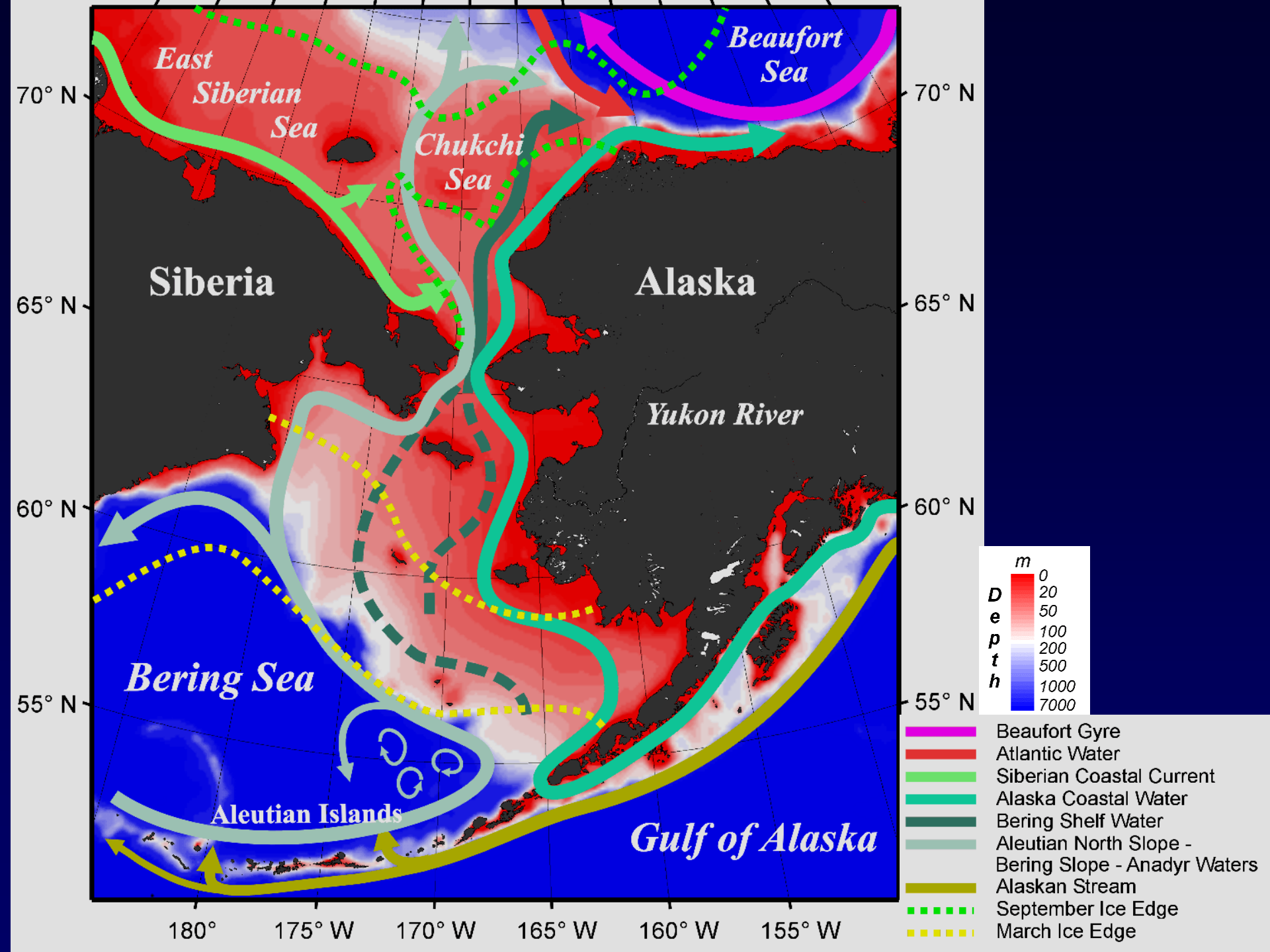
RUSALCA: Zooplankton

Russ Hopcroft
Ksenia Kosobokova

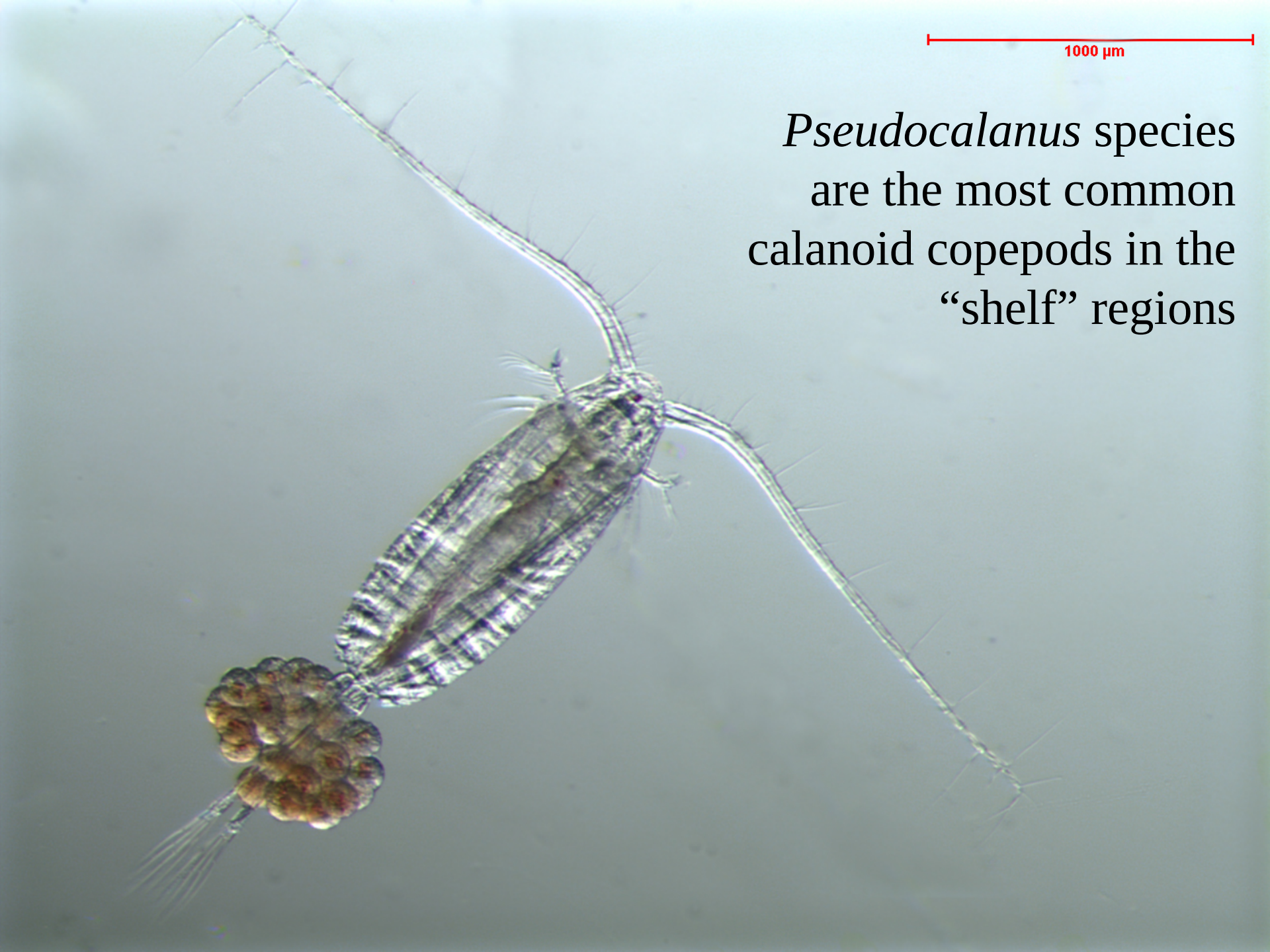
PP Shirshov Inst.
Moscow

UNIVERSITY OF ALASKA
FAIRBANKS


East Siberian Sea
Beaufort Sea
Chukchi Sea
Siberia
Alaska
Yukon River
Bering Sea
Aleutian Islands
Gulf of Alaska
70° N
65° N
60° N
55° N
180°
175° W
170° W
165° W
160° W
155° W
Depth
m
0
20
50
100
200
500
1000
7000
Beaufort Gyre
Atlantic Water
Siberian Coastal Current
Alaska Coastal Water
Bering Shelf Water
Aleutian North Slope - Bering Slope - Anadyr Waters
Alaskan Stream
September Ice Edge
March Ice Edge

