Supplementary Material: On inferring population trends of mobile waterbirds from transect surveys in variable environments

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Contents

1 Introduction and background

Section 2 provides background on the East Australian Waterbirds Count Data and antecedent rainfall data. In Section 3, for each species we present:

1. A graph consisting of (A) the total counts from the East Australian Waterbird Survey (EAWS), (B) the estimated proportion ($\hat{\phi}$) of the superpopulation on the surveyed wetland stratum, (C) the estimated abundance ($\hat{N}$) and 95% credibility intervals of the superpopulation being sampled by the EAWS on a linear scale, and (D) the same though on a logarithmic (base 10) scale.

2. A table containing parameter means, standard deviations and quantiles taken from the posterior MCMC chains, the probability (where relevant) that the parameter differs from zero, along with Gelman & Rubin's R statistic to assess convergence (values of $R < 1.1$ are generally considered to represent adequate convergence).

In Section 4 we present some further model diagnostics.

2 Data sources

2.1 Count data

The count data from the East Australian Waterbird Survey are archived in a publicly available National Waterbird survey database (`https://aws.ecosystem.unsw.edu.au/`). A description of the survey program and data is given in Kingsford et al. (2020).

2.2 Antecedent rainfall data

Antecedent rainfall data were calculated from monthly 5 km rainfall grids (Bureau of Meteorology: `http://www.bom.gov.au/climate/maps/rainfall`) for areas of the Australian mainland bounded to the west by 134°E and to the north by 18°S using the period 1969–2018 (50 years) as a baseline. Anomalies from this 50-year mean were calculated for antecedent 12-month and antecedent 6-month periods (Fig. 1 and Fig. 2).

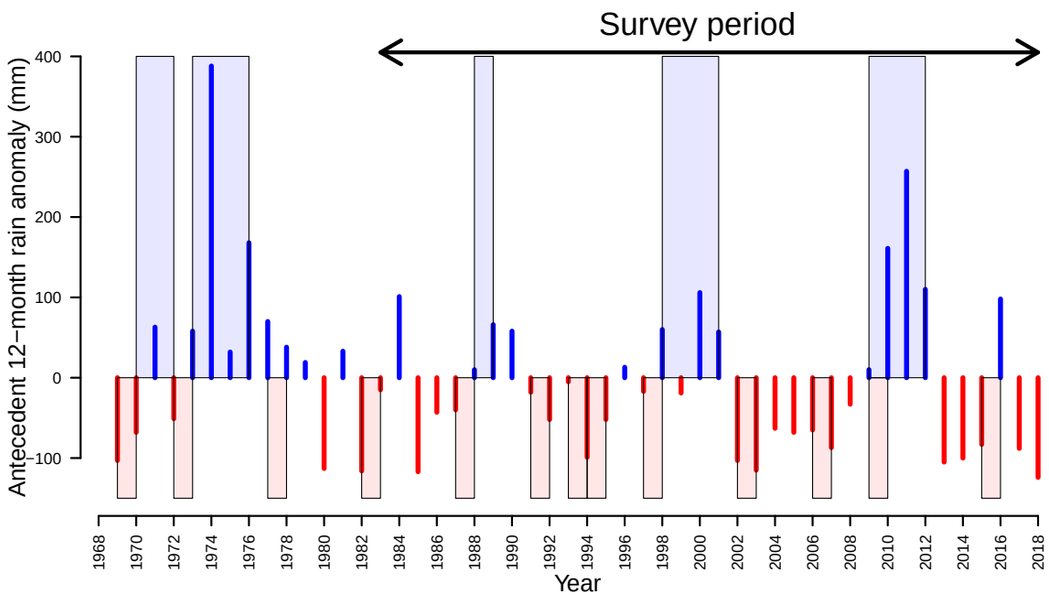

Figure 1: Anomaly in antecedent 12-month (October–September) rainfall from the 1969–2018 mean. La Niña and El Niño conditions are indicated by blue and red boxes respectively.

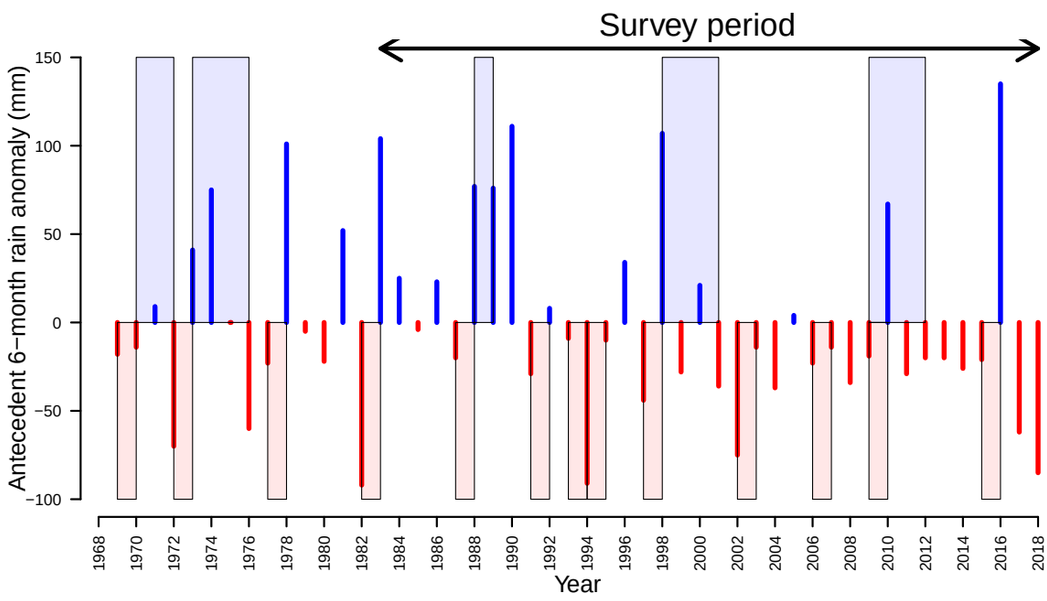

Figure 2: Anomaly in antecedent 6-month (April–September) rainfall from the 1969–2018 mean. La Niña and El Niño conditions are indicated by blue and red boxes respectively.

3 Fitted models for species with sufficient data

3.1 Avocet, red-necked (*Recurvirostra novaehollandiae*)

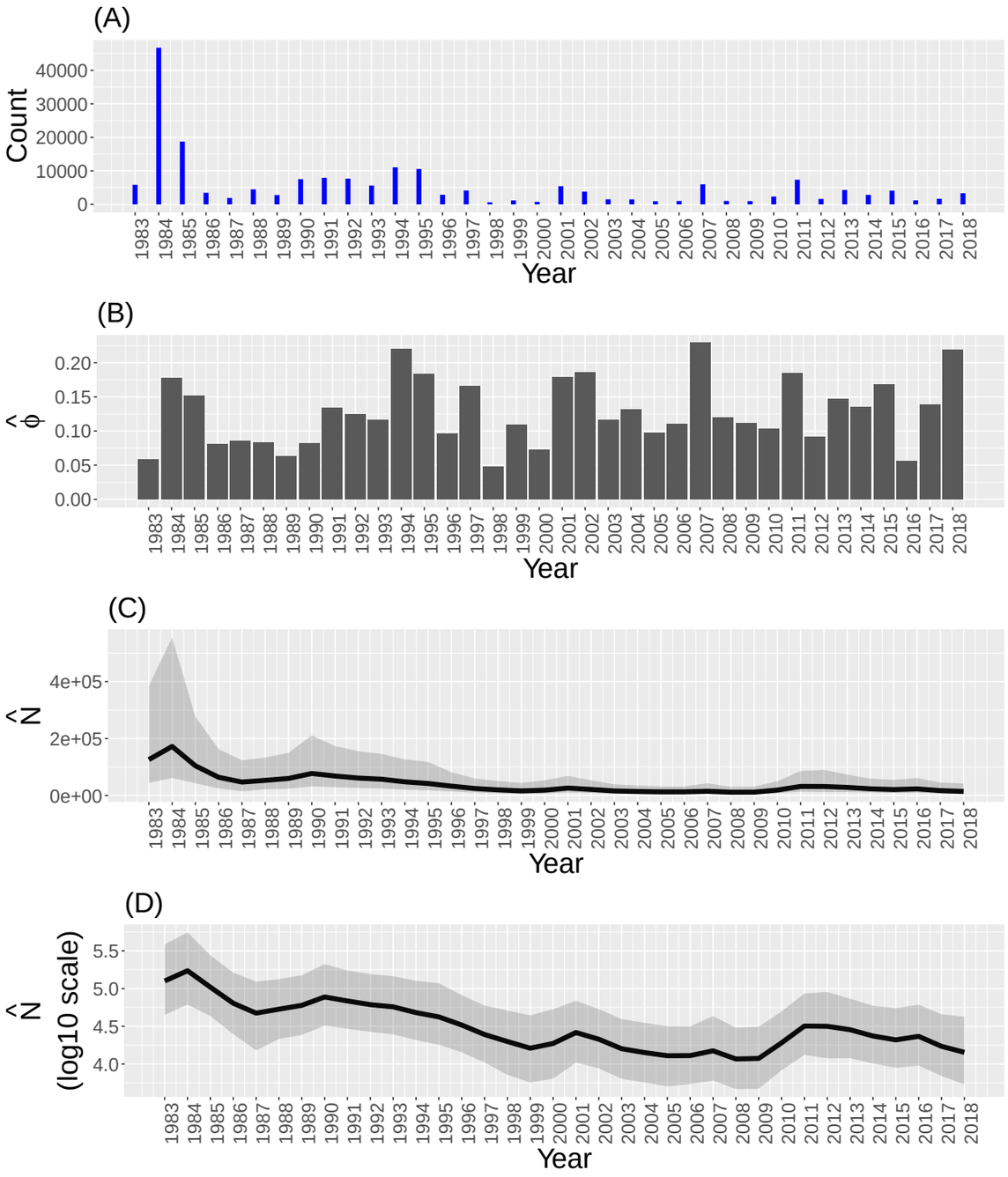

Figure 3: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the red-necked avocet. Grey shading represents 95% credibility intervals.

Table 1: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the red-necked avocet.

Parameter	**Mean**	**Std. Dev.**	**Median (95% C.I.)**	**Pr(|X|>0)**	**R**
r_0	-0.035	0.071	-0.036(-0.175 – 0.12)	0.74	1.01
β_1	0.209	0.133	0.204(-0.039 – 0.49)	0.95	1.00
β_2	-0.674	0.288	-0.672(-1.240 – -0.10)	0.99	1.00
σ_τ	0.482	0.278	0.488(0.025 – 1.01)	NA	1.01
σ_V	0.453	0.207	0.482(0.040 – 0.79)	NA	1.00
σ_W	0.366	0.184	0.342(0.060 – 0.78)	NA	1.01

3.2 Brolga (*Grus rubicunda*)

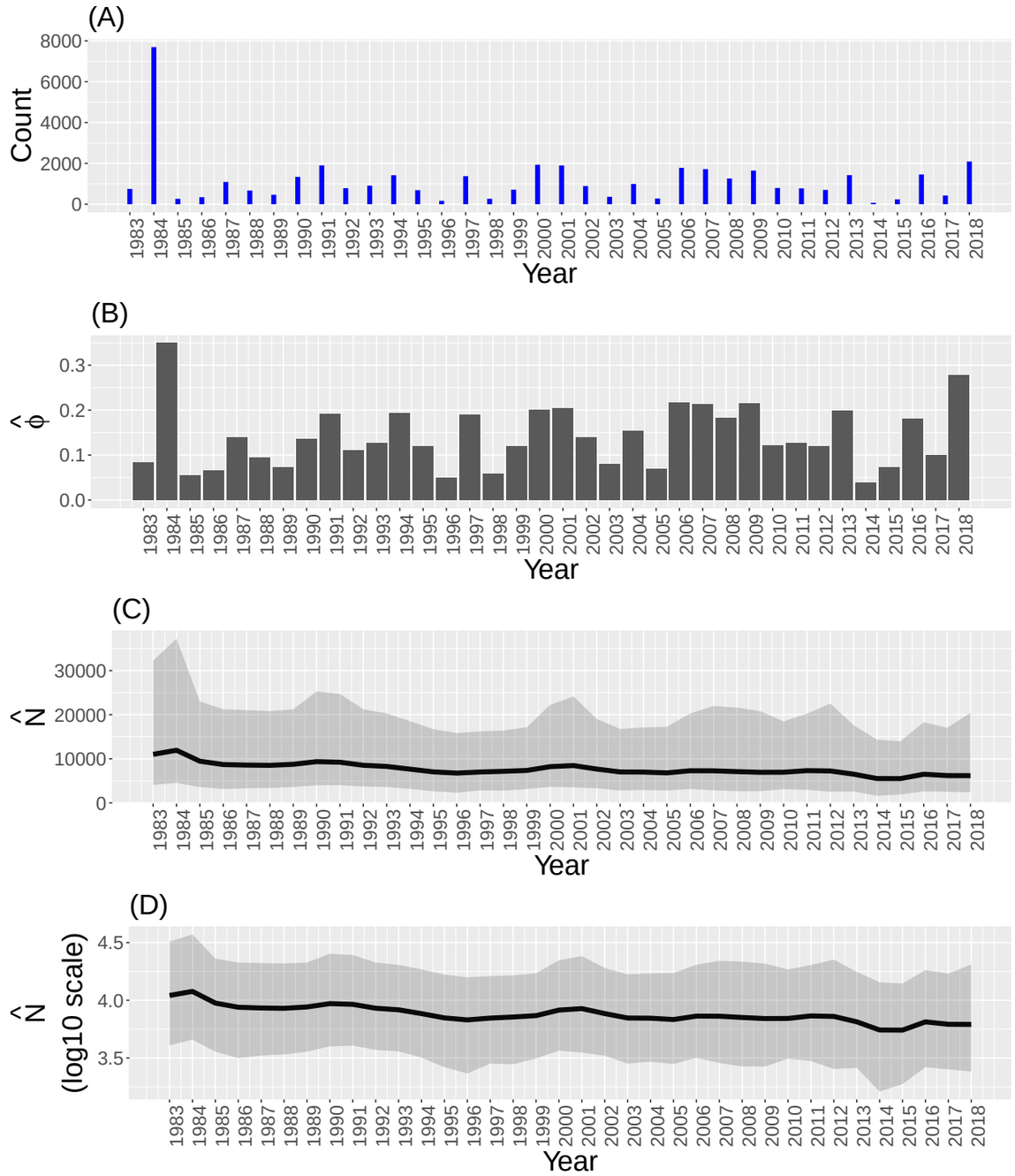

Figure 4: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the brolga. Grey shading represents 95% credibility intervals.

Table 2: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the brolga.

Parameter	**Mean**	**Std. Dev.**	**Median (95% C.I.)**	**Pr(|X|>0)**	**R**
r_0	-0.0067	0.055	-0.011(-0.1120 – 0.12)	0.61	1.02
β_1	0.0607	0.146	0.057(-0.2090 – 0.36)	0.65	1.01
β_2	-0.3350	0.365	-0.330(-1.0800 – 0.37)	0.83	1.00
σ_τ	0.8340	0.314	0.875(0.1010 – 1.37)	NA	1.01
σ_V	0.4780	0.232	0.502(0.0389 – 0.82)	NA	1.00
σ_W	0.2260	0.200	0.173(0.0043 – 0.74)	NA	1.02

3.3 Coot, Eurasian (*Fulica atra*)

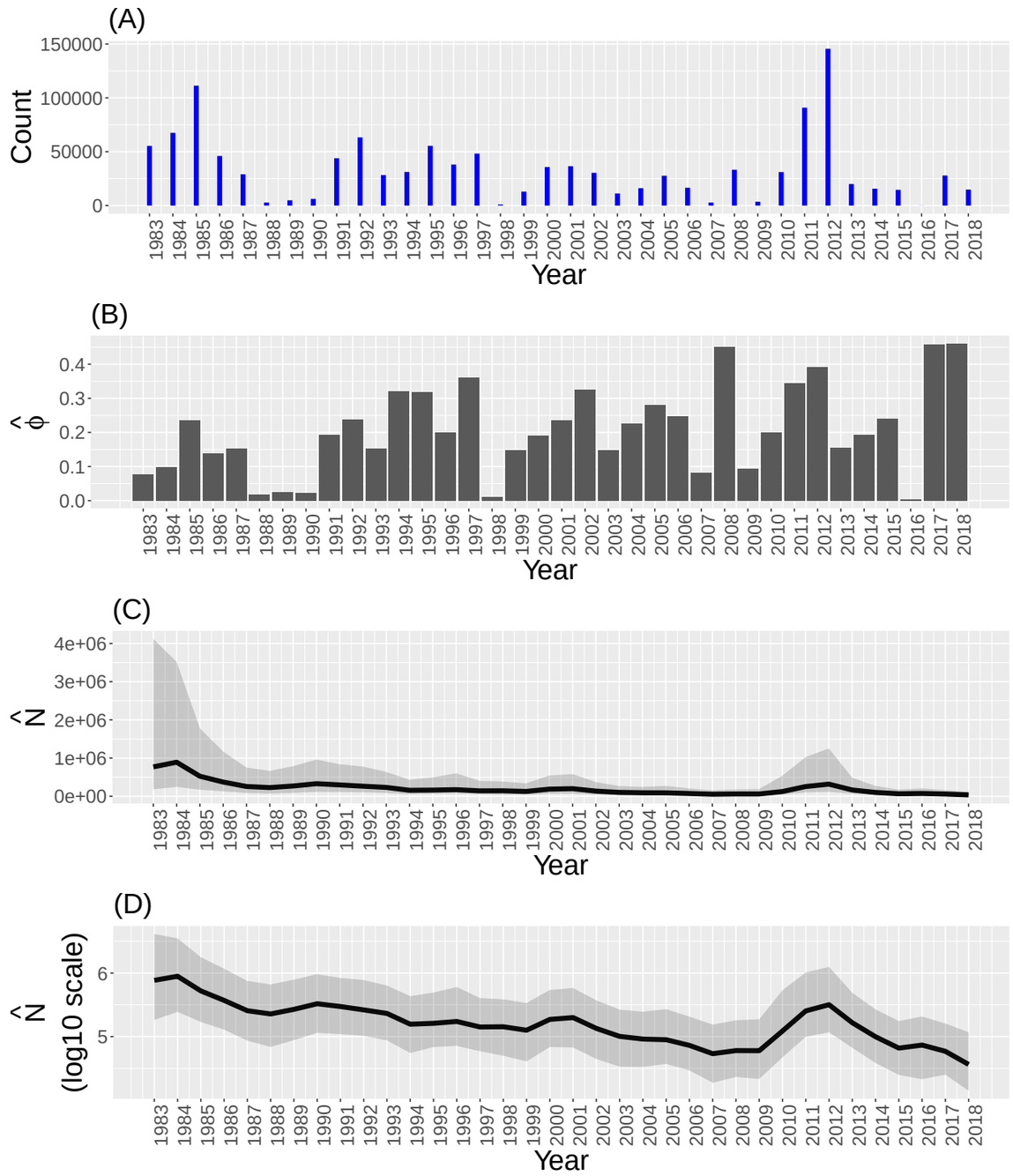

Figure 5: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Eurasian coot. Grey shading represents 95% credibility intervals.

Table 3: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Eurasian coot.

Parameter	**Mean**	**Std. Dev.**	**Median (95% C.I.)**	**Pr(|X|>0)**	**R**
r_0	-0.044	0.078	-0.043(-0.207 – 0.12)	0.78	1.02
β_1	0.327	0.151	0.322(0.032 – 0.64)	0.98	1.02
β_2	-2.060	0.438	-2.060(-2.950 – -1.21)	1.00	1.00
σ_τ	1.020	0.335	1.040(0.205 – 1.63)	NA	1.00
σ_V	0.403	0.233	0.392(0.029 – 0.81)	NA	1.00
σ_W	0.382	0.233	0.345(0.034 – 0.93)	NA	1.03

3.4 Cormorant, great (*Phalacrocorax carbo*)

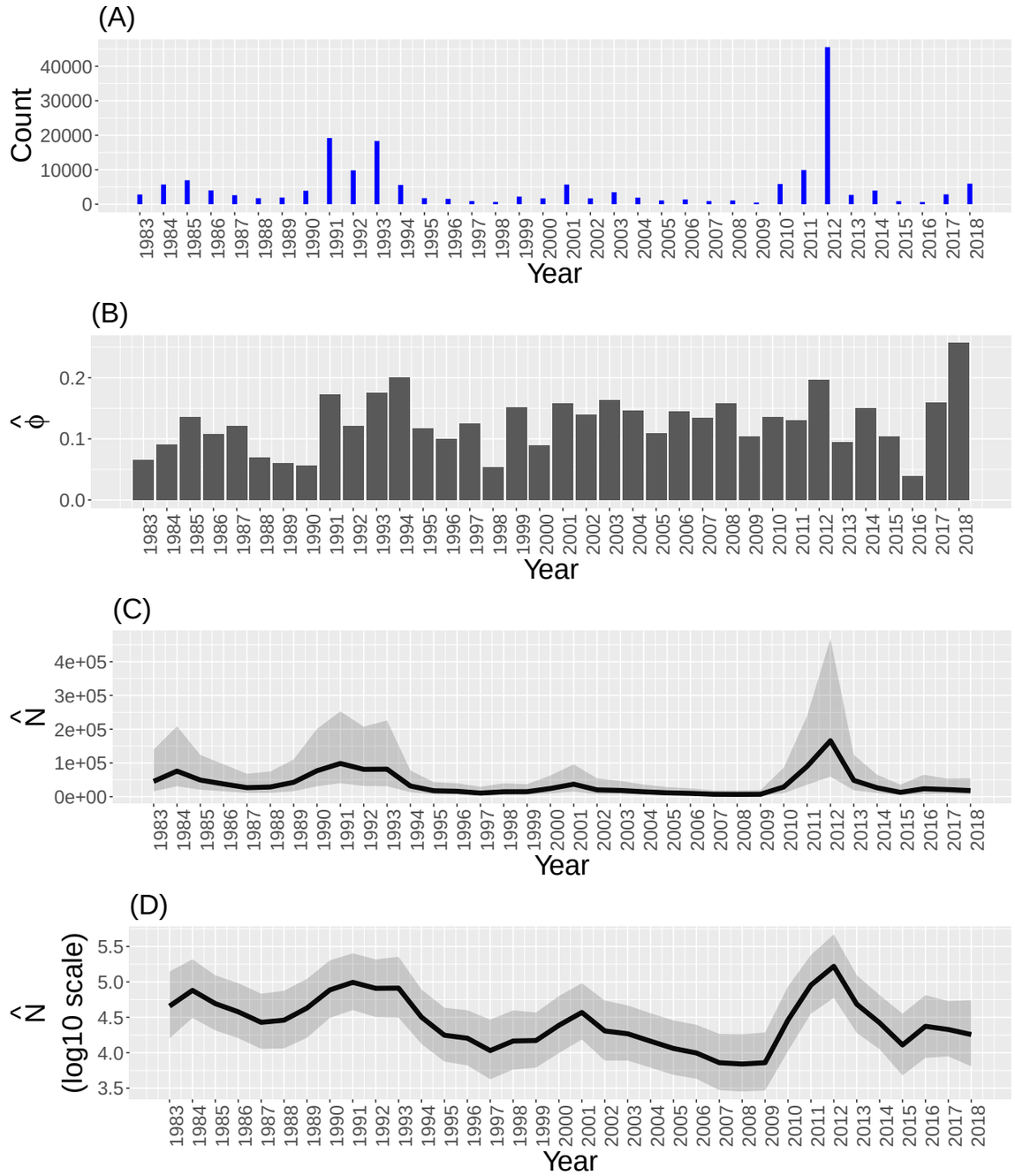

Figure 6: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the great cormorant. Grey shading represents 95% credibility intervals.

Table 4: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the great cormorant.

Parameter	**Mean**	**Std. Dev.**	**Median (95% C.I.)**	**Pr(|X|>0)**	**R**
r_0	0.033	0.084	0.03(-0.132 – 0.21)	0.67	1.01
β_1	0.538	0.134	0.54(0.272 – 0.80)	1.00	1.01
β_2	-0.736	0.277	-0.74(-1.280 – -0.18)	1.00	1.00
σ_τ	0.418	0.234	0.42(0.030 – 0.88)	NA	1.00
σ_V	0.378	0.198	0.39(0.024 – 0.74)	NA	1.00
σ_W	0.465	0.175	0.46(0.138 – 0.83)	NA	1.00

3.5 Cormorant, little black (*Phalacrocorax sulcirostris*)

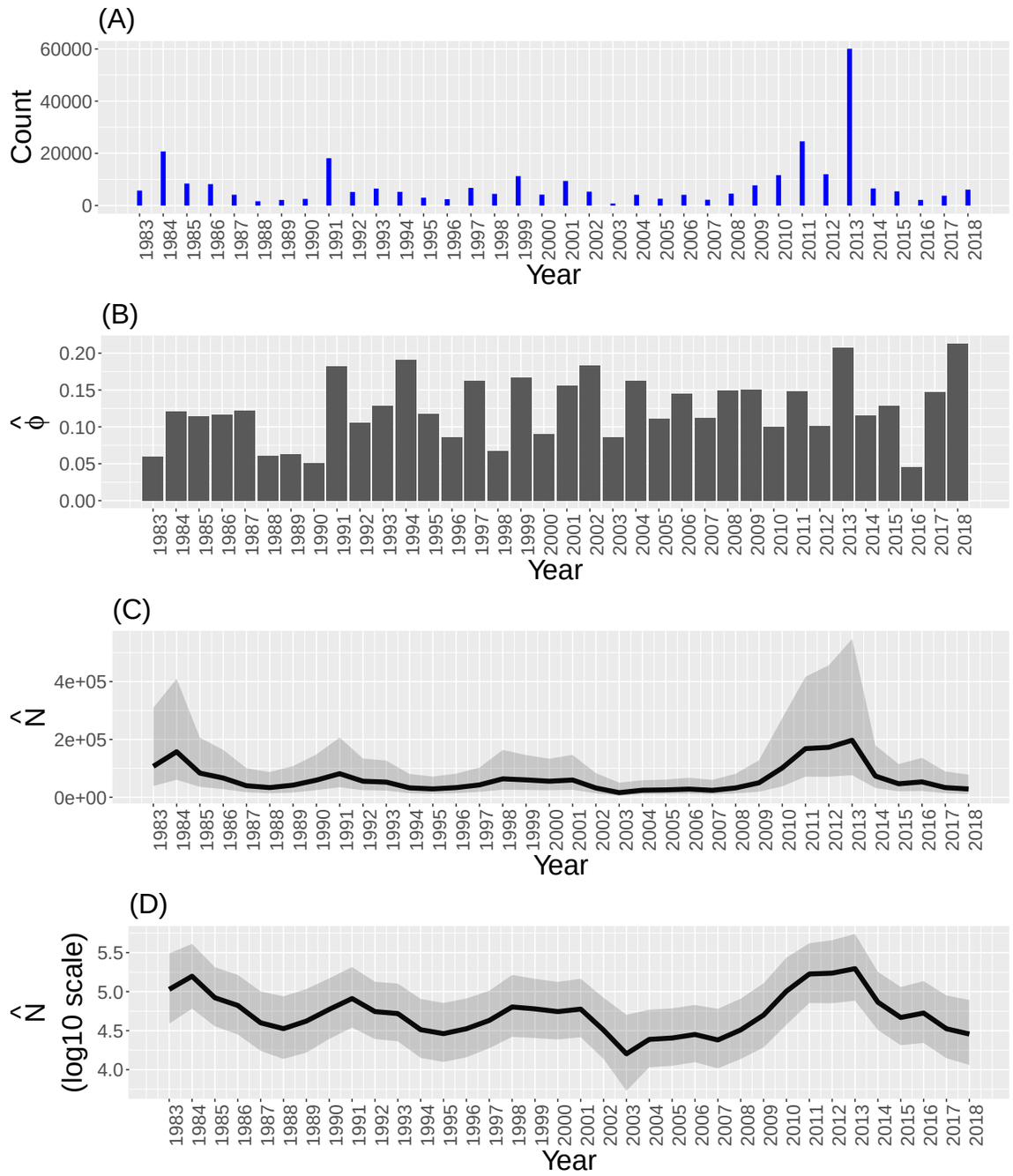

Figure 7: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the little black cormorant. Grey shading represents 95% credibility intervals.

