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Canada

Microplastics in marine ecosystems off the coast of British Columbia

PICES, Vladivostok, Russia

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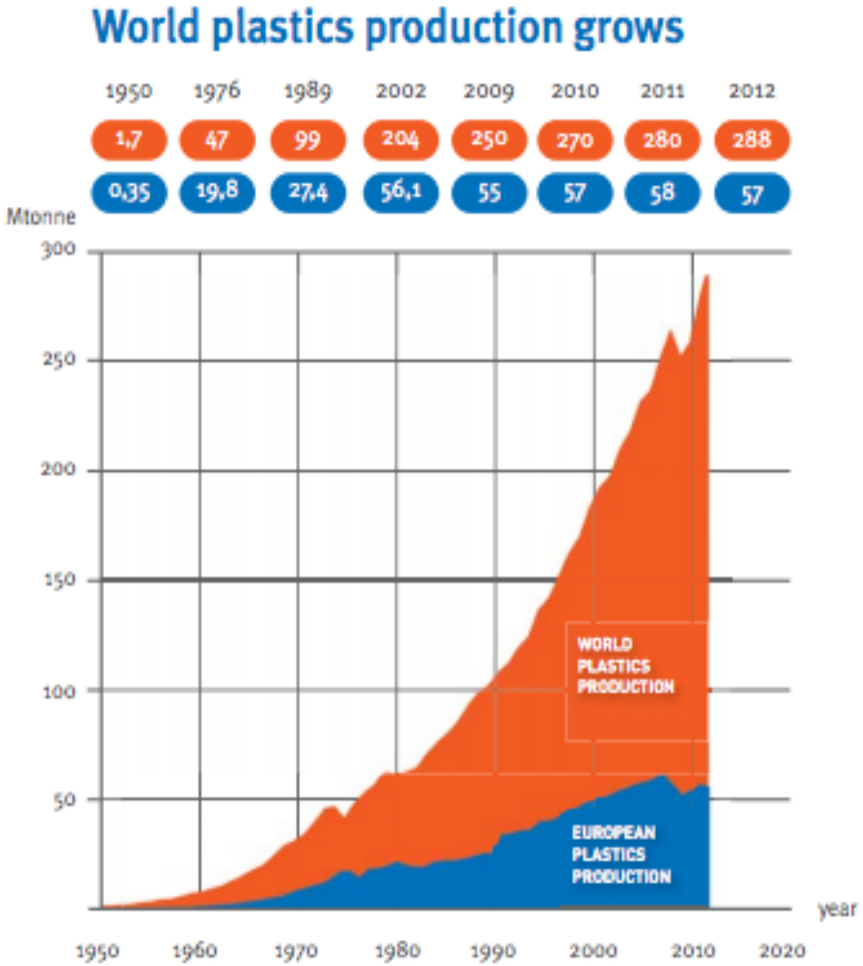
September, 2017

Plastic production and ocean debris



Source: PlasticsEurope (PEMRG)

Currently:

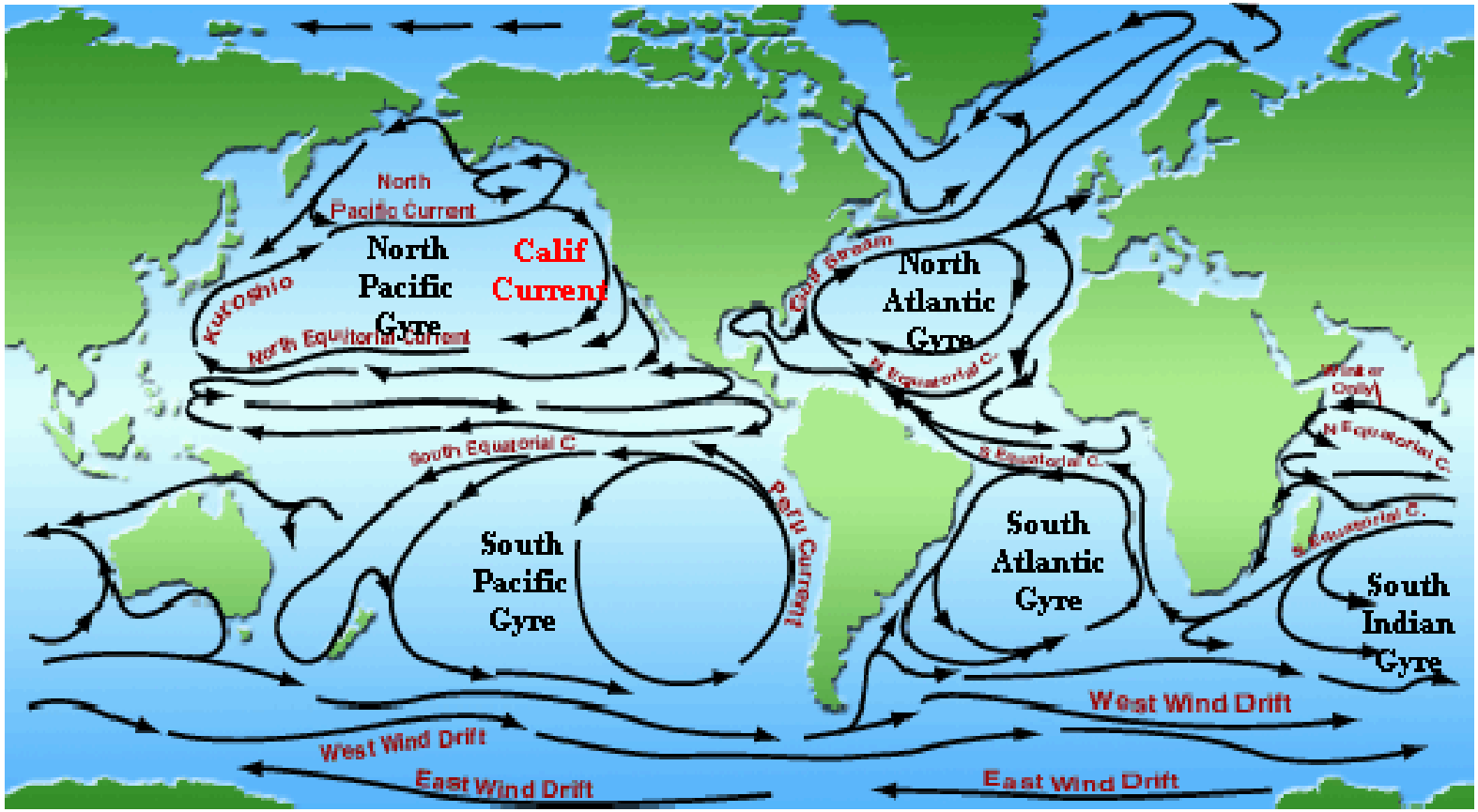
- >300 M tonnes produced per yr
- >8 (up to 12.7) M tonnes end up in the ocean – equal to garbage truck every minute
- Plastic accumulates
  - Resists chemical breakdown
  - Fragments due to UV, abrasion
- Microplastics now found in tap-water, table (sea) salt, and beer
- Plastic is a source of contaminants
  - At manufacture (e.g., bisphenol A)
  - Adsorbed in seawater (e.g., POPs)

