



Contribution ID : 13

Type : Oral

Integrating Duckweed into a Chain of Brine Reuse Enhancing the Value of Desalination for Food Production: The Case of Somalia

giovedì 1 ottobre 2026 15:15 (15)

Desalination brine, typically considered a disposal challenge, is evaluated through a resource recovery model that converts the concentrate into a valuable input for food production. A sequential system consisting of duckweed cultivation, fish production, and final irrigation of salt-tolerant halophytes is developed. Duckweed (*Lemna gibba*) serves as a key component by assimilating nutrients from fish influents and enhancing biomass production. It can achieve yields of approximately 10 g/m²/day (dry weight), with edible protein content of about 35%. The produced duckweed is primarily utilized as feed for herbivorous fish (grass carp), while contributing to the overall food production chain. The remaining saline brine is applied for cultivating halophyte crops (*Atriplex lentiformis*; *Salicornia bigelovii*). The model integrates the serial relationship between duckweed, fish, and halophyte, like agricultural practices implemented in Ramat Negev Regional Council, where groundwater salinity is approximately 4.4 dS/m. This similarity demonstrates the feasibility of utilizing saline resources for productive applications. For a small reverse osmosis desalination facility producing 50 m³/day of desalinated water and 27 m³/day of concentrate with an electrical conductivity of 20.31 mS/cm, approximately 0.36 hectares are required for brine utilization. The system can generate an estimated 10.3 tons of forage annually, supporting approximately 37 goats or sheep, 11 camels, or 5 cattle. The approach is scalable according to brine availability and land capacity. Although the direct economic value of the crops is relatively low (approximately €467/ha/year), the primary benefit is the conversion of desalination by-products into livestock feed resources while reducing risks.

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Scientific Session

Applications

Keywords

Duckweed; Fish; Halophyte; Desalination; Food;

References

N/A

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Session Classification : Applications II — wastewater & remediation