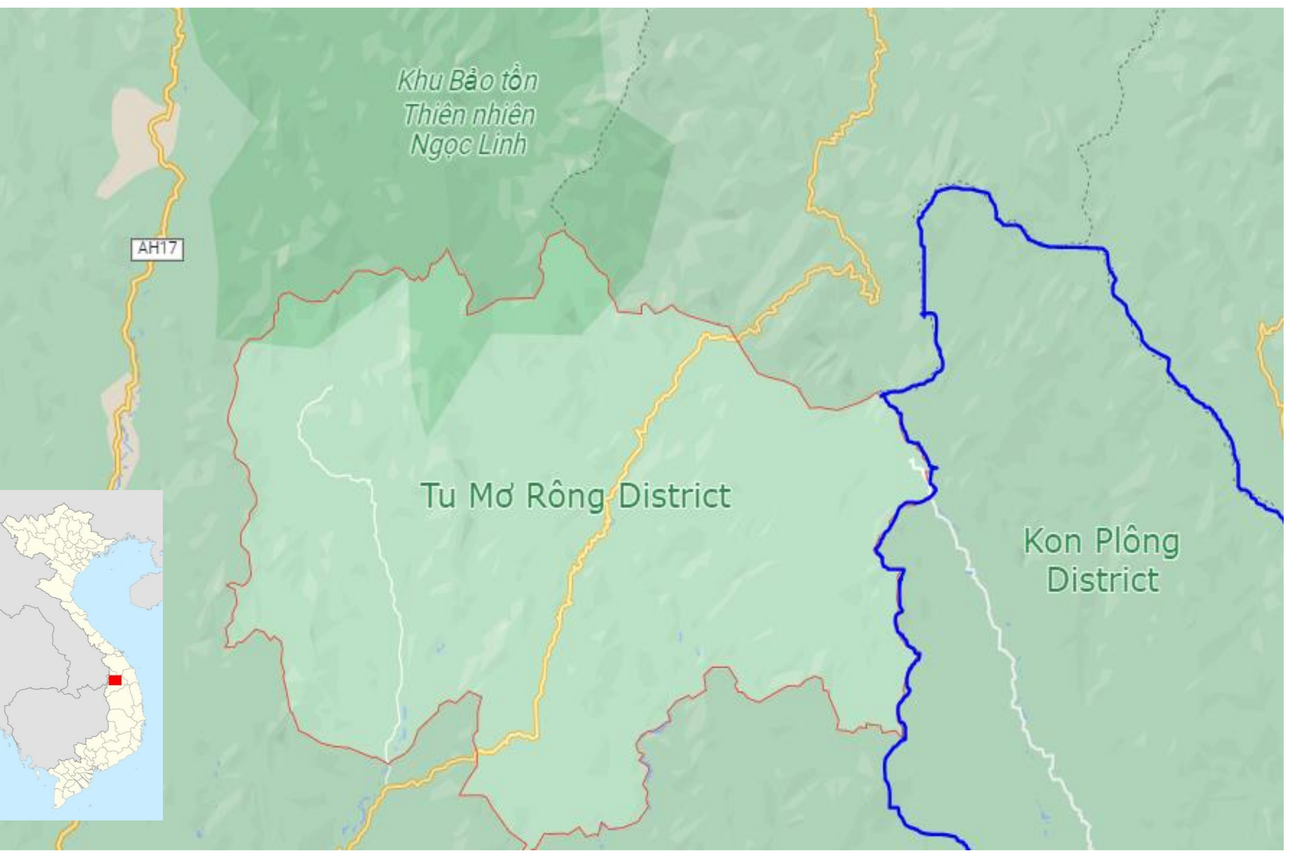
Population Density Estimate of Northern Yellow-Cheeked Gibbons (*Nomascus annamensis*) in the Tu Mơ Rông District, Vietnam

Konner Holzwart
19127662@brookes.ac.uk
OXFORD BROOKES UNIVERSITY

Northern Yellow-Cheeked Gibbons

- **Northern yellow-cheeked gibbons** (*Nomascus annamensis)* are small arboreal apes found in the tropical forests of Vietnam, Cambodia, and Laos [1]
- **Sexually Dichromatic-** Males are black with golden-orange cheeks and the females are blonde with a black crest on the top of their head [1]
- **Frugivorous-** Diet comprised of mostly fruits (60.36%), supplemented by leaves (22.60%), flowers (13.74%), flowers (13.74%), and mature leaves (3.30%) [2]
- Essential seed disperses for the habitats they occupy due to frugiviorous diet [3]
- **Pair-bonding** – Social groups formed through cohesive bonds between one mating male, one female, and their offspring [7]
- Highly territorial and defend their territory through vocal displays [9]
- Considered **Endangered** on IUCN Red List of Threatened Species [10]
- **Threats**-Habitat loss through deforestation and forest fragmentation, and hunting and capturing for subsistence, medicine, and the illegal pet trade [11]

Photo of two adult northern yellow-cheeked gibbons (*Nomascus annamensis*) and their juvenile offspring.



