OCEANOGRÀFIC (AQUARIUM) OF THE CITY OF ARTS AND SCIENCES

The largest marine complex in the whole of Europe is shown to the world as a unique space in the form of a journey through the seas and oceans of our planet to show visitors its most outstanding marine ecosystems.

Its avant-garde architecture, the arrangement of the various aquariums, and its scientific, leisure, and educational vocation make the marine world more accessible to visitors and make them aware of the need for protecting its fauna and flora. Furthermore, it serves as a platform for scientific research.

OBJECTIVES

1- Being a centre for research and the dissemination of the marine world by means of the reproduction of the world's most important ecosystems and also encourage respect for nature.

2- Supporting the recovery of marine fauna and flora so as to contribute towards environmental conservation and the biodiversity of the planet.

The Oceanogràfic is made up of different buildings that contain the most significant ecosystems representations of each planet's seas and oceans. There are 10 spaces in total:

- **Mediterranean.** It shows part of the biological richness of the Mediterranean Sea in the form of nine aquariums of different formats adapted to each habitat reproduced, with some 7,400 living creatures, fish and invertebrates.

- **Wetlands.** A spectacular sphere 26 metres in height, this space simulates two of the most singular wetland areas on the planet: mangrove swamps and fens.

- **Temperate and Tropical.** The installation of Temperate and Tropical invites the visitor to travel from temperate regions of Pacific and the Atlantic Ocean to the warm waters of the tropics through aquariums connected by a fantastic 70-metre underwater tunnel, the longest in Europe.

- **Oceans.** With a volume of 7 million litres of water, is the largest aquarium in the Oceanogràfic and one of the biggest in the world. It represents a voyage through the Atlantic Ocean from the Canary Islands to the Bermuda Islands by means of a tunnel where species such as the bull shark and grey shark can be contemplated, together with the sunfish, among others.

- **Antarctic.** A colony of penguins is the attraction of this reproduction of a rocky cliff with nesting and breeding areas; in its underwater section they can be watched swimming effortlessly.

- **Arctic.** A large dome by way of an igloo represents the Arctic region, which has rocky cliffs for the walruses and blocks of ice for the belugas to represent the natural living conditions of these magnificent mammals.

- **Islands.** Located in the open air, this feature reproduces the islands along the length of the South American coast, which are known for their large colonies of Patagonian sea lions.

- **Red Sea-Auditorium.** This name has been given to the large hall finished off with a roof shaped like a “pilgrim’s shell” or scallop. The backdrop to the auditorium found inside, which holds 466 people, is a spectacular aquarium that reproduces conditions in the Red Sea, in which species such as the masked butterfly fish and the Napoleon fish can be observed.

- **Underwater Restaurant.** Located in the centre of the complex, this is the most emblematic building of the Oceanogràfic owing to its unique roof designed by Felix Candela. It represents a paraboloid figure similar to that of a water lily, and contains a large aquarium on the ground floor that fits perfectly into the whole of its perimeter.

- **Dolphinarium.** The dolphinarium of the Oceanogràfic, which can hold some thirty individuals. The exhibition pool is the largest with a volume of 26 million litres and a depth of 10,5 m; it is situated opposite a public terrace with a capacity for 1.500 spectators.

The opening of the Aquarium in the year 2002, extended the City of Arts and Sciences’ cultural contents with an area devoted to nature and the marine world, which makes marine sciences more accessible to the public and carries an environmental conservation message. Designed as a natural park, a research, educational and scientific centre that contributes to the recovery of protected fauna and flora, the complex allows the visitor to make an underwater voyage through the entire world.

The aquarium was designed by the Valencia company Civis Project Management that successfully combined the spectacularly designed hyperbolic paraboloid roofs of Félix Candela with a huge natural park, a scientific and recreational centre, in the building of which the latest knowledge of marine fauna and flora had to be taken into account, incorporating technology and innovative concepts.

The Aquarium has also been awarded the Construmat 2005 Prize for Technological Innovation in the Civil Engineering category and one of the Obras Cemex 2005 prizes in the institutional/industrial building category.

The Aquarium: The largest aquarium in Europe with 45,000 living beings

The Aquarium of the City of Arts and Sciences invites us to discover an authentic marine park that encompasses the main seas and oceans of the planet. With an extension of 110,000 m^2 and a volume of more than 42 million litres (the equivalent of 15 Olympic swimming pools), it constitutes the largest aquarium in Europe.

For its conception and design, its spectacular size and content in species, the Aquarium has become a landmark among aquariums worldwide. The themes dealt with in its exhibitions provide a clear vision of the marine ecosystems and their great biodiversity, successfully transmitting a unique sensation of submerging ourselves in search of the ocean's secrets.

A spectacular design and a wealth of contents

The spectacular roofing design, the posthumous work of the architect **Félix Candela**, successfully combines an innovative conception and exquisite aesthetics in this grand complex, in the construction of which the very latest technological advances and the latest understanding of marine flora and flora are incorporated. In the Aquarium, two structures are incorporated that carry the unmistakable mark of this great architect in their design. They are the most emblematic buildings on the site whose white concrete roofs present a hyperbolic paraboloid figure similar to a water lily.