Table 5: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the little black cormorant.

Parameter	**Mean**	**Std. Dev.**	**Median (95% C.I.)**	**Pr(|X|>0)**	**R**
r_0	-0.0027	0.093	-0.0014(-0.194 – 0.19)	0.51	1.01
β_1	0.2900	0.133	0.2910(0.028 – 0.55)	0.98	1.00
β_2	-0.7400	0.250	-0.7390(-1.230 – -0.24)	1.00	1.00
σ_τ	0.3580	0.213	0.3550(0.017 – 0.78)	NA	1.01
σ_V	0.3190	0.181	0.3210(0.015 – 0.67)	NA	1.00
σ_W	0.4950	0.171	0.4810(0.187 – 0.87)	NA	1.01

3.6 Cormorant, little pied (*Microcarbo melanoleucos*)

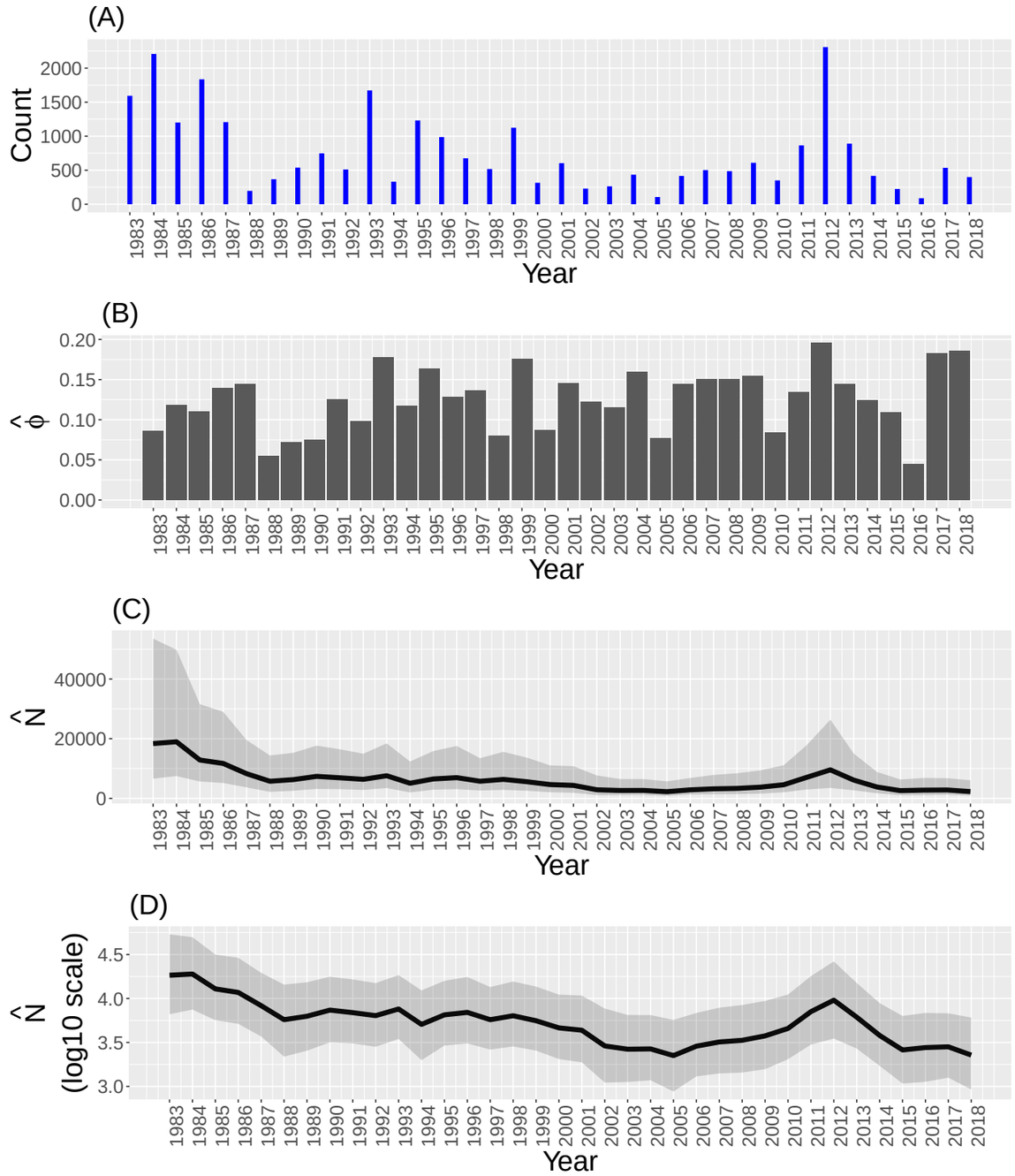

Figure 8: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the little pied cormorant. Grey shading represents 95% credibility intervals.

Table 6: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the little pied cormorant.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.038	0.072	-0.037(-0.187 – 0.11)	0.74	1.02
β_1	0.168	0.117	0.166(-0.057 – 0.41)	0.93	1.01
β_2	-0.555	0.248	-0.554(-1.050 – -0.07)	0.99	1.00
σ_τ	0.421	0.223	0.436(0.029 – 0.84)	NA	1.01
σ_V	0.329	0.185	0.329(0.023 – 0.69)	NA	1.00
σ_W	0.377	0.168	0.358(0.080 – 0.75)	NA	1.03

3.7 Cormorant, pied (*Phalacrocorax varius*)

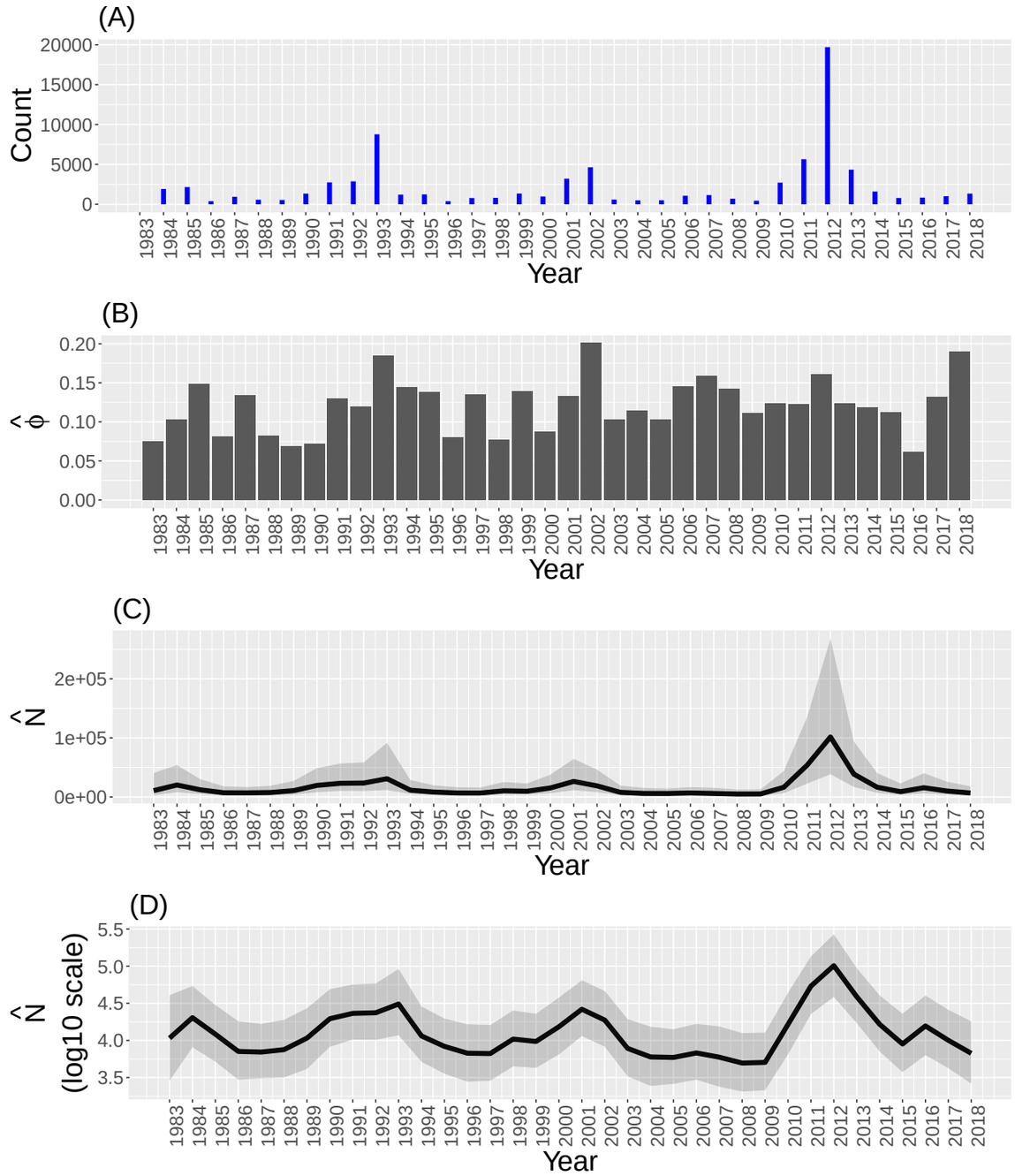

Figure 9: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the pied cormorant. Grey shading represents 95% credibility intervals.

Table 7: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the pied cormorant.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.048	0.078	0.048(-0.114 – 0.21)	0.76	1.03
β_1	0.559	0.124	0.558(0.315 – 0.81)	1.00	1.02
β_2	-0.519	0.259	-0.517(-1.040 – -0.02)	0.98	1.00
σ_τ	0.364	0.211	0.358(0.019 – 0.79)	NA	1.01
σ_V	0.358	0.184	0.370(0.021 – 0.70)	NA	1.00
σ_W	0.426	0.168	0.416(0.121 – 0.79)	NA	1.01

3.8 Darter, Australasian (*Anhinga novaehollandiae*)

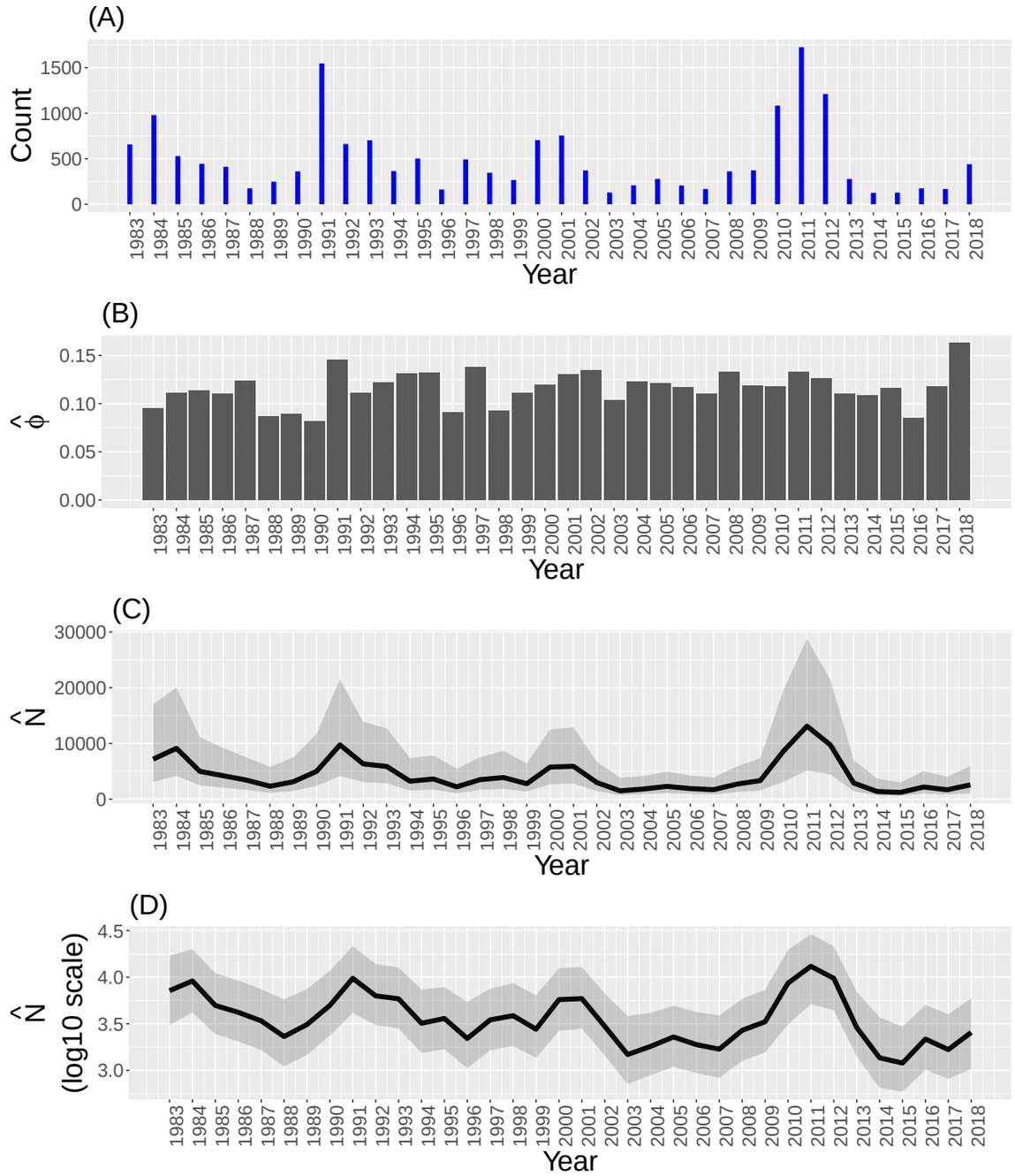

Figure 10: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australasian darter. Grey shading represents 95% credibility intervals.

Table 8: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australasian darter.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.016	0.089	0.014(-0.1590 – 0.20)	0.57	1.00
β_1	0.332	0.117	0.331(0.1020 – 0.56)	1.00	1.03
β_2	-0.272	0.196	-0.271(-0.6630 – 0.10)	0.92	1.00
σ_τ	0.229	0.157	0.209(0.0073 – 0.58)	NA	1.00
σ_V	0.198	0.139	0.179(0.0070 – 0.52)	NA	1.01
σ_W	0.521	0.131	0.527(0.2270 – 0.76)	NA	1.03

3.9 Duck, Australian wood (*Chenonetta jubata*)

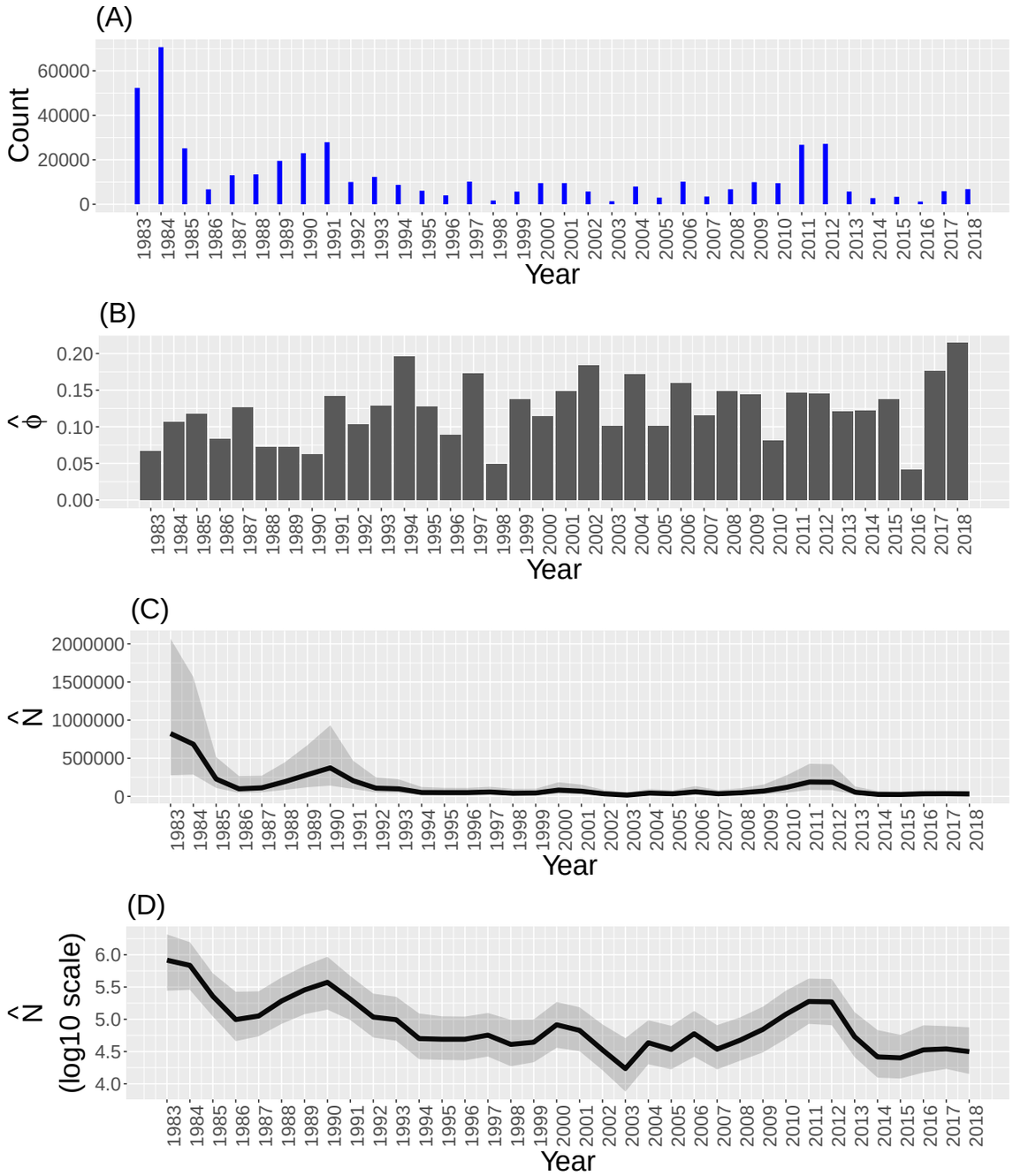

Figure 11: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australian wood duck. Grey shading represents 95% credibility intervals.

Table 9: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australian wood duck.

Parameter	**Mean**	**Std. Dev.**	**Median (95% C.I.)**	**Pr(|X|>0)**	**R**
r_0	-0.041	0.10	-0.044(-0.2400 – 0.17)	0.68	1.01
β_1	0.317	0.13	0.316(0.0549 – 0.59)	0.99	1.02
β_2	-0.763	0.22	-0.766(-1.1900 – -0.30)	1.00	1.00
σ_τ	0.258	0.17	0.237(0.0116 – 0.64)	NA	1.01
σ_V	0.199	0.14	0.178(0.0095 – 0.52)	NA	1.01
σ_W	0.587	0.14	0.588(0.3120 – 0.86)	NA	1.01

3.10 Duck, freckled (*Stictonetta naevosa*)

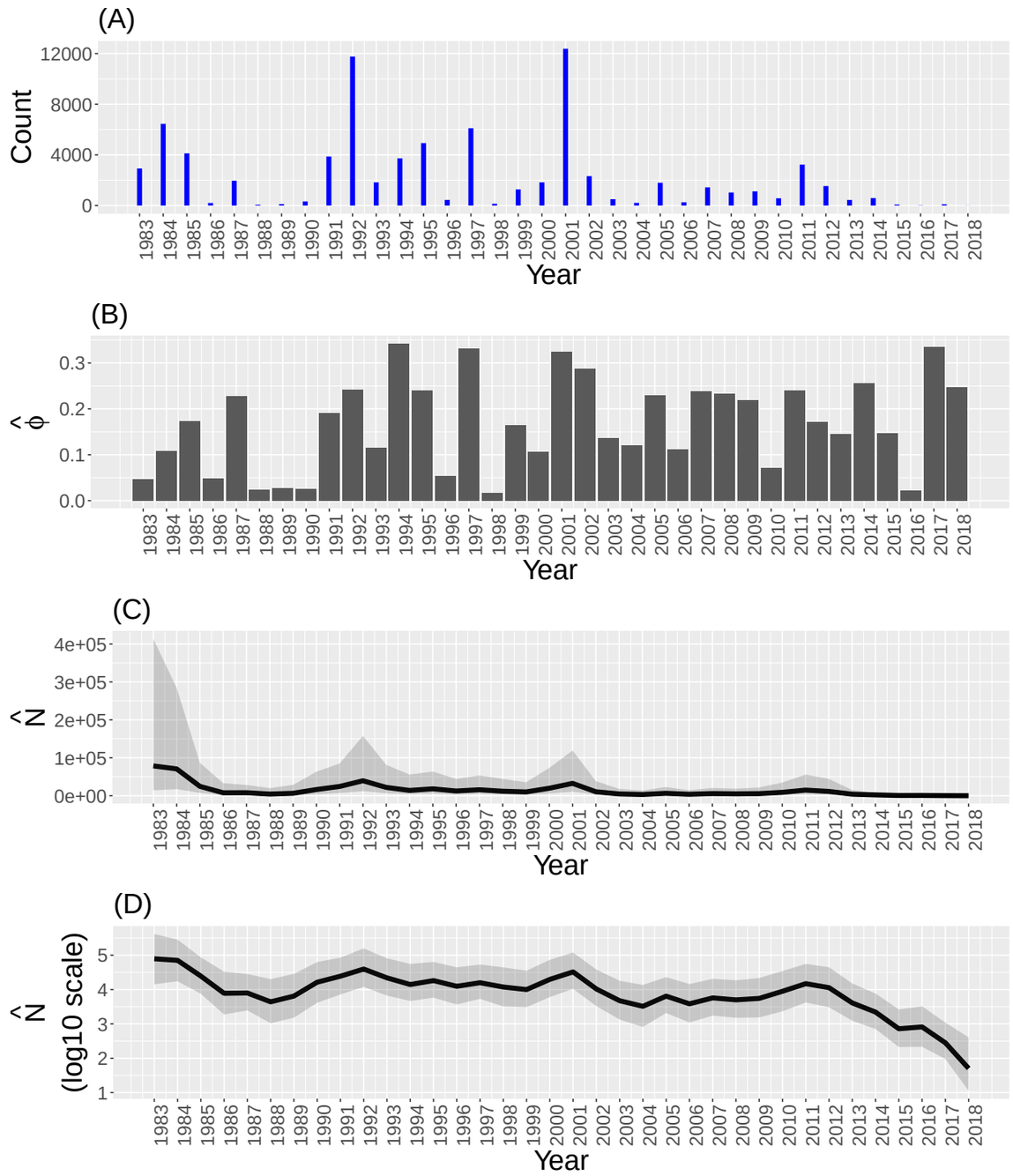

Figure 12: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the freckled duck. Grey shading represents 95% credibility intervals.

Table 10: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the freckled duck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.15	0.15	-0.15(-0.462 – 0.14)	0.86	1.00
β_1	0.43	0.21	0.43(0.022 – 0.87)	0.98	1.02
β_2	-1.66	0.45	-1.65(-2.580 – -0.79)	1.00	1.00
σ_τ	0.79	0.41	0.80(0.041 – 1.60)	NA	1.00
σ_V	0.44	0.24	0.46(0.021 – 0.81)	NA	1.00
σ_W	0.87	0.26	0.85(0.408 – 1.43)	NA	1.01

3.11 Duck, musk (*Biziura lobata*)

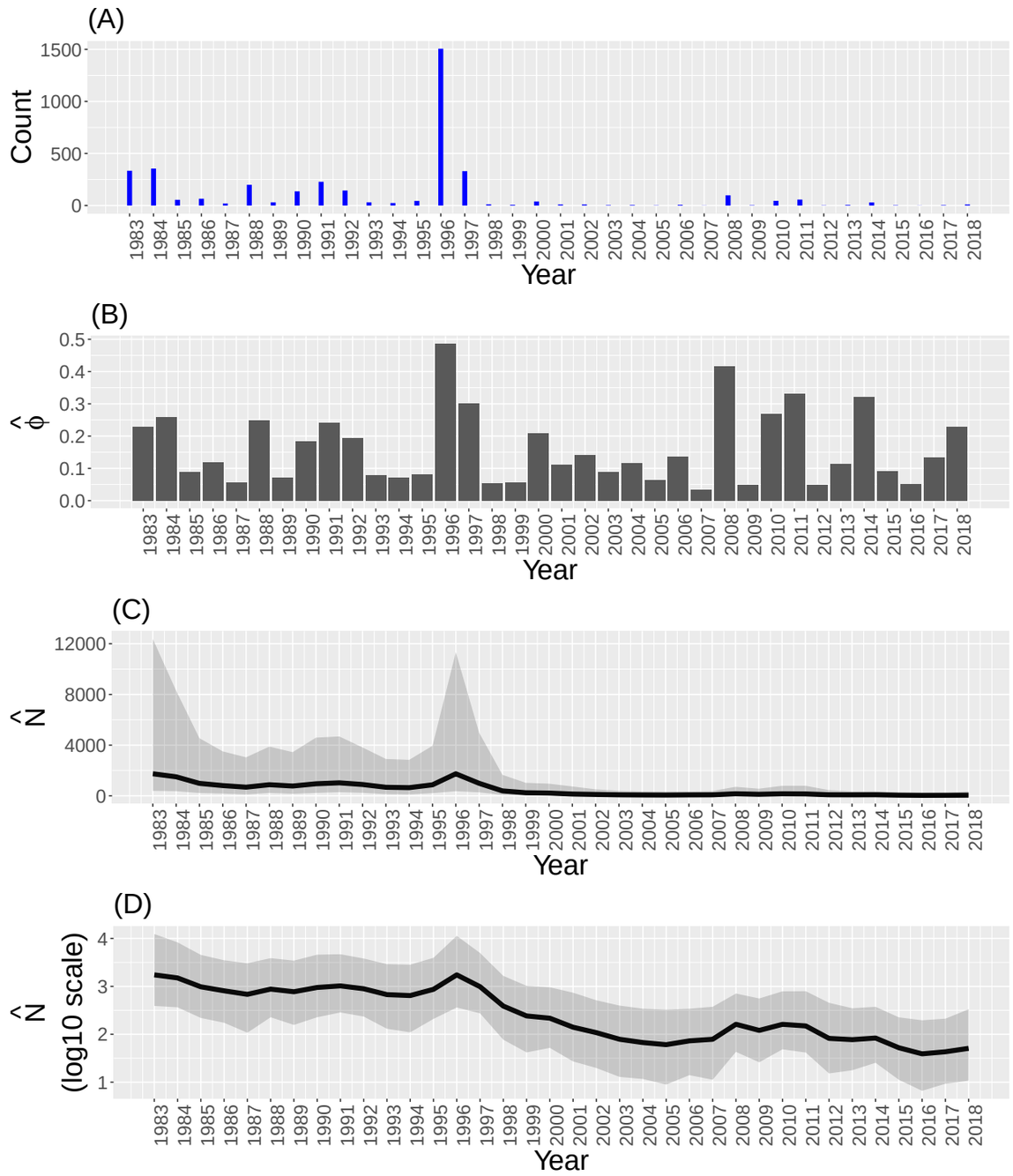

Figure 13: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the musk duck. Grey shading represents 95% credibility intervals.

