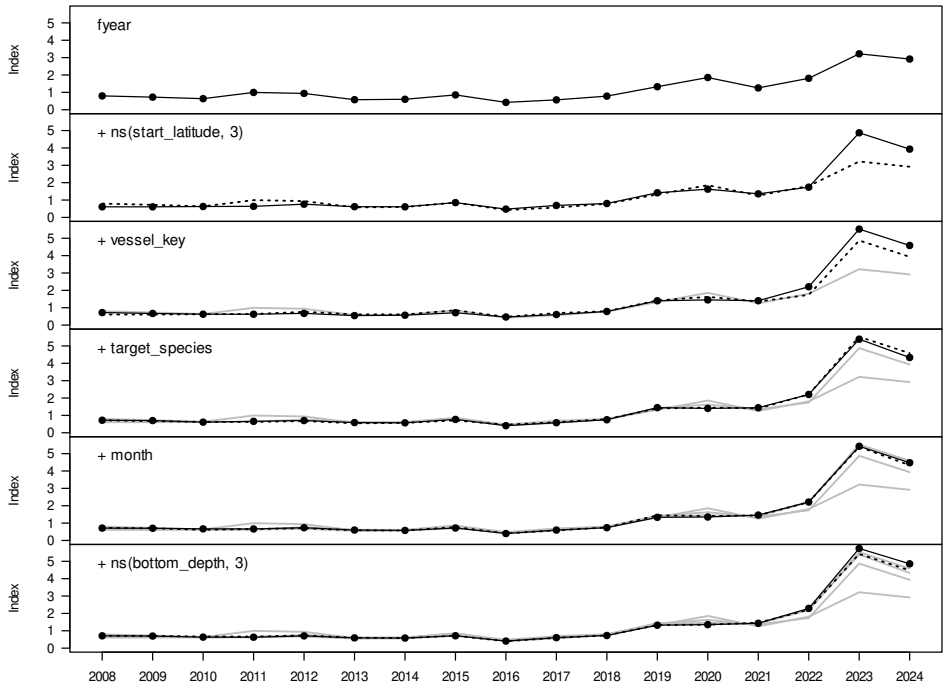

Figure C.79: Changes to the SNA2S BT.MIX event positive catch index as terms are successively entered into the lognormal model.

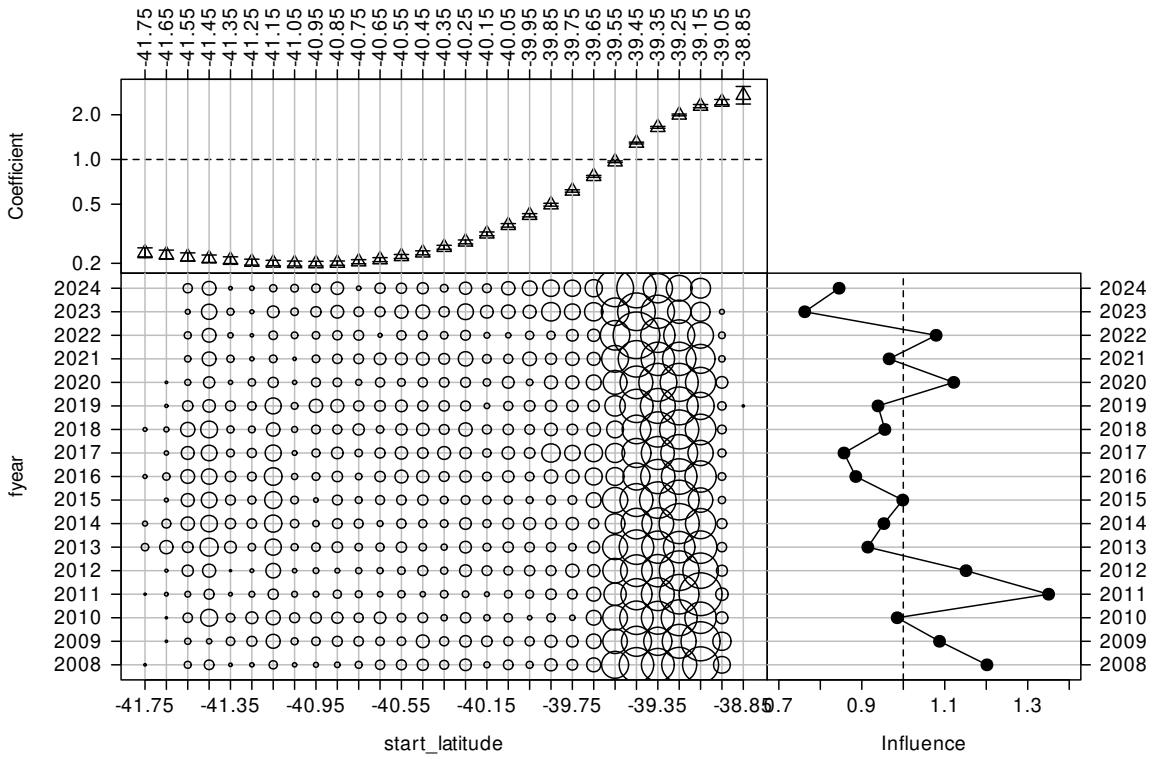

Figure C.80: CDI plot for start latitude for the lognormal model of positive catches in the SNA2S BT.MIX event catch-per-unit-effort dataset.

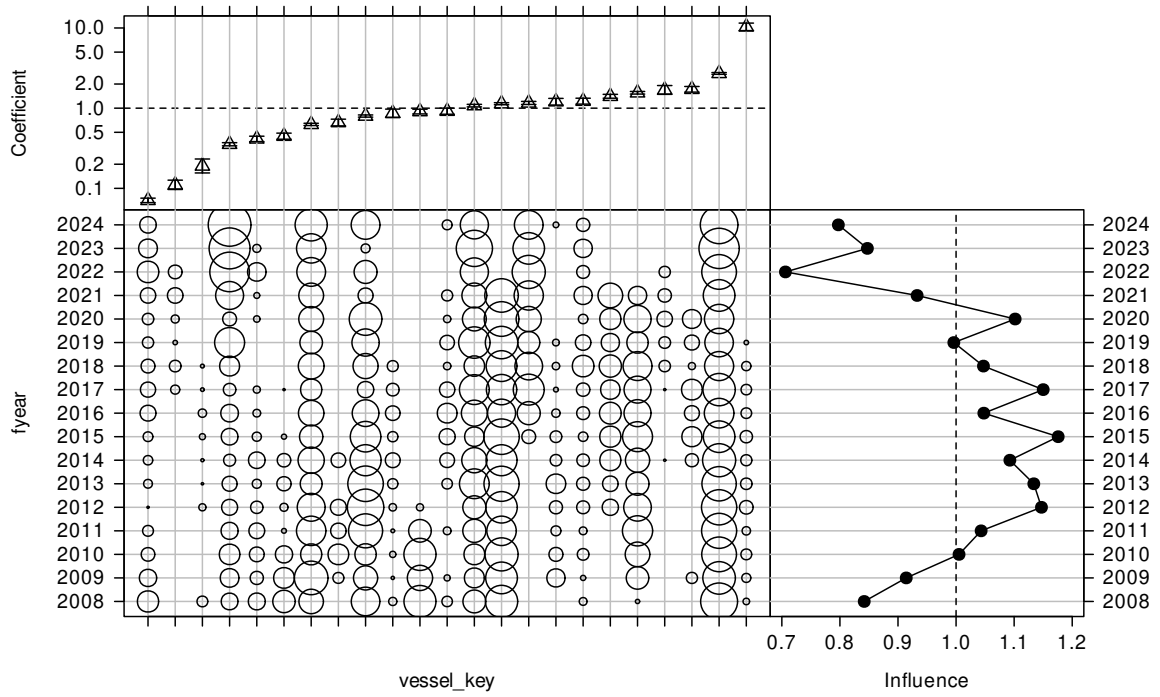

Figure C.81: CDI plot for vessel key for the lognormal model of positive catches in the SNA2S BT.MIX event catch-per-unit-effort dataset.

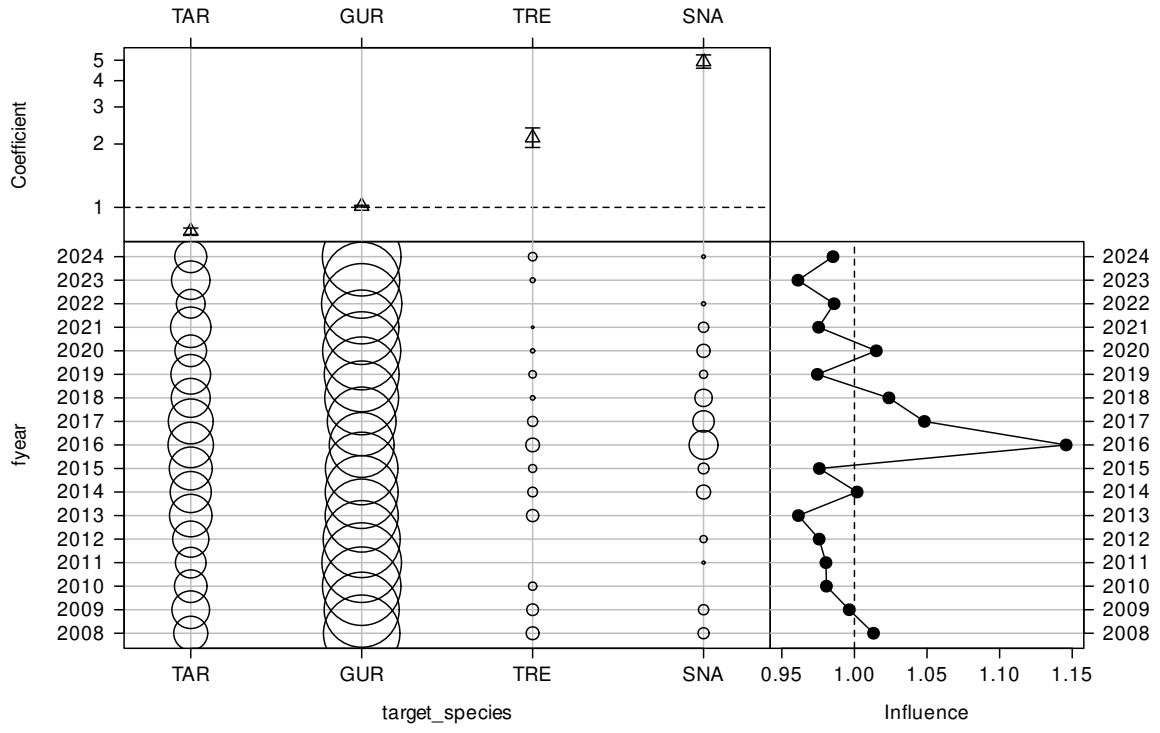

Figure C.82: CDI plot for target species for the lognormal model of positive catches in the SNA2S BT.MIX event catch-per-unit-effort dataset.

