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# RESTORATION OF RUPPIA MARITIMA IN THE CONDITIONS OF ACTIVE SALT EXTRACTION IN ATANASOVSKO LAKE, BULGARIA

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# BULGARIAN BIODIVERSITY FOUNDATION



A national non-government conservation organization was established in 1997.

BFB works towards:

- development of protected areas and Natura 2000 networks
- conservation and restoration of coastal and marine habitats, wetlands, dunes, woodlands, grassland habitats, peatlands, rivers and associated species
- mitigating and adapting to climate change
- participation in governance and management processes
- conservation education and training
- stakeholder involvement
- cross-border networking



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General location of the project area.  
Map of Atanasovsko Lake SAC location and its protected areas



**Legend:**

- SAC Atanasovsko ezero
- Managed reserve Atanasovsko Lake
- Protected site Burgas Salinas

0 1 2 3 4 5 km



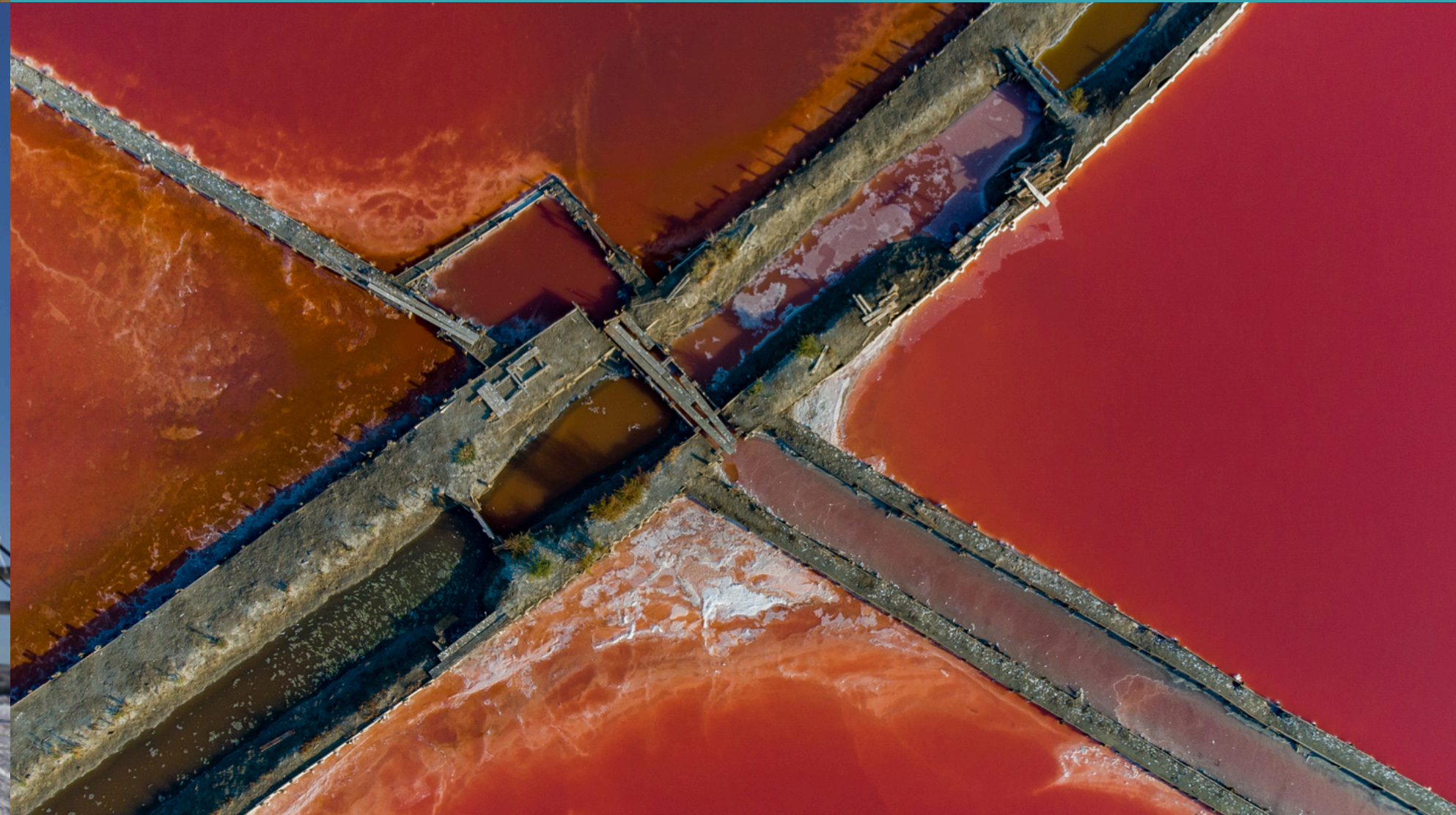
ATANASOVSKO LAKE






# SALT EXTRACTION

- separated lagoon into more than 170 basins with different conditions
- changes in the natural water regime
- Dramatic fluctuations in conditions:
  - depth, incl. drying out
  - temperature
  - salinity
  - transparency
  - substrate







