Estimating zooplankton production from images

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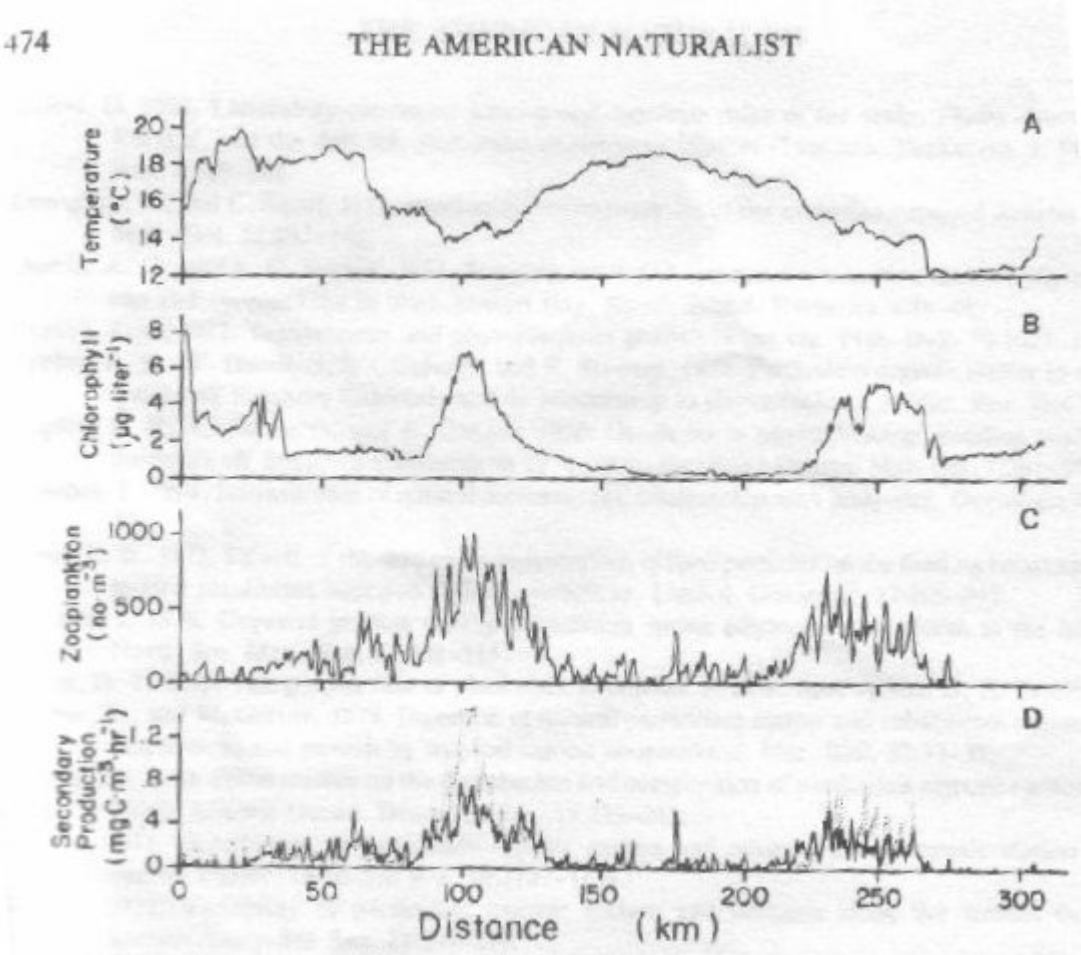
4^{th} Zooplankton Production Symposium,
Hiroshima, 2007

Rapid Measurements of Zooplankton Production



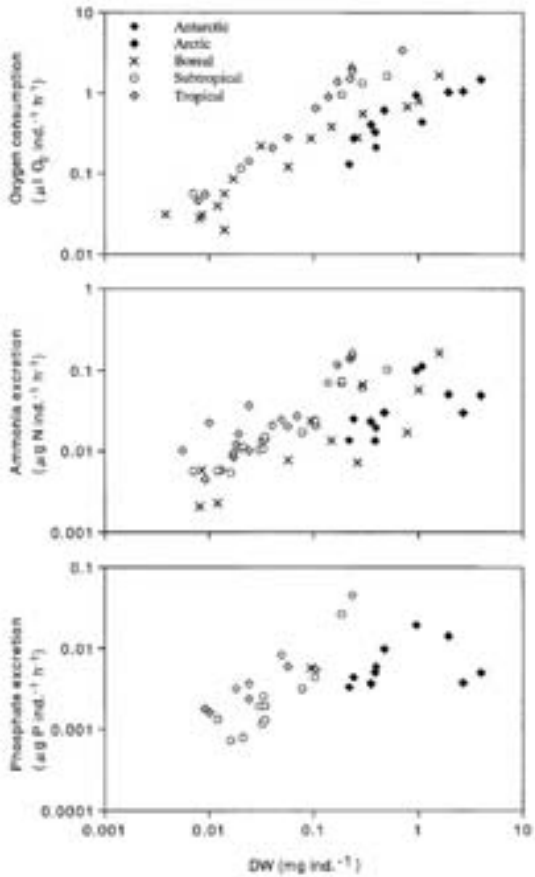
Huntley and Boyd (1984). Am Nat 124, 455-478

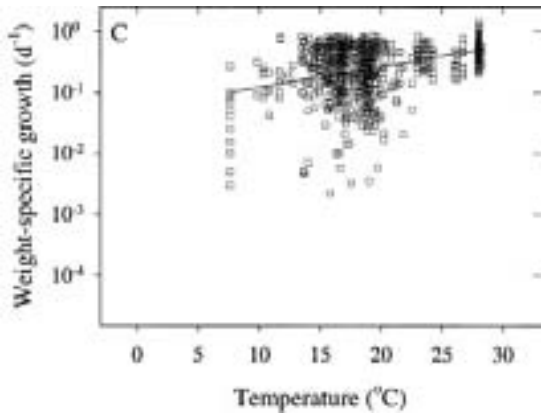
Why Measure Zooplankton Production?

