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Trends in Leopard Cat (*Prionailurus bengalensis*) Research through Co-word Analysis

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Abstract

This study aims to explore the knowledge structure of the leopard cat (*Prionailurus bengalensis*) research during the period of 1952-2017. Data was collected from Google Scholar and Research Information Service System (RISS), and a total of 482 author keywords from 125 papers from peer-reviewed scholarly journals were retrieved. Co-word analysis was applied to examine patterns and trends in the leopard cat research by measuring the association strengths of the author keywords along with the descriptive analysis of the keywords. The result shows that the most commonly used keywords in leopard cat research were Felidae, Iriomte cat, and camera trap except for its English and scientific name, and camera traps became a frequent keyword since 2005. Co-word analysis also reveals that leopard cat research has been actively conducted in Southeast Asia in conjugation with studying other carnivores using the camera traps. Through the understanding of the patterns and trends, the finding of this study could provide an opportunity for the exploration of neglected areas in the leopard cat research and conservation.

Key Words: Leopard cat, *Prionailurus bengalensis*, keyword network analysis, co-word analysis, keyword co-occurrence

Introduction

Co-word analysis, also called Keyword Network Analysis (KNA) analysis, measures the association strengths of terms and represents information from words into a specific visual (Callon et al. 1983; Ding et al. 2001; Callon et al. 1983; van den Besselaar and Heimeriks 2006). It has been used to explore the concept network in various fields such as engineering, medicine, environment research (Law et al. 1988; Law and Whittaker 1992; Cambrosio et al. 1993; Rikken et al. 1995; Coulter et al. 1998; Lee and Jeong 2008). It assumes that keywords contain the scientific concept, idea, and knowledge and sufficiently cover the description of their contents and links that papers address (Cambrosio et al. 1993).

In this study, we applied co-word analysis to explore the patterns and trends in the research of leopard cat (*Prionailurus bengalensis*), one of the most widely distributed, but relatively neglected, wild small cats. In spite of the wide range from the Russian Far East over the Korean Peninsula, throughout Southeast Asia and into India, the leopard cat has suffered from habitat loss, poaching and conflict with a

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human in human-dominated landscapes (Nowell and Jackson 1996; Rajaratnam et al. 2007; Ross et al. 2015). In some countries including Korea, Japan and Taiwan, the leopard cat has been included in the endangered species list and nationally protected (Izawa et al. 2009; Ministry of Environment 2015; Chen et al. 2016). Through this study, we aim to understand the fundamental information of leopard cat research patterns and trends and thus help to develop robust conservation and research strategies.

Materials and Methods

We constructed the dataset for this study from the Google Scholar and Research Information Service System (RISS). We initially cached 2,810 publications written in either English or Korean covering the period of 1952-2017 using the keywords, 'Priomailurus bengalensis' and 'leopard cat'. Then we restricted publications containing one of the searching keywords in the subject, keyword or abstract fields in peer-reviewed scholarly journals to capture the scholarly trends that have been validated by other scholars. Through the filtering, we selected 157 relevant papers, composed of 144 papers from international journals and 13 papers from Korean journals. Among 157 papers, we further excluded 32 papers, which did not contain author keywords. After the standardization of words such as changing plural forms to the singular form and capital letters to lowercase letters, we extracted 482 keywords. We divided the study period into 6 sub-periods, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2014, 2015-2017, in order to assess keyword changes over time. We did not include the period of prior to 1990 because there were only two papers available between 1952 and 1989. We then identified the most frequently used words for the whole period as well as 6 sub-periods. To explore the relationships among the keywords, we used NetMiner 4.2.2 (Cyram Inc., Seoul, Korea), a network analysis software specifically designed for exploratory analysis and visualization of network data. We measured the degree centrality, the number of ties that a node (here each keyword) has (Wasserman and Faust 1994). For mapping of the keyword co-occurrence based upon the degree centrality, we used keywords, which appeared more than once in the papers. In the map, the size of nodes presents the frequency of keywords and the thickness of links shows the degree centrality.

Results and Discussion

During the period 1952-2017, a total of 157 papers about the leopard cat were published in peer-reviewed journals. While the number of publications has increased over time, primarily since 2004, the first leopard cat paper was published not until 2008 in Korea (Fig. 1). We retrieved 482 unique keywords from 125 papers, which contained author keywords among the 157 papers. The occurrence frequency of each keyword varied from 1 to 38, and only 5 keywords had a frequency over 10. The most commonly used keywords in leopard cat research were *Felidae* (14 times), *Iriomte cat* (12 times), and *camera trap* (11 times) except for its English (*leopard cat*, 38 times) and scientific names (*Priomailurus bengalensis*, 28 times). According to the keyword frequency of 6 sub-periods, *camera traps, conservation,* and *endangered species* started frequently emerging since 2005. Based on the newly emerged keywords, it can be as-

