



69th Annual Meeting of the European Federation of Animal Science



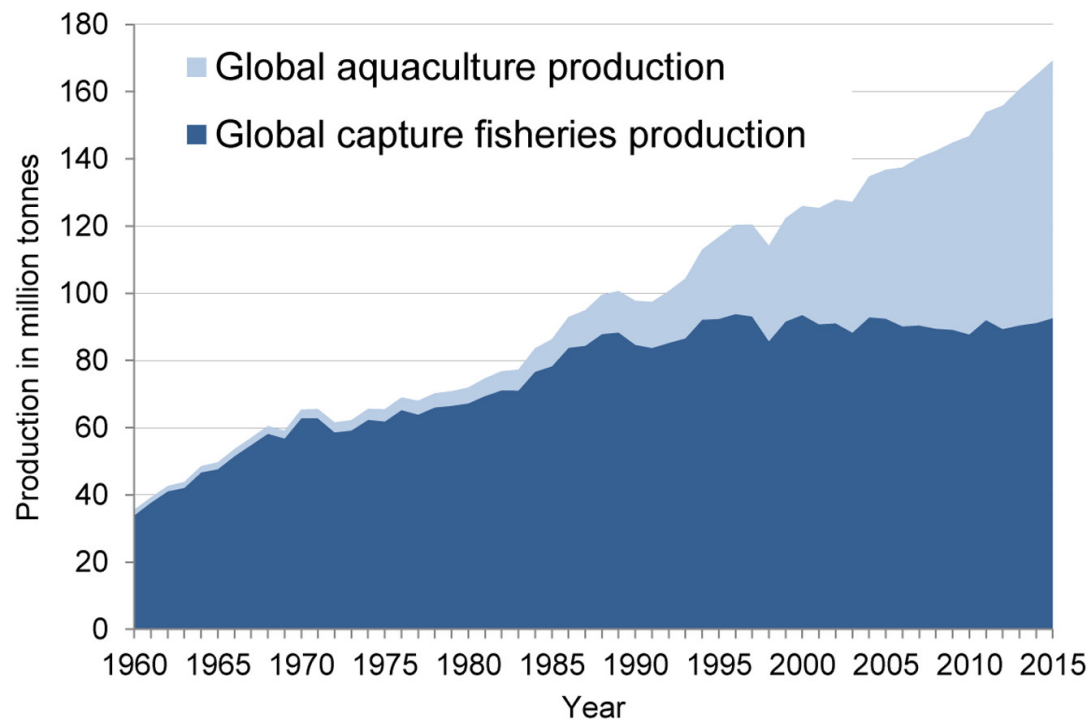
Gilthead seabream predation on mussel farms: a growing conflict



TANJA ŠEGVIĆ-BUBIĆ *, LEON GRUBIŠIĆ, IGOR TALIJANČIĆ, IVA ŽUŽUL



TRENDS IN AQUACULTURE PRODUCTION



Aquaculture production and the plan of National Strategy of Croatia for aquaculture

Species	2016	2017	2020 tonnes
Marine fish farming <i>Sparus aurata</i> , <i>Dicentrarchus labrax</i>	9.411	10.446	10.000
Bluefin tuna <i>Tunnus thynnus</i>	2.934	2.162	3.000* *minimum, depending on fishing quotas
Shellfish <i>Mytilus galoprovincialis</i> , <i>Ostrea edulis</i>	763	982	5.000
Total	13.235	13.843	24.050