Plastics and seabirds

- Plastic in 59% of 135 seabird species (1962-2012 - Wilcox et al. 2015 – PNAS)
  - 90% predicted today
  - 29% incidence rate (individuals)
- Global issue
  - Northern Fulmar as bio-monitor (Avery-Gomm et al. 2012 - MPB)
  - Thick-billed Murre in the Arctic (Provencher at al. 2010 - MPB)
- Lower trophic level
  - Ross et al. 2015
  - Dovekies (zooplanktivores) in Eastern Canada (Fife et al. 2015 – MPB)

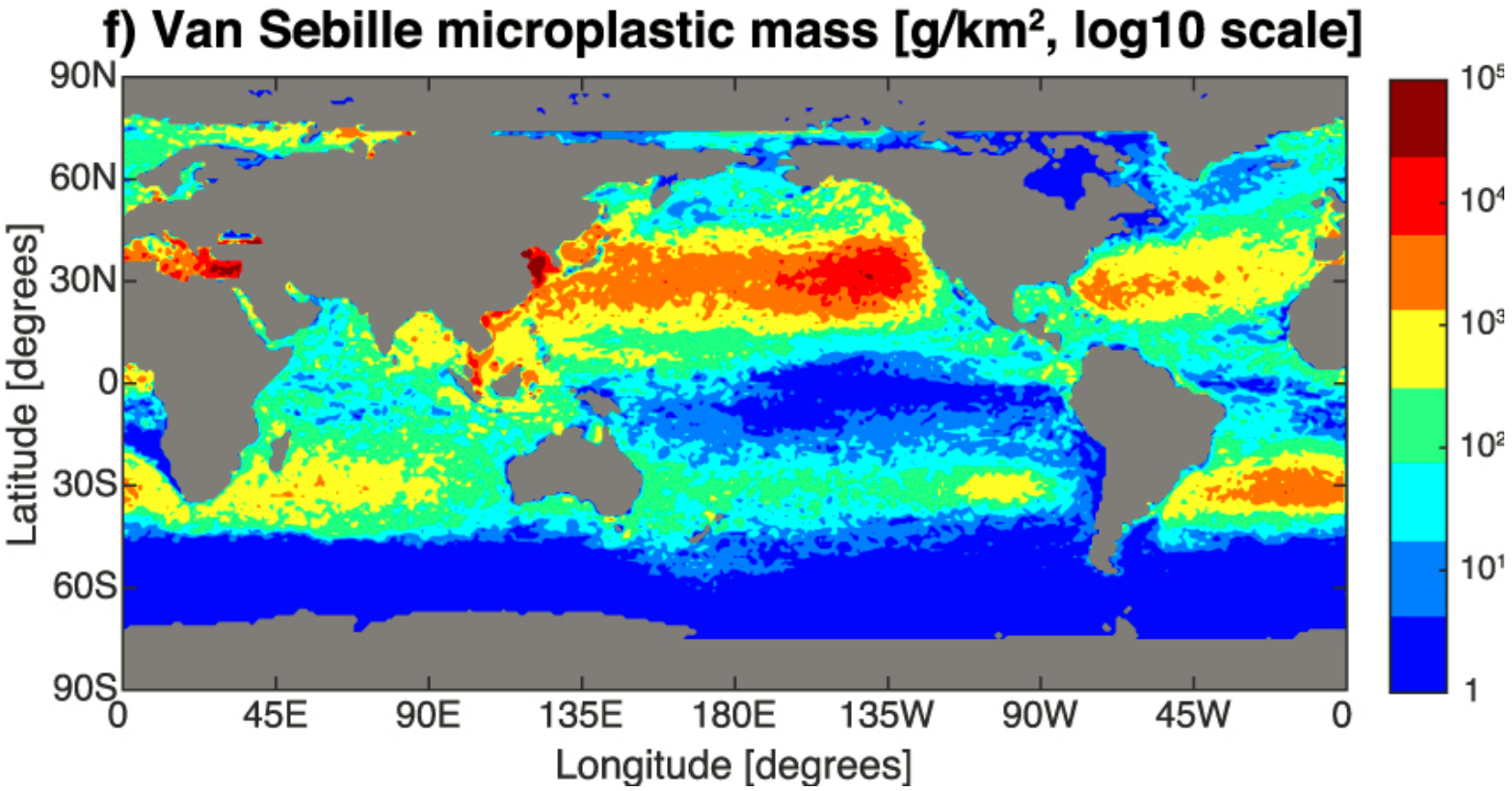
Norwexmovement.com

Ocean Transport and Retention



Source: www.geography.com

