WILDLIFE INFECTIOUS DISEASES AND THE EARLY WARNING SYSTEM USING ZOO NETWORKS OF THE WORLD

The 28th International Symposium of RRIAP

28th January, 2013

College of Bioresource Sciences, Nihon University, JAPAN

http://www.brs.nihon-u.ac.jp/

Host Organization: Regional Research Institute of Agricultural Production (RRIAP), College of Bioresource Sciences, Nihon University
Supporting Groups: Japanese Association of Zoo & Wildlife Medicine, Asian Society of Zoo and Wildlife Medicine
Japanese Association of Zoo & Aquariums, Yokohama Greenery Foundation

The 28th International Symposium of RRIAP

WILDLIFE INFECTIOUS DISEASES AND THE EARLY WARNING SYSTEM USING ZOO NETWORKS OF THE WORLD

PURPOSE

The purpose of the symposium is to understand and exchange of information about infectious diseases transmitted among wild and captive animals with a significant impact on the ecosystem, the livestock industry and human society such as highly pathogenic avian influenza and foot-and-mouth disease, and also to conduct fundamental research to implement through collaboration among global regions for preventing infectious diseases using zoo networks in the world.

PROGRAM

28th (Monday) January, 2013 from 10:00 am to 5:00 pm
College of Bioresource Sciences, Nihon University, JAPAN

10:00-10:30	Sign In	
10:30-10:35	Opening Remarks	Dr. Kiichi Kanayama , Professor/Director of RRIAP, Nihon University, Japan
10:35-10:40	Introduction	Dr. Koichi Murata, Professor, Nihon University, Japan
10:40-11:20	Keynote Lecture 1	Dr. Anthony W. Sainsbury, London Zoo, UK *Analyzing disease risks associated with translocations of wild animals*
11:20-12:00	Keynote Lecture 2	Dr. Chin, Shih-Chien, Taipei Zoo, Taiwan *Quarantine system of zoo and wild animals for infectious disease control at Taipei Zoo*
12:00-13:30	Lunch Time	
13:30-14:00	Lecture 1	Dr. Kyung Yeon EO, Seoul Grand Park Zoo, Korea *Infectious diseases of zoo and wildlife animals and its preventional control in Korea and Seoul Zoo*
14:00-14:30	Lecture 2	Dr. Serena Oh, Singapore Zoo, Singapore *Infectious diseases of zoo and wildlife animals and its preventional control in Singapore and Singapore Zoo*
14:30-14:45	Coffee Break	
14:45-15:15	Lecture 3	Dr. Paolo Martelli, Ocean Park, Hong Kong *Infectious diseases of zoo and wildlife animals and its preventional control in Hong Kong and the Hong Kong Ocean Park*
15:15-15:45	Lecture 4	Dr. Kazutoshi Takami, Osaka Tennoji Zoo, Japan *Infectious diseases of zoo animals and its control in Japanese Zoos*
15:45-16:15	Lecture 5	Dr. Mitsuhiko Asakawa, Rakuno Gakuen University, Japan *Infectious diseases of wildlife and its prevention in Japan*
16:15-16:45	Discussion	All lecturers
16:45-17:00	Closing Remarks	Dr. Koichi Murata
17:30-19:00	Welcome Party	

Contact address:
Laboratory of Wildlife Science, College of Bioresource Sciences, Nihon University
1866 Kameino, Fujisawa, Kanagawa 252-0880, Japan
TEL/FAX: +81-466-84-3776
k-murata@brs.nihon-u.ac.jp (Dr. Koichi Murata)

The purpose of The 28th International Symposium of RRIAP entitled “Wildlife infectious diseases and the early warning system using zoo networks of the world”

Koichi Murata, DVM, PhD, College of Bioresource Sciences, Nihon University

The purpose of the symposium is to understand and exchange of information about infectious diseases transmitted among wild and captive animals with a significant impact on the ecosystem, the livestock industry and human society such as highly pathogenic avian influenza (HPAI) and foot-and-mouth disease (FMD), and also to conduct fundamental research to implement through collaboration among global regions for preventing infectious diseases using zoo networks in the world.

