

## Global Seahorse Overexploitation: Can it be Stopped?

Seahorses are charming marine creatures that roam coastal waters along different continents (Pollom et al., 2021). With a horse-shaped head, colour-changing skin, and a small prehensile tail, seahorses have caught the hearts of many people, who are intrigued by their unique shape (Porter et al., 2013). They are one of the few known species where males give birth instead of females, and one of few marine species that aren't good at swimming (Porter et al., 2013; Planas et al., 2020). They have been a subject of interest for marine biologists due to their peculiar lifestyle. However, despite their popularity, seahorses are disappearing from the ocean at an alarming rate, as they are caught as bycatch and sold to companies to be used in medicine, as aquarium fish and more (Choo and Liew, 2005). This post focuses on bycatch rates and conservation strategies being employed to stop the mass decline in global seahorse populations.

### Let's learn a bit about seahorses:

Seahorses are quite the fascinating creatures, with a unique physiological structure and lifestyle adaptations. They are marine teleosts and belong to the genus *Hippocampus*, within the family Syngnathidae (Pierri et al., 2021; Perera et al., 2017). The word *Hippocampus* (Greek in origin) means "horse like sea monster," accurately reflecting the seahorses body shape – a horse like head, a long snout, eyes that move independently from one another, a flexible prehensile tail and camouflage skin (see Figure 1) (Porter et al., 2013). One feature that sets them apart from other marine fish is their lack of pelvic and caudal fins, making them poor swimmers, as they only have one dorsal fin that helps them float vertically (Porter et al., 2013). Another unique feature is their means of reproduction. Members of the Syngnathidae family are the only vertebrate organisms capable of embryonic development within male members (Lin et al., 2012). The female members deposit their eggs into the male's brood pouch, where the zygote develops (Planas et al., 2020). Seahorses thus differ from typical marine organisms in many ways.

Despite their small size, seahorses live up to their name as "sea monsters," as they have highly successful hunting mechanisms. Most seahorses can camouflage their skin to match that of their environment (Porter et al., 2013). This enables them to hide from predators or suddenly ambush un-knowing prey. Seahorses feed on small fish, copepods, and plankton, and they use their snouts to suck them up (Van Wassenbergh et al., 2011). They use a method called pivot feeding, wherein they attach themselves to the habitat using their tail, get very close to the prey, rotate their head upwards and suction the prey with their snout (Van Wassenbergh et al., 2011). This is an extremely fast process, allowing capture in less than 0.005s (Van Wassenbergh et al., 2011). Due to their small size and poor swimming skills, seahorses are susceptible to predation by multiple organisms, including crabs and stingrays (Porter et al., 2013). However, they have developed strategies such as camouflage and internal bony plates that can function as potential armour against predator attacks, making it difficult for them to be crushed (Porter et al., 2013).

Seahorses are found in a variety of habitats. As poor swimmers, they tend to live near the shore, where water is shallow, so they aren't pulled away by strong currents (Simpson et al., 2020). They are found in tropical waters and temperate salt waters, off the coast of all continents except polar regions (see Figure 2) (Pollom et al., 2021). They are osmoregulators with varied salinity tolerance, enabling them to inhabit estuaries and mangroves (da Hora et al., 2016). This can lead to low predation risks and easy access to food. Seahorses also inhabit coral reefs and seagrass meadows, as they can easily attach themselves onto those surfaces via their tails for attacking prey (Pollom et al., 2021). Thus, seahorses have varied habitation and characteristics.

**How seahorses are being exploited:**

As previously mentioned, seahorses are small and aren't good swimmers. Their fecundity is low, and they don't have a long life span (with species living up to a few years) (Planas et al., 2020). These factors, along with their habitats being in shallow waters, make seahorse species vulnerable to high fishing pressures.

