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Standardization of commercial catch per unit effort of Hogfish (*Lachnolaimus maximus*) from Florida Trip Ticket landings, 1994-2024

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Introduction

Indices of relative abundance were developed from the Florida Trip Ticket Program database for the two primary Hogfish (Lachnolaimus maximus) stocks within Florida: West Florida (WFL) and Southeast Florida including the Florida Keys (FLK/SEFL). These stock delineations are based on genetic analyses conducted on sampling from the WFL through North Carolina, suggesting little if any contemporaneous exchange between three distinct geographic groupings (WFL, FLK/SEFL, N. Carolina; Seyoum et al. 2014).

For SEDAR 37 Southeastern US Hogfish (SEDAR 37, 2014), Florida trip ticket indices were developed for WFL and FLK/SEFL by gear (Hook and Line, Spear; SEDAR 37-02). Additional commercial indices were developed from the Coastal Fisheries Logbook Program (CFLP) for hook and line and spear gear (SEDAR 37-12). For the WFL base model, the Florida trip ticket hook and line index was recommended due to the hook and line CFLP index showing low numbers of observations for vertical lines (including long lines). Due to the CFLP spear index being one year longer and likely a more accurate representation of the effort (dive hours) versus the trip tickets (per trip, accounting for trip days), it was considered the preferred commercial spear index for the WFL base model. For the FLK/SEFL base model, the recommended index for the hook and line commercial fishery was the Florida trip ticket hook and line index, which was more consistent with other indices. The CFLP spear index was recommended for the FLK/SEFL base model for the spear commercial fishery.

In 2017, significant changes were made to Hogfish commercial fishery regulations in federal waters of the South Atlantic and the Gulf of Mexico (Gulf of America) through Snapper Grouper Amendment 37 (SAFMC 2016) and Reef Fish Amendment 43 (GMFMC 2017) that potentially affected commercial catch per unit effort (CPUE). For the FLK/SEFL stock, SAFMC Snapper Grouper Amendment 37 led to a reduced commercial catch limit, a commercial closure on August 24, 2017, a 10-year rebuilding plan through 2027, an increased minimum size limit to 16” FL, and a commercial trip limit of 25 pounds whole weight. For the WFL stock, GMFMC Reef Fish

Amendment 43 increased the minimum size limit from 12” to 14” FL, prohibited powerheads for “stressed areas”, and set annual catch limits. The commercial season in the Gulf remained open year-round unless the catch limit was met. Therefore, additional indices were considered that truncated the time series at 2017 as the regulatory changes (trip limits, size limits, closures, catch limits) implemented late that year likely introduced non-stationarity in the catch rate series by altering effort dynamics, selectivity patterns, and harvest availability, thereby confounding the relationship between commercial catch-per-unit-effort and true population abundance.

Methods

Spatial and Temporal Extent

Given the distribution and stock structure of hogfish, separate indices were constructed spatially for the WFL and the FLK/SEFL. For the two Florida-centered stocks, only those landings from fishing areas and/or counties in the core distribution area were used: Franklin county to Collier county for the WFL stock, and Monroe county to Indian River county for the FLK/SEFL stock (Figure 1). Analyses were done for years starting in 1994 when the gear code became a requirement on the trip tickets. Prior to 1994, all gear information from the trip ticket data should be considered as an estimate. Indices of abundance were constructed for 1994-2024, which is considered the full time series, as well as for 1994-2017, which is a truncated time series before major regulation changes occurred in late 2017 (detailed above).

Trip Identification

To identify those commercial trips that were appropriate for catching hogfish, a cluster analysis was conducted to identify species often caught in association with hogfish. By identifying those trips that caught associated species but failed to catch hogfish, one can infer zero-catch trips that were appropriate to include in the analysis. The total landings of hogfish using hook and line versus spear is of a comparable magnitude over the time frame when recording of gear used was required on the Florida

Trip Tickets (Marine Fisheries Trip Ticket Program, 1994-present; Tables 1 and 2). As such, both gear types were analyzed, and indices of abundance were computed separately for the two for comparison. For this analysis, we use only those species objectively determined to be caught in association with hogfish for a given gear type to identify appropriate valid trips.

The data was filtered to remove all uncommon species that occurred on only a small proportion of the total trips and in particular those species that were rarely caught with hogfish. For both gear types, species caught on less than 1% of the total trips that caught hogfish were removed. Affinity propagation clustering (APC) was chosen to determine associated species, because it has been shown to perform well relative to other cluster techniques and does not require that the number of cluster be pre-specified (Frey and Dueck 2007). APC automatically chooses an optimal number of clusters in the dataset, thereby providing an objective criterion for which to group associated species. For the APC procedure, the Bray measure of similarity was used where data were converted to presence/absence of landings for each species and fishing trip. Once the associated species within the hogfish cluster were identified for each of the stocks and gear types, all trips on which these species were caught for a specific gear type were used as suitable valid trips in the subsequent analyses. The APC technique was done in R 4.4.3 (R Core Team 2025) using the apcluster package (Bodenhofer et al. 2011).

Standardization Model

Standardized indices of abundance were calculated using a generalized linear modeling procedure that combined the analysis of the binomial information on presence/absence with the lognormal-distributed positive catch data (also known as two-part, hurdle, or zero-adjusted models, Zuur et al. 2009) as:

$$I_y = c_y p_y \quad [1]$$

where c_y are estimated annual mean CPUEs of non-zero catches modeled as lognormal distributions and p_y are estimated annual mean probabilities of capture modeled as binomial distributions. The lognormal submodel considers only trips in which a hogfish was caught (*i.e.*, non-zero catches). The binomial model considers all trips in which hogfish or associated species were caught. While other approaches exist to model zero-inflated data (i.e., Poisson and negative binomial distributions; zero-inflated models; Zuur et al. 2009), the two-part model used here is advantageous in that it provides inferences on both the presence-absence and abundance processes occurring within a population, and can easily accommodate different predictor variables for each sub-model in the statistical analysis.

To determine the most appropriate models, predictor variables were selected using a forward step-wise approach where each predictor was added to each submodel individually and the resulting reduction in deviance per degree of freedom (Dev/DF) analyzed. The factor causing the greatest reduction in Dev/DF was then added to the base model. Year was retained in all models to obtain an index of abundance over time. Other potential predictors included month, depth fished, days fished, and region fished. The region fished variable applied only to the FLK/SEFL stock, where the Keys (Monroe county) and SEFL (Miami-Dade to Indian River counties) were keyed as separate regions to accommodate differences in reef habitat structure. We assume that there are no significant interaction terms with year in this model and consider only the main effects. Criteria for model inclusion also include a reduction in Dev/DF≥0.5%. This process was then repeated until no factor met criteria for model inclusion. Final year specific marginal means estimates and standard errors of the two sub-models were used to generate distributions of estimates for each sub-model from a Monte Carlo simulation (5000 Student's t distributed realizations). The product of these distributions (eq. 1) provided an estimate of the median catch rate with year-specific variability. All analyses were done using R 4.4.3 (R Core Team 2025).

Results and Discussion

Species Prevalence on Commercial Fishing Trips

In order to ascertain valid trips, species often caught in association with hogfish were selected through multiple procedures. The first filtering step was to determine only those species caught on greater than 1% of the trips that caught a hogfish. This was done to eliminate any species that were rarely caught with hogfish in order to simplify the cluster analysis (see section below). For the WFL spear fishery, hogfish was recorded on 2,876 trip tickets from 1994-2024. In the filtered data, flounders were the most often caught species, with nearly three times more records than hogfish for the WFL spear fishery. Hogfish were also recorded on a similar scale on trip tickets where hook and line was the primary gear type (n = 2,237) for WFL, but this was a small fraction of the total hook and line trips conducted relative to the total number of spear fishing trips. A similar pattern was evident in the FLK/SEFL, where 8,940 trip tickets recorded hogfish when the primary gear was spear, and a similar magnitude of hook and line trips additionally recorded hogfish (n = 6,455). However, hogfish were the most often caught species on spear fishing trips, but were caught on only a small fraction of the total hook and line trips in the FLK/SEFL region (Table 3).

Identification of Valid Commercial Trips

The APC technique was performed separately for the gears and two stocks (hook-and-line versus spear; WFL versus FLK/SEFL stocks) for both the full time series (1994-2024) and the truncated time series (1994-2017). For the full time series, WFL spear, the APC procedure selected 4 clusters from a total of 24 species. The species group in which hogfish clustered comprised the largest cluster with a total of ten other species (Table 5), including groupers, snappers, grunts, and amberjacks. For the WFL hook and line, the APC procedure selected 6 total clusters from a total of 37 species. The species group in which hogfish clustered was the 2nd largest cluster with seven other species, and similarly included the groupers, grunts, and snappers as in the spear fishing trips (Table 5). For the FLK/SEFL spear, the APC procedure selected 6 clusters

from a total of 26 species. The species group in which hogfish clustered included four other species (Table 5). Lastly for the full time series, for the FLK/SEFL hook and line, the APC procedure selected seven clusters from a total of 26 species. The species group in which hogfish clustered included five other species (Table 5).

The APC technique was also similarly performed for the truncated time series (1994-2017). For WFL spear, the APC procedure selected 4 clusters from a total of 21 species. The species group in which hogfish clustered comprised the largest cluster with a total of six other species (Table 6), including groupers, snappers, and grunts. For the WFL hook and line, the APC procedure selected 6 total clusters from a total of 36 species. The species group in which hogfish clustered included seven other species, and similarly included the groupers, grunts, and snappers as in the spear fishing trips (Table 6). For the FLK/SEFL spear, the APC procedure selected five clusters from a total of 25 species. The species group in which hogfish clustered included four other species (Table 6). Lastly for the full time series, for the FLK/SEFL hook and line, the APC procedure selected seven clusters from a total of 27 species. The species group in which hogfish clustered included four other species (Table 6).

Figure 2 presents the frequencies of pounds of hogfish caught per trip for the two stocks and gear types after filtering for only those trips expected to encounter a hogfish (i.e., those trips either catching a hogfish or the associated species) for years 1994-2024.

Standardization Model

The results from the forward-stepwise model selection procedure are presented in Tables 7-14 for the full and truncated time series. The final predictor variables for each model component (two time series, binomial and positives model components, two stocks, and two gear types: sixteen total models) were those that explained greater than 0.5% of the residual deviance/DF in the deviance tables (percent.reduction column). Figures 3-18 present the diagnostics plots for each of the sixteen component models. In

general, the models had relatively good fits to the positives data using a lognormal distribution (QQ plots are approximately normal).

The indices of abundance for the full time series (1994-2024) are presented in Tables 15-18 and Figure 19-22. Overall, the indices were moderately variable during the truncated years until 2017 with average coefficients of variation (CVs) of 18%, 24%, 8%, and 16% for the WFL spear, WFL hook-and-line, FLK/SEFL spear, and FLK/SEFL hook-and-line, respectively. However, after 2017, the average coefficients of variation increased dramatically for hook-and-line gear (66% and 53% for WFL and FLK/SEFL) and modestly increased for spear gear (19% and 13% for WFL and FLK/SEFL). The WFL spear CPUE increased from 1994 to 2012 in a stepwise fashion, with a first increase from 1999-2001, and a second increase from 2008-2012, followed by a subsequent declining trend through 2019, where CPUE has remained stable. The WFL hook-and-line CPUE did not demonstrate a similar pattern to the WFL spear CPUE but instead displayed a gradual decline across the entire time frame, marked with temporary increases from 2000-2003, 2010-2011, and 2014-2015 all of which were followed by declines in abundance. The FLK/SEFL CPUE indices for both spear and hook and line were relatively stable across the early time frame (1994-2016), and both showed drastic declines in 2017 where they remained low yet stable for the rest of the time series.

The indices of abundance for the truncated time series (1994-2017) are presented in Tables 19-22 and Figures 23-26. Overall, the truncated time series indices displayed equal or lower variability than the full time series with average coefficients of variation (CVs) of 17%, 24%, 6%, and 13% for the WFL spear, WFL hook-and-line, FLK/SEFL spear, and FLK/SEFL hook-and-line, respectively. The trends of truncated time series indices are very similar to trends described above for the full time series indices.

Literature Cited

Bodenhofer U, A Kothmeier, and S Hochreiter. 2011. APCluster: an R package for affinity propagation clustering. Bioinformatics 27:2463-2464. DOI: 10.1093/bioinformatics/btr406.

Frey, B. J., & Dueck, D. (2007). Clustering by passing messages between data points. *Science*, *315*, 972-976.

Gulf of Mexico Fishery Management Council. 2017. Amendment 43 to the Fishery Management Plan for Reef Fish Resources of the Gulf of Mexico: Hogfish (including Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility Act Analysis). https://gulfcouncil.org/amendments/reef-fish-amendment-43/

R Core Team. 2025. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

SEDAR 37. 2014. SEDAR 37 - The 2013 stock assessment report for Hogfish in the South Atlantic and Gulf of Mexico. SEDAR, North Charleston, SC. 500 pp.

Seyoum S, Collins AB, Puchulutegui C, McBride RS, Tringali MD. 2014. Genetic population structure of hogfish (Labridae: *Lachnolaimus maximus*) in the southeastern United States. SEDAR 37-01.

South Atlantic Fishery Management Council. 2016. Amendment 37 to the Fishery Management Plan for the Snapper Grouper fishery of the South Atlantic Region: Hogfish (including Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility Act Analysis). https://safmc.net/documents/snapper-grouper-amendment-37/

Zuur, AF, EN Ieno, NJ Walker, AA Saveliev, GM Smith. 2009. Mixed effects models and extensions in ecology with R. Springer Science+Business Media, New York NY. 574pp.

Tables

Table 1. Commercial landings (pounds) by year and gear type for the West Florida (WFL) stock.

Year	Diving	Hook and Line	Long Line	Other	Traps	Grand Total
1986				6634.47		6634.47
1987				9470.52		9470.52
1988				11488.50		11488.50
1989				30496.41		30496.41
1990	4382.07	28620.14		4906.77	1132.64	39041.62
1991	4216.26	27537.16		4721.10	1089.78	37564.29
1992	7569.27	14587.33	172.25	1796.53	2908.85	27034.24
1993	8873.52	21658.33	57.54	1207.13	10484.53	42281.05
1994	10216.22	15269.24	182.22	220.95	5044.68	30933.31
1995	6471.70	8640.18	156.26	31.48	1725.56	17025.18
1996	8398.39	5711.11	314.07	172.63	2388.91	16985.11
1997	9040.50	5701.57	213.20		4014.63	18969.90
1998	7020.27	2683.63	158.12		3184.92	13046.94
1999	4921.51	4560.34	148.26	2.01	3458.99	13091.12
2000	7782.48	8642.47	196.95		1851.44	18473.35
2001	12476.43	6761.89	40.38	5.61	2796.47	22080.79
2002	17615.99	4984.12	19.98		3594.18	26214.27
2003	16205.60	5646.36	80.48	25.00	1330.89	23288.33
2004	17831.30	2051.82	52.17		781.44	20716.73
2005	13211.30	2553.67	148.74		24.42	15938.13
2006	11938.62	1183.82		2.00	1.11	13125.55
2007	13726.31	1695.26	34.41		1.11	15457.09
2008	20328.26	1991.06	107.67	1.00		22428.00
2009	27416.05	2829.06				30245.11
2010	27997.83	5356.53			144.30	33498.66
2011	38326.74	5441.33	87.69		19.98	43875.74
2012	37177.74	3877.43		18.00		41073.17
2013	19001.79	2476.19	55.50		86.58	21620.06
2014	33016.19	1462.54	15.54		154.29	34648.56
2015	23016.21	3762.62		12.00	41.64	26832.47
2016	24700.71	3605.56	17.76		424.02	28748.04
2017	15359.73	752.14		4.44	374.32	16490.62
2018	10023.80	447.61	39.96		154.29	10665.66
2019	9526.71	875.07		1.00	74.37	10477.15
2020	8172.84	325.79		2.00	39.96	8540.59

2021	10458.26	427.41	14.43	2.00		10902.10
2022	8715.31	65.60			5.00	8785.91
2023	8243.62	426.73	35.52	1.00	6.00	8712.87
2024	6733.98	586.08				7320.06

Table 2. Commercial landings (pounds) by year and gear type for the Florida Keys and Southeast Florida (FLK/SEFL) stock.

