Comment on Examination question Q10-5 to Natural England

From Elizabeth Marogna
IP no 20045425

20 March 2024

Q10-5
Seahorses
Natural England
If there are smaller numbers or a dispersed population of short snouted seahorses which could be affected by piling noise, explain whether this would mean such adverse effects were less severe than if there were larger population numbers or densities.

Comment
In conversation with Neil Garrick-Maidment FBNA, Executive Director and Founder
'The Seahorse Trust'
Fellow of the British Naturalist Association
Visiting Fellow to the faculty of science and technology.
Bournemouth University
Recipient of the David Bellamy Award for distinction as a field naturalist 2023

He says and I quote:

"Seahorses by nature do not have dense populations and so even a few being affected would make a difference.
We do know seahorses are affected by noise and there have been experiments done by Natural England and other partners including ourselves and Southampton University on noise and how it affects them.
There has also been projects done in captivity clearly showing stress, Natural England are aware of them and should be flagging this up as a potential issue.
Any noise pollution is harmful to seahorses, and it will force them to leave any area."

He also shared research papers and dissertations, available upon request. These are as follows:

1) The Functions of Sound Production in the Lined Seahorse, *Hippocampus Erectus,* and effects of loud ambient noise on its behavior and physiology in captive environments
Paul August Anderson
A dissertation presented to the graduate school of the University of Florida in partial fulfillment of the requirements for the degree of Doctor of Philosophy University of Florida, 2009

2) Evoked potential audiogram of the lined seahorse, Hippocampus erectus (Perry), in terms of sound pressure and particle acceleration
Paul A. Anderson & David A. Mann
Received: 12 March 2010 / Accepted: 4 February 2011 / Published online: 13 May 2011
Springer Science+Business Media B.V. 2011

3) Sound, stress, and seahorses: The consequences of a noisy environment to animal health
Paul A. Anderson, Ilze K. Berzins, Frank Fogarty, Heather J. Hamlin, Louis J. Guillette Jr.
University of Florida IFAS/SFRC Progam in Fisheries and Aquatic Sciences, 7922 NW 71st St, Gainesville, FL 32653, USA
The Florida Aquarium Center for Conservation, 701 Channelside Dr., Tampa, FL 33602, USA
University of Florida Department of Biology, P.O. Box 118525, Gainesville, FL 32611, USA

4) Measuring anthropogenic noise pollution in Studland Bay Marine Conservation Zone

Thesis submitted to the University of Plymouth in partial fulfilment of the requirements for the degree of
MSc Marine Conservation
By **Annabel Ridsdale** (10722460)

Some main takeaways from the above research include:

- The Seahorse Trust reported a “massive” increase in seahorse sightings during 2020 when there were no boats using the area, but when the boats returned the seahorse numbers dropped rapidly.
- It is recommended that for Natural England to determine the impacts of noise on protected features (such as seahorses), acoustic data, although a valuable tool, needs to be supplemented by other monitoring measures such as counting the presence of species from spectrograms using automated detectors, or further studies to determine the acoustic characteristics of seahorses.
- Underwater anthropogenic noise was first recognised as a pollutant under the Marine Strategy Framework Directive (MSFD) which aims to monitor noise levels so that EU marine waters achieve “Good Environmental Status” (GES) which is defined as waters that are ecologically diverse and dynamic, clean, healthy, and productive (European Environment Agency, 2008).
- The “soundscape” of a habitat is the acoustic environment and can be split into biotic noise (the biophony), abiotic noise (the geophony which includes wind, rain and waves), and anthropogenic noise (the anthrophony) (Buscaino *et al*., 2016). Underwater anthropogenic noise has been shown to interfere with an ecosystem’s biophony by masking communication between organisms, affecting courtship and reducing mating success (Slabbekoorn *et al*., 2010). There has been lots of research into the effects of anthropogenic noise on marine mammals (Trigg *et al*., 2020; Erbe *et al*., 2019) and other mobile species such as fish (Simpson *et al*., 2016; Lamont *et al*., 2021). However, very few studies have researched the effects on benthic species such as seagrass (Solé *et al*., 2021), despite studies showing that plants react to sound vibrations (Mishra, Ghosh and Bae, 2016). Low-frequency wave sweeps (50-400 Hz) have been found to cause morphological damage such as loss and deformation of starch grains within cells (responsible for energy storage) in seagrass (*Posidonia oceanica)* (Solé *et al*., 2021). This range overlaps with the frequency range of sound that vessels emit when travelling (Erbe *et al*., 2019). Transient motorboat sound (63.4dB to 127.6dB) and continuous sound produced by the motorboat anchored above long-snouted seahorse (*Hippocampus guttulatus*) (up to 137.1 dB) has been found to cause stress responses such as an increased respiratory rate and site abandonment (Palma *et al*., 2019; Magalhães, 2016). As seagrass and seahorses are important protected species..., it is important to monitor noise levels and the impacts on these species to be able to protect them.
- ...increasing research demonstrating the negative impacts of anthropogenic noise on marine life (Trigg *et al*., 2020; Erbe *et al*., 2019; Simpson *et al*., 2016; Lamont *et al*., 2021)...
- The Seahorse Trust’s anecdotal observations of seahorse numbers greatly increasing during the Coronavirus lockdown in 2020 and then declining again when boats returned suggests the sensitivity of these protected seahorses to boat noise, and raises the necessity of understanding the level of biodiversity present to monitor the impact of noise long-term on marine organisms. One recommendation is for future studies to classify all organisms present by using deep learning models to analyse spectrograms and categorise the organisms present in the same way that has been recommended for detecting boats (Applelid and Karlsson, 2019; White et al., 2022).[1]

