

Report on the introduction of a rescued *Orcinus orca* individual into the Orca Ocean group

DATE: OCTOBER 5TH 2012

AUTHOR: **F. JAVIER ALMUNIA PORTOLÉS**
DOCTOR IN MARINE SCIENCES
DEPUTY DIRECTOR OF LORO PARQUE FUNDACIÓN

INTRODUCTION



- 1.1 Background
- 1.2 Facilities
- 1.3 Habituation sessions

1.1 BACKGROUND

On 21st November, 2011 a court of the district of Amsterdam pronounced judgement granting validity to the CITES permission issued for the transport of the killer whale Morgan to Loro Parque. Morgan was rescued on 24th June, 2010 by the Dutch coast guard service in a shallow zone of the Dutch coast of the Wadden Sea. After deciding that her return to the sea was not viable, the Department of Agriculture of the Government of Holland decided on her incorporation in a group of killer whales in captivity.

Harderwijk Dolphin Zoo asked Loro Parque to integrate Morgan into the group at Orca Ocean, considering it to be the most suitable for her. In consequence, after the judicial decision was made public, the operation for Morgan's transfer and introduction to Orca Ocean began.

The introduction process had been planned previously, and was structured in 4 phases:

- Adaptation to keepers and trainers
- Adaptation to facilities
- Adaptation to the management system
- Integration into the social group

In a preliminary way, we contacted researchers of St. Andrews University, who had carried out the determination of Morgan's vocal repertoire, to have a first impression of the similarity of her dialect with that of the individuals of Orca Ocean. The comparison of both repertoires showed that there were no coincidences, so we considered the need to get

Morgan used to the sounds of five individuals of Orca Ocean and vice versa.

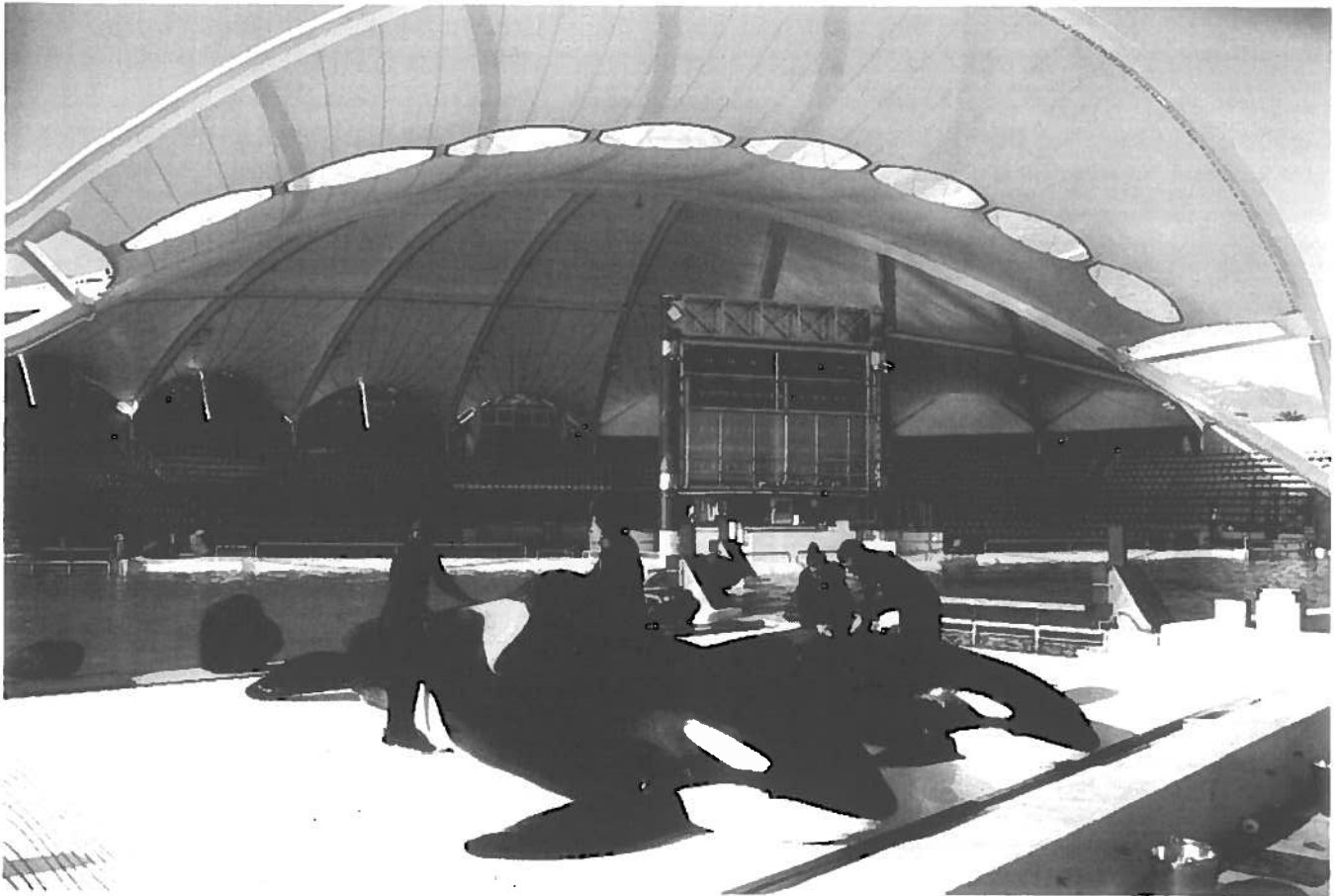
Also, in a preliminary way, Morgan's training level was evaluated by the head trainer of Orca Ocean, who observed a very basic behavioural repertoire, difficulties in crossing gates, and some aspects of the training method that had to be improved, especially those related to safety.

