Welcome to the CERES & ClimeFish Policy Session with EC & REA

Online conference Thursday 11th of June at 10.00 CEST

Advice for the meeting:

- Please, mute your microphone
- Turn off your video after you presented yourself
- Use the chat function for questions and comments (and don’t raise hand)

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Welcome to the CERES & ClimeFish Policy Session with EC & REA

Agenda:

- 10.00-10.05 Sign-in, switch off your camera and mute your microphone after you say hello
- 10.05-10.20 Welcome and goals for the meeting (Zampoukas, DG RTD)
- 10.20-10.40 Marine aquaculture (Aschan, Papandroulakis, Peck)
- 10.40-11.00 Freshwater (Peck, Aschan)
- 11.00-11.10 Stretch your legs and fetch a coffee
- 11.10-11.30 Marine fisheries (Aschan, Peck)
- 11:30-11:40 General conclusions and advice (Peck, Aschan)
- 11.40-11.50 Arctic impact on weather and climate, Blue-Action, (Payne, DTU)
- 11.50-12.00 Closing remarks (Zampoukas, DG RTD)

Policy Session:
BG-02-2015 - Forecasting and anticipating effects of climate change on fisheries & aquaculture

Climate change and European aquatic RESources

March 2016
26 partners
678193

CERES

Prof. Myron A. Peck
University of Hamburg

Co-creating a decision support framework to ensure sustainable fish production in Europe under climate change

April 2016
21 partners
677039

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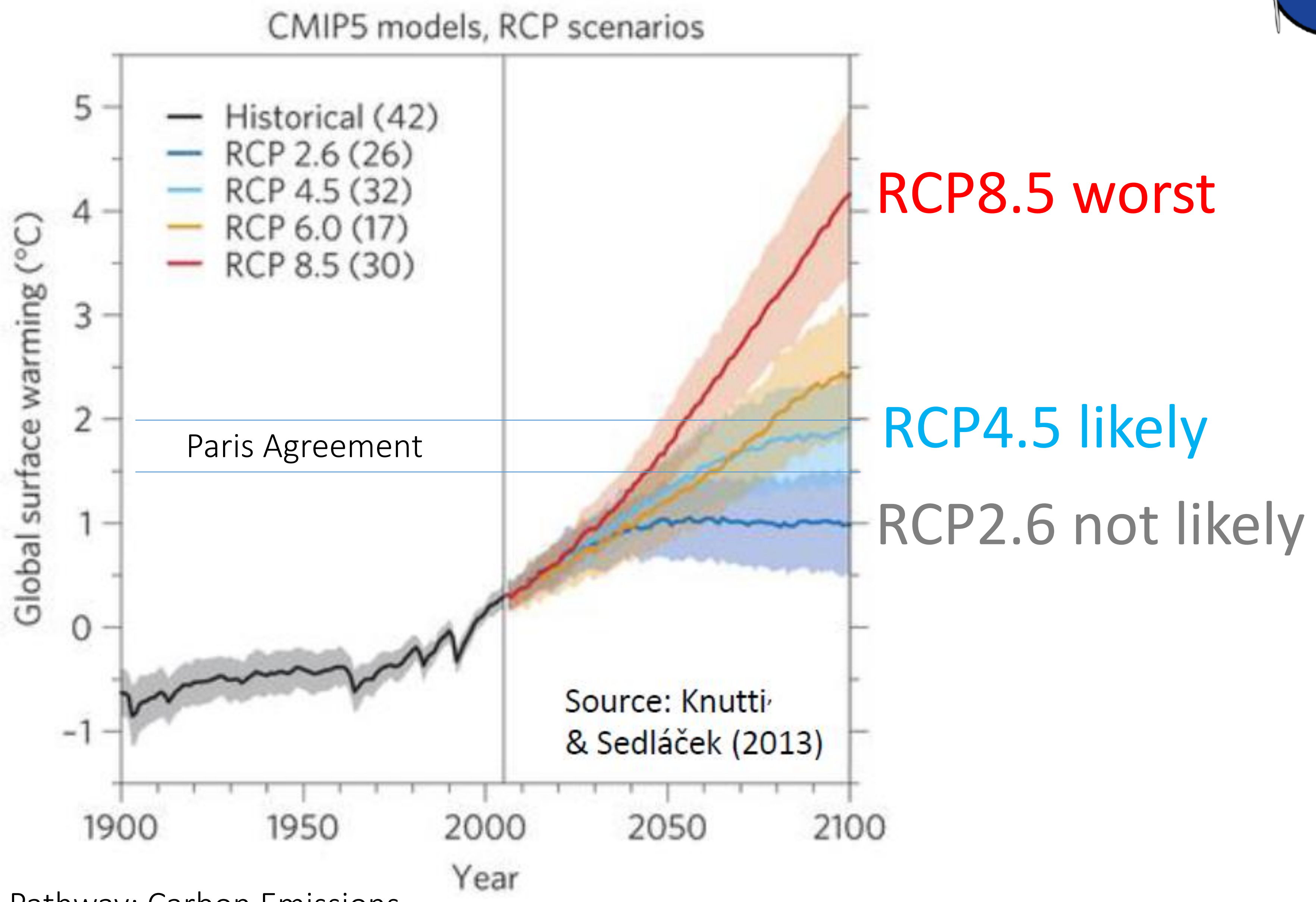
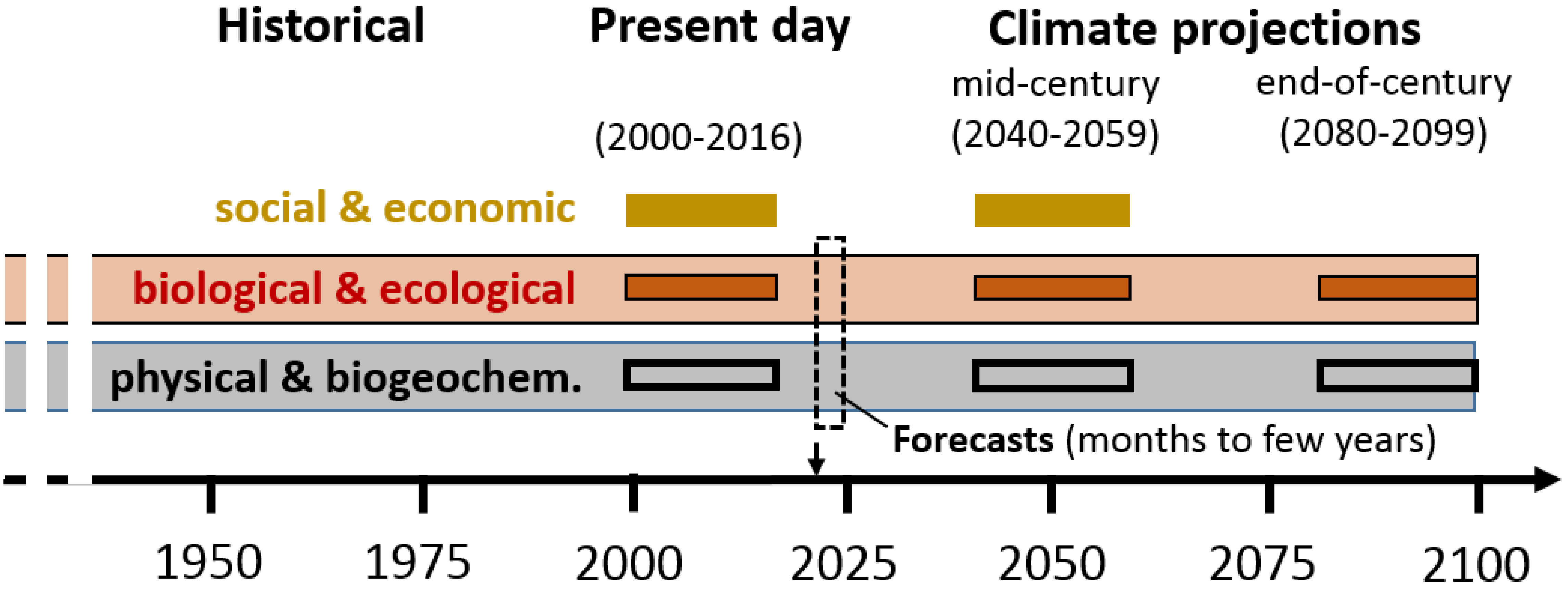
Prof. Michaela Aschan
UiT The Arctic University of Norway

European Commission – Online 11th June 2020

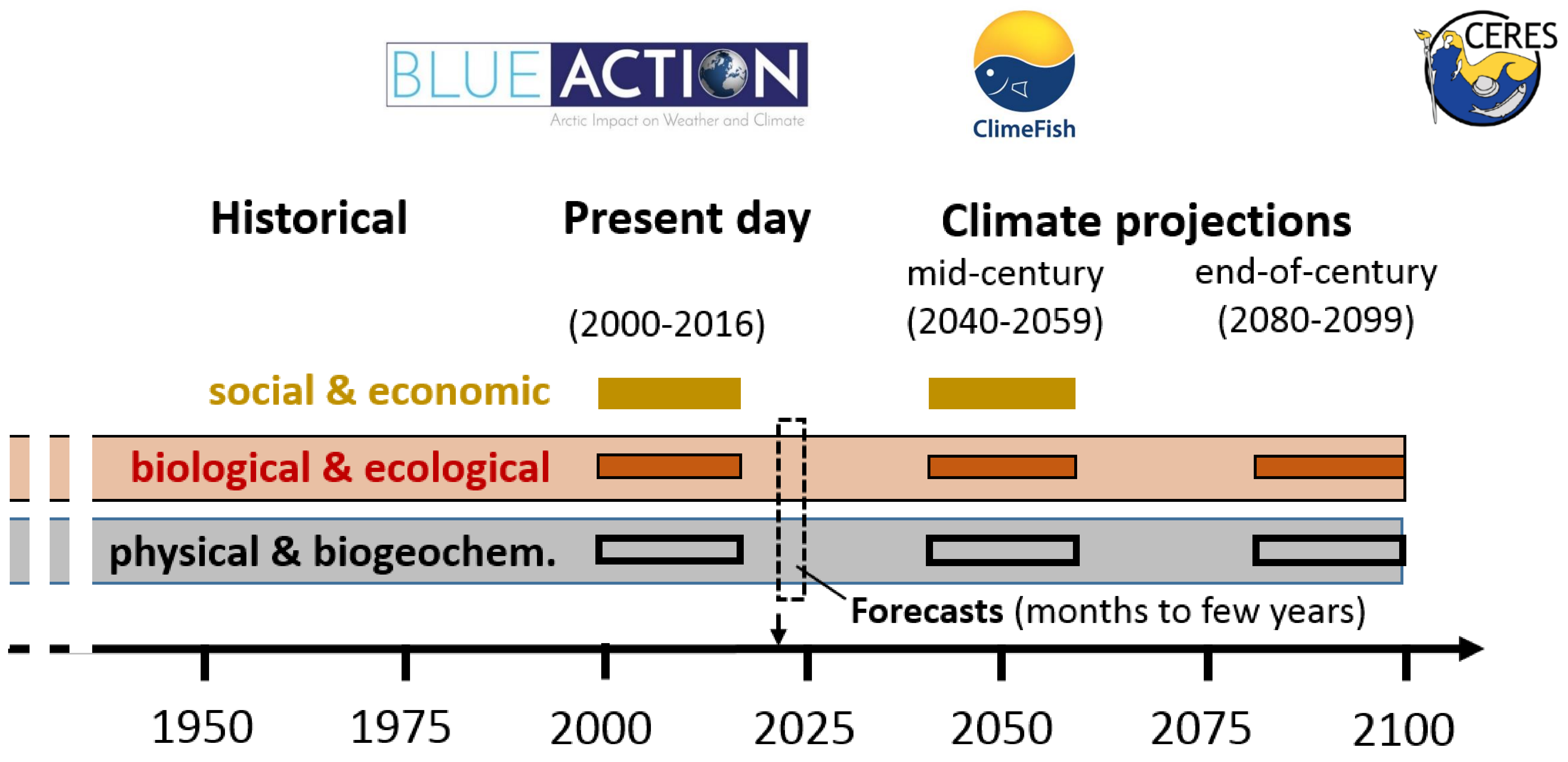
Two IPCC Scenarios (RCP4.5 and RCP8.5)



Representative Concentration Pathway: Carbon Emissions



Historical
Present day
Climate projections
mid-century
end-of-century
(2000-2016)
(2040-2059)
(2080-2099)
social & economic
biological & ecological
physical & biogeochem.
Forecasts (months to few years)
1950
1975
2000
2025
2050
2075
2100



BLUE ACTION
Arctic Impact on Weather and Climate
ClimeFish
CERES
Historical
Present day
Climate projections
mid-century
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(2000-2016)
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Forecasts (months to few years)
1950
1975
2000
2025
2050
2075
2100

CERES Storylines (ceresproject.eu)

#1 Rainbow trout in north-east Europe

#2 Rainbow trout in the eastern Mediterranean

#3 Carp in north-east Europe

#4 Pike-perch in south-east Europe

#5 Mussels in the North Sea

#6 Oysters in the North Sea

#7 Mussels in the Atlantic coast

#8 Oysters and clams in the Atlantic coast

#9 Mussels in the Mediterranean

#10 Salmon in the north-east Atlantic

#11 Meagre at the Atlantic coast

#12 Seabass and seabreem in West Med and European south Atlantic

#13 Seabass and seabreem in the eastern Mediterranean

#14 Herring, capelin, and cod in the Barents and Norwegian Seas

#15 Herring, sprat and cod in the Baltic Sea

#16 Herring in the North Sea

#17 Gadoids in the North Sea

#18 Mackerel in the north-east Atlantic

#19 Flatfish in the North Sea and north-east Atlantic

#20 Dolphinfish in the north-west Mediterranean

#21 Sardines and anchovies in the Bay of Biscay

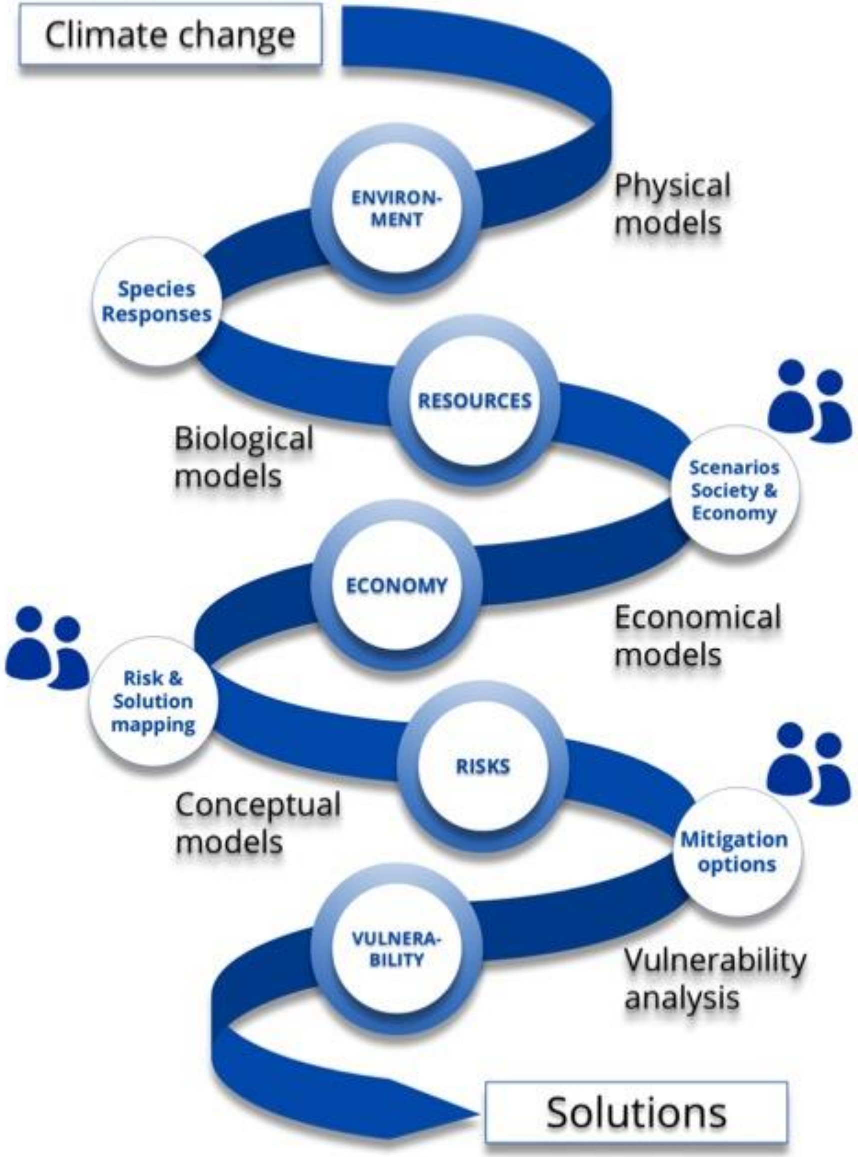
#22 Sardines and anchovies in the north-west Mediterranean

#23 Hake in the Aegean Sea and eastern Mediterreanean

#24 Bluefin Tuna in the north-west Mediterranean

Physics / biogeochemistry → Ecology ↔ Economics ↔ Sociology

CERES Storylines (ceresproject.eu)