Table 11: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the musk duck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.0671	0.14	-0.076(-0.342 – 0.24)	0.73	1.00
β_1	0.0074	0.24	0.004(-0.465 – 0.49)	0.51	1.00
β_2	-0.0165	0.60	-0.018(-1.200 – 1.19)	0.51	1.00
σ_τ	1.3600	0.42	1.360(0.450 – 2.19)	NA	1.00
σ_V	0.5290	0.23	0.583(0.048 – 0.82)	NA	1.00
σ_W	0.7490	0.40	0.711(0.084 – 1.67)	NA	1.01

3.12 Duck, Pacific black (*Anas superciliosa*)

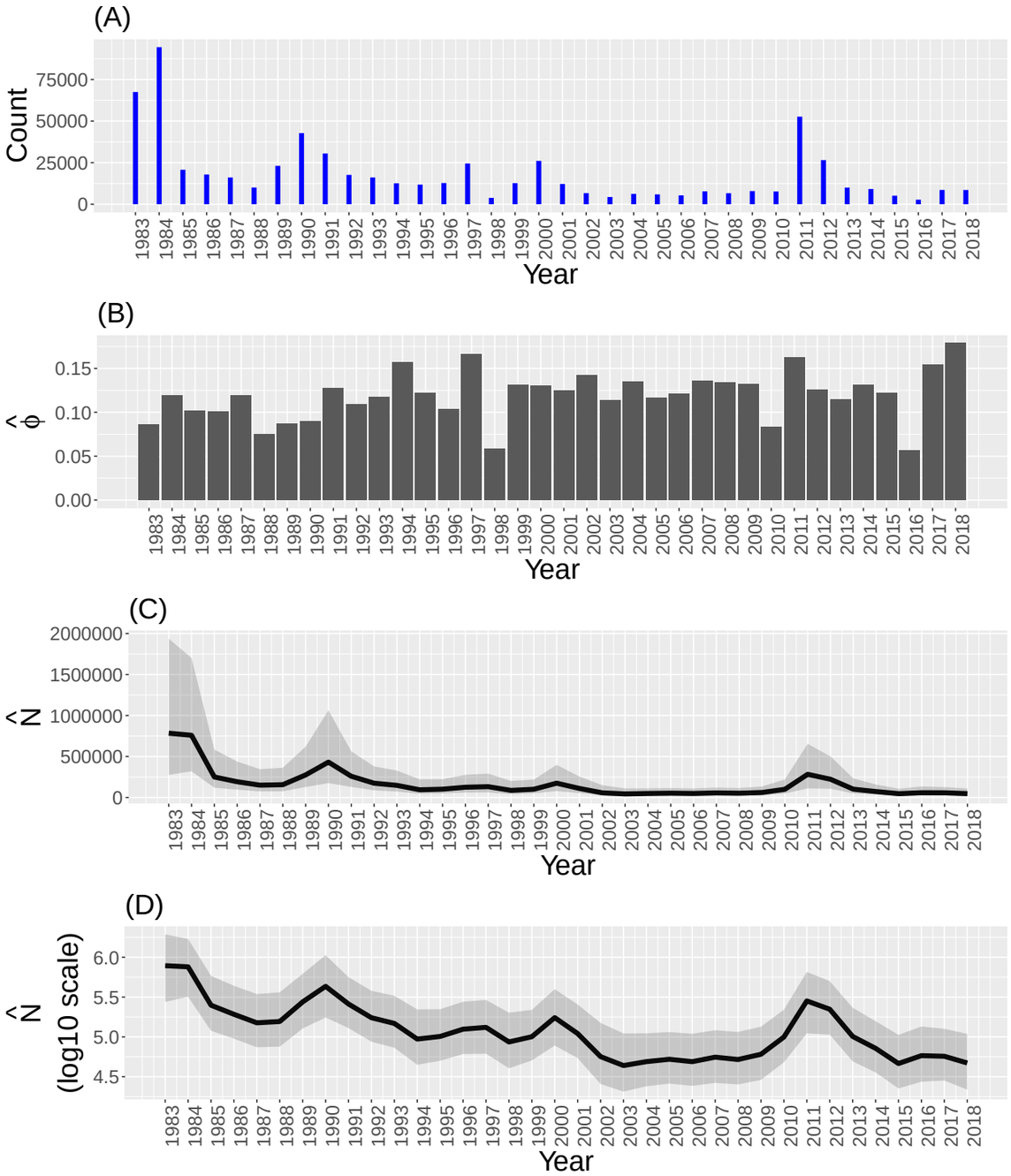

Figure 14: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Pacific black duck. Grey shading represents 95% credibility intervals.

Table 12: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Pacific black duck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.043	0.081	-0.042(-0.2090 – 0.119)	0.73	1.00
β_1	0.315	0.112	0.315(0.0977 – 0.538)	1.00	1.00
β_2	-0.489	0.201	-0.493(-0.8760 – -0.078)	0.99	1.00
σ_τ	0.244	0.159	0.227(0.0096 – 0.588)	NA	1.01
σ_V	0.215	0.140	0.198(0.0100 – 0.523)	NA	1.01
σ_W	0.444	0.138	0.451(0.1550 – 0.699)	NA	1.01

3.13 Duck, pink-eared (*Malacorhynchus membranaceus*)

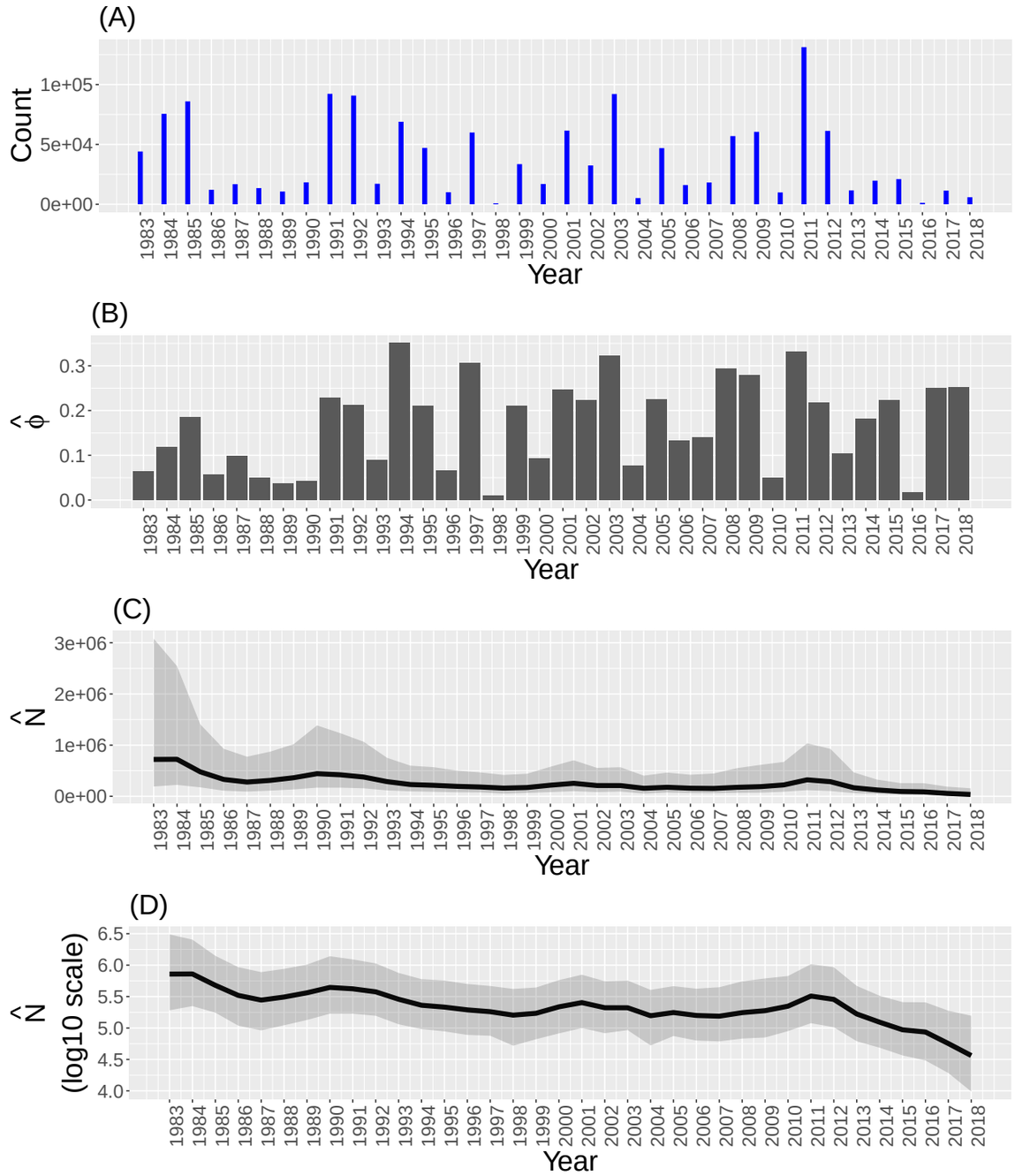

Figure 15: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the pink-eared duck. Grey shading represents 95% credibility intervals.

Table 13: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the pink-eared duck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.061	0.078	-0.056(-0.229 – 0.089)	0.82	1.00
β_1	0.169	0.144	0.166(-0.109 – 0.461)	0.88	1.01
β_2	-1.520	0.380	-1.520(-2.280 – -0.785)	1.00	1.00
σ_τ	0.792	0.318	0.827(0.112 – 1.360)	NA	1.00
σ_V	0.409	0.243	0.409(0.020 – 0.809)	NA	1.01
σ_W	0.395	0.194	0.381(0.041 – 0.827)	NA	1.03

3.14 Egret, eastern great (*Ardea alba*)

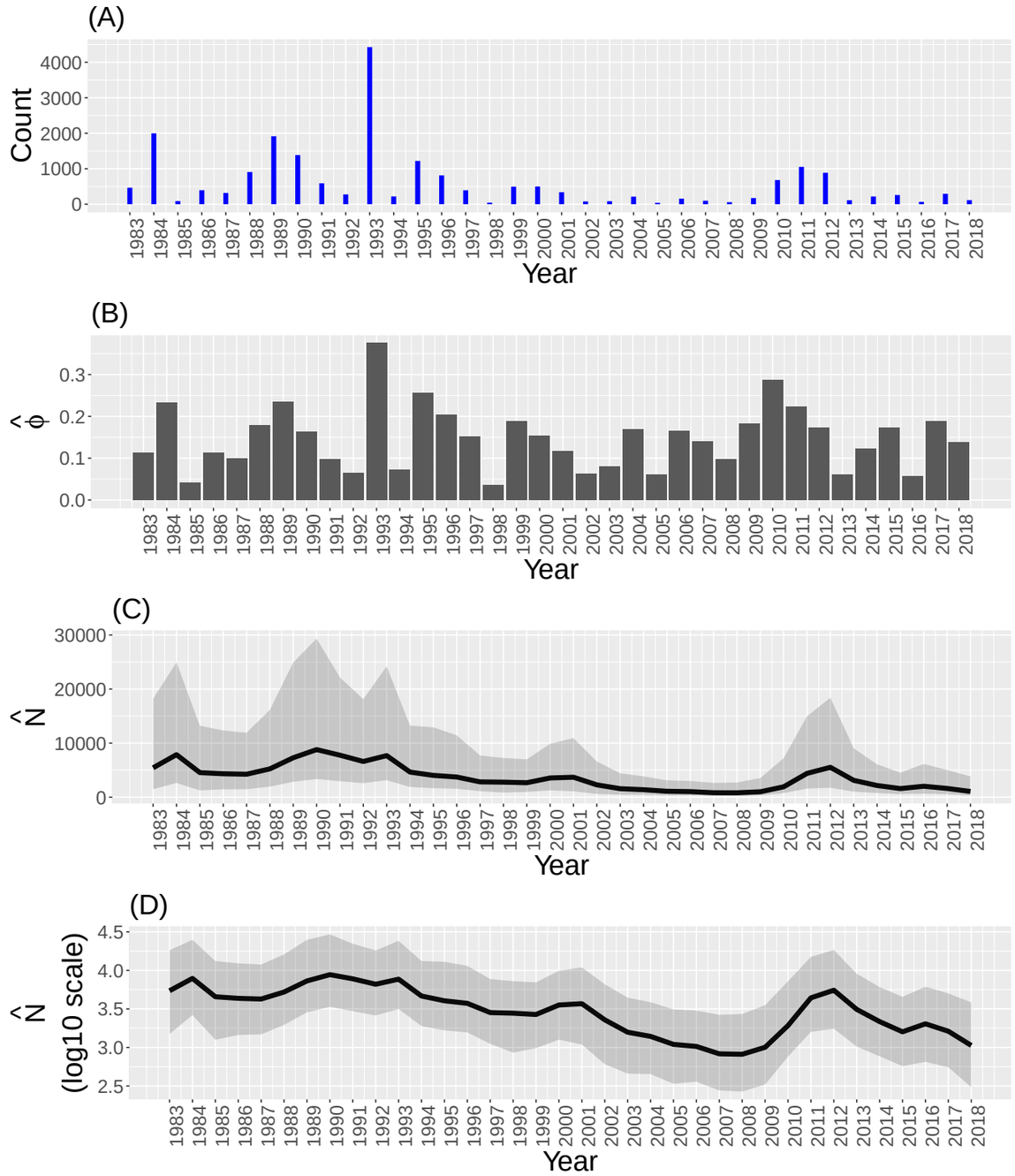

Figure 16: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the eastern great egret. Grey shading represents 95% credibility intervals.

Table 14: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the eastern great egret.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.0049	0.073	-0.0076(-0.151 – 0.15)	0.56	1.00
β_1	0.3390	0.158	0.3390(0.023 – 0.65)	0.98	1.01
β_2	-0.0396	0.413	-0.0473(-0.842 – 0.80)	0.55	1.00
σ_τ	0.9470	0.312	0.9750(0.220 – 1.51)	NA	1.00
σ_V	0.4340	0.244	0.4420(0.022 – 0.82)	NA	1.01
σ_W	0.3550	0.220	0.3340(0.024 – 0.87)	NA	1.00

3.15 Goose, Cape Barren (*Cereopsis novaehollandiae*)

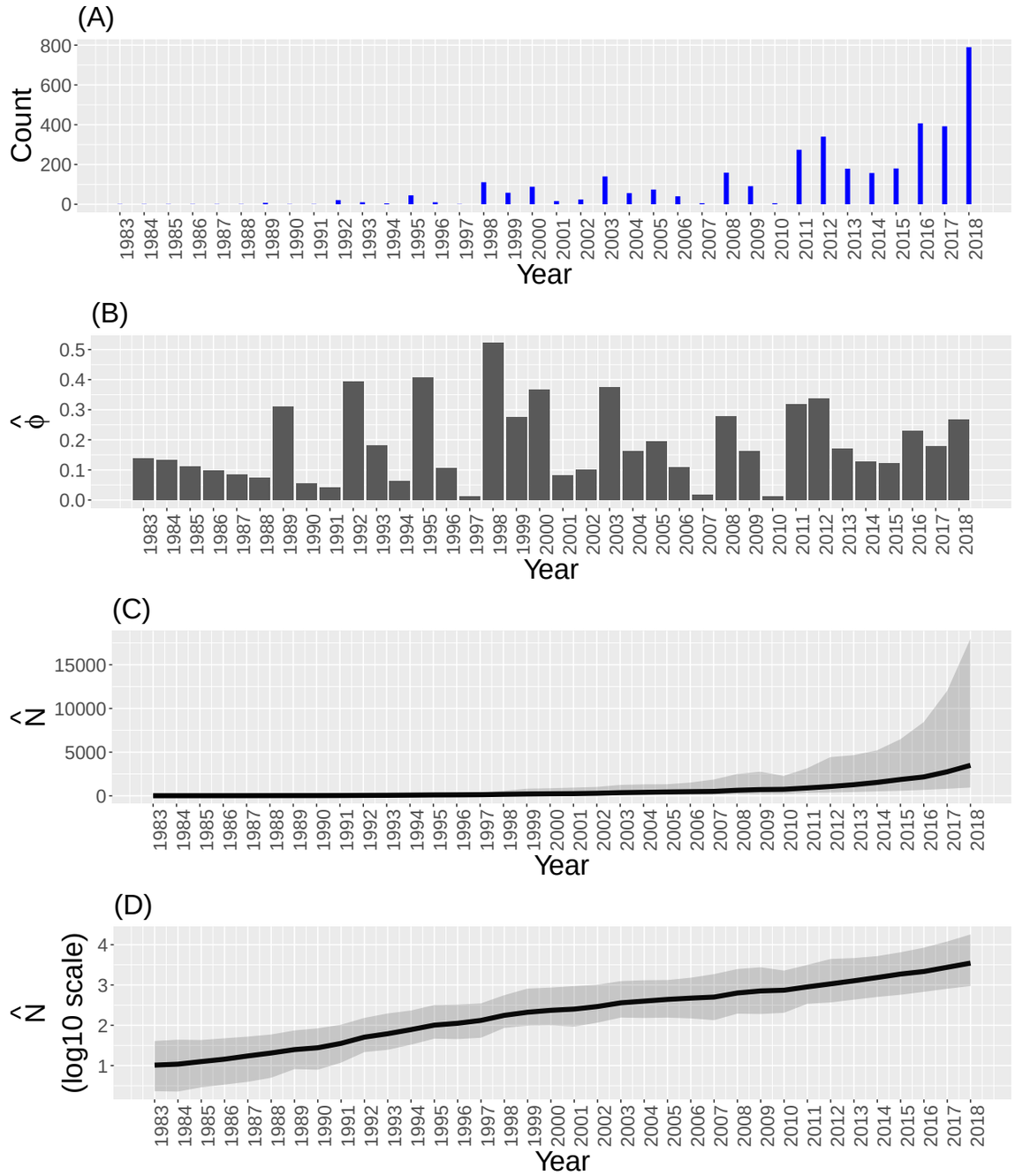

Figure 17: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Cape Barren goose. Grey shading represents 95% credibility intervals.

Table 15: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Cape Barren goose.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.138	0.065	0.143(-0.0091 – 0.26)	0.97	1.01
β_1	-0.033	0.164	-0.035(-0.3500 – 0.29)	0.58	1.01
β_2	0.185	0.554	0.176(-0.8980 – 1.26)	0.63	1.01
σ_τ	1.430	0.315	1.410(0.8650 – 2.12)	NA	1.00
σ_V	0.344	0.227	0.312(0.0159 – 0.79)	NA	1.01
σ_W	0.322	0.225	0.289(0.0116 – 0.85)	NA	1.04

3.16 Goose, magpie (*Anseranas semipalmata*)

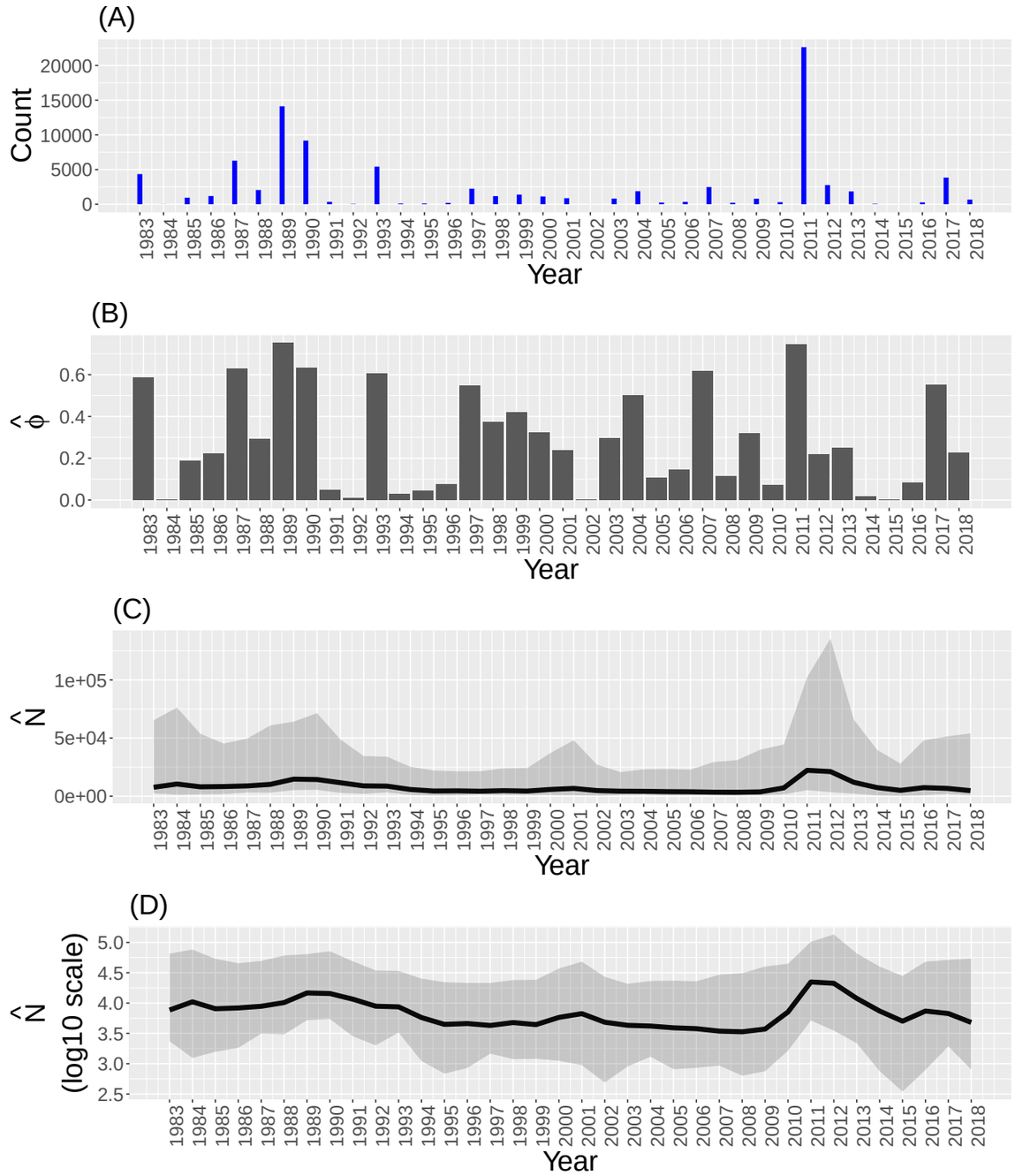

Figure 18: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the magpie goose. Grey shading represents 95% credibility intervals.

Table 16: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the magpie goose.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.022	0.11	0.021(-0.217 – 0.27)	0.61	1.01
β_1	0.301	0.28	0.316(-0.288 – 0.82)	0.86	1.01
β_2	0.877	1.12	0.896(-1.320 – 3.15)	0.79	1.01
σ_τ	3.040	0.61	2.950(2.080 – 4.51)	NA	1.00
σ_V	0.448	0.25	0.474(0.017 – 0.82)	NA	1.00
σ_W	0.560	0.37	0.493(0.041 – 1.46)	NA	1.01

3.17 Grebe, great crested (*Podiceps cristatus*)

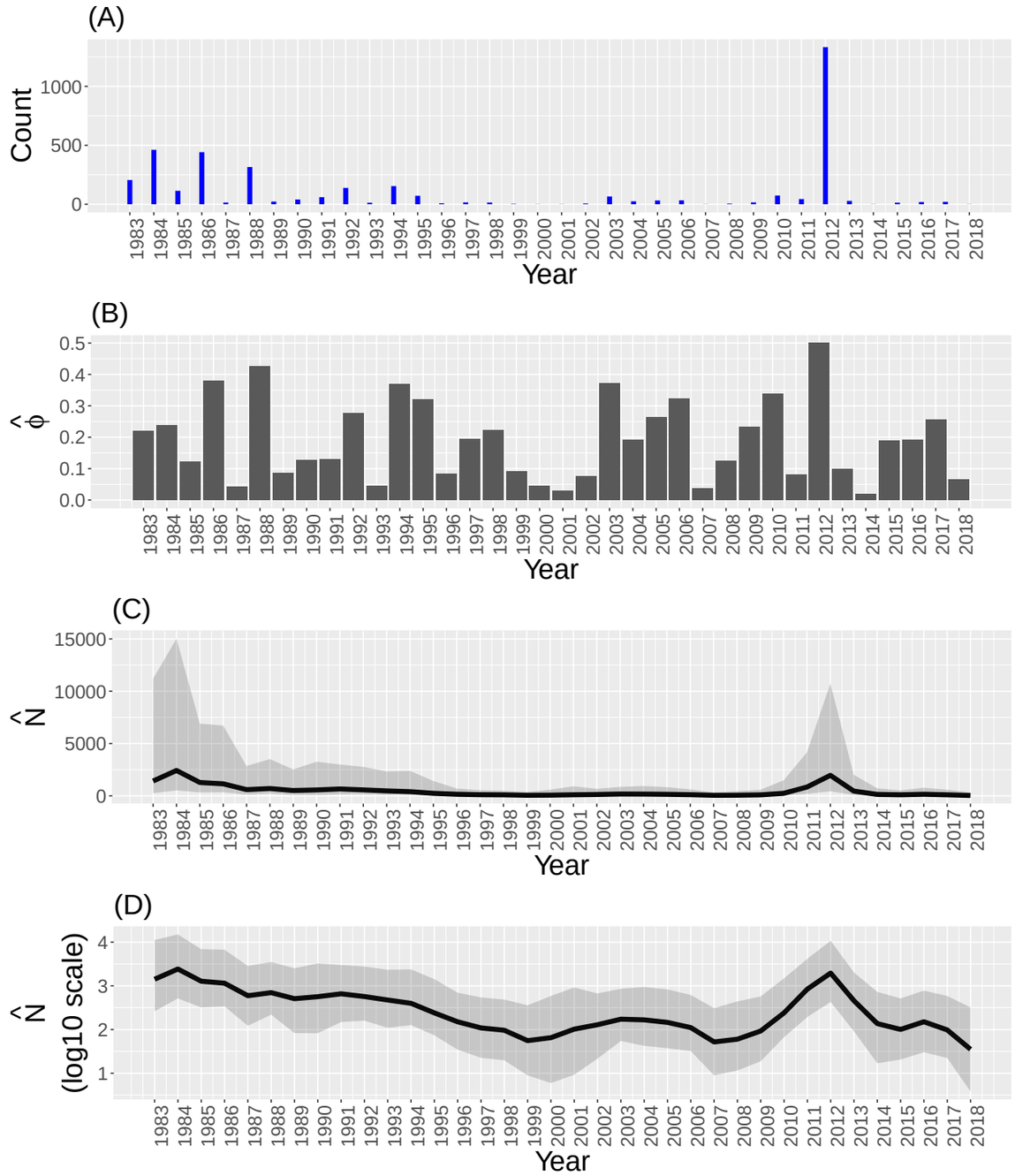

Figure 19: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the great crested grebe. Grey shading represents 95% credibility intervals.

