



#### Specific materials requested:

1. Records of deciduous and permanent emergence (and natural exfoliation of deciduous teeth) from captive orangutans in North American zoos where precise date of birth information is known (born in captivity). Provision of both historical records and new data obtained by opportunistic observation during regular husbandry and training and/or immobilizations for other reasons by orangutan SSP participating zoos is requested. No biological samples are needed for this project.
2. Data are to be collected on a voluntary basis by keepers/staff and relayed to researchers by email. Data requested include (species, Isis Identification number, house name, date of birth, which zoo the animal lives (lived) in when data were collected, whether hand or maternally raised, which tooth etc. A tooth ID chart and data collection form is attached. Any supporting notes and especially photographs will be greatly appreciated.
3. The goal is to collect as much data as possible for 1 year (June 2013 to June 2014) when an updated chart will be made available (September 2014). Data collection will continue with specific focus on emergence timings that still lack sufficient information.
4. According to the WAZA International studbook keeper, Megan Elder, there have been 1231-recorded births in zoos within North America, (including Mexico), United Kingdom and Europe. 569 have lived to 15 years and older and 219 are alive but have not yet reached 15 years of age. Therefore the potential sample size is certainly sufficient. However these data are unlikely to have been recorded for every individual and every tooth or may not be readily accessible but the potential is certainly adequate to warrant this project.

#### Goals and Outputs:

1. To produce a comprehensive updated compilation of dental emergence (sequencing and timing) from captive orangutans: (*Pongo pygmaeus*, *Pongo abelii*) in the form of a pocket-size tooth chart for each species for broad dissemination as a downloadable resource, in scientific journals, reports and presentations and with additional funding in a published laminated form suitable for use in the field and in zoo animal and primate departments. *Pongo pygmaeus x abelii* hybrid data will not be included in the final outputs but will be collected, as it may be informative especially if there appears to be differences between the species.
2. Acknowledgement of the Orangutan SSP's support and participating zoos will be noted in all output materials and/or presentations.

#### Background:

1. Very little published data on dental emergence in orangutans, especially of known-age individuals, exists in scientific literature (Swindler 2002). Most data that have been published come from dead wild-born specimens where precise age information was unknown (Schulz 1935, Smith 1989).
2. What is published for orangutans either predates current advances in taxonomy (knowledge of the two species distinction) or are lumped together due to small sample size (Schulz 1935, Fooden & Izor 1983, Smith 1989, Smith et al. 1994, Swindler 2002).
3. This project has already received strong endorsement from BIAZA (British International Association of Zoos and Aquariums) "as it is exactly the type of research we are keen to support, demonstrating links to in-situ conservation efforts and the role that captive populations can play." letter attached for reference. Data collection from British and European Zoo collections began in May 2013.



**Project Title: Captive orangutan dentition emergence  
Compilation project**

Felicity Oram MSc, Tatyana Humle PhD.



4. This work will produce a requested updated resource for veterinarians working in orangutan range countries. The project was conceived in collaboration with Steve Unwin, veterinary officer Chester Zoo (North England Zoological Society) and veterinary director of PASA (Pan African Sanctuary Alliance) and the Orangutan Veterinary Advisory Group (OVAG), an association of veterinarians working in rehabilitation centers and universities in Malaysia and Indonesia. While tooth emergence charts exist, range country veterinarians find what is currently available is often not specific enough to be particularly useful with respect to age assignment of rehabilitants. Since zoo veterinarians today generally have known ages of individuals (as essentially all are now born in captivity), this information gap can be filled and more comprehensive and useful charts can be produced.
5. Felicity Oram MSc in Primate Conservation from Oxford Brookes University, UK is the Programme Development Advisor for Hutan - KOCP (Kinabatangan Orangutan Conservation Programme) and the primary researcher for this project. Felicity has full support for this from Hutan - KOCP directors Isabelle Lackman PhD and Marc Ancrenaz DVM. Tatyana Humle PhD of the School of Anthropology and Conservation at the University of Kent, Canterbury UK is the academic advisor. We are also assisted by a Malaysian undergraduate student Shauna Tay, working on her BSc undergraduate thesis project.
6. Dental emergence has been recorded in general husbandry records, at immobilizations and during routine husbandry training, so key precise age data should be available. However, little systematic central compilation of these specific data has been made to augment the limited academic literature on this subject.
7. It is often assumed growth and development in captivity are accelerated. This is actually not supported with respect to dental emergence despite more rapid weight gain and body size growth overall, in macaques and chimpanzees where much more developmental trajectory data exist (Smith et al. 1994, Swindler 2002). Therefore, dental sequencing and emergence timings from captive orangutans may be broadly relevant as a general life history and husbandry resource for both captive and wild study subjects and for better age assignment of confiscated orphans in range countries.
8. Additionally orangutan dental emergence sequencing and timing is commonly assumed to closely parallel chimpanzees. However, recent published data as well as empirical observations by keepers and veterinarians indicate it appears significantly slower than chimpanzees and actually more closely parallel humans (Kelley & Schwartz 2010).

