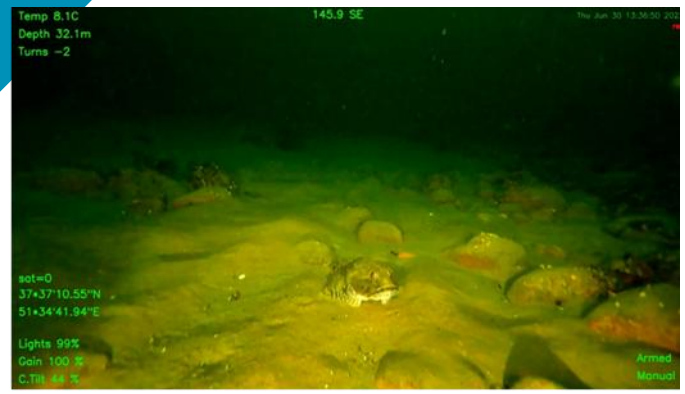
Field observations for cumulative pressure, impact and ecosystem functioning and service supply analysis

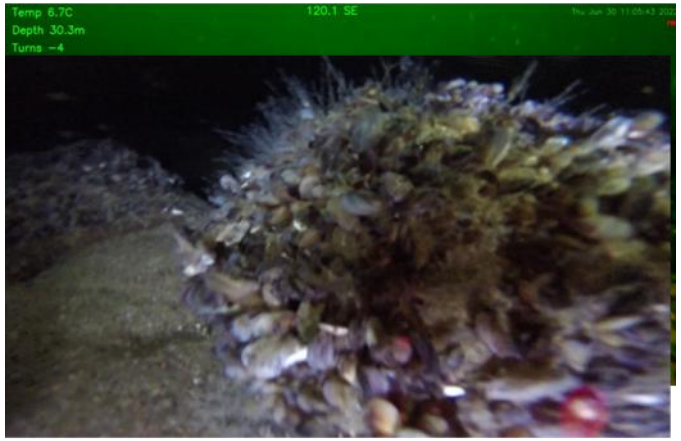
Aurelija Armoskaite, Ingrīda Andersone, Solvita Strāķe, Sandra Sprukta, Ieva Bārda

