



MAGISTRATO ALLE ACQUE DI VENEZIA



CONSORZIO VENEZIA NUOVA

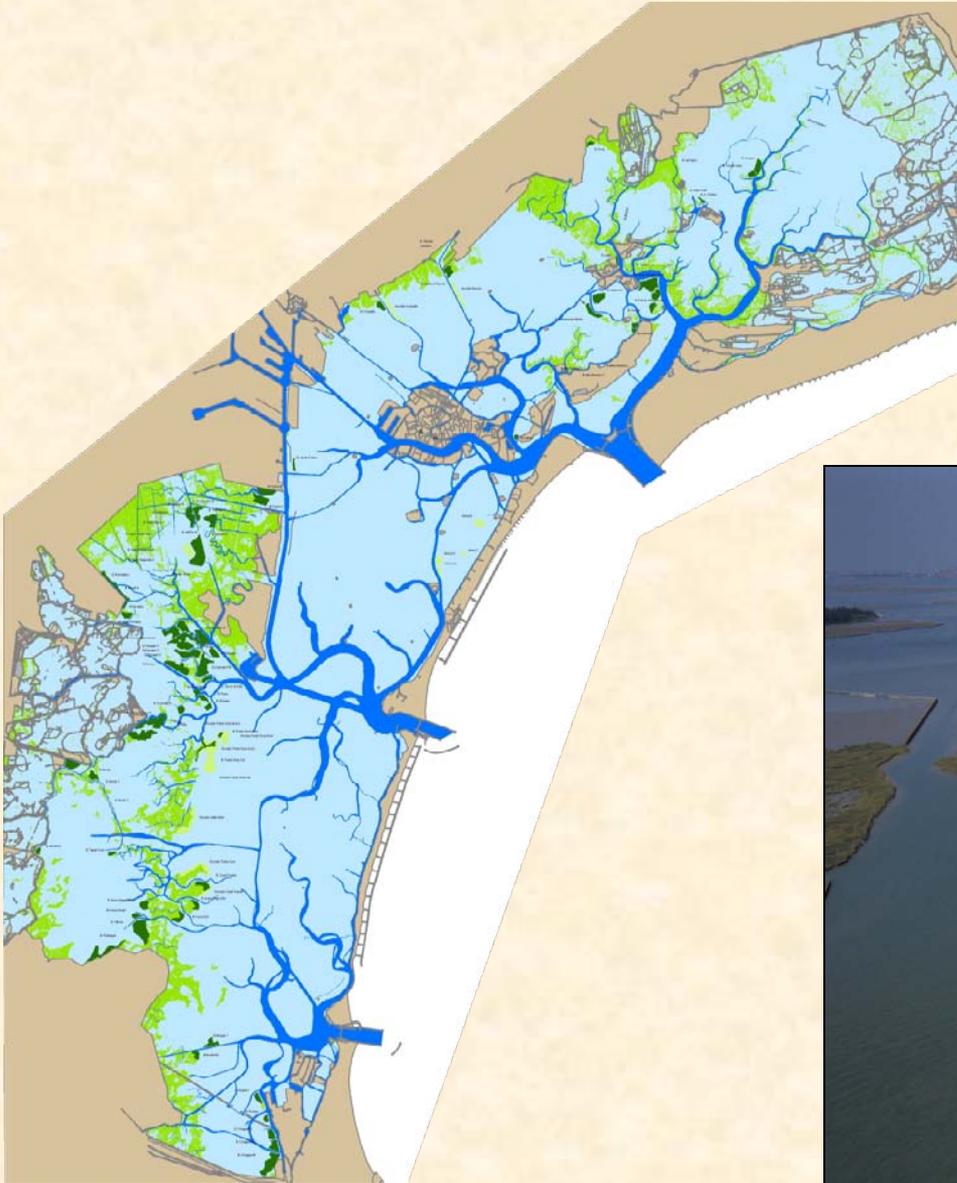
# Evaluation of the ecological status of reconstructed habitats in the Venice lagoon