1.2 FACILITIES

The facilities of Orca Ocean consist of a system of four pools, a main one (9.178 m³), two accommodation pools (7.082 and 4.534 m³ respectively) and a medical pool (363 m³) (see diagram in ANNEX I). Each one of the four pools has at least two metallic gates driven by means of an improved hydraulic system for quick opening and closing. This allows the management of the group of animals in the most suitable way, according to the desired type of grouping.

In the construction of the walls of the pool, reinforced concrete has been used to resist the water pressure, with a plastic treatment to make it water-proof. All surfaces have been smoothed and rounded, without cracks or holes, to keep the animals from been hurt accidentally. The top edge of the pools has been rounded with a radius of 50 cm.

The pools have been covered with a synthetic painting. This coating is applied to suppress the porosity of the concrete, facilitating



cleaning and reducing the possibility of algae and bacteria growing on the surfaces. Thus, the construction characteristics of the pools, and the paint used for the coating, guarantee the maximum possible hygiene and minimize the risk of animals getting hurt accidentally.

The enclosure has a canopy that gives shade to most of the pools' surface, offering the animals the possibility of being in the sun or the shade.

The vital support system consists of three separate filtration processes that keep the water, taken directly from the Atlantic Ocean by means of a coastal well, in optimal conditions. Water is passed across mechanical (sand) filters with a filtration speed of 30 m³/m² per hour. From there, water passes through protein skimmers where ozone is injected by means of Vénturi pipes to produce millions of small ozone bubbles. These bubbles aggregate and flocculate proteins in solution and suspension, and drag them towards a collector on top of the skimmer. Then water goes into a degassing chamber to eliminate the ozone excess before returning to the pool. Finally, an additional

treatment is made with chlorine coming from hidrolisis of sea water to oxidize completely the organic matter and to provide the water with a level of residual chlorine not higher than 0.4 mg/l.

The vital support system of the installation has been designed to guarantee the supply of a suitable volume of sea water, with the following physical-chemical specifications:

Temperature: 13 °C
Ammonium: <0.05 mg/l
Nitrites: <0.1 mg/l
Nitrates: <30 mg/l
Ph: 8.0-8.3
Dissolved oxygen:> 95 % of saturation
Chlorine: 0.4 mg/l

These parameters are those considered of major importance in the maintenance of marine mammals in captivity. Loro Parque applies a strict control of the physical-chemical parameters of the water in all its systems and, in the case of the marine mammals, several controls and daily analyses of water quality are carried out.

In addition, the water of the facilities

that accommodate marine mammals is also controlled to prevent the presence of pathogenic microorganisms that might have negative effects on the animals' health. In Loro Parque a weekly analysis of the microbiological characteristics of the water of the marine mammals' enclosure is carried out routinely. In these analyses, the presence or indication of pathogenic microorganisms is determined.

In conclusion, both the magnitude of the vital support system, and the daily routine of controls and analysis allow us to guarantee, under any circumstances, an optimal quality of the water for *Orcinus orca* individuals of the facility.

1.3 HABITUATION SESSIONS:

To carry out Morgan's habituation regarding the vocalizations of the five individuals of Orca Ocean, and vice versa, we contacted the specialists in bioacoustics of St Andrews University (Dr. Filipa Samarra) and a specialist in bioacoustics and ethology of Free University of Berlin (Prof. Dietmar Todt), along with the research group of the University of La Laguna which has been developing bioacoustic analysis tools for several years, with funds from Loro Parque Fundación (Dr. Fernando Rosa).

A complete set of sounds from the group of Orca Ocean was compiled and replayed

in Morgan's pool during the week before the transfer. At no time were reactions of stress or frustration observed in Morgan. At first, she didn't show interest in the sound source. As there was no feedback on the sound intensity played into the pool, the level was raised several times. At some point during the experiment Morgan focused on the direction of the underwater speaker, showing an apparent interest, but she soon lost it. During the experiment the dolphin trainers reported that the dolphins accommodated in the neighbouring installation were slapping tails on the water surface, indicating that the sound was so loud that it had reached the other side of the installation, passing through gates and channels.

Similarly, a few days before the transfer, Morgan's sounds were replayed in the medical pool of Orca Ocean, in two sessions, at different levels. Only Adán (the youngest individual) showed some slight sign of stress, with a high number of vocalizations. The rest of the group showed interest in the vocalizations at first, but they soon lost it.

The results of the habituation sessions showed that the animals were not reacting in a negative way to the sounds of a completely strange dialect, so we considered it not necessary to extend them.



ADAPTATION TO THE STAFF

2

- 2.1 Introduction
- 2.2 Transitory Phase
- 2.3 Results

2.1 INTRODUCTION

Although the animals are prevented from establishing an exclusive connection with a single keeper, it is encouraged that at least two trainers have a closer relationship, and work in a preferential way with a single animal. In this way, we encourage the animals to become accustomed to receiving signals from any of the keepers and to show the associated behaviour.

Thus, an adjustment phase was planned in order to carry out a gradual transition from the Harderwijk keepers to those of Loro Parque.



