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# A new distributional record of *Hippocampus kuda* Bleeker, 1852 (Teleostei, Syngnathidae) from Saudi Arabia in the South-Central Red Sea

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## Abstract

The common seahorse, *Hippocampus kuda*, is widely distributed throughout the Indo-Pacific region, occurring from East Africa to Hawaii, where it typically inhabits diverse ecosystems such as estuaries, lagoons, coastal zones, and seagrass beds. Despite its extensive geographic range, reports of its occurrence in the Red Sea remains limited, primarily restricted to the northern region of the Red Sea. Here, we report a new distributional record of *H. kuda* in Saudi Arabian waters within the south-central Red Sea. A single female specimen of *H. kuda* was collected through trawling conducted off the coast of Al Qunfudah at depths ranging from 15 to 20 meters. Morphological and molecular examination confirmed the identity of the specimen as *H. kuda*. The new record of *H. kuda* represents the second occurrence of this species in south-central Red Sea and expands its known distribution range 367 kilometers further south than the first reported record off Jeddah in 1838.

**Key words:** Seahorse, Al Qunfudah, trawl bycatch, COI, Gulf of Suez, Gulf of Aqaba, Indian Ocean

## Introduction

The seahorse genus *Hippocampus* Rafinesque, 1810 is represented by three species recorded in the Red Sea: *H. jayakari* Boulenger, 1900, *H. debelius* Gomon & Kuiter, 2009, and *H. kuda* Bleeker, 1852 (GBIF 2024; iNaturalist, 2024). Among these, *H. kuda* is distinguished by its wide distribution across the Indo-Pacific, ranging from the eastern coast of Africa to Hawaii. Within the Western Indian Ocean, *H. kuda* has been recorded along the eastern African coast in South Africa, Kenya, and Madagascar, as well as in the Red Sea spanning Egypt, Israel, and Saudi Arabia, and in the Persian Gulf in Iran, United Arab Emirates, and Oman (GBIF 2024; iNaturalist, 2024). *Hippocampus kuda* is typically found in estuaries, lagoons, harbors, and coastal seagrass beds, with a tendency to inhabit shallow waters not exceeding fifty-five meters in depth (Choo and Liew, 2003; Lourie *et al.*, 2004; Lipton and Thangaraj, 2013; Dody *et al.*, 2021; Kalisiak *et al.*, 2022).

Despite its widespread distribution, *H. kuda* faces conservation challenges, leading to its classification as vulnerable by the International Union for Conservation of Nature (IUCN, 2004), primarily due to threats posed by bycatch in shrimp trawling, targeted capture for aquarium and traditional medicine trade, habitat degradation, and its low fecundity attributed to the extensive parental brood care it undertakes. Additionally, internationally, *H. kuda* is listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2003). Although numerous records of *H. kuda* are reported in the Red Sea, they primarily occur from the northern regions, specifically the Gulf of Aqaba and Gulf of Suez in Egypt and Israel, respectively (GBIF, 2024; iNaturalist, 2024).

The first record of *H. kuda* in the Red Sea was recorded in Saudi Arabian waters in 1838. However, it was originally reported as the first record of the seahorse *H. fuscus* Rüppell, 1838, at the type locality of Jeddah. Subsequent taxonomic reassessment led to the reclassification of *H. fuscus* as a synonym of H. *kuda*, as no discernible morphological, genetic, or geographic disparities were found between *H. fuscus* and *H. kuda* from Southeast Asia

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(Lourie *et al.*, 2016). Despite these regional observations, records of *H. kuda* from the Red Sea are absent in the literature, particularly in Saudi Arabia.

In this study, we report a new distributional record of *H. kuda* within the south-central Red Sea, representing only the second record of this species in Saudi Arabia. During trawling activities off the coast of Al Qunfudah along the Southeast Red Sea Coast of Saudi Arabia in 2023, we collected a single female specimen of *H. kuda* at depths ranging from 15 to 20 meters. Morphological and molecular analyses confirmed the specimen's identification as *H. kuda*. The new record expands the southern range of *H. kuda* within the Red Sea, extending 367 kilometers further south from the first known record in Jeddah.

