

# Understanding the Pelagic waters and Coastal Transition Zone within Canada largest Area of Interest for Protection on the Pacific Coast [...for the development of monitoring plans]

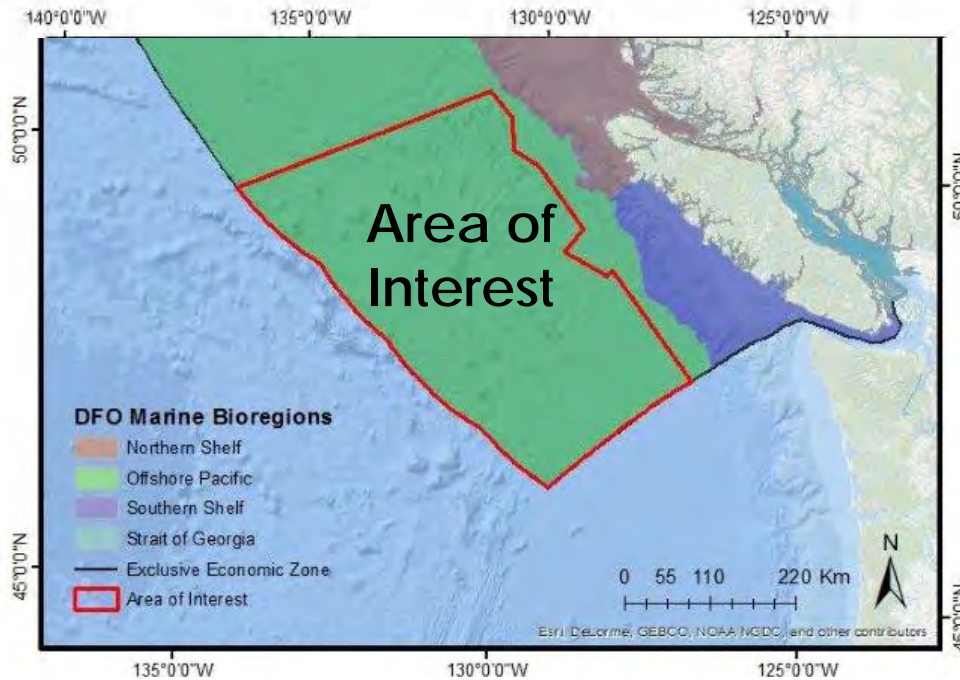
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Fisheries and Oceans Canada

International Symposium: Understanding Changes  
in Transitional Areas of the Pacific Ocean  
24<sup>th</sup> April 2018

# AOI location

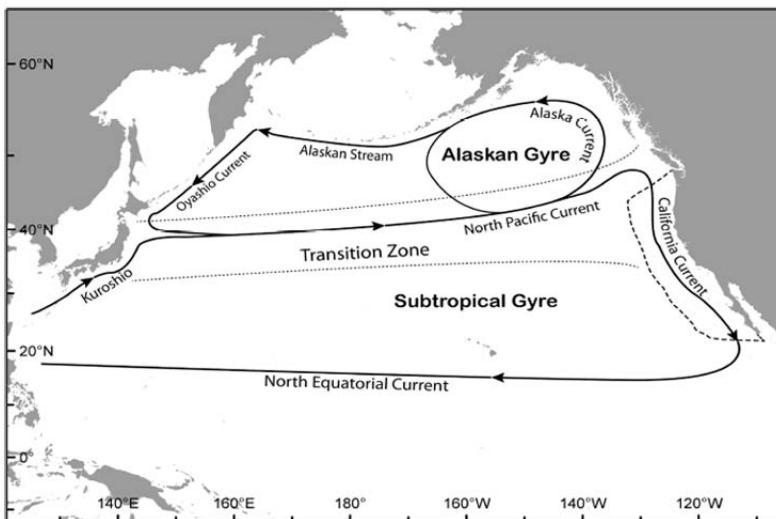


- **Area of Interest**

- Set to be Canada's largest MPA
- 140,000 km<sup>2</sup> or 420,000 km<sup>3</sup>
- 87% Canadian Seamounts
- 100% Canadian hydrothermal vents
- ALL surface & pelagic waters: from 0 to between 1,500 m and 4,500 m depth

- **The North Pacific Transitional Zone (NPTZ) is an associated CBD EBSA**

- extends west to east across the Pacific Ocean
- influences pelagic waters of the AOI