Year	Diving	Hook and Line	Long Line	Other	Traps	Grand Total
1986		47927.58				47927.58
1987		64211.28				64211.28
1988		64580.91				64580.91
1989		79673.58				79673.58
1990		77555.87				77555.87
1991	15225.93	25520.92	18.18	88.74	29775.02	70628.79
1992	24877.33	45528.72	758.42	663.06	21162.82	92990.35
1993	24959.22	48438.55	11.73	132.68	21461.18	95003.36
1994	23439.45	32543.92		150.33	6895.69	63029.39
1995	17731.35	22513.59	1302.88	329.86	6366.62	48244.29
1996	17441.91	20095.69	84.25	199.58	5902.57	43724.00
1997	15330.63	23516.87	10.53	134.62	8452.31	47444.97
1998	15576.45	11453.60	18.52	174.36	7362.53	34585.47
1999	9643.76	8948.32	2.28	207.85	15769.31	34571.52
2000	11666.36	8103.81	13.97	6.29	11217.54	31007.97
2001	12083.22	9307.78	156.42	3.13	2275.49	23826.05
2002	12952.29	9206.65		87.65	1890.44	24137.03
2003	8571.27	14580.87	218.67	38.00	2686.93	26095.73
2004	12382.67	13522.15	88.80	58.00	2404.37	28455.99
2005	8786.89	6718.02	17.76	6.00	1336.82	16865.48
2006	8191.12	4113.95		21.71	1891.55	14218.33
2007	7466.20	5414.64	314.13	10.00	1314.96	14519.93
2008	7491.27	4317.49	14.45	1.00	1397.33	13221.55
2009	7354.85	5308.82		8.00	1653.46	14325.13
2010	5381.21	5337.18		5.00	994.84	11718.22
2011	6291.79	4915.75		60.72	1273.39	12541.65
2012	8226.75	3819.78		11.77	2136.08	14194.38
2013	10881.86	4395.31		39.96	1824.40	17141.53
2014	13328.05	5102.47		57.28	3066.26	21554.06
2015	14201.26	4434.24	42.18	25.53	3360.97	22064.18
2016	11708.49	3978.83	12.21	4.00	1941.06	17644.59
2017	8066.47	1862.37	16.65		692.75	10638.24
2018	3548.80	824.24			169.05	4542.09
2019	1795.03	272.84			262.40	2330.27
2020	2623.57	211.28		25.53	95.24	2955.61
2021	2971.69	333.09			77.59	3382.37
2022	2619.23	348.68		1.00	85.03	3053.93
2023	2276.14	135.46			95.46	2507.06

2024	2220.12	181.08		10.00	54.17	2465.36

Table 3. Number of Florida trip tickets from 1994-2024 with recorded landings of each species for the two stocks (West Florida, WFL; Florida Keys and Southeast Florida, FLK/SEFL) and gear types (spearfishing, Spear; and hook-and-line, HL). Note: only those species that were caught on greater than 1% of the total trips catching hogfish are presented and subsequently used in the cluster analysis.

WFL Spear		WFL HL		FLK/SEFL Spear		FLK/SEFL HL	
Species	**# Trips**	**Species**	**# Trips**	**Species**	**# Trips**	**Species**	**# Trips**
FLOUNDERS (GULF)	8742	RED GROUPER	59289	HOGFISH	8940	KING MACKEREL	165157
GREY SNAPPER	3194	GAG GROUPER	44748	BLACK GROUPER	8038	YELLOWTAIL SNAPPER	120041
GAG GROUPER	3192	GREY SNAPPER	34724	GREY SNAPPER	7894	DOLPHIN	67499
FLOUNDERS (OTHER)	3144	GRUNTS	25286	RED GROUPER	6687	BLUE RUNNER	64885
RED GROUPER	2997	RED SNAPPER	15972	MUTTON SNAPPER	5335	LITTLE TUNNY (BONITO)	58539
HOGFISH	2876	SCAMP GROUPER	15572	SHEEPSHEAD	3590	GREY SNAPPER	52828
SHEEPSHEAD	2836	LANE SNAPPER	14849	GAG GROUPER	3135	MUTTON SNAPPER	39659
BLACK MULLET	1070	VERMILION SNAPPER	14742	FLOUNDERS (OTHER)	1342	CREVALLE JACK	27911
SCAMP GROUPER	1047	TRIGGERFISH	14265	FLOUNDERS (SOUTHERN)	1262	BLACK GROUPER	25264
TRIGGERFISH	852	SPOTTED SEATROUT	13533	COBIA	1141	GRUNTS	23180
RED SNAPPER	781	PORGIES (OTHER)	10851	YELLOWTAIL SNAPPER	1109	AMBERJACKS (GREATER)	21818
AMBERJACKS (GREATER)	760	SPANISH MACKEREL	7378	TRIGGERFISH	1042	SPANISH MACKEREL	17681
GRUNTS	667	CREVALLE JACK	6675	AMBERJACKS (GREATER)	1002	RED GROUPER	16466
BLACK GROUPER	555	PORGIES (RED)	6521	GRUNTS (MARGATES)	753	POMPANO	12438

VERMILION SNAPPER	398	AMBERJACKS (GREATER)	6372	MOJARRA	743	SPOTTED SEATROUT	12244
AMBERJACKS (ALMACO)	353	BLACK GROUPER	6356	GRUNTS	660	COBIA	10998
COBIA	309	PINFISH	6318	BLACK MULLET	597	SNOWY GROUPER	9663
MUTTON SNAPPER	298	KING MACKEREL	4699	RED SNAPPER	427	BLUEFISH	8672
BLACK DRUM	294	SHEEPSHEAD	4693	CREVALLE JACK	396	WAHOO	7218
PORGIES (OTHER)	292	POMPANO	4407	TRIGGERFISH	395	LADYFISH	7105
PORGIES (JOLTHEAD)	237	LADYFISH	4328	BLACK DRUM	359	HOGFISH	6455
LANE SNAPPER	215	COBIA	4088	DOLPHIN	353	MOJARRA	6265
PORGIES (RED)	213	BLACK MULLET	3822	KING MACKEREL	325	LANE SNAPPER	5789
GRUNTS (MARGATES)	170	YELLOWTAIL SNAPPER	3370	BLUE RUNNER	297	BLUELINE TILEFISH	5531
		DOLPHIN	2969	SCAMP GROUPER	278	BIGEYE SCAD	5447
		MOJARRA	2942	PORGIES (OTHER)	264	TRIGGERFISH	4987
		BLUEFISH	2705				
		GRUNTS (MARGATES)	2619				
		MUTTON SNAPPER	2401				
		HOGFISH	2237				
		PORGIES (KNOBBED)	2231				
		PORGIES (JOLTHEAD)	2131				
		FLOUNDERS (OTHER)	2086				
		FLOUNDERS (GULF)	1831				
		KINGFISH (WHITING)	1623				
		BLUE RUNNER	1577				
		SILK SNAPPER	1284				

Table 4. Number of Florida trip tickets from 1994-2017 with recorded landings of each species for the two stocks (West Florida, WFL; Florida Keys and Southeast Florida, FLK/SEFL) and gear types (spearfishing, Spear; and hook-and-line, HL). Note: only those species that were caught on greater than 1% of the total trips catching hogfish are presented and subsequently used in the cluster analysis.

WFL Spear		WFL HL		FLK/SEFL Spear		FLK/SEFL HL	
Species	**# Trips**	**Species**	**# Trips**	**Species**	**# Trips**	**Species**	**# Trips**
FLOUNDERS (GULF)	6625	GROUPER, RED	45533	HOGFISH	7388	MACKEREL, KING	130778
GROUPER, GAG	2523	GROUPER, GAG	36742	SNAPPER, GREY (MANGROVE)	6360	SNAPPER, YELLOWTAIL	92212
FLOUNDERS (OTHER)	2495	SNAPPER, GREY (MANGROVE)	26611	GROUPER, BLACK	5970	DOLPHIN	55390
SNAPPER, GREY (MANGROVE)	2420	GRUNTS	21155	GROUPER, RED	5500	BLUE RUNNER	50460
GROUPER, RED	2240	GROUPER, SCAMP	11527	SNAPPER, MUTTON	3826	TUNNY, LITTLE (BONITO)	45266
HOGFISH	2226	SEATROUT, SPOTTED	10460	GROUPER, GAG	2488	SNAPPER, GREY (MANGROVE)	41409
SHEEPSHEAD	1988	TRIGGERFISH	10382	SHEEPSHEAD	2221	SNAPPER, MUTTON	30744
GROUPER, SCAMP	780	SNAPPER, VERMILION	10108	FLOUNDERS (SOUTHERN)	943	JACK, CREVALLE	21520
MULLET, BLACK	742	SNAPPER, RED	9735	FLOUNDERS (OTHER)	901	GRUNTS	20659
TRIGGERFISH	670	SNAPPER, LANE	9670	SNAPPER, YELLOWTAIL	890	GROUPER, BLACK	19943
AMBERJACKS (GREATER)	620	PORGIES (OTHER)	8083	COBIA	888	AMBERJACKS	17349
GRUNTS	563	PINFISH	5947	TRIGGERFISH	696	MACKEREL, SPANISH	12797

SNAPPER, RED	446	MACKEREL, SPANISH	5440	AMBERJACKS (GREATER)	689	GROUPER, RED	12708
GROUPER, BLACK	339	JACK, CREVALLE	5369	GRUNTS (MARGATES)	571	SEATROUT, SPOTTED	10680
PORGIES (OTHER)	263	AMBERJACKS (GREATER)	4611	GRUNTS	524	POMPANO	9058
SNAPPER, VERMILION	251	PORGIES (RED)	4411	MULLET, BLACK	368	COBIA	8970
COBIA	220	GROUPER, BLACK	4284	MOJARRA	365	GROUPER, SNOWY	7336
DRUM, BLACK	217	SHEEPSHEAD	3923	JACK, CREVALLE	359	BLUEFISH	6775
PORGIES (RED)	169	MULLET, BLACK	3591	DOLPHIN	310	WAHOO	5892
GRUNTS (MARGATES)	145	POMPANO	3464	BLUE RUNNER	273	MOJARRA	5262
SNAPPER, MUTTON	129	MACKEREL, KING	3320	MACKEREL, KING	258	HOGFISH	4940
		LADYFISH	3220	DRUM, BLACK	213	SNAPPER, LANE	4373
		COBIA	3206	PORGIES (OTHER)	213	TRIGGERFISH	4315
		MOJARRA	2412	SNAPPER, RED	211	TILEFISH, BLUELINE (GRAY)	4062
		BLUEFISH	2194	TRIGGERFISH	198	LADYFISH	3976
		DOLPHIN	2143			SCAD, BIGEYE (GOGGLE EYE)	3710
		GRUNTS (MARGATES)	2115			GROUPER, GAG	3639
		PORGIES (KNOBBED)	1777				
		SNAPPER, YELLOWTAIL	1710				
		HOGFISH	1667				
		SNAPPER, MUTTON	1579				
		FLOUNDERS (GULF)	1555				
		FLOUNDERS (OTHER)	1533				
		KINGFISH (WHITING)	1279				

	PORGIES (JOLTHEAD)	1253
	BLUE RUNNER	991

Table 5. Species clusters for the two stocks (West Florida, WFL; Florida Keys and Southeast Florida, FLK/SEFL) and gear types (spearfishing, hook-and-line) used to select those trips where a hogfish was likely to occur for 1994-2024.

WFL Spear	WFL HL	FLK/SEFL Spear	FLK/SEFL HL
AMBERJACKS	COBIA	GROUPER, BLACK	AMBERJACKS
ALMACO JACK	GROUPER, BLACK	GROUPER, RED	GROUPER, BLACK
COBIA	GROUPER, GAG	HOGFISH	GROUPER, RED
GROUPER, GAG	GROUPER, RED	SNAPPER, GREY (MANGROVE)	HOGFISH
GROUPER, RED	GRUNTS	SNAPPER, MUTTON	SNAPPER, MUTTON
GROUPER, SCAMP	GRUNTS		TRIGGERFISH
GRUNTS	HOGFISH		
GRUNTS (MARGATES)	SNAPPER, GREY (MANGROVE)		
HOGFISH			
SNAPPER, GREY (MANGROVE)			
TRIGGERFISH			

Table 6. Species clusters for the two stocks (West Florida, WFL; Florida Keys and Southeast Florida, FLK/SEFL) and gear types (spearfishing, hook-and-line) used to select those trips where a hogfish was likely to occur for 1994-2017.

WFL Spear	WFL HL	FLK/SEFL Spear	FLK/SEFL HL
COBIA	GROUPER, GAG	GROUPER, BLACK	AMBERJACKS
GROUPER, GAG	GROUPER, RED	GROUPER, RED	GROUPER, RED
GROUPER, RED	GRUNTS	HOGFISH	GRUNTS
GRUNTS	GRUNTS (MARGATES)	SNAPPER, GREY (MANGROVE)	HOGFISH
GRUNTS (MARGATES)	HOGFISH	SNAPPER, MUTTON	SNAPPER, MUTTON
HOGFISH	SNAPPER, GREY (MANGROVE)		
SNAPPER, GREY (MANGROVE)			

Table 7. Deviance tables for the binomial and positive components of the WFL spear model for 1994-2024. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	3881	4911.917	4973.917	0
dep	-6	73.62984	3875	4838.288	4912.288	1.346486
days_fish	-3	98.60595	3872	4739.682	4819.682	1.935714
month	-5	14.89418	3867	4724.787	4814.787	0.179268

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	2577	4092.175	8640.069	0
days_fish	-3	396.3119	2574	3695.864	8380.412	9.579363
dep	-6	35.86245	2568	3660.001	8366.982	0.668175
month	-5	26.37362	2563	3633.627	8358.121	0.472917

Table 8. Deviance table for the binomial and positive components of the WFL hook-and-line model for 1994-2024. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	69034	14592.12	14654.12	0
dep	-5	734.6364	69029	13857.49	13929.49	5.027593
days_fish	-3	26.14156	69026	13831.35	13909.35	0.175042
month	-5	18.75821	69021	13812.59	13900.59	0.121707

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	1545	2476.177	5248.572	0
days_fish	-3	51.6782	1542	2424.498	5221.332	1.896524
month	-5	26.53995	1537	2397.959	5213.985	0.758251
dep	-5	20.18763	1532	2377.771	5210.661	0.504486

Table 9. Deviance table for the binomial and positive components of the FLK/SEFL spear model for 1994-2024. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	15179	20219.06	20281.06	0
dep	-5	1008.385	15174	19210.68	19282.68	4.955989
month	-5	23.9778	15169	19186.7	19268.7	0.08734
days_fish	-2	11.17932	15167	19175.52	19261.52	0.042813

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	7691	8864.937	23043.96	0
days_fish	-2	337.4752	7689	8527.462	22748.25	3.781833
month	-5	118.535	7684	8408.927	22650.16	1.27573
dep	-5	46.30216	7679	8362.625	22617.52	0.461303

Table 10. Deviance table for the binomial and positive components of the FLK/SEFL hook-and-line model for 1994-2024. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	67075	32188.67	32250.67	0
dep	-5	1905.45	67070	30283.22	30355.22	5.912617
region	-1	1043.814	67069	29239.41	29313.41	3.241686
month	-5	463.9708	67064	28775.44	28859.44	1.434874
days_fish	-2	22.68081	67062	28752.76	28840.76	0.067809

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	4461	6549.249	14505.46	0
days_fish	-2	331.7397	4459	6217.509	14275.96	5.022728
dep	-5	72.8001	4454	6144.709	14233.06	1.006706
region	-1	22.97873	4453	6121.73	14218.23	0.330388
month	-5	20.62711	4448	6101.103	14213.07	0.210613

Table 11. Deviance tables for the binomial and positive components of the WFL spear model for 1994-2017. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	3108	3863.074	3911.074	0
days_fish	-3	62.13024	3105	3800.944	3854.944	1.513246
dep	-5	83.97893	3100	3716.965	3780.965	2.020649
month	-5	14.92665	3095	3702.038	3776.038	0.232174

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	2113	3281.767	7031.272	0
days_fish	-3	468.5282	2110	2813.239	6708.076	14.15482
dep	-5	62.71549	2105	2750.524	6669.897	1.714383
month	-5	33.17124	2100	2717.352	6653.968	0.816719

Table 12. Deviance table for the binomial and positive components of the WFL hook-and-line model for 1994-2017. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	60486	13905	13953	0
dep	-5	730.4014	60481	13174.59	13232.59	5.244966
days_fish	-3	22.27263	60478	13152.32	13216.32	0.155498
month	-5	20.96505	60473	13131.36	13205.36	0.142984

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	1499	2415.769	5074.701	0
days_fish	-3	51.44392	1496	2364.325	5047.918	1.933241
month	-5	25.37461	1491	2338.951	5041.485	0.727147
dep	-5	20.01776	1486	2318.933	5038.394	0.508356

Table 13. Deviance table for the binomial and positive components of the FLK/SEFL spear model for 1994-2017. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	10711	13650.61	13698.61	0
dep	-5	712.2894	10706	12938.32	12996.32	5.173737
month	-5	37.73728	10701	12900.59	12968.59	0.232402
region	-1	26.07045	10700	12874.52	12944.52	0.18234
days_fish	-2	4.190158	10698	12870.33	12944.33	0.013083

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	6989	8451.421	21260.44	0
days_fish	-2	333.2023	6987	8118.218	20982.35	3.915064
month	-5	140.4631	6982	7977.755	20869.95	1.594863
dep	-5	42.30001	6977	7935.455	20842.66	0.433653

Table 14. Deviance table for the binomial and positive components of the FLK/SEFL hook-and-line model for 1994-2017. The null model with year as a predictor is listed as step 0, and subsequent steps list the most predictive factors.