## Methods

### Study area and sample collection

Trawling operations were conducted aboard a standard commercial shrimp trawler off the coastline of Al Qunfudah in the Southeast Red Sea Coast of Saudi Arabia (Fig. 1). During a one-hour trawl session conducted in the early hours

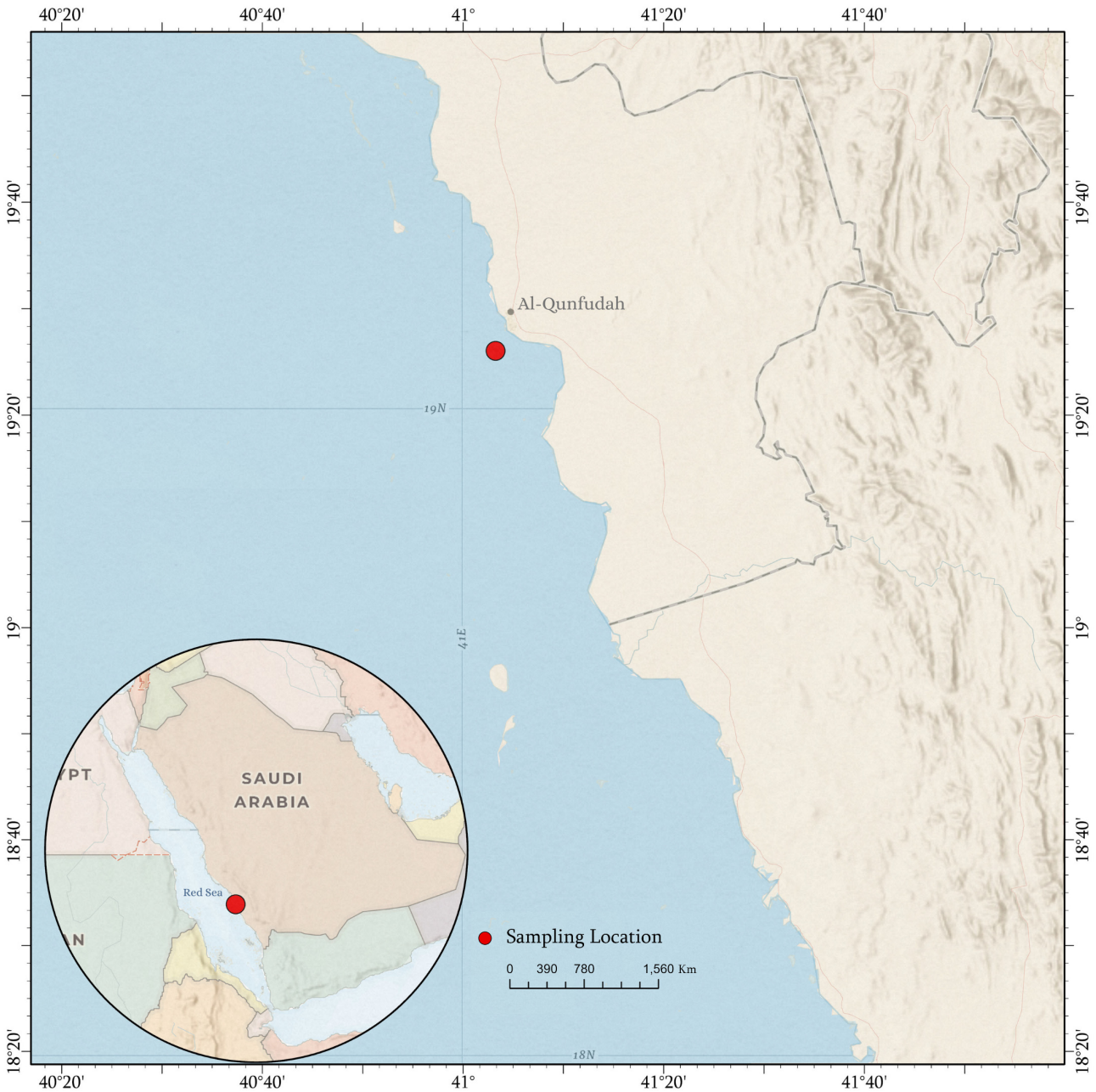


**FIGURE 1.** Sampling location of the yellow sea horse *H. kuda* collected off Al Qunfudah.

of August 2023 at approximately 04:10 AM, a seahorse specimen was collected from depths ranging between 15 to 20 meters in a heavily disturbed shrimp trawl ground consisting of seagrass beds (*Sargassum* sp.). Upon collection, the specimen underwent photographic documentation both onboard the vessel and subsequently in the laboratory. Species identification was carried out based on external morphological features following the field identification guide by Lourie *et al.* (2004) and on meristic characters (Lourie at al., 2016). Records and observations of *H. kuda* in the Red Sea were obtained from multiple databases including the Global Biodiversity Information Facility (GBIF), Oceanic Biodiversity Information System (OBIS), and iNaturalist. Morphological and morphometric characters, and genetic analyses at the COI gene, were obtained from a comprehensive examination of the specimen and used to confirm the identity of the specimen as *H. kuda*. The specimen was accessioned in the fish collections at the Australian Museum under voucher number AM I.51371-001.

### DNA extraction and genetic divergence

DNA extraction, primers, PCR conditions, sequence alignment, and analysis of CO1 sequence data generated for this study were performed following protocols described in Hamilton *et al.* (2017).

The COI sequence data generated from the collected specimen (Genbank accession number PP992517) were compared with publicly available barcoding sequences from GenBank and BOLD for *H. kuda* species sampled from the Indian Ocean. Some samples sourced from GenBank are designated as *H. fuscus* due to their collection predating the synonymisation with *H. kuda* or misclassification as *H. fuscus* (Appendix 1). Genetic distances (uncorrected p-distances) were calculated using MEGA v. 7.0.26 (Kumar *et al.*, 2008).

