The osprey project in the Mediterranean:

genetic, migration and management actions.

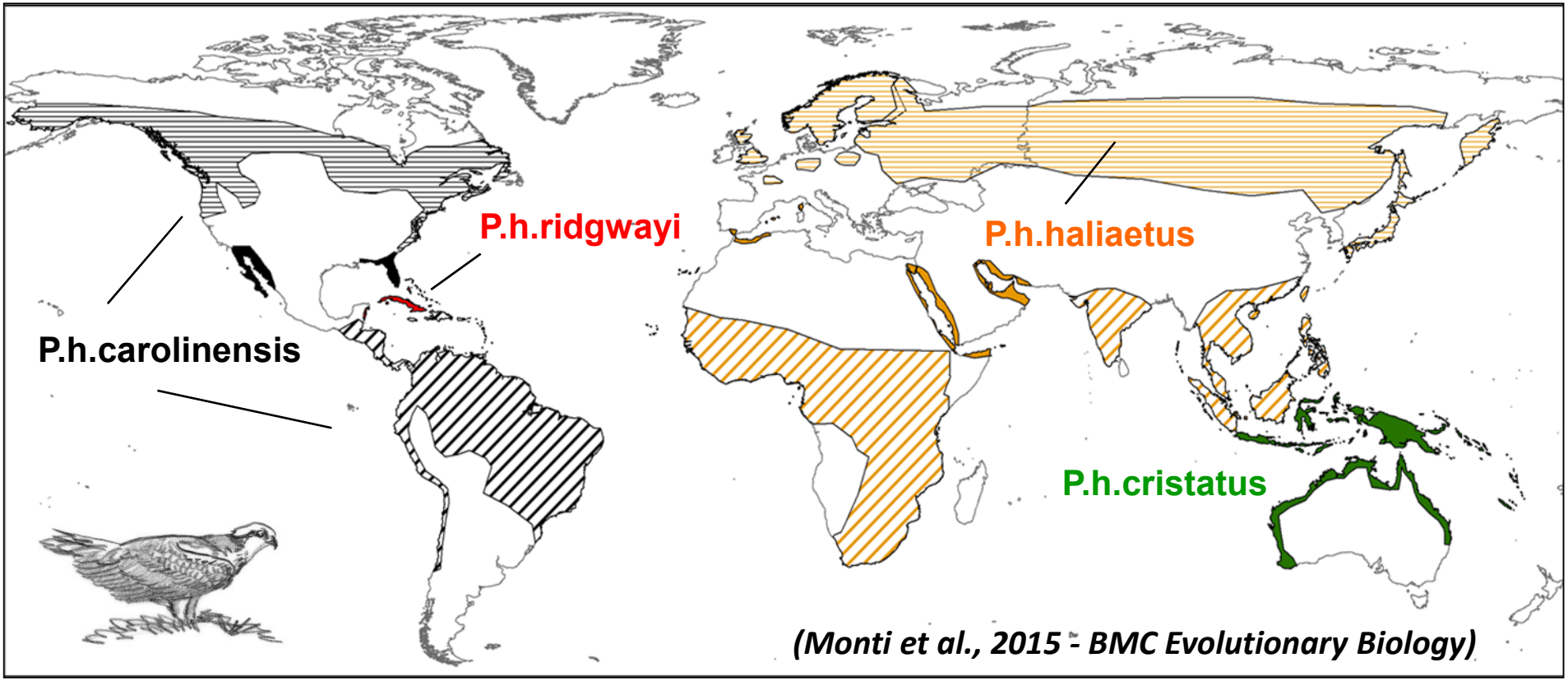
Flavio Monti

University of Siena

International workshops on osprey conservation for Central and Eastern Europe

6-8 March 2019 - Olsztyn, Poland

A Cosmopolitan raptor species



→ **Genetic diversity**

→ **Habitat diversity**

→ **Differences in migratory startegies**

→ **Different management and conservation approaches**

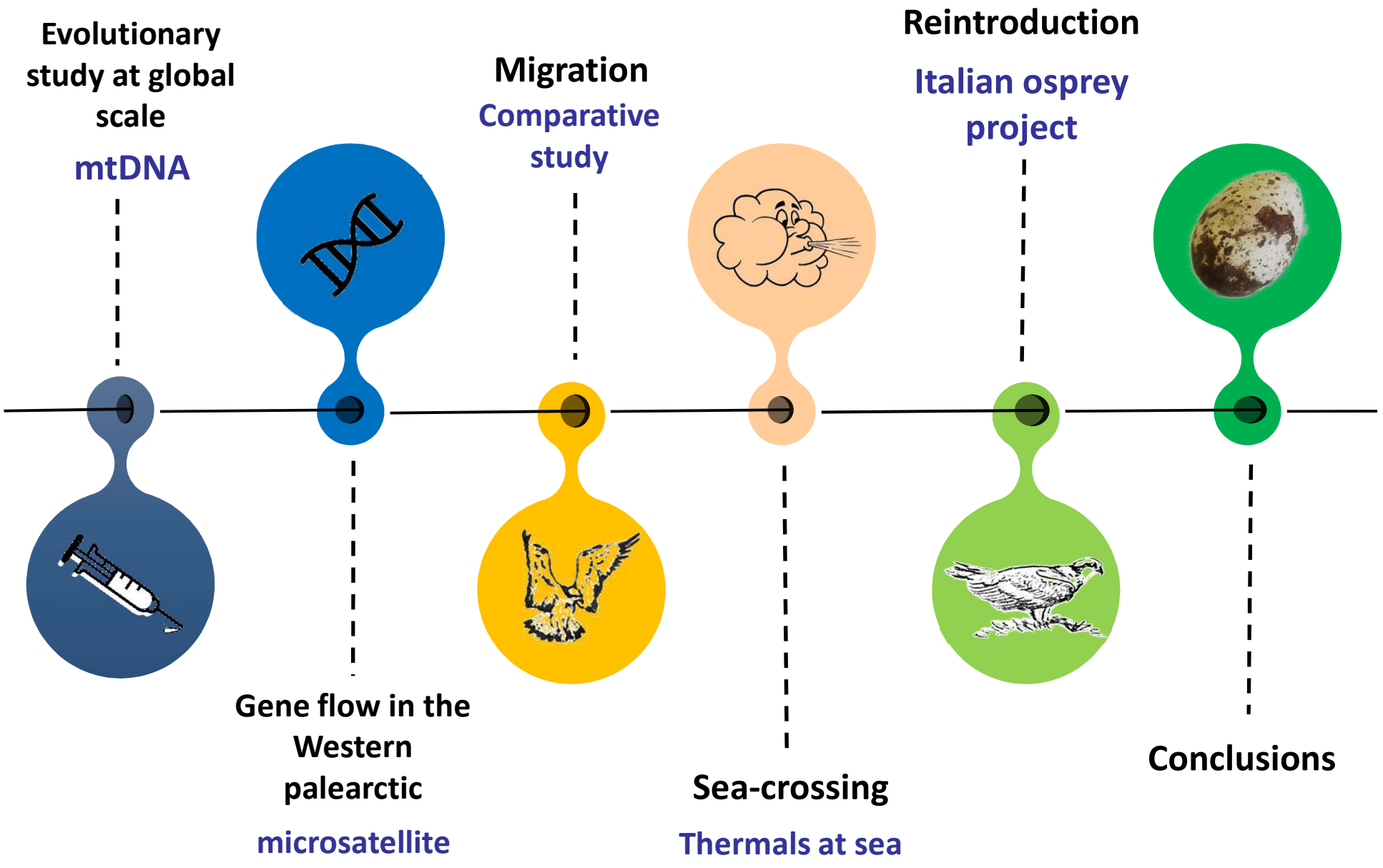
Breeding grounds in Europe and North America

- Nesting on the top of the tree
- Forest habitat
- Freshwater: river & lakes
- Stable or increasing populations

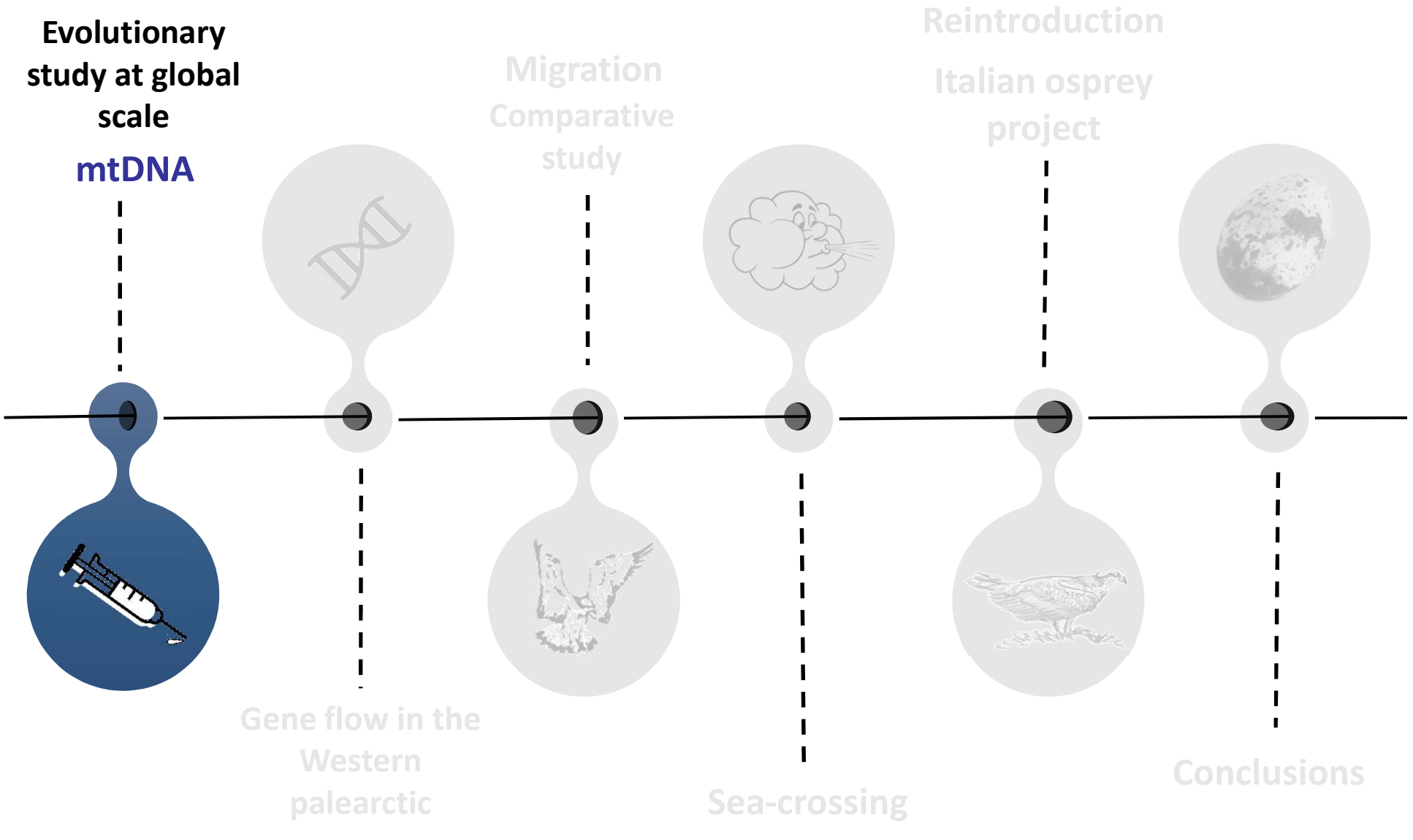
Breeding grounds in the Mediterranean

- Nesting on rocky pinnacles
- Marine environments and coastal areas
- Status “Vulnerable”

Presentation Outline:



Step 1: Evolutionary history of the Osprey



Genetic divergence among populations at global scale

mtDNA

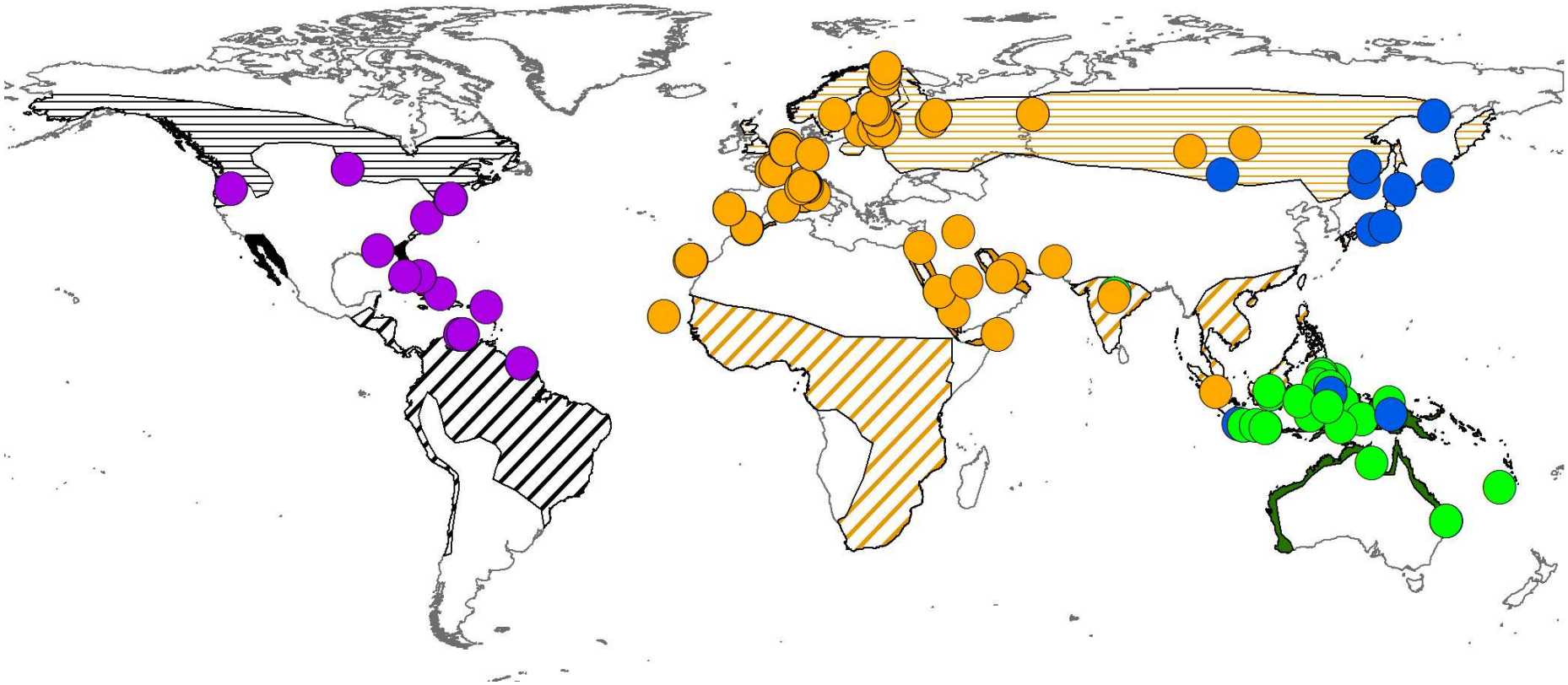
- Evolve at a constant rate
- Relatedness between populations
- Determine their taxonomic status
- Historical and evolutionary genetic divergence

Museum specimens → N = 91

Blood samples → N = 118

Genetic divergence among populations at global scale

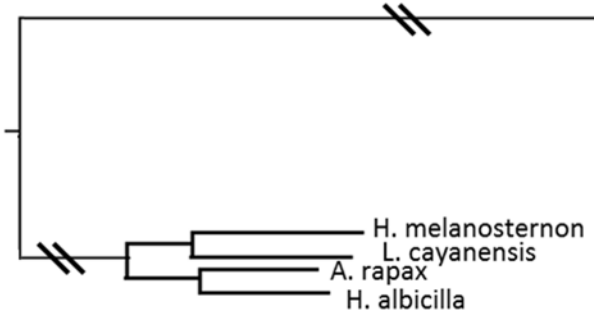
EVOLUTIONARY SCALE
Phylogeography - mtDNA (Cyt b)