Extract from pg 136[2]

1**Measuring anthropogenic noise pollution in Studland Bay Marine Conservation Zone**
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MSc Marine Conservation By **Annabel Ridsdale** (10722460) **pages 4 – 7, 26**

2**Sound, stress, and seahorses: The consequences of a noisy environment to animal health. Paul A. Anderson, Ilze K. Berzins, Frank Fogarty, Heather J. Hamlin, Louis J. Guillette Jr.** University of Florida IFAS/SFRC Program in Fisheries and Aquatic Sciences, 7922 NW 71st St, Gainesville, FL 32653, USA The Florida Aquarium Center for Conservation, 701 Channelside Dr., Tampa, FL 33602, USA University of Florida Department of Biology,

4.3. Primary stress indices
Cortisol concentrations peak within minutes of the onset of a stressor (Sumpter, 1997). However, the long-term response to a chronic stressor is characterized by concentrations that resolve to levels slightly higher than baseline (e.g., Barcellos et al., 1999; Sloman et al., 2001; Pottinger et al., 2002; Biswas et al., 2004), or, to baseline levels (e.g., Pickering and Pottinger, 1987; Ruane et al., 2002; Ruane and Komen, 2003). Assessment of the primary stress hormone in response to a chronic stressor is thus limiting, and sometimes, confounding. When extremely high values (suggesting an acute stress response to capture and handling) were removed from our data set, cortisol concentrations of remaining animals were higher in loud tanks, suggesting a chronic stress response.
4.4. Secondary stress indices
Cortisol induces karyorrhexis of lymphocytes (Dougherty, 1960) and increases blood heterophils but inhibits the migration of these cells to injured sites or inflammatory lesions and slows down wound healing (Wendelaar Bonga, 1997). A suite of studies have demonstrated lymphocytopenia and/or heterophilia in response to acute and chronic stress in fish (e.g., McLeay, 1973; McLeay and Brown, 1974; Ellsaesser and Clem, 1986; Barcellos et al., 2004; Svobodová et al., 2006). This pattern of change in the leukocyte differential has led scientists to invoke the H:L ratio as a measure of stress in animals (Gross and Siegel, 1983), and have associated this measure with increased plasma cortisol/corticosterone concentrations (Gross and Siegel, 1983; Hansen and Damgaard, 1993; Fisher et al., 1997), increased susceptibility to infectious disease (Al-Murrani et al., 2002; Huff et al., 2005), increased occurrence or duration of distress behaviors (Hansen and Damgaard, 1993; Campo et al., 2005, 2007; Case et al., 2005), reduced weight, and mortality (Huff et al., 2005; Duffy et al., 2006). Our study demonstrated significant and variable heterophilia among animals in loud tanks, leading to significantly higher and more variable H:L ratios. This study is the first to employ the H:L ratio as a measure of chronic stress in fishes.
4.5. Tertiary stress indices
4.5.1. Physiology
Seahorses in loud tanks declined in two of the arguably most important measures of success in (food) fish culture: weight and condition factor. Cortisol is known to depress growth rates both directly and through reduced food intake (e.g., Gregory and Wood, 1999). Crowding, confinement, tank color, and toxin ingestion are other stressors that have elicited reduced growth rates among exposed fishes (Pickering and Pottinger, 1987; Lumlertdacha et al., 1995; Procarione et al., 1999; Pottinger et al., 2002; Cotter et al., 2005).

It is important to reiterate the protected status of Seahorses in the UK. Irrespective of population density they are legally protected by virtue of the Wildlife and Countryside Act (WCA)(as amended 1981) Schedule 5, section 9.

Offences include:
- intentional killing, injuring, taking
- possession or control (live or dead animal, part or derivative)
- damage to, destruction of, obstruction of access to any structure or place used by a scheduled animal for shelter or protection
- disturbance of animal occupying such a structure or place

In summary, Seahorses are protected by the WCA from bodily disturbance, and via habitat damage, destruction, obstruction. The effects noise has on Seahorses is a researched topic as outlined above. The conclusions made are that anthropogenic noise can lead to negative effects such as habitat desertion (where is an alternate habitat if piling affects the whole of the Sussex Bay) and disruption to behaviours that increase mortality, if not directly. Other risk factors perhaps less highlighted are that of sedimentation during construction and decommissioning.

Sincerely,

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