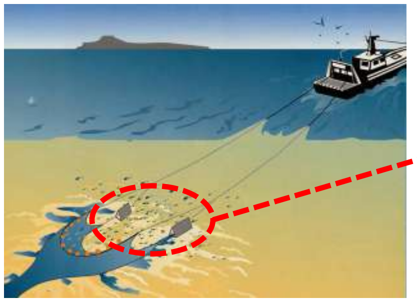
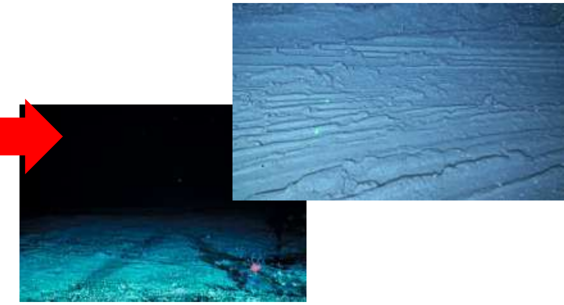
MARINE CABLES AND *POSIDONIA OCEANICA* MEADOWS: A FEASIBLE WEDDING

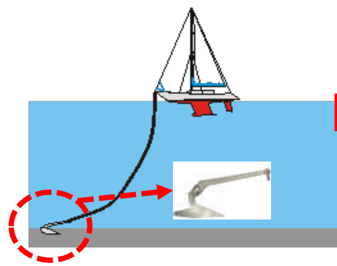
Developing electricity grids, protecting our seas

Palma de Mallorca, September 27th 2017

Marine cables and NTG (National Transmission Grid) safety : need of cables protection







Marine cables and NTG (National Transmission Grid) safety : need of cables protection

Marine cables damages

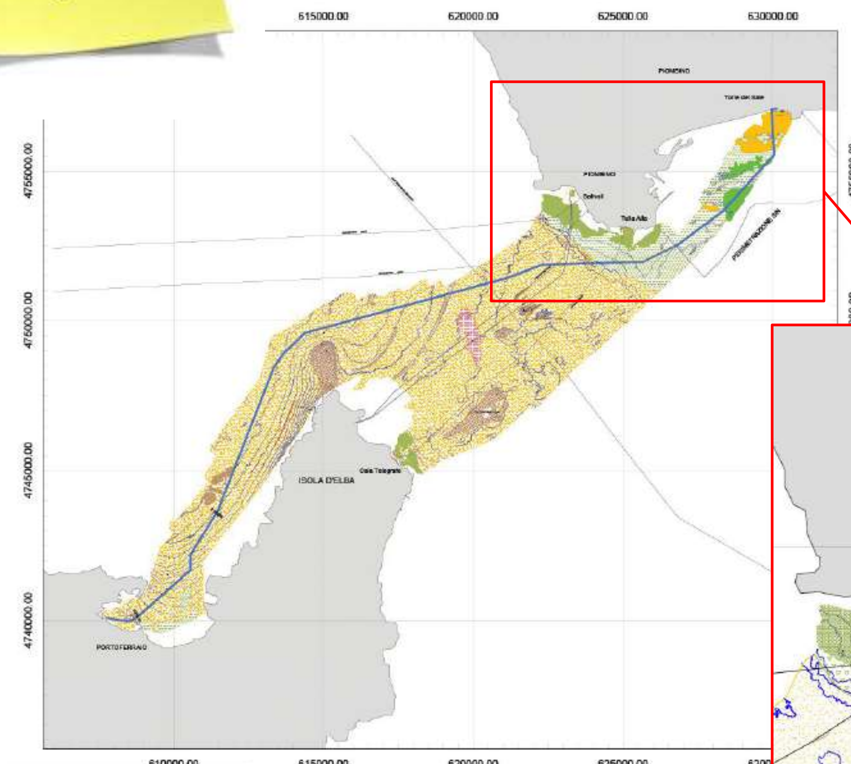
→ potential habitat disturbance

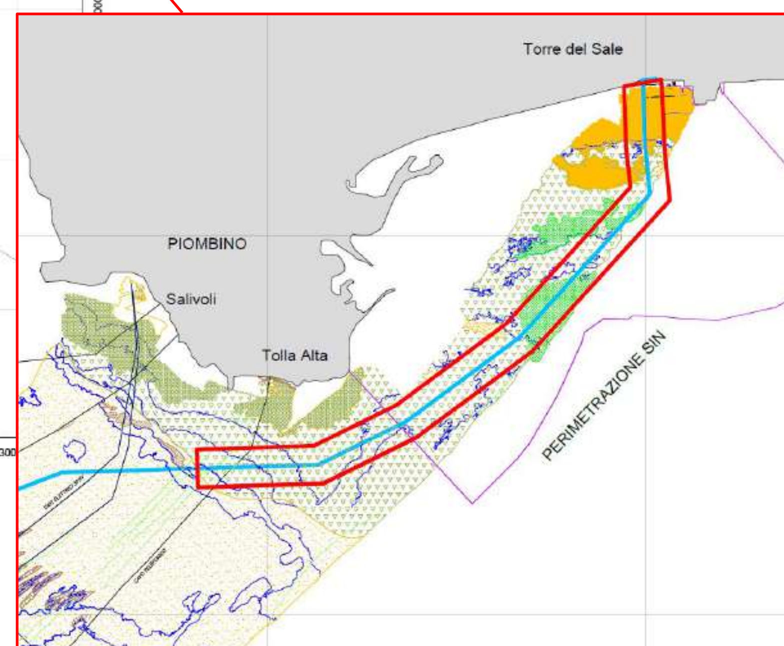
- possible oil leak,
- physical damage at time breaking,
- disturbance due to extraordinary maintenance activities

