Northern California Current (WA, OR, Northern CA) 
Hot Spots of Abundance for *Euphausia pacifica* and *Thysanoessa spinifera*

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A vertical plankton net was used for all samples.

The net is a 0.5m diameter ring net, with 202μm mesh, towed vertically from a maximum of 100m (or 5m off the bottom) to the surface.

Only night-time samples were used in the analysis.

The samples were analyzed for adult and juvenile *E.pacifica* and *T. spinifera*. Combining these life history stages to produce species specific biomass estimates for each sample.

Biomass is calculated using a dry weight to carbon relationship, and is expressed as mg of carbon per m$^3$ of water.
To achieve a coast-wide sampling distribution we used samples from multiple projects and multiple cruises within projects.

GLOBEC Long-Term Observations Program 1998-2002 (LTOP)  
$\text{n} = 220$

GLOBEC MESOScale 2000, 2002 (MESO)  
$\text{n} = 130$

Coastal Ocean Observing Process 2001 (CoOP)  
$\text{n} = 23$

Pacific Coast Ocean Observing System 2004-2006 (PaCOOS)  
$\text{n} = 124$. 
Spatial Distribution from Juan de Fuca 48° to Pt. Arena 38°

Majority of the stations sampled more than once.

N=497
Sample distribution by year, month and cruise

<table>
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<th>Year</th>
<th>Project</th>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
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<th>Dec</th>
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The yearly and within year distribution of samples is very good.

Best distribution between April and September.
**Euphausia pacifica** (*Epac*) coast-wide distribution. Mean biomass of 2.8 mgC/m$^3$.

**Thysanoessa spinifera** (*Tspin*) distribution coast-wide, and mostly on the shelf. Mean biomass 0.5 mgC/m$^3$. 
### Distribution of samples per month by species

<table>
<thead>
<tr>
<th>Month</th>
<th>Total # of samples</th>
<th>Epac present</th>
<th>Tspin present</th>
<th>Total # of samples without Epac or Tspin</th>
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<tr>
<td>Total</td>
<td>497</td>
<td>389</td>
<td>188</td>
<td>88</td>
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</table>

*Epac in 78% of the samples*

*Tspin in 38% of the samples*

*Only 18% of the samples had neither Epac or Tspin.*
Samples with high biomass probably indicate that we sampled swarms of adults.

Epac samples had biomass values ranging from 0-228mgC/m³

Tspin samples had biomass ranging from 0-35mgC/m³
2000 is the year with the most swarm samples.

The summer months of May, June and July have the most large samples.
Peak biomass is in the summer months between May and Aug.
Epac biomass not well related to cool or warm ocean conditions. 2000 was a very good year; 1999 (cold) and 2004 (warm) about equal in biomass.

Biomass by latitude

Epac mean biomass south of Cape Blanco is 3.7 mgC/m³, north 2.4 mgC/m³. Omitting the one outstanding sample the northern biomass mean is 1.8 mgC/m³.

Tspin biomass south of Cape Blanco is 0.77 mgC/m³, north 0.27 mgC/m³.
Using the mean density (#/m³) for each sampling location we created species-specific prediction charts to show “hot spots” for each species.
*Euphausia pacifica* (Epac)

- coast-wide distribution
- present in 78% of the samples
- consistent biomass values for the entire study area
- biomass values ranging from 0-228 mgC/m$^3$
- mean overall biomass of 2.8 mgC/m$^3$

*Thysanoessa spinifera* (Tspin)

- mostly on the shelf
- present in 38% of the samples
- biomass ranging from 0-35 mgC/m$^3$
- mean overall biomass of 0.5 mgC/m$^3$
Conclusion

- Sure would be nice if we could get some funding to do this study along the same grid at the same times every year!
- Particularly the “hot spots”; feeding grounds for fish (salmon), mammals and birds?
- Swarms seem real and need more work (acoustics + nets = the best alternative).
Acknowledgements

- GLOBEC (LTOP, MESO)
- NOAA/Stock Assessment Improvement Program
- NSF-CoOP/COAST
- Contribution to PaCOOS
- Many people who have supported these efforts
Biomass

Euphausia pacifica
1998-2006 Prediction Map
Biomass mgC/m³
Filled Contours
0.00 - 0.02
0.02 - 0.09
0.09 - 0.2
0.2 - 0.7
0.7 - 1.9
1.9 - 5.0
5.0 - 13.1
13.1 - 34.1
34.1 - 98.3
98.3 - 228.68
-200m depth

Thysanoessa spinifera
1998-2006 Prediction Map
Biomass mgC/m³
Filled Contours
0 - 0.03
0.03 - 0.09
0.09 - 0.2
0.2 - 0.7
0.7 - 1.9
1.9 - 5
5 - 13.1
13.1 - 34.1
34.1 - 98.3
98.3 - 228.68
-200m depth
Yearly Biomass using just April – Aug.