

THE 2013 EAAM SYMPOSIUM

41TH ANNUAL SYMPOSIUM OF THE EUROPEAN ASSOCIATION FOR AQUATIC MAMMALS

MARCH 15-18, 2013 . NUREMBERG . GERMANY

ORGANIZATION



European
Association
of Aquatic
Mammals



European
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of Aquatic
Mammals

Dear Participant;

Dear Member, colleague and friend.

Our 41st meeting is fast approaching.

It was an intense and interesting experience to receive all Abstracts and interact with many of you preparing this meeting.

To be at EAAM Board was one of my professionals' objectives. Here I am delighted with the amount of actions taken in just one year.

Hope that during our conference you can feel and appreciate all work done, to make your participation a real value on your professional and personal life.

The scientific committee had an important role analyzing and approving the abstracts submitted. A special thank you for Manuel Garcia Hartmann that was an incredible support for the organizing team.

I can not finish without thanking all effort from Dr. Lorenzo von Fersen and Dr. Katrin Baumgartner along the last year exchanging ideas and working hard to be our host.

Thank you Dr. Dag Encke for inviting us!



Dear guests, dear participants!

Zoo Nuremberg welcomes you sincerely to the 41st Symposium of the EAAM as our guests. We are proud to have the possibility to host you in our beautiful zoo and city. Therefore we will do our best to make you feel comfortable and to enjoy your stay here. Apart from offering you an excellent program with scientific and empirical presentations, we will enrich the program with moments of leisure being aware that part of the success of the symposium last not least depends on your well-being...

We also welcome you as participants of a symposium that will focus on two major aspects of our work. On one hand we will learn about important experience with marine mammals under human care. On the other hand we will listen to presentations challenging our scientific understanding and strategic thinking. The whole program serves the main goal: meeting the needs of the animals on the basis of scientific results and ethical responsibility.

We will discuss our present status in keeping marine mammals and try to find new hints for further developments of our skills and the animals' well-being.

In the result I heartly hope that you will leave the conference richer in knowledge, encouraged to head for new courageous projects.

With the best wishes for a symposium of hopefully good spirit and successful, inspiring scientific sessions and workshops,

Yours,



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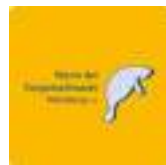
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SCIENTIFIC PROGRAM

Invited speakers

SATURDAY, 16TH MARCH 2013

LESLEY DICKIE

The new EAZA Strategy 2013-2016: What are the challenges and opportunities?

SUNDAY, 17TH MARCH 2013

VINCENT M. JANIK

Marine mammal acoustics: an integration of zoo and field research

MONDAY, 18TH MARCH 2013

COLIN ALLEN

Ethics and the science of animal welfare

Saturday, 16th March 2013

- 8:30 am > 13:00 pm **REGISTRATION DESK**
- 8:45 am > 9:00 am **WELCOME ADDRESS**
- 9:00 am > 10:00 am **THE NEW EAZA STRATEGY 2013-2016: WHAT ARE THE CHALLENGES AND OPPORTUNITIES?**
SPEAKER > Lesley Dickie
- 10:00 am > 11:00 am **SCIENTIFIC SESSION**
CHAIR > Katrin Baumgartner
- Breeding Polar Bears at Zoo Nuremberg
Fritz, P. and Krueger, S.
- Breeding behaviour and pregnancy detection in nulliparous polar bears (*Ursus maritimus*)
Cortinovis, L.; Zaccaroni, A. and Hartmann, M. G.
- The clinical history of a fatal encephalitis in two polar bears (*Ursus maritimus*) caused by a recombinant zebra herpesvirus
Greenwood, A. D.; Tsangaras, K.; Simon Y. W. Ho; Szentiks, C. A.; Veljko M. N.; Guanggang Ma; Damiani, A.; East, M. L.; Lawrenz, A.; Hofer, H. and Osterrieder, N.
- 11:00 am > 11:30 am **COFFEE BREAK**
- 11:30 am > 1:10 pm **SCIENTIFIC SESSION**
CHAIR > Manuel Garcia Hartman
- Animal Stories: Best Practices in Communication Management
Ornée, R. J.; Foppen, M. and Hess, S.
- Seed for the Future – Engaging the public in Nature Conservation
Vicente, E.; Neves, J. P.; Hale, R. and Ribeiro, E.
- Lisbon zoo dolphinarium life support system – 18 years of evolution
Sogorb, A.; Matias, S. and Ferreira, A.
- Description of a novel strain of Dolphin morbillivirus from a stranded striped dolphin (*Stenella coeruleoalba*) on Spanish Mediterranean Coast
Rubio-Guerri, C.; Jimenez, M. A.; Bellière, E. N.; Esperón, F.; Crespo, J. L.; Melero, M.; García-Párraga, D. and Sánchez-Vizcaíno, J. M.
- Diagnosis, management and follow up of an adenovirus outbreak in a Patagonian Sea Lion colony at the Oceanográfico
García-Párraga, D.; Álvaro, T.; Valls, M. and Kuiken, T.
- 1:10 pm > 2:10 pm **LUNCH BREAK**
- 2:10 pm > 6:00 pm **VISIT TO NUREMBERG ZOO**

Sunday, 17th March 2013

- 8:30 am > 1:00 pm **WELCOME DESK**
- 9:00 am > 10:00 am **MARINE MAMMAL ACOUSTICS: AN INTEGRATION OF ZOO AND FIELD RESEARCH**
 SPEAKER > Vincent M. Janik
- 10:00 am > 11:00 am **SCIENTIFIC SESSION**
 CHAIR > Lorenzo Von Fersen
- Whale changes hearing sensitivity when warned
 Nachtigall, P. E. and Supin, A. Y.
- Testing the hearing of marine mammals: implications for animal welfare and conservation
 Pacini, A. F. and Nachtigall, P. E.
- Low-frequency temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*)
 Smith, A. B. and Nachtigall, P. E.
- 11:00 am > 11:30 am **COFFEE BREAK**
- 11:30 am > 12:50 pm **SCIENTIFIC SESSION**
 CHAIR > Paul E. Nachtigall
- Do dolphins rehearse show-stimuli when at rest? Delayed matching of auditory memory
 Kremers, D.; Jaramillo, M. B.; Böye, M.; Lemasson, A. and Hausberger, M.
- Whistles recognition in Bottlenose dolphins (*Tursiops truncatus*): a tool to protect a wild population
 Schnoller, F.; Delfour, F. and Mauuary, D.
- Investigations on hearing abilities of harbour porpoises (*Phocoena phocoena*) in human care and the wild
 Siebert, U.; Ruser, A.; Lucke, K.; Houser, D.; Teilmann, J.; Van Elk, N.; Kristensen, J.; Wahlberg, M.; Everaarts, E. and Dähne, M.
- Results of a 20 year Erysipelas vaccination program in a dolphin population
 Lacave, G.; Cui, Y.; Salbany, A.; Roque, L.; Flanagan, C.; Silva, N. and Cox, E.
- 12:50 am > 1:50 pm **LUNCH BREAK**
- 1:50 pm > 2:50 pm **SCIENTIFIC SESSION**
 CHAIR > Jesus Fernandez
- Veterinary management of two bottlenose dolphin primiparous pregnancies and birth with the same prediction dates
 Grande, F.; Fiorucci, L.; Stella, V.; Pilenga, C.; Henriques, A.; Manfrini, V. and Flanagan, C.
- Hand-rearing orphaned harbour seal pups (*Phoca vitulina vitulina*) with a fish-based formula
 Sánchez Contreras, G. J.; Rubio García, A. and Juliá Acosta, C.
- Dolphin neonate behavior and management: a review
 Hartmann, M. G.
- 2:50 pm > 3:50 pm **COFFEE BREAK / POSTER SESSION**
- 3:50 pm > 5:10 pm **SCIENTIFIC SESSION**
 CHAIR > Birgitta Mercera
- It is not easy to foresee everything when your target is to see again
 Bourgain, J. L.; Lacave, G.; Hugué, E.; Pérez, M.; Gournay, W.; Caron, A.; Godet, C.; Roy, V.; Deschamps, J.; Le Meur, L.; Simonet, A. S.; Colitz, C. and Latimer, F.
- Behavioral disorder in a California Sea Lion (*Zalophus californianus*)
 Hein, A.
- Sea lions (*Zalophus californianus*) understand human gestures as communicative and referential cues
 Malassis, R.; Delfour, F.; Lévy, C. and Mercera, B.
- Visual laterality in dolphins: importance of the familiarity of stimuli
 Böye, M.; Blois-Heulin, C.; Crével, M. and Lemasson, A.
- 5:10 pm > 6:10 pm **ANNUAL GENERAL MEETING** (members only)
- 7:30 pm **GALA DINNER**

