Project Update: April 2019

Abstract
Seahorses have vulnerable life history characteristics including limited dispersal capabilities, fragmented distributions and live bearing among males. Majority of seahorses co-occur in estuaries and coastal habitats where habitat loss through pollution and human development is frequently reported. Despite these threats, seahorses along the Kenyan coast have continued to be harvested and traded for various uses including the Chinese traditional medicine. Thus, the continued exploitations, coupled with threats emanating from their vulnerable life histories, loss of suitable habitats and increased negative effects of climate through increasing water temperatures and flooding threatens their survival in the country. Due to paucity of data there are no conservation strategies for seahorses established in the country. A single questionnaire survey that was conducted more than a decade ago proposed the presence of four species of seahorses. Since then, however, there has been no subsequent surveys to reinvestigate species richness and distributions, information which could help-guide establishment of conservation strategies for the species. The aims were to determine the number of seahorse species and their spatial distribution patterns, at selected sites along the Kenyan coast, using a combination of retrospective analyses of historical data, questionnaires surveys, ecological surveys, citizen science involvement, and genetics. From the research activities conducted by the project, a total of three species: The Great seahorse, *Hippocampus kelloggi* (n = 31), Thorny seahorse, *Hippocampus histrix* (n = 24), and Sea pony seahorse, *H. fuscus* (n = 1) have been recorded. Two whole specimens per species were collected and well stored on 100% for long-term archiving. Also, tissue samples for genetic analyses were collected (i.e. *H. kelloggi*: n = 5; *H. histrix*: n = 4) and stored on 100% ethanol. Data analyses is still ongoing.

1. INTRODUCTION

Seahorses have vulnerable life histories including male pregnancy, small home ranges, low fecundity and low mobility between habitats. These life history characteristics makes them highly susceptible to extinction threats through anthropogenic activities and climate change. More than a decade ago, a total of four species of seahorses were previously proposed to co-occur along the Kenyan coast (McPherson and Vincent 2004). The species included the vulnerable Thorny seahorse, *Hippocampus histrix* Kaup, 1856 (Wiswedel 2012), the vulnerable Great seahorse, *H. kelloggi* Jordan & Snyder, 1901 (Wiswedel 2012), the data deficient Giraffe seahorse, *H. camelopardalis* Bianconi, 1854 (Project Seahorse. 2003) and the Sea pony, *H. fuscus* Rüppell, 1838 (currently not in IUCN Red List).

Despite the vulnerable life histories, seahorses have been subject of extensive exploitation along the Kenyan coast for various uses, including the Chinese traditional medicine. And as recent as February 2019, several dried seahorses and sea cucumbers were found being traded at the Standard Gauge Railway (SGR) terminal in Mombasa (Mkare per. obser). However, because of limited data on the species including species richness and their spatial distributions establishing conservation strategies to safeguard long-term availability of the species in the country has been a challenge.

Aims
To determine the number of seahorse species and their spatial distribution patterns, at selected sites along the Kenyan coast, using a combination of retrospective analyses, questionnaires, field surveys and citizen science.

The specific objectives of the project are;
1) To determine the number of species of seahorses occurring in the Kenyan waters;
2) To determine present and future spatial distribution patterns of the seahorse species using species distribution models (SDMs) and;
3) To identify and map out potential biodiversity "hotspots" for protection especially when they occur outside existing Marine Protected Areas (MPAs).

2. MATERIALS AND METHODS

a) Application and acquisition of sampling permit and animal ethics
Prior to commencement of the project, the project acquired a sampling permit (which also serves as animal ethics approval) in June 2018 from the Kenya Wildlife Service (KWS).

b) Examination of historical records
The project inspected long-term fisheries catch data archived at Kenya Marine and Fisheries Research Institute (KMFRI), and also from the State Department of Fisheries and Blue Economy. An inquiry of archived seahorses at the National Museums of Kenya was made in 2018, with an actual visit made in 2019. Searches were also made through the internet for any unpublished seahorse records for Kenya.

c) Questionnaire surveys
A total of 120 semi-structured questionnaires were prepared and administered among fishermen, fisheries observers, aquarium divers, and government and community-based conservation officials.

