



# Algae and climate

Kick-off meeting with CINEA/DG MARE

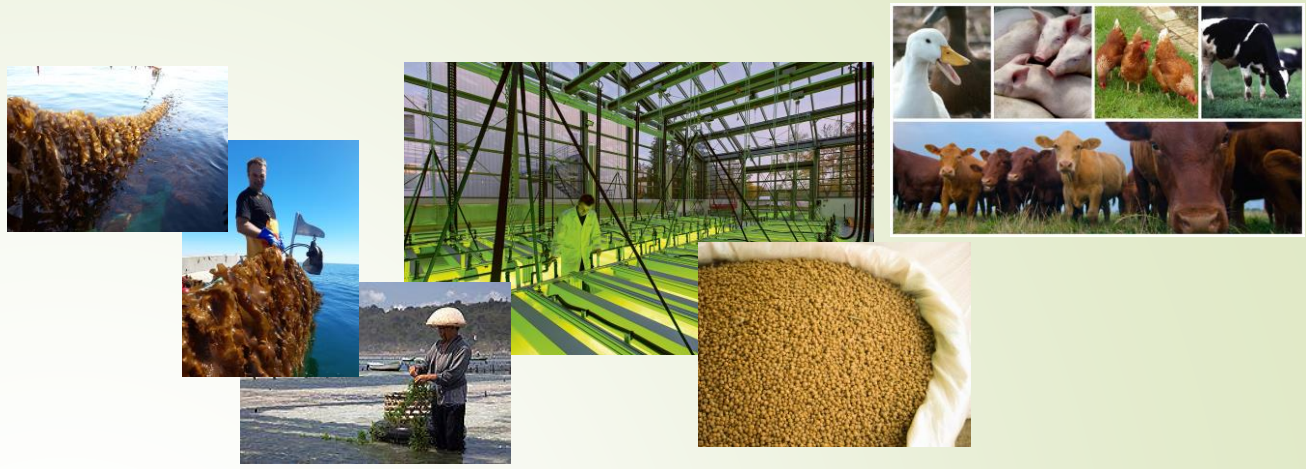
20/01/2022





# On the table

- **How?** Proposed methodology, selected issues
  - Technologies
  - Identity card
  - Feeds
  - Mapping and extrapolating
  - Sources of knowledge/data
  - The knowledge base
- **When?** Planning, synergies
- **What's next?**



# How? Methodology and expected results

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# Addressing the following key questions (1)

- ▶ What are **biomass and nutritional yields** for **different types of algae and production technologies** (e.g. marine waters versus land-based, closed versus open systems)?
- ▶ What are their **costs and greenhouse gas (GHG) emissions**, as well as their drivers? How do they **compare with land-based crops** with similar nutritional properties?



# Addressing the following key questions (2)

- For **inland systems fed by flue gases**
  - Under which conditions are algae production **competitive as compared to existing (land-based) feed**? With which (break-even) **carbon prices** (different algae/production types)?
  - What would be the **total potential** feed production, carbon dioxide captured and input (fertiliser, freshwater and land...) use?