In keeping with the current situation that in recent years, zoonotic infectious diseases such as HPAI and Nipah virus infection have been being spread by wild animals in wide areas across borders around the world, it is needed to build wildlife disease information networks, conduct fundamental survey research through international collaboration on the implementation of an early warning system for the occurrence of infectious diseases common in wildlife and to work on the risks of diseases transmitted by wildlife. With cooperation from zoos of the world, we could obtain information on wildlife infectious disease helping build a surveillance system aiming to prevent and control infectious diseases common in wild animals adapted to Asian region and also the world.

It is expected from the results of this study that a surveillance system will be built aiming to prevent and control infectious diseases common in wildlife in the Asia region and other countries, for the spread of new and re-emerging infectious diseases accompanying translocations of wild animals, wildlife habitat changes, international logistics, wildlife migration, *etc*.

As a result, the following will be possible: 1. to grasp the status of infection of wildlife with domestic animal infectious diseases effectively, 2. to take thorough measures to prevent diseases from captive animals including livestock based on the possibility of wildlife transmissible diseases to captive animals including zoo animals, 3. to investigate the infection routes in the case of a monitored infectious disease such as HPAI occurring in domestic animals, and 4. for zoos to suggest from the scientific standpoint to international society in regard to the development of international standards taking into account the wild animals being considered by OIE (World Organization for Animal Health).

Also, with surveillance methods of other countries as reference, it helps develop all kinds of technologies that can be utilized for comprehensive animal health management such as the development of new diagnostic procedures, wildlife management techniques and wildlife epidemiological study. And it can eventually contribute to the maintenance of animal health, human health and ecosystem health namely "One Health" based on conservation medicine.

Analyzing disease risks associated with translocations of wild animals

Anthony W Sainsbury BVetMed, MRCVS, CertZooMed, DVetMed, DipECZM (Wildlife Population Health), PGCAP, FHEA, European Recognised Specialist in Zoological Medicine (Wildlife Population Health)

Institute of Zoology
Zoological Society of London
Regent's Park
London NW1 4RY
UK

Destruction of wild animal habitat concomitant with an ever increasing human population has given rise to an unprecedented number of species extinctions. The human response to threats to wildlife populations has included a burgeoning of translocation (reintroduction and restocking) programmes for animal conservation. There are risks that translocations give rise to disease outbreaks because the ensuing changes in host-parasite interactions may lead to catastrophic epidemic disease and threaten both the translocated animals and the recipient populations. The rinderpest pandemic in Africa which followed the introduction of cattle harbouring the rinderpest virus in the late 19th century, and caused significant long-term changes to the ecosystem, is a good example of this phenomenon.

The recognition that disease outbreaks can be associated with translocations has led to an interest in assessing risk before animal movement takes place. Davidson and Nettles (1992) devised the first qualitative method to assess the risk of disease to wildlife translocations. Other early approaches to qualitative disease risk analysis for wildlife translocations (Leighton 2002; Armstrong et al 2003) built on a method of risk analysis devised by Covello and Merkhofer (1993) to assess the risk from all environmental threats to humans. Covello and Merkhofer's method was adapted by the OIE (World Organization for Animal Health) to produce guidelines for qualitative disease risk analysis for importation of domestic animals (OIE 1999; Murray et al 2004; Brückner et al 2010) and these guidelines were adapted by Sainsbury and Vaughan-Higgins (2012) to produce a qualitative method specific for conservation translocations which analysed threats throughout the translocation pathway and considered infectious and non-infectious hazards. In Sainsbury and Vaughan-Higgins (2012) method identification of parasite hazards was based on geographical and ecological barriers rather than artificial international boundaries. Quantitative approaches to disease risk analysis have also been devised (Armstrong et al 2003; Miller 2007) but qualitative disease risk analyses have been used more frequently, probably because of the large number of hazards involved in wild animal translocations (Sainsbury et al 2012).

Sainsbury and Vaughan-Higgins (2012) developed their method of disease risk analysis for conservation translocations on the basis of intervention in the conservation status of 22 native species. Disease risk analyses using the new method have been completed for six species but evaluation of the results will require further years of post-release health surveillance. Some results have been published, for example, a suspected alien cestode parasite of common dormice (*Muscardinus avellanarius*) was eliminated prior to reintroduction (Sainsbury et al

2003). In contrast a parasite of cirl buntings (*Emeriza cirlus*) was conserved in released birds to ensure parasite biodiversity was maintained (McGill et al 2010). Lead poisoning was recognised as a threat to red kites (*Milvus milvus*) post-release (Pain et al 2007).