- Because we are at a Zooplankton Production Symposium...
- Measure organic matter available to higher trophic levels
- Very difficult to measure experimentally

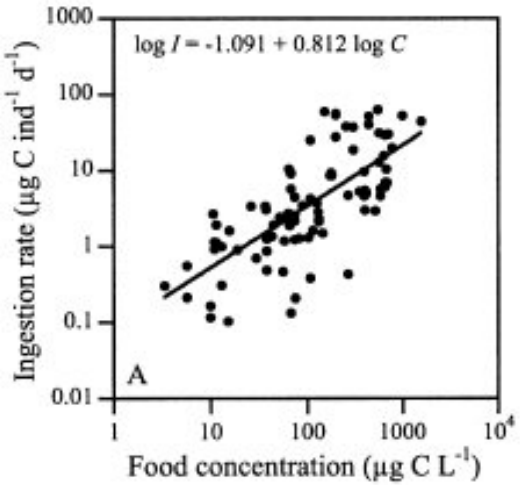
Scaling Zooplankton Production

$$CR = \sum_{i=1}^{n} P_i = \sum_{i=1}^{n} a * M^{AE} * e^{E/kT} * \frac{FC}{K_m + FC}$$





Hirst and Bunker (2003). Limnol Oceanogr 48, 1988-2010



Saiz and Calbet (2007). Limnol Oceanogr 52, 668-675

Ikeda et al (2001). Mar Biol 139, 587-596

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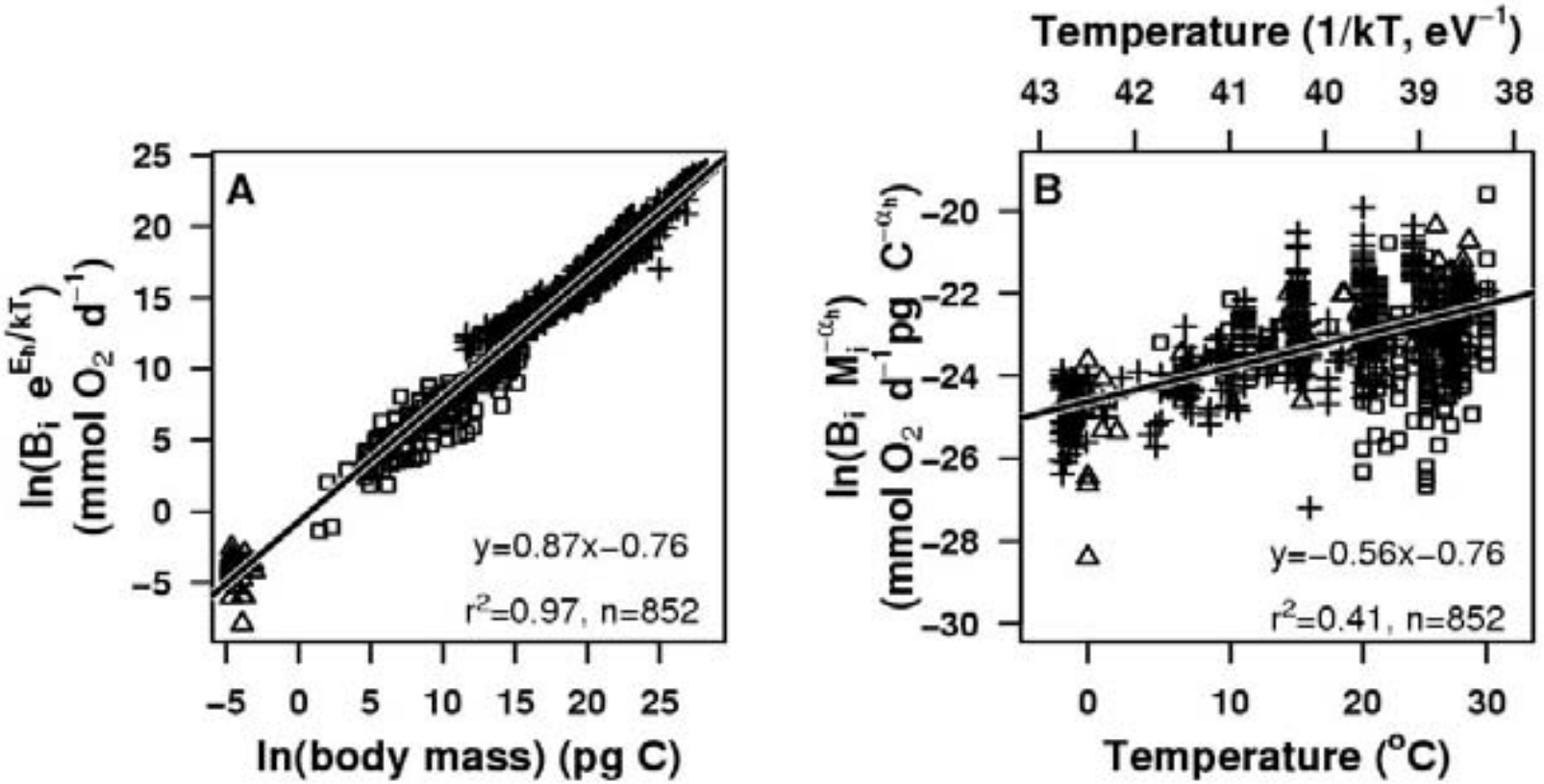