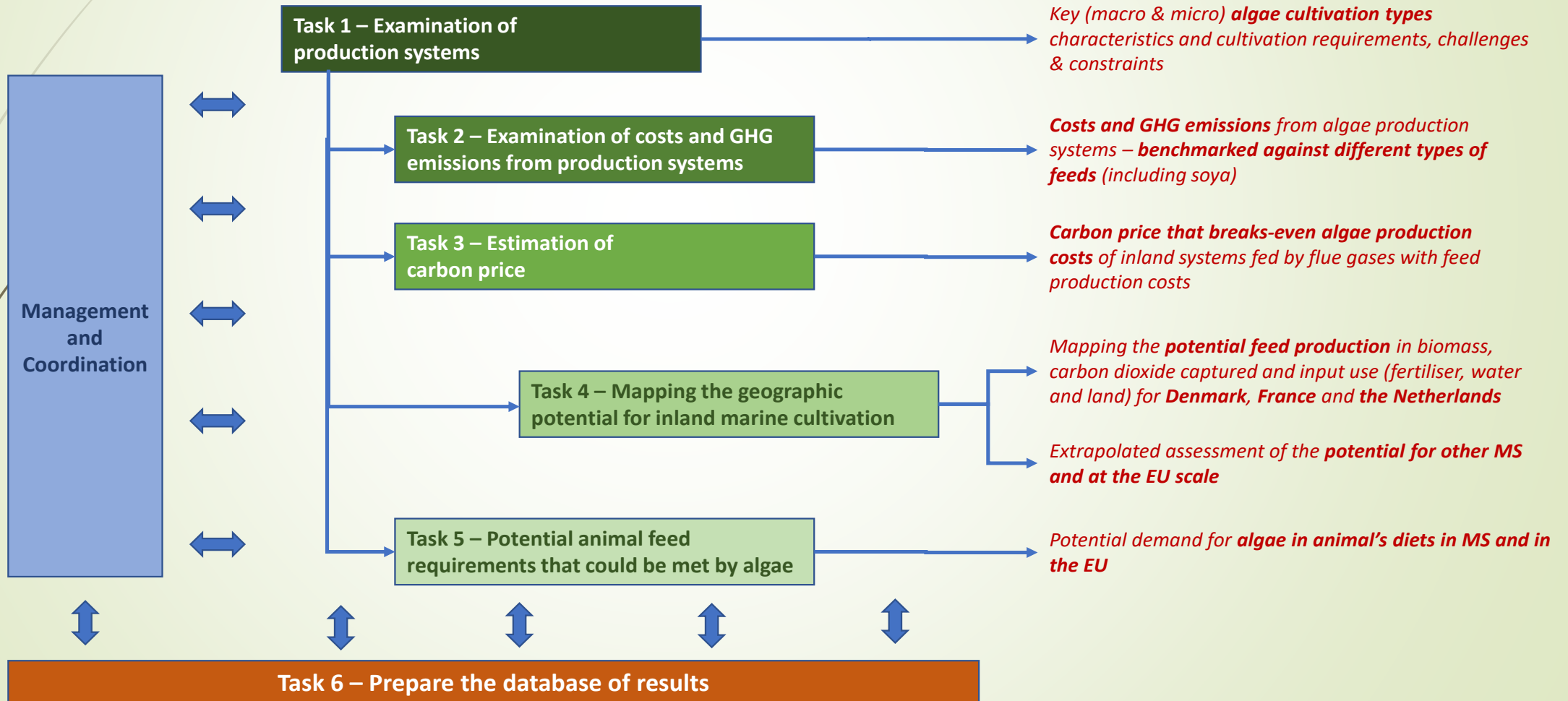
# Addressing the following key questions (3)

- ▶ Which **share of (today and future) animal's feed requirements** could be met by algae production? What are **key constraints** faced?
- ▶ To what extent can bioactive molecules produced by algae **reduce the contribution to GHG emission** from particularly ruminant livestock?

# The overall approach

From tasks and activities...

...to key results of the study



# A closer look at individual tasks (1)

Tasks	Activities	Comments/input
<b>Task 1 - Examination of production systems</b>	Production identity card, (database), literature review, interview guide & interviews, identification of knowledge gaps	
<b>Task 2 - Examination of costs and greenhouse emissions from production systems</b>	Collection of cost information and GHG (LCA) from the literature (link Task 1), integration in database, assessment of production costs in euros of different production systems (from database), collection of data on costs and GHG emissions of alternative sources of vegetable protein (including soya), critical comparison between algae and other sources of vegetable proteins	
<b>Task 3 - Estimation of carbon price</b>	Building on above results, calculation of break-even carbon price for inland systems fed by flue gases, collection of data on trends (past, future) in carbon price and flue gases (absolute/relative as compared to total GHG emissions, EU/MS scale for flue gases)	



