green energy in Adriatic sea

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Problematiche ambientali dell´eolico offshore nel Mar Adriatico

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Università Politecnica delle Marche

Let's grow up together
Adriatic IPA
Cross Border Cooperation 2007 2013

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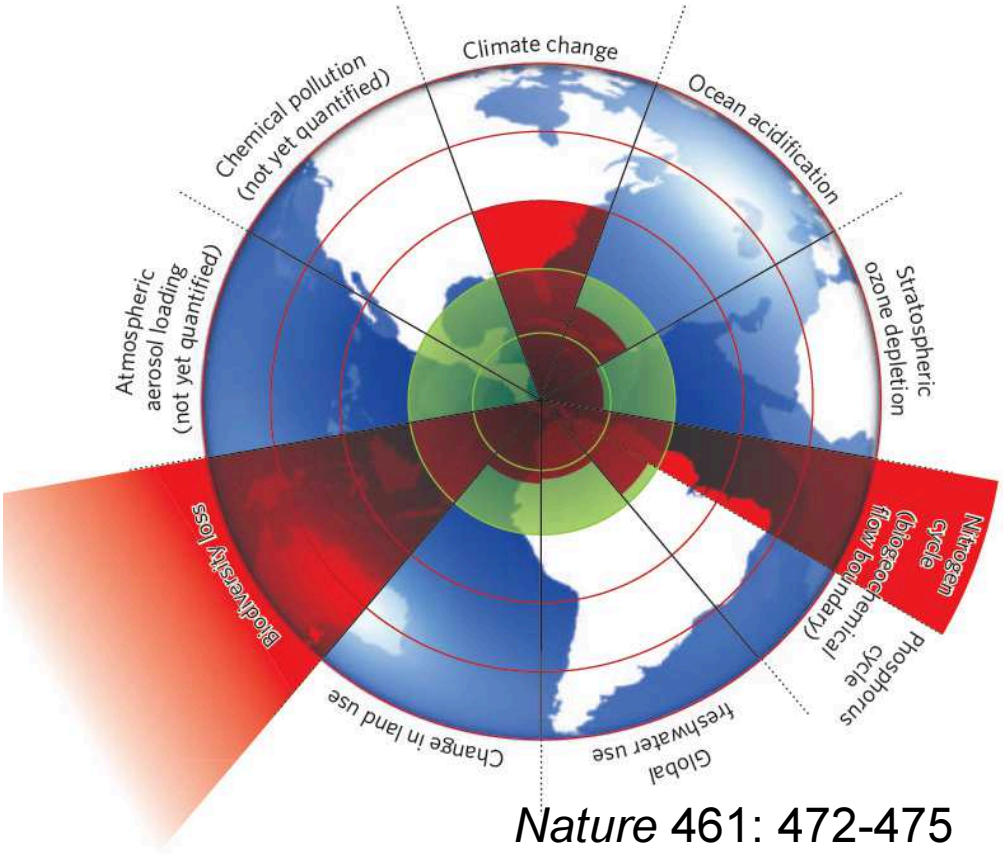
A safe operating space for humanity

Identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change, argue **Johan Rockström** and colleagues.



Nature 461: 472-475

PLANETARY BOUNDARIES

Earth-system process	Parameters	Proposed boundary	Current status	Pre-Industrial value
Climate change	(i) Atmospheric carbon dioxide concentration (parts per million by volume)	350	387	280
	(ii) Change in radiative forcing (watts per metre squared)	1	1.5	0
Rate of biodiversity loss	Extinction rate (number of species per million species per year)	10	>100	0.1–1
Nitrogen cycle (part of a boundary with the phosphorus cycle)	Amount of N_2 removed from the atmosphere for human use (millions of tonnes per year)	35	121	0
Phosphorus cycle (part of a boundary with the nitrogen cycle)	Quantity of P flowing into the oceans (millions of tonnes per year)	11	8.5–9.5	~1
Stratospheric ozone depletion	Concentration of ozone (Dobson unit)	276	283	290
Ocean acidification	Global mean saturation state of aragonite in surface sea water	2.75	2.90	3.44
Global freshwater use	Consumption of freshwater by humans (km^3 per year)	4,000	2,600	415
Change in land use	Percentage of global land cover converted to cropland	15	11.7	Low
Atmospheric aerosol loading	Overall particulate concentration in the atmosphere, on a regional basis		To be determined	
Chemical pollution	For example, amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals and nuclear waste in, the global environment, or the effects on ecosystem and functioning of Earth system thereof		To be determined	

9 processi planetari per mantenere la soglia di sostenibilità:
Per 3 di questi siamo oltre la soglia: CO_2, biodiversità e ciclo N
2 di questi 3 hanno rilevanza per la compatibilità ambientale dell'eolico offshore

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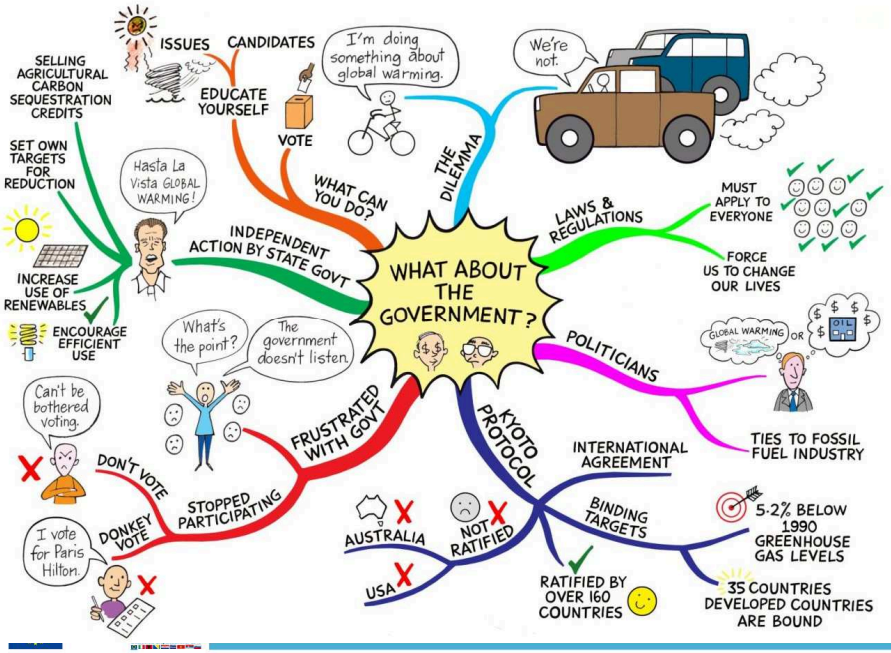
ENERGIA "GREEN" & CONSERVAZIONE



L'energia eolica possiede alcune caratteristiche chiave che permettono di prevederne un utilizzo compatibile:
- "zero" emissioni
- AMP *de facto*
- Diminuzione del numero di conflitti

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IL MARE ADRIATICO

- Piccolo bacino semi-chiuso
- Circolazione delle masse d'acqua ben definita e in grado di influenzare gli ecosistemi
- Forte influenza degli input fluviali
- Forti ingerenze antropiche
- Esposto (in anticipo) ai cambiamenti climatici
- "Collog di bottiglia funzionale per la Macro Regione Adriatica

Candidato per ospitare Impianti Eolici Offshore?

VULNERABILITÀ DELL'ADRIATICO

- Ampio *range* termico con forti fluttuazioni anche inter-annuali
- Microtidale
- Bassa profondità
- Cambiamenti sistemici repentini
- Elevata diversità (gamma)
- Imponente pressione antropica
- Snesibilità ai cambiamenti climatici
- Esposto ad azione sinergica di stressori multipli

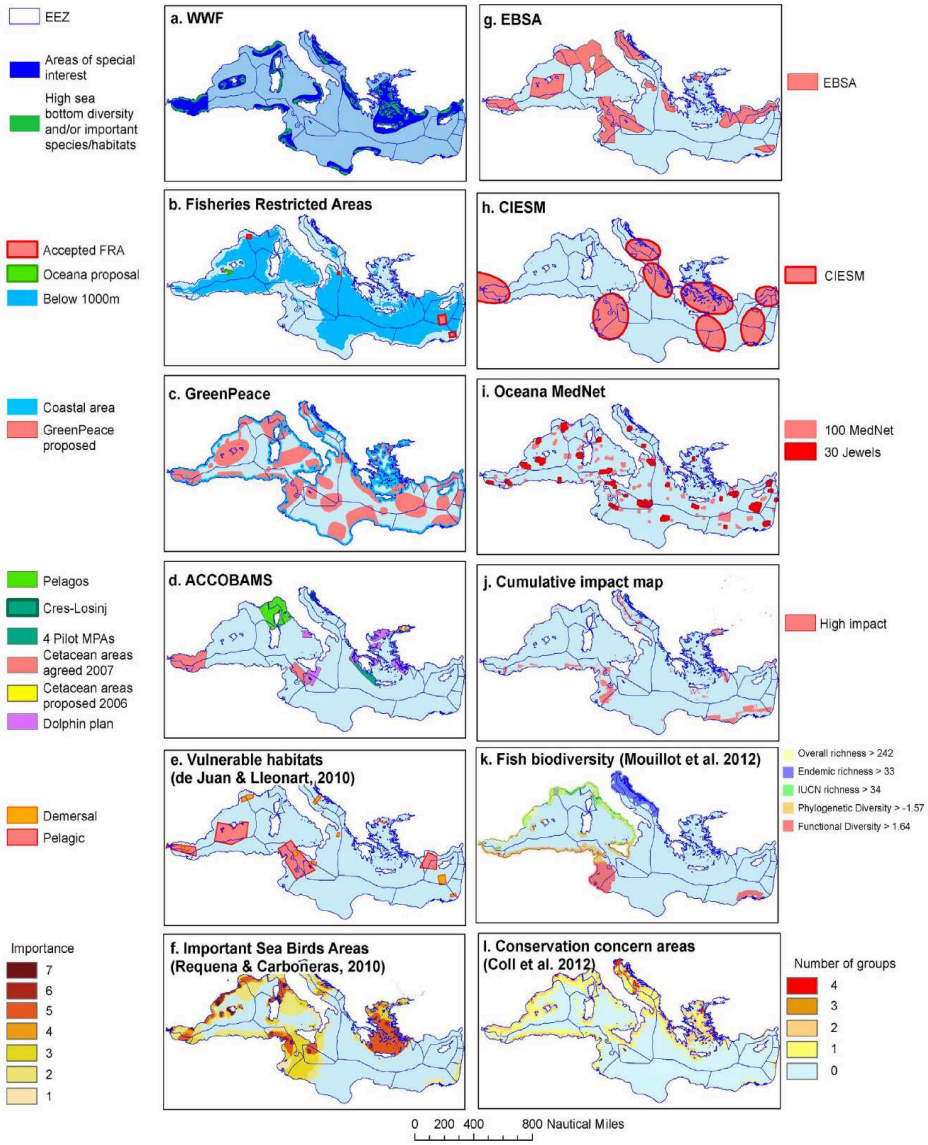
LE 10 "PIAGHE"

1. Inquinamento
2. Eutrofizzazione
3. Fioriture di alghe potenzialmente tossiche
4. Mucillagini (apparentemente in regressione)
5. Crisi anossiche
6. Sovrappesca
7. Invasioni biologiche
8. Cambiamenti nelle comunità (e.g. meduse)
9. Cambiamenti climatici
10. Barriere frangiflutti

Sostenibilità Ambientale

Qual'è la capacità portante per le attività umane?

Fin dove possiamo utilizzare risorse e spazio prima di comprometterne il loro utilizzo ?



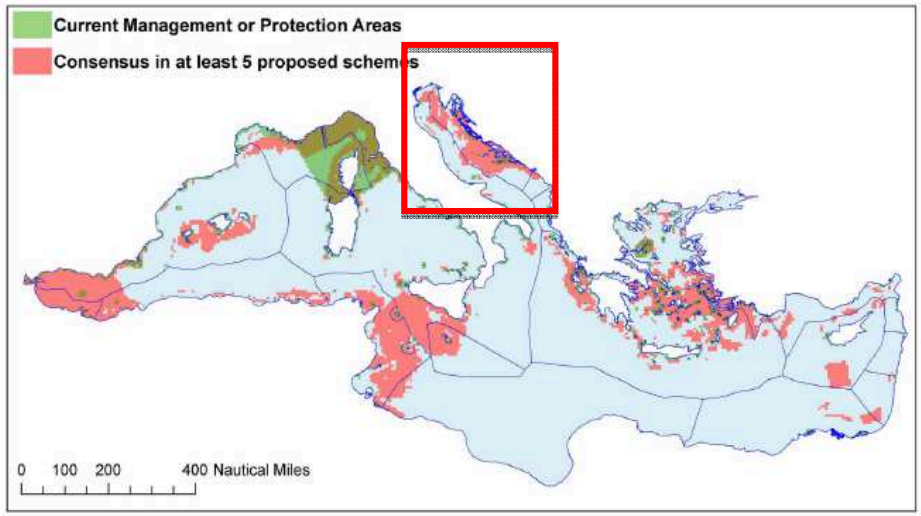
OPEN ACCESS Freely available online

PLOS ONE

Setting Priorities for Regional Conservation Planning in the Mediterranean Sea

Fiorenza Micheli[1]*, Noam Levin[2], Sylvaine Giakoumi[3,4], Stelios Katsanevakis[5], Ameer Abdulla[4,6], Marta Coll[7], Simonetta Fraschetti[8], Salit Kark[4,9], Drosos Koutsoubas[10], Peter Mackelworth[11], Luigi Maiorano[12], Hugh P. Possingham[4]

La maggior parte dei modelli indicano il Mare Adriatico come una delle aree più critiche



