Supporting information

Appendix S1

- Tables S1a-c shows detailed information of the questionnaires applied to zoo visitors in Brazil (a), the United Kingdom (b), New Zealand (c). The questionnaires were focussed on amphibian and conservation topics, taking into account the current evaluation of amphibian declines in each country. For the analysis of specific knowledge, categories were grouped together, and analysed for each country separately due to unbalanced nature of the questionnaire designed. Please note this is a paper version of the online questionnaire. Respondents used an iPad mini to answer each question. Respondents were unbale to move forward if question was not answered, additionally, it unable respondents to revisit answered questions. The iPad was chosen because it helps to eliminate bias (respondents answer questions with no interviewer input), respondents are allowed to zoon in and out as suit them, they can also have question be read to them on Siri (iPad function).
- Table S1d description of questionnaire given to zoos educational sector.
- Table S1.2 shows a summary of question categories for each country
- Table S1.3 shows a description of question categories

Table S1 a: Translated version of the questionnaire applied to zoos visitors in Brazil (n = 501) across all zoos (n = 6). Questions marked with (*) are common questions to all three countries. D1 - D3 = demographic data, Q = research questions (1-10). Please note the age range selected (18+) is to comply to the Brazilian Human Ethics committee.

Demographic questions				
	D1	Gender	A- Male	
			B- Female	
	D2	Age range	A- 18-23	
			B- 24+	
	D3	Are you resident in Brazil	A= Yes	
			B=No	

Research questions				
Categories	**Q#**	**Question**	**Response Option**	**Level of Confidence**
Biology	Q1*	Which group of animals in the picture represent the group amphibian	A = (Pictures with 4 groups of amphibians)	High, Medium, Low
			B= (Picture with groups of reptiles)	
Biology	Q2*	Where can we find amphibians?	A= Every continent except polar regions	High, Medium, Low
			B= Only in tropical areas	
Biology	Q3*	What type of food does an adult amphibian eat?	A= Insects	High, Medium, Low
			B= Plants	
			C= I don't know	
Biology	Q4*	Which factors are correct about amphibians?	A= Amphibians have damp skin, can breathe not only with their lungs, but also through their skin and usually lay eggs in wet places.	High, Medium, Low
			B= Amphibians have dry skins and waterproof eggs.	
			C= I don't know	
Biogeography	Q5	From the options below, what are the countries with the biggest number of amphibian species	A= Colombia	High, Medium, Low
			B= Brazil	
			C= Venezuela	
			D= I don't know	

Conservation	Q6*	Around the globe the number of amphibians' species is:	A= Increasing	High, Medium, Low
			B= Decreasing	
			C= I don't know	
Conservation	Q7*	What are the major threats to amphibians	A= Noise pollution	High, Medium, Low
			B= Diseases	
			C= I don't know	
Concepts	Q8*	What do you consider to be an alien/exotic species (in biology)?	A= A non-native species living outside its natural range	High, Medium, Low
			B= Crosses between populations within a single species	
			C= I don't know	
Biology	Q9*	What is a Biological indicator	A= A species capable of interbreeding and producing fertile offspring	High, Medium, Low
			B= A species that can be used to monitor the health of the environment of other ecosystems.	
			C= I don't know	
Conservation	Q10	From the options below, what do you consider to be the major impact to you if amphibian vanish from the earth?	A= Lack of food, because amphibians can be used as a food source	High, Medium, Low
			B= Increase in mortality rate amongst people, due to increased number of insect-borne diseases	
			C= I don't know	

Table S1.b. Questionnaire applied to zoos in New Zealand (n = 509) across all zoos (n = 4). For consistency with the data from Brazil respondents of age range below 18 years old was removed from the data base. D = demographic data (1-3), Q = Research questions (1-10). The research comply to the Human Ethic.

Demographic questions				
	D1	**Gender**	**A= Male**	
			B= Female	
	D2	**Age range**	**A= 18-23**	
			B= 23+	
	D3	**Are you a New Zealand resident?**	**A= Yes**	
			B= No	