## A closer look at individual tasks (2)

Tasks	Activities	Comments/input
<b>Task 4 - mapping the geographic potential for inland marine cultivation</b>	Development assessment framework for MS (key factors impacting potential), apply framework to three MS (Data collection, interviews, GIS and analysis), collecting MS data on key factors/variables, assessment of potential for individual MS and at the EU scale, development of EU-wide maps (country or potentially regional scale), building links between digital maps and the Atlas of the Seas, metadata development)	
<b>Task 5. Potential animal feed requirements that could be met by algae</b>	Collection of existing reference values (different countries, EU/international - e.g. FAO) of nutritional needs (different types of livestock & livestock characteristics), collecting and structuring livestock data (size of herds/flocks at the MS scale, basic characteristics...), optimisation on nutritional compounds for assessing maximum animal feeds that can be met by algae (interviews with livestock/animal feed experts and researchers), consideration of other factors and contextual elements that will impact the potential (MS scale), assessment of potential animal feeds that can be met by algae at MS/ EU scales	

# A closer look at individual tasks (3)

Tasks	Activities	Comments/input
<b>Task 6 - Prepare database of results</b>	Develop the database (Concept, computer-based version – link to the Atlas of the Seas), support input (Referencing and metadata), checks for data coherence and integrity, share and consolidate (consultation), user's guide and metadata	

# Sharing responsibilities

Backups for GIS and livestock

Tasks and activities	Roles and contributions			
	ACTeon (France)	AU-CBIO (Denmark)	KU (Denmark)	TNO (the Netherlands)
Task 1 - Examination of production systems	X	Lead	X	X
Task 2 - Examination of costs and greenhouse emissions from production systems	X	X	X	Lead
Task 3 - Estimation of carbon price	Lead			
Task 4 - mapping the geographic potential for inland marine cultivation	Lead (France)	X (Denmark)		X (The Netherlands)
Task 5. Potential animal feed requirements that could be met by algae	X	Lead	X	X
Task 6 - Prepare database of results	X	X	X	Lead
Project management and coordination	Lead	X	X	X

Role of AU-CBIO in Task 5?  
coordination and content (Mette Olaf Nielsen, SE)



# Issues for discussions

- ▶ **Issue 1** – Any priority **technology (ies)** (and why)?
  - ▶ 5 marine + 5 inland, macro and micro, systems fed by carbon dioxide in flue gas
  - ▶ From the evaluation: selection of species/production systems unclear, microalgae underrepresented
  - ▶ Initial ideas:
    - ▶ Marine/macro:: Traditional line cultivation, MACrigs, cultivation on nets, Multiuse solutions – synergy with marine energy production/other aquaculture/tourism/other
    - ▶ Inland/Macro+Micro: High Rate Algal Ponds (HRAP, raceway ponds, Tanksystems, Bioreactors – tubular, Bioreactors - Panels

# Issues for discussions

- **Issue 2** – The **identity card of individual technologies**: what to consider?
  - Current **state of development** (area/production capacity and volumes per country/regions, main value chains (qualitative/quantitative/monetary) and where)
  - **Basic characteristics**: algae species, product characteristics (mass yields/biomass productivity, nutritional yields – proteins but not only?), input requirements (water, land, energy, fertiliser, CO<sub>2</sub> uptake/assimilation... ) production costs (investments – including land price, O&M, **post-processing and transformation costs** (feed only, different value chains...), CO<sub>2</sub>/GHG emissions (balance? CO<sub>2</sub> and CO<sub>2</sub> eq for CH<sub>4</sub>, N<sub>2</sub>O, halomethanes ), current market price(s) under different value chains (when exist in Europe?), dependence on meteorological conditions (radiation, temperature, water temperature)
  - **Production constraints**: access to (sea)water, access to labour market, major infrastructure requirements (building/roads...) innovation transfer, governance, factors related to acceptability – odours, landscape, psychology...)
  - From the evaluation: nutritional yield estimation not addressed, cost estimation methods, CO<sub>2</sub> estimation not clearly explained + misses to consider CO<sub>2</sub> intake



# Issues for discussions

- ▶ **Issue 3** – Which **animal feeds** to consider for the comparative analysis with algae?
  - ▶ Sources of proteins (soja), other priority interest? Bring a global spatial and trade perspective in the assessments
  - ▶ For ruminants: anti-methanogenic feed additives, mineral supplements, protein supplement (provided digestibility issues can be overcome)
  - ▶ For various species: health promoting feed components (but quite complex to address).
  - ▶ Suggest that effects of health promoting components (complex to address, out of scope?) are mentioned as important bonus/additional benefits
  - ▶ Additional crops! rapeseeds, sunflower, beans



# Issues for discussions

- ▶ **Issue 4** – Mapping the geographical potential for inland marine algae cultivation **at the EU scale?**
  - ▶ Basic data for the EU wide « extrapolation »: availability of GHG/CO<sub>2</sub> from flue gases (fragmentation?), water availability/scarcity (marine waters on the coast?), land scarcity/price, eutrophication problems (fertiliser use), availability of waste heat for product drying, access (and distance) to value markets, access to labour, constraints imposed by environmental regulations....
  - ▶ Links to the Atlas of the Seas...



