

Rapid Communication

**First record of the introduced species big-belly seahorse
Hippocampus abdominalis Lesson, 1827 in South Korea**Yu-Jin Lee¹, Sum Rho² and Jin-Koo Kim³¹Environment and Fisheries Resources Research Division, West Sea Fisheries Research Institute, National Institute of Fisheries Science, Incheon 22383, Republic of Korea²Haechunma Co., Ltd., Jeju 63364, Republic of Korea³Department of Marine Biology, Pukyong National University, Busan 48513, Republic of KoreaCorresponding author: Jin-Koo Kim (taengko@hanmail.net)

Citation: Lee YJ, Rho S, Kim JK (2026) First record of the introduced species big-belly seahorse *Hippocampus abdominalis* Lesson, 1827 in South Korea. *BioInvasions Records* 15(2): 513–520, <https://doi.org/10.3391/bir.2026.15.2.24>

Received: 3 April 2025**Accepted:** 18 January 2026**Published:** 13 April 2026**Handling editor:** Yuriy Kvach**Thematic editor:** April Blakeslee**Copyright:** © Lee et al.

This is an open access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International - CC BY 4.0).

OPEN ACCESS

Abstract

The big-belly seahorse, *Hippocampus abdominalis* has been known to be limitedly distributed in the temperate seas of Australia and New Zealand. However, a single individual (197.14 mm in total length) of big-belly seahorse was collected using a fish trap from Pohang, Gyeongsangbuk-do, Republic of Korea on August 5, 2023. This is the first record of occurrence of the big-belly seahorse in the wild of Korea. We compared our single wild-captured individual with two aquarium-reared big-belly seahorse individuals from Jeju Island, using morphological and molecular methods. The big-belly seahorse specimens were well-matched with our wild-captured individual in terms of the numbers of dorsal fin rays (25–26), trunk rings (12–13), and tail rings (44–45). In addition, molecular analysis based on 609 bp of the mtDNA COI sequences showed a perfect match of 99.8–100%. Our wild-captured individual is likely to be escaped from the aquarium in Jeju Island and transported to Pohang by oceanic current. This record is noteworthy in providing potential of survival of the big-belly seahorse in the wild of Korea, suggesting that monitoring of the population of big-belly seahorses in the wild of Korea is necessary.

Key words: non-native species, Pohang, northwestern Pacific, new discovery**Introduction**

Seahorses belong to the genus *Hippocampus* (Syngnathiformes, Syngnathidae) and there are 57 species worldwide (Lourie et al. 1999; WoRMS 2025). Seahorses must be conserved due to their high commercial value and declining populations. Dried seahorses are used as medicinal ingredients in traditional medicine and Traditional Chinese Medicine, and live specimens are also maintained as ornamental species in aquaria (Woods 2007; Kumaravel et al. 2012). Furthermore, habitat destruction, overfishing, and bycatch are increasing their extinction possibility, leading to a listing in the 2002 CITES Appendix II, and making them a globally protected species (Lourie et al. 1999; Koldewey and Martin-Smith 2010; Cohen et al. 2017). Collecting and importing/exporting any wild seahorse species is strictly regulated, and only farmed seahorses are allowed for trade. Notably, the

big-belly seahorse (*Hippocampus abdominalis* Lesson, 1827) has been successfully farmed in China, Australia, and New Zealand; a success has been achieved on Jeju Island, Korea (Hong and Zhang 2003; Woods 2007; Shin et al. 2011). Aquaculture is essential for replacing the wild populations and ensuring a stable fish supply. However, introduced species occasionally escape into the wild due to aquaculture and adapt to the new environment; these can potentially impact native organisms (De Silva et al. 2009).

