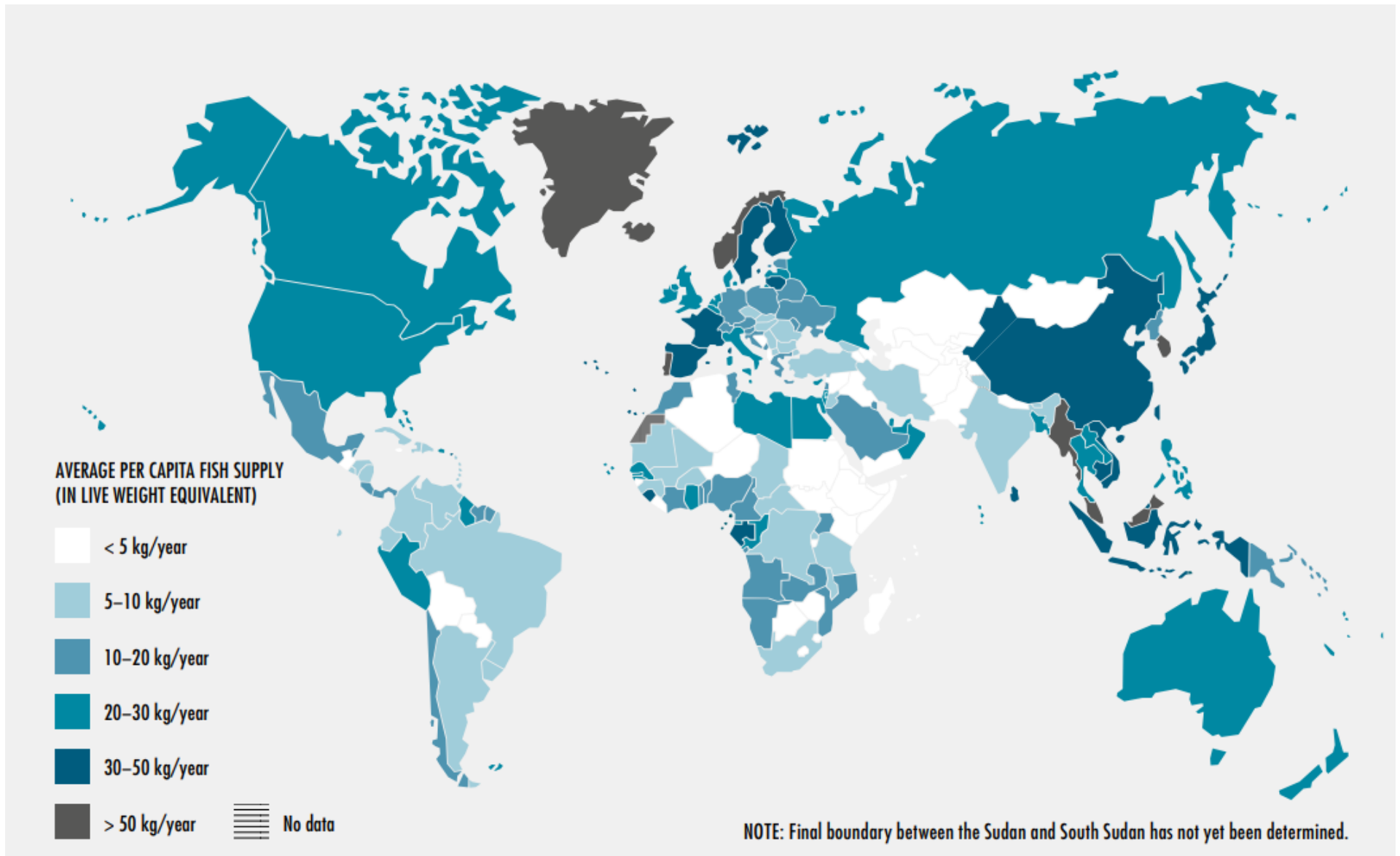


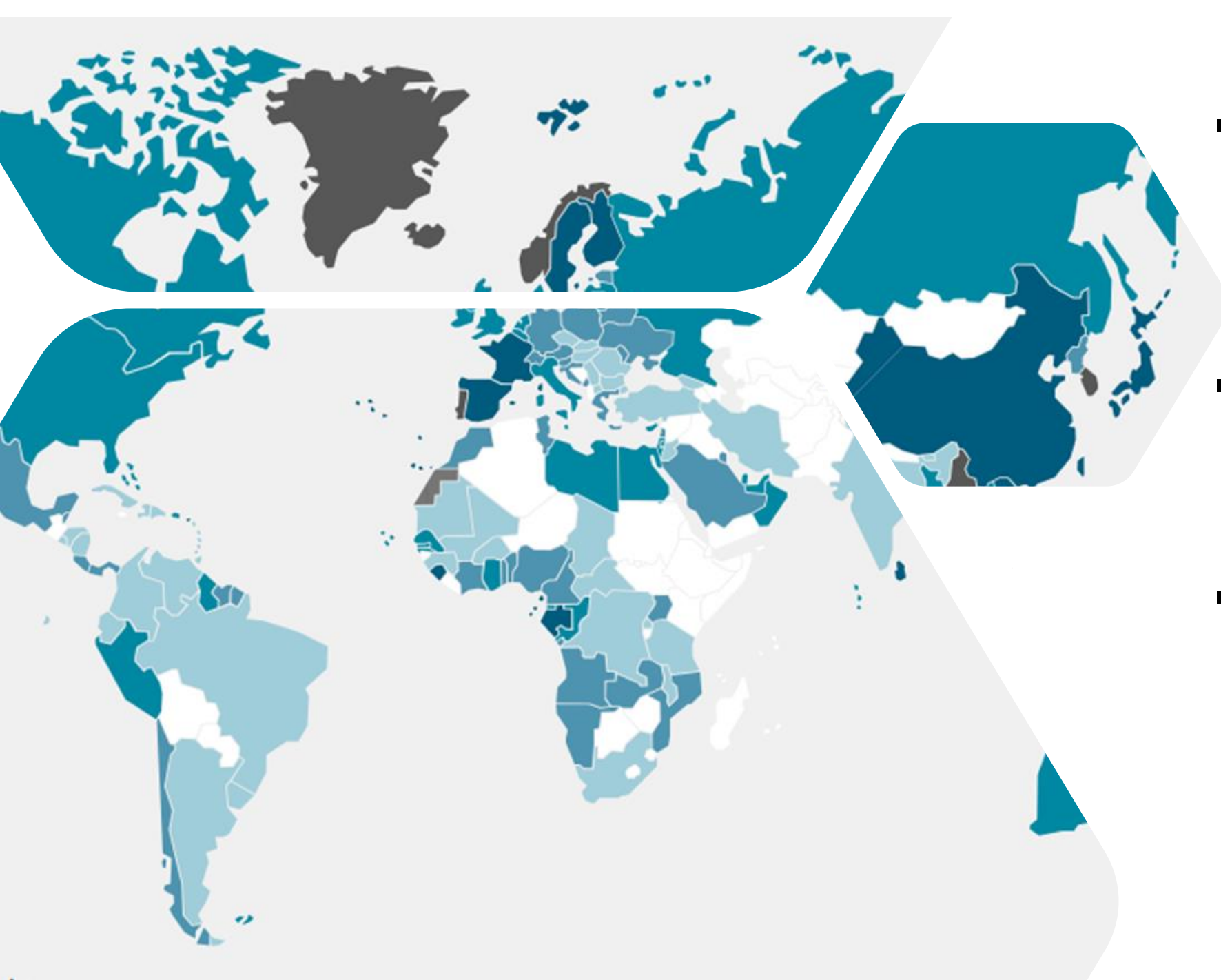
A large, jagged iceberg floats on the ocean's surface. The ice is white and textured with numerous cracks and ridges. In the center, a deep, circular crevice reveals a vibrant, deep blue pool of water, contrasting sharply with the white ice. The horizon is visible in the distance under a pale, overcast sky.