# Issues for discussions

- ▶ **Issue 5 – Collecting sound information and knowledge**
  - ▶ Projects and initiatives supported by the EC, key experts and stakeholders (including in non-EU countries/China e.g.)
    - ▶ Safe Seaweed Coalition, Norwegian Seaweed Technology Center, SeaWheat – EU COST network, Submariner network + partners, Oceans 2050, International Seaweed Organisation
    - ▶ Olavur Gregersen (Ocean Rainfores, active in the US), Silje Forbord & CO (Norwegian Seaweed Technology Center), Michele Stanley (SAMS, Scotland), Marie Magnusson (Waikato University, NZ), Muki Spigel (Haifa University), Korean network partners, John Bolton (South Africa) – and plenty more!
  - ▶ Link and synergies with EU4Algae for collecting evidence ? (which best windows for mobilising the emerging community – if any as it might be organised too late)



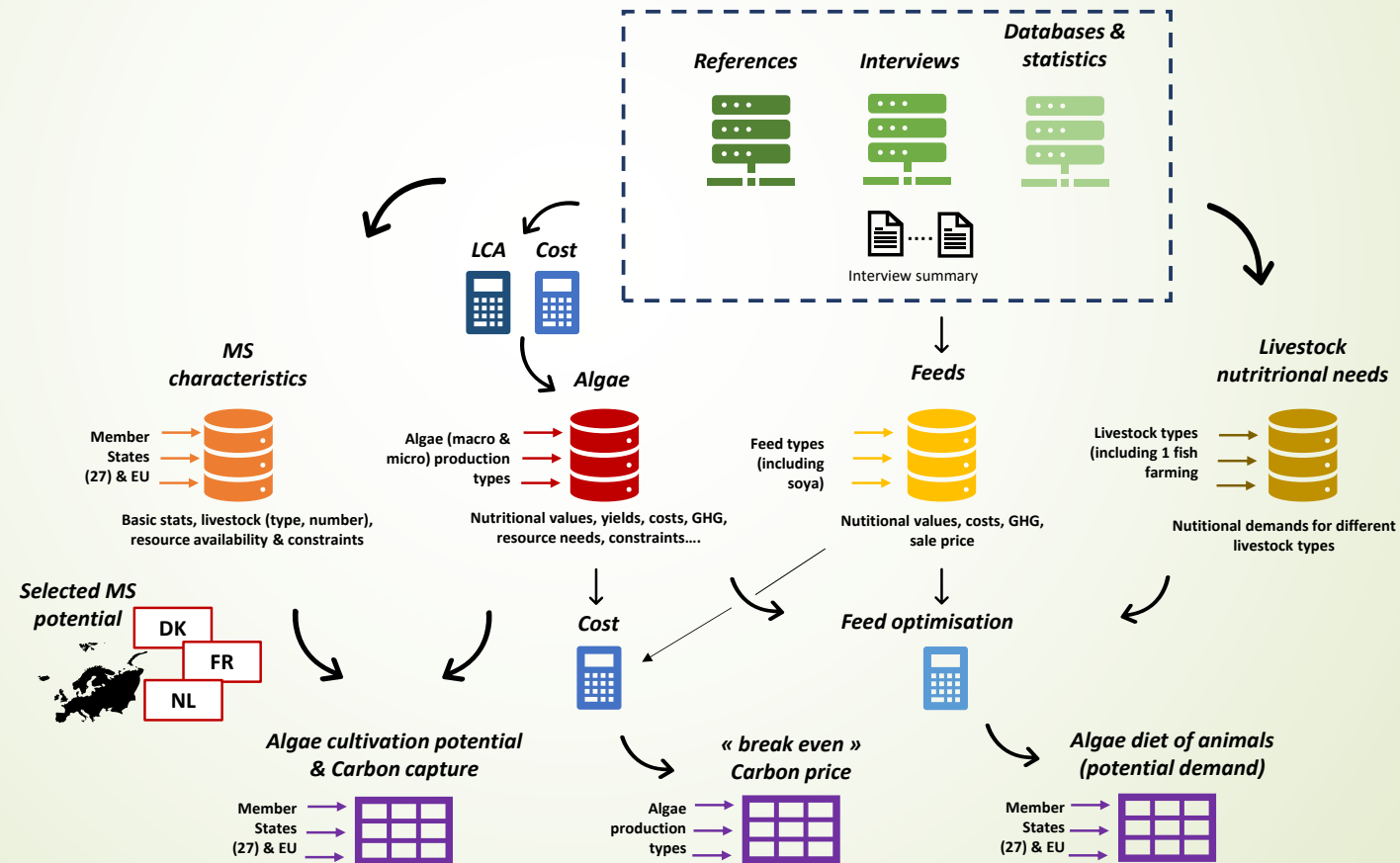


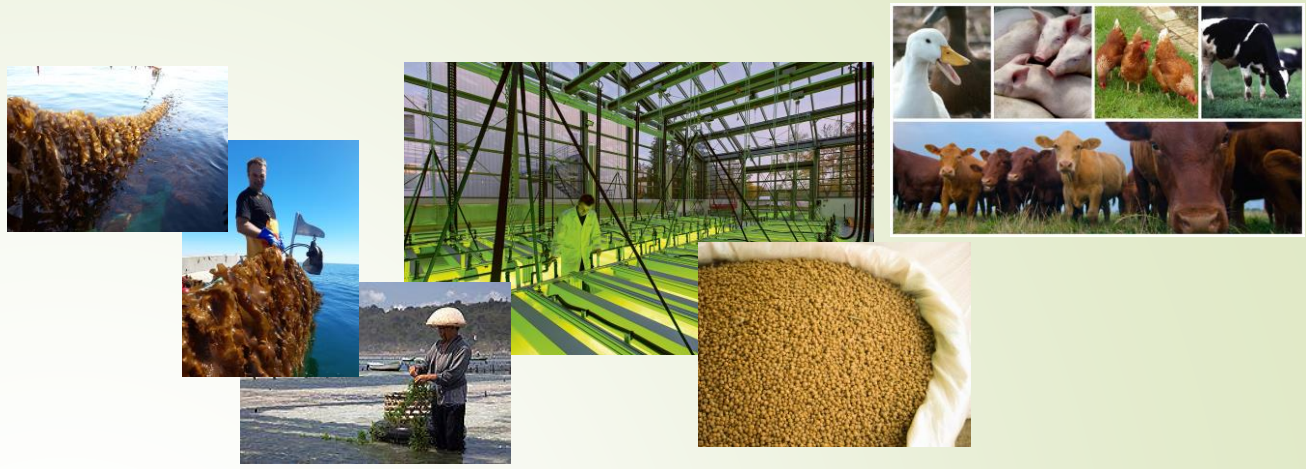
# Issues for discussions

- **Issue 6** – Developing and consolidating the **knowledge base**
  - Proposed structure & format (see next)
  - Future use (and EC users) after the project's end (=> targeting user's guide)
  - Links to the Atlas of the Seas (when to interact/contact person)
  - The consolidation process: consultation document with questions + online workshop, link to/role of the EU4Algae coalition?