Morgan to be carried out with different keepers of Orca Ocean, along with her former keepers in Harderwijk.

2.1 TRANSITORY PHASE

During the days before the transfer, the person in charge of Orca Ocean went to the Harderwijk facilities to become acquainted with the animal, its training level, the type of signals it was answering to, its nutrition, etcetera. During this time he began to carry out working sessions with the animal so that it started to get used to his presence.

During the transfer Morgan was escorted by Harderwijk keepers, the responsible Harderwijk veterinarian, as well as specialists and veterinarians from SeaWorld.

After the transfer, two trainers from Harderwijk stayed in Loro Parque for one week to make the transition more gradual for Morgan. During that week we encouraged sessions with

2.2 RESULTS

The phase of adaptation to the staff was concluded successfully and very rapidly. During the first days at Loro Parque Morgan carried out sessions with Loro Parque keepers in an unremarkable way, and she did not show any type of avoidance or difficulty of adapting to the new staff. After one week the Harderwijk keepers left Loro Parque, because the adaptation to the new staff was considered fully accomplished.

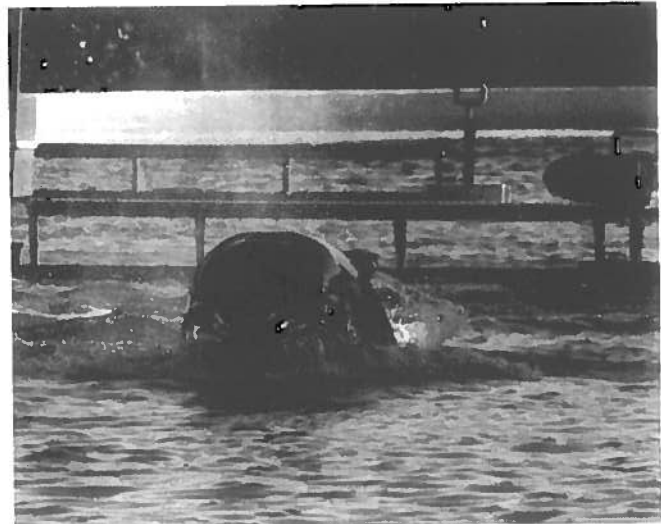
ADAPTATION TO THE FACILITIES

3

- 3.1 Initial Phase
- 3.2 Progressive Adaptation to the rest of the pools
- 3.3 Results

3.1 INITIAL PHASE

After Morgan's preliminary evaluation in Harderwijk, especially after showing her problems to cross gates and switch pools, the keepers at Loro Parque were afraid that the process of adaptation to the facilities would be very slow and time consuming. It was planned to lodge Morgan initially in the medical pool of Orca Ocean, since the rising floor facilitates enormously the manipulation of the animal in case of necessity. It was foreseen that this would be her main holding pool during the whole phase of introduction to the group, with the ultimate aim to achieve her access to the rest of the facilities as soon as possible. In the end this phase lasted less than 24 hours, because on the evening of 30th November Morgan accessed pool C.



C of the enclosure. On 1st December Morgan was already using pools B and C routinely, and was able to eat at any point of them. At that moment it was considered more suitable to first initiate the socialization, and afterwards to adapt the animal to pool A as the access channels are longer and predictably a longer process of habituation would be necessary.

In her second week in Orca Ocean Morgan had already entered pool A, and soon adapted to use it routinely, crossing the access channels.

3.2 PROGRESSIVE ADAPTATION TO THE REST OF THE POOLS

The connection between pools B and C with the medical pool consists of a gate with a very short channel (less than one meter). So, initially Morgan was adapted to use pools B and

3.3 RESULTS

In two weeks Morgan was completely adapted to the facilities of Orca Ocean, and was capable of using the whole space of the enclosure equally. To increase the use of the space, as with the other individuals, the pools where any activities (rest, playtime, feeding, etcetera) are carried out are switched frequently, as well as the grouping being altered.

ADAPTATION TO THE MANAGEMENT SYSTEM

4

4.1 Feeding

4.2 Consolidation of medical behaviours repertoire

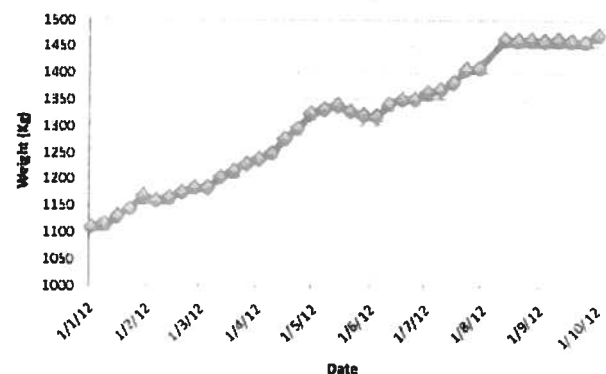
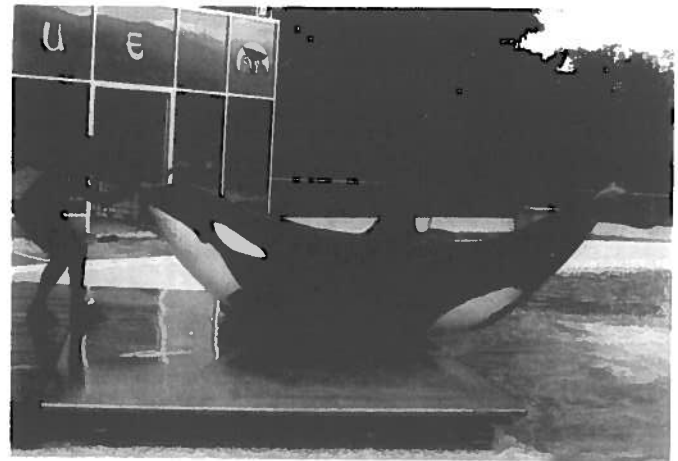
4.1 FEEDING

As expected, it was not necessary to adapt Morgan to the feeding at Loro Parque, since the nutrition of cetaceans is very standardized, both the species of fish used, as well as the feeding system, distribution of food throughout the day, food supplements, use of additional food such as gelatin, etcetera.

