Basic Information

This section contains basic information about the dataset, suitable for a minimal metadata entry.

Title: Coastline Fetch estimates for Pacific Canada

Dataset ID: coastline-fetch-bc

Status: Completed

Quality Control: Completed

Summary: Fetch is a useful proxy for exposure (an important driver of nearshore species distributions) in the absence of a wind-wave model. We derived the first-ever coast-wide estimates of fetch for Pacific Canadian waters. Fetch was calculated for over 41,720 km of the British Columbia coastline, at 50 m intervals, yielding 811,727 nearshore fetch points. Fetch was calculated for five regions in Pacific Canada: Haida Gwaii (HG), Queen Charlotte Strait (QCS), Strait of Georgia (SOG), West Coast Vancouver Island (WCVI), and the North Central Coast (NCC; Prince Rupert to Cape Caution). For all regions, a bearing interval of 5 degrees was used to generate fetch lines for each point along the shoreline, resulting in 72 fetch lines per point. A maximum fetch distance of 200 km was used to ensure the barrier effect of Haida Gwaii was captured.

Supplementary information provided includes the fetch geometry calculator script and user guide (Gregr 2014) and a report on the fetch processing objectives, process, and results (Gregr 2015).

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Cite this data as: Gregr, E., Peterman, M., and Lessard, J. 2018. Coastline Fetch estimates for Pacific Canada. Published Dec 20 2018. Marine Spatial Ecology Section, Fisheries and Oceans Canada, Nanaimo, BC.

Start Date: 2015-05-21

End Date: 2015-05-21

Contact Information

This section contains contact information for the data creator and program manager.

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General
General metadata compatible with the Canada Open Data metadata standard.

Topic Category: Oceans

Date Completed: 2015-05-21

Date Published: 2018-12-20

Status: Completed

Update Frequency: Not Planned

Dataset Level: Dataset

Keywords (GoC Thesaurus): habitats, ocean energy, coasts, wind

Science
This section contains metadata specific to the Science branch at DFO.

Science Keywords: fetch, waves, exposure, coastal zone

Theme: Base Mapping

Methods:
All fetch points were calculated using the Fetch Tool developed by SciTech Consulting for DFO. There are 3 steps to applying the tool: Creating the target fetch points, creating the necessary land barriers, and processing (fetch calculation, cleanup, and validation).

Creating the fetch points:
It is strongly recommended that all source data be Repaired initially. If a simplified barrier is desired, simplification must be done before generating fetch points to ensure all points remain on the defined seascape. Points that occur on the land polygons will not have fetch assigned.

For this work, fetch points were created along a line generated by buffering the land polygons for each region. The fetch documentation (Gregr 2014) recommends generating fetch points at some distance away from the coastline (rather than directly on the coastline) to avoid the potential loss of points to precision errors during the spatial Erase operation. An available toolbox (CreatePoints toolbox; Broad 2014) was used to generate points on the trimmed buffer line.

The following steps were applied to each target fetch points for each region:
1. Buffer the land polygon to the desired distance. The buffer should be applied to the final land barrier, otherwise some points may end up on the smoothed land.
2. Convert polygon buffer to polyline
3. Select buffer lines that intersect the original land file.

4. Invert the selection and export selected polyline.
5. Inspect the polyline and manually remove isolated lines in inlets, estuaries, etc. for which fetch would be essentially 0.
6. Apply the CreatePoints tool to the cleaned up polyline.
7. Delete duplicates. The CreatePoints tool can create duplicate points. Using the Delete duplicates tool, ensure no duplicate shapes occur in the final set of points.

Creating the land barriers:
The Fetch processing time is strongly influenced by the number of polygons in the land barrier file, and the length of the fetch line. Regions were therefore subdivided to minimize the extents of the land file required. In particular, in regions with many fjords and inlets (e.g., NCC, QCS) inside points were separated from more exposed points which required more distant offshore landmasses.

To reduce processing time, all land barriers were simplified to the extent where no features > 5 m diameter were lost (Simplify polygon operator, bend algorithm, tolerance = 10). After simplification, M and Z geometries were disabled during application of the Dissolve operation to the land polygon to create a single, multi-part feature. Finally, because the Simplify and Merge operations can create empty features, the Repair Geometry tool was applied to the final, dissolved land polygon. This reduces the chances of low-level geospatial operators failing.

When creating the land polygons, any overlapping land files were removed as this also slows processing time. Processing time was further improved by removing inconsequential polygons from the land features. Finally, the Repair Geometry tool was applied to all final land polygons.

Calculating Fetch:
After preparing the target points and land barriers for a sub-region, the Fetch Tool was applied. Written in Python as a toolbox for ArcGIS 10.2.x, the tool uses low-level geometry operators to optimize performance and ensure that the run time is proportional to the number of fetch points provided for calculation (i.e., Order N). The tool can support very large runs; many of the runs for this project required several days of processing time. Intermediate results were available in case of interruptions. Please see the Fetch Tool User Manual (Gregr 2014) for more details.

