PRELIMINARY CRUISE REPORT, W0107A
R/V WECOMA, 6-8 July 2001
GLOBEC/ENSO Long-Term Observations off Oregon

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PRINCIPAL INVESTIGATOR(S): GLOBEC: Adriana Huyer, Robert L. Smith, P. Michael Kosro, P. A. Wheeler, W. T. Peterson, Evelyn and Barry Sherr, and Jack A. Barth

PURPOSE: To determine physical, plankton and nutrient/chemical conditions over the continental margin for climate change studies in NE Pacific. In particular, to make CTD and CTD/rosette and net tow stations along the Newport Hydro line, to make continuous bio-acoustic observations between the 50-500m. isobath, and to make continuous observations of currents using ADCP and of surface-layer temperature, salinity and fluorescence by means of ship's thru-flo system. Figure 1 shows the location of the CTD stations. Table 1 shows the CTD station positions, and Table 2 shows the bio-chemical sampling depths.

SAMPLING PLAN:

1. Use ship's intake continuously for Temperature, Salinity, and Fluorescence
2. Continuous ADCP Profiling (150 kHz transducer) for water velocity and backscattering for bio-acoustics.
3. Standard CTD Stations using SBE 9/11 plus CTD system for Temperature, Salinity, Fluorescence, Light Transmission, Oxygen, PAR.
4. Rosette sampling: 5 liter bottles for nutrients, and chlorophyll.
5. Vertical net tows: 1/2 meter nets 100 m to surface; Horizontal net tows with 1 m^2 MOCNESS.
6. Continuous bio-acoustic observations between the 50-500m isobath along 1 section using a Hydroacoustics Technology, Inc., system towed alongside the ship.

CRUISE NARRATIVE

A brief overview of the cruise is presented here. An event log is provided in Table 3, and the participating personnel are listed in Table 4. Wecoma departed Newport at 1000 PST on 6 July 2001. CTD sampling started at NH-1. At NH-3, the HTI (bio-acoustic system) was deployed, and MOCNESS tows were started. The winds were between 15 - 23 kts. from N-NW, and the seas remained moderate for most of the Newport line. After completing 12 CTD's and net tows along the Newport Line at 1212 PST, 7 July, we began the transit to the FM line. At about 1400 PST, the ship had a breakdown in the main drive shaft that was unrepairable at sea. At 1445 PST the ship began to make its way slowly to Newport using the bow thruster. Arrangements were made to have the tug-boat, Terri L. Brusco, come from Astoria and meet us on the way in. At 1720 PST on 8 July, the tug met the Wecoma and a towline was rigged. We arrived alongside the pier at Newport at 1730 PST on 9 July 2001.