The big-belly seahorse is a temperate species inhabiting waters ranging from 8 °C to 24 °C, with a restricted distribution in Australia and New Zealand in the southwestern Pacific Ocean (Woods 2003; Nickel and Cursons 2012). This species is primarily observed in nearshore environments such as bays, harbors, and estuaries, where it attaches to substrates such as seaweed (Nickel and Cursons 2012). Seahorses have limited mobility and disperse via currents, which allows them to travel long distances during larval stages (Woods 2000). However, *H. abdominalis* prefers temperate waters and has never been reported in the Northern Hemisphere. In this study, we report the collection of a specimen of this species at the coast of Pohang, Korea. We provide detailed descriptions of its morphological characteristics and molecular traits.

Materials and methods

Sampling and morphological analysis

A single seahorse individual (197.14 mm in total length) was collected from Pohang, Gyeongsangbuk-do, Republic of Korea (36°02'31.8"N, 129°22'58.4"E, Figure 1) on August 5, 2023 using a fish trap, and two reared big-belly seahorse individuals were provided from aquarium in Jeju Island. Our wild-captured seahorse individual was identified as a big-belly seahorse (*Hippocampus abdominalis*) following Kuiter (2001). Morphological characteristics followed Kuiter (2001), Lourie et al. (2004), and Han et al. (2017). Measurements were taken to 0.1 mm using a vernier caliper. A total of 5 counts and 11 measurements were obtained. The measured values were converted into percentages of head length (HL) and trunk length (TrL).

DNA extraction and PCR amplification

Tissues were obtained from the right side of tails. DNA extraction kit (AccuPrep Genomic DNA Extraction Kit, Bioneer, Daejeon, Korea) was used to extract genomic DNA. A universal primer set was used FishF2 (5'-TCGACTAATCATAAAGATATCGGCAC-3') and FishR2 (5'-ACTTCA GGGTGACCGAAGAATCAGAA-3') by Ward et al. (2005) for analyzing mtDNA COI sequences. A polymerase chain reaction (PCR) was performed using a thermal cycler (Bio-rad MJ mini PCT-1148; Biorad, Hercules, CA, USA) as follows: pre-denaturation at 95 °C for 5 m; PCR reaction 35 cycles (denaturation at 95 °C for 30 s, annealing at 52 °C for 30 s, extension at 72 °C

