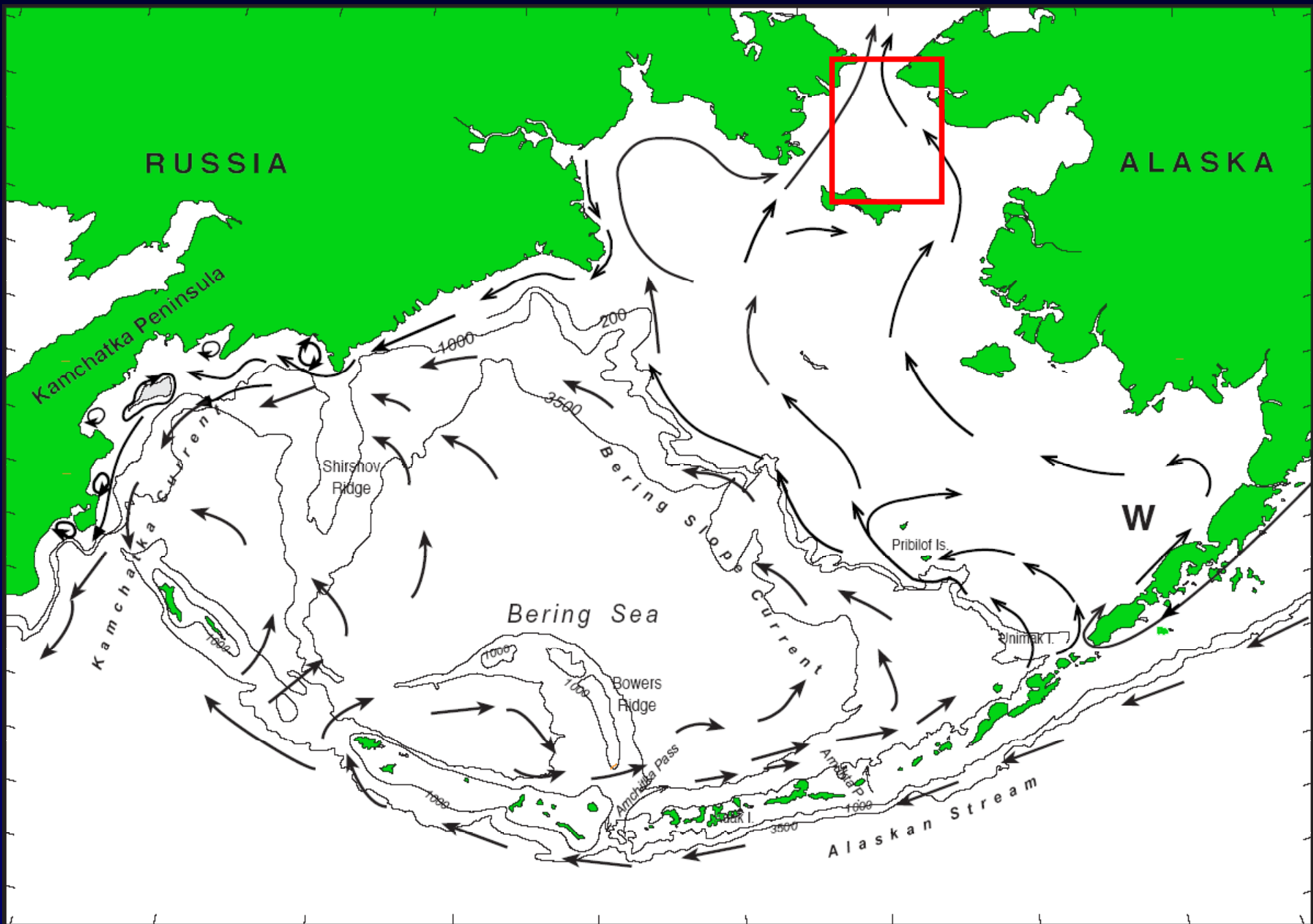
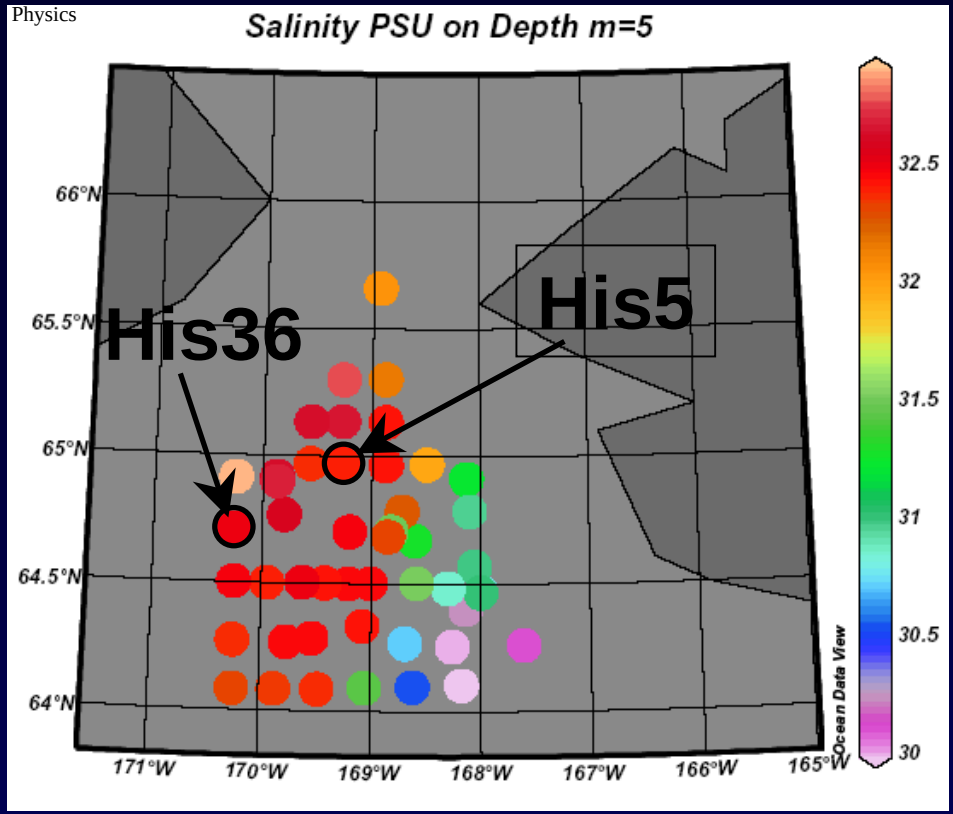
