# DEVELOPMENT OF SKELETAL DEFORMITIES IN GILTHEAD SEA BREAM *(Sparus aurata)* REARED UNDER DIFFERENT LARVAL CULTURE AND DIETARY CONDITIONS.

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## ABSTRACT

**Main deformities such as lordosis, opercular deformities and upper/lower jaws shortening are considered as quality descriptors in commercial marine fish fry production and seem to be related at least with culture conditions in early larval stages. The aim of this study was to obtain information about the contribution of the diet and rearing system to the apparition of these abnormalities in gilthead sea bream *(Sparus aurata)* larvae in semi-industrial scale facilities. For that purpose, two different larval rearing systems semi-intensive and intensive were compared by duplicate and with the same live feed enrichments; besides, two different rotifer enrichments were tested in an intensive system. Biochemical composition of larvae, preys and commercial products was analysed. At 50 days post hatching six hundred fish per treatment were individually studied under stereoscope and abnormalities frequency recorded. At 95 days post hatching fry were soft X ray monitored as well. A significantly lower percentage of deformity rate together with better survival and growth were obtained in the semi-intensive system, whereas rotifer enrichment with DHA Protein Selco significantly affected fatty acid composition and improved larval survival in comparison with Red Pepper Paste.**

## MATERIAL AND METHODS

**Two different cylindroconical fibre glass larval tanks designs were used, two 40 cubic meter tanks for semi-intensive system (7 eggs/l$^{-1}$) and 2 cubic meter tanks for intensive system (125 eggs/ l$^{-1}$). The feeding sequence, for both systems used is shown in figure 1. For dietary treatment, four 2m$^3$ cylindroconical fibre glass larval tanks were stocked with 125 eggs.l$^{-1}$ in intensive larval rearing system. Culture conditions were the same than in experiment I. Two commercial emulsions for enrichment of rotifers were tested: DHA Protein Selco, (DPS) (Inve Aquaculture, Dendermonde, Belgium) and Red Pepper Paste, (RPP) (Bernaqua bvba, Turnhout, Belgium).**

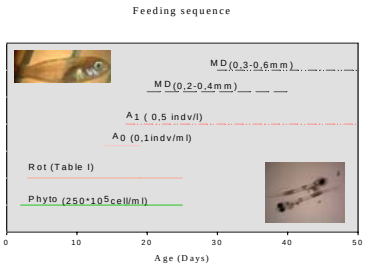



**Figure 1: Feeding sequence.**

**Table I: Some FA of enriched rotifers used. n=3 (mean± Std.dev;( P<0.05).**

| | Rotifers DPS | Rotifers RPP |
|---|---|---|
| % n-3 HUFA | 22,6± 0,10 $^a$ | 27,5± 1,96 $^b$ |
| DHA | 14,3± 0,66 $^a$ | 19,7± 2,01 $^b$ |
| EPA | 5,51± 0,52 $^a$ | 5,04± 2,04 $^a$ |
| ARA | 1,49± 0,35 $^a$ | 3,9± 2,97 $^a$ |
| DPA n-6 | 0,99± 0,04 $^a$ | 9,8± 5,05 $^b$ |
| DHA/EPA | 2,6± 0.37 $^a$ | 4,3± 2,16 $^a$ |
| DHA/DPA n-6 | 14,4± 0,08 $^a$ | 2,3± 1,41 $^b$ |

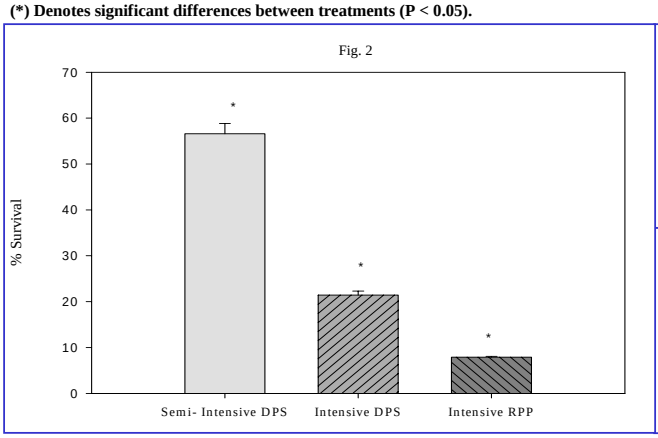
**Six hundred post-larvae (50 dah) per treatment were sampled, the internal and external morphology were individually monitored under stereoscope. Observed abnormalities were recorded and classified according with Divanach *et al.*, (1996).The abnormalities considered as quality criteria were classified in 5 categories according to the type of the malformation. (Table II).**

