

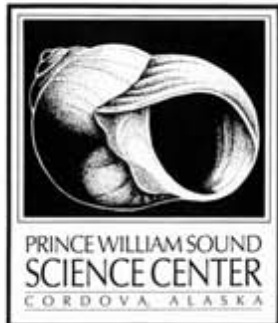
Meso- to small-scale distributions of plankton and marine snow in the southeastern North Sea in relation to fronts.

Rob Campbell

Prince William Sound Science Center

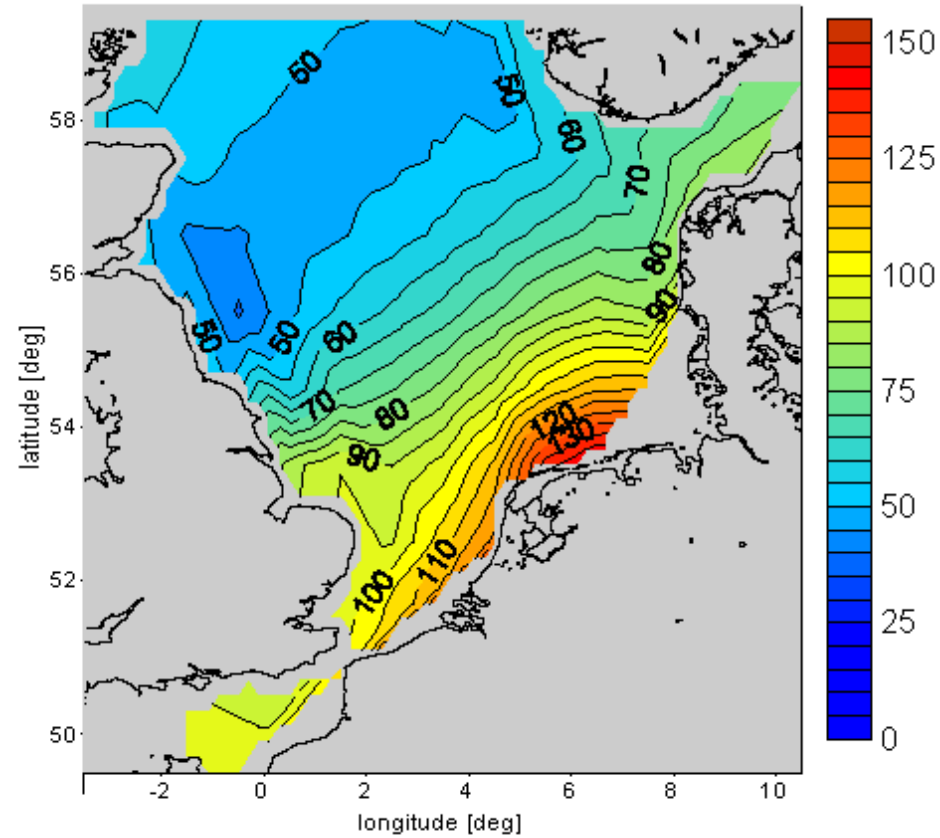
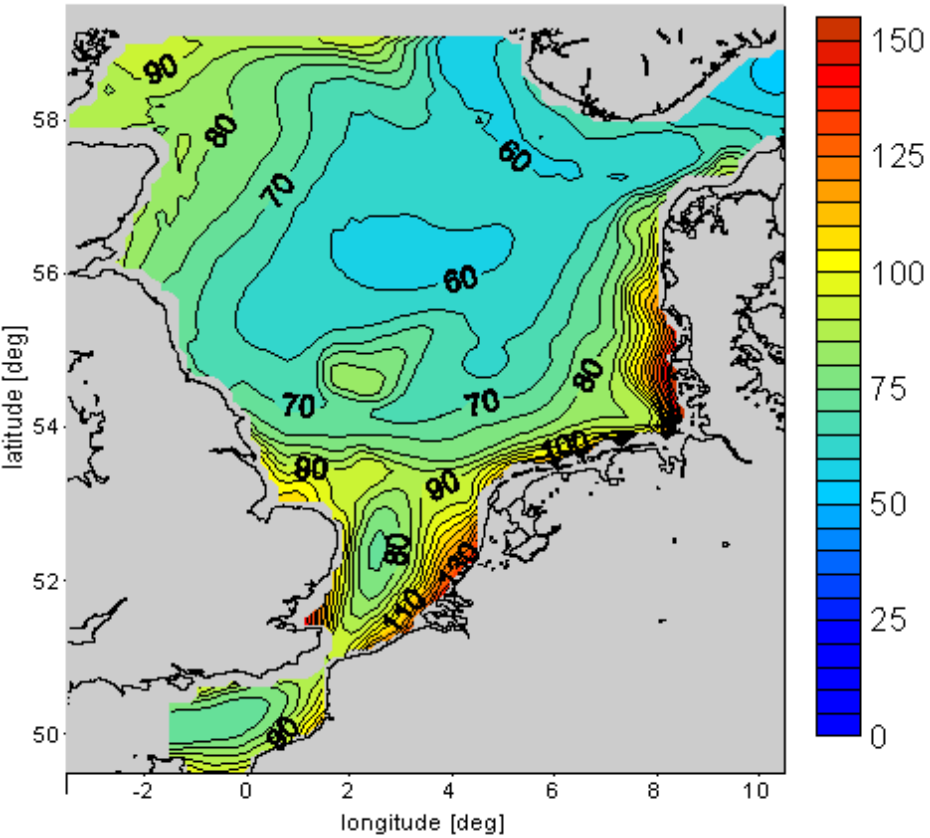
Morten Holtegaard Nielsen, Klas Möller

IHF, University of Hamburg



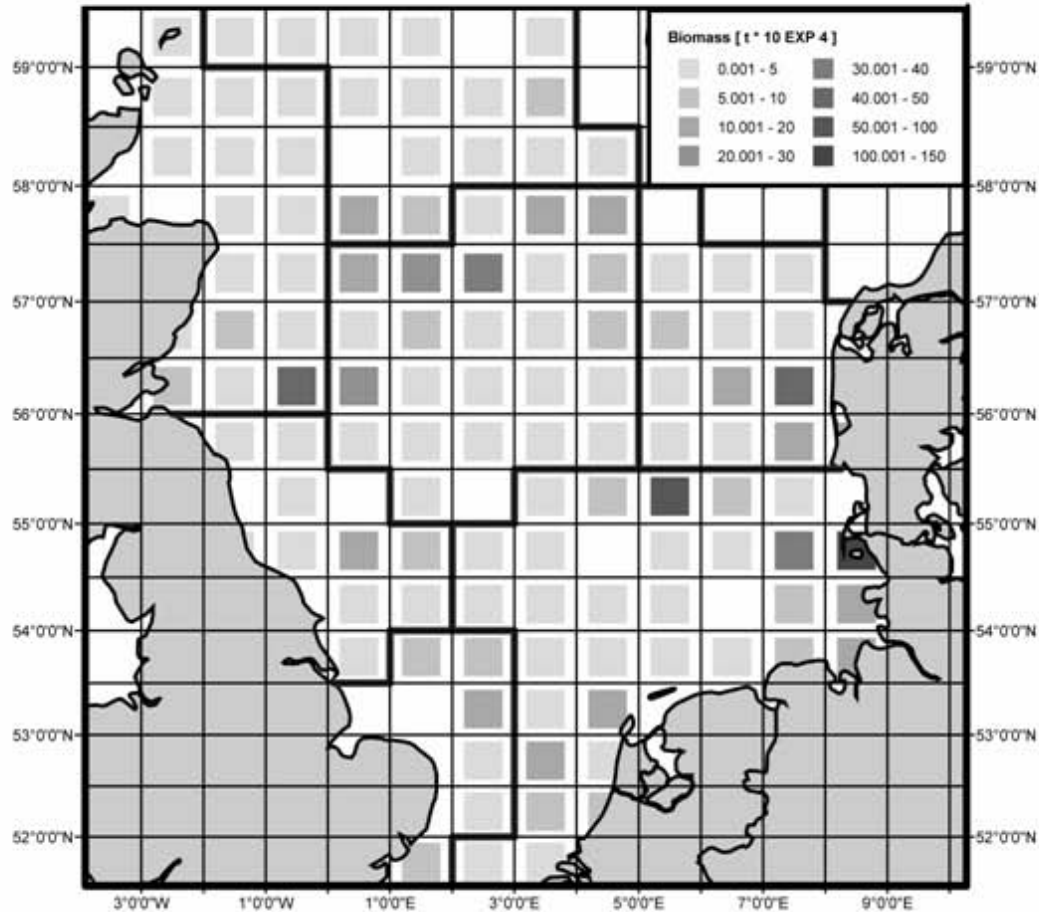
Annual phytoplankton production

mgC m⁻³ y⁻¹



LIFECO, 2004

North Sea fish biomass



LIFECO, 2004

GLOBEC Germany

Project goal: *Clarification of trophodynamic interactions between zooplankton and planktivorous fish in relation to reproductive success under the impact of physical forcing.*