Work in Progress

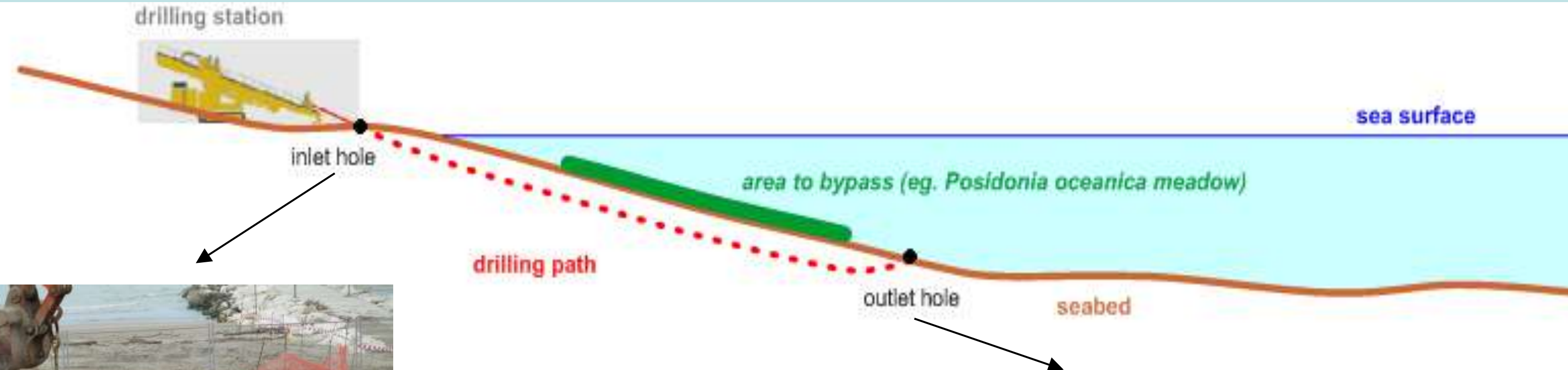
Project under authorization: submarine interconnection "Elba (Portoferraio) - Continente (Piombino)"

- about 31 km interconnection lenght
- cable burial for the whole length due to high anthropic pressure
- 8.7 km *Posidonia* meadow crossed at Piombino landing
- trenching on *Posidonia* meadow





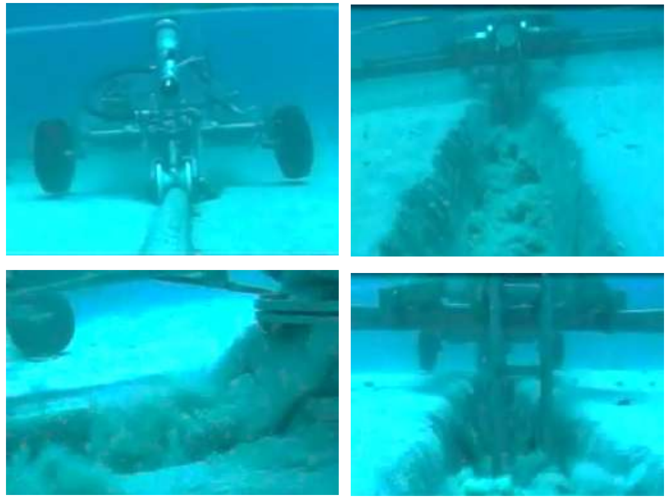
Protection techniques: HDD (high directional drilling)



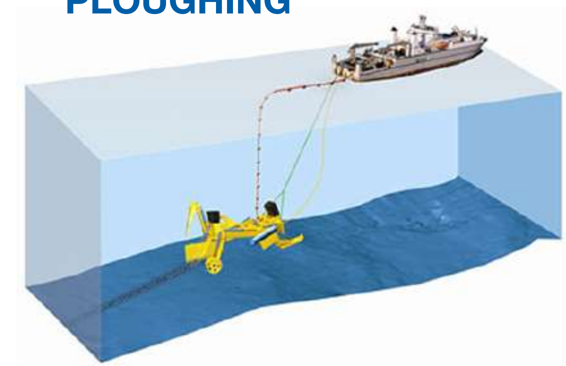
- maximum protection effectiveness
- Null impact in crossing environmental sensitive areas
- Limited lenght (usually at most 700 m)
- Depending on seabed nature feasibility
- High costs

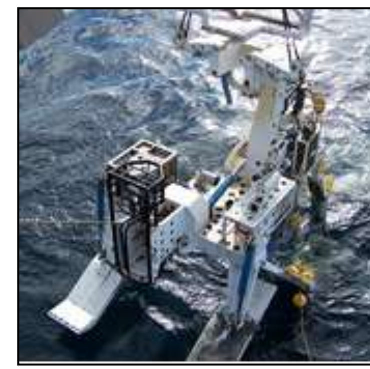
Protection techniques: jetting / ploughing / trenching