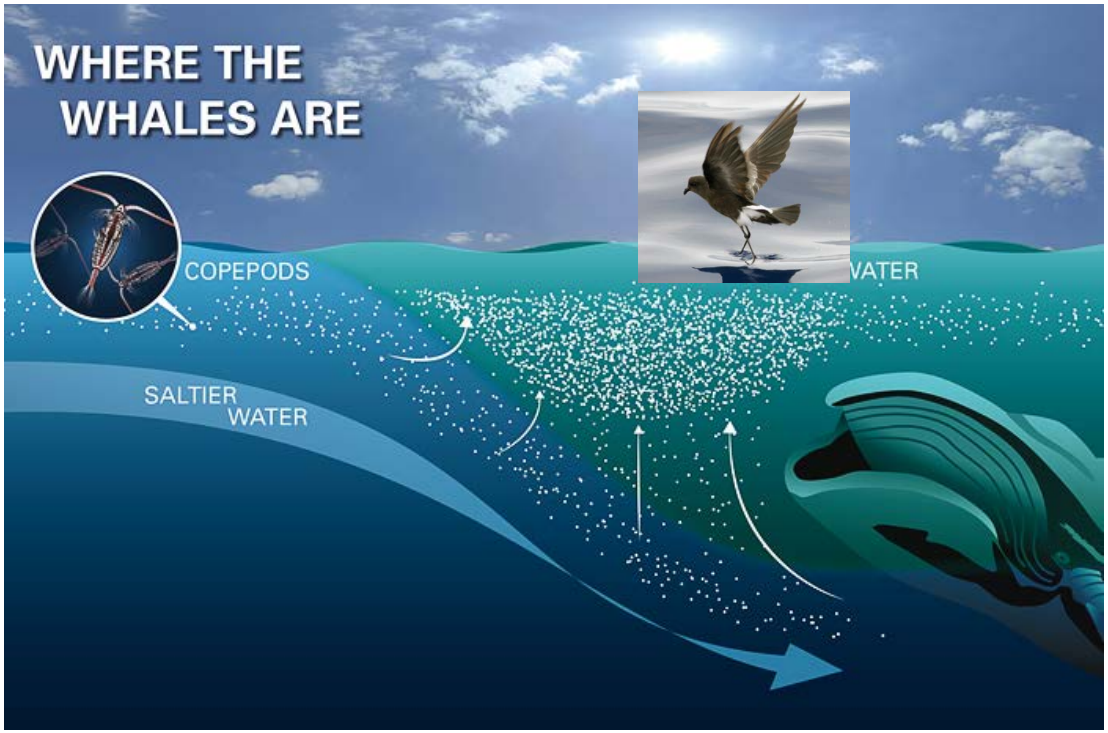
Ocean Transport and Retention



Van Sebille et al., A global inventory of small floating plastic debris. Environmental Research Letters, 2015

Microplastic and ocean productivity = vulnerability

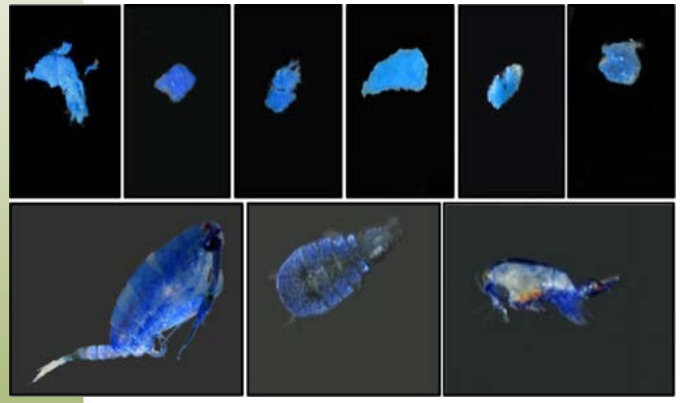
- Mesoscale process ---- water masses, and oceanographic features where there is increased primary production, also likely concentrate microplastic



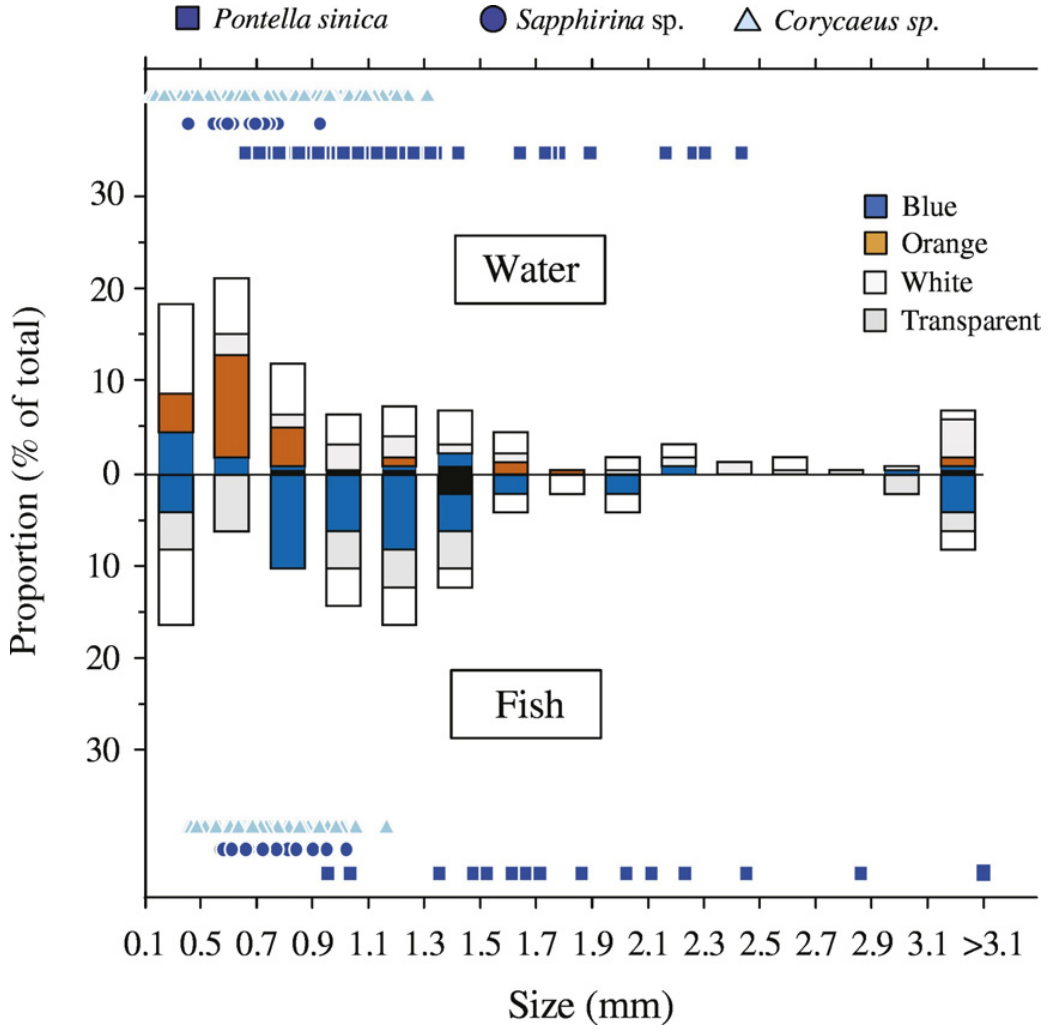
Source: Autonomous Undersea Vehicle Applications Center