# NATIVE COLONIES IN THE NORTHERN PART, 2015–2016

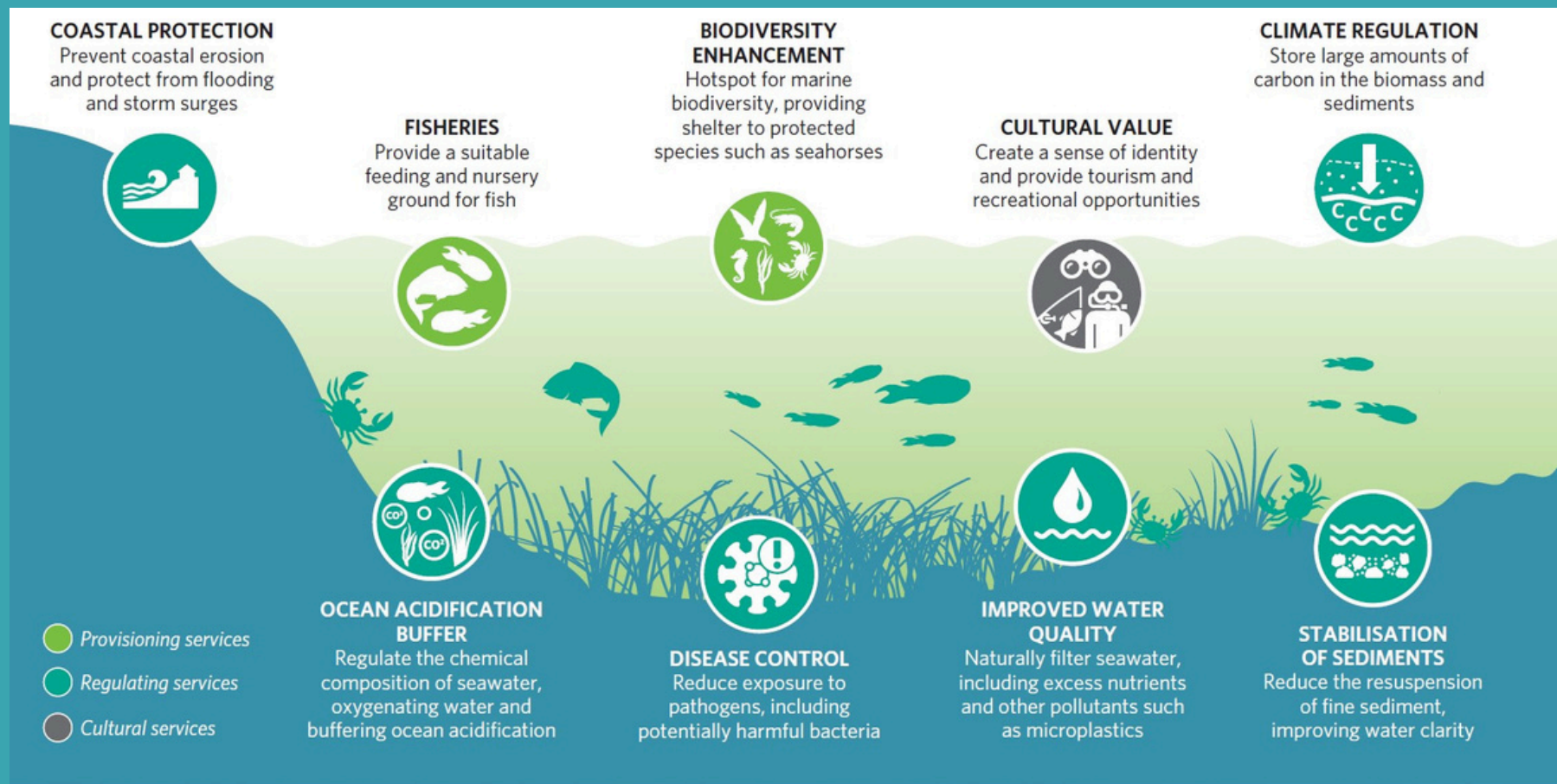


Several isolated colonies were found in 2015 and 2016

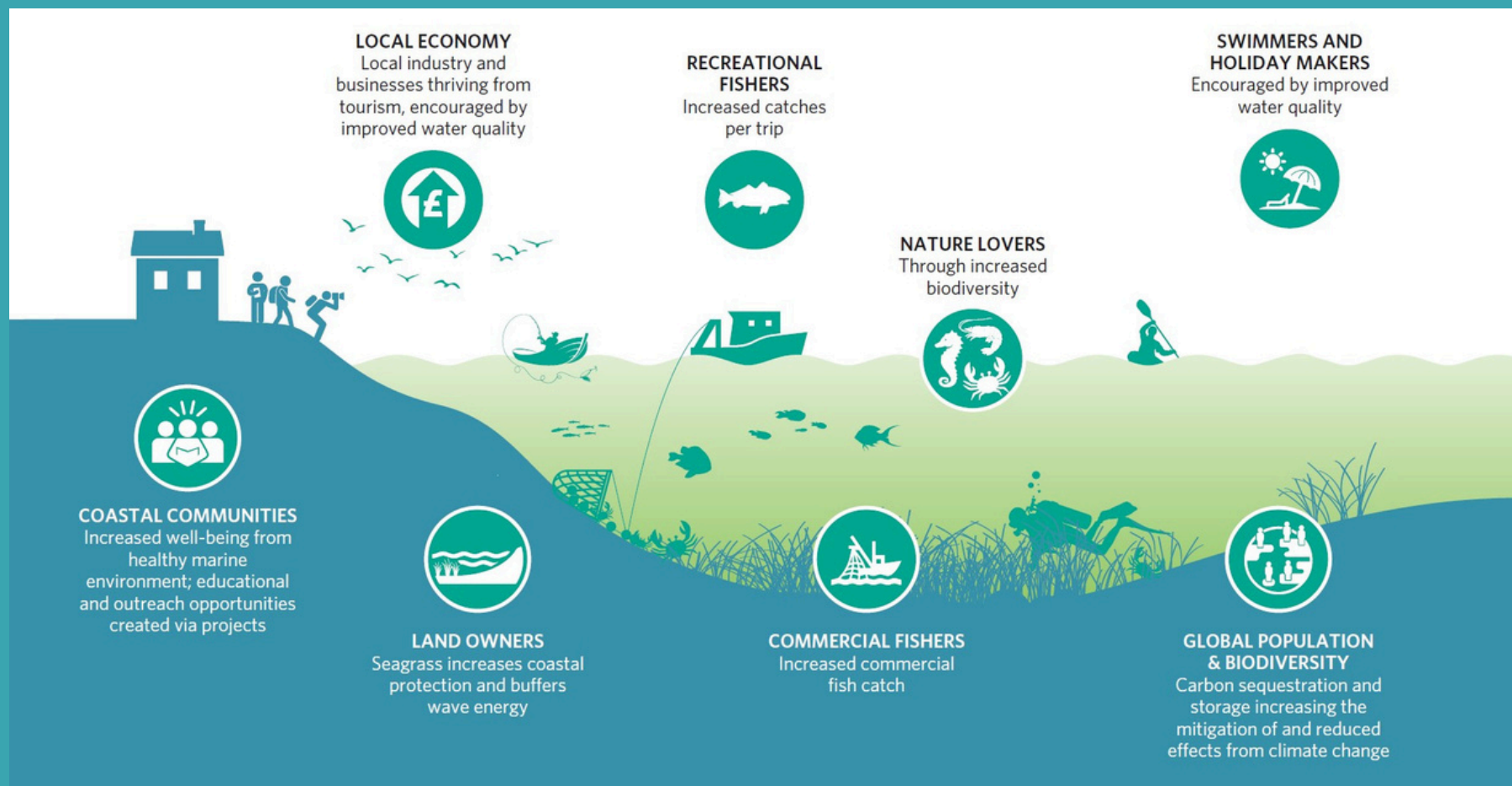
- they were located in a basin where conditions were close to natural
- colonies do not develop every year, probably due to fluctuations in water levels, transparency and temperature



