

Introduction

Overview

This atlas was produced as a spatial reference document in support of planning processes associated with the Pacific North Coast Integrated Management Area (PNCIMA) Initiative. The PNCIMA Initiative's aim is to ensure a healthy, safe, and prosperous ocean area by engaging all interested parties in the collaborative development and implementation of an integrated oceans management plan for PNCIMA.

The PNCIMA process will address both issue- and place-based management of marine uses and requires that information be represented spatially where possible. This atlas responds to that need by compiling geospatial information contained within other background reports produced for the PNCIMA process, including reports on:

- an ecosystem overview¹,
- a marine use analysis²,
- Ecologically and Biologically Significant Areas (EBSAs)^{3,4}, and
- marine environmental quality^{5,6}.

These large reports include maps that were generated by multiple authors and presented in a variety of formats, scales and resolutions. This atlas strives to make the maps more accessible by presenting them in one document and using consistent presentation to assist the reader in their own interpretation and use of the information. In many cases, relevant text from the above peer-reviewed reports has been directly extracted for inclusion in this atlas. In other cases, relevant information from the reports has been summarized.

Where possible, the atlas has incorporated the most current spatial data available, including data which have been updated since the publication of the original report from which they were taken. The atlas also contains relevant marine geospatial data gathered from other sources.

Atlas Layout

The atlas consists of maps containing geospatial representations of related data layer(s), accompanied by summary text from relevant sources. Maps are presented using a consistent template on the right hand page while summary text and other graphics are provided on the left hand page facing the map. References to source reports are provided in the footnotes accompanying the map text.

Though the atlas may be viewed in its entirety as a hard-copy printed document, each map with its associated text also tells a discrete story and stands alone.

Atlas Organization and Methods

The maps contained in the PNCIMA Atlas are organized based on several categories, explained below, according to the data presented. The atlas does not include all possible maps concerning these subjects. Even the maps presented are not intended to provide all the information required for planning. Rather, the atlas is intended as a introductory starting point to present information relevant to these categories and launch discussions. For the majority of maps, data layers have been clipped to the PNCIMA boundary. Other maps include data that were only generated within PNCIMA, such as Important Areas. Some maps, however, include data outside PNCIMA, respecting that administrative authorities, including Fisheries and Oceans Canada (DFO), and some features do not operate

exclusively within PNCIMA.

Cultural and socio-economic special areas were outside the scope of this atlas. Parties engaged in the PNCIMA Initiative are expected to present relevant and appropriate information during their participation in the PNCIMA planning process.

Context

The first two maps lay out the context of this atlas in terms of the geographic extent of information presented and PNCIMA's geographic boundary.

Communities

These maps present information about the human context of PNCIMA, including its communities and key infrastructure components.

Physical Oceanography

Maps in this category present data about the physical characteristics of the ocean space in PNCIMA. Physical oceanography influences the biological system, thereby shaping the ecology of an area. The maps present bathymetry, undersea features, surface currents and gyres.

Hydrology

This section presents information on water bodies, including watersheds within and influencing PNCIMA, and salmon stream escapement observations.

Ecological

This category of maps presents areas within the ocean space that are important from an ecological point of view. Included are areas that are currently afforded, or are proposed and anticipated for, legally designated marine protection. This includes estuaries, areas of marine protection, Ecologically and Biologically Significant Areas (EBSAs), eelgrass distribution, kelp distribution, and Important Areas (IAs).

IAs had been identified through an exercise to identify EBSAs, areas worthy of enhanced management or risk aversion. EBSAs were identified based on the locations of unique physical features, combined with identified species IAs. IAs that met EBSA criteria were identified through surveys of relevant experts. The criteria for EBSAs require that an area ranks highly in one or more of three characteristics, namely uniqueness, aggregation and fitness consequences, and could be weighted by two others, naturalness and resilience.⁷ Resulting IAs represented a variety of species of fish, invertebrates, marine mammals and reptiles, as well as oceanographic features, provincial ecounits, and Parks Canada areas of interest.

Commercial Fisheries

Commercial fisheries data are presented as cumulative effort. This displays the relative amount of fishing activity that occurs within PNCIMA. Where possible, catch within PNCIMA relative to coastwide catch is presented as a graph in the text accompanying the map.

