Correspondence :
iceekyoto2019@iceekyoto.org

# Programs

Theme of the conference :

**Learning from the Wild:**
**Animal Welfare,**
**Conservation and Education**
**in Harmony**

Japanese macaque / Photo by Aru Toyoda

# The 14th International Conference on Environmental Enrichment

22-26 June, 2019 KYOTO JAPAN

# Welcome Messages

**Historic Kyoto Prompts both Reflections and Advancements in Animal Welfare**

Tetsuro Matsuzawa
President, ICEE2019 Kyoto and Distinguished Professor of Kyoto University

Welcome to Kyoto and the 14th International Conference on Environmental Enrichment (ICEE2019). The conference will be held from June 22nd to 26th in the Clock Tower Centennial Hall of Kyoto University. I would like to take this opportunity for us to reflect upon the history of ICEE. It was established by Drs. Jill Mellen and David Shepherdson, with the first conference held in 1993 at the Oregon Zoo in Portland, Oregon. To date, the biannual conferences have also been held in Copenhagen, Orlando, Edinburgh, Sydney, Johannesburg, New York, Vienna, Torquay, Portland, Pretoria, Beijing, and Bogota.

ICEE2019 Kyoto is co-hosted by The Leading Graduate Program in Primatology and Wildlife Science, Kyoto University (PWS), Kyoto City Zoo, Japan Monkey Centre, SHAPE-Japan, and the International Core of Excellence for Tropical Biodiversity Conservation focusing on Large Animal Studies. Japan is home to an indigenous monkey species called the "Japanese Macaque" or "Snow Monkey". Thanks to the unique natural environment and local abundance of these primates, Japanese primatologists began fieldwork studying wild monkeys on Koshima Island on December 3, 1948.

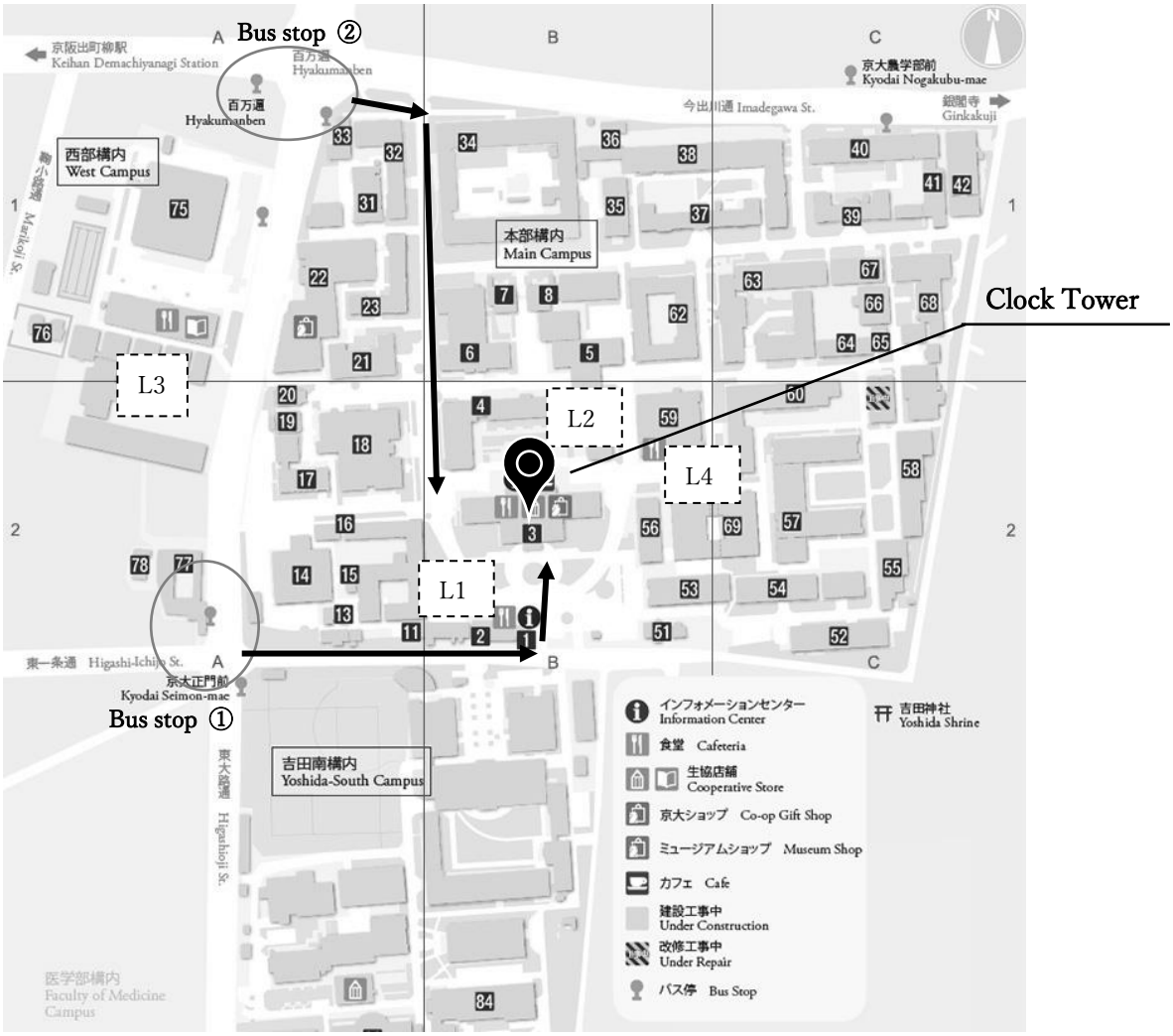
Based on these initial efforts, the Japan Monkey Centre was established in 1956 as both a museum and zoo of nonhuman primates. In 1957, it launched "*PRIMATES*" as the first international journal of primatology published in English. In my personal reflection, I began research with chimpanzee Ai at the Primate Research Institute of Kyoto University in 1977. In a parallel effort, I have also been studying wild chimpanzees at Bossou-Nimba in Guinea, West Africa since 1986. Based on the synthesis of this research across contexts, I believe there is much to learn from field studies conducted in natural habitats to promote environmental enrichment in terms of animal welfare.

As a unique contribution from Japan, the organizing committee of ICEE2019 adopted "Learning from the Wild: Animal Welfare, Conservation and Education in Harmony" as the conference theme. On behalf of the ICEE2019 organizing committee, I greatly appreciate your participation in this forum and hope that you enjoy the opportunity to interact with people who share similar concerns about environmental enrichment and animal welfare. We also encourage you to take time to enjoy the beautiful city of Kyoto which has both historic and modern treasures on every street corner. Kyoto was the capital of Japan for almost 1100 years, from 794 to 1868. As such, it provides an ideal setting for us to challenge ourselves to consider the important issues at-hand from a historical perspective while also looking toward the future.

# Conference Venue and Transportation

### 1. Kyoto University Clock Tower Centennial Hall (京都大学 百周年時計台記念館)

Address: Yoshida-Honmachi, Sakyo-ku, Kyoto, 606-8501 (〒606-8501 京都市左京区吉田本町)




**本部構内 Main Campus**

1 正門 / インフォメーションセンター
Main Gate/Information Center
2 カフェレストラン「カンフォーラ」
Café-Restaurant "Camphora"
3 百周年時計台記念館
Clock Tower Centennial Hall
歴史展示室
Historical Exhibition Room
レストラン「ラ・トゥール」
Restaurant "La Tour"
カフェ「タリーズコーヒー」
Tully's Coffe(Café)

Lunch spots inside of the main campus

（L1）Café Restaurant Camphora
Weekdays 11：00 - 21：30, Saturday 11：00 - 15：00, Sunday 11：00 - 15：00

（L2）Clock Tower CO-OP Shop
Weekdays 10：00 - 20：00, Saturday 11：00 - 15：00, Sunday closed
※You can only buy food to go. (This is not restaurant)

（L3）Cafeteria Renais
Weekdays 11：00 - 22：00, Saturday 11：00 - 19：30, Sunday 11：00 - 14：00

（L4）Central Canteen
Weekdays 8:00 – 21:00, Closed on Saturdays and Sundays

**1-1. Access to Kyoto University from Kyoto Station**

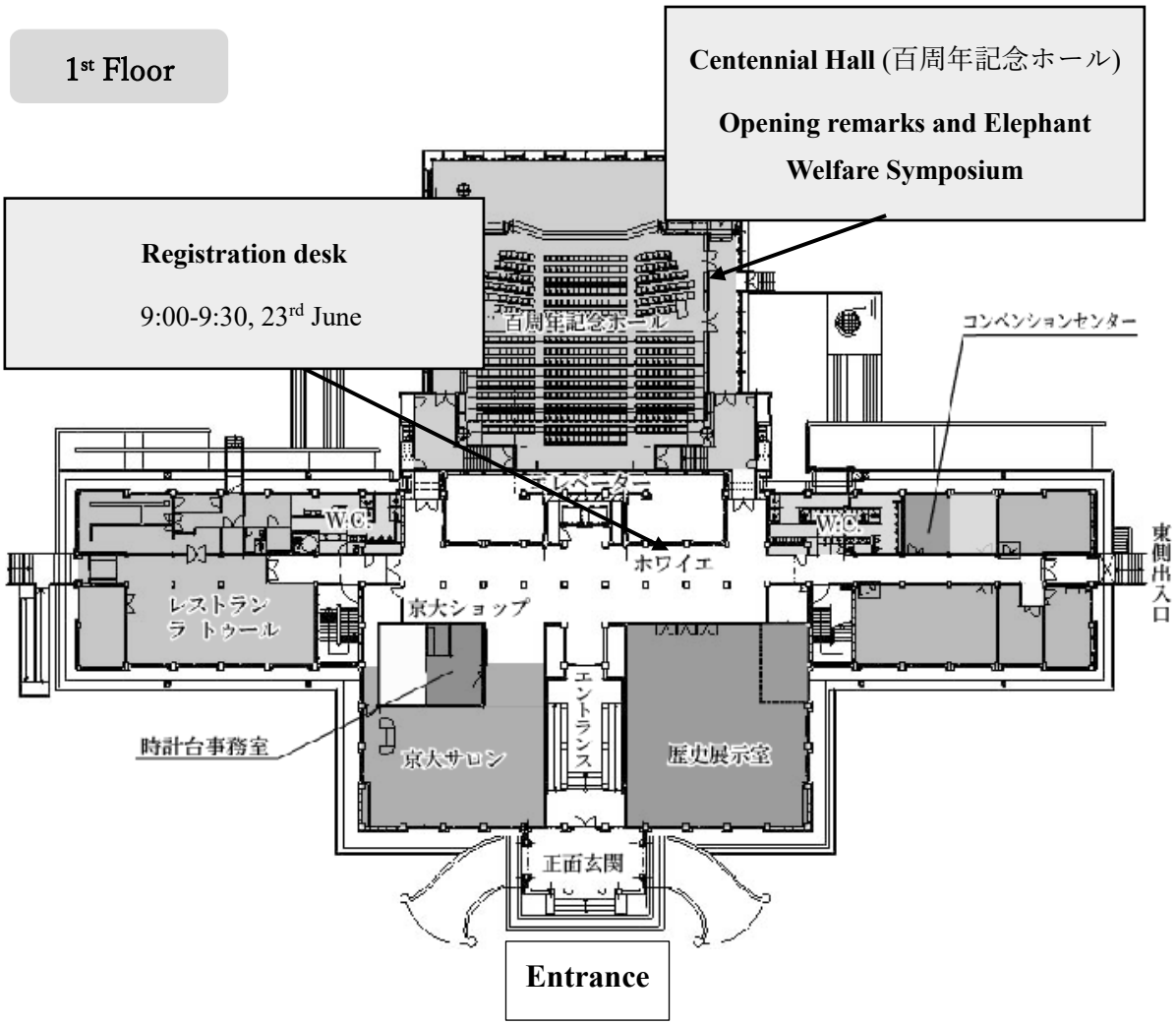
From JR Kyoto Station, take Kyoto City Bus **#206** or **#17**. Please get off at either ①"Kyodai Seimon-mae（京大正門前）" or ②"Hyakumanben（百万遍）" stops. It takes about 40 mins to the conference venue, depending on traffic.

詳細は以下の URL をご参照ください。Visit the link below for further details.

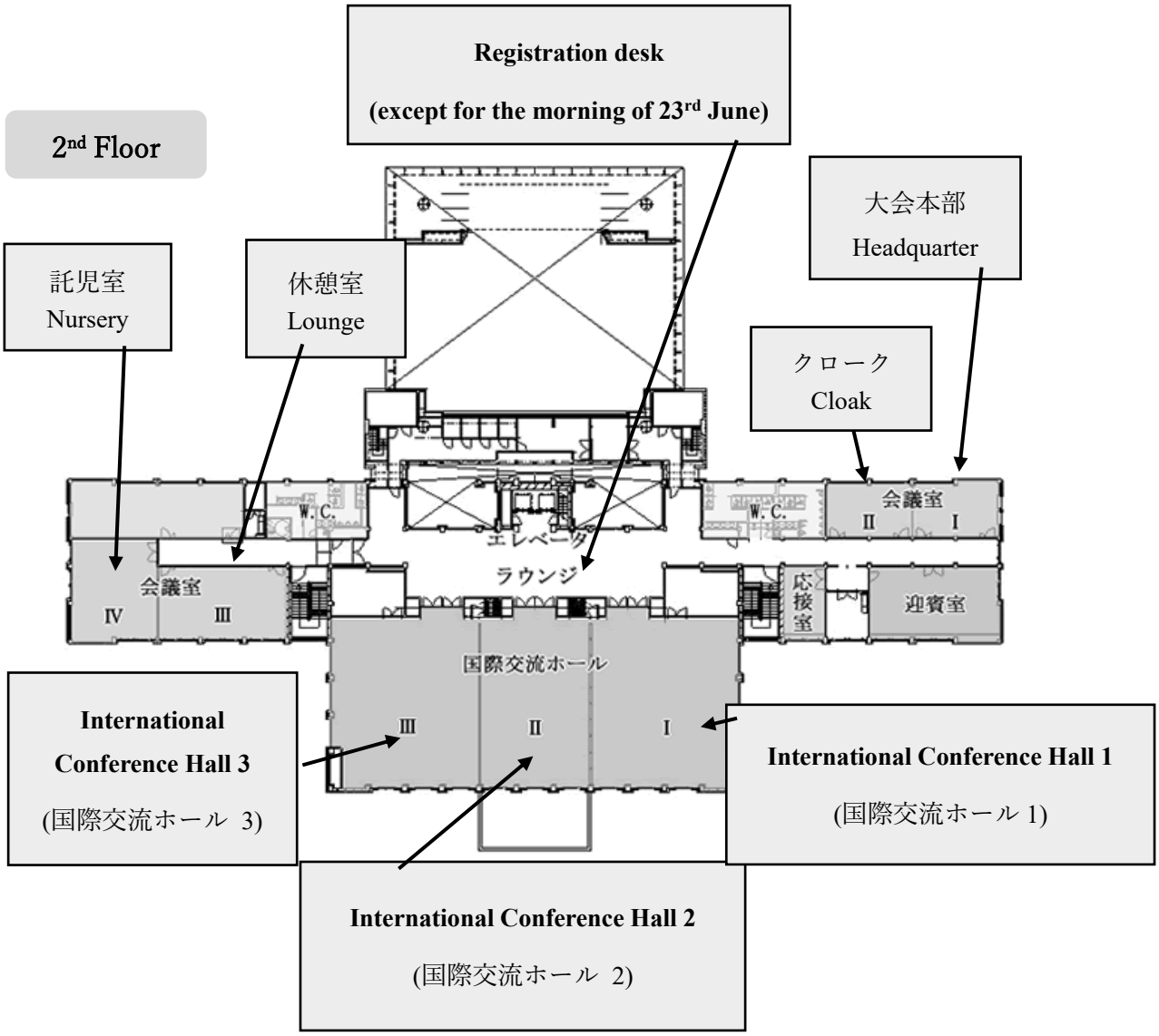
http://www.kyoto-u.ac.jp/ja/access/campus/yoshida/map6r_y/

（English）https://www.kyoto-u.ac.jp/en/access/main-campus-map.html

**1-2. Floor plan of the conference venue (Clock Tower, Kyoto University)**




1 階は飲食禁止です。Do not eat and drink on the first floor.




**廊下は飲食禁止です。飲食はホール内でのみ可能です。**

**Do not eat and drink in the corridor.**

## 2. Kyoto City Zoo (京都市動物園)

Address: Okazaki kouen, Okazaki Hosshouji-chou, Sakyo-ku, Kyoto City (〒606-8333　京都市左京区岡崎法勝寺町岡崎公園内)



### 2-1. Access to Kyoto City Zoo

<u>From JR Kyoto station</u>

- Kyoto City Bus

Take #5 or #100 (Raku-Bus) to ③"Doubutsuen-Mae（動物園前）"

Take #206 to ④"Higashiyama Nijo（東山二条）" then walk east for 5 mins

- Kyoto City Subway

Take subway Karasuma Line and transfer at "Karasuma Oike（烏丸御池）" to subway Tozai Line. Walk to the zoo for 5 mins from "Keage（蹴上）" station, or 10 mins from "Higashiyama（東山）" station.

<u>From Kyoto University</u>

- Kyoto City Bus

Take #201 or #206 either from “Hyakumanben（百万遍）” or “Kyodai Seimon-mae（京大正門前）” stops and get off at ④"Higashiyama Nijo（東山二条）," then walk east for 5 mins.

- By walk (Around 25-30 min)

# Important information

## 1. Registration

The registration desk will be located at the front of the International Conference Hall, on the second floor of Kyoto University Clock Tower Centennial Hall Building. The desk will be open between the following hours:

REGISTRATION DESK OPENING HOURS

| | |
|---|---|
| Sat 22 nd June | 14:00 – 19:00 |
| Sun 23 rd June | 09:00 – 19:30 |
| Mon 24 th June | 09:00 – 18:30 |
| Tue 25 th June | 09:00 – 17:30 |
| Wed 26 th June | 09:00 – 12:00 |

Entry to the building will not be possible before 09:00.
We hope participants who registered for "Whole Conference Participation" will register on the first half day of the conference (22nd June) as much as possible.
On 22nd June, we will have a 'Conserv'Session' documentary screening (BBC Horizon "Should We Close Our Zoos?") with discussion session and a welcome reception at the Clock Tower, Kyoto University.
Please join these events as well!

Registration time will be limited in the morning on full conference days.
Participants will be required to display their name tags when entering the conference rooms.

1) Attendees who have already registered and paid in advance: please collect your name tag and conference goods from the registration desk. Please wear your name tag on your person throughout the congress.

2) On-site registration
For on-site registration, please go to the registration desk. Fees are as follows:
Registration: Whole conference participation: 33,000 JPY (Regular) 22,000 JPY (Student)
Participation on daily basis 11,000 JPY

3) A receipt of payment is available upon request at the registration desk.

4) Hard copies of the program (without abstracts) will be available on-site, free of charge. Please

download the proceedings (lists of abstracts through our website).

## 2. Crèche Service (Nursery)

A crèche service will be available for the duration of the conference. Priority will be given to those who applied in advance (600 JPY / hour). However, there may still be places available. Please ask at the registration desk.

## 3. Message Board

To facilitate communication between attendees, a message board will be available next to the registration desk. No paging service will be provided, except in the case of emergency. Important notices from the organizing committee may also be posted on this message board.

## 4. Cloakroom

A cloakroom will be available in Meeting Room Ⅱ, on the second floor. Please note that we cannot store valuables or umbrellas. The cloakroom will be open at the following hours:

CLOAKROOM OPENING HOURS

| | |
|---|---|
| Sat 22 nd June | 14:00 – 19:00 |
| Sun 23 rd June | 09:00 – 19:30 |
| Mon 24 th June | 09:00– 18:30 |
| Tue 25 th June | 09:00 – 17:30 |
| Wed 26 th June | 09:00 – 17:00 |

## 5. Lunch

There are several restaurants and convenience stores near to the venue. Lunch is also available from Kyoto University cafeterias (please see the conference venue section). Some cafeterias are not open on weekends. To check weekend opening hours, please visit this website: http://www.s-coop.net/shop_guide (in Japanese).

We will provide rice balls and some snacks on 24th June, on the day of the Luncheon Seminar. On other days, please have lunch outside the venue.

## 6. Evening Welcome Reception

A welcome reception will be held on Saturday, 22nd June (17:00-19:00), in the International Conference Hall. It is free for whole conference participants. We will prepare food, drink and some cultural entertainment!

## 7. Banquet

A banquet will be held on the last day of the conference, 26 thJune (17:00 -19:00) in the International Conference Hall. On-line pre-registration is necessary. We will prepare food, drink and some cultural entertainment!

## 8. Workshop

Two official workshops (1: Environmental Enrichment, 2: Positive Reinforcement Training) will take place on Tuesday, 25th June. The registration is already closed for these two workshops, but you can attend the presentation parts of the Positive Reinforcement Training Workshop held in the International Conference Hall on 25th June (13:00-14:50). Please see further details in pp 21. Please go to the workshop venue by yourself.

The workshop by Disney's Animal Kingdom will be held on the morning of 26th June. The number of participants is limited. Please register at the onsite reception desk.

## 9. Public Symposium

The Public Symposium entitled "動物園動物の福祉：わたしたちはかかわる動物に何ができるのか？"Zoo animal welfare: Can we do something for the animals we interact with?" will be held on Saturday, 22 nd June (13:15-16:00) at Kyoto City Zoo. The official language of this public symposium is JAPANESE. Pre-registration via the Kyoto City Zoo website is necessary.

## 10. Kyoto City Zoo tour

We have prepared some special guides (in English) for ICEE participants in the afternoon of 26th June as follows. Please go to the zoo by yourself and enjoy! Entrance fee is free for ICEE2019 participants, if you show your name tag at the zoo entrance.

13:30 Chimpanzee or Exploring Japanese Animals zone*

14:00 Gorilla or Exploring Japanese Animals zone*

15:00 Bush dogs or Asian elephants

* Capacity for the tour "Exploring Japanese Animals zone" is limited, so registration at the ICEE2019 reception desk is required.

To attend the other guides, please go directly to the enclosure of each animal.

## 11. Parking

No parking spaces are available for attendees. Please use public transport.

# Presentation guidelines

## 1. Oral Presentations

Each speaker is allocated 15 mins in total (12 mins for presentation; 3 mins for Q & A). Each presentation will be timed: a bell will ring once at 10 mins, twice at 12 mins, and a buzzer will sound at 15 mins.

## 2. Rapid communications

Each speaker is allocated 5 mins (No time for Q & A). Please prepare using SIMPLE English.

## 3. Equipment for oral presentations and rapid communications

1) Each room will be equipped with a Microsoft Windows OS computer. This computer will only accept PowerPoint files (Microsoft PowerPoint 97-2003 compatible) or PDF files (Adobe Acrobat). PowerPoint presentations should be saved in PowerPoint Show format (.ppsx) to a USB or other portable format and handed in at the Speaker's desk, preferably the day before your presentation and no later than the session before your presentation. Please name your PowerPoint file using the presentation number followed by your surname, e.g. 'O33_Yamada.ppsx'. In order to keep strictly to time, use of your own personal computer will not be permitted. If you have videos or audio clips, they must be embedded in the presentation. We highly recommend you test your presentation in advance of your scheduled talk in the conference room. The length of presentation for symposium speakers can vary. Please see the program below.

2) Other equipment

If you wish to use any additional equipment for your presentation, please contact the organizing committee by email.

## 3. Poster Presentations

### 3-1. Poster Boards

Posters will be attached to individual poster boards measuring 210 cm tall by 90 cm wide. Your poster must not exceed the dimensions of the board. The poster boards will be numbered on the upper left corner. Please, be sure to attach your poster to the board showing the number matching your assigned poster ID number. Thumbtacks will be supplied to attach your poster.

### 3-2. Presentations

Posters will be displayed in International Conference Hall III. All posters must be displayed from 13:30 to the end of the poster presentation time (19:15 on 23rd June and 18:30 on 24th June). You may attach your poster to the appropriate board from 12:00 and please remove it by 19:30.

### 3-3. Poster Sessions

Two poster sessions are scheduled as follows:

Session 1 (No. P1-P29 & RP1-RP10 & R1): 18:15-19:15 on 23 rd June

Session 2 (No. P30-P65 & RP 11–RP14 & R2-R3): 17:30-18:30 on 24 th June

Poster presenters are required to stand in front of their posters throughout their assigned session.

Please check your poster number on the poster presentation list. (pp. 26-32)

## 4. Session Chairpersons

Session Chairpersons must be in the room at least 10 mins before the start of the session they are to chair. It is left to the discretion of each Chairperson to decide how they will chair the session, however please keep strictly to the scheduled times.

# Program

## Day 1 — 22nd June, 2019

**Venue: Kyoto City Zoo**

13:15-16:00 Public Symposium (in Japanese only, pre-registration is necessary)

**Venue: Clock Tower, Kyoto University**

**▼ International Conference Hall**

14:00-19:00 Registration

15:00-16:30 Conserv'Session: Chaired by Lucie Rigaill (Kyoto University)

Changing the perception of zoos and animal welfare: screening of BBC horizon "Should we close our zoos? " and discussion session

17:00-19:00 Welcome Reception (Free for Whole Conference Participants)

## Day 2 — 23rd June, 2019

**Venue: Clock Tower, Kyoto University**

9:00-19:00 Registration

**▼ Centennial Hall**

9:30 - 10:00 Opening Remarks

**Tetsuro Matsuzawa (Kyoto University)**

Learning from the wild: Animal welfare, conservation and education in Harmony

10:00 - 12:30 Elephant welfare: Perspectives from different cultural and working backgrounds:

Chaired by Shiro Kohshima (Kyoto University)

**10:00- 10:30 [S1] Raman Sukumar (Indian Institute of Science)**

The four pillars of captive elephant welfare in Asia

**10:30- 11:00 [S2] David Shepherdson (Oregon Zoo)**

Elephant enrichment and welfare

**11:00 - 11:15 [S3] Etsuo Narushima (Japanese Association of Zoos and Aquariums)**

Update on elephants welfare at JAZA member institutions

**11:15 – 11:30 [S4] Kyoko Kuroda (Kyoto City Zoo)**

Introduction of new elephants to a former solitary captive elephant: the process of forming social relationships

**11:30 – 11:45 [S5] Shintaro Hagiwara (Fukuyama City Zoo)**

Effects of environmental enrichment on the behavior of a female Borneo elephant (*Elephas maximus borneensis*) with tuberculosis in Fukuyama Zoo, Japan.

**11:45 - 12:30 Panel Discussion (Coordinated by Hiroto Kawabata)**

12:30- 13:30 Lunch break

## ▼ International Conference Hall 1

13:30-15:20 Cognitive tasks in captivity: studying primate cognition and serving as enrichment: Chaired by Jie Gao (Kyoto University)

**13:30 – 14:00 [S-6] Fay Clark (Bristol Zoological Gardens)**

Gorilla game lab: Developing high-tech cognitive enrichment for zoo-housed gorillas

**14:00 – 14:20 [S-7] Chris Martin (Indianapolis Zoo)**

Primate touch-panel tasks for research and enrichment at zoos: Hardware, software, and training methods

**14:20 – 14:35 [S-8] Yutaro Sato (Kyoto University)**

Great apes' psycho-physiological response toward others' injury and pain: a thermal imaging study

**14:35 – 14:50 [S-9] Yuri Kawaguchi (Kyoto University)**

Chimpanzees, but not bonobos, attend more to infant than adult conspecifics

**14:50 – 15:05 [S-10] Jie Gao (Kyoto University)**

How chimpanzees perceive other species: embodied and visual expertise

**15:05 – 15:20 General Discussion**

15:20-15:45 Coffee break

15:45-17:15 Welfare of industrial animals: Chaired by Tsuyoshi Shimmura (Tokyo University of Agriculture and Technology)

**15:45 –16:15 [S-11] Tsuyoshi Shimmura (Tokyo University of Agriculture and Technology)**

Toward animal computer interaction

**16:15 – 16:45 [S-12] Shigeru Ninomiya (Gifu University)**

Environmental enrichment for self-grooming in farm and zoo animals

**16:45 – 17:15 [S-13] Shogo Higaki (National Agriculture and Food Research Organization)**

Recent advancement in wearable sensing technologies for cattle health management, particularly of body surface temperature sensing

17:15-18:15 Rapid Communication 1: Chaired by Fay Clark (Bristol Zoological Gardens)

**[RP-1] Katie J Springer (San Diego Zoo)**

Enriching a Canadian beaver beyond its primary habitat

**[RP-2] Megumi Kouno (Kagoshima City Park Management Corporation)**

Enrichment projects conducted with the Japanese wild boar and raccoon dog, the local animals of Kagoshima

**[RP-3] Susan Joan Jansen (Dubai Safari Park)**

Comparison of several enrichment types and rotational display management for four captive lion prides in Dubai Safari Park

**[RP-4] Masato Yayota (Gifu University)**

Feeding enrichment using an automatic feeder for captive Asian elephants (*Elephas maximus*)

**[RP-5] Tomoko Kanazawa (Nihon University)**

Sleeping behavior of Asian elephants (*Elephas maximus*) in the zoo

**[RP-6] Keiichi Ueda (Okinawa Churashima Foundation)**

Development of score sheet for terminal care of old dolphins

**[RP-7] Kristena E Cooksey (Washington University)**

Socioecological predictors of health profiles in western lowland gorillas

**[RP-8] Kristin Havercamp (Kyoto University)**

Monitoring sleep in captive chimpanzees to enhance welfare

**[RP-9] Haruka Kasuga (Hokkaido University)**

Application of virtual reality to a science workshop for children at a zoo

**[RP-10] Shiori Mitsuya (Kyoto City Zoo)**

Introduction of activities by SHAPE-Japan

**[R-1] Nobuhiro Yamada (Noichi Zoological Park of Kochi Prefecture)**

Developmental support of chimpanzee with cerebral palsy

## ▼ International Conference Hall 2

13:30-15:15 Oral Presentation 1: Chaired by Tadatoshi Ogura (Kitasato University)

**13:30 – 13:45 [O-1] Takumi Sasaki (Saitama Children's Zoo)**

Spread of environmental enrichment in SCZoo

**13:45 – 14:00 [O-2] Eileen Kat Tuite (Charles Darwin University)**

The eye of the beholder: enrichment from the zoo keeper perspective

**14:00 – 14:15 [O-3] Jon Charles Coe (Jon Coe Design)**

Enrichment through animal rotation, tree-top trails and the 5C's

**14:15 – 14:30 [O-4] Tadatoshi Ogura (Kitasato University)**

Collaborative project between Kitasato University and Japanese zoos on environmental

enrichment for education and academic research

**14:30 – 14:45 [O-5] Hanna Chin (Singapore Zoo)**

A comprehensive enrichment program for domestic program animals in the zoo setting

**14:45 – 15:00 [O-6] Robert Young (University of Salford Manchester)**

Should we pamper zoo animals?

**15:00 – 15:15 [O-7] Kenji Wako (Osaka University of Arts)**

Built-in enrichment renovation at Tokiwa Zoo in Ube, Japan: Brachiation Forest for white handed gibbon

15:15-15:45 Coffee break

15:45-17:15 Oral Presentation 2: Chaired by Crickette Sanz (Washington University)

**15:45 – 16:00 [O-8] Erin Louise Gardiner (Zoo Victoria)**

Asian elephant enrichment - past, present and future

**16:00 – 16:15[O-9] Isabella Clegg (Animal Welfare Expertise)**

Using anticipatory behaviour to evaluate enrichment: dolphins looked forward most to non-food interactions with their trainers

**16:15 – 16:30[O-10] Ruta Vaicekauskaite (FOX Consulting)**

Environmental enrichment as a tool towards positive changes of Black Sea bottlenose dolphins' attitude and participations during educational presentations

**16:30 – 16:45[O-11] Zulfikar Gandong (Hasanuddin University)**

The influence of classical music stimulation to captive Californian sea lions (*Zalophus californianus*) behavioural responses

**16:45 – 17:00[O-12] Signe Preuschoft (Competence Centre Apes, Four Paws)**

Rehabilitation for later re-Introduction: Choosing appropriate enrichment for rescued ape orphans

**17:00-17:15[O-13] Vanessa Gris (Kyoto University)**

Facial expressions of acute pain in Japanese macaques: development of an assessment tool

17:15-18:15 Oral Presentation 3: Chaired by Lira Yu (Kyoto University)

**17:15 - 17:30 [O-14] Shintaro Ishizuka (Kyoto University)**

Bonobos' saliva remaining on the pith of terrestrial herbaceous vegetation can serve as non-invasive wild genetic resources

**17:30 – 17:45 [O-15] Nelson Broche (Kyoto University)**

Salivary alpha-amylase is a biomarker of acute stress in Japanese macaques (*Macaca fuscata*)

**17:45 – 18:00 [O-16] Dingzhen Liu (Beijing Normal University)**

Is excretion of mucous stools associated with captivity in the giant panda?

**18:00 – 18:15 [O-17] Xiaochan Yan (Kyoto University)**

Functional divergence of bitter taste receptor TAS2R38 in Sulawesi Macaques

### ▼ International Conference Hall 3

18:15-19:15 Poster Presentation 1 (P1-P29 & RP1-RP10 & R1) see pp.26-32

## Day 3 24th June, 2019

**Venue: Clock Tower, Kyoto University**

9:00-18:30 Registration

### ▼ International Conference Hall 1

9:15-10:45 Great apes in the wild and captivity: Chaired by Shinya Yamamoto (Kyoto University)

**9:15 – 9:45 [S-14] Stephen R Ross (Lincoln Park Zoo)**

A multifaceted approach to providing opportunities for chimpanzees to thrive in captive settings

**9:45 – 10:15[S-15] Crickette Sanz (Washington University)**

Studying chimpanzees and gorillas across contexts to enhance welfare and conservation

**10:15 – 10:45 [S-16] Cat Hobaiter (University of St. Andrews)**

What the study of ape gesture can tell us about ape minds

10:45-12:15 Oral Presentation 5: Chaired by Cat Hobaiter (University of St. Andrews)

**10:45 – 11:00 [O-24] Chiho Nakamura (Aquamarine Fukushima)**

Eurasian otter's natural nursing behavior induced by recreating the wild habitat in the exhibition enclosure.

**11:00 – 11:15 [O-25] Afiqah Mizan (Institute of Tropical Biology and Conservation)**

Population estimate of Bornean orangutans at rehabilitated eastern Bukit Piton in Sabah

**11:15 – 11:30 [O-26] Saki Yasui (Kyoto City Zoo)**

Environmental enrichment and birth support for western gorillas at the Kyoto City Zoo

**11:30 – 11:45 [O-27] Morgane Allanic (Kyoto University)**

Reciprocal turn-taking of social grooming in captive and wild pan species

**11:45 – 12:00 [O-28] Yuko Tsunekawa (Osaka Municipal Tennoji Zoological Gardens)**

Let koalas enjoy the arboreal life. ~a project of Osaka Tennoji Zoo, Japan.

**12:00 – 12:15 [O-29] Debby Ng (ZooLogic Training & Consultancy)**

Practical application of environment enrichment at a rescue centre in South-East Asia

12:30-13:30 Luncheon Seminar: Chaired by Yumi Yamanashi (Kyoto City Zoo)

**12:30 – 13:00 [OT-1] Megan Reinertsen Ross (Lincoln Park Zoo)**

Developing a work life balance as a zoo executive

13: 00 – 13:15 Questions and comments

13:30-16:00 Ex-situ conservation of endangered animal species and the role of zoos for future re

Introduction Chaired by Kazunari Ushida (Chubu University)

**13:30 – 13:40 [S-22] Kazunari Ushida (Chubu University)**

Ex-situ conservation of endangered animal species and the role of zoos for future re-introduction

**13:40 – 14:10 [S-23] Francis Cabana (Wildlife Reserve Singapore)**

How nutrition, diets and food presentation taken from the wild can be fuel for positive welfare

**14:10 – 14:25 [S-24] Sayaka Tsuchida (Chubu University)**

Ex-situ conservation protocol of Japanese rock ptarmigans based on their natural intestinal environment

**14:25 – 14:40 [S-25] Mitsunori Nagao (Kyoto City Zoo)**

Ex situ conservation of the Tsushima leopard cat by the cooperation with JAZA and MOE

**14:40 – 14:55 [S-26] Takashi Nagamine (Okinawa Wildlife Federation)**

Ex-situ conservation of Okinawa rail (*Hypotaenidia okinawae*)

**14:55 – 15:10 [S-27] Daisuke Watanabe (Miyazaki City Phoenix Zoo)**

Attempted captive conservation breeding of Japanese night herons Gorsachius goisagi and Amami spiny rats Tokudaia

15:10 – 15:20 Break

**15:20 – 16:00 General Discussion**

Commentator: Etsuo Narushima (Japanese Associations of Zoos and Aquariums)

16:00-16:30 Coffee break

16:30-17:15 Rapid communications 2: Chaired by Kristin Havercamp ( Kyoto University)

**[R-2] Margaret Rachel Hawkins (Taronga Conservation Society Australia)**

Marvelous monotremes: behavior and enrichment

**[R-3] Naoko Suzuki (Pet Service Mogose)**

Environmental enrichment: providing an "enriched life" for companion animals, their owners, and pet sitters

**[R-4] Rebecca Newman (University College Cork)**

The effectiveness of water enrichment in pair-housed lion-tailed macaques (*Macaca silenus*)

**[R-5] Cao Yani (Beijing Zoo)**

Application of traditional Chinese elements to treatment and enrichment

**[RP-11] Haruka Kasuga (Hokkaido University)**

How domestic dogs will behave when their owner interacts with a communication robot

**[RP-12] Ayuka Sato (Nihon University)**

Attempt of environmental enrichment for the Asian elephant (*Elephas maximus*) in Yokohama Municipal Kanazawa zoo

**[RP-13] Keiichi Ueda (Okinawa Churashima Foundation)**

Efforts to improve the quality of life for self-harm dolphins

**[RP-14] Ning Han (Kyoto University)**

Present animal welfare situation in Kunming Zoo

## ▼ International Conference Hall 2

9:15-10:45 Oral presentation 4: Chaired by David Shepherdson (Oregon Zoo)

**9:15 - 9:30 [O-18] Belinda Ann Hall (University of Melbourne)**

Cognitive enrichment for parrots: effects of design and personality

**9:30 - 9:45 [O-19] Wataru Anzai (Hiroshima City Asa Zoological Park)**

Natural breeding behavior of pinioned common shelduck through the underground nest box

**9:45 - 10:00 [O-20] Chaya Chathurani Sarathchandra (Rajarata University)**

Conservation of endemic *Pycnonotus penicillatus* considering the relative impacts of landscape change on its ecology, feeding and breeding

**10:00 - 10:15 [O-21] Uday Kumar (Bangalore University)**

Herbs composition, diversity and their conservation strategy in biopark of jnanabharati campus, Bangalore University

**10:15 – 10:30 [O-22] Novi Rosyid (Jakarta State University)**

Analysis of eco literacy and environmental awareness using mangrove storytelling for coastal children education

**10:30 – 10:45 [O-23] Kota Okabe (Kyoto City Zoo)**

Use of cardboard boxes as environmental enrichment for captive tigers (*Panthera tigris altaica*)

10:45- 12:30 Genome symposium: Chaired by Rebecca Johnson (Kyoto University)

**10:45 – 11:10 [S-17] Rebecca Johnson (Kyoto University)**

Management of captive and wild koala populations – lessons and applications from the koala genome

**11:10 – 11: 35 [S-18] Hiroo Imai (Kyoto University)**

Feeding behaviors of animals and sense of taste

**11:35 – 12:00 [S-19] Miho Murayama (Kyoto University)**

Understanding genetic background of personality for stress management in captivity

**12:00– 12:15 [S-20] Francis Cabana (Wildlife Reserve Singapore)**

Enriching the gut microbiome may provide more benefits than enriching the animal

**12:15 – 12:30 [S-21] Takashi Hayakawa (Hokkaido University)**

Gum feeding induces short-term gut microbiome change in captive slow loris

13:30-16:00 Equinology and equine animal welfare: Chaired by Satoshi Hirata (Kyoto University)

**13:30 – 14:00 [S-28] Satoshi Hirata (Kyoto University)**

Study of feral horse behavior in Serra D'Arga, Northern Portugal

**14:00 – 14:30 [S-29] Enrique Alonso Garcia (Consejo de Estado and Benjamin Franklin Institute-UAH, Spain)**

Animal cognition and animal welfare: feral horse social behavior and its translation, as applied animal welfare science, to domestic horse management

**14:30 – 15:00 [S-30] Coby Bolger (Horse1 - Equine Nutrition Centre)**

Indicators for equine wellbeing and the relationship with nutrition

**15:00 – 15:30 [S-31] Masaki Tomonaga (Kyoto University)**

Use of the touchpanel system for exploring the horse mind

**15:30 – 15:45 [S-32] Monamie Ringhofer (Kyoto University)**

Behavioral responses of feral horses toward dying and dead conspecifics

**15:45 – 16:00 [S-33] Shinya Yamamoto (Kyoto University)**

Investigation of social structure of feral horses using drones

16:00-16:30 Coffee break

16:30-17:30 Oral presentation 6: Chaired by Misato Hayashi (Kyoto University)

**16:30 – 16:45 [O-30] Naruki Morimura (Kyoto University)**

Measuring a degree of spatial freedom in wild chimpanzees, Bossou

**16:45 – 17:00 [O-31] Kelly Chew (Wildlife Reserves Singapore)**

Strategic usage of enrichment in increasing animal activity and visibility

**17:00 – 17:15 [O-32] Yumi Yamanashi (Kyoto City Zoo)**

Filling the gap: animal welfare risk assessment and its application to enhance the quality of life of zoo animals

**17:15 – 17:30 [O-33] Kanako Tomisawa (Omuta City Zoo)**

The zoo tells you animal welfare. – the introduction of Omuta City Zoo -

## ▼ International Conference Hall 3

17:30-18:30 Poster Presentation 2 (P30 - P66 & RP 11 – RP14 & R2- R3) see pp. 26-32

## Day 4 25th June, 2019

**Venue: Clock Tower, Kyoto University**

9:00-17:30 Registration

### ▼ International Conference Hall 1 & 2

**9:15-9:50 [OT-2] Plenary talk: Hannah Buchanan-Smith (University of Stirling)**

Enrichment for primates in laboratories and zoos: Same principles, different constraints

10:00-11:40 Applications for care and experiments of laboratory animals based on animal behavioral characteristics: Chaired by Shigiko Takei & Naoko Suda-Hashimoto (Japanese Association for Experimental Animal Technologists)

**10:00 - 10:05 [S-34]** Introduction of the symposium and approaches for laboratory animal welfare of JAEAT

**10:05 – 10:30 [S-35] Toshihiro Endo (Phenovance Research and Technology, LLC)**

Remodeling the housing and behavioral testing environment for laboratory mouse models of human diseases: IntelliCage system and beyond

**10:30 – 10:55 [S-36] Takako Miyabe – Nishiwaki (Kyoto University)**

Facial expression as a tool for assessment of pain in animals

**10:55 – 11:20 [S-37] Hironari Koyama (Astellas Pharma Inc.)**

Effects of social housing as environmental enrichment on behaviors and biochemical parameters in juvenile cynomolgus monkeys (*Macaca fascicularis*)

11:20 – 11:40 General Discussion

11:40-13:00 Lunch break

**13:00-17:00 Positive Reinforcement Training Workshop: Organized by Kazuyuki Ban and Kanako Tomisawa (Omuta City Zoo)**

(The room will open from 12:30. Pre-registration is necessary, but non-registrants can attend the presentation parts between 13:00 and 14:50 which are marked with asterisks. Non-registrants can observe the registered participants engaging in a “Shaping game” but cannot join the game.