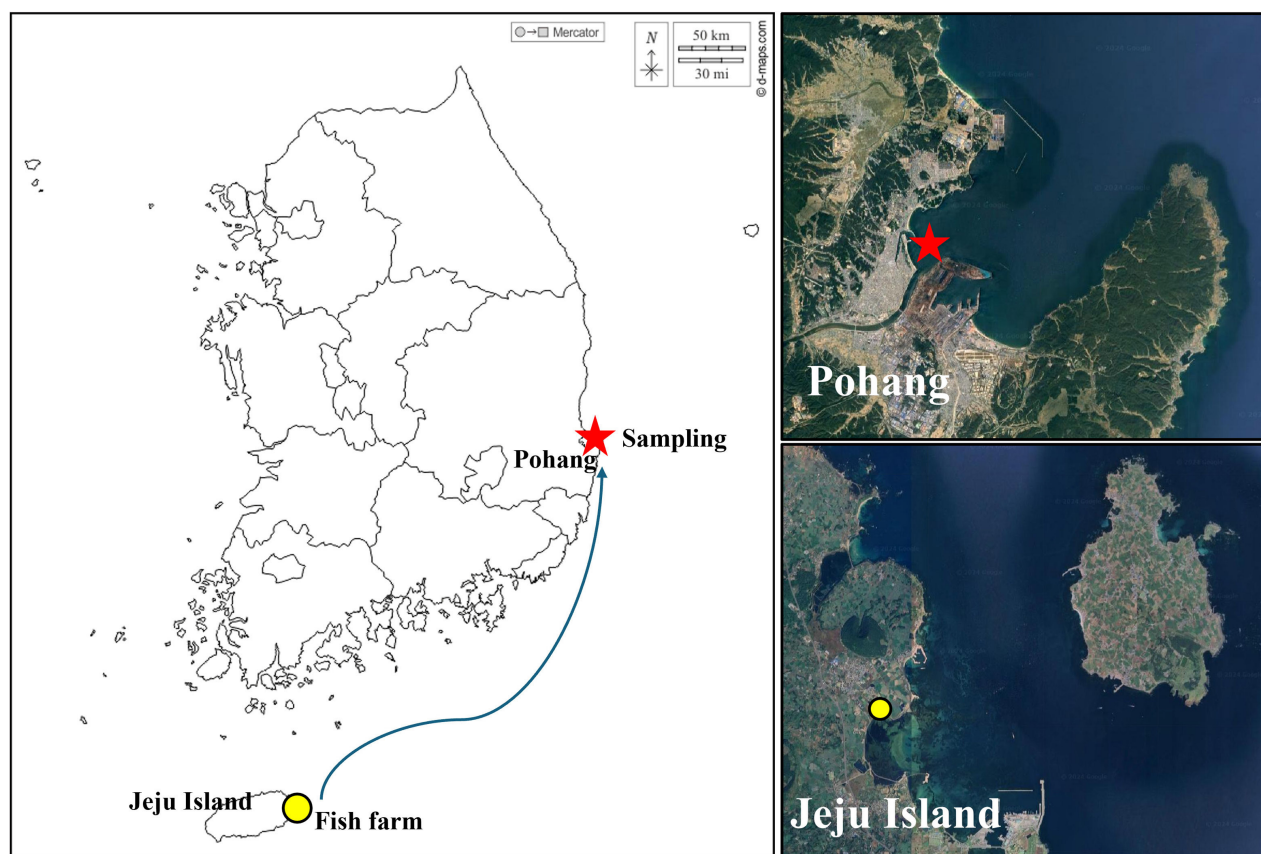


Figure 1. Sampling location of *Hippocampus abdominalis* from Korea. Red star (★): collection location in Pohang, East Sea, PKU 63101; Yellow circles (●): aquarium of Jeju Island, donated specimens PKU 22876–22877. The wild-captured bigbelly seahorse can be either transported through oceanic currents from the aquarium in Jeju Island to Pohang or derived from wild-reared individuals from the southern waters of Korea.

for 45 s); final extension at 72 °C for 7 m. BigDye (R) Terminator v3.1 cycle sequencing kits (Applied Biosystems, Waltham, MA, USA) of ABI PRISM 3730XL analyzer (96 capillary type) were used for sequence amplification. The obtained sequences were submitted to the National Center for Biotechnology Information (NCBI) and given registered numbers (PKU 63101, PP680775; PKU 22876, PP680777; PKU 22877, PP680776). The data that support the findings of this study are openly available in NCBI at <https://www.ncbi.nlm.nih.gov>. *H. abdominalis* (KY066104) and *H. kuda* (MG816695) of the ingroup (Syngnathidae) were compared with our specimens and *Fistularia commersonii* (OQ386372) belonging to the Syngnathiformes was used as an outgroup.

Molecular analysis

The sequences were arranged and edited using Clustal W software (Thompson et al. 1994) and BioEdit v7 (Hall 1999). A neighbor-joining tree was constructed by MEGA 11 (Tamura et al. 2021) to compare their genetic relationship. Genetic distances were calculated by Kimura 2-parameter (Kimura 1980) based on 1,000 bootstraps.

