

LONG-FINNED PILOT WHALE ABUNDANCE ESTIMATE IN THE WESTERN MEDITERRANEAN SEA

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BACKGROUND

The Mediterranean long-finned pilot whale (*Globicephala melas*) is listed in as Vulnerable in the Spanish List of Wild Species under Special Protection and the Spanish Catalogue of Threatened Species. This population is also listed as Endangered by the IUCN. These status were based on a decreased observed after a Morbillivirus epizootic and a population of less than 2500 mature individuals (Gauffier and Verborgh, 2021). ANSE has been collecting data on long-finned pilot whales in the southeast Iberian peninsula since 2000.

AIM

To estimate the abundance through Distance sampling and mark-recapture models

MATERIALS AND METHODS

The study area was the Gulf of Vera and the eastern part of the Alboran Sea (Fig. 1) based on previously known high density area for pilot whales. From 2020 to 2022, four surveys were carried out, following Distance sampling methodology. The sampling effort was designed with Distance 7.2 (Thomas et al. 2010), which covers the area uniformly with zig-zag linear transects.

Photo-identification data (2000-2022) was used to estimate total abundance in mark-recapture closed population models using MARK 9.0. Annual apparent survival estimates were obtained using Cormack-Jolly-Seber (CJS) capture-recapture models (Cormack, 1964; Jolly, 1965; Seber, 1965) were also designed within the MARK 9.0 program.

RESULTS

With 24 sightings of long-finned pilot whales collected during the surveys, and using over 200 previous sightings to build the detection function, distance sampling data analyses yielded an estimate of 0.148 individual density per square kilometer and an estimated abundance of 792 individuals (95% CI: 328-1946), between Motril and Cabo de Palos (not corrected for availability bias).

Using mark-recapture models and correcting with the proportion of marked individuals (90.3%), the population in the southeastern waters was estimated at 1,070 individuals (CV: 16.7%; 95% CI: 789-1505) throughout the study area.

The photo-identification catalogue included 968 individuals between 2000-2022. The best model (with a lower AICc) was with constant survival rate and taking into account transients (Φ) (trans+) and recapture probability (p) varying with time (t). This model indicates that long-finned pilot whales in the Gulf of Vera (insufficient data was obtained for the Alboran area) would have an average annual apparent survival rate of 0.932 (SE = 0.019; 95% CI: 0.884 - 0.961).

