Journal of Wildlife and Biodiversity
Online ISSN: 2588-3526

Volume 8(2): 122-133 (2024) (http://www.wildlife-biodiversity.com/)

Research Article

Monitoring on abundance and distribution of water monitors (*Varanus salvator*) at Kasetsart University Bangkhen, Thailand

Chayatorn Thongsub*, Pattariya Sonaca, Pimchanok Buranapitak, Prateep Duengkae

Department of Forest Biology, Faculty of Forestry, Kasetsart University, Bangkok 10900, Thailand

*Email address: dechang1999@gmail.com

Received: 16 December 2023 / Revised: 29 March 2024 / Accepted: 11 April 2024/ Published online: 01 May 2024.

How to cite: Thongsub, C., Sonaca, P., Buranapitak, P., Duengkae, P. (2024). Monitoring on abundance and distribution of water monitors (*Varanus salvator*) at Kasetsart University Bangkhen, Thailand, Journal of Wildlife and Biodiversity, 8(2), 122-133. **DOI**: https://doi.org/10.5281/zenodo.11097805

Abstract

Monitoring on abundance and distribution of Water monitors in an area of urban, changing land use, In the Kasetsart University Bangkhen Campus. The survey was conducted three times between July and November in 2012, 2018 and 2021. Use 2 survey methods were used transects and live traps to implant a microchip (PIT tag) on water monitors in the study area. Population size was analyzed using the R program in the package Rcapture (capture-recapture). From the line transect method and live trap, The water monitor distribution was concentrated along the water sources in the Kasetsart University, Bangkhen campus, The area where the most water monitors were found was the lotus pond next to the main auditorium, as well as Sam Buraphachan Monument area and the men's dormitory area. From the two survey methods it was found that the area where water monitors were not present was the pond area behind the Chulabhorn Swimming Pool and the Kasetsart University Laboratory Center for Educational Research and Development. We found the prevalence, population size and density increase during water monitors every year of the study. Therefore, there should be continuous Monitoring of abundance and distribution. and study the capacity to accommodate the population within the area and develop the area as a model for managing water monitor populations in urban areas.

Keywords: Water monitor, Kasetsart University, Abundance, Distribution, Density

Introduction

Hia [in Thai], or *Varanus salvator* (Huo, 2024) known internationally as the water monitor, belongs to a group of monitor lizards in the Family Varanidae (Panthep, 2000). Its characteristics as being a large reptile of up to 3.19 meters (Randow, 1932) in length, and molecular phylogeny shows it is an intermediary between snakes and iguanian lizards (such as agamids) (Piskurek and

Okada, 2007, Lásková et al., 2015). It has a black body, a white or yellow floral pattern on body skin, a purple tongue with a forked end, and a black-banded tail interspersed with light yellow. In Thailand, they are not found in Northern Thailand north of Sukhothai. They are also not found on the Khorat Plateau (Isaan), except for the mountainous regions to the west and south of the Khorat Plateau (Cota et al., 2009). There are small scales on the back of the neck, similar in size to the body scales with a prominent ridge in the middle of the scales. The nostril openings are quite round and are located at the tip of the mouth Jessop et al., (2003) found that the water monitor tongue serves to receive temperature and smell molecules in the air, making it possible to precisely pinpoint the location of its prey. When moving, the tongue sticks out to check the direction of the prey. At maturity, males are in the age range of 4-5 years and have a body length of 1.5-1.7 meters. Mature females in the age range of 3-4 years have a body length of 1.2-1.5 meters. Water monitors often lay eggs in burrows from June to August in the central region of Thailand. In the southern part of the nation, eggs are spawned almost all year round. The highest volume of egg production is from July to August, laying 15-30 eggs each time. Eggs usually take approximately 7-9 months to incubate according to the mating/egg laying/hatching cycle observed in Central Thailand. Napassanan (2005) found that water monitors do not hatch eggs. Males and females do not need to incubate the eggs. The babies will hatch naturally, and they can hunt food by themselves. The water monitor lays eggs in the rainy season, choosing an area that is easy to dig, such as under trees, in anthills, bamboo thickets, and areas with little sunlight. Water monitors dig a hole 0.5 m deep and bury their eggs for 60-70 days (Shine et al., 1998). The eggs are white and oval-shaped, and the shell is soft and sticky. Egg size depends on the physiology of the breeder. (Thompson et al., 2001). Water monitors activity started in the morning (6:00 a.m.) and lasted until the evening (5:00 p.m.) (Trivalairat, & Srikosamatara, 2022) (Cota, 2011b). They can eat a variety of food found and captured, from snakes, birds, lizards, freshwater crabs, and small monkeys to human pets, as well as food scraps from garbage dumps. Small water monitors and newborn water monitors eat insects and small animals.

