OGS National Institute of Oceanography and Applied Geophysics

Extinction in progress: the Adriatic endemic seaweed *Fucus virsoides*

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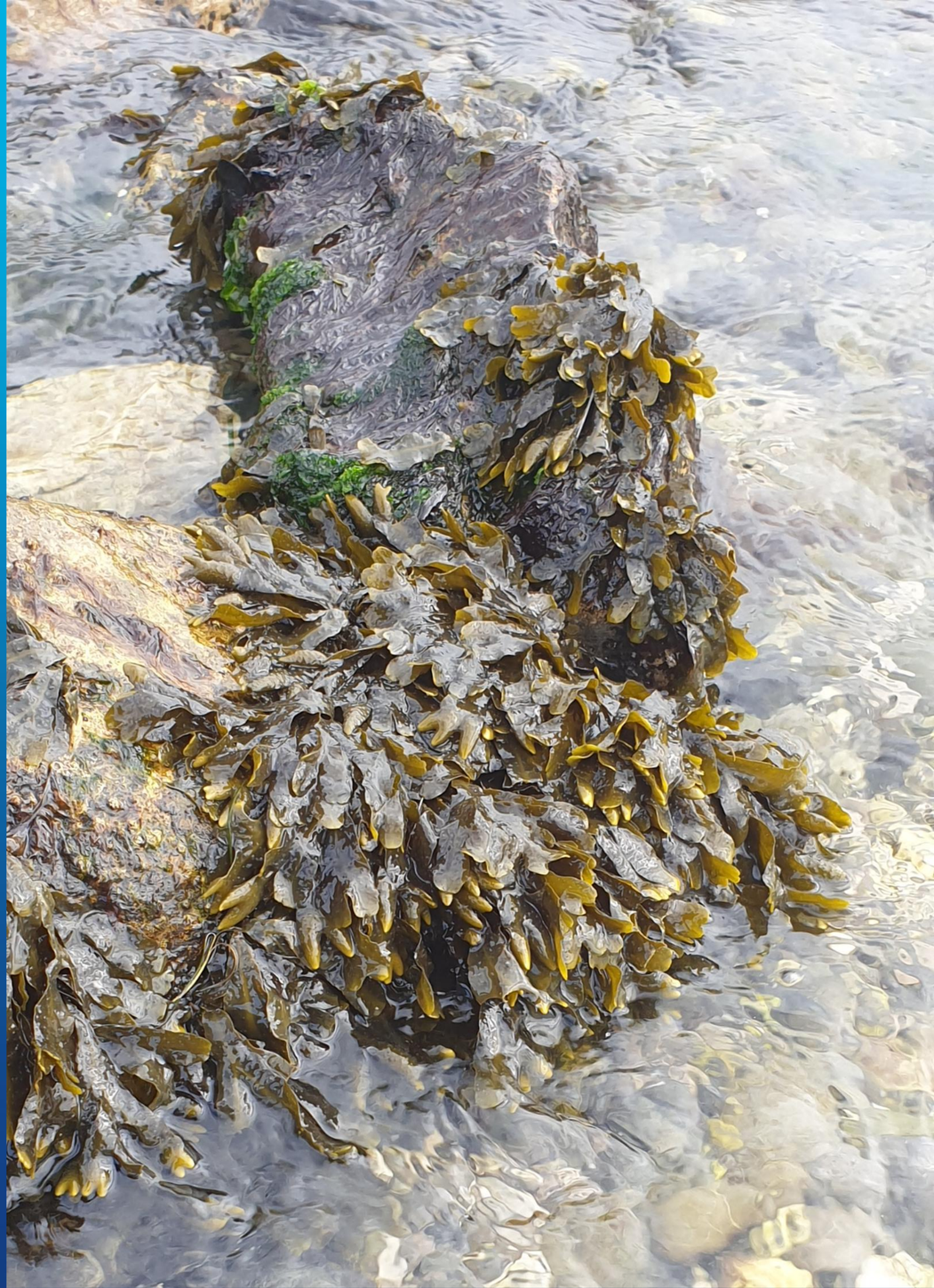
