mariasini@marine.aegean.gr

MPAs – Research & Monitoring

Use of Non-Destructive Methods

Mytilene ~ 2017

Maria Sini
(PhD on Marine ecology)

MPAs – research & monitoring

MPA benefits

- Conservation of marine biodiversity
- Protection of threatened, rare or endangered species
- Protection of commercially / economically important species
- Preservation of habitats that are critical for the survival and/or lifecycles of species
- Fisheries management (reduce fishing pressure, replenish fish-stocks, protect critical stages of species lifecycles, reduce by-catch, reduce competition among fishers)
- Sustainable economic development & tourism
- Education & public awareness (schools, universities, general public, stakeholders)
- Research purposes – provide natural laboratories and reference sites (e.g. transplantation of corals, effects of climate change)

MPAs – research & monitoring

MPA success largely depends on

- Clearly defining conservation targets.
- Reducing conflicts among different groups of people (stakeholders) and conservation targets.

Conservation targets (examples):

- a specific species (e.g. *Monachus monachus, Caretta caretta*)
- the protection of fish stocks
- the protection of a vulnerable habitat

Conservation targets determine management objectives

Management objectives and measures applied must be regularly evaluated and re-adjusted.

MPAs – research & monitoring

Before MPA establishment:

• Collect baseline data regarding the physical / ecological characteristics of the area of interest,

• Collect baseline data on the socio-economical characteristics.

• These provide important information for the planning process.

After MPA establishment:

• Evaluate whether management actions meet & satisfy conservation objectives.

• Reduce conflicting interests among different groups of people (stakeholders).

• Readjust management actions or conservation objectives.

Assessments should include evaluation of:

• Biological parameters

• Environmental parameters

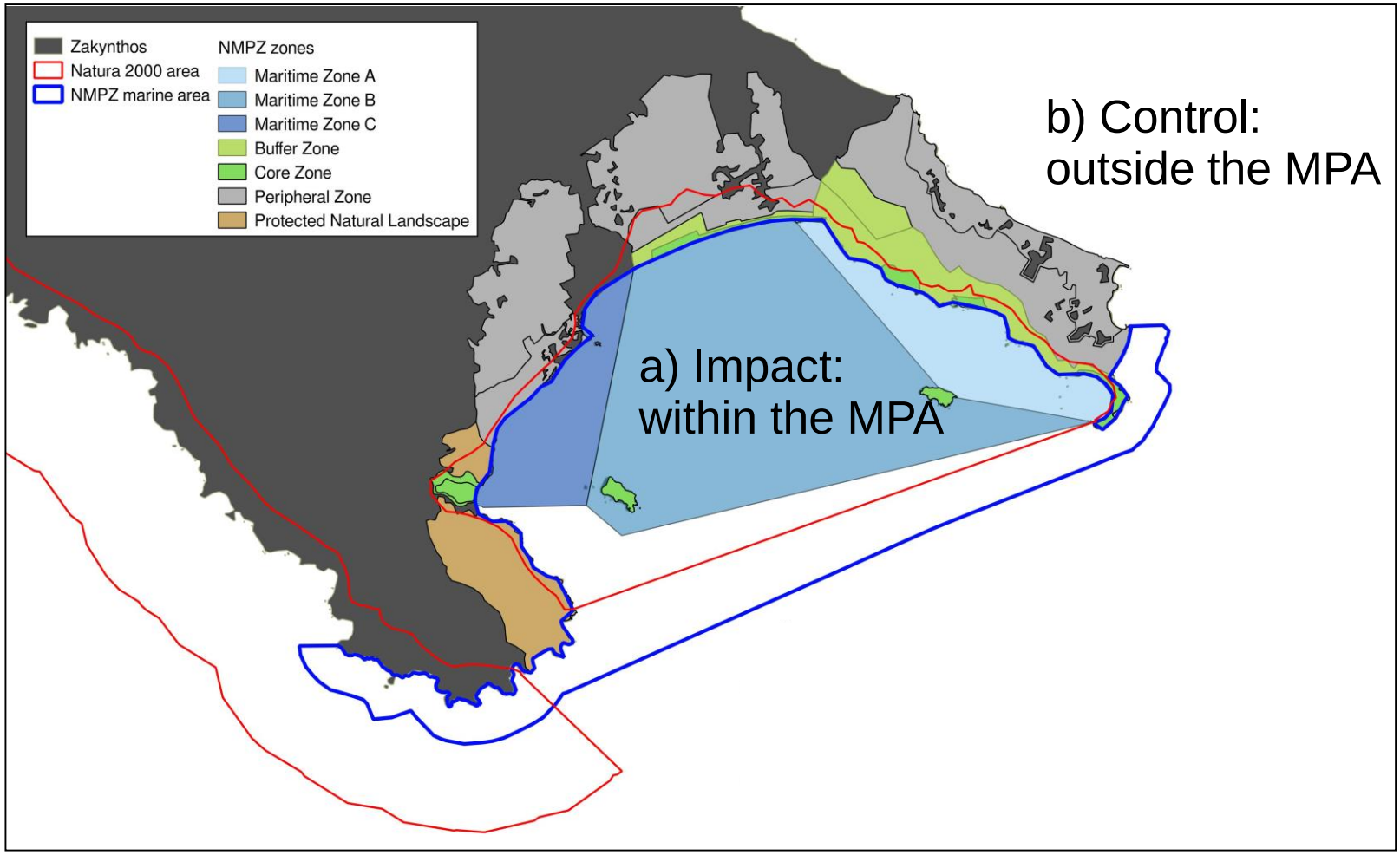
• Human uses

• Enforcement level

MPAs – research & monitoring

Ecological assessment designs:

- Assessments (in contrast to experiments) aim to quantify site-specific effects (e.g. due to existence of an MPA).
- Assume that there are two sites



MPAs – research & monitoring

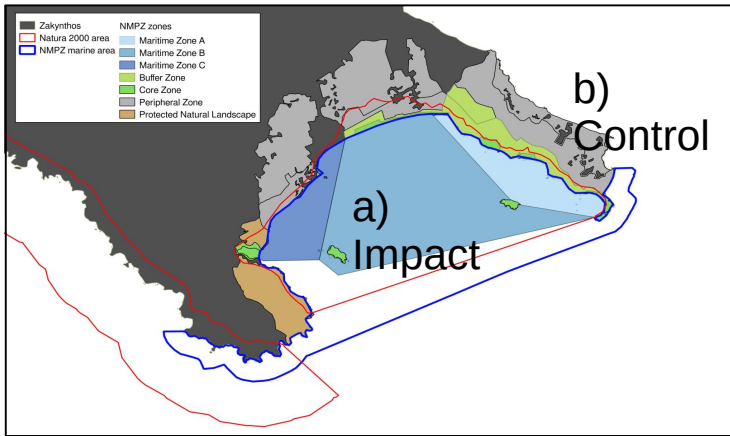
Ecological assessment designs:

• **"Impact only":** samples taken only within the MPA, after the MPA establishment. Problem: Very difficult to understand any effect.

• **"Control-Impact":** samples taken both within and outside the MPA, but only after MPA establishment. It the most common design. Problem: Easy to confuse MPA effect with spatial variability (e.g. differences in habitats).

•**"Before-After":** samples taken before and after MPA establishment, only within the MPA. Problem: MPA effects are confused with temporal variability.

• "**Before-After-Control-Impact (BACI)":** samples taken before and after MPA establishment both within (Impact area) and outside (control area) the MPA. Strong design to assess the MPA effects, especially if temporally replicated. But**:** It is important for impact and control sites to have similar dynamics.



mariasini@marine.aegean.gr

Destructive methods

Destructive / extractive methods: based on the extraction of material from the natural environment.

Examples:

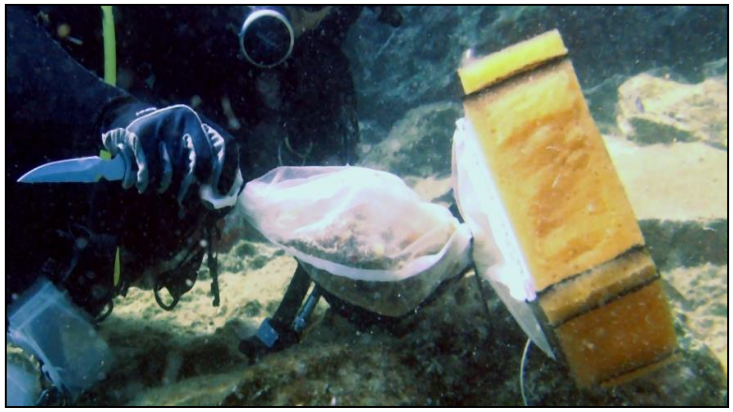
Fisheries dependant surveys (onboard commercial fishing boats)

Experimental fisheries (fisheries independent) surveys.

Use of bongo plankton nets.

Use of sediment samplers at soft substrates (e.g. van Veen, Eckman-Birge).

Use of scrape sampling at hard substrates.



Destructive methods

Destructive / extractive methods

~ CPUE (catch per unit effort data)
~ species diversity,
~ relative abundance,
~ body size,
~ other biological parameters (e.g. biomass, stomach contents, gonadal inspection, community level genetic analysis)

But require
The removal of material from the natural environment.
Handling & Sorting in the laboratory, which can be very time consuming (especially in the case of benthic samples).

So, sampling over large areas through destructive sampling poses several problems:
Destructive effects to habitats & species,
Time, Effort, Cost

mariasini@marine.aegean.gr

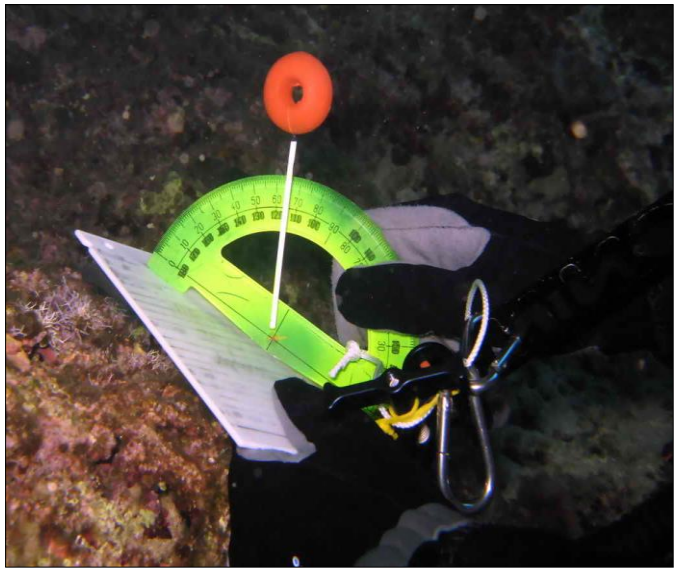
Non destructive methods

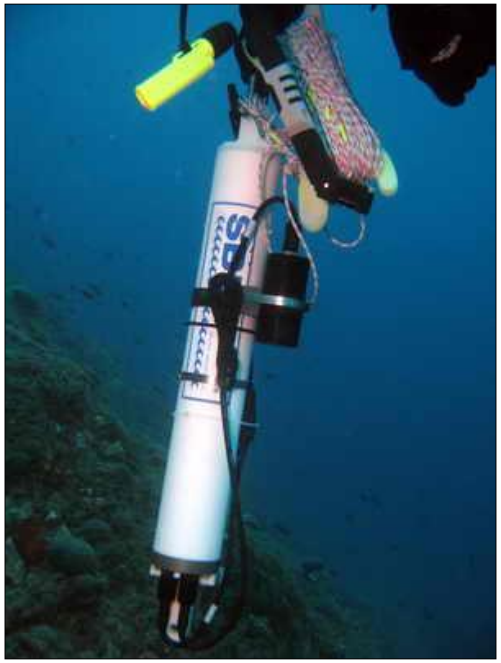
Non-destructive methods: have a minimum effect / disturbance on the environment or the organisms under study.

They are usually faster to apply than destructive methods.

They are ideal to use within MPAs.

Examples…



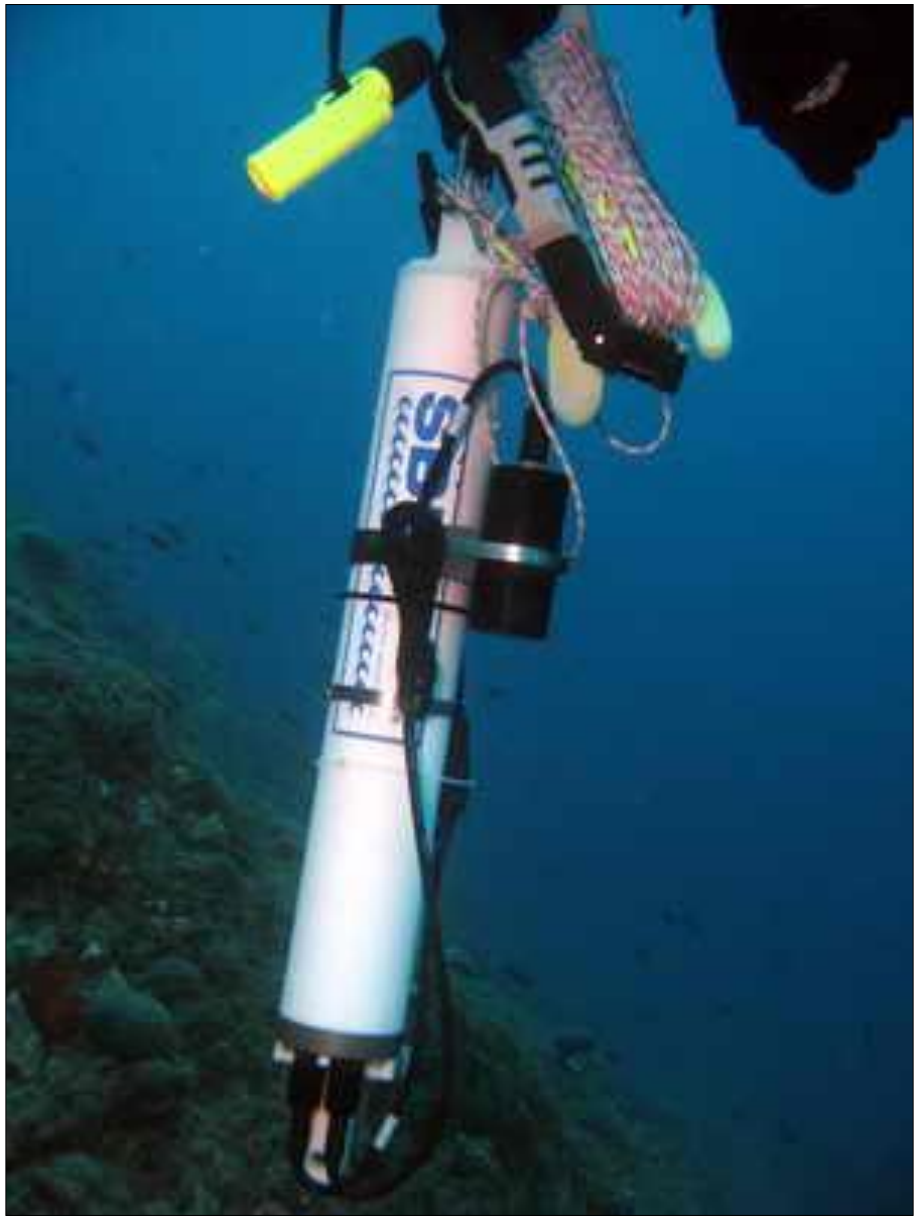


mariasini@marine.aegean.gr

Non destructive methods – For abiotic parameters

Examples of non-destructive methods for abiotic parameters

CTD – Conductivity, Temperature and Depth-meter, important tool for the measurement of abiotic parameters of the water column.