# Climate Change & Seafood An Industry Perspective

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Rome 25<sup>th</sup> February 2020





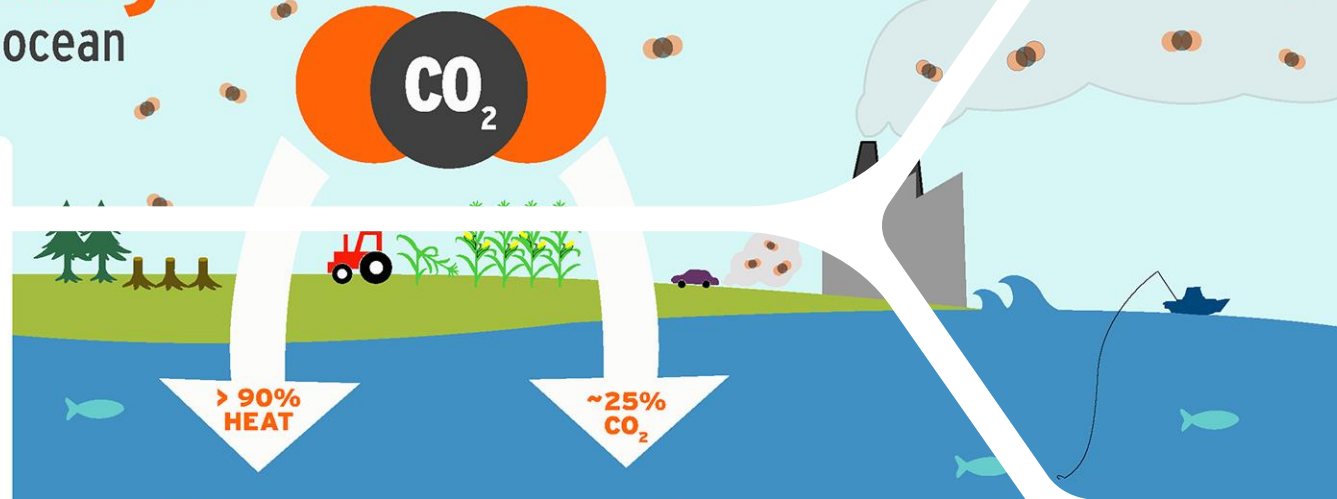


- More than 500 million people depend on fisheries & aquaculture for their livelihoods
- More than 4 billion people rely on fish for essential nutrition
- More than 37% of world fish production traded internationally

# Climate Change

## A triple threat for the ocean

Burning fossil fuels, deforestation, and other activities release carbon dioxide (CO<sub>2</sub>) and other heat-trapping gases into our atmosphere, causing our planet to warm. The ocean has buffered us from the worst impacts of climate change by absorbing more than 90 percent of this excess heat and about 25 percent of the CO<sub>2</sub>, but at the cost of causing significant harm to marine ecosystems.



The ocean absorbs:

- 90% of excess heat
- 25% of excess CO<sub>2</sub>

Causing:

- Increasing ocean temperature
- Ocean acidification
- Decreasing oxygen
- More severe and extreme weather & higher sea level



### SEA LEVEL

Sea level rise is accelerating, flooding coastal communities and drowning wetland habitats.



### BLEACHING

Warm-water coral reefs (marine biodiversity hotspots) could be lost if the planet warms by 2°C (3.6°F).



### TOXIC ALGAE

Larger and more frequent blooms are making fish, birds, marine mammals and people sick.



### HABITATS

Lower oxygen levels are suffocating some marine animals and shrinking their habitats.



### ACIDIFICATION

More acidic water harms animals that build shells, such as corals, clams, and oysters.



### FISHERIES

Disruptions in fisheries affect the marine food web, local livelihoods, and global food security.



