

Comparing Patrol-Based and Camera-Trap Mark-Resight Methods for Monitoring Population Size and Welfare in Free-Roaming Domestic Cats

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Introduction

- Free-roaming cats overpopulation is a global concern, affecting animal welfare, biodiversity, and public health.
- Trap-Neuter-Return (TNR) is widely implemented in many countries.
- Reliable monitoring tools are essential to assess population size, dynamics, demography, and welfare.

Study Aim

To compare two monitoring methods for evaluating a sterilized free-roaming cat population in a defined urban area:

Patrol-Based Physical Mark-Resight vs. Camera-Trap Virtual Mark-Resight regarding population size and dynamics, age and sex structure, reproductive status, body condition, and injuries.

Methods

Study Site

- Semi-closed university campus (Faculty of Agriculture, Rehovot, Israel)
- An established TNR-managed free-roaming cats colony

Monitoring Design (both methods)

- Monitoring over a year; series every 5 weeks
- Each monitoring series included two consecutive days; sunrise and sunset (four observation events per series)

Population Estimation

Lincoln-Petersen estimator

$$N = \frac{n_1 * n_2}{n_3}$$

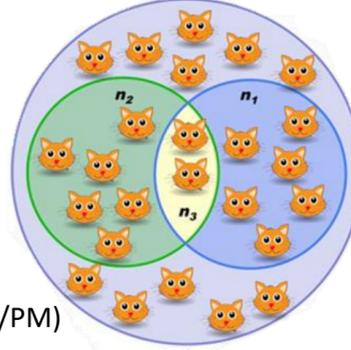
n_1 - Cats observed on Day 1

n_2 - Cats observed on Day 2 (AM/PM)

n_3 - Cats observed on both days

N - Mean population estimate

(calculated from morning and evening values)



Parameters Recorded (both methods)

- Number of cats
- Individual identification (coat pattern; scars; face shape)
- Age class (young/adult)
- Sex & Sterilization status (ear-tip mark)
- Body Condition Score (1, thin – 5, fat; Baldwin et al 2010)
- Injury score (1, healthy – 4, severe; Gunther et al 2018)

Patrol-Based Physical Mark-Resight

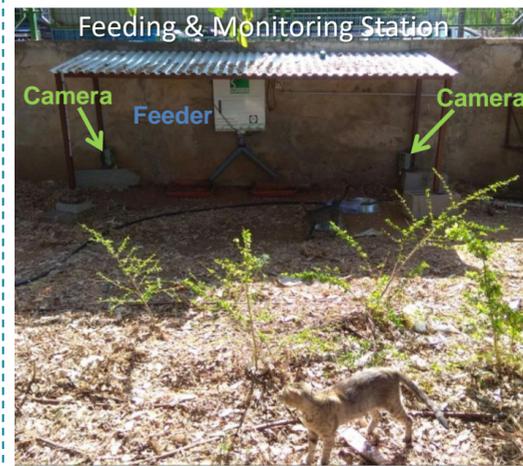


3 km fixed walking transect

Individual identification (coat pattern, scars, face shape)



Camera-Trap Virtual Mark-Resight



Automatic feeder (timer & control unit) commercial cat food at dawn & dusk

Motion-activated infrared cameras "Browning trail"



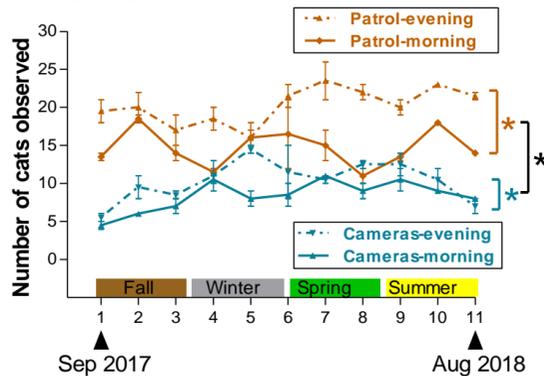
Images & Time-lapses

Individual identification

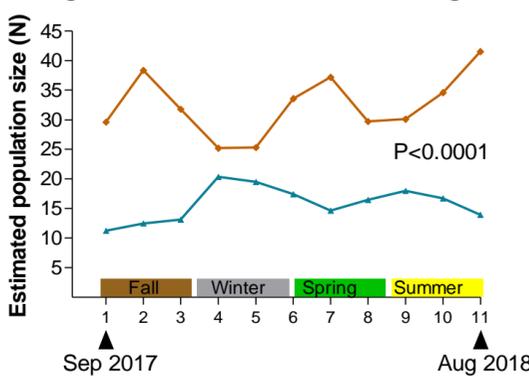


Results & Discussion

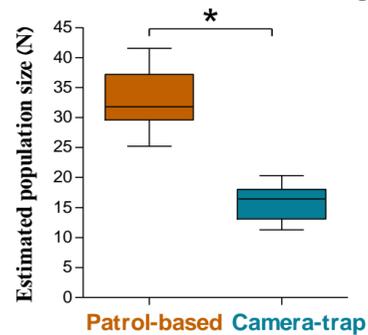
More individual cats observed in Patrol-Based Surveys; Higher detection at sunset vs. sunrise