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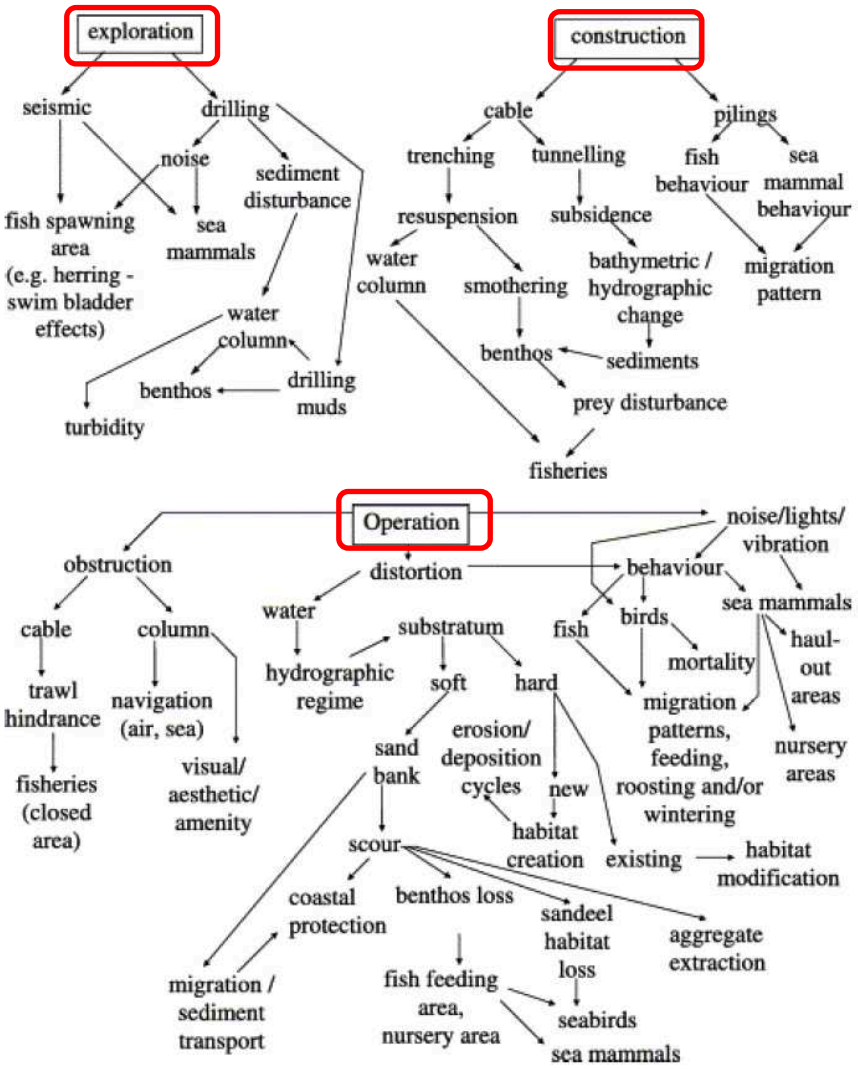
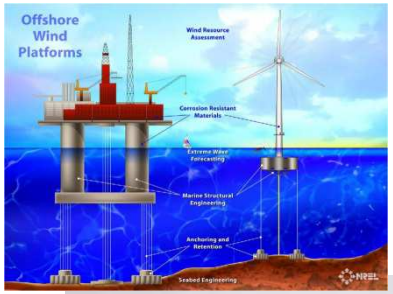
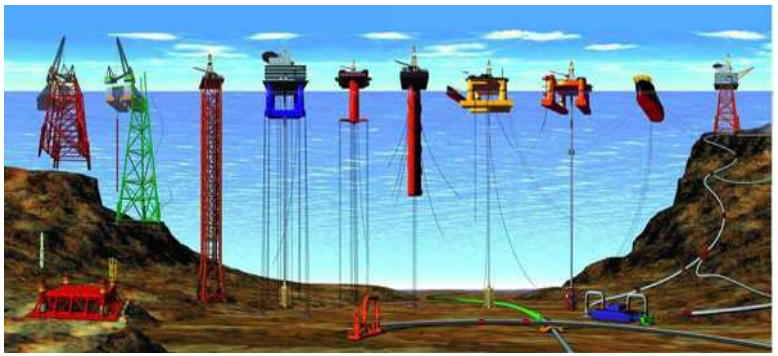
Energia dal Vento
Benefici attesi *vs*. Sostenibilità

1. Energia “pulita” a basso costo
2. Emissioni CO_2 ridotte
3. Emissioni SO_2 ridotte
4. Uso di risorse “rinnovabili”
5. Uso ridotto del paesaggio sottomarino
6. Minime emissioni di particolato
7. Protezione da usi illegali del mare
8. AMP “virtuali”

I PARCHI EOLICI NON SONO SCEVRI DA IMPATTI

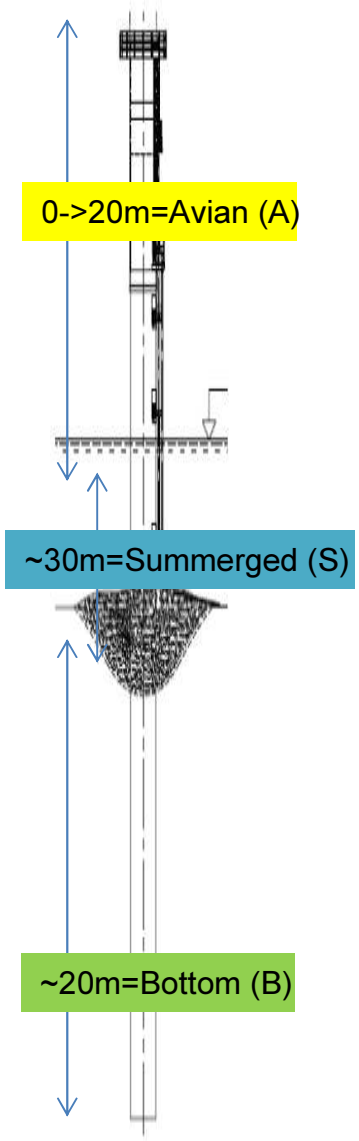






Wilson (2011) InTech, ISBN: 978-953-307-237-1

EFFETTI GENERICI DI UN PARCO EOLICO *OFFSHORE*



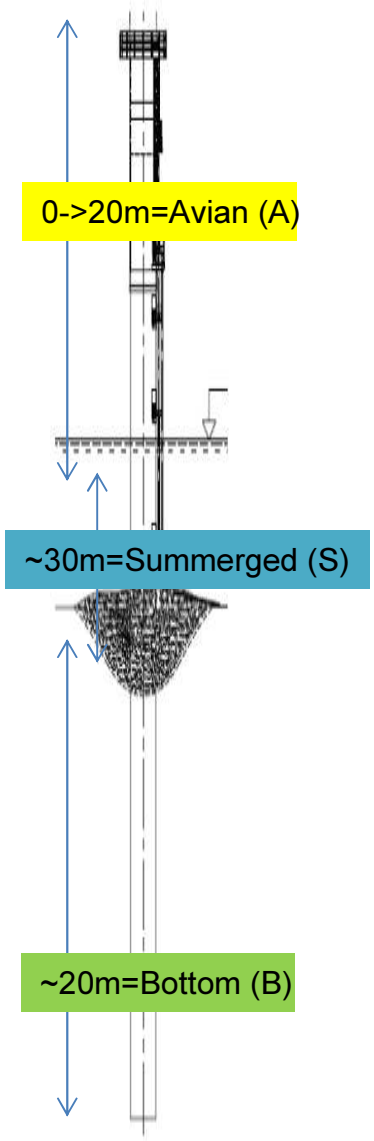
Esplorazione

- Disturbo locale associato al traffico navale, eventuale introduzione di strumentazione (invasiva) di indagine; effetti su porzioni aerea e sommersa (limati impatti sui fondali)

Installazione

- Rumore ed attività di escavo (tutte le fasce)
- Dislocazione e risospensione di sedimenti incluso rilascio di inquinanti
- Escavo naturale dovuto alle correnti (creazione di «nuovi» ecosistemi
- Traffico navale in forte aumento con conseguenze potenziali legate a collisioni, effetti sulle specie migranti e rilascio di inquinanti

EFFETTI GENERICI DI UN PARCO EOLICO *OFFSHORE*



Fase operativa

- Traffico navale ridotto ma costante (monitoraggio)
- Onde elettromagnetiche
- Mortalità aviaria per collisione
- Protezione dall'erosione (biologica ed abiologica)
  - Barriera artificiale: AMP *de facto* MPA (ridotta pesca, attività ricreativa controllata, possibilità di attività di acquacoltura integrata)
  - Effetto «stepping stone» (connettività ecologica)
  - Deframmentazione degli habitat se studiati come «network»
- Impianti «flottanti» possono agire da FAD (Fish Aggregating Devices)
- Aumento abbondanza pesci (spill-over)

Decommissioning

- Come per fasi di costruzione e installazione se impianti vengono rimossi (ex lege)
- Parco di «relitti» on grado di funzionare da AMP se lasciati *in situ*

	Impact/monitoring objective	Indicator
Benthic habitat and resources	Changes to seafloor morphology and structure (compared to preconstruction)	Increase or decrease in seabed volume
	Changes in median grain size, or organic content	(i) Deposition: decrease in median grain size, increase in organic content, increase in seabed volume (ii) Scour: increase in median grain size, decrease in organic content, decrease in seabed volume
	Turbidity during construction/decommissioning	Change in water column turbidity
	Change in target species abundance and distribution (e.g., species of importance)	Change in abundance, diversity, % cover, multivariate community composition
	Current speed/direction inside and outside farm	Change in residual flow rates
	Reef effects, colonization on foundations	Increase in % cover, biomass of epifaunal organisms; increase in presence of nonnative species
	Change in density, diversity, dominance structure of infauna	Change in abundance, diversity, % cover, multivariate community composition
Fish	Reef or aggregation effects	Increase in fish abundance around devices, shift in species composition, increase in presence of nonnative species
	Changes to abundance/distribution caused by disturbance or habitat alteration	Increase or decrease in fish abundance; increase or decrease in target species; shift in species composition; change in density, diversity, and dominance structure of fish species; increase in presence of nonnative species
	Blade strikes/pressure gradients (tidal power)	Observation of blade strike incidents
	EMF effects	Not feasible to monitor directly—changes in fish abundance, behavior, or species composition are indicators
	Installation or operational noise effects	Not feasible to monitor directly—changes in fish abundance, behavior, or species composition are indicators
Fisheries	Catchability (catch per unit effort) during construction	Catch per unit effort increases or decreases for target species
	Catchability (catch per unit effort) during operation	Catch per unit effort increases or decreases for target species
	Loss of access to grounds	Changes in numbers of vessels fishing near or inside of the renewable energy area, change in the presence of fixed fishing gear inside of or around a renewable energy installation
	Changes in species distribution	Shift in species composition, increase in presence of nonnative species
	Reef effects (aggregation)	Increase in fish abundance around devices; shift in species composition; increase in presence of nonnative species
Avian	Displacement/attraction	Increase or decrease in avian species-specific densities postconstruction in development area
	Barrier effects—effects on foraging, roosting, migratory movements	Migrating or commuting birds avoiding developed areas
	Collision mortality	Birds found dead or injured due to direct collision with infrastructure above the water
Marine mammals and sea turtles	Vessel strikes	Detection of dead or injured animals
	Noise generated during construction	Detection of dead or injured animals; changes in distribution, abundance, or behavior of populations
	Disturbance or injury during all stages of development, including from vessels	Detection of dead or injured animals; changes in distribution, abundance, or behavior of populations
	Noise generated during operation	Changes in distribution, abundance, or behavior of populations

Standard di monitoraggio

Shumchenia *et al.* (2012)
The Scientific World Journal
doi:10.1100/2012/450685

green energy in Adriatic sea

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WP5: Analysis and evaluation of environmental, infrastructural, energetic and technological issues

POWERED WP5 is designed to assess the environmental conflicts of offshore wind farms in the Adriatic Sea, by taking into account natural and anthropogenic sources of potential conflict

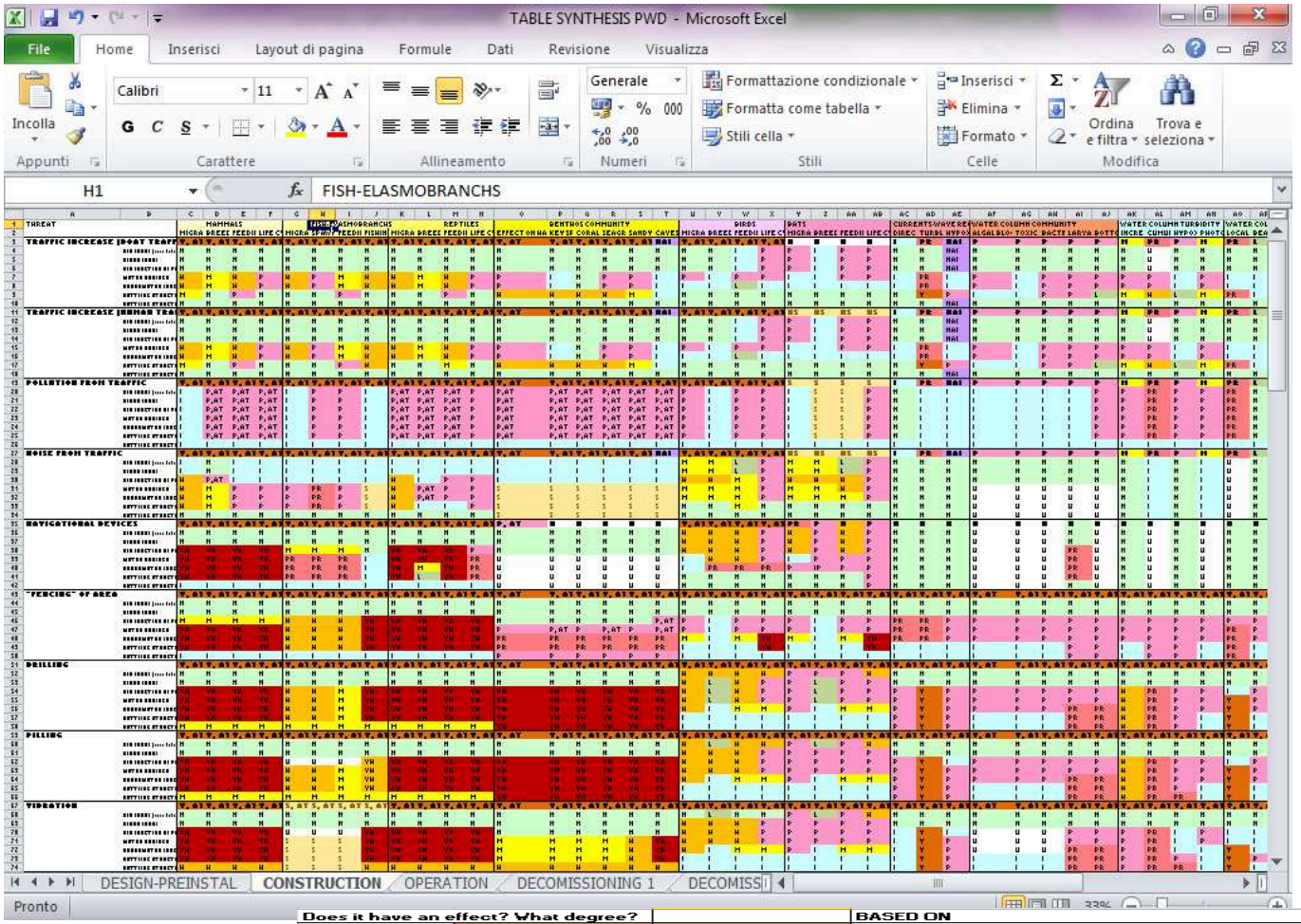
WP5 OUTLINE

1. OFFSHORE WIND FARMS IMPACT ANALYSIS
2. ENVIRONMENTAL CHARACTERISTICS OF THE ADRIATIC SEA
3. CONSTRAINS ASSESSMENT
4. CUMULATIVE CONSTRAINS ASSESSMENT IN THE ADRIATIC SEA
5. IDENTIFICATION OF MAIN RISKS RELEVANT TO OFFSHORE WIND FARMS DEVELOPMENT AND SAFETY AND CONTINGENCY RESPONSE RECOMMENDATIONS
6. USAGE OF A GEOREFERENCE INTERACTIONS DATABASE (“GRID”) TO EVALUATE THE IMPACT OF DIFFERENT SCENARIOS OF OWF SITING

