

## MEASURES FOR THE MANAGEMENT FOR THE PROTECTION OF THE BLACK SEA HORSE *HIPPOCAMPUS RAMULOSUS* LEACH, 1814 AT THE ROMANIAN LITTORAL

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**Abstract.** The sea horse *Hippocampus ramulosus* LEACH, 1814 represents one of the most attractive marine organisms from the Romanian littoral which is subject to anthropogenic pressure exerted on the marine ecosystem. It is a species of fish with a clear role in the Black Sea ecosystem that requires specific management measures to restore its natural populations. The paper aims at emphasizing the threats that the sea horse is exposed to, as well as the required preservation measures. Among these, aquaculture techniques represent a way of diminishing the anthropogenic impact. There is a presentation of the results of the experiments carried out by the NIMRD "Grigore Antipa" in 2008, within the "2 Mai - Durankulak area - Biodiversity Preservation and Public Awareness" project, launched by the Mare Nostrum NGO, implemented in partnership with NIMRD and WWF, the Kaliakra branch (Bulgaria) and financed through the cross-border cooperation PHARE programme.

**Keywords:** sea horse, the Black Sea, management, protection.

**Rezumat. Măsuri de management pentru protecția căluțului de mare *Hippocampus ramulosus* LEACH, 1814 de la litoralul românesc.** Căluțul de mare *Hippocampus ramulosus* LEACH, 1814 reprezintă unul dintre cele mai atractive organisme marine de la litoralul românesc care este supus presiunii antropice exercitate asupra ecosistemului marin. Este o specie de pește cu un rol bine definit în ecosistemul Mării Negre care necesită măsuri specifice de management pentru refacerea populațiilor sale naturale. Lucrarea are ca scop să evidențieze amenințările la care este supusă această specie, precum și a măsurilor de management necesare. Printre aceste măsuri, aplicarea tehnicilor de acvacultură reprezintă o cale de diminuare a impactului antropic. Sunt prezentate, de asemenea, rezultatele experimentărilor efectuate de INCDM „Grigore Antipa” în 2008, în cadrul proiectului „2 Mai – Durankulak – Protecția Biodiversității și Conștientizare Publică”, coordonat de ONG Mare Nostrum în parteneriat cu INCDM și WWF Bulgaria filiala Kaliakra și finanțat prin programul PHARE de cooperare transfrontalieră.

**Cuvinte cheie:** căluțul de mare, Marea Neagră, management, protecție.

### INTRODUCTION

One of the most popular species on the Romanian littoral is the sea horse *Hippocampus ramulosus* LEACH, 1814, which is the flag-species of the Marine reserve 2 Mai – Vama Veche. The sea horse population must be protected due to ecological, biological, economic, and medical reasons. This small fish species are predator benthic organisms, thus the diminishment of their populations can harm the ecosystem (Project Sea Horse, 2007). Their extraordinary life cycle – only the male becomes “pregnant”, and the pairs are monogamous - offers a great opportunity of exploring our understanding of their ecology.

The diminishment of the sea horse population on the Romanian littoral noticed during the past decades (Annual Studies – INCDM, 2008-2009), but with a tendency of repairing during the past years, is due to a number of causes:

- Pollution and destruction of the specific habitats;
- Accidental catches;
- Small dimensions significantly diminish the reproductive potential;
- The juveniles depend on the males, being carried around by them;
- They are a monogamous species, which does not reproduce until it has found a new partner;
- The low mobility restricts the re-colonization of the affected areas.

Management measures for the rehabilitation of the populations:

- Supporting the fishers communities (through consulting and training) in developing resource management abilities;
- Developing protocols regarding resource management;
- Reducing accidental catches;
- Rehabilitating specific habitats;
- Developing a Marine Protected Areas network;
- Developing culture technologies for aquarists (hobby-ists).

The experiments carried out in 2008 in this context, had as main purpose creating of a pilot "hatchery" for the reproduction and culture of the sea horse, releasing the juveniles into the sea and monitoring them. We also want to underline the necessary measures for the management of this important specie.

### MATERIAL AND METHODS

The setting up of the space and the experimental rooms was made at the National Institute for Marine Research and Development “Grigore Antipa” Constanța and consisted in:

- The "hatchery":

Fish tanks (Fig. 1) and aquaria (Fig. 2) for the growth of the spawners (parents), larvae and juveniles; four fiber glass tanks with a flat bottom, with a capacity of about 1500 l/tank and four aquaria with 70 l/aquarium; during the project, the small aquaria were equipped with air and water pumps and a large fish aquarium was purchased (Fig. 3) (also equipped with an air and water pump, filtration and sterilization installations).

