



**Integrated Aquaculture  
reduces land and seascape  
carbon footprints**

PROGREEN

# Increased blue food demand necessitates reformed food systems

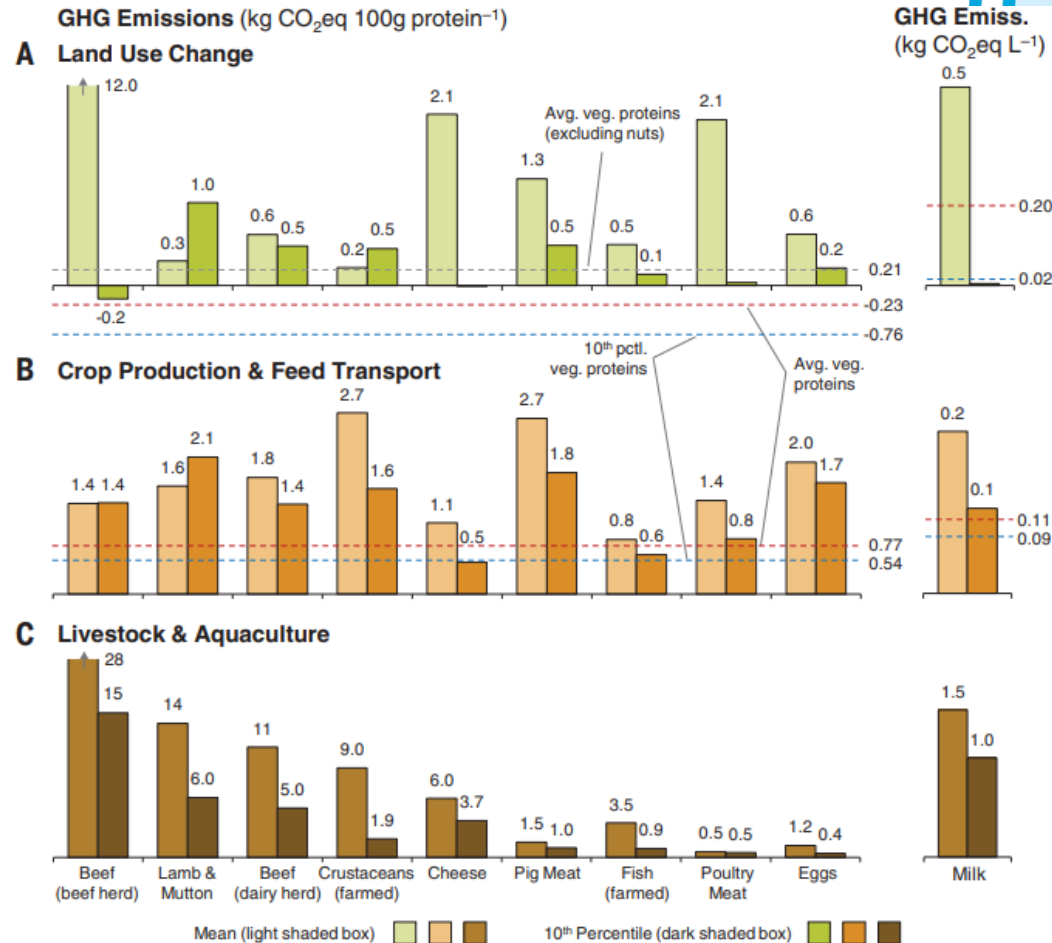
- Rising Climate Change and human population requires resilient and efficient food systems
- Aquaculture growth demands more resources from landscapes and may drive biodiversity losses
- Persistent yield gaps calls for use of better inputs
- Optimization of aquatic food systems in overall landscape critical