Research question				
Categories	**Q#**	**Question**	**Response Option**	**Level of Confidence**
Biogeography	Q1	New Zealand has 10 species of native frogs	A= True	High, Medium, Low
			B= False	
			C= I don't know	
Conservation	Q2*	What do you consider to be a Biological indicator	A= A species capable of interbreeding and producing fertile offspring	High, Medium, Low
			B= A species that can be used to monitor the health of the environment of other ecosystems.	
			C= I don't know	
Biology	Q3*	What type of food do an adult amphibian eat? Choose your answer based on the pictures below	A= Plants	High, Medium, Low
			B= Insects	
			C= I don't know	
Biogeography	Q4	Does the photo below show a native frog from New Zealand?	A= Yes	High, Medium, Low
			B= No	
			C= I don't know	
Biology	Q5	Does the diagram below shows a typical reproductive cycle off native frogs in New Zealand?	A= Yes	High, Medium, Low
			B= No	
			C= I don't know	
Biology	Q6	Are amphibians water dependent?	A= Yes	High, Medium, Low
			B= No	
			C= I don't' know	
Concepts	Q7*	What do you consider to be an alien/exotic species?	A= A non-native species living outside its natural range	High, Medium, Low

			B= Crosses between populations within a single species	
			C= I don't know	
Conservation	Q8*	Around the globe the number of amphibian species is:	A= Increasing	High, Medium, Low
			B= Decreasing	
			C= I don't know	
Biology	Q*9	Do the animals in the photo belong to the group of amphibians?	A= Yes (Photo of the 3 groups of amphibians)	High, Medium, Low
			B= No (Photo of the 4 groups of reptiles)	
			C= I don't know	
Biology	Q10 *	Where can we find amphibians?	A= Every continent except polar regions	High, Medium, Low
			B= Only in tropical areas	
			C= I don't' Know	

Table S1c - Questionnaire applied to zoo visitors in the UK (n = 283) across all zoos (n = 5). For consistency with the data from Brazil respondents of age range below 18 years old was removed from the data base. D = demographic data (1-3), Q = Research questions (1-10). The research comply to the Human Ethic committee of New Zealand. The research comply to the Human Ethic.

Demographic questions				
	D1	**Gender**	**A= Male**	
			B=Female	
	D2	**Age Range**	**A= 18-23**	
			B= 23+	
	D3	**Are you a UK resident?**	**A= Yes**	
			B=No	

Research questions				
Categories	**Q#**	**Question**	**Response Option**	**Level of Confidence**
Concepts	Q1*	Which group of animals in the picture represent the group amphibian	A = (Pictures with 4 groups of amphibians)	High, Medium, Low
			B= (Picture with groups of reptiles)	
Biology	Q2*	Where can we find amphibians?	A= Every continent except polar regions	High, Medium, Low
			B= Only in tropical areas	
Biology	Q3*	What type of food does an adult amphibian eat?	A= Insects	High, Medium, Low
			B= Plants	
			C= I don't know	
Biology	Q4*	Which factors are correct about amphibians?	A= Amphibians have damp skin, can breathe not only with their lungs, but also through their skin and usually lay eggs in wet places.	High, Medium, Low
			B= Amphibians have dry skins and waterproof eggs.	
			C= I don't know	
Biogeography	Q5	How many species of native amphibians does the UK have?	A= More than 6	High, Medium, Low
			B= Less than 6	
			C= 6	
			D= I don't' know	
Biogeography	Q6	Which of the following animals are native to the UK?	A= Picture with native species and their scientific and common names	High, Medium, Low
			B= Picture of introduced amphibians with their scientific names and common names	
Conservation	Q7*		A= Increasing	

		Around the globe the number of amphibian species is:	B= Decreasing	High, Medium, Low
			C= I don't know	
Conservation	Q8*	What are the major threats to amphibians	A= Noise pollution	High, Medium, Low
			B= Diseases	
			C= I don't know	
Concepts	Q9*	What do you consider to be an alien species?	A= A non-native species living outside its natural range	High, Medium, Low
			B= Crosses between populations within a single species	
			C= I don't know	
Conservation	Q10*	What do you consider to be a Biology indicator	A= A species capable of interbreeding and producing fertile offspring	High, Medium, Low
			B= A species that can be used to monitor the health of the environment of other ecosystems.	
			C= I don't know	

Table S1 d: Questionnaire applied to zoos educational sector (n = 15), across the countries (n = 3). Answers (n = 90) were completed by the zoo educational programmer officer.

Q#	Question	Response Option	Research Question category
Q1	Is there an amphibian display in your Zoo/Aquaria/Education Centre?	A = A display of live animals	Amphibian exhibit
		B= Interpretation and information of amphibian conservation	Interpretation
Q2	During school visits does the Zoo use amphibians as a case study to illustrate key issues within the school curriculum?	A= Yes	Linked to school curriculum
		B= No	
Q3	How often does your establishment uses keeper talks in topics related to amphibians?	A= Daily	Conservation in Action
		B= Weakly	
		C= Monthly	
		D= Annually	
		E= Never	
Q4	Does the zoo use amphibian ex-situ conservation for educational purpose?	A= Yes	Ex-situ and education
		B= No	
		C= Does not practice ex-situ conservation for amphibians	
Q5	Does the environmental education uses amphibian for closer animal encounter	A= Yes	Animal encounter
		B= No	
Q6	Does the education material have any focus on the native species and introduced species of amphibians?	A= Yes	Species focus
		B = No	

Table S1.1: Data summary including the code of zoos surveyed in each country, number of survey per zoos and total number of survey per country.