## Results

### Diagnosis

The collected specimen was identified as an adult female of *H. kuda* based on external morphological characters following the field identification guide by Lourie *et al.* (2004). General body shape and size as seen in Fig 2. Morphometric, meristic, and morphological characters are listed in Table 1. Distinct, angular and flat coronet; dorsal fin rays sixteen; pectoral-fin rays fifteen; anal fin rays four; trunk rings eleven; dorsal fin base raised dorsally; subdorsal rings four, dorsal fin base starting immediately posterior to ninth trunk ring and ending immediately posterior to first tail ring; tail rings 37. Body ornamentation: spines low and rounded, small spine above eye; lateral head spine ventral of coronet; small spine behind eye; double low spines below eye; cleithral spines small, uppermost at gill-opening, central spine at level of last pectoral-fin ray, lowermost single and not enlarged; snout spine absent; superior trunk ridge with enlarged spines on first, third, and fifth rings; superior trunk ridge on tail with small spines on each ridge, becoming gradually smaller posteriorly along the length of the tail; all inferior trunk ridge spines absent; caudal fin absent.

### Color

Post collection, the fresh specimen of *H. kuda* exhibits yellow coloration of the body: head, trunk, and tail (Fig. 2). In preservation, the specimen retains a pale yellow coloration.

### Generic divergence

Appendix 1 summarizes uncorrected p-distances at the COI gene, listing the genetic divergences between our collected specimen (AM I.51371-001) and previously sequenced *H. kuda* specimens from the Western Indian Ocean. The collected specimen diverges by 0.0% to 0.61% among Western Indian *H. kuda*, including South Africa, Tanzania, Egypt, Israel, and Iran.