Literature Review of OWFs impacts

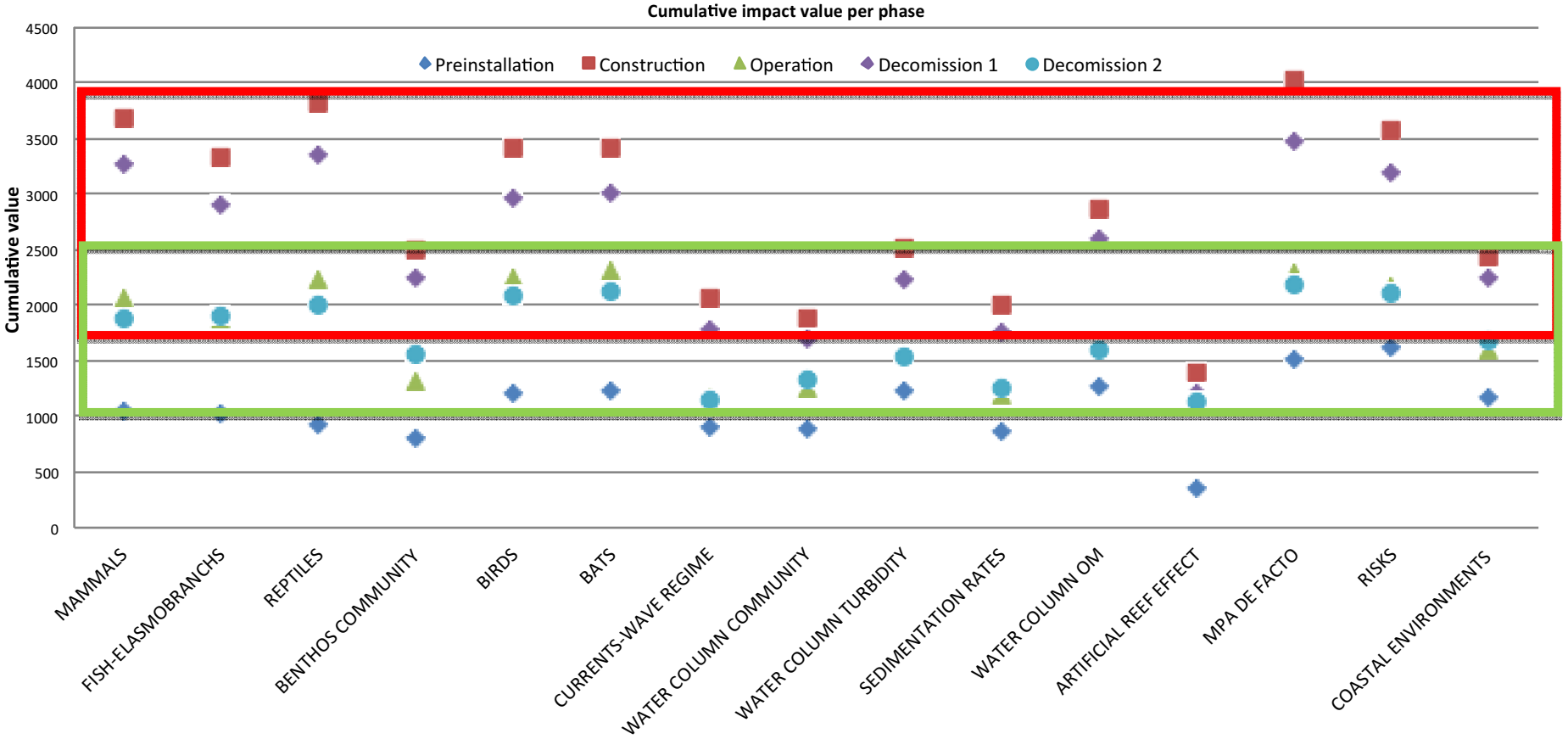
	Maximum effects	Turbine level	Avoidance
Preinstallation	Possible coring and seismic prospections	Bottom	Possible mitigation actions
Construction	Habitat destruction	Bottom	None
	Variation in migrating and feeding routes of mammals, birds, reptiles and bats	Water column Beach-surface	Putative mitigation actions
	Noise on all community components	All	Mitigation actions
Operation	Blades on birds and bats	Air portion	Research in progress for mitigation methods
	EMF on all community components	All	Putative mitigation actions?
	Artificial reef effect	All	None
Decommissioning 1	Habitat destruction	Water column Beach-surface	None
	Variation in migrating and feeding routes of mammals, birds, reptiles and bats	Water column Beach-surface	Putative mitigation actions
	Noise on all community components	All	Mitigation actions
Decommissioning 2	Removal of blades in short-term	Water column Bottom	None
	Variation in migrating routes of mammals, birds, reptiles and bats	Water column Beach-surface	Putative mitigation actions

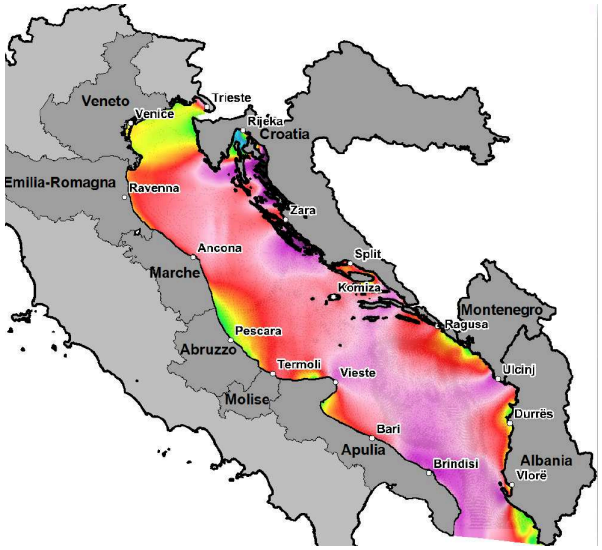
Identificazione dei conflitti



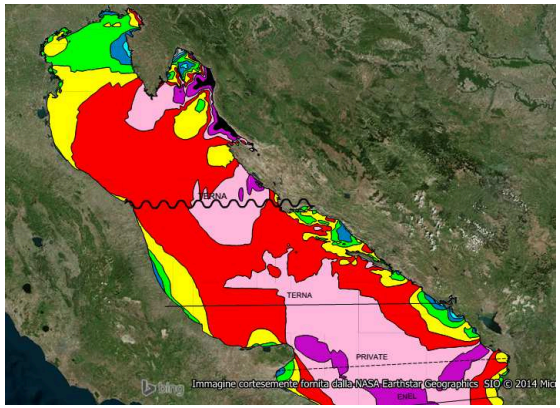
Does it have an effect? What degree?			BASED ON	CONSEQUENCES
YES	Y	9	DEMONSTRATED	
NO	N	1	DEMONSTRATED OR CONDITIONS DO NOT ALLOW "INTERACTION"	
VERY HIGH	VH	10	DEMONSTRATED OR CONDITIONS ALLOW "INTERACTION"	RADICALLY CHANGES BEHAVIOUR
HIGH	H	9	DEMONSTRATED OR CONDITIONS ALLOW "INTERACTION"	CHANGES BEHAVIOUR
MEDIUM	M	8	DEMONSTRATED OR CONDITIONS ALLOW "INTERACTION"	COULD AFFECT BEHAVIOUR
LOW	L	5	DEMONSTRATED OR CONDITIONS ALLOW "INTERACTION"	BEHAVIOUR CHANGE WON'T AFFECT LIFE STYLE
POSSIBLE	P	6	DEPENDS ON CONDITIONS, COMPONENTS	NOT ASSESSED CHANGE BUT PUTATIVELY
PROBABLE	PR	7	CLOSE TO DEMONSTRATED	PROBABILITIES ON BAHVIOUR CHANGE ARE HIGH
IMPROBABLE	I	2	DEPENDS ON CONDITIONS, COMPONENTS	IMPROBABLE BEHAVIOUR CHANGE
UNKNOWN	U		NO STUDIES FOUND	
SUSPECTED	S	3	HYPOTHETICALLY YES	
NO AVAILABLE INFO	NAI		NO AVAILABLE DATA-INFORMATION	
what extension of the effect?				
LONG-TERM	LT			
MEDIUM-TERM	MT			
SHORT-TERM	ST			
ALL TIMES	AT			
NOTE:				
DECOMISSIONING 1	WITH TOTAL REMOVAL OF STRUCTURES			
DECOMISSIONING 2	WITH PARTIAL REMOVAL OF STRUCTURES, UNDERWATER PILES REMAIN, DETACHMENT OF OPERATIONAL ELEMENTS (EMF, ROTOR MOVEMENT, ELECTRICITY, ETC)			

Il giusto peso agli impatti

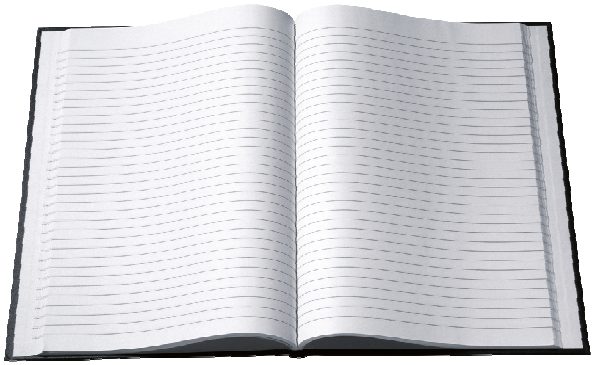




WP4
Mappe del vento



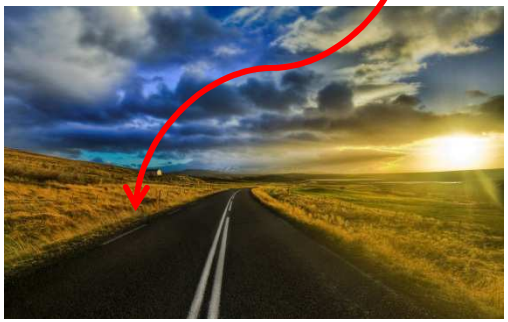
WP5
Analisi spaziale dei conflitti

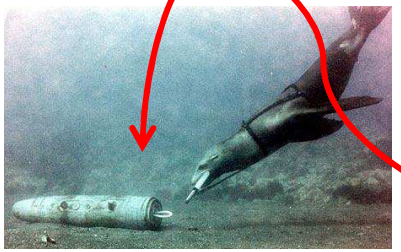


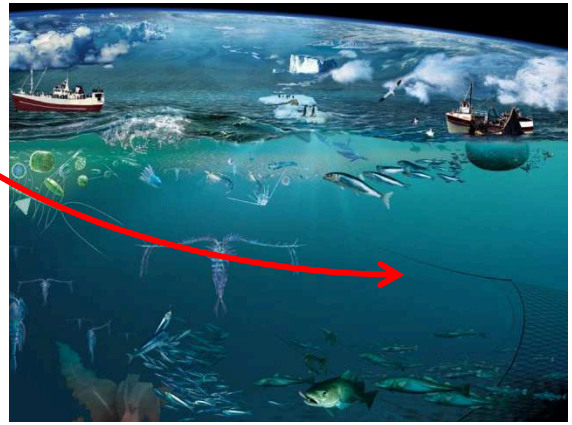
WP6
Linee guida

WP5 Partners' commitments list

1) OBSTACLES AND INTERFERENCES AT SEA WITHIN 12 MILES FROM THE COAST
2) ENVIRONMENTAL (including landscape) CONSTRAINTS AT SEA AND ON THE COAST
3) BIOECOLOGICAL ASPECTS
4) SPATIAL PLANNING AND LANDSCAPE USE (including present and future plans)







WP5 Procedura

✓ I Partners hanno compilato la griglia di competenze

- Pressioni ambientali
- Infrastrutture
- Bacini energetici
- Possibili problemi

AREA	PARTNERS											
MACROAREA	1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
1. OBSTACLES AND INTERFERENCES AT SEA WITHIN 12 MILES FROM THE COAST							P7					
1.1. Mining (oil and gas included) concessions and energy supply facilities at sea under authorization	P1	P2		P4	P5	P6		P8	P9	P10	P11	P12
1.2. Submarine cables, pipelines and any conduit under authorization	P1	P2		P4	P5	P6		P8	P9	P10	P11	P12
1.3. Offshore aquaculture plants (finfish and shellfish)	P1	P2	P3	P4	P5						P11	P12
1.4. Dumping areas at sea, including those for sediments resulting from dredging activities (including those carried out in harbors)	P1	P2		P4	P5			P8	P9	P10	P11	P12
1.5. Trade naval routes	P1	P2						P8	P9		P11	P12
1.6. Shipwrecks and archaeological sites (at sea and along the coast)	P1	P2		P4	P5						P11	P12
1.7. Unexploded ordnance and areas of interest or pertaining exclusively to military activities	P1	P2		P4	P5						P11	P12
1.8. Contaminated sites at sea and along the coast (currently in remediation or potentially to be reclaimed)		P2						P8		P10	P11	P12
1.9. Areas of submerged beach nourishment	P1	P2		P4	P5			P8		P10	P11	P12
1.10. Areas with a high risk of environmental crisis		P2						P8		P10	P11	P12
1.11. Underwater caves to supply relict sand (for the purpose of beach nourishment)	P1	P2		P4	P5			P8		P10	P11	P12
1.12. Areas pertaining to harbor activities (including access corridors and transit)	P1	P2		P4	P5	P6		P8			P11	P12
1.13. Areas used for diving and spearfishing	P1	P2		P4	P5						P11	P12
2. ENVIRONMENTAL (including landscape) CONSTRAINTS AT SEA AND ON							P7					
2.1. Special Protection Areas (SPA)		P2					P7			P10	P11	P12
2.2. Sites of Community Interest (SCI) (at sea and along the coast)		P2					P7			P10	P11	P12
2.3. Zones of biological protection		P2								P10	P11	P12
2.4. Ramsar Areas		P2								P10	P11	P12
2.5. Parks and Marine Reserves		P2								P10	P11	P12
2.6. Areas subjected to special attention for purposes of hydrogeological asset	P1		P3	P4	P5	P6				P10	P11	P12
2.7. Areas hosting historical buildings of public interest	P1	P2		P4	P5	P6				P10	P11	P12
2.8. Areas of public and/or military interest along the coast	P1	P2		P4	P5	P6				P10	P11	P12
2.9. Areas pertaining to Local/Regional/National landscape Plans	P1	P2		P4	P5	P6				P10	P11	P12
2.10. Scenic Drives, aggregation points and places of memory	P1			P4	P5	P6				P10	P11	P12
3. BIOECOLOGICAL ASPECTS							P7					
3.1. Migration routes of birds		P2								P10	P11	P12
3.2. Quality of sea water (in relation to harvesting, culturing and marketing of bivalve mollusks)	P1	P2	P3	P4	P5	P6					P11	P12
3.3. Monitoring data according to the dictates of the EU Marine Framework Directive (where ver available or applicable), with specific reference to benthic biocoenoses and habitats			P3								P11	P12
3.4. Bio-ecological data included in environmental studies for EIA (Environmental Impact Assessment) procedures at the regional and / or national level at sea or on land, but with potential consequences to the sea	P1			P4	P5	P6	P7				P11	P12
3.5. Bio-ecological data derived from LIFE, IPA, INTERREG and any other EU or national funded projects, related with marine ecosystems	P1	P2		P4	P5	P6	P7				P11	P12
3.6. Areas of clam fishing	P1	P2	P3	P4	P5	P6				P10	P11	P12
3.7. Distribution of fishing effort and fleet composition		P2	P3								P11	P12
4. SPATIAL PLANNING AND LANDSCAPE USE (including present and future plans)							P7					
4.1. Synthesis of local/regional/national plans of landscape management presently in force or that are going to be established in the	P1	P2		P4	P5	P6					P11	P12
4.2. Information dealing with coastal traffic, tourism management and development and so on...	P1			P4	P5	P6					P11	P12
4.3. Any other info possibly of interest to your opinion	P1	P2	P3	P4	P5	P6	P7		P9		P11	P12
5. RISK ANALYSIS (SINOSSI & SINTESI)								P8				

