

A status report on Canadian marine zooplankton production rate measurements

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Objective → assess the current status of marine zooplankton productivity measurements for Canadian waters as per the activities of PICES WG37-
"Zooplankton Production Methodologies, Applications and Measurements in PICES Regions"

Secondary Production

- Amount of new zooplankton tissue elaborated per unit time
- Two main types of measurements:
 1. Somatic - growth during moulting
 2. Fecundity – adults do not moult so their production is expressed as reproductive output

Common Methods for Estimating Secondary Production

- Traditional methods
 - Incubations/cohort analyses
 - Egg production method
- Global predictive models
- Instantaneous methods
 - Radiochemical
 - Nucleic acid (RNA content)
 - Enzymatic (aminoacyl-tRNA synthetases, chitobiase)

Secondary Production in Canada



East Coast of Canada

Location	Method	Species	Time Period	Sampling	Authors
St. Lawrence Estuary	Egg production	<i>Calanus finmarchicus</i>	Apr-Aug 1991	Single station	Plourde & Runge 1993 Ohman & Runge 1994
			Jun-Jul 1991	Multiple stations	
Labrador Sea	Egg production	<i>Calanus finmarchicus</i>	1994	Transect	Cabal et al. 1997
			2004	Transect	Yebra et al. 2009
			1997	Multiple stations	Campbell & Head 2000
			1997-2010	Transect	Head et al. 2012
Nova Scotia	Egg production & cohort method	<i>Eurytemora herdmani</i>	1970	Single station	McLaren & Corkett 1981
Labrador Sea	AARS activity	<i>Calanus finmarchicus</i>	2002 & 2004	Transect	Yebra et al. 2009
Bay of Fundy	Artificial cohort method	<i>Acartia hudsonica</i> & <i>Eurytemora herdmani</i>	2003	Single station	Finlay & Roff 2006
Scotian Shelf	P/B ratios	Entire copepod community	1979-1980	Multiple stations	Tremblay & Roff 1983

West Coast of Canada

Location	Method	Species	Time Period	Sampling	Authors
Strait of Georgia	Chitobiase	Entire crustacean community	2004	Single station	Sastri & Dower 2006
			2004 & 2005	Single station	Sastri & Dower 2009
West coast BC, Bering and Chukchi Sea, Western Beaufort	Chitobiase	Entire crustacean community	2008 & 2009	Transect	Sastri et al. 2012
Saanich Inlet	Chitobiase	Entire crustacean community	2010 & 2011	Single station	Suchy et al. 2016
West Coast Vancouver Island	Chitobiase	Entire crustacean community	2006-present	Multiple stations	Sastri, Suchy, Venello (unpublished)

Which methods dominate?

- Egg production (East Coast) – fecundity measurement
 - Feasible in the field
 - Limitations: assumes production during incubations reflects *in situ* conditions
 - Cannot be applied to the entire community
- Chitobiase (West Coast) – somatic measurement
 - Feasible in the field; does not rely on a quantitative net cast
 - Community-level measurement
 - Limitations: no species-specific information

What's missing?

- Studies comparing methods
- Community-level production estimates on the East Coast; Fecundity on the West coast
- Nearly no measurements in the Arctic
- Routine sampling with resolution comparable to standard primary production measurements

Why are routine measurements needed?

Biomass \neq Production Rate

- Process-oriented studies:
 - Food-web interactions; Rates respond faster than biomass
 - Energy-dynamics (trophic transfer efficiency)
 - Biogeochemistry: Mesozooplankton and carbon sequestration
- Monitoring programs:
 - Productivity response to changes in biogeography
 - Extreme events (i.e. ENSO; warm water anomalies)
 - Fisheries management

Next Steps...

- Formal Canada-specific report; Perspectives MS?
- Recommendations:
 - Consensus on method(s);
 - Region-specific target populations / communities
 - Greater spatial resolution required:
 - Region-specific study areas? i.e. bell-weather stations?
 - Measure productivity on regularly sampled stations/transects
 - More process-oriented studies