World Conference for TOKYO Resilience: Aiming for " *Safety for the Next 100 Years*"

8 May 2024 Italian Cultural Institute Tokyo *16:30-17:45 Pannel Discussion*

Building Bridges of Knowledge and Practice A Path Forward Through Resilience and Collaboration

Enhancing Socio-Ecological Resilience in Venice and Tokyo

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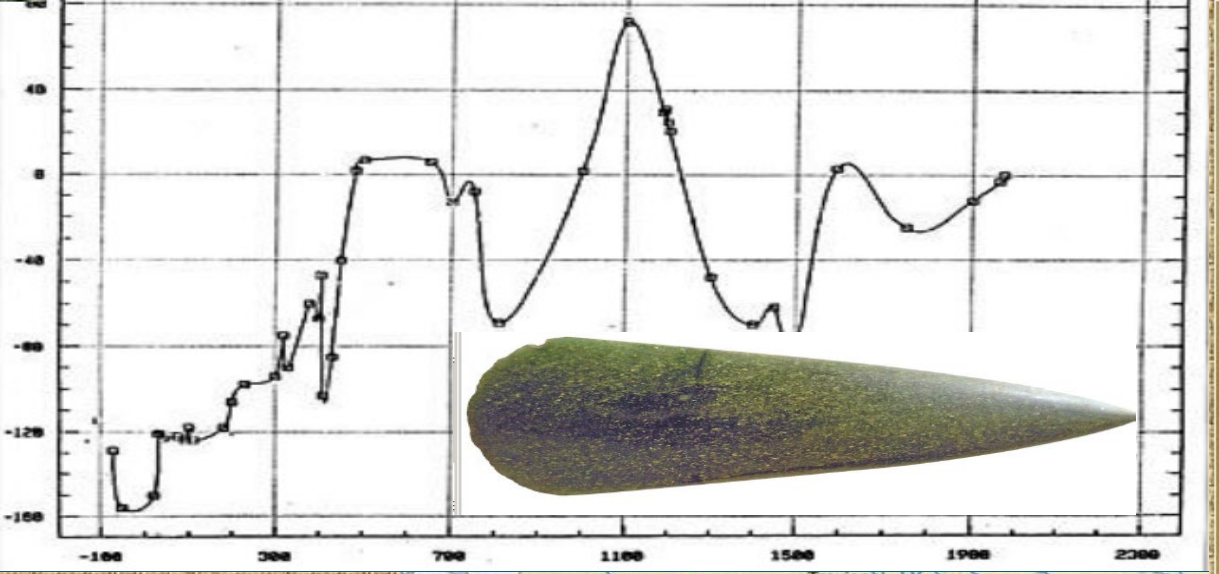
A Highly Complex Dynamical System

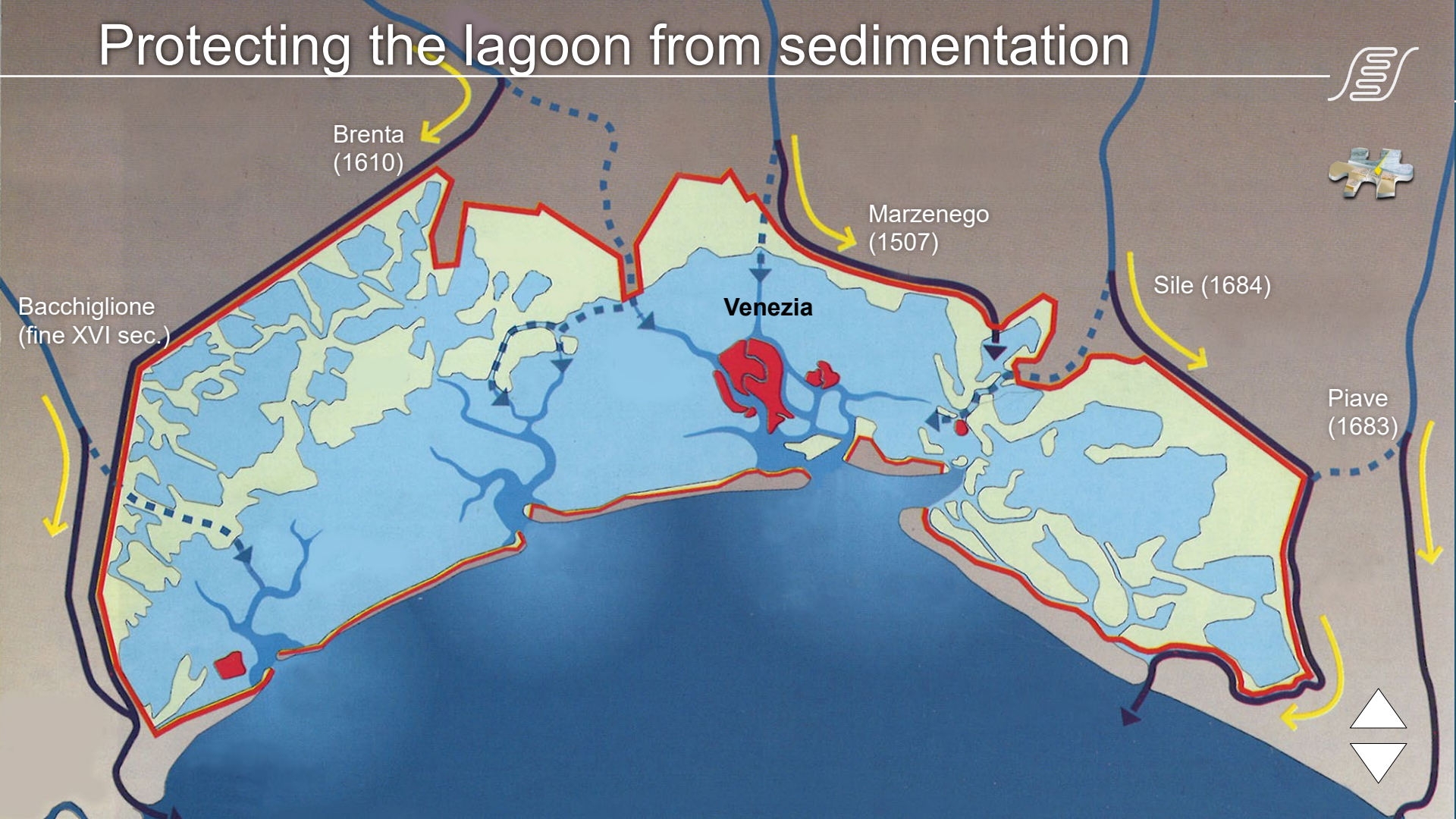
Adaptation : Living on Water/Nature and Learning by Doing

Co-Evolution by Co-Petition



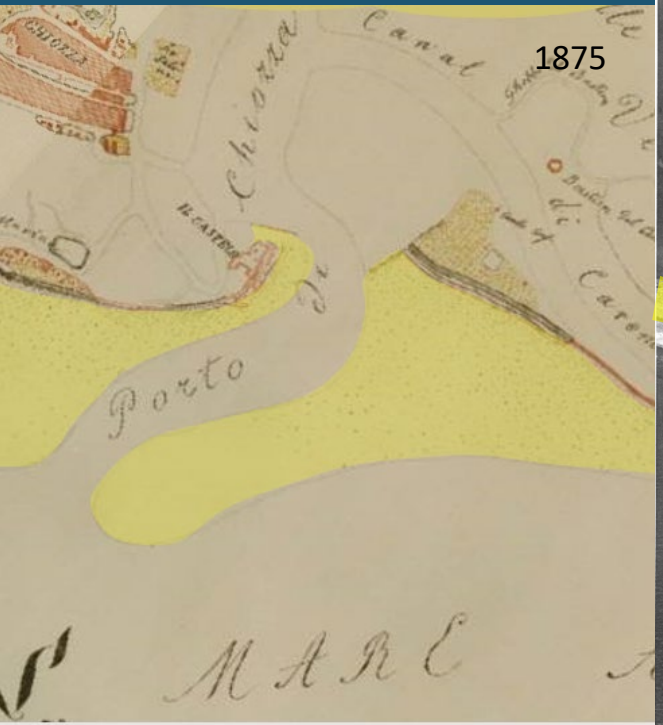
Adaptations to the Climate Change of the Past

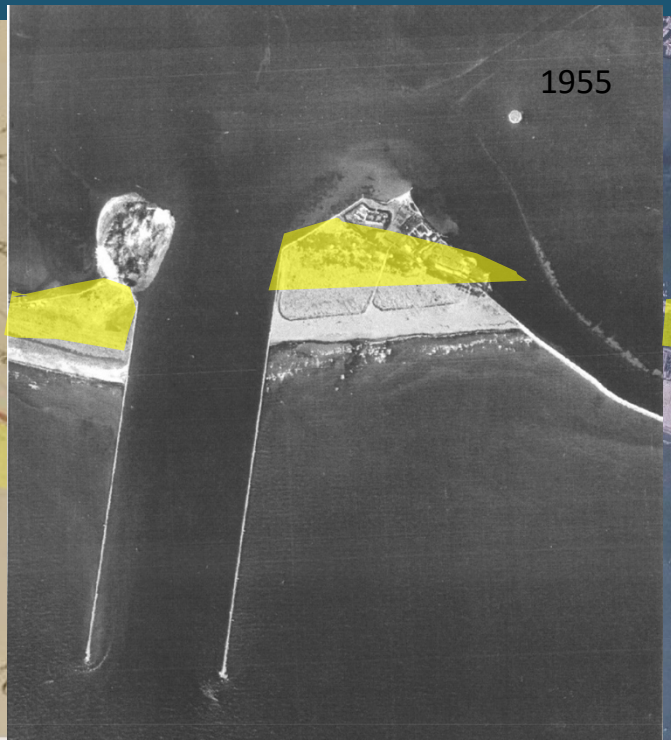
Protecting the lagoon from sedimentation



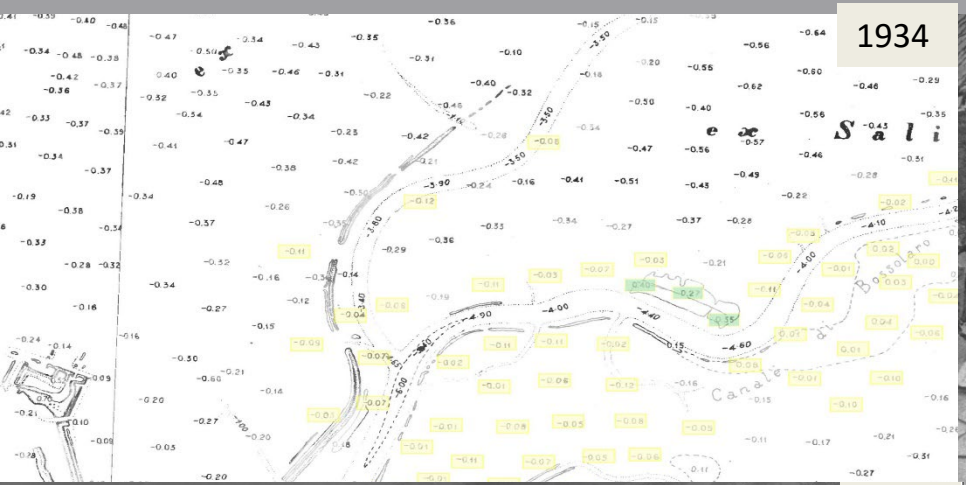
Win-Win Co-Evolution in Chioggia

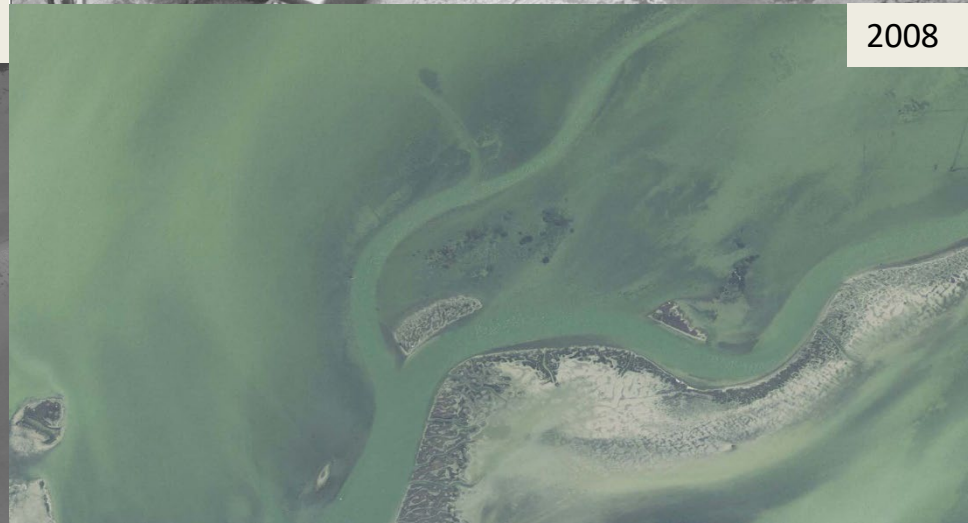
How a Natural Based Solutions to Navigation Safety Produced Opportunities for Biodiversity





