Received: 7 May 2025 | Revised: 19 September 2025 | Accepted: 23 October 2025

DOI: 10.1002/ecy.70296

DATA PAPER

ECOLOGY
ECOLOGICAL SOCIETY OF AMERICA

FracFeed: Global database of the fraction of feeding predators

Mark Novak[1] | **Paige Foust**[1] | **Shannon Hennessey**[1] | **Brian P. Tanis**[1] | **Kyle E. Coblentz**[1,2] | **Christopher Wolf**[3] | **Leah M. Segui**[1] | **Jeremy S. Henderson**[1] | **Kurt E. Ingeman**[1] | **Landon P. Falke**[1] | **Tamara J. Layden**[1] | **Daniel J. Gradison**[1] | **Zachary Randell**[1] | **Colin L. Harris**[1] | **Serena Lester**[1] | **Kira A. Naito**[1] | **Thanachot Nakata**[1] | **Grayden Nichols**[1] | **Benjamin C. Postma**[1] | **Rodrigo Alves**[1] | **Cheyenne N. Jarman**[1] | **Augustin R. Kalytiak-Davis**[1] | **Arina Martin**[1] | **Timeyin J. Pajiah**[1] | **Andrés Pinos-Sánchez**[4] | **Daniel L. Preston**[1,5,6]

[1]Department of Integrative Biology, Oregon State University, Corvallis, Oregon, USA

[2]Department of Biology, Colby College, Waterville, Maine, USA

[3]Department of Forest Ecosystems and Society, Oregon State University, Corvallis, Oregon, USA

[4]Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University, Corvallis, Oregon, USA

[5]Department of Fish, Wildlife and Conservation Biology, Colorado State University, Fort Collins, Colorado, USA

[6]Graduate Degree Program in Ecology, Colorado State University, Fort Collins, Colorado, USA

Correspondence
Mark Novak
Email: mark.novak@oregonstate.edu

Present addresses
Shannon Hennessey, NOAA Alaska Fisheries Science Center, Kodiak, Alaska, USA; Brian P. Tanis, Biology Program, Oregon State University-Cascades, Bend, Oregon, USA; Kyle E. Coblentz, School of Biological Sciences, University of Nebraska-Lincoln, Lincoln, Nebraska, USA; Kurt E. Ingeman, Environmental Studies Department, Linfield University, McMinnville, Oregon, USA; Landon P. Falke, Azura Consulting LLC Contractor for NOAA's Northeast Fisheries Science Center, Woods Hole, Massachusetts, USA; and Zachary Randell, Conservation Programs & Partnerships Department, Seattle Aquarium, Seattle, Washington, USA.

Funding information
Division of Environmental Biology, Grant/Award Number: DEB-1353827

Abstract

The proportion of individuals that are found to have empty stomachs during a survey of a predator population's diet has been used as an indicator of the average individual's state of energy balance and of the degree to which its feeding rate (i.e., its functional response) is saturated with respect to prey availability. As such, the proportion of empty stomachs provides insights into the effects of prey on predators and vice versa, although it is typically unreported in deference to descriptions of the contents of the non-empty stomachs. The *FracFeed* database is an ongoing compilation of the proportions of empty and non-empty stomachs (for gut content surveys) and of feeding and not feeding individuals (for direct observation surveys) reported in publications of predator diet surveys. *FracFeed* contains data from 4920 diet surveys on 1507 taxa (>4.3 million individuals) spanning cnidarians, ctenophores, chaetognaths, birds, annelids, amphibians, arthropods, mammals, mollusks, reptiles, echinoderms, and fishes that were surveyed in terrestrial, marine, and freshwater ecosystems across the globe over more than 135 years (1887–2023). For most surveys, covariate data include information on the spatial and temporal extent of the diet survey, its central geographical coordinates, the method by which the survey was performed (lethal gut contents, lavage, or

Handling Editor: Kathryn L. Cottingham

direct observation), as well as each predator's standardized taxonomic name and identifier in the Open Tree of Life, its body mass (compiled mostly from independent compilations and additional publications), and its apparent diet's taxonomic richness and resolution. We appeal to more researchers who perform diet surveys to report on the number of empty stomachs they find and encourage additional contributions to the database—particularly from underrepresented geographic regions (e.g., North and Central Asia, North and Central Africa)—to help grow its scope and utility. The database is provided under a CC-BY-NC-S4 4.0 license. Users are requested to cite this data paper when using the data.

KEYWORDS

body mass, energy balance, feeding success, functional response saturation, predator diet surveys, predator feeding surveys, proportion empty stomachs, running on empty, vacuity

DATA AVAILABILITY STATEMENT

The complete dataset is available as Supporting Information. Data are also available in Figshare at https://doi.org/10.6084/m9.figshare.13139705.v3.

ORCID

Mark Novak https://orcid.org/0000-0002-7881-4253
Shannon Hennessey https://orcid.org/0000-0002-6737-1362
Kyle E. Coblentz https://orcid.org/0000-0002-0069-8491
Kurt E. Ingeman https://orcid.org/0000-0002-0111-3619
Landon P. Falke https://orcid.org/0000-0001-6256-2306
Zachary Randell https://orcid.org/0000-0003-2342-1652
Daniel L. Preston https://orcid.org/0000-0002-0486-3466

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Novak, Mark, Paige Foust, Shannon Hennessey, Brian P. Tanis, Kyle E. Coblentz, Christopher Wolf, Leah M. Segui, et al. 2026. "*FracFeed*: Global Database of the Fraction of Feeding Predators." *Ecology* 107(1): e70296. https://doi.org/10.1002/ecy.70296

Title:

FracFeed: Global database of the fraction of feeding predators

Authors:

Mark Novak[1], Paige Foust[1], Shannon Hennessey[1,2], Brian P. Tanis[1,3], Kyle E. Coblentz[1,4,5], Christopher Wolf[6], Leah M. Segui[1], Jeremy S. Henderson[1], Kurt E. Ingeman[1,7], Landon P. Falke[1,8], Tamara J. Layden[1], Daniel J. Gradison[1], Zachary Randell[1,9], Colin L. Harris[1], Serena Lester[1], Kira A. Naito[1], Thanachot Nakata[1], Grayden Nichols[1], Benjamin C. Postma[1], Rodrigo Alves[1], Cheyenne N. Jarman[1], Augustin R. Kalytiak-Davis[1], Arina Martin[1], Timeyin J. Pajiah[1], Andrés Pinos-Sánchez[10], and Daniel L. Preston[1,11,12]