The site includes two very different scenarios: the **installations for fish, invertebrates and birds** in which the different marine ecosystems are exhibited, and the environments characterised by the presence of **marine mammals.** Both are perfectly combined into a single site, forming the concept of the City of Arts and Sciences' Aquarium, a world reference point among new generation parks that combine the main technological advances with state-of-the-art design.

During the visit and along the way, we can get to know at first hand the behaviour and form of life of more than 45,000 specimens among 500 different species. Among the species of most interest and that arouse great expectations, the visitor can see, among others, dolphins, belugas, walruses, sea lions, seals, penguins, turtles, sharks, rays, swordfish, jellyfish, starfish, sea urchins, a wide variety of crustaceans, as well as typical wetland birds, such as those that live in the Albufera of Valencia and in tropical mangrove swamps.

Environmental and marine fauna conservation activities

The Aquarium of the City of Arts and Sciences is conceived not only as a leisure and entertainment project, but also for education and research into marine sciences, the aim of which is to raise awareness of the need for conserving marine biodiversity.

The huge size of the aquariums, the absence of visual barriers and the special installations, such as tunnels or domes, allow us to go deeper into the underwater world. The sensations we experience make it unique and make us responsive to the conservation message, in line with the aims of scientific and cultural promotion that the Valencia Regional Government is promoting through the complex.

Because of the need to know and conserve that which we have close at hand, the Mediterranean Sea is of especial interest. Here we can inquire about the "health of the sea". To do so, scientific, educational and dissemination programmes are developed in line with the philosophy of the most modern and important aquariums in the world.

Representing the most important marine ecosystems in the world so as to increase understanding and investigate the aquatic environment and to contribute to the recovery and defence of marine life are the main aims of this latest generation aquarium housed in the City of Arts and Sciences of Valencia.

The centre has research laboratories for the conservation and recovery of marine species and has implemented scientific and research projects in collaboration with the Ministry of Agriculture, Fisheries and Food, the Ministry of the Environment, the Ministry of Education and Science, The Regional Ministry of Agriculture, Fisheries and Food, The Regional Ministry for Environment, The University of Valencia, the Catholic University of Valencia, the Polytechnic University of Valencia, the Universidad Complutense of Madrid, and with the Spanish Oceanographic Institute. It also collaborates with the Cornell University in the United States, the Hawaii Research Institute of Marine Biology, and the Universidad de Baja California in Mexico.

General and technical data

- **More than 9,5 milions of visitors since opened to the public** in February 2003

- **Close to 100 birth of animals:** Over its first seven years the Aquarium has successfully developed reproduction in captivity and research programmes resulting in the birth in 2003 of a Chilean flamingo, a harbour seal and a brown shark, the fifth baby shark in the world to be born in captivity. In 2004, two bottlenose dolphins and two Humboldt penguins were born at the Aquarium. In 2005, the births continued with two baby penguins, the three first sea lions and the second example of a common seal. In January 2006, the first example of a brown seal, six baby sea lions and two dolphins were born. Moreover, various examples of scarlet ibis, pink spoonbill, common egret, green heron and red crested pochard were born, as well as several reptiles such as a Florida turtle and a Mediterranean pond terrapin. In 2007 a third example of a common seal was born, together with two male Patagonian sea lions and a number of birds of various species. During 2008, two seals were born, three marine lions and in 2009 more than 40 birds of different species (Black-crowned Night Heron, Roseate Spoonbill, Little Egret, Black-

necked Swan, Tufted Duck and Cinnamon Teal, besides three specimens of Common Bottlenose Dolphin and two marine lions.

- However, without doubt, the greatest reproductive success happened on 2nd November 2006 with the birth of the baby beluga whale, the first of this species to be born in captivity in Europe. The baby survived for 25 days and, despite this expected outcome, given that its possibilities of survival were already known to be slim, the pregnancy and birth of this cetacean is a huge landmark in the conservation of beluga whales and has provided infinite information for understanding the biology of these animals and for future pregnancies of that species in the Aquarium and other centres.

- **Facilities specifically designed for school parties (workshop rooms and guided visits) attended by more than 700,000 pupils of all ages since 2003.**

- **The marine sciences education programmes have included the "Tuesdays at the Oceanogràfic" lecture series aimed at the general public and free of charge. It is now in its sixth year and has featured the participation of international experts from different areas of marine sciences. More than 2,700 people have attended these lectures since they began**.

- **Surface area:** 110,000 square metres, distributed on two levels: Upper (central lake, recreational areas, swimming pools for marine mammals and turtles, aviary, catering, educational, research and administrative buildings). Lower (80% of the animal exhibitions, the technical gallery of the site and a car park for 830 vehicles).

- **Landscaped surface area:** 13,300 square metres on the upper level.

- **Volume:** more than **42 million litres of salt water** (equivalent to 15 Olympic swimming pools where all the oceans and seas of the planet are represented). 10 million litres of water for the fish installations and 32 million for mammals. **Volume of fresh water**: 11 million litres in the central lake that has a surface area of 14,000 square metres. 240.000 litres in the tanks located at the Wetlands Tower.