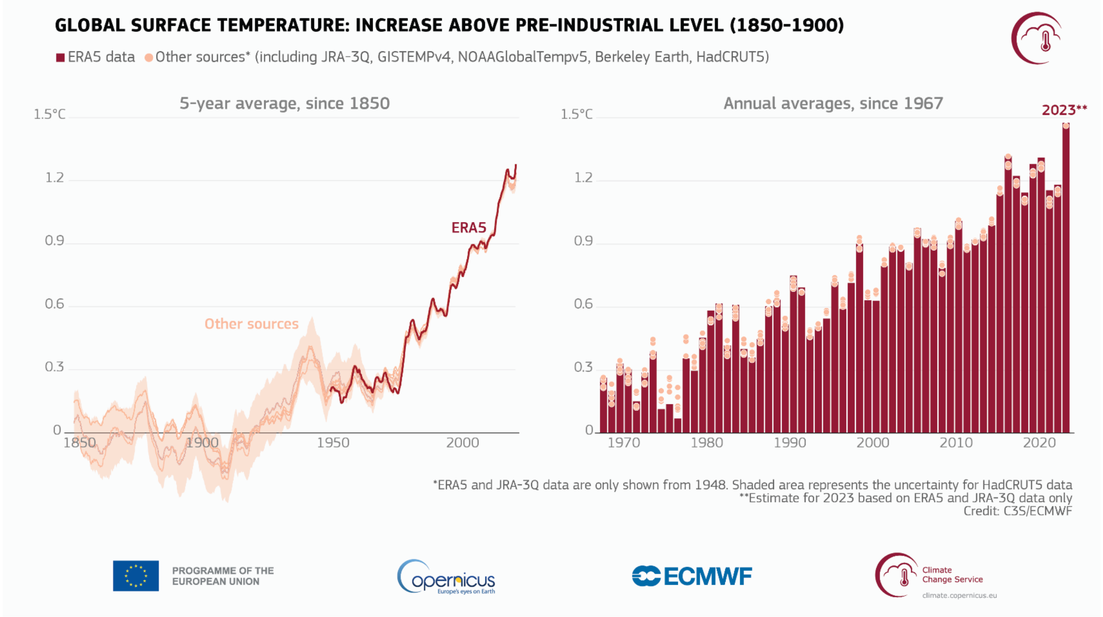
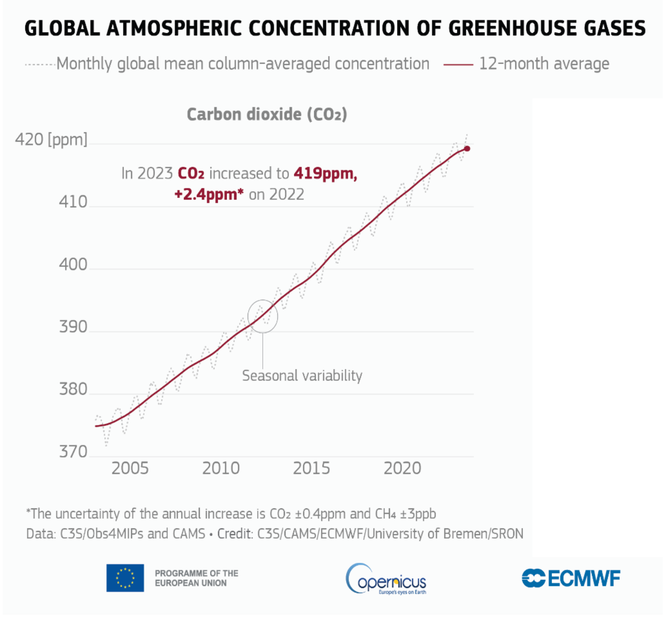
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
NATIONAL BIODIVERSITY FUTURE CENTER