Adaptation and biodiversity triggered by sea level rise

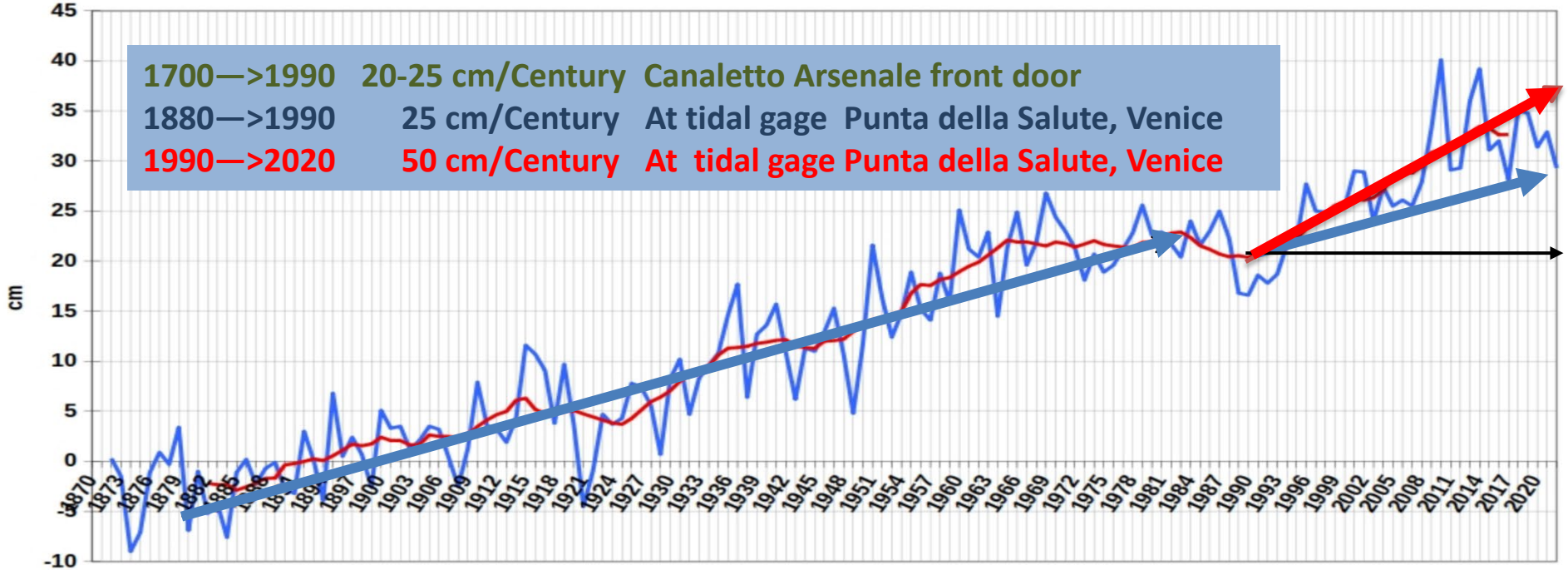





2000
2008
2002
2012

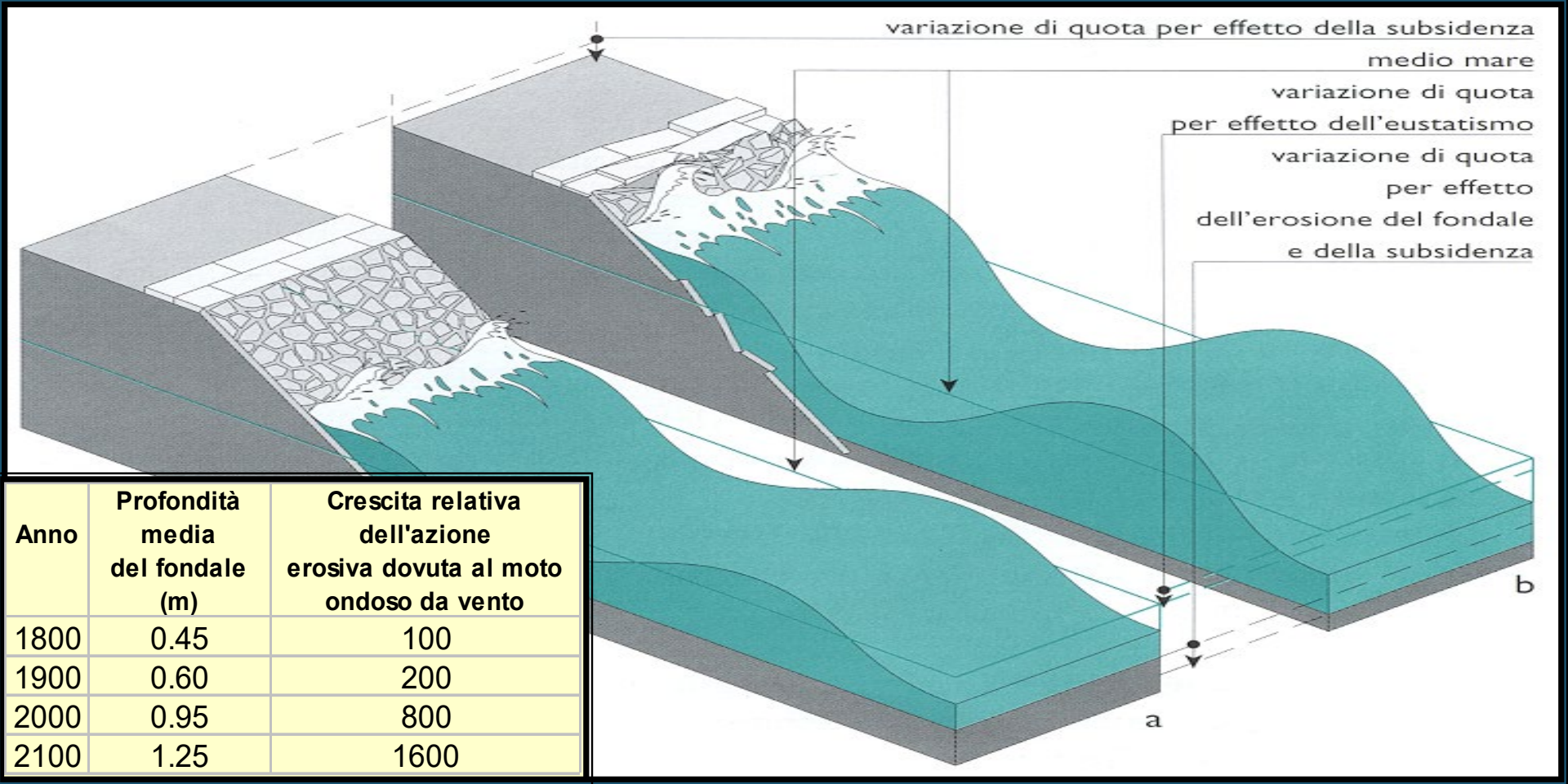
RELATIVE SEA LEVEL RISE IN VENICE IN 300 YEARS FROM CANALETTO CAMERA OBSCURA PAINT (1720 TO 202O)

75 CM IN 300 YEARS = 25 CM /CENTURY . IN THE LAST 30 YEAR THE TREND HAS DOUBLED TO 50 CM /CENTURY



(Changes of the mean sea level in Venice from 1872 to 2022 and 11-years moving average)

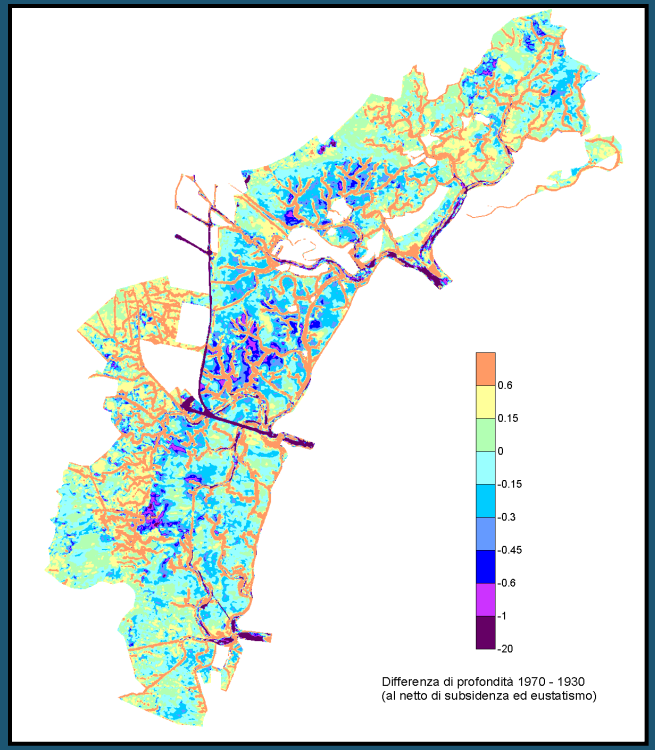
Exponential increase of wave energy and erosion

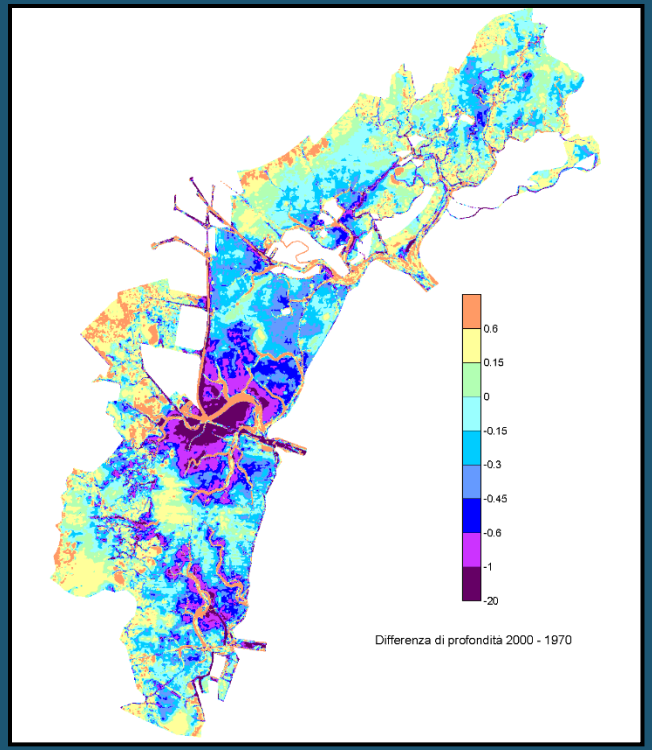


Anno	Profondità media del fondale (m)	Crescita relativa dell'azione erosiva dovuta al moto ondoso da vento
1800	0.45	100
1900	0.60	200
2000	0.95	800
2100	1.25	1600

Between 1930 and 1970 secondary canals were buried and the seabed eroded

Between 1970 and 2000 there was great erosion on the side of the artificial canals



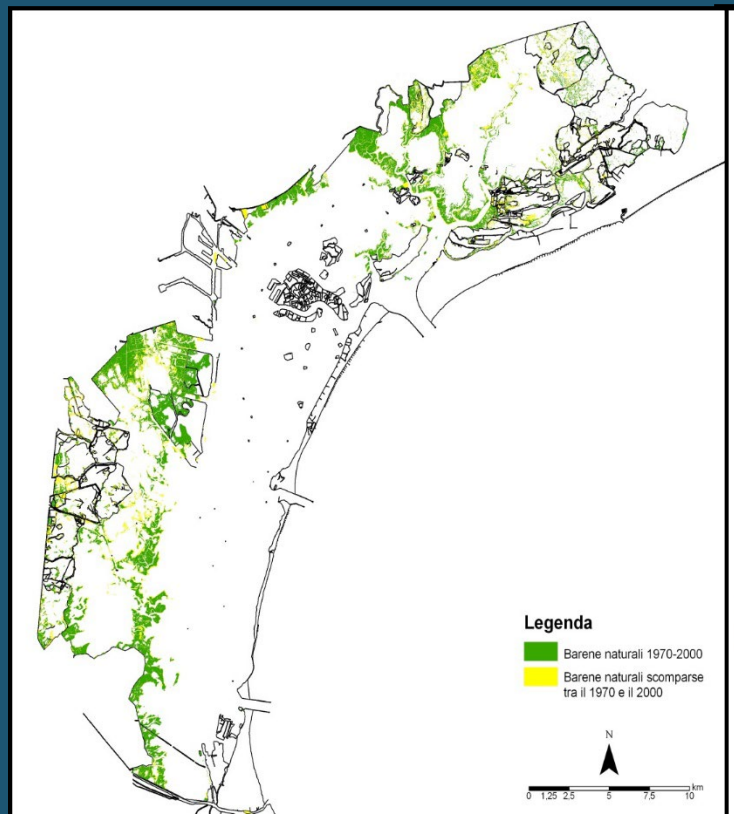


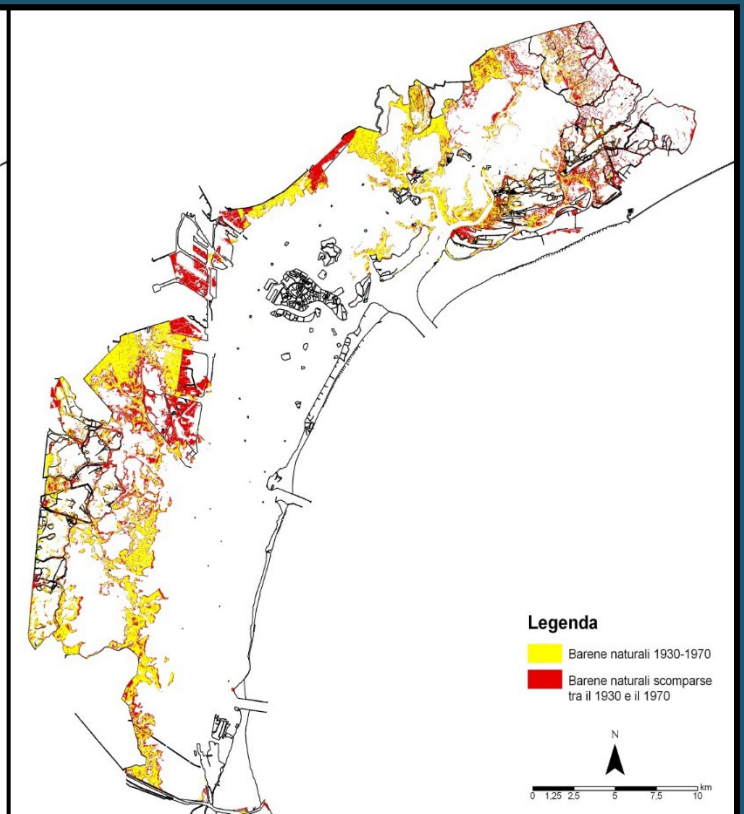
Interramenti ed erosioni da differenze di quota di carte idrografiche