Binomial						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	63714	31580.85	31628.85	0
region	-1	2184.366	63713	29396.48	29446.48	6.915283
dep	-5	960	63708	28436.48	28496.48	3.032798
month	-5	403.2428	63703	28033.24	28103.24	1.270011
days_fish	-2	24.82626	63701	28008.41	28082.41	0.07584

Positive						
Step	**Df**	**Deviance**	**Resid. Df**	**Resid. Dev**	**AIC**	**percent.reduction**
	NA	NA	4352	6487.914	14191.85	0
days_fish	-2	342.6665	4350	6145.248	13958.39	5.238064
dep	-5	69.47673	4345	6075.771	13918.64	0.963542
region	-1	21.69478	4344	6054.076	13904.99	0.313411
month	-5	20.21201	4339	6033.864	13900.35	0.20474

Table 15. Standardized index of abundance from the WFL spear model for 1994-2024

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	50	28	22.46	6.74	0.30
1995	85	58	28.68	5.91	0.21
1996	155	101	24.96	4.10	0.16
1997	130	91	25.50	4.33	0.17
1998	112	71	23.76	4.61	0.19
1999	117	62	18.16	3.97	0.22
2000	145	95	22.89	3.83	0.17
2001	137	87	50.50	8.67	0.17
2002	151	106	43.69	7.05	0.16
2003	153	97	37.92	6.39	0.17
2004	111	77	34.19	6.33	0.19
2005	101	59	38.53	8.16	0.21
2006	92	56	37.06	8.01	0.22
2007	91	49	41.14	9.86	0.24
2008	151	114	54.15	8.19	0.15
2009	178	123	65.92	9.98	0.15
2010	178	125	71.70	10.44	0.15
2011	148	102	77.60	12.40	0.16
2012	126	98	80.22	12.68	0.16
2013	115	81	46.37	8.37	0.18
2014	190	139	55.85	7.63	0.14
2015	164	115	38.91	5.89	0.15
2016	157	120	61.95	9.15	0.15
2017	123	83	44.20	7.73	0.17
2018	119	79	31.26	5.75	0.18
2019	136	81	18.97	3.53	0.19
2020	126	70	19.36	3.97	0.21
2021	98	65	32.13	6.31	0.20
2022	91	64	27.27	5.43	0.20
2023	101	58	22.28	4.90	0.22
2024	81	54	21.73	4.59	0.21

Table 16. Standardized index of abundance for the WFL hook-and-line model for 1994-2024

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	2630	149	0.73	0.10	0.14
1995	2786	86	0.69	0.12	0.18
1996	3014	111	0.62	0.10	0.16
1997	3101	92	0.50	0.09	0.17
1998	3618	70	0.27	0.05	0.20
1999	3624	78	0.33	0.06	0.18
2000	4230	136	0.64	0.09	0.14
2001	3770	141	0.65	0.09	0.14
2002	3403	118	0.81	0.13	0.16
2003	3270	64	0.49	0.10	0.20
2004	3225	53	0.23	0.05	0.23
2005	2649	47	0.41	0.10	0.24
2006	2153	28	0.39	0.12	0.32
2007	2099	21	0.24	0.08	0.36
2008	2138	24	0.43	0.14	0.34
2009	2750	36	0.47	0.13	0.28
2010	1609	30	0.97	0.28	0.29
2011	1521	58	1.55	0.33	0.21
2012	1574	21	0.61	0.22	0.36
2013	1745	25	0.24	0.08	0.32
2014	1885	29	0.21	0.06	0.30
2015	1774	48	1.43	0.34	0.24
2016	1601	43	0.80	0.20	0.25
2017	1461	15	0.31	0.13	0.42
2018	1251	6	0.16	0.11	0.72
2019	1136	12	0.17	0.08	0.49
2020	1109	8	0.08	0.05	0.61
2021	1117	13	0.12	0.06	0.46
2022	987	4	0.01	0.01	0.91
2023	959	4	0.46	0.42	0.91
2024	876	6	0.43	0.32	0.73

Table 17. Standardized index of abundance for the FLK/SEFL spear model for 1994-2024.

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	474	241	11.78	1.01	0.09
1995	517	264	10.66	0.90	0.08
1996	669	403	10.34	0.71	0.07
1997	855	487	7.74	0.48	0.06
1998	834	487	8.81	0.57	0.06
1999	498	274	7.43	0.61	0.08
2000	570	346	8.64	0.62	0.07
2001	677	401	9.08	0.63	0.07
2002	748	444	7.79	0.51	0.07
2003	552	292	8.14	0.67	0.08
2004	538	342	9.89	0.73	0.07
2005	479	317	9.76	0.74	0.08
2006	428	265	8.15	0.68	0.08
2007	428	259	7.84	0.65	0.08
2008	336	214	10.11	0.89	0.09
2009	412	197	8.49	0.81	0.10
2010	308	141	9.14	1.02	0.11
2011	373	156	9.42	1.02	0.11
2012	413	163	9.38	1.00	0.11
2013	533	276	11.76	0.94	0.08
2014	544	232	10.66	0.93	0.09
2015	577	322	12.71	0.94	0.07
2016	466	273	12.99	1.03	0.08
2017	522	217	8.00	0.74	0.09
2018	370	115	5.37	0.68	0.13
2019	393	87	3.57	0.53	0.15
2020	447	113	4.76	0.61	0.13
2021	320	98	5.91	0.79	0.13
2022	306	100	6.00	0.80	0.13
2023	329	96	5.50	0.76	0.14
2024	294	100	5.69	0.76	0.13

Table 18. Standardized index of abundance for the FLK/SEFL hook-and-line model for 1994-2024.

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	2454	231	1.12	0.16	0.14
1995	3527	364	1.13	0.13	0.11
1996	3871	326	1.03	0.12	0.12
1997	3971	239	0.78	0.11	0.14
1998	3698	241	0.70	0.09	0.13
1999	2478	117	0.63	0.12	0.19
2000	2483	218	1.10	0.16	0.14
2001	3106	280	1.13	0.14	0.13
2002	2848	286	1.29	0.16	0.13
2003	3046	317	1.60	0.19	0.12
2004	3187	253	1.20	0.16	0.13
2005	2669	150	0.86	0.15	0.17
2006	2041	133	1.06	0.19	0.18
2007	1948	122	0.89	0.17	0.19
2008	1882	129	1.19	0.22	0.18
2009	2372	152	1.33	0.22	0.16
2010	2240	119	1.58	0.30	0.19
2011	2194	114	1.15	0.22	0.19
2012	1842	124	1.26	0.23	0.18
2013	1644	107	1.20	0.24	0.20
2014	1863	138	1.27	0.22	0.17
2015	1653	96	1.13	0.23	0.21
2016	1678	85	1.00	0.22	0.22
2017	1389	35	0.46	0.16	0.34
2018	1220	15	0.19	0.10	0.54
2019	1104	26	0.22	0.09	0.41
2020	1001	14	0.14	0.08	0.57
2021	881	8	0.11	0.09	0.79
2022	983	26	0.30	0.12	0.40
2023	923	10	0.11	0.07	0.67
2024	910	17	0.16	0.08	0.51

Table 19. Standardized index of abundance from the WFL spear model for 1994-2017

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	49	28	23.41	7.00	0.30
1995	84	58	29.54	5.98	0.20
1996	155	101	25.86	4.10	0.16
1997	129	91	26.09	4.35	0.17
1998	110	71	25.31	4.80	0.19
1999	116	62	20.55	4.37	0.21
2000	143	95	25.01	4.11	0.16
2001	135	87	54.85	9.16	0.17
2002	149	106	47.35	7.35	0.16
2003	152	97	40.39	6.56	0.16
2004	110	77	37.85	6.68	0.18
2005	99	59	43.33	9.02	0.21
2006	91	56	35.97	7.56	0.21
2007	91	49	40.91	9.59	0.23
2008	150	114	56.45	8.02	0.14
2009	178	123	68.66	9.83	0.14
2010	174	125	75.33	10.50	0.14
2011	147	102	83.18	12.83	0.15
2012	126	98	85.28	12.61	0.15
2013	115	81	49.10	8.37	0.17
2014	186	139	58.40	7.56	0.13
2015	163	115	44.33	6.47	0.15
2016	157	120	66.94	9.23	0.14
2017	123	83	51.26	8.71	0.17

Table 20. Standardized index of abundance for the WFL hook-and-line model for 1994-2017

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	2561	149	0.76	0.11	0.14
1995	2666	86	0.74	0.13	0.18
1996	2851	111	0.66	0.11	0.16
1997	3005	92	0.51	0.09	0.17
1998	3503	70	0.28	0.06	0.20
1999	3548	78	0.34	0.06	0.19
2000	4148	136	0.66	0.10	0.15
2001	3706	141	0.66	0.10	0.14
2002	3353	118	0.84	0.13	0.16
2003	3235	64	0.50	0.10	0.21
2004	3200	53	0.23	0.05	0.23
2005	2627	47	0.42	0.10	0.24
2006	2139	28	0.40	0.13	0.31
2007	2086	21	0.24	0.09	0.36
2008	2110	24	0.44	0.15	0.33
2009	2732	36	0.49	0.13	0.27
2010	1596	30	0.98	0.29	0.30
2011	1510	58	1.58	0.35	0.22
2012	1550	21	0.64	0.23	0.36
2013	1723	25	0.25	0.08	0.33
2014	1869	29	0.21	0.06	0.30
2015	1757	48	1.47	0.35	0.24
2016	1590	43	0.82	0.21	0.25
2017	1445	15	0.32	0.14	0.43

Table 21. Standardized index of abundance for the FLK/SEFL spear model for 1994-2017.

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	393	241	14.62	0.92	0.06
1995	438	264	13.17	0.81	0.06
1996	577	403	12.70	0.65	0.05
1997	733	487	9.63	0.46	0.05
1998	752	487	10.41	0.51	0.05
1999	426	274	9.30	0.57	0.06
2000	494	346	10.64	0.58	0.05
2001	584	401	11.22	0.59	0.05
2002	651	444	9.52	0.48	0.05
2003	432	292	11.25	0.67	0.06
2004	479	342	11.88	0.68	0.06
2005	438	317	11.26	0.65	0.06
2006	362	265	10.32	0.64	0.06
2007	356	259	10.01	0.63	0.06
2008	278	214	12.84	0.87	0.07
2009	338	197	10.93	0.78	0.07
2010	263	141	11.20	0.94	0.08
2011	283	156	12.90	1.02	0.08
2012	324	163	12.16	0.94	0.08
2013	428	276	14.75	0.90	0.06
2014	435	232	13.38	0.87	0.06
2015	472	322	15.82	0.88	0.06
2016	388	273	15.91	0.96	0.06
2017	411	217	10.35	0.70	0.07

Table 22. Standardized index of abundance for the FLK/SEFL hook-and-line model for 1994-2017.

Year	Total.num.trips	Num.pos	Mean	std.dev	CV
1994	2336	231	0.93	0.10	0.11
1995	3609	364	0.90	0.08	0.09
1996	3974	326	0.80	0.07	0.09
1997	4612	239	0.52	0.05	0.10
1998	4138	241	0.51	0.05	0.11
1999	2797	117	0.43	0.06	0.15
2000	2832	218	0.77	0.08	0.11
2001	3637	280	0.78	0.08	0.10
2002	3498	286	0.88	0.09	0.10
2003	3319	317	1.25	0.12	0.10
2004	3238	253	0.99	0.10	0.10
2005	2673	150	0.73	0.10	0.13
2006	2275	133	0.77	0.11	0.14
2007	1999	122	0.70	0.10	0.14
2008	2133	129	0.83	0.12	0.14
2009	2447	152	1.01	0.13	0.13
2010	2306	119	1.13	0.16	0.14
2011	2225	114	0.82	0.12	0.15
2012	1881	124	0.91	0.13	0.14
2013	1636	107	0.93	0.14	0.15
2014	1774	138	1.03	0.14	0.14
2015	1515	96	0.98	0.16	0.16
2016	1560	85	0.82	0.14	0.17
2017	1324	35	0.35	0.09	0.27

Figures

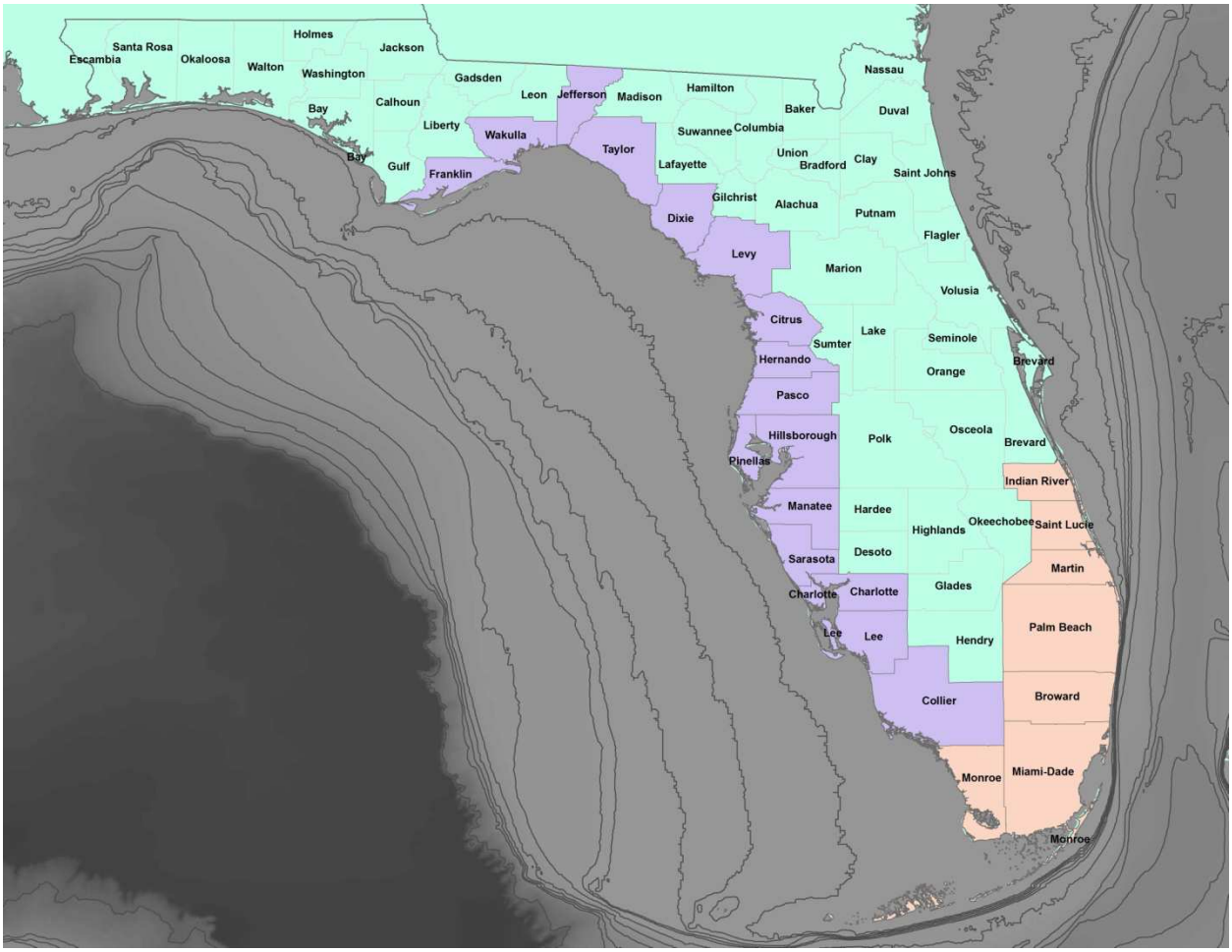

Figure 1. Florida county delineations used to represent the core distributions of the two Hogfish stocks: West Florida (WFL; purple) and Southeast Florida including the Keys (FLK/SEFL; peach).

