Marine Conservation Cambodia
Seahorse Population Assessment: June-July 2011

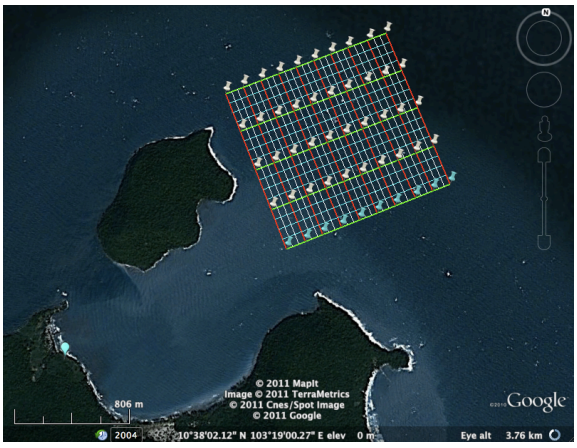
Overview:

During June and July of 2011 a population assessment of seahorses was completed within a specified area of interest to conservation in the waters off Koh Rong Samloem Island, Cambodia. Population assessments provide a useful tool for measuring the current condition of a population by allowing for accurate estimates of abundance and structure of organisms within a studied area. Each assessment functions as a "snapshot" of the population for the sampled period of time. When used in conjunction with later population assessments of the same area, these studies allow for the observation of trends occurring within the studied population. This assessment will therefore allow the seahorse population of the Corral site to be tracked and the effects of disturbance, such as destruction from trawling boats, to be monitored over time. Other trends, such as shifts in the dynamics of species composition and age structure can also be observed over time.

Study Area:

Koh Rong Samloem Island is located 2 hours West of Sihanoukeville, a port city on Cambodia's southern coast. The island's coastline is largely shallow, composed mainly of sand flats, seagrass beds and coral reef habitats. Previous studies have identified 5 geographically separated coastal areas as seahorse habitat, and designated one particular area, the Corral site, as a location for targeted seahorse research, due to its large breeding populations and close proximity to MCC facilities.

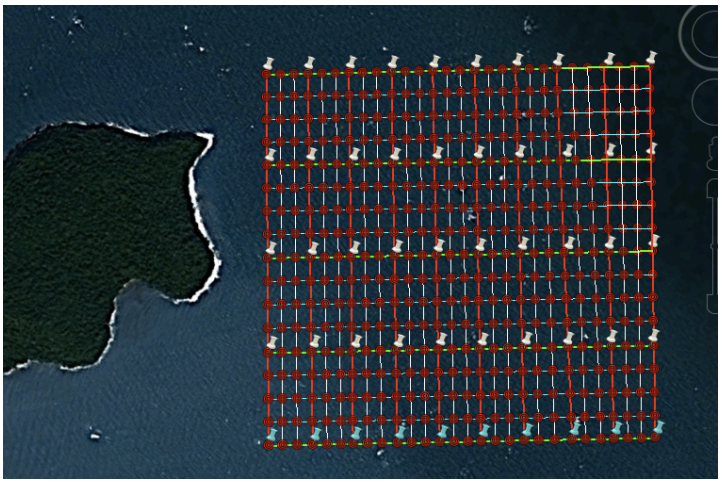
The Corral site is located to the west of Koh Koun, a small island located off the northern coast of Koh Rong Somloem. The area is dominated by sand flats, which slope gradually from the east coast of Koh Koun, with depths ranging between 5-20m. The area supports populations of bivalves, soft corals, hydrozoans and large numbers of pencil urchins (*Prionacidaris spp*), which provide valuable holdfasts for seahorses.



Species diversity of the area has been observed to be unusually high, with 6 species identified from photographic evidence taken at the Corral site (*Hippocampus spinosissimus, Hippocampus trimaculatus, Hippocampus kuda, Hippocampus comes, Hippocampus kelloggi, Hippocampus barbouri*). *Hippocampus spiniossismus* and *H. trimaculatus* have been most commonly found in the area, with *H. spinosissimus* heavily dominating the population.

This habitat was observed to be in excellent condition in 2007, but damage from trawling activity has greatly impacted the habitat since, reducing biodiversity and productivity of the local ecosystem. Field observations from 2007 suggest that seahorse species diversity was previously higher, and has decreased over time to strongly favor *H. spinosissimus*. Protection of the habitat has been established in the form of a 300m no take zone extending from Koh Koun island. Protection measures are often ignored or circumvented, however, and frequent monitoring is necessary to prevent trawling activity in the area. Regularly conducted population assessments provide the consistent data necessary to measure the recovery of this area, and to make comparisons to its previously observed productivity of the ecosystem.