Questions:

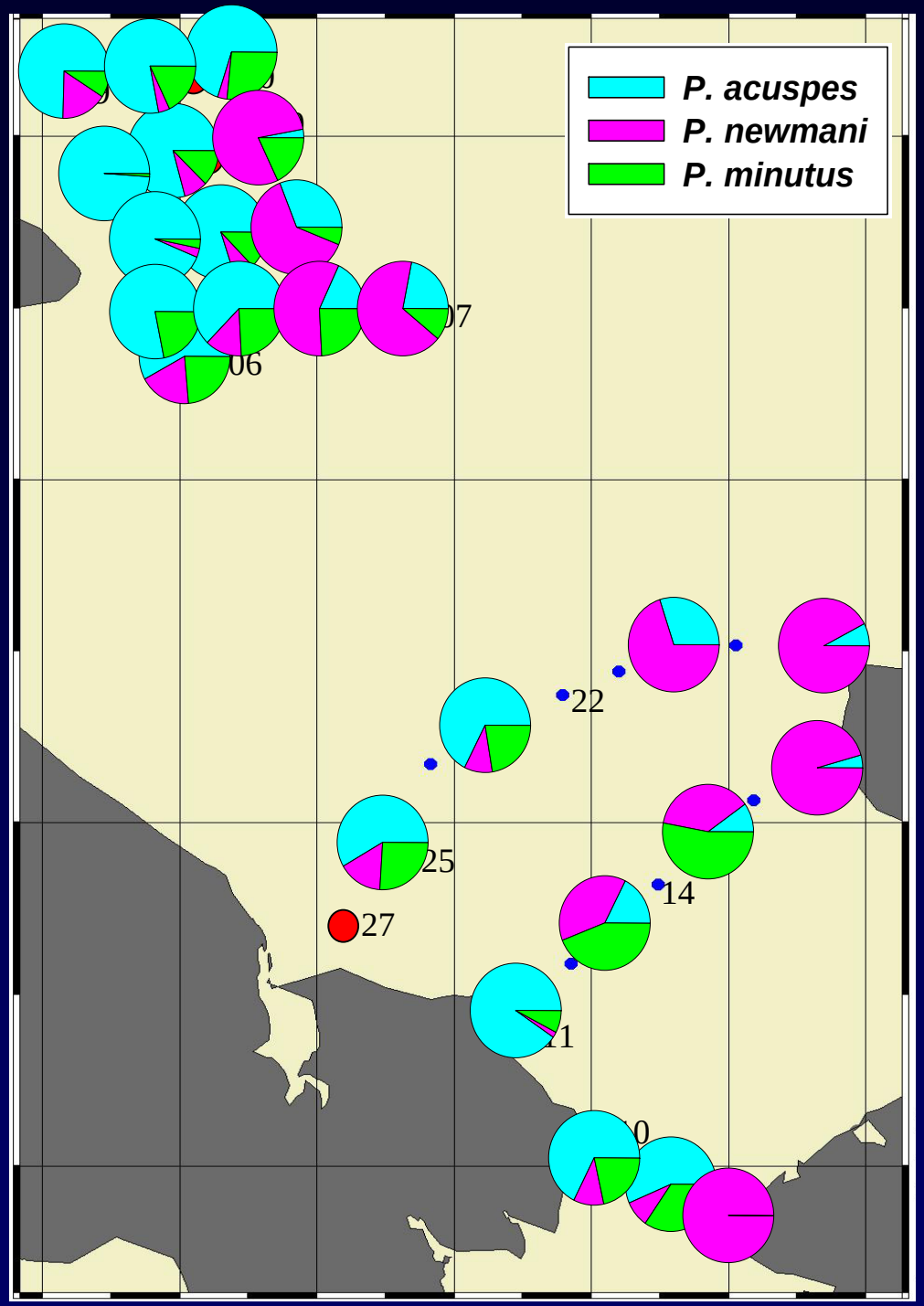
- How do these different water sources influence the composition of zooplankton?
- How far do these species and waters penetrate into the Chukchi Sea and Arctic Ocean?
- How might this arctic “gateway” change with ongoing warming trends?
- **How does this impact the rates of reproduction of the dominant copepods?**



Pseudocalanus species are the most common calanoid copepods in the "shelf" regions

Pseudocalanus spp.

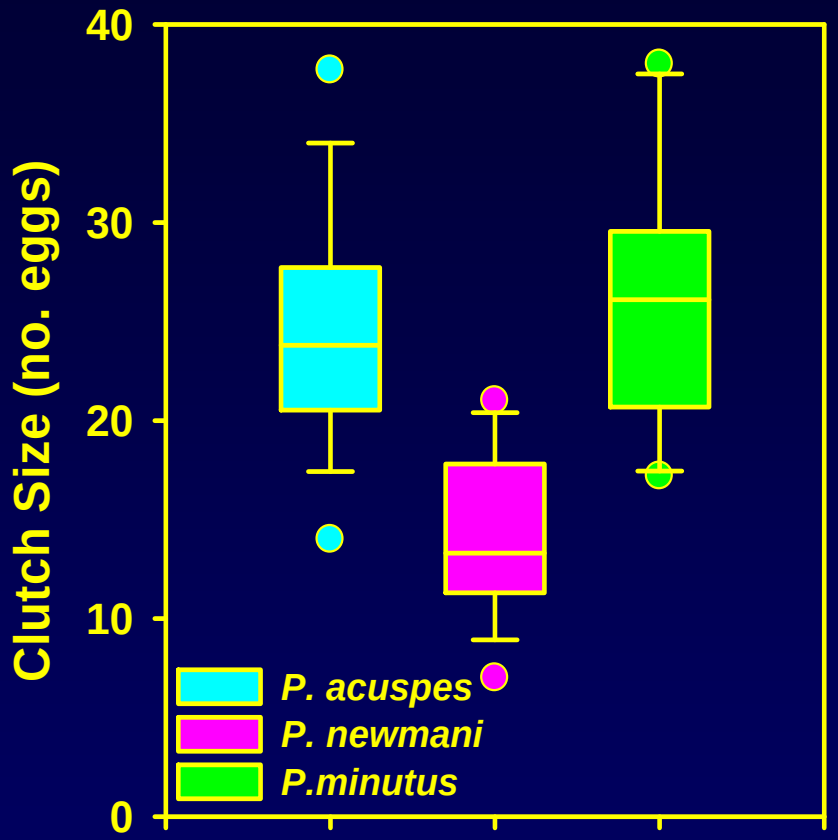
- Egg production rates measured over 2 days for 40-120 randomly selected *Pseudocalanus* females
- Incubated at ~2°C
- Females checked daily for new clutches
- Species identified post-preservation
- Population daily egg production rates, plus weight-specific production rates derived

