Anchors away!
Mitigating direct anthropogenic impacts on *Posidonia* beds

Athens
21-22 November 2019

ANCHORING ON *POSIDONIA OCEANICA* MEADOWS:
IMPACTS, MONITORING AND POSSIBLE SOLUTIONS

Montefalcone Monica
Posidonia oceanica meadows (EUNIS MB252, HD 1120)
This map has been generated based on Telesca et al., 2015 and the IUCN Red list (2015).
ESTIMATED REGRESSION IN THE WESTERN MEDITERRANEAN 56%
Mediterranean seagrass vulnerable to regional climate warming (Jorda et al., 2012, Nature Climate Change)

WARMING WILL LEAD TO THE FUNCTIONAL EXTINCTION OF POSIDONIA OCEANICA MEADOWS BY THE MIDDLE OF THIS CENTURY (YEAR 2049±10) EVEN UNDER A RELATIVELY MILD GREENHOUSE-GAS EMISSIONS SCENARIO
Temporal trend of *Posidonia oceanica* meadow extent in Liguria (NW Mediterranean), combining modelling, estimations, and quantitative cartographic measurements.

**ESTIMATED REGRESSION > 50%**

\[ y = 0.2849x^2 - 1146.7x + 1E+06 \]

\[ R^2 = 0.9935 \]
RESULTS OF CONSERVATION MEASURES AND MANAGEMENT INTERVENTIONS

**Posidonia oceanica** meadow of Bergeggi

Change in the position of the upper limit

Reference condition

Survey records

Last decades trend

**MPA**
Natural and anthropogenic factors that influence a *Posidonia oceanica* seascape

HIGH NATURAL HERITAGE → HIGH ANCHORING PRESSURE

Anchoring pressure on coastal seabed habitats using AIS data between 2010 and 2015 in France.

Around 30% of the habitats between 0 and 80 m exhibit anchoring pressure, and *Posidonia oceanica* seagrass beds are the most impacted habitat in terms of duration.
Anchoring pressure on *Posidonia oceanica*: 3 stages
Anchoring and mooring impacts change the seascape structure.
Holes formed from swinging-chain moorings
Holes formed from swinging chain moorings.
Sidescan sonar images (each 20 m across) of seagrass bed showing scars due to (a) mooring chain and (b) anchoring.

Anchor type affects the degree of the disturbance, with larger anchors having a greater impact on *Posidonia oceanica*.

Mean (±SE) number of shoots uprooted/broken by the three anchor types used in the presence of the anchor chain or a rope during the three anchoring stages.

Milazzo et al. 2004
Study conducted in Alga Bay (8°43’52” E; 42°34’20” N), an area of 1 km² of intensive anchoring in Calvi Bay (Corsica, France), colonized by a *P. oceanica* meadow covering 0.78 km².

Proportion of anchoring on the three different substrates for boats with a length lower than 10 m; between 10 and 20 m, upper than 20 m and for all classes.

Abadie et al. 2016
Map representing the positioning pattern of the anchoring chains-system in the Prelo cove (San Michele di Pagana, Rapallo).
C: percentage cover by living Posidonia oceanica; DM: dead matte.
Frame of the study area divided into subareas. Dark grey indicates the areas with chains, and light grey indicates the areas without chains. The two different portions of the cove analysed, shallow (S) and deep (D), were also reported.

Montefalcone et al. 2006
Conservation Index (CI)

\[ CI = \frac{P}{P+D} \]

\( P \) = percent cover of live *Posidonia oceanica*

\( D \) = percent cover of dead matte
Conservation Index: \( CI = P/(P + D) \)

where \( P \) is the percent cover of living \textit{Posidonia oceanica} and \( D \) is the percent cover of dead matter.