- **Seawater supply:** Up to 150,000 litres per hour can be supplied from a flow station located on Malvarrosa beach. Once the water arrives at the aquariums, it is incorporated into a closed circulation system, limiting the water supply to a minimum daily renewal rate that varies depending on the needs of the animals and the seasons. However, given that marine animals largely depend on the quality of their environment, the Oceanogràfic has two synthetic water manufacturing plants, one for fish and another for marine mammals. If the periodic analyses should show that the water quality does not reach the standard required, the capturing of natural sea water will be abandoned in favour of the manufacturing of synthetic sea water until the quality problems have been solved.

- **Dolphinarium:** One of the largest dolphinariums in the world, 26 million litres of water and a depth of 10.5 metres. Consisting of a set of 5 pools (1 for shows, 2 for training, 1 central 42-metre long breeding pool and 1 special pool for medical treatments).

- In building the Aquarium, 150,000 square metres of concrete and 15.000 tonnes of steel were employed. **It has 124 methacrylate panels** with a total weight of more than 307 tonnes that form a total surface area of 6,761 square metres for the aquarium's viewing panels. The thickness of the panels varies from 2 to 33 centimetres.

- **Technical gallery surface area: 20,000 square metres**. It includes a cogeneration plant that ensures a continuous energy supply, composed of 3 generators each of 1.1 megawatts. Moreover, the complex has two synthesis plants for manufacturing seawater: one for fish and the other for mammals.

- **More** than 25 kilometres **of pipes** with diameters from 1.4 centimetres to 1.3 metres.

- **101 filters for purifying the process waters of the aquariums, with an overall filtering volume of more than 14,000 cubic metres**. All the water on the site is purified through specific filtering systems. Recycling time varies from 4 hours in the case of the installation that contains most water, the dolphinarium, to 27 minutes in the case of aquariums with less volume aquariums.

The Aquarium buildings

Access building.

This is a spectacular circular building with 26-metre high glass walls designed by the architect Félix Candela. Information points, shops and other general services are located on the ground floor. It is also used to house temporary exhibitions on the marine world which complement a visit to the facilities.

MEDITERRANEAN

This space, which can be accessed directly from the access building, displays a part of the biological wealth of the Mediterranean Sea through an exhibition of seven aquariums of different formats, adapted to the habitat they represent. The public, as well as being able to see the different species, can experience the sounds and images typical of this sea.

The **Mediterranean** includes around 7,400 specimens from different points along the Spanish coast and consists of the following aquariums:

1.- Posidonia prairies.

In this aquarium the star attraction is *Posidonia oceanica*, a surface plant with flowers, fruit and roots that has managed to adapt itself to life in the sea. It forms large dense areas of underwater prairies of great ecological importance, being the place where many species breed and raise their young. In the Posidonia prairies we find fish such as gold line breams, wrasses, peacock wrasse and invertebrates such as sea cucumbers, sea urchins and starfish, among others.

2.- Ports

Using a recreation of a wooden jetty next to a sunken boat and a marker buoy, this aquarium shows how fascinating marine organisms such as spotted sea bass, mullet, bass and flatfish, have adapted to living in rough water environments such as that of ports, which, moreover, can be highly polluted.

3.- Inner-shoreline.

Here, the permanently submerged habitat closest to the coast is recreated. It is an environment exposed to intense light so allowing a dense coverage of algae. The special feature of this aquarium are the huge blocks of artificial rocks between which flow strong channels of water caused by the waves typical of these areas. Such varied species as rays, moray eels, painted combers, damselfish, gold line bream, and invertebrates such as hermit crabs, sea urchins and starfish are to be found at these shallow marine depths.

4.- Mid-shoreline.

This shows the typical flora and fauna adapted to the regular movement of the waves, the mid-shoreline area being defined as the area “between tides”, inhabited by gudgeons, and scorpion fish, among other species of fish, as well as a great diversity of invertebrates.

5.- Contact pool.

Within the Mediterranean zone, this aquarium provides the opportunity to “touch” some of the animals previously seen, as, for example, the captain starfish, the sea cucumber, the sea snail, or the violet urchin always under the careful supervision of specialist staff who provide explanations and advice.

6.- Breaking wave.

The unique design of this aquarium enables us to enter the heart of the waves. Through a tunnel, the public enters the aquarium itself protected by an acrylic bell from where they can see and feel how a wave breaks against a rocky cliff producing a turbulent effect. The Breaking wave is equipped with a microphone and several loudspeakers that reproduce in real time the sound captured. Fish such as the bream, small-scaled scorpion fish, the two-banded

sea bream, and the Annular Sea Bream show how they have adapted to this marine environment.

7.- Coral reef.

This is the Mediterranean ecosystem that, due to its wide diversity, has the most in common with corral reefs of tropical latitudes. However, scarce light intensity considerably limits the vegetation cover, mainly represented by red coral algae. Other species representative of this aquarium are the conger eel, swallow-tail sea perch, the royal mullet, boardfish invertebrate organisms such as the lobster, king crab or crayfish and large groups of swallowtail seaperch.