Source: Ministry of agriculture, State Institute of Statistics

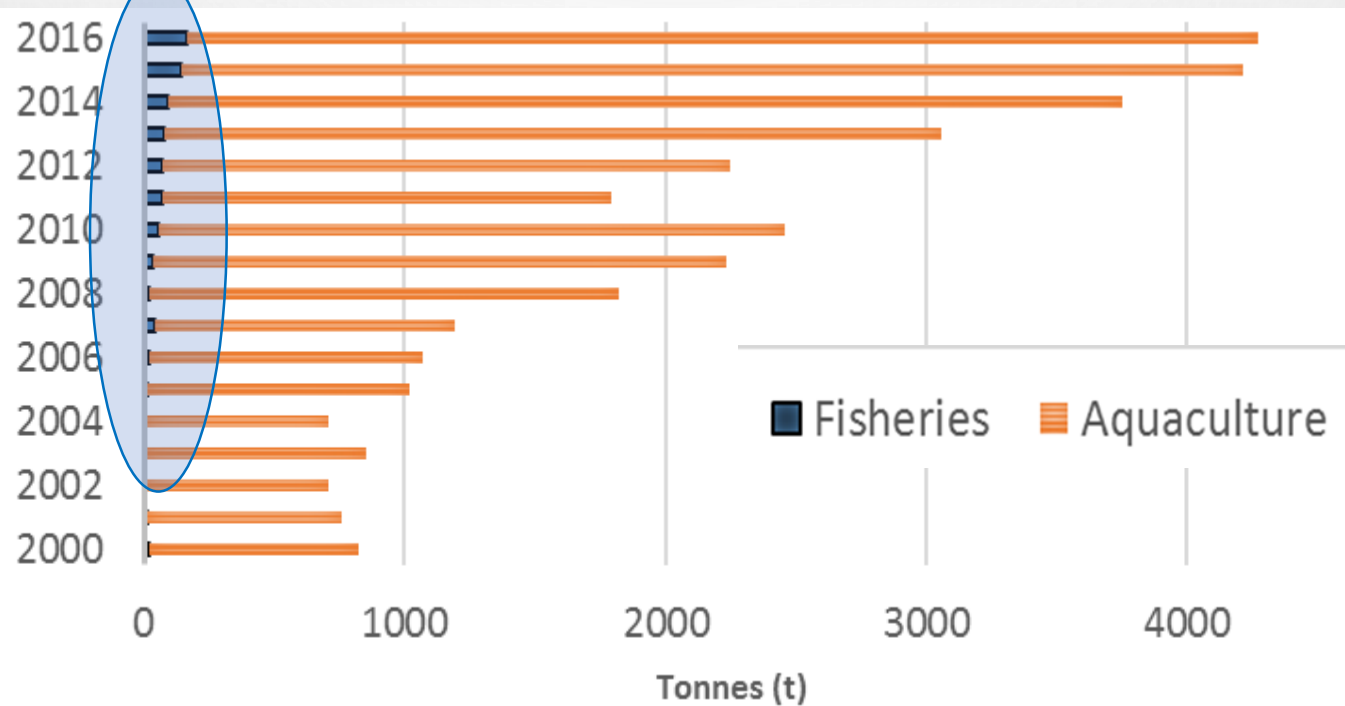


Wild gilthead seabream in the Adriatic Sea

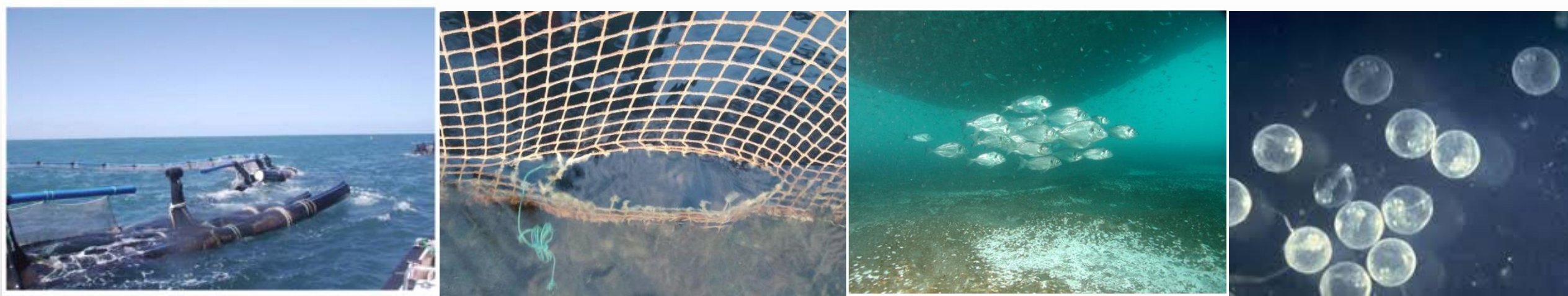
littoral zones



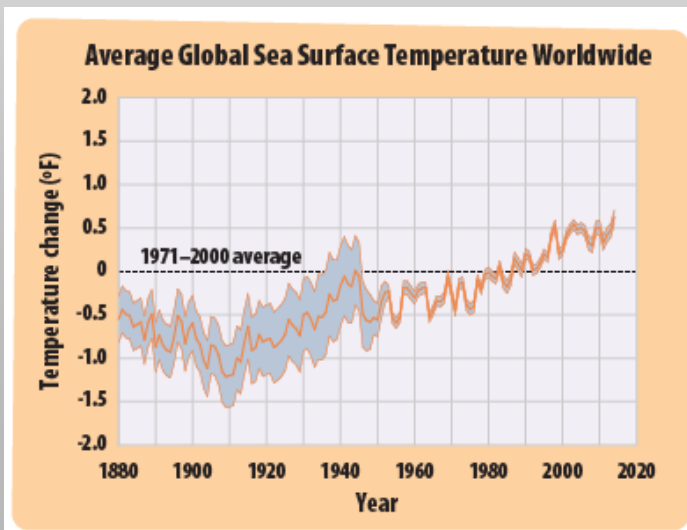
purse-seine catch



- ✓ The escape of fish from sea-cage aquaculture and escape of eggs and larvae through spawning in cages



- ✓ The effects of climate-driven changes in temperature on seabream productive capacity, growth, survival, and migration



Earlier maturation of wild female with gonads exhibiting 30% of the total body weight (250g).



Damages on mussel farms potentially caused by fish predation—Self service on the ropes?

