Growth Rates of *Neocalanus* Species in the Northern Gulf of Alaska

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Cheryl Clarke
3 species:

- Neocalanus cristatus
- Neocalanus plumchrus (& flemingeri)
Typical Life cycle
Information Gap

Although we know overall life cycle, we lack precise or direct measurements of:

• development times
• growth rate
• Reproductive output
Approach

1. Determine direct rates from freshly collected animals at *in situ* temperatures throughout the annual cycle
   - Single stage incubations
   - Artificial cohorts

2. Determine maximal food satiated rates in the lab at multiple temperatures

3. Determine reproductive output

4. Compare these measured rates to those inferred from field observations
Gulf of Alaska
GLOBEC
Artificial Cohorts (4-5 days)

- Multi-stage/size distribution is cut into distinct stages/sizes
- Incubated 100-500 *Neocalanus* in 20-100L
- Change in stage and size noted
- Development time and growth rate calculated
Single stage incubation (4-5 days)

![Graph showing frequency of prosome length (µm) across different stages and genders.]

- **Stage 1**
- **Stage 2**
- **Stage 3**
- **Stage 4**
- **Stage 5**
- **Female**
- **Male**

**Y-axis:** Frequency

**X-axis:** Prosome length (µm)
Stage durations

Initial stage

Stage duration (d)

Mar Gak6
Mar Gak9
MarPWS
Apr Gak1
Apr Gak4
Apr Gak9
Apr Gak13
May Gak1

Apr Gak13 cohorts
Apr Gak1 cohorts
Apr PWS cohorts
May Gak4 cohorts
Growth Rate

![Graph showing growth rate over different stages and cohorts]

- **Initial stage**: 1, 2, 3, 4
- **Instantaneous Growth (d⁻¹)**: 0.00, 0.02, 0.04, 0.06, 0.08, 0.10, 0.12, 0.14, 0.16, 0.18

**Legend**:
- Mar Gak6
- MarG9
- MarPWS
- Apr Gak1
- Apr Gak4
- Apr Gak9
- Apr Gak13
- May Gak1
- Apr Gak13 cohorts
- Apr Gak1 cohorts
- Apr PWS cohorts
- May Gak4 cohorts
Generation time

• Average faster than previous estimates [i.e. 12.6-16.6 days estimated (Miller, 1993), 24-25 days for C3 & C4 determined (Miller and Nielsen, 1988)]

• First 4 copepodite stages would be completed in 30-60 days … populations poorly synchronized

• Assuming *N. femingeri/plumchrus* naupliar development of 30-40 days (Saito & Tsuda, 2000); it would appear that 70-100 days from hatching are required to reach C5.

• The duration of the longer-lived stage C5 in the upper water column (prior to diapause) remains to be established
Influence of environment

- Temperature relatively constant during all three cruises (4.5-6°C)
- Chlorophyll and degree of stratification increased on subsequent cruises
- Current task: to explore the relationship between measured rates and these variables
...move on to egg production