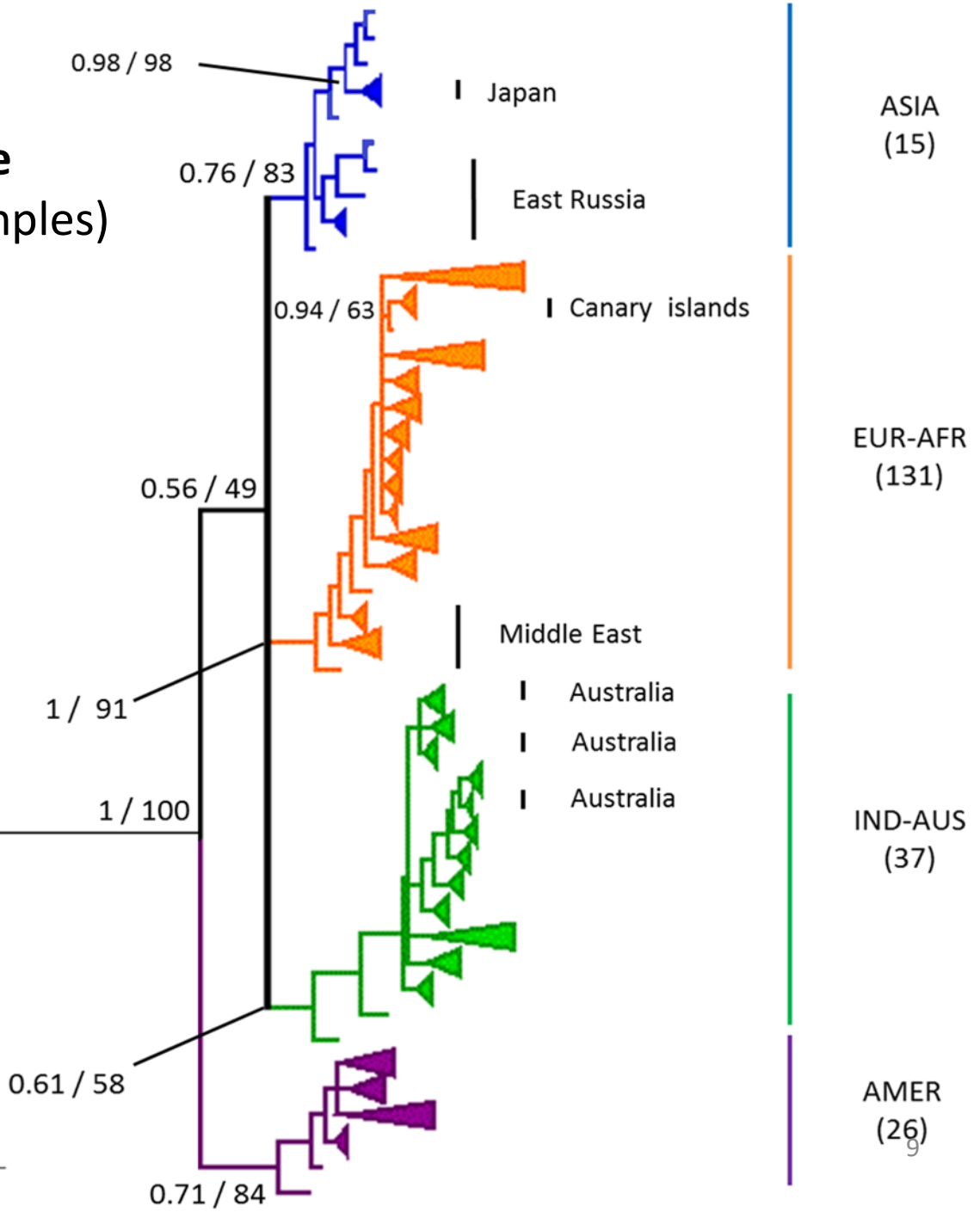


TOTAL = 209 samples from all around the world

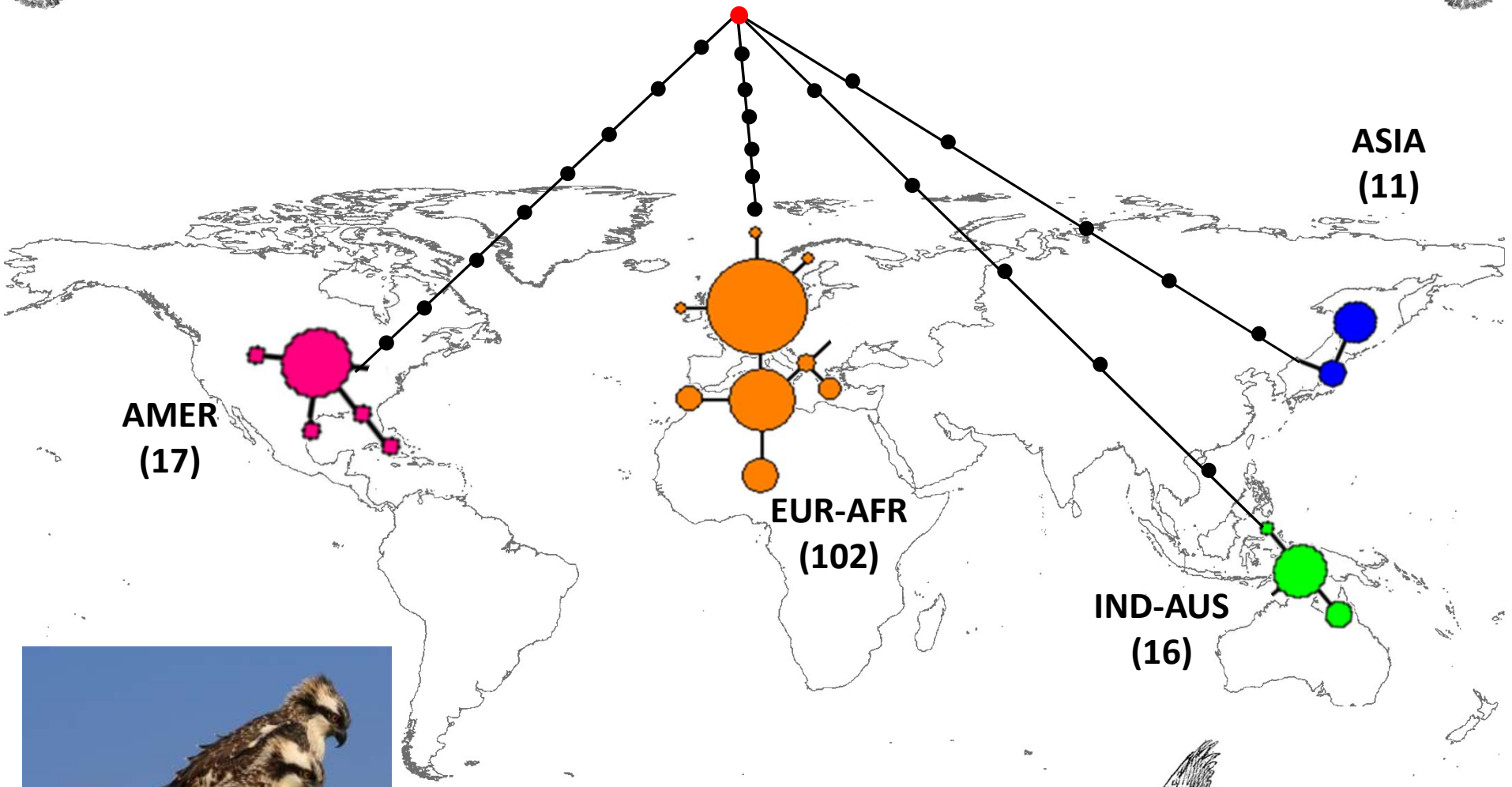
Wide distributional range → covered

Cyt b phylogenetic tree
(1103 nucleotides / 209 samples)





Genetic divergence among populations at global scale



CYTB phylogenetic network
(661 pb / 146 individuals)

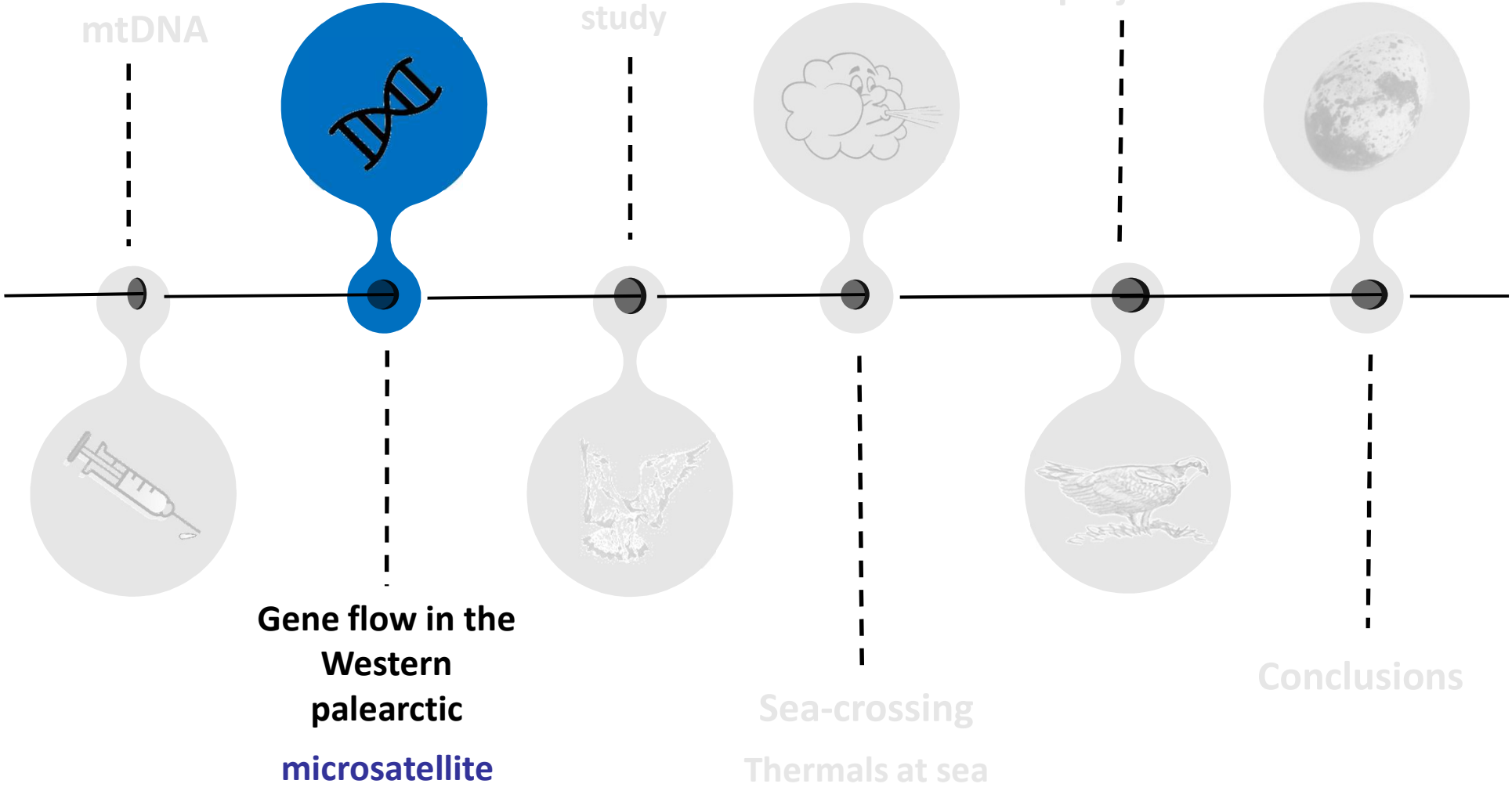
Global Scale & Evolutionary Time

- Four Evolutionary Significant Units
- Marked differences between lineages
- *carolinensis* ospreys **did not differ** from *ridgwayi.*
- The subspecies *haliaetus* includes **two molecular clades**: Western Palearctic and Eastern Palearctic

Regional Scale & Historical Time

- Two distinct sub-units (NE vs Med)
- Low rate of connectivity (gene flow >4%)
- All Mediterranean populations are connected by gene flow
- Respect genetic structure when planning translocations

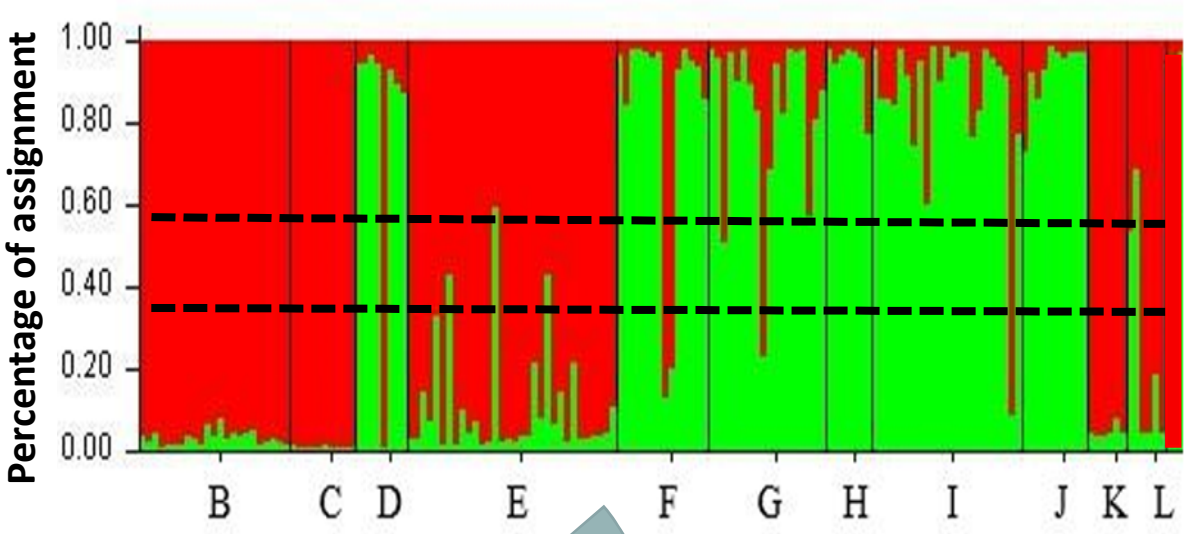
Step 2: Gene flow in the Western Palearctic

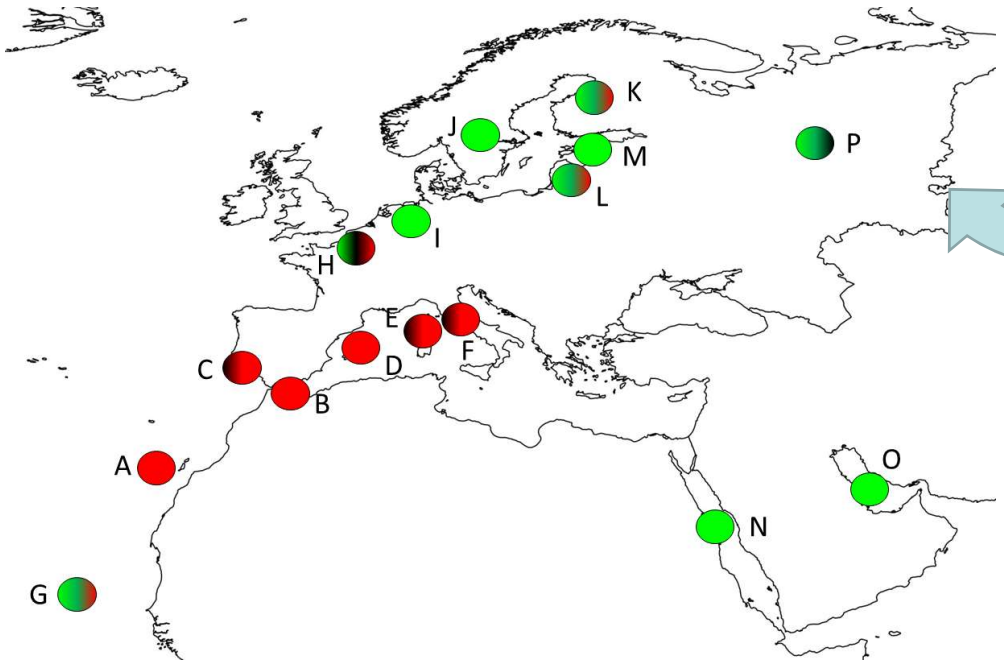


Genetic structure in the Western Palearctic

(n =178)

Test of genetic assignment *Structure v.2.01.* provided two clusters (K=2)