Non destructive methods – For abiotic parameters

Current-meter


Source: Maria Sini


Source: www.tresanton.co.uk

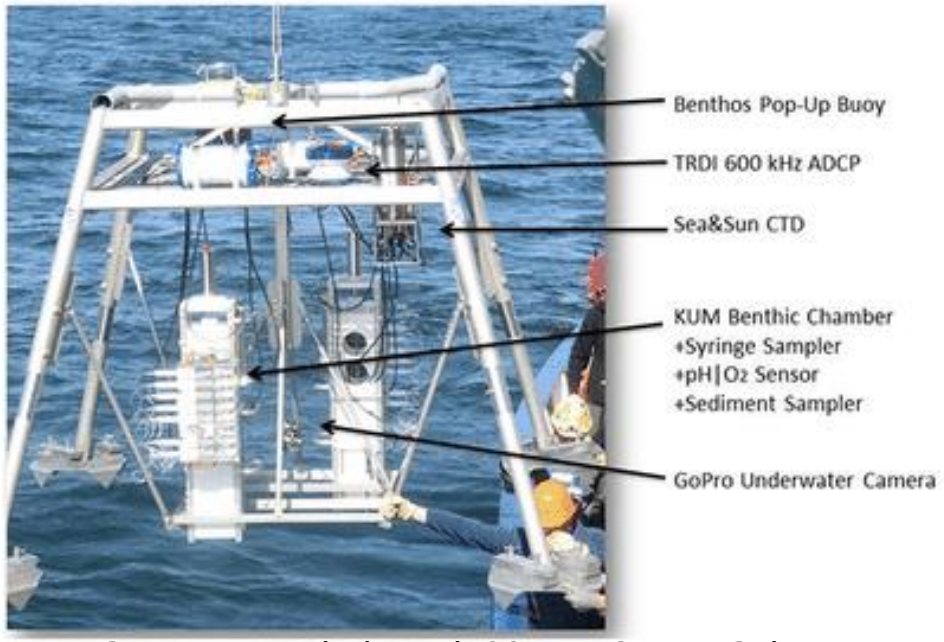
mariasini@marine.aegean.gr

Non destructive methods – For abiotic parameters

Landers

A lander is a versatile mechanical platform used for carrying tools, instruments, scientific samples, imagery, measurements, etc. between the surface and the bottom of the sea. (Source: schmidtocean.org)

Particularly useful: for long term monitoring and the inaccessible deep sea



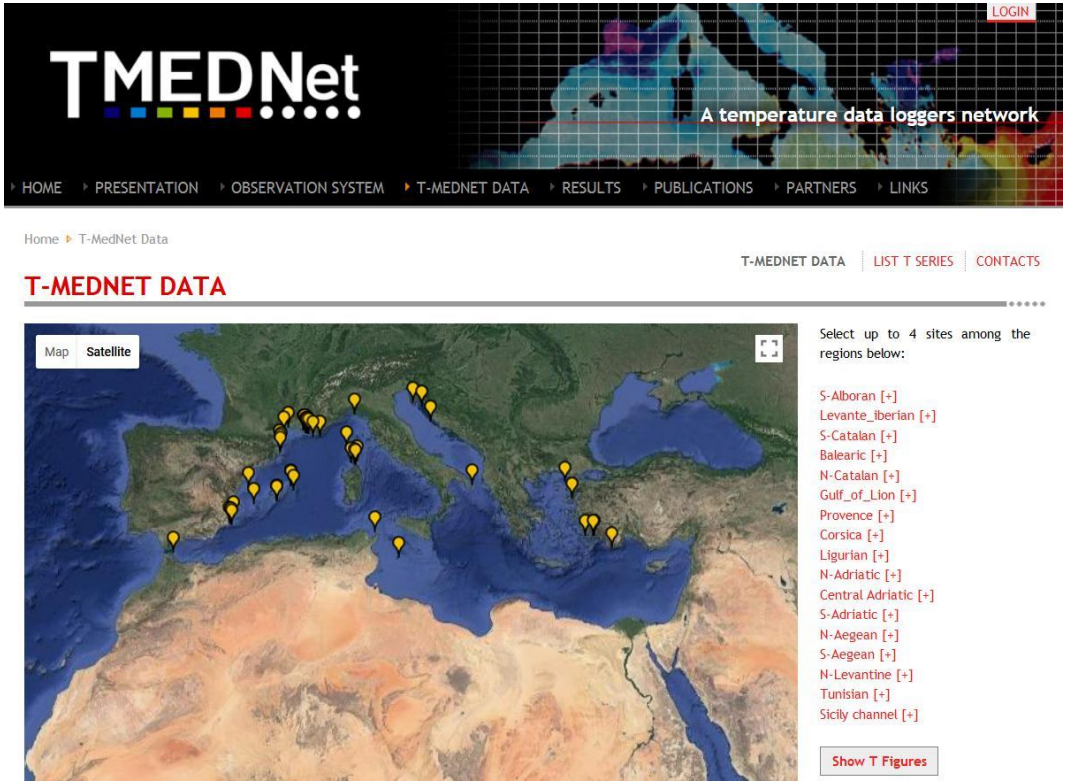
Source: Baschek et al. 2017 – Ocean Science

(b)

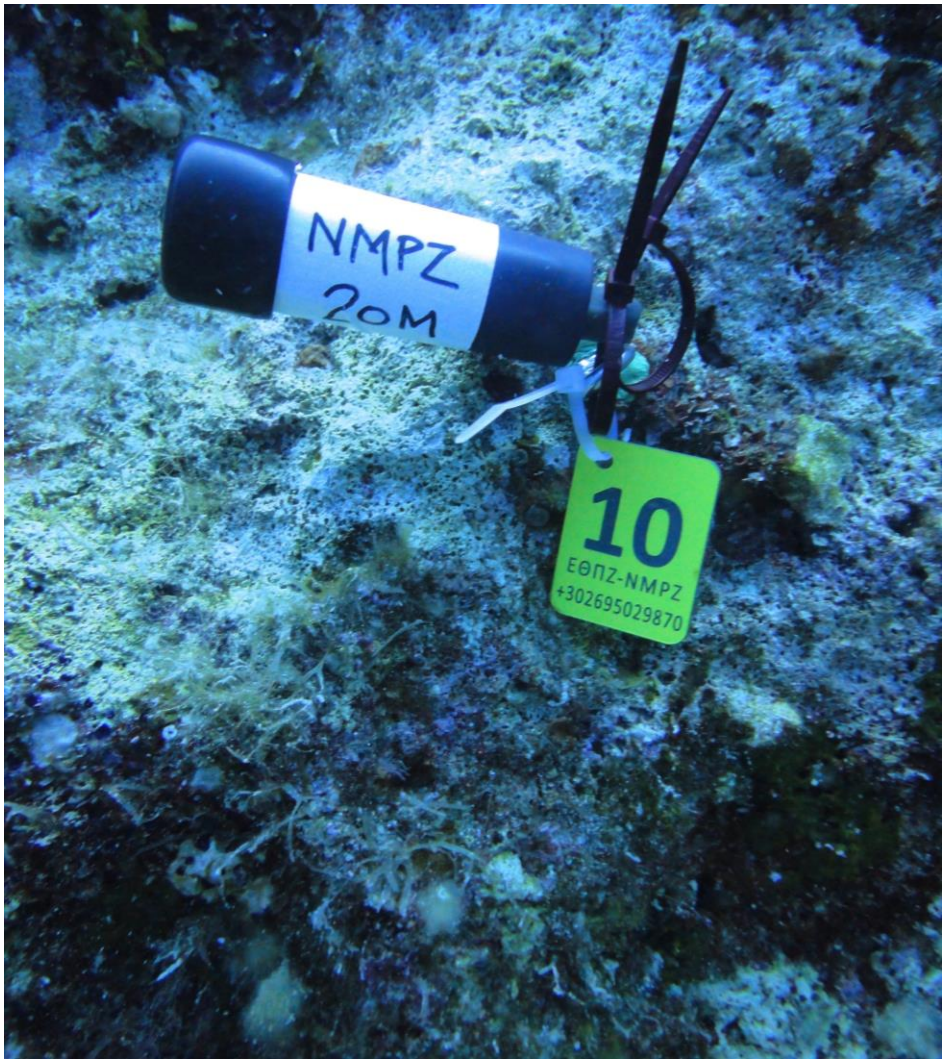
mariasini@marine.aegean.gr

Non destructive methods – For abiotic parameters

Temperature loggers



www.t-mednet.org



mariasini@marine.aegean.gr

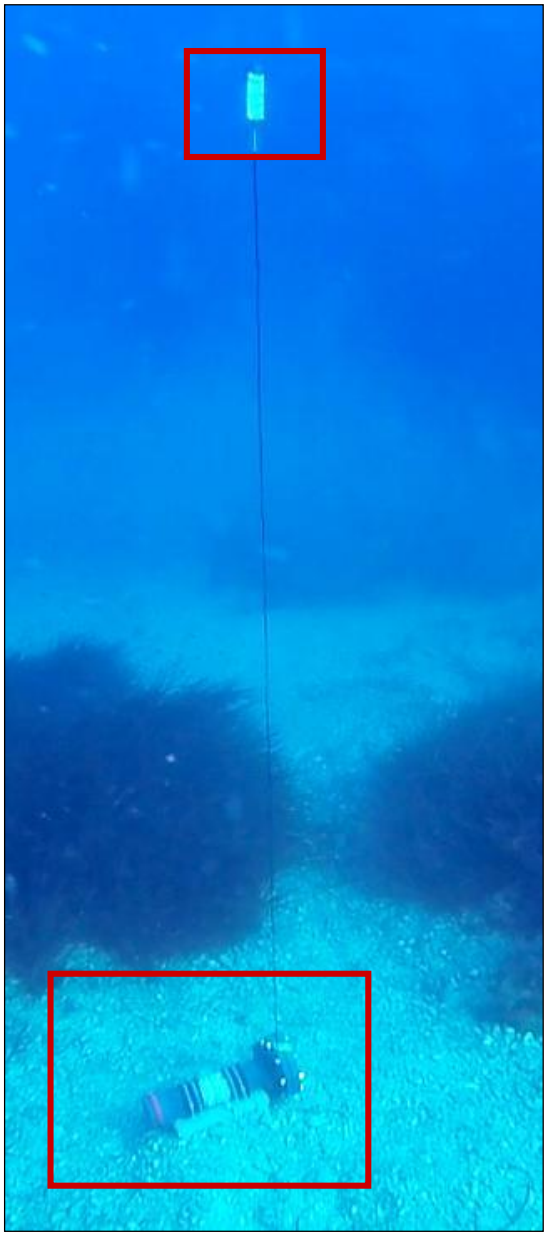
Non destructive methods – For abiotic parameters

Light loggers

mariasini@marine.aegean.gr

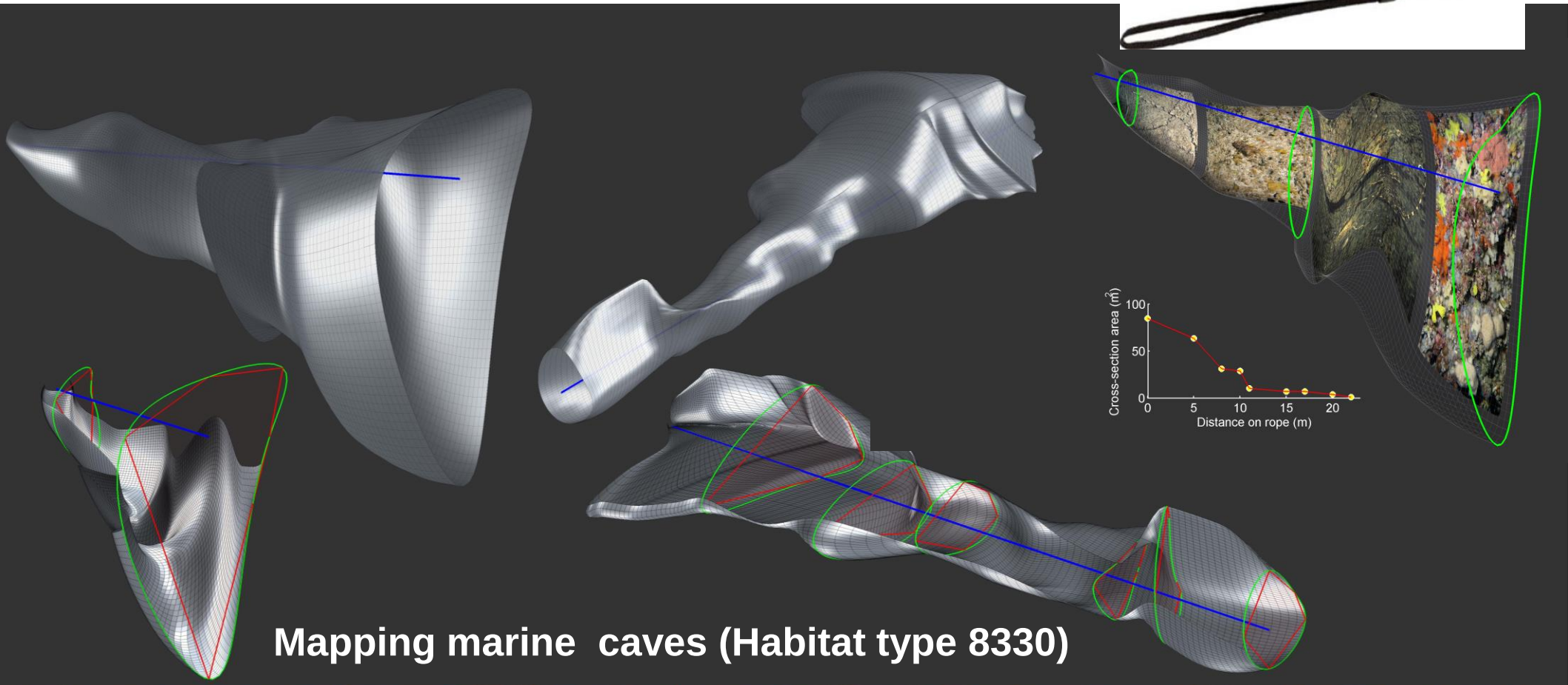
Non destructive methods – For abiotic parameters

…**Passive acoustics (hydrophones):** use for assessing noise levels as well as to assess the presence of different species.

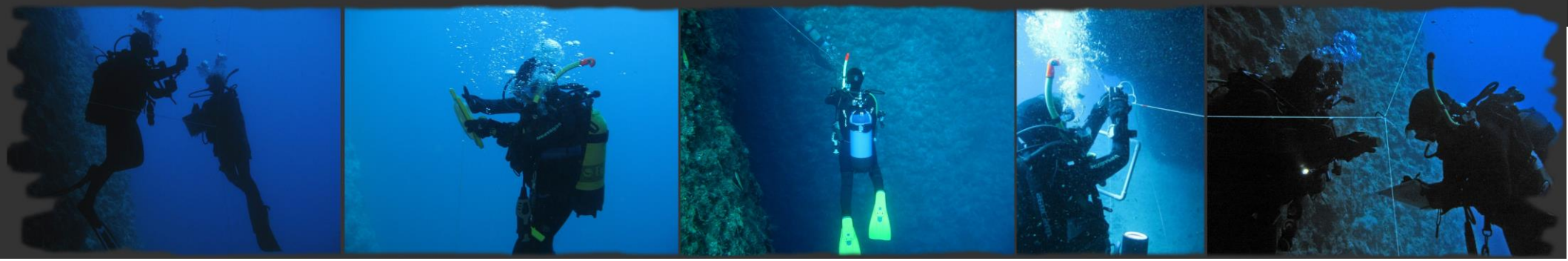


mariasini@marine.aegean.gr

Non destructive methods – For abiotic parameters



Mapping marine caves (Habitat type 8330)



photos: Β. Γεροβασιλείου, Ε. Ακριτοπούλου

mariasini@marine.aegean.gr

Non destructive methods – For biotic parameters

For biotic parameters

Non-destructive methods are applied in several cases:

~ monitor protected species (e.g. marine turtles, seals, cetaceans)