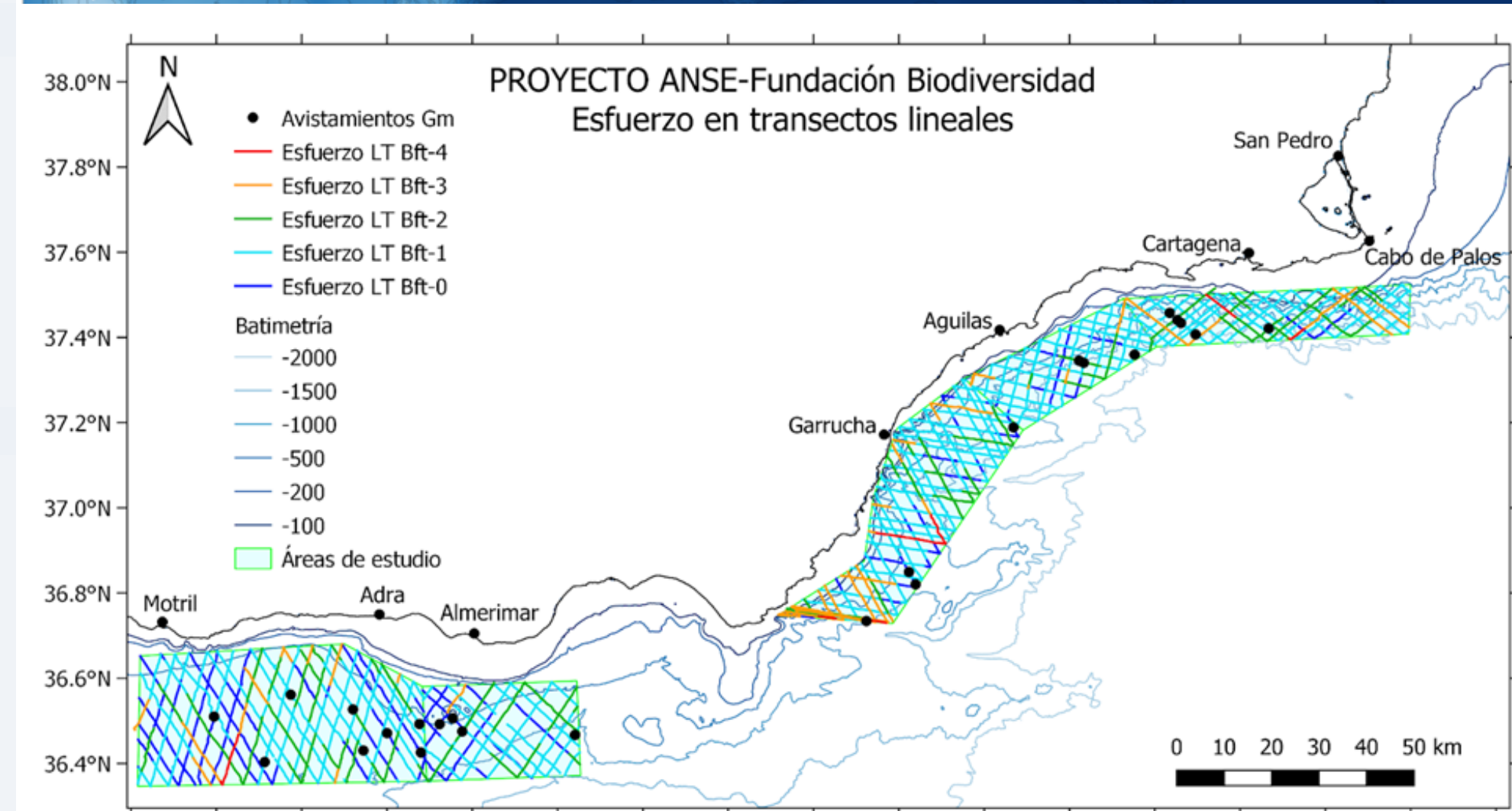
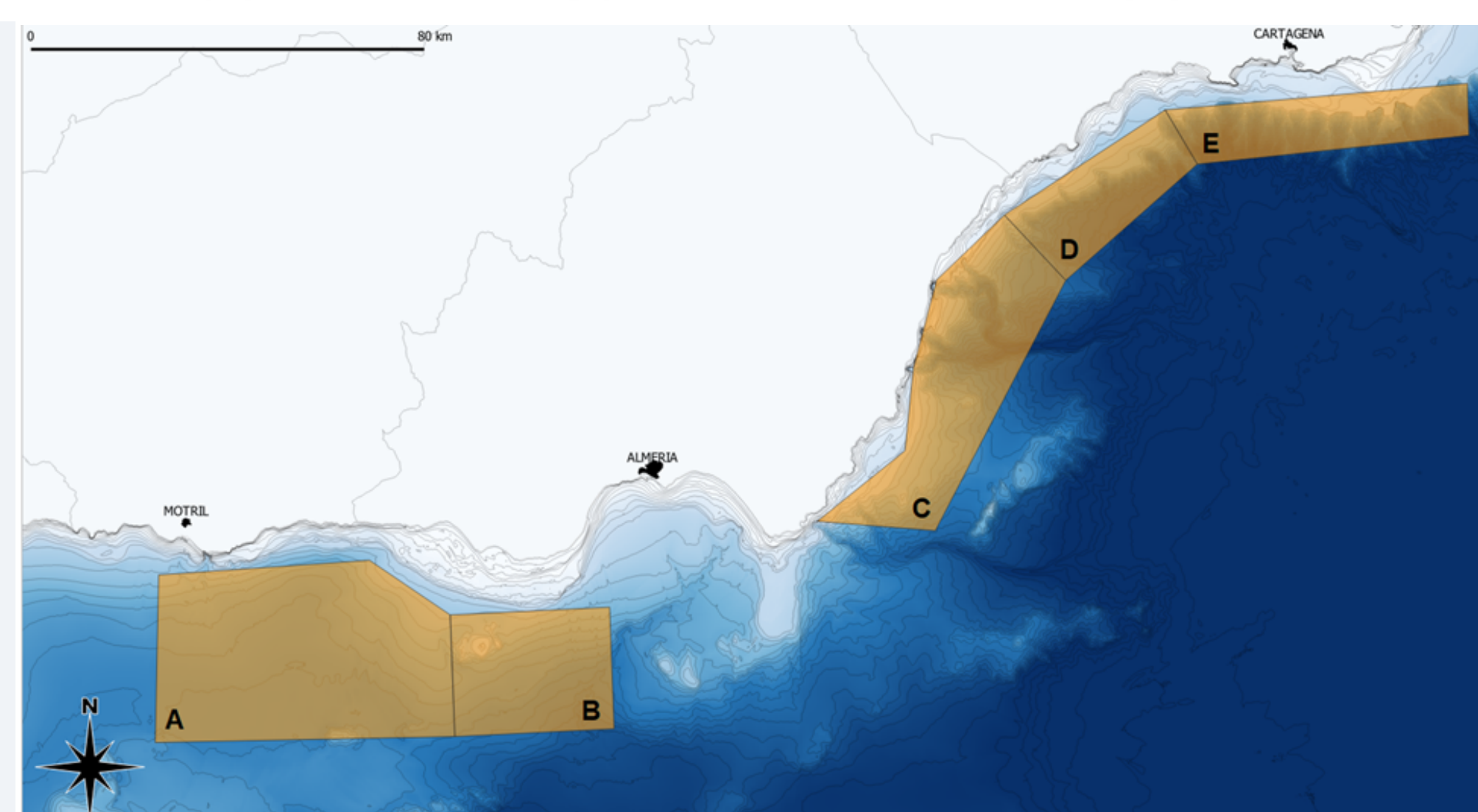


