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Seahorse Aquaculture, Biology and Conservation: Knowledge Gaps and Research Opportunities

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ABSTRACT

Seahorses are currently experiencing an unprecedented level of anthropogenic pressure promoted by habitat destruction and increasing fishing effort to supply premium markets. The present study provides an overview of the scientific literature on seahorses in the 21st century and critically discusses five major knowledge gaps and research opportunities to advance the state of the art on this research field. The average number of publications per year increased from 10 (2001-2002) to ~40 (2001-2015), the majority addressing issues on seahorse ecology, biology and aquaculture, with the most studied species being *Hippocampus kuda*, *H. guttulatus*, *H. reidi*, *H. abdominalis*, *H. erectus*, *H. hippocampus*, and *H. trimaculatus*. This study explores the opportunity of using seahorses as flagship species to foster mangrove conservation and decrease trawling fisheries. It also suggests that further scientific studies are needed to better understand and manage the populations of the most heavily traded seahorse species, as well as the need to monitor their vulnerability to emerging pollutants and climate change. Sustainable seahorse aquaculture can play an important role in seahorse conservation, as well as in the development of reliable traceability tools to fight the illegal trade of these highly priced organisms.

Keywords: bibliometry, seahorse trade, sustainability, sustainable aquaculture, marine ornamental species, threatened species.

INTRODUCTION

Marine habitats are exposed to an unprecedented level of anthropogenic pressure, including unsustainable fishing, degradation and loss of habitat, pollution and global climate change (Pan et al., 2013). For successful conservation actions and plans, the perception of marine conservation issues must raise awareness on a broader community level. Most threats to marine habitats will only be mitigated through a change in human behaviour through educational and awareness-raising actions, which has been the greatest challenge faced by conservationists (Wright et al., 2015).

Marketing tools have been successfully used to influence human behaviour in favour of conservation (Wright et al., 2015). A common marketing approach in biological conservation is the use of flagship species. Flagship species (*sensu* Heywood, 1995 and Walpole and Leader-Williams, 2002) are species that can be used as symbols in conservation campaigns to raise awareness and funding for specific conservation issues. The use of a particular species (or group of species) as flagship can benefit its conservation and the protection of its habitat and other associated species. Several features may qualify a species as a suitable flagship, as long as it appeals to the target audience, to the conservation issue being addressed and to the local context (Bowen-Jones and Entwistle, 2002; Home et al., 2009; Verissimo et al., 2011). Some charismatic features may favour the selection of a given species as flagship (Home et al., 2009). An example is the seahorses (Shokri et al., 2009; Vincent et al., 2011; Yasue et al., 2012), with their unique morphology similar to ponies and their reproduction mode, in which the males incubate the eggs in an abdominal chamber.

Currently, 54 extant species of seahorses are taxonomically recognized as valid, all within a single genus: *Hippocampus* (according to World Register of Marine Species – available at: <<http://www.marinespecies.org/>>; accessed in March 2016). Most of these species live in association with seagrasses and mangroves, as well as macroalgae, sponges and corals, generally within the shallow waters of tropical and temperate, and exceptionally in deeper habitats regions (Foster and Vincent, 2004; Kuitert, 2009). Seahorses are vulnerable species because of their habitat degradation (Vincent et al., 2011; Harasti, 2016) and also due to the collection of millions of specimens every year to supply the traditional Chinese medicine and, to a lower extent, the marine aquarium and curio trade (Vincent et al., 2011; Foster et al., 2016). Indeed, habitat degradation and the pressure arising from illegal, unreported and unregulated collection of seahorses worldwide prompted the inclusion of all *Hippocampus* species into CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix II in 2002 – a decision that became effective in 2004 (CITES, 2004).

The above rationale is the main driver that encourages scientists worldwide to investigate seahorses. The aim of this study was to provide a critical overview on the scientific literature addressing seahorses in the 21st century and discuss research opportunities and gaps of knowledge on these remarkable organisms.

DATA SURVEY

In March 2016, a survey was conducted using all databases of Thomson ReutersTM Web of ScienceTM (available at: <http://apps.webofknowledge.com>) to collect all references related to seahorses (Actinopterygii: Syngnathidae) published from 2001 to 2015. The term

“seahorse” was used in the “Topic” field to conduct the search. Except for patents, all types of publications (scientific journals, book chapters, meetings abstracts, magazines, and short communications) were used for the analyses. A total of 796 references were retrieved, with each one of them being screened individually to determine whether they were within the scope of this study. Most of the excluded references were studies that used the word seahorse in a context other than the fish (e.g., seahorse extracellular flux analyzer).

Selected references were included in a gross table containing first author, title, year, journal, and country for both the first and last authors (as these are commonly the corresponding authors). If the first authors were affiliated with more than one country, the publication was considered as originating from both of them. The scientific name of the seahorse species studied was also annotated (according to the World Register of Marine Species – available at: <<http://www.marinespecies.org/>>; accessed in March 2016) and each reference was assigned to up to three different research fields. A total of 10 different research fields were selected to assign each reference: aquaculture, biology, conservation, ecology, morphology, pathology, pharmacology, physiology, taxonomy, and trade. The rationale employed to assign a given reference to a specific research field is detailed in Table 1. Whenever the publication did not detail the name of the species being addressed in the title or abstract, and it was not possible to gain access to the original text of the publication, it was registered the name as “Absent”. When studies addressed too many species (more than eight) or was a “broad scope” publication addressing seahorses in a generalist way (e.g., did not detail any species in particular) they were registered as “*Hippocampus* spp.”.

Overall scientific production on seahorses per year was used to assemble a frequency distribution histogram, which also included the cumulative frequency. To provide an overview of the most published topics on seahorses, all titles were plotted in a word cloud (program available at: <http://www.wordclouds.com>; accessed in March 2016). The principle of a word cloud is simple, in which the size of the word is related to its frequency of appearance in the titles of publications. To make the word cloud more informative, the four most repeated (and not informing) words and its derivatives were eliminated: “Hippocampus” (Genus), “Seahorse”, “Syngnathidae”, and “Species”. Popular names, whenever followed by scientific names, were also eliminated.

The percentage of the most studied species and research fields was calculated, as well as the total number of publications produced per country, while also discriminating per research field. Because the percentage of countries to which the 1st and the last author were affiliated was similar (~88%), only the 1st author’s country was used for analysis. Additional histograms of frequency distribution were made to highlight the top 10 journals publishing research on seahorses, as well as which seahorse species have been addressed in scientific literature across different research fields.

To end the critical review of scientific literature of seahorses during the period being covered (2001-2015), five knowledge gaps and research opportunities were identified and guidelines for future studies are presented.

SEAHORSE SCIENTIFIC LITERATURE PUBLISHED IN THE 21ST CENTURY

A total of 423 publications retrieved were relevant for this study and selected for analysis (see Table S1 on supplementary information). In spite of their recognised iconic character,

the knowledge on biology of seahorses was scarce before the present century. Over the past 15 years (2001 to 2015) there has been an increase in the number of scientific publications addressing seahorses, with the average number of publications per year raising from 10 in 2001-2002 to ~40 in 2001-2015 (Fig. 1). This increase in scientific publications may be related to the inclusion of seahorses in CITES Appendix II. The need for scientific data to support regulation and management decisions may have promoted research effort towards seahorse-related topics. Therefore, the inclusion of seahorses in this list has contributed to their conservation (Foster et al., 2016), and scientific knowledge.

Thirty-five species of *Hippocampus* were referenced in at least one of the publications selected for this study, which covers 65% of all extant species of seahorses. Nonetheless, most publications retrieved (76%) are focused on only seven species (~13% of all extant species) (Fig. 2). From these seven species, three are among the most heavily traded, either dried for traditional Chinese medicine (*H. trimaculatus* and *H. kuda*) or live for aquariums (*H. kuda* and *H. reidi*) (Foster et al., 2016). This finding shows a trade-driven research effort on these species. Seahorses were included in traditional Chinese medicine probably more than 600 years ago (Vincent, 1996). The trade of live seahorses for marine aquariums is more recent, dating to the early 1900's, with the beginning of the marine ornamental trade (Vincent, 1996; Wood, 2001). Trade regulation and management claims for scientific data, namely in the fields of ecology and biology (Fig. 2). Thus, it is expected that some of the heavily traded species to be among the ones most addressed by scientific research. Additionally, the increasing demand for knowledge on genus *Hippocampus* may prompt other countries to conduct research on species occurring in their national waters,

even if not significantly traded (e.g., *H. erectus* in the USA, *H. guttulatus* and *H. hippocampus* in EU countries, and *H. abdominalis* in Australia).

The word cloud highlighted the most common words recorded on the titles of the publications selected for this study (Fig. 3). As expected, the names of the seven most studied seahorse species ranked among the most repeated words. Other words highlighted in the word cloud are mostly related to seahorse aquaculture and unique features. Among these, it is possible to see the words “growth”, “juvenile”, “feeding” “survival”, “development”, “fed”, “*Artemia*”, “cultured” and “diet”, which clearly refer to some of the bottlenecks in seahorse aquaculture (e.g., rearing of early life stages) (Koldewey and Martin-Smith, 2010; Olivotto et al., 2011). The growing awareness and concern for the global trade of seahorses and conservation were drivers fostering research reflected by words such as “population”, “conservation”, “trade”, “threatened” and “habitat”. The role of the male in brood care and pregnancy, along with the upright body position displayed by seahorses and their unusual flexibility – for a fish whose body is covered by bony plates – have inspired many studies reflected by the words “male”, “reproductive”, “pregnancy”, “pouch”, “morphological”, and “tail”. Finally, words such as “genetic”, “mitochondrial”, “molecular”, “microsatellite”, and “evolution” were also commonly recorded among titles because of the increasing number of studies using genetic tools for seahorse taxonomy, evolution, population structure, and distribution.

Based on the affiliation country of the first author, forty-three countries published at least one scientific publication addressing seahorse since 2001; however, nine countries accounted for more than 60% of all publications (Fig. 4). Canada and the USA produced the most in this century (Fig. 4). From a continental perspective, Europe represented 33%

of all publications followed by Asia (26%), North America (21%), Oceania (10%), South America (8%), and Africa (1%). Publications on ecology, trade, and conservation were mostly from Canada (Fig. 4). This country held one of the head offices of the Project Seahorse, which is the largest seahorse conservation group in the world. Members of Project Seahorse have contributed a significant number of scientific publications addressing different species of *Hippocampus* (available at: <<http://www.projectseahorse.org/>>; accessed in March 2016). China was the leading country on publications addressing seahorse aquaculture, followed by Spain, the USA, and Australia (Fig. 4). Most scientific studies on seahorse morphology were from Belgium, followed by the USA (Fig. 4). Publications on pathology were mostly from Spain, followed by the USA and India (Fig. 4). Studies on pharmacology were performed only in Asia, where seahorses are used for medicinal purposes.

The *Journal of Fish Biology* (Wiley-Blackwell) and *Aquaculture* (Elsevier Science B.V.) were the scientific journals, indexed in Thomson Reuters™ Web of Science™, which published more studies addressing seahorses in this century, accounting for 17% of all publications on this topic (Fig. 5). *Aquaculture*, *Journal of the World Aquaculture Society* (Wiley-Blackwell), and *Aquaculture Research* (Wiley-Blackwell) published 60% of all publications on seahorse aquaculture.

KNOWLEDGE GAPS AND RESEARCH OPPORTUNITIES

The critical analysis of the information retrieved from this survey revealed five major knowledge gaps and research opportunities that are essential to advance the state of the art on seahorse research: (1) Maximizing the potential of seahorses as flagship species for

marine conservation; (2) Filling knowledge gaps on the most traded seahorse species; (3) Understanding the potential impact of emerging pollutants and climate change on seahorses; (4) Developing a sustainable low-cost aquaculture of seahorses; (5) Improving the traceability of traded seahorses to foster marine conservation.

Maximizing the potential of seahorses as flagship species for marine conservation

The unique morphology and reproduction makes seahorses charismatic animals. These features suggest that they could be good flagship species for marine conservation. Nonetheless, more than charismatic, a flagship species should fit a specific goal on conservation, in line with local context (Bowen-Jones and Entwistle, 2002; Home et al., 2009). According to Verissimo et al. (2011), flagship species are “*species used as the focus of a broader conservation marketing campaign based on its possession of one or more traits that appeal to the target audience.*” Therefore, the question that should be investigated is whether the marketing strategies based on seahorse images are efficient enough to raise awareness on people for a specific conservation issue and allow the raising of enough funding to support it.

Seahorses inhabit many tropical and temperate shallow water habitats around the globe, including coral reefs, mangroves, and seagrass beds (Kuitert, 2009; Foster and Vincent, 2004). These areas are among the most affected areas in the sea, mainly through fishing, pollution, and tourism (Alongi, 2002; Hughes et al., 2003; Waycott et al., 2009). It has been shown that Syngnathids can be efficient flagship species for estuarine seagrass beds conservation, using as rationale that some additional species can also benefit from seahorse conservation (Shokri et al., 2009). Indeed, Project Seahorse also showed the

effective use of seahorses as flagship species through the creation of some marine protected areas in central Philippines (Vincent et al., 2011). Nonetheless, further studies are still needed to link seahorses to their habitats and evaluate the true potential of them as flagship species, as well as on marketing strategies featuring these species. An urgent goal could be the use of seahorses to promote mangrove conservation. Mangroves are recognised as key marine habitats being amongst some of the most threatened tropical ecosystems (Alongi, 2002). Regions where mangroves are inhabited by seahorses (e.g., *H. reidi* in Brazil and *H. kuda* in Southeast Asia) (Foster and Vincent, 2004) should be associated with the species and studies on their potential as flagship to foster habitat conservation should be performed. Another goal that could benefit from seahorse image would be the conservation of coastal seabed through the reduction of destructive trawling fisheries (namely for shrimp). Study the feasibility of raising awareness of wild shrimp consumers by a “seahorse safe” label – developing and promoting fishing practices that do not harm seahorse populations. If costumers change their preference for a product originating from a more responsible fishing practices (e.g. “seahorse safe”), it can certainly affect the whole shrimp supply and value chain, and even benefit other marine species.

Filling knowledge gaps on the most traded seahorse species

Five seahorse species (*H. trimaculatus*, *H. spinosissimus*, *H. kelloggi*, *H. kuda*, and *H. algiricus*) account for more than 90% of the world trade of seahorses (Fig. 6), with most being traded as dried specimens collected from the wild (Foster et al., 2016). Except for *H. kuda*, scientific studies addressing these species are scarce (Fig. 6). On the other hand, *H. kuda* and *H. reidi*, species that are more well represented in the marine aquarium trade,

have greatly been subject to scientific studies, namely in the field of aquaculture (Fig. 6). Even though not significantly traded internationally, *H. erectus*, *H. abdominalis*, *H. guttulatus*, and *H. hippocampus* are often referred as potential species for the marine aquarium trade (Koldewey and Martin-Smith, 2010) and have been widely studied (Fig. 6). Therefore, the aquarium trade has driven scientific research of seahorses, especially their aquaculture (Fig. 6). The higher prices fetched by live specimens, when compared to dried ones (Koldewey and Martin-Smith, 2010), may be the reason of this bias. In some way, it is puzzling that research efforts are not being target towards the most heavily traded species.

