

Dataset: Dates of sea ice movement and sea ice distance in McMurdo Sound, Antarctica from MODIS and SSM/I imagery between 1978-2015 (McMurdo Predator Prey project)

Project(s): Food web dynamics in an intact ecosystem: the role of top predators in McMurdo Sound (McMurdo Predator Prey)

Abstract: Fast/sea ice movement was quantified from visible-wavelength images from the Moderate-resolution Imaging Spectroradiometer (MODIS) aboard the Aqua and Terra satellites (250 m resolution; processing occurred for 2002/03-2014/15 seasons and Terra satellite data from 2000-2002 were not used) and sea ice concentration derived from the Scanning Multichannel Microwave Radiometer- and Special Sensor Microwave Imager-family passive microwave sensors (SSM/I; 25 km resolution; 1978/79-2014/15). MODIS data were acquired in one of two ways, from either processing of Level 1 swath data into “true color” images using SeaDAS software v. 6.4 (2002-2012), or from the Corrected Reflectance (True Color) layers of the NASA Worldview website (<http://worldview.earthdata.nasa.gov/>; 2012-2015). Fast ice areas were generated manually from clear-sky images by drawing polygons in GIS software; pack ice was excluded from analysis. The fast ice in MODIS images was sometimes obscured by clouds, so for days with missing imagery we interpolated linearly between valid data. From the MODIS imagery, we also measured the direct linear distance between McMurdo Station and the nearest open water. For SSM/I, daily or bi-daily fractional sea ice cover was extracted from data available at the National Snow and Ice Data Center (NSIDC). SSM/I ice concentration was retrieved from the NSIDC web site and ftp site (<http://nsidc.org/data/seaice/>). To minimize the biases inherent to the different data processing algorithms and in order to reduce the daily variability introduced by the movement of pack ice, we took the maximum of either the Bootstrap or NASATEAM processed values (Comiso, 2000; Cavalieri and others, 2015), and then used a 5-day median filter to smooth changes in sea ice concentration. To further compensate for short-term oscillations we masked ice concentrations greater than 80% when extracting the dates of changes in sea ice cover. For detecting the timing of sea ice changes, sea ice concentrations below 15% were excluded from our analysis, following the methods of Comiso and Steffen (2001). > To simplify discussion in the following, we use the inclusive term “fast/sea ice” to refer to fast ice as determined by MODIS and sea ice as determined by SSM/I. Fast/sea ice area was plotted over time, and the following sequential pattern of fast/sea ice events is identified: (1) initial fast/sea ice retreat from winter maximum; (2) final rapid fast/sea ice retreat to minimum extent; (3) fast/sea ice cover minimum in the entire McMurdo Sound; and (4) fast/sea ice advance. From the MODIS data, we additionally determined (5) fast ice cover minimum on the west side of the Sound; and (6) fast ice cover minimum on the east side of the Sound. For a complete list of measurements, refer to the supplemental document 'Field_names.pdf', and a full dataset description is included in the supplemental file 'Dataset_description.pdf'. The most current version of this dataset is available at: <http://www.bco-dmo.org/dataset/674819>

Description: Dates of sea ice movement in McMurdo Sound, Antarctica from MODIS and SSM/I imagery

This dataset contains dates relevant to sea ice movement including dates of initial ice retreat, final ice retreat, ice minimum, general ice minimum, ice minimum for the west of McMurdo Sound, ice minimum for the east of McMurdo Sound, and refreeze start. It also includes the minimum distance to the ice edge from McMurdo Station.

Dates were derived from Moderate-resolution Imaging Spectroradiometers (MODIS) collected between 2003 and 2015 and Scanning Multichannel Microwave Radiometer and Special Sensor Microwave Imager-family passive microwave sensors (SSM/I) imagery collected between 1978 and 2015.

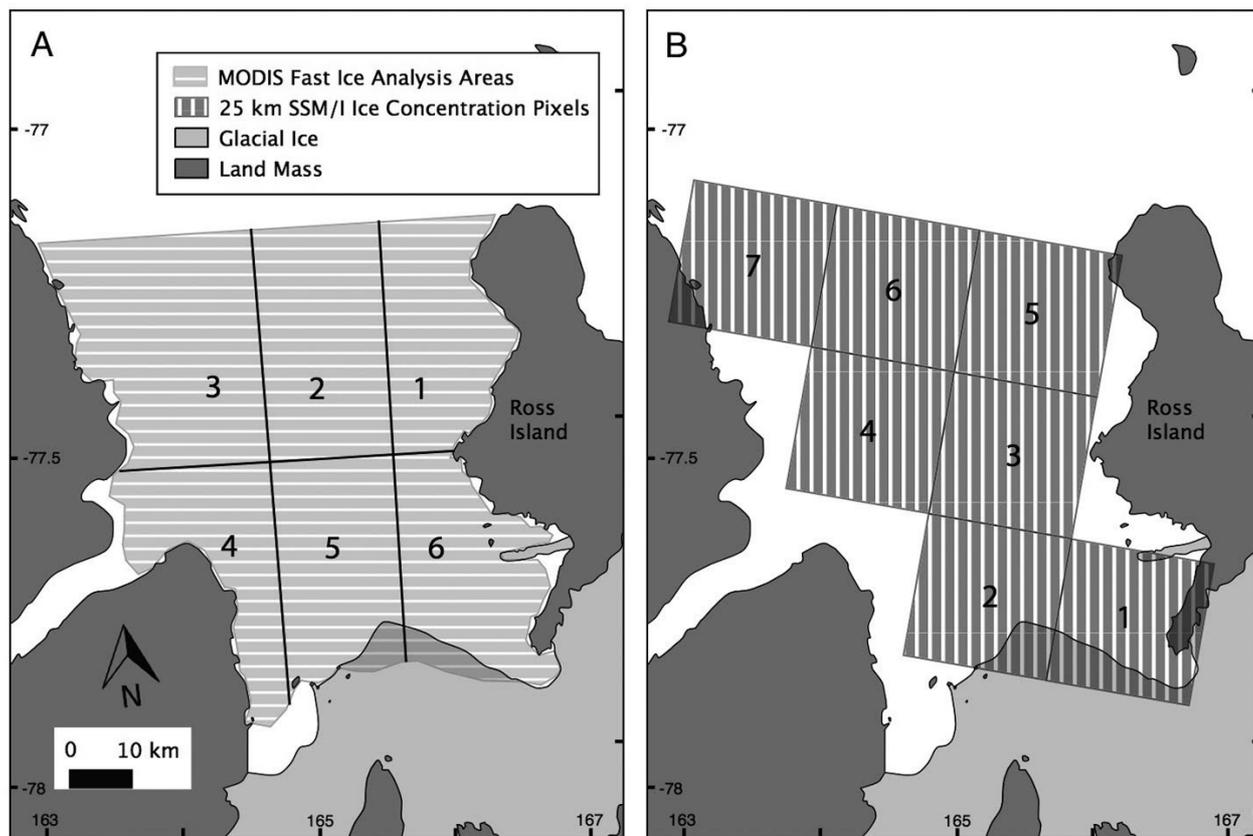
Acquisition MODIS:

