International Conference "MARINE RESEARCH HORIZON 2020"
September 17-20 2013, Golden Sands, Varna, Bulgaria

Developing the methodological standards for favourable conservation status and good environmental status assessment of *Mytilus galloprovincialis* beds for the HD and MSFD implementation in the Bulgarian Black Sea

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Introduction

- *Mytilus galloprovincialis* is the only reef building marine organism in the Bulgarian Black Sea (apart from *Ostrea edulis*, which is extinct).
- Mussel beds are biogenic concretions over sandy mud and mud through a wide range of depths (15 – 80 m) but most abundant between 30 - 60 m.

Photo: L. Klissurov

Introduction

Ecosystem services and benefits:

- Biodiversity maintenance - *Mytilus* is a habitat engineer that creates hard substrate above the surrounding sedimentary bottom for the attachment of diverse epifauna and providing multitude of microhabitats suitable for plenty of other species. Mussel beds harbour various threatened and sensitive species.
- Resilience maintenance - Due to powerful biofiltration mussel beds play a key ecological role in the Black Sea by effectively transforming the phytoplankton production into secondary production, thus ensuring the pelagic-benthic coupling and ecosystem resilience to eutrophication.
- Regulation of water quality - Through biofiltration and forming pseudo-faeces mussels increase the rate of sedimentation and transfer of substances from the water column to the seabed, and modify the sediments by enriching them with organic matter.
- Socio-economic importance - and provide habitat and represent fishing area of plenty commercially valuable species.

Introduction

Mussel beds in the Black Sea are qualified as:

- Subtype of the Habitats Directive (HD) Annex I habitat type 1170 “Reefs”;
- Subtype of the predominant seabed habitat “Shelf sublittoral rock and biogenic reefs” sensu the Marine Strategy Framework Directive (MSFD).
- Mussel beds shall be maintained in favourable conservation status in specially designated SCIs (NATURA 2000).
- Mussel beds shall achieve good environmental status by 2020.