4.2 CONSOLIDATION OF MEDICAL BEHAVIOURS REPERTOIRE

From the arrival of the animal, a process of training began to consolidate and adapt her repertoire of medical behaviours, and thus to facilitate her correct management and control by the veterinary team. Currently (to the date of writing this report) Morgan has learned all the medical behaviours except for the voluntary urine sampling. In less than one month the keepers succeeded in training her to voluntarily weigh herself, which was critical to adapt her diet to her energy needs. Since then she has been regularly weighed (see graph) and is gaining weight as expected in a young animal.

From her arrival, the keepers noticed that Morgan was not responding to the bridge (whistle) signal used to inform the animals the requested behaviour has finished. Other sound signals (like slapping on the water surface -call-, ice cube dropping -targeting-, or fish dropping -enrichment-) were inconsistently responded to or even ignored, especially when Morgan was alone in one of the pools and the stimulus were behind her. As a consequence, the keepers inferred a hearing problem and developed



a new visual bridge signal (join hands above trainers head) that proved to work fine in the development of her training.

Currently Morgan's training is focused in the maintenance of the medical behaviours, the acquisition of voluntary urine sampling and the preparation for the audiogram test.

As Morgan has been integrated in the group, she is more often participating in the general training sessions and, as a consequence, acquiring the entire behavioural repertoire of the group, either by imitation or direct request. She has been also present in presentations (pool A) to avoid routine arrangements and frustration.

PROCESS OF INTEGRATION IN THE SOCIAL GROUP

5

- 5.1 Acoustic Contact
- 5.2 Process of Introduction
- 5.3 Results

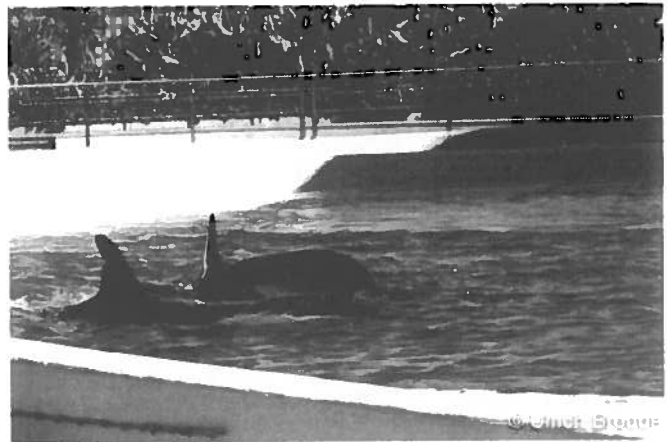
5.1 ACOUSTIC CONTACT

From the moment that Morgan arrived to the facilities of Orca Ocean the acoustic contact with the rest of the individuals began. The following day especially, Morgan made many vocalizations out of the water and also made lots of aerial sounds when she first visually contacted Adán through one of the gates.

When still in Harderwijk, Morgan had a very marked tendency to vocalize on the surface, perhaps because for one year and a half her only contact was with the trainers. During the first weeks at Loro Parque the aerial vocalizations were decreasing in frequency, possibly because she became more focused on underwater vocalizations. Nevertheless her aerial vocal behaviour hasn't been extinguished, and she is still the most vocal at the surface (compared with the rest of the animals), especially when trying to get the keeper's attention. The facilities of Orca Ocean have a 24 h recording system that is collecting all sounds from Morgan and the rest of individuals for subsequent analysis.

5.2 PROCESS OF INTRODUCTION

Morgan's social introduction began the day following her arrival, by means of controlled introduction events of increasing duration. Every introduction event was observed by the keepers, who intervened to separate the animals when they noticed any type of social displacement, agonistic reaction or aggression. Since the enormous interest that Adán showed from the moment of Morgan's introduction into the installation, it was decided that the first



contact would be with him. A brief controlled contact was carried out in the medical pool the day after her arrival, which turned out to be very positive.



The same day after the arrival, when Morgan had already become accustomed to pool C, she met Skyla, and no agonistic reaction nor signs of incompatibility were observed. In later days she met the rest of individuals of the group on a one-to-one basis (first with Kohana, later with Tekoa and finally with Keto after ten days of having arrived at Orca Ocean). During the individual meetings no cases of social displacement, agonistic reaction or aggression were observed from any individual.

Simultaneously, Morgan began to be introduced to pairs of animals during the first week. This began with the potentially more compatible pair (Kohana and Skyla), and they showed a very good relationship, without reactions of displacement or agonistic behaviours. From the second week introductions began with other pairs of animals.

