Question			Answer	Marks	AO	Guidance	
14	(a)		E.g. $\int \frac{50}{50n-n^2}\,\mathrm{d}n = 0.1\int \mathrm{d}t$	M1	1.1a	Attempt to separate variables	
				M1	3.1a	Attempt to use partial fractions on LHS	
			$\int\left(\frac{1}{n}+\frac{1}{50-n}\right)\mathrm{d}n = 0.1\int \mathrm{d}t$	A1	1.1		
			$\ln n - \ln(50-n) = 0.1t + c$	M1	3.1a	Integrate both sides providing LHS contains a ln expression	
			$\ln\frac{n}{50-n} = 0.1t + c$	M1	1.1	Use log law on LHS	
			$\frac{n}{50-n} = A\mathrm{e}^{0.1t}$	M1	3.1a	Apply inverse of ln and deal with $+c$ Accept e^{c} oe	
				M1	1.1	Make n the subject of their expression	
			$n = \frac{50A\mathrm{e}^{0.1t}}{1+A\mathrm{e}^{0.1t}}$	A1	1.1	Accept e^{c} oe	
			$n = \frac{50A}{\mathrm{e}^{-0.1t}+A}$	E1	1.1	Multiply numerator and denominator by $\mathrm{e}^{-0.1t}$. AG	
				[9]			
14	(b)		As t becomes large, $\mathrm{e}^{-0.1t}$ becomes approximately 0, A cancels and so 50 birds are expected in the long term	E1	3.4	50 seen www	
				[1]			
14	(c)		E.g. Only allow integer values of t E.g. Include an initial value for A E.g. John could record the maximum number of each species that he sees.	E1	3.5c	For one refinement	
				[1]			

Question			Answer	Marks	AO	Guidance	
14	(d)		E.g. The model is continuous not discrete E.g. It treats all birds of any species as equivalent, but they will respond to the food in different ways.	E1 [1]	3.5a		