**Overall Research Aims and Specific Benefits:**

1. Specifically, a summation of accumulated updated knowledge in a single document:
  - a. will provide zoos with an updated resource of baseline normals for tooth emergence (sequencing and timing). Since orangutans are a slow-growing long-lived species of a semi-solitary nature many zoos hold only a few individuals so the benefit of accumulated knowledge in a simple format will be useful for husbandry and veterinary care of zoo residents.
  - b. will provide key irrefutable evidence for law enforcement in confiscation situations to determine if an orphan is truly likely to be a young animal ranging independently or whether it is more probable that a mother was killed to procure an infant for the pet trade.
  - c. will aid husbandry and rehabilitation of confiscated and displaced individuals in range countries. Size alone is often not an accurate indicator of age and therefore stage of development. Especially as, some confiscated orangutans arrive at rehabilitation centers as inadequately but overfed former pets while others are rescued wild individuals who may be severely nutritionally stressed from being displaced by agricultural conversion.



**Project Title: Captive orangutan dentition emergence  
Compilation project**

Felicity Oram MSc, Tatyana Humle PhD.



- d. will aid academic research by serving to test whether late emergence of dentition in orangutans indeed differentiates Asian and African apes with respect to normal growth and development (Smith 1989, Smith et al. 1994).
- e. may inform developmental milestones to independence in wild free-living populations. While knowledge of the orangutan has expanded considerably in the past 25 years. Understanding of growth and development of these species in the wild still remains scant (van Noordwijk et al. 2009). Yet this knowledge is needed to manage and maintain viable wild populations in increasingly compressed and fragmented forest habitats especially in very long-lived slow reproducing species like the orangutan.

2. This is a good opportunity to build synergy between zoos, field conservation partners and rehabilitation facilities to work together for conservation of Asia's only great ape, whereby zoo orangutans contribute data that are very difficult to obtain from wild individuals to benefit all orangutans.

### References

- Fooden, J., Izor, R. J. (1983) Growth curves, dental emergence norms, and supplemental morphological observations in known age captive orangutans. *American Journal of Primatology*, 5, pp. 285-301.
- Kelley, J, Schwartz, G.T. (2010) Dental development and life history in living African and Asian apes. *PNAS* , 107(3): pp. 1035-1040.
- Smith, B.H. (1989) Dental development as a measure of Life history in Primates, *Evolution* , 43(3), pp. 683-688.
- Smith, B.H., Crummett, T.L., Brandt, K.L. (1994) Ages of eruption of primate teeth: A compendium for aging individuals and comparing life histories, *Yearbook of Physical Anthropology* , 37, pp.177-231.
- Schultz, A.H., (1935) Eruption and decay of the permanent teeth in primates, *American Journal of Physical Anthropology* , 19(4), pp. 489-581.
- Swindler, D.R. (2002) *Primate Dentition, An introduction to the Teeth of Non-human Primates* , Cambridge University Press, Cambridge UK. pp. 296.
- van Noordwijk MA, Sauren SEB, Nuzuar, Abulani A, Morrogh-Bernard HC, Utami Atmoko SS, and van Schaik CP. (2009). Development of independence Sumatran and Bornean orangutans compared. In: Wich SA, Utami Atmoko SS, Mitra-Setia T, and van Schaik C.P., editors. 2009. *Orangutans. Geographic Variation in Behavioural Ecology and Conservation* . Oxford: Oxford University Press. pp. 189-203.