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## Reproductive biology and broodstock maintenance of seahorse *Hippocampus comes* as a prospect aquaculture commodity

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# Reproductive biology and broodstock maintenance of seahorse *Hippocampus comes* as a prospect aquaculture commodity

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**Abstract.** Seahorse is a unique bony fish, which has appearance male pregnancy. Seahorses also have properties that are very effective in treating the potential of deadly antimicrobial attacks. Therefore, the traditional system of consuming seahorses, because of overfishing, causing the population to become extinct. Seahorses are rare animals and only found in certain regions. All of *Hippocampus* are listed species under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). which is intended as a sea horses export must be obeyed by countries that have signed CITES. Another effort that can be done is by developing cultivation. To support these activities, it is necessary to provide seahorses in bulk and not depending on the season. In other words, the procurement of juwana must be programmed so that they can be produced on time, the right type, the right quality and quantity and also the exact location. These criterias can only be obtained from hatchery activities. Seahorses hatchery is still very new and not developed yet, especially in Indonesia. In addition, information on reproductive biology aspects is also very limited, so more in-depth research is needed.

**Keywords:** overfishing, reproductive, seahorse

## 1. Introduction

Seahorses is one of marine commodities that has advantages as ornamental fish (live seahorses) and raw material for medicines (dead seahorses). Not only used as raw material for traditional medicine but also as a raw material for modern medicine. Seahorse has a very important function in increasing and balancing vitality and stamina that throughout in the body, and has medicinal roles to several diseases for example, impotence and unfertil, asthmatic, increased cholesterol, goitre, kidney problems, and skin disorders for example acute pimple irritation [1].

An innovative class of peptide which is anti-inflammatory, insulated of the *H. comes*, exhibits characteristic effects against arthritis, which is a major chondrocytic degenerative disease characterised by the articular cartilage which is excessive degradation of extracellular matrix (ECM) and synovial inflammation [2]. The expressions of MMP, iNOS, and COX-2 are inhibited by peptides from the seahorse through the activation of both MAPK and NF- $\alpha$ , inducing TPA and the differentiation of



osteoblastic and human chondrocytes [2]. A new peptide, inhibiting the release of collagen through suppression of collagenase 1 and 3 at regulating the nitric oxide products by NF-kB/p38 kinase, was isolated from a seahorse called SHP-1 [2].

During this time seahorses were obtained by being caught in nature, while seahorses need for was getting higher. This can result in a low population of seahorses in nature. Seahorses are rare animals and only found in certain regions. Therefore, to save this commodity, seahorses has been put in the Appendix II [3]. Preventive action of sustainability threats and extinction of seahorses, a technology is needed that can provide seahorse seeds so that they do not depend on catches and maintain continuity. Seahorse hatchery and cultivation can be considered as an alternative to suppress wild seahorse population caught [4]. One important aspect to achieve the above, the complete control of the reproductive cycle is absolutely necessary for the success of seahorse hatchery. Seahorse hatchery is still very new and not yet developed, especially in Indonesia. In addition, information especially regarding aspects of reproductive biology is also very limited, so more in-depth research is needed.

Crypsis is a color pattern used by seahorse in its camouflaging ability to both capture prey and avoids predators. During this camouflaging activity, they barely move to match the background. They can well change colors for several days or weeks as they also have skin filaments that are better at adapting to their habitats. Short-term color changes occur during intra-species interactions and mating [3].

Seahorse culture can be considered as an alternative source for reducing the pressure on the wild population [4]. Some of the problems arising in seahorse farming are mostly related to hatchery and reproduction [5]. However, seahorse hatching and reproduction in captivity is well known for several species as a result of research progress and available information. An important factor in the farming system is the maintenance of water quality to provide conditions that support and benefit the seahorse broodstock [6, 7].

The farmed organism aims to increase stock and to add to the wild stocks. Producing and releasing sustainable aquaculture commodities involve the increment of stocks and the development of successful farming technologies [8]. One of the main factors influencing the results of teleost fish spawning is adequate nutrition [9]. Seedling and seed production techniques must be developed at the hatchery while releasing strategies such as site selection, microhabitat assessment, the collection of baseline data on wild population, size of stocking and the development of marking techniques to evaluate the survival and efficiency of stocking strategies, must also be investigated [10].

## 2. Materials and Methods

Adult seahorse were collected from fisherman at Teluk Betung, Lampung, Indonesia. These seahorse were conditions for a month before being used breeding trials. Adult artemia were used as feed during this conditioning period. Only healthy seahorses were used for all experiments. Breeding experiments were conducted at Reproduction Laboratory Aquaculture Department, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University (IPB). In IPB, broodstock were conditioned in breeding media filtration system. For breeding tank, similar system as conditioning tank was set using square aquaria (100x70x40cm). The sea water used in the brooder aquaria was treated by rapid sand filtration and bio-filtration. Broodstock was fed twice daily, *ad libitum* with adult artemia. seahorse waste and left over feed were siphoned daily before and after feeding. Water depth in the tank was maintained throughout the experimental period. Portable Spectrophotometer were used to measure dissolved oxygen/DO (ppm), temperature (°C), salinity (ppt), pH, ammonia (ppm), twice a week throughout this experiment.

