Supplementary material for:

Application of the Socio-Economic Impact Classification for Alien Taxa (SEICAT) to a global assessment of alien bird impacts

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Table S1. Impact descriptions used to guide the SEICAT assessment process (from Bacher et al. 2018).

Impact Category	Description
Minimal Concern (**MC**)	No deleterious impacts reported despite availability of relevant studies with regard to an alien species' impact on human well-being.
Minor (**MN**)	The alien species has a negative effect on human well-being, such that it is difficult for people to participate in their normal activities. Individual people in an activity suffer in at least one constituent of well-being (i.e. security; material and non-material assets; health; social, spiritual and cultural relations). Reductions of well-being can be detected through e.g. income loss, health problems, higher effort or expenses to participate in activities, increased difficulty in accessing goods, disruption of social activities, induction of fear. However, no change in activity size is reported (i.e. the number of people participating in that activity remains the same).
Moderate (**MO**)	The alien species has negative effects on human well-being, leading to changes in activity size, with fewer people participating in an activity, although the activity is still carried out. Reductions in activity size can be for various reasons, e.g. moving the activity to regions where the alien taxon is not present or to areas less invaded by the alien taxon; a human fatality caused by the alien species; partial abandonment of an activity without replacement by other activities; or a switch to other activities while staying in the same area invaded by the alien taxon. Also, spatial displacement, abandonment or switch of activities does not increase human well-being compared to levels before the alien taxon invaded the region (no increase in opportunities due to the alien taxon).
Major (**MR**)	The alien species causes the local disappearance of an activity from all or part of the area invaded (collapse of the specific social activity, switch to other activities, or abandonment of activity without replacement, or emigration from region). This impact is likely to be reversible within a decade of the removal or control of the alien species. 'Local disappearance' does not necessarily imply the disappearance of activities from the entire region assessed, but refers to the typical spatial scale over which social communities in the region are characterised (e.g. a human settlement)
Massive (**MV**)	The alien species causes local disappearance of an activity from all or part of the area invaded. This impact is likely to be permanent and irreversible for at least a decade after the removal of the alien species, due to fundamental structural changes of the socio-economic community or environmental conditions ('regime shift').
Data Deficient (**DD**)	There is no information to classify the taxon with respect to its impact, or insufficient time has elapsed since its introduction for impacts to have become apparent.

Table S2. Contingency table (unconditional exact test: the FunChisq package (Zhong and Song 2019)) showing actual and expected numbers of alien bird species for each order, with and without recorded impacts. Expected values are displayed in italics. Data for impacts by Falconiformes were removed from the dataset for the test, due to low sample size (one **MN** impact).

	No. of species with recorded impacts	**No. of species without recorded impacts (DD)**	**Total**
Passeriformes	25 *28.08*	157 *153.92*	**182**
Psittaciformes	13 *9.56*	49 *52.44*	**62**
Galliformes	9 *8.33*	45 *45.67*	**54**
Anseriformes	5 *5.71*	32 *31.29*	**37**
Columbiformes	4 *4.32*	24 *23.68*	**28**
Total	**56**	**307**	**363**

Chi-square value = 1.071, degrees of freedom = 4, *P* = 0.841, estimate = 0.054

Table S3. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations to less severe (**MC** & **MN)** and more severe (**MO)** impact categories for each alien bird order. Expected values are displayed in italics. Data for impacts by Falconiformes were removed from the dataset for the test, due to low sample size (one **MN** impact).

	No. of MC & MN impacts (less severe impacts)	**No. of MO impacts (more severe impacts)**	**Total**
Passeriformes	45 *46.27*	2 *0.74*	**47**
Psittaciformes	31 *30.51*	0 *0.49*	**31**
Galliformes	15 *14.76*	0 *0.24*	**15**
Anseriformes	21 *20.67*	0 *0.33*	**21**
Columbiformes	13 *12.8*	0 *0.2*	**13**
Total	**125**	**2**	**127**

Chi-square value = 0.214, degrees of freedom = 4, *P* = 0.958, estimate = 0.041

Table S4. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations to less severe (**MC** & **MN)** and more severe (**MO)** impact categories for each impact mechanism. Expected values are displayed in italics. Data for disease transmission impacts were removed from the dataset for the test, due to low sample size (one **MN** impact).

	No. of MC & MN impacts (less severe impacts)	**No. of MO impacts (more severe impacts)**	**Total**
Damage to agriculture	82 *81.69*	1 *1.31*	**83**
Damage to public facilities, buildings and utilities	26 *25.59*	0 *0.41*	**26**
Nuisance	14 *13.78*	0 *0.22*	**14**
Aviation safety	3 *3.94*	1 *0.06*	**4**
Total	**125**	**2**	**127**

Chi-square value = 0.922, degrees of freedom = 3, *P* = 0.66, estimate = 0.085

Table S5. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations by region, to less severe (**MC** & **MN)** and more severe (**MO)** impact categories. Expected values are displayed in italics.

