ICES CM 2014/3728 A:07

Effects of *Pelagia noctiluca* jellyfish swarms on caged gilthead sea bream

Bosch-Belmar, Mar [1,4]; Kéfi-Daly Yahia, Ons [2]; M'Rabet, Charaf [2]; Dhaouadi, Raouf [3]; Fuentes, Verónica [4] ; Chalghaf, Mohamed [5]; Piraino, Stefano [1]
[1] Dipartimento di Scienze e Tecnologie Biologiche ed Ambientali, Università del Salento, 73100 - Lecce (Italy), [2] Laboratoire de planctonologie, Institut National Agronomique de Tunisie, [3] Ecole Nationale de Médecine Vétérinaire de Tunisie, [4] Institut de Ciències del Mar, ICM-CSIC, [5] Institut Supérieur de Pêche et d'Aquaculture de Bizerte.
Corresponding author: maria.boschbelmar@unisalento.it

Summary

In recent years, interactions between caged finfish and jellyfish have been increasingly reported, with major fish mortalities and severe economic impacts to aquaculture facilities. The scyphomedusa *Pelagia noctiluca* has been responsible for documented mortality events in Eastern Atlantic (Irish Sea) and the Mediterranean Sea. We investigated he impact of *P. noctiluca* stings on the gilthead sea bream (*Sparus aurata*) in laboratory experiments. Fish were pulse-incubated for 8 hours with 3 different jellyfish densities in experimental tanks. Gill disorders were assessed through histological analyses at time intervals (0, 3, 9, 24, and 48 h, and 1, 2, 3 and 4 weeks) after the pulse exposure to jellyfish. Our results demonstrated that *P. noctiluca* may severely affect caged sea bream gill integrity as soon as 3 h after interaction with jellyfish tissues.

Introduction

With the increased use of the marine environment by anthropogenic activities, including aquaculture, and increased jellyfish proliferations in some areas, the probability of interaction between them is rising, which may involve large economic losses for aquaculture companies. For example in Ireland, the average economic losses are 12% annually.
Over recent decades, jellyfish blooms have caused the death of thousands of farmed fish of different species (*Salmo salar*, *Dicentrarchus labrax* and *Sparus aurata*) in several regions throughout the world (Palma *et al. (*2007), Baxter *et al.* (2011)). Jellyfish blooms that concentrate around aquaculture facilities may pass through the mesh of cages either as whole animals or tentacle fragments. Cnidarian envenomations may severely damage fish skin and gills by venom discharged from their specialized stinging cells, and prolonged exposure can cause secondary infections leading fish to death (Rodger *et al*. (2011), Baxter *et al.* (2011b)). Also, clogging of the net could cause a de-oxygenation of the surrounding water and suffocation of farmed fish.

The aim of the current study was a qualitative and quantitative assessment of the effects of interactions between the scyphozoan *Pelagia noctiluca*, the most abundant stinging jellyfish in the Mediterranean Sea, and one of the most common farmed fish, the sea bream (*Sparus aurata*).

Material and Methods

The experiments were carried out using 8 circular tanks of 300 liters, with continuous flow of twice pre-filtered (5 μm, 1 μm mesh) seawater. The water circulation flow was kept at natural temperature and salinity (T^a=14.5±1.0 °C, S = 36.8±0.3 ppt with a low aeration system.
Four experimental groups were established and each duplicated: a control group and 3 treatment groups with 3 different possible densities of *P. noctiluca* blooms (10, 25 and 50 ind m^{-3}). The experiment started when jellyfish were placed in contact with fish within the treatment tanks and

continued for 8 hours. Fish health was monitored up to 4 weeks from the start of the experiments, at 0, 3, 9, 24, and 48 h, and 1, 2, 3 and 4 weeks after the start of the experiment. Fish were sampled and anesthetized with UNICAINE (2%), weighed, measured, and gill samples taken for histological analysis. The gill samples were preserved in formaldehyde 10%. All histological slides were stained by a standard haematoxylin and eosin protocol and interpretation based on the histopathological index by Mitchell *et al.* (2012).

Because data were not normally distributed, non-parametric Kruskal-Wallis tests were conducted and significant differences were investigated post- hoc using Pair-wise comparisons.

Results and discussion

After 8 h exposure to *P. noctiluca* jellyfish, some fish in the experimental treatment groups displayed external lesions and persistent gross pathological changes of the gills over the course of the study. Differences in gill damage intensity were significant between control and all treatment groups and also among treatment groups. The greater damage was recorded in medium and high jellyfish density groups. Although gill damage was observed in all treatment groups after only 3 h, for the low and medium density groups significant differences regarding start of the experiment were found after 1 week of exposure, and for high density at the early time sampling (but without significant differences along the time).

These results show that *P. noctiluca* may represent a high risk for marine finfish aquaculture farms. This is the most abundant jellyfish species in the Mediterranean Sea and can generate enormous blooms of millions of individuals. Its presence varies among locations, but in some localities like Tunisia and the Strait of Messina (Italy), it can be recorded all year (Rosa *et al.* (2013)). We observed that an interaction of a few hours with a bloom of *P. noctiluca* can generate considerable damage, presenting the first gill lesions 3 h after contact. Comparable gill damage was previously observed in farmed salmon (*Salmo salar*) during blooms of *P. noctiluca* and two hydrozoans (*Solmaris corona* and *Muggiaea atlantica*) (Mitchell *et al.* (2012)).

Our findings will improve understanding of the potential threat of this abundant jellyfish to finfish aquaculture, as well as knowledge about the nature and extent of the damage, which may be used for future fish farm monitoring.

References

Baxter E., Sturt M., Ruane N., Doyle T., McAllen R., Harman L., Rodger H. 2011. Gill damage to Atlantic salmon (*Salmo salar*) caused by the common jellyfish (*Aurelia aurita*) under experimental challenge. PLoS One, 6: e18529

Baxter, E., Rodger, H., McAllen and R., Doyle, T. 2011b. Gill disorders in marine-farmed salmon: investigating the role of hydrozoan jellyfish. Aquac Environ Interact, 1:245–257

Mitchell, S., Baxter, E., Holland, C. and Rodger, H. 2012. Development of a novel histopathological gill scoring protocol for assessment of gill health during a longitudinal study in marine-farmed Atlantic salmon (*Salmo salar*). Aquac Int, 20:813–825

Palma, S., Apablaza, P. and Silva, N. 2007. Hydromedusae (Cnidaria) of the Chilean southern channels (from the Corcovado Gulf to the Pulluche-Chacabuco Channels). Sci Mar, 71:65–74

Rodger, H., Henry, L. and Mitchell, S. 2011. Non-infectious gill disorders of marine salmonid fish. Rev Fish Biol Fish, 21:423–440

Rosa, S., Pansera, M., Granata, A. and Guglielmo, L. 2013. Interannual variability, growth, reproduction and feeding of *Pelagia noctiluca* (Cnidaria: Scyphozoa) in the Straits of Messina (Central Mediterranean Sea): Linkages with temperature and diet. J Mar Syst, 111–112: 97–107