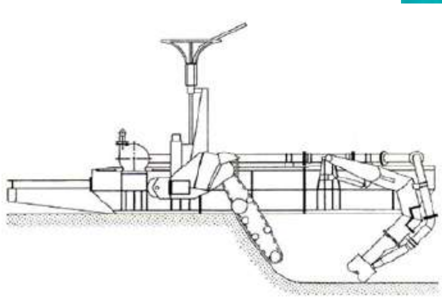
JETTING



PLOUGHING



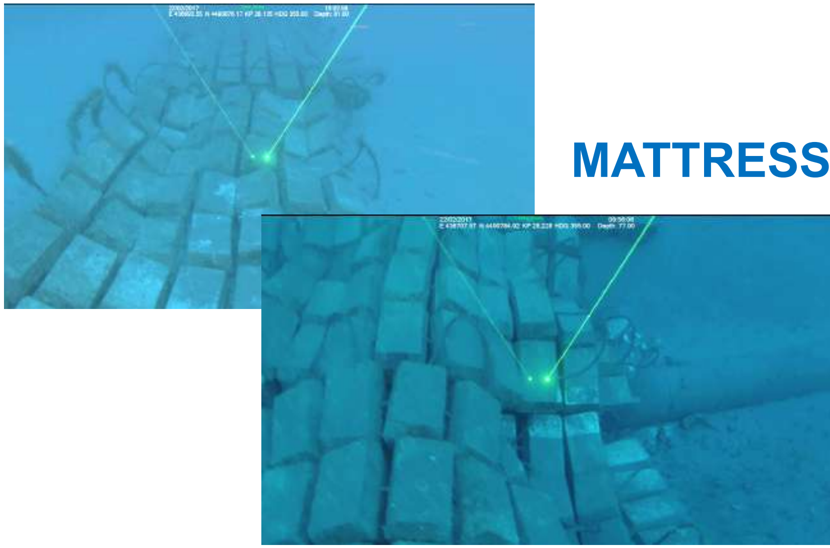




TRENCHING

- Well experienced techniques
- Moderate impact
- Choice based on seabed type

Protection techniques: mattresses / geobag / rock dumping



MATTRESSES

GEOBAG

ROCK DUMPING

These techniques are indicated in special cases in which it isn't possibile to proceed with usual protection ones

Protection: plastic or cast iron shells

CAST IRON SHELLS

PLASTIC SHELL

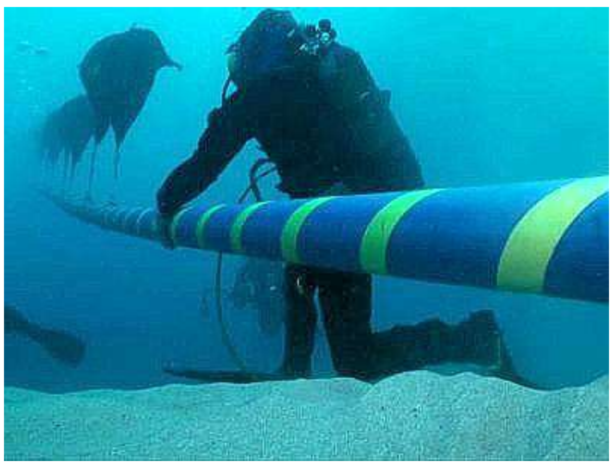
This technique has poor protection effectiveness

Utilization when more effective techniques cannot be adopted

Linear infrastructures: cables and pipeline differences

MARINE CABLE:

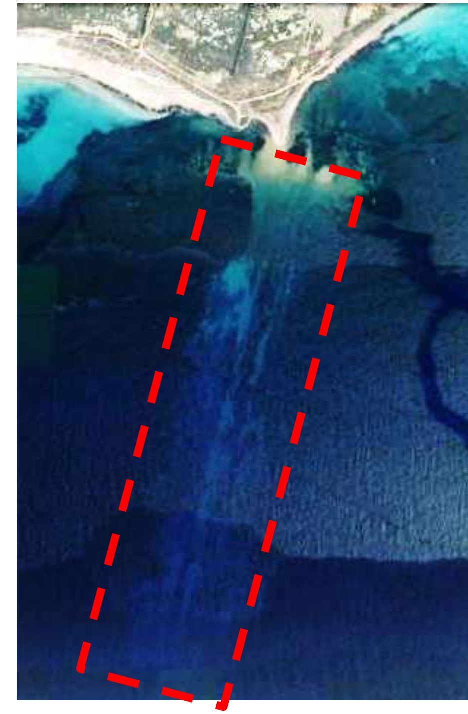
- Average diameter 15-20 cm
- Very tight laying trench (up to 50 cm)
- Average burial depth 1 m
- Low impact burial techniques



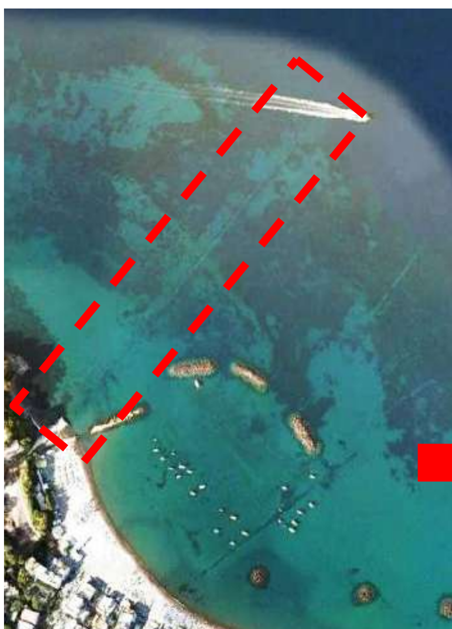
MARINE PIPELINE

- Average diameter 50-100 cm
- Wide laying trench
- Average burial depth 2 m or more

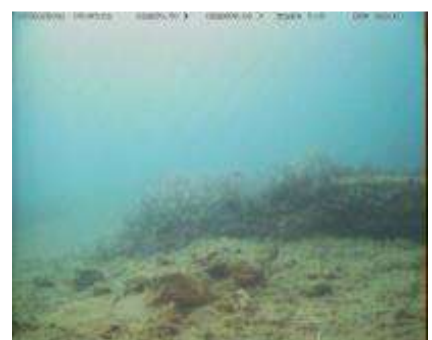
Linear infrastructure trenching protection: differences



Italy- Algeria pipeline (about 100 m trench)

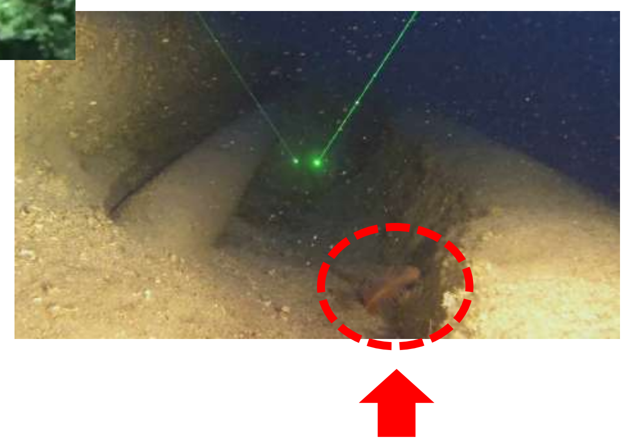


Pozzuoli-Ischia pipeline (about 25 m trench)



Linear infrastructure trenching protection: differences

Layed cables by trenching



Linear infrastructure trenching protection: differences

Linear infrastructure trenching protection

Nevertheless…
Also in more critic cases of marine pipeline protection
not everything is lost!