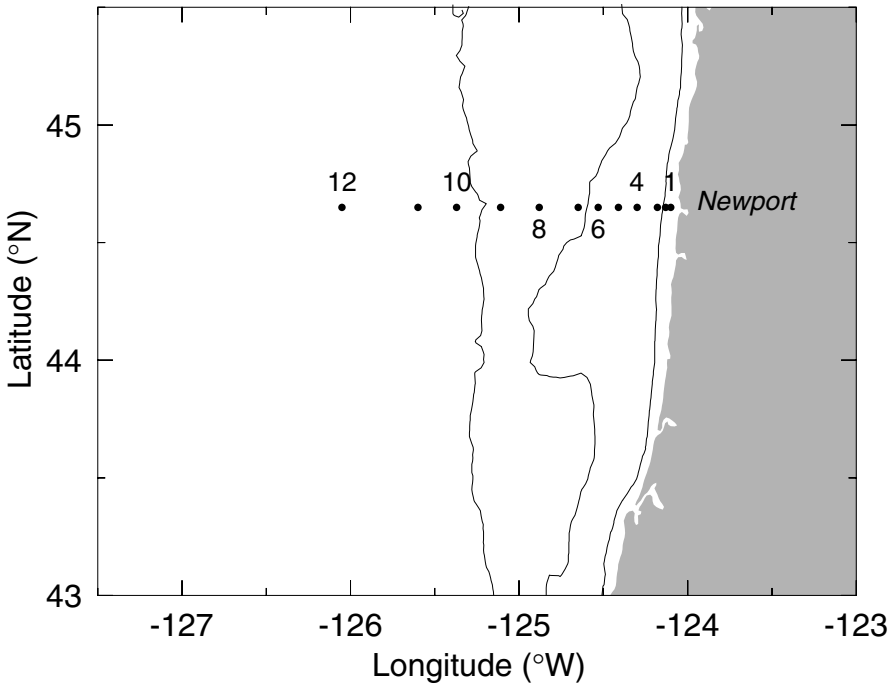


Figure 1. Location of CTD stations during W0107A.

PRELIMINARY RESULTS

Vertical sections of the parameters measured by the SBE CTD system (temperature, salinity, density, fluorescence voltage, percent light transmission and dissolved oxygen concentration) are presented at the end of this report. Also included is a vertical section of the alongshore currents measured by the shipborne Acoustic Doppler Current Profiler (ADCP).

Winds during most of the cruise were upwelling favorable at 15-23 knots, and out of the NW. The low temperatures and high salinities observed at inshore stations showed that coastal upwelling was occurring. The surface temperature of 8°C at the most inshore station, NH-1, was the coolest surface temperature off Newport that we have observed since the revival of sampling of the Newport hydrographic line in July 1997. The winds had been continuously favorable for upwelling for a week prior to the cruise, so the observations reflect conditions during a sustained upwelling event rather than an ‘anomalously’ cool ocean. The ADCP section shows a weak poleward flow undercurrent over the outer shelf. The attached zooplankton report was provided by Dr. Wm. Peterson, and the attached microzooplankton report was provided by the Drs. Evelyn and Barry Sherr.

Table 1. CTD station positions during W0107A, and sampling at each station (C: Bio/Chem bottle sampling, N:half-meter vertical net tows, M:Mocness, P:Pigment, O:Oxygen samples).

Station		Distance	Lat.	Long.	Bottom	Cast	Sampling
Name	No.	from shore	°N	°W	Depth	Depth	Type
NH-1	1	3.0	44.65	-124.10	29	23	N
NH-3	2	5.4	44.65	-124.13	48	43	P
NH-5	3	9.3	44.65	-124.18	61	56	C,N,M
NH-10	4	18.3	44.65	-124.29	82	77	P,N
NH-15	5	27.6	44.65	-124.41	93	86	C,N,M
NH-20	6	37.0	44.65	-124.53	143	135	P,N
NH-25	7	46.5	44.65	-124.65	291	286	C,N,M
NH-35	8	65.0	44.65	-124.88	440	435	C,N,M
NH-45	9	83.3	44.65	-125.12	706	700	C,N,M
NH-55	10	103.2	44.65	-125.37	2863	1005	P
NH-65	11	121.5	44.65	-125.60	2859	1006	C,N
NH-85	12	157.2	44.65	-126.05	2883	1006	C,O2

Table 4. Names, affiliations, and responsibilities of scientific personnel participating on W0107A.

Adriana Huyer	Chief Scientist	OSU	CTD
Robert L. Smith	Co-Chief Scientist	OSU	CTD
Jane Fleischbein	Technician	OSU	CTD
Dale Hubbard	Technician	OSU	CTD, oxygen
Margaret Sparrow	Technician	OSU	CTD
Julie Arrington	Technician	OSU	nuts, chl
Woody Moses	Graduate Student	OSU	nuts, chl
Sylvie Larock	Graduate Student	OSU	nuts, chl
Jennifer Harman	Undergraduate Student	OSU	nuts, chl
Carlos López	Technician	OSU	microzooplankton
Jesse Lamb	Technician	HMSC	zooplankton
Julie Keister	Technician	HMSC	zooplankton
Leah Feinberg	Technician	HMSC	zooplankton
Anders Roestad	Technician	ODFW	zooplankton
Linda Fayler	Technician	OSU	martec
Daryl Swensen	Technician	OSU	martec

Table 2: Actual sample depths and types of subsamples for biochemical sampling during the Jul.-'01 LTOP GLOBEC cruise.

