

Prioritizing areas for the conservation of tropical seabirds in Cuba under current and future development plans



Antonio Garcia-Quintas
Adrien Brunel
Christophe Barbraud
Dennis Denis
Jérémy Omer
Sophie Lanco Bertrand



Centre d'Études
Biologiques de
Chizé



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Introduction



Seabirds

- Essential components of marine ecosystems
- Ecosystem sentinels (alterations, pollution, disturbance)
- Patrimonial species
- Touristic attraction



Barret *et al.* (2007)
Gaglio (2017)
Cherel *et al.* (2018)

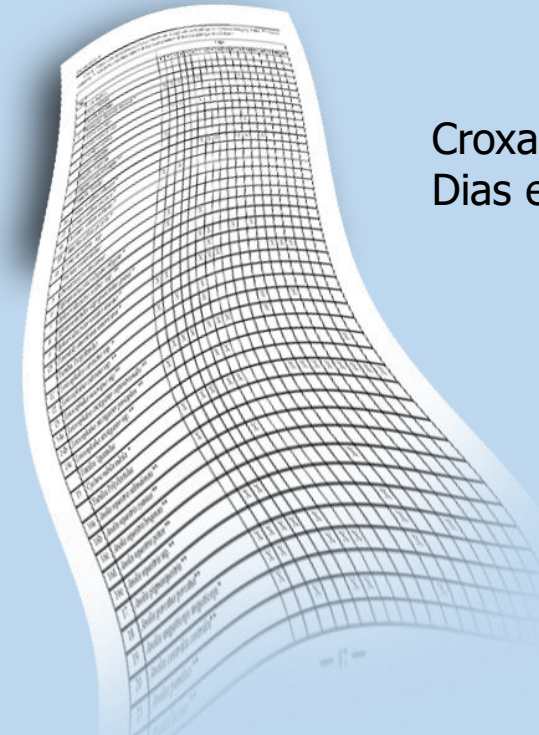
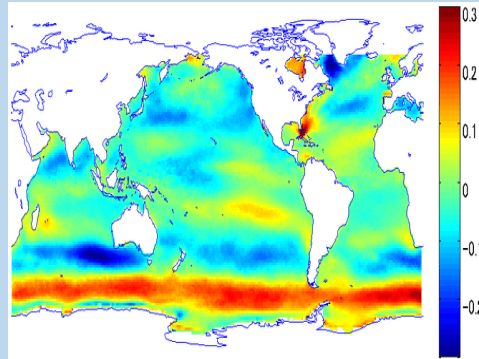
Introduction



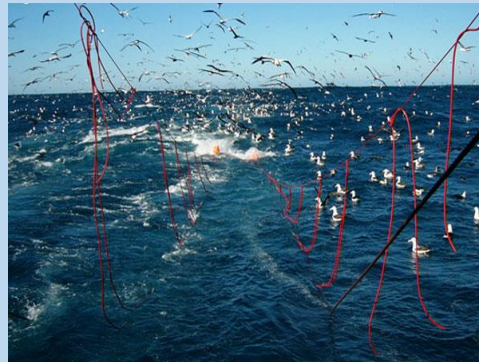
Seabirds



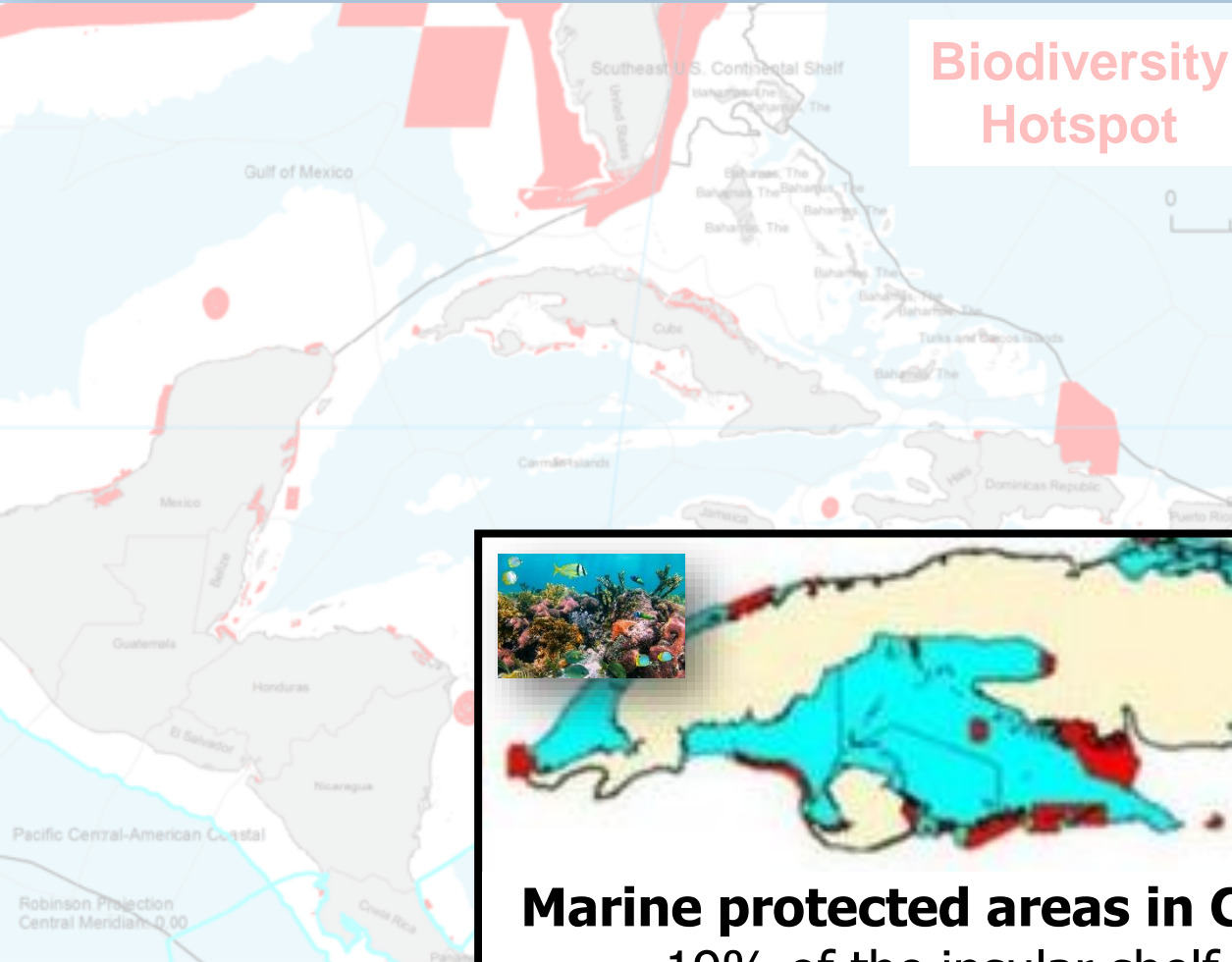
Among the most threatened groups of birds in the world



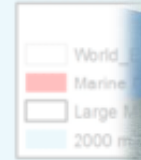
Croxall et al. (2012)
Dias et al. (2019)



Introduction



Biodiversity Hotspot



Human disturbance



Marine protected areas in Cuba:
19% of the insular shelf

Gerhartz-Muro et al. (2018)
Perera et al. (2018)