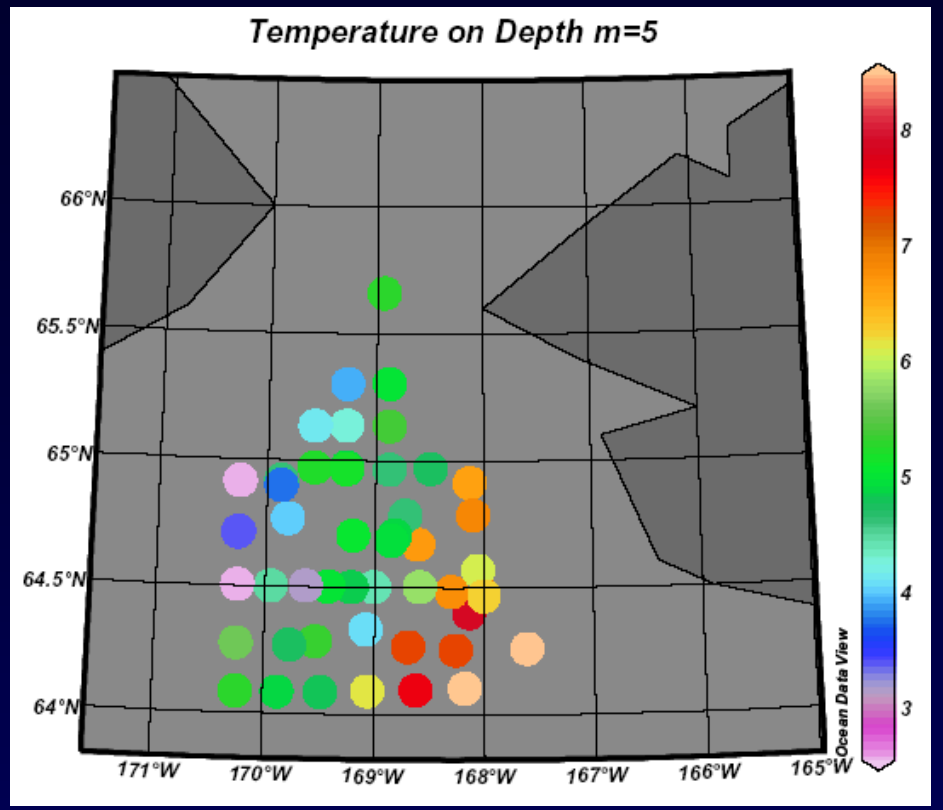
Community composition and production of larvaceans in the Northern Bering Sea