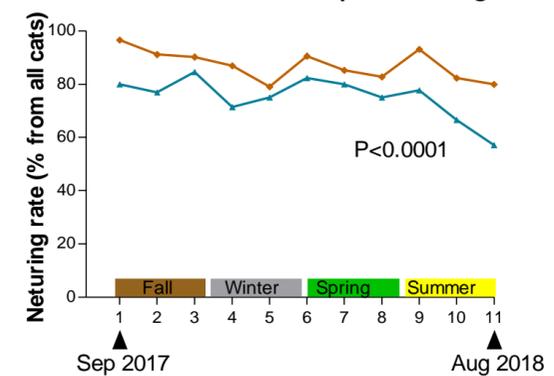
Estimated population size varied seasonally; Higher with Patrol-Based Mark-Resight



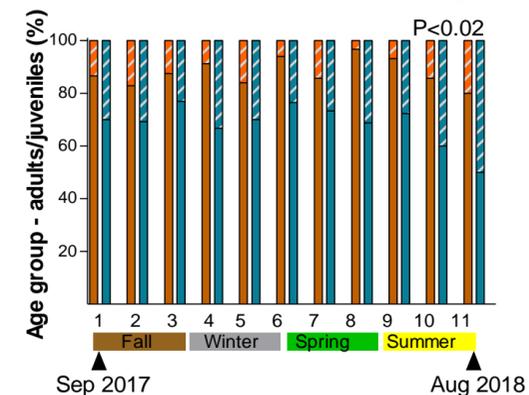
Higher annual population estimates in Patrol-Based Mark-resight



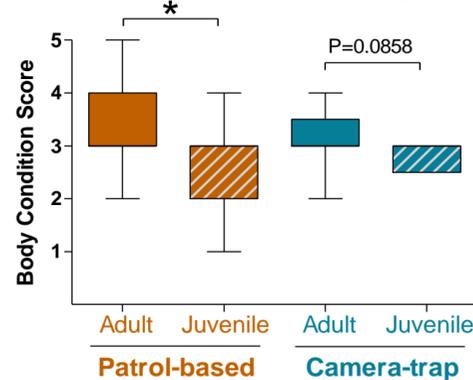
Patrol-Based recorded a higher neutering rate than Camera-Trap Mark-Resight



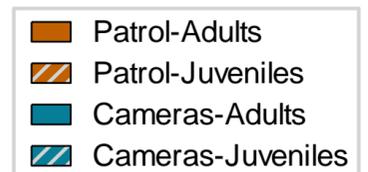
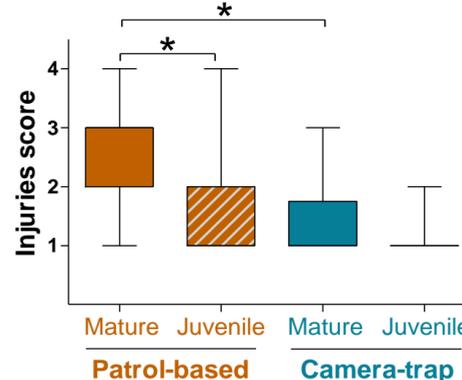
Camera-Trap detected more juveniles & fewer adults than Patrol-Based Mark-Resight



Juvenile cats had lower body condition scores than adults in both monitoring methods



Injury Scores were lower in juveniles; higher variability via Patrol-Based Mark-resight



Patrol surveys and camera traps offer complementary strengths; together they provide the most reliable assessment of TNR-managed colonies

Domain	Patrol-Based Physical Mark-Resight	Camera-Trap Virtual Mark-Resight
Field effort	High (trained personnel, patrols)	Moderate (installation + maintenance)
Coverage flexibility	High (adaptive routes and timing)	Limited to camera placement
Standardization	Moderate (observer-dependent)	High (automated, consistent sampling)
Animal-level assessment	Strong (direct welfare evaluation)	Limited (image-dependent)
Sensitivity to welfare indicators	High (BCS, injuries, behavior)	Moderate (restricted by image quality/angle)
Disturbance risk	Moderate	Minimal

Future Work

- Multi-station camera networks
- Automated image-recognition tools
- Long-term evaluation of TNR effectiveness
- Expansion to additional urban environments

Reference

- Baldwin, et al. (2010). *J Am Anim Hosp Assoc*, doi.org/10.5326/0460285
 - Gunther, I., Raz, T., & Klement, E. (2018). *Prev Vet Med* doi10.1016/j.pvetmed.2018.05.018
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- The authors declare no competing interests