13:00 – 13:20 Greetings and Self-introduction

13:20 – 13:50 Naoko Sugiyama (Seisa University)*

Behavior analysis as the science of animal training

13:50 – 14:10 Shaping game

14:10 – 14:30 Jodi Carrigan (Zoo Atlanta)*

Overview of the Zoo Atlanta Gorilla Training Program

14:30 – 14:50 Kazuyuki Ban (Omuta City Zoo)*

Case Study of Husbandry Training at Omuta City Zoo

14:50 – 17:00 Group work

### ▼ International Conference Hall 3

10:00-12:00 Oral presentation 7: Chaired by Stephen R. Ross (Lincoln Park Zoo)

**10:00 - 10:15 [O-34] Ikki Matsuda (Chubu University)**

Connection between wild and captivity: a case study on endangered proboscis monkeys

**10:15 – 10:30 [O-35] Jie Liu (Kyoto University)**

Modeling habitat suitability for Yunnan Snub-nosed monkeys in Laojun Mountain National Park

**10:30 – 10:45[O-36] Himani Nautiyal (Kyoto University)**

Struggle for existence: An investigation to decode perception of farming community towards non-human primate and their interactions in western Himalayas

**10:45 – 11:00 [O-37] Sumir Keenan (Kyoto University)**

Long-term vocal recognition of past social partners in bonobos.

**11:00 – 11:15 [O-38] Saein Lee (Ewha Womans University)**

Visitor effect and the impact of isolation on the behavior of yellow-cheek gibbon (*Nomascus gabriellae*) and white-handed gibbon (*Hylobates lar*) in captivity

**11:15 – 11:30 [O-39] Marsenia Haris (Dubai Safari Park)**

Keeper preference as a sensory stimuli in positive reinforcement training for four species of reptiles

**11:30 – 11:45 [O-40] Noe Nakashima (Osaka Municipal Tennoji Zoological Garden)**

Implementation of husbandry training to provide medical care to an old puma

**11:45 – 12:00 [O-41] Andrew MacIntosh (Kyoto University)**

Show me chaos! Seeking fractal time in captive animal behavior

### Venue: Kyoto City Zoo

13:00-17:00 Enrichment Workshop: Organized by SHAPE-Japan (Pre-registration is necessary.)

## Day 5 — 26th June, 2019

### Venue: Clock Tower, Kyoto University

9:00-12:00 Registration

### ▼ Centennial Hall

**9:15-9:50 [OT-7] Plenary talk: Daniel Mills (University of Lincoln)**

Environmental Enrichment in the Horse (and other animals)

## ▼ International Conference Hall 1 & 2

10:00-11:50 Managing death in captive social animals: Chaired by André Gonçalves (Kyoto University)

**10:00 – 10:15 [S-38] André Gonçalves (Kyoto University)**

Managing death in social animals: the case for non-human primates

**10:15 – 10:30 [S-39] Claire Watson (Kyoto University)**

Nonhuman primate mothers behavior toward their dead infants: captive welfare issues

**10:30 - 10:45 [S-40] Nachiketha Sharma (Kyoto University)**

Lessons from the wild: behavioral responses of Asian elephants towards dying conspecifics and its possible implications on welfare of captive elephants

**10:45 – 11:00 [S-41] Tetsuji Iseda (Kyoto University)**

Being grateful for sacrifices of animals: Japanese animal ethics as a kind of relational ethics

**11:00 – 11:15 [S-42] Josue Alejandro Pastrana (Kyoto University)**

Animal Memorials: a welfare practice for animal and caregivers

**11:15 – 11:30 [S-43] James Russel Anderson (Kyoto University)**

Captive primates and stress: self-aggression, self-injurious behaviour, but no suicide: why?

11:30 – 11:50 General Discussion

**17:00-19:00 Banquet**

## ▼ International Conference Hall 3

10:00 - 12:00 Workshop: Cultivating a Behavior-Driven Enrichment Program: Organized by Angela Miller (Disney's Animal Kingdom)

## Venue: Kyoto City Zoo

13:30-16:00 Kyoto City Zoo tour

| Poster Presentations and Other Exhibitions at the Poster Sessions | | | | |
|---|---|---|---|---|
| Type | No. | Date | Presenter's Name | Title |
| Poster | P1 | 23-Jun | Hanling Yeow | Chimpanzee reactions to death stimuli |
| | P2 | 23-Jun | Kimberly Hernandez Carrillo | Odonata assemblages and faunistic survey from riparian habitats found in Don Marcelino and Malita, Davao Occidental, Philippines |
| | P3 | 23-Jun | Tomomaru Matsuda | Flight range of the stable fly for blood-sucking in a zoo |
| | P4 | 23-Jun | Annegret Moto Naito | Genetic diversity of neutral markers and MHC genes in captive Japanese golden eagles: insights into immunity and mate choice |
| | P5 | 23-Jun | Tadatsugu Hosoya | New practice to join the local issue of animal harm and the issue of animal welfare in zoo, “Wild meát Zoo” |
| | P6 | 23-Jun | Kumiko Inoue | The flamingos are interested in feeding than breeding? |
| | P7 | 23-Jun | Chihiro Kase | Effect of zoo visitors on pool use of captive Humboldt penguins (*Spheniscus humboldti*) |
| | P8 | 23-Jun | Hiroshi Yamada | The evaluation of anti-anxiety effects of the bedding material and touching on guinea pigs |
| | P9 | 23-Jun | Akiho Muramatsu | Portable touch monitor cognitive study in zoo-housed macaques |
| | P10 | 23-Jun | Himena Mano | Individual difference of behavior under the environmental enrichment in pigs |
| | P11 | 23-Jun | Ayaka Takimoto-Inose | Social buffering by conspecifics and humans in adult domestic horses |

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|---|---|---|---|---|
| | P12 | 23-Jun | Yusuke Aramaki | Effects of three types of environmental enrichment on the behaviors of captive Brazilian tapirs |
| | P13 | 23-Jun | Amanda Leanne Catwell | Enrichment to assist rehabilitation of bears rescued from bile farms |
| | P14 | 23-Jun | Koji Kanda | Finless porpoise project in Nagoya port |
| | P15 | 23-Jun | Fumio Nakahara | Above-surface vocalizations of captive bottlenose dolphins to attract attention from humans |
| | P16 | 23-Jun | Naoko Hashimoto | Procedure manual for environmental enrichment devices for non-human primates. |
| | P17 | 23-Jun | Ena Onishi | The social relationships of breeding pairs in monogamous groups of captive common marmosets (*Callithrix jacchus*) |
| | P18 | 23-Jun | Misato Hayashi | Change of behavior and space use in a captive group of chimpanzees after an expansion of enclosures |
| | P19 | 23-Jun | Lira Yu | The development of tempo-flexibility between 18 and 42 months in human infants |
| | P20 | 23-Jun | Mari Morimoto | Effectivity of environmental education program using small animals kept in Japanese elementary schools. |
| | P21 | 23-Jun | Satoru Hoshino | Seasonal variation in *in vivo* digestibility of a captive proboscis monkey (*Nasalis larvatus*) |
| | P22 | 23-Jun | Duncan Andrew Wilson | Exploring attentional bias towards emotional faces in chimpanzees using the dot probe task |
| | P23 | 23-Jun | Raquel Filomena Pereira Costa | Assessment of the current impact of mountain gorilla ecotourism in Bwindi National Park, Uganda |

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|---|---|---|---|---|
| | P24 | 23-Jun | Tomoe Torii | Aging characteristics of permanent teeth in chimpanzee |
| | P25 | 23-Jun | Tomomi Ochiai | The history and current status of captive chimpanzees (*Pan troglodytes*) in Japan |
| | P26 | 23-Jun | Daisuke Nagano | On altruistic behavior towards a chimpanzee who underwent right hip disarticulation in a group of five captive chimpanzees |
| | P27 | 23-Jun | Masaki Tomonaga | Behavioral biometrics for the chimpanzees |
| | P28 | 23-Jun | Masayuki Tanaka | Ten years of long-lasting cognitive enrichment for zoo primates: cultural transmission in Kyoto City Zoo |
| | P29 | 23-Jun | Yoko Sakuraba | Evaluating of physical state on a female chimpanzee with cerebral palsy: a case study |
| | P30 | 24-Jun | Shotaro Hirata | The impact of super-typhoon Jebi on the health status of dairy cattle in Osaka |
| | P31 | 24-Jun | Tomoyuki Tajima | Male reproductive success in Bornean orangutans (*Pongo pygmaeus*) |
| | P32 | 24-Jun | Nelson Wan | Let's give some challenges to the keeper |
| | P33 | 24-Jun | Haruna Bando | Environmental enrichment projects for geriatric rhesus macaques with zoo visitors |
| | P34 | 24-Jun | Eri Iwata | Enriched environment affects aggressive behaviour and sexual maturity in Siamese fighting fish (*Betta splendens*) |
| | P35 | 24-Jun | Takashi Tsuji | Bird traps and their impact on Palawan Island in the Philippines |

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|---|---|---|---|---|
| | P36 | 24-Jun | Courtney Collins | Penguins' behavioural response to zoo visitors with and without environmental enrichment |
| | P37 | 24-Jun | Kanae Shimada | Assessing the effect of visitor contact on stress levels in guinea pigs by measuring salivary cortisol levels |
| | P38 | 24-Jun | Hikaru Asano | The effects of environmental enrichment on anxiety-like behavior, learning behavior and hippocampal gene expression in Hatano rats. |
| | P39 | 24-Jun | Yuto Taki | Investigating genetic structure of the Ryukyu flying fox |
| | P40 | 24-Jun | Yuki Ishida | Japan is too cold for Malayan tapirs!? |
| | P41 | 24-Jun | Natsumi Nishikawa | Environmental enrichments for ponies and Hartmann's mountain zebras in Kamine Zoo |
| | P42 | 24-Jun | Sakiho Ochi | The function of vocalizations relating to social relationships in free ranging horse groups (*Equus caballus*) |
| | P43 | 24-Jun | Daisuke Kohari | A Fundamental study of pacing behaviours in captive bears |
| | P44 | 24-Jun | Hiroto Yoshimura | Plant eating habit of captive snow leopard (*Panthera uncia*) |
| | P45 | 24-Jun | James Brooks | Evidence of self-domestication in wild coyotes? |
| | P46 | 24-Jun | Megumi Fukuzawa | Effects of different room temperatures and floor features on the behaviour of pet dogs |
| | P47 | 24-Jun | Huiyuan Qi | Investigation about the teenagers' attitude towards the problem of free-roaming cats in Tokunoshima with the use of Structural Equation Modelling (SEM) |

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| | P48 | 24-Jun | Atef Mohamed Kamel Ahmed | Effect of captive environmental conditions and visitors on behavior of african lions (*Panthera leo*) and their welfare at Giza Zoological Garden, Egypt |
| | P49 | 24-Jun | Maho Araki | Sleeping behaviors of captive commerson's dolphins (*Cephalorhynchus commersonii*) |
| | P50 | 24-Jun | Kodzue Kinoshita | Evaluation of external environment by non-invasive hormone assay in snow leopards (*Panthera uncia*) |
| | P51 | 24-Jun | Ryo Ohta | Effect of environmental enrichment on reproductive behavior in Hatano rats. |
| | P52 | 24-Jun | Kei Nemoto | Improving living environment of Lesser Slow Loris |
| | P53 | 24-Jun | Hikari Kawade | Installing enrichment items for decreasing aggressive behavior of captive Toque macaques |
| | P54 | 24-Jun | Shenwen Xu | Sensitivity to workload: prioritizing behavior of a three-choice task in free-ranging Japanese macaques |
| | P55 | 24-Jun | Makiko Uchikoshi | Evaluating the effectiveness of mixed-species pairing to reduce the number of singly-housed gibbons at Japan Monkey Centre |
| | P56 | 24-Jun | Misako Namiki | Significance of feeding branches to captive western gorillas (*Gorilla gorilla*) |
| | P57 | 24-Jun | Shuto Ishida | Environment enrichment for gibbons |
| | P58 | 24-Jun | Ryuhei Ano | Evaluation of social enrichment in cohabitation between female of owl Monkey |
| | P59 | 24-Jun | Yuji Kondoh | The new enclosure for chimpanzees in Nagoya Higashiyama zoo and botanical gardens |

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|---|---|---|---|---|
| | P60 | 24-Jun | Shohei Shibata | Does intragroup aggression affect males' choice of parties to attend? Study on fission-fusion grouping of male chimpanzees in Kalinzu Forest Reserve, Uganda. |
| | P61 | 24-Jun | Hsiao-Wei Kuo | Reconstruction of exercise yards and introduction of enrichment furniture at Taipei Zoo |
| | P62 | 24-Jun | Kenta Araki | Improve living environment and animal welfare of Anubis baboon based on experience in natural habitat |
| | P63 | 24-Jun | Yuta Shintaku | Learn from past zoo animals: temporal change of morphology in captive Japanese Yaku macaques |
| | P64 | 24-Jun | Rie Akami | Enrichment experience activity in the wild summer camp |
| | P65 | 24-Jun | Ruta Vaicekauskaite | Does enrichment improve well being in animals under human care? A case study of two harbor seals (*Phoca vitulina*) |
| Rapid Communication and Poster | RP1 | 23-Jun | Katie J Springer | Enriching a Canadian beaver beyond its primary habitat |
| | RP2 | 23-Jun | Megumi Kouno | Enrichment projects conducted with the Japanese wild boar and raccoon dog, the local animals of Kagoshima |
| | RP3 | 23-Jun | Susan Joan Jansen | Comparison of several enrichment types and rotational display management for four captive lion prides in Dubai Safari Park |
| | RP4 | 23-Jun | Masato Yayota | Feeding enrichment using an automatic feeder for captive Asian elephants (*Elephas maximus*) |
| | RP5 | 23-Jun | Tomoko Kanazawa | Sleeping behavior of Asian elephants (*Elephas maximus*) in the zoo |

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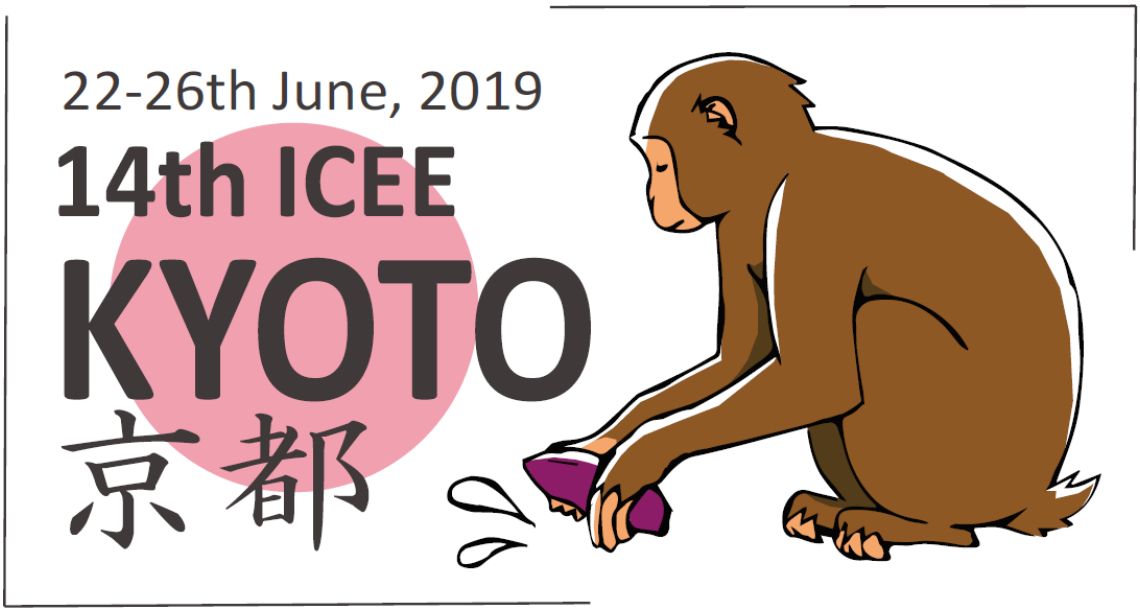
| | RP6 | 23-Jun | Keiichi Ueda | Development of score sheet for terminal care of old dolphins |
| | RP7 | 23-Jun | Kristena E Cooksey | Socioecological predictors of health profiles in western lowland gorillas |
| | RP8 | 23-Jun | Kristin Havercamp | Monitoring sleep in captive chimpanzees to enhance welfare |
| | RP9 | 23-Jun | Haruka Kasuga | Application of virtual reality to a science workshop for children at a zoo |
| | RP10 | 23-Jun | Shiori Mitsuya | Introduction of activities by SHAPE-Japan |
| | RP11 | 24-Jun | Haruka Kasuga | How domestic dogs will behave when their owner interacts with a communication robot |
| | RP12 | 24-Jun | Ayuka Sato | Attempt of environmental enrichment for the Asian elephant (*Elephas maximus*) in Yokohama Municipal Kanazawa zoo |
| | RP13 | 24-Jun | Keiichi Ueda | Efforts to improve the quality of life for self-harm dolphins |
| | RP14 | 24-Jun | Ning Han | Present animal welfare situation in Kunming Zoo |
| Special exhibitions | SE1 | 23 & 24 June | Network for Zoo Enrichment | Enrichment Award, 17years history in Japan |
| | SE2 | | Yuko Ikkatai | Ask participants: perception of animal death |
| | SE3 | | KYOTO - STEAM | The KYOTO STEAM – International Arts x Science Festival project: Art × Science IN Kyoto City Zoo What do chimpanzees feel in arts? |




# ICEE 2019 KYOTO

**Learning from the Wild:**
**Animal Welfare, Conservation**
**and Education in Harmony**

# Abstracts

## Welcome Messages

# Historic Kyoto Prompts both Reflections and Advancements in Animal Welfare

Tetsuro Matsuzawa
President, ICEE2019 Kyoto and Distinguished Professor of Kyoto University

Welcome to Kyoto and the 14th International Conference on Environmental Enrichment (ICEE2019). The conference will be held from June 22nd to 26th in the Clock Tower Centennial Hall of Kyoto University. I would like to take this opportunity for us to reflect upon the history of ICEE. It was established by Drs. Jill Mellen and David Shepherdson, with the first conference held in 1993 at the Oregon Zoo in Portland, Oregon. To date, the biannual conferences have also been held in Copenhagen, Orlando, Edinburgh, Sydney, Johannesburg, New York, Vienna, Torquay, Portland, Pretoria, Beijing, and Bogota.

ICEE2019 Kyoto is co-hosted by The Leading Graduate Program in Primatology and Wildlife Science, Kyoto University (PWS), Kyoto City Zoo, Japan Monkey Centre, SHAPE-Japan, and the International Core of Excellence for Tropical Biodiversity Conservation focusing on Large Animal Studies. Japan is home to an indigenous monkey species called the “Japanese Macaque” or “Snow Monkey”. Thanks to the unique natural environment and local abundance of these primates, Japanese primatologists began fieldwork studying wild monkeys on Koshima Island on December 3, 1948.

Based on these initial efforts, the Japan Monkey Centre was established in 1956 as both a museum and zoo of nonhuman primates. In 1957, it launched “*PRIMATES*” as the first international journal of primatology published in English. In my personal reflection, I began research with chimpanzee Ai at the Primate Research Institute of Kyoto University in 1977. In a parallel effort, I have also been studying wild chimpanzees at Bossou-Nimba in Guinea, West Africa since 1986. Based on the synthesis of this research across contexts, I believe there is much to learn from field studies conducted in natural habitats to promote environmental enrichment in terms of animal welfare.

As a unique contribution from Japan, the organizing committee of ICEE2019 adopted “Learning from the Wild: Animal Welfare, Conservation and Education in Harmony” as the conference theme. On behalf of the ICEE2019 organizing committee, I greatly appreciate your participation in this forum and hope that you enjoy the opportunity to interact with people who share similar concerns about environmental enrichment and animal welfare. We also encourage you to take time to enjoy the beautiful city of Kyoto

which has both historic and modern treasures on every street corner. Kyoto was the capital of Japan for almost 1100 years, from 794 to 1868. As such, it provides an ideal setting for us to challenge ourselves to consider the important issues at-hand from a historical perspective while also looking toward the future.

Conserv'Session

# Changing the Perception of Zoos and Animal Welfare: Screening of BBC Horizon "Should We Close Our Zoos? " and Discussion Session

Conserv'Session* (Annegret Moto Naito[1], Kenneth Keuk[2], Shenwen Xu[2], Vanessa Gris[2], Josue Samuel Alejandro Pastrana[2])

1. Wildlife Research Center, Kyoto University, 2. Primate Research Institute, Kyoto University

**Abstract:**

Many zoos around the world have transformed over the past centuries – in some cases from museums with living animals, to centers for education and conservation. But how much has the public's perception of captive animals and their welfare changed over the course of this transformation? In this workshop, we will screen a BBC Horizon film, "Should We Close Our Zoos?", and discuss relevant, and perhaps even controversial, issues in zoo science and animal welfare. We plan to divide into smaller groups to talk about topics such as, 'how should the public's perception of zoos be changed, if at all?' and 'how can zookeepers, researchers, and other experts better contribute to the public's perception of animal welfare?' To contextualize these discussion questions, a brief overview of the situation in Japan will also be provided. All conference attendees are welcome to join. This session will be facilitated by members of Conserv'Session, a student group of Kyoto University's Leading Graduate Program in Primatology and Wildlife Science aiming to raise awareness about animal welfare and conservation issues.

## Symposium

### 23rd June 2019

**Symposium 1**
**Elephant Welfare: Perspectives from Different Cultural and Working Backgrounds**
from S-1 to S-5

**Symposium 2**
**Cognitive Tasks in Captivity: Studying Primate Cognition and Serving as Enrichment**
from S-6 to S-10

**Symposium 3**
**Welfare of Industrial Animals**
from S-11 to S-13

### 24th June 2019

**Symposium 4**
**Great Apes in the Wild and Captivity**
from S-14 to S-16

**Symposium 5**
**Genome Symposium**
from S-17 to S-21

**Symposium 6**
**Ex-Situ Conservation of Endangered Animal Species and the Role of Zoos for Future Re-Introduction**
from S-22 to S-27

**Symposium 7**
**Equinology and Equine Animal Welfare**
from S-28 to S-33

## Symposium 1

# Elephant Welfare: Perspectives from Different Cultural and Working Backgrounds

Elephants are one of the most charismatic and endangered megafauna species. Recently, wild elephant conservation and captive elephant welfare has received much media attention. There is now increasing debate about whether elephants should be kept in captivity at all. Historically, captive elephants have formed a symbolic and integral part of cultural ceremonies, as well as tourism, in a number of Asian countries. Although captive animal populations contribute towards ex-situ conservation, species like elephants require large home ranges and need complex social interactions. Some zoos have attempted to build larger enclosures and implement various kinds of environmental enrichment. However, for most zoos maintaining elephants is very cost-intensive. This has become a big concern within the Japanese zoo community and Japanese animal welfare organizations. Therefore, in this session we will bring in various experts studying elephants in both the wild and captivity to formulate better welfare practices and discuss the future of captive elephants in Japan and other countries.

## S-1
## The Four Pillars of Captive Elephant Welfare in Asia

Raman Sukumar
Indian Institute of Science

**Abstract:**
The elephant is believed to have been tamed in Asia at least 4600 years ago by the Harappan culture. Captive elephants played a pivotal role in the rise and fall of Asian civilizations. Perhaps over a million elephants have been captured and used by humans over the centuries. With our contemporary understanding of the sentient nature of this animal, the need to ensure the welfare of the 15,000 or more captive elephants has become imperative. With the escalation of elephant-human conflicts in many regions of Asia it has become imperative to capture a limited number of elephants to mitigate conflicts. This management imperative is bringing into sharp public focus the need to considerably improve the welfare standards for elephants in captivity. In this talk I would argue that the four pillars on which we have to develop the framework for elephant welfare are setting standards for (i) the methods for the capture of elephants from the wild, (ii) humane training of elephants using positive reinforcement or other methods suited to a particular context, (iii) elephant husbandry including nutrition and health care under different conditions such as zoos, temples and forest camps, and (iv) acceptable use of captive elephants. I would argue that the forest camps present the best conditions for the welfare of captive elephants, and that other facilities should learn from such conditions for the enrichment of the lives of elephants under their care.

## S-2
## Elephant Enrichment and Welfare

David Shepherdson
Oregon Zoo

**Abstract:**
Enrichment has become a primary tool for addressing welfare issues in a wide variety of species kept in zoos. Research clearly demonstrates the benefits of enrichment for zoo animal welfare. The principles of enrichment are simple, learn from the natural behavior and ecology of the species and apply this knowledge to the zoo environment. This is more challenging for some species than others clearly and elephants pose some of the bigger challenges due to their huge size, intelligence, and complex social behavior. However recent research provides encouraging evidence that activity based exhibit designs and husbandry protocols applying the well-known concepts of enrichment do result in improved welfare for elephants in zoos. As with other zoo animal species, a better understanding of keeper animal relationships and technologies and protocols for continuous monitoring of behavior and other welfare indicators will pay dividends in the future.

## S-3
# Update on Elephants Welfare at JAZA Member Institutions

Etsuo Narushima
Japanese Association of Zoos and Aquariums

**Abstract:**
The Japanese Association of Zoos and Aquariums (JAZA) comprises 91 zoo members and 58 aquarium members. The member institutions collaborate on conservation issues, zoo/aquarium animal welfare issues, and environmental education issues.

Eighty-three Asian elephants (♂21, ♀62) are kept at 32 JAZA zoos and 31 African bush elephants (♂6, ♀25) are kept at 15 JAZA zoos. The JAZA conservation committee has compiled a care manual for elephants and is now preparing standards for elephant facilities. The draft will be completed in fall 2019.

Elephants live in groups and establish a highly social community. Therefore, for their welfare, they should be cared for and housed in a meaningful group context.

However, there are 15 singly-housed elephants at JAZA member institutions. Of these, 10 are Asian elephants, 5 are African bush elephant.

We are committed to improving the welfare of elephants by integrating singly-housed elephants into a group structure where possible. However, this is a challenge as some elephants have lived alone for a long time and may refuse contact with new elephants.

This is not a simple problem that can be solved by the efforts of individual institutions. Thus, JAZA aims to improve singly-housed elephant's welfare by integrating these solitary elephants into group living, improving the environmental quality, providing extensive environmental enrichment programs, and offering choices, control, and environmental complexity under the leadership of the elephants sub-committee of the JAZA Safety Measures committee.

## S-4

# Introduction of New Elephants to a Former Solitary Captive Elephant: The Process of Forming Social Relationships

Hiroki Yoneda[1], Mitsunori Nagao[1], Kyoko Kuroda[1*], Kanae Shimada[1], Yusuke Aramaki[1], Ryota Seo[1], Yoko Sakuraba[1, 2], Yumi Yamanashi[1, 2], Masayuki Tanaka[1, 2]

1. Kyoto City Zoo, 2. Wildlife Research Center, Kyoto University

**Abstract:**

Elephants are highly social animals and group living is important for their welfare. To provide a singly-housed captive elephant with the opportunity to live in social environment, group formation was attempted at the Kyoto City Zoo. In 2014, the Kyoto City Zoo accepted four juvenile elephants from Lao P.D.R and established a new Asian elephant enclosure. We introduced these four juvenile elephants to a female elephant named Mito (born in 1971) who had been living alone in captivity for more than 10 years. After the elephants habituated to the new enclosure in 2016, we set up four stages for group acclimation. The first stage was habituation over fences in their indoor compartments. The second stage was habituations over electric fences in their outdoor compartments. In the third stage, we removed the electric wires between the enclosures and allowed the elephants to make direct contact over the fence. After we observed affiliative behaviors over the fence, we proceeded with the fourth stage of acclimation: allowing the elephants to be in the same compartment. The fourth stage started on January 29, 2018 with 30 min trials. We gradually expanded the duration and frequency of the trials. On the first day of the fourth stage, when the four young elephants first entered the compartment, Mito chased, pushed, and attacked them. However, a relationship was gradually established. In this presentation, we will introduce the acclimation process and discuss future perspectives on elephant management in our zoo.

## S-5

# Effects of Environmental Enrichment on the Behavior of a Female Borneo Elephant (*Elephas maximus borneensis*) with Tuberculosis in Fukuyama Zoo, Japan

Shintaro Hagiwara
Fukuyama City Zoo

**Abstract:**
In 2016, it was confirmed that a female Borneo elephant (*Elephas maximus borneensis*) at Fukuyama Zoo was infected with tuberculosis (TB). We recorded the behavioral repertoire specific to this disease to enable early detection in the future parallel with anti-TB medication. During the onset of TB, weakness in the trunk, waving of the head up and down with the trunk held up to the mouth, wide opening of the mouth and standing, and coughing were observed. These symptoms improved with continuous medication.

We then developed feeders and enrichment devices using fire hoses, bamboo, and scrap materials such as tires to improve quality of life of the elephant and prevent further decline in immunity. Behavior was evaluated using instantaneous sampling at 1-minute intervals. Compared with behavior with tire-only enrichment several years earlier, feeding and feeder-use increased and stereotyped behavior decreased with the introduction of multiple enrichment devices. We raised approximately 7.5 million yen from 931 people by crowdfunding to purchase TB test kits and develop a large feeder. Given that there are no companies in Japan that produce large-scale enrichment devices, we asked a contractor that produces large play equipment for humans to develop the feeder. We made a prototype and improved it based on behavioral data. We are now examining the effects of this large feeder on behavior. We hope that these new efforts will improve elephant husbandry techniques in Japan.

## Symposium 2

# Cognitive Tasks in Captivity: Studying Primate Cognition and Serving as Enrichment

The objective of this symposium is to connect cognitive studies in animals, especially primates, with enrichment efforts for these animals in captivity. Primates have high level of intelligence in various aspects. Cognitive enrichment is important for their well-being. In order to understand the cognitive abilities of animals, it is necessary to conduct cognitive tasks in captive animals. Those tasks also serve as an enrichment for the animals at the same time. In this symposium, four speakers will present their scientific findings in various fields through cognitive tasks in different primate species of different facilities: touch panel exhibition with orangutans in Indianapolis Zoo, touch panel training in Japanese macaques in Japan Monkey Centre, preferences to infants, response to others' injury, and body perception in great apes in research facilities of Kyoto University. They will present how the cognitive tasks serve as enrichment directly (at the zoo) and indirectly (at research facilities). Additional information about environment enrichment will be provided to show the living conditions of animals participated in cognitive studies. We hope both the contents of the scientific research and how it serves as enrichment at the same time will help people working with these animals and relevant researchers understand their cognition, as well as inspire the audience with new ideas to provide enrichment for the animals.

## S-6
# Gorilla Game Lab: Developing High-Tech Cognitive Enrichment for Zoo-Housed Gorillas

Fay E Clark[1*], Peter Bennett[2], Stuart I. Gray[2] & Katy V. Burgess[3]

1. Department of Field Conservation & Science, Bristol Zoological Society c/o Bristol Zoo Gardens, 2. Department of Computer Science, University of Bristol, 3. Department of Psychological Science, University of Bristol

**Abstract:**

Cognitive enrichment is rapidly gaining popularity within zoos; recent attempts have either involved the creation of non-computerized maze puzzles, or computer touchscreen systems. The middle ground, where computer technology is incorporated within physically complex and tactile puzzles, has not been pursued until now. The Gorilla Game Lab (GGL) project is brings together zoo animal welfare science at Bristol Zoo Gardens, with computer science, engineering and psychology at the University of Bristol (UK). Most importantly, it places the troop of Western lowland gorillas (*Gorilla gorilla gorilla*) at Bristol Zoo Gardens at the center of the design process, creating a bespoke product and technologies to suit their cognitive skills and motivations, while considering the needs of animal care staff, visitors and researchers as secondary.

In the first year of the GGL project, we designed, produced and evaluated the first GGL device. This was a highly tactile wooden and acrylic plastic finger maze, made from over 20 cubic modules which could be arranged within a grid to create thousands of novel arrays. Technology was used inconspicuously; we placed hidden loggers into the back of the device to automatically log how the gorillas used it, which supersedes the traditional approach of observing animal behaviour live or recording on cameras.

Through an iterative design process, the GGL device was provided three times as a prototype (with parts of the design changing), and a further three times as a final product. In this presentation, we discuss how this collaborative project took place, from our initial brainstorming sessions to the product evaluation stage. We provide evidence for the GGL device being a form of cognitive enrichment, and discuss our future plans for the GGL project. We end with suggestions for other zoos wishing to pursue cognitive enrichment, with low-tech and high-tech options.

## S-7

# Primate Touch-Panel Tasks for Research and Enrichment at Zoos: Hardware, Software, and Training Methods

Christopher Flynn Martin[1*], Akiho Muramatsu[2], Robert W Shumaker[1], Tetsuro Matsuzawa[2]

1. Indianapolis Zoo, 2. Institute for Advanced Studies, Kyoto University

**Abstract:**

Touch-panel tasks designed for primates at zoos can deliver broad opportunities for scientific research, animal enrichment, and visitor education. Despite such benefits, the use of touch-panels by zoo animals is relatively uncommon, and zoo administrators and workers are largely unfamiliar with the long history and benefits of touch-panel tasks being given to primates for voluntary/noninvasive research and enrichment purposes in university settings. To catalyze interest and facilitate the adoption of the paradigm among zoos, an effort was made to create a novel portable touch-panel apparatus, a software suite of cognitive and wellness tasks, and a methodology for training primates to use the new technology. At the Indianapolis zoo, the new apparatus and software have been integrated into a wider effort to use technology with orangutans. At the Japan Monkey Centre, they were used to train ten species of macaques to do touch-panel tasks as part of a comparative research project. In both cases the hardware, software, and training methodology comprised a cohesive approach to increasing enrichment and cognitive research opportunities with zoo-housed primates.

## S-8

# Great Apes' Psycho-Physiological Response toward Others' Injury and Pain: A Thermal Imaging Study

Yutaro Sato[1*], Fumihiro Kano[2], Satoshi Hirata[1]

1. Wildlife Research Center, Kyoto University, 2. Institute for Advanced Study, Kyoto University

**Abstract:**

Previous studies have shown that humans experience negative emotions (i.e., empathic pain) when seeing contextual cues of others' pain such as injury, even without observing behavioral expressions of distress. We investigated psycho-physiological reactions to others' injury and pain in two species of great apes: six chimpanzees (*Pan troglodytes*) and six bonobos (*Pan paniscus*). Specifically, we used infrared thermal imaging to measure their nasal skin temperature when they were viewing a real-life theatrical demonstration by a human experimenter. Previous studies suggest that reduced nasal skin temperature is a characteristic of arousal, particularly arousal associated with negative valence. First, we presented apes with a realistic injury: a familiar human experimenter with a prosthetic wound and artificial running blood. Chimpanzees, especially adult females, exhibited a greater nasal temperature reduction in response to injury compared with the control stimulus, whereas such a clear difference was not observed in bonobos. Second, apes were presented with a familiar experimenter who stabbed their (fake) thumb with a needle, with no running blood, a situation that may be more challenging in terms of understanding the cause of pain. Apes did not physiologically distinguish this condition from the control condition. These results suggest that apes can infer the cause of pain from contextual cues, but have difficulty understanding situations without explicit cues. Moreover, we found potential inter- and intra-specific differences in the physiological response, implying that several factors, such as a history of direct experience or social bonding with the injured individual, can modify the phenomenon.

## S-9
# Chimpanzees, but not Bonobos, Attend More to Infant than Adult Conspecifics

Yuri Kawaguchi[1*], Fumihiro Kano[2], Masaki Tomonaga[1]
1. Primate Research Institute, Kyoto University, 2. Kumamoto Sanctuary, Kyoto University

**Abstract:**
Primate infants have several physical features that distinguish them from adults in appearance, including the well-known "baby schema", for example, a relatively large head and eyes, and a small nose and mouth. Humans typically prefer infants of both conspecifics and allospecifics with strong baby schema. In nonhuman primates, infants of some (e.g. chimpanzees) but not all species (e.g. bonobos) have species-specific infantile colouration besides species-common infantile features. This study examined whether closely-related chimpanzees (*Pan troglodytes*) and bonobos (*Pan paniscus*) have a preference for infants, and if so, whether they are attracted to species-common features, or species-specific features. We used eye-tracking to measure eye movements while participants viewed naturalistic images of a mother-infant pair. We adopted a cross-species design so that both species viewed images of chimpanzees, bonobos, and Japanese macaques. We found that chimpanzees viewed the faces of infants for longer than those of adults when presented with conspecific images, but not when presented with allospecific images. Chimpanzees also did not show any preference in a follow-up experiment in which facial colouration was matched between conspecific infants and adults. Chimpanzees thus seem to respond particularly to the special infantile colouration of conspecifics. Bonobos clearly differed from chimpanzees in that they did not view conspecific infants for longer than adults and, interestingly, viewed allospecific adults for longer than infants. These observed species differences may be related to the two species' species-typical social and rearing styles. We found no evidence that chimpanzees and bonobos were attracted to the species-common infantile features.

## S-10

# How Chimpanzees Perceive Other Species: Embodied and Visual Expertise

Jie Gao[1, 2*], Masaki Tomonaga[1]

1. Primate Research Institute, Kyoto University, 2. Research Fellow of Japan Society for the Promotion of Science

**Abstract:**

Bodies are important social cues for animals. Recognizing conspecifics and other species is vital for animals to live. Previous research has found that chimpanzees are better at recognizing conspecifics' bodies when they are upright compared to when they are inverted, and that they do not show this inversion effect to other objects. It suggests that chimpanzees use a special way (the configural processing) to process bodies of conspecifics, compared to other objects. This study aims to examine whether chimpanzees show the same special way to bodies of other species, and what clues they use if they do so. We tested chimpanzees using matching-to-sample tasks on touch screens with different kinds of bodies of other species, and examined their recognition for upright stimuli and inverted stimuli respectively for comparison. Among the stimuli, chimpanzees have visual expertise (experience), to bipedal humans showing familiar postures, and no visual expertise to bipedal humans showing unfamiliar postures, crawling humans, and horses; they share the embodied expertise, i.e. quadrupedal postures, with crawling humans and horses, but not with all the bipedal human stimuli. They showed the inversion effect to crawling humans and horses, suggesting that they use embodied experience when processing other species. They also showed the inversion effect to bipedal humans showing familiar postures but not to those with unfamiliar postures, suggesting that they use visual experience in processing other species. In summary, we found that chimpanzees do use specific processing to other species, and it is based on both embodied and visual expertise.

## Symposium 3

# Welfare of Farm Animals

The importance of farm animal welfare has spread throughout the world. In this symposium, we introduce the welfare of farm animals and also show our research trials using recent technologies for automatically sensing their activity and physical condition. Since these technologies can be applied to other animals, we hope that our introduction will contribute to a better understanding and management of wild and zoo animals.

## S-11
## Toward Animal Computer Interaction

Tsuyoshi Shimmura
Department of Biological Production, Tokyo University of Agriculture and Technology

**Abstract:**
The importance of farm animal welfare has spread throughout the world, with animal-based measurements used to understand their condition. Recent advances in technology, e.g. artificial intelligence (AI) and internet of things (IoT), are being introduced into farm animal management. Some of technologies for automatically sensing the activity and physical condition of farm animals has already been developed and introduced at the farm level, which has led to better management for both animals and managers. In this symposium, I introduce our trials for automatically sensing the behavior of chickens using information engineering. I also outline a study on an animal computer interaction (ACI) system (Shimmura et al. *Nature Communications* 2017) and then introduce the study for regulating the behavior of chicks using bird-specific imprinting behavior and mother chicken-modified robotics. Since these technologies can be applied to other animals, I hope that our introduction will contribute to a better understanding and management of wild and zoo animals.