Monterey Bay Aquarium  
Research Institute



Monterey Bay  
Aquarium

Biophysical  
changes from  
global warming

Changes in:

Ocean currents  
ENSO  
Sea level rise  
Rainfall  
River flows  
Lake levels  
Thermal structure  
Storm Severity  
Storm frequency  
Acidification

Effects on:

Production  
Ecology

Fishing &  
Aquaculture  
operations

Communities  
Livelihoods

Wider society &  
Economy

Impacts on:

Species composition  
Production & yield  
Distribution  
Diseases  
Coral bleaching  
Calcification

Safety & efficiency  
Infrastructure

Loss/damage to assets  
Risk to health & life  
Displacement & conflict

Adaptation & mitigation costs  
Market impacts  
Water allocation





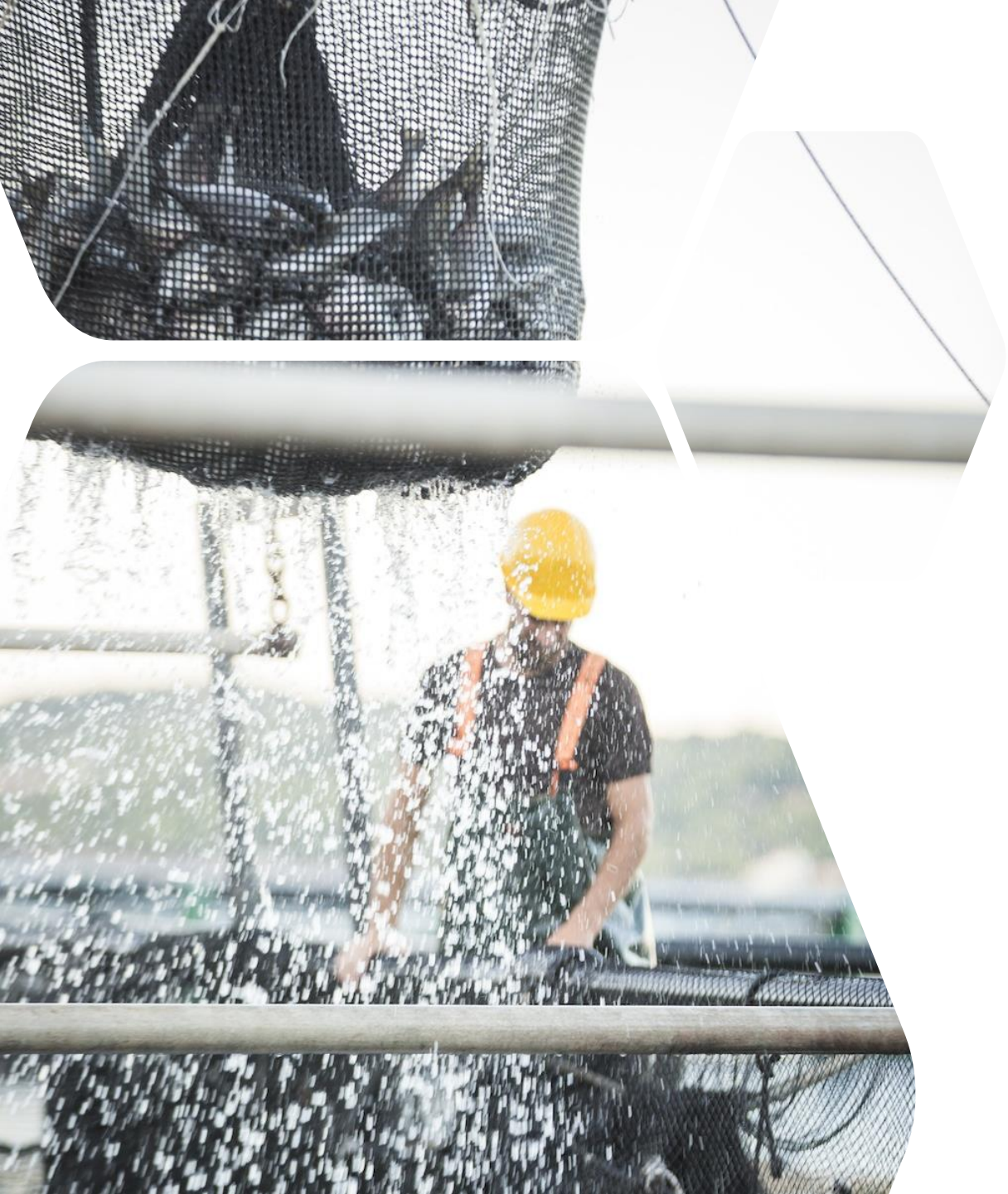
Aquaculture is likely to be both negatively and positively affected by changes in:

- Precipitation
- Temperature
- Drought
- Storms and floods

all of which would have socioeconomic implications.

Climate- and acidification-related impacts on aquaculture are expected to vary by :

- Location
- Species
- Method of aquaculture



Climate Change is expected to impact Aquaculture by affecting:

- Genetic Material
- Feeds
- Fish Health & Welfare
- Environmental challenges
- Economic factors

And within the context of Climate Change, Aquaculture is likely to affect the environment through its effluents





## Genetic Material

- Species produced need to be resilient enough to cope with oncoming changes
- Fish produced may face challenges as the surrounding average temperature may lie in a sub-optimal range.
- Average temperature will rise approximately 1-1.5 °C, but the lowest and highest temperature may lie in the extreme ranges for the fish to cope with. Welfare issues arising???
- Temperature changes may play a role in sex determination and thus create issues as the main Mediterranean species are naturally producing and release gametes. Growth losses attributed to this can become substantial





# Fish Feeds

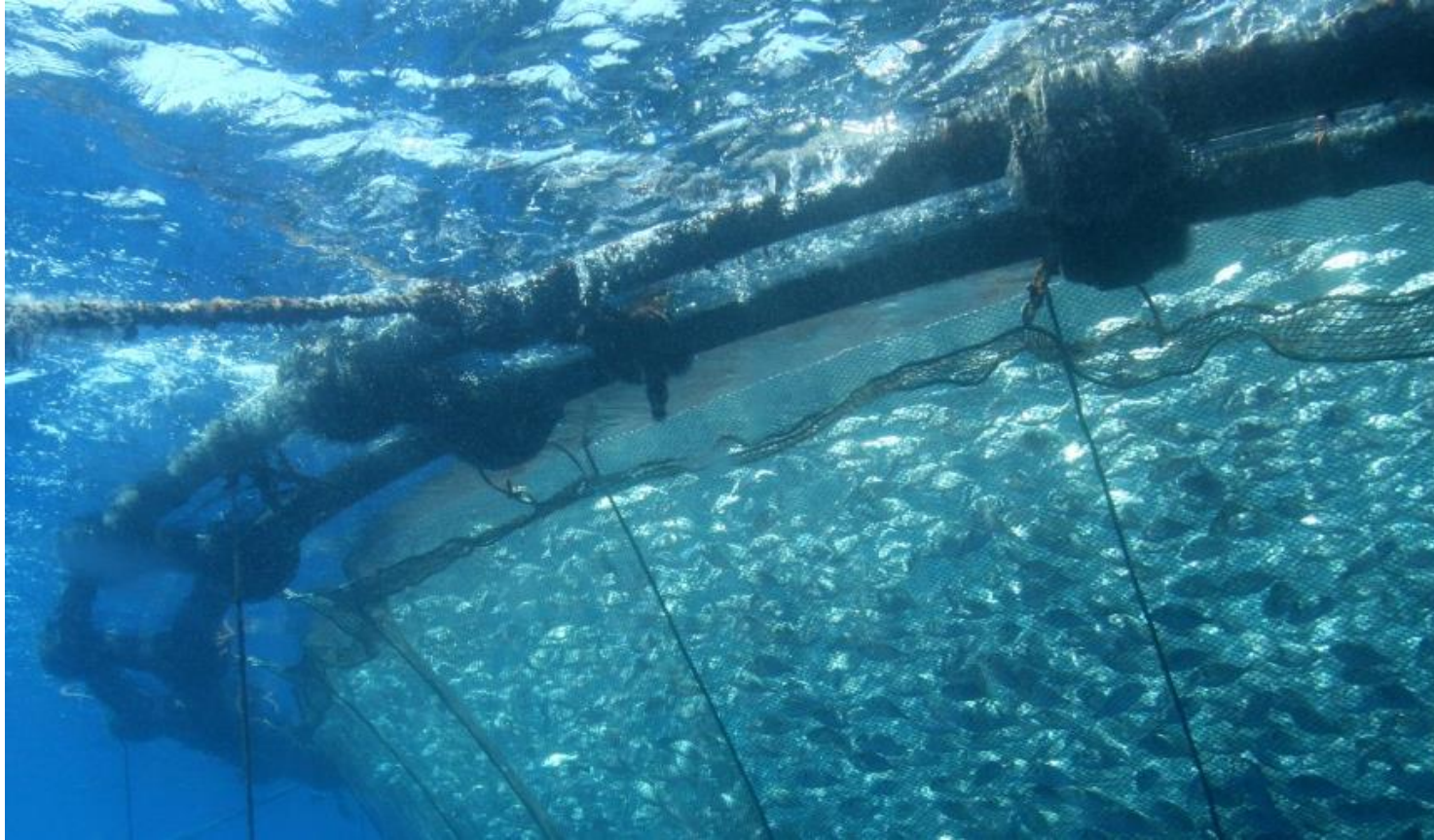
- **Will raw materials used for fish feed be enough?**
- How will the wild stocks used for fish feeds cope with the upcoming changes? Will they be resilient enough? What about the El Niño effect?
- **Fish feeds may need to be changed in order to cope with the increased feeding needs**
- The feeding needs of the fish may well change as the temperature will change
- Different feed formulation will be needed in order to cover the nutritional needs (lipids, protein, vitamins & minerals)
- Different feed formulation for winter and summer diets
- Fish may exhibit different feeding habits (time of feeding, SFR, no of meals, needed)



