Experimental culture of Aphia minuta. Study on the maintenance in captivity, nutritional requirements, ecological needs and possibility of controlled reproduction

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Experimental culture of *Aphia minuta*. Study on the maintenance in captivity, nutritional requirements, ecological needs and possibility of controlled reproduction

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SUMMARY – The project "Experimental culture of *Aphia minuta"* is a combined initiative of the Department of Aquaculture of Aula del Mar-Malaga and the Provincial Council of Malaga. The aim of this project is to determine the technical and biological viability of the culture of this species, based on a study of its maintenance in captivity, on nutritional requirements, ecological needs and the possibility of a controlled reproduction. This project is organised in three stages, each lasting one year. The first stage began with a bibliographical study, carried out by contacting people and organisations (e.g. fishermen's associations) related to the subject, defining a work protocol, setting up the laboratory, and taking note of some experiences of maintenance and reproduction with species of the same family. Now, at the second stage of the project, research is based on the capture of adult species at a reproduction stage, pathological, microbiological and nutritional studies, control of the physical-chemical parameters of the water and photoperiod, induction to spawning, sex identification, moment of sexual maturation and images. Finally, the third stage will focus on obtaining first spawnings and larvae, improvement of their survival percentage, and a better understanding of the complete biological cycle of this fish.

Key words: *Aphia minuta,* new candidate species.

RESUME – *"Culture expérimentale de* Aphia minuta*. Etude du maintien en captivité, des besoins nutritionnels, des besoins écologiques et de la possibilité de reproduction contrôlée". Le projet "Culture expérimentale de* Aphia minuta*" est une initiative combinée du Département d'Aquaculture de Aula del Mar-Malaga et du Conseil Provincial de Malaga. Le but de ce projet est de déterminer la viabilité technique et biologique d'élevage de cette espèce, en se basant sur une étude de son maintien en captivité, des besoins nutritionnels, des besoins écologiques et de la possibilité de reproduction contrôlée. Ce projet est organisé en trois étapes, dont chacune dure une année. La première étape a commencé par une étude bibliographique, menée en contactant des personnes et des organisations (par exemple, associations de pêcheurs) rattachées à ce domaine, en définissant un protocole de travail, en mettant sur pied un laboratoire, et en prenant note de quelques expériences de maintien et de reproduction avec des espèces de la même famille. Actuellement, pour la deuxième étape du projet, la recherche est basée sur la capture d'espèces adultes au stade de reproduction, sur des études pathologiques, microbiologiques et nutritionnelles, sur le contrôle des paramètres physico-chimiques de l'eau et la photopériode, l'induction de la fraye, l'identification sexuelle, le moment de la maturation sexuelles et sur des images. Finalement, la troisième étape sera axée sur l'obtention de premières pontes et larves, l'amélioration de leur pourcentage de survie, et une meilleure compréhension du cycle biologique complet de ce poisson.*

Mots-clés : Aphia minuta*, nouvelles espèces candidates.*

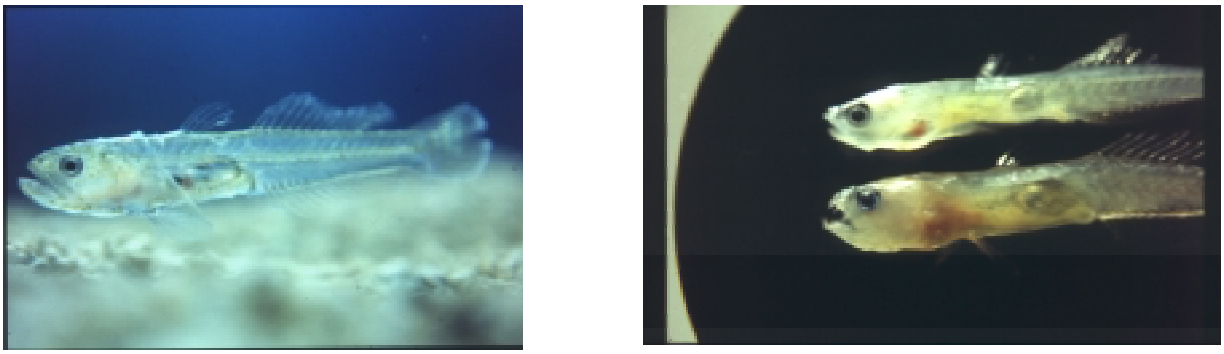
Introduction

The project "Experimental culture of *Aphia minuta*" (transparent goby) is a combined initiative of the Department of Aquaculture of Aula del Mar-Malaga and the Provincial Council of Malaga. The aim of this project is to learn the technical and biological viability of the culture of this species, based on a study of its maintenance in captivity, on nutritional requirements, ecological needs and the possibility of a controlled reproduction.