CLIMATE CHANGE AND LIVING ORGANISMS

- Climate change was **predicted** in the past, but is being **observed** in the present!
- Copernicus: 2023 **hottest** year on record, global temperatures close to **1.5°C** above pre-industrial times





CLIMATE CHANGE AFFECTING SPECIES IN DIFFERENT WAYS

- **Distribution** changes: species shifting their habitats poleward
- **Ecological** and **behavioural** changes
- **Physiological** changes
- **Genetic** changes

Increasing extinction risk!

HOW MANY SPECIES EXTINCT DUE TO CLIMATE CHANGE?

- IPCC (6° Ass. Rep., 2023): only for two species (a frog and a rat) climate change **strongly related** to extinction
- **IUCN Red List**: for 36 out of 926 extinct species climate change cited as one of the threats
- Mostly **weak/hypothesized** only relationships
- Mostly species with very **restricted** geographical range (islands, lakes, small valleys)

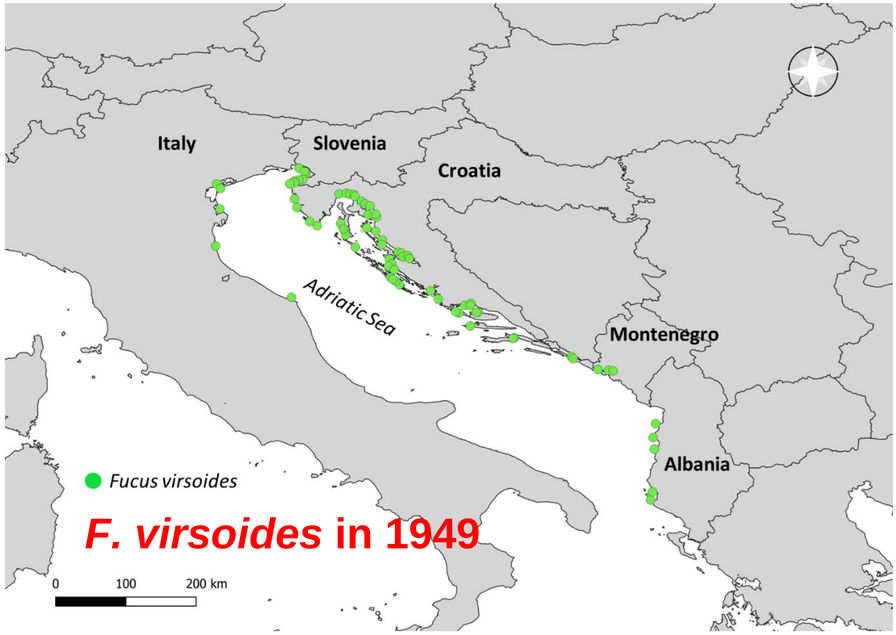
FUCUS VIRSOIDES: AN ADRIATIC ENDEMIC

- ✓**Cold** affinity species with a limited area of distribution, **endemic** to the Adriatic Sea
- ✓Glacial relict in the Mediterranean: all other congeners in Atlantic, North Sea, Baltic, Irish Sea, etc.
- ✓In the **intertidal** (between low and high tide) fringe, on hard substrates
- ✓Alarming **decline/disappearance** during recent decades
- ✓***A PhD research promoted in 2021, collaboration between OGS and University of Trieste***

ECOSYSTEM SERVICES:
PROVIDED FOR **FREE** BY NATURAL ECOSYSTEMS AND SUSTAINING **EACH AND EVERY** HUMAN ACTIVITY

Ecosystem services provided by seaweeds:

- Habitat forming species: increasing **biodiversity** by providing 3D habitat for living, shelter, and food for different species
- Possible source of **bioactive components** used in cosmetics, pharmaceutics, ...
- Capturing and storing CO_2: **mitigation** of climate change
- The global macroalgal Net Primary Production is of **comparable** magnitude and area to that of the **Amazon forest** (Duarte et al., 2022)



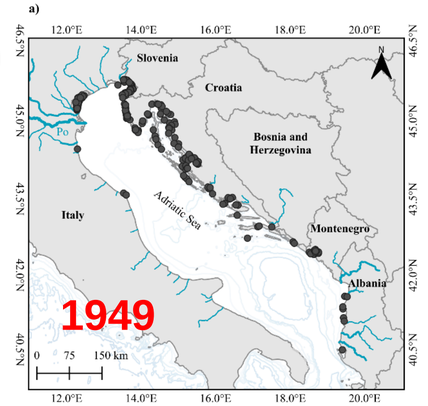
***F. virsoides* in 1949**


***F. virsoides* in Marina Julia 2022**

FUCUS VIRSOIDES: WHAT DID WE DO

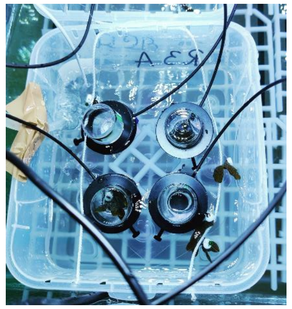
Mapping past and present distribution of *F. virsoides* in the Adriatic

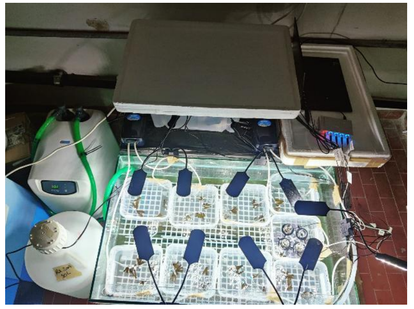
- Assessed the **regression** of *F. virsoides* populations along all Adriatic
- Few **not connected** populations remain (no resilience!)
- Mostly on **artifical** artifacts, close to **freshwater** discharges
- Basis for inclusion on **IUCN Red List** as «Critically Endengered»