Map of Tu Mơ Rông District in Vietnam in relation to Kon Plông District and the Ngọc Linh Nature Reserve.

Tu Mơ Rông District

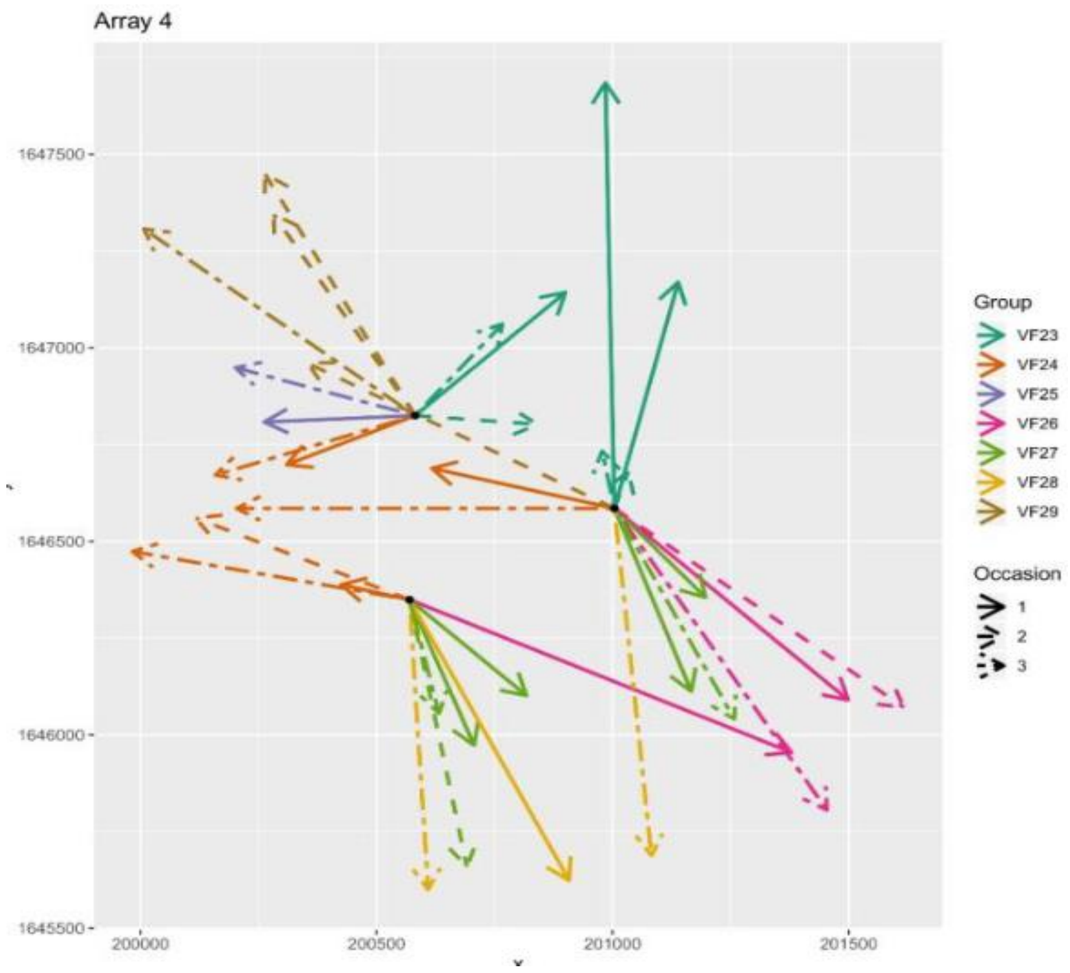
- In Kon Tum Province of Vietnam
- Between two gibbon strongholds, **Ngoc Linh Nature Reserve** and **Kon Plong District**
- Kon Plong District has the highest density of northern yellow-cheeked gibbons in Vietnam[12]
- Ngoc Linh Nature Reserve considered a priority site for northern yellow-cheeked gibbons [13]
- There has never been a population density estimate in Tu Mo Rong.
- Population density estimate can inform conservation management in the area and help in the creation of a habitat corridor, connecting Ngoc Linh Nature Reserve and Kon Plong