Lopez-Urrutia et al (2006). PNAS 103, 8739-8744

Scaling Zooplankton Production

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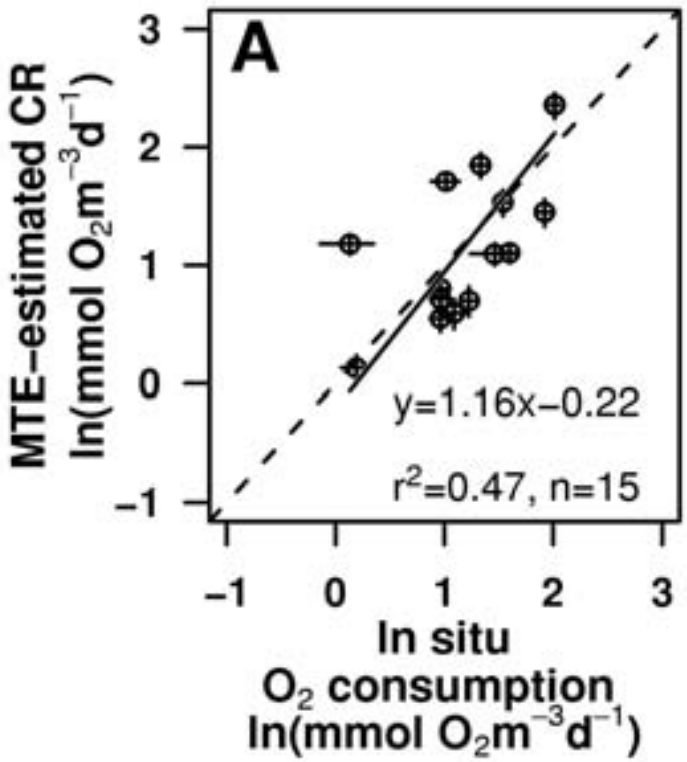
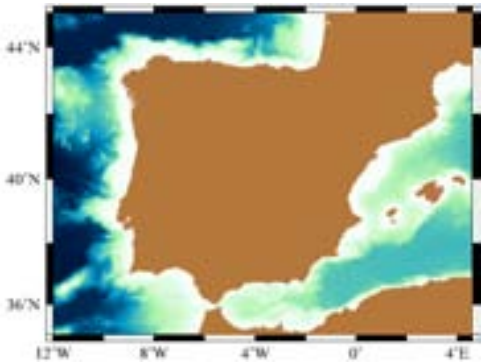
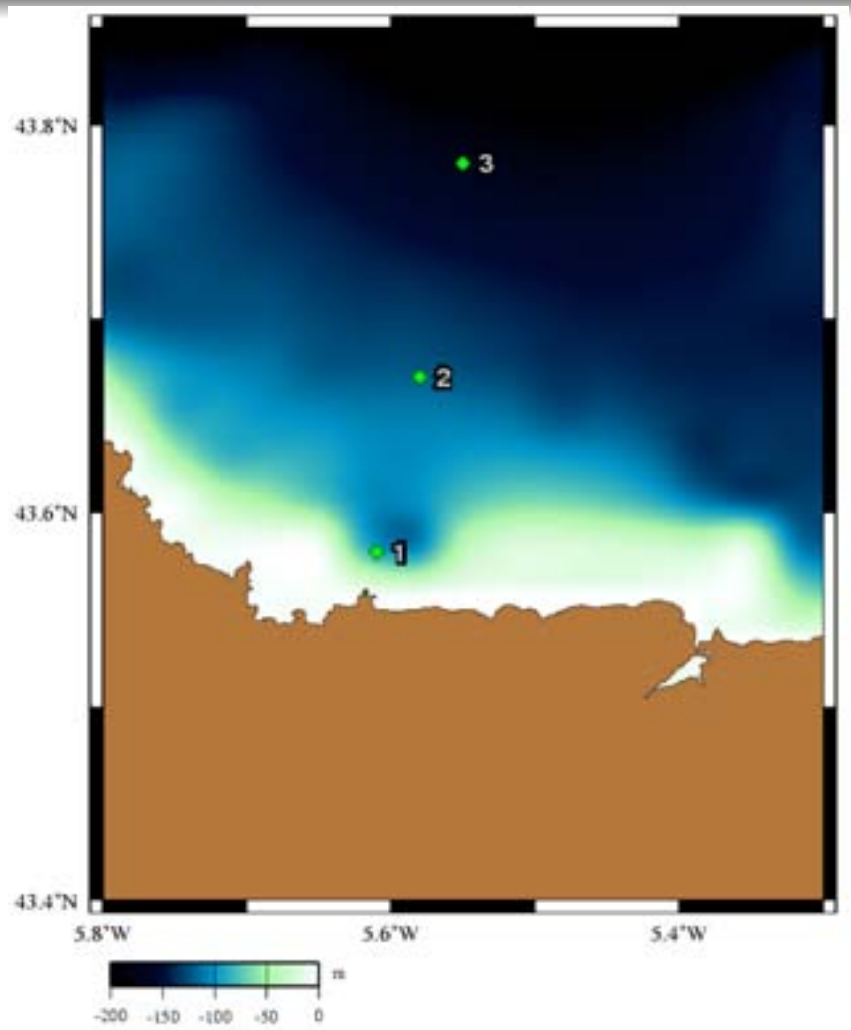


Lopez-Urrutia et al (2006). PNAS 103, 8739-8744

Application of image analysis to count and size zooplankton

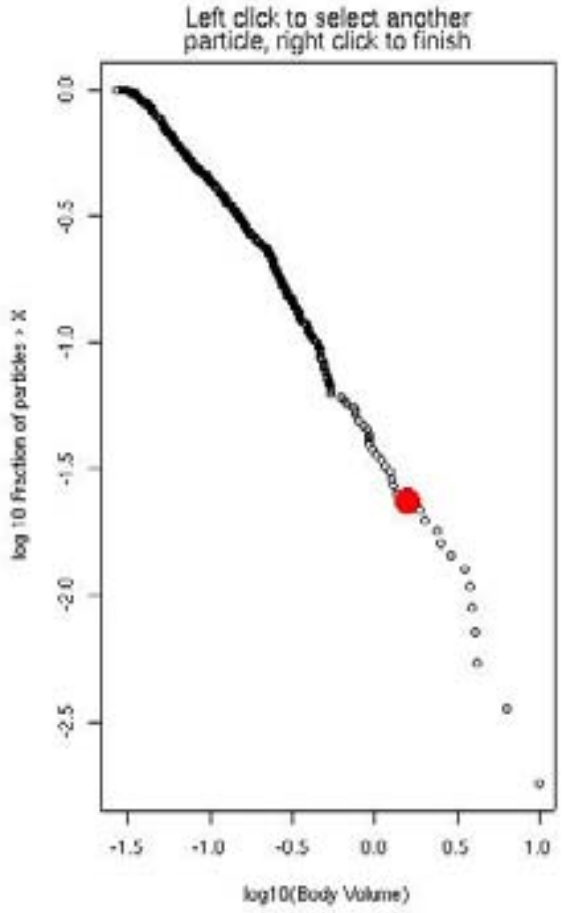




Application of image analysis to count and size zooplankton

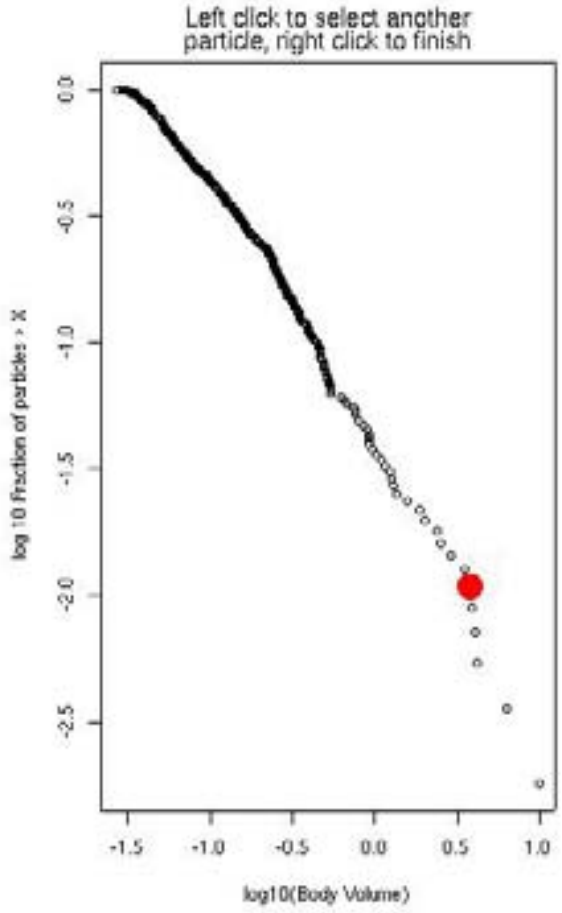
RAPID - Research into Automatic Plankton Identification