There is uncertainty in the information on which current disease risk analyses are based, for example, predicting the pathogenicity of parasites in ecosystems altered by the translocation process. We will gain a better understanding of these uncertainties if detailed post-release health surveillance is carried out on existing translocation programmes, and the results used to improve future disease risk analyses.

References

Armstrong, D., Jakob-Hoff, R. & Seal, U.S. (Editors) (2003) Animal movements and disease risk: a workbook. Conservation Breeding Specialist Group (SSC/IUCN), Apple Valley, MN.

Bruckner, G., MacDiarmid, S., Murray, N., Berthe, F., Muller-Graf, C., Sugiura, K., Zepeda, C., Kahn, S. & Mylrea, G. (2010) *Handbook on Import Risk Analysis for Animals and Animal Products*. Office International des Epizooties, Paris, France.

Covello, V.T. & Merkhofer, M.W. (1993) *Risk assessment methods: approaches for assessing health and environmental risks*. Plenum Press, New York, USA.

Davidson, W.R. & Nettles, V.F. (1992) Relocation of wildlife: identifying and evaluating disease risks. *Transactions of the North American Wildlife and Natural Resources Conference* 57**:**466–473.

Leighton, F. A. 2002. Health risk assessment of the translocation of wild animals. Revised scientific. tech. Office of International Epizootics (OIE) **21:** 187-195.

McGill I, Feltrer Y, Jeffs C, Sayers G, Marshall RM, Peirce MA, Stidworthy MP, Pocknell AM, Sainsbury AW 2010. Isosporoid coccidiosis in translocated cirl buntings (*Emberiza cirlus*). Veterinary Record 167: 656-660.

Miller, P.S. 2007. Tools and techniques for disease risk assessment in threatened wildlife conservation programmes. International Zoo Yearbook **41:** 38-51.

Murray, N., Macdiarmid, S.C., Wooldridge, M., Gummow, B., Morley, R.S., Weber, S.E., Giovannini, A. & Wilson, D. (2004) *Handbook on Import Risk Analysis for Animals and Animal Products.* Office of International Epizootics (OIE).

Office International des Epizooties (1999) *International Animal Health Code*. Office International des Epizooties, Paris, France.

Pain, D.J., Carter, I., Sainsbury, A.W., Shore, R.F., Eden, P, Taggart, M. A, Konstantinos, S, Walker, L.A, Meharg, A.A and Raab, A. 2007. Lead contamination in captive and free-living red kites *Milvus milvus* in England. Science of the Total Environment 376: 116-127.

Sainsbury AW, Flach EJ, Sayers G, Cunningham AA and Macgregor SK 2003. Health Surveillance of Common Dormice (*Muscardinus avellanarius*) in a Reintroduction Programme. Proceedings of a Joint PTES / Wildlife Trusts Conference on the Conservation of Common Dormice, February 2003.

Sainsbury AW, Vaughan-Higgins RJ. **2012.** Analyzing disease risks associated with translocations. Conservation Biology 26: 442-452. DOI: 10.1111/j.1523-1739.2012.01839

Infectious Diseases of Zoo And Wildlife Animals And Its Preventive Control in Taipei Zoo in Taiwan

Jason SC Chin, DVM MS, Taipei Zoo, Taipei, Taiwan ROC

Taiwan is an island off the southeast coast of Mainland China. The total area of Taiwan is 36,000km^2 and the altitude ranges from 0-4,000 m with great diversities in ecosystems, fauna and flora. There are 70 species under 8 orders of mammal, more than 130 species of bird stay in Taiwan and over 350 species of migratory bird. Taipei Zoo, established in north of Taiwan, has more than 250 species and over 3000 individual animals. The Centers for Disease Control (CDC) is responsible for epidemic prevention of human, the Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ) is responsible for animal disease and health inspection in Taiwan. Taipei Zoo has to perform statutory assay of disease surveillance protocols setting for both domestic and imported animals, as well as the tourists. Meanwhile, the rescued program and smuggling animals assistance have increased the risk of uncertain diseases to the zoo. Therefore, Taipei Zoo has to set up and re-enforce appropriate biosecurity procedures for zoo animals by itself. As a result, more serious quarantine protocols than official were set independently for different species to prevent the introduction of infectious agents. Health check plan, fecal test, serology screening and serum bank were accomplished to collect basic database and evaluate health situation routinely. Some surveillance schemes involved collaborations with experts of infectious diseases from different universities and institutes. A professional quarantine house with negative pressure wards was established for keeping rescued and imported animals in order to separate them away from zoo exhibition. Annual health screening program for staffs assisted personnels to identify and avoid disease. The awareness of conducting self protection system within the zoo might lower the risk of reemerging event or infectious disease, however, a persistent monitoring and communication network are still needed and should be developed and maintained well between the zoo, researchers and government officers. The sharing and updating of data could improve the appropriate strategy to meet the needs of preventative actions to disease control in Taipei Zoo.