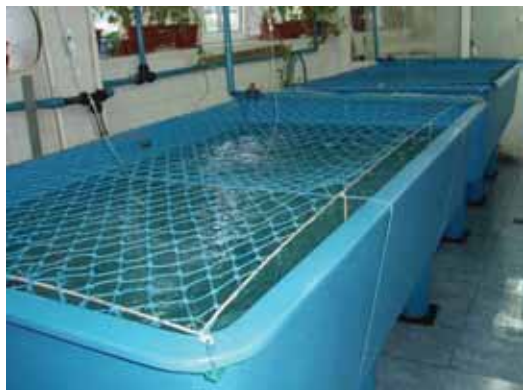


Figure 1. Tanks for sheltering spawners and adults.  
Figura 1. Bazine de parcare reproducători și creștere adulți.  
(foto T. Zaharia).

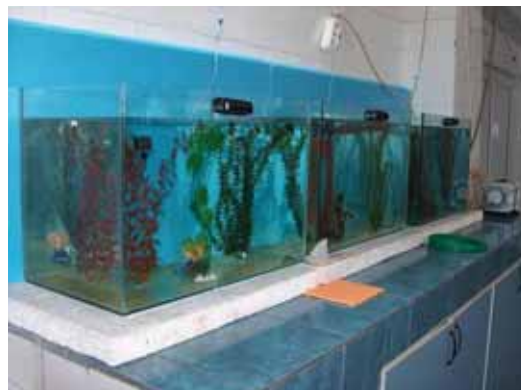


Figure 2. Aquaria for sheltering pairs of selected spawners.  
Figura 2. Acvarii de parcare a cuplurilor de reproducători selectați. (foto T. Zaharia).



Figure 3. Aquarium for the culture of juveniles.  
Figura 3. Acvariu pentru creșterea puietului. (foto T. Zaharia).

- Live feed obtaining sector:

The microphyte algae room: where the microphyte algae strains are kept and where the culture is obtained in

recipients with various capacities (according to the feeding requirements);

The invertebrates culture room: ten Zug-Weiss recipients were used for the project, where the cultures for the *Artemia salina* phylopods were placed.

- Biological materials:

Microphyte algae strains: *Tetraselmis suecica* species and diatomeae;

*A. salina* cysts from Salt Lake, USA, which have a high rate of hatching;

*H. ramulosus* spawners, captured by divers from the areas close to the Marine Reserve 2 Mai-Vama Veche (NOT in its perimeter, as the Functioning Regulation and the Management Plan of the Reserve forbid it).

Methods: classical methods for fish culture, using "clear waters" (the distribution of phytoplankton is realized only for *Artemia* nutrition). For phytoplankton culture, we used Walne's medium, in continuous system.

## RESULTS AND DISCUSSIONS

**Description of the specie:** *Hippocampus ramulosus* LEACH, 1814 (Fig. 4) (RADU & RADU, 2008):

**Fishing area:** 37.4.2.

**Systemic inclusion:** Order: Syngnathiformes, Family: Syngnathidae

**Synonyms:** *Hippocampus rosaceus* RISSO, 1826

*Hippocampus guttulatus* CUVIER, 1829

*Hippocampus ramulosus* LAWE, 1860

*Hippocampus hippocampus microstephanus* SLASTENENKO, 1937

*Hippocampus guttulatus microstephanus* BĂNĂRĂSCU, 1964

**Popular names:** Romanian: căluț de mare; English: sea horse; French: cheval marin, hipocampe; Bulgarian: morskoe konchë; Russian: morskoi konek; Ukrainian: morskii konik; Turkish: denizati

Figure 4. The sea horse - *Hippocampus ramulosus* (photo O. Șerbănescu).  
Figura 4. Căluțul de mare - *Hippocampus ramulosus* (foto O. Șerbănescu).



**Description:** The body is short, laterally pressed; the torso and the head form a 90° angle. The head, the back and along the superior margins of the caudal area is equipped with well-developed, sharp or rounded tubercles (thorns). Larger and smaller thorns alternate. Sometimes, the tubercles on the head bear tegumentary annexes. There is a ridge on the ventral side of the torso. The incubatory sack of the male is short, situated in front of the caudal area, on the belly. At the ring joiner points, the ridges are higher, forming sharp, rounded, flattened or wide thorns. The lateral-dorsal ridge is continued by the dorsal ridge of the tail. The gill opening is reduced to a small, round orifice on the superior part of the head. The lateral line is present.