# THE CHALLENGE

IT'S NOT THAT STRAIGHTFOWARD

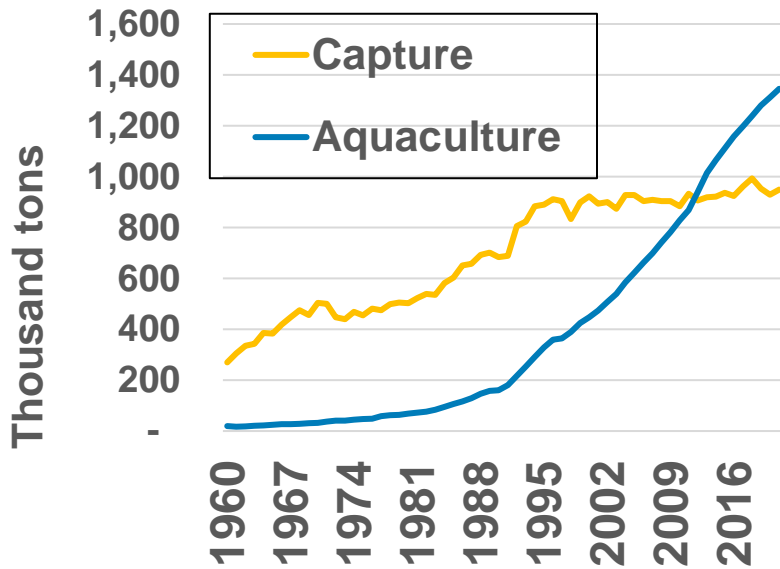
*“Food production accounts for 26% of global greenhouse gas emissions”*  
 (Poore and Nemecek, 2018)

Unknowns about the effects of food production, including aquaculture, limit appropriate policy and action



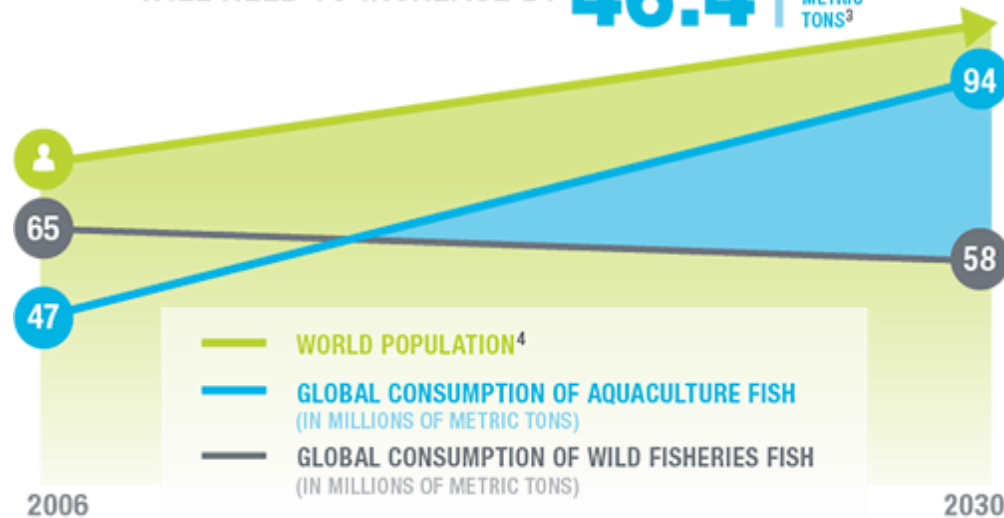


# Turning the Challenge of a Rapidly Growing Aquaculture Sector into an Opportunity



Source: *World Development Indicators*

TO MEET THE WORLD'S SEAFOOD NEEDS,  
**AQUACULTURE PRODUCTION**  
 WILL NEED TO INCREASE BY **46.4**↑ MILLION METRIC TONS<sup>3</sup>



Global Aquaculture Alliance

# Principles of Eco-friendly aquaculture: integration and restoration



By **changing mindset**, harnessing new materials & technology on food, to stop waste and pollution