~ assess communities & habitats

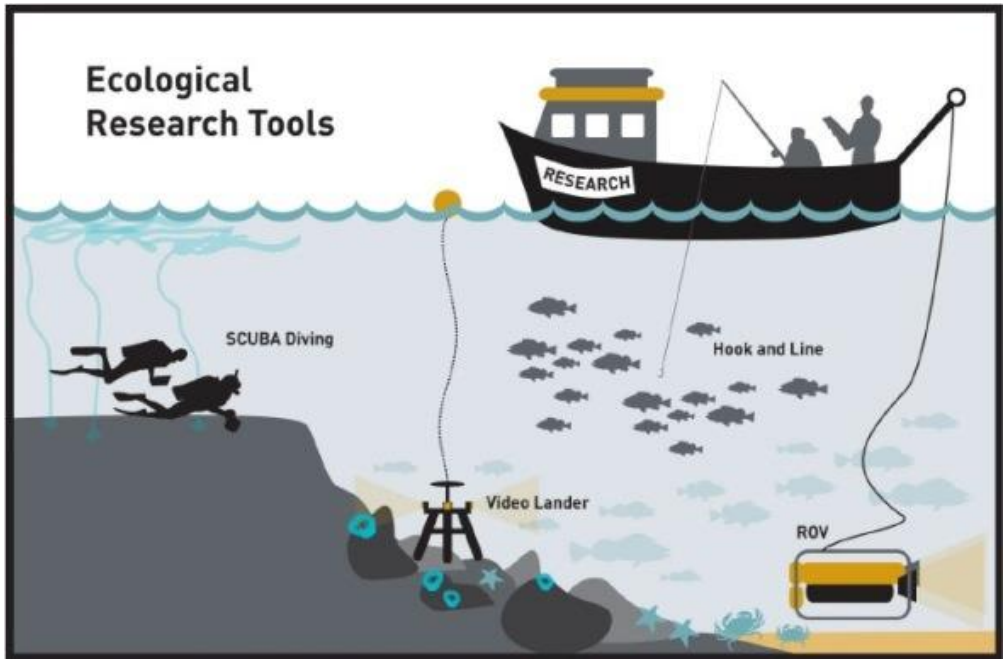
Different types

•Underwater visual census

•Video & photography

•Telemetry

•Acoustic methods

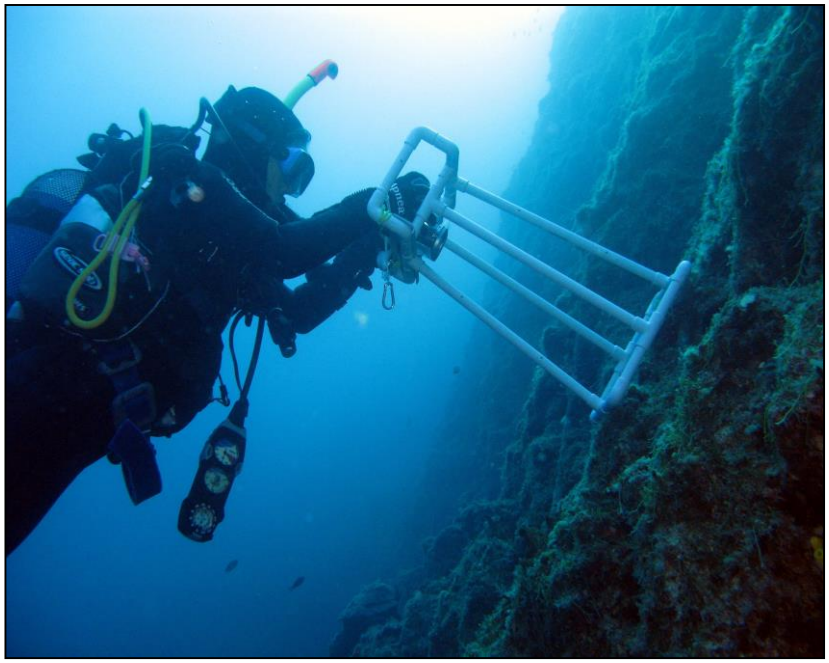


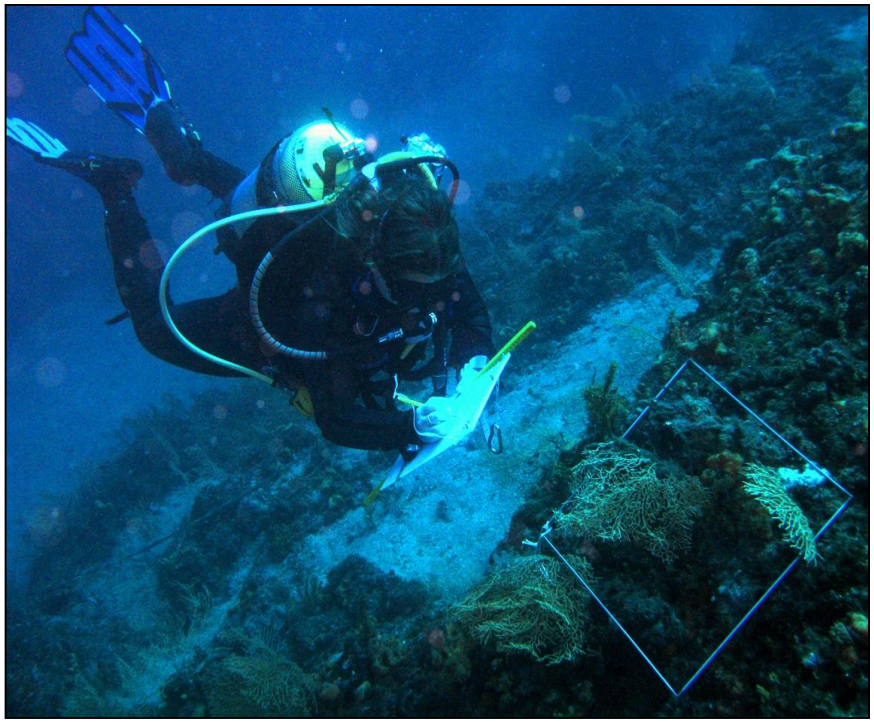
Let's look at some examples…

Non destructive methods – Underwater Visual Census

Underwater Visual Census

refers to *in situ* observations made by divers (free or SCUBA diving).





Let's look at some examples…

mariasini@marine.aegean.gr

Non destructive methods – Underwater Visual Census

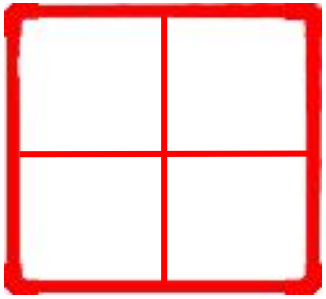
Assessment of *Posidonia oceanica* meadows

mariasini@marine.aegean.gr

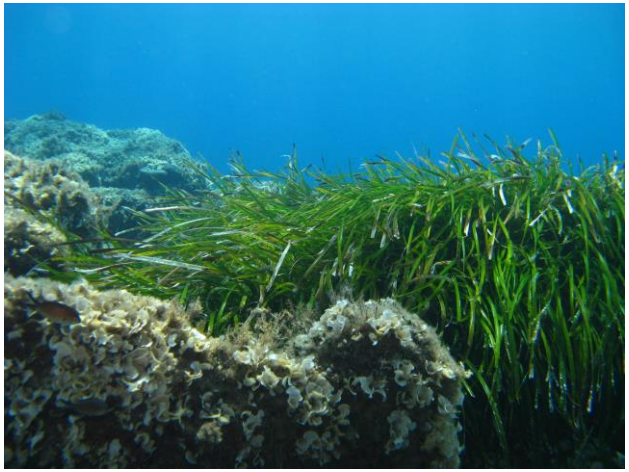
Non destructive methods – Underwater Visual Census

Assessment of *Posidonia oceanica* meadows

- **Shoot density** within quadrats



- **Meadow structure** within line transects

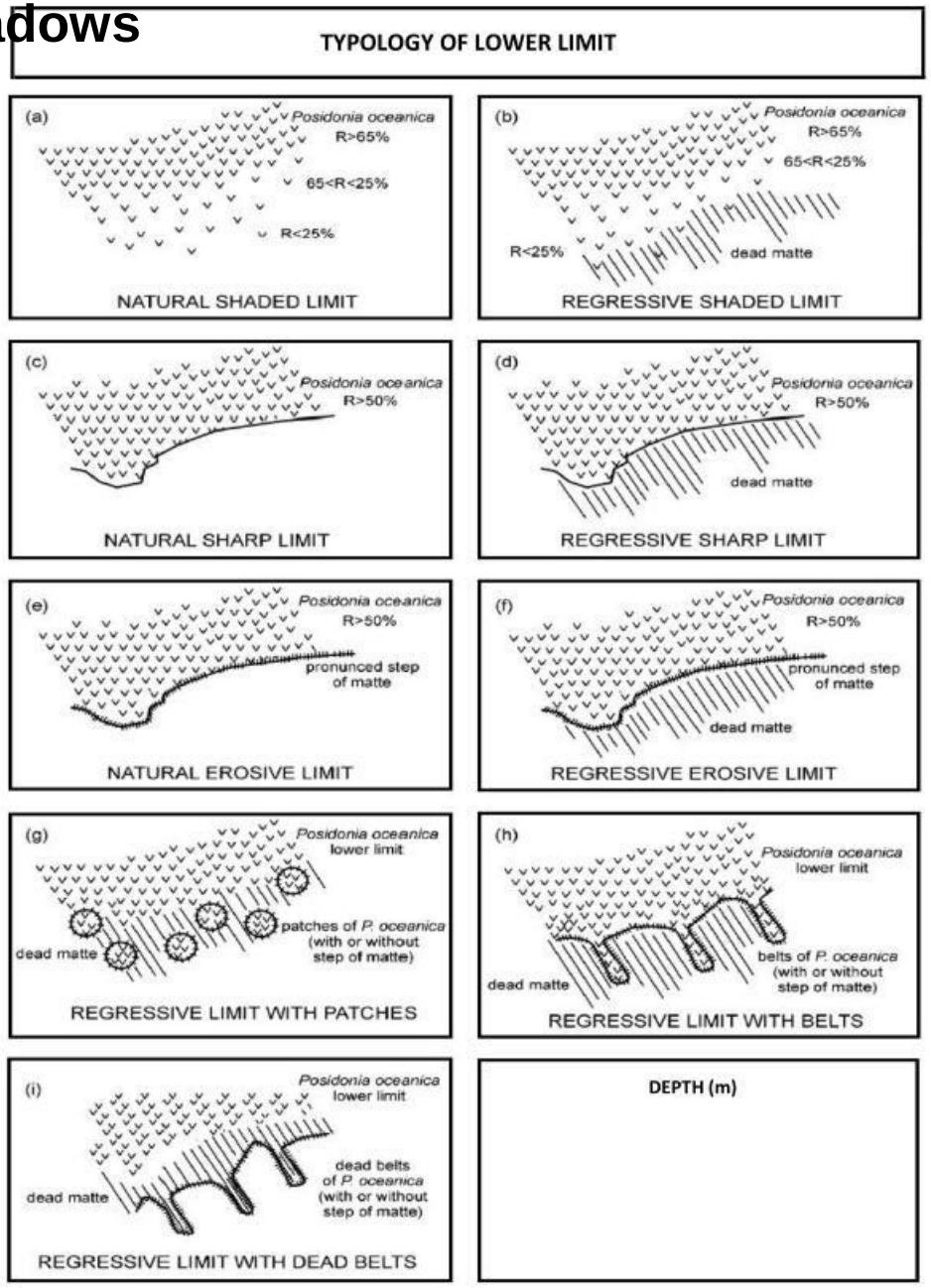


TRANSECT	A			B			C		
QUADRAT	1			2			3		
COMMENTS									
POSIDONIA	10	20	25	10	20	25	10	20	25
P.O = P. oceanica D.M = Dead matte H.S = H. stipulacea C.N = C. nodosa C.R = C. racemosa C.P = C. prolifera S = Sand R = Rock	5	15	20	5	15	20	5	15	20
	0	10		0	10		0	10	

Non destructive methods – Underwater Visual Census

Assessment of *Posidonia oceanica* meadows

- **Meadow's lower limit typology** through visual observation or video



mariasini@marine.aegean.gr

Sampling reefs & associated species

1. **Occupancy surveys**
2. **Strip transects**
3. **Line transects**
4. **Quadrats**
5. **Photoquadrats**
6. **Photography and Video**

Ημερομηνία	Σταθμός	Όνομα	Lat-Lon
Protected: Charonia variegata (**Cha**), Tonna galea (**Ton**), Pinna (**Pin**), Luria lurida (**Lur**), Erosaria spurca (**Eros**), Zonaria pyrum (**Zon**), Ophidiaster (**Oph**), Centrostephanus (**Centro**), Aplysina (**Apl**), Axinella cannabina (**A.can**), Axinella polypoides (**A.pol**), Axinella spp (**A. spp**), Sarcotragus (**Sarc**), Geodia (**Geo**), Tethya (**Teth**), Cladocora (**Clad**), Hippocampus hipppocampus (**Hh**), Hippocampus gutulatus (**Hg**) * **Για είδη εκτός λίστας: +:** Παρουσία, **Σπάνιο:** 1-10%, **Κοινό:** 10-25%, **Αφθονο:** 25-50%, **ΑΑ** πολύ άφθονο: 50-75%, **Ν:** Νεκρό άτομο, **ΝΝ:** Νεκρός πληθυσμός			
30-25m			**Οικότοπος, Πιέσεις**
25-20m			**Οικότοπος, Πιέσεις**
20-15m			**Οικότοπος, Πιέσεις**
15-10m			
10-5m			
5-0m			

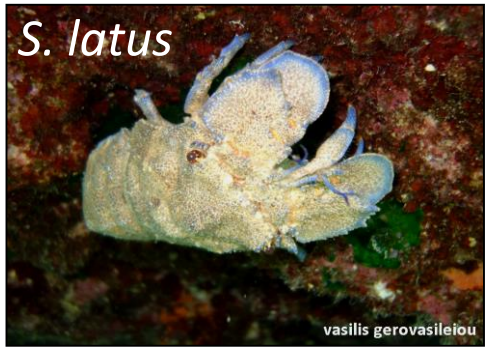
mariasini@marine.aegean.gr

Sampling reefs (Habitat type 1170) & associated species

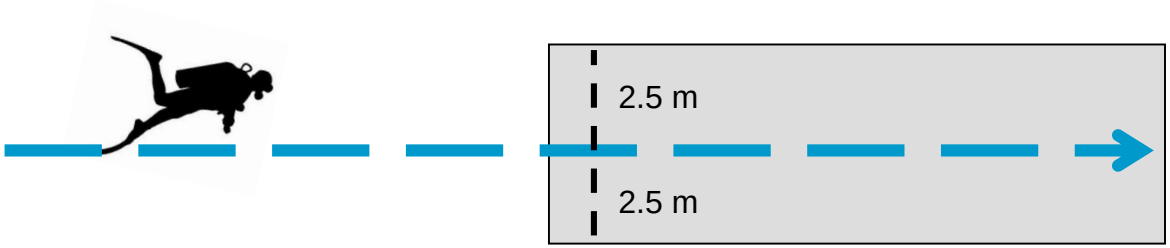
1. Occupancy surveys (quantitative method):

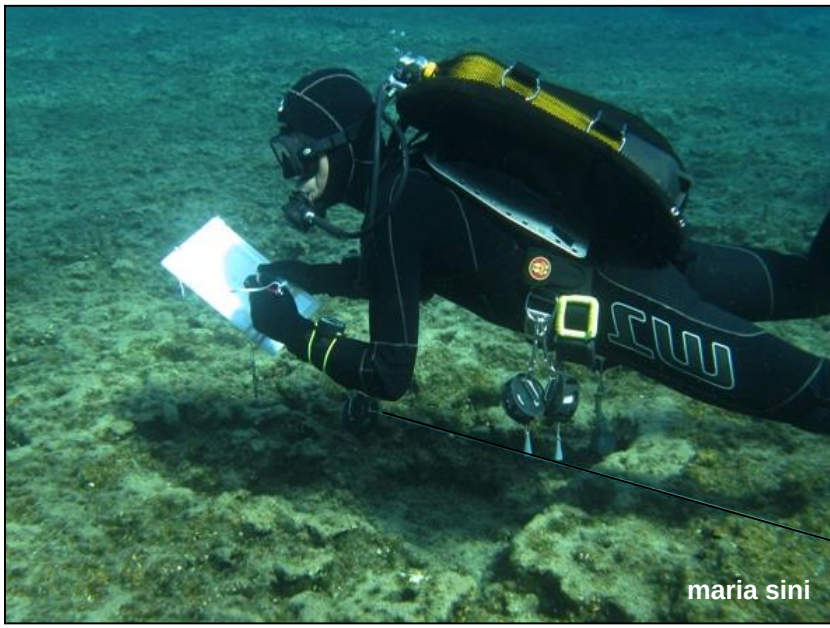
- used for the assessment of fish, benthos, habitats.
- two observers.
- predefined depth zones.
- specific observation time.

Ημερομηνία	Σταθμός	Όνομα	Lat-Lon
Protected: Charonia variegata (**Cha**), Tonna galea (**Ton**), Pinna (**Pin**), Luria lurida (**Lur**), Erosaria spurca (**Eros**), Zonaria pyrum (**Zon**), Ophidiaster (**Oph**), Centrostephanus (**Centro**), Aplysina (**Apl**), Axinella cannabina (**A.can**), Axinella polypoides (**A.pol**), Axinella spp (**A. spp**), Sarcotragus (**Sarc**), Geodia (**Geo**), Tethya (**Teth**), Cladocora (**Clad**), Hippocampus hipppocampus (**Hh**), Hippocampus gutulatus (**Hg**) * **Για είδη εκτός λίστας: +:** Παρουσία, **Σ**πάνιο: 1-10%, **Κ**οινό: 10-25%, **Α**φθονο: 25-50%, **ΑΑ** πολύ άφθονο: 50-75%, **Ν:** Νεκρό άτομο, **ΝΝ:** Νεκρός πληθυσμός			
30-25m			**Οικότοπος, Πιέσεις**
25-20m			**Οικότοπος, Πιέσεις**
20-15m			**Οικότοπος, Πιέσεις**
15-10m			**Οικότοπος, Πιέσεις**
10-5m			**Οικότοπος, Πιέσεις**
5-0m			**Οικότοπος, Πιέσεις**



Sampling reefs (Habitat type 1170) & associated species





2. Strip transects (quantitative method):

- used for the assessment of fish, benthos, habitats.
- one diver moving along a transect line of predetermined width.