Colors: the body is brown-reddish or darkish; the ventral area is grey or whitish: there are blue spots on the superior part of the body. The edge of the dorsal is white and under this white edge, there is a dark line, sometimes almost black, with variable heights and densities. Just like the chameleon, the sea horse can change its skin colour and can rotate its eyeballs independently.

**Radial formula:** D 18-22, P 16-19, A (3) 4 (5), 11 trunk rings, 34-27 caudal rings, 9 sub-dorsal rings, 11-13 rings between the head and the posterior edge of the dorsal.

**Dimensions:** maximum 12 cm, common 8-10 cm.

**Morphologically convergent species:** from a morphological point of view it cannot be mistaken with other species.

**Distribution, biology:** It is spread in the Atlantic Ocean, the Mediterranean Sea, the Black Sea and the Azov Sea. It dwells in sea grass bushes, close to the shores, as well as on rocky bottoms, clinching its tails on the marine plants. It swims vertically with the help of the dorsal. Its biology is extremely interesting, but very little studied. The reproduction takes place during the summer, when females lay their spawn (up to 400-500 pyriform roes) in the incubating sack of the males, which opens during this period, then it closes. The incubation takes 4 weeks. After the hatching, the sack opens, releasing the larvae, and then it closes again. It feeds mainly with small crustaceans.

**Exploitation, valorization, stocks:** It has no economic value, being interesting as far as its body shape and biology are concerned. It is present in the shore catches, in fishing and drag nets. Due to the fact that it has no economic importance, no evaluations of the stock state were ever done. It is not reported in the FAO statistics.

**Threats:** In Europe, the sea horse is fished intentionally or accidentally in Portugal and sold as a curiosity. They are also accidentally fished in Italy, France, Spain, Croatia and Black Sea countries, including Romania. The volume of the sea horse trade is unknown, but, with non appropriate management, it may become a threat for the species. The species is also threatened by the vulnerability of the habitats, especially under human influence.

**The list of threats** (according to IUCN):

- 1.4.1. Habitat loss/degradation - Development of infrastructure and industry;
- 1.4.2. Habitat loss/degradation - Development of infrastructure - human settlements;
- 1.4.3. Habitat loss/degradation - Development of infrastructure - tourism, leisure;
- 3.5.3. Collecting - Cultural, scientific, leisure activities - Regional/international trade.

#### **Preservation measures required**

All species of the *Hippocampus* genus were listed in the Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in November 2002. All species of the genus were included on the implementation list, starting with May 2004. A full statement for the animal trade of this type is required also by the European Union. In addition, a similar system of tracing the dry animals trade is under construction.

#### **Preservation measures list (IUCN)**

- 1.2.2.2 Legal measures - Legislation - Implementation - National level
- 2.2. Communication and Education - Public awareness
- 3.1. Scientific research – Taxonomy (to be approached)
- 3.2. Scientific research – Population evaluation, distribution (to be approached)
- 3.3. Scientific research – Biology and Ecology (to be developed)
- 3.4. Scientific research – State of Specific Habitats (to be developed).

Seahorse populations should be preserved for ecological, biological, economic, and medical reasons. These fishes are important predators on benthic organisms, so removing them may well disrupt ecosystems. Securing the future for seahorses, their relatives and their habitats will require the cooperation of scientists, regulatory authorities and non-governmental organizations around the world. We need to apply the next measures of management (VINCENT, 1996):

- Help subsistence fishing communities, through consultation and training, develop the skills and legal authority to manage the resources they exploit.
- Develop new management protocols and models for fisheries and understand the ecological and economic impacts of non-food fisheries.
- Reduce incidental by-catch in non-selective fishing gear, particularly for species that are difficult to exclude from the fishery.
- Restore degraded habitats specific for this fish.
- Implement marine protected areas (MPAs) to increase fish number, size and diversity within the MPA and to enhance fisheries outside the MPA.
- Develop alternative livelihoods that are ecologically sensitive and economically sustainable, in order to reduce fishing pressure on exploited wild populations.

## Experiments regarding the reproduction and culture of the sea horse in captivity on the Romanian littoral

### 1. Controlled breeding and reproduction experiments

Selecting the spawners: the spawners were brought in by divers in May 2008 from areas close to the reserve, were placed in the lab in the fiber glass tanks (where artificial vegetation was put in order to create a habitat similar to the natural one); following an adaptation period of about 10 days, the pairs formed (1 female - about 7 cm/individual and 1 male - about 8 cm/individual – Fig. 5), they were selected and placed in the aquaria of the "hatchery" (10 pairs/aquarium – a total of 3 tanks = 30 pairs = 30 males bearing the spawn in the incubating sack).



