



# How much do FADs modify the habitat of tropical tunas ?

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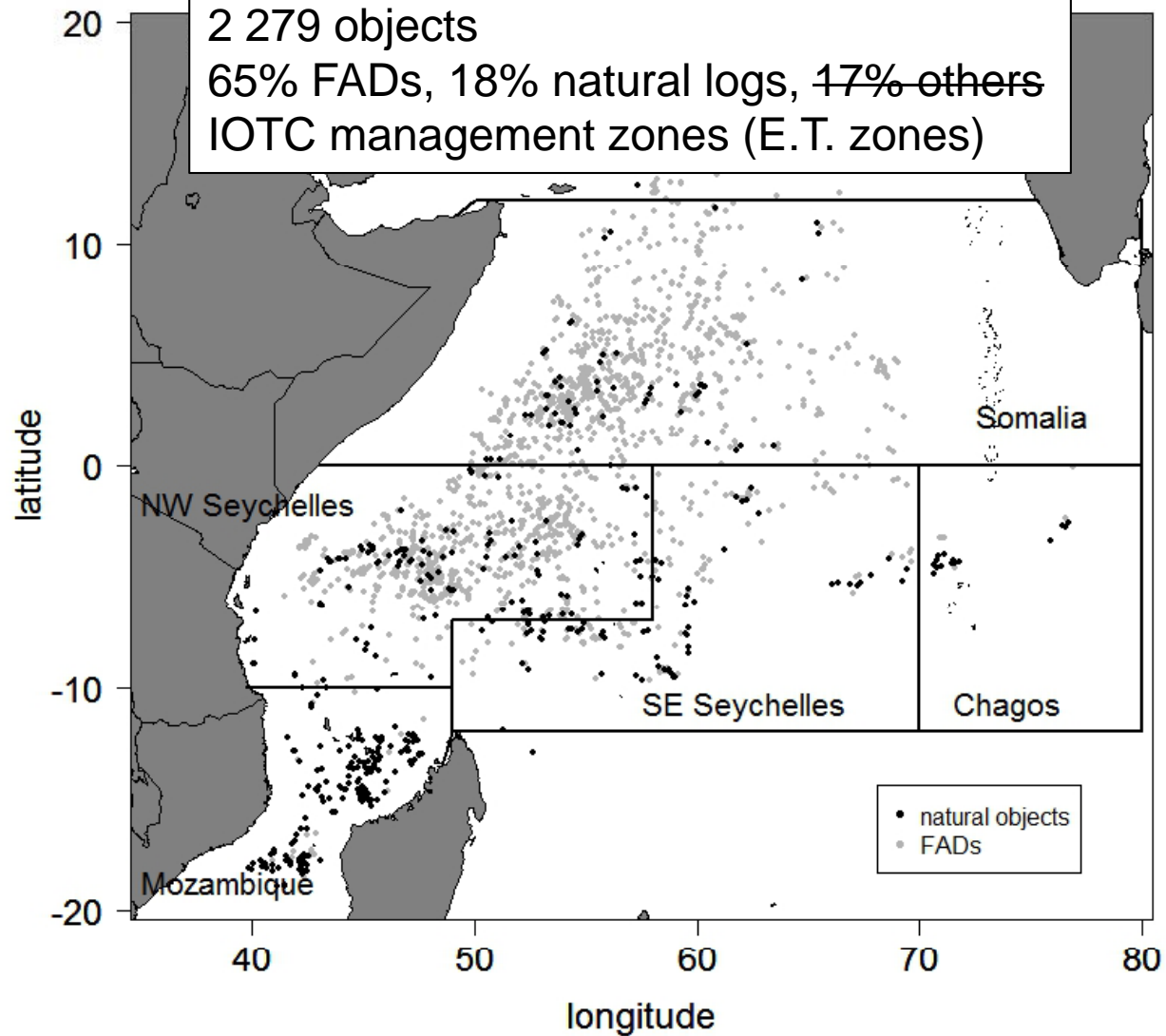
### Observers' data