PRESENT TIME

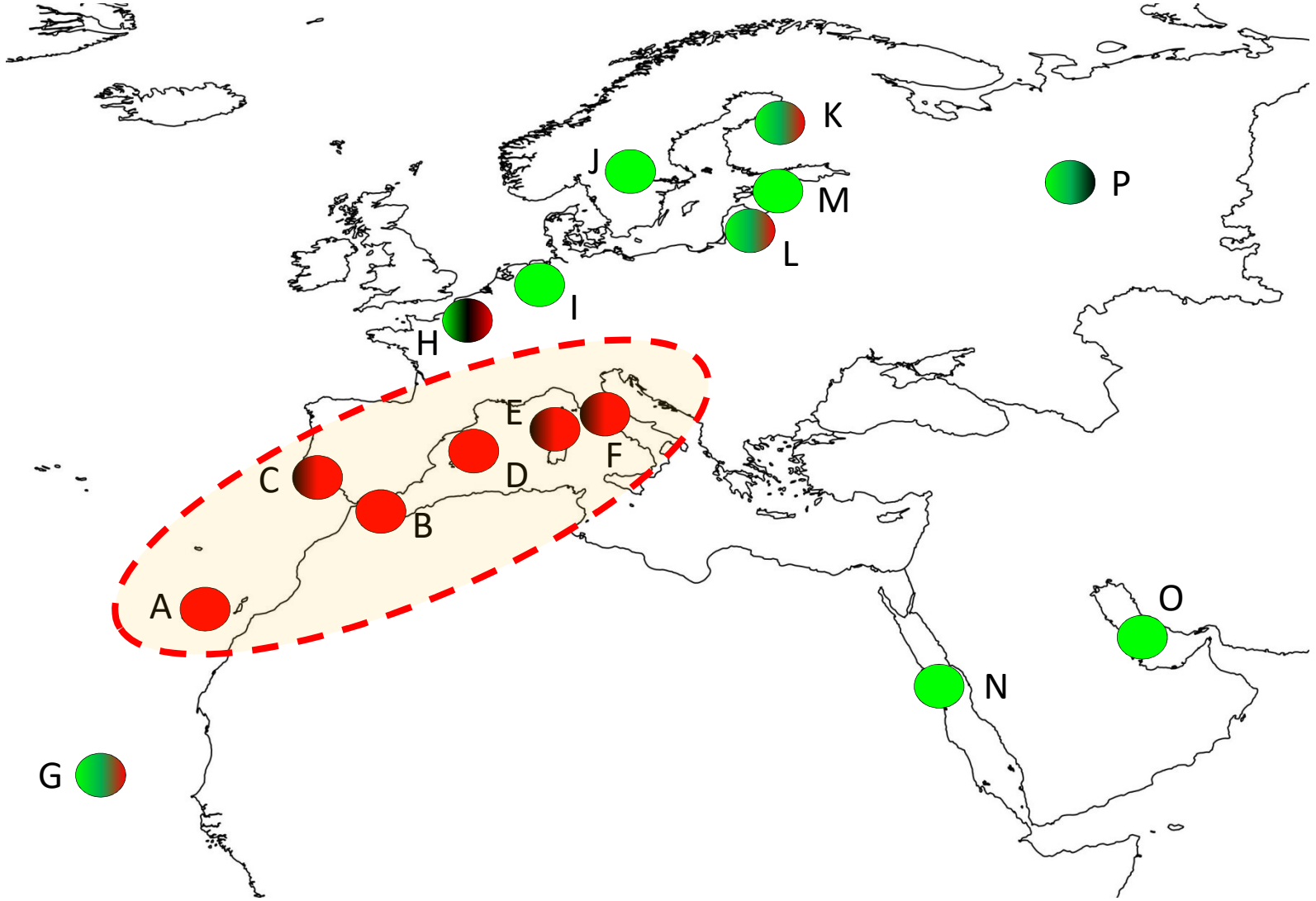
microsatellite study

CONTINENTAL

MEDIT

HYBRID (40% < prob of assignment < 60%)

Genetic diversity in the Western Palearctic: microsatellite study



Two distinct sub-units partially interconnected by gene flow

(Monti et al., 2018 - Conservation Genetics)

Global Scale & Evolutionary Time

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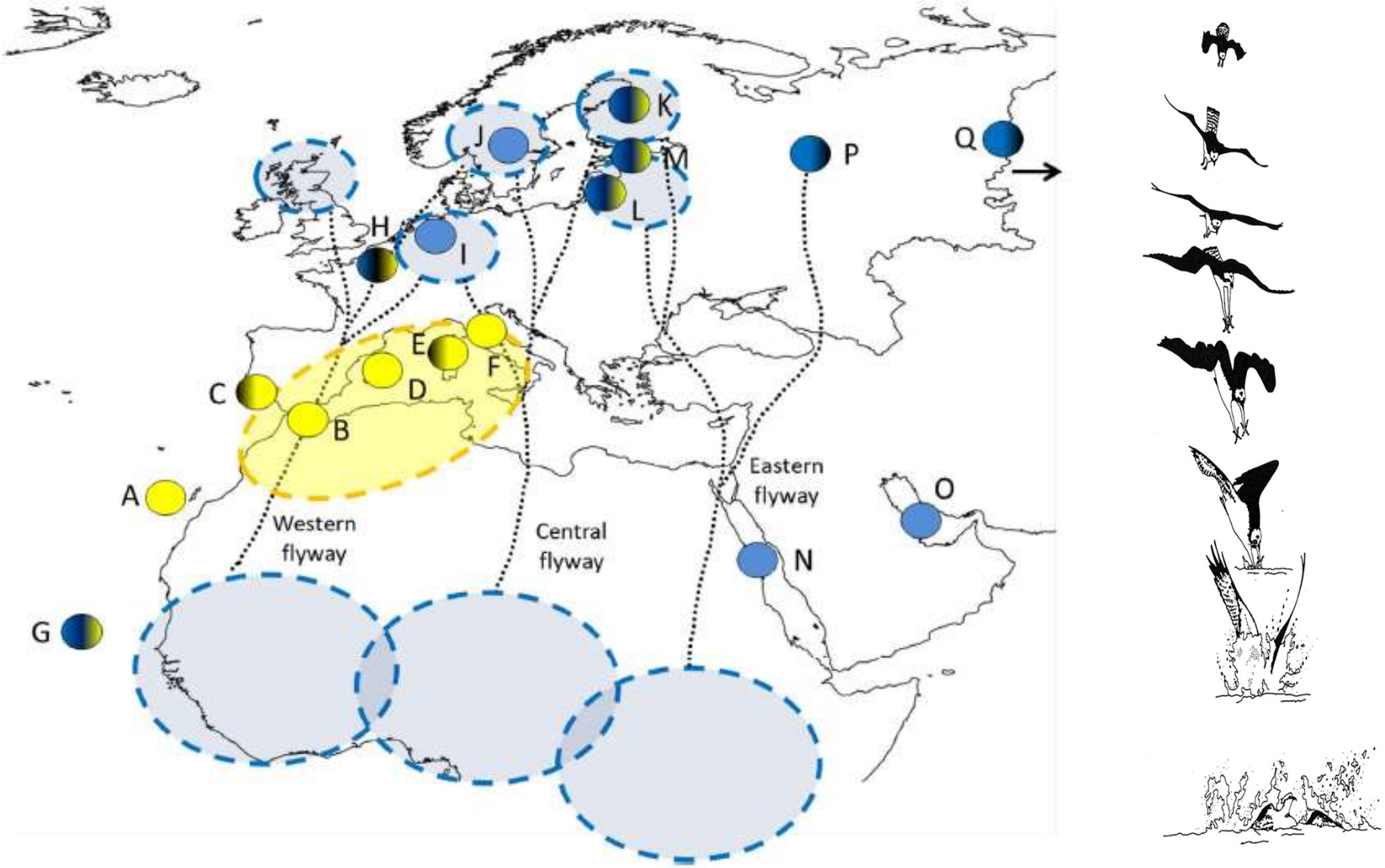
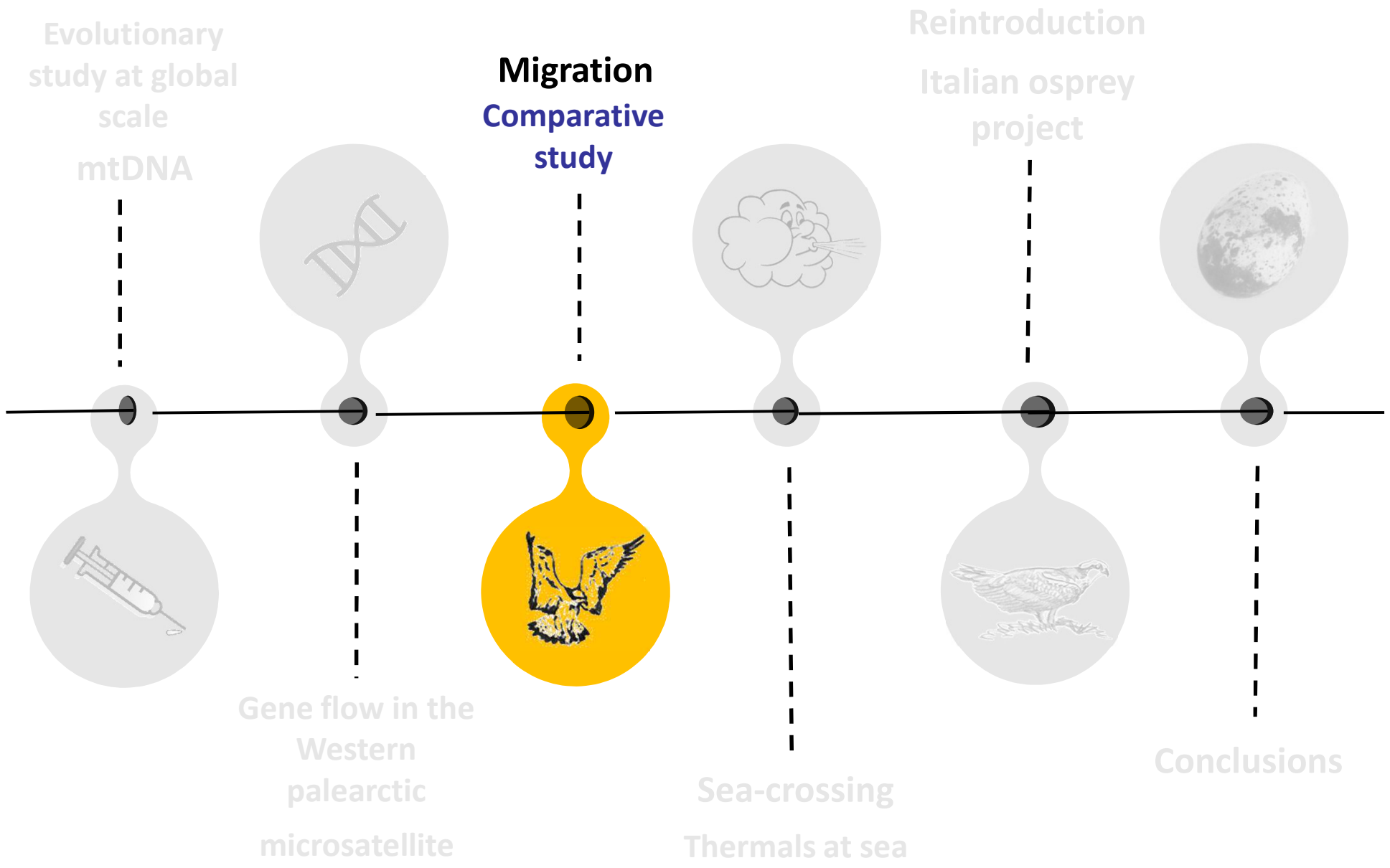
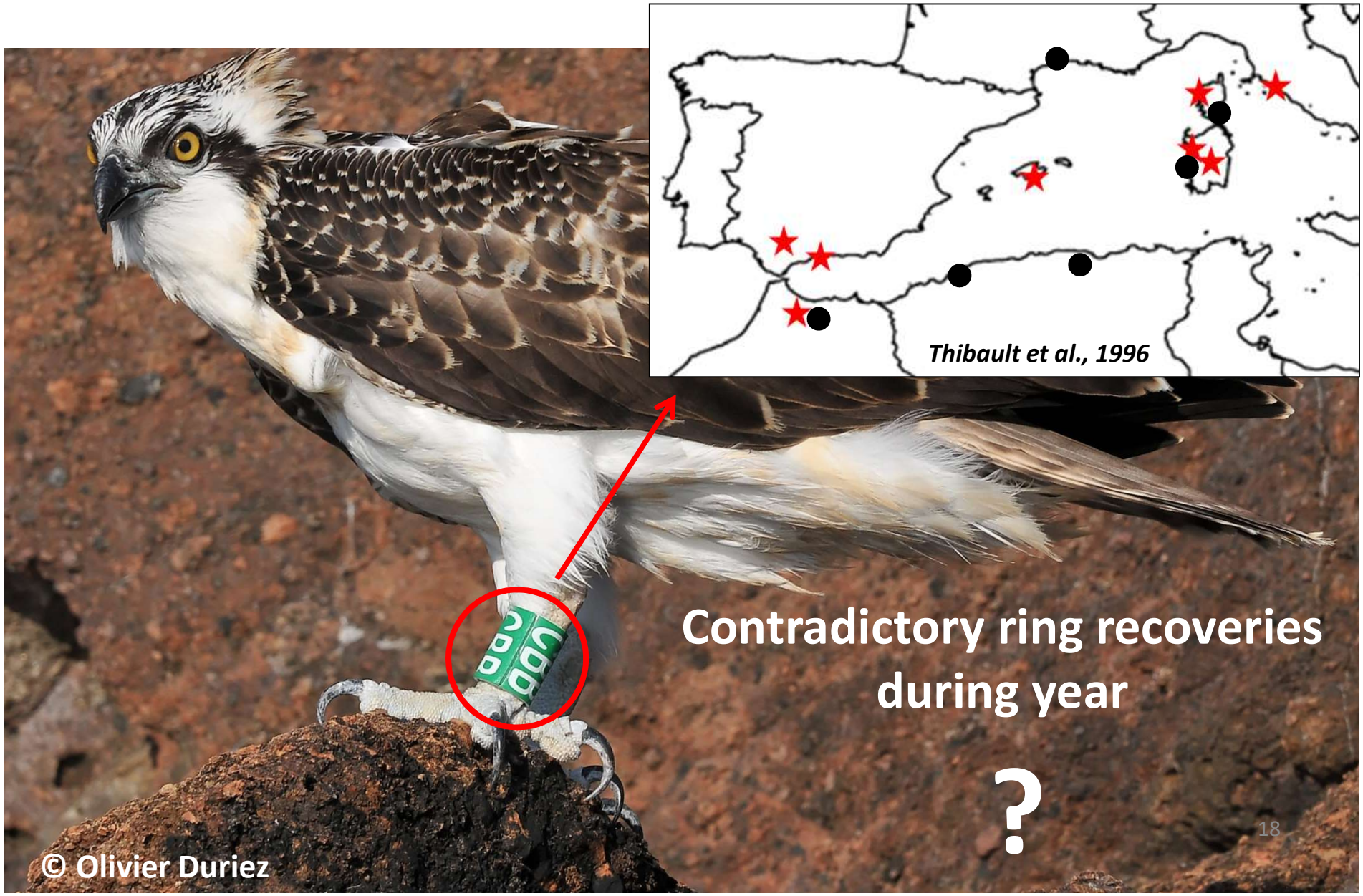


Genetic structuration of osprey populations in the Western Palearctic reflects main migratory flyways

Step 3: Migration strategies

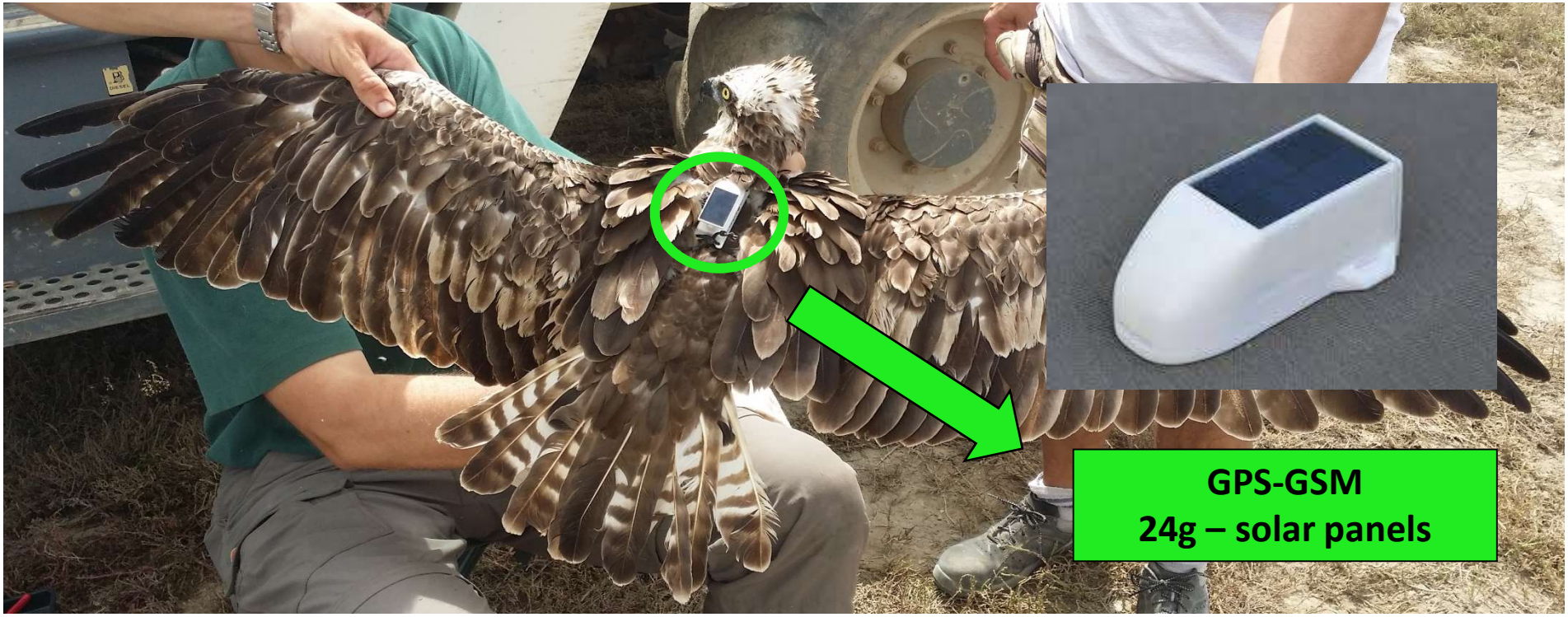


Beyond the main osprey flyways: what happens in the Central Mediterranean basin?



