Abundance data for invertebrate assemblages from intertidal mussel beds along the Atlantic Canadian coast

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Abstract

This data set describes the abundance of invertebrate taxa found in intertidal mussel beds along the Atlantic Canadian coast. The data resulted from a regional-scale study that investigated the effects of wave exposure on the richness and composition of invertebrate assemblages from intertidal mussel beds. Abundance data are provided for taxa representing the Annelida, Arthropoda, Bryozoa, Chordata, Cnidaria, Echinodermata, Mollusca, Nematoda, Nemertea, and Platyhelminthes. The data characterize mussel beds from wave-sheltered and wave-exposed locations spanning 315 km of coast. Univariate and multivariate analyses revealed that the compositional structure of these invertebrate assemblages differed markedly depending on wave exposure. Overall, this data set exhibits important properties that could make it useful to test broader ecological theory. Such properties include its taxonomic diversity, the possession of data for basal, intermediate, and top trophic levels, and the coverage of two extremes of environmental stress. Thus, areas of ecology that could experience advances using this data set are those concerning environmental stress models of community organization, abundance–occupancy relationships, species co-occurrence, species abundance distributions, dominance and rarity, spatial scales of population and community variation, and distribution of functional and phylogenetic diversity.

Key words: Abundance, diversity, ecosystem engineer, environmental stress, foundation species, intertidal, invertebrate, rocky shore, wave exposure.

METADATA

CLASS I. DATA SET DESCRIPTORS

A. Data set identity
Data on the abundance of invertebrate taxa from intertidal mussel beds along the Atlantic Canadian coast.

B. Data set identification code
One data file: `data.csv`

C. Data set description

1. Originators
Ricardo A. Scrosati. St. Francis Xavier University, Department of Biology, 2320 Notre Dame Avenue, Antigonish, Nova Scotia B2G 2W5, Canada.

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2. Abstract
This data set describes the abundance of invertebrate taxa found in intertidal mussel beds along the Atlantic Canadian coast. The data resulted from a regional-scale study that investigated the effects of wave exposure on the richness and composition of invertebrate assemblages from intertidal mussel beds. Abundance data are provided for taxa representing the Annelida, Arthropoda, Bryozoa, Chordata, Cnidaria, Echinodermata, Mollusca, Nematoda, Nemertea, and Platyhelminthes. The data characterize mussel beds from wave-sheltered and wave-exposed locations spanning 315 km of coast. Univariate and multivariate analyses revealed that the compositional structure of these invertebrate assemblages differed markedly depending on wave exposure. Overall, this data set exhibits important properties that could make it useful to test broader ecological theory. Such properties include its taxonomic diversity, the possession of data for basal, intermediate, and top trophic levels, and the coverage of two extremes of environmental stress. Thus, areas of ecology that could experience advances using this data set are those concerning environmental stress models of community organization, abundance–occupancy relationships, species co-occurrence, species abundance distributions, dominance and rarity, spatial scales of population and community variation, and distribution of functional and phylogenetic diversity.

D. Key words
Abundance, diversity, ecosystem engineer, environmental stress, foundation species, intertidal, invertebrate, rocky shore, wave exposure.

CLASS II. RESEARCH ORIGIN DESCRIPTORS

A. Overall project description

1. Identity

Data on the abundance of invertebrate taxa found in mussel beds from rocky intertidal habitats in Atlantic Canada.

2. Originators

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3. Period of study

We completed the field surveys between early September and early October 2012.