## S-12
# Environmental Enrichment for Self-Grooming in Farm and Zoo Animals

Shigeru Ninomiya[1*], Nana Kojima[1, 2], Kie Higashi[1], Miyu Fujimura[1], Yumi Yamanashi[3, 4], Ayumi Kawamura[3], Hiroki Fukuizumi[3]

1. Faculty of Applied Biological Sciences, Gifu University, 2. The Graduate School of Natural Science and Technology, Gifu University, 3. Kyoto City Zoo, 4. Wildlife Research Center, Kyoto University

**Abstract:**

In an artificial environment, animals are sometimes restricted to expressing normal behaviour. Which type of behaviour we try to stimulate is an important issue when using environmental enrichment. In this presentation, I will discuss about the relationship between animal welfare and normal behaviours. When are animals' behavioural needs generated? Which factors induce them? I will also introduce our studies using environmental enrichment for fattening cattle, which assessed the relationship between self-grooming and a bedding management at Minokamo Farm of Gifu University, and for giraffe which investigated using self-grooming devices in them at Kyoto City Zoo. Our studies aimed to clarify whether installing such enrichment devices stimulate self-grooming behaviour and improve welfare.

## S-13

# Recent Advancement in Wearable Sensing Technologies for Cattle Health Management, Particularly of Body Surface Temperature Sensing

Shogo Higaki*, Koji Yoshioka
National Institute of Animal Health, National Agriculture and Food Research Organization

**Abstract:**
Recently, several dozens of wearable sensors for cattle health management are available. However, although some invasive wearable sensors (such as lumen and vaginal boluses) have been available for monitoring physiological changes, most of the non-invasive wearable sensors (such as neck/leg mounted accelerometers) focus only on behavioral changes. Due to the importance of physiological monitoring for identifying animal health status, we developed a new non-invasive body surface temperature sensor, which is attached to the ventral tail base, and determined whether the sensor could be used to detect estrus and predict calving time. During the estrous cycle, residual temperatures (RT = actual surface temperature − mean surface temperature for the same hour on the previous 3 days) increased sharply during 24 h and 48 h before ovulation which was associated with luteinizing hormone surge within estrus. When setting the appropriate threshold, estruses were detected at a sensitivity of 78% and a precision of 70%. On the other hand, there was a continual decrease in RT from approximately 36 h before calving. With the appropriate threshold, calving time can be predicted within 24 h before calving at a sensitivity of 89% and a precision of 71% during warm season, and a sensitivity of 80% and a precision of 65% during cool season. These results indicate that body surface temperature of ventral tail base could be monitored continuously and this technique would be useful for automatic estrous detection and calving time prediction. This study was supported by a grant from BRAIN, NARO (ai01).

## Symposium 4

# Great Apes in the Wild and Captivity

## S-14

# A Multifaceted Approach to Providing Opportunities for Chimpanzees to Thrive in Captive Settings

Stephen R. Ross
Lester E. Fisher Center for the Study and Conservation of Apes, Lincoln Park Zoo

**Abstract:**
Free-ranging wild chimpanzees live in diverse and complex physical environments and navigate dynamic and challenging social environments. Such complexity is likely impossible to replicate in captive settings, but decades of behavioral and cognitive research can help guide managers to reproduce the important functionality that allows chimpanzees to thrive. In this presentation, I will review the wide range of studies that inform progressive chimpanzee management and describe the opportunities and challenges to implementing them. Specifically, I will describe the work conducted as part of the Lester Fisher Center for the Study and Conservation of apes. Here, we have the unique opportunity to (a) conduct behavioral and cognitive research at the zoo that helps validate effective means to enriching chimpanzees, (b) partner with the Goualougo Triangle Ape Project to protect imperiled wild populations and ecosystems that help inspire the functional naturalism approach we implement, and (c) leverage such research to improve the daily lives of chimpanzees not only at the zoo, but also those living in other captive environments.

## S-15
# Studying Chimpanzees and Gorillas across Contexts to Enhance Welfare and Conservation

Crickette Sanz[1, 2*], Heidi Hellmuth[3], Jake Funkhouser[1], Stephen Ross[4], David Morgan[4]
1. Department of Anthropology, Washington University, 2. Congo Program, Wildlife Conservation Society, 3. Saint Louis Zoo, 4. Lincoln Park Zoo

**Abstract:**
Understanding a species' natural behaviors has long-been held as relevant to discussions of captive animal welfare, however less emphasis has been placed on benefits to the conservation of wild populations from advancements in the management of apes in zoos, sanctuaries, and research centers. Based on our collective experience of working with apes in field and captive contexts, we synthesize research findings from wild populations to guide behavior-based enrichment programs. We also present information originating from captive settings which has improved our knowledge of these species in the wild. In addition to providing an overview of the overall activity patterns of sympatric central chimpanzees (*Pan troglodytes troglodytes*) and western lowland gorillas (*Gorilla gorilla gorilla*) in the Congo Basin which are the main foci of our in situ research efforts, we expand the spectrum of species-typical behaviors by collating our observations of microhabitat use, foraging behaviors, object manipulation, and complex social behaviors. We also discuss the paired implementation of observational research methods and remote video surveillance in both wild and captive contexts. The results of which can be used in captive settings to empirically document particular indicators of wellbeing and objectively evaluate behavior-driven enrichment, as well as inform ex situ management and assess the impacts of disturbance in wild populations. Finally, we emphasize the importance of such partnerships to enhance captive and wild animal welfare while ensuring the long-term conservation of these endangered great apes and their remaining wild habitats.

## S-16
# What the Study of Ape Gesture Can Tell Us about Ape Minds

Catherine Hobaiter
School of Psychology and Neuroscience, University of St Andrews

**Abstract:**
All great apes, including humans, employ a rich repertoire of vocalizations, facial expressions, and gestures to communicate. Great ape gestural repertoires are particularly elaborate, and they represent the only *system* of communication outside human language in which there is widespread evidence of intentional use: that is, use towards a recipient and with a specific goal in mind. As a result, gesture offers us a means to explore ape cognition: we can use gesture as a window on to the ape mind. Ape communication, like other behavior, is adapted to the socio-ecological niche in which it evolved. Across different environments there are fundamental differences in who apes communicate with, in what they have to communicate about, and in what information they have available or need to acquire. I will explore what ape gesture can tell us about ape cognition. I will argue that to understand ape cognition, we must 1) employ a ape-centric approach, which centers ape behavior in comparative questions, and 2) study apes across a diverse range of socio-ecological environments.

## Symposium 5

# Genome Symposium

## S-17
# Management of Captive and Wild Koala Populations – Lessons and Applications from the Koala Genome

Rebecca N Johnson[1, 2*] and colleagues from the Koala Genome Consortium
1. Australian Museum Research Institute, Australian Museum, 2. Wildlife Research Center, Kyoto University

**Abstract:**
Koalas are both biologically unique and evolutionarily distinct as the only living representative of the marsupial family *Phascolarctidae*. Wild koalas are increasingly vulnerable to the detrimental effects of population bottlenecks, disease, the loss of genetic diversity and climate change as increased urbanisation reduces and changes their native habitat. As a result, koala populations are expected to decline across Australia by up to 50% over the next three generations (approx. 20 years) in the regions with the most genetically diverse animals but by contrast culling measures are likely in the southern parts of the distribution due to overcrowding and starvation, thus significant conservation intervention measures will be required.

Koalas are also one of the most desirable species held in captivity by zoos and conservation parks with many of these facilities running captive breeding programs. Understanding genetic diversity and the underlying genomic basis of life history characteristics of captive populations is important at both the individual and species level.

In this presentation I will present an overview of the work of the Koala Genome Consortium, established in 2013 with the aim of ensuring the long-term survival of this important marsupial by understanding it at the genomic level. This information has since been used for management of wild and captive koala populations. These results will be discussed.

## S-18
## Feeding Behaviors of Animals and Sense of Taste

Hiroo Imai
Primate Research Institute, Kyoto University

**Abstract:**
Feeding is most basic and prerequisite behavior of animals. It is necessary to fit the animals' nutritional and sensational requirements. How we can know the sense of taste? Recently, we developed the system for elucidating the animals' sense of taste by combinations of in vitro functional assays and in vivo behavioral observations.

We use the gene of taste receptors of animals for expression of the taste receptor protein in cultured cells. After the expression, the function of the receptors were investigated by Calcium imaging assay, which visualize the increase the Calcium signal in the cells after the stimulation by various types food items. For example, sugars increase the signal by sweet taste receptors (TAS1Rs) while bitter compounds increase the signal by bitter taste receptors (TAS2Rs).

So far, we characterized the sweet taste receptors of macaques and colobines, and found they are different from human. Macaques show increased response in some sugars, while colobines showed no response, and which is confirmed by behavior. For bitter compounds, each species (chimpanzees, macaques, colobines, and lemurs) and individuals show different sense of tastes. These basic knowledge may be referenced in the feeding in zoos and institutions as a part of enrichments.

## S-19
# Understanding Genetic Background of Personality for Stress Management in Captivity

Miho Inoue-Murayama
Wildlife Research Center, Kyoto University

**Abstract:**
It is true that every human is unique not only in their appearance but also in personality, and both the environment and our genotype greatly affect human personality. Is it also true in other animals? Since it is known that some personality traits are related with stress and physical condition in humans, the genotype of personality-related gene can be a marker to estimate individual personality, and to provide information for stress management for better reproduction, health and longevity of captive animals. The candidate genes are linked to signal transduction of neurotransmitters or hormones. We surveyed the polymorphism of candidate genes in non-human primates and the relationship of genotype and personality. In chimpanzees the sequence of gene-expression regulation sites of the dopamine transporter and monoamine oxidase were different from those of humans. The regions were cloned and connected with the reporter gene and transfected into cells. The results suggested that cellular expression of the dopamine transporter was higher in chimpanzees than in humans indicating that monoamines re-uptake was fast and thus the length of the signal was short. For oxidase, the expression of the gene in chimpanzees was low indicating that degradation was not efficient and therefore that the signal was strong. In summary, compared to humans, in chimpanzees the signal is estimated to be shorter and stronger. Accumulation of these differences might cause species differences in brain function.

## S-20

# Enriching the Gut Microbiome May Provide More Benefits than Enriching the Animal

Francis Cabana[1, 2*], Jonathan B. Clayton[2, 3], Wei Wei Thwee[4], Henning Seedorf[5]

1. Wildlife Nutrition Centre, Wildlife Reserves Singapore, 2. Primate Microbiome Project, 3. Department of Computer Science and Engineering, University of Minnesota, 4. Department of Microbiology and Immunology, Yong Loo Lin School of Medicine, National University Singapore, 5. Temasek Life Sciences Laboratory, 1 Research Link

**Abstract:**

The gut microbiome (community of microbes in their intestines) of primates very significantly between individuals in the wild and those under human care. This disparity may be due to social grouping, environment and to a large extent, the food they eat. Diets in the wild are generally more diverse and contain a higher concentration of fibre fractions and lower concentrations of soluble carbohydrates when compared to typical diets of primates under human care. This has significant health impacts because unbalanced microbiomes have been linked with a long list of diseases. With so much effort put into primate enrichment programs and devices, we seem to have forgotten to enrich their microbiome. Here, we will present two case studies where wild animals have informed us how to feed our animals under human care to enrich their microbiomes, improving health, welfare and expression of natural behaviours. Feeding a natural diet of insects and tree gum to Javan slow lorises (Nycticebus javanicus) decreased potential pathogens and increased short-chain fatty acid producing microbes. This led to better weight retention, normal faeces, reduction of stereotypic behaviours and an increase in feeding, foraging and locomotive behaviours. Colobine primates also had significantly different gut microbiomes after their diet was changed to more closely reflect those of wild congeners. The microbiome profile also shifted more towards wild type, although was not able to reach identical gut microbe communities. Faecal cytokine analysis resulted in significant reductions of pro-inflammatory cytokines after the diet change. The resulting microbiome was much more protective and reduced inflammation of the intestinal tract which also reduced the risk of chronic subclinical health issues. Enriching the microbiome is every bit as important as enriching the primate itself.

## S-21

# Gum Feeding Induces Short-Term Gut Microbiome Change in Captive Slow Loris

Takashi Hayakawa[1, 2*]

1. Faculty of Environmental Earth Science, Hokkaido University, 2. Japan Monkey Centre

**Abstract:**

Lessor slow loris (*Nycticebus pygmaeus*) mainly relies on plant gum as diet. However, it is not popular to feed plant gum for slow loris in captive conditions such as zoos. In this study, we fed plant gum continuously for two male, adult lesser slow lorises reared in Japan Monkey Centre, which had been rarely provided plant gum. We analyzed the effect of change in their gut microbiota from the viewpoint of animal welfare and feeding enrichment. Plant gum is composed of low degradable polysaccharide. Slow lorises may depend on gut microbiota for digestion of plant gum. We collected their feces before and after feeding gum arabic for one month, respectively. We massively sequenced the V1-V2 region of the bacterial 16S rRNA using Illumina Miseq. Sequenced data is analyzed by Clident, Qiime and R platforms. We found that the microbiome structure is quite changed drastically after two days from starting feeding gum, which is the same as their detention time. Especially, the most drastic changed happened in the bacterial family Prevotellaceae. Some taxa had decreased or complementarily increased and some had vanished. These results will contribute to understanding slow loris ecology and performing animal welfare and feeding enrichment.

## Symposium 6

# Ex-Situ Conservation of Endangered Animal Species and the Role of Zoos for Future Re-Introduction

Role of zoos has changed from "simple exhibition of exotic wildlife to the city residents" to the "education of the ecosystems of biosphere". Conservation of endangered species becomes a great issue of aim of zoological gardens.

"Conservation of the endangered species" should involve not only the saving the animal species, but also saving their original living environment. These efforts are defined as in-situ conservation. Then what is the role of zoos in the ex-situ conservation?

"Conservation of endangered species in zoos" is still limited, in most of the case, to "the conservation of genetic resources", in which captive animals are regarded as container of their genomes. We need to define the role of zoo in ex-situ conservation in connection with in-situ conservation, otherwise "Conservation of endangered species in zoos" and "Enrichment" may be regarded as a poor excuse to the criticism from those who have doubts about zoo ethics.

Preparation for re-introduction of endangered species should be stated more clearly as the potential role of zoos. The current efforts on "Conservation of endangered species in zoos" and "Enrichment" should be oriented more towards re-introduction, by which these efforts in zoos have significance for the in-situ conservation of endangered species.

# S-22
# Ex-Situ Conservation of Endangered Animal Species and the Role of Zoos for Future Re-Introduction

Kazunari Ushida
Academy of Emerging Sciences, Chubu University

**Abstract:**
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"Conservation of the endangered species" should involve not only the saving the animal species, but also saving their original living environment. These efforts are defined as in-situ conservation. Then what is the role of zoos in the ex-situ conservation?

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Preparation for re-introduction of endangered species should be stated more clearly as the potential role of zoos. The current efforts on "Conservation of endangered species in zoos" and "Enrichment" should be oriented more towards re-introduction, by which these efforts in zoos have significance for the in-situ conservation of endangered species.

## S-23
# How Nutrition, Diets and Food Presentation Taken from the Wild Can be Fuel for Positive Welfare

Francis Cabana[1, 2*]
1. Wildlife Nutrition Centre, Wildlife Reserves Singapore, 2. Primate Microbiome Project

**Abstract:**
In the pursuit of maximal welfare for animals under captive care, nutrition (the food that is fed to animals) and enrichment (techniques and devices used to encourage natural behaviour) are powerful tools that are often separately utilized. However, integrating the two by focusing not only on what is fed but also on how its fed holds much potential for fueling both positive mental and physical welfare. In this talk, I use a suite of case studies to demonstrate how the mimicking of animals' wild feeding behaviours can vastly improve animal husbandry outcomes. Carnivores, for example, often perform pacing behaviours, which are generally taken as an indication of existing or past negative welfare. However, given differences in feeding method for large versus small cats, could this assumption perhaps be inaccurate in either one of those feline groups? In primates in particular, how foods are fed go a long way in dictating their behavioural repertoire: while animal care staff often cut food into small pieces and scatter feed it, in the wild these animals would often have to negotiate with large and often hard pieces of food, a necessity which may drive a range of behaviours not often witnessed in captivity. Such in-field observations of animals as they feed can also serve as a valuable source of information when it comes to creating diets that improve welfare. Observations can bring to light large discrepancies between wild and commercial diets caused by inappropriate nutrient provision, with the gum-feeding behaviour of slow lorises (*Nycticebus spp.*) standing out as a particularly good example. In the final section of my talk, I will make the link between animal nutrition, visibility when on exhibit, and guest satisfaction. This direct link will highlight just how powerful of a tool animal nutrition can be in the care and exhibition of captive animals.

## S-24

# Ex-Situ Conservation Protocol of Japanese Rock Ptarmigans Based on Their Natural Intestinal Environment

Sayaka Tsuchida[1*], Atsushi Kobayashi[2], Koichi Murata[3], Hiroshi Nakanura[4], Kazunari Ushida[1]

1. Academy of Emerging Sciences, Chubu University, 2. Faculty of Science, Toho University, 3. Faculty of Bioresource Sciences, Nihon University, 4. General Foundation Hiroshi Nakamura International Institute for Ornithology

**Abstract:**

The Japanese rock ptarmigan (*Lagopus muta japonica*) is a natural monument of Japan. This bird has been designated as a national endangered species due to their recent sharp decline in population size. Both *in-situ* and *ex-situ* conservation programs are ongoing. Activities such as collection of eggs from their nests and artificially raising the chicks have been done. But there are still many problems to be overcome for their future re-introduction back to the wild. Of major concern is the loss of wild type beneficial bacteria under captivity conditions which suggests a hindrance of introduction back to their natural habitat. We isolated indigenous bacteria of rock ptarmigans and identified their functionality in order to use them as probiotics for the artificially raised chicks. In addition, careful observations done by us on the wild rock ptarmigans revealed how these essential bacteria are transferred from mothers to chicks.

We therefore seek to develop the reconstruction of wild type intestinal microflora in captive rock ptarmigans as an attempt to prepare our future re-introduction protocol. This research was supported by the Environment Research and Technology Development Fund (4-1608) of the Ministry of the Environment, Japan.

## S-25

# Ex-Situ Conservation of the Tsushima Leopard Cat by the Cooperation with JAZA and MOE

Mitsunori Nagao
Kyoto City Zoo

The Tsushima leopard cat (*Prionailurus bengalensis euptilura)* is a subspecies of the Mainland leopard cat *(Prionailurus bengalensis)* and only lives in the Tsushima Island in Nagasaki Prefecture. It is thought to have come from the Eurasian continent about 100,000 years ago. The number of Tsushima leopard cats is decreasing (the estimated number of individuals is 70-100) because of habitat destruction. Ministry of the Environment (MOE) designated the Tsushima leopard cat as Endangered Species of Wild Fauna and Flora (Endangered IA CR) in1994, formulated a conservation and breeding project plan in 1995, and set up reintroduction of captive individuals to their original habitat as one of the goals. At zoo facilities throughout Japan, the Fukuoka City Zoo introduced a founder individual from the habitat in 1996, started a conservation and breeding project outside the habitat, and succeeded in the first captive breeding in 2000. In May-2014, Japanese Association of Zoos and Aquariums (JAZA) and MOE signed Agreement on Promotion of Biodiversity Conservation. The activities based on the agreement are expected to bridge the wild and captive population management. As of March 31, 2019, 34 individuals are kept in 8 facilities. The breeding season of Tsushima leopard cats is once a year (January to April). 5 facilities are trying to breed them naturally (4 facilities) or artificially (1 facilities). Artificial breeding has been succeeded in the closely-related species, Amur Leopard Cat, but not yet in Tsushima leopard cat. We have not obtained the expected result yet because the captive population is aging and the number of breeding success remains restrained. In this presentation, I will report on the current status and future of this project.

## S-26
## Ex-Situ Conservation of Okinawa Rail (*Hypotaenidia okinawae*)

Takashi Nagamine[1*], Yumiko Nakaya[1], Manabu Onuma[2], Shoko Tamanaha[1], Shinichiro Mukai[1], Michio Kinjo[1], Kiyoaki Ozaki[3]

1. Okinawa Wildlife Federation, 2. National Institute for Environmental Studies, 3. Yamashina Institute for Ornithology

The Okinawa Rail (*Hypotaenidia okinawae*) is a flightless bird and a species endemic to the northern forest area of Okinawa Island. It was found to be new to science in 1981 by researchers of the Yamashina Institute for Ornithology, and was described as a new species. The number of Okinawa rail was estimated about 1800 when it was found. However, its population decreased to 700 in 2005 and became one of the most endangered birds in Japan. The factors causing population decline are predation by invasive carnivores (mongoose; *Herpestes auropunctatus*, and feral cats; *Felis catus* and others), traffic accidents and habitat loss. Therefore the Ministry of Environment made conservancy plan called "Protection and Recovery Program for the Okinawa Rail", and had carried out *in-situ* management approach while technological development of captive breeding had gotten started as ex-situ conservation. These *in-situ* and *ex-situ* conservation activities have been taken place in cooperation with Okinawa prefecture, three villages of Okinawa Rail's habitat, local residents and NGO.

The aim of captive breeding program is to create another population which can be reintroduced to the wild when it's necessary. We started experimental release of captive bred rails in 2014, and revealed that the half of released individuals died due to predation . The predators are natural enemy, such as habu (*Protobothrops flavoviridis*) and large-billed crow (*Corvus macrorhynchos*). Based on this result, we have worked on developing methods to have rails aware of natural enemy since 2017.

## S-27

# Attempted Captive Conservation Breeding of Japanese Night Herons *Gorsachius goisagi* and Amami Spiny Rats *Tokudaia osimensis*

Daisuke Watanabe[1*], Yukie Konemura[1], Hiroyuki Hokamura[1], Masato Takeda[1], Toshihisa Deguchi[1], Yoshihiko Takaki[2], Hideto Toyoda[2], Yosuke Amano[2], Kuniei Tabata[3], Ayumi Yamaguchi[3], Ryuji Kimura[3], Tomoki Itoh[4], Atsushi Kashimura[5], Takamichi Jogahara[6], Chihiro Koshimoto[6], Testuo Morita[6, 7]

1. Miyazaki City Phoenix Zoo, 2. Saitama Children's Zoo, 3. Ueno Zoological Gardens 4. Chikozan Park Children's Zoo, 5. Faculty of Agriculture, Tokai University, 6. Division of Bio-Resources, Department of Biotechnology, Frontier Science Research Center, University of Miyazaki, 7. Captive Wildlife Nutrition Society

**Abstract:**

The Japanese night heron *Gorsachius goisagi* and Amami spiny rat *Tokudaia osimensis* are both categorized as Endangered by the IUCN. *G. goisagi* breeds almost exclusively in Japan as a summer migrant, and has only recently been kept in captivity with any degree of success. *T. osimensis* is restricted to the island of Amami-Oshima and has never bred successfully in captivity. This study reports successes in maintaining both species at Miyazaki City Phoenix Zoo, Kyushu.

Unusually for a heron, *G. goisagi* feeds mainly on forest soil animals and freshwater crabs. A diet of fish caused astasia in captive birds, but this was cured by introducing ingredients previously used in mole feeds. Monthly monitoring revealed that increases in serum cholesterol and body mass of *G. goisagi* are spontaneous and reversible, suggesting that annual variations in nutritional status may be related to migration rather than diet. These results will inform the development of feeds to facilitate long-term maintenance and captive breeding.

In *T. osimensis*, body weights increased markedly following removal from the wild, probably as a result of increased energy intake and reduced locomotor activity. Although obesity has been thought to have an inhibitory effect on reproduction, we know from experience that in small mammals animals with greater body mass and high nutritional status tend to be fertile. Thus we continued *ad lib* feeding, and breeding was achieved in the second year of captivity.

We suggest that feeding ecology and physiology may be crucial achieving successful conservation breeding of these difficult-to-rear species.

## Symposium 7

# Equinology and Equine Animal Welfare

## S-28
# Study of Feral Horse Behavior in Serra D'Arga, Northern Portugal

Satoshi Hirata [1*]
1. Wildlife Research Center, Kyoto University

**Abstract:**
Horses were first domesticated at least 5500 years ago. Since then, humans and horses have kept close relationship with each other. In our modern society throughout the world, horses play important roles for human activities in areas such as agriculture, equestrianism, and horse racing. Number of researches have been conducted on horses which has led to accumulated knowledge on them. However, these researches are mainly from veterinary or agricultural perspectives, and there have been fewer studies on their behavior and ecology in naturalistic situations. In order to study naturalistic aspects of horse characteristics, we established a new field site in northern Portugal, at Serra D'Arga mountain. The breed of horse inhabiting in the region is called garrano, which is categorized as a pony. The social system of feral horses is unique among ungulates as they form stable bisexual social groups similar to those of primates. The social system of horses is characterized by mixed-sex groups composed of one or a few males with multiple unrelated females and their immature offspring, while some males form bachelor groups. Observations of garranos in Portugal, based on identification of > 250 individuals belonging to > 30 groups, are in consistent with the aforementioned general descriptions. An average group size was 8.2 individuals/group, and the most frequent composition was single-stallion group, while multi-stallion groups were fewer in number. Our findings on the nature of feral horses have important implications for management, conservation, and welfare of both captive and feral domestic horses.

## S-29

# Animal Cognition and Animal Welfare: Feral Horse Social Behavior and Its Translation, as Applied Animal Welfare Science, to Domestic Horse Management

Enrique Alonso García[1*] , Lucy Rees[2*]

1. Consejo de Estado and Benjamin Franklin Institute-UAH, Spain, 2. Independent researcher

**Abstract:**

Although science, including evolutionary cognition, tend to focus on knowledge acquisition leaving for "others", e.g. social movements, ethics, policy and law makers, its translation to individual or collective practice governing the animal-human relationships, the fact is that such translation by law (EU) must be based in science, thus leading to a solid body applied animal welfare science (AAWS). Its current holistic content (from the biological to the behavioral, functional and pragmatic "schools", and more recently, to more interdisciplinary approaches that include new fields, e.g. health & nutrition, ICTs, big data analysis, genomics, neuroscience, and of course, animal cognition) is progressively being applied to different animal species; and its results enrich such human-animal relationships (from farm animals, to classic pets, and more recently to *ex situ* and *in situ* wild animals). Equidae were until very recently an exception, since most species were so efficiently submitted to "direct domestication" and zootechny as the base of this multifaceted relationship (agriculture, transport, equestrianism –warfare, sports, cultural representations-, and more recently therapies and recreation/companionship) that two of the inextricably linked pillars of AAWS are barely starting: observation of horses´ minds and natural behaviors from which to derive reliable data for cognition science and scientifically-based well-being. The presentation will include the latest ethology-based data on social behavior of wild horses (Pottokas) in Piornal (Spain) of expert Lucy Rees, as source of cognition, and its translational potential, as AAWS, to human-animal relationships through the analysis of the different types of stressed behaviors.

# S-30
# Indicators for Equine Wellbeing and the Relationship with Nutrition

Coby Bolger
Equine Nutritionist and Founder Horse1, Equine Nutrition Centre

**Abstract:**
In the current political climate, horse welfare and ethical treatment is fast becoming a flashpoint. Recent mandates in Europe are clear; equids have the right to a dignified life. Defining equine welfare is a singular challenge as equids are defined as pets, athletes and as food. Legislation varies between countries and type of horse.

The extensive foundation of scientifically contrasted research, related to equine physiology and nutrition simplifies the creation of objective welfare guidelines that will serve equine enthusiasts, riders and commercial horse meat producers.

The equine digestive tract is so sensitive that if the equid is provided with indigestible feedstuffs or nutritional mismanagement, the animal in question will quickly suffer from depression, reduced athletic capacity, illness or death.

An outline of horse welfare checkpoints related to equine nutrition should include:

1. Evaluating **corporal fat deposition** on the horse.
2. Ensuring sufficient **fiber** and **water** intake.
3. Ensuring that the feedstuffs are **appropriate for the equid digestive tract.**
4. Evaluating the **timing** of the feedstuffs provided.
5. Evaluating **how** the feedstuffs are provided.
6. Evaluating **how and where** the feedstuffs are provided within the **social group**.
7. Evaluating the **hygiene** of the **feedstuffs** and the **feed storage areas**.
8. **Minimizing** the use of cereals in the diet only to amounts necessary to guarantee a sufficient energy level.
9. Evaluating the **strategy** used when organizing the rations.

## S-31
# Use of the Touchpanel System for Exploring the Horse Mind

Masaki Tomonaga[1*], Kiyonori Kumazaki[2], Carlos Pereira[3], Tetsuro Matsuzawa[4]

1. Primate Research Institute, Kyoto University, 2. Horseman Kakamigahara, 3. Université Paris III Sorbonne Nouvelle, 4. Institute for Advanced Study, Kyoto University

**Abstract:**

To understand divergence and convergence of cognitive abilities among mammals, it is necessary to study various kinds of species adapted in variety of ecological/social environments. For this purpose, we have started to explore perceptual and cognitive abilities in horses and compare these with the other mammals like primates. To overcome the “curse” of the Clever Hans, we needed more objective methods for experimental setting. Thanks to the advancements in the comparative cognitive studies of chimpanzees, we successfully introduced computer-controlled touchpanel system to the horses. Using this system, we examined various aspects of visual perception in horses. In this presentation, we summarize the results of ongoing horse cognition project. Topics are as follows: 1) Perception of the size and shape, 2) Relative numerosity judgments, and 3) visual concept of “horse”. These results are discussed by comparing with the other mammal species such as dolphins, chimpanzees, and humans.

## S-32
# Behavioral Responses of Feral Horses toward Dying and Dead Conspecifics

Monamie Ringhofer*, Renata S. Mendonça
Kyoto University Institute for Advanced Study

**Abstract:**
There are only few anecdotal reports on death-related behaviors of horses, mostly concerning horses in captivity. We introduce a rare case of social interactions between a wounded foal and other individuals including her mother, observed in feral horses at Serra D'Arga, Portugal. We found a male foal, wounded possibly by wolves' attack, became unable to stand up. We video-recorded the reaction of the mother and other individuals toward the foal until the foal died. The mother tried to stay with her foal, although her group's male tried to take her back to the group. When the mother was some distance away from the foal, we observed direct interaction and affiliative behaviors of the individuals in other group toward the foal. Especially one adult female showed maternal-like-behaviors toward him. When the mother kept staying with the foal and away from her group, she behaved aggressively toward two bachelor males trying to approach her. Finally, the mother went back to her group leaving her foal. This episode illuminates a conflict between the female-offspring bond and female-group bond. When we observed horses' reaction toward this foal after his death and toward other four carcasses by camera traps, horses stared at the carcasses, but show no direct interactions. Horses react differently toward wounded or dead kin and non-kin conspecifics, and they seem to avoid approaching dead ones. Observing such social interaction between inter and intra group individuals in natural settings will provide important information to improve housing and management conditions of horses in captivity.

## S-33
# Investigation of Social Structure of Feral Horses Using Drones

Shinya Yamamoto
Institute for Advanced Study, Kyoto University

**Abstract:**
We investigated social structure of feral horses at Serra D'Arga mountain, northern Portugal, where we succeeded in identification of > 250 individuals in > 30 groups. We introduced a new methodology to observe the wild horses: aerial drones. With this newly developed technology, we can observe the animals from the air, which enables us to record precise location of all individuals in the fields. We also established a new recording method: 30-min time sampling with drones. With this method, we can analyze the data quantitatively and track time-dependent changes. We succeeded in analyzing social networks among individuals both within and between groups in the whole community of the site. The positional data taken by drones showed that, within a group, a male is located at the periphery of the group. Among groups, their home ranges were largely overlapping and the area of convex hull of these groups was significantly smaller than each home range, which suggests harems and bachelors aggregate to form a herd. Moreover, this herd had a structure such that large harems were likely to be in the center, with bachelors in the peripheral zone, and small harems somewhere between them. This stable spatial pattern strongly indicates a multilevel structure of feral horse society. These studies are the first, to our knowledge, to reveal the characteristics of spatial positioning of large mammalian groups using drone technology, and could have important implications for management, conservation, and welfare of both captive and feral domestic horses.

## Symposium 8

# Applications for Care and Experiments of Laboratory Animals Based on Animal Behavioral Characteristics

The “3Rs”, comprising Replacement, Reduction, and Refinement are principals developed by Russell and Burch in 1959, which are treated as international basic principles for care and use of experimental animals. The experimental animal technician also plays an important role in the development of laboratory animal science. The Japanese Association for Experimental Animal Technologists (JAEAT) was founded in 1966 as a nationwide organization for improving the quality and status of experimental animal technicians. JAEAT is engaged in various activities for promoting the welfare of experimental animals and for advancing the ethical appropriateness of animal experiments. Although consideration for animal behavioral characteristics is required in experimental animal management such as in environmental enrichment, there is a lack of information on behavioral management; therefore, several technicians are not aware of how they should implement a behavioral management systematically and appropriately. The purpose of this symposium is to deepen the understanding of more welfare experimental techniques and caring methods based on animal behavior and to expand knowledge on the evaluation method of welfare status as well. We hope that this will contribute to the improvement of all captive animal management technology in various fields as well as the care and use of laboratory animals.

## S-34
# Introduction of the Symposium and Approaches for Laboratory Animal Welfare of JAEAT

Naoko Hashimoto*, Hitoshi Arakawa, Hiroko Nakano, Yuji Sakamoto, Shigiko Takei, Akira Okamoto

Animal Welfare Division, Japanese Association for Experimental Animal Technologists

**Abstract:**

The “3Rs”, comprising Replacement, Reduction, and Refinement are principals developed by Russell and Burch in 1959, which are treated as international basic principles for care and use of experimental animals. The experimental animal technician also plays an important role in the development of laboratory animal science. The Japanese Association for Experimental Animal Technologists (JAEAT) was founded in 1966 as a nationwide organization for improving the quality and status of experimental animal technicians. JAEAT is engaged in various activities for promoting the welfare of experimental animals and for advancing the ethical appropriateness of animal experiments. Although consideration for animal behavioral characteristics is required in experimental animal management such as in environmental enrichment, there is a lack of information on behavioral management; therefore, several technicians are not aware of how they should implement a behavioral management systematically and appropriately. The purpose of this symposium is to deepen the understanding of more welfare experimental techniques and caring methods based on animal behavior and to expand knowledge on the evaluation method of welfare status as well. We hope that this will contribute to the improvement of all captive animal management technology in various fields as well as the care and use of laboratory animals.

## S-35

# Remodeling the Housing and Behavioral Testing Environment for Laboratory Mouse Models of Human Diseases: IntelliCage System and Beyond

Toshihiro Endo

Phenovance Research and Technology, LLC

**Abstract:**

Valid animal models of human diseases are mission-critical bridges for translating basic science findings to clinical applications. Majority of researchers in pre-clinical fields, however, are still utilizing laboratory animals under environments which persistently constrain the animal's sensory experience, physical exercise, and social stimulus. Accumulating evidence shows that laboratory mice kept in these constraints result in developing the physical, anatomical, and behavioral alterations caused by the impoverished rearing. IntelliCage system was developed to overcome these problems and allows examining of the group-housed mice in a fully-automated, environmentally-enriched, and ethologically-valid mouse cage. IntelliCage system is also a highly flexible cognitive behavioral testing platform utilizing programmable operant chambers, where each mouse spontaneously explore, pokes its nose, and is given the reward depending on the task paradigm designed by researchers. This presentation will introduce how IntelliCage system has successfully been demonstrating a wide variety of previously-unknown aspects of high-functioning behaviors in mice. I will also show the compatibility of IntelliCage system with other latest phenotyping technologies such as biotelemetry and different RFID-based systems, as a tool for further maximizing heap of biological information acquired from a life of a mouse, without constraining the quality of housing/testing environment.

## S-36
# Facial Expression as a Tool for Assessment of Pain in Animals

Takako Miyabe-Nishiwaki
Primate Research Institute, Kyoto University

**Abstract:**

Pain has a significant impact on animal welfare. Experimental animals undergo various painful experimental procedures; in addition, veterinary therapeutic procedures may also be painful. Despite the use of anaesthesia and analgesia, difficulty with pain assessment in animals may lead to undertreatment. In humans, pain is usually assessed based on self-report; however, facial expressions are also utilised, especially in the case of young children and individuals who lack the ability for verbal communication. The grimace scale of rodents published in 2010 had a great impact on pain management strategies for animals (Langford et al 2010, Sotocinal et al 2011). Since then, similar studies have been conducted on other species including horses (Costa et al 2014) and sheep (McLennan et al 2016).

Facial action coding systems (FACS) is a well-established method for analysis of facial expressions based on underlying musculature in humans. FACS has been adapted to various non-human species, e.g. chimpFACSs for chimapnzees (Parr and Waller 2006) and maqFACS for rhesus macaques (Parr et al 2010). The sensory and affective aspects of pain appeared to be differentially encoded in the human facial expression (Kunz et al 2011). Comparative studies of pain-associated facial expressions may elucidate the affective aspects of pain in animals. In this talk, I will review the published methods for pain assessment using facial expressions in rodents, horses and sheep. In addition, I will introduce our progress to develop pain assessment tools based on facial expressions using a morphometric approach in Japanese macaques and common marmosets.

## S-37

# Effects of Social Housing as Environmental Enrichment on Behaviors and Biochemical Parameters in Juvenile Cynomolgus Monkeys (*Macaca fascicularis*)

Hironari Koyama*, Kaoru Takaura, Sou Wada, Yuki Naganuma, Michiko Hashimoto
Research Regulatory Management, Drug Discovery Research, Astellas Pharma Inc.

**Abstract:**
The well-being of laboratory animals and compliance with the 3Rs needs to be improved in laboratory settings.

Use of environmental enrichment is recommended for improving the well-being of laboratory animals. Environmental enrichment includes improving the space, social, exercise, and sensory aspects of housing, among others. In particular, it is important to enrich the social environment for highly social animals such as nonhuman primates. For laboratory monkeys, single housing induces behavioral and physiological abnormalities, while group housing decreases abnormal behaviors.

These abnormalities are undesirable for achieving biomedical research objectives and for improving animal welfare, indicating the importance of providing social environmental enrichment to animals. Therefore, further research is required to investigate the influence of environmental enrichment on the psychology, behavior, and physiology of laboratory animals

Based on the above background, we investigated the behavioral and physiological effects of environmental enrichment by studying the behavioral differences and biochemical parameters associated with changes in housing conditions (single vs paired housing) in juvenile cynomolgus monkeys.

Under paired housing, the stereotypic behavior decreased, and the affiliative behavior increased or showed an increasing trend. Under single housing, the stereotypic behavior increased, and the affiliative behavior decreased. Paired housing decreased serum calcium and urine cortisol concentrations and decreased plasma cortisol and plasma 4-etylphenyl sulfate (4EPS) concentrations.

In conclusion, paired housing improved behavioral abnormalities and changed serum calcium, plasma and urine cortisol and 4EPS concentrations in juvenile cynomolgus monkeys, suggesting that it may be an effective environmental enrichment paradigm.

## Symposium 9

# Managing Death in Captive Animals: Building a Bridge Between Research and Practice

Death is not only an emotionally charged topic and a multi-layered concept but it is also an inexorable fact of life. Humans have a long history exhibited by numerous cultural practices associated with the death of community members and loved ones. At their core, however, they are but expressions of states of sadness and loss which betray an even longer evolutionary past. Thanatology, the study of death and dying as long been applied to humans, but only recently has this been explored in non-human animals. This could be an important matter considering welfare of long-lived social animals in captivity. Research has shown that animals such as primates, elephants and cetaceans not only form enduring bonds amongst themselves but also show special interest to their dead. Of particular importance is the issue of grief and bereavement they appear to show following the death and removal of a companion. Looking at their wild counterparts, instead of dead individuals being removed from the scene, the living interact with them and only then choose to abandon the body. While a full concept of death would entail other responses such as suicide, it appears non-human animals do not engage in these acts. We explore these behaviors in species comprising non-human primates and elephants but also humans. While managing death is not only a human affair, it is important to consider such impacts in human caretakers. Considering close bonds do form between the caretakers and the animals, illness, euthanasia or sudden death may come at an emotional cost for the caretaker. In these situations, memorial services have emerged as a form to deal with such losses. A dual question arises: could such practices (leaving the body on display, holding a ceremony) mitigate stress for both the animals and the keepers, and should these be more widespread in places like zoos or sanctuaries? Answers to these questions are not straightforward, but these questions underlie a growing need for education for human and non-human animals to better cope with death and its potential to improve their lives.

## S-38
# Managing Death in Social Animals: The Case for Non-Human Primates

André Gonçalves*, Masaki Tomonaga
Primate Research Institute, Kyoto University

**Abstract:**
For the past two centuries, non-human primates have been reported to inspect, protect, retrieve, carry or drag the dead bodies of their conspecifics and, for nearly the same amount of time, sparse scientific attention has been paid to such behaviours. Given that there exists a considerable gap in the fossil and archaeological record concerning how early hominins might have interacted with their dead, extant primates may provide valuable insight into how and in which contexts thanatological behaviours would have occurred. First, we outline a comprehensive history of comparative thanatology in non-human primates, from the earliest pre-ethological accounts to the present, bringing to light the interpretations of previous researchers and their contributions to the field of primate thanatology. Second, we review the recent evidence of thanatological responses and organise it into distinct terminologies: direct interactions (physical contact with the corpse) and secondary interactions (guarding the corpse, vigils and visitations). We also provide a critical evaluation of the behavioural and emotional aspects of these responses in infants, adults and non-conspecifics, pointing towards its form and function. Third, we provide an integrative perspective of primate thanatology, bringing together different fields of research and their recent advances to clarify how thanatological behaviours would have emerged on the evolutionary, sensory/cognitive, developmental and archaeological spectrum. Finally, we discuss the importance of detailed reports on primate thanatology and suggest different empirical avenues to shed further light on this topic.