Station, Depth, Dist. From Shore	**Sample Collection Depths (m)**	**Type of Sample Collected**
NH-03, 48m, 6km	43, 11, 1.6, 1.8	Slide Samples, Nutrients, POC/PON and Chl at 11 and 1.6 m
NH-05, 58m, 9km	56, 50, 40, 30, 25, 20, 15, 5, 1	TOC (all depths), Nutrients, TN (all depths), Chl, POC/PON
NH-10, 82m, 18km	57, 13, 4, 1	Slide Samples, Nutrients, POC/PON and Chl at 13 and 1 m
NH-15, 94m, 28km	86, 69, 60, 50, 40, 30, 24, 20, 12, 10, 5, 1	TOC (all depths), Nutrients, TN (all depths), Chl, POC/PON
NH-20, 144m, 37km	121, 26, 1	Slide Samples, Nutrients, POC/PON and Chl at 26 and 1 m
NH-25, 295m, 46km	285, 200, 150, 100, 70, 50, 40, 30, 20, 15, 10, 2	TOC (all depths), Nutrients, TN (all depths), Chl, POC/PON
NH-35, 441m, 65km	435, 220, 150, 100, 70, 55, 50, 40, 30, 20, 10, 1	TOC (surface), Nutrients, TN (surface), both Chl, POC/PON (except 435, 220 and 150 m)
NH-45, 693m, 83km	643, 500, 150, 100, 70, 55, 49, 40, 30, 20, 10, 2.5	TOC (surface), Nutrients, TN (surface), both Chl, POC/PON (except 643, 500 and 150m)
NH-55, 2865m, 103km	1005, 785, 645, 409, 45, 1	Slide Samples, Nutrients, POC/PON and Chl at 45 and 1 m
NH-65, 2860m, 121km	1000, 230, 150, 100, 71, 56, 50, 40, 30, 20, 10, 1.7	TOC (surface), Nutrients, TN (surface), both Chl, POC/PON (except 1000, 230 and 150m)
NH-85, 2884m, 157km	1004, 366, 150, 101, 70, 59, 50, 40, 30, 20, 10, 2	TOC (all depths), Nutrients, TN (all depths), both Chl and POC/PON (except 1004, 366 and 150 m)

