

First records of Columbus crabs *Planes minutus* associated with loggerhead turtles *Caretta caretta* in Galicia (NW Spain)

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The loggerhead turtle (*Caretta caretta* Linnaeus, 1758) is distributed in temperate and tropical oceans and seas worldwide (Wallace et al., 2010). Most of the loggerheads that appear on the European Atlantic coast are juveniles originating from nesting areas in the western Atlantic (Bolten et al., 1998). These specimens have either deviated from their usual developmental migration within the north Atlantic Gyre system (Witt et al., 2007), or have originated from Cape Verde having been displaced by storms (Monzón-Argüello et al., 2012). Since 1990, in Galicia (NW Spain) an average of 9.7 individuals are recorded yearly by the stranding network: they are juveniles that are found stranded at the coast or accidentally captured in fishing gear, both alive and dead (López et al., 2014).

The Columbus crab (*Planes minutus* Linnaeus, 1758) is a small pelagic species that is found in the north Atlantic, western coast of Africa, Mediterranean Sea and western Indian Ocean, living on floating material, both natural and artificial, and frequently associated with sea turtles (Pfaller et al., 2019). In Galicia, these crabs have been found on beaches, associated with the gooseneck barnacle (*Lepas anatifera* Linnaeus, 1758) (Urgorri et al., 1990), but they had never been observed on sea turtles. However, according to the records summarised by Pfaller et al. (2019) the species has been reported on turtles in nearby areas including the Canary Islands, Madeira, the Azores and France.

From 1990 to 2016 a total of 122 live loggerhead turtles were examined in Galician rehabilitation facilities, and no Columbus crabs were reported. In 2017, the first crab was found on the single live turtle that was examined. From 2018 to 2020 just one live turtle was examined and no crabs were recorded. But in 2021, 4 crabs were found in 3 of 4 examined live turtles, evidencing an increase of the crab's occurrence on turtles. All five reported crabs were observed around the tail and rear flippers of the turtles (Fig. 1), which are the places where they are usually found (Davenport, 1994), although they have also been observed occupying a wound in the carapace (Anjos et al., 2021). The smallest turtle with an associated crab had a straight carapace length of 21.5 cm. It could be thought that this is a very small size to have this kind of epibiont, but crabs have been found on smaller loggerhead turtles in Madeira (Dellinger et al., 1997). Actually, the crab is more frequently present on juvenile turtles, which live in epipelagic habitats, than on subadult and adult turtles that



Figure 1. One of the Columbus crabs found on a loggerhead turtle captured accidentally on 20 April 2021

occupy mostly neritic habitats (Pfaller et al., 2019).

The crabs were measured with a Vernier digital calliper and weighed with a digital scale Pesola MS500 (Table 1). According to body measurements proposed by Dellinger et al. (1997), all the crabs were adults, but none of the three females carried eggs. In previous studies it had also been observed that the vast majority of crabs recorded on turtles were adults (Dellinger et al., 1997; Scaravelli et al., 2008). The reason for this would be that juvenile small crabs colonise floatsam and large ones can move to sea turtles with little or even no swimming involved, when the turtles rest or feed close to floatsam (Dellinger et al., 1997). Two of the crabs, female and male, were found together on the same turtle. Heterosexual couples have been reported previously, even sometimes being more frequent than solitary individuals (Dellinger et al., 1997; Scaravelli et al., 2008).

The relationship between the turtle and the crab could be considered as mutualistic, since both species gain a benefit. The crabs that live on turtles feed on other epibionts, including crabs, or capture food particle while the turtle is feeding, obtaining a higher diversity of prey than crabs living on flotsam; meanwhile, the turtle receives a cleaning service (Frick et al., 2004) which prevents the proliferation of epibionts that can alter the swimming capabilities of the turtle (Anjos et al., 2021).

Table 1. Columbus crabs recorded on loggerhead turtles in Galicia (NW Spain)

Date	Coordinates	Turtle SCL (cm)	Condition	Crab			
				Sex	SCL (mm)	SCW (mm)	Weight (g)
06/12/2017	43°45' N, 007°38' W	52.5	Gillnet by-catch	M	20.54	19.98	3.9
03/03/2021	42°20' N, 008°46' W	21.5	Gillnet by-catch	F	18.74	18.66	3.1
20/04/2021*	43°44' N, 007°50' W	23.0	Gillnet by-catch	F	17.88	17.71	2.3
20/04/2021*	43°44' N, 007°50' W	23.0	Gillnet by-catch	M	15.72	15.53	2.0
09/07/2021	42°11' N, 008°47' W	22.1	Stranded	F	17.06	16.74	2.4

*Crabs found on the same loggerhead turtle, F – female, M – male, SCL – straight carapace length, SCW – straight carapace width

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