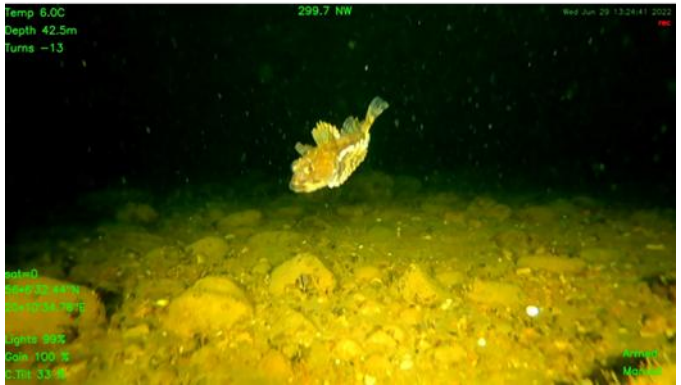
Latvian Institute of Aquatic Ecology

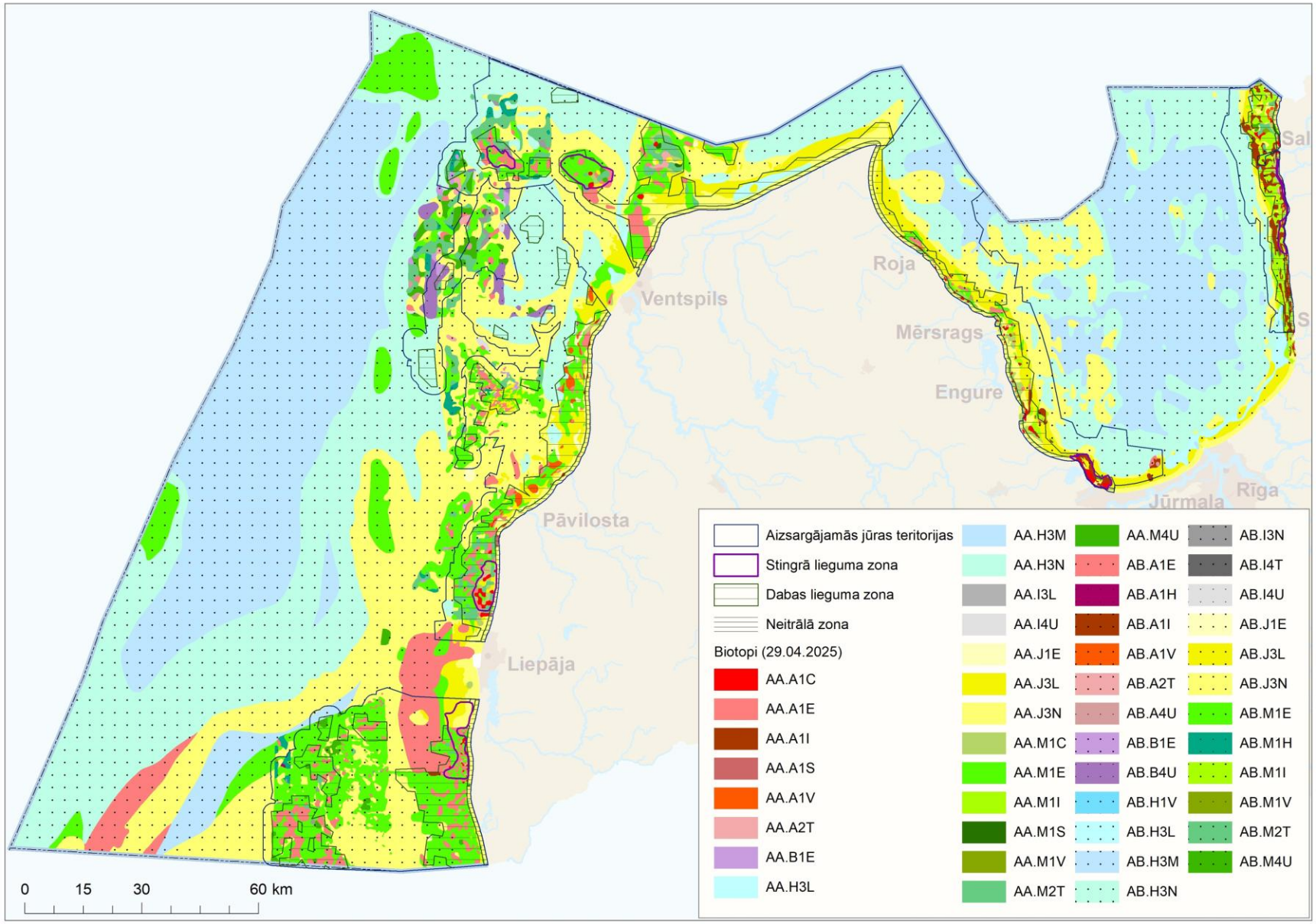
reef.daba.gov.lv

Understanding ecosystem state – species, habitats and the functions they perform



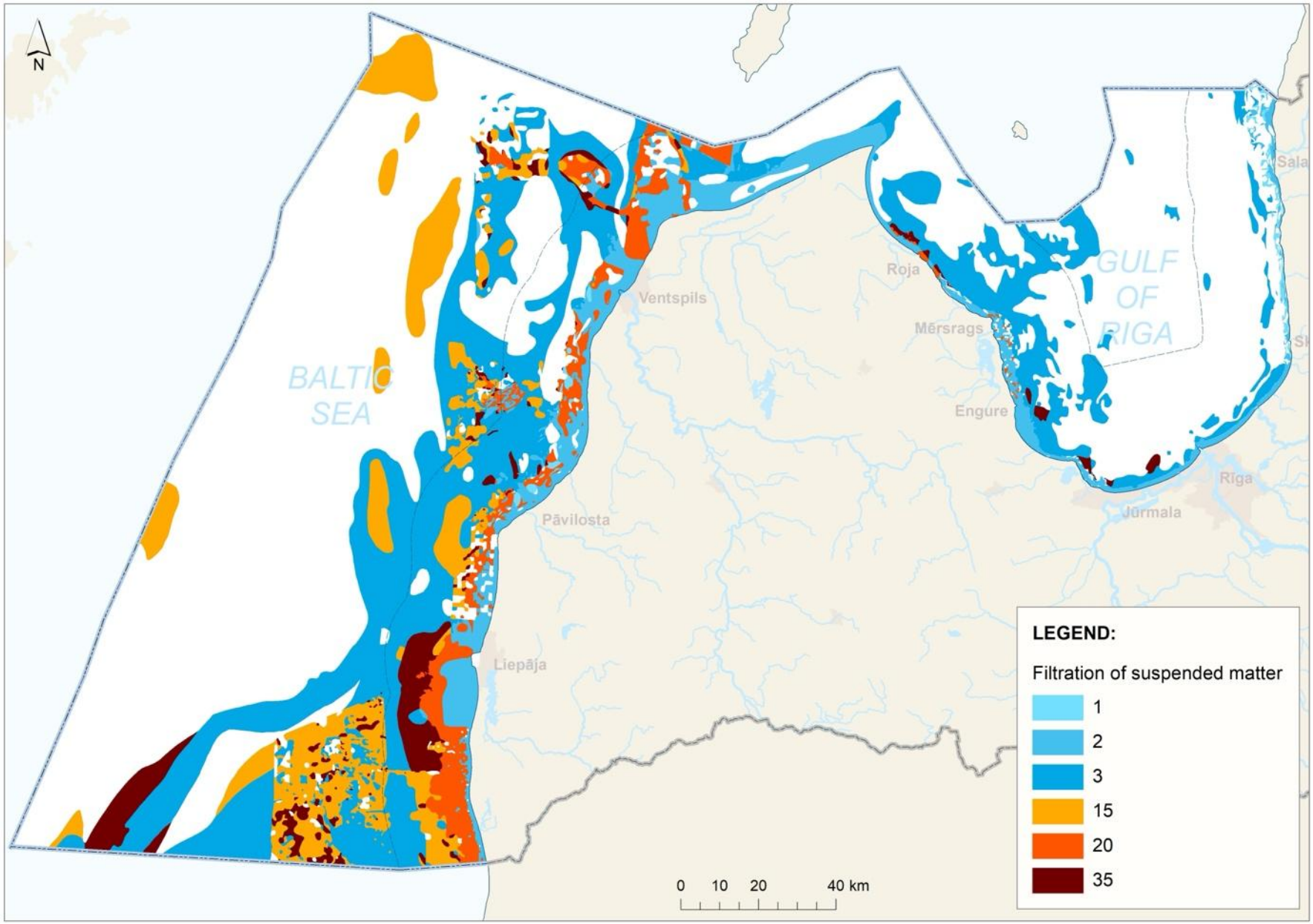






Ecosystem Functions

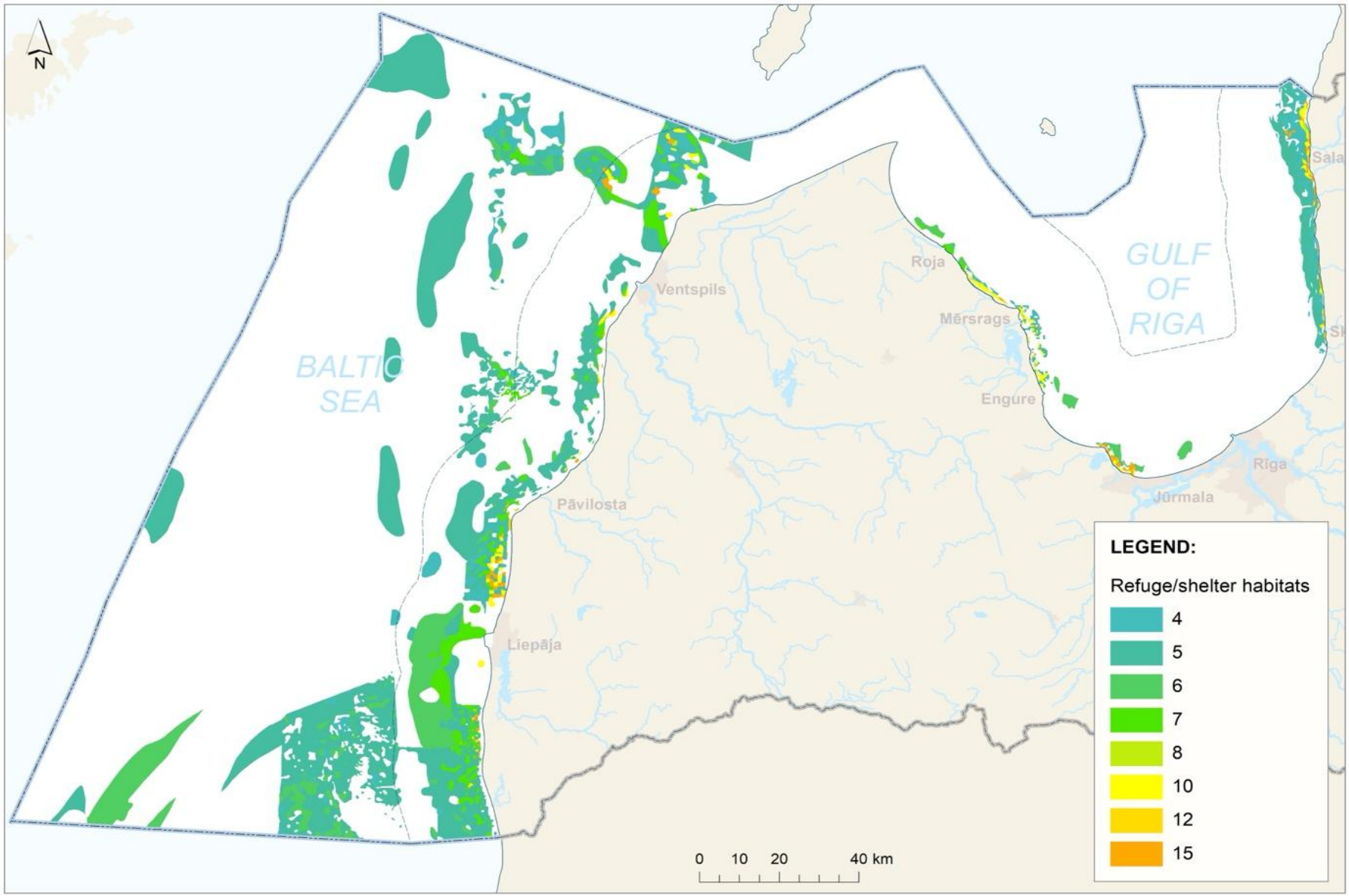
- Areas essential for the filtration of suspended matter.
- Filtration is performed mainly by bivalves, found on hard, mixed and, at times, soft substrates in photic and aphotic conditions