Measures	
area	2488.00
width	58.00
length	93.00
ExpandedArea	5394.00
Perimeter	671.00
ESD	56.26
XCentr	0.03
YCentr	0.07
XGeometrMean	0.47
XGeometrMean	0.32
XSkewness	3.30
YSkewness	0.50
XKurtosis	1.98
YKurtosis	2.29
Area_	79.54
XgCentr	0.02
YgCentr	0.10
XgGeoMean	0.50
YgGeoMean	0.33
XgSkewness	4.18
YgSkewness	4.29
XgKurtosis	0.02
YgKurtosis	0.03
YgKurtosis	0.03
Elongation	0.07
Roundness	34.04
Elongation	1.60
Compactness	0.60
HuMoSkewness	0.27
Intensity	163808.92



RAPID - Research into Automatic Plankton Identification

Measures	
area	5250.00
width	74.00
length	137.00
ExpandedArea	10139.00
Perimeter	980.00
ESD	81.76
XCentre	0.09
YCentre	0.09
XCentreVariation	0.57
YCentreVariation	0.37
XSkewness	10.39
YSkewness	7.87
XKurtosis	2.19
YKurtosis	2.65
Area_	70.02
XyCentre	0.09
xycentre	0.05
XyCentreVariation	0.61
YyCentreVariation	0.43
RadiiKurtosis	10.92
YyKurtosis	5.20
XyKurtosis	0.03
YyKurtosis	0.03
YyKurtosis	0.03
RadiiMean	0.07
RadiiMean	48.79
Elongation	1.85
Compactness	0.60
RadialDispersion	0.19
Intensity	392810.06



RAPID - Research into Automatic Plankton Identification

Measures	
[illegible]	1814.00
[illegible]	33.00
[illegible]	92.00
[illegible]	3036.00
[illegible]	371.00
[illegible]	48.06
[illegible]	0.05
[illegible]	0.00
[illegible]	0.53
[illegible]	0.44
[illegible]	2.95
[illegible]	0.02
[illegible]	2.01
[illegible]	2.16
[illegible]	78.83
[illegible]	0.04
[illegible]	0.02
[illegible]	0.55
[illegible]	0.49
[illegible]	0.77
[illegible]	0.46
[illegible]	0.02
[illegible]	0.03
[illegible]	0.03
[illegible]	0.17
[illegible]	25.10
[illegible]	2.79
[illegible]	0.52
[illegible]	0.20
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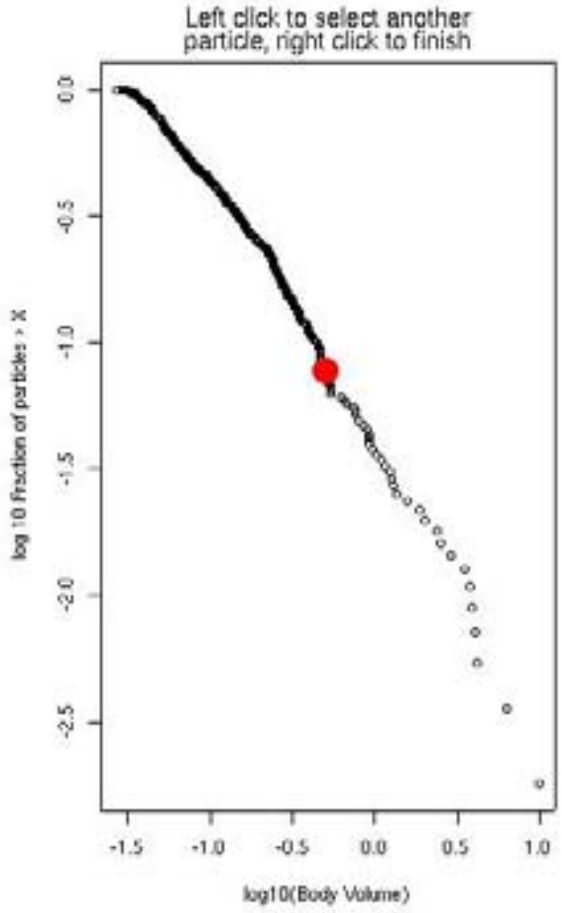
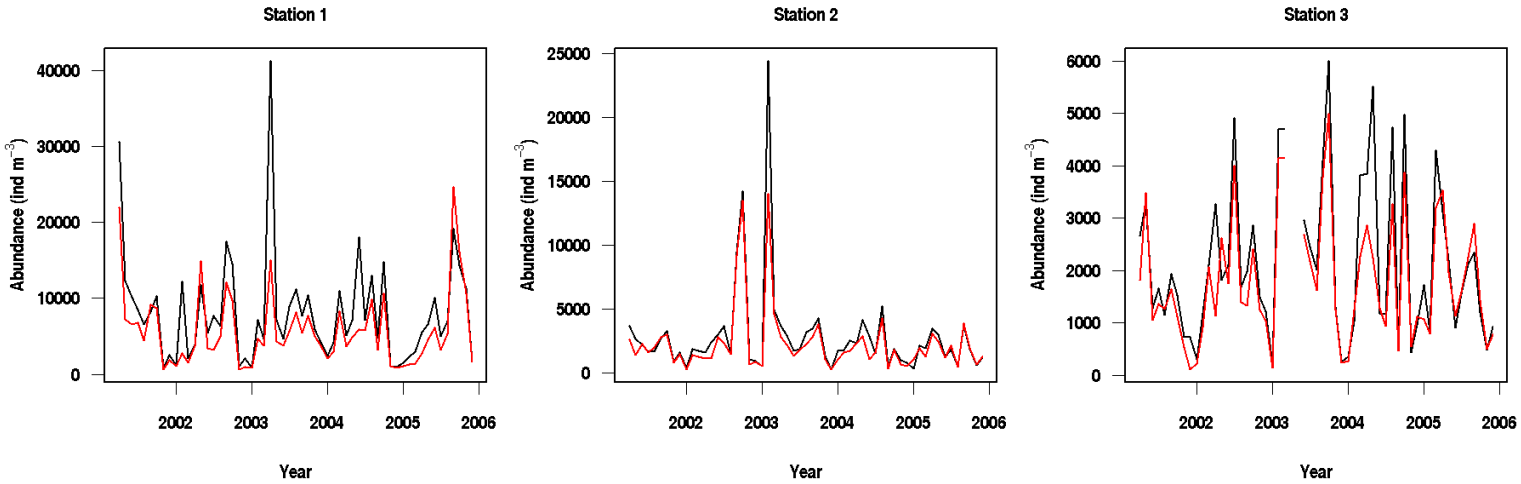