In field restoration studies

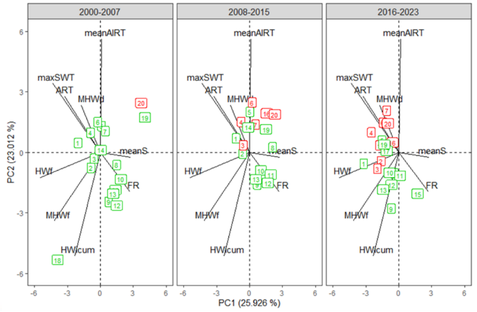
- Protocol for **reproduction** in laboratory set up and working
- Restorations in different areas of Gulf of Trieste **not successful**
- **Different** possible causes: feeding, water quality, hydrodynamics





Laboratory manipulative experiments

- How is *F. virsoides* affected by different levels of **nutrients**?
- Very **tolerant** species, no significant effects
- High concentrations of nutrients may help **offset** negative effects of other stressors



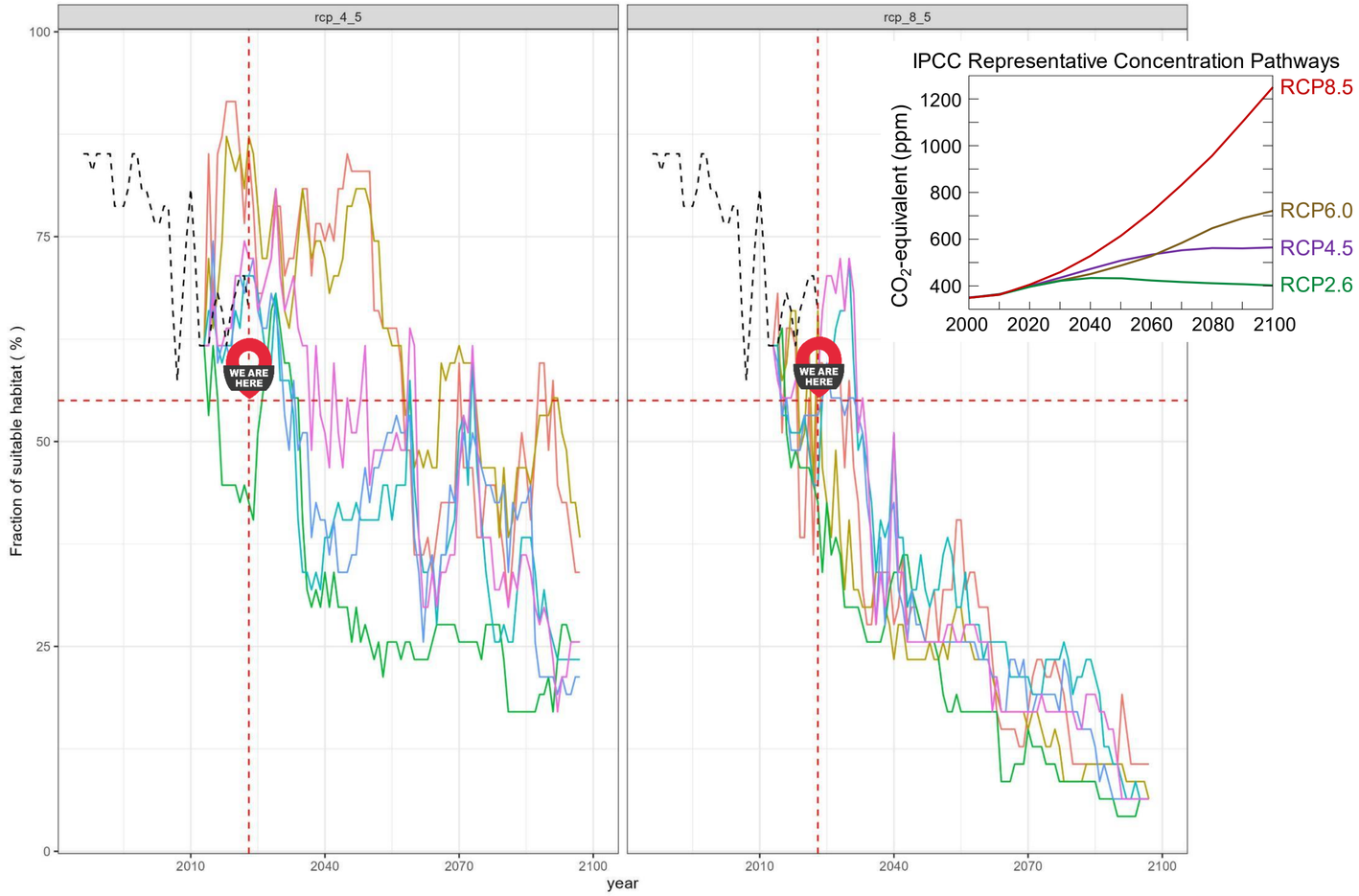
Identification of causes for decline:

- Local: **habitat destruction** by human interventions
- Local/regional: **decreasing nutrients**
- Regional: **climate change!**

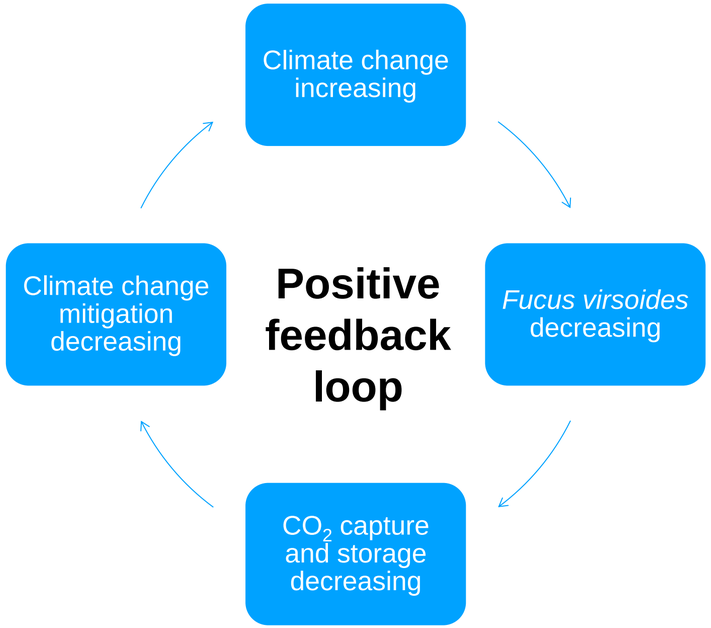
FUCUS VIRSOIDES: A TOLL OF CLIMATE CHANGE

Statistically strong evidence that climate change (mean air temperature) is correlated to *F. virsoides* decline

- Based on ERA5 reanalysis and 6 regional climate models predicting two IPCC scenarios
- RCP4.5 intermediate scenario (+2.5-3°C), RCP8.5 worst-case scenario (+ 5°C)



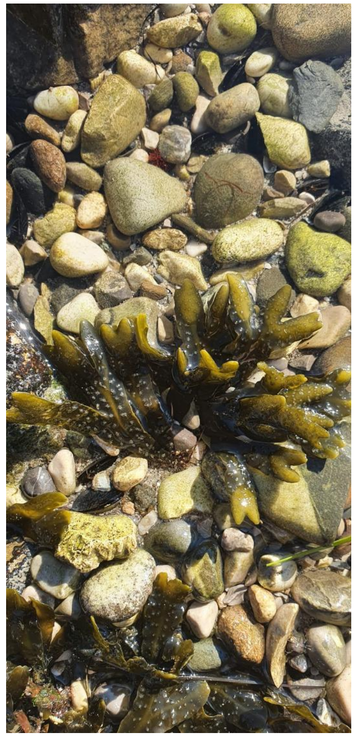
- The first species with **wide distribution range** (spanning 5° LAT and 8° LONG)
- The first **marine** species
- The first **macroalgae** species ***driven to extinction by climate change!***



FUCUS VIRSOIDES: CAN IT BE SAVED?

1. PROTECTION

- Inclusion on **IUCN Red List** and relevant legislation
- Establishment of a **network** of protected areas for remnant populations



2. STUDY

- **Physiology** (e.g., TEMP effects)
- **Genetic** studies
- **Dispersal** dynamics
- Local and regional **stressors**

3. RESTORATION

- Plan effective **restoration** actions on local and/or regional scale
- Identify **suitable** areas
- Consider **connectivity** to ensure long-term resilience

4. CONSERVATION

- Develop protocols for **ex-situ** cultivation
- Network of **aquariums**

WANTED!

5. SENSIBILIZATION AND INVOLVEMENT OF CITIZENS

IF YOU SEE FUCUS VIRSOIDES, PLEASE REPORT TO US!

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THANK YOU FOR YOUR ATTENTION!

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