Methods:



The population assessment was conducted through 35 underwater visual transects that were randomly located within the 1.8km^2 Corral study area. The starting point of each 500m^2 transect was randomized by a random number generator, which selected numbers that corresponded to specific GPS coordinates within the study area. The direction of transects was also randomized, with a random number generator assigning a value that corresponded to one of eight possible directions (N, NE, E, SE, S, SW, W, NW). Transects were created by laying two 50m lines parallel, spaced 10m apart, projecting from the starting point in the randomly assigned direction. Two divers swim from the origin side by side between the two lines, each surveying the 2.5m area adjacent to the nearest tape. At the far end of the tapes, the divers would turn and survey the 2.5m area to the outside of each of the tapes. The total surveyed area for each transect was 500m^2. Seahorse species, demographic class, trunk and snout length,

and associated habitat were recorded for each seahorse within the transect area. Juveniles were defined as any seahorse with a trunk length under 2cm, and were not identified to the species level due to difficulties in differentiating small individuals without fully developed sexual and species characteristics. Counts of pencil urchins, soft corals, anemones, seagrass, hydrozoans, sea pens and manmade structures were also recorded. Estimates of substrate cover were determined by swimming a $1m^2$ circle with the center at the starting point, and estimating percentage of substrate area covered by benthic organisms.

Results:

A total of 62 seahorses were observed over 35 sampled sites, with a combined area totaling $17{,}500m^2$. Three species were identified within the study area, *Hippocampus spinosissimus*, *Hippocampus kuda*, and *Hippocampus trimaculatus*, with the population heavily dominated by *H. spinosissimus*. The observed population structure was balanced between males and females, and dominated overall by juveniles, which were not differentiated by species. An extrapolation of the seahorse population observed in this study can be used to estimate the Corral area population at about 6,500 seahorses from at least three species. The majority of the individuals counted in this estimate would be juveniles with low survivorship, and as such this estimate is not representative of the viable population size.

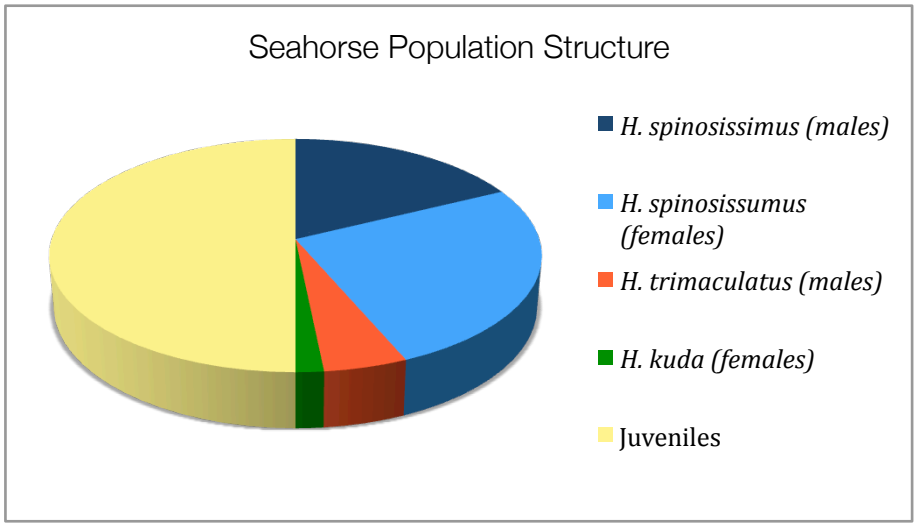


Figure 1. Seahorse population structure for the Corral study area, including *H. spinosissimus*, *H. kuda* and *H. trimaculatus*. Juveniles are undifferentiated by species.

The observed population structure was dominated by juveniles, which comprised roughly half of the total observed population. This result was expected, as seahorse reproduction occurs through localized dispersal of many well-developed offspring with low-survivorship. This structuring may be representative of seasonal trends in reproduction, as previous studies have found spawning to be associated with high water temperatures, such that the reproductive highest rates occur at the end of the dry season in April and May. Future population

assessments during different seasons are needed to determine if the observed juvenile-dominated population structure is indicative of a seasonal peak in reproduction.

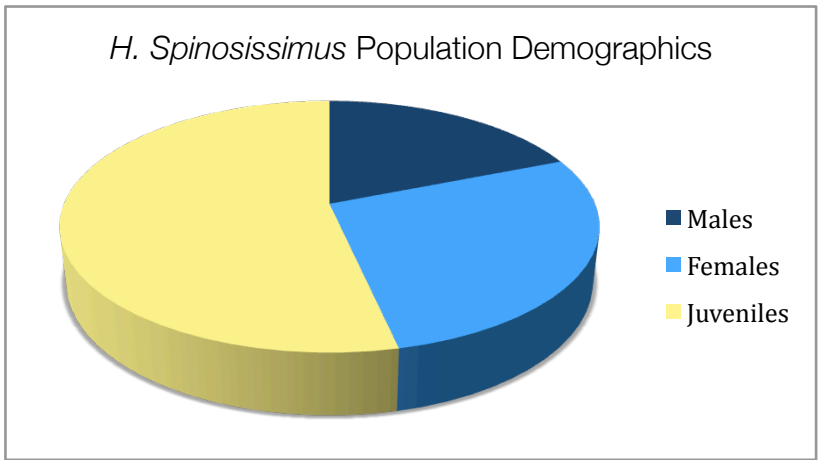


Figure 2. Population demographics for *Hippocampus spinosissimus* in the Corral study area.