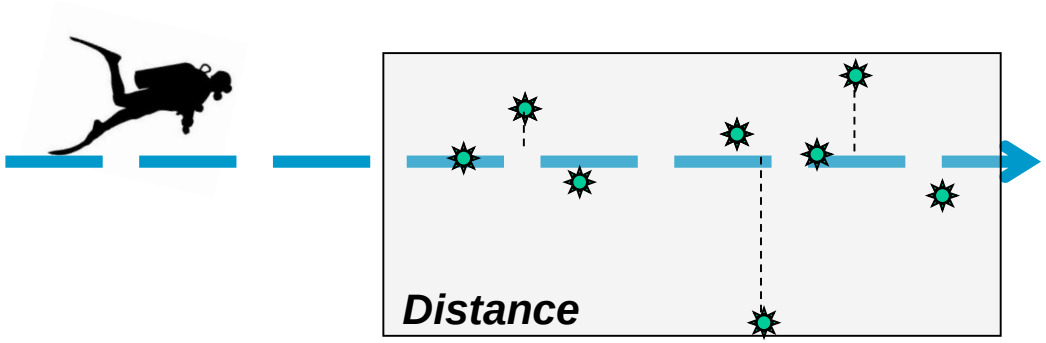
Epinephelus marginatus

Diplodus sargus

Sarpa salpa

Siganus luridus

Sampling reefs (Habitat type 1170) & associated species



3. Distance sampling using line transects (quantitative method):

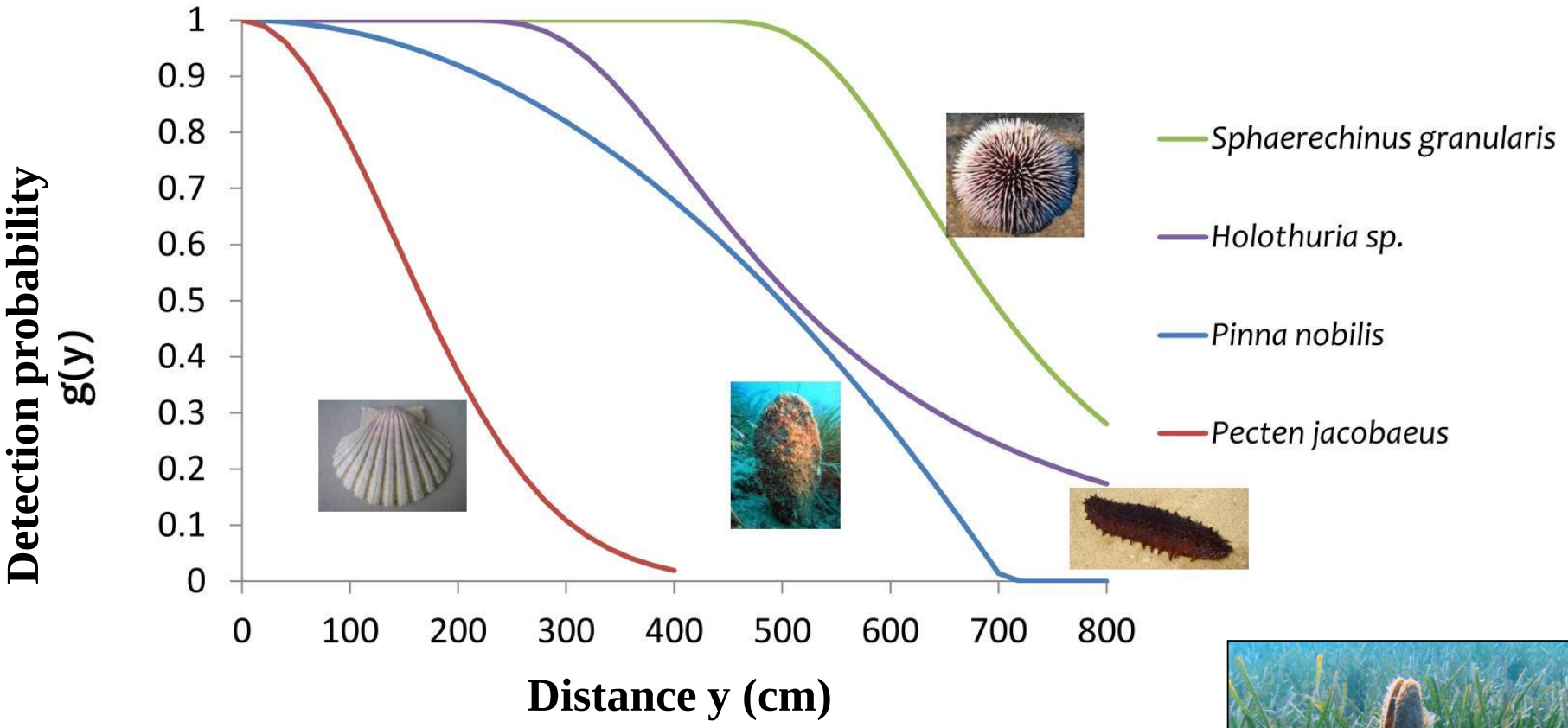
- used for the assessment of fish, benthos, habitats
- one diver moving along a transect line of no specific width
- recording the distance of target features from the line.

ΠΡΩΤΟΚΟΛΛΟ ΑΦΘΟΝΙΑΣ ΠΙΝΝΑΣ ΜΕ ΔΕΙΓΜΑΤΟΛΗΨΙΑ ΑΠΟΣΤΑΣΕΩΝ				
ΗΜΕΡΟΜΗΝΙΑ	ΣΤΑΘΜΟΣ	ΠΑΡΑΤΗΡΗΤΗΣ	ΣΥΝΤΕΤΑΓΜΕΝΕΣ	ΚΑΤΕΥΘΥΝΣΗ ΤΟΜΗΣ:
ΤΜΗΜΑ ΤΟΜΗΣ	ΜΕΓΕΘΟΣ ΑΤΟΜΟΥ	ΚΑΘΕΤΗ ΑΠΟΣΤΑΣΗ	ΒΑΘΟΣ	ΠΕΡΙΓΡΑΦΗ ΒΙΟΤΟΠΟΥ / ΠΑΡΑΤΗΡΗΣΕΙΣ / ΠΙΕΣΕΙΣ
0-5				
5-10				
10-15				
15-20				
20-25				
...-...				

mariasini@marine.aegean.gr

Sampling reefs (Habitat type 1170) & associated species

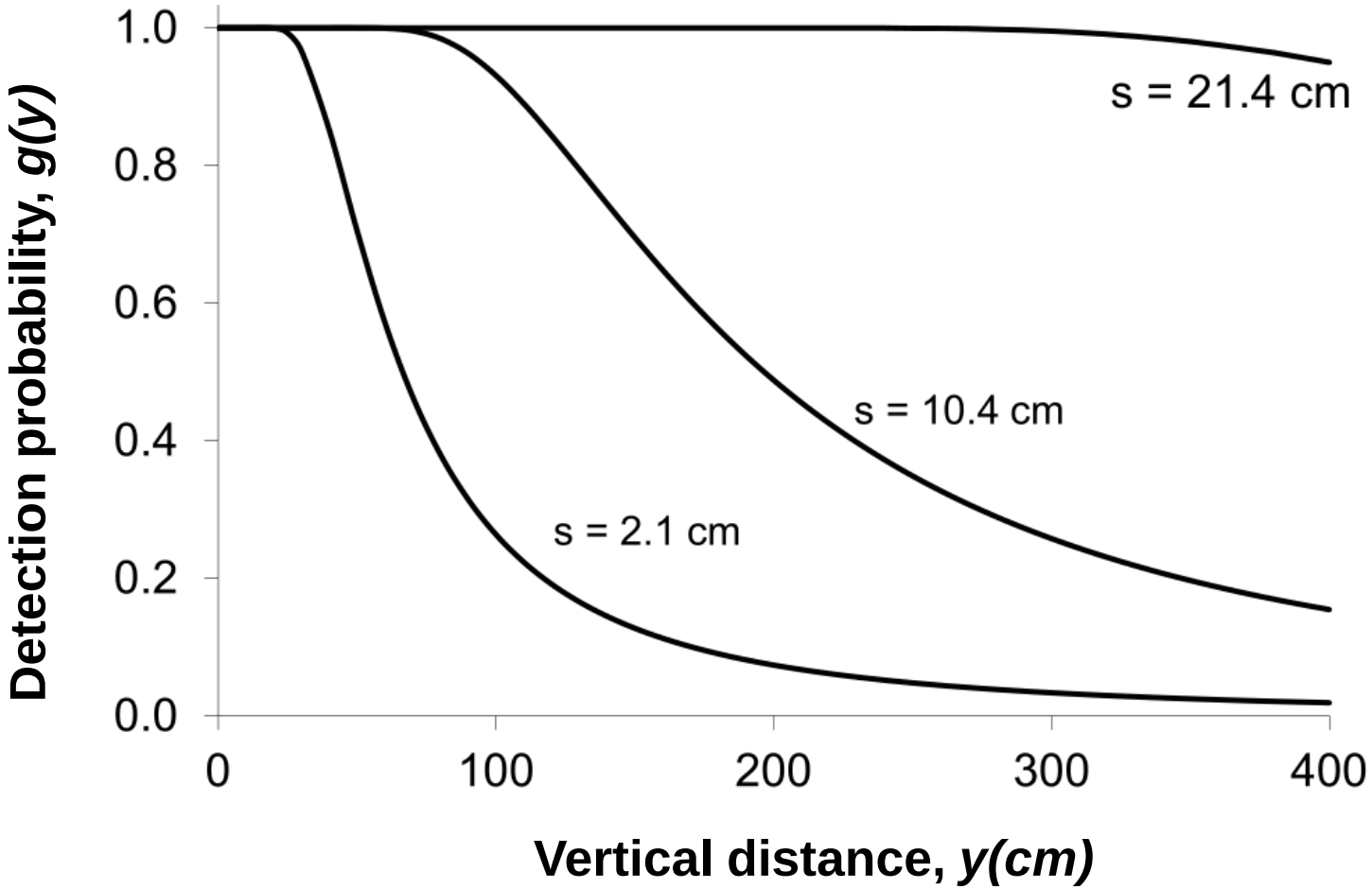
3. "Distance" sampling – detection probability of different species



Source: Katsanevakis 2009

Sampling reefs (Habitat type 1170) & associated species

3. "Distance" sampling – detection probability of different species



Source: Katsanevakis and Thessalou-Legaki 2009 – Aquatic Biology

mariasini@marine.aegean.gr

Sampling reefs (Habitat type 1170) & associated species

4. Quadrat sampling (quantitative method):

- used for the assessment of benthos and habitats.
- visual observation over predetermined area defined through the use of a quadrat.
- recording the distance of target features from the line.

example...

Lithophaga

Ημερομηνία: _____Σταθμός:_____GPS:_____

Παρατηρητής:_____

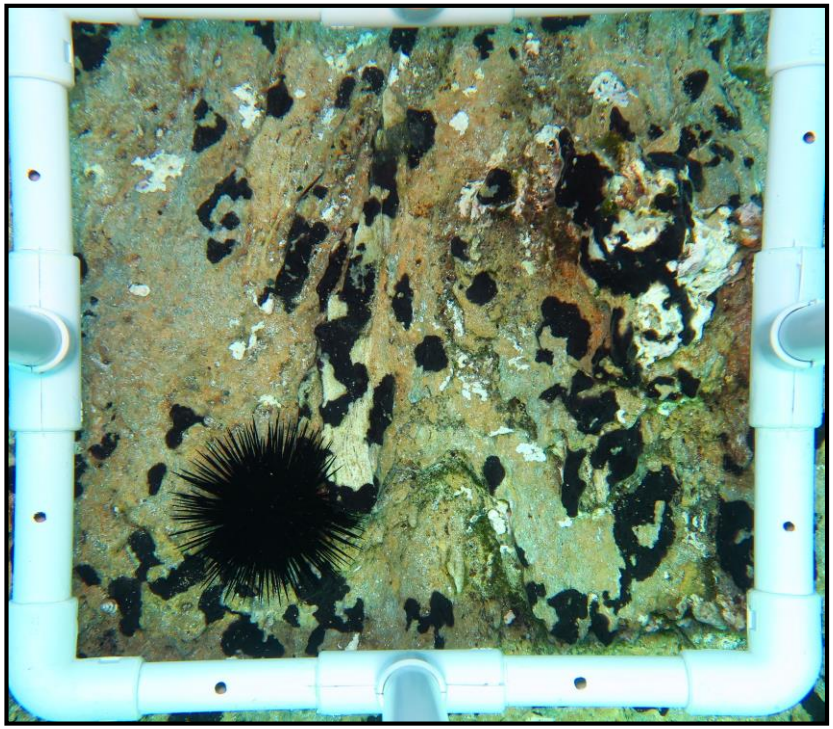
	Πλαίσιο 1	Πλαίσιο 2	Πλαίσιο 3	Πλαίσιο 4	Πλαίσιο 5	Πλαίσιο 6
Αρ. οπών Με / Χωρίς ζωντανό άτομο						

Παρατηρήσεις:_____

_____

mariasini@marine.aegean.gr

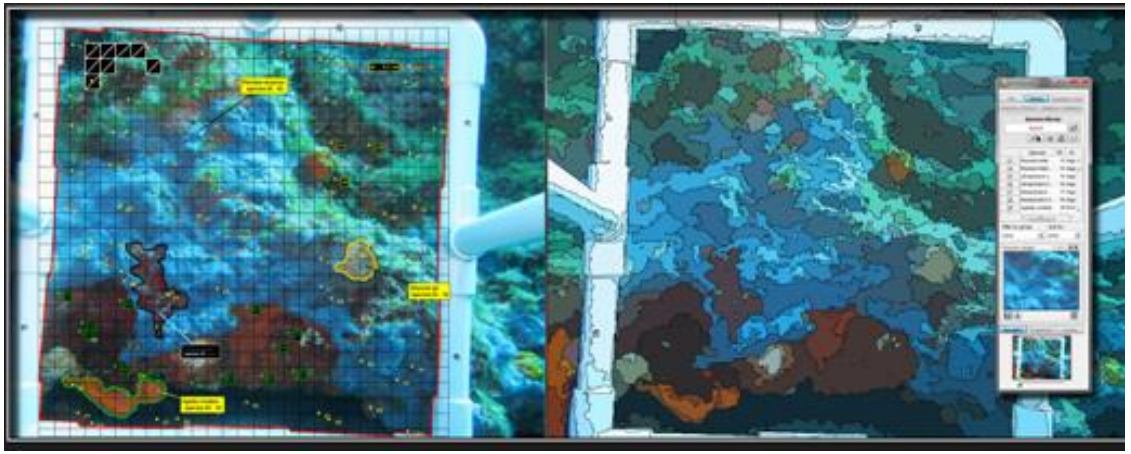
Sampling reefs (Habitat type 1170) & associated species



5. Photoquadrats (quantitative method):

• used for the assessment of benthos and habitats.

photoQuad
photo quadrat analysis software
www.mar.aegean.gr/sonarlab/photoquad

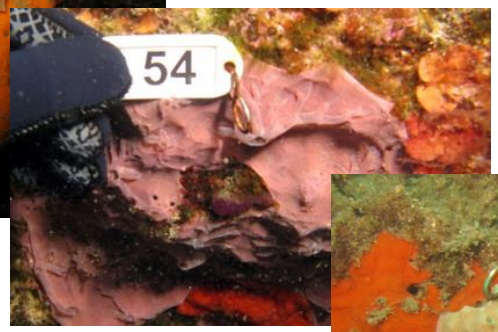


mariasini@marine.aegean.gr

Sampling reefs (Habitat type 1170) & associated species

Selected biological samples are sometime collected for:

- Further identification in the laboratory
- Estimation of biomass

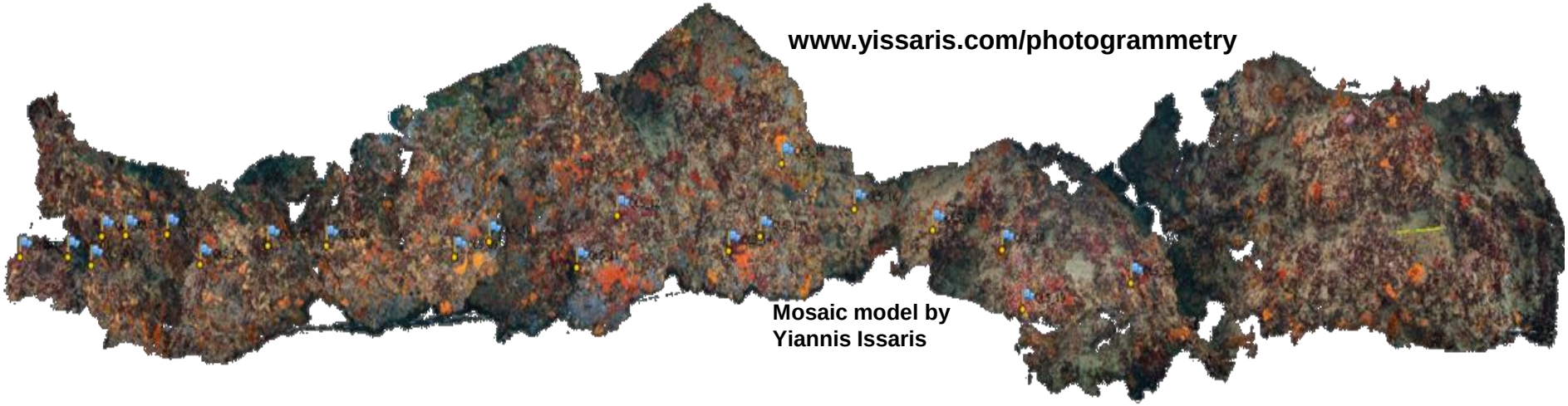


mariasini@marine.aegean.gr

Sampling reefs (Habitat type 1170) & associated species

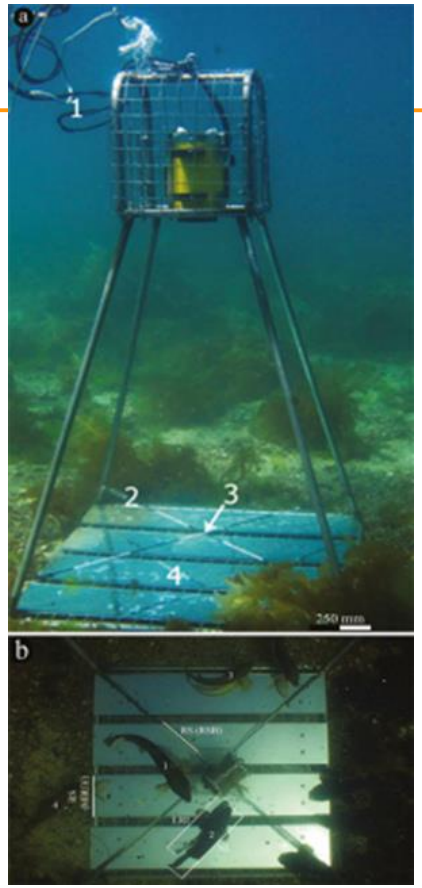
6. Photography & Video (quantitative or qualitative methods):

- Using photography for creating 3-D photomosaics



mariasini@marine.aegean.gr

Sampling reefs (Habitat type 1170) & associated species



6. Sterophotography & Video (quantitative methods):

- Two cameras positioned at a known distance apart.
- Used for the assessment of fish, benthos, habitat.
- Prerequisite: system calibration.