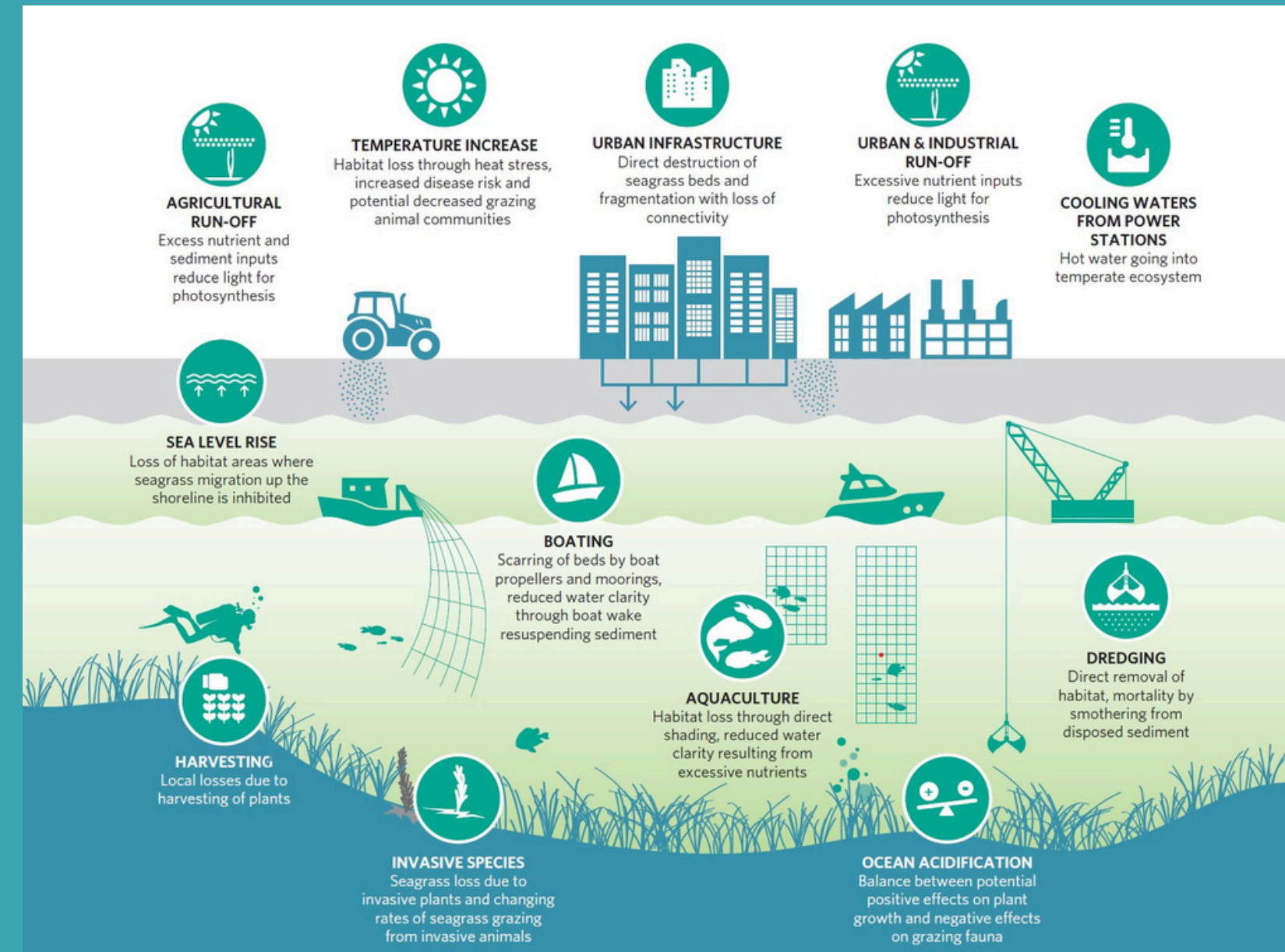
# SEAGRASSES



## ECOSYSTEM SERVICES



## BENEFICIARIES



## THREATS

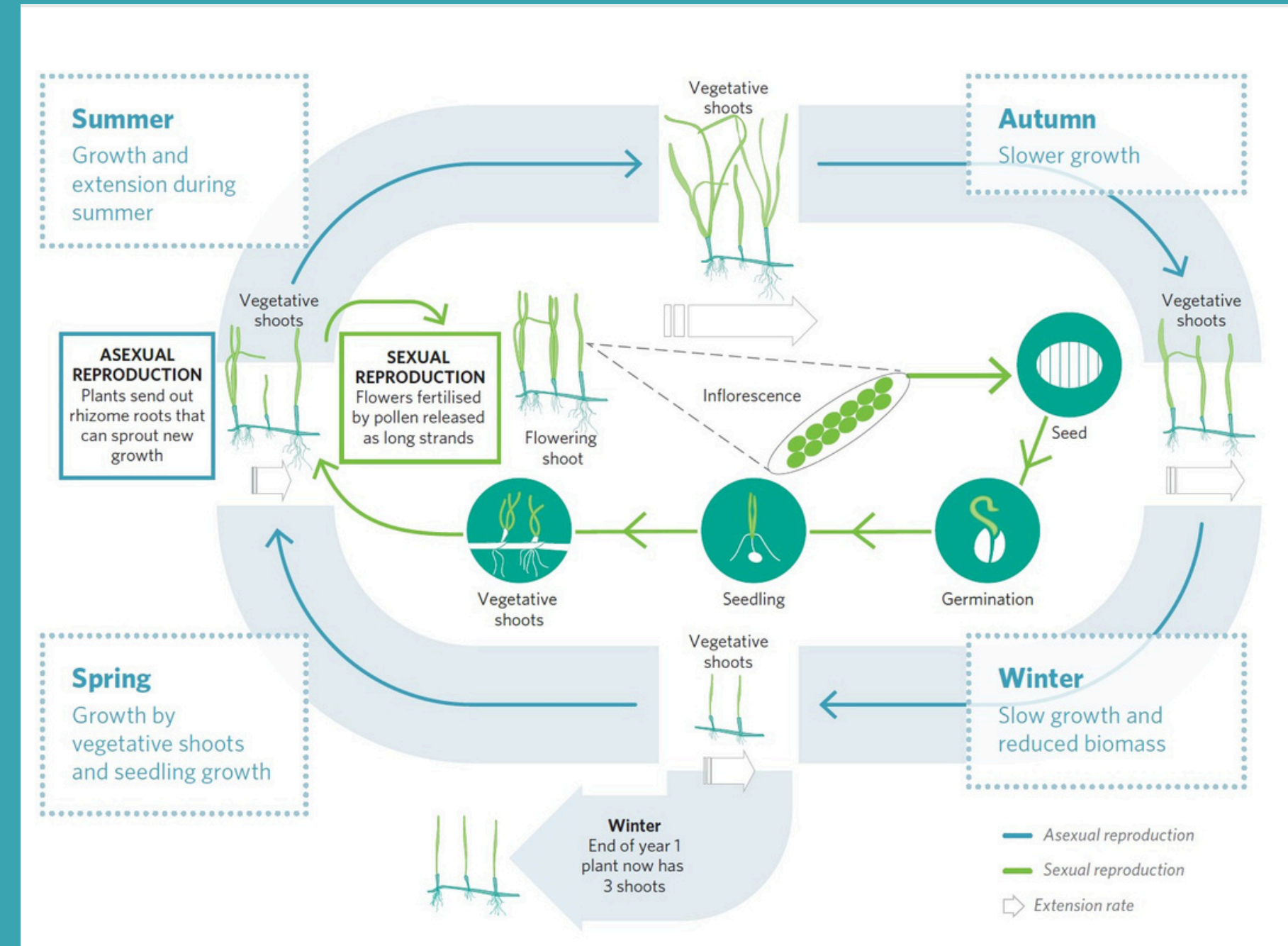


# RUPPIA MARITIMA L.



pH	Salinity	O <sub>2</sub> Saturation	Conductivity	Temperature
7-9	10-36‰	50-200%	6000-40000 μS /cm <sup>-1</sup>	15-30°C
Depth	Transparency	Water flow	Wave height	Substrate
15-50cm	>15cm	<4cm/s	0-10cm	Silty, Silty-sandy

**Table 1.** Optimal parameters of *R. maritima* in Atanasovsko lake





# TRANSPLANTATION METHODS



Several transplant methods with no satisfactory results have been studied and tested:

- transfer of individual plants
- planting in biodegradable buckets
- seed method



# TERFS METHOD



- Making a wooden frame
- Attaching the plants to the frame
- Placing and fixing in the substrate



