

The plight of Indian sea horses: Need for conservation and management

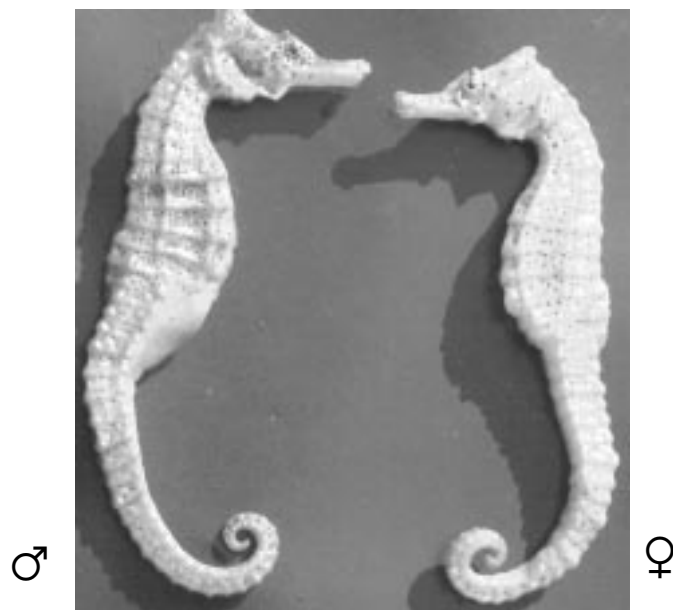
Sea horses (genus *Hippocampus*) are members of the family Syngnathidae, which also includes pipefishes, pipehorses and seadragons. They are found in shallow, coastal, tropical and temperate waters from about 45°S to 45°N (ref. 1). They inhabit many ecologically sensitive aquatic habitats, including coral reefs, seagrasses, mangroves and estuaries, with most species in the Indo-Pacific and western Atlantic regions. Sea horses primarily occupy inshore habitats in narrow strips along the coast and prefer shallow waters (< 15 m depth), but have been encountered in shallow rock pools. Many temperate and tropical sea horse species inhabit seagrass meadows, while others inhabit mangrove ecosystems and coral reefs. They are also known to be associated with soft-bottom communities such as sponges, sea quirts and gorgonians. Some sea horse species require very specific habitat; for example, *H. bargibanti* has been recorded only from two species of gorgonid corals². They are a fascinating and remarkable group of fishes with their unusual body shape and their biology, with males incubating the fertilized eggs in a brood pouch. Extraordinary myths also surround them. Ironically, it is their very popularity that places them in danger, as they are sought in large numbers for use in traditional medicine, aquarium fish and curios (souvenirs).

Sea horses are used as an ingredient in traditional medicine, particularly in southeast Asia where traditional Chinese medicine and its derivatives (e.g. Japanese and Korean traditional medicine) are practised and have been used perhaps for about 600 years³. Sea horses are credited with having a role in increasing and balancing vital energy flows within the body, as well as a curative role for such ailments as impotence and infertility, asthma, high cholesterol, goitre, kidney disorders, and skin afflictions such as severe acne and persistent nodules. They are also reported to facilitate parturition, act as a powerful general tonic and as a potent aphrodisiac²⁻⁴. Traditional Chinese medicine is recognized by the World Health

Organization as a valid form of medicine and is accepted by more than one-quarter of the world's population⁵.

Since the mid 1990s, there has been mounting concern over the decline in some exploited wild stocks of sea horses and other syngnathids⁶. In 1995, it was conservatively estimated that at least 20 million sea horses (more than 56 metric tonnes) were caught for the traditional medicine market. In addition, more than one million live sea horses are caught for aquarium trade, mostly destined for sale in North America, Europe, Japan and Taiwan³. The value of sea horses is quite high; the price of dried sea horses in Hong Kong markets ranges from Rs 11,500 to 50,400 (US\$ 275 to 1200) per kg depending on the species, quality and size⁷. About 50 countries are involved in sea horse exploitation and trade. The largest known importers of dried sea horses are China, Hong Kong, Singapore, Korea, Malaysia and Taiwan⁴. In response to decline in sea horse supplies in Asian waters, new countries such as Ecuador, Guinea, Jordan, Maldives, Mozambique, Nigeria, Peru and Senegal are now entering the sea horse trade.

In response to a significant increase in international demand, a target fishery for sea horses along the east coast of India in the Gulf of Mannar was started in 1992 (ref. 8). India is one of the largest exporters of dried sea horses globally, exporting at least 3.6 tonnes (~ 1.3 million sea horses) annually³, and contributes to about 30% of the global sea horse trade. There is also a significant trade in sea horses as aquarium fishes, as supplements in some specialized cuisine and as curios. Sea horses are exploited both as an incidental catch (by-catch in trawl nets) and target catch, for export. Presently, the commercial exploitation of sea horses is being carried out from Tamil Nadu and Kerala coasts⁷. Along Ramnad coast in Tamil Nadu, dried sea horse is used as a medicine to arrest whooping cough in children⁹. Our survey along the Goa-Maharashtra coast also indicated a similar usage. Demand for medicinal purposes has increased 10-fold during the 1980s and continues to grow at an annual rate of about 8–10% in China alone, predominantly due to China's economic boom which promotes increased consumer-spending on traditional medicines. A similar trend is



Male and female adult seahorse, *Hippocampus kuda*

expected in other countries with large Chinese populations¹⁰.

