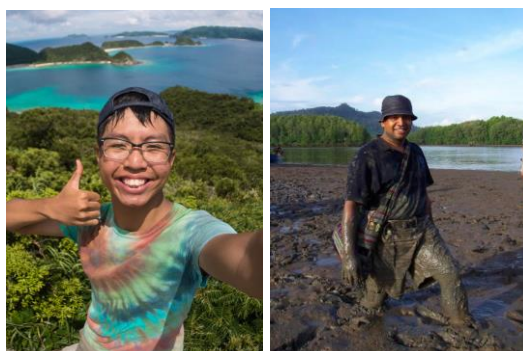


## REPORT

# OBSERVATIONS OF THE VARIATION IN GROUP STRUCTURE OF TWO URBAN SMOOTH-COATED OTTER *Lutrogale perspicillata* GROUPS IN THE CENTRAL WATERSHED OF SINGAPORE

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### ABSTRACT

The population and distribution of the smooth-coated otter *Lutrogale perspicillata* in Singapore have increased since 1998. In recent years, the species has established itself in urban areas with high human exposure within the Central Watershed of Singapore. The ease of following *L. perspicillata* in such areas has facilitated the monitoring of two urban groups, allowing the temporal variation in their group structures to be scrutinized. Field observations from two studies, and observations from the ground between December 2014 and December 2017, were compiled. Breeding pairs from both groups each gave to a total of seven litters of pups, with a mean litter size of 4.86. A change in group behaviour from pre-pregnancy, pre-natal and to post-natal were observed. Natural mortality resulting from intraspecific aggression and other natural causes, and an instance of anthropogenic mortality, were observed. Wild records of parturition, litter size, movement pattern and mortality are rare for this species from anywhere in its world range.

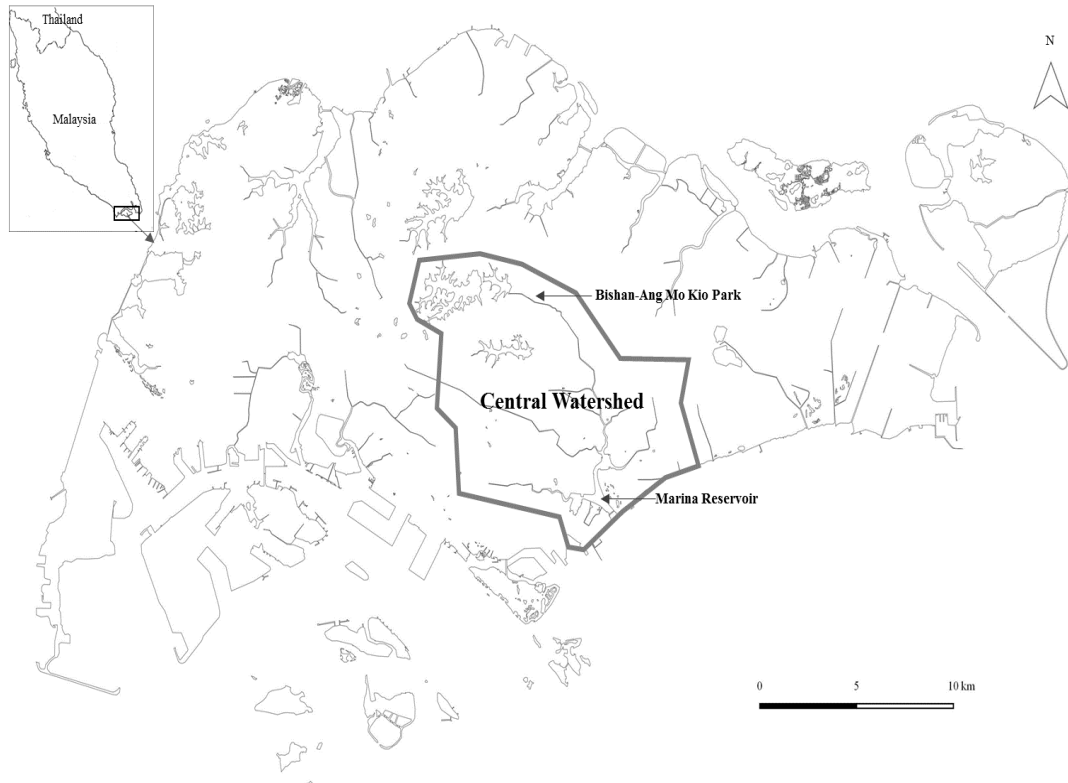
Key words: smooth-coated otters, Singapore, group structure, home range, breeding

