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Sole larvae perform best on algae-and-rotifer diet

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Addition of algae improved the growth and survival

In recent years, research on the culture of Senegal sole (*Solea senegalensis)* has focused on optimizing production and promoting culture in geographic areas outside their native range. Larval rearing is regularly carried out using a range of initial feeding protocols.

Study compared feeding regimes to improve the growth, survival and quality of Senegal sole.

Larval feeding study

The authors recently conducted a study to compare four initial feeding regimes to improve the growth, survival, and quality of Senegal sole larvae. Larvae were reared at 19 degrees-C in eight circular, 280-liter tanks at a density of 50 larvae per liter. Diet A included (*Chlorella* sp.) algae at 300,000 cells per ml in tank and 20 (*Brachionus plicatilis)* rotifers per ml enriched with (*Isochrysis galbana)*. Diet B was artemia nauplii at 1.4 per ml, while diet C was comprised of artemia nauplii at 2.9 nauplii per ml. Diet D was artemia nauplii at 4.3 per ml.

The diet B regime was calculated based on the dry weight of rotifers, with diets C and D initially two and three times that of diet B and increasing afterwards based on larvae demand. From eight days after hatching on, the A regime larvae were fed only commercial enriched artemia.

Results

Similar growth rates for dry weight and length were found with the four diets. Partial growth rates and final survival are shown in Table 1. At 47 percent, the A diet regime had the highest survival rate.

Chereguini, Partial growth rates and final survival of sole larvae, Table 1

	Diet A	Diet B	Diet C	Diet D
0-8 days after hatch	20.21	21.68	19.17	20.64

8-13 days after hatch	24.92	25.92	26.00	23.48
13-27 days after hatch	14.21	9.88	11.55	12.18
27-36 days after hatch	7.94	15.05	18.20	13.17
Survival (%)	47.01	27.75	21.88	19.95

Table 1. Partial growth rates and final survival of sole larvae fed trial regimes.

Similar protein content at eight and 39 days after hatch (38.5 percent and 43.5 percent dry weight, respectively) and similar lipid content eight days after hatch (26.5 percent) were found for the test diets. However, significant differences at 39 days after hatching were obtained among the larvae fed regime A (19.5 percent) and the B, C, and D regimes (25 percent).

Results for total lipids composition of the larvae are shown in Tables 2 and 3. Sum (omega-3)/sum (omega-6) levels were higher for the A regime eight days after hatch, but similar to the other regimes after 39 days. The 22:6 omega-3 DHA content was higher in larvae fed the A regime (10 percent of total fatty acid) when compared to the other regimes (4.5 percent of total fatty acid). DHA/EPA was also higher for the A regime at both eight and 39 days after hatching.

Chereguini, Lipid composition of sole larvae at eight days after hatch, Table 2

Lipid	Lipid Composition (% total) A	Lipid Composition (% total) A	Lipid Composition (% total) B	Lipid Composition (% total) B	Lipid Composition (% total) C	Lipid Composition (% total) C	Lipid Composition (% total) D	Lipid Composition (% total) D
PUFAs	33.87	28.67	39.41	40.90	40.70	28.37	26.26	26.24
Saturated	20.33	20.79	22.03	20.43	21.83	20.90	22.92	22.73
Monounsaturated	45.80	50.54	38.57	38.67	37.92	50.73	50.82	51.03
Sum (n-3)	24.83	20.72	17.64	19.14	18.83	19.24	17.51	17.50
Sum (n-6)	8.05	7.03	7.90	8.51	8.40	8.49	7.94	8.05
(n-3)/(n-6)	3.08	2.95	2.23	2.25	2.24	2.27	2.21	2.17
20:5 (n-3)	9.07	7.52	9.03	9.74	9.19	9.89	9.40	9.03
22:6 (n-3)	10.53	8.82	4.27	4.89	5.17	4.95	4.28	4.36
22:6 (n-3)/ 20:5 (n-3)	1.16	1.17	0.47	0.50	0.56	0.50	0.46	0.48

Table 2. Lipid composition of sole larvae at eight days after hatch. Two tests per trial regime.

Chereguini, Lipid composition of sole larvae at 39 days after hatch, Table 3

Lipid	Lipid Composition (% total) A	Lipid Composition (% total) A	Lipid Composition (% total) B	Lipid Composition (% total) B	Lipid Composition (% total) C	Lipid Composition (% total) C	Lipid Composition (% total) D	Lipid Composition (% total) D
PUFAs	39.14	38.99	39.37	39.25	40.80	39.61	39.70	40.39
Saturated	26.42	25.95	23.91	23.66	23.21	24.76	24.08	23.61
Monounsaturated	34.35	36.06	36.72	37.09	35.99	35.63	36.22	35.99
Sum (n-3)	30.63	30.54	31.12	31.00	31.92	30.92	31.01	31.80
Sum (n-6)	7.94	7.99	7.91	7.90	8.51	8.30	8.20	8.25
(n-3)/(n-6)	3.86	3.82	3.94	3.93	3.75	3.72	3.78	3.85
20:5 (n-3)	3.28	3.34	3.35	3.34	3.75	3.34	3.44	3.40
22:6 (n-3)	7.09	6.21	5.10	4.68	5.84	5.46	5.10	5.07
22:6 (n-3)/ 20:5 (n-3)	2.16	1.86	1.52	1.40	1.56	1.63	1.48	1.49

Table 2. Lipid composition of sole larvae at 39 days after hatch. Two tests per trial regime.

Results similar to haddock, turbot, halibut

The higher survival rates in larvae fed the initial enriched rotifer diet agreed with data reported for haddock (*Melanogrammus aeglefinus).* Differences in partial growth rates at 13 to 27 and 27 to 36 days after hatching, and total lipid content at 39 days between the diet A and other regimes were likely related to the artemia supply.

These results are in agreement with research previously reported for turbot (*Scophthalmus maximus)* and halibut (*Hippoglosus hippoglossus).* The addition of algae improved the growth and survival of larvae by modifying bacterial flora in the water and stabilizing rotifer nutritional quality. Moreover, the lipid content and fatty acid composition of the larvae reflected the composition of the microalgae used, and so may be an effective tool to control fatty acid content.

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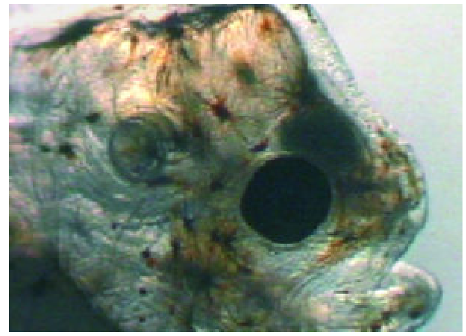

Close-up of larval Senegal sole.

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