New aliens in Australia: 18 years of vertebrate interceptions

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Table S1. Candidate Poisson generalised linear models based on the effects of time and alien species category on predicted annual record frequency

Candidates are ranked by Akaike's information criterion corrected for small sample sizes (AICc). Pseudo-R^2 goodness of fit (1-residual deviance/null deviance) is provided for the chosen model. Candidate models with interactive effects between explanatory variables are denoted with 'x'. Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species)

Candidate model	Number of parameters	AICc	Delta AICc
Frequency ~ year × alien status (Pseudo R^2 = 0.717)	6	418.73	0
Frequency ~ year + alien status	4	474.72	55.99
Frequency ~ alien status	3	602.28	183.55
Frequency ~ year	2	686.38	267.65
Frequency ~ 1	1	814.11	395.38

Table S2. Parameter effect sizes, standard errors and significance values for the model selected in Table S1.

Interactions between variables are donated with ':'. New alien, alien species not known to be present in Australia; alien widely kept, alien species known to be widely kept in Australia; alien present, alien species present in Australia (i.e. in the pet trade, captivity or zoos with permits, or previously intercepted, not established or widely kept)

Predictor	Estimate	Standard error	z-value	P-value
Intercept (new alien)	2.530	0.116	21.9	7.36×10^{-106}
Year	0.0668	0.00939	7.11	1.13×10^{-12}
Alien present	0.635	0.148	4.28	1.85×10^{-5}
Alien widely kept	–2.17	0.270	–8.03	9.58×10^{-16}
Year: alien present	–0.0349	0.0124	–2.83	4.72×10^{-2}
Year: alien widely kept	0.105	0.0196	5.36	$9.01 \quad 10^{-8}$

Table S3. Candidate Poisson generalised linear models based on the effects of time, detection category and vertebrate class on predicted annual incident frequency

Candidates are ranked by Akaike's information criterion corrected for small sample sizes (AICc). Pseudo-R^2 goodness of fit (1-residual deviance/null deviance) is provided for the chosen model. Candidate models with interactive effects between explanatory variables are denoted with 'x'. Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species)

Candidate model	Number of parameters	AICc	Delta AICc
Frequency ~ year × class × detection category (Pseudo R^2 = 0.791)	32	1152.33	0
Frequency ~ year × detection category	16	1447.72	295.4
Frequency ~ year + class + detection	8	1994.19	841.87
Frequency ~ class + detection category	7	2121.36	969.03
Frequency ~ year × class	8	2203.37	1051.04
Frequency ~ year + class	5	2263.99	1111.66
Frequency ~ class	4	2391.19	1238.87

Frequency ~ year × detection category	8	2660.39	1508.06
Frequency ~ year + detection category	5	2798.69	1646.36
Frequency ~ detection	4	2925.89	1773.57
Frequency ~ year	2	3068.61	1916.28
Frequency ~ 1	1	3195.86	2043.54

Table S4. Parameter effect sizes, standard errors and significance values for the model selected in Table S3.

Interactions between variables are donated with ':'

Predictor	Estimate	Standard error	z-value	P-value
Intercept (at-large Amphibia)	−1.92	0.757	-2.53	1.13×10^{-2}
Year	0.173	5.34×10^{-2}	3.25	1.16×10^{-3}
Aves	1.86	0.809	2.30	2.17×10^{-2}
Mammalia	1.89	0.901	2.10	3.61×10^{-2}
Reptilia	1.84	0.816	2.25	2.42×10^{-2}
Captive	1.76	1.19	1.48	0.138
Smuggling	−1.55	2.51	−0.618	0.536
Stowaway	3.68	0.776	4.73	2.19×10^{-6}
Year: Aves	1.35×10^{-2}	5.70×10^{-2}	0.236	0.813
Year: Mammalia	−0.165	6.94×10^{-2}	−2.37	1.76×10^{-2}
Year: Reptilia	-1.01×10^{-3}	5.75×10^{-2}	−0.0176	0.986
Year: captive	−0.422	0.173	−2.44	1.47×10^{-2}

