

Diving into yelkouan shearwater foraging behaviour with time-depth-recorders.

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Yelkouan shearwaters (*Puffinus yelkouan*) dive predominantly during the day but show peaks in foraging activity at dawn and dusk: This has important implications when promoting night setting with fishermen because deviations from nocturnal hours might increase bycatch risk (Fig 1).

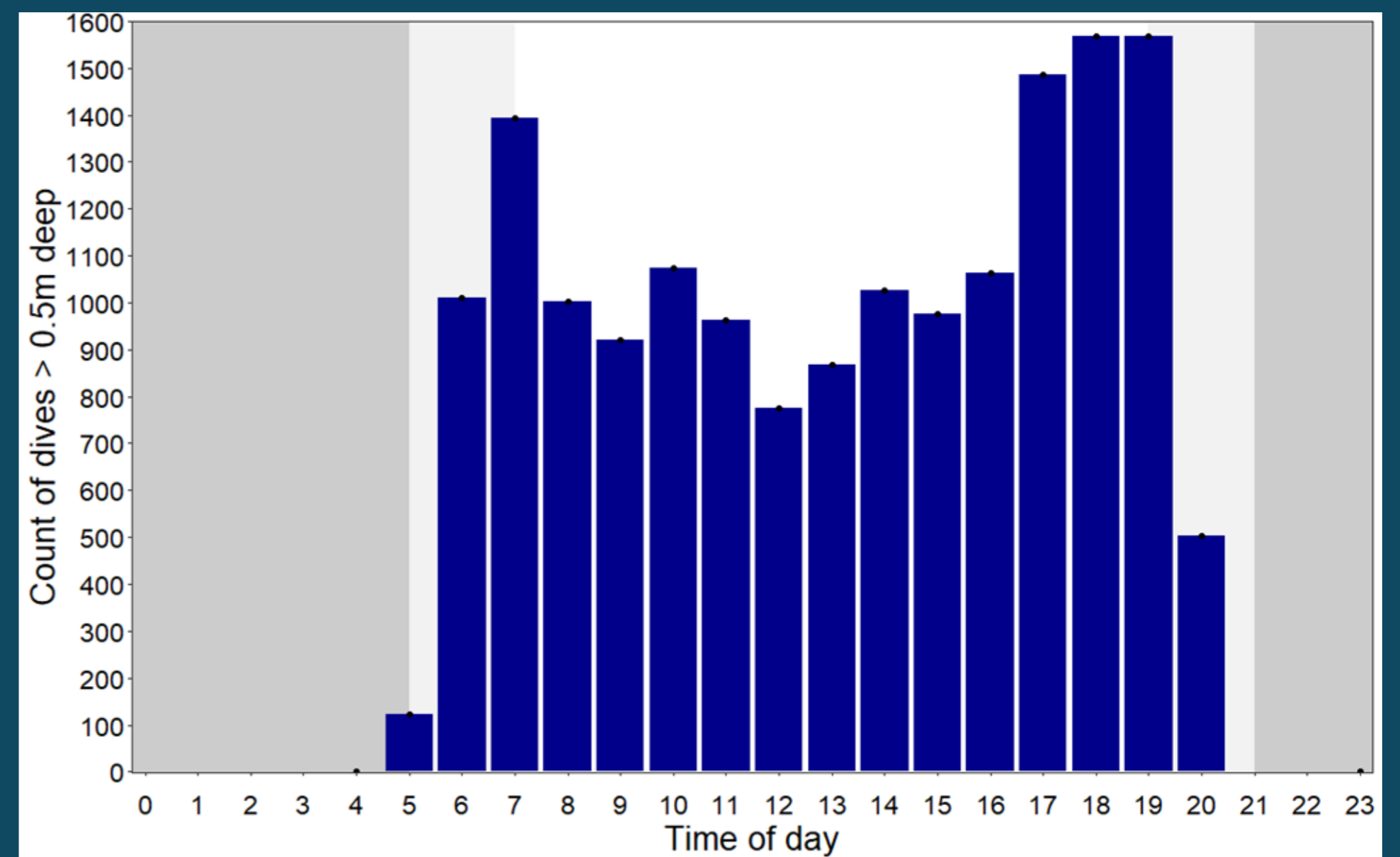


Figure 1. Number of dives by yelkouan shearwaters deeper than 0.5m per hour (blue bars, black points show max. count). Dark grey panels show night time hours and light grey panels show twilight periods.

1. Introduction

- Diving behaviour in seabirds can help understand what prey species are being targeted, but also susceptibility to bycatch.
- The yelkouan shearwater (YS) has been extensively tracked, but we lack knowledge of its diving behaviour.

2. Methodology

- We deployed 8g Axy-Trek loggers (TechnoSmart) on YS on Malta (MT) and Greece (GR)(Fig 2).
- GPS position was recorded every 5-mins, while pressure was measured at 1Hz (MT) or every 10s (GR).
- We removed pressure sensor offset and identified each dive using the R package 'diveMove'¹. We estimated bottom time as duration spent below 80% of maximum depth of each dive², and bathymetry data was obtained from GEBCO³.