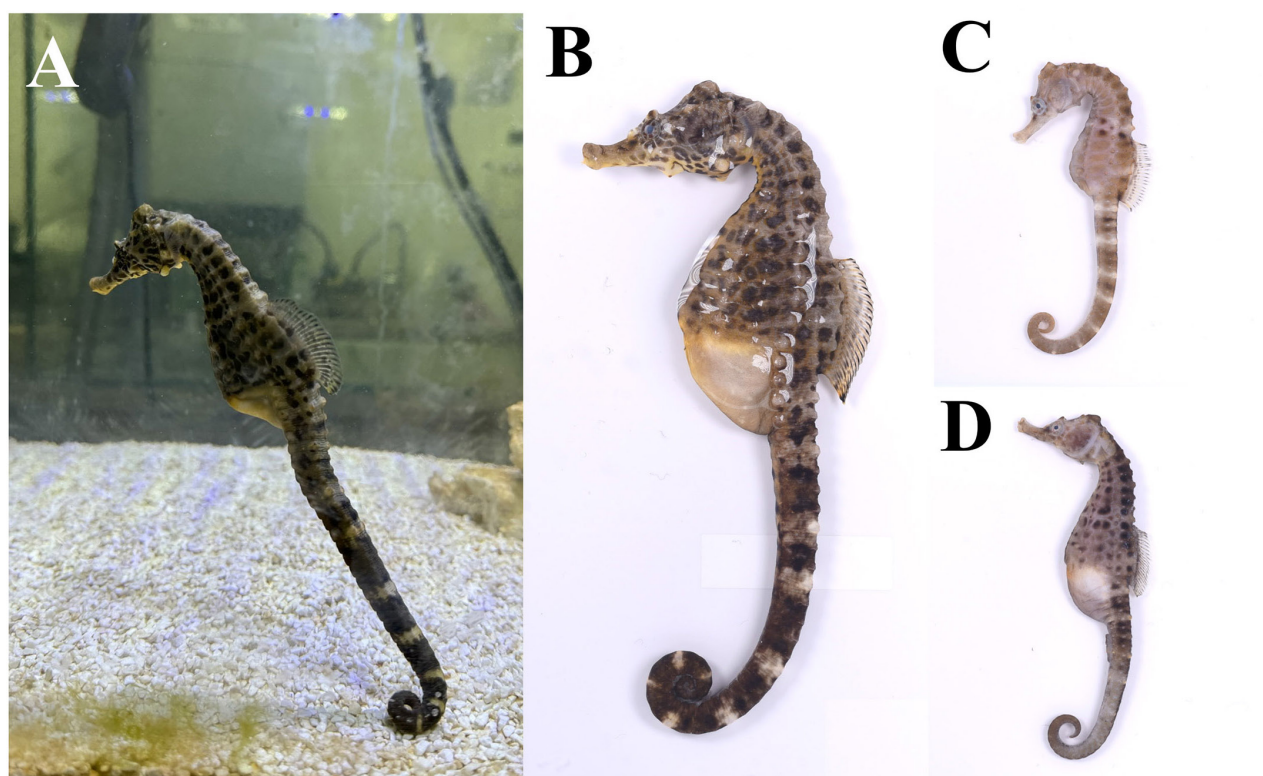


Figure 2. Photographs of *Hippocampus abdominalis*. A–B: wild-captured specimen from Pohang, PKU 63101; C–D: reared specimens from the aquarium of Jeju Island, PKU 22876–22877; photos by Yu-Jin Lee.

Results

Hippocampus abdominalis Lesson, 1827

(New Korean name: keun-bae-hae-ma) (Figure 2)

Hippocampus abdominalis Lesson 1827: 127 (type locality: New Zealand); Kuitert 1993: 97 (southeastern Australia); Stewart 2015: 1055 (New Zealand); Lourie et al. 2016: 13 (southeast Australia; New Zealand).

Morphological description

The collected specimen and two reared specimens were identified following Kuitert (2001). They matched perfectly with *H. abdominalis* (dorsal fin rays 25–28; pectoral fin rays 15–16 [mod 15]; anal fin rays 4; subdorsal rings 3–4 + 1–2; trunk rings 12–13; tail rings 44–45). Measurements and counts are presented in Table 1. Head length in trunk length 56.0%; dorsal fin base length in trunk length 39.9%. Snout length in head length 39.4%; snout depth in head length 12.5%; eye diameter in head length 15.5%; interorbital length in head length 8.0%; postorbital length in head length 48.5%.

Body compressed; head and eyes small; eye and cheek spines prominent; profile of snout to coronet curved; anterior coronet spine blunt; posterior coronet triangular, low and blunt; head filaments fleshy; snout elongated; mouth small; nape curved; abdomen profile round and deep; pectoral fin reaching to second trunk ring; the origin of dorsal fin located 9th trunk ring;

Table 1. Counts and measurements of *Hippocampus abdominalis*.