### INTRODUCTION

The Smooth-coated otter *Lutrogale perspicillata* re-established itself in Singapore since 1998, after their apparent absence from the country for three decades (Theng and Sivasothi, 2016). Since then, the population of *L. perspicillata* has increased and its distribution has widened. This includes establishing in and adapting to urban areas with high human exposure, as observed nowhere else in the world (Theng and Sivasothi, 2016). Within these urban areas in Central Watershed of Singapore, the ease of following *L. perspicillata* has facilitated its monitoring compared with the challenges of such tracking for groups in wilder habitats. As such, the large numbers of records for two groups of urban *L. perspicillata* over the years allow temporal variation in group structures to be scrutinized.

## STUDY AREA

The Central Watershed of Singapore (Fig. 1) consists of a series of rivers that have been modified into stormwater channels and four reservoirs that drains (Public Utilities Board, n.d.). Two groups of *L. perspicillata* occupied the Central Watershed area during the study period. In 2014, one group established in Marina Reservoir (1.286°N, 103.8673°E), a freshwater estuarine reservoir created by barraging the river mouth. In 2015, second group established in Bishan-Ang Mo Kio Park (1.3634° N, 103.8436° E), an urban park with a naturalised river. The three kilometer stretch of river in this park was once a concrete canal, and was naturalised and de-concretised in 2012 to form a meandering river with vegetated banks (National Parks Board, 2018).



**Figure 1.** Map of Singapore showing the Central Watershed and the two areas where the two *L. perspicillata* groups established.