During the second month at Loro Parque the duration of the introduction events with pairs was increased. When three or more individuals were involved in the introduction events, the social displacements and adjustments appeared, and as a consequence several keepers were carefully supervising every single introduction event.



By February (two months after the arrival) Morgan spent several nights either in pool A, B or C with Konaha and Tekoa (either all together or in pairs). That was a major milestone in her integration process, as it means 12 hours without direct supervision of the keepers. By this time the integration events already included groups of four animals (three plus Morgan). By the end of February the first integration event of 5 animals (all except Adan) was accomplished.

In March the integration process was considered accomplished, as Morgan was able to spend the whole night regularly in any pool with any animal. And all the group (the six animals) were together several times in

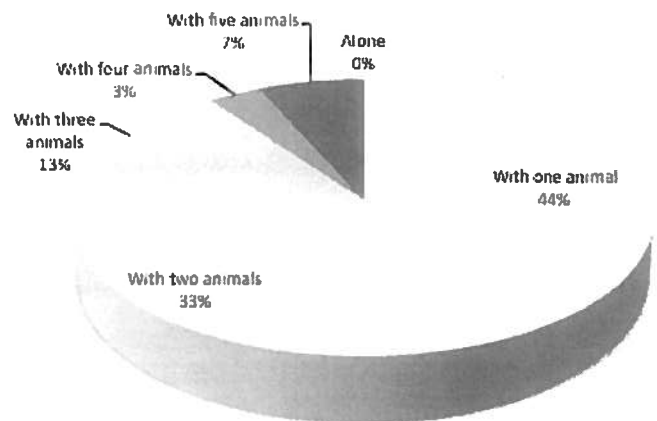


introduction events (longer than 30 minutes). From then on, the socialization process of Morgan started. From the very beginning she showed a very peculiar social behaviour, with strong and vigorous playful interactions with any other animal in spite of the hierarchy. This can possibly be the effect of de-socialization of the animal during the time she was alone. This particular behaviour (pushing down the other animals, even trying to bite them in the genital area) sometimes triggers social displacements or agonistic reactions by the other animals. As a consequence Morgan has scars and rack marks produced by the rest of the group, but none of them has ever need veterinary attention. During the socialization process it is expected to experience social readjustments, displacements and agonistic reactions as the individuals feel the need to impose their positions in the hierarchy.

5.3 RESULTS

The introduction process was considered completed by the end of March. Since then Morgan is spending time with any animal of the group, she is able to use any of the pools

in the installations and can be grouped in any possible configuration. She can also spend the night time (12 hours without direct supervision of the keepers) with any animal, and in any of the pools. As an example, the graph of the night time configurations for Morgan during the month of October is included, showing that she was not alone any night, but in pairs or groups of three, four, five or all the animals together. The socialization process is very well under way, and she is finding her position in the hierarchy.



INTEGRATION IN THE SCIENTIFIC RESEARCH



- 6.1 Introduction
- 6.2 Ongoing Projects
- 6.3 Research requests
- 6.4 New Projects

6.1 INTRODUCTION

The scientific research activities of Loro Parque are based in The Research and Conservation Program 2010-2015. This Program is the official document in which the fundamental criteria and guidelines for the research and conservation activities are established. These criteria are based in the recommendations of different zoological institutions related with Loro Parque (WAZA, EAZA, AIZA, EAAM), and several biodiversity conservation organizations related with Loro Parque Fundación (IUCN, SSC, CSBG, etc.).

The main goal of this Program is to optimize the financial, material and human resources that Loro Parque dedicates to the research and conservation activities, either directly or through Loro Parque Fundación. As no zoological institution can run research and conservation projects for every single species in its zoological collection, the Research and Conservation Program of Loro Parque establishes the criteria to distribute the resources among the most appropriate projects and species, based on their biodiversity conservation potential.

The selection of the scientific and conservation activities is based on an analysis of the potential value for research and conservation (either *in situ* or *ex situ*) of every single species in the zoological collection. To determine this potential value several criteria will be used, such as: status in the IUCN Red List of Threatened Species, availability of breeding programs (ISB, EEP or ESB), level of knowledge about species biometrics, biology or physiology, number of individuals available

in the collection, level of husbandry, suitability of the holding facilities, etc.

Based on the potential conservation and research analysis, a set of research proposals are submitted every year to the Board of Directors of the Loro Parque Fundación. All the proposals are evaluated in the Advisory Board Annual Meeting, using the most up-to-date scientific knowledge of the board of independent members. The Board of Directors approve the research and conservation proposal (*in situ* and *ex situ*), which are published in a final document.

In 2011 the LPF Advisory Board decided to fund 27 main projects with a total of 977,210 US\$, of them 22 were focused on parrots and terrestrial ecosystems, and 5 of them focused on cetaceans and marine ecosystems. Two out of the five marine projects had *ex situ* activities related with *Orcinus orca*.

6.2 ONGOING PROJECTS

As a consequence, when Morgan arrived to Orca Ocean there were two active research projects, funded by Loro Parque Fundación, that implied *ex situ* activities with *Orcinus orca*, and Morgan was integrated in both.

