



UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM TIMISOARA

"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH IN APPLIED LIFE SCIENCES"



"Young people and multidisciplinary research in applied life sciences"

21-22 November 2024

THE IMPACT OF CLIMATE CHANGES ON AQUACULTURE AREAS

Oachis Alexandru¹, Pascalau Raul¹, Smuleac Laura¹

¹University of Life Sciences" King Mihai I" from Timisoara, 300645, 119, Calea Aradului, Timisoara, Romania
e-mail: raul.pascalau@usvt.ro

Abstract: The relationship that exists in a complex manner between climate change and global practices of aquaculture merits a thorough investigation of how these two aspects are interlinked. With the escalation of sea temperatures, issues related to ocean acidification and shifts in precipitation patterns increasingly pose threats to ecosystems aquatic in nature, thus rendering the sustainability of aquaculture—the practice of cultivating organisms from aquatic environments—rather uncertain. This introductory section shall delineate the breadth of the research, bringing to light the susceptibilities of regions engaged in aquaculture that depend significantly on stable environmental conditions, which in turn calls for management strategies that are adaptive in nature. Moreover, it is of paramount importance to acknowledge that the repercussions of these shifts in climate extend further than just immediate ecological consequences, as they also affect socio-economic factors, including food security, livelihoods, and the economies of local areas.

• Introduction

In the quest to unravel the complex interrelation that exists between climate change and aquaculture, this research text aims to outline the distinct vulnerabilities that aquaculture systems in the Caribbean encounter. The analysis incorporates a thorough exploration of climate-related indicators that markedly impact fish habitats, distributions, and reproductive behaviours, as indicated in the extant literature, which observes that climate change is presently exerting an influence on Caribbean fisheries and aquaculture via alterations to vital fish habitats (Bryony L. Townhill et al., 2021).

• Material and method

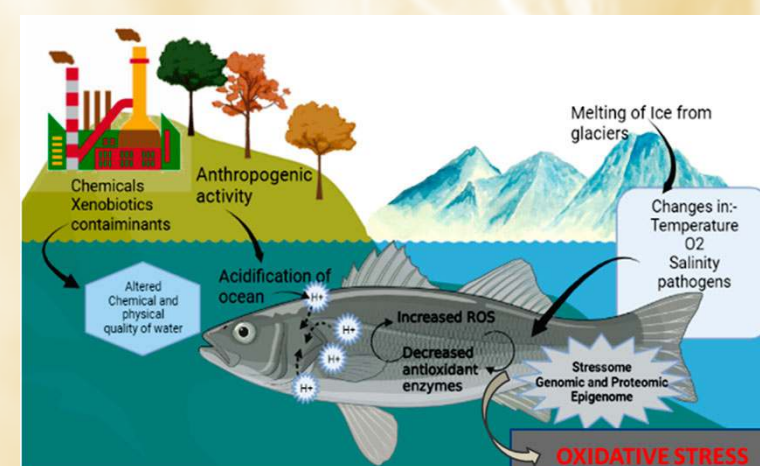
As the phenomenon of climate change persistently modifies environmental conditions, the outcomes for aquatic ecosystems are notably deep and complex. Increasing temperatures, modifications in precipitation patterns, and elevated sea levels pose threats to the fragile equilibrium of these systems, thereby influencing species composition and productivity levels. Additionally, the alteration of thermal conditions may impact the metabolic rates as well as reproductive cycles of aquatic organisms, which could result in disturbances within food web dynamics. Particularly, coastal aquaculture regions function as essential biogeochemical hotspots, where pronounced carbon sequestration mechanisms are noted, as indicated by research demonstrating a net carbon sequestration capacity that is markedly superior to that of restored wetlands (Ziyu Wang, 2024).