Russell R. Hopcroft
Cheryl Clarke

UNIVERSITY OF ALASKA
FAIRBANKS


RUSSIA
ALASKA
Kamchatka Peninsula
Kamchatka current
Shirshov Ridge
200
1000
3500
Bering slope Current
Bering Sea
Bowers Ridge
Pribilof Is.
W
Unimak I.
Amchitka Pass
Amukta P.
Alaskan Stream

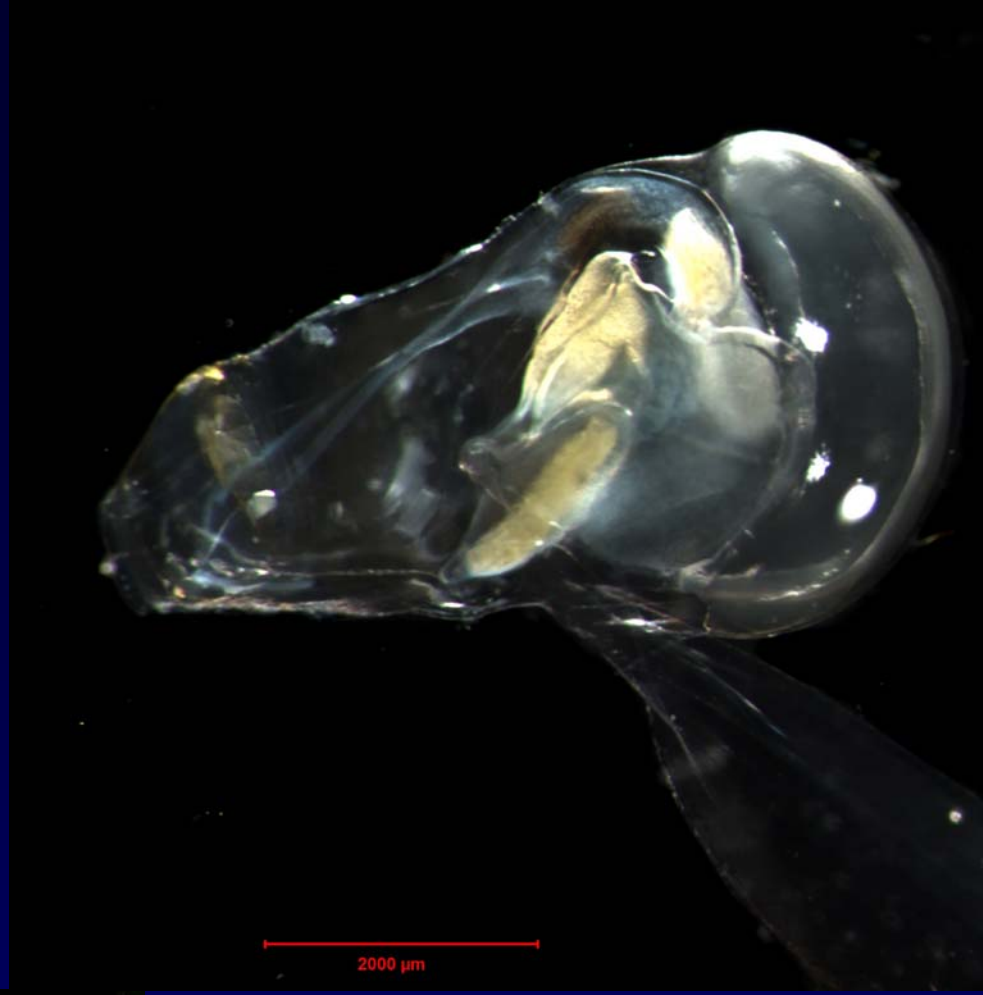


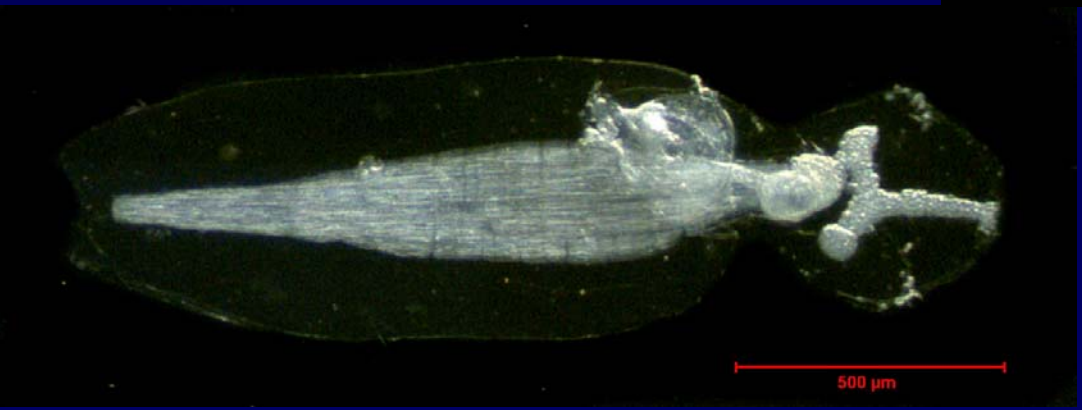


- July 2002, station depths 30-50m
- Warmer, fresher, stratified water in east
  - Alaska Coastal water
- Cooler less stratified water in remainder
  - Bering Shelf water

