

# MIGRALION

## A large-scale research programme on the flying fauna of the Gulf of Lion (Mediterranean sea, France)

Total budget: 4,2M€ | 2021-2025

The Gulf of Lion (Mediterranean sea, France) is an important area for both seabirds and terrestrial migratory birds: every year, large numbers of birds use or fly over this region. Which parts of the Gulf are used by seabirds? Which migratory species cross it? What are the patterns of migratory flows over the sea, and when do they occur? At which altitudes do these species fly? The MIGRALION programme was launched in 2021 to answer these questions and to monitor the seasonal and annual variations in these parameters. **The objective? To provide new knowledge to help in assessing the impact of human activities—particularly offshore wind energy—on the flying fauna that use this maritime area.**

### An unprecedented data collection effort



#### Telemetry tracking

GPS tags deployed on 458 and 51 individuals from 18 large terrestrial migratory bird species and 3 seabird species

→ Precise locations, behaviour, altitudes

→ Data transmitted via the mobile phone network (therefore without recapture)

GLS devices deployed on 321 individuals from 19 species of small terrestrial migratory birds

→ Imprecise locations, large-scale movements, accurate altitude profiles

→ No data transmission (recapture required)



#### At-sea surveys by boat

Visual observations (daytime)

→ Number of bird individuals per species, distribution

Onboard radars (day and night)

→ Horizontal and vertical radars, bird density (without species identification), altitudes, flight directions

Acoustic monitoring (day and night)

→ Detection of birds and bats



#### Coastal bird radars

Fixed radar (one site) + Mobile radar (multiple sites) of the BirdScan type

→ Continuous detection of migratory birds, identification by species groups (passerines, waterbirds, etc.), migration flows (in number of individuals), altitudes and flight directions