Subsample	Replicates
TOC	3
Nutrients	1
TN	3
Chl	2
POC/PON	1
Slides	2

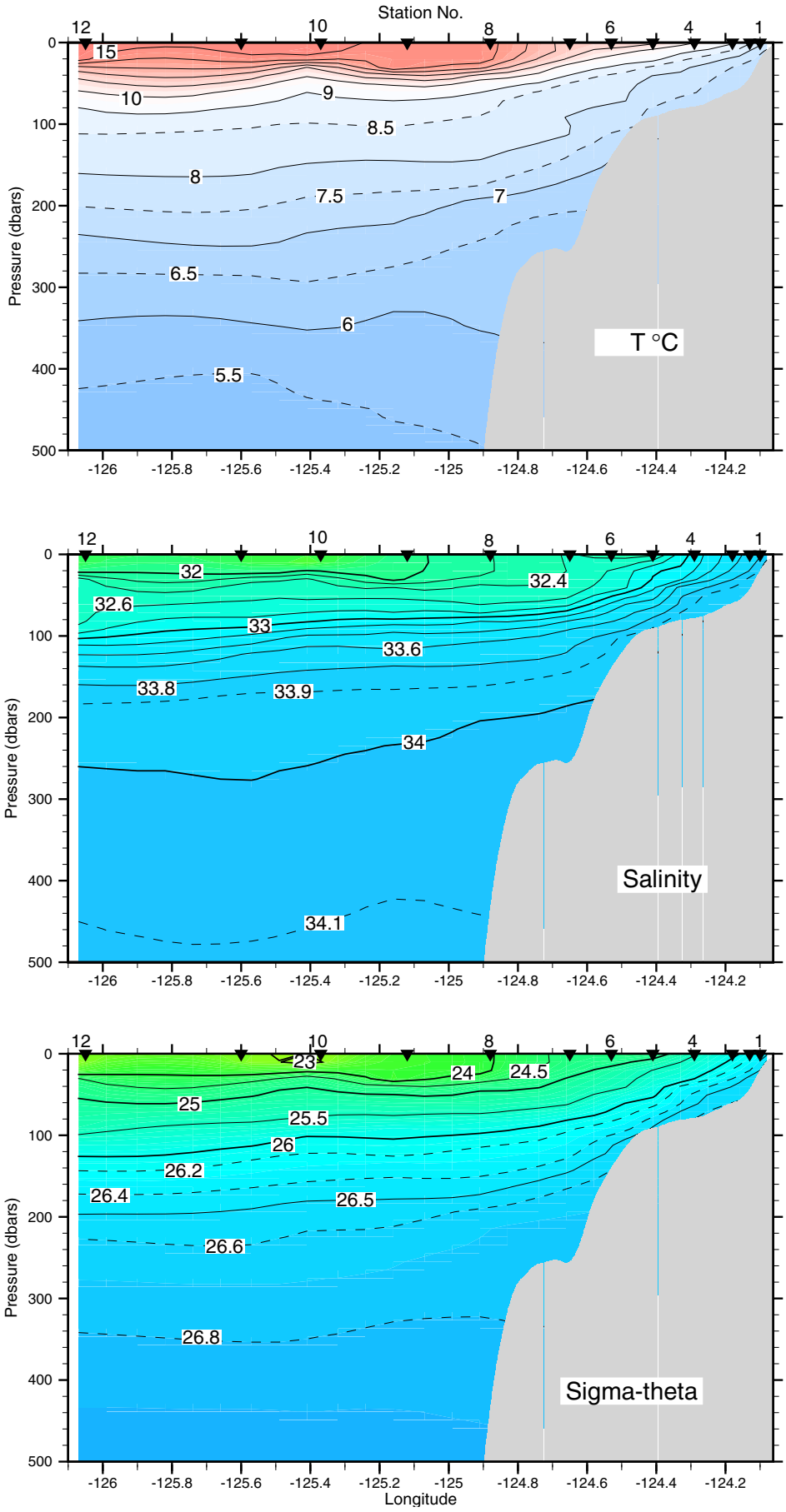
Table 2. R/V WECOMA Cruise W0107A

	Start	End	Sta.	Sta.	Latitude		Longitude		Bottom	Atmos	Wind	Wind	Event	Event ID
(UT)	Time	Time	No.	Name	(deg)	(min)	(deg)	(min)	Depth	Press	Dir.	Speed		
	(UT)	(UT)							(m)	(mbar)	(deg T)	(kts)		
6-Jul	1700												Depart Newport	
	1702												Start echosounder	
	1707												Start ADCP	
	1708												Start DAS	
	1820												air calibration of transmissometer	
	1855		1	NH-1	44	39.1	-124	06.0	29	1023.3	305	16	CTD	WE18701.01
	1909				44	39.1	-124	06.0					vertical net tow	WE18701.02
	1936		2	NH-3	44	39.1	-124	07.8	48	1022.1	340	15	CTD with pigments at 1m, 11m	WE18701.03
	1950				44	39.1	-124	07.8					HTI deployed	WE18701.04
	2012				44	39.1	-124	06.1					secchi disk	WE18701.05
	2021		3	NH-5	44	39.0	-124	10.8	61	1023.1	340	17	CTD with biochem, mzp	WE18701.06
	2038	2044			44	38.9	-124	11.0					vertical net tow, 58 m	WE18701.07
	2053												Start flo-thru	
	2054				44	38.0	-124	11.3					Mocness deployed	WE18701.09
	2130				44	39.0	-124	11.4					Mocness aboard	WE18701.10
	2218		4	NH-10	44	39.1	-124	17.7	82	1022.0	330	14	CTD with pigments at 1m, 13m	WE18701.11
	2233				44	39.1	-124	17.7					vertical net tow, 75 m	WE18701.12
	2243				44	39.10	-124	17.98					drifter 27438	WE18701.13
	2333		5	NH-15	44	39.1	-124	24.7	93	1021.9	340	23	CTD with biochem, mzp	WE18701.14
	2355				44	39.0	-124	24.9					secchi disk	WE18701.15
	2357	0002			44	39.0	-124	24.9					vertical net tow to 86 m	WE18701.16
7-Jul	0006	0016			44	38.9	-124	24.9					1 m surface tow	WE18801.01
	0017	0025			44	39.0	-124	25.1					vertical net tow to 86 m	WE18801.02
	0031				44	39.1	-124	25.4					Mocness deployed	WE18801.03
	0101				44	39.9	-124	26.4					Mocness aboard	WE18801.04
	0110				44	39.97	-124	26.57					drifter 27439	WE18801.05
	0117												Cleaned flo-thru filters	
	0149		6	NH-20	44	39.1	-124	31.8	143	1021.0	348	21	CTD with pigments at 1m, 26 m	WE18801.06
	0207	0213			44	38.9	-124	32.0					vertical net tow, 100m	WE18801.07