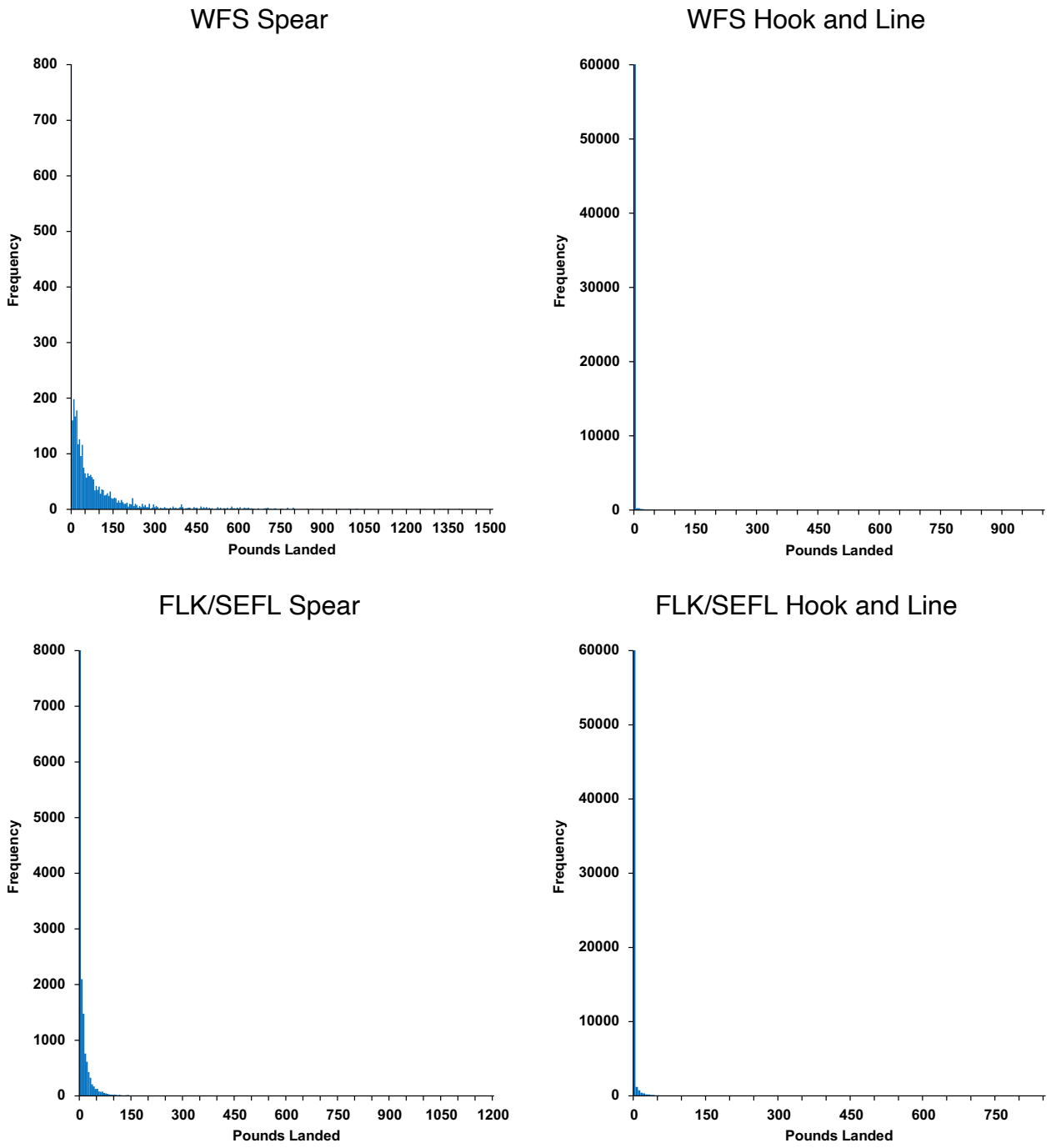

Figure 2. Frequencies for the pounds of hogfish landed per trip using spear fishing (a, c) and hook and line (b, d) for the WFL stock (a, b) and the FLK/SEFL stock (c, d) for years 1994-2024.

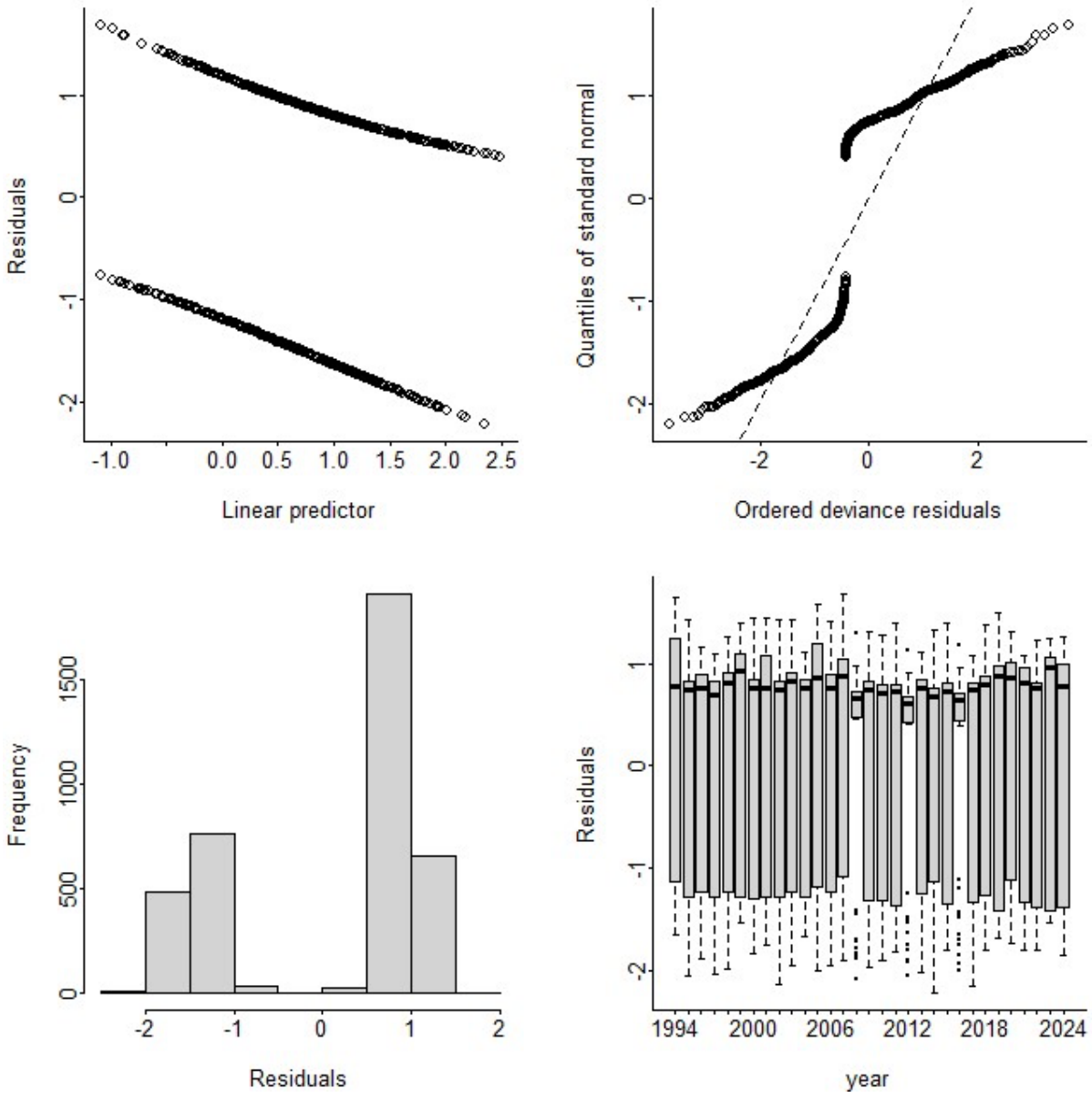

Figure 3. Diagnostic plots from the binomial component of the WFL spear model for 1994-2024.

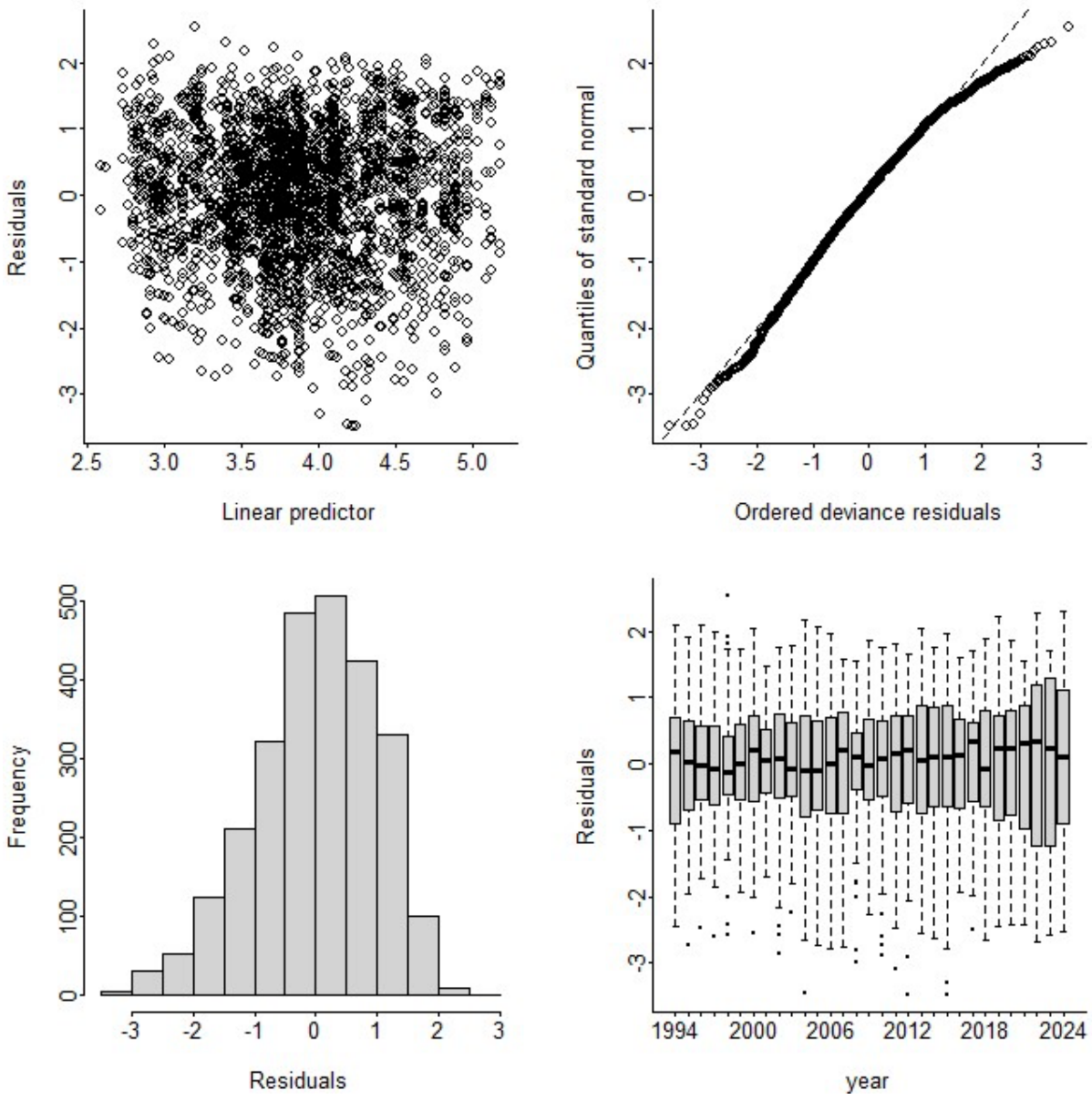

Figure 4. Diagnostic plots from the positive component of the WFL spear model for 1994-2024.

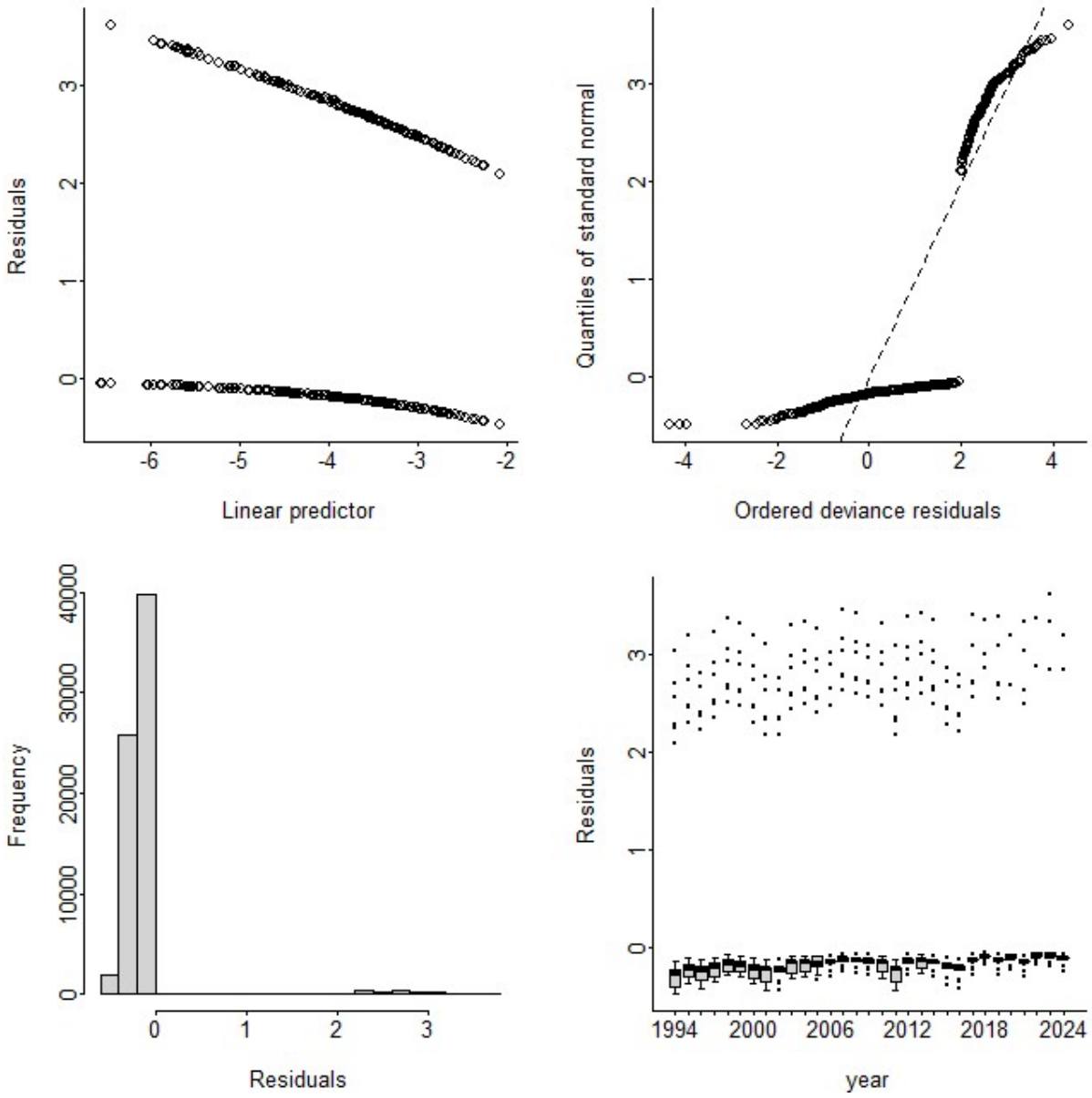

Figure 5. Diagnostic plots from the binomial component of the WFL hook-and-line model for 1994-2024.