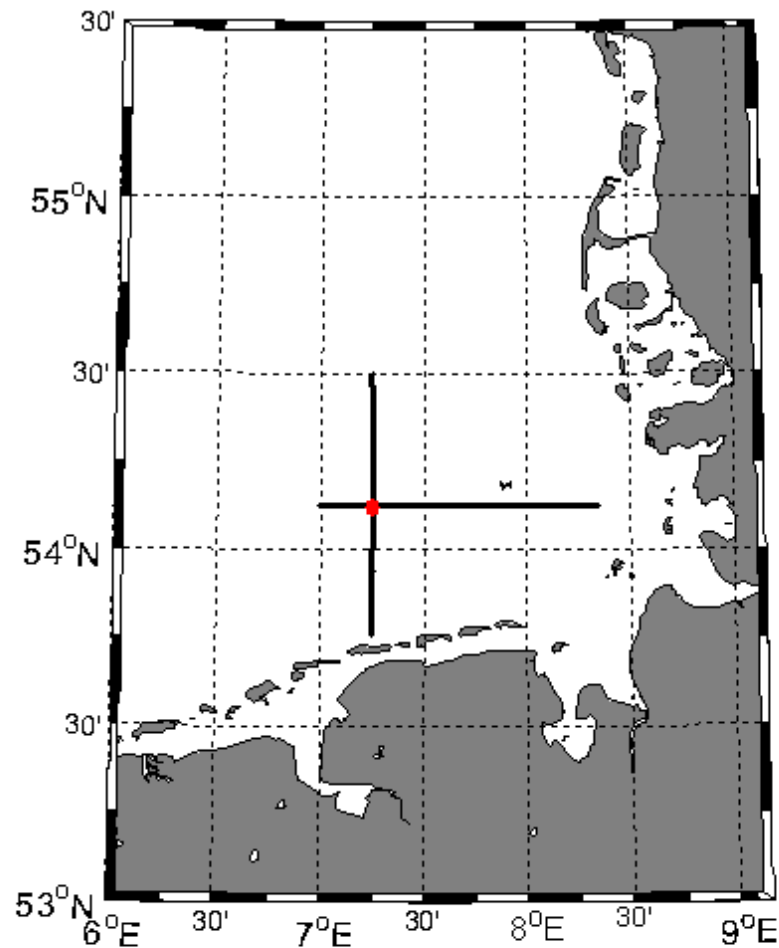


SeaScan VPR



North Sea transects

+24 h station

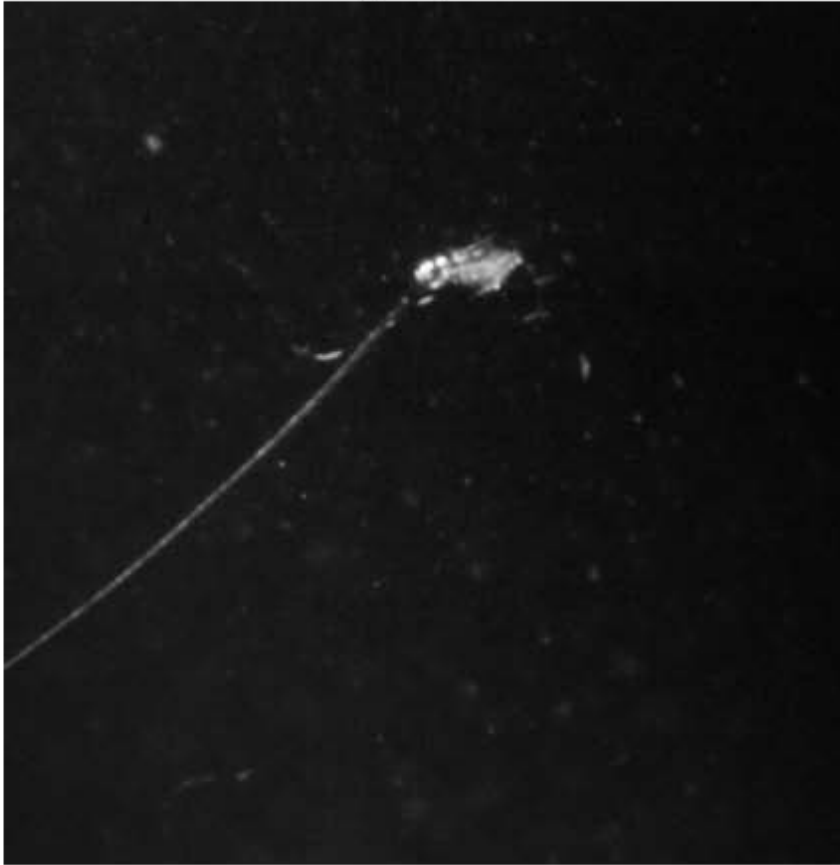


Cruise 1: 17 May – 24 May 2005

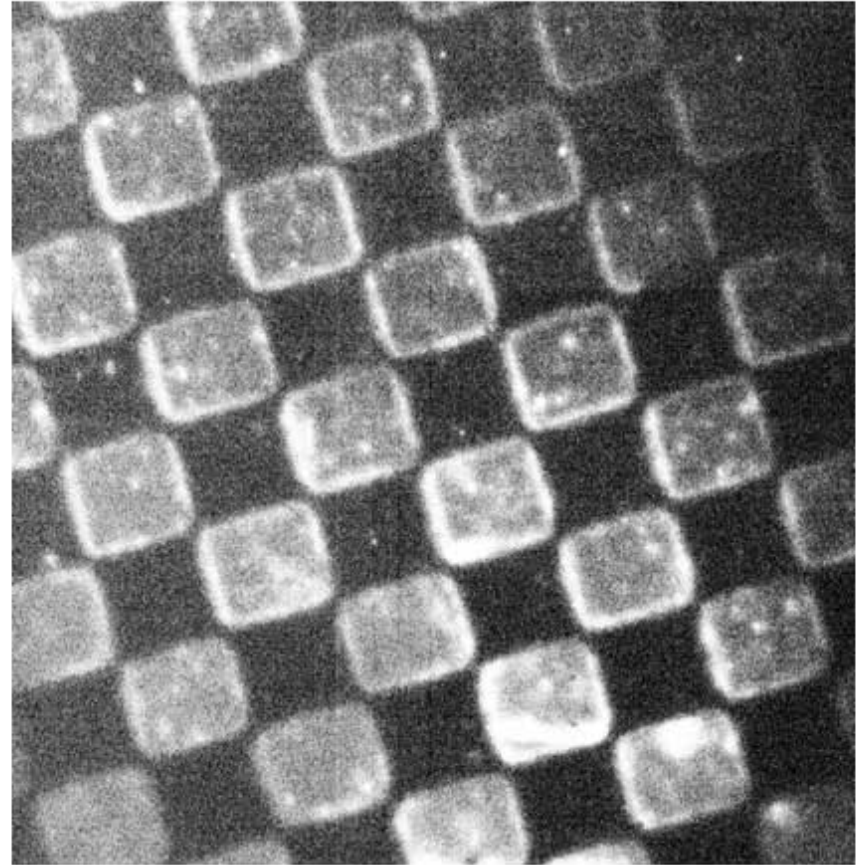
Cruise 2: 27 June – 8 July 2005

Focus calibration