## S-39

# Nonhuman Primate Mothers Behavior toward Their Dead Infants: Captive Welfare Issues

Claire FI Watson[1, 2*], Naoko Suda-Hashimoto[2], Tetsuro Matsuzawa[2, 3]

1. Wildlife Research Center, Kyoto University, 2. Primate Research Institute, Kyoto University, 3. Kyoto University Institute for Advanced Study, Kyoto University

**Abstract:**

In this talk, I will first give an overview of current knowledge about post-partum attentive behaviors by ape and monkey mothers to their infant's corpse. Nonhuman primate mothers' natural responses includes dead-infant carrying (sometimes of extended duration) but also inspection, proximity, maternal care such as grooming, protective behaviors and filial cannibalism. Second, I will focus on mothers' stress and welfare in relation to: infant death, continued transportation and premature removal of the corpse, together with captive management considerations. I will suggest ways to quantitatively assess stress and welfare. Do nonhuman primate mothers experience stress when their infant dies? Might carriage and care-taking of the infant-corpse mitigate stress in nonhuman mothers? If the infant corpse is removed while she remains motivated to carry it, this likely increases stress for bereaved mothers. In captivity, standard procedure is to remove corpses at the first opportunity. Reasons for this include: performing a necropsy while feasible, concerns about public perception, lack of knowledge about dead infant-carrying behavior, or misinterpretation as an abnormal response. Lastly, to illustrate the difficulties in determining when a mother is no longer motivated to carry the infant-corpse, we present the case report of a Japanese macaque (*Macaca fuscata*) mother. After 22 days of carrying, she would move up to 20 meters away from the dead infant, yet would consistently return to retrieve it. Topics covered in this presentation have broader relevance across other taxa in captivity.

## S-40

# Lessons from the Wild: Behavioral Responses of Asian Elephants towards Dying Conspecifics and Its Possible Implications on Welfare of Captive Elephants

Nachiketha Sharma[1, 2*], Sanjeeta Sharma Pokharel[2], Shiro Kohshima[1], Raman Sukumar[2]
1. Wildlife Research Center of Kyoto University, 2. Centre for Ecological Sciences, Indian Institute of Science

**Abstract:**
In recent years, initiatives and ideas for better management and welfare of captive animals are widely evolving. Among the debated topics of whether to keep large bodied mammals with longer home ranges and complex behavioural traits, such as elephants, in the captivity and if so, how efforts are taken to mimic their natural habits and habitats to facilitate the enrichment, have been the major concern. Elephants are highly social animals with high cognitive capabilities. One of the aspects that goes unattended in captivity is whether elephants possess the sense of 'awareness'. Such awareness could be for any situation around them, for instance, abuses or physical harassment, distress or death. Studies on African elephants documented that they are aware about distress and death of their conspecifics. In this talk, we will highlight detailed direct-observational evidence (opportunistically recorded) of free-ranging Asian elephants responding towards death of their conspecifics and in one case, towards heterospecifics. In all four observations, we found that Asian elephants were responding towards distress and death by exhibiting behaviour, such as epimeletic or helping, approach or exploratory behaviours, towards injured, dying and dead individuals. In one of the observations, indirect evidence of funerary-like activities were also observed. Elephants were also observed avoiding a dead heterospecifics. Such observations indicate that elephants are 'aware' about the distress and death around their vicinity. Insights like these are important to understand elephants' cognitive abilities and particularly in the context of captivity, to facilitate better behavioural enrichments to avoid any adverse psychological influences on elephants.

## S-41

# Being Grateful for Sacrifices of Animals: Japanese Animal Ethics as a Kind of Relational Ethics

Tetsuji Iseda
Graduate School of Letters, Kyoto University

**Abstract:**
Even though more and more people are concerned with animal welfare issues in Japan, introduction of Western-style animal welfare measures into Japanese animal facilities is rather slow. To understand why Japanese people are not eager to adopt Western animal welfare ideas, we need to look into the ways Japanese people see the relationship between human beings and animals.

Animal commemoration rituals (Dobutsu Irei or Dobutsu Kuyo) are widespread among various types of facilities related to animals: animal experimentation facilities, slaughterhouses, zoos, etc. Those rituals are supposed to show the gratefulness of participants to the animals who sacrificed their life for human needs. However, from the viewpoint of Western animal ethics, the importance of the rituals after the death of animals is hard to see.

Another interesting phenomenon in Japanese animal ethics is ethical discourse associated with 'Itadakimasu'. Itadakimasu literally means "I receive it, sir", and customarily pronounced at the beginning of a meal. One interpretation of this expression is getting more and more widespread for last twenty years. According to this new interpretation, Itadakimasu specifically means "I receive your life," addressed to animals and plants in the food. Moreover, such exhibition of gratefulness for sacrifices is supposed to justify the consumption of living forms, which is again puzzling from viewpoint of Western animal ethics.

In this talk, I will show that those puzzling features of Japanese animal ethics can be made sense by introducing the idea of relational ethics, which is similar to so-called ethics of care.

## S-42
# Animal Memorials: A Welfare Practice for Animal and Caregivers

Josue Alejandro*, Michael A. Huffman
Primate Research Institute, Kyoto University

**Abstract:**
Positive interactions between animal and caregiver not only improve or insure the welfare of the animal, but also the welfare and safety of the caregiver. Animals are more likely to stay calm and cooperate with caregivers that they trust more than ones they do not. In research settings, these interactions can improve research both directly and indirectly. Animals under pain or stress maybe more cooperative in front of caregivers they trust, hence providing better care that would lead to better and more consistent results. Nonetheless, these positive human-animal interactions may come at an emotional cost. Staff may find themselves conflicted when animals under their care fall ill or may be euthanized for various reasons. As our concept of animal care and improvement in welfare practices have evolved over time, one practice that has increased over the past decades is providing the facilities that house animals with a memorial service. These types of ceremonies are increasing all over the world, and our work aims to elucidate where are these ceremonies taking place, what are the perceptions, and do they feel these types of practices demonstrate or promote better welfare. Specifically, we would like to know how memorial services are perceived within institutions between staff that have close bonds to animals compared to those that do not. We hope our findings will contribute to the emerging literature on memorial services for departed animals and what they signify to people that work alongside them.

## S-43

# Captive Primates and Stress: Self-aggression, Self-injurious Behaviour, but No Suicide: Why?

James R Anderson
Graduate School of Letters, Kyoto University

**Abstract:**
Inadequate rearing conditions and impoverished housing conditions often lead to the emergence of self-directed aggression and stereotyped movements in captive primates. Although they probably differ in etiology, both of these behavioural pathologies can result in significant self-injury. But if self-aggression and stereotypies can be considered as learned responses that help the animal to cope with stress, the question arises why nonhuman primates appear never to opt for the ultimate escape from stress: suicide. Even among our nearest evolutionary neighbours there appear to be no cases of individuals purposefully ending their own lives. I will discuss this issue in relation to understanding the concept of death, and objective self-awareness.

## Symposium 10 (S-44)

# Workshop: Cultivating a Behavior-Driven Enrichment Program

Angela Miller*, Michelle Skurski, Christina Alligood
Behavioral Husbandry, Disney's Animal Kingdom

**Abstract:**
Disney's Animal Kingdom® has recently expanded our behavioral-goal-based enrichment program and cultivated a culture of developing the next level of enrichment. The program is using strategies for setting behavioral goals by focusing on both the "what" and the "why" of the natural behaviors significant to each species. We have also updated a brainstorming process for enrichment development. We will share how a small team of keepers and managers are elevating the enrichment program to an all new level by developing, implementing and evaluating innovative enrichment. Specific examples of the creation and implementation of initiatives will be shared. Participants will be able to take the concepts and further develop them back at their facilities.

## Oral Presentations

### 23rd June 2019

**Oral Presentations 1**
from O-1 to O-7

**Oral Presentations 2**
from O-8 to O-13

**Oral Presentations 3**
from O-14 to O-17

### 24th June 2019

**Oral Presentations 4**
from O-18 to O-23

**Oral Presentations 5**
from O-24 to O-29

**Oral Presentations 6**
from O-30 to O-33

### 25th June 2019

**Oral Presentations 7**
from O-34 to O-41

## O-1
## Spread of Environmental Enrichment in SCZoo

Takumi Sasaki*, Rieko Tanaka
Saitama Children's Zoo

**Abstract:**
Saitama Children's Zoo (SCZoo) in Saitama Prefecture, Japan, opened in 1980. The area of this zoo is 46 ha, with approximately 200 species of animals. In 1999, we obtained data on environmental enrichment being followed in the United States and conducted a study on zookeepers on the basis of this data collected.

In 2000, we were the first to launch an enrichment-themed event in Japan wherein participants learned about environmental enrichment. In a stamp rally-type event called "Zoo Orienteering," in which anyone can participate, participants learned about the zoo's efforts at environmental enrichment. This event was awarded the "Enrichment Award 2006" sponsored by NPO Corporation.

In 2008, we launched a monthly event called "Enrichment Day" wherein the environmental enrichment that we have been conducting for more than 43 species of animals and our efforts at creating a rich environment for all animals were introduced to visitors. The event led to increased awareness of environmental enrichment among zookeepers.

## O-2
# The Eye of the Beholder: Enrichment from the Zoo Keeper Perspective

Eileen 'Kat' Tuite*, Simon Moss
College of Health and Human Sciences, Charles Darwin University

**Abstract:**
The use of enrichment for animals in captivity is increasingly common for many species. In the zoo environment, delivery of novel devices and routines to stimulate the senses of wild animals that are also large and dangerous can be challenging. In particular, iconic species of animals, such as polar bears and tigers, are somewhat prone to displays of stress related behaviours. Zoos have a vested interest in continually building on enrichment strategies to both ensure the welfare of their animals and maintain a positive visitor experience. However, there may be approaches to enrichment that zoos are seen to shy away from due to concerns of public scrutiny.

This qualitative study involved a constructivist approach using semi-structured interviews. Zoo keeping staff working with big cats in 12 facilities across Australia, Asia, Africa and Europe were interviewed. Keepers' experience with enrichment and the limitations they face were coded in a qualitative software package. Thematic analysis of the collective data output in this study revealed some of the pervasive barriers and facilitators to enrichment from the keeper perspective.

Key findings highlight some of the enrichment strategies that cannot be readily implemented in many regions of the world. One commonly identified barrier amongst keepers is the restrictions on using enrichment that may be misinterpreted by the public, despite the potential advantage available to the animals. The approaches zoo keepers find useful and supportive for effective big cat enrichment delivery will also be presented, with implications for similar enrichment practices of other zoo species.

# O-3
# Enrichment Through Animal Rotation, Tree-Top Trails and the 5C's

Jon Charles Coe
Jon Coe Design

**Abstract:**
Animals in traditional zoos, sanctuaries and research facilities may spend their entire lives in a limited area depending on caregivers for both sustenance and enrichment. Yet Hediger (1950) described natural animal territories as pathway networks connecting critical resources. These networks are more than just connections, but pass through complex environmental gradients including illumination, scents, sounds, temperature and humidity, social encounters and much more. The animals themselves meet their needs by choosing from these combinations of environmental factors, also benefiting from a wide range of varied experiences along the way. Several zoos and sanctuaries are attempting to follow this model, consecutively rotating (alternating) different species through multiple and varied enclosures, including arboreal and ground trail networks as much as three thousand metres long. Formal and anecdotal evaluations show such rotation to be enriching for both animals and visitors. As the enrichment movement enlarges to embrace new thinking about overall animal welfare, a new encapsulated line of thinking has also emerged. How can we provide animals with the 6 C's, choice, control, complexity, challenge, change and competence? Simple new "smart" digital technologies can now allow selected animals to open gates to take themselves or their troop for a walk, access food, turn on heaters or coolers and operate enrichment features whenever they choose, day or night. Parallel interfaces record these activities into research files or alert visitors on animals' activities, locations and stories.

## O-4

# Collaborative Project between Kitasato University and Japanese Zoos on Environmental Enrichment for Education and Academic Research

Tadatoshi Ogura[1, 2]

1. School of Veterinary Medicine, Kitasato University, 2. SHAPE-Japan

**Abstract:**

Environmental education and scientific research on wild animals are included in the missions of many modern zoos. Nevertheless, most Japanese zoos have limitations in terms of manpower and budget costs to conduct education programs and research activities independently. Similarly, educational facilities, such as universities, have difficulties in keeping their own collections of wild animals for academic investigation and classroom education. Therefore, our laboratory, at Kitasato University, has worked together with zoos on educational and research activities focusing on environmental enrichment. For example, at Morioka Zoological Park, in one of our university classes, the students made enrichment devices, such as box feeders and bamboo feeders for Japanese monkeys *Macaca fuscata*, box feeders for a Canadian otter *Lontra canadensis*, fire hose feeders for masked palm civets *Paguma larvata* and so on. The zoo uses them as a part of their enrichment repertoire. We have also conducted some experimental and observational studies in zoos, including Kyoto City Zoo and Morioka Zoological Park. These studies revealed the beneficial effects of sensory enrichment, such as olfactory enrichment for carnivores (lions *Panthera leo*, a cougar *Puma concolor*, tigers *Panthera tigris*, jaguars *Panthera onca*, and a Canadian otter) and auditory enrichment for raptors (Ural owls *Strix uralensis*, snowy owls *Bubo scandiacus*, and golden eagle *Aquila chrysaetos*) to stimulate their natural behaviors. The project did not involve only researchers, but also students and zoo staff members too, producing the durable educational and research benefits. I will introduce some case studies in this presentation.

## O-5
# A Comprehensive Enrichment Program for Domestic Program Animals in the Zoo Setting

Hanna Chin*, Natalie Chan
Animal Presentations Department, Singapore Zoo

**Abstract:**
Wildlife Reserves Singapore manages 4 zoological parks - Singapore Zoo, Night Safari, River Safari and Jurong Bird Park. The Animal Presentations Department is responsible for all animals engaged in programs and visitor interactions at all parks. At WRS we are committed to insuring the highest quality of care and well-being for all animals. Program animals differ from exhibit animals in terms of housing, daily routine, handling, and human interaction. The challenge is to mitigate potentially negative consequences and maximize positive elements while meeting the behavioral needs of the different species.

In Kidzworld at the Singapore Zoo we have a variety of domestic animals including dogs, cats, rodents, birds, and chickens that are engaged in daily shows and visitor interactions. One of our primary strategies to maximize welfare is the implementation of a comprehensive formal enrichment program. Program structure involves forming teams that are assigned to specific groups of animals on a monthly rotational basis. Each team identifies behavioral goals for their animals, researches enrichment strategies to address those goals, and then produces a monthly calendar of enrichment to insure variability and at least one activity each day. A simple assessment of each enrichment is recorded every day and applied to decision-making for the following month. This program has been highly effective in increasing activity levels, providing complex and comfortable housing, addressing behavioral problems, and enhancing a health care program based on desensitization and voluntary cooperation. Because of this success, it is being applied in other presentation areas in all parks.

## O-6
## Should We Pamper Zoo Animals?

Robert J. Young
University of Salford Manchester

**Abstract:**
There is common misconception that maintaining high levels of animal welfare in captivity means eliminating stress from the lives of captive animals. This is due to a naïve understanding of animal physiology and wellbeing. Stress hormones per se are not an animal welfare problem and their presence does not, necessarily, indicate poor levels of animal welfare. It is important to remember that it is the correct activation of the physiological systems that produce stress hormones is essential to animal survival because they generate survival behaviours such as food searching (i.e., good stress). The problem occurs when these systems are overstimulated, and a very acute or chronic stress response is produced; this situation is correctly referred to as distress (i.e., bad stress). Distress should be avoided for captive animals, but stress should be provided at optimised levels for animal welfare. Environmental enrichment can be used as a positively stimulating source of good stress for captive animals. For example, exposing zoo animals briefly to the smell of a predator not only stimulates survival behaviours, but in social species it may also enhance social bonding between group members. It is not possible to manage zoo animals without some exposure to stress; for example, the introduction of a new group member or even a birth within a group can be stressful. Research shows that animals can build up a resistance to stressful events or stimuli by being exposed to such processes gradually overtime and this is an effective manner for animals to be able to cope with the challenges of their captive environment. This has been referred to as "The Stress Inoculation Theory of Environmental Enrichment". Furthermore, it is important to realise that too much stimulation through environmental enrichment can produce bad stress; for example, if an enrichment activity requires abnormally high levels of physical exercise. Thus, it can be argued that environmental enrichment should be used to optimise levels of good stress in captive environments rather than trying to eliminate all stress.

## O-7
# Built-In Enrichment Renovation at Tokiwa Zoo in Ube, Japan: Brachiation Forest for White Handed Gibbon

Kenji Wako
Faculty of Arts, Osaka University of Arts

**Abstract:**
Tokiwa Zoo in Ube city, Japan was remodeled and reopened in 2016. It exhibits animal behavior by recreating a natural environmental exhibit based on research of their habitat. The white handed gibbons exhibit creates the structure of the forest which allows three-dimensional flight, and their habitat, based on the habitat survey, elicits active brachiation jumping among branches. For gibbons we conducted a habitat survey on Sumatra Island in order to create an environment which would encourage their characteristic behavior, brachiation. As a result, we discovered that their brachiation is not a movement parallel to the ground but a three-dimensional movement behavior: up, down in the forest. In order to create such an environment, we selected and transplanted tall trees such as *Celtis sinensis*, *Quercus serrata*, *Illex rotunda*, *Apjanathe aspera* and *Quercus glauca* from around the park where zoo is located, and under trees we selected and transplanted medium and low trees with horizontally extended branches, such as quercus ubame oak (*Quercus pullyraeoides*) with a height of a 3-5m, making it easy to brachiate up and down among the planted trees. As a result, the gibbons swiftly brachiate up, down. For their brachiation, because bending of branches is also important, trees with a particular tree shape have been arranged above and below. The gibbon forest is separated from visitor's path by a 4m wide, river style water moat.

## O-8
# Captive Asian Elephants Enrichment - Past, Present and Future

Erin Louis Gardiner[1, 2, 3]
1. Zoo Victoria, 2. Melbourne Zoo, 3. Trail of the Elephants Precinct

**Abstract:**
Zoo Victoria has a cohesive multi-generational herd that consists of 1.5 Asian Elephants ranging in age from 5 to 45 years old.

Because of the dynamic herd environment we have had to grow and evolve with the elephants to provide the best welfare state possible in our current exhibit design.

We look to their wild counterparts to inspire natural behaviour and to encourage both cognitive and physical stimulation as well as herd cohesiveness.

This has required us to comprehensively research and assess our current enrichment schedule and compare this to elephants natural daily activity budget. The result showed what was being supplied to the herd was inadequate.

In response to the findings which were undertaken via a details research study we have combined technology and natural elephant biology to provide an enrichment program that covers not only food based enrichment but also sound, smell, sight and touch; as well as encouraging naturalistic behaviours.

Part of the auditory enrichment program is live musicians who play to the herd fortnightly. This is currently a research project which will be completed in March 2019. The findings of this program will give us an in depth scientific understanding of the short and long term effects of live audio on captive Asian Elephants.

Zoo Victoria endeavours to continuously improve in our utilisations of behavioural and environmental enrichment to provide a dynamic and engaging environment. We look to the past to learn from, we actively work on the present and we strive for the future.

## O-9

# Using Anticipatory Behaviour to Evaluate Enrichment: Dolphins Looked forward Most to Non-Food Interactions with Their Trainers

Isabella L. K. Clegg[1, 2, 3*], Heiko G. Rödel[2], Xavier Boivin[4, 5] and Fabienne Delfour[3, 2]

1. Animal Welfare Expertise, 2. Laboratoire d'Ethologie Expérimentale et Comparée E.A. 4443 (LEEC), Université Paris 13, 3. Parc Astérix, 4. INRA, UMR1213 Herbivores, 5. Clermont Université, VetAgro Sup, UMR Herbivores

**Abstract:**

The type and frequency of anticipatory behaviour animals perform in preparation for upcoming events can reveal how they perceive the event itself. Bottlenose dolphins (*Tursiops truncatus*) in captivity have been shown to conduct anticipatory behaviour before feeding sessions but their activity before non-food related events, such as enrichment, has not been investigated. In this study, we conditioned the dolphins to three sound cues predicting the arrival of either: toys in their pool; a positive, non-food Human-Animal Interaction (HAI) with a familiar trainer; or no environmental change (a control). We then measured their anticipatory behaviour before each event. Firstly, the test design was validated by the confirmation that dolphins performed significantly more anticipatory behaviour before the toys and HAI contexts than the control, by means of increased frequencies of surface looking and spy hopping. Moreover, anticipatory behaviour was significantly higher before HAIs than toy provision. In addition, we found that higher anticipatory behaviour before each of the HAIs, toy provision, and feeding session contexts was correlated to higher participation in the event itself (measured by time spent with humans/toys, and number of times dolphins left during sessions). In conjunction, these results indicate that the dolphins found the toys and HAIs rewarding, and that non-food familiar human interactions were a particularly positive form of enrichment. We strongly support further work into anticipatory behaviour and its promising links to animal emotions and welfare.

## O-10

# Environmental Enrichment as a Tool towards Positive Changes of Black Sea Bottlenose Dolphins' Attitude and Participations During Educational Presentations

Ruta Vaicekauskaite[1, 2*], Jonas Livet[1], Tania Monreal-Pawlowsky[3], Fabienne Delfour[4]

1. Fox Consulting, 2. Marine Research Institute, Klaipeda University, 3. International Zoo Veterinary Group, 4. Laboratoire d'Ethologie Expérimentale et Comparée E.A. 4443, Université Paris 13

**Abstract:**

Zoological institutions use different environmental enrichments (EE), defined as any technique designed to improve animals' biological functioning and to encourage animals under human care to display their complete ethogram. However, not all EE sessions follow a rigorous scientific program to evaluate and to monitor the effectiveness of these practices. To our knowledge the use of EE before educational presentations has not been studied in dolphins up to now. This study is also the first one to consider animal attitude within the process.

The aim of the study was to assess the importance of familiar humans on behaviour and attitude changes of Black Sea bottlenose dolphins (Tursiops truncatus ponticus) while using environmental enrichment before educational presentations. We conducted attitude scoring system as a tool for identifying dolphin attitude during educational presentations for six bottlenose dolphins in Attica Zoological Park, Greece. An attitude assessment method was elaborated to be easily and thoroughly used by animal care staff during each educational presentation and was implemented during a three-month period.

## O-11

# The Influence of Classical Music Stimulation on Captive Californian Sea lions (*Zalophus californianus*) Behavioural Responses

Zulfikar Basrul Gandong[1, 2*], Ruedi Nager[2], Nikki Morisson[3]

1. Veterinary Public Health and Animal Welfare Department, Hasanuddin University, 2. Institute of Biodiversity, Animal Health & Comparative Medicine, University of Glasgow, 3. Sea Lion Team Blair Drummond Safari Park

**Abstract:**

Environmental enrichment is a husbandry technique which has various aims such as improving the welfare of animals through environmental modification. As one category of environmental enrichment, sensory enrichment is less popular than other categories. Several studies have demonstrated that auditory enrichment could reduce the presence of stereotypic behaviors in captive animals. Although several studies have highlighted that classical music has a positive effect, namely enhancing the welfare and well-being of some species of animals (dogs, horses, cows), there is no evidence that classical music influences sea lion behavior, despite that classical music could make animals feels relax. Therefore, this study test whether classical music has an effect on sea lion behavior. Experiments were conducted over 18 days in which nine were used as controls with no specifics auditory stimulation and the next nine days were used as treatments with addition of classical music. Trials lasted 60-minutes, during which we recorded sea lion behavior using instantaneous sampling methods. For auditory stimulation, we used *The Very Best of the Classical Experience* album because the album has been shown to have a positive welfare effect in some animals (gorillas and captive-housed dogs). Here, we found less pattern swimming -an abnormal behavior- and more random swimming, resting, and mutual grooming when exposed to the classical music. However, there was no effect of treatment on social. Our results demonstrate how captive Californian sea lions respond positively to auditory enrichment with reduced frequency of abnormal behavior and increases in the occurrence of normal behavior. We anticipate this auditory enrichment result could be a beginning for other scholars who are keen to know the effects of auditory enrichment in marine mammals.

# O-12
# Rehabilitation for Later Re-Introduction: Choosing Appropriate Enrichment for Rescued Ape Orphans

Signe Preuschoft[1, 2*], Nur Aoliya[1], Paloma Corbi[1, 2], Elfriede Kalcher-Sommersguter[1, 3]
1. Yayasan Jejak Pulang, 2. Competence Centre Apes, Four Paws, 3. Department Of Zoology University of Graz

**Abstract:**
Enrichment for captive primates aims at providing more species-appropriate living conditions. When wild-born ape orphans are rehabilitated for later re-introduction, knowledge about Learning must inform decisions about modes of enrichment. Because of apes' extended childhoods with their dependence on learning of survival skills, it is impossible for immatures not to be affected by their rearing environment. Rehabilitation practitioners therefore must be vigilant to forestall even inadvertent learning of deleterious habits. Jejak Pulang's rehabilitation programme for rescued orangutan orphans strives to imitate the natural rearing environment. This includes staying in a "Forest School" 24 hours, choices of enrichment materials, modes of learning, and how orphans and caregivers relate. A sense of situation control is developed by the orphans when sensitive allo-mothering is combined with shared attention and modelling activities such as food choice and preparation, nest building, off-the ground positioning and ranging by surrogate mothers. A major challenge arises from immatures' evolved "expectation" to have exclusive and permanent access to maternal care for the first six years of life. Rescued orphans have to put up with allo-mothering, cooperative care and "siblings", i.e. peers who are not only playmates but also share maternal attention. Balancing each orphan's need for secure attachment with opportunities to explore in a natural habitat and learn socially while leaving the initiative to the immature is likely to mitigate the well-documented negative effects of maternal loss and cross fostering. Continuous records of behaviour shown by orphans and caregivers help to assess individual development and psychological health.

## O-13
# Facial Expressions of Acute Pain in Japanese Macaques: Development of an Assessment Tool

Vanessa Gris[1*], Takako Miyabe-Nishiwaki[1], Kanako Muta[2], Nelson Broche Jr.[1], Lauren Finka[3], Akihisa Kaneko[1], Munehiro Okamoto[1], Michael A. Huffman[1], Juri Suzuki[1], Ryohei Nishimura[2], Daniel Mills[3]

1. Primate Research Institute, Kyoto University, 2. Department of Veterinary Medical Sciences, University of Tokyo, 3. School of Life Sciences, University of Lincoln

**Abstract:**

Changes in facial expression provide a means of assessing pain in mammals. While biomedical research has a continuing demand for primate models, evaluation of welfare is a crucial issue for the validity of the research and the animal itself.

We are developing methods to assess pain in Japanese macaques (*Macaca fuscata*) by observing and describing facial expressions using a morphometric approach. Eight adult healthy female macaques that underwent laparotomy were enrolled in the study. Video recording with a digital camera was performed with the macaques undisturbed in their cages at least one day before the procedure and 1 day after the surgery. Screenshots from the pre and post-surgical periods were taken from the videos and selected for analysis on the basis of their facial orientation to the camera. The software ImageJ was then used to annotate the face pictures with 42 landmarks related to specific points selected for their relationship to key areas affected by the facial musculature. The images were then compared at the level of individual subject before being pooled (total: 76 images “no pain”; 52 “pain”).

There were consistent changes in the faces of macaques which suggest that pain is associated with tightening of the muzzle, as has been observed in other species. This work potentially offers an effective complement for existing way to train others in the evaluation of pain and welfare in captive primates, using data generated as part of their use in other research procedures.

## O-14
# Bonobos' Saliva Can Serve as Non-Invasive Wild Genetic Resources

Shintaro Ishizuka [1,2*], Yoshi Kawamoto[3], Kazuya Toda[1], Takeshi Furuichi[1]

1. Primate Research Institute, Kyoto University, 2. Japan Society for the Promotion of Science, 3. Nippon Veterinary and Life Science University

**Abstract:**

Evaluating the genetic diversity of natural populations of endangered species is important for conservation. Although the genetic analysis of wildlife usually requires collecting DNA non-invasively, variety of non-invasive DNA sampling methods is limited for each species. We present a method to obtain DNA of an endangered species, the bonobo (*Pan paniscus*), in which the pith of the terrestrial herbaceous vegetation (THV) that they consumed was newly utilized. We investigated the 1) frequency of encountering remnant saliva on three types of THV pith; 2) concentrations of DNA in the saliva samples by the real-time quantitative PCR; and 3) rates of positive PCR, accurate genotyping, and allelic drop out by analyzing two autosomal microsatellite loci (D7s817 and D9s910). The number of remnant saliva samples was recorded by following bonobo groups on a daily basis. The frequency of encountering DNA samples was higher in saliva samples than in fecal samples. More than half of the saliva samples remaining on two types of THV pith provided sufficient concentrations of bonobo DNA (> 200 pg/μl). Rates of positive PCR and accurate genotyping were high, and allelic drop out rate was low when the amount of template DNA was above 200 pg per reaction. Our results suggest that the remnants of bonobo saliva on the pith of THV are potential resource for obtaining DNA, and better than other kinds of samples from the perspective of the abundant sampling opportunities.

## O-15
# Salivary Alpha-Amylase Enzyme is a Biomarker of Acute Stress in Japanese Macaques (*Macaca fuscata*)

Nelson Broche Jr.[1*], Rafaela S. C. Takeshita[1], Keiko Mouri[1], Fred B. Bercovitch[2, 3], Michael A. Huffman[1]

1. Primate Research Institute, Kyoto University, 2. Wildlife Research Center, Kyoto University, 3. Save The Giraffes

**Abstract:**

Salivary alpha-amylase (sAA) enzyme functions as a digestive enzyme in many species which consume starch in their diet. However, over the last several decades human studies have revealed sAA enzyme activity levels are positively correlated with the release of the *fight-or-flight* stress hormone norepinephrine, allowing sAA to act as a biomarker for sympathetic nervous system activity. Non-human primate studies have begun including sAA as a physiological stress marker in rhesus macaques, chimpanzees, bonobos, and gorillas. However, to date, there are no published reports investigating the time course of sAA from a stressful event to return to baseline levels in non-human primates. Furthermore, no validation of sAA as a stress biomarker has been reported for Japanese macaques, which could provide a useful tool for stress-related research questions as well as practical uses in animal welfare. This study had two primary aims: [1] develop a systematic method for non-invasive saliva collection and [2] investigate sAA as a biomarker of acute stress in *M. fuscata* in order to better understand its acute stress-related characteristics. We developed a non-invasive method for cooperative saliva collection using positive reinforcement training and tracked individual progress over 595 trials in 10 individually housed Japanese macaques. Then, we confirmed that *M. fuscata* possess sAA enzyme via kinetic reaction assay. Finally, we performed 22 acute stress tests to verify when sAA activity returns to baseline after an acute stressor. Our report reveals for the first time the temporal dynamics of sAA when applying acute stress to a non-human primate.

## O-16
# Is Excretion of Mucous Stools Associated with Captivity in the Giant Panda?

Zixiang Li[1], Xuefeng Liu[2], Juan Zhao[2], Yanhui Liu[2], Haihong Xu[2], Changqing Li[2], Tao Ma[2], Bo Wang[2], Yanping Lu[2], Barbara Padalino[3,4], Dingzhen Liu[1*]

1. Key Laboratory of Biodiversity Sciences & Ecological Engineer of MOE, College of Life Sciences, Beijing Normal University, 2. Beijing Key Laboratory of Captive Animal Technology at Beijing Zoo, 3. Department of Veterinary Medicine, University of Bari, 4. Jockey Club College of Veterinary Medicine and Life Sciences, City University of Hong Kong

**Abstract:**

Captive giant pandas (*Ailuropoda melanoleuca*) may suffer from mucous excretion showing uncomfortable and inactive state. Up to date, the causes of this phenomenon remain highly unknown. The aim of this study was to investigate possible associations among the occurrence of mucous stools and season and pandas' age, sex, and quantity of feces. A total of 900 occurrences of mucus excretion and 32,856 daily defecation output in weight in 18 giant pandas were recorded at Beijing zoo from April 2003 to June 2017. The results showed that the likelihood of mucous excretion occurrence decreased by 11.34% for each 1 Kg of fecal output ($Z$ = -4.12, $p < 0.0001$), whilst increased by 5.89% per year of age ($Z$ = 4.02, $p < 0.0001$). Whist individual differences in gender had no significant effect on the mucous occurrence ($Z$ = -0.75, $p$ = 0.4508), a typical seasonal change in mucus occurrence was found. The mean frequencies of mucus occurrence was significantly higher in March and October than in July ($Z$ = 2.26, $p$ = 0.0239 and $Z$ = 2.25, $p$ = 0.0244, respectively). Our results documented the occurrence of mucous stools and confirmed their possible associations with the pandas' age and their fecal output based on a 15-year prospective study. This study not only adds to our knowledge of panda physiology but also suggests the need for further studies examining the causes of the excretion of mucous stools in captive pandas. Reducing the incidence of mucous excretion would not only promote ex situ conservation but enhance panda welfare as well.

## O-17
# Functional Divergence of Bitter Taste Receptor TAS2R38 in Sulawesi Macaques

Xiaochan Yan[1*], Kanthi Arum Widayati[2], Nami Suzuki-Hashido[3], Fahri Bajeber[4], Akihiro Itoigawa[1], Laurentia Henrieta Permita Sari Purba[2], Bambang Suryobroto[2], Yohey Terai[5], Hiroo Imai[1]

1. Primate Research Institute, Kyoto University, 2. Department of Biology, Bogor Agricultural University, 3. Academy of Emerging Sciences, Chubu University, 4. Department of Biology, Tadulako University, 5. Department of Evolutionary Studies of Biosystems, The Graduate University for Advanced Studies

**Abstract:**

Sulawesi macaques have diverged into 7 species and live allopatrically on Sulawesi Island, Indonesia. All seven species are listed as endangered species, and *M. nigra* is critically endangered. Thus, it is important to understand species difference when designing conservation plans for endangered species. Bitter taste plays a role in avoiding ingestion of toxins and resisting bacteria and parasites. We investigated a well-studied bitter taste gene, TAS2R38, receptor for the bitter glucosinolates in brassica vegetables and Phenylthiocarbamide (PTC). We studied PTC sensitivity and TAS2R38 polymorphism in *M. hecki* (N: 16), *M. tonkeana* (N: 12), *M. nigrescens* (N: 11) and *M. nigra* (N: 15). Initially, we found behavior response on PTC varies between four species. All individuals of *M. hecki* are sensitive to PTC while some individuals of *M. tonkeana*, *M. nigra* and *M. nigrescens* are low sensitive. Determining TAS2R38 sequence, we found low sensitivity of PTC was mediated by specific TAS2R38 variants. In *M. tonkeana*, substitution on amino acid sites 117, 130 and 134 led to 'low sensitivity', whereas, in *M. nigrescens* and *M. nigra*, two base deletion and one base insertion respectively caused premature stop codon at site 85 and 178. Furthermore, we found these specific variations have independently arisen three times. Later we conducted cell-based functional analysis. We confirmed that the specific variants accurately predicted low PTC sensitivity in vitro. Interestingly, 'low sensitive' variants in *M. tonkeana* can express apparently intact TAS2R38 receptor, with low response to PTC. The intact 'low sensitive' variants may respond to other bitter compounds. We suggested high frequency of 'low sensitive' variants in *M. tonkeana* appeared in the root of divergence of Sulawesi macaques. Our findings revealed species difference on bitter taste; however, whether these differences were resulted from local adaptation need to be studied.

## O-18
# Cognitive Enrichment for Parrots: Effects of Design and Personality

Belinda A Hall[1*], Sally Sherwen[2], Becca Franks[3], David M McGill[4], Rebecca E Doyle[1]
1. Animal Welfare Science Centre, University of Melbourne, 2. Department of Environmental Studies, New York University, 3. Faculty of Veterinary and Agricultural Science, University of Melbourne, 4. Wildlife Conservation & Science, Zoos Victoria

**Abstract:**
Collaborating with zoo keepers, animal scientists and designers has allowed us to improve the welfare of captive animals while adding to scientific knowledge through the development of innovative enrichments. Our first project developed puzzle boxes and a study investigating the effect of personality on the use and effectiveness of cognitive enrichment in parrots. The enrichment created was a puzzle feeder made up of four different tasks: a dispenser, ramp, door and weight displacement task. Each task can be added to each other in any order or removed completely for future use but for our study they were provided individually. The study involved six parrots; two individuals from *Lophochroa leadbeateri, Ara ararauna, Eclectus roratus,* housed in pairs. Before the enrichments were provided behavioural data was collected by direct observation, and keeper surveys on the parrot's personalities were conducted ($n$ = 5). On days when enrichments were present, interactions with the enrichments and time budgets were also recorded. Preliminary results show individual birds varied in their approach to the enrichments, their ability to solve the task, their time budgets and their personality scores. As cognitive enrichment can exercise both mind and body it is a valuable enrichment type, however, it is often costly and difficult to implement. The data collected from theses parrots will be used to look for predictors of successful cognitive enrichment. By identifying personality traits or behaviours which correlate with the use and/or benefits of cognitive enrichment, we aim to help identify animals that are most likely to benefit from cognitive enrichment.

## O-19
# Natural Breeding Behavior of Pinioned Common Shelduck through the Underground Nest Box

Wataru Anzai*, Akinori Tanada
Hiroshima City Asa Zoological Park

**Abstract:**
Common shelduck (*Tadorna tadorna*) is the migratory waterfowl which breeds in northern Eurasia in summer and some individuals overwinter in Japan. In 2011, a few pairs of shelduck newly arrived at Asa zoo, but their wings were pinioned. Other birds living together in the same cage breed in the nest box where 1~2m high position, while the wingless shelducks could not use the boxes. Although some boxes for them were put on the ground, they did not prefer it. Thus, we made the new "underground" nest box by references to the wild breeding behavior, nesting in rabbit burrows. On February 2017, we fill the nest box with the wooden tunnel in the digging trench, besides covered it with fallen branches and leaves. After it was placed, a pair of shelduck often looked into the nest box, moreover female entered inside. Three month later, first egg was laid in the nest. During a month female sat on the eggs, male attack the other species hardly. In June, three chicks hatched and grown up favorably. Next year, we exchange the adult pair between exhibition and narrow backyard to confirm whether another pair also use the underground nest box. As a result, these moved shelducks laid and incubate their eggs in the box. Consequently, the underground structure which mimic the wild nest encourage pinioned shelduck to natural breeding. Our success suggests that providing the environment similar to species history is important for captive animals to breeding behavior, even with the physical disability.

## O-20

# Conservation of Endemic *Pycnonotus penicillatus* Considering the Relative Impacts of Landscape Change on Its Ecology, Feeding and Breeding Behavior in Knuckles Mountain Range of Sri Lanka

Chaya Sarathchandra*, Sriyani Wickramasinghe
Department of Biology, Rajarata University

**Abstract:**
*Pycnonotus penicillatus* (YEBB) is a near threatened endemic resident breeder in the wet zone highlands of Sri Lanka. High population of YEBB, 68% was recorded in higher elevation least disturbed transects compared to 23% the lower elevation transects. In higher elevation undisturbed transects recorded high population counts 72% compared to higher elevation fragmented forest transects57%. YEBB prefer sub canopy feeding to canopy and understory feeding showing five major types of feeding techniques. Nests 89% were located in mid-elevation evergreen forest trees which were ranging from 5m to 8m heights. Breeding coincides with high fruit availability of point endemic *Ilex knuckelensis* and the distribution of this plant is related YEBB ecology. Thus reducing habitat loss (due to cardamom & *Pinus caribaea*) is a top priority for the conservation of YEBB and related ecosystem vitality. Both sexes participated in nest construction took 5 – 8 days to complete (mean = 6.58 ±1.43 days, $n$ = 8). Majority of the nests (> 48%; $n$ = 10) built on *Eleocarpus glandulifer* plants and *Bambusa multiplex*, mean nest height 4.62± 1.26 m. The clutch size ranged from one to two with 87.5% of nests containing two eggs in higher elevation least disturbed sites while this reduced to 53% in lower elevation sites.

## O-21

# Herbs Composition, Diversity & Their conservation strategies in Biopark of Jnanabharathi Campus, Bangalore University, Karnataka

Uday Kumar*, Vidyashree. S, Vishnu H V, Sowmyashree K, B C Nagaraja
Department of Environmental Science, Bangalore University

**Abstract:**

Despite a growing awareness that the herbaceous layer serves a special role in maintaining the structure and function of tropical forests, this stratum remains an underappreciated aspect of forest ecosystems. Published literature reveals that species diversity is highest in the herb layer; forest biodiversity is largely a function of the herb-layer community in tropical dry forest. Furthermore, the herb layer and the overstory can become linked through parallel responses to similar environmental gradients. Herb layer responds sensitively to disturbance across broad spatial and temporal scales, its dynamics can provide important information regarding the site characteristics of forests, including patterns of past land-use practices.

The present study has been carried in Biopark in Jnanabharathi campus of Bangalore University.

Preliminary results reveals that a total of 79 species of herbs & grasses recorded in the study Of which *Chromolaena odorata, Borreria articularis* and *Hyptis suaveolens* were dominant herbs recorded in the campus. The species such as *Evolvulus alsinoidis, Atylosia scarabaeoides* and *Andrographis paniculata* were also recorded, which were known for their medicinal value. Apart from herbs two endemic ground orchids such as *Habenaria roxburgii* and *Spathoglottis pubescence* were also recorded in the campus.