Figure 5. Female and male sea horse.

Figura 5. Căluț de mare: femelă și mascul. (foto T. Zaharia).



Figure 6. Unfertilized roes. / Figura 6. Icre nefecundate. (foto T. Zaharia).



Figure 7. Embryos before hatching. / Figura 7. Embrioni înainte de eclozare. (foto T. Zaharia).



Figure 8. Males bearing the spawn. / Figura 8. Masculi purtători de punga. (foto T. Zaharia).



Figure 9. Larvae immediately after the expulsion from the incubating sack. / Figura 9. Larve imediat după expulzarea din punga incubatoare. (foto T. Zaharia).

b. Growing the juveniles up to a size appropriate for their release into the natural environment (WEISS, 2008): it was done in the large tank, with daily maintenance (feed distribution - the *A. salina* phytopod and microphyte algae);

c. The release into the natural environment: the release of the juveniles was done at the beginning of October, at an age of about 3 months (about 5 cm in size/individual); the release was done in the buffer area of the Marine Reserve, into the *Cystoseira barbata* fields (Figs. 10 – 15), as this habitat is characteristic for the sea horse. The buffer area of the reserve is dedicated to measures of ecological reconstruction and rehabilitation of specific marine populations and habitats.

### 3. Results of the experiments:

a. As a follow up of the controlled reproduction and culture of the sea horse, the first results of this type were obtained for the Black Sea basin, obtaining, first of all, important data regarding the ecology and ethology of this

species. The concrete results, expressed in survival percentages and number of animals released into the sea, are modest, but prove that this is possible. Thus, from 30 selected pairs (30 males bearing the spawn) we obtained in average 60 larvae/male that is 1,800 larvae as a total. The survival percentage up to 3 months was only of 4%, obtaining 78 juveniles, which were released in the Marine Reserve. The release area was monitored by divers during the following period (10 days).

b. During the development of the experiments, the juveniles and adults were fed with live feed (*A. salina* nauplii, respectively meta-nauplii), ensuring in the juvenile sea horse culture tank a density of 2-6 individuals/l. 24 hours before the feeding, it is recommended to enrich the living feed with special additives (WEISS, 2008). DHA Protein Selco was used for the project, which enriches considerably the unsaturated fat acids content of the organisms used for feeding. In addition, *A. salina* was fed with microscopic algae obtained in lab cultures.

c. We consider these results as preliminary, the continuation of the research being a necessity, contributing this way to the sustainable management of this species valuable for the Black Sea ecosystem.



Figure 10. *C. barbata* field in the Marine Reserve (specific habitat) (NIMRD photo).

Figura 10. Câmp de *C. barbata* în Rezervația Marină (foto INCDM).



Figure 11. Sea horse in its specific habitat (photo D. Micu).

Figura 11. Căluț de mare în habitatul său specific (foto D. Micu).



Figures 12 – 13. Diver on a mission: releasing the sea horses in the Marine Reserve 2 Mai – Vama Veche (NIMRD photo).

Figuri 12 – 13. Scafandru în misiune: eliberarea căluților în Rezervația marină (foto INCDM).



Figures 14 – 15. Immediately after the release: seeking for hiding places (NIMRD photo).

Figuri 14 – 15. Imediat după eliberare: căutarea locurilor de ascunziș (foto INCDM).

## CONCLUSIONS

Seahorse populations should be preserved for ecological, biological, economic, and medical reasons. These fishes are important predators on benthic organisms, so removing them may well disrupt the ecosystems. Securing the future for seahorses, their relatives and their habitats will require the cooperation of scientists, regulatory authorities, and non-governmental organizations around the Black Sea. We need to apply some measures of management for this important specie.

The experiments carried out in 2008 by NIMRD with a view to use the aquaculture techniques for the reproduction and culture of the sea horse led to:

- The setting up of the "hatchery" at the headquarters of NIMRD, consisting in: the live feed obtaining room and the tanks and aquaria room for the sheltering of spawners and growing the larvae and juveniles;
- Obtaining a stock of 1,800 larvae, respectively 78 juveniles at the age of three months;
- The release of the juveniles into the Marine Reserve 2 Mai – Vama Veche at the beginning of October;
- Consequent monitoring of the area where the juveniles were released.

During the experiment, important data regarding the behaviour of this species were obtained, especially the reproduction and juvenile period. The research must be continued and increased, for the application of the results obtained within a reproduction and culture technology in captivity of the seahorse, in the same time with the development of the management measures.

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