### 3. Result and Discussion

#### 3.1. Reproductive biology

This study used male seahorses chosen are those larger than female body weight, male seahorses weight is  $\pm 10$  to 14 g and female body weight ranges between  $\pm 9$  to 12 g, with length between 12 to 17 cm, at a sex ratio of 1 female: 2 male (figure 1). Good condition juveniles may also produced by larger parents. Large parents of *H. comes* are known to produce offspring with postnatal growth that is significantly higher than the offspring from younger and smaller parents [11]. A very important biological variable is the size of an organism, because it will be used in the study of reproduction, ecology and behavior also, habitat selection, used systematically, population data collection and fisheries modeling [12]. Seahorse size at maturity was closely correlated with seahorse maximum height, and kudalaut menunjukkan ketertarikan menjalin hubungan pada kudalaut yang memiliki ukuran yang sama atau lebih besar pada periode kematangan gonad yang pertama as well as marine teleosts [3].

#### *Hippocampus comes*

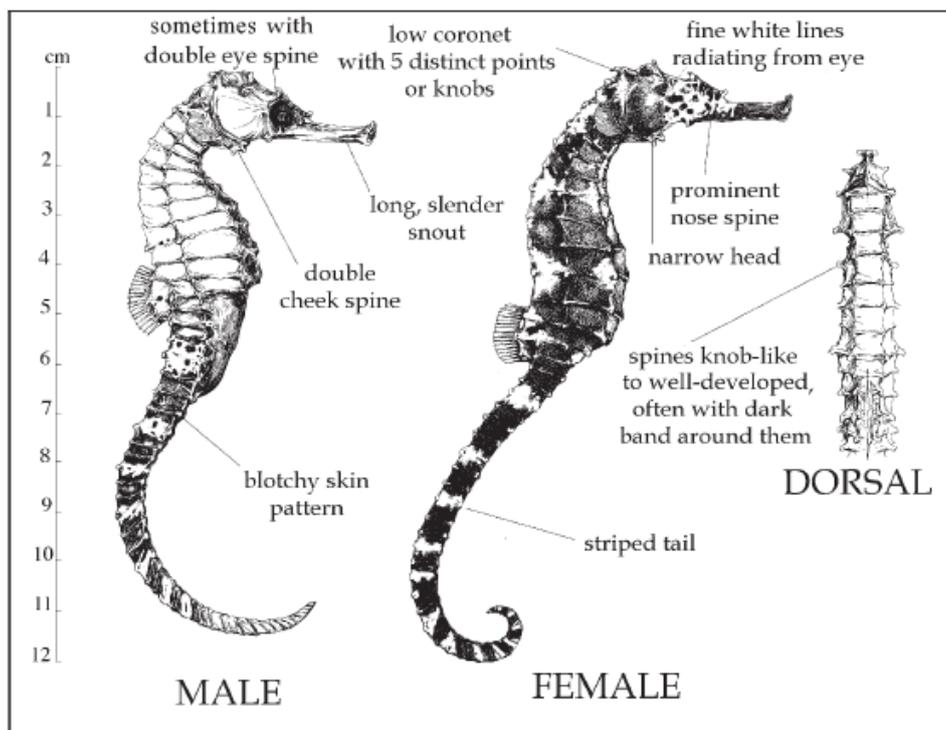
Cantor 1850

##### Common names

Tiger tail seahorse (U.S.A.)