- What proportion of the Mediterranean osprey population is migratory?
- Where are the wintering destinations?
- What is the timing of their migration and what are the routes taken by individuals to reach their destination?
- Which habitats are ospreys using in winter?

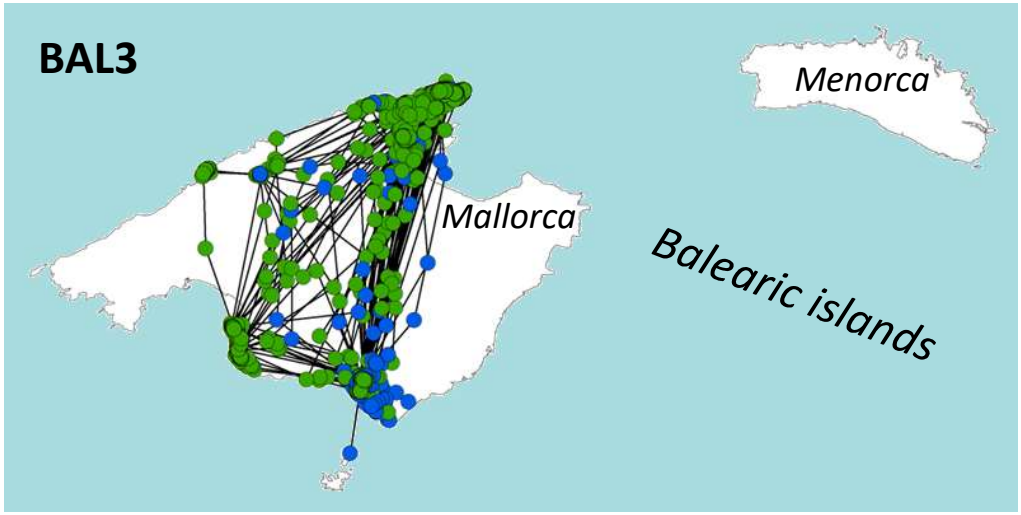
Migration, Dispersal, Wintering, Daily movements and home ranges

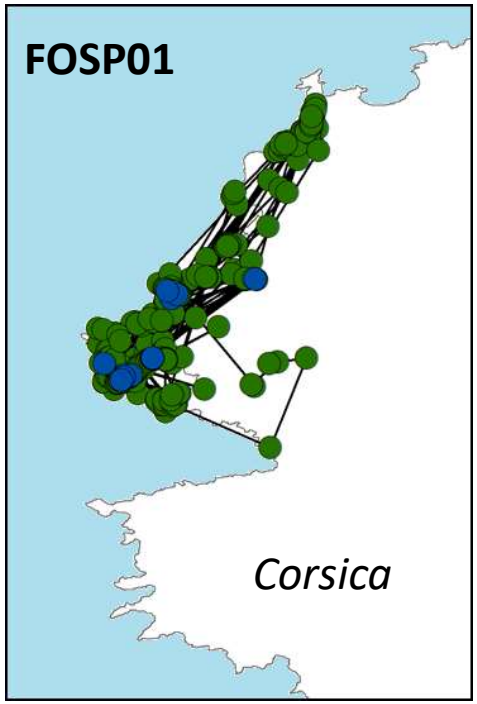


Mediterranean

Resident Ospreys

(27 %)





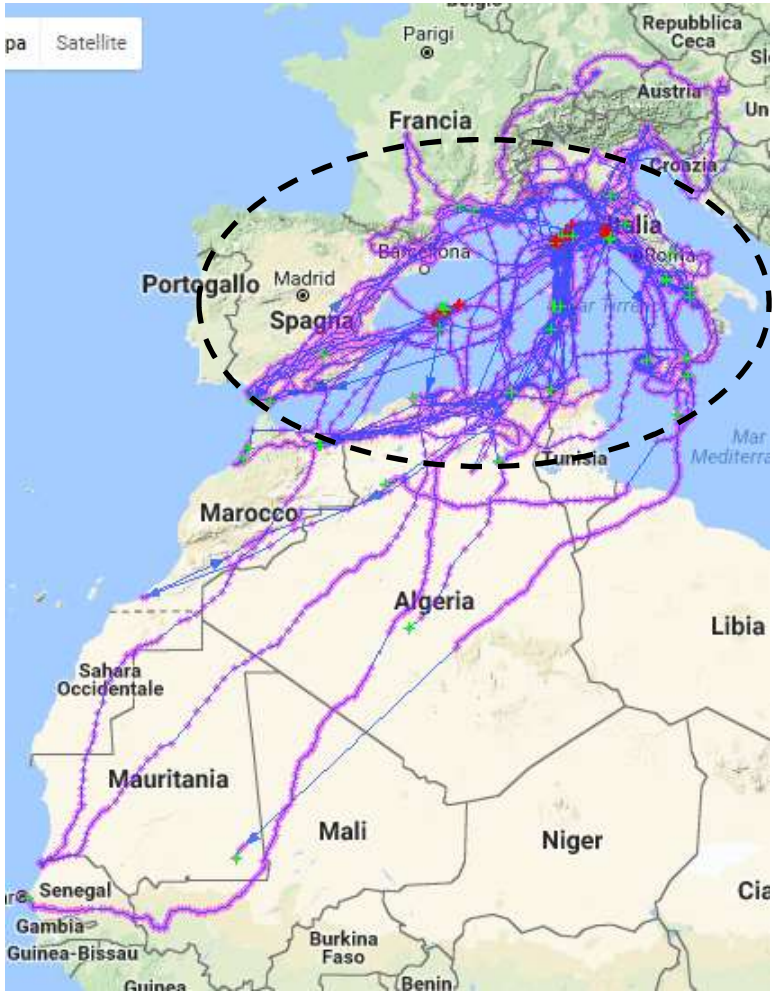
Breeding movements

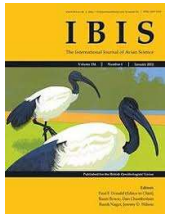
Wintering movements

All year round

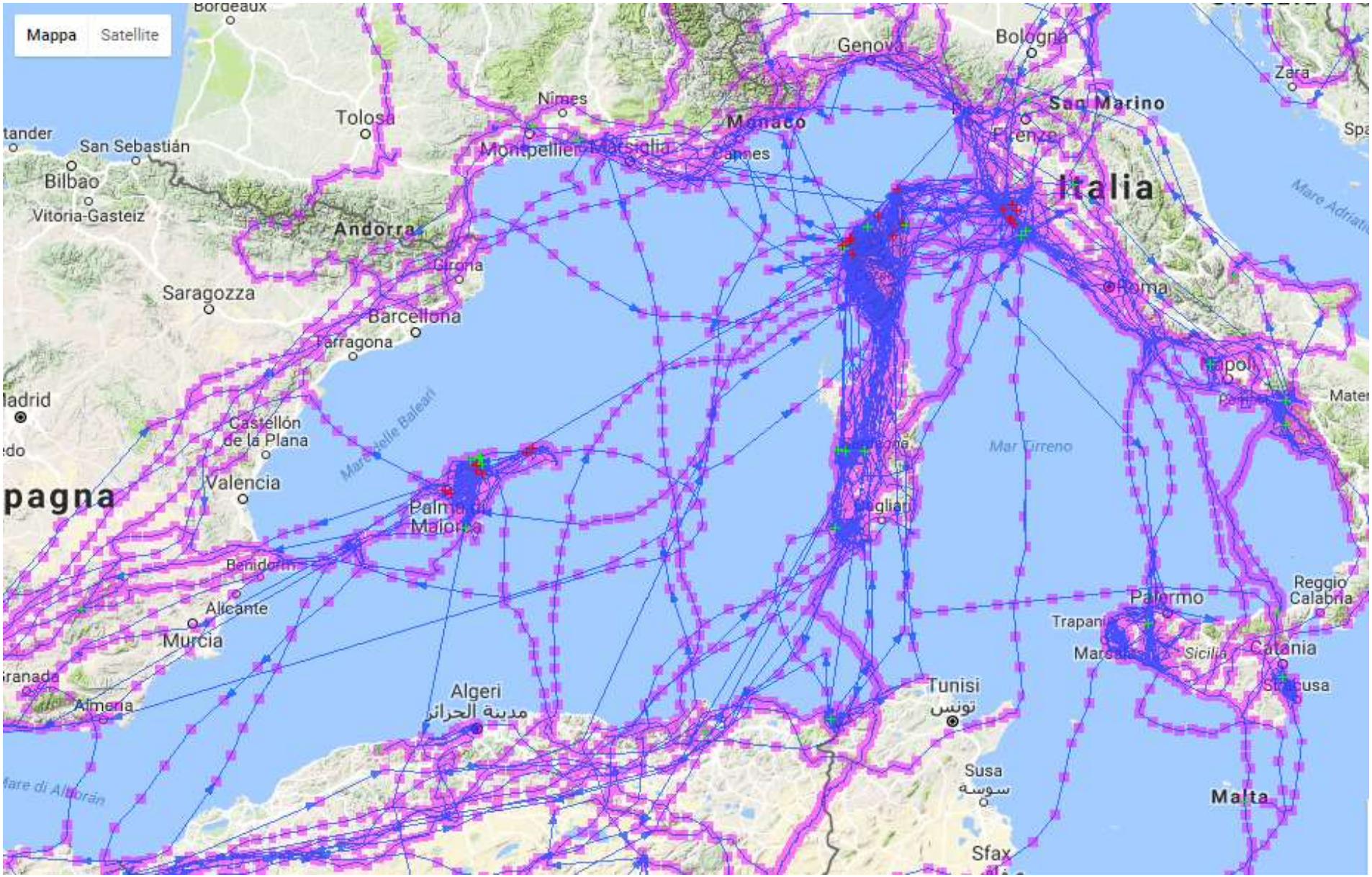
Migratory Ospreys

(73 %)

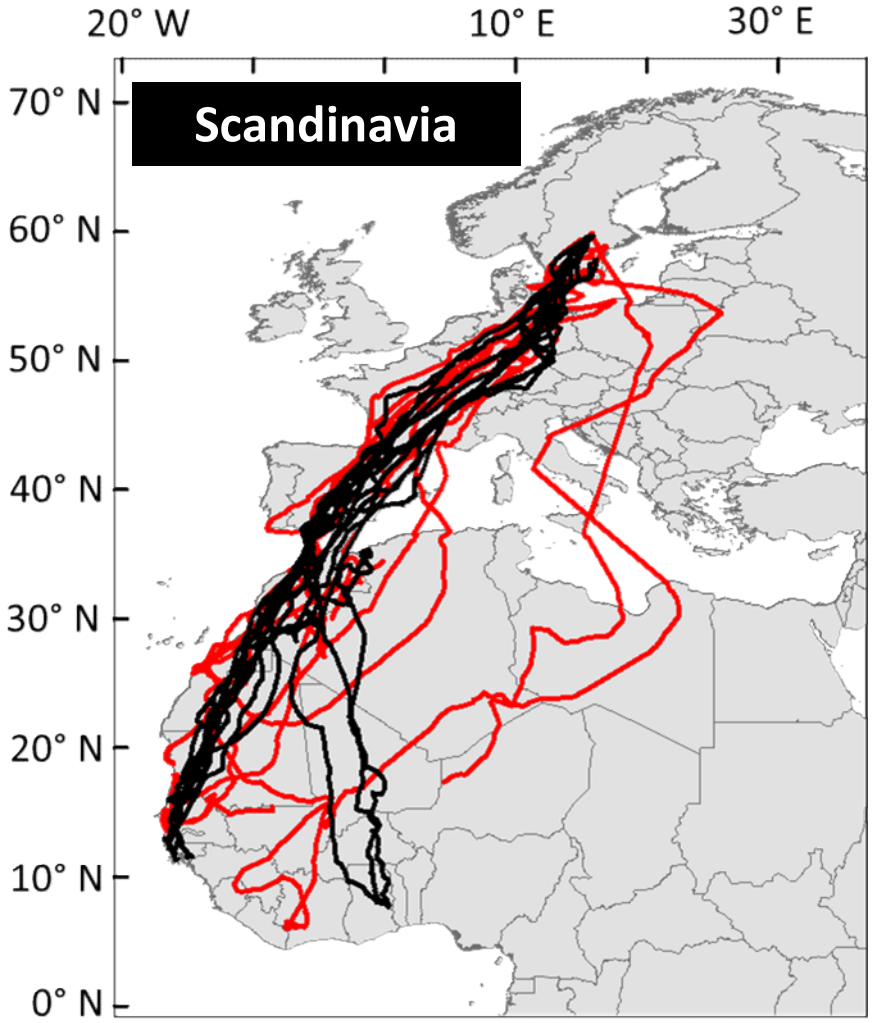




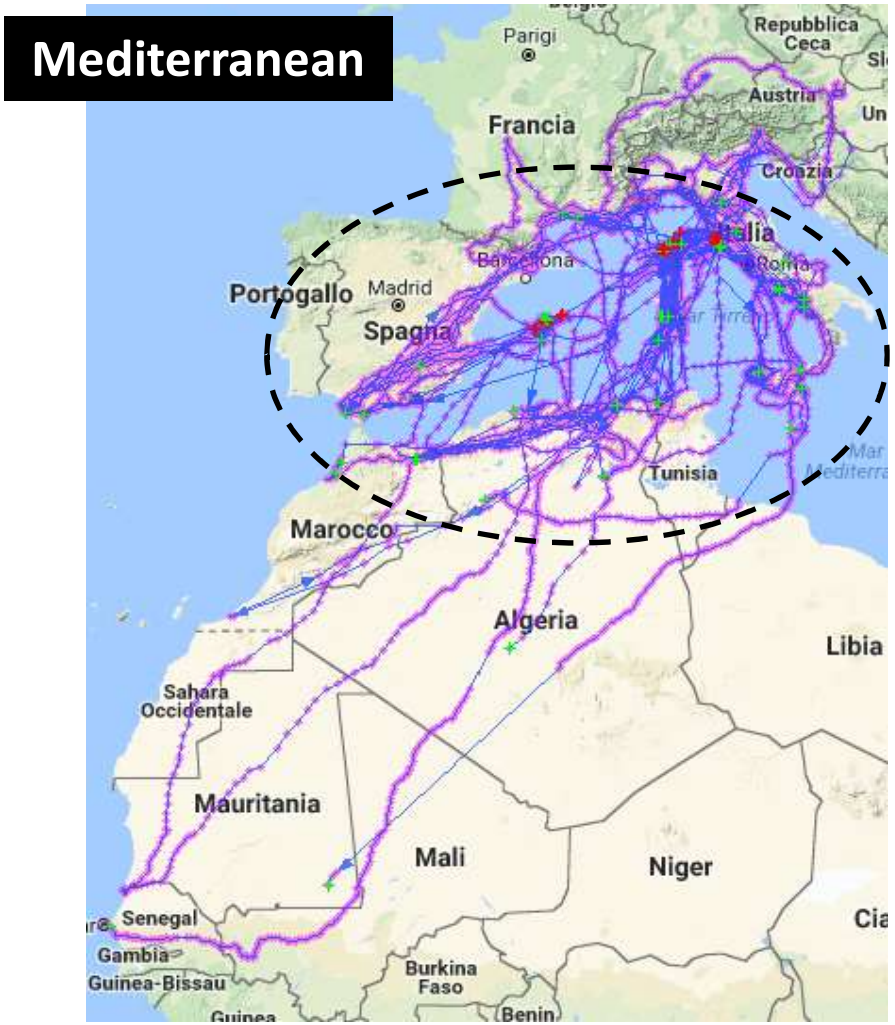
Monti et al., 2018 - Ibis



The majority of Mediterranean ospreys is short-distance migratory and winter at temperate latitudes, in the Mediterranean basin.