The first was a bioacoustics project, aimed to develop tools to improve the bioacoustic research. When Morgan arrived the project team was acquiring individually identified sounds in order to establish individual repertoires. As soon as Morgan could be held in the experimental pool (Holding Pool 2) the setting

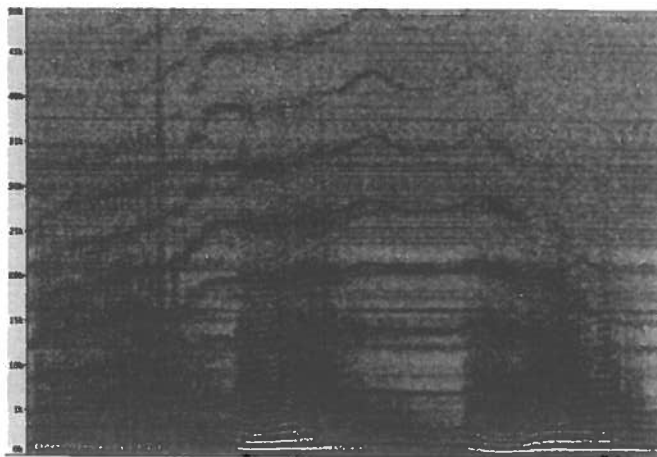
up of her individual repertoire was initiated. As a result over 250 Morgan vocalizations have been recorded and archived since January 2012.

The other on-going research project in which Morgan has been included since her arrival at Loro Parque is the "Pollution markers in European bottlenose dolphins". The orcas and Californian sea lions were added to the project as all of them were sharing the same diet with the dolphins at Loro Parque, and the comparative results would shed light on the bioaccumulation mechanisms among three different species feeding on the same resource. The project team is now analysing toxicology samples obtained from stranded and live wild dolphins, and the results will be compared with those from the animals in a controlled environment. Morgan's blood samples have been obtained regularly (as for the rest the group) and shipped to the research team in order to be analysed and to track any possible variation of the pollution markers.

6.3 RESEARCH REQUESTS

Loro Parque Fundación has received two formal requests to perform scientific research with Morgan since her arrival. The first came from the Museum of Natural History of Copenhagen, which needed good quality genetic material to perform a comparison between different species of marine mammals. As they already used Morgan's genetic samples in a previous stage of the project (when they obtained the samples to determine Morgan's original pod), they wanted to use genetic material from the same individual to continue the project. The foundation arranged the CITES permits to export the blood samples, and sent them to the research team, which received and processed them accordingly.

The last request to perform scientific research with Morgan has come from the University of St. Andrews (Scotland), from the research team that made the comparison of Morgan's dialect with the records of pod dialects from the three major orca populations in the North Atlantic. This research team requested to follow up the acoustic evolution of

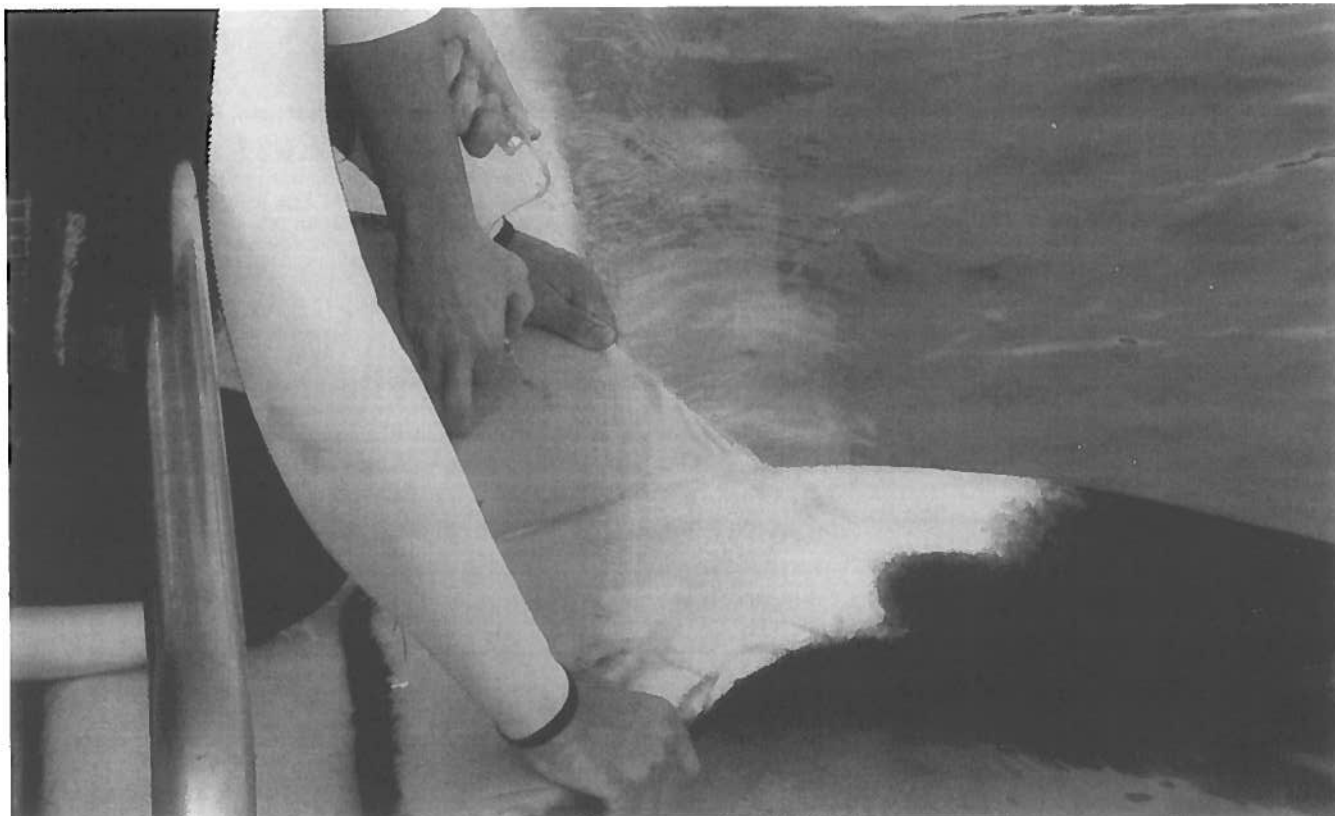


Spectrogram of one of the sounds attributed to Morgan that were registered during the introduction phase.