Description:

Dates of fast ice movement were determined from visible-wavelength scenes from the MODIS aboard the Aqua and Terra satellites. MODIS images are available only for the months when there is sunlight, generally October to April, and image resolution was 250 m. Figure A (below) shows the division of McMurdo Sound into six zones; fast ice areas were generated manually from clear-sky images by drawing polygons in GIS software, and pack ice was excluded from analysis. The fast ice in MODIS scenes was sometimes obscured by clouds, so for days with missing imagery we interpolated linearly between valid data. Areas of persistent multiyear ice or glaciers that were not considered in the analysis (white in the figure). Linear distance between McMurdo Station and the nearest open water on the day the ice reached the minimum extent for the season was also measured.

SSM/I:

In the SSM/I record, images were available for all months of the year, and image resolution was 25 km. Figure B (below) shows the total of seven pixels in the 25 km polar stereographic projection that encompassed McMurdo Sound; for each pixel, daily or bi-daily fractional sea ice cover was extracted. SSM/I passive microwave sea ice observations do not distinguish between fast ice and pack ice. There are small amounts of land and ice shelf contamination in pixels 1, 2, 5 and 7.



Processing

Description: The value "notobs" indicates the phenomena was not observed for two possible reasons; either the phenomena did not occur that season or imagery was not available (e.g. MODIS visual imagery was only collected during daylight months). The value 'nd' indicates no data (e.g. SSM/I imagery was too coarse to distinguish east and west side minimums).

SSM/I:

Data were processed using the bootstrap algorithm (National Snow and Ice Data Center, Comiso, 2000, Cavalieri et al. 2015) for the 1978/79-2014/15 seasons.

Comiso, J (2000, updated 2015) Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS. Version 2, 1979-2015. Boulder, Colorado USA: NASA DAAC at the National Snow and Ice Data Center.

Cavalieri DJ, Parkinson CL, Gloersen P, and Zwally HJ (2015) Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data, Version 1.1 Southern Hemisphere, 1978-2015. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. (doi:10.5067/8GQ8LZQVL0VL) Accessed 11 Dec 2015.

BCO-DMO Data Manager Processing Notes:

- * added a conventional header with dataset name, PI name, version date
- * modified parameter names to conform with BCO-DMO naming conventions
- * blank values indicating no observed phenomena replaced with no data value 'nd'
- * added approximate latitude and longitude of McMurdo Station

Project Information

Food web dynamics in an intact ecosystem: the role of top predators in McMurdo Sound

Instrument Information

| | |
|---------------------------------------|---|
| Instrument | Scanning Multichannel Microwave Radiometer |
| Description | Scanning Multichannel Microwave Radiometer |
| Generic Instrument Name | Radiometer |
| Generic Instrument Description | Radiometer is a generic term for a range of instruments used to measure electromagnetic radiation (radiance and irradiance) in the atmosphere or the water column. For example, this instrument category includes free-fall spectral radiometer (SPMR/SMSR System, Satlantic, Inc), profiling or deck cosine PAR units (PUV-500 and 510, Biospherical Instruments, Inc). This is a generic term used when specific type, make and model were not specified. |

| | |
|---------------------------------------|---|
| Instrument | MODIS |
| Description | Moderate-resolution Imaging Spectroradiometers (MODIS) |
| Generic Instrument Name | Radiometer |
| Generic Instrument Description | Radiometer is a generic term for a range of instruments used to measure electromagnetic radiation (radiance and irradiance) in the atmosphere or the water column. For example, this instrument category includes free-fall spectral radiometer (SPMR/SMSR System, Satlantic, Inc), profiling or deck cosine PAR units (PUV-500 and 510, Biospherical Instruments, Inc). This is a generic term used when specific type, make and model were not specified. |

| | |
|---------------------------------------|---|
| Instrument | SSM/I |
| Description | Special Sensor Microwave Imager-family passive microwave sensors (SSM/I) |
| Generic Instrument Name | unknown |
| Generic Instrument Description | The correct value is not known to and not computable by the creator of this information. However a correct value probably exists. |