A review of vaccination against foot and mouth disease in Seoul zoo

Kyung-Yeon Eo, DVM, PhD, Zoo Planning Division, Seoul Zoo, Gwacheon 427-702, Korea

To vaccinate all foot and mouth disease (FMD) susceptible zoo animals can be considered to protect rare and endangered species in zoos when FMD outbreaks nationwide. Korea has been FMD free country for 66 years since 1934. But recently FMD occurred five times from 2000 to 2010. The government has successfully eradicated four times by stamping out policy without vaccination. Unfortunately the last FMD occurred in November 2010 was devastating disaster nationwide. It spread out all country so rapidly that about 3,700 farms were infected with FMD in short time. The government set-up National emergency management agency and made a decision of nation-wide FMD vaccination policy in history.

Seoul zoo closed from 1 January 2011 to 25 January 2011. It was first closing in zoo history of Korea. And we should obey the vaccination policy of national government. We have 49 species 569 heads of FMD susceptible animals. To vaccinate many different species of zoo animals was a big challenge. The drug, FMD vaccine (Aftopord ^{R}) manufactured by MERIAL in UK, was milky emulsion with viscosity. It made harder for zoo vets to inject with blow-pipe under below zero temperature circumstances. The initial vaccination was done twice by 1 month interval and booster injection has been done every 6 months. But we lost some animals caused by high stress with vaccination. Especially it happened in Cervidae including Barasingha deer and Korean water deer. Fortunately there has been no FMD infection in Seoul zoo.

Prevention of infectious Diseases of Zoo and Wildlife animals in Hong Kong Ocean Park

Paolo Martelli, Hong Kong Ocean Park

Hong Kong is a very densely populated small nation. The contribution of agriculture to the overall Hong Kong economy is negligible with poultry by far the largest sector covering 53% of the local consumption; piggeries only produce 6% of local consumption.

In spite of that approximately 70% of the land area is natural cover. This includes 24 country Parks, home to 50 species of mammals, 500 birds, 80 reptiles, 20 amphibians, 230 butterflies, 115 dragon flies etc.

The natural areas, nature reserves and leisure parks are well connected allowing a reasonable abundance of local wildlife including barking deer, porcupines, leopard cats, wild boar and macaques. Hong Kong is a good model for nations that are developing quickly and do not rely heavily on agriculture or the exploitation of primary resources.

Infectious diseases of concern include rabies, still common in China. Hong Kong has been free of rabies since the early eighties. Government policy is strict and well implemented for Domestic dogs that must be registered and vaccinated against rabies.

Although the total volume of live animals destined to Hong Kong is not large, there is also a large volume of animals that are not covered by agricultural and public health laws, such as live fish, live turtles and wildlife products such as are consumed in enormous quantities for traditional Chinese medicine. There are no biosecurity regulations in place to prevent potential epidemics brought in by these species. However, to date there have not been epidemics of economic or ecologic importance linked to this trade and it is not certain that biosecurity regulations are needed. Of course trade and conservation minded regulations and codes of practice are needed, but lacking.

Recently two zoonotic pathogens of global importance originated from (or had a high prevalence in) Hong Kong. SARS became a case study and led to better mechanisms for international biosecurity. Various Avian Influenzas including H3N2 (the Hong Kong Flu) and H5N1.

H5N1 is seasonally endemic in Hong Kong, with the highest prevalence in wild birds in the winter. Hong Kong is along the “East Asia/Australian Flyway” migrating route and numerous bids stop over, mingling with resident birds and ‘sharing/updating’ influenzas.