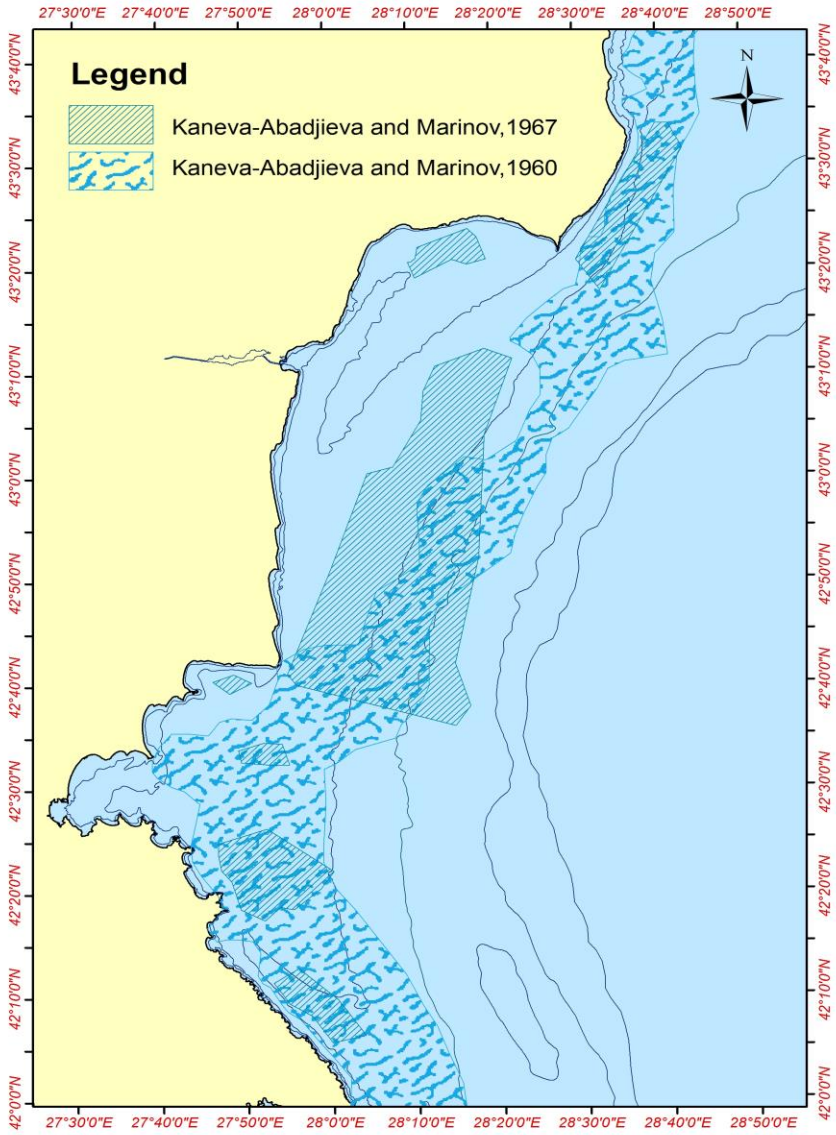
Goal

- Examine/validate methods and propose indicators for the evaluation of mussel beds conservation and environmental status in the Bulgarian Black Sea;
- Assess the current environmental status;
- Define areas suitable for designation of SCIs for maintenance of mussel beds at FCS;
- Define targets for good environmental status of mussel beds.

Criteria and Descriptors

- Favourable conservation status sensu HD:
  1. Range,
  2. Area,
  3. Specific structures and functions (including typical species)
- Good environmental status sensu MSFD:
  1.4. Habitat distribution
  — Distributional range (1.4.1)
  — Distributional pattern (1.4.2)
  1.5. Habitat extent
  — Habitat area (1.5.1)
  1.6. Habitat condition
  — Condition of the typical species and communities (1.6.1)
  — Relative abundance and/or biomass, as appropriate (1.6.2)

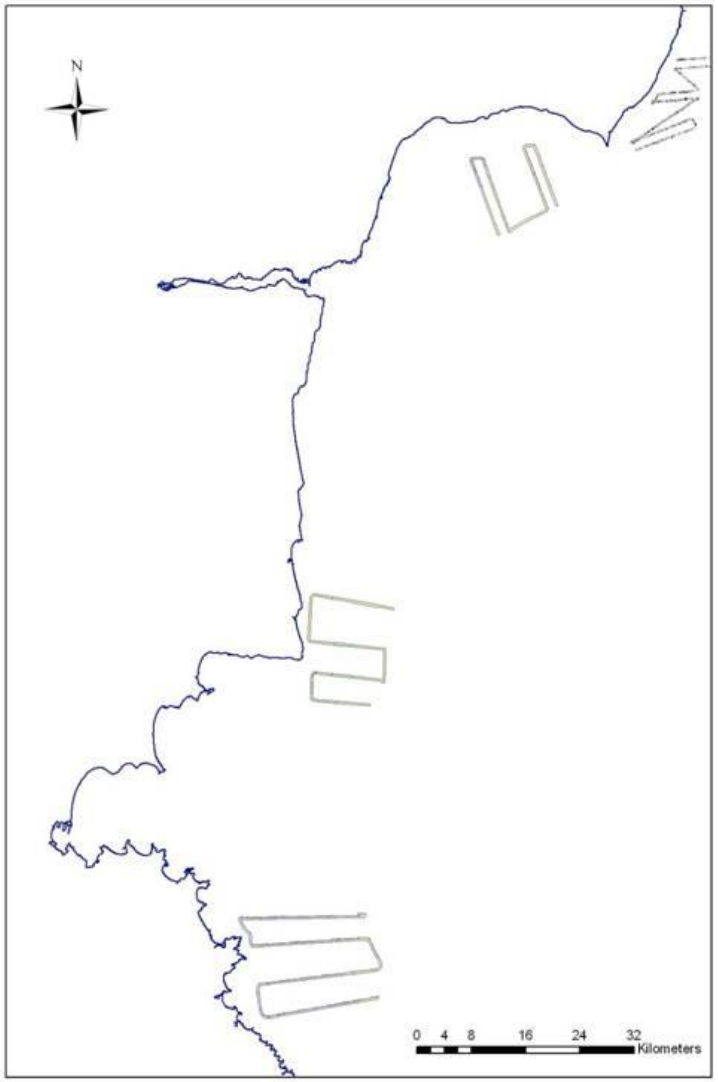
Methods and results



- The historical distributional range of mussel beds was reproduced by geo-referencing paper maps available in grey literature: Kaneva-Abadjieva and Matinov (1960, 1967).