The water monitor is a reptile indicative of the fertility of an area. Water monitors are common in Thailand, except in the northern and the northeastern regions, where they do not occur over most of those areas (Cota et al., 2009). It is the fourth largest reptile in Thailand and the second largest of the monitor lizards found worldwide. They are always found near water sources, including salt water, fresh water and brackish water. They can live in human-inhabited areas, especially in the central region of Thailand (Shine et al., 1996, Lauprasert,1999). However, water monitor are still animals that spend most of their lives on dry land (Groombridge and Luxmoore, 1990; Bernett, 1995). The law of Thailand has classified water monitors as protected animals according to the

Wild Animal Reservation and Protection Act, BE 2535 (1992). The International Union for Conservation of Nature and Natural Resources in 2011 classified Water monitors as species of Least Concern (LC), meaning they are in the group least threatened with extinction.

KUBC is an area where water monitors can be found, because the university is a lowland area with ponds, ditches, and wet areas having dense vegetation scattered everywhere. This matches the ecological characteristics of water monitors' needs. There is also enough food to support a water monitor population. Most of the water monitor space-using behaviours are spent on finding food rather than resting. In that area, there are often hollows under buildings, trees and outdoor areas around ponds suitable for habitat. At present, the environment has changed a lot. There are various constructions such as buildings and residential buildings, but the area is still an abundant and suitable habitat for various animals, including mammals, birds, reptiles and amphibians. These other animals constitute food sources for water monitors. From the above environment, KUBC is an area where water monitors spread within the university, leading to this study monitoring the abundance and distribution of water monitors on the KUBC.

Material and methods

Study site

KUBC is located in Bangkok, the capital of Thailand. It has a total area of 135.68 ha. Plain areas have ponds, ditches, wet areas, and scattered dense vegetation. These areas match the ecological characteristics of the water monitors' needs. There is also enough food for the water monitors to live on. There are burrows under buildings, trees and outdoor areas around the ponds that are suitable as habitats. The area is a fertile, suitable habitat for various animals, including mammals, birds, amphibians and reptiles (Fig. 1)