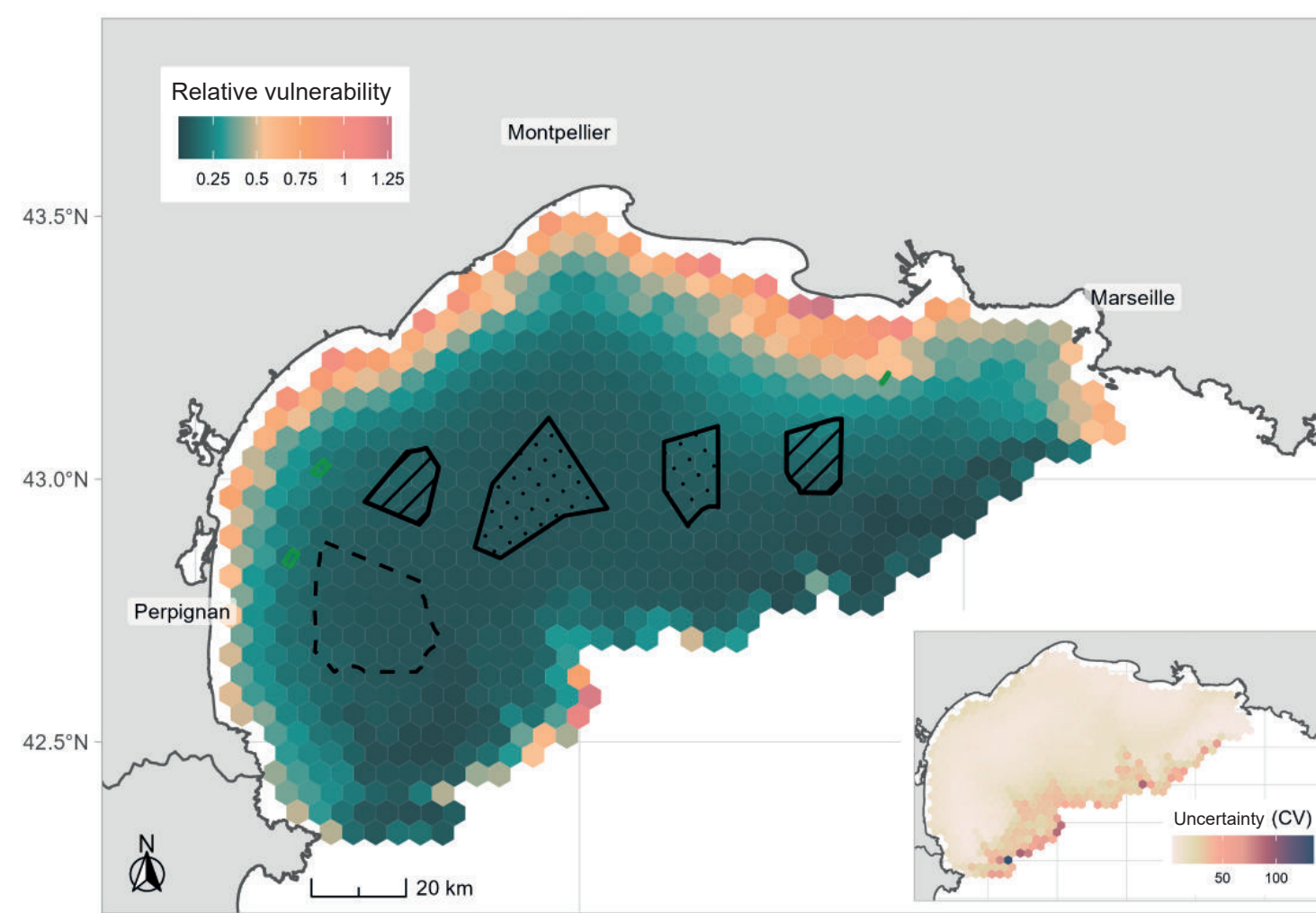
### A combined analysis of the data



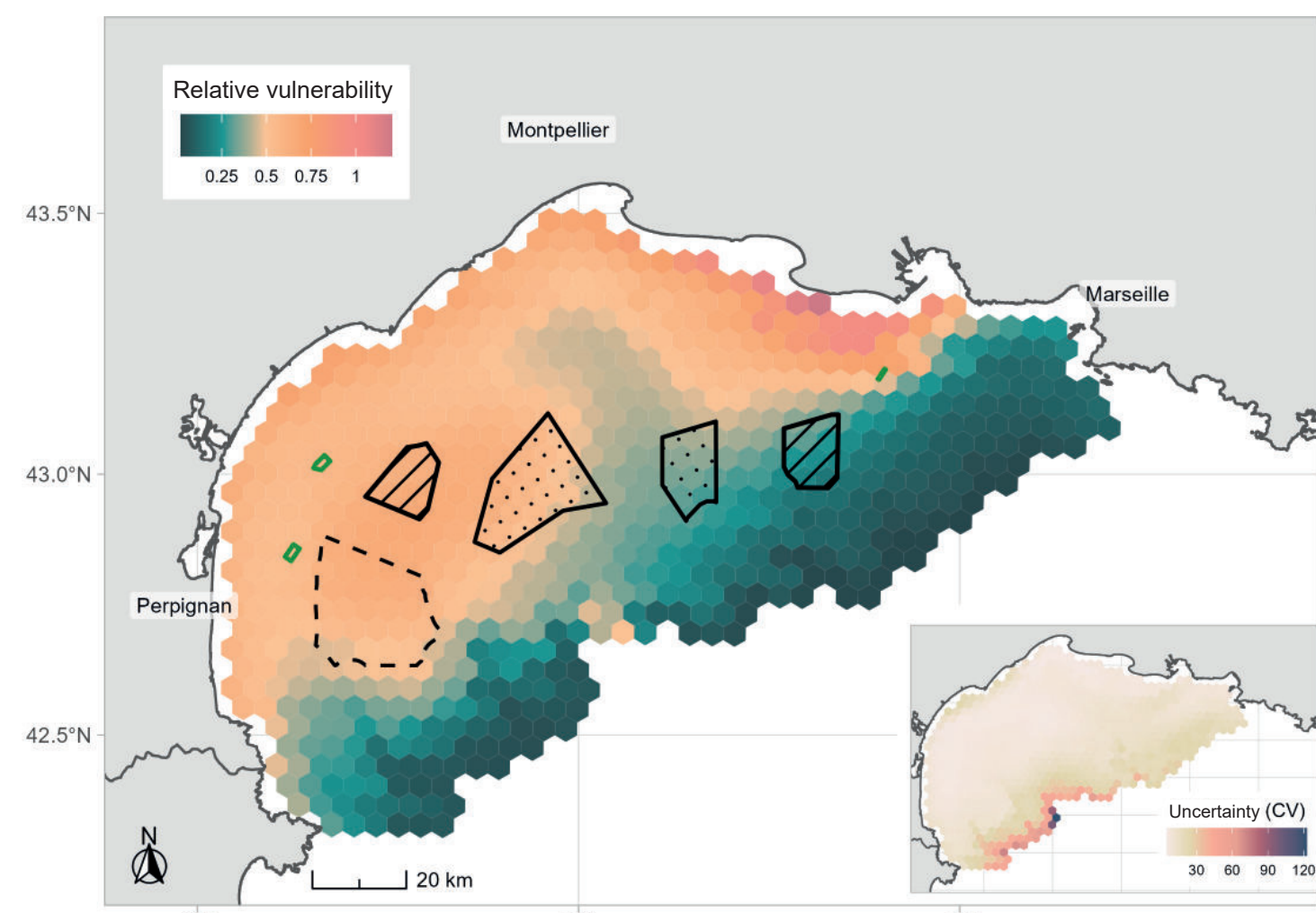
#### Seabirds

Spatial relative space-use modelled using visual count data from boat-based surveys and/or GPS telemetry tracking data (7–11 species), weighted by a vulnerability index (collision and displacement risk, conservation status) (Bradbury et al. 2014)