Acoustic Spatially Explicit Capture-Recapture

- **Spatially Explicit Capture-Recapture (SECR)** is a method used to acquire the population density of free-ranging animals through an array of detectors, Bayesian statistical models, and Poisson distribution [13]
- A synthesis of mark capture-recapture and distance sampling, creating a more flexible model in estimating the likelihood of capture, animal location, and densities rather than population size [14]
- **aSCR** uses proximity detectors to record vocalisations, allowing for non-invasive detection of animals [15]
- Vocalisations are "captured" by one detector and "recaptured" by other detectors in an array

Methods

- Arrange a triangular array of three listening posts spaced 500 m apart at six locations in the forest of Tu Mơ Rông
- Survey at the listening posts using human detectors for three consecutive days for each array [15]
- Record only gibbon groups, and disregard lone males
- Record the start and stop times of the vocalisations, distance and bearing of the songs, group composition, and plot each occurrence in relation to the array [16]
- Once data is collected, model the probability of detection as a function of distance from the detector using the R package 'ascr' v2.2.3 to find the gibbon group density estimates [17]



Gibbon group detections from an array. Block dots indicate listening post, lines indicate distance and bearing of calls, colour indicates distinct groups, and line type indicates which morning the call was recorded [12]

References

[1] Thinh, V. N., Mootnick, A. R., Thanh, V.N., Nadler, T, and Roos, C. (2010). A new species of crested gibbon, from the central Annamite mountain range. Vietnamese Journal of Primatology 4, pp. 1-12
[2] Hon, N., Behie, A.M., Rothman, J.M. and Ryan, K.G. (2018). Nutritional composition of the diet of the northern yellow-cheeked crested gibbon (*Nomascus annamensis*) in northeastern Cambodia. *Primates*, 59(4), pp.339–346.
[3] McConkey, K.R. Seed Dispersal by Primates in Asian Habitats: From Species, to Communities, to Conservation. *International Journal of Primatology* ***39,*** *466–492 (2018). https://doi.org/10.1007/s10764-017-0013-7*
[7] Palombit RA. Infanticide and the evolution of pair bonds in nonhuman primates. Evolutionary Anthropology. 1999;7:117-129. DOI: 10.1002/(SICI)1520-6505(1999)7:4<117::AIDEVAN2> 3.0.CO;2-O
[9] Cowlishaw, G. U. Y. (1992). Song function in gibbons. Behaviour, 121(1-2), 131-153.
[10] IUCN. 2021. The IUCN Red List of Threatened Species. Version 2021-3. *https://www.iucnredlist.org. Accessed on [14, March 2022]*
[11] Thinh Van Ngoc, Roos, C., Rawson, B.M., Nguyen, M.H., Duckworth, J.W., Hoang Minh Duc, Nijman, V. & Thien Nguyen Van. 2020. Nomascus annamensis. The IUCN Red List of Threatened Species 2020, doi:10.2305/IUCN.UK.2020-2.RLTS.T120659170A120659179.en
[12] Wearn, O.R., Trinh Dinh, H., Nguyen Quyet, T., Dao Cong, A., Nguyen Van, P., Nguyen Minh, P., Le Viet, M., Tran Ngoc, T., Hoang Quoc, H., Nguyen, A. (2021). Myth to reality in the forests of Kon Plong: The exceptional biodiversity value of Kon Plong District, Kon Tum Province. Fauna & Flora International – Vietnam Programme, Hanoi pp: 34-43
[13] Borchers, D. (2012). A non-technical overview of spatially explicit capture–recapture models. Journal of Ornithology, 152(2), 435-444.
[14] Borchers, D. L., & Efford, M. (2008). Spatially explicit maximum likelihood methods for capture–recapture studies. Biometrics, 64(2), 377-385.
[15] Vu, T.T. & Tran, L.M. (2019). An application of autonomous recorders for gibbon monitoring. International Journal of Primatology, 40(2), pp.169–186
[16] Stevenson, B. C., van Dam-Bates, P., Young, C. K., and Measey, J. (2021). A spatial capture–recapture model to estimate call rate and population density from passive acoustic surveys. Methods in Ecology and Evolution, 12(3), 432-442.
[17] Kidney, D., Rawson, B. M., Borchers, D. L., Stevenson, B. C., Marques, T. A., and Thomas, L. (2016). An efficient acoustic density estimation method with human detectors applied to gibbons in Cambodia. PloS one, 11(5), e0155066.