**Food products** cannot last for ever, but we can Keep them **in circulation**, so they don't end up in landfill



**Nutrient cycling** enhances natural resources & restores nature to better state

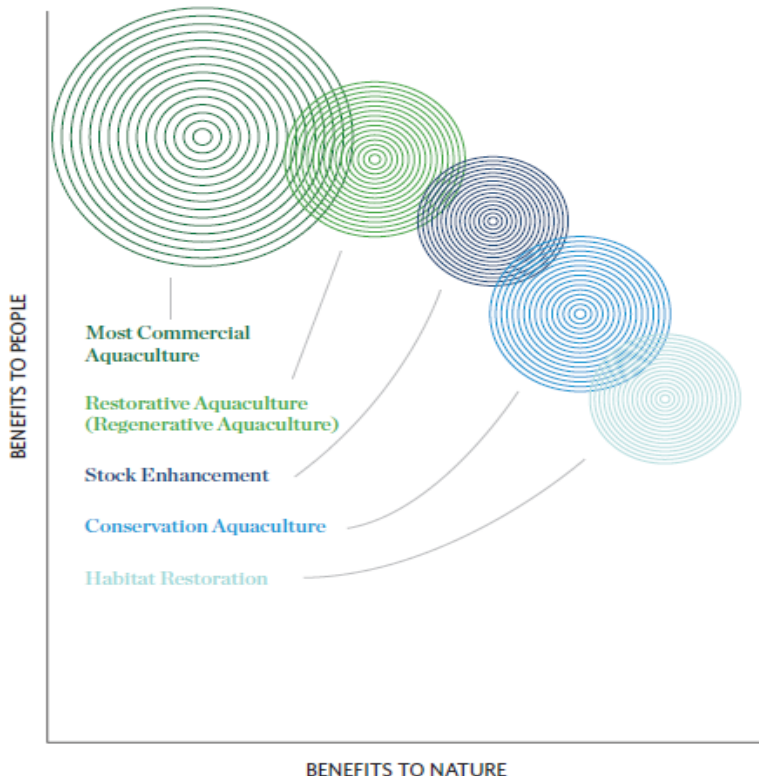
Tackle Climate change, **biodiversity loss**, social needs

→ **decoupling profits, & grow prosperity, jobs, and resilience**

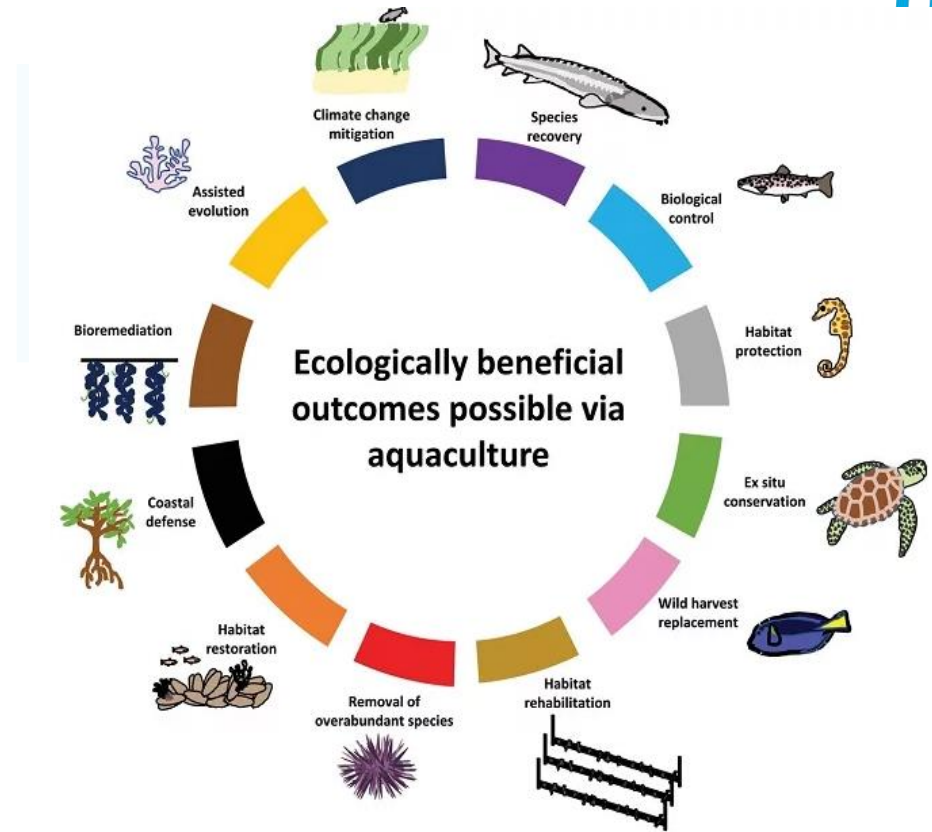
→ **cut production cost, greenhouse gas emissions, waste & pollution**

