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Sea turtles on Clipperton Island (Eastern Tropical Pacific)

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Clipperton Island (10° 17' N, 109° 12' W; Fig. 1) is located between the tip of Baja California and the Equator, in the Eastern Tropical Pacific. The closest other land masses are the Revillagigedo Islands, 950 km to the north, and Manzanillo on the coast of Colima, Mexico, 1000 km to the northeast. The 3-4 km wide atoll (Fig. 2) has a complete land ring, 40-360 m wide and 1.7 km^2 in area, which encloses a 7.2 km^2 lagoon (Jost 2003). The depth of 200 m is reached between 300 and 700 m from the seashore. Except for an isolated volcanic rock 29 m above sea level, the highest elevation is 4 m. The soil, of coral rubble and sand, is covered with guano. Apart from introduced coconut palms, the woody vegetation is absent, and the herbaceous vegetation is scarce (Lorvelec *et al*. 2006). Before 1839, two channels connected the lagoon with the open sea, the first located in the southeast of the atoll, close to the volcanic rock, the second in the northeast. Sometime between 1839 and 1858, thanks to hurricane effects, the lagoon was isolated from the ocean, and became a brackish ecosystem (Sachet 1960).

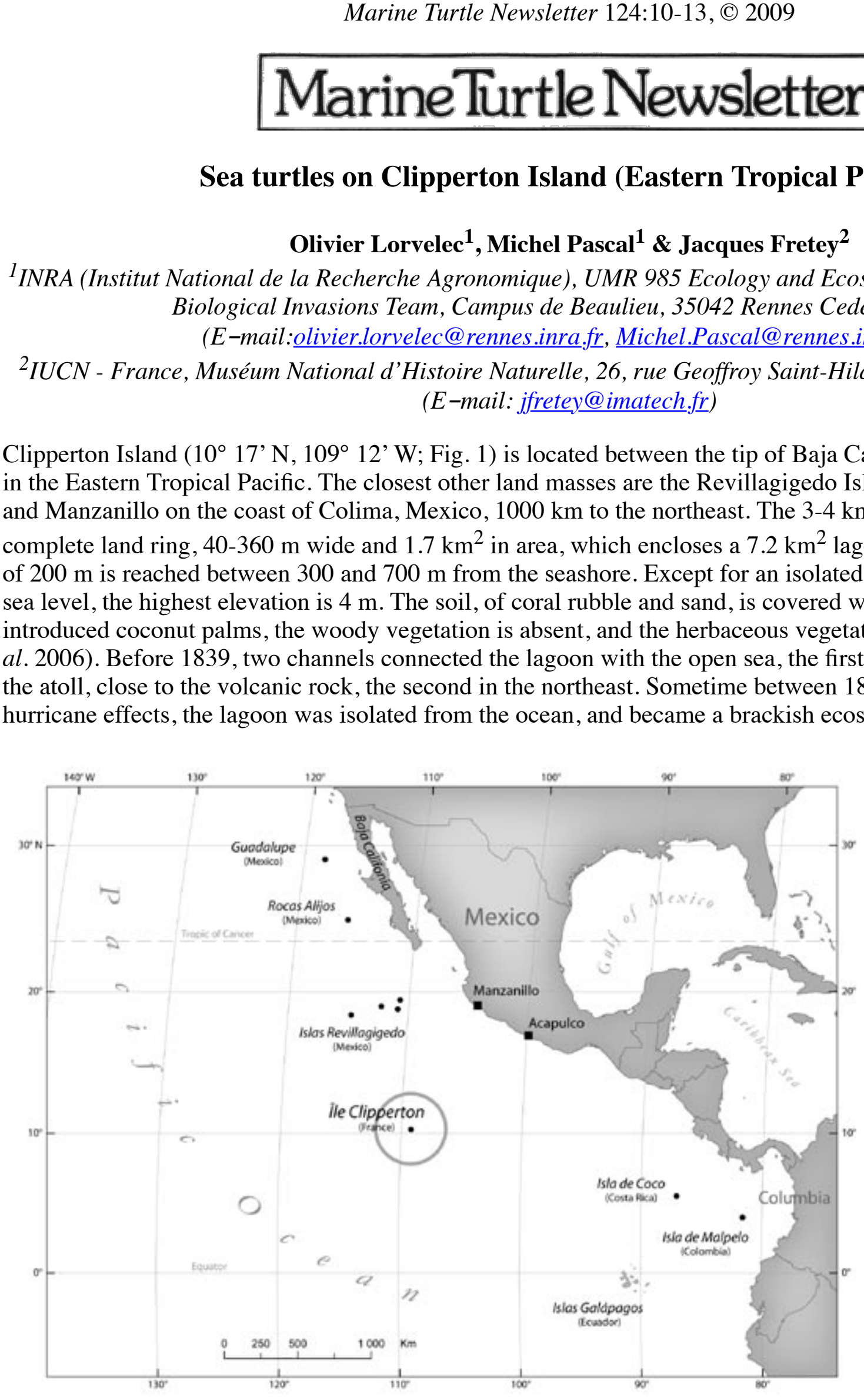

Figure 1. Clipperton Island in the Eastern Tropical Pacific.

