Appendix L. Bioaccumulation Input and Output from the KABAM Model

Cells shaded yellow represent specific input or output values used in modeling.

Typical Application Rate

Input Values

Table 1. Chemical characteristics of Bifenthrin.		
Characteristic	**Value**	**Comments/Guidance**
Pesticide Name	**Bifenthrin**	**Required input**
Log K_{OW}	**6.477121255**	**Required input** Enter value from acceptable or supplemental study submitted by registrant or available in scientific literature.
K_{OW}	**3000000**	No input necessary. This value is calculated automatically from the Log K_{OW} value entered above.
K_{OC} (L/kg OC)		**Required input** Input value used in PRZM/EXAMS to derive EECs. Follow input parameter guidance for deriving this parameter value (USEPA 2002).
Time to steady state (T_S; days)	**820**	No input necessary. This value is calculated automatically from the Log K_{OW} value entered above.
Pore water EEC (µg/L)	**0.00748**	**Required input** Enter value generated by PRZM/EXAMS benthic file. PRZM/EXAMS EEC represents the freely dissolved concentration of the pesticide in the pore water of the sediment. The appropriate averaging period of the EEC is dependent on the specific pesticide being modeled and is based on the time it takes for the chemical to reach steady state. Select the EEC generated by PRZM/EXAMS which has an averaging period closest to the time to steady state calculated above. In cases where the time to steady state exceeds 365 days, the user should select the EEC representing the average of yearly averages. The peak EEC should not be used.
Water Column EEC (µg/L)	**0.014**	**Required input** Enter value generated by PRZM/EXAMS water column file. PRZM/EXAMS EEC represents the freely dissolved concentration of the pesticide in the water column. The appropriate averaging period of the EEC is dependent on the specific pesticide being modeled and is based on the time it takes for the chemical to reach steady state. The averaging period used for the water column EEC should be the same as the one selected for the pore water EEC (discussed above).

Table 2. Input parameters for rate constants. "calculated" indicates that model will calculate rate constant.

Trophic level	k_1 (L/kg*d)	k_2 (d^{-1})	k_D (kg-food/kg-org/d)	k_E (d^{-1})	k_M* (d^{-1})
phytoplankton	calculated	calculated	0*	0*	0
zooplankton	calculated	9.272916359	calculated	0	0
benthic invertebrates	calculated	3.221752446	calculated	0	0
filter feeders	calculated	calculated	calculated	0	0
small fish	calculated	0.0182	calculated	0	0
medium fish	calculated	0.0182	calculated	0	0
large fish	calculated	0.0182	calculated	0	0

* Default value is 0.

k_1 and k_2 represent the uptake and elimination constants respectively, through respiration.

k_D and k_E represent the uptake and elimination constants, respectively, through diet.

k_M represents the metabolism rate constant.

Table 3. Mammalian and avian toxicity data for Bifenthrin. These are required inputs.

Animal	Measure of effect (units)	Value	Species	If selected species is "other," enter body weight (in kg) here.
Avian	LD_{50} (mg/kg-bw)	**1800.00**	Northern bobwhite quail	
	LC_{50} (mg/kg-diet)	**1280.00**	mallard duck	
	NOAEC (mg/kg-diet)	**75.00**	Northern bobwhite quail	
	Mineau Scaling Factor	1.15	Default value for all species is 1.15 (for chemical specific values, see Mineau et al. 1996).	
Mammalian	LD_{50} (mg/kg-bw)	**53.80**	laboratory rat	
	LC_{50} (mg/kg-diet)	N/A	other	
	Chronic Endpoint	**30.00**	laboratory rat	
	units of chronic endpoint*	ppm		

*ppm = mg/kg-diet

Output Results

Table 11. Estimated concentrations of Bifenthrin in ecosystem components.				
Ecosystem Component	**Total concentration (µg/kg-ww)**	**Lipid normalized concentration (µg/kg-lipid)**	**Contribution due to diet (µg/kg-ww)**	**Contribution due to respiration (µg/kg-ww)**
Water (total)*	0	N/A	N/A	N/A
Water (freely dissolved)*	0	N/A	N/A	N/A
Sediment (pore water)*	0	N/A	N/A	N/A
Sediment (in solid)**	0	N/A	N/A	N/A
Phytoplankton	1,066	53322	N/A	1,066.44
Zooplankton	88	2945	24.04	64.31
Benthic Invertebrates	25	830	8.78	16.12
Filter Feeders	1,422	71077	494.47	927.07
Small Fish	641	16037	108.36	533.11
Medium Fish	706	17658	462.37	243.94
Large Fish	818	20452	704.77	113.31
* Units: µg/L; **Units: µg/kg-dw				