# Fish Health & Welfare

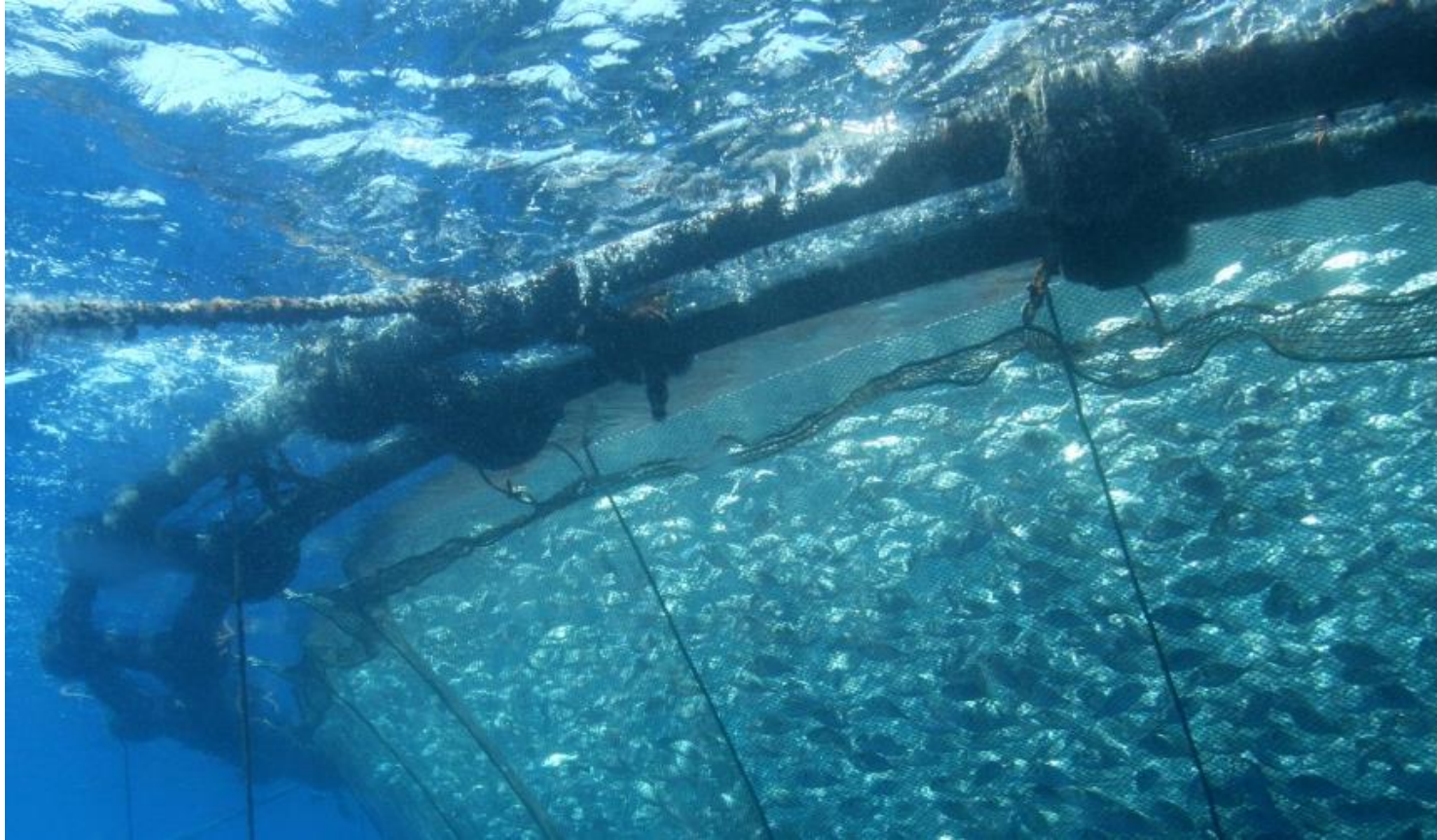
- Emerging and unknown diseases caused by new pathogens
- Will pathogens presence be manifested in unexpected ways?
- New syndromes affecting the fish health or welfare
- Old pathogens in new environmental conditions
  - Will working vaccines be still efficient?
  - A need for new antibiotics / chemotherapeutants?





# Environmental Impacts & Challenges

- Environmental condition changes may be too complex to be understood completely and in a timely manner
- The water average temperature may rise 1-1.5°C. But locally due to hydrogeological conditions, the temperature changes may be even more severe
- Water acidification may negatively affect the osmoregulatory functions of the fish affecting the fish health and welfare
- Availability of O<sub>2</sub> may change in the water column due to the chemical properties of water itself but also due to algal physiological needs
- Algal blooms could be created, or their duration may last longer with apparent effects on the fish health but also on the product quality