Protection

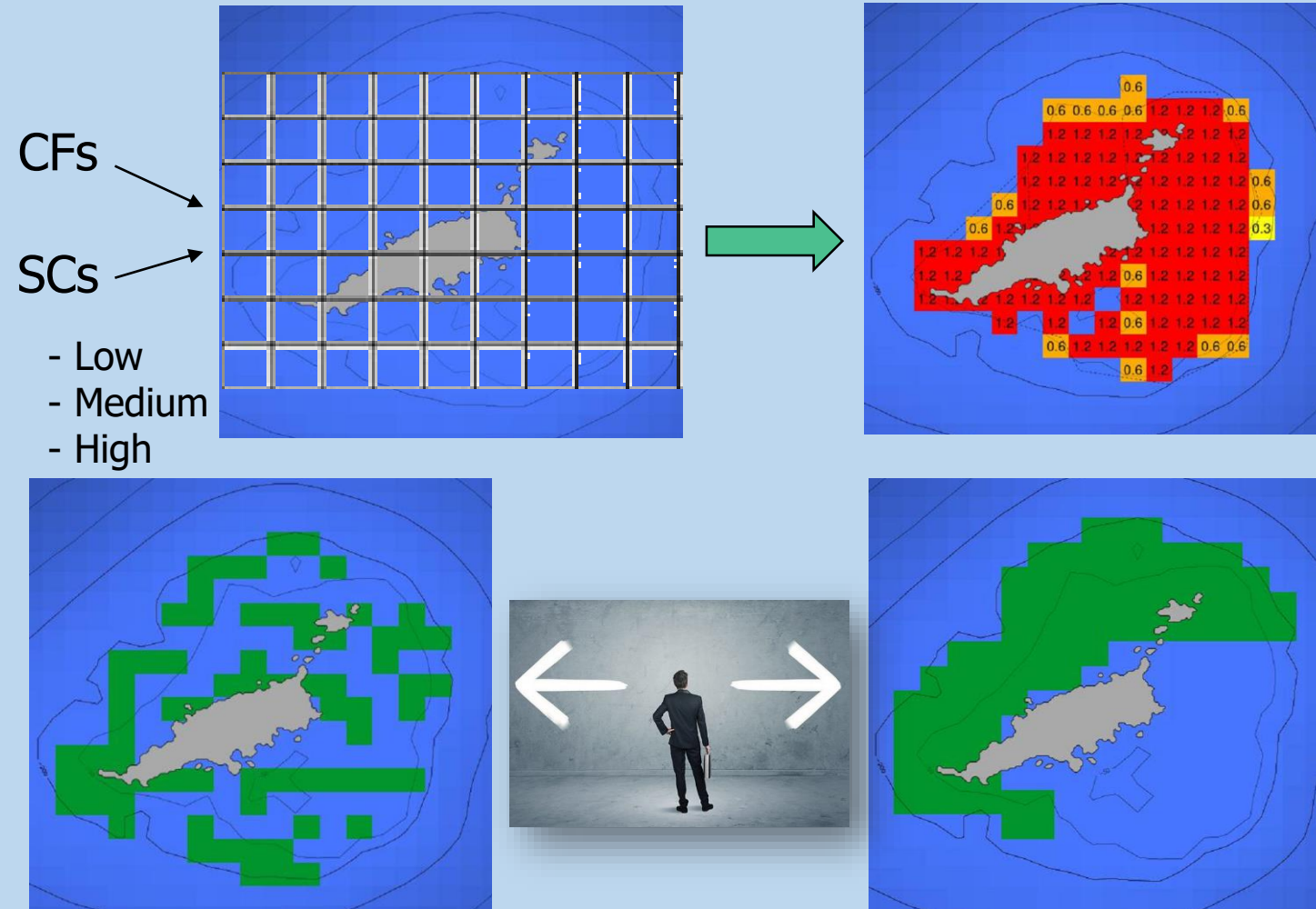
Objectives

- 1) Identify areas for the conservation of breeding habitats of Laridae in Cuba considering several scenarios with current and future human disturbances.
- 2) Compare the coverage of the computed conservation areas with respect to the current system of marine protected areas in Cuba.

Methods

Systematic reserve site selection:

What is the least-cost collection of pixels containing sufficient levels of each CF?



CFs: Conservation features

- Defined targets to conserve for each CF (%)

SCs: Socioeconomic costs

- Assign weight for each SC

$$\text{Global Cost Function} = \sum_{i \in I} SC_i \times \frac{\omega_i}{\sum_{i \in I} \omega_i}$$

$$\text{Global Cost Function} = \sum_{i=1}^n SC_i \times \frac{\omega_i}{\sum_{i=1}^n \omega_i}$$

SC_i = Individual cost

ω = weight

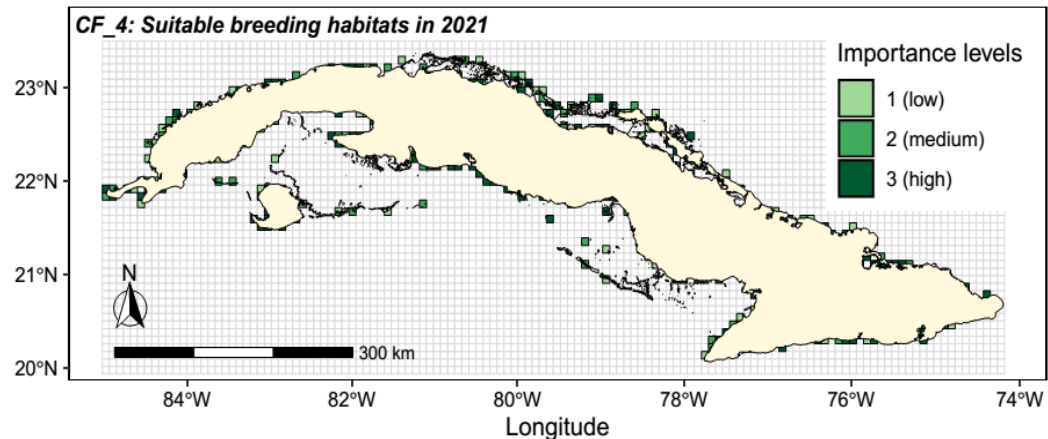
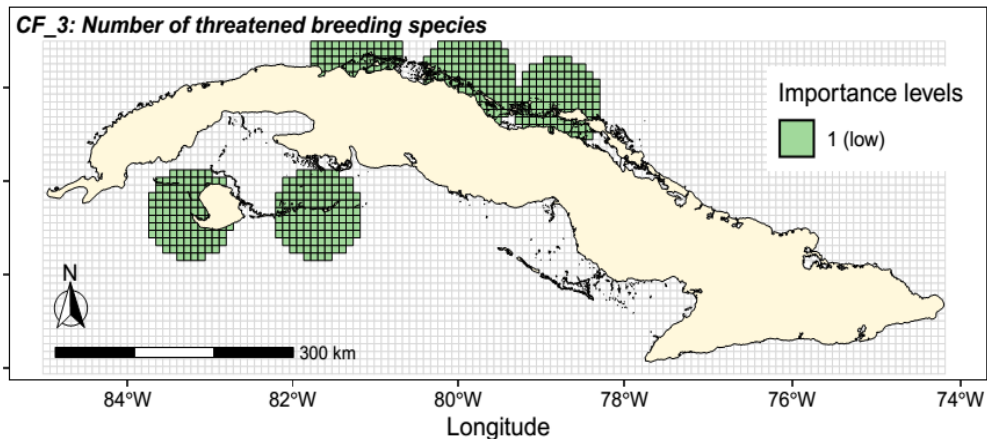
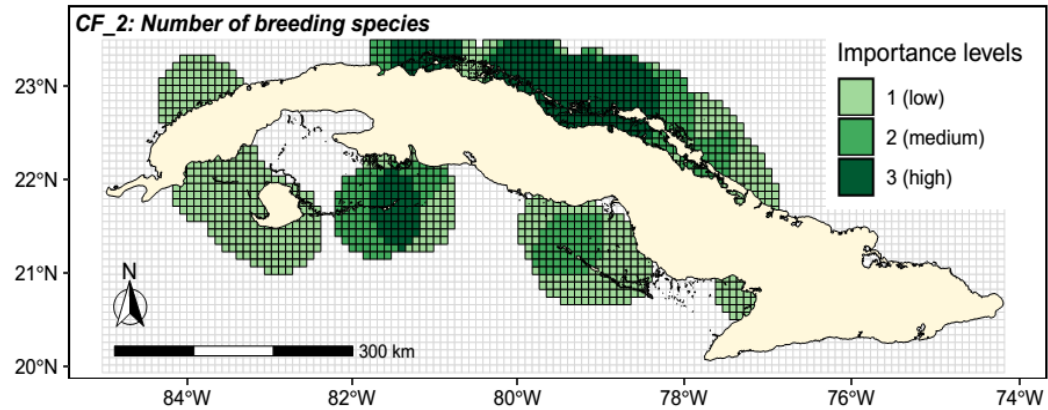
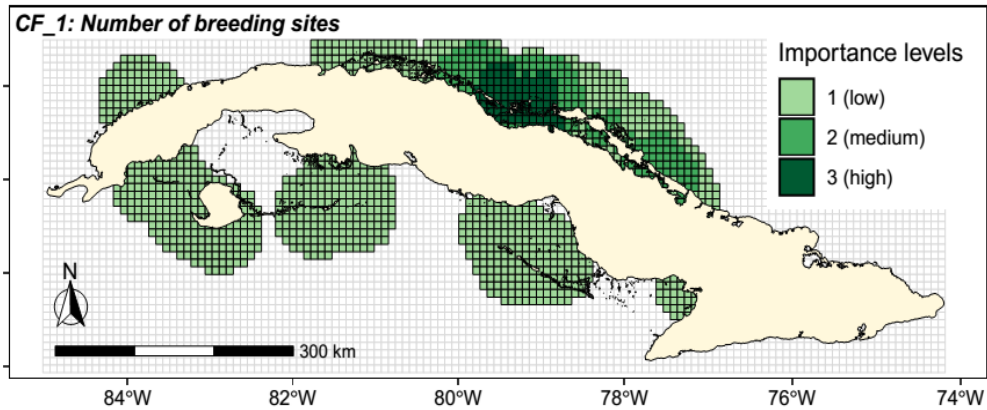
n = number of SCs