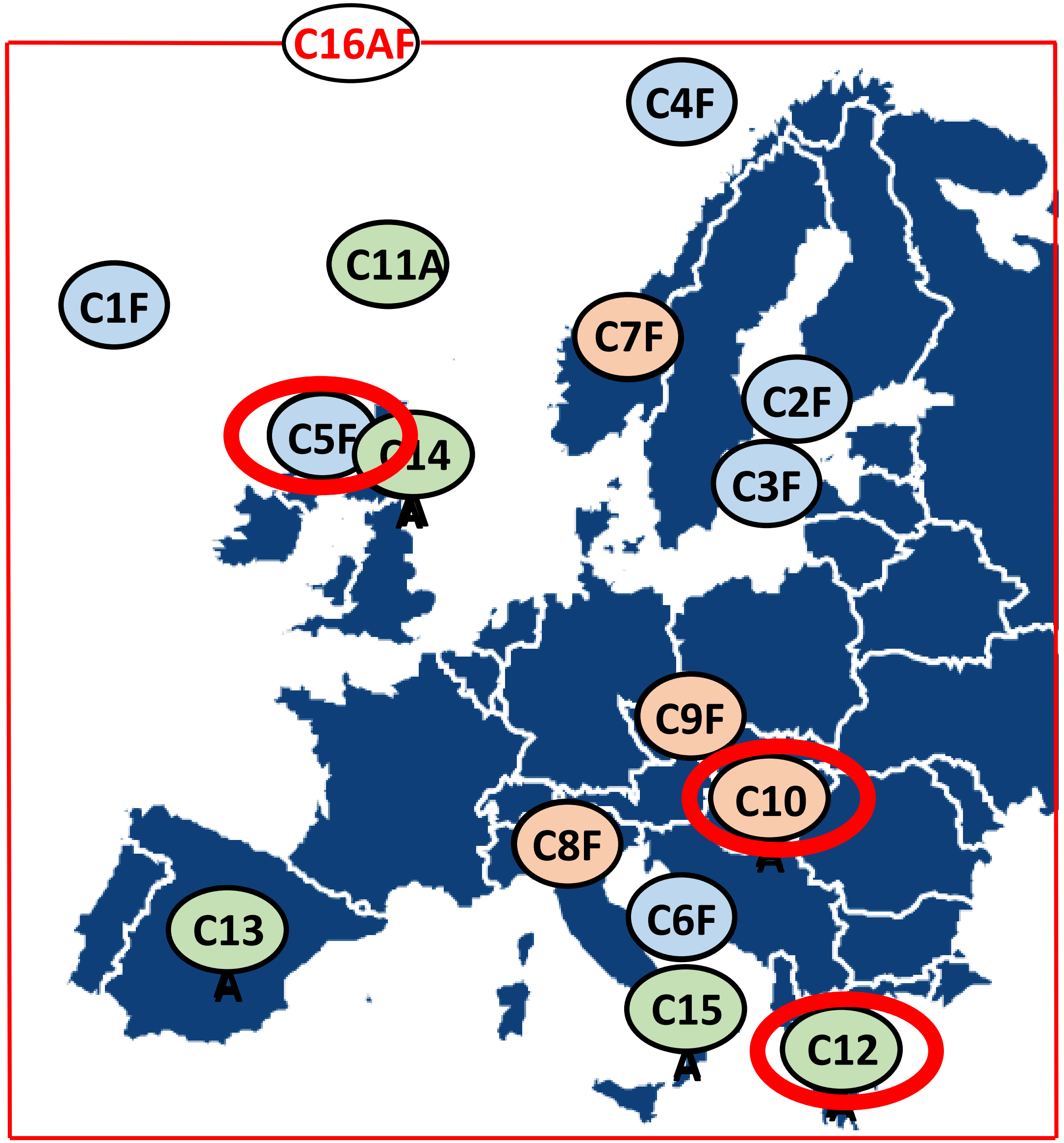


ClimeFish Case Studies in 3 sectors

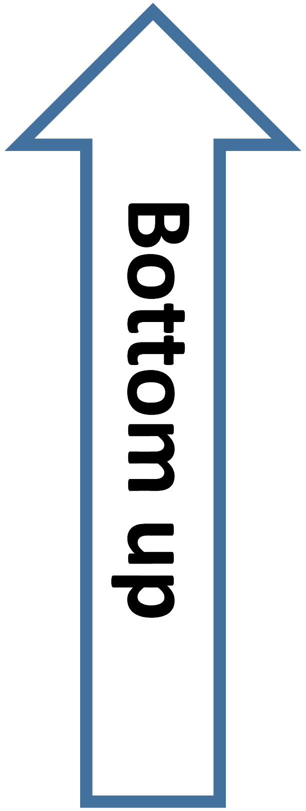
Fisheries

Aquaculture

Lakes and ponds



European level



Case study level

ClimeFish

European Union´s
:tion under grant

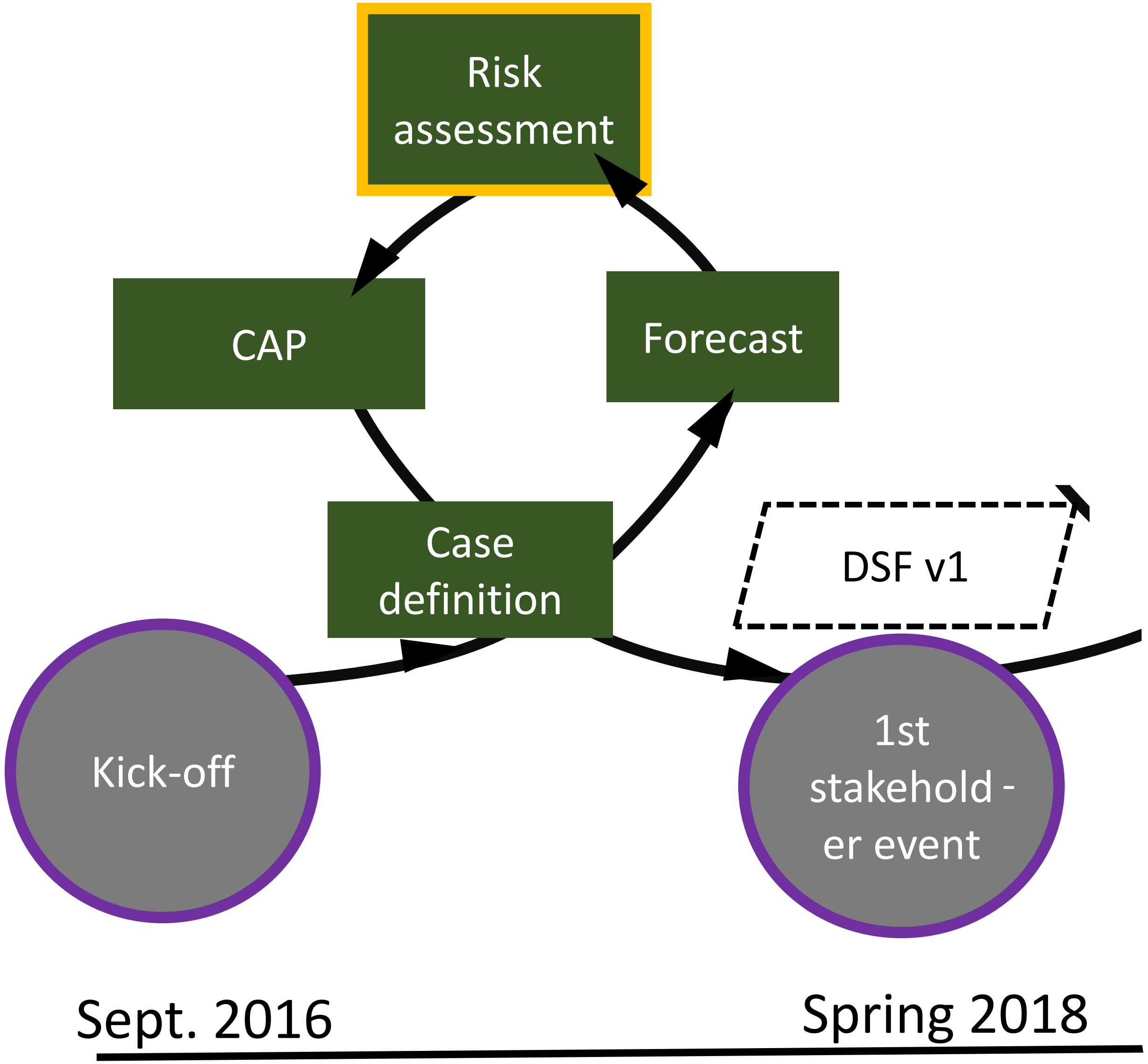
Seafood Sectors and ClimeFish Case Studies

Fisheries	Lakes and Ponds	Aquaculture
Northeast Atlantic Pelagic Fisheries	Hungarian Pond Production	Northeast Atlantic: Marine Aquaculture
West of Scotland: Demersal fisheries	Lake Garda Fisheries	Greece: Marine Aquaculture
		Shellfish production in Galicia

ClimeFish

This project has received funding from the European Union´s Horizon 2020 research and innovation action under grant agreement no. 677039

ClimeFish Decision Support Framework developed with stakeholders



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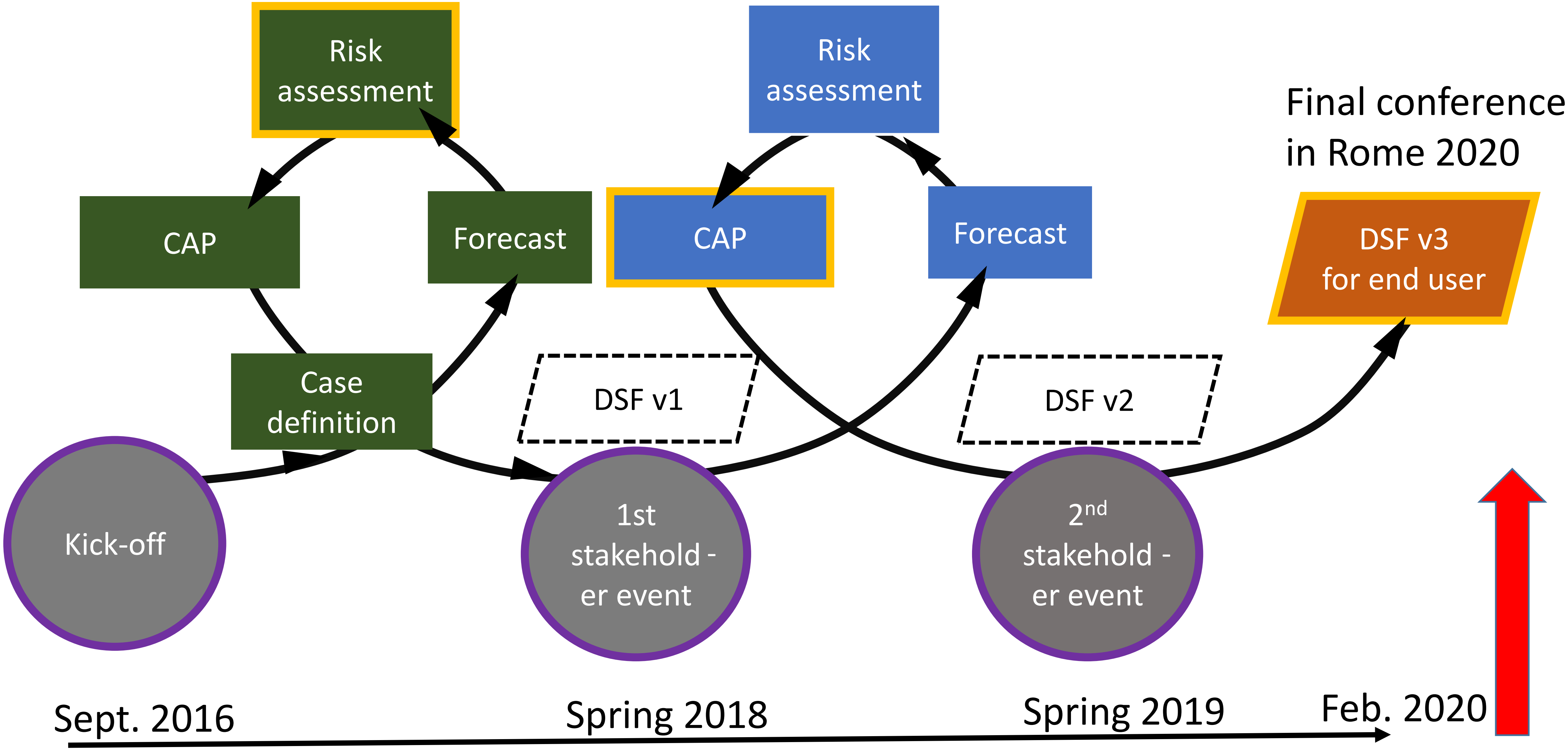

What was included in ClimeFish models?

			C1F	C2F	C3F	C5F	C6F	C7F	C8F	C9F	C10A	C11A	C12A	C13A	C14A	C15A
stressors/drivers	climate-related	Sea level rise	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap
		wind (including storms)	Modelled	Modelled	Modelled	Knowledge gap	Knowledge gap	Considered	Modelled	Knowledge gap	Modelled	Knowledge gap	Modelled	Modelled	Knowledge gap	Knowledge gap
		temperature	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled
		heat waves	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Knowledge gap	Modelled	Knowledge gap	Knowledge gap	Considered	Considered	Knowledge gap	Knowledge gap	Knowledge gap
		salinity	Modelled	Modelled	Modelled	Knowledge gap	Knowledge gap	Not applicable	Not applicable	Not applicable	Not applicable	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap
		dissoved oxygen	Modelled	Modelled	Modelled	Knowledge gap	Knowledge gap	Knowledge gap	Considered	Knowledge gap	Modelled	Knowledge gap	Considered	Knowledge gap	Knowledge gap	Knowledge gap
		nutrients (eutrophication)	Modelled	Modelled	Modelled	Knowledge gap	Modelled	Not applicable	Considered	Considered	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap
		pH	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Not applicable	Not applicable	Not applicable	Not applicable	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap
		food availability	Modelled	Modelled	Modelled	Modelled	Modelled	Considered	Considered	Modelled	Modelled	Not applicable	Not applicable	Modelled	Modelled	Modelled
		invasions / HABs	Knowledge gap	Modelled	Modelled	Knowledge gap	Modelled	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap	Considered	Knowledge gap	Knowledge gap
		diseases / treatment	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Considered	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap
	managerial	fishing mortality	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Modelled	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
		feeding	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Modelled	Modelled	Modelled	Not applicable	Not applicable	Not applicable
		seeding/stocking time	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Modelled	Modelled	Modelled	Modelled	Knowledge gap	Modelled
		seeding/stocking den. /size	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Modelled	Not applicable	Modelled	Modelled	Knowledge gap	Knowledge gap	Knowledge gap	Knowledge gap

Legend: Modelled; Considered; Knowledge gap; Not applicable

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Aquaculture

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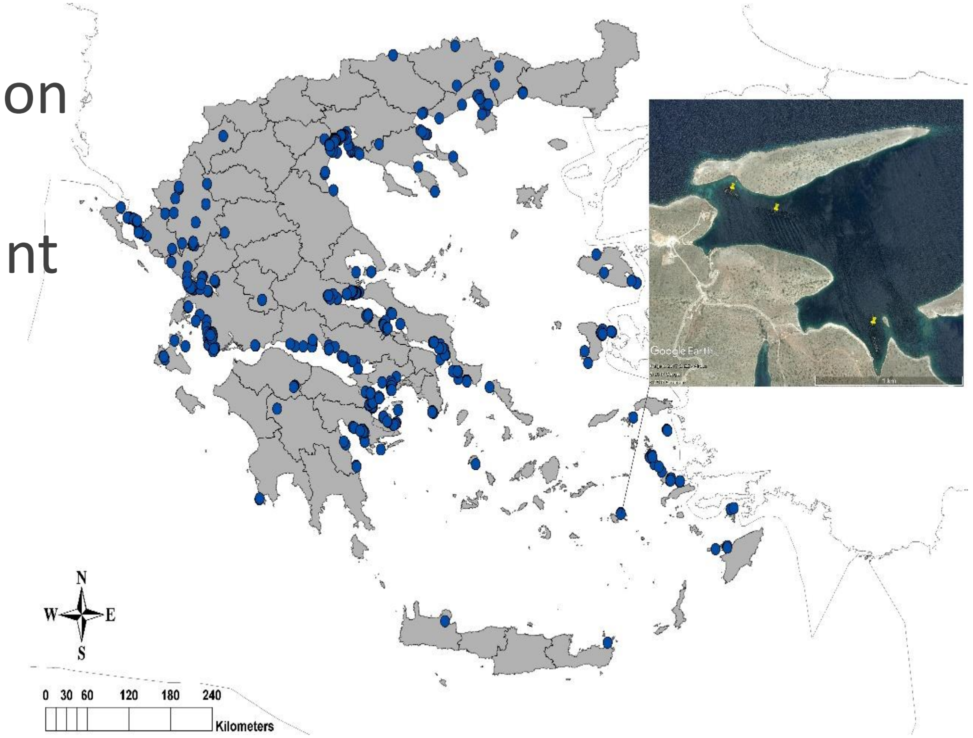
Greek marine aquaculture is a growing sector

- Stands for more than 63% of national fish production
- 63 companies run 318 finfish farms
- European sea bass and gilthead seabream important



ClimeFish studied CC effects

- European sea bass and meagre (emerging)

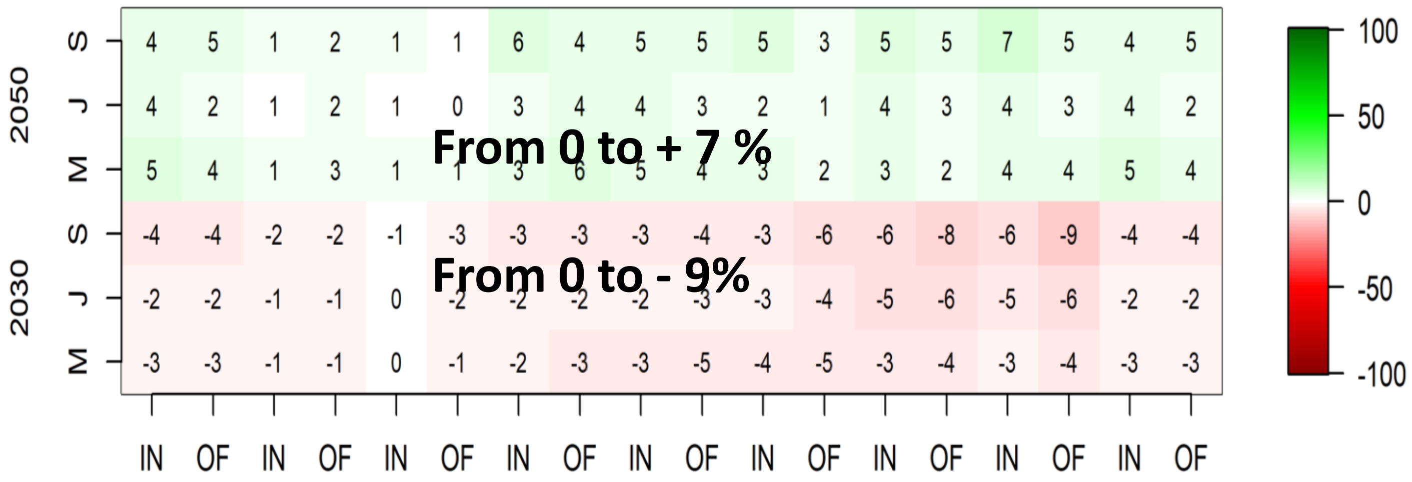
Effects at the individual level

RCP8.5

E. seabass, 800 g

Change in days to reach harvest size

- 2030: no – negative effect
- 2050: positive effect



Effect of husbandry on growth is higher than that of temperature and wind velocity