Ecosystem Functions

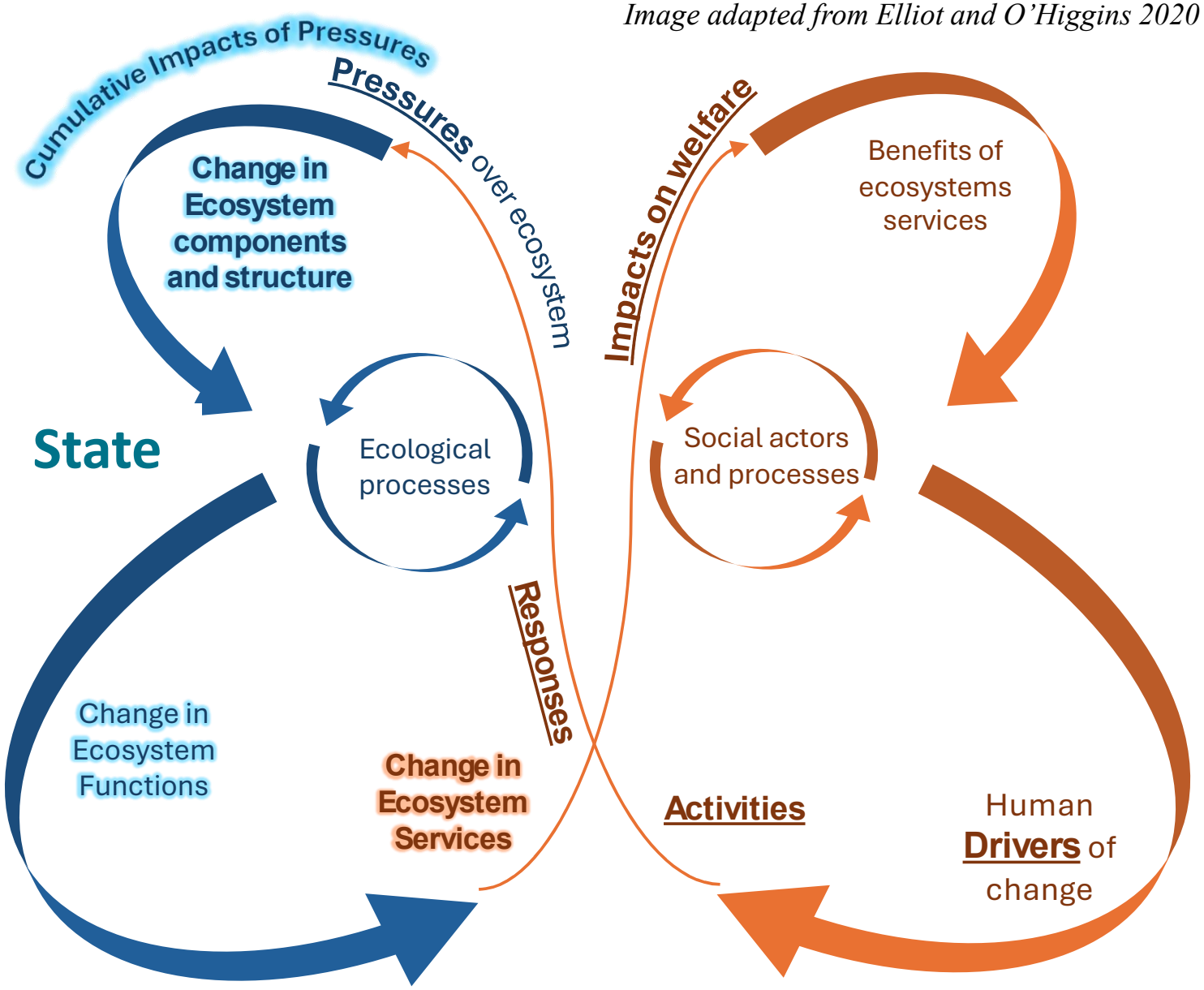
- Important refuge and shelter areas created by benthic habitats.

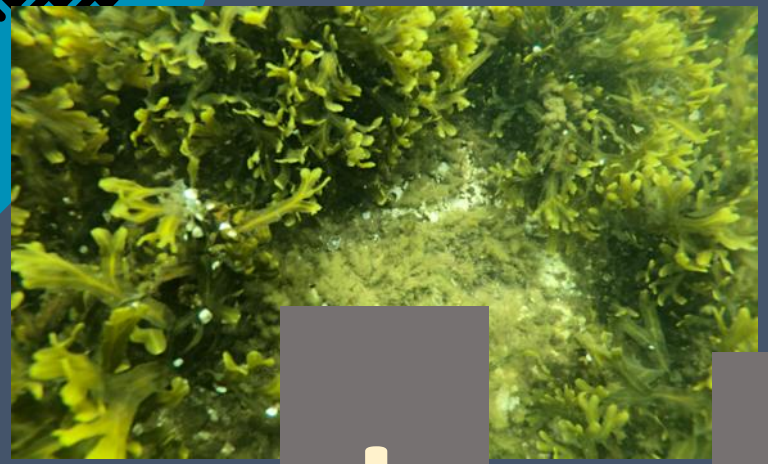
- These are primarily
- photic and aphotic hard and mixed substrate benthic habitats, the most important of which are characterised by perennial algae



The state of the ecosystem is part of the bigger picture!

Image adapted from Elliot and O'Higgins 2020





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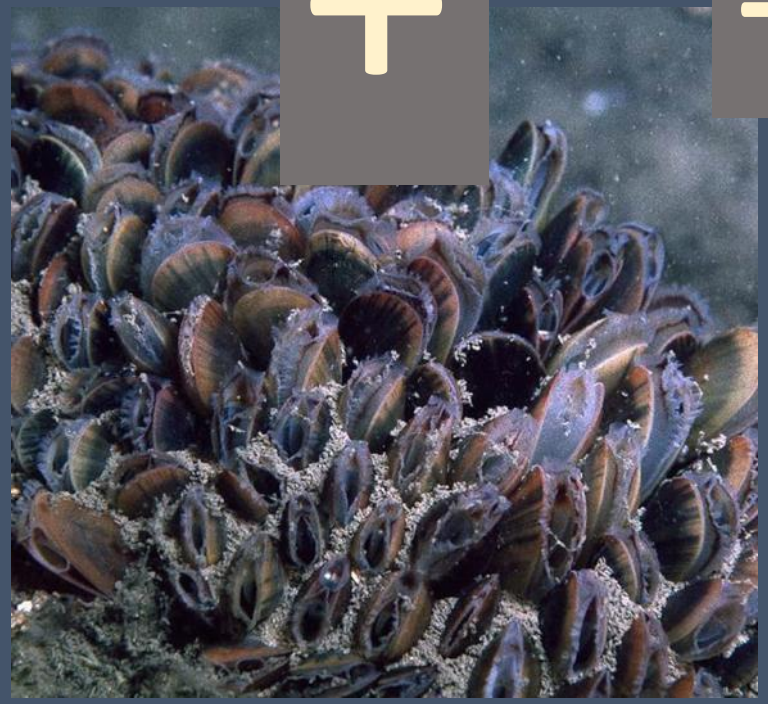

