Application of fatty acid in fish ecology and origin identification

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Abstract

Fatty acid (FA) analysis provides an effective biochemical approach to evaluate aquatic ecosystem health and fishery sustainability. This integrated study combines insights from both estuarine and marine environments to emphasize the ecological, physiological, and traceability significance of FA profiling. In estuarine systems, such as those studied in juvenile European flounder (*Platichthys flesus*), variations in lipid classes and polyunsaturated fatty acids (PUFAs)—notably docosahexaenoic acid (DHA), docosapentaenoic acid (DPA), and eicosapentaenoic acid (EPA)—reflect water quality and stress conditions. Elevated PUFA levels indicate healthy ecosystems and optimal trophic energy transfer, whereas reductions correspond to eutrophication, pollutant exposure, and multi-stressor impacts. Additionally, increased lipid reserves and elevated C18 fatty acids in flounders from aquaculture-impacted estuaries suggest trophic contamination from fish farming waste, highlighting the physiological response to anthropogenic pressures. In pelagic species such as the European sardine (Sardina pilchardus), FA composition of white muscle serves as a natural biochemical fingerprint capable of distinguishing geographic origin with up to 83% classification accuracy. Key discriminant markers include 14:0, 16:0, 18:1n-7, 20:5n-3, and 22:6n-3. These biomarkers reflect dietary and environmental influences and support practical applications in seafood authentication, ecological monitoring, and enforcement against illegal, unreported, and unregulated (IUU) fishing. FA profiling thus offers a powerful tool for sustainable fisheries management.

Reference

Laurent, J., Le Grand, F., Bideau, A., Le Berre, I., Le Floch, S., Pichereau, V., & Laroche, J. (2025). Fatty acid analysis in an estuarine fish species to assess the health status of hydrosystems impacted by eutrophication and multistressors. *Estuarine, Coastal and Shelf Science*, *319*, 109279.

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