Breeding season (summer) – 7 breeding species



Non-breeding season (winter) – 11 wintering species



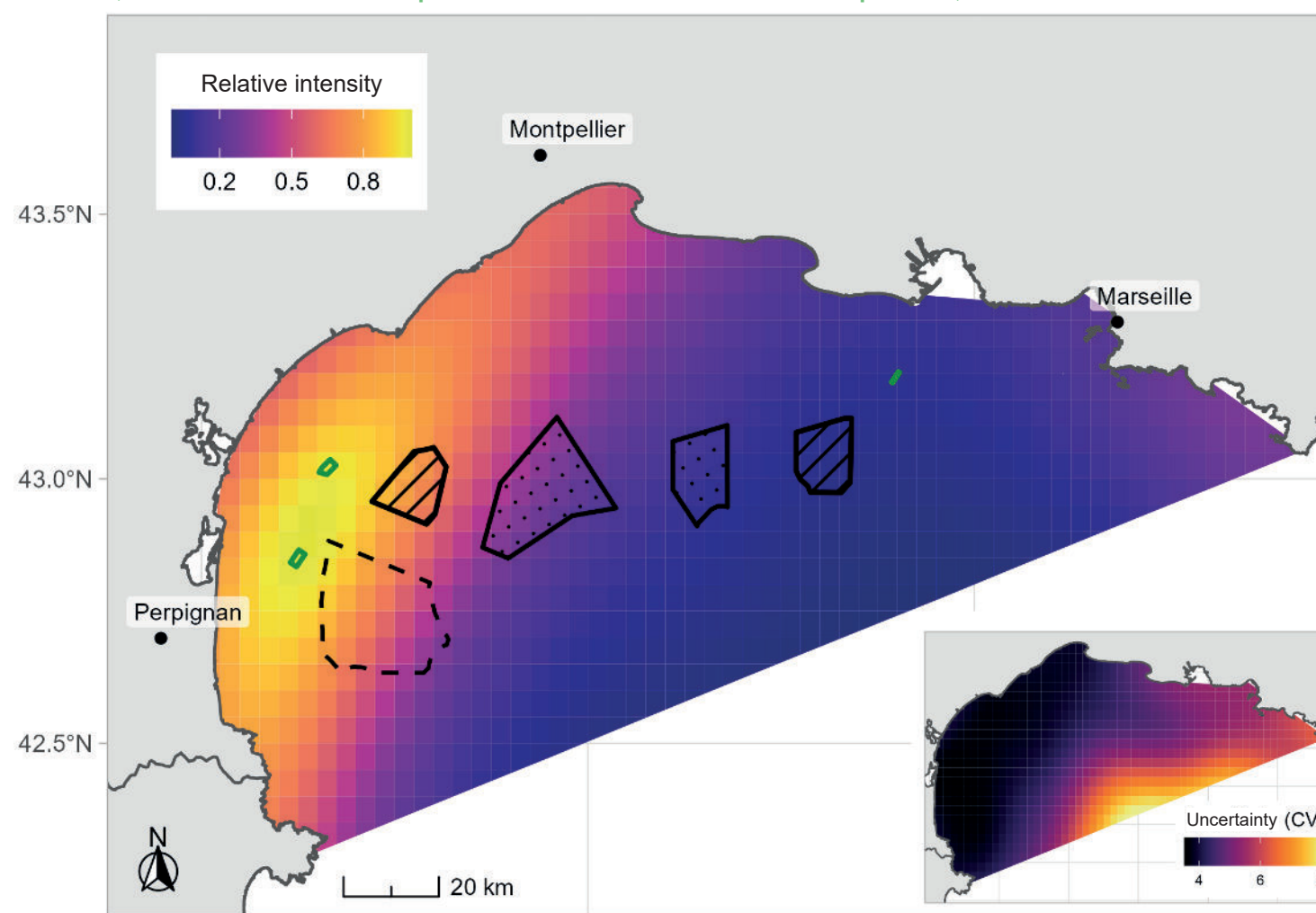
During the breeding season (summer), the areas presenting the greatest risk to seabirds from offshore wind farms are mostly located near the coast (0–20 km zone). During the non-breeding season (winter), a larger part of the Gulf of Lion presents a high level of risk.