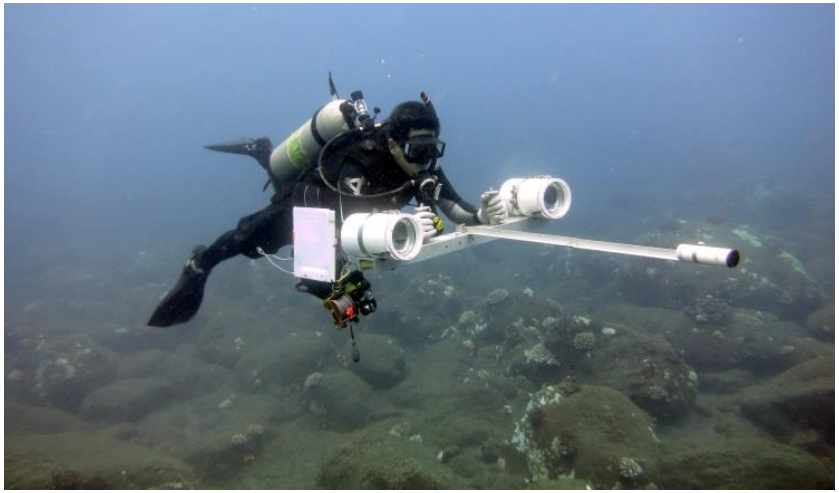
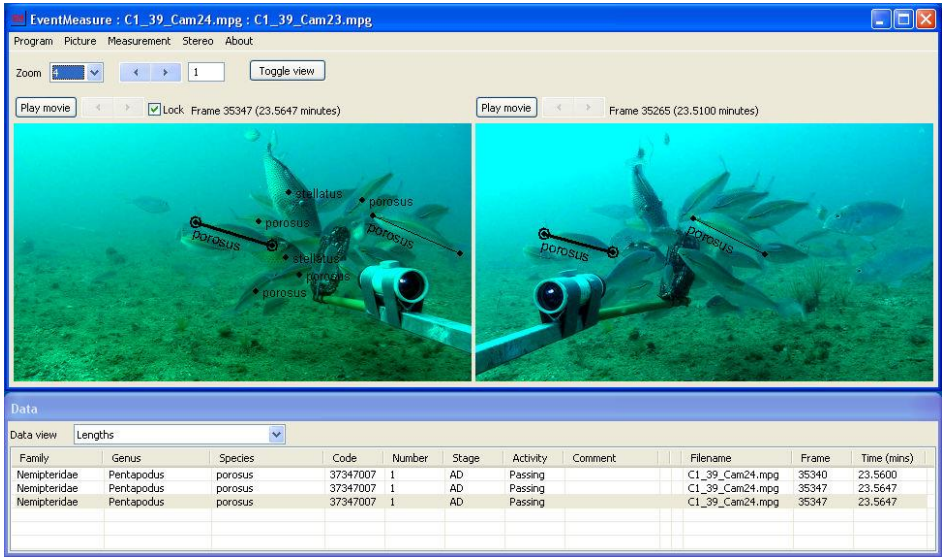


photo: Andrew Gray/NOAA
https://www.omao.noaa.gov/learn/diving-program

Analysis software:
www.seagis.com.au

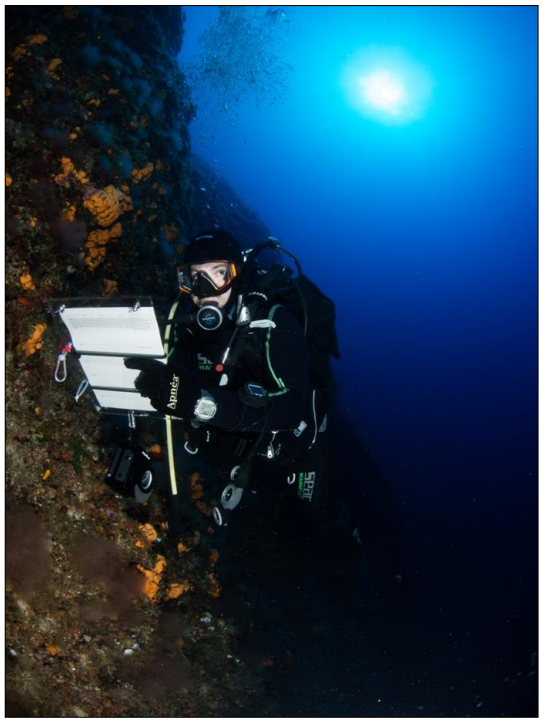


mariasini@marine.aegean.gr

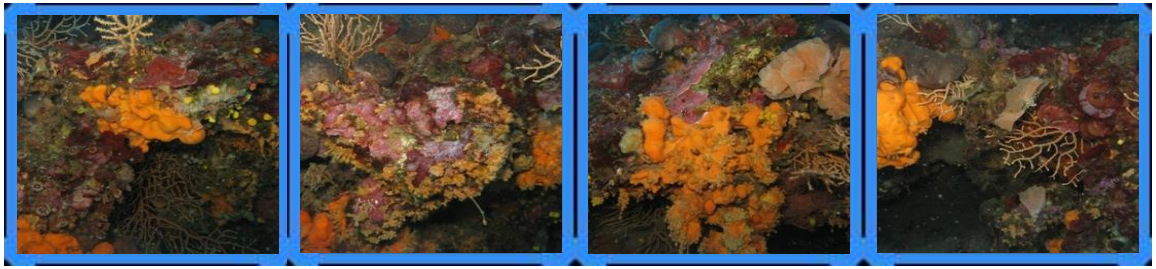
Sampling coralligenous assemblages (Habitat type 1170) & associated species

Date	Station	Name	Lat/Lon
Εύρος βάθους παρατήρησης Ελάχιστο βάθος m: Μέγιστο βάθος m:	Οριζόντια εξάπλωση <5 m / 5-10 m / 10-20 m / >20 m	Συνέχεια ενδιαιτήματος 	
Κλίση υποστρώματος 	Τραχύτητα 	Προσανατολισμός 	
Ρεύματα: Καθόλου/Ήπιο / Δυνατό	**Ορατότητα:** Καθαρά / Μερική / Θολά	**Πάχος:** 0-5, 5-10, >10, >20 cm	**Ίζημα:** Καθόλου/Λίγο/Πολύ
Βενθικά είδη (είδος, Σχετική αφθονία):			
Κινητή πανίδα (Ψάρια, Εχινόδερμα, Καρκινοειδή, Σχετική αφθονία):			
Αλλόχθονα (είδος, Σχετική αφθονία):			
Νέκρωση: **Calc algae** (είδος, αρ. ατόμων με νέκρωση >50%) **Σπόγγοι** (είδος, αρ. ατόμων με νέκρωση >50%) **Σκληρακτίνια** (είδος, αρ. ατόμων με νέκρωση >50%)		**Άλλες απειλές:**	
Γοργονίες (είδος, αριθμός αποικιών με νέκρωση <50%, 50-98% και 100% σε 50x50cm πλαίσια)			
* **ΣΧΕΤΙΚΗ ΑΦΘΟΝΙΑ: +:** Παρουσία, **Σ**πάνιο:1-2, **Κ**οινό:4-15, **Α**φθονο:15-30, **ΑΑ** πολύ άφθονο:>30, **Ν**:Νεκρό άτομο, **ΝΝ**:Νεκρός πληθυσμός			
Φωτογραφίες 8Χ5			

Combine visual census with photoquadrat sampling



Photoquadrats for estimating benthic cover of algae or other animals



Sampling caves (Habitat type 8330) & associated species

Combine visual census with photoquadrat sampling

Περιοχή:		**Ημερομηνία:**		**Δύτες:**	
Latitude		**Longitude**			
Τύπος σπηλαίου: Βυθισμένο / Ημιβυθισμένο		**Τύπος σπηλαίου:** Αδιέξοδο / Σήραγγα (αρ. εισόδων:)			
Συνολικό μήκος:	**Βάθος (m)**	**Ύψος (m)**	**Πλάτος (m)**	**Προσανατολισμός**	
Είσοδος Α'					
Είσοδος Β'					
Εσωτερική παραλία:	**Θύλακες αέρα:**		**Σπηλαιοδιάκοσμος:**		
Θρυμματοφάγα / παμφάγα είδη (αριθμός ειδών & ατόμων που παρατηρήθηκαν εντός 5 min)					
Herbstia condyliata	0	1–2	3–4	5–10	>10
Galathea strigosa	0	1–2	3–4	5–10	>10
Scyllarus arctus	0	1–2	3–4	5–10	>10
Hermodice carunculata	0	1–2	3–4	5–10	>10
	0	1–2	3–4	5–10	>10
	0	1–2	3–4	5–10	>10
Mysida	0		ελάχιστα		σμήνος
Plesionica	0		ελάχιστα		σμήνος

Είδη ψαριών που καταγράφηκαν στο σπήλαιο	**Είδη δεκαπόδων που καταγράφηκαν στο σπήλαιο**

***Cerianthus membranaceus* (αριθμός ατόμων)**			***Arachnanthus oligopodus* (αριθμός ατόμων)**		
0	1–2	>2	0	1–2	>2
Προστατευόμενα / χαρακτηριστικά είδη			**Απειλές**		

mariasini@marine.aegean.gr

Non destructive methods – Other methods

Photography & Video through the use of ROVs and small submersibles:

- ROVs (remotely operated vehicles).
- Used for the assessment of fish, benthos, habitat
- Especially useful for deep waters.
- Provides both quantitative & qualitative information.
- Prerequisite for quantitative information: system

Thetis - HCMR

Non destructive methods – Other methods

Remote sensing, monitoring and tracking:

Telemetry means measuring (-metry) from a distance (tele-). It is a process by which measurements and other data are collected at remote or inaccessible points and transmitted to receiving equipment for monitoring.

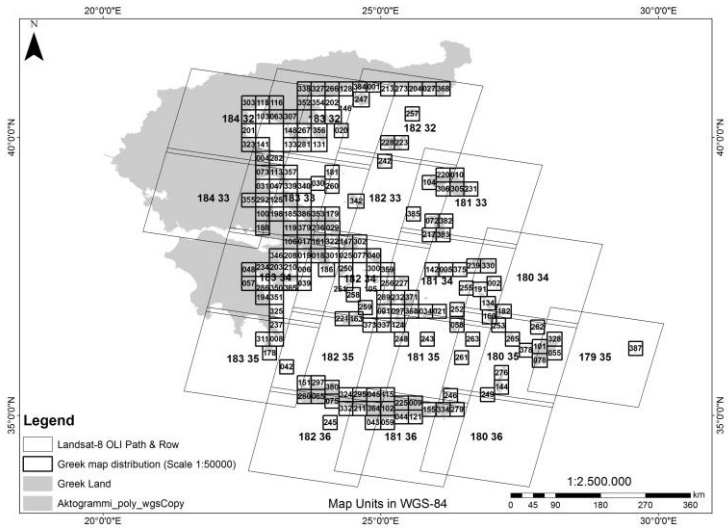
mariasini@marine.aegean.gr

Non destructive methods – Other methods

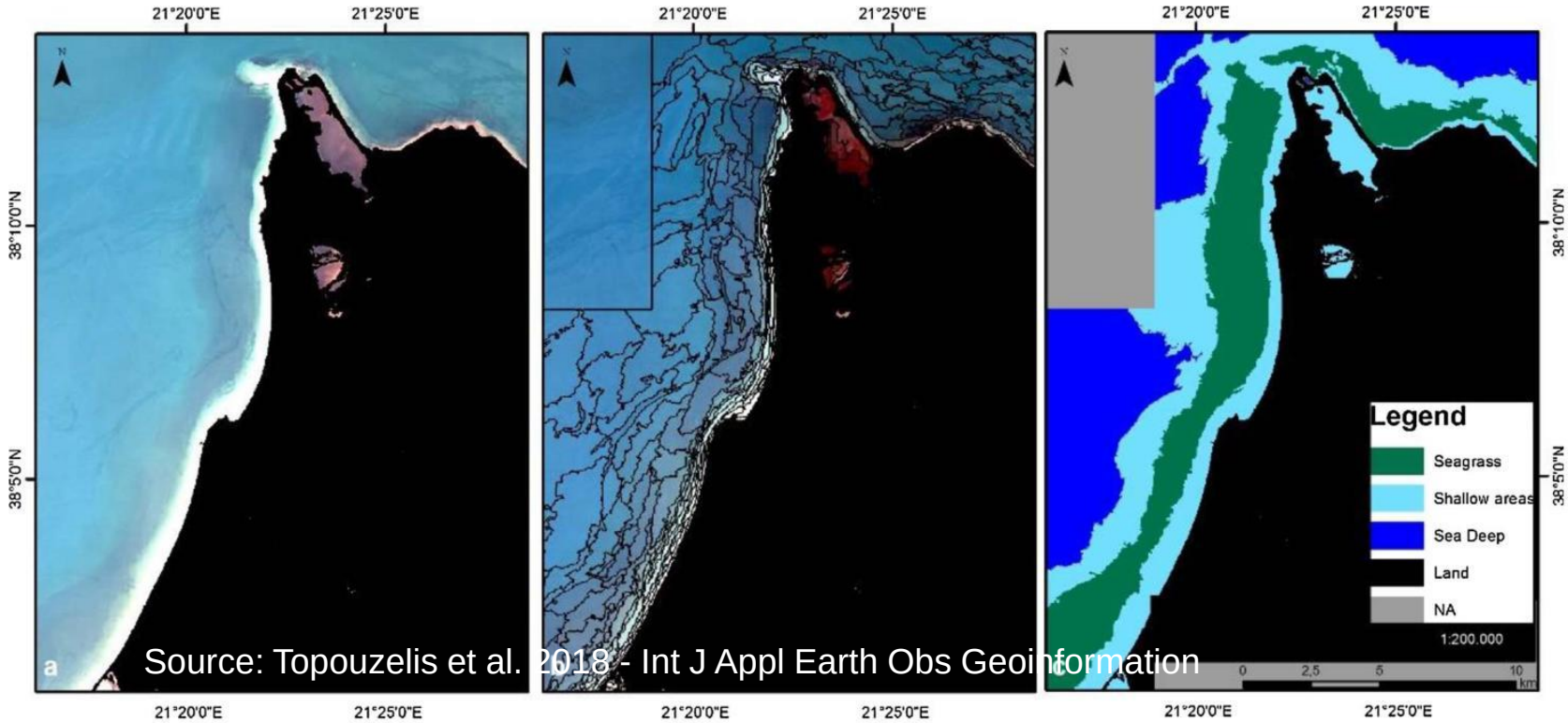
Remote sensing, monitoring and tracking:

Satellite telemetry: Information obtained through satellites

- Used for habitat mapping, oil-spill detection.



e.g. Habitat mapping of *P. oceanica* in the Aegean– MARISCA project



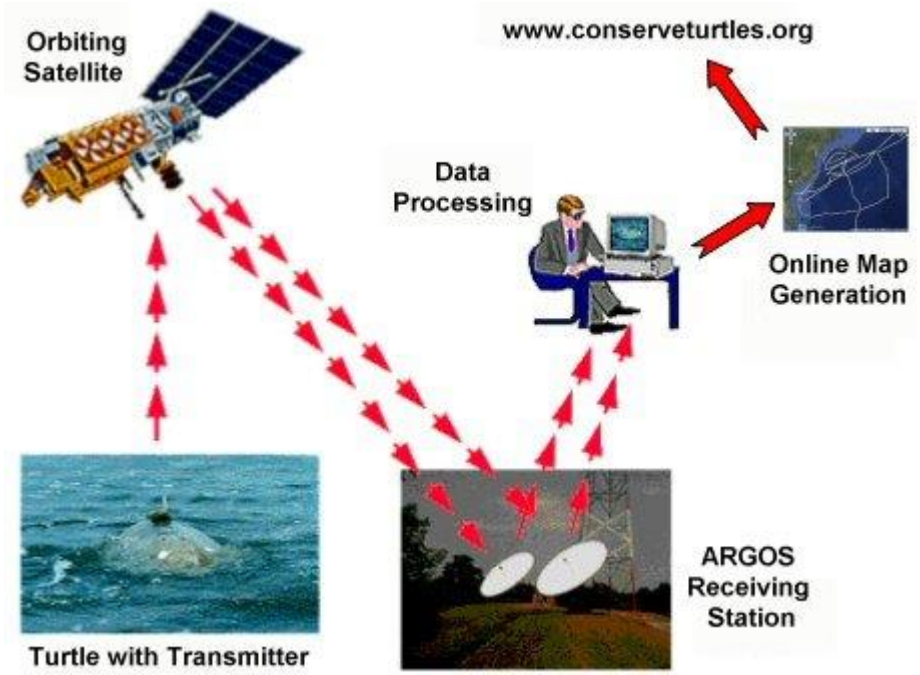
Source: Topouzelis et al. 2018 - Int J Appl Earth Obs Geoinformation

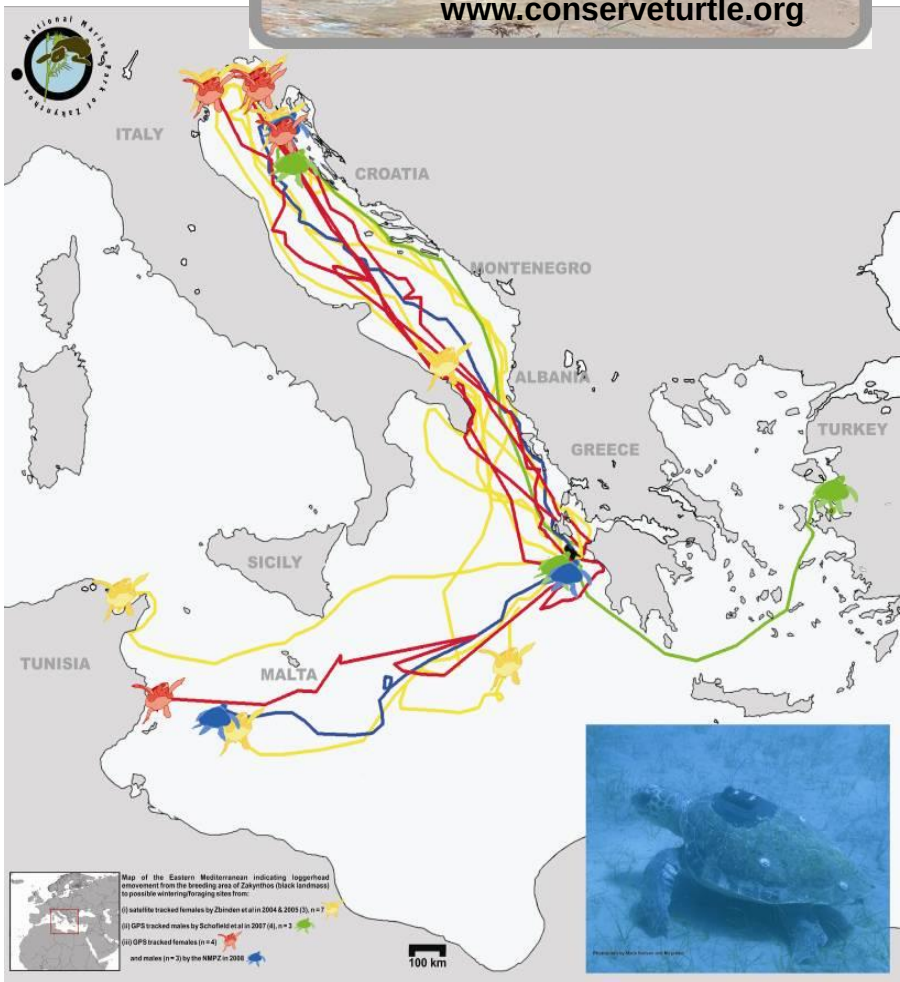
mariasini@marine.aegean.gr

Non destructive methods – Other methods

Telemetry methods:

- Tagging techniques and telemetry tracking
- Used for animal tracking.