Current aquaculture practices are not economically feasible for seahorses demanded by traditional Chinese medicine because of the low market price. Nevertheless, low-cost production of seahorse may be feasible and profitable (Fonseca et al., 2015). Thus, studies addressing the development of low-cost production systems should be prioritized. Additionally, studies addressing the population and fishery biology of the traded species should also be promoted to allow a better management of the fisheries, ensuring the maintenance of natural stocks and species conservation. Except for *H. algiricus* that is from West Africa, all other four most traded seahorse species are distributed across Southeast Asia (Foster and Vincent, 2004). Therefore, research focusing on the topics referred above (aquaculture and population biology) should be encouraged in Asian countries and be prioritized in international funding programs targeting marine conservation.

Transport is one of the highest costs in marine ornamental production, especially in countries where air shipping is necessary. Nevertheless, papers focus on transport of live seahorses are very scarce. An experiment conducted with *H. abdominalis* showed that it can tolerate extensive handling and confinement up to 35 hours of transportation (Wright et

al., 2007). This shows a good opportunity to test the density during transport, since more animals in the same bag would significantly reduce freight. Cunha et al. (2011) showed that essential oil of *Lippia alba* can be an effective anesthetic for slight sedation and transport of *H. reidi*. No information on the effect of the micro environment inside bags is available. Seahorses are very low swimmers, have an efficient visual system, and use their camouflage for protection. Thus, the use of some specific colors background and inert substrates might reduce stress during transport, increasing survival, animal health and welfare. Studies on transportation of traded species are certainly an important avenue for new research. The optimization in this step may bring significant economic benefits and contribute to the animal welfare.

Some highly traded species lack of essential information for conservation. It is widely accepted that seahorse populations are threatened by overexploitation, bycatch, and generalized habitat degradation (Vincent et al., 2011; Harasti, 2016). Nonetheless, 67% of the 40 species included in the IUCN red list are classified as “Data Deficient” (IUCN, 2015-4). Only 11 species are categorised as “Vulnerable” and one as “Endangered” (*H. capensis*) (IUCN, 2015-4). Four of the seven most studied species are within the “Data Deficient” category (Fig. 6). Yet, most traded species are classified as “Vulnerable” (Fig. 6), probably based only on trade and fisheries quantification (Perry et al., 2010). The species *H. reidi* is highly traded for marine aquariums, but is classified as “Data Deficient” although many research efforts have been made to study this species. The “IUCN Seahorse, Pipefish and Stickleback Specialist Group” has developed significant efforts to provide information to improve the conservation of these fish (available at: <https://iucn-seahorse.org>; accessed in May 2016). Nonetheless, there are still knowledge gaps on

growth, maximum size, longevity, reproduction biology, population structure and distribution, and population size of the most traded species. Overall, there are gaps on ecological and biological data from wild populations that needs to be overcome to promote regulations for a more sustainable fishery and conservation. Particularly, studies on time series in wild populations are imperative to ascertain the right assignment among IUCN categories and further conservation plans if required. Currently, there is not enough information to assess the endangerment status for most seahorse species.

Understanding the potential impact of emerging pollutants and climate change on seahorses

The low swimming capacity, small home range and preference for coastal habitats, enhance the vulnerability of seahorses to pollution (Vincent et al., 2011; Delunardo et al., 2013) and susceptibility to climate change (Faleiro et al., 2015). Nevertheless, seahorses may thrive in polluted areas (Tiralongo and Baldacconi, 2014) and even increase their populations (Correia et al., 2015). Exposure to crude oil has been studied in seahorses (Delunardo et al., 2013). The authors reported that crude oil can damage *H. reidi* cells, but that at an exposure of 10 ml/L during a 14-day period was not enough to induce severe gill damage (Delunardo et al., 2013). Others studies revealed that seahorses can bioaccumulate organochlorine pesticide and heavy metals (Nenciu et al., 2014; Zhang et al., 2016), a feature that coupled with their low motility suggests that these organisms can be good bioindicators (Delunardo et al., 2015). Nonetheless, pollution type and its extent may vary in marine habitats and generalizations may lead to pitfalls in decision-making. Thus, it is therefore important to study the effect of pollution on seahorse individuals and populations to understand in which scenarios they might be affected. Additionally, studies should address the bioaccumulation on

seahorses used for traditional Chinese medicine, as pollution could hamper any potential medical benefits or even pose a risk to human health. There is a knowledge gap in ecotoxicology assays evaluating the vulnerability of seahorses to emerging pollutions, such as nanoparticles, microplastic, and drugs.

Climate change can affect fish in different levels, from organisms, to populations, communities, and spatial ecosystems (Koenigstein et al., 2016). The main effects of climate change on oceans is the rising of water temperature, sea level, and acidification. Seahorse low motility might hamper migration from a changing environment, which would require adaptation to survive. The dependency of many seahorse species on adequate substrates, mainly certain species of macroalgae and seagrass, would certainly be affected by the availability of anchoring elements and the composition, density and distribution of natural prey (strongly dependent on the type of vegetation) in temperature rising environments. Therefore, the biogeographical distribution of seahorse species could be altered (Planas et al., 2012). It was demonstrated that the combined effects of ocean warming and acidification negatively affect the behaviour and physiology of adult *H. guttulatus* (Faleiro et al., 2015). Further studies are therefore necessary to monitor the impact of climate change in seahorses because of their unique breeding strategy, and the broad distribution of the genus from temperate to tropical regions, including habitats where fish can be more resistant to climate change (e.g., estuaries) (Perry et al., 2015). Early life stages of some fish show abnormal calcification of otoliths (Munday et al., 2011) and skeleton (Pimentel et al., 2014) when exposed to acidification. The impact on seahorses should be investigated mainly because their bony plates are essential for protection against predation and their prehensile tail plays a key role in their stability in benthic substrates. Moreover, the paternal

osmoregulation of pouch salinity in seahorses (Stölting and Wilson, 2007) is a feature that may also be affected under climate change scenarios and may negatively affect the offspring fitness.

Developing a sustainable low-cost aquaculture of seahorses

Although aquaculture of marine ornamental species is often presented as an option to relieve the collection of specimens from the wild, it can also drive negative environmental and social impacts (Tlusty, 2002). As an example, *H. reidi*, a West Atlantic species that has been mostly cultured in Sri Lanka (Foster et al., 2016), a practice that may promote ecological issues through escapees (Vincent et al., 2011). The increase of captive bred seahorses in the trade (Foster et al., 2016) should make researchers consider the sustainability of these practices as a whole and not solely focus on the reduction of fishing effort targeting natural populations.

Most studies and commercial aquaculture practices of seahorses rely on the use of intensive monoculture systems, with animals being kept in aquariums or tanks under controlled water parameters and being totally depended on exogenous feeding to thrive. A system that depends exclusively on exogenous feeding might be inefficient for species that are difficult to feed, as seahorses have no stomach and this feature can reduce their ability to digest non-natural diets (Palma et al., 2014). Therefore, systems that could somehow allow the provisioning of natural food might be more sustainable than those currently used and even promote better results. An example is the cage-culture approach within an integrated multi-trophic aquaculture (IMTA) system. Some seahorse species can support a relatively high range of salinity (euryhaline) and temperature (eurythermal) (Hilomen-

Garcia et al., 2003; Wong and Benzie, 2003; Curtis and Vincent, 2005; Lin et al., 2009; Hora et al., 2016), which makes them good candidates for cage-culture production in coastal areas, including coastal lagoons and estuaries. The natural growth of a periphyton-based community in the nets of grow-out cages, along with the natural flow-through of wild plankton, are suitable sources of natural food. Pilot trials have reported promising results during the grow-out of *H. reidi* in floating cages inside ponds destined for penaeid shrimp and oyster production (Fonseca et al., 2015). The authors reported a mean survival of ~80%, with seahorses attaining commercial size (7-8 cm) within approximately three months at a density of 40 ind.m⁻³ and without the input of any exogenous food. By growing *H. reidi* in an IMTA system already used to address the production of penaeid shrimp and oysters, seahorse aquaculture could be labelled as low-cost and economically feasible (Fonseca et al., 2015). Xu et al. (2010) have also shown that the integration of macroalgae (*Chaetomorpha* sp) grow-out in the production system increases survival and growth of juvenile *H. erectus*. Future studies addressing low-cost production systems should be supported, as this approach can also provide an opportunity to low-income coastal communities and make conservation efforts more perceptible at a local and regional scale. By enrolling local communities into such aquaculture practices, it can be possible to contribute towards a decrease of illegal, unregulated, and undeclared collection of seahorses from the wild and enhance environmental and social sustainability. Such enrolment would certainly require a simplification of the rearing system.

Improving the traceability of traded seahorses to foster marine conservation

Seahorses are the only group of marine ornamental fish traded to supply the aquarium industry that is currently included in CITES Appendix II (Vincent et al., 2014; Foster et al., 2016). This aspect puts seahorses in the forefront of trade regulations and management disputes. Nonetheless, there is still a substantial mismatch in species and volumes reported by CITES export and import records (Foster et al., 2016), with no method being currently available to confirm the origin of collection, nor to differentiate wild-caught from captive bred seahorses. Recently, the export of *H. algiricus*, one of the top five most traded species (Foster et al., 2016), was banned from Senegal and Guinea (Project Seahorse, 2016) and further restrictions can be anticipated to the trade of others seahorse species in the future. As captive cultured specimens are under less restricting regulations, these may be an alternative to fulfil demand. Nonetheless, without a reliable traceability toolbox, neither cultured specimens, nor those originating from sustainable collection, can be successfully discriminated from specimens illegally poached from the wild. Traceability is essential to enforce any conservation effort and avoid the collapse of their trade and the socio-economic impacts this scenario may pose (Cohen et al., 2013).

Before fine tuning traceability methods for seahorses, it is essential to identify the end market. Seahorses have two key and very distinct markets: the trade of millions of dried specimens for human consumption (traditional Chinese medicine) and the trade of thousands of live specimens for marine aquariums (Foster et al., 2016). Clearly, this dichotomy between markets requires different traceability methods and strategies for their implementation. The traceability of dried seahorses may be more easily achieved through the use of geochemical, biochemical, and molecular approaches already described for the seafood supply chain (Leal et al., 2015). Two studies highlighted the possibility to sample

tissues from partial fin-clipping of seahorses for molecular and stable isotopes analysis (Valladares and Planas, 2012; Woodall et al., 2012). Nonetheless, the drying process of specimens may affect the reliability of some of these methods and further studies are required to validate their use. The fatty acid profile is a promising tool for geographical traceability of seafood (Leal et al., 2015), and might be suitable to trace dried seahorse. Previous biochemical analysis showed significant difference on fatty acids composition among six seahorse species from the coast of China (Lin et al., 2008). Recently, Shen et al. (2016) developed and validated a sensitive and specific lipidomic protocol for the detection of phospholipids in dried seahorses. The authors were able to differentiate five wild species of dried seahorse based on phospholipid class. Therefore, future studies should investigate the reliability of this method to differentiate wild seahorses from captive bred ones, and to differentiate specimens from the same species originating from different origins (regions or farms). Concerning the trade of live seahorses to supply marine aquariums worldwide, the production of different colour morphs and shapes through hybridization might be a good way to differentiate captive bred seahorses. Two scientific studies reported interspecific hybridization in seahorses so far, one between male *H. algiricus* and female *H. hippocampus* (Otero-Ferrer et al., 2015), and other between male *H. erectus* and female *H. redi* (Ho et al., 2015). This method however poses environmental risks due to potential escapees (Cohen et al., 2013). The use of bacterial communities-based signatures present in fish mucus for their origin traceability has been addressed for marine fish in general (Leal et al., 2015) and marine ornamentals in particular (Cohen et al., 2013). The only study available to date on the phylogenetic characterization of bacterial communities associated with seahorses showed that the microbiological composition of the cutaneous mucus and

that of both the surrounding seawater and the live food differ significantly (Balcázar et al., 2010). The low motility of seahorses may favour the use of this approach to differentiate wild populations, as well as wild and cultured specimens, in a non-invasive and non-destructive way. It is reasonable to assume that even in the wild, seahorses would stay in the same geographic area long enough to develop a local-specific bacterial signature in their mucus that may be used for traceability. With the advent of a reliable traceability method for seahorses, certification and eco-labelling could be implemented by CITES to trace animals throughout the whole supply chain, supporting a conscious and more sustainable trade.

CONCLUDING REMARKS

A multitude of factors may motivate researchers to study seahorses. Nonetheless, it is important to flag the paramount research fields to advance the state of the art to subsidize decision makers to address the issues affecting production, trade and upkeep the natural populations. This study highlights five knowledge gaps and research opportunities that can generate information to supply dry and live markets and promote seahorse conservation. Overall, a well-managed and sustainable trade of these emblematic marine organisms includes sustainable fisheries and aquaculture. Research should provide science-based information to develop a sustainable industry. This can contribute to marine conservation and foster socio-economic activities in developing regions.

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Figure 1. Number of scientific publications addressing seahorses retrieved from Thomson ReutersTM Web of ScienceTM (all databases) from 2001 to 2015. Bars show the number of publications per year and the line shows the cumulative number of publications.

Figure 2. Percentage of scientific publications addressing each seahorse species (Orange – left) and the most studied research fields (Blue – right) based on data retrieved from 423 scientific publications using Thomson Reuters™ Web of Science™ (all databases) from 2001 to 2015. Note: some publications addressed more than one species and/or field.

Figure 4. Number of scientific publications addressing seahorses ranked by country and their main field of study based on data retrieved from Thomson Reuters™ Web of Science™ (all databases) from 2001 to 2015.

Figure 5. Top 10 scientific journals publishing scientific research on seahorses retrieved from Thomson Reuters™ Web of Science™ (all databases) from 2001 to 2015.

Figure 6. Number of scientific publications for the most studied and traded species of seahorses according to Thomson Reuters™ Web of Science™ (all databases) from 2001 to 2015. The risk of extinction for each species is indicated according to IUCN red list: VU = Vulnerable; and DD = Data Deficient. Total number of publication for each species – all studied fields included – is indicated in the boxes. Trade percentage was retrieved from Foster et al. (2016), which is an estimated mean of annual trade volume from CITES Trade Database (2004-2011).

Table 1. Criteria employed to assign each reference addressing seahorses retrieved from Thomson ReutersTM Web of ScienceTM (all databases) from 2001 to 2015 to a given research field.