Table 17: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the great crested grebe.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.048	0.14	-0.042(-0.360 – 0.24)	0.64	1.00
β_1	0.480	0.26	0.481(-0.025 – 0.97)	0.97	1.03
β_2	0.364	0.71	0.353(-1.050 – 1.81)	0.71	1.02
σ_τ	1.580	0.48	1.570(0.611 – 2.59)	NA	1.03
σ_V	0.441	0.24	0.452(0.021 – 0.81)	NA	1.00
σ_W	0.842	0.38	0.812(0.229 – 1.67)	NA	1.04

3.18 Gull, silver (*Chroicocephalus novaehollandiae*)

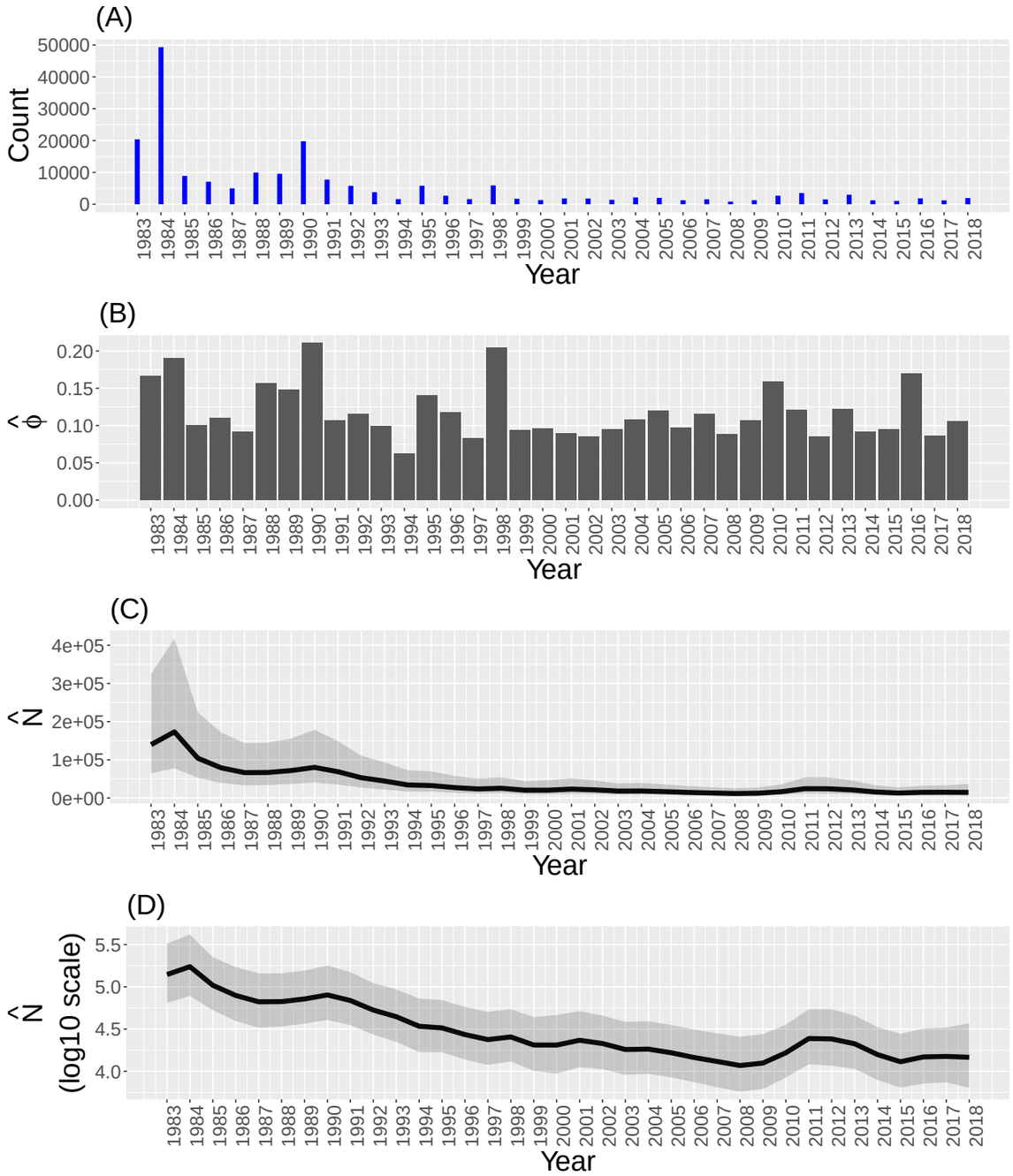

Figure 20: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the silver gull. Grey shading represents 95% credibility intervals.

Table 18: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the silver gull.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.046	0.047	-0.048(-0.1350 – 0.056)	0.86	1.01
β_1	0.155	0.083	0.155(-0.0058 – 0.325)	0.97	1.02
β_2	0.492	0.189	0.488(0.1270 – 0.870)	0.99	1.00
σ_τ	0.288	0.164	0.292(0.0142 – 0.599)	NA	1.02
σ_V	0.281	0.142	0.298(0.0155 – 0.530)	NA	1.01
σ_W	0.245	0.109	0.227(0.0783 – 0.494)	NA	1.02

3.19 Hardhead (*Aythya australis*)

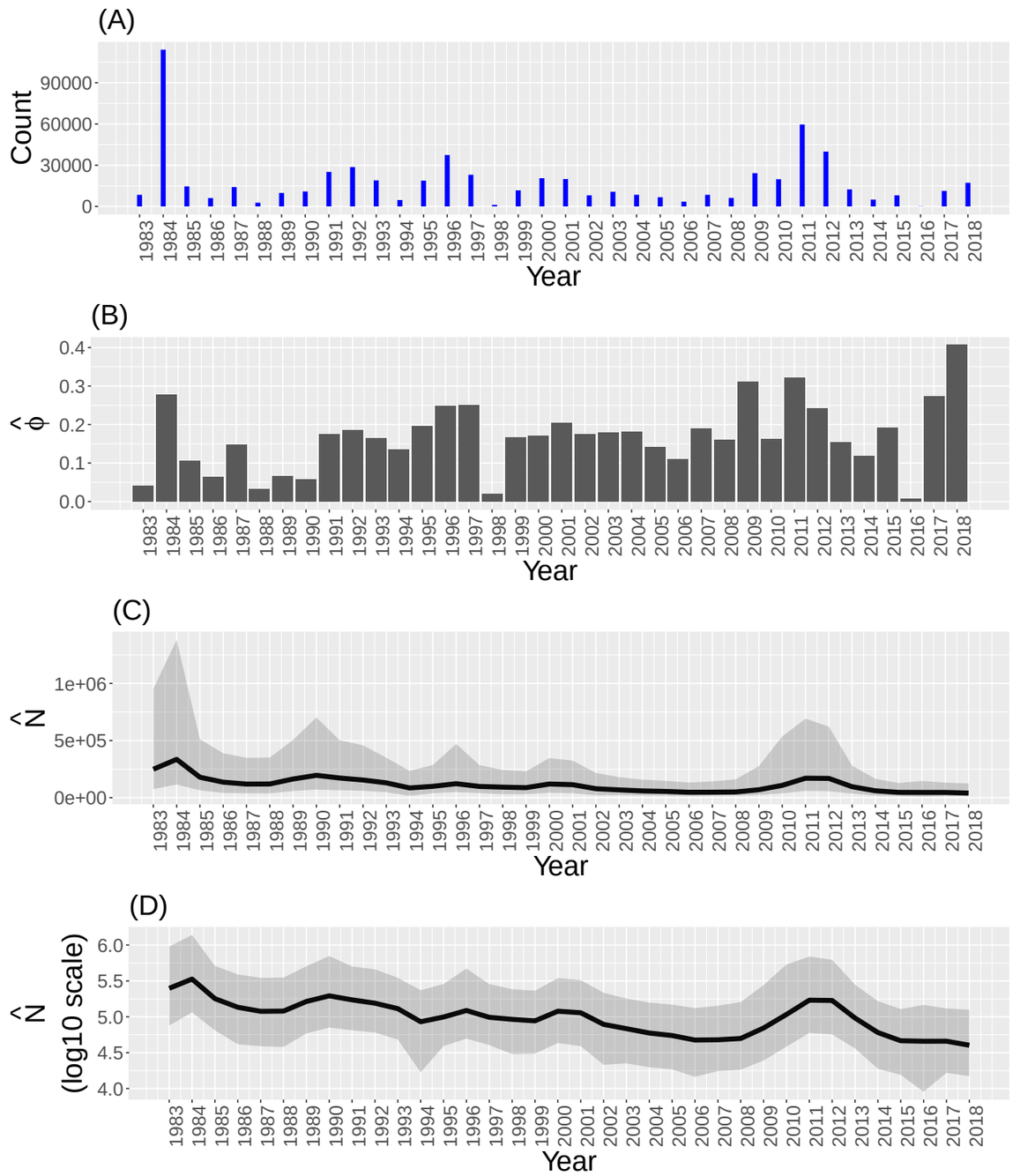

Figure 21: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the hardhead. Grey shading represents 95% credibility intervals.

Table 19: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the hardhead.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.019	0.094	-0.022(-0.210 – 0.20)	0.66	1.00
β_1	0.227	0.160	0.223(-0.087 – 0.56)	0.93	1.00
β_2	-1.330	0.409	-1.330(-2.140 – -0.53)	1.00	1.00
σ_τ	0.888	0.337	0.922(0.141 – 1.49)	NA	1.00
σ_V	0.397	0.240	0.393(0.017 – 0.81)	NA	1.00
σ_W	0.432	0.302	0.380(0.019 – 1.14)	NA	1.01

3.20 Heron, white-faced (*Egretta novaehollandiae*)

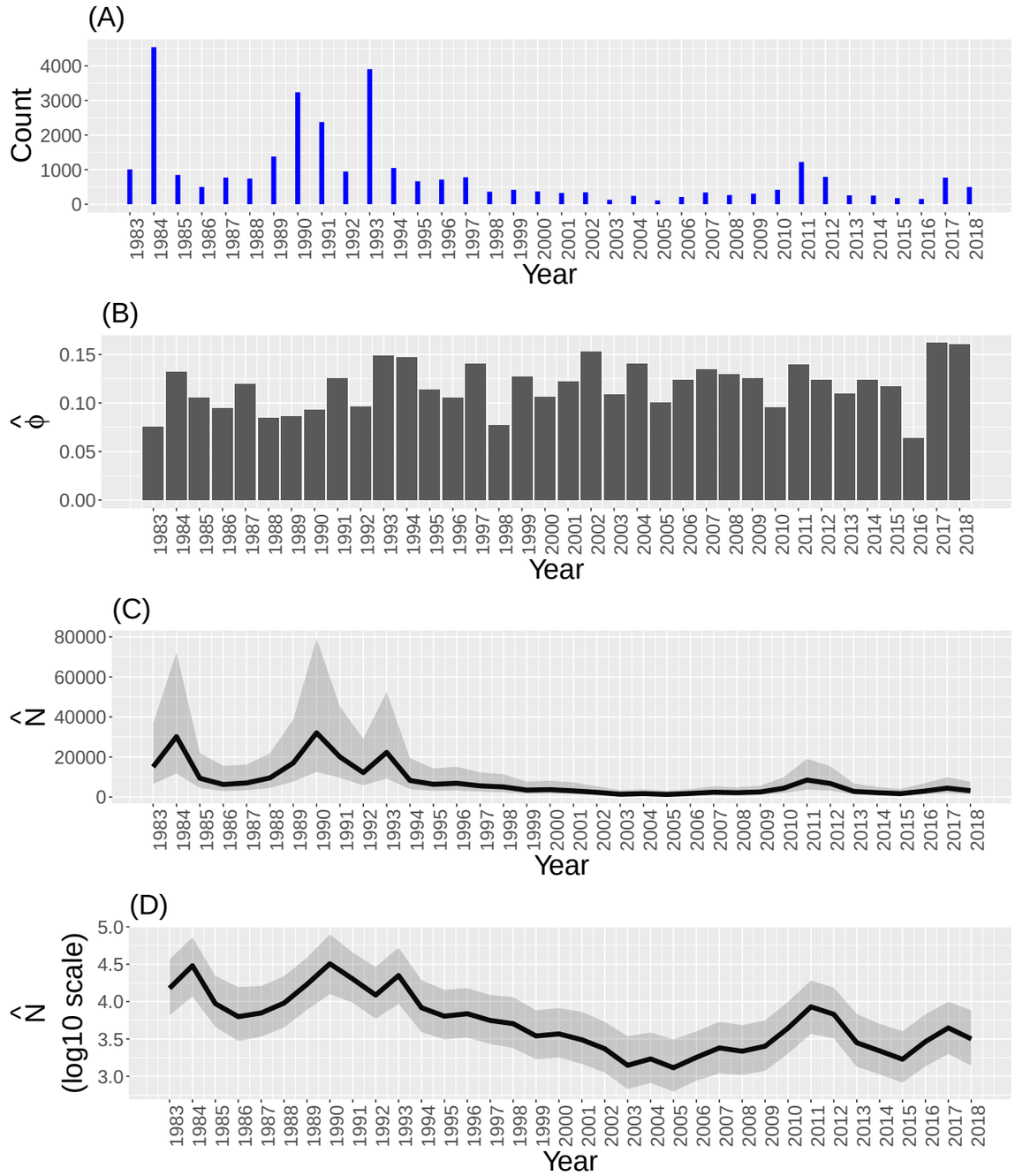

Figure 22: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the white-faced heron. Grey shading represents 95% credibility intervals.

Table 20: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the white-faced heron.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.0044	0.093	0.00083(-0.176 – 0.1980)	0.50	1.05
β_1	0.3430	0.137	0.34100(0.081 – 0.6190)	0.99	1.12
β_2	-0.4140	0.201	-0.41500(-0.809 – -0.0067)	0.98	1.01
σ_τ	0.2380	0.154	0.22000(0.014 – 0.5720)	NA	1.05
σ_V	0.2190	0.139	0.20400(0.015 – 0.5170)	NA	1.06
σ_W	0.5210	0.136	0.52100(0.260 – 0.7880)	NA	1.18

3.21 Heron, white-necked (*Ardea pacifica*)

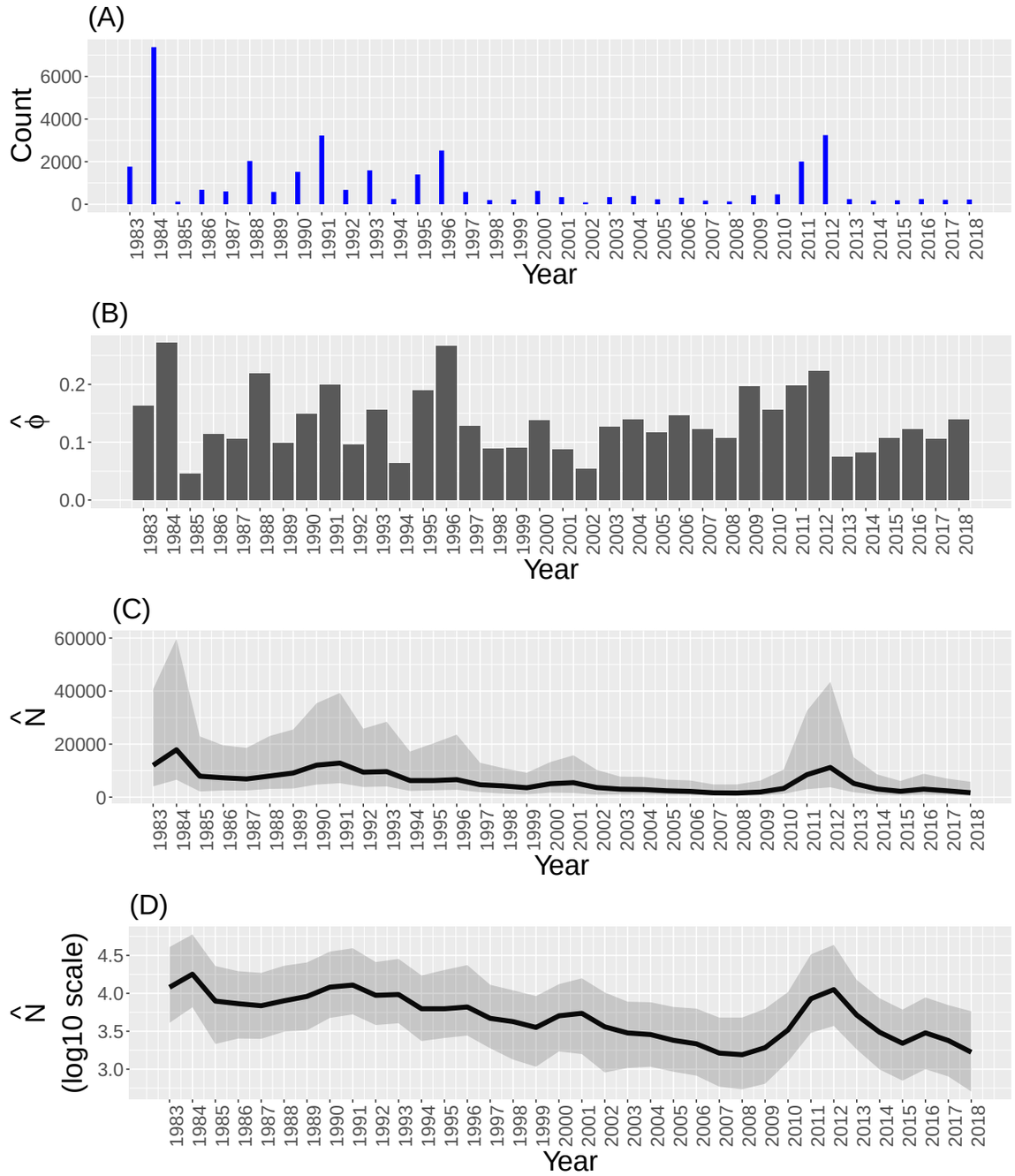

Figure 23: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the white-necked heron. Grey shading represents 95% credibility intervals.

Table 21: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the white-necked heron.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.0097	0.08	-0.014(-0.168 – 0.17)	0.60	1.00
β_1	0.3700	0.16	0.364(0.070 – 0.71)	0.99	1.02
β_2	0.2210	0.38	0.224(-0.541 – 0.95)	0.73	1.00
σ_τ	0.7370	0.33	0.765(0.075 – 1.34)	NA	1.00
σ_V	0.4630	0.24	0.488(0.032 – 0.82)	NA	1.01
σ_W	0.3920	0.25	0.355(0.019 – 0.96)	NA	1.00

3.22 Ibis, Australian white (*Threskiornis molucca*)

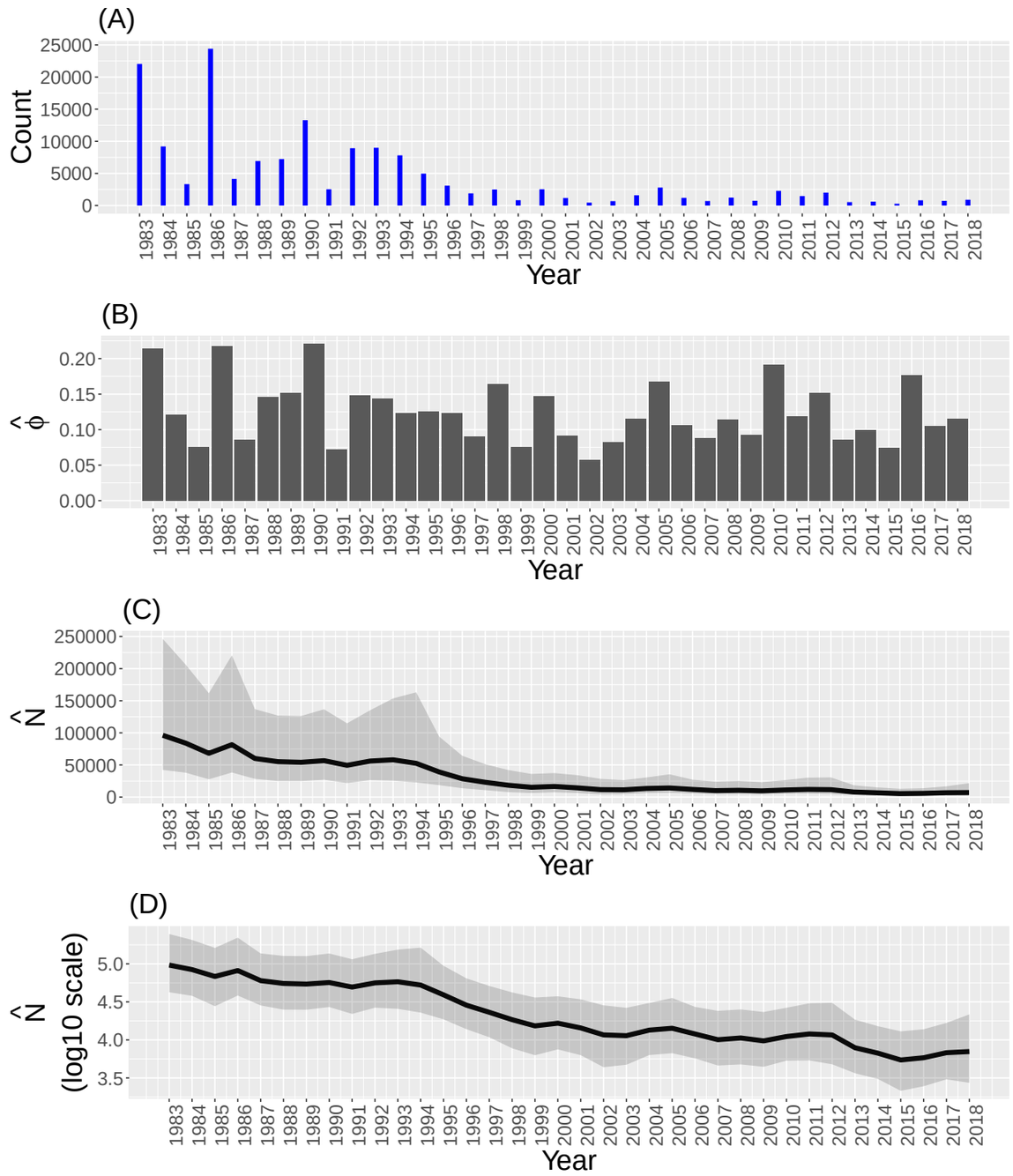

Figure 24: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australian white ibis. Grey shading represents 95% credibility intervals.

Table 22: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australian white ibis.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.066	0.063	-0.071(-0.1880 – 0.077)	0.88	1.04
β_1	0.047	0.109	0.044(-0.1660 – 0.270)	0.67	1.02
β_2	0.500	0.257	0.498(0.0057 – 1.010)	0.98	1.00
σ_τ	0.435	0.227	0.455(0.0377 – 0.834)	NA	1.01
σ_V	0.311	0.193	0.301(0.0125 – 0.681)	NA	1.06
σ_W	0.311	0.192	0.281(0.0264 – 0.767)	NA	1.05

3.23 Ibis, glossy (*Plegadis falcinellus*)

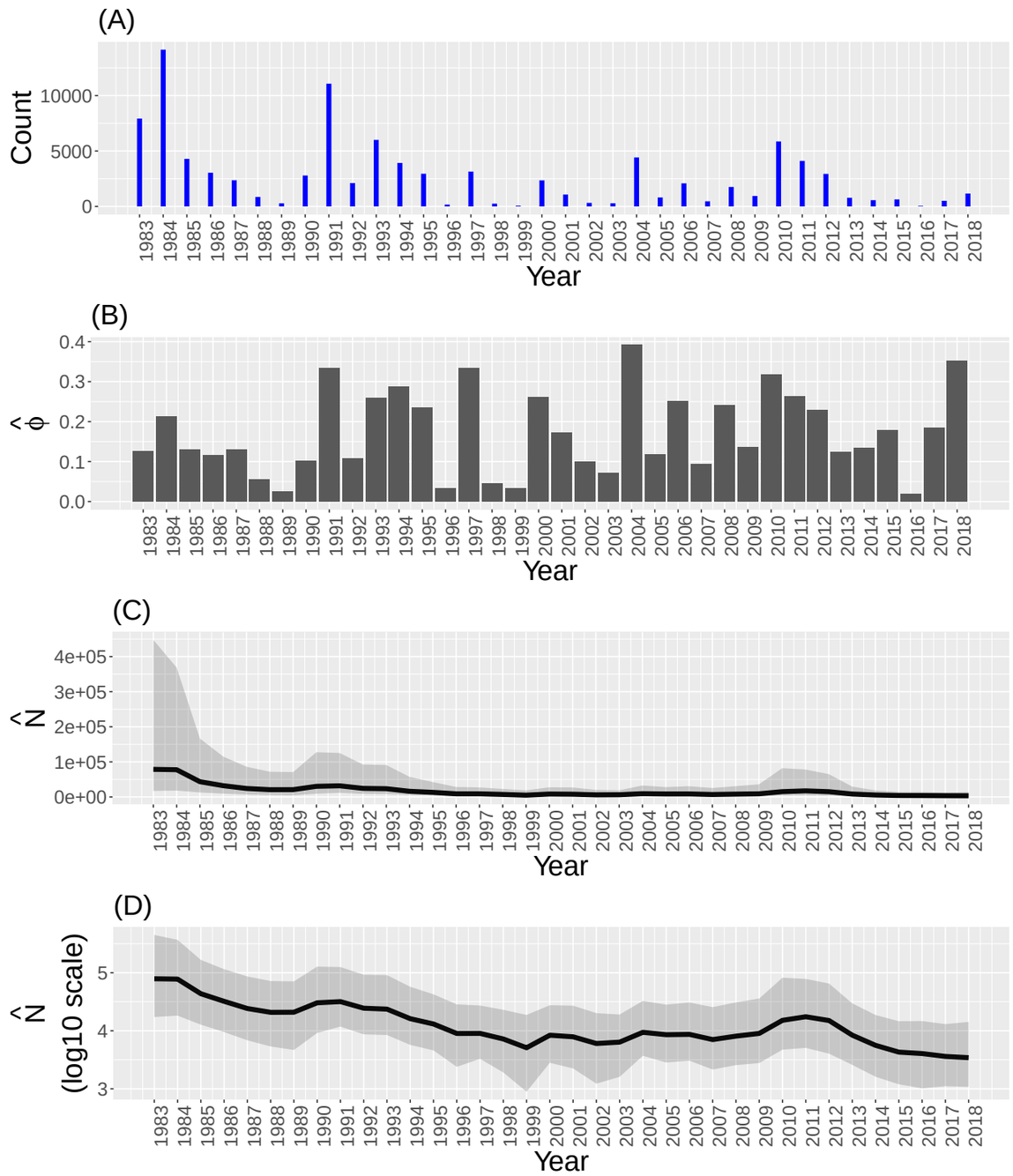

Figure 25: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the glossy ibis. Grey shading represents 95% credibility intervals.

