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Comments on 'Alien chelonians in north-eastern Spain: New distributional data' by Poch et al. - A possible novel *Mauremys mutica* x *Mauremys leprosa* hybrid

Poch et al. (2020) present a good review of records of chelonian alien species in north-eastern Spain, in the region of Catalonia, together with novel data supplied by the authors. In their article they depict two *Mauremys mutica*, one an old female specimen (their Fig. 4.4) the other an individual that appears to show a mixture of external characters diagnostic of both *Mauremys leprosa* and *M. mutica* (their Fig. 3.4). The authors indicate that at least one of the specimens was captured at "Riera de Santa Maria, Caldes de Malavella". This area is part of the Natura 2000 Network ES5120017 "Estany de Sils-Riera de Santa Coloma", where a population of the species *M. leprosa* is also known to be present (Generalitat de Catalunya, 2018). It would be helpful to know if the specimen in their Figure 3.4 was captured in this area as it could be a *M. leprosa* x *M. mutica* hybrid.

The proposed hybrid (Fig. 1B) shows an orange colored, elongated, but short postorbital blotch, that seems to be a combination of characteristics of both parental species. *Muremys mutica* (Fig. 1A) shows a prominent light yellow stripe running from the posterior border of the orbit over the tympanum to anterior neck (Ernst & Barbour, 1989; Yasukawa et al., 1996) while young *Mauremys leprosa* have a small, round orange blotch that lies between the tympanum and the orbit, that usually fades with age (Ernst & Barbour, 1989; Díaz-Paniaguaet al., 2015) (Fig. 1C). The proposed hybrid has two marked facial lines, under its jaw and in the commissure. *Mauremys leprosa* shows many other facial lines. For *M. mutica*, the throat and ventral surface of the neck is pale to light yellow, lighter than the dorsal surface of the head and neck. The neck and front limbs of both *M. leprosa* and the proposed hybrid show a series of marked orange stripes. *Mauremys mutica* does not show any pattern on its legs. The limbs and tail are dark olive dorsally and laterally, pale or greyish yellow ventrally. The neck shows a broad yellow stripe extending backward from the orbit over the tympanum to the neck. A second yellow stripe may extend diagonally downward and backward from the lower edge of the orbit or the corner of the mouth to below the tympanum. There is a dorsomedial yellow stripe on the neck. Head and neck are dorsally grey to olive (Ernst & Barbour, 1989). *Mauremys leprosa* is dark green colored (Diaz-Paniagua, 2015). The proposed hybrid is dark brown and apparently exhibits a mosaic of the external characters typical of both *M. leprosa* and *M. mutica*; the elongated postorbital blotch and the stripes on the forelimbs being diagnostic.

Such a hybrid has not been observed previously but its occurrence would not be surprising as Stuart and Parham (2007) state that among geoemydid species reproductive isolation mechanisms are not well established. Furthermore *M. mutica* is known to produce interspecific hybrids with *Mauremys reevesii* (Fujiiet al., 2014) and even intergeneric hybrids with *Cuoratri fasciata* (Parham, 2001). If possible, the specimen should be recaptured to make morphological measurements and to take samples for genetic analysis.

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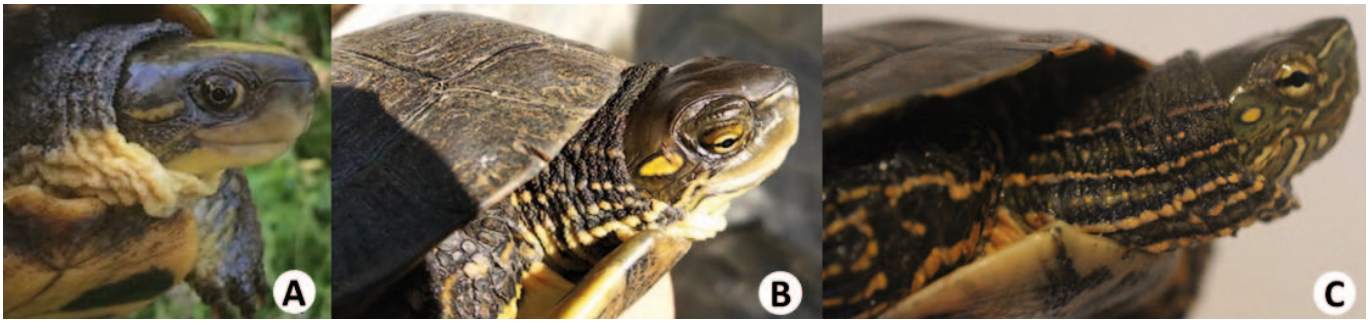

Figure 1. Comparison between **B.** Proposed hybrid *M. leprosa* x *M. mutica*, and its parent species **A.** *M. mutica* and **C.** *Mauremys leprosa*. **A. & B.** are from Poch et al., 2020

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JOSE MARIA LOPEZ-SANCHEZ
Sociedad Herpetológica Valenciana – SOHEVA. P.O. Box 99, 46210 Picanya, Spain.
Author e-mail: txemalopez@hotmail.com

Reply to 'Comments on 'Alien chelonians in north-eastern Spain: New distributional data' by Poch et al. - A possible novel *Mauremys leprosa* x *Mauremys mutica* hybrid'.

The two specimens of *Mauremys mutica* illustrated in Poch et al. (2020) showed several external characters that meet the description of this species, both in the plastral and cephalic coloration. Some of the characters proposed by López-Sánchez (above) to differentiate the potential hybrid from a non-hybrid specimen of *M. mutica* are of doubtful utility. For example, when describing the head coloration of *M. mutica*, this author omitted that it can also be blackish-brown (Bonin et al., 2006). Moreover, he noted that in a typical specimen of *M. mutica* the postorbital blotch is light yellow, whereas in the proposed hybrid it is orange, a trait inherited from a *M. leprosa* parent. However, on page 333 of Bonin et al. (2006) a specimen of *M. mutica* is shown with an orange-brown postorbital blotch, similar in coloration to the specimen found in Girona.

We believe that taking in account the wide intraspecific variability of *M. mutica* (Bonin et al., 2006), it would be impossible using a partial photograph alone to determine the parental species of the specimen proposed as a hybrid. Besides, the situation is complicated because a hybrid specimen could have been bred in captivity and then released. Therefore the parental species could be any other species of the genus *Mauremys* and cannot be restricted to *M. leprosa* not least because the presence of stripes on the forelimbs is not an exclusive character of this species (Bonin et al., 2006). Moreover when we captured the specimen for the first time, it had already reached adult size. If this specimen had been born in the wild, we would have probably detected it much earlier during our periodical surveys (Escoriza et al., 2020). Considering all the reasons above, we deem it bold for anyone to attempt the description of a novel hybrid based solely on partial photographs without any solid molecular evidence.

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GUILLEM PASCUAL[1], SANTIAGO POCH[2], PAU SUNYER[3], DANI BOIX[2] & DANIEL ESCORIZA[2*]
[1]GALANTHUS, 17460 Celrà, Spain
[2]GRECO, University of Girona, Campus Montilivi, 17071 Girona, Spain
[3]Fundació Emys, Carretera de Santa Coloma Km 21, 17421 Riudarenes, Spain
[*]Corresponding author e-mail: daniel_escoriza@hotmail.com

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