

## **The Nora lagoon**

The Nora lagoon, like every coast lagoon, is a transition area between continental hydrographic systems (rivers and streams) and the marine ones. It has a 55-hectare surface and comprises the branched canal and island system, which is typical of the mouth of its stream, Rio Arrieras. It is a particularly important ecosystem for biodiversity, where various living beings (human and plant) live.

Our lagoon is separated from the sea by the Fradis Minoris peninsula, formed by Panchina tirreniana, a geological formation, which dates back to Pleistocene (about 1.8 million years ago). It is rich in marine sediments with lots of fossil remains, especially mollusks and sponges.

The Nora lagoon is a dynamic environment since it is fed by fresh water of a small stream, Rio Arrieras, and by tides that incessantly allow its waters to flow into the sea (ebb tide) and during the following six hours to receive fresh water rich in oxygen from the sea (high tide).

The saltiness of its water varies: in winter the stream softens the water of the lagoon and enriches them of very important elements for the life cycles, of every life form; in summer the saltiness of its water significantly rises due to dryness of the stream Arrieras, and the evaporation due to the strong insolation and the constant wind. These are factors that make the saltiness of the Nora lagoon surpass the sea saltiness by 10 points.

The saltiness variations and the high temperature range of the water between the seasons make this environment tough for vegetal and animal organisms. They had to adapt and had to use some particular contrivances. Therefore in this environment you will only find halophile species, such as the glasswort, Sea orache, the elecampane or the sea-lavender. These species can endure high concentration of salt both in the water and the soil that is permeated by it.

The fishes that live in this lagoon had to adapt as well. You will only find Euryhaline organisms, such as grey mullets, sea basses, eels and sea breams. Fishes migrate from the sea to the lagoon through 2 tide canals, they against the current looking for small planktonic organisms, that they eat, and a shelter.

### **Aquarium**

The aquarium hosts fish species, which populate our Lagoon and Bay.

These specimens are accidentally captured by local fish men, quickly recovered, acclimatized and put back in nature after a couple of weeks.

#### **Aquarium n1**

Sea bass (*Dicentrarchus labrax*) is a euryhaline species, which considerably populates our Lagoon and often returns freshwater courses.

It is a voracious predator of fishes and invertebrates; the younger are gregarious, whereas the older are solitary. They gather in numerous groups and reproduce between January and March.

#### **Aquarium n2**

Mulletts are euryhaline gregarious fishes, which eat small seaweeds, invertebrates and organic debris. They are numerous and present all year round in the Lagoon. They reproduce between August and September and roes, which are used to prepare bottarga are extracted from females.

Prawns living in our Lagoon are detritivorous species. They are connected with shallow water environments, where they can hide between vegetation and rocks.

### **Aquarium n3**

Moray (*Muraena helena*) is a nocturnal habits species. It prefers rocky bottoms mixed with *Posidonia oceanica*, where it can hide and take cover. It eats mollusk, little fishes and crustaceans. It always keeps its mouth open, not to show its teeth but to better oxygenate gills. It can reach a length of 1.5 meters.

### **Aquarium n4**

In the Mediterranean Sea there are several species of wrasse, some of which are very colourful. They prefer rocky bottoms coastal waters mixed with *Posidonia oceanica*, where they eat little invertebrates. This room hosts East Atlantic peacock wrasse: the smallest specimens, grey and brown coloured, are females whereas males are showier in plumage. It is sequential hermaphroditism species.

### **Aquarium n4**

Scorpion fishes (*Scorpaena porcus*) are fishes, which prefer rocky bottoms covered with vegetation. Here, thanks to their high camouflage abilities, they can better hide from predators and their preys. They eat small fishes, crustaceans and invertebrates.

Atlantic stargazer (*Uranoscopus scaber*) is a species, which loves hide between soft bottoms. Here it hunts little invertebrates, crustaceans and little fishes.

### **Aquarium n5**

The European eel (*Anguilla anguilla*) is a species diffused in fresh waters, salt waters and sea waters, that populates our lagoon as well. The males remain mostly in salt waters while the females can ascend the river and remain there. It has an elongated and serpentine body.

