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*Opinion*

# Effects of fish farming due to climatic change

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## DESCRIPTION

Globally, climate change is projected to have a significant impact on aquaculture. As we move through with our plan to expand and diversify aquaculture production, rising temperatures will have an increasingly significant influence on fish farming, resulting in a slew of fish welfare challenges. Temperature has an impact on the physiology of both fish and infections, and it has the potential to promote disease outbreaks in aquaculture systems, resulting in considerable financial losses. The Mediterranean Sea is expected to see significant temperature fluctuations in the future. As a result, we want to evaluate and debate what we already know about disease outbreaks in Mediterranean finfish farming in the context of climate change. The goal is to illustrate the effects of temperature on the physiology of both fish and pathogens, as well as to list and discuss the major diseases of the three main Mediterranean fish species, gilthead sea bream, European sea bass, and meager. We'll try to link each disease's pathophysiology to a specific temperature range, as well as explore potential future disease dangers linked to the Mediterranean Sea's climate change patterns. The number of studies on the association between the adaptive immune system and temperature in European sea bass, Gilthead Sea bream, and meager is limited, while data on other fish species are available. Low temperatures decrease primary antibody responses, but if immunological memory has been acquired at a high temperature, the secondary antibody response can be induced at low temperatures. Lower temperatures cause a delay in the peak primary antibody response but have no effect on the amplitude of the reaction. One or more thermo-sensitive phases, influenced by distinct events during the maturation and/or cooperation of immunological competent cells, have been proposed as the mechanism underpinning this. Aquaculture in the Mediterranean is important economically, and it has grown steadily and diversified significantly over the previous few decades. Its main sources of income are shellfish and marine finfish, which account for 98 percent of total production, with freshwater farming accounting for the remaining 2%. Finfish farming, in particular, has grown rapidly in comparison to shellfish farming, now accounting for half of Mediterranean aquaculture production in terms of volume and over two-thirds in terms of value. The industry focuses on carnivorous species raised in marine cages and is dominated by two species: gilthead sea bream and European sea bass, which produce 200,000 and 208,000 tons of fish per year, respectively. In the Mediterranean, these two species account for 95% of total finfish production. Greece is the leading European producer, accounting for 58.8% of gilthead sea bream and 51.1 percent of European sea bass production, with Spain and Italy following closely behind. These five nations, along with Turkey and Egypt, account for more than 90% of total Mediterranean production. In comparison to the number of bacterial and parasitic pathogens present, just a few species of virus and fungi are harmful to fish species bred in the Mediterranean Sea. Furthermore, there is a scarcity of research on the effects of temperature on these viral and fungal infections, and little is understood about the biology of climate change.

Epitheliocystis is a condition caused by a range of non-cultivable bacteria that live inside the cells. It's linked to a variety of mortality rates in farmed animals all around the world, mostly impacting larvae and juveniles. Intracellular bacteria that replicate inside the host cell develop cyst-like inclusions, most commonly in the gills, causing hyperplasia, respiratory difficulty, and death. Temperature, among other abiotic factors, was recently proposed as a measure impacting the occurrence and course of this disease in a recent review. Despite the inability to isolate and culture the agent *in vitro*, illness seasonality has been seen for distinct host species in different locales.

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## Temperature effect on fish physiology

Fish thrive best in a temperature range suited to their species, demonstrating rapid development rates and robust physiology. There is a positive relationship between temperature and assimilation of nutrients and growth within this ideal range, with an increase in temperature often favouring high metabolic and enzymatic activity and hence assimilation of nutrients and growth. Outside of this range, however, biological performance plummets, and if certain key thresholds are crossed, vital metabolic activities are blocked, leading to diseases and death. Further research on fish hosts should eventually concentrate on species-specific developmental plasticity in order to determine the thermal limitations to which juveniles can be adapted in the hatchery before being exposed to offshore ambient temperatures.