Because the sub-regional land files were created to fit the fetch points as closely as possible, the fetch lines for some points inevitably 'slipped' through the sub-regional land files. These points were collected and processed using a final run of the Fetch Tool, using a larger, regional land polygon. The stray points were then merged back with the main group of points (the PointID field is preserved). The delivered fetch databases for the 5 regions include points and lines for each sub-region, and (except for NCC) a merged fetch feature class for the complete region. A maximum fetch distance of 200 km was used to ensure the barrier effect of Haida Gwaii was captured.

Citations:
Broad, I. (2014). ArcGIS Toolbox – Create Points on Polylines. Tool downloaded Oct 6, 2014. http://ianbroad.com/arcgis-toolbox-create-points-polylines-arcpy/

Gregr, E. (2014). Fetch Geometry Calculator Version 1.0; User Guide. Report produced for Fisheries and Oceans Canada. Unpublished. Revised November 12, 2014; 5 pp.

Gregr, E. (2015). Fetch Processing for Pacific Canada. Report produced for Fisheries and Oceans Canada. Unpublished. Revised May 21, 2015; 7pp.

Data Sources:

    Source:

    Originator: Canadian Hydrographic Service, Fisheries and Oceans Canada Publication_Date: 2014 Title: Murfitt polygons for coastal British Columbia Other_Citation_Details: Land polygon features for the Pacific Canadian Coast derived for digital hydrographic charts. Online_Linkage: None.

    Originator: SciTech Environmental Consulting Publication_Date: 2014 Title: 20 m bathymetry for the West Coast of Vancouver Island Other_Citation_Details: Davies, S.C., E. J. Gregr, J. Lessard, P. Bartier, and P. Wills. Development Of Bathymetric Elevation Models For Ecological Analyses In Pacific Canadian Coastal Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 3321. 2019. Online_Linkage: https://waves-vagues.dfo-mpo.gc.ca/Library/40821134.pdf.

Scripts or Software Routines: The Fetch Geometry Calculator is an ArcGIS geoprocessing toolbox with a Python script that calculates directional fetch for a specified set of point features based on a specific set of land barriers (see Gregr 2014).

Modified version of the code referred to above. This version only outputs csv files with coordinates and bearings, not any spatial format (file geodatabases): https://gitlab.com/dfo-msea/environmental-layers/gridded-nearshore-fetch

Spatial Data Quality: A true representation of fetch within the limitations of the available coastline data, and reasonable proxy of exposure. The quality of this proxy can be significantly improved when average weather direction can be estimated.

Positional Accuracy: Horizontal accuracy is variable and depends on the coastline files used for this work. Since the fetch points were generated either 2 m or 5 m from the coastline (depending on region), the points may end up on land when using other coastline representations.

Attribute Accuracy: The accuracy of the Fetch is a function of the resolution of the coast, and is considered to be high. If interpolated, the attribute accuracy would drop quite quickly with distance tangentially to the coastline, but along the coast, it would remain relatively constant.

Logical Consistency: The data set is logically consistent, however users should note that the NCC feature class has a different projected coordinate system (WGS 1984/UTM Zone 9N) than the other feature classes (NAD 83/BC Albers).

Completeness: The analysis is complete for the entire Pacific Canadian coastline.

Absence Data: None

Uncertainties: At the time fetch was calculated, there was some uncertainty regarding the location of the Pacific Canadian high and low water lines. Thus, somewhat different methods of generating the point files on which fetch is calculated were applied. Refer to Gregr (2015) for detailed descriptions of source data for each region.

Use Restrictions: Not suitable as an index for bottom exposure unless using nearshore points.

Change History

Date of Change	Description of Change
2018-12-20	Dataset published
	https://github.com/dfo-msea/delete-identical/blob/master/delete_identical.py
	Script run on data to remove duplicates.
	32 points removed from HG
2020-01-14	1599 points removes from SOG

Species Data

Code and Name	Age Data	Obs Type

References:

Reference: Gregr, E. J., D. M. Palacios, A. Thompson, & K. M. A. Chan. (2016). Why less complexity produces better forecasts: An independent data evaluation of kelp habitat models. Ecography, 41: 1-16.

Reference: Keeling, B., M. Hessing-Lewis, C. Housty, D. K. Okamoto, E. J. Gregr, & A. K. Salomon. (2017). Factors driving spatial variation in egg survival of an ecologically and culturally important forage fish. Aquatic Conservation: Marine and Freshwater Ecosystems, 27(4): 814-827.

Reference: F., Alejandro, M. McGreer, D.R. Haggarty, J. Beaumont & E.J. Gregr. (2016). Rockfish size and age: The crossroads of spatial protection, central place fisheries and Indigenous rights. Global Ecology and Conservation, 8: 170-182.

Reference: Gregr, E.J., R. Gryba, M.Z. Li, H. Alidina, V. Kostylev, & C.G. Hannah. (2016). A benthic habitat template for Pacific Canada's continental shelf. Canadian Technical Report of Hydrography and Ocean Sciences, 312: vii + 37 pp.

Collaboration: SciTech Environmental Consulting

Confidentiality: Not Protected