## METHODS

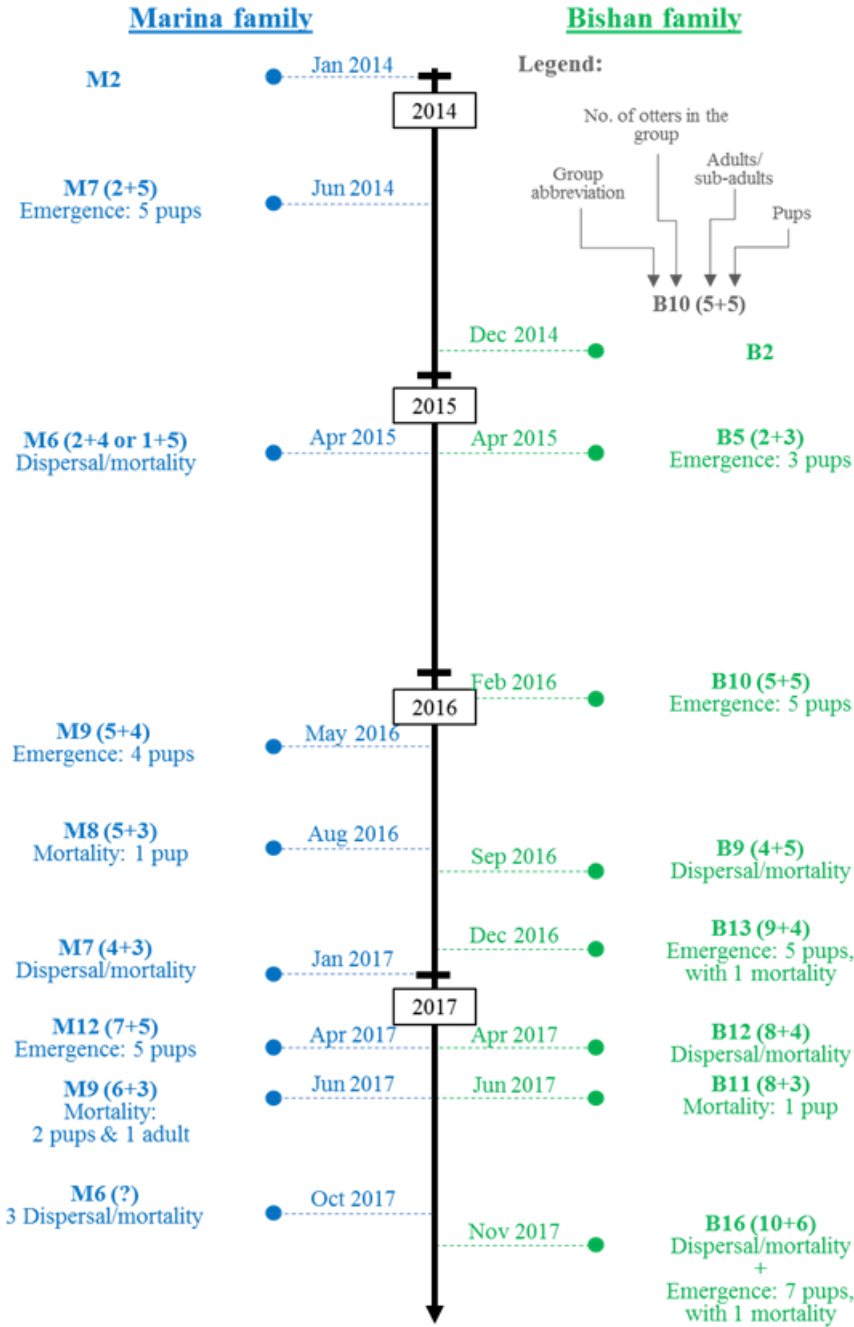
Observations from this study were mainly opportunistic observations from a home range and population structure of *L. perspicillata* study in June–December 2015 and August 2016 - April 2017. In addition, photographic and videographic records between December 2014 and December 2017 were compiled. The bulk of these records were obtained from a group of 15 otter enthusiasts and photographers, and were verified either by matching the observations to the photographic or videographic evidence, or through ground-truthing by the authors to ensure their accuracy.

## RESULTS

### Breeding activities

All emergence periods of the seven litters of pups from the natal holt occurred between November and June (Fig. 2), which suggests that parturition occurred between October and May, based on the six week pre-emergence period (see below).

Four of the interval periods between parturition were between ten months to 11 months, and one period was 48 months.



**Figure 2.** Timeline of the variation in group structure of Marina and Bishan *L. perspicillata* groups

**Litter sizes**

Breeding pairs from the Marina and Bishan groups gave birth to three and four litters respectively, with a mean litter size of  $4.86 \pm 0.459$  (SE) (n=7, range: 3-7).

**Differences in group behaviour between pre-pregnancy, pre-natal, and post-natal periods from four litters**

*L. perspicillata* groups were observed to typically travel and go on foraging trips as a whole group when none of the females in the group were pregnant. They

changed their holt frequently as well (at least once every three days). During the pre-natal stage (as observed by the increase in size of the females' belly), which lasts for approximately 62 days (Yadav, 1967; Desai, 1974), groups still travelled and foraged as a whole, but were observed to return to the same holt when the expected parturition date draws close. This is followed by a sudden change in group behaviour, where adults within the group no longer went on foraging trips as a whole, but at least one individual stayed in the natal holt at all times. When this change in group behaviour occurred, it was inferred that parturition have taken place. During the post-natal stages after parturition, pups remained in the natal holt for approximately 6 to 6.5 weeks before emergence. A week after emergence, pups were observed learning how to swim. Also, groups were observed shifting away from their natal holt. After the pups emerged, till they were approximately 10 weeks old, adults were observed to go on some foraging trips without pups and some foraging trips with part litters of pups. After the pups were 10 weeks old, the typical behaviour of the *L. perspicillata* group travelling in a group was resumed.