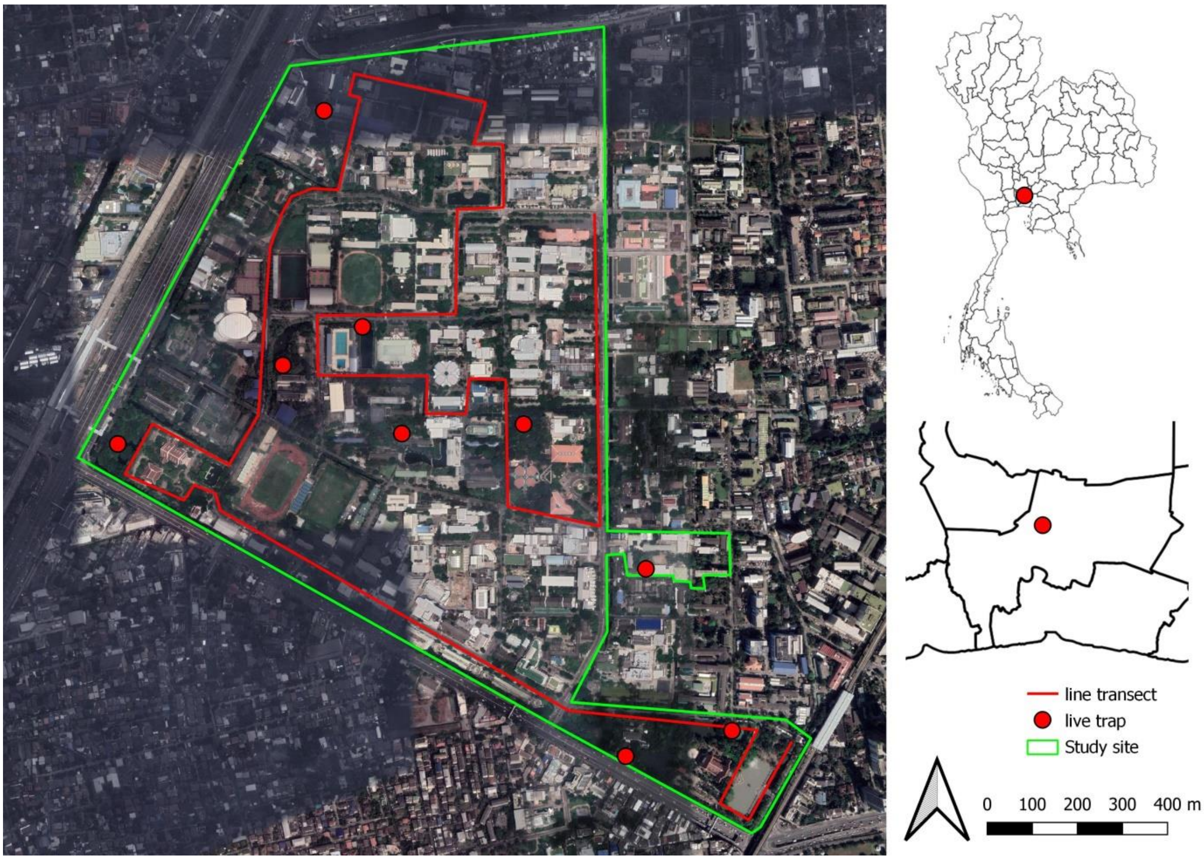

Figure 1 live trap point and line transect in the area of Kasetsart University Campus (KUBC), Bangkok, Thailand.

Data collection

The study of water monitor abundance and distribution, The survey was conducted three times between July and November in 2012, 2018 and 2021. Placing live trap spots in different areas was conducted throughout the KUBC. The bait was bound to a capture mechanism inside a cage. When an animal bit, snatching the bait, a hook used to hang the bait was moved, closing the cage door. The cage was labelled with the project title and contact number on its tops so that viewers could understand what was going on and be able to contact researchers when an animal was trapped in the cage. This was done to reduce the danger and stress to the animal. Live trap locations were placed on 7 trap nights each, at a total of 9 points. Each day, cages were inspected at 3 time intervals: 7:00 A.M., 12:00 P.M., and 5:00 P.M. Sterile microchips with 13-digit codes were attached to each water monitor. By tacking the microchips under the skin behind the water monitor's neck, a 13-digit number was created for a unique data set for each water monitor caught, used separately for each, The microchips were later read using a microchip scanner in the area where the microchip was tacked. Finally, the water monitor was released back to nature. With the line transect method, The water monitor survey was conducted using a route around KUBC 1 time/week from 9:00 AM to 10:00 AM until completion of the live trap survey.

The survey of water monitor distributions at KUBC by line transect method was conducted using a route around the KUBC 1 time/week from 9:00 AM to 10:00 AM until completion of the live trap survey.

Data analysis

Determination of the abundance of water monitors in the KUBC by live trap and line transect methods. The data were analyzed by finding the percentage of prevalence from the equation.

$$Relative\ Abundance = \frac{Number\ of\ surveys\ where\ wildlife\ was\ seen}{Number\ of\ surveys} \times 100$$

Demographic analysis was carried out through the R program in the package Recapture. From the live trap method, the water monitor population survey at KUBC was conducted by embedding a microchip as a marker to be used to identify the water monitor when re-captured. Recapture is a package in the R program that uses log-linear models for capture-recapture experiments. It is an estimation of abundance and other demographic parameters for closed populations, and open populations, and the robust design in capture-recapture experiments using log-linear models.

The formula for calculating population density.

$$D = \frac{N}{Area}$$

Where	D	= the population density
	N	= the total population
	Area	= the study area size

Results

Live trap method

The live trap prevalence survey in 2012, 2018, and 2021 found that the water monitor prevalence tends to decrease and increase. The percentage of prevalence was 40%, 34.29% and 38.09% respectively (Fig. 2).