Year: smuggling	–0.117	0.205	–0.570	0.569
Year: stowaway	–0.107	5.52×10^{-2}	–1.95	5.15×10^{-2}
Aves: captive	–3.55	1.37437953	–2.59	9.73×10^{-3}
Mammalia: captive	–2.41	1.39	–1.73	8.33×10^{-2}
Reptilia: captive	1.33	1.23	1.08	0.281
Aves: smuggling	0.974	2.61	0.373	0.709
Mammalia: smuggling	–1.49	3.36	–0.443	0.658
Reptilia: smuggling	3.88	2.54	1.53	0.126
Aves: stowaway	–5.15	1.26	–4.10	4.05×10^{-5}
Mammalia: stowaway	–6.78	1.80	–3.78	1.590×10^{-4}
Reptilia: stowaway	–2.31	0.857	–2.69	7.08×10^{-3}
Year: Aves: captive	0.450	0.179	2.51	1.21×10^{-2}
Year: Mammalia: captive	0.504	0.183	2.75	6.01×10^{-3}
Year: Reptilia: captive	0.245	0.175	1.40	0.161
Year: Aves: smuggling	-5.49×10^{-2}	0.214	–0.257	0.797

Year: Mammalia: smuggling	0.127	0.285	0.444	0.657
Year: Reptilia: smuggling	–0.156	0.207	–0.75	0.453
Year: Aves: stowaway	-3.57×10^{-2}	9.91×10^{-2}	–0.360	0.719
Year: Mammalia: stowaway	0.243	0.133	1.83	6.77×10^{-2}
Year: Reptilia: stowaway	2.90×10^{-2}	0.0612	0.473	0.636

Table S5. Candidate Poisson generalised linear models based on the effects of time and vertebrate class on cumulative species diversity

Candidates are ranked by Akaike's information criterion corrected for small sample sizes (AICc). Pseudo-R^2 goodness of fit (1-residual deviance/null deviance) is provided for the chosen model. Candidate models with interactive effects between explanatory variables are denoted with 'x'. Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species)

Candidate model	Number of parameters	AICc	Delta AICc
Frequency ~ year × class (pseudo R^2 = 0.919)	8	515.76	0
Frequency ~ year + class	5	554.94	39.18
Frequency ~ class	4	1183.55	667.8
Frequency ~ year	2	1814.52	1298.76
Frequency ~ 1	1	2443.31	1927.56

Table S6. Parameter effect sizes, standard errors and significance values for the model selected in Table S5.

Interactions between variables are donated with ':'

Predictor	Estimate	Standard error	z-value	P-value
Intercept (Amphibia)	1.35	0.162	8.35	6.64×10^{-17}
Year	0.130	0.0121	10.8	4.11×10^{-27}
Aves	–0.771	0.263	–2.93	3.34×10^{-3}
Mammalia	–0.275	0.247	–1.11	0.266
Reptilia	1.98	0.176	11.2	2.40×10^{-29}
Year: Aves	0.0453	0.0189	2.39	1.68×10^{-2}
Year: Mammalia	–0.00109	0.0184	–0.0591	0.953
Year: Reptilia	–0.0450	0.0132	–3.40	6.84×10^{-4}

Table S7. Candidate Poisson generalised linear models based on the effects of time and commodity category on predicted annual stowaway incident frequency

Candidates are ranked by Akaike's information criterion corrected for small sample sizes (AICc). Pseudo-R^2 goodness of fit (1-residual deviance/null deviance) is provided for the chosen model. Candidate models with interactive effects between explanatory variables are denoted with 'x'. Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species)

Candidate model	Number of parameters	AICc	Delta AICc
Frequency ~ year × commodity type (pseudo-R^2 = 0.685)	6	296.33	0
Frequency ~ year + commodity type	4	329.06	32.73
Frequency ~ commodity type	3	382.62	86.29
Frequency ~ year	2	487.79	191.46
Frequency ~ 1	1	541.53	245.2

Table S8. Parameter effect sizes, standard errors and significance values for the model selected in Table S7.