Several seahorse species are now at risk of being endangered, primarily due to overexploitation by non-selective fishing. Seahorses are used in Chinese traditional medicine, known for curing health problems such as backaches and asthma (Choo and Liew, 2005). In many South-east Asian coastal communities, seahorses are also consumed as traditional snacks and sold as souvenirs, in the form of keychains and as decorations (Choo and Liew, 2005). In USA and Europe, they are commonly traded as aquarium fishes (Pierri et al., 2021). Based on these uses, it can be inferred that seahorse are quite valuable to specific regions hence they're in high demand. However, demand has now surpassed availability (Pierri et al., 2021).

Seahorse populations and habitats face decline as they are captured via non-selective fishing gear. This is demonstrated through the results of a research study done on seahorse trade in Peninsular Malaysia. Researchers conducted interviews with fishermen on the eastern coast regarding catch rates and documented by-catch seahorse specimen (Choo and Liew, 2005). Peninsular Malaysia is home to four species of seahorses, including *H. kelloggi*, *H. kuda*, *H. trimaculatus* and *H. spinosissimus*. Daily seahorse by-catch was composed of all 4 species, all of which were captured by sea-trawlers (except for *H. kuda*, that were victims of drift and scoop nets). Malaysian fishing ports housed many trawlers, with one port operating up to 500 trawlers. The researchers reported that in just 1 year, up to 565,640 seahorses were captured (with a total weight of 1.85 metric tons) and sold in TCM markets and as aquarium fish (Choo and Liew, 2005). According to fishermen, bycatch rates were decreasing across all fishing ports as fishing activity increased. Fishermen claimed that in past years, one trawl trip can capture up to 30 seahorses, however, at the time of the research, barely one was caught (Choo and Liew, 2005). This study was conducted in 2001; the rates have likely declined even further now. Thus, there is evidence to show that seahorse populations are declining with increasing catch rates.

A study focused on bycatch rates of *Hippocampus erectus* in the Gulf of Mexico showed similar data. *H. erectus* were caught as by-catch in shrimp trawl fisheries that targeted shrimp in seagrass beds (Baum et al., 2003). Researchers recorded bycatch numbers and specimen features (sex, size, weight) per trawler trip. It was noted that, as trawlers hauled up shrimp catch, benthic seagrass was also caught, along with corals and algae (Baum et al., 2003). This likely impacts resident species that rely on these habitats for protection and food. Over 95 fishing trips were recorded, during which 916 *H. erectus* were caught. Recordings in 1998 showed 87.7% adults were captured, comprising of mostly adult male catch, which is worrisome as they give birth to offspring. Most by-catch was kept for aquarium sales, though some was discarded back into the ocean. Researchers estimated that, via non-selective gear, up to 72,000 seahorses were captured per annum (Baum et al., 2003). Overall, high bycatch rates were recorded.

While the trawl fisheries directly reduce numbers through capture, they have indirect effects as well. Bycatch that is discarded back into the ocean have low mortality rates as they are more susceptible to predation (Baum et al., 2003). Seahorses may be separated from their mates, and removal of female seahorses can lower reproduction rates. Seahorses can also get injured and can have trouble swimming and capturing prey (Baum et al., 2003). High global demand of seahorses has caused them to face intense fishing pressure, alongside environmental pressure, and habitat degradation. Action must be taken accordingly to help conserve them.

**Conservation Efforts (CITES, Seahorse Hotels, MPAs and more):**

With the substantial decline in seahorse populations, multiple efforts are underway for conservation. One of the most successful steps taken toward seahorse conservation is their addition as the first marine species to the “Convention of International Trade in Endangered Species” (CITES) in 2002 (Harasti et al., 2014). This a treaty agreed upon by multiple nations to ensure international trade won’t impact wildlife populations of species being threatened by overexploitation (Foster and Vincent, 2005). Being listed allows regulations to be placed on how seahorses can be traded and brings international awareness to seahorse overexploitation.

Research was performed on management tools for seahorse trade regulations suggested by CITES. Researchers collected raw data on 33 different species of seahorses to identify a standard seahorse size that should be used in international trade and settled on a minimum size limit of 10 cm (Foster and Vincent, 2005). This size was ideal as it allowed for species to reproduce first before fishery recruitment and helped avoid capture of juvenile species (Foster and Vincent, 2005). This has helped relieve fishing pressures on seahorses and has brought attention to population decline due to nonselective equipment (Foster and Vincent, 2005).