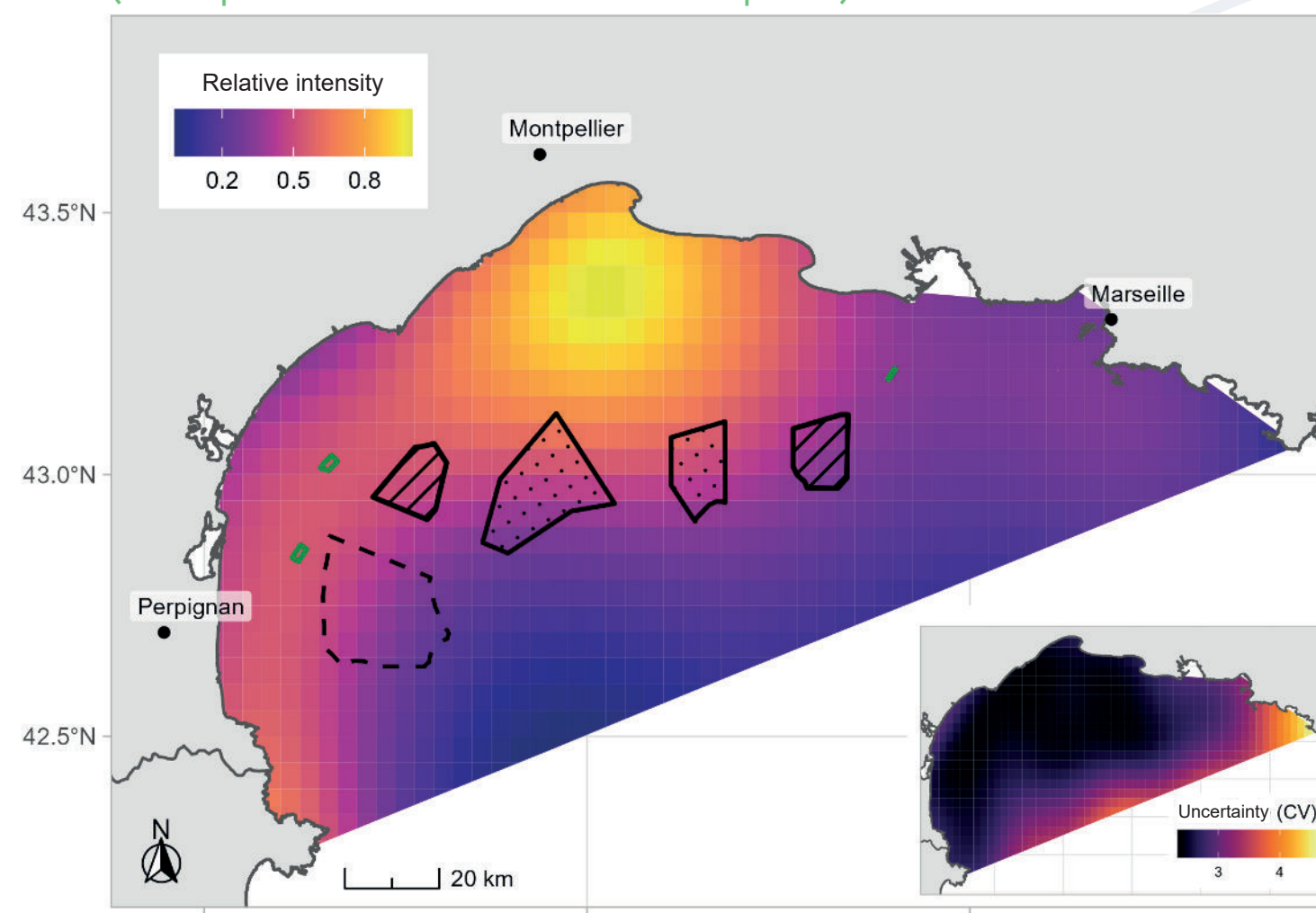
#### Terrestrial migratory birds

Spatial relative intensity of migratory flows modelled using GPS tracking of 22 and 29 species (out of approximately 300 terrestrial migratory bird species using the area), respectively, and data from vertical radars (5 at-sea survey campaigns by boat)