Microplastic enters food web

Actively - zooplanktivores mistake microplastic for prey



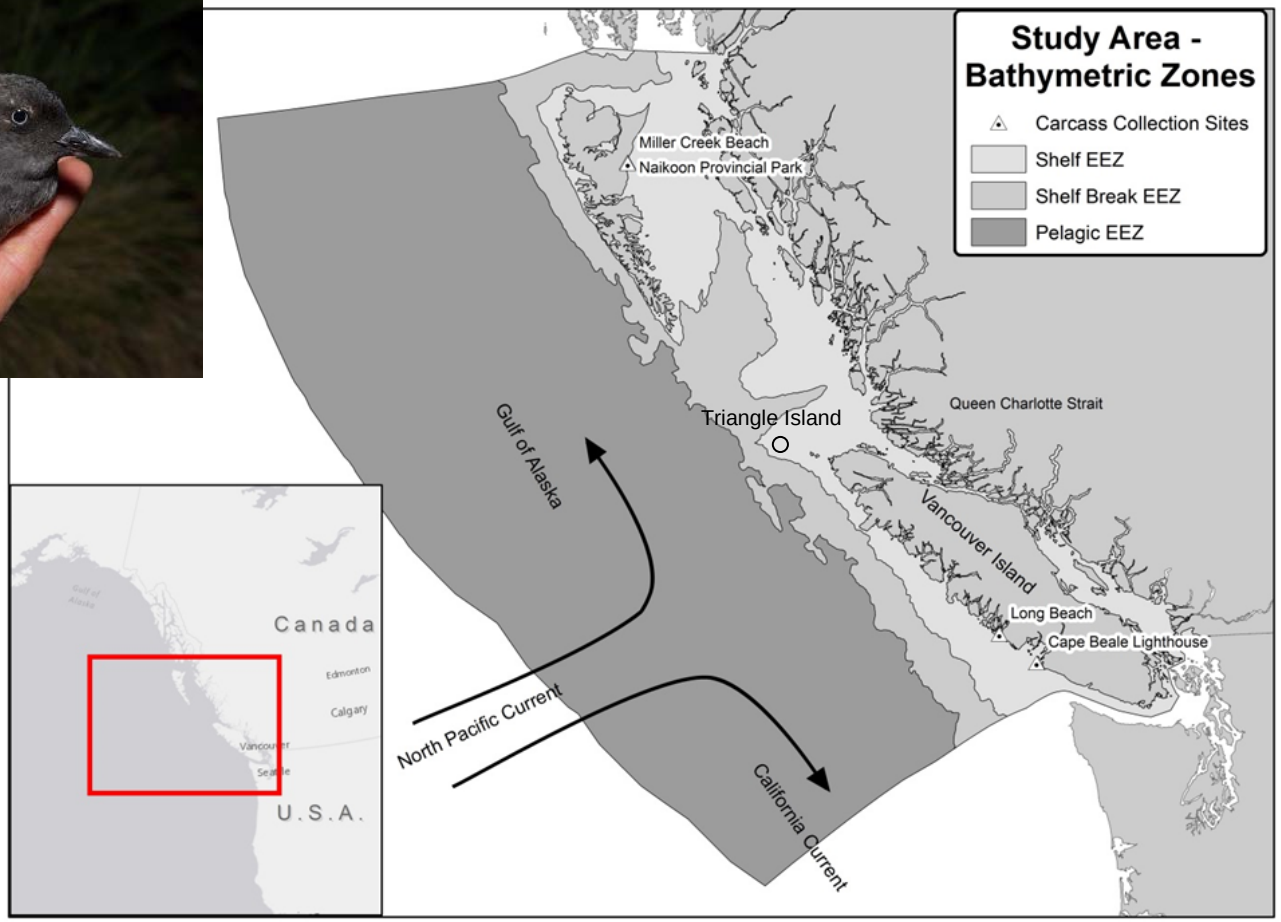
Ory et al. 2017 - STE



Cassin's Auklet – BC's most abundant breeding seabird

J Lamont