4. Objective

The original goal of the study that produced this data set was to investigate if the species composition of invertebrate assemblages living in intertidal mussel beds along the Atlantic Canadian coast depend on wave exposure. That study was part of the long-term research line on rocky intertidal ecology that defines the Marine Ecology Lab of St. Francis Xavier University. The results addressing that research question were published by Arribas et al. (2014), who concluded that wave exposure indeed has a large influence on such invertebrate assemblages. While the ecology of primary-space holders (algae and invertebrates attached to the intertidal substrate) from the NW Atlantic coast was relatively well known before our study (Menge 1978, Hunt and Scheibling 2001, Bertness et al. 2004, Lauzon-Guay et al. 2005, Tam and Scrosati 2011), a knowledge gap on even basic species composition existed for invertebrate assemblages within mussel beds. This knowledge gap was important to address because, as shown by Arribas et al. (2014), a high level of intertidal biodiversity unknown until then was ultimately revealed. Furthermore, Arribas et al. (2014) were able to identify these intertidal mussels as important foundation species whose conservation seems essential to preserve a level of invertebrate biodiversity that is even higher than levels previously known for invertebrate primary-space holders on this coast (Scrosati and Heaven 2007). As the data generated by Arribas et al. (2014) have properties relevant for broader areas of ecology, this Data Paper makes the full data set available for ecologists in general.

5. Abstract

See section I.C.2.

6. Sources of funding

Grants awarded to Ricardo A. Scrosati by:

Natural Sciences and Engineering Research Council (NSERC), 350 Albert St., 16th floor, Ottawa, Ontario K1A 1H5, Canada (Discovery Grant),

Canada Research Chairs (CRC) Program, 350 Albert St., 16th floor, P. O. Box 1610, Ottawa, Ontario K1P 6G4, Canada (Canada Research Chair Tier II Grant), and

Canada Foundation for Innovation (CFI), 230 Queen St., Suite 450, Ottawa, Ontario K1P 5E4, Canada (Leaders Opportunity Grant).

Canadian Bureau for International Education (CBIE), 220 Laurier West, Suite 1550, Ottawa, Ontario K1P 5Z9, Canada (Emerging Leaders of the Americas Program scholarship to support Lorena P. Arribas's work in Canada).

B. Specific subproject description

1. Site description

a. Site type

Wave-sheltered and wave-exposed rocky intertidal habitats.

b. Geography

We surveyed wave-sheltered and wave-exposed rocky intertidal locations spanning 315 km of the Atlantic coast of Nova Scotia, Canada. The wave-exposed locations face the open ocean directly, with no land visible from the shore: Coote Rock area (45° 10' 58" N, 61° 21' 12" W), Crystal Crescent Beach (44° 26' 51" N, 63° 37' 20" W), and Kejimkujik (43° 49' 7" N, 64° 50' 5" W). Values of daily maximum water velocity (a proxy for wave exposure) in wave-exposed habitats from this coast average 8 m s^{-1} (Scrosati and Heaven 2007), with peaks of 12 m s^{-1} (Hunt and Scheibling 2001). The wave-sheltered locations face land at distances between tens of m and a few hundreds of m, with no open waters visible from the shore: Gull Island Cove (45° 11' 18" N, 61° 21' 17" W), Casino Nova Scotia (44° 39' 7" N, 63° 34' 25" W), and Halifax Harbourfront (44° 38' 53" N, 63° 34' 13" W). Values of maximum water velocity in wave-sheltered habitats in this region average 4 m s^{-1} (Scrosati and Heaven 2007), with calm waters occurring frequently.

c. Habitat

Rocky intertidal zone.

d. Geology, landform

The studied biological communities occur on rocky intertidal substrate that regularly becomes exposed to the air during low tides.

e. Watersheds, hydrology

The studied locations are intertidal and, thus, located right on the sea shore.

f. Site history

The studied intertidal habitats are (very) rarely reached by humans.

g. Climate

The studied coast is washed by cold-temperate waters, although the most extreme values of temperature at the mid-intertidal zone (where we conducted our surveys) are reached during low tides in winter (-14 ℃; Scrosati 2011) and summer (24 ℃; Watt and Scrosati 2013).