THE HYDRO-MORPHOLOGICAL PROBLEM OF THE LAGOON

Salt marshes reduced to 2/3

1930 – 1970 59 to 47 km² 1970 – 2000 47 to 40 km²

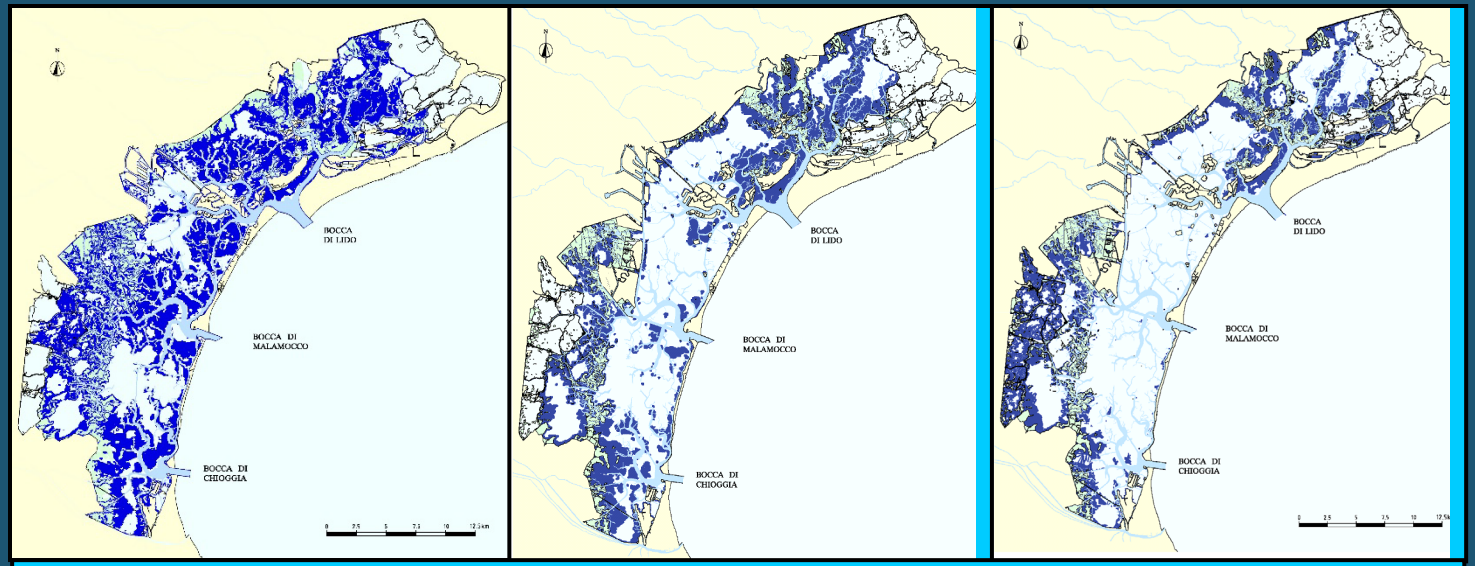




THE HYDRO-MORPHOLOGICAL PROBLEM

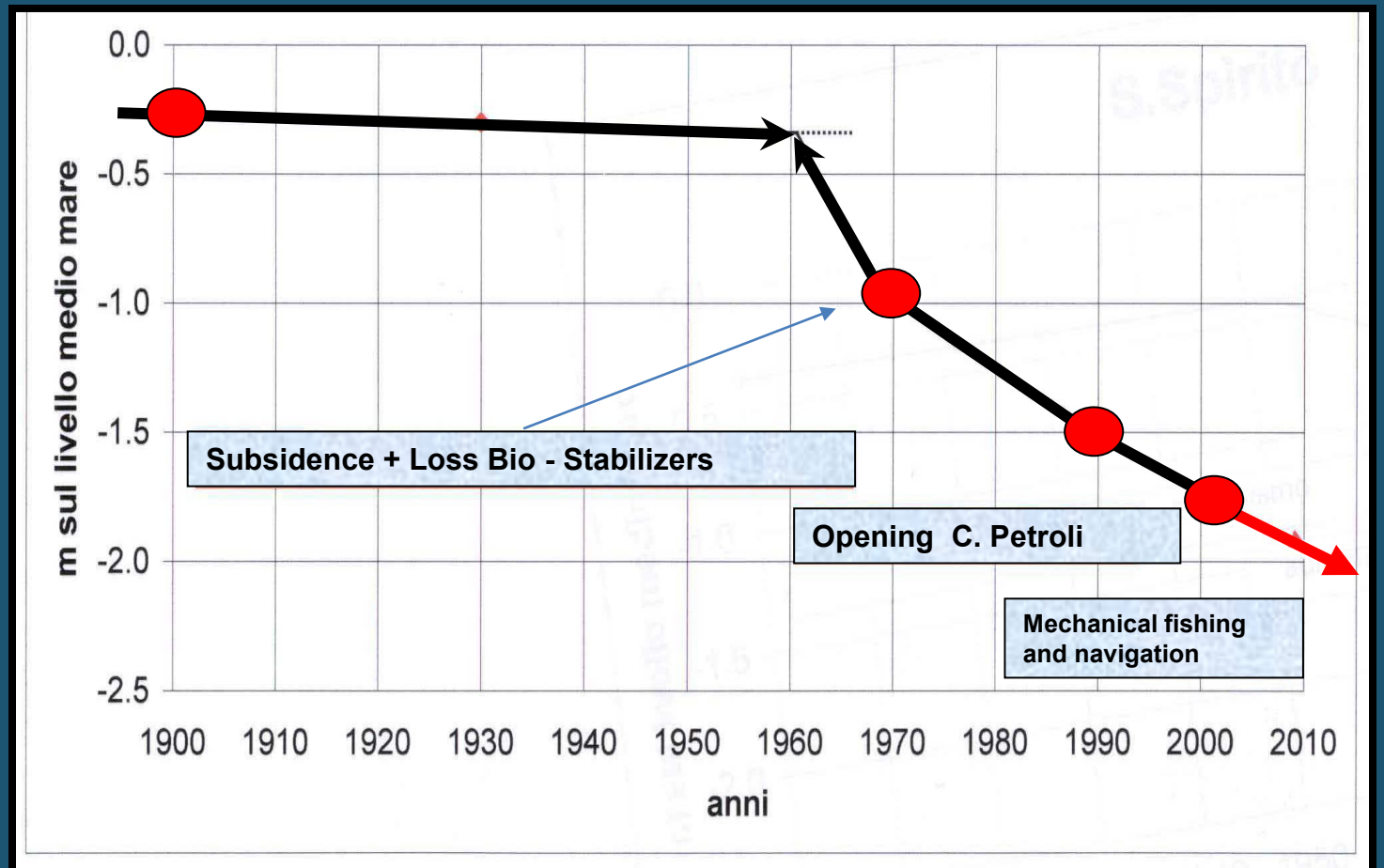
Shallow waters from 0 to -60 cm a.s.l. reduced to 1/3

1930 168km^2 1970 105km^2 2000 60km^2



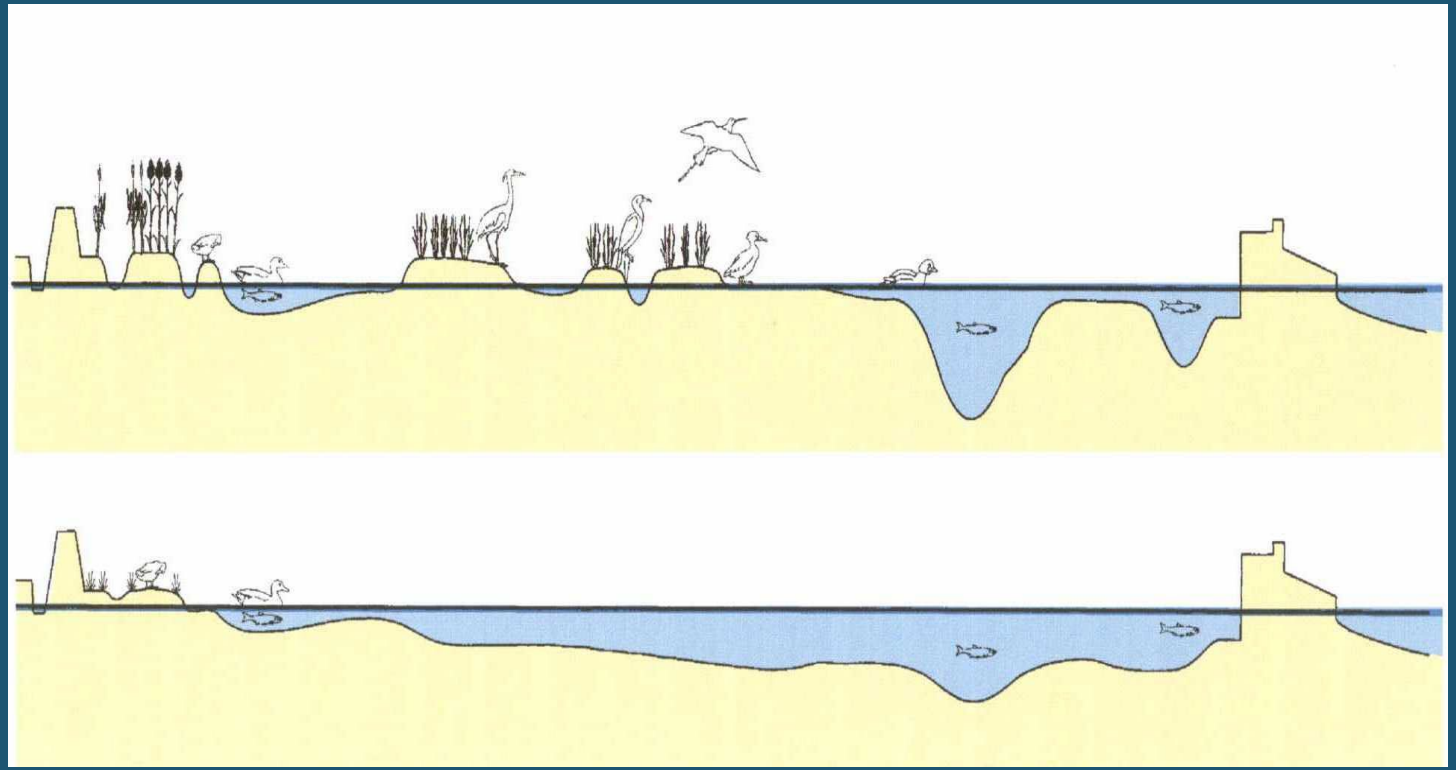
Seabed around the island of Fisolo in the central lagoon.

Effect of sea level rise on erosion

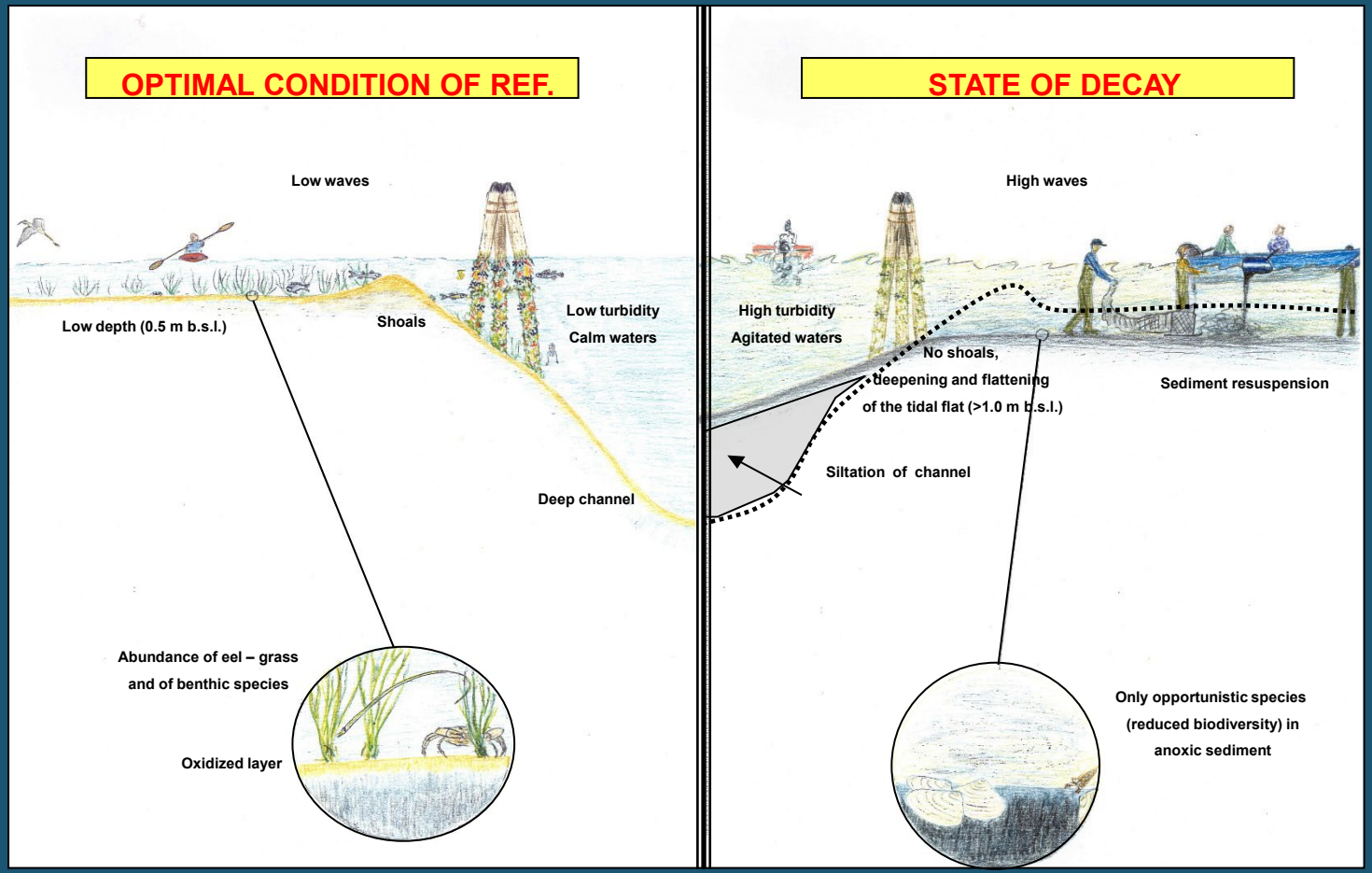


FROM LAGUNA TO BAY :