Organizations	No. of survey per organizations	Country	No. of surveys per country
Bra 101	113	Brazil	501
Bra100	101		
Bra 107	63		
Bra 104	74		
Bra 102	79		
Bra 105	71		
NZL 114	148	New Zealand	509
NZL 116	126		
NZL 115	117		
NZL 113	118		
GBR 100	56	the United Kingdom	283
GBR 104	51		
GBR 102	66		
GBR 105	64		
GBR 107	46		
Total: 15		3	1293

Table S1.2: Summary of data of predictor variables: Questions categories (Question Cat.). Numbers varied according to countries culture and amphibian diversity, therefore for analysis purpose categories were grouped separately per country.

Country	Category	Surveys
Brazil	Biology	200
	Concepts	100
	Conservation	150
	Biogeography	50
New Zealand	Biology	153
	Concepts	102
	Conservation	102
	Biogeography	153
United Kingdom	Biology	85
	Concepts	85
	Conservation	57
	Biogeography	57

Table S1.3: Definition of questions categories, defined for this study only, based on Cambridge online dictionary (http://dictionary.cambridge.org, accessed 10/04/2017).

Categories	Definition
Biology	Topics related to the biology of amphibians, i.e. anatomy, reproduction, physiology of the group, the relations of organisms to one another and to their physical surroundings.
Conservation	Related to protection, distribution, preservation, and threats.
Concepts	Related to deductive ideas. For example, (Alien species have different connotation in different countries, therefore it was considered as a concept)
Biogeography	Related to the bio-geographic information of native amphibian species of each country studied (related to as Biogeography for analysis purpose)

Appendix S2

Table S2.1 Description: GLMM for no moderated answers (no CBM) model averaging
following steps 1-5 of Grueber et al. (2011). To generate the Generalised linear mixed model
(GLMM), we first fit a global GLMM using the lmer function implemented in the lme4 package
(Bates & Maechler 2009), defined below in 'R':

{LC_glmm_final <- glmer(Response_binomial ~ (Question_Cat+Country+Gender)^3 +
(1|ZooID/ID), family=binomial(), control = glmerControl(optimizer = "bobyqa"),data =
Final_LC)}

Once the global model was defined we have standardized the input variables using Gelman's
(2008) approach using the arm package (Gelman's et al. 2009). The standardization is essential
for interpreting the parameter estimates after model averaging (Grueber et al. 2011). We have
obtained the top $5AIC_c$ of model by using a cut off delta AIC < 6 (Richards 2008) .

Table S2.1: R output model averaging standardised parameters for the GLMM, examining effects of various covariates detecting probability of answers on predictor response for all ten questions (n= 12930) used for overall knowledge across organizations (n=15) and countries (n= 3) NZ=New Zealand, UK= United Kingdom, BR= Brazil. Single parameters were added each time, which included a maximum of 2 random effects (ZooID and respondent's ID). Predictor variables were: Questions Cat= Category: B= Biology, Cc=Concepts, Cs=Conservation, G= Biogeography, Gender, and countries. We evaluated all models compared to the base model using Akaike's Information Criterion (AICc), ΔAIC, and changes in model deviance (Dev) (Arnold 2010. Model averaging (Weight (W_i) are based on the relative importance of the the models. Note that model weights are recalculated for the set of models that are being averaged only.

Component models	df	loglik	AICc	ΔAIC	Weight (W_i)
1+2+3+6	15	-7156.99	14344.01	0	0.4
1+2+3+4+6	17	-7155.23	14344.51	0.49	0.31
2+3+6	14	-7158.91	14345.85	1.84	0.16
1+2+3+4+5+6	20	-7153.63	14347.32	3.3	0.08

Variables					
c.Gender	Country	Question category	c.Gender:Country	c.Gender:Question Category	Country:Question category
1	2	3	4	5	6

Model-averaged coefficients					
	Estimate	SD	s.e.	z	p
(Intercept)	1.6039	0.0875	0.0875	18.3280	<0.0001
c.Gender	0.1396	0.1121	0.1121	1.2460	0.2129
CountryNZ	-0.5015	0.1294	0.1294	3.8750	0.0001
CountryUK	0.3090	0.1515	0.1515	2.0390	0.0414
Question_CatCc	-1.1911	0.0900	0.0901	13.2270	<0.0001
Question_CatCs	-0.3464	0.0855	0.0855	4.0520	0.0001