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Effects at the individual level

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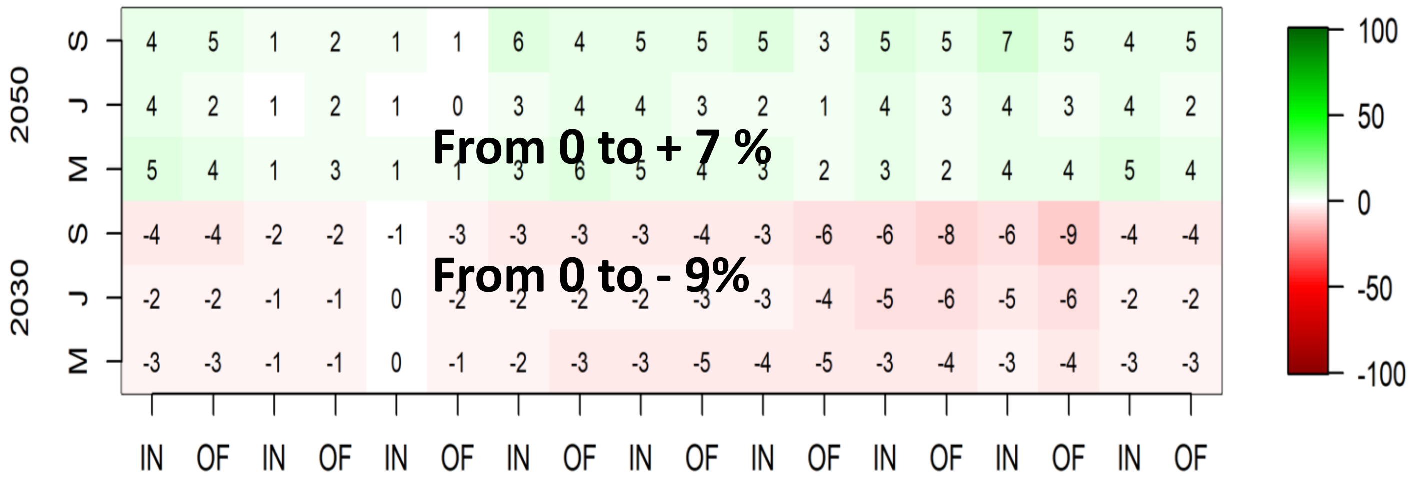
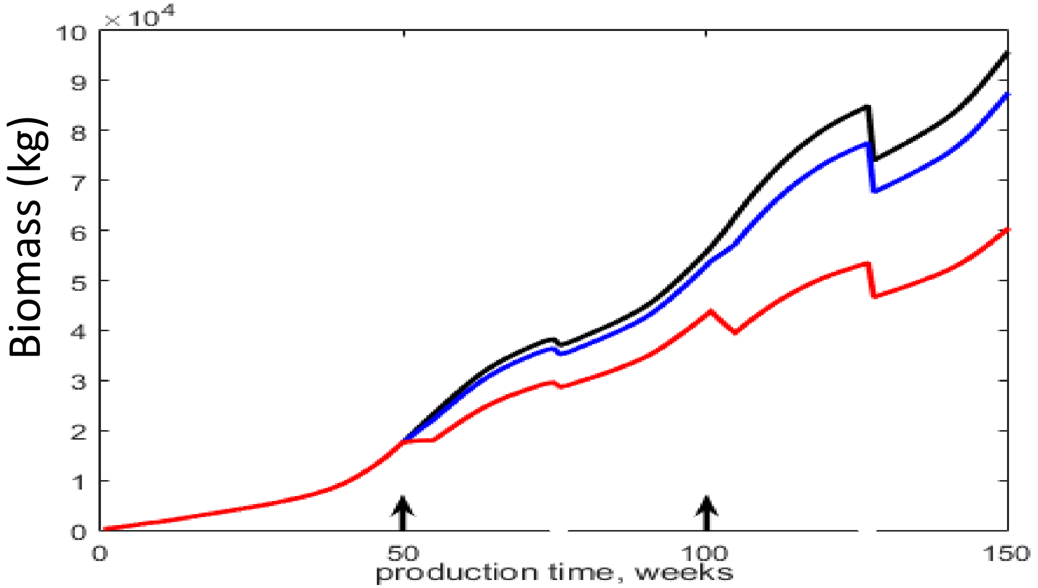


Effect of husbandry on growth is higher than that of temperature and wind velocity

Effect at the farm level

Extreme events

- higher mortality rates
- negative effect on biomass productio



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Shared Impacts of CC across Aquaculture CS

Hungarian Ponds, North Atlantic Salmon, Mediterranean Seabass, Iberian Upwelling Shelfish

Growth/size variabilty and mortality

- **Growth rates and yields**
- Increased size variability
- **Changes to growing season**
- **Increased mortality**

Escapees, predation and HABs

- **Increased Escapees / Detachment**
- Increased predation
- HABs and jellyfish blooms
- **Occurrence of pathogens**

Suboptimal conditions

- Increased fouling
- Anoxic conditions
- Accessibility and human safety issues
- **Infrastructure deterioration**

Suitability of sites

- Change site productivity
- **Conflicts of space and farm allocation**
- Harvesting closures

Changes in productivity

- Changes in production capacity
- **Changes in feed conversion rates**
- **Increased production costs**

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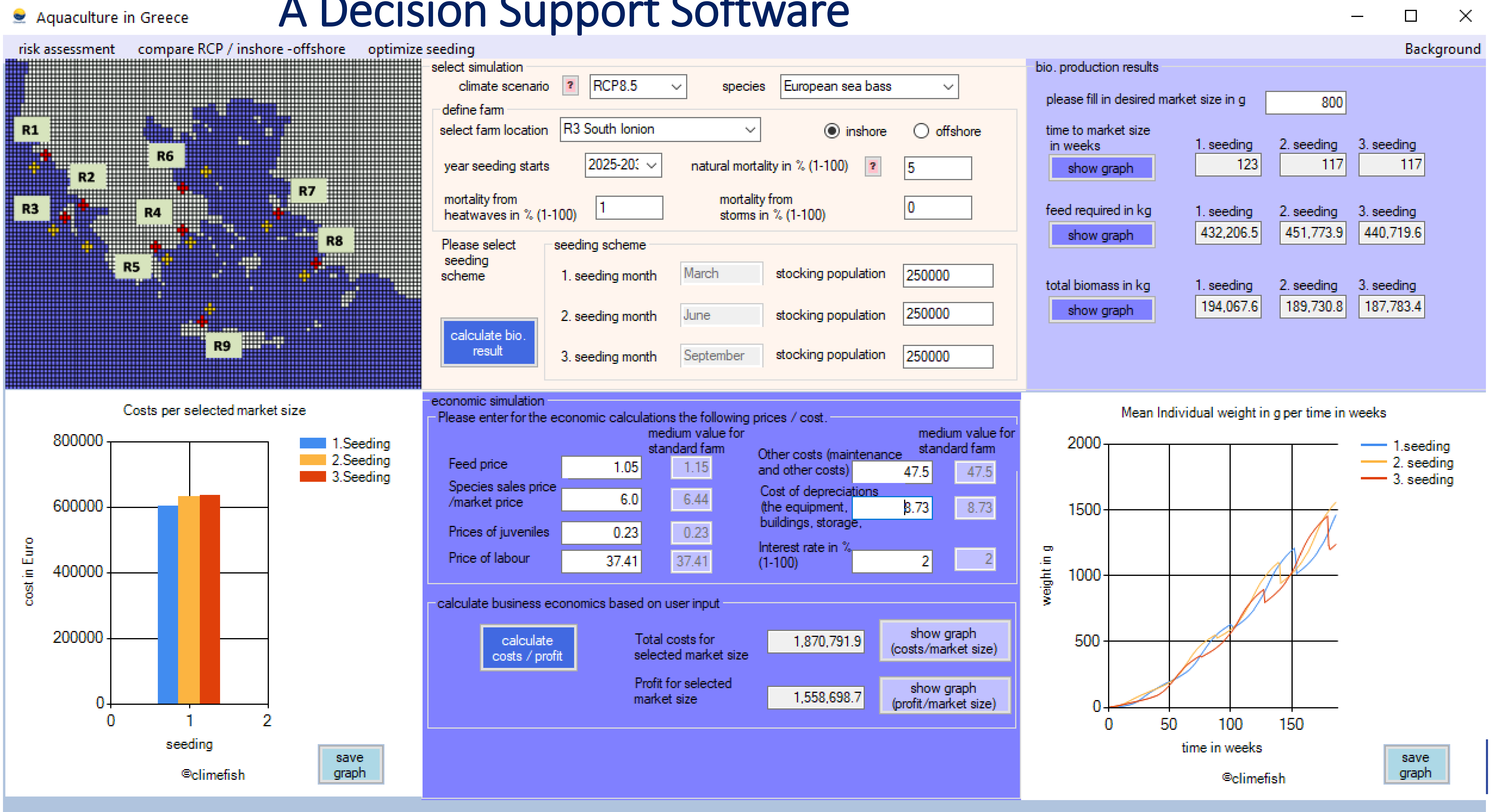
…ing … Horizon 2020 research and innovation action under grant agreement no. 677039

A Decision Support Software



Risk assessment
Adaptation measures

Stakeholders have a say!

2 stakeholder meetings:
Athens, April 2018, June 2019

In total 24 adaptation measures/ actions identified on 4 levels

- Technical/ Industry
- Research and knowledge building
- Policy and Regulation
- Funding

Contribution to a sectoral Adaptation Plan at Regional and EU level

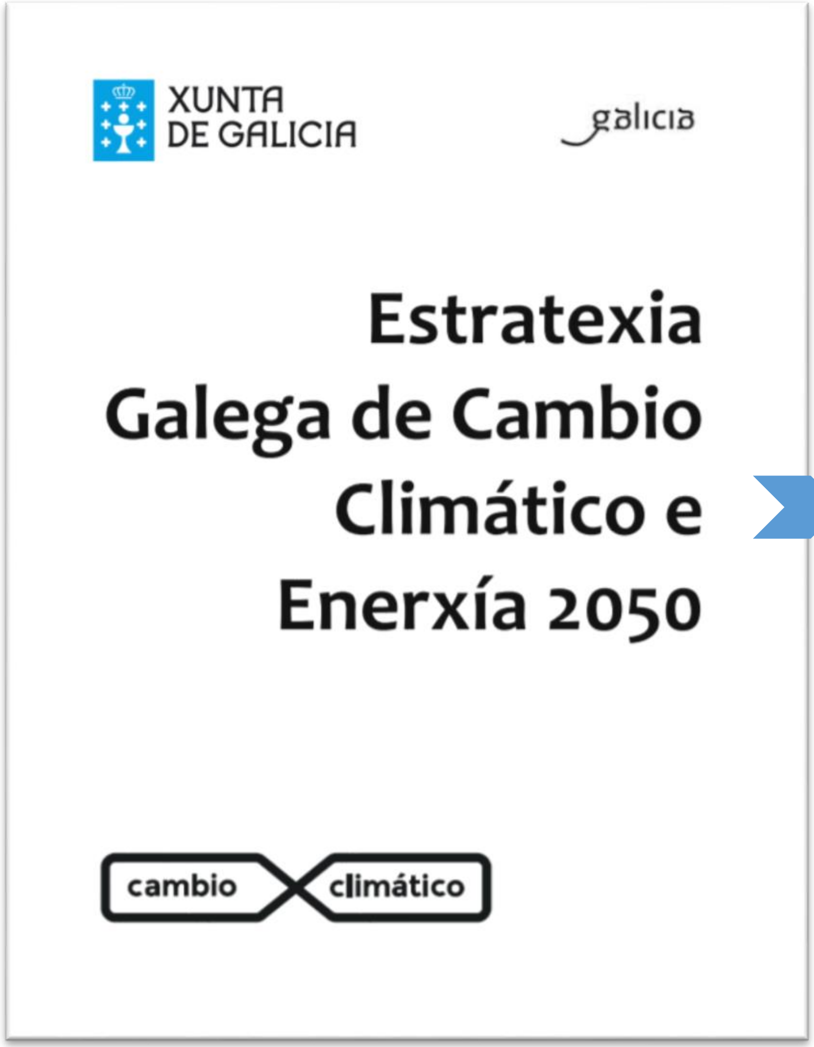
Towards a national Climate Adaptation Plan

- Industry
  - increase collaboration between farms in a wider organizational level (zones of development)

- Research community
  - understand the biological mechanisms implicated in response to various climate change drivers

- Administration
  - establish a flexible legal framework for the operation of the farms and designation of new sites
  - support research and innovation

ClimeFish in the Galician Climate Change Strategy


XUNTA DE GALICIA

galicia

Estratexia Galega de Cambio Climático e Enerxía 2050

cambio climático

6.2.3.2.-Vulnerabilidade e risco do sector pesqueiro en Galicia

En Galicia, a pesca considérase un sector característico da economía galega por ser fonte de ingresos, subministro de alimentos e actividade dinamizadora do mercado laboral. Segundo o Instituto Galego de Estatística (IGE), no ano 2015, o sector da pesca supuxo **un 1,9% do PIB** de Galicia, empregou a 33.503 persoas e un VAB de 1.097.577€.

Segundo os últimos rexistros nas lonxas galegas a especie máis capturada en 2017 foi a xarda pintada, cun 27,5% do total de capturas, seguida da merluza (16,5%), o xurelo (14,4%) e o lirio (12,3%).

Actualmente, a importancia da repercusión do cambio climático sobre o comportamento e a distribución das especies mariñas de maior interese comercial está a ser analizada no marco do proxecto europeo Climefish. España e Portugal tamén traballan conxuntamente no proxecto MarRisk para analizar e monitorar a evolución do clima litoral, así como impulsar a resiliencia dos sectores económicos estratéxicos da costa galega, como é o caso da explotación do mexillón.

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Implementation of advice on EU level:

ClimeFish provided recommendations for the new "Strategic guidelines for sustainable development of EU aquaculture" at Aquaculture Technical Seminar with the MS in Brussels 10th of October 2020.

- This event was organized by DG Mare
- Advice on how to include climate change adaptation into the Multi Annual Plans for Aquaculture in Member States and how the new knowledge can be utilized

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Top-value species to European Aquaculture Examined

Salmon
Salmo salar

Trout
Oncorhynchus mykiss

Sea bass
Dicentrarchus labrax

Carp
Cyprinus carpio

Sea bream
Sparus aurata

Blue mussel
Mytilus edulis

Cupped oyster
Crassostrea gigas

Mediterranean mussel
Mytilus galloprovincialis

European clam
Ruditapes decussatus

https://ec.europa.eu/fisheries/cfp/aquaculture/species_en

Impacts of Climate Change on Growth Performance of Aquaculture Species

- Physiological-based cultivation model calibrated against specific farms (same model for all species / countries).
- Climate change ‘winners‘ and ‘losers‘ depending on location and species.
- Some shellfish farms do particularly poorly due to warming and reduced primary production projected for 2100 (much less change by 2050).
- Only direct and no indirect effects included here.