Ing. Giovanni Cecconi

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Venice, Italy



# CONSTRUCTED SALTMARSHES



19.5 million m<sup>3</sup> of sediments have been re-used for constructing 123 units of tidal flats and salt marshes over a period of 25 years:

- 11 Km<sup>2</sup> of salt marshes
- 2 km<sup>2</sup> of tidal flats

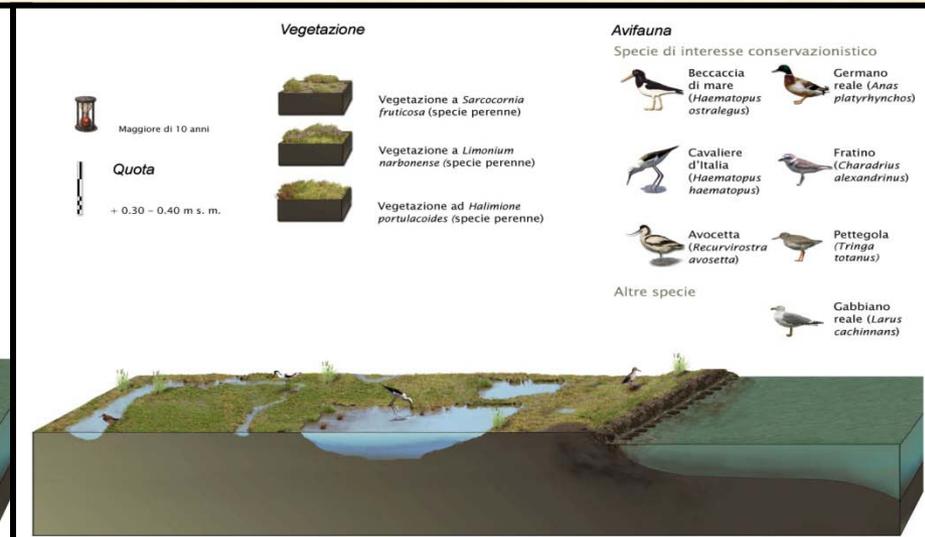
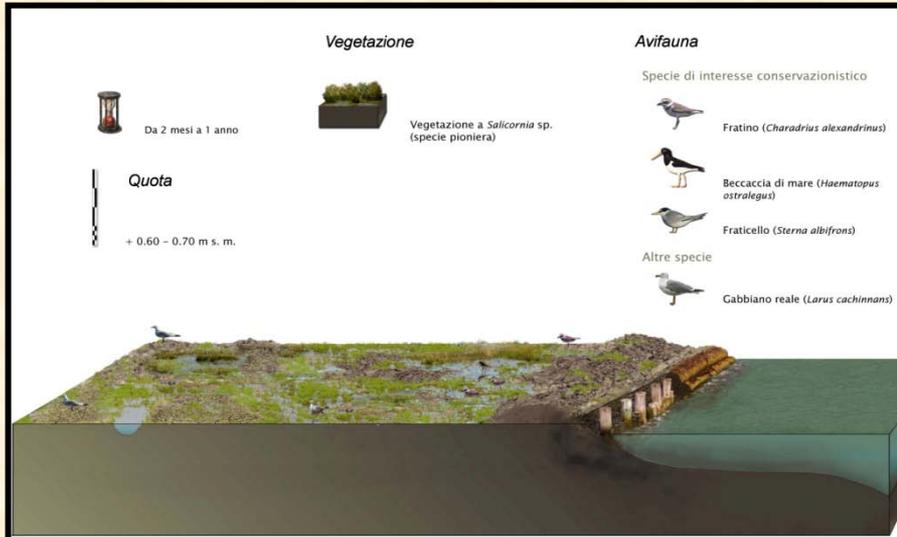


## The monitoring of constructed salt marshes:

- **Habitat evolution** in accordance with well defined expected stages
- **Biodiversity** induced by adaptive and protective works



# Expected stages of constructed salt marsh



STAGE 1: up to 1 year after sediment filling

STAGE 5: after 10 years

# Nesting

In the stage 1 the bare soil is a nesting habitat for: Kentish plover (*Charadrius alexandrinus*), Little tern (*Sterna albifrons*), Eurasian Oystercatcher (*Haematopus ostralegus*) and Yellow-legged gull (*Larus michahellis*) occasionally

