**FITFISH WG1-3 stakeholder workshop Exercise in Aquaculture**

**October 20 2017, Dubrovnik (Croatia)**

The workshop Exercise in Aquaculture was organised by WG1 and WG3 of the FITFISH COST action. The objective of the workshop was to discuss with fish farmers the importance of swimming exercise in aquaculture and how swimming exercise can be implemented in practical terms. The total number of participants was 19, both fish farmers and Action members coming mostly from the research sector. The attendees gave a good representation of different parts of Europe, from north to south and east to west.

**Program**

| | | |
|---|---|---|
| 14.00-14.20 | COST Action FA1304 FITFISH | Arjan Palstra |
| 14.20-14.40 | Physiological benefits of swimming exercise on fish | Arjan Palstra |
| 14.40-15.00 | Feed intake and oxygen availability in fish: The impact of swimming activity | Leonardo Magnoni |
| 15.00-15.20 | Practical applications and perspectives of exercise in aquaculture | Sunil Kadri |
| 15.20-15.40 | Current views of fish farmers on swimming exercise in aquaculture | Helgi Thorarensen |
| 15.40-16.10 | coffee break | |
| 16.10-16.20 | Introducing issues for discussion | Helgi Thorarensen |
| 16.20-17.20 | Group discussions | |
| 17.20-18.00 | Synthesis and discussion on the way forward | |

The meeting began with presentations by Arjan Palstra, the FITFISH chair, where he opened the meeting and introduced the project. Then he reviewed the Physiological benefits of swimming exercise on aquaculture fish.

Leonardo Magnoni gave a talk titled Feed intake and oxygen availability in fish: The impact of swimming activity. He reviewed the regulation of voluntary feed intake in fish and how this is affected both by environmental factors such as temperature and oxygen levels and then by feed composition and internal factors such as energy requirements of swimming fish. He pointed out that there is still relatively little known about the effect of swimming activity on voluntary feed intake. Based on what is known about the interaction between voluntary feed intake, environmental factors and feed composition it is likely that a specially formulated feed may be required for exercising fish.

Sunil Kadri has a broad perspective on aquaculture both as an academic and also as a private consultant for fish farmers. He suggested that fish farmers are well aware of the benefits of swimming exercise for aquaculture fish. He described the challenges of employing swimming exercise in land based units and possibilities designing new closed and semi closed open sea rearing units to allow fish to swim more than in conventional net cages.

Helgi Thorarensen summarized the results of an informal survey conducted by members of WG3. The objective of the survey was to (1) Hear opinions of fish farmers and others who are involved in aquaculture about the importance of swimming exercise for aquaculture fish; (2) Get information on the practical control of currents in aquaculture facilities; (3) Assess the potential for increasing production with strategic use of water current (4) Gauge the interest of fish farmers to participate in

research projects related to water current in rearing units. In total, 19 fish farmers and other stakeholders associated with fish farming responded. The answers suggest that most fish farmers are aware of the benefits of swimming exercise for aquaculture fish. Most respondents thought that swimming exercise would be beneficial for fish and could improve growth performance. Furthermore, most farmers in land based fish farms can and do regulate the current in tanks. Their objectives are to facilitate cleaning of tanks and creating a better rearing environment for the fish with reference to swimming speed and feed distribution. Most think that size of fish is an important determinant of current velocity and many mentioned that current should be between 1 and 2 body-lengths$\cdot s^{-1}$. Around 40% of the respondents thought that they could increase their production capacity with the choice of the right currents. In total, 87% of the respondents were ready to participate in a research project on swimming exercise.

Part of the group attending the FITFISH workshop.

The last part of the meeting was spent in group discussions. Three groups were formed and some of the following questions discussed:

1. Are fish farmers already fully aware of the benefits of swimming exercise for aquaculture fish?
2. Are we already regulating currents in rearing units to reaping the full benefits of swimming exercise on aquaculture fish?
3. How can we further exploit the benefits of swimming exercise for aquaculture fish?
4. What research questions do we still need to address for regarding swimming exercise in aquaculture?

In response to the first question, there was a consensus in the discussion groups that salmon farmers were well aware of the benefits of swimming exercise. This may not be the case in Mediterranean

aquaculture. Fish farmers regulate current both with reference to fish welfare but also to ensure proper cleaning of tanks.

In response to the second and third question, the conclusion was that perhaps fish farmers were not fully aware of the benefits of swimming exercise and that there could still be possibilities of improving performance of fish farms by maintaining optimum current. Furthermore, there may be both technical limitations and other issues that the farmers must address when regulating the current, such as proper cleaning of tanks, that prevent farmers from attaining the optimum current. Moreover, in facilities such as raceways it is generally not possible to maintain higher current velocities.

In response to the fourth question a number of issues were raised. The attendees agreed that there are indeed gaps in our knowledge on the effect of swimming exercise on aquaculture fish. There are clearly gaps in the knowledge on the effect of exercise on early life stages. The effects of exercise on fecundity are not known and as are the effects on deformities. The effects of the duration of the exercise are not known, is it perhaps enough just to have intermittent exercise. Furthermore, most studies are short term experiments. There is a need for more long term studies on the effect of swimming exercise. Also, swimming exercise could benefit fish that are reared for restocking although there is only limited information available on this issue.

Invitees

| | |
|---|---|
| Arjan Palstra | Wageningen University & Research |
| Reinhold Hanel | Thünen Institute of Fisheries Ecology |
| Leonardo Magnoni | CIIMAR |
| Helgi Thorarensen | Holar University College |
| Arnþór Gústavsson | Arctic Fish |
| Ólafur Ingi Sigurgeirsson | Holar University College |
| Paul Daniel Sindilariu | Tropenhaus |
| Luisa Valente | CIIMAR |
| Pedro Encarnação | Biomin |
| Neil Duncan | IRTA |
| Sunil Kadri | Alimentos Ventures |
| Tin Klanjscek | IRB |
| Kees Kloet | Kingfish Zeeland |
| Kees-Jan Bastiaansen | Kingfish Zeeland |
| Sanel Ridjanovic | Dzemal Bijedic University of Mostar |
| Ana Riaza | Stolt Seafarms |
| Carlos Mazorra | Naturix |
| Paule Spasojevic | Dzemal Bijedic University of Mostar |
| Harald Sveier | Leroy Seafood Group |