The source data for the maps representing commercial catch and/or effort are derived from various logbook programs. The data provided by commercial harvesters is confidential. Source data were screened consistent with the *Access to Information and Privacy Act*. This Act provides for public access to data while protecting personal and confidential data. To

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allow for spatial representation of this information, the data had to be grouped to eliminate the possibility of confidential information being released. A four by four km grid was established where individual point data representing a fishing event were summed. When data were available for three or more fishing licences in one cell of a Geographical Information System (GIS) grid, the summed data representing the fishing activity within that cell were displayed. For cells with data pertaining to fewer than three licences, the data had to be removed for confidentiality purposes (*see figure below*). Therefore, additional areas may be fished that are not displayed on the map.

A (10) B (5) B (7) C (1) C(2) C (3)	A (1) A(3) B (10)
A (3) B (6) B (9) D (1) D(2)	G(1)
E(10) F (3) E(10)	B(9) G(2) C(3) D(6) A(1) F(12)

The *grid above* represents effort values (#) by individual licensed holders (A, B etc). Therefore, A(1) represents licence 'A' fishing the cell with an effort value of 1 (effort units vary among fisheries). Only cells with three or more licences reporting are included in the data (*see grid below*) summing effort values for all licences reporting fishing activity within the cell.

The following caveats apply to the maps in this section:

28	Removed (two licences, A and B)
21	Removed (one licence, G)
Removed (two licences, E and F)	33

• The way the data are presented does not take into account variations in fishing activity over time due to factors such as fisheries management measures, behaviour of individual vessels, or changes in technology or fishing practices.

• The maps do not represent economic valuations or biological trends such as stock health, stock dynamics, or areas of species abundance (neither in fished nor in closed areas).

• Changes in environmental and management conditions have changed the distribution of fisheries over time, meaning that the years for which data are displayed on the maps may not reflect current or future conditions.

• Dive fisheries that target sedentary species (e.g. geoduck, urchins and sea cucumber) cannot be spatially compared to fisheries for species which are more mobile.

• It is difficult to compare weight caught for a low volume versus a high volume fishery, because the effort expended to capture target species differs among fisheries.⁸

Recreation and Tourism

This section contains a single map, focusing on recreational fishing lodges. The data presented on this topic were derived from a report that contributed to the sport fishery section within the PNCIMA Marine Use Analysis report. Lodge locations were obtained from a recent spatial layer generated by the BC Marine Conservation Analysis.

Aquaculture

Maps in this section present the location of finfish and shellfish aquaculture sites. The source for these data was the Province of BC tenure data accessed November 2010. A point feature class was created from small tenure polygons in order to be visible at the scale displayed on the atlas page.

Energy

This section includes maps relevant to energy potential and investigation by renewable energy and oil and gas sectors.

Forestry

Marine-based log handling tenures are presented in this section. Log handling sites are tenure locations from the Province of BC. Points were created from small tenure polygons in order to be visible at the scale displayed on the atlas page.

Mining

This category contains a map of active and inactive mine sites in the watersheds that drain into PNCIMA.

Point Source Pollution

This category contains a map of disposal at sea sites.

Marine Transportation

Most of the maps in this section are vessel traffic density maps. The Marine Communications and Traffic Services (MCTS) program of the Canadian Coast Guard monitors ship traffic using radio contact, radar detection and satellite tracking. Ship information is documented along with position, direction and speed approximately every four minutes. Ship locations were estimated and documented by MCTS in their databases.⁹

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MCTS data used for this atlas are from 2003, and 2005 to 2008. Only data based on RDR¹⁰ and ODR¹¹ were included, since these methods are considered the most consistent for repeatable and sensible position representation. Because of the size of this database, the number of observations was reduced to one uniquely identifiable ship observation per five by five km cell in a GIS grid. Due to limited radar coverage, vessel traffic data in most fjords was not available.

Ship traffic was categorized into six classes, three of which are included in the PNCIMA Atlas as follows (using MCTS codes to identify the ship type – see table below).