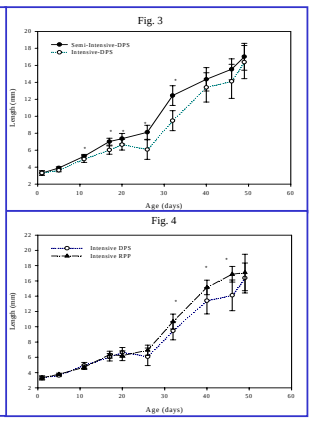
**Table II: Definition of the different categories of abnormalities considered in this study.**

| Category | Description |
|---|---|
| Op. | Fish with gill cover anomalies. |
| Jaw. | Fish with pugheadeness, crossbite, lower jaw reduction, ventrally projected hyobranchial skeleton and pike jaw deformity. |
| Fu. | Fish affected by vertebral fusion, dislocation, shortening deformation or lack of the centra. |
| Lo. | Fish showing lordosis; (+) acute: deformation forming a marked angle of the vertebral column externally noticeable;, (-) light: deformation forming a curvature only detectable by radiography. |
| LSK. | Fish showing the association of lordosis, scoliosis and kyphosis |

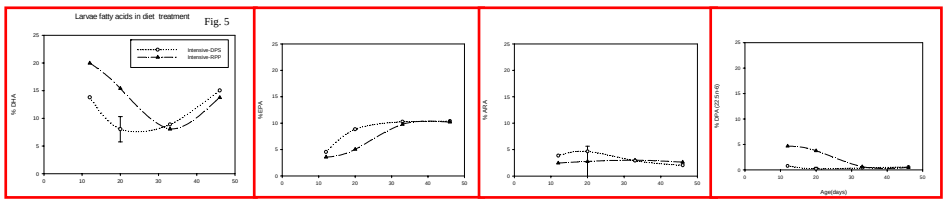
## RESULTS

**Figure 2,3,4: Survival rates at 110 dah ( Fig 2.) and total length evolution per treatment (Fig 3,4). (*) Denotes significant differences between treatments (P < 0.05).**




**Figures 5,6: Larvae fatty acids from system and dietary treatment expressed in area % of total lipids.**



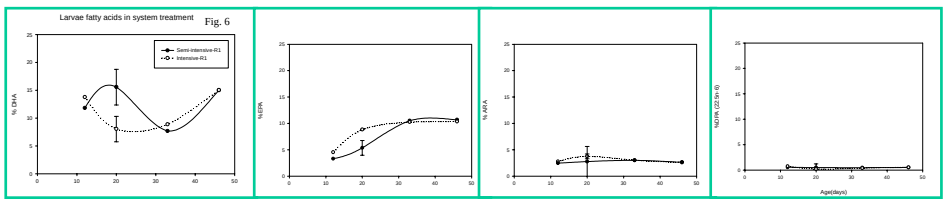




**Table III. Percent of different skeleton anomalies in visual and soft-X ray morfo-anatomical characterization at 50 and 95dah respectively. Different letters in the same column within the same age denote significant differences (P<0,05).**

| Quality Evaluations | | Op | Jaw | Fu | Lo- | Lo+ | LSK |
|---|---|---|---|---|---|---|---|
| *50d* | *Semi-Intensive DPS* | 0,2 $^a$ | 0,7 $^a$ | - | - | 0,2 $^a$ | 0,2 $^a$ |
| | *Intensive DPS* | 6,2 $^b$ | 1,1 $^{ab}$ | - | - | 0,3 $^{ab}$ | 0,2 $^{ab}$ |
| | *Intensive RPP* | 5,1 $^b$ | 2,3 $^b$ | - | - | 1,2 $^b$ | 0,7 $^b$ |
| *95d* | *Semi-Intensive DPS* | 1,5 $^a$ | 1,1 $^a$ | 2,4 $^a$ | 3,5 $^a$ | 1,4 $^a$ | 0,0 $^a$ |
| | *Intensive DPS* | 10 $^b$ | 4,2 $^b$ | 2,7 $^{ab}$ | 13,9 $^b$ | 5,9 $^b$ | 0,7 $^b$ |
| | *Intensive RPP* | 4,2 $^c$ | 2,0 $^b$ | 4,5 $^b$ | 6,5 $^c$ | 5,1 $^b$ | 1,1 $^b$ |

## CONCLUSIONS

- **Intensive rearing conditions could be acting as chronic stressors, resulting in a stress related mortality and poor growth in this type of system.**
- **High amounts of DPA (22:5n-6) in rotifers enrichments seems to have negative effect over larval survival although no effect was found over larval quality.**
- **The relationship between deformities and rearing system is mainly due to significantly lower different rates in opercular abnormalities and lordosis in semi-intensive system.**
- **The level of DHA in the rotifers phase is suggested as a key factor to reduce the opercular deformities in *Sparus aurata* larval rearing.**

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