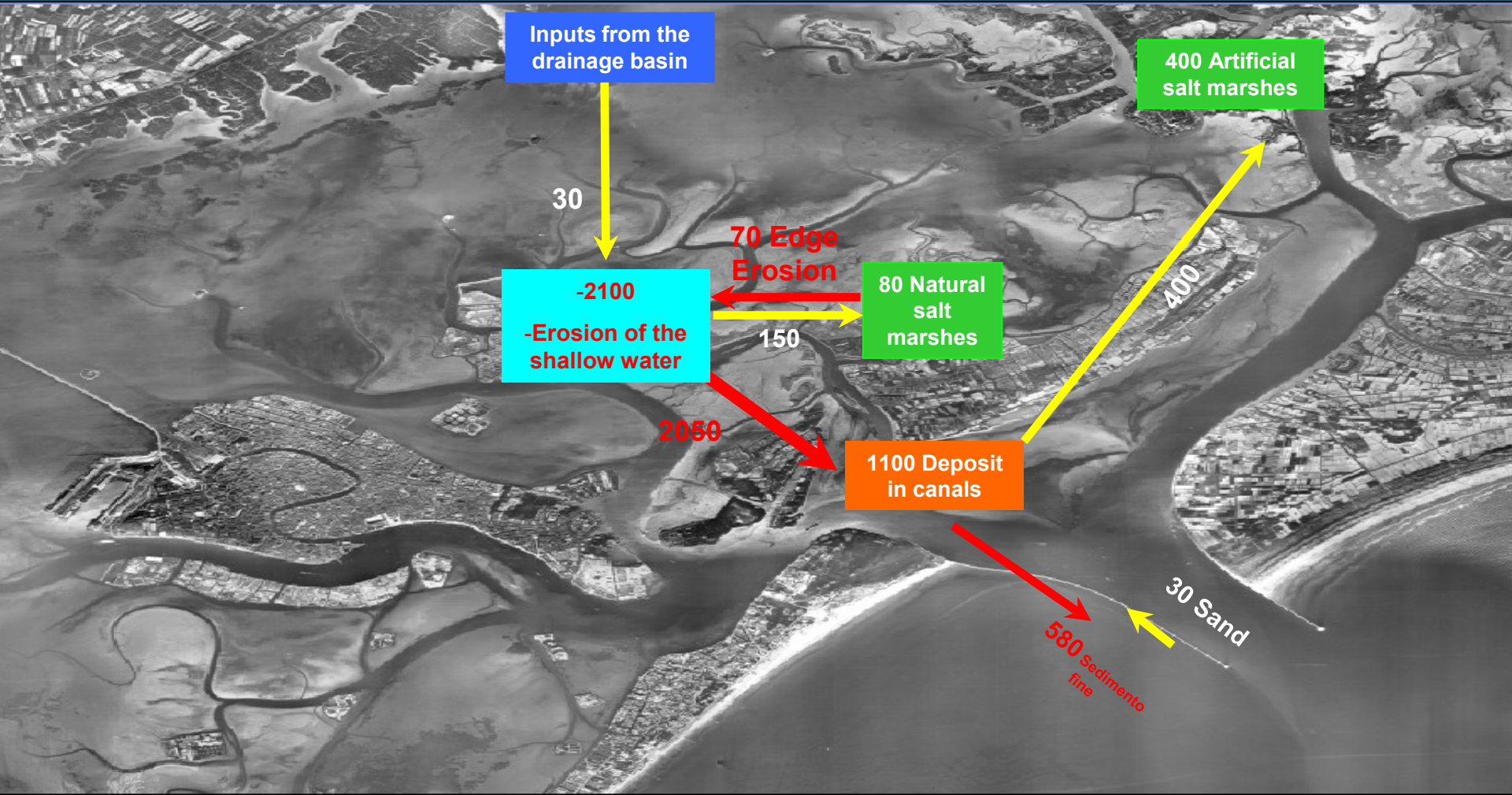
A LOSS OF FUNCTIONALITY AND SIMPLIFICATION OF FORMS



DEGRADATION OF FORMS ➔ DEGRADATION OF PHYSICAL AND BIOLOGICAL PROCESSES



Sediment balance: volumes in thousands of m3



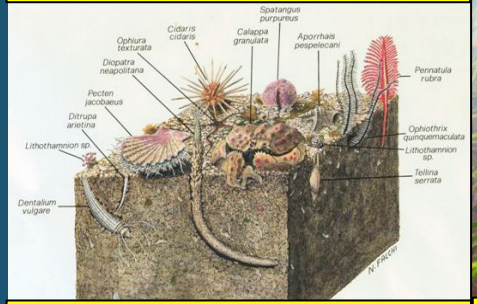
Urban local flood protection and restoration

The Seven Natural Engineers

1. Reeds at the mouths of rivers

2. Halophytic salt marsh plants

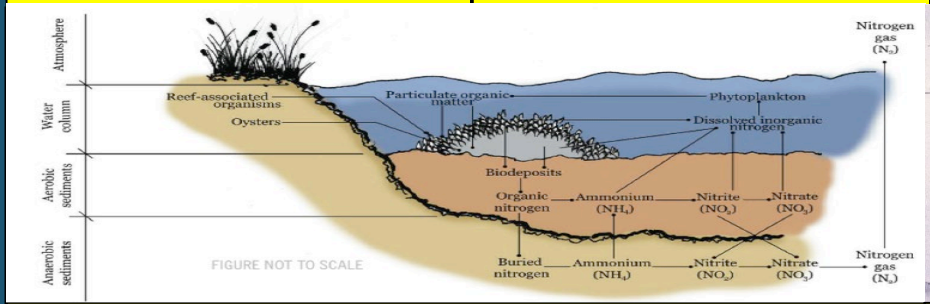
3. Dune (Ammophila littoralis)



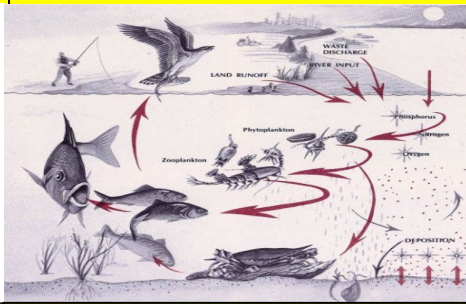
4.Macrozoobenthos

5.Angiosperme (ell-grass)

6. Microbial mats



7.Oyster and mussel reefs



THE FOOD-CHAIN

What has been done by Consorzio Venezia Nuova, Concessionaire of Magistrato Acque, Min.Pub.Works, in 35 years, spenditure of 12 billion euro

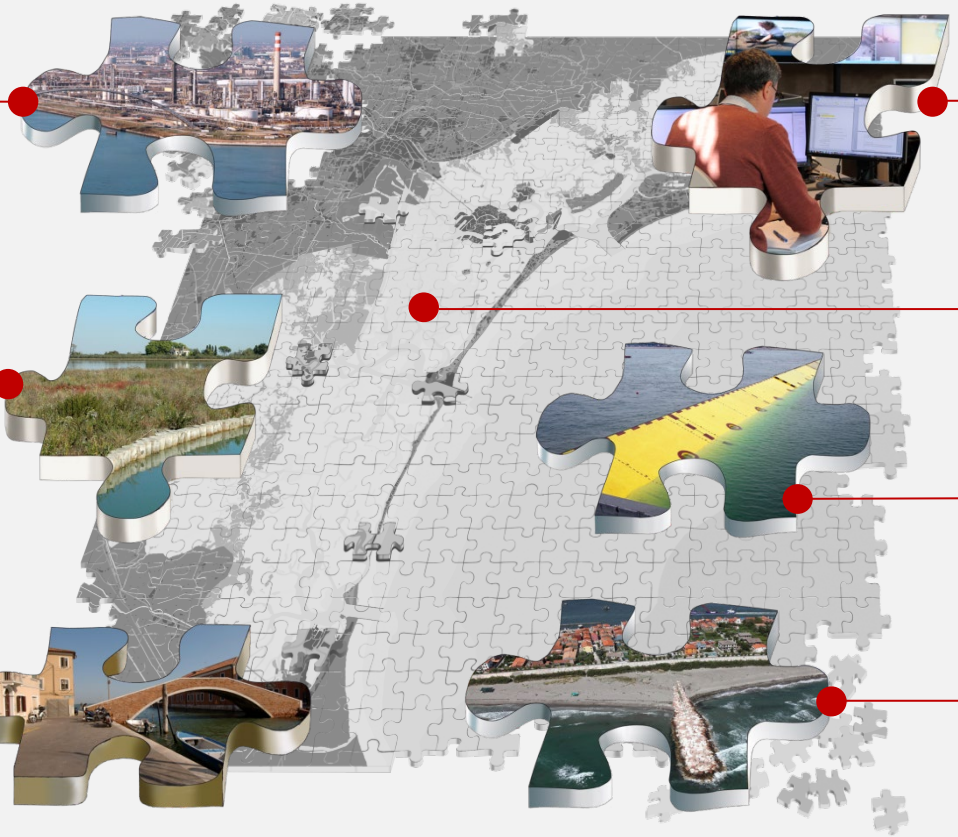
Pollution controll and Nature based solutions with the reuse of Dredged Sediments

PROTECTED BEACH NOURISHMENT

URBAN ADAPTATION

STORM SURGE BARRIERS AT LAGOON INLETS

Integrated solutions for a complex system



Environmental protection

Increase environmental resilience

Increase urban resilience

Management and control

A National Venice Lab

DRR with Mobile barriers

Coastal protection

The Venice lagoon Safeguard and The Mose System

Littoral Protection

56 km protected beach nourischment
12 km constructed coastal dunes
11 Km reinforced breakwaters

MOSE 1,6 km, 78 Flap gates, 4 barriers at 3 inlets

Lido Nord 420 m; Lido Sud 400m; Malamocco 380m; Chioggia 360m

Local flood Protection

100 km of urban and lagoon embankments raised and reinforced

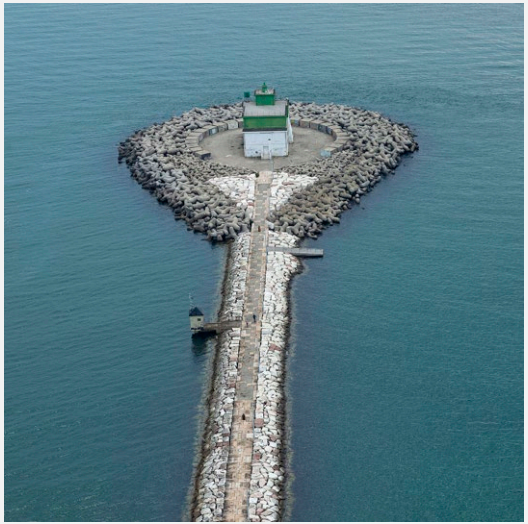
Morphological and Environmental restoration

40 km of industrial canal banks
12 islands
7 dumps sites
39 ha of phytodepuration areas
39 km wave protection of salt marshes
16 km² of *Building with Nature* salt marshes

Coastal Protection

56 km
Protected beach nourishment

12 km
Dune Restoration

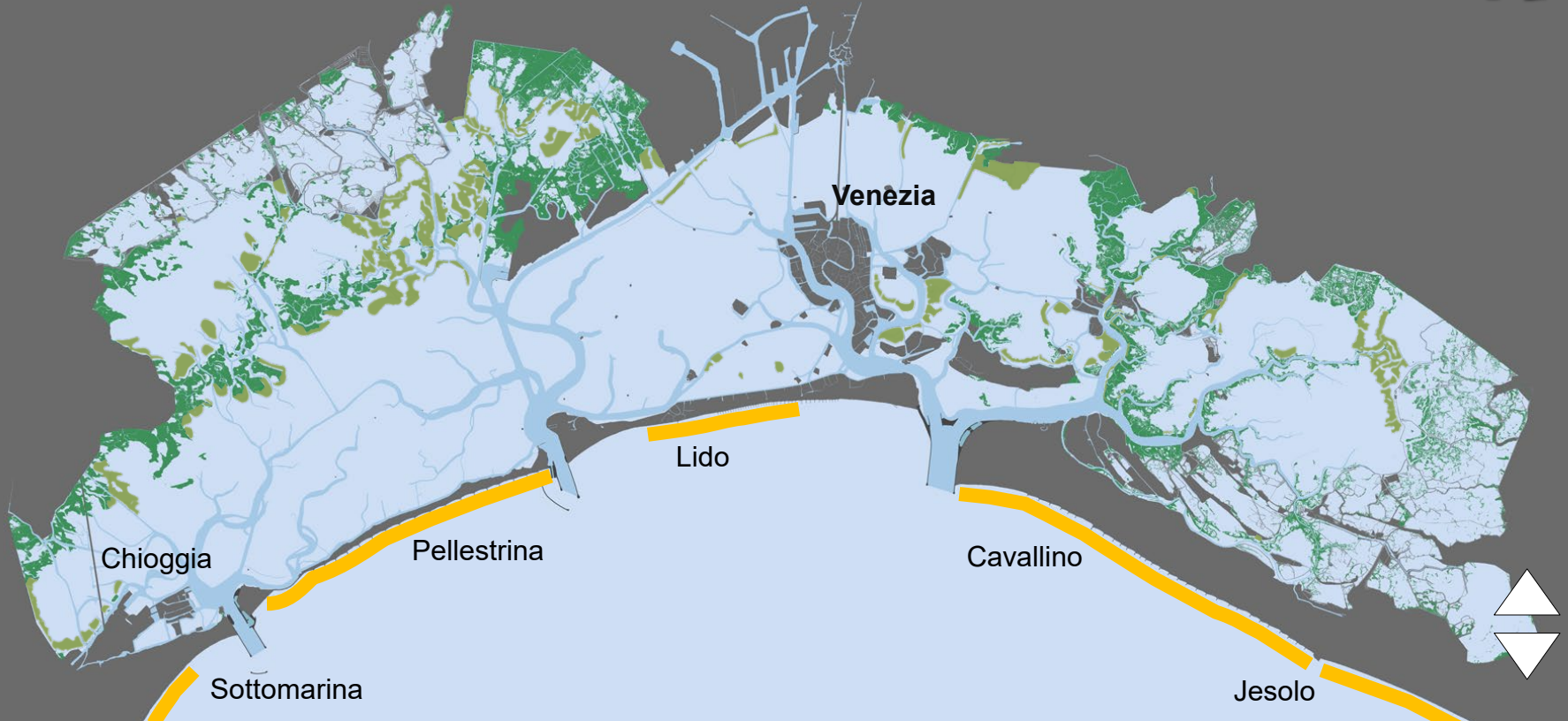


11 km
Reinforced Breakwaters

Coastal Protection

Venetian coastline(November 1966)