# Bifurcation Zone

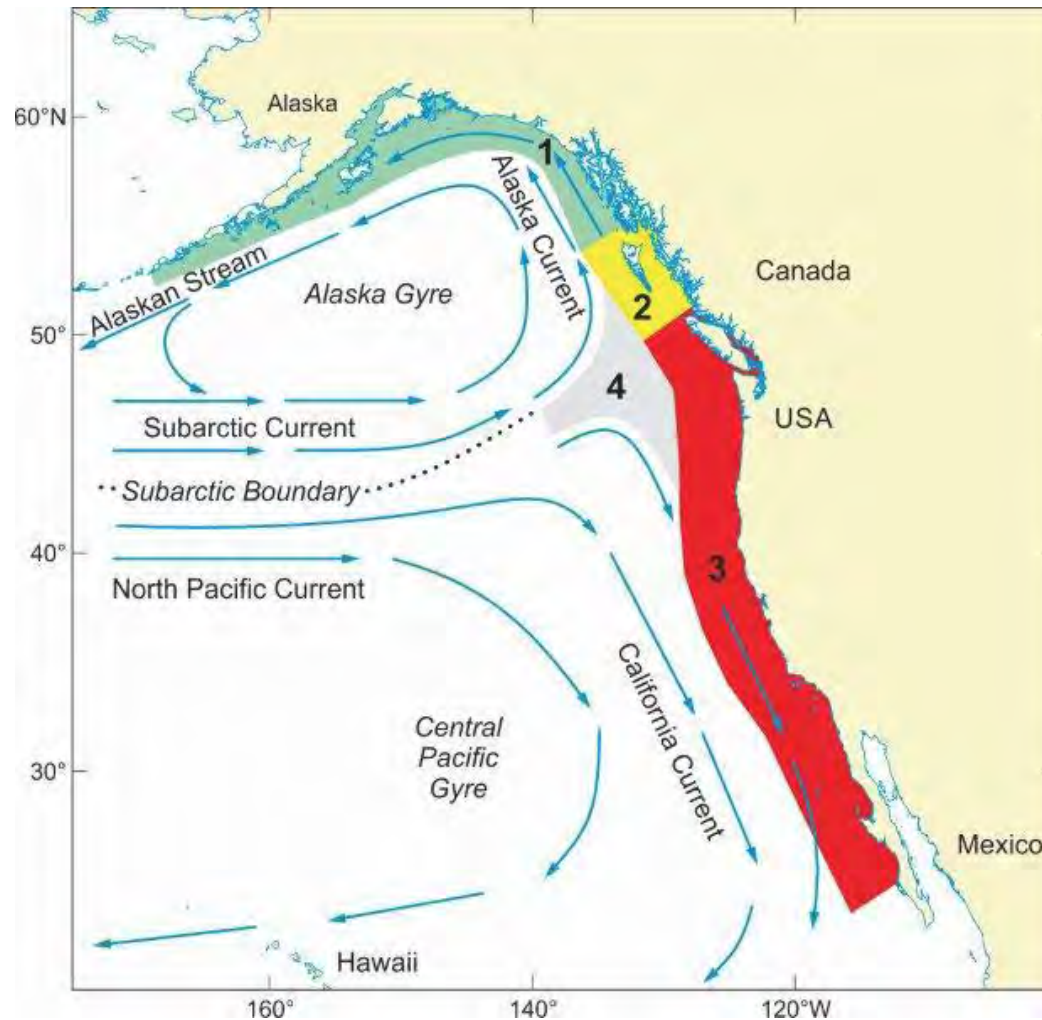


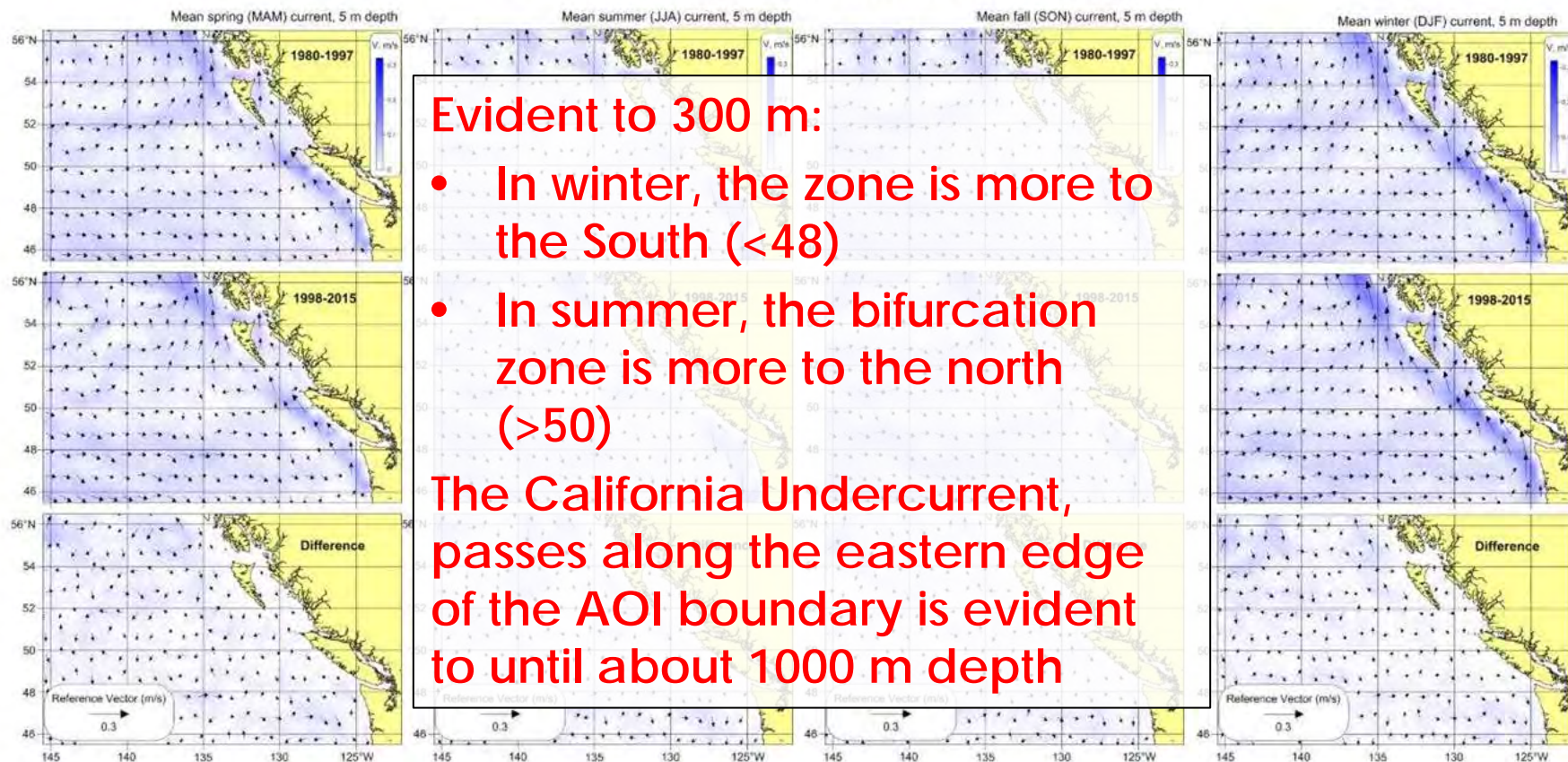
Figure 9. Ocean Circulation in the Northeast Pacific. Area 1 Coastal Downwelling Zone, Area 2 Upwelling/Downwelling Transition Zone, Area 3 Coastal Upwelling Zone, and **Area 4 Bifurcation Zone** (DFO, in press).



# Modeling of currents

Figure F 1. HORIZONTAL MAPS OF CURRENTS AT 5 m, 100 m, 300 m, 500 m, 1000 m, 1500 m and 2000 m for four seasons (1980-1997, 1998-2015, difference between the two time periods)

## 5 meter models (scale 0 to 0.3 m/s current velocity)



Evident to 300 m:

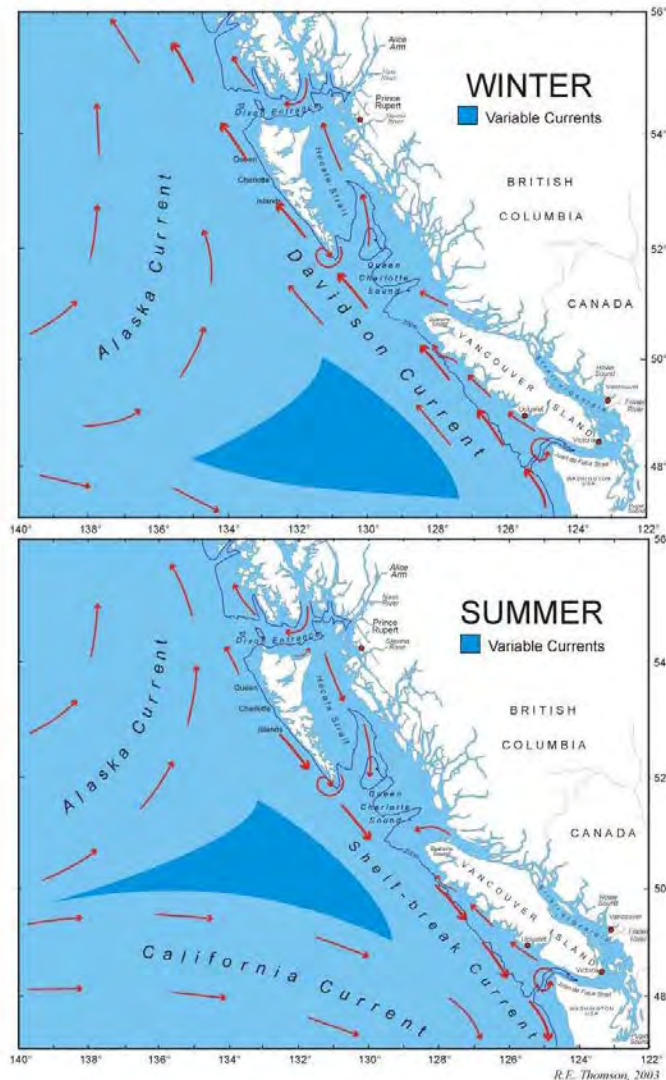
- In winter, the zone is more to the South (<48)
- In summer, the bifurcation zone is more to the north (>50)

The California Undercurrent, passes along the eastern edge of the AOI boundary is evident to until about 1000 m depth

DFO (in press)

-Analysis of split of Simple Ocean Data Assimilation (SODA) data, Completed at 5m(example above), 100m, 300m, 500m 1000m, 1500m and 2000m.

# Bifurcation Zone



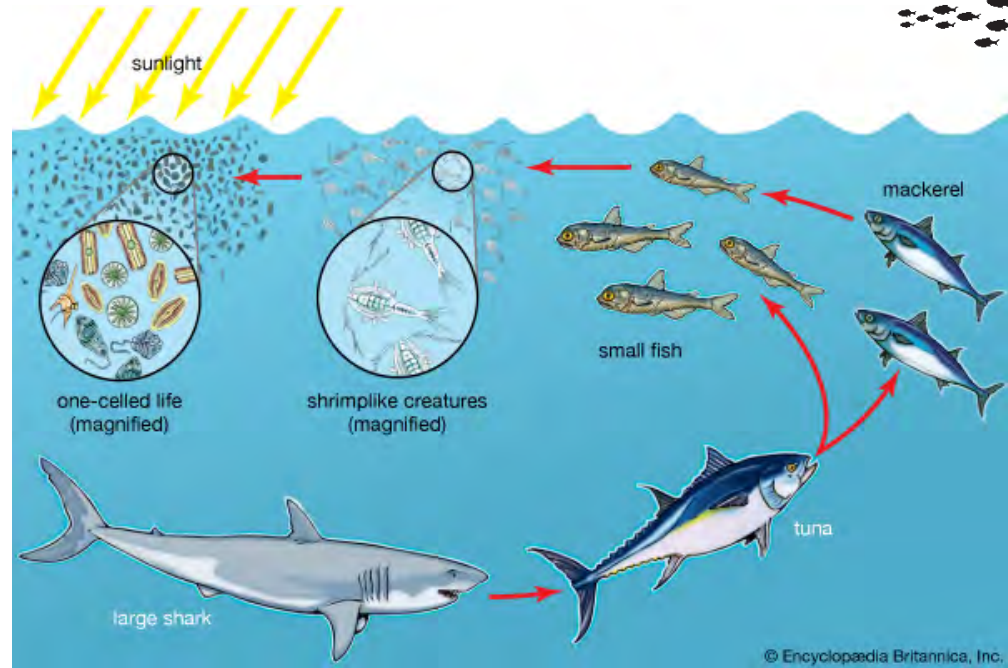
- Bifurcation Zone (CTZ)
  - split of the North Pacific current into the Alaska current & the California current
  - mobile region of variable currents (mid AOI in winter; northern AOI in summer)
- Other important features in the AOI
  - oceanic fronts
  - mesoscale eddies
  - seamount circulation patterns
  - upwelling/downwelling events
  - tides, wind, buoyancy effects
  - dynamic and mobile: difficult to draw boundaries, locate, and study