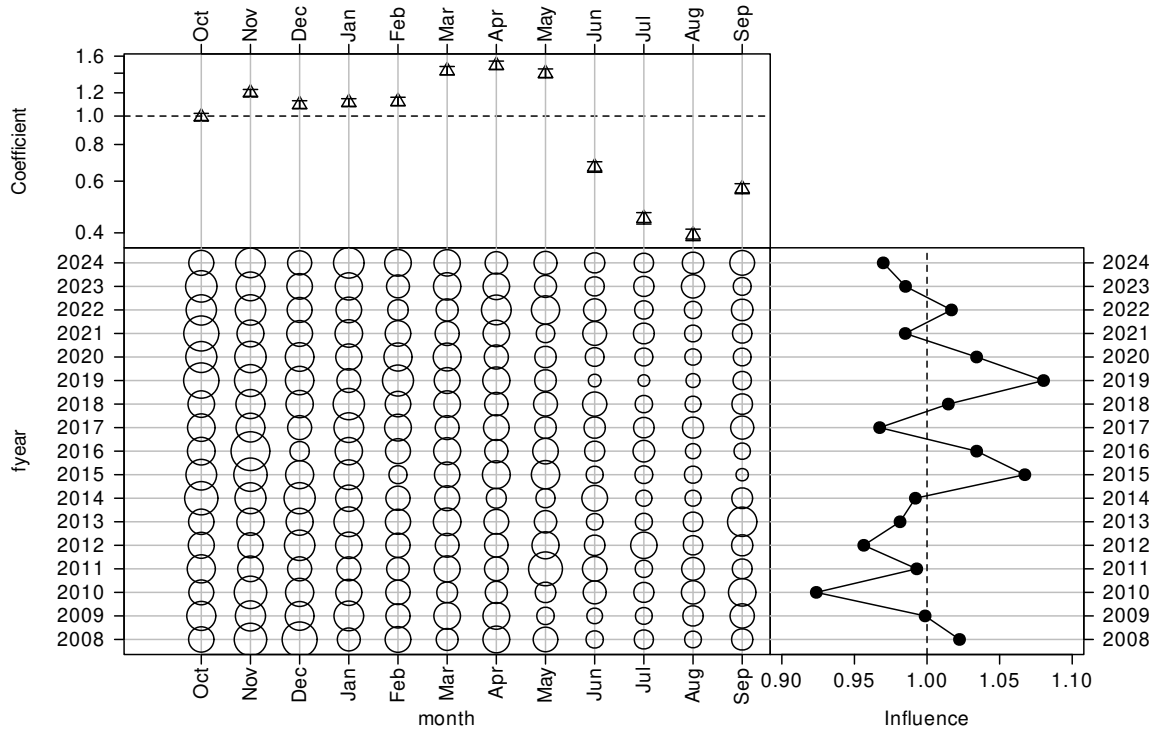

Figure C.83: CDI plot for month for the lognormal model of positive catches in the SNA2S BT.MIX event catch-per-unit-effort dataset.

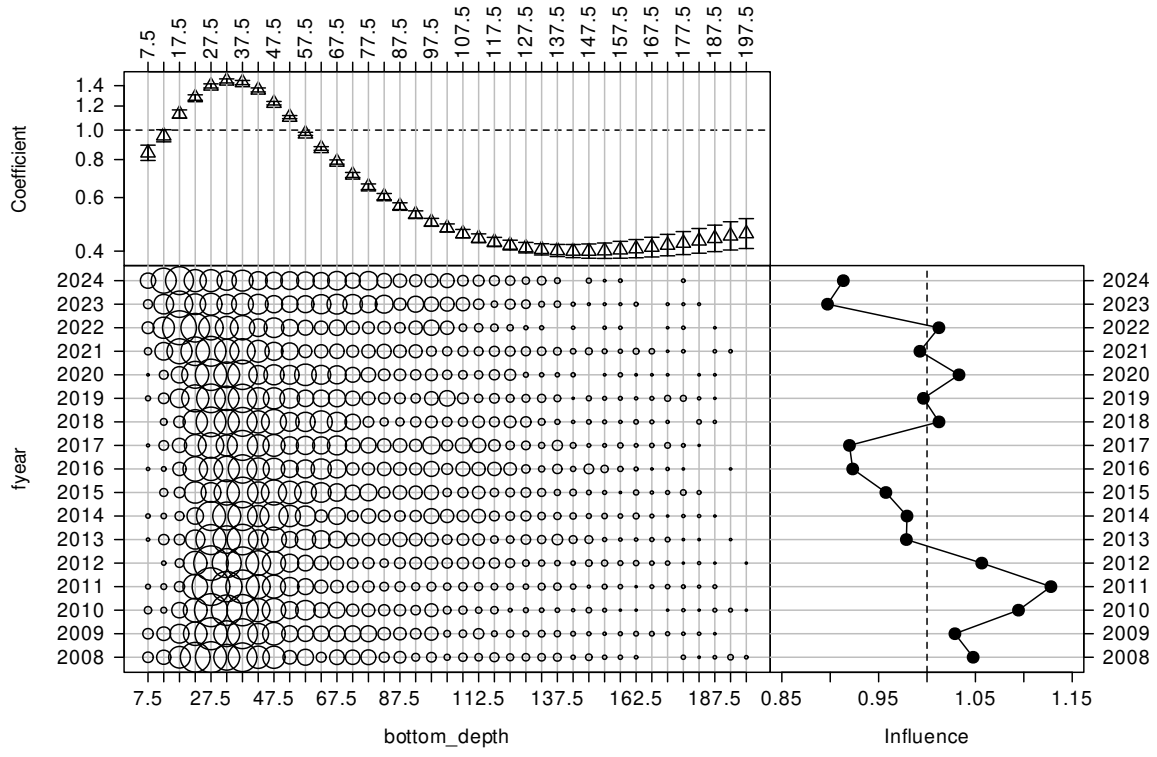

Figure C.84: CDI plot for bottom depth (m) for the lognormal model of positive catches in the SNA2S BT.MIX event catch-per-unit-effort dataset.

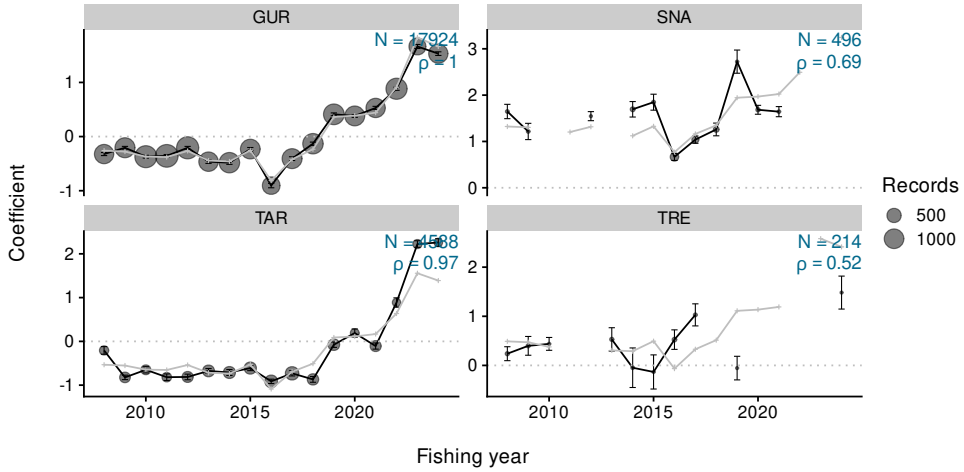

Figure C.85: Residual implied coefficients for target-year in the lognormal positive catch model for the SNA2S BT.MIX event dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in a target-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

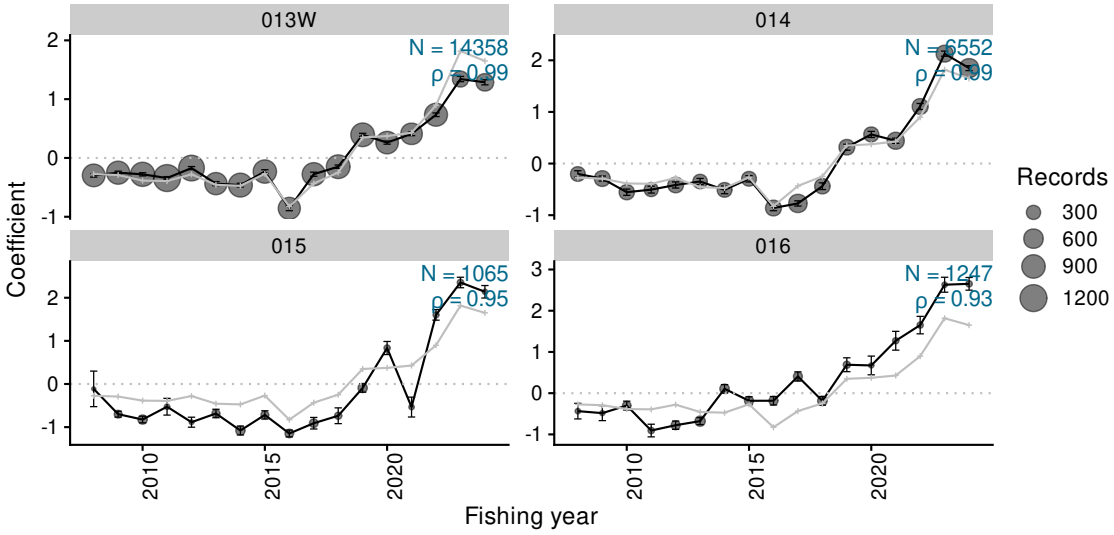

Figure C.86: Residual implied coefficients for area-year in the lognormal positive catch model for the SNA2S BT.MIX event dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data 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.

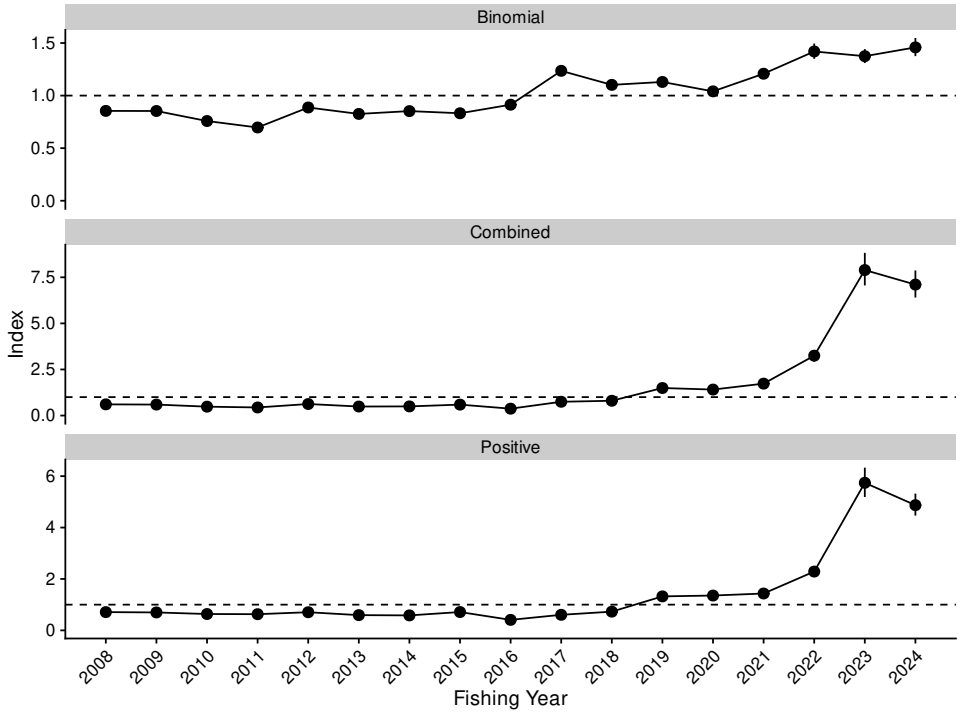

Figure C.87: Standardised indices and 95% confidence intervals for the SNA2S BT.MIX event dataset.

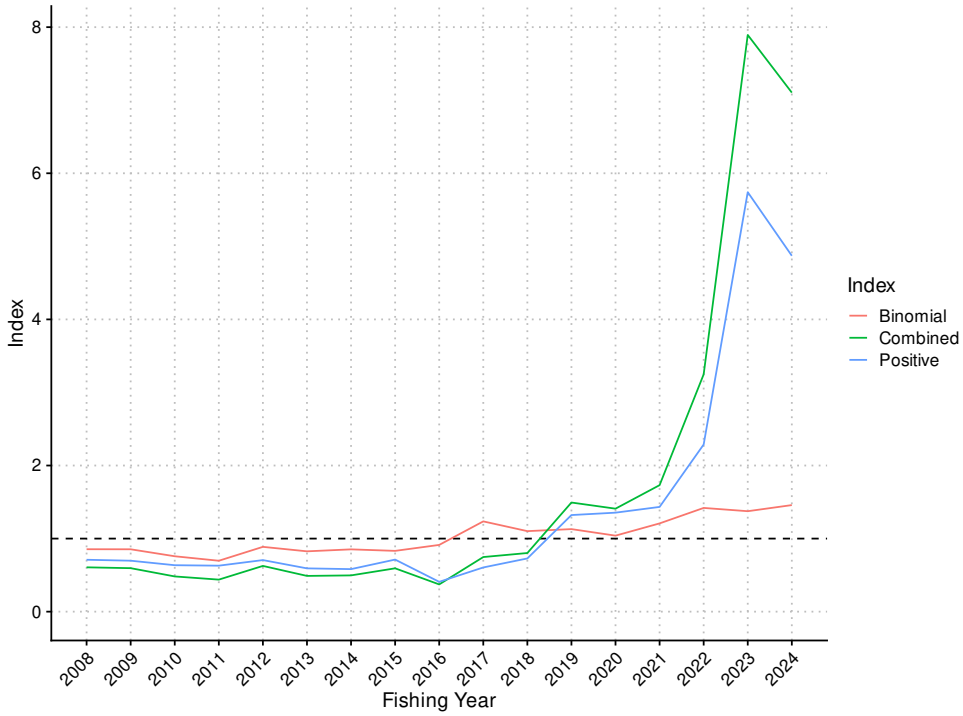

Figure C.88: Standardised indices for the SNA2S BT.MIX event dataset.