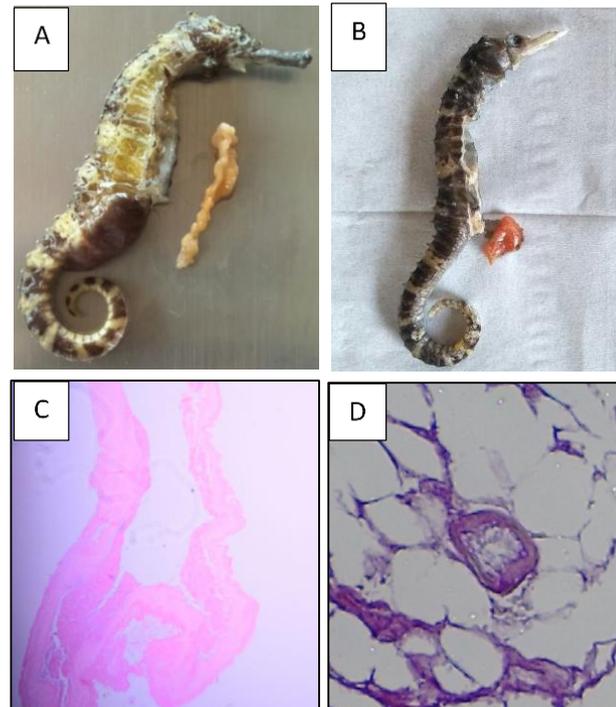
##### Synonyms

None known



**Figure 1.** Description : Maximum recorded adult height: 18.7 cm<sup>2</sup>, Trunk rings: 11, Tail rings: 35-36 (34-37), HL/SnL: 2.2 (1.9-2.5), Rings supporting dorsal fin: 2 trunk rings and 1 tail ring, Dorsal fin rays: 18 (17-19), Pectoral fin rays: 17 (16-19), Coronet: small and Low with five distinct, rounded knobs or spines Spines: Range from knob-like and blunt to well-developed and sharp; often with dark band near tip. Other distinctive characteristics: Double Cheek spines ; Spines below are double and some types are above the eyes; stand out, sharp nose spine; long, slender snout. Colour/pattern: usually has yellow and black, tail was striped (in dark specimens, often not visible); on body had mottled or blotched pattern; sometimes of eyes radiated fine white lines.

Most species of seahorses, adult female with a body length of 9-14 cm can produce eggs average between 600 to 800 eggs, while adult male who have a length of 10-12 cm will release from 300 to 600 juveniles [13]. *H. hippocampus* juvenile has obtained 1,572 to 1,753 [14], *H. ingens* has also produced adolescents up to 6000. in different species it has been supported between 100-200 adolescents have been produced in *H.ramalassus* [15], *H. guttatus* also has succeeded in producing as much as 150-600 juveniles. Male maturation seahorses have pale yellow testicles while female maturation has bright orange yellow ovaries (figure 2).



**Figure 2.** Structure of the mature seahorse *H.comes* : A. male of *H.comes*; B. female of *H.comes*; C. section of *H. comes* testis; D. section of *H. comes* ovary.

### 3.2. Broodstock maintenance

**3.2.1. Feeding.** Diets that given for seahorses broodstock were adult artemia used as feed *ad libitum* twice daily during this conditioning period. Newly hatched *Artemia* nauplii were grown in circular fibreglass tank with vigorous aeration. *Artemia* nauplii were fed with mixed of rice flour, molase and yeast until reach adult stage. seahorses are catching predators, the type of prey consumed is the living prey they take [16]. The prey which heading towards their mouths will be ambushed using a long snout and suction quickly [3].

Variety of feeds were given to seahorse broodstock in captivity which include adult *Artemia*, mysid shrimp, amphipods and shrimps, given as live or frozen [11]. In this study the author used artemia as a feed because in addition easy to handling, easy to obtain and have a good nutrient content for gonadal development in particular. in this study author's reason used artemia as a feed because in addition to easy of handling, easy to obtain it and have a good nutrient content for gonadal development in particular. The most common feed given to seahorses are frozen mysis and live *Artemia* as they are easier produce or obtain commercially [4].

*Artemia* determines the nutritional value of various marine fish and crustaceans as it is related to the composition of feed protein which greatly affects the reproductive performance of marine fish [9, 10]. The composition of n-3 DHA and n-3 EPA containing n-3 eicosapentaenoic acid (EPA) especially DHA which is considered as a major dietary requirement in the reproductive process that can affect steroidogenesis, sperm and other reproductive parameters [9]. A special focus applying to the

cultivation system is at the feeding stage to develop techniques suitable for the maintenance of the broodstock and the reproductive process [7]. The development of gonads and the quality of sperm of seahorses are greatly influenced by both the quality and quantity of feed and the size of the broodstock [17].

**3.2.2. Water quality.** The water temperature was maintained at 26-28°C in seahorse farming. Salinity was also in the range of 30-33 ppt while dissolved oxygen ranged from 5.0 to 7.5 ppm. 30-50% of the water was replaced daily by removing excess food and dirt from the bottom of the aquarium. The total volume of water replacement was 30% of fresh sea water. Mild aeration was provided continuously. In the water tank, there was seawater that has been filtered to remove sand and equipped with light aeration. The temperature of 26-28°C was considered as the optimal temperature for reproduction of *H. comes* and the achievement of gonadal maturity [18]. During spawning and embryogenesis, water temperature was very important in influencing egg quality as it can affect the metabolism, activity, and structure of the developing embryos [19]. The effects of temperature, especially low temperature, on gonadal development can harm *H. comes* [20]. Maintaining water quality is an important factor, especially in aquaculture system to provide favorable conditions for seahorses [6, 7]. The ability of the egg to be fertilized and developed into a normal embryo is called egg quality. The parameter commonly used to assess egg quality in fish is to observe the size of the egg or the contents of the yolk. Environmental (irradiation, temperature, salinity and water pH) and biological factors can influence egg quality in the oogenetic process [19]. The height of the tank is another important factor for the success of *H. comes* breeding. It is important to determine the minimum water depth needed to ensure successful egg transfer during spawning. High water levels will cause difficulties in the maintenance of the *H. comes*. A minimum depth of 60-70 cm is required [21].

#### 4. Conclusion

*Hippocampus comes* provides excellent farming opportunities. This study focuses on the reproductive biology and maintenance of broodstock in captivity. Beyond the limitations in the information provided about the broodstock maintenance methods described here, this information has at least contributed to the conservation and economy of aquaculture technology for this species.

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