Monday, 18th March 2013

- 8:30 am > 1:00 pm **WELCOME DESK**
- 9:00 am > 10:00 am **ETHICS AND THE SCIENCE OF ANIMAL WELFARE**
SPEAKER > Colin Allen
- 10:00 am > 11:00 am **SCIENTIFIC SESSION**
CHAIR > Élio Vicente
- “If only I could breathe water”: Bioethical challenges for a Veterinarian of aquatic animals
Gili, C.
- Habitat complexity for marine mammals housed under human care
Brando, S.
- Measuring and interpreting salivary cortisol levels in bottlenose dolphins during disturbances produced by construction work
Rickert, D.
- 11:00 am > 11:30 am **COFFEE BREAK**
- 11:30 am > 12:30 pm **SCIENTIFIC SESSION**
CHAIR > Daniel García-Párraga
- Vitamin status of bottlenose dolphins (*Tursiops truncatus*) in european facilities
Gimmel A.; Baumgartner K. and Liesegang A.
- Two cases of gastric impaction in *Stenella coeruleoalba*
Saviano, P.; Mazzariol, S.; Guglielmi, E.; Povinelli, M.; Centelleghé, C.; Giurizzato, M.; Tessarin, C. and Zaccaroni, A.
- Micronuclei as possible indicators of toxicological damage in cetaceans
Hartmann, M. G.; Cortinovis, L.; Formigaro, C. and Zaccaroni, A.
- 12:30 pm > 1:00 pm **FINAL REMARKS**
- Announcement of the Student's Award
- Presentation of the Candidates for the 2015 Symposium
- Presentation of the 2014's Host Facility
- Closing Ceremony
- 1:00 pm > 2:00 pm **LUNCH**
- 2:20 pm > 2:40 pm **TRANSPORT TO THE NUREMBERG ZOO**
- 3:00 pm > 5:00 pm **WORKSHOP**
- Life Support Systems
CHAIR > Peter Haack
- Animal Welfare
CHAIR > Sabrina Brando
- Animal Presentation in the course of time
CHAIR > Christiane Thiere

ABSTRACTS



SATURDAY, 16TH MARCH 2013

INVITED SPEAKER

The new EAZA Strategy 2013-2016: What are the challenges and opportunities?

Lesley Dickie¹

¹ Executive Director, European Association of Zoos and Aquaria

EAZA has over the past year developed its new 2013-2016 strategic plan, encompassing a wide range of activities of concern both to members individually and as an association. The strategy was developed with greater transparency to the wider membership than ever before and is highly ambitious in scope. A clear aspect of the new strategy is its framing as to how a zoo association develops and achieves its aims against the background of the UN Decade of Biodiversity. However, it also focuses on key public trust issues such as good welfare standards. If everything detailed in the strategy were to come to fruition EAZA would be placed in a position of notable strength – opportunities are everywhere. However, we also need to carefully consider the challenges to successful implementation and a business plan is being developed alongside the strategy to ensure its full implementation. Arguably the most likely reason for failure will be internal rather than the highly visible challenges from external animal rights bodies and the prevailing economic environment. All these will be explored and discussed within this presentation.

POLAR BEAR SESSION

CHAIR > Katrin Baumgartner

CONSERVATION, LSS AND VETERINARY SESSIONS

CHAIR > Manuel Garcia Hartman

Breeding Polar Bears at Zoo Nuremberg

Fritz, P.* and Krueger, S.¹

¹Tiergarten Nuremberg, Am Tiergarten 30, 90480 Nuremberg, Germany, 3fritzens@gmx.de

Zoo Nuremberg's Polar Bear breeding programme started in 1948 with 27 successful births. Since 2004 a new exhibit for 1. 2 polar bears was constructed. In 2007 both females gave birth nearly at the same time in different areas of the exhibit. Due to external disturbance Vilma lost her offspring and Vera started carrying the cup around the enclosure, apparently looking for a safer place. It was decided to hand-rear this cup. In order to improve the future breeding situation Vilma was given to another zoo.

In 2008 she gave birth to two cups, but both died within a few days of coccidiosis.

After these events management plan was changed:

- intensive barn training
- improvements of the housing
- installation of a digital camera and a microphone

The plan was to make her feel safe and to avoid any disturbance. In 2010 two cups were born, the mother behaved well. After six weeks we entered the stable because of a problem with the drinking trough. This didn't cause any problems.

We vaccinated the cups against Leptospirosis and after 3,5 months they left the barn. In the first months Vera was nervous because the male was in the adjacent enclosure, but the cups did well.

Breeding behaviour and pregnancy detection in nulliparous polar bears (*Ursus maritimus*)

Cortinovis, L.^{*1,2}; Zaccaroni, A.¹; Hartmann, M. G.²

¹ Large Pelagic Vertebrates Research Group, Department Veterinary Medical Sciences, University of Bologna, Italy

² Conservation Research Center (CRC) Marineland Antibes, 306, Avenue Mozart, 06600 Antibes, France, crc@marineland.fr

Polar bear reproduction is characterized by a strictly seasonal breeding and the particularity of a diapause, leading either to abortion or implantation. Pregnancy testing in polar bears has been described as “difficult at best” by several authors.

Here we describe the first development of reproductive behavior and hormone testing results in a young couple of nulliparous polar bears held in a marine park.

Daily behavioural observations were done from May to June, registering courtship and mating activity. Non-invasive hormonal analyses for progesterone (P4) were performed on faeces and urine with a commercial CLIA test.

Courtship behaviour was seen in the male, while the female refused the male for the first weeks of mating attempts. The mating period lasted for weeks and several matings were seen on land and in the water.

After mating the female behaved similar to pregnant wild females, including a significant increase in food intake and den excavation. Nevertheless, the hormonal profile revealed no peak in progesterone (P4) level at any time after the summer.

To our knowledge, this is the first description of nulliparous polar bear reproductive behaviour, where we describe what we believe to be a “learning process”.

The lack of confirmation of a pregnancy after the diapause period in this nulliparous female could be related to several reasons: (1) lack of implantation, (2) young age of the male and the female, hence not being fully reproductive yet and (3) other possible causes, which will be discussed.

The clinical history of a fatal encephalitis in two polar bears (*Ursus maritimus*) caused by a recombinant zebra herpesvirus

Greenwood, A. D.¹; Tsangaras, K.¹; Simon Y.W. Ho²; Szentiks, C. A.¹; Veljko M. N.^{1,3}; Guanggang Ma³; Damiani, A.³; East, M. L.¹; Lawrenz, A.^{*4}; Hofer, H.¹ and Osterrieder, N.³

¹ Leibniz-Institute for Zoo and Wildlife Research, Alfred-Kowalke-Strasse 17, 10315 Berlin, Germany

² School of Biological Sciences, University of Sydney, Edgeworth David Building A11, Sydney, NSW 2006, Australia

³ Institut für Virologie, Freie Universität Berlin, Philippstrasse 13, Haus 18, 10115 Berlin, Germany

⁴ Zoological Garden Wuppertal, Hubertusallee 30, 42117 Wuppertal, Germany, lawrenz@zoo-wuppertal.de

Two cohoused polar bears (*Ursus maritimus*), suffered epileptiform seizures at the Zoological Gardens Wuppertal, Germany. The 20-year-old female, Jerka, presented symptoms first and died 8 days after the onset of clinical signs. The 16-year-old male, Lars, survived after medical intervention, which included intravenous administration of a hypertonic electrolyte solution, two different antibiotics, glucocorticosteroid and diazepam to prevent seizures. It took several weeks for him to fully recover. Necropsy indicated moderate to severe nonsuppurative encephalitis and gliosis of unknown etiology as the cause of death. The lesions were consistent with virus infection, but inclusion bodies that are associated with some viral pathogens, including herpesviruses, were not identified.

Retrospective a new recombinant zebra herpesvirus could be discovered in both polar bears. The mode and source of transmission of this opportunistically to new species jumping virus remains unknown and makes the control difficult and is critically threaten to polar bears.

New health and safety measures have to be implemented in the husbandry of polar bears.

Animal Stories: Best Practices in Communication Management

Ornée, R. J.¹; Foppen, M.² and Hess, S.³

¹ Ornée, R. J.; MBA, PhD.(cand.), Owner/Managing Director, IC/DC Consultancy (Ltd. Under Dutch Law), Dr. Perquinstraat 44, 2265 BJ Leidschendam, The Netherlands, rolf@ornee.com

² Marten Foppen, General Manager, Dolfinarium Harderwijk, Strandboulevard Oost 1, 3841 AB Harderwijk.

³ Hess, S.; Communication Manager, Dolfinarium Harderwijk, Strandboulevard Oost 1, 3841 AB Harderwijk

Zoo's, in particular where iconic animals as Dolphins are kept under human care, are faced with a more hostile communication environment. Stakeholders and non-stakeholders communicate actively and extensively, pushing Zoo's/Aquarium's into a defensive position. For a long time "education" and "conservation" have served us well against the "tipping point" of the still favourable public opinion. Today we are challenged to explain animal welfare in laymen's terms.

