Welfare implications of the commercial use of seahorses Hippocampus sp.

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Introduction

The seahorse is a unique and intriguing fish in many respects and worldwide interest in its commercial uses -traditional medicine, the curio trade, and as an aquaria species - is increasing. At least 51 nations and territories around the world are involved in the seahorse trade (Job et al, 2002). Presently most seahorses destined for these markets are wild-harvested from source countries such as the Philippines and Thailand. However, intensive culturing of seahorses is developing as an industry. In both situations, welfare implications go largely unconsidered. Studies on other fin fish species have suggested that wild-caught fish, when introduced into intensive aquaculture or aquarium systems, never completely acclimatise to captive conditions, with stress responses being more severe than in captive-bred stock (Grutter and Pankhurst, 2000).

Discussion

Studies of wild seahorse behaviour suggest unique social and spatial organisations. Behaviour is characterised by monogamous pairing and fidelity to narrow home ranges amongst all species studied (Carcupino et al, 2002) and elaborate daily greetings, courtship rituals and reproductive interactions between bonded pairs (Vincent, 1995; Vincent and Sadler, 1995). Considering the fact that there are little consistent published data for the appropriate cultivation of seahorses in captivity, the following questions are raised: what are the welfare implications of harvesting wild seahorses; and is intensive aquaculture an appropriate alternative?

Perante et al (2002) studied the biology of Indo-Pacific seahorses Hippocampus comes in a wild population in the central Philippines. Their experiment aimed to study seahorse habitat choice and movement as well as observing the social structure of the colony and interactions among individuals. The colony was viewed for 16 months, 55 times at varying tide levels and times of day. Each individual within the colony was tagged, identified, located on a grid, and its holdfast (any object to which a seahorse "hitches" itself with its prehensile tail), reproductive state and associations with other seahorses were recorded. Pair bonds were determined through proximity (putative partners were distinctly closer to each other and often coiled together) and reproductive status (always complementary between breeding partners). Seahorses are easy to study in the field in this manner due to their narrow home ranges, limited swimming speed, tendencies to return daily to specific holdfasts, and low densities in the wild. The number of seahorses observed on the site neither increased nor decreased during the course of the study and sex ratios were equal.

It was found that a seahorse would only change its holdfast and home range in the event of loss of its partner or destruction of the holdfast. Seahorses remained faithful to their mate, never divorcing and only seeking another partner in the event of death or disappearance of their mate. When leaving their holdfasts, seahorses were subjected to increased risk of predation and exposure to wave and current effects, a topic to be considered when selective wild harvesting of seahorses breaks pair bonds by removal of one partner. Previous studies suggest that in monogamous pair-bonded seahorses, sexual isolation from mates can have significant effects on metabolic rates of individuals (Masonjones, 2001). Perante et al also reported that seahorses eschewed individuals other than their exclusive mate, even when in close proximity. This observation is consistent with previous studies of wild seahorse populations (Kvarnemo et al, 2000; Vincent and Sadler, 1995) and is not a behavioural characteristic compatible with high density stocking in intensive aquaculture.

Seahorse behaviour in intensive aquaculture is often characterised by aggressive interactions such as males competing for eggs by snapping and tail wrestling (Vincent, 1994), perhaps as

a result of the restriction on behavioural monogamy being expressed due to intensive situations. Aggressive behaviour is evidence of the welfare implications of placing an animal found in such low densities in the wild (Perante et al, 2002) into intensive situations characterised by high stocking densities.

Woods (2003) studied the effects of gender segregation and varying stocking densities on H. abdominalis under intensive conditions. Captive-bred fry (ponies) were placed into replicated treatments of one, two and five seahorses per litre. Woods (2003) then recorded, on five separate days randomly over a number of weeks, the number of juveniles per treatment being grasped by a conspecific. The amount of physical interference (strenuous tail grasping and wrestling) increased significantly with higher stocking density (5/L). Woods attributed significantly lower survival rates of juveniles within this treatment to this significantly higher level of physical interference between individuals.

Woods (2003) also investigated effects of gender segregation, placing sexually mature seahorses into three treatments of male only, female only, and male with female. Males and females together engaged in typical courtship and reproductive rituals. Interaction between same-sex individuals within the two other treatments was also observed, although with a reduced occurrence and without full expression of typical behaviour. This is interesting considering wild seahorses associate only with their exclusive mate, which suggests the importance of engagement in such daily activities - morning greetings and the "courtship dance" (Vincent, 1995; Vincent and Sadler, 1995) - for the welfare of seahorses. It also indicates that the impacts of behavioural restriction in intensive situations are not fully understood.

There are few published scientific studies that detail consistent basic husbandry methods for seahorse farming and emphasise the importance of achieving optimal seahorse health and welfare (Wong and Benzie, 2003). In aquaculture, consideration of such factors as salinity, temperature, dissolved oxygen and gas levels, water contaminants, and loss of nutrients from feed sources before consumption by fish, all have ramifications on animals' welfare (Castell, 2000). Nutritional requirements of seahorses (at a scientific level) are unknown and Artemia, not a natural prey item for seahorses, are the most widely-used feed in the seahorse farming industry. Job et al (2002) found significant differences in survival rates between three treatments of captive-bred Hippocampus kuda when fed Artemia enriched with three different enrichment products - blended whole fish (treatment 1), blended planktonic crustacea (treatment 2) and a mixture of both (treatment 3). Survival to market size was almost twice as high in seahorses from both treatments fed Artemia enriched with crustacea compared to a solely fish-based diet. Growth rate, however, was found to be the same for all treatments. The importance of many nutrient components of the seahorse diet is not yet understood (Payne and Rippingale, 2000). This suggests the importance of further research and developments in bettering the basic aspects of welfare (suitable environmental conditions and adequate nutrition) for cultivated seahorses.

Conclusion

Continuing high demand for seahorses in traditional medicine and aquarium trade makes it probable that seahorse aquaculture will develop into a viable commercial enterprise (Job et al, 2003). Further research is required to fully explore acceptable husbandry and cultivation techniques in terms of both welfare and economic feasibility. Considering the unique behavioural characteristics of wild seahorse species, alternative methods of sustainable seahorse harvesting may need to be considered, for example, intensive management of selected wild populations and use of sea cages. There is also the consideration that in many source countries where wild-seahorse trade is an important economical enterprise, finance and resources required for the extensive cultivation of captive seahorses are not available. Further research on commercial utilisation of seahorses must be conducive to the improvement of welfare of these remarkable animals.

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