**FIGURE 2.** Yellow sea horse *H. kuda* collected off Al Qunfudah.

**TABLE 1.** Relative measurements and counts obtained for *H. kuda*

| | ***Hippocampus kuda*** |
|---|---|
| Voucher | AM I.51371-001 |
| Trunk rings | 11 |
| Tail rings | 37 |
| Dorsal fin-rays | 16 |
| Pectoral fin-rays | 15 |
| SL (mm) | 105.2 |
| **%SL** | |
| Head length (HL) | 17.00 |
| Trunk length (TrL) | 29.40 |
| Tail length (TaL) | 53.60 |
| Trunk depth (TD4) | 6.70 |
| Trunk depth (TD9) | 8.80 |
| **%HL** | |
| Head depth (HD) | 53.97 |
| Snout length (SnL) | 40.74 |
| Post orbital (PO) | 38.10 |
| Coronet height (CH) | 34.92 |
| **SnL%** | |
| Snout depth (SnD) | 27.79 |

## Discussion

Despite its extensive geographic range, reports of its occurrence in the Red Sea remains sparse, primarily restricted to the northern region of Egypt and Israel in the Gulf of Aqaba and the Gulf of Suez (GBIF, 2024; iNaturalist, 2024). Museum records are restricted to specimens collected in the Gulf of Suez in Egypt between 1869-1933 (MNHN IC 0000-5632, 1869; MNHN IC 1966-0357, 1928; MNHN IC 1966-0359, 1928; MNHN IC 1966-0358, 1929; MNHN IC 1966-0360, 1933). Photographic observations of *H. kuda* in the Red Sea, however, are more recent, all of which have been recorded in Egypt and Israel in the 2000's on iNaturalist (Table 2).

**TABLE 2.** iNaturalist observations of *H. kuda* in the Red Sea

| Location | Country | iNaturalist observation | Year |
|---|---|---|---|
| Gulf of Aqaba | Egypt | 110831036 | 2003 |
| Gifton Islands | Egypt | 1485195 | 2004 |
| Gifton Islands | Egypt | 1443456 | 2005 |
| Gulf of Aqaba | Egypt | 110831031 | 2010 |
| Gulf of Suez | Egypt | 126860728 | 2024 |
| Gulf of Suez | Egypt | 1092696 | 2004 |
| Gulf of Aqaba | Israel | 146471415 | 2007 |
| Gulf of Aqaba | Israel | 124753659 | 2019 |
| Gulf of Aqaba | Israel | 121227875 | 2021 |

The first record of *H. kuda* in the Red Sea was recorded in Jeddah, Saudi Arabia in 1838. This record was originally based on the first description of *H. fuscus* (Rüppell, 1840), which was later synonymized with *H. kuda* due to the lack of discernible morphological, genetic, or geographic differences from *H. kuda* (type locality Singapore) in a revision of *Hippocampus* (Lourie *et al.*, 2016). The holotype of *H. fuscus* (specimen SMF 4914) is housed in the fish collections at the Senckenberg Nature Museum, Frankfurt, Germany. Therefore, we treat all previous records of *H. fuscus* in the Red Sea as *H. kuda* in this study. Similarly, *H. suezensis*, first described by Duncker in 1940 (type locality Hurghada, Egypt) is considered synonymous with *H. fuscus* for the scope of this study.

Our collected specimen represents the second record of *H. kuda* reported in Saudi Arabia and a new distributional record in the south-central Red Sea. This new record expands the southern range of *H. kuda* within the Red Sea, extending 367 kilometers further south from the first known record in Jeddah. Mehanna and Al-Mahdawi (2006) reported the first record of *H. kuda* from the Yemeni coast of the Red Sea, which would extend the range of the species to the southern extremity of the Red Sea. However, scrutiny of their study reveals numerous instances of misidentification among the seahorse species listed in their study. Furthermore, the photographic images accompanying their descriptions lack clarity, posing challenges in accurately identifying the species at the species level.