Methods

Laridae (gulls, terns and skimmers): The most represented family of Cuban seabirds

Breeding species (9)



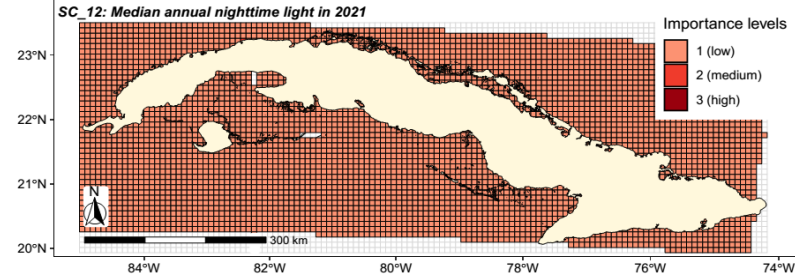
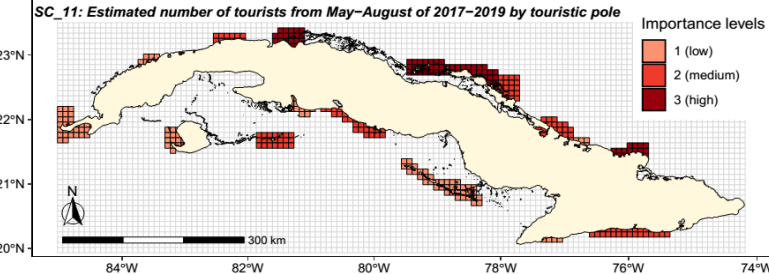
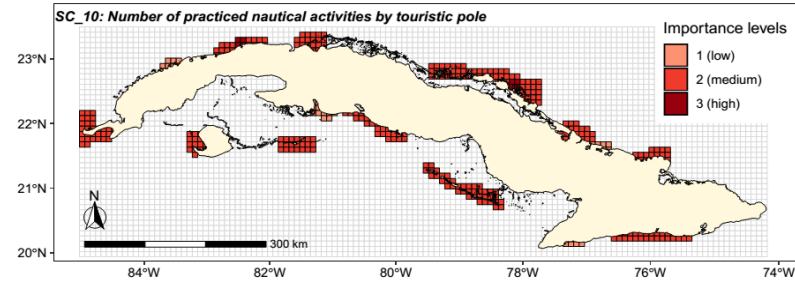
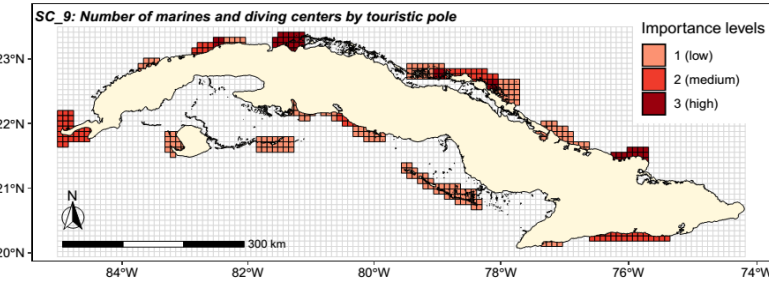
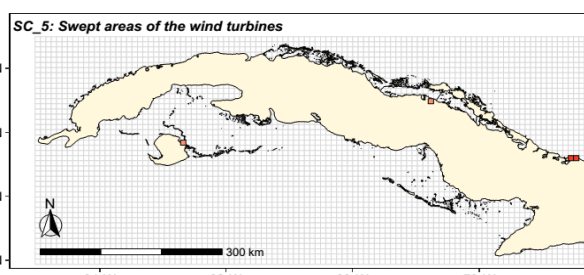
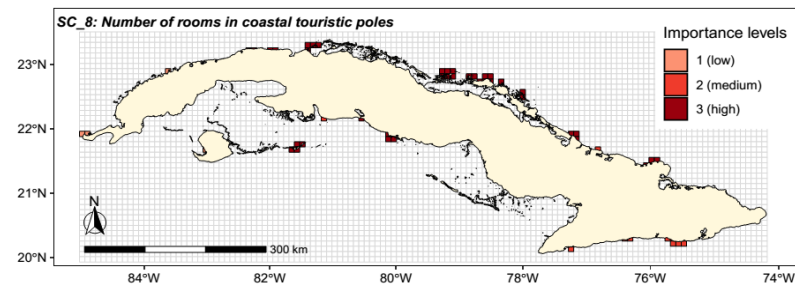
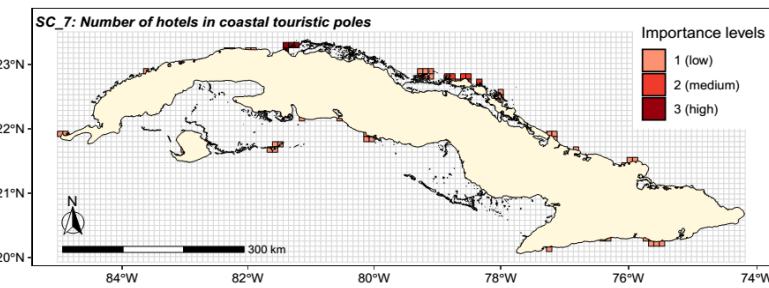
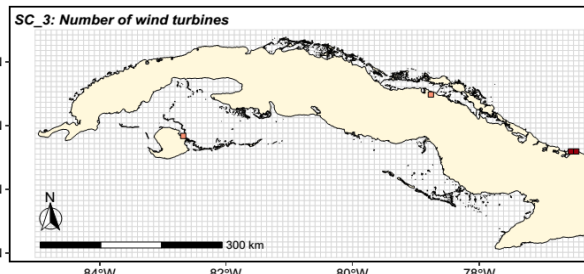
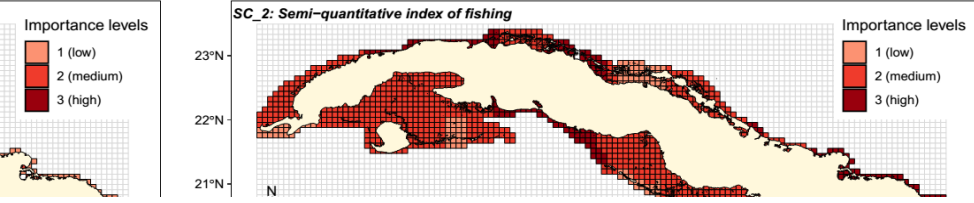
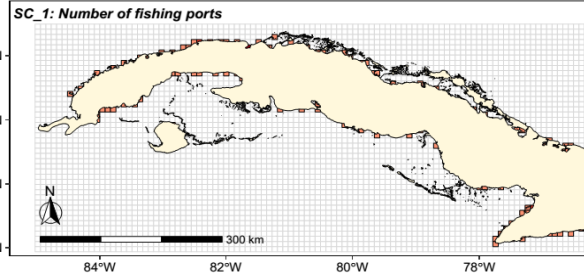
Targets
 50/50/90/50 %
 75/75/90/75 %
 90/90/90/90 %