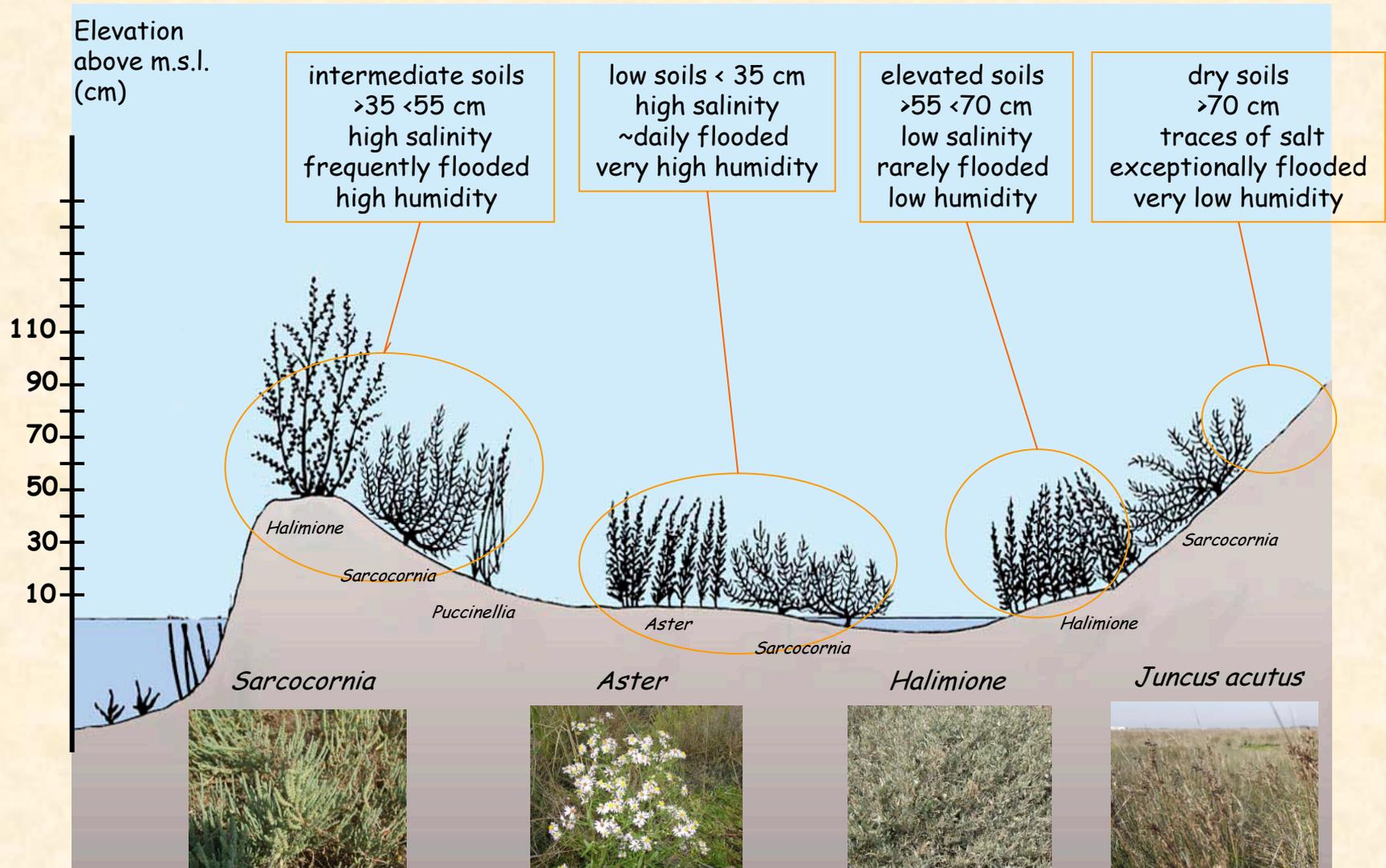
**Little tern**



**Avocet**



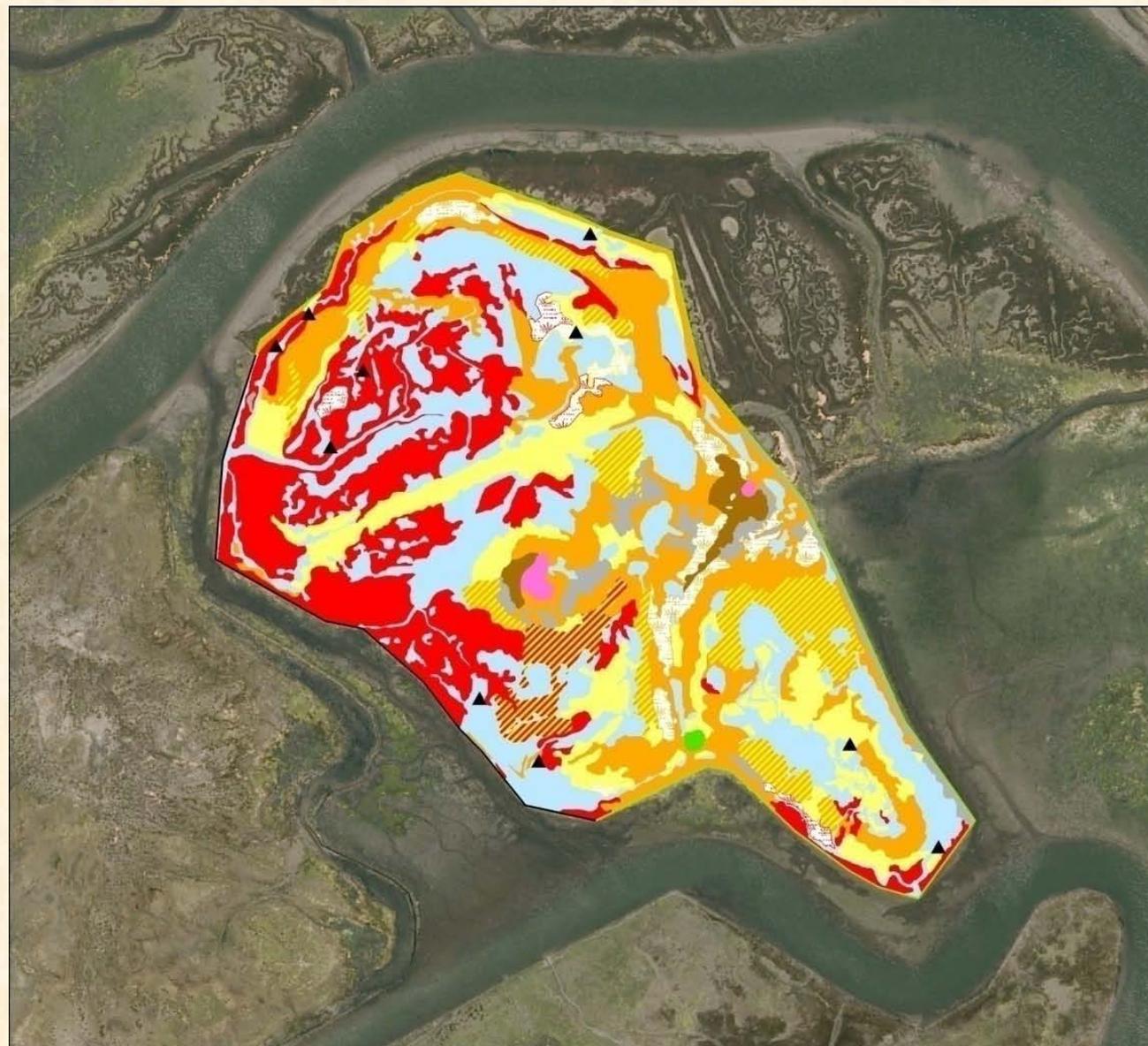
# Alophilus Vegetation



Distribution of halophilous species is driven by the elevation of the soil. Each species is adapted to a short range of elevation of  $\pm 5$  cm.

