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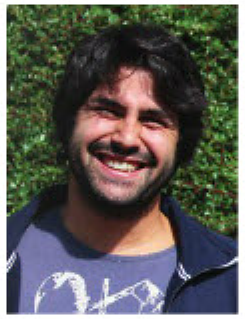
Watching the stocks

Monitoring provides insight into species' behaviour within salmon net pens



BY BENJAMIN ZERAFA, HERVE MIGAUD, ERIC LECLERCQ

The European salmon industry is committed to continually apply greener, safer and more efficient production methods and disease control strategies. In recent years, cleaner fish have emerged across the industry as a strategic component to the sustainable control of the potentially devastating salmon sea lice.

Many challenges have been rapidly overcome to achieve the current level of biological sea lice control. However, bottlenecks remain to optimise the reliability of this strategy across salmon sites and production cycles and secure the long-term application and global benefits of the method.

Key to the continual improvement of husbandry practices in any farming system is the visual observation of the livestock. A lot can be learned through observation on stock normal behaviour, natural rhythms, requirements and sub-optimal conditions.

These can lead to informed decisions on best husbandry practices. Monitoring of cleaner fish deployed at low densities within commercial Atlantic salmon net pens is inevitably restricted and remains largely anecdotal.

In this study, an acoustic telemetry system allowing fine-scale tracking of individual specimens at frequent intervals was used to better understand swimming activity of cleaner fish deployed.

The study was performed from March 24 to June 1, 2015, at a Scottish salmon sea site under full commercial management.

Two 25m square pens, 20m depth, were stocked with 2 kg Atlantic salmon and either wild ballan wrasse or farmed lumpfish previously deployed in summer 2014, hence fully acclimatised.

Cleaner fish shelters were provided at 5 to 10 m depth. The sea lice count remained below trigger level and no therapeutic treatments were applied over the period.

Water temperature rose from 7.2 to 9.1 deg C and salinity was around 27 ppt. A 3D tracking system (Hydroacoustic TechnologyInc) was used, including acoustic tags emitting at a set periodicity providing a unique fish ID and an array of hydrophones for positioning by triangulation.

Ballan wrasse (n=9) and lumpfish (n=9) were surgically implanted with acoustic tags pinging every six to 10 seconds, returned to their original pen and tracked. Control tags were also deployed at known locations within the pens to validate the accuracy of the acoustic system.

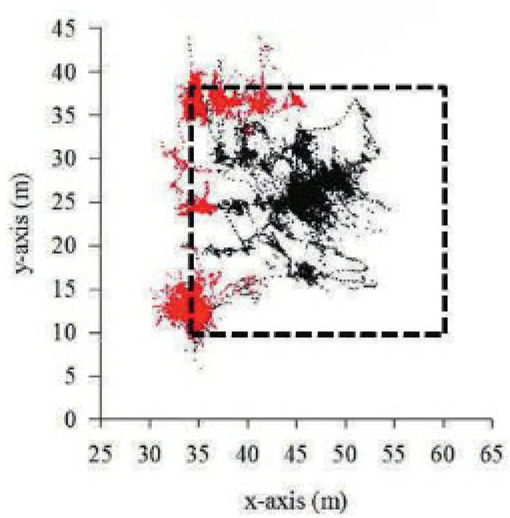
More than 90 per cent of emitted signals were positioned by the system. The accuracy of the acoustic positions averaged 0.6 m across the three dimensions of all control tags and was below 1m in 93 per cent of the cases.

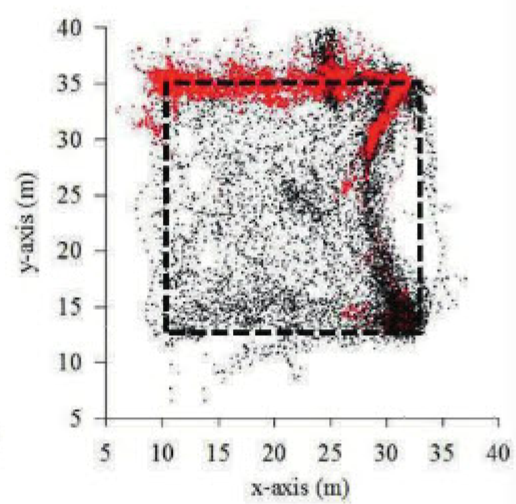
Results showed strong species specific behaviour in the pens. Lumpfish spent 80 per cent of their time in the top 10m of the pen during both day and night, compared to 15 and 30 per cent respectively for ballan wrasse.