	Present study PKU 63101	Lesson, 1827	Kuiter, 2001	Present study PKU 22876-22877
Number of specimens	1	1	–	2
Counts				
Dorsal fin rays	25	26	25–28	25–26
Anal fin rays	4	–	–	4
Pectoral fin rays	15	15	15–16	15
Trunk rings	13	12	12–13	13–14
Tail rings	44	47	44–45	44–45
Measurements				
Total length (mm)	197.1	–	60–180	86.7–93.3
In head length (%)				
Snout length	39.4	–	31–37	42.4–45.8
Snout depth	12.5	–	–	11.3–11.6
Eye diameter	15.5	–	–	20.2–20.7
Interorbital length	8.0	–	–	8–10.1
Post orbital length	48.5	–	–	38.8–42.3
In trunk length (%)				
Head length	56.0	–	62–77	49.6–50.2
Dorsal fin base length	39.9	–	–	42.8–46.4

anus located at the posterior of dorsal fin; small tail tubercles present; tail prehensile; skin filaments absent; body covered with consecutive rings and bony plate.

Body coloration of fresh specimens

Wild-captured specimen: body dark brown; abdomen light brown or yellow; head and body with dark spots; tail with pale white bars; dorsal fin with black edges and yellow stripe.

Reared specimen: body yellowish-brown or light brown; body with dark spots; dorsal fin with dark stripes; tail with white stripes.

Molecular data

In all, 606 bp of COI gene sequences were obtained after alignment. They were well-matched with *H. abdominalis* isolated from Australia (KY066104). The genetic distance with congeneric species, *H. kuda* (MG816695), was 15.2%. The molecular results supported our morphological analysis (Figure 3).

Discussion

The big-belly seahorse (*Hippocampus abdominalis*) has been known to be endemic to Australia and New Zealand in the Southern Hemisphere (Woods 2003), but a single big-belly seahorse individual (197.14 mm TL) was collected off the coast of Pohang, Korea (Northern Hemisphere), using a fish trap. Most of the morphometric characteristics of our wild-captured big-belly seahorse closely matched the original description by Lesson (1827), except for the number of tail rings (44 in the collected specimen vs. 47 in the original description) and the presence of anal fin rays (4 vs. none). However, Kuiter (2001) later reported tail ring numbers of 44–45 and four

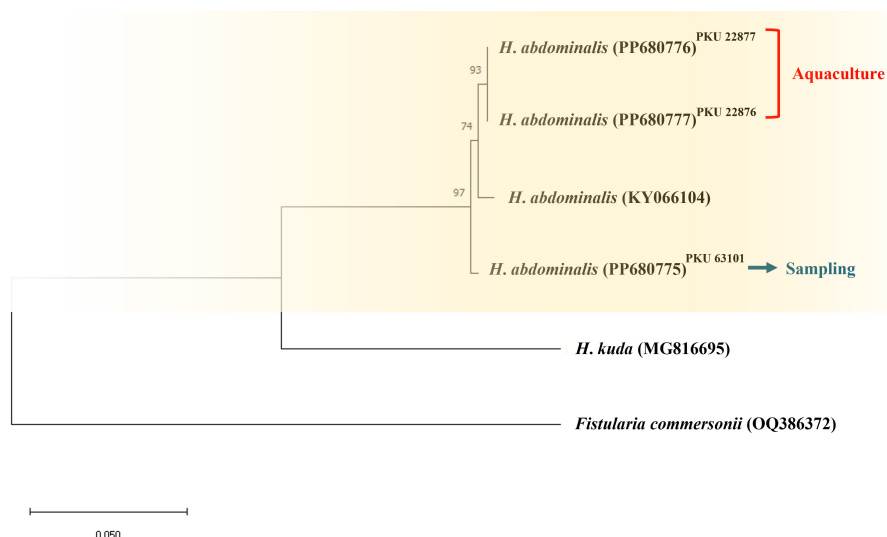


Figure 3. A neighbor-joining tree was constructed with the 606 bp COI gene sequences. Three specimens from Korea were well-matched with *H. abdominalis* from Australia (KY066104) registered in NCBI. Bootstrap values are indicated above the branches. The scale bar indicates the genetic distance.