On the basis of three recent cases the authors give an overview of effective communication management and methods. One of the cases is Orca Morgan. What can be improved, what impacts have the latest developments in the (social) media on reputation, stakeholder-management, resulting in a best practices list for individual zoo's and their organizations alike. In short best practices applied for effective strategies.

The overall objective is to focus the collective communication efforts towards "uninterrupted learning" for the general public. Storytelling, about the welfare of animals under human care.

Modern methods of unified communication, accelerating our individual efforts to a joint strong "voice". Resulting in a long future for our Zoo, in continuous dialogue with society.

Seed for the Future – Engaging the public in Nature Conservation

Vicente, E.¹; Neves, J. P.¹; Hale, R.¹ and Ribeiro, E.²

¹ Zoomarine – EN 125, km 65, Guia, 8201-864 Albufeira, Portugal, eliovicente@zoomarine.pt

² ALMARGEM – EN 125, km 65, Guia, 8201-864 Albufeira, Portugal

As the general public often feels mystified and disconnected from conservation issues, the EUZoos-XXI project was idealized and implemented as a 3-year project funded by the Seventh Framework Program of the European Commission aiming to bring the general public closer to science.

Through a partnership amongst 5 zoological facilities (4 European and 1 North-American), one research center and an environmental consultancy company, EUZoos-XXI developed scientific-based educational materials and activities, implemented programs and involved society on four main conservation topics: Ecological connectivity, Biodiversity, Alien Invasive Species and Endangered Species.

Several approaches were used to gain the insight of the general visiting public on conservation issues. One of these approaches were the Public Participation Meetings (PPM), held on each of the four European zoological partners, involving a social sample of the visitors' universe. These PPM aimed to propose demonstration projects to be implemented in each of those zoological facilities. Another example was the International Biological Art Contest, which engaged amateur and professional artists to express their views on the four conservation topics. The feedback was important in helping the partner zoos and marine parks to alter and develop educational programmes that better fit their visitors.

As one of the project founders, Zoomarine-Portugal was deeply involved in all of the above approaches, proving it was a crucial learning experience for the managing team as well. With on-field managing responsibility, Zoomarine's participation and objectives became more than just engaging the public... Beside the compelling results for the general public, the project left seeds for our future educational approaches.

Lisbon zoo dolphinarium life support system – 18 years of evolution

Sogorb, A.^{*1}; Matias, S.¹ and Ferreira, A.¹

¹Jardim Zoológico de Lisboa, Estrada de Benfica, 158, 1549-004, Lisboa, Portugal, baiagolf@zoo.pt

Lisbon Zoo dolphinarium was inaugurated in May 1995. Marked improvement over traditional water treatments was achieved by combining the latest technology in water treatment with design of the life support system.

Life support system (LSS) was also designed to minimize sound exposure. Piping and valves system provides the flexibility to allow any necessary bypass and daily visual inspection.

Full biological treatment, together with ozone as primary disinfectant, was initially adopted. Throughout our experience of the visual and operational aspects and also microbiological growth took us to rethink the initial LSS protocols. Biological treatment is a key element since remove soluble organic substances and reduce the amount of ammonia. In association with residual chlorine levels we obtain water clarity with balanced quality.

We perform daily, weekly, quarterly and monthly chemical and microbiological tests. Every three months water samples are tested for Total Organic Carbon, TOC, levels and trihalomethanes, THMs, which allows a full evaluation of LSS efficiency.

The LSS operation and alarm system are coordinated by a computer program though a manual option is also available.

Dolphinarium facilities are inherently complex and must blend the requirements of visitors, staff and animals into a facility that can function reliably and economically.

Description of a novel strain of Dolphin morbillivirus from a stranded striped dolphin (*Stenella coeruleoalba*) on Spanish Mediterranean Coast

Rubio-Guerr, C.^{*1}; Jimenez, M. A.²; Bellière, E. N.³; Esperón, F.³; Crespo, J. L.^{1,4}; Melero, M.¹; García-Párraga, D.⁴ and Sánchez-Vizcaíno, J. M.¹

¹ VISAVET Center and Animal Health Department, Veterinary School, Complutense University of Madrid, Av Puerta del Hierro s/n, 28040 Madrid, Spain, consuelo@sanidadanimal.info

² Animal Health Research Centre, Ctra. de Algete a El Casar s/n, 28130 Madrid, Spain

³ Medicine and Surgery Department (Anatomic Pathology), Veterinary School, Complutense University of Madrid, 28040 Madrid, Spain

⁴ Veterinary Services, Oceanogràfic, Ciudad de las Artes y las Ciencias, C/ Eduardo Primo Yúfera (Científic), 46013 Valencia, Spain

Dolphin morbillivirus has been responsible for many systemic infections which caused massive strandings on Mediterranean Sea. On October 2012 a young male striped dolphin (*Stenella coreuleoalba*) stranded on Alcossebre, Spanish Mediterranean Sea. During necropsy, selected tissue samples were collected. Subsequently, histopathology, immunohistochemistry and conventional reverse transcription polymerase chain reaction (RT-PCR) were performed to identify Morbillivirus. The virus was found in all tissues except liver and skin revealing a systemic infection of CeMV. The analysis of the phosphoprotein sequences confirmed that it belongs to DMV group. Nevertheless a divergence between this sequence with the sequences from 1990 and 2007 DMV epizootic suggests that a novel DMV strain could be circulating in striped dolphin population on Mediterranean Sea.

Diagnosis, management and follow up of an adenovirus outbreak in a Patagonian Sea Lion colony at the Oceanográfico

Garcia-Párraga D.^{*1}; Álvaro T.¹; Valls M.¹ and Kuiken T.²

¹ Veterinary Services, Oceanográfico, Eduardo Primo Yúfera, 10B, 46013 Valencia, Spain, dgarcia@oceanografic.org

² Department of Virology, Erasmus MC P.O. Box 2040, 3000 CA Rotterdam, The Netherlands, t.kuiken@erasmusmc.nl

An original breeding colony of 14 adult Patagonian sea lions was established at the aquarium since 2002 without any posterior new acquisitions. In December 2009 one reproductive male presented with progressive weakness and vision impairment, developing episodes of peracute abdominal pain with frank anorexia and diarrhea. Blood samples revealed anemia, hypoglycemia and a mild inflammatory profile. Additional tests were performed including X-rays, ultrasound, urinalysis, serology (canine adenovirus, *Leptospira* sp, canine distemper virus, Influenza B, *M. tuberculosis* complex), *Dirofilaria* microfiltration test and heavy metal levels in blood (Cu, Pb, Se, As, Hg, Cd, Zn) without any conclusive results. Few weeks later, another 5 animals became sick showing anorexia, abdominal pain and severe dyspnoea dying 2 of them in less than 24h. All symptomatic animals were isolated while diagnosis of adenovirus infection was confirmed based on serology, PCR and sequencing, histopathology and electronic microscopy. A new "Sea Lion" adenovirus sequence was described and a specific RT-PCR probe for the new sequence was designed in order to make a better follow up of the outbreak. During the next months several contingency measurements (including preventive vaccination of naïve population) were taken until the affected group had maximum guarantees to have fully overcome the infection.

SUNDAY, 17TH MARCH 2013

INVITED SPEAKER

Marine mammal acoustics: an integration of zoo and field research

Vincent M. Janik

Sea Mammal Research Unit, School of Biology, University of St Andrews, Fife KY16 8LB, UK

The study of marine mammal acoustics is currently experiencing a second advent. An early focus on communication and intelligence has now been replaced with a concern over the effects of anthropogenic noise on marine mammals. For acoustics research, studies in zoos and in the wild have been of major importance. Each of these environments has unique advantages and disadvantages for the study of marine mammal biology. Zoos have the advantage of highly controlled conditions and animals can be easily accessed and trained. Studies on wild animals allow observations of large numbers of animals in their natural habitat on scales that cannot be replicated in zoos. In acoustic research, accessibility is important since signal production cannot be ascertained easily. Being able to isolate animals or to use passive acoustic localization in combination with visual observations of individuals has allowed us to learn about signal development, use and function in a variety of marine mammals. Controlled conditions are also important in the development and testing of methods such as tagging and audiometry based on auditory evoked potentials before applying them in the wild. Last but not least, zoos can provide important control groups that are difficult to find in the wild such as animals with a low noise exposure history. I will illustrate these points with specific examples from recent studies in my own laboratory that will show that besides morphological work a combination of studies on wild and zoo animals was crucial for our current understanding of marine mammal acoustics.