2007-2008

2 279 objects

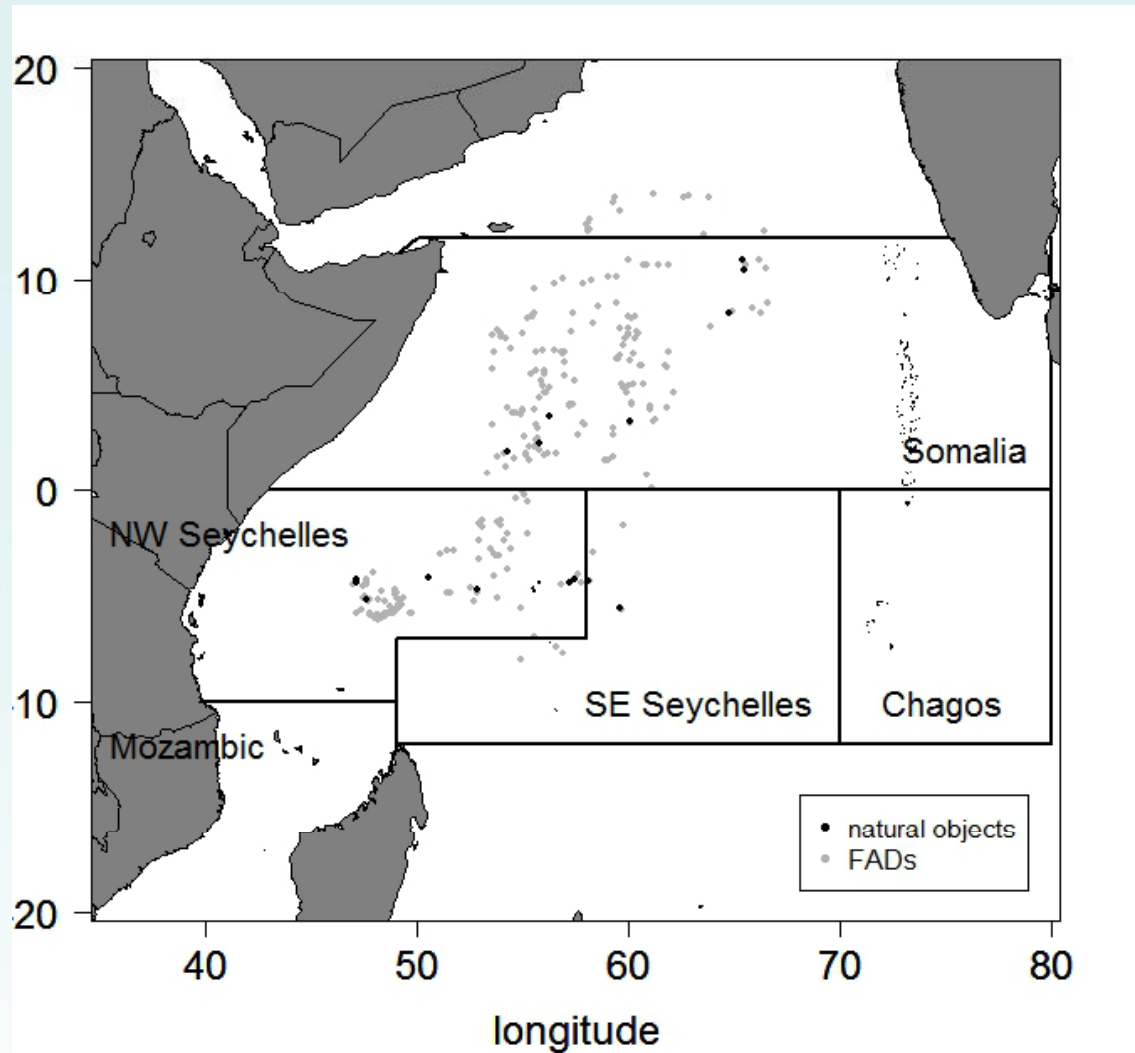
65% FADs, 18% natural logs, 17% others

IOTC management zones (E.T. zones)