Klaassen *et al.*, 2008. *Behav Ecol Sociobiol 62:1427-1432*



(Monti et al., 2018 - Journal of Avian Biology)

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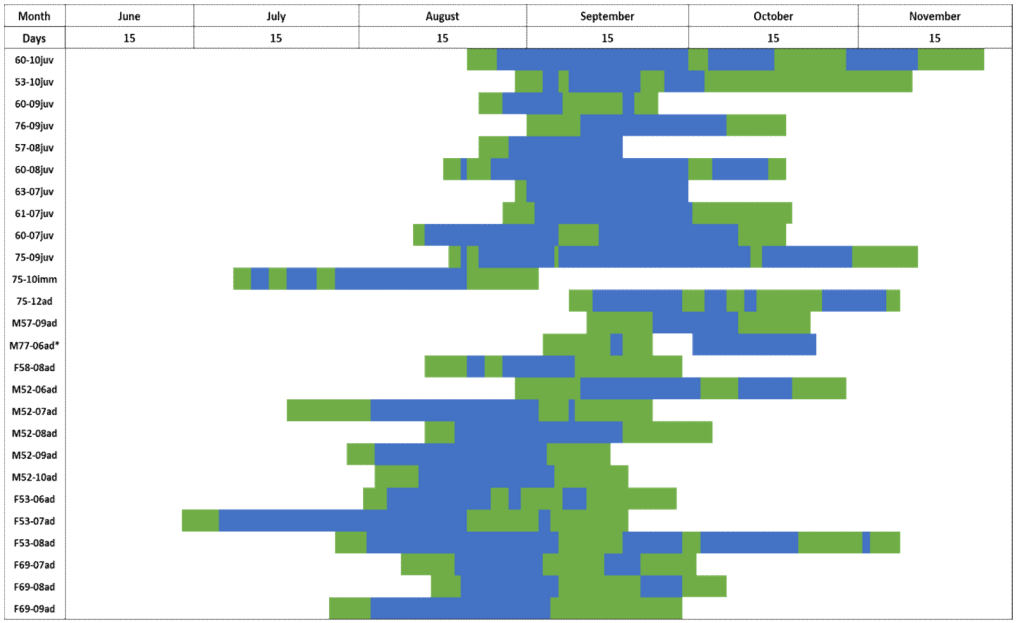
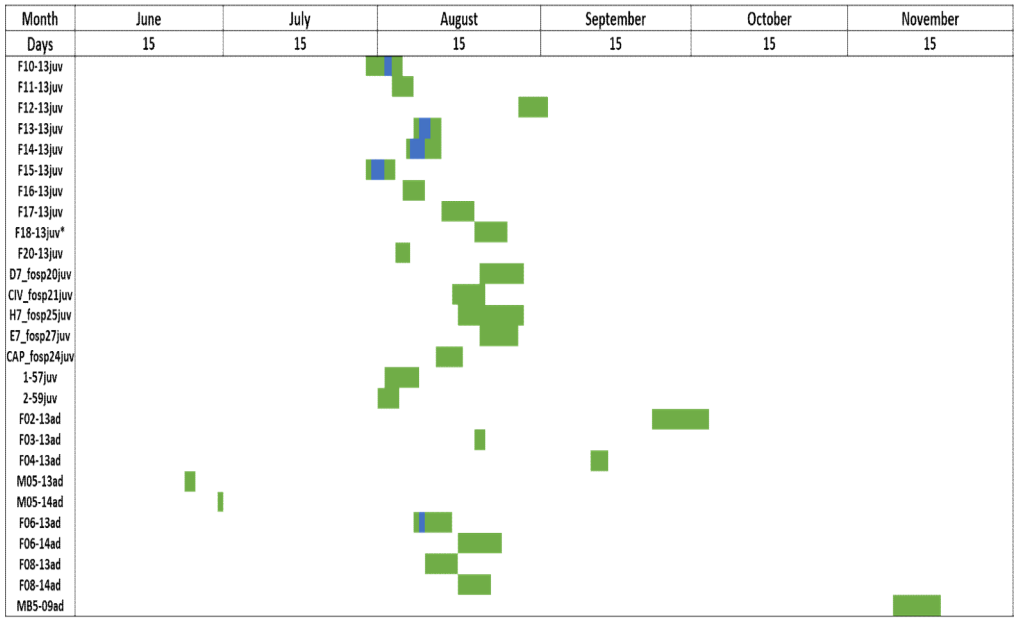


Scandinavia

- **Migration** = ~6000 km
- **Duration** = 61.0 ± 17.8 days
- **Time-Budget** = 50% stopover



Mediterranean

- **Migration** = ~1000 km
- **Duration** = 5.1 ± 2.5 days
- **Time-budget** = 0% stopover

Travel days

Stop-over days

(Monti et al., 2018 – Journal of Avian Biology)

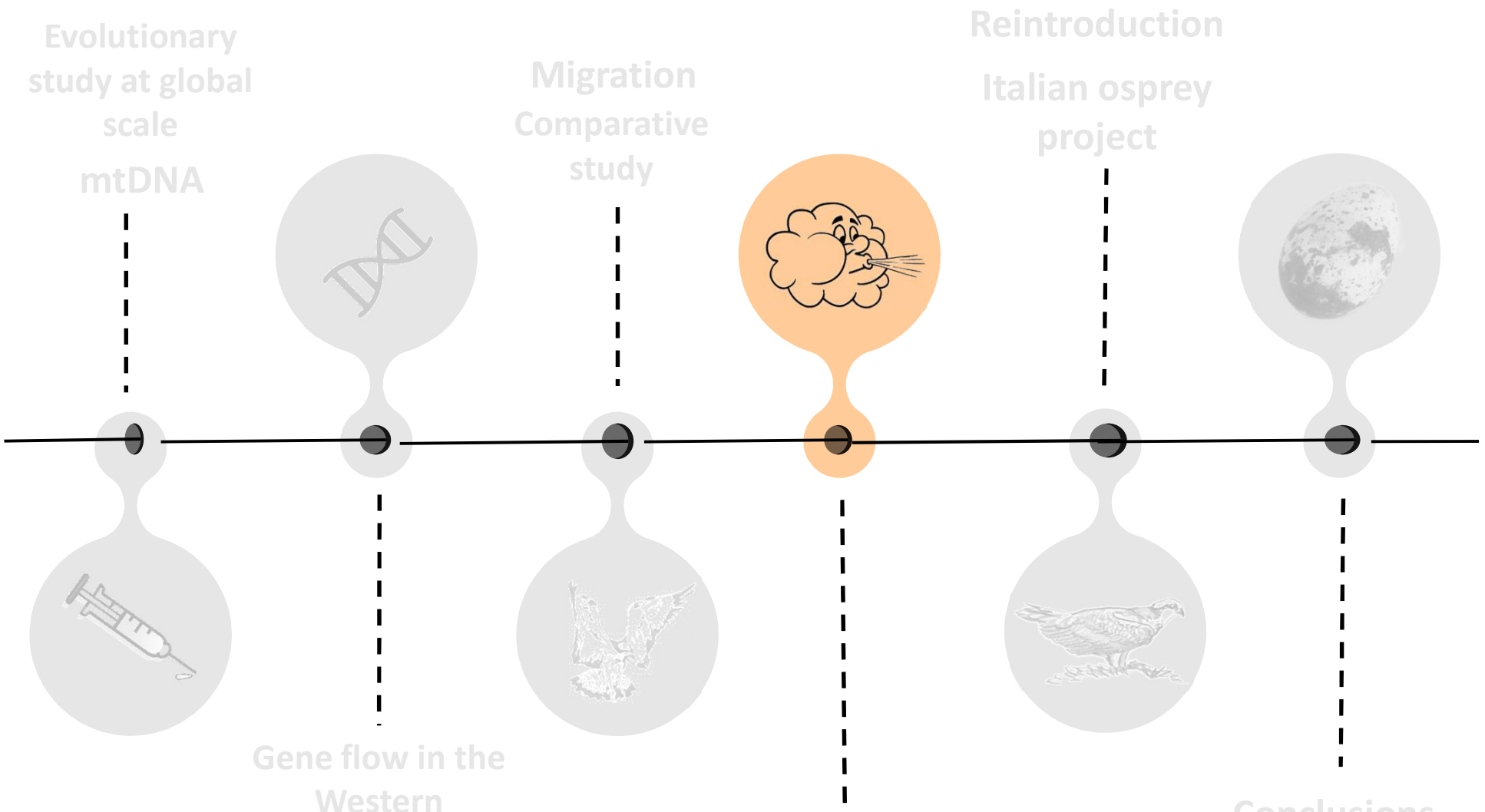
- Ospreys breeding at different latitudes in the WP used **different migration strategies**;

- LDM ospreys travelled distances **five** times larger than SDM;

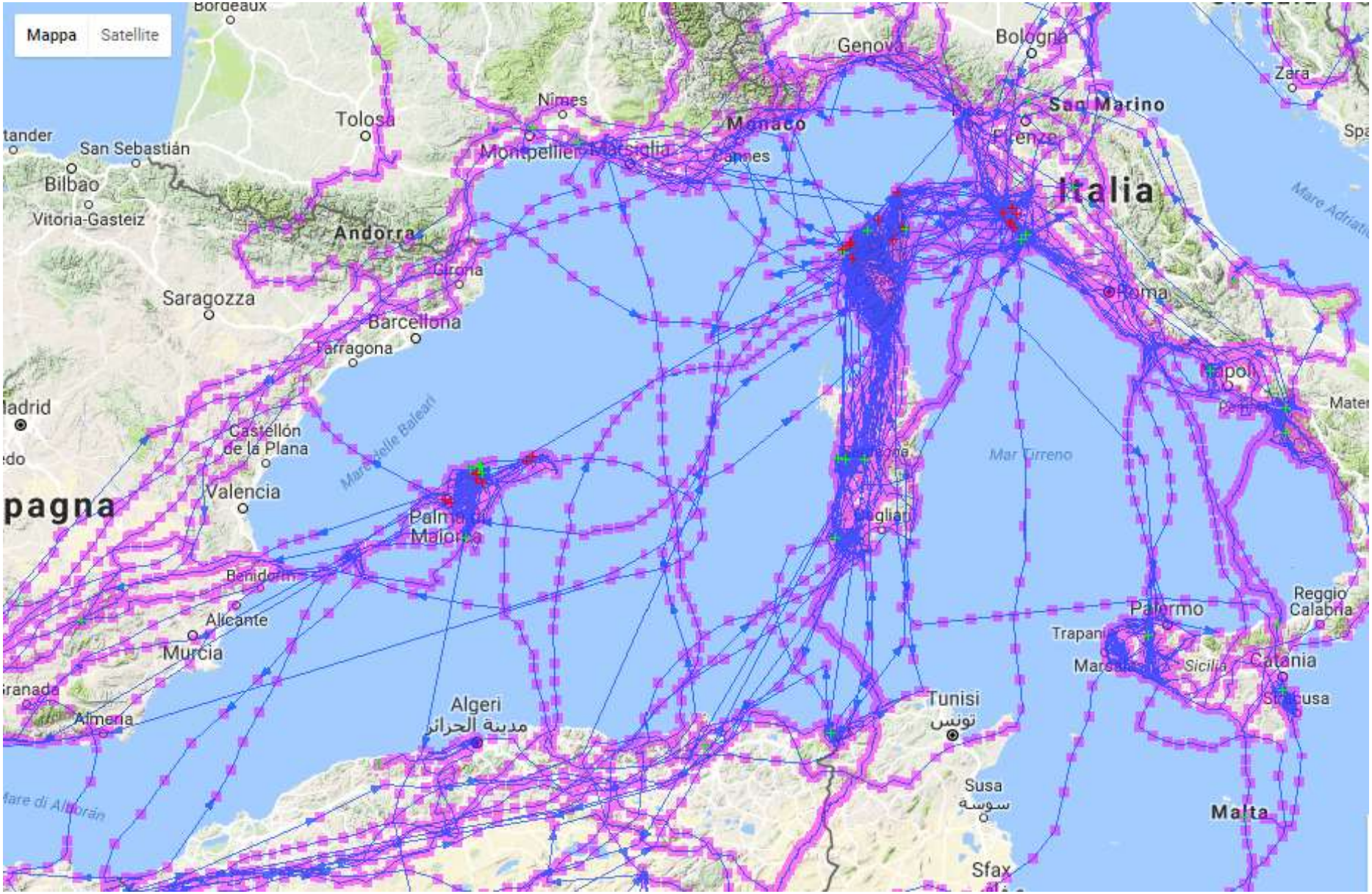
- Total migration speed was **2.4** times slower for LDM;

- Difference in total migration speed was due to a greater **use of stopovers** (both in number of stop-overs and duration of stay at stopover) by LDMs compared to SDMs.

Step 4: The use of thermals at sea



How do they fly over the sea ??