ACCOUSTICS SESSION

CHAIR › Lorenzo Von Fersen

ACCOUSTICS AND VETERINARY SESSION

CHAIR › Paul E. Nachtigall

NEONATOLOGY SESSION

CHAIR › Jesus Fernandez

TRAINING AND PHYSIOLOGY SESSION

CHAIR › Birgitta Mercera

Whale changes hearing sensitivity when warned

Nachtigall, P. E.¹ and Supin, A. Y.²

¹ University of Hawaii, nachtiga@hawaii.edu

² Russian Academy of Sciences

We have been examining the hearing of both the outgoing clicks and the returning echoes of actively echolocating odontocetes using evoked auditory potential techniques. In order to protect themselves from the loud outgoing sound while still maximizing the hearing of the acoustic echo return, odontocete echolocators appear to have developed both passive and active control of hearing. Passive control has been demonstrated by comparing hearing of their own outgoing signals to similar signals presented to them from the outside. Clicks produced by the animal itself are heard about 40 dB down. Active control has been demonstrated by a comparison of hearing outgoing clicks during target present and target absent trials. During target absent trials, when searching for targets, hearing is 20 dB more sensitive than during target present trials. The current critical question is: If the animal is warned that a loud sound is about to arrive, does it possess a mechanism of self-mitigation that will allow it to control its own hearing and reduce the level of the incoming sound? Initial results indicate that a false killer whale will reduce hearing sensitivity by at least 15 dB when warned that a 170 dB signal is about to arrive.

Testing the hearing of marine mammals: implications for animal welfare and conservation

Pacini, A. F.¹ and Nachtigall, P. E.¹

¹ Marine Mammal Research Program, Hawai'i Institute of Marine Biology, Kane'ohe, HI 96744, USA, aude@hawaii.edu

Our understanding of the hearing of marine mammals remains to this date limited to a small number of species. The use of the auditory evoked potentials (AEP) technique represents a valuable tool for researchers, veterinarians, animal caretakers and management agencies to understand the hearing mechanisms of various marine mammals. This technique is advantageous as it requires little or no training and it relies on non invasive methods such as contact electrodes embedded in suction cups. Additionally, a full audiogram or hearing measurement by frequencies usually takes about an hour if it is run continuously. This presentation will focus on the complete methods used to measure the hearing of marine mammals and will then present various audiograms collected in a wide range of settings such as laboratory, field and marine parks. These measurements include endangered species such as polar bears and beaked whales that require particular attention when it comes to their conservation and management. AEP methods are a great example of a multi-disciplinary technique that requires the constant collaborations of researchers and animal care takers not only to improve our knowledge of marine mammal species and their welfare but also to ensure the best strategies for their conservation.

Low-frequency temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*)

Smith, A. B.^{*1} and Nachtigall, P. E.¹

¹ Marine Mammal Research Program, Hawai'i Institute of Marine Biology, PO Box 1346, Kane'ohe, HI 96744, USA, adambsmi@hawaii.edu

There is growing concern about the increasing levels of anthropogenic noise in the ocean and the impacts it may have on the hearing of marine mammals. Much of this noise increase occurs at lower frequencies from activities such as shipping traffic, seismic exploration and sonar. While multiple studies have investigated the effects of mid-frequency noise exposure on the hearing of odontocetes, few studies have looked at the effects of similar exposure at lower frequencies below 4 kHz. Understanding the potential effects of increased exposure to noise is important for decisions concerning conservation and management. Using auditory evoked potentials, temporary threshold shift (TTS) is being investigated in a bottlenose dolphin (*Tursiops truncatus*) after exposure to a broadband fatiguing noise from 1 to 5 kHz. Exposure duration

is 30 minutes at 165 dB SPL. Hearing thresholds are measured at frequencies between 1.4 and 11.2 kHz immediately prior to exposure and at time intervals from 5-80 minutes following completion of the exposure. The magnitude of TTS and time until complete recovery is analyzed and discussed. We expect TTS to be greatest approximately 0.5 octaves above the fatiguing noise and complete recovery time to be positively correlated with shift magnitude.

Do dolphins rehearse show-stimuli when at rest? Delayed matching of auditory memory

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Delphinids are able to copy sounds from their environment that are not produced by conspecifics. So far these mimics occur associated with the context in which they were learned. No separation between auditory memory formation and spontaneous vocal copying was observed as it is for example in songbirds.

In our study we report that bottlenose dolphins (*Tursiops truncatus*) are able to produce, during night time non-dolphin sounds that they heard during the day: they copy whale sounds that had been broadcast during daily public presentations. We know that these captive dolphins had never had the opportunity to hear whale sounds before then. Moreover, recordings made before the whale sounds started being broadcast revealed that they had never emitted such sounds before.

This is, to our knowledge, the first evidence of a separation between formation of auditory memories and the production of calls that match these memories in a marine mammal.

One hypothesis is that dolphins may rehearse special events heard during the day time and that they then express vocally what could be conceived as a more global memory.

These results open the way for broader views on how animals might rehearse life events while resting or may be dreaming.

Whistles recognition in Bottlenose dolphins (*Tursiops truncatus*): a tool to protect a wild population

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Due to difficult visual observations and rare encounters, the population of bottlenose dolphins (*Tursiops truncatus*) faces a data deficient status in Reunion Island (IUCN, 2010).

Here we propose an innovative and easy-to-use method to complement visual observation for population monitoring. This procedure is based on individual "signature whistle" identification. For four years, the Abyss Ngo has regularly observed groups of common bottlenose dolphins (*Tursiops truncatus*) off the coasts of Reunion Island. Scientists used underwater HD video cameras for visual and stereo acoustic recordings; their quality is high enough to allow a spectral analysis of the dolphins' vocalisations. 750 hours of survey and 18 sightings/encounters with bottlenose dolphins provided more than 1800 narrow-band frequency-modulated signals. Two observers classified them according to 40 models of potential signature whistles (Kappa test: 81). The analysis shows a strong correlation between visual observations (34 identification visual marks) and the recorded potential signature whistles (Monte-Carlo test: $p < 0.0001$ and coefficient of contingency 0,969).

We will discuss here the benefits of using this procedure to assess the size of a bottlenose dolphins population and to get knowledge on its structure. This finding also brings valuable information on the context of emission of whistles by wild dolphins in interspecific encounters.

Investigations on hearing abilities of harbour porpoises (*Phocoena phocoena*) in human care and the wild

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Harbour porpoises are protected under European legislation according to the Habitats Directive as a migrating species within their entire range. The German offshore wind energy is supposed to expand to a nominal capacity of 25 GW until 2030. Pile-driving with hydraulic hammers is considered to produce noise pollution with a potential negative impact for the hearing of harbour porpoises. The present investigation uses a non-invasive method for deriving auditory evoked potentials (AEP) for determination of hearing thresholds. Porpoises were reported from Danish fishermen when incidentally caught in pound nets or investigated and trained on animals under human care at the SOS Dolphinarium in Harderwijk, the Netherlands and at Fjord and Baelt Center, Denmark. Audiometric investigations were conducted and baseline audiograms measured on four free-ranging harbour porpoises. Six audiograms were created during the experiments on harbour porpoises in human care. They showed high agreement with one another although differences of up to 30 dB were registered within the range of best hearing from 20 to 140 kHz. The study will continue with the ultimate goal to test harbour porpoises for a temporary threshold shift using an airgun as a sound source.

Results of a 20 year Erysipelas vaccination program in a dolphin population

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Erysipelas is found worldwide in different species. Most of the knowledge about erysipelas in dolphins has been extrapolated from studies with swine. The infection in dolphins happens mainly through ingestion of contaminated fish. Two major forms of the disease can be found in dolphins: an acute septicaemic form, with hyperacute death without previous or very little symptoms other than a very high WBC count and a subacute form, with very typical rhomboid lesions on the skin. If identified on time, which is seldom the case for the acute situation, the disease can be controlled by antibiotics and general support. The other protection mean is immunisation through vaccination. In the past, in America, South Africa and Australia, with the use of attenuated live or inactivated dead vaccines, people have experienced reversion or anaphylactic (allergic) shock, followed by the death of the animal very shortly after the immunisation, which had prompted the cessation of vaccination in many facilities. Nowadays animals are vaccinated, when vaccinated, with a swine dead vaccine. The present study concentrates on the immunisation of a dolphin population – at different ages, with different backgrounds and with different schedules – with two swine vaccines, the European “Eurovac Ery®” vaccine, used until May 2010 and then the American “Er Bac® Plus” vaccine and its immunological profile results over a 20 year time span. The results suggest that animals born in the wild seem to have enough with a vaccination every two years (possibly because of their exposure in the wild to subclinical pathological infection). Young animals born in captivity seem to need a bi-yearly vaccination (their reaction to the vaccine is short lived, maybe due to the overprotection in a controlled environment). In older animals born in captivity, a yearly vaccination seems appropriate. The cut-off, for captive born animals between bi-yearly and yearly vaccination, where possibly the humoral immunity or other factors come into account, still has to be better defined. No case of erysipelas infection was observed in this population during the vaccination period.