It mainly eats at night: crustaceans, small fishes and invertebrates that it can find thanks to a very developed sense of smell. Their reproduction is interesting: the eel is a catadromous species that descends rivers and goes to spawn in the Sargasso Sea and in the Atlantic Ocean.

During this long migration a degeneration of the gastrointestinal tract and a growth of the eyes is highlighted, thereby extroversing thereof. The females, after having spawned, die. At this point the larva, called blind, do the same journey to return to the Mediterranean Sea in 3 about years.

Unfortunately, it is a species very likely to become extinct. The Red List of the International Union for Conservation of Nature (IUCN) considers it Critically Endangered, due to the forced fishing.

### **Aquarium n6**

The painted comber (*Serranus scriba*) is a coastal species present in rocky coastlines and in *Posidonia oceanica* too. It is usually solitary and territorial with conspecific specimen. It is a Hermaphrodite species. It eats small crustaceans and invertebrates.

### **Aquarium n7**

Diplodus is a coastal omnivorous fish, found in the Atlantic and Indian Ocean. It is a gregarious and Hermaphrodite species. In the Nora's Lagoon, there are different species such as the sharpsnout seabream, the two-banded seabream, the white seabream and the annular seabream.

## **Aquarium n8**

The common octopus (*Octopus vulgaris*) is a mollusk belonging to the class Cephalopoda with the head directly connected to 8 tentacles. Thanks to its chromatophores it can well hide itself from predators and its preys between rocks or in *Posidonia oceanica*.

The females, having spawned, do not eat for about 2 months, until the eggs open, losing weight and frequently dying.

## **Benthos fish tank**

All those animal and vegetal organisms that live closely with the bottom or that are fixed to it, as the coral, are part of the benthos.

Hermit crab (*pagurus bernhardus*) is a species that belongs to this category and lives on the rocky bottoms rich in vegetation.

It arises in a larval shape, it grows and at a certain point it passes to a benthic stage. In this stage it develops its abdomen, that will be the only part of its body devoid of the exoskeleton: in order to protect its self, it will need to take shelter on the inside of the mollusk shell.

It establishes a symbiosis with some sea anemones (stinging organisms) in order to increase its defences.

The Beadlet anemones (*actina equina*) are animals that populate shallow waters. They have a cylindrical body fixed to the bottom of the sea by a sucker.

Usually red or green, they have one or two crowns of stinging tentacles around the mouth.

The sea urchins (*paracentrotus lividus* and *arbia lixula*), echinoderms provided with numerous spines, live in the rocky bottoms rich in vegetation, of which they feed.

The sea cucumbers (*holothurian poli*) are echinoderms with a cylindrical body that live both on rocky or soft bottoms rich in debris.

## **Cetacean's museum**

An expository space dedicated to biology and to the ecology of whales and dolphins: huge marine mammals that populate the Mediterranean sea and that swim along the Sardinian coasts.

The visit to the room dedicated to these magnificent mammals starts with the leading whale song.

The most considerable collection of cytological finds of Sardinia is exposed in the Gallery, and all the finds come from the work of the rehabilitation centre "Laguna di Nora".

We have been looking after these mammals since 1993.

The cetaceans, despite the fact that morphologically remind us of a little bit the fishes and that they live in water, are mammals to all effects as humans: the puppies, indeed, after a breech birth, will feed for the first months of life from their mother, provided with udders from which the puppy will suck the milk.

The milk is completely different from the human one: it is, indeed, a milk rich in fats that will make it difficult to mix with water and, moreover, it is very nourishing for the puppy.

The cetaceans are also animals that breath with lungs, they are homeothermic and viviparous.

During the calving the female is assisted by another female belonging to the same school that will help her during this delicate stage.

Cetaceans are divided into Odontoceti (with dentition) and Baleen whales (with baleen).

Under the glass case you can see the skull of an old male of *Pseudorca*. This animal was found in Santa Margherita di Pula in 1992. It was 5 meters long and it weighed a ton.

Being old, it was taken ill with a lung parasite disease which caused his death.