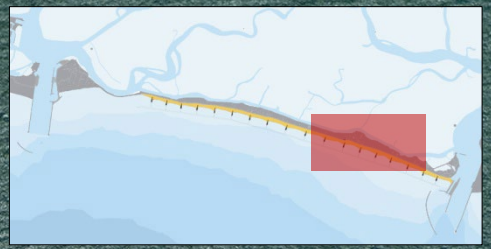
Coastal Protection



Protected Beach Nourishment

Pellestrina

Before 1999

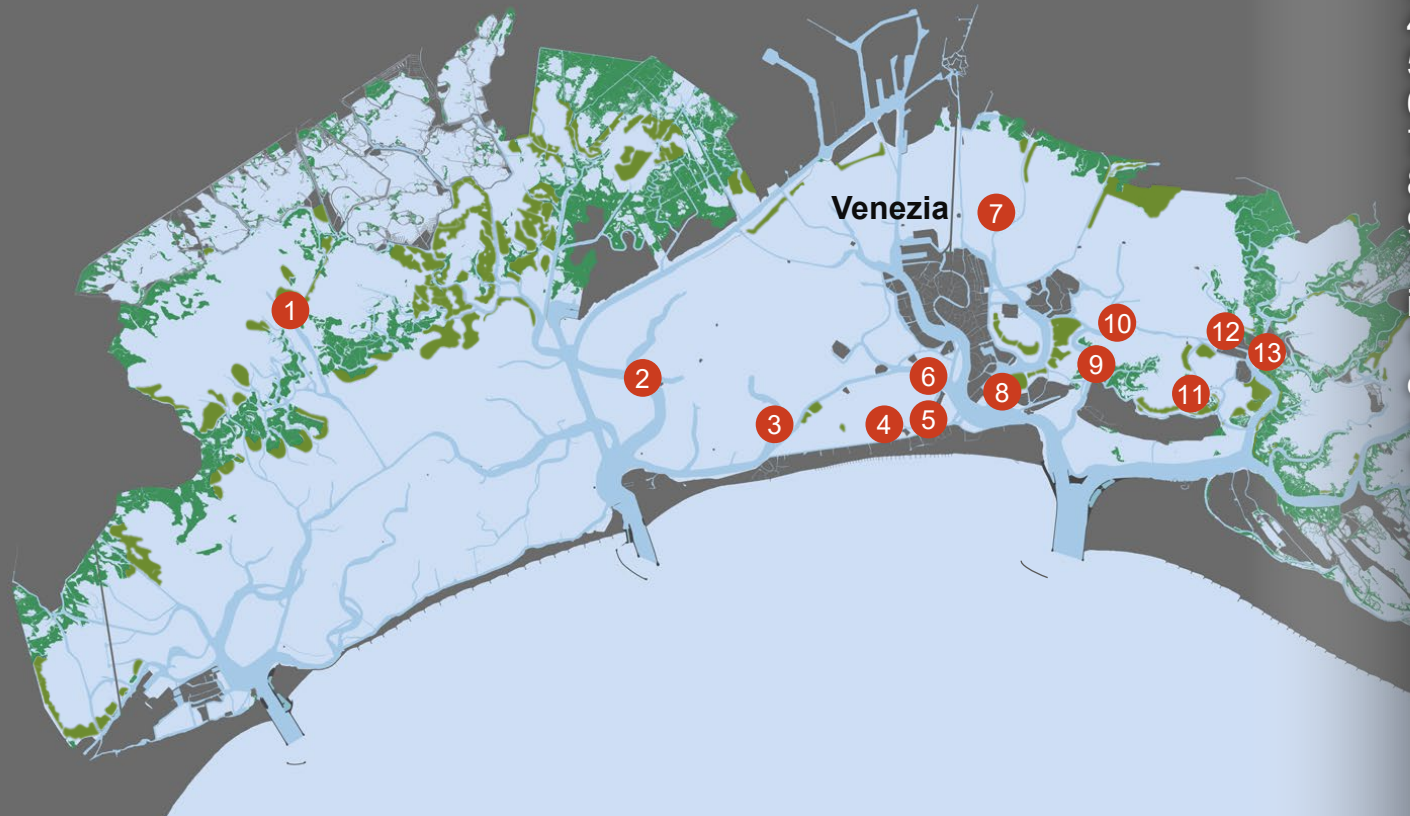


Protected Beach Nourishment

Pellestrina

After 2000

Restoration of Historical Island

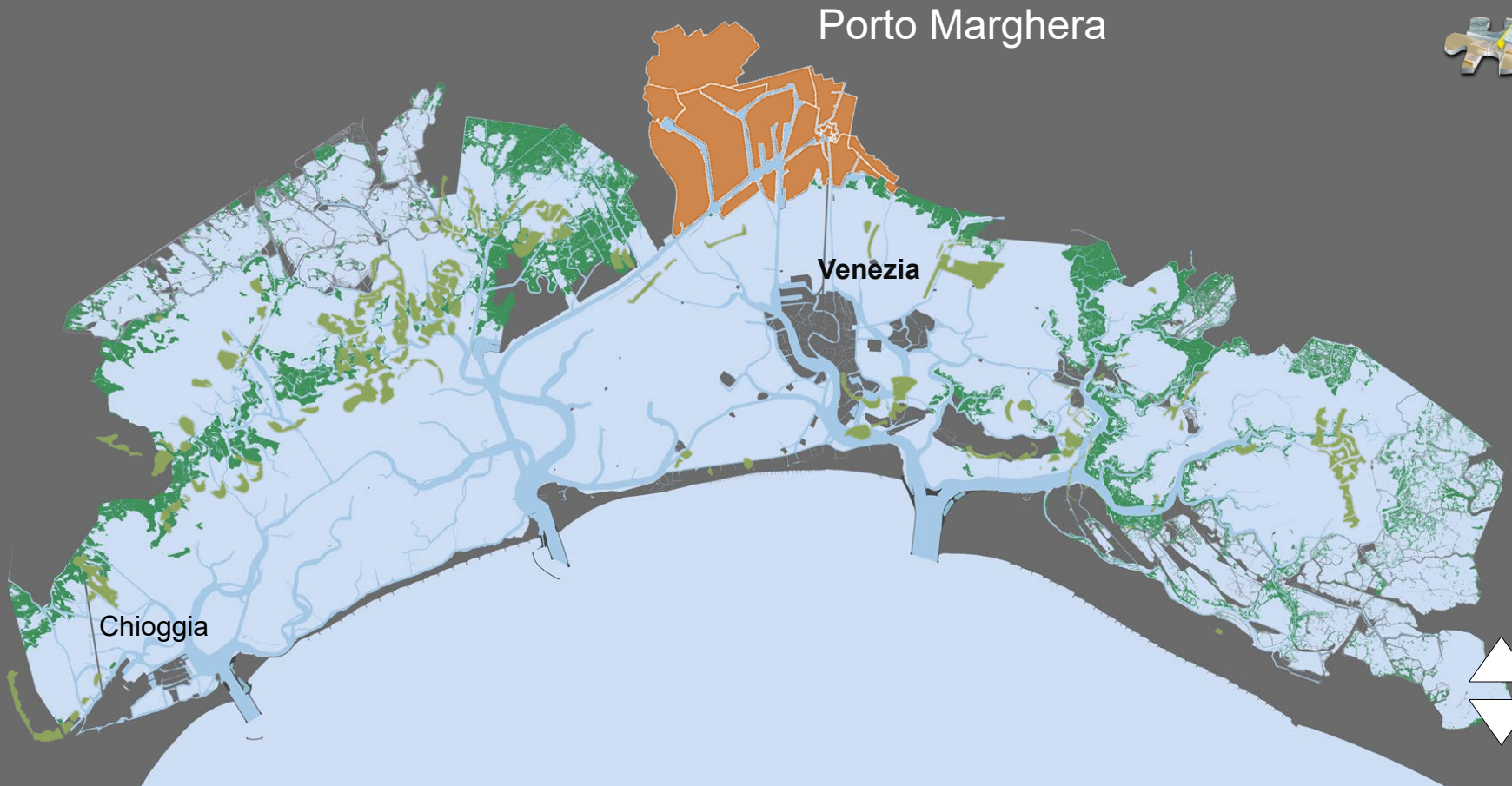


1. Motta Millecampi
2. Fisolo
3. Poveglia
4. Lazzaretto vecchio
5. Armeni
6. S. Servolo
7. Campalto
8. Certosa
9. Lazzaretto nuovo
10. S. Giacomo in paludo
11. S. Francesco del deserto
12. Laghi
13. Torcello

Poveglia Island Restoration

1. Octagon Restoration/Consolidation
2. Renovation / consolidation of masonry banks
3. Side reinforcement
4. Rehabilitation / redevelopment of the internal canal
5. Cavana renovation

