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Brief Communication

Prospects and challenges in monitoring the seahorse population of South Carolina, USA

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Abstract

Seahorses are bony fish considered endangered as a result of bycatch of the fishing industry and being used as a component of chinese medicine. The seahorse' monogamous and stationary behavior, combined with a threatened habitat, render them more susceptible to a decline in population. In the ocean waters off the state of South Carolina, the lined seahorse (*Hippocampus erectus*) presence was documented by Perry in 1810. This brief communication presents a current evaluation of wild seahorse populations off the coast of South Carolina. It suggests a multi-pronged and potential collaborative strategy to study seahorse distribution and the prospect for monitoring and conservation of seahorses in their native South Carolina environment. [JMATE. 2013;6(2):6-11]

Keywords: Seahorses, Conservation, Monitoring, Habitats

Introduction

Seahorses are bony fish which have been exploited for aquariums and used in Chinese medicine. Since 2004, all seahorses are regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known as the 'Washington Convention'. The lined seahorse (*Hippocampus erectus*) (Figure 1) is the most common of the *Hippocampus* (*H.*) found in the western north Atlantic whereas the longsnout seahorse (*H. reidi*) is scarce (3, 4, 8, 11). The body armor of seahorses is composed of plates that overlay to allow ventral bending. The armor is flexible and fracture resistant due to the complex plate and segments designed to slide and slip when compressed (21). Regardless their resilient bony structure, seahorses do not survive when taken as a bycatch in deep-water trawling operations. Intense harvesting of seahorses causes a decrease in their population numbers as seen in the Gulf of Mexico (2). The lined seahorse is listed in the Red List of Threatened Species and implications for conservation and management of this species has been addressed internationally and in the USA (3, 6, 7, 16).

In a marine environment, depending on their species, seahorses feed on amphipods, copepods, shrimp, and larval fish (25, 26). When juvenile seahorses leave the male's pouch they are very similar to the adult seahorse, but smaller in size. Immediately after birth, seahorses are able to feed on live prey. However when they are abandoned by their parents they are targeted by other fish species, resulting in high mortality rates (3).

Figure 1: Lined seahorse (*Hippocampus erectus*). Reproduced with permission.

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Evaluation of the seahorse digestive system at birth shows a simple apparatus with a buccopharynx oesophagus, an intestine composed of a midgut with intestinal villi and a hindgut preceded by an intestinal valve (20). Despite the simplicity of their digestive tract, complications do arise when the animals are held in captivity. The aquaculture of the seahorse has been fully evaluated and studied (14). Captivity and commercial aquaculture are considered to be solutions to the depletory effect of wild collection. One study showed that the lined seahorse has a higher resilience and can adjust to an aquaculture environment (17).

Captive breeding of native juvenile seahorses for reintroduction in the wild (called *ex-situ* conservation) is an option, however it can be a challenging and an erratic strategy. Seahorse reproduction decreases in captivity (5). Additionally acoustic disturbances must be considered during captive seahorse rearing. Stress caused by acoustic anomalies may compromise seahorse disease resistance and growth (1). The introduction of captive debilitated populations, immune-depressed or disease carriers and with a dissimilar genetic make-up can cause health issues to the native species of the reintroduction site. Even with imperfect seahorse husbandry, it is important to consider breeding as one component of the mosaic for the survival of wild seahorse populations and their management. Other management options have been proposed, including the reduction of the number of fishers, gear restrictions, caging pregnant male seahorses and sex-selective fishing leaving pregnant males in their aquatic environment (3, 28). The reduction of fishers is debatable with preservation being more feasible. Identification and conservation of a natural marine site where wild populations have been consistently detected and monitored is one solution.

Due to the significant availability of inshore seahorse populations, only Florida has an extensive fisheries-depended monitoring program related to this species. In South Carolina there are programs to monitor fish populations which are considered important in recreational and commercial fisheries (3). However, no record of a community level fisheries independent monitoring program for wild populations and harvest rates for seahorses currently exists.

Materials and Methods

In this study the author used available peer-reviewed and scientific literature from online databases and search engines including Pubmed (ncbi.nlm.nih.gov/pubmed), Wiley Online Library (onlinelibrary.wiley.com) and Science Direct (sciencedirect.com). Sources were complemented with informal interviews with staff of South Carolina Aquarium, South Carolina Department of Natural Resources (SCDNR) of Researchers, South Atlantic Fishery Management Council (safmc.net) conservationists and scientists involved in fishery management (see acknowledgments). Preliminary information on seahorses population of South Carolina and fishery data available was obtained from the Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) data or SEAMAP trawl survey data from SCDNR. National Oceanic Atmospheric Administration (marineprotectedareas.noaa.gov) and U.S. Fish and Wildlife Service (fws.gov), websites were accessed for a list of marine protected areas (Figure 2).