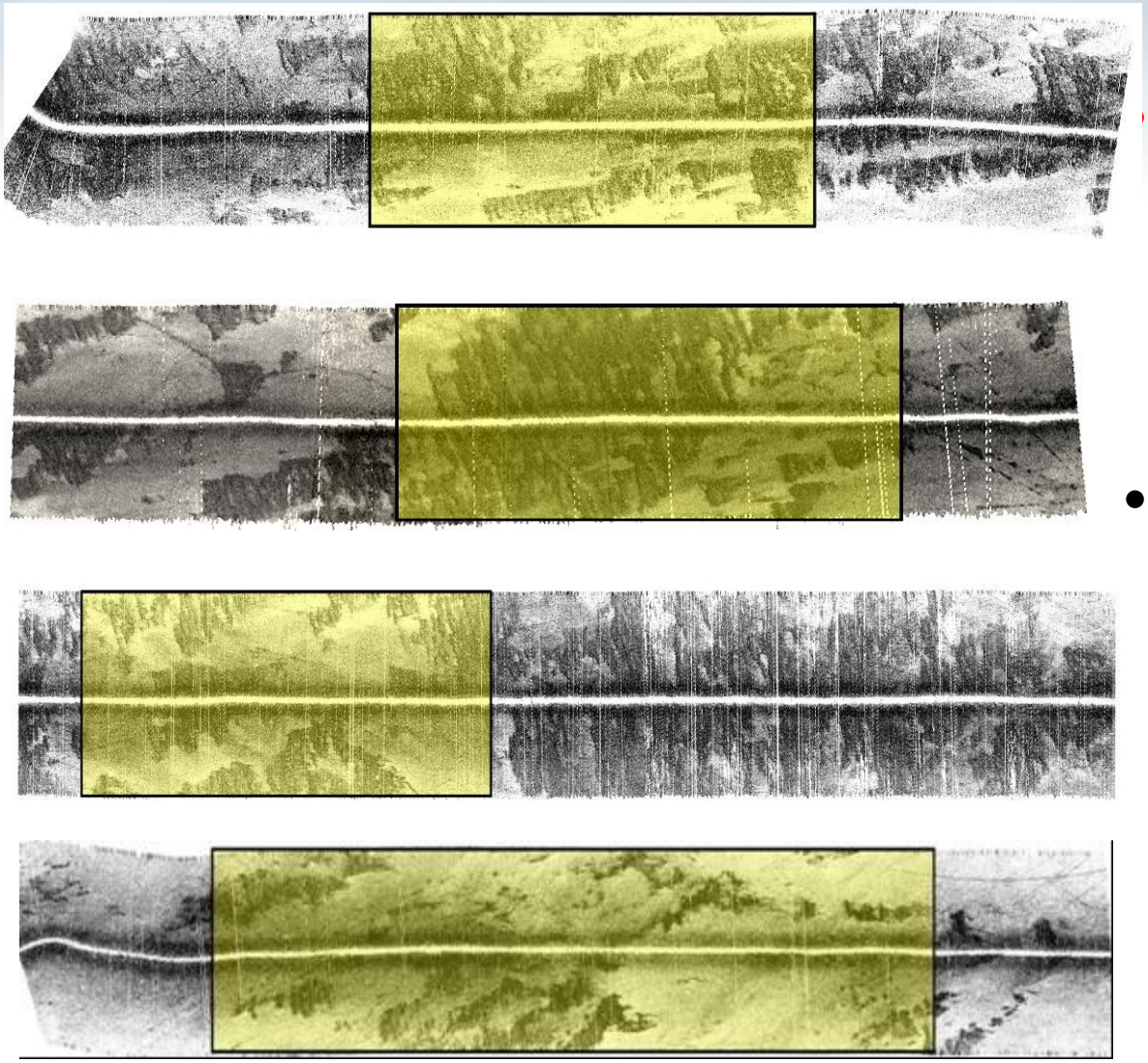
- The historical reference area was calculated in GIS environment at 4064.77 km^2

Methods and results



- Multi-beam mapping was carried out at selected transects to validate the occurrence and define the current distributional pattern (mussel cover).
- The data confirmed the presence of mussel beds in the historical range but is insufficient to determine the overall distributional range and area at present.