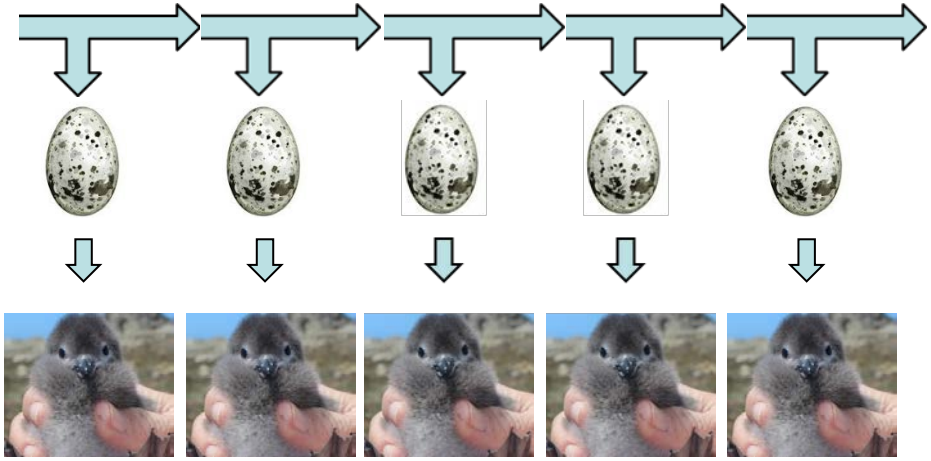
- Zooplanktivorous



Cassin's Auklet – BC's most abundant breeding seabird

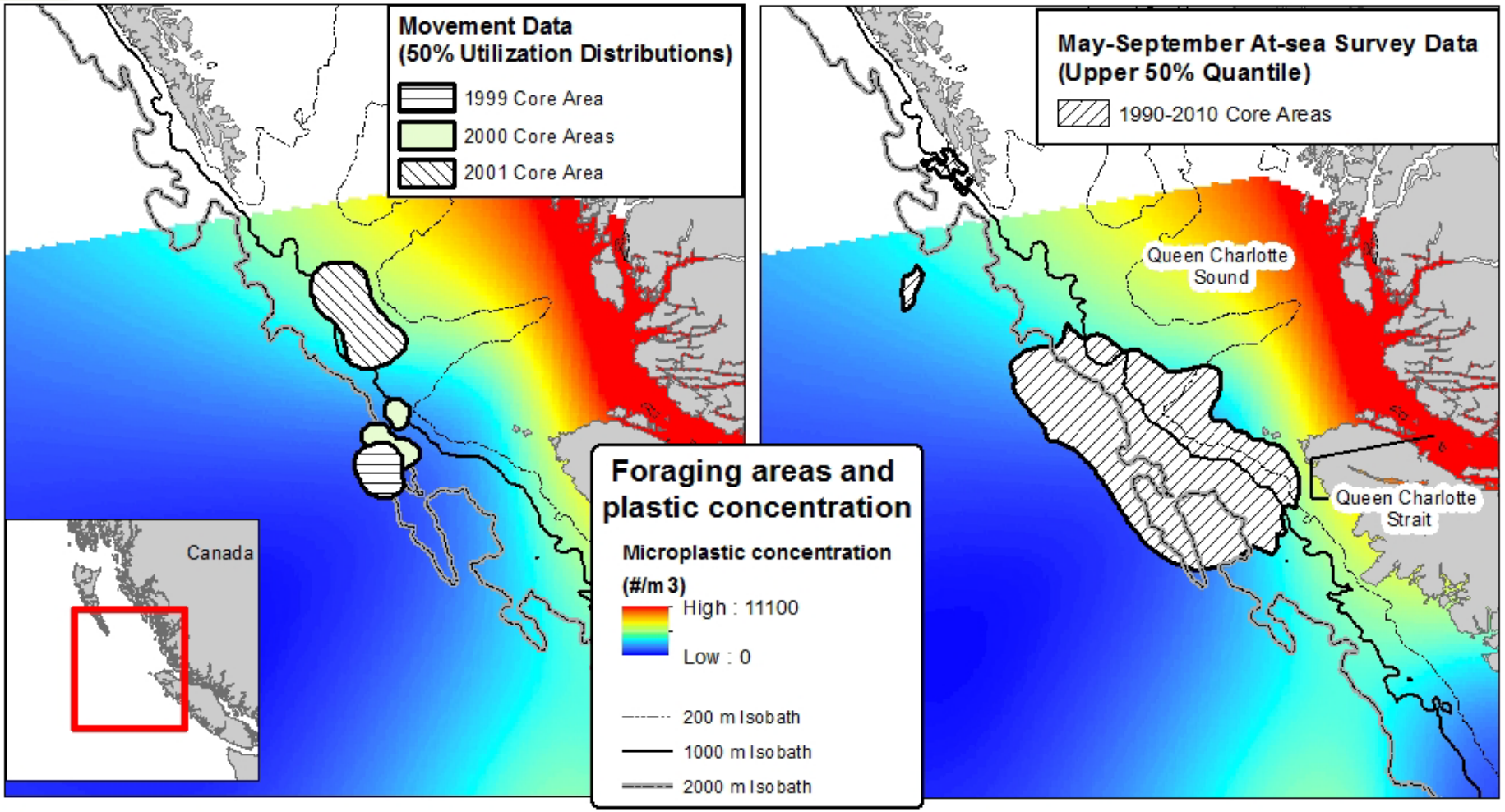
J Lamont

- Zooplanktivorous
- Long lived (many reproductive attempts)