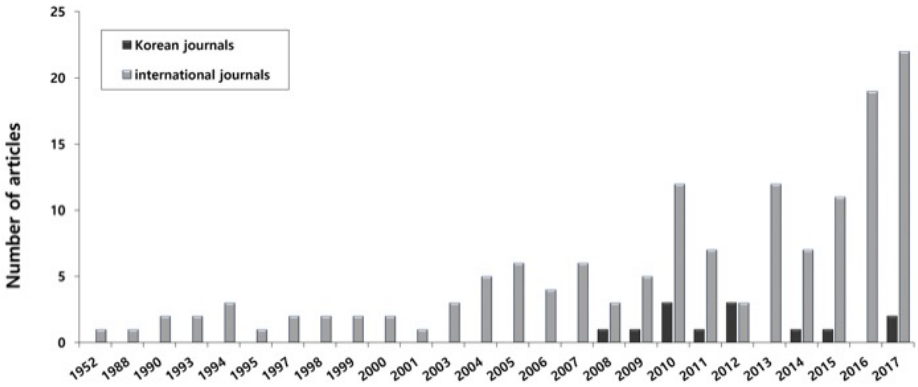

Fig. 1. Number of research articles published between 1952 and 2017.

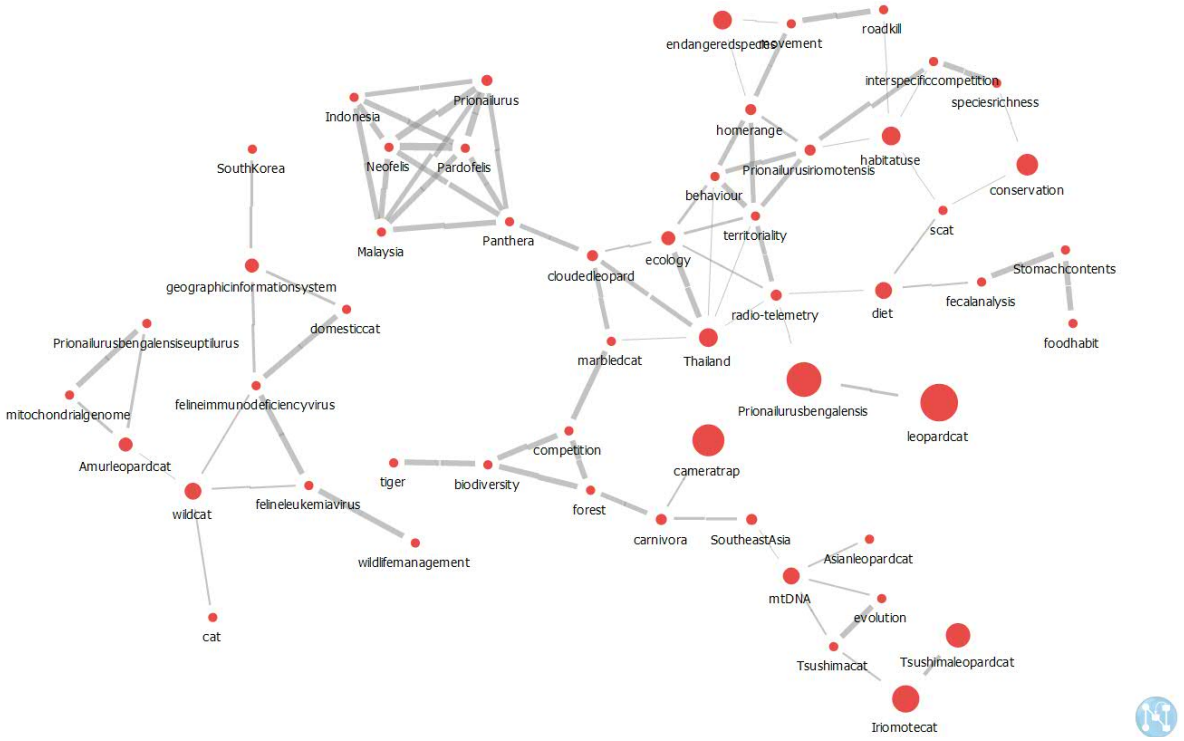

Fig. 2. A map of degree centrality of keywords.

sumed that camera traps have been a predominant tool in the leopard cat research and population of leopard cat could have decreased.

According to the co-ward analysis, there were 2 clusters formed in the leopard cat research, one related to disease and management and the other related to ecology and conservation (Fig. 2). The degree centrality map reflected that leopard cat research had been actively conducted in Southeast Asia in conjugation with studying other carnivores such as a clouded leopard (*Neofelis nebulosa*) and marbled cat (*Pardofelis marmorata*) using the camera traps. Furthermore, a radio-telemetry often has been used for the study of behavior and home range. Poaching and conflict with a human are major threats of leopard cats; on the contrary related keywords were not featured in the analysis. That is, while conservation has become one of the main issues, there may be lack of understanding of the direct threats.

In spite of the wide range, the number of published papers on leopard cats was very limited, especially comparing the research on big cats. With the limited number of papers available, however, our result confirmed that keyword Network Analysis is a useful tool to understand the overall trends in the leopard cat research. Through the understanding of the patterns and trends, the finding of this study also provides an opportunity for the exploration of neglected areas in the leopard cat research and thus helps to develop conservation and research strategies. Furthermore, this approach could be applied to a broader range of disciplines with readily available publication records to better understand trends and patterns that could impact research priorities.

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