Mean daily vessel movements were summarized using two different grids: one of ten by ten km cells for offshore waters and another of three by three km cells for inshore waters. This was necessary to show differences in data quality for different parts of the BC coast, specifically differences in accuracy (e.g. of the radar) and in the frequency with which vessel positions were recorded. More detailed and accurate information could be obtained from vessels monitored inshore (from 200 to 1,000 m between recorded vessel locations), compared to vessels monitored offshore (from two to ten km between recorded vessel locations). Ships that did not move from one grid cell to another were removed, i.e. only identifiable ships that changed cells were included in the summation, thereby representing ship movement. Ships were uniquely identifiable because the MCTS data included both ship name and Lloyd's registry number, allowing the data to be reduced to one ship observation per grid cell. Yearly estimates were extracted by multiplying mean daily estimates by 365 days. Seasonal movements (summer: 1 April – 30 September; winter 1 October – 30 March) were estimated by multiplying daily mean estimates by 182.5 days (6 months).

Vessel traffic density maps showing the same vessel type in a different season, or different vessel types, cannot be compared directly to the individual maps in this section because the range in number of vessel movements will vary among seasons and vessel types. In a marine planning context, data may be considered current for four to five years.⁸

Map Data Sources

The maps are all presented using the BC Albers projection, NAD 83 datum at a scale of 1:2,700,000 when printed at 6.5 by 11.2 inches. The base map (template) for the atlas uses the following source layers with spatial scale resolution provided in parentheses:

Vessel traffic classes used in PNCIMA Atlas

Column headings in shapefile attribute table	MCTS Identified Vessel Types	PNCIMA Atlas Map
'FISH'	'CRABBER', 'FISH FACTORY', 'FISH PACKER', 'FISH PROCESSOR', 'FISH(ING) FACTORY', 'FISHING VESSEL', 'LONGLINER', 'PROCESSOR', 'SEINER', 'TRAWLER'	• Fishing Industry Vessel Traffic Density (Summer) • Fishing Industry Vessel Traffic Density (Winter)
'OIL'	'LIQ GAS CARRIER', 'OCEAN OIL TANKER', 'VEG OIL/MOLASSES', 'COASTAL TANKER', 'OIL TANKER'	• Oil Tanker Vessel Traffic Density (Summer) • Oil Tanker Vessel Traffic Density (Winter)
'CRUI'	'PASSENGER', 'PASSENGER SHIP'	• Cruise Ship Traffic Density (Summer)

- Coastline polygon: the 'CHS Coastline' was produced by the Canadian Hydrographic Service, DFO in 2004 (1:1.5K to 1:525K).
- Offshore bathymetry: a geo-referenced JPEG image file produced by Oceans, Habitat and Enhancement Branch, Pacific Region, DFO in 2005 from Natural Resource Mapping Data (1:250K) and CAORWALL: Bathymetry for the California, Washington and Oregon EEZ (1:250K and 1:1,000K).
- Community names: Gazetteer, GeoBC Information Services Branch, Province of BC.
- State of Alaska shapefile: produced by the Alaska Department of Natural Resources in 2001 (1:250K).

Data overlaid on these base layers are from varying sources. Source information is provided on individual maps. Maps were generated using GIS software ArcGIS 9.3.¹² To maximize the marine area displayed the base map was rotated by -25 degrees, as visually depicted by the north arrow. A scale bar is included, but since the maps are intended for distribution as electronic versions as well as hard-copy they may ultimately be viewed at multiple sizes and therefore scale text was not included on the maps.

Quality Control

The maps and text were prepared by individuals working for DFO, Haida Fisheries Program, North Coast-Skeena First Nations Stewardship Society, PNCIMA and the University of Victoria. Internal review and a series of revisions were undertaken prior to review by the PNCIMA Planning Office, which is made up of representatives of federal, provincial and First Nation governments.

Warranty Disclaimer

This atlas, and the information presented on it, is provided as a public service by the collaborative governance parties to PNCIMA. The information in this atlas is provided 'as is' without warranty of any kind, whether expressed or implied. All implied warranties, including, without limitation, implied warranties of merchantability, fitness for a particular purpose and non-infringement are hereby expressly disclaimed.