Veterinary management of two bottlenose dolphin primiparous pregnancies and birth with the same prediction dates

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In September 2012, Zoomarine Rome experienced two bottlenose dolphin (*Tursiops truncatus*) births for the first time. In preparation for the births the Zoomarine Portugal veterinary and trainer protocol was adapted and implemented. The protocols included 24 hour observations a month prior to birth and one month postpartum, regular ultrasounds and blood sampling of the pregnant female and a monthly check-up of the calf's at 30 day intervals. The design and construction of a hydraulic medical platform was fundamental but by no means uneventful. The two primiparous females both 10 years of age gave birth within the prediction dates 11 days apart with two very different outcomes. The first calf presented with a cephalic position at birth and has developed well without medical intervention apart from regular weight control and blood and faecal sampling. The second calf had an uneventful birth but died suddenly 9 days later with acute respiratory distress that did not respond to emergency medical treatment. With a general overview we propose to share the general problems overcome and lessons learned with the two births.

Hand-rearing orphaned harbour seal pups (*Phoca vitulina vitulina*) with a fish-based formula

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Wild harbour seals (*Phoca vitulina vitulina*) give birth in May, June and July along the coast of The Netherlands. Human disturbances and/or severe weather conditions are often the cause of the separation of the mother and pup pair in this geographical location. Orphaned pups are vulnerable as they are not able to fend by themselves, becoming dehydrated and emaciated until eventual death. The Seal Rehabilitation and Research Centre (SRRC), in Pieterburen, has rehabilitated more than 2000 orphaned pups since 1971, 496 of them with the umbilical cord still attached. The SRRC has had great success on the rehabilitation of these newborn stranded animals. Staff has been following a hand-rearing feeding protocol of a simple fish-based formula – consisting of herring, oral rehydration salts and a high calorie supplement paste – which is more economical than milk replacers and premature weaning on day 13-15 after arrival. This protocol has shown good results in both growing (average 105 g/day until weaning and 294 g/day until release) and survival rate (84%). Thus, our results suggest that the methods used by the SRRC are more successful and cost effective than those used in other rehabilitation centres or zoological parks.

Dolphin neonate behaviour and management: a review

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Dolphin neonate mortality has long been an important subject in the management of dolphin reproduction under human care. In the year 2012, a round table discussion about "Dolphin Neonatology" was held by the author at the EAAM Symposium in Madrid, Spain. Several participants asked for the behavioral indicators used to evaluate dolphin neonate health, especially those which could indicate the necessity of veterinary intervention. Contrary to former believe, dolphin calves in our experience show several such indicators, including, among others, breathing frequency, swimming patterns, lactation patterns and visible body symptoms. In this talk, we present the protocols used currently to evaluate neonate behaviour, which have been elaborated over almost 20 years. Furthermore, we present our management protocols for mothers and their neonates, as well as some of our conclusion on the origin of dolphin neonatal mortality.

It is not easy to foresee everything when your target is to see again

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When he arrives at Nausicaa in 1998, Algon is a bad tempered California sea lion that has a tendency to bite. Through training, particularly medical training, he becomes progressively less aggressive towards his trainers.

In 2002, the first symptoms of a chronic superficial keratitis appear, requiring daily administration of ophthalmic drops, with as first objective to limit the progression of the disease. With time a diagnosis of pannus (or chronic keratitis of immunologic origin) is established, some that different from what is now frequently called otariid keratopathy because of its immunity relation. Some years later, Algon develops a cataract that strongly reduces his vision and leads the trainers to modify their training technique: the visual cues gradually become vocal cues and Algon accustoms himself progressively to this new life, becoming more and more confident with his trainers.

In November 2011, the 10th Marine Mammal Medical Workshop, devoted this time to ophthalmology, is organized at NAUSICAA. Hands-on ophthalmologic sessions with the sea lions take place during the workshop and it is foreseen to operate Algon from his cataract as a surgery demonstration. In spite of a good training level and a long-standing desensitization to the squeeze cage and maybe due to a certain anxiety and precipitation from the team to act, because of the presence of so many people for the workshop and the need to succeed, we experienced that nothing is ever taken for granted. During the anesthesia's induction Algon shows his strong character and bites the bars of the squeeze cage resulting in an unexpected complete open fracture of the upper maxilla. The demonstration of ophthalmological surgery transforms itself in an orthopedic surgery demonstration in which his jawbone is fixed and only cyclosporine implants are placed under his conjunctiva.

In the following months, Algon's recovery is monitored on a daily basis, while being desensitized to new behaviours that would limit risks at the time of his new anesthesia.

In June 2012, Algon is eventually operated of his cataract and the wires in his maxilla are removed. But once the surgery completed, a heavy post-surgical follow-up begins for the trainers.

This paper presents the events that allowed Algon, after 10 years, to recover good eyesight, his change of environmental assessment post surgically, the behaviours that have been put in place, the relation between trainers and Algon and the relation between veterinarians and trainers.

Behavioral disorder in a California Sea Lion (*Zalophus californianus*)

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Since April 2012 the male California Sea Lion "Scott" (born in Zoo Nuremberg in July 2009) has been observed nibbling his fore-flippers frequently – there were no signs of a dermatological problem, thus his behaviour was considered abnormal. During 6 weeks "Scott's" behaviour was observed and analyzed, focusing on the following aspects: frequency, occurrence, location dependence and finally triggering factors of this behaviour.

First results showed that the fore-flipper nibbling behaviour appeared mainly during training and in cases of anticipation. "Scott's" translocation to a new exhibit in Zoo Nuremberg revealed an improvement, in fact during the first weeks he didn't show the fore-flipper nibbling behaviour.

Nevertheless when barn training was started in September 2012 he showed this behaviour again. A modification in the training schedule led to a significant decrease of this behavioral disorder. Saliva samples have been collected to measure cortisol levels.

Sea lions (*Zalophus californianus*) understand human gestures as communicative and referential cues

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The authors studied the spontaneous responsiveness of human-socialized sea lions (*Zalophus californianus*) to novel human communicative gestures in three different object-choice tasks based on directional cues. In Study 1, three of the four tested subjects were able to generalize their responses from the first trials and apply them to distorted variations of basic pointing gestures (i.e., gaze only, cross-body pointing, elbow pointing and foot pointing). Study 2 showed that the subjects could follow the pointing gestures geometrically, in order to select the correct target between two on the same side of the informant. The subjects were also able in Study 3 to follow pointing gestures to targets hidden behind barriers, despite the presence of visible items. These results show that sea lions can follow precise linear vectors along different pointing body parts to identify targets, even in complex or ambiguous situations. We argue that they understand the communicative and referential nature of these cues. However, the exact nature of this understanding remains in discussion. We suggest that trained marine mammals develop routine obedience, similar to dogs, to human gestural commands, reinforced by food rewards and social praise. This process may enhance their ability to pay close attention to human gestures and understand them as communicative and referential cues.

Visual laterality in dolphins: importance of the familiarity of stimuli

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Many studies of cerebral asymmetries in different species lead, on the one hand, to a better understanding of the functions of each cerebral hemisphere and, on the other hand, to develop an evolutionary history of hemispheric laterality. In this context dolphins are particularly interesting because of their original evolutionary path, i.e. return to aquatic life after a terrestrial phase.

Very few studies have analyzed the environmental factors that could influence dolphin's visual laterality.

We investigated visual laterality expressed spontaneously at the water surface by a group of five common bottlenose dolphins (*Tursiops truncatus*) in response to various stimuli classified as very familiar objects, familiar objects and unfamiliar objects.

At the group level, dolphins used their left eye to observe very familiar objects and their right eye to observe unfamiliar objects. However, eyes are used indifferently to observe familiar objects with intermediate valence.

Our results suggest different visual cerebral processes based either on the global shape of well-known objects or on local details of unknown objects. Our experimental results pointed out some cognitive capacities of dolphins which might be crucial for their wild life given their fission-fusion social system and migratory behaviour.

MONDAY, 18TH MARCH 2013

INVITED SPEAKER

Ethics and the science of animal welfare

Colin Allen

Indiana University-Bloomington, College of Arts and Sciences, USA

Is “animal welfare” a term of science or of philosophy? Ethicists and legislators increasingly turn to science to provide guidance about the impacts of human treatment on the cognitive and emotional states of other animals – states that are presumed to be morally significant for animal welfare. I describe an argument structure which frames debates about appropriate human treatment of animals. There is an apparent gap in this framework between the states and capacities of animals that are part of the scientific consensus and the states and capacities that ethicists and concerned citizens take to be relevant to the moral issues. I will discuss some approaches to diminishing the gap, but argue that they do not immediately satisfy those who seek a firm scientific basis for claims about the morally significant questions. I will propose that the proper response to the situation is to continue basic research within an ambitious project of creating a phylogenetically-organized database of scientific methods, measures and results.