	Estimate	SD	s.e.	z	p
Question_CatG	-1.2005	0.1127	0.1127	10.6560	<0.0001
CountryNZ:Question_CatCc	-1.6183	0.1393	0.1394	11.6120	<0.0001
CountryUK:Question_CatCc	0.5418	0.1571	0.1571	3.4490	0.0006
CountryNZ:Question_CatCs	0.5518	0.1297	0.1297	4.2530	0.0000
CountryUK:Question_CatCs	-0.3306	0.1650	0.1650	2.0030	0.0452
CountryNZ:Question_CatG	0.4551	0.1389	0.1390	3.2750	0.0011
CountryUK:Question_CatG	-0.9827	0.1752	0.1752	5.6090	<0.0001
c.Gender:CountryNZ	-0.0644	0.1162	0.1162	0.5550	0.5792
c.Gender:CountryUK	-0.1140	0.1750	0.1750	0.6510	0.5150
c.Gender:Question_CatCc	0.0044	0.0459	0.0459	0.0950	0.9243
c.Gender:Question_CatCs	0.0005	0.0436	0.0436	0.0110	0.9913
c.Gender:Question_CatG	0.0243	0.0750	0.0750	0.3230	0.7464
(conditional average)					
	Estimate	SD	s.e.	z	p
(Intercept)	1.6039	0.0875	0.0875	18.3280	<0.0001
c.Gender	0.1658	0.1028	0.1028	1.6130	0.1068
CountryNZ	-0.5015	0.1294	0.1294	3.8750	0.0001
CountryUK	0.3090	0.1515	0.1515	2.0390	0.0414
Question_CatCc	-1.1911	0.0900	0.0901	13.2270	<0.0001
Question_CatCs	-0.3464	0.0855	0.0855	4.0520	0.0001
Question_CatG	-1.2005	0.1127	0.1127	10.6560	<0.0001
CountryNZ:Question_CatCc	-1.6183	0.1393	0.1394	11.6120	<0.0001
CountryUK:Question_CatCc	0.5418	0.1571	0.1571	3.4490	0.0006
CountryNZ:Question_CatCs	0.5518	0.1297	0.1297	4.2530	0.0000
CountryUK:Question_CatCs	-0.3306	0.1650	0.1650	2.0030	0.0452
CountryNZ:Question_CatG	0.4551	0.1389	0.1390	3.2750	0.0011

CountryUK:Question_CatG	-0.9827	0.1752	0.1752	5.6090	<0.0001
c.Gender:CountryNZ	-0.1674	0.1336	0.1336	1.2530	0.2102
c.Gender:CountryUK	-0.2960	0.1603	0.1603	1.8460	0.0648
c.Gender:Question_CatCc	0.0319	0.1205	0.1205	0.2640	0.7915
c.Gender:Question_CatCs	0.0035	0.1177	0.1177	0.0290	0.9765
c.Gender:Question_CatG	0.1769	0.1184	0.1184	1.4940	0.1352

Relative variable importance:					
	Country	Question Category	Country: Question Category	c.Gender	c.Gender: Country
Importance:	1	1	1	0.84	0.39
N containing models:	5	5	5	4	2

Relative variable importance:	
	c.Gender:Question Category
Importance:	0.14
N containing models:	2

Table S2.2: GLMM R model output after standardization. Questions Cat= Category: B= Biology, Cc=Concepts, Cs=Conservation, G= Biogeography. NZ=New Zealand, UK= United Kingdom, BR= Brazil.

Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']

 Family: binomial (logit)

Formula: Response_binomial ~ (Question_Cat + Country + Gender)^3 + (1 |ZooID/ID)

   Data: Final_LC

Control: glmerControl(optimizer = "bobyqa")

AIC	BIC	logLik	deviance	df resid
14354.8	14549	-7151.4	14302.8	12904

Scaled residuals

Min	1Q	Median	3Q	Max
-3.6023	-7.7353	0.4277	0.5882	4.1558

Random effects:

Groups	Name	Variance	Std.Dev.
ID:ZooID	(Intercept)	0.55018	0.7108
ZooID	(Intercept)	0.01832	0.1353

Number of obs: 12930, groups: ID:ZooID, 1293; ZooID, 15

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	1.4730	0.1076	13.6920	<0.0001
Question_CatConcepts	-1.1601	0.1238	-9.3680	<0.0001
Question_CatConservation	-0.2604	0.1174	-2.2190	0.0265
Question_CatBiogeography	-1.3296	0.1552	-8.5680	<0.0001

