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RETASTE:

**Rethink Food Resources,
Losses, and Waste**

5th International Conference

Athens, September 24-27, 2025

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Publication

Hellenic Mediterranean University, School of Agriculture, Department of Agriculture
Estavromenos, 71 410 Heraklion, Greece

First published on September 24-27, 2025, in Heraklion, Greece by Hellenic Mediterranean University, School of Agriculture, Department of Agriculture.

ISBN: 978-618-87330-1-5

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RETASTE 2025 was co-organized by the Hellenic Mediterranean University and Harokopio University.

Transforming Shell Waste Into Sustainable Feed Ingredients

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Abstract

Faxonius limosus (Rafinesque, 1817), commonly known as the spiny-cheek crayfish, is among the most invasive crayfish species in Europe, with the capacity to outcompete native fauna and significantly disrupt aquatic ecosystem functions (Zorić et al., 2020). The disposal of their shells composed predominantly of calcium carbonate (CaCO_3) and chitin presents a growing environmental concern, particularly in regions with aquaculture activity. Despite their abundance, these shells remain an underutilised resource and are often discarded in landfills, contributing to pollution and representing a missed opportunity for sustainable resource recovery. Recent studies have highlighted the potential of crayfish shells not only as a source of chitin but also for their content of amino acids, minerals, and bioactive compounds suitable for use in animal feed. The shells are notably rich in calcium carbonate, a mineral essential for the development and maintenance of skeletal and shell structures in animals (Topić Popović et al., 2020; Cheong and Muskhazli, 2021; Horomiš et al., 2024; Zhan et al., 2021). This study evaluated the chemical composition of crayfish shells, focusing on their amino acid, mineral, and carotenoid content. Specimens of spiny-cheek crayfish were collected from the Begeč region of the Danube River. The shells were separated from the flesh, dried, ground, and subsequently analysed. Amino acid profiling identified the presence of 17 amino acids, with essential amino acids accounting for 8.57 g/100 g and non-essential amino acids for 14.19 g/100 g of the total dry matter. Chemical analysis revealed the presence of seven elements in the shell, with calcium being the most abundant at 17.90 g/100 g dry weight. Other trace elements were present in the following order of concentration: $\text{Ca} > \text{Na} > \text{Mg} > \text{Mn} > \text{Fe} > \text{Zn} > \text{Cu}$. Concentrations of heavy metals such as lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As) were below detectable limits. Furthermore, the shells were found to contain the carotenoid astaxanthin at a concentration of 44.39 mg/100 g. Astaxanthin is a potent antioxidant with well-documented health benefits and is particularly valued for its pigmentation properties in aquaculture and animal feed applications. These findings indicate that crayfish shells from this section of the Danube, being rich in amino acids, calcium, essential minerals such as magnesium and zinc, and valuable carotenoids like astaxanthin, hold considerable promise as a cost-effective feed supplement. Their utilisation not only improves animal nutrition but also promotes environmental sustainability by converting biological waste into valuable resources.

Keywords: shell waste, feed, invasive crayfish

References

References: Zorić, K., Atanacković, A., Ilić, M., Csányi, B., Paunović, M., 2020 The spiny-cheek crayfish *Faxonius limosus* (Rafinesque, 1817) (Decapoda: Cambaridae) invades new areas in Serbian inland waters. *Acta Zool. Bulg.*, 72(4), 623–627. Topić Popović, N.; Lorencin, V.; Strunjak-Perović, I.; Čož-Rakovac, R., 2023. Shell Waste Management and Utilization: Mitigating Organic Pollution and

Enhancing Sustainability. Applied Science, 13, 623. doi.org/10.3390/app13010623. Cheong, J.Y; Muskhazli, M., 2021. Turning leftover to treasure: An overview of astaxanthin from shrimp shell wastes. Global Perspectives on Astaxanthin: From Industrial Production to Food, Health, and Pharmaceutical Applications, 253 - 279, doi.org/10.1016/B978-0-12-823304-7.00022-2. Hromiš, N., Popović, S., Šuput, D., Pantić, J., Rakita, S., Tomićić, Z., Čabarkapa, I., 2024. Valorisation of shell waste of invasive crayfish from Danube River (*Faxonius limosus*): Protein extraction and characterization. Food and Feed Research, 51(2), 143-153. doi.org/10.5937/ffr0-53099 Zhan J, Lu J, Wang D., 2021. Review of shell waste reutilization to promote sustainable shellfish aquaculture. Review Aquaculture. 14: 477-488. <https://doi.org/10.1111/raq.12610>.

Acknowledgments: This research was supported by the Science Fund of the Republic of Serbia, Grant No. 7417: Reducing the negative impact of invasive crayfish *Faxonius limosus* in the Danube by smart exploitation of their meat and shells (DANUBEcare).