Figure 2: This map depicts reported areas where seahorse presence has been detected during the years 2011-2012.

Challenges of conservation and monitoring seahorses populations

Population monitoring is an important element to establish current seahorse population data and the first step to formulate any plan to conserve their numbers in their native South Carolina habitat.

Aquariums serve as an important function of educating the public in the conservation of seahorses and in particularly the lined seahorse populations. For example, the South Carolina Aquarium in Charleston is active and involved in promoting conservation of many different local species. However, at the time of this publication, there have been no specific projects undertaken that involve a wider variety of individuals and organizations to monitor and preserve South Carolina seahorse populations in their native marine habitat. Collaborations between individuals and organizations involved in marine conservation would be a feasible tool to monitor seahorse populations.

The Mediterranean Hippocampus Mission is an example of the use of recreational survey of the seahorse's distribution by guided volunteers in marine conservation monitoring (9). In this study, researchers recruited recreational scuba divers that they trained to report sightings of two Mediterranean species: short snouted seahorse (*Hippocampus hippocampus*) and common seahorse (*Hippocampus ramulosus*). A questionnaire was created and distributed to scuba diving schools and centers. The recreational scuba divers documented sightings of each species they observed and photographed them. Through the information obtained from the scuba diving volunteers, researchers established overlapping geographic distributions of the two species, and their numbers in the northern Adriatic Sea as well as their presence in the central-southern Tyrrhenian Sea (9). By using trained volunteers who provided large pools of current data, important information was obtained about the two native species over a short period of time and at a low cost. As the Mediterranean study showed, an association with the amateur natural resource users can be a great asset for scientific monitoring of biodiversity along coastal waters. For example in South Carolina, the Association of Recreational Scuba Divers as well as marine researchers could serve in this capacity. Indeed, when a local scuba diving school was contacted, their staff were eager to assist in a research project to monitor seahorse populations.

The use of underwater flash photography might raise some concerns of population disturbance by human activity that could induce stress in the seahorses population. However studies on the effect of flash photography on the White's seahorse (*Hippocampus whitei*), an Australian species, have shown no significant changes in behavioral response, movement and site persistence of seahorses exposed to flash photography. However, handling did have some consequences on short-term behavioral responses (10). Therefore, photography can be an acceptable and a safe tool for identification of seahorses provided recreational scuba divers reduce the impact of their presence by refraining from handling the individual seahorses (10, 15).

Aside from the participation of recreational scuba divers, active involvement should be sought from voluntary participation of professional fishermen in educational conservation projects and programs. Successful use of fishermen's knowledge and collaboration in research has been demonstrated in foreign countries (18, 19, 22). Educational programs and activities to raise conservation awareness helps fishermen understand the interdependence of the biology of their catch and possibly lead to the promotion of seahorse sustainability in South Carolina.

It is important to widely educate everyone on the minimum 10 cm size limit for South Carolina lined seahorse harvesting, established since May 2004 (3). Furthermore, it should be emphasized that wild seahorses form faithful pair bonds and removal of one of the pair will dramatically affect reproduction. In addition, due to a number of other factors including seahorse low numbers, the local muddy waters, and the seahorse stationary behavior, the impact of any disruption to the pair bond is even more magnified (3, 27). It is not known if local Charleston County fishermen are willing to enter into a dialogue with researchers to collaborate in monitoring seahorse populations or if they are willing to accept the establishment of a natural sanctuary. An informal interview with a few local fishermen resulted in negative response, but it is possible that given the numbers of recreational fisherman, others would be willing to collaborate with scientists.

To accurately determine the numbers of native seahorse populations, researchers must establish the

number of unintentional seahorse catches within the state of South Carolina. Scientists involved in other species monitoring programs, when they accidentally encounter seahorses, should report the findings to a specific database. The establishment of abundance and seasonal distribution is important for monitoring program related to any fish species (13).