# SODS (TURF) METHOD

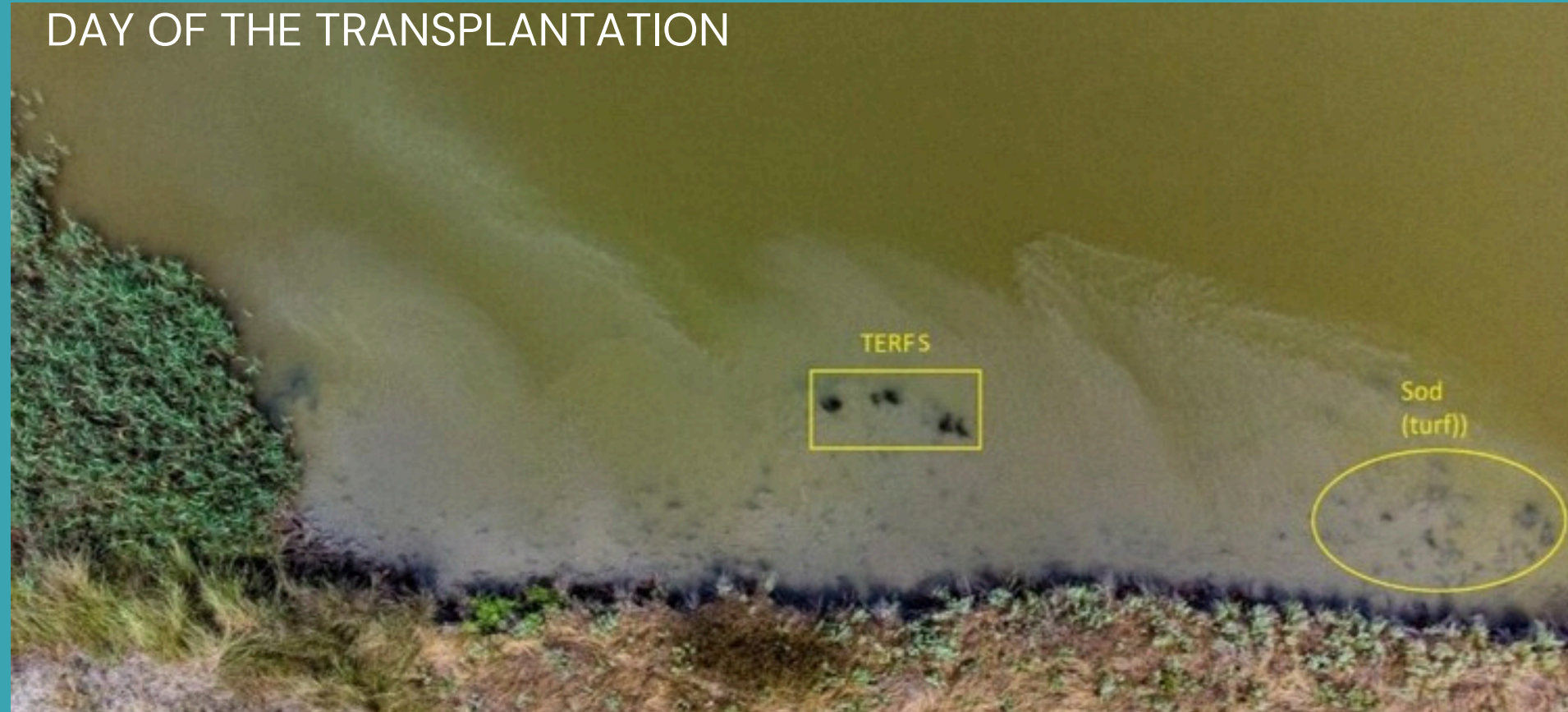


- Removal of tuffs
- Placement in the substrate
- Fixing



# RESULTS

DAY OF THE TRANSPLANTATION



Transplanted area of more than 30 m<sup>2</sup> (with TERFS and Sods methods) – 2022

30 days after transplantation:

- the plants had adapted to the new sites and established in the substrate
- starts spreading through the new shoots



# RESULTS



## 60 days after transplantation:

- new plants disperse up to 30 m from transplant sites
- beginning of flowering
- seed formation





# RESULTS

## THE NEW COLONY IN 2023

- The plants spread by suckers and seeds
- Occupy an area of about 3000 m<sup>2</sup>





# CONCLUSIONS

- Both methods have their advantages and disadvantages
- The combination gives better results
- Before transplantation all threats must be removed/reduced and appropriate conditions restored
- Transplantation improves the conservation status of coastal habitats and their ecosystem functions and services
- Currently, although successful, restoration is expensive, requires much manual work, and in limited areas



# THANK YOU FOR YOUR ATTENTION!

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