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Organic fish products – authentication by stable isotope analysis

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Dwindling natural resources increase the importance of aquaculture in the production of edible fish. The potential risk for conventional aquaculture products being wrongly labelled as organic must be encountered by an improved traceability of edible fish, particularly at the retail level. In a BÖLN funded project (German Federal Programme on Organic Farming and Sustainable Agriculture, project no. 08OE026) the applicability of C and N stable isotope ratio analysis to discriminating between organically and conventionally farmed fish as well as wild-caught fish of selected carnivorous species was evaluated.

Samples of salmon, brown trout and pangasius originating from different farms or sea areas were collected over a period of 18 months, partly comprising processed products. After extraction of lipids from the fillet, defatted dry matter (DDM) and lipids (LIP) were subjected separately to stable carbon isotope ($\delta^{13}C$) analysis. In addition, stable nitrogen isotopes ($\delta^{15}N$) were analysed in DDM. Analyses were performed using a Thermo Scientific EA-IRMS system (Flash EA 1112, ConFlo III, DELTAplus XL).

Salmon, brown trout and pangasius from organic aquaculture showed higher $\delta^{15}N$ than the respective conventionally farmed fish, which allowed to identify the different husbandry largely. Whereas differentiation by $\delta^{15}N$ was complete for salmon and pangasius, the authentication of organic brown trout could be accomplished by combining $\delta^{15}N$ and $\delta^{13}C$ of DDM. Wild salmon could be distinguished from conventional by $\delta^{15}N$ and from organic by $\delta^{13}C_{LIP}$. Hence, the combination of $\delta^{15}N$ and $\delta^{13}C_{LIP}$ allowed the simultaneous identification and differentiation of all three origins, irrespective of processing. Samples of wild brown trout or pangasius were not included in this work.

The food chain level of animal prey and the percentage of plant versus animal material in the feed are important factors determining the isotopic signature of fish, thus allowing the authentication of organic fish from selected species.