Alterations in water temperature and its impact on species distribution

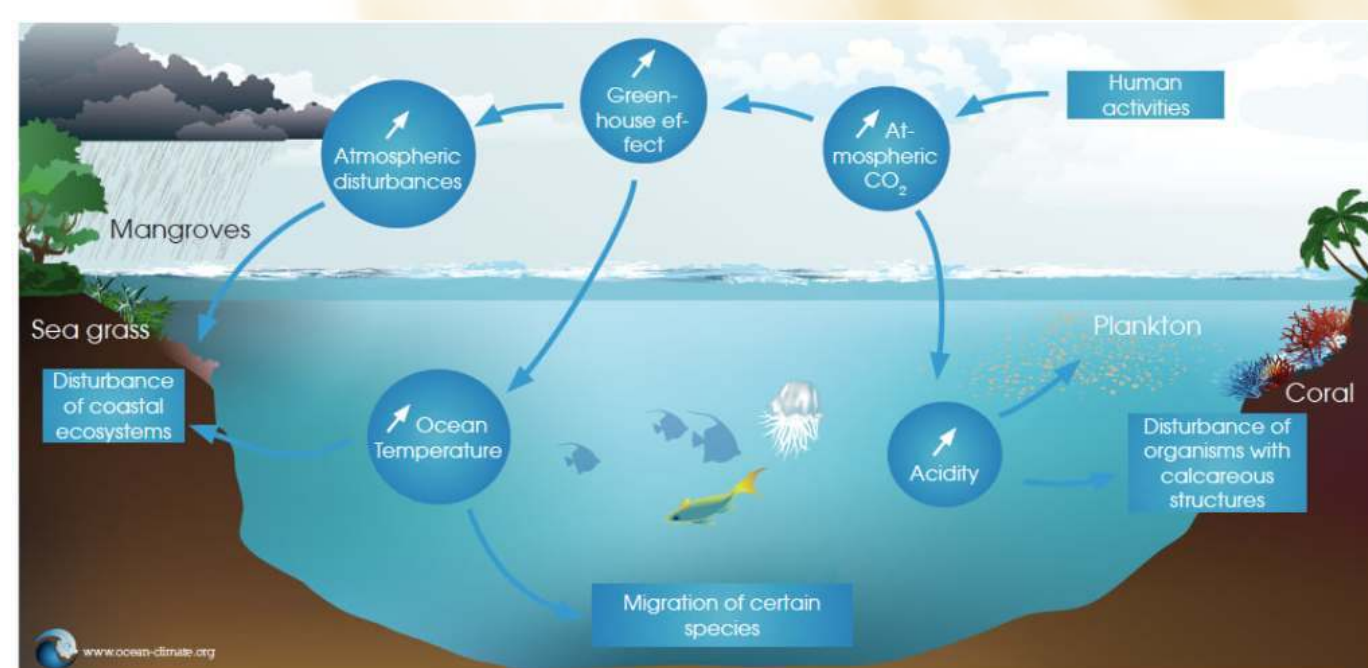
Such transitions induce ripple effects throughout the food web, especially affecting commercially significant taxa like fish and invertebrates. Investigations suggest that the ongoing climate change phenomenon could lead to a significant reallocation of global catch capacities, where high-latitude areas may observe an uptick exceeding 30%, conversely, tropical regions stand to witness potential declines reaching 40% in their catch potential due to these thermal transformations (P. Ambus, 2009).

Changes in salinity levels and their effects on aquaculture species

Variations in levels of salinity are now increasingly acknowledged as a considerable stressor for species involved in aquaculture, especially in light of climate change's role in modifying environmental conditions. Numerous marine organisms exhibit a specific salinity tolerance range that is essential for their physiological functions as well as their overall health status. With the transformations occurring in oceanic and freshwater systems — due to increases in temperature and altered precipitation patterns — the resulting salinity fluctuations may negatively impact species growth rates, reproductive success, and survival chances.



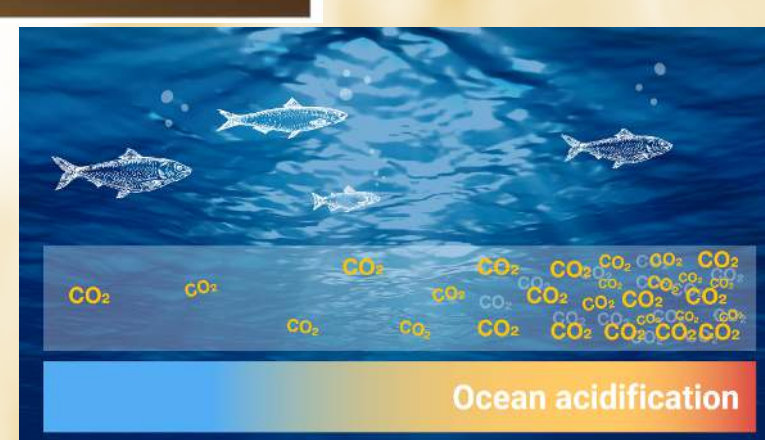
Water physicochemical factors and oxidative stress physiology in fish



The role of ocean acidification in aquatic health and productivity

The decline of marine biodiversity

What is Ocean Acidification?