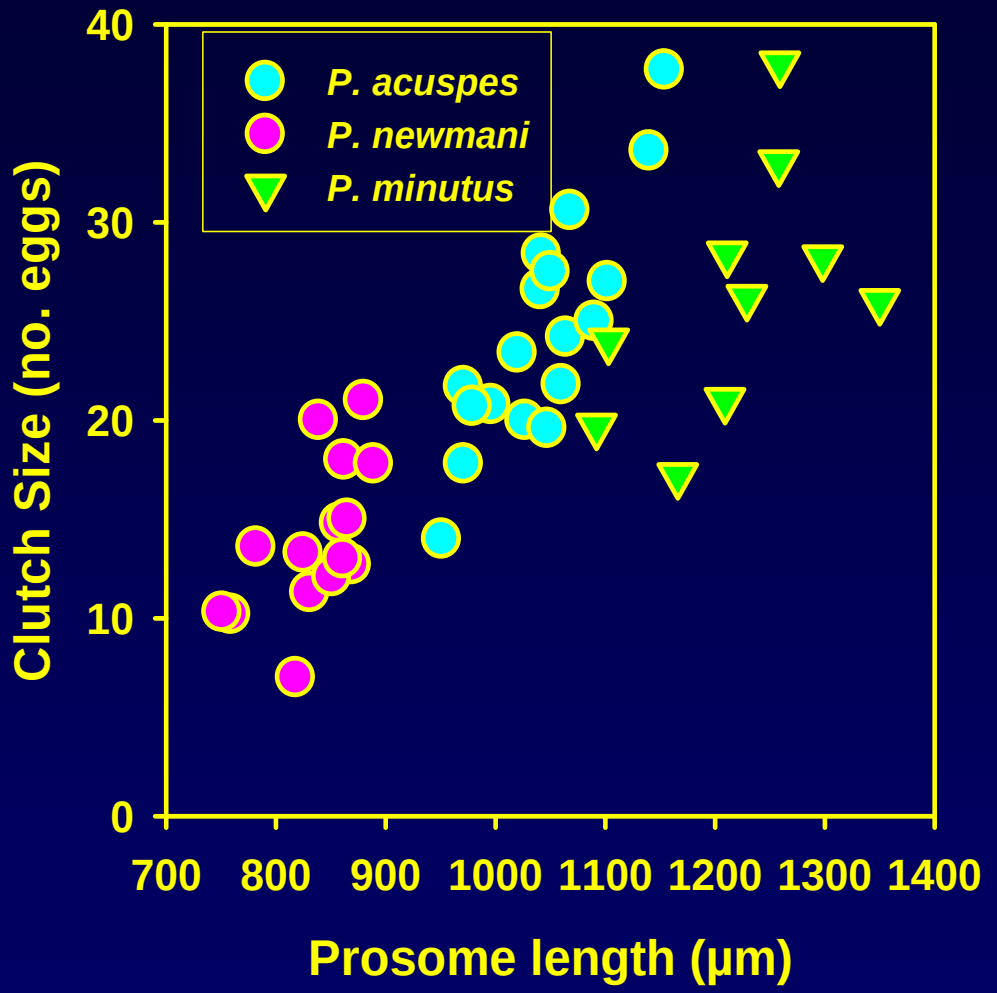


Composition

- 3 species present
- Alaska Coastal water warmer, with lower chlorophyll, dominated by sub-arctic *P. newmani*
- Anadyr and Arctic waters dominated by Arctic species *P. acuspes* and *P. minutus*
- Alaskan Coastal water can be traced as far as Herald Canyon, based on species composition

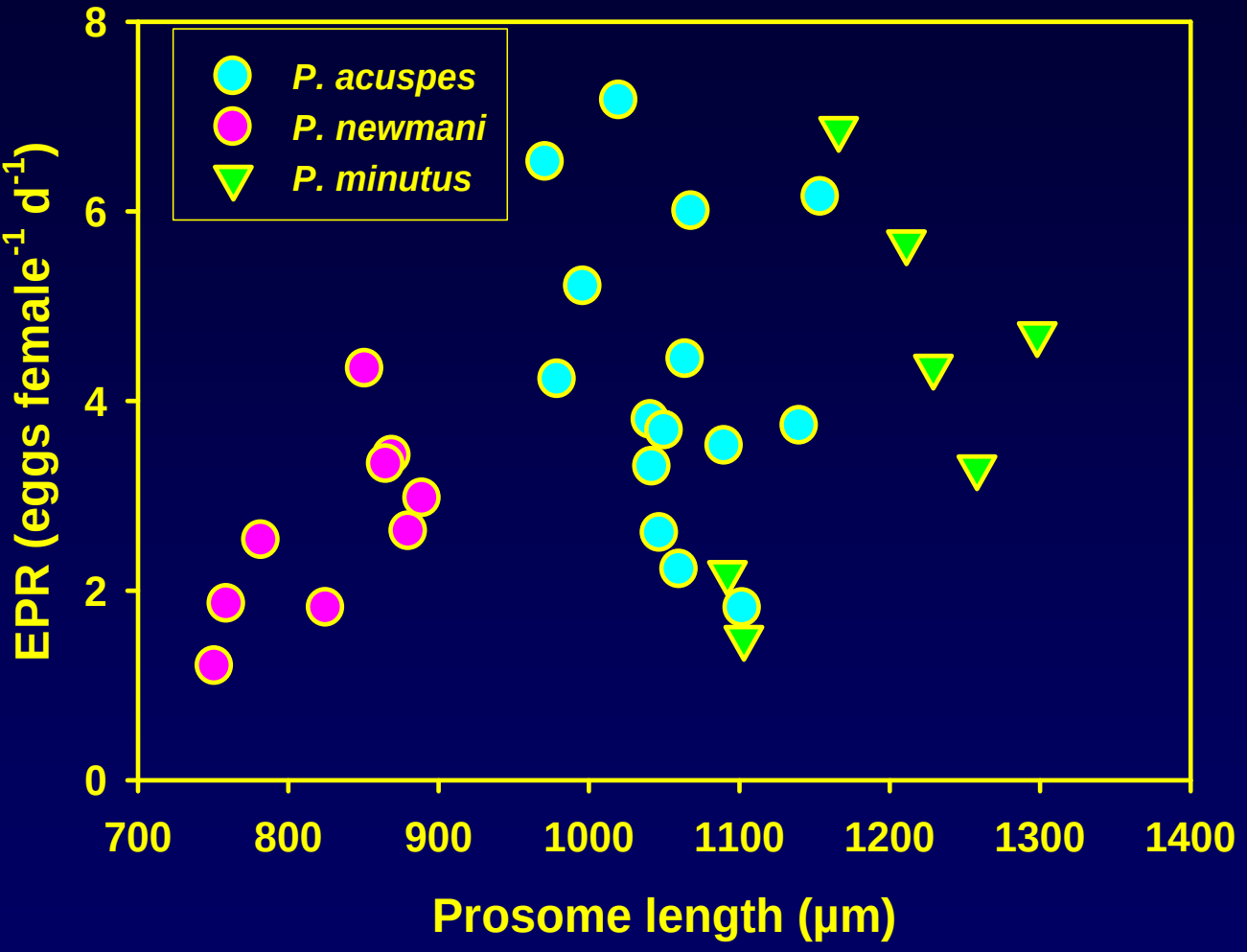
Egg Production: clutch size





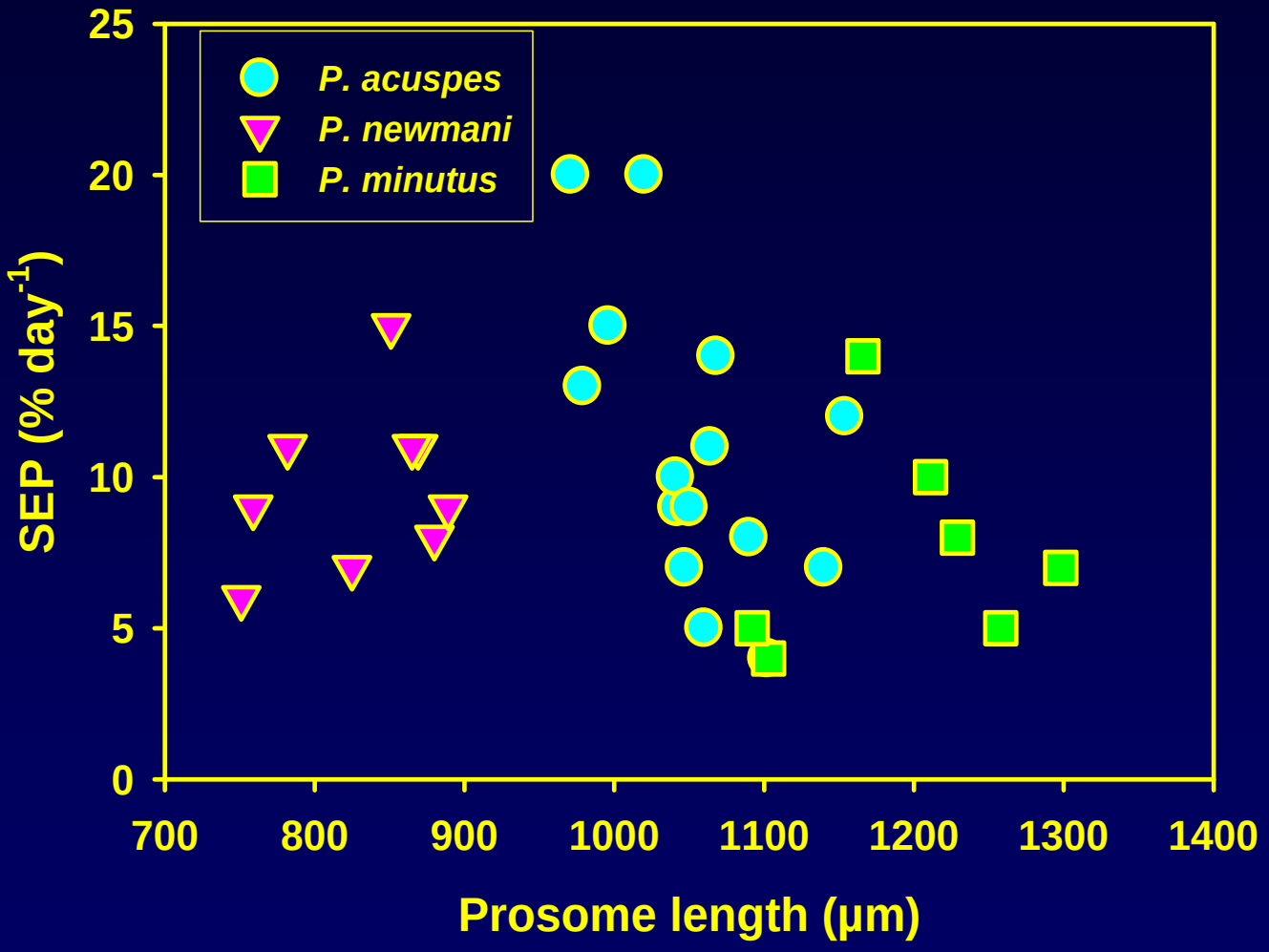
- Differences between species
- Largely due to body-size