Methods

Costs scenarios

SCs: Fishing, Wind farms, Tourism (marine-coastal), Light pollution

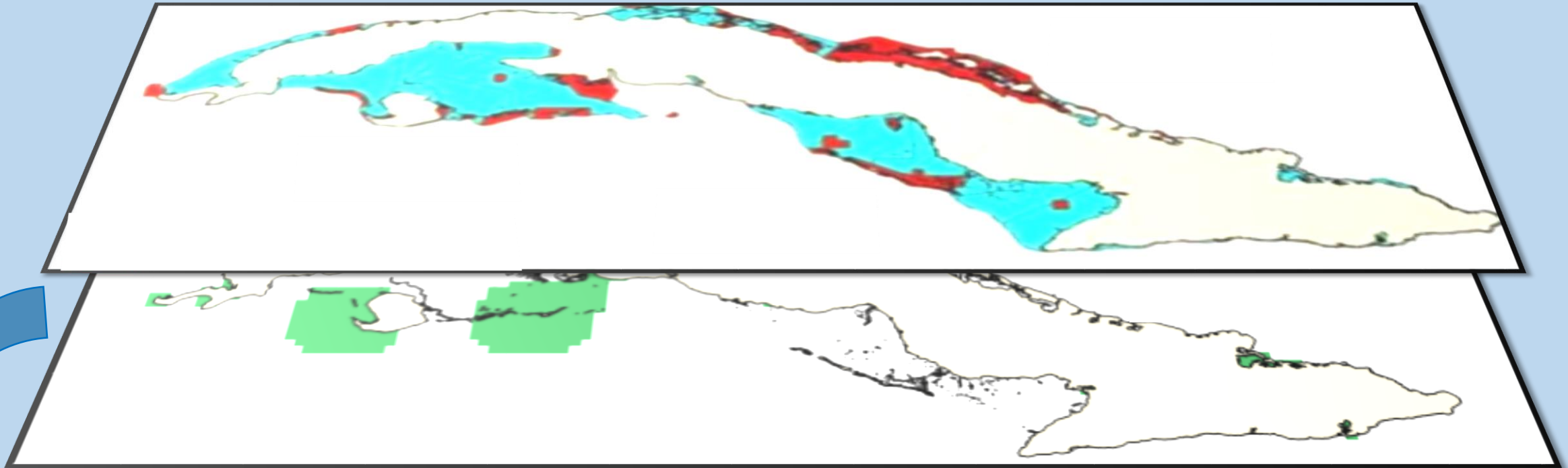
Fishing: 2 / Others: 1
 Wind farms: 2 / Others: 1
 Tourism: 2 / Others: 1
 Light pollution: 2 / Others: 1
 Fishing: 3 / Tourism: 2 / Others: 1
 Fishing: 2 / Tourism: 3 / Others: 1



Costs future scenario
 Wind farms: 2 / Others: 1

Methods

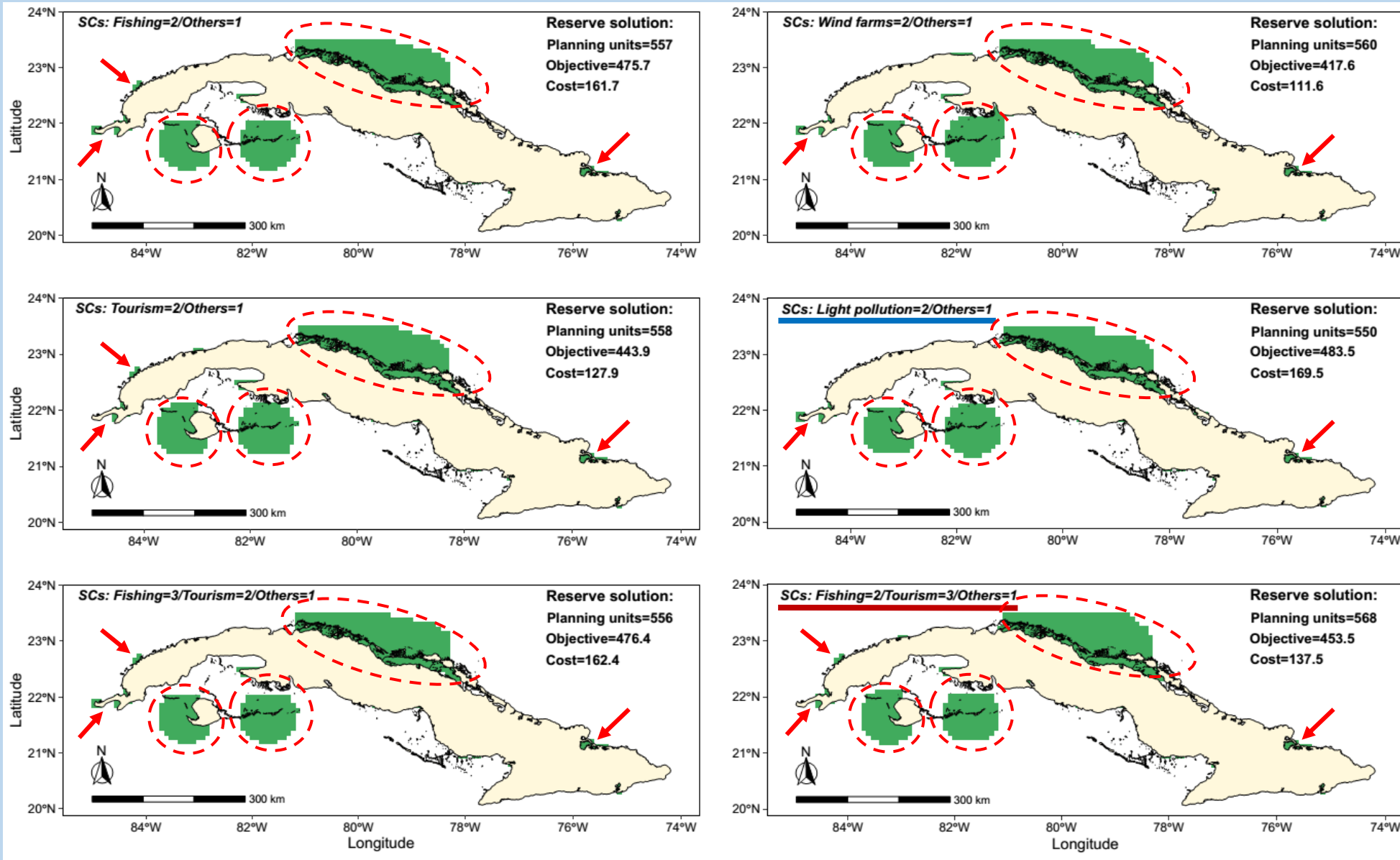
Comparison of each current proposed scenario with the Cuban system of Marine Protected Areas