After some time the state evolves **positively**:

Posidonia oceanica,

while damaged by laying activities performed with invasive techniques, shows **evident signs of recovery**!

State of places after some decade of laying: Pozzuoli - Ischia pipeline (2009)_1

- Crossing of 400 m of *Posidonia* meadows (between -6 e -14 m)

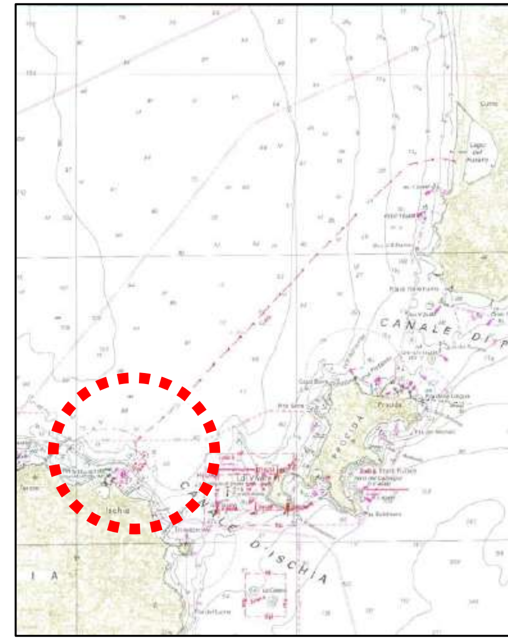
- Trenching performed with hydraulic excavator with spoon bucket mounted on a pontoon anchored to the seabed by means of stabilizing pylons

- Trapeze shape trenching:
  excavation depth width 2 m,
  top width 3 m,
  average height 2.5 m

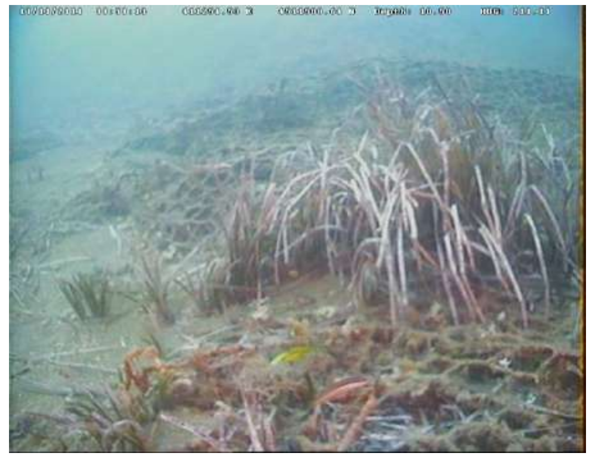
- Pipeline layed inside trench and protected by concrete blocks

- Trench covered with excavation material: sand and rock crushing of various sizes
- In the meadows crossing lenght, bigger pieces were utilized as surface trench coverage, alternate with calcarenitic boulders to favour the recolonization mechanisms (see Capo Feto)

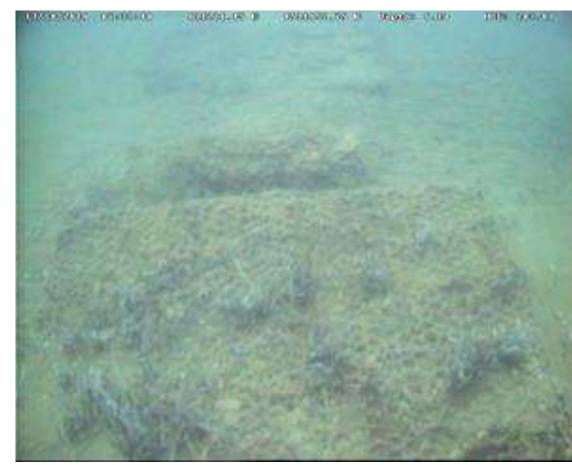
- *Posidonia* loss estimated 1600 m^2
  (1200 m^2 for direct damages)



State of places after some decade of laying: Pozzuoli - Ischia pipeline (2009)_2

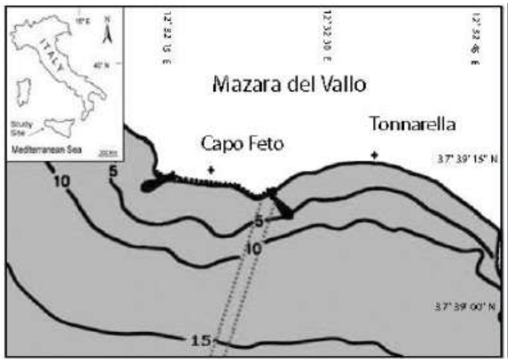




Regrowth **5 years** after laying

State of places after some decade of laying:
TRANSMED Italy – Algeria pipeline (1979, 1980, 1993, 1995)

Marine linkage Capo Feto (Mazara del Vallo,TP) - Capo Bon (Tunisia)