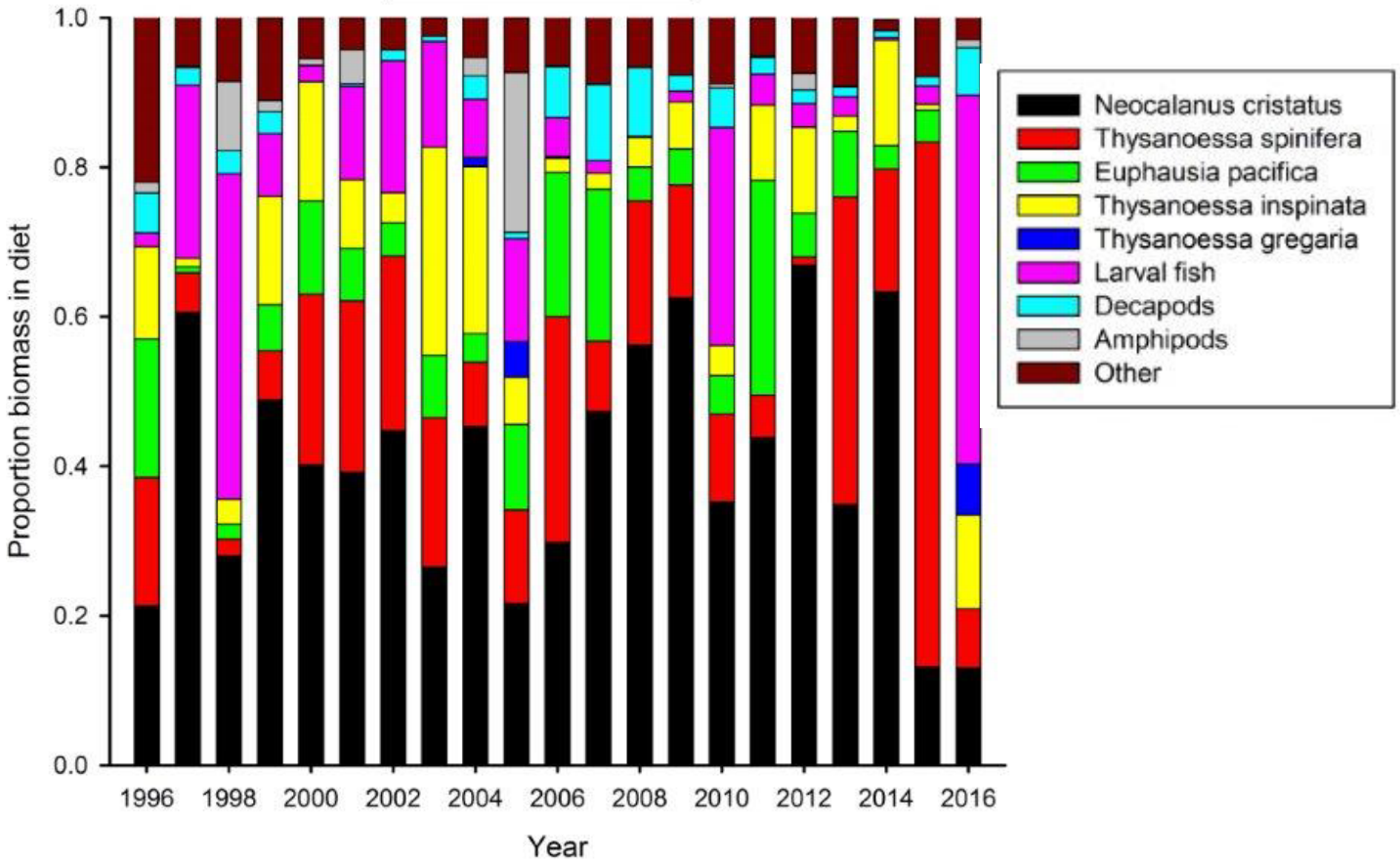
Pete Warzybok

Foraging areas of breeding Cassin's Auklets relative to microplastic

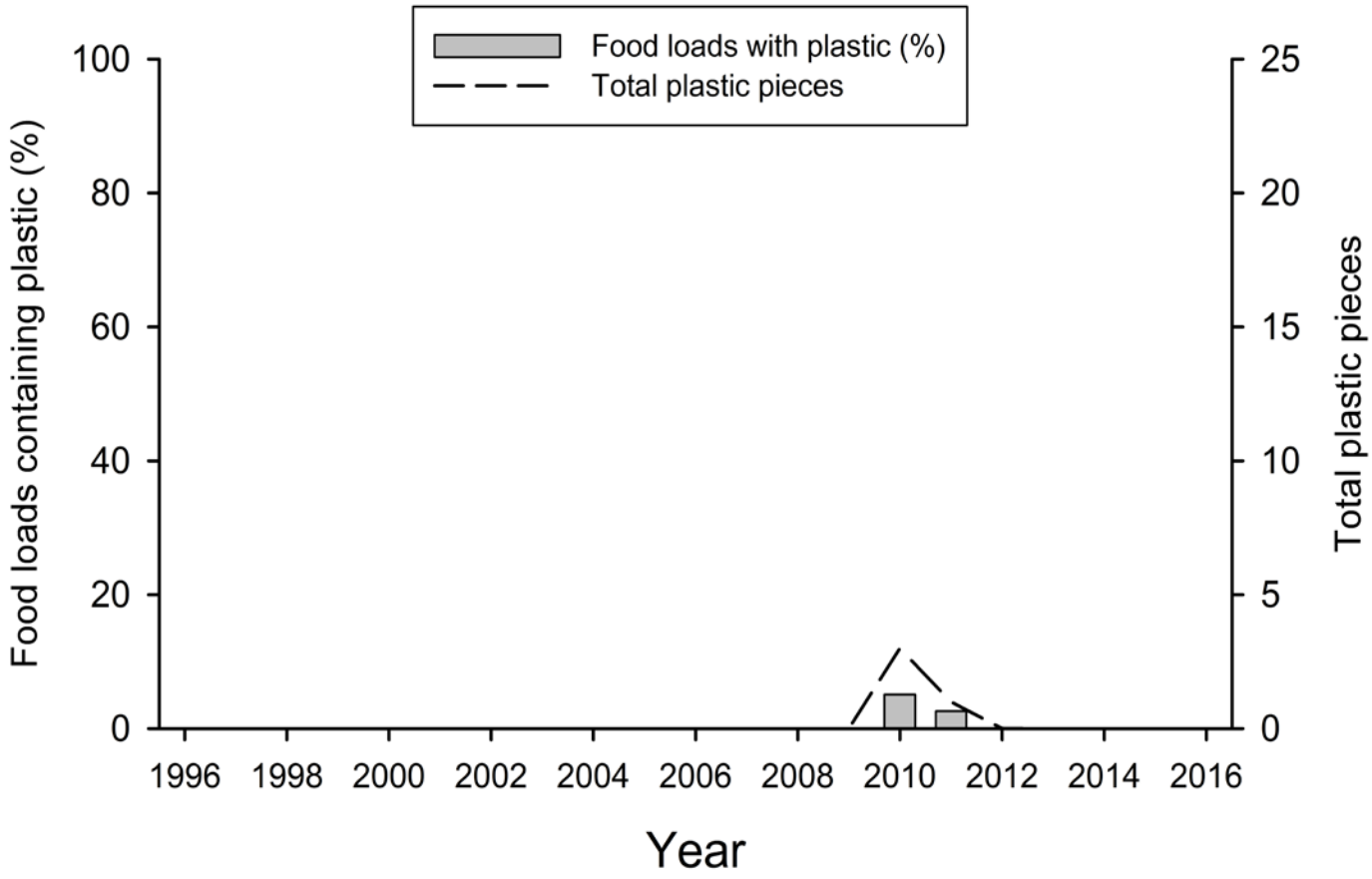


Diets fed to nestlings are monitored on Triangle Island

And any plastic found is quantified