Table 23: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the glossy ibis.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.057	0.11	-0.058(-0.2820 – 0.183)	0.75	1.01
β_1	0.169	0.20	0.161(-0.2210 – 0.592)	0.81	1.00
β_2	-0.983	0.48	-0.982(-1.9400 – -0.013)	0.98	1.00
σ_τ	1.110	0.38	1.130(0.2610 – 1.830)	NA	1.00
σ_V	0.401	0.24	0.397(0.0085 – 0.809)	NA	1.00
σ_W	0.555	0.30	0.527(0.0537 – 1.240)	NA	1.00

3.24 Ibis, straw-necked (*Threskiornis spinicollis*)

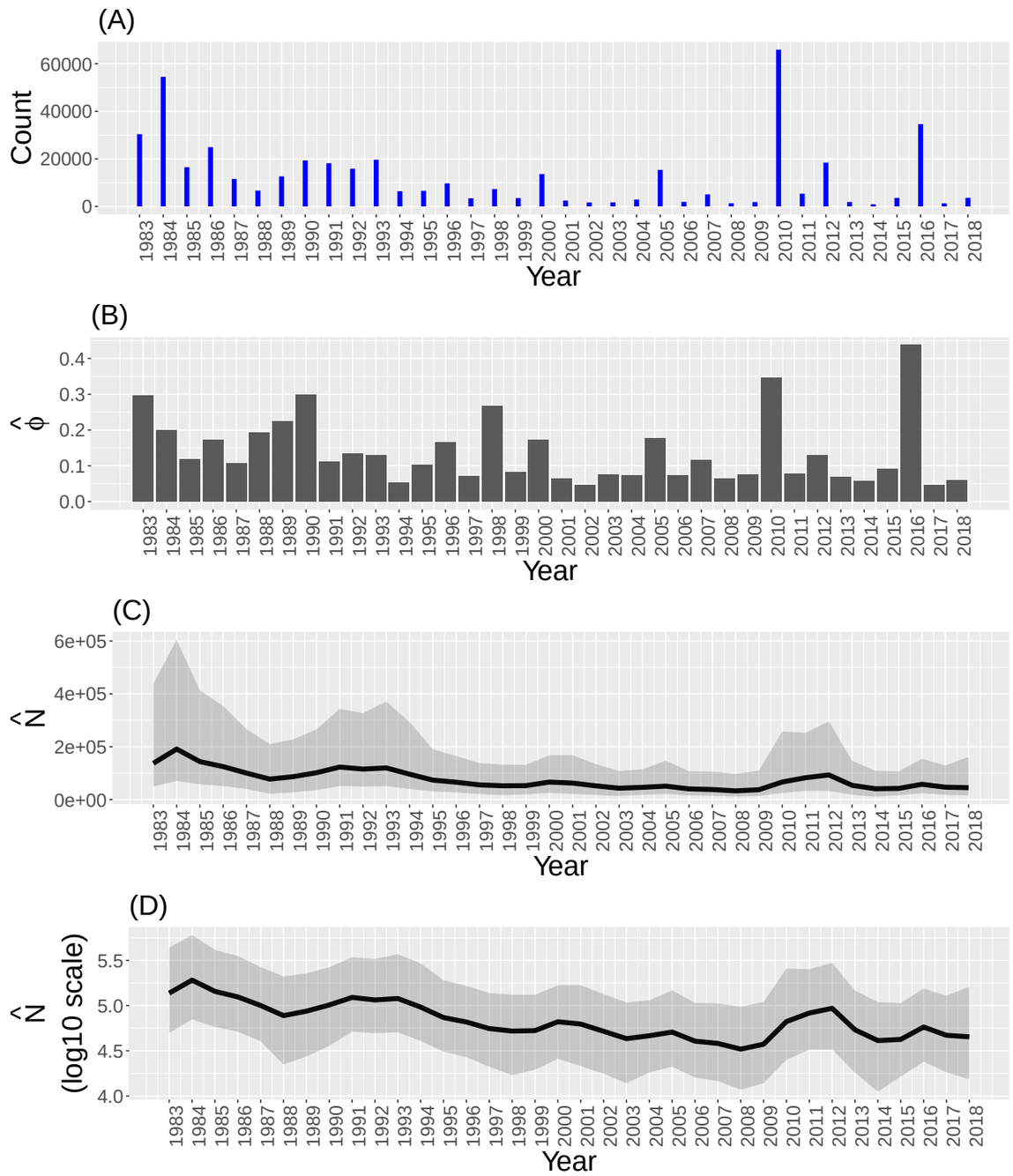

Figure 26: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the straw-necked ibis. Grey shading represents 95% credibility intervals.

Table 24: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the straw-necked ibis.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.012	0.082	-0.016(-0.184 – 0.17)	0.63	1.03
β_1	0.179	0.149	0.175(-0.121 – 0.48)	0.90	1.01
β_2	1.230	0.378	1.210(0.527 – 2.03)	1.00	1.00
σ_τ	0.493	0.295	0.485(0.023 – 1.08)	NA	1.01
σ_V	0.562	0.203	0.613(0.066 – 0.82)	NA	1.01
σ_W	0.369	0.257	0.328(0.018 – 0.96)	NA	1.01

3.25 Lapwing, banded (*Vanellus tricolour*)

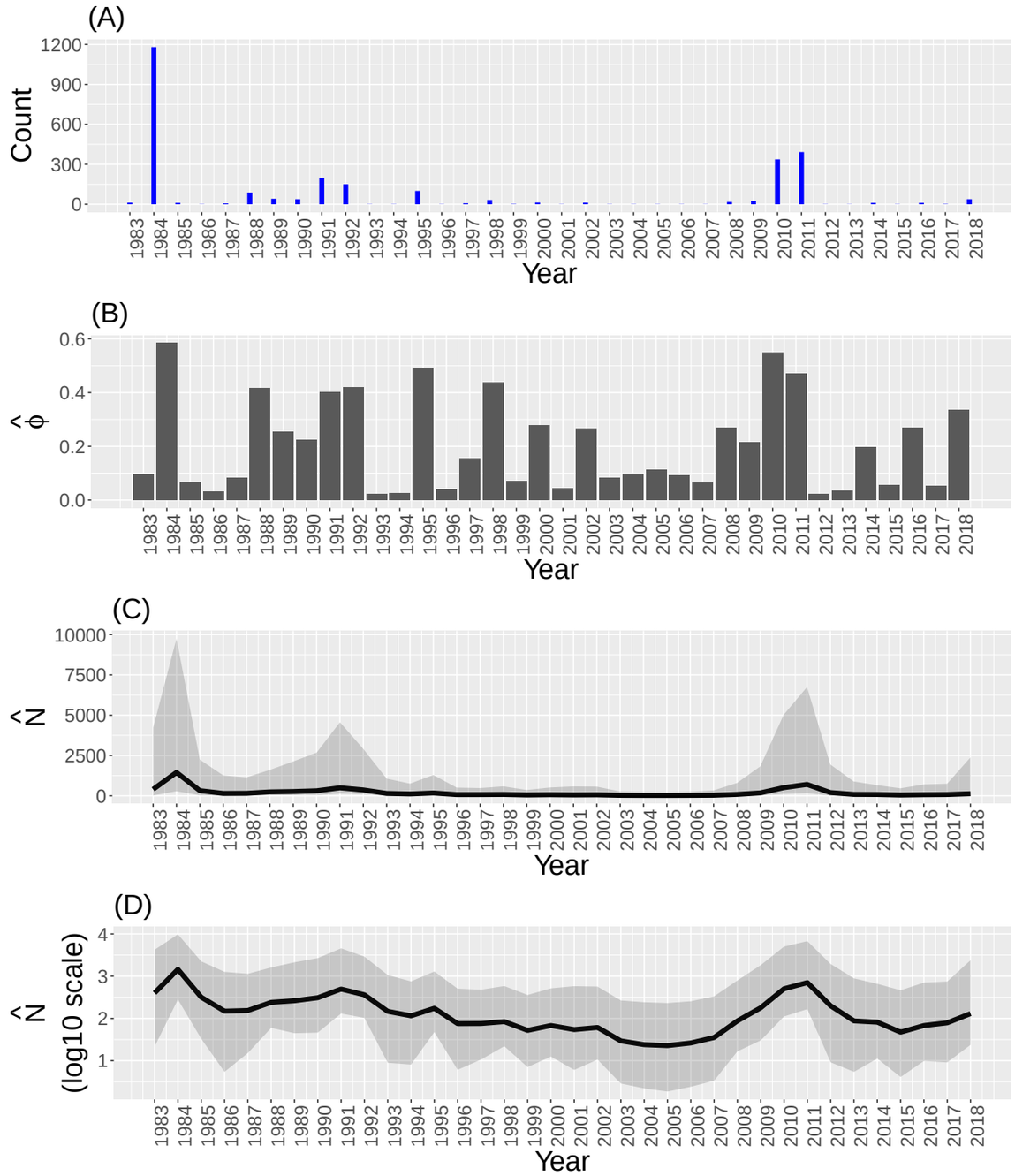

Figure 27: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the banded lapwing. Grey shading represents 95% credibility intervals.

Table 25: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the banded lapwing.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.0042	0.20	-0.00058(-0.400 – 0.43)	0.50	1.00
β_1	0.2120	0.33	0.22300(-0.501 – 0.85)	0.77	1.01
β_2	0.8040	0.92	0.77000(-0.944 – 2.71)	0.82	1.01
σ_τ	2.0500	0.65	2.09000(0.523 – 3.28)	NA	1.01
σ_V	0.4900	0.24	0.52500(0.041 – 0.82)	NA	1.01
σ_W	1.2100	0.61	1.11000(0.265 – 2.69)	NA	1.01

3.26 Lapwing, masked (*Vanellus miles*)

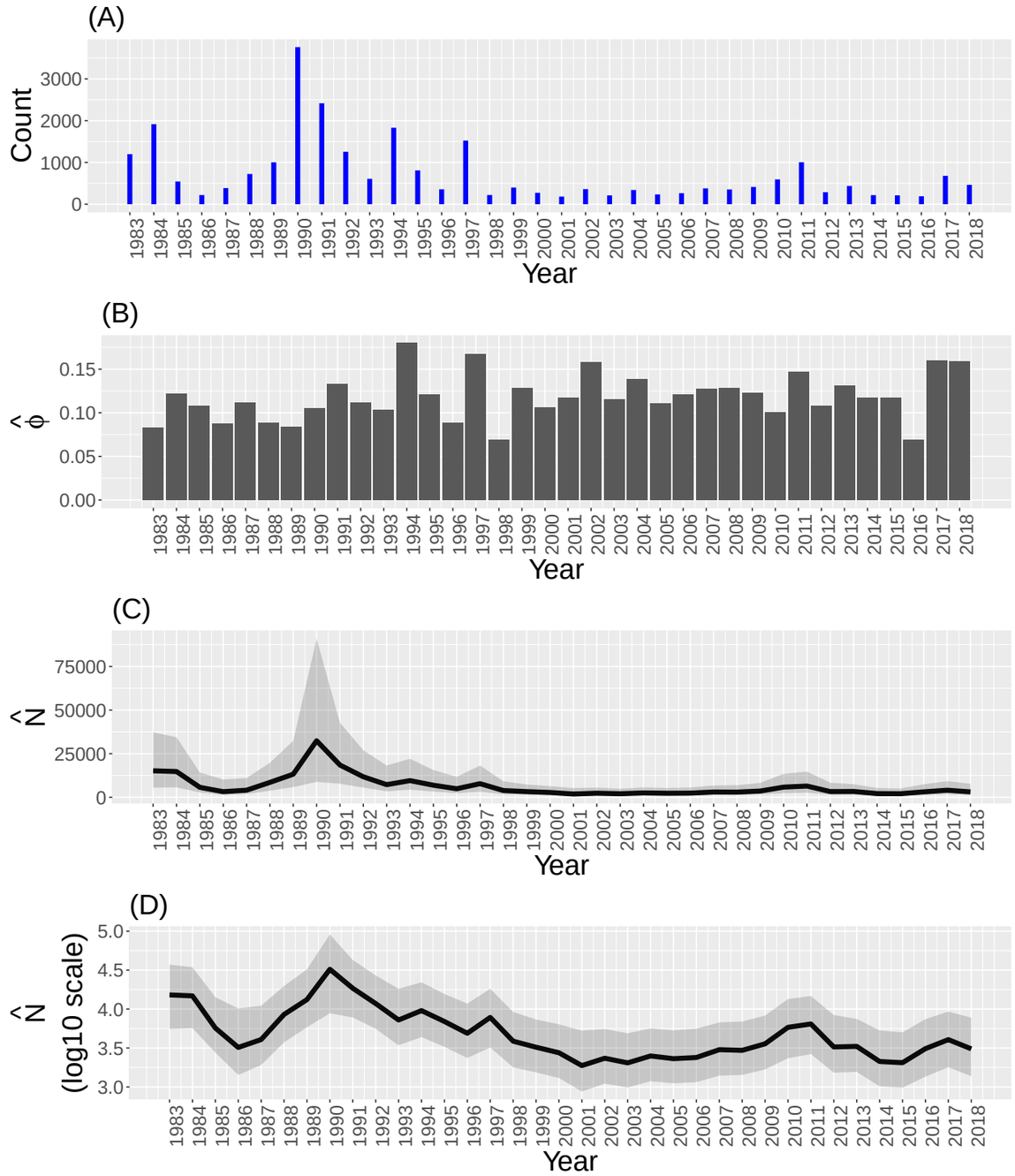

Figure 28: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the masked lapwing. Grey shading represents 95% credibility intervals.

Table 26: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the masked lapwing.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.014	0.10	-0.018(-0.2080 – 0.194)	0.58	1.02
β_1	0.104	0.14	0.101(-0.1590 – 0.378)	0.79	1.05
β_2	-0.427	0.23	-0.432(-0.8740 – 0.071)	0.96	1.01
σ_τ	0.258	0.18	0.232(0.0079 – 0.667)	NA	1.00
σ_V	0.236	0.17	0.211(0.0079 – 0.609)	NA	1.02
σ_W	0.558	0.16	0.569(0.2130 – 0.858)	NA	1.02

3.27 Moorhen, dusky (*Gallinula tenebrosa*)

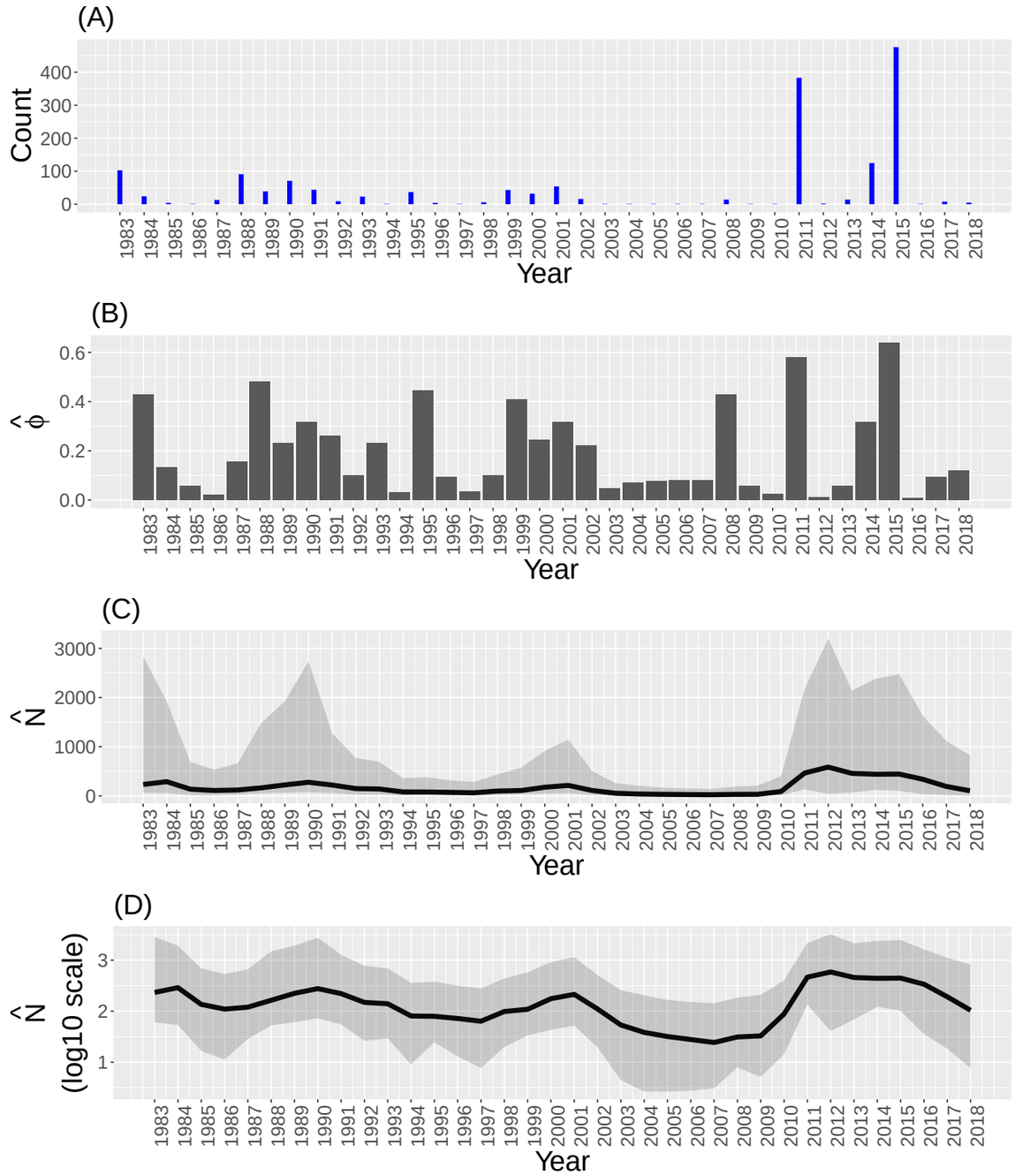

Figure 29: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the dusky moorhen. Grey shading represents 95% credibility intervals.

Table 27: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the dusky moorhen.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.0099	0.13	0.026(-0.308 – 0.26)	0.61	1.05
β_1	0.4300	0.26	0.443(-0.128 – 0.91)	0.94	1.04
β_2	-0.0201	0.86	-0.040(-1.680 – 1.73)	0.52	1.03
σ_τ	2.0300	0.50	2.020(1.000 – 3.08)	NA	1.07
σ_V	0.5060	0.24	0.554(0.029 – 0.82)	NA	1.00
σ_W	0.6980	0.49	0.577(0.053 – 1.88)	NA	1.25

3.28 Native-hen, black-tailed (*Tribonyx ventralis*)

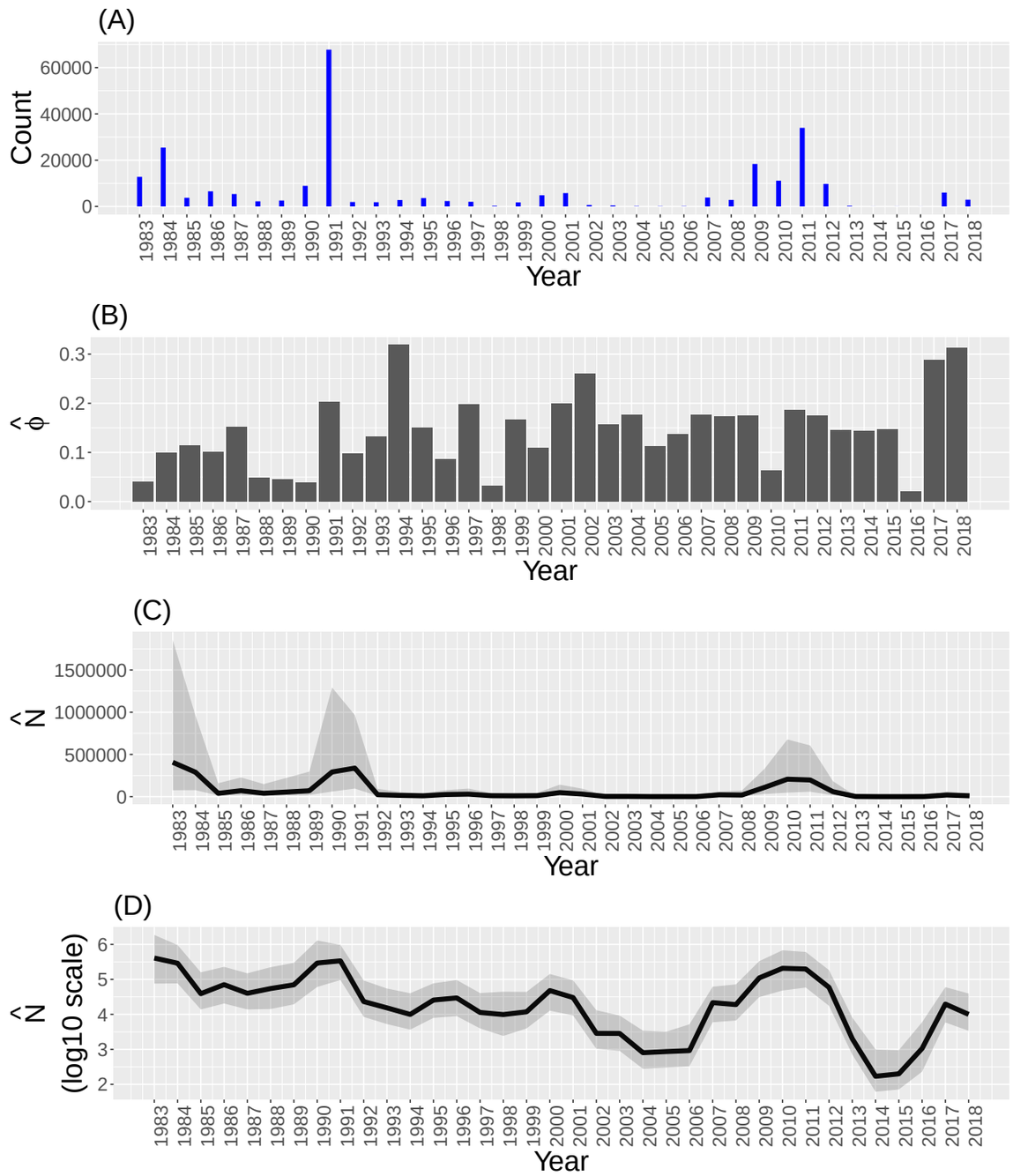

Figure 30: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the black-tailed native-hen. Grey shading represents 95% credibility intervals.

Table 28: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the black-tailed native-hen.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.046	0.25	-0.048(-0.539 – 0.46)	0.57	1.03
β_1	0.394	0.34	0.392(-0.268 – 1.07)	0.88	1.04
β_2	-1.390	0.53	-1.390(-2.440 – -0.37)	1.00	1.00
σ_τ	0.414	0.33	0.342(0.016 – 1.23)	NA	1.01
σ_V	0.319	0.21	0.288(0.014 – 0.76)	NA	1.01
σ_W	1.620	0.26	1.600(1.150 – 2.19)	NA	1.02

3.29 Pelican, Australian (*Pelecanus conspicillatus*)

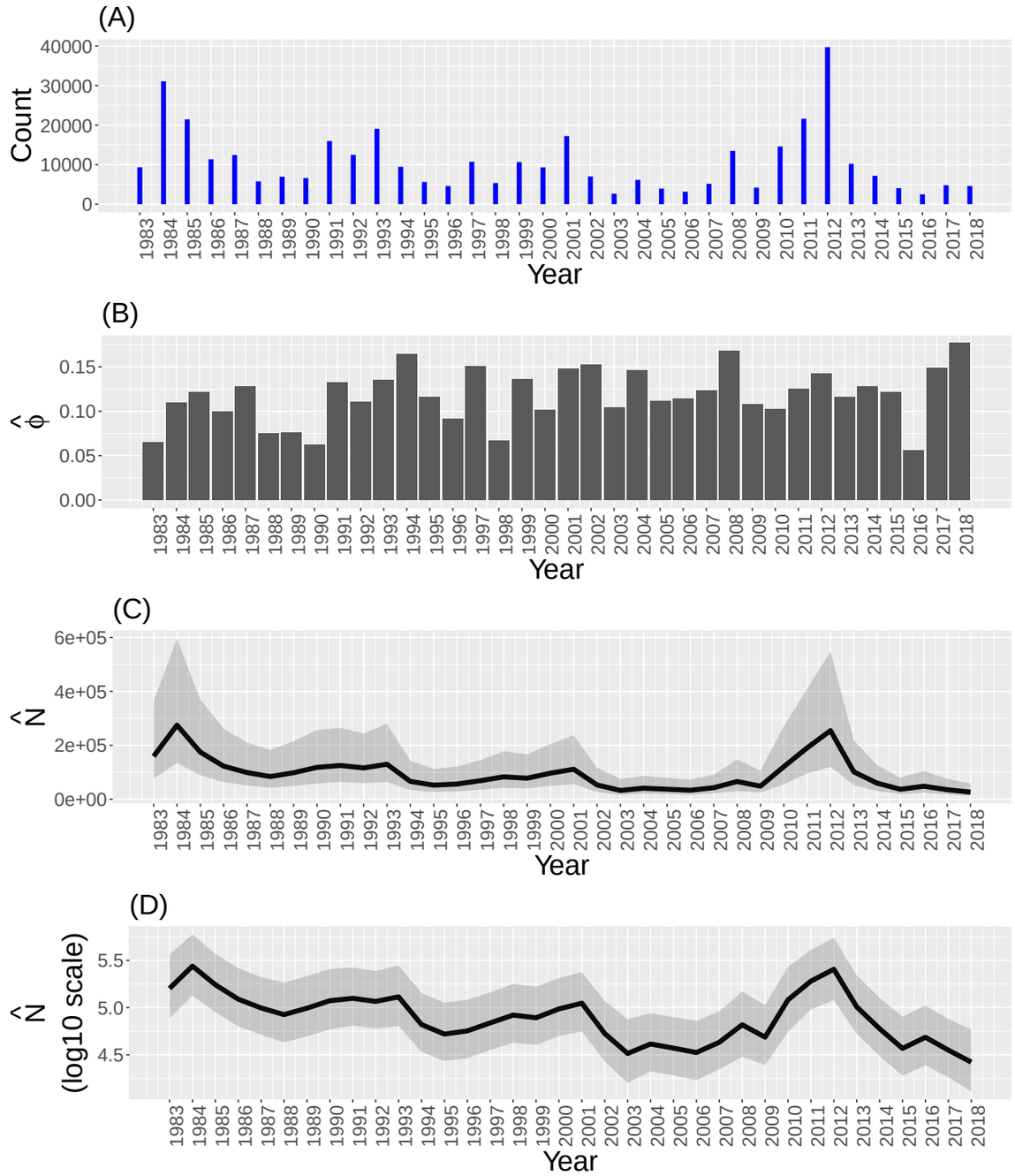

Figure 31: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australian pelican. Grey shading represents 95% credibility intervals.