Figure 2. Map of Clipperton Island.

Travel accounts (Sachet 1960) showed that the island was discovered by two French vessels on April 3, 1711, which was a Good Friday, known in French as "Passion Friday". Hence, the former name of this island was *"île de la Passion"*. It has also been suggested, without evidence, that the island had been know previously by Magellan in 1521 (Nunn 1934), followed by Spanish sailors, and finally by the English pirate John Clippington, *i.e*. Clipperton, in 1705. The French Navy officially took possession of the island in 1858. Later, there was a conflict between France and Mexico over sovereignty of the island, but an international arbitrage was pronounced in 1931 to the benefit of France. Today, status of this island is special: recent French legislation (February 21, 2007) puts Clipperton Island under the direct authority of the government, which had delegated administration aspects to the French Polynesia government commissioner (February 3, 2008).

The first landing on Clipperton Island is supposed to have been made by the U.S. sailor Benjamin Morrell in 1825 (Sachet 1960). Since the 1890s, despite geographic isolation, human activities have deeply altered this insular ecosystem. Intensive human impact began with the extraction of phosphates by an American company between 1893 and 1914, followed by the activities of a Mexican settlement and garrison between 1906 and 1917, and then short stays by the armed forces of the United States (1945) and France (between 1966 and 1969). Clipperton Island is currently uninhabited but remains of temporary encampments testify that it is used for short visits, probably by crews of fishing boats and few tourists.

Since the natural history observations and collections reported by John Arundel in 1897 (Sachet 1960), several scientific expeditions have studied flora and fauna of the land, the lagoon and the surrounding marine environment of Clipperton Island. A comprehensive study of the history and ecological functioning of this island was carried out by Sachet (1960, 1962a, b, c, 1963). A recent expedition organised by Dr Jean-Louis Étienne took place between December 2004 and April 2005, and included scientists from agencies of several countries. One of its major goals was to update the inventories of flora and fauna. Within this expedition, the authors (OL & MP) carried out an inventory of terrestrial vertebrates (Lorvelec & Pascal 2006, in press). These authors, as well as Pitman *et al*. (2005), have proposed conservation measures that contrasted with previous proposals of economic development suggested by Jost (2003, 2005).

Since its discovery, man introduced two mammal species in Clipperton Island. The pig (*Sus scrofa*), which was introduced to Clipperton in 1897, built up a population of 58 feral animals in 1958. Its detrimental impact on the masked booby (*Sula dactylatra*), the brown booby (*Sula leucogaster*), and several other breeding seabird species

led the U.S. scientist Kenneth Stager to eradicate the pigs in 1958 (Stager 1959, 1964). This eradication induced the recovery of sea bird breeding populations, which presently include the masked booby's largest breeding colony and the brown booby's second largest one in the world (Pitman *et al*. 2005). The ship rat (*Rattus rattus*) was introduced to Clipperton between September 1998 and November 1999 as a consequence of a ship wreck (Pitman *et al*. 2005). Presently, rats have colonised all the terrestrial habitats of the atoll (Lorvelec & Pascal 2006).

Benjamin Morrell is the only person who has mentioned sea turtle nesting on Clipperton Island. On August 17, 1825 he wrote: "… *The whole island is literally covered with sea-birds, such as gulls, whale-birds, gannets, and the booby. There are also a few small land-birds, which were probably blown from the American coast during the hurricane months. Fur-seal and sea-elephant resort here in small numbers in the proper seasons, and green turtle come hither to deposite their eggs… After taking what few fur-seal could be found about the island, we got underway and sailed for the Gallapagos Islands…*" (Morrell 1832: 219).

Although there are no other records of sea turtle nesting on Clipperton Island, Morrell's quote was cited by Sachet (1962a, b) as evidence of nesting. Nevertheless, even if Morrell does record sea turtle nesting, he does not specify if he personally observed such nesting, and the species identification is questionable because of a lack of description (Lorvelec & Pascal 2006).

On the western coasts of America, the green turtle (*Chelonia mydas*) exhibits a particular form ("*agassizii*"), the names is black turtle or East Pacific green turtle, which was sometimes ranked at the level of subspecies or species by some authors. It is speculated that the sea turtle recorded as the "*green turtle*" in Morrell's text may have been this form, which, according to Marquez (1990), currently nests from Jalisco, Mexico, to Manta, Ecuador, as well as on oceanic islands such as the Galapagos and the Revillagigedo (Fig. 1). According to this author, Juarez-Ceron *et al*. (2002) and Seminoff (2004), the major nesting grounds are located on these oceanic islands, on the coast of Michoacán, Mexico, and on several places of Central America. Clipperton Island is located between the Galapagos and the Revillagigedo islands, so it is possible that this turtle was nesting on this atoll during the 19th century. As the nesting season of this turtle changes with latitude (Marquez 1990) and covers more or less the total year, a full year survey would be required to fix nesting events, if they currently exist, on Clipperton Island.