anal fin rays for *H. abdominalis*, which well matched with our findings. Comparisons with Kuitert (2001) revealed slight differences in snout length and head length relative to body length: our specimen had a longer snout (39.4 vs. 31–37) and a shorter head (56.0 vs. 6–77). In addition, reared specimens from the aquarium of Jeju Island had morphometric traits consistent with a wild specimen but significant differences in snout length and head length, likely due to growth variation between young (reared) and adult (wild) individuals.

Seahorses have minimal mobility, which limits dispersal (Woods 2000). However, the big-belly seahorse can be transported hundreds of meters per day as it drifts attached to seaweed for 2 to 4 weeks during the planktonic larval stages (Woods 2000; Martin-Smith and Vincent 2005; Vincent et al. 2005). Despite this, *H. abdominalis* cannot move across the equator from the Southern Hemisphere to the Northern Hemisphere because it cannot tolerate high temperatures (habitat water temperature range: 8–24 °C) (Woods 2003; Nickel and Cursons 2012). Furthermore, since *H. abdominalis* primarily inhabits coastal areas, its natural range expansion is difficult without human intervention (Nickel and Cursons 2012).

In Korea, *H. abdominalis* has been reared near Seongsanpo, Jeju Island, for aquaculture purposes. Comparative analyses with reared specimens have revealed that the counts and morphometric traits of *H. abdominalis* well-matched molecular results. Pohang has an annual average seawater temperature of approximately 11.5–25.3 °C, which falls within the suitable temperature range for *H. abdominalis* (Sea Temperature Info 2025). It is possible that some individuals remain undetected, and since their spawning and growth temperatures appear to correspond with the marine environment of Pohang, they may have the potential to reproduce and establish a self-sustaining population. Notably, *H. abdominalis* has been

introduced to Korea for aquaculture for over a decade. According to Lovett (1969), *H. abdominalis* takes approximately 3–4 years to grow beyond 19 cm, indicating that the individual found (197 mm) is at least three years old. Therefore, our wild-captured specimen is presumed to have escaped from the aquarium in Jeju Island and subsequently drifted to Pohang, located approximately 400 km away in the southern East Sea of Korea. This region consists of rocky coastal waters where warm and cold currents converge, creating a suitable habitat for *H. abdominalis* (Yoo et al. 2006; Choi et al. 2010). Further biological investigation is needed to confirm whether the species has settled in the Korean waters. In Pohang, three native seahorse species (*Hippocampus haema* Han, Kim, Kai & Senou, 2017; *Hippocampus mohnikei* Bleeker, 1853; *Hippocampus trimaculatus* Leach, 1814) are known to inhabit the area. They can be distinguished by differences in the number of dorsal fin rays (25–28 in 11–14 in *H. haema* vs. 17–21 in *H. trimaculatus* vs. 15–16 in *H. mohnikei*) (Han et al. 2017; Vinod 2024). These species primarily feed on amphipods, copepods, and mysids, potentially competing for food and habitat with *H. abdominalis*, which has a similar diet. Although only a single wild specimen was discovered in this study, careful monitoring is necessary to assess the potential interactions, hybridization risks, and other ecological impacts on the native seahorses in Korea. Since there have been no reports of such introduced marine fish species in Korea, this case is considered highly important as the first record.

Authors' contribution

YJ contributed to research conceptualization, sample design and methodology, investigation and data collection, data analysis and interpretation, and writing of the original draft. JK contributed to sample collection, review, and editing of the manuscript. S also contributed to the review of the manuscript.