## O-22

# Analysis of Eco-Literacy and Environmental Awareness Using Mangrove Storytelling for Coastal Children Education

Novi Utami Rosyid
Environmental Education Department, Jakarta State University

**Abstract:**

The purpose of this study was to analyze the relationship of the level of eco-literacy to environmental awareness of coastal children in Banten using mangrove storytelling on environmental concepts. The research method used in this study is the ex-post facto correlational method. In this study the data taken was the level of eco-literacy and environmental awareness that were qualitative so that data collection used instruments in the form of observation sheets that have previously been proceed by validity and reliability tests. The population was all students of Elementary School in Coastal Banten. The research sample was 3rd grade of students in SDN Cerocoh – Banten used purposive sampling based on the existence of mangroves around the school. The results of this study can be concluded that there was a significant relationship about 0.897 in positive correlation between the level of eco-literacy and environmental awareness. Based on the results of the study, it can be concluded that the level of eco-literacy of student mangroves was directly connected to students' environmental awareness of mangrove conservation. To make students who can active in mangrove conservation, increasing the mangrove eco-literacy of students is the best solution.

## O-23

# Use of Cardboard Boxes as Environmental Enrichment for Captive Tigers (*Panthera tigris altaica*)

Kota Okabe[1*], Masayuki Matsunaga[1], Ryuichiro Kado[1], Sachiko Seko[2], Kazuhiko Nakano[1], Kaname Okahashi[1], Katsuji Uetake[3]

1. Animal Husbandry and Conservation Section, Kyoto City Zoo, 2. Center for Research and Education of Wildlife, Kyoto City Zoo, 3. School of Veterinary Medicine, Azabu University

**Abstract:**

In small zoos, it is important that the environment is enriched with many items to encourage behavioral diversity in the animals. However, the introduction of a new item sometimes results in accidents and may disrupt their activities. A cardboard box can be easily handled by anyone and can have many uses. Furthermore, some cardboard is Forest Stewardship Council certified and can be used as a material for environmental education. Therefore, we investigated the habituation of tigers to cardboard boxes and explored their possible uses. We found that some tigers would not touch a cardboard box that had been introduced to their enclosure. Therefore, we first habituated the tigers with a box. We found that gradually changing the height of the box from flat to a more box-like shape over consecutive days resulted in the tigers becoming used to it in approximately one month. When using the box, the tigers exhibited behaviors that are associated with hunting. For example, they carried it to a place where they could settle and tore it as they would a prey's skin. In our education program, visitors drew pictures of the forest on a cardboard box and presented it to the tigers by setting it inside their enclosure, leading to an increased awareness of conservation among visitors. Thus, this single item not only increased the tigers' behavioral diversity but also allowed visitors to connect to nature indirectly. These activities could be conducted at any zoo and may contribute to the zoo's activities.

## O-24

# Eurasian Otter's Natural Nursing Behavior Induced by Recreating the Wild Habitat in the Exhibition Enclosure.

Chiho Nakamura[1*], Toshiaki Mori[1], Hikari Yoshizato[1], Jun Yasuda[2]

1. Aquamarine Fukushima, 2. Aquamarine Inawashiro Kingfishers Aquarium

**Abstract:**

Aquamarine Fukushima started to keep Eurasian otters from 2010 and succeeded in breeding them 6 times. We renewed the exhibit in 2015 to recreate natural habitat of wild otters. We employed a novel technique in planting waterweeds and land plants, so that otters cannot damage them easily. In order to exhibit otters with fish, we conducted tests to know which fish species show high survival rate. As a result, we could make the new enclosure's environment as natural as possible for otters. Furthermore, we observed new breeding and nursing behaviors which we had never seen before in captivity. The details of those behaviors are as below.

1) In the old enclosure, the mother otter gave birth in a nest which she usually used. However, in the new enclosure, the mother used several nests prior to parturition and gave birth in the nest which she didn't usually use.

2) In the old enclosure, the mother used only one nest during nursing period. On the other hand, the mother carried pups and changed the nest frequently in the new enclosure. Nest selections were also affected by the weather.

3) Wild Eurasian otters normally defecate in water during nursing period. In the old enclosure, the mother defecated on land and in water, but in the new enclosure, the mother defecated only in water.

These new behaviors are observed in field researches in Europe. Therefore, it may suggest that these natural behaviors were induced from many options for nest and the diverse environment of the new enclosure.

## O-25
# Population Estimate of Bornean Orangutans at Rehabilitated Eastern Bukit Piton in Sabah

Afiqah Mizan*, Henry Bernard
Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah

**Abstract:**
Nearly half of the free-ranging primate species are threatened with extinction due to habitat destruction and illegal poaching. The orangutans inhabiting the islands of Borneo and Sumatra are no exception and are all critically endangered. We assessed the current status of the population estimate of Northeast Bornean orangutans (*Pongo pygmaeus morio*) by counting their nests at the eastern part of Bukit Piton Class I Forest Reserve, Sabah, Malaysia, which had undergone a reforestation effort under the Ulu Segama Malua Sustainable Management Project since 2008. We further categorized the forest into >5 years old compartments (West; 26.5 $km^2$) and <5 years old compartments (East; 27.5 $km^2$). We used the Standing Crop Nest Count method where all built nests are counted during line transect survey. Applying Modified Kelker to obtain the Maximum Reliable Strip Width, we found a total of 72 nests at both forest areas, ranging from 1 to 20 nests per 1-km trail. The initial population density was 1.31 ind/$km^2$ at the East compartment and 1.86 ind/$km^2$ at the West compartment. The combined density was 1.58 ind/$km^2$ with an estimate of 85 orangutan individuals. Our results serve to inspect the effectiveness of the forest rehabilitation program, which is one of the central features in primate conservation, on the orangutan population trend.

## O-26
# Environmental Enrichment and Birth Support for Western Gorillas at the Kyoto City Zoo

Saki Yasui*, Fumiko Nakahara, Naoko Takagi
Kyoto City Zoo

**Abstract:**
There are only 22 gorillas in Japan now, mainly because of a lull in the import of gorillas for breeding a few decades ago. Our zoo has kept gorillas since 1960, with five instances of successful reproduction. We have worked steadily to improve the captive environment and encourage reproduction of gorillas.

In 2014 we built a new enclosure with an artificial structure that allows the gorillas to climb and brachiate and obtain food near the ceiling. It has worked very well to increase their movement patterns, and allows visitors to enjoy watching brachiation. We also provide various enrichment tools for gorillas. This presentation will introduce some of the enrichment tools, and describe how we monitor heart health for husbandry training.

In December 2018 we had our first birth in seven years. When the mother, Genki, gave birth in 2011 to her first son, Gentaro, she didn't have enough milk for him and he was nursed by keepers for his first ten and a half months. We therefore took steps to encourage milk production for the recent birth. We also had our silverback, Momotaro, and Gentaro present for the birth, the first time either had seen a birth. We report here on the arrangements for the mother's second birthing and the behaviors of the family around the birth.

## O-27
# Reciprocal Turn-Taking of Social Grooming in Captive and Wild *Pan* Species

Morgane Allanic[1*], Misato Hayashi[1], Masaki Tomonaga[1], Takeshi Furuichi[1], Satoshi Hirata[2] and Tetsuro Matsuzawa[3]

1. Primate Research Institute, Kyoto University, 2. Wildlife Research Center, Kyoto University and 3. Institute for Advanced Study, Kyoto University

**Abstract:**

Conversation is characterized by a reciprocal turn-taking of short and flexible speech between two or more individuals. Social grooming in nonhuman primates is often considered to be analogous to human conversation, and similarly, it can be characterized by a reciprocal turn-taking of unidirectional grooming. Moreover, to reciprocate, nonhuman primates can also simultaneously groom each other (bi-directional grooming). While simultaneous speech is usually seen as a mistake in modern human societies, it is frequently used in some hunter-gather societies. This study aimed to investigate the turn-taking and turn-allocation during social grooming in both captive and wild chimpanzees (*Pan troglodytes*) and bonobos (*Pan paniscus*). Subjects were twelve captive chimpanzees and six captive bonobos from Kumamoto Sanctuary, Japan; seven wild chimpanzees from Bossou, Guinea; and fifteen wild bonobos from Wamba, DRC. We used video recording of social grooming interactions and analyzed the frequency of uni- and bi-directional grooming, turn-taking and turn-allocation. Data are currently under analysis and results will be presented during the talk. However, preliminary results on uni- and bi-directional grooming showed both species and environmental differences with chimpanzees and captive individuals performing more bi-directional grooming than bonobos and wild individuals, respectively.

## O-28
# Let Koalas Enjoy the Arboreal Life ~a Project of Osaka Tennoji Zoo, Japan

Yuko Tsunekawa*, Hideki Tsujimoto, Kenji Aburaya, Michiko Niki, Masamichi Tsuchiya, Harunobu Hisada, Shoichi Ochi, Shin Nishioka.
Osaka Municipal Tennoji Zoological Gardens

**Abstract:**
Koala is arboreal animal, but it is not common to give opportunities to climb up natural trees to koalas kept in zoos in many countries. We assume that the natural trees can lead to natural behavior of koala, so we started the attempt to provide them to our male koala which was born in 2006. We keep him in outdoor area in the daytime and in indoor area at night. There are about 30 natural eucalyptus trees 10m high in the outdoor area. Natural trees used to be protected and he could climb only artificial trees 1.5m high. We removed the protections of trees in March 2016. Soon, he climbed up natural trees, and his behavioral diversity has been increased remarkably. Now, he usually stays in natural trees much higher than artificial trees. He sometimes climbs up so high to the thin branch which is waved in the wind and stays there balancing, occasionally even leaps to the next trunk from high branch. In hot summer days, he attaches his body to the tree trunk to decrease body temperature like wild koalas. Our attempt shows that the natural trees can lead to diverse natural behavior of koalas and contribute to improvement of the captive environment for them. We will keep on seeking the better way to let him enjoy the arboreal life.

## O-29
# Practical Application of Environment Enrichment at a Rescue Centre in South-East Asia

Debbie Ng[1*], Margaret Whittaker[2]
1. ZooLogic Training & Consultancy 2. Creative Animal Behavior Solutions

**Abstract:**
Many South-East Asian rescue centres share common challenges in their pursuit to rehabilitate and release as many wild animals as possible, or in having to absorb those that are non-releasable into their own collections. Dealing with the needs of large numbers of animals presents its own set of challenges. Primary among those is limited funding, which naturally has an effect on other aspects of animal care including facilities, hiring and maintaining professional, experienced animal care and management teams, and keeping current with global animal welfare and care standards. Another regularly encountered problem is predation. South-East Asia has a healthy population of wild Reticulated and Burmese pythons. These large snakes actively hunt at night and often predate on captive animals, both in zoos and rescue centres. Facilities take measures to protect collection animals from predation, which is typically in the form of snake trapping, shifting animals to a safe holding area and/or having snake proof containments. These forms of protection keep collection animals safer, but at a cost. Animals who are shifted into holding areas typically spend a considerable amount of time in holding where they may have less space and limited behavioural opportunities. Animals living behind snake proof fencing have limited visual range and opportunity to see distances due to the small mesh sized necessary to prevent predation by snakes. This paper will explore how a rescue centre used environmental enrichment to protect and rehabilitate rescued wild animals, to increase their chances for release back to the wild, and to enhance welfare and their ability to cope with the conditions of captivity enabling them to live rich, full lives.

## O-30
## Measuring a Degree of Spatial Freedom in Wild Chimpanzees, Bossou

Naruki Morimura
Kumamoto Sanctuary of Wildlife Research Center, Kyoto University

**Abstract:**
Maximizing a degree of behavioral freedom is one of major welfare concerns for all captive animals. However, how to measure the behavioral freedom has not been discussed on evidential basis. Characteristics in physical environment can vary in terms of space and time. Animal behavior can also be determined by the two dimensions. On the place where an animal stays as spatial information, if an animal is kept in small area, we can easily predict the animal place at a certain sampling point (N) from a previous point (N-1), indicating less degree of spatial freedom. In other words, the more an animal moves within its home range/cage, the more the degree of spatial freedom increases, irrespective of captivity or the wild. The present study focused on a habitat use of wild chimpanzees, in order to examine an effectiveness of the index for measuring a degree of spatial freedom. An observational study was conducted by following seven well-habituated chimpanzees in Bossou, Guinea, between December 2018 and January 2019. A cumulative traveling distance was calculated for eight periods of overlapping 3-hour such 8am-10am, 9am-11am, and so on in each single day. Traveling distances were compared in within-day and between-day. As the results, in between-day comparison, the traveling distance in eight periods varied significantly more than overall traveling distance, suggesting the importance of time dimension in spatial freedom such that wild chimpanzees were more flexible in decision-making on when they travel, while the total traveling distance daily was relatively constant with about 4km.

## O-31
# Strategic Usage of Enrichment in Increasing Animal Activity and Visibility

Kelly Chew*, Delvinder Kaur
Wildlife Reserves Singapore

**Abstract:**
Enrichment is a commonly proposed method for promoting natural behaviours, increasing activity levels and ameliorating stereotypic behaviour. Apart from improving captive animal welfare, an increase in the display of natural behaviours would also add to a positive zoo experience for visitors. Our study attempts to explore how enrichment can be strategically used to increase animal activity levels and amount of time spent utilising the exhibit space by targeting specific periods of inactivity and non-visibility. A preliminary survey of all exhibits within the walking trails at Night Safari was conducted over a period of four hours to identify exhibits that had visibility levels below 60%. Data was collected on animal behaviour, visibility and activity levels, as well as guest satisfaction levels and guests' perception of the animals. From the survey, we identified eight exhibits which housed the following species: lesser mouse-deers (*Tragulus kanchil*), Asian small-clawed otters (*Aonyx cinereus*), fishing cats (*Prionailurus viverrinus*), common palm civets (*Paradoxurus hermaphroditus*), Asian golden cat (*Catopuma temminckii*), spectral tarsiers (*Tarsius tarsier*), red and white giant flying squirrel (*Petaurista alborufus*), Indian giant flying squirrel (*Petaurista philippensis*) and sugar gliders (*Petaurus breviceps*). Various enrichment tools were rotated daily within the exhibits in the form of food presentation, auditory and olfactory stimuli, and novel items to evaluate their effects on the activity levels and time spent in visible areas of the exhibit. The findings of this study and the efficacies of prudent enrichment application will be presented in greater detail during the presentation.

## O-32
# Filling the Gap: Animal Welfare Risk Assessment and Its Application to Enhance the Quality of Life of Zoo Animals

Yumi Yamanashi[1, 2*], Yoko Sakuraba[1, 2], Fumio Itoh[1], Yasunori Takenaka[1], Ryuichiro Kado[1]

1. Kyoto City Zoo, 2. Wildlife Research Center, Kyoto University

To effectively improve animal welfare, the gap in animal welfare across species and related determining factors requires systematic comprehension. At the Kyoto City Zoo, a process of animal welfare risk assessment was initiated to define which priorities to improve from 2017 onward. Animal welfare assessment sheets developed by Wild Welfare were used, which included questions related to physical and social environment, nutrition, behavior, health, and animal care. Keepers and researchers rated the enclosures using the sheets. A total of 51 enclosures were assessed between November 2017 and May 2018. We found that taxonomy, environmental variables, and keepers' experience affected the average scores. Among the low-scored animals, we chose three species (scarlet and great green macaws and a Japanese black bear) as targets for the year. We also evaluated the effects of environmental enrichment by performing behavioral observations between July 2018 and January 2019. Although the effects varied among species and individuals, the targeted enrichment affected animal behaviors, with effects more evident in Japanese black bears than in macaws. In this presentation, we will provide details on the efforts made to improve the quality of life of animals by using a combination of enrichment, research, and educational activities, and we will discuss the tasks and strengths of this approach to promote positive welfare.

## O-33
# The Zoo Tells You Animal Welfare – the Introduction of Omuta City Zoo –

Kanako Tomisawa[1, 2*], Kazuyuki Ban[1, 3] Shun-ichi Shiihara[1]
1. Omuta City Zoo, 2. Teikyo University of Science, 3. Graduate School of Education, Seisa University

**Abstract:**
Omuta City Zoo was established in 1941, and it had been in danger of shutting down a couple of times due to the decline of attendance. However, the yearly attendance increased after the zoo's concept was changed to "the zoo that tells you animal welfare". This concept means that we don't only show animals, but also show the zoo's staff who make efforts for animal welfare, and that we would like visitors to think about animal welfare together. The "welfare" aspect is the key for such regeneration of the zoo, and environmental enrichment is the key approach to enhance quality of life (QOL) to achieve the animal welfare.

In this presentation, I would like to introduce various examples of environmental enrichment including feeder, furniture in the enclosure, the way of feeding, a petting zoo with consideration for animals, and so on.

## O-34
# Connection between Wild and Captivity: A Case Study on Endangered Proboscis Monkeys

Ikki Matsuda[1, 2, 3, 4*], Henry Bernard4, Augustine Tuuga[5], Sen K.S.S. Nathan[5], John C.M. Sha[6], Ismon Osman[7], Rosa Sipangkui[5], Satoru Seino[8], Sanae Asano[9], Anna Wong[4], Michael Kreuzer[10], Diana A. Ramirez Saldivar[5], Marcus Clauss[11]

1. Chubu University Academy of Emerging Sciences, 2. Wildlife Research Center, Kyoto University, 3. Japan Monkey Centre, 4. Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, 5. Sabah Wildlife Department, 6. School of Sociology and Anthropology Department, Sun Yat-sen University, 7. Singapore Zoo, Wildlife Reserve Singapore, 8. Zoorasia, Yohohama Zoological Gardens, 9. Department of Animal Science and Resources, Nihon University, 10. ETH Zurich, Institute of Agricultural Sciences, 11. Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich

**Abstract:**

Today, habitat destruction and poaching threaten nearly half of the free-ranging primate species with extinction. Hence, conservation programs have become integral aspects of zoological management. Studies in captivity have revealed that foregut-fermenting primates, i.e., colobines, were historically difficult to maintain healthy in captivity, and they had shorter lifespans compared to free-ranging individuals. Proboscis monkeys (*Nasalis larvatus*), endangered and endemic to Borneo, are the largest foregut fermenting colobines. They are notoriously difficult to maintain and breed in captivity. By introducing the case studies of proboscis monkeys, light might be shed on the establishment of a constructive in-situ and ex-situ collaborative link. This link should aid the management of their dietary needs and possibly to provide impetus necessary for conservation and education initiatives, which will be beneficial for their long-term conservation.

## O-35
# Modeling Habitat Suitability for Yunnan Snub-nosed Monkeys in Laojun Mountain National Park

Jie Liu[1*], Maegan Fitzgerald[1], Haohong Liao[3], Yongmei Luo[4], Tong Jin[4], Xiaolan Li[3], Xuerong Yang[5], Satoshi Hirata[1], Tetsuro Matsuzwa[2]

1. Wildlife Research Center, Kyoto University, 2. Institute for Advanced Study, Kyoto University, 3. The Nature Conservancy, Yunnan Office, 4. The Nature Conservancy, Beijing Office, 5. Lijiang Laojun Mountain Biodiversity Conservation Center

**Abstract:**

In this study, we provided new information on Yunnan snub-nosed monkey (*Rhinopithecus bieti*) behavioral ecology and contributed to future conservation efforts within the Laojun Mountain National Park. Habitat evaluation procedures are used to quantify the value of land as habitat for a species. We analyzed environmental variables hypothesized to influence habitat suitability for Yunnan snub-nosed monkeys, and mapped the distribution of suitable habitat across the study area and adjacent areas. Spatial analysis with GPS data was conducted to investigate home range change of these monkeys. Predictor variables were generated using ArcMap and R. We prepared 34 environmental variables at 30-m spatial resolution. Maxent was used to analyze environmental variables that contributed to suitability. Using satellite remote sensing and GIS, we modeled the distribution of suitable habitat for Yunnan snub-nosed monkeys in the Jinsichang area of the Laojun Mountains in China. Habitat suitability was affected by several variables. The environmental variables that contributed most to habitat suitability, as determined by permutation importance, were mean diurnal range (31.6%), precipitation during the wettest quarter of the year (30.4%), average annual precipitation (17%), normalized difference vegetation index (5%), wetness (4.6%), and aspect (4.5%). This habitat suitability model provided important information about the potential current distribution of Yunnan snub-nosed monkeys that is essential for appropriate implementation of conservation actions.

## O-36

# Struggle for Existence: An Investigation to Decode Perception of Farming Community towards Non-Human Primate and Their Interactions in Western Himalayas

Himani Nautiyal
Kyoto University, Primate Research Institute Japan.

**Abstract:**
The farming communities of small villages in the Himalayan Mountains are poor due to harsh weather, low agricultural yields and less connectivity with the consumer markets, resulting in low employment, making farming; an only aid towards basic necessities of food and income. The frequent damages to the crops by wildlife has resulted in direct conflicts with the local farmers. The detailed study has been carried out to understand the factors governing interactions between the Central Himalayan Langur (*Semnopithecus schistaceus*) and the local farming community along with their perception. A detailed questionnaire was administrated to 215 households of six villages to understand their perception of the langurs and the factors governing interactions with them and the local farming community. The Waited Rank Index (WRI) was used to rank the importance of responses to questions with multiple responses. We assessed langur crop damage as a binary response and analyzed the effect of agriculture type and socioeconomic conditions through general linear mixed models (GLMM). We found significant differences in crop raiding by langurs among these 6 villages in the same valley (GLMM, $p < 0.0001$). Villages with terraced fields had low agricultural productivity, low economic status and high dependency on the surrounding forest. They faced more crop damage compared to villages with flat open, well-irrigated fields, high production and low dependency on the surrounding forest. The people's perception of langurs was complex. First responses were largely negative, projecting langurs as agricultural pests. Planting of fodder trees around the terraced fields and over-exploitation of the surrounding forest were perceived as being a reason for increased crop raiding by langurs and other wildlife. This study shows that overexploitation of oak trees, the dominant species in the surrounding forest, and an important fruiting tree for langurs, is the main reason for crop damage. Planting of key tree species "oak" in the forest would be a potential solution for the crop-raiding problem in the terraced field farming villages.

## O-37

# Long-Term Vocal Recognition of Past Social Partners in Bonobos

Sumir Keenan[1, 2*], Nicolas Mathevon[2], Jeroen MG Stevens[3], Jean Pascal Guéry[4], Klaus Zuberbühler[5, 6], Florence Levréro[2]

1. Institute for Advanced Study, Kyoto University, 2. Equipe Neuro-Ethologie Sensorielle, ENES/Neuro-PSI, Université de Lyon/Saint-Etienne, 3. Centre for Research and Conservation, Royal Zoological Society of Antwerp, 4. Vallée des Singes Zoological Park, 5. School of Psychology & Neuroscience, University of St. Andrews, 6. Department of Comparative Cognition, Université de Neuchâtel

**Abstract:**

Long-term social recognition is vital for species with complex social networks, where familiar individuals can encounter one another after long periods of separation. For non-human primates who live in dense forest environments, visual access to one another is often limited, and recognition of social partners over distances largely depends on vocal communication. Vocal recognition after years of separation has never been reported in any great ape species, despite their complex societies and advanced social intelligence. Here we show that bonobos, *Pan paniscus,* demonstrate reliable vocal recognition of social partners, even if they have been separated for five years. We experimentally tested bonobos' responses to the calls of previous group members that had been transferred between captive groups. Despite long separations, subjects responded more intensely to familiar voices than to calls from unknown individuals - the first experimental evidence that bonobos recognise familiar individuals even years after their last encounter. Our study also suggests that bonobos may cease to discriminate between familiar and unfamiliar individuals after a period of eight years, indicating that voice representations or interest could be limited in time in this species.

## O-38

# Visitor Effect and the Impact of Isolation on the Behavior of Yellow-Cheek Gibbon (*Nomascus gabriellae*) and White-Handed Gibbon (*Hylobates lar*) in Captivity

Saein Lee[1*], Heungjin Ryu[2, 3], Yoonjung Yi[1], Seonah Jang[4], Haeun Gye[5], Bae Keun Lee[5], Jaechun Choe[2]

1. Laboratory of Behaviour & Ecology, Interdisciplinary program of EcoCreative, Ewha Womans University, 2. Research Institute of Ecoscience, Ewha Womans University, 3. Division of Basic Ecology, National Institute of Ecology, 4. Department of Biological Sciences, Pusan National University, 5. Division of Zoological Research & Management, National Institute of Ecology

**Abstract:**

Various types of social interactions are critical for the welfare of captive animals. A high number of human visitors are known to have impacts on captive animals, which is called visitor effect. Social interactions with conspecifics are essential for group-living species, and they also may moderate stress caused by visitors. Therefore, if social interactions are not available, such as isolation, it can affect the behavior of captive animals. This study mainly focused on quantifying the effect of number of human visitors and the social isolation from conspecifics on behaviors of a captive yellow-cheek gibbon (*Nomascus gabriellae*) and a white-handed gibbon (*Hylobates lar*) in the National Institute of Ecology, South Korea. We examined how the number of visitors and the social isolation affected gibbons' stress responses by monitoring self-scratch, yawning and space use. There was no visitor effect on the stress response before the isolation. However, during and after the isolation, the stress responses increased when more visitors were around. There was visitor effect on space use of gibbons. After isolation, both gibbons used the smallest island more than before where they can visually examine visitor's presence. Our results suggest that visitor effect can vary depending on the social group setting. Therefore, captive management activities should consider impact of social settings of animals and visitors for the welfare of social animals.

## O-39

# Keeper Preference as a Sensory Stimuli in Positive Reinforcement Training for Four Species of Reptiles

Marsenia Trinanda Haris*, Francisco Reyes Valdes, Demi Charlie Booth, Aikee Jay Veloso, Raymond Larioque Norte

Dubai Safari Park, Dubai, United Arab Emirates

**Abstract:**

Positive Reinforcement Training (PRT) is not only a valuable technique in animal care and management, it has also become an environmental enrichment strategy, however very few studies have evaluated environmental enrichment strategies for reptiles. Four different species suspected to be wild caught were evaluated in this study (Nile Crocodile, Komodo Dragon, Water Monitor Lizard and Desert Monitor). A PRT program for each species were put together using Sensory Stimuli which includes visual stimuli (target training), olfactory stimuli (scent based target) and auditory stimuli (clicker or keeper calls) in handling for health checks as well as to train the animals to move to a certain location. Four keepers then take turns on implementing the PRT towards the four reptile species. Behavioural observations using time scan sampling with 30 second intervals were done on three types of training sessions consisting of pre-training control, training session, and post-training session of 30-min each and conducted over a two-week period. Results show that behavioural response from animals towards four different keepers were significantly different during the training session whereas there are no behavioural differences during pre-control and post-training session. The difference found indicates that keeper preference play a role in the efficacy of the training and measured through the animal's response and progress to the trainings. There were no difference in response of reptiles towards the three types of training. The results suggest that preference may be a significant factor in the efficacy of positive reinforcement training although further investigation is required to understand the impact of human-animal relationship.

## O-40
# Implementation of Husbandry Training to Provide Medical Care to an Old Puma

Noe Nakashima*, Takeshi Machide, Kenji Ooshiro, Katsuyuki Nishida, Hiroyuki Nakayama
Osaka Municipal Tennoji Zoological Garden

**Abstract:**
Recently, positive reinforcement training has increasingly been adopted in zoos to improve the quality of life of captive animals. We also have been implementing this training for our 17-year-old puma to provide medical care for these past two years.

So far, we have succeeded in ocular instillation, vaccine administration and blood collection from tail vain without anesthesia, and punch biopsy with local anesthesia alone, though little has been reported on application of painful biopsy method without general anesthesia for large felids in Japan.

Currently, we are instilling glycerin solution in her eyes every day to prevent the progression of corneal clouding caused by the disorder in corneal endothelium. And we are also monitoring the blood test data periodically by using collected blood samples to prevent the deterioration in kidney function and to measure the level of antibody to combination vaccine for felines. Furthermore, we conducted a punch biopsy of subcutaneous masses and diagnosed them as lipoma.

These cases indicate that the positive reinforcement training is useful for the health management of the aged animals kept in zoos.

## O-41
# Show Me Chaos! Seeking Fractal Time in Captive Animal Behavior

Andrew J J MacIntosh[1*], Christopher F Martin[2]
1. Kyoto University Primate Research Institute, 2. Indianapolis Zoo

**Abstract:**
Patterns of animal behavior have long been used as indicators of captive animal health and welfare. However, at least two major challenges continue to plague behavioral welfare assessment: (1) determining which aspects of behavior might be most indicative, which typically varies with the system being investigated; (2) quantifying behavioral variation across individuals, species and contexts in a systematic and objective fashion. Here, we show that exploring organizational properties in behavior time series may shed light on animal welfare states, and thereby provide a means to objectively assess the utility of various enrichment programs. First, we highlight the results of multiple studies showing that complexity in the temporal structure of behavior is biologically adaptive, and that complexity loss, i.e. deviations from normal along a stochastic-deterministic behavior gradient, may be diagnostic of stressed, diseased or otherwise challenged individuals. In the process, we also highlight physiological, ecological and even phylogenetic determinants of so-called '*complexity signatures*', to better understand the mechanisms that might underlie the emergence of fractal patterns in animal behavior. We then address some avenues for implementing fractal time series analysis and other related approaches in the assessment of animal welfare and enrichment. While by no means a silver bullet, we propose that injecting some complexity science into the study of animal welfare and enrichment may help solve some of the challenges of behavioral welfare assessment by offering objective tools that can be applied universally across systems and contexts.

## Other Talks

### 24th June 2019

**Luncheon Seminar**

**Developing a Work Life Balance as a Zoo Executive**

Megan R. Ross (Chair: Yumi Yamanashi)

OT-1

### 25th June 2019

**Plenary Talk**

**Enrichment for Primates in Laboratories and Zoos: Same Principles, Different Constraints**

Hannah M. Buchanan-Smith

OT-2

**Workshop**

**Positive Reinforcement Training Workshop: What is Scientific Training? ~the basic applied behavior analysis (ABA) and its application~**

OT-3: Behavior Analysis as the Science of Animal Training (Naoko Sugiyama)

OT-4: Overview of the Zoo Atlanta Gorilla Training Program (Jodi K Carrigan)

OT-5: Case Study of Husbandry Training at Omuta City Zoo (Kazuyuki Ban)

### 26th June 2019

**Workshop**

**Environmental Enrichment Workshop: Practical Tips for Creative Enrichment: we are happy and we wear happi! (SHAPE-Japan)**

OT-6: A Practical Approach to Enrichment (Valerie J Hare and Karen E Worley)

### 27th June 2019

**Plenary Talk**

**Environmental Enrichment in the Horse (and other animals)**

Daniel S Mills (Chair: Takako Miyabe)

OT-7

# OT-1
# Developing a Work Life Balance as a Zoo Executive

Megan R Ross
Lincoln Park Zoo

**Abstract:**
The promotion of a work-life balance, in which a person creates synergy between professional expectations and personal needs to achieve both productivity and happiness, is of growing interest to progressive organizations but often difficult to achieve. Doing so requires individuals to clearly identify their personal goals and priorities as well as the personal and professional challenges that may buffer their progress. As a female zoo director in a role that has traditionally been male-dominated, and as a scientist in an environment that traditionally has not relied on empirical evaluation to shape organizational mission, I have faced several challenges to not only meet my own goals but to promote a work-life balance for others at my organization as well. In this discussion, I will describe my personal leadership journey to becoming the first woman director in the 151-year history of Lincoln Park Zoo in Chicago, USA. This will include managing the dual expectations that many people face in their roles as professionals and parents, how I have incorporated a scientific outlook in my role as an executive leader, and setting a culture of work-life balance for a leading zoological park.

## OT-2
# Enrichment for Primates in Laboratories and Zoos: Same Principles, Different Constraints

Hannah M Buchanan-Smith
Department of Psychology, University of Stirling

**Abstract:**
Compared with laboratory housing, zoo enclosures are usually, larger, more complex, and most primates have free choice to access indoor and outdoor areas. Most research conducted in zoos is non-regulated and so must not have the potential to cause the primates pain, suffering, distress or lasting harm. Whilst research testing in individual cubicles is increasing in zoos, separation from the group and participation is on a voluntary basis, unlike the strict constraints of study protocols and scientific procedures performed on laboratory-housed primates. Despite such differences in the environment and husbandry that may constrain possibilities for environmental enrichment, many principles for promoting good welfare remain the same. The role that humans play in both settings is critical to the welfare of the primates. Drawing on over thirty years of research experience on primates in zoo and laboratory environments, as well as in the wild, I shall describe how we can provide opportunities for animals to have positive affective states, taking a 24/7 across the lifespan approach.

# OT-3
# Behavior Analysis as the Science of Animal Training

Naoko Sugiyama
Graduate School of Education, Seisa University

**Abstract:**
Human beings have trained animals for centuries to assist them with transportation and productivity such as riding, working, and hunting. In addition, they have trained animals even for entertainment purposes. Circuses and horse racing are popular entertainment in various cultures, and many people enjoy dog sports like agility recently. In the long history of animal training, human beings had developed ingenious techniques to handle animals. However, most of those techniques were established through trial and error, instead of the science of animal behavior.

A Russian physiologist, Ivan Pavlov (1849-1936) and an American psychologist, B. F. Skinner (1904-1990) were the two key persons who bought science into animal training. In modern science of learning, animal behaviors are shaped based on two principles, respondent conditioning and operant conditioning. Pavlov discovered the former and Skinner found the latter. Especially, Skinner used rats and pigeons as his experimental animals and systematically changed their behavior by giving them food rewards. Skinner eventually systematized behavioral principles which he had discovered experimentally and established behavior analysis as the science of behavior. Skinner was not only a distinguished scientist but also a great practitioner. During World War II, he worked with his assistant, Marian Kruse, on Pelican Project, in which pigeons were trained to guide missiles at the request of the Navy.

In this address, the basic principles of behavior such as reinforcement, punishment, extinction, stimulus control, shaping, and chaining will be illustrated, and how to apply these to the scientific animal training will be described.

## OT-4
## Overview of the Zoo Atlanta Gorilla Training Program

Jodi K Carrigan
Zoo Atlanta

**Abstract:**
Zoo Atlanta is home to one of the largest populations of gorillas in North America, including two gorillas over the age of 56. While we are proud to feature such a wide variety of life stages and social groupings, there are challenges in caring for such a large population, not to mention the inherent challenges to caring for aging gorillas. In order to effectively manage these challenges, Zoo Atlanta animal care professionals work to proactively train the animals in order to improve husbandry and reduce stress around medical procedures. Through groundbreaking efforts in training through positive reinforcement, gorillas have been trained for voluntary blood pressure readings, cardiac ultrasounds and heart rates, and blood draw. This training has been critical in advancing the diagnosis, treatment, and management of great ape heart disease, the leading cause of mortality in gorillas living in a zoological setting. Additionally, Zoo Atlanta has expanded training efforts to include voluntary radiographs, voluntary milk collection, voluntary prenatal ultrasounds and fetal echo ultrasounds to help us monitor fetal growth. While managing a large and diverse population of gorillas can be challenging, those challenges can be minimized through a forward-thinking training program.

# OT-5
# Case Study of Husbandry Training at Omuta City Zoo

Kazuyuki Ban[1, 2, 3]
Omuta City Zoo
1. Omuta City Zoo, 2. Graduate School of Education, Seisa University, 3. SHAPE-Japan

**Abstract:**
Omuta city zoo has a concept “A zoo that tells you animal welfare”, and we make efforts for husbandry training and environmental enrichment. We use Husbandry training to make it as the technique that all the keepers at our zoo can use.

We have done husbandry training for 53% of our animals and do more than 30 kinds of trainings. Furthermore, we’ve succeeded the blood sampling without anesthesia of twelve species, and five of them have been the first time in Japan. In this presentation, I introduce three examples of husbandry training at our zoo.

The first example is the blood sampling of big cat species. The key step is how to make animals get used to the stimulation by the needle on its tail. On the same position, we can have body temperature measurement, intravenous injection, and so on.

The second example is the blood sampling of Mandrill. The key step is to make the animal put his arm into the attachment and keep gripping the bar inside the attachment underhand firmly.

The last example is the combination of environmental enrichment and husbandry training for Fox. The key step is how to make the animal get closer to the puzzle feeder. This example indicates husbandry training can work when the environmental enrichment doesn’t work naturally.

We’d like to apply husbandry training for other species within various kinds of trainings to improve animal welfare.

## OT-6
# A Practical Approach to Enrichment

Valerie J Hare, Karen E Worley
Co-founders, The Shape of Enrichment

**Abstract:**
The most successful enrichment plans are behavior-based, goal-oriented, holistic, and assessed. Enrichment strategies should be based on the animal's behavioral biology, targeting behaviors and abilities appropriate for both the species and the individuals involved. At The Shape of Enrichment, we have used a systematic planning process based on these concepts for over 19 years in a variety of situations around the world. This has proven to be an excellent mechanism to ensure effective and efficient enrichment planning.

# OT-7
# Environmental Enrichment in the Horse (and other animals)

Daniel S Mills
School of Life Sciences, University of Lincoln

**Abstract:**
Equids occupy a unique niche in their relationship with humans and thus provide a good model for understanding the value of, and challenges to, enrichment in a wide variety of captive systems. In some contexts they are working animals kept for their utility; however, they are also often seen as close companions with a strong emotional bond extended from their carers. Each of these statuses bring important but different potential challenges to providing a suitably enriched environment. In the former case, a focus on performance may place profitability ahead of other concerns; while in the latter case, there may be an emotional distortion of what the animal needs due to anthropomorphic views about a horse's needs and wants.

Enrichment is often "sold" on the basis of the need to improve the captive environment, address problems or prevent welfare issues, all of which emphasise (even if subliminally) a problem with the environment. This negative message can result in psychological barriers to implementing effective changes. In this presentation, I will argue, that if we are to maximise the potential of enrichment, we need to develop a more positive message, based on connecting and communicating with carers and keepers at a level which recognises their needs, hopes and aspirations; emphasising how enrichment can help them get more of what they want. I will also highlight the value of thinking about enrichment in terms of the provision on unexpected positive reinforcement. The principles discussed apply to all captive animals.

## Poster Presentations

**23rd June 2019**

**Day 1**

from P-1 to P-29

**24th June 2019**

**Day 2**

from P-30 to P65

## P-1
## Chimpanzee Reactions to Death Stimuli

Hanling Yeow[1*], Hirata Satoshi[1], James Anderson[2]
1. Wildlife Research Centre, Kyoto University, 2. Department of Psychology, Kyoto University

**Abstract:**
Putrescine is a substance released when bodies decay, with a distinctive unpleasant odor. In humans, exposure to putrescine increases vigilance during tasks and provokes escape behaviours, as well as thoughts of escape. Subliminal exposure, where the humans are unaware of the substance, has an effect on humans as well - it causes increased aggression and hostility to an outgroup member.

What are their effects on chimpanzees, our closest living relative? This research presents stimuli of death, including putrescine, to chimpanzees at Kumamoto Sanctuary, to observe and identify their reaction. Chimpanzees are presented with a dead, preserved bird along with the smell of putrescine and video-recorded for 5 minutes. Behaviours such as approaching or moving away, aggressive or excitable actions like hooting and displaying, and self-directed behaviours like scratching and rocking are coded. Ammonia and water are used as the control smells, and a stuffed glove is used as the control to the bird.

The results presented here are from preliminary trials, indicating that chimpanzees do react slightly differently to putrescine than to other scents. Eventually, we hope to provide some insights to explain certain behaviours seen in the wild, such as dead infant carrying.

## P-2

# Odonata Assemblages and Faunistic Survey from Riparian Habitats Found in Don Marcelino and Malita, Davao Occidental, Philippines

Kimberly H. Carrillo-Mizutani[1*], Reagan Joseph T. Villanueva[2], Hendrik Freitag[3]

1. Master of Science in Biology Graduate, Ateneo de Manila University, 2. IUCN (International Union for Conservation of Nature), Southern Philippines Medical Center, 3. Research Coordinator, Ateneo de Manila University, BIO-PHIL International Biodiversity Teaching Network

**Abstract:**

Odonata is an order of carnivorous insects that are good bioindicators of environmental health. Despite the great efforts in recording the Odonata fauna in the Philippines, there are still riparian habitats that are unexplored. Such include the extensive riparian networks in Malita and Don Marcelino, Davao Occidental. Due to the habitat destruction caused by development projects (e.g. deforestation), it is urgent to conduct faunistic survey on the existing pristine habitats.

The present study surveyed the selected riparian habitats from January to October 2018. Odonata specimens were collected and preserved. These preserved specimens were identified up to the species level.

There were a total of 294 specimens belonging to 19 species, 13 genera, and 8 families recorded. There was a total of 11 Philippine endemic species found in this study, most of them are Zygopterans. Two *Risiocnemis* species are Mindanao Endemic.

The data gathered were standardized and subjected to multivariate statistical analysis, particularly CCA or Canonical Correspondence Analysis. CCA at $r^2>0.6$ revealed that the Altitude and Level of Disturbance were strongly correlated to the distribution of Odonata assemblages.

Among the collected taxa *Vestalis melania*, *Euphea amphiyana*, *Risiocnemis atripes,* and *Risiocnemis tendipes* showed to be prominent specialists, preferring high altitudes and minimal disturbance. The data confirms the viability of some Odonata species as bioindicators.

The collected specimens contribute to the distributional knowledge of Odonata diversity in the Philippines. This provides the baseline study for Odonata in the study areas. This can support future entomology research and conservation efforts.

## P-3
# Flight Range of the Stable Fly for Blood-Sucking in a Zoo

Tomomaru Matsuda*, Daisuke kohari
Ibaraki University

**Abstract:**
To clarify the flight range of the stable fly for blood-sucking, we investigated the distribution of stable flies and behavioral changes in zoo animals before and after repellent spraying.

Five animal species (black rhinoceros, pony, Japanese deer, goat, and capybara) were observed for 6 days in summer and 6 days in autumn at Hitachi City Kamine Zoo, Japan. In both seasons, the first 3 days were the control period and the following 3 days were the repellent period. The repellent was only sprayed on black rhinoceroses and ponies. We recorded the self-maintenance behaviors of each animal by 1-min instant sampling. The frequency of fly-repelling behavior of each animal was recorded by continuous observation during exhibition time (09:00–16:00). We set up 28 traps in the zoo and compared the number of flies captured during the control and repellent periods.