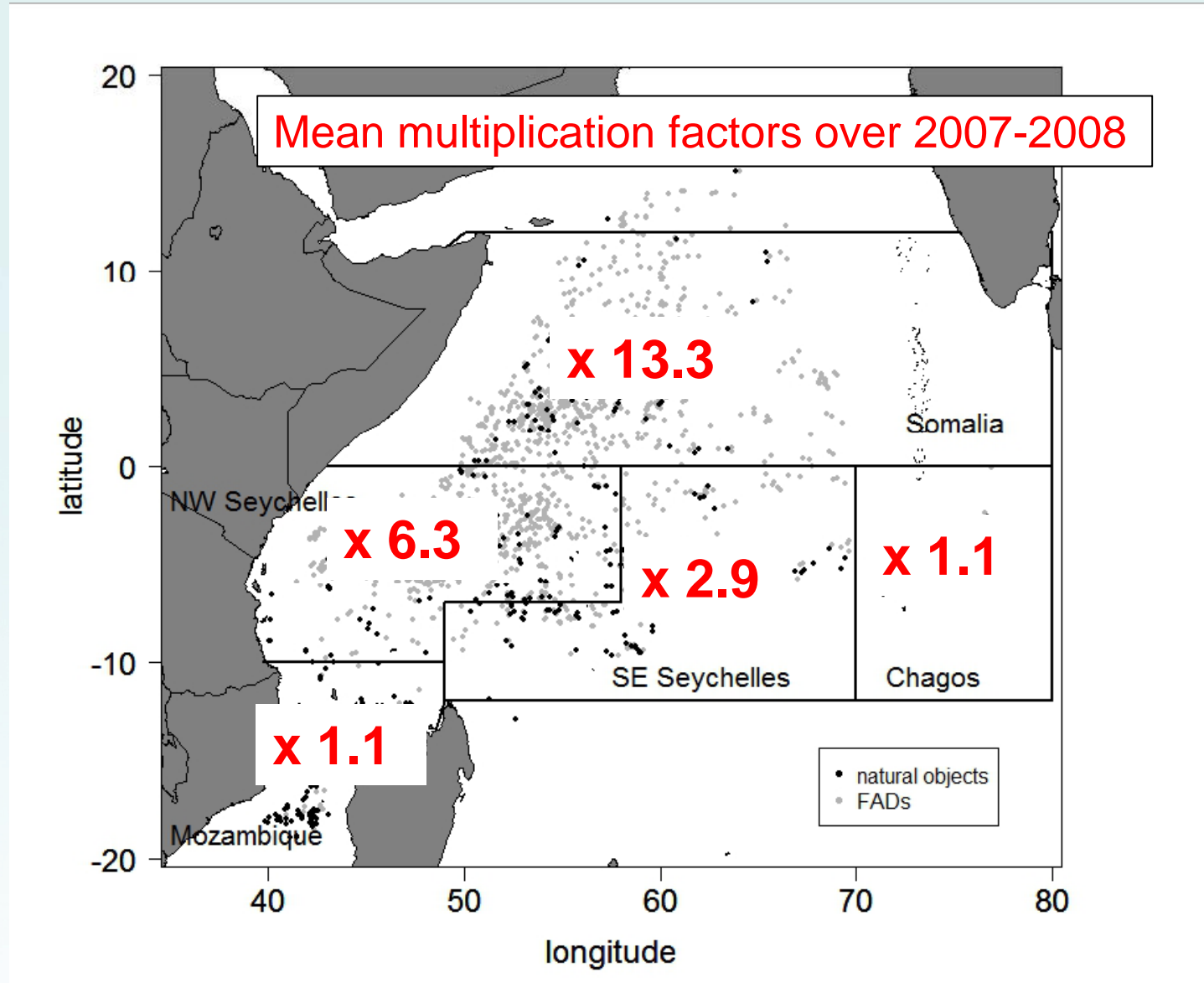
2008 – 4th quarter





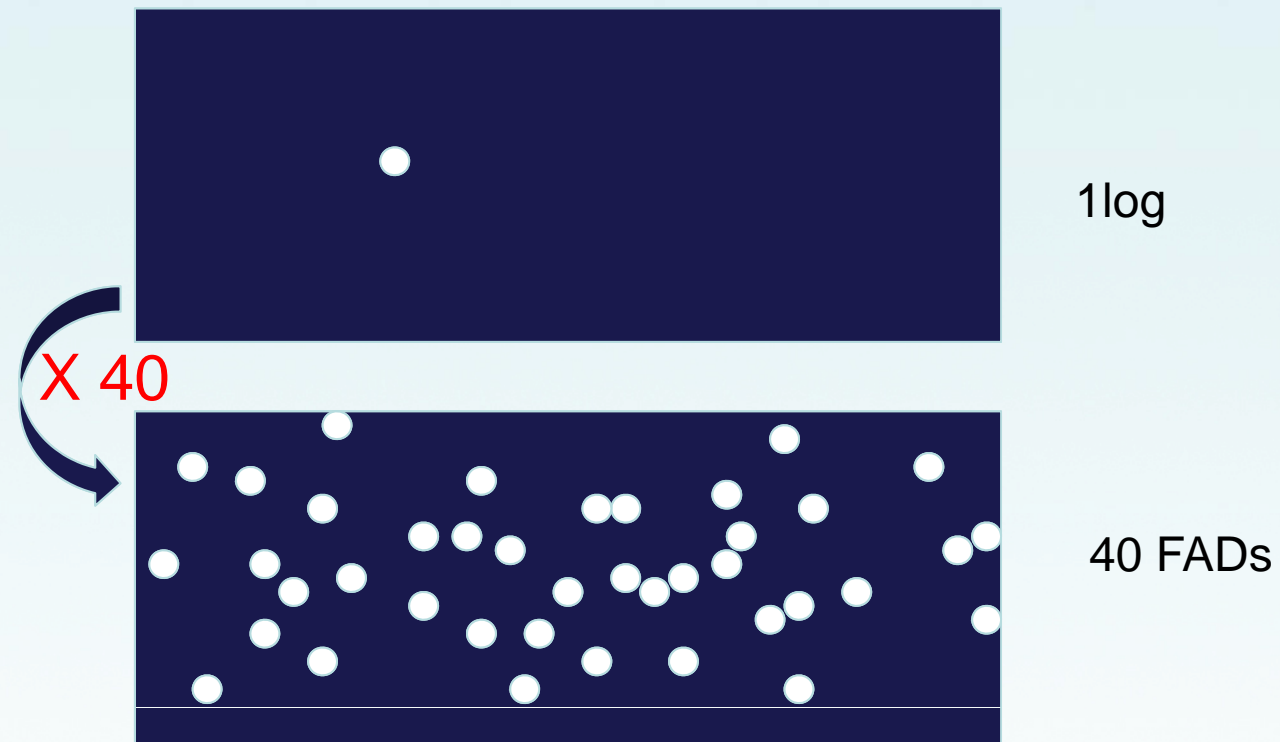
Two hypotheses were tested:

- (1) FADs occupy areas that are free of natural floating objects (creating new floating object areas)
- (2) FADs have drastically increased the density (or numbers) of floating objects in areas where natural objects already occur





Largest increase of densities of floating objects : **multiplication by a factors of 40 (2007, 4th quarter, Somalia area)**



*Laurent's representation of what « x 40 » means*



Do FADs occupy areas that were free of logs ?