Table 29: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australian pelican.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.0083	0.066	-0.0095(-0.1390 – 0.13)	0.56	1.01
β_1	0.3380	0.092	0.3370(0.1600 – 0.52)	1.00	1.03
β_2	-0.5580	0.158	-0.5560(-0.8780 – -0.25)	1.00	1.00
σ_τ	0.2060	0.126	0.1990(0.0093 – 0.46)	NA	1.00
σ_V	0.1970	0.115	0.1960(0.0116 – 0.43)	NA	1.00
σ_W	0.3760	0.101	0.3700(0.1960 – 0.59)	NA	1.01

3.30 Shelduck, Australian (*Tadorna tadornoides*)

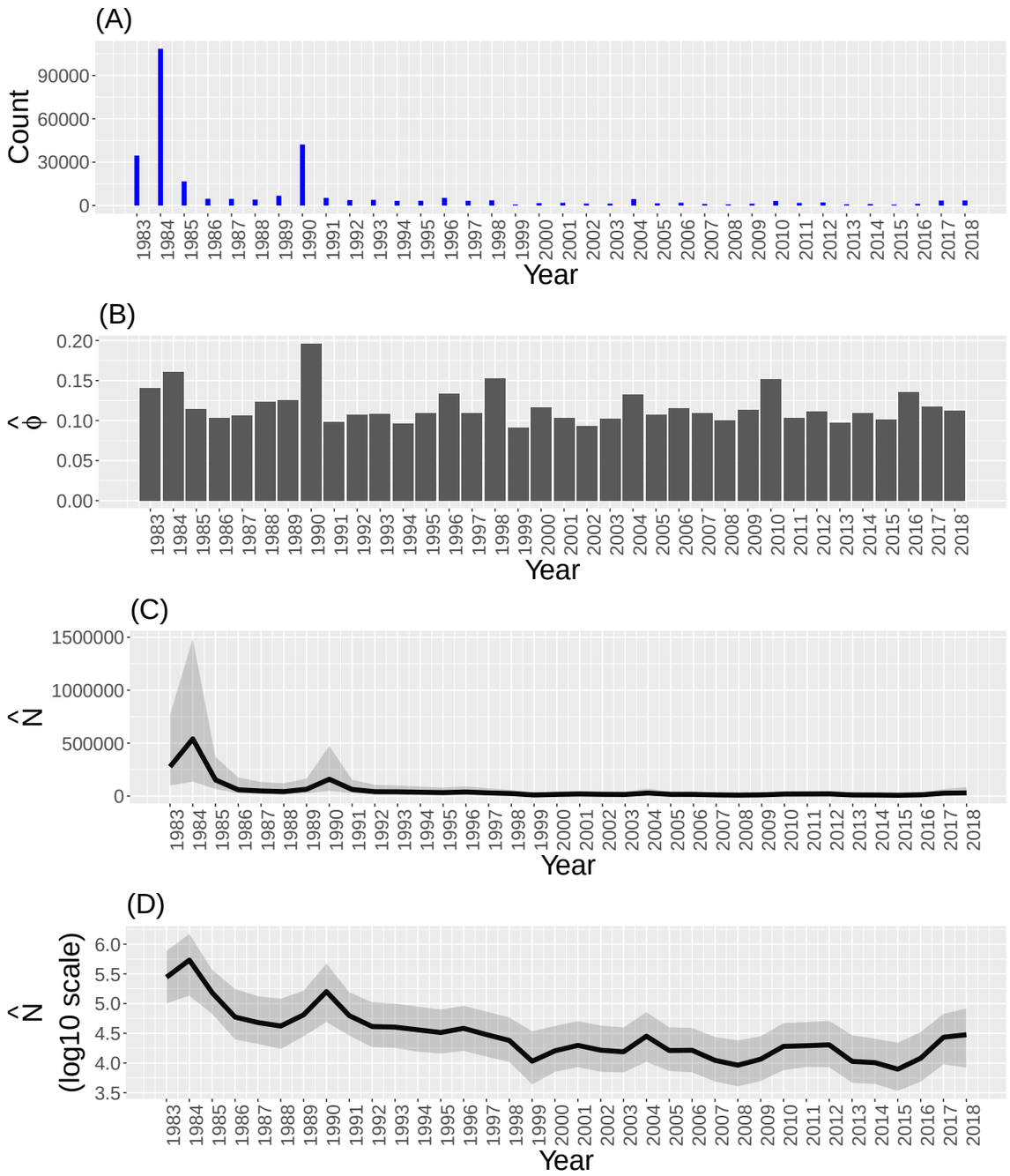

Figure 32: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australian shelduck. Grey shading represents 95% credibility intervals.

Table 30: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australian shelduck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.015	0.12	-0.026(-0.232 – 0.25)	0.59	1.03
β_1	0.251	0.16	0.242(-0.048 – 0.61)	0.95	1.02
β_2	0.246	0.26	0.242(-0.250 – 0.76)	0.84	1.00
σ_τ	0.293	0.21	0.259(0.012 – 0.76)	NA	1.01
σ_V	0.308	0.19	0.295(0.014 – 0.71)	NA	1.00
σ_W	0.621	0.21	0.633(0.185 – 1.00)	NA	1.00

3.31 Shelduck, radjah (*Radjah radjah*)

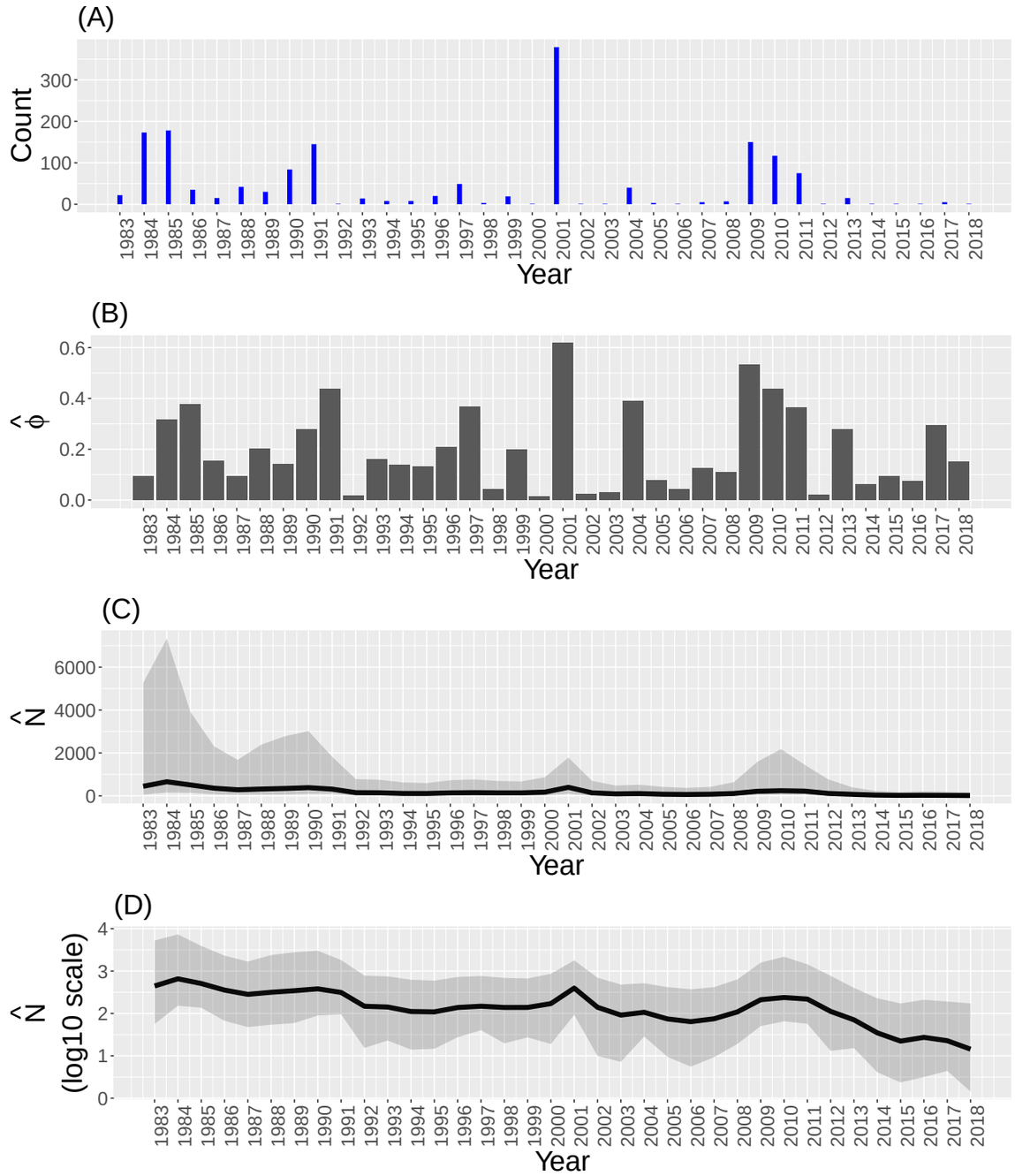

Figure 33: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the radjah shelduck. Grey shading represents 95% credibility intervals.

Table 31: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the radjah shelduck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.062	0.15	-0.058(-0.391 – 0.25)	0.70	1.01
β_1	0.203	0.26	0.195(-0.290 – 0.75)	0.80	1.01
β_2	-0.218	0.79	-0.232(-1.740 – 1.38)	0.62	1.00
σ_τ	1.920	0.50	1.910(0.940 – 2.97)	NA	1.01
σ_V	0.483	0.24	0.521(0.030 – 0.82)	NA	1.01
σ_W	0.864	0.49	0.788(0.089 – 2.02)	NA	1.04

3.32 Shoveler, Australasian (*Anas rhynchotis*)

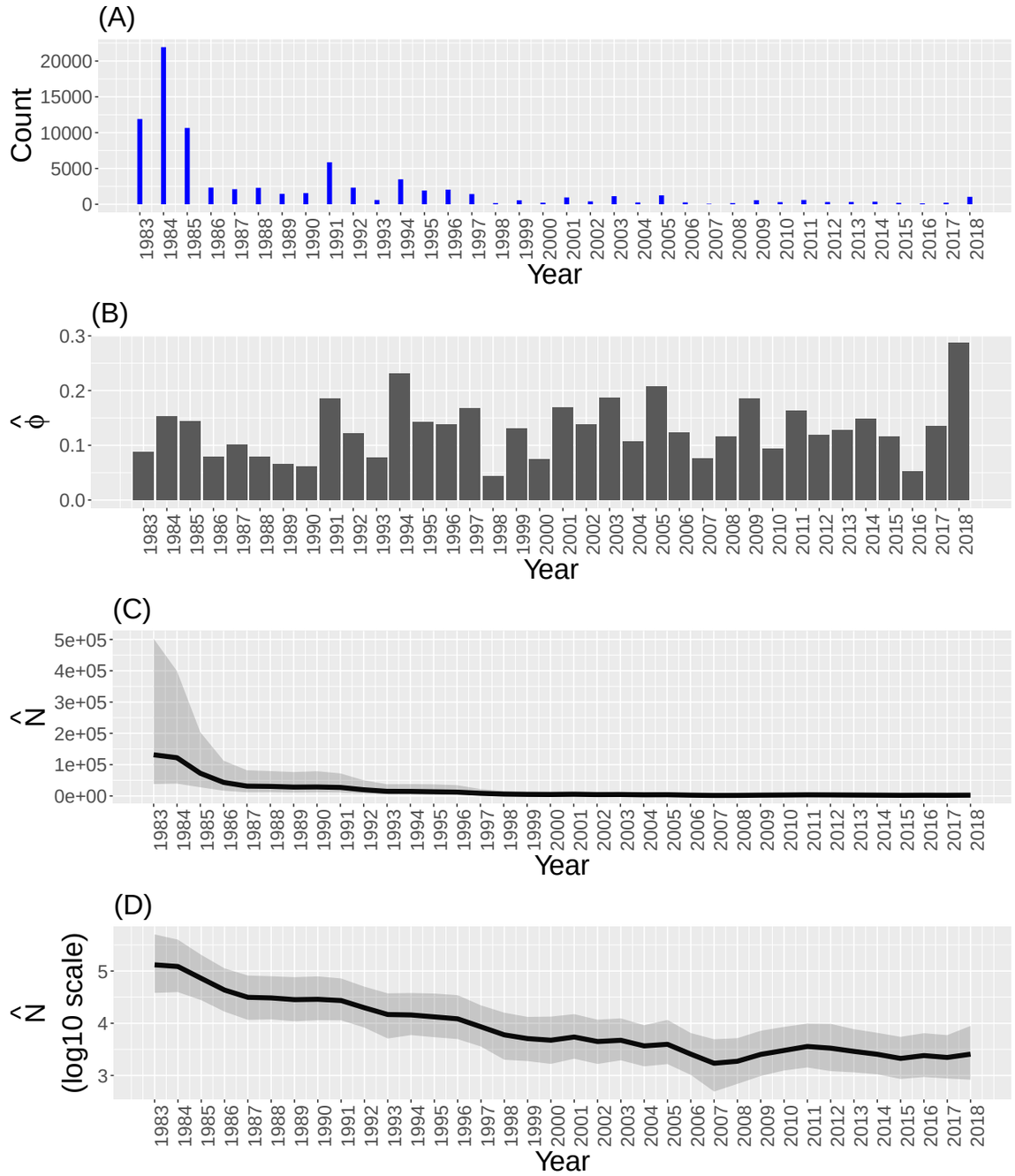

Figure 34: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australasian shoveler. Grey shading represents 95% credibility intervals.

Table 32: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australasian shoveler.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.095	0.082	-0.096(-0.261 – 0.079)	0.90	1
β_1	0.096	0.143	0.100(-0.192 – 0.368)	0.76	1
β_2	-0.682	0.303	-0.684(-1.280 – -0.085)	0.99	1
σ_τ	0.533	0.285	0.549(0.040 – 1.060)	NA	1
σ_V	0.435	0.224	0.459(0.031 – 0.796)	NA	1
σ_W	0.418	0.211	0.387(0.088 – 0.904)	NA	1

3.33 Spoonbill, royal (*Platalea regia*)

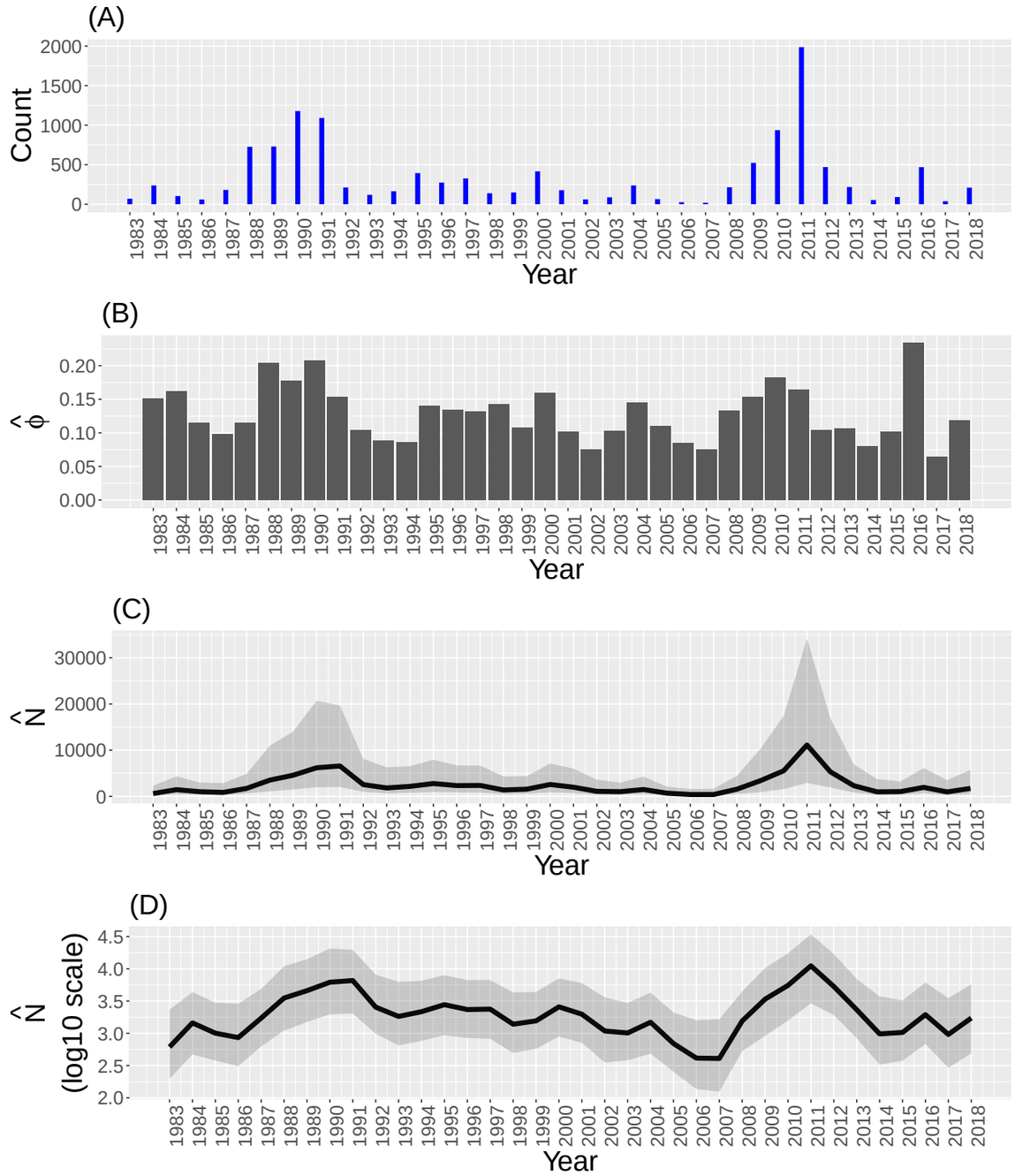

Figure 35: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the royal spoonbill. Grey shading represents 95% credibility intervals.

Table 33: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the royal spoonbill.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.056	0.12	0.054(-0.195 – 0.31)	0.69	1.00
β_1	0.247	0.18	0.248(-0.118 – 0.61)	0.91	1.01
β_2	0.461	0.37	0.450(-0.249 – 1.21)	0.91	1.00
σ_τ	0.491	0.32	0.462(0.020 – 1.17)	NA	1.01
σ_V	0.362	0.22	0.353(0.017 – 0.78)	NA	1.01
σ_W	0.762	0.24	0.761(0.292 – 1.23)	NA	1.02

3.34 Spoonbill, yellow-billed (*Platalea flavipes*)

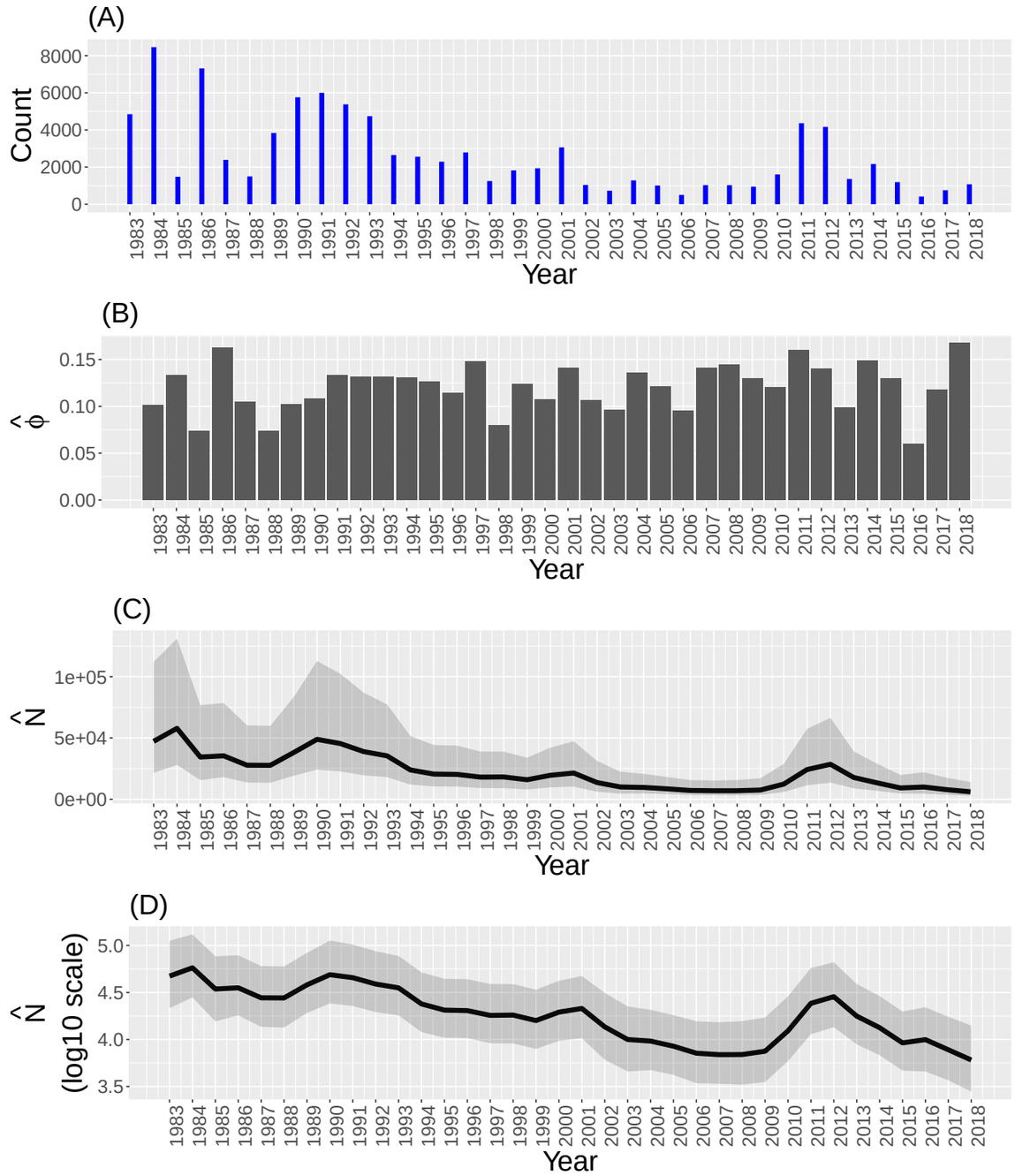

Figure 36: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the yellow-billed spoonbill. Grey shading represents 95% credibility intervals.

Table 34: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the yellow-billed spoonbill.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.026	0.048	-0.027(-0.125 – 0.075)	0.76	1.00
β_1	0.273	0.085	0.272(0.106 – 0.444)	1.00	1.01
β_2	-0.287	0.192	-0.289(-0.657 – 0.092)	0.93	1.00
σ_τ	0.341	0.178	0.364(0.019 – 0.650)	NA	1.01
σ_V	0.269	0.155	0.273(0.012 – 0.556)	NA	1.03
σ_W	0.241	0.123	0.231(0.029 – 0.524)	NA	1.02

3.35 Stilt, banded (*Cladorhynchus leucocephalus*)

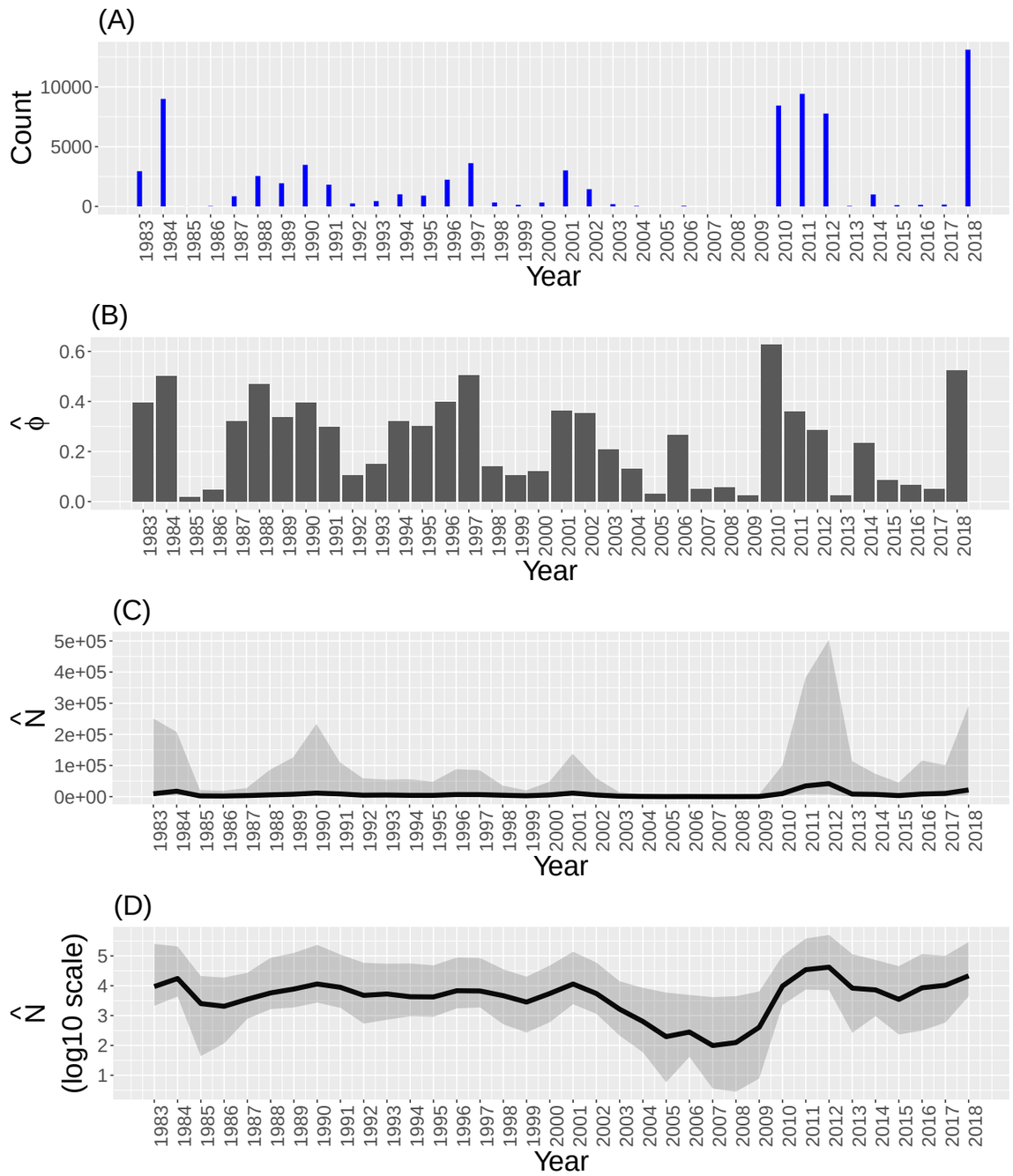

Figure 37: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the banded stilt. Grey shading represents 95% credibility intervals.