Such high exploitation rates in India, Indonesia, Philippines, Thailand and Vietnam have resulted in a decline in the population of sea horses by 25–75% over the last five years³. There is also a substantial reduction in the size of the harvested individuals and increased removal of immature males. The indiscriminate exploitation of sea horses coupled with a general degradation of their habitats put their populations under pressure. Sea horse biological characteristics such as slow growth rate (they take one year to attain maturity), low natural adult mortality, structured mating patterns (monogamous), low fecundity – with each pair producing about 1000 young per year (very low compared to other fishes), lengthy parental care, sparse distribution, limited mobility, and site fidelity make them vulnerable, particularly to selective fishing pressure. The IUCN Red List of Threatened Animals includes most of Indo-Pacific sea horse species¹¹. The Red List draws the conservation concerns about species, but has no direct legislative or legal implications for trade⁵.

Our knowledge on sea horse taxonomy from India is limited to a few reports¹² where morphology has been used as the sole criterion for describing the species. Although it has been reported that two species of *Hippocampus* occur in our waters⁹, no description of species other than *H. kuda* has been made. The general shape of the sea horse is familiar and easily recognizable, but detailed identification is quite difficult as sea horses often change colour and grow filaments to blend with their surroundings. They also lack certain key physical features (e.g. pelvic and caudal fins) as in other fish species, and variation in body proportions and meristic counts used to determine species membership, often overlap among species¹. Such subtleties in species distinctions can lead to ‘lumping’ of multiple ‘cryptic’ species under the same name¹³. Over 120 scientific names have been cited for what are now described as 32 different species². Lack of knowledge on the identities of sea horses restricts research on geographic ranges, population density and viability, hinders the

understanding of trade routes and consumer preferences for particular species. Proper species identification, on the other hand, will help us to modify fishing practices appropriately, design protective marine reserves, and assess captive breeding potential for sea horses. Taxonomic confusion complicates assessment of species’ conservation status, forcing unnecessary listing in IUCN Red List of Threatened Species, and greatly increasing the possibility of omitting species at risk.

Morphometric characters in combination with DNA sequence data (such as the cytochrome-*b* region of the mitochondrial genome and 12S ribosomal RNA) can be applied to determine taxonomy, phylogeny, genetic divergences, etc. Molecular markers, especially those that uncover fixed allelic differences at diagnostic loci are proving increasingly valuable in identifying the species and will be useful, particularly for sea horse taxonomy.

As an immediate and proactive solution to the problem, the National Institute of Oceanography, Goa under its marine biodiversity programme, has initiated a comprehensive study on the abundance and distribution of sea horse species along the Indian coast. Recently, the Ministry of Environment and Forests, Government of India through a Gazette Notification has included all Syngnathids in Schedule I of the Wild Life (Protection) Act, 1972 (ref. 14). Although this is good news for sea horses, however, such a notification without the promotion of conservation awareness programmes among the stakeholders and subsistence fishers could drive the trade underground and could divert the scarce resources towards enforcement. The threats that these fishes are facing today are similar to many marine species and therefore more emphasis should be laid on habitat improvement. Sea horses could serve as a popular flagship species for engendering support for general concerns in marine conservation and sustainable management.

1. Lourie, S. A., Pritchard, J. C., Casey, S. P., Truong, S. K., Hall, H. J. and Vincent, A. C. J., *Biol. J. Linn. Soc.*, 1999, **66**, 231–256.

2. Lourie, S. A., Vincent, A. C. J. and Hall, H. J., *Project Seahorse*, Project Seahorse, London, 1999, p. 214.
3. Vincent, A. C. J., *Traffic International*, Cambridge, UK, 1996, p. 163.
4. Vincent, A. C. J., *NAGA, ICLARM Quart.*, 1995, **18**, 18–19.
5. Moreau, M. A., Hall, H. J. and Vincent A. C. J., in Proceedings of the First International Workshop on the Management and Culture of Marine Species used in Traditional Medicines, Project Sea horse, Montreal, Canada, 1998, p. 240.
6. Woods, C. M. C., *N. Z. J. Mar. Freshwater Res.*, 2000, **34**, 475–485.
7. Anil, M. K., Kakati, V. S., Ganga, U. and Zacharia, S., *Mar. Fish. Inf. Serv., T&E Ser.*, 1999, **162**, 23–25.
8. Lipton, A. R., in Proceedings of the First International Workshop on the Management and Culture of Marine Species used in Traditional Medicines, Project Sea Horse, Montreal, Canada, 1998, pp. 75–77.
9. Marichamy, R., Lipton, A. P., Ganapathy, A. and Ramalingam, J. R., *Mar. Fish. Inf. Ser., T&E Ser.*, 1993, **119**, 17–20.
10. CITES Appendices, website: <http://www.cites.org/eng/notifs/1999/043a3.doc>.
11. Baillie, J. and Groombridge, B. (eds), *IUCN Red List of Threatened Animals*, World Conservation Union, Gland, Switzerland.
12. Raj, S. B., in Proceedings of the Twenty-seventh Indian Science Congress, 1941, p. 156.
13. Knowlton, N., *Annu. Rev. Ecol. Syst.*, 1993, **24**, 189–216.
14. Ministry of Environment and Forests, Govt. of India, Gazette Notification, SO665 (E), 12 July 2001.

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