Year 2100

Country	Species	Harvest weight		Total Prod	
		RCP4.5	RCP8.5	RCP4.5	RCP8.5
Ireland	Salmon				
Norway	Salmon				
Turkey	Sea bass				
Spain	Sea bream				
Poland	Carp				
Turkey	Rainbow trout				
Denmark	Blue mussels				
Netherlands	Blue mussels				
Netherlands	Pacific oysters				
Portugal	Med mussels				

much lower
same average and range
significantly greater
significantly lower
same average, wider range
much greater
lower average
≥ present day
≤ present day
Higher average

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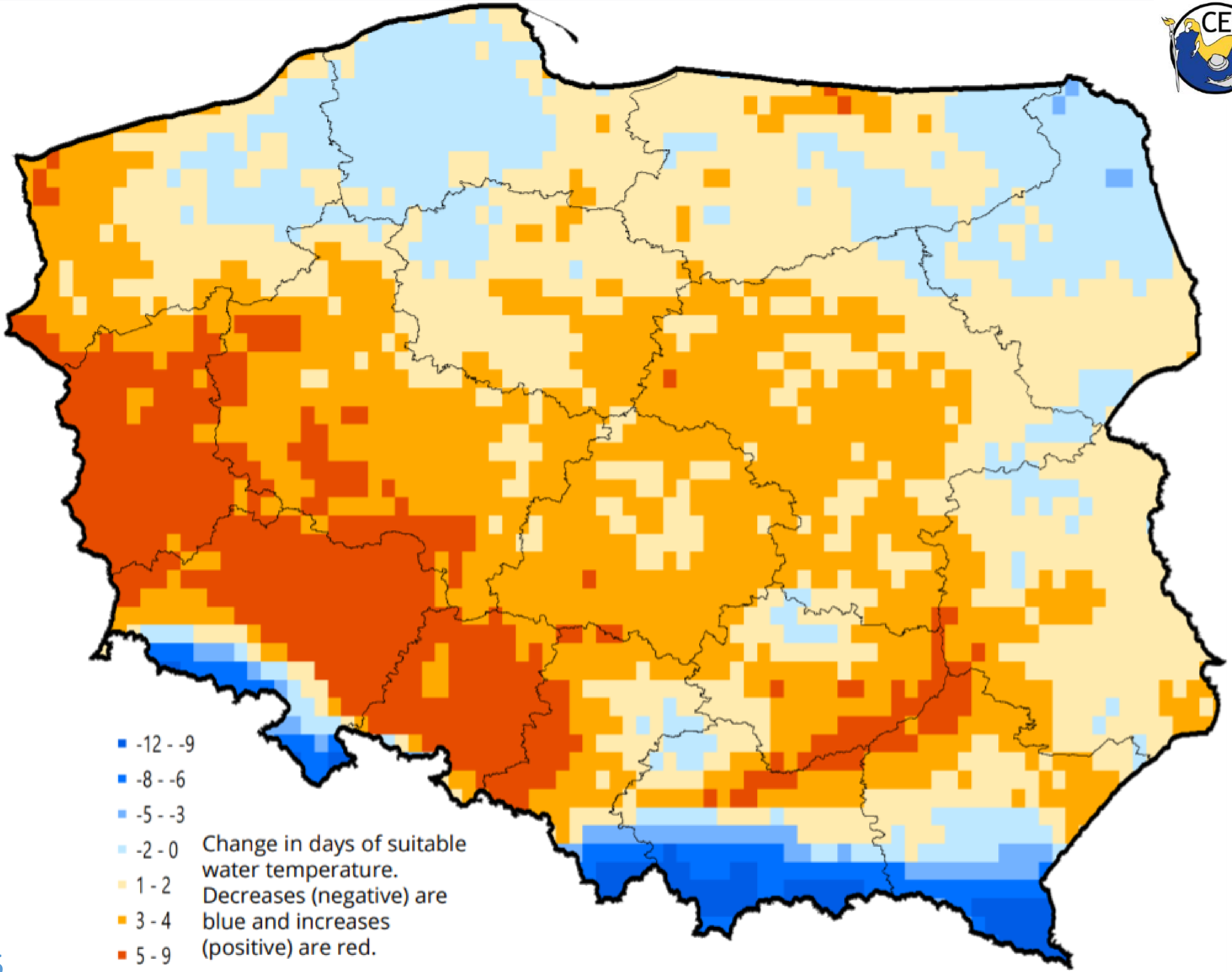
Indirect Effects of Climate Change

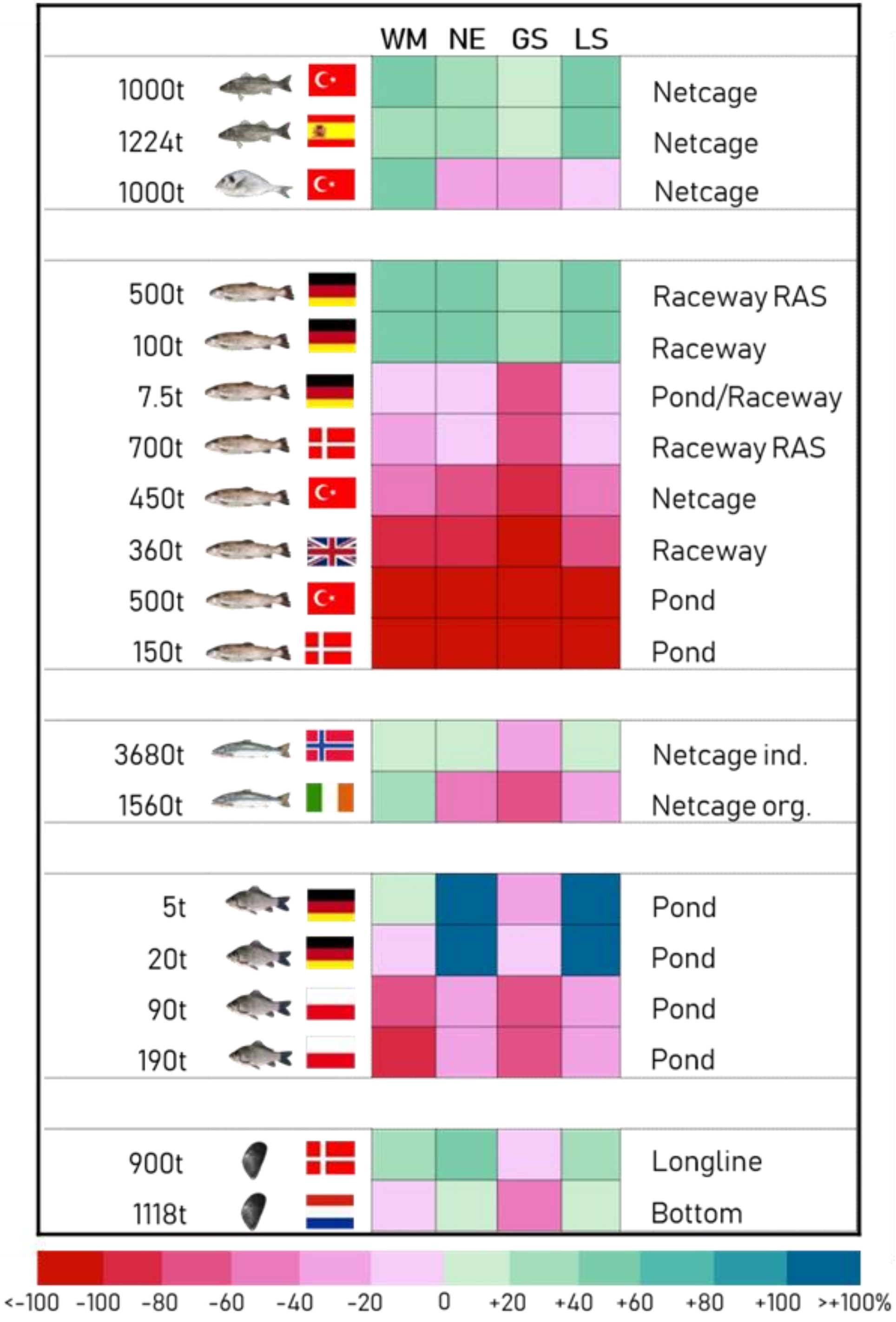
- Examples: Disease, HABs, Jellyfish.
- Focus on disease –global significance & major stakeholder concern.
- Tools developed to study impacts under present day and future climate scenarios.
- >20 diseases, across 6 host species and 10 countries investigated.
- Other EU and national programs creating short-term (1- to 2-wk) forecasts for HABs. More work needed on jellyfish.

- Projection of change in suitable days for specific diseases
- Shown is example for Spring Viraemia of carp in Poland (RCP8.5, 2050)



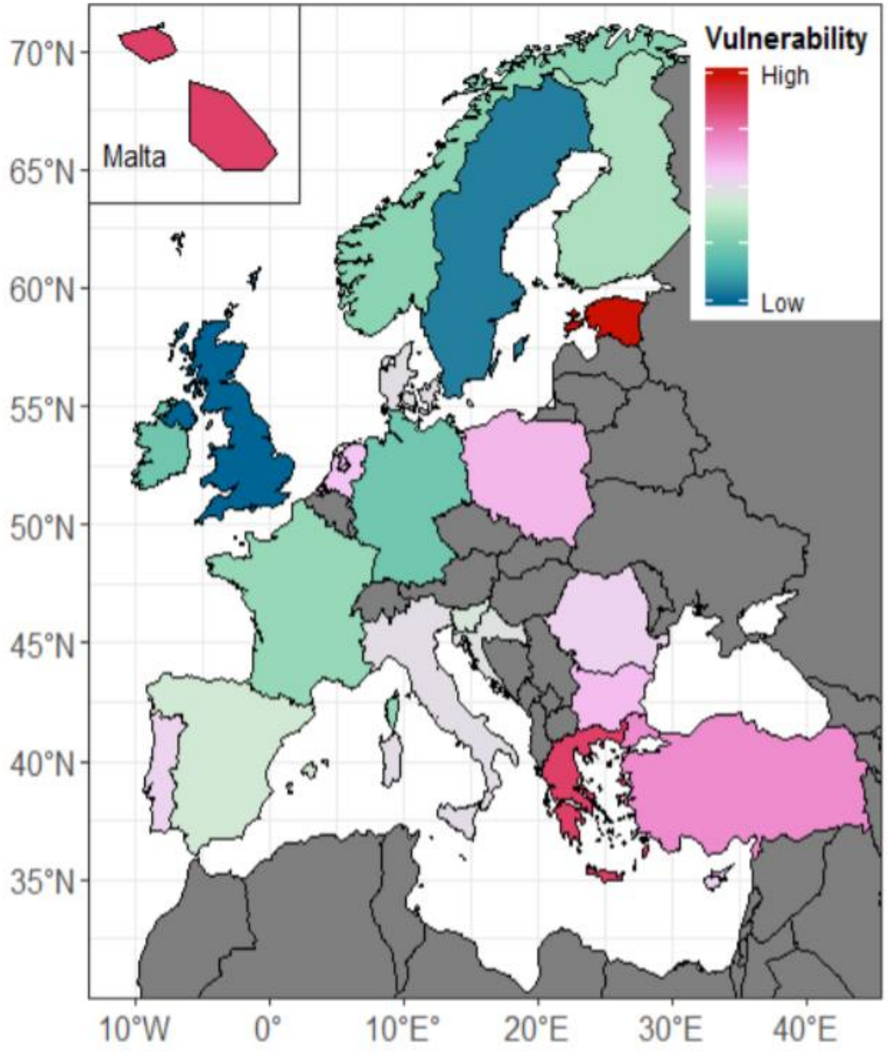
Economic Impacts on Aquaculture: Typical Farms

- Typical farm models constructed for species / regions and four scenarios tested: World Markets (WM), National Enterprise (NE), Global Sustainability (GS) and Local Stewardship (LS).
- Projections indicated sea bass, salmon and best-practice trout farms were most profitable
- Substantial losses in profit projected for some farms of same / other species (trout and carp in ponds).
- Losses or gains often scenario-dependent. Results depend more on future social-economic trajectories than on direct effects of climate change.
- For example, fish price relatively low in more global (GS) compared to nationalistic scenarios (NE & LS). Innovation needed to control fishmeal / oil prices.



Climate Change Vulnerability Assessment

- Ranked national vulnerability based on farmed species, methods, economic indicators, expert evaluation.
- climate-driven warming (RCP8.5, 2050) caused little reduction in habitat suitability based on species thermal growth performance.
- Small farms lacking environmental control (e.g. traditional trout, carp and shellfish farms) more vulnerable (low adaptive capacity by technological innovation).
- SE Europe vulnerable due to relative importance of aquaculture to GDP, smaller portfolio of species, and status of national climate adaptation plans.
- Measures increasing economic performance (e.g. vertical integration, RAS) will also reduce climate change vulnerability.



CERES Synthesis Report: Chapter 5

Stakeholder Mind-mapping: Turkish Trout Farms

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Strongest expected climate impacts

- Changes in season patterns
- Increased temperatures
- Decreased rainfall

Projected consequences for production

- Production period shorter
- Reduced growth
- Reduced reproduction
- Increased disease and parasites

Social and economic impacts

- Reduced jobs
- Reduced market but higher prices
- Large firms buy up and dominate sector
- High logistics cost as production moves to higher latitudes

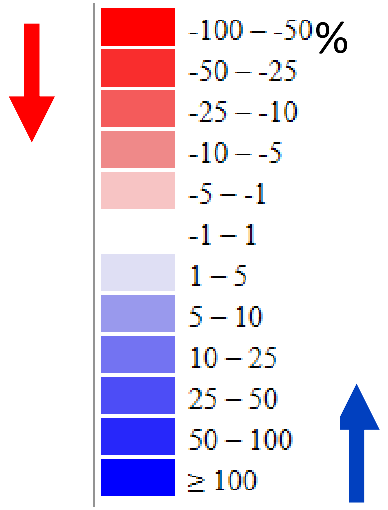
Most preferred mitigation measures

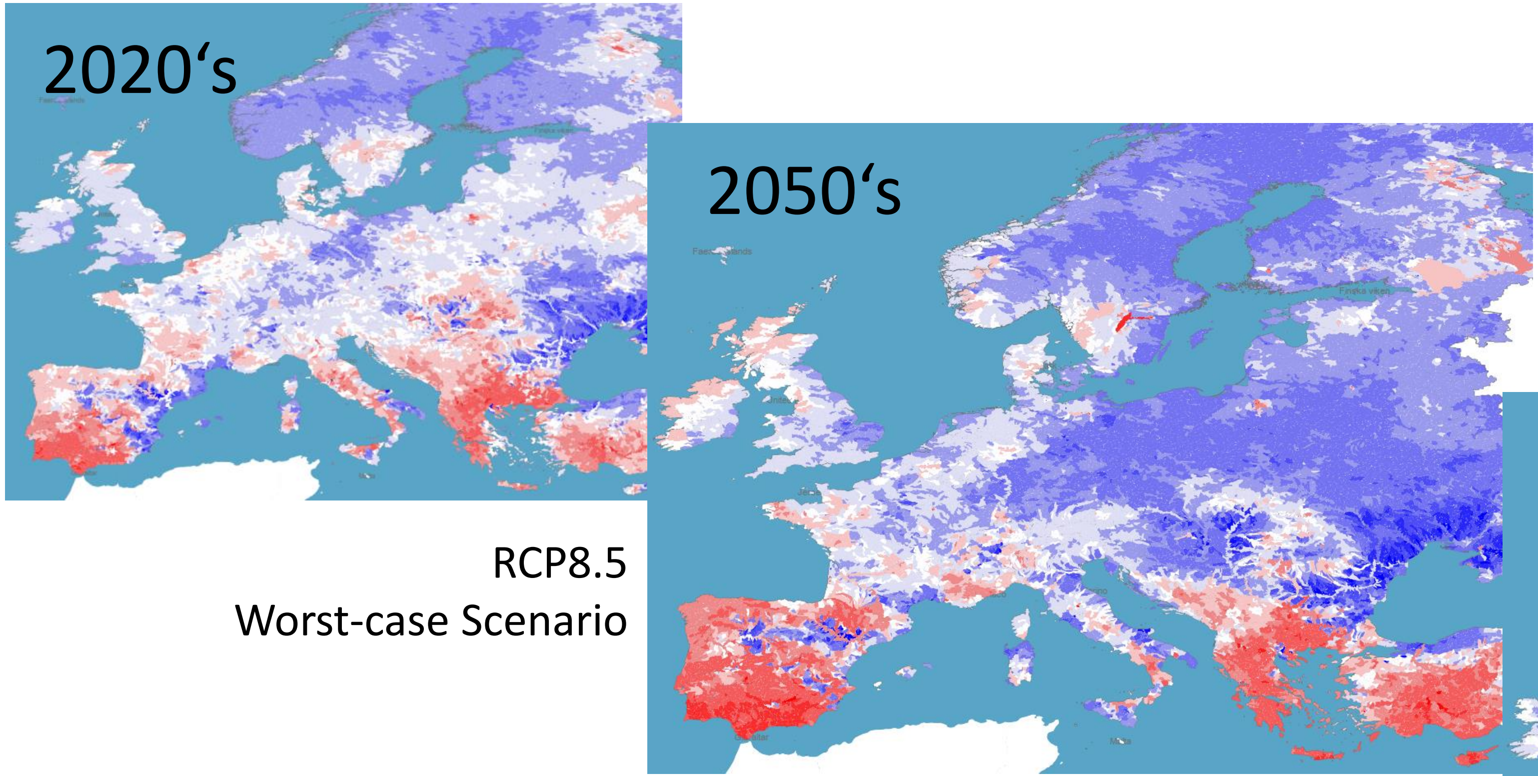
Government: (1) support cultivation of new species (2) pay compensation (3) help designate more production sites

Technology: (1) use recirculation systems (2) use technology to reduce some CC impacts

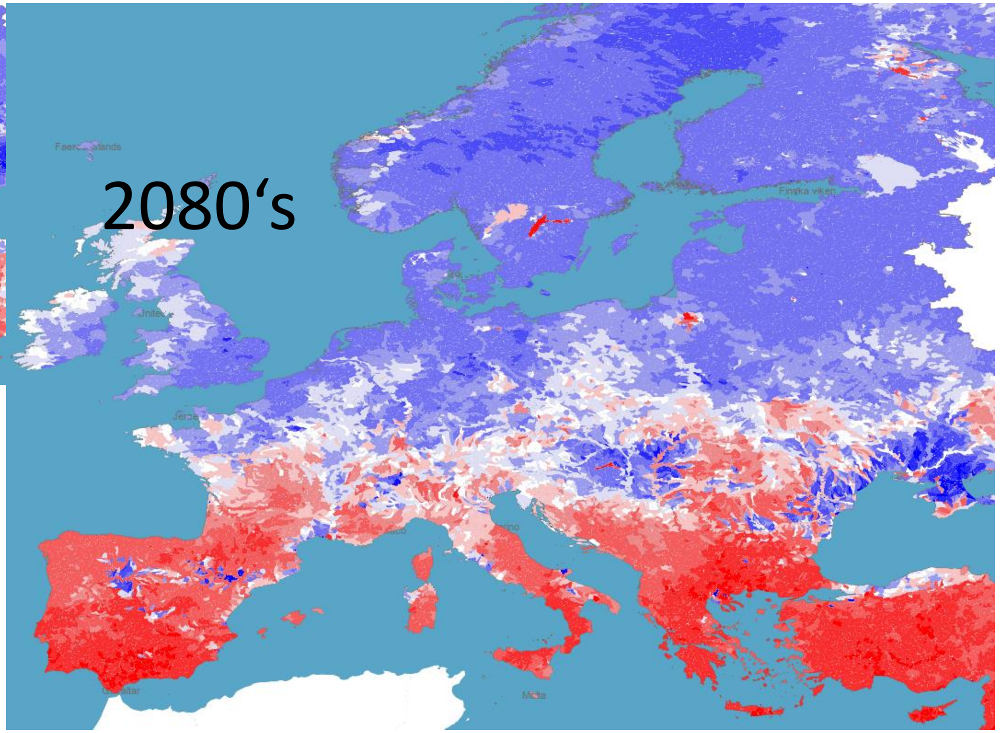
(mind-mapping conducted in all 24 Storylines)