Interactions between variables are donated with ':'

Predictor	Estimate	Standard error	z-value	P-value
Intercept (commodity contaminant)	0.732	0.287	2.55	0.0108
Year	0.0632	0.0235	2.70	7.00×10^{-3}
Transport stowaway	1.43	0.323	4.44	9.05×10^{-6}
Unknown	−2.68	0.626	−4.27	1.92×10^{-5}
Year: transport stowaway	−0.0168	0.0265	−0.632	0.528
Year: unknown	0.192	0.0440	4.40	1.09×10^{-5}

Table S9. Number of records in each class group and alien species category for all detection categories

New alien, alien species not known to be present in Australia; alien widely kept, alien species known to be widely kept in Australia; alien present, alien species present in Australia (i.e. in the pet trade, captivity or zoos with permits, or previously intercepted, not established or widely kept). Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species)

Detection category	Species-status code	Class group				
		Amphibia	Aves	Mammalia	Reptilia	Total
Stowaway	Alien present in au	0	0	0	45	45
	Alien widely kept	0	3	0	0	3
	New alien	207	3	4	134	348
	Total	207	6	4	179	496
Smuggling	Alien present in au	0	3	0	54	57
	Alien widely kept	0	8	0	0	8
	New alien	1	0	1	21	23
	Total	1	11	1	75	88
At large	Alien present in au	16	1	6	120	143
	Alien widely kept	0	135	10	0	145
	New alien	4	18	3	4	29
	Total	20	154	19	124	317

Captive						
	Alien present in au	2	13	12	305	332
	Alien widely kept	1	25	9	0	35
	New alien	0	0	3	45	48
	Total	3	38	24	350	415

Table S10. Negative binomial generalised additive model effect sizes, standard errors and significance values for the effect of time on annual incident frequency for each detection category, with thin-plate regression splines

Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species)