Methods and results



Mussel cover was estimated by histogram analyses of the sonar images.

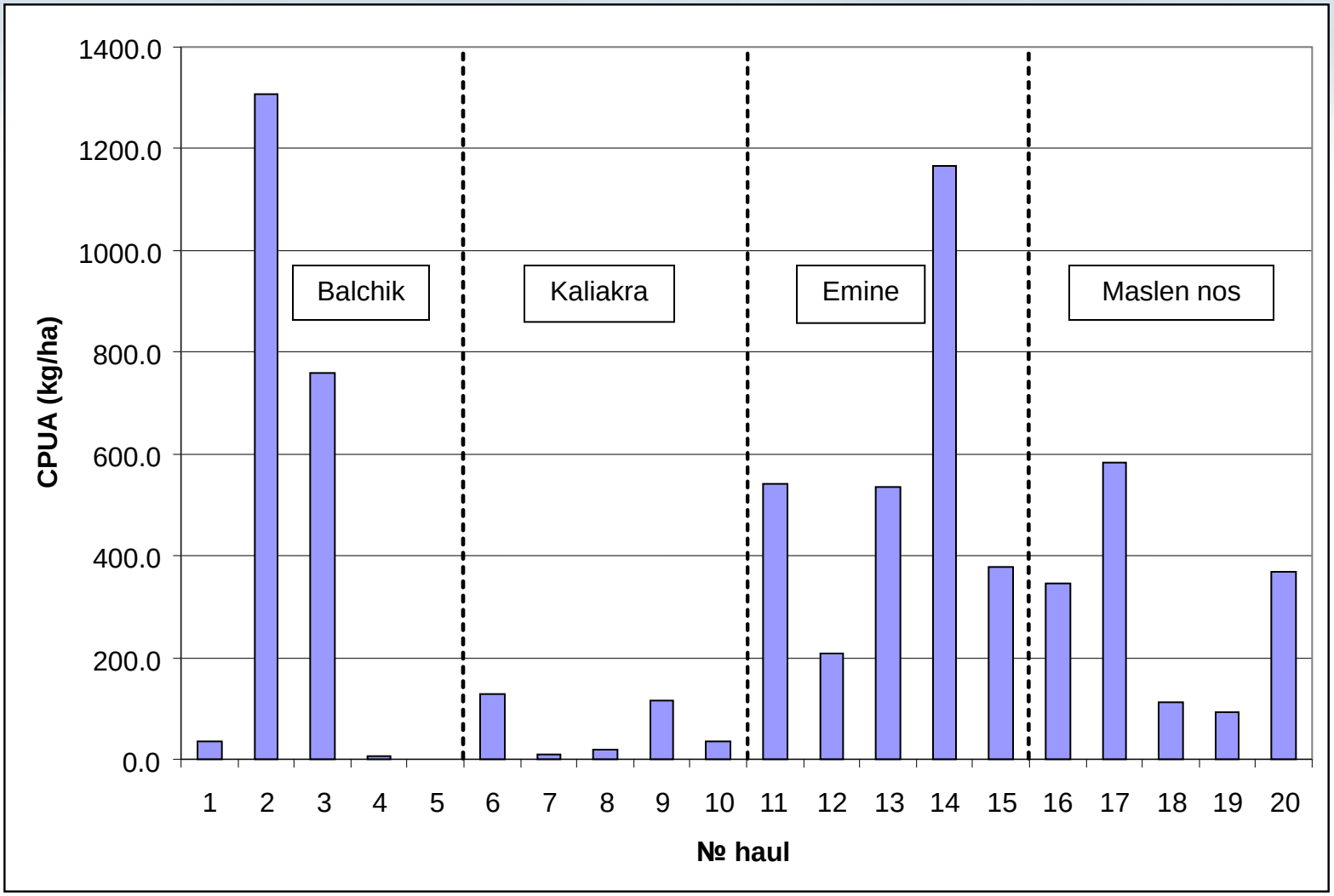
- In areas of historical occurrence of mussel beds the cover varied between 5 % and over 20 %.