3. Results

- We obtained 17 tracks and registered 16323 dives (>0.5m).
- Dives were diurnal but peaked at dawn and dusk (Fig 1).
- The majority of dives were short and shallow (<5m) and only 7.5% of dives were deeper than 20m. The max. recorded depth was 51.6m.
- Dives were deeper, and bottom time longer in shallow coastal waters (<50m depth) (Fig 4).

4. Discussion

- We showed that YS dive deeper than previously recorded⁴.
- Our findings inform bycatch mitigation measures. Night setting should strictly occur in nocturnal hours to avoid bycatch risk, while the next steps of research is to characterise dives in proximity to fishing vessels.

Figure 2. An Axy-Trek TechnoSmart logger deployed using TesaTape on an adult breeding yelkouan shearwater



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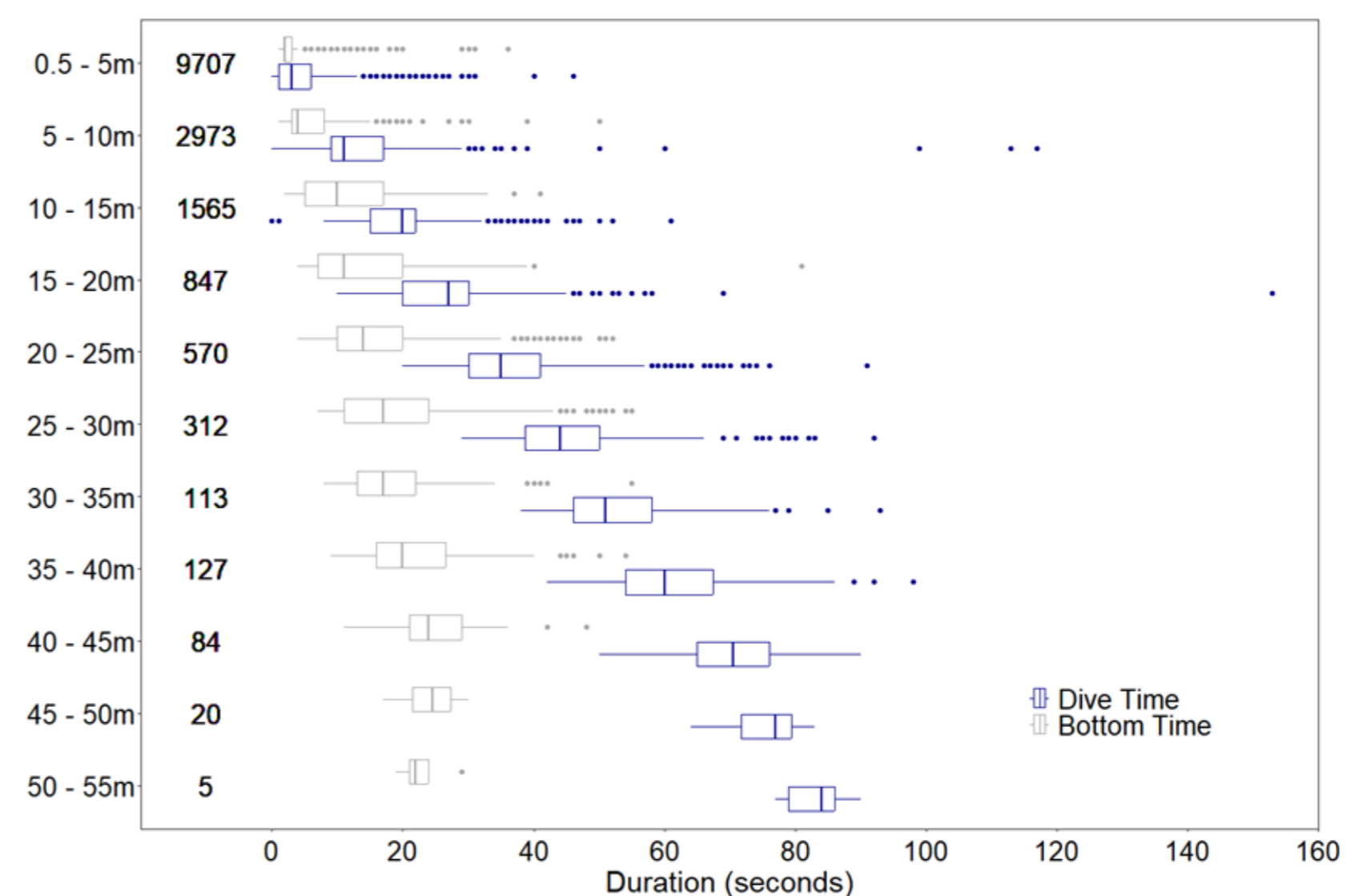


Figure 3. Number of dives in yelkouan shearwaters (N=17) per depth category, with the total dive duration in blue boxplots and the bottom time (> 80% of max. depth) in grey boxplots.