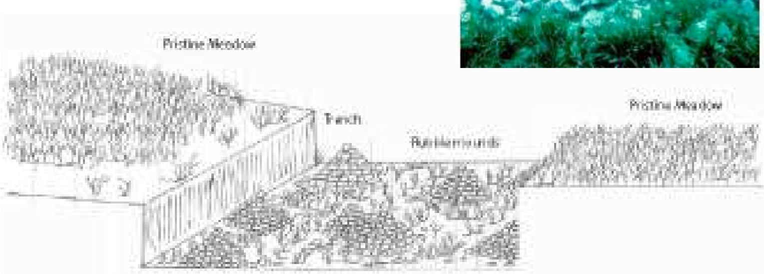


1979-1980: three pipelines laying in unique trench with dredging; trench recoat with excavation materials

1993-1995: two pipelines laying in two different trenches filled with various materials among which calcareous boulders

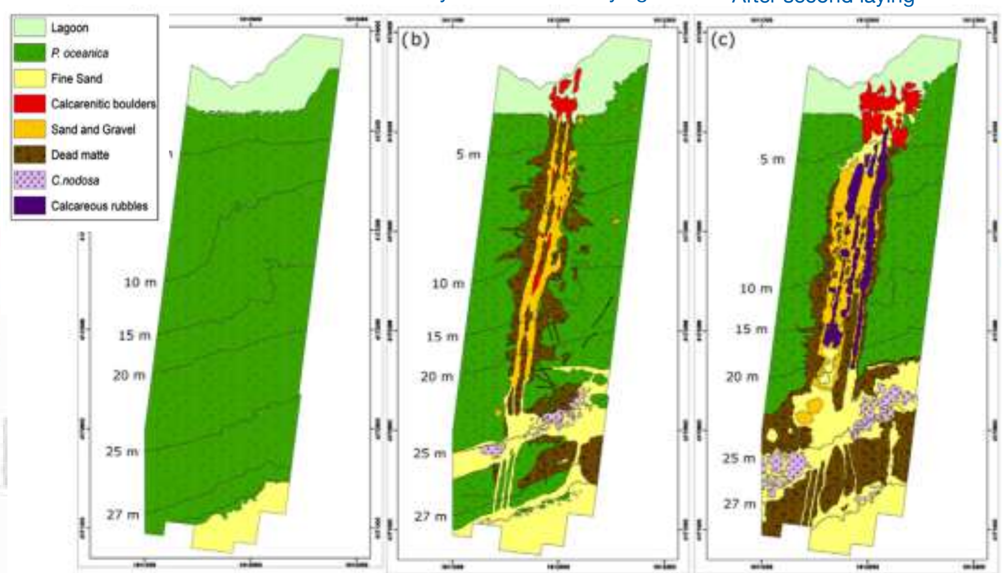
Extimated total loss: about 150 ha of *Posidonia*.

Impacted area composed by different substrates:
- various sizes calcareous boulders
- gravel
- limestone rubble
- sand
- dead matte



13 years afterf first laying

After second laying



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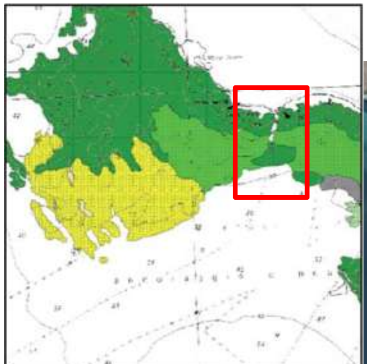
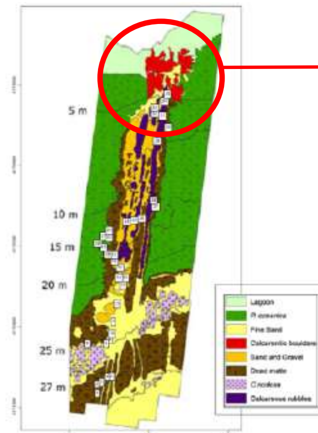
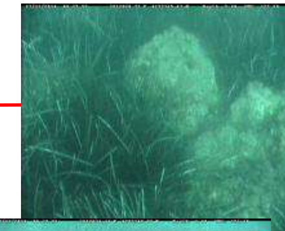
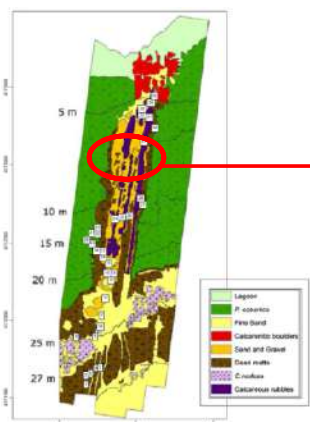
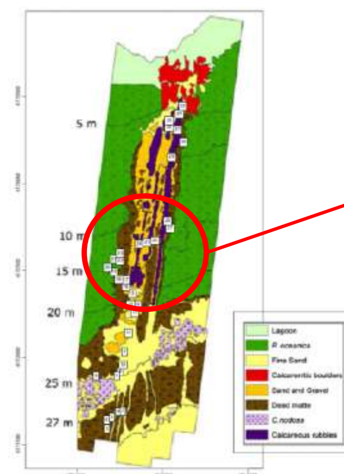