Authors' ORCIDs

YJL: [0000-0002-9511-0610](https://orcid.org/0000-0002-9511-0610); JKK: [0000-0002-8499-406X](https://orcid.org/0000-0002-8499-406X).

Acknowledgments

We sincerely thank Suk-Ja Chae for catching the sample. We also thank the anonymous reviewers for their valuable comments that improved the quality of this article.

Funding declaration

This work was supported by the management of Marine and Fishery Bio-resources Center (2026) funded by the National Marine Biodiversity Institute of Korea (MABIK).

References

- Cohen FPA, Valenti WC, Planas M, Calado R (2017) Seahorse aquaculture, biology and conservation: knowledge gaps and research opportunities. *Reviews in Fisheries Science & Aquaculture* 25: 100–111, <https://doi.org/10.1080/23308249.2016.1237469>
- Choi YK, Jeonog HD, Kwon KY (2010) Water distribution at the east coast of Korea in 2006. *Journal of the Environmental Sciences* 19: 399–406, <https://doi.org/10.5322/JES.2010.19.4.399>
- De Silva SS, Nguyen TT, Turchini GM, Amarasinghe US, Abery NW (2009) Alien species in aquaculture and biodiversity: a paradox in food production. *Ambio: a Journal of the Human Environment* 38: 24, <https://doi.org/10.1579/0044-7447-38.1.24>
- Hall TA (1999) BioEdit: A user-friendly biological sequence alignment editor and analysis program for windows 95/98/ NT. *Nucleic Acids Symposium Series* 41: 95–98