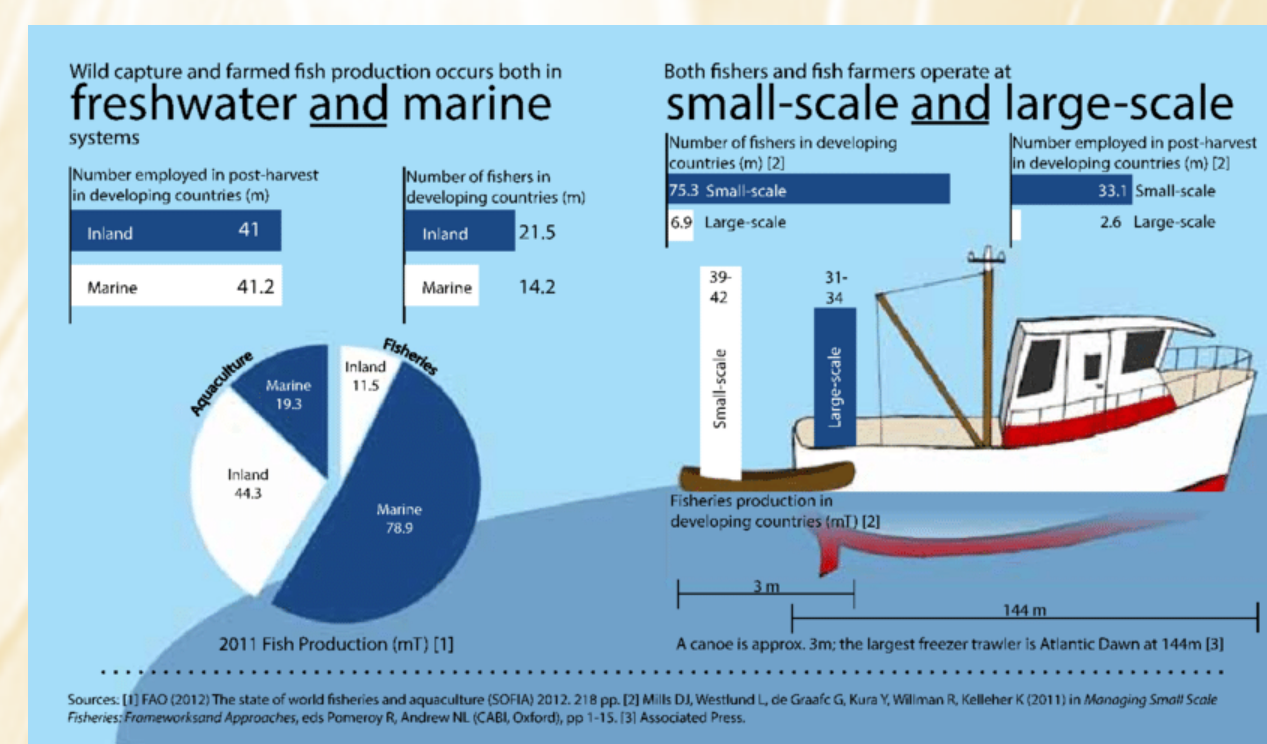
• Conclusions

The ramifications of climate change upon aquaculture regions manifest in a significant and intricate manner, thereby necessitating immediate measures and educated strategies for adaptation. Data derived from the BarentsWatch portal indicate that notable variations in temperature have already been documented, with certain locations in the southern and western regions of Norway exceeding the critical temperature limits of 20 °C, which may threaten the sustainability of Atlantic salmon farming (Lynne Falconer, 2024). In addition, research pertaining to the thermal tolerances exhibited by silver pompano indicates that acclimatization to elevated temperatures serves to bolster their capacity to withstand heat (Damodaran Nair Divu, 2024).

• Results and discussions

Economic impacts of climate change on fishery yields

Climate change presents notable challenges to the yields of fisheries, wielding considerable economic consequences for communities that depend on aquaculture for their means of subsistence. With the increasing occurrence of temperature variations and extreme weather phenomena disrupting aquatic ecosystems, the sustainability of fish stocks finds itself in a state of uncertainty, thereby threatening the stability of food supplies and pricing regimes.



