

Will we see you again?

Population evaluation of *Palinurus elephas* inside a marine reserve from Capture-Mark-Recapture data

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Scope

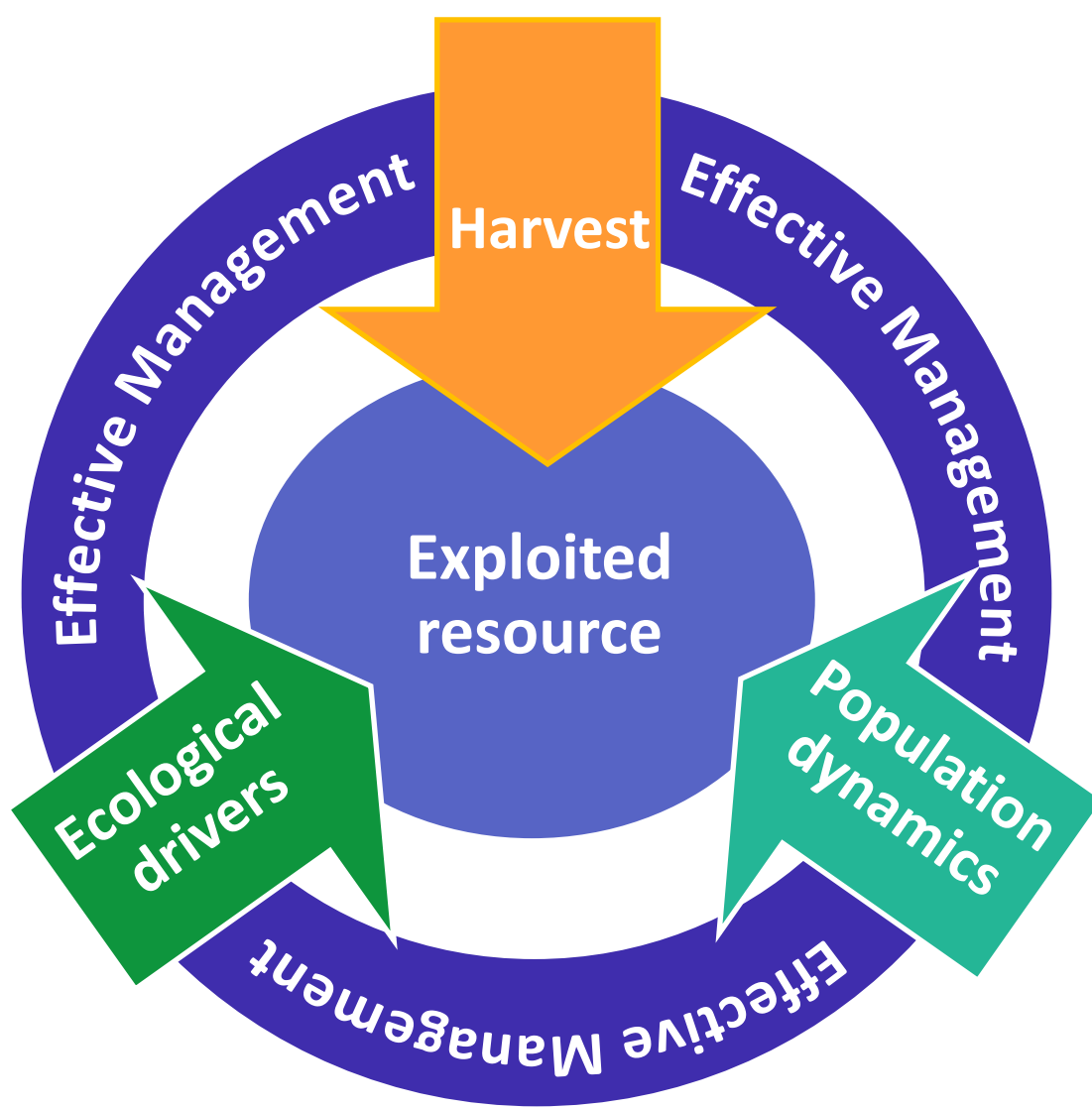
Palinurus elephas is a key resource in the Northeast Atlantic and Mediterranean.

Over-exploited throughout its range

Sustainable management requires understanding complex processes of populations dynamics and factors driving their changes in the short- and long-term.

Marine protected areas (MPAs):

Key tool in the face of uncertainty and lack of knowledge.