Future Changes in River Flow





RCP8.5
Worst-case Scenario

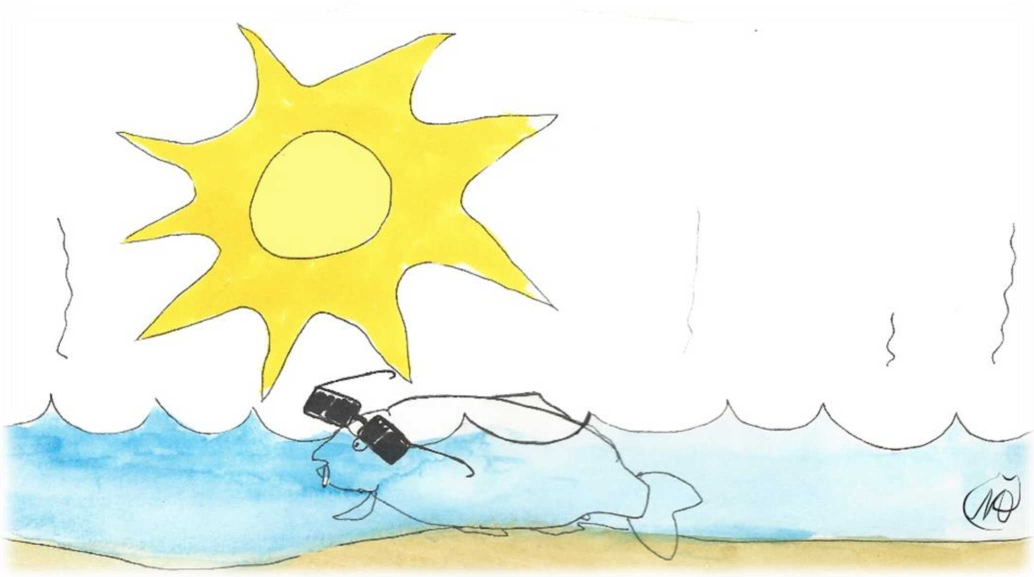


- Rainfall pattern projected to change across Europe (drier in south)
- River discharge projected to decrease in south and increase across northern Europe
- High degree of uncertainty within ensemble of different models but large-scale pattern is robust

CERES Synthesis Report: Chapter 2

Biological forecasting Hungarian pond aquaculture

- Higher change in yield at lower stocking density
- Increased evaporation, more supplementary water will be needed
- Increasing occurrence of sub-optimal oxygen levels



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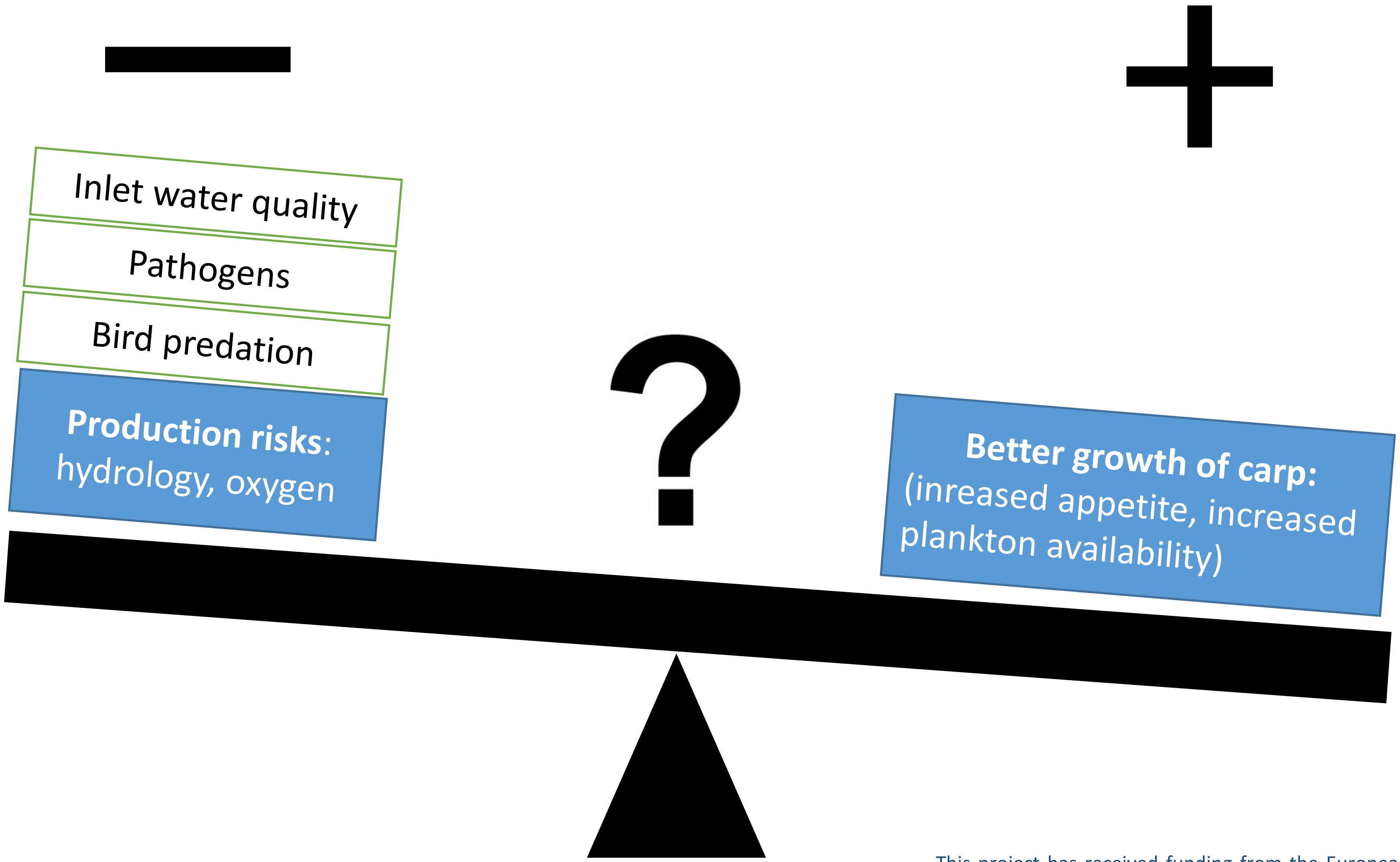
The prospects of the industry: modelled & non-modelled forecasts



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Adaptation measures identified

- Monitoring (real time diagnostics)
- Develop infrastructures to withstand floods
- Use of aerators, oxygen manipulation
- Adequate stocking rate and biomass management

Industry-level

- More detail in official statistics

Governance

- Breeding programmes
- Monitoring and mapping disease outbreaks
- Preventive treatments and vaccines

Research & knowledge building

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Aquaculture: Questions?

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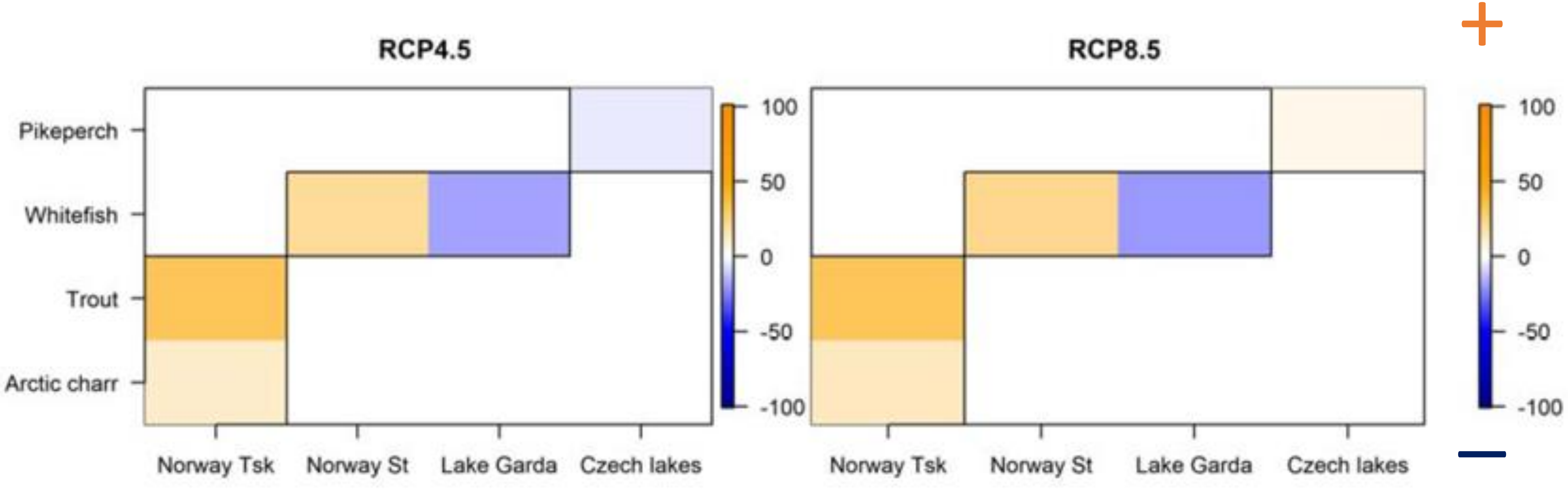
Lake fishery: Relative change by 2050 with present day fishing pressure



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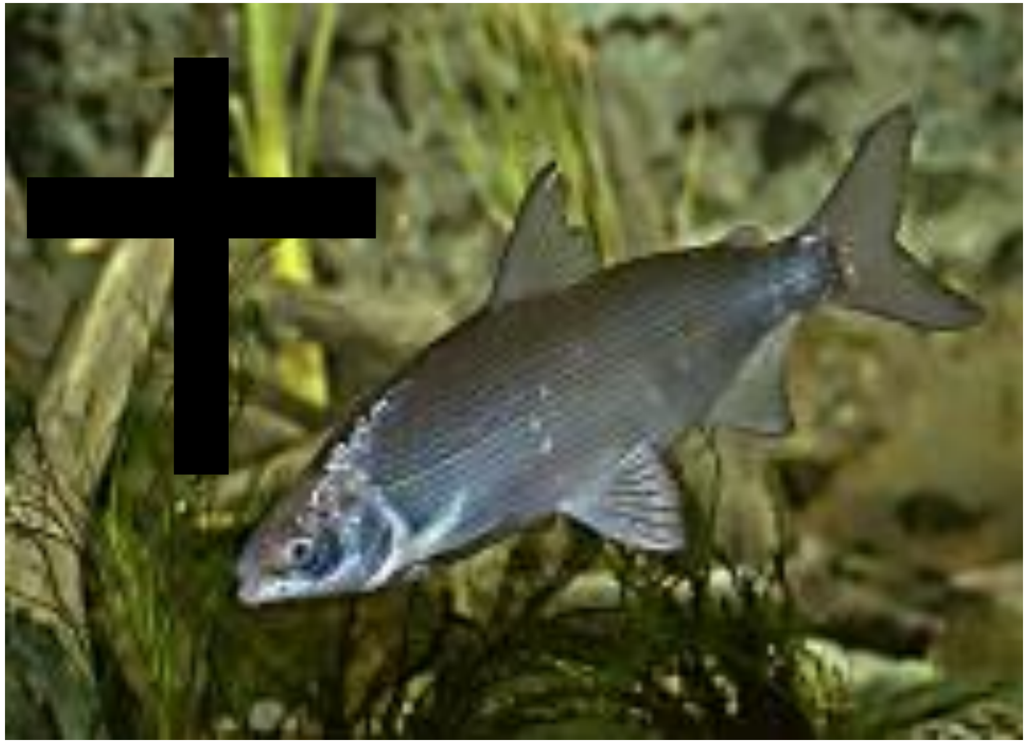
Decline in whitefish in South and Central Europe

- Despite potential for increased growth and production
- Predation by invading species- e.g. pike-perch is a threat
- Reduced reproduction due to increase in predation, siltation, oxygen deficit, too high incubation temperatures.



In Czech whitefish **lost 90%** of original distribution

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Consequences for the good ecological status (GES)

- **Salmonid fish** are considered the indicators of GES everywhere
- Expect decline in ES in southern and central Europe
- Slowing or reversing this trend requires huge effort
- **Protect, prevent invasive species, conduct (semi)artificial reproduction**

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Consequences for the good ecological status (GES)

- **Cyprinid fish** are considered the indicators of degraded Ecological state
- Many will competitively benefit from warming
- ES is very likely to decline

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Shared Impacts CC on Freshwater Operations

Italian Lake Garda – Hungarian Ponds

Natural feed availability and increased mortality

- Affects fish stocks and size
- Natural recruitment / Feed availability
- Increased risk suboptimal conditions - anoxia

HABs, pathogens and invasive species

- Frequent outbreaks of HABs
- Harmful bacteria and pathogens
- Species replacement
- Decreased ecological balance

Decreased water quality

- Water turbidity
- Deterioration of water inlet

Increased Evaporation

- Decreased water availability
- Increased water prices
- Water shortage affects region's income

Costs and Income

- Increased feed demand
- Increased operational costs
- More controls / systems required

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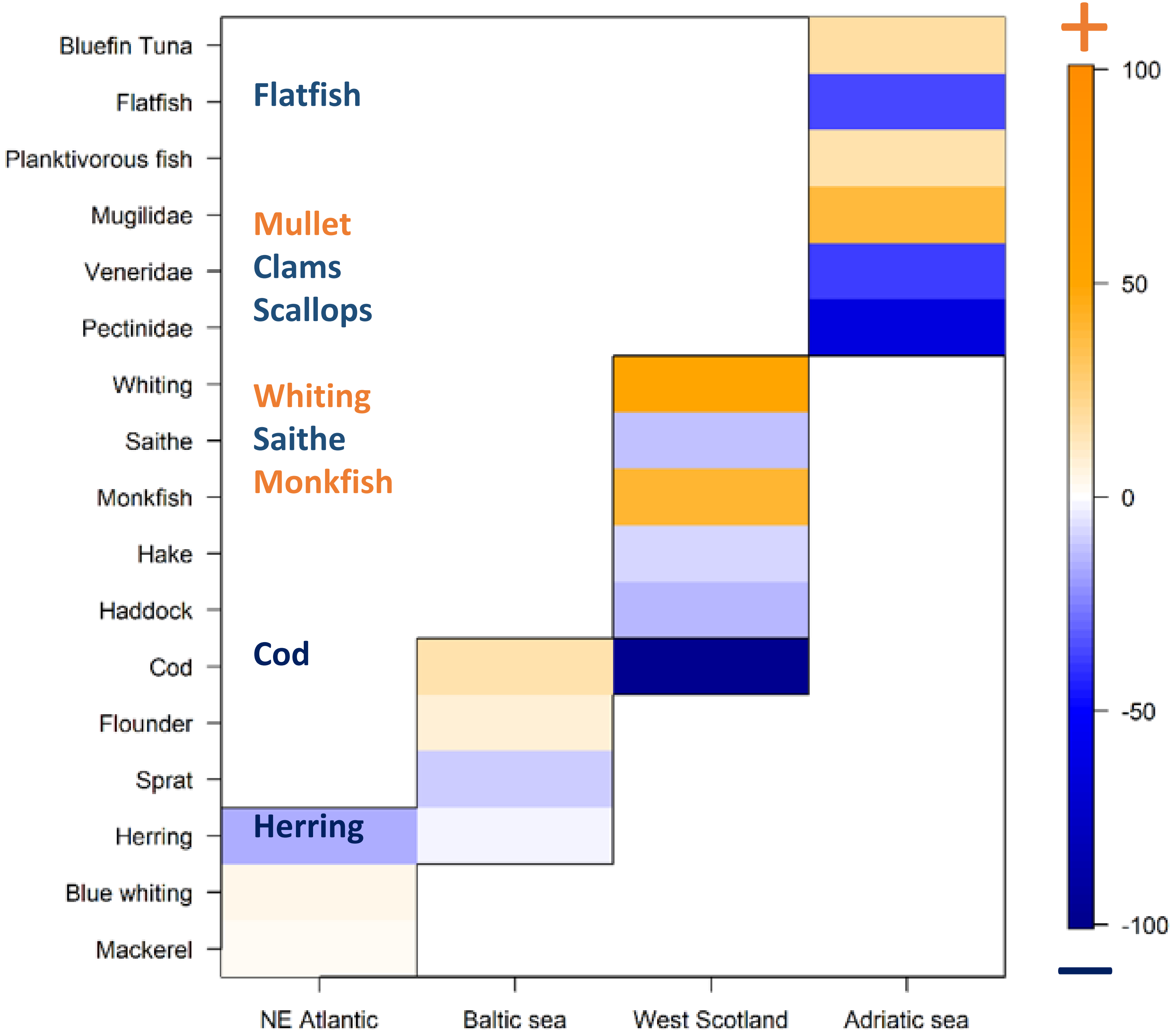
Stretch your legs!

