CASE STUDY I

Team members:

6.- Let $E1(t)$ be the number of species seen exactly once in the initial trapping period and then seen at least once in the new trapping period.
a) Derive the equivalent of formula (6.15).
Formula 6.15 is the expected value of the number of species that have been not seen in the initial trapping period and then seen at least once in the new one, so the probability of seeing a specie that has only been seen once is the following:

$$Poi(\lambda) = \frac{e^{-\lambda} * \lambda^x}{x!}$$

$$Poi(\theta_k) = e^{-\theta_k} * \theta_k; x = 1$$

Therefore, the probability is the following

$$(e^{-\theta_k} * \theta_k) * (1 - e^{-\theta_k * t})$$

And the expected value is the following:

$$E(t) = \sum_{k=1}^{s} (e^{-\theta_k} * \theta_k) * (1 - e^{-\theta_k * t})$$

$$E(t) = S \int_0^s (e^{-\theta} * \theta) * (1 - e^{-\theta * t}) * g(\theta) d\theta$$

b) What is the equivalent of (6.19)?
We can expand the previous integral into the following equation

$$E(t) = S \int_0^s (e^{-\theta} * \theta) * (\theta * t - \frac{(\theta * t)^2}{2!} + \frac{(\theta * t)^3}{3!} - \frac{(\theta * t)^4}{4!} ...) * g(\theta) d\theta$$

$$E(t) = S \int_0^s (e^{-\theta}) * (\theta^2 * t - \frac{\theta^3 * t^2}{2!} + \frac{\theta^4 * t^3}{3!} - \frac{\theta^5 * t^4}{4!} ...) * g(\theta) d\theta$$

$$E(t) = S \int_0^s \frac{e^{-\theta} * \theta^{x+1}}{x!} * g(\theta) d\theta$$
$$E(t) = S \int_0^s (x+1) \frac{e^{-\theta} * \theta^{x+1}}{(x+1)!} * g(\theta) d\theta$$
$$(x+1) * e_{x+1} = (x+1) * S \int_0^s (x+1) \frac{e^{-\theta} * \theta^{x+1}}{(x+1)!} * g(\theta) d\theta$$

Therefore, the equivalent of equation 6.19 is the following

$$E(t) = (x+1) * [e_2 * t - e_3 * t^2 + e_4 * t^3 - e_5 * t^4 ...]$$
$$\hat{E}(t) = (x+1) * [y_2 * t - y_3 * t^2 + y_4 * t^3 - y_5 * t^4 ...]$$