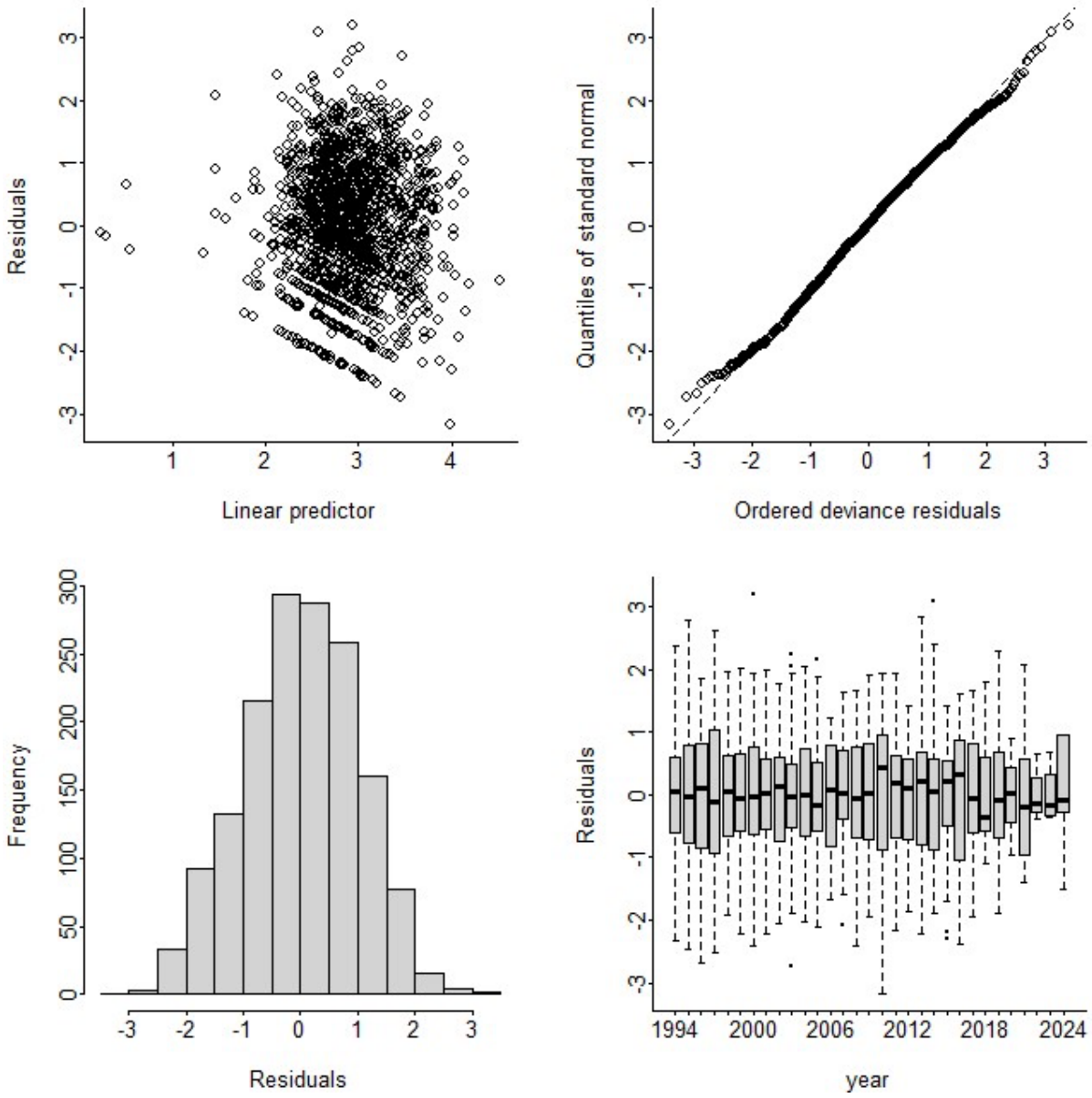

Figure 6. Diagnostic plots from the positive component of the WFL hook-and-line model for 1994-2024.

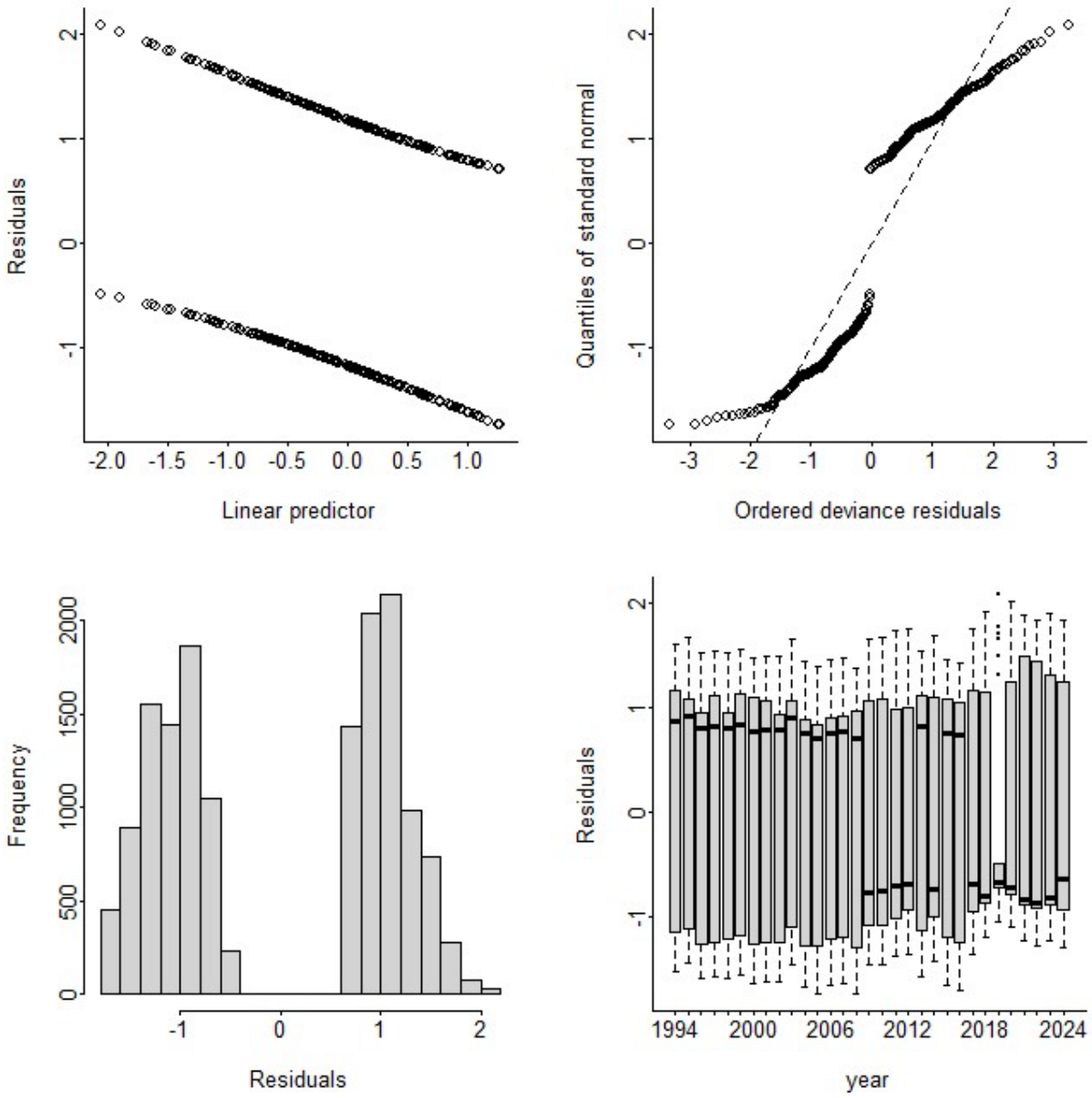

Figure 7. Diagnostic plots from the binomial component of the FLK/SEFL spear model for 1994-2024.

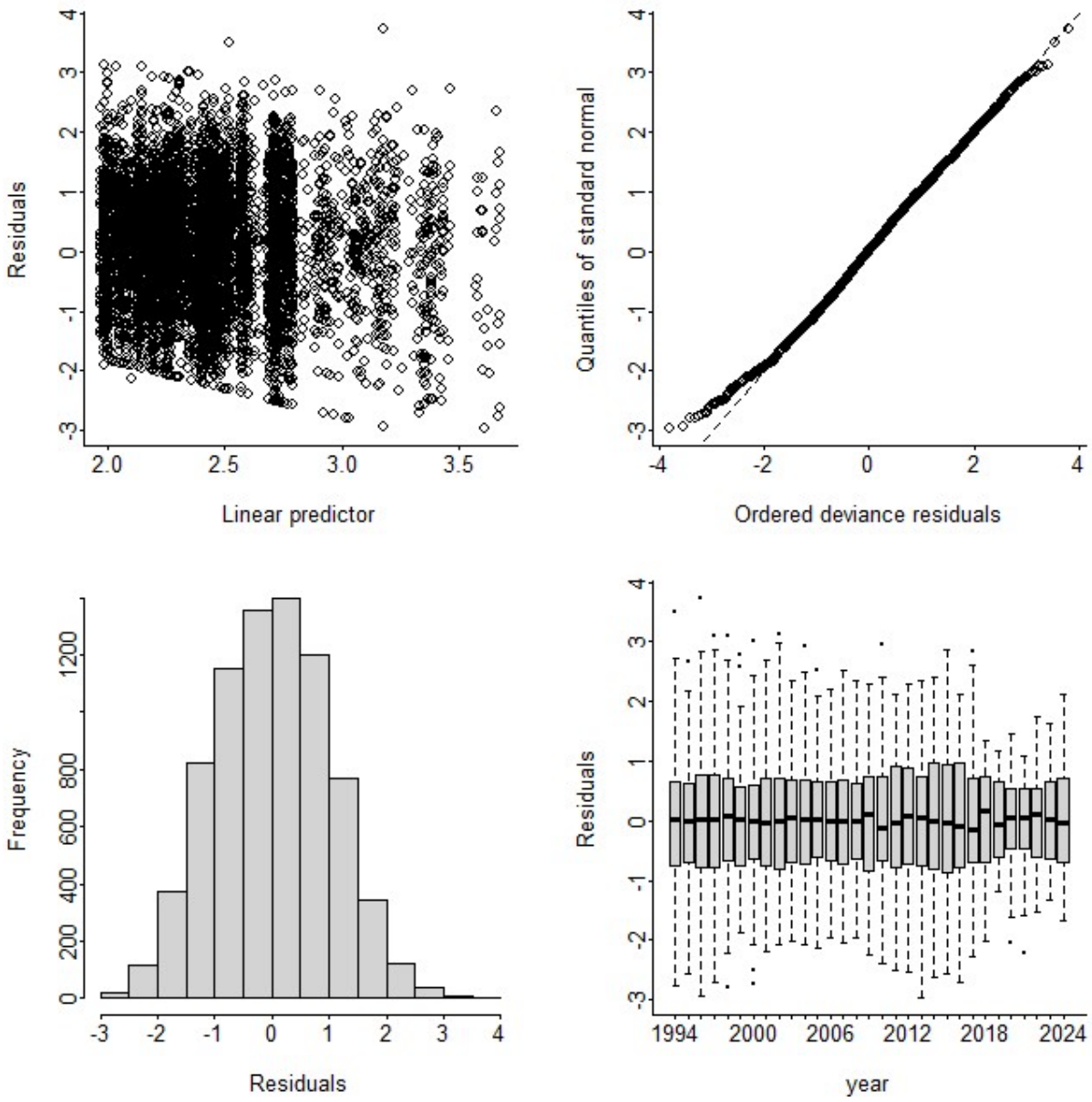

Figure 8. Diagnostic plots from the positive component of the FLK/SEFL spear model for 1994-2024.

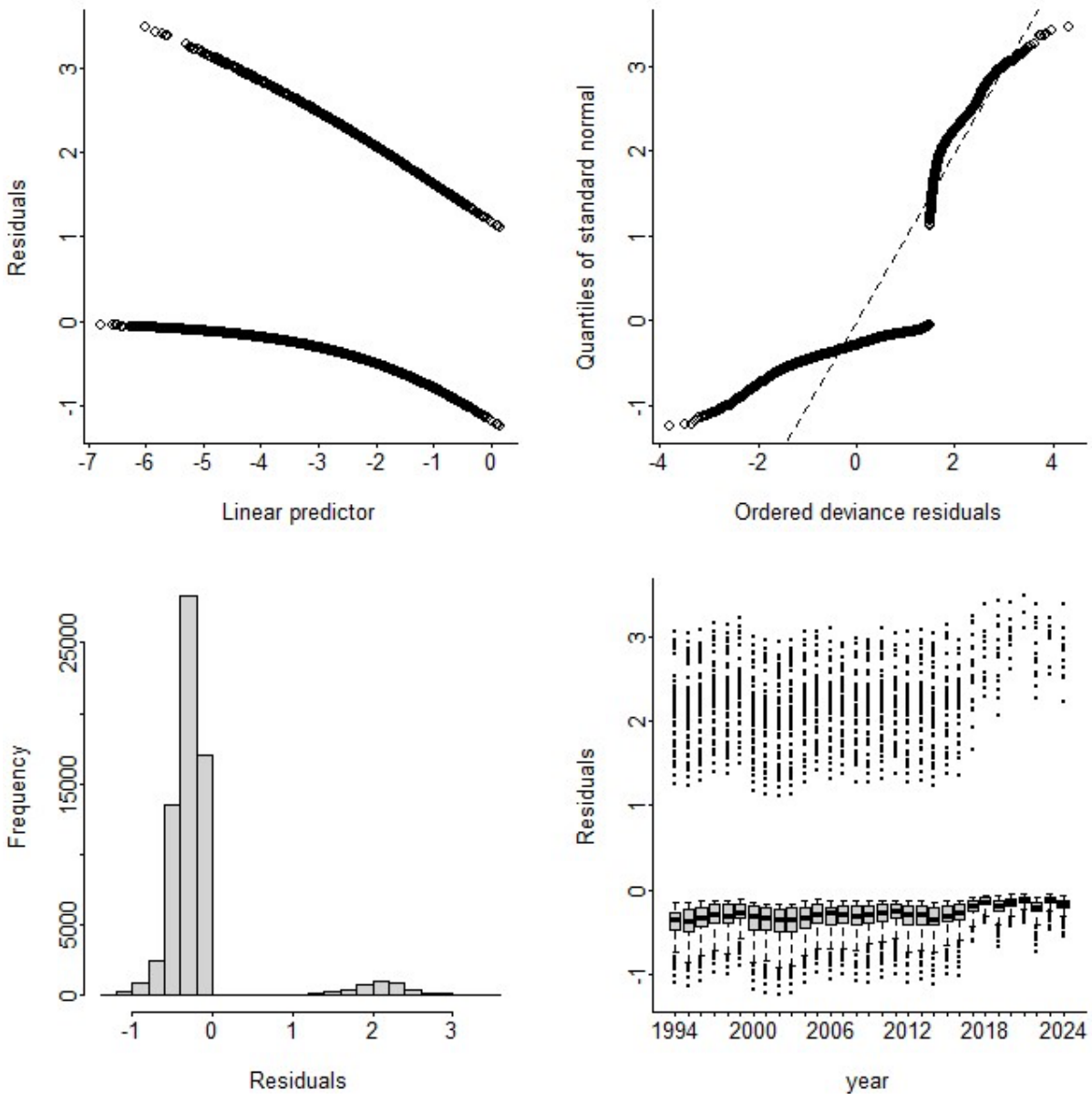

Figure 9. Diagnostic plots from the binomial component of the FLK/SEFL hook-and-line model for 1994-2024.

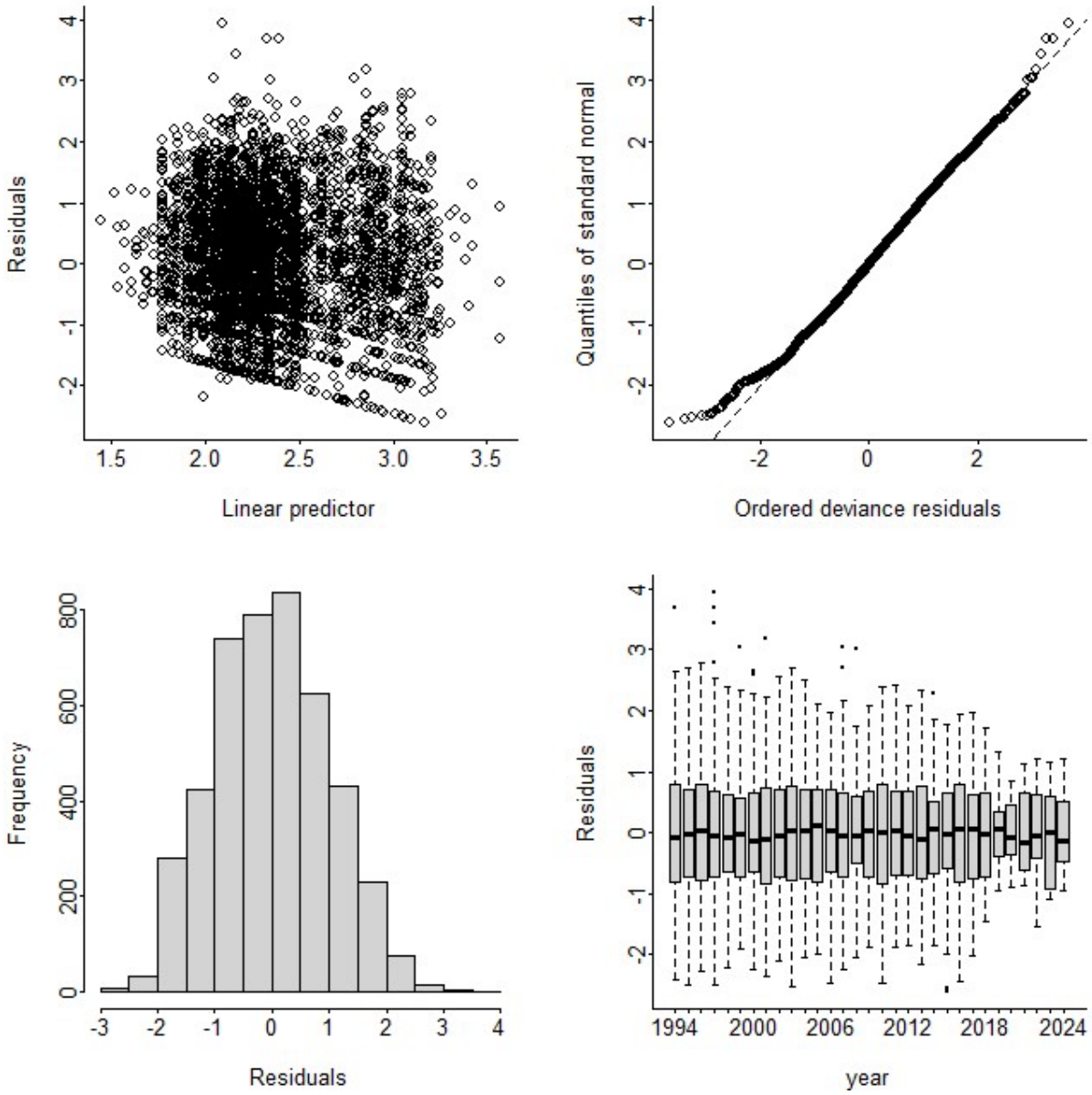

Figure 10. Diagnostic plots from the positive component of the FLK/SEFL hook-and-line model for 1994-2024.