Plate 1: Seahorse ecological survey team. The team includes divers from Kenya Wild life Service (KWS) game rangers, community-conservation officials and KMFRI.

d) Ecological surveys

Ecological surveys were conducted at three sites including Watamu Marine National Park and Reserve, Mombasa Marine National Park and Reserve, and Kuruwitu in Kikambala. Unlike Watamu and Mombasa which are governmental protected areas, Kuruwitu on the other hand is a community protected area. Wardens who were employees of Kenya Wildlife Service (KWS) and also being trained open water divers were invited to participate. At each of three areas, two larger quadrats measuring 30 m x 20 m were established, one in the no take zone and the other inside a reserve where fishing is permitted. GPS positions were collected at each corner of the larger quadrats. Additionally, metal rods were erected at each corner. Line transects measuring 2 m wide were established and marked using ropes. A total of five line transects per quadrat were surveyed. Four (4) days were set aside for each site. The distance sampling approach where an observer swims along a straight line (1 m from either side of the transect) and observes seahorses right straight ahead or from either side at right angles was used. During surveys, water temperatures and visibility was recorded using dive computer and Secchi disk. The Watamu and Mombasa surveys sites were accessed using boats while Kuruwitu accessed by foot. Also, along each transect line, habitat characteristics were investigated by using a 1 m^2 quadrat that was placed at the beginning, middle and at the end of each line transect.

e) Citizen science

A total of 15 citizen scientists with members drawn from the various stakeholder groups (e.g. government and community-based conservation officials, fishermen, fisheries observers, divers, researchers and students who frequently participate in ecological surveys at sea involving SCUBA diving and snorkelling) were formally trained and commissioned as citizen scientists for the project. Most importantly, some of the people invited for the citizen training included those that had already been trained on seahorse identifications while at the respective working areas. This training was however, done this year (2019).

Plate 2: Seahorse-based citizen training meeting

f) DNA analyses
Presently, the project has a total of four (4) tissue samples of *Hippocampus histrix* and five (5) samples for *H. kelloggi* which are being analysed. High quality DNA has been extracted and well stored at -20 °C prior to PCR amplifications.

3. PRELIMINARY RESULTS

Seahorse records

A total of three species have been recorded by the project mainly through its citizen scientists. There are 24 georeferenced records of *Hippocampus histrix* (photos available: Plate 3), 31 georeferenced records (including photos) of *Hippocampus kelloggi* (photos available), and a single georeferenced record of *H. fuscus* (photo available). Archived specimens of *H. histrix* and *H. kelloggi* were also available at the National Museums of Kenya (photos and GPS positions available). However, the specimen of *H. kelloggi* at the National Museums of Kenya had erroneously been identified and labelled as *Hippocampus capensis*.

Plate 3. Photo of *Hippocampus histrix* captured and supplied by one of the citizen scientists (source: Mgeni Wamwachai)

Tissues samples for DNA analyses were collected for *Hippocampus histrix* (n = 4), and *H. kelloggi* (n = 5). We also have two whole specimens for each species that are stored on 100% ethanol for long-term storage, and these will serve as reference specimens. Apart from these tissue samples, there are also several individuals of *H. kelloggi* (i.e. 30 individuals) which are stored at -80 °C at KMFRI. These latter specimens were collected for storage because they were already dead when they were spotted by our citizen fisheries observers aboard prawn trawlers and there was thus no need to throw them back into the waters.

4. CONCLUSIONS

Seahorse observation records for the project were obtained through citizen scientists, museum visits and internet records. Of the 56 seahorse records being reported by the project, 47 records were made through citizen science (i.e. *H. histrix*: n= 16; *H. kelloggi*: n = 30; *H. fuscus*: n = 1). The citizen science team has increased from 15 to 25 and has an active Whatsapp group where constructive discussions about seahorse conservation are made.

Both tissue samples for two species (n= 9) and whole specimens were collected for analyses and long-term archival. High quality genomic DNA has been obtained from the samples and PCR amplification and sequencing ongoing.

One intriguing observation is that seahorses are now increasingly observed by some of my citizen scientists in the south cost of Kenya, especially in Shimoni where 12 records of *Hippocampus* and the only record for *H. fuscus* have been made.

Data analyses is ongoing for all three types of data sets (i.e. questionnaire survey data, georeferenced observations data, and genetics data).

Species distribution modelling is done using Maximum Entropy software, MaEnt (Phillips et al. 2006) and QGIS software. Environmental variables such as sea surface temperature (SST), surface air temperature (SAT), salinity, and chlorophyll-a were downloaded from Bio-ORACLE.

Also, all seahorse photos of the project will be submitted to the iSeahorse portal towards the end of the project.

5. WAYFORWARD

- The National Museums of Kenya currently do not have adequate samples of seahorses especially *Hippocampus kelloggi*. Therefore, two specimens of the project will be submitted in the near future.
- Data collection through citizen science is an ongoing activity and is expected to continue into the future. However, to make it even more effective, additional trainings will be required so as to increase the number and spatial coverage across the Kenyan coast.
- Although all research activities proposed by the project have so far been made, data analyses has to be completed so that useful information with conservation implication can be generated. When the information is finally out, stakeholder meetings will be convened so as to begin the process of establishing seahorse-based conservation/management plan
- The next project will have to include south coast areas of Kenya such as Shimoni where several observations have been made at unprotected areas. With adequate funding, the future project could utilise citizen science and, environmental eDNA as some of its data collection tools.

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