# Environmental Impacts & Challenges

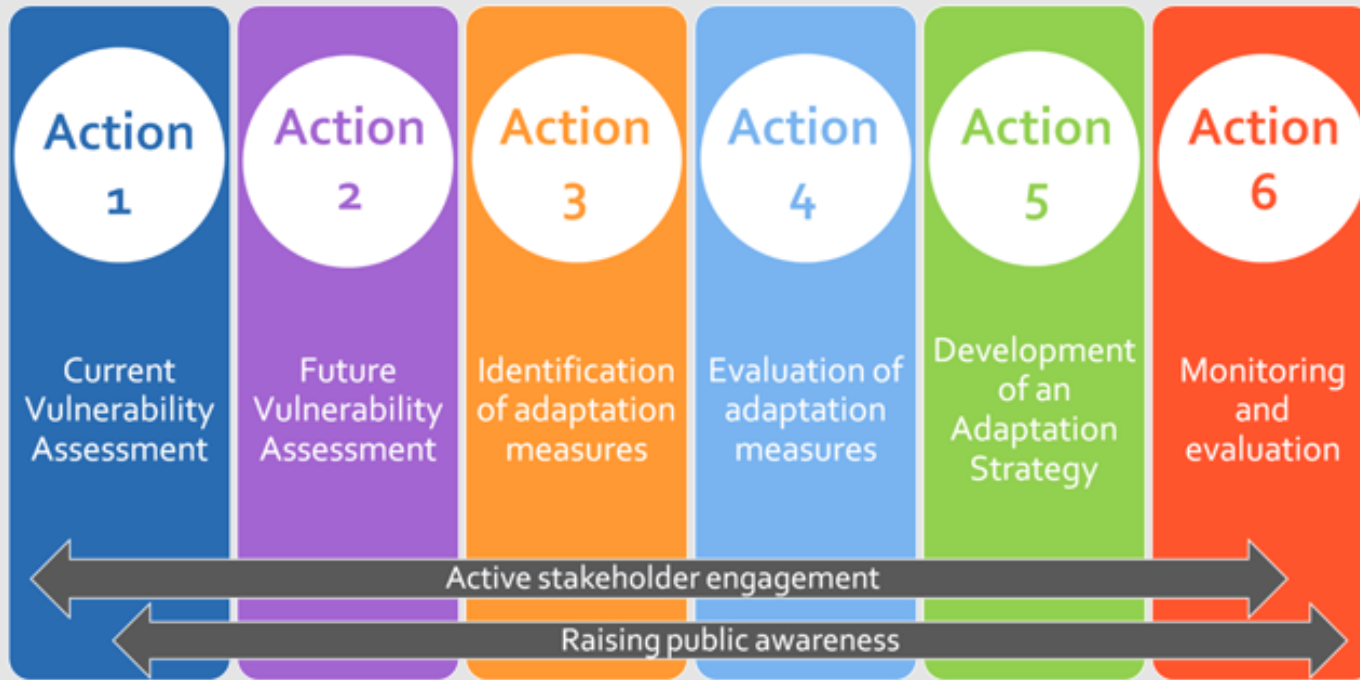
- Waves and currents in the Mediterranean basin are mostly affected by the temperature.
- Biodiversity changes. New species may be present adjacent to the farming areas, either through Leseptian migration either due to the environmental changes as well as the interactions with aquaculture.
- Farms may need to **relocate** as new biota may occupy the environment around the farms (eg *Posidonia oceanica* meadows appearing bellow existing farms)



# Energy Consumption

- Land based facilities
- Packaging stations
- Cold chain integrity
- Transportation





## The Way Forward: Climate adaptation strategies

- Need action at the EU and Member State level
  - Planning & design of adaptation strategies
  - Mitigation actions
- Science based knowledge
  - Data on current situation + robust forecasting tools
- Enhancing support mechanisms such as the CFP, EMFF, insurance schemes and others



[illegible]

- Greater collaboration between industry and scientific community
- Prediction models for the weather condition changes (per factor-temperature, currents, waves etc.)
- All prediction models should be applied with a focus to small geographical areas in order to mitigate the changes on the farm level.
- Research needed for the evaluation of the re-emergence of old known pathogens.



# Industry Strategies

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- Industry needs to invest in its future together with relevant authorities
- Private/Publicly funded research
- Aquaculture industry Data collection to improve prediction models (IoT, monitoring stations etc.)
- Species diversification / alternative species production
- Alternative fish-feed raw materials
- The level of the industry preparedness should be raised: need to constantly evaluate business model changes as well as environmental change
- Industry should invest on designing more robust equipment (netpens, moorings etc.) to mitigate any adverse conditions
- Spatial planning with future provisions based on scientific data
- Changes in insurance policies?



Thank you for your attention