CountryNZ	-0.3764	0.1547	-2.4340	0.0149
CountryUK	0.5277	0.2079	2.5380	0.0112
GenderMale	0.2766	0.1347	2.0530	0.0400
Question_CatConcepts:CountryNZ	-1.7441	0.1876	-9.2980	<0.0001
Question_CatConservation:CountryNZ	0.4865	0.1731	2.8110	0.0049
Question_CatBiogeography:CountryNZ	0.5228	0.1876	2.7860	0.0053
Question_CatConcepts:CountryUK	0.5439	0.2350	2.3150	0.0206
Question_CatConservation:CountryUK	-0.5663	0.2448	-2.3140	0.0207
Question_CatBiogeography:CountryUK	-0.9764	0.2579	-3.7860	0.0002
Question_CatConcepts:GenderMale	-0.0682	0.1798	-0.3790	0.7044
Question_CatConservation:GenderMale	-0.1835	0.1712	-1.0710	0.2840
Question_CatBiogeography:GenderMale	0.2669	0.2262	1.1800	0.2380
CountryNZ:GenderMale	-0.2580	0.1935	-1.3340	0.1824
CountryUK:GenderMale	-0.4254	0.2577	-1.6510	0.0988
Question_CatConcepts:CountryNZ:GenderMale	0.2747	0.2794	0.9830	0.3256
Question_CatConservation:CountryNZ:GenderMale	0.0864	0.2616	0.3300	0.7411
Question_CatBiogeography:CountryNZ:GenderMale	-0.1376	0.2805	-0.4910	0.6238
Question_CatConcepts:CountryUK:GenderMale	0.0115	0.3170	0.0360	0.9711
Question_CatConservation:CountryUK:GenderMale	0.4478	0.3323	1.3480	0.1778
Question_CatBiogeography:CountryUK:GenderMale	-0.0477	0.3531	-0.1350	0.8927

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Figure S1. Graph showing GLMM estimated probability of overall answers for the fitted model with predictor response: Overall correct answers (No moderated with CBM).
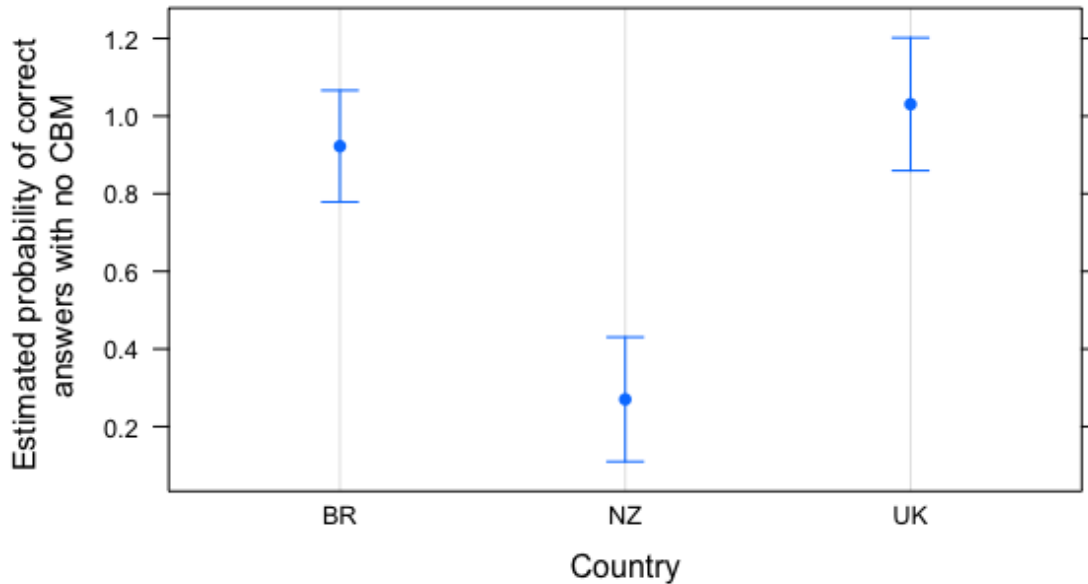

Fig. S1: Generalized linear mixed model estimates (GLMM). Probability of correct answers, considering all correct answers without CBM. Y axis drawn around the estimated effect of the interaction predictor response = correct answers, predictor variables: Country, question category and gender. Error bars 95% confidence intervals (CI).