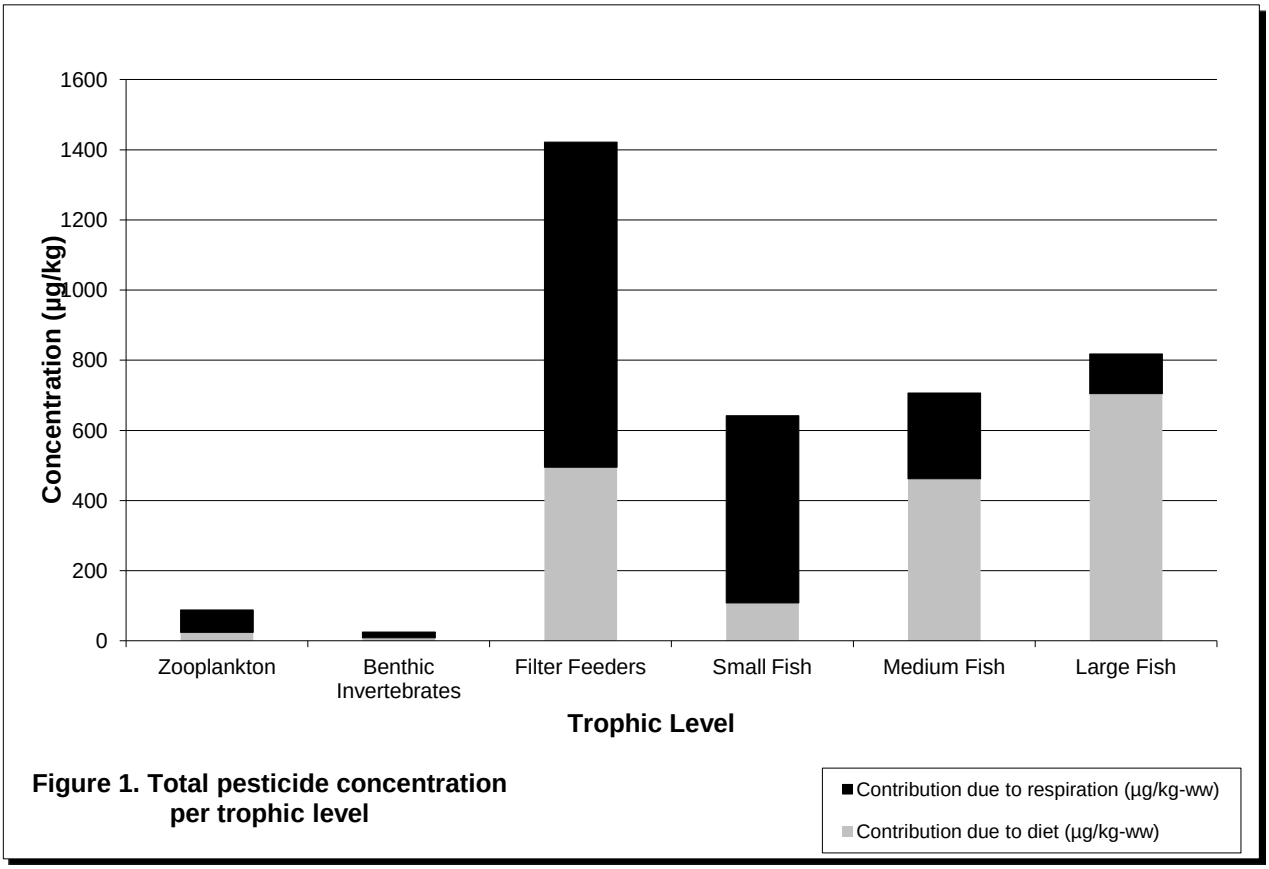

Figure 1. Total pesticide concentration per trophic level

Table 12. Total BCF and BAF values of Bifenthrin in aquatic trophic levels.