Author Affiliations:

[1] Department of Integrative Biology, Oregon State University, Corvallis, OR 97331, USA
[2] NOAA Alaska Fisheries Science Center, Kodiak, AK 99615, USA
[3] Biology Program, Oregon State University-Cascades, Bend, OR 97702, USA
[4] School of Biological Sciences, University of Nebraska-Lincoln, Lincoln, NE 68588, USA
[5] Department of Biology, Colby College, Waterville, ME USA
[6] Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR 97331, USA
[7] Environmental Studies Department, Linfield University, McMinnville, OR 97128, USA
[8] Azura Consulting LLC Contractor for NOAA's Northeast Fisheries Science Center, Woods Hole, MA 02543, USA
[9] Conservation Programs & Partnerships Department, Seattle Aquarium, Seattle, WA 98101, USA
[10] Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University, Corvallis, OR 97331, USA
[11] Department of Fish, Wildlife and Conservation Biology, Colorado State University, Fort Collins, CO 80523, USA
[12] Graduate Degree Program in Ecology, Colorado State University, Fort Collins, CO 80523, USA

Corresponding Author:

Mark Novak (mark.novak@oregonstate.edu)

Open Research statement:

The complete data set is available as Supporting Information and is also available on FigShare at https://doi.org/10.6084/m9.figshare.13139705 and on GitHub at https://github.com/marknovak/FracFeed_DB.

Abstract: The proportion of individuals that are found to have empty stomachs during a survey of a predator population's diet has been used as an indicator of the average individual's state of energy balance and of the degree to which its feeding rate (i.e. its functional response) is saturated with respect to prey availability. As such, the proportion of empty stomachs provides insights into the effects of prey on predators and vice versa, although it is typically unreported in deference to descriptions of the contents of the non-empty stomachs. The *FracFeed* database is an ongoing compilation of the proportions of empty and non-empty stomachs (for gut content surveys) and of feeding and not feeding individuals (for direct observation surveys) reported in publications of predator diet surveys. *FracFeed* contains data from 4920 diet surveys on 1507 taxa (> 4.3 million individuals) spanning cnidarians, ctenophores, chaetognaths, birds, annelids, amphibians, arthropods, mammals, molluscs, reptiles, echinoderms, and fishes that were surveyed in terrestrial, marine, and freshwater ecosystems across the globe over more than 135 years (1887-2023). For most surveys, covariate data includes information on the spatial and temporal extent of the diet survey, its central geographical coordinates, the method by which the survey was performed (lethal gut contents, lavage, or direct observation), as well as each predator's standardized taxonomic name and identifier in the Open Tree of Life, its body mass (compiled mostly from independent compilations and additional publications), and its apparent diet's taxonomic richness and resolution. We appeal to more researchers who perform diet surveys to report on the number of empty stomachs they find and encourage additional contributions to the database — particularly from underrepresented geographic regions (e.g., North and Central Asia, North and Central Africa) — to help grow its scope and utility. The database is provided under a CC-BY-NC-S4 4.0 license. Users are requested to cite this data paper when using the data.

Keywords: *Predator diet surveys, predator feeding surveys, proportion empty stomachs, feeding success, energy balance, functional response saturation, running on empty, vacuity, body mass.*

Metadata S1

Class I. Data Set Descriptors

A. Data set identity:

FracFeed: Global database of the fraction of feeding predators

B. Data set identification code:

FracFeed_Data.csv

FracFeed_Data_Metadata.csv

FracFeed_Citations.csv

FracFeed_Citations_BodyMass.csv

C. Data set description

1. Originators:

Mark Novak, Shannon Hennessey, Brian P. Tanis, Kyle E. Coblentz, Christopher Wolf, Leah M. Segui, Jeremy S. Henderson, Kurt E. Ingeman, Landon P. Falke; Daniel L. Preston.

2. Abstract:

The proportion of individuals that are found to have empty stomachs during a survey of a predator population's diet has been used as an indicator of the average individual's state of energy balance and of the degree to which its feeding rate (i.e. its functional response) is saturated with respect to prey availability. As such, the proportion of empty stomachs provides insights into the effects of prey on predators and vice versa, although it is typically unreported in deference to descriptions of the contents of the non-empty stomachs. The *FracFeed* database is an ongoing compilation of the proportions of empty and non-empty stomachs (for gut content surveys) and of feeding and not feeding individuals (for direct observation surveys) reported in publications

of predator diet surveys. *FracFeed* contains data from 4920 diet surveys on 1507 taxa (> 4.3 million individuals) spanning cnidarians, ctenophores, chaetognaths, birds, annelids, amphibians, arthropods, mammals, molluscs, reptiles, echinoderms, and fishes that were surveyed in terrestrial, marine, and freshwater ecosystems across the globe over more than 135 years (1887-2023). For most surveys, covariate data includes information on the spatial and temporal extent of the diet survey, its central geographical coordinates, the method by which the survey was performed (lethal gut contents, lavage, or direct observation), as well as each predator's standardized taxonomic name and identifier in the Open Tree of Life, its body mass (compiled mostly from independent compilations and additional publications), and its apparent diet's taxonomic richness and resolution. We appeal to more researchers who perform diet surveys to report on the number of empty stomachs they find and encourage additional contributions to the database — particularly from underrepresented geographic regions (e.g., North and Central Asia, North and Central Africa) — to help grow its scope and utility. The database is provided under a CC-BY-NC-S4 4.0 license. Users are requested to cite this data paper when using the data.

D. Key words/phrases:

Predator diet surveys, predator feeding surveys, proportion empty stomachs, feeding success, energy balance, functional response saturation, running on empty, body mass.

Class II. Research origin descriptors

A. Overall project description:

1. Identity:

   FracFeed is an ongoing compilation of published predator diet surveys that report on the proportion of "empty stomachs" or "not feeding individuals" (and thereby the *Frac*tion of *Feed*ing individuals).

2. Originators:

   See above.

3. Period of study:

   The compiled surveys span the period 1887 to 2023 (Fig. 1).