Egg Production Rate

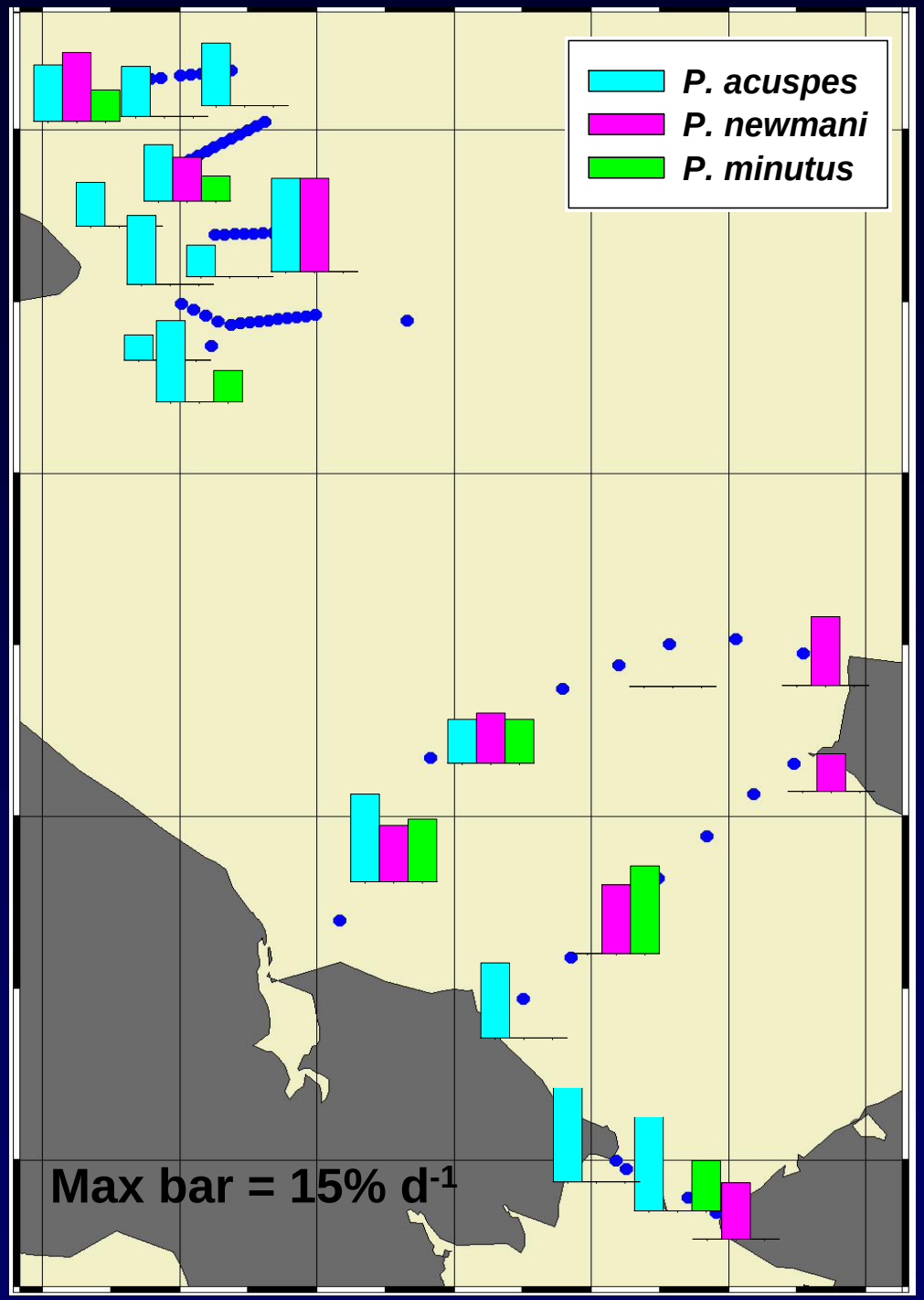


Note: data restricted to cases where 8 or more females of a species incubated

Specific Egg Production



Note: data restricted to cases where 8 or more females of a species incubated



SEP

- No clear patterns…
  - in part because species do not co-occur in adequate numbers to compare
- When species co-occur, SEP is often similar

Pseudocalanus Conclusions

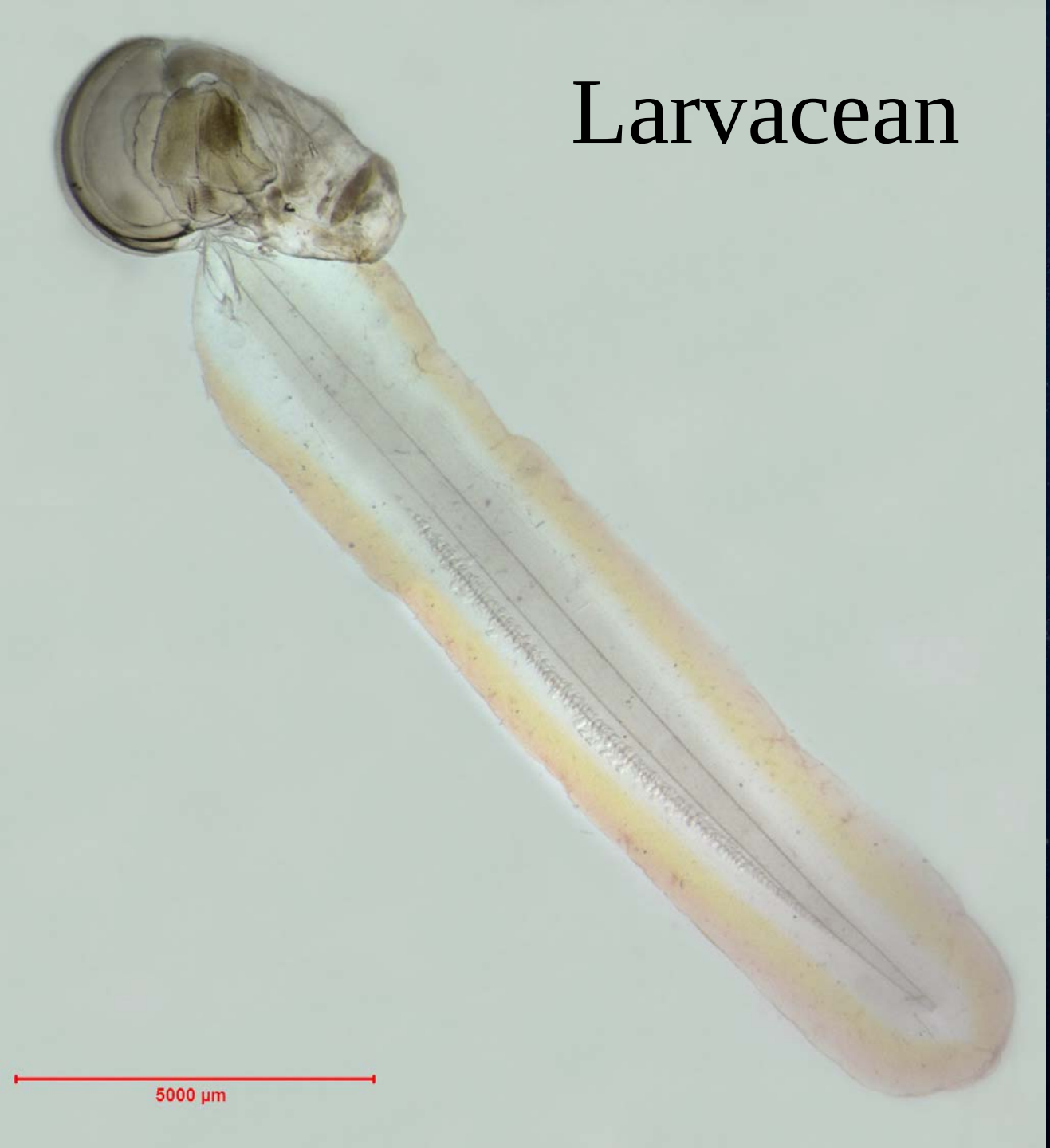
- Although there was a clear pattern in species composition (tied to water masses), there was no obvious pattern in weight-specific egg production
- This is surprising given strong chlorophyll gradients associated with these water masses
- Increased penetration of Pacific water will lead to increased penetration of *Pseudocalanus newmani*,
- BUT all other things being equal, secondary production may not change significantly other than that expected from temperature-dependent rate increases alone