Image Analysis to Count Zooplankton



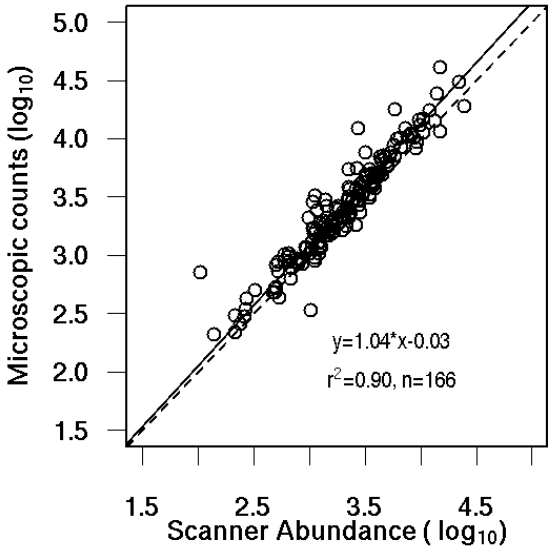
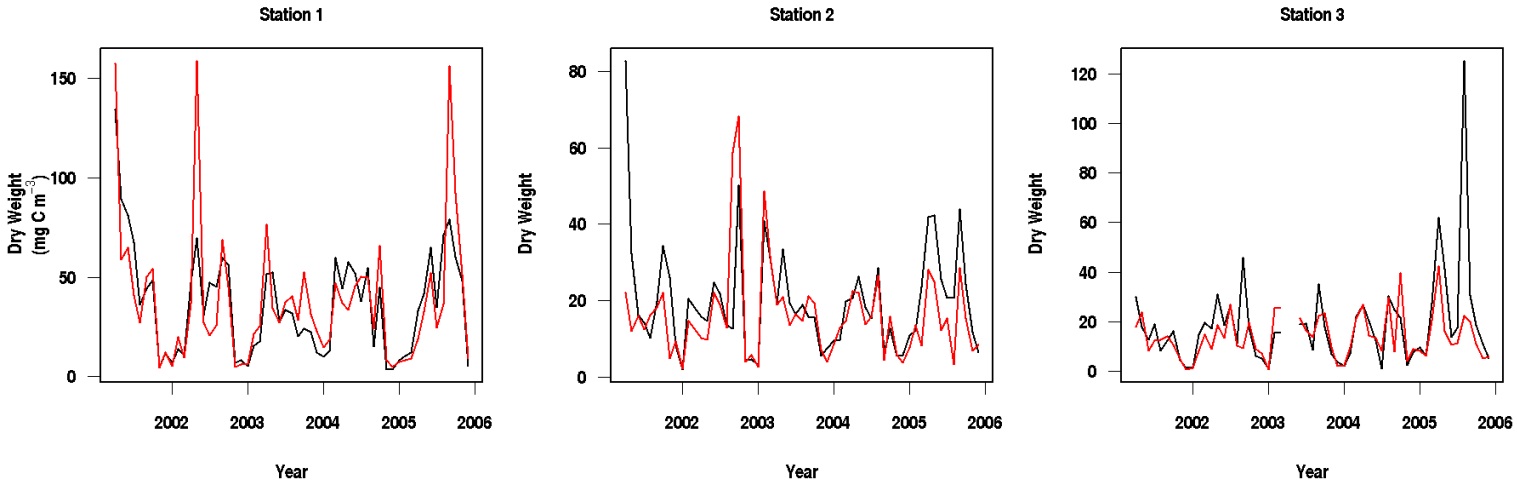


Image Analysis to Estimate Zooplankton Biomass



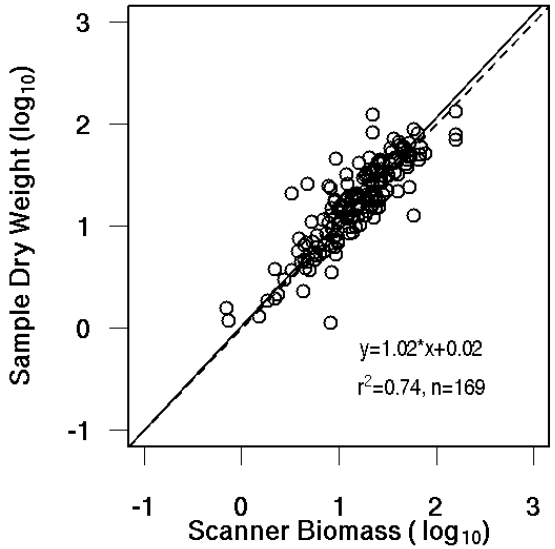
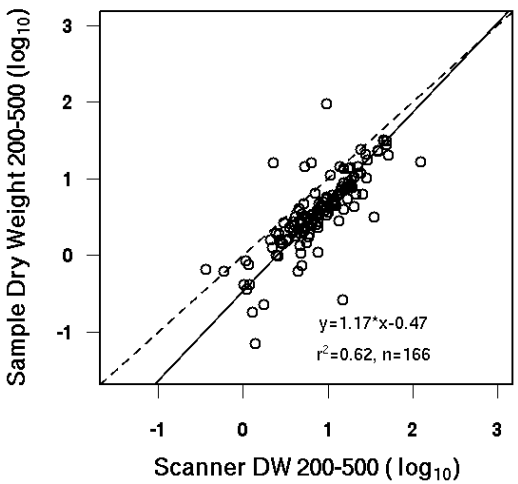
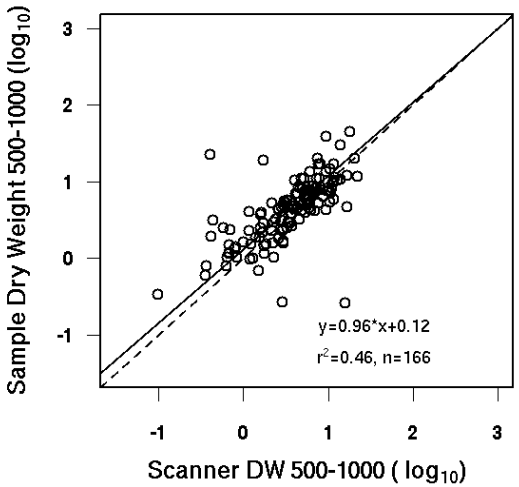