Figure 1 and 2. Study area and Distance Sampling effort.

| BLOQUE | N.º OBSERV. | DENSIDAD/K M ² | CV | ABUND. | 95% IC | TE/100 KM |
|--------|-------------|---------------------------|------|--------|------------|-----------|
| A | 8 | 0,141 | 0,38 | 285 | 138 - 589 | 0.59 |
| B | 4 | 0.197 | 0,53 | 158 | 59 - 423 | 0.82 |
| C | 4 | 0,094 | 0,52 | 114 | 43 - 303 | 0.39 |
| D | 3 | 0.159 | 0,60 | 95 | 31 - 290 | 0.66 |
| E | 5 | 0.194 | 0,47 | 140 | 57 - 341 | 0.81 |
| TOTAL | 24 | 0,148 | 0,50 | 792 | 328 - 1946 | 0.61 |

| Modelo | AICc | Delta AICc | NP | Deviance |
|--------------------------|---------|------------|------|----------|
| { Φ (trans+) p(t)} | 1.615,1 | 0,0 | 20,0 | 401,0 |
| { Φ (trans+t) p(t)} | 1.645,8 | 30,7 | 41,0 | 386,7 |
| { Φ (trans+) p(.)} | 1.790,5 | 175,4 | 3,0 | 611,4 |
| { Φ (trans+t) p(.)} | 1.796,5 | 181,5 | 24,0 | 574,1 |

Figure 3 and 4. Density estimates, coefficient of variation (CV), abundance with confidence intervals (95% CI), and encounter rate of groups per 100 km sailed in each block. Survival rate models' results of long finned pilot whales in the southeastern Iberian Peninsula from 1999 to 2022

REFERENCES

Cañadas & Hammond, 2006. Model-based abundance estimates for bottlenose dolphins off southern Spain: implications for conservation and management.
Gauffier, P. & Verborgh, P. 2021. *Globicephala melas* (Inner Mediterranean subpopulation). The IUCN Red List of Threatened Species 2021