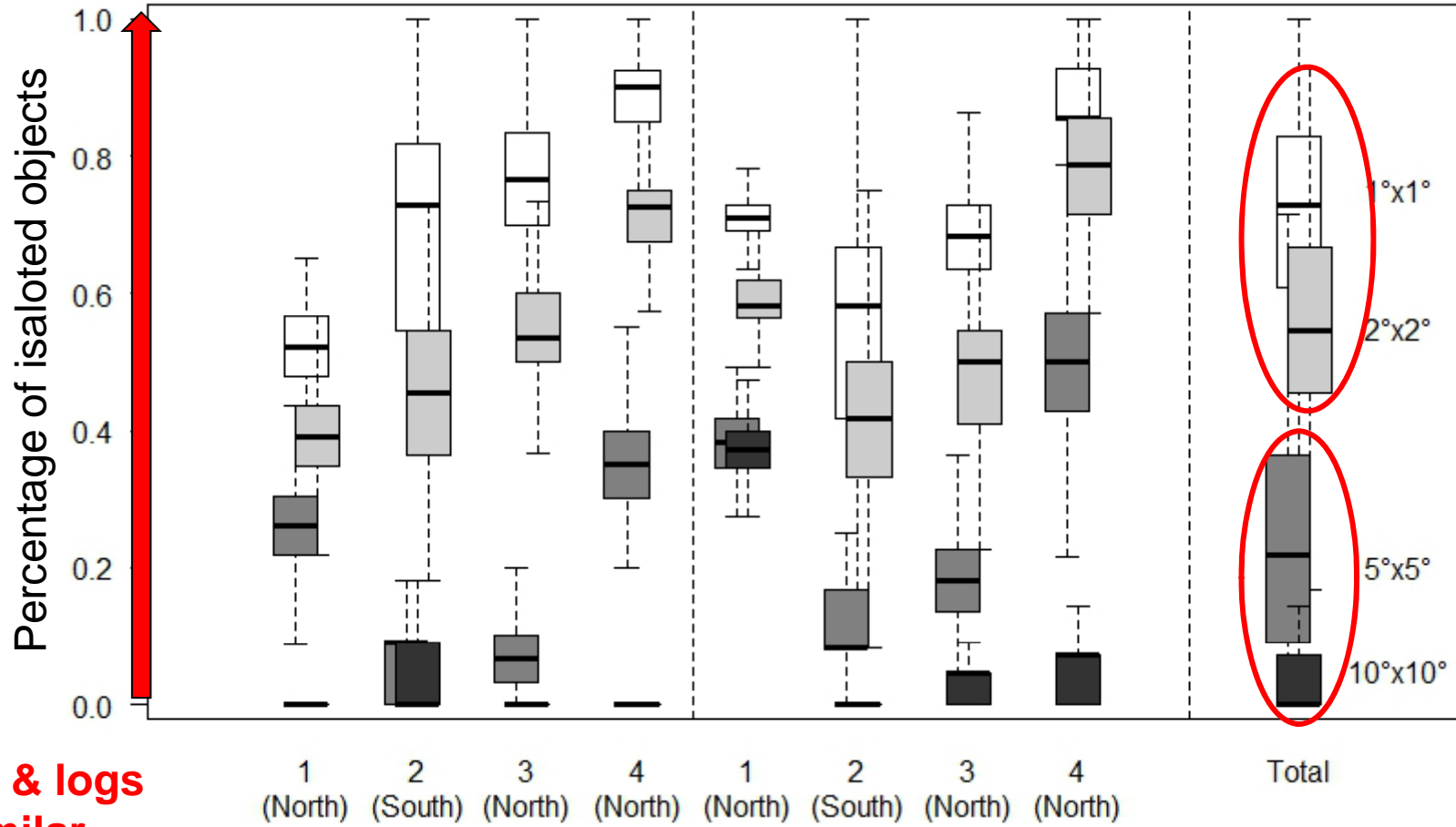
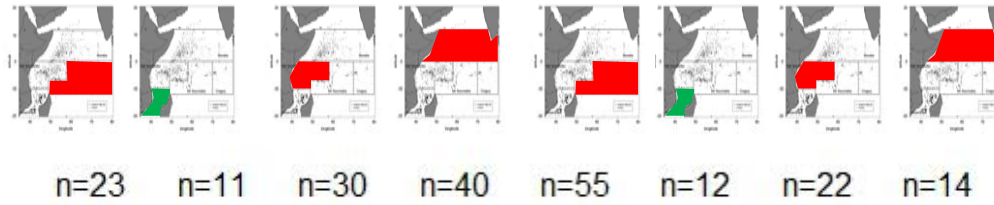
- The answer is obviously **scale dependent** (locally, at point level: not; regionally, at IO level: yes)
- the answer must account for the **contrast in densities** between FADs and logs

We thus:

- **re-sampled** FAD to the level of logs (except in the Mozambic channel where it was reverse)
- computed the **proportion of FADs observed in quadrats without natural objects**:
  - 1 ~ FADs and logs do not occupy the same areas
  - 0 ~ identical spatial distributions
- use quadrats of  $1^{\circ} \times 1^{\circ}$ ,  $2^{\circ} \times 2^{\circ}$ ,  $5^{\circ} \times 5^{\circ}$  and  $10^{\circ} \times 10^{\circ}$