# Pelagic ecological

- Surface waters support primary production: phytoplankton
- ↳ zooplankton
- ↳ small fish & jellies
- ↳ larger fish, squids, birds
- ↳ marine mammals, sharks, other large predators (tuna)



- **Exceptions of high productivity**
  - fronts and boundary regions (eddies, gyres, seamount effects)
  - fronts and boundary regions may also act as a natural barrier (hindering dispersal)
- Deeper pelagic regime is dominated by gelatinous zooplankton (feeding on marine snow falling from above)
  - large populations of deep megafauna thought to exist (squid)



## Threats & vulnerabilities

- Increased **ship** traffic (marine noise), oil spill & human activities on the seabed below
- **Fishing** in the AOI
  - removal of top predators; trophic cascade → species replacement
  - bycatch of vulnerable species (pelagic birds, e.g., albatrosses; sea turtles; marine mammals)
- Climate changed
  - change oceanographic features and patterns resulting in significant ecosystem impacts; altered food web and changes in species **distributions** (increasing surface temperatures → poleward redistributions)
  - Increased occurrence of **hypoxic** (low oxygen) zones → “dead zones”
  - Increased dissolved carbon dioxide → **ocean acidification** → decrease in animals with carbonate “shells” (e.g., zooplankton, mussels, corals)



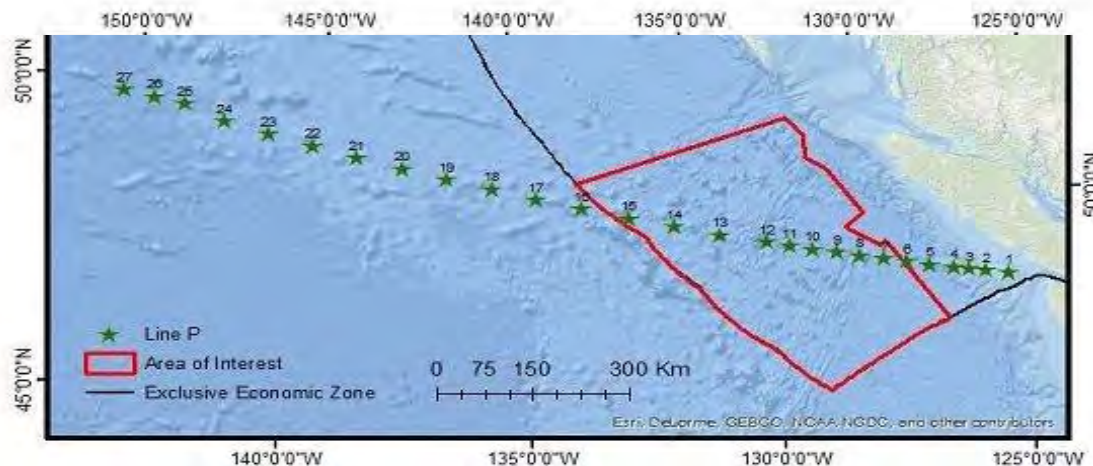
# Developing monitoring

Challenge is to develop a monitoring plan that can be attributed to the entire AOI



Current sampling programs includes the:

- Line P (important source of information)
  - Sampled 2-4x year<sup>-1</sup> since 1981
  - Some data going back to 1949
- Point Oceanographic Sampling around Research surveys
  - [what type of sampling should we focus on?]
  - Seamount Surveys
  - Hydrothermal Vent Surveys
  - Many Others
- ARGO Floats







## Challenges

- A large area which is spatially and temporally dynamic
- Developing a plan that is can take advantage of single survey data collections compared to data collections that are collected in a long time series
- Work with researches to collect oceanographic data that will support the monitoring objectives



# Next steps



- Developing a monitoring plan that can utilize the current oceanographic technologies
- Understand the data required to collect a more complete picture of Bifurcation Zone throughout the year



An underwater scene with sunlight filtering through the water, creating a bright, shimmering effect. The water is a deep blue color, and the light rays are visible as they penetrate the surface.

Thank you for your attention.  
Questions? Ideas?