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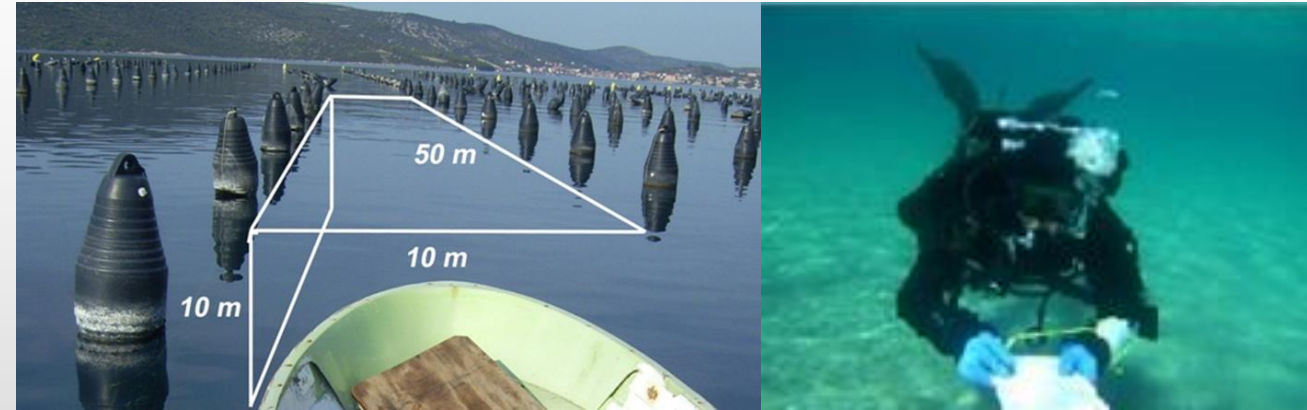
The aim of present study:

- ✓ to determine the abundance and composition of wild fish communities in vicinity of shellfish farms, with focus on wild gilthead seabream *Sparus aurata*
- ✓ to quantify the amount of mussels *Mytilus galloprovincialis* losses due to fish predation activities at farms located in most productive shellfish areas
- ✓ to describe the nutrition preferences of wild seabream by analysing stomach content



➤ SEABREAM ABUNDANCE

- Visual census by scuba divers
- Spatial and temporal design, univariate PERMANOVA



➤ ESTIMATION OF MUSSEL LONGLINES LOSSES

- Monitoring of 280 new ropes with an approximate length of 2.5 m during June 2017, September 2017 and January 2018
- Initially, a sample of 40 ropes was weighed and mussel length and density per meter were measured in order to obtain approx. length–weight rope ratio
- Based on empirical sample date, 1 m of rope had approximately 3 kg of mussels, with average density of 652 ± 47 and shell length of 34.3 ± 2.54 mm.

- ESTIMATION OF MUSSEL LONGLINES LOSSES

- Initial rope length

- Total rope length and length containing mussels after 24 h, 7 days and 30 days of deposition

- **Loss (24 h)%** = $100 \times (\text{total rope length } (L_t) - \text{rope length with mussels } (L_{t1})) / L_t$,

- **Loss (one week)%** = $100 \times (L_{t1} - \text{rope length with mussels } (L_{t2})) / L_t$.