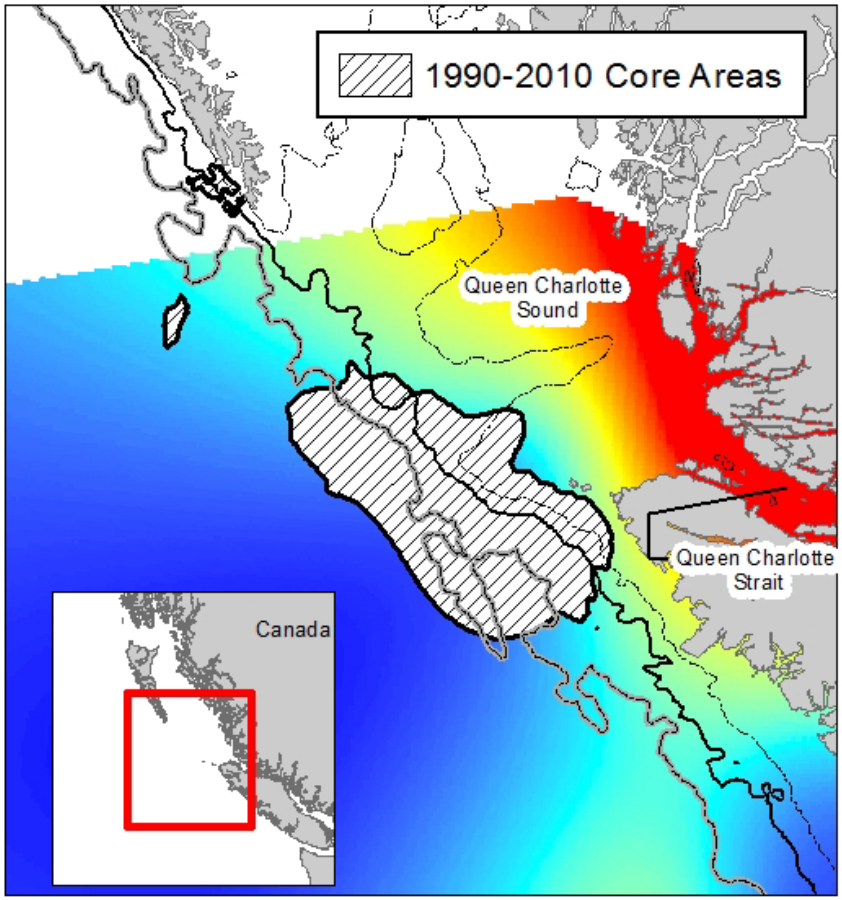


As predicted, microplastic is rare in Cassin's Auklet gurge

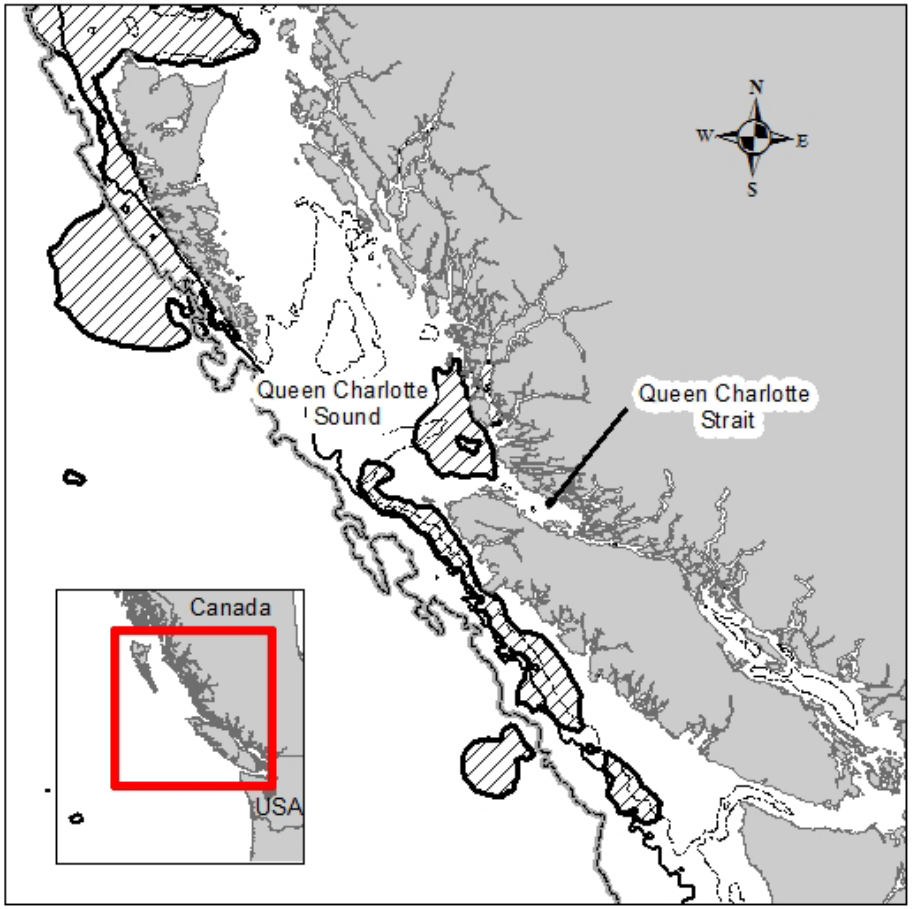


Foraging areas of Cassin's Auklets shift towards coastal areas

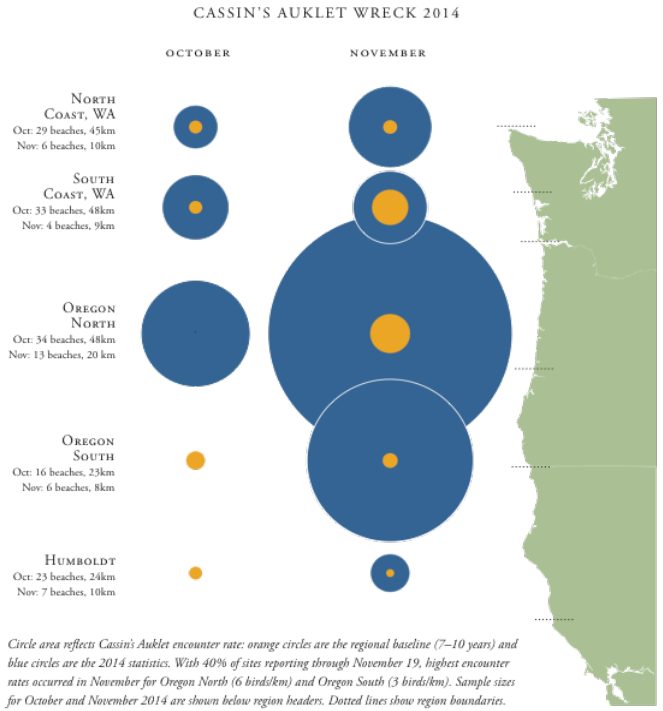
May – Sept.



