



Authors: Amine Chaabane¹ and Jean-François Gabarrou¹
¹PHODE Animal Care, ZI Albigpôle, 81150 TERSSAC, FRANCE
Corresponding author: achaabane@phode.fr

Introduction and objectives

Most salmon farming systems involve practices exposing animals to acute handling stressors that have negative consequences on behavior, growth, performance and survivability. Sedatives or anesthetics are commonly administered to fish to mitigate these consequences. Nevertheless, these products themselves can be harsh and cause stress to fish (Ackerman et al., 2005)⁴. The present experiment aimed to study the effect of a plant-based solution (Olpheel Zen, Laboratoires Phodé, France) mainly based on a proprietary blend of essential oil bioactives, on the stress induced by handling and crowding.

Material & Methods

▶ ANIMALS

- Control group: 100 mixed sex Atlantic salmon
- Experimental groups: 4 x 100 mixed sex Atlantic salmon
- Average body weight: 196.74 ± 2.88 g
- Initial density: 30.27 kg/m³

▶ HANDLING STRESSOR SIMULATION

- From day 1 to day 14: acclimation
- On day 14: stressor
 - 35 min post treatment: transfer to new tank (new density: 85 kg/m³)
 - 4 hours post treatment, back to normal tank

▶ FEEDING PROGRAM AND PRODUCT ADMINISTRATION

- Standard pelleted diet for control and treatment groups.
- Control (Group A): no exposure to product
- Treatment:
 - Treatment administration on day 14.
 - Product exposure time: 4 hours
 - Inclusion rate (water tank concentration, treatment group):
 - B: 20 ppm (35 min before stressor)
 - C: 40 ppm (35 min before stressor)
 - D: 60 ppm (35 min before stressor)
 - E: 20 ppm (35 min before stressor) + 20 ppm (2 hrs after 1st application)