Meristic, morphometric, and morphological characters documented in our collected specimen of *H. kuda* agree with those documented for *H. kuda* following the field identification guide by Lourie *et al.* (2004) and the taxonomic revision of *Hippocampus* (Lourie *et al.*, 2016) for this species. The general appearance of the specimen is quite distinct from the other two species of seahorses, *H. jayakari* and *H. debelius,* occurring in the Red Sea, including differences in the aforementioned characters and size.

Genetic analysis of the COI gene, as listed in Appendix 1, indicates minimal divergence between the sequences obtained from our collected specimen and *H. kuda* originating from the Western Indian Ocean, including the Red Sea and Persian Gulf. Specifically, the genetic variation ranges from 0.00 to 0.31 when compared to sequences from South Africa. In contrast, divergence ranges from 0.0 to 0.61 when compared to sequences from Egypt and Israel in the Red Sea. A sequence retrieved from Saudi Arabia in the Persian Gulf (Genbank accession number KU236029) exhibits a divergence of 0.74 from our specimen.

## Implications for conservation

In the Red Sea, there is currently no comprehensive data available on the trade or exploitation of seahorses. It is essential to gather data on various aspects of this trade, including the species involved, trade routes, volumes traded, and monetary values associated with syngnathid trade, particularly from countries bordering the Red Sea. The existing records on the distribution of *H. kuda* in the Red Sea highlights the urgent need for further research into the fishing impact on seahorses throughout the Red Sea, especially in areas like the southern Red Sea off Al Qunfudah and Jizan, where shrimp trawlers operate. It is crucial to assess the effects of trawling on seahorse populations and their sustainability. Efforts should be made to raise awareness among trawl fishermen about the importance of conserving seahorse species. The fishermen should be educated about the significance of avoiding seagrass beds during their harvesting activities, as this can significantly enhance the prospects of protecting this vulnerable species in the Red Sea. Furthermore, expanding knowledge about the distribution of specific seahorse species, such as *H. kuda*, in the Red Sea has significant conservation implications. Newly documented occurrences should be considered in the formulation of conservation strategies and management efforts for seahorse populations in the region.

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**Appendix 1.**

| | ***Hippocampus_ kuda*_PP992517_ Saudi_Arabia** | ***Hippocampus_ kuda*_KU236029_ Saudi_Arabia** | ***Hippocampus_ fuscus*_ KY066107_Egypt** | ***Hippocampus_ kuda*_ MF123924_Isreal** | ***Hippocampus_ fuscus*_ MG875005_Red_ Sea** | ***Hippocampus_ fuscus*_ MG875006_Red_ Sea** | ***Hippocampus_ fuscus*_MG875007_ Red_Sea** | ***Hippocampus_ fuscus*_ MG875008_Red_ Sea** | ***Hippocampus_ fuscus*_ MG875009_Red_ Sea** |
|---|---|---|---|---|---|---|---|---|---|
| ***Hippocampus_kuda*_ PP992517_Saudi_ Arabia** | | | | | | | | | |
| ***Hippocampus_kuda*_ KU236029_Saudi_ Arabia** | 0.0061 | | | | | | | | |
| ***Hippocampus_ fuscus*_KY066107_ Egypt** | 0.0032 | 0.0095 | | | | | | | |
| ***Hippocampus_kuda*_ MF123924_Isreal** | 0 | 0.0061 | 0.0032 | | | | | | |
| ***Hippocampus_ fuscus*_MG875005_ Red_Sea** | 0.0032 | 0.0078 | 0.0033 | 0.0032 | | | | | |
| ***Hippocampus_ fuscus*_MG875006_ Red_Sea** | 0 | 0.0047 | 0.0033 | 0 | 0.0031 | | | | |
| ***Hippocampus_ fuscus*_MG875007_ Red_Sea** | 0.0016 | 0.0062 | 0.0016 | 0.0016 | 0.0015 | 0.0015 | | | |
| ***Hippocampus_ fuscus*_MG875008_ Red_Sea** | 0.0032 | 0.0078 | 0.0016 | 0.0032 | 0.0031 | 0.0031 | 0.0016 | | |
| ***Hippocampus_ fuscus*_MG875009_ Red_Sea** | 0.0016 | 0.0062 | 0.0049 | 0.0016 | 0.0047 | 0.0016 | 0.0031 | 0.0047 | |
| ***Hippocampus_ fuscus*_MG875011_ Red_Sea** | 0.0032 | 0.0078 | 0.0033 | 0.0032 | 0.0031 | 0.0031 | 0.0016 | 0.0031 | 0.0047 |
| ***Hippocampus_ fuscus*_MG8750010_ Red_Sea** | 0.0032 | 0.0094 | 0.0065 | 0.0032 | 0.0078 | 0.0047 | 0.0062 | 0.0078 | 0.0062 |
| ***Hippocampus_kuda*_ AB983272_Iran** | 0.0032 | 0.0032 | 0.0067 | 0.0032 | 0.008 | 0.0048 | 0.0064 | 0.008 | 0.0064 |