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Nutrient regulation by incorporation in biomass

Exploring a wider range of relationships and developing linkage chains

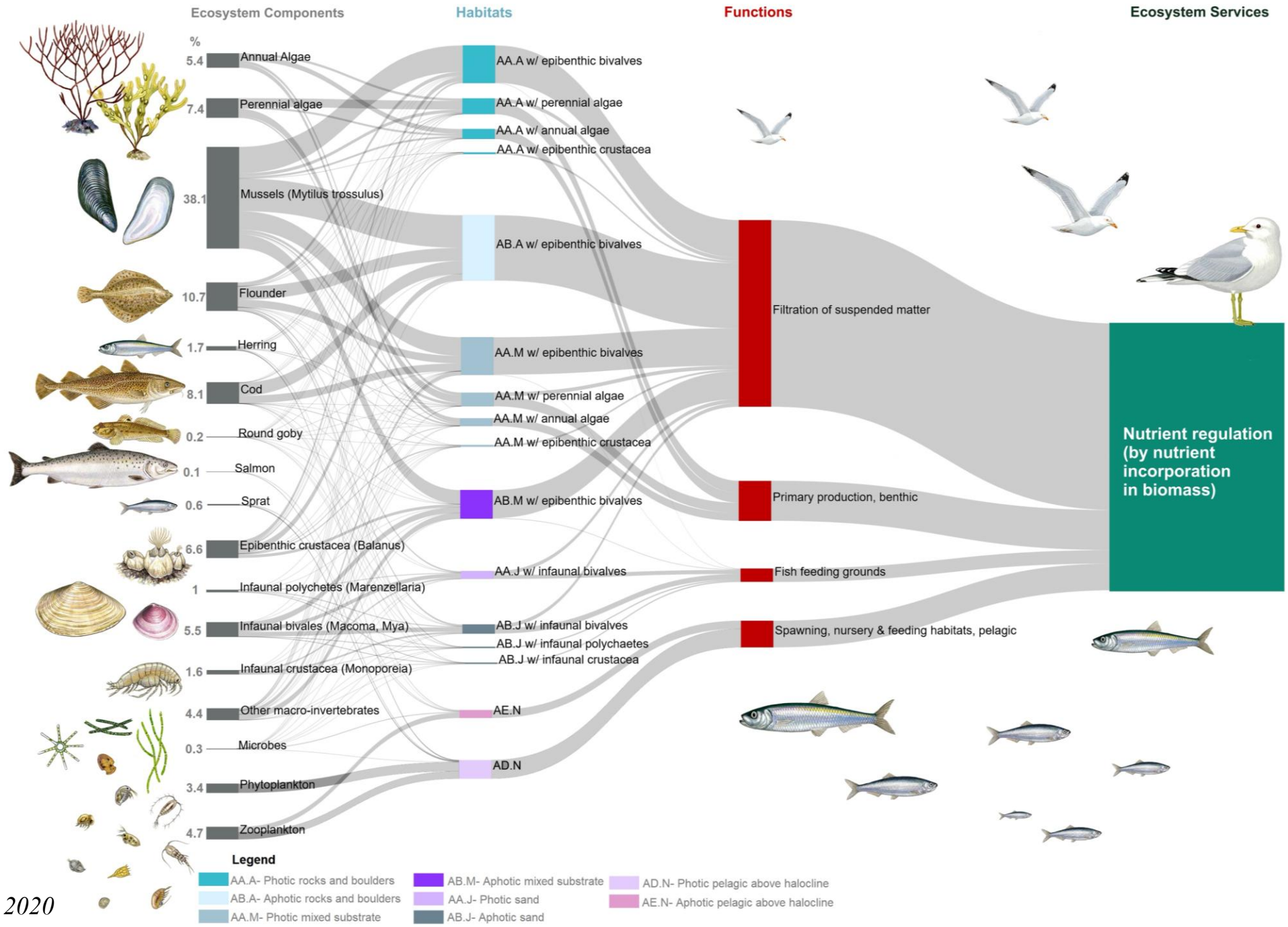
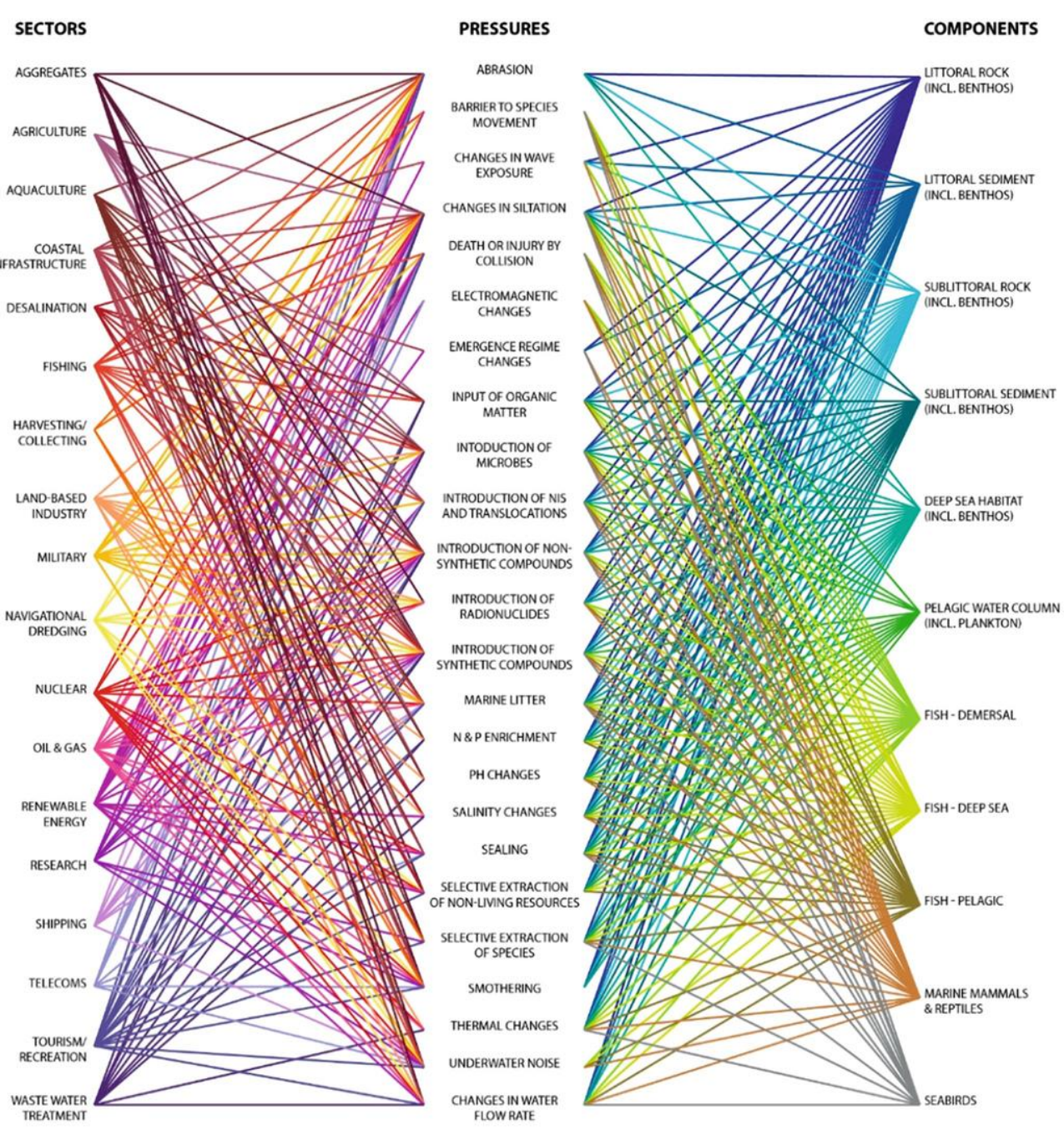
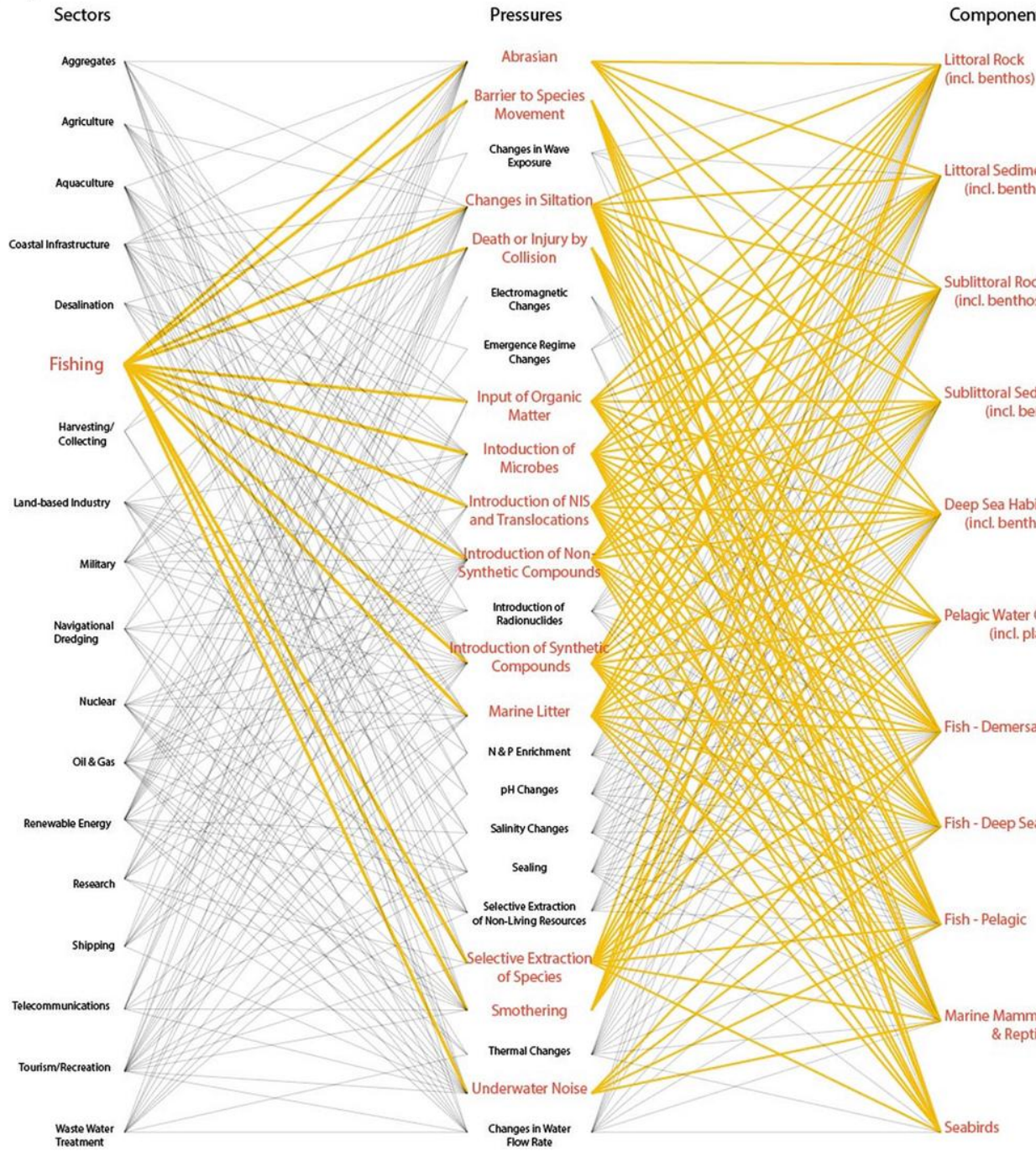