Aim: Analyze short- and long-term changes of adult *P. elephas* inside an MPA using Capture-Mark-Recapture data

How

Tag - recapture surveys: Annually from 1997 to 2007, inside the Columbretes MPA (Figures 1a & 1b).

All new lobsters were tagged and their recaptures were used in the analyses.

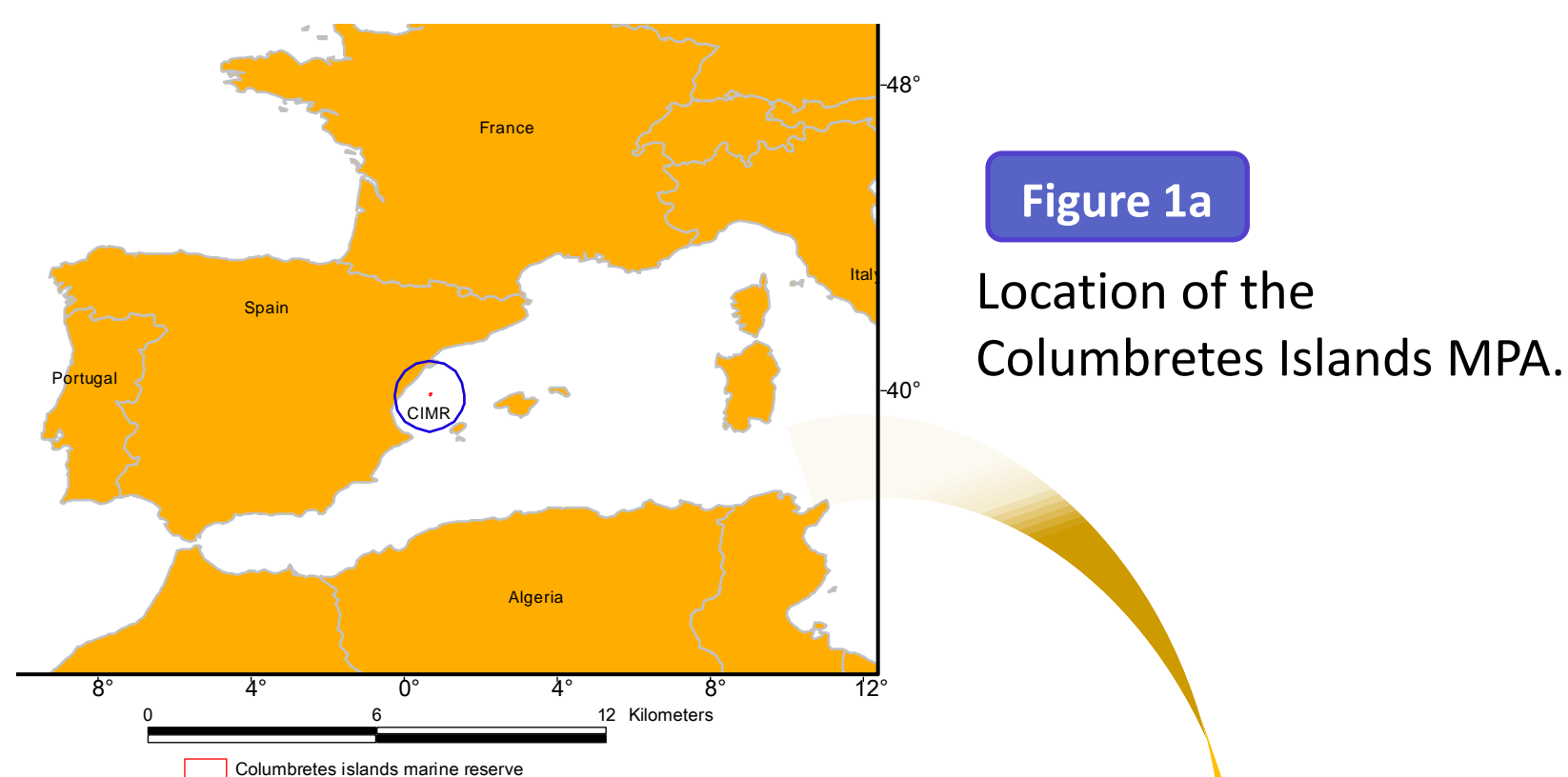
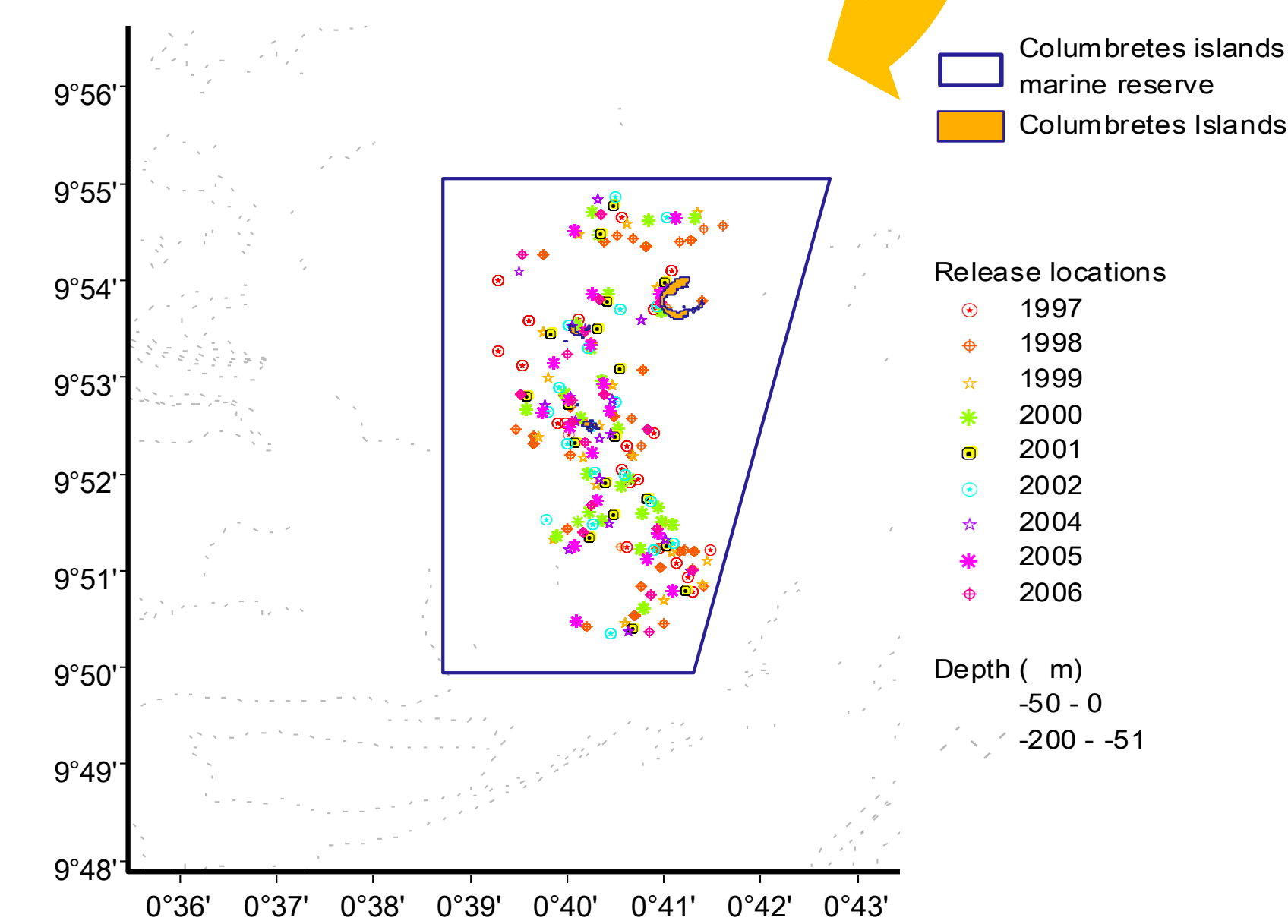