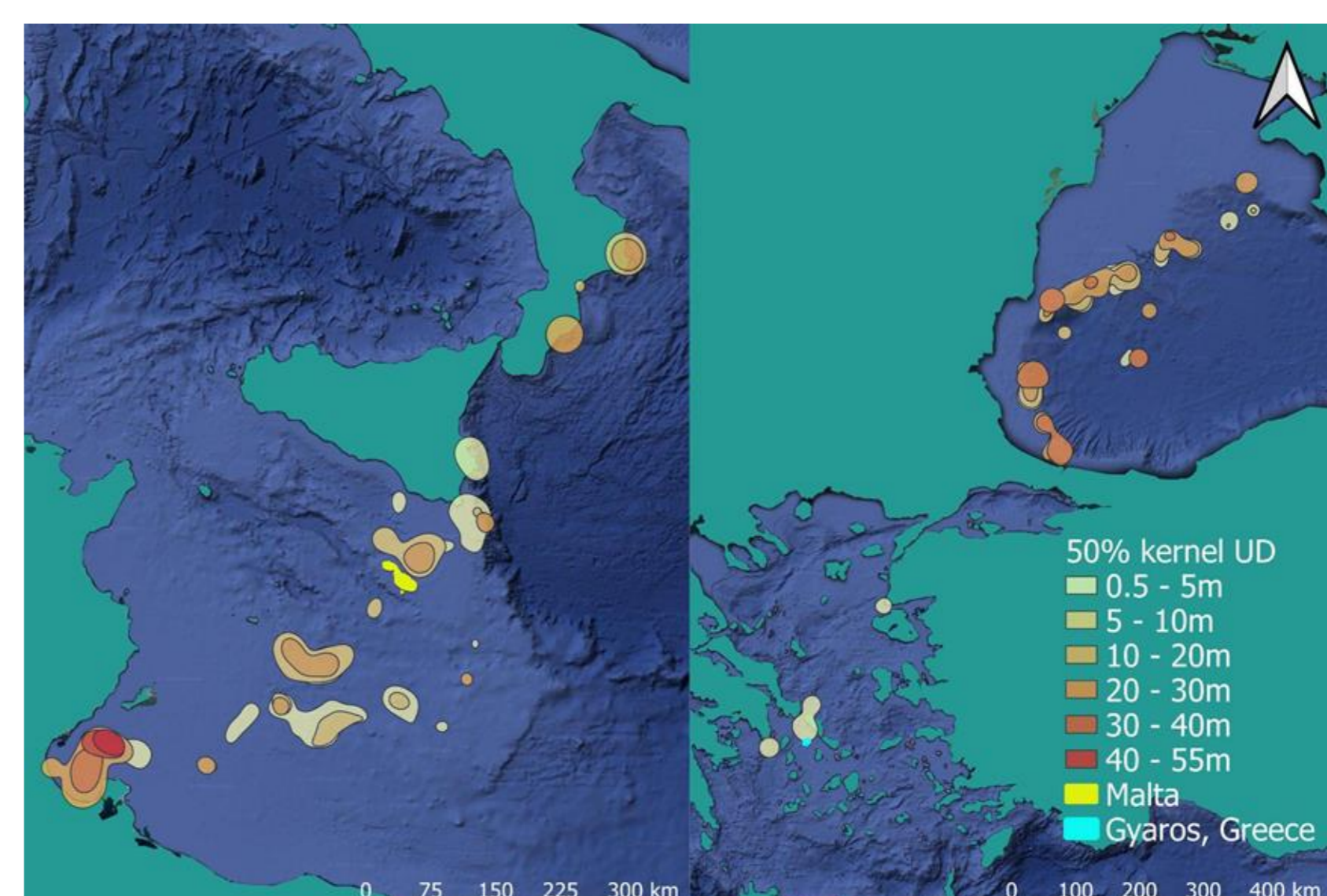


Figure 4. Diving locations by yelkouan shearwaters tagged in Malta (N=13) and Greece (N=4), summarised as 50% kernel utilisation distribution polygons per dive depth category

References

- ¹ Luque, SP. (2024). diveMove: Dive Analysis and Calibration. R package version 1.6.2, <https://CRAN.R-project.org/package=diveMove>
- ² Iida, E., Sato, N., Okado, J., Kikuchi, D.M., Takahashi, A. and Watanuki, Y. (2024). Foraging area, diving and prey chase behaviour of a wing-propelled diver under contrasted prey regimes. *Marine Biology*, 171(5)
- ³ GEBCO Compilation Group (2024). GEBCO 2024 Grid, doi:10.5285/1c44ce99-0a0d-5f4fe063-7086abc0ea0f
- ⁴ Péron, C., Grémillet, D., Prudor, A., Pettex, E., Saraux, C., Soriano-Redondo, A., Authier, M. and Fort, J. (2013). Importance of coastal Marine Protected Areas for the conservation of pelagic seabirds: The case of Vulnerable yelkouan shearwaters in the Mediterranean Sea. *Biological Conservation*, 168

Data was handled and analysed in R v4.2.3 (R Core Team, 2021).

Maps were produced in QGIS 3.34.9, in EPSG 4326 WGS 84.



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