Trophic Level	Total BCF (µg/kg-ww)/(µg/L)	Total BAF (µg/kg-ww)/(µg/L)
Phytoplankton	144001	76175
Zooplankton	4600	6311
Benthic Invertebrates	1153	1778
Filter Feeders	71936	101539
Small Fish	40707	45819
Medium Fish	18183	50451
Large Fish	8316	58434

Table 13. Lipid-normalized BCF, BAF, BMF and BSAF values of Bifenthrin in aquatic trophic levels.

Trophic Level	BCF (µg/kg-lipid)/(µg/L)	BAF (µg/kg-lipid)/(µg/L)	BMF (µg/kg-lipid)/(µg/kg-lipid)	BSAF (µg/kg-lipid)/(µg/kg-OC)
Phytoplankton	7200045	3808730	N/A	#DIV/0!
Zooplankton	153333	210376	0.06	#DIV/0!
Benthic Invertebrates	38417	59280	0.04	#DIV/0!
Filter Feeders	3596792	5076930	3.83	#DIV/0!
Small Fish	1017678	1145482	8.50	#DIV/0!
Medium Fish	454580	1261279	2.09	#DIV/0!
Large Fish	207894	1460854	1.16	#DIV/0!

Table 14. Calculation of EECs for mammals and birds consuming fish contaminated by Bifenthrin.

Wildlife Species	Biological Parameters				EECs (pesticide intake)	
	Body Weight (kg)	Dry Food Ingestion Rate (kg-dry food/kg-bw/day)	Wet Food Ingestion Rate (kg-wet food/kg-bw/day)	Drinking Water Intake (L/d)	Dose Based (mg/kg-bw/d)	Dietary Based (ppm)
Mammalian						
fog/water shrew	0.02	0.140	0.585	0.003	0.015	0.02
rice rat/star-nosed mole	0.1	0.107	0.484	0.011	0.333	0.69
small mink	0.5	0.079	0.293	0.048	0.207	0.71
large mink	1.8	0.062	0.229	0.168	0.162	0.71

small river otter	5.0	0.052	0.191	0.421	0.135	0.71
large river otter	15.0	0.042	0.157	1.133	0.129	0.82
Avian						
sandpipers	0.0	0.228	1.034	0.004	0.7190	0.70
cranes	6.7	0.030	0.136	0.211	0.0975	0.72
rails	0.1	0.147	0.577	0.010	0.1924	0.33
herons	2.9	0.040	0.157	0.120	0.0575	0.37
small osprey	1.3	0.054	0.199	0.069	0.1408	0.71
white pelican	7.5	0.029	0.107	0.228	0.0873	0.82

Table 15. Calculation of toxicity values for mammals and birds consuming fish contaminated by Bifenthrin.

Wildlife Species	Toxicity Values			
	Acute		Chronic	
	Dose Based (mg/kg-bw)	Dietary Based (mg/kg-diet)	Dose Based (mg/kg-bw)	Dietary Based (mg/kg-diet)
Mammalian				
fog/water shrew	112.97	N/A	3.15	30
rice rat/star-nosed mole	76.64	N/A	2.14	30
small mink	50.52	N/A	1.41	30
large mink	35.73	N/A	1.00	30
small river otter	27.67	N/A	0.77	30
large river otter	21.03	N/A	0.59	30
Avian				
sandpipers	1296.77	1280.00	N/A	75
cranes	3101.85	1280.00	N/A	75
rails	1564.86	1280.00	N/A	75
herons	2735.70	1280.00	N/A	75
small osprey	2411.27	1280.00	N/A	75

white pelican	3154.78	1280.00	N/A	75

Table 16. Calculation of RQ values for mammals and birds consuming fish contaminated by Bifenthrin.

Wildlife Species	Acute		Chronic	
	Dose Based	Dietary Based	Dose Based	Dietary Based
Mammalian				
fog/water shrew	0.000	N/A	0.005	0.001
rice rat/star-nosed mole	0.004	N/A	0.156	0.023
small mink	0.004	N/A	0.147	0.024
large mink	0.005	N/A	0.163	0.024
small river otter	0.005	N/A	0.175	0.024
large river otter	0.006	N/A	0.219	0.027
Avian				
sandpipers	0.001	0.001	N/A	0.009
cranes	0.000	0.001	N/A	0.010
rails	0.000	0.000	N/A	0.004
herons	0.000	0.000	N/A	0.005
small osprey	0.000	0.001	N/A	0.009
white pelican	0.000	0.001	N/A	0.011