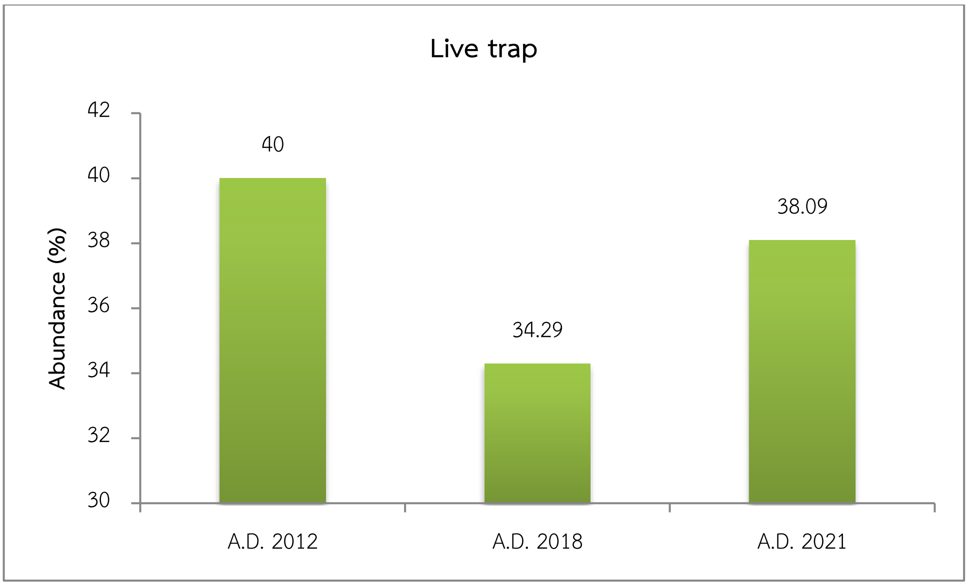

Figure 2 Graph of the abundance of water monitored by live trap in each survey year.

Live trap density surveys in 2012, 2018, and 2021 showed that the population size tended to increase significantly. The population size was 36, 44±11 and 101±53, respectively (Fig. 3). As a result, the density tends to increase as well. The densities were 0.26 water monitors/ha., 0.32 water monitors/ha., and 0.74 water monitors/ha., respectively (Fig. 4).

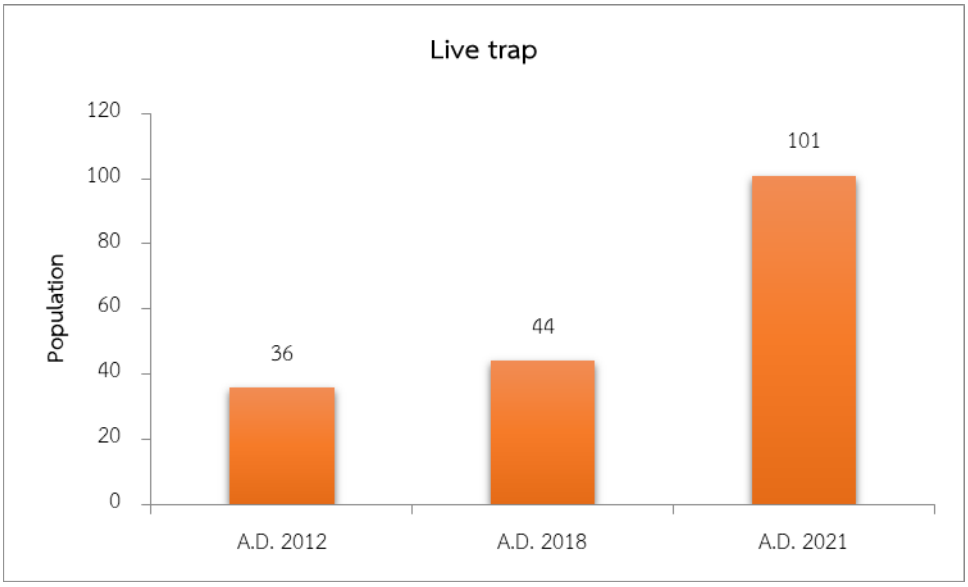

Figure 3 Graph of the population of water monitored by live trap in each survey year.