# Percentage of isolated FADs

FADs & logs distinct

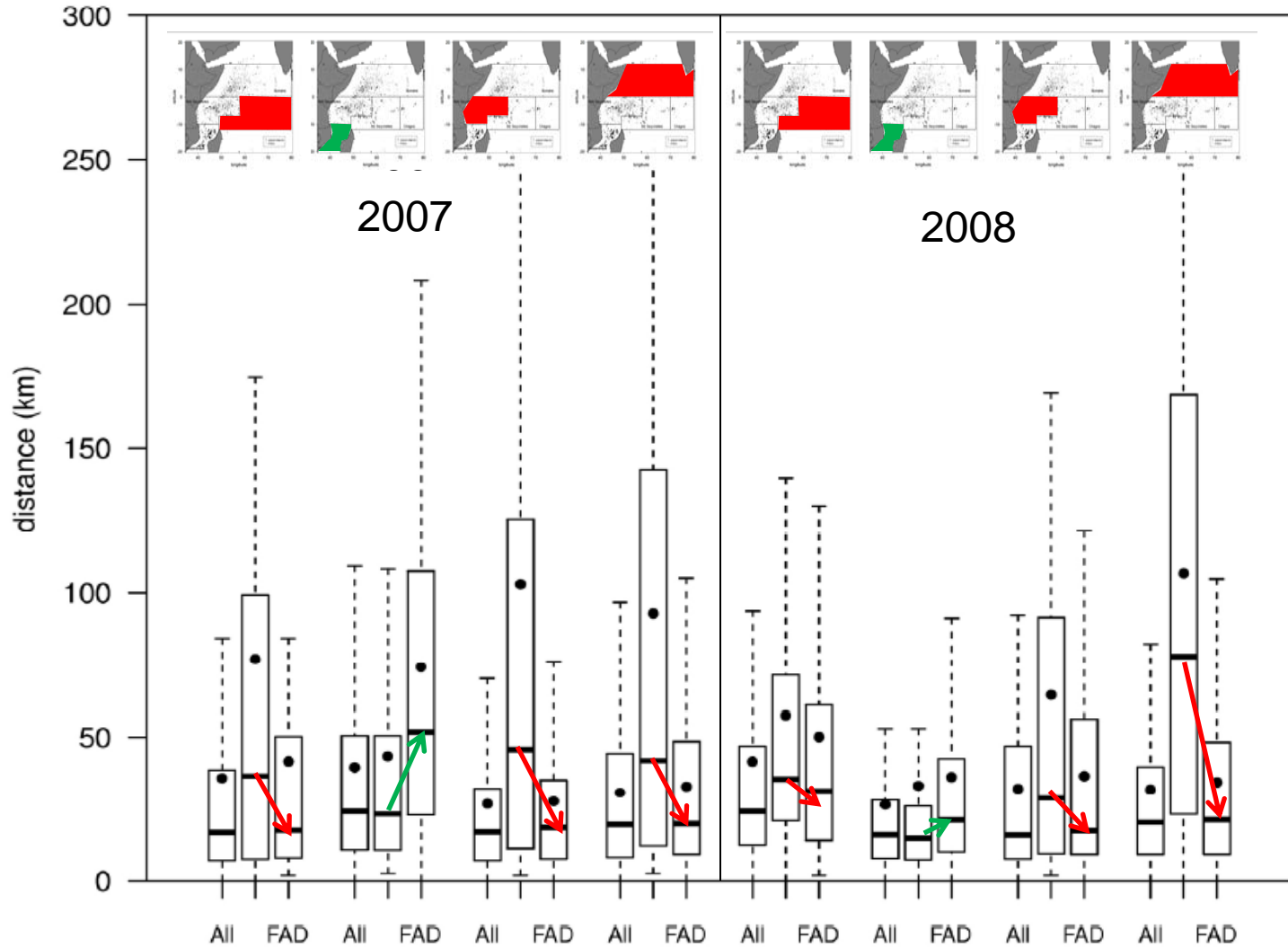


FADs & logs similar





# Nearest neighbours by quarter





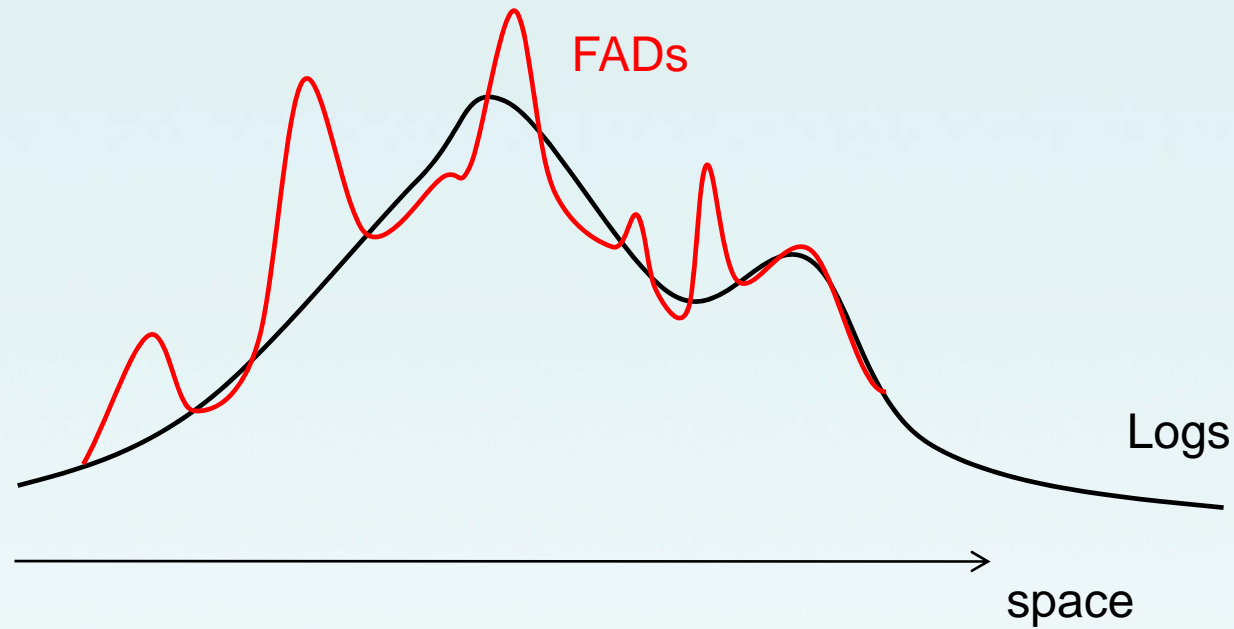
Hypothesis 1 (FADs occupy areas free of floating objects) was **rejected at scales larger than quadrats of 2°x2°**, but not at shorter scales.