# Issues for discussions

## ➤ Issue 6 – Developing and consolidating the **knowledge base**





# When? Time-table and key milestones

Kick-off meeting with CINEA/DG MARE

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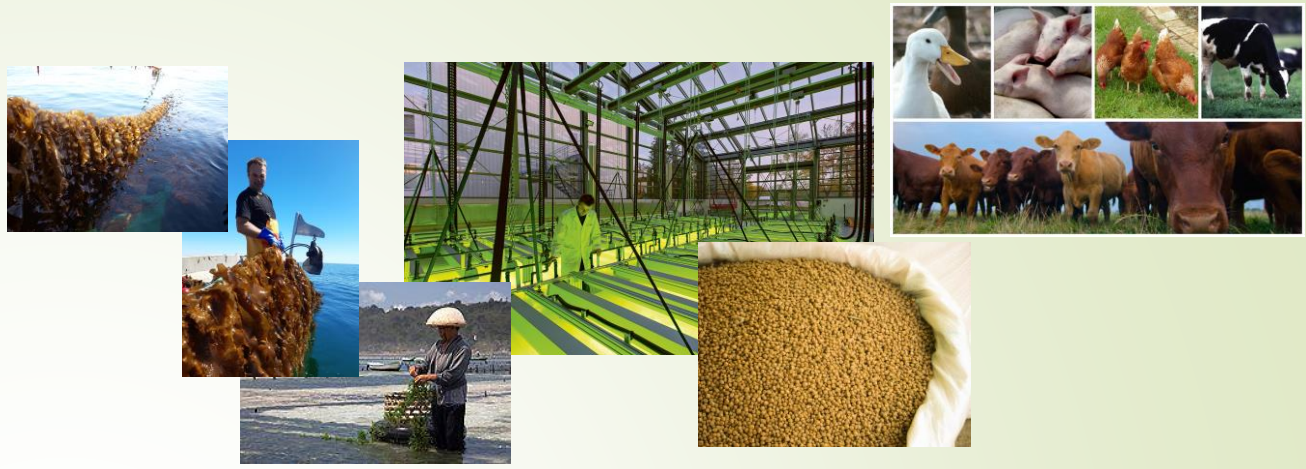
# General planning

- ▶ Study started December 17th, 2021
- ▶ **12 month** duration
- ▶ Two transversal tasks: (a) **management** and (b) prepare the **database** of results

# General planning

Key dates we need to account for?

Tasks and activities	Months											
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
<b>Project management and coordination</b>	[Green bar across all months]											
Management of the contract and project team	[Green bar across all months]											
Meetings with the EC	[Meeting icon]						[Meeting icon]				[Meeting icon]	
Reporting					[Bar]					[Bar]		[Bar]
<b>Task 1 - Examination of production systems</b>	[Green bar across M1-M3]											
Review of literature	[Bar]	[Bar]										
Interviews with key experts, stakeholders and researchers	[Bar]	[Bar]										
<b>Task 2 - Examination of costs and greenhouse emissions from production systems</b>	[Green bar across M3-M5]											
Assessment of production costs in euros of different production systems			[Bar]	[Bar]	[Bar]							
Assessment of GHG emissions using LCA methods			[Bar]	[Bar]	[Bar]							
Benchmarking with alternative sources of vegetable protein (including soya)				[Bar]	[Bar]							
<b>Task 3 - Estimation of carbon price</b>	[Green bar across M5-M7]											
Estimation of carbon price that can break even for inland systems fed by flue gases					[Bar]	[Bar]	[Bar]					
Comparing estimated prices with current and past carbon prices					[Bar]	[Bar]	[Bar]					
<b>Task 4 - mapping the geographic potential for inland marine cultivation</b>	[Green bar across M4-M10]											
Development of the assessment framework for individual MS				[Bar]								
Apply the assessment framework for three MS					[Bar]	[Bar]	[Bar]					
Extrapolation to the EU including outermost regions							[Bar]	[Bar]	[Bar]			
Digital maps							[Bar]	[Bar]	[Bar]			
<b>Task 5. Potential animal feed requirements that could be met by algae</b>	[Green bar across M7-M11]											
Assessment of nutritional needs of livestock (and one type of fish farms)								[Bar]	[Bar]	[Bar]		
Livestock features in Europe								[Bar]	[Bar]	[Bar]		
Assessment of the potential animal feeds that could be met by algae								[Bar]	[Bar]	[Bar]		
<b>Task 6 - Prepare database of results</b>	[Green bar across all months]											
Develop the database	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]
Support the input of information into the database				[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]	[Bar]
Consolidation of the database									[Bar]	[Bar]	[Bar]	[Bar]
User's guide and metadata										[Bar]	[Bar]	[Bar]



# What's next?

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# Key actions

What?	Who?	When?
Synthesis of the kickoff meeting	Consortium/ACTeon	A week after the meeting



# Many thanks!

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