Prospects and solutions for the conservation of seahorse populations

Seahorses and other marine species are facing many challenges in South Carolina waters: pesticide runoff into waters, pollution contaminants from vessels, urban development, fishing, loss of habitat and habitat modification. Among population preservation strategies, creating a natural sanctuary would be preferable to the use of artificial environments for seahorse refuge, as artificial structures can interfere with the biological cycle of some marine species. In some cases artificial habitats encourage and sustain survival of a larger quantity of amphipods and copepods upon which seahorses feed (12).

Creating sea life awareness within the public and commercial fisheries as a means to protect marine natural resources is also significant as noted in studies undertaken in foreign countries (3, 19, 22). Reinforcing a positive relation between society and the sea can result in a strong public interest in species such as seahorses. Finally, recognizing the importance of seahorses as a flagship group, will help in the evaluation and conservation planning of certain marine habitats and their biodiversity (24).

Shrimp trawler fishery has been suggested as another reason of the decline in seahorse populations (2, 3). Studies on experimental closure of South Carolina's sounds and bays to commercial trawling in addition to the creation of Marine Protected Areas have shown to be beneficial to other fish species (29, 30). However the United States shrimp industry is facing hardship because of the competition from foreign markets and aquaculture, which have driven lower cost foreign shrimp sales (31). Therefore it is understandable when researchers face reluctant fishermen involved in commercial trawling.

Because crabs feed on young seahorses (3), sometime these species can be caught together. Physically tending crab traps may negatively impact seahorses in some areas by disturbance or incidental capture. Therefore crab fishermen should also be included as an outreach group for conservation tactics. The importance of conservation is increasingly accepted by the public. This combined with the fishermen's natural commitment to the preservation of the very natural resources they depend upon, could provide a deeper understanding and provide incentive for the consumer to promote local marine catch.

South Carolina coastal waters and estuaries have natural marine characteristics which offer a variety of ideal habitats for seahorses. This species has the ability to adjust to different ranges of salinity levels and varying temperatures (3, 11, 23). A promising solution could be the establishment of a natural sanctuary where native population of seahorses has been detected and no trawling fishing activities are allowed. As an alternative, the creation of a Tenurial system which is a local ownership of marine resources should be considered (3). There are different areas off the coast of South Carolina which are possible suitable candidates for a sanctuary. In the year 2011 trawling data available from the Southeast Area Monitoring and Assessment Program (SEAMAP) showed the presence of seahorses in specific areas represented by a single catch in the inner zone area of Myrtle Beach, Crescent Beach, Cherry Point, Waties Island, Debidue Island, Magnolia Beach, Surfside Beach, Sandy Point, Cape Romain, Murphy, North and South Islands (Figure 2). However for the same year there is no record of seahorse catch off the coast of Edisto, Kiawah Island, Folly Beach, Sullivans Island, Isle of Palms, Dewees, Capers, Bulls Island. For the year 2012, through verbal communication, SCDNR staff reported seahorses found in Calibogue Sound, between Hilton Head and Daufuskie Islands in Beaufort County. Clearly a more thorough analysis of available data would be helpful. For example, historical SEAMAP data could be used to examine population trends and important habitat along the South Carolina coast.

The correlation between the presence of seahorse population and coastal preservation status should be evaluated to provide useful information for conservation tactics. Rapid environmental changes can make it difficult to identify and promote a specific area for a sanctuary. However an established marine protected area

such as Cape Romain is a potentially good prospect as a seahorse natural reserve. With the establishment of a seahorse reserve, local media should emphasize the importance of the maintenance of wild seahorse population in the sanctuary's habitat and the compliance of the minimum size limit as well as the negative impact of harvesting male seahorses carrying progenies (3).

To conclude, a list of South Carolina marine areas which are closed to commercial trawling is available in the summary of regulation for commercial shrimp trawling obtained from the Marine Resources Division of South Carolina Department of Natural resources. These areas are represented by Winyan Bay, Isle of Palms, Folly Beach, St. Helena Sound, Trenchards Inlet and Hilton Head. If lined seahorses are detected in the coastal waters of these zones, conservationists should consider them as possible candidates for seahorse sanctuaries and submit a proposal to the National System of Marine Protected Area for these new marine zones to become preserves, in addition to Cape Romain.

Conclusion

This brief communication is an update on the prospects and challenges in the monitoring and conservation of the wild seahorse populations of South Carolina. It emphasizes the importance of collaborations between organizations and individuals to promote conservation and underline the importance of further studies on the distribution and abundance of lined seahorses. Finally, it suggests the creation of a sanctuary to preserve one of the most fascinating fish species living in South Carolina coastal waters.

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