Another solution is the introduction of “seahorse hotels” (Simpson et al., 2020). These are artificial structures that have been engineered to mimic actual habitats and reefs, allowing for seahorse species to grow and reproduce (Simpson et al., 2020). Researchers in Australia tested the hypothesis if these seahorse hotels can be used as alternative habitats in areas where *H. whitei* species have faced habitat loss. Researchers created 3 hotel designs (see Figure 3), and placed them in the Port Stephens estuary in New South Wales. They surveyed each hotel monthly to record seahorse populations (Simpson et al., 2020). The researchers found that the hotels were able to successfully support a vast population of *H. whitei* in regions with habitat loss, with increasing abundance in populations as the months went by, suggesting good reproduction rates (Simpson et al., 2020). The results proved how effective artificial habitats can be for seahorse conservation and are being pushed for use in areas with declining populations.

One alternative solution presented is the establishment of marine protected habitats (MPAs). MPAs are closed off regions in the ocean, often near the coast, where human activities such as fishing are limited for ecosystem conservation (O’Leary et al., 2018). One might expect MPAs to benefit seahorse populations, but unfortunately, research shows otherwise.

A study performed on MPAs in New South Wales, Australia showed that MPAs hosted less populations of seahorses than control sites. Researchers hypothesized that there would be a significant difference in seahorse populations between non-sanctuary and sanctuary sites in their monthly surveys (throughout 2006-2009) of MPA sites (Harasti et al., 2014). They primarily focused on the common seahorse species in the area, *Hippocampus whitei*. The results showed that the average monthly number of seahorses in MPAs was significantly lower than in the non-sanctuary zones (Harsati et al., 2014). One MPA site even showed a *H. whitei* decline throughout the months. The researchers stated that this is due to higher predation risks in MPAs, as the MPAs had a greater abundance of seahorse predators, including scorpionfish and cephalopods (Harsati et al., 2014). The researchers concluded that though MPAs reduce fishing pressures, they still need to be monitored cautiously due to predator abundance (Harasti et al., 2014).

Other conservation suggestions include limiting fishing during times of peak seahorse breeding season, to allow for high reproduction rates (Choo and Liew, 2005). On the individual level, people should refrain from purchasing seahorse products that directly profit companies taking part in harmful practices. On a national level, governments should monitor seahorse illegal trade and create regulations accordingly.