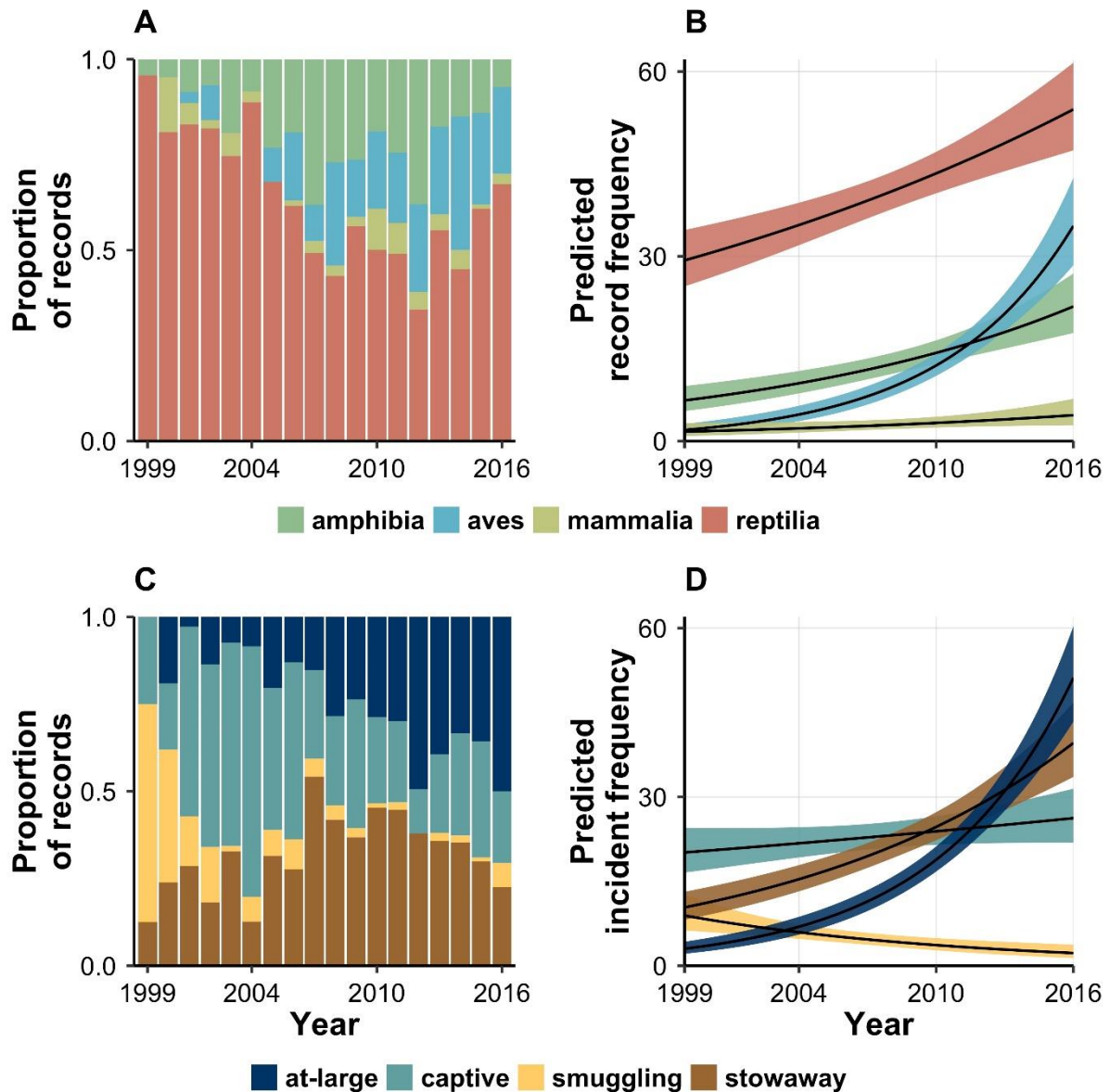| Detection category	Intercept				Splines (year)		R^2
	Estimate	Standard error	z-value	P-value	χ^2-test	P-value	
Stowaway	2.92	0.0656	44.6	$<2 \times 10^{-16}$	54.08	1.62×10^{-11}	0.764
Smuggling	1.18	0.141	8.4	$<2 \times 10^{-16}$	35.39	1.3×10^{-6}	0.779
At large	2.47	0.0968	25.5	$<2 \times 10^{-16}$	94.3	$<2 \times 10^{-16}$	0.841
Captive	3.00	0.0833	36.0	$<2 \times 10^{-16}$	25.79	2.19×10^{-4}	0.556