Tethered copepod

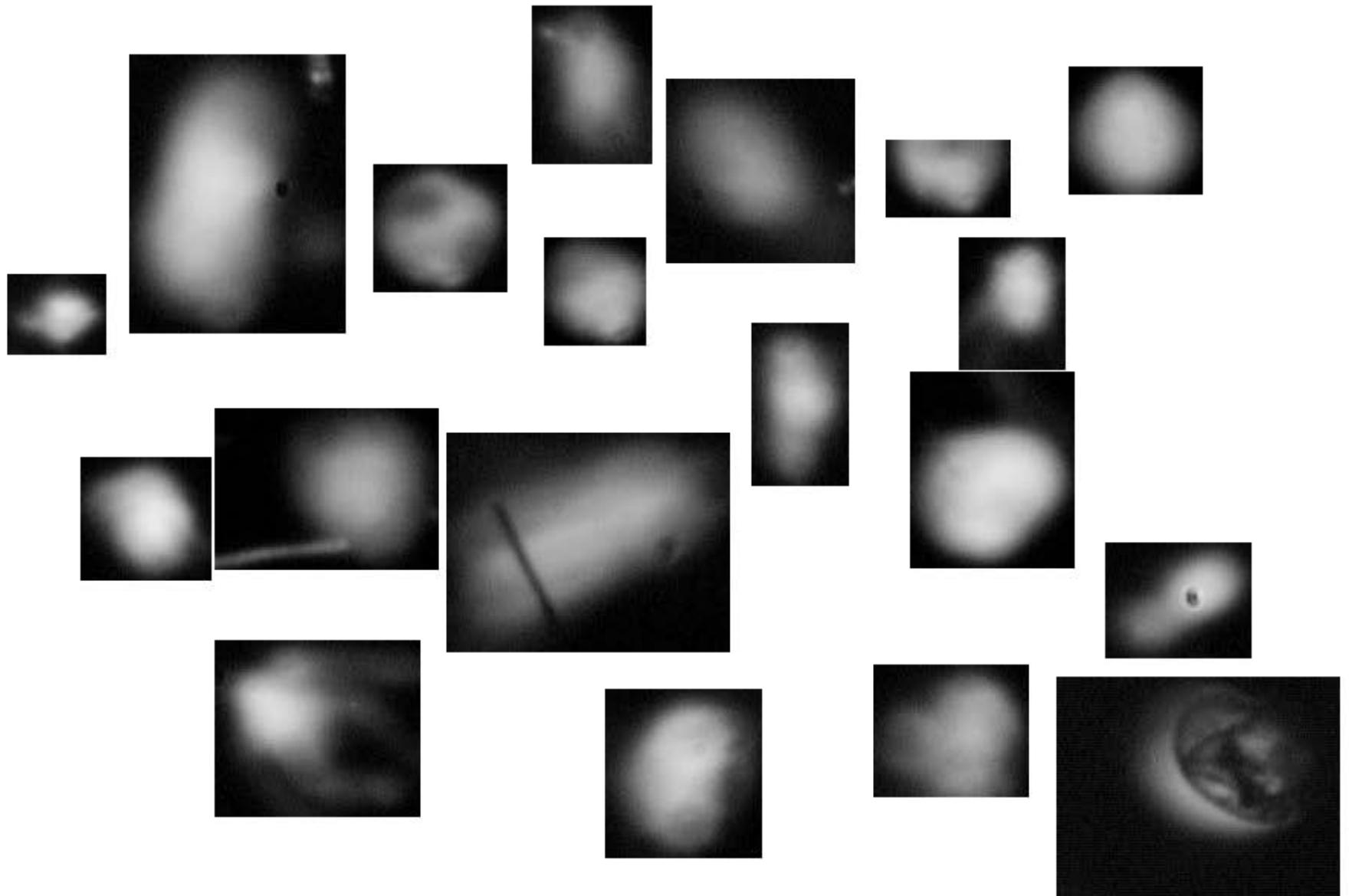


Transparent grid



used “conservative” thresholding settings

Problem #1 – the “average” image

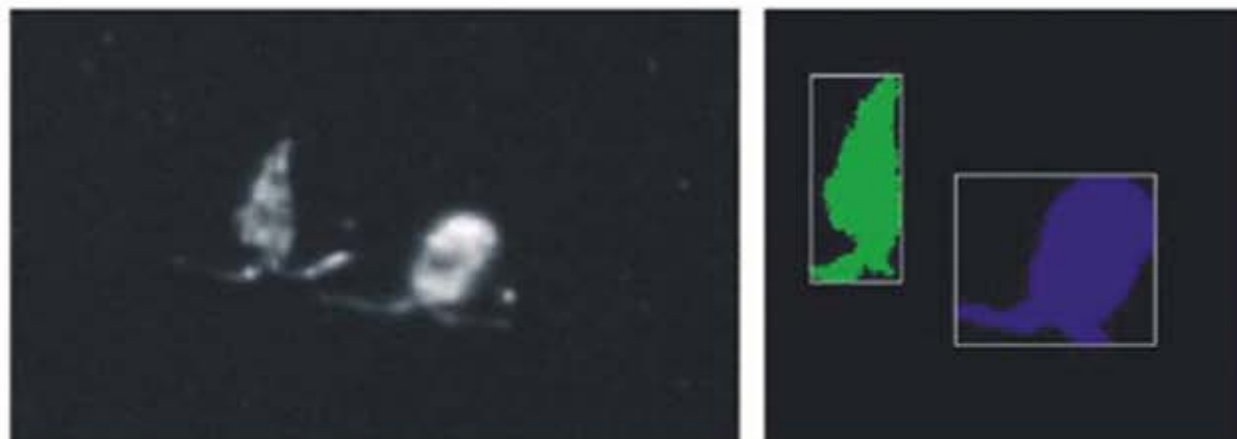


Initial focus detection: Sobel and Canny w/ empirical coefficients)