The skeleton of the Pilot Whale (*Globicephala menas*) belonged to a 6-years-old subadult female found beached in Sarroch (California) in 1996. The Pilot Whale is a dolphin which normally lives in the Mediterranean Sea and prefers the open sea, so it's unusual to sight it in coastal areas.

The 2-months-old Sperm Whale calf (*Physeter macrocephalus*) was found floating adrift in the Gulf of Cagliari in 1988. These mammalians can live more than 70 years and they can dive down to 3000 meters, holding their breath for more than 2 hours. They feed mostly on Cephalopoda.

The female of Common Dolphin (*Delphinus delphis*) was found in Bosa in the 90's, while the subadult Grampo (*Grampus griseus*) was found stranded in Pula (California) in 2016. This two Cetaceans, called Odontoceti, were taken ill with Morbillivirus, a terminal viral disease.

We have the chance to observe under a microscope some planktonic organisms populating the lagoon and the salt pans. These small crustaceans (*Artemia salina*) are Flamingo's food, giving them their typical pink-orange plumage once they are sexually mature (after their second year of life).

### **Sea turtles rehabilitation centre**

La Laguna di Nora (Nora's Lagoon), recovery centre for Cetacea and Sea Turtles, was founded in 1993 to welcome, treat and rehabilitate animals that were stranded or in difficult conditions.

Currently, it is part of the regional network for the marine fauna preservation and it is responsible for the rescues in the area between the Gulf of Cagliari and Arbus. The area is considered an "hot spot", meaning particularly critical for the preservation of the loggerhead turtle (*Caretta caretta*). Here, the interaction between human activities and these sea reptiles is stronger.

There are two loggerheads in the motor rehabilitation fish tanks at the moment. Among the three species that live in the Mediterranean Sea the Loggerhead turtle is the most common and smallest one, in fact it can reach about 140 cm in length (on average 100 cm) and about 140 kg in weight. It lives throughout the Mediterranean Sea and it can make long migrations passing through the Strait of Gibraltar. It feeds on various organisms like jellyfish, crustaceans, mollusks, fishes, sea sponges and coral. The Loggerhead turtle lay eggs (between 30 and 100 eggs) in a hole dug in the sand (deep about 40-50 cm) during the night hours. The eggs are white and they have a soft shell by the size of a ping pong ball. The nest's average temperature is important to establish the sex of the newborns, in fact, between 24° and 28°C, males will be predominant on females because females need higher temperatures. During the night, newborns will reach the sea using stars and moon lights which are reflected on the sea surface. They are able to perceive the wave propagation once they are in the sea, so they start to swim continuously for about two days trying to reach the open sea where the predatory pressure is definitely low so that they can start eating plankton. Newborns will stay in the oceanic environment (marine environment beyond 200 m in deepness) between 5 and 10 years where they will grow up and then come back to the neritic zone (marine environment from the beach line up to a depth of 200 meters) where they will complete their growth. They will reach their sexual maturity between 15 and 30 years with a size of about 70-80 cm. Couplings are made in the areas opposite the oviposition places of the females and very often nesting beaches coincide with birth beaches. The causes that lead to the decrease of sea turtles are attributed to man and the worst are accidental captures and pollution of the

marine environment. Fishing nets, lines and hooks from the longline, plastics and other waste, are the cause of death for many sea turtles, and the main causes that lead them to be hosted in our recovery center.

Efisía is a very young species of *Caretta caretta* found drifting floating two miles far from Capo Pula. The animal had plastic fragments along its digestive tract which caused it an intestinal obstruction.

After its hospitalization at CRTM Laguna di Nora, Efisia has expelled all the fragments independently in the following weeks.

The animal is now in a rehab phase which will allow it to get back to nature at the end of July.

Canelles is an adult female *Caretta caretta* found in Portoscuso along the southwestern Sardinian coast floating in swimming trouble.

X-Ray had, unfortunately, highlighted a comminuted fracture of the right forelimb. It will be treated with an antibiotic therapy and a motor rehab therapy which will allow it to go back to the sea at the end of the summer.