# Alophilus Vegetation

## Tezze Fonde marsh 15 years after sediment filling



### BARENA TEZZE FONDE

#### LEGENDA

VEGETAZIONI PURE A DOMINANZA DI:

- Suaeda maritima*
- Salicorniasp.*
- Salicornia sp. a copertura rada (<25%)*
- Spartina maritima*
- ▲ *Spartina x townsendii /Spartina anglica*  
(presenza puntiforme)
- Limonium narbonense*
- Limonium narbonense a copertura rada (<25%)*
- Juncus maritimus*
- Aster tripolium*
- Sarcocornia fruticosa*
- Sarcocornia fruticosa a copertura rada (<25%)*
- Halimione portulacoides*
- Specie ruderali  
(*Elymetum atherici, Phragmites australis, ecc.*)
- *Baccaris halimifolia*(presenza puntiforme)

MOSAICI VEGETAZIONALI A DOMINANZA DI:

- Limonium narbonense/Aster tripolium*
- Limonium narbonense/Juncus maritimus*
- Salicorniasp./Limonium narbonense*
- Salicorniasp./Aster tripolium*
- Salicorniasp./Limonium narbonense/Aster tripolium*
- Sarcocornia fruticosa/Limonium narbonense*
- Sarcocornia fruticosa/Halimione portulacoides*
- Sarcocornia fruticosa/Salicorniasp.*
- Sarcocornia fruticosa/Salicorniasp./Aster tripolium*

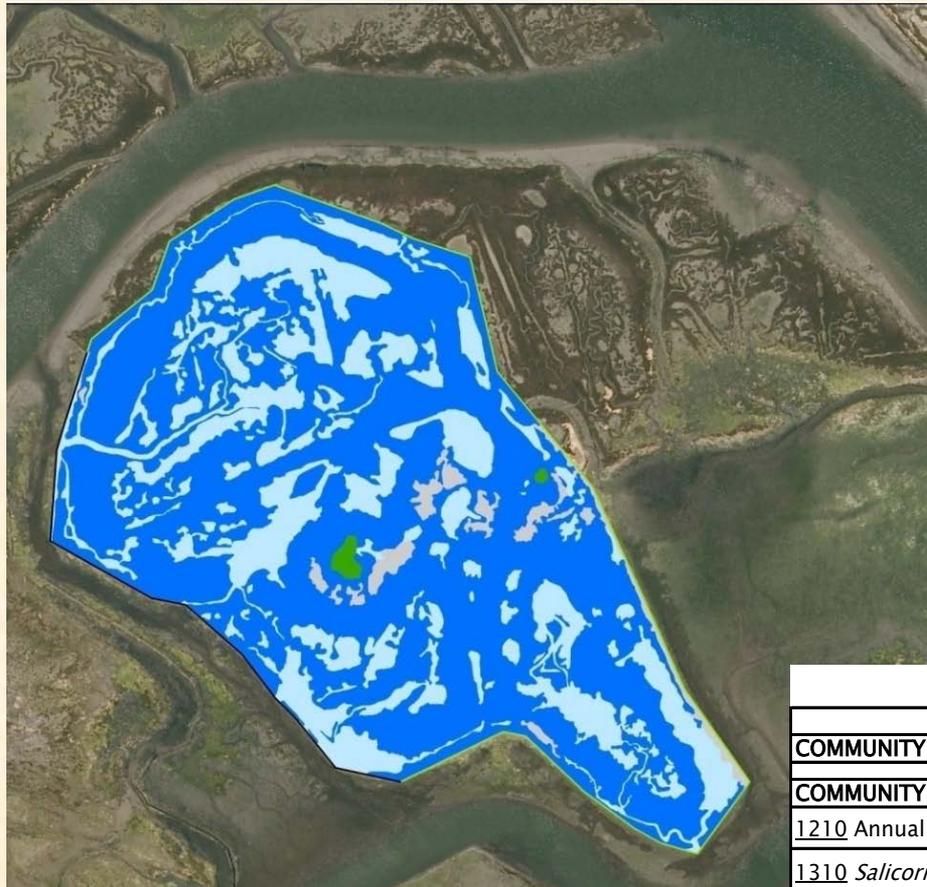
ALTRE CATEGORIE

- Zone prive di vegetazione
- Superfici ad acqua

CONTERMINAZIONI

- Conterminazione
- Confine con barena naturale
- Taglio palificata a quota barena