Poultry (chicken and ducks) imported to Hong Kong from China pose a potential threat of H5N1 all year round. Chickens are sold live in the markets and slaughtered in the markets, a dangerous practice that persists for cultural reasons. This makes the occasional contact of the general public with H5N1 inevitable and recurrent. This probably explains the 1 to 3% prevalence of antibodies in humans.

Ocean Park bio-security strategies

As an animal park we must ensure that our collection remains free of diseases some of which may also infect other animals or our staff and guests.

Ocean Park occupies 91 hectares located on a small peninsula at the southern tip of the Hong Kong Island. Ocean Park employs 2000 staff and is visited by 7 million people annually.

Ocean Park Animal Collection Summary 2012 (as of 31 December 2012)

Animal Group	Species Number	Specimen Number
Marine Mammals	6	57
Terrestrial Mammals	12	50
Birds	96	708
Fish	308	11061
Reptiles	23	80
Amphibians	11	65
Invertebrates	100	2979
Corals	32	408
Total	**588**	**15408**

Infectious contagious diseases may be introduced in our collection through acquisition of new animals, through the local wildlife and by our staff and visitors.

We know the health status of our animals, therefore the risk of zoonosis is very small. The park veterinary department counts 27 staff. In house diagnostic laboratories are of high standards.

We have very limited knowledge of the health status and infectious risks posed by our visitors. Some visitors from Hong Kong or from just across the border may well have been tending to their livestock or buying live food from the markets hours before coming to Ocean Park, potentially carrying infectious germs. One must set up systems that limit germ exchange in both directions. Footbaths, hand wash and alcohol rubs are distributed throughout the park. We do not allow uncontrolled feeding of the animals or spitting, contact programs with our animals are strictly regimented.

Prevention of rabies is carried out by vaccination and by pre-import screening.

The biggest challenge to Ocean Park is Avian Influenza. The law requires the destruction of poultry on premises positive for H5N1. Our birds are not considered 'poultry' as that only covers domestic quails, chickens and ducks. When there is an outbreak of AI in Hong Kong or in the neighboring Chinese provinces Ocean Park will close the walk-through aviaries to avoid potential infection of our birds through soiled clothes or shoes.

If some of our birds were to contract HPAI it would be an enormous problem from a sanitary, logistic and PR point of view. Fortunately the role of wild birds in transmitting the disease is much smaller in the real World than it is in the media.

To avoid introducing other species-specific diseases we will review known diseases, their clinical and epidemiological or zoonotic relevance and the prevalence of such diseases in the country of facility that we plan to import from. Using that information we can then formulate a pre-import quarantine plan and a post-import quarantine plan.

From a realistic point of view, one must also consider how rare the animals are and how grave the disease is. For example while we would not consider importing animals with tuberculosis regardless of rarity or conservation value, we may consider importing Brucella positive walrus.

There are 2 Guiding principles that seem to be contradictory but in reality complement each other.

The first is to follow to the letter protocols and procedures. Government regulations are always followed but sometimes they are not sufficient in which case we will add on to those. Procedures are inflexible by nature and therefore they are not always applicable if new situations arise. Due to the nature of bureaucracy, it is always possible to complicate regulations and to add layers of procedures but very difficult or impossible to simplify. There is tendency when following the bureaucratic route that matters become more convoluted, more complicated and slower. In a real situation of biosecurity threat, not being able to act fast is generally detrimental.

The second guiding principle is that it is essential when writing procedures to allow for exceptions, under veterinary control. This must only be used to improve on bio-security or welfare and not be abused to satisfy political, economic or managerial pressures.

The teams in charge of animal collections must continually imagine potential problems and associated solutions, foster good relations with government agencies and have easy access to updated lists of diagnostic laboratories and experts colleagues. Nowadays with the internet it should be very easy and very cheap. Surprisingly however, in the zoo and wildlife rescue circles, we often realize that dedicated, hard-working colleagues do not always possess that information, including ourselves. This is because the field of wildlife medicine is very vast and specialized literature is 5 to 15 years behind practice. Abstracts of wildlife veterinary conferences are generally too limited to serve as reference and the full text not available. The internet is cheap but attending conferences is not. Also, not all facilities understand the strategic importance of a strong veterinary department and instead use the vets as fire-fighting technical staff.