Marine fisheries next

Marine Fishery

Relative change by 2050 under RCP4.5. with present day fishing pressure



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Shared Impacts CC across marine Fisheries:

North Atlantic pelagic, WoS demersal

Species composition

- Northwards shift of species
- Increased stocks: Mackerel, Whiting, Hake
- Decreased stocks: Herring, Cod
- Emerging species: Seabass

Species phenology and growth

- Alterations year-class
- Food availability
- Growth rates

Distribution and fisheries dynamics

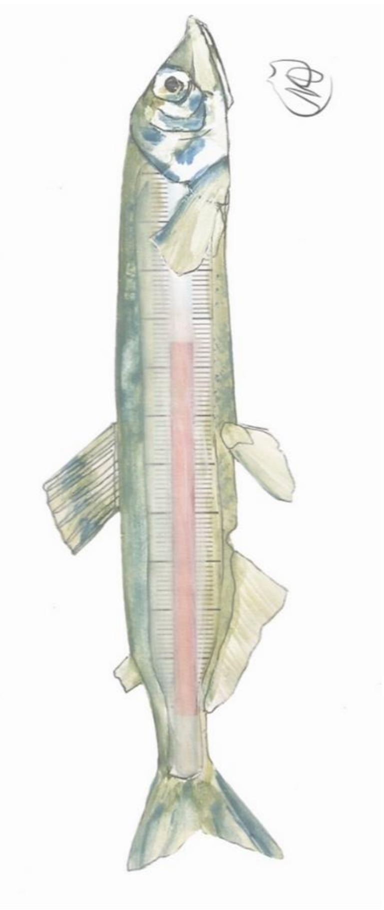
- Catch composition
- Spatial distribution
- Deployment of gear and catch efficiency

Quota allocation, licenses and TAC

- Increased complexity in negotiations
- Overfishing of shared stocks
- Choke Species

Production dynamics

- Longer distance to fishing grounds
- Reduced safety
- Damaged infrastructure
- Reduced fishing days / Increased costs



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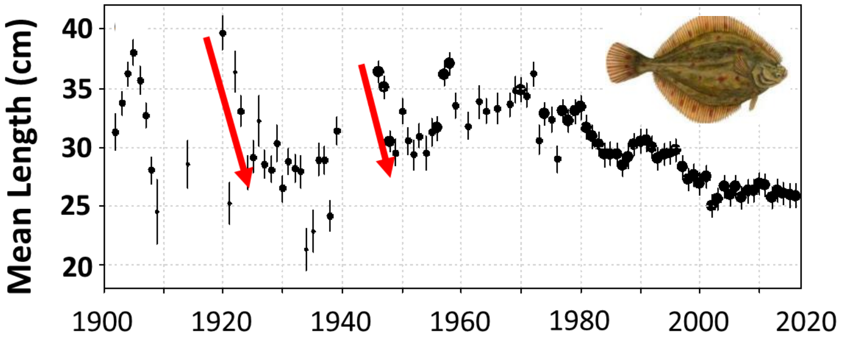
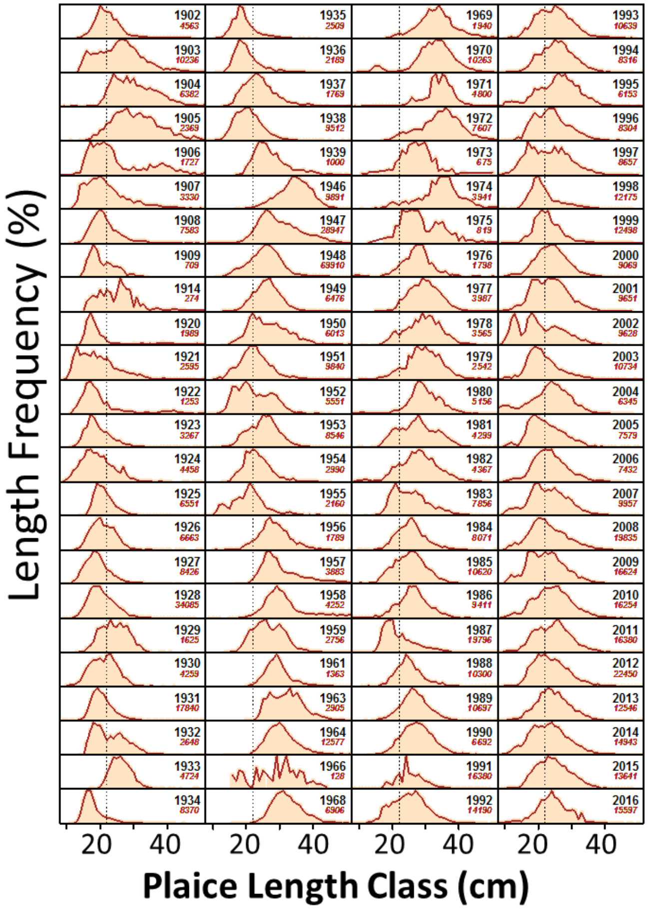
Attribution - Importance of Biological Time Series

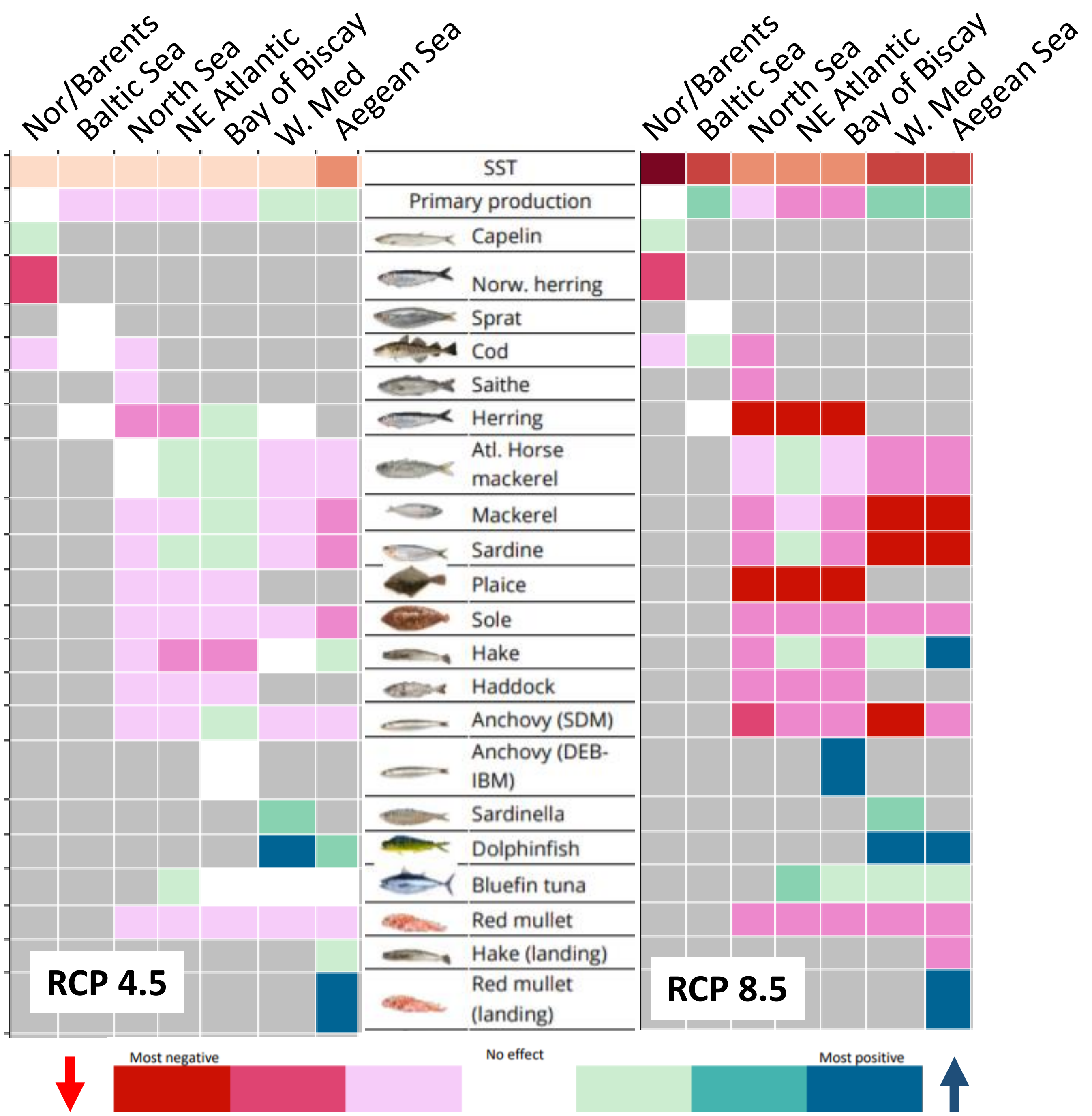


- Time series analyses (11 applications) of single or multiple species within 8 European regions.
- Historical changes in stocks mainly driven by fishing but climate variability has triggered (amplified or weakened) observed responses.
- Capacity to build reliable projection models requires robust (long, continuous, data-rich) time series for the main European Seas and inland waters. Such time series are scarce and in only a few areas.
- Healthy stocks will display less climate-driven variation (until physiological thresholds are passed) underscoring importance of sustainable, ecosystem-based management for climate adaptation



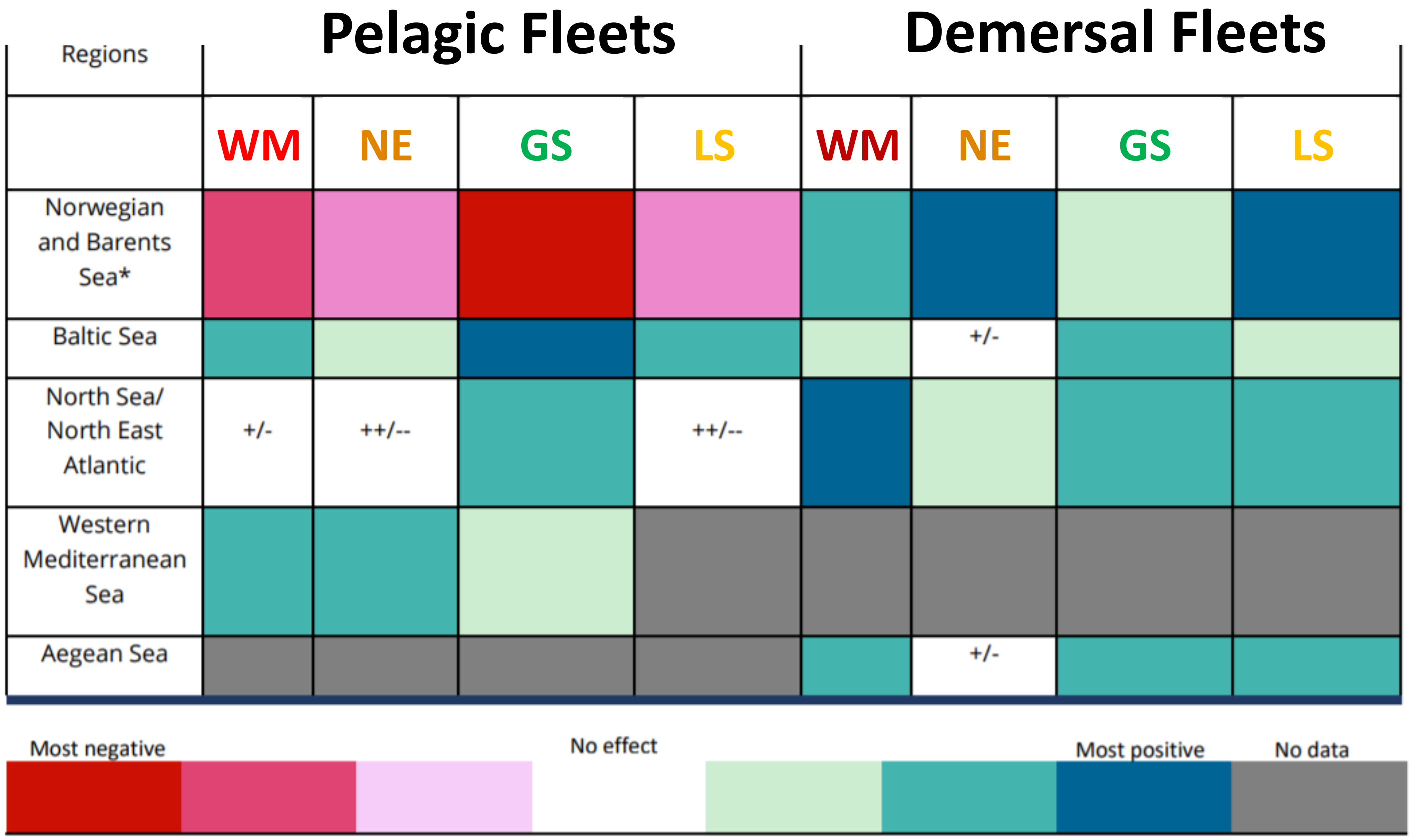
Projected Climate Change Effects on Marine Fishery Targets

- Applied 12 state-of-the-art biological projection models (often 2 models per region).
- Projections of shift are consistent across different types of models – shown is % change by 2050
- Markedly stronger effects of RCP8.5 (right) compared to RPC4.5 (left)
- Winners and losers (e.g. also when comparing stocks of same species)
- Models projected change for species currently in region – future, novel species not considered



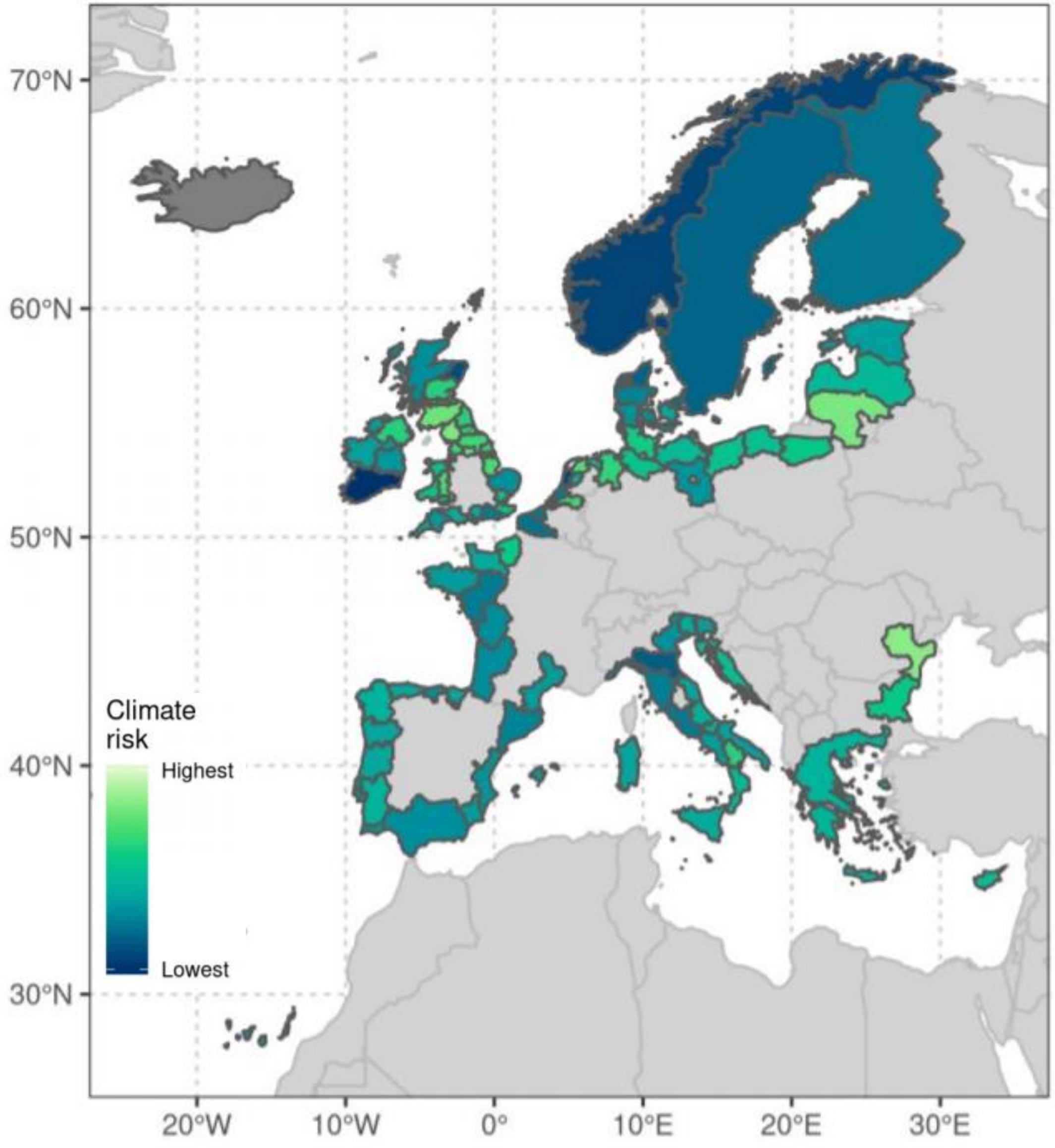
Economic Impacts on Fleets

- Profitability at 2050 tested under four scenarios (consistent narratives of environmental, economic, legal, technological and political change)
- Changes in policy (e.g. access) and economics (fuel / fish price) more important than direct, biological effects of climate change.
- Shifts in profitability between fleet segments projected in Norwegian / Barents Sea.