Population structure for *Hippocampus spinosissimus* is largely similar to the overall population structure for seahorses in the Corral area, as the *H. spinosissimus* is highly abundant in the area. Juveniles were not differentiated by species in the study, and appear more highly represented in Figure 2 though their abundance remains unchanged from Figure 1.

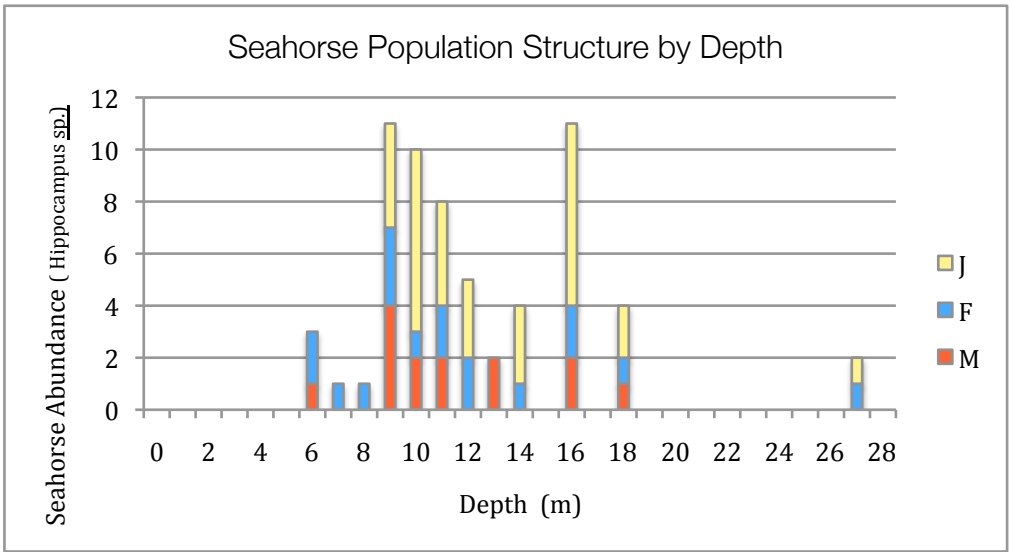


Figure 3. Seahorse population structure by depth for all seahorse species within the Corral study area.

No clear relationship between depth and seahorse demography was observed. Most seahorses were found between 6 and 18 meters, though the presence of juveniles and females at 27 meters suggests that seahorses are distributed throughout the Corral study area at varying depths. As the majority of sampled sites were between 6 and 27 meters, the greater abundance of seahorses at these levels may be a reflection of the greater sampling intensity at these depths.

Class	P-Value
Males	9.52378E-05
Females	9.74307E-05
Juveniles	0.000107587

Table 1. Analysis of urchin densities related to seahorse density, separated by demographic class. P-Values were determined by a paired t-test.

A strong association was found between the densities of pencil urchins (*Prionacidaris spp)* and seahorses, for all demographic classes. The results of the paired t-test were highly significant, suggesting that *Prionacidaris spp* may be a key indicator of seahorse population viability within the region. Seahorses were only recorded at sites where pencil urchins were present, however, several sites were observed to have large populations of pencil urchins where seahorses were absent. This association is likely a commensal relationship in which *Prionacidaris spp* provide important habitat to seahorses, but are not directly affected by their presence or absence.

Relevance:

This assessment provides a valuable snapshot of the seahorse population of the Corral site, and allows for observation of population demographics, species diversity and habitat associations of seahorses. Future analysis of the data will expand upon current comparisons to include species diversity of invertebrate communities as well as the presence of manmade structures upon seahorse densities. GIS and ANOVA will also be used to explore these relationships more inclusively with the physical characteristics of the Corral habitat. A second population assessment is planned for December of 2011, which will provide a reference to compare seasonal effects on seahorse population demography, and repeated samplings will allow for the observation of breeding, immigration and dispersal patterns. Over time, these assessments will produce more accurate estimates of seahorse populations in the area, and make it possible to track major trends in disturbance or recovery, allowing for more targeted and effective conservation of seahorses in Cambodian waters.