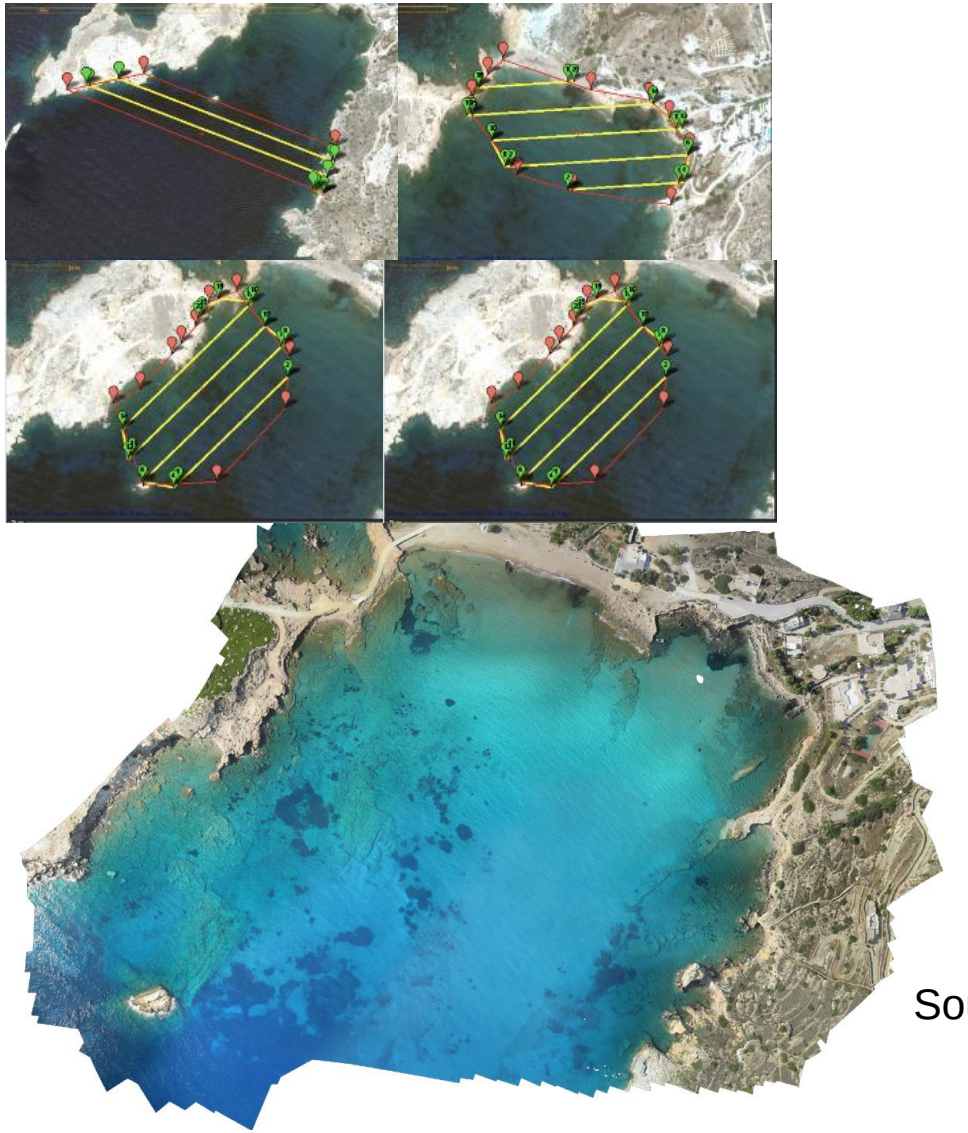


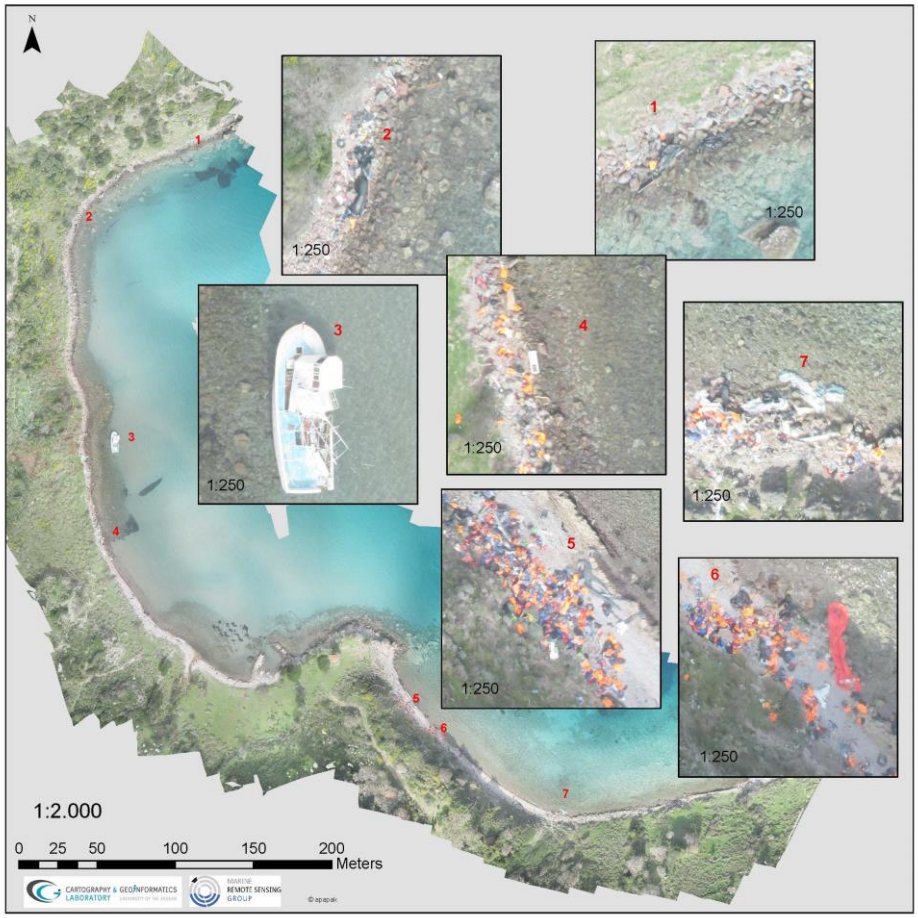
mariasini@marine.aegean.gr

Non destructive methods – Other methods

Use of UAVs (unmanned aerial vehicles): quadcopters

- Production of orthophotomaps, used for habitat mapping, marine litter mapping





Source: Marine Remote Sensing Group - mrsg.aegean.gr

MARISCA project – www.marisca.eu

mariasini@marine.aegean.gr

Sampling fish species along transects

Measure / count:

Size

Density

Estimate:

Biomass ($W = a \times L^b$)

Where: ***W*** = weight in grams

L= Length in cm

STATION: DATE: GPS:	Transect 1 Depth ……	Transect 2 Depth ……	Transect 3 Depth ……
Diplodus sargus – Σαργός			
Diplodus vulgaris – Κακαρέλος			
Sarpa salpa - Σάλπα			
Sparisoma cretense - Σκάρος			
Siganus luridus – Γερμανός			
Siganus rivulatus			
Epinephelus costae - Στήρα			
Epinephelus marginatus -Ροφός			
Other – άλλα			

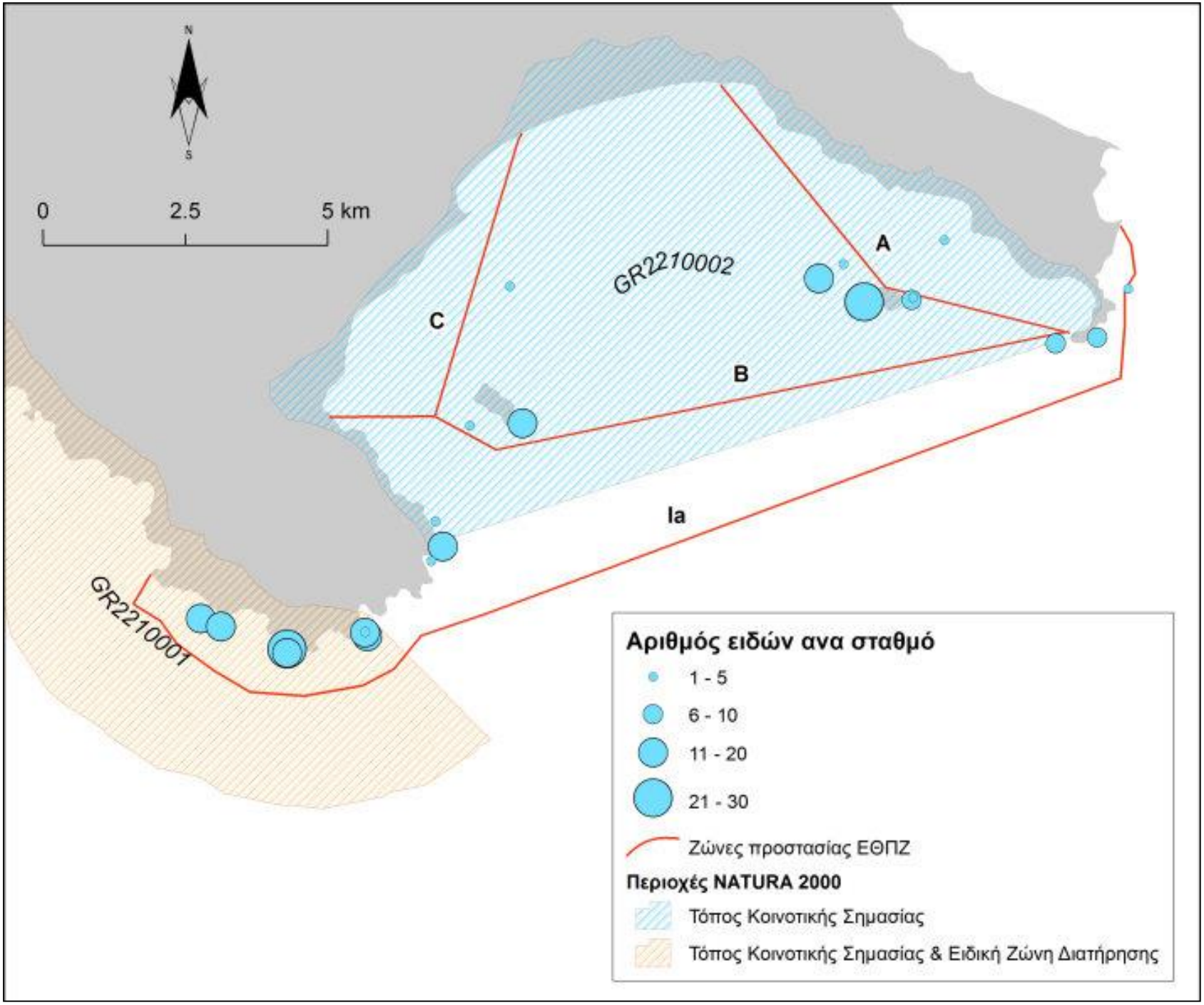
***a* (intercetpt) & *b* (slope)** = parameters obtained from modeling the length × weight relationship. Also available from literature (e.g. www.fishbase.org)

Native **Allochtonous**

Epinephelus marginatus *Diplodus sargus* *Sarpa salpa* *Siganus luridus*

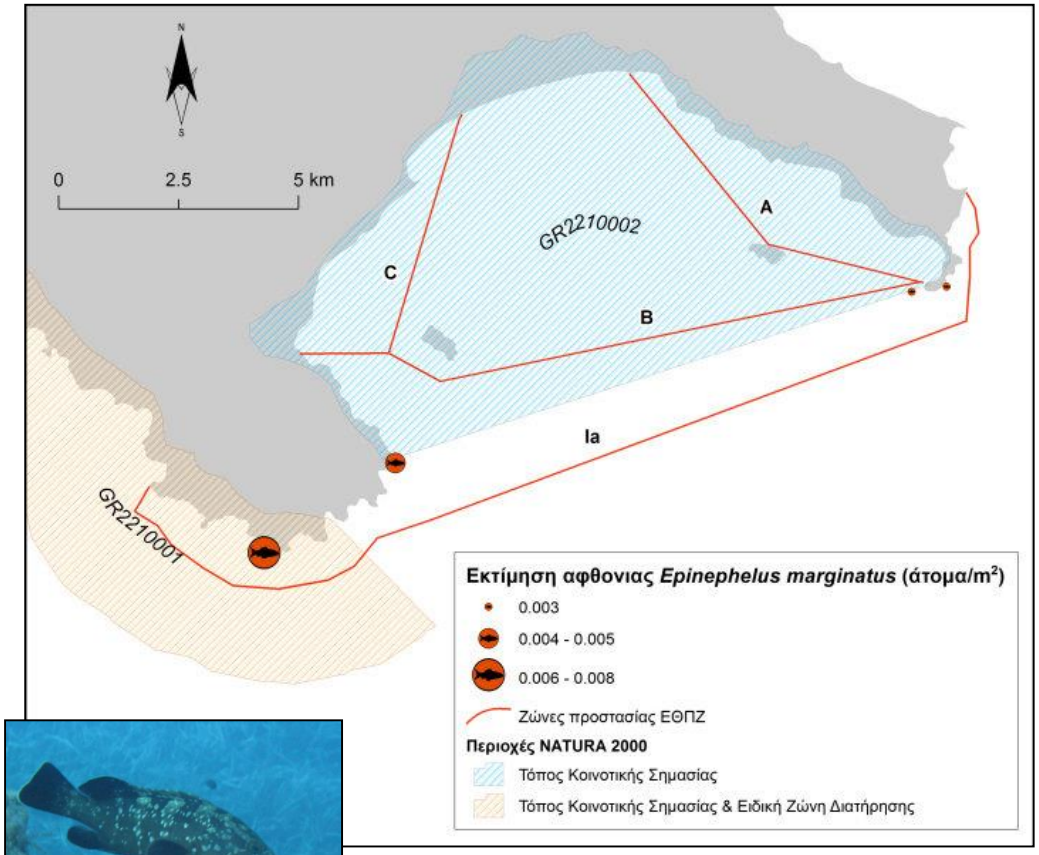
Number of species per station

University of the Aegean – Department of Marine Sciences
mariasini@marine.aegean.gr