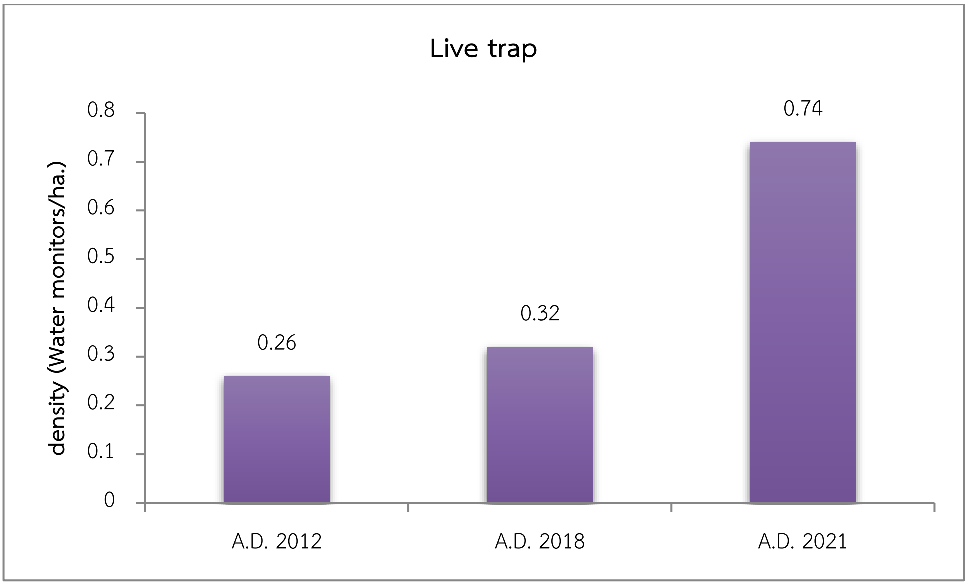

Figure 4 Graph of the density of water monitor by live trap in each survey year.

Line transect method

The prevalence survey using line transect in 2012, 2018, and 2021 found that the prevalence tends to increase. The percentage of prevalence was 88.89%, 93.33%, and 100% respectively (Fig. 3).

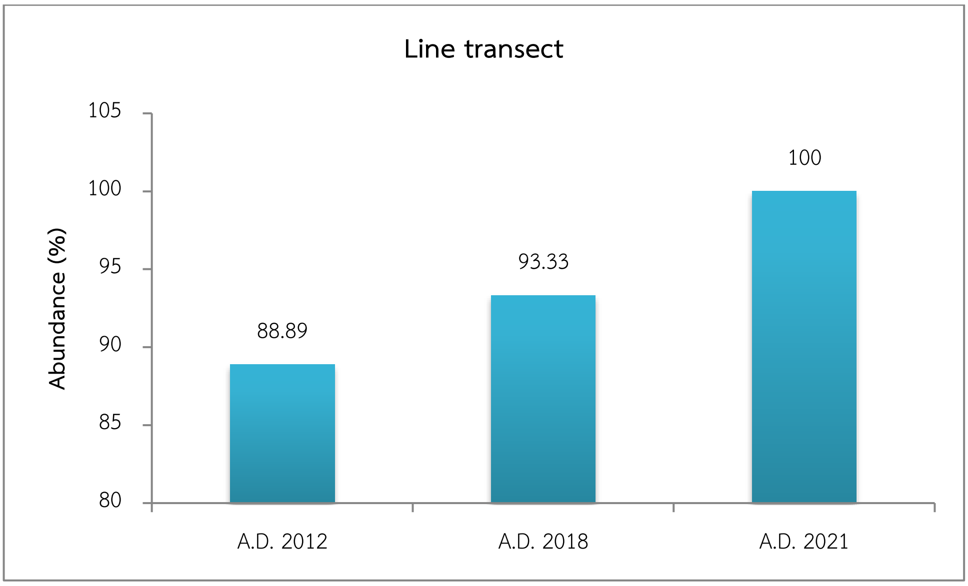

Figure 5 Graph of the abundance of water monitor by line transect in each survey year.

Comparing the two methods (Fig. 4), there was an inconsistency, which may be due to the abundance of food sources. Water monitors have more hunting options. Therefore, the percentage of occupied traps would be reduced. This may include learning behaviour not to eat the prey in the trap. There have been cases where prey in a trap has disappeared and traces of rummaging have been found. Prey has been pulled from the side of the trap cage.