Black rhinoceroses exhibited significantly decreased walking and increased resting behaviors, and ponies exhibited significantly increased feeding during the repellent period in autumn. Some behavioural changes were also observed in the species which weren`t sprayed with repellent. Repelling behaviors significantly decreased in ponies and Japanese deer during the repellent period in both seasons.

Fewer stable flies were trapped in repellent periods than in control periods in both seasons. Although the repellent was applied to only two species, the number of stable flies trapped around other species did not increase during the repellent periods.

Based on these results, we suggest that the flight range of the stable fly for blood-sucking may be limited.

## P-4

# Genetic Diversity of Neutral Markers and MHC Genes in Captive Japanese Golden Eagles: Insights into Immunity and Mate Choice

Annegret M Naito[1*], Yu Sato[1], Giovanni Forcina[1], and Miho Inoue-Murayama[1, 2]
1. Wildlife Research Center, Kyoto University, 2. National Institute for Environmental Studies

**Abstract:**
The Japanese golden eagle (*Aquila chrysaetos japonica*) is an endangered subspecies inhabiting Japan and parts of Korea. Due to habitat degradation and consequent reduced breeding success, there are only 500 individuals left in the wild, and 50 in zoos as part of a captive breeding program. It is crucial to survey genetic diversity in this subspecies to avoid inbreeding depression and other negative consequences. Past conservation genetics studies have focused on neutral genetic markers (16 microsatellite loci and 2 mtDNA regions, $n$ = 22 in captivity), which revealed relatively high genetic diversity (observed heterozygosity $Ho$ = 0.608) and low inbreeding ($F$ = -0.085). We are also starting to study functional genes in golden eagles, especially those with adaptive significance. Here, we summarize preliminary surveys of the major histocompatibility complex (MHC) class IIB gene, which has immunological and reproductive functions. Using whole genomes and database sequences from eight individuals of three subspecies (captive *A. c. japonica, n* = 3; wild *A. c. homeyeri, n* = 4; wild *A. c. chrysaetos, n* = 1), we found 39 polymorphic sites in exon 2. We will expand this survey to 22 captive individuals with data on pairing and breeding success, using next generation sequencing techniques. Results from such analyses could inform susceptibility to disease and pairing scenarios in the captive population. In the future, we wish to expand this study of MHC genes to gain a better understanding of population health and mate choice in wild golden eagles as well.

## P-5

# New Practice to Join the Local Issue of Animal Harm and the Issue of Animal Welfare in Zoo, “Wild meæt Zoo”

Tadatsugu Hosoya[1, 2*], Kazuyuki Ban[1, 3, 4], Nariaki Onda[2], Masato Ohbuchi[1, 5], Naoto Nishimura[1, 6], Satoshi Tagawa[1, 7]

1. Wild meæt Zoo, 2. Institute of Decision Science for a Sustainable Society, Kyushu University, 3. Omuta City Zoo, 4Graduate School of Education, Seisa University, 5. Science Communicator (Freelance), 6. Itoshima Gibier Laboratory, 7. Shimane East Agriculture and Forestry Promotion Center

**Abstract:**

The carnivorous animal eats a processed mainly muscle piece at the zoo, whereas the animals pushes skin and bone aside and gets muscle in nature. Recently, “carcass feeding”, which is an approach feeding a zoo’s carnivorous animal a large carcass, is getting attention as environmental enrichment in Europe and America. However, it is hard to obtain the large carcass in Japan, and hence the carcass feedings are not performed. On the other hand, deer and wild boar are captured to reduce negative impact on agriculture and forest vegetation in the various parts of Japan. However, the use of captured deer and wild boar is limited. Therefore, we connected stakeholder concerned with “the problem of the animal welfare in zoo” and “the issue of local beast harm” using technique of the scientific communication, and have begun to grope for solution to the problem as the joint project from the summer in 2017. We are active currently as “Wild meæt Zoo”. In the results of feeding of carcass and behavior, extension of feeding time and diversification and a change of feeding pattern were observed. The results suggest that carcass feeding is effective as enrichment for zoo’s carnivorous animal. The difference of sterilization did not affect feeding behavior. In our experiment, we fed the carcasses whose blood, internal organs and head were removed. This process may reduce the psychological burden (loathsomeness etc.) on park visitors.

## P-6
## The Flamingos are Interested in Feeding Than Breeding?

Kumiko Inoue[1*], Daisuke Kohari[2]
1. Hitachi City Kamine Zoo, 2. Ibaraki University

**Abstract:**
We sale foods for Chilean Flamingo (*Phoenicopterus chilensis*) in our zoo.
The visitors can feed them freely while it opens. However, the courtship and mating display of Flamingo seems to be decreased since starting this feeding. In this research, we investigated the relationship between feeding from visitors and flamingo's display. 42 Chilean Flamingos, 16 males and 26 females, from 2014 to 2017 was used as objects of this research. They are all adults. We set the periods the visitors cannot feeding, recorded withdrawal it and the number of the day that were observed some displays during these periods. In addition, plowing frequency by keepers at the nest building area was recorded. Frequency of the displays during withdrawal period were significantly higher than that of during not withdrawal period ($F = 10.18$, $p < 0.001$). However, plowing frequency during withdrawal periods did not affected their display frequency ($R = 0.30$, $n = 11$, *n.s.*). It is suggested that feeding by visitors influence Flamingo's breeding behavior.

## P-7
# Effect of Zoo Visitors on Pool Use of Captive Humboldt Penguins (*Spheniscus humboldti*)

Chihiro Kase[1, 2*], Chika Masuda[2], Yoshio Koyama[3], Hideto Toyoda[3]
1. School of Veterinary Medicine, Azabu University, 2. Faculty of Risk and Crisis Management, Chiba Institute of Science, 3. Saitama Children' s Zoo

**Abstract:**
Previous studies have indicated that human disturbance can have negative impacts on zoo animals. In particular, when zoo visitors are permitted to enter the living enclosure, animals may be more affected than when they maintained at a distance from visitors in a general exhibition area. We examined the effect of visitors on 35 Humboldt penguins (*Spheniscus humboldti*) at Saitama Children's Zoo in Saitama Prefecture, Japan by randomly imposing two treatments: (1) no visitor contact for 6 days, achieved by closing the zoo, and (2) exposure to visitors for 6 days, with the penguin exhibit open as usual. The behavior of all penguins was recorded using scan sampling at 5-min intervals, and the use of space was recorded at 10-min intervals during a total of 6 h on each of the 12 observation days. The penguins spent 14% of their time in the pool, with no significant differences between the two treatments. Furthermore, there were no significant differences in behavior between the treatments, except for play behavior, which significantly increased when the penguins were exposed to visitors ($P < 0.05$). These results suggest that the penguins had become completely habituated to visitors at this zoo, apparently experiencing few negative impacts. The increase in play behavior is believe to be derived from the enclosure having a glass wall through which visitors could play with the penguins and interact visually with them, implying that visitor behavior may function as an environmental enrichment.

## P-8
# The Evaluation of Anti-Anxiety Effects of the Bedding Material and Touching on Guinea Pigs

Hiroshi Yamada[1*], Arisa Moriya[2], Hiromitsu Mizuno[3], Shinichi Saga[4], Saiko Nagano[5]
1. College of Agriculture, Food and Environment Sciences, Rakuno Gakuen University, 2. Obihiro Zoo, 3. Kushiro Zoo, 4. Asahiyama Zoo, 5. Sapporo Maruyama Zoo

**Abstract:**
Guinea pigs often provided as petting animals in many children's zoos, need to receive less stressful conditions of touching and their environment from the viewpoint of animal welfare. This study examines the effect of giving two ways of touching and placing the bedding material on the behavioral and physiological emotional states of guinea pigs.

Thirty-six female guinea pigs, reared in four zoos, experienced six combinations of experiments with three conditions of touching (on head and neck and nothing) and two conditions of bedding materials (placing dried timothy grass or nothing). The animals' emotional behaviors and skin temperature of the nose were measured when the animals faced approaching hand and were placed in an open field. The experimental procedure contained four stages: (1) Observation of pre-experiment behavior of guinea pigs, (2) touching head, neck or nothing for one minute, (3) open field test with or without the bedding material for three minutes, and (4) observation of post-experiment behavior. Statistical analysis of skin temperature and emotional behaviors showed that two ways of touching had no significant changes compared to the control condition, whereas placing bedding material on open field increased locomotion behaviors of the guinea pigs. The results correspond to those from our previous experiment that the touching was ineffective, but the bedding material was useful. Careful attention should be paid to the use of the bedding material for the handling of the guinea pigs.

## P-9
# Portable Touch Monitor Cognitive Study in Zoo-Housed Macaques

Akiho Muramatsu[1*], Christopher Flynn Martin[2], Tetsuro Matsuzawa[1]
1. Institute for Advanced Study, Kyoto University, 2. Indianapolis Zoo

**Abstract:**
Cognitive studies with primates using touch monitors are typically conducted at research facilities, yet there is a growing trend to expand the practice to zoo settings. Cognitive studies at zoos can provide 1) new enrichment for animals, 2) a new exhibition and an educational opportunity for zoo-visitors, and 3) a wider range of participants for researchers. However, they can also require a renovation of zoo facilities, and this cost is one of the barriers to start a cognitive study at a zoo. Our new apparatus enables zoos and researchers to introduce a cognitive study easily. The whole system is set in one portable touch monitor machine, and you can conduct a cognitive task by attaching this machine on an existing mesh cage. Using our machine, we have started a study in zoo-housed macaques at Japan Monkey Center, Aichi, Japan. Our participants include six macaca species, pig-tailed macaque (*Macaca nemestrina*), rhesus macaque (*Macaca mulatta*), Japanese macaque (*Macaca fuscata*), bonnet macaque (*Macaca radiata*), toque macaque (*Macaca sinica*), and Tibetan macaque (*Macaca thibetana*). The study started with a habituation phase, then moved to a touch monitor task phase with the tasks gradually becoming more difficult. We show the course of monkeys' learning and compare the dominance style among these six species.

# P-10
# Individual Difference of Behavior under the Environmental Enrichment in Pigs

Himena Mano[1*], Akitsu Tozawa[2], Shusuke Sato[2]
1. Graduate School, Teikyo University of Science, 2. Teikyo University of Science

**Abstract:**
Environmental enrichment is one of popular methods to improve welfare of animals in captivity. However it is not known exactly how each individual responds to environmental enrichment. Ten pigs selected from the group consisting of 30 finishing pigs of about 150 day-old on free-ranging system were observed about 7 hours per day in the morning and evening for 2 days in Japan. The behavior of each pig was instantaneously sampled every 6 minutes. Behavior categories were resting (standing still or lying), eating concentrates in the feeding trough, investigating edible food (appetitive behavior of eating: routing, biting tree root or branch), exploration (smelling environment or touching human or other objects), and other behaviors (drinking, excretion, moving, social behaviors). In addition, the behavior of each pig during loading onto a vehicle was categorized as "calm" or "struggle".

Time budgets were 0.51 ± 0.07 in resting, 0.13 ± 0.05 in eating, 0.18 ± 0.06 in food-investigating, 0.06 ± 0.04 in exploration, and 0.12 ± 0.05 in others. Coefficient of variation was the highest on exploration (0.68), followed by eating (0.38) and food-investigating (0.33). Exploration and food-investigating are specific behaviors under the enriched environment. Exploration and food-investigating were negatively correlated with resting ($r$ = -0.62, $p$ = 0.05) and eating ($r$ = -0.73, $p < 0.05$), respectively. There was no difference of behaviors between "calm" ($n$ = 6) and "struggle" ($n$ = 4) pigs by t-test. Specific behaviors under the enriched environment were largely different among individuals in pigs. However, these individual differences were not related with ease of loading.

# P-11
# Social Buffering by Conspecifics and Humans in Adult Domestic Horses

Ayaka Takimoto-Inose[1, 2*], Chihiro Baba[1], Tomohiro Mitani[3], Masahito Kawai[3]

1. Department of Behavioral Science, Graduate School of Humanities and Human Sciences, Hokkaido University, 2. Center for Experimental Research in Social Sciences, Hokkaido University, 3. Field Science Center for Northern Biosphere, Hokkaido University

**Abstract:**

Social buffering is a phenomenon in which animals' responses to stressors are attenuated by the presence of another individual. Social buffering in domestic animals may have important implications for animal welfare and agriculture because stress affects their body weight gain and productivity. Previous studies have focused only on very young subjects despite the fact that domestic animals, especially horses, play various roles in human society throughout their long life-span. In Experiment 1, we investigated whether social buffering occurs in adult horses with conspecifics. A test horse was isolated from his/her herd and exposed to a novel environment for fifteen minutes alone in the solitary condition or with a conspecific partner in the social condition. We recorded locomotion, whinny and defecation as the test horses' stress-induced behaviors. Locomotion (73 vs. 30 times) and whinny (5.0 vs. 0 times) occurred significantly less often and defecation (2.0 vs. 1.0 times, $p = 0.055$) tended to occur less in the social condition than in the solitary condition. In Experiment 2, we tested whether social buffering occurs in adult horses with humans by using a similar procedure to that of Experiment 1. Locomotion (42 vs. 30 times) occurred significantly less often, and whinny (0.1 vs. 0 times, $p = 0.077$) and defecation (2.5 vs. 2.0 times, $p = 0.058$) tended to decrease in the social condition than in the solitary condition. These results suggest that the presence of the conspecific or human partner reduced the test horses' stress-induced behaviors.

## P-12
# Effects of Three Types of Environmental Enrichment on the Behaviors of Captive Brazilian Tapirs

Yusuke Aramaki*, Nobuaki Iwahasi, Saki Yasui
Kyoto City Zoo

**Abstract:**
Environmental enrichment has been performed in various species of animals. However, there are several species differences in the diversity of the enrichment offerings and its research. In case of tapirs, some items of enrichment have been documented, but studies evaluating the effects of enrichment are limited in number. In this study, we focused on the feeding and sensory enrichment of two Brazilian tapirs (*Tapirus terrestris*) at the Kyoto City Zoo and investigated the effect of three items of enrichment (buoy feeder, browse, and urine provisioning) by quantifying changes in the feeding time and daily behaviors before and after implementing enrichment. For each condition, observation was conducted for 7 days. Among the items of enrichment, the buoy feeder was the most effective in attracting their attention, especially when food items with high palatability, such as apples, were fed. However, when food items with low palatability, such as pellets, were used, motivation to use the feeder gradually decreased with each passing day (consumption of pellets: 27% on day 1, 7% on day 3, 0% on day 7). The tapirs showed interest in the urinary smell of another tapir to some extent. Adding some browse also attracted their attention, but the resulting effect was not as pronounced as that observed in the case of the other types of enrichment. These findings suggest that the items of enrichment showed effects on the behaviors of tapirs, but their effectiveness depended upon the types of foods and materials used.

## P-13
# Enrichment to Assist Rehabilitation of Bears Rescued from Bile Farms

Amanda Leanne Catwell*, Heidi Quine, Sarah van Herpt
Vietnam Bear Rescue Centre, Animals Asia Foundation

**Abstract:**
Animals Asia Foundation (AAF) operates bear sanctuaries in China and Vietnam where bears rescued from the bear bile industry are rehabilitated and cared for. To date, AAF has rescued more than 600 bears. The rehabilitation journey for each individual is unique and includes a multi-modal approach, considering both their psychological and physical recovery. Asiatic black bears Sky and Precious were rescued from bear bile farms in Vietnam. As is common in bear farms, both bears were housed in small cages where they were unable to carry out natural behaviours, fed a poor diet of congee and subjected to repeated bile extraction procedures. As a result of inadequate conditions on the farm, both bears were overweight and engaged in stereotypic behaviours. A tailored enrichment programme was developed for both bears. Recognizing bears are an intelligent species, a novel bamboo puzzle-feeder with moveable compartments hiding food items was used to encourage the bears to problem solve. Similarly, a variety of scents were utilised to stimulate the bears olfactory response and inquisitive nature. To build muscle tone and strength, the bears were provided with increasingly challenging climbing structures to encourage confidence in climbing and coordination. Sky and Precious arrived scared and reluctant to interact with people or conspecifics. The use of a tailored enrichment programme has been integral in their rehabilitation, resulting in the emergence of both bears' unique personalities and an improvement in their psychological and physical health.

## P-14
# Finless Porpoise Project in Nagoya Port

Koji Kanda[1*], Yayoi Yoshida[2], Satoko Soen Kimura[3], Wakana Matsunami[4], Satoshi Nagamine[2], Tomoya Kako[1], Yuki Oshima[1], Masanori Kurita[1], Hiroshi Nitto[1]

1. Port of Nagoya Public Aquarium, 2. School of Marine Science and Technology, Tokai University, 3. Institute for Liberal Arts and Sciences, Kyoto University, 4. Graduate School of Agriculture, Kyoto University

**Abstract:**

Nagoya port (NP) is one of the most major and largest ports in Japan, with high volumes of cargo and trade. Therefore, there are many industrial influences in NP such as reclaimed lands, regularly dredging operations, factory wastewater and also high vessel traffic, where fisheries have been prohibited. Nonetheless, Port of Nagoya Public Aquarium (PNPA) has found that the narrow-ridged finless porpoises occur in NP during winter in Japan. In 2017, PNPA, Tokai University and Kyoto University started the "Finless porpoise project in NP" to investigate the ecology of the finless porpoises. How many porpoises are present and why in the NP? Are they present only in winter?

In 2017, we deployed the A-tag (stereo acoustic event recorder) to record the finless porpoise echolocation to understand their occurrence at Shiomi-pier, located relatively bay-head of NP. The porpoises were acoustically detected in winter. In October 2018, we deployed the A-tag at the mouth of NP to record their occurrence throughout the year and visual inspection were carried out twice a month continuously for a year. In January 2019, we sighted a big group of 50 porpoises visually. Finless porpoises are generally found as an individual, in pairs or in groups of up to 20 individuals. This result indicated that NP is an important place for porpoises in winter. However, the public awareness of the finless porpoise occurrence and their surrounding environment in NP is relatively low. Our goal is to increase public awareness regarding the habitat protection of their potential neighbor.

## P-15
# Above-Surface Vocalizations of Captive Bottlenose Dolphins to Attract Attention from Humans

Fumio Nakahara[1*], Masayuki Komaba[2, 3], Kumiko Komaba[2, 3], Ryoichi Sato[2], Masato Kaku[2], Akihiro Kawakubo[2]

1. Tokiwa University, 2. Saikai National Park Kujukushima Aquarium, 3. Aquament Inc.

**Abstract:**

Positive human-animal relationships are believed to play a role in promoting the welfare of captive animals. Dolphins, which are adapted to life underwater, are known to communicate using a variety of sounds. Their communication with each other occurs mainly underwater; dolphins in the wild are rarely known to vocalize while they are above the water surface. However, such behavior has been observed among dolphins in aquariums. The purpose of this study was to determine the contexts in which captive bottlenose dolphins vocalize while above the water surface, to reveal the function of vocalizations uttered under these conditions, and to discuss the role of human-dolphin communication in environmental enrichment. Our results showed that above-surface vocalizations among bottlenose dolphins were not only related to the behaviors of themselves, but were also associated with the characteristics and behaviors of humans with whom the dolphin interacts. In addition, we found that the dolphins utter above-surface vocalizations that are different in their acoustic properties from those of their underwater vocalizations and that are audible to humans. These results indicated that above-surface vocalizations uttered by dolphins are used for the purpose of attracting human attention and demonstrated that the dolphins were actively trying to promote a connection between themselves and the humans with whom they interacted.

## P-16
# Procedure Manual for Environmental Enrichment Devices for Non-Human Primates

Naoko Hashimoto*, Seitaro Aisu
Primate Research Institute, Kyoto University

**Abstract:**
Behavioral management is an important strategy in the enhancement of laboratory animal welfare. Behavioral management for non-human primates (NHPs) requires a holistic approach including an appropriate environmental enrichment plan, positive reinforcement training, socialization, and behavioral monitoring. At Primate Research Institute, Kyoto University, there are about 1200 NHPs of 12 species including macaques, common marmosets, and chimpanzees. There are various housing types for different species and different purposes, e.g., breeding or research, including outdoor open enclosures, indoor/outdoor group cages, and single/pair housing in indoor individual cages. It is necessary to provide appropriate environmental enrichment for each animal species and housing type. For efficient implementation of environmental enrichment programs as part of daily management, it is necessary to provide information for personnel such as care staff, vet, manager, and researcher. As part of these efforts, we have created an enrichment device manual especially for macaques and marmosets. It includes information about appropriateness (species, individuals, housing type, and safety issues), efficiency, and sustainability based on behavioral monitoring records. It also contains instructions for each device (how to make and how to use). In addition, we are considering incorporating a check sheet linked with the manual into the existing database to efficiently record and evaluate enrichment programs for each individual. As well as environmental enrichment device, we need to prepare SOPs of holistic behavioral management programs in more detail to improve and refine the psychological well-being of laboratory animals.

## P-17

# The Social Relationships of Breeding Pairs in Monogamous Groups of Captive Common Marmosets (*Callithrix jacchus*)

Ena Onishi[1*], Katsuki Nakamura[2], Miki Miwa[2], Kazunori Yamada[3], Masayuki Nakamichi[3]

1. Wildlife Research Center, Kyoto University, 2. Primate Research Institute, Kyoto University, 3. Department of Human Sciences, Osaka University.

**Abstract:**

Understanding a species' sociality is vital for appropriate rearing and enrichment in captivity. Common marmosets (*Callithrix jacchus*) are well known for their unique cooperative breeding, which makes them behavioral neighbors to humans. Despite the interesting links between humans and other cooperative breeders, the contributions of helpers to the breeding pair beyond infant rearing remain largely unknown. Therefore, in this study, we observed intragroup interactions of six monogamous breeding pairs of captive common marmosets with varying numbers of offspring for 117 hours using video recordings at the Primate Research Institute, Kyoto University. The study aimed to test the hypothesis that as the number of offspring (prospective helpers) increase, the frequency of social interactions between the breeding pairs will decrease. This hypothesis was developed based on the possibility that helpers may contribute to a breeding pair's mate guarding, which could then reduce the necessity of strong bonding between the breeding pair. Although the results obtained from this study did not support the hypothesis statistically, we found interesting possible effects of sex, age, and pregnancy on the social relationships of breeding pairs. These findings indicate that social factors other than the number of offspring may be affecting the results of the study. Hence we propose possible future research plans aiming to investigate factors impacting social relations in common marmosets, including but not limited to the number of helpers, while taking into account the limitations of the present study.

## P-18
# Change of Behavior and Space Use in a Captive Group of Chimpanzees after an Expansion of Enclosures

Misato Hayashi*, Raquel Costa, Norihiko Maeda
Primate Research Institute, Kyoto University

**Abstract:**
Primate Research Institute of Kyoto University holds 12 chimpanzees in enriched enclosures. We had two cages (named as East- and West- Sunroom) and one outdoor/open-air compound with rich vegetations and 15m-high climbing flames to keep two groups of chimpanzees. From 8 October 2015, chimpanzees started to use the third cage and their living space was enormously expanded. The behavior and space use of chimpanzees was compared before and after the facility expansion. In the new cage, they spent less time in lying and more time in moving. In both phases, chimpanzees spent longer time in wooden walkways placed along outer walls of the cages specifically in the second-top floor. Chimpanzees also preferred some spots on the wooden walkways. These preferred spots were explained by factors such as heat/rain avoidance and outside view. Given the choice between old-smaller cages and new-larger cage, high-ranking chimpanzees tended to stay in the new-larger cage and the other chimpanzees frequently used the other cage. When the open-air compound was available for a day-time use, most of the chimpanzees preferred to stay in the open-air compound. Expansion of living space for chimpanzees increased the freedom of choice to stay and they spontaneously developed preferred spots which do not overlap with unassociated individuals, resembling to the fission-fusion grouping pattern observed in their natural habitat. The complex and enriched environment enabled the naturalistic management of the chimpanzee group in captivity.

## P-19

# The Development of Tempo-Flexibility between 18 and 42 Months in Human Infants

Lira Yu[1*], Masako Myowa[2]

1. Wildlife Research Center, Kyoto University, 2. Graduate School of Education, Kyoto University

**Abstract:**

An ability to match timing of the movement with those of others is fundamental for cooperative behavior. A comparative study on humans and chimpanzees demonstrated that humans have uniquely fast and accurate ability to adjust one's movement to match with others in time (Yu et al., 2018). The current study investigated the developmental origins of this human unique ability on tempo adjustment. Three age groups, 18, 30 and 42 months old, participated and played drum along with either their mom or a drumming robot. Preliminary results show that infants from 18 months old can adjust their drumming tempo to a slower beat then their spontaneous motor tempo when they drum with their mom. Infants in 30 and 42 months old were able to slow down their drumming tempo in both mom and robot condition but they showed higher synchronization accuracy when they drum with their mom. We speculate that engaging in the same action with a social partner facilitates infants' motivation and attention to match the movement in time.

## P-20
# Effectivity of Environmental Education Program Using Small Animals Kept in Japanese Elementary Schools

Mari Morimoto*, Haruna Tamura
Faculty of Agriculture, Tokyo University of Agriculture

**Abstract:**
Japanese elementary schools have kept small animals for purpose of instructional support. Although many teachers have expected that interaction with animals has positive effects on the behavioral and emotional development of children, some studies revealed undesirable animal welfare outcomes such as unsanitary housing and neglect of animals especially during holidays. Our own study revealed other problems involving housing conditions of school-owned animals such as rabbits, fowls and turtles in Kanagawa prefecture. One obvious problem is the absence of clear educational goals upon which teachers can evaluate teaching efficiency and leaving little use of animals in classrooms. We assumed that one of the reasons for poor animal well-being is the absence of animal-assisted teaching programs in schools.

The effectiveness of environmental education program using small animals kept in elementary schools needs to be evaluated. We tested an educational program that teaches the continuity of life (a tripartite relationship among rabbit, soil animals and plant) through stimulating student interests toward rabbits kept in schools. A study was carried out in elementary schools, as part of the life environment study. The program was evaluated by two methods. Firstly, we conducted pre- and post-test quiz type tests. Next, we analyzed and described contents of worksheets used by respondents. The results showed improved knowledge level of students on the relationship between soil animals and rabbits and enhanced their interest toward rabbits. Better evaluation of the learning outcomes of the program is needed.

## P-21
# Seasonal Variation in *in vivo* Digestibility of a Captive Proboscis Monkey (*Nasalis larvatus*)

Satoru Hoshino[1, 2*], Kurumi Hirayama[2, 3], Satoru Seino[4], Ikki Matsuda[5, 6], Masato Yayota[2, 7]

1. The United Graduate School of Agricultural Science, Gifu University, 2. Zoo Biology Research Center, Gifu University, 3. The Graduate School of Nature Science and Technology, Gifu University, 4. Yokohama Zoological Gardens "ZOORASIA", 5. Chubu University Academy of Emerging Sciences, 6. Wildlife Research Center of Kyoto University, 7. Faculty of Applied Biological Sciences, Gifu University

**Abstract:**

One of the important goals in *ex situ* animal management is to determine the nutritional requirements of animals, to ensure that an appropriate diet is made available, and to facilitate their breeding. Foregut-fermenting primates, i.e., colobines, were historically difficult to maintain healthy in captivity. Notably, proboscis monkeys (*Nasalis larvatus*), endangered and endemic to Borneo, are notoriously difficult to maintain and breed in captivity due to the fact that a limited information is available about digestion, absorption and metabolism. *In vivo* digestibility in captive proboscis monkey was only determined by Dierenfeld et al. (1992), conducted such experiment in a group of six adult proboscis monkeys, and thus must be regarded as potentially biased for the accurate individual digestibility. To determine *in vivo* digestibility of captive proboscis monkey in different seasons, we performed the digestive trials in one proboscis monkey individually kept at Yokohama Zoological Gardens "ZOORASIA" in three seasons: summer, autumn and winter. *In vivo* dry matter (DM), crude protein (CP), neutral and acid detergent fiber (NDF and ADF) digestibility of one proboscis monkey was measured in each season. Overall, the nutrient contents of fruits and vegetables were almost constant through the seasons. The nutrient contents of tree leaves showed a little difference among three seasons and digestibility of whole diets was 84.5, 75.4 and 83.0% in summer, autumn and winter, respectively. Since the diets in summer and winter included more digestible feeds such as fruits and vegetables, digestibility in summer and winter was higher than that in the autumn diet.

## P-22
# Exploring Attentional Bias Towards Emotional Faces in Chimpanzees Using the Dot Probe Task

Duncan Wilson*, Masaki Tomonaga
Primate Research Institute, Kyoto University

**Abstract:**
Recently, cognitive measures from human psychological research have been used to assess emotion and welfare in animals. The dot-probe task has been used extensively to examine the relationship between attentional bias and emotion in humans, but few studies have been conducted in non-human primates. This was the first study to investigate whether the task can measure attentional biases towards threatening facial expressions in chimpanzees. Eight adult chimpanzees at the Primate Research Institute, Kyoto University, voluntarily participated in a series of touchscreen dot-probe tasks. We predicted faster response times to touch the dot appearing after threatening faces relative to neutral faces, and faster response times towards faces of high threat intensity (scream) than low threat intensity (bared teeth). Contrary to prediction, no significant difference in response times was found for bared teeth faces versus neutral faces, or scream faces versus neutral faces. In addition, we found no difference in response times between faces of high threat intensity and low threat intensity when paired with scrambled faces. In conclusion, we found no convincing evidence that the touchscreen dot-probe task can measure attentional biases specifically towards threatening faces in our chimpanzees. Methodological limitations of using the task to assess emotion and welfare in animals including: emotional state, stimulus threat intensity, stimulus presentation duration and manual responding, as well as procedural improvements, will be discussed.

## P-23

# Assessment of the Current Impact of Mountain Gorilla Ecotourism in Bwindi National Park, Uganda

Raquel Costa[1, 2*], Misato Hayashi[1], Michael A. Huffman[1], Gladys Kalema-Zikusoka[3], Lilly Ajarova[4], Fred Bercovitch[5, 6], Masaki Tomonaga[1]

1. Primate Research Institute, Kyoto University, 2. Primate Cognition Research Group, Portugal, 3. Conservation Through Public Health, Uganda, 4. Chimpanzee Sanctuary & Wildlife Conservation Thrust, 5. Save the Giraffes, 6. Wildlife Research Centre, Kyoto University

**Abstract:**

Ecotourism is an emergent and controversial topic in the field of wildlife management. Ecotourism plays a significant role in the conservation of mountain gorillas (*Gorilla beringei beringei*). Despite the growing number of tourists visiting mountain gorillas and an increasing number of habituated groups, very little behavioral data has been collected on the potential impacts of ecotourism on these wild populations. The present study examines how interactions with human tourists influence gorilla behaviour. For this study, we collected behavioural data (focal and scan sampling) before, during and after tourist visits over a 9-month period (December 2017-February, 2019) one habituated group (15 individuals) in Bwindi Impenetrable National Park, Uganda. Kruskall Wallis tests are used to compare pre-contact, contact and post-contact periodsPreliminary analysis shows that “Human directed behaviour” (mainly physical contact) increases more than 5 times during the tourist visit. On the other hand, gorillas will charge only when tourist are within 7 meters of the gorillas. These effects are more pronounced when the tourists come too close to the gorillas (within 3 meters, which elicit reactions from the animals). Moreover, group social dynamics are affected by close distance to humans as well - affiliation, agonism and submission behaviours increase within 7 meters from the tourists. Further analysis is necessary, but the present results caution a disturbance in the gorilla`s behaviour related to the visit tourist. The problems are most pronounced when people get too close to the gorillas, in violation of standard rules.

## P-24
# Aging Characteristics of Permanent Teeth in Chimpanzee

Tomoe Torii[1]*, Kazato Oishi[2], Satoshi Hirata[1], Naruki Morimura[1]
1. Wildlife Research Center, Kyoto University, 2. Graduate School of Agriculture, Kyoto University

**Abstract:**
Chimpanzee has the same number of permanent teeth as humans. The permanent teeth of humans are worn or decayed mainly by caries and aging, but the tendency for loss of permanent teeth in chimpanzees is unclear. The objective of this study was to investigate the change in permanent teeth of adult chimpanzees. The records of dental checkup for 110 chimpanzees obtained from 1980 to 2018 in Kumamoto Sanctuary were analyzed. The slopes of regression lines of age to total number of teeth for males were smaller than those for females, which indicated that males lost their teeth more rapidly than females. When the percentages of worn teeth to total teeth were compared between upper and lower teeth, the percentage of worn canines was higher for upper teeth than lower teeth only in males and the percentages of worn incisors were higher for upper teeth than lower teeth in both sexes. Canines and premolars of males were worn at a higher rate than those of females, which might be due to high incidence of fighting among males. Incisors were worn with aging in both sexes. Humans generally lose molars, but chimpanzees in the present study rarely lost molars. In conclusions, aging characteristics of permanent teeth in chimpanzees differ from those of humans, and the patterns of changes in permanent teeth of chimpanzees are different between sexes due to social behaviors such as fighting in males.

## P-25
# The History and Current Status of Captive Chimpanzees (*Pan troglodytes*) in Japan

Tomomi Ochiai
Network for Zoo Enrichment, Mukogawa Women's University

**Abstract:**
A total of 307 chimpanzees were found in 49 facilities across Japan as of March 1st, 2019. They are housed in research institute, sanctuaries and zoological parks not for as biomedical laboratory animals and as pets, however one of which being owned as performers for animal show, television and advertisements. Japanese Association of Zoos and Aquariums (JAZA) have been trying to gather information about live chimpanzees since the 1980s. Currently all live chimpanzees are registered in the studbook by JAZA. Great Ape Information Network (GAIN), a grant-in-aid research project by the Ministry of Education, Culture, Sports, Science and Technology, also have been created a database of high quality and transparency on great apes in Japan.

The first record of a living chimpanzee in Japan was an individual brought by an Italian circus in 1921. In 1926, two chimpanzees were brought by a foreign visitor arrived Yokohama port. One of the two was a male infant, later called "Taro". It was the first record of a zoo exhibition in Osaka 1927. In the 1930s attempts were made to import some chimpanzee infants into Japanese zoos, but then in 1941 imports stopped due to WWII. By the end of WWII, only one single live chimpanzee left, kept in Nagoya. Total of 28 individuals were identified kept in Japan before 1945. All of them were unregistered individuals of the internal studbook of JAZA. Six of them were individuals that had entered Japan as pets and circus animals, 21 were imported for keeping in zoos, and 1 was stillbirth.

## P-26

# On Altruistic Behavior Towards a Chimpanzee Who Underwent Right Hip Disarticulation in a Group of Five Captive Chimpanzees

Daisuke Nagano*, Shinji Hukuhara, Nobuo Honda, Yumiko Hujiwara
Kumamoto City Zoo

**Abstract:**
Among a group of five captive chimpanzees, we have observed several actions taken only for the sake of one chimpanzee, Yuko, who underwent right hip disarticulation on November 25th, 2017. These actions appear altruistic; for example, they usually walk behind Yuko and match her pace in narrow spaces, and they usually don't take food from the same area where Yuko is collecting food.

Therefore, we conducted a behavioral observation to determine whether these actions are altruistic or not. Every day all the chimpanzees go outside to an exhibition area that is surrounded by a pond. In order to reach this area, the chimpanzees must cross a bridge area. Once across, the chimpanzees can freely move around the area to collect food.

We focused on two actions: one was the overtaking of chimpanzees on the bridge, and the other was the taking of food from the same area as other chimpanzees. We compared the differences in these actions when they targeted Yuko and when they targeted other chimpanzees. We would now like to present the results of our observations.

## P-27
# Behavioral Biometrics for the Chimpanzees

Masaki Tomonaga[1*], Yutaka Kawasaki[2], Yoshihiro Tanaka[2]
1. Primate Research Institute, Kyoto University, 2. Nagoya Institute of Technology

**Abstract:**
Identifying individuals without using invasive methodology is quite important for managing and conserving animals both under the captive and natural environments. Recently, the technologies of biometrics are extensively developed, and some of them are also introduced to the nonhuman animals, such as visual identification using machine learning. On the other hand, individual differences of behavioral patterns can also be used, these technologies are called “behavioral biometrics”. In this presentation, we have tried to introduce behavioral biometrics to chimpanzees. We trained very simple computer-controlled task to 8 chimpanzees, in which they were required to touch 4 locations with free order, and recorded the response times, response order, and response strength. These behavioral data were used for identifying individuals by the support vector machine (SVM) and deep neural network (DNN). Resulting accuracy of individual identification is approximately 90% both for SVM and DNN. Behavioral patterns contain individual information and can be used for non-invasive biometrics in nonhuman animals.

## P-28

# Ten Years of Long-lasting Cognitive Enrichment for Zoo Primates: Cultural Transmission in Kyoto City Zoo

Masayuki Tanaka[1, 2*], Yoko Sakuraba[1, 2]

1. Center for Research and Education of Wildlife, Kyoto City Zoo, 2. Wildlife Research Center, Kyoto University

**Abstract:**

It is important to effectively and continuously provide Environmental Enrichment (EE). From 2008 onwards, Kyoto City Zoo has provided opportunities to participate in cognitive tasks with touch-sensitive monitors as cognitive enrichment for chimpanzees, western gorillas, lar gibbons, and mandrills. The task was related to serial learning wherein participants learned to touch Arabic numerals on the monitor. Touching all numbers in the correct order was followed by the reward of a piece of food (e. g., an apple or carrot). In each species, a group of individuals were provided with the opportunity to perform the task. Some started the task, while others moved away and took rest. In chimpanzees, a male/female often took the task monitor out of the other's possession. In other cases, the participant spontaneously moved away from the monitor, and the other took over. During sessions, we could see various social interactions. The task was held for 40–50 minutes a day, and three to four times a week. Participation in this task depended on the motivation of each ape and monkey. While the task was continued across 10 years with two chimpanzees that were newly moved to the zoo, it was started in an incidental manner. One chimpanzee infant spontaneously started to touch the monitor and learned the task, although it got no reinforcement for at least the first several weeks. Recently, the second infant also started to touch the monitor together with its mother. Adult gorilla parents were socially facilitated by their son. The task was openly demonstrated to zoo visitors to facilitate understanding of the intelligence of their evolutionary cousins.

## P-29

# Evaluating of Physical State on a Female Chimpanzee with Cerebral Palsy: A Case Study

Yoko Sakuraba[1, 2*], Nobuhiro Yamada[3], Ichiro Takahashi[4], Fumito Kawakami[5], Jun'ichi Takashio[6], Hideko Takeshita[7], Misato Hayashi[8], Masaki Tomonaga[8]

1. Kyoto City Zoo, 2. Kyoto University, Wildlife Research Center, 3. Noichi Zoological Park, 4. Home nursing station Otasukeman, 5. Chubu University, 6. Biwakogakuen Medical and Welfare Center, 7. Otemon Gakuin University, 8. Kyoto University, Primate Research Institute

**Abstract:**

A female chimpanzee *(Pan troglodytes)* with physical disability, named Milky, lives in Noichi Zoological Park. Milky was born on July 14, 2013, to a mother under anesthesia due to a difficult delivery, and she has been cared by humans ever since. After birth, Milky was found to have developmental retardation, including serious paralysis of her right-side body caused by cerebral palsy. Therefore, caretakers provided her with many rehabilitation supplies in her daily living enclosure (e.g., mattresses, a slope, stable/unstable chairs, a mirror, balance balls, monkey bars) and Milky began rehabilitation activities administered collaboratively by her caretakers, a physical therapist, an occupational therapist, and researchers to improve her physical/cognitive development. This presentation aims to evaluate her physical state and development. We analyzed data collected from January 2017 by time sampling per 10 seconds of video recording in daily state. In results, the regression analysis of dorsiflexion of the right ankle joint, focusing on sitting and prone position, to longitudinal data shows a weak and positive linear relationship, although the variation is large ($R^2$ = 0.197(sitting), $R^2$ = 0.096(prone)). This result may suggest that our support and rehabilitation activities have a positive effect on improving her physical state. However, this is just a case study, and it is necessary to compare the present behavioral data with that of no activity days to clarify whether these activities lead to good rehabilitation for her. Moreover, social interactions with other chimpanzees must be encouraged in the future to further promote her well-being.

## P-30
# The Impact of Super-Typhoon Jebi on the Health Status of Dairy Cattle in Osaka

Shotaro Hirata[1*], Hidenobu Hoshi[2]

1. Livestock Department, Osaka Prefectural Federated Agricultural Mutual Aid Association, 2. Graduate School of Humanities and Sustainable System Sciences, Osaka Prefecture University

**Abstract:**

The super typhoon Jebi, the strongest typhoon in the past 25 years, was struck Japan. The typhoon resulted losing electric power, occurring flood, and killing 13 peoples. In Osaka, about 1.6 million households lost electric power. In this study, we evaluated the impact of the super typhoon and subsequent of the power failure on the health status of dairy cattle in Osaka.

First, we conducted hearing investigations for the grasp of occurrence of power failure and damage in cattle barn. These investigations revealed that the majority of Osaka dairy farmers encountered both of power failure and damage to cattle barn. Then, we confirmed how Osaka dairy farmers prepared disaster countermeasure against Typhoon Jebi. Almost farmers did not pre-reinforce cattle barn and prepare private power generator. These results indicated preparation to typhoon was not sufficient. We presumed Typhoon Jebi might induce health hazard of dairy cattle in Osaka. Therefore, we compared body condition score, rumen fill score, teat score and panting score before and after Typhoon Jebi. In all tests, health index of dairy cattle deteriorated over time. Also, we compared the alternation of health index among farmers with or without power generator to identify the importance of preparation. Dairy cattle in generator-installed farms were significantly healthier than non-installed ones.