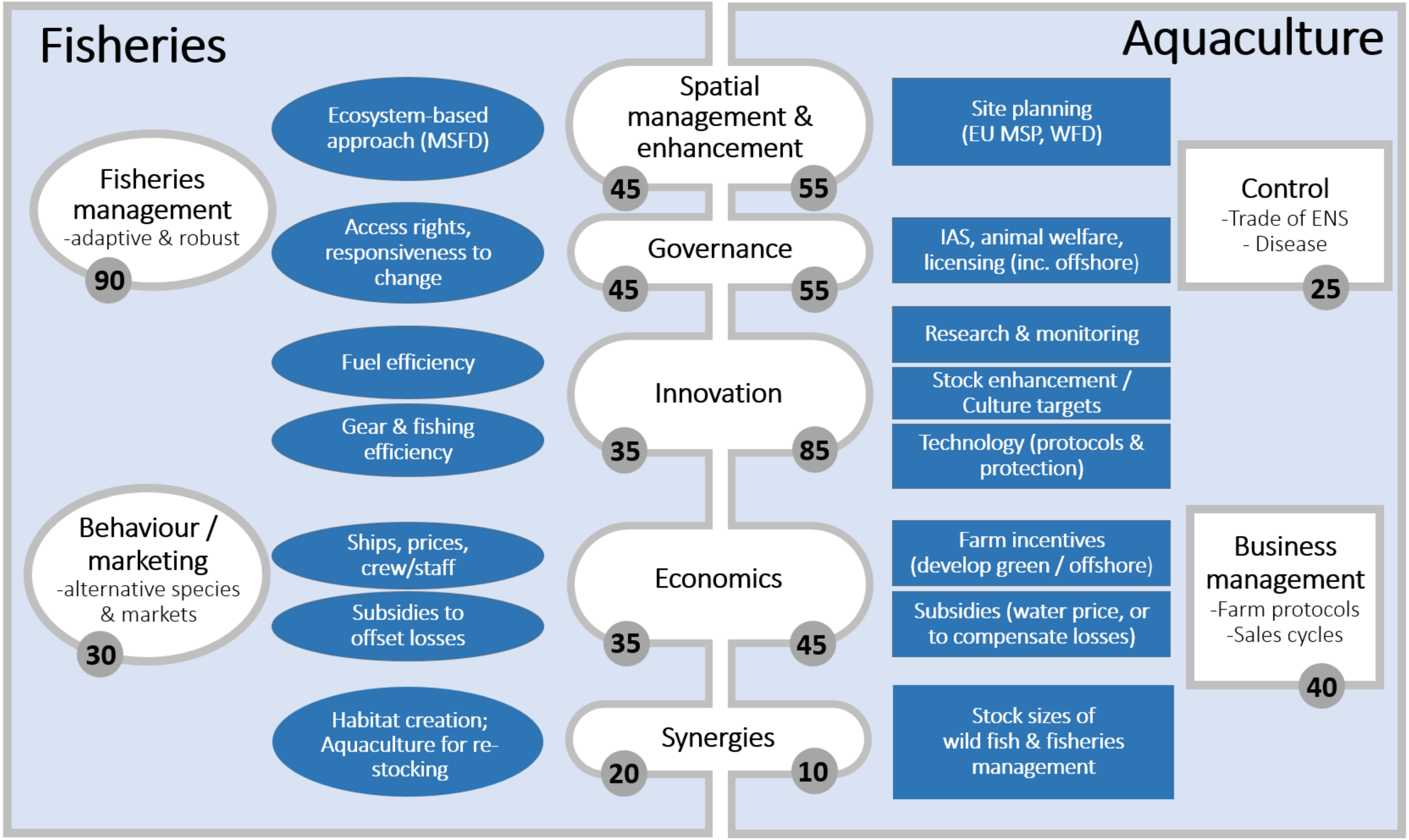
Climate Change Risk Analysis

- Regions in SE Europe and UK have highest risk to both fleets and communities (low GDP, few targeted species)
- In other regions, risk is greatest at fleet or community level but considerable differences exist, even within a country
- Smallest vessels (less than 6m) had much higher risk than other size classes (Mediterranean - Croatia, Bulgaria, France, Malta and Greece)
- In some regions (e.g. SE Baltic) increasing resilience needed (e.g. creating alternative employment opportunities in community)
- In regions where fleet risks dominate, prioritize increasing fleet efficiency / diversity.



Stakeholder Mind-mapping: Example for dolphinfish Western Mediterranean

Stakeholder Mind-mapping: Tranformative Climate Change Adaptation



General: outcomes and recommendations

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Key exploitable outcomes at case study level

- Identified knowledge gaps (published papers)
- Forecasting models for fish production
- Identified risks and opportunities
- Climate Adaptation Plans for fisheries and aquaculture
- The ClimeFish Decision Support Framework
- Decision Support Software

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Key exploitable outcomes at EU level

- E-learning course on “Climate Change Adaptation and Mitigation in Fisheries and Aquaculture” at FAO learning Academy
- Guidelines for establishing legal good practice
- Recommendations for co-creation practices
- Guidelines for making Climate Adaptation plans for fisheries and aquaculture - European voluntary standard (CWA)
- Contribution to the EU Adaptation Strategy Package for fisheries and aquaculture

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Guidelines for creating Climate Adaptation Plans (CAPs)

European Committee for Standardization

CEN Workshop Agreement CWA 17518:2020

Good practice recommendations for making Climate Adaptation Plans for fisheries and aquaculture

1 Assess risks and opportunities	1. Evaluate current status 2. Forecasts 3. Risk assessment
2 Identify adaptation measures	4. Vulnerability assessment 5. Adaptation needs 6. Adaptation measures
3 Operationalize CAPs	7. Implementation plan

Outcomes

Main risks and opportunities

Main vulnerabilities

Adaptation measures and trade-offs

Implementation plan for adaptation measures

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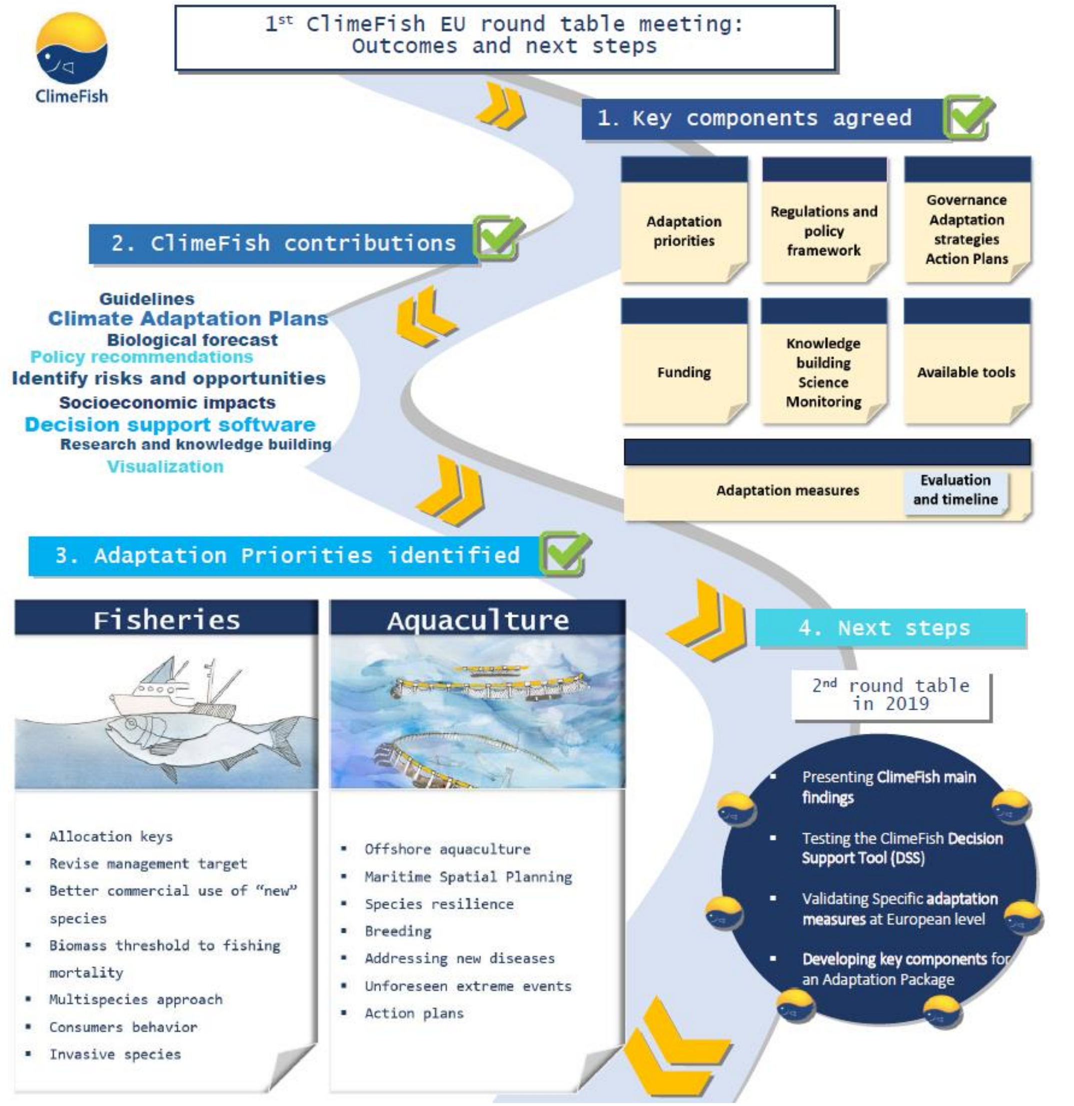
Adaptation Strategy Package for EU fisheries and aquaculture

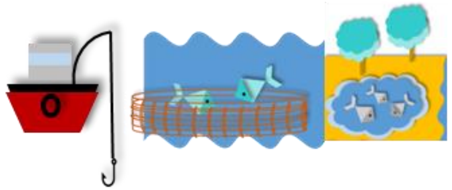


Key elements:

1. Adaptation priorities
2. Regulation and policy framework
3. Funding
4. Available tools
5. Knowledge building
6. Adaptation strategies and action plans
7. Adaptation measures idenified
8. Evaluation and timeline for implementation

Stakeholders that participated in the case study events

64 Industry representatives and fishers



6 NGOs

5 Advisory bodies

44 policy makers

12 external scientists

45 Climefish scientists

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Recommendations for Future Research

1) Integrating climate research across disciplines: It is inherently challenging to conduct inter-disciplinary science, foster training programs. Need to embed social scientists as facilitators of stakeholder engagement. Perceived N-S gradient in European emphasis.

2) Conducting trans-disciplinary climate change science: Barriers to cooperation between climate scientists and industry (aquaculture and fisheries) are disappearing. Calls needed that focus on artisanal fishers and farmers.

Pelagic Freeze-trawler Asscociation
Association of 9 European pelagic freezer-trawler companies

VisNed:
Association of producer organizations in Dutch Demersal Fisheries

Inskie Centrum Rybactwa :
Large ponds: carp, whitefish, pikeperch

Longline Environment
Consultancy for aquaculture companies, risk assessment

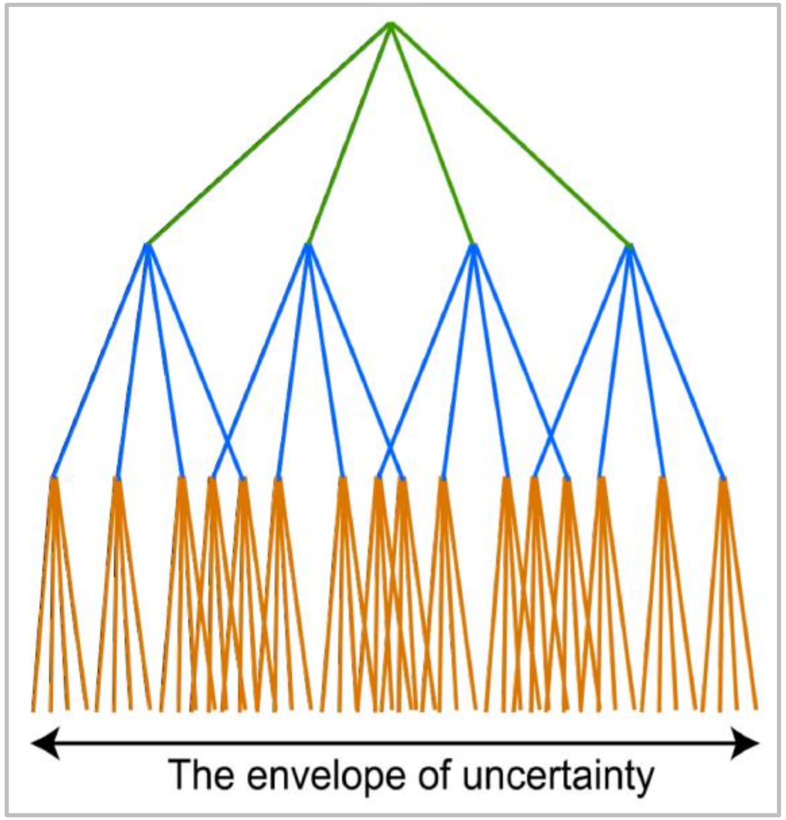
Vet Aqua International:
Veterinary practice & consultancy for aquaculture companies

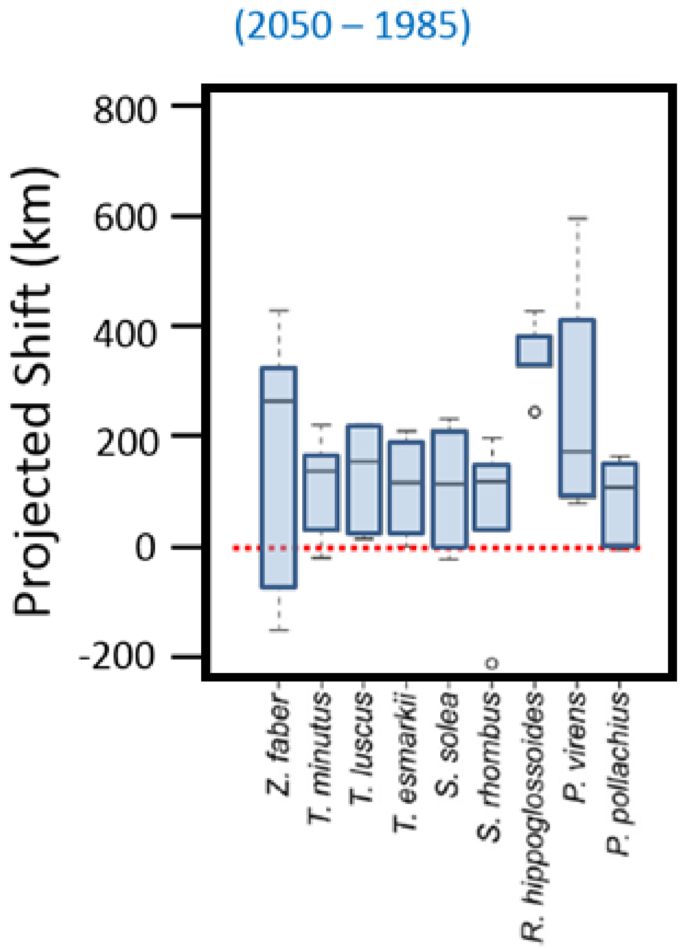
Sagremarisco Viveiros de Marisco
Interface between industry, education and scientific research

Kiliç:
Large aquaculture facilities: trout, seabass, seabream, meagre

Recommendations for Future Research

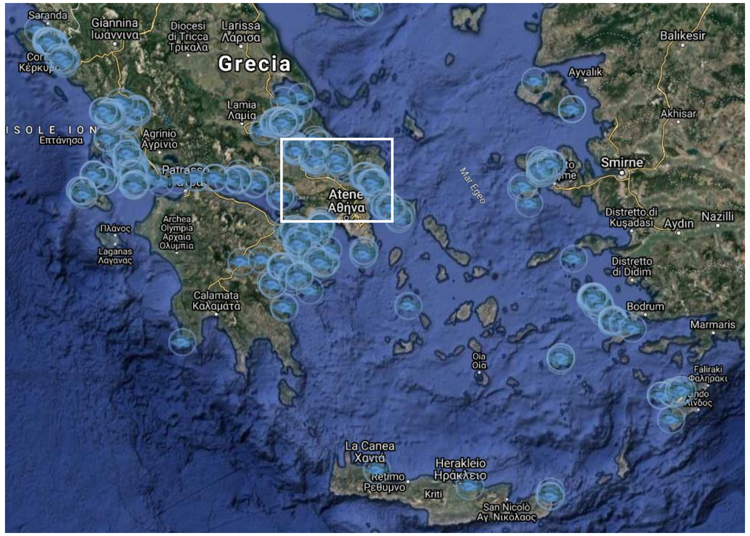
3) Capturing uncertainty in physical & biological projections: Multiple RCPs (scenarios), multiple GCMs downscaled to regional hydrodynamic models, multiple biological models…



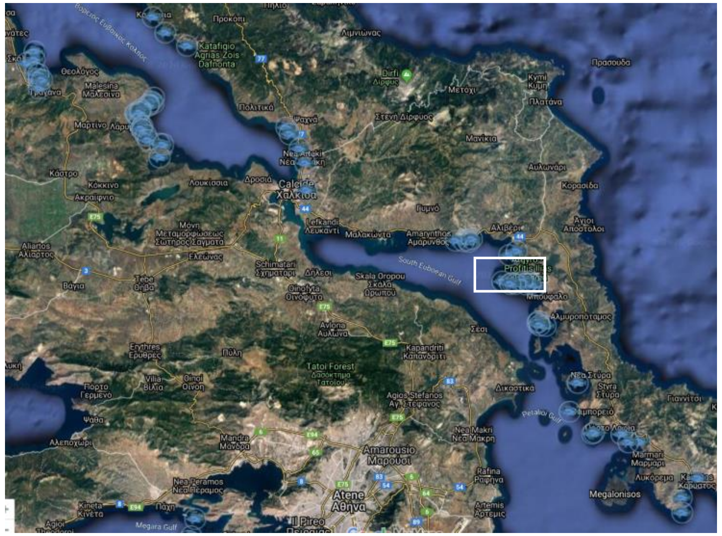


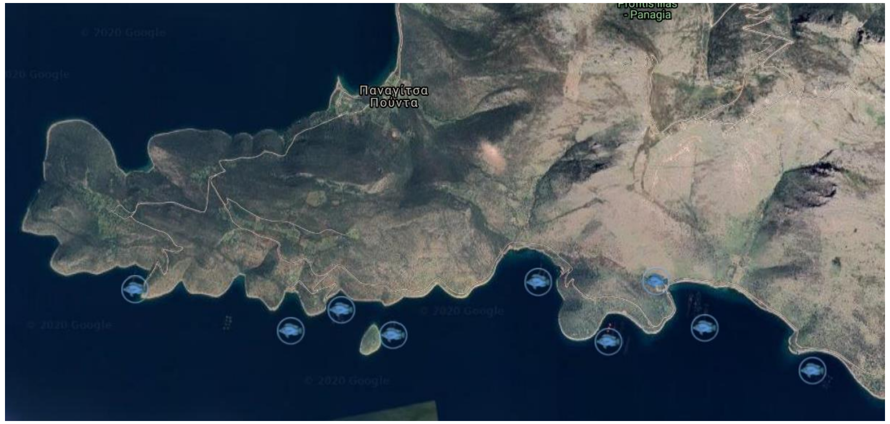
Recommendations for Future Research

4) Spatial and temporal resolution of physical impacts: Move from regional climate change (sub-basin scales). Need projections with higher spatial resolution… local scale