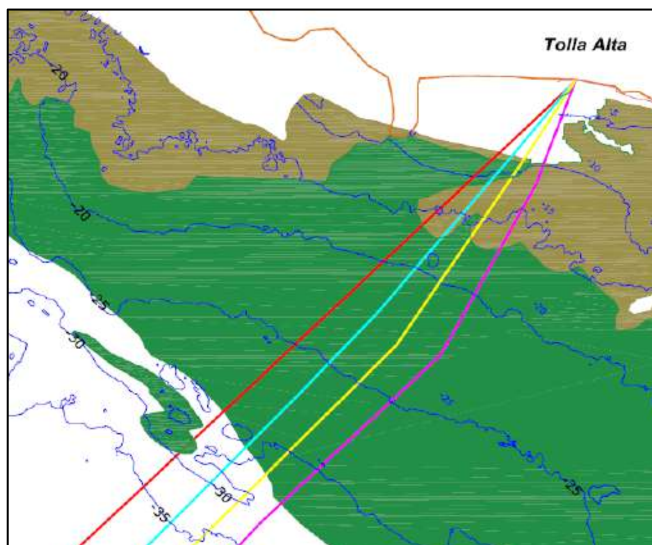




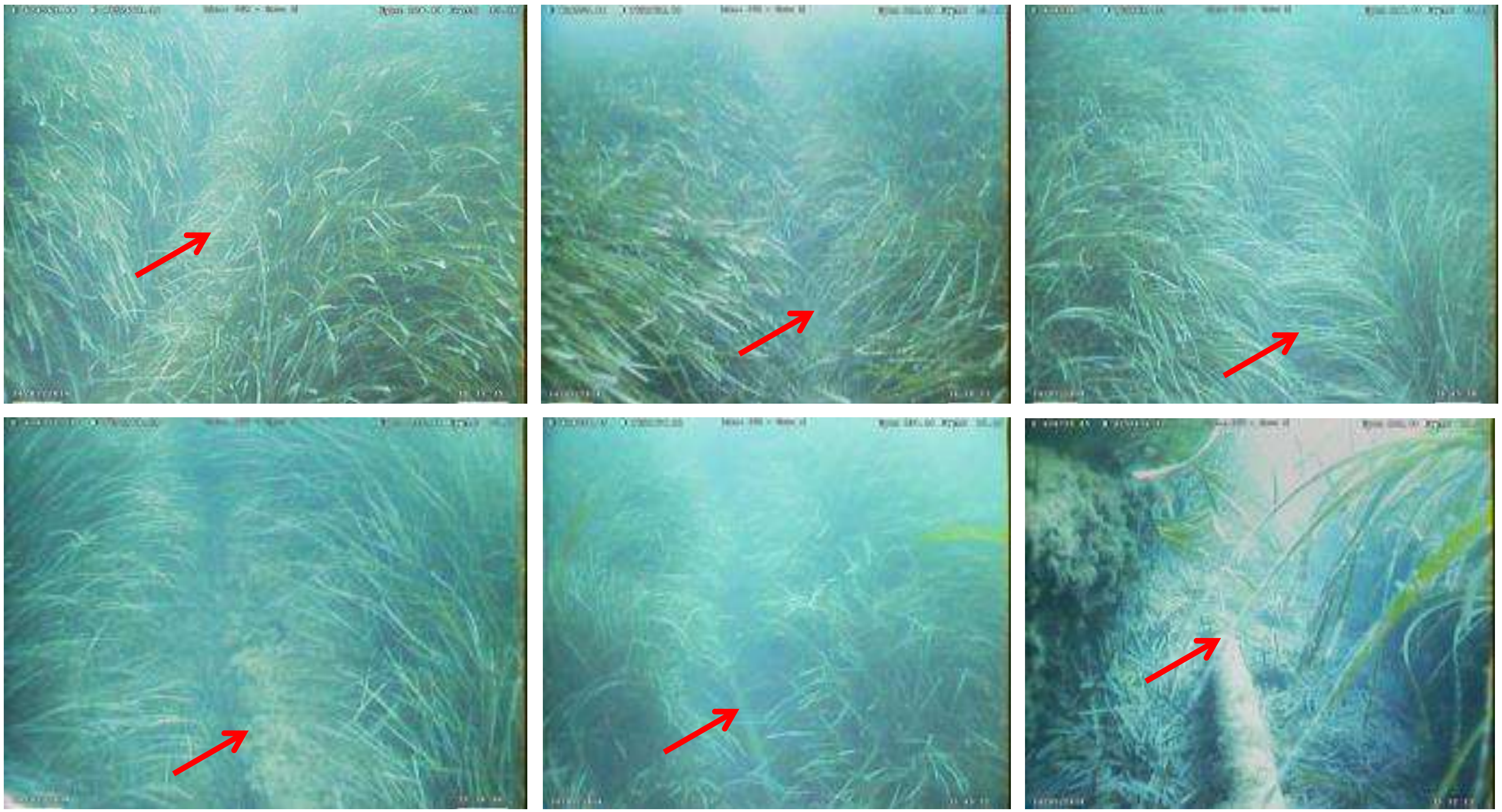
Regrowth **from 19 to 35 years** after laying

State of places after some decade of laying :
Submarine interconnection Piombino - Elba (1984-1985)

- Four power cables layed in four threnches 100 m away from each other
- Laying in 1984 - 1985
- *Posidonia* meadow crossing at Piombino landing about 1800 m



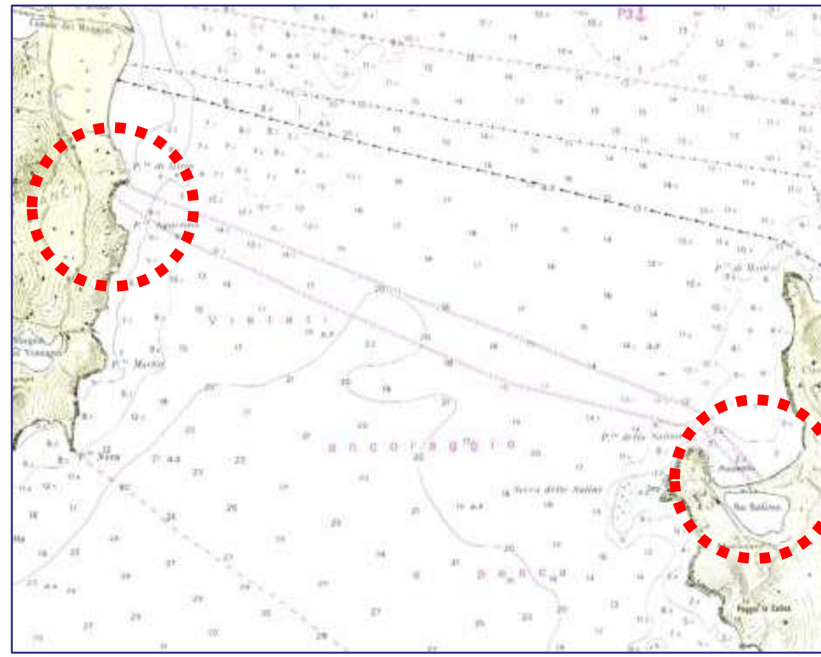
State of places after some decade of laying :
Submarine interconnection Piombino - Elba (1984-1985)