Production and employment in fisheries and aquaculture

Changes in employment patterns within aquaculture sectors

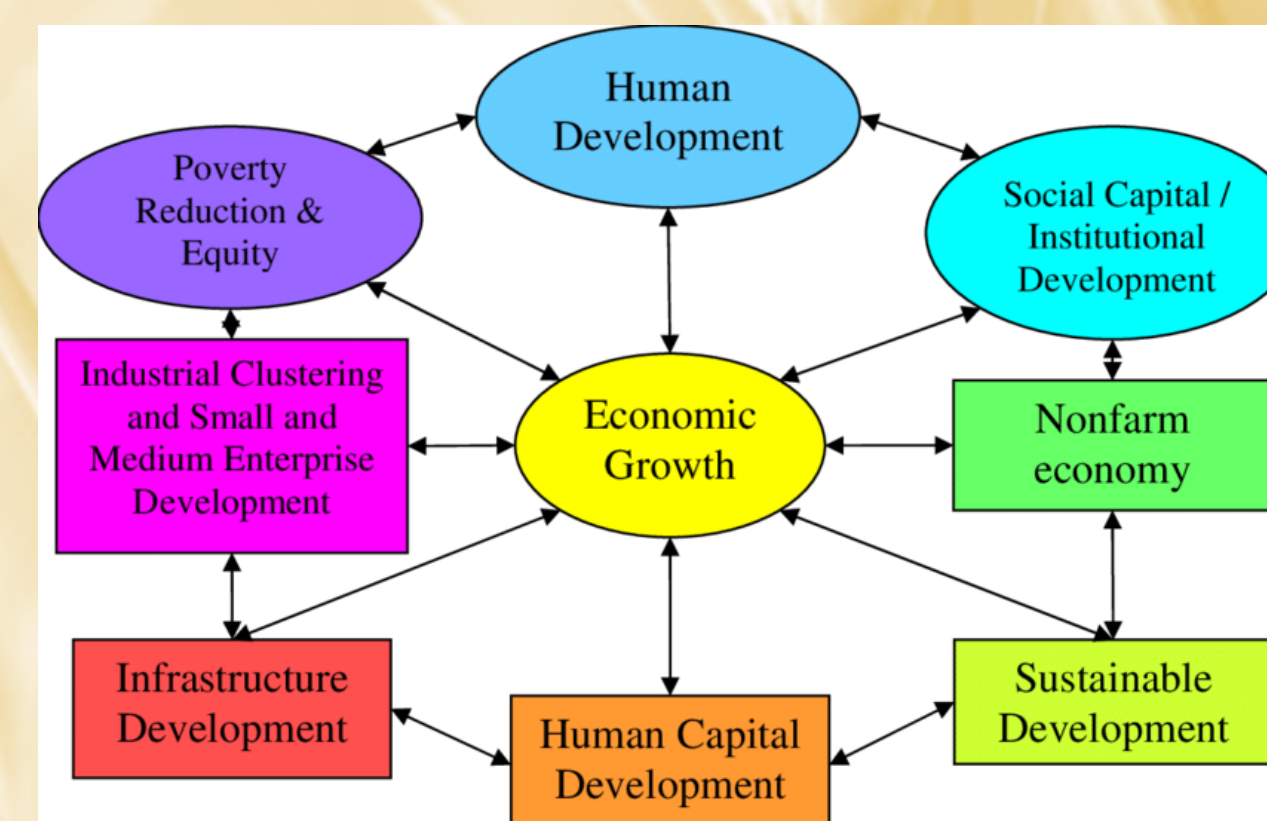
In response to the ongoing tribulations posed by climate change, aquaculture spheres are undergoing substantial transformations regarding employment patterns. There is a growing demand for proficient personnel capable of manoeuvring through the intricate details of sustainable practices, thereby necessitating a shift from conventional farming roles towards positions that prioritise innovation and the management of environmental matters.

The influence of climate change on food security and local economies

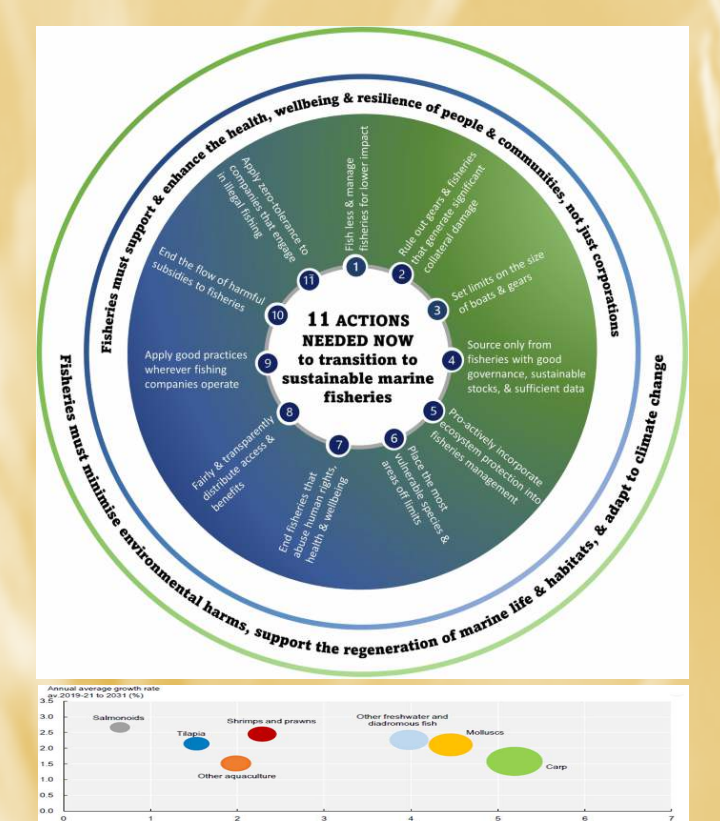
In light of the intensifying repercussions of climate change, the aquaculture industry is progressively opting for novel farming methodologies aimed at bolstering both resilience and sustainability. Approaches such as integrated multitrophic aquaculture (IMTA) have surfaced as potentially effective strategies, facilitating the concurrent cultivation of diverse species spanning various trophic echelons within a singular system.