- Assess the coverage proportion of the Cuban protected marine areas
- Identify conservation needs for colonies according to anthropogenic pressures

Results & Discussion

Current scenarios

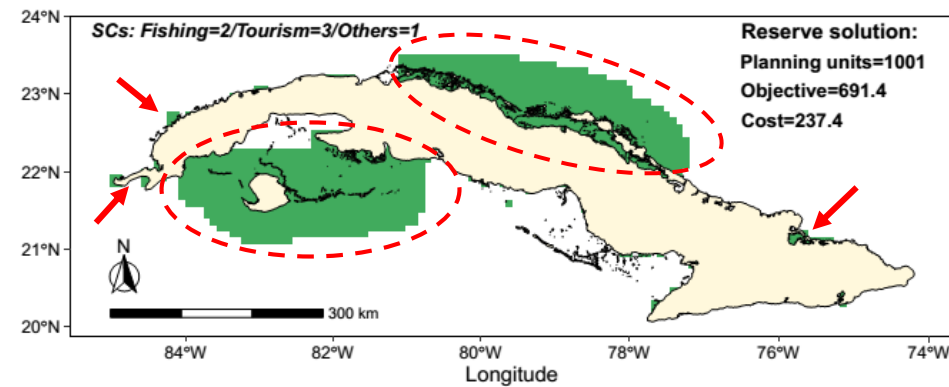
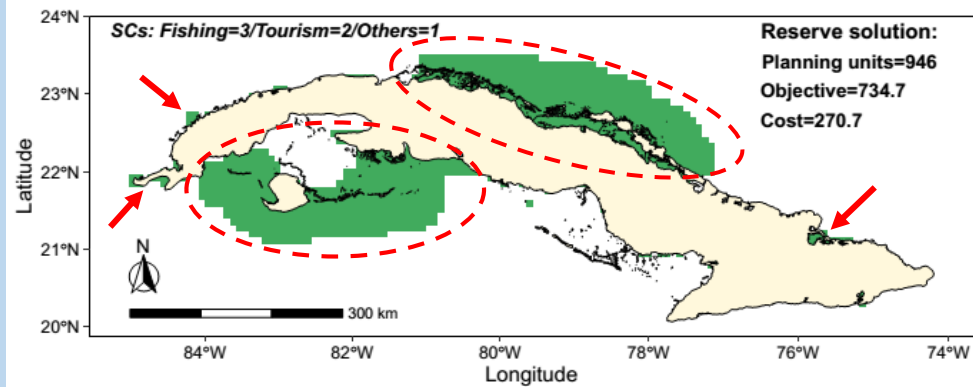
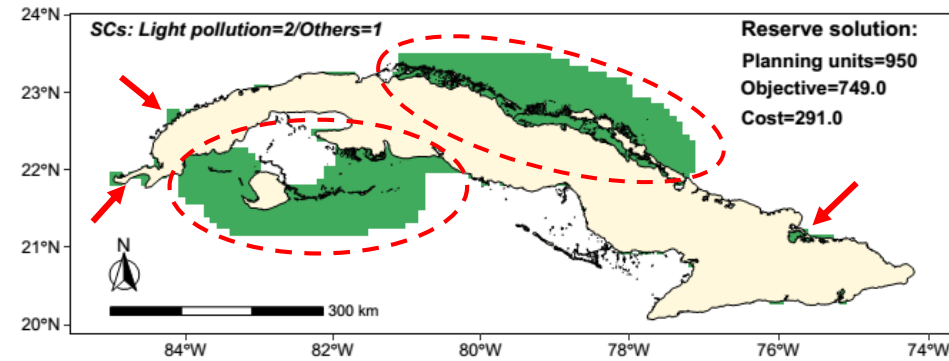
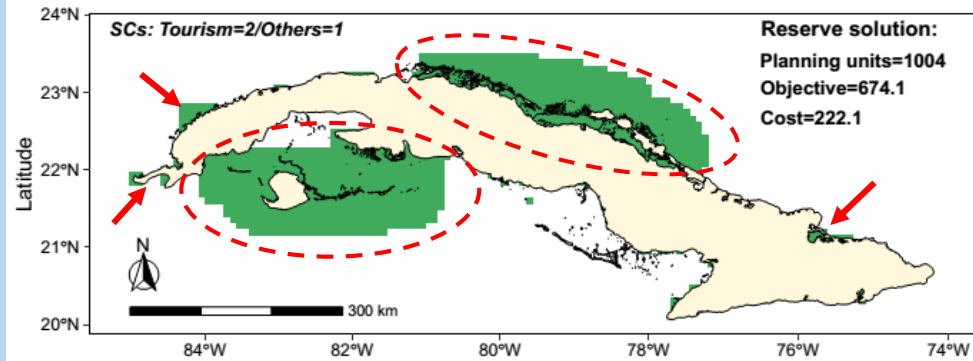
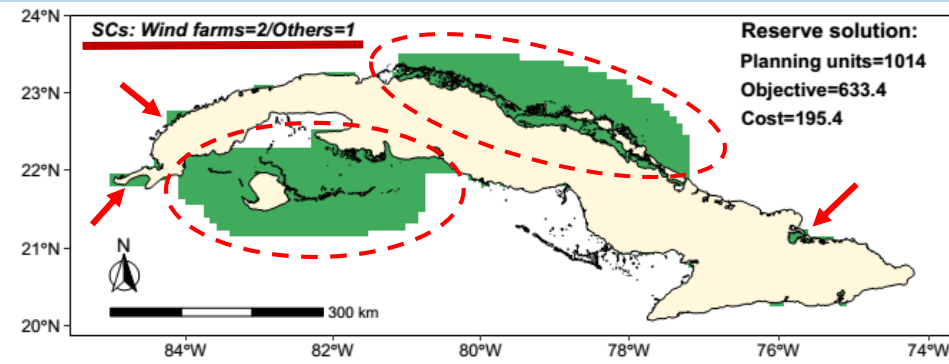
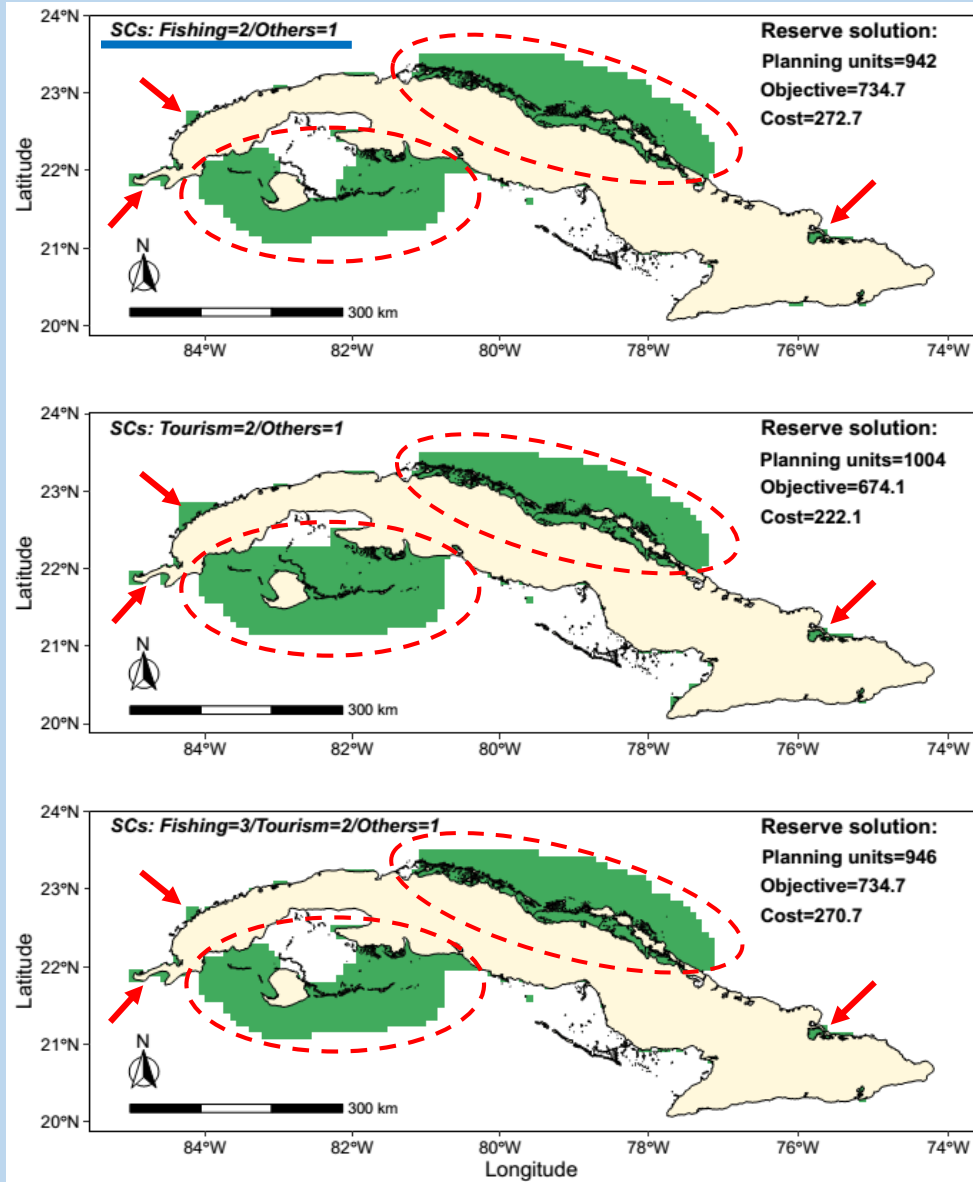