8.- Cephalopod (Squid and Cuttlefish)

With a volume of 1.600 litres of water, a seabed is represented by rocks and different varieties of algae in which adapt those who are the major marine invertebrates, the Cephalopod. With regard to the cuttlefishes, the size of the specimens is of approximately 15 centimetres, getting as a adult in the natural environment 30-40 cm. They reproduce in captivity for which the aquarium has arranged of a type of rope or similar in order that they could fix the eggs on it. They are in full view of everyone to observe their evolution and growth. In case of the Squid, and due to the fact that they are extremely territorial animal, an animal is included in the aquarium.

Rocks have been located at the back of the aquarium to be able to offer to the animal a place where to hide. The water temperature is around 16 ºC in both cases, Squid and Cuttlefishes.

9. Invertebrate

WETLANDS

With a spectacular 26-metre high sphere, the Wetlands area represents two of the most curious wetland areas in the world: the **mangrove swamp** and marshland. Both tend to occupy a narrow coastal strip, which is like a frontier between the terrestrial ecosystems and the marine ecosystems, constituting one of the environments with the greatest ecological value of the planet.

1.- Mangrove swamps.

This part of the installation represents those confined areas of shallow waters, located in tropical and sub-tropical areas that are characterised by an enormous biological diversity. Their peculiarity is the formation of tall forests, with a complex system of aerial roots make up dense and shady landscapes. As the species most represented, we find fish like the black bass and, lepomis gibbosus, and birds such as the pink spoonbill or scarlet ibis, as well as reptiles such as the Florida turtle.

2.- The Mediterranean marshland

This area represents an ecosystem typical of the Mediterranean shoreline such as the Albufera of Valencia. These wetlands play host to numerous native species and constitute a key piece in the conservation and sustainability of European avifauna.

Birds such as the heron, the little egret, and egret, and reptiles such as the Mediterranean pond terrapin and fish such as the European eel, river mullet and the common carp can be found in this environment.

TEMPERATE AND TROPICAL

The Temperate and Tropical installation invites us to take a trip from the mild water oceanic regions to the warm waters of the tropics, through exhibitions connected by an amazing underwater tunnel of 70 metres in length, the largest in Europe.

The Temperate Zone includes the following exhibitions:

1.- Kelp forests.

The main attraction of this aquarium are the forests of the most complex and impressive algae on the planet (these algae can grow to up to 50 metres high and grow up to 75 cm in a single day) where species such as Garibaldi damselfish, the California sheephead, the hammerhead shark and the leopard shark, the giant green anemone and sunflower starfish live. The spectacular size of the kelp (Macrocystis pyrifera), similar to a forest of pine trees, is what makes this type of ecosystem so unique.

2.- The Izú peninsula.

This exhibition is dedicated to one of the most interesting zones of the North Pacific, the rocky coastline of the Izú peninsula in Japan. Situated over one of the greatest tectonic faults of the planet, a unique mixture of hot and cold waters converge in this peninsula, which together with the irregular underwater topography, allows the appearance of species, with several truly fascinating morphological adaptations and dimensions. The great star of this aquarium is the giant Japanese crab, which, as an adult, can be more than 4 metres in length and weigh between 16 to 20 kilos. Other interesting species include, Puffer Fish, the microcantus, longstripe spinefish and the three-tailed Sakuradai.

3.- Seal exhibition.

This space represents the habitat of a colony of common seals, complete with a group of rocks that one would typically expect to find at the foot of cliffs. The behaviour of this family of pinnipedia (group that also includes walruses, sea lions and elephant seals) can be observed from the upper and lower levels.

4.- Jellyfish, seahorses and sea dragons.

In this area, sponsored by Caja Duero, the visitors can wonder at the four aquariums dedicated to jellyfish, seahorses and sea dragons. The exhibition aims, moreover, to put over the message on the need to conserve seahorses, as they are exposed to threats from direct exploitation and accidental capture by non-selective fishing practices and, above all, through the degradation of their habitat.

Of the two aquariums where the seahorses are housed, one is dedicated to children who will be able to see three different types of these fish: the common seahorse, the long nose seahorse and the spotted seahorse. Seahorses form part of the syngnathidae group, which possesses special characteristics in their external anatomy setting them apart from other fish. This does not hold true for their internal anatomy, which is practically the same as other fish.

Sea dragons are the most spectacular group of Sygnathidae. These are very beautiful fish that, in contrast to Seahorses, do not possess a prehensile tail. Their special feature is their ability to imitate their surroundings using their fleshy appendices to simulate the form of a leaf

At the jellyfish aquarium, visitors will be able to discover, with the help of information panels, the characteristics of these invertebrate animals belonging to the cnidaria group – which also includes corals and sea anemones-, as well as the particular life-cycle of these marine animals.