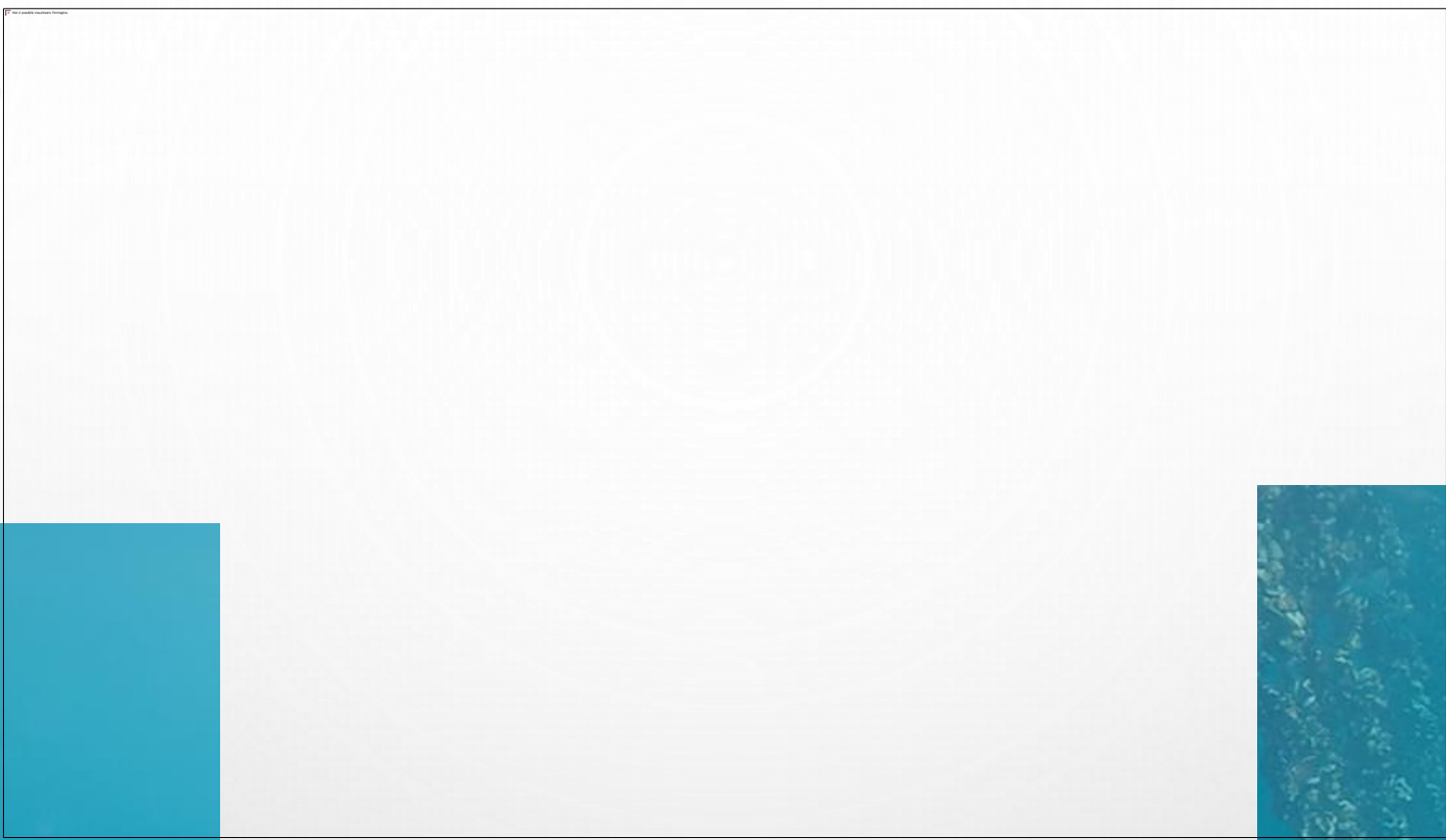
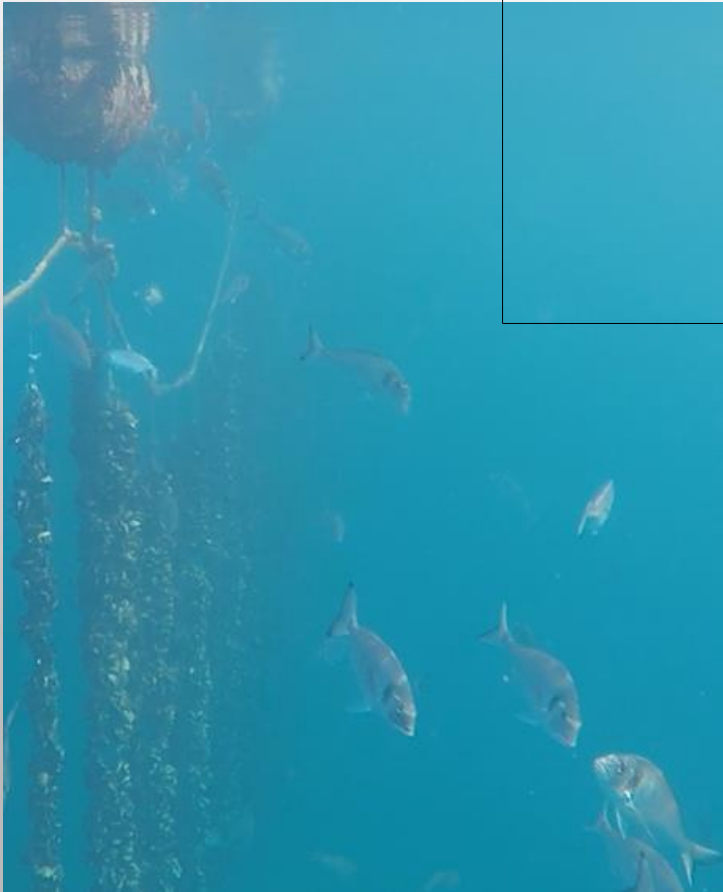
Empty ropes due to predation



Abundance and composition of wild fish communities in vicinity of shellfish farms