	No. of MC & MN impacts (less severe impacts)	**No. of MO impacts (more severe impacts)**	**Total**
Africa	7 *6.89*	0 *0.11*	**7**
Asia	11 *10.83*	0 *0.17*	**11**
Australasia	47 *47.25*	1 *0.75*	**48**
Europe	20 *19.69*	0 *0.31*	**20**
North and Central America	15 *15.75*	1 *0.25*	**16**
Islands	26 *25.59*	0 *0.41*	**26**
Total	**126**	**2**	**128**

Chi-square value = 0.208, degrees of freedom = 5, *P* = 0.98, estimate = 0.04

Table S6. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations by region, to each impact mechanism. Expected values are displayed in italics. Data for disease transmission impacts were removed from the dataset for the test, due to low sample size (one **MN** impact).

	Damage to agriculture	**Damage to public facilities, buildings and utilities**	**Nuisance**	**Aviation safety**	**Total**
Africa	6 *4.57*	0 *1.43*	1 *0.77*	0 *0.22*	**7**
Asia	8 *7.19*	3 *2.25*	0 *1.21*	0 *0.35*	**11**
Australasia	31 *30.72*	11 *9.62*	5 *5.18*	0 *1.48*	**47**
Europe	11 *13.07*	6 *4.09*	1 *2.2*	2 *0.63*	**20**
North and Central America	9 *10.46*	4 *3.28*	2 *1.76*	1 *0.5*	**16**
Islands	18 *16.99*	2 *5.32*	5 *2.87*	1 *0.82*	**26**
Total	**83**	**26**	**14**	**4**	**127**

Chi-square value = 9.318, degrees of freedom = 15, *P* = 0.812, estimate = 0.156

Table S7. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations by confidence score, to less severe (**MC** & **MN)** and more severe (**MO)** impact categories. Expected values are displayed in italics. Data for disease transmission impacts were removed from the dataset for the test, due to low sample size (one impact of low confidence).

	Low confidence	**Medium confidence**	**High confidence**	**Total**
Damage to agriculture	78 *78.43*	5 *3.27*	0 *1.31*	**83**
Damage to public facilities, buildings and utilities	25 *24.57*	0 *1.02*	1 *0.41*	**26**
Nuisance	14 *13.23*	0 *0.55*	0 *0.22*	**14**
Aviation safety	3 *3.78*	0 *0.16*	1 *0.06*	**4**
Total	**120**	**5**	**2**	**127**

Chi-square value = 1.7, degrees of freedom = 6, *P* = 0.86, estimate = 0.082

Table S8. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations by confidence score, to each region. Expected values are displayed in italics.

	Low confidence	**Medium confidence**	**High confidence**	**Total**
Africa	7 *6.62*	0 *0.27*	0 *0.11*	**7**
Asia	11 *10.4*	0 *0.43*	0 *0.17*	**11**
Australasia	46 *45.38*	2 *1.88*	0 *0.75*	**48**
Europe	19 *18.91*	1 *0.78*	0 *0.31*	**20**
North and Central America	14 *15.13*	0 *0.63*	2 *0.25*	**16**
Islands	24 *24.58*	2 *1.02*	0 *0.41*	**26**
Total	**121**	**5**	**2**	**128**

Chi-square value = 1.4, degrees of freedom = 10, *P* = 0.98, estimate = 0.074

Table S9. Contingency table (unconditional exact test) showing actual and expected numbers of impact allocations by confidence score, to less severe (**MC** & **MN)** and more severe (**MO)** impact categories. Expected values are displayed in italics.

	Low confidence	**Medium confidence**	**High confidence**	**Total**
No. of MC & MN impacts (less severe impacts)	121 *119.1*	4 *4.92*	1 *1.97*	**126**
No. of MO impacts (more severe impacts)	0 *1.89*	1 *0.08*	1 *0.03*	**2**
Total	**121**	**5**	**2**	**128**

Chi-square value = 8.17, degrees of freedom = 2, *P* = 0.01, estimate = 0.206

References

Bacher S, Blackburn TM, Essl F, Genovesi P, Heikkilä J, Jeschke JM, Jones G, Keller R, Kenis M, Kueffer CM, Angeliki F, Nentwig W, Pergl J, Pyšek P, Rabitsch W, Richardson DM, Roy HE, Saul WC, Scalera R, Vilà M, Wilson JRU, Kumschick S (2018) Socio-economic impact classification of alien taxa (SEICAT). Methods in Ecology and Evolution 9(1): 159-168. doi: 10.1111/2041-210X.12844.

Zhong H, Song M (2019) A fast exact functional test for directional association and cancer biology applications. IEEE/ACM Transactions on Computational Biology and Bioinformatics 16(3): 818-826. doi: 10.1109/TCBB.2018.2809743.