Weak

Sea-crossing propensity

Strong

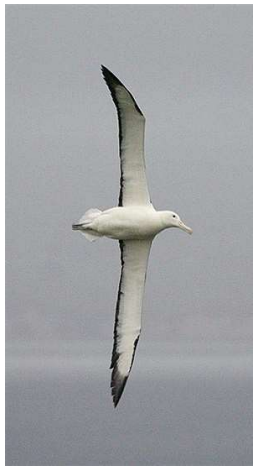
Griffon vulture

Short-toed eagle

Osprey

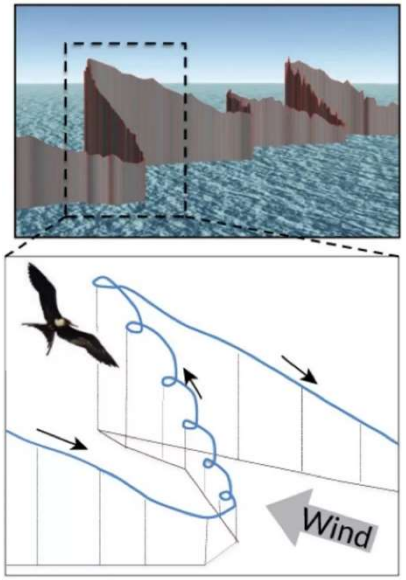
Yellow-legged gull

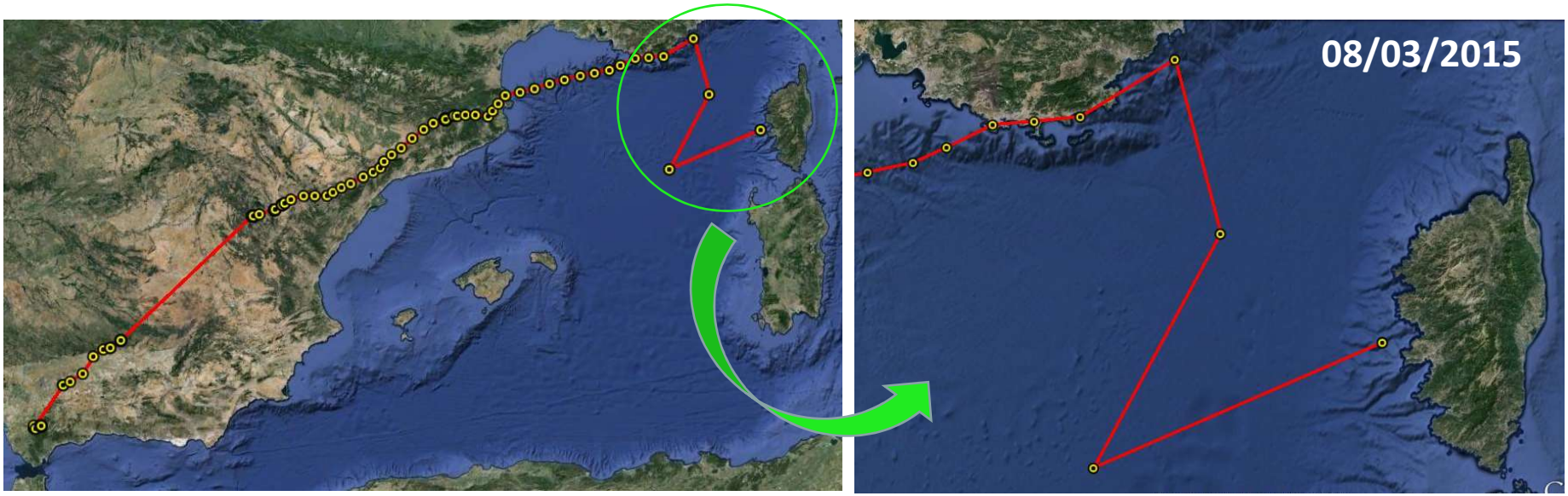
Frigatebird



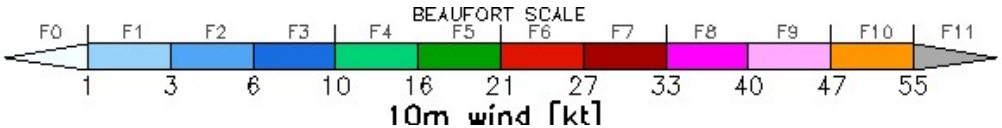
Albatross

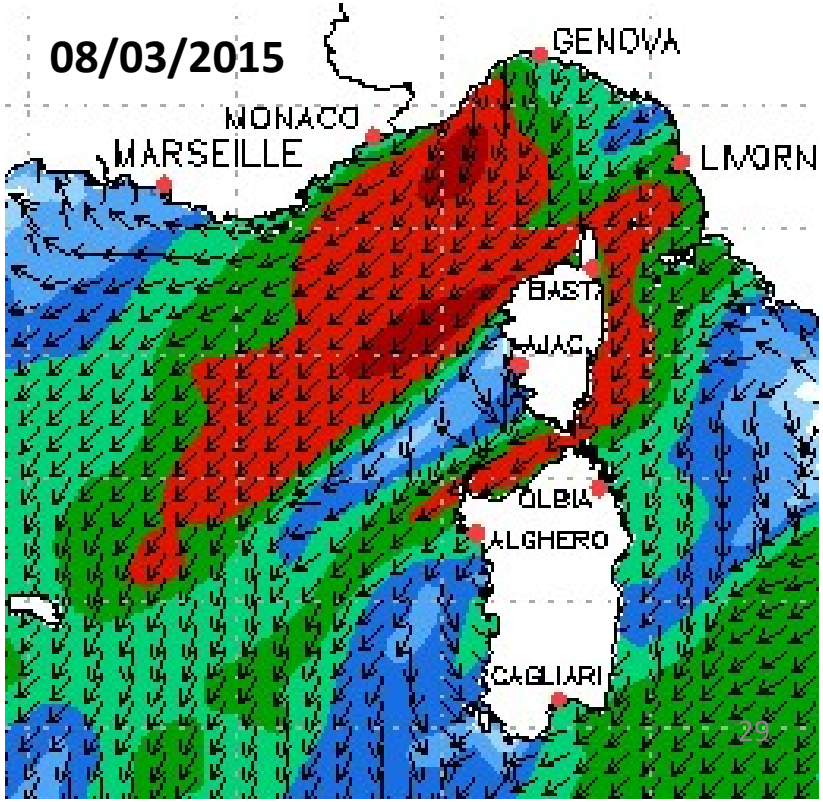
Dynamic soaring



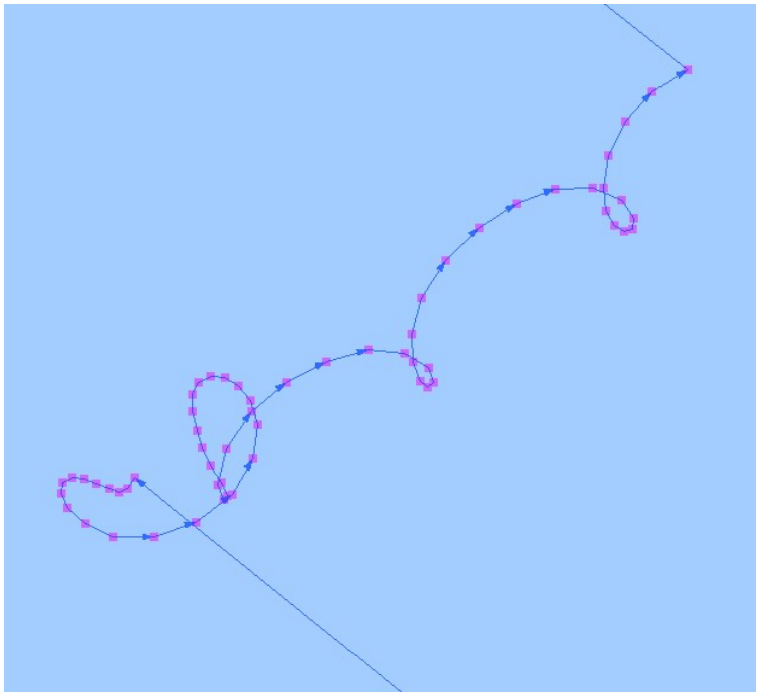


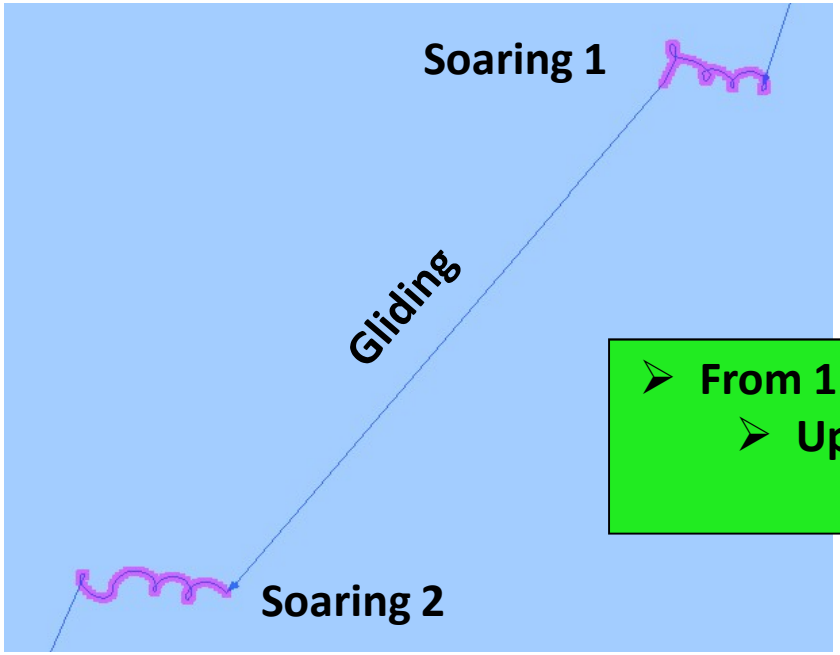
Fosp06 spring migration 2015





Ornitela





- From 1 fix per hour to 1 fix every 5 minutes
- Up to 60 fixes per minute (bursts)
- Bursts every 5 minutes

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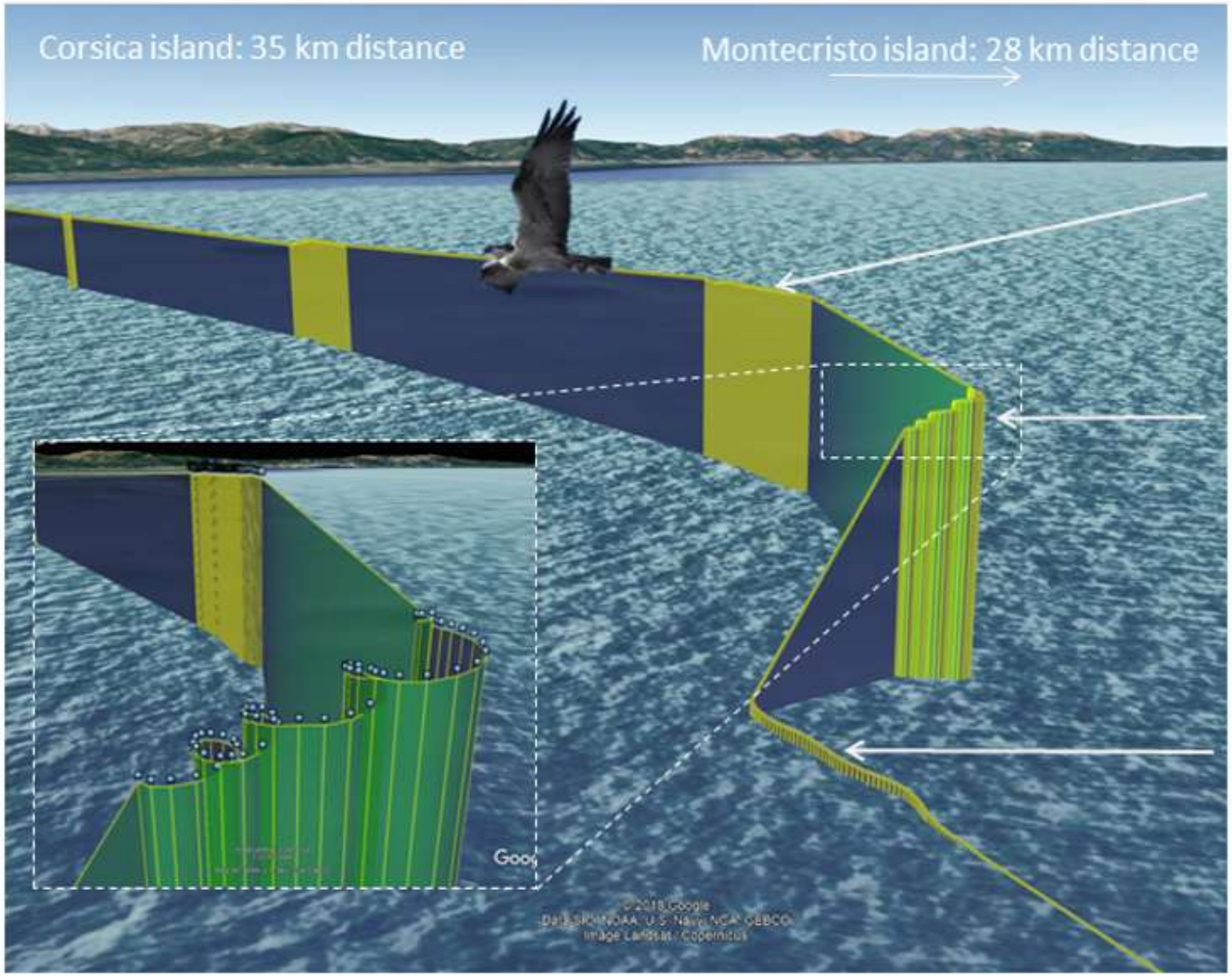
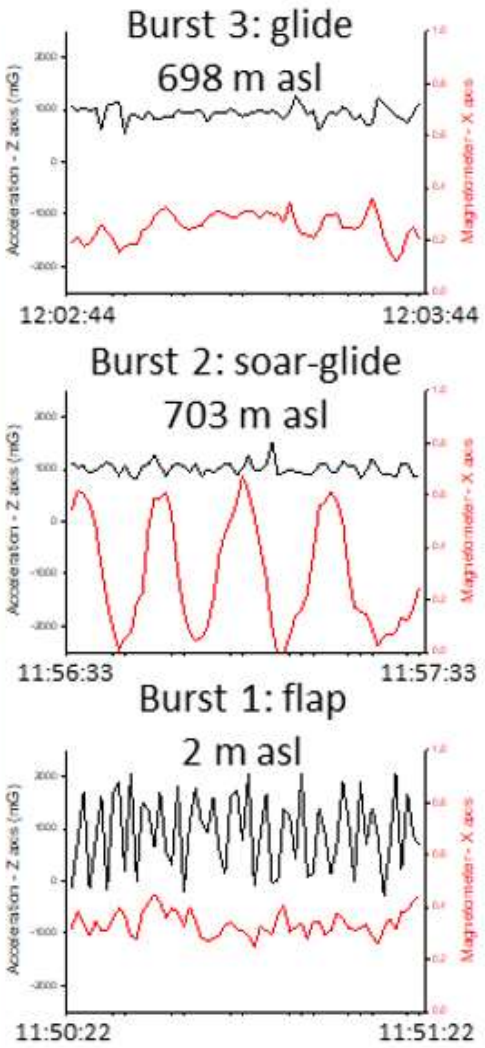
Lyon 1

Migrating ospreys use thermal uplift over the open sea





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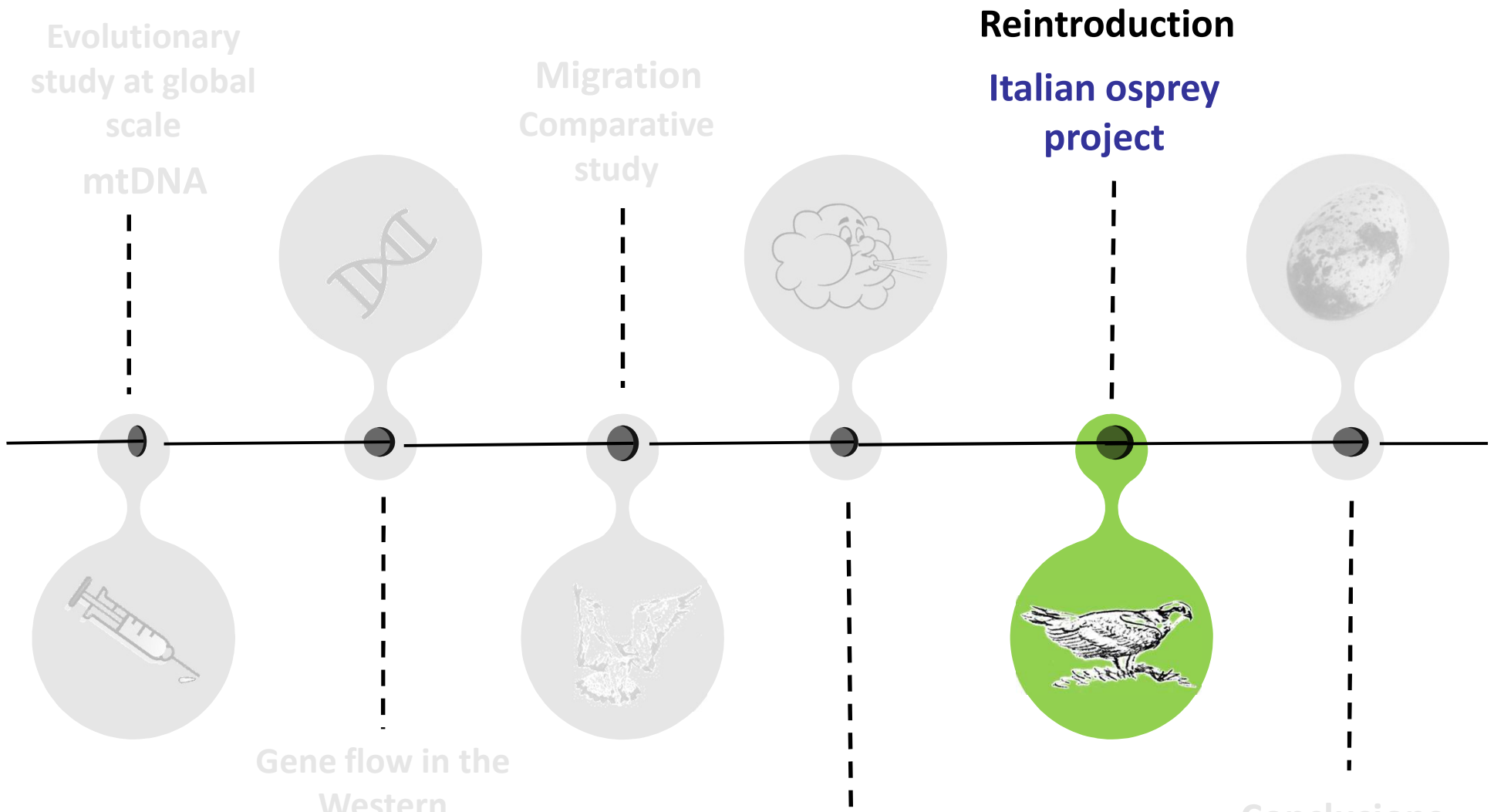
Lyon 1

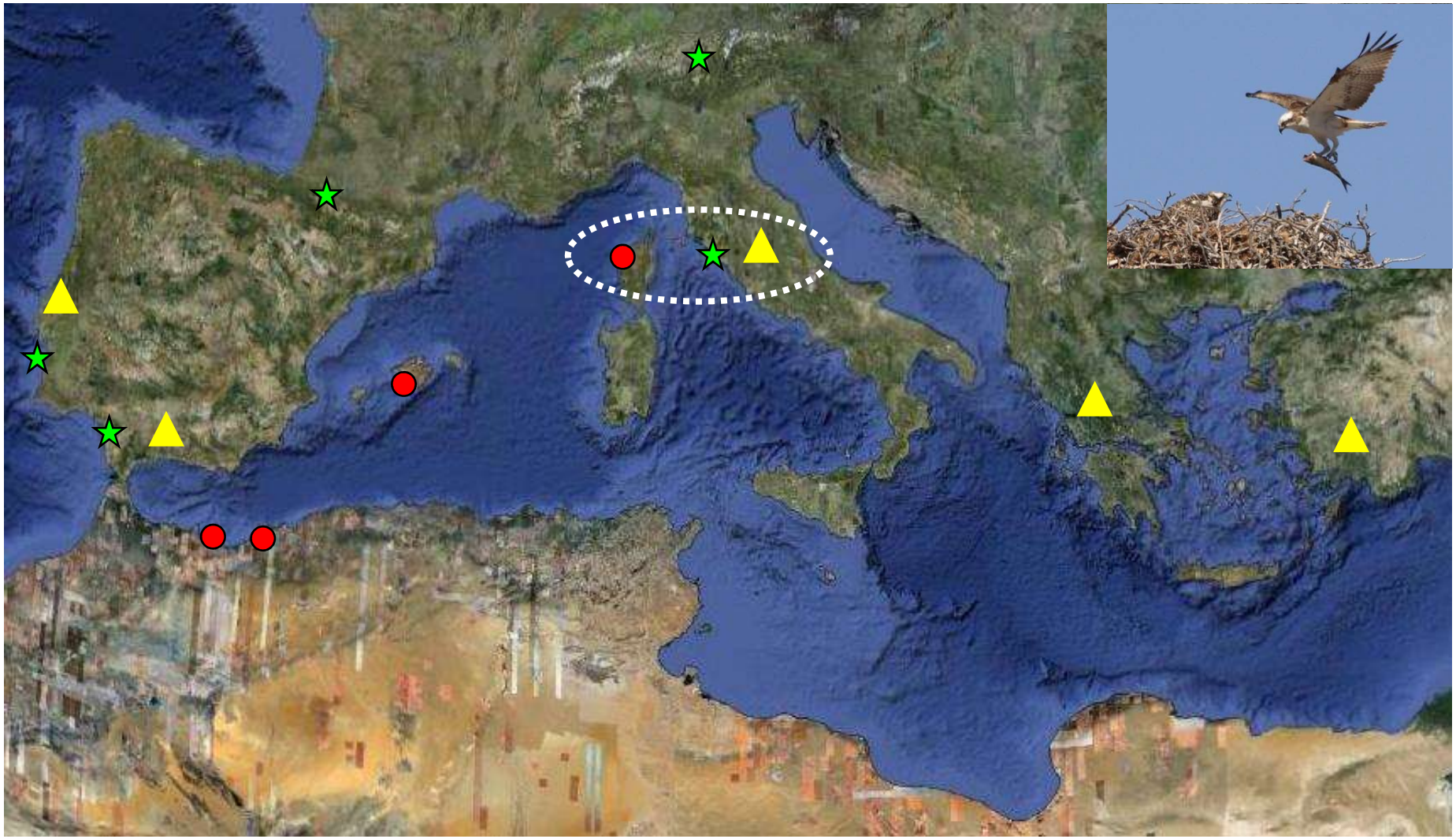
BIOLOGY LETTERS

(Duriez et al., 2018 – Biology Letters)