Table 35: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the banded stilt.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	0.066	0.21	0.073(-0.416 – 0.52)	0.68	1.00
β_1	0.734	0.42	0.685(0.018 – 1.67)	0.98	1.01
β_2	0.304	1.12	0.231(-1.710 – 2.73)	0.59	1.00
σ_τ	2.400	0.95	2.520(0.356 – 3.88)	NA	1.02
σ_V	0.449	0.23	0.462(0.029 – 0.81)	NA	1.01
σ_W	1.340	0.78	1.280(0.096 – 2.86)	NA	1.03

3.36 Stilt, black-winged (*Himantopus himantopus*)

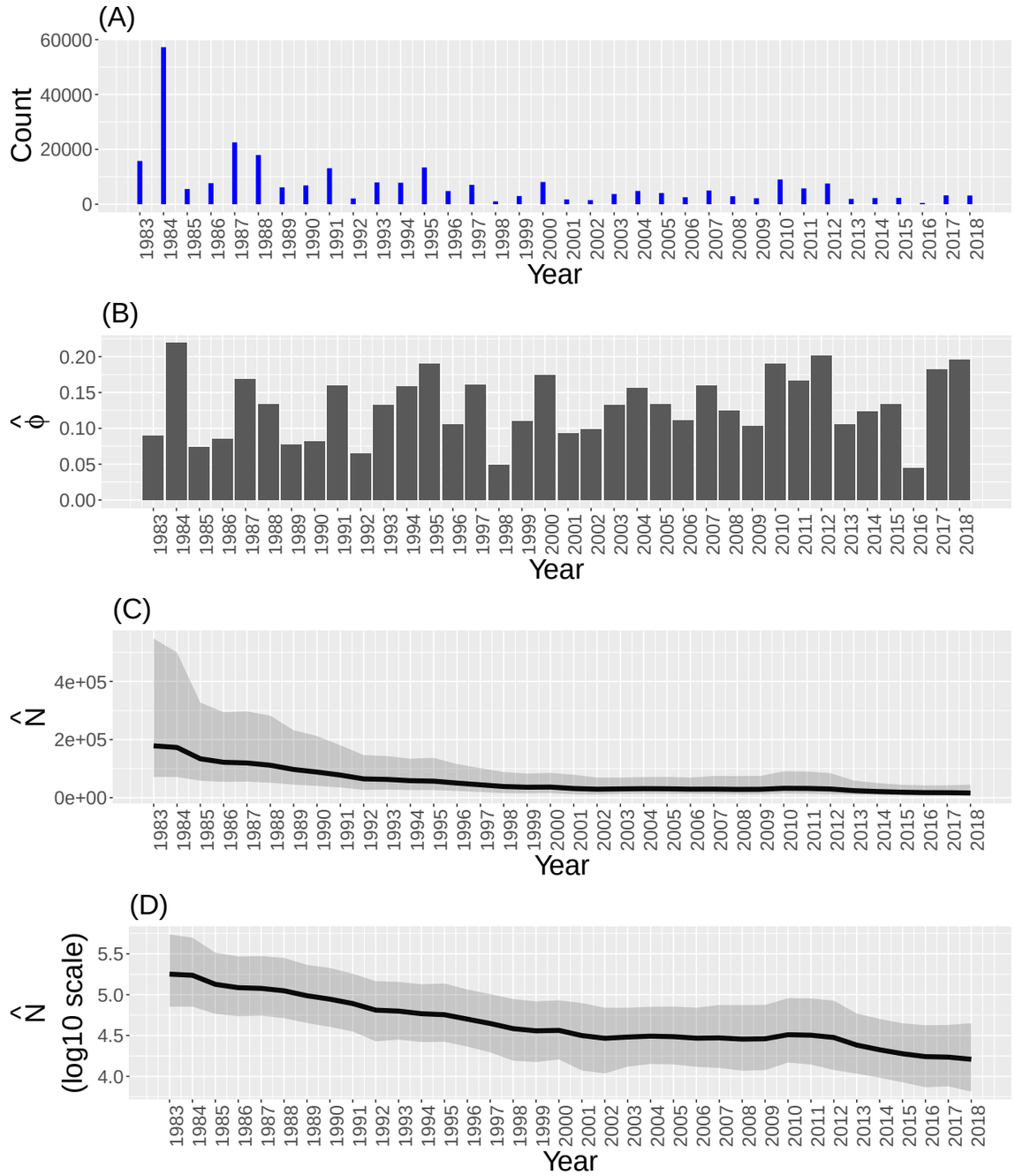

Figure 38: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the black-winged stilt. Grey shading represents 95% credibility intervals.

Table 36: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the black-winged stilt.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.063	0.051	-0.063(-0.169 – 0.044)	0.92	1.01
β_1	0.023	0.116	0.020(-0.200 – 0.261)	0.57	1.01
β_2	-0.453	0.286	-0.454(-1.020 – 0.114)	0.94	1.00
σ_τ	0.562	0.272	0.605(0.035 – 1.030)	NA	1.00
σ_V	0.419	0.226	0.442(0.023 – 0.788)	NA	1.00
σ_W	0.231	0.153	0.205(0.011 – 0.600)	NA	1.00

3.37 Stork, black-necked (*Ephippiorhynchus asiaticus*)

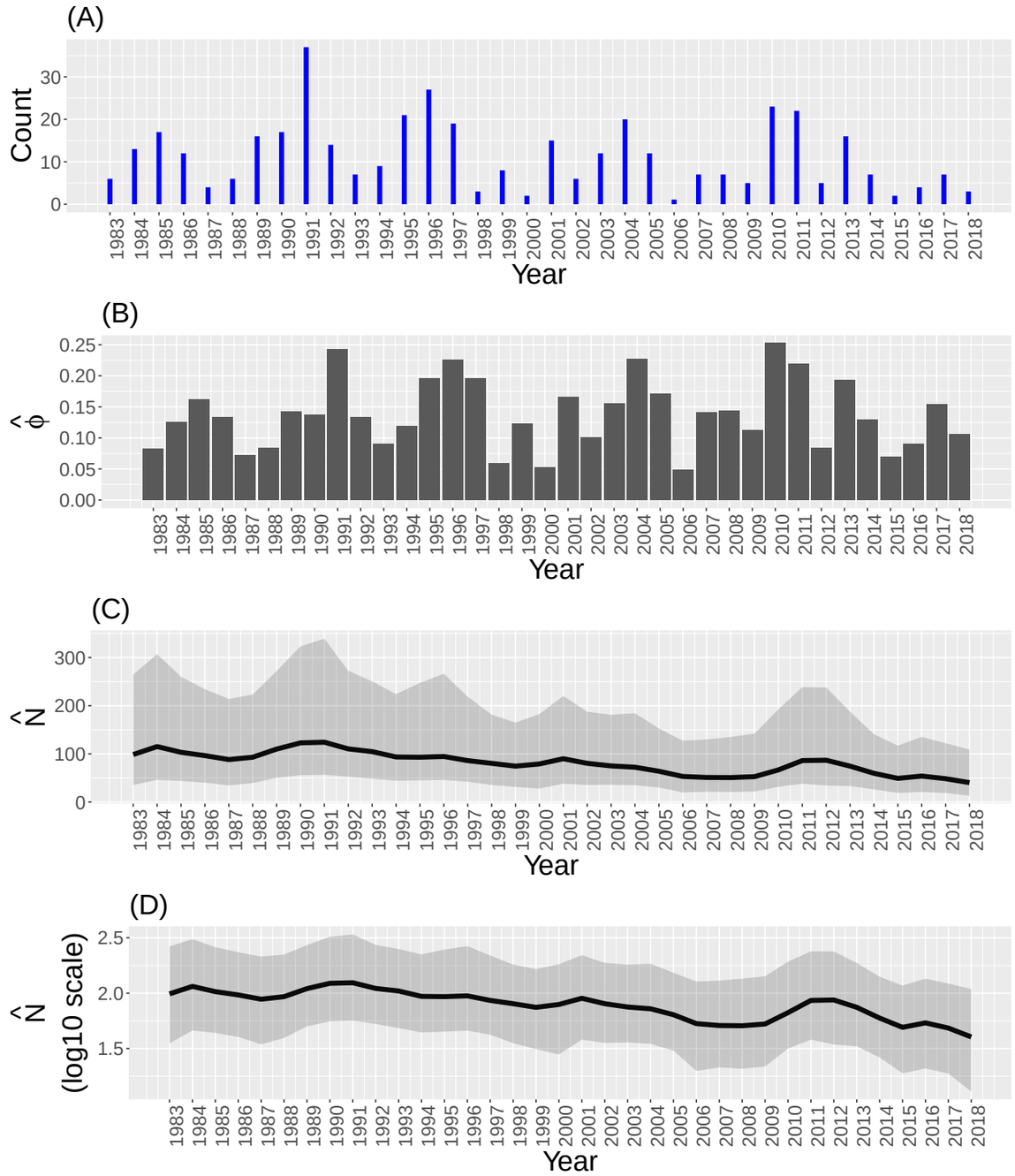

Figure 39: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the black-necked stork. Grey shading represents 95% credibility intervals.

Table 37: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the black-necked stork.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.012	0.047	-0.012(-0.1130 – 0.086)	0.65	1.01
β_1	0.118	0.118	0.121(-0.1160 – 0.348)	0.84	1.02
β_2	-0.174	0.322	-0.170(-0.8250 – 0.456)	0.71	1.00
σ_τ	0.699	0.297	0.752(0.0538 – 1.190)	NA	1.01
σ_V	0.396	0.242	0.384(0.0186 – 0.803)	NA	1.00
σ_W	0.211	0.180	0.168(0.0034 – 0.674)	NA	1.04

3.38 Swamphen, purple (*Porphyrio porphyrio*)

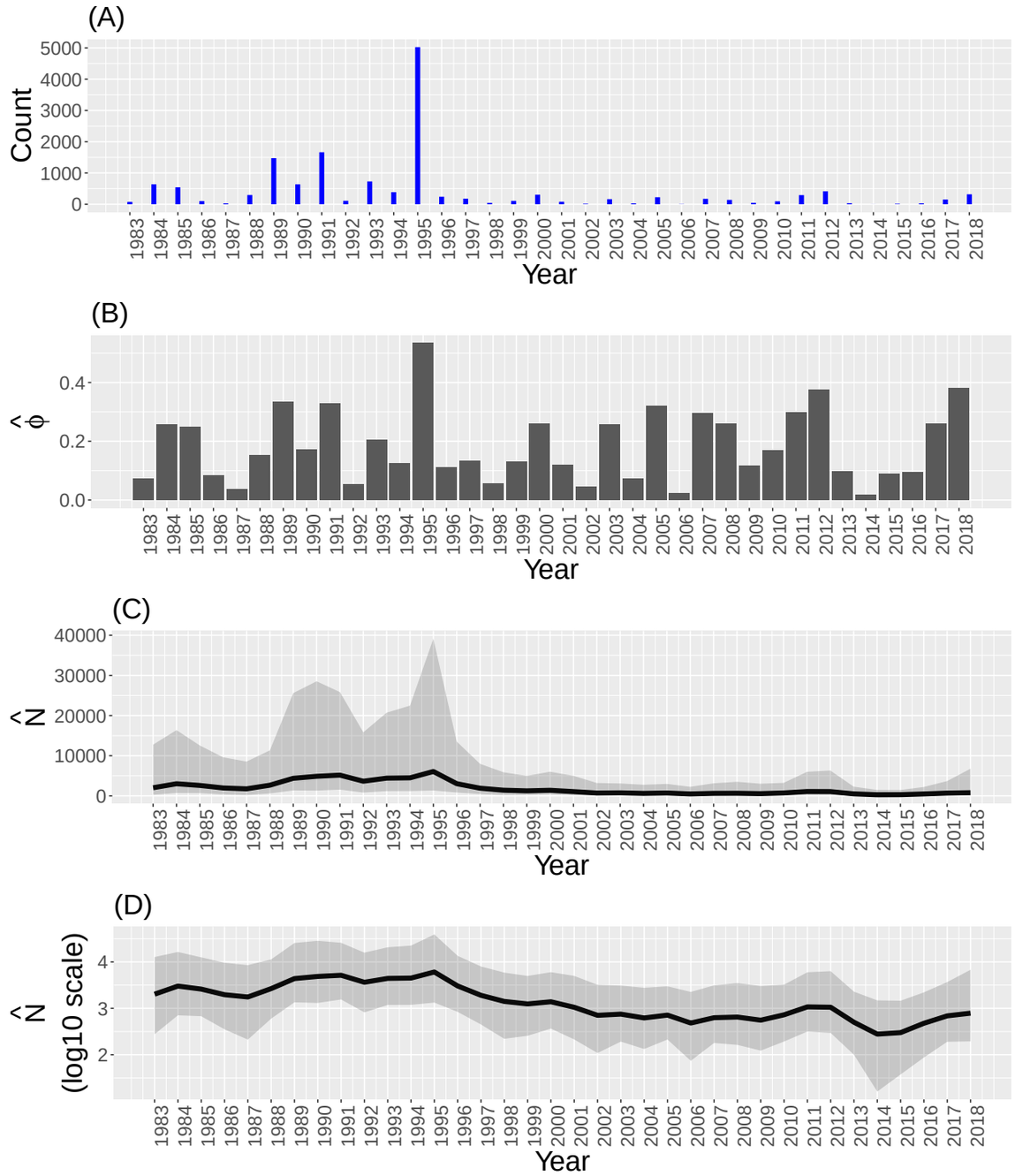

Figure 40: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the purple swamphen. Grey shading represents 95% credibility intervals.

Table 38: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the purple swamphen.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.015	0.14	-0.024(-0.288 – 0.29)	0.59	1.01
β_1	0.146	0.25	0.134(-0.315 – 0.66)	0.73	1.01
β_2	-0.141	0.63	-0.146(-1.370 – 1.11)	0.59	1.01
σ_τ	1.530	0.46	1.540(0.457 – 2.40)	NA	1.01
σ_V	0.474	0.23	0.504(0.030 – 0.82)	NA	1.00
σ_W	0.721	0.43	0.657(0.043 – 1.70)	NA	1.02

3.39 Swan, black (*Cygnus atratus*)

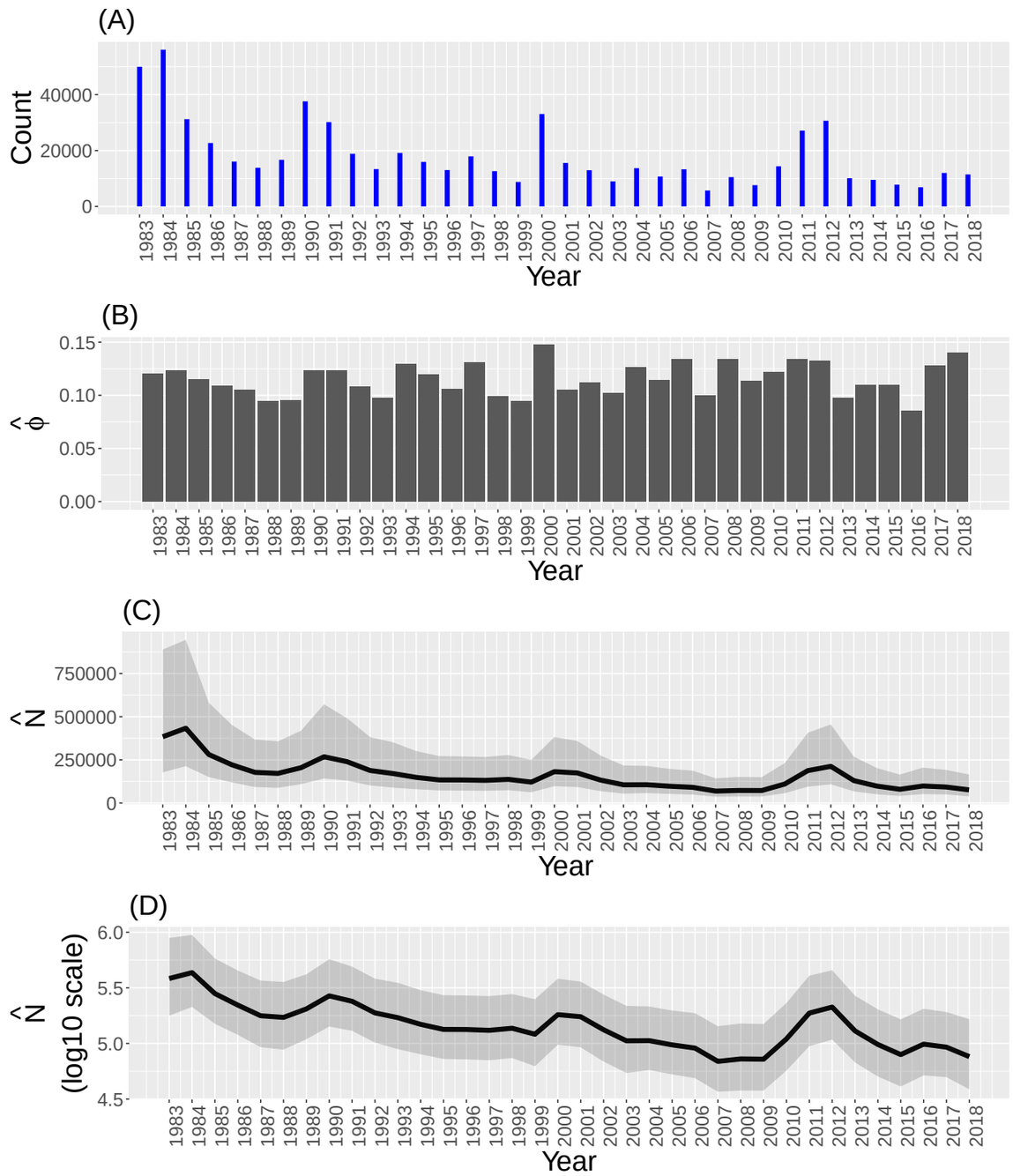

Figure 41: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the black swan. Grey shading represents 95% credibility intervals.

Table 39: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the black swan.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.02	0.040	-0.02(-0.104 – 0.067)	0.75	1.00
β_1	0.23	0.069	0.22(0.104 – 0.375)	1.00	1.00
β_2	-0.11	0.139	-0.12(-0.387 – 0.164)	0.80	1.00
σ_τ	0.23	0.127	0.23(0.011 – 0.466)	NA	1.00
σ_V	0.20	0.113	0.20(0.011 – 0.414)	NA	1.01
σ_W	0.20	0.111	0.19(0.016 – 0.433)	NA	1.01

3.40 Teal, chestnut (*Anas castanea*)

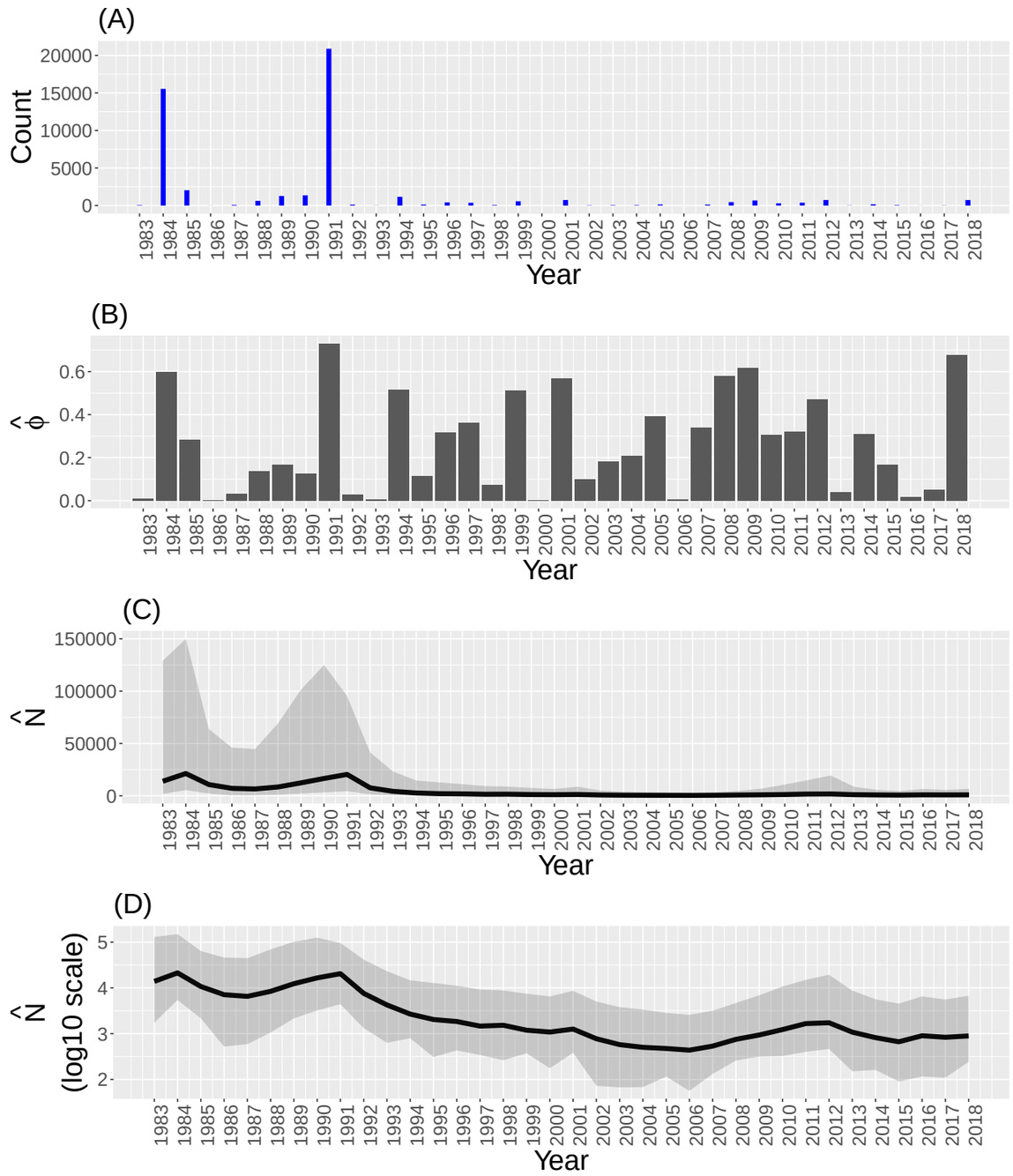

Figure 42: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the chestnut teal. Grey shading represents 95% credibility intervals.

Table 40: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the chestnut teal.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.03	0.14	-0.038(-0.307 – 0.28)	0.63	1.01
β_1	0.24	0.24	0.232(-0.222 – 0.74)	0.85	1.01
β_2	-1.57	1.00	-1.530(-3.690 – 0.30)	0.95	1.01
σ_τ	2.65	0.50	2.610(1.770 – 3.72)	NA	1.00
σ_V	0.46	0.24	0.493(0.028 – 0.82)	NA	1.00
σ_W	0.78	0.39	0.739(0.120 – 1.70)	NA	1.02

3.41 Teal, grey (*Anas gracilis*)

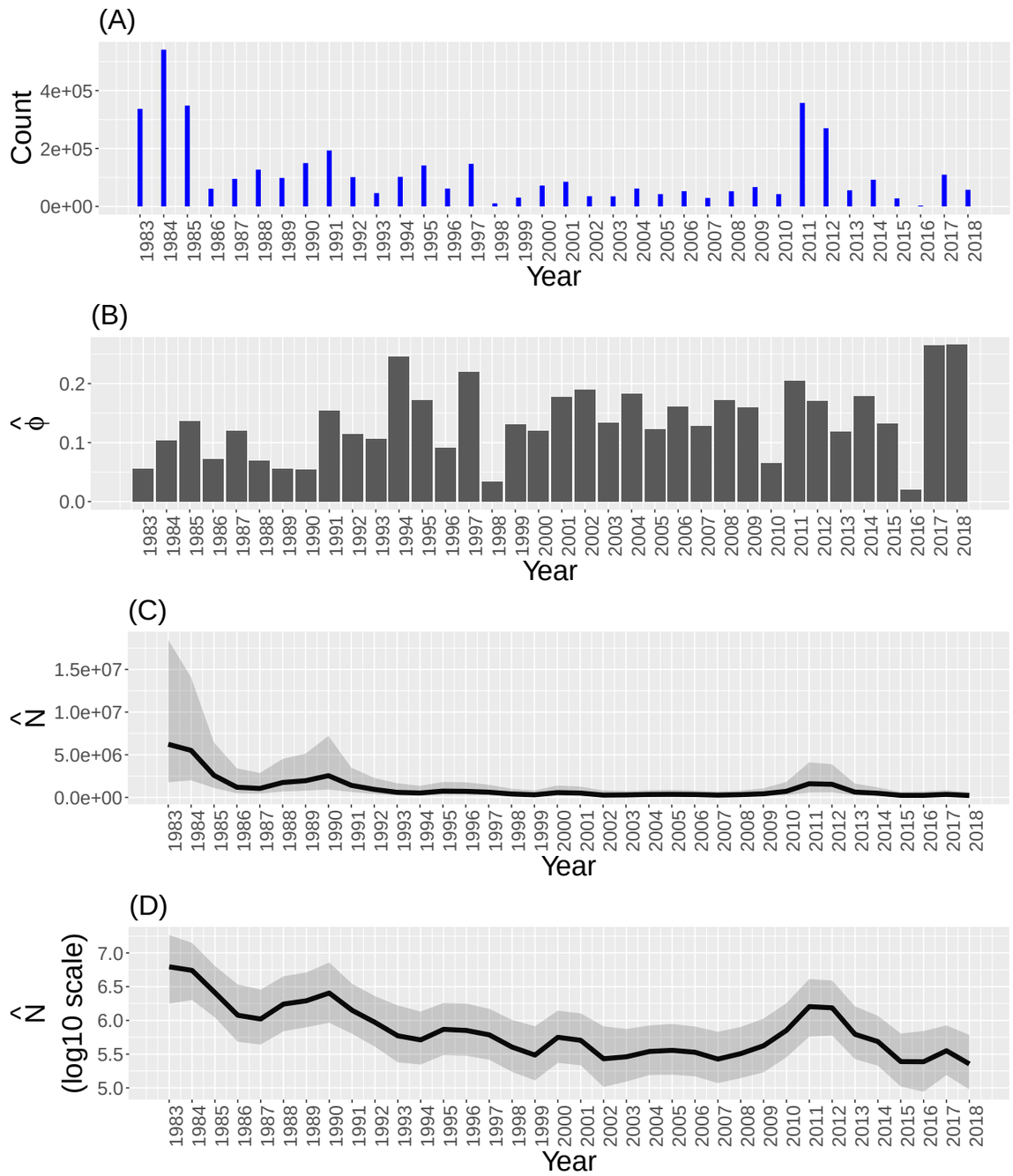

Figure 43: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the grey teal. Grey shading represents 95% credibility intervals.