5.- Underwater tunnel. Oval Hall

Through this 70-metre long tunnel, visitors can cross the Atlantic Ocean from the temperate latitudes to the tropical ones. Throughout the passage, it is very interesting to note the gradual change in species that comes about due to that change in latitude. Outstanding among these species are the rubberlip drums, sea bream, mackerel, guitarfish, lookdowns, and blue cromis, and crustaceans like the the horseshoe crab, as well as great schools of almaco jacks.

At the other end of the underwater tunnel, a new room (the Oval Hall) represents the Tropical Zones. Equipped with grand panoramic exhibitions, this magnificent hall recreates the reefs most typical of the oceanic world: the Indo-Pacific and the Caribbean.

Through the 24-metre long viewing windows, the two corral ecosystems can be compared, both characterised by a great wealth of species and colours:

- Outstanding in the Indo-Pacific aquarium are fish such as the Napoleon wrasse, the surgeonfish, the puffers, the butterfly fish, the angelfish and the spotted eagle ray.

- In the Caribbean aquarium there are grunts, snappers, wrasses, and sergeant majors, the green or tropical moray eels, cownose rays among many other species

- Coral reef aquarium

OCEANS

This is the largest tank in the Aquarium and one of the biggest in the world, with a volume of 7 million litres. The building is made up of two underwater zones connected at the lower level by a 35-metre long acrylic tunnel. It represents a simulated voyage through the Atlantic Ocean from the West coast (the Bermuda Islands) to the East Coast (the Canary Islands). Highlights are the impressive sandbar sharks, the grey sharks, saw fish and other spectacular species such as the guitarfish, the violet ray, the eagle ray, the ocean sunfish and the barracuda as well as the great shoals of fish like the horse mackerels, Atlantic mackerels and jacks, as well as Atlantic bonitos and Atlantic little tunnys, some of them consisting of hundreds of individuals.

ARCTIC

A huge igloo-shaped dome that represents the Arctic zone, in which, true to these very cold latitude environments, the natural living conditions of the walruses and beluga whales are reproduced. The building recreates the environmental features of the arctic region through rocky cliffs in the case of the walruses and blocks of ice for the beluga whales.

In the case of the belugas, the only examples currently to be found in any European zoo, this represents a pioneering experiment in Europe, as it allows us to study a type of marine mammal whose biology is still not well known. This species is also known by the name of “Canary of the Sea” and is characterised by one of the greatest acoustic repertoires among the odontocetes (dolphins, killer whales etc.) studied so far. The aim of a research project undertaken in the installations of the Aquarium is to delve deeper into the bio-acoustic study in captivity of this animal whose beauty and personality are unique.

The Oceanogràfic is only the second centre in Europe to contain examples of walruses, after the Dolfinarium of Harderwijk in the Netherlands. The facilities are home to one male and four females, which as adults grow to weigh 1,300 and 900 kilograms respectively.

ANTARCTIC

A colony of penguins is the star attraction of this exhibition, recreating on a rocky cliff with areas for mating and rearing. Under the water level, we can watch the penguins gracefully swimming seemingly without effort.

ISLANDS

This zone, located in the open air, takes as a reference point the islands situated along the South American coasts featuring large colonies of sea lions from Patagonia. These marine mammals can be watched on three different beaches. These animals of gregarious habits are surprising for their great intelligence and affection, as well as for their great skill underwater during their marine incursions.

RED SEA-AUDITORIUM

This is the name of the grand hall covered by a roof in the form of a “pilgrim’s shell”. Inside there is an auditorium the backdrop of which is a spectacular aquarium representing the Red Sea in which we can see species such as the shoal surgeon fish, the pennant coralfish, the partially masked butterfly fish as well as blacktip reef sharks. One interesting item of information we should also mention is that the acrylic used is the thickest of all the tanks, 33 centimetres thick throughout its 16.8 metre extension.
The hall holds 466 persons and the exhibition includes an interaction between an on-stage presenter and a diver inside the aquarium, who together reveal different aspects of the Red Sea and the species that inhabit it to the attending public, as well as explaining some of the secrets about how the Aquarium operates. It is also used for holding scientific and cultural congresses.

UNDERWATER RESTAURANT

Situated in the centre of the site, this is the most emblematic building of the aquarium due to the peculiarity of the roof designed by Félix Candela, presenting a parabolic shape similar to a water lily, and the installation on the lower floor of a huge aquarium all the way around its perimeter.

The aim of the aquarium is to recreate an oceanic environment of open waters where we can see large shoals of pelagic fish. The setting is of exceptional beauty due to the contrast between the intense blue of the water and the silver of the fish, and the harmony and synchronisation of their movements as they swim around the building.

The upper floor of the building is like an island, surrounded by a lake. It provides the communications nucleus between the different thematic buildings. In the lake, the public can see three different species of pelicans and cormorants and various species of anatidae. Next to the Underwater Restaurant there is an island that hosts a colony of Chilean flamingos. From here, we can see their egg-laying and rearing zones and admire their spectacular appearance.

DOLPHINARIUM

The Dolphinarium of the Aquarium, large enough to host more than thirty specimens, is designed to exhibit, maintain and reproduce a group of bottlenose dolphins. Currently, the installations have around twenty examples of this species.