Clipperton beaches presently consist of sand mixed with coral debris and they are largely flooded during high tides. Access to the island is difficult and dangerous because of fringing reefs and breakers, as described by Sachet who visited the atoll in 1958 (1962a). Lorvelec & Pascal (2006) have suggested that Clipperton beaches are presently unsuitable for sea turtle nesting, but, hypothetically, the hawksbill (*Eretmochelys imbricata*), and perhaps other species, might nest in these conditions on the highest part of some beaches. There is no information on the quality of the beaches when Morrell landed on Clipperton, but as the lagoon was connected to the sea during his visit, the island may have hosted suitable nesting beaches for sea turtles inside the lagoon (Lorvelec & Pascal 2006).

However, during the period of guano exploitation between 1893 and 1917, it is likely that egg and adult exploitation by humans as well as nest destruction by pigs during the first half of the 20th century, could have contributed to the disappearance of the nesting population (Lorvelec & Pascal 2006). For the record, pigs, like rats, are known to prey on eggs of Chelonia on beaches close to Mexican villages (Pacific Sea Turtle Recovery Team 1998).

Turtle	Date	Stage, sex	CCL	CCW	PL	CoS	InS	Sp	Observations
T1	Dec. 10	?	-	-	-	-	-	?	Remains, some bones
T2	Dec. 21	?	-	-	37.5	-	-	?	Remains, some bone
T3	Dec. 27	Juvenile	51.5	55.5	30.5	5-May	4+p.	Lo	Dead, intact, b., freshly stranded, Fig. 3
T4	Jan. 1	?	-	-	44	-	-	Lo?	Start of decay, carapace broken, no head
T5	Jan. 1	Mature, male	63	71	44.5	6-Jun	4+p.	Lo	Desiccated, trapped in fishing line
T6	Jan. 1	Juvenile	-	-	-	-	-	?	Dead, partly buried
T7	Jan. 1	Juvenile	52.5	58	35	6-Jun	4+p.	Lo	Dead, intact, freshly stranded
T8	Jan. 2	Mature, male?	65	71	45	5-May	4+p.	Lo	Moribund, b.
T9	Jan. 2	?	-	-	-	-	-	?	Dead, partly buried

Table 1. Sea turtle strandings recorded on Clipperton Island between December 8, 2004 and January 4, 2005. CCL: curved carapace length; CCW: curved carapace width; PL: plastron length; CoS: costal scutes (on the left / on the right); InS: pairs of inframarginal scutes; p.: presence of pore in each inframarginal; Sp: species; Lo: *Lepidochelys olivacea*; b.: presence of barnacles on the carapace.

During our stay on the island, between December 8, 2004 and January 4, 2005, we did not check specifically for evidence of nests or turtle nesting. However, nine stranded sea turtles were discovered during sorties to various parts of the atoll devoted to different terrestrial studies, and during two complete explorations of the seashore (Fig. 3; Tab. 1). Seven of nine carcases were found on the eastern side, but we have no explanation about this distribution pattern. Where possible, carapace and plastron measurements, costal and inframarginal scutes counts, sex, and observations on body condition were recorded. Four animals were confirmed to be *Lepidochelys olivacea*, the olive ridley (presence of four pairs of inframarginal scutes, each bearing one pore), a fifth, headless animal with a broken carapace, was also thought to be olive ridley, and four cadavers were so badly decomposed that it was not possible to determine the species. Two carcasses were reduced to just long bones and carapace bones, and had evidently stranded weeks or perhaps months before they were found in December (T1, T2). The seven remaining animals, all with severe injuries, had recently stranded, between December 27 and January 2; six were dead and the last was moribund (T8). Unfortunately, no bones or tissues were collected from additional individuals that were recorded stranded after our departure.

Figure 3. Olive ridley stranded on Clipperton Island (December 2004).

The degree of body damage (T4 lacked the head and flippers, and the carapace was badly broken), or entangling

in long line (T5; picture at <http://www.seaturtle.org/imagelib>) indicate that at least some of the strandings derive from mortality in fisheries activities. During the month of January 2005, after our departure, purse seine tuna boats anchored off Clipperton Island. We suggest that the nine stranded turtles we recorded were a small percentage of animals that were injured and killed by Eastern Tropical Pacific fishing activities, certainly by long liners and perhaps by purse seine tuna boats.

On the western coasts of America, the olive ridley regularly nests from Baja California to Columbia (Fritts *et al*. 1982; López Castro 1999) and sporadically in mainland Ecuador (Alava *et al*. 2007) and Peru (Brown & Brown 1982). In some places, this species constitutes large massed nesting populations ("arribadas"), and the most important breeding grounds are the central coast of Mexico and several places of Central America (Marquez, 1990). Moreover, Eguchi *et al*. (2007) show that observations at sea of this species are currently frequent in the Eastern Tropical Pacific, and satellite tracking of male, female and juvenile olive ridleys, demonstrated that they can undertake long journeys (Parker *et al*. 2003). Hence, the olive ridleys that strand on Clipperton Island could come from any number of nesting populations.

Large numbers of olive ridleys occurring on the high seas in Eastern Tropical Pacific could be the result of the efficient conservation programs undertaken by Mexico and Costa Rica since the early 1990s. Nevertheless, by-catch mortality remains important, and our observations confirm this threat for the species.

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