Community patterns

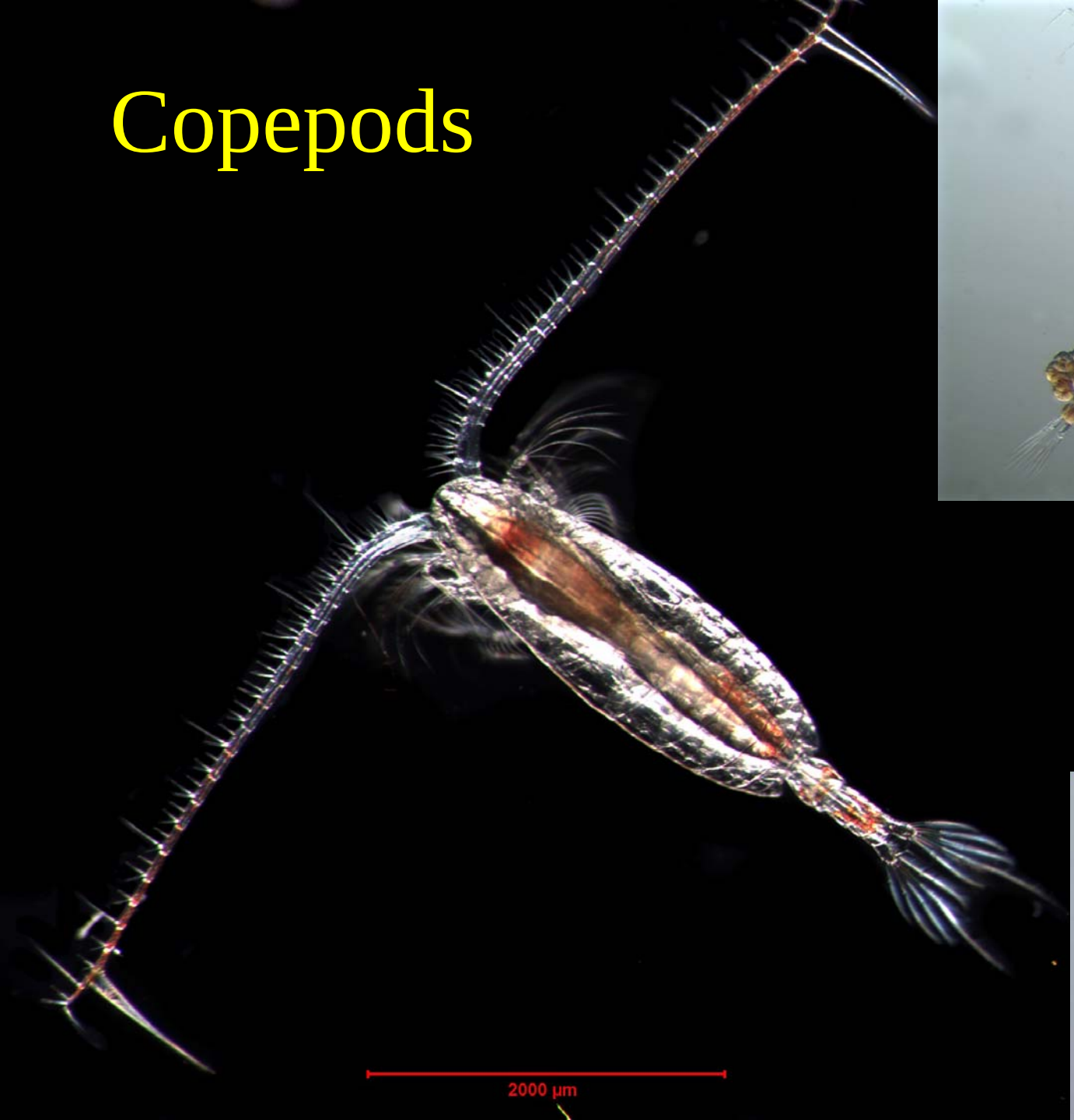
- Summary of broad patterns of composition, abundance & biomass
- 1) Southeren Chukchi predominated by Bering Sea fauna during summer
- 2) Meroplankton (larval forms of benthic species) very abundant throughout lower stations, reduced in canyon
- 3) Contribution by larvaceans (appendicularians) significant in majority of samples
- 4) Community composition strongly tied to water masses