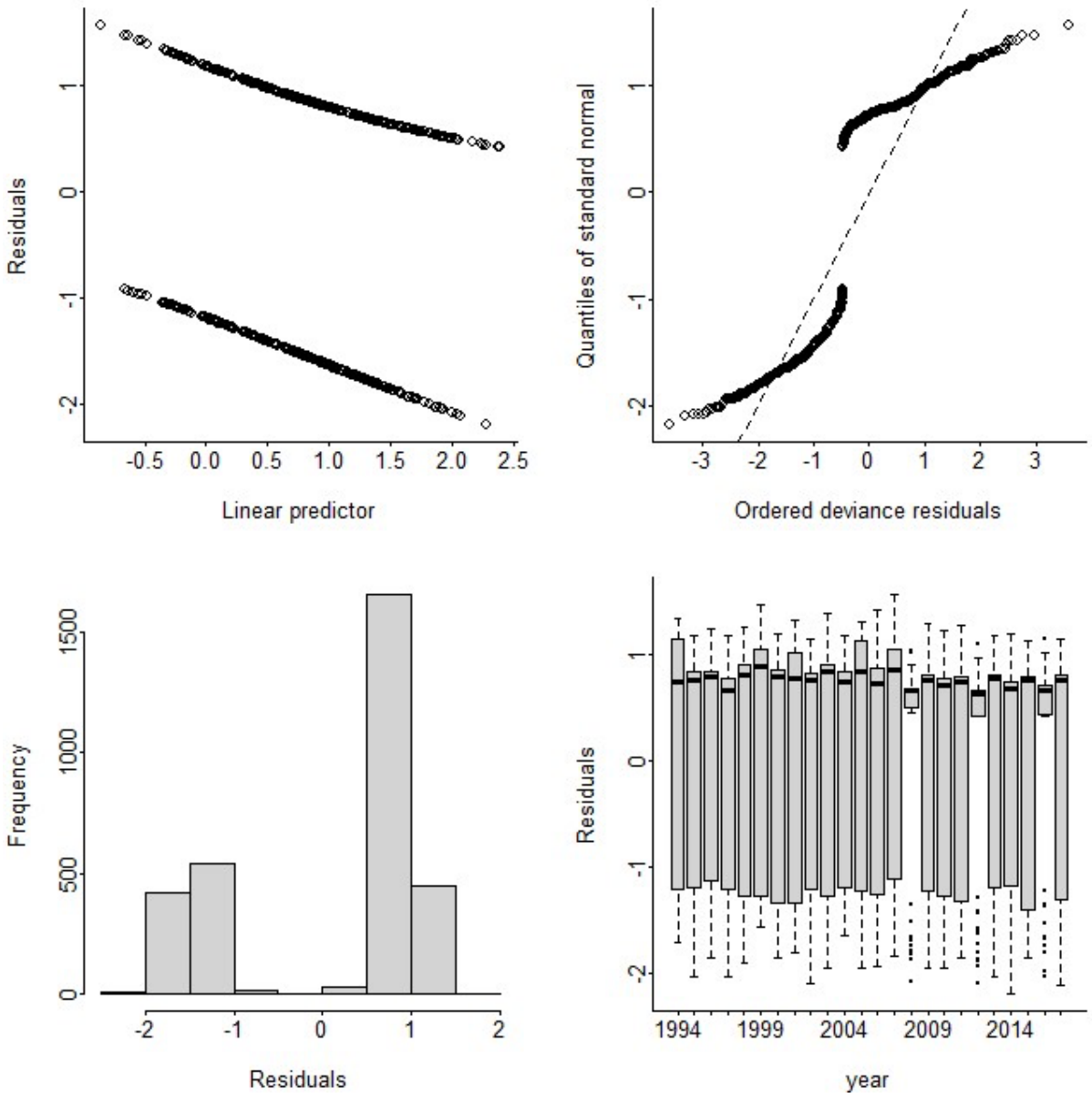

Figure 11. Diagnostic plots from the binomial component of the WFL spear model for 1994-2017.

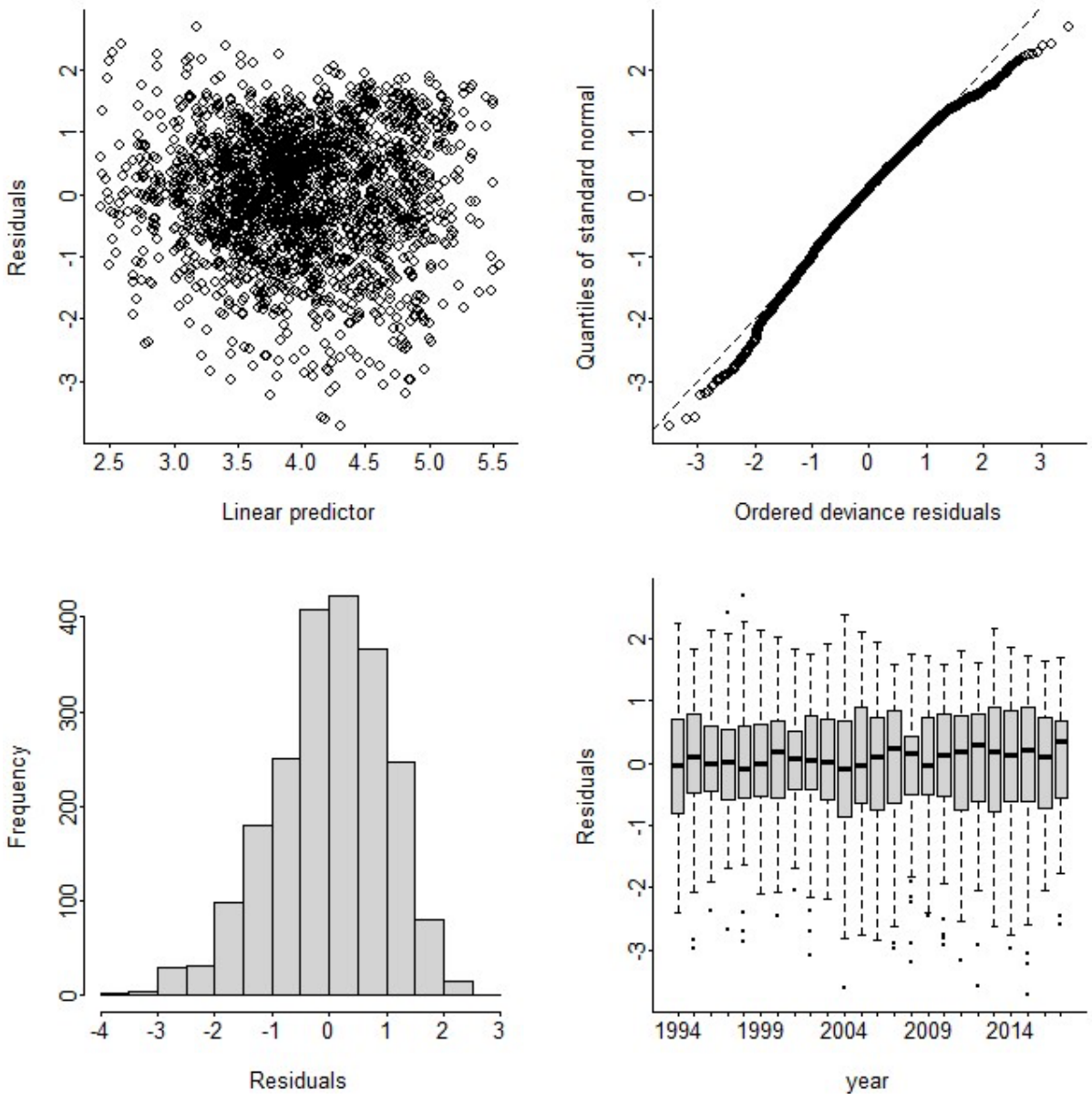

Figure 12. Diagnostic plots from the positives component of the WFL spear model for 1994-2017.

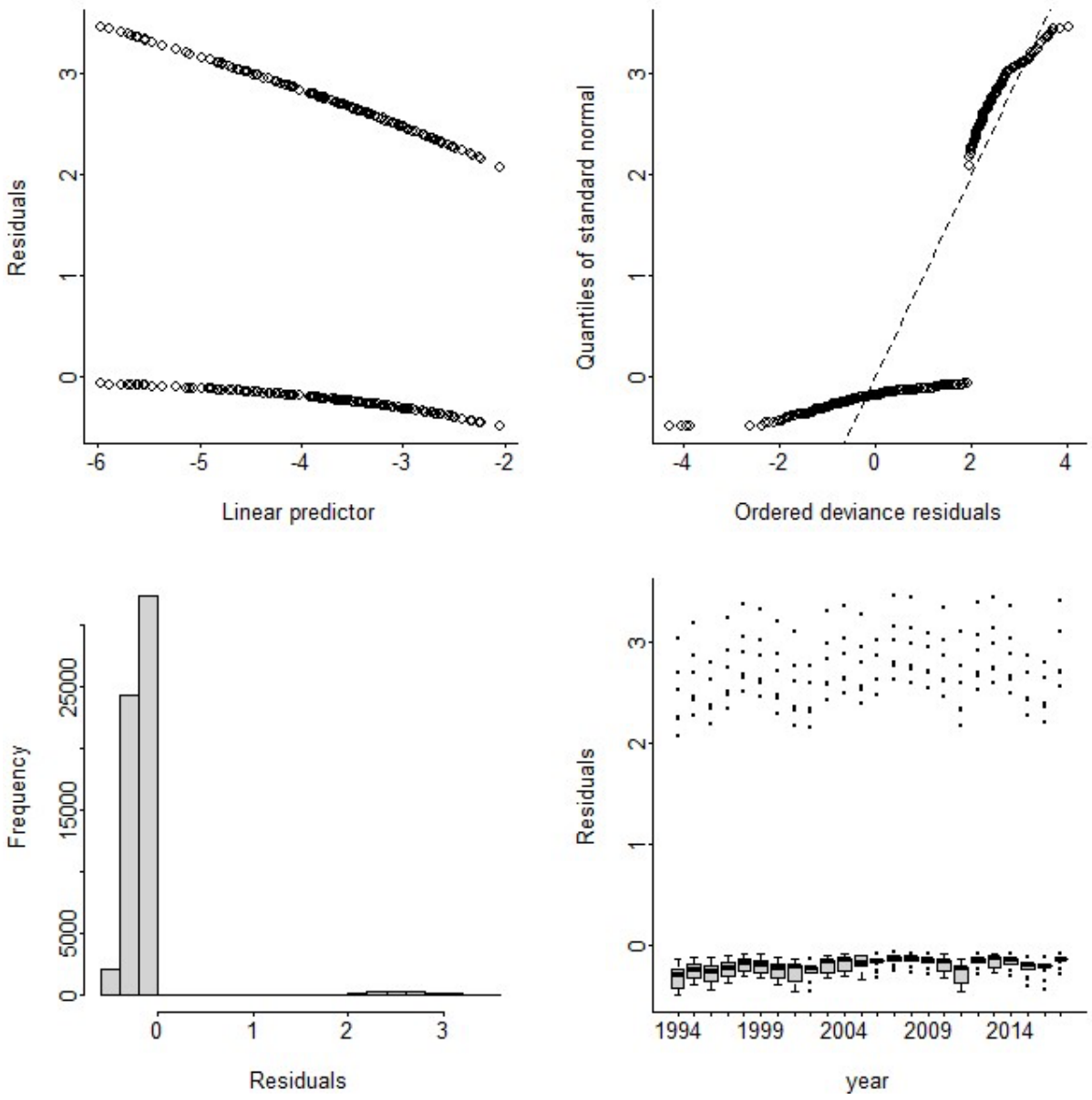

Figure 13. Diagnostic plots from the binomial component of the WFL hook-and-line model for 1994-2017.

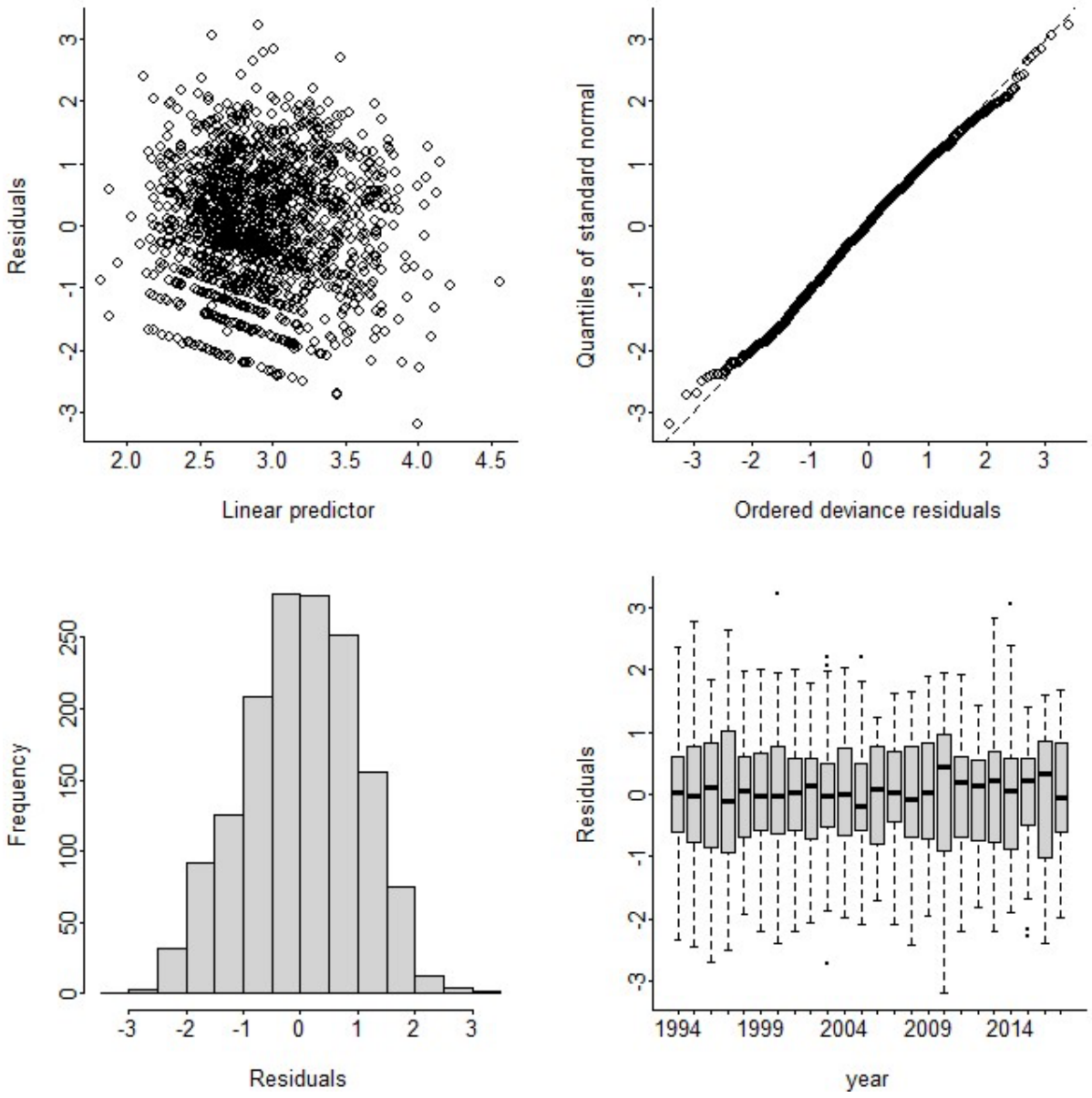

Figure 14. Diagnostic plots from the positives component of the WFL hook-and-line model for 1994-2017.

