Refining Primate Community Monitoring through Multi-Method Approaches: A Case Study from West Bali National Park, Indonesia

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Monitoring primate communities in dense forest habitats is challenging due to rugged terrain, thick vegetation, and species-specific ecological traits—such as arboreality and activity patterns—that can bias survey results. As over two-thirds of primate species face extinction, it is crucial to identify the strengths and limitations of different survey techniques and explore their combined application to achieve comprehensive and accurate community monitoring. In West Bali National Park, Indonesia, we evaluated four survey methods—Line Transect Distance Sampling (LTDS; 224 km), Point Distance Sampling (PDS; 340 points), Non-Random PDS (Nr-PDS; 160 km of roads), and 34 ground-based camera traps (CT; 3094 camera days)—to estimate population density and occupancy of two sympatric species: the arboreal ebony langur (*Trachypithecus auratus*) and the semi-terrestrial long-tailed macaque (*Macaca fascicularis*). PDS and Nr-PDS proved unreliable, with the former yielding too few detections to support reliable density modelling and the latter significantly overestimating densities. LTDS yielded reliable density estimates for ebony langurs but underrepresented long-tailed macaques, which were seldom seen by observers despite their widespread presence ($\psi = 1$), as revealed by camera traps. CTs recorded a high volume of macaque detections, enabling robust density models. Although fewer in number, langur detections from CTs were sufficient for density estimation and uncovered presence in areas missed by LTDS, as well as rare ground-based behaviours. LTDS proved more effective for monitoring ebony langurs, and CT for long-tailed macaques, but their combined use provided the most complete picture of the local primate community. Depending on the ecology and behaviour of a species, specific methods may be more appropriate, but integrating complementary approaches improves community-level assessments and helps counteract method-specific biases. This integrated approach is also logistically practical, as CTs can be installed along transects and maintained during LTDS replicates. These results underscore the value of combining complementary methods to improve monitoring across species with diverse ecological traits and to guide more effective conservation strategies.