Morgan's dialect, as there is a hypothesis about the evolution of the orcas dialect during their entire lifetime. If this hypothesis proved to be correct, Morgan's dialect should be modified with the incorporation of calls specific to the Orca Ocean group. Similarly, the five animals of Orca Ocean would be integrating sounds from Morgan into their dialect. A researcher from St. Andrews University visited Loro Parque during the first week of February and again during the first week of June to make observations on Morgan's dialect. Complimentarily, Loro Parque Fundación shared all the identified sounds of Morgan that were registered since she was arrived to Loro Parque with the research team.

The preliminary analysis does not show any incorporation of sounds from the Orca Ocean group into Morgan's dialect. On the other hand, it seems that Adan has incorporated one sound from Morgan to his individual dialect, but no incorporations of Morgan calls into the dialect of the other animals has been found. This preliminary results open interesting questions about how the individual dialects are modified, and which role the social relations play in the process.

Anyway, to validate the conclusions of any bioacoustic study, the hearing ability of the animals involved should be previously checked, especially taking into account some indications that Morgan could have a hearing deficit. Soon after she arrived at Loro Parque the trainers noticed that she did not respond consistently to the sound bridge (whistle), nor to other sound signals (slaps in the water, underwater tone system, etc.)



Voluntary blood extraction of an orca at Loro Parque

In order to validate the results of this research Morgan will be submitted to an evoked potential test, in order to have a detailed audiogram that gives the exact measurement of her auditory capacity. At the beginning of 2012 a team of experts in measuring hearing capacity in wild rescued cetaceans was contacted, and they suggested evoked potential as the ideal methodology to test Morgan. She is being trained to perform the evoked potential test following their indications, and this will be undertaken as soon as the animal is ready and the experts can perform the measurements.

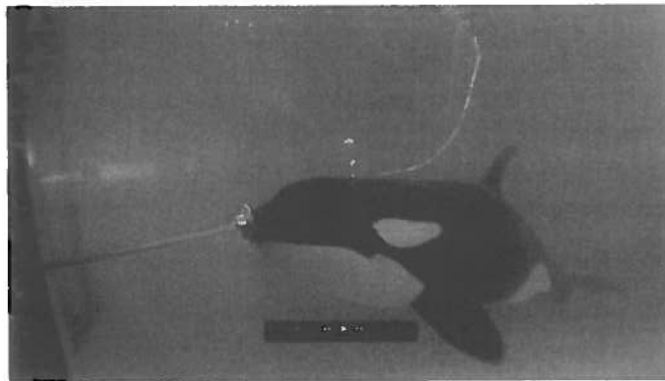
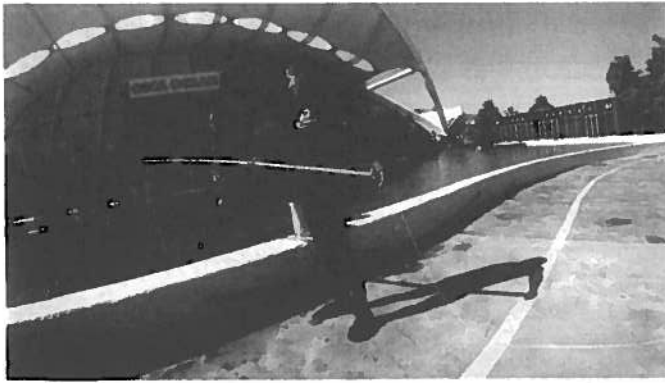
6.4 NEW PROJECTS

In 2012 the LPF Advisory Board decided to fund 37 projects with a total of 1.180.651 US\$, of them 29 were focused on parrots and terrestrial ecosystems, and 8 of them focused on cetaceans and marine ecosystems. Four out of the seven marine projects had *ex situ* activities related with *Orcinus orca*, one of them is the continuation of the immunotoxicology project, and the other three are new projects.

The first is aimed to find the way to obtain biometric data from the bioacoustic signals of the orcas. This project is based on

the technology developed by the University of La Laguna and Loro Parque Fundación in a previous 6 year project finished in 2011. Thanks to this technology, an individual repertoire for each of the six orcas is being established. The research team is working in the parametrization of the calls as the stage prior to obtaining information related to the biometry of the animal producing the sound. The animals are also carefully measured and weighed on a regular basis to collect the accurate biometric information. The bioacoustic records of the group (including Morgan) have been made available to researchers when required, after presentation of an adequate scientific proposal. The hydrophone system at Orca Ocean is being improved to digitalize the sound signals before any amplification. That will provide the top quality measurements needed to parametrize de signals and, subsequently find for biometric characteristics in the bioacoustic signals.