✓ Ogni partner ha fornito un «report» sintetico conferendo informazioni per la razionalizzazione delle informazioni

Data mining

1) OBSTACLES AND INTERFERENCES AT SEA WITHIN 12 MILES FROM THE COAST

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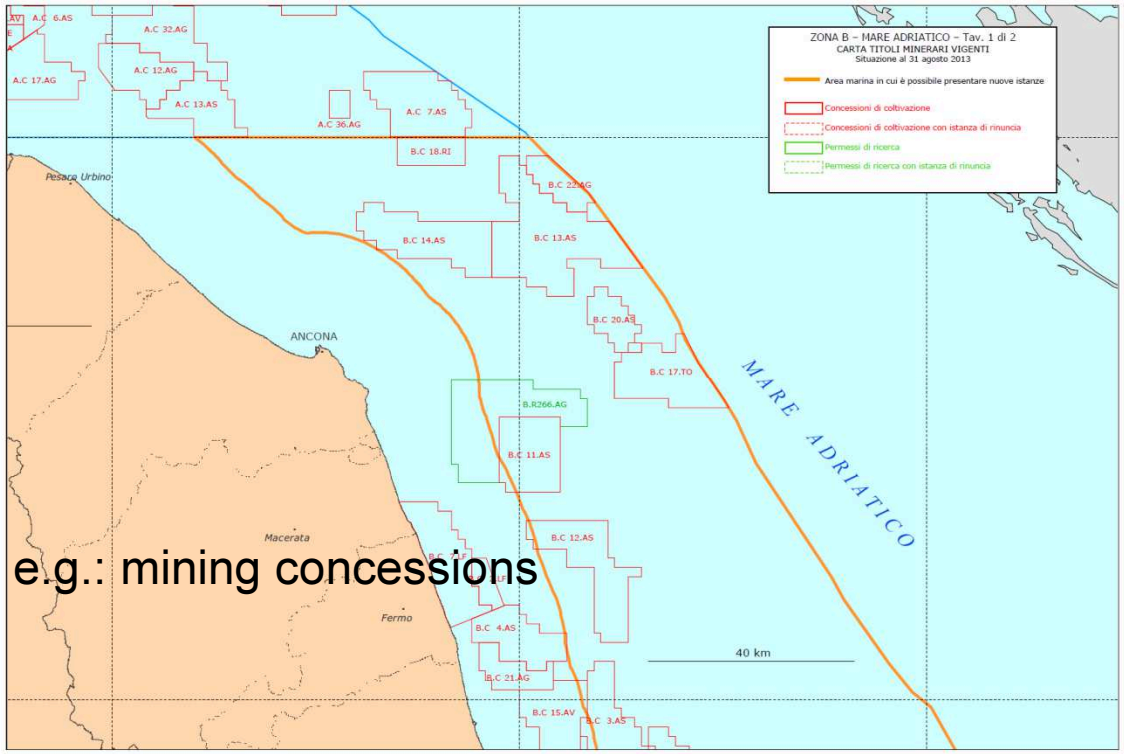
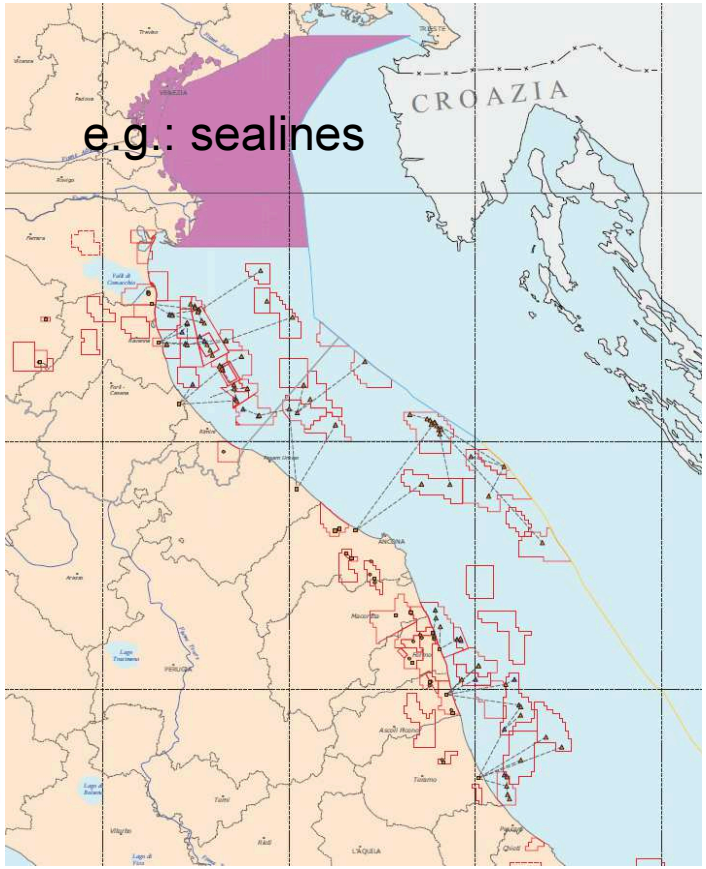
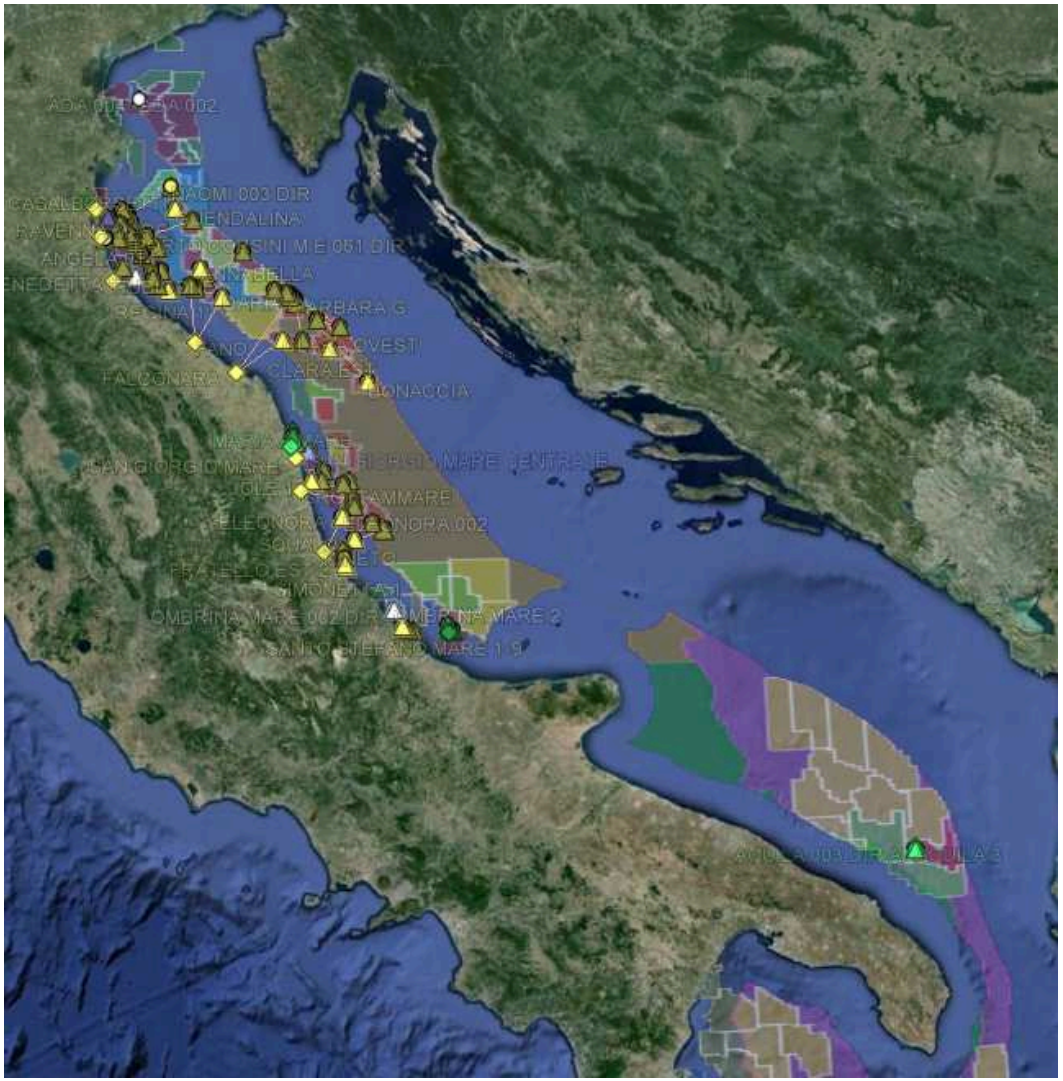
Data mining


ZONA B – MARE ADRIATICO – Tav. 1 di 2
CARTA TITOLI MINERARI VIGENTI
Situazione al 31 agosto 2013
Area marina in cui è possibile presentare nuove istanze
Concessioni di coltivazione
Concessioni di coltivazione con istanza di rinuncia
Permessi di ricerca
Permessi di ricerca con istanza di rinuncia
Pesaro Urbino
ANCONA
Macerata
Fermo
MARE ADRIATICO
40 km
e.g.: mining concessions


CROAZIA
e.g.: sealines

Data mining



Livelli

Titoli minerari

- Permessi
- Concessioni

Istanze

- Istanze di permesso
- Istanze di concessione di coltivazione

Centrali

- Centrali di raccolta e trattamento a gas
- e ad olio

Strutture marine

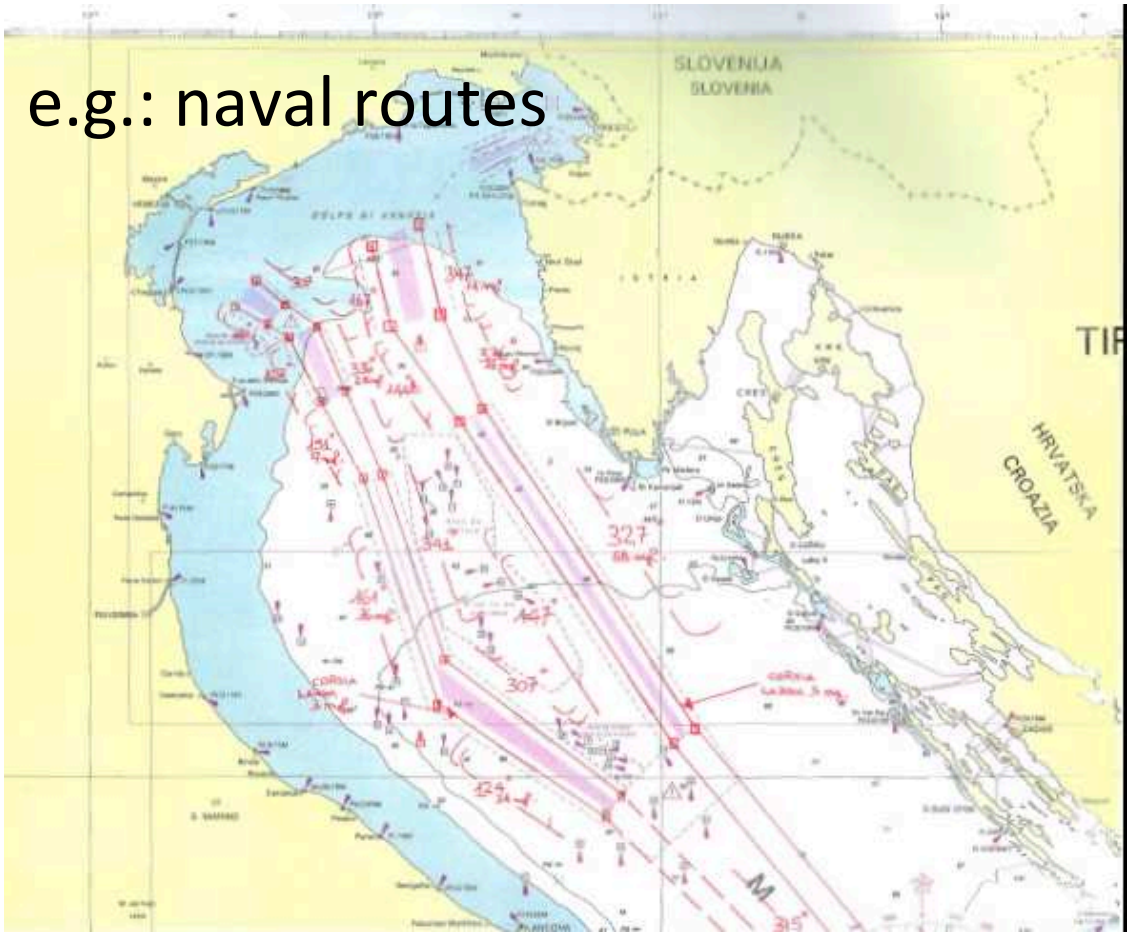
- Piattaforme marine produzione gas
- produzione olio
- supporto
- inattive
- Collegamenti
- Aree marine in cui possono essere presentare nuove istanze

Pozzi

- Pozzi produttivi a gas
- e ad olio
- Pozzi ad altro utilizzo
- non eroganti
- potenziale stoccaggio
- reiniezione
- monitoraggio
- altro utilizzo