Figure 1a Location of the Columbretes Islands MPA.

Figure 1b The experimental fishing sets inside the MPA, comprising a series of nine release events and their subsequent recaptures until 2007.



Cormack-Jolly-Seber (CJS) live recapture model:

apparent survival ϕ_t and recapture probability p_t (MARK v.6.0, White and Burnham 1999).

Goodness-of-fit tests on the fully time-dependent model $\phi_{gt} \cdot p_{gt}$ (built-in software RELEASE)

Candidate models ranked

(Quasi-AIC_c-adjusted for small N & corrected by the variance inflation factor)



European spiny lobster, *Palinurus elephas* Photo D. Díaz

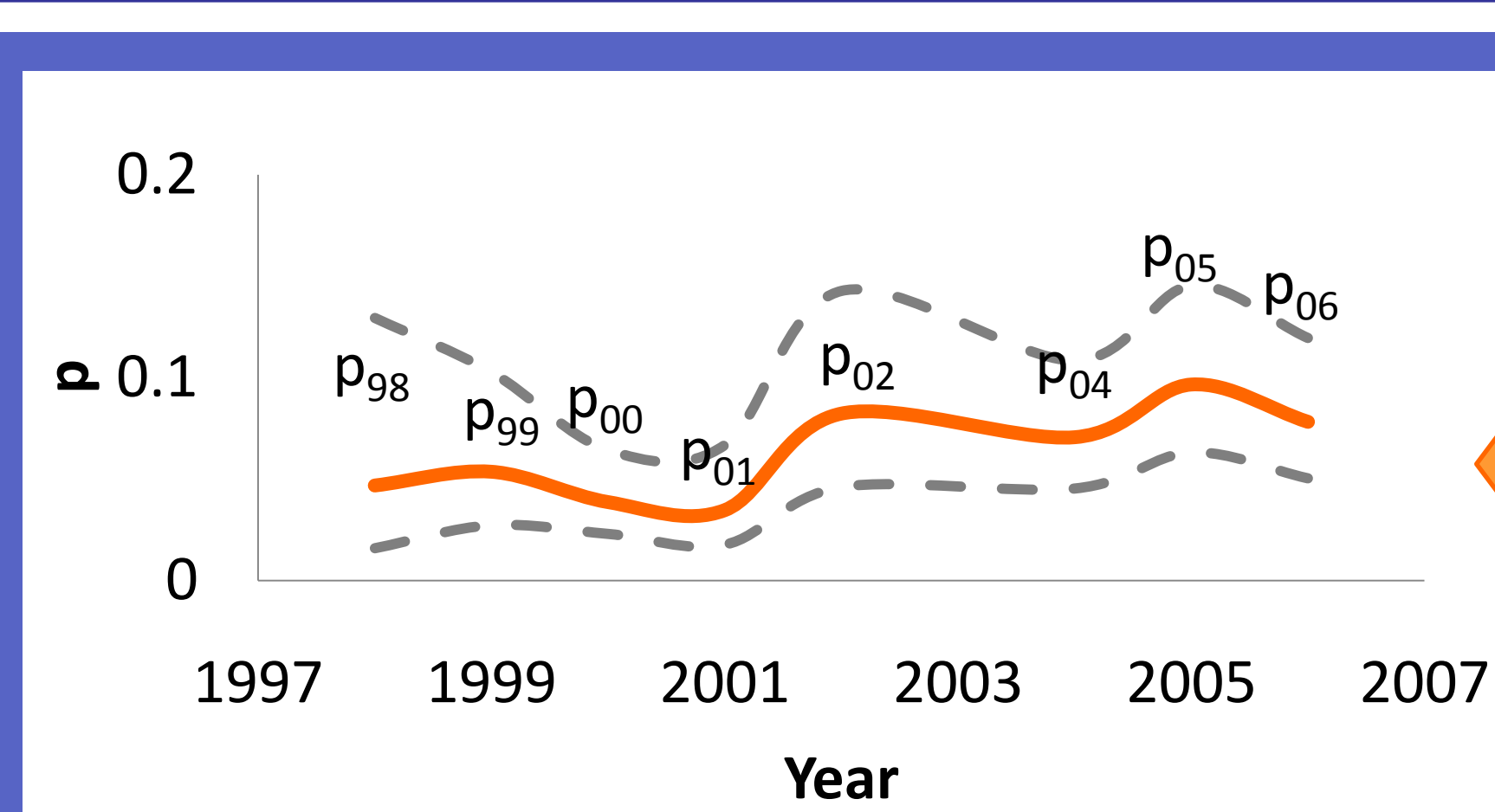


Figure 2. Evolution of probability of encounter (sexes combined)