Environmental Protection



Environmental Protection

40 km
Industrial Channel banks insulated and waterproofed

7
Dump site secured

39 ettari
phytoremediation areas

Environmental Protection

Protection of dump sites

Prima dei lavori

Environmental Protection

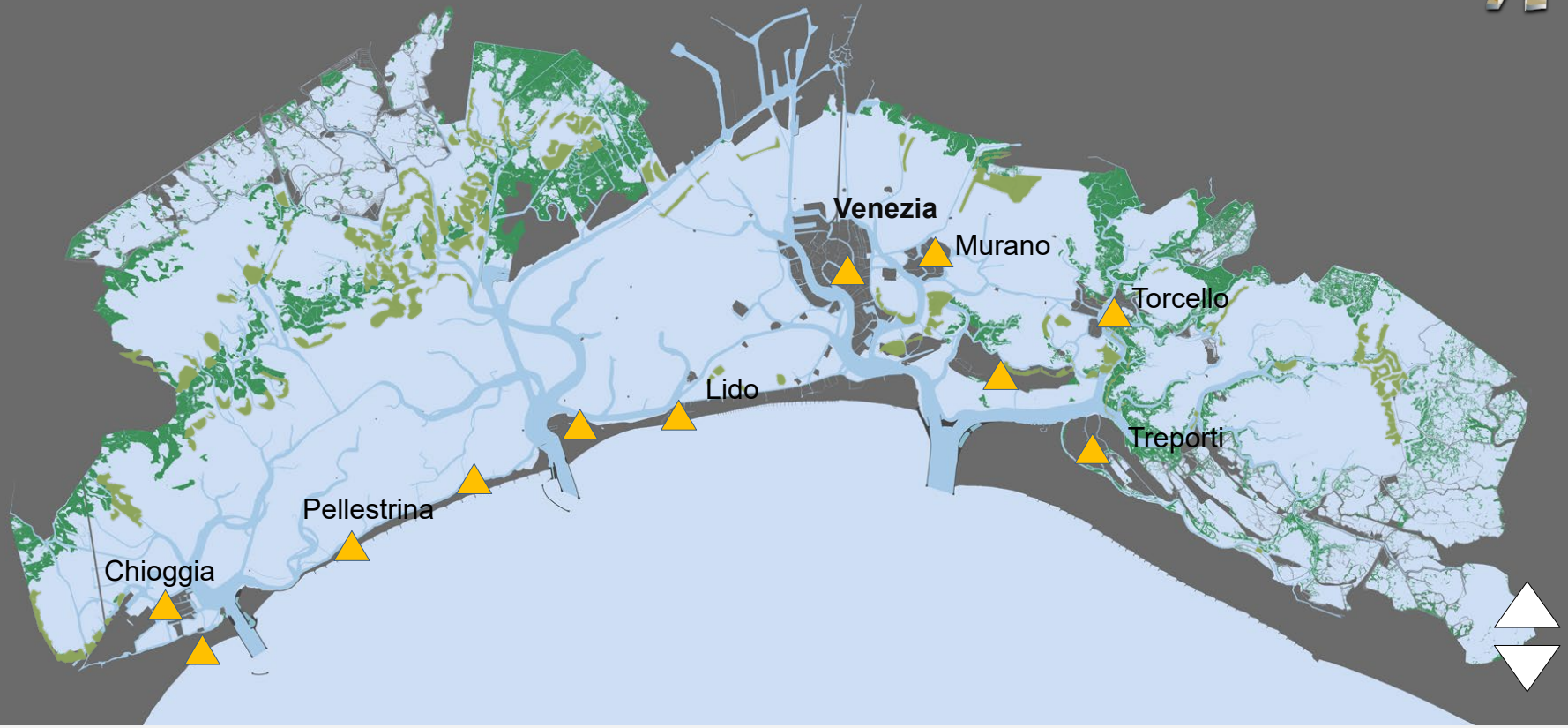
Protection of dump sites

Dopo i lavori

Urban local flood protection and restoration

100 km
Elevation and flood protctcion
of urban space

Local flood protection and restoration



Urban local flood protection and restoration

Venezia – La riva delle Zattere prima dei lavori

Urban local flood protection and restoration

Venezia – la riva delle Zattere dopo i lavori

Urban local flood protection and restoration

Chioggia, before the works

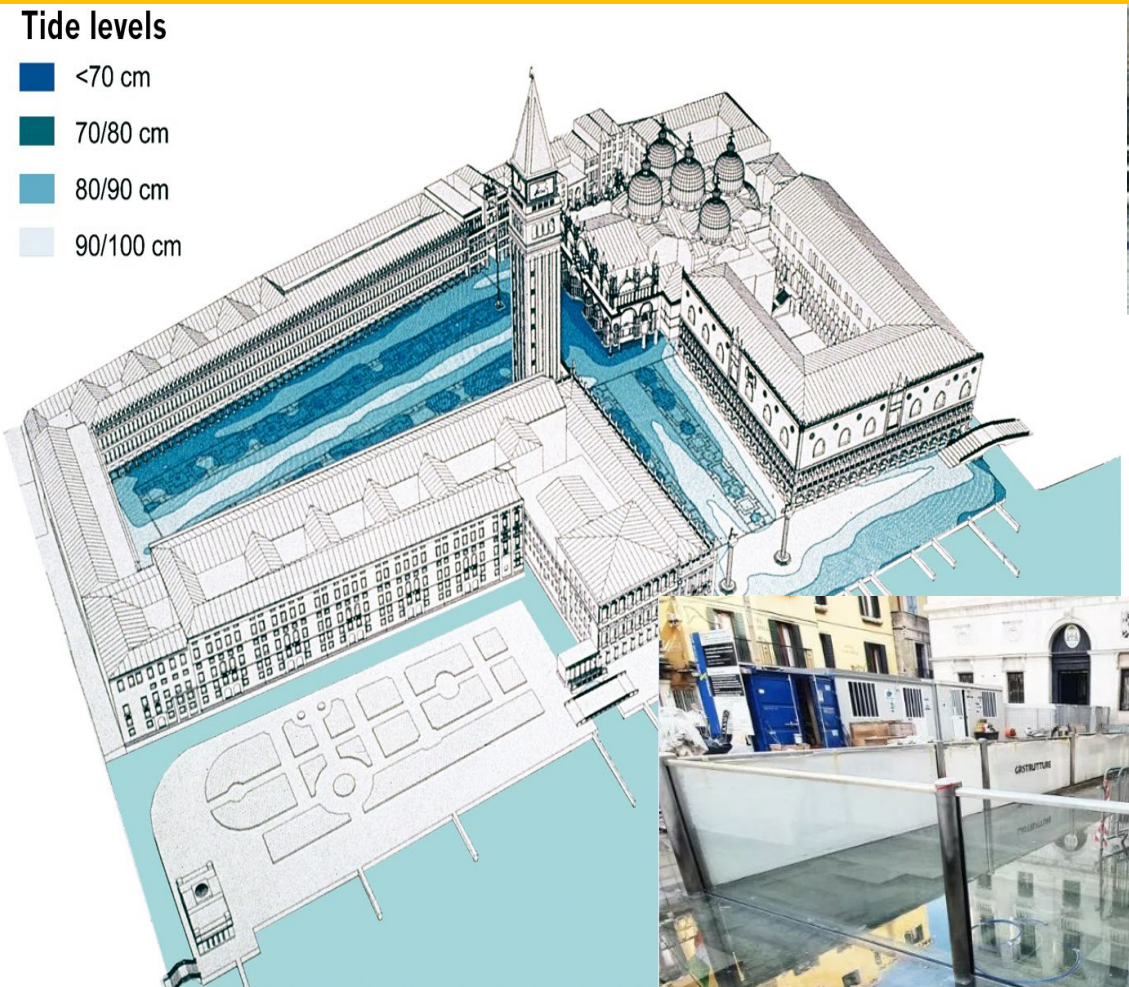
Local urbana adaptation to sea level rise

Urban local flood protection and restoration

Chioggia, Baby Mose

- Chioggia Mini Mose

Piazza San Marco problems and first interventions



Overtopping

Back-flow

Seepage

Glass Barriers

Environmental Restoration

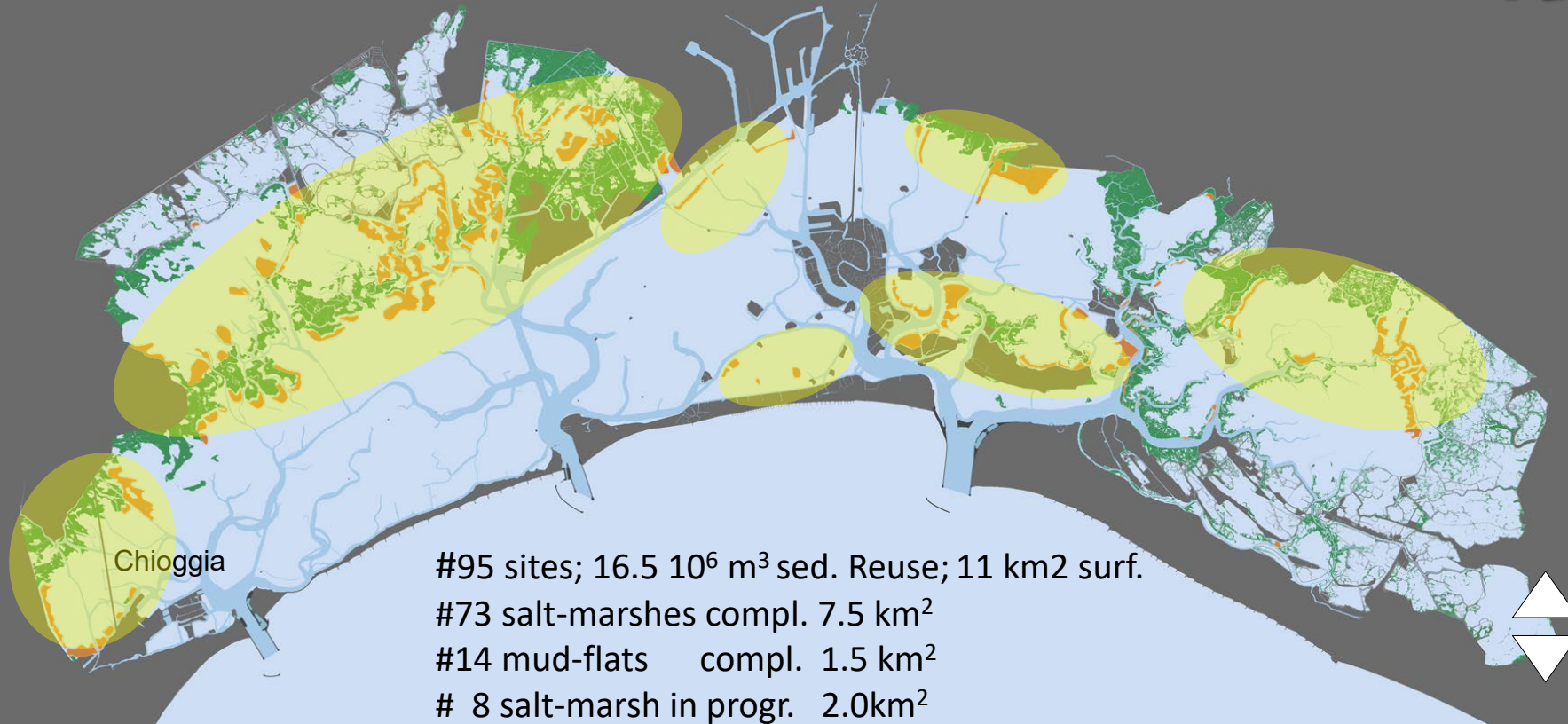
16 km^2
Constructed salt marshes

39 km
Wetland wave protection

12
Number of island restored and protected

Environmental Restoration and Resilience

Constructed salt-marshes and mud-flats reusing sediments from channel maintenance dredging



#95 sites; 16.5 10^6 m^3 sed. Reuse; 11 km2 surf.
#73 salt-marshes compl. 7.5 km^2
#14 mud-flats compl. 1.5 km^2
8 salt-marsh in progr. 2.0km^2

Environmental Restoration and resilience

Construction of gabion boundary to confine pumped sediments

Environmental Restoration and resilience

Natural development of alophitic plants after 5 years

Local protection of the edges of mudflats and salt marshes: 33 km
also through the experimentation of primers
(sedimentation screens, surface nourishment, vivification channels, vegetation transplants)

Thin-layer nourishment

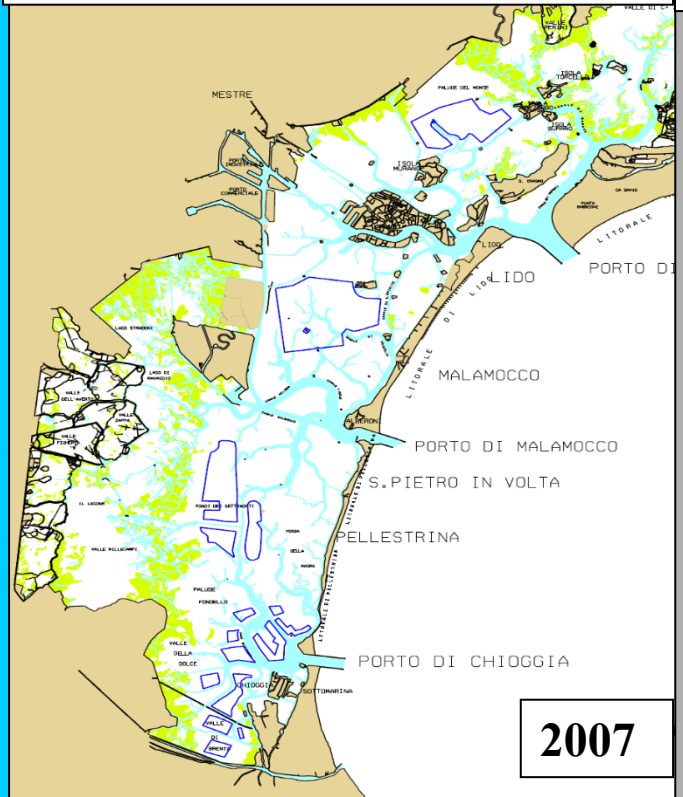
Vivification Channels

«Scomensera»

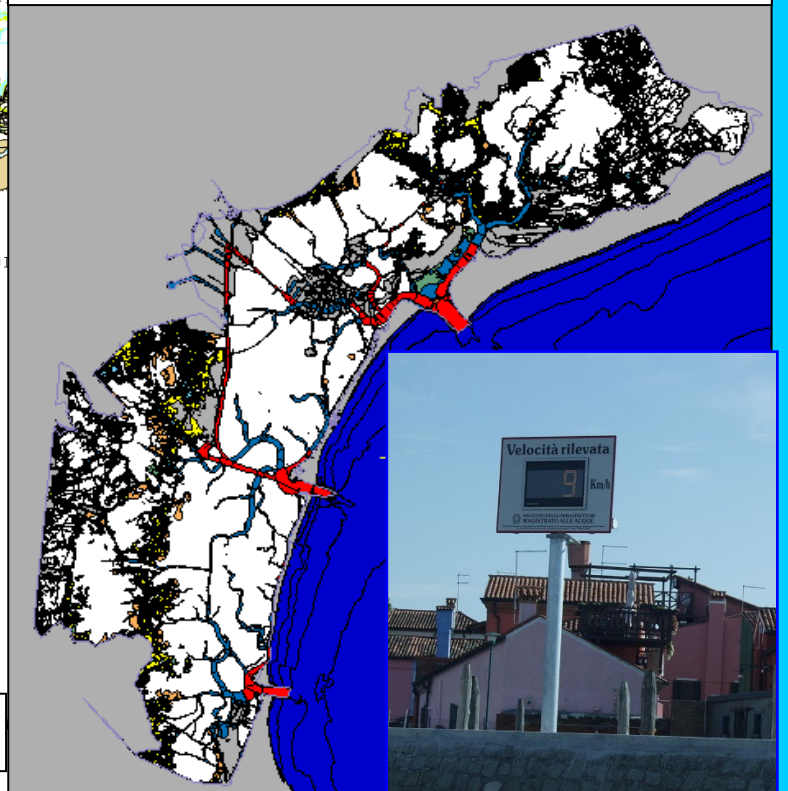
Vegetation transplants

Prevention activities: Fisheries plan of the Province of VE and MAV;
Regulation and control of navigation and deterrence systems

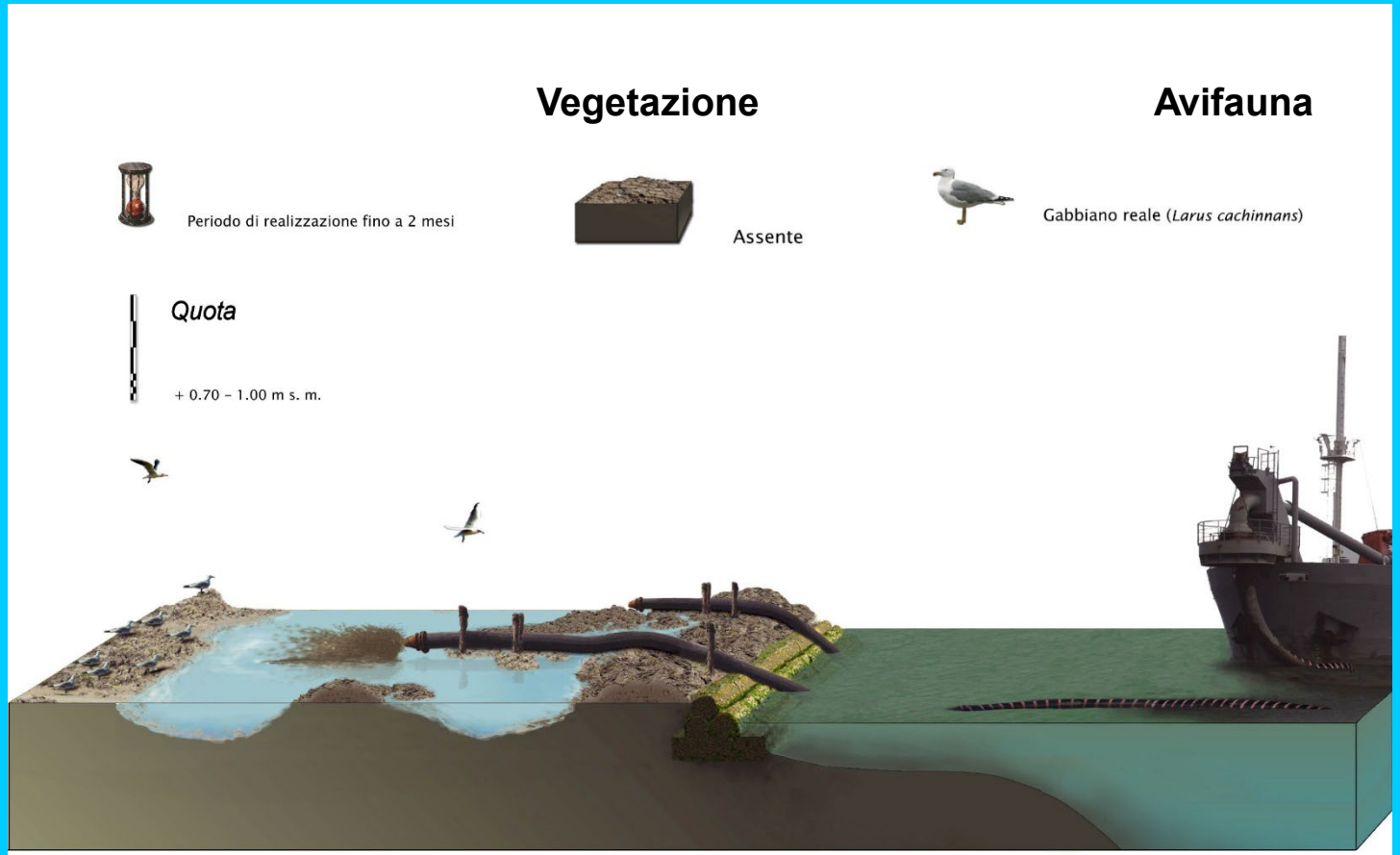
Concession areas for Tapes fishing



Speed Limits MAV Order 2007



STAGE 0 (up to 2 months after construction)



STAGE 1 (2 months to 1 year after completion)

Vegetazione

Da 2 mesi a 1 anno

Vegetazione a *Salicornia* sp. (specie pioniera)

Quota

+ 0.60 – 0.70 m s. m.