Regrowth **20 years** after laying

State of places after some decade of laying : S. Antioco - Carloforte cables (1989)

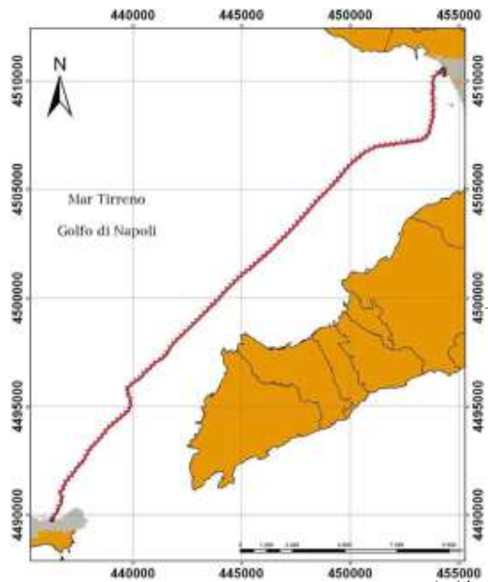
- Two marine cables
- Laying in September 1989
- Crossing of *Posidonia* meadow in good conservation status for almost the whole length
- Various laying and protection techniques depending on substrate type and seabed morphologic characteristics among which:
  - protection with cast iron shells,
  - cover with cement bags,
  - burial with airlift pump on *Posidonia*



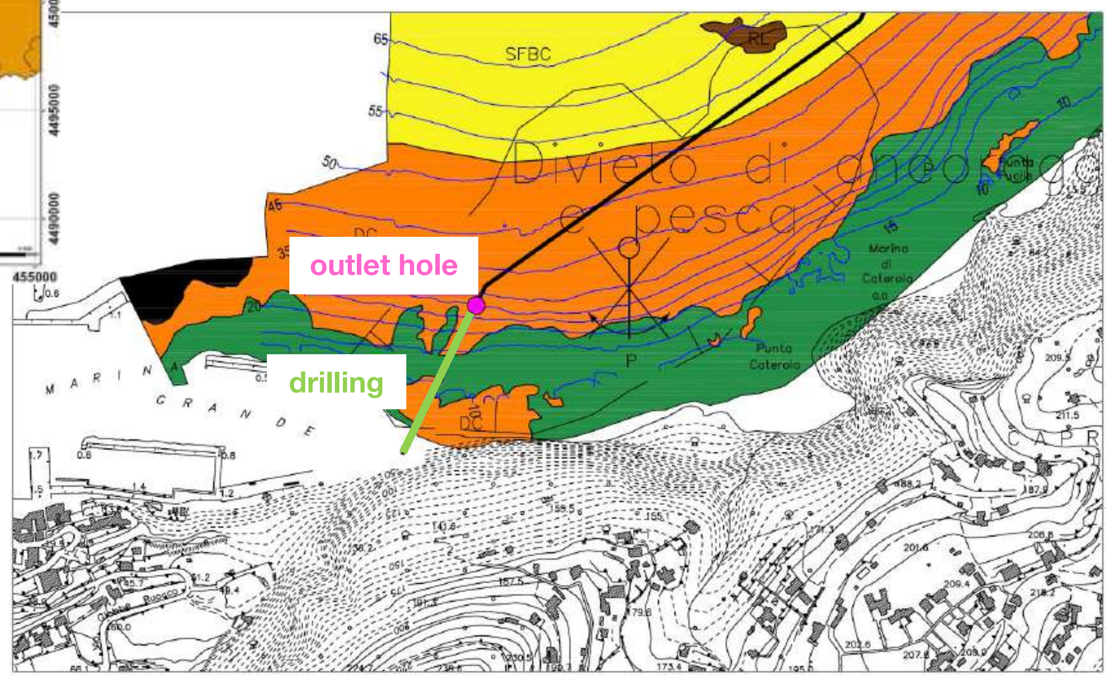
State of places after some decade of laying :
S. Antioco - Carloforte cables (1989)

Regrowth **25 years** after laying

Posidonia oceanica recolonization of a recent trench: Capri - Torre Annunziata case study (laying on 2014)



- Interconnection lenght about 30 km
- *Posidonia* meadow by-pass at Capri landing with HDD
- HDD output hole at about 30 m depth
- Protection with jetting, geobag and rock dumping