2. Experimental or sampling design

a. Design characteristics

We used a 100-cm^2 square frame (quadrat) as the sampling unit. At each of the locations surveyed along the coast, we randomly determined the position of 15 quadrats following the coastline at the mid-intertidal zone on substrate areas where mussel cover was 100 % (i.e., areas where the substrate was not visible because it was fully covered by mussels). From each of the replicate quadrats, we collected all of the mussels and all of the invertebrates living on, and among, the mussels. See section II.B.3.a for details on the field work.

b. Permanent plots

Information on the position of each random quadrat was discarded after sample collection, but the geographic position of each surveyed location is indicated in section II.B.1.b for future reference.

c. Data collection period, frequency, etc.

See sections II.B.2.a and II.B.3.a.

3. Research methods

a. Field work

We conducted our field work during low tides to be able to collect the mussels and associated invertebrate assemblages with precision and in safe conditions. After randomly determining the position of the targeted 15 replicate quadrats at each surveyed location (see section II.B.2.a), we carefully removed all of the mussels that were attached to the substrate at each quadrat and the associated invertebrates found on, and among, the mussels. We stored the mussels and associated fauna collected from each quadrat in a separate plastic bag. Soon after, we transported the resulting bags in a cooler to the laboratory. We then stored the bags in a freezer until identification and counting of the associated invertebrates were done.

b. Instrumentation

We measured the abundance of invertebrate taxa collected from each replicate quadrat by counting the corresponding organisms under a laboratory microscope.

c. Taxonomy and systematics

We identified all invertebrates (> 0.5 mm) to the lowest possible taxonomic level (often species) using field guides (Knopf 1981, Gibson 2003) and a taxonomic key (Pollock 1998). We updated all species names in April 2020 using the World Register of Marine Species (WoRMS 2020).

d. Permit history
No collection permits were necessary.

4. Project personnel
The three authors of this Data Paper designed and conducted all of the the research that produced the attached data set.

CLASS III. DATA SET STATUS AND ACCESSIBILITY

A. Status

1. Latest update
April 2020

2. Latest archive update
April 2020

3. Metadata status
Compiled in April 2020.

4. Data verification
Taxonomic and abundance data were checked by the three authors in April 2020.

B. Accessibility

1. Storage location and medium
Data are saved in electronic spreadsheets in computers maintained by Ricardo A. Scrosati, Lorena P. Arribas, and Luigia Donnarumma.

2. Contact persons
Ricardo A. Scrosati. St. Francis Xavier University, Department of Biology, 2320 Notre Dame Avenue, Antigonish, Nova Scotia B2G 2W5, Canada. Phone: 1-902-867-5289. Fax: 1-902-867-2389. E-mail addresses: rscrosat@stfx.ca or scrosati@gmail.com

Lorena P. Arribas. Universidad Nacional de la Patagonia, Instituto de Biología de Organismos Marinos, Boulevard Brown 2915, Puerto Madryn, U9120ACD Chubut, Argentina. E-mail addresses: arribas@cenpat-conicet.gob.ar or lorearribas@yahoo.com.ar

Luigia Donnarumma. Università degli Studi di Napoli Parthenope, Dipartimento di Scienze e Tecnologie, Centro Direzionale Isola C4, 80143 Naples, Italy. E-mail address: luigia.donnarumma@uniparthenope.it

3. Copyright restrictions
Use of this data set for academic or educational purposes is allowed as long as the data source is properly cited.

4. Proprietary restrictions

a. Release date
Not applicable.

b. Citation
When used for academic or educational purposes, this data set should be cited using the title of this Data Paper, the names of its authors, the year of publication, and the corresponding volume and article numbers.

c. Disclaimer
None.