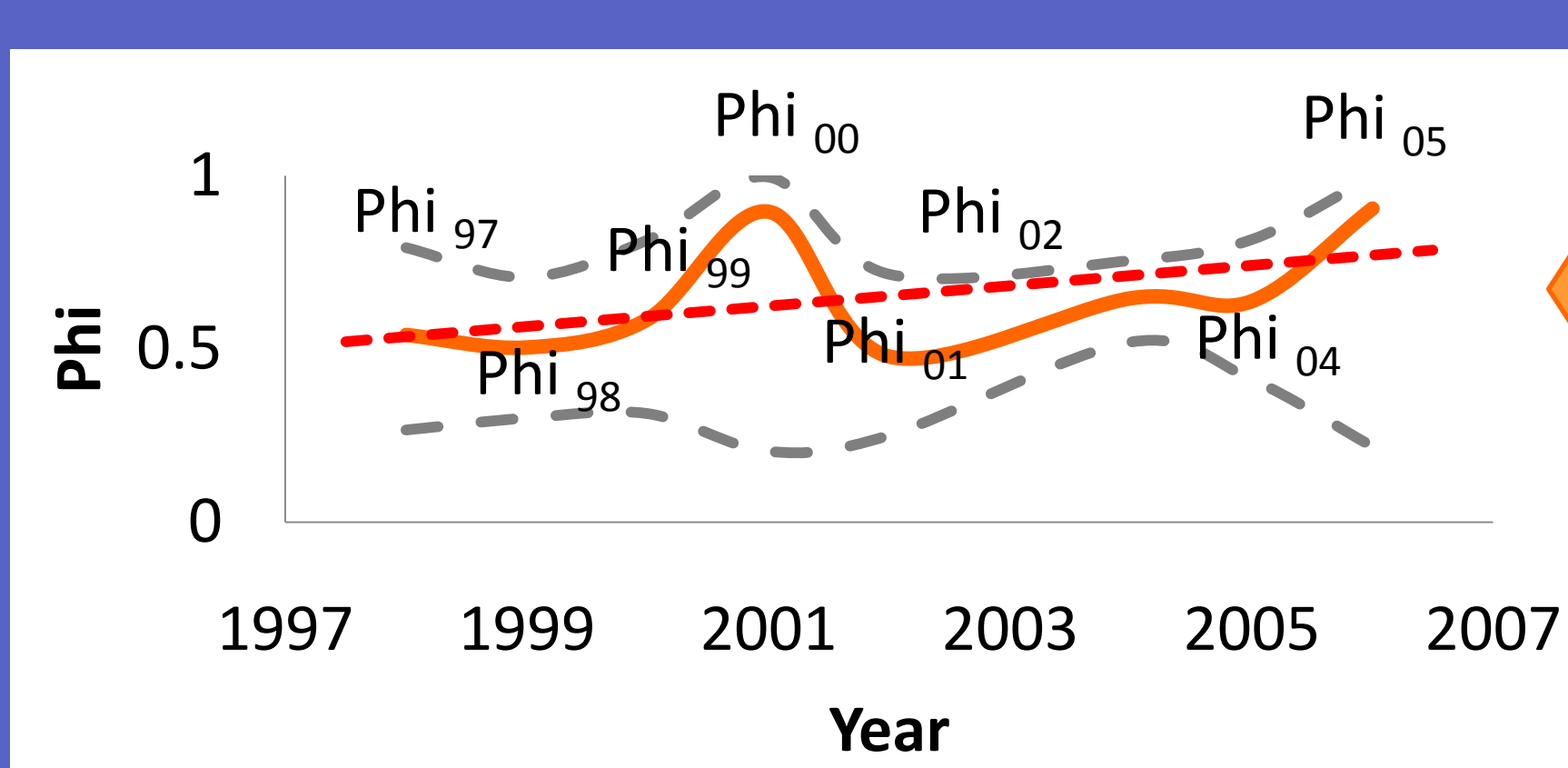


Figure 3. Evolution of probability of apparent survival, which comprises true survival and emigration (sexes combined)