*.....continued on the next page*

**Appendix 1.** (Continued)

| | *Hippocampus_kuda*_PP992517_Saudi_Arabia | *Hippocampus_kuda*_KU236029_Saudi_Arabia | *Hippocampus_fuscus*_KY066107_Egypt | *Hippocampus_kuda*_MF123924_Isreal | *Hippocampus_fuscus*_MG875005_Red_Sea | *Hippocampus_fuscus*_MG875006_Red_Sea | *Hippocampus_fuscus*_MG875007_Red_Sea | *Hippocampus_fuscus*_MG875008_Red_Sea | *Hippocampus_fuscus*_MG875009_Red_Sea |
|---|---|---|---|---|---|---|---|---|---|
| ***Hippocampus_kuda*_ADC09-087_BOLD_South_Africa** | 0.0031 | 0.0095 | 0.0063 | 0.0031 | 0.0065 | 0.0032 | 0.0048 | 0.0048 | 0.0048 |
| ***Hippocampus_kuda*_GU805014_South_Africa** | 0 | 0.0062 | 0.0032 | 0 | 0.0032 | 0 | 0.0016 | 0.0032 | 0.0016 |
| ***Hippocampus_kuda*_GU805015_South_Africa** | 0 | 0.0062 | 0.0032 | 0 | 0.0032 | 0 | 0.0016 | 0.0032 | 0.0016 |
| ***Hippocampus_kuda*_GU805016_South_Africa** | 0 | 0.0062 | 0.0032 | 0 | 0.0032 | 0 | 0.0016 | 0.0032 | 0.0016 |
| ***Hippocampus_kuda*_GU805017_South_Africa** | 0 | 0.0062 | 0.0032 | 0 | 0.0032 | 0 | 0.0016 | 0.0032 | 0.0016 |
| ***Hippocampus_fuscus*_GQ502132_Tanzania** | 0.0015 | 0.0077 | 0.0047 | 0.0015 | 0.0048 | 0.0016 | 0.0032 | 0.0048 | 0.0032 |

**Appendix 1.** (Continued)

| | *Hippocampus_fuscus*_MG875011_Red_Sea | *Hippocampus_fuscus*_MG8750010_Red_Sea | *Hippocampus_kuda*_AB983272_Iran | *Hippocampus_kuda*_ADC09-087_BOLD_South_Africa | *Hippocampus_kuda*_GU805014_South_Africa | *Hippocampus_kuda*_GU805015_South_Africa | *Hippocampus_kuda*_GU805016_South_Africa | *Hippocampus_kuda*_GU805017_South_Africa | *Hippocampus_fuscus*_GQ502132_Tanzania |
|---|---|---|---|---|---|---|---|---|---|
| ***Hippocampus_kuda*_PP992517_Saudi_Arabia** | | | | | | | | | |
| ***Hippocampus_kuda*_KU236029_Saudi_Arabia** | | | | | | | | | |
| ***Hippocampus_fuscus*_KY066107_Egypt** | | | | | | | | | |
| ***Hippocampus_kuda*_MF123924_Isreal** | | | | | | | | | |