Taken together, our study showed that super typhoon impacted the health of dairy cattle and generator pre-installation could save the emergency. Veterinarian and livestock industry concerned person should act enlightenment activity for the construction of disaster prevention basis.

## P-31
# Male Reproductive Success in Bornean Orangutans (*Pongo pygmaeus*)

Tomoyuki Tajima[1]*, Titol P. Malim[2], Vijay S. Kumar[3], Eiji Inoue[4]

1. Graduate School of Science, Kyoto University, Japan, 2. Sabah Wildlife Department, Sabah, Malaysia, 3. Biotechnology Research Institute, Universiti Malaysia Sabah, Malaysia, 4. Faculty of Science, Toho University, Japan

**Abstract:**

Among primates, the male's reproductive success is not always associated with the status of dominance. Male orangutans exhibit intra-sexual dimorphism, and clear dominant relationships exist between the two male morphs. Previous studies have reported that both the morphs are able to sire offspring, but this information is still limited. The present study aims to investigate the differences in reproductive success between the two male morphs in the Bornean orangutans. We conducted sample collection and behavioral observation in a free-ranging population of Bornean orangutans. We then assigned the paternity of eight infants using 12 microsatellite loci. We found that a flanged male sired most of the offspring born from parous females, and an unflanged male sired a firstborn offspring. This is consistent with behavioral observation: the dominant flanged male showed little interest with nulliparous females, in contrast to the unflanged males, which frequently mated with them. This suggests that the dominant flanged male may be able to monopolize most of the fertilizations of parous females, while unflanged males may seek any mating opportunity available in the absence of the flanged male and copulate with females, including nulliparous ones, even though their conception probability is relatively low. Currently, we are conducting paternity analyses of the wild population of Bornean orangutans in the Danum Valley Conservation Area, Sabah: whether multiple flanged males can share reproductive success or if it is a winner-takes-all scenario.

## P-32
## Let's Give Some Challenges to the Keeper

Nelson Wan*, Laura Chan, Kay Tam, Jill Chiu, Ringo Cheung
Ocean Park Hong Kong

**Abstract:**
Talking of enrichment, people will always imagine something novel and unpredictable that is fun and interesting to animals. Animals need stimulation from the environment, so do humans. It is not uncommon that a zookeeper finds it difficult to think of new ideas for their enrichment program, especially when one has worked with the same group of animals for years.

To stimulate new ideas towards the creation of enrichment items and to boost the creativity of our staff, we held an enrichment competition in 2018 which aimed not only to enhance animal welfare but also to keep our staff empassioned. To create groups of zookeepers with different backgrounds that would work together to exchange ideas and create novel enrichment programs.

As a result, Ebony, one of the Harbor Seal was benefited by more new enrichments were introduced and those enrichments which contains social element are also a bridge for Ebony to improve the relationship with other Harbor seal. More than that, those participants who never work with the seal had transformed into someone who could able to design some species specific enrichment items to the seal which meet the goal as well as making the seal's team appreciated. The chemical reaction between different animal departments inspired both teams on better understanding the needs of the animals and the spirit of enrichment program. Who said environment enrichment is just benefiting the animal?

## P-33
# Environmental Enrichment Projects for Geriatric Rhesus Macaques with Zoo Visitors

Haruna Bando*, Yumi Yamanashi, Naoko Takagi, Yoko Sakuraba
Kyoto City Zoo

**Abstract:**
We hold a participatory event named “The project of the welfare about animals” for the first time. The event was held for the purpose of thinking about what the welfare about animals was. We explained to participants about what is the environmental enrichment, and they observed the features of animals. They talked about what enrichments the animals needed and made them, and then they observed how they used them.

Our zoo has 2 groups of the rhesus monkeys, one is elderly group and another is younger. We did this event for the elderly group. We made investigations into the educationally effects of this event with the questionnaire, it was done for 4 times, before the event, immediately after it, one month after, and 3 months after. I will make a report for the detail of this event and results of questionnaire.

## P-34

# Enriched Environment Affects Aggressive Behaviour and Sexual Maturity in Siamese Fighting Fish (*Betta splendens*)

Eri Iwata[1, 2*], Kyouhei Masamoto[3], Hiroyuki Kuga[3], Miho Ogino[3]

1. Department of Veterinary Medicine, Okayama University of Science, 2. Institute of Osaka Marine Research, 3. College of Science and Engineering, Iwaki Meisei University

**Abstract:**

Teleost fish are known to respond to environmental manipulation, and thus make an ideal model animal for testing relationships between environment and behaviour. The Siamese fighting fish, *Betta splendens*, is a solitary and highly territorial fish displaying fierce stereotyped aggressive behaviour towards conspecifics or other species. Adult fish in captivity, especially males, are typically kept in isolation. As these characteristics of betta fish can make their care challenging for aquarium keepers, decreasing the aggressiveness of betta fish is desirable as it would make them a more suitable species for aquariums while also increasing their welfare. One solution to this problem is to produce less aggressive bettas by selective breeding; however, this method requires a significant amount of time. An alternative solution is to decrease the aggressiveness of betta fish through environmental manipulation. Here we report evidence that a complex and enriched rearing environment can decrease aggression in betta fish and allow adults to be kept in a group. *B. splendens* were hatched in our laboratory and raised in a group in an enriched environment, and some fish were relocated to a poor environment and kept in isolation at different times. Independent of sex, 6-month-old fish isolated at age 4 months showed a longer aggressive display and had higher plasma cortisol concentrations than 6-month-old fish isolated at age 2 months. The fish with a low level of aggression showed delayed sexual maturation. These results suggest that the timing of isolation influences aggression and sexual maturity of *B.splendens*.

## P-35
# Bird Traps and their Impact on Palawan Island in the Philippines

Takashi Tsuji
Graduate School of Agriculture, Saga University

**Abstract:**
Birds are primarily hunted by other animals to obtain protein. However, humans also catch them for several other purposes, including: domestication, hunting for sport, and extermination as pests. Humans have developed hunting skills and various types of bird traps to catch their prey. On Palawan Island (Philippines), catching birds is prohibited. However, since laws are not fully enforced this has not stopped the practice. At least 30 kinds of birds are captured on Palawan Island, with most of these bird species being now classified as endangered. In this study, I examined the bird traps used on Palawan Island and I discussed the reasons why people hunt birds. The indigenous people possess at least 14 kinds of bird hunting skills. These skills are broadly divided into two categories: creating snare traps and wire traps. Snare traps (49%) tend to kill birds, while wire traps (51%) capture them alive. Beside overhunting, the bird population is also decreasing in the Philippines due to environmental destruction, such as Tabon Scrubfowl (*Megapodius cumingii*), Palawan Peacock-Peasant (*Polyplectron emphanum*). While it is important to protect endangered bird species in the Philippine to preserve its ecosystem, the economic impact of bird protection and bird hunting has to be considered. On one side, substantial effort and environmental education is needed to protect birds, but the Philippine government may not be able to afford such investment. On the other side, birds represent economic resources for people to enrich their daily lives. This study considers and discusses the appropriate balance for bird conservation.

## P-36
# Penguins' Behavioural Response to Zoo Visitors with and without Environmental Enrichment

Courtney Collins[1*], Ruth O'Riordan[1], Declan Kennedy[2]
1. School of Biological, Earth and Environmental Sciences and The Environmental Research Institute, University College Cork, 2. School of Education, University College Cork

The behaviour of zoo visitors towards captive animals is a largely under-studied area of research. However, certain behaviours by visitors like shouting, banging and staring can negatively affect animals. Previous methods to minimise negative visitor behaviours have generally focused on physical exhibit alterations, such as barriers. The current study, carried out at Fota Wildlife Park and Dingle Oceanworld Aquarium in Ireland, used an educational intervention (EI), which included visitors making an environmental enrichment device, to reduce negative visitor behaviour and promote positive animal welfare. The visitors were groups of children, while the animals included in the study were two penguin species (*Spheniscus humboldti*) and (*Pygoscelis papua*). The children were studied under two conditions: 1) control groups who did not receive the educational intervention: no enrichment was present during viewings and 2) treatment groups who received the educational intervention: enrichment was present during viewings. Children's and penguins' behaviour were simultaneously recorded using behaviour and scan sampling. The results showed a statistically significant reduction in negative behaviour by the children in the treatment groups at both penguin exhibits. Findings varied for the birds' behaviour. Generally, there was no corresponding change in the penguins' behaviour associated with the rate of negative behaviour or the presence of a treatment group (with enrichment) or control group (without enrichment). In conclusion, education programs in zoos could be enhanced by introducing programs aimed at reducing negative visitor behaviour. However, the penguins did not show a behavioural response to either the enrichment or reduction in negative visitor behaviour.

## P-37

# Assessing the Effect of Visitor Contact on Stress Levels in Guinea Pigs by Measuring Salivary Cortisol Levels

Kanae Shimada*, Aoi Takahashi, Fumiko Nakahara, Yumi Yamanashi
Kyoto city Zoo

**Abstract:**
Zoos in Japan commonly have a petting zoo where visitors can handle companion animals. However, the stress caused to the animals by visitor contact has not been well studied. At Kyoto City Zoo, the style of visitor contact with guinea pigs and rabbits has been modified to improve animal welfare. We investigated differences in salivary cortisol (SC) levels of guinea pigs between two different styles of visitor contact: 1) visitors hold the animals on their chest and 2) visitors gently stroke the animal's back while the animals are in baskets. Saliva samples were collected from 10 guinea pigs (8 females, 2 castrated males) at two time points in three conditions: immediately before and 10 min after the two styles of visitor contact and at identical times on days when the subjects did not experience visitor contact (baseline condition). To collect saliva, cotton buds were inserted into the guinea pigs' cheek pouches for 30–60 second. SC was measured using a commercially-available enzyme-linked immunoassay kit. A generalized linear mixed model was used for statistical analysis. The results showed that SC levels were significantly higher after visitor contact compared to before visitor contact, and there was no effect of the style of visitor contact on SC. In addition, SC levels were significantly higher on days of visitor contact than in baseline condition. These findings indicate that the current practice is insufficient to reduce stress and that further modifications of visitor contact methods are required to improve animal welfare.

## P-38

# The Effects of Environmental Enrichment on Anxiety-Like Behavior, Learning Behavior and Hippocampal Gene Expression in Hatano Rats

Hikaru Asano[1*], Airi Nakayama[1], Hasuka Okawa[1], Hideyo Tokuoka[1], Ryo Ota[2], Wataru Kasai[3], Maiko Kawaguchi[1]

1. Lab of Animal Behavior and Environmental Science, Graduate School of Agriculture, Meiji University, 2. Hatano Research Institute, Food and Drug Safety Center, 3 .Lab of Animal Behavior and Environmental Science, School of Agriculture, Meiji University

**Abstract:**

Environmental enrichment using object placement and a running wheel can reduce anxiety-like behavior and improve memory learning. However, environmental enrichment effects may differ depending on traits and genetic background. We conducted experiments using Sprague-Dawley rats (SD) and Hatano rats (HAA, LAA) selected from SD by active avoidance test to investigate effects of environmental enrichment. HAA are known to exhibit higher anxiety-like behavior than LAA, and show higher avoidance in active avoidance learning tests. In our study, 4-week old animals were introduced into either standard environment (SE) cages or into enriched environment (EE) cages containing a running wheel, tube and shelter. These animals underwent elevated plus maze and passive avoidance tests at 8 and 15 weeks of age, respectively. Brains were sampled at 20 weeks of age and gene expression levels of Brain-derived neurotrophic factor (BDNF) exon 1, 3 and 4, Tyrosine receptor kinase B (TrkB), Glucocorticoid receptor (GR) and Wingless-type MMTV integration site family member 3A (Wnt3a) in the hippocampus were measured using Real-time PCR. LAA reared in EE showed lower anxiety-like behavior than LAA reared in SE, but there was no effect of EE on SD or HAA. In contrast, EE rearing did not reduce learning behavior in LAA, or SD, but it did reduce such behavior in HAA. BDNF exon 3, 4 and GR increased in both HAA and LAA reared in EE, but BDNF exon 1 and TrkB increased only in LAA. These results suggest that environmental enrichment effects differ between strains.

## P-39
# Investigating Genetic Structure of the Ryukyu Flying Fox

Yuto Taki[1*], Christian E. Vincenot[2], Yu Sato[1], Miho Inoue-Murayama[1]
1. Wildlife Research Center, Kyoto University, 2. Department of Social Informatics, Kyoto University

**Abstract:**
There are 122 mammal species in Japan, and 37 of them are bats. The Ryukyu flying fox (*Pteropus dasymallus*) is one of the bat species in Japan, distributed in the Ryukyu archipelago, Taiwan, and possibly the Philippines, and is divided into 5 subspecies. They mainly eat fruits, nectar, and sometimes leaves, and has an important role in pollination and seed dispersal. Although they are listed as VU (vulnerable) in IUCN Red List, few genetic analyses have been conducted for their conservation. The purpose of this study is to evaluate genetic diversity, genetic differentiation, and gene flow of the Ryukyu flying fox between islands. At first, we conducted mtDNA haplotype analysis with the samples collected in 8 islands where one of the subspecies *P.d. yaeyamae* live. We identified 39 haplotypes in 526bp of the control region of 142 samples. 14 haplotypes were shared between some islands, and haplotype network for the 8 islands did not show any clear genetic structure. This might be because of migration between islands, but individual identification is needed to check actual gene flow. Also, some haplotypes were only found in particular islands, so there might be some genetic structure which could not be revealed by mtDNA analysis. Therefore, we developed microsatellite markers for more specific analyses. We designed new primers and tested their polymorphism. As a result, the markers were highly polymorphic and genetic diversity was generally high.

## P-40
# Japan is Too Cold for Malayan Tapir!?

Yuki Ishida [1, 2*], Daisuke Kohari[2]
1. Chiba Zoological Park, 2. Ibaraki University

**Abstract:**
Most Malayan tapirs (*Tapirus indicus*) are kept in outdoor facilities in Japan. However, the climate of Japan is quite different from Southeast Asia, which is the origin of Malayan tapir. We investigated the influence of ambient temperature on the behavior of captive Malayan tapirs in Japan. We observed three Malayan tapirs (Yukimi: ♀ 26 years old, Sako: ♀ 10 years old, Yumeta: ♂ 11 years old) which were kept in Chiba Zoological Park. They lived in a pit style enclosure that had sand floor, some trees and a pool that could completely hide their body. Their behaviors were recorded via CCD (Charge Coupled Device) video cameras during exhibition time (from Apr to Oct: 9:00~16:30, from Nov to Mar: 9:30~16:00) once a month over two years. At the same time, we took ambient temperature by data logger. We observed their maintenance behavior (resting, eating, moving, foraging, swimming) and social behavior by one-minute instantaneous sampling. The resting of all the tapirs were correlated with the temperature (Yukimi: $R = 0.69$, $p < 0.05$, Sako: $R = 0.69$, $p < 0.05$, Yumeta: $R = 0.80$, $p < 0.05$). Logistic regression revealed that the resting became less than 50% when the temperature were less than 9.8 ℃ (Yukimi), 21.8 ℃ (Sako) and 15.6 ℃ (Yumeta), respectively. It was suggested that we should consider low temperature in winter when we think about Malayan tapir's animal welfare in Japan.

## P-41
# Environmental Enrichments for Ponies and Hartmann's Mountain Zebras in Kamine Zoo

Natsumi Nishikawa
Hitachi City Kamine Zoo

**Abstract:**
In this presentation, I will introduce the environmental enrichments provided for ponies and Hartmann's mountain zebras in Kamine zoo. I have provided six types of enrichment strategies over three years, which were mainly feeding and physical enrichments. As one of the feeding enrichments, grass was given to the ponies in the mesh cage. The feeding time with enrichments more than doubled when compared with that for feeding without enrichments. In addition, as one of the physical enrichments, stones were added to the enclosures of the zebras to reproduce their wild habitat, viz., the mountainous regions of Africa, and to erode their hooves. Additionally, for the zebras, husbandry training aimed at hoof trimming without anesthesia has been conducted as an enrichment since November 2016. The effects of these enrichments will be documented and evaluated to obtain feedback for devising new plans.

## P-42
# The Function of Vocalizations Relating to Social Relationships in Free Ranging Horse Groups (*Equus caballus*)

Sakiho Ochi*, Satoshi Hirata
Wildlife Research Center, Kyoto University

**Abstract:**
For a better understanding of animal behavior or society, various studies on animal vocalizations have been conducted, and that is also important for animal welfare from the perspective of potentially monitoring their emotional states or social relationships. It is known that horses (*Equus caballus*) frequently communicate by using vocalizations, and previous studies show that vocalization has a big role in forming horse groups in some situations; for example, adult mares make calls when they are separated from other group members or their offspring. However, few studies discuss how those vocalizations are used for maintaining their social relationships thoroughout their daily life as a member of a group. In the present study, we aim to understand the function of vocalization in free ranging horse groups, and also aim to investigate whether they also use their vocalization to communicate with human caretakers. To achieve those goals, we recorded horses' vocalizations from 58 individuals from five groups, in four contexts: 1) separation from a familiar individual(s), 2) demanding food from humans, 3) aggression to another individual, 4) free ranging. We attached small microphones to all individuals' heads in the target group to identify which individual made the vocalization, and recorded their vocalizations for ten hours per day. We also observed their social behavior to evaluated their social ranking by applying an average dominance index. From those data, we investigate the spectral difference between vocalizations, by using the Hidden Markov Model. In this presentation, we will present the preliminary results of those analysis.

## P-43
# A Fundamental Study of Pacing Behaviours in Captive Bears

Daisuke Kohari[1*], Saeka Ohba[1], Satoshi Kimura[2], Isamu Ohuchi[2], Tabito Nakamoto[2], Haruhisa Masatou[2], Nobutaka Namae[2]

1. College of Agriculture, Ibaraki University, 2. Hitachi city Kamine zoo

**Abstract:**

We focused on pacing behaviours (Stereotypic repetitive walking) in captive bears and conducted a fundamental study to clarify their peculiarity.

This study was conducted for three days at three different periods (spring, summer, and autumn) at Hitachi City Kamine Zoo in Japan. We observed two brown bears (*Ursus arctos*) and two Asiatic black bears (*Ursus thibetanus japonicus*) housed in similar captive enclosure. We recorded the time budget of pacing and other behaviours such as resting, eating, walking, investigating, swimming and others for 24 hrs using 2 min scan sampling methods. In addition, we analyzed daily walking distance, walking velocity, and area usage using a two-dimension Direct Linear Transformation (DLT) method of video analysis. We aimed at clarifying the seasonality and daily patterns of this stereotypic behaviours. Pacing behaviours were observed significantly more in spring and performed mainly during the day. Walking velocity differed significantly between brown bears and Asiatic black bears and that in pacing was faster than that in normal walk. Walking distance did not significantly differ between species and seasons. However, it tended to different among the individuals. Individuals who walked more distances also performed more pacing behaviours. Analyzing their moving locus, pacing behaviours were intensively observed near the doorway area. Our study suggests that pacing behaviours differed between seasons and individuals, even in similar captive conditions, which may be related to the walking motivation of each bear. Further, detailed observation is necessary for us to distinguish between pacing and normal walking.

## P-44
# Plant Eating Habit of Captive Snow Leopard (*Panthera uncia*)

Hiroto Yoshimura[1*], Kazuyuki Ban[2, 3], Kiyoko Takatsu[4], Kodzue Kinoshita[1]

1. Wildlife Research Center, Kyoto University, 2. Omuta City Zoo, 3. Graduate School of Education, Seisa University, 4. Tama Zoological Park

**Abstract:**

Scats of wild snow leopards (*Panthera uncia*) frequently contain plant materials. However, cellulose intake is known to prevent digestion of food. The reason why they eat plant materials frequently is unknown. Domestic cats (*Felis silvestris catus*) are generally believed to eat plants to excrete hair balls, therefore it was predicted that the plant eating habit of snow leopards also relates to hair evacuation. In addition, fiber intake was predicted to have little effect on snow leopards' digestion. In this study, behaviors were observed in six captive snow leopards and scat analysis was carried on in another two individuals.

From the results, four individuals tended to spend longer time for plant eating on the day they spent longer time for grooming. Scat analysis showed hair weight didn't increase according to plant weight in same scat. On the other hand, many hairs were contained in scats evacuated after plants were excreted ($r = 0.58$, $p < 0.1$, Pearson's product moment correlation). As for digestion, we fed sesame seeds to two individuals to measure their transit time. The transit time increased when eating plant materials with daily meat-based diet, and digestibility didn't decrease against the results of previous studies in other carnivorous cats.

Hence, it was presumed that plant intake might be advantageous for snow leopards to excrete hairs and it might have little effect on their digestion although further researches are required to confirm the conclusion.

## P-45
## Evidence of Self-Domestication in Wild Coyotes?

James Brooks[1*], Roland Kays[2, 3], Brian Hare[4, 5]

1. Wildlife Research Center, Kyoto University, 2. College of Natural Resources, North Carolina State University, 3. Biodiversity Lab, North Carolina Museum of Natural Sciences, 4. Department of Evolutionary Anthropology, Duke University, 5. Duke Institute for Brain Science, Duke University

**Abstract:**

The question of how cognition evolves has long been a topic of intense investigation to researchers. One proposal, the self-domestication hypothesis, suggests that selection for less reactive temperament leads to a suite of cognitive and physiological changes, including both increased tolerance as well as juvenilization of morphology and behaviour. Despite the self-domestication hypothesis predicting the possibility of self-domestication in wide-ranging species, no studies have tested the possibility of self-domestication in currently evolving, wild living species. We used camera traps across the state of North Carolina to test coyotes' temperament based on reaction to noticing the camera (as a type of novel object task), predicting coyotes in more urbanized areas (resembling the environment of early dogs) will approach the camera more often. Consistent with this hypothesis, we found a significantly higher proportion of coyotes approached the camera in areas of higher human density. These findings validate reactions to camera traps as a temperament task in wild animals, strengthen the proposal to look for self-domestication in wild animals, and may have important implications for wildlife management of Eastern coyotes.

## P-46

# Effects of Different Room Temperatures and Floor Features on the Behaviour of Pet Dogs

Megumi Fukuzawa*, Saki Horikiri, Ayano Katsumata
College of Bioresource Sciences, Nihon University

**Abstract:**

There are many dogs to spend in the house, but it is not considered whether it is an environment where dogs are able to spend comfortably. We selected four floor types (wood, carpet, tatami, concrete) that are widely used in general homes in Japan, and evaluated the dogs' behaviour on these floor conditions in different room temperature environments. Eight healthy dogs were participated in the study. Each dog spent in the cage for 30 minutes in the three types of temperature environment "25 ℃. (Control condition)", "air-conditioned 20 ℃. (Cooling condition)", and "heated 30 ℃. (Heating condition)", and then, spent freely for 30 minutes in one of four floor environments. The dogs were exposed to one temperature condition for 4 consecutive days. After 3 days intervals, another condition was started. Posture (6 categories) and behaviour (11 categories) were recorded. The sitting posture on concrete and standing posture on tatami were significantly longer for Cooling than for Heating, respectively. In all floor types, the duration of panting was significantly longer for Heating, and the number of sighs was high for Heating on concrete and carpet. Although the environmental temperature of air-conditioned 20 to 25 ℃. does not significantly affect the dog's floor use behaviour, heated 30 ℃. is seemed to be less comfortable for dogs. It was also suggested that the features of the floor surface affect the dog's behaviour.

## P-47
# Investigation about the Teenagers' Attitude Towards the Problem of Free-Roaming Cats in Tokunoshima with the Use of Structural Equation Modelling (SEM)

Huiyuan Qi[1*], Tadashi Miyashita[2], Yuya Watari[3], Mutsumi Minobe[4]

1. Wildlife Research Center, Kyoto University, 2. Faculty of Agriculture, The University of Tokyo, 3. Forestry and Forest Products Research Institute, 4. NPO Shima-niji of Tokunoshima

**Abstract:**

Tokunoshima, one subtropical island in Japan, owns its unique ecosystem with the thriving of many endangered species. It is shown by previous researches that 1. the predation by free-roaming domestic cats is one serious threat to those endangered animals, 2. residents' feeding is likely to worsen the impact. Aiming to get residents' understanding and cooperation of the free-roaming cat management, we need to clarify both the characteristics of feeders and also the residents' attitudes towards the management. Self-administered questionnaire survey was conducted in all the junior and senior high school in Tokunoshima, including 1162 respondents (total: 1255, response rate: 92.6%). We chose structured equation modelling (SEM) to analyze hierarchical structured attitude items. The results showed that teenagers who love cats did not have high contribution to the feeding frequency, while those with cat ownership, and those believing cats are useful in rodent control, tended to have higher feeding frequency. Instead of the recognition of ecosystem damage, those who recognized the cat-caused public health related damage, e.g. zoonoses and rubbish foraging,were more likely to support the free-roaming cat management. Considering that teenagers are being influenced largely by their parents and neighbors, it is implied that in Tokunoshima, enlightenment mainly targeting at cat owners and agricultural workers, and paying more attention to the recognition of cat-caused public health damage might be helpful in order to attain residents' understanding and cooperation of the invasive cat management.

## P-48

# Effect of Captive Environmental Conditions and Visitors on Behavior of African Lions (*Panthera leo*) and their Welfare at Giza Zoological Garden, Egypt

Atef Mohamed Kamel Ahmed

Department of Wildlife Conservation and Zoo Medicine, Faculty of Veterinary Medicine, Suez Canal University

**Abstract:**

Environmental factors play a critical role in determining the behavioural and physiological responses of animals to captivity. Understanding these responses in order to establish new and improved techniques of enclosure design and animal husbandry is integral to environmental enrichment. The goal of current research was to evaluate the behavioral adjustments of African lion (*Panthera leo)* in different sized enclosures (closed and open yard) at Giza Zoo. A two group of African lions was observed at Giza Zoo (Site 1 &Site 2) having one caged solitary lion, one breeding pair and a group have yard for doing activities. The frequency of different behavior patterns displayed by these lions was studied at both study sites for three hours once a week by instantaneous sampling method for 16 weeks, from 10$^{th}$ December 2018 to 10$^{th}$ February in 2019. The frequency of stereotypic behavior including auto mutilation, refusal of food stuff, feces licking, unnatural aggressiveness, pacing, head tossing was more periodic in lions housed at Giza Zoo (Site 1) in contrast to lions at display in yard at Giza Zoo (Site 2). The frequency of natural behavior was periodic in African lions housed at Site 2 open yard. In the present study stereotypic behavior in lions represented here as a tool to measure the level of comfort at both housing sites. There is a relationship between area range weather (closed or open yard) and frequency of various normal and abnormal behavior in captive African lions. The effects of visitors on behaviour and stress response of African lion are variable and depend on different factors, such as Lack of space, social stress, presence of visitors, diseases and other health problems, and medical procedures are some of the main challenges facing zoos when they want to guarantee an optimal welfare status for the animals under their care.

## P-49

# Sleeping Behaviors of Captive Commerson's Dolphins (*Cephalorhynchus commersonii*)

Maho Araki[1*], Yayoi Yoshida[2], Junichi Jingu[3], Yusuke Tanaka[3], Mako Terasawa[3], Yuske Sekiguchi[4], Hisashi Matsubayashi[1]

1. Laboratory of wildlife biology,Tokyo University of Agriculture, 2. Tokai Univercity,Marine Science, 3. Sendai Uminomori Aquarium, 4. Chiba University of Commerce

**Abstract:**

For animals, lack of sleep causes deterioration of physiological conditions. Therefore, it is thought that knowing an accurate sleep state contributes to improvement of captive environment. With regard to cetaceans, the only " closed eyes" method is selected as a sleep determination method that does not affect the individual. However, commerson's dolphins had a black face, and it was considered difficult to continuously check the eye condition (Shpak 2008). Only at Sendai Uminomori Aquarium in Japan, it was possible to check the opening and closing of the eyes in bright time.

Therefore, in this study, we conducted the world's first sleep survey focusing on the opening and closing of the comerson's dolphin's eyes.

The target is a family of 3 commerson's dolphins.

The observation was performed for 290 hours in total from 6 am to 18 pm from March 2017 to December 2018. The swimming speed, breathing frequency, diving depth, swimming route, and sound were recorded. We defined sleep when one of the eyes was closed for more than 10 seconds (Mukhametov et al 1974). As a result, clear sleeping characteristics were confirmed in the swimming route and in the sound. The swimming route is limited to the monotonous ones that swim in a large circular course along the tank wall. Sleep duration range from 10 seconds to 13 minutes. Their speed while sleeping(1.11m/s)is the same as when they are awake by about 80%.In addition, during sleep, the average number of utterances decreases to 1⁄4 of awakening.

## P-50
# Evaluation of External Environment by Non-Invasive Hormone Assay in Snow Leopards (*Panthera uncia*)

Kodzue Kinoshita
Wildlife Research Center, Kyoto University

**Abstract:**
The animal is connected to the external environment (e.g., social environment, habitat environment) via their brain, and the hormone plays an important role as its transmitter substance. In other words, when the external environment changes, hormones are secreted to adjust the internal environment in response. Therefore, hormone analysis is a useful tool that enables to know animal's physiological state under various environments.

As one of physiological response, “stress response” is presumed to be it. Animals have two kinds of stress; acute stress and chronic stress. Usually, the stress can be monitored by the adrenocortical hormone concentration in scats, which we can obtain non-invasively from animals. However, in scats, hormones are accumulated until the evacuation, and the acute hormone elevation is masked. Hence, when we use the evacuated materials for the analysis, we should mainly focus on not acute but chronic (prolonged) stress.

For over five years, I have monitored the stress level (cortisol) and the reproductive state (estrogen and progesterone) by fecal hormonal analysis in captive snow leopards in detail. My study suggested that the environment surrounding of captive snow leopards (housing condition) can effect a change of their stress levels and the stress can suppress female estrus levels. From the results, I have confirmed that the measurement of fecal hormone concentration is a useful tool to estimate their physiological state. In this presentation, I’ll introduce the studies in captivity and discuss the application possibility of hormonal analysis for the estimation of animal’s internal change in wildlife.

## P-51
# Effect of Environmental Enrichment on Reproductive Behavior in Hatano Rats

Hasuka Okawa[1], Ryo Ohta[2*], Airi Nakayama[1], Hikaru Asano[1], Wataru Kasai[3], Shohei Kobayashi[1], Maiko Kawaguchi[1, 3]

1. Lab of Animal Behavior and Environmental Science, Graduate School of Agriculture, Meiji University, 2. Hatano Research Institute Food and Drug Safety Center, 3. Lab of Animal Behavior and Environmental Science, School of Agriculture, Meiji University

**Abstract:**

Environmental enrichment, such as living in a spacious environment and having various toys has a large biological effect, especially if experienced early in life. The purpose of environmental enrichment is to bring out natural behavioral and endocrinological reactions which can enhance animals' quality of life, but it does not always have a good impact on all animals. To explore the effect of environmental enrichment on animals with different characteristics, we studied Hatano high-avoidance (HAA) and low-avoidance (LAA) rats. These rats were originally selected from Sprague-Dawley (SD) rats for high and low active avoidance tests, and so have different reproductive behavior. Four-week old male Hatano (HAA and LAA) and SD rats were continuously subjected to either a standard environment (SE), or to an enriched environment (EE) that comprised a large cage with a tunnel, running wheel and hiding place. After seven weeks in these environments, the respective rats were subject to behavioral tests for measurement of reproductive behavior, namely a socio sexual behavior test and a sexual behavior test. The LAA rats reared in EE showed later mount latency than LAA rats reared in SE. Also, HAA rats reared in EE showed later intromission latency than HAA rats reared in SE. These results showed that there was a difference in the effect of environmental enrichment on HAA and LAA. This work was supported by Research Project Grant (A), Institute of Science and Technology, Meiji University.

## P-52
## Improving Living Environment of Lesser Slow Loris

Kei Nemoto[1*], Yumi Yamanashi[2, 3], Koshiro Watanuki[4], Akinori Dosyo[1], Josue Alejanro Pastrana[5]

1. Japan Monkey Centre, 2. Kyoto City Zoo, 3. Wildlife Research Center, Kyoto University, 4. Ministry of the Environment, 5. Primate Research Institute, Kyoto University

**Abstract:**

The Japan Monkey Centre (JMC) keeps 13 individuals of Lesser Slow Loris which are rescued at the airport from illegal trade. We used to keep them in small bird cages in non-exhibition area. The space given to them was only 0.1to 0.3 cubic meter per individual, which obviously was not enough. In 2014, we measured fecal glucocorticoid level as an indicator of stress and we found that their stress levels were far higher than those living in the exhibition area of JMC and other zoos. We aimed to improve their living conditions by modifying physical, dietary and social environment. We renovated the old nocturnal exhibition room for them to use. As a result, the space for each individual was extended to 1.0to 16.0 cubic meter. We also changed their food from sugar-rich fruits to Gum Arabic and insects which are close to their original dietary. At the same time, we provided feeding enrichment to stimulate their exploratory behavior. We give them dental check on a regular basis to improve their oral condition. We have tried matching process to bring their social ability. We tried over 20 different pairs and at the point of January 2019, a pair of 2 males, a group of 3 females, and a pair of opposite-sex were successfully made. We have observed social behavior such as grooming and sharing space. We work with researchers and verify the effects scientifically.

## P-53
# Installing Enrichment Items for Decreasing Aggressive Behavior of Captive Toque Macaques

Hikari Kawade*, Yoshitaka Kimura, Nao Kawamoto
Tokiwa Zoo

**Abstract:**
We installed enrichment feeders to extend the feeding time for Toque macaques (10 individuals of varying ages); an adult male named "Nigo" frequently attacked a young male named "Mana." To decrease aggressive behavior, we installed hammocks and feeders that were difficult for adults to operate. We assessed the behaviors of the Toque macaques over a 4-month period in 2018 divided into three stages: "before" (no enrichment: July to Aug), "period-1" (hammocks: Aug to Sep), and "period-2" (hammocks and feeders: Sep to Oct) and conducted observations for 10 days during each period. We recorded the macaques' behavior (13 categories) and utilized places (top, high, middle, and bottom) for 15 min after the last feeding time four times using instantaneous scan sampling every 30 s. We recorded contact with the feeders by 1/0 sampling every 1 min. We also counted aggressive behaviors and recorded whether an individual performed or received an attack. Nigo and Mana didn't make contact with the enrichment feeders. Nigo's utilization of the middle place decreased and utilization of the high and bottom places increased during "period-2". Mana decreased his utilization of the top place and increased his utilization of the high place from "before" to "period-2". There were no changes in the number of aggressive behaviors from "before" ($4.2 \pm 0.6$) to "period-1" ($3.9 \pm 0.7$), but there was a decrease from "period-1" to "period-2" ($0.2 \pm 0.4$). Our results suggest that aggressive behavior was decreased by altering the places utilized by individual macaques by installing enrichment items.

## P-54
# Sensitivity to Workload: Prioritizing Behavior of a Three-Choice Task in Free-Ranging Japanese Macaques

Shenwen Xu[1*], Kazunori Yamada[2], Masayuki Nakamichi[2], Masaki Tomonaga[1]

1. Primate Research Institute, Kyoto University, 2. Graduate School of Human Sciences, Osaka University

**Abstract:**
Animals do not always optimize their decisions in response to energetic workload. To examine how their decisions were biased, we introduced a three-choice task in free-ranging Japanese macaques (*Macaca fuscata fuscata*). We varied the workload among choice options across trials. Monkeys could pull each of three boxes in any order to obtain a piece of sweet potato from inside. We presented monkeys with three conditions, in each of which we varied the workload by adding a certain number of weights to the boxes (1.5kg/weight), ranging from zero weights to a maximum of three weights. All three conditions included low-, middle-, and high-workload options. Results show that monkeys prioritized the low-workload box for their first choice, but when they did not, they chose randomly between the other two boxes. Regardless of their first choice, monkeys did not optimize subsequent behavior according to workload. In the last condition with a free-food option in which the monkeys did not need to pull the box, the free food was prioritized for monkeys' second choice if it was not chosen for their first choice. Our findings suggest that in monkeys' optimization process, they solely respond to workload by prioritizing the option when it had a relatively lower workload.

## P-55

# Evaluating the Effectiveness of Mixed-Species Pairing to Reduce the Number of Singly-Housed Gibbons at Japan Monkey Centre

Makiko Uchikoshi[1, 2*], Shuto Ishida[2], and Masaya Yamada[2]

1. Primate Research Institute, Kyoto University, 2. Japan Monkey Centre

**Abstract:**

Gibbons are apes in the family *Hylobatidae.* They are distributed in Southeast Asia, South Asia and southern China. All 20 species are threatened with extinction. At present, 176 gibbons are living in Japan at 43 captive facilities. We have a duty to provide for their lifelong well-being and give them a proper environment in which to express their natural behavior. We also need to contribute to conserving their habitats in the wild. One of our recent challenges is to reduce the number of singly-housed gibbons to zero. Although gibbons are highly social animals, more than 20% live in solitude in Japan. Here, we report two cases of heterosexual pairing of gibbons (*Hylobates spp.*). Two mixed-species pairs were formed from Aug. 2016 to Sept. 2017 following standard introduction procedures. We gave oral contraceptive pills to the females every day to prevent breeding. Behaviors including physical contact and vocalizations were recorded to assess their compatibility. 24-hour sound recordings were also made to evaluate the pairs' simultaneous singing behavior. Activity budgets before and after pairing were compared. In both pairs, we observed an increase in affiliative behaviors, such as social play, allogrooming, copulation. In one female, inactive time decreased. In both females, song structure changed with males' participation. By the last stage of the introductions both pairs sang duets together every morning. These observations suggest that mixed-species pairing, coupled with contraception, could be an effective way to improve gibbon well-being. Further effort is needed to improve the welfare of other singly-housed gibbons.

## P-56
# Significance of Feeding Branches to Captive Western Gorillas

Misako Namiki*, Toyokazu Kobayashi
Faculty of Animal Science, Teikyo University of Science

**Abstract:**
It has been reported that many deaths were presumed to be caused by heart disease in middle-aged captive gorillas (Lyn and Raskin, 2007). From the perspective of health care, it is recommended to assess the antioxidant properties which have been shown to be effective in preventing humans' heart disease. Although the assessments of them have been made for human food products, same assessment for branches have been not implemented yet. Also, it is important to know their preference of branches.

In this study, we examined a seasonal change in antioxidant properties of the branches fed to six Western gorillas at Ueno Zoo (Tokyo) and the their branch foraging behavior for each tree species from 2017 to 2018..Antioxidant properties were determined using the BAP method (measuring the antioxidative activities of all antioxidants contained in the samples by reducing Fe3+ to Fe2+).

By direct observation, the gorillas' holding duration of the branches and feeding behavior at the enclosure were recorded by every tree species, which was assumed that might reflect gorillas' preference.

The result showed that seasonal changes in concentration of antioxidant properties were found to be larger in deciduous trees than in evergreens and larger in leaves than bark throughout the study period. It was higher in both leaves and bark than in vegetables and fruits that were fed together. The gorillas' preference showed a common tendency between young and adult individuals.

We did not know the actual amount of feed intake, therefore, quantitative analysis needs to be conducted in the future.

## P-57
## Environment Enrichment for Gibbons

Shuto Ishida[1*], Masaya Yamada[1], Makiko Uchikoshi[1, 2]
1. Japan Monkey Centre, 2. Primate Research Institute Kyoto University

**Abstract:**
The Japan Monkey Centre (JMC) has been providing numerous ways of environmental enrichment for nonhuman primates in the zoo. In this presentation, we will introduce the case of gibbons, *Hylobatidae* (2genus, 5 species, 25 individuals) living in JMC. 1) Structural enrichment: We set perches and fire hoses and plant trees in their enclosures to encourage their natural forms of locomotion. We also create space carefully considered for physically challenged or elderly individuals. 2) Feeding enrichment: We use various materials to make feeders. We adjust difficulty levels by considering individuals' characteristics. We provide browse on a daily basis. We requested food donation which helps to increase the number of feeding items. 3) Social enrichment: In the wild, gibbons form deep, long-term pair bonds in a small group. In captivity, however, there are many cases that gibbons live alone for various reasons, such as difficuluty to find conspecific partner. We made two male-female pairs with three different species; females were *Hylobates muelleri* and *Hylobates agilis*, males *Hylobates lar* to avoid crossbreeding, contraceptives are given to females. As a result, we were able to observe them grooming, playing and singing together, which were not able to do when they were alone. We also successfully reintroduced hand-rearing siamangs (*Symphalangus syndactylus*) to their conspecifics. We continue to make effort to give better lives for gibbons in captivity and explore new ways of environmental enrichment. We would like to share the information to other facilities to raise the standard of gibbon care in Japan.

## P-58
# Evaluation of Social Enrichment in Cohabitation between Female of Owl Monkey

Ryuhei Ano[1*], Yoshihiro Kagami[1], Chigusa Tanaka[1], Koshiro Watanuki[2]
1. Japan Monkey Centre, 2. Ministry of the Environment

**Abstract:**
Primates are social animals. Therefore, it is important to provide opportunities for primates to develop social behavior even in captive environment. In zoos, sometimes animals are kept in limited space and breeding restriction is inevitable. One possible way to realize both the development of social behavior and reproduction control is to keep the animals of the same sex together.

The purpose of this study is to examine whether cohabitation of females of owl monkeys (*Aotus* sp.) improve their welfare status. Owl monkeys are monogamous species and form unimale-unifemale group in wild. We observed two pairs of female owl monkeys before cohabitation, after cohabitation, and half a year later. Each observation record was taken for three days. We recorded night behavior of owl monkeys using a video camera with infrared light. We had scan sampling of every 5 minutes for 250 minutes on evening feeding. We recorded frequency and duration time of the stereotyped behavior and self-directed behavior. As a result, we found that frequency and duration time of both behaviors were decreased after the cohabitation. Stereotyped behavior and self-directed behavior were shown in response to loud sounds and movement of other individuals before cohabitation. We observed the similar reactions after cohabitation but frequency was much lower. Our study showed that cohabitation of same sex individuals could improve social welfare of monogamous monkeys. We will continue the observation and we would like to also measure fecal corticoid metabolite to see their stress level.