Only three species:

- *Oikopleura vanhoeffeni*
- *(O. labradoriensis)*
- *Fritillaria borealis typica*





O. vanhoeffeni egg production

- Animals collected by large volume non-filtering cod end on a 64-µm net during a dead-flat clam day
- Diluted into large pail, and bright orange-headed animals captured underwater into a jar
- 7 successfully retrieved with rip ovary intact
- Trunks length averaged 3665 µm (3050-4350 µm)
- Egg counts averaged 2690±1320STD, range 1210-4730
- diameter 127 ± 4 µm (STD), n=139

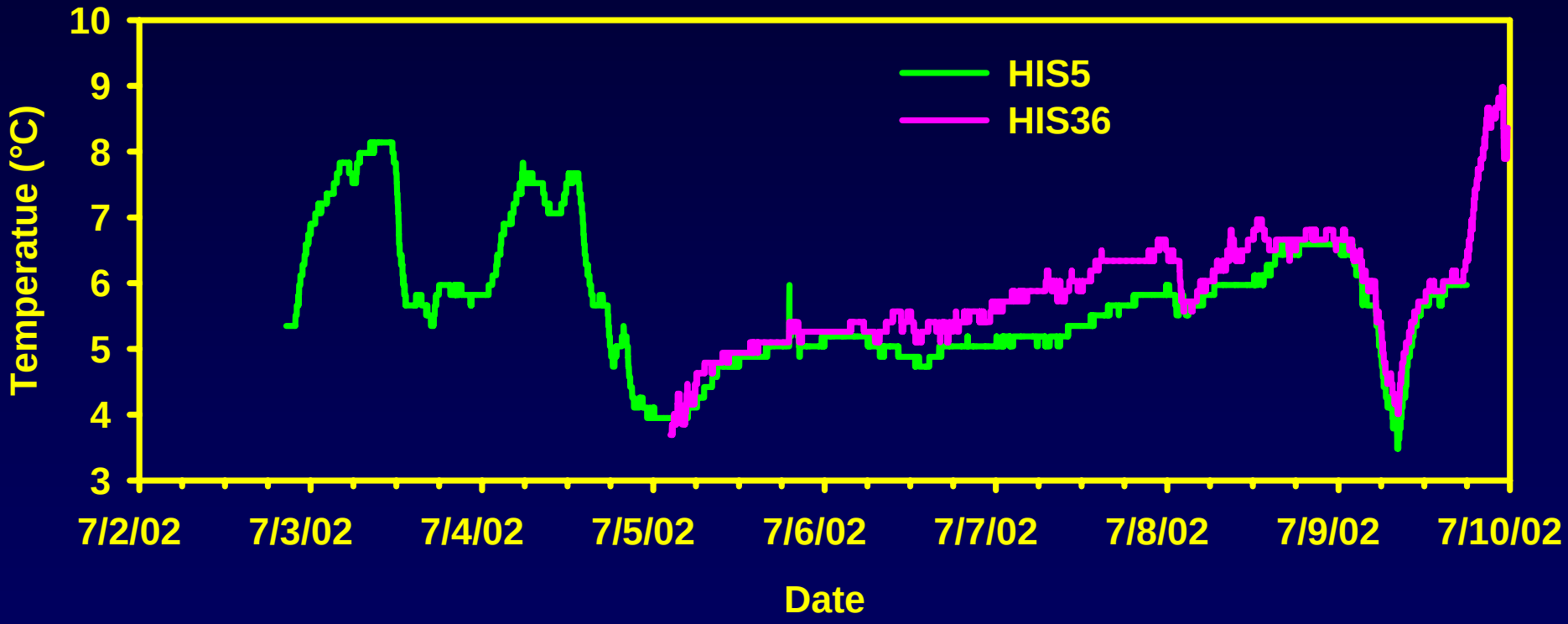
Hatching time

- Some spawned eggs were fertilized *in vitro* over a 2 hr interval using sperm released from other animals
- ~200 of these were incubated in incubators at each of 3° & 6°C
- Eggs hatched at 3°C after 36-39 hrs, at 45-48 hrs tail rotation occurred, at 59 hrs close to initiating feeding
- Eggs at 6°C appeared to develop, but never hatched