Methods and results

- Semi-quantitative sampling by beam trawling was carried out to ground-truth the acoustic images.

- Catch per unit area (CPUA) was determined as a proxy of the mussel population biomass.

Methods and results

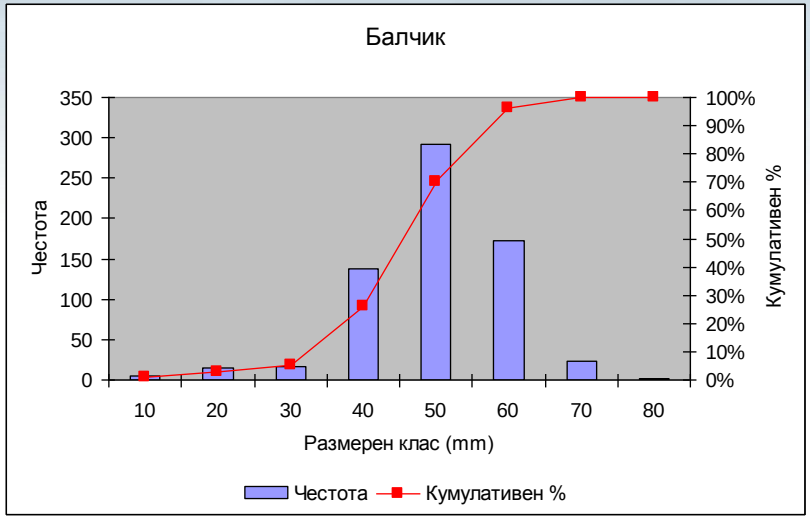


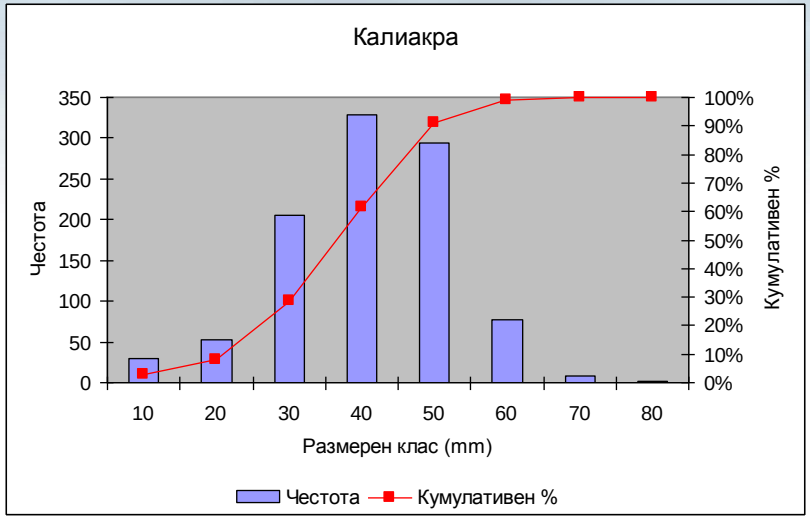
CPUE of *Mytilus galloprovincialis*

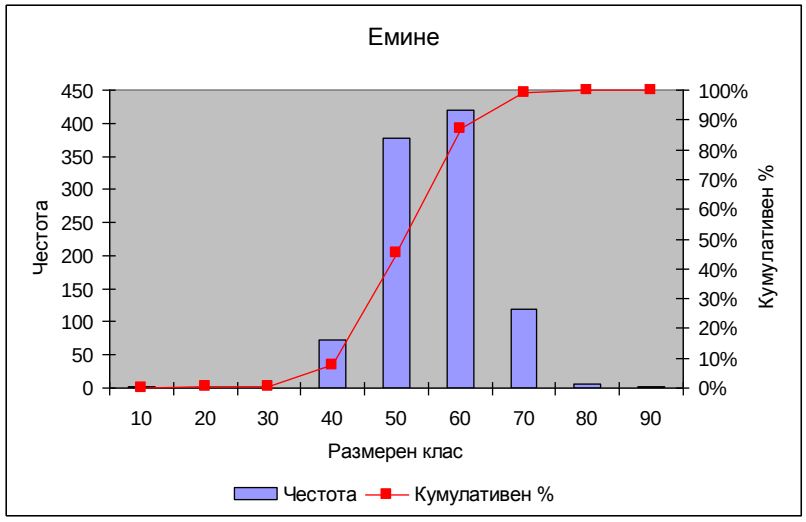
Methods and results

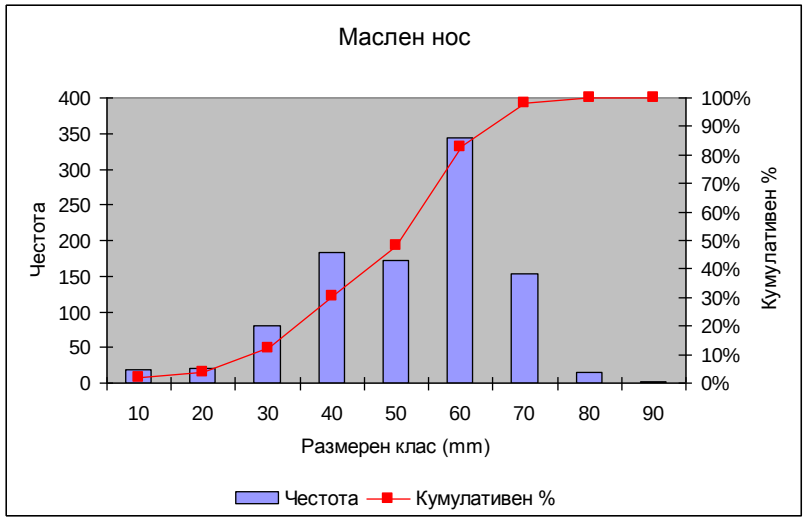
- Body length was measured to define the size structure and derive other mussel population demographic characteristics.

Methods and results









Size structure of *Mytilus galloprovincialis*

Established indicators

1.4. Habitat distribution

— Distributional range (1.4.1)

- Historical range – defined
- Recent range - undefined

— Distributional pattern (1.4.2)

- Historical pattern – patchy, av. cover assumed from % occurrence ≈ 25 %
- Recent pattern – patchy, varied cover < 5% to > 20%

1.5. Habitat extent

— Habitat area (1.5.1)

- Historical area – defined at 4064.77 km^2
- Recent area - undefined

Established indicators

1.6. Habitat condition

— Condition of the typical species and communities (1.6.1)

1.2. Population size of *Mytulus galloprovincialis*

— Population biomass (1.2.1) measured as CPUA

- Historical CPUA – impossible to estimate
- Recent CPUA – defined at four assessment areas

Assessment area	Av. CPUA ± St.Dev. ($kg.ha^{-1}$)
Kaliakra	61.337 ± 54.755
Balchik	701.108 ± 636.879
Emine	655.208 ± 349.593
Maslen nos	300.291 ± 203.687

Established indicators

1.3. Population condition of *Mytilus galloprovincialis*

— Population demographic characteristics - body size class structure (1.3.1)