4. Objectives:

   The database was compiled to assess taxonomic, spatial, and temporal patterns in the proportions of individuals that were found to have empty stomachs (or to not be feeding) during diet surveys of predator populations. Although subject to several potential sources of bias (e.g., Vinson and Angradi 2011), the proportion of individuals with empty stomachs is considered to reflect the average individual's state of energy balance (Huey et al. 2001) and the degree to which its feeding rate (i.e. its functional response) is saturated with respect to prey availability (Coblentz et al. 2025).

5. Abstract:

   See above.

6. Sources of funding:

   Compiling of the studies was initiated under National Science Foundation award DEB-1353827. The involvement of several contributors was made

possible by Oregon State University's URSA Engage Program for undergraduate research and the OSU College of Science Research and Innovation Seed (SciRIS) Program (https://beav.es/ihi).

B. Specific subproject description

1. Site description

a. Site type:

The dataset includes surveys conducted in marine, freshwater (lotic and lentic), and terrestrial ecosystems (Fig. 2).

b. Geography:

The compiled surveys were performed across the globe (see Fig. 3).

c. Habitat:

Not applicable

d. Geology, landform:

Not applicable

e. Watersheds, hydrology:

Not applicable

f. Site history:

Not applicable

g. Climate:

Not applicable

2. Experimental or sampling design

    a. Design characteristics:

    Not applicable

    b. Permanent plots:

    Not applicable

    c. Data collection period, frequency, etc.:

    Not applicable

3. Research methods

    a. Field/laboratory:

    Not applicable

    b. Instrumentation:

    Not applicable

    c. Taxonomy and systematics:

    The compilation includes surveys of Cnidarians, Ctenophores, Chaetognaths, Birds, Annelids, Amphibians, Arthropods, Mammals, Molluscs, Reptiles, Echinoderms, and Fishes (Fig. 4). Many taxa have been reclassified or renamed since the original publication of their survey. For taxonomic standardization, we resolved synonyms using the Open Tree of Life (Hinchliff et al. 2015, Michonneau et al. 2016), ReptileDatabase (Uetz et al. 1996), WoRMS (Horton et al. 2018), FishBase (Froese and Pauly 2025, Houde et al. 1993), or by online searches using GoogleScholar and Google. (The variable “ott_id” in *FracFeed_data.csv* refers to each taxon’s unique identifier in the Open Tree of Life.)

d. Permit history:

Not applicable

e. Legal/organizational requirements:

Not applicable

4. Project personnel:

Not applicable

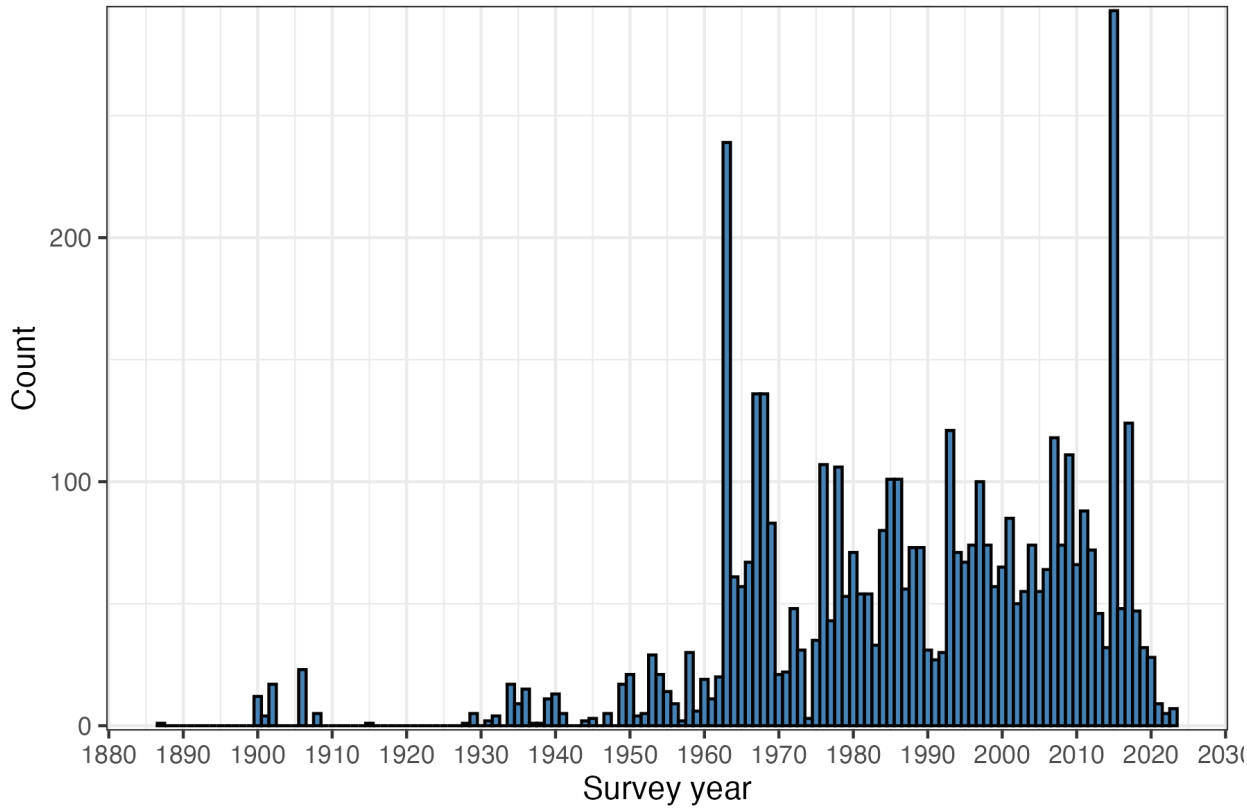

Figure 1. Frequency of surveys by year.