Table C.24: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for each model in SNA2S BT.MIX event.

	Binomial				Combined				Positive			
Fishing year	index	SE	LCI	UCI	index	SE	LCI	UCI	index	SE	LCI	UCI
2008	0.854	0.021	0.813	0.896	0.607	0.030	0.549	0.668	0.710	0.030	0.653	0.773
2009	0.854	0.020	0.814	0.893	0.595	0.028	0.540	0.650	0.697	0.028	0.642	0.753
2010	0.758	0.020	0.719	0.799	0.482	0.024	0.437	0.531	0.636	0.025	0.588	0.686
2011	0.697	0.021	0.657	0.739	0.438	0.020	0.401	0.480	0.629	0.023	0.586	0.676
2012	0.887	0.020	0.848	0.924	0.626	0.027	0.575	0.681	0.706	0.026	0.656	0.756
2013	0.826	0.020	0.786	0.863	0.489	0.024	0.445	0.539	0.592	0.025	0.543	0.642
2014	0.853	0.019	0.814	0.887	0.496	0.022	0.455	0.540	0.582	0.023	0.537	0.629
2015	0.832	0.020	0.792	0.872	0.593	0.027	0.541	0.648	0.713	0.028	0.657	0.767
2016	0.913	0.020	0.872	0.948	0.373	0.018	0.339	0.411	0.408	0.017	0.376	0.444
2017	1.235	0.025	1.189	1.288	0.747	0.031	0.690	0.812	0.605	0.024	0.559	0.654
2018	1.102	0.020	1.062	1.141	0.802	0.036	0.733	0.872	0.728	0.028	0.673	0.783
2019	1.130	0.022	1.088	1.173	1.494	0.066	1.369	1.627	1.322	0.052	1.219	1.424
2020	1.040	0.021	0.999	1.082	1.409	0.065	1.283	1.539	1.355	0.057	1.240	1.463
2021	1.208	0.024	1.163	1.256	1.731	0.084	1.582	1.913	1.433	0.060	1.322	1.555
2022	1.420	0.037	1.350	1.495	3.248	0.162	2.927	3.560	2.288	0.098	2.102	2.486
2023	1.375	0.034	1.310	1.442	7.893	0.451	7.060	8.826	5.741	0.291	5.189	6.330
2024	1.458	0.044	1.375	1.547	7.104	0.375	6.402	7.871	4.871	0.218	4.465	5.320

C.5 SNA2S BT.MIX event (Hawke Bay)

Table C.25: Definition for the dataset, core fleet criteria, and Generalised Linear Modelling approach used in the catch-per-unit-effort (CPUE) standardisation for the SNA2S BT.MIX event (Hawke Bay) CPUE series.

Series	SNA2S BT.MIX event (Hawke Bay)
QMS stock	SNA 2
Reporting forms	TCP, TCE, ERS - Trawl
Fishing methods	BT
Target species	GUR, TRE, TAR, SNA
Statistical Areas	013, 014
Period	2007-10-01, 2024-09-30
Resolution	Fishing event
Core fleet years	5
Core fleet trips	5
Default model	allockg_top5 ~ fyear + vessel_key + target_species + month + stat_area + ns(log(fishing_duration), 3) + ns(bottom_depth, 3) + ns(effort_width, 3) + ns(effort_height, 3)
Stepwise selection	Yes
Positive catch distribution	Weibull

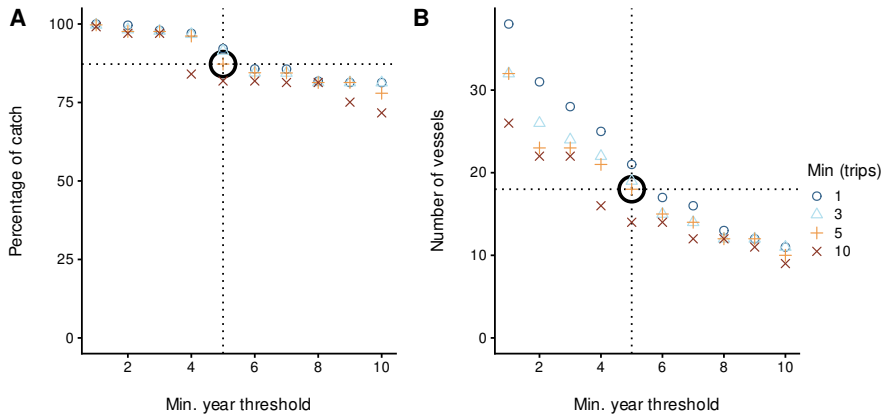

Figure C.89: Percentage of catch and number of vessels for different core vessel selection criteria for the SNA2S BT.MIX event (Hawke Bay) CPUE series. The bold open circle represents the core vessel selection criteria applied in the modelling dataset, specified by the number of years a vessel participated in the fishery and the number of trips per year.

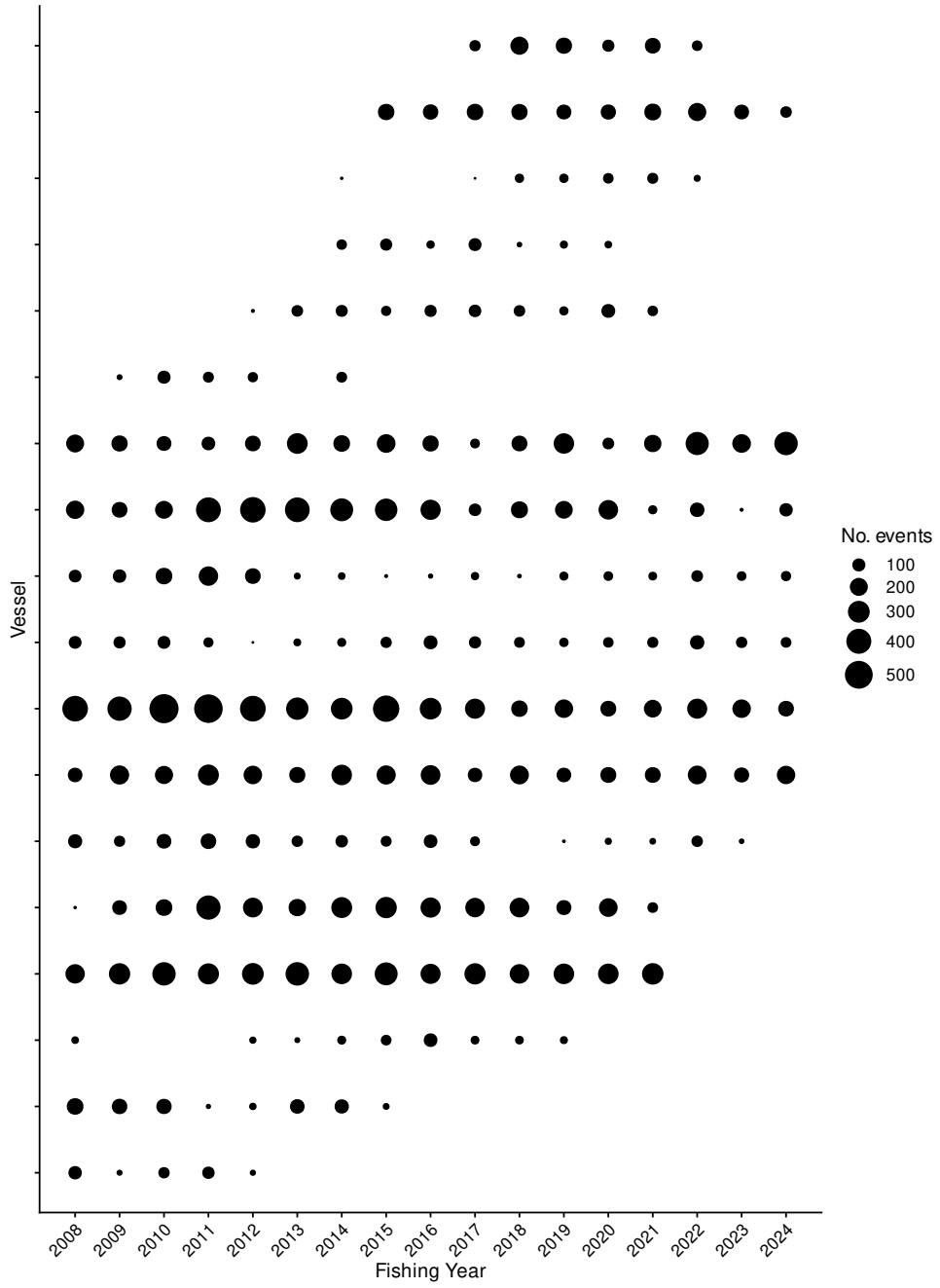

Figure C.90: Number of events by fishing year for core vessels in the SNA2S BT.MIX event (Hawke Bay) series. The area of the circles is proportional to the number of events undertaken by a vessel in a fishing year.

Table C.26: Summary of the SNA2S BT.MIX event (Hawke Bay) 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. (Continued on next page)

Filter	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ungroomed data	175 (100%) n: 5749	186 (100%) n: 6237	161 (100%) n: 6386	161 (100%) n: 6151	146 (100%) n: 4929	121 (100%) n: 4890	128 (100%) n: 5195	116 (100%) n: 5084	140 (100%) n: 4569
Fishing duration is not NA	175 (100%) n: 5748	186 (100%) n: 6233	161 (100%) n: 6386	161 (100%) n: 6150	146 (100%) n: 4929	121 (100%) n: 4890	128 (100%) n: 5194	116 (100%) n: 5083	140 (100%) n: 4569
Positive fishing duration	175 (100%) n: 5748	186 (100%) n: 6233	161 (100%) n: 6386	161 (100%) n: 6150	146 (100%) n: 4929	121 (100%) n: 4890	128 (100%) n: 5194	116 (100%) n: 5083	140 (100%) n: 4569
Fishing duration under 10hrs	175 (100%) n: 5736	186 (100%) n: 6227	161 (100%) n: 6379	161 (100%) n: 6143	146 (100%) n: 4926	121 (100%) n: 4883	128 (100%) n: 5190	115 (100%) n: 5075	140 (100%) n: 4561
Bottom depth shallower than 200m	175 (100%) n: 5636	186 (100%) n: 6178	161 (100%) n: 6338	161 (100%) n: 6109	146 (100%) n: 4910	121 (100%) n: 4855	128 (100%) n: 5173	115 (100%) n: 5059	140 (100%) n: 4543
Assigned to 013W	96 (55%) n: 3717	105 (56%) n: 3731	81 (51%) n: 3873	91 (57%) n: 3798	77 (53%) n: 2907	48 (39%) n: 2588	55 (43%) n: 3142	70 (61%) n: 3381	79 (56%) n: 2875
Latitude in range	94 (54%) n: 2581	103 (55%) n: 2401	80 (50%) n: 2880	90 (56%) n: 2852	75 (52%) n: 2244	45 (37%) n: 2023	52 (40%) n: 2233	67 (58%) n: 2430	77 (55%) n: 2104
Core fleet selection	61 (35%) n: 1804	60 (32%) n: 1768	56 (35%) n: 2309	78 (48%) n: 2572	75 (51%) n: 2154	45 (37%) n: 2022	52 (40%) n: 2145	67 (58%) n: 2372	77 (55%) n: 2072