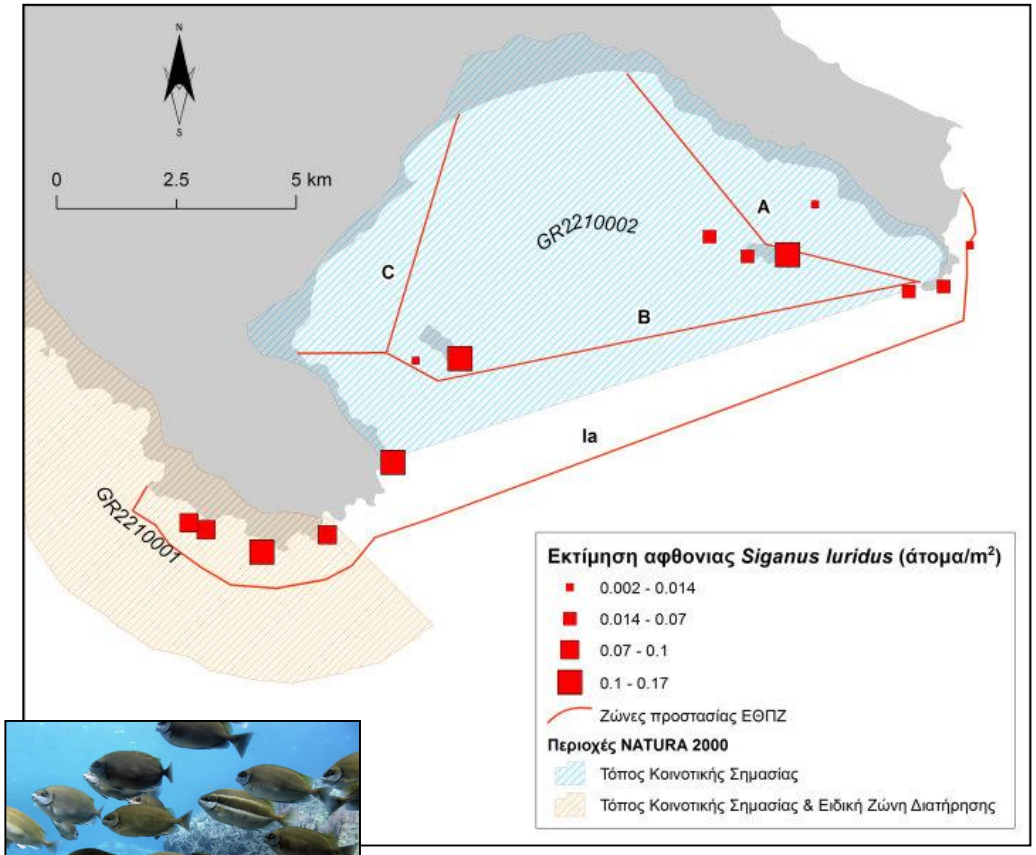


Fish sampling – Visual census on belt transects

Epinephelus marginatus

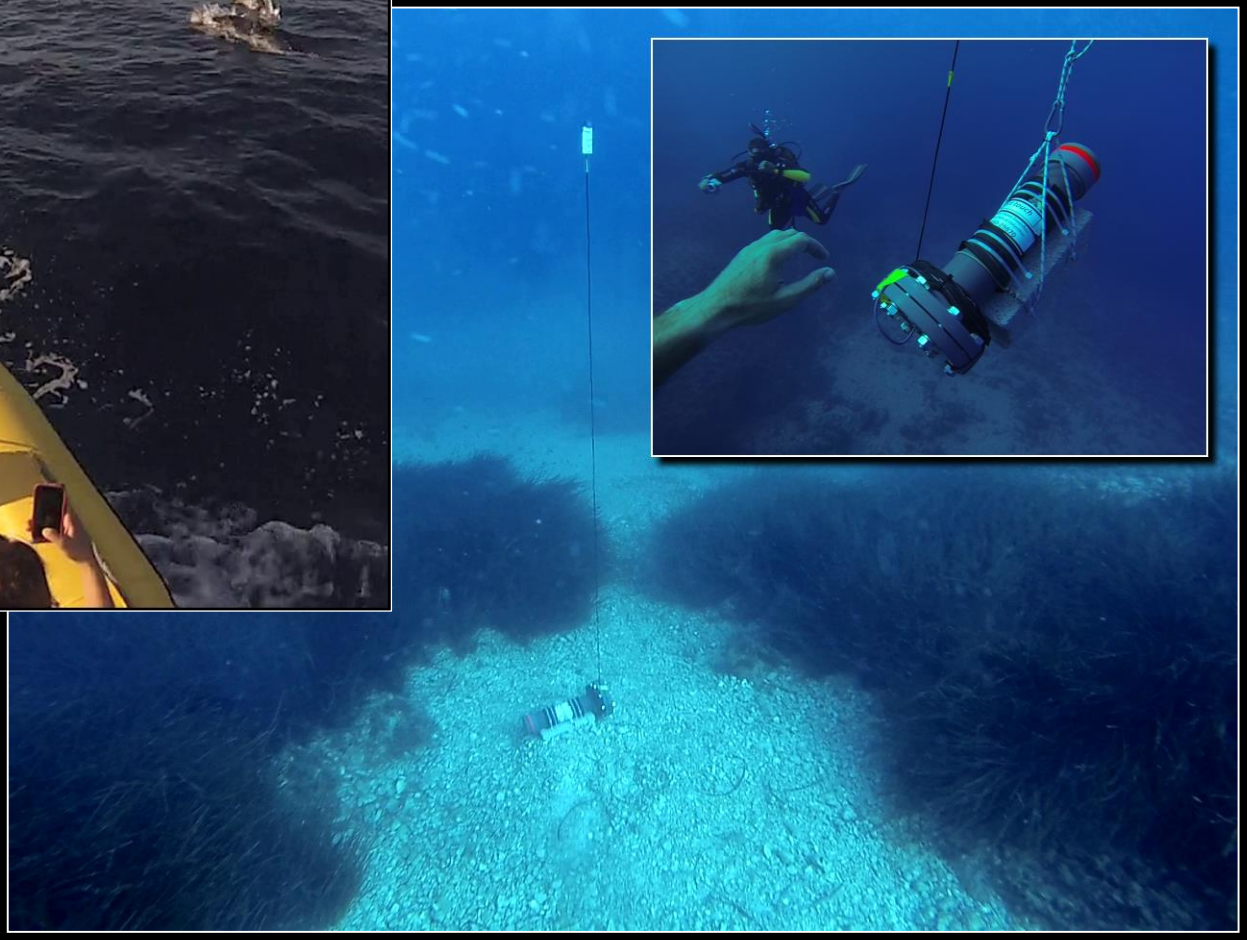


Siganus luridus



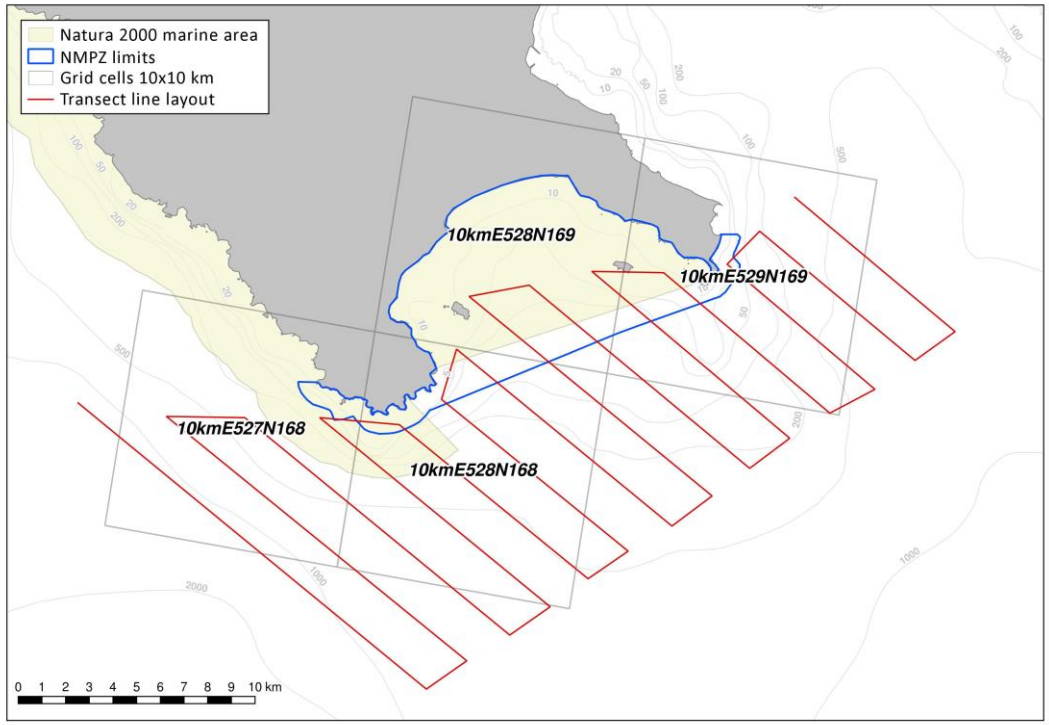
University of the Aegean – Department of Marine Sciences
mariasini@marine.aegean.gr

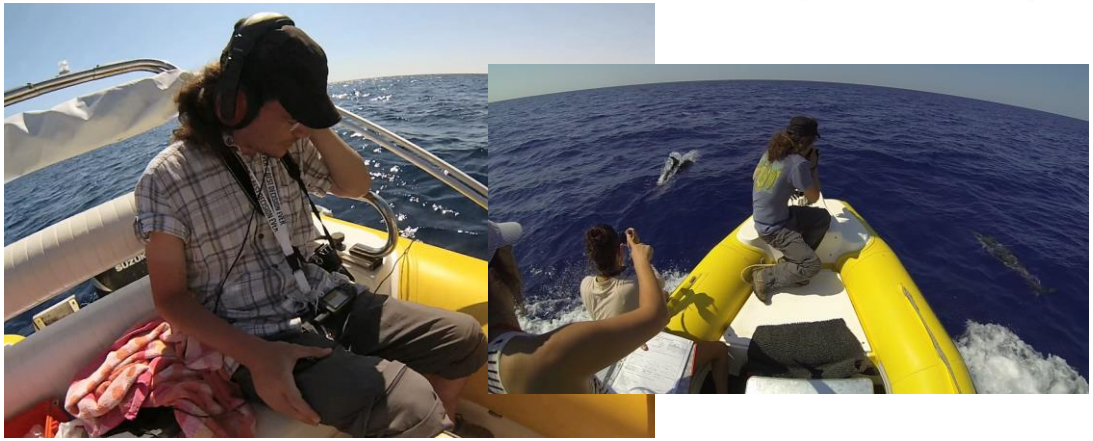
Cetacean surveys & underwater noise level monitoring



mariasini@marine.aegean.gr

Monitoring cetacean presence and noise levels





ΠΑΡΑΡΤΗΜΑ 1

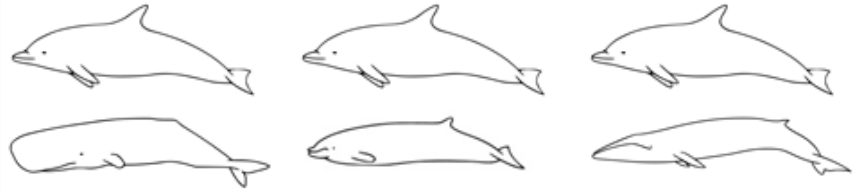
ΠΡΩΤΟΚΟΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ

σελ. /	Παρατηρητής	Ημερομηνία	Ώρα	Στίγμα	Lat Lon
Κωδικός θέσης	Περιοχή		Διαδρομή #		Αρ. παρατήρησης (sighting) #
			Κατεύθυνση		
			Μήκος		

Προσπάθεια ΝΑΙ | ΟΧΙ	Μηχανή ΝΑΙ | ΟΧΙ	Απόσταση από ακτή (m)	Beaufort	Ορατότητα	Βάθος (m)

ΕΙΔΟΣ	Γενική περιγραφή συμπεριφοράς (κίνηση, κατάδυση, πυκνότητα κοπαδιού ...)
1.	
2.	
3.	

Χαρακτηριστικά σημάδια



Αριθμός ατόμων A: J: C:	photo-ID ΝΑΙ | ΟΧΙ	Αρ. 1ης φωτ. #	Υδρόφωνα ΝΑΙ | ΟΧΙ	Ακουστ. ανίχνευση ΝΑΙ | ΟΧΙ | MONO	Ακουστ. εκτίμηση αριθμού #

Γωνία	Κάθετη απόσταση	Οριζόντια απόσταση	Αρχ. ταχύτητα	Σχόλια

Αρχική συμπεριφορά	
Αλλαγή συμπεριφοράς κατά την παρατήρηση	
Αρχική πυκνότητα κοπαδιού	
Αλληλεπίδραση με το σκάφος?	ΝΑΙ | ΟΧΙ
Γενική αίσθηση αποφυγής	ΝΑΙ | ΟΧΙ

σημειώσεις

mariasini@marine.aegean.gr

Monitoring cetacean presence and noise levels

ΠΡΩΤΟΚΟΛΛΟ ΠΙΕΣΕΩΝ & ΑΠΕΙΛΩΝ

σελ. /	Παρατηρητής	Ημερομηνία	Ώρα	Στίγμα	Lat Lon

Κωδικός θέσης	Περιοχή	Αρ. Διαδρομής	Απόστ. από ακτή (m)	Beaufort	Ορατότητα

ΠΑΡΟΥΣΙΑ ΕΙΔΟΥΣ

(x εντός κύκλου, πολλαπλές επιλογές επιτρέπονται)

Κοινό δελφίνι	Ρινοδέλφινο	Σταχτοδέλφινο	Ζωνοδέλφινο	Φυσητήρας	Ζιφιός	Πτεροφάλαινα	_____
x	x	x	x	x	x	x	x

ΠΑΡΟΥΣΙΑ ΠΙΕΣΗΣ / ΑΠΕΙΛΗΣ

(x εντός κύκλου, πολλαπλές επιλογές επιτρέπονται)

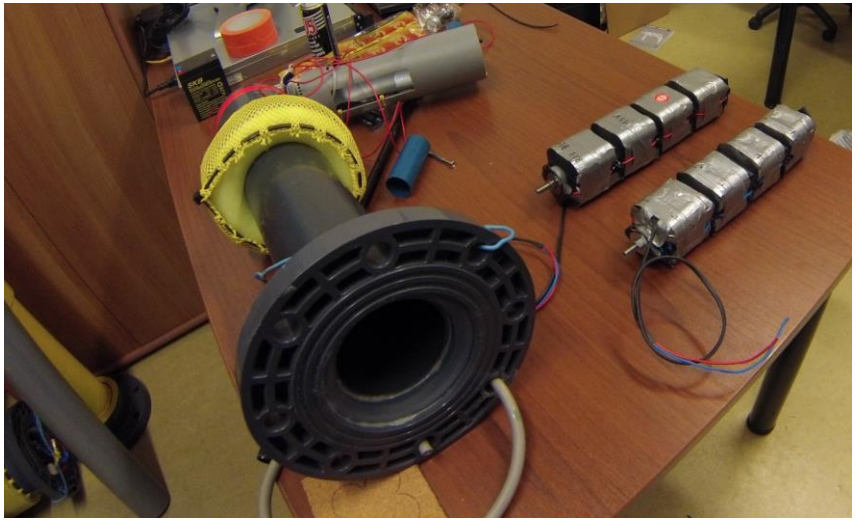
	x	Σχόλια:
	x	Σχόλια:
	x	Σχόλια:
	x	Σχόλια:
	x	Σχόλια:
	x	Σχόλια:
	x	Σχόλια:
	x	Σχόλια:

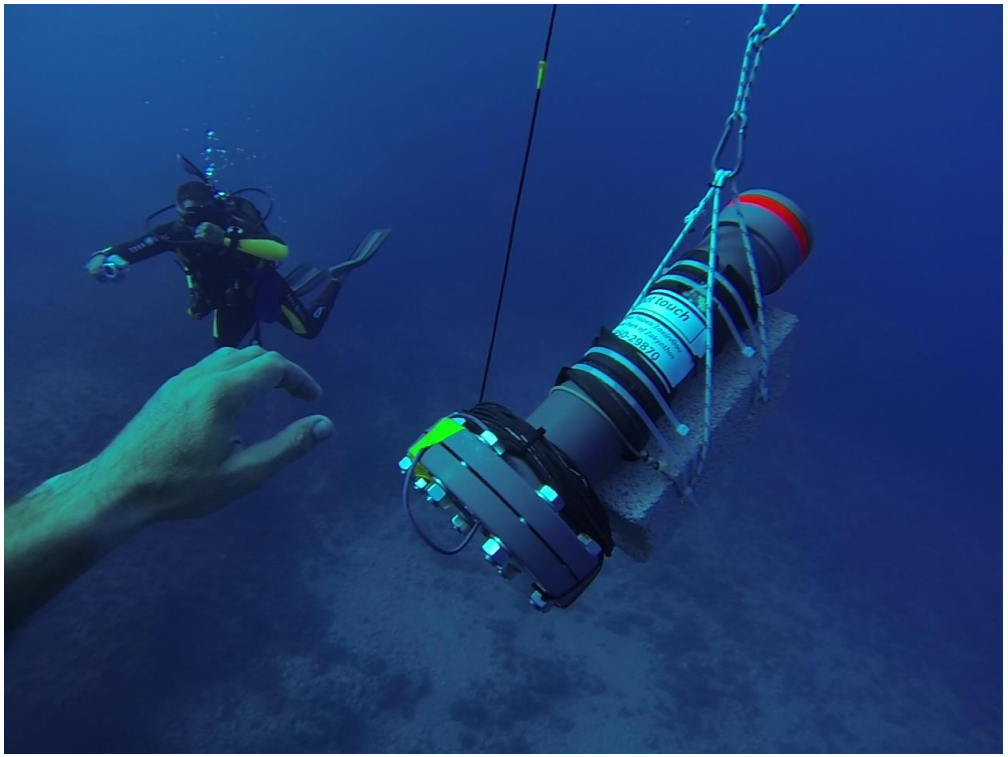
Υπόμνημα

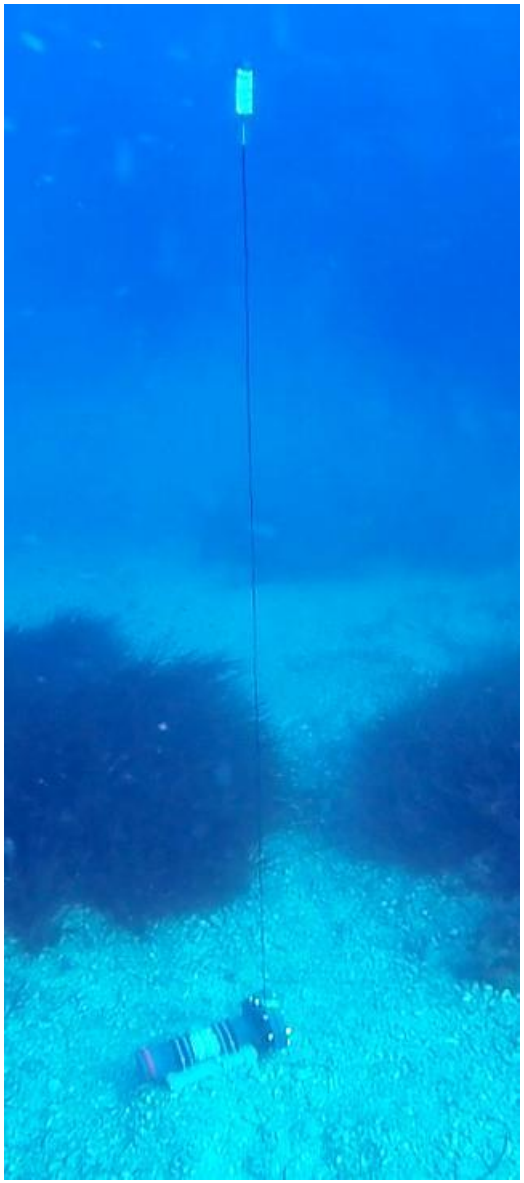
	Αλιευτική δραστηριότητα		Δίχτυα, λοιπά αλιευτικά εργαλεία
	Παρουσία σκαφών		Εσκεμμένη/ακούσια παρενόχληση
	Υποβρύχια ηχορύπανση		Πετρελαϊκή ρύπανση
	Απορρίμματα, ενδείξεις ρύπανσης		Παράκτιες δραστηριότητες