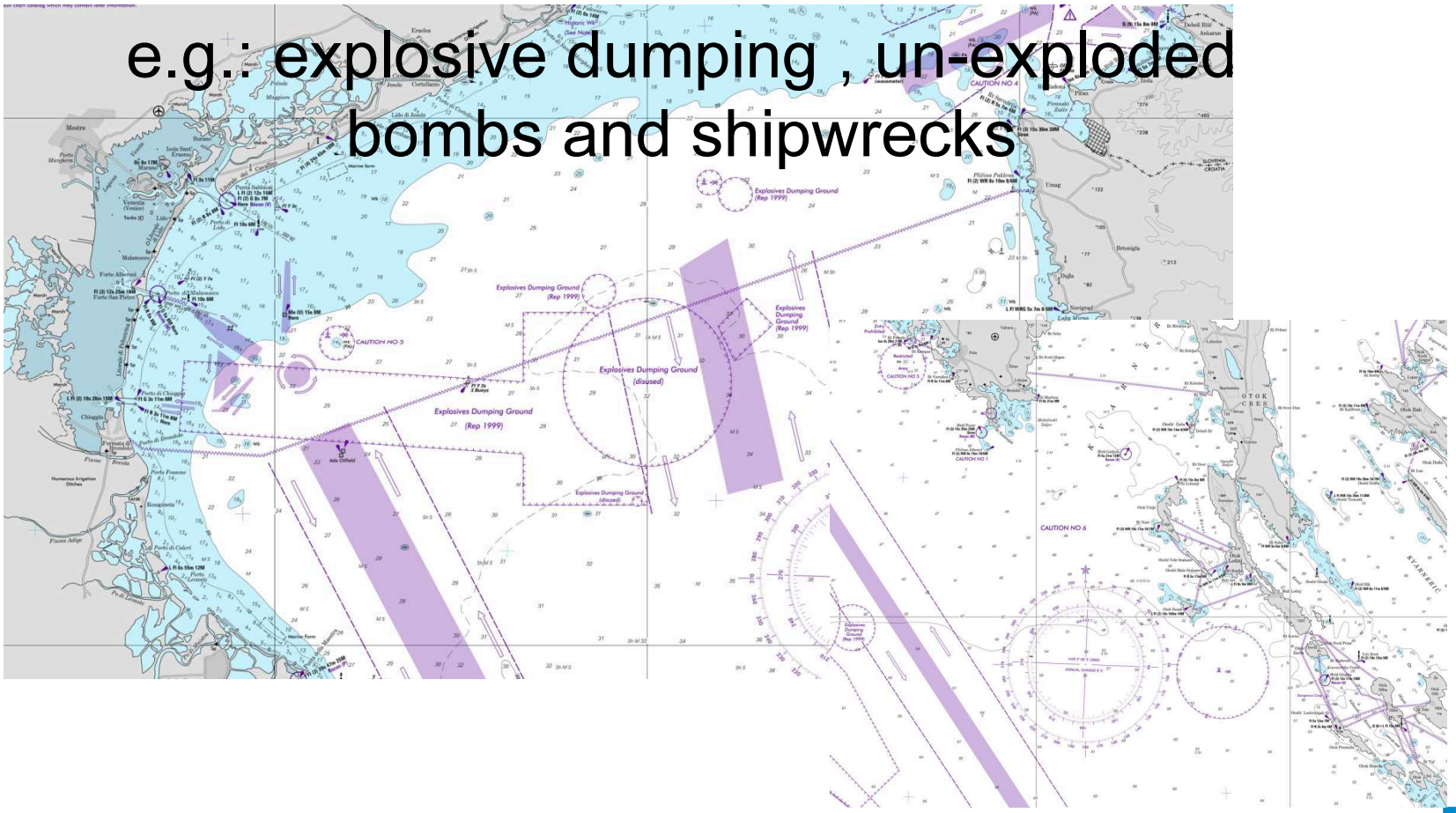
Torna alla pagina precedente

Obstacles and iterferences at sea within 12nm from the coast

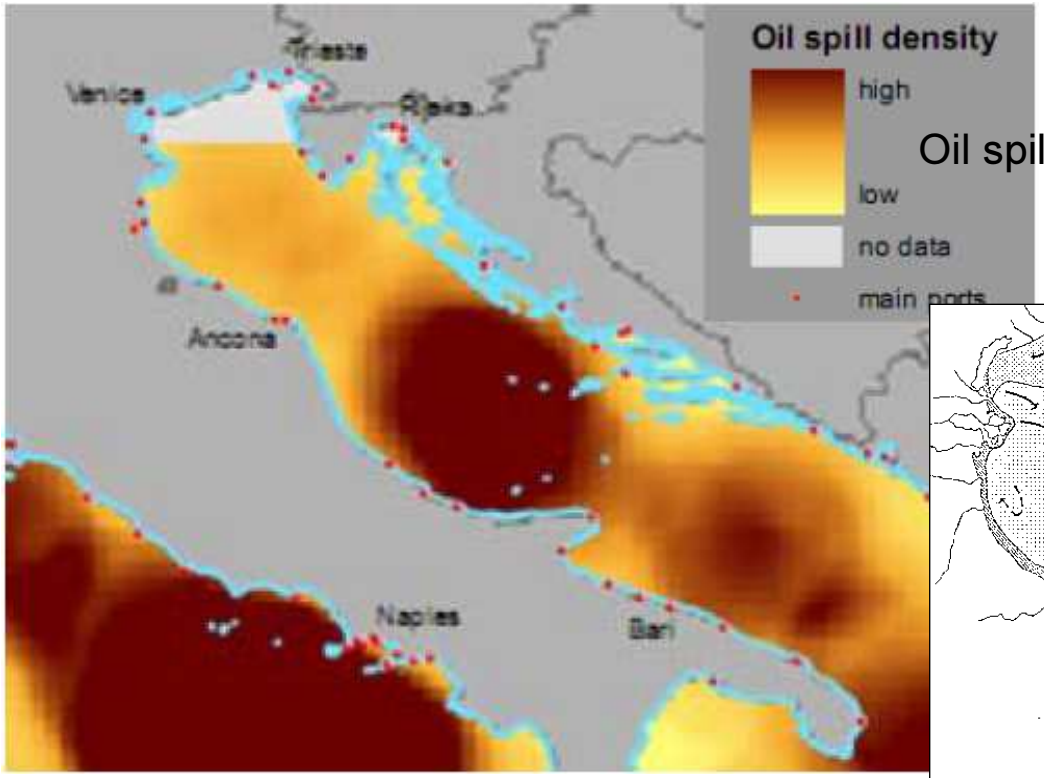


Obstacles and interferences at sea within 12nm from the coast

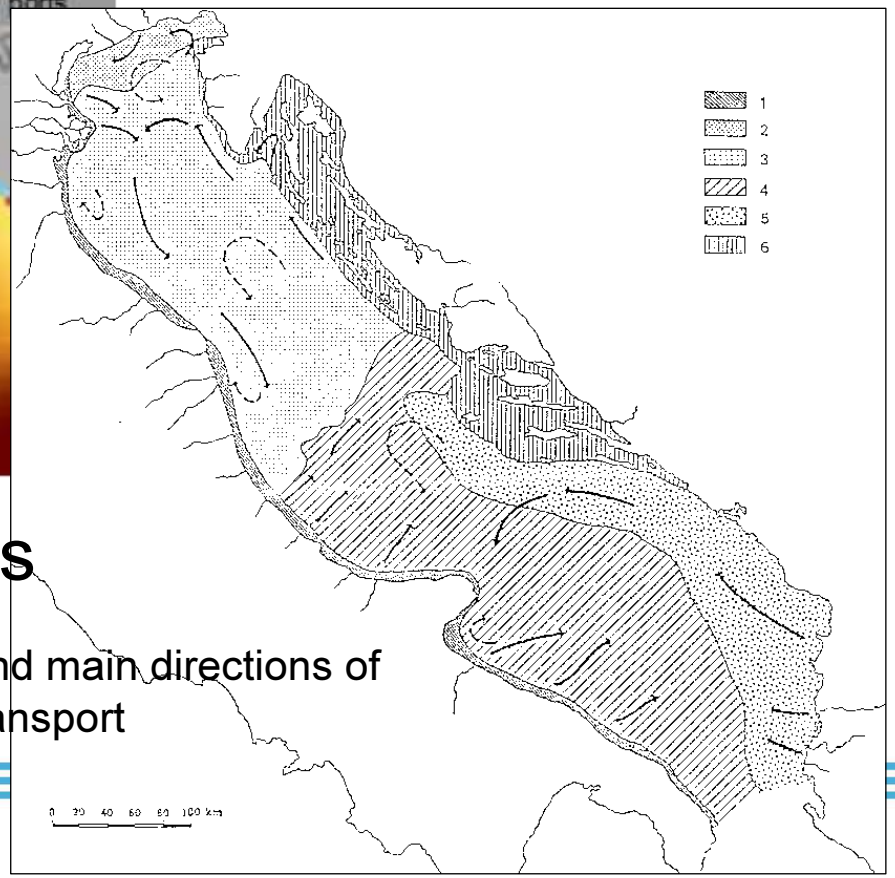
e.g.: explosive dumping , un-exploded bombs and shipwrecks



Obstacles and interferences at sea within 12nm from the coast



Oil spill density in the Adriatic Sea



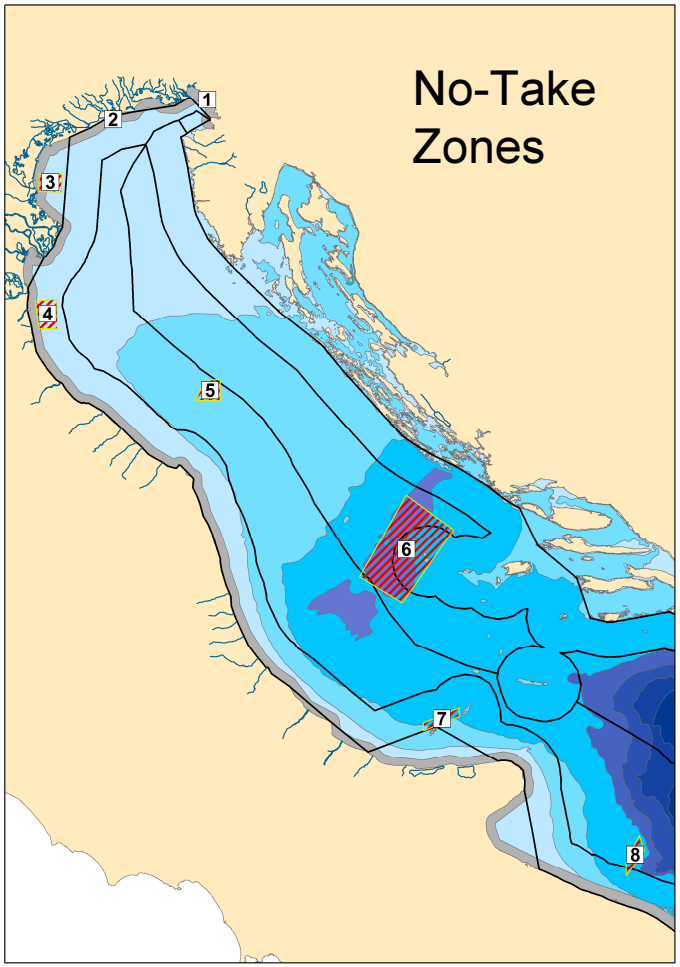
e.g. environmental risk areas

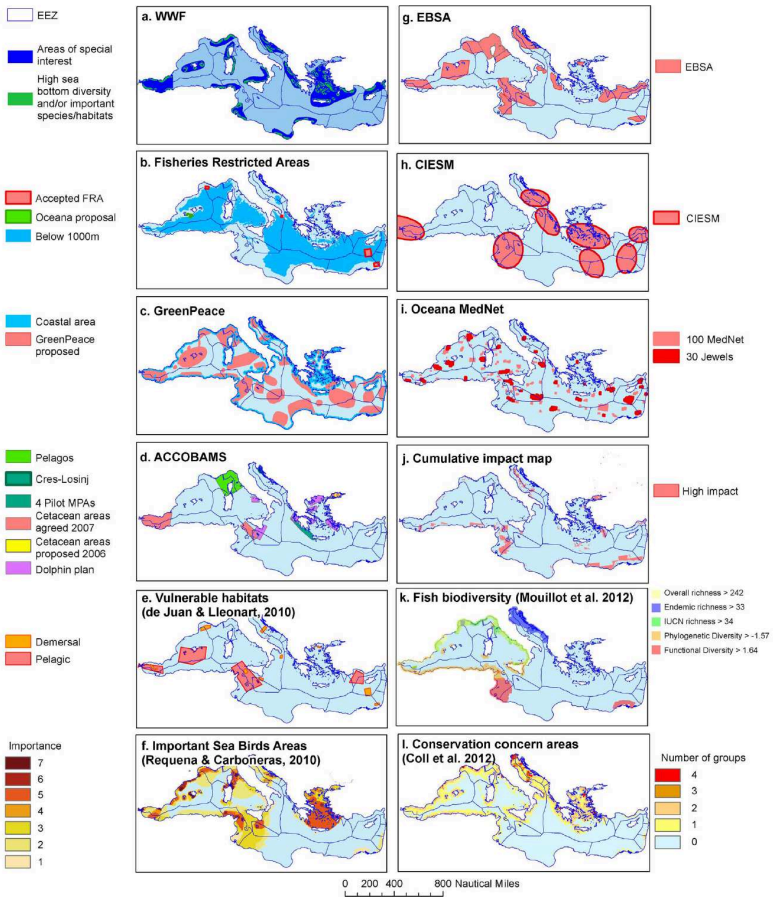
Sedimentary provinces and main directions of sediment transport

2) ENVIRONMENTAL (including landscape) CONSTRAINTS AT SEA AND ON THE COAST

1. - Special Protection Areas (SPA)
2. - Sites of Community Interest (SCI) [at sea and along the coast]
3. - Zones of biological protection
4. - Ramsar Areas
5. - Parks and Marine Reserves
6. - Areas subjected to special attention for purposes of hydrogeological asset
7. - Areas hosting historical buildings of public interest
8. - Areas of public and/or military interest along the coast
9. - Areas pertaining to Local/Regional/National Landscape Plans
10. - Scenic Drives, aggregation points and places of memory

Environmental constrains

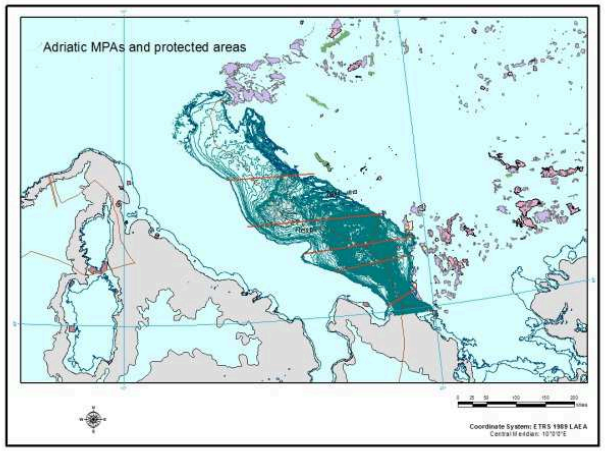


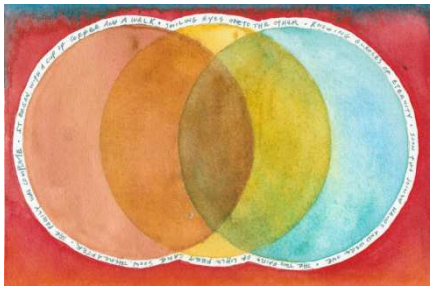


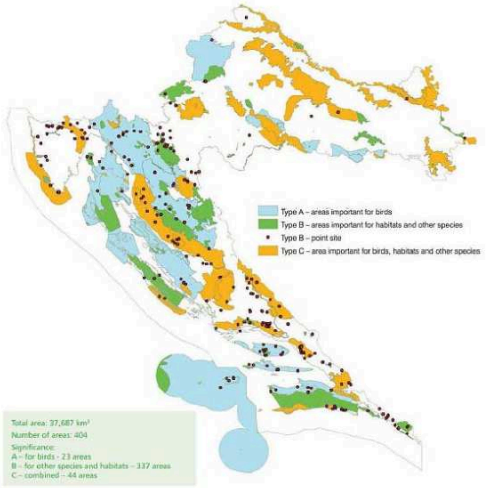
Proposed conservation priority areas in the Mediterranean Sea (from Micheli et al., 2013).