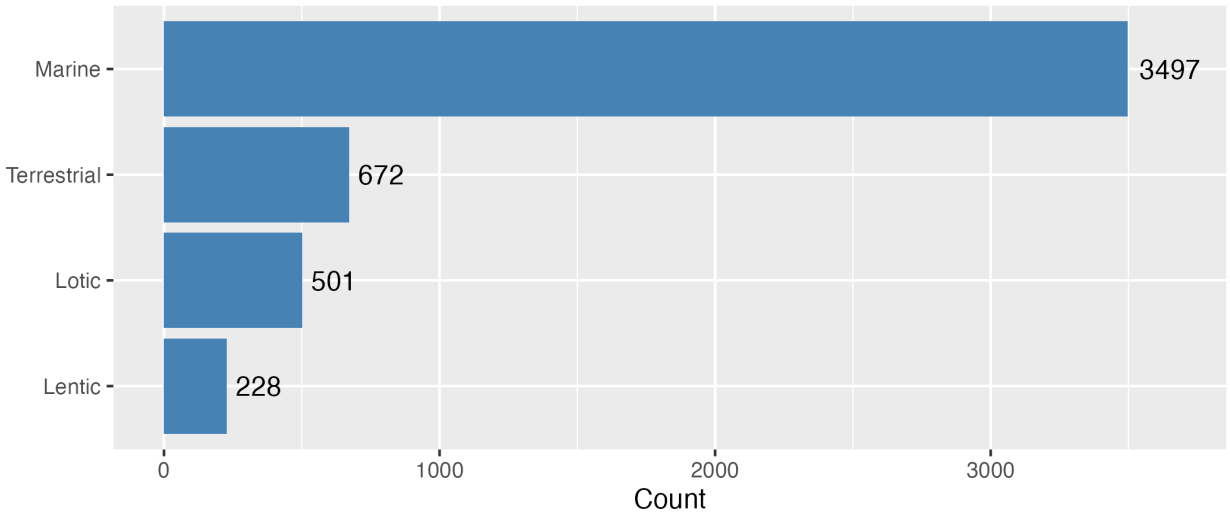

Figure 2. Frequency of surveys by ecosystem.

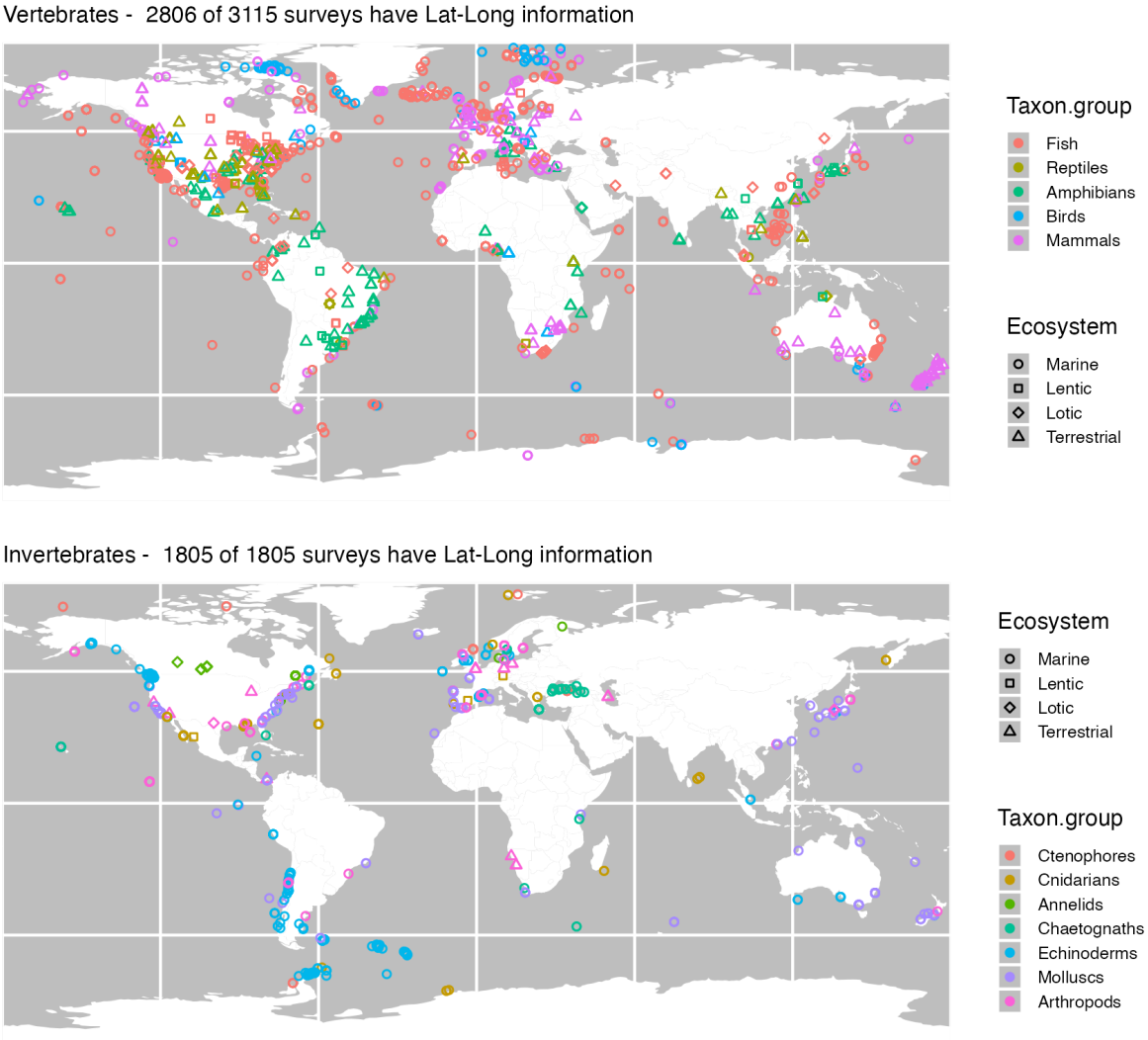

Figure 3. Global distribution of surveys represented by each survey's spatial midpoint.