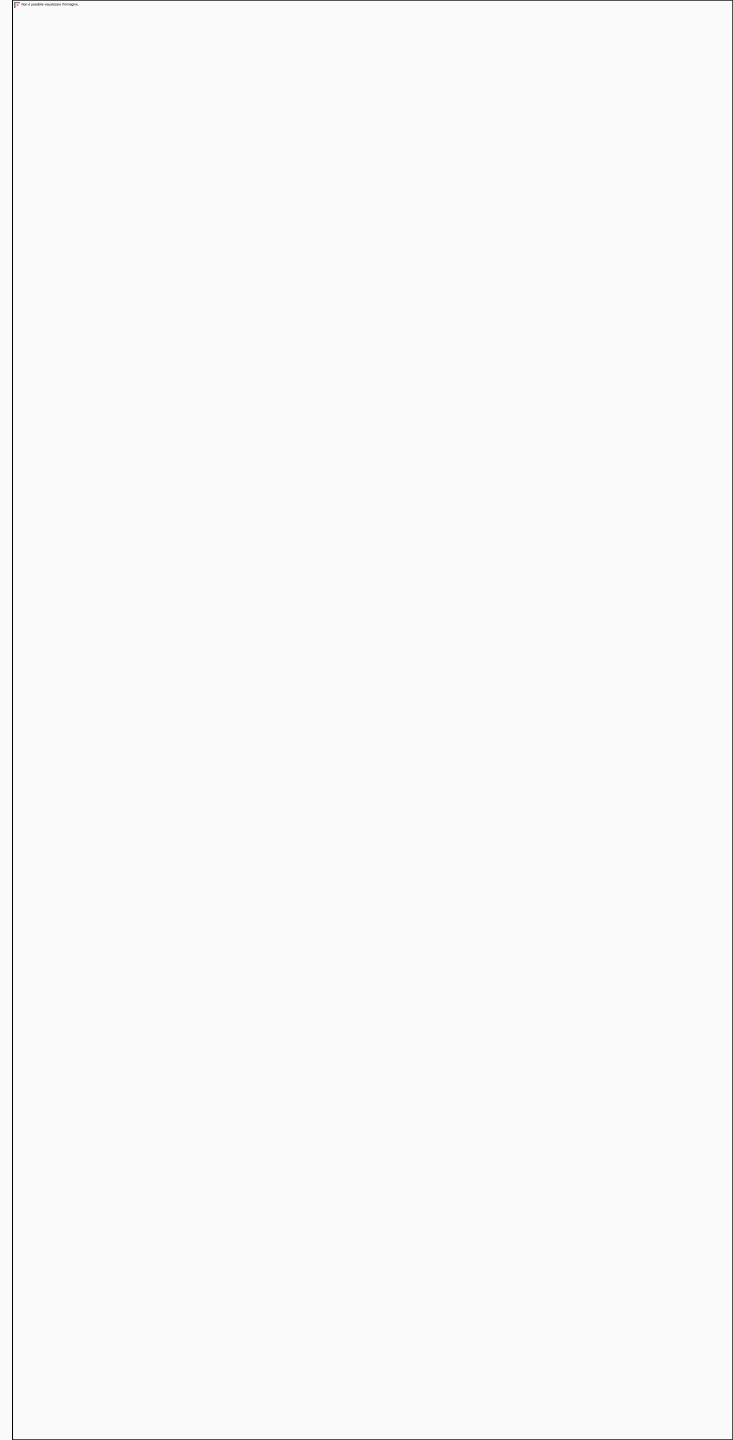
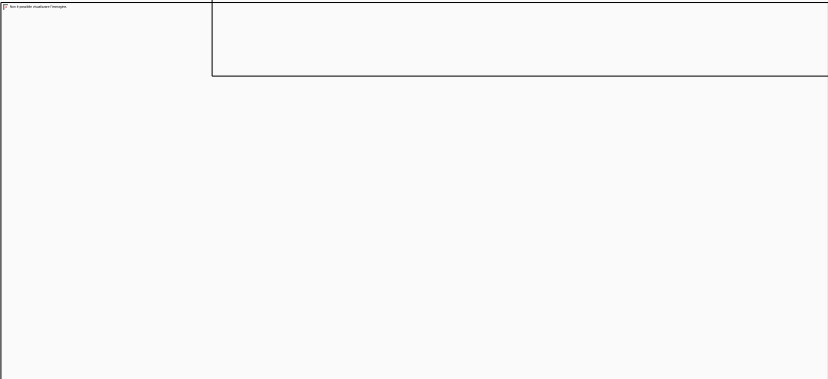
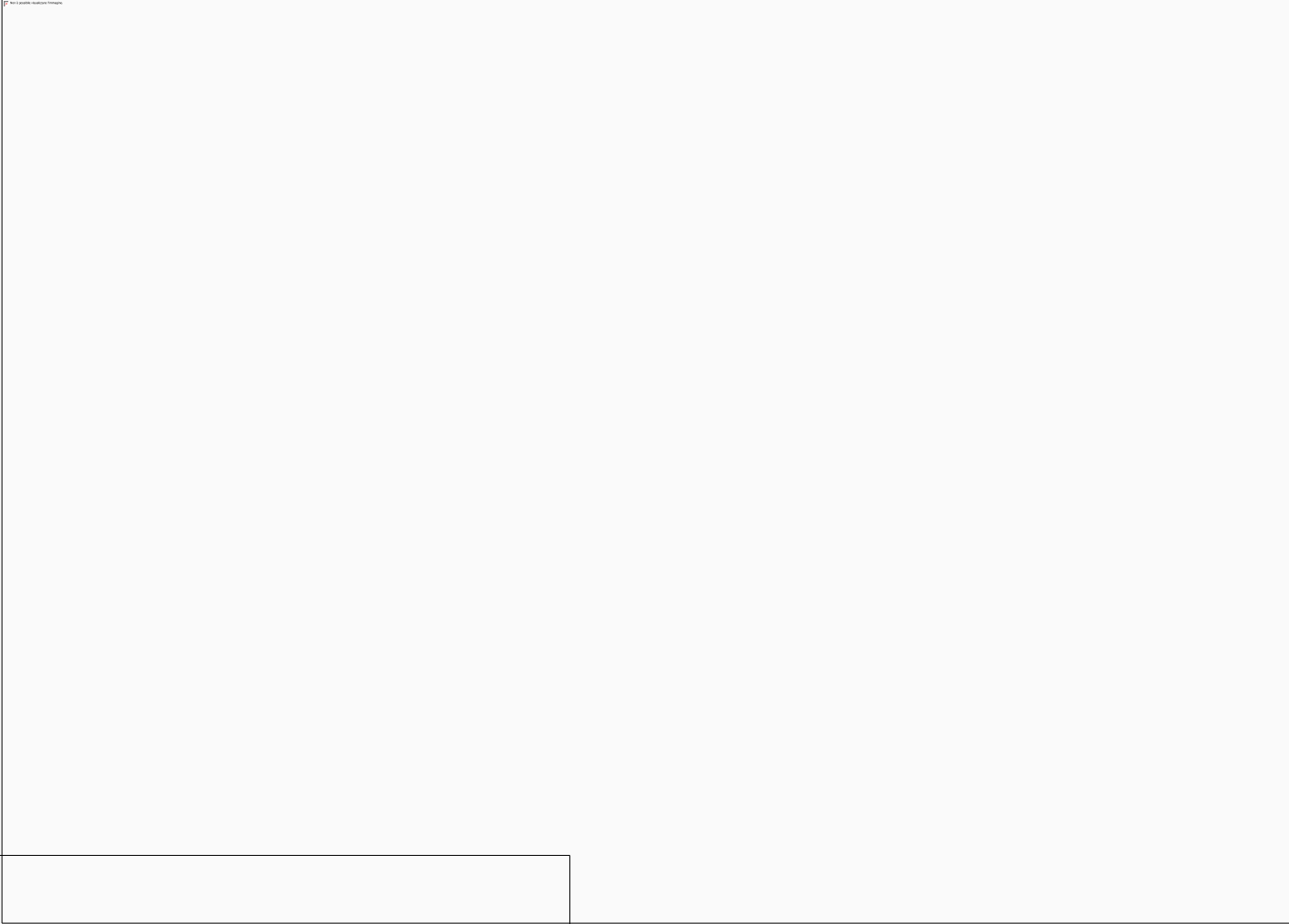
Average abundance of wild fish species (mean \pm s.e.) per 5000 m³ at the mussel farms and at control locations