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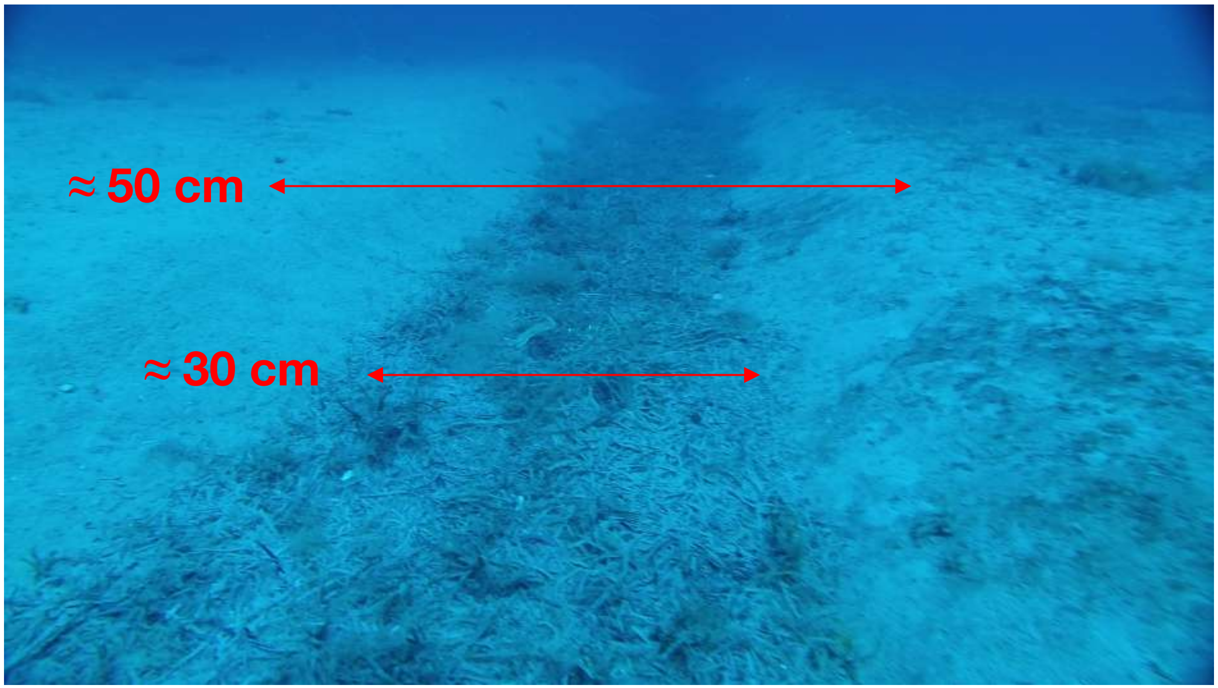
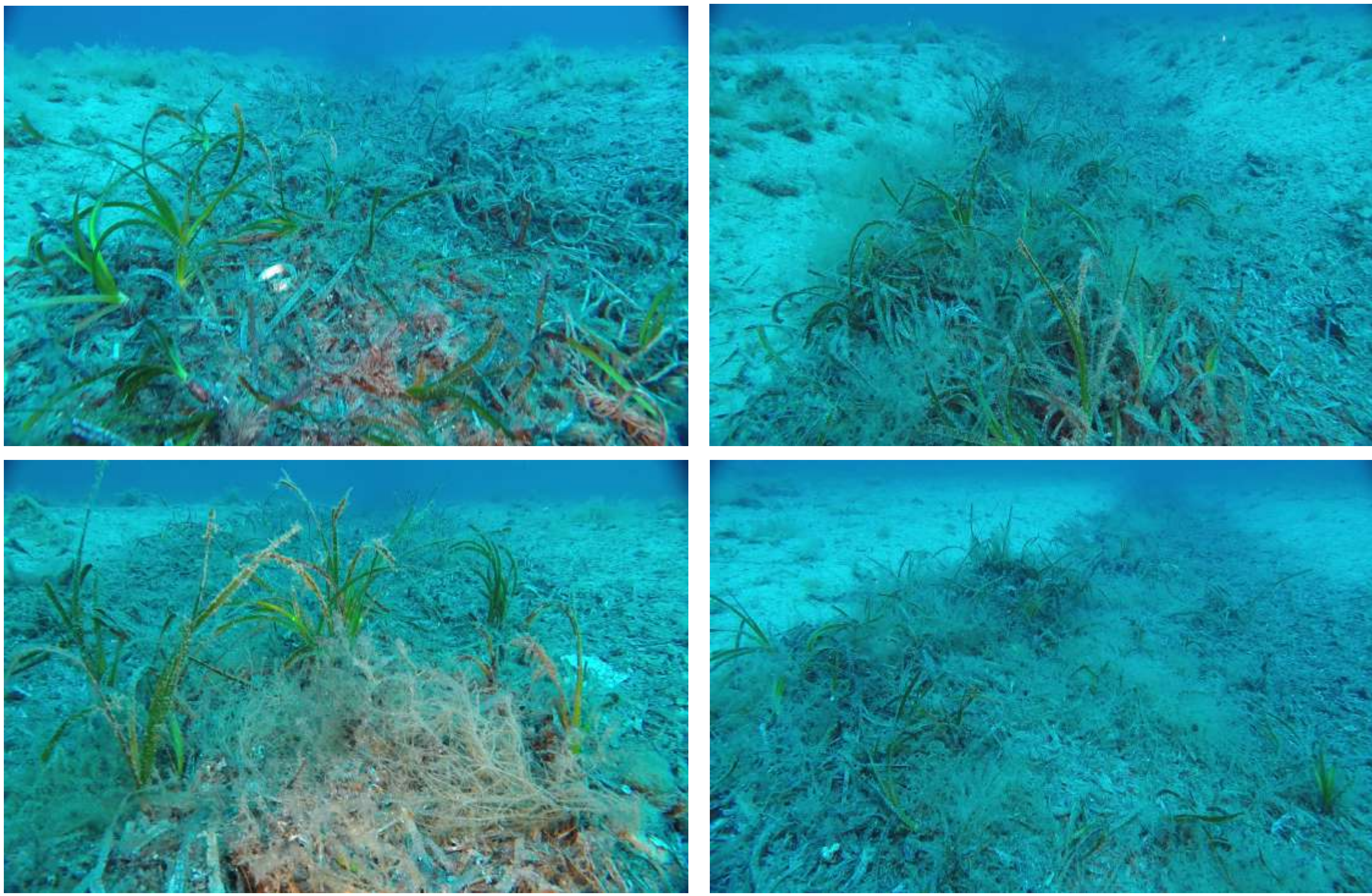


Seabed subsidence close to trench coated by moved jetting sediments and various materials carried through currents

Posidonia oceanica recolonization of a recent trench: Capri - Torre Annunziata case study (laying on 2014)



Presence of *Posidonia oceanica* leaf bundles between -29 m and -40 m depth only within trench created subsidence


THANK YOU