This idea has arisen as a result of the crisis of the local fishing sector and the fishing practices in the bay of Malaga, where there is a continuous and intensive capture of immature fish of different species, which are sold like false "chanquetes", or transparent gobies, in spite it being prohibited. In addition, this activity tends to grow with the increase of the tourism along the coast.

Aphia minuta

Aphia minuta is a small marine fish (average size 25 mm) that belongs to the *Aphia* genus and to the *Gobiidae* family. Its body is translucent and presents a very marked sexual dimorphism, especially in the morphology of the teeth, the anal fin and the second dorsal fin (Fig. 1).



a b

Fig. 1. Photos of *Aphia minuta*. a: translucent body of an adult male; and b: differences between female head (top) and male head (bottom).

This species can be found in the north-eastern Atlantic, in the western area of the Baltic Sea, in the Mediterranean Sea and the Black Sea. Its habitat is mainly located near the seabed and at river mouths, on sandy, muddy bottoms and meadows of marine vegetation. *Aphia minuta* normally appears in free waters, in dense shoals, moving to the sea bottom at the onset of the reproduction period. Spawning takes place on the inner face of empty shells. The progenitors die soon after spawning.

The project

This project is organised in three stages, each lasting one year. The first stage began with the bibliographical study, by contacting people and organisations (e.g. fishermen's associations) related to the subject, by defining a work protocol, by setting up the laboratory, and with some experiences in maintenance and reproduction with species of the same family. Now, at the second stage of the project, research is based on the capture of adult species at the reproductive stage, pathological, microbiological and nutritional studies, the control of the physical-chemical parameters of the water and photoperiod, the induction of spawning, sex identification and the moment of sexual maturation and images. Finally, the third stage will be focused on obtaining the first spawning and larvae, improving their survival percentage, and a better understanding of the complete biological cycle of this fish.

Preliminary results

During the first six months of 1999 there were fifteen captures. The survival rate of the first captures was very low; probably due to the strong impact of the capture process and the transport from the place they were captured to the laboratory. Therefore our first efforts were devoted to improving the capture and transport conditions and to reduce the time between capture and transport to the quarantine tanks.

One of our main objectives at this stage was to establish medical treatment to eliminate possible bacterial, viral and parasitic infections suffered by some of the captured specimens.

On average, about 100 fish were transported to the quarantine tanks. Initially, most of them died within 48 hours, due to injuries and traumas of the capture and transport. Only those with very good health remained alive (about 20%). This is what we call "shock time". Thereafter, with the application

of preventive treatments against bacteria, fungus and parasites, the survival rates have improved and reached about 80%.

We currently have about 600 animals, from different captures, in very good conditions. They are classified in sizes, between 25 mm (youths) and 55 mm (adults). The adult individuals were captured from January to April and the youths from May to June following a positive gradation of growth. The captures made in June showed an average size of 35 mm (Fig. 2).