Table 41: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the grey teal.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.061	0.095	-0.058(-0.2610 – 0.13)	0.76	1.00
β_1	0.270	0.136	0.269(0.0024 – 0.54)	0.98	1.00
β_2	-1.130	0.268	-1.130(-1.6500 – -0.59)	1.00	1.00
σ_τ	0.382	0.235	0.376(0.0145 – 0.85)	NA	1.01
σ_V	0.307	0.187	0.293(0.0169 – 0.69)	NA	1.00
σ_W	0.531	0.184	0.528(0.1890 – 0.89)	NA	1.01

3.42 Tern, Australasian gull-billed (*Gelochelidon macrotarsa*)

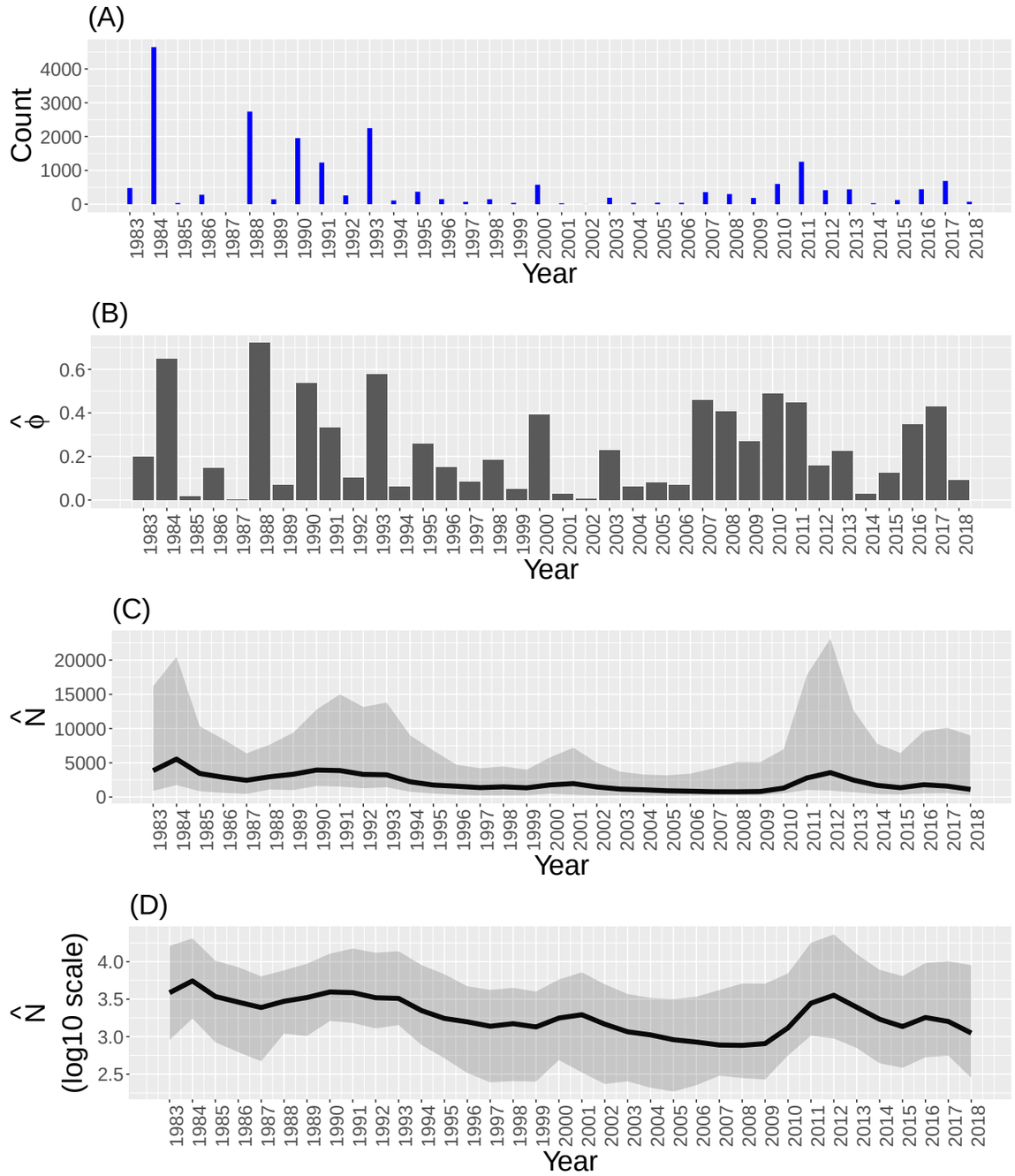

Figure 44: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Australian gull-billed tern. Grey shading represents 95% credibility intervals.

Table 42: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Australian gull-billed tern.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.00011	0.085	-0.0054(-0.1700 – 0.19)	0.54	1.07
β_1	0.29000	0.192	0.2890(-0.0852 – 0.68)	0.94	1.07
β_2	1.29000	0.743	1.2800(-0.1620 – 2.79)	0.96	1.01
σ_τ	2.06000	0.428	2.0200(1.3200 – 3.02)	NA	1.01
σ_V	0.39700	0.247	0.3930(0.0095 – 0.81)	NA	1.02
σ_W	0.38800	0.305	0.3170(0.0149 – 1.21)	NA	1.15

3.43 Tern, Caspian (*Hydroprogne caspia*)

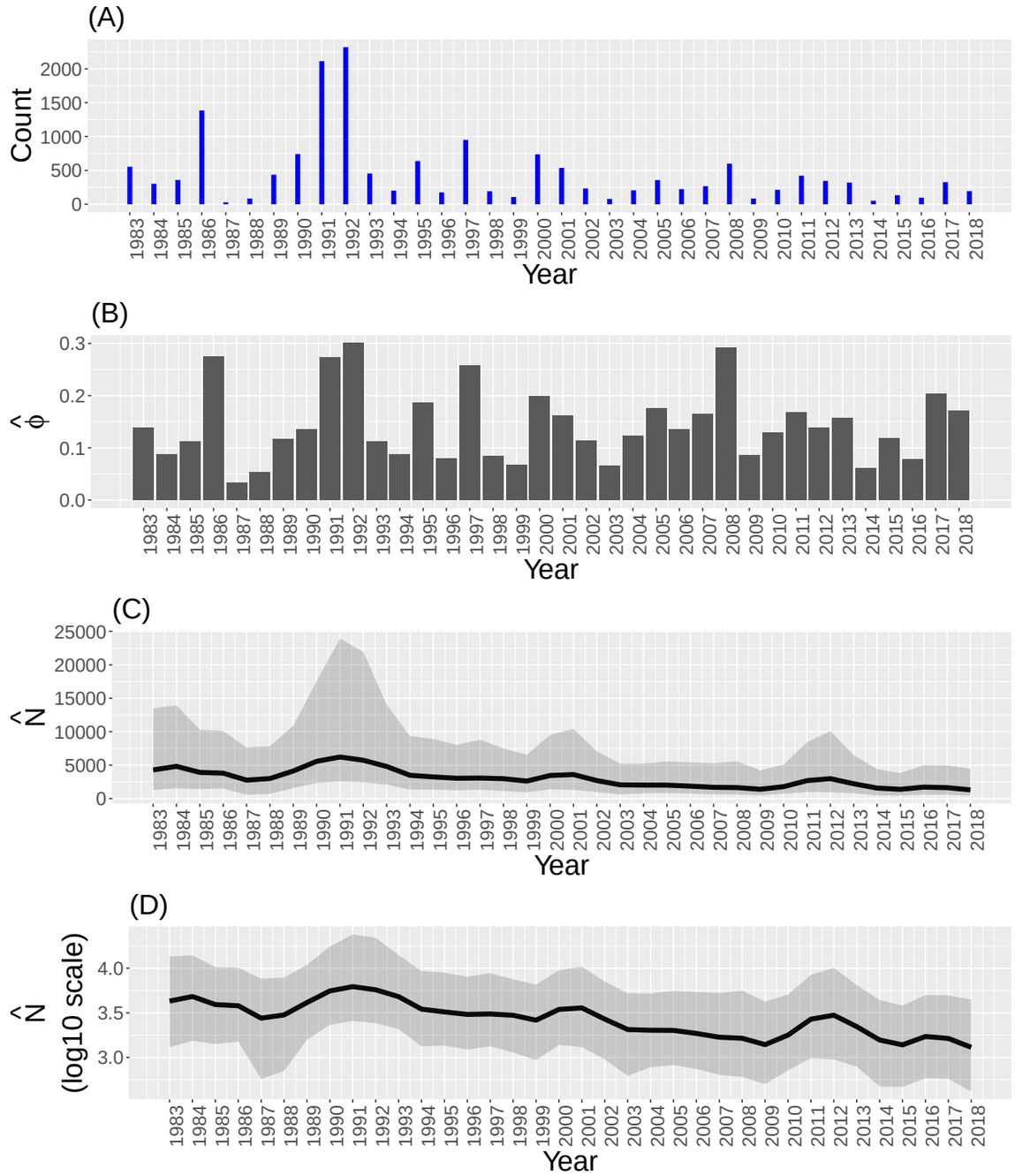

Figure 45: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the Caspian tern. Grey shading represents 95% credibility intervals.

Table 43: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the Caspian tern.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.0088	0.072	-0.014(-0.151 – 0.15)	0.61	1.01
β_1	0.1950	0.156	0.189(-0.095 – 0.52)	0.90	1.07
β_2	-0.2160	0.379	-0.215(-0.969 – 0.53)	0.72	1.00
σ_τ	0.8610	0.330	0.904(0.106 – 1.43)	NA	1.00
σ_V	0.4260	0.243	0.429(0.023 – 0.81)	NA	1.00
σ_W	0.3330	0.242	0.287(0.012 – 0.91)	NA	1.01

3.44 Tern, whiskered (*Chlidonias hybrida*)

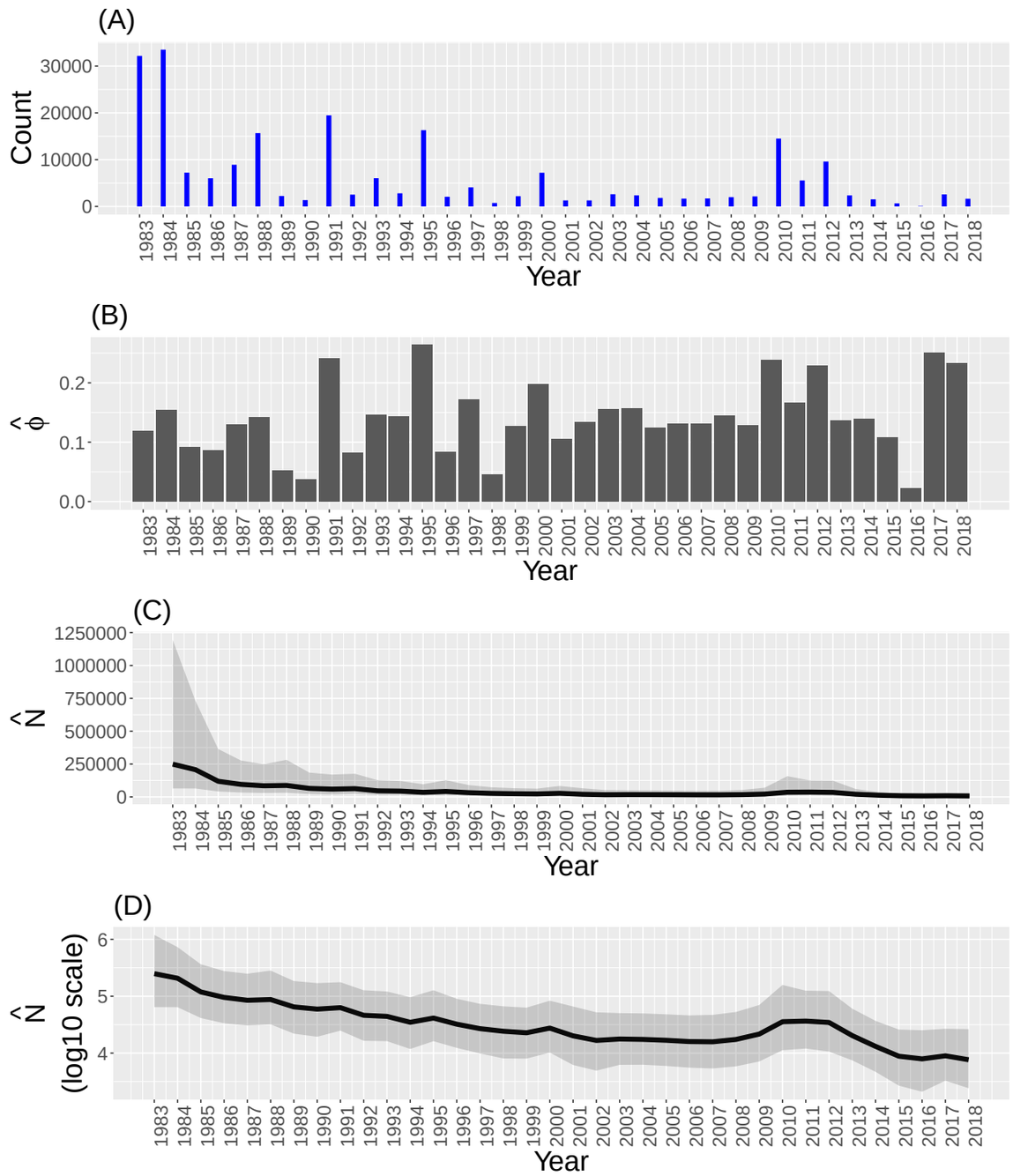

Figure 46: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the whiskered tern. Grey shading represents 95% credibility intervals.

Table 44: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the whiskered tern.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.085	0.092	-0.080(-0.288 – 0.0983)	0.86	1.02
β_1	0.094	0.167	0.091(-0.228 – 0.4360)	0.72	1.02
β_2	-0.753	0.378	-0.754(-1.500 – -0.0039)	0.98	1.00
σ_τ	0.729	0.324	0.753(0.070 – 1.3300)	NA	1.00
σ_V	0.492	0.226	0.528(0.039 – 0.8160)	NA	1.00
σ_W	0.460	0.235	0.433(0.068 – 0.9900)	NA	1.02

3.45 Whistling-duck, plumed (*Dendrocygna eytoni*)

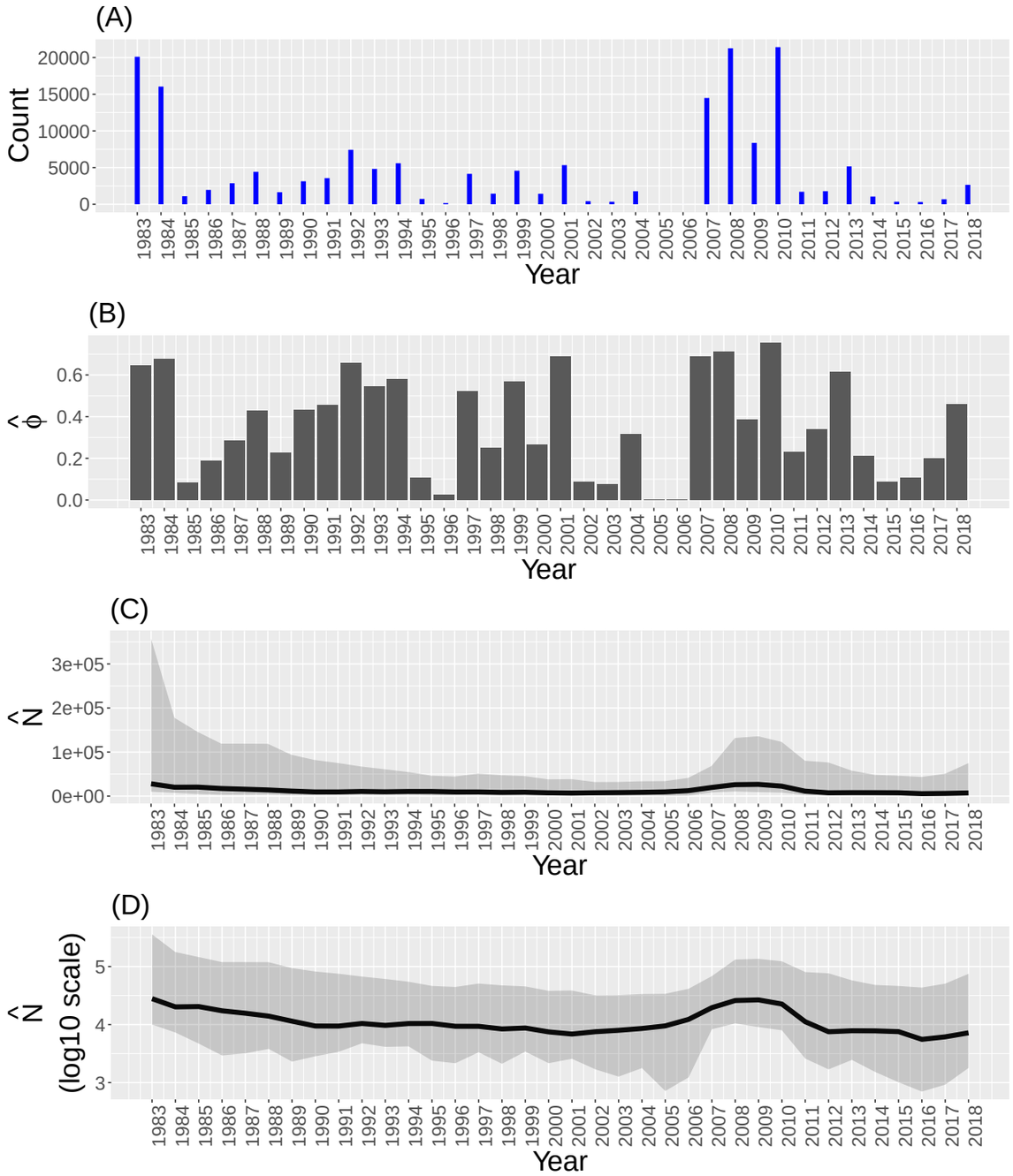

Figure 47: (A) Counts summed over all bands, (B) Estimated proportion of superpopulation ($\hat{\phi}$) on the wetland stratum within the survey bands (C) Modelled superpopulation ($\hat{N}$) on linear scale, and (D) Modelled superpopulation ($\hat{N}$) on a logarithmic (base 10) scale for the plumed whistling-duck. Grey shading represents 95% credibility intervals.

Table 45: Parameter, mean, standard deviation, lower 95 %C.I., median, upper 95 %C.I., Pr(|X|>0) and Gelman & Rubin's R for the plumed whistling-duck.

Parameter	Mean	Std. Dev.	Median (95% C.I.)	Pr(|X|>0)	R
r_0	-0.0494	0.11	-0.049(-0.281 – 0.17)	0.73	1.04
β_1	-0.1710	0.22	-0.178(-0.602 – 0.30)	0.80	1.01
β_2	-0.0021	1.21	-0.014(-2.470 – 2.44)	0.50	1.00
σ_τ	3.2100	0.81	3.090(1.910 – 5.17)	NA	1.03
σ_V	0.3670	0.23	0.349(0.012 – 0.80)	NA	1.00
σ_W	0.5230	0.32	0.465(0.051 – 1.29)	NA	1.14

4 Model diagnostics

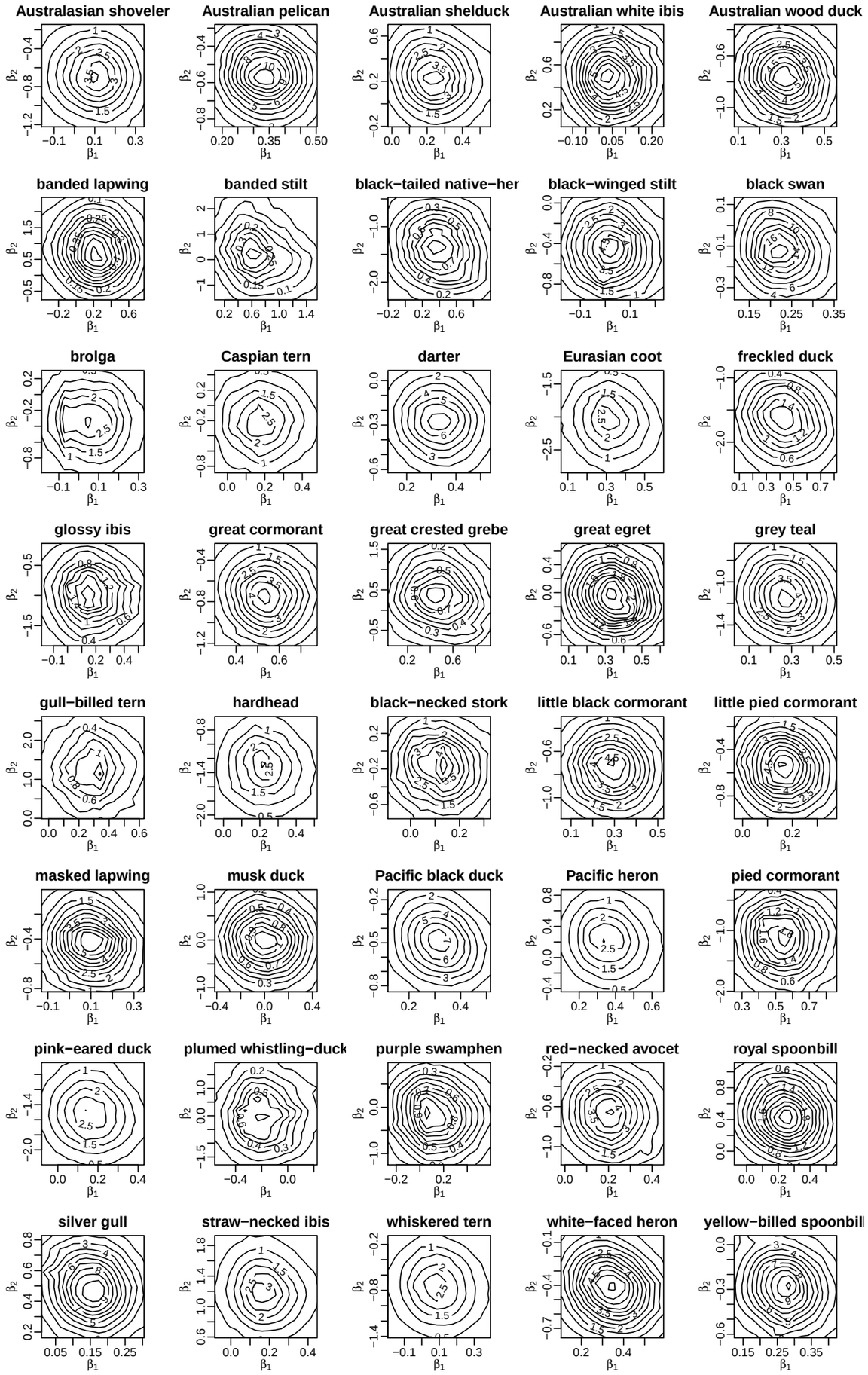

Figure 48: Contour plots of the joint posterior for the effect (β_1) of antecedent 6-month rainfall on the proportion of the super-population on transects (ϕ), and the effect (β_2) of antecedent 12-month rainfall on population growth rate (r).

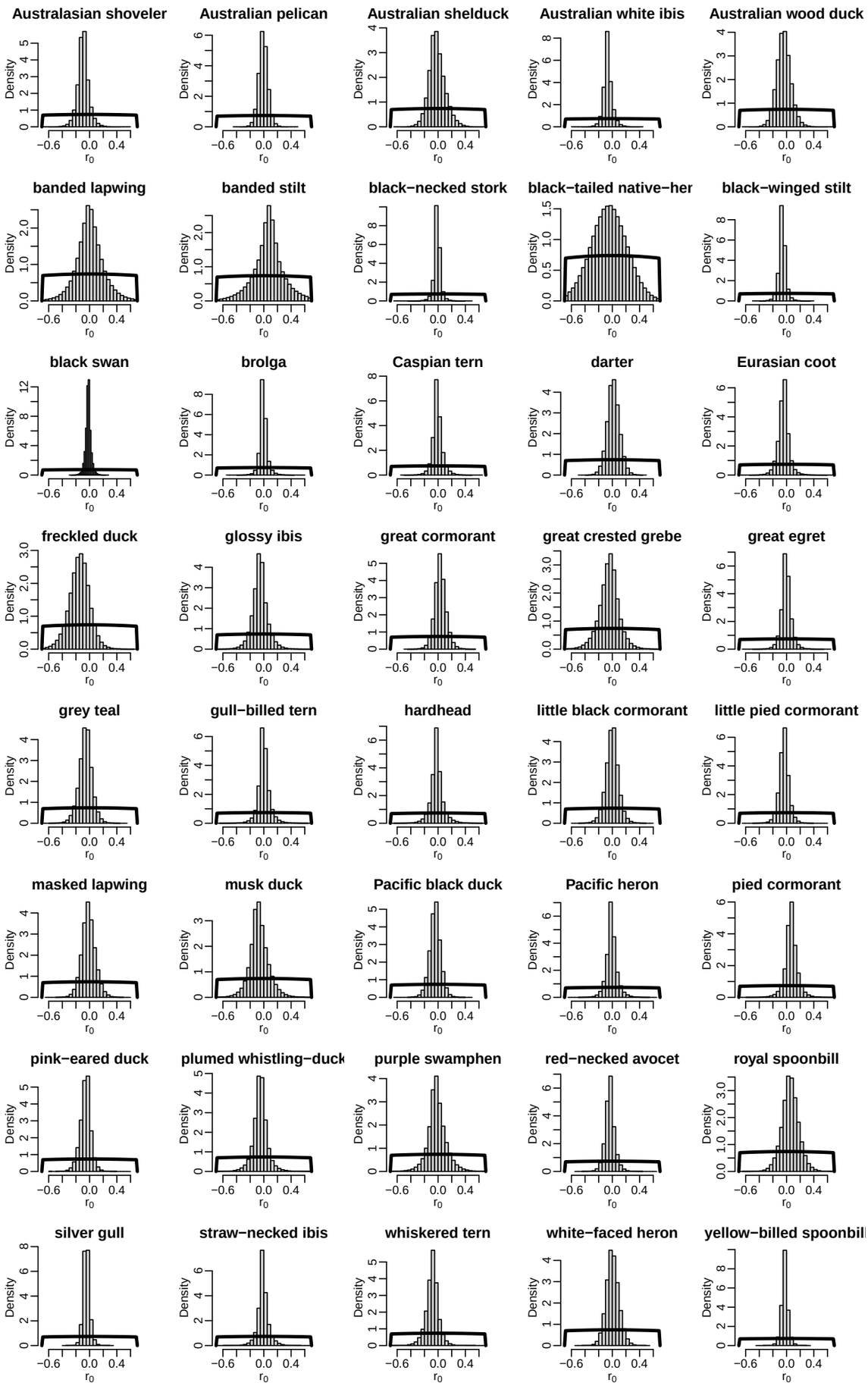

Figure 49: Prior (solid lines) and posterior distributions (histograms) for r_0 (the rate of increase under average rainfall conditions) illustrating the extent to which the data have informed the prior.

5 Acknowledgments

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6 References

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Index