→ At short scale (smaller or equal to 2°x2°), FADs occupy different areas than logs

Hypothesis 2 (FADs drastically increase the number of objects) was clearly **validated** by observations.



## Probability density function (in space) of inhomogeneous point processes



with

$$\theta_{\text{Natural objects (I.O.)}} \ll \theta_{\text{FADs (I.O.)}}$$



## Conclusions

New small ( $\sim 1^\circ \times 1^\circ$ ) patches of floating objects (FADs) are now observed, but they are usually located within larger areas ( $5^\circ \times 5^\circ$ ) that naturally have logs.

→ the processes for FADs to drive tunas to new areas, and possible consequences of such movements on the biology of individuals, are primarily to be looked for at scales smaller than  $2^\circ \times 2^\circ$ .

→ the processes for FADs to retain tuna longer in some areas are to be investigated considering multiplication factors of densities of floating objects up to 40.



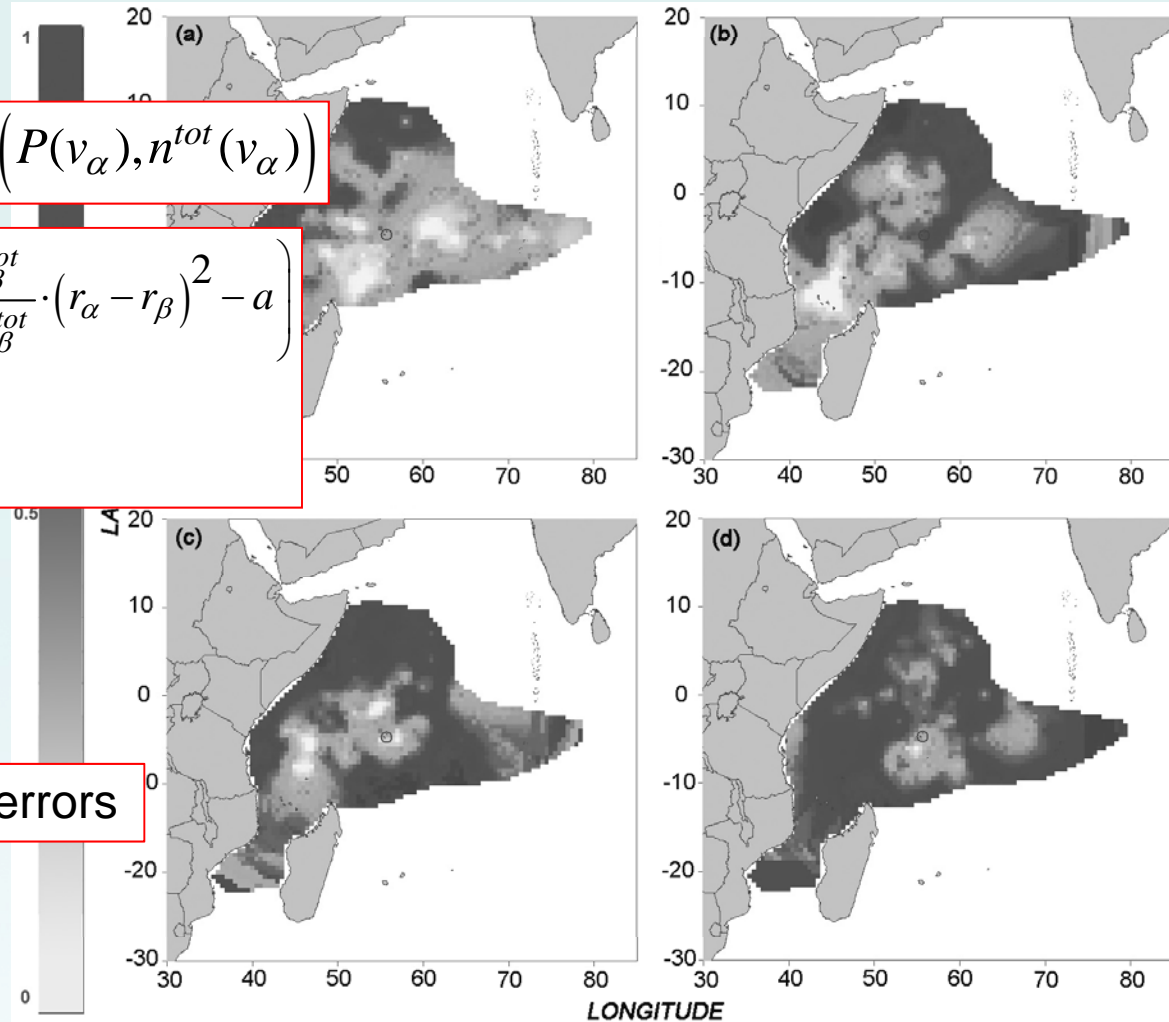
$$N^{FAD}(v_\alpha) | P(v_\alpha) \sim \text{Bin}(P(v_\alpha), n^{tot}(v_\alpha))$$