Image adapted from Armoskaite et al. 2020

(b)

Image source: Robinson et al. 2014 cited in Culhane et al.2020





Prominent pressures and activities in the Latvian Coastal Zone and the EEZ

- Eutrophication
- Invasive species
- Hazardous substances
- Species extraction
- Physical disturbance – infrastructure development (e.g. offshore wind farms) and fishing

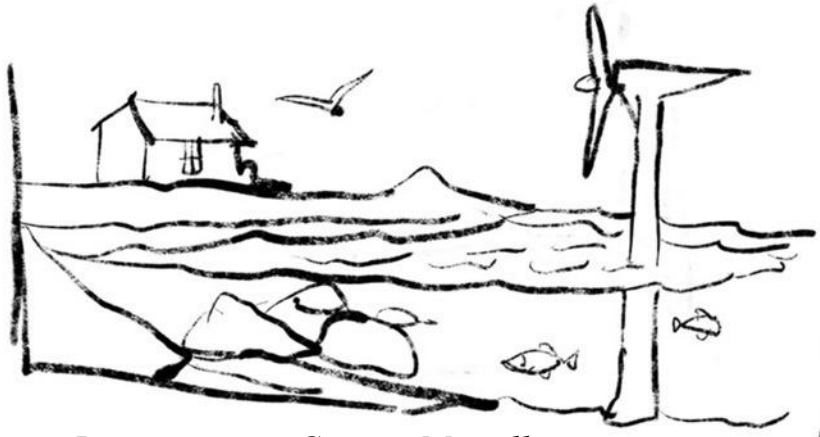
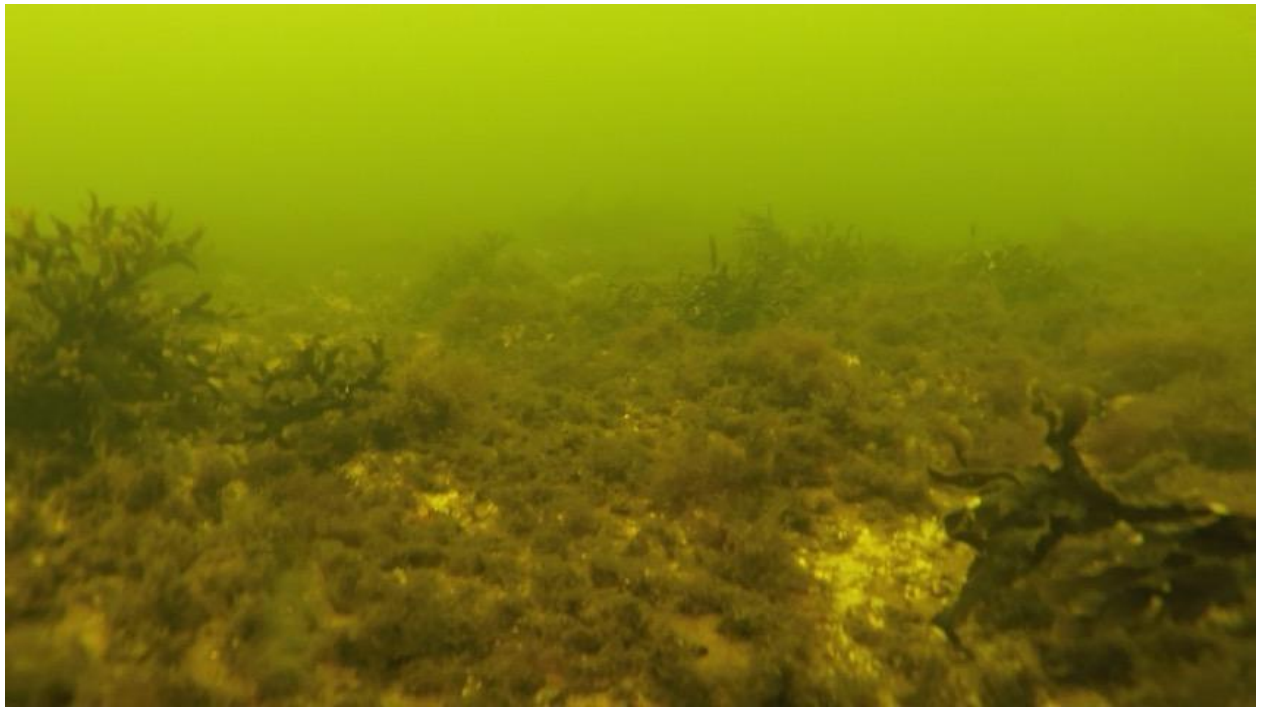