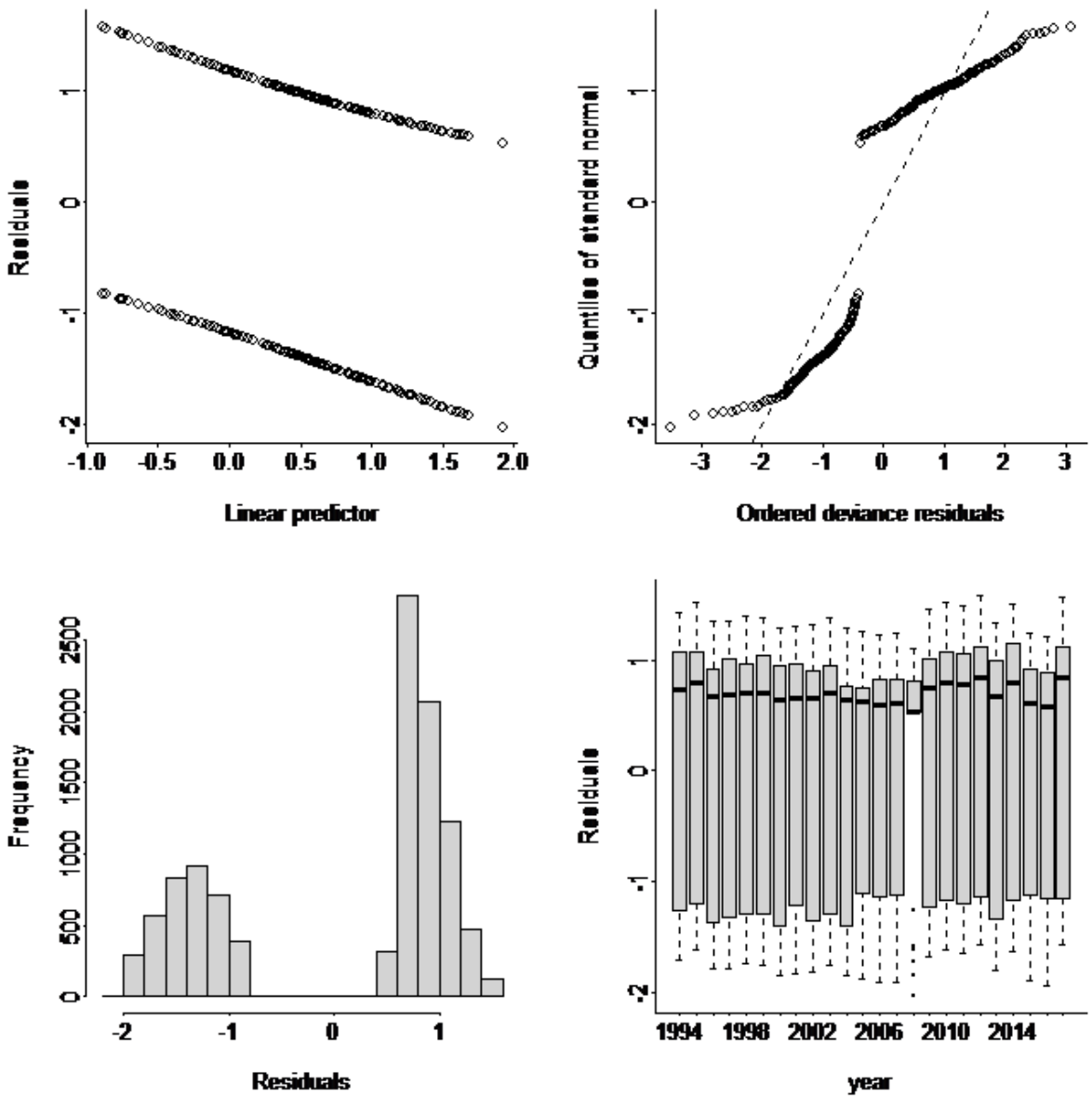

Figure 15. Diagnostic plots from the binomial component of the FLK/SEFL spear model for 1994-2017.

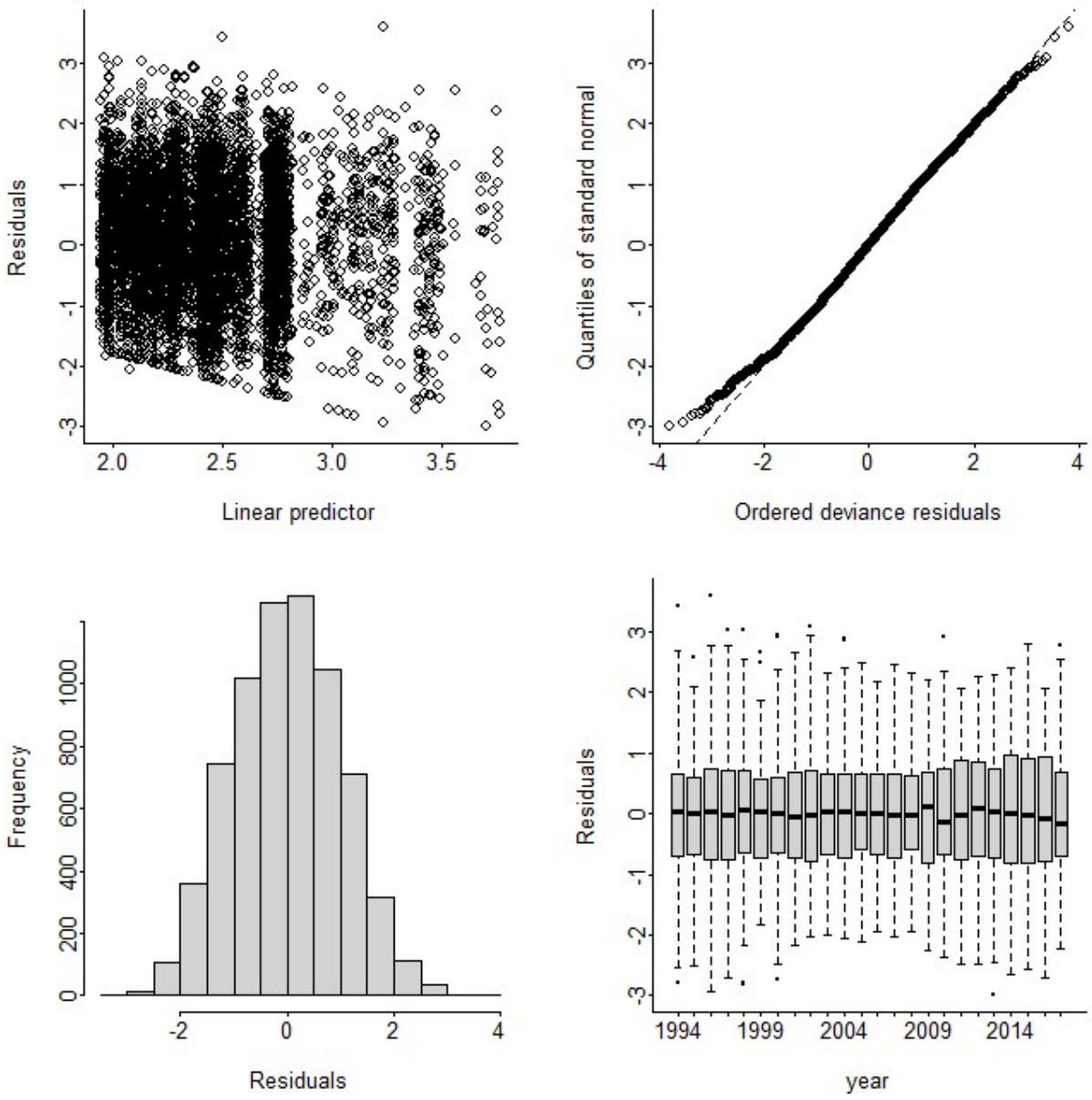

Figure 16. Diagnostic plots from the positives component of the FLK/SEFL spear model for 1994-2017.

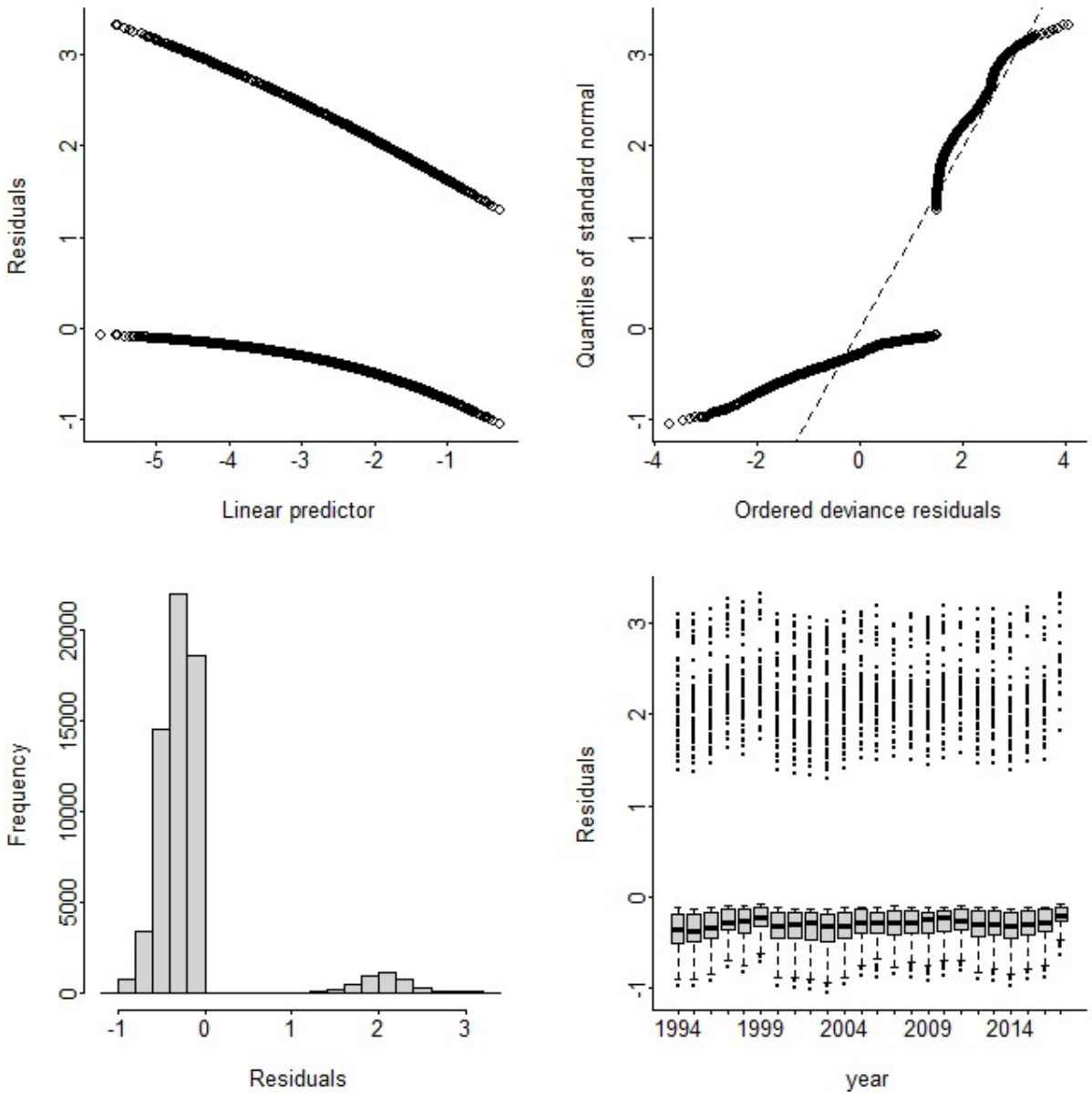

Figure 17. Diagnostic plots from the binomial component of the FLK/SEFL hook-and-line model for 1994-2017.

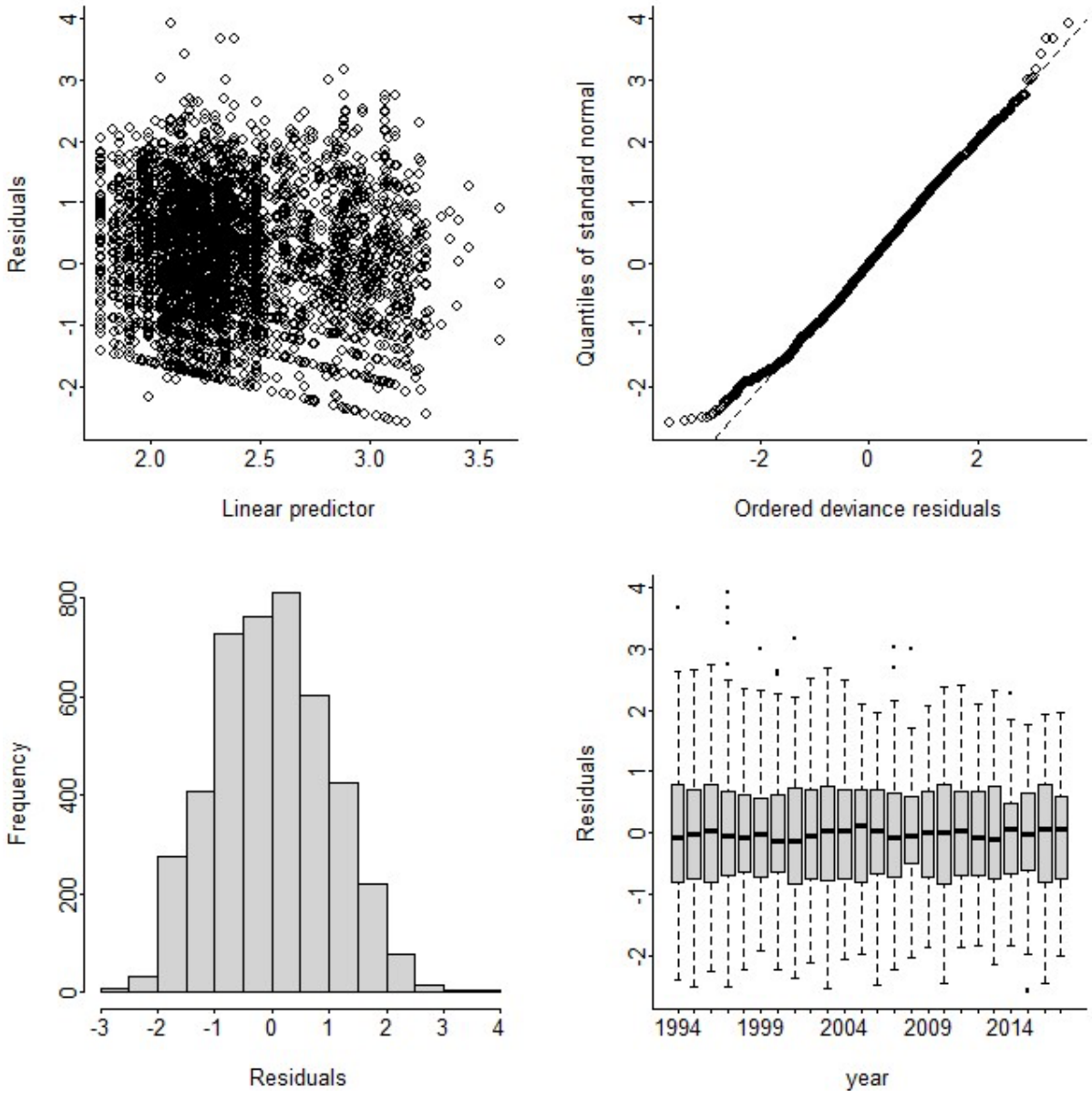

Figure 18. Diagnostic plots from the positives component of the FLK/SEFL hook-and-line model for 1994-2017.

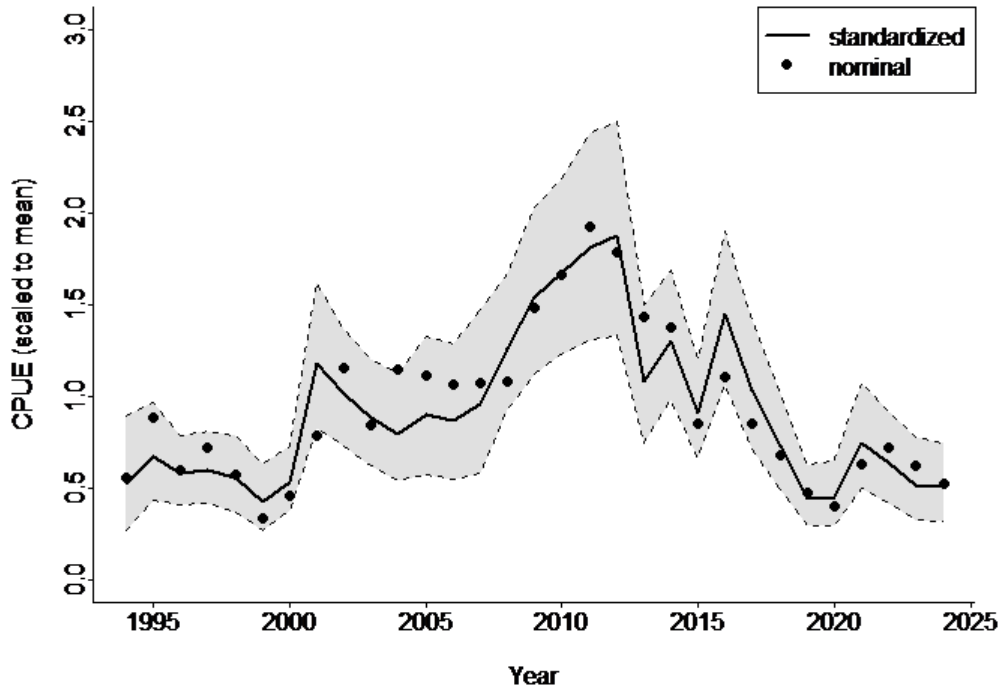

Figure 19. Standardized index of abundance for the WFL spear model for 1994-2024.