Filter	2017	2018	2019	2020	2021	2022	2023	2024
Ungroomed data	177 (100%) n: 4362	184 (100%) n: 4231	199 (100%) n: 4010	182 (100%) n: 3535	176 (100%) n: 3334	213 (100%) n: 3324	218 (100%) n: 2456	281 (100%) n: 2674
Fishing duration is not NA	177 (100%) n: 4362	184 (100%) n: 4231	199 (100%) n: 4009	182 (100%) n: 3534	176 (100%) n: 3334	213 (100%) n: 3324	218 (100%) n: 2455	281 (100%) n: 2674
Positive fishing duration	177 (100%) n: 4362	184 (100%) n: 4231	199 (100%) n: 4009	182 (100%) n: 3530	176 (100%) n: 3331	213 (100%) n: 3321	218 (100%) n: 2454	281 (100%) n: 2672
Fishing duration under 10hrs	177 (100%) n: 4353	183 (100%) n: 4222	198 (100%) n: 3997	182 (100%) n: 3524	176 (100%) n: 3327	213 (100%) n: 3319	218 (100%) n: 2453	281 (100%) n: 2670
Bottom depth shallower than 200m	177 (100%) n: 4333	183 (99%) n: 4203	198 (100%) n: 3990	181 (99%) n: 3520	176 (100%) n: 3312	213 (100%) n: 3316	218 (100%) n: 2449	281 (100%) n: 2668
Assigned to 013W	91 (51%) n: 2506	91 (50%) n: 2876	104 (52%) n: 2623	110 (60%) n: 2456	113 (64%) n: 2292	139 (65%) n: 2414	137 (63%) n: 1733	158 (56%) n: 1972
Latitude in range	86 (49%) n: 1729	86 (47%) n: 1991	95 (48%) n: 1789	102 (56%) n: 1729	104 (59%) n: 1553	120 (56%) n: 1851	107 (49%) n: 1051	113 (40%) n: 1165
Core fleet selection	85 (48%) n: 1688	81 (44%) n: 1808	93 (47%) n: 1749	99 (55%) n: 1672	102 (58%) n: 1516	95 (44%) n: 1506	79 (36%) n: 841	101 (36%) n: 1012

Table C.27: Summary of the SNA2S BT.MIX event (Hawke Bay) 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 snapper.

Fishing year	Vessels	Trips	Records	Hours	Catch (t)	Records caught
2008	12	406	1 804	6 462.15	61.26	54.05
2009	12	409	1 768	6 485.00	60.02	57.13
2010	12	502	2 309	8 622.47	56.50	48.46
2011	12	474	2 572	9 673.65	77.60	52.06
2012	14	456	2 154	8 125.35	74.65	57.66
2013	12	414	2 022	7 490.80	44.87	46.14
2014	15	433	2 145	8 042.10	51.69	47.79
2015	14	433	2 372	9 016.23	67.17	43.84
2016	13	494	2 072	7 883.07	76.68	42.95
2017	15	400	1 688	6 600.62	84.63	58.53
2018	14	444	1 808	7 002.53	80.73	55.14
2019	15	444	1 749	6 866.47	93.43	58.09
2020	14	380	1 672	6 896.22	99.42	57.36
2021	13	443	1 516	5 745.53	101.58	59.96
2022	10	441	1 506	5 500.90	94.66	71.85
2023	8	238	841	3 313.80	79.33	65.52
2024	7	313	1 012	3 479.55	100.58	76.19

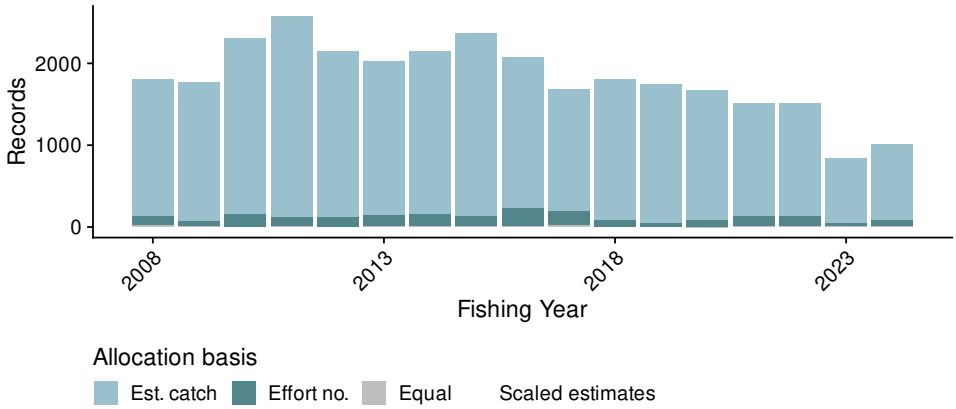

Figure C.91: Allocation basis for attributing landings to records in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset. Allocation basis is in terms of estimated catch, effort number, and/or equal.

Table C.28: Summary of stepwise selection for occurrence of positive catch in the SNA2S BT.MIX event (Hawke Bay) 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	15	41 941	2.0	2.0	*
+ ns(bottom_depth, 3)	3	39 255	8.3	6.3	*
+ vessel_key	17	37 358	12.8	4.5	*
+ month	11	36 535	14.8	2.0	*
+ target_species	3	36 359	15.2	0.4	
+ ns(log(fishing_duration), 3)	3	36 247	15.5	0.3	
+ ns(effort_height, 3)	3	36 177	15.7	0.2	
+ stat_area	1	36 122	15.8	0.1	
+ ns(effort_width, 3)	3	36 111	15.8	0.0	

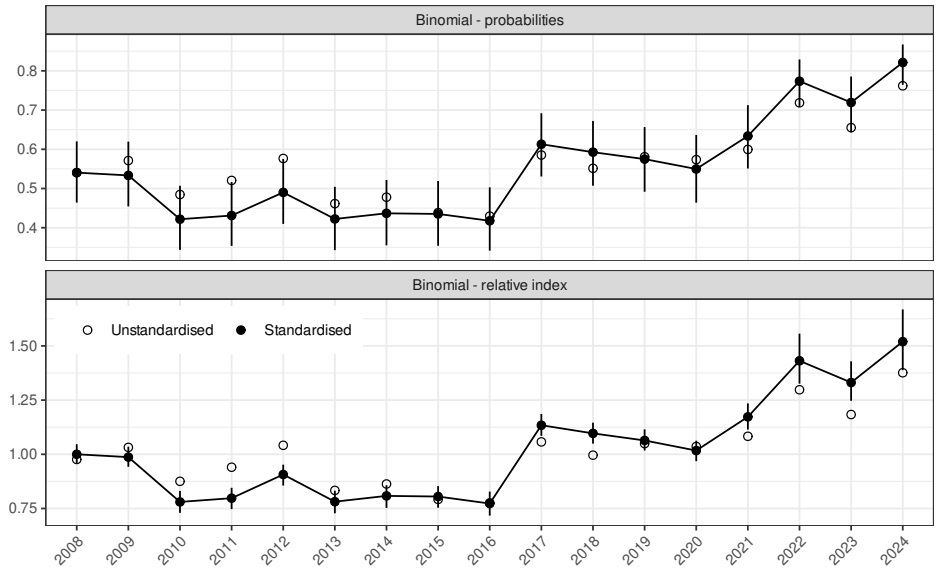

Figure C.92: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for occurrence of catch in the SNA2S BT.MIX event (Hawke Bay) dataset, plotted as both probability of occurrence and as a relative index standardised to the geometric mean.

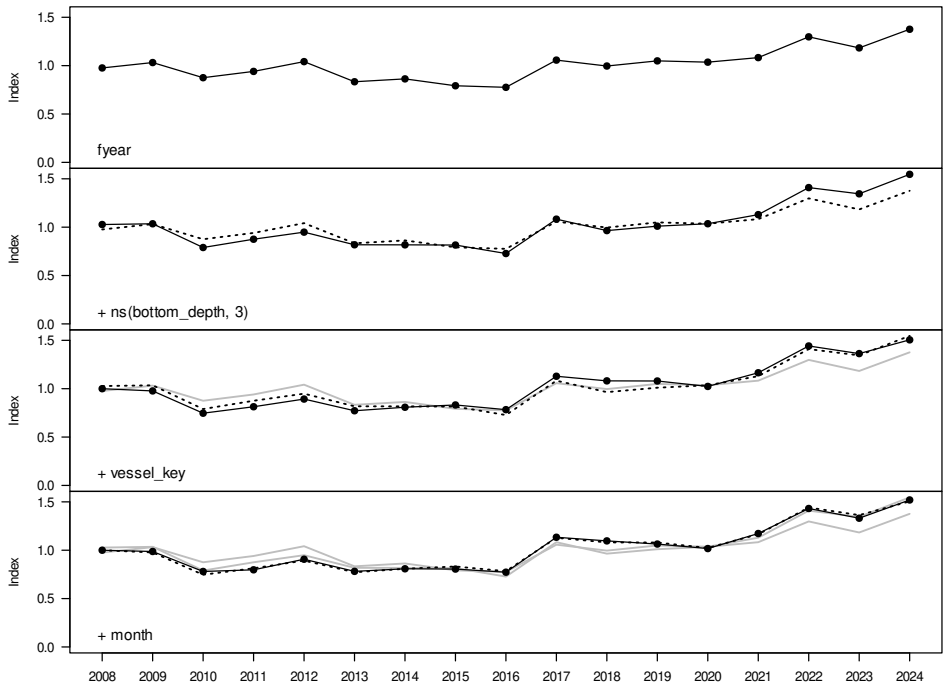

Figure C.93: Step plot for occurrence of catch in the SNA2S BT.MIX event (Hawke Bay) dataset.

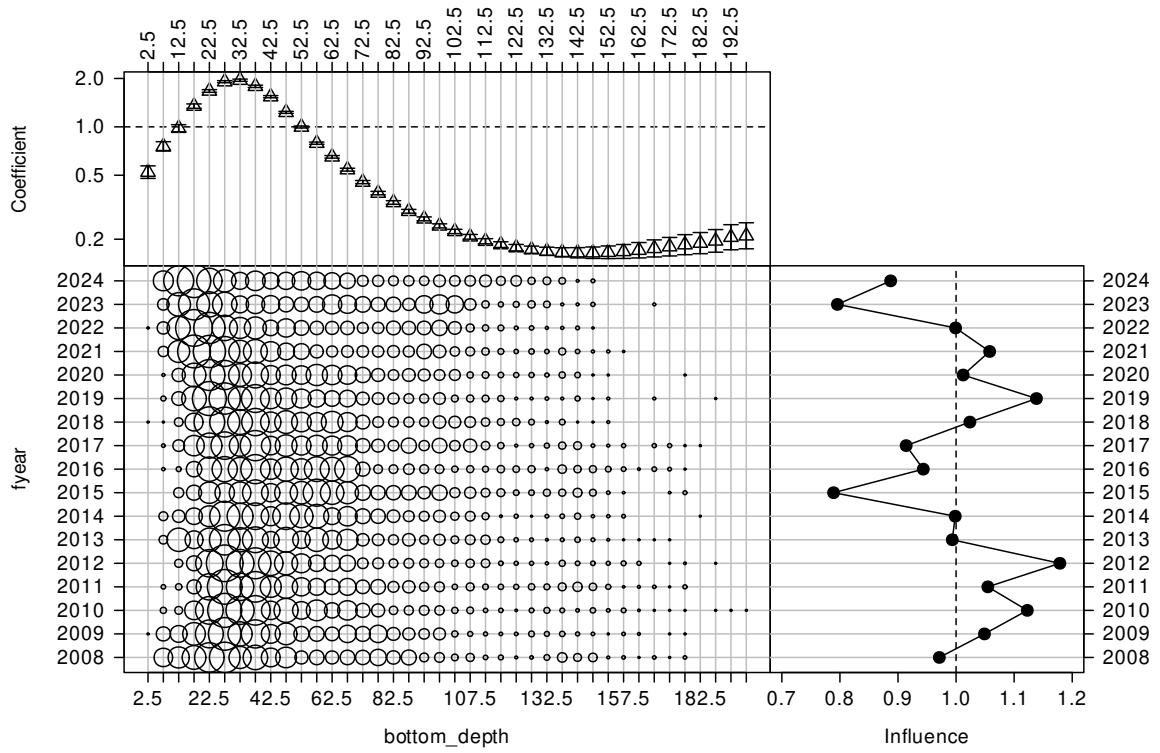

Figure C.94: CDI plot for bottom depth (m) for the occurrence of positive catch in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