▶ MEASURES

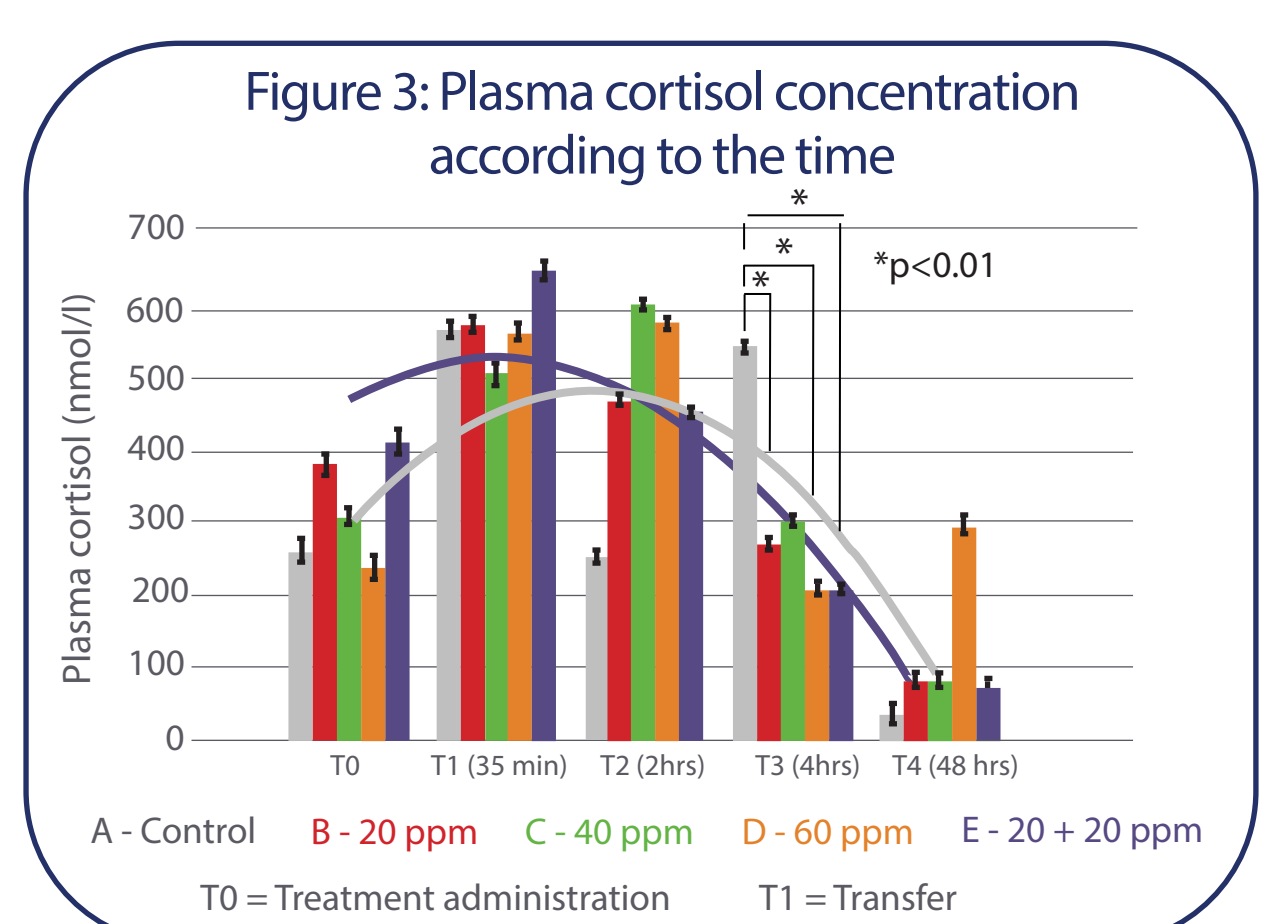
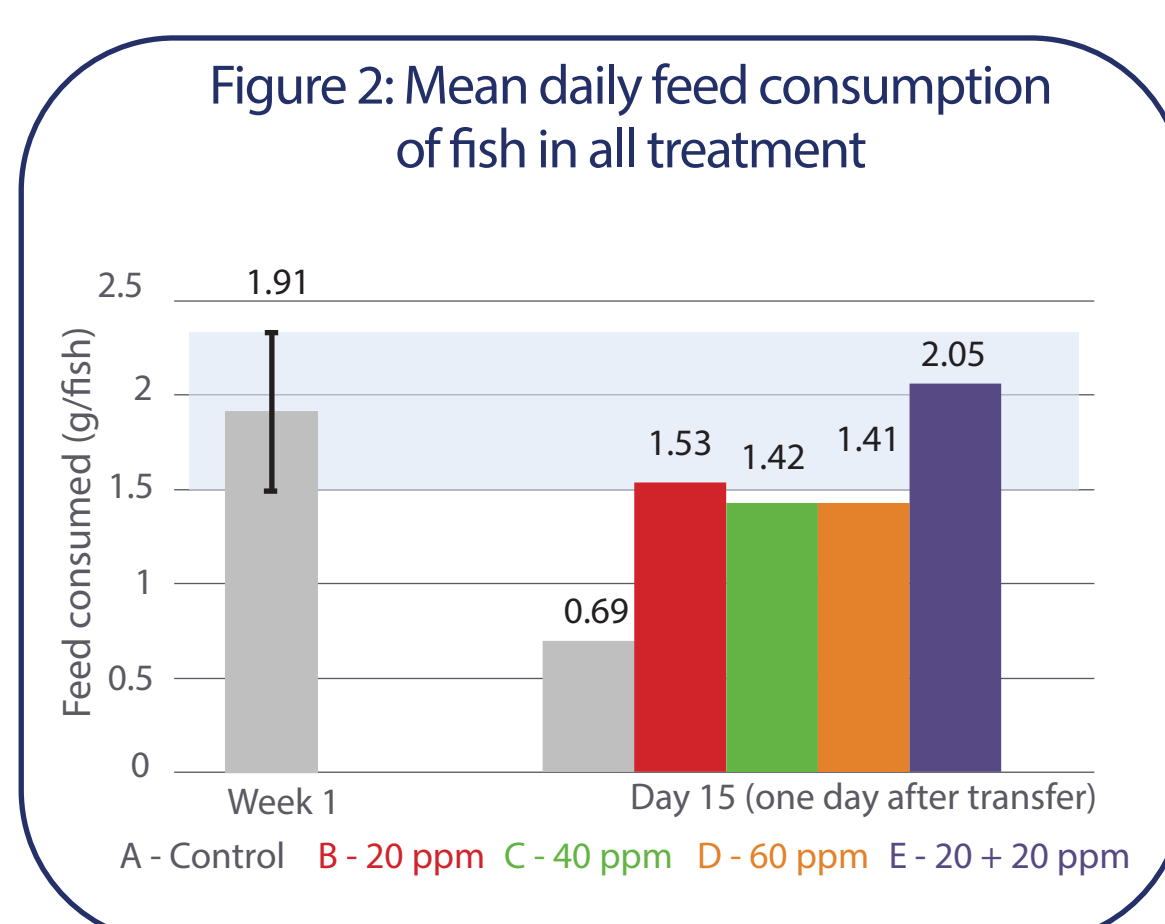
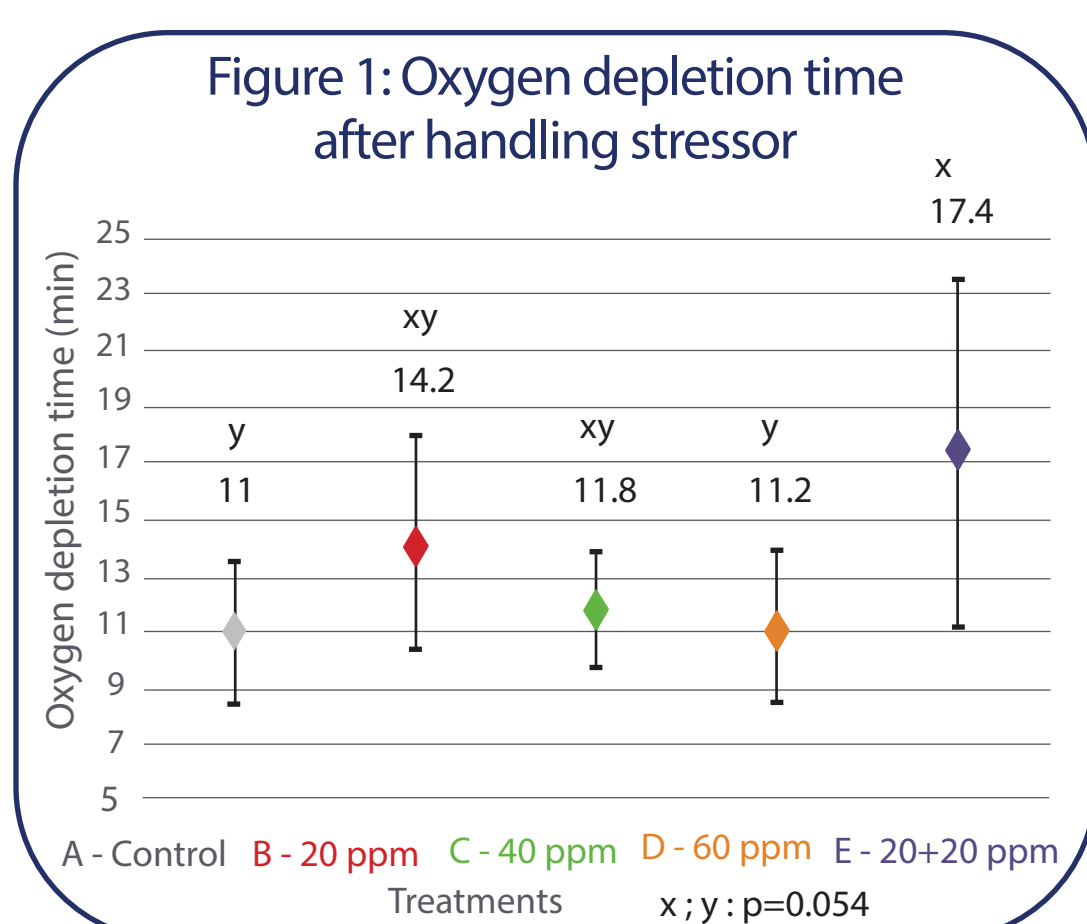
- Plasma cortisol concentration was measured at 5 different times following the first product incorporation (0 min; 35 min, 2 hrs, 4 hrs and 48 hrs).
- A video recording was done 60 seconds before the first pooled blood samplings and served as support to assess fish behavior. The scoring system is described in table 1.

