ULST Timisoara
Multidisciplinary Conference on Sustainable Development
15-16 May 2025

# More Than Just Fish: The Complex Chemistry and Quality Story of Seafood

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**Abstract**: The study dives into the various components that make up seafood meat and the many factors that influence its quality. Seafood is a major source of animal protein around the world, known for its high water, protein, and fat content, which together make up about 98% of its overall composition. The nutritional value, functional characteristics, sensory qualities, and storage stability of fish meat is shaped by a range of biological factors (like species, age, and sex), environmental conditions (such as temperature and habitat), and post-harvest practices (including storage and processing). The research particularly highlights the biochemical composition of seafood (Rainbow Trout and Lake Trout), specifically water content, ash, minerals, proteins, minerals, amino acids and vitamins, and how these can vary from one type of fish to another. Moreover, the study looks into spoilage processes and quality changes that happen after capture, such as microbial growth and chemical breakdown, which are crucial for ensuring food safety and extending shelf life. This thorough overview lays the groundwork for future research and better practices in the handling, processing, and assessment of seafood quality.

***Keywords:*** *Fish meat quality, seafood composition, food safety, nutritional value*

## INTRODUCTION

- Only about 1,000 fish species are commercially fished for food, along with around 100 crustacean and 100 molluscan species. Fish is consumed fresh or as processed products like frozen, salted, dried, smoked, or canned. Global demand has steadily risen, with annual fishery yields reaching 90–95 million metric tons. Fish products are rich in essential nutrients—high-quality proteins, essential amino acids (e.g., lysine, methionine), vitamins A and D, trace minerals (e.g., iodine, iron, zinc), and omega-3 PUFAs, which help prevent various diseases.

- Seafood composition varies with factors like temperature, size, age, and maturity. Water, protein, and fat make up 98% of the meat, influencing its nutrition, taste, and shelf life. Minor components like carbs, vitamins, and minerals play key roles in post-mortem tissue changes

Table 1. Mineral content of three different fish species

| Mineral | Common Carp | Rainbow Trout | Lake Trout | Comment |
|---|---|---|---|---|
| Ca (mg/100g) | 41.0 | 59.0 | - | Rainbow Trout has higher Ca. |
| Mg (mg/100g) | - | 38.8 | 30.0 | Rainbow Trout richest in Mg; no data for Carp. |
| K (mg/100g) | 333.0 | 643.7 | - | Rainbow Trout has nearly double the K compared to Carp. |
| Na (mg/100g) | 49.0 | 516.3 | 80.0 | Rainbow Trout has very high Na compared to others. |
| P (mg/100g) | 415.0 | 435.8 | - | Both Carp and Trout have high P, Rainbow Trout slightly higher. |
| Fe (mg/100g) | 1.24 | 0.905 | 0.75 | Common Carp highest in Fe. |
| Zn (mg/100g) | 1.48 | 0.797 | 0.44 | Common Carp richest in Zn. |
| Mn (mg/100g) | 0.042 | 0.0535 | - | Rainbow Trout has more Mn than Carp; no data for Lake Trout. |
| Cu (mg/100g) | 0.057 | 0.0862 | 0.04 | Rainbow Trout has highest Cu. |
| Ni (mg/100g) | - | 0.00045 | 0.006 | Very small amounts; Lake Trout slightly higher than Rainbow Trout. |
| Hg (mg/kg) | 0.0076–0.0129 | 0.020–0.058 | - | Hg is low but higher in Rainbow Trout compared to Common Carp. |

Higher mineral content like **K, Ca, P, Mg** suggests good nutritional quality. However, even trace amounts of **Hg** are important to monitor for food safety.

## Conclusion

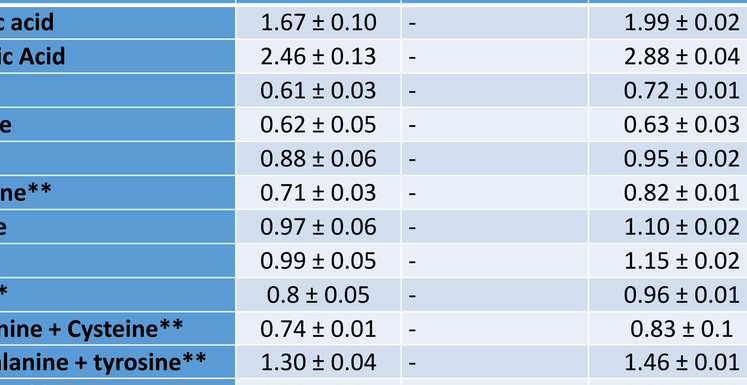
This study underscores the complex biochemical makeup and nutritional significance of various freshwater fish species, particularly Rainbow Trout, Lake Trout, and Common Carp. The data reveal distinct differences in amino acid profiles, mineral content, and fatty acid composition, each contributing uniquely to the fish's nutritional value and health benefits. Rainbow Trout stands out with its high levels of omega-3 fatty acids and essential minerals, while Common Carp offers rich sources of iron and zinc. Understanding these variations is crucial for optimizing fish selection, ensuring food safety, and guiding sustainable fisheries and aquaculture practices. These findings form a foundation for future research into seafood quality enhancement and informed consumer choices.

## RESULTS AND DISCUSSION

Amino Acid Profiles of Rainbow Trout and Lake Trout and Common Carp

| Amino Acids | Rainbow Trout | Lake Trout | Common Carp |
|---|---|---|---|
| Aspartic acid | 1.67 ± 0.10 | - | 1.99 ± 0.02 |
| Glutamic Acid | 2.46 ± 0.13 | - | 2.88 ± 0.04 |
| Serine | 0.61 ± 0.03 | - | 0.72 ± 0.01 |
| Histidine | 0.62 ± 0.05 | - | 0.63 ± 0.03 |
| Glycine | 0.88 ± 0.06 | - | 0.95 ± 0.02 |
| Threonine** | 0.71 ± 0.03 | - | 0.82 ± 0.01 |
| Arginine | 0.97 ± 0.06 | - | 1.10 ± 0.02 |
| Alanine | 0.99 ± 0.05 | - | 1.15 ± 0.02 |
| Valine** | 0.8 ± 0.05 | - | 0.96 ± 0.01 |
| Methionine + Cysteine** | 0.74 ± 0.01 | - | 0.83 ± 0.1 |
| Phenylalanine + tyrosine** | 1.30 ± 0.04 | - | 1.46 ± 0.01 |
| Isoleucine** | 0.79 ± 0.04 | - | 3.38 ± 0.83 |
| Leucine** | 1.13 ± 0.07 | - | 1.54 ± 0.02 |
| Lysine** | 1.52 ± 0.09 | - | 1.79 ± 0.06 |
| Proline | 0.50 ± 0.03 | - | 0.60 ± 0.01 |
| TAA | 15.93 | - | 18.34 |

Animal cells cannot synthesize amine groups, they make body proteins from amino compounds they get by eating plants. The human body cannot make amino acids. It also has limited ability to change amino acids from one another. These amino acids must be taken with food. These amino acids are called essential amino acids: Isoleucine, Leucine, Lysine, Phenylalainem, Methionine, Tryptophan, Histidine and arginine.




Rainbow Trout is rich in heart-healthy omega-3s, with high levels of EPA (2.15%) and DHA (6.07%). Common Carp contains more monounsaturated and saturated fats like oleic and palmitic acid, suited for energy storage. Lake Trout, though lower in most fats, has elevated palmitoleic acid, linked to metabolic benefits. These differences highlight the nutritional diversity among freshwater fish Gökoğlu, N., & Yüksel, A. N. (2002).