Table S2.3: Fig S1. Glmm unmoderated responses. *Post hoc,* pairwise multiple comparison testing interaction between the countries (BR=Brazil, NZ= New Zealand, UK = United Kingdom) by pairwise comparison after model standardization, for all correct responses across countries. Odds ratio= coefficient estimates, standard errors SE., associated Wald's z-score and significance level *p* for all predictor response across the three schools: Correct answers with no level of confidence. Tukey method for comparing a family of 6 estimates. Tests are performed on the log scale. Results are averaged over the levels of: countries.

contrast	Odds ratio	SE	z	p
BR - NZ	0.6612	0.1112	5.9440	<.0001
BR - UK	-0.1167	0.1152	-1.0130	0.5683
NZ - UK	-0.7779	0.1214	-6.4110	<.0001

Appendix S 3

Table S3.1: Moderated answers. Multinomial logistic regression model (MLR). Model Selection using a series of likelihood ratio(LR) tests. Models examining effects of various covariates by detecting probability of answers on predictor response: level of confidence across all questions (n=12930), across organizations (n=15) and countries (n= 3). In the candidate models, single parameters were added each time, LR = likelihood ratio. Model selection was based on AIC (Akaike's information Criterion(AIC) (Burham & Anderson 2002). Residual *df* and residual deviation. LC= High, medium and low.

Response: Level of confidence (LC)

Model	Variables	Residual *df*	Residual Dev	Test	*df*	LR stat.	*p*	AIC
A	1 + 2 + 3	25844	25818					25850.29
B	**1+ 2 + 3+4)^² (Best model)**	**25810**	**25629**	**1 vs 2**	**34**	**189.0553**	**< 0.0001**	**25729.23**
C	(1 + 2 + 3 +4)^3	25776	25575	2 vs 3	34	54.2853	0.0150	25742.95
D	(1 + 2 + 3 +4)^4	25764	25559	3 vs 4	12	16.2830	0.1786	25750.67

*Predictor response= LC (high, medium and low); predictor variables: 1= Country (3 levels); 2= Question Category (4 levels), 3= Gender (2 levels), ^no. = including up to (2,3 or 4) ways interaction between variables.

Appendix S4

1. Figure S4.1 - Description: GLMM plot of the effect of estimate and their interactions for the fitted model regarding the specific visitor's knowledge about amphibians. Predictor responses = Overall correct answers (binomial), predictor variables = question categories, gender, amphibian exhibit and country.

2. Table S4.1, GLMM *Post- hoc* test with multiple comparison, determining which pairwise was responsible for any overall difference detected in the samples.
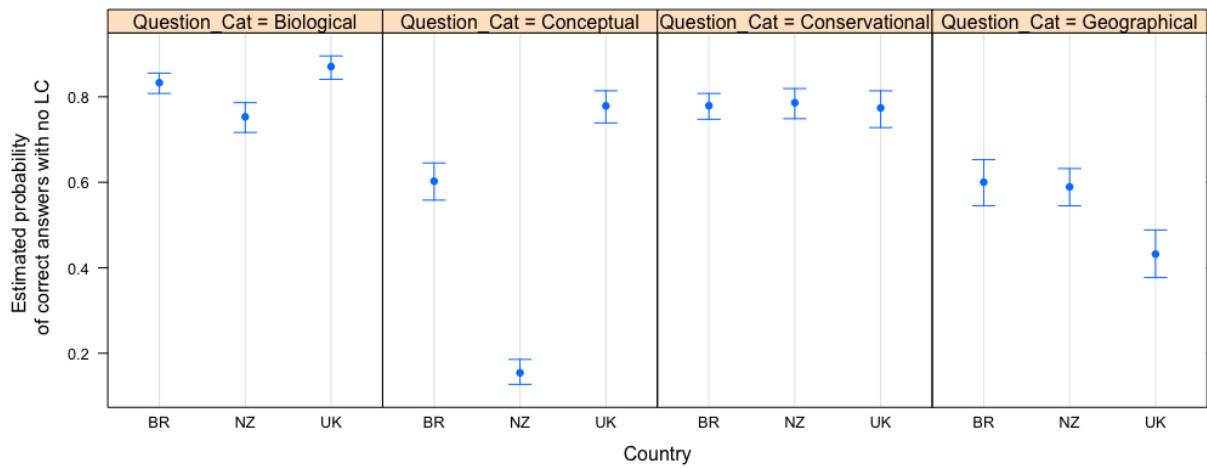

Fig. S4.1: Unmoderated responses. Generalised linear mixed model estimates. Estimated probability of correct answers by category, no level of confidence added. Y axis drawn around the estimated effect of the interaction predictor responses = all correct answers, predictor variables = Country (BR= Brazil, NZ= New Zealand, UK= United Kingdom), question category (B=Biology, Cc=Categorical, Cs=Conservation, G= Biogeography). Error bars are 95% confidence intervals (CI).