The daily mean depth of farmed lumpfish averaged 6.8m, was consistent over April and May and did not differ between day and night.

Lumpfish made frequent, steep and short-term vertical migration to deeper depths, while generally cruising across all four sides of the net.

In comparison, wild wrasse displayed lower horizontal spread and vertical amplitude, therefore covering a lower volume area. They were located at 15m depth average, and progressively rose up with time and water temperature.





Above: Farmed lumpsucker and wild ballan wrasse deployed to salmon sea pen. **Below and opposite page:** Example of 3D track, top-view and depth profile of an individual ballan wrasse (l) and lumpfish (r) over 48h

The swimming speed of lumpfish during the day but not at night increased with raising water temperature, along with a reduced use of shelters.

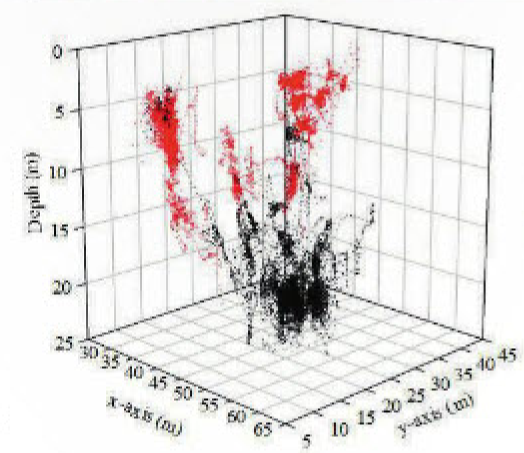
Together, these behavioural patterns suggest increasing delousing activity with raising temperature for both species.

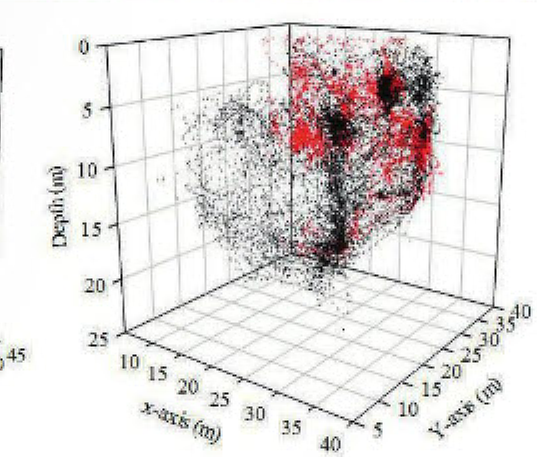
Of interest, a third of the wrasse consistently migrated to shallower depth at night. This may have been driven by well documented day-night variations in the vertical distribution of salmon, which highlights the potential for overnight creel re-capture at shallower depth to minimise swim bladder over-inflation.

Lumpfish spent 50 per cent of their night time but 35 per cent of their day time in shelters, while ballan wrasse seldom used the shelters provided. This could have practical implications in controlling lumpfish position in close proximity to salmon.

In addition, the mean swimming speed of ballan wrasse was 30 per cent slower than that of lumpfish, which was not expected based on the species' body morphology.

Finally, the swimming speed of lumpfish increased by 33 per cent and their mean depth decreased in response to the presence of continuous artificial light, which had no apparent effects on ballan wrasse.





Artificial light altered lumpfish behaviour and its impact on delousing potency should therefore be considered.

Tidal water flow and feeding of the salmon stock had no apparent effect on the swimming speed, depth distribution and pen habitat usage of both species.

The 3D tracking system performed extremely well given that it was tested for the first time in such challenging farm conditions, including salmon densities, tidal flow, and salinity variations, as well as noise from seal scarers and boats.

The methodology provides an effective tool for monitoring cleaner fish behaviour according to species, origins, history and seasonal, environmental and stocking conditions.

A better understanding of cleaner fish swimming activity on farms will provide information on the overall welfare of the stocks and their efficiency at delousing salmon. This knowledge will lead to improved cleaner fish stocking strategies and husbandry practices, and enhance the reliability and efficiency of this new biological control.

The project was funded by Sainsbury's, the Scottish Aquaculture Innovation Centre and Marine Harvest (Scotland).

A Sainsbury's spokesman said: 'The development of novel methods for the control of sea lice on farmed salmon are fundamental to the future sustainability of the industry.'

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