# Habitat of interest in according to 92/43/EU Directive



## BARENA TEZZE FONDE

### HABITAT COMUNITARI secondo Direttiva 92/43/CE

- COMUNITARI NON PRIORITARI**
- 1210-Vegetazione annua delle linee di deposito
  - 1310-Vegetazione pioniera a *Salicornia* e altre specie annuali delle zone fangose e sabbiose
  - 1410-Pascoli inondati mediterranei (*Juncetalia maritimi*)
  - 1420-Praterie e fruticeti alofili mediterranei e termo-atlantici (*Sarcocornetea fruticosi*)
- NON COMUNITARI**
- Specie ruderali (vegetazione erbacea, canneto, ecc.)

#### ALTRE CATEGORIE

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- Superfici ad acqua

#### CONTERMINAZIONI

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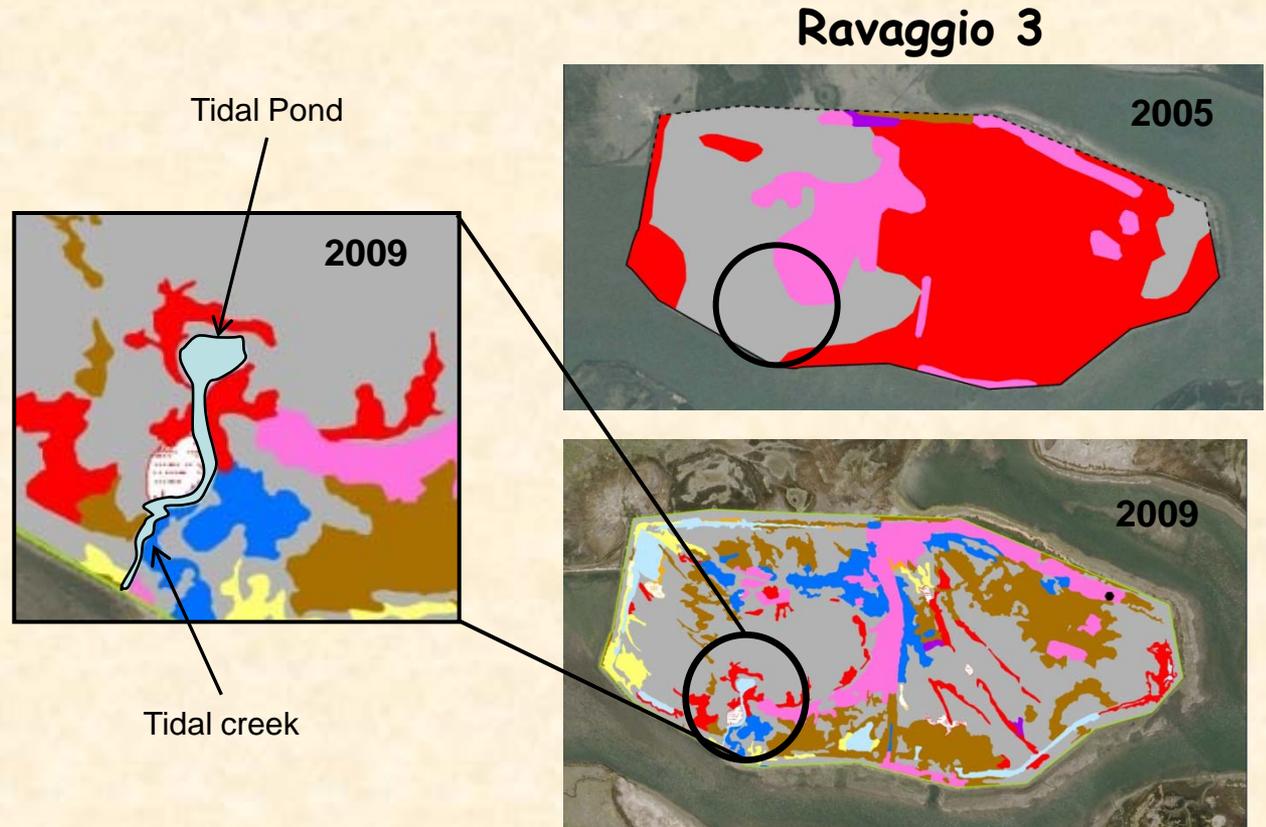
	COMMUNITIES DOMINATED BY:
<b>COMMUNITY PRIORITY HABITATS</b>	Absent
<b>COMMUNITY HABITATS NON PRIORITY</b>	
<u>1210</u> Annual vegetation of drift lines	<i>Suaeda maritima</i>
<u>1310</u> <i>Salicornia</i> and other annuals colonising mud and sand	<i>Salicornia</i> sp.
<u>1410</u> Mediterranean salt meadows ( <i>Juncetalia maritimi</i> )	<i>Limonium narbonense</i> <i>Puccinellia palustris</i> <i>Aster tripolium</i> <i>Juncus maritimus</i> <i>Spartina maritima</i>
<u>1420</u> Mediterranean and thermo-Atlantic halophilous scrubs ( <i>Sarcocornetea fruticosi</i> )	<i>Sarcocornia fruticosa</i> <i>Halimione portulacoides</i>
Mosaic of Habitats <u>1210/1310/1410/1420</u>	Mosaics of the above communities
<b>NON COMMUNITY HABITATS</b>	Ruderal species

