A Taxonomy based Meta-analysis of Risk-sensitive Foraging Models from 1950 to Present

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Purpose

- Analysis of over 180 articles is being conducted related to risk-sensitive foraging in mammals, birds, reptiles, and arthropods. Articles span research conducted from 1950 to present.
- Articles will be coded to identify the primary models supported by research in addition to experimental methodologies using a formulaic ranking system.
- Primary goals include identifying trends between and within taxonomic categories in sensitivity, comparing different models of foraging (e.g., optimal foraging, daily energy budget, sequential choice, scalar expectancy theory), specimen origin (e.g., lab reared or wild caught), experimental location (e.g., field or lab), and deciphering key trends within the literature base.

Introduction

- ***Risk-Sensitive Foraging Theory (RSFT):*** Risk-sensitive Foraging Theory (RSFT) was developed to explain a forager's shift in choice between a variable (risk-prone) or constant (risk-averse) option. In typical RSFT studies, a risk-averse choice yields a constant return, whereas a risk-prone choice yields a variable return. If an organism displays a risk-prone or risk-averse choice bias, the organism is said to be risk-sensitive. Currently, three models have been used to describe changes in risk-sensitivity.
- ***Optimal Foraging Theory (OFT):*** OFT predicts that animals will utilize behavioral strategies that maximize energy intake per unit time spent foraging.
- ***The Daily Energy Budget Rule (DEB):*** DEB describes an animal in a caloric deficit, a negative energy budget, as risk-prone whereas a forager in a positive energy budget, a caloric surplus, will be risk-averse.
- ***Scalar Utility Theory (SUT):*** SUT predicts that when reward amount is manipulated, individual's will be risk-averse, but when delay to reward is manipulated, foragers become risk-prone.

Introduction (Continued)

- ***Sequential Choice Model (SCM):*** In a natural environment, animals are rarely presented with options simultaneously, rather patches are encountered sequentially. SCM states that sequential or forced choice trial latencies are predictive of a forager's choice when rewards are presented simultaneously. In addition, SCM predicts response latencies will be longer in forced choice trials and shorter in free choice trials.

Methodology

- Initial articles were found through searching databases with key words. Subsequent articles were found within these initial article references. This process gives us confidence that we possess all relevant articles (see figure 1).
- Each article is reviewed and coded for the information within the following table by two people.

Article Type	Experiment, Meta-analysis or Lit Review
Species	Genus species
Experiment Location	Lab or field
Animal Origin	Lab-reared or Wild-caught
N	Sample size used
Manipulation	Reward Amount, Reward Quality, Reward Delay, Effort
Risk Sensitivity	Yes or No
Result	Risk Prone, Risk Averse, Mixed
Optimal Foraging	Level of support: (0=none, 1=partial, 2=full)
Daily Energy Budget	Level of support: (0=none, 1=partial, 2=full)
Scalar Expectancy	Level of support: (0=none, 1=partial, 2=full)
Sequential Choice	Level of support: (0=none, 1=partial, 2=full)

Progress

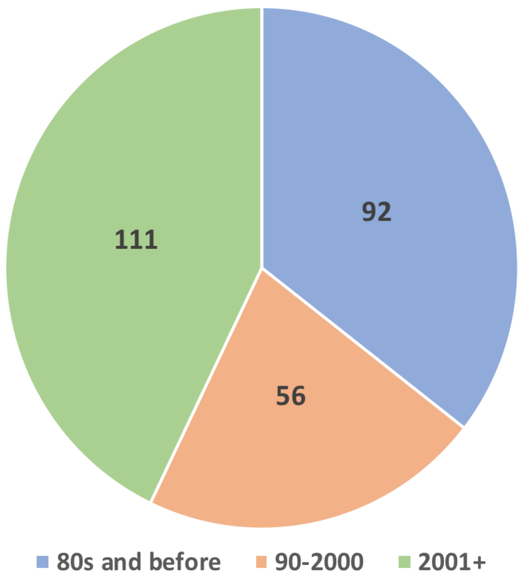

Figure 1. Number of articles found so far within each time period.

- We have finished our article search and believe we have cataloged all articles in the field.
- Our goal is to be finished coding all articles by the end of this quarter. We then can go on to analysis.

Discussion

- Implications of the meta-analysis will vary depending on results, however we expect to find a few key trends within the literature base.
- One potential trend is the relationship between species metabolic rate and foraging decisions. We expect species with higher metabolic rates will trend more towards DEB, while species with lower metabolic rates will trend towards SUC or SCM
- Another key area of interest is different species sensitivity to manipulation types. We may for example find that mammals are more sensitive to delay than amount in general. This would be consistent with recent findings from SPU's learning and behavior lab.