Environmental constrains

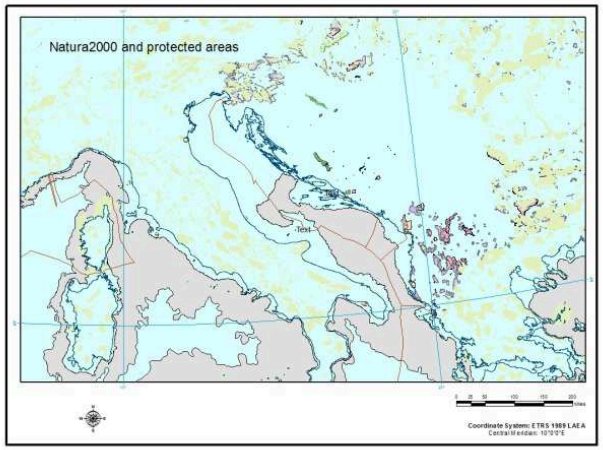
Bathymetry constraints



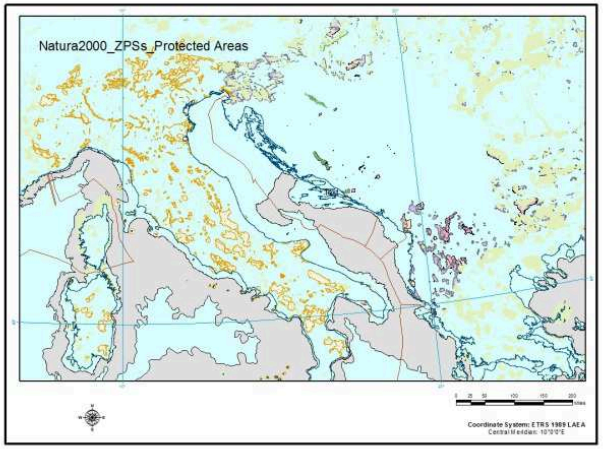




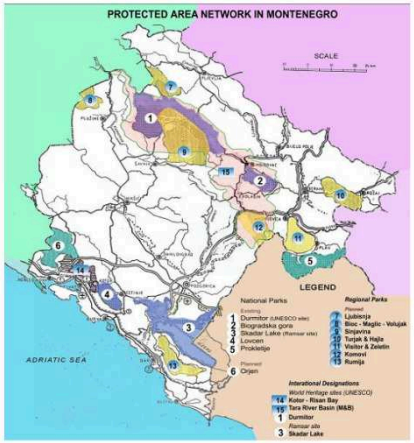
SICs and ZPSs



Natura2000 sites



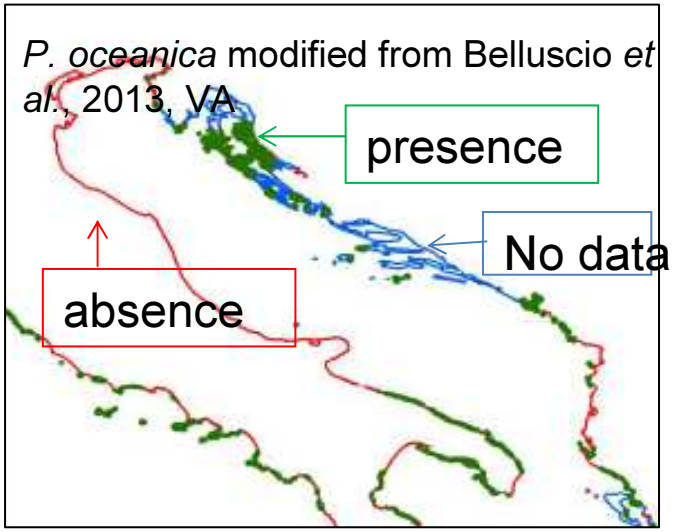
EMERALD zones

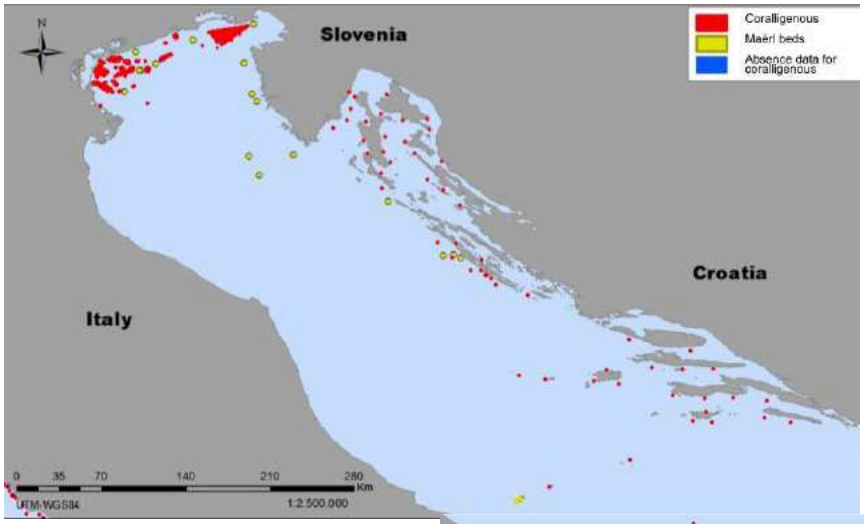


3) BIOECOLOGICAL ASPECTS

11. Migration routes of birds
12. Quality of sea water (in relation to harvesting, culturing and marketing of bivalve mollusks)
13. Monitoring data according to the dictates of the EU Marine Framework Directive (wherever available or applicable), with specific reference to benthic biocoenoses and habitats
14. Bio-ecological data included in environmental studies for EIA (Environmental Impact Assessment) procedures at the regional and / or national level at sea or on land, but with potential consequences to the sea
15. Bio-ecological data derived from LIFE, IPA, INTERREG and any other EU or national funded projects, related with marine ecosystems
16. Areas of clam fishing
17. Distribution of fishing effort and fleet composition

Biological aspects





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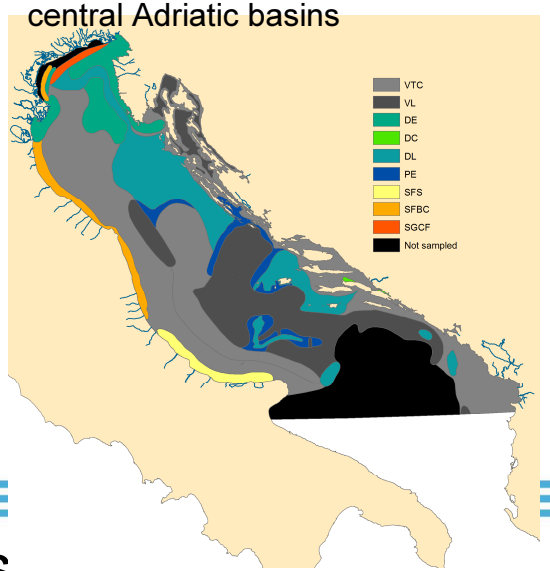
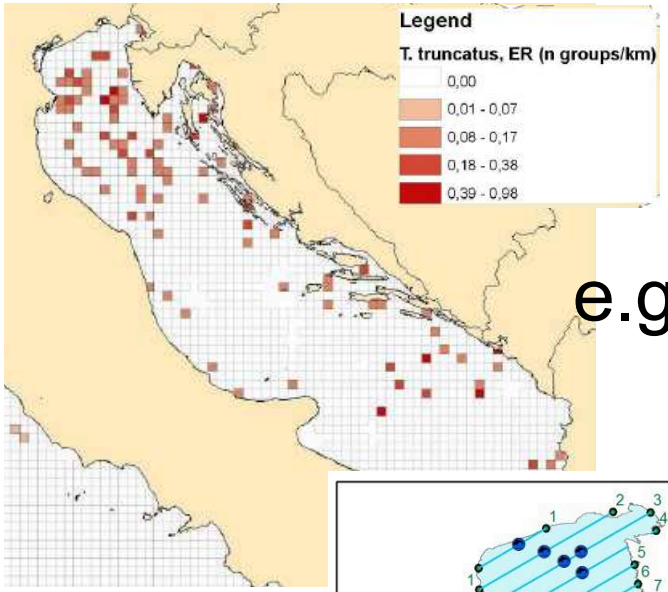
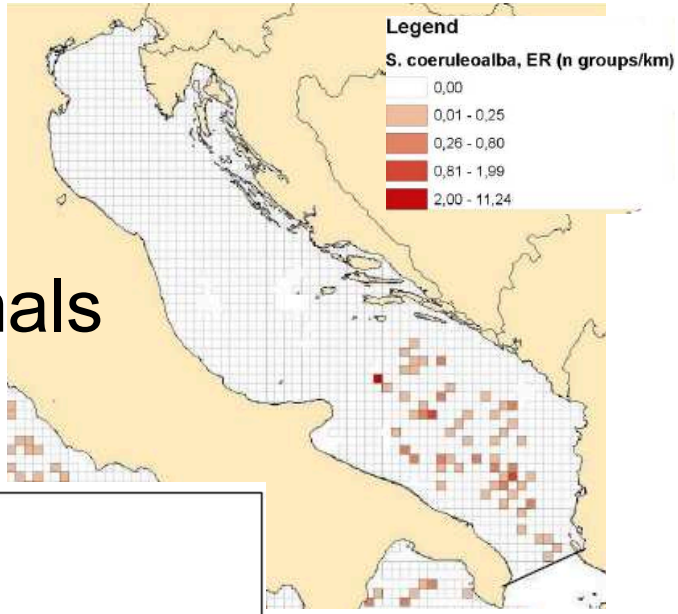
Main soft-bottoms benthic communities of the northern and central Adriatic basins



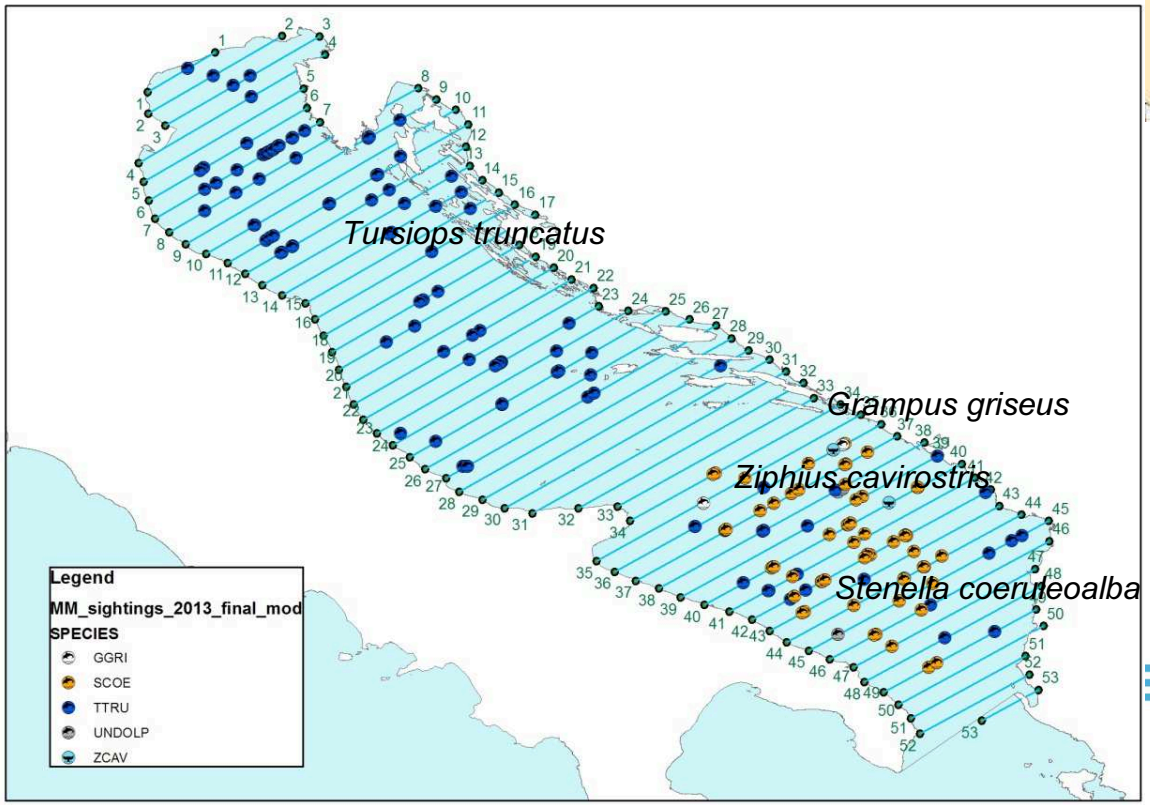
e.g.: coastal and open-sea benthic biocenoses