mariasini@marine.aegean.gr

Monitoring cetacean presence and noise levels

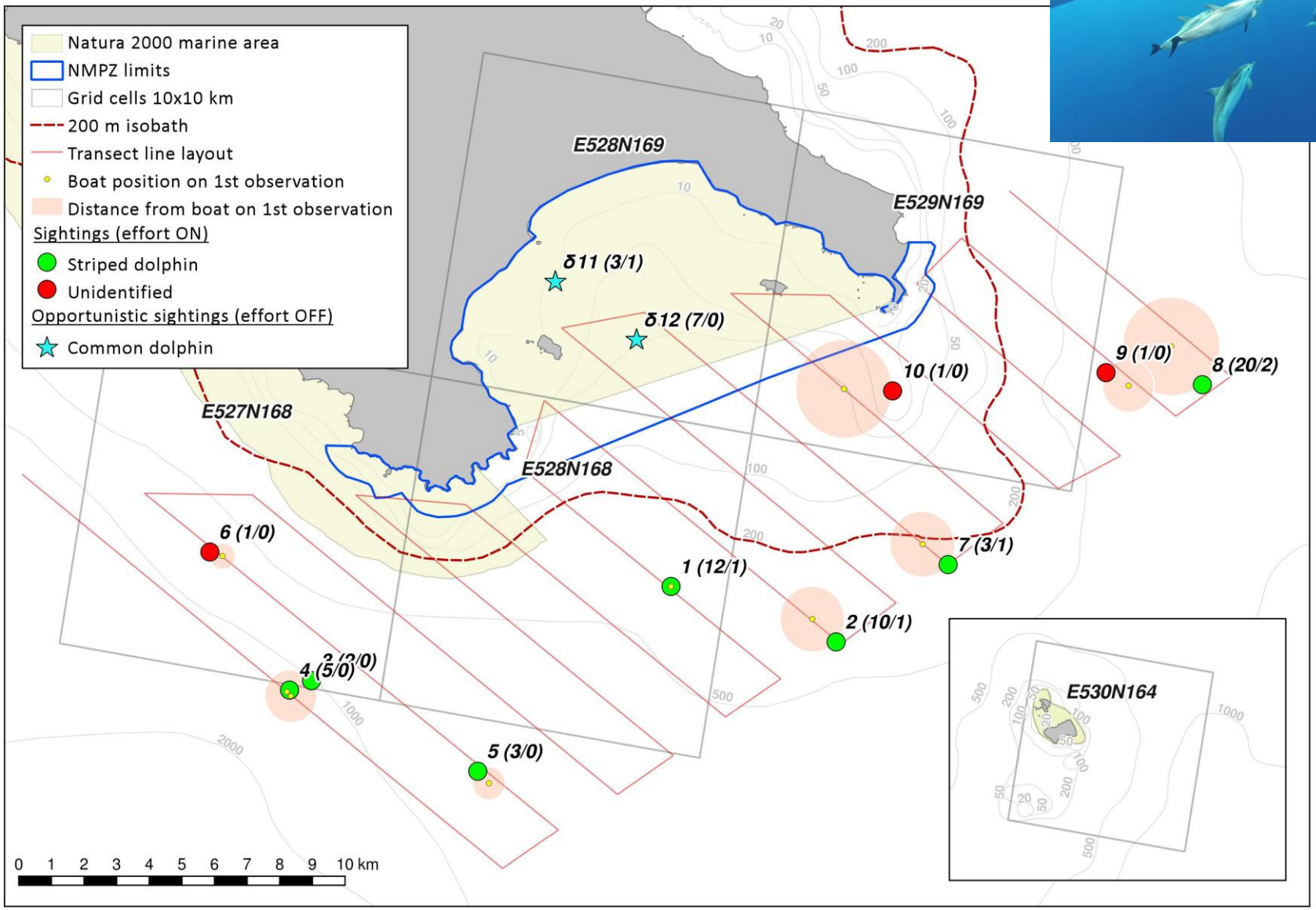






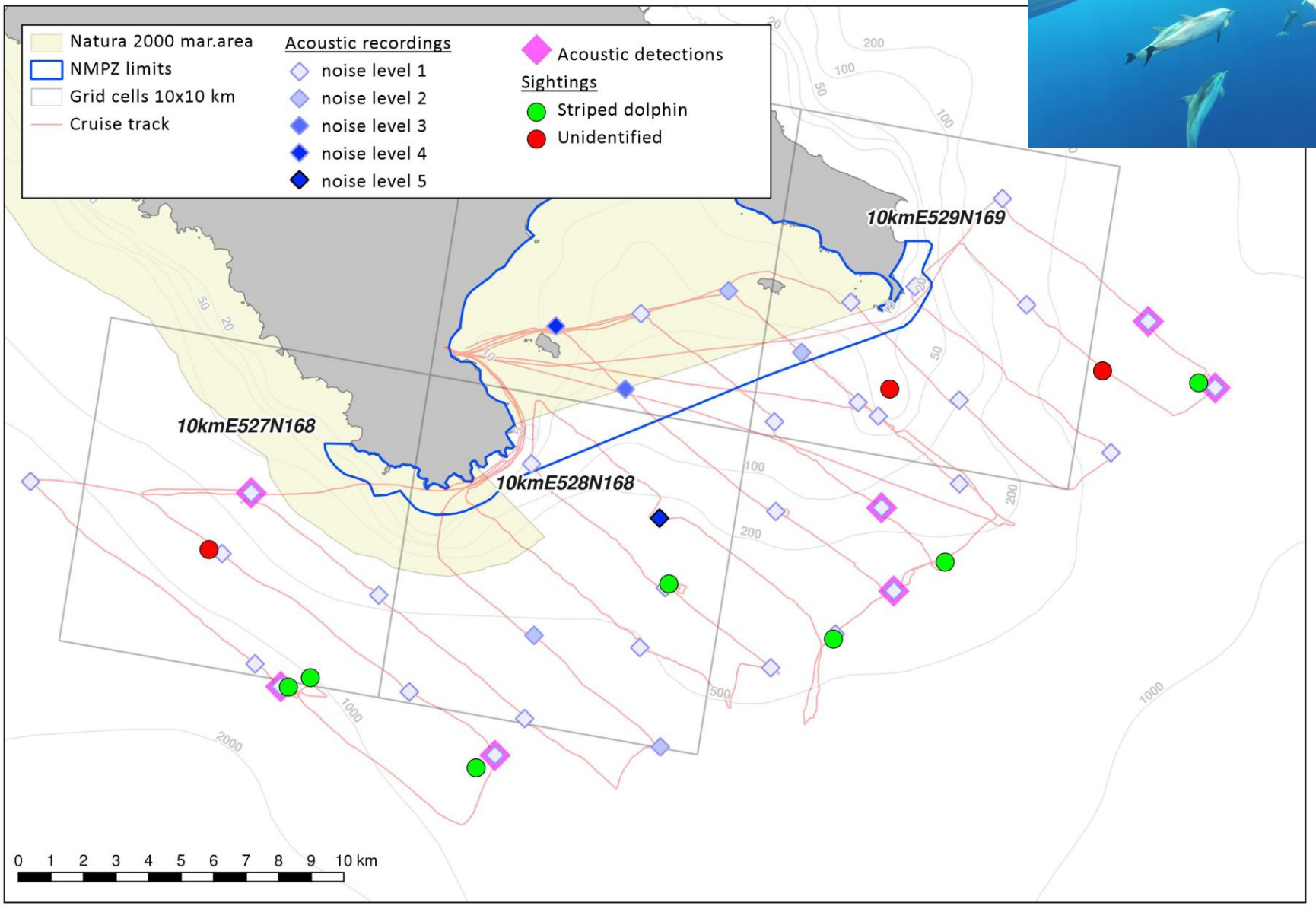
mariasini@marine.aegean.gr

Monitoring cetacean presence and noise levels



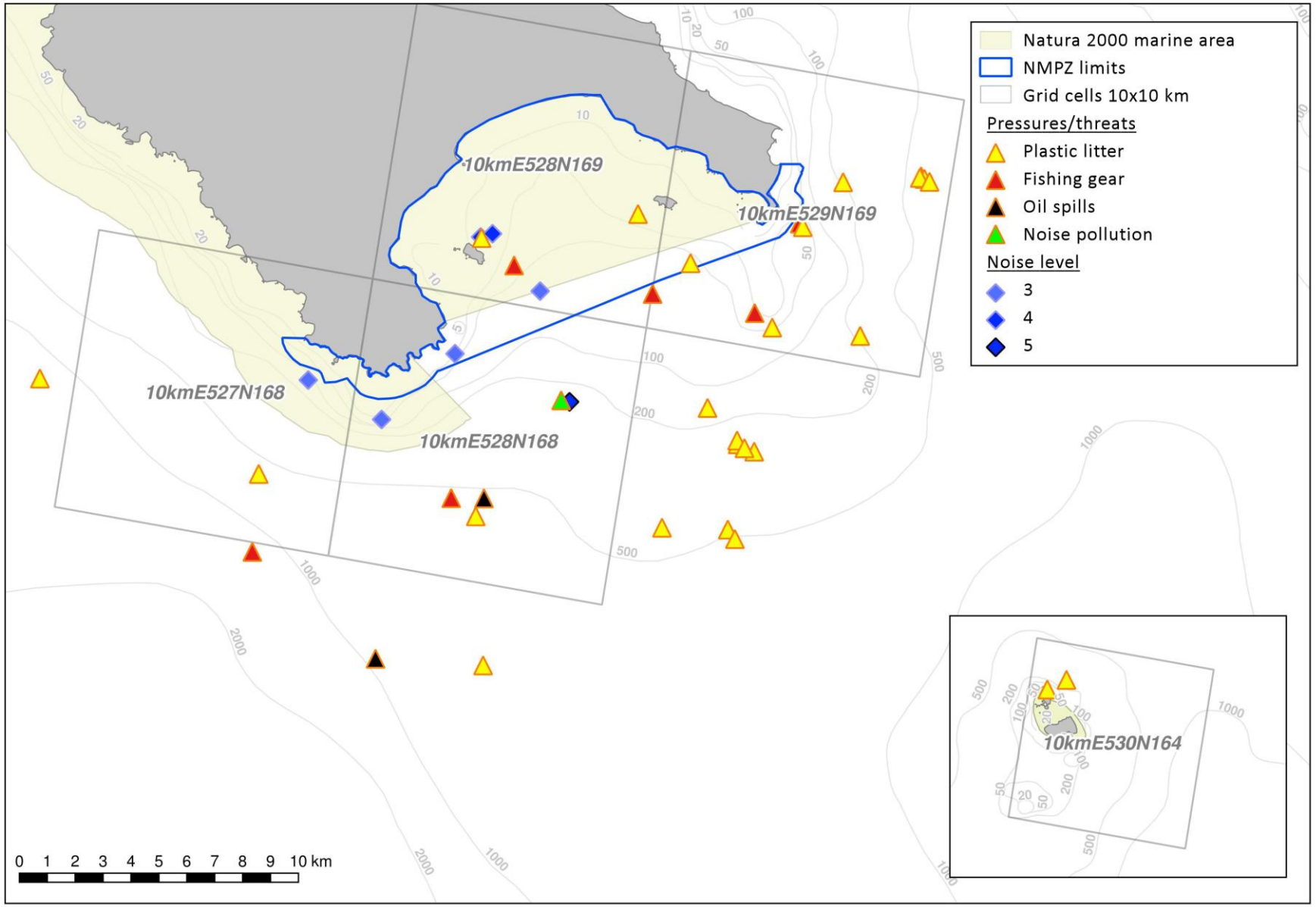
mariasini@marine.aegean.gr

Monitoring cetacean presence and noise levels



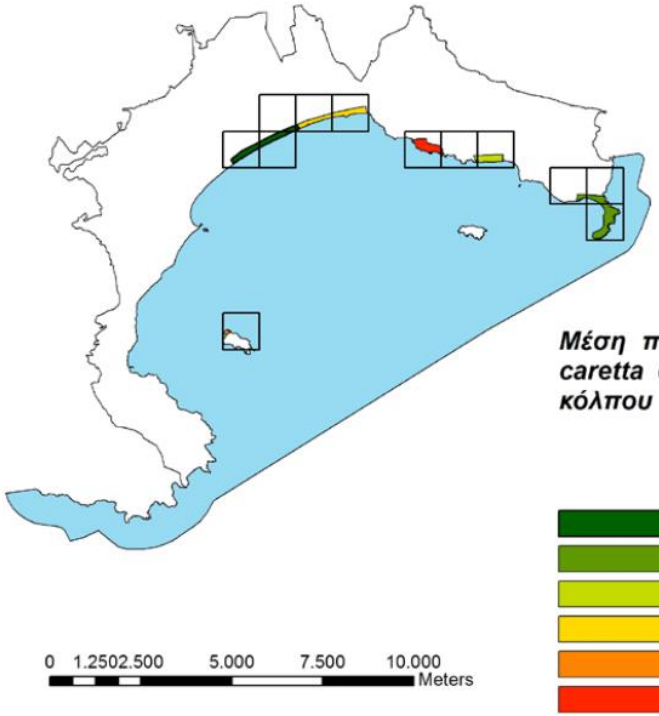
mariasini@marine.aegean.gr

Monitoring cetacean presence and noise levels



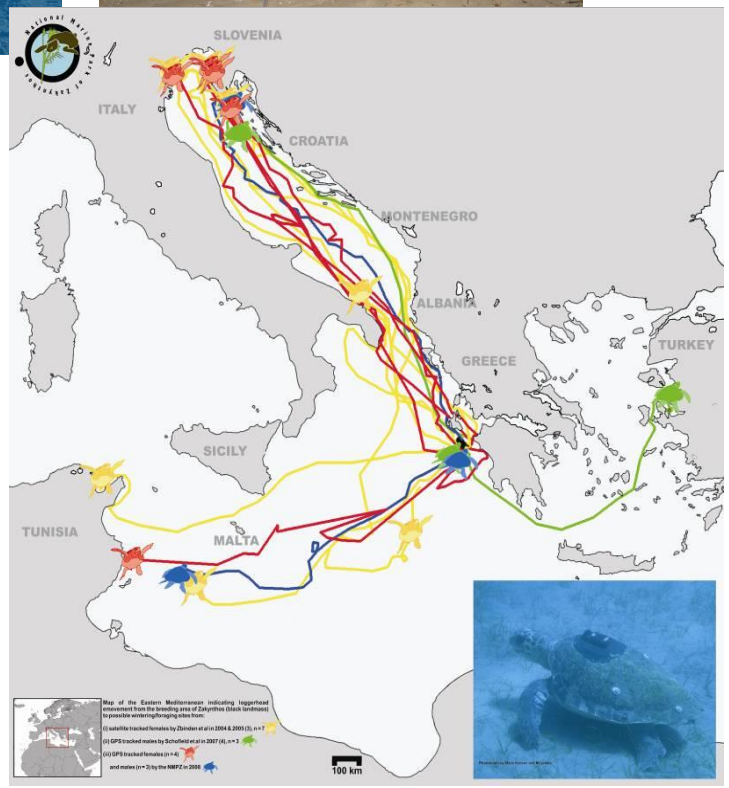
Monitoring other protected species

Nesting beaches & reproductive activity of *Caretta caretta*



Μέση πυκνότητα φωλιών της Caretta caretta στις 6 παραλίες ωοτοκίας του κόλπου του Λαγανά

~52 nests/km/year (East Laganas)
~136 nests/km/year (Gerakas)
~ 157 nests/km/year (Daphni)
~179 nests/km/year (Kalamaki)
~258 nests/km/year (Marathonisi)
~827 nests/km/year (Sekania)



mariasini@marine.aegean.gr

Monitoring other protected species

- Loggerhead sea turtle *(Caretta caretta)*
- Monk seal (*Monachus monachus)*
- Eleonora's falcon (*Falco eleonora*)
- Cory's shearwater (*Calonectris diomeda*)
- Coastal habitat, e.g. Sand dunes


See you next week…