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Perspective

Impact of *Ulva* Macroalgae on Aquaculture Ponds before and After the Yellow Sea Green Tide

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DESCRIPTION

The Yellow Sea green tide, an extensive algal bloom dominated by the macroalgae *Ulva*, has been a significant environmental event, particularly affecting aquaculture ponds. *Ulva*, a green macroalgae, is naturally found in many coastal regions, where it plays a role in the marine ecosystem. However, the outbreak of green tides has transformed *Ulva* from a beneficial organism into a major concern for aquaculture operations. This article explores the role of *Ulva* in aquaculture ponds before and after the green tide outbreak in the Yellow Sea, highlighting the challenges and management strategies associated with this phenomenon. Before the onset of the Yellow Sea green tide, *Ulva* macroalgae were present in aquaculture ponds, but their impact was largely benign. *Ulva* provided several ecological benefits and contributed to the overall health of the aquaculture environment. *Ulva* played a role in nutrient cycling within aquaculture ponds. By absorbing nutrients such as nitrogen and phosphorus from the water, *Ulva* helped maintain water quality and prevent eutrophication. This process supported a balanced aquatic ecosystem and promoted the growth of farmed species. The presence of *Ulva* created habitats for various small aquatic organisms. These organisms, in turn, contributed to the biodiversity of the ponds and provided a natural food source for farmed species. Through photosynthesis, *Ulva* contributed to oxygen production in aquaculture ponds. Adequate oxygen levels are essential for the health and growth of aquatic organisms, including fish and shellfish. *Ulva* acted as a biofilter, trapping suspended particles and improving water clarity. This filtration capability enhanced the living conditions for farmed species and supported overall pond health. The Yellow Sea green tide, characterized by massive blooms of *Ulva*, has had significant impacts on the marine environment and aquaculture operations. Several factors contributed to the outbreak, including nutrient pollution, favorable environmental conditions, and the proliferation of *Ulva*.

Increased nutrient inputs from agricultural runoff, industrial discharges, and urban wastewater led to higher levels of nitrogen and phosphorus in coastal waters. These nutrients fueled the rapid growth of *Ulva*, resulting in large-scale algal blooms.

Favorable environmental conditions, such as warm temperatures and ample sunlight, supported the rapid proliferation of *Ulva*. The shallow waters of the Yellow Sea provided an ideal environment for the algae to thrive. The reproductive capabilities of *Ulva*, including both sexual and asexual reproduction, allowed it to spread quickly and form dense mats on the water surface. These mats blocked sunlight and disrupted the aquatic ecosystem. The outbreak of the Yellow Sea green tide brought several challenges to aquaculture operations, significantly altering the dynamics of aquaculture ponds. The dense mats of *Ulva* led to reduced light penetration and oxygen depletion in aquaculture ponds. This resulted in poor water quality, which stressed or killed farmed species. The decomposition of large quantities of *Ulva* further exacerbated oxygen depletion and released harmful substances such as ammonia and hydrogen sulfide. The accumulation of *Ulva* mats on the water surface physically interfered with aquaculture operations. These mats obstructed water flow, clogged nets and equipment, and made it difficult to manage and harvest farmed species. The deterioration of water quality and the presence of decaying organic matter created favorable conditions for disease outbreaks. Pathogens and parasites proliferated in the degraded environment, posing a significant threat to farmed species. The combined effects of poor water quality, physical interference, and disease outbreaks resulted in substantial economic losses for aquaculture operations. Reduced yields, increased mortality rates, and higher management costs placed a significant financial burden on aquaculture farmers.

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