Biological aspects





e.g.: marine mammals



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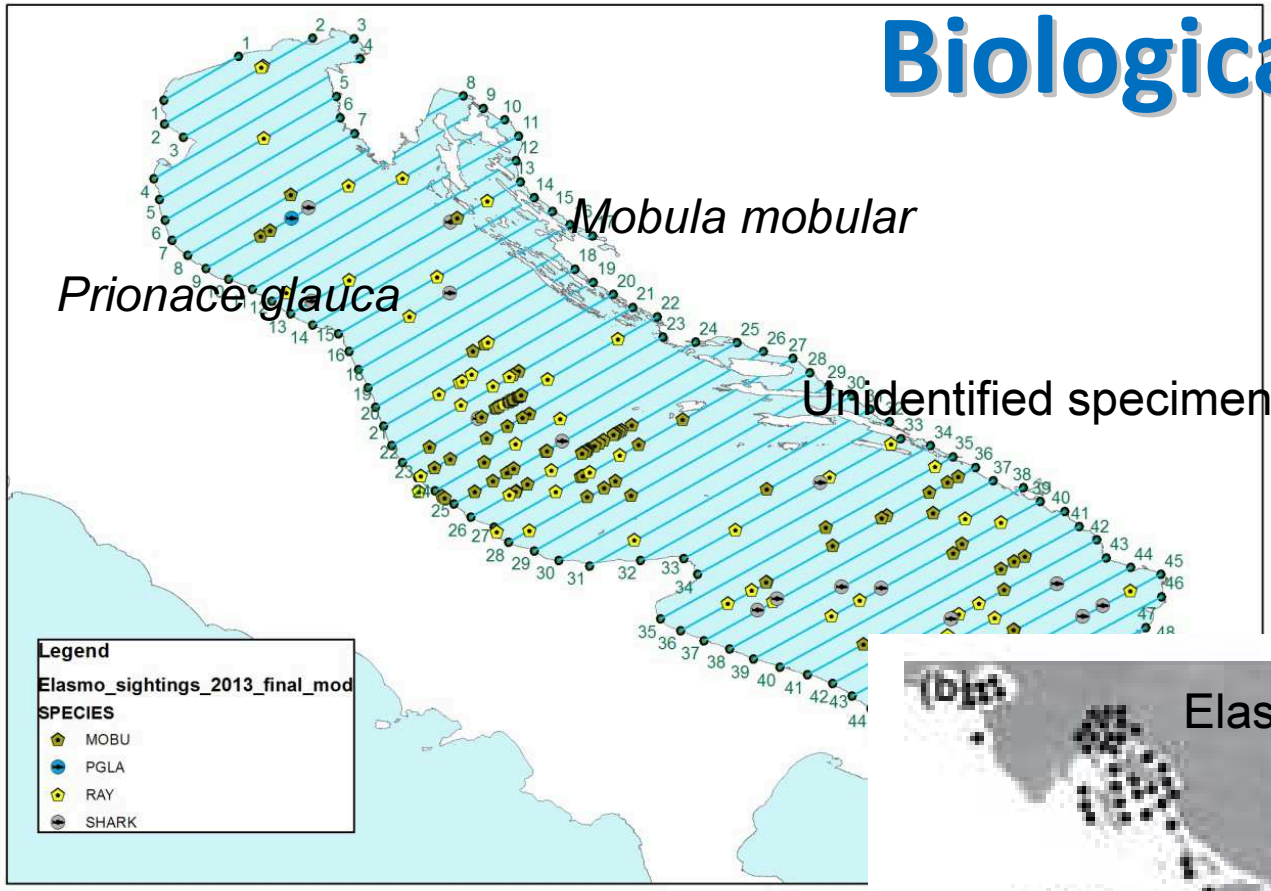
Biological aspects

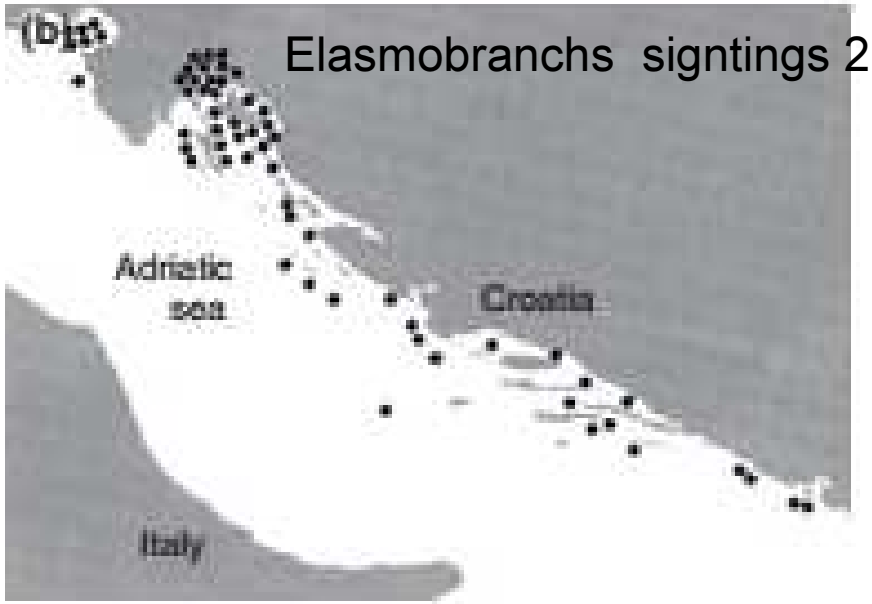
Mobula mobular

Prionace glauca

Unidentified specimen

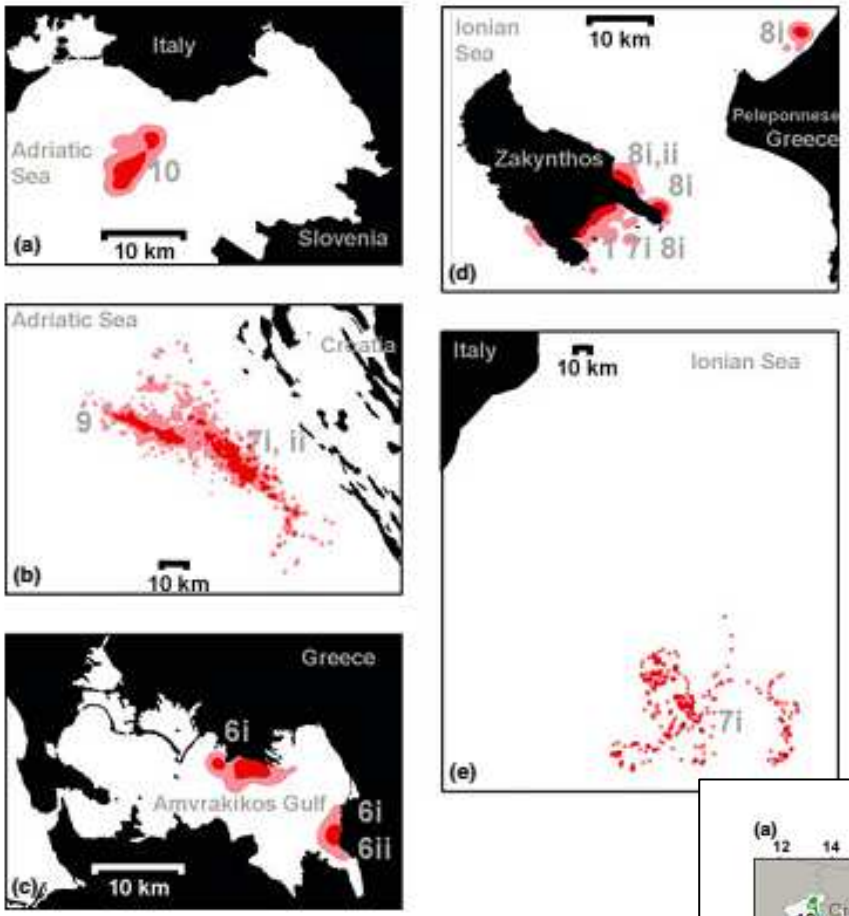


e.g.: elasmobranchs

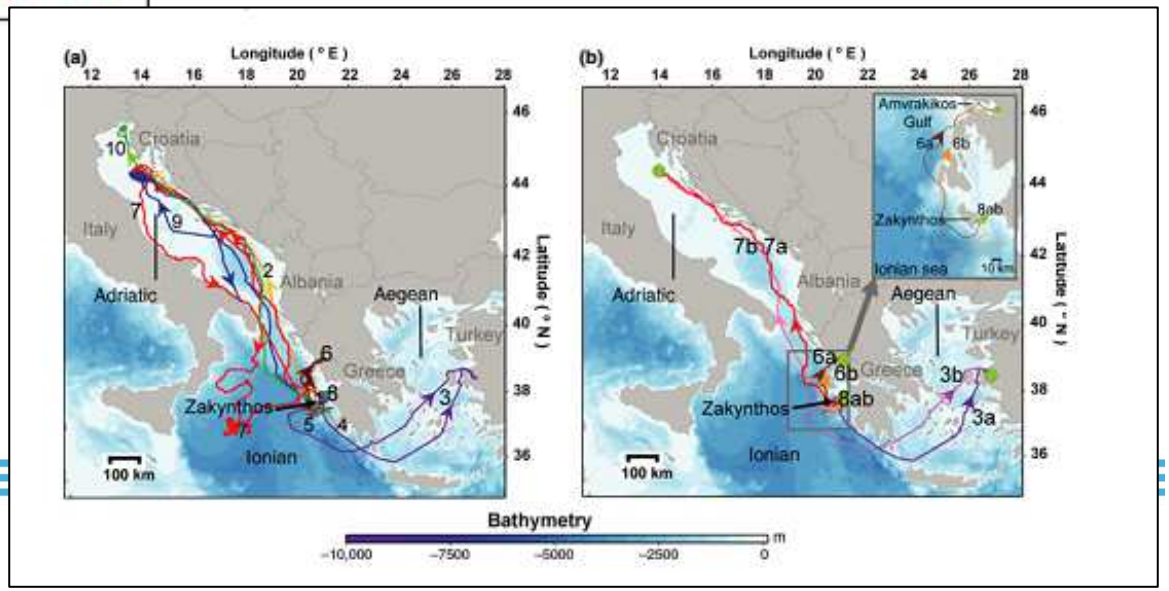


Biological aspects

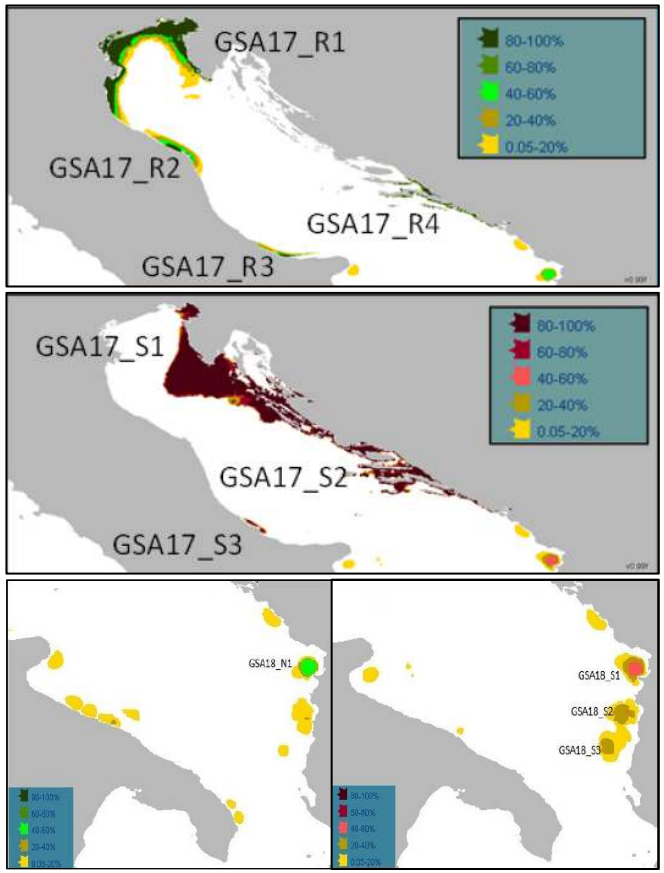
e.g. : feeding areas for turtles



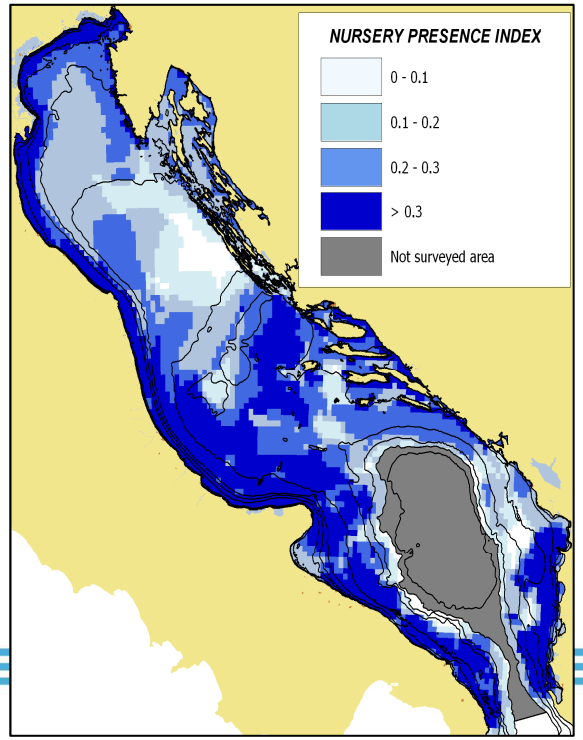
e.g.: Migration routes of *Caretta caretta*