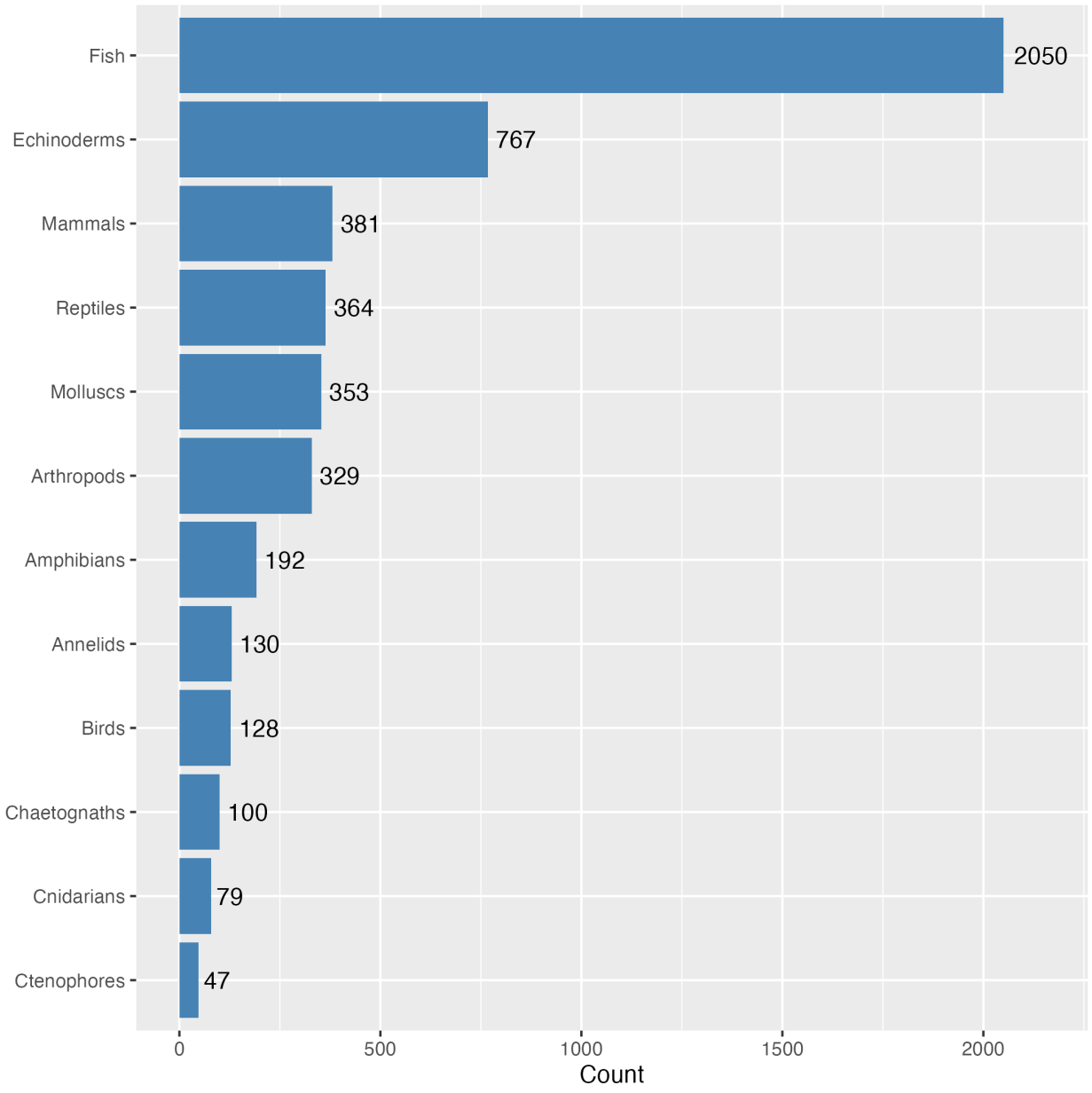

Figure 4. Frequency of surveys by taxonomic group.

Class III. Data set status and accessibility

A. Status

1. Latest update:

   September 2025

2. Latest archive date:

   September 2025

3. Metadata status:

   September 2025

4. Data verification:

   Data quality assurance checking completed.

B. Accessibility

1. Storage location and medium:

   FigShare at https://doi.org/10.6084/m9.figshare.13139705
   GitHub at https://github.com/marknovak/FracFeed_DB

2. Contact persons:

   Mark Novak, Oregon State University, Dept. of Integrative Biology
   mark.novak@oregonstate.edu

3. Copyright restrictions:

4. Proprietary restrictions:

    a. Release date:

        None

    b. Citation:

        Please cite this data paper when using its data in publications.

    c. Disclaimer(s):

        None

5. Costs:

        None

FracFeed

Class IV. Data structural descriptors

FracFeed_Data.csv contains the dataset. Each row represents a predator diet survey. The columns (with abbreviated column names) contain all associated identifiers and variables.

FracFeed_Data_Metadata.csv contains the descriptions of each of the abbreviated column names in *FracFeed_Data.csv* and includes information on whether the variable was entered manually or was generated/calculated by a script.

FracFeed_Citations.csv contains the citation information for the studies from which the diet surveys were extracted.

FracFeed_Citations_BodyMass.csv contains the citation information for the sources from which each predator taxon's body mass was obtained.

A. Data set file

1.

a. Identity:

FracFeed_Data.csv

b. Size:

24 columns and 4921 rows including header row, 1 MB.

c. Format and storage mode:

Comma-delimited csv

d. Header information:

See column descriptions in section B.

e. Alphanumeric attributes:

Mixed

f. Special characters/fields:

None

g. Authentication procedures:

None

Table 1. Description of the column contents within *FracFeed_Data.csv* (as also detailed in *FracFeed_Data_Metadata.csv*.)

Variable Abbreviation	Variable Name	Variable Description	Variable Values	Generated By Scripts
CiteID	CitationID	citation identifier	LastName_Year (e.g., Segui_2015a, Segui_2015b)	FALSE
ConID	Consumer.identity	species identity of focal consumer (genus for non-specific taxa)	Genus.species (as possible)	FALSE
ott_id	ott_id	tree of life identifier for consumer	*numeric*	TRUE
TSc	Total.stomachs.count	number of stomachs surveyed	*numeric*	FALSE
FSc	Feeding.stomachs.count	number of non-empty stomachs	*numeric*	TRUE
fF	Fraction.feeding	proportion of individuals with non-empty stomachs	*numeric* (0-1)	TRUE
TG	Taxon.group	taxon group of consumer	Amphibians, Annelids, Arthropods, Birds, Chaetognaths, Cnidarians, Ctenophores, Echinoderms, Fish, Mammals, Molluscs, Reptiles	FALSE
EE	EndoEcto	endothermic vs ectothermic	Endotherm, Ectotherm	TRUE
BM	BodyMass	consumer body mass (grams) (to 4 signif. digits)	*numeric*	TRUE
Eco	Ecosystem	ecosystem type in which survey was performed (Lentic = lakes, Lotic = rivers/streams)	Marine, Lotic, Lentic, Terrestrial	FALSE
Lat	Latitude	reported or mid-point latitude (decimal degrees to 2 dp)	*numeric*	FALSE
Lon	Longitude	reported or mid-point longitude (decimal degrees to 2 dp)	*numeric*	FALSE
TA	Time.averaging	how much time do diet data represent (i.e. their temporal extent) (rounded down to order of magnitude)	Decades, Years, Months, Days, Hours, Minutes	FALSE