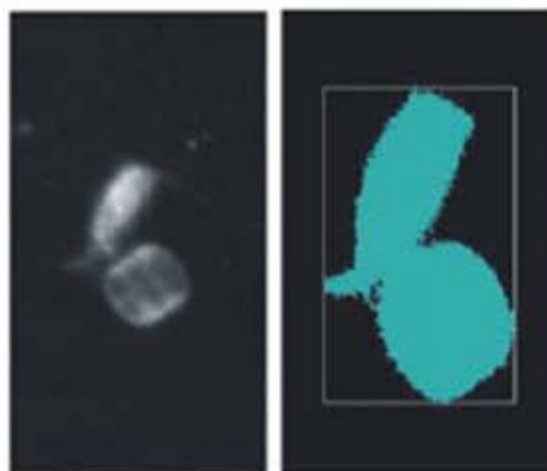
Problem #2: Multiple images

Rethresholded (triangle method) and labeled

Successful



Unsuccessful



Processing steps

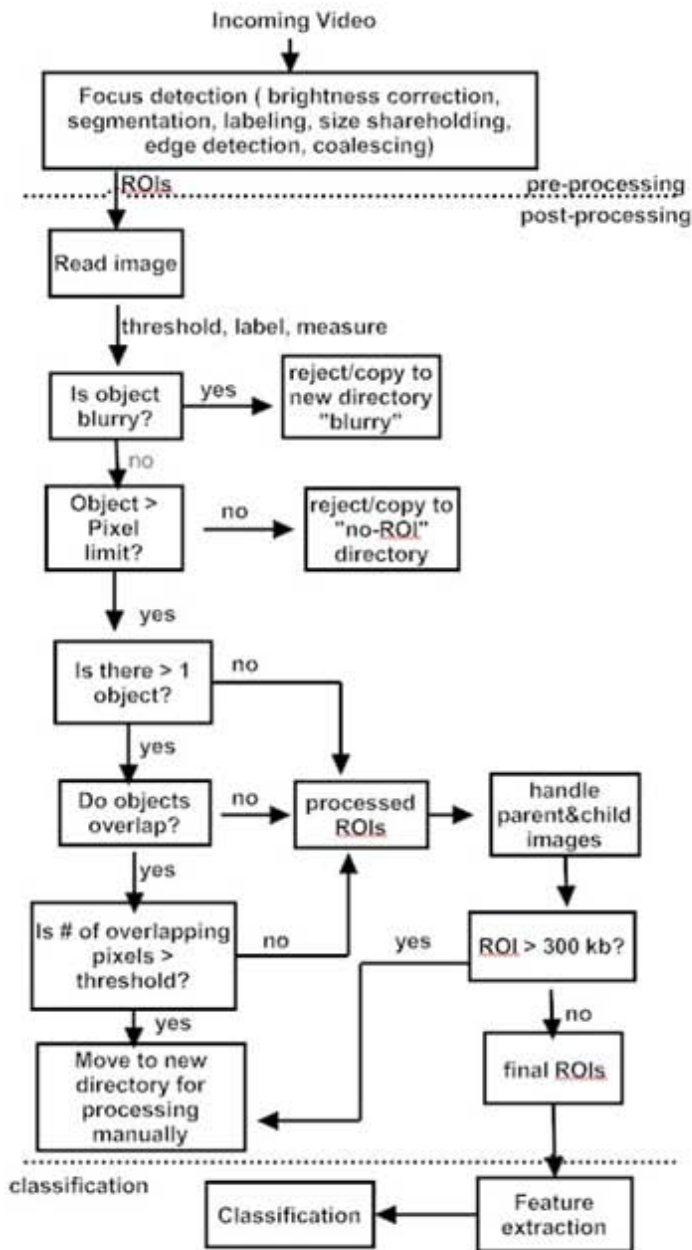


Image classification

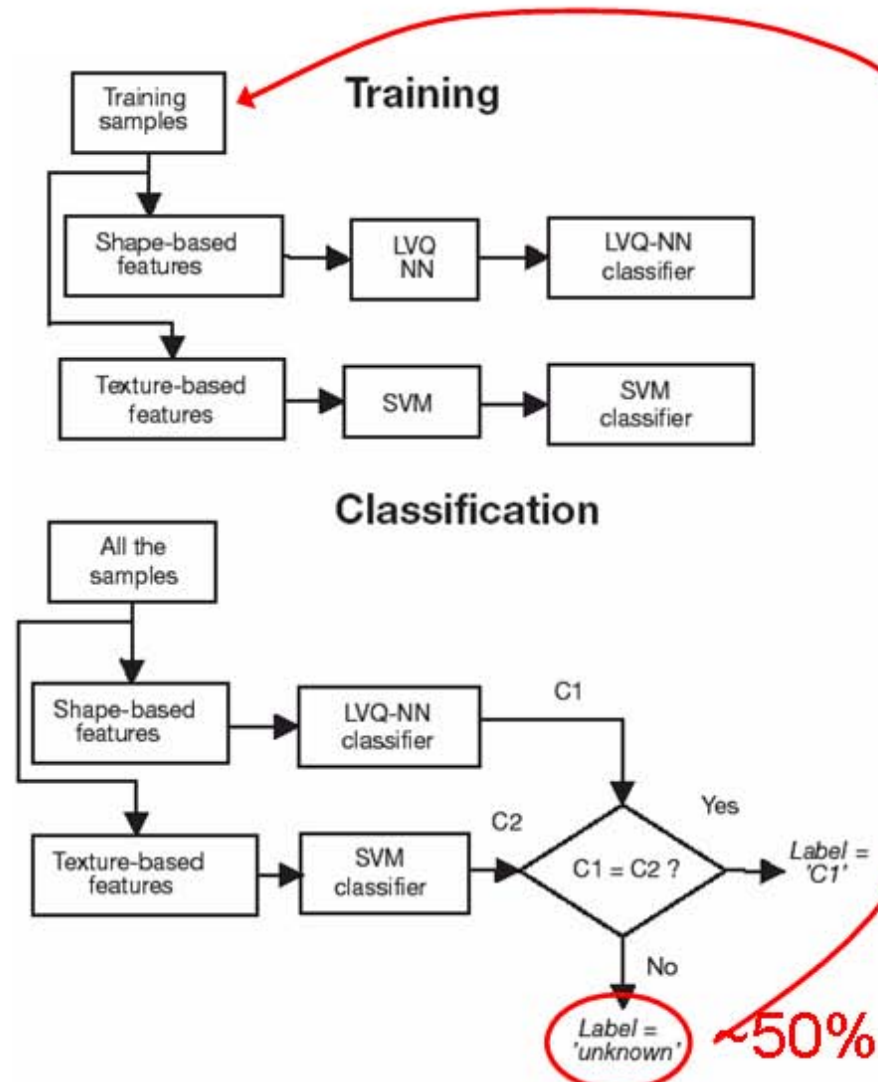


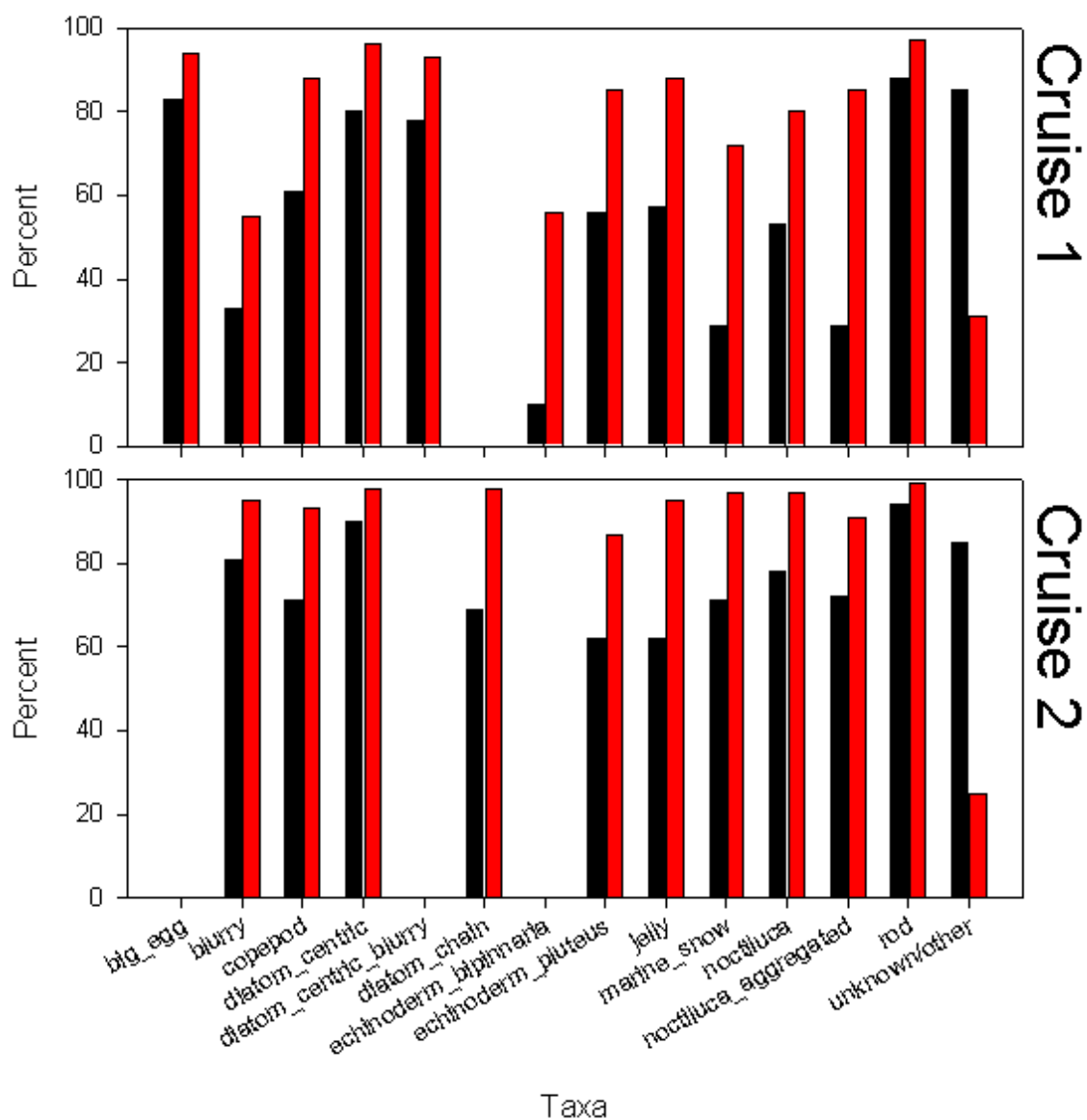
Fig. 1. Schematic diagram of dual-classification system. LVQ: learning vector quantization; NN: neural network; SVM: support vector machine

Cruise 1 confusion matrix

Classification		Membership												SP
		big_egg	blurry	copepod	diatom_centric	diatom_centric_blurry	echinoderm_pluteus	jelly	marine_snow	noctiluca_aggregated	noctiluca_single	rod_shaped	other	
big_egg	166	0	0	0	0	0	0	7	0	1	0	3	94	
blurry	0	66	7	3	7	11	2	4	1	1	0	19	55	
copepod	0	7	121	0	0	2	0	2	0	0	1	4	88	
diatom_centric	0	0	0	159	4	0	0	1	0	0	0	1	96	
diatom_centric_blurry	0	8	0	3	156	0	0	0	0	0	0	1	93	
echinoderm_pluteus	0	2	1	0	0	112	1	0	0	0	0	12	85	
jelly	0	1	1	0	0	0	114	0	0	0	0	10	88	
marine_snow	2	0	1	1	0	0	2	58	5	1	0	11	72	
noctiluca_aggregated	0	0	0	0	0	0	0	0	41	7	0	0	85	
noctiluca_single	0	2	0	1	0	1	1	0	20	106	0	1	80	
rod_shaped	0	2	1	0	0	0	0	3	0	0	176	0	97	
unknown	32	112	68	33	33	73	78	123	73	84	23	352	31	
P(detection)	83	33	61	80	78	56	57	29	29	53	88	85		