Step 5: The Osprey reintroduction in Italy



Osprey status and conservation in the Mediterranean region



Vulnerable at regional scale

Less than 100 breeding pairs

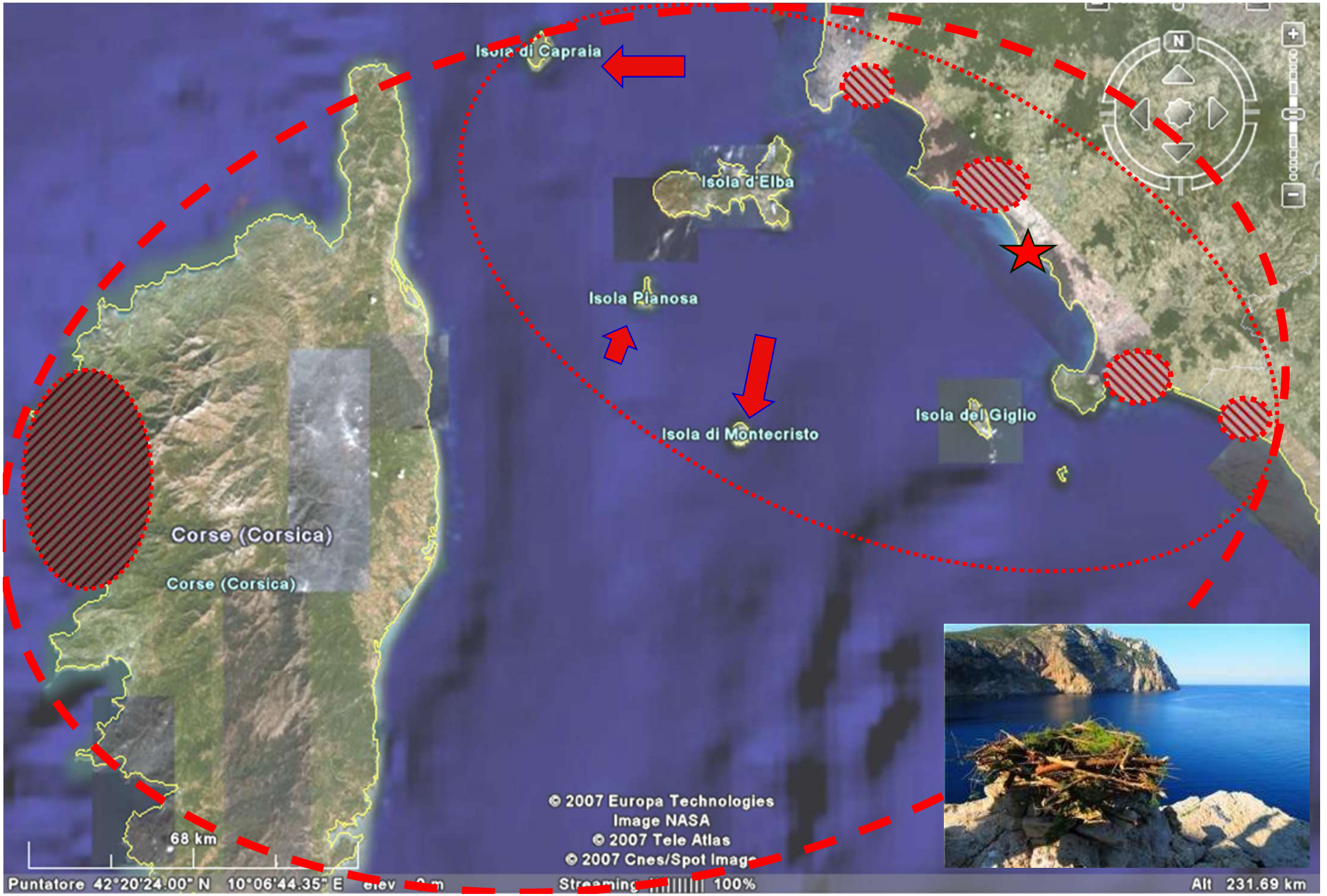
Several reintroduction projects

Breeding sites

Recent extintion events

Reintroduction projects

The Corsican-Tuscan complex



Italian Osprey project

Maremma Regional Park – Corsica Regional Park

RE-ESTABLISHING AN OSPREY BREEDING POPULATION IN THE COASTAL TUSCANY

Parc naturel régional de Corse
Parcu di Corsica

2 Phases

PARCO REGIONALE DELLA MAREMMA

A

ENCOURAGE THE NATURAL RECOLONIZATION

- artificial nests;
- osprey models.

B

TRASLOCATION

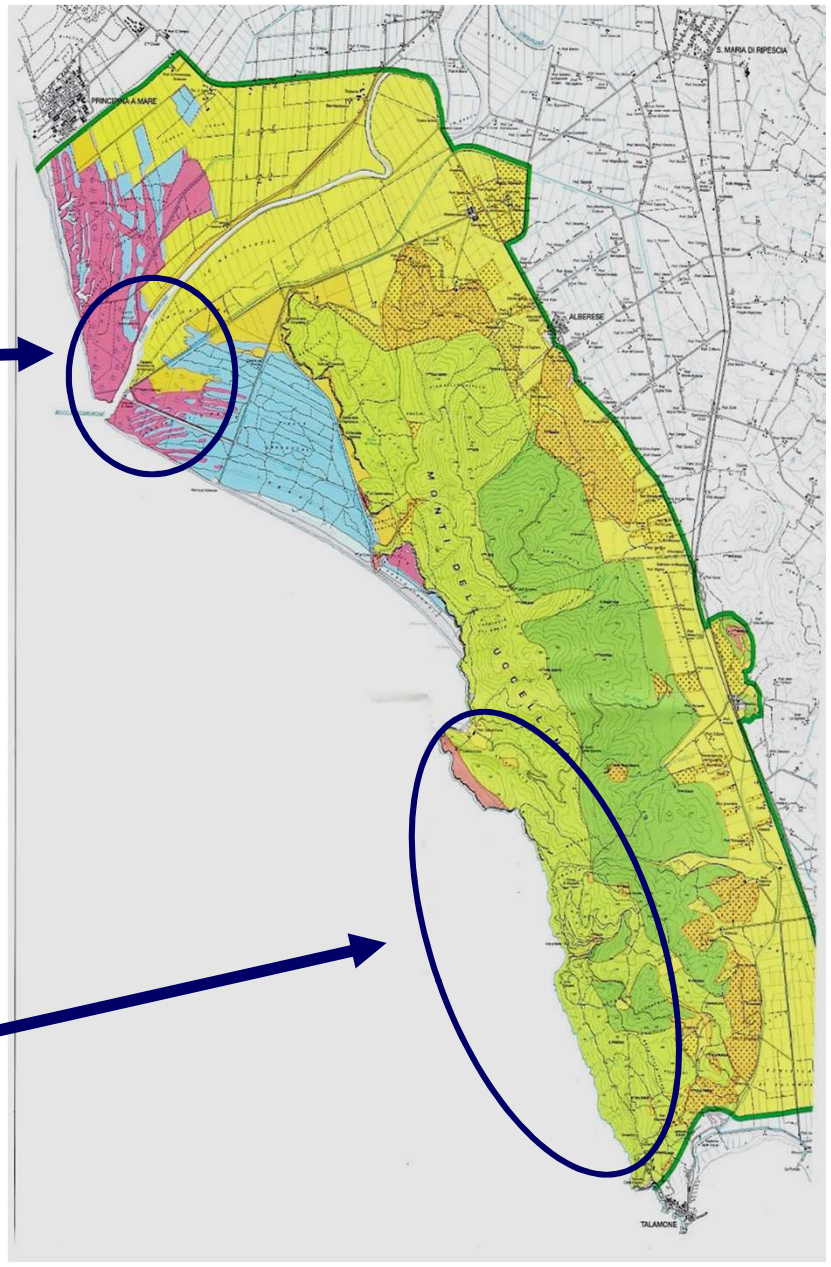
“HACKING TECHNIQUE”

- capture of chicks in the wild;
- permanence in a release pen;
- release;
- monitoring.

Ombrone river

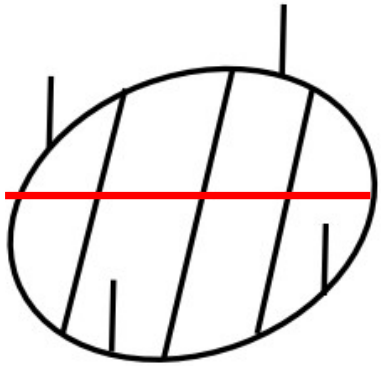
Phase A

Rocky coast



Maremma Regional Park: locations of artificial nests

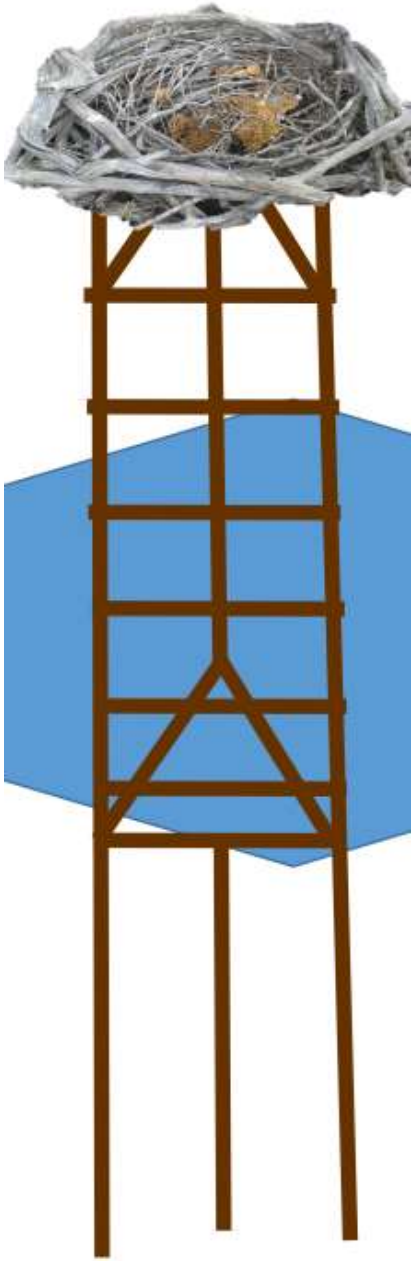
Steps to follow for the artificial nests construction

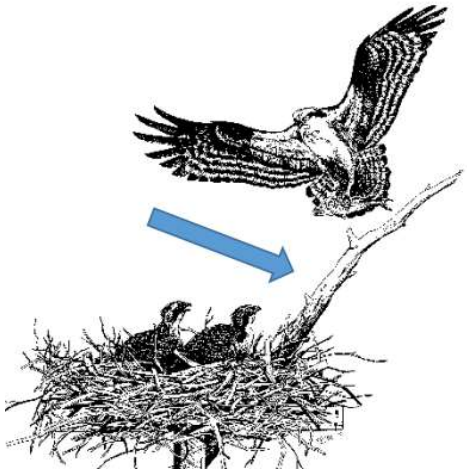


Iron structure as base of the nest (1,20 m diameter)

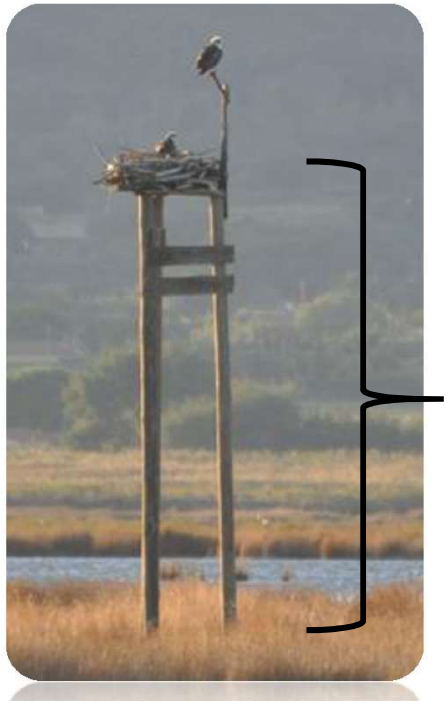
Tree branches of *Pinus maritimus* or *Juniperus oxycedrus*

Filled internally with lining material *Posidonia oceanica*





Nest provided of a long branch to be used as a perch by the male osprey



9-12 m high

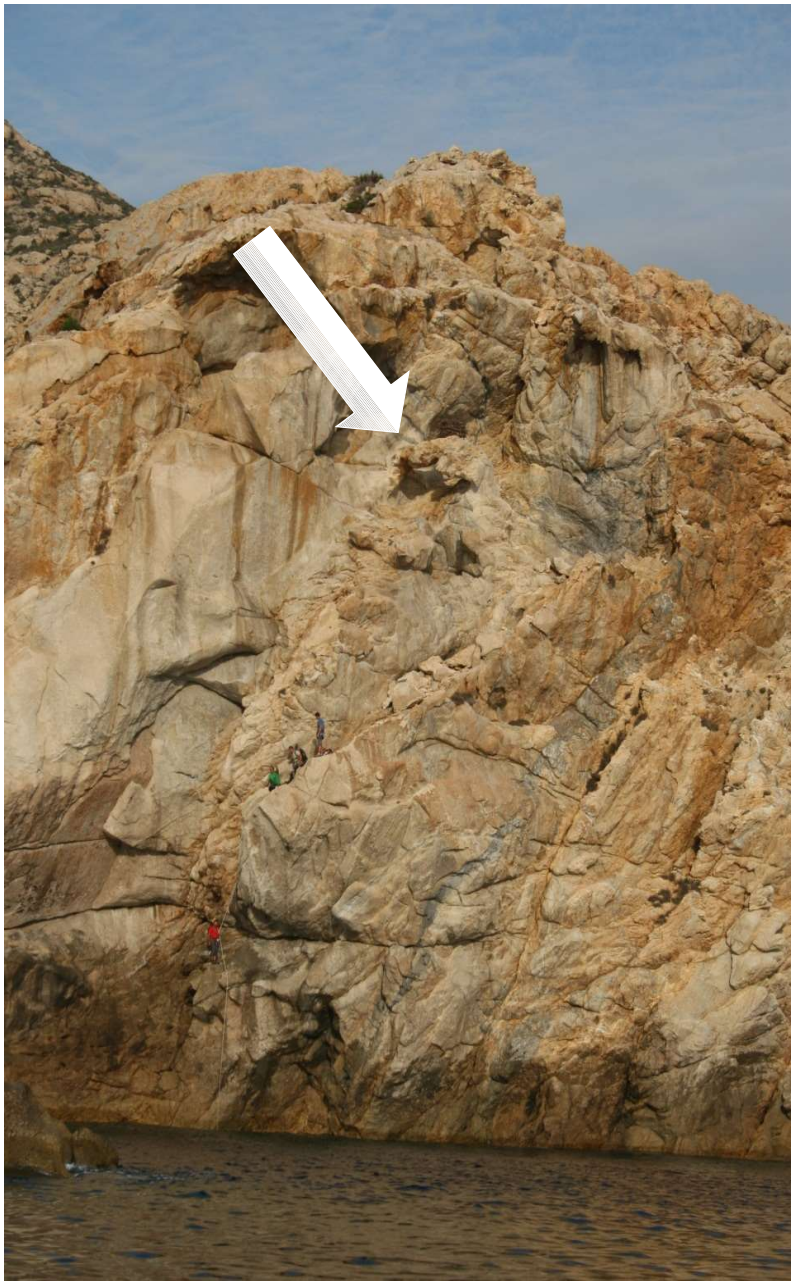
-eventually install ladder/rung to facilitate the climbing in the last 5 m