Family	Species	TC	Marina Bay		Lim Bay		Mali Ston Bay	
			Farm	Control	Farm	Control	Farm	Control
Atherinidae	<i>Atherina hepsetus</i>	Mi	47.2 \pm 13.9	0.9 \pm 0.4	22.2 \pm 7.1	3.3 \pm 1.9	6.3 \pm 4.6	3.3 \pm 1.9
Belonidae	<i>Belone belone</i>	Mi	1.7 \pm 0.6	0.3 \pm 0.2	0.2 \pm 0.2	0.3 \pm 0.3	1.4 \pm 0.6	0.3 \pm 0.3
Carangidae	<i>Seriola dumerili</i>	Ma	0.2 \pm 0.1	0	0.03 \pm 0.03	0	0.1 \pm 0.1	0
	<i>Trachinotus ovatus</i>	Ma	0.1 \pm 0.05	0	0	0	0	0
Clupeidae	<i>Sardina pilchardus</i>	Mi	43.1 \pm 12.7	0	0	0	1.7 \pm 0.9	0
Moronidae	<i>Dicentrarchus labrax</i>	Ma	0.1 \pm 0.1	0	0	0	0	0.8 \pm 0.4
Mugilidae		O	15.7 \pm 4.6	0.3 \pm 0.2	3.9 \pm 1.2	1.4 \pm 0.7	5 \pm 1.5	1.0 \pm 0.5
Pomatomidae	<i>Pomatomus saltatrix</i>	Ma	8.7 \pm 2.8	0	1.8 \pm 1.0	0	7.2 \pm 3.1	0
Sparidae	<i>Boops boops</i>	Mi	0	1.0 \pm 0.4	0	0.4 \pm 0.3	10.5 \pm 2.9	0
	<i>Diplodus annularis</i>	Me	3.9 \pm 1.3	0.14 \pm 0.1	2.4 \pm 0.8	0	0.4 \pm 0.2	0
	<i>Diplodus puntazzo</i>	Me	1.5 \pm 0.6	0.03 \pm 0.03	3.0 \pm 0.7	0.03 \pm 0.03	2.1 \pm 0.6	0.08 \pm 0.08
	<i>Diplodus vulgaris</i>	Me	6.2 \pm 2.9	0.1 \pm 0.09	4.6 \pm 2.1	0	0.7 \pm 0.4	0
	<i>Lithognathus mormyrus</i>	Me	0	0	0	0	0.9 \pm 0.4	0
	<i>Oblada melanura</i>	Mi	15.4 \pm 7.6	0	10 \pm 6.2	0.06 \pm 0.06	0	0
	<i>Sarpa salpa</i>	O	10.1 \pm 7.2	0	7.3 \pm 4.5	0.3 \pm 0.2	10.6 \pm 2.8	0
	<i>Sparus aurata</i>	Me	30.6 \pm 4.1	0.11 \pm 0.1	7.2 \pm 1.7	0.03 \pm 0.03	20.5 \pm 5.1	0.31 \pm 0.2