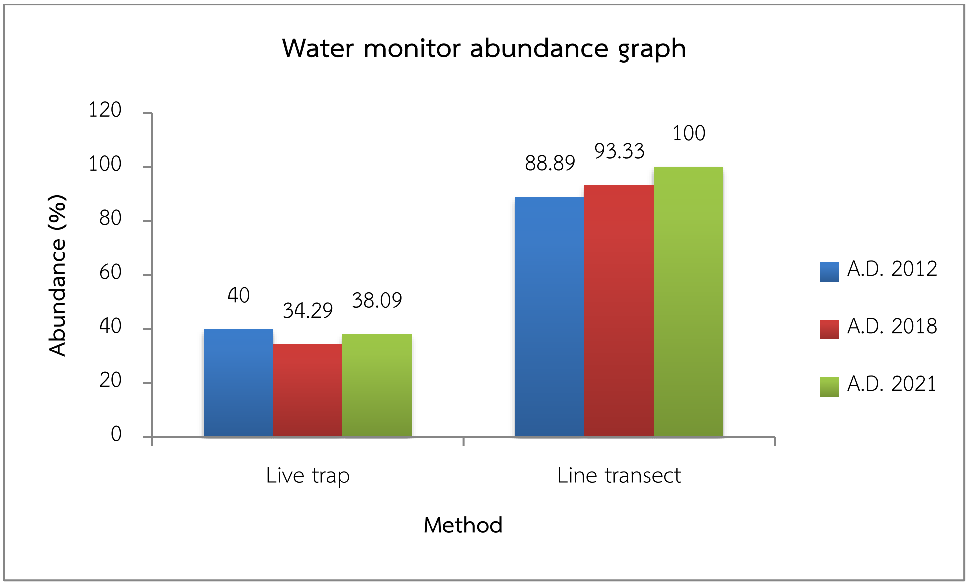

Figure 6 Comparative graph of the abundance of water monitors by live trap and line transect methods in each survey year.

Distribution

The diffusion survey found that water monitors were distributed in bodies of water that are shaded by trees and buildings. They tended to be in areas that were less exploited by humans, except for the lotus pond area next to the main auditorium. The lotus pond was mainly a place for sunbathing, This made use of a common area for water monitors and humans. However, it can still be found in general within KUBC. Throughout the 3 years of surveying, it was found that the areas where the area was regularly used and where water monitors could often be seen were around the lotus pond next to the main auditorium, the men's dormitory area and the Sam Buraphachan Monument area where water monitors were not found was in the pond area behind the Chulabhorn Swimming Pool and the Kasetsart University Laboratory Center for Educational Research and Development, Because in that area there are human activities. It is also an area with heavy traffic, especially Monday to Friday and during peak hours, overlapping with when water monitors use the area. (Fig. 5).

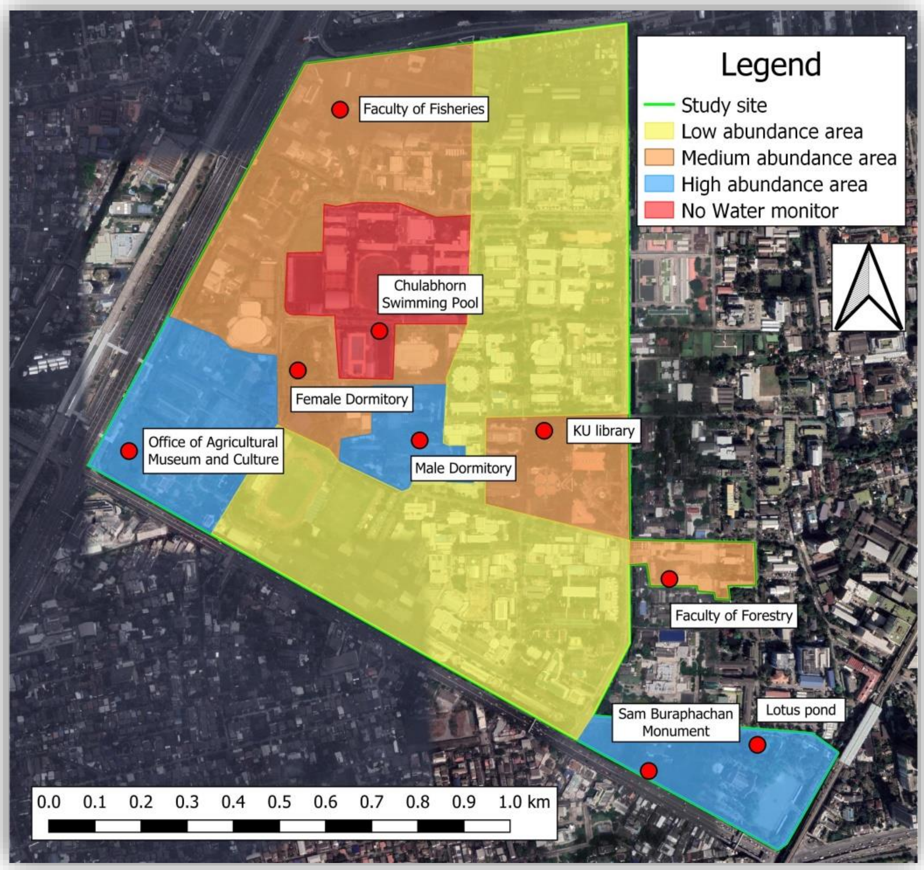

Figure 7 Map distribution levels and live trap points.