Table S4.1: Unmoderated responses. Estimated regression parameters for the generalized linear mixed models GLMM output. The table shows the pairwise comparison, for predictor response: correct answers, predictor variables: Question categories and countries. Odds ration = coefficient estimates, standard errors= SE, associated Wald's z score and significant level *p* value for all predictor responses: answers on the use of amphibian on enrichment programmes. Results are averaged over the level of gender. P value adjustment: Tukey method for comparing a family of 4 estimates. Test are performed on the log scale. Not significant interaction highlighted in bold.

Question category= Biology

contrast	Odds ratio	SE	*z*	*p*
BR - NZ	1.6343	0.2104	3.8150	0.0004
BR - UK	**0.7404**	**0.1115**	**-1.9960**	**0.1132**
NZ - UK	0.4530	0.0707	-5.0730	<0.0001

Question category= Concepts

contrast	Odds ratio	SE	*z*	*p*
BR - NZ	8.3141	1.2245	14.3810	<0.0001
BR - UK	0.4306	0.0624	-5.8180	<0.0001
NZ - UK	0.0518	0.0083	-18.4770	<0.0001

Question category Conservation

contrast	Odds ratio	SE	*z*	*p*
BR - NZ	**0.9595**	**0.1331**	**-0.2980**	**0.9522**
BR - UK	**1.0304**	**0.1583**	**0.1950**	**0.9792**
NZ - UK	**1.0739**	**0.1767**	**0.4330**	**0.9016**

Question category = Biogeography

contrast	Odds ratio	SE	*z*	*p*
BR - NZ	**1.0467**	**0.1539**	**0.3110**	**0.9482**
BR - UK	1.9745	0.3222	4.1680	0.0001
NZ - UK	1.8863	0.2795	4.2830	0.0001

Appendix S5

1. Table S5.1 Description: Global amphibian declines model averaging following steps 1-5 of Grueber et al. (2011). To generate the Generalised linear mixed model (GLMM), we first fit a global GLMM using the lmer function implemented in the lme4 package (Bates & Maechler 2009), defined below in 'R':

{Am_Dec_1 <- glmer(Response_binomial ~ Country + Gender + Age + (1|ID/ZooID), family="binomial", data = data1)}

Once the global model was defined we have standardized the input variables using Gelman's (2008) approach using the arm package (Gelman's et al. 2009). The standardization is essential for interpreting the parameter estimates after model averaging (Grueber et al 2011). We have used all models by setting a cut off delta AIC < 6 (Richards, 2008).

Table S5.1: Unmoderated responses. R output model averaging standardised parameters for the GLMM, examining effects of various covariates detecting probability of answers on predictor response for all ten questions (n= 1293) used for one question only 'Global amphibian declines' across organizations (n=15) and countries (n= 3) NZ=New Zealand, UK= United Kingdom, BR= Brazil. Single parameters were added each time, which included a maximum of 2 random effects (ZooID and respondent's ID). Predictor variables were: Questions Cat= Category: B= Biology, Cc=Concepts, Cs=Conservation, G= Biogeography, Gender, and countries. We evaluated all models compared to the base model using Akaike's Information Criterion (AICc), ΔAIC, and changes in model deviance (Dev) (Arnold 2010. Model averaging (Weight (W_i) are based on the relative importance of the the models. Note that model weights are recalculated for the set of models that are being averaged only.

Component models	df	loglik	AICc	ΔAIC	Weight (W_i)
1+3	6	-759.07	1530.21	0.00	0.30
1+2+3	7	-758.63	1531.34	1.13	0.17
3	5	-760.66	1531.37	1.16	0.17
1	4	-762.12	1532.28	2.07	0.11
2+3	6	-760.19	1532.44	2.23	0.10
1+2	5	-761.74	1533.53	3.32	0.06
(Null)	3	-763.8	1533.62	3.41	0.06

Variables					
c.Age	c.Gender	Country			
1	2	3			

Model-averaged coefficients					
	Estimate	SD	s.e.	z	p
(Intercept)	0.8317	0.1209	0.1210	6.8750	0.0001
c.Age	0.2113	0.2143	0.2144	0.9850	0.3240
CountryNew Zealand	0.1625	0.1533	0.1534	1.0590	0.2890
CountryUnited Kingdom	0.3044	0.2308	0.2309	1.3190	0.1870