Research fields	Criteria
Aquaculture	Refers to the culture of seahorse in captivity.
Biology	Refers to behavior, growth, reproductive biology, and mating system of seahorses.
Conservation	Refers to seahorse conservation.
Ecology	Refers to population, habitats, distribution, migration, abundance, population dynamics, and natural diet.
Morphology	Refers to the description and function of body parts, morphological development, muscles, and skeletons.
Pathology	Refers to bacteria, virus, fungus or any other pathogen isolated from seahorses.
Pharmacology	Refers to seahorse extract and compounds such as peptides, glycoproteins, and antioxidants.
Physiology	Refers to seahorse metabolism, biochemistry, and general physiology, including studies of ecotoxicology.
Taxonomy	Refers to species description and identification, including works with phylogeny.
Trade	Refers to the seahorse trade.

Supplementary Table S1. All 423 references addressing seahorses retrieved from Thomson Reuters™ Web of Science™ (all databases) from 2001 to 2015 in March 2016.

1 st Author	Year	Title	Source	Seahorse Species Addressed		
Adriaens, D.	2015	Computer modelling and biomimetics for understanding the evolution of tail grasping in seahorses	Faseb Journal	Absent		
Aylesworth, L. A.	2015	Regional-scale patterns of habitat preference for the seahorse <i>Hippocampus reidi</i> in the tropical estuarine environment	Aquatic Ecology	<i>H. reidi</i>		
Bathige, S. D. N. K.	2015	Characterization of Mitochondrial Heat Shock Protein 75 (mtHSP75) of the Big-belly Seahorse <i>Hippocampus abdominalis</i>	Korean Journal of Fisheries and Aquatic Sciences	<i>H. abdominalis</i>		
Blanco, A.	2015	Mouth Growth and Prey Selection in Juveniles of the European Long-snouted Seahorse, <i>Hippocampus guttulatus</i>	Journal of the World Aquaculture Society	<i>H. guttulatus</i>		
Boehm, J. T.	2015	Population Genomics Reveals Seahorses (<i>Hippocampus erectus</i>) of the Western Mid-Atlantic Coast to Be Residents Rather than Vagrants	Plos One	<i>H. erectus</i>		
Boylan, S. M.	2015	Liquid nitrogen cryotherapy for fibromas in tarpon, <i>Megalops atlanticus</i> , Valenciennes 1847, and neoplasia in lined sea horse, <i>Hippocampus erectus</i> , Perry 1810	Journal of Fish Diseases	<i>H. erectus</i>		
Buen-Ursua, S. M. A.	2015	Improved reproductive performance of tiger tail seahorse, <i>Hippocampus comes</i> , by mysid shrimp fed singly or in combination with other natural food	Aquaculture International	<i>H. comes</i>		
Cariello Delunardo, F. A.	2015	Seahorse (<i>Hippocampus reidi</i>) as a bioindicator of crude oil exposure	Ecotoxicology and Environmental Safety	<i>H. reidi</i>		
Caspermeyer, J.	2015	Unraveling the Genetic Basis of Seahorse Male Pregnancy	Molecular Biology and Evolution	<i>H. abdominalis</i>		
Chen, L.	2015	The genus <i>Hippocampus</i> -A review on traditional medicinal uses, chemical constituents and pharmacological properties	Journal of Ethnopharmacology	<i>H. spp.</i>		
Chen, L.	2015	A Comparative Study of the Effects upon LPS Induced Macrophage RAW264.7 Inflammation in vitro of the Lipids of <i>Hippocampus trimaculatus</i> Leach	Journal of Oleo Science	<i>H. trimaculatus</i>		
Correia, M.	2015	Effects of artificial holdfast units on seahorse density in the Ria Formosa lagoon, Portugal	Journal of Experimental Marine Biology and Ecology	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Correia, M.	2015	Seahorse (<i>Hippocampinae</i>) population fluctuations in the Ria Formosa Lagoon, south Portugal	Journal of Fish Biology	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Corse, E.	2015	Analysis of the diet of the long-snouted seahorse <i>Hippocampus guttulatus</i> by 18SrDNA amplification of prey in faeces	Aquaculture Nutrition	<i>H. guttulatus</i>		
Fedrizzi, N.	2015	Population Genetic Structure of the Dwarf Seahorse (<i>Hippocampus zosterae</i>) in Florida	Plos One	<i>H. zosterae</i>		
Gristina, M.	2015	Abundance, distribution and habitat preference of <i>Hippocampus guttulatus</i> and <i>Hippocampus hippocampus</i> in a semi-enclosed central Mediterranean marine area	Marine Ecology-an Evolutionary Perspective	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Kolberg, J.	2015	<i>Mesonia hippocampi</i> sp nov., isolated from the brood pouch of a diseased Barbour's Seahorse (<i>Hippocampus barbouri</i>)	International Journal of Systematic and Evolutionary Microbiology	<i>H. barbouri</i>		
Lawson, J. M.	2015	Novel life-history data for threatened seahorses provide insight into fishery effects	Journal of Fish Biology	<i>H. kelloggi</i>	<i>H. spinosissimus</i>	<i>H. trimaculatus</i>
Lee, J.	2015	Molecular Genetic Characterization and Analysis of Glucocorticoid Receptor Expression in the Big-belly Seahorse <i>Hippocampus abdominalis</i>	Korean Journal of Fisheries and Aquatic Sciences	<i>H. abdominalis</i>		
LePage, V.	2015	Diseases of captive yellow seahorse <i>Hippocampus kuda</i> Bleeker, potbellied seahorse <i>Hippocampus abdominalis</i> Lesson and weedy seadragon <i>Phyllopteryx taeniolatus</i> (Lacepede)	Journal of Fish Diseases	<i>H. kuda</i>	<i>H. abdominalis</i>	

Li, F.	2015	Comparison of the Intestinal Bacterial Flora in Healthy and Intestinal-diseased Seahorses <i>Hippocampus trimaculatus</i> , <i>Hippocampus erectus</i> , and <i>Hippocampus spinosissimus</i>	Journal of the World Aquaculture Society	<i>H. erectus</i>	<i>H. spinosissimus</i>	<i>H. trimaculatus</i>						
Lim, A. C. O.	2015	Sound production in the tiger-tail seahorse <i>Hippocampus comes</i> : Insights into the sound producing mechanisms	Journal of the Acoustical Society of America	<i>H. comes</i>								
Lopez, A.	2015	Conservation Genetics of Threatened <i>Hippocampus guttulatus</i> in Vulnerable Habitats in NW Spain: Temporal and Spatial Stability of Wild Populations with Flexible Polygamous Mating System in Captivity	Plos One	<i>H. guttulatus</i>								
Luo, W.	2015	A novel method for the identification of seahorses (genus <i>Hippocampus</i>) using cross-species amplifiable microsatellites	Fisheries Research	<i>H. histrix</i>	<i>H. mohnikei</i>	<i>H. trimaculatus</i>	<i>H. kelloggi</i>	<i>H. kuda</i>	<i>H. comes</i>	<i>H. barbouri</i>	<i>H. spinosissimus</i>	
Novelli, B.	2015	Development of seahorse (<i>Hippocampus reidi</i> , Ginsburg 1933): histological and histochemical study	Fish Physiology and Biochemistry	<i>H. reidi</i>								
Otero-Ferrer, F.	2015	Spatial and seasonal patterns of European short-snouted seahorse <i>Hippocampus hippocampus</i> distribution in island coastal environments	African Journal of Marine Science	<i>H. hippocampus</i>								
Otero-Ferrer, F.	2015	First records of <i>Hippocampus algiricus</i> in the Canary Islands (north-east Atlantic Ocean) with an observation of hybridization with <i>Hippocampus hippocampus</i>	Journal of Fish Biology	<i>H. algiricus</i>	<i>H. hippocampus</i>							
Park, J. M.	2015	Length-weight relationships and reproductive characteristics of the crowned seahorse (<i>Hippocampus coronatus</i>) in eelgrass beds (<i>Zostera marina</i>) of Dongdae Bay, Korea	Marine Biology Research	<i>H. coronatus</i>								
Porter, M. M.	2015	Bioexploration: How engineering designs help elucidate the evolution of seahorse tails	Integrative and Comparative Biology	Absent								
Porter, M. M.	2015	Why the seahorse tail is square	Science	Absent								
Segade, A.	2015	Effects of the diet on seahorse (<i>Hippocampus hippocampus</i>) growth, body colour and biochemical composition	Aquaculture Nutrition	<i>H. hippocampus</i>								
Su, Y.	2015	Study on the extraction and purification of glycoprotein from the yellow seahorse, <i>Hippocampus kuda</i> Bleeker	Food Science & Nutrition	<i>H. kuda</i>								
Thuong, T. D.	2015	Rearing the spotted seahorse <i>Hippocampus kuda</i> by feeding live and frozen copepods collected from shrimp ponds	Aquaculture Research	<i>H. kuda</i>								
Wang, B.	2015	Complete mitochondrial genome sequence of the Barbour's seahorse <i>Hippocampus barbouri</i> Jordan & Richardson, 1908 (Gasterosteiformes: Syngnathidae)	Mitochondrial DNA	<i>H. barbouri</i>								
Whittington, C. M.	2015	Seahorse Brood Pouch Transcriptome Reveals Common Genes Associated with Vertebrate Pregnancy	Molecular Biology and Evolution	<i>H. abdominalis</i>								
Woodall, L. C.	2015	Past and present drivers of population structure in a small coastal fish, the European long snouted seahorse <i>Hippocampus guttulatus</i>	Conservation Genetics	<i>H. guttulatus</i>								
Yasue, M.	2015	Monitoring landed seahorse catch in a changing policy environment	Endangered Species Research	<i>H. comes</i>								
Yip, M. Y.	2015	Food and feeding habits of the seahorses <i>Hippocampus spinosissimus</i> and <i>Hippocampus trimaculatus</i> (Malaysia)	Journal of the Marine Biological Association of the United Kingdom	<i>H. spinosissimus</i>	<i>H. trimaculatus</i>							
Zhang, D.	2015	A Comparison of Growth, Survival, and Fatty Acid Composition of the Lined Seahorse, <i>Hippocampus erectus</i> , Juveniles Fed Enriched Artemia and a Calanoid Copepod, <i>Schmackeria dubia</i>	Journal of the World Aquaculture Society	<i>H. erectus</i>								
Zhang, Y.	2015	Complete mitochondrial genome sequence of the lined seahorse <i>Hippocampus erectus</i> Perry, 1810 (Gasterosteiformes: Syngnathidae)	Mitochondrial DNA	<i>H. erectus</i>								
Zhang, Y.	2015	Growth, Survivorship, Air-bubble Disease, and Attachment of Feeble Juvenile Seahorses, <i>Hippocampus kuda</i> (Bleeker, 1852)	Journal of the World Aquaculture Society	<i>H. kuda</i>								
Basusta, A.	2014	Length-Weight Relationship and Condition Factor of <i>Hippocampus hippocampus</i> and <i>Hippocampus guttulatus</i> Inhabiting Eastern Black Sea	Pakistan Journal of Zoology	<i>H. hippocampus</i>	<i>H. guttulatus</i>							
Blanco, A.	2014	Implications of physical key factors in the early rearing of the long-snouted seahorse <i>Hippocampus guttulatus</i>	Aquaculture	<i>H. guttulatus</i>								
Chakraborty, B.	2014	Characterization of Yellow Seahorse <i>Hippocampus kuda</i> feeding click sound signals in a laboratory environment: an application of probability density function and power spectral density analyses	Bioacoustics-the International Journal of Animal Sound and Its Recording	<i>H. kuda</i>								

Correia, M.	2014	The use of a non-invasive tool for capture-recapture studies on a seahorse <i>Hippocampus guttulatus</i> population	Journal of Fish Biology	<i>H. guttulatus</i>			
Declercq, A. M.	2014	White necrotic tail tips in estuary seahorses, <i>Hippocampus kuda</i> , Bleeker	Journal of Fish Diseases	<i>H. kuda</i>			
Edelstein, L. W.	2014	An evo-devo study of evolutionary novelties: the origin of the seahorse tail	Integrative and Comparative Biology	<i>H. zosterae</i>			
Franz-Ondendaal, T. A.	2014	Comparative developmental osteology of the seahorse skeleton reveals heterochrony amongst <i>Hippocampus</i> sp and progressive caudal fin loss	EvoDevo	<i>H. reidi</i>	<i>H. subelongatus</i>	<i>H. zosterae</i>	
Gonzalez, R.	2014	Genetic evidence and new morphometric data as essential tools to identify the Patagonian seahorse <i>Hippocampus patagonicus</i> (Pisces, Syngnathidae)	Journal of Fish Biology	<i>H. patagonicus</i>			
Gonzalez, R.	2014	Reply to Luzzatto et al. (2014): "Comment on 'Genetic evidence and new morphometric data as essential tools to identify the Patagonian seahorse <i>Hippocampus patagonicus</i> (Pisces, Syngnathidae), Gonzalez et al. (2014)'"	Journal of Fish Biology	<i>H. patagonicus</i>			
Harasti, D.	2014	Does a No-Take Marine Protected Area Benefit Seahorses?	Plos One	<i>H. whitei</i>			
Harasti, D.	2014	Ontogenetic and sex-based differences in habitat preferences and site fidelity of White's seahorse <i>Hippocampus whitei</i>	Journal of Fish Biology	<i>H. whitei</i>			
Haris, K.	2014	Multifractal detrended fluctuation analysis to characterize phase couplings in seahorse (<i>Hippocampus kuda</i>) feeding clicks	Journal of the Acoustical Society of America	<i>H. kuda</i>			
Jiang, Z.	2014	Preparation process of active enzymolysis polypeptides from seahorse bone meal	Food science & nutrition	<i>H. trimaculatus</i>			
Kasapoglu, Nazli	2014	Some Population Characteristics of Long-snouted Seahorse (<i>Hippocampus guttulatus</i> Cuvier, 1829) (Actinopterygii: Syngnathidae) in the Southeastern Black Sea	Acta Zoologica Bulgarica	<i>H. guttulatus</i>			
Luis Balcazar, J.	2014	<i>Mycobacterium hippocampi</i> sp nov., a Rapidly Growing Scotochromogenic Species Isolated from a Seahorse with Tail Rot	Current Microbiology	<i>H. guttulatus</i>			
Luzzatto, D. C.	2014	Comment on 'Genetic evidence and new morphometric data as essential tools to identify the Patagonian seahorse <i>Hippocampus patagonicus</i> (Pisces, Syngnathidae) by Gonzalez et al. (2014)'	Journal of Fish Biology	<i>H. patagonicus</i>			
Nenciu, M. I.	2014	Pollutant bioaccumulation in the Long-Snouted Seahorse at the Romanian Coast	Journal of Environmental Protection and Ecology	<i>H. guttulatus</i>			
Neutens, C.	2014	Grasping convergent evolution in syngnathids: a unique tale of tails	Journal of Anatomy	<i>H. reidi</i>	<i>H. capensis</i>	<i>H. abdominalis</i>	<i>H. breviceps</i>
Ofelio, C.	2014	Isolation and molecular identification of the scuticociliate <i>Porpostoma notata</i> Moebius, 1888 from moribund reared <i>Hippocampus hippocampus</i> (L.) seahorses, by amplification of the SSU rRNA gene sequences	Journal of Fish Diseases	<i>H. hippocampus</i>			
Oliveira, T. P. R.	2014	Sounds produced by the longsnout seahorse: a study of their structure and functions	Journal of Zoology	<i>H. reidi</i>			
Otero-Ferrer, F.	2014	Embryonic developmental plasticity in the long-snouted seahorse (<i>Hippocampus reidi</i> , Ginsburg 1933) in relation to parental preconception diet	Reproduction, fertility, and development	<i>H. reidi</i>			
Palma, J.	2014	The effect of diet on ontogenic development of the digestive tract in juvenile reared long snout seahorse <i>Hippocampus guttulatus</i>	Fish Physiology and Biochemistry	<i>H. guttulatus</i>			
Praet, T.	2014	Understanding the mechanics of tail grasping in seahorses using a parametrized computer model	Integrative and Comparative Biology	Absent			
Qin, G.	2014	Effects of water current on swimming performance, ventilation frequency, and feeding behavior of young seahorses (<i>Hippocampus erectus</i>)	Journal of Experimental Marine Biology and Ecology	<i>H. erectus</i>			
Rose, E.	2014	Genetic Evidence for Monogamy in the Dwarf Seahorse, <i>Hippocampus zosterae</i>	Journal of Heredity	<i>H. zosterae</i>			
Saavedra, M.	2014	Dietary fatty acid enrichment increases egg size and quality of yellow seahorse <i>Hippocampus kuda</i>	Animal Reproduction Science	<i>H. kuda</i>			
Sanaye, S. V.	2014	Evaluation of antioxidant activities in captive-bred cultured yellow seahorse, <i>Hippocampus kuda</i> (Bleeker, 1852)	Aquaculture	<i>H. kuda</i>			