WELFARE SESSION

CHAIR > Élio Vicente

VETERINARY SESSION

CHAIR > Daniel Garcia-Parraga

“If only I could breathe water”: Bioethical challenges for a Veterinarian of aquatic animals

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The perception of animal welfare within our society has begun to increase proactively in the last decade. At present time, the attention paid to bioethical issues emerging from human-animal relationship and animal management focuses particularly on Veterinarians, who have the key role to identify and implement the criteria related to animal welfare. Considering all the aspects of this very important and delicate issue, we can certainly claim that this category of professional workers has a deep knowledge and cultural understanding of the issues related to health and husbandry procedures but, very often, the perception of all the other aspects involved needs a strict cooperation with other professionals. This concept applies to all Veterinarians, including those who work with aquatic animals.

Veterinarians are involved in operations that proceed from the animal choice and acquisition and quarantine to direct handling, reproduction, diagnostic, therapy and... up to the “final end” of the animal life. All these procedures represent the key steps of the daily animal management of an aquarium or zoo and each one of these includes different ethical aspects related not only with animal welfare, but also environmental sustainability and social impact. The “future Veterinarians” should therefore increase and improve the know-how of all these aspects, in order to prepare the new generations to these far-reaching perspectives of animal care.

Habitat complexity for marine mammals housed under human care

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Marine mammals have been housed under human care for over a 100 years. Management has changed, with great advances in veterinarian care, water management, nutrition and training methods. Habitats of marine mammals have also changed, for some species more than others, but overall not dramatically in complexity. The complexity of marine mammal habitats is a lot less complex compared with other species housed in modern zoological facilities. Modern zoos aim to reconstruct natural looking habitats, not only pleasing to the visitor's eye but also to satisfy and fulfill the need for species specific affordances and opportunities. For marine mammals environmental enrichment activities have been developed, with the in-water activities most taken place at the surface, such as floating objects and training sessions with trainers. Most marine mammal habitats do not have many choices with regards to substrates, different temperatures i.e. on land and or water, currents, waves, visibility, plant life, feeding opportunities, hiding places and other, due to the need for visitor visibility. An increase of complexity with regards to cognitive, behavioral and physiological opportunities can reap short – and long term welfare benefits. This presentation will discuss opportunities and the need to enhance the complexity of marine mammal habitats.

Measuring and interpreting salivary cortisol levels in bottlenose dolphins during disturbances produced by construction work

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After many years of planning in 2008 Zoo Nuremberg started the construction of a new exhibit for dolphins, sea lions and manatees. In order to evaluate the effect of the disturbances produced by the construction site, behaviour and cortisol levels of the dolphins were recorded and analysed. Parallel to the behavioural and hormonal data, noise level of the different disturbances was also recorded.

Cortisol levels were measured using saliva obtained via a non-invasive method. All the animals were trained to open their mouth and the saliva was collected using a swab. Afterwards the samples were centrifuged and analysed by immunoassay with chemoluminescence detection. Data were collected during the construction phase and during the first months after the animals were moved to the new exhibit. During this presentation a first evaluation of the effect of construction noise on the behaviour of the animals will be presented.

First results can be summarized as follows: strong correlation between blood and saliva cortisol levels, dominant animals show on average higher cortisol levels compared to others, different noise sources seems to elicit dissimilar reactions and cortisol levels.

Vitamin status of bottlenose dolphins (*Tursiops truncatus*) in European facilities

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The objective of this study was to provide vitamin blood levels of bottlenose dolphins (*Tursiops truncatus*) in European facilities and insight into effective vitamin supplementation.

Fish-handling techniques and vitamin supplementation were evaluated via questionnaire sent to 25 European facilities. Blood samples from 57 dolphins out of 10 facilities were analysed. Blood was collected and shipped immediately to the same laboratory. Retinol, Thiaminepyrophosphat, Cobalamin, Calcifediol and Tocopherol were analysed and compared to vitamin supplementation and other factors.

Aquavits® and Seatabs® were the main supplements used in European facilities. The fish was mainly thawed in a refrigerator, followed by thawing at room temperature. The 95% confidence interval of blood levels for Retinol and Tocopherol were higher and for Calcifediol significantly lower than the interval measured in free ranging animals. Additionally Thiamine blood levels increased significantly when fish was thawed in a refrigerator.

Different Thiamine levels indicated that water soluble vitamins get lost depending on thawing technique. High serum Retinol and Tocopherol confidence intervals suggested that supplementation is generally too high. Excess Retinol and Tocopherol are stored in large quantities in liver and blubber and blood levels only start to increase when the stores are filled.

Two cases of gastric impaction in *Stenella coeruleoalba*

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In the Northern and Central Adriatic Sea striped dolphins (*Stenella coeruleoalba*) are considered occasionally present in this basin (9.8% of strandings). In the first 3 months of 2012, the striped dolphin strandings' trend abruptly increased to 60%: two animals were found still alive and hematobiochemical exams and ultrasound examinations were attempted. Despite rehabilitation efforts they died and a complete necropsy was carried out, collecting samples for histopathology, virology, microbiology, parasitology and serology.

A massive ulcerative gastritis associated with *Anisakis* spp. attached to the gastric wall, sometimes obstructing the passages between gastric concamerations, was the most relevant finding. This resulted in severe gastric impaction diagnosed with ultrasonography at the moment of the strandings. Stomachs from the other animals were completely empty. Microscopic examination revealed abundant cytoplasmic pigments in pulmonary, splenic and lymphnodal macrophages, along with a severe lymphoid depletion. Pigments were positive to Danscher's staining and ESEM x-ray microanalysis confirmed the presence of inorganic mercury granules (HgSe). Postmortem analyses did not reveal any of the most relevant cetacean's pathogens.

A significant decrease in fisheries' captures and the presence of seismic surveys running in the area should be considered as important factors plausibly linked to the northward migration of striped dolphins.

Micronuclei as possible indicators of toxicological damage in cetaceans

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In cetacean medicine, Howell-Jolly-bodies are usually considered a normal finding, being part of the continuous normal blood regeneration process. In toxicological research, the same nuclei remains in circulating erythrocytes are called micronuclei and are used as an indicator of toxicological damage. In the year 2005, a first publication suggested that micronuclei may possibly serve to detect toxicological events in cetaceans as well.

We have chosen two individuals of the same species and the same environment, *Orcinus orca*, with very different toxicological profiles to test the hypothesis whether micronuclei in this species may be used as toxicological indicators.

The toxic elements we studied included As, Cd, Hg, Pb and POPs in serial blood takes over time. In serial blood smears of both animals, a total of >80.000 erythrocytes were counted manually and evaluated for the presence of micronuclei.

Significant correlations were found between an increase of micronuclei and Cd, As and to a lesser extend, Pb. A negative correlation was found between micronuclei numbers and POPs.

Our results suggest that only some toxic elements are possible candidates for increasing micronuclei in killer whales. Further studies with more individuals of the same species and also with bottlenose dolphins (*Tursiops truncatus*), are under way.



POSTER SESSION

POSTER SESSION

Preliminary description of histological variations in normal skin from different anatomical regions in the Mediterranean striped dolphin (*Stenella coeruleoalba*)

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The present study describes the normal skin histology of the striped dolphin (*Stenella coeruleoalba*) along different body regions. The aim of this work is to determine the diverse histological features of the normal skin in order to obtain baseline information to compare with the histology of certain skin lesions. For this purpose, twenty skin biopsies from different dorsal and ventral areas of the whole body of a fresh stranded striped dolphin as well as from genital slit, eyelids, blowhole, flippers, dorsal fin and flukes have been studied. The skin consists of epidermis (stratified squamous epithelium), dermis (dense irregular connective tissue) and hypodermis or blubber (loose connective tissue composed of fat cells interlayered with bundles of collagen). The epidermis is very thick compare to other mammals and slight variations are observed between body regions. Pigmentation is very variable, ranging from complete absence to the presence of numerous melanin granules in all the epidermal layers. The epidermis-dermis junction presents numerous finger-like projections of epidermis (rete ridges) extending into a highly vascularized superficial dermis (dermal papillae), which range in shape and length. The amount of collagen bundles in the blubber was also very variable. This communication shows a preliminary study based in the samples obtained from a striped dolphin. More animals, including other species of dolphins, are going to be examined in order to better characterize the histologic features of the dolphin skin.

Choice and control in marine mammal care

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We make many decisions on behalf of marine mammals housed under human care. Some because we know what the animals prefer but many other decisions are taken because of our working hours, health and safety protocols, stagnant husbandry programs, or because of personal preferences. Choice and control are hot topics in animal welfare studies; how much control, how many choices, how do choices and control affect welfare? And how do we hand more of this control over to the animal, how do we gain insight in what they want and need? There are still many unanswered questions but scientific evidence shows that predictability with a certain degree of unpredictability maintains curiosity and the seeking system while decreasing unwanted behaviours like stereotypic behaviours, lethargy and or extreme vigilance. Choice of bedding materials can positively affect sleep and rest and predictability in feeding times can reduce anxiety. In animal training and enrichment one can also apply the choice and control paradigm, to be able to choose when or where, or what activities one can engage in. Animals could choose their trainers, object, social companions or type of reinforcement. This presentation will look at the effect of choices and control on animal welfare.