Meroplankton

Larvacean

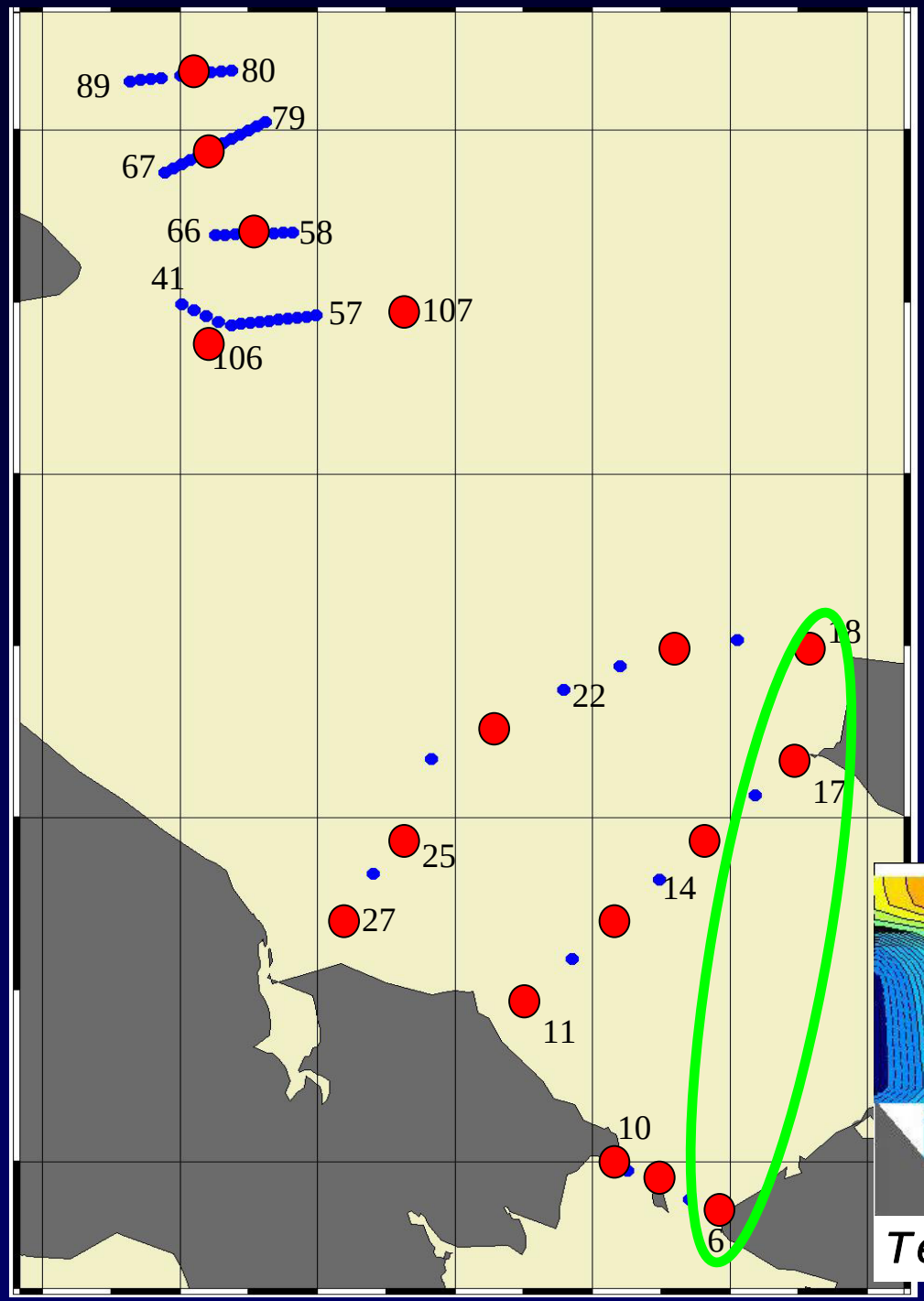


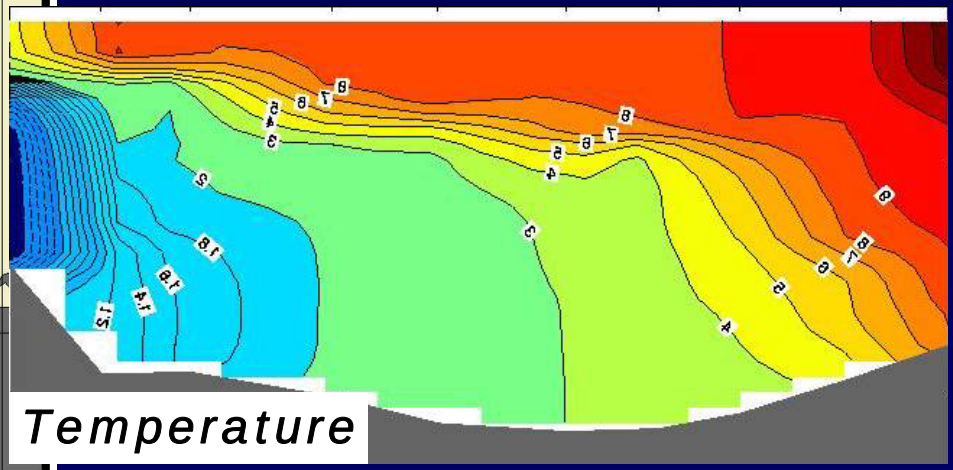
Copepods

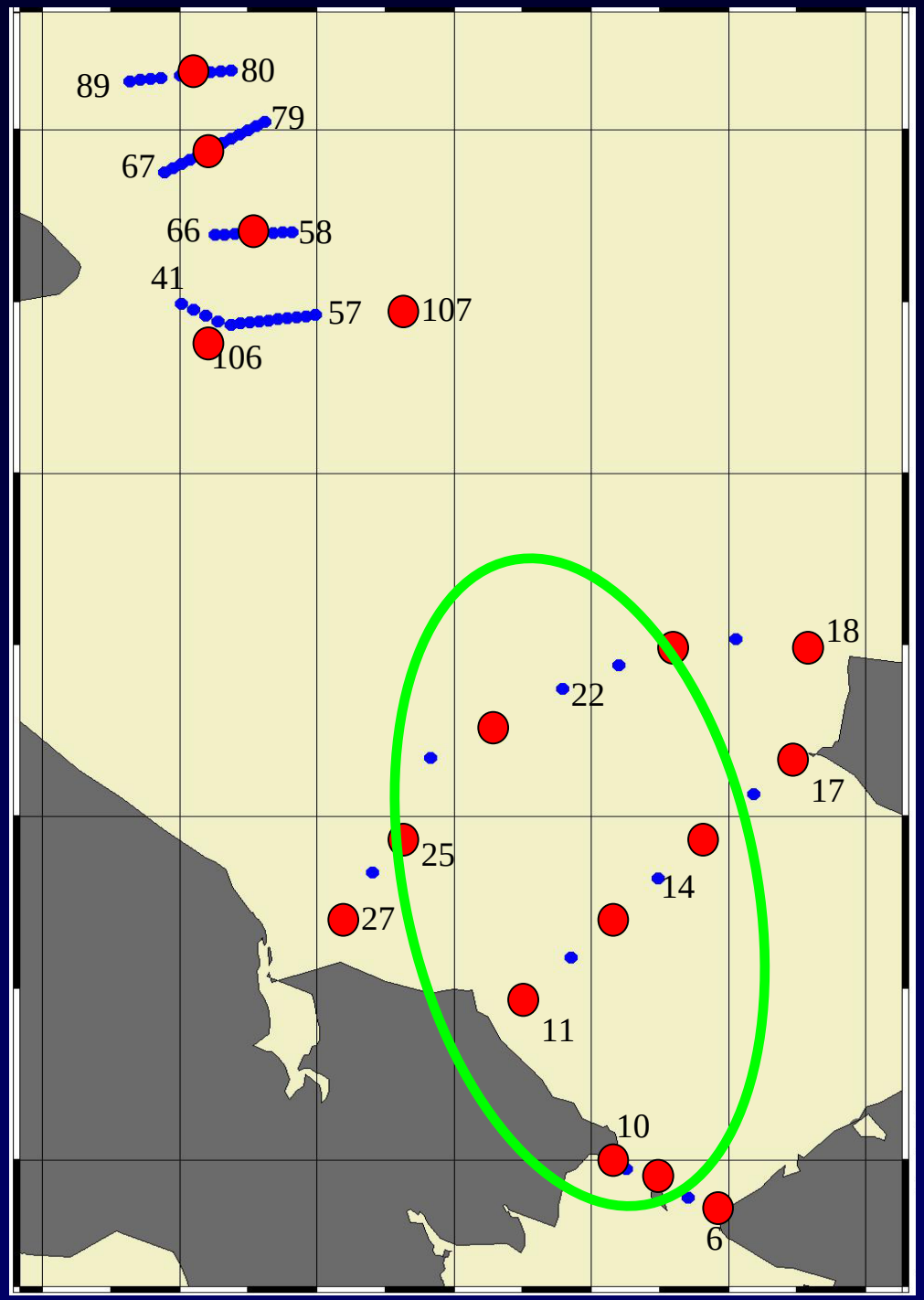


Alaska Coastal Current

- Small shelf and coastal species dominate abundance and biomass
- Meroplankton often dominate numerically
- Very little large algae in nets





