Variations in climate conditions, including current strength and direction, strongly affect ecosystems.[1] The BC coast lies at a transition zone between two large Pacific gyres (giant circular surface currents). This zone migrates north and south depending on the dominance of the atmospheric pressure systems whose winds drive the gyres.[2] Coastal currents are largely driven by wind and freshwater, and are controlled by the shape of the coast and depth profile of the continental shelf. Wind conditions and currents tend to differ between summer and winter.[3]

Ecosystems in PNCIMA are affected by the strength and direction of several currents

Offshore Circulation

The Subarctic Current (also called West Wind Drift or North Pacific Current) is a large, slow (~5 to 10 cm/s), trans-Pacific current that splits into the Alaska Current and the California Current (see figure). The Alaska Current curves to the north into the Gulf of Alaska and flows around the Alaskan Gyre, while the California Current veers south and flows around the East Pacific Gyre. The strength, position and size of the gyres vary seasonally as they are driven by the atmospheric Aleutian Low and North Pacific High pressure systems. The Alaska Current intensifies in winter as the Aleutian Low strengthens. This changes the location where the Subarctic Current splits, from as far north as the Alaskan Panhandle in summer, and as far south as the coasts of Washington and Oregon in winter.[3]

Currents moving north along the coast are pushed towards the coast by the Earth's rotation, and create a "downwelling" environment where low-nutrient surface waters are pushed toward the coast and denser, high-nutrient waters are pushed deeper. For this reason downwelling is often associated with reduced ocean productivity. Southward moving currents are turned away from the coast and create an "upwelling" environment where deep ocean waters are brought to the surface along the coast. These waters are rich in nutrients and create areas of enhanced productivity. PNCIMA coastal regions experience strong downwelling in winter and weak upwelling in summer. Tide- and wind-driven mixing are other significant factors in the supply of nutrients to the ocean surface, and oxygen to bottom waters over the continental shelf. [3]

Circulation off the Central and Northern BC Coast

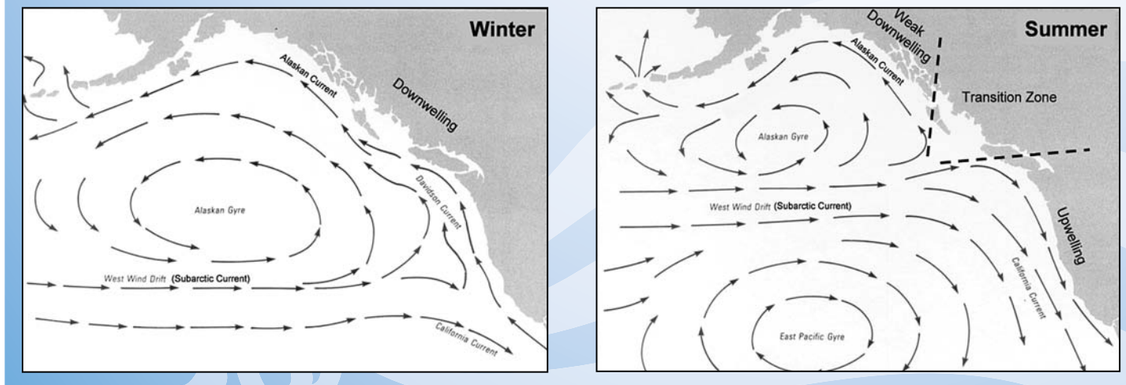
Ocean currents off central BC are driven by a combination of tidal and non-tidal currents. Tidal currents generally dominate water movement over time scales of hours; however, the ebb/flood cycle can result in little net movement. Tidal flows are often masked by non-tidal currents. The speed and direction of the currents are modified by the bathymetry and coastline. The central BC shelf region is dominated by banks and troughs, which modify and steer tidal and non-tidal flows.[3]

The average currents along BC's continental slope can flow either north or south depending on the wind patterns and the forcing of cross-shelf sea surface slope due to coastal runoff of fresh water. These currents are stronger than those further offshore and are generally seasonal. In winter, the Davidson Current flows northward off Vancouver Island, extending to Queen Charlotte Sound, which may disrupt this current along the shore. In summer, the southward Shelf Break Current flows approximately 50 km from the Vancouver Island coastline. The northerly flow off the northwest coast of Haida Gwaii in winter, termed the Haida Current, is driven by the wind and the alongshore sea surface slope. It is warmer than the surrounding waters by one to two degrees Celsius. In summer, with the weakening of the Aleutian Low, these shelf break currents weaken, often reversing to southerly flow.[3]

The Vancouver Island Coastal Current flows northward close to the island's shoreline. In winter, southeasterly winds push this current past the Brooks Peninsula. In summer, the current's direction often reverses due to the physical barrier created by the peninsula, and by wind driven currents moving southward.[3]

Material presented is extracted almost directly from the following literature reviews, which include primary references:
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 Crawford, W., Johannessen, D., Birch, R., Borg, K. and Fissel, D. 2007. Appendix B: Meteorology and climate. In Ecosystem overview: Pacific North Coast Integrated Management Area (PNCIMA). Edited by Lucas, B.G., Verrin, S. and Brown, R. Can. Tech. Rep. Fish. Aquat. Sci. 2667: 18p.
3 Crawford, W., Johannessen, D., Whitney, F., Birch, R., Borg, K., Fissel, D. and Vagle, S. 2007. Appendix C: Physical and chemical oceanography. In Ecosystem overview: Pacific North Coast Integrated Management Area (PNCIMA). Edited by Lucas, B.G., Verrin, S. and Brown, R. Can. Tech. Rep. Fish. Aquat. Sci. 2667: vii + 77 p.
4 Figure modified from Chevron Canada Resources Ltd. 1982. Initial environmental evaluation for renewed petroleum exploration in Hecate Strait and Queen Charlotte Sound. 1. Section 1-3. Chevron Canada Resources Ltd.

Offshore circulation in the northeast Pacific Ocean in winter and summer.[4]



9 Sea Surface Currents