Preventive control of infectious diseases in Singapore

Serena Oh, Assistant Director, Veterinary Services, Wildlife Reserves Singapore, 80 Mandai Lake Road, Singapore 729826, SINGAPORE

Singapore is an island nation which has lost much of its original biota. Only a small agricultural industry remains. This includes a small number of egg production chicken farms, vegetable farms, fish farms, orchid farms and ornamental fish farms. Trade is important due to Singapore’s economic status as a major trading hub, hence the need for preventive animal disease control. Singapore is declared free from a number of diseases, for example, rabies and Food and Mouth Disease. The government agencies monitor different diseases through legislation, border checks and import requirements. Wildlife Reserves Singapore (WRS) monitors infectious diseases within our parks as the presence of diseases would similarly impact business operations. Our disease prevention requirements are slightly different, with added considerations for diseases which will affect our captive animal collection. Several government agencies monitor zoonotic and anthropo-zoonotic infectious diseases in the country. Wildlife veterinarians at WRS play important roles in these efforts.

Infectious diseases of zoo animals and its control in Japanese Zoos

Kazutoshi Takami, VMD PhD, Osaka Municipal Tennoji Zoological Gardens, Osaka, Japan

Since zoo is keeping variety of species and large number of individuals, it has a potential to improve measures against the infectious diseases which could occur in the wild. At the same time it is necessary to be aware of zoo's potential risk of transmitting the pathogens, because zoo is the place in which large number of animals and visitors are concentrated.

Zoo is defined as a conservation center which maintains a collection of wild animals including many endangered species. Therefore it must protect wild animals in captivity from the every threat. As one of these activities, ex-situ conservation effort is essential for the zoo. To maintain a viable population in captivity, it is necessary to exchange the individuals among the institutions. On the other hand, many of laws and rules formulated to control infectious diseases in Japan demand the restriction on movement of animals in captivity. This means that there is a conflict between infectious disease control and ex-situ conservation. In order to improve coordination and harmonization of these actions, more flexible and detailed approaches are required.

As actual, some cases of serious infectious diseases such as tuberculosis and highly-pathogenic avian influenza have been reported in Japanese zoos sporadically. In order to respond to this situation, organizational measures are required. Japanese Association of Zoos and Aquariums (JAZA) is the fundamental organization for zoo and aquarium community in Japan consisting of 152 member institutions, 86 zoos and 66 aquariums. To control infectious diseases within the zoological institutions, JAZA has set up a special division. The main activities of this division are collection of information on infectious diseases relating to zoos and aquariums, formulation of effective measures, dissemination of information and measures, and provision of specific instructions. Since JAZA is responsible for the coordinated ex-situ conservation actions by zoos and aquariums in Japan, it is expected to promote appropriate measures to protect endangered species from infectious diseases.

Infectious diseases of wildlife and its prevention in Japan

M. Asakawa DVM, MSc Wild Animal Health (UK), PhD, Dipl. JCZWM, Department of Pathobiology, School of Veterinary Medicine, Rakuno Gakuen University, Hokkaido, Japan

In our increasingly managed environment, where the maintenance of many ecosystems, habitats and species rests largely in human hands, disease control is now an important process in the active conservation of wildlife because individual disease outbreaks are known to have killed many tens of thousands of a wide range of species. On the other hand, most infectious agents, especially commensal viruses, are component parts of the ecosystems in which free-ranging hosts occur, they have co-evolved, and the infectious agents do not necessarily cause disease. But, some infectious diseases have killed wildlife. Considerable environmental change has occurred in Japan, especially, Hokkaido, which is one of mailands and located at a most northern part of our nation, over the last 150 years, but, recently there have been suspicious infectious and parasitic diseases in wildlife, especially since the 1990s. Examples include fascioliasis in deer, mange in raccoon dog, Mareck's disease in white-fronted goose, atoxoplasmosis and staphylococcosis, and salmonelosis in sparrows, and so on. Among them, some pathogens could infect each other among human, captive and wild animals, and it seems to have a negative impact on the development of both Japanese society and ecosystem. To maintain ecohealth, some potential strategies including monitoring with consideration of ecology of the agents will be continued because the agents related to the diseases could infect not only humans but also captive animals.