Phases of artificial nests installation on the field

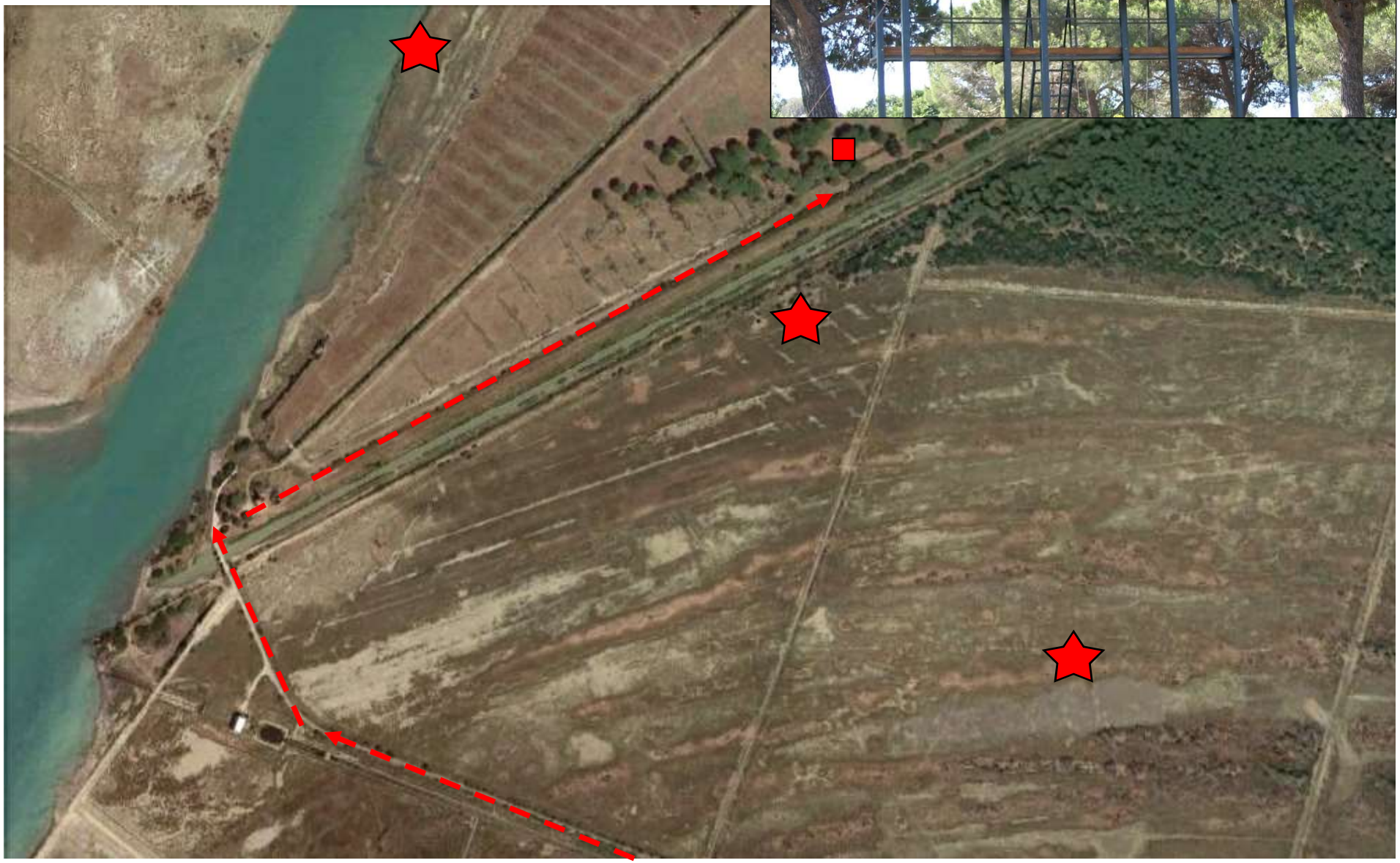
Artificial nests were irregularly occupied by passing-by ospreys.

In some cases it happened just a couple of days after nest construction.

Building artificial nests on the islands of the Tuscan Archipelago NP



Release pens were always approached by the rangers, using secondary roads behind the pens to not be visible by ospreys.



- **At arrival main body measurements were taken.**
- **Blood and feathers sampling were carried out for genetic sex determination.**
- **Artificial feeding (fresh fish) was provided before putting the birds in the release pens.**
- **Each young osprey was fitted with rings and a tail-mounted VHF transmitter.**

(Monti et al., 2014 - *Bird Study*)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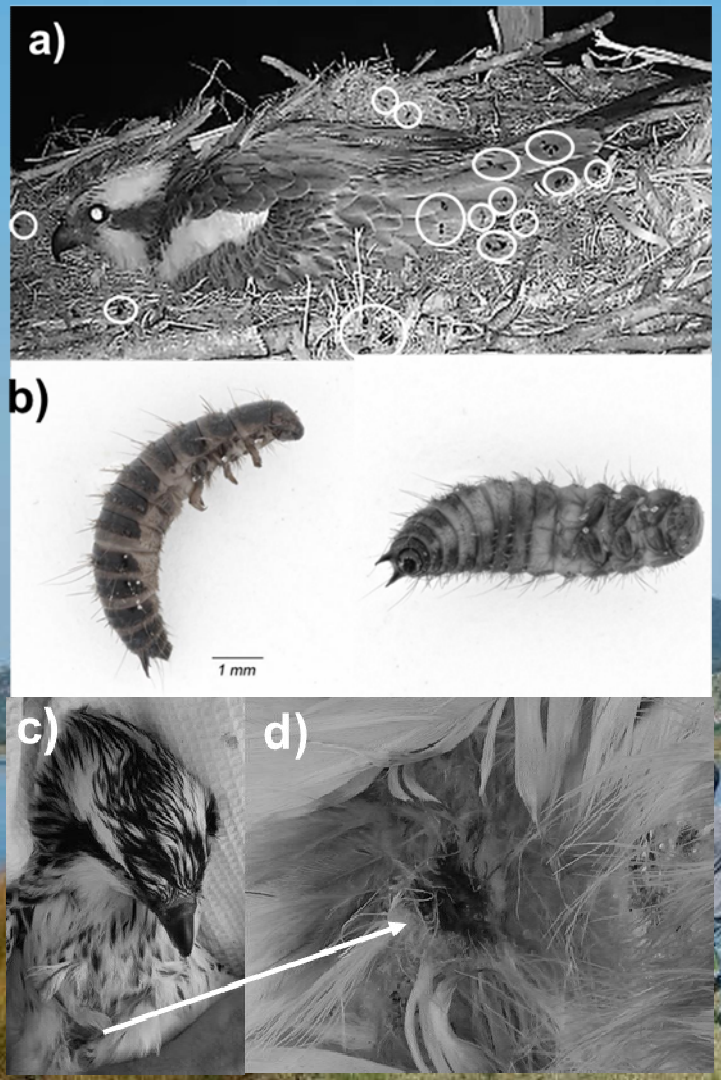
Twelve years of Osprey Project in a Nutshell

- ✓ 12 years of activity (2006-2018)
- ✓ 33 juveniles were translocated (2006-2010)
- ✓ First reproduction in 2011
- ✓ 4 breeding pairs in 3 different wetlands
- ✓ 17 breeding events
- ✓ 37 eggs laid
- ✓ 33 wild chicks fledged

PARCO REGIONALE DELLA MAREMMA

Example of a «smart» artificial nest for the osprey

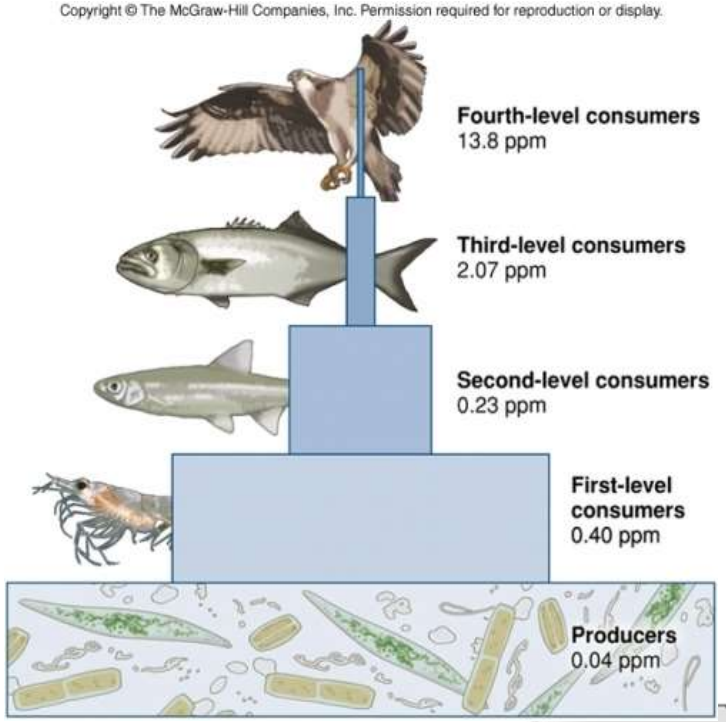


Web camera

Solar panels

Monti et al., 2019 - Journal of Raptor Research

First survey on heavy metals concentrations in Mediterranean Osprey eggs.



- ***One of the most polluted region worldwide***
- ***Vulnerable population / Peculiar ecology***
- ***Historical demographic decreases***
- ***Absence of detailed studies for the species***

- **35 Unhatched eggs collected**
- **3 Sites around the Mediterranean**

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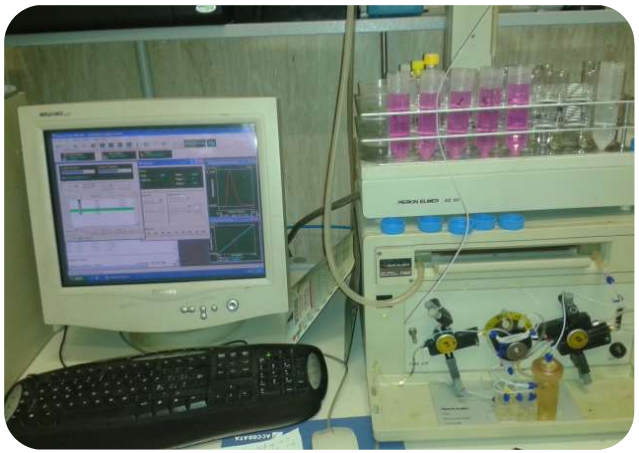
Methods and Lab procedures

❖ Measures

❖ Preparation of samples

❖ Freeze-drying

❖ **Decomposition in acid solutions & high temperatures**



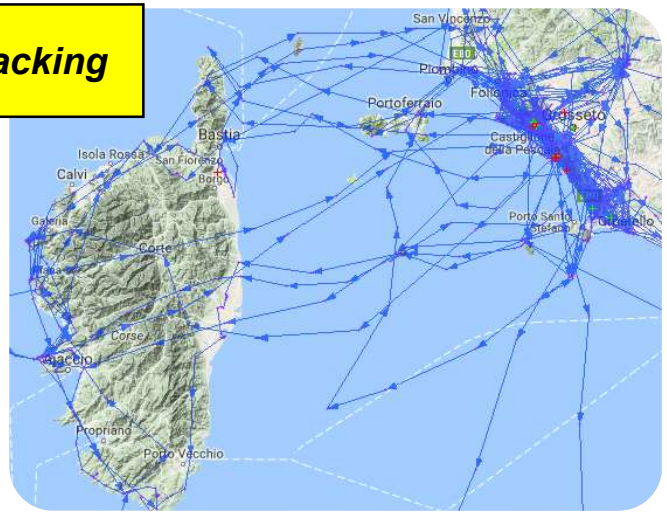
Other Pollutants from samples collected in target areas

- **Ocs - Organochlorine compounds**

*PCDDs
*PCDFs
*PCBs
*DDTs

- **Dioxin**
- **Flame retardants**
- **PFCs - perfluorinated compounds**
- **PAH - polycyclic aromatic hydrocarbons**

GPS tracking



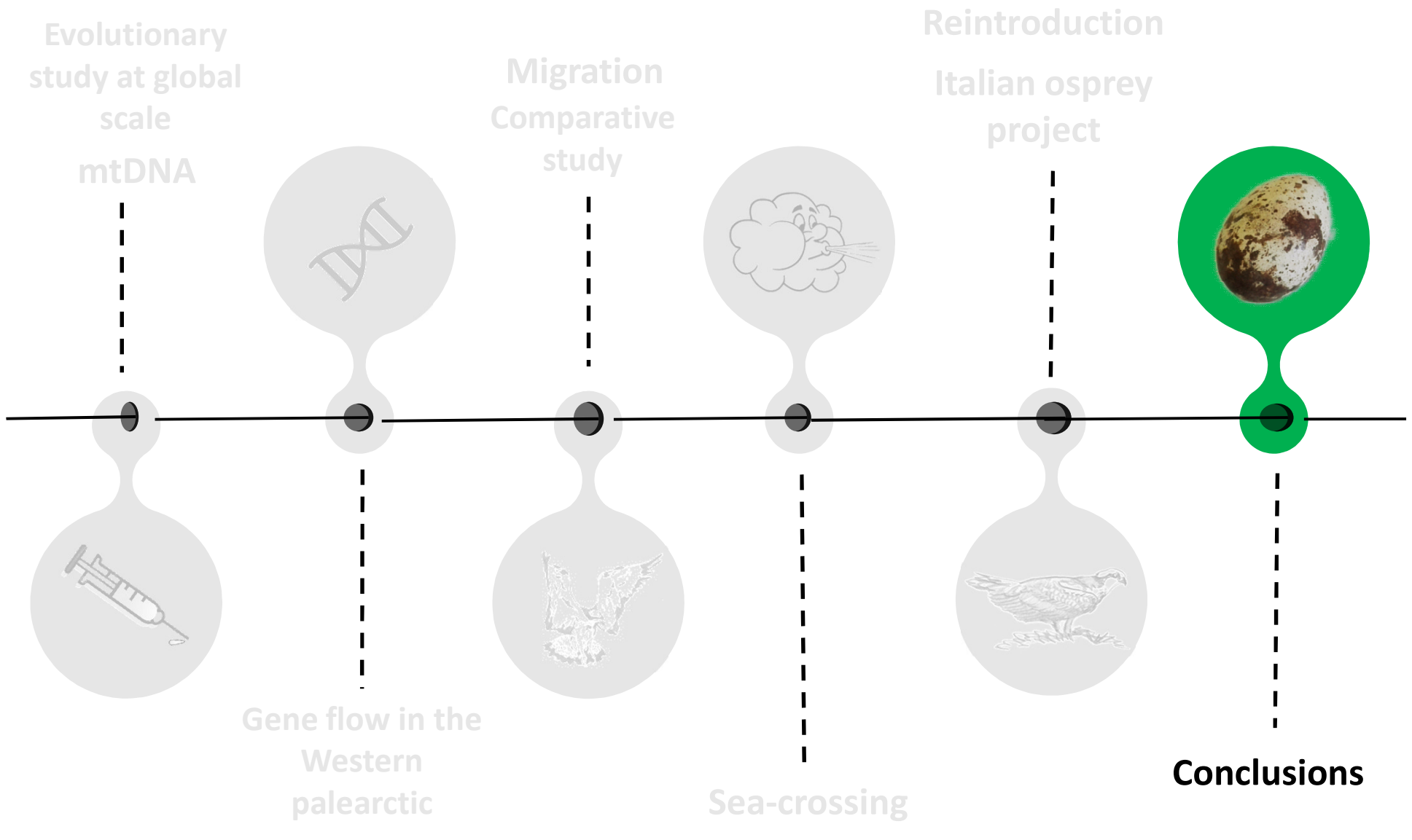
Information on location where contaminants were absorbed

Dead birds
(body retrieved)

Blood samples
(ringing campaigns)

Fish samples
(target areas)

Step 6: Conclusions



What we have discovered…

- Four distinct evolutionary clades at global scale
- Two distinct sub-units in the WP (NE vs Med)
- Different migration strategies (LDM vs SDM)
- Thermal uplift at sea: the osprey exception?
- Medit Osprey populations deserve particular attention

Towards a scientific-oriented conservation approach

- ✓ Respect genetic differences at the right scale
- ✓ Source pop belonging to the same M.U.
- ✓ Respect migratory flyways when planning translocations.
- ✓ Promote population connectivity
- ✓ Monitoring studies at the population level


Thank you for your attention…
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CENTRE D'ECOLOGIE FONCTIONNELLE & EVOLUTIVE
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Parcu di Corsica
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FONDATION PRINCE ALBERT II DE MONACO


Questions ?