Mussel longline losses



Mussel longline losses – seasonal aspect





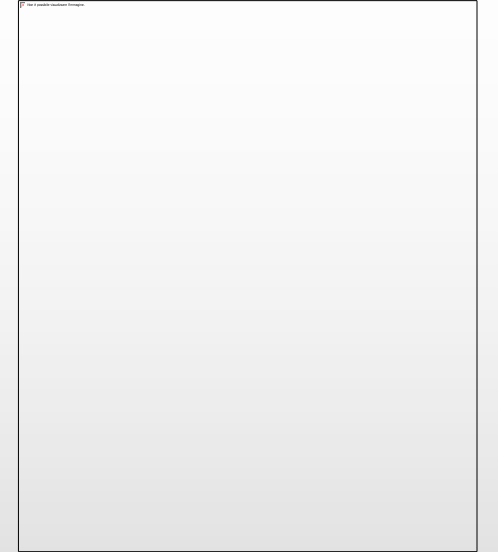
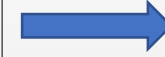
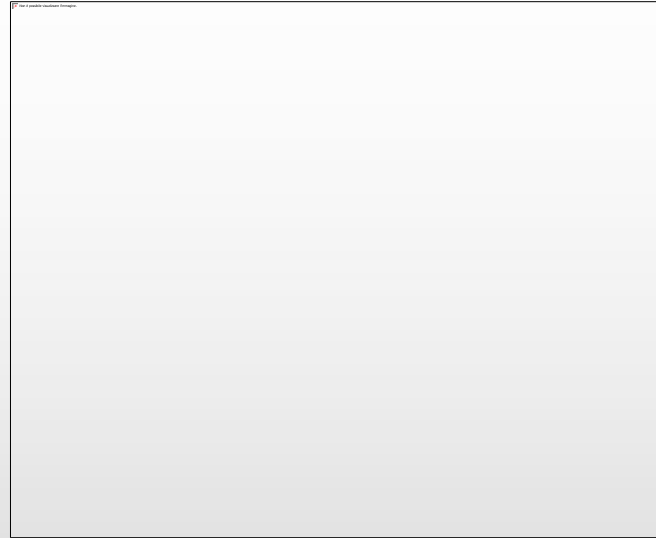
Damages on mussel farms caused by fish predation

Raša Bay:

seabream bites plastic net

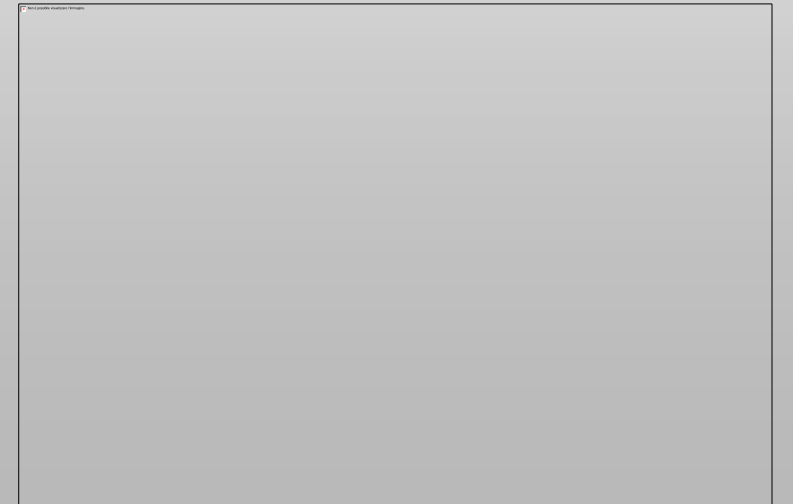
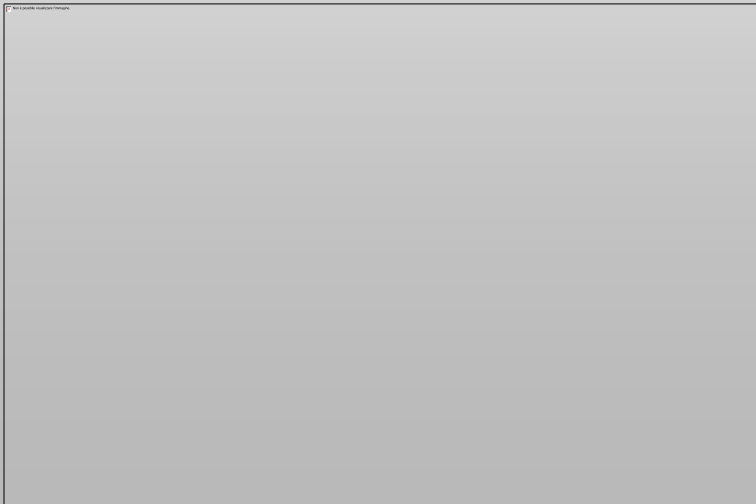
Ways of Protection ??

- Anti-predators nets – ‘Spanish bags’