It takes two: The replication of a social interaction to quantify variations in acoustic cues with animal position and head morphology

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Strong evidence indicates that odontocetes use acoustic cues in order to discriminate conspecifics' location and direction of movement. Such abilities are achieved by acute directional hearing and head morphology is hypothesized to shape the received signal. Currently there is limited information describing the characteristics and changes of a bioacoustic signal at the receiver. Our research examines (1) how an odontocete's outgoing signals (echolocation clicks and whistles) changes dependent on a receiver's location and (2) how the receiver's head shapes that signal. A bottlenose dolphin (*Tursiops truncatus*), the signaller and a false killer whale (*Pseudorca crassidens*), the receiver, both stationed underwater in a hoop 2-6m away from each other for an echolocation and whistle task. In both paradigms the receiver was positioned at various angles from 0°-180° from the signaller, while wearing a digital acoustic recording tag (Dtag). The Dtag was placed on 3 different locations on the lower jaw believed to be involved in sound reception in odontocetes. The characteristics of the signals recorded by the Dtag will be compared across receiver and Dtag positions. We expect characteristics of recorded signals to differ in received sound pressure level, frequency content and time of arrival.

First record of anomalously white pigmentation in a striped dolphin (*Stenella coeruleoalba*) in the strait of Gibraltar

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Anomalously white pigmentation is unusual in cetaceans and it has not been reported in striped dolphins (*Stenella coeruleoalba*). This uncommon coloration pattern has been identified as leucism or albinism, also vitiligo has not been described previously in this species. We report the first case of anomalously white pigmentation in striped dolphin and we summarize all white anomalously records in cetaceans available in the scientific literature and new recent unpublished cases. The animal was observed using opportunistic platforms during the whale watching cruises in summer 2012 in the strait of Gibraltar. The hypopigmented dolphin was observed twice in the center of the area and it was observed feeding and travelling towards the Atlantic Ocean; the dolphin did not present any reaction to the boat and maintain its behaviour during the sighting. This unusual pigmentation combined with dark spots in the body suggested that the animal could be suffer a leucistic condition, possibly due of a pathologic condition of a genetic origin as described in other cetacean species. However, we should not rule out other possibilities like vitiligo (disease which causes depigmentation and irregular light pattern through the body). Further studies should be conducted to confirm the origin of this unusual pigmentation.

Behavior of Manatees: exploring a new habitat in Zoo Nuremberg

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The relocation of three Antillean-manatees of Zoo Nuremberg into their new home, the so-called "Manati-Haus" made it possible to start a detailed behavioral observation of those manatees. During 8 weeks of daily observations a detailed ethogram comprising 33 behavioral patterns was established. These patterns were assigned to functional categories

such as: active, passive, feeding and social behavior. A quantitative analysis of the results showed individual differences regarding general activity and breathing frequency. Thus the breathing frequency seems to depend on the size and activity of the animal. Also the distribution of single behavioral patterns differs in regard to the individuals. In this context it was seen that some behavioral patterns have been recorded only in some animals and not in the other ones. Some patterns seem to be sex dependent.

Furthermore it was possible to perform a comprehensive analysis of the social structure and to draw a sociogram. Most of the observed social contacts were originated from a male towards a female individual. To summarize: the behavioural categories observed in this study are comparable to the recorded behaviour of manatees in other locations.

Following the South American river dolphin (*Inia geoffrensis*) in Venezuela

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On March 16th 1975 Dr. Wolfgang Gewalt, the former zoo director of Zoo Duisburg in Germany arrived with 3.2 South American river dolphins (*Inia geoffrensis*) at Duesseldorf airport. Animal keeper Peter Schulz who participated in their capture was privileged to work with two of these animals for more than 30 years. In 2007 and 2009 Peter Schulz wanted to go back to the roots and visit Venezuela again, 32 years after his initial adventure. He and his colleague Roland Edler, under the guidance of the local veterinarian Dr. Ernesto Boede, explored various rivers of Venezuela (Cojedes, Portuguesa, Apure, Arauca, Orinoko, Samanapo, Capanaparo and Cinaruco) and were able to take amazing pictures of wild river dolphins and even record their communication sounds with the help of a hydrophone. In addition, they were able to learn more about the local current threats that are constantly reducing the number of river dolphins each year. This multimedia poster will take you onto a journey to Venezuela.

Meeting Dolphins and Sea Lions at Tiergarten Nürnberg

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Tiergarten Nürnberg offers a variety of visitors` programs behind the scenes. Our goal is to educate and bring awareness about the animals to individuals and groups. Animal interaction programs provide guests with a very special and emotional experience.

Our dolphin and sea lion encounters are very popular, with the dolphins attracting visitors from all over Germany and recently even from neighbouring countries.

The sea lion encounter in the lagoon is a personalized program dedicated to an interaction with one of our female California Sea lions. All interaction is guided by a trainer – containing activities on land and in water.

A dolphin encounter is limited to a group of up to 6 people. During 2,5 hours near and at the dolphin tank, guests can learn a lot about dolphin biology and the keeping of dolphins. They join a training session and maybe do a few behaviours with the dolphins. Visitors also spend time with the dolphins in free contact, playing with them, observing them, maybe taking an active role in providing environmental enrichment. Getting up close with the dolphins is up to the dolphins. We are very dedicated to making the visit positive for the animals. Therefore the program varies – depending on animals and guests.

People with special needs are also invited to enjoy our dolphins during an individual program. Our dolphins often make it a once in a lifetime experience for the guest.

We are convinced that our programs are an enriching experience for both people and animals.

Directional hearing of a bottlenose dolphin, measured using auditory evoked potentials

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Various studies have explored the exceptional hearing capabilities of odontocete cetaceans but there are still many unanswered questions about the anatomy and physiology behind sound reception in these animals. In particular, the sound pathways and three-dimensional hearing capabilities of odontocetes are not well known. Our study uses auditory evoked potential (AEP) techniques to investigate the directional hearing of a young bottlenose dolphin (*Tursiops truncatus*). Hearing thresholds of the dolphin will be measured at three frequencies, at various angles and depths. An audiogram using AEP techniques is being obtained to determine the low, mid and high frequency of the animal's hearing and these are the three frequencies that will be used for the study. Hearing thresholds will be measured at 13 different angles (0°, ±15°, ±30°, ±45°, ±60°, ±75° and ±90°) and three different depths (0.5m, 1m and 1.5m) around the animal's head. We expect to find hearing sensitivity to be non-symmetrical around the animal's head. This study will allow us to gain a better understanding of the unknowns of the directional hearing capabilities of an odontocete species.

Malignant T-cell lymphoma in a Humboldt Penguin (*Spheniscus humboldti*)

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In birds, lymphomas can be spontaneous or virus induced. In this case, a 27-years old female Humboldt Penguin (*Spheniscus humboldti*) presented with dysphagea. The endoscopy showed fish particles, stones and straw in the esophagus which were removed. Due to an erosive esophagitis, the penguin was treated with antibiotics and analgetics for a total of seven days. The penguin recovered well with normal feeding. Three weeks later, the penguin presented again with dysphagea. A solid mass (6x3x1cm) was palpable in the cranial part of the esophagus. Endoscopy revealed erosive esophagitis and gray-white masses in the esophagus with subtotal obstruction of the lumen. The status of the penguin deteriorated and the animal died several days later due to dehydration and hypoglycemia. Necropsy and histopathology identified an esophageal lymphoma with neoplastic lymphoid cells in the adrenal glands, liver, kidneys, lungs, proventriculus and gizzard. The neoplastic cells were immunoreactive to CD3 antigen, verifying a T-cell lymphoma. In this penguin, the test results were negative for Marek's disease virus, avian leukosis virus and reticuloendotheliosis virus. Thus, a non-viral cause of the lymphoma is most likely. This is the first report of disseminated T-cell lymphoma in a Humboldt Penguin.