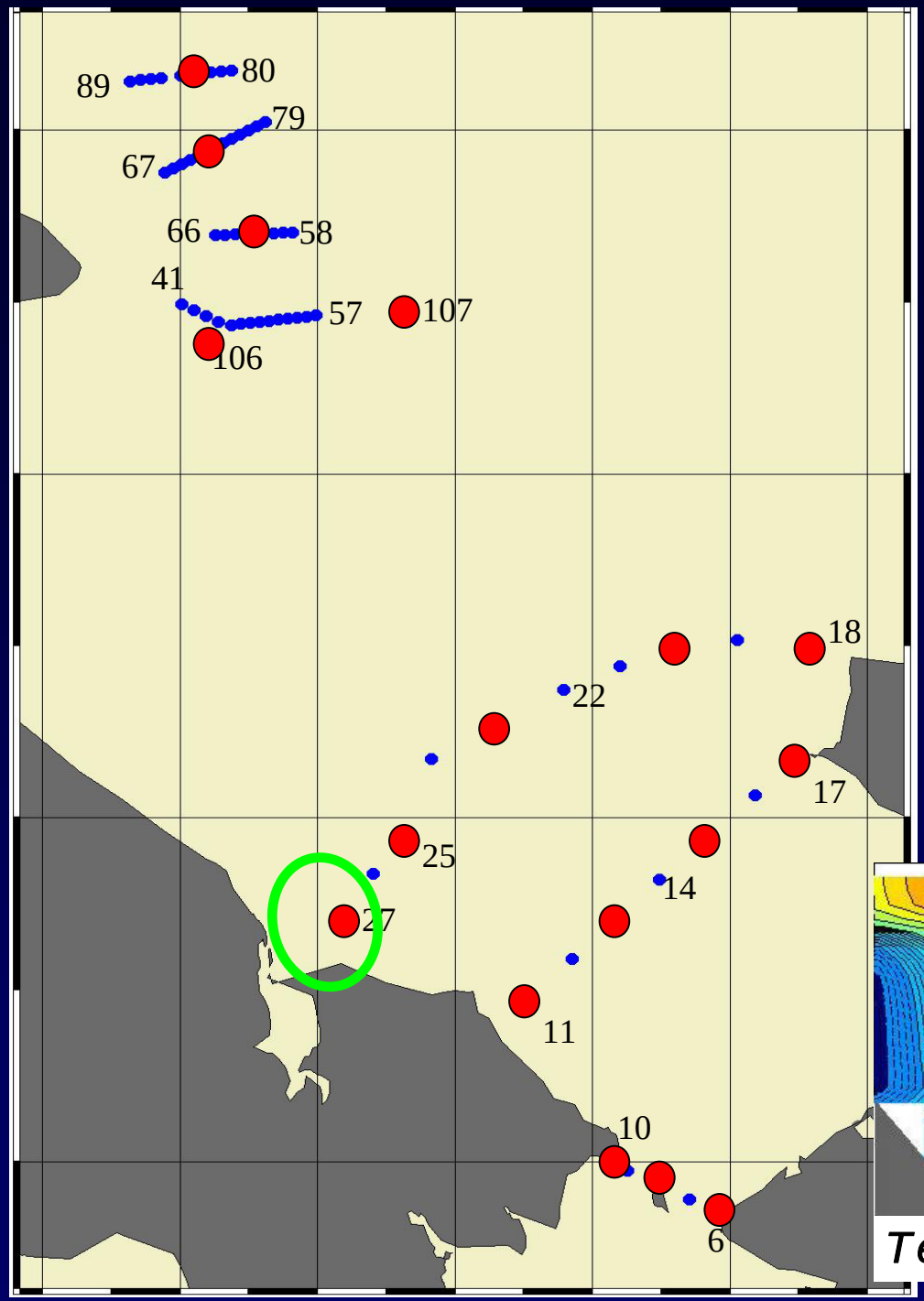


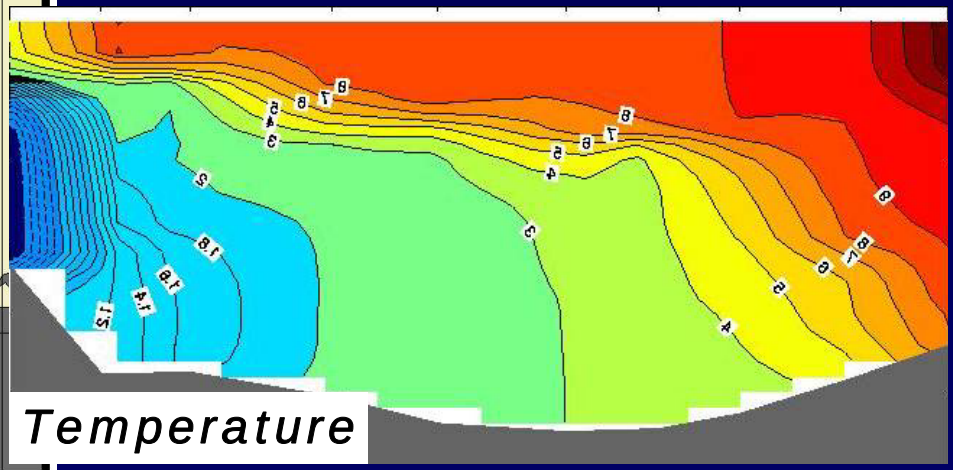
Anadyr & Bering Shelf Water

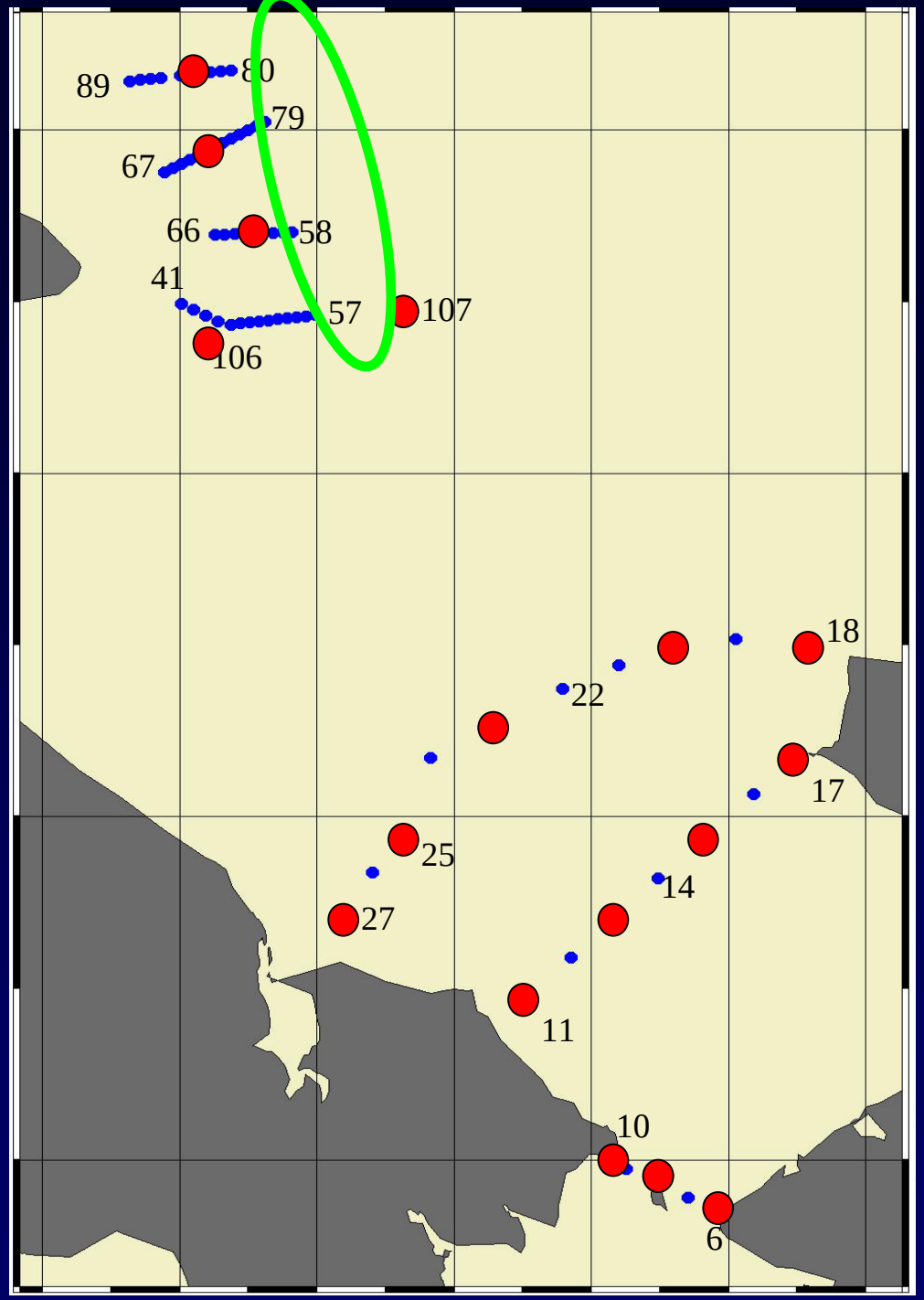
- Large Copepods dominate Biomass
- Small copepods dominate numbers (*Pseudocalanus*)
- Meroplankton reduced
- Moderate larvacean biomass
- Often moderate to high algae

East Siberian Current

- Pacific species gone
- *Calanus glacialis* dominates biomass, it is only large copepod
- No algae in nets