	Estimate	SD	s.e.	z	p
c.Gender	-0.0424	0.0941	0.0942	0.4500	0.6530
(conditional average)					
	Estimate	SD	s.e.	z	p
(Intercept)	0.8317	0.1209	0.121	6.875	<0.0001
c.Age	0.3282	0.1816	0.1818	1.805	0.0711
CountryNew Zealand	0.2172	0.1397	0.1399	1.553	0.1205
CountryUnited Kingdom	0.4069	0.1717	0.1719	2.368	0.0179
c.Gender	-0.1174	0.1254	0.1256	0.935	0.3498
Relative variable importance:					
	Country	c. Age	c. Gender		
	0.75	0.64	0.36		
N Containing models	4	4	4		

Appendix S6

Table S6.1: Moderated responses. Multinomial logistic regression (MLR) model selection using a series of likelihood ratio (LR) tests. Models examining effects of various covariates by detecting probability of answers on predictor response: level of confidence across all questions regarding global amphibian declines(n=1293), across organizations (n=15) and countries (n= 3). In the candidate models, single parameters were added each time, LR = likelihood ratio. Model selection was based on AIC (Akaike's information Criterion(AIC) (Burham & Anderson 2002). Residual df and residual deviance. LC = High, medium and low.

Response: Level of Confidence (LC)

Model		Residual df	Residual deviance	Test	*df*	LR stat.	*p*	AIC
1- LC-	**1+2+3+4+5 (Best model)**	**2576**	**2606**					**2626.35**
2 -LC-	(1+2+3+4+5) ^2	2566	2576	1 vs 2	10	13.6978	0.1872	2636.10
3 -LC	(1 + 2+ 3+5) ^3	2562	2568	2 vs 3	4	2.1409	0.7099	2656.25

**Variables: Predictor response = LC (CBM; high, medium and low), Predictor variables: 1= Response binomial (Correct and incorrect); 2= Country (3 levels); 3=Question category (4 levels); 4=Gender (2 levels), 5=Amphibian Exhibit (2 level); ^no. = including up to (2 or 3) ways interaction between variables, + adding variables

Appendix S7

Table S7.1. Unmoderated responses. GLMM model output. For the analysis of amphibian content in the educational programmes of zoos. Predictor response; Response 1 = Yes, contain amphibians content related to questions, 0 = No, does not contain amphibian related question; Predictor variables: Question, country; Random effect: ZooID; Countries: Brazil (n=6), United Kingdom (n= 5) and New Zealand (n=4). Total response = 90, number of institution (n= 15).

summary(fit_glmer_1)

Generalized linear mixed model fit by maximum likelihood

  (Laplace Approximation) [glmerMod]

 Family: binomial (logit)

Formula: Response ~ Question + Country + (1 | ID)

   Data: Zoo_Edu

Control:

glmerControl(optimizer = "optimx", calc.derivs = FALSE, optCtrl = list(method = "nlminb",

   starttests = FALSE, kkt = FALSE))

AIC	BIC	logLik	deviance	df.resid
93.7	116.2	-37.9	75.7	81

Scaled residuals:

Min	1Q	Median	3Q	Max
-1.6286	-0.2719	0.0328	0.2397	3.2186

Random effects:

 Groups Name   Variance Std.Dev.

 ID   (Intercept) 9.426   3.07

Number of obs: 90, groups: ID, 15

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	0.6269	1.5669	0.4	0.68912	
QuestionAni_Enc	-3.7036	1.3536	-2.736	0.00622	**
QuestionF_Edu	-3.7036	1.3536	-2.736	0.00622	**
QuestionIn_Situ_C_&_E	-2.9602	1.3052	-2.268	0.02333	*
QuestionInterp	-1.5354	1.2092	-1.27	0.20416	
QuestionK_talk	-2.9602	1.3052	-2.268	0.02333	*
CountryNZ	1.8898	2.1648	0.873	0.38269	
CountryUK	4.9745	2.2191	2.242	0.02498	*

Signif. codes: 0 '   ' 0.001 '***   ' 0.01 '**   ' 0.05 *'.   ' 0.1 '   ' 1

Correlation of Fixed E   ffects:

	(Intr)	QstA_E	QstF_E	QI_S_C	QstnIn	QstnK_	CntrNZ
QustnAn_Enc	-0.347						
QuestinF_Ed	-0.347	0.598					
QsI_S_C_&_E	-0.351	0.584	0.584				
QuestnIntrp	-0.361	0.525	0.525	0.538			
QuestnK_tlk	-0.351	0.584	0.584	0.583	0.538		
CountryNZ	-0.536	-0.099	-0.099	-0.1	-0.068	-0.1	
CountryUK	-0.526	-0.114	-0.114	-0.084	-0.041	-0.084	0.428