Triploid Fish

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Over the past decades, evidence is emerging that triploid fish exhibit interesting genetic, anatomical, cellular and biochemical peculiarities with potential growth advantages for the Aquaculture industry are including economic gains and improved feed conversion rate. A review of the current literature indicates that an assessment of the possible advantages and disadvantages of farming triploid sea bass should include the effects of ploidy on flesh quality parameters and in the capacity for aerobic and anaerobic metabolism at different seasonal temperatures.

Keywords: Aquaculture development ; triploid fish fish welfare

1. Conjecture Content

Triploid fish offer new prospects for aquaculture development. When sterile, triploid fish can grow and convert food better as no energy is allocated for the investment in reproduction. There some evidence to suggest that triploid fish may have limited capacity to handle hypoxic conditions which may be often experienced in warm hypoxic estuarine situations, for example during nighttime oxygen may drop in eutrophic waters. global warming can make this a frequent phenomenon creating a double challenge for any fish which have to deal with low oxygen and with rising and challenging thermal conditions. The evidence is not conclusive, reports on aerobic capacity and thermal tolerance of triploid fish are scarce and limited to few species. Nevertheless, the topic is interesting and should be explored to ensure the welfare of farmed triploid fish. The hypothesis presented here, is that Triploid fish may be vulnerable to hypoxic and high-temperature waters, for example, experienced by farmed fish which are restricted in floating cages and have no option to escape from unfavourable thermal extremes which may frequently occur and combined with hypoxic conditions caused by algal blooms in eutrophic waters.

2. Background or History Introduction

Over the past decades, the evidence is emerging that triploid fish exhibit interesting genetic, anatomical, cellular and biochemical peculiarities with potential growth advantages for the Aquaculture industry are including economic gains and improved feed conversion rate[1] Molecular approaches can reveal how ploidy affects gonadal development, indicators of cellular metabolism can elucidate the metabolic differences between diploid and triploid fish Compared to diploid, triploid fish have different body shapes, larger cells, impaired reproductive gonadal development and different metabolic properties. Recently published papers are presenting evidence that triploid fish exhibit different metabolic specialization with implications for their survival, growth and welfare. Compared to diploids, triploid fish may exhibit increased capacity for anaerobic metabolism, exhibit different dietary requirements and other physiological traits through differentiated gene expression .

3. Review of relevant research work.

Triploid fish exhibit a reduced capacity for aerobic metabolism[2] (Virtanen et al. 1990). This problem at least partially a result of the larger (compared to diploid fish) size of red blood cells and muscle cells which creates larger distances for the diffusion of oxygen in triploid fish, resulting in a lower potential for aerobic metabolism ([3]Nathanailides et al. 2019). Although there are reports that the difference in the aerobic capacity between diploid and triploid is small[4] (Bowden et al. 2018), the topic is important and further research with other species and conditions would elucidate this issue. Triploid fish reared in floating cages may experience a combination of unfavourable environmental conditions that may challenge them to the extremes, and fish reared in floating cages do not have the option to explore diurnal or seasonal migration to escape from extreme environmental conditions even if they briefly occur. For example, global climate change coupled with rising aquaculture production may result in the exposure of farmed fish to a range of challenging environmental conditions including thermal extremes and hypoxia exposing fish to rapidly changing and challenging environmental conditions. Unfortunately, the physiology of triploid fish may limit their ability for adapting to raised temperatures and

hypoxia ([3]Nathanailides et al 2019) creating doubts for the welfare of farmed triploid fish in the, for example in floating marine fish cages. Research on ploidy effects on farmed fish is a rapidly rising field and nowadays, researchers have a range of methods to induce and evaluate polyploidy in fish and to study the significance of ploidy at molecular, cellular and organism level.

From the perspective of Aquaculture production ploidy of fish is a phenomenon that historically was and is rigorously studied. Apparently, the filed is now in a mature stage, with several papers reporting the superior growth and economic benefits of farming triploid fish (Puvanendran et al. 2019)[5]. Fish biologists continue in this research direction, utilizing the wide range of available practical approaches, creating the basis for developments in the Aquaculture industry in accordance with the global rising population needs and rising demand for farmed fish. There are at least two recent independent research reports of limited capacity for thermal challenges of triploid fish which provide some evidence to suggest that this issue should be investigated ([4][3]The implications of stress on farmed fish include lethal and sublethal consequences which include effects on the quality of farmed fish final product[6]. Leal et al. 2019; Nathanailides et al.2019). Furthermore, the welfare of farmed fish is a critical issue for aquaculture development and further research on the potential limits of triploid fish will enable the successful exploration of aquaculture potential developments of triploid fish farming.

[4][7][4][1][4][8][4][3][4][5][4][2]

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