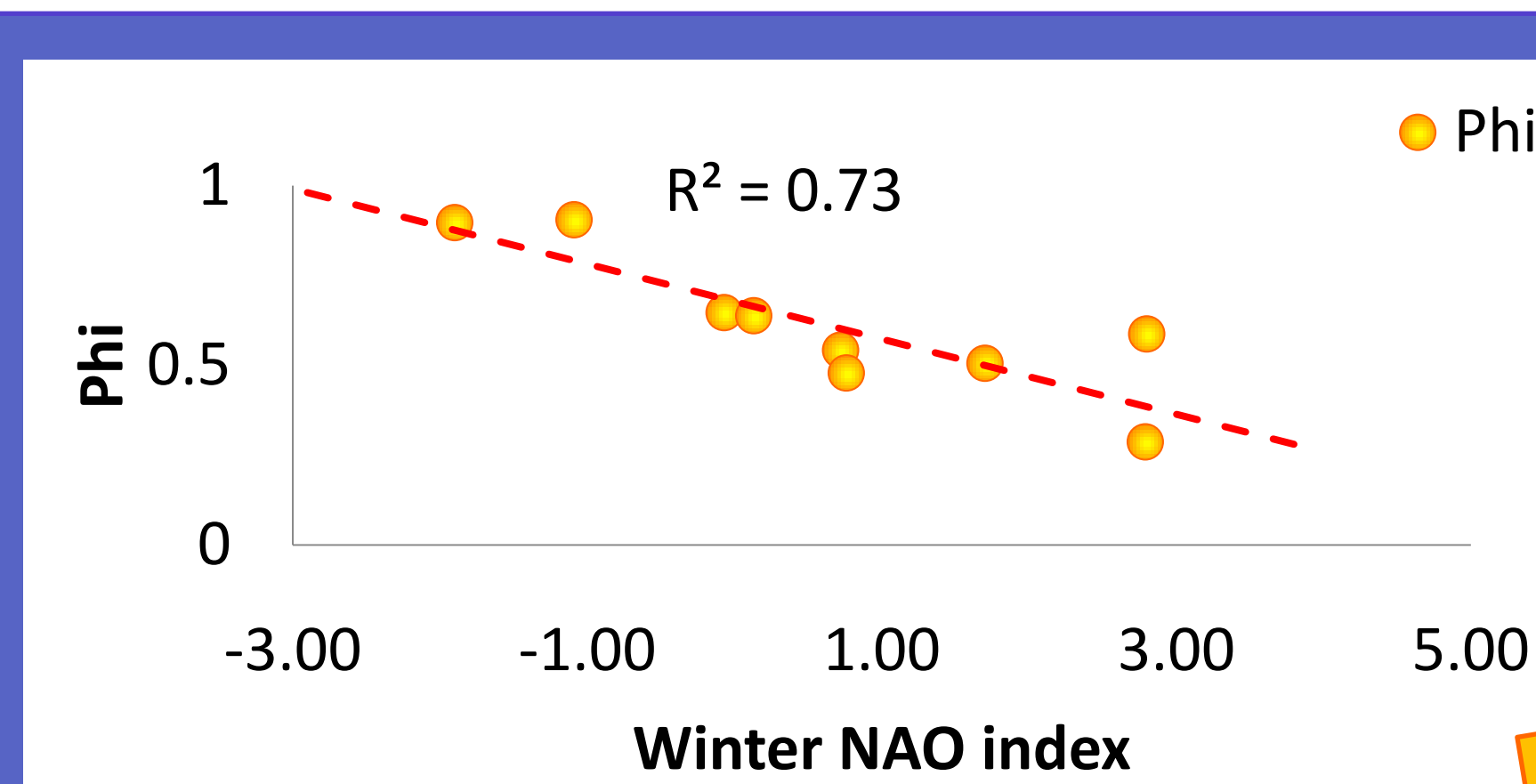


Figure 4. Correlation between the apparent survival estimates and the winter NAO index