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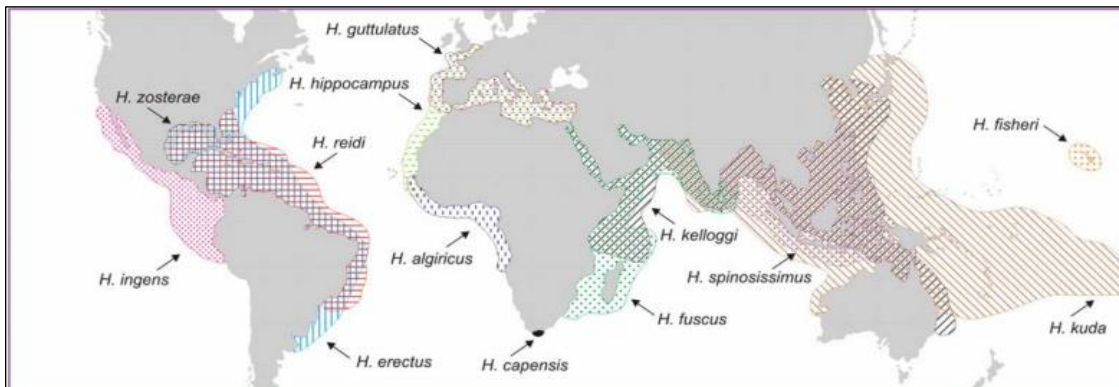
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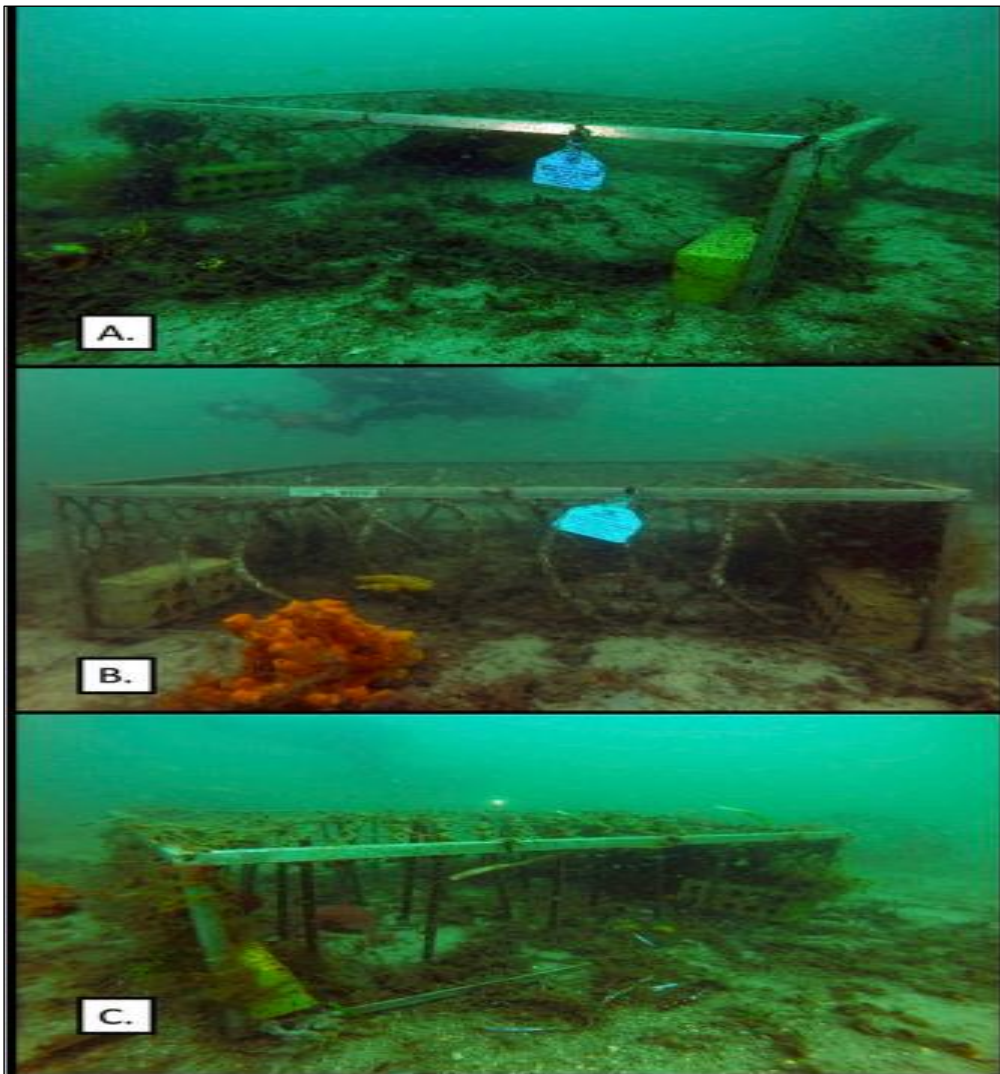
### Appendix:



**Figure 1, *Hippocampus kuda* (common seahorse):** The image above shows a *Hippocampus kuda*. Note the structure of the seahorse; it's horse-shaped head, the long snout used for pivot feeding, it's prehensile tail and dorsal fin. The image was taken from WildRepublic.com.



**Figure 2, *Hippocampus* species population distribution across the globe:** The image above shows the spatial distribution of different seahorse species in the world (Teske et al., 2007).



**Figure 3, Sample seahorse hotel designs:** These images are taken from a study done on artificial seahorse habitats, created by Michael Simpson et al. The researchers designed three kinds of “hotels”; A is an open cage design, B is a rope holdfast design and C is a wooden holdfast design (Simpson et al., 2014).