Comparison between plasmatic and faecal hormones levels in different captive species: bottlenose dolphins (*Tursiops truncatus*) and killer whales (*Orcinus orca*)

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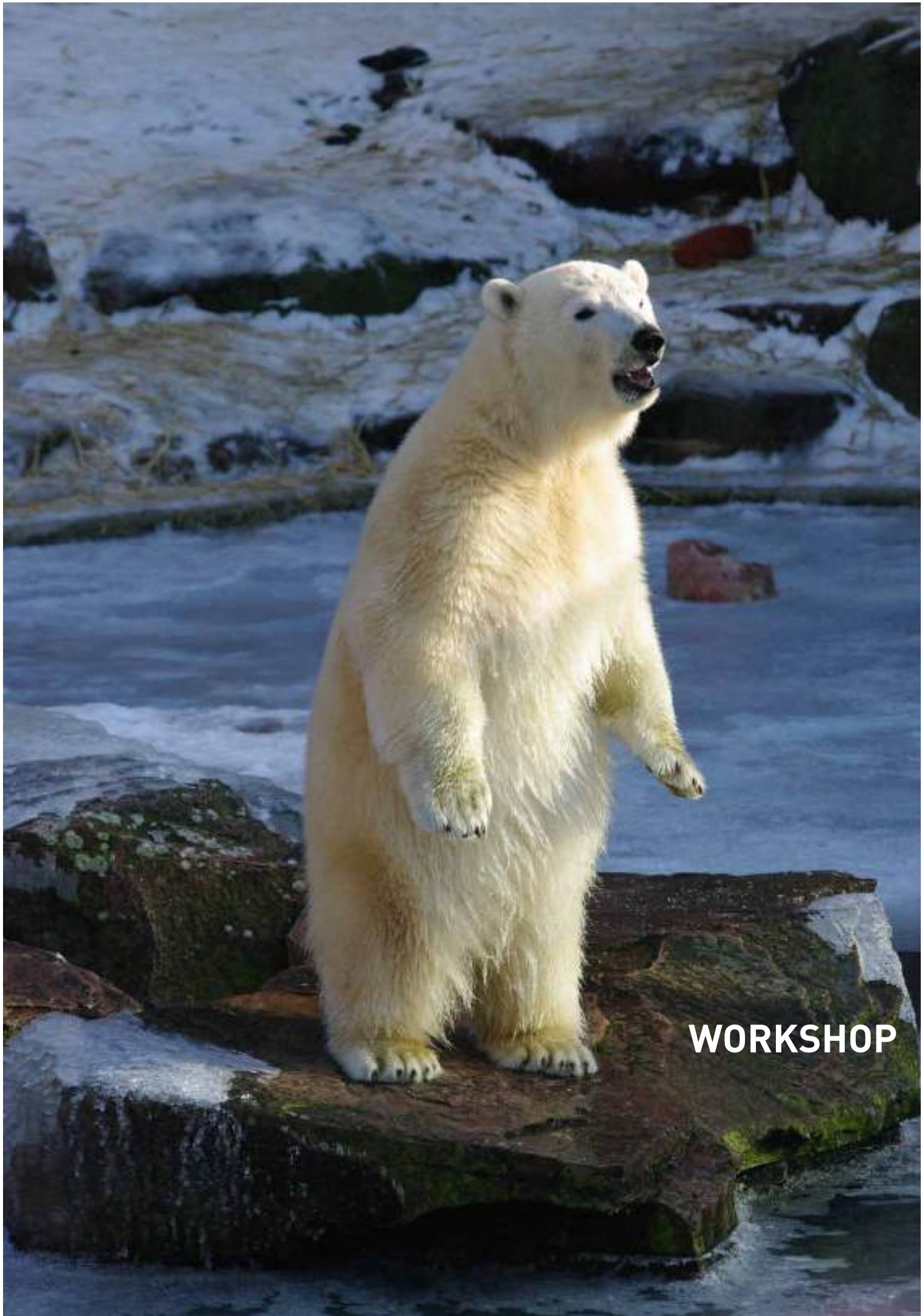
² Marineland Antibes Conservation Research Center, 306 Avenue Mozart, 06600 Antibes, France, crc@marineland.fr

Due to the increasing interest in cetaceans, research is attempting to enlarge the knowledge on these species to guarantee a better conservation and management.

In this study hormonal profiles of captive bottlenose dolphins (*T. truncatus*) and killer whales (*O. orca*) were monitored using plasma and faeces samples.

Samples were collected from trained animals (4 killer whales and 12 bottlenose dolphins) for 4 months (March-July 2011). While plasma samples were used as such, hormone extraction was performed on dried faeces with a double ethanol extraction. All samples were then analyzed with commercial enzyme-linked immunoassay (ELISA) kits for thyroxine (T4) and triiodothyronine (T3) and with commercial chemiluminescent immunoassay (CLIA) kits for progesterone (P4).

Obtained data showed different profiles, with dolphins having higher levels of all hormones in plasma (T3: $1,28 \pm 0,39$ ng/g vs $1,53 \pm 0,64$ ng/g; T4: $8,18 \pm 1,47$ ng/g vs $17,56 \pm 5,64$ ng/g; P4: $1,16 \pm 2,68$ ng/g vs $8,95 \pm 8,81$ ng/g in killer whales and dolphins respectively) and killer whales having higher excretion of T4 and P4 compared to dolphins (T4: $2692,45 \pm 4009,28$ ng/g vs $613,76 \pm 743,18$ ng/g; P4: $2688,27 \pm 5319,53$ ng/g vs $427,06 \pm 437,38$ ng/g). This higher secretive capacity can be considered a partial explanation for lower plasmatic levels observed in killer whales with respect to dolphins, even though the deep meaning of this finding is under investigation. These preliminary results underlined physiological differences that have a keyrole and effect in the management of these two species of interest.



WORKSHOP

Workshop

LIFE SUPPORT SYSTEMS

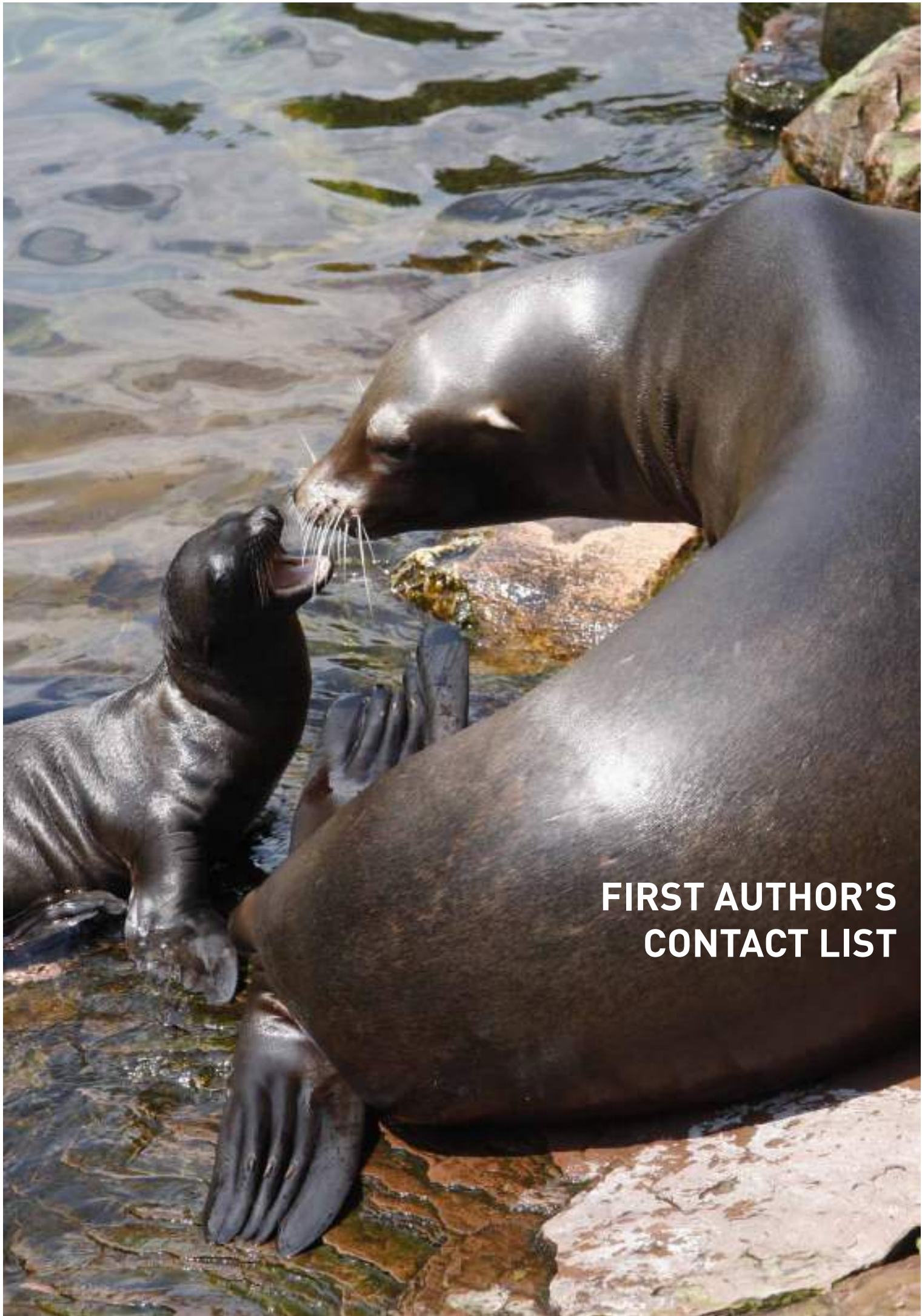
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ANIMAL WELFARE

CHAIR › Sabrina Brando, Animal Concepts

ANIMAL PRESENTATION IN THE COURSE OF TIME

CHAIR › Christiane Thiere, Nuremberg Zoo



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