Image source: Cosimo Miorelli

Image source: Solvita Strake



Which one of these, would you say, tells us that the ecosystem is providing us with more services?

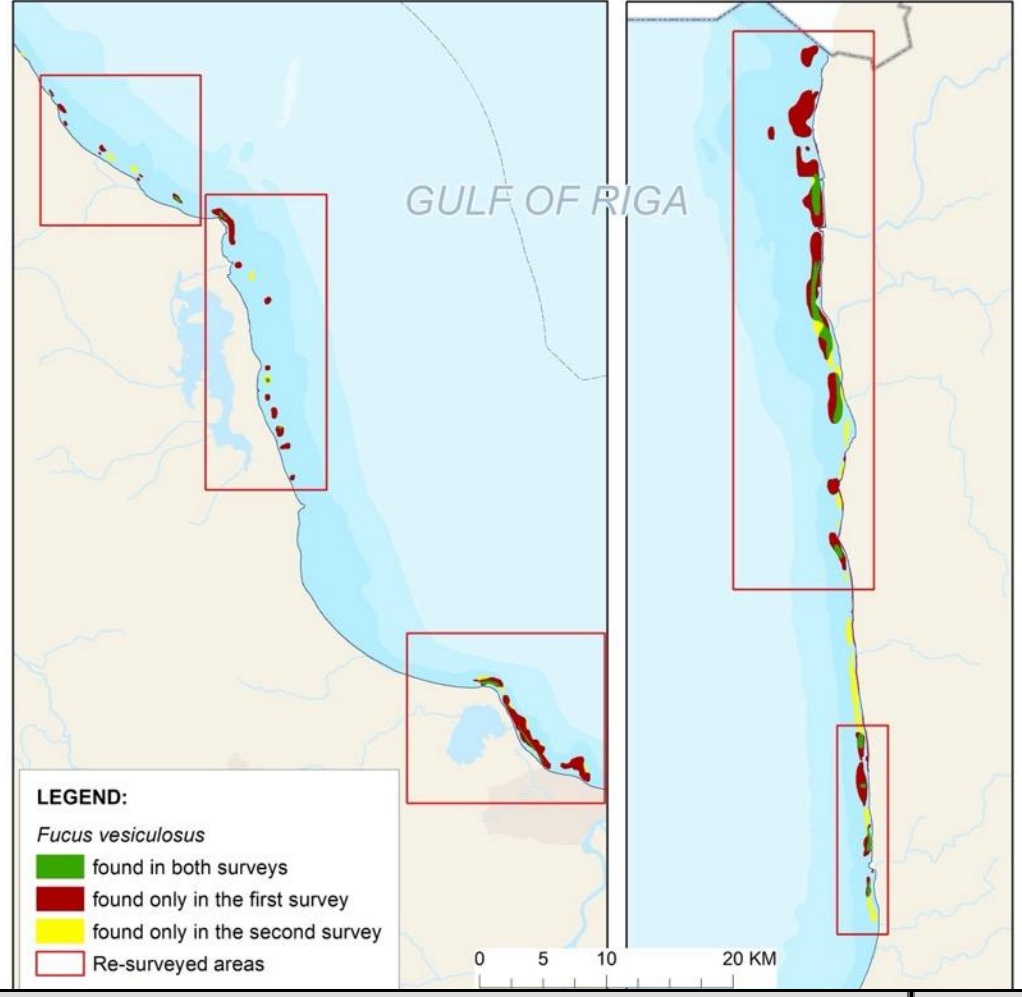
Image source: Solvita Strake

Beaches in Liepaja

Change in macroalage cover in the Gulf of Riga

The distribution of a key stony reef species, perennial macroalgae *Fucus vesiculosus*, in surveyed sites based on surveys before and after 2020.

MPA Western coast of the Gulf of Riga



MPA Eastern coast of the Gulf of Riga

MPA	Species	Area surveyed (ha)											Area before 2020 (ha)	Area after 2020 (ha)	Remaining cover %
		Cover % increase				Cover % decrease				Cover % unchanged					
		from 0 to <=1%	from 0 to >1%	from <=1% to >1%	total	from 0 to <=1%	from 0 to >1%	from <=1% to >1%	total	>1%	<=1%	0			
Eastern coast of the Gulf of Riga	Fucus	175,7	78,2	127,2	381,2	224,9	660,8	1175,8	2061,6	89,5	197,5	20180,2	2475,7	893,0	36%
Western coast of the Gulf of Riga	Fucus	67,1	36,1	25,6	128,8	107,4	408,6	265,7	781,8	187,8	67,0	12547,6	1062,1	491,0	46%

Change in ecosystem functioning and service supply in the Gulf of Riga

Relative decrease in ecosystem functioning and service supply due to decreased perennial algae across the Eastern coast of the Gulf of Riga to 36% of cover and the Western coast of the Gulf of Riga to 46% cover