Sánchez-Cardozo, L. M.	2014	Efecto de la dieta en el crecimiento y supervivencia de crías de caballito de mar <i>Hippocampus reidi</i> em condicionaes de laboratorio	Boletín de Investigaciones Marinas y Costeras - INVEMAR	<i>H. reidi</i>		
Shin, S. Y.	2014	Seahorse-derived peptide suppresses invasive migration of HT1080 fibrosarcoma cells by competing with intracellular α -enolase for plasminogen binding and inhibiting uPA-mediated activation of plasminogen	BMB Reports	<i>H. kuda</i>		
Silveira, R. B.	2014	Morphological and molecular evidence for the occurrence of three <i>Hippocampus</i> species (Teleostei: Syngnathidae) in Brazil	Zootaxa	<i>H. erectus</i>	<i>H. patagonicus</i>	<i>H. reidi</i>
Song, H.	2014	Complete mitochondrial genome sequence of the thorny seahorse <i>Hippocampus histrix</i> (Gasterosteiformes: Syngnathidae)	Mitochondrial DNA	<i>H. histrix</i>		
Song, H. Y.	2014	Mitogenomic circumscription of a novel percomorph fish clade mainly comprising "Syngnathoider" (Teleostei)	Gene	<i>H. kuda</i>		
Subburaman, S.	2014	First distributional record of the giraffe seahorse, <i>Hippocampus camelopardalis</i> Bianconi 1854 (Family: Syngnathidae) from Gulf of Kachchh waters, North west coast of India	Indian Journal of Geo-Marine Sciences	<i>H. camelopardalis</i>		
Tiralongo, F.	2014	A conspicuous population of the Long-Snouted seahorse, <i>Hippocampus guttulatus</i> (ACTINOPTERYGII: SYNGNATHIFORMES: SYNGNATHIDAE), in a highly pollut mediterranean Coastal Lagoon	Acta Ichthyologica Et Piscatoria	<i>H. guttulatus</i>		
Valladares, S.	2014	First records of the seahorse <i>Hippocampus hippocampus</i> in Galician waters (NW Spain)	Cybiurn	<i>H. hippocampus</i>		
Van Wassenbergh, S.	2014	New Insights into Muscle Function during Pivot Feeding in Seahorses	Plos One	<i>H. kuda</i>	<i>H. reidi</i>	
Vieira, R. P.	2014	Length-weight relationships of six syngnathid species from Ria Formosa, SW Iberian coast	Cahiers De Biologie Marine	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Vincent, A. C. J.	2014	The role of CITES in the conservation of marine fishes subject to international trade	Fish and Fisheries	<i>H. spp.</i>		
Vite-Garcia, N.	2014	Growth and survival of <i>Hippocampus erectus</i> (Perry, 1810) juveniles fed on Artemia with different HUFA levels	Latin American Journal of Aquatic Research	<i>H. erectus</i>		
Vite-Garcia, N.	2014	Assessment of lipid classes and fatty acid levels in wild newborn seahorses (<i>Hippocampus erectus</i>) (Perry 1810): implications for survival and growth in aquarium culture	Marine and Freshwater Behaviour and Physiology	<i>H. erectus</i>		
Williams, S. L.	2014	Ornamental Marine Species Culture in the Coral Triangle: Seahorse Demonstration Project in the Spermonde Islands, Sulawesi, Indonesia	Environmental Management	<i>H. barbouri</i>		
Xu, Dong-Hui	2014	Protective effects of seahorse extracts in a rat castration and testosterone-induced benign prostatic hyperplasia model and mouse oligospermatisim model	Environmental Toxicology and Pharmacology	<i>H. trimaculatus</i>	<i>H. kuda</i>	
Zhang, Y.	2014	Genetic Variations in Two Seahorse Species (<i>Hippocampus mohnikei</i> and <i>Hippocampus trimaculatus</i>): Evidence for Middle Pleistocene Population Expansion	Plos One	<i>H. trimaculatus</i>	<i>H. mohnikei</i>	
Anderson, P. A.	2013	Mixed Metazoan and Bacterial Infection of the Gas Bladder of the Lined Seahorse-A Case Report	Journal of Aquatic Animal Health	<i>H. erectus</i>		
Anderson, P. A.	2013	Acoustic characterization of seahorse tank environments in public aquaria: A citizen science project	Aquacultural Engineering	<i>H. spp.</i>		
Aurelio, M.	2013	Physiological and behavioral responses of temperate seahorses (<i>Hippocampus guttulatus</i>) to environmental warming	Marine Biology	<i>H. guttulatus</i>		
Boehm, J. T.	2013	Marine dispersal and barriers drive Atlantic seahorse diversification	Journal of Biogeography	<i>H. erectus</i>	<i>H. patagonicus</i>	<i>H. hippocampus</i>
Caldwell, I. R.	2013	A sedentary fish on the move: effects of displacement on long-snouted seahorse (<i>Hippocampus guttulatus</i> Cuvier) movement and habitat use	Environmental Biology of Fishes	<i>H. guttulatus</i>		
Cariello Delunardo, F. A.	2013	Genotoxic and morphological damage in <i>Hippocampus reidi</i> exposed to crude oil	Ecotoxicology and Environmental Safety	<i>H. reidi</i>		
Chang, Chia-Hao	2013	The complete mitochondrial genome of the tiger tail seahorse, <i>Hippocampus comes</i> (Teleostei, Syngnathidae)	Mitochondrial DNA	<i>H. comes</i>		
Correia, Miguel	2013	Can artificial holdfast units work as a habitat restoration tool for long-snouted seahorse (<i>Hippocampus guttulatus</i> Cuvier)?	Journal of Experimental Marine Biology and Ecology	<i>H. guttulatus</i>		

Di Cicco, E.	2013	Scuticociliatid ciliate outbreak in Australian Pot-Bellied seahorse, <i>Hippocampus abdominalis</i> (Lesson, 1827): Clinical signs, histopathologic findings, and treatment with metronidazole	Journal of Zoo and Wildlife Medicine	<i>H. abdominalis</i>				
Faleiro, Filipa	2013	Preypredator dynamics in seahorses (<i>Hippocampus guttulatus</i>): deciphering fatty acid clues	Aquaculture Research	<i>H. guttulatus</i>				
Faleiro, Filipa	2013	The disadvantages of mating outside home: How breeding in captivity affects the reproductive success of seahorses?	Journal of Sea Research	<i>H. guttulatus</i>				
Freret-Meurer, N. V.	2013	Seahorse fingerprints: a new individual identification technique	Environmental Biology of Fishes	<i>H. reidi</i>				
Garcia-Manchon, J.	2013	First feeding regimes for long-snout seahorse <i>Hippocampus reidi</i> larvae	Communications in agricultural and applied biological sciences	<i>H. reidi</i>				
Gemmell, B. J.	2013	Morphology of seahorse head hydrodynamically aids in capture of evasive prey	Nature Communications	<i>H. zosterae</i>				
Harasti, D.	2013	Does underwater flash photography affect the behaviour, movement and site persistence of seahorses?	Journal of Fish Biology	<i>H. whitei</i>				
Laksanawimol, P.	2013	Trade of seahorses, <i>Hippocampus</i> spp. (ACTINOPTERYGII: SYNGNATHIFORMES: SYNGNATHIDAE), on the East Coast of the Gulf of Thailand	Acta Ichthyologica Et Piscatoria	<i>H. mohnikei</i>	<i>H. spinosissimus</i>	<i>H. kuda</i>	<i>H. trimaculatus</i>	
Lewisch, E.	2013	Occurrence of nephrolithiasis in a population of longsnout seahorse, <i>Hippocampus reidi</i> Ginsburg, and analysis of a nephrolith	Journal of Fish Diseases	<i>H. reidi</i>				
Luzzatto, D. C.	2013	Rafting seahorses: the presence of juvenile <i>Hippocampus patagonicus</i> in floating debris	Journal of Fish Biology	<i>H. patagonicus</i>				
Maia, A.	2013	How seahorses hang on to their life	Integrative and Comparative Biology	Absent				
Melo-Valencia, A. F.	2013	Efecto de la salinidad em la supervivencia y crecimiento de crias de Caballito de mar <i>Hippocampus reidi</i> Ginsburg em cautiveiro	Boletín de Investigaciones Marinas y Costeras - INVEMAR	<i>H. reidi</i>				
Morgan, S. K.	2013	Life-history reference points for management of an exploited tropical seahorse	Marine and Freshwater Research	<i>H. comes</i>				
Murugan, A.	2013	Preliminary observation on breeding three spotted seahorse, <i>Hippocampus trimaculatus</i> (Leach, 1814), solely fed with wild caught amphipods under ex - situ condition	Indian Journal of Animal Sciences	<i>H. trimaculatus</i>				
Muth, M.	2013	Use of anesthetics on seahorses: Are intrageneric dose correlations possible	Abstracts of Papers of the American Chemical Society	Absent				
Nenciu, M. I.	2013	Characterisation of the environmental conditions of the Long-Snouted seahorse habitat of the Romanian Coast	Journal of Environmental Protection and Ecology	<i>H. guttulatus</i>				
Neutens, C.	2013	Evolutionary morphology of the prehensile tail in syngnathid fishes: from pipefish to seahorse	Integrative and Comparative Biology	Absent				
Pangestuti, R.	2013	Optimization of hydrolysis conditions, isolation, and identification of neuroprotective peptides derived from seahorse <i>Hippocampus trimaculatus</i>	Amino Acids	<i>H. trimaculatus</i>				
Pham, N. K.	2013	The Effects of Different Feed Enrichments on Survivorship and Growth of Early Juvenile Longsnout Seahorse, <i>Hippocampus reidi</i>	Journal of the World Aquaculture Society	<i>H. reidi</i>				
Planas, M.	2013	Maturation of <i>Hippocampus guttulatus</i> and <i>Hippocampus hippocampus</i> females by manipulation of temperature and photoperiod regimes	Aquaculture	<i>H. hippocampus</i>	<i>H. guttulatus</i>			
Porter, M. M.	2013	Highly deformable bones: Unusual deformation mechanisms of seahorse armor	Acta Biomaterialia	<i>H. kuda</i>				
Souza-Santos, L. P.	2013	Prey selection of juvenile seahorse <i>Hippocampus reidi</i>	Aquaculture	<i>H. reidi</i>				
Van Wassenbergh, S.	2013	Mechanics of snout expansion in suction-feeding seahorses: musculoskeletal force transmission	Journal of Experimental Biology	<i>H. reidi</i>				
Whittington, C. M.	2013	Behavioural cues of reproductive status in seahorses <i>Hippocampus abdominalis</i>	Journal of Fish Biology	<i>H. abdominalis</i>				
김성용	2013	First Record of <i>Hippocampus sindonis</i> (Syngnathiformes: Syngnathidae) from Korea	Korean Journal of Ichthyology	<i>H. sindonis</i>				