FracFeed

Variable Abbreviation	Variable Name	Variable Description	Variable Values	Generated By Scripts
TAlog	Time.averaging.log	time averaging converted to hours and log10-transformed (to 3 signif. digits) assuming 30.44 days per month (e.g., TA = 'hours' => TAlog = log10(1) and TA = 'months' => TAlog = log10(24*30.44))	*numeric*	TRUE
SA	Space.averaging	how much space do diet data represent (i.e. their linear spatial extent) (rounded down to order of magnitude)	1000km, 100km, 10km, 1000m, 100m, 10m, 1m, 1cm, 1mm	FALSE
SAlog	Space.averaging.log	space averaging converted to meters and log10-transformed (e.g., SA = '1m' => SAlog = log10(1) and SA='10m' => SAlog = log10(10))	*numeric*	TRUE
Yr	Year	year in which survey was conducted (or the mid-point of a range of years)	*YYYY*	FALSE
DT	Date	date	*YYYY:MM:DD H:M:S*	TRUE
tWS	Days.since.winter.solstice	approximate number of days since last winter solstice	*numeric*	TRUE
FD	Feeding.data.type	method by which consumption was inferred (Gut content - lethal = dissection; Gut content - non-lethal = lavage)	Gut content (lethal), Gut content (non-lethal), Direct observation	FALSE
PS	Survey.population.split	whole-, sub-population or individual (eg. male/female, breeding/non-breeding, age, size, etc.)	Whole population, Sub-population, Individual	FALSE
PST	Subpopulation.type	(open list) e.g., male, female, adult, juvenile, breeding, non-breeding	*string*	FALSE
DR	Diet.richness.minimum	minimum number of distinct taxa recorded in diet (at whatever taxonomic resolution available, including mixed resolutions)	*numeric*	FALSE
Drc	Diet.resolution.coarsest	lowest resolution recorded in prey data (e.g., Phylum) (polyphyletic groups classified into lowest resolution taxonomic category possible)	Kingdom, Phylum, Class, Order, Family, Genus, Species	FALSE
Drf	Diet.resolution.finest	highest resolution recorded in prey data (e.g., Species)	Kingdom, Phylum, Class, Order, Family, Genus, Species	FALSE

2.

a. Identity:

FracFeed_Data_Metadata.csv

b. Size:

5 columns and 25 rows including header row, 3 KB.

c. Format and storage mode:

Comma-delimited csv

d. Header information:

See column descriptions in section B.

e. Alphanumeric attributes:

Mixed

f. Special characters/fields:

None

g. Authentication procedures:

None

Table 2. Description of the column contents within *FracFeed_Data_Metadata.csv.*

Variable Name	Variable Type	Variable Description	Example
VariableAbbreviation	String	Abbreviation of the variable	ConID
VariableName	String	Name of the variable	Consumer.identity
VariableDescription	String	Description of variable	Species identity of focal consumer
VariableValues	String	Possible variable values	numeric
GeneratedByScripts	Boolean	Whether variable was manually entered or generated by script	TRUE, FALSE

3.

a. Identity:

FracFeed_Citations.csv

b. Size:

3 columns and 640 rows including header row, 151 KB.

c. Format and storage mode:

Comma-delimited csv

d. Header information:

See column descriptions in section B.

e. Alphanumeric attributes:

Mixed

f. Special characters/fields:

None

g. Authentication procedures:

None

Table 3. Description of the column contents within *FracFeed_Citations.csv. The .bib* file of Bibtex citations is located in the /*bib* folder within the GitHub repository.

Variable Name	Variable Type	Variable Description	Example
CiteID	String	Unique citation identifier for source publication	Segui_2005
Bibcite	String	Bibtex cite key	\citep{Segui:2005aa}
Citation	String	Full citation of source publication	-

4.

a. Identity:

FracFeed_Citations_BodyMass.csv

b. Size:

3 columns and 305 rows including header row, 78 KB.

c. Format and storage mode:

Comma-delimited csv

d. Header information:

See column descriptions in section B.

e. Alphanumeric attributes:

Mixed

f. Special characters/fields:

None

g. Authentication procedures:

None

Table 4. Description of the column contents within *FracFeed_Citations_BodyMass.csv. The .bib* file of Bibtex citations is located in the /*bib* folder within the GitHub repository.

Variable Name	Variable Type	Variable Description	Example
CiteID	String	Unique citation identifier for source publication	Segui_2005
Bibcite	String	Bibtex cite key	\citep{Segui:2005aa}
Citation	String	Full citation of source publication	-

B. Variable information

1. Variable identity:

   See Tables 1-4

2. Variable definition:

   See Tables 1-4

3. Units of measurement:

   See Tables 1-4

4. Data type

   a. Storage type:

      See Tables 1-4

   b. List and definition of variable codes:

      See Tables 1-4

   c. Range for numeric values:

      See Tables 1-4

   d. Missing value codes:

      NA

   e. Precision:

      See Tables 1-4

5. Data format

    a. Fixed, variable length

        See Tables 1-4

    b. Columns:

        See Tables 1-4

    c. Optional number of decimal places

        See Tables 1-4

C. Data anomalies:

    None noted

Class V. Supplemental descriptors

A. Data acquisition

1. Data forms or acquisition methods:

We initially searched the ISI Web Of Knowledge database (Clarivate Analytics) for publications of predator diet surveys. We avoided keywords referring to, for example, "empty stomachs" to avoid potential biases. Our searches combined a set of generic terms with taxon-specific keywords. The generic terms were TS = ("*diet**" OR "*gut content*" OR "*stomach content**" OR "*feeding preference**" OR "*prey preference**" OR "*diet preference**" OR "*prey selection*" OR "*foraging ecology*" OR "*feeding ecology*" OR "*prey choice*" OR "*feeding habit**" OR "*prey composition**") and included additional terms to reduce the number of non-ecological publications (e.g., NOT SU = ("*nutrition dietetics*" OR *anthropology* OR "*agriculture dairy animal science*")). Taxon-specific terms (e.g., TS=(*echinoderm** OR *asteroid** OR *seastar** OR *starfish**)) were used to divide our search effort among co-authors. Additional studies were identified through cited references and on an *ad hoc* basis, including through Google Scholar and ResearchGate recommendation feeds. We did not include primarily parasitic, herbivorous, detritivorous, and omnivorous consumer species, restricting our dataset to predominantly predatory species (i.e. species consuming primarily live and countable prey animals).