### **Mortality**

Mortality occurred for both natural and anthropogenic reasons. One form of natural mortality that occurred was intraspecific aggression. Three pups from the second and third litters of the Marina group, estimated to be between 3.5 to 4.5 months old, died due to intraspecific aggression between the Bishan and Marina groups. Another form of suspected natural mortality of a pup was where it was no longer recorded with the group after its litter's first emergence from the natal holt. This occurred in the third and fourth litters of the Bishan group. This was assumed to be natural mortality instead of anthropogenic because the holt was in a secluded area that is hard to be reached by humans. Lastly, suspected natural mortality of a male adult otter (estimated age: 7 years old) in the Marina group, suspected to be the alpha male, occurred. It was first observed to be straining during defecation, with blood in its spraints. Tests from its faecal blood sample did not reveal any infectious disease. The alpha male looked thin and sluggish, but still followed the group although it was barely keeping up. Regurgitation of food was observed six days after blood was observed in its spraints, and it disappeared (suspected mortality) from the group seven days after blood was first observed.

Only one case of anthropogenic mortality was recorded: this was for a seven-month-old pup from the Bishan group's third litter. It was found dead in a fishing bubu trap (Fig. 3) that was found floating in the water. A vet determined the pup to have died of heatstroke.

### **Dispersal**

Various times an adult or sub-adult *L. perspicillata* was recorded to have disappeared from each group permanently, but it was unclear when this was from dispersal and when from mortality. On two accounts of suspected dispersal, it was observed that the individual periodically left and joined the group for a few days or weeks before permanently leaving.

### **Movement patterns**

Movement patterns were categorised by Hussain and Choudhury (1995) into either small-scale movement for foraging in an area or extensive movement between foraging sites and holts. In this study, four accounts of long-distance movements in canalised rivers across large areas of each group's home range were recorded within a short time frame (Table 1).



**Figure 3.** The dead otter pup in a fishing bubu trap (Public Utilities Board, 2017)

**Table 1.** Records of long distance movements within short time frames for Marina and Bishan groups of Smooth-coated Otters *Lutrogale perspicillata*, Singapore.

Group name	Date	Group structure	Distance travelled (km)	Canalised river width (m)	Time taken	Average speed (km/hr)
Bishan	18 Dec 2015	Two adults, three 9.5-month-old pups	7.91	5 – 100	5hrs	1.58
	9 Jul 2016	Five adults, five six-month-old pups	8.97	5 – 100	11hrs 58mins	0.75
Marina	14 Dec 2016	Four adults, three 9.5-month-old pups	1.79	25 – 50	1hr 9mins	1.56
	1 Jun 2017	Seven adults, five three-month-old pups	3.3	25 – 50	1hr 30mins	2.20

## DISCUSSION

Records of parturition periods for *L. perspicillata* are rare, with these being the first in Singapore. In the National Chambal Sanctuary of India, Hussain (1993) recorded *L. perspicillata* to be a winter (October – February) breeder. In Bangladesh, two studies reported this species to be non-seasonal breeders instead (Feeroz et al., 2011). Singapore's seasons comprises of two main monsoon periods (December to early March (higher rainfall), and June to September (lower rainfall)) with inter-monsoon periods in between (Meteorological Service Singapore, n.d.). Hence, it is likely that *L. perspicillata* in Singapore are non-seasonal breeders as well since

current parturition periods (between October and May) falls within both monsoon and inter-monsoon periods.