Anderson, P. A.	2012	Sexual Dimorphism in Morphometry and Allometry of the Adult Lined Seahorse, <i>Hippocampus erectus</i>	Copeia	<i>H. erectus</i>	
Bahr, A.	2012	Mutual mate choice in the potbellied seahorse (<i>Hippocampus abdominalis</i>)	Behavioral Ecology	<i>H. abdominalis</i>	
Blanco, A.	2012	First observations of conjoined twins in newborn seahorses, <i>Hippocampus guttulatus</i> Cuvier	Journal of Fish Diseases	<i>H. guttulatus</i>	
Caldwell, I. R.	2012	Revisiting two sympatric European seahorse species: apparent decline in the absence of exploitation	Aquatic Conservation-Marine and Freshwater Ecosystems	<i>H. guttulatus</i>	<i>H. hippocampus</i>
Celino, F. T.	2012	Feeding selectivity of the seahorse, <i>Hippocampus kuda</i> (Bleeker), juveniles under laboratory conditions	Aquaculture Research	<i>H. kuda</i>	
Choi, Young-Ung	2012	Population characteristics of two seahorses, <i>Hippocampus coronatus</i> and <i>Hippocampus mohnikei</i> , around seagrass beds in the southern coastal waters of Korea	Ichthyological Research	<i>H. coronatus</i>	<i>H. mohnikei</i>
Freret-Meurer, N. V.	2012	Activity rate of the seahorse <i>Hippocampus reidi</i> Ginsburg, 1933 (Syngnathidae)	Acta Ethologica	<i>H. reidi</i>	
Garcia, Luis Maria B.	2012	Diet composition and feeding periodicity of the seahorse <i>Hippocampus barbouri</i> reared in illuminated sea cages	Aquaculture	<i>H. barbouri</i>	
Harasti, D.	2012	Population dynamics and life history of a geographically restricted seahorse, <i>Hippocampus whitei</i>	Journal of Fish Biology	<i>H. whitei</i>	
Himaya, S. W. A.	2012	Paeonol from <i>Hippocampus kuda</i> Bleeker suppressed the neuro-inflammatory responses in vitro via NF-kappa B and MAPK signaling pathways	Toxicology in Vitro	<i>H. kuda</i>	
Kayis, S.	2012	<i>Nerocila bivitata</i> (Cymothidae, Isopoda) infestation on Syngnathid Fishes in the Eastern Black Sea	Bulletin of the European Association of Fish Pathologists	<i>H. guttulatus</i>	
Kumaravel, K.	2012	Seahorses - A source of traditional medicine	Natural Product Research	<i>H. spp.</i>	
Kwon, K. S.	2012	An Anti-inflammatory Peptide Isolated from Seahorse <i>Hippocampus kuda</i> bleeler Inhibits the Invasive Potential of MG-63 Osteosarcoma Cell	Fisheries and Aquatic Sciences	<i>H. kuda</i>	
Lin, Q.	2012	The dynamics of reproductive rate, offspring survivorship and growth in the lined seahorse, <i>Hippocampus erectus</i> Perry, 1810	Biology Open	<i>H. erectus</i>	
Lopez, A.	2012	A microsatellite panel for mating system analysis and broodstock management of captive long-snouted seahorse <i>Hippocampus guttulatus</i>	Aquaculture	<i>H. guttulatus</i>	
Luis Balcazar, J.	2012	<i>Oceanibacterium hippocampi</i> gen. nov., sp. nov., isolated from cutaneous mucus of wild seahorses (<i>Hippocampus guttulatus</i>)	Antonie Van Leeuwenhoek International Journal of General and Molecular Microbiology	<i>H. guttulatus</i>	
Luis Balcazar, J.	2012	<i>Vibrio inhibens</i> sp nov., a novel bacterium with inhibitory activity against <i>Vibrio</i> species	Journal of Antibiotics	<i>H. guttulatus</i>	
Luzzatto, D. C.	2012	The presence of the seahorse <i>Hippocampus patagonicus</i> in the Argentine Sea based on the cytochrome b sequence of mitochondrial DNA	Cybiurn	<i>H. patagonicus</i>	
Martinez-Cardenas, L.	2012	Substrate-attachment Preferences of Cultured Newborn Pot-bellied Seahorses, <i>Hippocampus abdominalis</i> (Lesson, 1827)	Journal of the World Aquaculture Society	<i>H. abdominalis</i>	
Martinez-Cardenas, L.	2012	Effect of stocking density and photoperiod on growth and survival in cultured early juvenile pot-bellied seahorses <i>Hippocampus abdominalis</i> Lesson, 1827	Aquaculture Research	<i>H. abdominalis</i>	
Nickel, J.	2012	Genetic diversity and population structure of the pot-belly seahorse <i>Hippocampus abdominalis</i> in New Zealand	New Zealand Journal of Marine and Freshwater Research	<i>H. abdominalis</i>	
O'Donnell, Kerrie P.	2012	Comparing Fisher Interviews, Logbooks, and Catch Landings Estimates of Extraction Rates in a Small-Scale Fishery	Coastal Management	<i>H. comes</i>	
Otero-Ferrer, F.	2012	Effect of Different Live Prey on Spawning Quality of Short-Snouted Seahorse, <i>Hippocampus hippocampus</i> (Linnaeus, 1758)	Journal of the World Aquaculture Society	<i>H. hippocampus</i>	
Palma, J.	2012	Growth, Reproductive Performances, and Brood Quality of Long Snout Seahorse, <i>Hippocampus guttulatus</i> , Fed Enriched Shrimp Diets	Journal of the World Aquaculture Society	<i>H. guttulatus</i>	

Planas, M.	2012	Temperature-induced changes of growth and survival in the early development of the seahorse <i>Hippocampus guttulatus</i>	Journal of Experimental Marine Biology and Ecology	<i>H. guttulatus</i>	
Praet, T.	2012	Inspiration from nature: dynamic modelling of the musculoskeletal structure of the seahorse tail	International Journal for Numerical Methods in Biomedical Engineering	<i>H. reidi</i>	
Qian, Zhong-Ji	2012	Isolation and antioxidant activity evaluation of two new phthalate derivatives from seahorse, <i>Hippocampus Kuda</i> Bleeler	Biotechnology and Bioprocess Engineering	<i>H. kuda</i>	
Qin, Geng	2012	Effect of broodstock origin, background and substrate color on skin coloration of three-spotted seahorses <i>Hippocampus trimaculatus</i> Leach, 1814	Journal of Experimental Marine Biology and Ecology	<i>H. trimaculatus</i>	
Roth, O.	2012	Male Pregnancy and Biparental Immune Priming	American Naturalist	Absent	
Salter, C. E.	2012	Dermatitis and systemic mycosis in lined seahorses <i>Hippocampus erectus</i> associated with a marine-adapted <i>Fusarium solani</i> species complex pathogen	Diseases of Aquatic Organisms	<i>H. erectus</i>	
Singh, K. V.	2012	Microsatellite loci to determine population structure in the yellow seahorse (<i>Hippocampus kuda</i>) and the three-spotted seahorse (<i>H. trimaculatus</i>)	Marine Biodiversity	<i>H. kuda</i>	<i>H. trimaculatus</i>
Smith, R. E.	2012	Extreme habitat specialisation and population structure of two gorgonian-associated pygmy seahorses	Marine Ecology Progress Series	<i>H. bargibanti</i>	<i>H. denise</i>
Sommer, S.	2012	Standardised classification of pre-release development in male-brooding pipefish, seahorses, and seadragons (Family Syngnathidae)	Bmc Developmental Biology	<i>H. abdominalis</i>	
Tanu	2012	A study on bacteria associated with the intestinal tract of farmed yellow seahorse, <i>Hippocampus kuda</i> (Bleeker, 1852): characterization and extracellular enzymes	Aquaculture Research	<i>H. kuda</i>	
Uncumusaoglu, A. A.	2012	A preliminary research on heavy metals accumulated in liver and muscle tissue of seahorse (<i>Hippocampus hippocampus</i>) caught from Tirebolu Coasts (Giresun, Eastern Black sea)	Fresenius Environmental Bulletin	<i>H. hippocampus</i>	
Valladares, S.	2012	Non-lethal dorsal fin sampling for stable isotope analysis in seahorses	Aquatic Ecology	<i>H. guttulatus</i>	
Van Wassenbergh, S.	2012	Three-dimensional model of force transmission in the suction feeding system of seahorses	Integrative and Comparative Biology	Absent	
Willadino, L.	2012	Ingestion rate, survival and growth of newly released seahorse <i>Hippocampus reidi</i> fed exclusively on cultured live food items	Aquaculture	<i>H. reidi</i>	
Woodall, L. C.	2012	Partial fin-clipping as an effective tool for tissue sampling seahorses, <i>Hippocampus</i> spp	Journal of the Marine Biological Association of the United Kingdom	<i>H. kuda</i>	
Yasue, M.	2012	Seahorses helped drive creation of marine protected areas, so what did these protected areas do for the seahorses?	Environmental Conservation	<i>H. spp.</i>	
Yin, F.	2012	Lipid Metabolic Response, Peroxidation, and Antioxidant Defence Status of Juvenile Lined Seahorse, <i>Hippocampus erectus</i> , Fed with Highly Unsaturated Fatty Acids Enriched <i>Artemia</i> Nauplii	Journal of the World Aquaculture Society	<i>H. erectus</i>	
Zheng, L.	2012	Rapid finding and quantification of the major antioxidant in water extracts of three marine drug organisms from China by online HPLC-DAD/MS-DPPH	Natural Product Research	<i>H. japonicus</i>	<i>H. kuda</i>
Ahnesjo, I.	2011	The biology of Syngnathidae: pipefishes, seadragons and seahorses	Journal of Fish Biology	<i>H. spp.</i>	
Anderson, P. A.	2011	Evoked potential audiogram of the lined seahorse, <i>Hippocampus erectus</i> (Perry), in terms of sound pressure and particle acceleration	Environmental Biology of Fishes	<i>H. erectus</i>	
Anderson, P. A.	2011	Sound, stress, and seahorses: The consequences of a noisy environment to animal health	Aquaculture	<i>H. erectus</i>	
Bahr, A.	2011	The impact of sex-role reversal on the diversity of the major histocompatibility complex: Insights from the seahorse (<i>Hippocampus abdominalis</i>)	Bmc Evolutionary Biology	<i>H. abdominalis</i>	
Buen-Ursua, S. M. A.	2011	Effects of UV-Treated Sea Water, Chlorinated Sea Water, and Formalin-Treated Copepods on Survival and Growth of Newborn Seahorses, <i>Hippocampus comes</i>	Israeli Journal of Aquaculture-Bamidgeh	<i>H. comes</i>	
Caldwell, I. R.	2011	Advances in tagging syngnathids, with the effects of dummy tags on behaviour of <i>Hippocampus guttulatus</i>	Journal of Fish Biology	<i>H. guttulatus</i>	

Cunha, M. A.	2011	Anesthetic induction and recovery of <i>Hippocampus reidi</i> exposed to the essential oil of <i>Lippia alba</i>	Neotropical Ichthyology	<i>H. reidi</i>		
Gurkan, S.	2011	Gut Contents of Two European Seahorses <i>Hippocampus hippocampus</i> and <i>Hippocampus guttulatus</i> in the Aegean Sea, Coasts of Turkey	Pakistan Journal of Zoology	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Hellyer, C. B.	2011	Manipulating artificial habitats to benefit seahorses in Sydney Harbour, Australia	Aquatic Conservation- Marine and Freshwater Ecosystems	<i>H. whitei</i>		
Jawad, L.	2011	On the occurrence of the Egyptian seahorse <i>Hippocampus suzeensis</i> Duncker, 1940 in Muscat, Sultanate of Oman	Acta Adriatica	<i>H. suzeensis</i>		
Kayis, S.	2011	Ascidian Tunicate, <i>Botryllus schlosseri</i> (Pallas, 1766) infestation on Seahorse	Bulletin of the European Association of Fish Pathologists	<i>H. guttulatus</i>		
Kleiber, D.	2011	The importance of seahorses and pipefishes in the diet of marine animals	Reviews in Fish Biology and Fisheries	<i>H. spp.</i>		
Krishnan, T. S.	2011	Occurrence of western Indian Ocean seahorse <i>Hippocampus borboniensis</i> Dumeril, 1870, in the Gulf of Mannars, Southeastern India	Indian Journal of Geo- Marine Sciences	<i>H. borboniensis</i>		
Lee, H. R.	2011	Morphological and behavioral limit of visual resolution in temperate (<i>Hippocampus abdominalis</i>) and tropical (<i>Hippocampus taeniopterus</i>) seahorses	Visual Neuroscience	<i>H. abdominalis</i>	<i>H. taeniopterus</i>	
Leysen, H.	2011	Morphological Variation in Head Shape of Pipefishes and Seahorses in Relation to Snout Length and Developmental Growth	Journal of Morphology	<i>H. reidi</i>		
Leysen, H.	2011	Modelling stress in the feeding apparatus of seahorses and pipefishes (Teleostei: Syngnathidae)	Biological Journal of the Linnean Society	<i>H. abdominalis</i>	<i>H. reidi</i>	<i>H. zosterae</i>
Leysen, H.	2011	Musculoskeletal structure of the feeding system and implications of snout elongation in <i>Hippocampus reidi</i> and <i>Dunckerocampus dactylophorus</i>	Journal of Fish Biology	<i>H. reidi</i>		
Lim, A. C. O.	2011	Diversity, habitats and conservation threats of syngnathid (Syngnathidae) fishes in Malaysia	Tropical Zoology	<i>H. spp.</i>		
Luis Balcazar, J.	2011	Novel Mycobacterium Species in Seahorses with Tail Rot	Emerging Infectious Diseases	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Martinez-Cardenas, L.	2011	Effect of Temperature on Growth and Survival in Cultured Early Juvenile Pot-bellied Seahorses, <i>Hippocampus abdominalis</i>	Journal of the World Aquaculture Society	<i>H. abdominalis</i>		
Mobley, K. B.	2011	The genetics and genomics of Syngnathidae: pipefishes, seahorses and seadragons	Journal of Fish Biology	Absent		
Murugan, A.	2011	Fishery biology, demography of three spotted seahorse, <i>Hippocampus trimaculatus</i> inhabiting Gulf of Mannar region, Southeast coast of India	Indian Journal of Geo- Marine Sciences	<i>H. trimaculatus</i>		
Negreiros, L. A.	2011	Effects of hypoxia and petroleum on the genotoxic and morphological parameters of <i>Hippocampus reidi</i>	Comparative Biochemistry and Physiology C- Toxicology & Pharmacology	<i>H. reidi</i>		
Olivotto, I.	2011	Advances in Breeding and Rearing Marine Ornamentals	Journal of the World Aquaculture Society	<i>H. spp.</i>		
Palma, Jorge	2011	Effect of different Artemia enrichments and feeding protocol for rearing juvenile long snout seahorse, <i>Hippocampus guttulatus</i>	Aquaculture	<i>H. guttulatus</i>		
Pawar, H. B.	2011	Effect of Background Color of Tanks on Growth and Survival of Juvenile Yellow Seahorse, <i>Hippocampus kuda</i> (Bleeker 1852), in the Pelagic Phase	Israeli Journal of Aquaculture-Bamidgeh	<i>H. kuda</i>		
Pawar, H. R.	2011	Comparative efficacy of four anaesthetic agents in the yellow seahorse, <i>Hippocampus kuda</i> (Bleeker, 1852)	Aquaculture	<i>H. kuda</i>		
Reijnen, B. T.	2011	Fish, fans and hydroids: host species of pygmy seahorses	Zookeys	<i>H. bargibanti</i>	<i>H. denise</i>	<i>H. pontohi</i>
Roos, G.	2011	Effects of snout dimensions on the hydrodynamics of suction feeding in juvenile and adult seahorses	Journal of Theoretical Biology	<i>H. reidi</i>		
Rosa, I. L.	2011	Fisheries and trade of seahorses in Brazil: historical perspective, current trends, and future directions	Biodiversity and Conservation	<i>H. reidi</i>	<i>H. erectus</i>	
Rosenqvist, G.	2011	Sexual signals and mating patterns in Syngnathidae	Journal of Fish Biology	<i>H. spp.</i>		