# Adaptative works leading to biodiversity through temporary disturbances

Excavation of a creek and pond in salt marsh Chioggia B1



The new tidal flow and different soil elevation contribute to the formation of suitable habitats for fishes, birds and vegetation



# Birds

Overall, the constructed salt marshes have a mosaic of habitats, that can support several guilds of birds, since they can exploit many different patches.

Tidal Ponds and creeks habitat are used by waterbirds for feeding;

Fence and mounds with drift lines are used by Passerines for feeding.

## CANALE TESSERA SALT MARSH



# Fishes

Constructed salt marshes host a diverse and abundant fish community similarly to natural salt marshes:

4 endangered species: nono (*Aphanius fasciatus*), ghiozzetto di laguna (*Knipowitschia panizzae*), ghiozzetto cinerino (*Pomatoschistus canestrinii*) and cavalluccio marino (*Hippocampus guttulatus*).

many species of commercial interest both adults and juvenile: latterino (*Atherina boyeri*), ldiverse species of cefalo (*Liza spp.*, *Chelon labrosus*), gamberetto di laguna (*Palaemon sp.*), gamberetto grigio (*Crangon crangon*) e l'orata (*Sparus aurata*)

## Sheltering effect of hard structure

Protection and confined water body provide shelter for many fish species



## Terrestrial invertebrates

Dry patches at an elevation above the tidal range and drift lines increase local biodiversity allowing the survival of endangered insects of nice coastal ecosystem



*Anisodactylus poeciloides*

# Conclusions

- The reuse of large volumes of sediment has produced an increase of 32% of salt marshes and tidal flats of Venice Lagoon creating EU community habitats of alophilus vegetation that sustain birds and fishes listed in protection list ( 92/43/EU and EC Birds Directive)
- The new habitat contribute to improve water quality of the lagoon according to the Water Framework Directive, reducing the risk of anoxia.
- The techniques have been improved over a period of 25 years of monitoring and adaptation measures.
- Adaptation on protection works are essential to trigger the naturalization processes and the biodiversity with a limited disturbance.
- Moreover biodiversity is locally increased by the new activities of fencing works in according to the ecological principles for habitat protection also using biostabilizing structures:
  - ✓ Sandy beaches and screens to create drift lines above high tide for birds and insects;
  - ✓ Channeling protections with living bivalves;
  - ✓ Fresh water inputs to support fragmites;
  - ✓ Microbial mats development;
  - ✓ Seagrass transplanting.