Targets
 50/50/90/50 %

Coverage range:
 44 550 km²
 to
 46 008 km²

Results & Discussion

Current scenarios

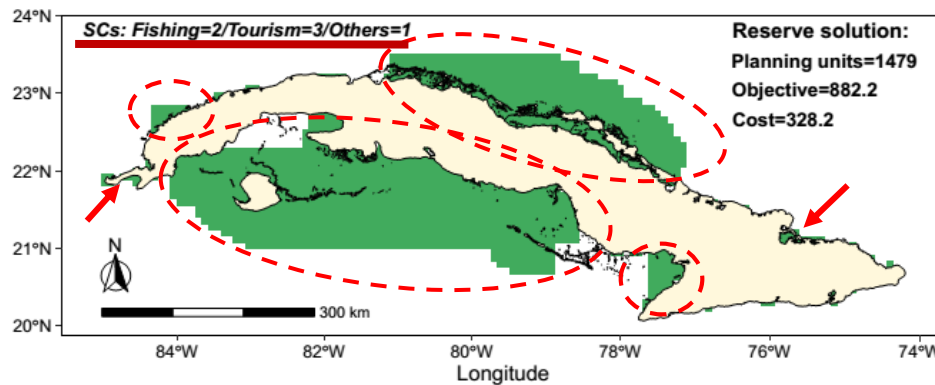
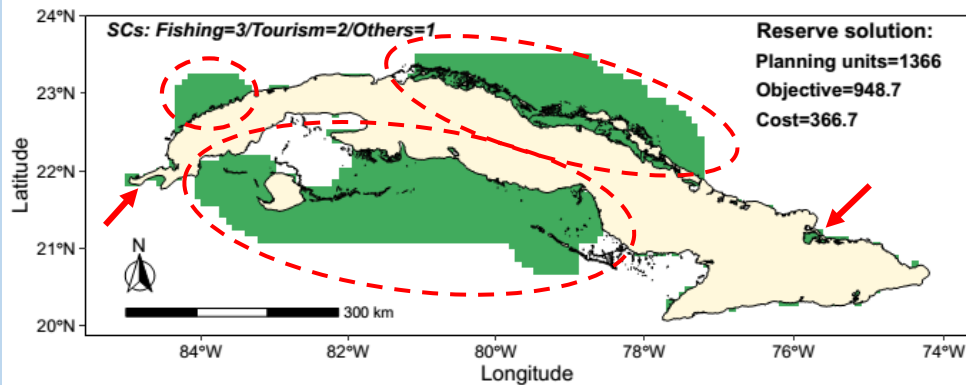
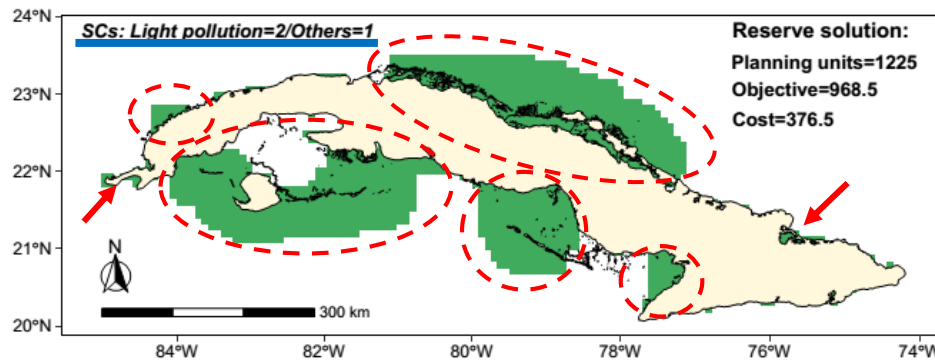
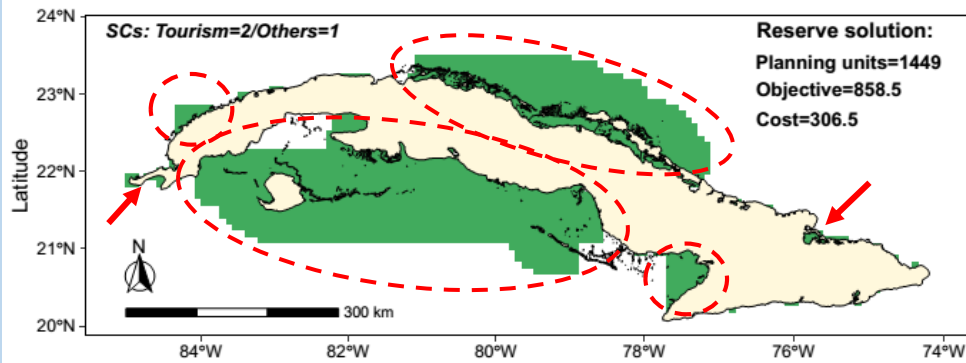
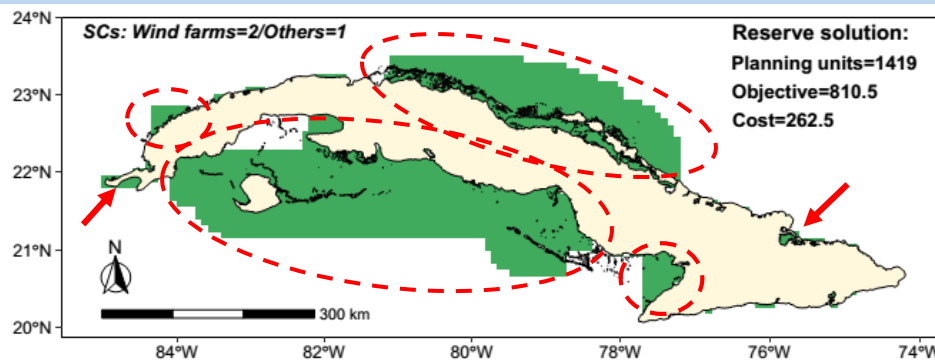
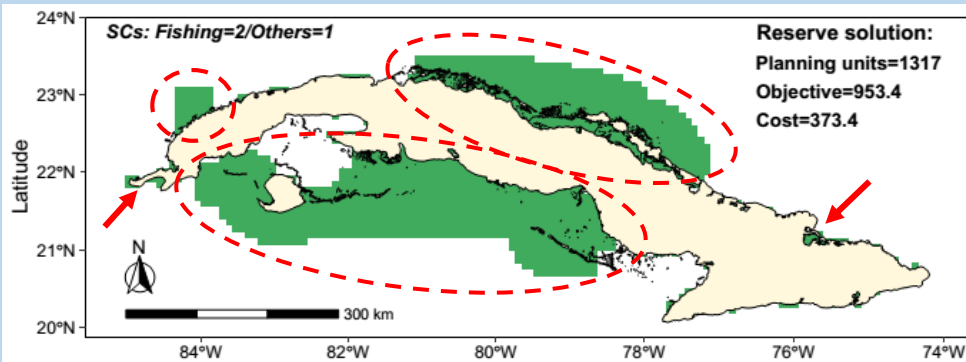