Sears, B. F.	2011	A new species of Myxosporean (SPHAEROMYXIDAE), a parasite of lined seahorses, <i>Hippocampus erectus</i> , from the Gulf of Mexico	Journal of Parasitology	<i>H. erectus</i>		
Shin, S. P.	2011	Identification of scuticociliate <i>Philasterides dicentrarchi</i> from indo-pacific seahorses <i>Hippocampus kuda</i>	African Journal of Microbiology Research	<i>H. kuda</i>		
Singh, K. V.	2011	Molecular identification and phylogenetic relationship of seahorse, <i>Hippocampus kuda</i> (Bleeker 1852) using mitochondrial 16S rRNA and COI gene sequences from east and west coasts of India	Indian Journal of Animal Sciences	<i>H. kuda</i>		
Szabo, Z.	2011	On the status of the Hawaiian seahorses <i>Hippocampus hilonis</i> , <i>H. histrix</i> and <i>H. fisheri</i> (Syngnathidae)	Marine Biology Research	<i>H. hilonis</i>	<i>H. histrix</i>	<i>H. fisheri</i>
Thangaraj, M.	2011	Assessment of genetic variation in closely related seahorse species (Genus: <i>Hippocampus</i>) using mtDNA marker	Indian Journal of Biotechnology	<i>H. kuda</i>	<i>H. trimaculatus</i>	
Van Wassenbergh, S.	2011	An adaptive explanation for the horse-like shape of seahorses	Nature Communications	<i>H. reidi</i>	<i>H. breviceps</i>	<i>H. abdominalis</i>
Vincent, A. C. J.	2011	Conservation and management of seahorses and other Syngnathidae	Journal of Fish Biology	<i>H. spp.</i>		
Wilson, A. B.	2011	The evolutionary origins of Syngnathidae: pipefishes and seahorses	Journal of Fish Biology	<i>H. spp.</i>		
Woodall, L. C.	2011	Historical and contemporary population genetic connectivity of the European short-snouted seahorse <i>Hippocampus hippocampus</i> and implications for management	Journal of Fish Biology	<i>H. hippocampus</i>		
Woodall, L. C.	2011	Serial monogamy in the European long-snouted seahorse <i>Hippocampus guttulatus</i>	Conservation Genetics	<i>H. guttulatus</i>		
Zhang, D.	2011	Criteria for assessing juvenile quality of the lined seahorse, <i>Hippocampus erectus</i>	Aquaculture	<i>H. erectus</i>		
Ahnesjo, I.	2010	Seahorses and their relatives	Journal of Fish Biology	<i>H. spp.</i>		
Balcazar, J. L.	2010	Identification and characterization of bacteria with antibacterial activities isolated from seahorses (<i>Hippocampus guttulatus</i>)	Journal of Antibiotics	<i>H. guttulatus</i>		
Balcazar, J. L.	2010	Phylogenetic characterization and in situ detection of bacterial communities associated with seahorses (<i>Hippocampus guttulatus</i>) in captivity	Systematic and Applied Microbiology	<i>H. guttulatus</i>		
Balcazar, J. L.	2010	Isolation of <i>Vibrio alginolyticus</i> and <i>Vibrio splendidus</i> from captive-bred seahorses with disease symptoms	Antonie Van Leeuwenhoek International Journal of General and Molecular Microbiology	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Faleiro, F.	2010	Lipid dynamics during early development of <i>Hippocampus guttulatus</i> seahorses: Searching for clues on fatty acid requirements	Aquaculture	<i>H. guttulatus</i>		
Foster, R.	2010	A new seahorse (Teleostei: Syngnathidae: <i>Hippocampus</i>) from south-western Australia	Zootaxa	<i>H. paradoxus</i>		
Garcia, L. M. B.	2010	Culturing Seahorse (<i>Hippocampus barbouri</i>) in Illuminated Cages with Supplementary Acetes Feeding	Israeli Journal of Aquaculture-Bamidgeh	<i>H. barbouri</i>		
Harasti, D.	2010	Striking a balance between retaining populations of protected seahorses and maintaining swimming nets	Aquatic Conservation-Marine and Freshwater Ecosystems	<i>H. abdominalis</i>	<i>H. whitei</i>	
Koldewey, H. J.	2010	A global review of seahorse aquaculture	Aquaculture	<i>H. spp.</i>		
Leysen, H.	2010	Cranial Architecture of Tube-Snouted Gasterosteiformes (Syngnathus rostellatus and <i>Hippocampus capensis</i>)	Journal of Morphology	<i>H. capensis</i>		
Lin, Q.	2010	Effects of light intensity, stocking density and temperature on the air-bubble disease, survivorship and growth of early juvenile seahorse <i>Hippocampus erectus</i> Perry, 1810	Aquaculture Research	<i>H. erectus</i>		
Lopez, A.	2010	Species identification and genetic structure of threatened seahorses in Gran Canaria Island (Spain) using mitochondrial and microsatellite markers	Conservation Genetics	<i>H. hippocampus</i>	<i>H. guttulatus</i>	
Luis Balcazar, J.	2010	<i>Bacillus galliciensis</i> sp nov., isolated from faeces of wild seahorses (<i>Hippocampus guttulatus</i>)	International Journal of Systematic and Evolutionary Microbiology	<i>H. guttulatus</i>		
Luis Balcazar, J.	2010	<i>Vibrio hippocampi</i> sp nov., a new species isolated from wild seahorses (<i>Hippocampus guttulatus</i>)	Fems Microbiology Letters	<i>H. guttulatus</i>		

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Lin, Q.	2009	Weaning of juvenile seahorses <i>Hippocampus erectus</i> Perry, 1810 from live to frozen food	Aquaculture	<i>H. erectus</i>					
Lin, Q.	2009	Biochemical composition of the wild and cultured seahorses, <i>Hippocampus kuda</i> Bleeker and <i>Hippocampus trimaculatus</i> Leach	Aquaculture Research	<i>H. kuda</i>	<i>H. trimaculatus</i>				
Lin, Q.	2009	Effects of substrate color, light intensity and temperature on survival and skin color change of juvenile seahorses, <i>Hippocampus erectus</i> Perry, 1810	Aquaculture	<i>H. erectus</i>					
Mai, A. C. G.	2009	Aspectos ecológicos do cavalo-marinho <i>Hippocampus reidi</i> no estuário Camurupim/Cardoso, Piauí, Brasil, fornecendo subsídios para a criação de uma Área de Proteção Integral	Biota Neotropica	<i>H. reidi</i>					
Mattle, B.	2009	Body size preferences in the pot-bellied seahorse <i>Hippocampus abdominalis</i> : choosy males and indiscriminate females	Behavioral Ecology and Sociobiology	<i>H. abdominalis</i>					
Molina Dominguez, L.	2009	Aquaculture and marine biodiversity boost: case examples from the Canary Islands	Water Resources Management V	<i>H. hippocampus</i>					
Murugan, A.	2009	Breeding and mass-scale rearing of three spotted seahorse, <i>Hippocampus trimaculatus</i> Leach under captive conditions	Aquaculture	<i>H. trimaculatus</i>					
Nadeau, J. L.	2009	Preservation causes shrinkage in seahorses: implications for biological studies and for managing sustainable trade with minimum size limits	Aquatic Conservation- Marine and Freshwater Ecosystems	<i>H. guttulatus</i>					
Naud, Marie-Jose	2009	Mate choice, operational sex ratio, and social promiscuity in a wild population of the long-snouted seahorse <i>Hippocampus guttulatus</i>	Behavioral Ecology	<i>H. guttulatus</i>					
Roos, G.	2009	Ontogeny of feeding kinematics in the seahorse <i>Hippocampus reidi</i> from newly born to adult	Integrative and Comparative Biology	<i>H. reidi</i>					
Roos, G.	2009	Kinematics of suction feeding in the seahorse <i>Hippocampus reidi</i>	Journal of Experimental Biology	<i>H. reidi</i>					
Roos, G.	2009	Linking Morphology and Motion: A Test of a Four-Bar Mechanism in Seahorses	Physiological and Biochemical Zoology	<i>H. reidi</i>					
Ryu, B. M.	2009	Purification of a peptide from seahorse, that inhibits arthritis-related cytokines through MAPK/NF-kappa B activation, and induces human osteoblastic and chondrocytic differentiation	Febs Journal	<i>H. kuda</i>					
Shokri, M. R.	2009	The effectiveness of seahorses and pipefish (Pisces: Syngnathidae) as a flagship group to evaluate the conservation value of estuarine seagrass beds	Aquatic Conservation- Marine and Freshwater Ecosystems	<i>H. spp.</i>					
Storero, L. P.	2009	Prey Selectivity and Trophic Behavior of the Patagonian Seahorse, <i>Hippocampus patagonicus</i> , in Captivity	Journal of the World Aquaculture Society	<i>H. patagonicus</i>					
Teske, P. R.	2009	Evolution of seahorses' upright posture was linked to Oligocene expansion of seagrass habitats	Biology Letters	<i>H. reidi</i>	<i>H. ingens</i>	<i>H. zosterae</i>	<i>H. breviceps</i>	<i>H. bargibanti</i>	
van de Vliet, M. S.	2009	Highly polymorphic microsatellite markers for the short-snouted seahorse (<i>Hippocampus hippocampus</i>), including markers from a closely related species the long-snouted seahorse (<i>Hippocampus guttulatus</i>)	Conservation Genetics Resources	<i>H. hippocampus</i>	<i>H. guttulatus</i>				
Van Wassenbergh, S.	2009	Suction is kid's play: extremely fast suction in newborn seahorses	Biology Letters	<i>H. reidi</i>					
Van Wassenbergh, S.	2009	Pivot feeding performance in pipefish and seahorses analysed by forward dynamic modelling	Comparative Biochemistry and Physiology a-Molecular & Integrative Physiology	Absent					
Woodall, L. C.	2009	First occurrence of the lined seahorse <i>Hippocampus erectus</i> in the eastern Atlantic Ocean	Journal of Fish Biology	<i>H. erectus</i>					
Zalohar, J.	2009	Two new species of seahorses (Syngnathidae, <i>Hippocampus</i>) from the Middle Miocene (Sarmatian) Coprolitic Horizon in Tunjice Hills, Slovenia: The oldest fossil record of seahorses	Annales De Paleontologie	<i>H. sarmaticus</i>	<i>H. slovenicus</i>				
Baine, M. S. P.	2008	Residence and movement of pygmy seahorses, <i>Hippocampus bargibanti</i> , on sea fans (<i>Muricella</i> spp.)	Coral reefs	<i>H. bargibanti</i>					
Bijukumar, A.	2008	MORPHOMETRY AND MERISTICS OF LONGNOSE SEAHORSE, <i>HIPPOCAMPUS TRIMACULATUS</i> (ACTINOPTERYGII: SYNGNATHIDAE), FROM KERALA, SOUTH-WEST COAST OF INDIA	Acta Ichthyologica Et Piscatoria	<i>H. trimaculatus</i>					
Bruner, E.	2008	Morphological Variation in the Seahorse Vertebral System	International Journal of Morphology	<i>H. hippocampus</i>					

Castro, A. L. C.	2008	Assessing diet composition of seahorses in the wild using a non destructive method: Hippocampus reidi (Teleostei: Syngnathidae) as a study-case	Neotropical Ichthyology	<i>H. reidi</i>						
Clynick, B. G.	2008	Harbour swimming nets: a novel habitat for seahorses	Aquatic Conservation- Marine and Freshwater Ecosystems	<i>H. whitei</i>	<i>H. abdominalis</i>					
Curtis, J. M. R.	2008	Use of Population Viability Analysis to Evaluate CITES Trade- Management Options for Threatened Marine Fishes	Conservation Biology	<i>H. guttulatus</i>						
Faleiro, F.	2008	Seahorse behaviour and aquaculture: How to improve Hippocampus guttulatus husbandry and reproduction?	Aquaculture	<i>H. guttulatus</i>						
Freret-Meurer, N. V.	2008	Field studies of a Brazilian Seahorse population, Hippocampus reidi Ginsburg, 1933	Brazilian Archives of Biology and Technology	<i>H. reidi</i>						
Kitsos, M. S.	2008	Diet composition of the seahorses, Hippocampus guttulatus Cuvier, 1829 and Hippocampus hippocampus (L., 1758) (Teleostei, Syngnathidae) in the Aegean Sea	Journal of Fish Biology	<i>H. guttulatus</i>	<i>H. hippocampus</i>					
Krupczynski, R.	2008	Diversity of fin-activation patterns in the longsnout seahorse, Hippocampus reidi	Comparative Biochemistry and Physiology a-Molecular & Integrative Physiology	<i>H. reidi</i>						
Li, Y.	2008	Cathepsin B inhibitory activities of three new phthalate derivatives isolated from seahorse, Hippocampus kuda Bleeler	Bioorganic & Medicinal Chemistry Letters	<i>H. kuda</i>						
Lin, Q.	2008	Breeding and juvenile culture of the lined seahorse, Hippocampus erectus Perry, 1810	Aquaculture	<i>H. erectus</i>						
Lin, Q.	2008	Biochemical composition of six seahorse species, Hippocampus sp., from the Chinese coast	Journal of the World Aquaculture Society	<i>H. kuda</i>	<i>H. trimaculatus</i>	<i>H. kelloggi</i>	<i>H. spinosissimus</i>	<i>H. histrix</i>	<i>H. comes</i>	
Lourie, S. A.	2008	Three new pygmy seahorse species from Indonesia (Teleostei: Syngnathidae: Hippocampus)	Zootaxa	<i>H. pontohi</i>	<i>H. severnsi</i>	<i>H. satomiae</i>				
Martinez-Cardenas, L.	2008	Light-dark variations in plasma melatonin concentrations in the pot- bellied seahorse Hippocampus abdominalis Lesson, 1827	Journal of Fish Biology	<i>H. abdominalis</i>						
Morgan, S. K.	2008	Threatened fishes of the world: Hippocampus spinosissimus Weber 1913 (Syngnathidae)	Environmental Biology of Fishes	<i>H. spinosissimus</i>						
Murugan, A.	2008	Seahorses and pipefishes of the Tamil Nadu coast	Current Science	<i>H. kelloggi</i>	<i>H. kuda</i>	<i>H. trimaculatus</i>				
Okuzawa, K.	2008	Stock enhancement of threatened species in Southeast Asia	Reviews in Fisheries Science	<i>H. barbouri</i>	<i>H. comes</i>	<i>H. kuda</i>				
Olivotto, I.	2008	Breeding and rearing the longsnout seahorse Hippocampus reidi: Rearing and feeding studies	Aquaculture	<i>H. reidi</i>						
Palma, J.	2008	Growth and survival of adult long snout seahorse (Hippocampus guttulatus) using frozen diets	Aquaculture	<i>H. guttulatus</i>						
Patron, J. J.	2008	Prolactin and growth hormone levels in the pouch fluid of gravid male seahorse, Hippocampus barbouri Jordan and Richardson 1908	Asia Life Sciences	<i>H. barbouri</i>						
Pinnegar, J. K.	2008	Occurrence of the short-snouted seahorse Hippocampus hippocampus in the central North Sea	Cybium	<i>H. hippocampus</i>						
Planas, M.	2008	Establishment and maintenance of threatened long-snouted seahorse, Hippocampus guttulatus, broodstock in captivity	Aquaculture	<i>H. guttulatus</i>						
Qian, Zhong-Ji	2008	Free Radical and Reactive Oxygen Species Scavenging Activities of the Extracts from Seahorse, Hippocampus kuda Bleeler	Biotechnology and Bioprocess Engineering	<i>H. kuda</i>						
Qian, Zhong-Ji	2008	Physiological activities of phthalate derivatives isolated from seahorse, Hippocampus kuda Bleeler	Journal of Biotechnology	<i>H. kuda</i>						
Sanders, J. G.	2008	The tip of the tail: molecular identification of seahorses for sale in apothecary shops and curio stores in California	Conservation Genetics	<i>H. barbouri</i>	<i>H. histrix</i>	<i>H. ingens</i>				
Storero, L. P.	2008	Feeding habits of the seahorse Hippocampus patagonicus in San Antonio Bay (Patagonia, Argentina)	Journal of the Marine Biological Association of the United Kingdom	<i>H. patagonicus</i>						
Thangaraj, M.	2008	Survival and Growth of Captive Reared Juvenile Seahorse (Hippocampus kuda) Fed Live Feeds and Fishmeal	Israeli Journal of Aquaculture-Bamidgeh	<i>H. kuda</i>						
Begemann, G.	2007	Evolution and Development The quest for genes that prepare male seahorses for pregnancy	Zebrafish	Absent						