→ **recover nutrients in soils, energy**

# Benefits of Aquaculture to people and nature

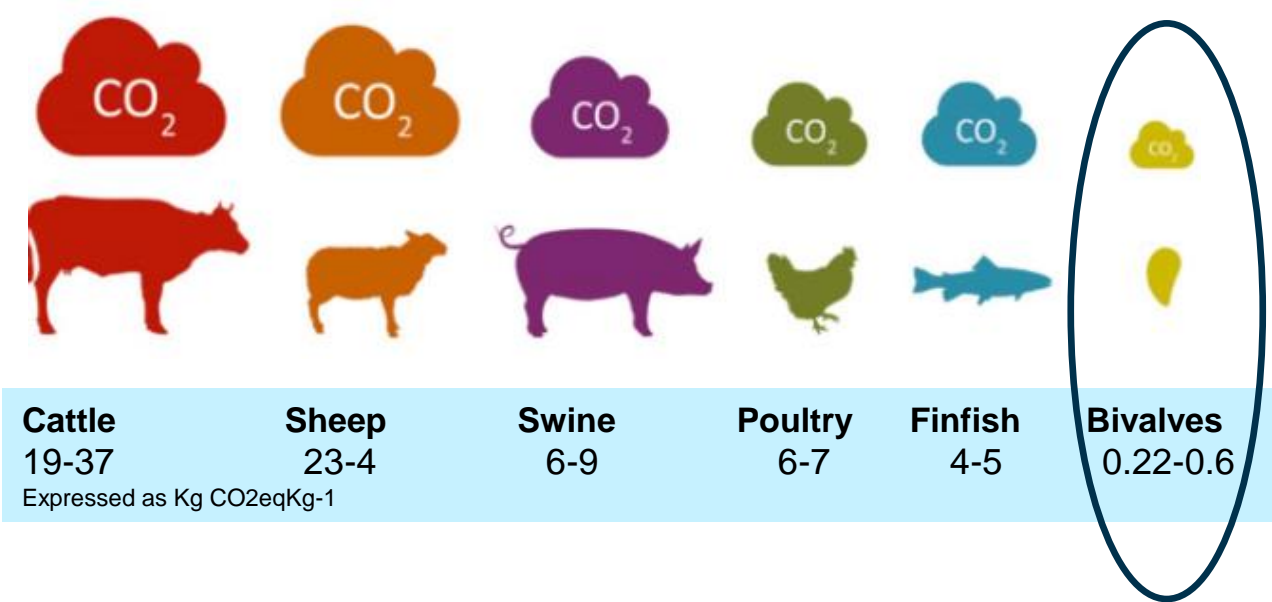


Source: Wayne et al. (2018)



Source: Overton et al., (2023).