1 - \( CI < 0.3 \): bad conservation status
2 - \( CI \) between 0.3 and 0.5 excluded: poor conservation status
3 - \( CI \) between 0.5 and 0.7 excluded: moderate conservation status
4 - \( CI \) between 0.7 and 0.9 excluded: good conservation status
5 - \( CI \geq 0.9 \): high conservation status

CI values in subareas with chains and in subareas without chains, respectively in the shallow portion (a) and in the deep portion (b) (mean + S.D.). *** Highly significant differences (Student’s t-test).

Frequencies of the subareas (both shallow and deep) characterized by the presence of dead matte and *Caulerpa prolifera* on dead matte, in the subareas with and without chains.

Montefalcone et al. 2006
More than 2800 m$^2$ of meadow has been destroyed over the last few decades in Prelo. This value corresponds to 5.8% of the total surface area occupied by *P. oceanica* in the cove and should be compared with the 0.2% occupied by the chains themselves.

The chains system totals 1130 m in length

every linear metre of chain deployed led to a loss of 2.5–3 m$^2$ of meadow

Montefalcone et al. 2006
Effects of the chain in correspondence of four different *Posidonia oceanica* meadow situations: (a) high cover; (b) medium cover; (c) low cover; and (d) dead matte.
The symmetrical BACI design used in this study. S = shallow portion of the meadow; D = deep portion of the meadow; L = low-covered *Posidonia oceanica* meadow; M = medium-covered *P. oceanica* meadow; H = high-covered *P. oceanica* meadow.
Mean values (+se) of the **shoot density** (a), the **rhizome baring** (b) and the **percentage of dead shoots** (c) at each sample site for each class of *Posidonia oceanica* cover (high, medium, low) in the shallow (light grey) and the deep (dark grey) portions of the meadow, in the early and the late phases of the impact. Ct = control site; Im = impact site.
Absolute number (N) of shoots lost (a) and net shoot density decline rate (%) after the anchoring chain impact for each class of *Posidonia oceanica* cover (high, medium, low) in the shallow (light grey) and the deep (dark grey) portions of the meadow from 10% to 55% net decline even a seasonal disturbance can create heavy marks on the meadow, from which recovery is difficult in the short-term (> 150 years)

50–120 shoots m\(^{-2}\) lost each season

Montefalcone et al. 2008
The direct effect of anchoring: 20 shoots on average are broken or uprooted when the anchor locks into the bottom and a further 14 shoots on average when it is retrieved with an electrical windlass. This average total of 34 broken or uprooted shoots represent a loss of about 50 shoots m$^2$. The effect increases with weak matte compactness and high rhizome baring but not with shoot density.

Mean number (±SE) of intermats of *P. oceanica* as a function of mooring and location (PM and CM).

MONITORING ANCHORING IMPACT

1. COLLECTION OF THE AVAILABLE INFORMATION ON THE PRESSURE OF ANCHORING AND BOATS FREQUENTATION (e.g., DAILY DENSITY) AND ON HABITATS

2. DEFINITION OF THE MOST SUITABLE DESCRIPTORS

3. ASSESSMENT OF THE HEALTH STATE OF POSIDONIA OCEANICA MEADOWS SUBJECTED TO ANCHORING

A case study from the Liguria Sea
1. COLLECTION OF THE AVAILABLE INFORMATION ON THE PRESSURE OF ANCHORING AND BOATS FREQUENTATION AND ON HABITATS

Camogli (CM)  Paraggi-Punta Pedale (PP)  Riva Trigoso (RT)
EVALUATING THE DAILY FREQUENCY OF ANCHORING BY PLEASURE BOATS ALONG THE LIGURIAN COAST

Paraggi-Punta Pedale, within the Marine Protected Area of Portofino, August 2007.