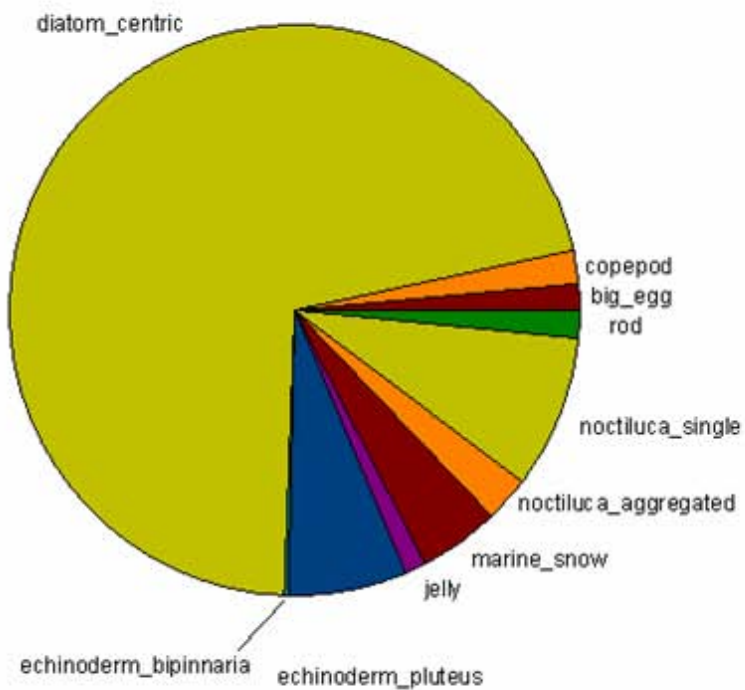
Classification accuracy

Pr(detection)
Specificity

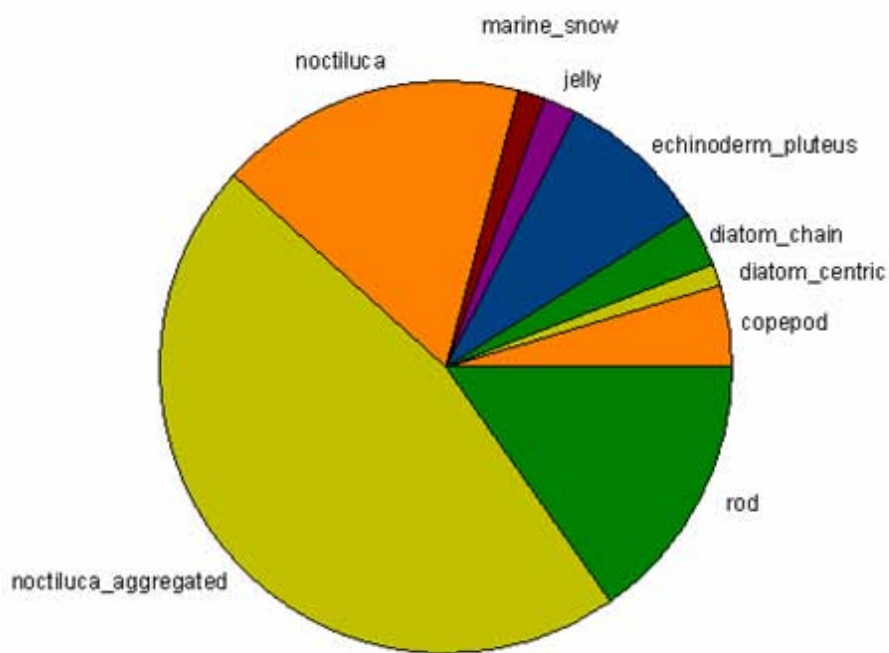


Classification results

Cruise 1

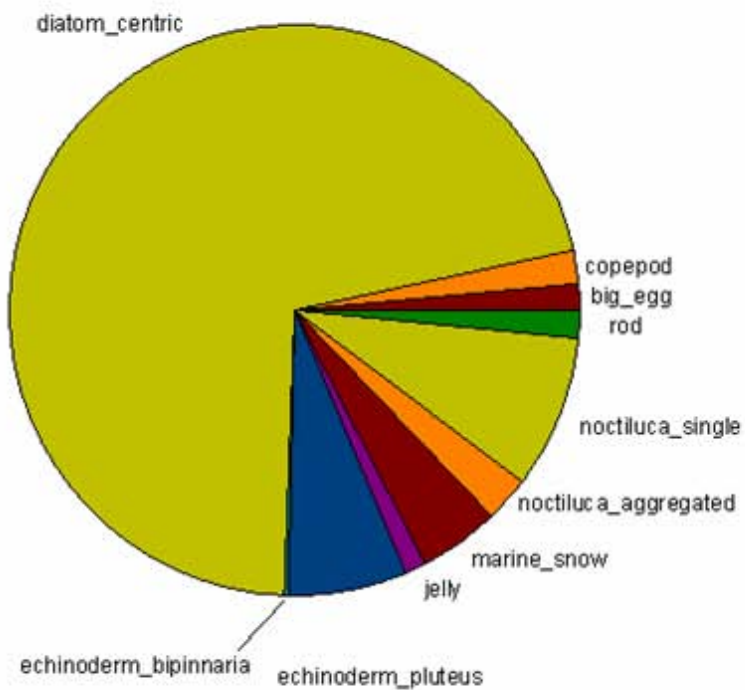


Cruise 2

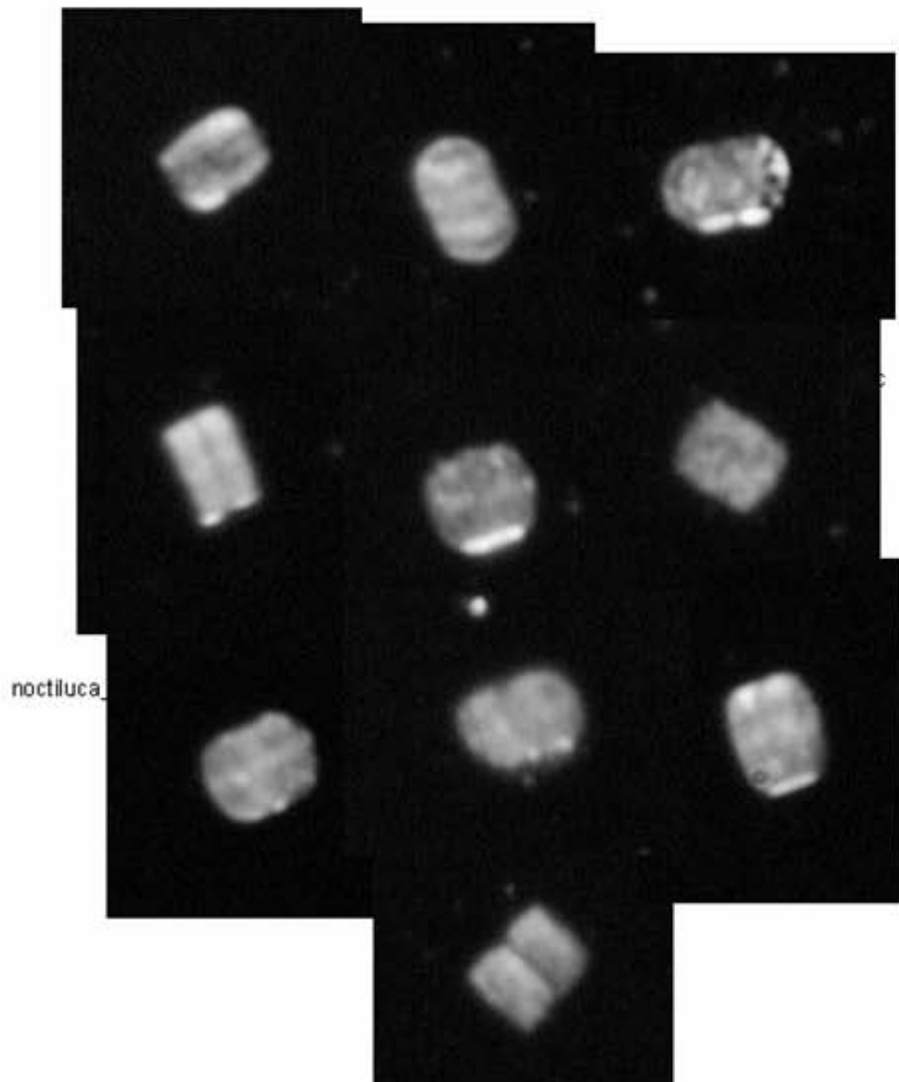