All studies which provided the information necessary for estimating the proportion of feeding individuals fell into two categories: those that performed gut ("stomach") contents analysis and those that used "direct observation". The latter category was restricted—though not universal—to surveys of echinoderms (primarily sea stars), molluscs (primarily marine gastropod whelks), and terrestrial arthropods (spiders), and entailed the

systematic inspection of individuals to "catch them" in the active act of feeding (e.g., Paine 1966, Novak et al. 2017). For gut contents surveys (e.g., Huey et al. 2001, Preston et al. 2017), we distinguished between "lethal" and "non-lethal" (i.e. lavage) surveys and determined the proportion of feeding individuals from the reported proportion or from the number of non-empty stomachs using the total number of surveyed individuals when given. For surveys using direct observation, we determined the fraction of feeding individuals from the reported proportion, or the number of inspected individuals that were not handling prey using the total number of surveyed individuals when given.

When available, we extracted information on all covariates described in Table 1. For surveys whose (mid-point) dates were resolved to days or months, we estimated the number of days since the winter solstice (northern or southern hemisphere) as a continuous measure of season. This was only done for annual and decadal-scale studies when their surveys were consistently performed within the same seasonal time window of the year. Although the distinction between lotic and lentic freshwater ecosystems was relatively simple, we were unable to unambiguously distinguish benthic and pelagic foragers in marine environments, hence did not include this distinction in compiling studies.

The FracFeed database includes information extracted from two existing datasets on the proportions of empty stomachs found for lizards (Huey et al., 2001; 117 surveys) and fishes (Arrington et al., 2002; 190 surveys) whose authors summarized the surveys they had performed over their careers. For the fishes, we used RFishbase (Boettiger et al. 2012) to determine ecosystem type, collapsing "River" and "Lake" (Lentic) into "Freshwater" when a species was indicated as occurring in both. We collapsed "Sea", "Bay", "Gulf" and "Lagoon" into "Marine". We included only the insectivorous and piscivorous fishes, excluding omnivores, algivores, and detritivores as

categorized by Arrington et al. (2002). Omnivorous and herbivorous lizards as categorized by Huey et al. (2001) were also removed.

The predator taxon's body mass (in grams) was obtained from the original publication, unpublished primary data (MN), searches of the primary literature, published allometric relationships, and databases, with priority determined in that order when conflicts arose. Most mass data represent mean adult wet mass. For fishes for which Fishbase did not report mass but did report body length, we used the allometric coefficients of Froese et al. (2014) to convert length to mass. For lizards, we used the maximum snout-ventral lengths and allometric coefficients of Meiri (2018). Conflicts among published databases were resolved with priority given in the following order: Meiri (2018), Oliveira et al. (2017), Brown et al. (2018), Smith et al. (2003), Anderson et al. (2017), Gillooly et al. (2016), Jennings et al. (2002), Lislevand et al. (2007), Killen et al. (2016), Feldman et al. (2016), Tucker et al. (2014a, b), Hirt et al. (2017), Eklof et al. (2017), Cai et al. (2015), Animal Diversity Web (via Qaardvark), AnAge (Tacutu et al., 2013), Fishbase (Froese and Pauly, 2025), Sealifebase (Palomares and Pauly, 2025), and DataRetriever (including mammal-life-hist, bird-size, home-ranges, amniote-life-hist, socean-diet-data, vertnet- amphibian, vertnet-reptiles; McGlinn et al. 2017). When a published database provided multiple adult body masses, we used their geometric mean.

2. Location of completed data forms:

   None

3. Data entry verification procedures:

   Ambiguity regarding a given publication's relevance or covariate information was resolved through review and discussion among co-authors. Data entry made use of GoogleSheets having column-specific data-validation rules and drop-down selection lists. The GoogleSheet also ensured that studies are not

erroneously entered more than once. All entries into the database were independently verified by a second author.

B. Quality assurance/quality control procedures:

A series of R scripts was used for quality insurance, ensuring that there are no duplicate entries and, for example, that entered numerical values are positive were required, that *Empty.stomach.count/Total.stomach.count* = 1-*Percent.feeding.given*, and that $0 \leq$ *Fraction.feeding* ≤ 1. A series of data visualizations was used to scan for outliers, incorrect latitude-longitude entries, etc.

C. Related materials:

None

D. Computer programs and data-processing algorithms:

The /*R* folder within the GitHub repository contains a suite of R scripts for taxonomic standardization, data checking, and simple data visualization.

E. Archiving

1. Archival procedures:

FigShare at https://doi.org/10.6084/m9.figshare.13139705

2. Redundant archival sites:

GitHub at https://github.com/marknovak/FracFeed_DB

F. Publications and results:

None

G. History of data set usage

1. Data request history:

   None

2. Data set update history:

   None

3. Review history:

   None

4. Questions and comments from secondary users:

   None

H. Potential biases

The compiled surveys are not free of spatial biases and omissions reflective of the biases and omissions of an English scientific literature that is dominated by studies conducted in Western Europe and North America. The surveys are also not free of biases associated with potential spatial, temporal, and taxonomic differences in scientific interests and sampling methods.

I. Acknowledgements

We wish to thank the authors of all included studies for reporting on the number of empty stomachs they found, rather than discarding this information to focus solely on the contents of the non-empty stomachs. MN is indebted to an anonymous reviewer of a previously-associated manuscript for their phenomenally meticulous assessment of a prior version of this database. We also thank Beatriz Werber, Samantha Sturman, and Jonathan Schwartz for their early involvement in the effort.

Literature Cited

Anderson, D. M. and J. F. Gillooly (2017). Physiological constraints on long-term population cycles: a broad-scale view. Evolutionary Ecology Research, 18(6), 693-707.

Arrington, D. A., K. O. Winemiller, W. F. Loftus, and S. Akin. (2002) How often do fishes "run on empty"? Ecology, 83(8):2145–2151.