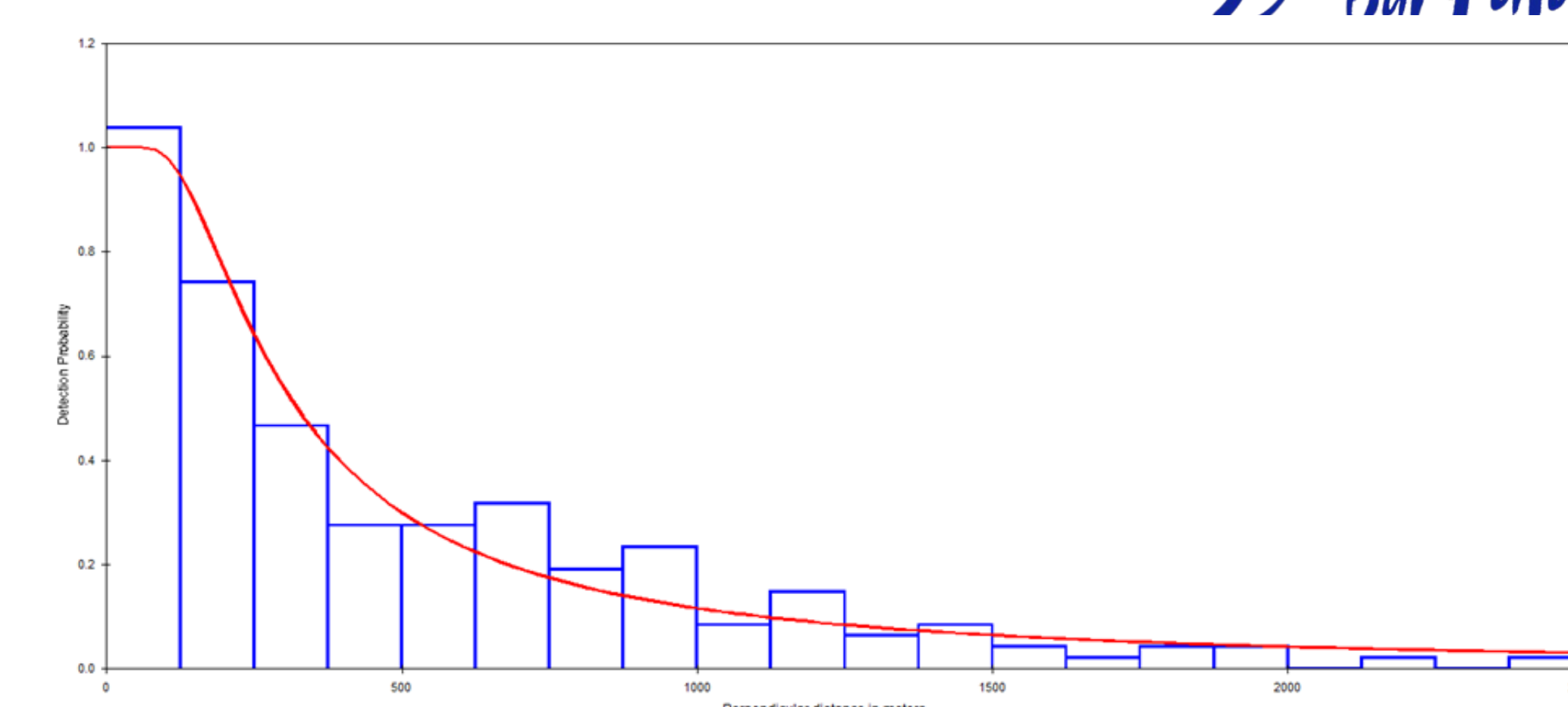


Figure 5. Detection curve truncated to 2,500 meters for a better fit, an effective strip of 514 meters estimated for the vessel Else



Figure 6. One of the sightings made during the four sailing campaigns.

CONCLUSIONS

The abundance data obtained is lower than the only previous estimate available in this area, which is 2,888 long-finned pilot whales (95% CI: 2565-3270) that used the Strait of Gibraltar, the northern Alboran Sea and the Gulf of Vera between 1992 and 2009 (A. Cañadas, unpublished data) using the spatial modeling described in Cañadas & Hammond, 2006.

The rapid decline observed combined with low levels of survival rates in recent years, could make this population disappear in the coming decades if the reasons for this decline are not understood and managed properly.

Future studies should include other types of analysis to estimate abundance, such as GAMs, which would allow a higher number of sightings to be used. The spatial abundance estimate here is based solely on 24 sightings, while there are more than 200 available in ANSE's historical data through non-systematic effort (although in a more restricted spatial area), which could be used for spatial GAM models.

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