	0309		7	NH-25	44	39.1	-124	39.1	291	1020.4	350	21	CTD with biochem, mzp	WE18801.08
	0337	2042			44	39.0	-124	39.2					vertical net tow, 100 m	WE18801.09
	0351				44	39.1	-124	39.2					Mocness deployed	WE18801.10
	0448				44	41.0	-124	39.2					Mocness aboard	WE18801.11
	0458				44	41.05	-124	39.33					drifter 27440	WE18801.12
	0634		8	NH-35	44	39.1	-124	53.0	440	1020.9	345	20	CTD with biochem, mzp	WE18801.13
	0708	0715			44	39.0	-124	53.0					vertical net tow, 100 m	WE18801.14

	Start	End	Sta.	Sta.	Latitude		Longitude		Bottom	Atmos	Wind	Wind	Event	Event ID
(UT)	Time	Time	No.	Name	(deg)	(min)	(deg)	(min)	Depth	Press	Dir.	Speed		
	(UT)	(UT)							(m)	(mbar)	(deg T)	(kts)		
7-Jul	0723				44	39.2	-124	53.1					Mocness deployed	WE18801.15
	0825				44	41.2	-124	53.2					Mocness aboard	WE18801.16
	1000		9	NH-45	44	39.1	-125	07.0	706	1020.0	350	20	CTD with biochem, mzp	WE18801.17
	1044	1050			44	39.1	-125	07.0					vertical net tow, 100m	WE18801.18
	1058				44	39.2	-125	07.1					Mocness deployed	WE18801.19
					44	41.1	-125	09.0					Mocness aboard	WE18801.20
	1215				44	41.06	-125	09.31					drifter 27441	WE18801.21
	1335			NH-55	44	39.2	-125	22.0					HTI recovered	WE18801.22
	1444		10	NH-55	44	39.2	-125	22.0	2863	1021.2		15	CTD with pigments at 1m, 45 m	WE18801.23
	1532		11	NH-65	44	39.1	-125	36.0	2859	1021.6	345	12	CTD with biochem, mzp	WE18801.24
					44		-125						vertical net tow, 100 m	WE18801.25
	1637				44	39.06	-125	36.14					drifter 27442	WE18801.26
	1819		12	NH-85	44	39.1	-126	03.0	2883	1022.2	340	7	CTD with biochem, oxygen	WE18801.27
	1912												begin transit to FM-9	
	2031												air calibration of transmissometer	
	~2100												breakdown in ship's main drive shaft	
	2145												begin transit to Newport (bow-thruster)	
8-Jul	1312												Cleaned flo-thru filters	
	~1720												Tug arrives to tow ship to Newport	
	2309												shut down flow through system	
	2327												shut down echosounder	
	2331												shut down ADCP	
	2337												shut down DAS	
9-Jul	0030												arrive at pier in Newport	

