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# Utilizing solar energy for duckweed (*Lemna spp.*) growth in arid regions as a potentially important food additive in animal and human nutrition

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## Motivation

* Worldwide shortage of food production.
* Worldwide shortage of high water quality (fresh water).
* Efficient use of solar energy for food production, primarily in arid regions.
* Experiments indicating good growth of Duckweed in brine from water desalination plant.
* Health tests conducted on fish fed duckweed, grown in brine, showed it to be safe for human use.

Arid zones are characterized by high solar radiation, high temperatures, water scarcity, food shortage and difficult living conditions.

## Materials and Methods

* Experiments on duckweed growth in brine were conducted in 100-l containers
* Experiments on fish feeding duckweed grown in brine were conducted in 100- l containers
* Health tests conducted on fish fed on duckweed, grown in brine, for health assessments, were carried out by an external official laboratory

Mean solar energy at the experiment location, 6.25 kCal/m2/h

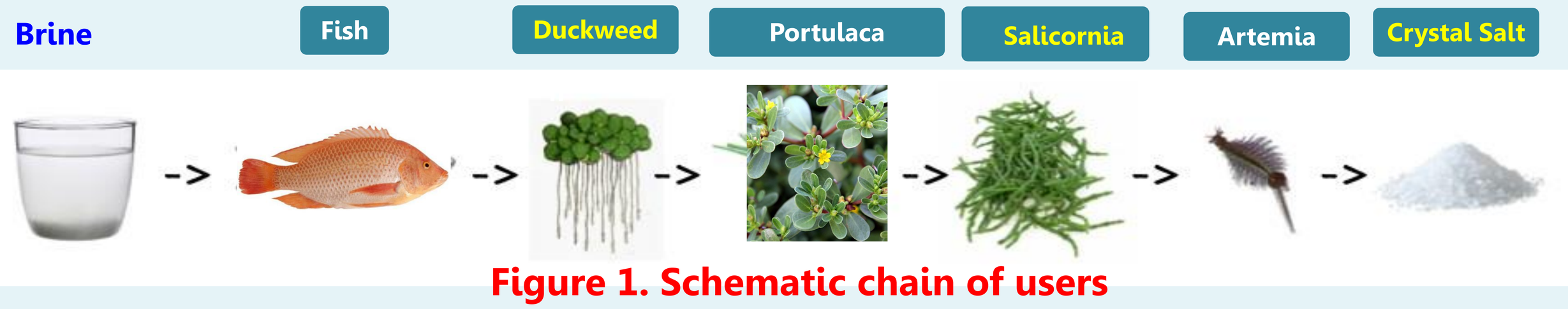


**Figure 1. Schematic chain of users**

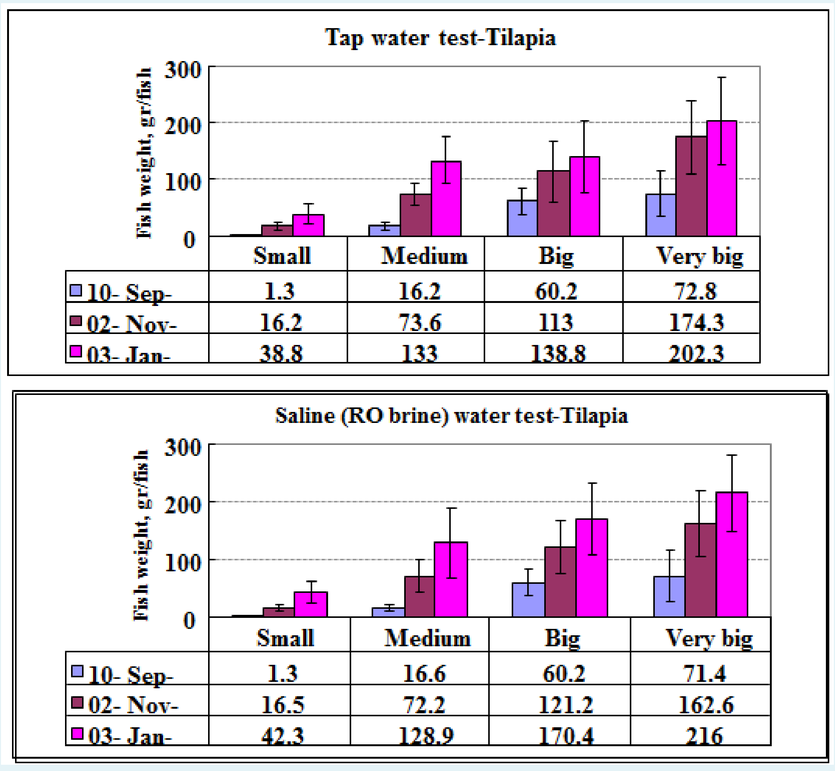


**Figure 1. Fish growth rates cultured in freshwater and in brine**

**Table 2. Selected content of microelements in various waters**

| Element | Content of elements in RO brine in Tilapia experiment, mg/L | Content of elements in RO brine in Barramundi experiment, mg/L | Maximum allowed content in waters-Israeli Standards, mg/L |
|---|---|---|---|
| Ba | 0.320 | 0.272 | 1.0 |
| Cd | 0.003 | * | 0.005 |
| Cr | 0.008 | 0.005 | 0.05 |
| Cu | 0.008 | 0.008 | 1.4 |
| Fe | 0.07 | 0.065 | 1.0 |
| Mn | - | - | 0.5 |
| Ni | 0.027 | 0.016 | 0.05 |
| Pb | 0.007 | - | 0.01 |

* Negligible

## Summary and Conclusions

Solar energy enables the intensive production of duckweed and fish in the same water, whether brine or fresh, forming a chain of users where both benefit from the other.

Duckweed can potentially be used on a larger /industrial scale as a feed additive for herbivorous and omnivorous fish.

Duckweed can greatly contribute to animal and human food, particularly in arid regions, rich in solar energy and in poor in freshwater.

Fish fed duckweed, grown in the same water, were found safe for human consumption.

Mean solar energy at the experiment location, 6.25 kCal/m2/h (in northern location, 5.0 kCal/m2/h)

**Fig. 3. DUCKWEED**

**Fig. 4. Fish consuming fresh duckweed**