Table 1: Behavioral scoring system

Criteria	Score	Description
Swimming activity	0	Normal swimming - No abnormality
	1	Excited, increased activity
	2	Decreased activity
Orientation	0	Normal swimming - No abnormality
	1	Tilting
	2	Flanking

- The time to reach a 30% oxygen depletion was measured from the transfer.
- Resumption of feed intake has been assessed from day 15 to 21.
- Data were analysed using ANOVA (General linear model) when appropriate.

Results



Regardless of the solution concentration, salmon's body orientation wasn't affected through the study and was similar to control fish. However, at 4 hours, fish in treatment C and D were excited while a decrease of swimming activity was observed in treatment B and E, compared to the control one (Table 2).

The cortisol level observed in each group was increased from 35 min on ($p<0.001$), which indicates a stress response to the experimental transfer model. It became significantly lower ($p<0.05$) in treated groups 4 hours post-treatment, and once again group E stood out displaying the lowest cortisol concentration at this time compared to the control fish (Figure 3; 204 vs. 547 nmol/l; $p<0.01$). Thus, fish in treatment E came back faster to normal behavior after the stressor.

The oxygen depletion time was significantly the longest for fish in treatment E and the lowest for control fish (Figure 1; 17.4 vs. 11 min; $p=0.054$).

One day after the transfer (Day 15), all treated fish displayed a quicker resumption of feed intake compared to the control, especially fish from treatment E (Figure 2; 2.05 g vs. 0.69 g).

Table 2: Behavioral assessment

	Swimming activity	Orientation
A - Control	0	0
B - 20 ppm	2	0
C - 40 ppm	1	0
D - 60 ppm	1	0
E - 20+20ppm	2	0

CONCLUSION : All the results obtained during this experiment are consistent between them and highlight the product's capacity to alleviate negative effects of handling stressors. Salmon that received Olpheel Zen displayed calmer behaviour without any evidence of sedation, and resumed back to feeding faster than the control group after the stressor. A 20-ppm concentration appears to be the most efficient concentration and especially when re-applied 2 hours later. Finally, the cortisol data complete these results and suggest that Olpheel Zen is as an alternative to sedatives to decrease fish stress imposed by procedures like transportation, crowding and handling.