## P-59
# The New Enclosure for Chimpanzees in Nagoya Higashiyama Zoo and Botanical Gardens

Yuji Kondoh
Nagoya City Zoo

**Abstract:**
New enclosures for chimpanzees and western gorillas at the “African Forest Area” was open to the public in Higashiyama zoo in September 2018. The new chimpanzee house covers 667 square meters in outdoor open space which area is about 3 times wider and 231 square meters in indoor exhibit which area is approximately 5.5 times wider than the old one in size, and has holding areas on the first basement floor. The indoor exhibit has a plurality of towers imaging high trees in the forest. And respective towers are connected by metallic beams so as to obtain the chimpanzees’ performance of moving laterally at high places. Four towers, the 11-meter-high tower which was transferred from the old enclosure, 15-meter-high, 5-meter-high, 5.5 meter high new towers, are set up in the outdoor space. The distance between a chain of towers coupled by beams is roughly 25 meters in length, which is the longest one out of chimpanzee enclosures in Japan. The enlarged and complicated house is also equipped with ant mounds, fallen-tree feeders and stones used to crack the shell of nuts to induce various behaviors in chimpanzees.
The exhibit also has a “pan lab”, where visitors can recognize the intelligence of chimpanzees through touch panel operation by themselves in addition to enhanced signs and displays to inform people of the environment surrounding the apes in the viewing aisles, as visitors can have fun while learning about chimpanzees.

## P-60

# Does Intragroup Aggression Affect Males' Choice of Parties to Attend? Study on Fission-Fusion Grouping of Male Chimpanzees in Kalinzu Forest Reserve, Uganda

Shohei Shibata*, Chie Hashimoto, Takeshi Furuichi
Primate Research Institute, Kyoto University

**Abstract:**
Group living animals benefit by lessening predation risks, enhancing feeding efficiencies and increasing mating opportunities. However, they also face intragroup competition for food and reproductive resources. Therefore, individuals need to balance such benefits and costs in order to maintain group living. Chimpanzees (*Pan troglodytes*) are known to perform fission-fusion grouping in which group members sprit into temporary and flexible parties during foraging. In this study, we examined intragroup aggression and presence of cycling females as factors which could affect the fission-fusion dynamics.

I conducted field works and observed male chimpanzees in M group at Kalinzu Forest Reserve, Republic of Uganda for about 6 months in 2018. We found that the number of males in a party were significantly larger in the presence of females showing maximum sexual swelling (MSS) than in the absence of those females. In the absence of females with MSS, males tended to spend time alone or in small parties. Especially, lower-ranked males spent time alone significantly more frequently than higher-ranked males. Regardless of the absence/presence of females with MSS, the frequency of male aggressive behaviors per number of males observed in a party increased with the number of males in the party. These results suggest that male chimpanzees of different ranks show different tendencies of attendance to parties. Although fission-fusion grouping of chimpanzees has been explained by feeding efficiency or mating behaviors, this study suggests that avoidance of aggression from other males might be one of the factors for such grouping pattern of chimpanzees.

## P-61
# Reconstruction of Exercise Yards and Introduction of Enrichment Furniture at Taipei Zoo

Hsiao-Wei Kuo*, Szu-Lung Chen, Eric Hsieh-Shao Tsao
Conservation and Research Center, Taipei Zoo

**Abstract:**
The Conservation and Research Center at Taipei Zoo currently takes care of eight Critically Endangered Bornean orangutans, *Pongo pygmaeus*. Most of them had been confiscated or rescued by the government authority then settled at Taipei Zoo. The holding enclosures were modified from old facility to include two big outdoor cage exercise yards, each links to four indoor dens. To letting more individual orangutans to better use the outdoor exercise yards, ensuring the safety of orphaned raised by mother orangutan, and we have constructed one smaller and lower cage to each outdoor exercise yards. Each cage then has two entrances to the indoor dens to form the loop for better allocating the orangutan individuals. As for behavior enrichment, we have added and improved climbing, interacting, food hiding, and provided essential oils as olfactory stimulation. The observations show that the effects caused by reconstruction of small cages or introduction of enrichment materials were not significant on behaviors of male orangutans. However, after the reconstruction of extra smaller cage exercise yards, the interaction between female orangutans and their neighbors increased slightly. Before and after behavior enrichment, the mother-child interactions were more when there were no male orangutans in the next exercise yards. Since this is the first trial to use essential oils as a potential olfactory enrichment, it's not quite clear whether the orangutans have a clear preference on odors. The results suggested that the improvement of exercise yards combines various behavioral enrichment facilities, can largely enhance the convenience of captive management and provide an environment for more benign interactions.

## P-62

# Improve Living Environment and Animal Welfare of Anubis Baboon Based on Experience in Natural Habitat

Kenta Araki[1*], Yuki Oshima[1], Koshiro Watanuki[2]

1. Japan Monkey Centre, 2. Ministry of the Environment

**Abstract:**

Japan Monkey Center (JMC) keeps about 80 Anubis baboons in a simple enclosure with the floor covered with concrete and simple iron towers at the center. This enclosure does not have enough space for baboons to rest or to hide when conflict occurs. They did not even have opportunity to search for food.

In 2014, JMC started to send staffs to natural habitats of non-human primates to understand their original lives in the wild. Based on the observation of wild Anubis baboons in the Gombe National Park (Tanzania), we tried to improve the facility of enclosure.

For the physical enrichment, we set fire hoses around the iron tower like vines of the plants so that they are able to behave just as they would do in the wild. We also set some hammock made with fire hoses and extended the tower with thinned wood to make more space to rest.

For the feeding enrichment, we divided the part of the enclosure and set woodchips and dry leaves. We hide their food in it and let them search for the food.

We evaluated the effects of these enrichment by direct observation. As a result, we found that more individuals use extended tower for resting and evacuation from the conflict. The feeding enrichment extended the feeding time and to bring up the searching behavior.

We found that environmental enrichment based on the original behavior in the wild helps to improve living environment in captivity and animal welfare.

## P-63

# Learn from Past Zoo Animals: Temporal Change of Morphology in Captive Japanese Yaku Macaques

Yuta Shintaku[1, 2*]

1. Wildlife Research Center, Kyoto University, 2. Japan Monkey Centre

**Abstract:**

Captive condition in zoo is different from wild environment in various aspects such as climate, food, activity, and population density. These differences would affect to various morphological characters of captive animals. Japan Monkey Centre (JMC) has kept one group of Japanese Yaku macaques (*Macaca fuscata yakui*) since 1957. Throughout 60 years of history, zoo staffs recorded information about more than 850 individuals, with maternal lineage. JMC also stores many dissection records and skeletal specimens of dead individuals. Thus, Japanese Yaku macaques of JMC is important resource to analyze temporal change of animal morphology under captive condition. In this study, I analyzed skeletal specimens and internal organ weight recorded at dissection of these Japanese Yaku macaques, especially focused on the differences among generations determined by maternal lineage. As a result, body size change was observed in males. In skeletal characters, size was increased till 3rd generation, and decreased after 4th generation. In internal organ weight, the size was maximized in 2nd generation. This complex size change might be affected by mixed factors such as improved nutrient condition and high population density. In contrast, females did not show size change among generations. Different pattern of male and female was explained by difference in strategy related to reproduction.

## P-64
# Enrichment Experience Activity in the Wild Summer Camp

Rie Akami[1*], Tomo Takano[1], Yuta Shintaku[1], Ayako Eto[1], Wakana Sakakura[1], Yoshihiro Kagami[1], Koshiro Watanuki[2], Masaki Tomonaga[1,3]

1. Japan Monkey Centre, 2. Ministry of the Environment, 3. Primate Research Institute, Kyoto University

**Abstract:**

"Wild Summer Camp" is a one night and two days zoo camp for children held by Japan Monkey Centre since 2015. The aim of this educational program is to learn the skills and pleasures of fieldworks from real wildlife researchers. Children experience various types of wildlife research methods such as trap camera for wild animals, light trap for insects, and focal animal observation for captive primates. They also experience a night walking in the zoo, making BBQ, putting up a tent, and sleeping in sleeping bags.

The final activity of this program is the "Enrichment Experience". After learning about the life of target primates in the wild, children discuss how they can enrich the captive primates' environment. If the ideas children suggest are allowed by the keepers as safe and possible, children can implement them. There have already many ideas realized by the children. For example, making insect feeder for lemurs, setting the feeder for gibbons at the higher place, and making bamboo wind-bell for a gorilla.

From the results of the questionnaire, most of children listed the Enrichment Experience as one of their favorite activities in the camp. Maybe there was a bias because the Enrichment Experience was the final activity so it's easy to recall, but the Enrichment Experience was definitely an impressive activity for them. For the future tasks, the follow-up survey of the educational effect on the children is needed.

## P-65

# Does Enrichment Improve Well Being in Animals under Human Care? A Case Study of Two Harbor Seals (*Phoca vitulina*)

Ruta Vaicekauskaite1,2*, Jennifer N. Schneider, Ph.D.3, Fabienne Delfour, Ph.D.4

1. Fox Consulting, France, 2. Marine Research Institute, Klaipeda University, 3. Social Science Department, LCC International University, 4. Laboratoire d'Ethologie Expérimentale et Comparée E.A. 4443, Université Paris 13

**Abstract:**

Traditionally, environmental enrichment is designed to encourage animals under human care to increase time spent performing desirable natural behaviours and decrease undesirable ones. Numerous examples of enrichment can be found in zoos, but no seal specific protocols. We present a study on the effects of environmental enrichment on two Harbor seals (*Phoca vitulina*) in Attica Zoological Park (Greece). The purpose of this study was to evaluate an object-based environmental enrichment program on stimulating exploration and play and improving conspecific social interactions and human–animal relationships (HAR) during a four-month period. Zoo staff conducted the environmental enrichment program as part of the daily animal care program. Seals were given objects haphazardly and were observed for 20 minutes; and seals' responsiveness during training sessions before and after enrichment was assessed. Seals showed interest in objects throughout the study and interacted more times per session with objects during the later months. The two pinnipeds showed preferences for objects that were suspended in the water column. Their affiliative interactions did not change. One seal showed better responsiveness to trainers in training sessions that followed an enrichment session. This study was limited by the small group size of seals at Attica Zoological Park, making it impossible to make species-specific generalizations. Further research should be conducted to examine the effectiveness of enrichment programs with larger groups, in mixed sex and age groups, and at all times of the year. Collaborative research efforts between zoos and aquaria are therefore necessary for the development of quality enrichment guidelines for Harbor seals.

## Rapid Communication and Poster

### 23rd June 2019

**Session 1**

from RP-1 to RP-10

### 24th June 2019

**Session 2**

From RP-11 to RP-14

# RP-1
# Enriching a Canadian Beaver Beyond Its Primary Habitat

Katie Springer
San Diego Zoo

**Abstract:**
The San Diego Zoo currently houses a 9-year-old 0.1 Canadian beaver. She is housed at our animal ambassador facility called Wegeforth bowl. She is part of our shows as well as special tours, night programs and off grounds events to fulfil part of our mission, which is to help connect people to wildlife. Her habitat is inclusive of a wet area with a pool, a dry area with different substrates and an area where she can build a den. Although this space is sufficient for her to thrive in, we wanted the ability to take her to other areas to explore. In order to do this, we needed to implement a training system with no leash or collar using relationship based training and operant conditioning. With some time, we have established a successful training system which allows us to take her to different areas within the zoo to swim and walk, enriching her beyond her primary habitat. I would like to discuss the steps in which it took us to get to where we are today.

## RP-2
# Enrichment Projects Conducted with the Japanese Wild Boar and Raccoon Dog, the Local Animals of Kagoshima

Megumi Kouno*, Azusa Kawakubo
Hirakawa Zoological Park

**Abstract:**
We have an area called “the local animals of Kagoshima”, where we display the local animals of Kagoshima. We carried out enrichment projects with the Japanese wild boar (*Sus scrofa leucomystax*) and Japanese raccoon dog (*Nyctereutes procynoides viverrinus*). Our zoo has one Japanese boar (male, 2 years old, rescued when young). He did not appear to know how to dig up dirt (rooting). We placed a log containing dry dog food within small holes that we drilled in his enclosure. He began to play with the log using his nose and started to show signs of rooting. In addition, when we kept the sandpit wet, he began rooting and afterwards, wallowed in the mud. We have a herd of six Japanese raccoon dogs; a family and a non-kin individual (male, X). Fights have broken out between X and the three young, which have often resulted in bleeding wounds. We hung a bamboo pipe with small -holes in the bamboo nodes filled with dog food within the enclosure. By shaking this bamboo pipe with their nose and front paws, which they use to forage for food, they were able to obtain the dog food. Since we started conducting this project, the number of fights has decreased from 29 to 11 between the months of April through January compared to the same months last year. The number of injuries inflicted on X by Young Female Y, —who he fought with the most, has also decreased.

## RP-3
# Comparison of Several Enrichment Types and Rotational Display Management for Four Captive Lion Prides in Dubai Safari Park

Marsenia Trinanda Haris, Demi Charlie Booth, Susan Joan Jansen*, Victor Odhiambo Andiwo, Arsyad Jamaludin
Dubai Safari Park, Dubai, United Arab Emirates

**Abstract:**
In this study, three enrichment techniques (sensory, food and manipulative) is introduced to four prides of lions (*Panthera leo*). Enrichment was given both in the exhibit and in the dens and a comparison was made on the effectiveness of the enrichment in both areas. Dubai Safari Park is the home to four lion prides and to two lion exhibits. Due to one pride being an adult bachelor pride, it was made sure that the pride was kept separate from any female lions. This introduced the rotational display management that had to be implemented for three other lion prides. Within the study it was made sure that the three lion prides were able to have access to the exhibit every single day through different time periods. Data were collected for 14 days to evaluate the effects of three different enrichment techniques on four different prides of lions in two different environments (exhibit and den). Instantaneous scan-sampling was used to record behavior and all-occurrences data for the animal's interaction with the enrichment item. From the observations it was evident that the lions spent more time interacting with the sensory and food enrichment technique and a higher active period was shown when the animal was displayed in the exhibit in comparison to the den. Through this management of display and combination of enrichment, it is not only beneficial for the welfare of the animals, but it will also be a positive experience for guests.

## RP-4

# Feeding Enrichment Using an Automatic Feeder for Captive Asian Elephants (*Elephas maximus*)

Yukari Kashima[1], Yuma Tsuchiya[1], Masato Yayota[2, 3*], Yusuke Aramaki[4], Ryuichiro Kado[4], Hideyuki Ito[4]

1. Graduate School of Natural Science and Technology, Gifu University, 2. Faculty of Applied Biological Sciences, Gifu University, 3. Zoo Biology Research Center, Gifu University, 4. Kyoto City Zoo

**Abstract:**

Reducing pacing in an indoor paddock is crucial in captive zoo animals. This study investigated the effect of feeding enrichment using an automatic feeder on the eating and pacing of captive Asian elephants (*Elephas maximus*) in an indoor paddock during night time. Four Asian elephants (age: 6–10 years old; 3 females, 1 male) in the Kyoto City zoo was used. In the conventional condition (CON), all evening meals were placed on the paddock floor at 4:00 pm. In the enrichment condition (ENR), 5 kg of fresh grass (5% of all feeds as dry matter basis) was placed into an overhead iron grid feeder (> 3.6 m from the floor) at 4:00 pm and 6:00 am using an automatic feeder. The elephants could reach the feeder using their trunk. The remaining feeds in the ENR were provided as well as CON at 4:00 pm. The experimental period lasted 3–4 weeks. Eating, pacing, locomoting, sleeping, and resting behavior were continuously recorded using a video camera from 3 pm to 9 am. Feeding at 6:00 am increased eating and decreased pacing with the ENR than that with the CON. Accordingly, the elephants in the ENR showed a slightly longer eating time (18.7%) than those in the CON (16.9%; $P < 0.1$). However, pacing occupied 23.8% and 22.7% in the CON and ENR during the observation, respectively, and no difference was detected between the treatments. The results suggested that more frequent feeding might be required to reduce pacing behavior.

## RP-5
# Sleeping Behavior of Asian Elephants (*Elephas maximus*) in the Zoo

Tomoko Kanazawa[1*], Sayuri Hanzawa[2], Koichi Murata[1]
1. College of Bioresource Sciences, Nihon University, 2. Yokohama Municipal Kanazawa Zoo

**Abstract:**
Sleep is essential for survival; however, sleeping patterns are diverse and highly adaptable. When the quantity and quality of sleep is insufficient, biological functions can deteriorate, which may result in death. Sleeping behavior is, therefore, one of the most important animal behaviors to monitor when rearing animals in varied environments. In this study, we have investigated the nighttime sleeping patterns of two Asian elephants (*Elephas maximus*)—one male and one female—in Yokohama Municipal Kanazawa Zoo. The average total sleeping time was 259.2 min for the male and 279.3 min for the female, and this did not vary significantly between the sexes. The frequency of naps taken was 4 per night for the male and 3.4 per night for the female. In addition, it was confirmed that they alternated the side of their bodies in contact with the resting surface during each such sleep period throughout the night. It is suggested that the duration of the naps varies between the sexes and is affected by different environmental factors influencing sleep behavior. In future, a more detailed analysis involving more factors affecting sleep is required.

## RP-6
# Development of Score Sheet for Terminal Care of Old Dolphins

Keiichi Ueda*, Suguru Higa, Katsuya Hokama, Koji Tokutake, Miwa Suzuki
Okinawa Churashima Foundation

**Abstract:**
There are a number of zoos and aquaria in Japan, in which a huge variety of animals are kept. The facilities make efforts on animal environmental enrichment for optimal psychological and physiological well-being and for improving their quality of life. In addition, lifespans of the animals are becoming extended than ever due to significant improvement of healthcare skills. Okinawa Churaumi Aquarium has several old dolphins over 40 years of age. It is very difficult to keep them healthy due to their age-related deficit, and generally, they recover from illness quite slowly. These circumstances made us implement the terminal care for old dolphins from the point of view of animal welfare, as well as for reduction of psychological/physical stress of keepers. Japanese Association of Zoos and Aquariums allows veterinarians to commit euthanasia to relief animals from suffering; however, there are no established criteria to determine a necessity for terminal care or euthanasia. Thus, we tried to develop a score sheet for the care that can quantify dolphin's physical condition and can evaluate effects of treatments by reference to those for terminal care of human and zoo mammals.

## RP-7
# Socioecological Predictors of Health Profiles in Western Lowland Gorillas

Kristena Cooksey[1], Jean Marie Massamba[2], Thierry Fabrice Ebombi[2], Juan Salvador Ortega Peralejo[2], Ivonne Kienast[2], Crickette Sanz[1, 2], David Morgan[2, 3]

1. Department of Anthropology, Washington University in Saint Louis, 2. Wildlife Conservation Society, Congo Program, 3. Fisher Center for the Study and Conservation of Apes, Lincoln Park Zoo

**Abstract:**

Socioecological factors have been linked to health outcomes, overall health profiles, and disease transmission in primates. Due to their close phylogenetic relatedness to humans, great apes are particularly susceptible to anthropogenic disease infection. A number of infectious diseases have been documented in wild gorilla populations that have manifested varying patterns of disease prevalence that may be attributable to differences in social groupings and patterns of intergroup contact. We assess a suite of potential socioecological predictors (social rank, sex, group size, rate of stressful social interactions, resource scarcity) of health incidences across three groups of western lowland gorilla (*Gorilla gorilla gorilla*) in northern Republic of Congo. Observational health assessments were conducted during daily follows of focal gorilla groups in the Goualougo and Djeke Triangles from April 2014 to October 2018. While overall presence of disease was relatively low, we detected several respiratory episodes and chronic health issues within our focal populations. Based on the observed dynamics of disease spread, we discuss probable mechanisms of transmission within and between groups. Further, we suggest that identification of the specific predictors and modes of disease transmission can be used to mitigate some specific health risks. Recommendations for best practices and management protocols within both wild and captive settings are presented as they relate to improving health profiles in gorillas.

## RP-8
# Monitoring Sleep in Captive Chimpanzees to Enhance Welfare

Kristin Havercamp[1, 2*], Etsuko Nogami[2], Yusuke Mori[2], Satoshi Hirata[1, 2]

1. Wildlife Research Center, Kyoto University, Japan, 2. Kumamoto Sanctuary, Kyoto University, Japan

**Abstract:**

Primates, like many other animals, spend more than half of their lifetime sleeping and resting, yet this behavior is almost completely unstudied compared to daytime activities. In their natural habitats, it might be difficult or impossible to directly observe nocturnal activities, but in captivity, where we are able to closely monitor both day and night activity, the opportunity exists to record, study and thus better understand individual and/or group sleeping behavior and patterns. In humans, Alzheimer's, cardiovascular disease, diabetes, obesity, stress, depression and even social isolation have shown significant and sometimes causal links to poor sleep (i.e. sleep loss, disruption). If such relationships exist in humans, sleep quality may also influence the behaviors and physical and mental health of our close primate relatives. Primate caretakers, researchers and staff working in a captive setting have the unique opportunity and responsibility to provide the best possible care to each individual. We suggest that monitoring sleep can contribute to a better understanding of individual needs and behaviors, including the use and preference of bedding materials. We will present our preliminary results of sleeping patterns and postures of captive chimpanzees at Kumamoto Sanctuary and how supplementary bedding materials might affect their sleep quality and postures throughout the night. We argue that the sleeping behavior of captive primates should not be ignored, and that a lack of information about their nighttime activities and sleep quality limits our understanding of not only chimpanzee biology and behavior, but also individual wellbeing.

# RP-9
# Application of Virtual Reality to a Science Workshop for Children at a Zoo

Haruka Kasuga[1, 2 *], Masataka Yamamoto[1], Yusuke Konishi[1], Haruna Kitamura[1], Machiko Ohashi[1], Yuichiro Ikeda[2, 3], Takashi Murai[1]

1. the Communication in Science and Technology Education and Research Program, Center for Open Education, Institute for the Advancement of Higher Education, Hokkaido University, 2. Co. Ltd., Animaware, 3. Graduate School of Information Science and Technology, Hokkaido University

**Abstract:**

In Japan zoos, it is common to see visitors screaming "*Kawaii*," which means "cute," around the animals. However, the mission of the zoo extends beyond recreation. In this study, we focused on the educational role of zoos and designed a workshop for children in collaboration with the Sapporo Maruyama Zoo. To extract deeper interests about animal ecology, we expected synergistic effects from seeing actual animals at the zoo and feeling a virtual sense of animals using virtual reality, which enables people to experience virtual worlds that they cannot actually experience. Here, we report a case of introducing virtual reality into a science workshop for children at a zoo.

Based on academic articles and under supervision by a researcher, we produced three videos as art: i) turtles' and tortoises' eyesight, ii) cats' and dogs' color vision, and iii) geckos' and frogs' dynamic vision. Thirty-nine elementary school children visited three booths as part of a workshop tour and experienced instructor explanation and virtual reality, and then took quizzes. After the tour, all children answered a questionnaire.

The results highlighted three main points. First, children participated in the workshop because of intrinsic motivation such as "interest in VR" or "interest in animals' vision," rather than extrinsic motivation such as "recommendation from my parents." Second, children thought they understood animals' vision better after attending our workshop. Finally, though the number of species of animals in our video works was limited, children were interested in the vision of a variety of animal species.

# RP-10
# Introduction of Activities by SHAPE-Japan

Shiori Mitsuya[1*], Saika Yamazaki[2], Tadatoshi Ogura[3], Shintaro Hagiwara[4], Naoko Suda-Hashimoto[5], Kota Okabe[1], Yu Nakayama[6, 7], Shinichi Kioka[8], Kazuyuki Ban[9], Yudai Arai[10], Yuki Ishida[6, 11], Yumi Yamanashi[1], Yuki Taguchi[12], Nao Koyama[13]

1. Kyoto City Zoo, 2. Inokashira Park Zoo, 3. School of Veterinary Medicine, Kitasato University, 4. Fukuyama Zoo, 5. Primate Research Institute, Kyoto University, 6. Ibaraki University, 7. Tokyo University of Agriculture and Technology, 8. Ueno Zoological Gardens, 9. Omuta City Zoo, 10. Morioka Zoological Park, 11. Chiba Zoological Park, 12. Asa Zoo, 13. Atelier T.M.Barger Co.,Ltd

**Abstract:**

SHAPE-Japan is the regional division of the Shape of Enrichment, Inc., the host of the biennial international conference (ICEE), and dedicated to developing, presenting, and sharing scientific information on animals and environmental enrichment; it provides a closer link between the research organizations and animal-keeping institutions, such as zoos, labs, and farms, which may also keep companion animals. The founding members of SHAPE-Japan were the participants of the 10th ICEE held in Portland, Oregon in 2011. Although the principles of caring for animals are universal, we felt that it was important to consider the cultural and social characteristics of Japanese communities to promote environmental enrichment and science-based animal keeping across the country. During the past 7 years, our activities have included sharing information on web-based platforms, such as Facebook, Twitter, and our website, and holding workshops and seminars on environmental enrichment. Through these activities, we aim to provide platforms for exchanging as well as sharing information and ideas not only among the animal caretakers but also among the different community groups, including researchers. We collect information on the environmental enrichment in animal-keeping institutes and provide up-to-date scientific findings, including translation of scientific journals and technical information from overseas. In this poster presentation, we plan on introducing our past activities, with a focus on enrichment workshops held in Japanese zoos.

# RP-11
# How Domestic Dogs Will Behave When Their Owner Interacts with a Communication Robot

Haruka Kasuga
Authors' Affiliations
1. Graduate School of Information Science and Technology, Hokkaido University

**Abstract:**
Recently, communication agents such as smart speakers have been introduced into homes. In the future, communication robots with a human-like body will be introduced into homes and will interact with the dog owners. When a communication robot attracts a dog owner's attention in the triad relationship, namely a dog, its owner, and a communication robot, how will dogs behave? We investigated difference between the effect of humanoid robots and communication agents with common type of shape in dogs' daily life on dogs' behavior. We conducted an exploratory experiment using a within-subject design. In our experiment, 21 dogs and their owners participated and encountered 4 types of agents: smart speaker, smaller humanoid robot, bigger humanoid robot, and a plastic dog with the order counterbalanced across participants. In the test, a dog owner ignored his/her dog and concentrated on an agent for one minute; then, the owner was silent as the agent spoke to the dog. Results of behavioral analysis revealed a significant difference on the number of dogs which did following three behaviors: i) touching the face and rump of an agent, ii) interrupting interactions between their owner and the agent in the plastic dog condition than other conditions and iii) reacting more to an agent's words in the smaller humanoid robot condition than other conditions.

## RP-12

# Attempt of Environmental Enrichment for the Asian Elephants (*Elephas maximus*) at the Yokohama Municipal Kanazawa Zoo

Ayuka Sato[1*], Naoya Nishimura[1], Maki Sakamoto[1], Sayuri Hanzawa[2], Masato Ando[2], Koichi Murata[1], Tomoko Kanazawa[1]

1. College of Bioresoure Science, Nihon University, 2. Yokohama Municipal Kanazawa Zoo

**Abstract:**

Compared to wild elephants, captive elephants spend less time feeding and exhibit poor feeding patterns. One of the causes is the placement of food on the floor. Improvement of the captive environment is possible by changing the feeding management schedule. This is feasible during the day when the staff are working; however, it is difficult to do so at night. Therefore, an automatic feeder that provides branches and leaves or a suspension feeder that provides pellets was introduced at night and early morning (17:00–08:00) to stimulate the action of raising the trunk to feed. To verify the effect, a female elephant at the Kanazawa Zoo was observed using a behavioral methodology.

An automatic feeder was activated at night (18:00–20:00) and early morning (06:00–07:00). No difference in behavior was observed at night; however, increase in manipulation behavior and decrease in stereotypic behavior were confirmed in the early morning. Thus, early morning feeder activation was effective when feeding by staff is difficult. A suspension feeder was placed at a height of 3.7 m before housing the individual. The effect was verified by changing the size of the hole for pellet delivery. A bore size of 1.5 cm led to a significant increase in feeding behavior; however, the effect was short-term. A bore size of 2.0 cm showed a constant effect for six days after feeder introduction inducing the action of raising the trunk. We believe further investigation is necessary with changes in the size of the hole.

# RP-13
# Efforts to Improve the Quality of Life for Self-harm Dolphins

Keiichi Ueda[1*], Suguru Higa[1], Katsuya Hokama[1], Koji Tokutake[1], Miwa Suzuki[2]
1. Okinawa Churashima Foundation, 2. Nihon University

**Abstract:**
Captive conditions give animals less stimulus than the wildlife habitats do, because animals do not have to explore the ocean to forage or run away from predators. In addition, captive dolphin are generally held in simple-shaped pools with acquainted members. Therefore, keepers are required to contrive to give variation to the captive conditions for animals.

Two rough-toothed dolphins at Churaumi Aquarium had displayed a self-harm behavior; they were frequently rubbing themselves to a pool wall until they suffered abrasion. In order to give variety to their environmental conditions, we tried to release the dolphins to beach fenced by nets on a regular basis, only when the beach was closed to public.

At the beginning of the trial, the dolphins did not swim free easily. They gradually started to display various behaviors and to swim in a wider range as they got more experienced. During the trial, their self-harm behavior was significantly reduced in frequency; it suggests that the release to the beach may be effective to prevent the self-harm behavior. However, the levels of serum cortisol, that is a commonly-used indicator of stress, were comparatively higher during the trial, possibly due to the process of transport between pool and beach. It is necessary to reduce stressors during transportation as possible by introducing shock-absorbing mattresses and vehicles with better suspension system and so on.

# RP-14
# Present Animal Welfare Situation in Kunming Zoo

Ning Han[1, 2]
1. Freelance Writer and Translator, 2. Kunming University of Science and technology

**Abstract:**
The article aims at presenting the present major animal welfare measures taken by Kunming zoo and how it can play a better role in zoo community concerning the promotion of animal welfare. More than 200 species can be found in Kunming Zoo, which enjoys the longest history of zoo in Yunnan Province, China. In modern society, the social function of zoos has changed greatly: from showing exotic animals to satisfy people's hunting for novelty to collecting animal species and preserving endangered species to maintain natural diversity of the earth. Kunming Zoo is taking actions to approach international standards on animal welfare. The article analyzes the elephant pedicure reaching out activity organized by Kunming zoo to show how animal welfare has been improved and how educational outreach has been combined with zoo management. In the end, the article pinpoints the challenges concerning welfare of the intelligent species such as, chimpanzees, snub-nosed monkeys and gibbons face in Kunming zoo, hoping animal welfare can be further reinforced among all species in Kunming Zoo.

## Rapid Communication

**23rd June 2019**

R-1

**24th June 2019**

from R-2 to R-5

## R-1
# Developmental Support of Chimpanzee with Cerebral Palsy

Nobuhiro Yamada[1*], Hideko Takeshita[2], Junichi Takashio[3], Yoko Sakuraba[4, 5], Ichiro Takahashi[6], Fumito Kawakami[7], Misato Hayashi[8], Masaki Tomonaga[8]

1.Noichi Zoological Park of Kochi Prefecture, 2. Otemon Gakuin University, 3. Biwakogakuen Medical and Welfare Center, Kusatsu, 4. Kyoto City Zoo, 5 Wildlife Research Center of Kyoto University, 6. Home nursing station Otasukeman,7. Chubu University, 8. Primate Research Institute Kyoto University

**Abstract:**

A female chimpanzee (*Pan troglodytes*), Milky (born on July 14, 2013), lives in Noichi Zoological Park. Due to a difficult delivery her mother was anesthetized during delivery, and Milky has been cared by humans ever since. She has been cerebral palsy from birth. The paralysis of the right half of the body is more serious than the left. Caretakers work on the rehabilitation and enrichment with physical therapists, occupational therapists and developmental psychologists.

The first step was “independence.” She had to be able to eat herself and to move to where she wanted. The functional enhancement of the left half of the body was necessary for it. It seemed that it was difficult to achieve the improvement of physical function by monotonous training. Our team had been evaluated her curiosity and desire to play from behavior such as smiling. Caretakers continued to modify the playroom little by little. As the results, she gradually showed proper posture and movement. Although there are still many challenges, she has achieved her first step.

Caretakers continued to show Milky to other chimpanzees in the park and they had interact through a mesh from birth. The next step must be “introduction” to the group.

## R-2
## Marvelous Monotremes: Behavior and Enrichment

Margaret R. Hawkins
Taronga Conservation Society Australia and Shape of Enrichment

**Abstract:**
The Montremes, echidna (*Tachyglossus and Zaglossus spp*) and platypus (*Ornithorynchus anatinus*) are mammals unique to Australia and New Guinea and only the short-beaked echidnas (*Tachyglossus aculeatus)* are seen much in zoos outside Australia. Their habitats are completely different, the echidna is terrestrial and the platypus fresh water aquatic but there are similarities in behavior as well as in their unique egg laying plus suckling reproductive strategies. This short video presentation will demonstrate behavioral differences and similarities and show some of the challenges in captivity.

## R-3

# Environmental Enrichment: Providing an "Enriched Life" for Companion Animals, Their Owners, and Pet Sitters

Naoko Suzuki[1*], Fumiko Kawase [2], Hiroko Kanno[2], Hisako Sugawara[2], Teiko Higuchi[2], Yumi Yamauchi[2], Mayako Yamazaki[2], Sayaka Taguchi[23], Shinichi Kioka[45], Yuudai Arai[56], Tadatoshi Ogura[57], Ayumi Aoki[8]

1. Pet Service Mogose, 2. Mogose's users, 3. Artstudio KOHARUBIYORI, 4. Ueno Zoological Gardens, 5. SHAPE-Japan, 6. Morioka Zoological Park, 7. Kitasato University, 8. AYUMI Lab.

**Abstract:**

Our team consisting of a professional pet sitter working in Fukushima, Japan, and the sitter users, have recently planned to introduce environmental enrichment techniques for dogs. They have thus produced several unique enrichment items and provide examples of ways in which they can effectively be used to improve the welfare of companion animals. For example, we created enrichment devices called "Delu delu," which provide imitative ways for dogs to exercise their natural foraging characteristics when removing internal organs from prey. These devices have successfully been used to stabilize an animal's appetite, thereby helping it to appropriately gain weight. We also created cardboard enrichment feeders. A dog that previously avoided such stimuli were incrementally able to add these devices to their enrichment routines. Natural foraging experiences by these devises might largely influence the positive behavioral and emotional changes of these dogs. We also held a seminar on environmental enrichment that included lectures given by zookeepers. This was done because we believe that enrichment theories and experiences relevant to zoo animals are also applicable to companion animals. From the perspective of environmental enrichment for companion animals, we will continue to act as a local hub for improving animal welfare (not only for dogs, but also cats, rabbits, and others) by considering their natural behaviors. The natural instincts and needs of companion animals are sometimes unfortunately underestimated. We thus aim to provide ways for companion animals to exercise more natural behavior and for people to enjoy their life with animals during those activities.

## R-4

# The Effectiveness of Water Enrichment in Pair-housed Lion-tailed Macaques (*Macaca silenus*)

Rebecca Newman[1*], Sean McKeown[2], Teresa Power[2], Thomas Quirke[1] and Ruth M. O'Riordan[1]

1. School of Biological, Earth and Environmental Sciences/Environmental Research Institute, University College Cork, 2. Fota Wildlife Park

**Abstract:**

Water as a form of enrichment has great potential, particularly for macaque species, several of which have been observed frequently to swim and forage in water. In this study, the effectiveness of several water-based enrichments were examined by looking at frequency of interaction in a pair-housed male and female lion-tailed macaque, located in Fota Wildlife Park, Ireland. Two separate trials of this enrichment were undertaken, with time of day and enrichment-type chosen at random. Interaction with each enrichment was recorded using instantaneous scan sampling methods. Enrichment was given using a reversal design, alternating between the baseline (water-only) and intervention (water with food items, non-food items (stones, shells), or a mix of both food and non-food items). Enrichment was provided in a bucket that was secured in an indoor pen. The data were then analysed using randomisation tests. A difference in frequency of interaction between the different enrichment types, particularly between food-only and mixed was found, although this was not statistically significant. This enrichment study shows that the provision of non-food items along with food items may increase interaction with an enrichment. This type of enrichment is simple, cost-effective and easy to modify making it ideal for many zoos and other captive settings.

# R-5
# Application of Traditional Chinese Elements to Treatment and Enrichment

Cao Yani[1*], Allison Leach[2]
1. Welfare Technician, Beijing Zoo, 2. Enrichment Volunteer, Beijing Zoo

**Abstract:**
The Beijing Zoo has an elderly orangutan resident named Pang Pang, who suffers from reduced mobility in her lower legs. After examinations from veterinarians and consultations with orangutan experts from around the world, the Beijing Zoo has embarked upon an innovative treatment plan combining the ancient healing arts of Traditional Chinese Medicine (TCM) with physiotherapy.

Traditional Chinese Medicine is an ancient practice that has developed over the last 2,500 years and offers a wealth of healing options. The Beijing Zoo is using TCM theory with traditional Chinese medicine massage techniques to improve Pang Pang's motor function and restore optimal energy flow to her blood circulation.

A team was formed at the zoo to develop TCM treatment methods specifically tailored to the orangutan's physical needs. Using human acupressure points as a reference and a modern meridian scanner, the staff was able to plot 19 of the major pressure points related to physical movement on Pang Pang's body.

The resulting TCM physiotherapy rehabilitation has increased Pang Pang's mobility in a more delicate and less intensive way than other treatments.

The Beijing Zoo also applies traditional Chinese elements to the enrichment of other populations, such as gibbons, golden monkeys, pheasants and black muntjacs. This unique approach furthers the development of enrichment with Chinese characteristics and enhances the wellbeing of the animals.

## Special Exhibitions

### 23rd & 24th June 2019

**SE-1**
Enrichment Award, 17 Years History in Japan

**SE-3**
Ask Participants: Perception of Animal Death

**SE-2**
The KYOTO STEAM – International Arts × Science Festival project: Art × Science IN Kyoto City Zoo What do chimpanzees feel in arts?

## SE-1
# Enrichment Award, 17 Years History in Japan

Network for Zoo Enrichment

**Abstract:**
Network for Zoo Enrichment, a non-profit organization of Japan, was founded in 2001. Our Mission is to raise awareness of overall society for the global environment surrounding animals including humans with achieving a good relationship between citizens and zoos. Since 2002, we have been carrying out an annual project named "Enrichment Award". The aim is to support and encourage persons trying efforts for animal welfare at organizations such as zoos, aquariums, and research institutes. In addition, it will be to enhance the proper interest and understanding of citizens concerning captive animals and their environmental enrichment. At this poster exhibit, we introduce the overview of the 17years history of enrichment award and past award winners. We also present some of the poster passing first stage competition of enrichment award last year.

## SE-2

# The KYOTO STEAM – International Arts × Science Festival project: Art × Science IN Kyoto City Zoo What do chimpanzees feel in arts?

Fumihiro Kano[1], Yutaro Sato[2], Yumi Yamanashi[2, 3]

1. Institute of Advanced Study, Kyoto University, 2. Wildlife Research Center, Kyoto University, 3. Center for Research and Education of Wildlife, Kyoto City Zoo

**Abstract:**

As a part of the KYOTO STEAM – International Arts x Science Festival project, this study aimed to bridge between contemporary art and comparative science. We conducted an experiment presenting movie clips that were specifically made to attract chimpanzees' attention by four artists. Using eye-tracking technologies, we compared eye movement of total 10 chimpanzees living in the Kyoto City Zoo and Kumamoto Sanctuary, Kyoto University, Japan, and 36 human participants, including 11 art-related people, 10 animal researchers, 5 animal caretakers, and 10 novices. Overall, chimpanzees watched the movies on average 70-80 % of presentation time. No particular group difference was found among human participants. Chimpanzee-human similarities were clear when their eye movement patterns were compared with an established computer vision which "sees" visually salient elements in the movies. Moreover, both humans and chimpanzees tended to watch the main "subject" of movies, namely foreground objects and specific actions of an agent in focus, particularly during the first several seconds of presentation. However, while humans kept focusing on the same subjects over time, chimpanzees gradually shifted their attention to background objects. Overall, the observed differences in response toward artworks between humans and chimpanzees seem to derive from differences in expectation for artworks, rather than from fundamental differences in perception and understanding of artworks.

Artists: Kazuki Hitoosa, Nobuaki Itoh, Mirai Mizue, Yuriko Sasaoka×Wataru Kawashima
Art Coordinator: Keiko Yamamoto (Kyoto STEAM)
This introductory movie was edited by Kenta Kobayashi.

## SE-3
# Ask Participants: Perception of Animal Death

Yuko Ikkatai[1], André Gonçalves[2], Josue Alejandro Pastrana[2], Yumi Yamanashi[3, 4]
1. Institute for the Physics and Mathematics of the Universe, Tokyo University, 2. Primate Research Institute, Kyoto University, 3. Center for Research and Education of Wildlife, Kyoto City Zoo, 4. Wildlife Research Center, Kyoto University

**Abstract:**
How do you perceive an animal's death? Zoos and animal institutes often have a memorial service for animals in Japan. It gives time to people to console and show gratitude for their animals. However, it has not been investigated on how such practices are spread around the world. We considered that exploring the perception of animal death could be important for the well-being of humans and animals. ICEE2019 is a good chance to collect participants' experiences. We will ask three questions about animals' death at the venue. Do you have the custom to console dead animals in your institute? Do you think giving animals time to say goodbye to dead group members is important? If you have ever done such a thing, how? Based on the experiences collected, we will explore cultural differences and our perception of animal death. We would like to hear what you have experienced, please come and tell us!

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iceekyoto2019@iceekyoto.org






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