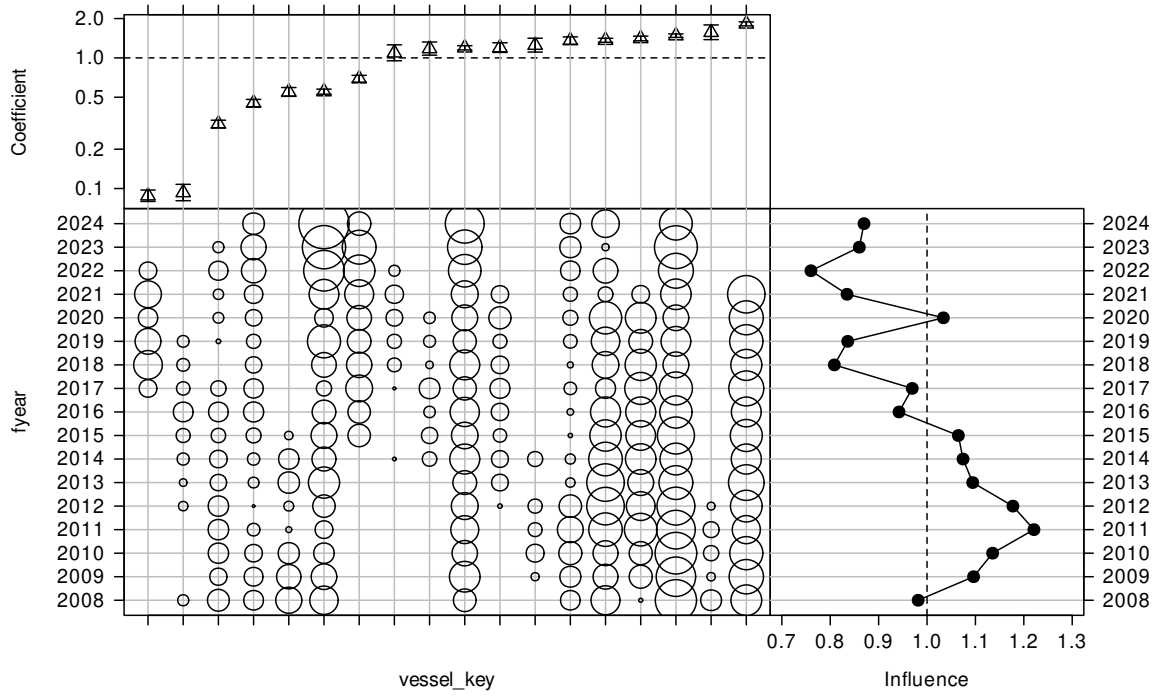

Figure C.95: CDI plot for vessel key for the occurrence of positive catch in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

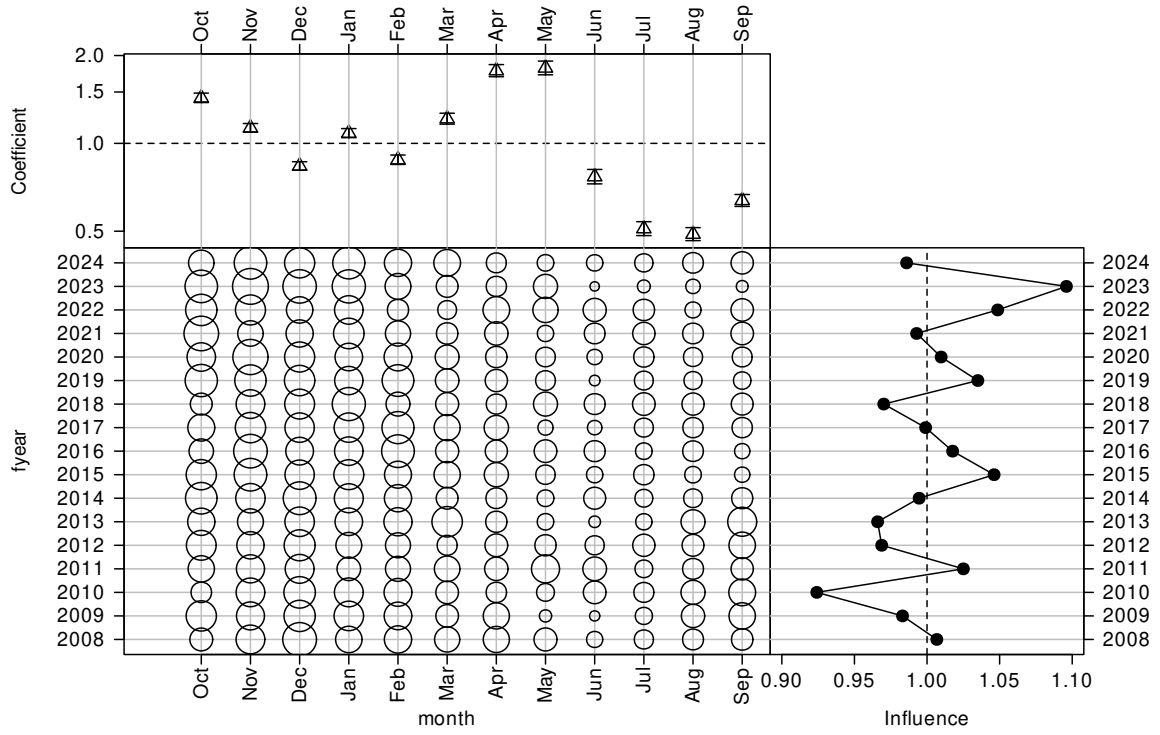

Figure C.96: CDI plot for month for the occurrence of positive catch in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

Table C.29: Summary of stepwise selection for the Weibull model for positive catches in the SNA2S BT.MIX event (Hawke Bay) 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	18	174 192	4.1	4.1	*
+ vessel_key	17	169 577	28.8	24.7	*
+ ns(bottom_depth, 3)	3	168 417	35.0	6.2	*
+ month	11	167 853	38.1	3.1	*
+ target_species	3	167 590	39.6	1.4	*
+ ns(log(fishing_duration), 3)	3	167 450	40.3	0.8	
+ ns(effort_height, 3)	3	167 326	41.0	0.7	
+ ns(effort_width, 3)	3	167 283	41.3	0.3	
+ stat_area	1	167 261	41.4	0.1	

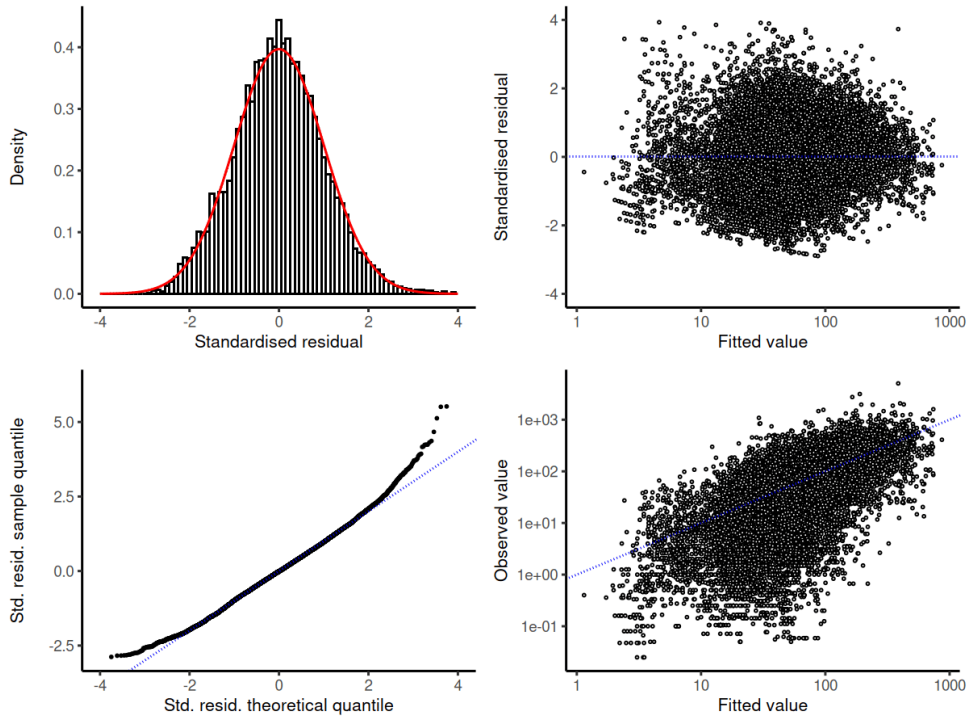

Figure C.97: Diagnostic plots for the selected Weibull model for positive catches in the SNA2S BT.MIX event (Hawke Bay) dataset.

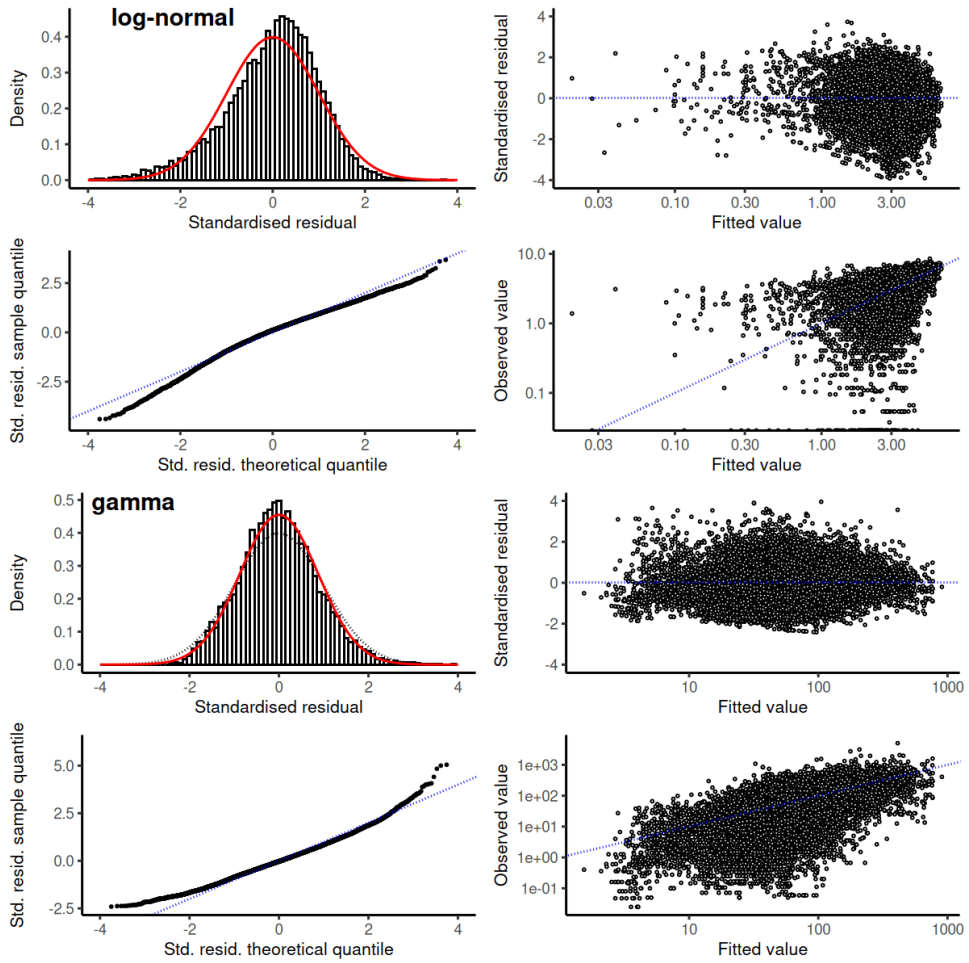

Figure C.98: Diagnostic plots for the alternative log-normal and gamma models considered for positive catches in the SNA2S BT.MIX event (Hawke Bay) dataset.