Highest Application Rate

Input Values

Table 1. Chemical characteristics of Bifenthrin.		
Characteristic	**Value**	**Comments/Guidance**
Pesticide Name	**Bifenthrin**	**Required input**
Log K_{OW}	**6.477121255**	**Required input** Enter value from acceptable or supplemental study submitted by registrant or available in scientific literature.
K_{OW}	**3000000**	No input necessary. This value is calculated automatically from the Log K_{OW} value entered above.
K_{OC} (L/kg OC)		**Required input** Input value used in PRZM/EXAMS to derive EECs. Follow input parameter guidance for deriving this parameter value (USEPA 2002).
Time to steady state (T_S; days)	**820**	No input necessary. This value is calculated automatically from the Log K_{OW} value entered above.
Pore water EEC (µg/L)	**0.014**	**Required input** Enter value generated by PRZM/EXAMS benthic file. PRZM/EXAMS EEC represents the freely dissolved concentration of the pesticide in the pore water of the sediment. The appropriate averaging period of the EEC is dependent on the specific pesticide being modeled and is based on the time it takes for the chemical to reach steady state. Select the EEC generated by PRZM/EXAMS which has an averaging period closest to the time to steady state calculated above. In cases where the time to steady state exceeds 365 days, the user should select the EEC representing the average of yearly averages. The peak EEC should not be used.
Water Column EEC (µg/L)	**0.014**	**Required input** Enter value generated by PRZM/EXAMS water column file. PRZM/EXAMS EEC represents the freely dissolved concentration of the pesticide in the water column. The appropriate averaging period of the EEC is dependent on the specific pesticide being modeled and is based on the time it takes for the chemical to reach steady state. The averaging period used for the water column EEC should be the same as the one selected for the pore water EEC (discussed above).

Table 2. Input parameters for rate constants. "calculated" indicates that model will calculate rate constant.

Trophic level	k_1 (L/kg*d)	k_2 (d^{-1})	k_D (kg-food/kg-org/d)	k_E (d^{-1})	k_M* (d^{-1})
phytoplankton	calculated	calculated	0*	0*	0
zooplankton	calculated	9.272916359	calculated	0	0
benthic invertebrates	calculated	3.221752446	calculated	0	0
filter feeders	calculated	calculated	calculated	0	0
small fish	calculated	0.0182	calculated	0	0
medium fish	calculated	0.0182	calculated	0	0
large fish	calculated	0.0182	calculated	0	0

* Default value is 0.

k_1 and k_2 represent the uptake and elimination constants respectively, through respiration.

k_D and k_E represent the uptake and elimination constants, respectively, through diet.

k_M represents the metabolism rate constant.

Table 3. Mammalian and avian toxicity data for Bifenthrin. These are required inputs.

Animal	Measure of effect (units)	Value	Species	If selected species is "other," enter body weight (in kg) here.
Avian	LD_{50} (mg/kg-bw)	**1800.00**	Northern bobwhite quail	
	LC_{50} (mg/kg-diet)	**1280.00**	mallard duck	
	NOAEC (mg/kg-diet)	**75.00**	Northern bobwhite quail	
	Mineau Scaling Factor	1.15	Default value for all species is 1.15 (for chemical specific values, see Mineau et al. 1996).	
Mammalian	LD_{50} (mg/kg-bw)	**53.80**	laboratory rat	
	LC_{50} (mg/kg-diet)	N/A	other	
	Chronic Endpoint	**30.00**	laboratory rat	
	units of chronic endpoint*	ppm		

*ppm = mg/kg-diet

Output Results

Table 11. Estimated concentrations of Bifenthrin in ecosystem components.				
Ecosystem Component	**Total concentration (µg/kg-ww)**	**Lipid normalized concentration (µg/kg-lipid)**	**Contribution due to diet (µg/kg-ww)**	**Contribution due to respiration (µg/kg-ww)**
Water (total)*	0	N/A	N/A	N/A
Water (freely dissolved)*	0	N/A	N/A	N/A
Sediment (pore water)*	0	N/A	N/A	N/A
Sediment (in solid)**	0	N/A	N/A	N/A
Phytoplankton	1,066	53322	N/A	1,066.44
Zooplankton	88	2945	24.04	64.31
Benthic Invertebrates	25	843	8.78	16.50
Filter Feeders	1,444	72182	494.47	949.17
Small Fish	655	16364	108.73	545.82
Medium Fish	721	18037	471.71	249.76
Large Fish	833	20830	719.89	113.31
* Units: µg/L; **Units: µg/kg-dw				