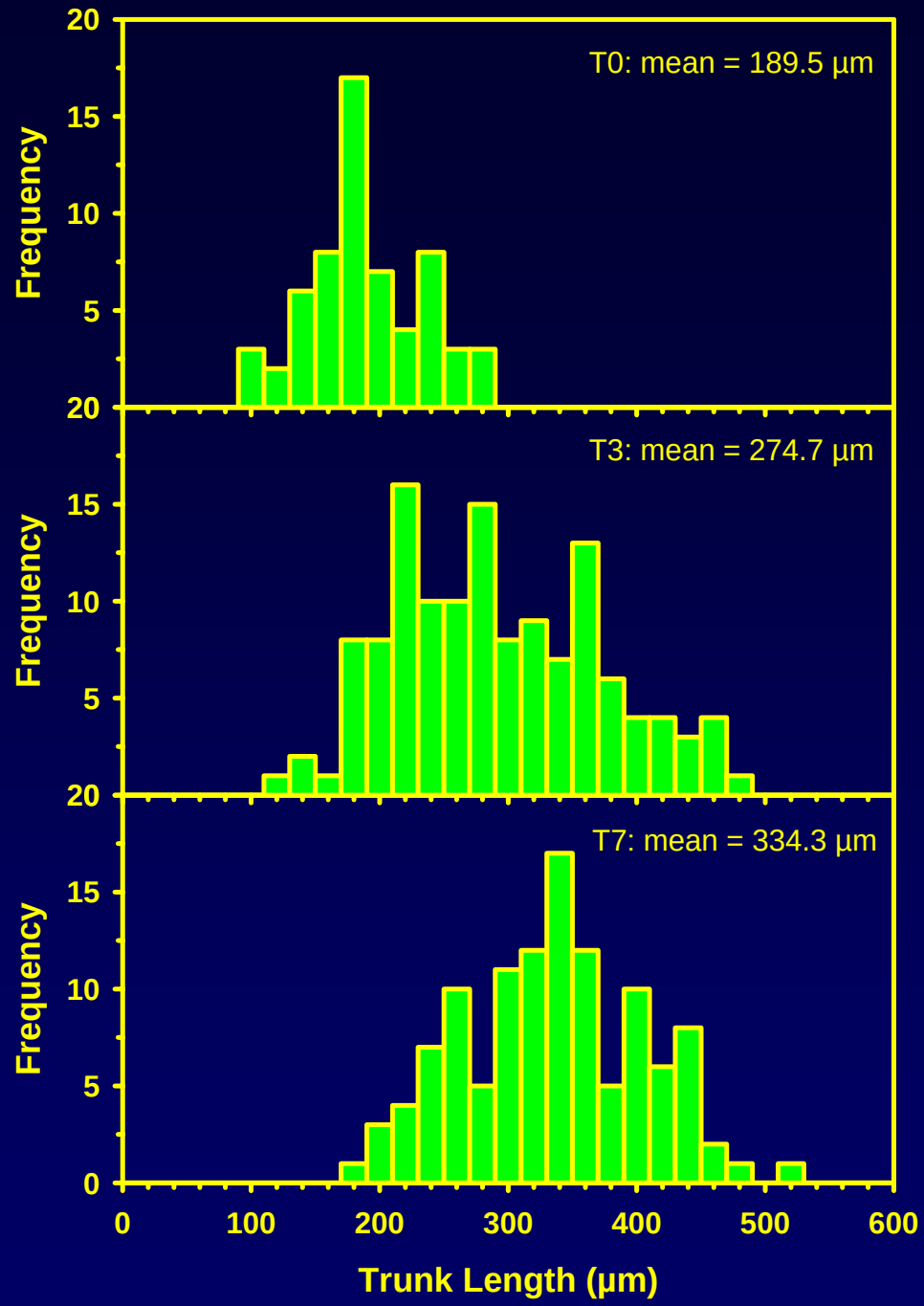
Growth Rate Experiments

- 2 stations –water collected at 5m using 10L Niskin bottles & pre-screened through 200 um mesh to create "artificial cohorts"
- 360L screened onto 45 µm mesh as T0
- 720L incubated on deck at sea-surface temperature, and 360L screened onto 45µm mesh after 3 & 5 (HIS36) or 3 & 7 days (HIS5)
- Trunk lengths measured in preserved samples, and growth estimated form change in predicted weight at mean size