Oct. - May



Cassin's Auklet Mass Mortality Event (MME), fall and winter 2014-15

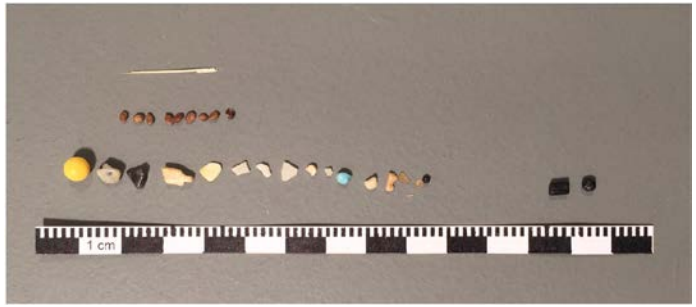


COASST – UWA

J Forsythe - COASST

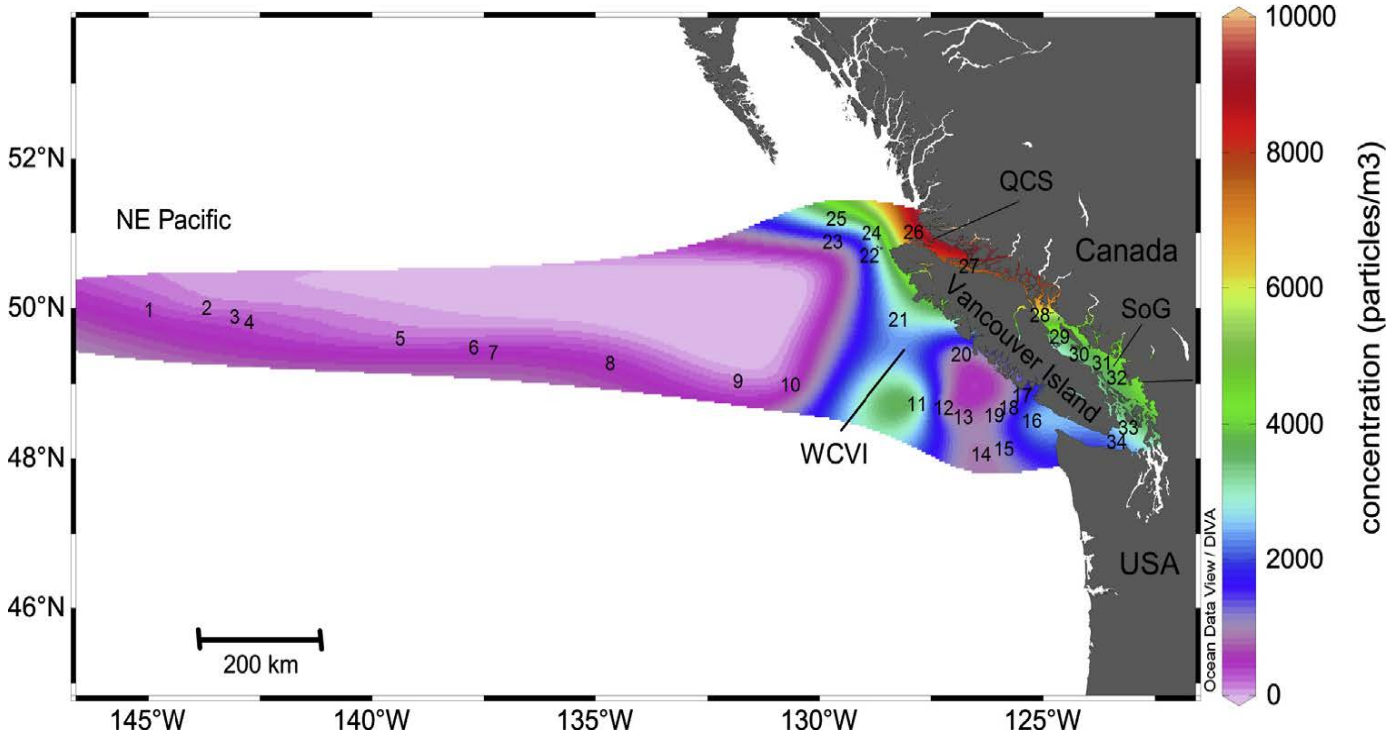
Plastic in Cassin's Auklets from MME

- In BC, 83 Cassin's Auklets recovered
  - 41% (34/83) of all birds had microplastic in gut (Dovekies – 14%)
  - 40% (23/58) of adults
  - 44% (11/25) of juveniles/immatures
- Types and amounts of microplastic found
  - 83% user (vs. industrial)
  - Average mass/bird = 0.022 g
  - Range mass/bird = 0.0006 – 0.32 g (< 0.16% of body mass)
- Very similar results in OR, WA (Floren & Shugart 2017 – MPB)



Variable Exposure or Prey Selection?

- Seasonal Oceanography
  - no upwelling during non-breeding season



Desforges et al. 2014 - MPB

Variable Exposure or Prey Selection?

- Seasonal Oceanography
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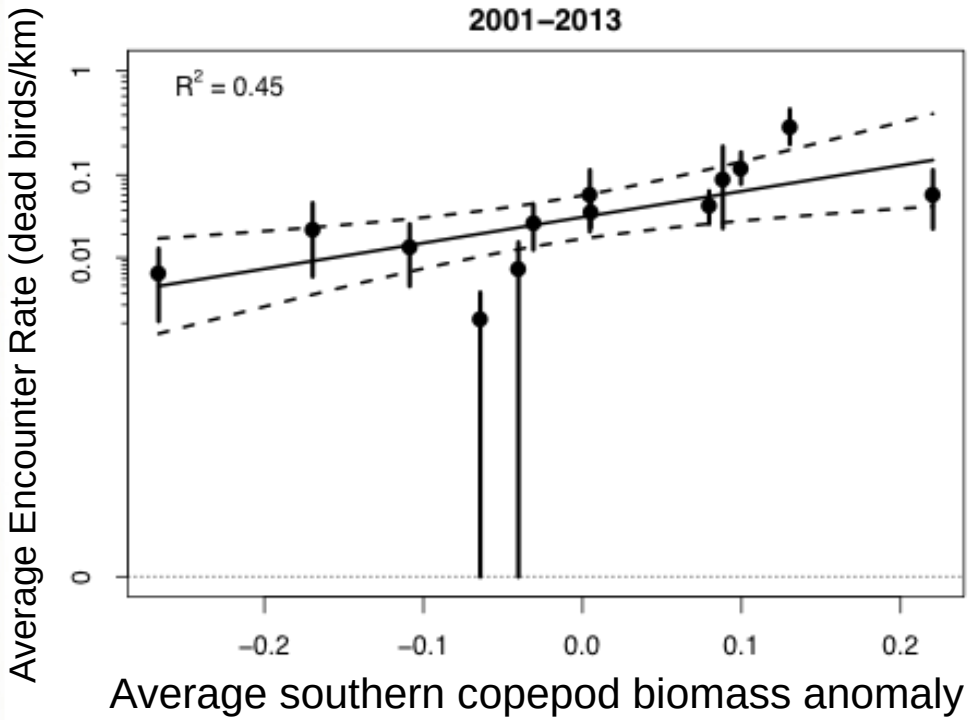
- Seasonal distributions
  - Move onto the shelf during non-breeding season

Variable Exposure or Prey Selection?

- Seasonal Oceanography
  - no upwelling during non-breeding season
- Seasonal distributions
  - Move onto the shelf during non-breeding season
- Microplastics in CAAU during non-breeding season
  - Select for microplastics when food availability low?
  - Incidental intake?
  - Cumulative effects?

MME was caused by lack of quality food – birds starved



- COASST BBS, U Washington
- More Cassin's Auklets recovered dead on beaches in winters when southerly species dominate the zooplankton community
- Plastic *probably not* causal in MME, but…
- **Did hungry birds target microplastics?**

T. Jones & J Parrish, UWA

спасибо