With a total of five pools, the dolphinarium is one of the most important of the world. The exhibition pool has the largest dimensions, with a volume of 24 million litres of water and a depth of 10.5 metres and is positioned in front of a public viewing stand that can hold more than 1,500 spectators.

It was designed employing the guidelines of the so-called new generation dolphinariums, integrating functionality with careful aesthetics. Here the public can enjoy demonstrations of dolphin intelligence through an exhibition that is as surprising as it is educational.

SEAWATER SUPPLY

The largest aquarium in Europe, it is supplied through the gathering and pumping of water from the sea, and at the same time, has an alternative salt water manufacturing system with a modern synthesis plant located in the installations of the site. Seawater can be then be supplied using either of these two systems that both fulfil the necessary quality requirements.

The aquarium supplies its aquariums through a seawater gathering and pumping system from the north breakwater of Malvarrosa beach. The water from this zone is subject to continuous analysis and fulfils all the requirements needed to guarantee quality.

Once the seawater has been gathered, it is pumped from Malvarossa beach to the Aquarium where it is stored in different distribution tanks. From these tanks, after a filtration and disinfection treatment, the water is distributed to the different exhibitions in the aquariums and pools.

However, the Aquarium also has an alternative supply source with the manufacture of saltwater through two synthesis plant (one for fish and the other for marine mammals) in the event of there being pollution in the gathering area. The synthesis plant can manufacture, in a short period of time, up to 1,100,000 litres of water, if necessary, should any incident cause the sea to be lacking in the levels of quality demanded.

Seawater manufacture is undertaken from a mixture of fresh water and salts with an identical composition to that of seawater. The synthesis plant allows, through automatic processes, the mixing of both components, so achieving seawater identical to natural seawater and with a degree of salinity that ensures the maintenance and development of marine life in captivity. Just like the other supply source, the water is supplied to tanks, from where it is distributed, following a filtration treatment, to the different exhibitory areas of the site.

THE EDUCATIONAL AND RESEARCH PROJECT

Commitment for the respect and conservation of the marine environment

CONSERVATION, EDUCATION AND RESEARCH

With the aim of providing everyone with a space to enjoy the marine world and to transmit a message of protection and respect for our environment, the Aquarium also shares the aims on which Hemisfèric (Imax and Full Dome) and Science Museum Príncipe Felipe are based, that of providing everyone with a unique space to enjoy culture, to become familiar with, in an educational way, advances in science and research, to discover new technologies, as well as to promote the respect, conservation and admiration for nature.

The aquarium, in this way, fulfils the main aims that led to its construction by the Valencia Regional Government: to create a centre from which to spread knowledge and investigate the marine environment and to support the recovery and rehabilitation of protected flora and fauna, so contributing to the environmental conservation and the biodiversity of the planet.

The Aquarium promotes educational activities and research programmes into the marine world. For that purpose, it includes an Education and Research building that houses laboratories for maintenance and the tasks of species conservation, as well as special classrooms where educational activities concerning the marine world are undertaken.

Much more than just a leisure provision: EDUCATION

The main idea of the Aquarium's educational project is to deliver the message on the conservation of the seas and their inhabitants. The educational aim is based on raising public awareness of the need to conserve the marine environment. To this end, two different aspects within the educational field are tackled: formal education, designed and aimed at the schooling sector and non-formal education, information with bio-educational content aimed at the general public.

An example of the latter is "Oceanogràfic Tuesdays", a cycle of conferences that seeks to tackle, among other issues, the problems of marine ecosystems and the threats to biological diversity. These conferences-talks that are now in their sixth consecutive year, have the aim of presenting and making the public at large, and especially younger generations, aware of the main difficulties that the marine world is facing and the possible solutions. Similarly, the Aquarium also puts on introductory courses to marine biology, the handling and maintenance of sharks and marine mammals and the biology, recovery and conservation of sea turtles.

Specific activities for schoolchildren from Primary School to Sixth Form are classified into different visit options:

- **Free visit.** The teacher him/herself leads the school group through the proposed routes.

- **Guided tour.** The group is accompanied by an educator that introduces them to the marine world through an entertaining route, where the pupils have to solve educational and interactive problems.
- **Sea classrooms.** After a pre-arranged visit, the pupils develop in depth the educational issues posed in rooms especially designed for this purpose.

In addition, outside the school timetable, there are also educational and training activities, as for example, during educational fairs such as Expojove, where the educational and conservation message is launched. Also during the summer season, a Summer School is organised for primary school pupils in the installations of the Aquarium at which the pupils can widen their knowledge of the marine world and environmental values are strengthened.

SEA CLASSROOMS

The upper floor of the Education and Research Building houses the space dedicated to educational provision. The essential objective of all the activities is to encourage the conservation of the seas and oceans of the planet. The workshops aim to generate in the pupils positive and respectful attitudes towards the environment in general and the marine world in particular. The classroom workshops thus become a very useful resource for teachers, as the former have been developed taking into account the contents of the official curricula and the level of development for each age group, with the use of an active methodology that allows the pupils to participate actively and to have fun as they learn.