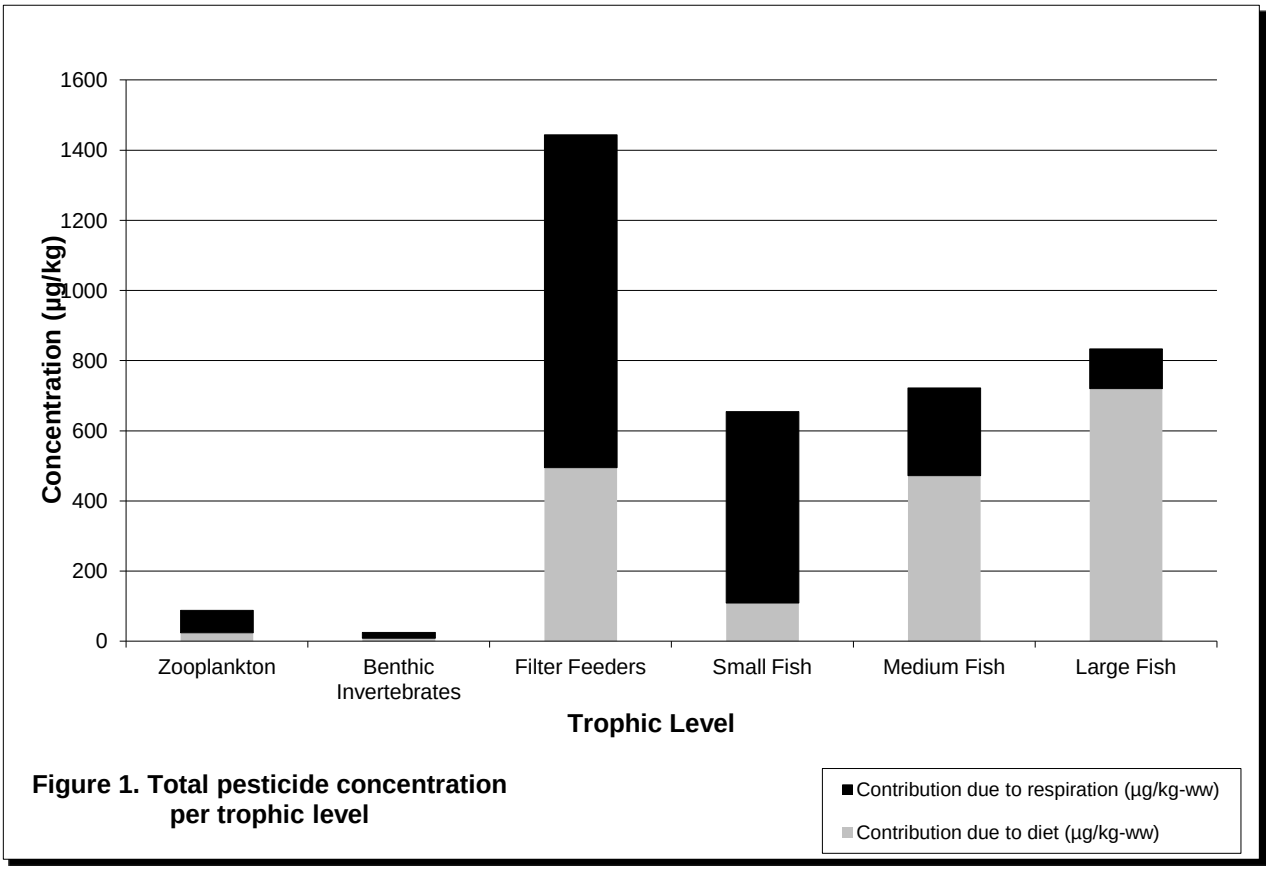

Figure 1. Total pesticide concentration per trophic level

Table 12. Total BCFand BAF values of Bifenthrin in aquatic trophic levels.		
Trophic Level	**Total BCF (µg/kg-ww)/(µg/L)**	**Total BAF (µg/kg-ww)/(µg/L)**
Phytoplankton	144001	76175
Zooplankton	4600	6311
Benthic Invertebrates	1180	1806
Filter Feeders	73651	103117
Small Fish	41678	46753
Medium Fish	18617	51534
Large Fish	8316	59514