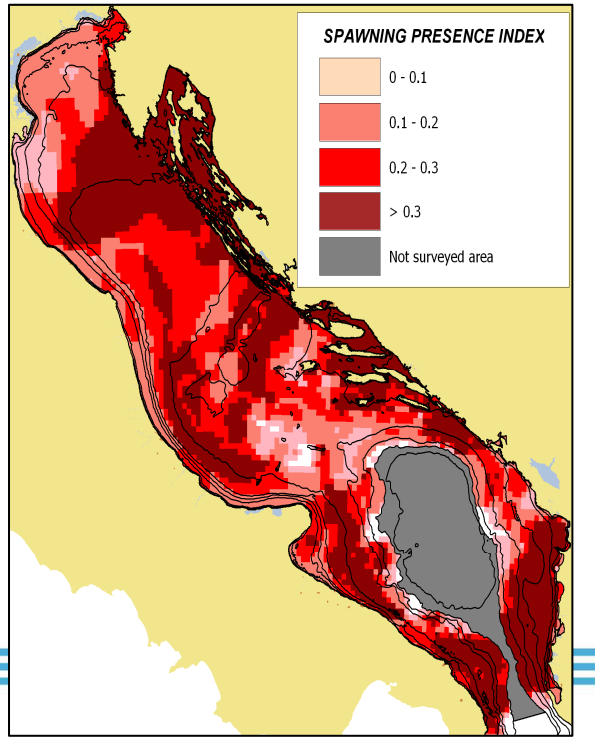


Biological aspects

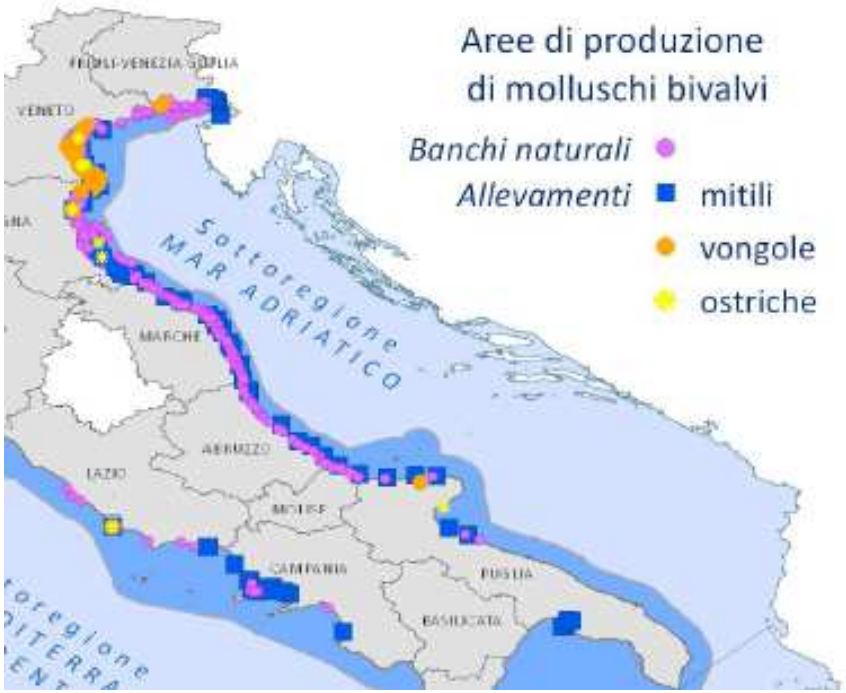


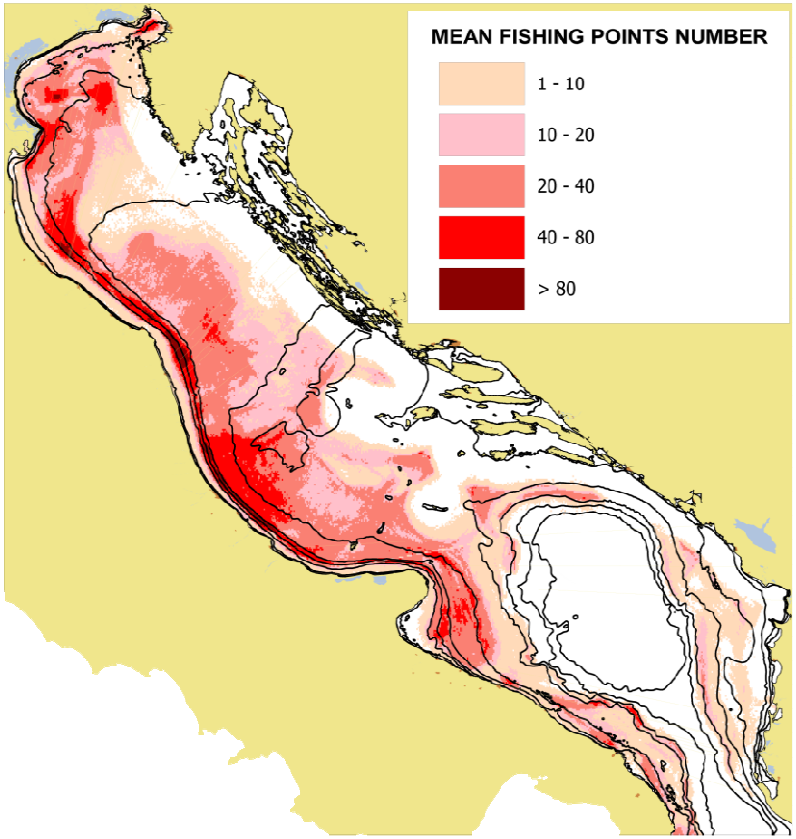
e.g.: fish nursery and spawning areas





Biological aspects



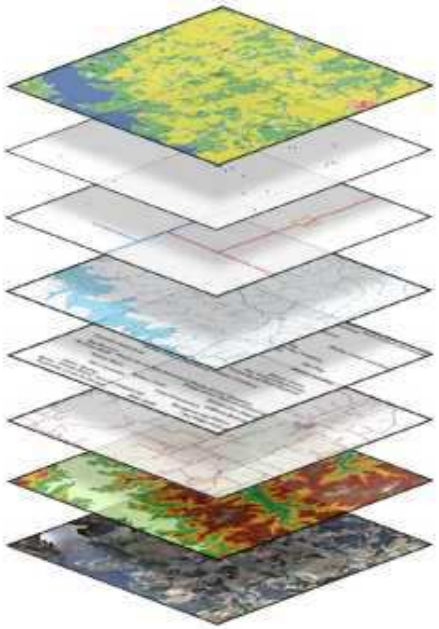


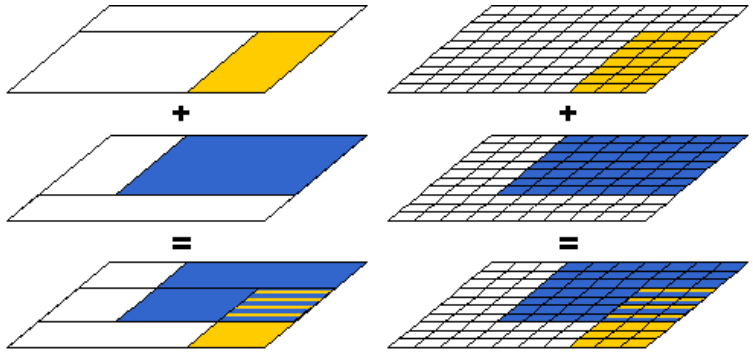
e.g.: fishing areas and fishing effort

4) SPATIAL PLANNING AND LANDSCAPE USE (including present and future plans)

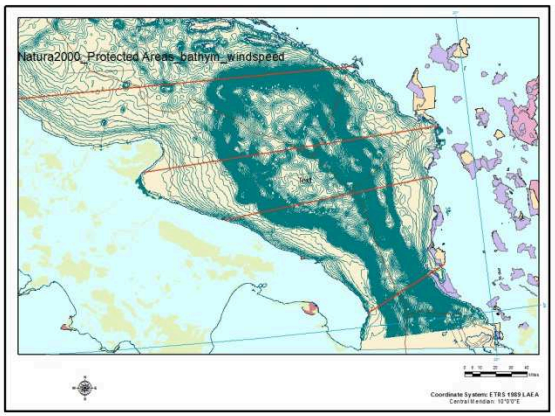
1. Synthesis of local/regional/national plans of landscape management presently in force or that are going to be established in the near future

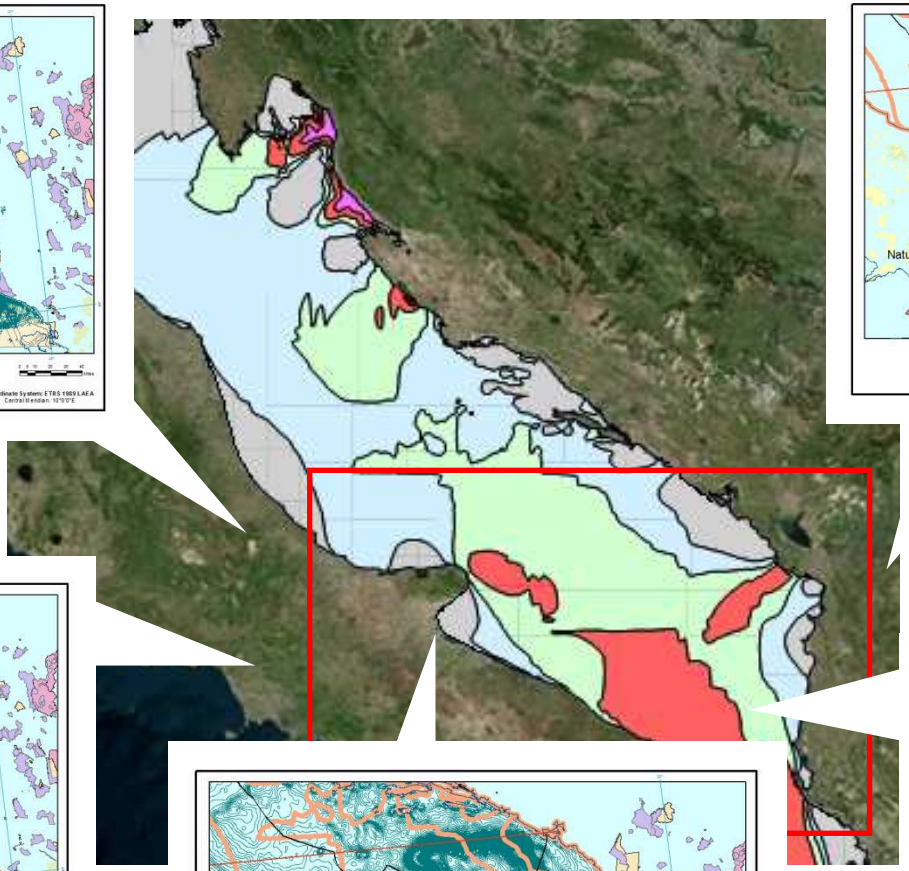
2. Information dealing with coastal traffic, tourism management and develoment and so on...

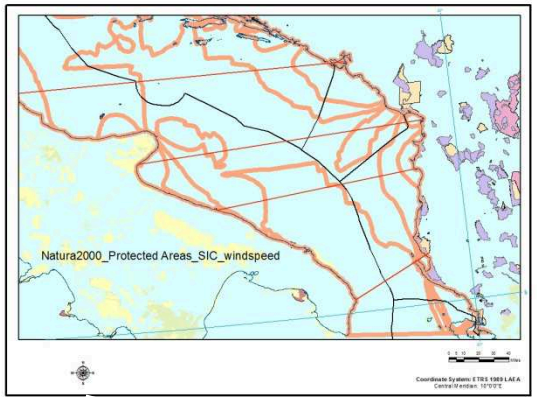


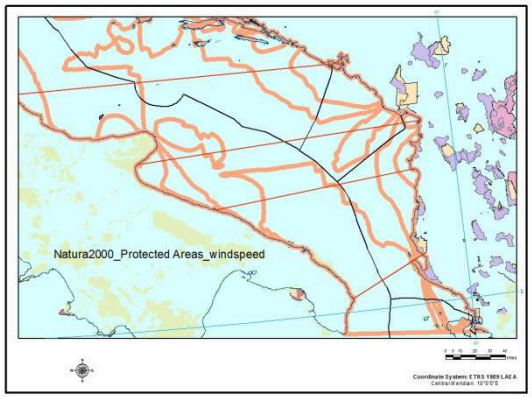


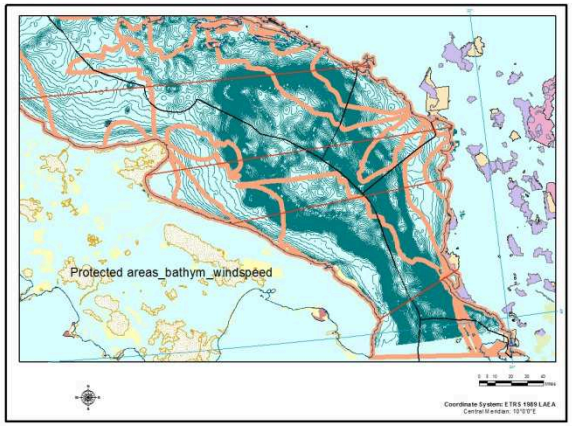
Source layers

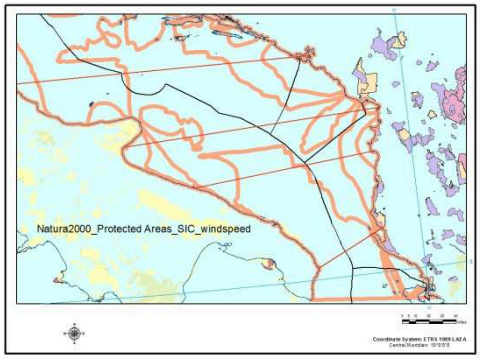












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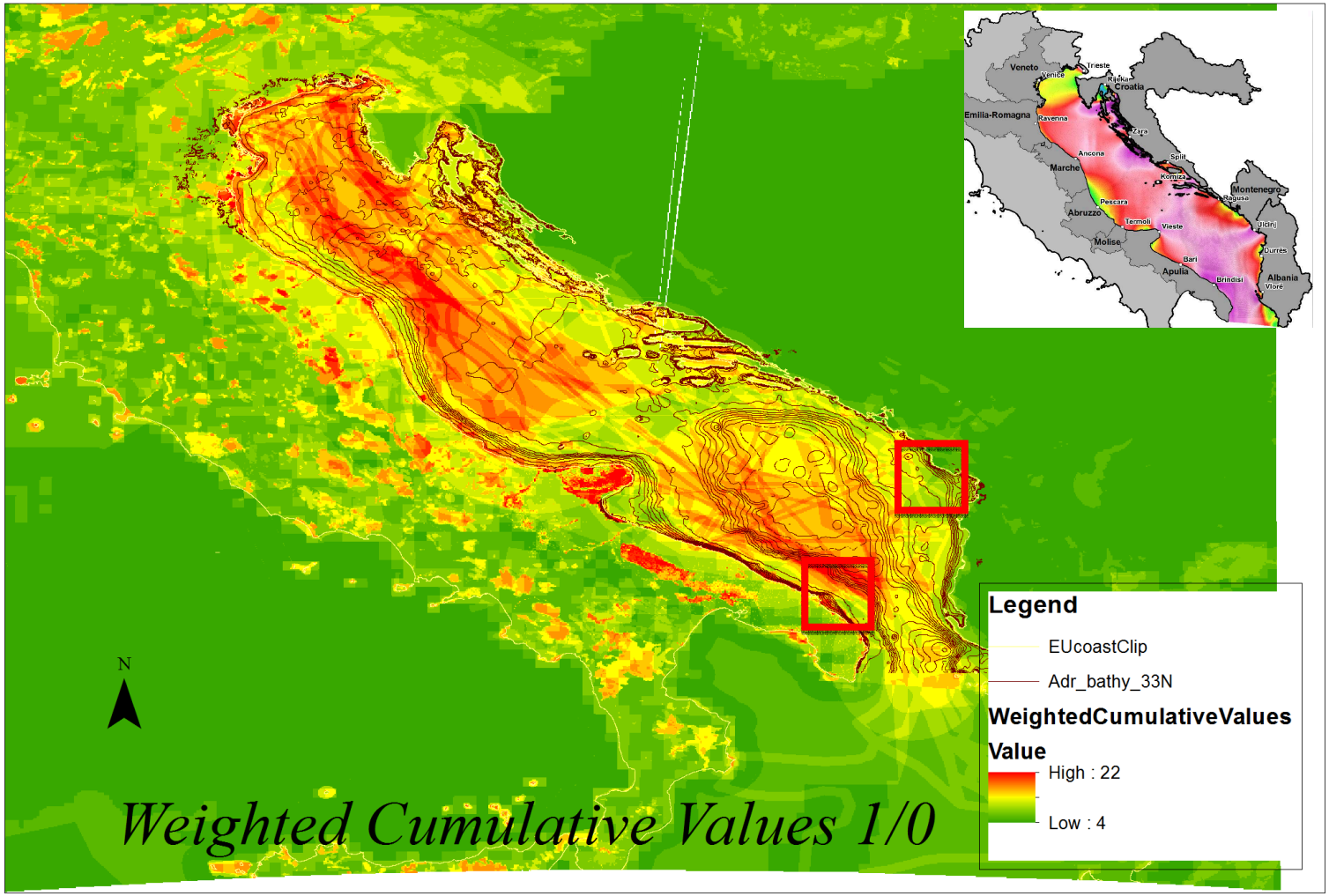
Elevate criticità ambientali anche nelle aree con “buon vento”



Area candidabile “con riserva”: compromesso tra stato ambientale e recupero