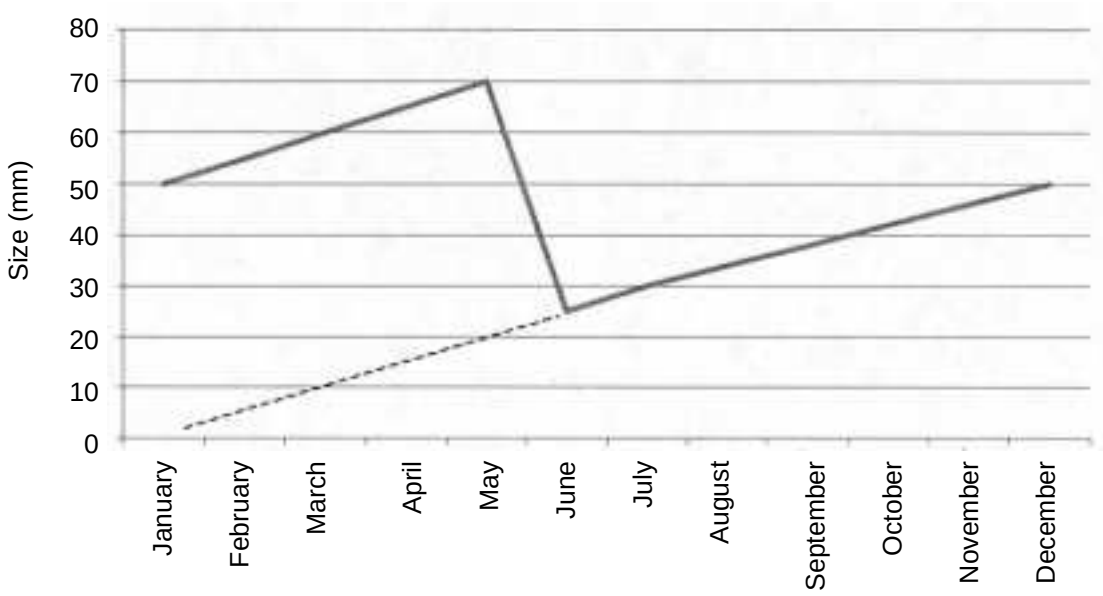


Fig. 2. Evolution of the average capture sizes throughout the year.

From half-size animal data obtained throughout 1999, we were able to identify a spawning period between the months of January and February. This data allowed us to establish a biological cycle for this species of approximately 18 months. The majority of the animals survive until spawning.

Finding the best kind of food to satisfy their nutritional requirements has been a great success. Although initially it was necessary to provide live food (*Artemia* spp.), little by little the animals began to eat a diet exclusively based on specific sea bottom fish food. As no specific feed for this specimen exists, they are fed alternatively with different kinds of food to maintain a complete and varied diet. The composition of inert feed is:

Crude proteins.....46%
Crude fat.....5%
Crude fibre.....2%
Humidity.....8%

At the beginning the food was based exclusively on vitamin fodder. Due to physical deterioration that the animals were gradually suffering, we proceeded to increase the proportion of live feed as opposed to fodder. We established a different feed pattern based on the stage of development of the animals (Figs 3 and 4).

The adults (size between 35-65 mm), were fed with a 75% of live food and 25% of vitamin complex. The juvenile animals (approximate size 25-35 mm) were feed with 50% of live food and 50% vitamin fodder.

During the first two months of 1999 some interesting changes in their behaviour took place, very closely related to courtship. We did not obtain any spawning, probably because the captivity conditions were not optimum. During January and February 2000 we obtained spontaneous laying from different females, not followed by the courtship. This fact has meant that males do not fertilize the oocytes and therefore we spawn manually using sperm from mature males.