Policy frameworks and regulations supporting sustainable aquaculture

The promotion of sustainable aquaculture is significantly influenced by efficient policy frameworks and regulations, especially amidst the challenges posed by climate change. A thorough comprehension of various international conventions, for instance, the United Nations Convention on the Law of the Sea (Montego Bay, 1982), proves vital, as these conventions set essential guidelines for the management of marine resources in a responsible manner (Omar Er-rousse et al., 2024).



Sustainable development and governance framework



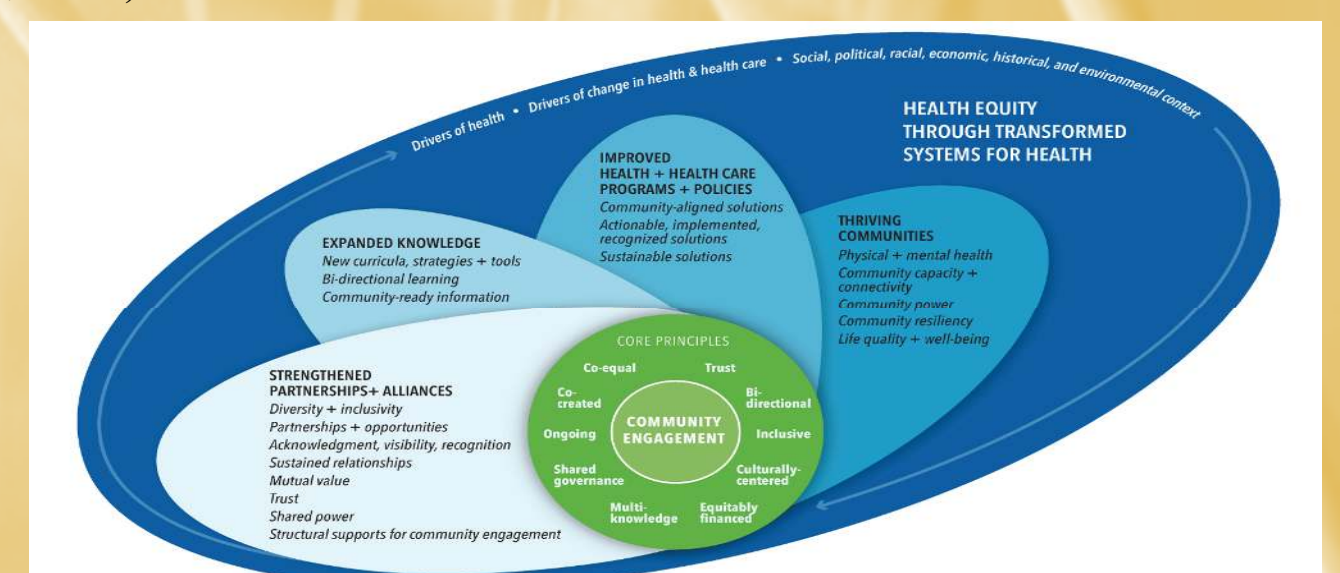
Rethinking sustainability of marine fisheries for a fast-changing planet

Community engagement and education for resilience building

The significance of efficacious community engagement and education is considerably crucial in nurturing resilience in relation to climate change, especially within sectors that are vulnerable, like aquaculture. This is underscored by the CREATE Resilience project, which posits that the amalgamation of indigenous knowledge and active involvement culminates in a more substantial comprehension of risks associated with climate and mitigation strategies within community constituents (K. Semmens et al., 2023).



National Standards for Community Engagement



Assessing Meaningful Community Engagement: A Conceptual Model to Advance Health Equity through Transformed Systems for Health