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Balancing Aquatic Weed Management and Fishery Conservation

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Introduction

Aquatic weeds can pose significant challenges to the health and productivity of freshwater ecosystems. To combat the proliferation of these nuisance plants, weed-control agents are often employed. However, the use of such agents raises concerns about their potential effects on sport fish populations. This article explores the impact of weed-control agents on sport fish, highlighting the need for a balanced approach that ensures effective weed management while safeguarding fishery conservation.

Chemical herbicides are commonly used to control aquatic weeds. These agents work by targeting specific plant species or inhibiting their growth processes. Herbicides are typically applied directly to the water, where they are absorbed by the plants and disrupt their physiological functions. The effectiveness of herbicides in weed control can vary depending on factors such as water chemistry, target species, and application timing.

Weed-Control Agents

Biological agents, such as fish species or insects, can be introduced to control aquatic weeds. These agents rely on their natural feeding habits to consume or damage the target plants. For instance, grass carp (Ctenopharyngodon idella) are often used to control submerged aquatic vegetation. However, the use of biological agents requires careful consideration to prevent unintended consequences, as some species may also impact native vegetation or disrupt the ecosystem balance.

The use of weed-control agents can lead to habitat alterations that affect sport fish populations. Aquatic weeds provide critical habitat components such as shelter, breeding grounds, and food sources for many fish species. Removing or reducing weed cover can result in habitat loss, potentially impacting the abundance and distribution of sport fish. The loss of these crucial habitat elements can disrupt the natural balance of the ecosystem and lead to changes in fish behavior and population dynamics.

Weed-control agents, particularly chemical herbicides, can have indirect impacts on sport fish through alterations in water quality. Some herbicides may cause water quality degradation, leading to oxygen depletion or the release of toxins that can affect fish health and survival. Reduced oxygen levels can stress or suffocate fish, particularly in situations where decomposing plant matter consumes oxygen during the decay process. Proper assessment and management of water quality parameters are essential to minimize these impacts.

Impact on Sport Fish Populations

Balancing effective weed control with the conservation of sport fish populations is a complex challenge. Weed-control agents, whether chemical or biological, can have both direct and indirect impacts on sport fish, affecting their habitat, behavior, and overall population dynamics. As such, it is crucial to adopt a holistic and scientifically informed approach to weed management, considering the specific ecological context and goals of each fishery.

Integrated weed management strategies that combine various control methods, such as mechanical removal, biological agents, and selective herbicide use, can help minimize the negative impacts on sport fish populations while effectively managing aquatic weeds. Rigorous monitoring, research, and adaptive management approaches are essential to evaluate the outcomes of weed-control practices and make necessary adjustments to ensure the long-term sustainability of both aquatic ecosystems and sport fishing activities.

By prioritizing the conservation of sport fish populations, considering the ecological consequences of weed-control agents, and embracing sustainable management practices, we can strike a balance between effective weed management and the preservation of thriving and diverse fishery resources.

Grass carp, a native Chinese freshwater fish species, has been widely introduced and established worldwide for different purposes (protein source, weed control agent, and sport fish). This species can be very effective in controlling aquatic plants. A few countries, such as Afghanistan, Myanmar, Laos and Vietnam, have cultured grass carp as human food for decades. In contrast, other countries, such as Bangladesh, India, and Iran, initially cultured grass carp as weed control agents and later transitioned to using them as food fish. The uncontrolled population of grass carp and the adverse ecological effects cause concern. Grass carp are a source of nutrients, including essential omega-3 fatty acids, Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA), which greatly benefit human health. Farming and consuming low trophic-level fish is more sustainable than relying on high trophic-level fish. A sustainable Polyculture system yields positive social, economic, ecological and aquaculture outcomes.

It involves culturing grass carp together with filter-feeding fish of different ecological requirements, feeding habits and behaviours in the same pond. The application of sustainable feeding materials (e.g., food processing waste and food waste-based fish feed pellets) may significantly improve sustainable aquaculture. It might mitigate the adverse ecological impacts experienced by some countries.

The proposed indices were structured based on specific welfare indicators, reference values, individual weights and associated scores to address the Animal Welfare Five Freedoms and a Life Worth living concepts. Two types of indices were proposed: (1) partial welfare indices (PWIx), specific to each of the four observed/analysed freedoms; (2) general welfare index (GWI), which simultaneously summarizes the addressees' freedoms in a single variable. Both indices range from 0 (critical welfare impairment) to 1.0 (minimal risk of welfare impairment). The study was based on a comprehensive systematic review of the literature using the PRISMA method. The proposed indices were based on 10 environmental indicators, nine indicators for health, five for nutrition and four for behaviour. The PWIx can be used to determine how each category of indicators contributes to the GWI, which defines the level of fish farm welfare at a given point in time and which needs are affected or met during a production cycle.

A growing number of scientific literature on anatomical, physiological, behavioural and pharmacological aspects has provided solid evidence that fish have nociceptive and cognitive abilities; they can feel pain, anxiety and fear, similar to other vertebrates. The scientific community's recognition of the sentience of fish is reflected in society's stance calling for greater control over how animals are kept and managed in captivity, particularly when they are intended for human consumption. These demands have led, for example, to changes in technical regulations and aquaculture standards that now consider animal welfare as a prerequisite for production.