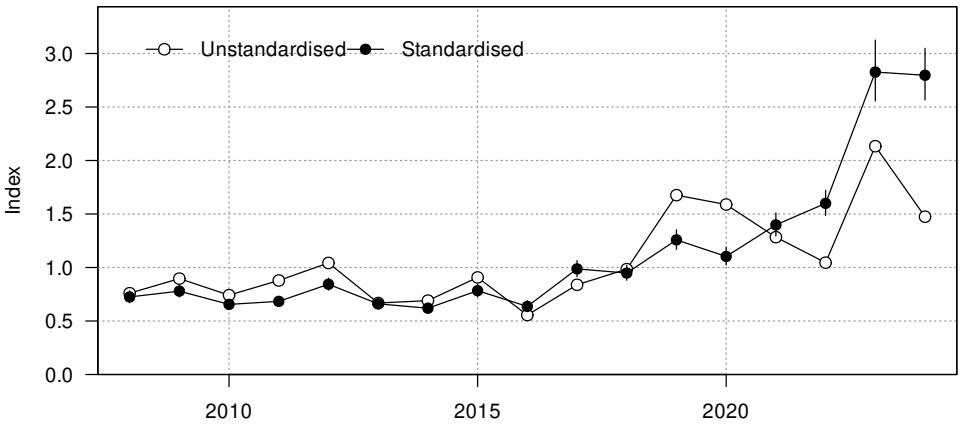

Figure C.99: Unstandardised (geometric mean; open circles) and standardised indices (black circles) for positive catch using the Weibull model for the SNA2S BT.MIX event (Hawke Bay) dataset.

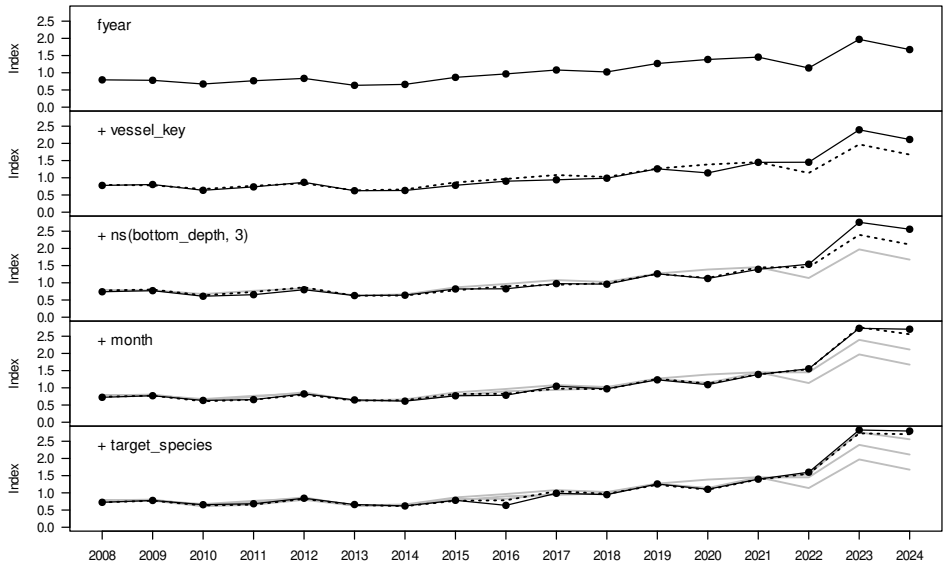

Figure C.100: Changes to the SNA2S BT.MIX event (Hawke Bay) positive catch index as terms are successively entered into the Weibull model.

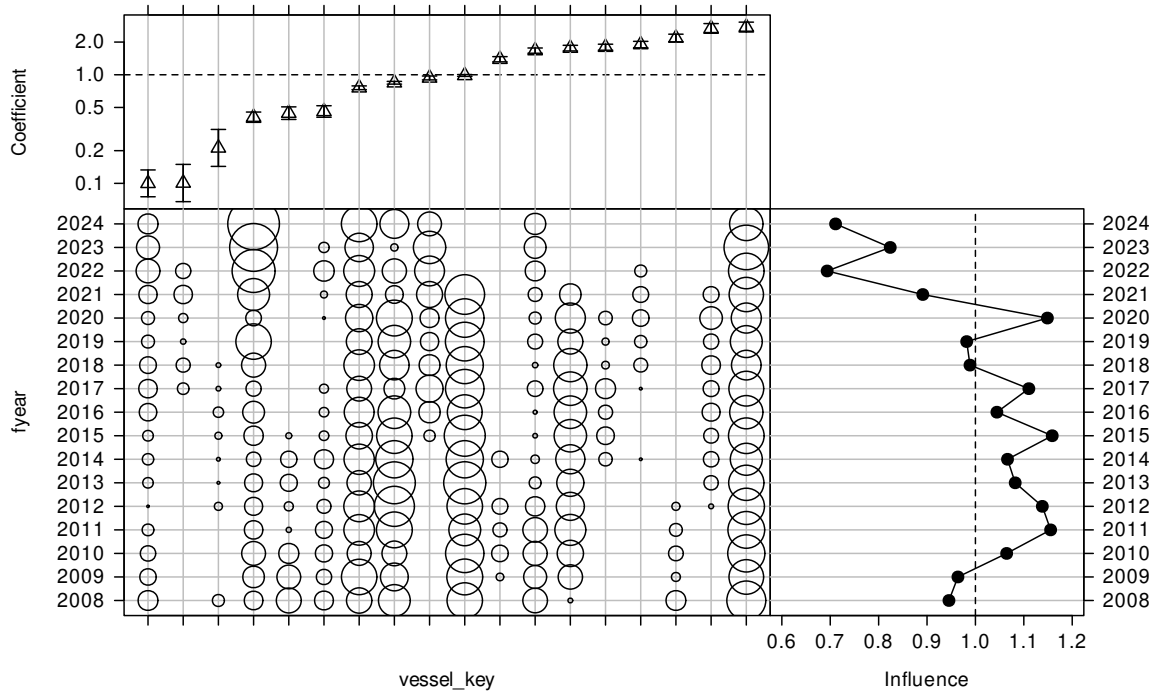

Figure C.101: CDI plot for vessel key for the Weibull model of positive catches in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

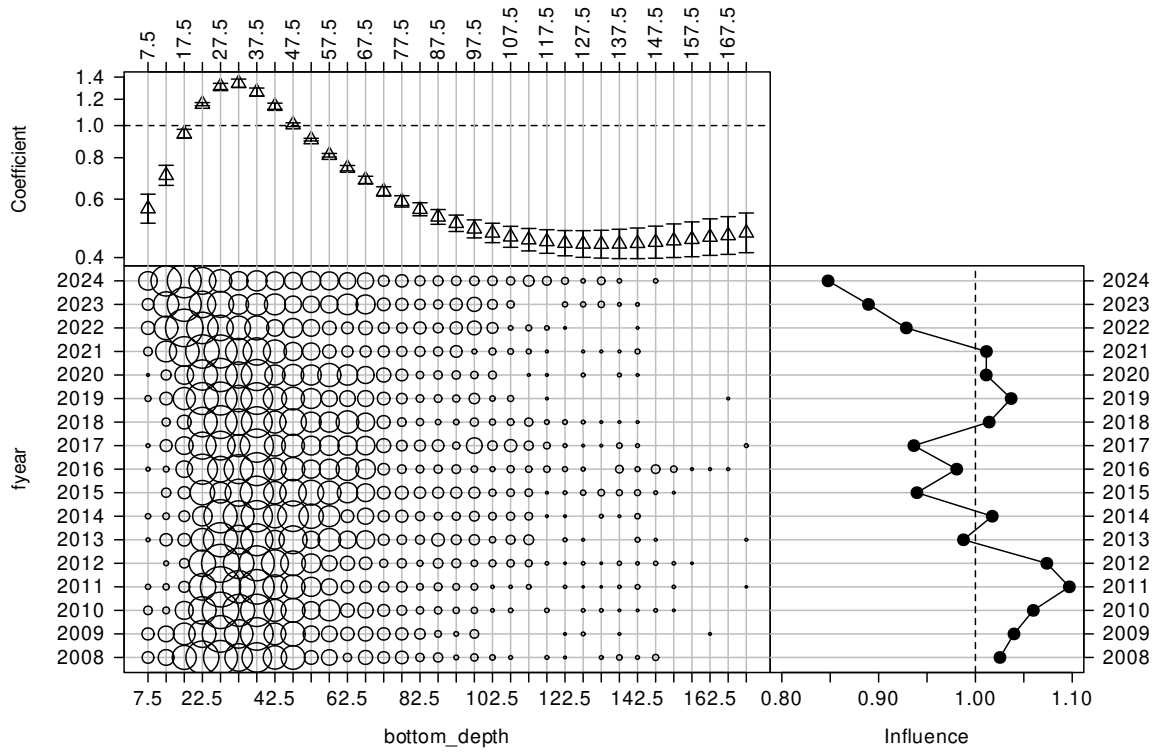

Figure C.102: CDI plot for bottom depth (m) for the Weibull model of positive catches in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

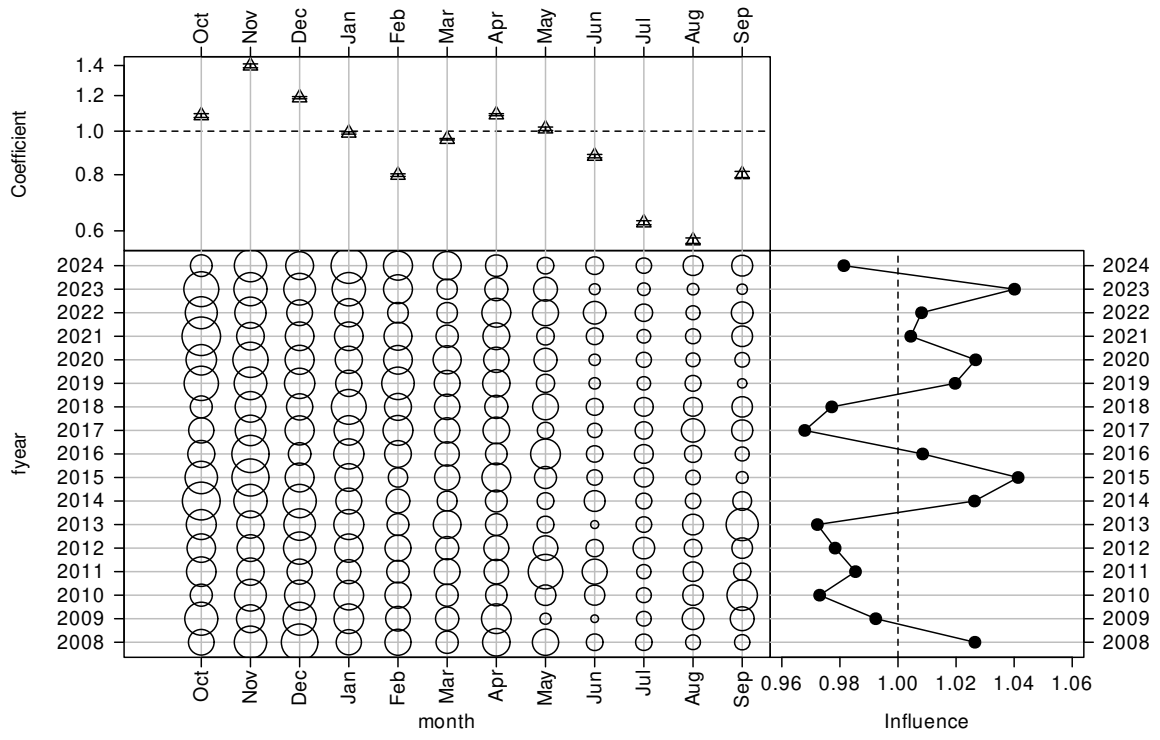

Figure C.103: CDI plot for month for the Weibull model of positive catches in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