$$\gamma_P^*(h) = \frac{1}{2N(h)} \sum_{\substack{\alpha, \beta \\ \alpha \neq \beta \\ h_{\alpha\beta} \approx h}} \left( \frac{n_\alpha^{tot} \cdot n_\beta^{tot}}{n_\alpha^{tot} + n_\beta^{tot}} \cdot (r_\alpha - r_\beta)^2 - a \right)$$

$$\gamma_P^*(h) = \gamma^w(h) - K(h) \cdot a$$

$$P_0^* = \sum_{\alpha} \lambda_{\alpha} \frac{n_{\alpha}^{FAD}}{n_{\alpha}^{tot}}$$

≈ Kriging with observation errors

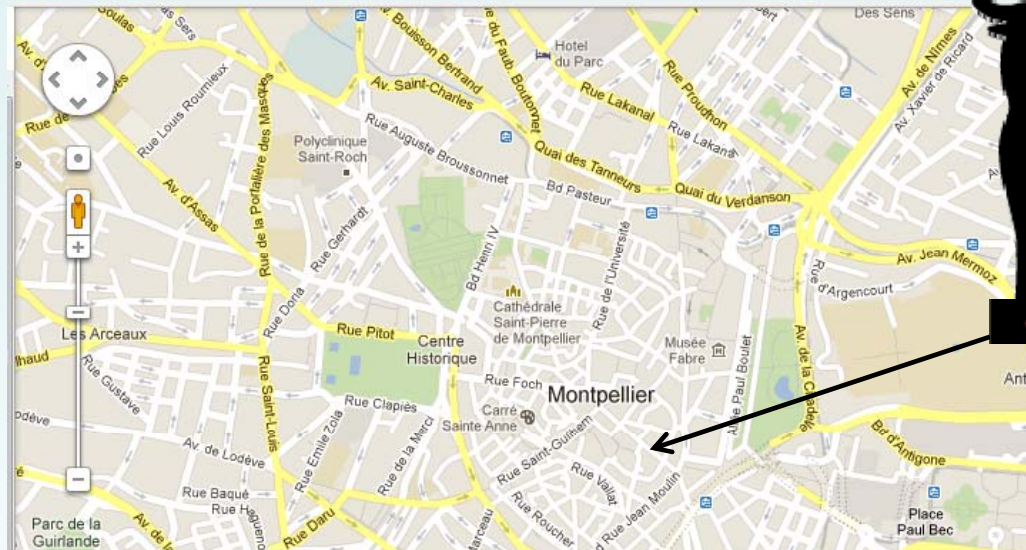


In: Walker et al., 2008

Kriging maps of %FAD per quarter



# Merci de votre attention.



A possible FAD for us tonight ... Fitzpatrick's Irish Pub (21h, down town, Montpellier)