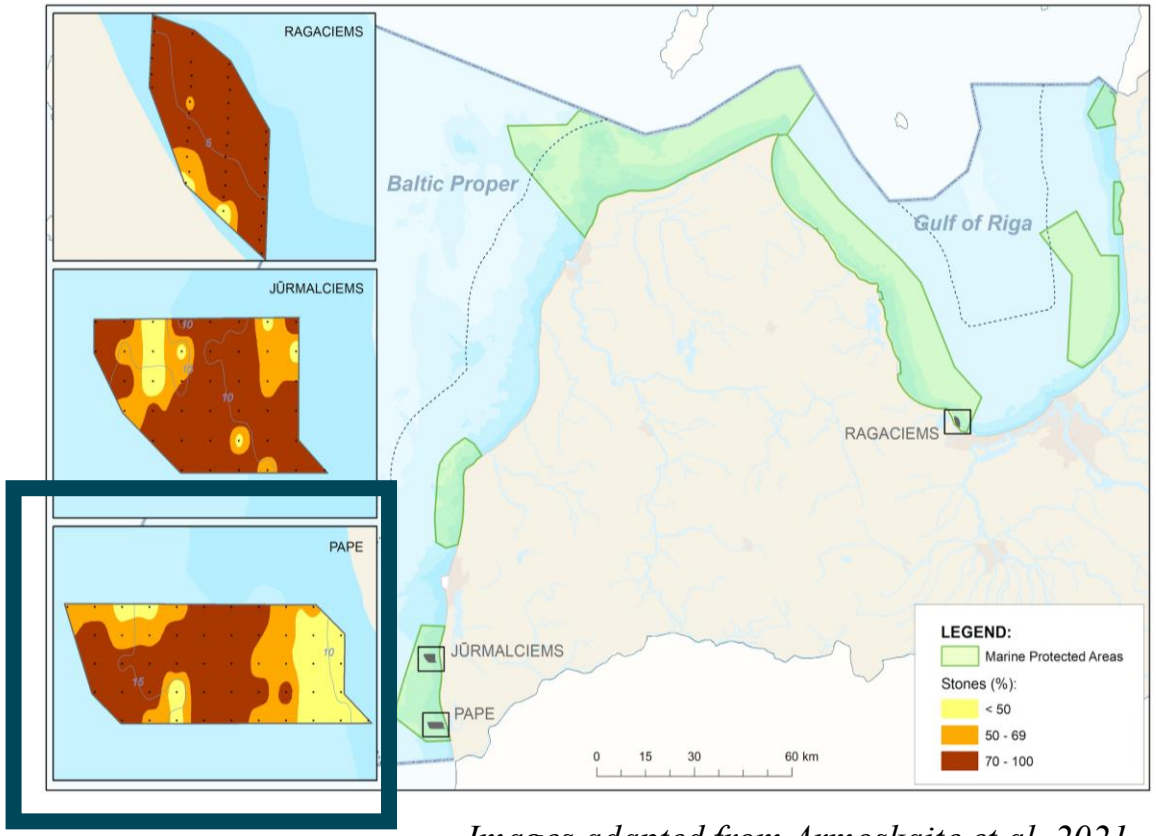
	Ecosystem function and service type	Change (%) AJT Rīgas līča austrumu piekraste	Change (%) AJT Rīgas līča rietumu piekraste
Functions	Spawning & nursery habitats, benthic	-35,22	-29,71
	Spawning, nursery & feeding habitats, pelagic	0,00	0,00
	Refuge/shelter habitats	-8,81	-7,44
	Primary production, benthic	-88,67	-74,81
	Primary production, pelagic	0,00	0,00
	Fish feeding grounds	0,00	0,00
	Filtration of suspended matter	-4,83	-4,08
	Transport of materials & dispersal	0,00	0,00
	Accumulation of materials	0,00	0,00
	Microbial transformations	-0,67	-0,56
Regulation and maintenance services	Nutrient regulation (by denitrification)	-0,48	-0,40
	Nutrient regulation (by N, P burial)	0,00	0,00
	Nutrient regulation (by nutrient incorporation in biomass)	-4,72	-3,99
	Nutrient regulation (by N assimilation)	0,00	0,00
	Hazardous substances accumulation & transformation	-2,06	-1,74
	Physicochemical retention of pollutants	0,00	0,00
	Carbon sequestration	-2,96	-2,50
Provisioning services	Wild plants	-24,98	-21,07
	Plant energy	-24,98	-21,07
	Materials from algae	-24,98	-21,07
	Wild fish, pelagic- herring	-8,81	-7,43
	Wild fish, pelagic- sprat	-0,07	-0,06
	Wild fish, benthic-flounder	-10,15	-8,57
	Wild fish, benthic- cod	-1,69	-1,43
	Wild fish, benthic-round goby, ealpout	-12,46	-10,51
	Fishmeal	-6,44	-5,44
Cultural services	Water environment for recreation	-0,77	-0,65
	Water environment for science & education	-6,11	-5,16
	Water environment for cultural & historical heritage	-0,06	-0,05
	Water environment for spiritual experience	-0,42	-0,35
	Existence of habitats & species	-5,65	-4,77
	Water environment for enjoyment of seascape	-0,40	-0,33

Biotopes

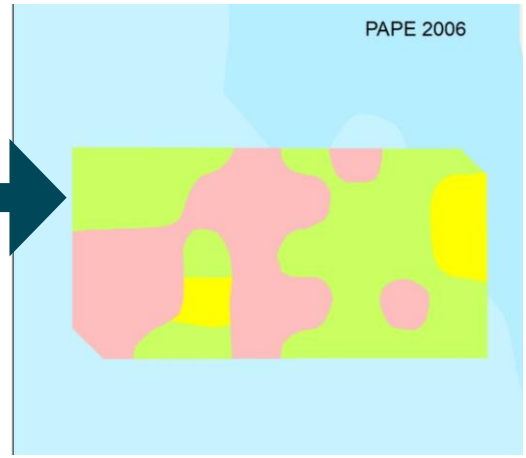
Hard substrate characterised by
- perennial macroalgae (AA.A1C)
- mussels (*Mytilus spp.*) (AA.A1E)
- barnacles (*Balanidea*) (AA.A1I)

Mixed substrate characterised by
- perennial macroalgae (AA.M1C)
- annual macroalgae (AA.M1S)
- mussels (*Mytilus spp.)* (AA.M1E)
- barnacles (*Balanidea*) (AA.M1I)
- sparse epibenthic macrocommunity (AA.M2T)

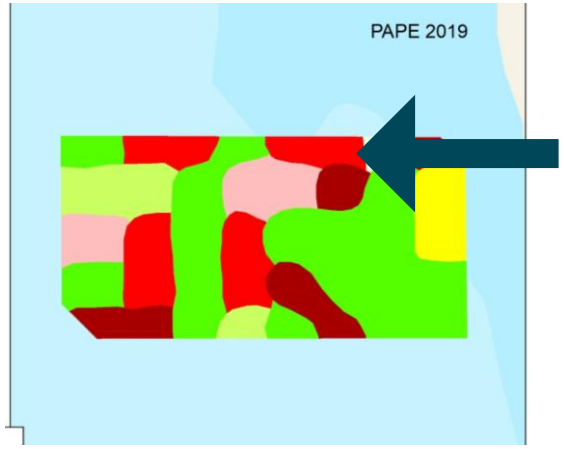
Sand characterised by
- Infaunal bivalves (AA.J3L)