The litter size of seven pups from the fourth litter of the Bishan group is the largest wild-born litter so far, with litter sizes of wild and semi-captive groups ranging between two and five (Hussain 1997; Feeroz et al., 2011). In captivity, there has been one record of seven pups in a litter: from Prague Zoo (Johnston, 2017).

After parturition, the time during which pups stay in their natal holt before emergence was similar to the only record available from a zoo, where pups emerged from the holt 1.5 months after parturition (Yadav, 1967). The change in group behaviour during pregnancy to post-natal stages, where the group sticks to a single holt, and all adults may not go on foraging trips together, may be used as an indicator where parturition has occurred.

Data on *L. perspicillata* movement are severely lacking, with only two studies on home range (in India and Malaysia) and one on movement pattern (in India) (Wayre, 1974; Hussain and Choudhury, 1995). Even then, the study on movement pattern recorded *L. perspicillata* as loners and duos, but not in any larger groups. The longest distance travelled by a group in this study, of 8.97 kilometers in under 12 hours, exceeds the longest distance recorded by a sub-adult male, of 7.75 kilometers (Hussain and Choudhury, 1995).

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## RÉSUMÉ

### **OBSERVATIONS SUR LA VARIATION DANS LA STRUCTURE DU GROUPE AU SEIN DE DEUX POPULATIONS DE LOUTRE À PELAGE LISSE *Lutrogale perspicillata* DANS LE BASSIN HYDROGRAPHIQUE CENTRAL DE SINGAPOUR**

La population et la distribution de la loutre à pelage lisse *Lutrogale perspicillata* est en augmentation depuis 1998. Ces dernières années, l'espèce a colonisé des zones urbaines fortement exposées à l'homme dans le bassin hydrographique central de Singapour. L'aisance du suivi *L. perspicillata* dans de telles zones a facilité le monitoring de deux groupes urbains, ce qui a permis de contrôler la variation temporelle de leurs structures de groupe. Nous avons compilé les observations de terrain des deux études et les observations au sol entre décembre 2014 et décembre 2017. Les couples reproducteurs des deux groupes ont donné chacun un total de 7 portées de loutrons, avec une portée moyenne de 4,86. Un changement dans le comportement du groupe a été observé avant la gestation, avant et après la naissance. Nous avons observé une mortalité naturelle résultant d'agression intraspécifique et d'autres causes naturelles, ainsi qu'un cas de mortalité lié à l'homme.

Des relevés dans le milieu naturel de la parturition, de la taille de la portée, du schéma de déplacement et de la mortalité sont rares pour cette espèce où que ce soit dans son aire de répartition mondiale.

## RESUMEN

### **OBSERVACIONES SOBRE LA VARIACIÓN EN LA ESTRUCTURA GRUPAL DE DOS GRUPOS URBANOS DE NUTRIA LISA *Lutrogale perspicillata* EN LA CUENCA CENTRAL DE SINGAPUR**

La población y la distribución de la nutria lisa *Lutrogale perspicillata* en Singapur, han aumentado desde 1998. En años recientes, la especie se ha establecido en áreas urbanas con alta exposición a los seres humanos, en la Cuenca Central de Singapur. La facilidad para seguir a *L. perspicillata* en tales áreas, permitió el monitoreo de dos grupos urbanos, permitiendo analizar a fondo la variación temporal en sus estructuras grupales. Compilamos las observaciones de terreno de dos estudios, y otras observaciones, entre Diciembre 2014 y Diciembre 2017. Las parejas reproductivas de ambos grupos, cada una dió a luz un total de siete camadas de crías, con un tamaño medio de camada de 4.86. Se observó un cambio en el comportamiento de grupo en la pre-preñez, pre-nacimiento y post-nacimiento. Observamos mortalidad natural resultante de agresión intraespecífica y otras causas naturales, y un caso de mortalidad antropogénica. Los registros en la naturaleza de partos, tamaño de camada, patrones de movimiento y mortalidad son raros para esta especie -en cualquier sector de su área mundial de distribución.