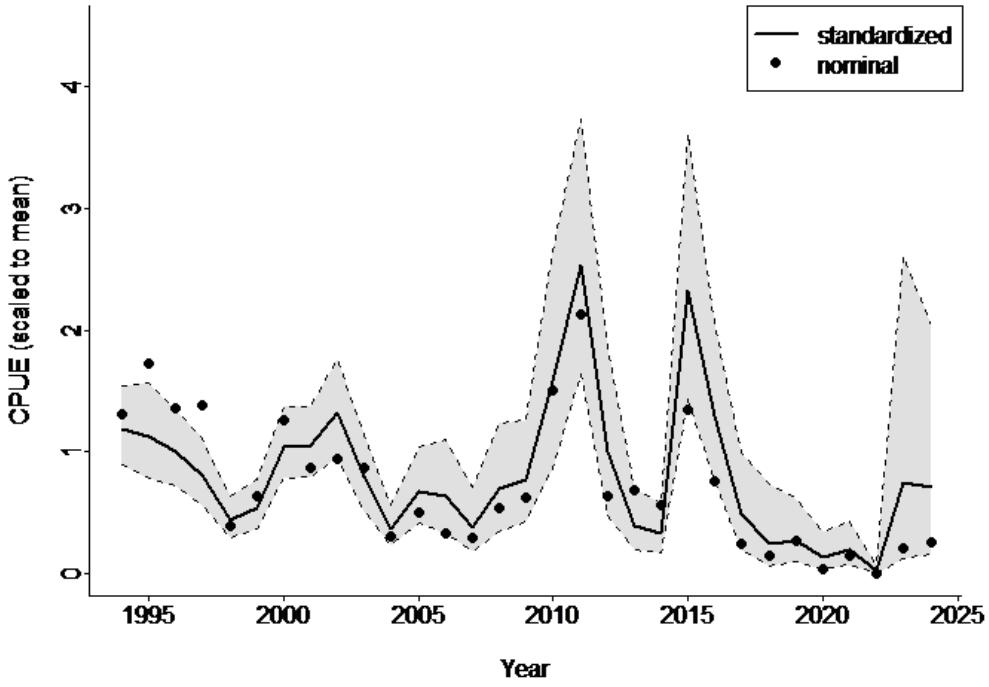

Figure 20. Standardized index of abundance for the WFL hook-and-line model for 1994-2024.

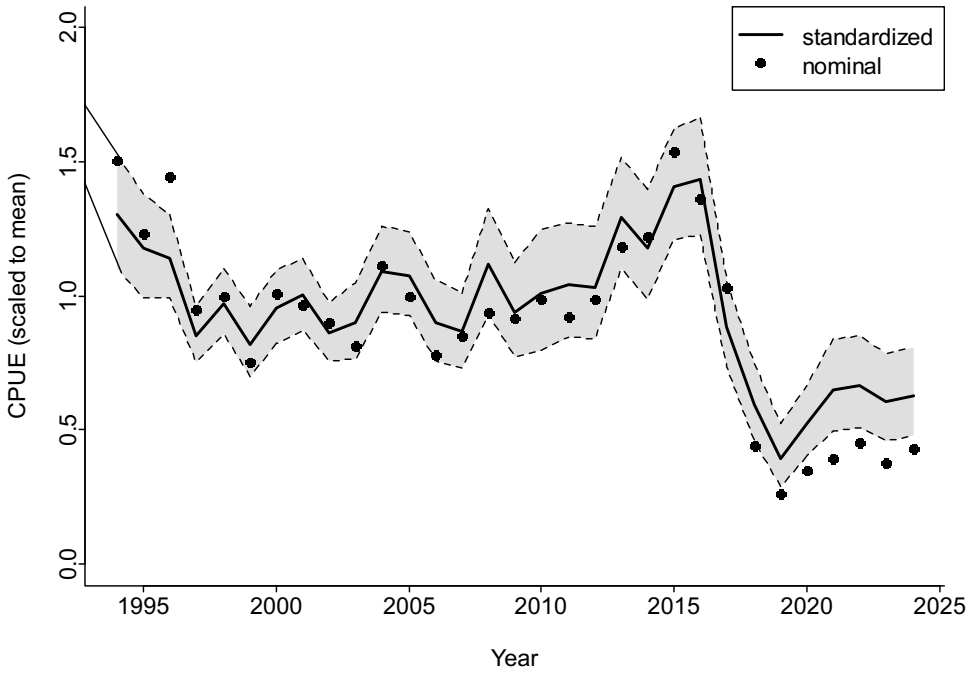

Figure 21. Standardized index of abundance for the FLK/SEFL spear model for 1994-2024.

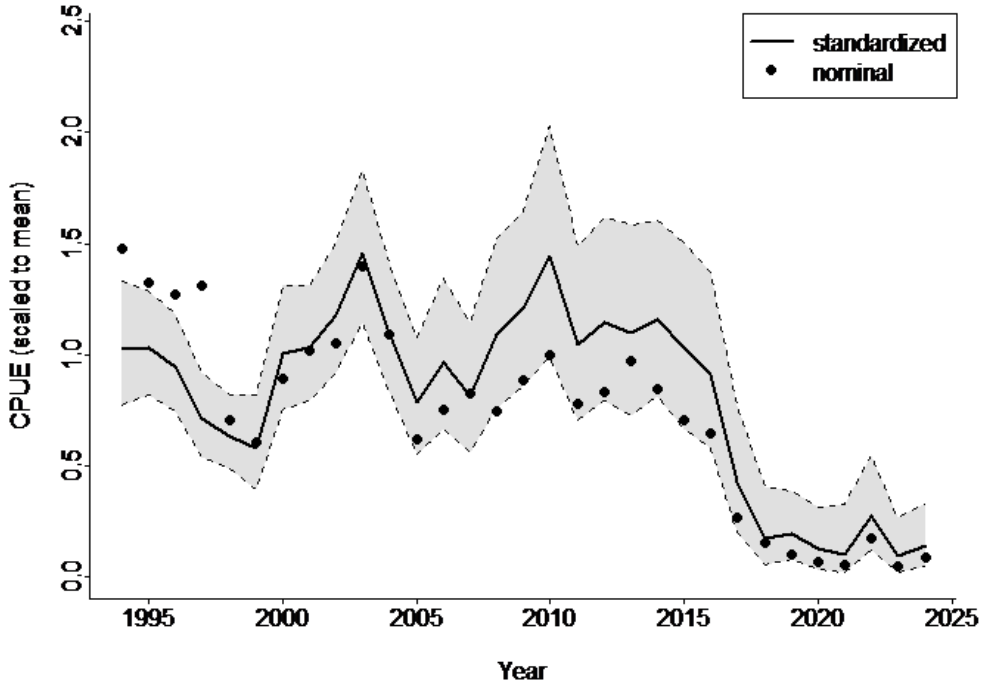

Figure 22. Standardized index of abundance for the FLK/SEFL hook-and-line model for 1994-2024.

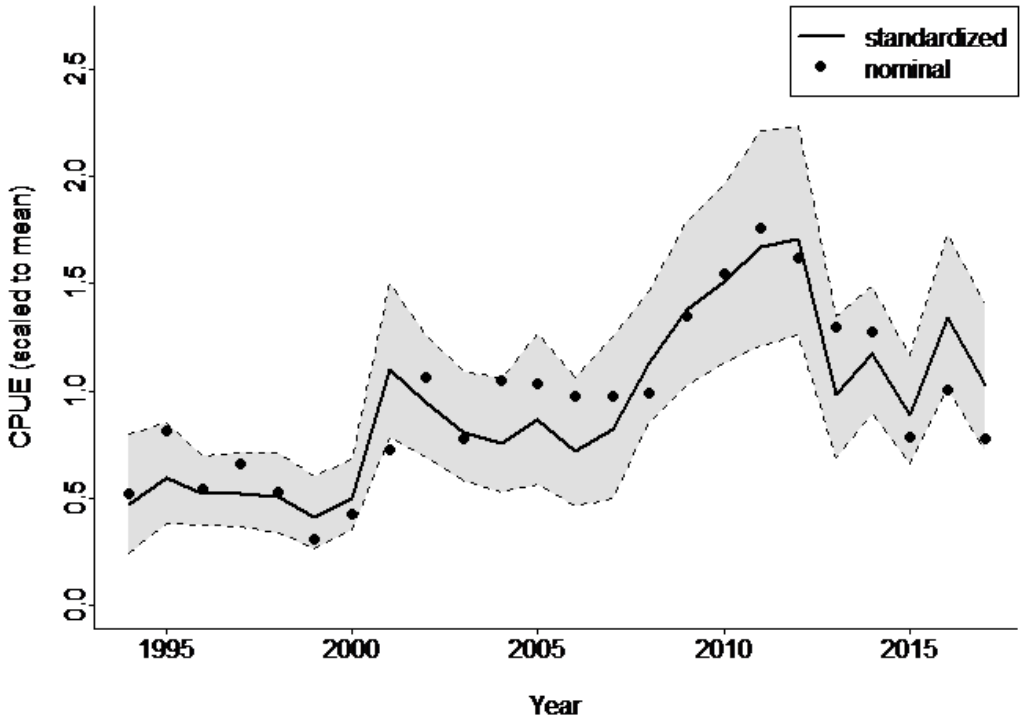

Figure 23. Standardized index of abundance for the WFL spear model for 1994-2017.

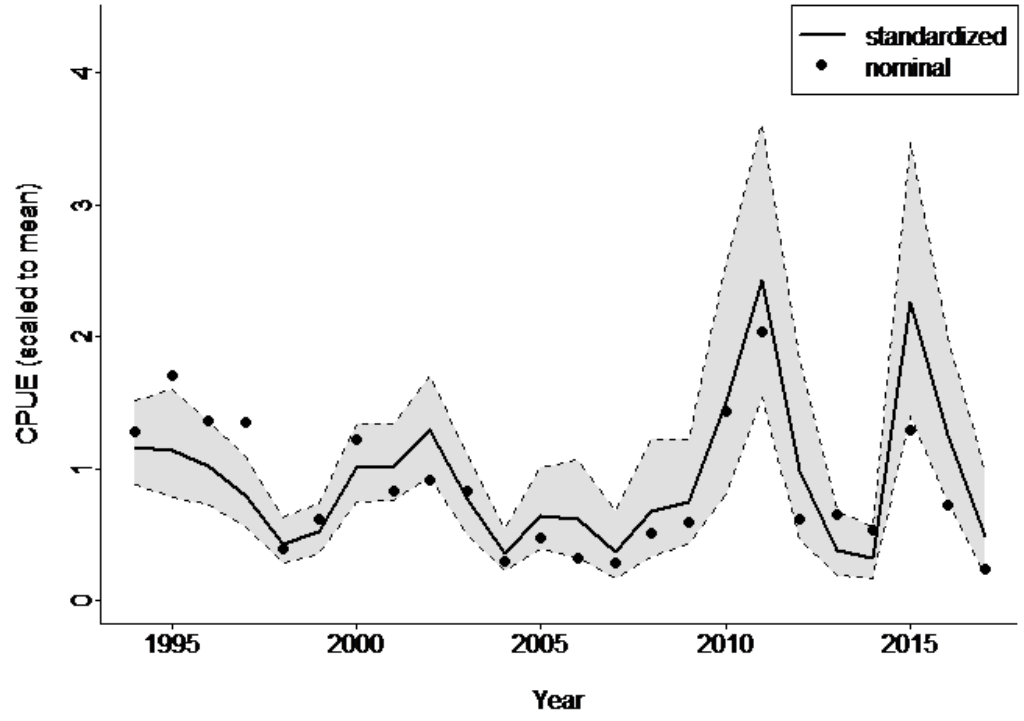

Figure 24. Standardized index of abundance for the WFL hook-and-line model for 1994-2017.

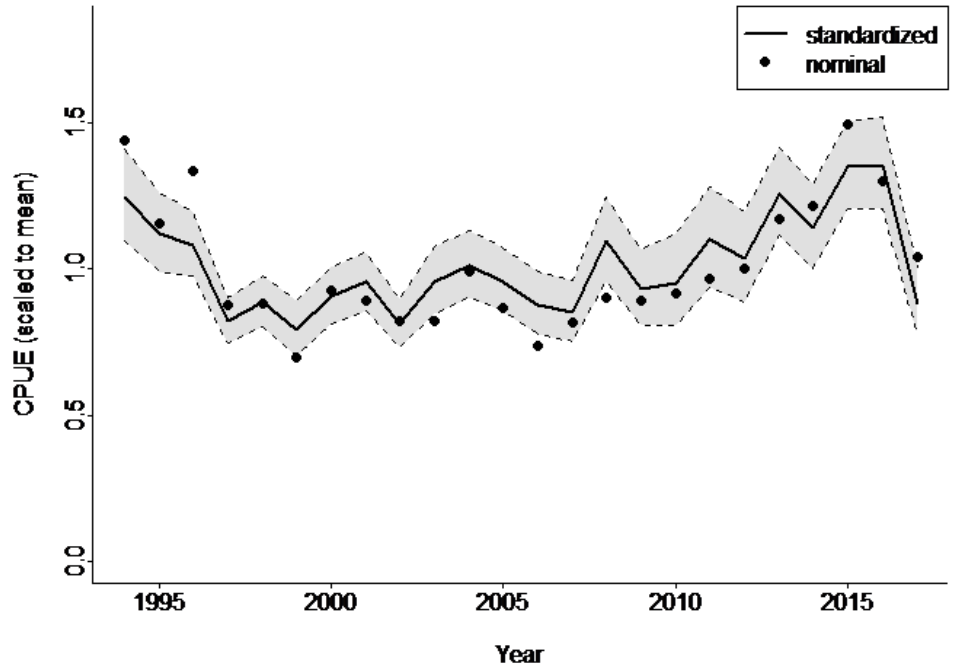

Figure 25. Standardized index of abundance for the FLK/SEFL spear model for 1994-2017.

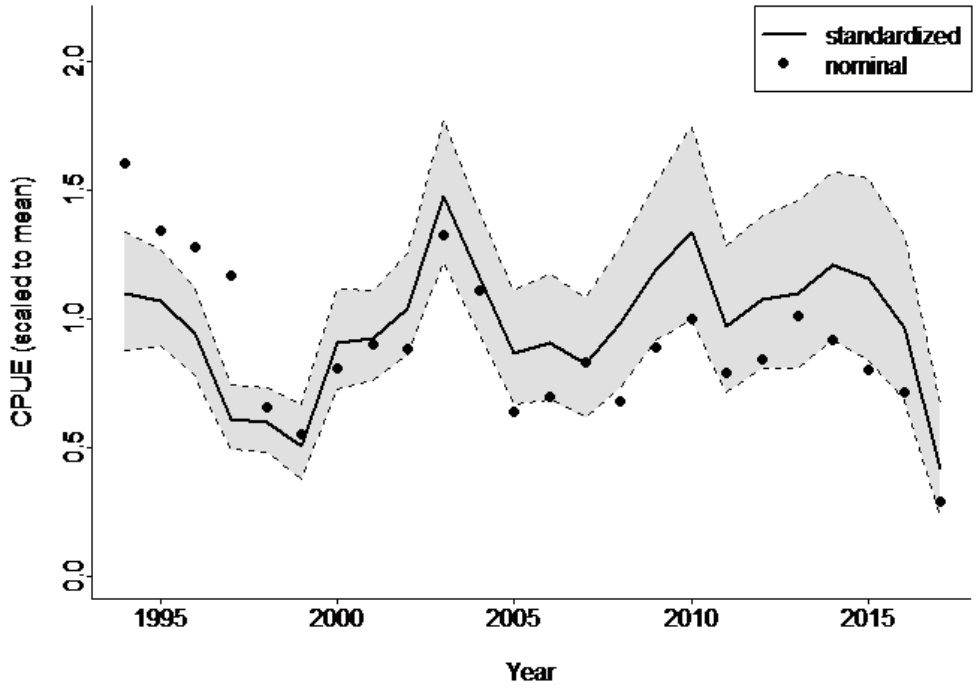

Figure 26. Standardized index of abundance for the FLK/SEFL hook-and-line model for 1994-2017.