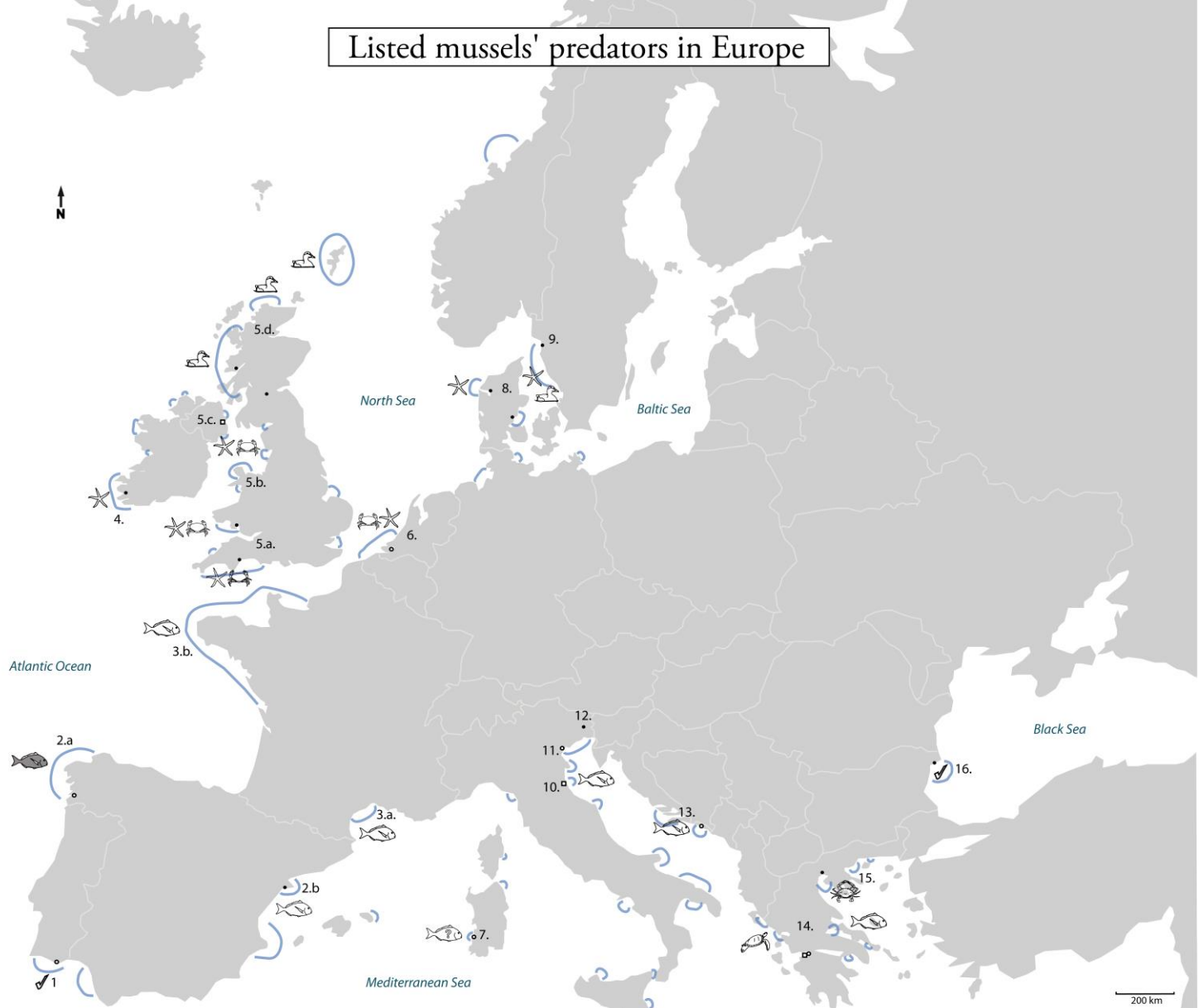


high biofouling biomass – reduced lateral water transport – negative impact on mussel growth

- Net barriers



Listed mussels' predators in Europe



Legends

Context

Area of mussels exploitation

Listed predators

- Predation by Sparus orata
- Predation by Spondylus orata

Situation by areas :

- 1. South of Portugal : No predation problem. High food availability supplies species' needs.
- 2.a. North-West of Spain : Mussels' seed are preyed on by Spondylus orata. Mussel growers use nets on raft to protect mussels from fishes.
- 2.b. Elbe's deltas : Mussels are preyed on by Sparus orata. Mussel growers use nets for 6 months until mussels reach...
- 3.a. ...
- 3.b. ...
- 4. ...
- 5.a. ...
- 5.b. ...
- 5.c. ...
- 5.d. ...
- 6. ...
- 7. ...
- 8. ...
- 9. ...
- 10. ...
- 11. North-East of Italy : Population of gilthead sea bream is increasing. Mussels farms aren't threatened but coasts fishermen protect young clams against it.
- 12. Veneto region : Mussels are preyed on by Sparus orata. Mussel growers are associated with fishermen to solve the problem and it's effective.
- 13. Croatia : Mussels are preyed on by Sparus orata. No solution have...
- 14. ...
- 15. ...
- 16. ...

5.b. Wales : Mussels are preyed on by starfishes and little crabs. No solutions has been found.

5.c. Northern Ireland : Mussels are preyed on by starfishes. Solutions have been developed with starfishes mop.

5.d. North-West of Scotland : Mussels are preyed on by starfishes and eider ducks. Mussel growers use acoustic repellents against birds which is effective.

OBSERVATIONS AND CONCLUSIONS:

- Strong trophic connectivity between seabream and mussel farms
- Mussels - dominant prey item for gilthead seabream - take advantage of mussel farms that provide a highly abundant and easily accessible food source
- In respect to mussel farm losses, average mussel damage observed in first week of rope deposition amounted to 54% of the initial recruitment inputs
- Mussel losses caused by predation showed seasonal variability
- Zotechnical activities at farm should be performed in the colder period of the year when the predation activity is less pronounced
- New protecting methods are needed (underwater sound repellent against seabream or allowing species targeted fishing in mussel farming area) for supporting farm management stability.