Experimental Temperatures

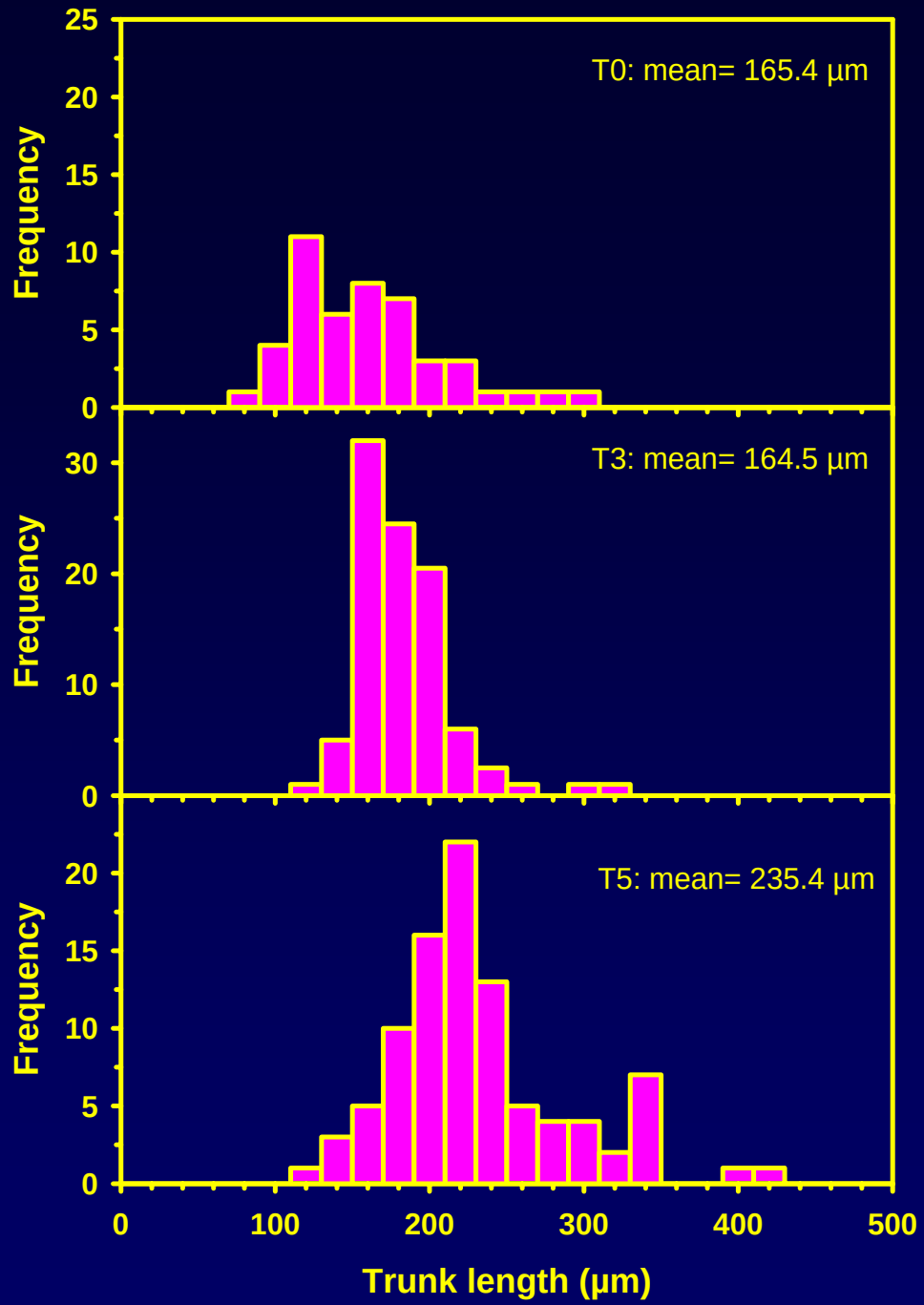


His5 averaged 5.7°C, His36 averaged 5.8°C



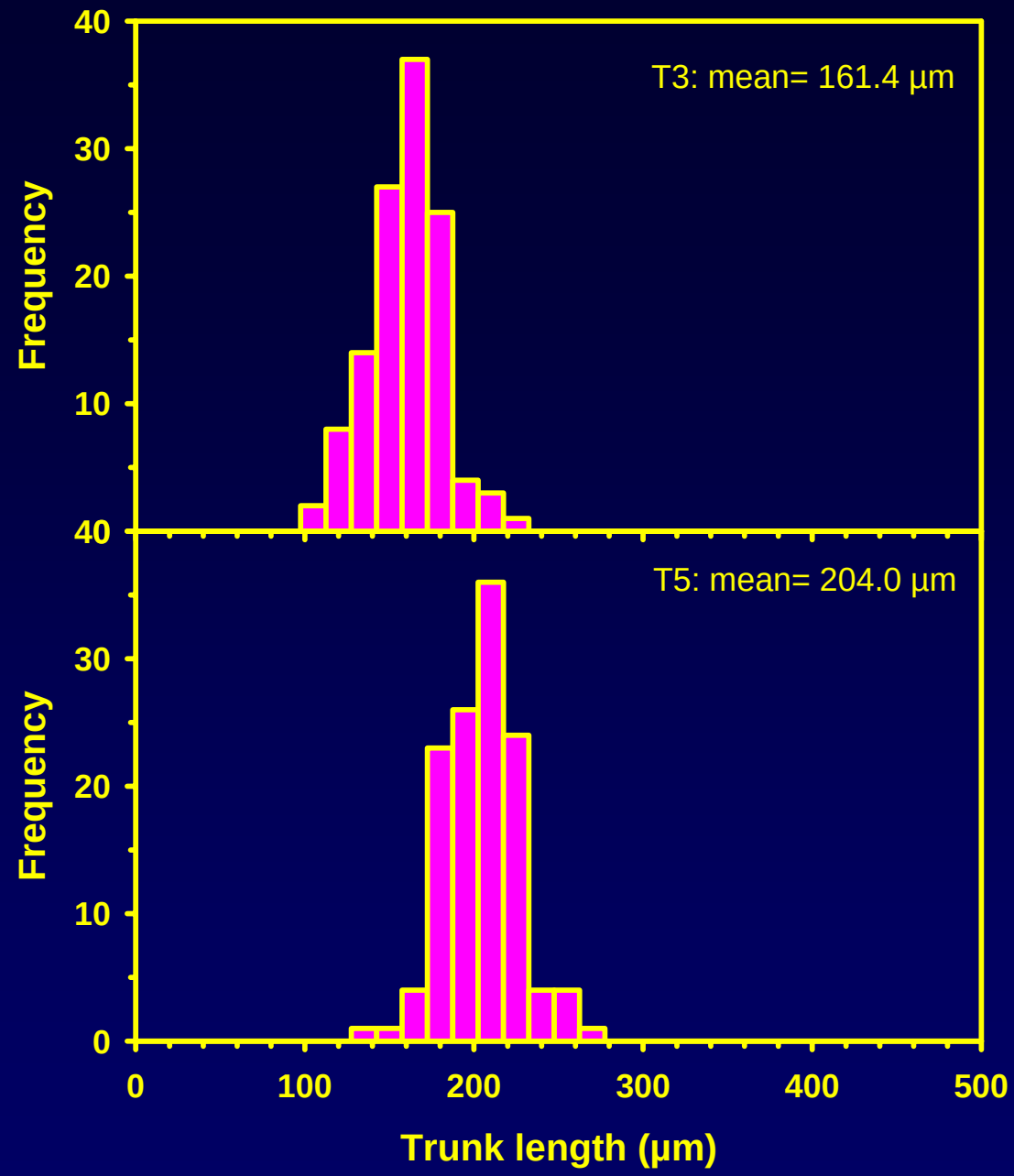
Fritillaria borealis

- HIS5
- To avoid bias we used T3-T7 because:
  - hatching continues between T0 &T3
  - size dependent mortality may occur at T0 (i.e. larger individuals damaged by screening)
- Growth rate = 18% per day



Oikopleura vanhoeffeni

- HIS5
- Growth rate = 25% per day



Oikopleura vanhoeffeni

- HIS36
- Growth rate = 41% per day
- No animals at T0

Growth rate implications:

- Using these growth rates, size at hatching & size of adults, we can make preliminary estimates of generation times
- *These will be underestimates because laboratory work suggests growth may decline with increasing size*
- For *Oikopleura vanhoeffeni* estimates are 42 and 26 days
- For *Fritillaria borealis*, estimate is 28 days

O. vanhoeffeni house production rates

- Collected by large volume non-filtering cod end on a 64 µm net on “dead-flat” clam day
- Diluted into large pail, animals reforming houses captured underwater into a jar
- 3-5 individuals placed into each of 6 20L pails
- Checked every 3-6 hrs for 24 hrs; discarded houses counted & removed