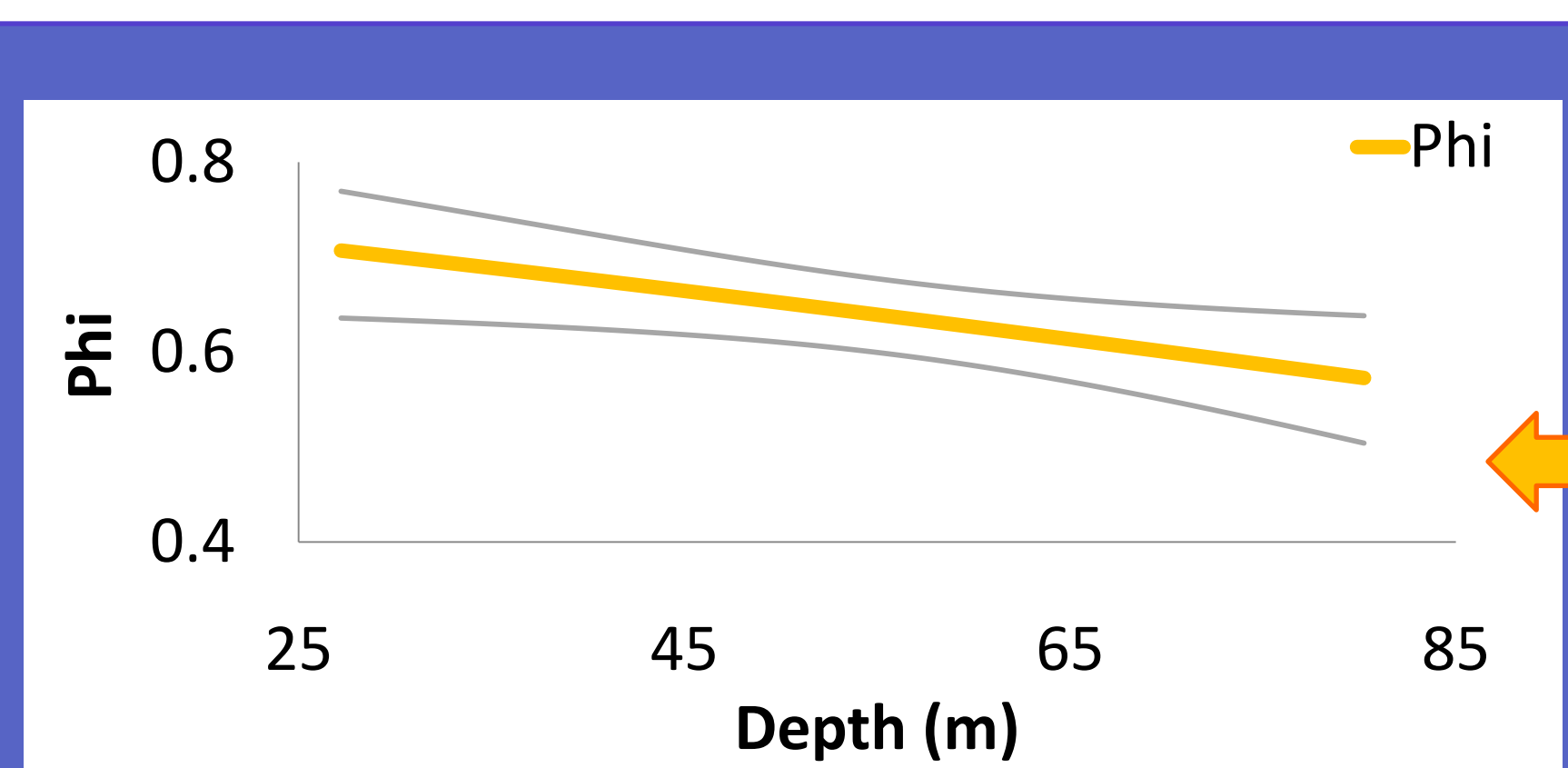


Figure 5. The covariate 'initial depth' explained 7% of the variance only, suggesting deeper animals are less likely seen again