Targets
 75/75/90/75 %

Coverage range:
 76 302 km²
 to
 82 134 km²

Results & Discussion

Current scenarios



Targets
 90/90/90/90 %

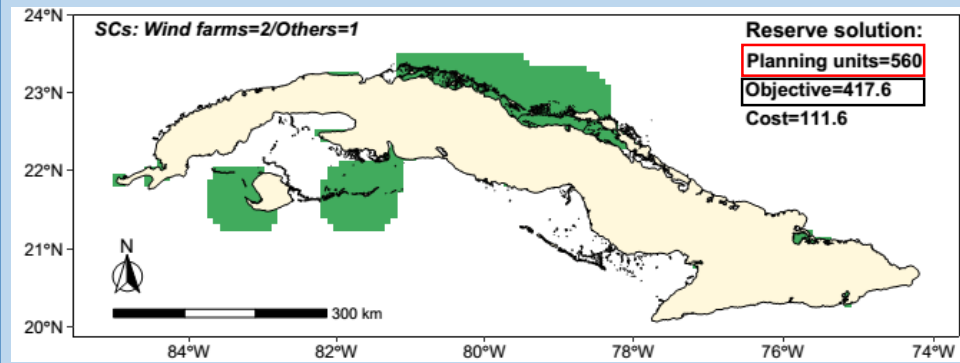
Coverage range:
 99 225 km²
 to
 119 799 km²

Proudfoot *et al.* (2020)
 Brunel *et al.* (2022)

Results & Discussion

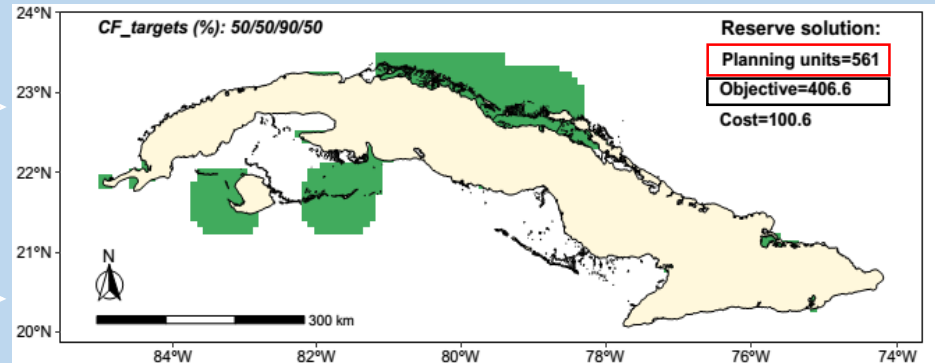
Future scenarios (Wind farms)