Pre-breeding season (January–June): Northward migration (GPS data used as input: 187 individuals from 22 species)



Post-breeding season (July–December): Southward migration (GPS input data: 423 individuals from 29 species)



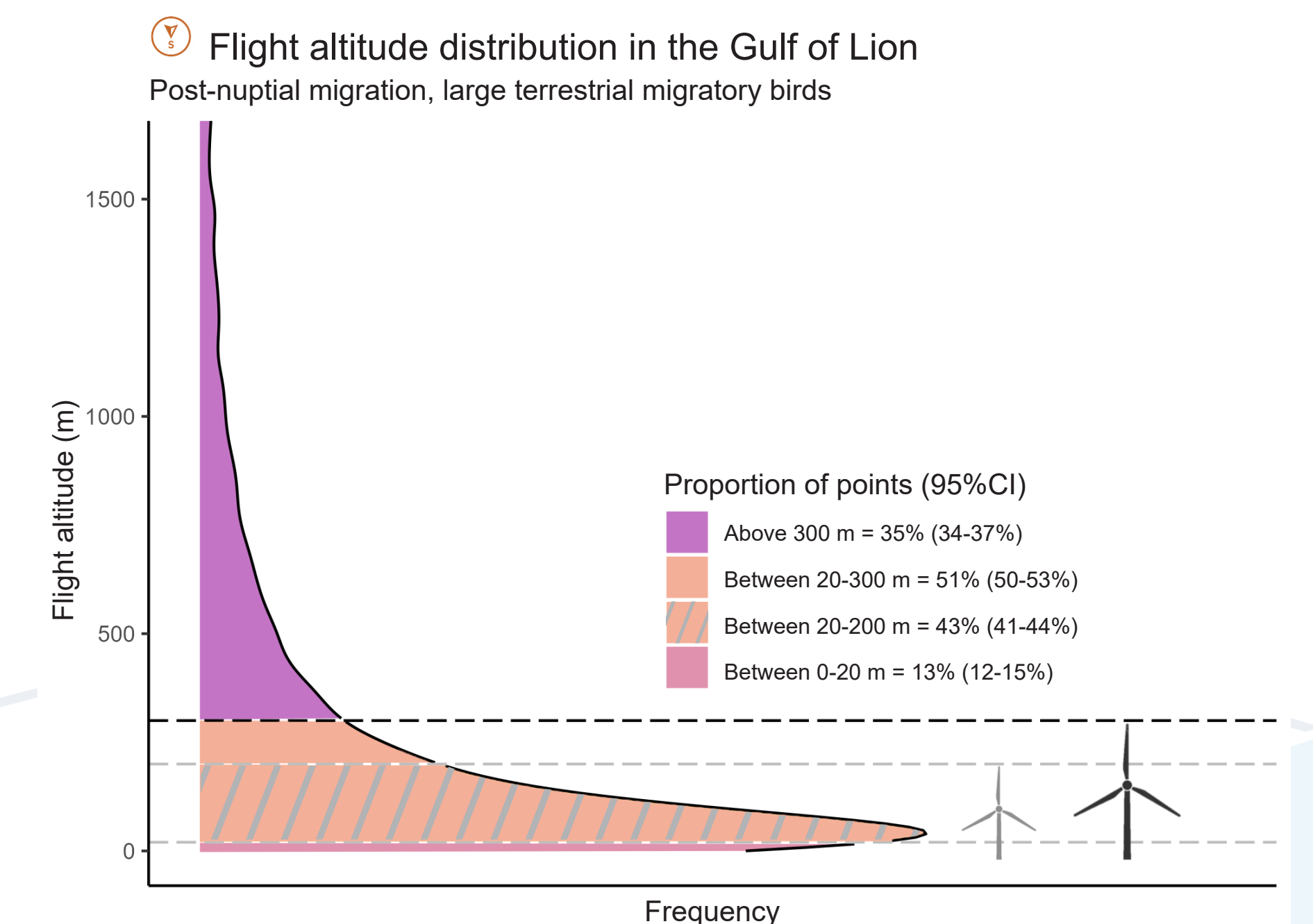
During the post-breeding season, the entire coastal strip (0–50 km) is used by large migratory birds, with some direct crossings also observed. During the northward migration (pre-breeding season), the flow appears to be concentrated in the Western part of the Gulf.