Fig. S1. (*a*) The relative proportion of interception records through time by vertebrate class. (b) Poisson generalised linear model predictions of records through time for each vertebrate class, with 95% confidence intervals. Interactive effects for year and vertebrate class are included in model predictions. (*c*) The relative proportion of interception incidents through time by detection category. (*d*) Poisson generalised linear model predictions of incidents through time for each detection category, with 95% confidence intervals. Interactive effects for year and detection category are included in model predictions. Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species).
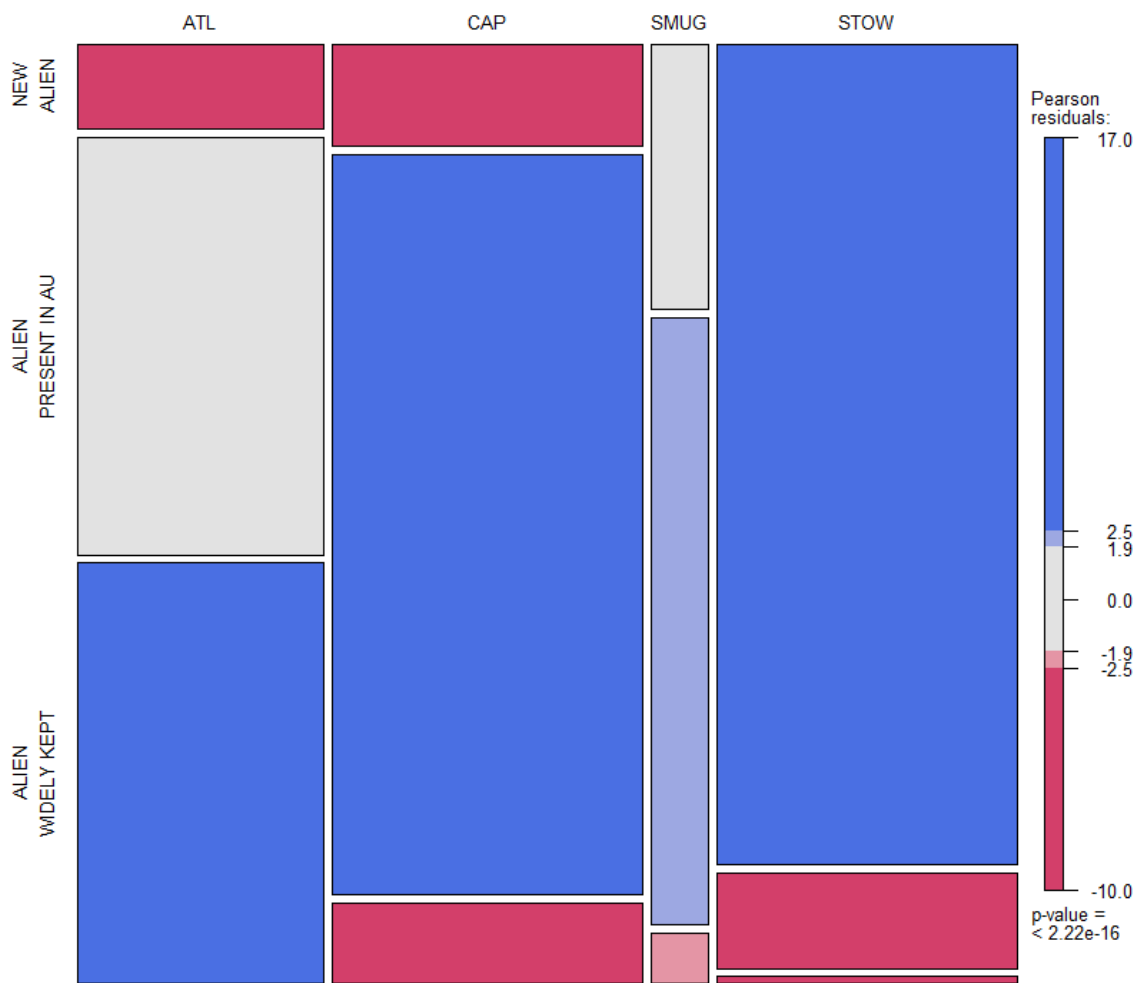