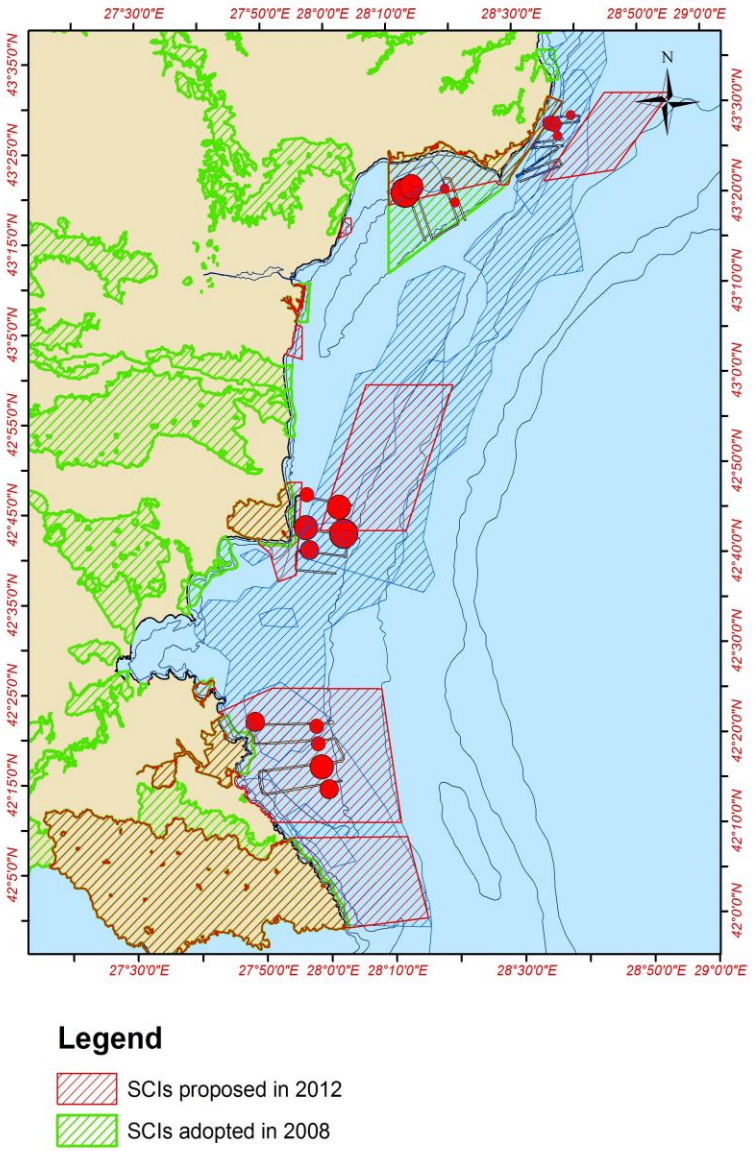
- Recent size characteristics – defined at four assessment areas

Indicators	Balchik	Kaliakra	Emine	Maslennos
Av. length (mm)	49.97	40.84	56.32	52.41
Av. length (mm) of individuals **>P95**	67.2	62.7	73.6	74.9
Cumulative % of size classes ≥ 80 mm	0.3	0.2	0.9	1.7

Results – established target for GES

- The distributional range and area of *Mytilus gallorpovinvialis* beds on sediments are stable or increasing and not smaller than 90 % of the reference historical range and area established in the 1950-1960-ies.
- The population biomass and demographic characteristics of the typical species *Mytilus gallorpovinvialis* increase relative to the current state established by the Initial assessment.

Results – extension of NATURA 2000



- Formal proposals submitted to MOEW for extending the marine range of six already adopted SCIs and for designation of three new marine SCIs.
- Thus 4-fold enlargement of the marine areas under protection within NATURA 2000 ecological network will be achieved from the current 61112.7 ha на 247694.5 ha.
- The proposals were accepted by the National Council on Biodiversity on 04.12.2012 and have been undergoing national consultation procedures before submission to the EC.

Horizon 2020 – impoving the knowledge base

- Define the current distribution (range and pattern) and extent (area) of mussel beds through habitat mapping;
- Improve the data (resolution and coverage);
- Adopt age-based indicators of the typical species *M. galloprovincialis* - age structure, mortality);
- Adopt indicators of the community state
- Relate the pressures to state, demonstrate causality, define acceptable pressure levels

Horizon 2020 – achieving GES?

- Achieve the targets for GES (re-assessment)

- Based on improved knowledge - redefine GES (if needed) and targets for the next period (adaptive management).

Acknowledgements

The current study was funded by

Contract 7976/04.04.2011 with EMEPA for the accomplishment of "Extension of the ecological network Natura 2000 in the Bulgarian Black Sea".

Contract № 203 / 09. 08. 2012 with BSBD for the accomplishment of „Initial state assessment, definition of criteria for good environmental status and targets for the marine environment".

Thank you!

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