Avifauna

Specie di interesse conservazionistico

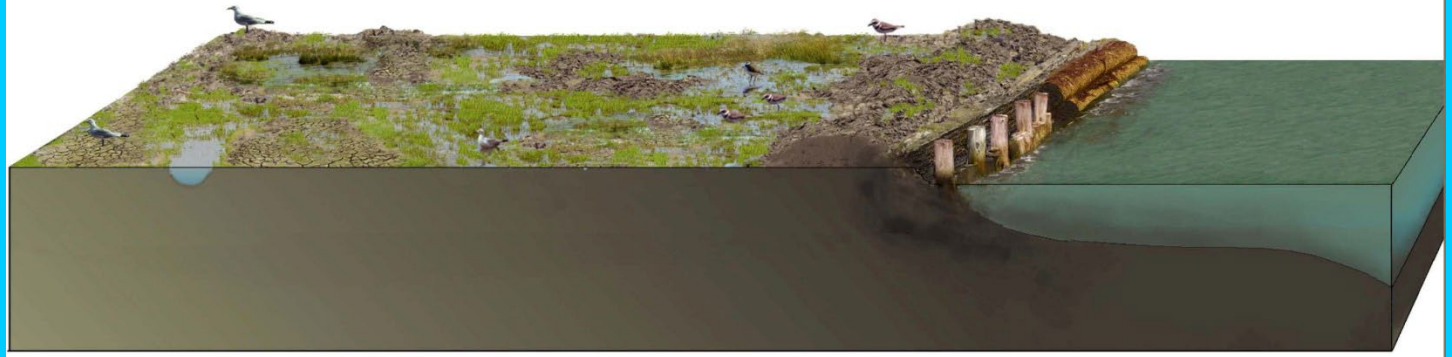
Fratino (*Charadrius alexandrinus*)

Beccaccia di mare (*Haematopus ostralegus*)

Fraticello (*Sterna albifrons*)

Altre specie

Gabbiano reale (*Larus cachinnans*)



STAGE 2 (1 to 3 years from completion)

Da 1 a 3 anni

Quota

+ 0.45 – 0.55 m s. m.

Vegetazione

Vegetazione a *Salicornia* sp. (specie pioniera)

Vegetazione a *Puccinellia palustris* e a *Sarcocornia fruticosa* (specie perenni)

Avifauna

Specie di interesse conservazionistico

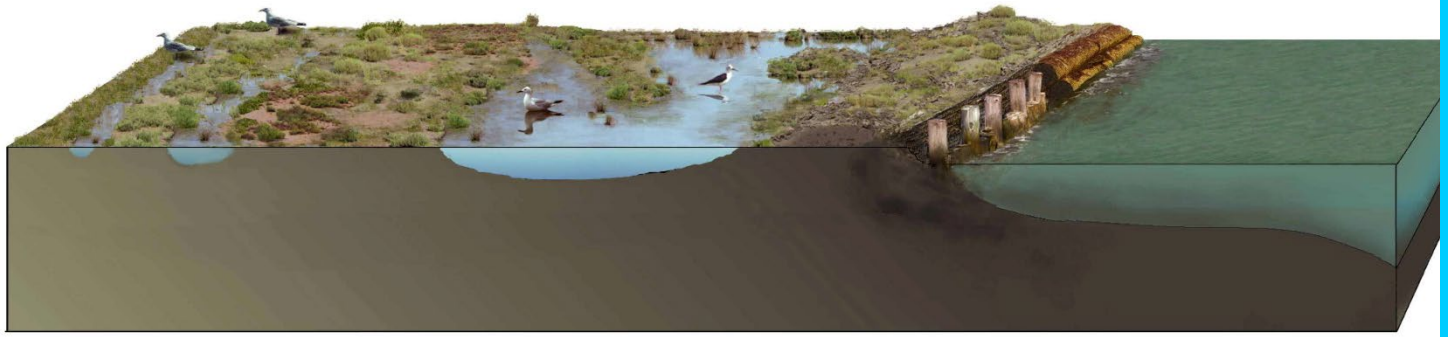
Fratino (*Charadrius alexandrinus*)

Beccaccia di mare (*Haematopus ostralegus*)

Fraticello (*Sterna albifrons*)

Altre specie

Gabbiano reale (*Larus cachinnans*)



STAGE 3 (3 to 6 years from completion)

Da 3 a 6 anni

Quota

+ 0.40 – 0.50 m s. m.

Vegetazione

Vegetazione a *Sarcocornia fruticosa* (specie perenne)

Vegetazione a *Limonium narbonense* (specie perenne)

Vegetazione ad *Halimione portulacoides* (specie perenne)

Avifauna

Specie di interesse conservazionistico

Beccaccia di mare (*Haematopus ostralegus*)

Germano reale (*Anas platyrhynchos*)

Cavaliere d'Italia (*Haematopus haematopus*)

Fratino (*Charadrius alexandrinus*)

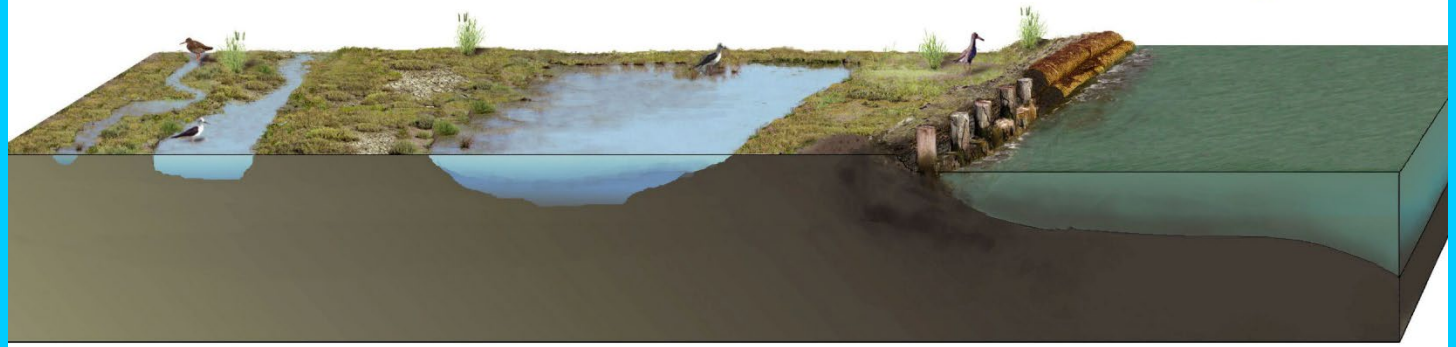
Avocetta (*Recurvirostra avosetta*)

Pettegola (*Tringa totanus*)

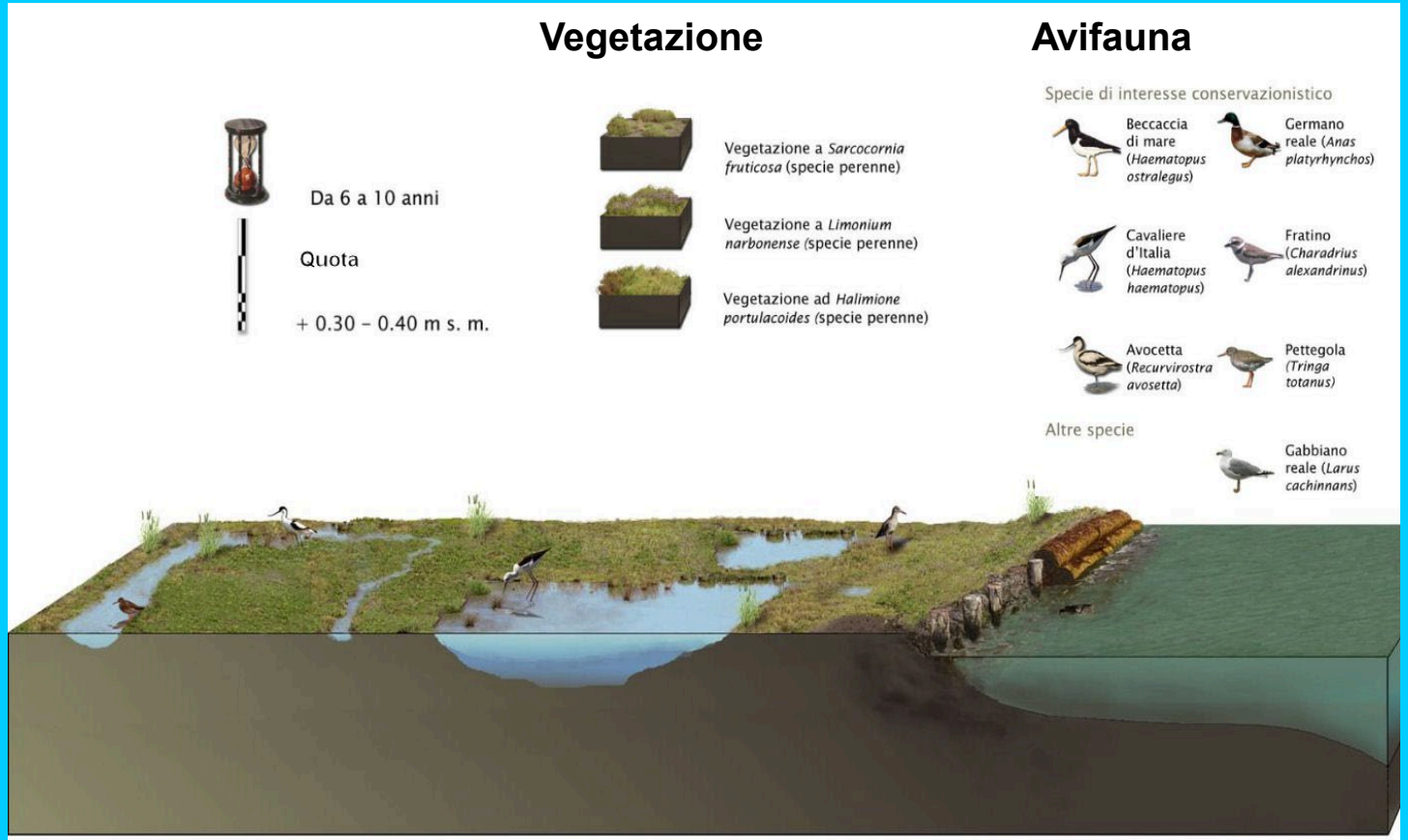
Volpoca (*Tadorna tadorna*)

Altre specie

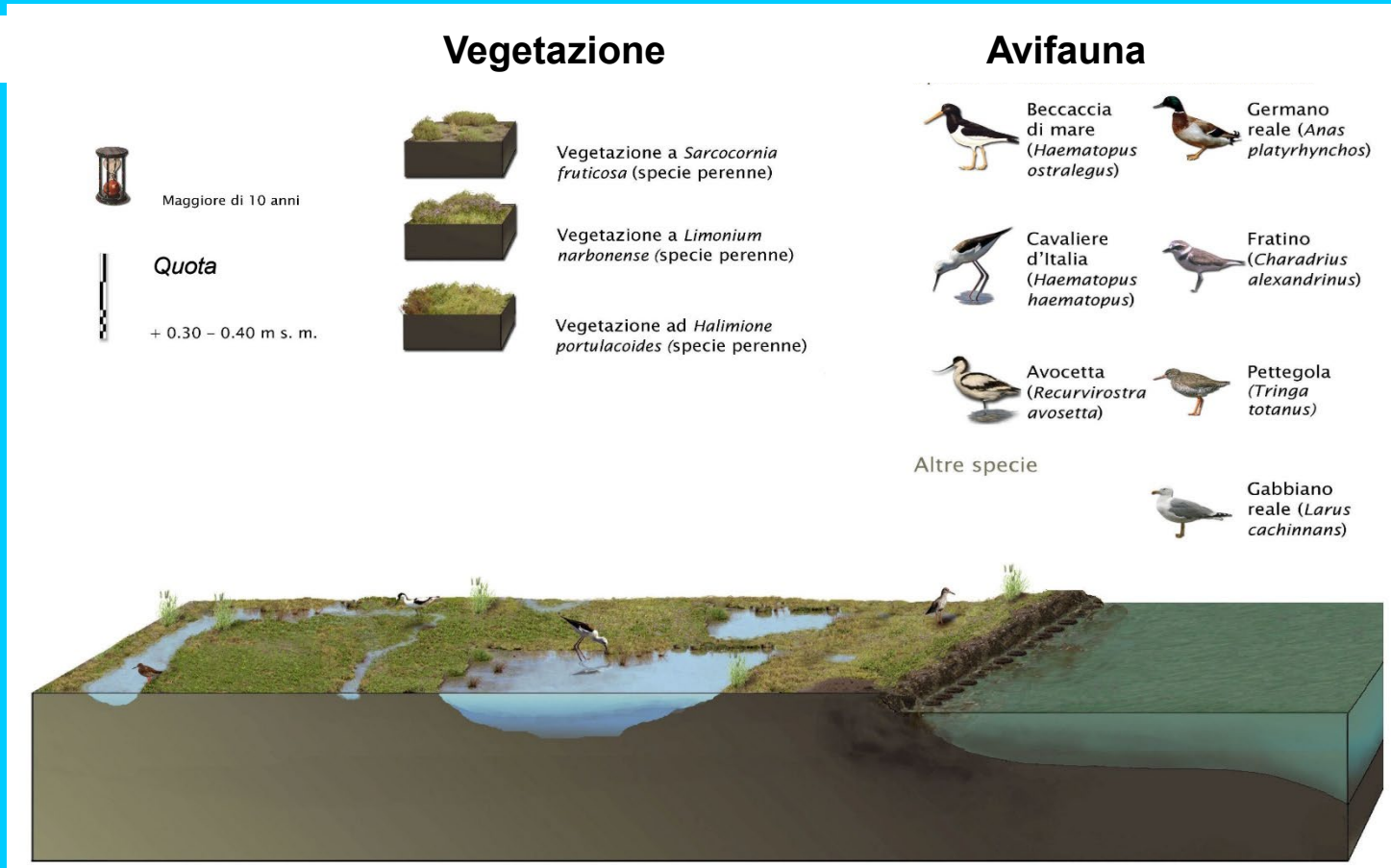
Gabbiano reale (*Larus cachinnans*)