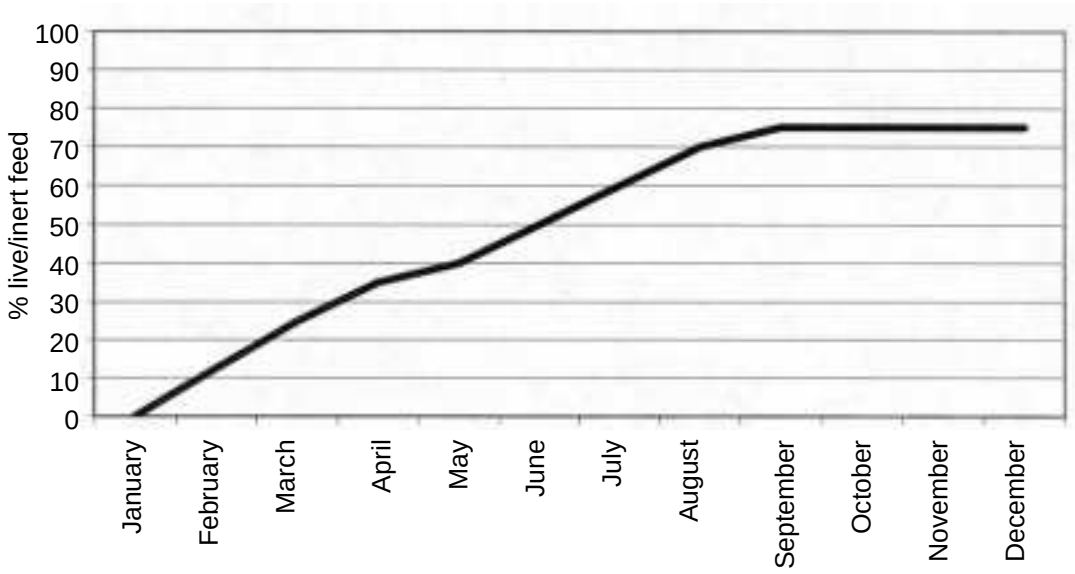


Fig. 3. Feed for adults (35-65 mm).

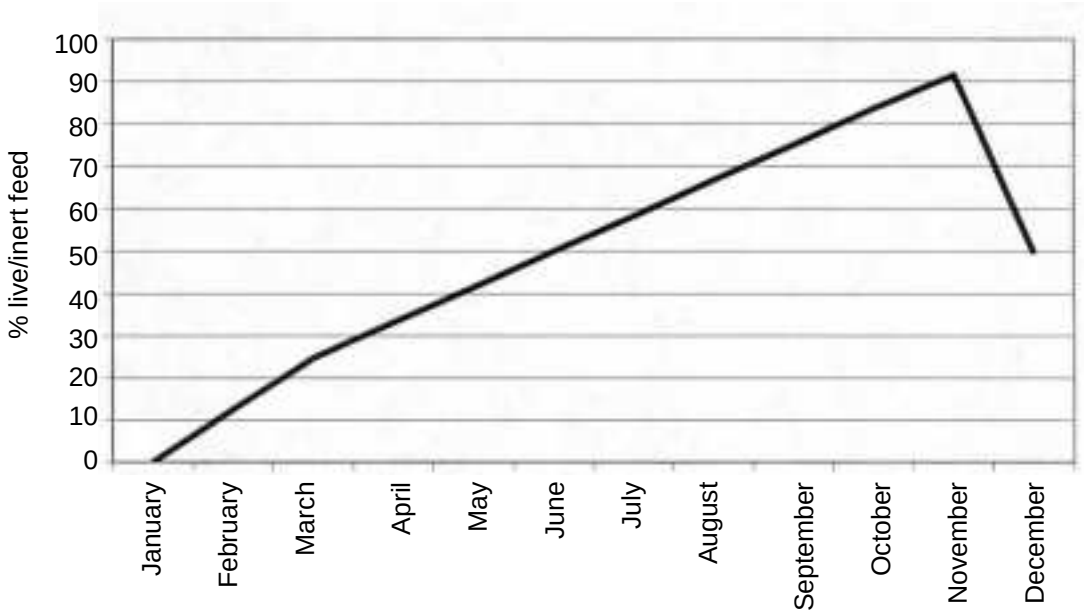


Fig. 4. Feed for juveniles (25-35 mm).

Our efforts have now made this laying viable. As the number of males in captivity was superior to that of females, we found nests with only one male inside. Males are very aggressive when another male approaches his nest. We suppose that this behaviour is the previous process to spawning, corresponding with the courtship of the fish. This data could be confirmed by the fact that some females show signals that they are reaching their sexual maturity.

Conclusions

Our conclusions after the first six months of the second stage of the study are the following:

(i) *Aphia minuta*_s20 is an animal of coastal habitat, small size and high capacity to adapt to life in captivity.

(ii) Voracious fish, the temperature at which it lives ranges from 16 to 20°C.

(iii) Gregarious fish; it is only alone during reproduction time living at the bottom of the sea, and uses shells for courtship and spawning.

(iv) Its translucent body shows the vertebral column and viscera clearly. The viscera are rose-coloured which shows up when the animals are in a group.

(v) Very clear sexual dimorphism: males bigger than female, with a prominent head and big teeth and bigger fins. Male aggressiveness during courtship is very clear with those of the same sex.

(vi) Very resistant to high concentrations of nitrites.

(vii) Breeders found in every capture. There is a clear reproduction period during the first six months of the year, with a peak in March and April.

Further reading

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