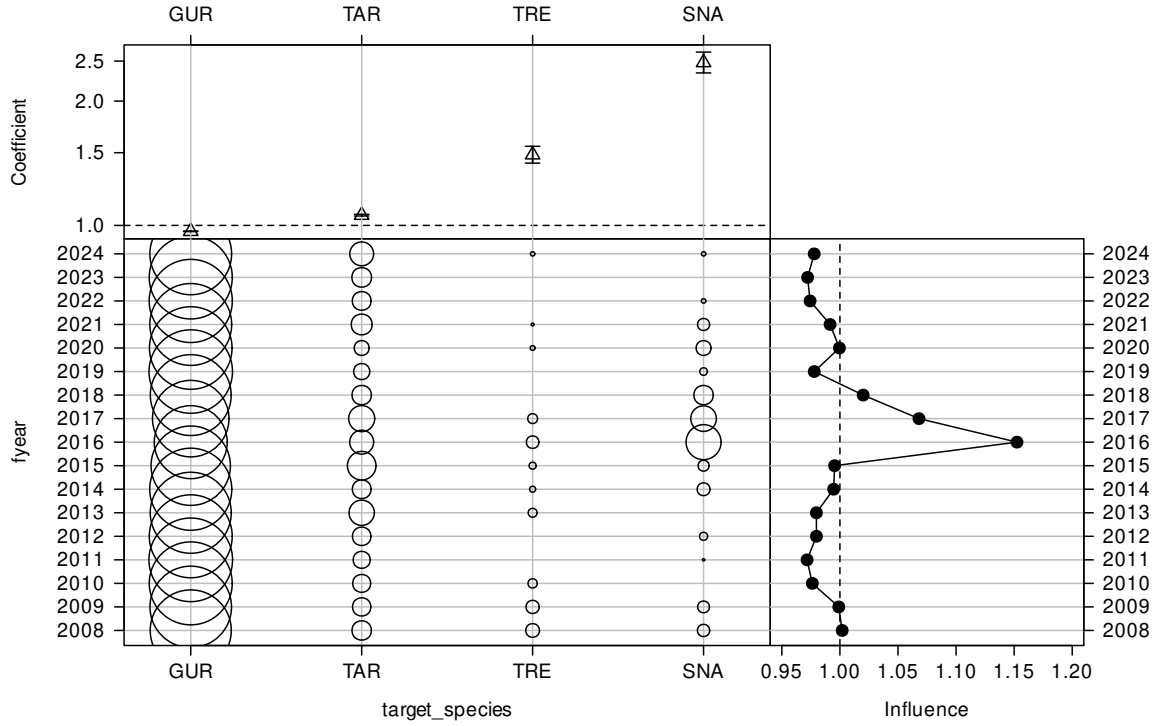

Figure C.104: CDI plot for target species for the Weibull model of positive catches in the SNA2S BT.MIX event (Hawke Bay) catch-per-unit-effort dataset.

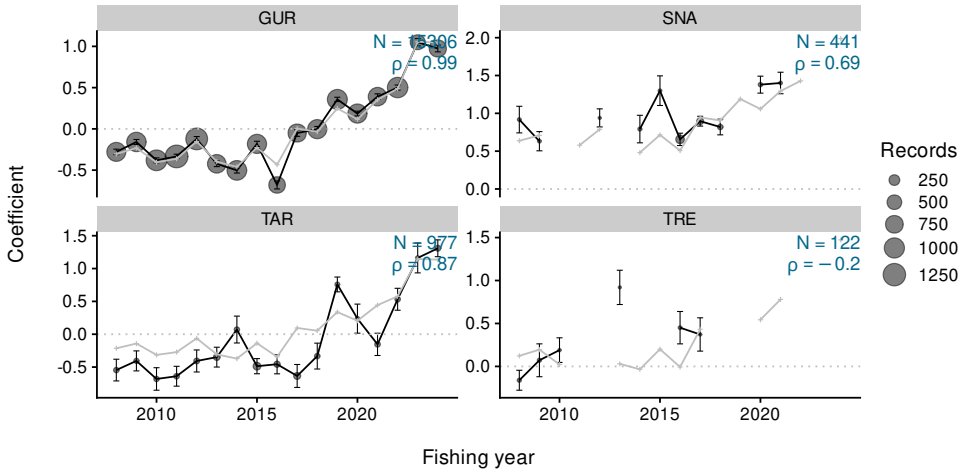

Figure C.105: Residual implied coefficients for target-year in the Weibull positive catch model for the SNA2S BT.MIX event (Hawke Bay) dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 10 data points in a target-year stratum. The light grey line and points indicate the overall year indices; these are only plotted where there are data in a stratum.

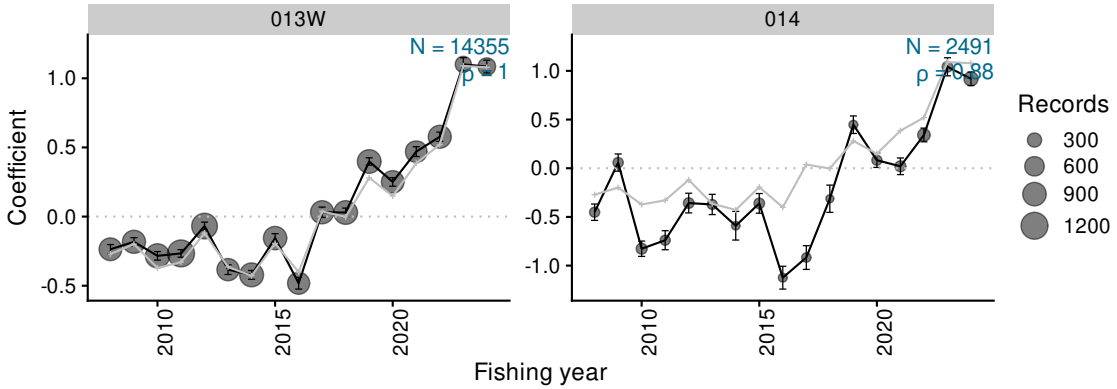

Figure C.106: Residual implied coefficients for area-year in the Weibull positive catch model for the SNA2S BT.MIX event (Hawke Bay) dataset (black points, mean +/- one standard error). The dark grey circles indicate the number of data points. Implied coefficients are only plotted when there are at least 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.

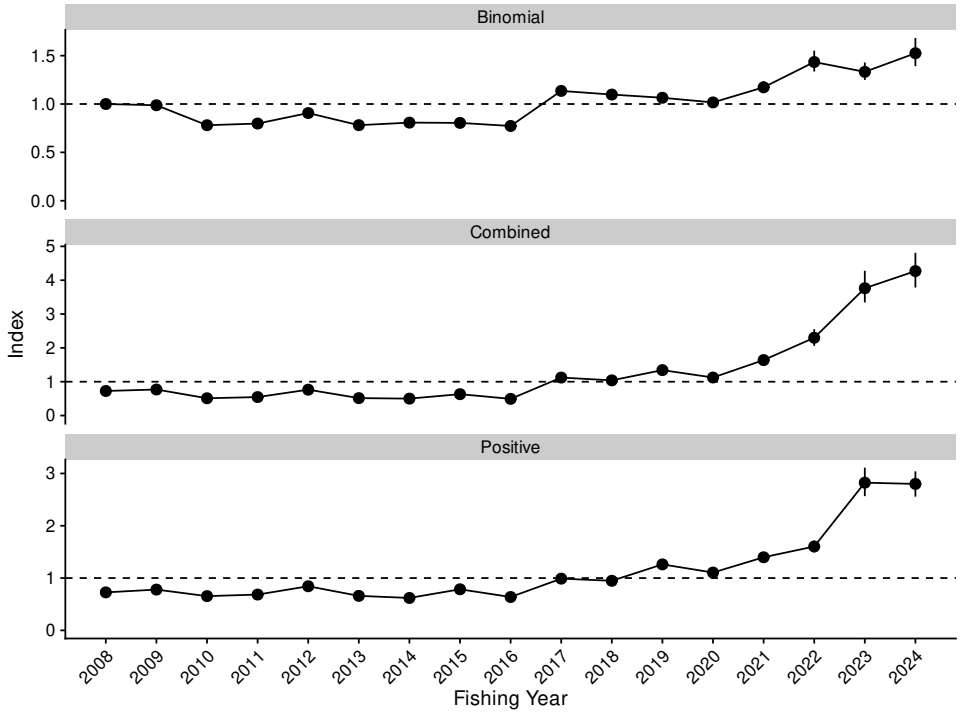

Figure C.107: Standardised indices and 95% confidence intervals for the SNA2S BT.MIX event (Hawke Bay) dataset.

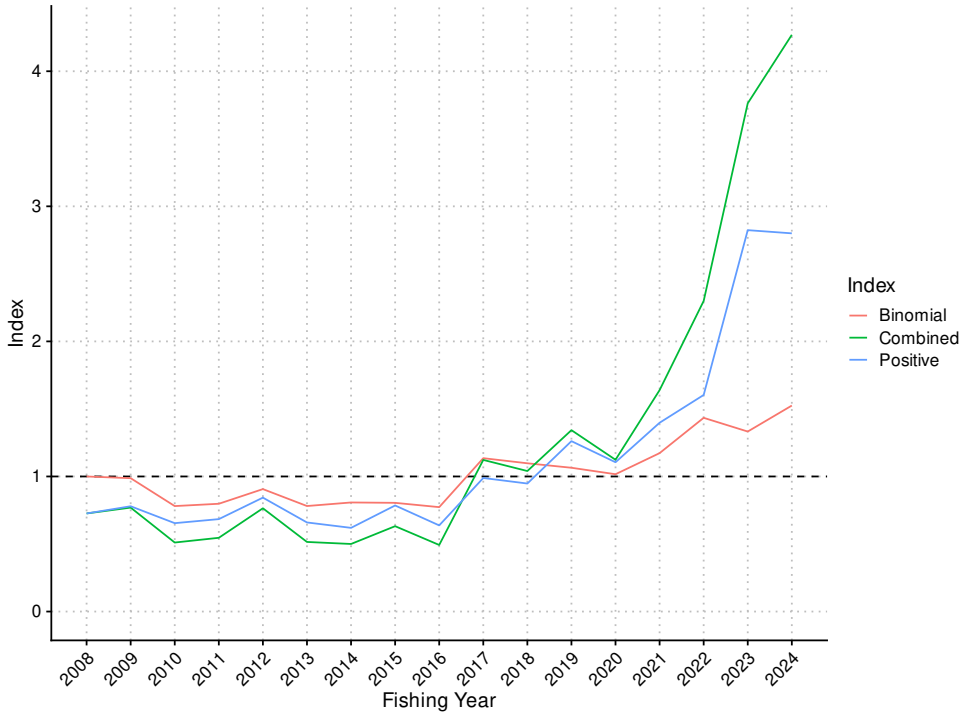

Figure C.108: Standardised indices for the SNA2S BT.MIX event (Hawke Bay) dataset.

Table C.30: Annual indices and standard errors, with upper and lower bounds (LCI: 2.5%, UCI: 97.5%) for each model in SNA2S BT.MIX event (Hawke Bay).