*.....continued on the next page*

**Appendix 1.** (Continued)

| | ***Hippocampus_ fuscus_* MG875011_Red_ Sea** | ***Hippocampus_ fuscus_* MG8750010_Red_ Sea** | ***Hippocampus_ kuda*_AB983272_ Iran** | ***Hippocampus_ kuda*_ADC09-087_BOLD_ South_Africa** | ***Hippocampus_ kuda*_GU805014_ South_Africa** | ***Hippocampus_ kuda*_GU805015_ South_Africa** | ***Hippocampus_ kuda*_GU805016_ South_Africa** | ***Hippocampus_ kuda*_GU805017_ South_Africa** | ***Hippocampus_ fuscus_* GQ502132_ Tanzania** |
|---|---|---|---|---|---|---|---|---|---|
| ***Hippocampus_ fuscus*_MG875005_ Red_Sea** | | | | | | | | | |
| ***Hippocampus_ fuscus*_MG875006_ Red_Sea** | | | | | | | | | |
| ***Hippocampus_ fuscus*_MG875007_ Red_Sea** | | | | | | | | | |
| ***Hippocampus_ fuscus*_MG875008_ Red_Sea** | | | | | | | | | |
| ***Hippocampus_ fuscus*_MG875009_ Red_Sea** | | | | | | | | | |
| ***Hippocampus_ fuscus*_MG875011_ Red_Sea** | | | | | | | | | |
| ***Hippocampus_ fuscus*_MG8750010_ Red_Sea** | 0.0078 | | | | | | | | |
| ***Hippocampus_kuda_* AB983272_Iran** | 0.008 | 0.0096 | | | | | | | |
| ***Hippocampus_kuda_* ADC09-087_BOLD_ South_Africa** | 0.0065 | 0.0065 | 0.0067 | | | | | | |
| ***Hippocampus_kuda_* GU805014_South_ Africa** | 0.0032 | 0.0032 | 0.0033 | 0.0031 | | | | | |
| ***Hippocampus_kuda_* GU805015_South_ Africa** | 0.0032 | 0.0032 | 0.0033 | 0.0031 | 0 | | | | |
| ***Hippocampus_kuda_* GU805016_South_ Africa** | 0.0032 | 0.0032 | 0.0033 | 0.0031 | 0 | 0 | | | |

*.....continued on the next page*

**Appendix 1.** (Continued)

| | ***Hippocampus_ fuscus_* MG875011_Red_ Sea** | ***Hippocampus_ fuscus_* MG8750010_Red_ Sea** | ***Hippocampus_ kuda*_AB983272_ Iran** | ***Hippocampus_ kuda*_ADC09-087_BOLD_ South_Africa** | ***Hippocampus_ kuda*_GU805014_ South_Africa** | ***Hippocampus_ kuda*_GU805015_ South_Africa** | ***Hippocampus_ kuda*_GU805016_ South_Africa** | ***Hippocampus_ kuda*_GU805017_ South_Africa** | ***Hippocampus_ fuscus_* GQ502132_ Tanzania** |
|---|---|---|---|---|---|---|---|---|---|
| ***Hippocampus_kuda_* GU805017_South_ Africa** | 0.0032 | 0.0032 | 0.0033 | 0.0031 | 0 | 0 | 0 | | |
| ***Hippocampus_ fuscus*_GQ502132_ Tanzania** | 0.0048 | 0.0048 | 0.0049 | 0.0047 | 0.0015 | 0.0015 | 0.0015 | 0.0015 | |