Boettiger, C., D. T. Lang, and P. C. Wainwright (2012). rfishbase: exploring, manipulating and visualizing FishBase data from R. Journal of Fish Biology, 81(6), 2030-2039.

Brown, J. H., C. A. S. Hall, and R. M. Sibly (2018). Equal fitness paradigm explained by a trade-off between generation time and energy production rate. Nature Ecology & Evolution, 2(2), 262-268.

Cai, T., Z. Wen, Z. Jiang, and Y. Zhen (2025). Distinct latitudinal patterns of molecular rates across vertebrates. Proceedings of the National Academy of Sciences, 122(19):e2423386122.

Coblentz, K. E., M. Novak, and J. P. DeLong. (2025). Simple, universal rules predict trophic interaction strengths. Ecology Letters. 28(5):e70126.

Eklöf, J., Å. Austin, U. Bergström, S. Donadi, B. D. H. K. Eriksson, J. Hansen, and G. Sundblad (2017). Size matters: relationships between body size and body mass of common coastal, aquatic invertebrates in the Baltic Sea. PeerJ, 5, e2906.

Feldman, A., N. Sabath, R. A. Pyron, I. Mayrose, and S. Meiri (2016). Body sizes and diversification rates of lizards, snakes, amphisbaenians and the tuatara. Global Ecology and Biogeography, 25(2):187–197.

Froese R. and D. Pauly. (2025) FishBase: www.fishbase.org.

Froese, R., J. T. Thorson, and R. B. Reyes Jr. (2014). A Bayesian approach for estimating length-weight relationships in fishes. Journal of Applied Ichthyology, 30(1), 78--85.

Gillooly, J. F. J. P. Gomez, E. V. Mavrodiev, Y. Rong, and E. S. McLamore (2016). Body mass scaling of passive oxygen diffusion in endotherms and ectotherms. Proceedings of the National Academy of Sciences, 113(19):5340–5345.

Hinchliff, C. E., S. A Smith., J. F. Allman and K. A. Cranston (2015). Synthesis of phylogeny and taxonomy into a comprehensive tree of life. Proceedings of the National Academy of Sciences, 112(41), 12764-12769.

Hirt, M. R., W. Jetz, B. C. Rall, and U. Brose (2017). A general scaling law reveals why the largest animals are not the fastest. Nature Ecology \& Evolution, 1(8), 1116-1122.

Horton T., A. Kroh, S. Ahyong, et al. (2018) World Register of Marine Species (WoRMS) http://www.marinespecies.org.

Houde, E. D. and C. E. Zastrow (1993). Ecosystem-and taxon-specific dynamic and energetics properties of larval fish assemblages. Bulletin of Marine Science, 53(2), 290–335.

Huey, R. B. , E. R. Pianka, and L. J. Vitt. (2001) How often to lizards “run on empty”? Ecology, 82(1):1–7.

Jennings, S., J. K. Pinnegar, N. V. C. Polunin, and K. J. Warr (2002). Linking size-based and trophic analyses of benthic community structure.. Marine Ecology Progress Series, 226, 77-85.

Killen, S. S., D. S. Glazier, E. L. Rezende, T. D. Clark, D. Atkinson, A. S. T. Willener, and L. G. Halsey (2016). Ecological Influences and Morphological Correlates of Resting and Maximal Metabolic Rates across Teleost Fish Species. American Naturalist, 187(5), 592-606.

Lislevand, T., J. Figuerola and T. Székely (2007). Avian body sizes in relation to fecundity, mating system, display behavior, and resource sharing. Ecology, 88(6), 1605-1605.

McGlinn, D., H. Senyondo, S. Taylor, M. Pohlman, and E. White. (2017) rdataretriever: R Interface to the Data Retriever. R package version 1.0.0.

Meiri, S. (2018). Traits of lizards of the world: Variation around a successful evolutionary design. Global ecology and biogeography, 27(10), 1168-1172.

Michonneau, F., J. W. Brown and D. J. Winter (2016). {rotl}: an R package to interact with the Open Tree of Life data. Methods in Ecology and Evolution, 7(12), 1476-1481.

Novak, M., C. Wolf, K. E. Coblentz, and I. D. Shepard (2017). Quantifying predator dependence in the functional response of generalist predators. Ecology Letters, 20(6), 761-769.

Oliveira, B. F., V. A. Sao-Pedro, G. Santos-Barrera, C. Penone, and G. C. Costa (2017) AmphiBIO, a global database for amphibian ecological traits. Scientific Data, 4(1):170123.

Palomares M. L. D. and D. Pauly (2025) SeaLifeBase: www.sealifebase.org.

Paine, R. T. (1966). Food Web Complexity and Species Diversity. The American Naturalist, 100(910), 65--75.

Preston, D. L., J. S. Henderson, L. P. Falke, and M. Novak (2017). Using Survival Models to Estimate Invertebrate Prey Identification Times in a Generalist Stream Fish. Transactions of the American Fisheries Society, 146(6), 1303-1314.

Smith, F. A., S. K. Lyons, S. K. M. Ernest, K. E. Jones, D. M.Kaufman, T. Dayan, P. A.Marquet, J. H. Brown, and J. P. Haskell (2003). Body mass of late quaternary mammals (v.10.2). Ecology, 84(12), 3403--3403.

Tacutu, R., Craig, T., Budovsky, A., Wuttke, D., Lehmann, G., Taranukha, D., Costa, J., Fraifeld, V. E., de Magalhaes, J. P. (2013). Human Ageing Genomic Resources: Integrated

databases and tools for the biology and genetics of ageing. Nucleic Acids Research 41(D1):D1027-D1033

Tucker, M. A. and T. L. Rogers (2014a). Examining predator--prey body size, trophic level and body mass across marine and terrestrial mammals. Proceedings of the Royal Society B: Biological Sciences, 281(1797).

Tucker, M. A., T. J. Ord, & T. L. Rogers (2014b). Evolutionary predictors of mammalian home range size: body mass, diet and the environment. Global Ecology and Biogeography, 23(10), 1105-1114.

Uetz, P. and T. Etzold (1996). The EMBL/EBI reptile database. Herpetology Review, 27, 175.

Vinson, M. R. and T. R. Angradi (2011). Stomach emptiness in fishes: Sources of variation and study design implications. Reviews in Fisheries Science, 19(2):63–73.