	Binomial				Combined				Positive			
Fishing year	index	SE	LCI	UCI	index	SE	LCI	UCI	index	SE	LCI	UCI
2008	1.000	0.022	0.956	1.044	0.726	0.033	0.661	0.790	0.726	0.028	0.671	0.780
2009	0.987	0.024	0.939	1.033	0.770	0.034	0.705	0.837	0.780	0.028	0.728	0.837
2010	0.781	0.026	0.731	0.831	0.511	0.024	0.464	0.560	0.654	0.022	0.612	0.699
2011	0.798	0.024	0.751	0.846	0.546	0.025	0.498	0.595	0.684	0.023	0.642	0.732
2012	0.907	0.023	0.861	0.953	0.764	0.032	0.703	0.828	0.843	0.027	0.792	0.898
2013	0.781	0.029	0.727	0.839	0.515	0.027	0.462	0.569	0.660	0.026	0.609	0.710
2014	0.808	0.026	0.753	0.857	0.500	0.025	0.452	0.549	0.620	0.023	0.576	0.665
2015	0.805	0.025	0.753	0.852	0.632	0.031	0.572	0.693	0.785	0.026	0.734	0.837
2016	0.773	0.029	0.715	0.827	0.493	0.026	0.444	0.546	0.638	0.026	0.590	0.693
2017	1.135	0.027	1.085	1.190	1.123	0.050	1.030	1.226	0.989	0.038	0.918	1.066
2018	1.098	0.023	1.053	1.144	1.040	0.042	0.966	1.129	0.948	0.033	0.884	1.015
2019	1.065	0.025	1.015	1.113	1.343	0.058	1.232	1.459	1.261	0.046	1.172	1.351
2020	1.017	0.024	0.968	1.062	1.124	0.051	1.027	1.226	1.105	0.040	1.026	1.182
2021	1.173	0.032	1.112	1.236	1.639	0.076	1.489	1.789	1.398	0.051	1.297	1.499
2022	1.434	0.055	1.336	1.552	2.299	0.125	2.061	2.552	1.603	0.058	1.492	1.718
2023	1.333	0.046	1.249	1.429	3.763	0.239	3.343	4.278	2.824	0.139	2.566	3.111
2024	1.525	0.074	1.391	1.682	4.270	0.261	3.784	4.808	2.800	0.123	2.557	3.040

APPENDIX D: COMPARISON WITH PREVIOUS SERIES

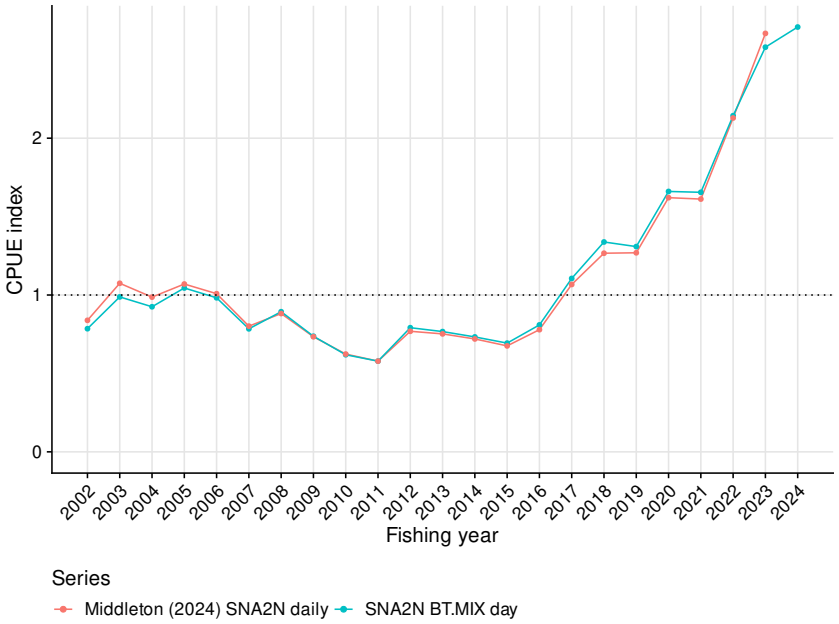

Figure D.1: Comparison between the SNA2N BT.MIX day series and the previous update to 2024 (Middleton 2024). All series are scaled to a geometric mean of one for the years in common.

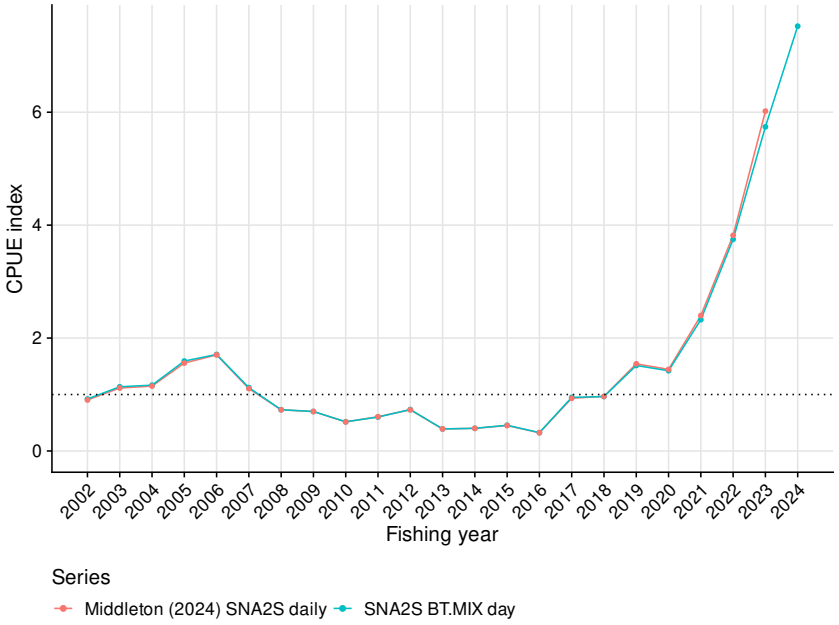

Figure D.2: Comparison between the SNA2S BT.MIX day series and the previous update to 2024 (Middleton 2024). All series are scaled to a geometric mean of one for the years in common.

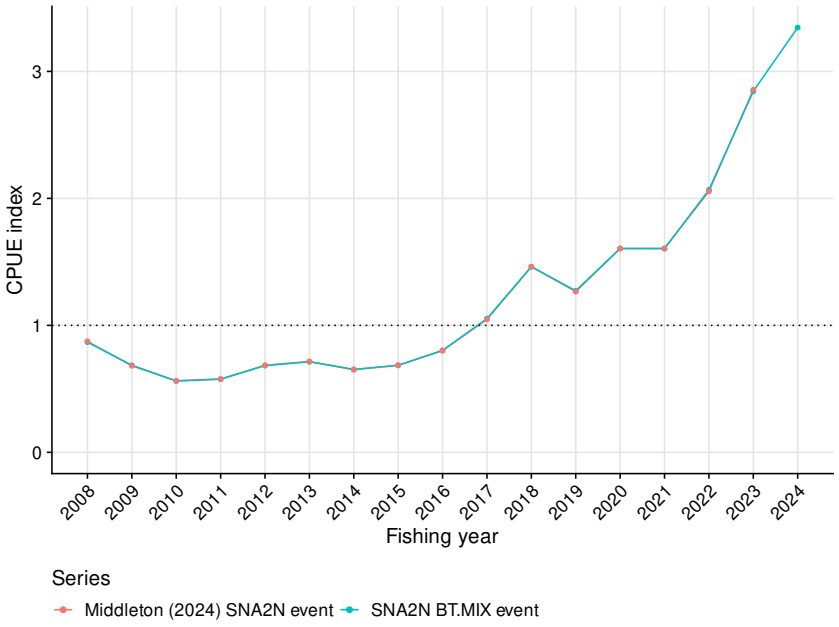

Figure D.3: Comparison between the SNA2N BT.MIX event series and the previous update to 2024 (Middleton 2024). All series are scaled to a geometric mean of one for the years in common.

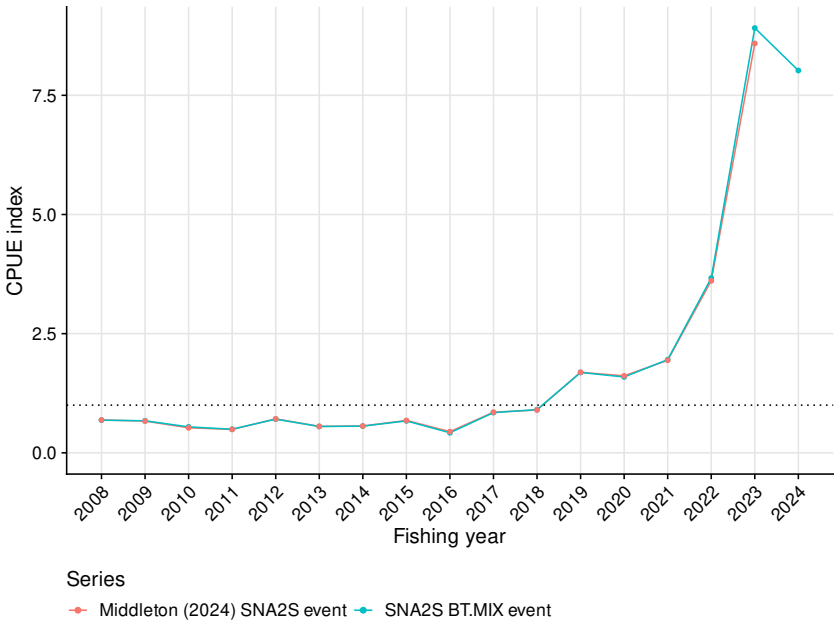

Figure D.4: Comparison between the SNA2S BT.MIX event series and the previous update to 2024 (Middleton 2024). All series are scaled to a geometric mean of one for the years in common.

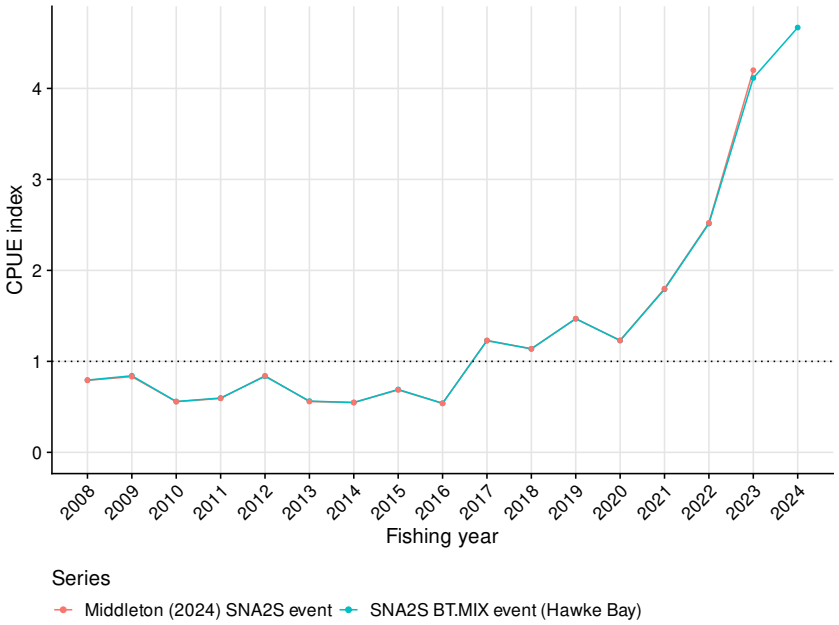

Figure D.5: Comparison between the SNA2S BT.MIX event (Hawke Bay) series and the previous update to 2024 (Middleton 2024). All series are scaled to a geometric mean of one for the years in common.

APPENDIX E: GLOSSARY

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

Code	Description
DRE	Dressed
DVC	Dressed-V cut (stargazer)
FIL	Fillets: skin-on
GRE	Green (or whole)
GUT	Gutted
HDS	Heads
HGU	Headed and gutted
SKF	Fillets: skin-off

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

Code	Description
CEL	Catch, Effort and Landing Return (CELR)
ERS - Trawl	Electronic Reporting System - Trawl
ERS - Netting	Electronic Reporting System - Netting
ERS - Lining	Electronic Reporting System - Lining
ERS - Potting	Electronic Reporting System - Potting
ERS - Diving	Electronic Reporting System - Diving
ERS - Seining	Electronic Reporting System - Seining
LCE	Lining Catch Effort Return (LCER)
NCE	Netting Catch, Effort and Landing Return (NCELR)
TCE	Trawl Catch Effort Return (TCER)
TCP	Trawl Catch, Effort and Processing Return (TCEPR)
TUN	Tuna Longlinging Catch Effort Return (TLCER)
LTC	Lining Trip Catch Effort Return (LTCER)

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

Code	Description
BLL	Bottom longline
BT	Bottom trawl
DS	Danish seine
PRB	Precision bottom trawl
SN	Set net
T	Troll

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

Code	Common name	Scientific name
GUR	Gurnard	*Chelidonichthys kumu*
SNA	Snapper	*Pagrus auratus* (*Chrysophrys auratus*)
TAR	Tarakihi	*Nemadactylus macropterus, Nemadactylus* sp. (King tarakihi)

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.

		Date				Included in		
Code	Description	Introduced	Revoked	Final	Retainable	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