NASO Maps Greece
https://www.google.com/maps/d/viewer…

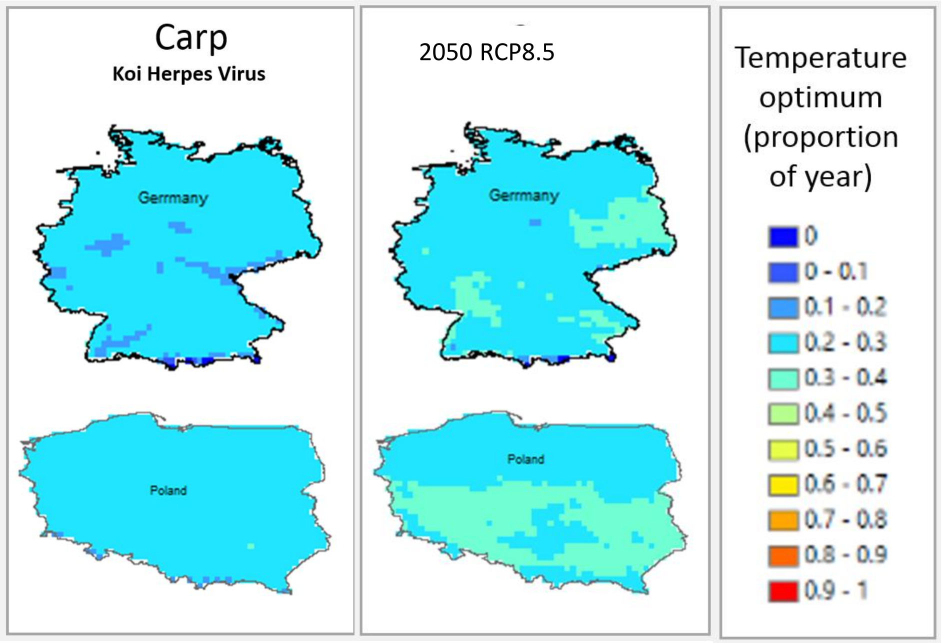


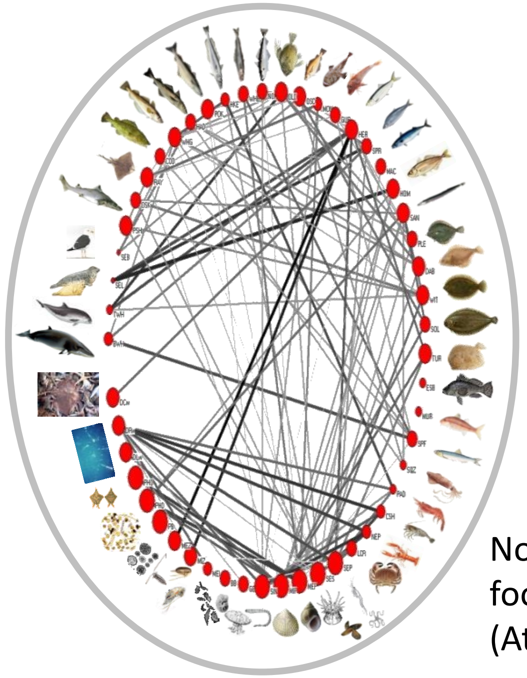


Recommendations for Future Research

5) Direct biological effects of climate change on aquatic living resources: Gap analysis identified research needs on interacting factors and life stage responses.

6) Indirect biological effects of climate change need to be better represented in models such as (novel) food webs or future prevalence of disease.

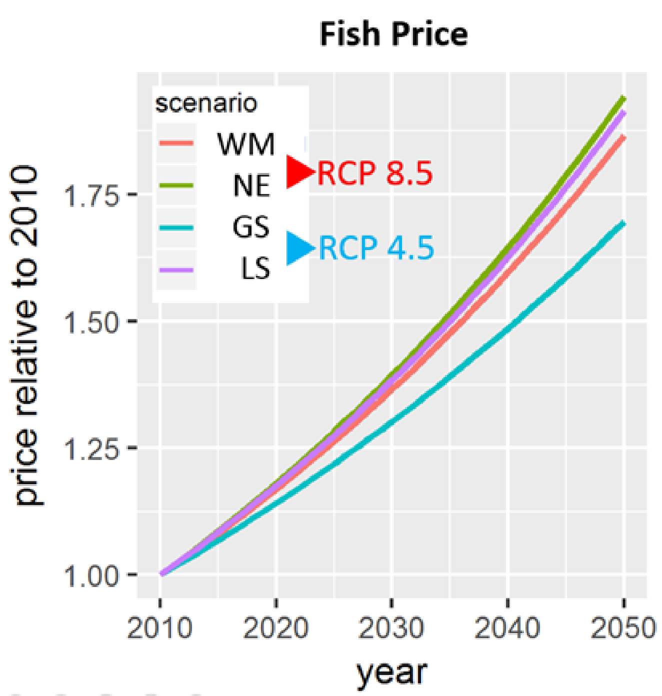


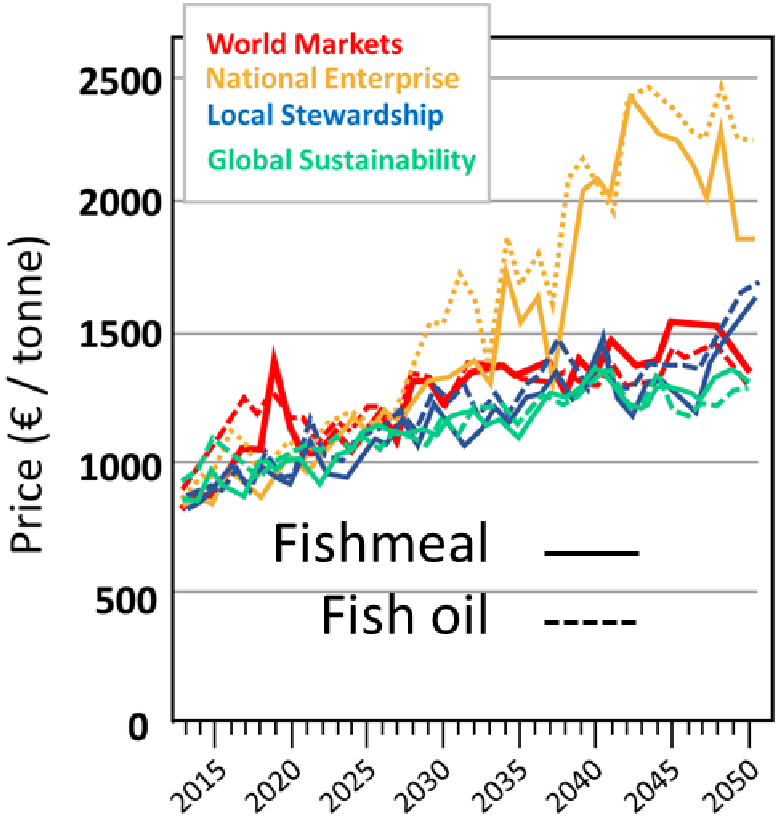


North Sea food web (Atlantis)

Recommendations for Future Research

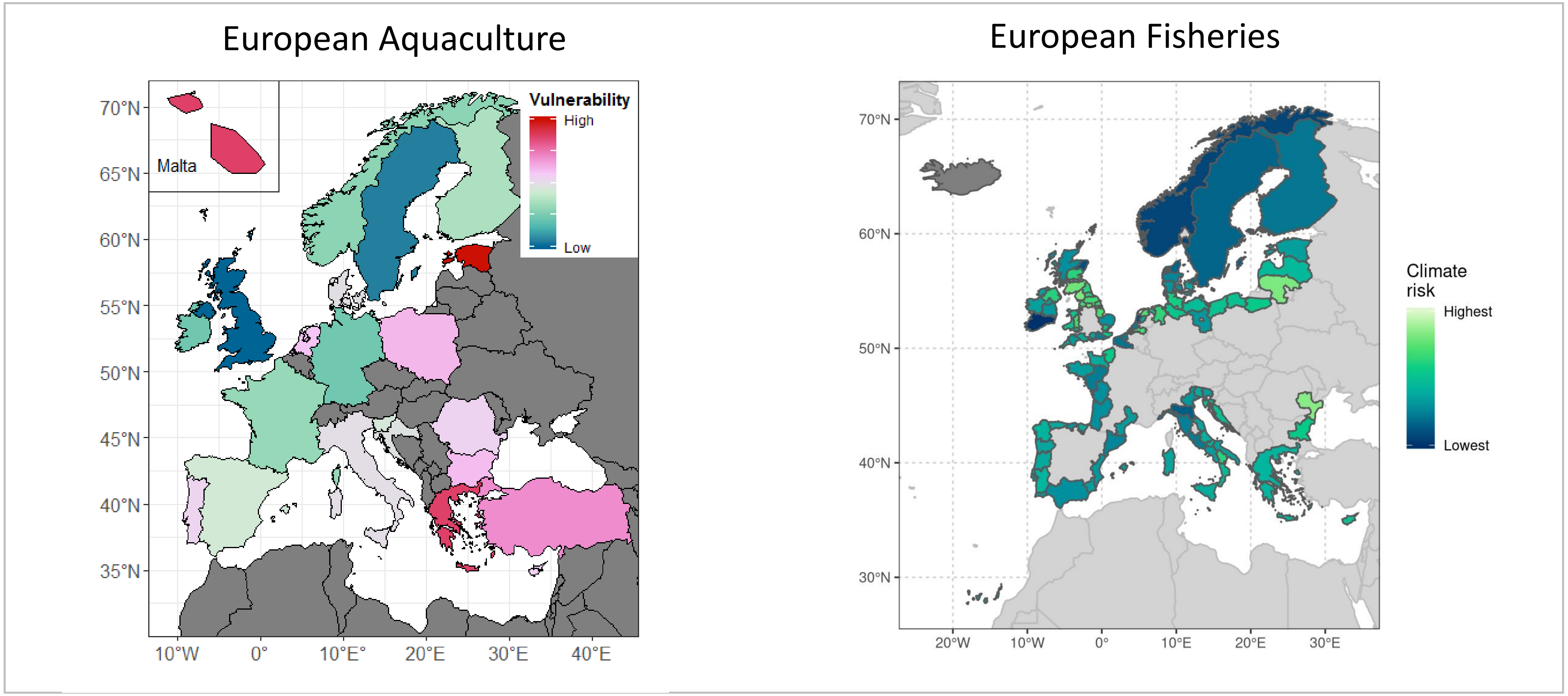
7) More effort on producing bioeconomic scenarios for mid- to late-century: For both sectors, future changes in policy or economics often more important than direct, biological effects of climate change (e.g. scenarios considered now would differ because of Covid-19).



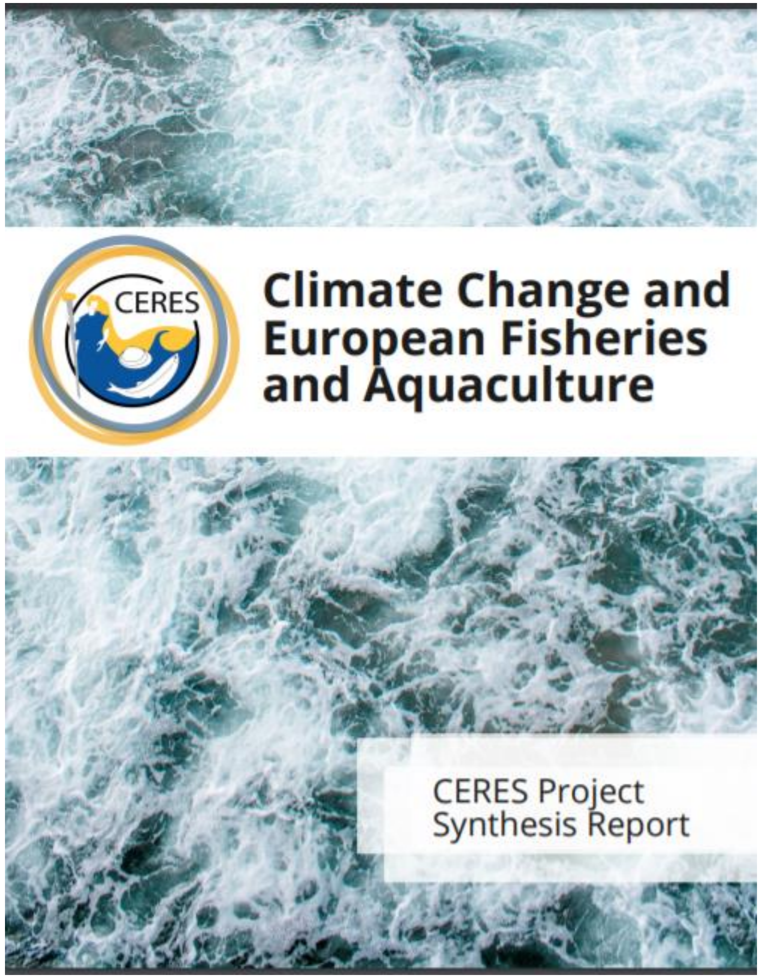


Recommendations for Future Research

8) Climate change vulnerability / risk: better represent sensitivity and adaptive capacity of dependent human communities (bottom-up approach) – social-ecological systems.



Spreading our Message	#
Radio or TV	11
Exhibition	16
Flyers	6
Peer-reviewed publications	50
Publications (in prep)	19
Popularised publications	10
Project Deliverable Reports	16
CERES Conferences	6
CERES Workshops	38
Activity w/ H2020 project(s)	8
Conferences Attended	142
Workshops Attended	54
Press releases	13
Social media	10
Training	14
Video/film	8
Apps	4



CERES Synthesis Report

CERES in 2020 Report

ceresproject.eu

WATER

WATER: Where can Aquaculture Thrive in EuRope

Use WATER to map depth, wave height, oxygen, and other parameters in regional seas. You can also use it to find out how well a particular species will grow in marine waters.

MET Database

Get data on the cultivation thresholds of aquatic animals and plants on the Maritime and Environmental Thresholds for Aquaculture database

MET

ClimeFish home page: https://climefish.eu/

Home | The Project | 2020 Forum | News | Results | Stakeholders

- **When**: 25-26 February 2020
- **Where**: FAO Headquarters, Rome
- **What**: Programme

@ClimeFish, 1500+ followers

Virtual fact sheets

Case 1 **Northeast Atlantic Fisheries**

Cases 2-3 **Baltic Sea Fisheries**

Case 4 **Barents Sea Fisheries**

Case 5 **West of Scotland Fisheries**

Case 6 **Adriatic Sea Fisheries**

Case 7 **North Norwegian Lakes**

Case 8 **Italian Lake Garda**

Case 9 **Czech Lake Lipno**

Case 10 **Hungarian Ponds**

Case 11 **Northeast Atlantic Aquaculture**

Case 12 **Greek Aquaculture**

Case 13 **Spanish Aquaculture**

Case 14 **Scottish Aquaculture**

Case 15 **Italian Aquaculture**

Case 16 **European Waters Overall**

Strong internal and external collaboration in both projects

ClimeFish

CERES

Universities

CoNISMa Consorzio Nazionale Interuniversitario per le Scienze del Mare

DTU

NUI Galway OÉ Gaillimh

Mersin Üniversitesi 1992

UH Universität Hamburg DER FORSCHUNG | DER LEHRE | DER BILDUNG

University of Hull

Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Research institutes

Cefas

hcmr ΕΛΚΕΘΕ

HAVFORSKNINGSINSTITUTTET INSTITUTE OF MARINE RESEARCH

CSIC Consejo Superior de Investigaciones Científicas

Ifremer

INCDDD TULCEA

IPMA

PML Plymouth Marine Laboratory

SMHI

THÜNEN

WAGENINGEN UNIVERSITY & RESEARCH

Industry partners

KILIÇ

LONGLINE ENVIRONMENT

PFA Pelagic Freezer-Trawler Association

FishVet Group

VisNed

CETMAR

CSIC

ICES CIEM

Institute of Marine Research Havforskningsinstituttet

matís

SYNTESA Innovation to market

Biology Centre CAS

Nofima

Stockholm University Baltic Sea Centre

FEAP

HAKI

Food and Agriculture Organization of the United Nations

NTU

b-tu Brandenburg University of Technology Cottbus - Senftenberg

hcmr

University of Stirling

AVS

University of Aberdeen

Memorial University

University of Tromsø

CERES Consortium and Research Advisory / Reference User Groups

Ingrid van Putten (CSIRO)

Selina Stead (Newcastle University)

Sandra Shumway (UCONN)

Greta Pecl (IMAS)

Anne Hollowed (NOAA/NMFS)

William Cheung (UBC)

Patrick Sorgeloos (U Ghent)

Steven Cooke (Carleton)

Johan Johansen (Salten AP)

Tyler Eddy (Memorial Univ.)

Derek Tittensor (Dalhousie)

Marta Carreras (MEDAC)

Mariló López (Culmarex)

Fabio Massa (GFCM)

Stefan Meyer (EATIP)

Ion Munteanu (DDBRA)

Thank you for your work and support!

ClimeFish

More productivity metrics
(8 babies – 6 shown)

Arthur
(2017)

Matilda
(2018)

Sene
(2018)

Mila
(2018)

George
(2019)

Samuel
(2020)

CERES

… and likely a few more „in prep“

15+ ClimeFish Babies

Hanne – Bjørk and August
Andrea – Erica
Rosa – Martinio
Gergõ – Anna and Marcel
David – Lada
Anne – Helena Jane
Scott – Emery
Juliana – Aurora
Unn – Jonas
Ragga – Arndis Anna and Edda Margrét
Szilivia – Ariana
Charlie – Freja

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General thoughts and advice after four years

- Good to run two projects in parallel. Request cooperative measures and budget in topic text and in DoA
- Request that Climate-ADAPT and other established platforms are used
- Encourage and support cooperation across Areas and Pillars in Horizon Europe
- Flexibility to move resources between WPs and Partners is essential when workforce moves or goes on parental leave
- Thanks to our very supportive and friendly Project officer and Policy Officer!

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Blue Action next