# Aquaculture can reduce overall carbon footprint in animal protein production systems

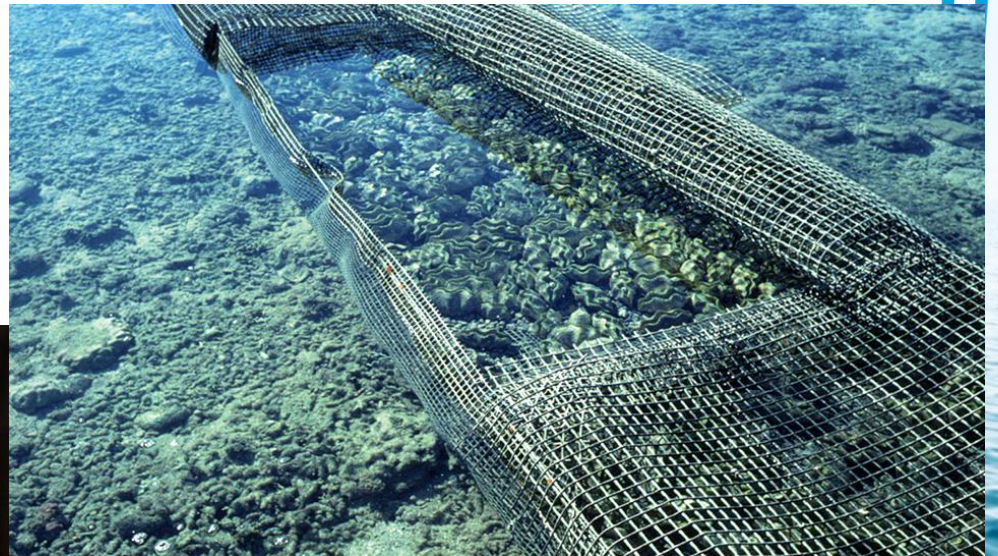


Source: MacLeod et al. (2020).



# FOCUS AREAS

- INTEGRATED AQUACULTURE INTO LAND AND SEASCAPES
- RESTORATIVE AQUACULTURE
- WASTE MANAGEMENT
- ALTERNATIVE RAW MATERIALS





# Integrated Aquaculture Strategies confer low carbon footprint than intensive systems

Farming Strategy	Carbon Footprint
<b>Integrated Strategies</b>	↓ CO <sub>2</sub> ↓ CH <sub>4</sub>
Intensive shrimp farming	↑ CO <sub>2</sub> ↑↑ CH <sub>4</sub>
Marine finfish cage farming	↑↑ CO <sub>2</sub> ↑ CH <sub>4</sub>
Intensive crab farming	↑ CO <sub>2</sub> ↑ CH <sub>4</sub>

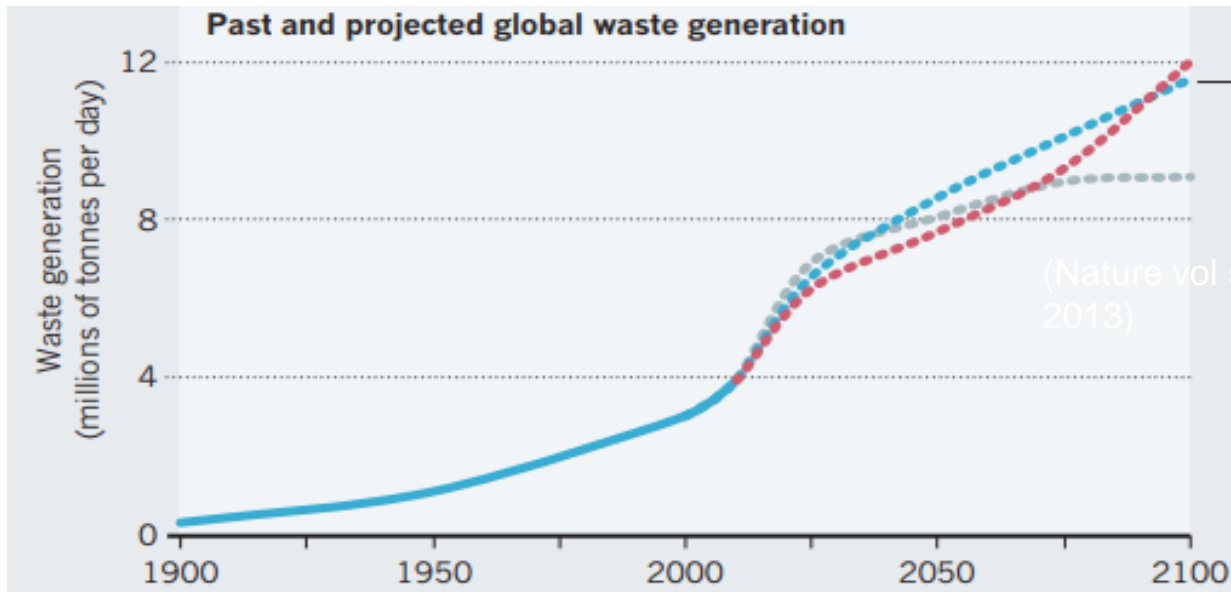
Source: Araujo et al. (2021)