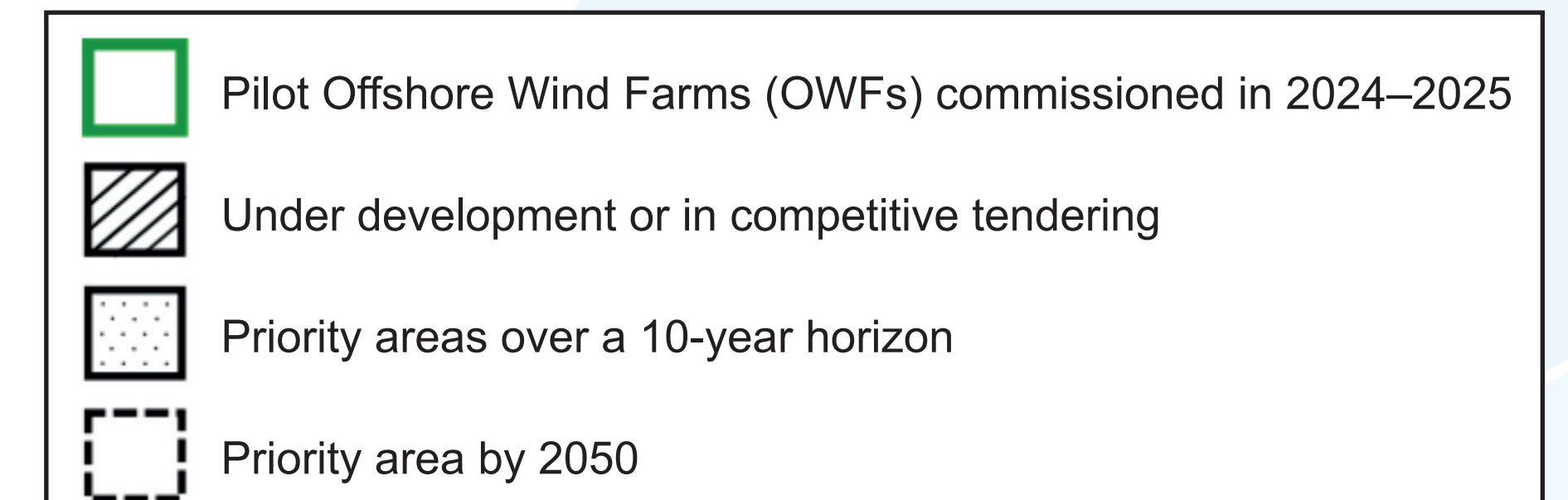
#### Flight altitudes

Distribution of flight altitudes estimated from GPS telemetry tracking data and coastal bird radar data

Flight altitudes of large terrestrial migratory birds during the post-breeding season. Model based on flight altitude data from GPS tracking data (349 individuals from 26 species, out of approximately 300 species using the area; individuals > 75 g) and coastal bird radar data



Large terrestrial migratory birds fly at relatively low altitudes over the Gulf of Lion, with a significant proportion (half) of flights occurring within the altitude range of offshore wind turbine blades



### Summary and perspectives

MIGRALION is an innovative research programme that stands out for the unprecedented scale of avifauna data collected at sea in the Gulf of Lion. For the first time in France, complementary monitoring methods were implemented over several consecutive years, and the resulting data were combined for a comprehensive analysis. MIGRALION provides unprecedented new knowledge into the areas used by seabirds at sea, the preferred offshore migration flow areas of terrestrial migratory birds, the timing of their presence, and their flight altitudes.

These key knowledge concerning the areas of interaction with human activities (notably offshore wind energy) provide a solid foundation for addressing conservation challenges and adapting environmental measures (mitigation and avoidance). This work deserves to be continued and expanded, particularly regarding small terrestrial migratory birds and bats (which are underrepresented here), migration strategies, links with environmental conditions, and the finer-scale impacts of offshore wind farms on avifauna.

#### Programme management

#### Scientific and technical partners

#### With the financial support of