Image Analysis to Measure Zooplankton Size Structure





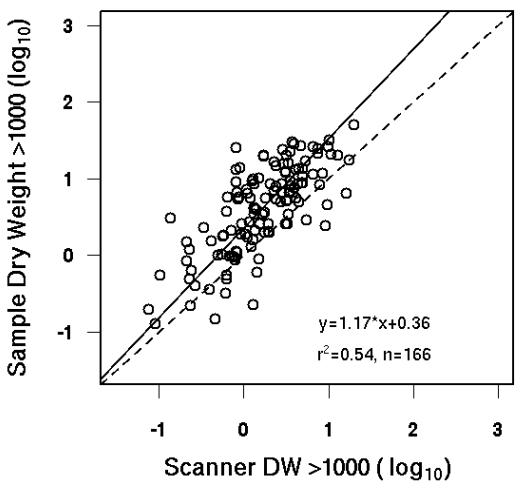
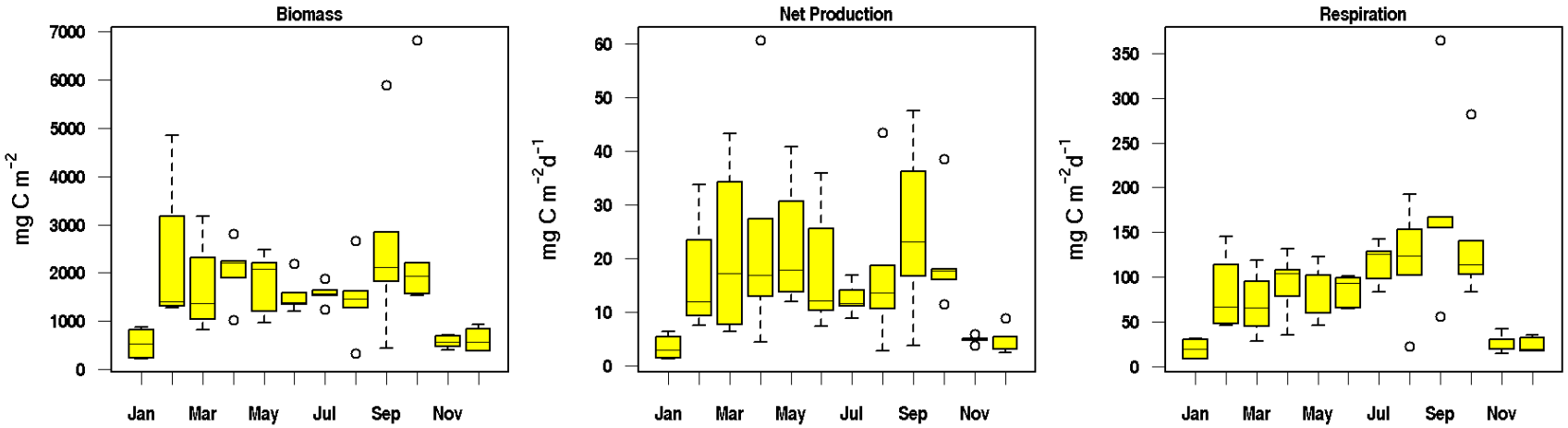


Image Analysis to Estimate Zooplankton Production



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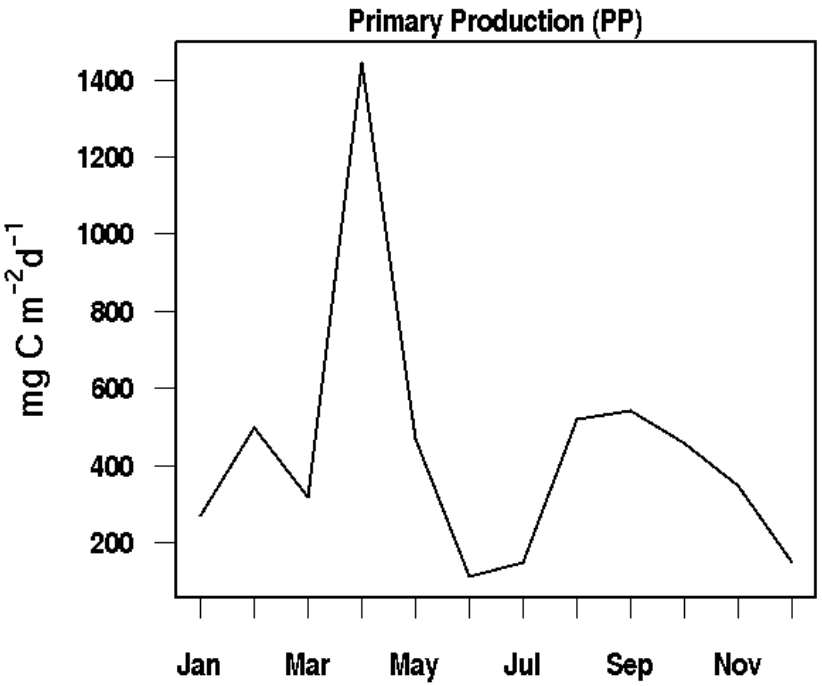