## WHY IS THAT?

- Reused resources
- Reduced feed demand
  - Alternative ingredients
  - Use of waste products
- Improved water quality
- Enhanced ecosystem status

# Waste Management



Source: Hoornweg et al., 2013 - Nature vol 502



Source: World Bank, 2018





# Alternative Raw Materials

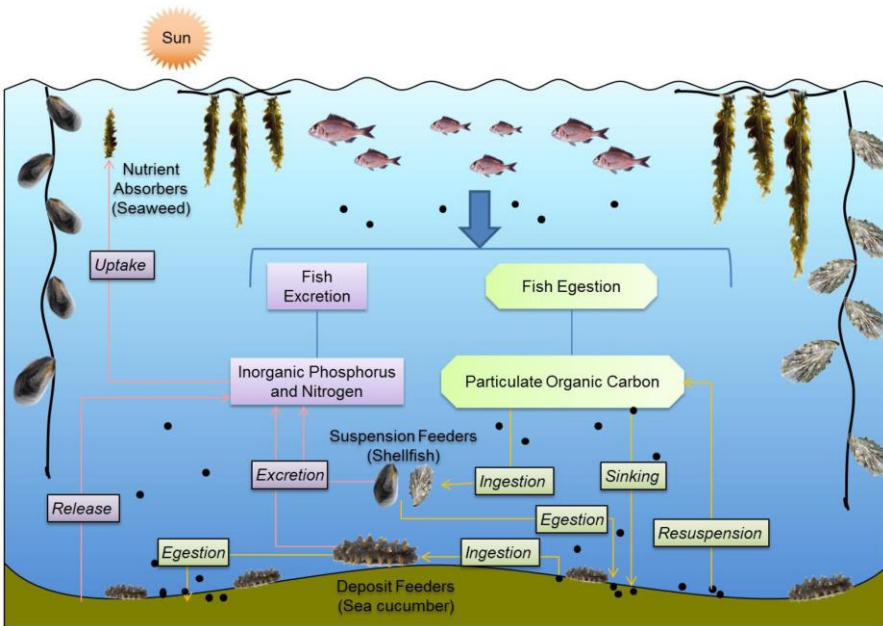
## Challenges for sustainable Aquafeed production

- Raw materials are scarce and price volatile
- Sustainable replacement of fish meal and oil
- Aquafeed is an important production cost





# Integrated Multitrophic Aquaculture (IMTA)



Source: Zhang et al. (2019)

Multiple aquatic species from different trophic levels are farmed in an integrated fashion to improve efficiency, reduce waste, and provide ecosystem services

- SPACE OPTIMIZATION
- NUTRIENT LOAD REDUCTION
- NUTRIENT RECOVERY INCREASE
- SPECIES DIVERSIFICATION
- ALTERNATIVE INCOMES
- NEW NICHE MARKETS
- IMPROVE CONSUMER PERCEPTION

Environmental Benefits

Economic Benefits

Market-oriented Benefits

## Inclusion of Aquaculture into Land and Seascape Programs

Quantification and monetization of ecosystem services to inform policies and inform aquaculture investments

**PROBLUE**



**Global Program for the Blue Economy**  
*Healthy oceans, economies, and communities*

**PROGREEN**



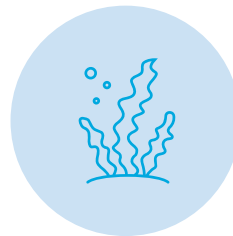
**Global Partnership for resilient and sustainable landscapes**

# World Bank Response

- **Understanding the role of aquaculture and fisheries in carbon sequestration**
- **Evaluate the role of integrated and restorative aquaculture**
  - Food security, income and jobs
  - Provision of ecosystem services
  - Climate change action – mitigation and adaptation



**THE WORLD BANK  
PROVIDE ANALYTICS,  
DISSEMINATE  
KNOWLEDGE AND  
ENHANCE AWARENESS**



**PROMOTE FIELD  
ADOPTION WITH WBG  
CLIENTS**



**FACILITATE INVESTMENT**





## Invest in Integrated Aquaculture

Many thanks!