Water monitors were also found to have very little overlapping distribution in each age group, namely pre-reproductive age, preferring to live in grassy areas or rather tall shrubs, and it was an area in which large water monitors were not often found, Sometimes found Pre-reproductive age in reproductive age areas is often found while doing various activities on trees. In the study area, it was found that it was in the area of the Vibhavadi Gate, Faculty of Fisheries, behind the KU library. The large reproductive age and post-reproductive age groups were found to be widely distributed within the study area, especially in the water areas with shade trees, basements and open spaces for sunbathing (Fig. 6).

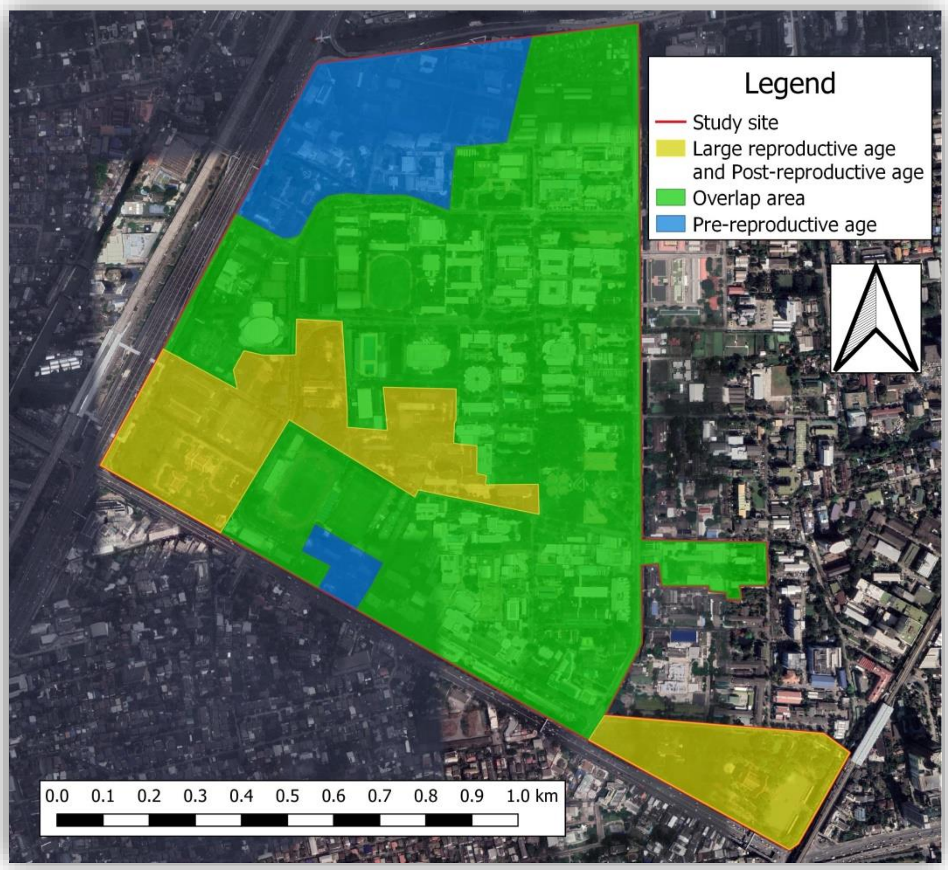

Figure 8 Map of the distribution of water monitor of different sizes.

Discussion

Abundance Comparison

Three surveys of monitor lizard prevalence in 2012, 2018, and 2021 showed trends in prevalence, population size, and density. This is consistent with the work of Karunarathna et al., (2017) urban populations of monitor lizards seemed to be fairly abundant, having adapted to human activity and adversity of urbanisation. And from rapid growth and high reproductive rates (Shine et al., 1996).

Distribution

Distribution areas often change according to the environment suitable for the lizard. With the changing environment water monitors, therefore, chose living areas, sunbathing, resting and foraging areas according to the environment that was conducive to life. Distribution of dogs within Kasetsart University Bangkhen Campus, therefore, changes in each survey year. But it's a small change, in areas with high prevalence, it is still very abundant. Only the order of abundance has changed. But it is still the same area that is very abundant. And in areas where water monitors are not found there is still no change in that area.

However, the tendency of water monitors to increase in population size may lead to problems between humans and water monitors in the future. To avoid or reduce problems that may arise, therefore, there should be a study, survey and planning for a water monitor management project within the area of KUBC. If such a plan or project had already been made, this area could be an example area for water monitor management in various parks scattered throughout Bangkok with the problem of overpopulation exceeding their carrying capacity.