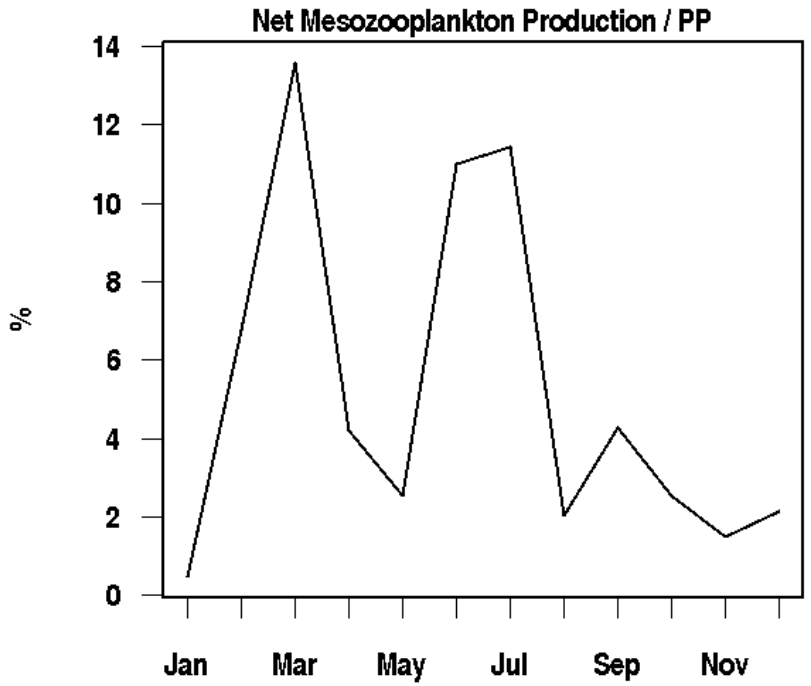

Life history effects on zooplankton production

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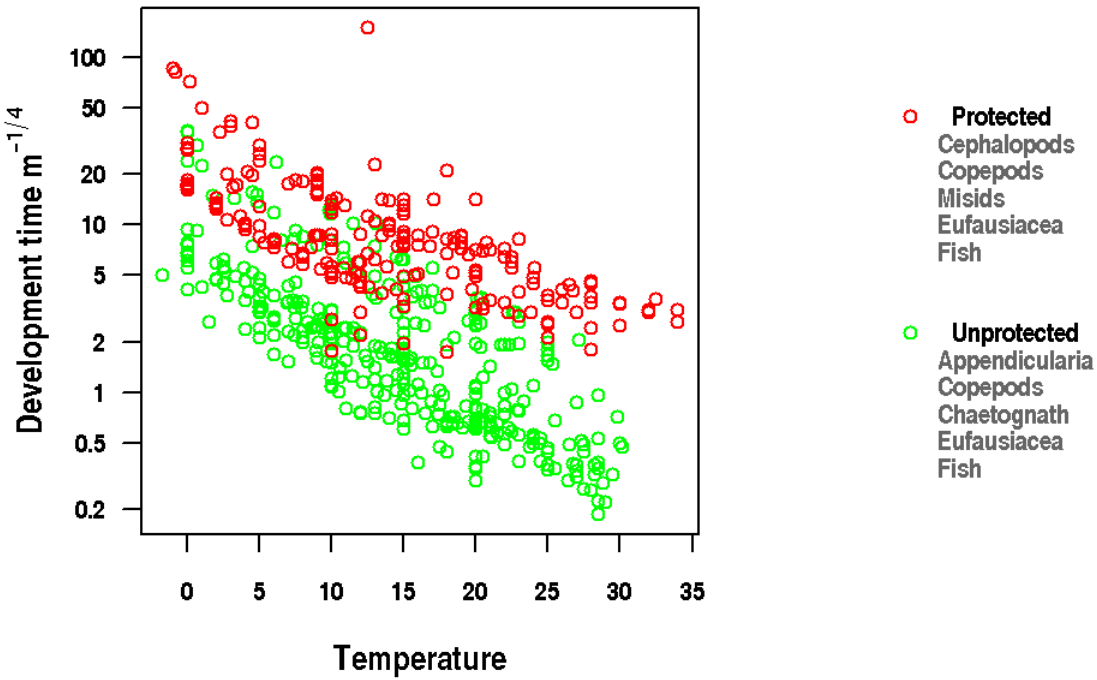
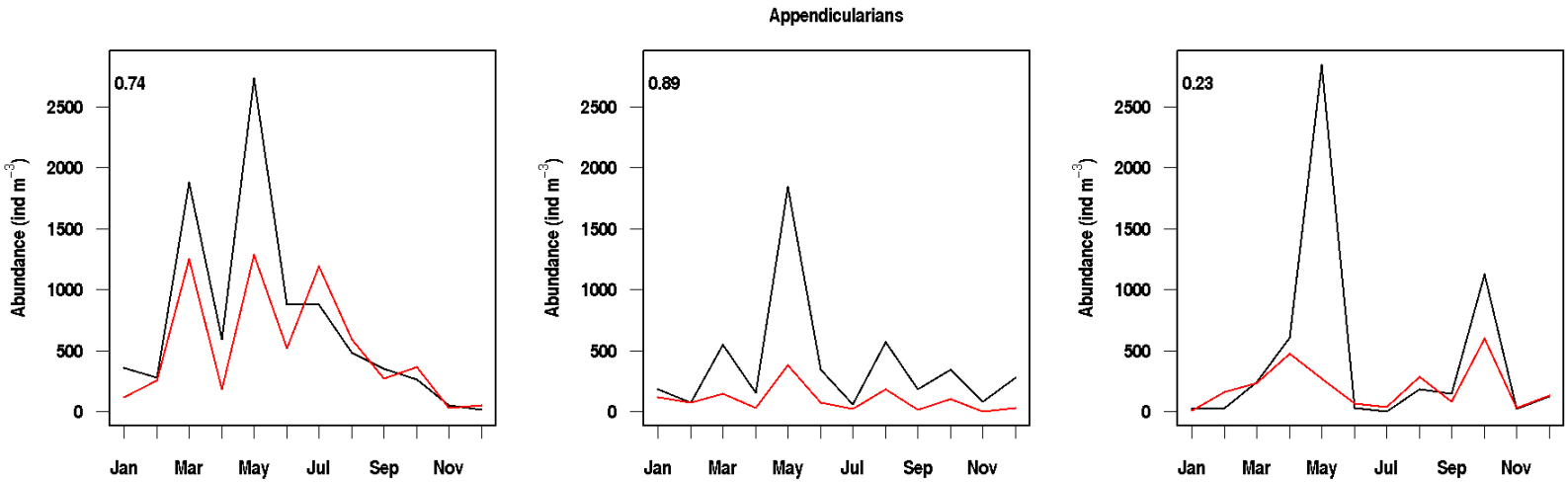