Classification results

Cruise 1

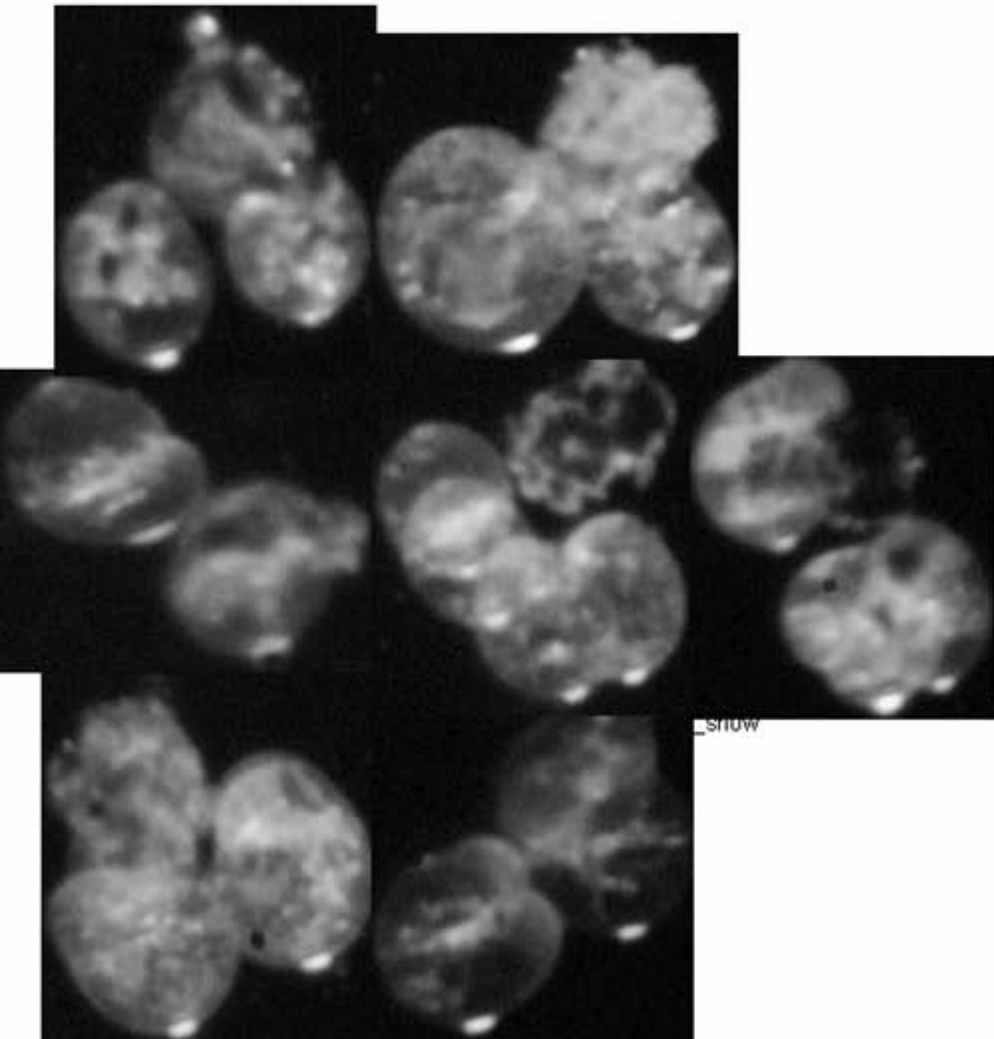


Cruise 2

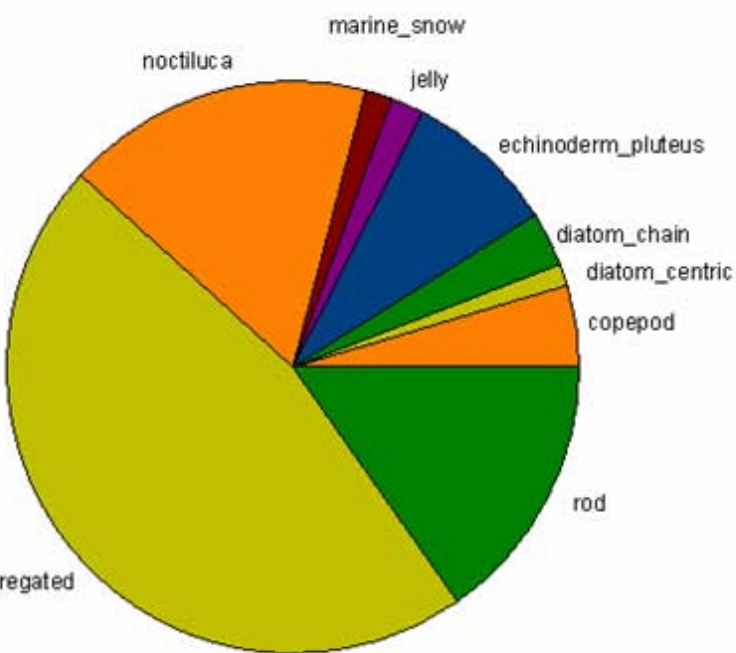


Classification results

Cruise 1

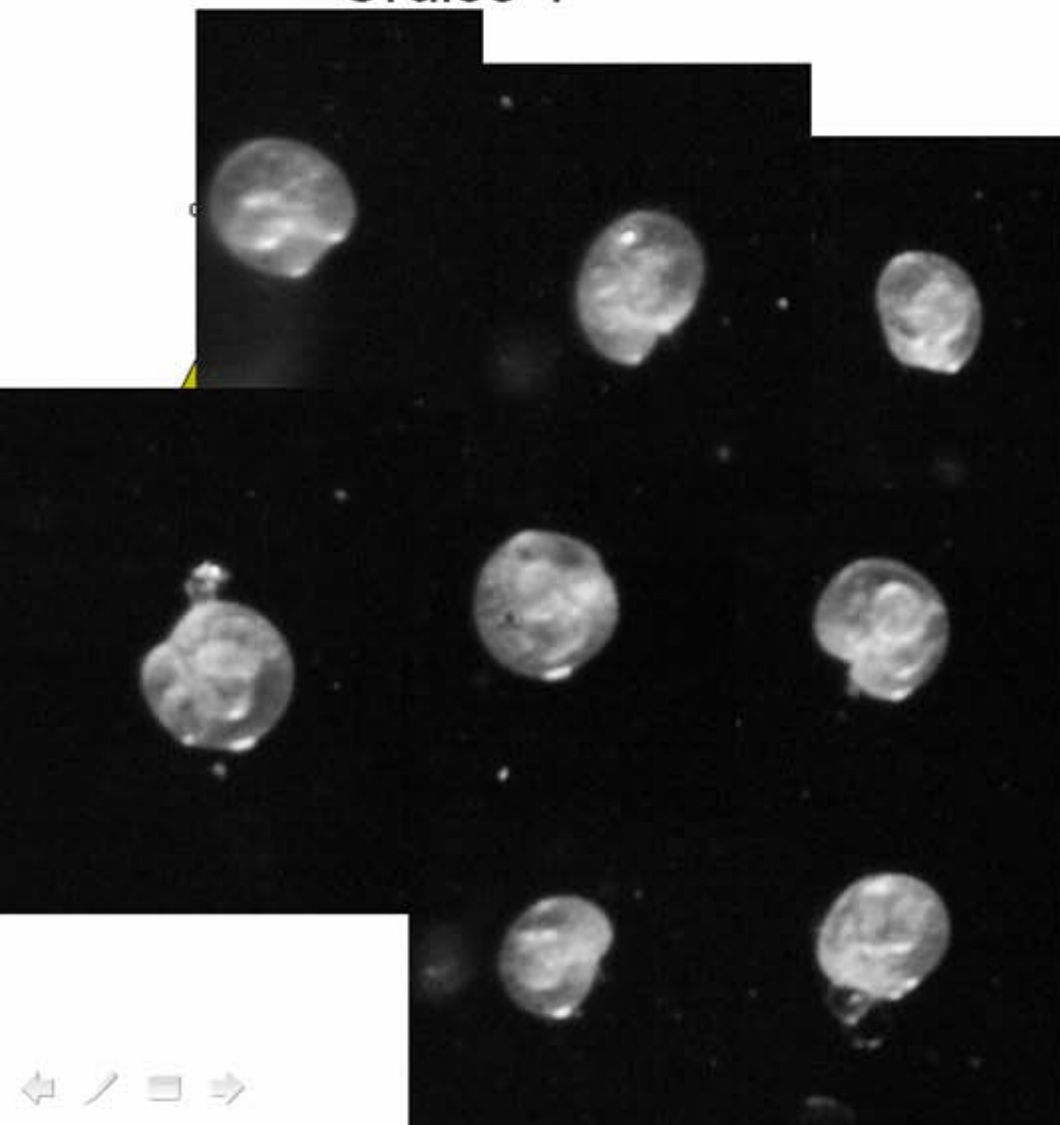


Cruise 2

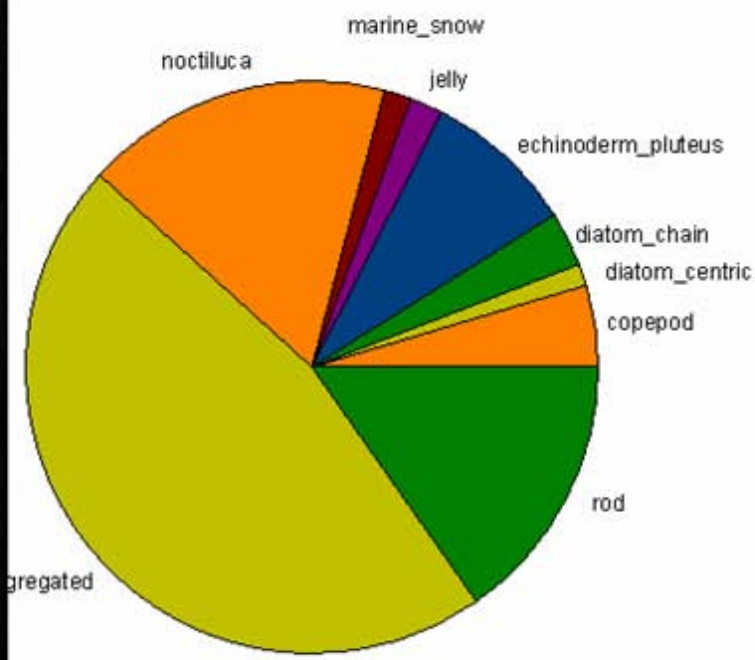