Conclusion

From surveys during 2012, 2018, and 2021, water monitors found that the population was abundant. and increased density Although the live trap survey method had a relatively constant abundance of 40%, 34.29% and 38.09%, the line transect survey method can see that the abundance increased clearly, namely 88.9%, 93.3 and 100% respectively, and from the population survey It was found that the population size increased to 36, 44, and 101 water monitors, respectively, and the density increased to 0.26, 0.32, and 0.74 water monitors/hectare, respectively.

Acknowledgements

The Department of Forest Biology, Faculty of Forestry, Kasetsart University, Bangkok, Thailand provided supporting material and advice. The Faculty of Environment, Kasetsart University provided the noise and air pollution data. Various people made useful contributions to data collection and on this project generally.

References

Bernett, D. (1995) *A little book of monitor lizards*. Aberdeen Viper Press, Aberdeen.

Cota, M. I. C. H. A. E. L., Chan-Ard, T. A. N. Y. A., & Makchai, S. U. N. C. H. A. I. (2009). Geographical distribution and regional variation of Varanus salvator macromaculatus in Thailand. *Biawak*, 3(4), 134-143.

Cota, M. I. C. H. A. E. L. (2011). Burrows with submerged and water filled entrances and nocturnal retirement of Varanus salvator macromaculatus in Thailand. *Biawak*, 5(3), 44-47.

Jessop, T. S., Sumner, J., Rudiharto, H., Purwandana, D., Imansyah, M. J., & Phillips, J. A. (2004). Distribution, use and selection of nest type by Komodo Dragons. *Biological Conservation*, 117(5), 463-470.

Karunarathna, S., Surasinghe, T., Madawala, M., Somaweera, R., & Amarasinghe, A. T. (2017). Ecological and behavioural traits of the Sri Lankan water monitor (Varanus salvator) in an urban landscape of Western Province, Sri Lanka. *Marine and Freshwater Research*, 68(12), 2242-2252.

Jančúchová-Lásková, J., Landová, E., & Frynta, D. (2015). Are genetically distinct lizard species able to hybridize? A review. *Current Zoology*, 61(1), 155-180.

Lauprasert, K. (1999) *Species diversity, distribution and morphological difference of monitor lizard (Family Varanidae) in southern Thailand* [Master's thesis, Chulalongkorn

University]. CU. ScholarWorks. Thai Thesis Database. http://thaithesis.org/detail.php?id=1082542001269

Groombridge, B. & Luxmoore, R. A. (1990) *Asian Monitor Lizards*. Lausanne, CITES.

Huo, X., Kunya, K., Ritthijan, N., Lohtongkam, P., Sukwan, C., Wongma, S., ... & Kumroptanasan, P. (2024). A preliminary study of the effects of enrichment on the activity and spatial distribution of captive monitor lizards in Nakhon Ratchasima Zoo, Thailand: https://doi. org/10.12982/VIS. 2024.015. Veterinary Integrative Sciences, 22(1), 193-2.

Napassanan, P. (2005) *Knowing about wild animals*. Reptile series. Banbooks Publishing House, Bangkok. [in Thai]

Panthep R. (2000) *Wildlife Party* (1 st ed.). edition. Phakthas Publishing House, Bangkok. [in Thai]

Piskurek, O., & Okada, N. (2007). Poxviruses as possible vectors for horizontal transfer of retroposons from reptiles to mammals. *Proceedings of the National Academy of Sciences*, 104(29), 12046-12051.

Randow, H. (1932). Fauna und Flora von Dehiwala auf Ceylon. *Wochenschrift für Aquarien-und Terrarienkunde*, 29(47), 471-473.

Shine, R., Harlow, P. S., & Keogh, J. S. (1996). Commercial harvesting of giant lizards: the biology of water monitors Varanus salvator in southern Sumatra. *Biological Conservation*, 77(2-3), 125-134.

Shine, R., & Harlow, P. S. (1998). Ecological traits of commercially harvested water monitors, Varanus salvator, in northern Sumatra. *Wildlife Research*, 25(4), 437-447.

Thompson, G. G., & Pianka, E. R. (2001). Allometry of clutch and neonate sizes in monitor lizards (Varanidae: Varanus). Copeia, 2001(2), 443-458.

Trivalairat, P., & Srikosamatara, S. (2022). Daily activities and population of water monitors (Varanus salvator (Laurenti, 1768)) in urban wetland, Bangkok, Thailand. ARPHA Preprints, 3, e93504.