The “Sea Classrooms” provision encompasses four separate subjects: biodiversity, marine ecosystems, the vital functions of marine organisms and sea turtles. Within each of these generic themes, various workshops are organised for groups depending on age. As well as these four main blocks, there are also specific workshops for adults, for pupils going on a trip at the end of their course, and for higher secondary school education levels. Likewise, other workshops exist that use materials suitable for groups with special educational needs and pupils in the process of integration.

RESEARCH PROGRAMMES

Outstanding among their activities is the research **programme of the Aquarium focused on the study of the** “**Health of the Seas**”. That programme has two fundamental aspects: to undertake quality research on marine biodiversity, contributing to its dissemination and raising public awareness of the conservation problems facing many marine species.

To do so, **three research lines** are developed that, with the “**Health of the Seas**” as their common denominator, have, on the one hand, biological knowledge applications for the animals acclimatised in the site (reproduction, behaviour or illnesses), and, on the other hand, the conservation of species threatened in their natural habitat, with special reference to those that live in the Mediterranean.

Research into the "Parasites of Marine Species" on the site and the illnesses that they present is undertaken. This is about getting to know and analyse the parasites that different species of fish, turtles and marine mammals carry, their action and transmission paths. To do so, we enjoy the experience of the University of Valencia which has international scientific prestige in this speciality. The results, moreover, have positive benefits for the state of health of the species in the installation and on their maintenance.

An area of enormous interest for the Aquarium is that of the "**Studies on marine species' behaviour"** that is undertaken with the help of hugely experienced staff from the Autonomous University of Madrid. One of the main behavioural aspects has to do with the bioacoustics of belugas, dolphins and osseous fish.

THE BIOACOUSTICS OF BELUGAS

The objective of one of the research projects being carried out by the Oceanogràfic is the detailed analysis of the acoustic behaviour of belugas. The sounds emitted by odontocetes have two functions. The first is social communication, which is essential for maintaining group coherence, establishing hierarchies and preferences in family groups, and also competing with one's fellows so as to reproduce successfully and participate in the genetic stock of the species. The second is echolocalisation or acoustic vision, which is given by the emitting of sounds and the reception of its echoes in a similar way to the use of sonar and sounders in modern ships.

The long-term analysis of the social vocalisation and associated behaviour of the group of belugas of the Oceanogràfic will contribute to our scanty knowledge of the biology of this species. The results of this project will be very useful for future studies in the animals' natural habitat. For example, advances in knowledge of their communication will contribute towards the study of belugas' social structure and the detection of possible dialects in the various populations. If we can come to distinguish populations of belugas from their calls, this will facilitate the study of migratory patterns and the distribution of the species; this information is essential for the legal protection of these animals.

The results of the 2003-2007 study on beluga communication had provided detailed knowledge of the acoustic behaviour of the two belugas kept at the Oceanográfico.

- The sound repertoire recorded amounts to a total of **32 different sounds (sounds with the same acoustic structure)**. It is one of the most complete descriptions in captivity. Six categories have been identified within which 97% of the sounds recorded have been classified. It is the highest number published to date.

- The results obtained during 3 years studying the beluga knowledge and the acoustic activity, including the process of birthing and studies of the

young beluga, allowed us to conclude **the description of variations in the production of sounds that could be used as an indirect indication of beluga welfare**. In possible stressful situations, acoustic activity is drastically reduced, and it remains very low during the adaptation and recovery period. This shows that **sound communication is very sensitive to changes in the animals' surroundings, and can therefore be used as a diagnosis tool**.

- The **SOUND-BEHAVIOUR RELATIONSHIP** has shown that:

1. Some sounds are associated with certain behaviour, such as those related to exploration and interaction with visitors or keepers.
2. Those sounds only emitted by young belugas.

This indicates **a high degree of complexity in the communication of this species, which is greater than that of other well-studied dolphinids** such as the bottlenose dolphin or common porpoise.

Research is also being carried out on the "**Reproductive biology of large fish"** such as sharks and tuna, some of which are under threat, e.g. the red tuna, so as to be able to apply it both in aquaculture and to improving the state of conservation of the species. An example of this was the successful birth of a grey shark in the Oceans tank of the Aquarium, helped by the support of the Spanish Oceanographic Institute which develops research work on tunny and are European pioneer in this field.

ARCA DEL MAR (Area for the Recovery and Conservation of Sea Animals)

In addition a **research and awareness-raising programme on the "Conservation of Fauna Under Threat in the Mediterranean"** is also undertaken. For this, the Aquarium enjoys the wide experience on this issue of the Regional Ministry of Environment of the Valencia Regional Government. This includes the Aquarium in the Stranding Protocol of the Valencia Regional Government in order to help in the processes of rehabilitating threatened marine species, as are the mammals and turtles that from time to time appear injured or ill on the Valencia coastline and has meant that the recovery rate of turtles is between 90 and 95%.

Thanks to the collaboration agreement for the development of the conservation and dissemination of the marine biodiversity of the Region of Valencia, which has been signed by the City of Arts and Sciences and the Regional Ministry for the Environment, since 2007 the Oceanogràfic has had the most modern facilities in Europe to have been especially designed for the recovery of sea turtles and dolphins. The ARCA allows the treatment of between 15 and 20 turtles at the same time.