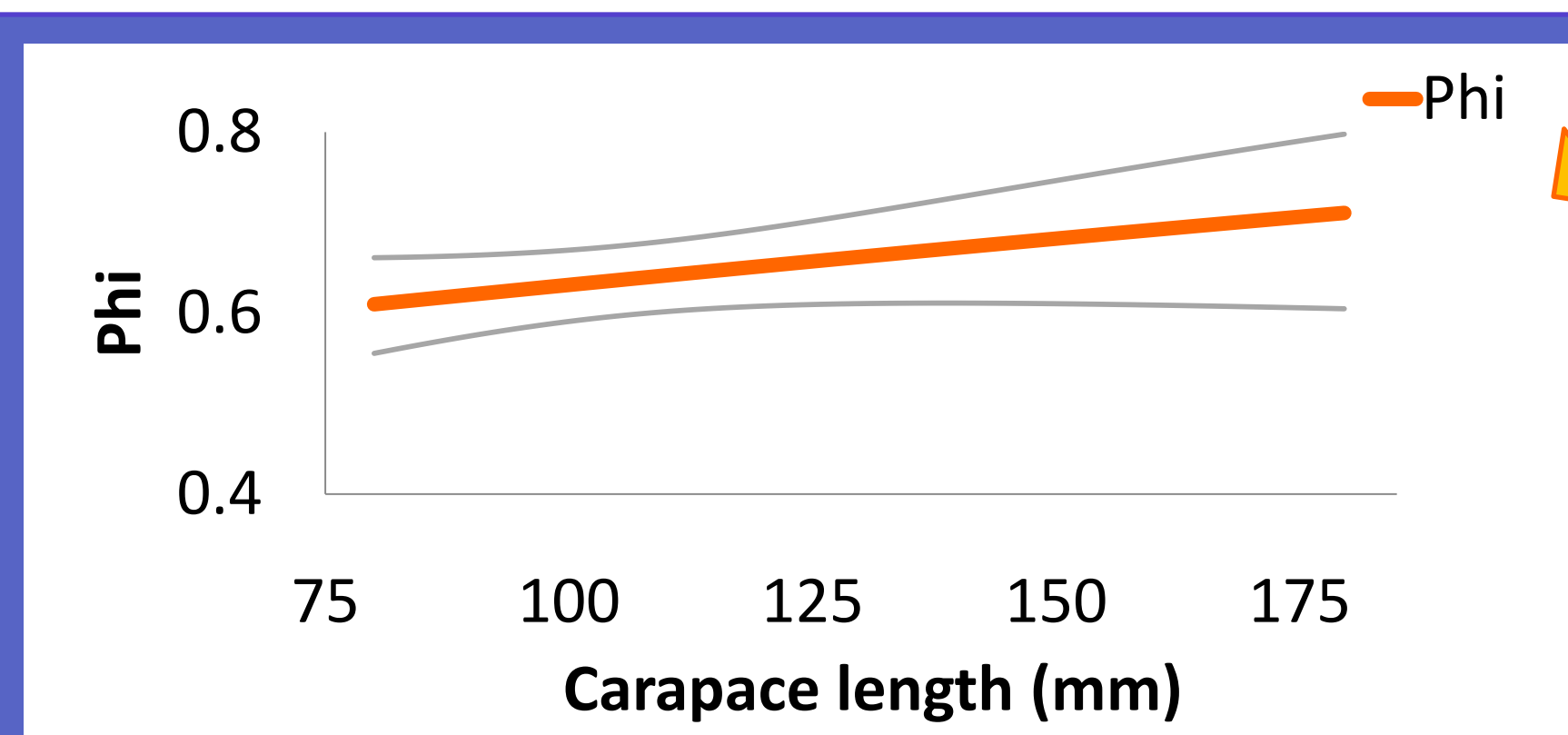


Figure 6. The covariate 'initial size' explained 4% of the variance only, suggesting bigger animals tend to survive more within the MPA / emigrate less

Best model: Time dependency

Best fit (71% of the statistical support): Φ_t, p_t temporal dependent Φ and p

Other less influencing factors were:

- Initial size at tagging
- Initial depth of capture
- Sex

Recapture probability

Probability of recapture p remained relatively low during the whole studied period (Figure 2).

Increase after year 2001 as result of the enhanced transience after one of the strongest storm events in the Western Mediterranean (Genoves et al. 2006).

Apparent survival

Highly variable apparent survival (Figure 3).

Long term upward trend consistent with the beneficial effect of the MPA (Goñi et al. 2006, Goñi et al. 2010).

Findings!

The closure to fishing is noticeably rising the probability of survival.

The deeper a lobster is seen, the less likely it will be re-encountered in the MPA

The larger a lobster is, the more likely it will be seen again in the MPA.



Photo D. Díaz

Other sources of variation in Φ

Climatic forces

Winter NAO index negatively correlated ($r = -0.85$, $r^2 = 0.73$) with mortality and/or emigration (Figure 4).

Depth

Depth of capture is negatively correlated with mortality and/or emigration: residency affected by bathymetric segregation (Figure 5).

Size

Large animals tend to survive and stay within the MPA (Figure 6).

References

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- Goñi R, Quetglas A, Reñones O, 2006. Mar Ecol Prog Ser 308: 207-219
- Goñi R, Hilborn R, Díaz D, Mallol S, Adlerstein S, 2010. Mar Ecol Prog Ser 400: 233-243
- White GC, Burnham KP, 1999 Bird Study 46 Supplement:120-138

For further information

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