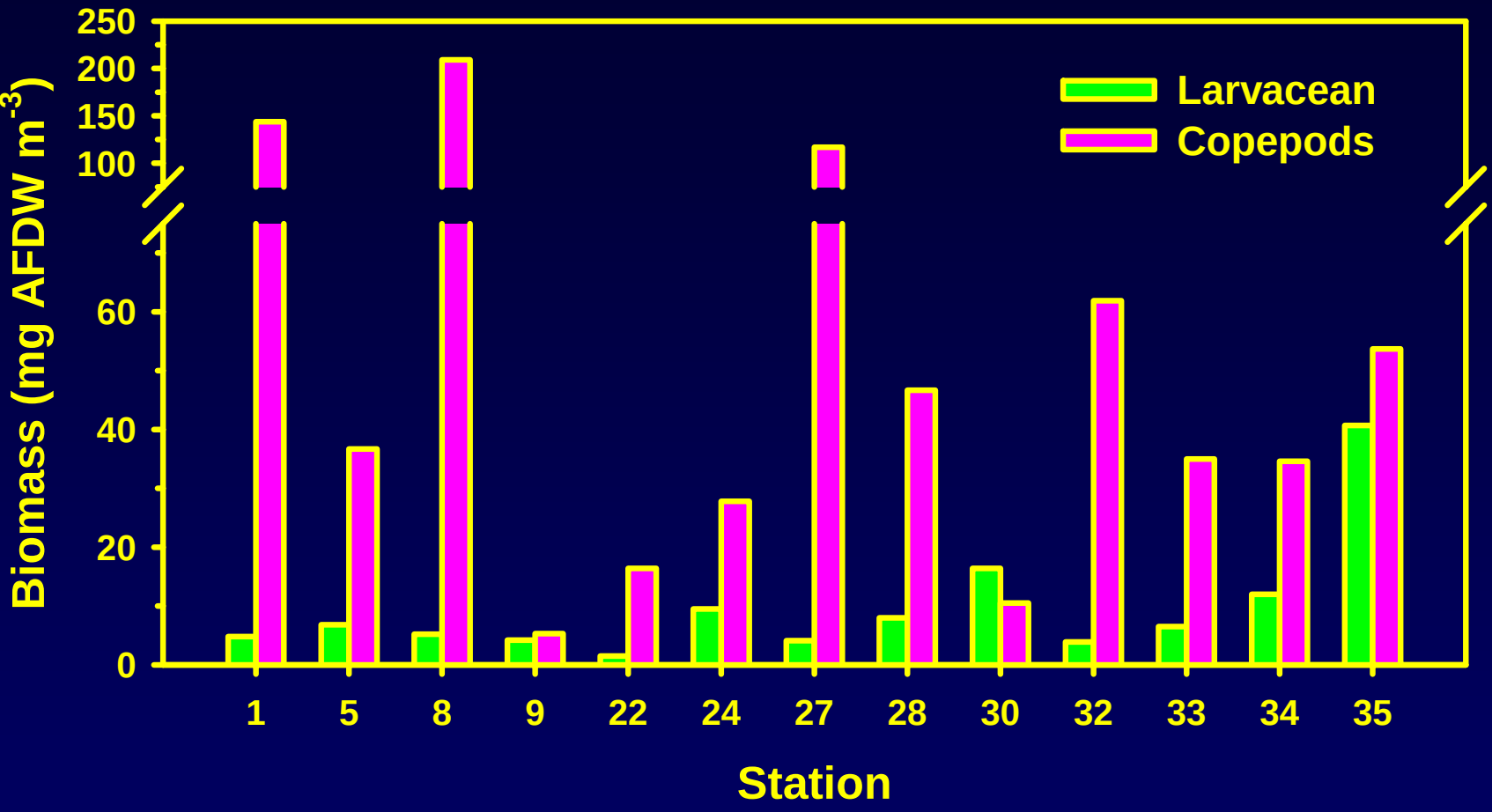
Pail	animals	house/day
1	3	1.67
2	3	2.00
3	4	3.25
4	5	2.80
5	5	3.00
6	4	2.50

- Mean 2.4 ± 0.7 day^{-1}

Survey Mode

- Simultaneous collections with metered 53 and 150 µm nets, hauled vertically from 5m above bottom to surface
- Nauplii, small copepods (*Oncaea*, *Oithona*, *Pseudocalanus*, *Acartia*), *Fritillaria*, and small *Oikopleura* processed from 53 µm net
- All other taxa processed from 150 µm net
- Lengths measured; biomass predicted from taxa-specific length-weight relationships
- Only ~1/3 of stations processed to date

Preliminary Results



- Larvacean biomass averages 34.5% (arithmetric) or 16.4% (geometric) of copepod biomass

Conclusions

- Estimates of growth rates and generation times of larvaceans range from ~equal, to several fold faster than copepods
- Life-time fecundity of larvaceans is also several fold, to an order of magnitude higher
- Both of these would allow quicker response to environmental variation in resources than is possible for the copepods
- These rate differences offset differences in observed biomass, implying that larvacean production may be equal, if not greater than that of the copepods

A picture is worth a thousand words