

Endangered limpets change sex to improve their chances of survival

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Ribbed limpet during sexing process. This was a female, as suggested by the reddish colour at the bottom of the syringe. Credit: Iván Acevedo

The Ribbed Mediterranean Limpet is one of the most endangered invertebrates of the Mediterranean Sea and is classed as being in danger of extinction. Researchers at the Spanish National Museum of Natural Sciences have discovered their reproductive strategy, consisting in

changing sex from male to female and vice versa, which improves their ability to adapt to changes in their environment.

The Ribbed Mediterranean Limpet, *Patella ferruginea*, shares the unfortunate privilege of being included in the Spanish Catalogue of Endangered Species, together with other better known species such as the Iberian Lynx and the Imperial Eagle, under the maximum protection category, 'in danger of extinction'.

This is why a National Strategy was formed in 2008 for this invertebrate, commonly known as the ribbed limpet, for the conservation of the species. Fines for fishing for shellfish with this limpet range between 60,000 and 300,000 euros.

"One of the problems involved in the recovery of the *Patella ferruginea* is the lack of knowledge regarding basic aspects of its biology. This is the first time we have encountered this part of its [reproductive strategy](#) on an experimental basis", Javier Guallart, main author of the project and researcher at the Spanish National Museum of Natural Science, told SINC.

The lack of biological knowledge surrounding the species is not unusual, given that the species is so endangered that there are only a few natural colonies left good enough to carry out the research projects. One of the most important colonies of the whole area in which they are located is the Spanish archipelago of the Chafarinas Islands opposite the coast of North Africa..

A team led by Guallart has spent six years travelling to this area to conduct research to explore one of the most essential aspects of the species' biology; its method of reproduction.

"Sexing" limpets is a complicated task

According to the scientist, the ribbed limpet had until now been believed to be a protandric hermaphrodite species. "As a reproductive strategy, this term means that youngsters, when they reach sexual maturity, do so as males and then, at some point during their vital cycle, change sex and become females".

This occurs often in molluscs and, in particular, in limpets. However, this conclusion has normally been based on indirect information. "For example, it is based on the fact that smaller specimens tend to be male and larger ones tend to be female", adds Guallart.

In order to confirm that they really do [change sex](#), in 2006 a complex task began, involving sexing a number of specimens and returning to do it again a year later, during the next reproductive period (this species only reproduces once a year), to check whether they had changed sex.

"This may seem simple, but it is not. Sexing specimens means separating them from the substratum during the time of the year in which they are mature, between October and November, handling them and performing a small biopsy with a syringe to take a small sample of gonad in order to establish the sex according to the sample extracted (oocytes or sperm)", outlines the author.

The specimens were then returned to the coast, in the same place they were captured and this was done so they could adhere to the substratum, enabling them to continue with their way of life.

Also, given that it is a highly protected species, the death rate related to this handling operation had to be minimised which, as outlined in the article, has been achieved by following a protocol that was designed and tested for this purpose.

Females also change sex

In 2007 we discovered that a specimen previously sexed as male in 2006 was now a female, which meant this was the first direct and unprecedented proof of a sex change in the *Patella ferruginea*.

The work carried out between 2007 and 2008 also brought about further developments. On the one hand, it was confirmed that a number of specimens previously sexed as male were now females and a new unusual development was unearthed: a female had become a male between consecutive reproductive periods.

"The results obtained were fascinating. This reverse sex change from female to male was something anecdotally described for a species of limpet. During subsequent periods, between 2010 and 2011, we discovered that this was not an isolated case; a whole new approach to the method of reproduction of this protected species, which helps it to survive", stated the scientist. When and why the [sex change](#) occurs in each case is yet to be explained.

Knowing the main biological parameters of endangered [species](#) such as this one is vital in order to implement any strategy aimed at their conservation and recovery. "There is still a long way to go", reiterated Guallart.

More information: Javier Guallart, Marta Calvo, Iván Acevedo y José Templado (2013) "Two-way sex change in the endangered limpet *Patella ferruginea* (Mollusca, Gastropoda)" *Invertebrate Reproduction & Development*, 57(3): 247-253.

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