The effect of ozone treatment on egg and larvae performance in the gilthead seabream Sparus aurata and other marine fish species.

Ben-Atia. S., S. Lutzky, Y. Barr, R. Weiss, K. Gamsiz, Y. Shtupler, B. Koven and A. Tandler
Pathogens transport axis
Ozone as a prophylactic agent*

<table>
<thead>
<tr>
<th>disinfectants</th>
<th>viruses inactivation</th>
<th>bacteria inactivation</th>
<th>cysts inactivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ozone</td>
<td>1.00</td>
<td>0.60</td>
<td>1.40</td>
</tr>
<tr>
<td>chlorine</td>
<td>6.00</td>
<td>0.90</td>
<td>201</td>
</tr>
<tr>
<td>iodophore</td>
<td>not effective</td>
<td>1.00</td>
<td>not effective</td>
</tr>
</tbody>
</table>

CT value = Concentration(mg/L) x Time(minutes)

*Harrison, J. F and Blazek, P (1997)
Ozone physical and chemical properties

3O₂ → 2O₁ + 2 O₂ → 2O₃

UV radiation, electrical discharge

Oxidation potential = 2.076V

Temperature, pH, Organic material = Half life in water
The disinfecting method

Ozone generator → Ozone sensor → Disinfecting chamber

Sea water + O₃

0.3 mg/L +10%

Ozone sensor → O₂

O₃

Sea water + O₃ out

0.3 mg/L

Ozone reduction rate (%) vs. Time (minutes)
Methods

Eggs stage

Non treated

Washing with sterile seawater

Ozone treatments at concentration of 0.3mg/L

Samples for bacterial growth detection

Control

CT-0

CT-0.6

CT-1.2

CT-2.4

CT-4.8

Hatching

Survival

Swim bladder inflation

Larvae deformation appearance

Measurements at larval stage

16 min

8 min

4 min

2 min

2 min

4 min

8 min

16 min

2 min

4 min

8 min

16 min
The effect of ozone treatments in gilthead seabream eggs on bacterial growth in marine agar

144 h after incubation

No. of colonies/egg

control 0 0.6 1.2 2.4 4.8

CT value

a b c c c c
The effect of ozone treatment in gilthead seabream egg on the ability of larvae to hatch
Effects of prophylactic treatment on larval performance

Previous studies showed:

- connection between non inflation of larval swim bladder and bacteria infection *.

*Marty et al. (1995)
The effect of ozone treatments in seabream egg on swim-bladder inflation

![Graph showing the effect of CT value on inflated swim-bladder percentage. The graph compares different CT values (0, 0.6, 1.2, 2.4, 4.8) against the control (a) and treatments (b). The graph indicates that ozone treatments at CT values 0.6, 1.2, 2.4, and 4.8 increase the inflated swim-bladder percentage compared to the control and other treatments.]}
Effects of prophylactic treatment on larval performance

Previous studies showed:

The connection between bacteria infection and larval deformation*.

* Bergh et al. (1992), Brown & Nunez (1998), Madsen et al. (2001),

The connection between the non inflation of larvae swim bladder and larval deformation**.

** Chatain et al. (1994), Kitajima et al. (1994)

Day 1  
Day 13  
Day 13
The effect of ozone treatments in sea bream eggs on the % deformed larvae

Deformed larvae %

control 0 0.6 1.2 2.4 4.8

CT value

day 1 day 13

0 0.6 1.2 2.4 4.8
The effect of ozone treatments in seabream eggs on larvae mortality

Cumulative mortality (%) vs. Days post hatching graph showing the effect of ozone treatments on larvae mortality. The treatments are indicated by different colors and letters (a, b, c, d) and concentrations (0, 0.6, 1.2, 2.4, 4.8). The graph shows a significant increase in cumulative mortality with increasing ozone concentration, with the control group having a lower mortality rate compared to the treated groups.
Ozone as prophylactic treatment for eggs in other marine species

• Eggs resistance to Ozone—is it species specific?
The effect of ozone on hatching success in different marine fish species

![Graph showing the effect of ozone on hatching success in different marine fish species. The graph includes data for sea bass, seabream, red drum, and barramundi. The x-axis represents species, and the y-axis represents the percentage of control. The graph shows that ozone treatment reduces hatching success, with different species responding differently.](image-url)
Conclusions

The exposure of marine fish eggs to ozone as prophylactic treatment reduces significantly the risk of bacteria and other pathogen transfer from broodstock to eggs.

Ozone as prophylactic treatment of fish eggs improves larvae performance.

There is a correlation between egg diameter and resistance to ozone exposure.