Table 13. Lipid-normalized BCF, BAF, BMF and BSAF values of Bifenthrin in aquatic trophic levels.				
Trophic Level	**BCF (µg/kg-lipid)/(µg/L)**	**BAF (µg/kg-lipid)/(µg/L)**	**BMF (µg/kg-lipid)/(µg/kg-lipid)**	**BSAF (µg/kg-lipid)/(µg/kg-OC)**
Phytoplankton	7200045	3808730	N/A	#DIV/0!
Zooplankton	153333	210376	0.06	#DIV/0!
Benthic Invertebrates	39333	60195	0.05	#DIV/0!
Filter Feeders	3682543	5155865	3.89	#DIV/0!
Small Fish	1041940	1168835	8.64	#DIV/0!
Medium Fish	465418	1288345	2.10	#DIV/0!
Large Fish	207894	1487860	1.15	#DIV/0!

Table 14. Calculation of EECs for mammals and birds consuming fish contaminated by Bifenthrin.						
Wildlife Species	**Biological Parameters**				**EECs (pesticide intake)**	
	Body Weight (kg)	**Dry Food Ingestion Rate (kg-dry food/kg-bw/day)**	**Wet Food Ingestion Rate (kg-wet food/kg-bw/day)**	**Drinking Water Intake (L/d)**	**Dose Based (mg/kg-bw/d)**	**Dietary Based (ppm)**
Mammalian						
fog/water shrew	0.02	0.140	0.585	0.003	0.015	0.03
rice rat/star-nosed mole	0.1	0.107	0.484	0.011	0.339	0.70
small mink	0.5	0.079	0.293	0.048	0.212	0.72
large mink	1.8	0.062	0.229	0.168	0.165	0.72

small river otter	5.0	0.052	0.191	0.421	0.138	0.72
large river otter	15.0	0.042	0.157	1.133	0.131	0.83
Avian						
sandpipers	0.0	0.228	1.034	0.004	0.7312	0.71
cranes	6.7	0.030	0.136	0.211	0.0992	0.73
rails	0.1	0.147	0.577	0.010	0.1963	0.34
herons	2.9	0.040	0.157	0.120	0.0588	0.37
small osprey	1.3	0.054	0.199	0.069	0.1439	0.72
white pelican	7.5	0.029	0.107	0.228	0.0889	0.83

Table 15. Calculation of toxicity values for mammals and birds consuming fish contaminated by Bifenthrin.

Wildlife Species	Toxicity Values			
	Acute		Chronic	
	Dose Based (mg/kg-bw)	Dietary Based (mg/kg-diet)	Dose Based (mg/kg-bw)	Dietary Based (mg/kg-diet)
Mammalian				
fog/water shrew	112.97	N/A	3.15	30
rice rat/star-nosed mole	76.64	N/A	2.14	30
small mink	50.52	N/A	1.41	30
large mink	35.73	N/A	1.00	30
small river otter	27.67	N/A	0.77	30
large river otter	21.03	N/A	0.59	30
Avian				
sandpipers	1296.77	1280.00	N/A	75
cranes	3101.85	1280.00	N/A	75
rails	1564.86	1280.00	N/A	75
herons	2735.70	1280.00	N/A	75
small osprey	2411.27	1280.00	N/A	75

white pelican	3154.78	1280.00	N/A	75

Table 16. Calculation of RQ values for mammals and birds consuming fish contaminated by Bifenthrin.

Wildlife Species	Acute		Chronic	
	Dose Based	Dietary Based	Dose Based	Dietary Based
Mammalian				
fog/water shrew	0.000	N/A	0.005	0.001
rice rat/star-nosed mole	0.004	N/A	0.159	0.023
small mink	0.004	N/A	0.150	0.024
large mink	0.005	N/A	0.166	0.024
small river otter	0.005	N/A	0.179	0.024
large river otter	0.006	N/A	0.223	0.028
Avian				
sandpipers	0.001	0.001	N/A	0.009
cranes	0.000	0.001	N/A	0.010
rails	0.000	0.000	N/A	0.005
herons	0.000	0.000	N/A	0.005
small osprey	0.000	0.001	N/A	0.010
white pelican	0.000	0.001	N/A	0.011