5. Costs
None.

CLASS IV. DATA STRUCTURAL DESCRIPTORS

A. Data set files

1. Identity
One data file: `data.csv`

2. Size
12382 bytes, representing 5551 cells (61 rows × 91 columns).

3. Format and storage mode
File type: comma-separated values (csv).

4. Header information
The first row contains the column headers. The header of the first column is labelled "Taxon" because that column provides the names of the identified taxa (rows 2 to 61). The subsequent column headers (columns 2 to 91) represent the surveyed quadrats: columns 2 to 16 (labelled KE1 to KE15) refer to the 15 quadrats sampled at Kejimkujik, columns 17 to 31 (labelled CC1 to CC15) refer to the 15 quadrats sampled at Crystal Crescent Beach, columns 32 to 46 (labelled CR1 to CR15) refer to the 15 quadrats sampled at the Coote Rock area, columns 47 to 61 (labelled CN1 to CN15) refer to the 15 quadrats sampled at Casino Nova Scotia, columns 62 to 76 (labelled HH1 to HH15) refer to the 15 quadrats sampled at the Halifax Harbourfront, and columns 77 to 91 (labelled GI1 to GI15) refer to the 15 quadrats sampled at Gull Island Cove. Therefore, the cell numbers indicate the number of individuals of each taxon found in each surveyed quadrat. Since the area of each quadrat was 1 dm^2 (10 cm x 10 cm), the cell numbers can also be read as density of individuals (individuals/dm^2).

5. Alphanumeric attributes
Mixed.

6. Special characters/fields
None.

7. Authentication procedures
`data.csv` MD5 checksum: `f01457cbf2db56f4ca6b4f4dc823100b`

B. Variable information

1. Variable identity
2. Variable definition
See section IV.A.4.

3. Units of measurement
For all taxa, the cell numbers in the spreadsheet indicate the number of individuals found in each surveyed quadrat. Since the area of each quadrat was 1 dm^2 (10 cm x 10 cm), the cell numbers in the spreadsheet also indicate density of individuals (individuals/dm^2).

4. Data type

a. Storage type
Data are integer numbers.

b. List and definition of variable codes
See section IV.A.4.

c. Range for numeric values
Data range between values of 0 and 358.

d. Missing value codes
There are no missing values. Each taxon identified in every quadrat received a value of abundance. When a given taxon did not occur in a given quadrat, a zero was given for the corresponding cell.

e. Precision
Data are integer numbers.

5. Data format

a. Fixed, variable length
b. Columns
The `data.csv` file has 61 rows and 91 columns.

C. Data anomalies
There are no detected anomalies in our data. See also IV.B.4.d.

CLASS V. SUPPLEMENTAL DESCRIPTORS

A. Data acquisition

1. Data forms or acquisition methods

After measuring the abundance of each taxon from each quadrat under a laboratory microscope (see section II.B.3.b), we immediately saved the values in an electronic spreadsheet in a computer.

2. Location of completed data forms

The data are saved in copies of that electronic spreadsheet in computers maintained by Ricardo A. Scrosati, Lorena P. Arribas, and Luigia Donnarumma (see section III.B.2 for institutional addresses).

3. Data entry verification procedures

We checked all values to ensure their accurate registration in electronic format.

B. Quality assurance/quality control procedures

We measured the abundance of each taxon by carefully following the procedure described in section II.B.3.b.

C. Related materials

All of the abundance data were registered electronically and are included in the attached data set.

D. Computer programs and data-processing algorithms

The attached data set contains the raw data without any transformations.

E. Archiving

1. Archival procedures

In addition to being stored in our computers (see section III.B.1), the attached data set will be permanently stored by Wiley once this Data Paper is published.

2. Redundant archival sites

The original electronic spreadsheet containing the abundance data was copied from one computer to another following standard procedures.

F. Publications and results

We published only location averages of species abundance in this article:

Arribas, L. P., L. Donnarumma, M. G. Palomo, and R. A. Scrosati. 2014. Intertidal mussels as ecosystem engineers: their associated invertebrate biodiversity under contrasting wave exposures. Marine Biodiversity 44:203–211.

G. History of data set usage

1. Data request history

No history for the moment.

2. Data set update history
The attached data set is the original set.

3. Review history
The data set has not been modified since its inception.

4. Questions and comments from secondary users
No questions or comments from secondary users are available for the moment.

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