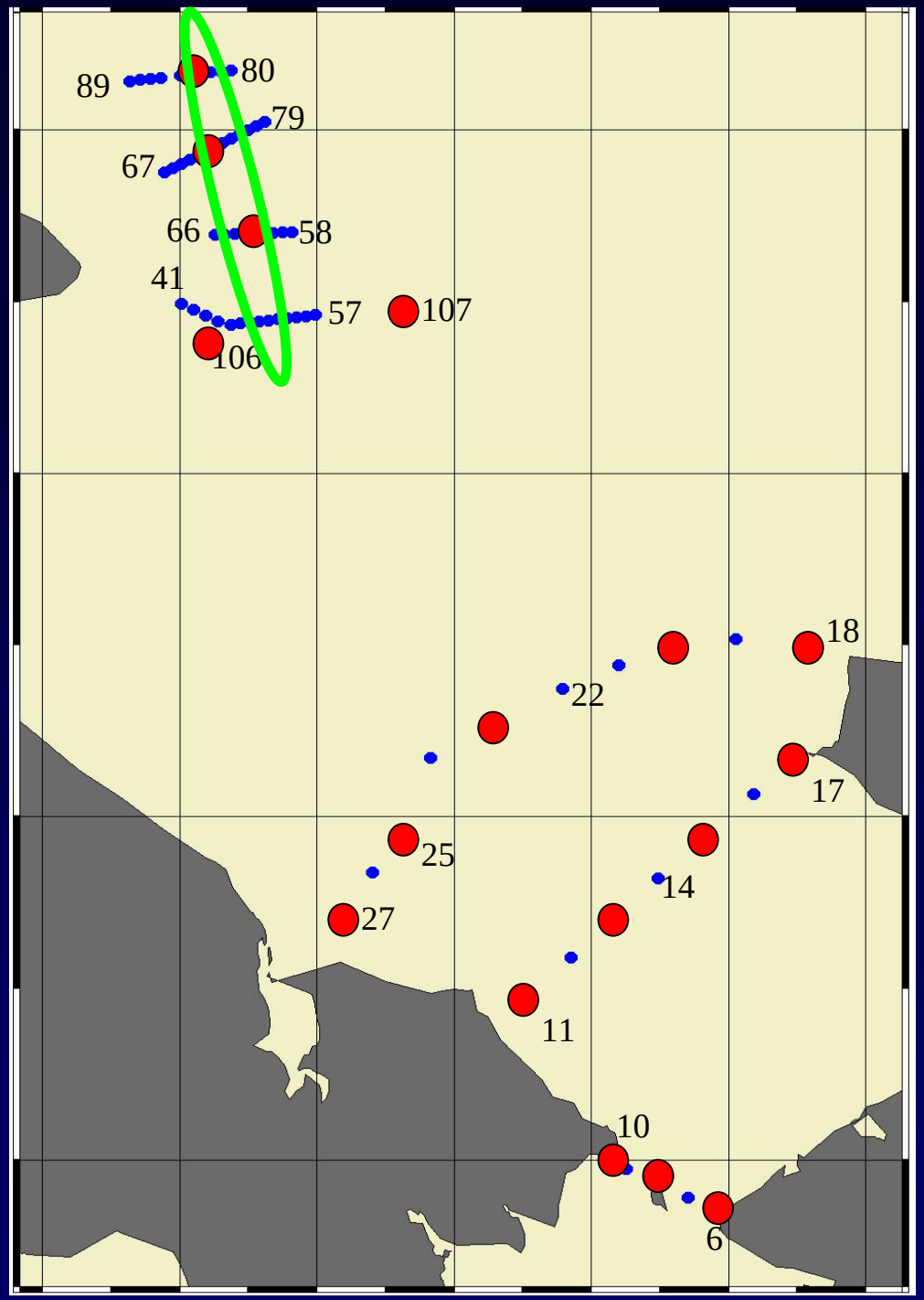






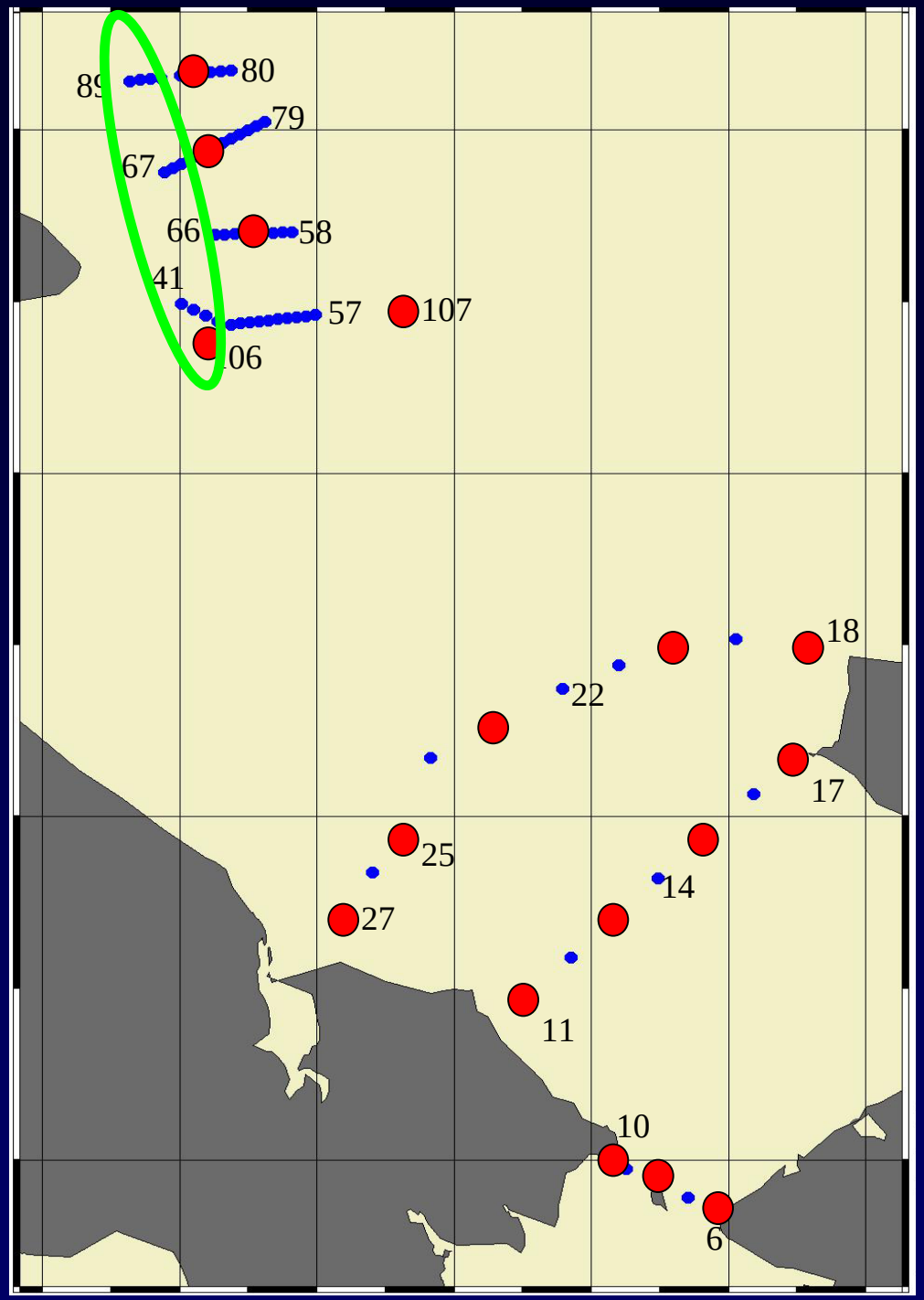
Harold Canyon East

- Coastal copepods dominate numbers and biomass
- Large copepods present in low numbers (Pacific *Calanus marshallae*?)
- Meroplankton reduced
- Moderate larvacean biomass
- Reduced Algae



Harold Canyon Central

- Coastal copepods dominate numbers
- Large copepods present in low numbers (*Calanus* spp.)
- Meroplankton reduced
- Moderate-high larvacean biomass
- Lots of algae



Harold Canyon West (Ice edge)

- *Pseudocalanus* dominates copepod numbers and biomass
- Large copepods present but subdominant (Arctic *Calanus glacialis*?)
- HUGE larvacean biomass ≥ copepods
- Nets clogged with algae and marine snow within first few meters of haul!

Bigger picture impact

- Increased penetration of Pacific water will lead to changes in composition, AND size structure of zooplankton communities
- Many predators feed based on size of prey, this could have impacts higher up the food chain
- Pacific species have different timing and duration to their life cycles… impact?... viability?
- Larvaceans more success in exploiting water column production than copepods… this has impact on flux to sediments