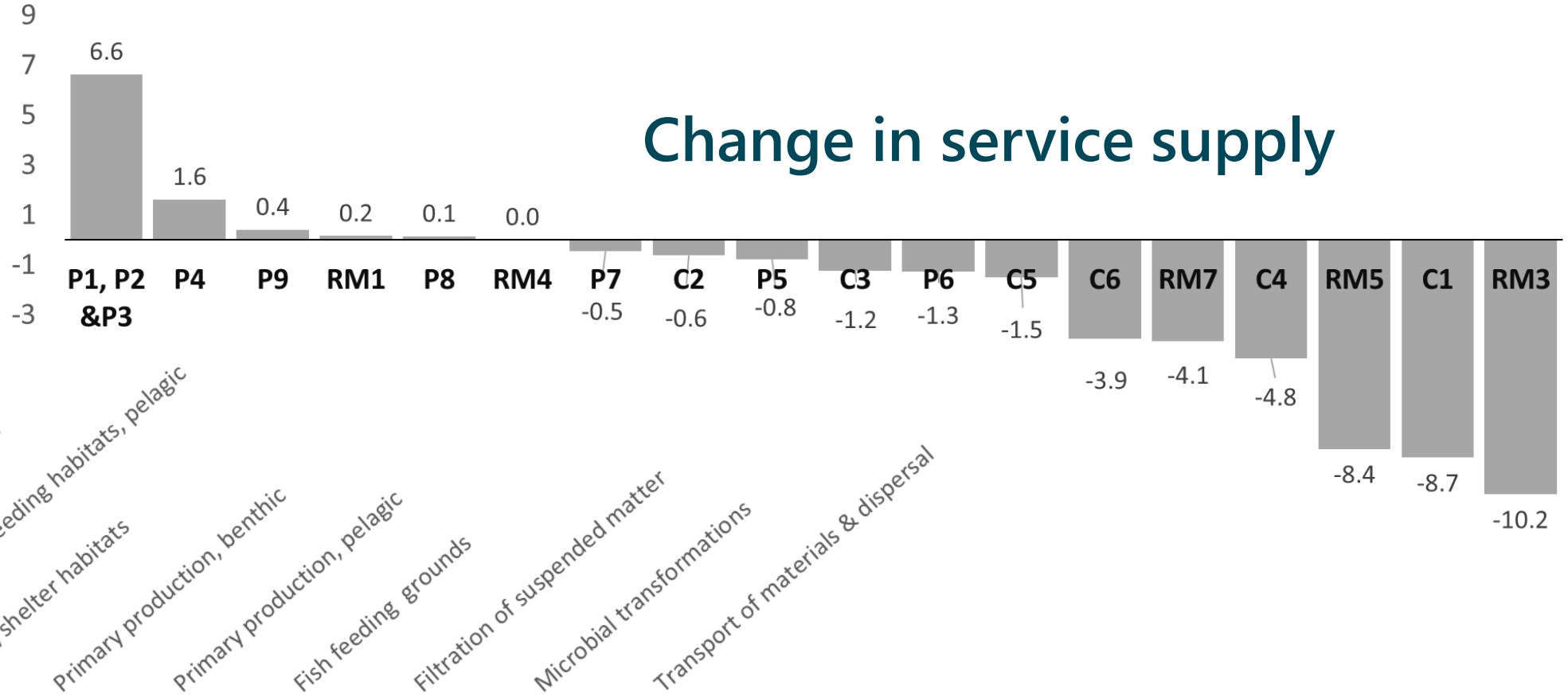
Images adapted from Armoskaite et al. 2021



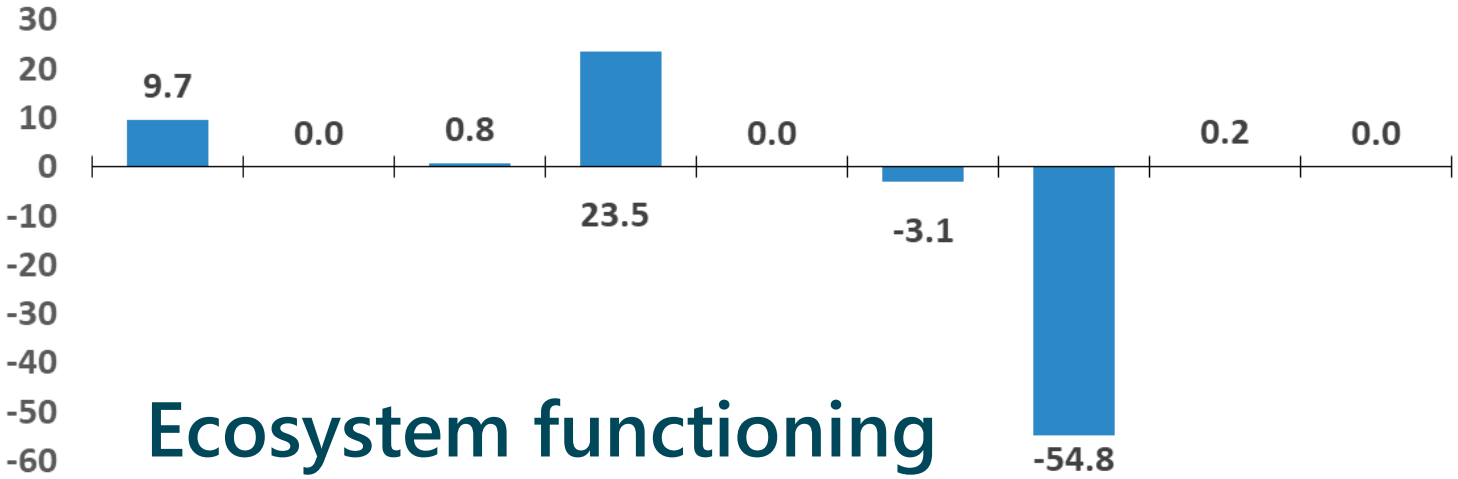
Change in habitat composition in Latvian protected stony reefs



Change in service supply



Ecosystem functioning



Images adapted from Armoskaite et al. 2021

Cumulative pressure, impact and change in ecosystem service supply analysis

Cumulative Impact Analysis (Halpern et al. 2008)

Ecosystem Service Supply Analysis (Armoskaite et al. 2023)

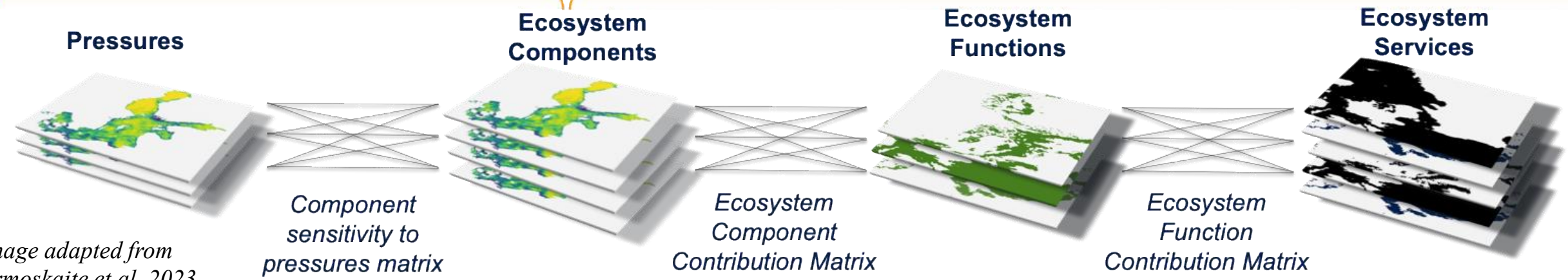


Image adapted from Armoskaite et al. 2023

! For those interested in the methodology - there is a poster in the room.

Thank you!

Aurelija Armoskaite, PhD
Latvijas Hidroekoloģijas institūts
Voleru iela 4, Riga, Latvia

aurelija.armoskaite@lhei.lv

reef.daba.gov.lv

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