- Han SY, Kim JK, Kai Y, Senou H (2017) Seahorses of the *Hippocampus coronatus* complex: taxonomic revision, and description of *Hippocampus haema*, a new species from Korea and Japan (Teleostei, Syngnathidae). *ZooKeys* 712: 113, <https://doi.org/10.3897/zookeys.712.14955>
- Hong W, Zhang Q (2003) Review of captive bred species and fry production of marine fish in China. *Aquaculture* 227: 305–318, [https://doi.org/10.1016/S0044-8486\(03\)00511-8](https://doi.org/10.1016/S0044-8486(03)00511-8)
- Kimura M (1980) A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16: 111–120, <https://doi.org/10.1007/BF01731581>
- Koldewey HJ, Martin-Smith KM (2010) A global review of seahorse aquaculture. *Aquaculture* 302: 131–152, <https://doi.org/10.1016/j.aquaculture.2009.11.010>
- Kuiter RH (1993) Coastal fishes of south-eastern Australia. University of Hawaii Press, Honolulu, USA, 437 pp
- Kuiter RH (2001) Revision of the Australian seahorses of the genus *Hippocampus* (Syngnathiformes: Syngnathidae) with descriptions of nine new species. *Records of the Australian Museum* 53: 293–340, <https://doi.org/10.3853/j.0067-1975.53.2001.1350>
- Kumaravel K, Ravichandran S, Balasubramanian T, Sonneschein L (2012) Seahorses - A source of traditional medicine. *Natural Product Research* 26: 2330–2334, <https://doi.org/10.1080/14786419.2012.662650>
- Lesson RP (1827) Espèce nouvelle d'Hippocampe. *Bulletin des Sciences Naturelles et de Géologie (Férussac)* 11: 127–128
- Lourie JR, Vincent ACJ, Hall HJ (1999) Seahorses: An Identification Guide to the World's Species and Their Conservation. Project Seahorse, London, 214 pp
- Lourie SA, Foster SJ, Cooper EW, Vincent AC (2004) A guide to the identification of seahorses. *Project Seahorse and TRAFFIC North America* 114: 1–120
- Lourie SA, Pollom RA, Foster SJ (2016) A global revision of the seahorses *Hippocampus* Rafinesque 1810 (Actinopterygii: Syngnathiformes): taxonomy and biogeography with recommendations for further research. *Zootaxa* 4146: 1–66, <https://doi.org/10.11646/zootaxa.4146.1.1>
- Lovett JM (1969) An introduction to the biology of the seahorse *Hippocampus abdominalis*. Honours thesis, University of Tasmania, Tasmania, Australia, 103 pp
- Martin-Smith KM, Vincent ACJ (2005) Seahorse declines in the Derwent estuary, Tasmania in the absence of fishing pressure. *Biological Conservation* 123: 533–545, <https://doi.org/10.1016/j.biocon.2005.01.003>
- Nickel J, Cursons R (2012) Genetic diversity and population structure of the pot-belly seahorse *Hippocampus abdominalis* in New Zealand. *New Zealand Journal of Marine and Freshwater Research* 46: 207–218, <https://doi.org/10.1080/00288330.2011.632014>
- Shin SP, Han JE, Gomez DK, Kim JH, Choresca Jr CH, Jun JW, Park SC (2011) Identification of scuticociliate *Philasterides dicentrarchi* from indo-pacific seahorses *Hippocampus kuda*. *African Journal of Microbiology Research* 5: 738–741
- Stewart AL (2015) Family Syngnathidae. In: Roberts CD, Stewart AL, Struthers CD (eds), The Fishes of New Zealand v. 3, Wellington, New Zealand, pp 1050–1062
- Tamura K, Stecher G, Kumar S (2021) MEGA11: molecular evolutionary genetics analysis version 11. *Molecular Biology and Evolution* 38: 3022–3027, <https://doi.org/10.1093/molbev/msab120>
- Thompson JD, Higgins DG, Gibson TJ (1994) CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acids Research* 22: 4673–4680, <https://doi.org/10.1093/nar/22.22.4673>
- Vincent AC, Evans KL, Marsden AD (2005) Home range behaviour of the monogamous Australian seahorse, *Hippocampus whitei*. *Environmental Biology of Fishes* 72: 1–12, <https://doi.org/10.1007/s10641-004-4192-7>
- Vinod K (2024) Introduction to the identification of seahorses. In: Training Manual on “Know Your Marine Biodiversity and Environment (MarBiE 2)” Taxonomy of Marine Organisms. CMFRI Training Manual Series (41). ICAR - Central Marine Fisheries Research Institute, Kochi, pp 137–145
- Ward RD, Zemlak TS, Innes BH, Last PR, Hebert PD (2005) DNA barcoding Australia's fish species. *Philosophical Transactions of the Royal Society B: Biological Sciences* 360: 1847–1857, <https://doi.org/10.1098/rstb.2005.1716>
- Woods CMC (2000) Preliminary observations on breeding and rearing the seahorse *Hippocampus abdominalis* (Teleostei: Syngnathidae) in captivity. *New Zealand Journal of Marine and Freshwater Research* 34: 475–485, <https://doi.org/10.1080/00288330.2000.9516950>
- Woods CMC (2003) Factors affecting successful culture of the seahorse, *Hippocampus abdominalis* Leeson, 1827. In: Cato JC, Brown CL (eds), Marine Ornamental Species: Collection, Culture & Conservation, Blackwell Publishing Company, Ames, Iowa, USA, pp 277–288, <https://doi.org/10.1002/9780470752722.ch20>
- Woods C (2007) Aquaculture of the big-bellied seahorse *Hippocampus abdominalis* Lesson 1827 (Teleostei: Syngnathidae) PhD Thesis, Te Herenga Waka-Victoria University of Wellington, Melbourne, Australia, 251 pp
- Yoo JS, Park IS, Song YC, Seo YW, Doe GY, Lee JW, An JK (2006) Characteristics and structure of benthic algal community in Pohang New Port Area. *Journal of Navigation and Port Research* 30: 309–314, <https://doi.org/10.5394/KINPR.2006.30.4.309>

Web sites, online databases and software

- Sea Temperature Info (2025) Sea Temperature Info. <https://seatemperature.info> (accessed 25 March 2025)
- WoRMS (2025) World Register of Marine Species. <https://www.marinespecies.org> (accessed 25 March 2025)