Fig. S2. Mosaic plot displaying the proportion of each alien species status per vertebrate class, with Pearson residuals and χ^2-test significance value.
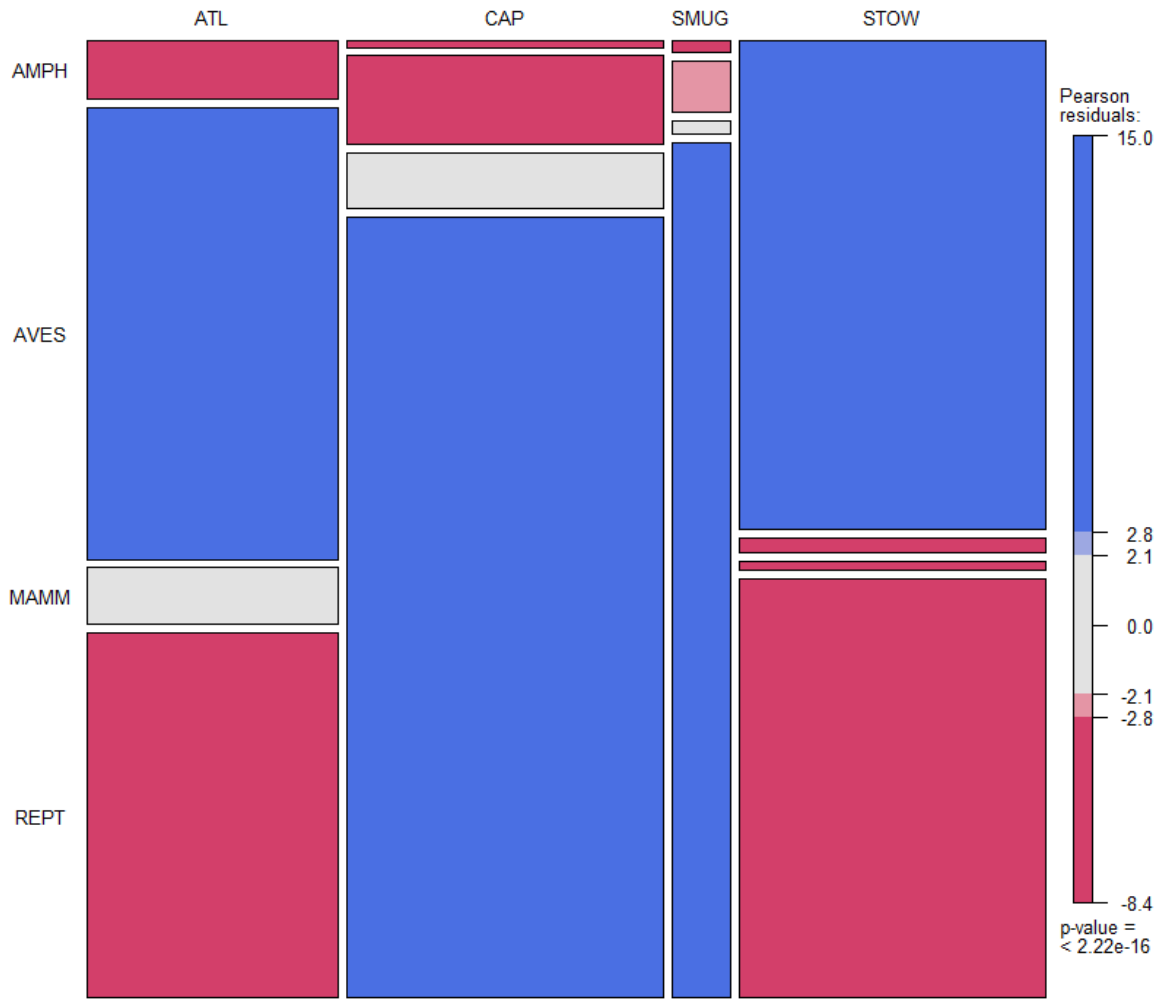
Fig. S3. Mosaic plot displaying the proportion of each vertebrate class per detection category, with Pearson residuals and χ^2-test significance value.
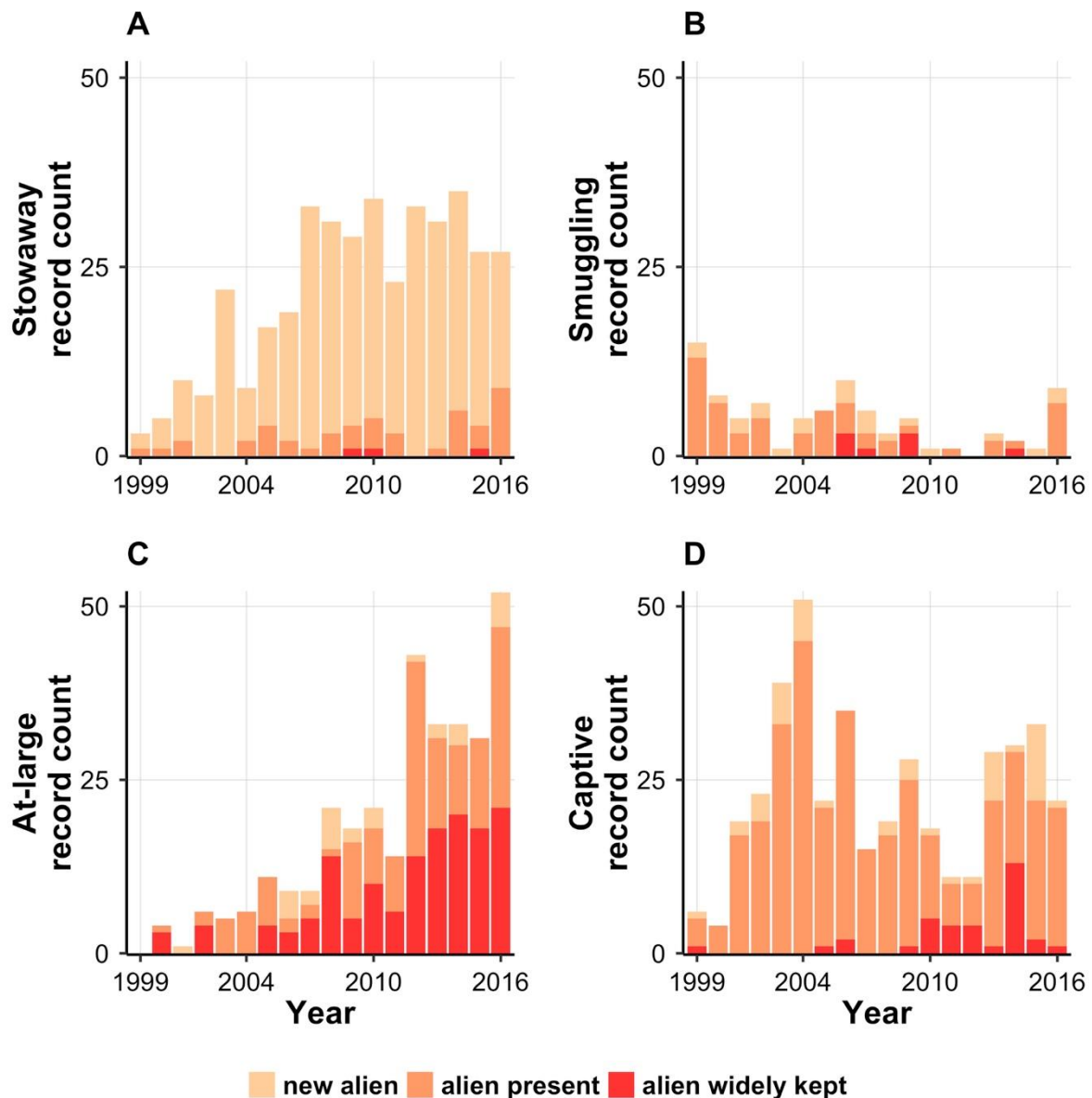
Fig. S4. (*a*) The number of smuggling interception records through time for all yet-to-establish, identifiable alien species status categories. (*b*) The number of stowaway interception records through time for all yet-to-establish, identifiable alien species status categories. (*c*) The number of at large interception records through time for all yet-to-establish, identifiable alien species status categories. (*d*) The number of captive interception records through time for all yet-to-establish, identifiable alien species status categories. New alien, alien species not known to be present in Australia; alien widely kept, alien species known to be widely kept in Australia; alien present, alien species present in Australia (i.e. in the pet trade, captivity or zoos with permits, or previously intercepted, not established or widely kept). Data exclude native, unidentified and established alien species as well as fish. Data with unknown years or data-deficient years prior to 1999 were omitted. If interception records had the same arrival location, source location, date, transport method, and detection category, these were defined as the same incident. Hence, a single incident can consist of several records (more than one individual and more than one species).