There are several reasons that the reptiles have been brought into the centre, principally accident fishing (using paternoster lines or nets). Other less common reasons include digestion of plastics and collision with boats. The turtles spent an average of 136 days at the centre before being released.

In April 2010, the centre celebrated the recovery of its 100th turtle since the Sea Ark was set up in 2007. The centre is run by the Valencian Department of the Environment and located in the Oceanográfic in Valencia. It stands out as the largest facility in Spain and one of the largest in Europe dedicated to caring for and rehabilitating these reptiles.

The presence of the Aquarium in international forums should also be mentioned, as a centre for the defence, conservation of marine life and development of educational and research programmes as, for example, in the 20th holding of the European Aquariums Congress, held in October 2002 in La Rochelle Aquarium (France); the 31st Annual Symposium of the European Association of Aquatic mammals (EAAM), held in Tenerife from 14th to 17th March 2003, an international meeting at which the Aquarium presented its lines of conservation and research on marine mammals, among which were included the projects for the recovery of animals under threat and the behaviour of marine species such as the bioacoustics of beluga whales, dolphins and osseous fish; the international Symposium of Sea Sciences and the Annual Meeting of the Iberian Association of SOS and Aquariums (AIZA), the 32nd Annual Symposium of the European Society of Marine Mammals (EAMM), all of which were held in the Aquarium, among others.

In March 2007, it hosted to the “1st International Workshop on Beluga Whale Research”, which gathered together for the first time all scientific beluga specialists from all over the world. It was a landmark meeting at which these experts could exchange their experiences with others who are studying the species both in aquariums and in the wild. Representatives from all the Arctic countries (the United States, Canada, Russia, Norway, Denmark, and Iceland), as well as from native Eskimo communities from the Arctic regions of Alaska and Canada, took part in this congress, which ended with the drawing up of a global agenda to include the main lines of action over the coming years for beluga conservation and research. This encounter was a follow-up to two meetings of scientists that took advantage of their date with the Oceanogràfic in order to develop parallel projects on belugas, the PATOB (Pan Arctic Tracking of Beluga Whales Project), and that carried out by the Marine Mammal Commission (MMC) of the United States.

The Oceanogràfic also organised in 2007 the first course on endoscopy applied to marine mammals, which brought together the most prestigious international specialists in this technique in both the field of the medicine of aquatic animals and that of endoscopy in human and veterinarian medicine.

In 2008 organized the 1st International Festival of Underwater Imagery (Festival Internacional de Imagen Submarina, FIIS), and the first World Conference on Marine Biodiversity organised by the MARBEF, a network of excellence

founded by the European Union that includes 94 marine research institutions, and CSIC. City of Arts and Sciences received this meeting in which participated more than 500 scientists proceeding from Asia, North America, South America, Oceania and Europe who resolved the " Declaration of Valencia: an allegation for the protection of the marine biodiversity ".

The main aims of this event are to evaluate current knowledge of exploration into marine biodiversity and understanding of its role in how marine ecosystems work and the services it provides for society. It will also be weighing up present and future threats as well as possible strategies to conserve marine diversity. Moreover, it aims to identify future research priorities.

In 2009 the Oceanogràfic received the 26th Congress of the European Union of Aquarium Curators (EUAC), whose main aim was to encourage communication between the specialists that work in these kinds of facilities and who at the same time collaborate with the European Association of Zoos and Aquariums (EAZA). More than 130 experts attended from a total of 62 mainly European aquariums, although they will also come from China, Japan, the United States and Kuwait.

CATERING SERVICES

The aquarium also provides a gastronomy and merchandising service, as well as all the services necessary for enjoying this particular adventure through the oceans.

The catering points are as follows:

UNDERWATER RESTAURANT

Situated in the centre of the park inside its most emblematic building. The upper floor that is located on the same level as the public accesses is the space reserved for aperitifs. The restaurant is located on the lower floor surrounded by 8 acrylic sheets that house 10,000 pelagic fish. It holds **350 people** who can choose from a high quality menu.

OCEANS RESTAURANT

This is located on the roof of the Oceans building. It has a single floor and a terrace that is projected over the surface of the lake. The restaurant holds 190 people and the terrace a further 150 people. Its location next to the lake and its careful chosen meals make it the incomparable site to enjoy its meats and Mediterranean products.

LA LONJA SELF-SERVICE

Located opposite the Dolphinarium stadium and with a capacity for 410 people, it specialises in quick service of all types of meals. A self-service restaurant with a great variety of dishes designed for all the family.

PIZZERIA & MEDITERRANEAN ICE CREAM PARLOUR

Situated next to the Mediterranean building, customers can enjoy freshly made pizzas and other specialities that complement a good choice. The ice cream parlour is the perfect complement whatever the choice when it comes to eating.

TABARCA HAMBURGER BAR

Under the terraced seating of the theatre-dolphinarium, this cafe offers classic hamburgers, quick and appetizing so as not to waste a minute without missing out on anything.