The second project is a continuation of a previous project (2005-2008) which was focused on the group dialect evolution at Orca ocean, since the four animals forming the original group had different dialects. The project will study the long term evolution of this group dialect and its implication in the individual



Morgan desensitization training session. From left to right and top to down: 1 attaching dummy suction cups, 2 giving signal to put nose on target, 3 correct position and 4 incorrect position.

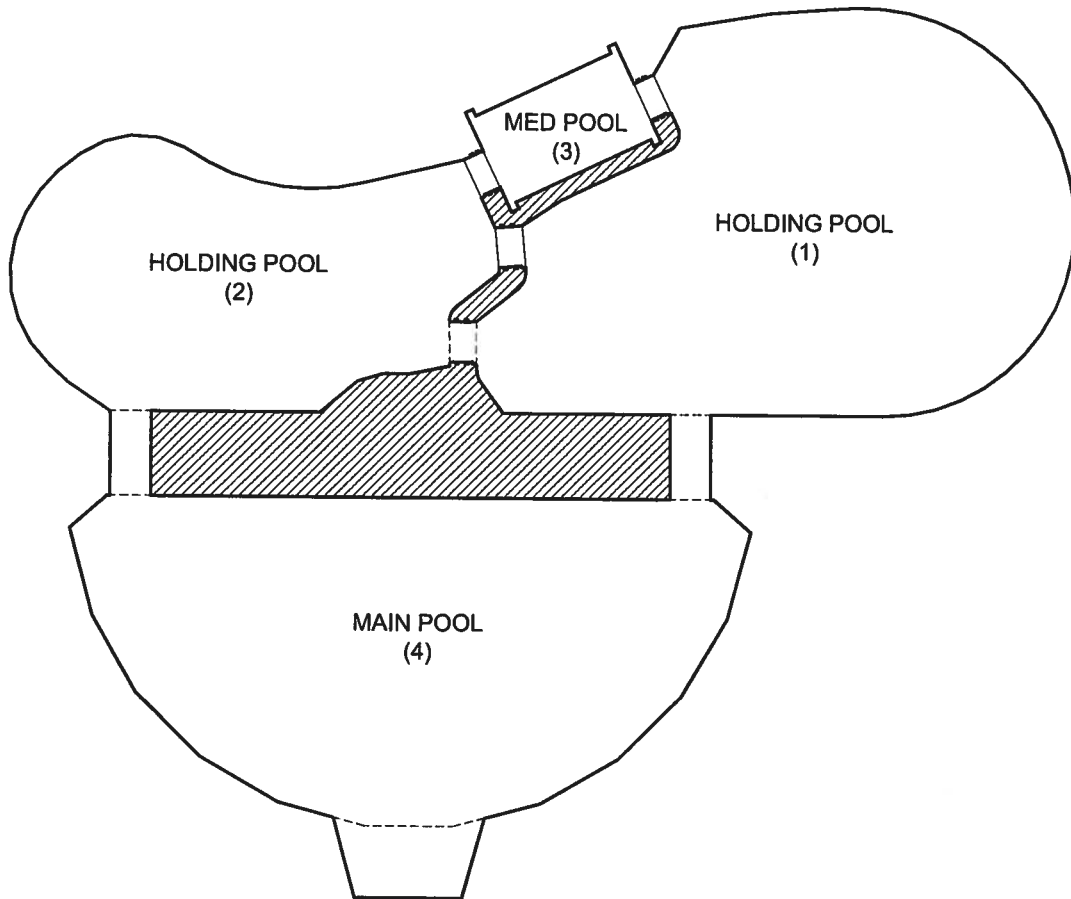
dialects. Besides, it will also focus on the animals' normal behaviours, e.g. parameters of their vocalizations and measures of their motor coordination, and use such data gain information about relationships between the Orcas' psychophysical state, e.g. degrees of their well-being, and their social or ecological conditions.

The third project will take advantage of the unique opportunity to observe the vocal adaptation of an introduced animal to an established group, and vice versa. The analysis of the individual and social dialect evolution can shed light on the vocal communication of the species, the plasticity of its vocal culture and the evolution of the dialects in time. This project will be developed in cooperation with the team of the University of St. Andrews (Scotland).

Finally, as Morgan hearing capacity must be accurately established to continue with the proposed bioacoustic studies, she is being trained to perform a complete audiogram. This hearing test of Morgan will be used to acquire information on the auditory capacity of the species, as three other orcas of the group are being trained to perform the audiogram too. The actual knowledge on the auditory capacity of the species comes from a study on a subadult male 40 years ago, and one more recent with two females over 20 years old. All the animals tested in this experiment are under 17 years old, which will give a better approach to the auditory capacity of the species.

ANNEX I

KILLER WHALE EXHIBIT AND REPRODUCTION AREA



TOTAL VOLUME: 21,157,000 LITERS

15 SAND FILTERS, CPS CHAMBER (3No. PROTEIN SKIMMERS, FLUIDISED CARBON CHAMBER, VENTURI CHAMBER) WITH A TURN OVER OF 210 MINUTES.
DESINFECTATION BY CHLORINE AND OZONE.

	<u>MAX. DEPTH</u>	<u>MAX. HORIZONTAL WIDTH</u>	<u>MAX. HORIZONTAL LENGTH</u>
MAIN POOL	12m.	24.5m.	50.8m.
MED POOL	4.2m.	7.1m.	12.4m.
HOLDING POOL 1	8.1m.	30.5m.	44.8m.
HOLDING POOL 2	8.1m.	20.5m.	36.5m.