Curtis, J. M. R.	2007	A conservation trade-off? Interspecific differences in seahorse responses to experimental changes in fishing effort	Aquatic Conservation- Marine and Freshwater Ecosystems Fishery Bulletin	<i>H. hippocampus</i>	<i>H. guttulatus</i>
Curtis, J. M. R.	2007	Validation of a method for estimating realized annual fecundity in a multiple spawner, the long-snouted seahorse (<i>Hippocampus guttulatus</i>), using underwater visual census		<i>H. guttulatus</i>	
Galbusera, P. H. A.	2007	Isolation of microsatellite markers for the endangered Knysna seahorse <i>Hippocampus capensis</i> and their use in the detection of a genetic bottleneck	Molecular Ecology Notes	<i>H. capensis</i>	
Gurkan, Sule	2007	Length-weight relationships for syngnathid fishes of the Aegean Sea, Turkey	Belgian Journal of Zoology	<i>H. hippocampus</i>	<i>H. guttulatus</i>
Jung, Min-Min	2007	Coexisting Fish Fauna in the Seahorse Habitats	Journal of Aquaculture	<i>H. mohnikei</i>	<i>H. coronatus</i>
Kvarnemo, C.	2007	Sexually selected females in the monogamous Western Australian seahorse	Proceedings of the Royal Society B-Biological Sciences	<i>H. subelongatus</i>	
Lin, Q.	2007	The effects of food and the sum of effective temperature on the embryonic development of the seahorse, <i>Hippocampus kuda</i> Bleeker	Aquaculture	<i>H. kuda</i>	
Lipton, A. P.	2007	Evaluation of a simple tagging method to monitor the growth of endangered species of seahorse	Current Science	<i>H. kuda</i>	
Marcus, J. E.	2007	Benthic status of near-shore fishing grounds in the central Philippines and associated seahorse densities	Marine Pollution Bulletin	<i>H. comes</i>	
Martinez-Cardenas, L.	2007	Effect of tank colour on <i>Artemia</i> ingestion, growth and survival in cultured early juvenile pot-bellied seahorses (<i>Hippocampus abdominalis</i>)	Aquaculture	<i>H. abdominalis</i>	
Morgan, S. K.	2007	The ontogeny of habitat associations in the tropical tiger tail seahorse <i>Hippocampus comes</i> Cantor, 1850	Journal of Fish Biology	<i>H. comes</i>	
Mosk, V.	2007	Spectral sensitivities of the seahorses <i>Hippocampus subelongatus</i> and <i>Hippocampus barbouri</i> and the pipefish <i>Stigmatopora argus</i>	Visual Neuroscience	<i>H. barbouri</i>	<i>H. subelongatus</i>
Pardo, B. G.	2007	Novel microsatellite loci in the threatened European long-snouted seahorse (<i>Hippocampus guttulatus</i>) for genetic diversity and parentage analysis	Conservation Genetics	<i>H. guttulatus</i>	
Roos, G.	2007	High-speed kinematics of feeding behavior in the seahorse <i>Hippocampus reidi</i>	Journal of Morphology	<i>H. reidi</i>	
Rosa, I. L.	2007	Population characteristics, space use and habitat associations of the seahorse <i>Hippocampus reidi</i> (Teleostei : Syngnathidae)	Neotropical Ichthyology	<i>H. reidi</i>	
Sheng, J.	2007	Effect of starvation on the initiation of feeding, growth and survival rate of juvenile seahorses, <i>Hippocampus trimaculatus</i> Leach and <i>Hippocampus kuda</i> Bleeker	Aquaculture	<i>H. trimaculatus</i>	<i>H. kuda</i>
Stoelting, K. N.	2007	Male pregnancy in seahorses and pipefish: beyond the mammalian model	Bioessays	<i>H. spp.</i>	
Teske, P. R.	2007	<i>Hippocampus queenslandicus</i> Home, 2001 - a new seahorse species or yet another synonym?	Australian Journal of Zoology	<i>H. queenslandicus</i>	
Teske, P. R.	2007	Does the endangered Knysna seahorse, <i>Hippocampus capensis</i> , have a preference for aquatic vegetation type, cover or height?	African Zoology	<i>H. capensis</i>	
Teske, P. R.	2007	Signatures of seaway closures and founder dispersal in the phylogeny of a circumglobally distributed seahorse lineage	Bmc Evolutionary Biology	<i>H. spp.</i>	
Thangaraj, M.	2007	Occurrence of the Japanese seahorse <i>Hippocampus mohnikei</i> Bleeker 1854 from the Palk Bay coast of south-eastern India	Journal of Fish Biology	<i>H. mohnikei</i>	
Uyarra, Maria C.	2007	The quest for cryptic creatures: Impacts of species-focused recreational diving on corals	Biological Conservation	<i>H. reidi</i>	
Van Look, K. J. W.	2007	Dimorphic sperm and the unlikely route to fertilisation in the yellow seahorse	Journal of Experimental Biology	<i>H. kuda</i>	
Vasil'eva, E. D.	2007	Seahorse species (genus <i>Hippocampus</i> , pisces) described by C. Linne	Folia Zoologica	<i>H. hippocampus</i>	<i>H. brevirostris</i>
Vincent, A. C. J.	2007	Characterizing a small-scale, data-poor, artisanal fishery: Seahorses in the central Philippines	Fisheries Research	<i>H. comes</i>	

Wilson, A. B.	2007	Genetic monogamy despite social promiscuity in the pot-bellied seahorse (<i>Hippocampus abdominalis</i>)	Molecular Ecology	<i>H. abdominalis</i>		
Wright, K. A.	2007	Recovery from acute, chronic and transport stress in the pot-bellied seahorse <i>Hippocampus abdominalis</i>	Journal of Fish Biology	<i>H. abdominalis</i>		
Alves, R. R. N.	2006	From cnidarians to mammals: The use of animals as remedies in fishing communities in NE Brazil	Journal of Ethnopharmacology	<i>H. reidi</i>		
Choo, C. K.	2006	Morphological development and allometric growth patterns in the juvenile seahorse <i>Hippocampus kuda</i> Bleeker	Journal of Fish Biology	<i>H. kuda</i>		
Curtis, J. M. R.	2006	Life history of an unusual marine fish: survival, growth and movement patterns of <i>Hippocampus guttulatus</i> Cuvier 1829	Journal of Fish Biology	<i>H. guttulatus</i>		
Curtis, J. M. R.	2006	Visible implant elastomer color determination, tag visibility, and tag loss: Potential sources of error for mark-recapture studies	North American Journal of Fisheries Management	<i>H. guttulatus</i>		
Curtis, J. M. R.	2006	A case of mistaken identity: skin filaments are unreliable for identifying <i>Hippocampus guttulatus</i> and <i>Hippocampus hippocampus</i>	Journal of Fish Biology	<i>H. guttulatus</i>	<i>H. hippocampus</i>	
Do, H. H.	2006	Otolith morphology, microstructure and ageing in the hedgehog seahorse, <i>Hippocampus spinosissimus</i> (Weber, 1913)	Journal of Applied Ichthyology	<i>H. spinosissimus</i>		
Dzyuba, B.	2006	Effect of parental age and associated size on fecundity, growth and survival in the yellow seahorse <i>Hippocampus kuda</i>	Journal of Experimental Biology	<i>H. kuda</i>		
Giles, B. G.	2006	The catch and trade of seahorses in Vietnam	Biodiversity and Conservation	<i>H. spinosissimus</i>	<i>H. trimaculatus</i>	<i>H. kuda</i>
Hoffman, E. A.	2006	Male pregnancy and the evolution of body segmentation in seahorses and pipefishes	Evolution	Absent		
Job, S.	2006	Growth and survival of the tiger tail seahorse, <i>Hippocampus comes</i>	Journal of the World Aquaculture Society	<i>H. comes</i>		
Jung, Min-Min	2006	Morphological Development, Growth and Survival of Barbour's Seahorse, <i>Hippocampus barbouri</i>	Journal of the Korean Society of Oceanography	<i>H. barbouri</i>		
Karina, A.	2006	Feeding behavior of the longsnout seahorse <i>Hippocampus reidi</i> Ginsburg, 1933	Journal of Ethology	<i>H. reidi</i>		
Laksanawimol, P.	2006	Alteration of the brood pouch morphology during gestation of male seahorses, <i>Hippocampus kuda</i>	Marine and Freshwater Research	<i>H. kuda</i>		
Lin, Q.	2006	The effect of temperature on gonad, embryonic development and survival rate of juvenile seahorses, <i>Hippocampus kuda</i> Bleeker	Aquaculture	<i>H. kuda</i>		
Martin-Smith, K. M.	2006	Exploitation and trade of Australian seahorses, pipehorses, sea dragons and pipefishes (Family Syngnathidae)	Oryx	Absent		
Meeuwig, J. J.	2006	Quantifying non-target seahorse fisheries in central Vietnam	Fisheries Research	<i>H. spinosissimus</i>	<i>H. trimaculatus</i>	
Ortega-Salas, A. A.	2006	Fecundity, survival, and growth of the seahorse <i>Hippocampus ingens</i> (Pisces : Syngnathidae) under semi-controlled conditions	Revista De Biologia Tropical	<i>H. ingens</i>		
Rosa, I. L.	2006	Collaborative monitoring of the ornamental trade of seahorses and pipefishes (Teleostei : Syngnathidae) in Brazil: Bahia State as a case study	Neotropical Ichthyology	<i>H. reidi</i>	<i>H. erectus</i>	
Sheng, J.	2006	Effects of food, temperature and light intensity on the feeding behavior of three-spot juvenile seahorses, <i>Hippocampus trimaculatus</i> Leach	Aquaculture	<i>H. trimaculatus</i>		
Thangaraj, M.	2006	Onset of sexual maturity in captive-reared endangered Indian seahorse, <i>Hippocampus kuda</i>	Current Science	<i>H. kuda</i>		
Wilson, Z.	2006	Nitrogen budgets for juvenile big-bellied seahorse <i>Hippocampus abdominalis</i> fed Artemia, mysids or pelleted feeds	Aquaculture	<i>H. abdominalis</i>		
Baum, J. K.	2005	Magnitude and inferred impacts of the seahorse trade in Latin America	Environmental Conservation	Absent		
Braicovich, P. E.	2005	First record of <i>Corynosoma australe</i> (Acanthocephala, Polymorphidae) parasitizing seahorse, <i>Hippocampus</i> sp (Pisces, Syngnathidae) in Patagonia (Argentina)	Acta Parasitologica	<i>H. sp.</i>		
Bruckner, A. W.	2005	The importance of the marine ornamental reef fish trade in the wider Caribbean	Revista De Biologia Tropical	<i>H. zosterae</i>	<i>H. erectus</i>	
Collette, B. B.	2005	Is the east-west division of haplotypes of the three-spot seahorse along Wallace's Line novel among marine organisms?	Journal of Biogeography	<i>H. trimaculatus</i>		