Targets

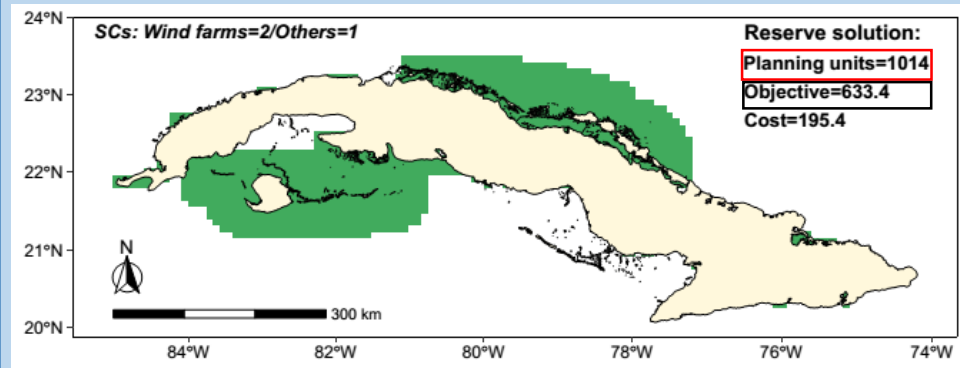


+ 0.18 %

- 2.63 %

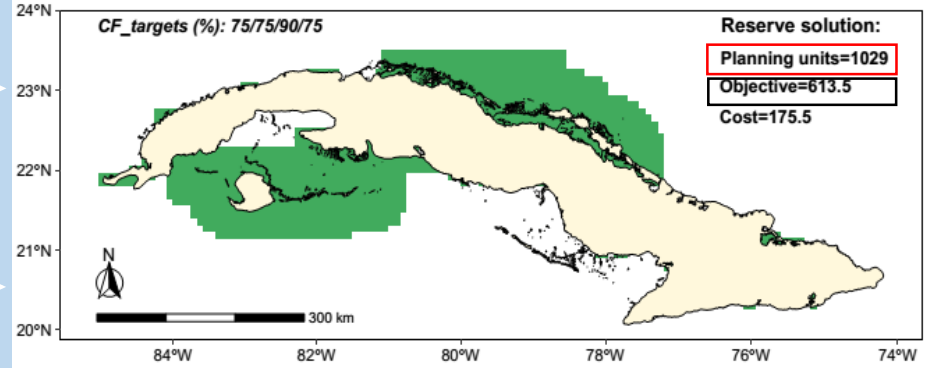


50/50/90/50 %

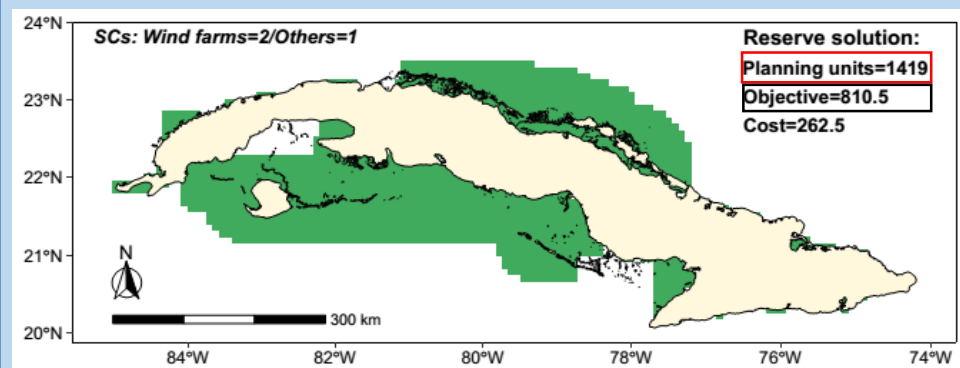


+ 1.48 %

- 3.14 %

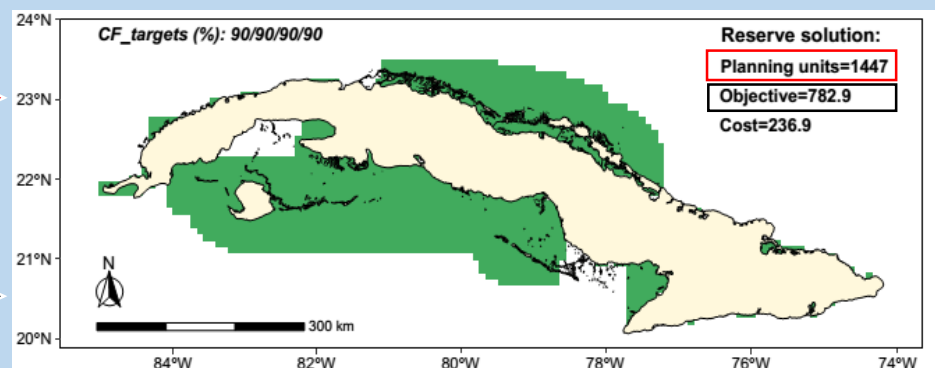


75/75/90/75 %



+ 1.97 %

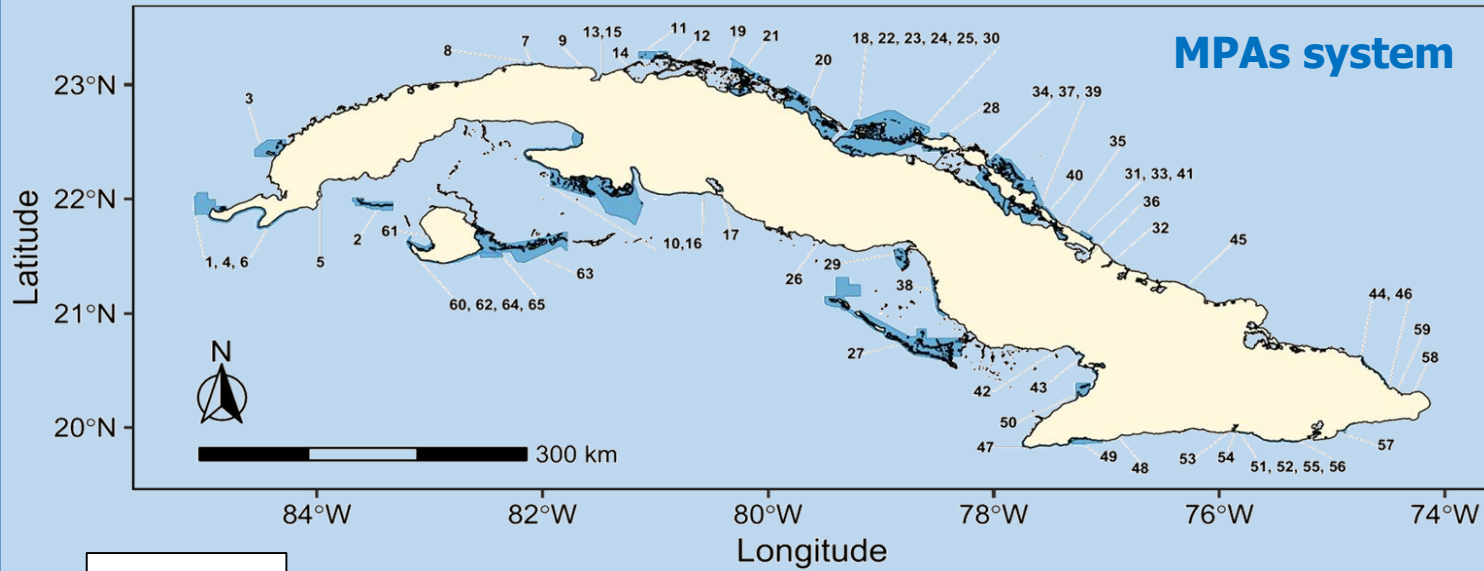
- 3.41 %



90/90/90/90 %

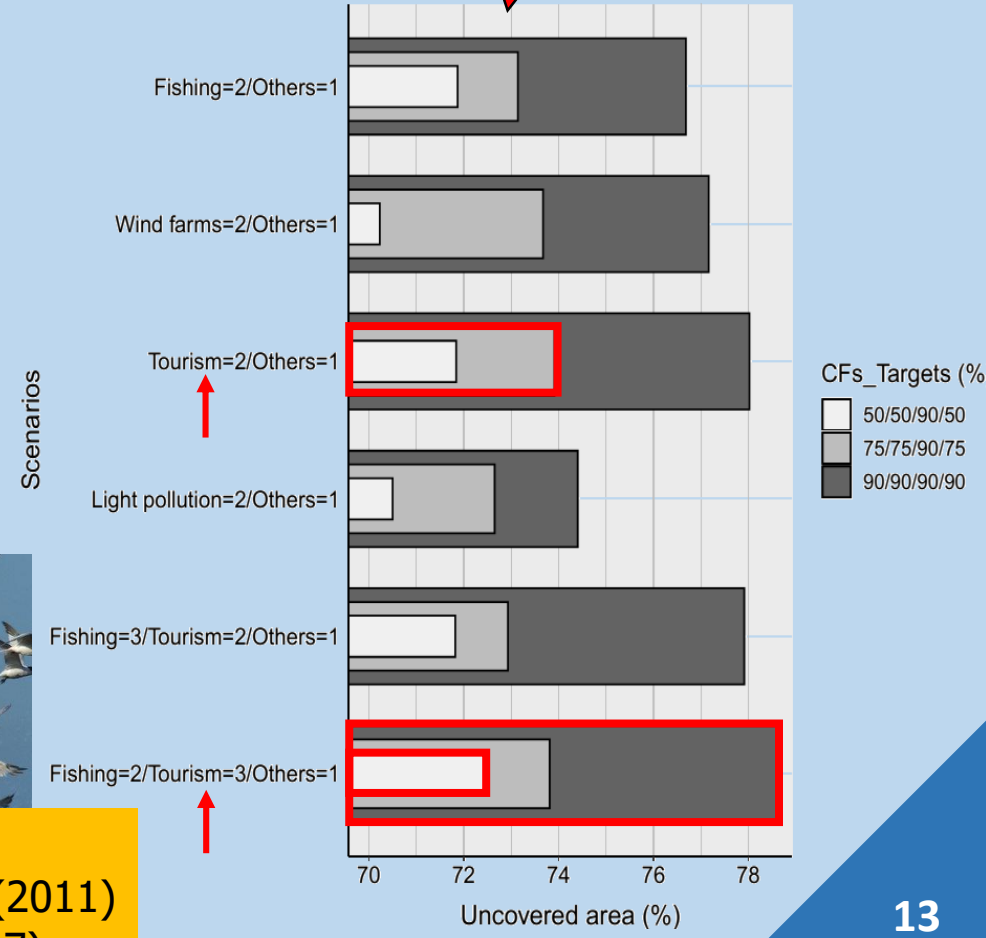
Results & Discussion

Coverage of conservation areas for breeding Laridae by Cuban MPAs



- 65 MPAs
- 23 with more restrictive categories (32.33 % of the overall coverage)
- 43.48 % are nested inside the less restrictive MPAs

+ 70 % uncovered areas



Yorio *et al.* (2001)
Velando & Munilla (2011)
Marcella *et al.* (2017)

Jacquemont *et al.* (2022)
Schultz *et al.* (2022)
Driedger *et al.* (2023)



Conclusions

- There is a consensus spatial pattern of conservation areas for breeding Laridae conservation in Cuba; highlighting the Sabana-Camagüey and Canarreos archipelagos.
- The spatial connectivity approach of the computed conservation areas was more satisfying for larger targets.
- Our tool also contributes to future planning based on forecasts of socioeconomic activities (such as the wind farms in Cuba).
- The MPAs system offers remarkably insufficient coverage of conservation areas for the breeding Laridae in Cuba.
- The potential of the applied decision support tool for conservation is high, based on its flexibility and capability to integrate current and future ecological and socioeconomic interests, that in fact, has been applied to design several scenarios in both marine and terrestrial systems.
- The computed results can help to decision makers and planners to target and prioritize management actions.



Thanks