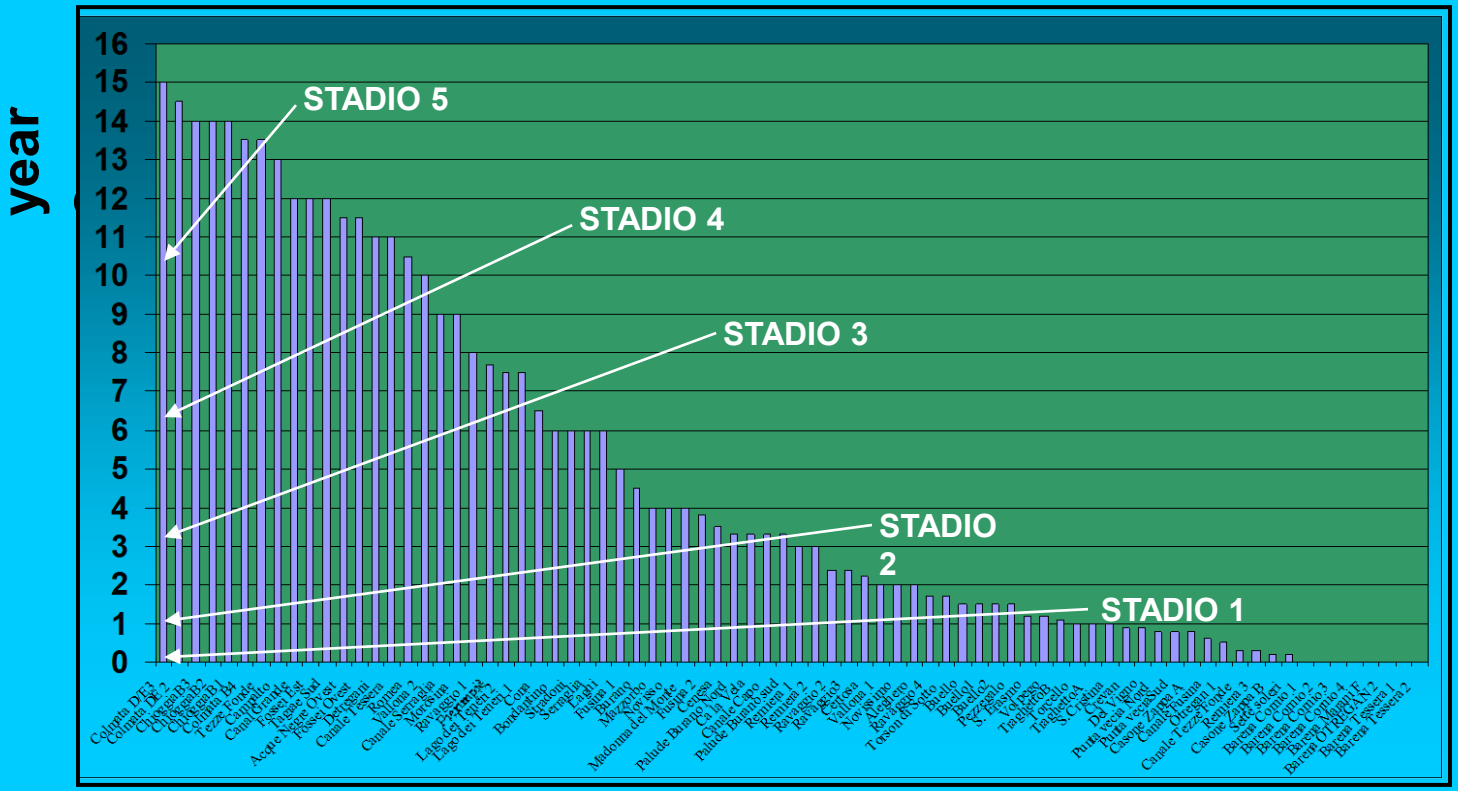
STAGE 4 (6 to 10 years from completion)



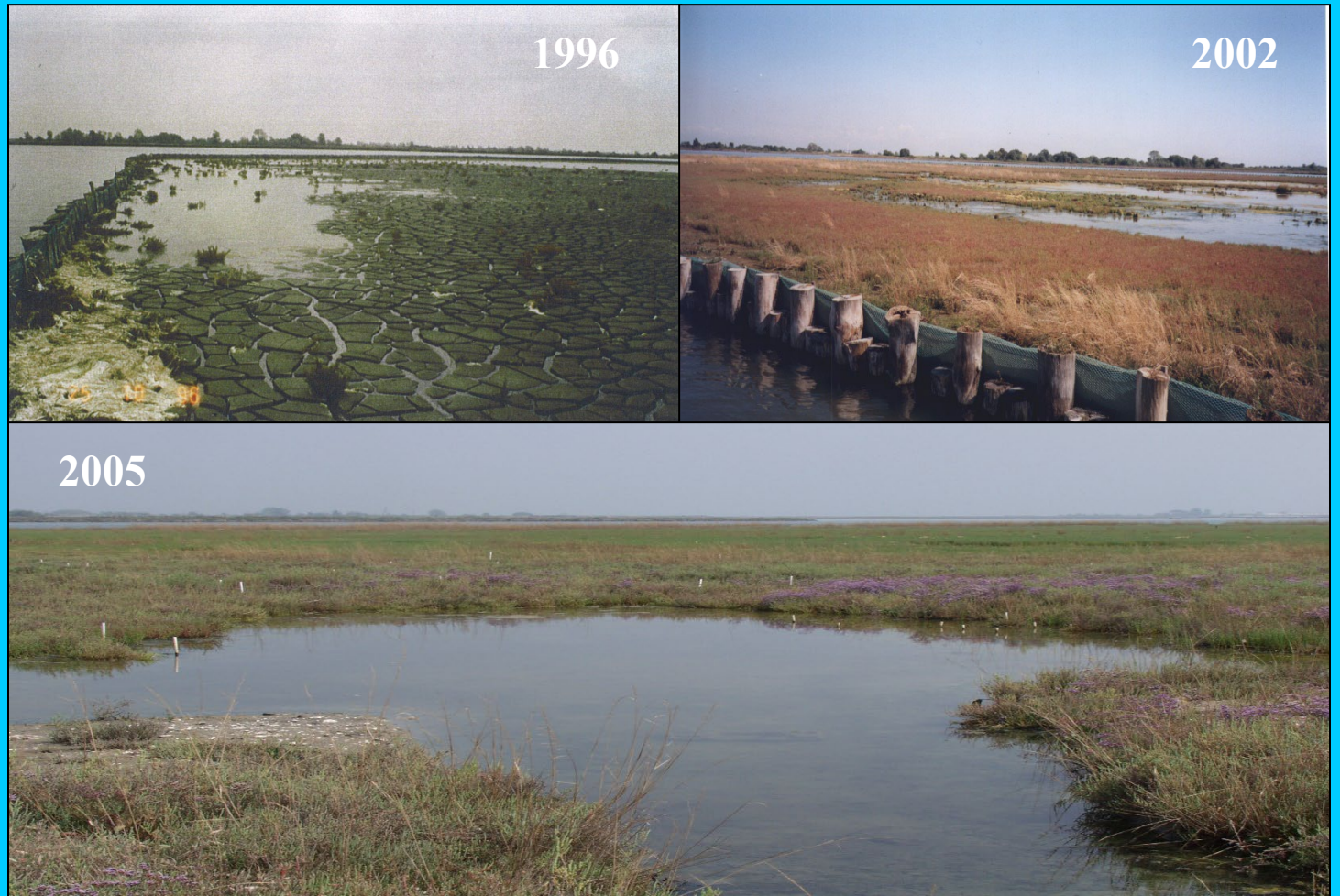
STAGE 5 (more than 10 years since construction)



Eta' barene realizzate al 31 Dicembre 2008

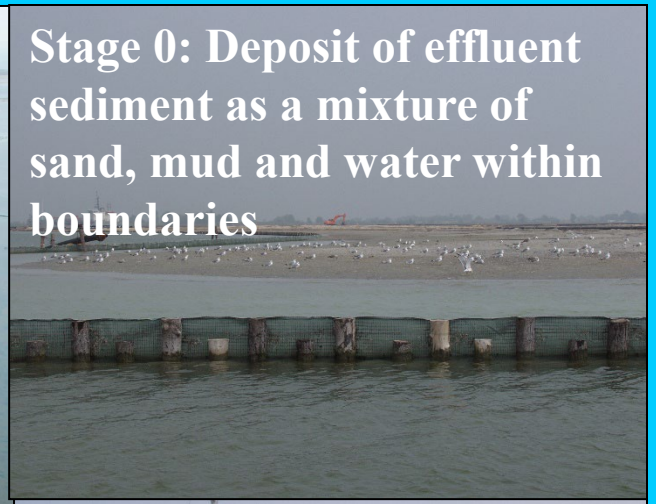


Naturalization process: B. Detregani in S.Leonardo



Artificial salt marshes are not THE COPY of natural salt marshes.
Rather, they are the RE-PRODUCTION of the natural processes to which the soils and salt marshes are subjected, triggered by artificial sediment deposits

La naturalizzazione dei depositi procede nel tempo in modo discontinuo attraverso **5 stadi**, a partire dallo stadio del cantiere.



Environmental Restoration and resilience

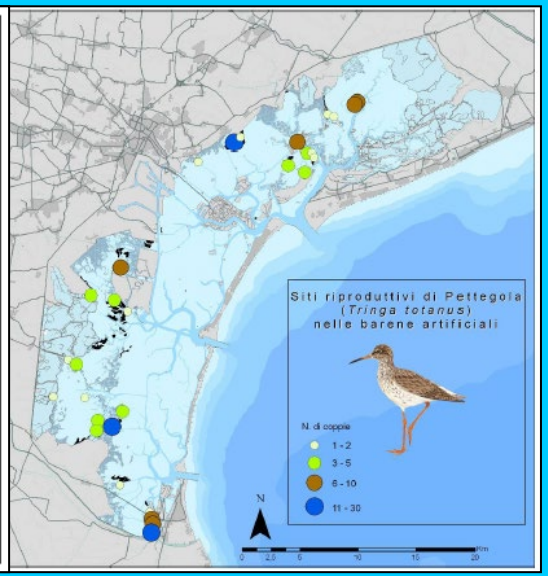
Environmental Restoration and resilience

Wave protection with oyster and stone inside HPDE gabions

THE CONSERVATION OF THE MUDFLATS AND SALT MARSHES IS A GUARANTEE OF HABITAT FOR NESTING BIRDS

a. In the natural salt marshes of a few km2 nest 4-6 species of naturalistic interest: redshank, mallard, sandwich flycatcher, black-winged stilt, but also plover and little tern.
b. With the addition of artificial salt marshes, there are 3 other species: woodcock, shelduck, and little plover, with a substantial increase in specific wealth.
c. In natural salt marshes, and especially in artificial ones, the density of redshank, a particularly important species, is remarkable, with 40 pairs/km2.

Specie	In barene artificiali	In Italia[18]	Contributo % delle barene artificiali
Volpoca	12	300	4
Germano reale	19	> 50.000	<0.1
Pavoncella	5	2000	<0.1
Beccaccia di mare	40	134	30
Cavaliere d'Italia*	62	3500	2
Avocetta*	35	1900	2
Corriere piccolo	18	3150	0.5
Fratino*	131	1650	8
Pettegola	110	1600	7
Gabbiano reale	796	45000	2
Fraticello*	379	4250	9



Unexpected new island induced by the Mose closures limiting winter shoal overtopping

Environmental Restoration and resilience

Living with nature

a. Adaptation to sea level rise and wave erosion:
Construicted morphological structures (salt marshes and tidal flats) are able to grow (0,5 cm/year) by capturing sediments to maintain their elevation compensating sea level rise and subsidence.

b. They provide a great number of ecosystem services:

- Fencing and dumping of ever-increasing waves due to deeper waters
- Self maintenance of channel depths guiding the tidal currents and stopping crossflow
- Tidal mixing and water renewal
- Trapping of sediments and nutrients, avoiding the dispersal into deeper channels and sea,
- Carbon sink (200 Co2 gr/m2year)
- New fish and bird habitats
- Biodiversity
- Food production of commercial importance (e.g.clam, schrimp, crab, Go)
- Amenities and sentimental Landscape

"By formal and informal exchanges with other water cities
Venice continue to be the oldest city of the future
This knowledge is now available both
by institutional exchanges and bottom-up local community cooperations"

Venice Lab Adaptive Hospitality

Ing. Giovanni Cecconi
Former dir. of the Mose Information Service
& Control Room of Consorzio Venezia Nuova
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