Classification results

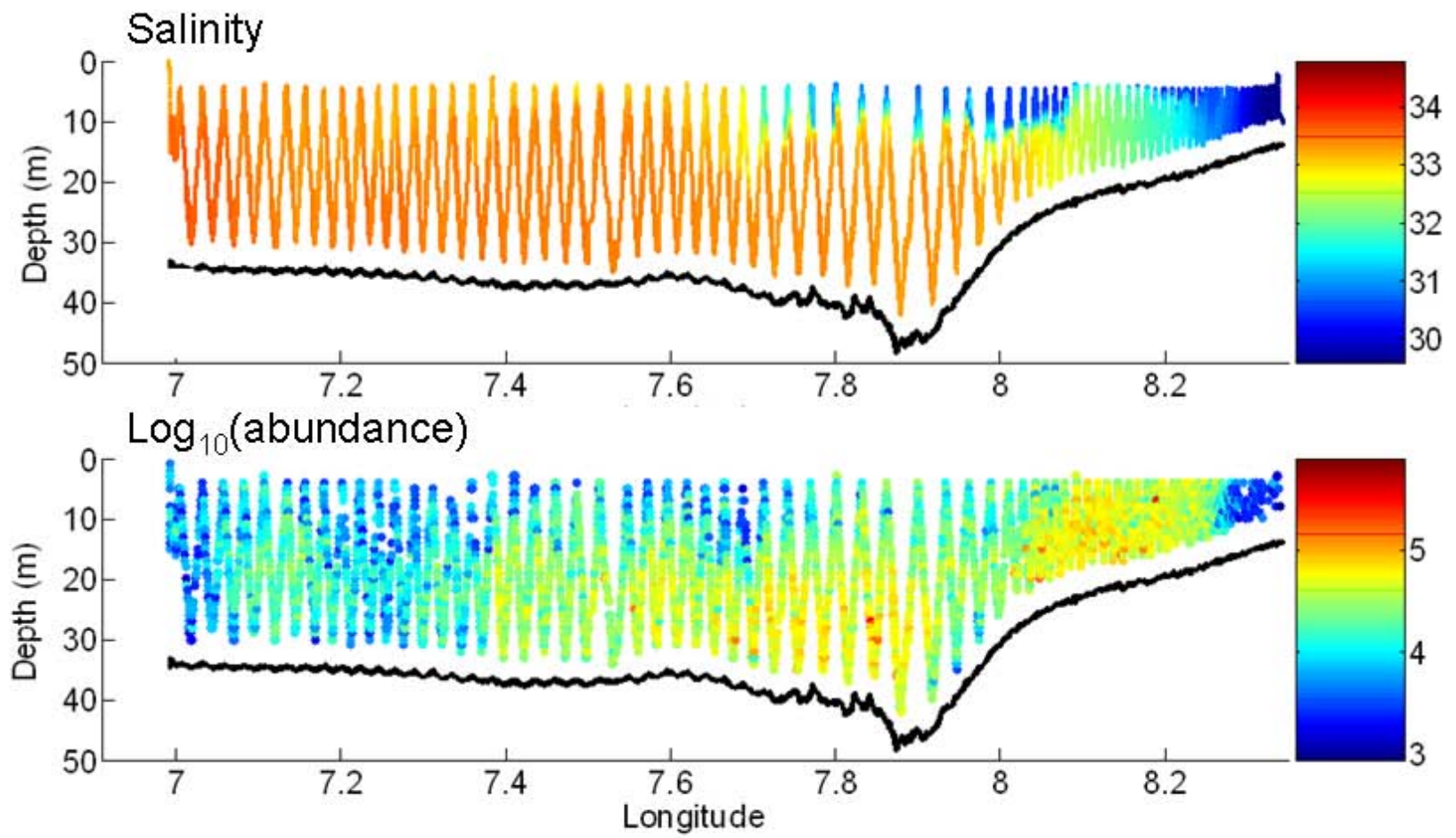
Cruise 1



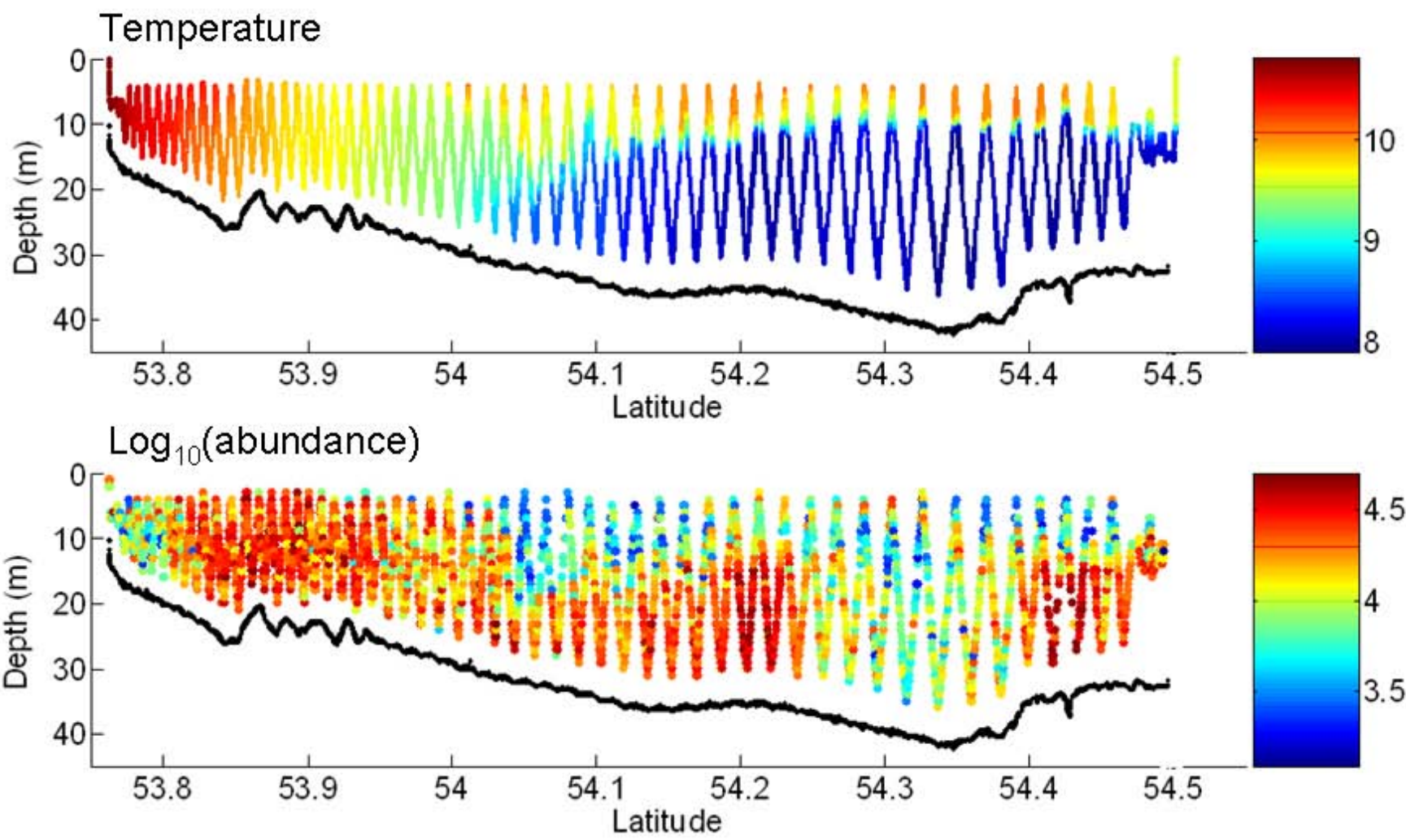
Cruise 2



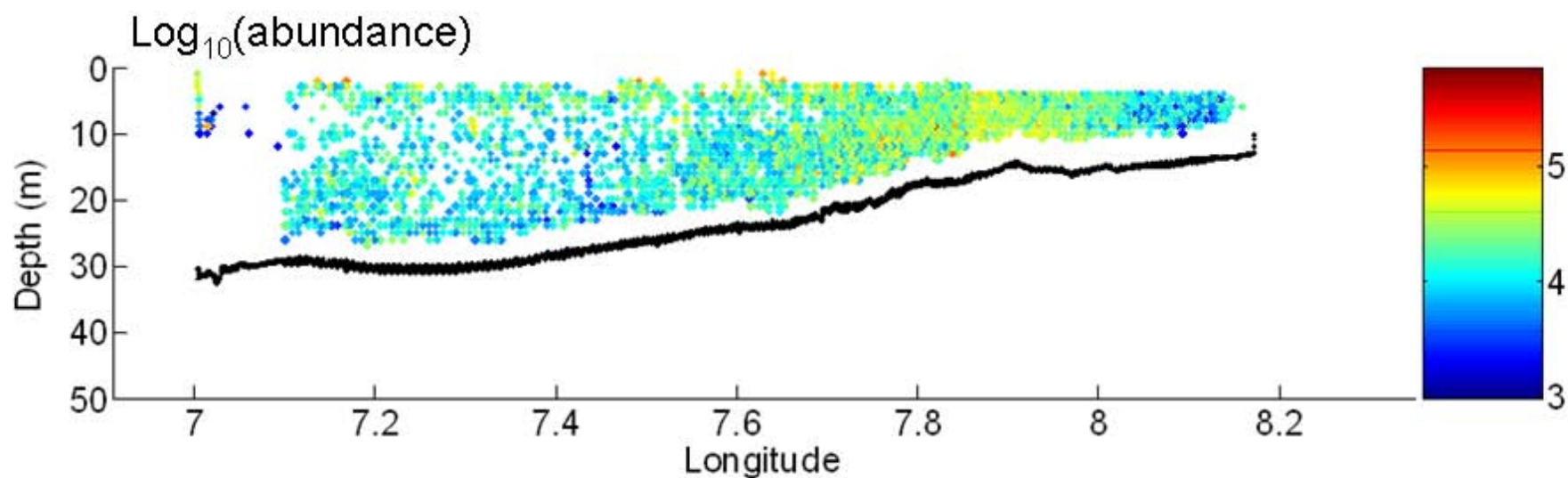
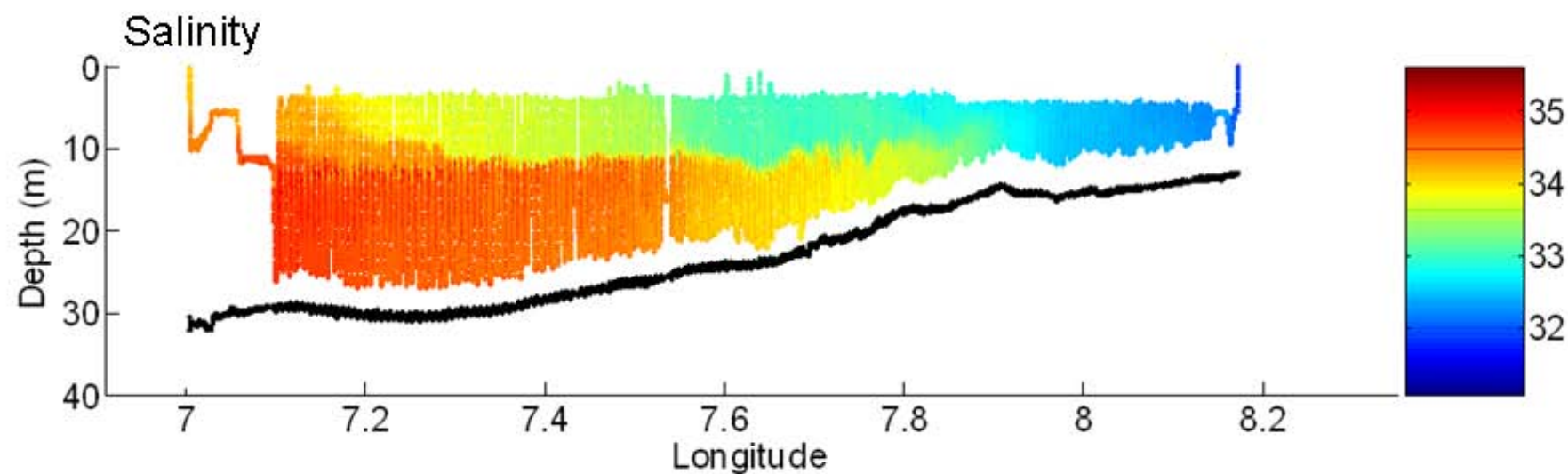
May - Diatoms – Estuarine Front