Limitation of Liabilities

The information presented in this atlas may not be current and/or may be incorrect or missing information. Areas where no fish or wildlife species, habitat, or other data are depicted on the map should not be construed as having no value for fish

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or wildlife, or their habitat. The information presented in this atlas should never be used for the purposes of navigation. Some of the information presented in this document was obtained from third parties who should be contacted to ascertain the source, description and potential usage restrictions of the information.

Under no circumstances will the parties to PNCIMA be liable to any person or business entity for any direct, indirect, special, incidental, consequential or other damages based on any use of information contained in this atlas including, without limitation, any lost profits, business interruption, or loss of programs or information.

- 1 Lucas, B.G., Verrin, S. and Brown, R. (Editors). 2007. Ecosystem overview: Pacific North Coast Integrated Management Area (PNCIMA). Can. Tech. Rep. Fish. Aquat. Sci. 2667: xiii + 104 p.
- 2 MacConnachie, S., Hillier, J. and Butterfield, S. 2007. Marine use analysis for the Pacific North Coast Integrated Management Area. Can. Tech. Rep. Fish. Aquat. Sci. 2677: viii + 189 p.
- 3 Clarke, C.L. and Jamieson, G.S. 2006. Identification of ecologically and biologically significant areas in the Pacific North Coast Integrated Management Area: Phase I – identification of important areas. Can. Tech. Rep. Fish. Aquat. Sci. 2678: vi + 89 p.
- 4 Clarke, C.L. and Jamieson, G.S. 2006. Identification of ecologically and biologically significant areas in the Pacific North Coast Integrated Management Area: Phase II – Final Report. Can. Tech. Rep. Fish. Aquat. Sci. 2686: v + 25 p.
- 5 Johannessen, D.I., Macdonald, J.S., Harris, K.A. and Ross, P.S. 2007. Marine environmental quality in the Pacific North Coast Integrated Management Area (PNCIMA), British Columbia, Canada: a summary of contaminant sources, types and risks. Can. Tech. Rep. Fish. Aquat. Sci. 2716: xi + 53 p.
- 6 Johannessen, D. I., Harris, K., Macdonald, S. and Ross, P.S. 2007. Marine environmental quality in the North Coast and Queen Charlotte Islands, British Columbia, Canada: a review of contaminant sources, types and risk. Can. Tech. Report Fish. Aquat. Sci. 2717.

- 7 DFO. 2004. Identification of ecologically and biologically significant areas. CSAS Ecosystem Status Report 2004/006: 15 p.
- 8 British Columbia Marine Conservation Analysis Project Team. 2011. Marine atlas of Pacific Canada: a product of the British Columbia Marine Conservation Analysis. Available from www.bcmca.ca (Accessed March 2011).
- 9 Patrick O'Hara, EC-CWS Birds Oiled at Sea Research Scientist and Adjunct Assistant Professor, Department of Biology, University of Victoria. Personal communication via emailed methodology document, February 16, 2009.
- 10 Radar tracked vessel, vessel track linked to radar sensor.
- 11 Offshore Dead Reckon, based on 96/24 hour advance reports submitted by vessels prior to entering Canadian territorial waters.
- 12 ESRI. 2008. ArcMAP. Redlands, CA: ESRI.



Photo: Brenda Bauer

Photo: Mueller

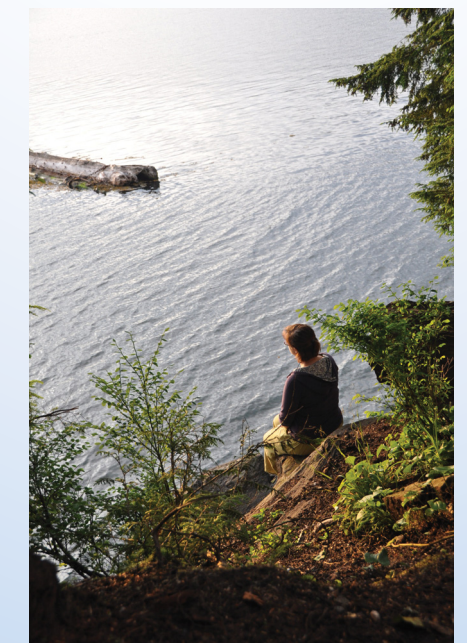


Photo: Carol Keehn