Hirst and Lopez-Urrutia (2006). MEPS 326, 817-822

Image classification into functional groups



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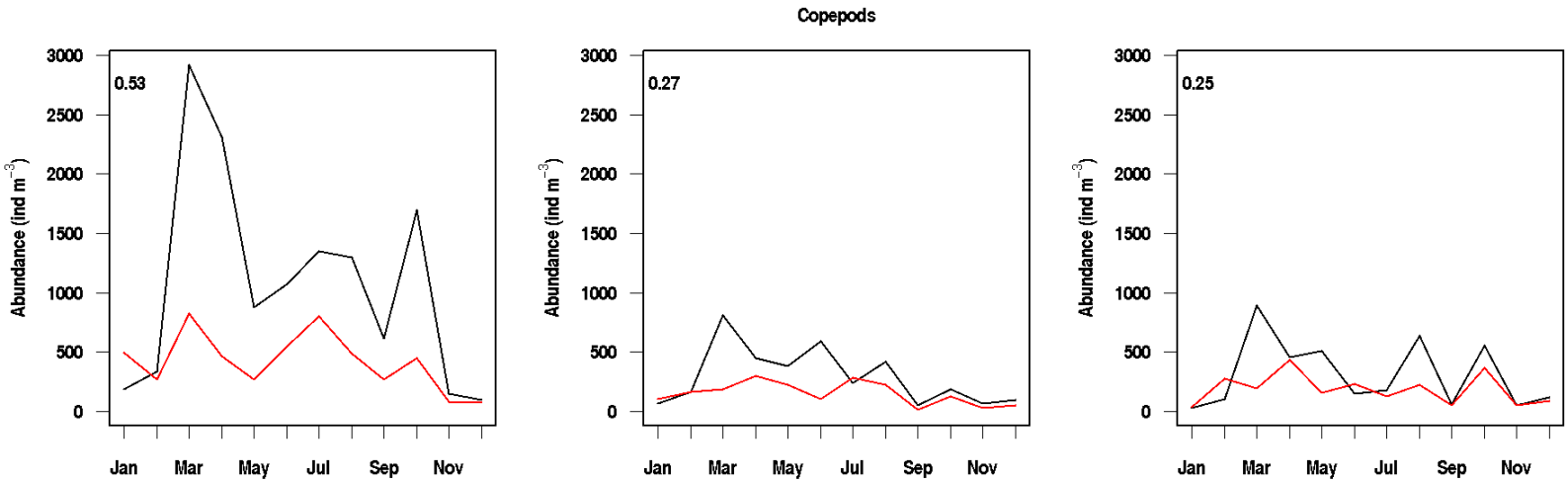

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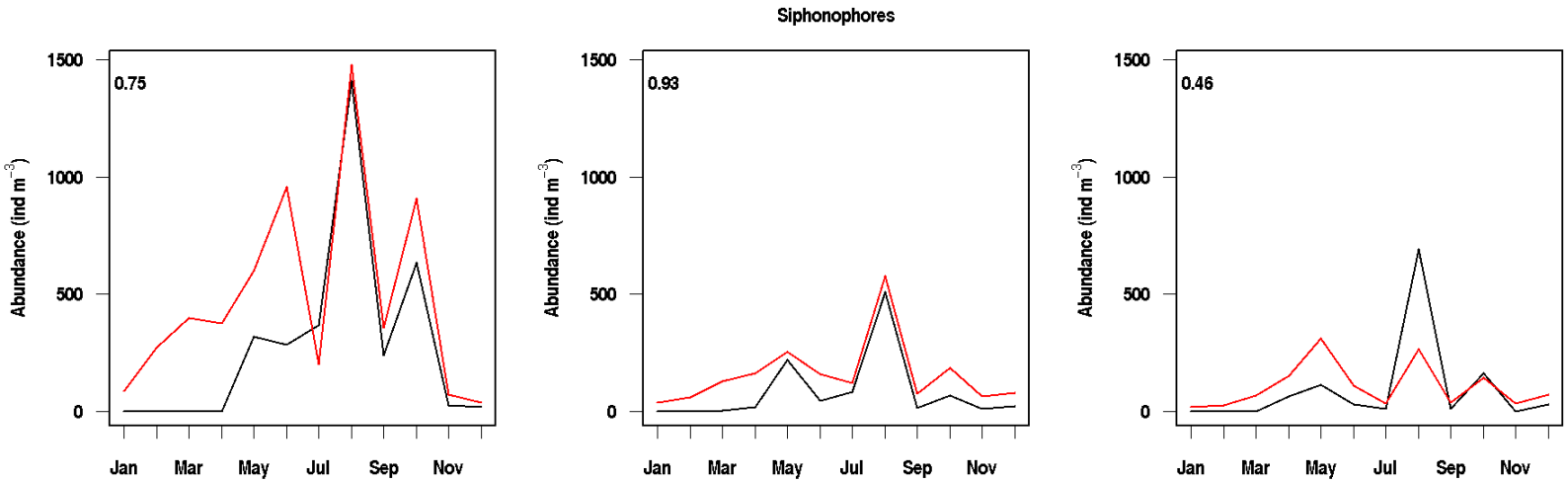

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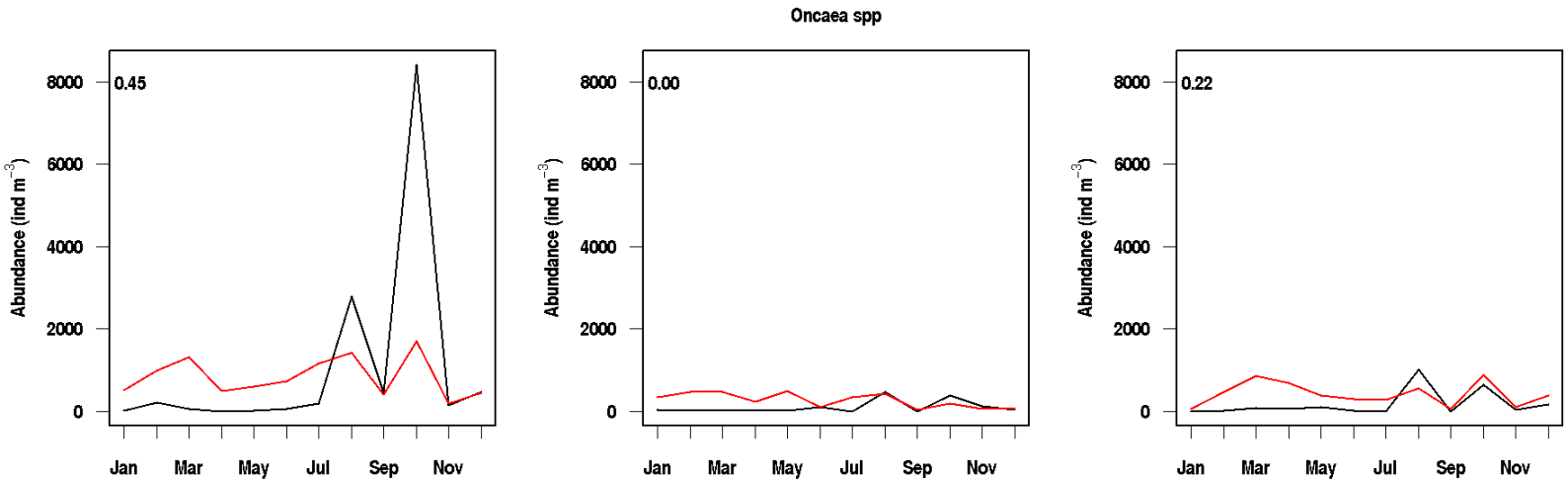

Why are this type of estimates so rare?

Huntley and Boyd (1984). Am Nat 124, 455-478
Hirst et al (1999). MEPS 177, 133-146
Roman et al (2000). DSRII 47, 1423-1450
Roman et al (2002). DSRII 49, 175-192
Coyle and Pinchuk (2003). Fish Oceang 12, 327-338
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