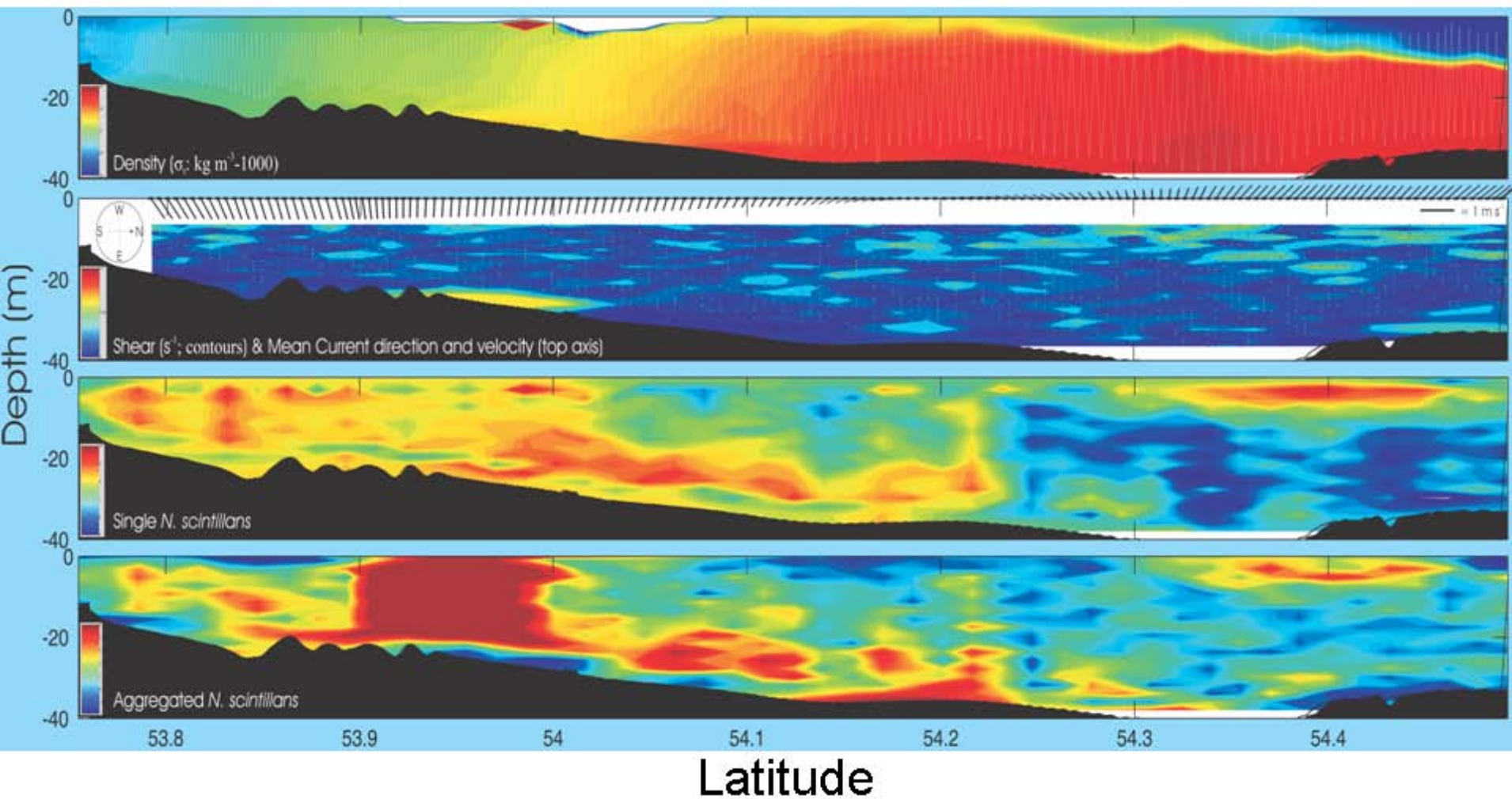
May - Diatoms – Tidal Front



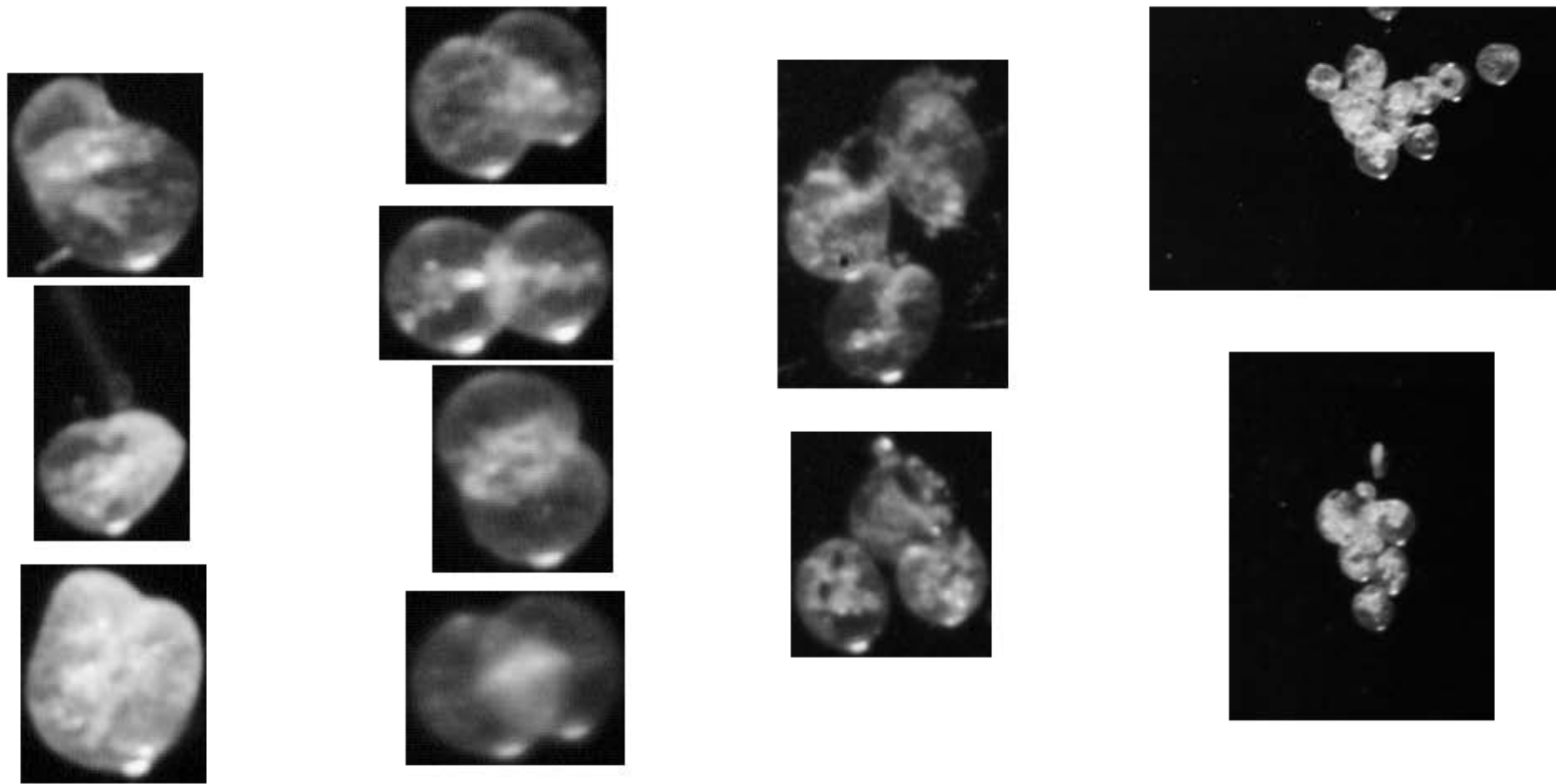
June/July – Noctiluca – Estuarine Front



June/July – Noctiluca – Tidal Front



The “Noctiluca continuum”

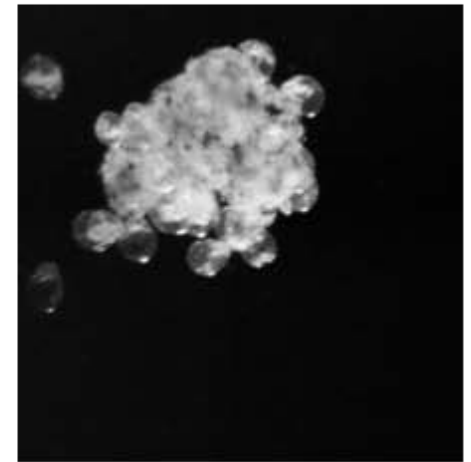
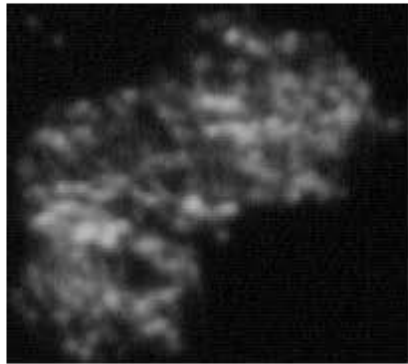
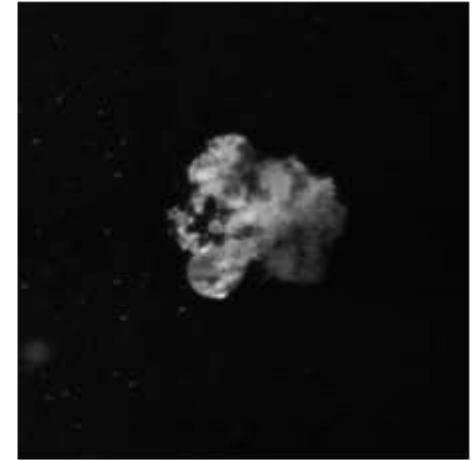
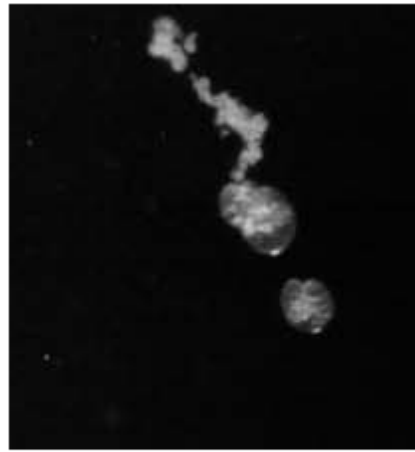
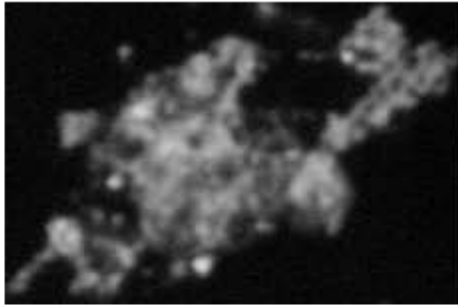


single



many

The “Noctiluca/snow continuum”



aggregates → Noctiluca aggregates → colonized (?) aggregates

Thanks!

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Esa Rahtu	University of Oulu
Verena Tunnicliffe	University of Victoria

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