Riva Trigoso, close to Sestri Levante, August 2007.
1. COLLECTION OF THE AVAILABLE INFORMATION ON THE PRESSURE OF ANCHORING AND BOATS FREQUENTATION AND ON HABITATS

IDENTIFICATION OF A GRADIENT OF PRESSURE

1. CAMOGLI: **NO ANCHORING PRESSURE** BECAUSE NAVIGATION AND ANY TYPE OF ANCHORING IS FORBIDDEN OVER THE “TONNARA”

2. RIVA TRIGOSO: **INTERMEDIATE ANCHORING PRESSURE**
   (AVERAGE NUMBER OF BOATS PER DAY IN THE SUMMER SEASON = 9.8 ± 0.45 AND MAXIMUM NUMBER REACHED IN A DAY EQUAL TO 100 BOATS)

3. PARAGGI-PUNTA PEDALE: **HIGH ANCHORING PRESSURE**
   (AVERAGE NUMBER OF BOATS PER DAY IN THE SUMMER SEASON = 15 ± 0.62 AND MAXIMUM NUMBER REACHED IN A DAY EQUAL TO 150 BOATS)
1. COLLECTION OF THE AVAILABLE INFORMATION ON THE PRESSURE OF ANCHORING AND BOATS FREQUENTATION AND ON HABITATS
## 2. Definition of the Most Suitable Descriptors

<table>
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<tr>
<th>SOURCE</th>
<th>Shoot density</th>
<th>Cover %</th>
<th>Leaves number and length</th>
<th>Proportion of orthotropic/plagiotropic rhizomes</th>
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<th>Rhizomes baring</th>
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3. ASSESS THE MEADOWS’ STATE OF HEALTH

PUNTA PEDALE:
> ANCHORING PRESSURE
< CONSERVATION STATUS
> SEASCAPE HETEROGENEITY
3. ASSESS THE MEADOWS’ STATE OF HEALTH

APPROACH BASED ON MEASURING SEASCAPE INDICES DIRECTLY ON MAPS WHEN THE SCALE IS > 1: 5000

PHYSIONOMIC-SEASCAPE APPROACH, TO DESCRIBE THE STRUCTURE AND THE MEADOW STATE OF HEALTH THROUGH THE COMBINED USE OF STRUCTURAL DESCRIPTORS (e.g., SHOOT DENSITY, COVER, RHIZOMES BARING), ECOLOGICAL INDICES (e.g., CONSERVATION INDEX) AND SEASCAPE INDICES (e.g., PATCHINES, HETEROGENEITY) WITH A DETAILED HABITAT MAPPING
MOORING SOLUTIONS

SEAGRASS-FRIENDLY MOORING SYSTEM

SCI “Fondali del Monte di Portofino”
Monitoring the ‘Harmony’ anchors in *Posidonia oceanica* meadows in Agay Bay and in the Port-Cros National Park (Var, North-West Mediterranean).

Francour and Soltan, 2000
ANCHORING SOLUTIONS

ROCKS

SANDY OR SEDIMENTARY BOTTOMS

DEAD MATTE AND LIVING MEADOW

Francour and Soltan, 2000
BEST PRACTICES

EFFECTIVE PROTECTION OF *P. OCEANICA* FROM ANCHORING:

(1) establish **free zones for anchoring**, located in places where seagrasses are not present, reducing the boat pressure on the forbidden areas and on mooring fields;

(2) a **maximum number of boats** should be permitted to access the area, established on the base of the number of mooring buoys available and the capacity of designated anchorage areas on sandy bottoms;

(3) traditional mooring systems in seagrass meadows should be replaced by ‘seagrass-friendly’ systems in order to make plant recovery possible in the areas damaged by anchoring and mooring; the number, concentrations and localization of buoys should be carefully determined;

(4) considering the general inobservance of restrictions on anchoring, **local surveillance** should be implemented, also employing video technologies and closer co-operation with law enforcement;

(5) one of the main conservation goals should be the implementation of a proper and **periodical educational program**, containing awareness actions about the importance of marine habitats and campaigns in order to change boaters’ attitudes and behaviours regarding anchoring in coastal areas;

(6) Design a **long-term monitoring plan** to measure the effects of any new management strategy.
Thank you for your attention