Curtis, J. M. R.	2005	Distribution of sympatric seahorse species along a gradient of habitat complexity in a seagrass-dominated community	Marine Ecology Progress Series	<i>H. guttulatus</i>	<i>H. hippocampus</i>				
Foster, S. J.	2005	Enhancing sustainability of the international trade in seahorses with a single minimum size limit	Conservation Biology	<i>H. spp.</i>					
Grey, M.	2005	Magnitude and trends of marine fish curio imports to the USA	Oryx	Absent					
Kendrick, A. J.	2005	Variations in the dietary compositions of morphologically diverse syngnathid fishes	Environmental Biology of Fishes	<i>H. breviceps</i>	<i>H. subelongatus</i>				
Kim, Suam	2005	Morphological Development and Reproductive Behavior of Hedgehog Seahorse <i>Hippocampus spinosissimus</i> (Teleostei: Syngnathidae)	Korean Journal of Fisheries and Aquatic Sciences	<i>H. spinosissimus</i>					
Lourie, S. A.	2005	Dispersal, habitat differences, and comparative phylogeography of Southeast Asian seahorses (Syngnathidae : Hippocampus)	Molecular Ecology	<i>H. barbouri</i>	<i>H. trimaculatus</i>	<i>H. kuda</i>	<i>H. spinosissimus</i>		
Martin-Smith, K. M.	2005	Seahorse declines in the Derwent estuary, Tasmania in the absence of fishing pressure	Biological Conservation	<i>H. abdominalis</i>					
Melamed, P.	2005	The male seahorse synthesizes and secretes a novel C-type lectin into the brood pouch during early pregnancy	Febs Journal	<i>H. comes</i>					
Monteiro, N. M.	2005	Implications of different brood pouch structures in syngnathid reproduction	Journal of the Marine Biological Association of the United Kingdom	<i>H. spp.</i>					
Rosa, I. M. L.	2005	Fishers' knowledge and seahorse conservation in Brazil	Journal of Ethnobiology and Ethnomedicine	<i>H. reidi</i>					
Salin, K. R.	2005	Fisheries and trade of seahorses, <i>Hippocampus</i> spp., in southern India	Fisheries Management and Ecology	<i>H. spp.</i>					
Teske, P. R.	2005	Molecular evidence for long-distance colonization in an Indo-Pacific seahorse lineage	Marine Ecology Progress Series	<i>H. kuda</i>	<i>H. fuscus</i>	<i>H. capensis</i>			
Vandendriessche, S.	2005	Juvenile <i>Hippocampus guttulatus</i> from a neuston tow at the French-Belgian border	Belgian Journal of Zoology	<i>H. guttulatus</i>					
Vincent, A. C. J.	2005	Home range behaviour of the monogamous Australian seahorse, <i>Hippocampus whitei</i>	Environmental Biology of Fishes	<i>H. whitei</i>					
Woods, C. M. C.	2005	Evaluation of VI-alpha and PIT-tagging of the seahorse <i>Hippocampus abdominalis</i>	Aquaculture International	<i>H. abdominalis</i>					
Woods, C. M. C.	2005	Reproductive output of male seahorses, <i>Hippocampus abdominalis</i> , from Wellington Harbour, New Zealand: implications for conservation	New Zealand Journal of Marine and Freshwater Research	<i>H. abdominalis</i>					
Woods, C. M. C.	2005	Growth of cultured seahorses (<i>Hippocampus abdominalis</i>) in relation to feed ration	Aquaculture International	<i>H. abdominalis</i>					
Casey, S. P.	2004	The origin and evolution of seahorses (genus <i>Hippocampus</i>): a phylogenetic study using the cytochrome b gene of mitochondrial DNA	Molecular Phylogenetics and Evolution	<i>H. spp.</i>					
Foster, S. J.	2004	Life history and ecology of seahorses: implications for conservation and management	Journal of Fish Biology	<i>H. spp.</i>					
Fricke, R.	2004	Review of the pipefishes and seahorses (Teleostei: Syngnathidae) of New Caledonia, with descriptions of five new species	Stuttgarter Beitrage zur Naturkunde Serie A (Biologie)	<i>H. spp.</i>					
Goffredo, S.	2004	Volunteers in marine conservation monitoring: a study of the distribution of seahorses carried out in collaboration with recreational scuba divers	Conservation Biology	<i>H. ramulosus</i>	<i>H. hippocampus</i>				
Kuang, C. C.	2004	A record of seahorse species (family Syngnathidae) in East Malaysia, with notes on their conservation	Malayan Nature Journal	<i>H. trimaculatus</i>	<i>H. kuda</i>	<i>H. barbouri</i>	<i>H. kelloggi</i>	<i>H. comes</i>	<i>H. histrix</i> <i>H. spinosissimus</i>
Kvarnemo, C.	2004	Testes investment and spawning mode in pipefishes and seahorses (Syngnathidae)	Biological Journal of the Linnean Society	<i>H. spp.</i>					
Lourie, S. A.	2004	A marine fish follows Wallace's Line: the phylogeography of the three-spot seahorse (<i>Hippocampus trimaculatus</i> , Syngnathidae, Teleostei) in Southeast Asia	Journal of Biogeography	<i>H. trimaculatus</i>					
Martin-Smith, K. M.	2004	Collaborative development of management options for an artisanal fishery for seahorses in the central Philippines	Ocean & Coastal Management	<i>H. comes</i>					
McPherson, J. M.	2004	Assessing East African trade in seahorse species as a basis for conservation under international controls	Aquatic Conservation-Marine and Freshwater	<i>H. borboniensis</i>	<i>H. camelopardalis</i>	<i>H. fuscus</i>	<i>H. histrix</i>	<i>H. kelloggi</i>	

			Ecosystems						
Moreau, M. A.	2004	Social structure and space use in a wild population of the Australian short-headed seahorse <i>Hippocampus breviceps</i> Peters, 1869	Marine and Freshwater Research	<i>H. breviceps</i>					
Oh, T.	2004	Early Life History and Rearing of the Yellow Seahorse <i>Hippocampus kuda</i> (Teleostei: Syngnathidae)	Korean Journal of Ichthyology	<i>H. kuda</i>					
Piacentino, G. L. M.	2004	<i>Hippocampus patagonicus</i> sp nov., new seahorse from Argentina (Pisces, Syngnathiformes)	Revista del Museo Argentino de Ciencias Naturales Nueva Serie	<i>H. patagonicus</i>					
Poortenaar, C. W.	2004	Reproductive biology of female big-bellied seahorses	Journal of Fish Biology	<i>H. abdominalis</i>					
Song, C. B.	2004	Molecular Phylogeny of Syngnathiformes Fishes Inferred from Mitochondrial Cytochrome b DNA Sequences	Korean Journal of Fisheries and Aquatic Sciences	<i>H. histrix</i>	<i>H. ingens</i>	<i>H. abdominalis</i>	<i>H. kuda</i>	<i>H. erectus</i>	<i>H. kelloggi</i>
Teske, P. R.	2004	The evolutionary history of seahorses (Syngnathidae : <i>Hippocampus</i>): molecular data suggest a West Pacific origin and two invasions of the Atlantic Ocean	Molecular Phylogenetics and Evolution	<i>H. spp.</i>					
Thangaraj, M.	2004	Species-specific proteins in closely-related seahorses	Current Science	<i>H. kuda</i>	<i>H. trimaculatus</i>				
Vincent, A. C. J.	2004	Temporal and spatial opportunities for polygamy in a monogamous seahorse, <i>Hippocampus whitei</i>	Behaviour	<i>H. whitei</i>					
Wetzel, J. T.	2004	Embryogenesis in the dwarf seahorse, <i>Hippocampus zosterae</i> (Syngnathidae)	Gulf and Caribbean Research	<i>H. zosterae</i>					
Willens, S.	2004	Fibrosarcoma of the brood pouch in an aquarium-reared lined seahorse (<i>Hippocampus erectus</i>)	Journal of Zoo and Wildlife Medicine	<i>H. erectus</i>					
Woods, C. M. C.	2004	Visible implant fluorescent elastomer tagging of the big-bellied seahorse, <i>Hippocampus abdominalis</i>	Fisheries Research	<i>H. abdominalis</i>					
Baum, J. K.	2003	Bycatch of lined seahorses (<i>Hippocampus erectus</i>) in a Gulf of Mexico shrimp trawl fishery	Fishery Bulletin	<i>H. erectus</i>					
Bell, E. M.	2003	First field studies of an Endangered South African seahorse, <i>Hippocampus capensis</i>	Environmental Biology of Fishes	<i>H. capensis</i>					
Cohen, P. J.	2003	Role of kairomones in feeding interactions between seahorses and mysids	Journal of the Marine Biological Association of the United Kingdom	<i>H. abdominalis</i>					
Gardner, T.	2003	The copepod/ <i>Artemia</i> tradeoff in the captive culture of <i>Hippocampus erectus</i> , a vulnerable species in lower New York State	Marine Ornamental Species: Collection, Culture & Conservation	<i>H. erectus</i>					
Hilomen-Garcia, G. V.	2003	Tolerance of seahorse <i>Hippocampus kuda</i> (Bleeker) juveniles to various salinities	Journal of Applied Ichthyology	<i>H. kuda</i>					
Jones, A. G.	2003	Sympatric speciation as a consequence of male pregnancy in seahorses	Proceedings of the National Academy of Sciences of the United States of America	<i>H. spp.</i>					
Kuiter, Rudie H.	2003	A new pygmy seahorse (Pisces: Syngnathidae: <i>Hippocampus</i>) from Lord Howe Island	Records of the Australian Museum	<i>H. colemani</i>					
Lourie, S. A.	2003	A new pygmy seahorse, <i>Hippocampus denise</i> (Teleostei : Syngnathidae), from the Indo-Pacific	Zoological Studies	<i>H. denise</i>					
Oconer, E. P.	2003	Immunolocalization of hormones involved in male gestation in the seahorse, <i>Hippocampus barbouri</i> Jordan and Richardson 1908	Philippine Agricultural Scientist	<i>H. barbouri</i>					
Oconer, E. P.	2003	Reproductive morphology and gonad development of the male seahorse, <i>Hippocampus barbouri</i> Jordan and Richardson 1908	Asia Life Sciences	<i>H. barbouri</i>					
Payne, M. F.	2003	Rearing the coral seahorse, <i>Hippocampus barbouri</i> , on live and inert prey	Marine Ornamental Species: Collection, Culture & Conservation	<i>H. barbouri</i>					
Sales, J.	2003	Nutrient requirements of ornamental fish	Aquatic Living Resources	<i>H. spp.</i>					
Shapawi, R.	2003	The value of enriched <i>Artemia</i> in supporting growth and survival of juvenile pot-bellied seahorses <i>Hippocampus abdominalis</i>	Journal of the World Aquaculture Society	<i>H. abdominalis</i>					
Teske, P. R.	2003	Population genetics of the endangered Knysna seahorse, <i>Hippocampus capensis</i>	Molecular Ecology	<i>H. capensis</i>					

Vincent, A. C. J.	2003	Correlates of reproductive success in a wild population of <i>Hippocampus whitei</i>	Journal of Fish Biology	<i>H. whitei</i>
Wilson, A. B.	2003	The dynamics of male brooding, mating patterns, and sex roles in pipefishes and seahorses (family Syngnathidae)	Evolution	Absent
Wong, J. M.	2003	The effects of temperature, Artemia enrichment, stocking density and light on the growth of juvenile seahorses, <i>Hippocampus whitei</i> (Bleeker, 1855), from Australia	Aquaculture	<i>H. whitei</i>
Woods, C. M. C.	2003	Frozen mysids as an alternative to live Artemia in culturing seahorses <i>Hippocampus abdominalis</i>	Aquaculture Research	<i>H. abdominalis</i>
Woods, C. M. C.	2003	Factors affecting successful culture of the seahorse, <i>Hippocampus abdominalis</i> leeson, 1827	Marine Ornamental Species: Collection, Culture & Conservation	<i>H. abdominalis</i>
Woods, C. M. C.	2003	Effect of stocking density and gender segregation in the seahorse <i>Hippocampus abdominalis</i>	Aquaculture	<i>H. abdominalis</i>
Woods, C. M. C.	2003	Effects of varying Artemia enrichment on growth and survival of juvenile, seahorses, <i>Hippocampus abdominalis</i>	Aquaculture	<i>H. abdominalis</i>
Woods, C. M. C.	2003	Growth and survival of juvenile seahorse <i>Hippocampus abdominalis</i> reared on live, frozen and artificial foods	Aquaculture	<i>H. abdominalis</i>
Zhang, N.	2003	Molecular profile of the unique species of traditional Chinese medicine, Chinese seahorse (<i>Hippocampus kuda</i> Bleeker)	Febs Letters	<i>H. kuda</i>
Ashley-Ross, M. A.	2002	Mechanical properties of the dorsal fin muscle of seahorse (<i>Hippocampus</i>) and pipefish (<i>Syngnathus</i>)	Journal of Experimental Zoology	Absent
Carcupino, M.	2002	Functional significance of the male brood pouch in the reproductive strategies of pipefishes and seahorses: a morphological and ultrastructural comparative study on three anatomically different pouches	Journal of Fish Biology	<i>H. hippocampus</i>
Golani, D.	2002	On the occurrence of <i>Hippocampus fuscus</i> in the eastern Mediterranean	Journal of Fish Biology	<i>H. fuscus</i>
Job, S. D.	2002	Culturing the oceanic seahorse, <i>Hippocampus kuda</i>	Aquaculture	<i>H. kuda</i>
Perante, N. C.	2002	Biology of a seahorse species, <i>Hippocampus comes</i> in the central Philippines	Journal of Fish Biology	<i>H. comes</i>
Rosa, I. L.	2002	Threatened fishes of the world: <i>Hippocampus reidi</i> Ginsburg, 1933 (Syngnathidae)	Environmental Biology of Fishes	<i>H. reidi</i>
Schmid, M. S.	2002	Seahorses - Masters of adaptation	Vie Et Milieu-Life and Environment	Absent
Woods, C. M. C.	2002	Natural diet of the seahorse <i>Hippocampus abdominalis</i>	New Zealand Journal of Marine and Freshwater Research	<i>H. abdominalis</i>
Adams, M. B.	2001	Effect of acute and chronic ammonia and nitrite exposure on oxygen consumption and growth of juvenile big bellied seahorse	Journal of Fish Biology	<i>H. abdominalis</i>
Alcaide, E.	2001	<i>Vibrio harveyi</i> causes disease in seahorse, <i>Hippocampus</i> sp	Journal of Fish Diseases	<i>H. kuda</i>
Consi, T. R.	2001	The dorsal fin engine of the seahorse (<i>Hippocampus</i> sp.)	Journal of Morphology	<i>H. erectus</i>
deBruyn, A. M. H.	2001	Detecting lunar cycles in marine ecology: periodic regression versus categorical ANOVA	Marine Ecology Progress Series	<i>H. spp.</i>
Horne, M. L.	2001	A new seahorse species (Syngnathidae: <i>Hippocampus</i>) from the Great Barrier Reef	Records of the Australian Museum	<i>H. queenslandicus</i>
Jones, A. G.	2001	Mating systems and sexual selection in male-pregnant pipefishes and seahorses: Insights from microsatellite-based studies of maternity	Journal of Heredity	Absent
Kanou, K.	2001	Early life history of a seahorse, <i>Hippocampus mohnikei</i> , in Tokyo Bay, Japan	Ichthyological Research	<i>H. mohnikei</i>
Kornienko, E. S.	2001	Reproduction and development of some pipefish and seahorse genera of the family Syngnathidae	Biologiya Morya (Vladivostok)	<i>H. spp.</i>
Kuiter, R. H.	2001	Revision of the Australian seahorses of the genus <i>Hippocampus</i> (Syngnathiformes: Syngnathidae) with descriptions of nine new species	Records of the Australian Museum	<i>H. spp.</i>

Masonjones, H. D.	2001	The effect of social context and reproductive status on the metabolic rates of dwarf seahorses (<i>Hippocampus zosterae</i>)	Comparative Biochemistry and Physiology: Molecular and Integrative Physiology	<i>H. zosterae</i>					
Shaw, M. E.	2001	Effect of diet on body composition and growth parameters in juvenile seahorses (<i>Hippocampus</i> spp.) at the Toronto zoo	Proceedings of the Aza Nutrition Advisory Group Fourth Conference on Zoo and Wildlife Nutrition	Absent					
Teixeira, R. L.	2001	Reproduction and food habits of the lined seahorse, <i>Hippocampus erectus</i> (Teleostei: Syngnathidae) of Chesapeake Bay, Virginia	Brazilian Journal of Biology	<i>H. erectus</i>					
Wilson, A. B.	2001	Male pregnancy in seahorses and pipefishes (Family Syngnathidae): Rapid diversification of paternal brood pouch morphology inferred from a molecular phylogeny	Journal of Heredity	<i>H. barbouri</i>	<i>H. comes</i>	<i>H. erectus</i>	<i>H. kuda</i>	<i>H. zosterae</i>	