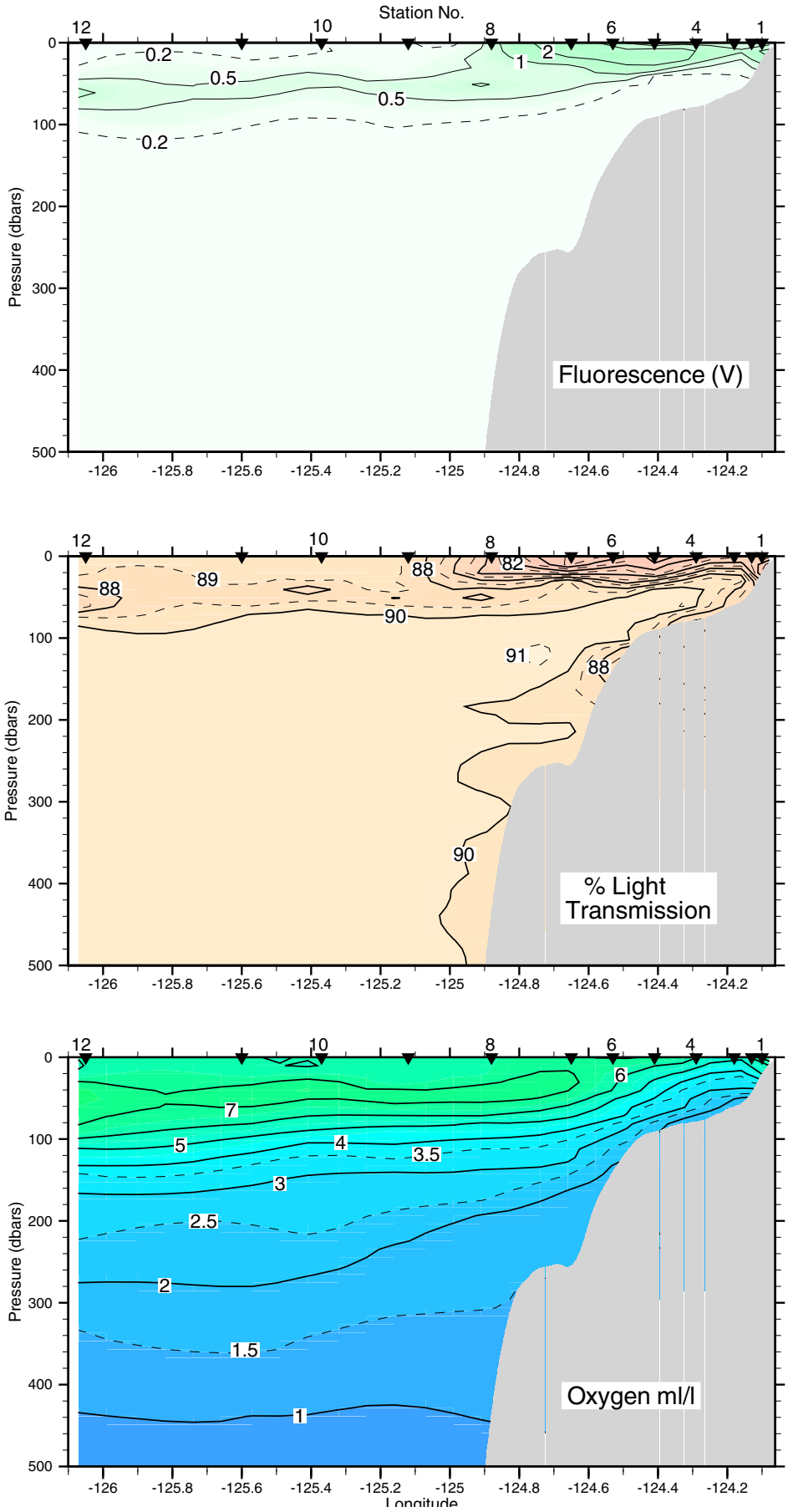
Newport Hydro Line 44° 39'N

6-7 July 2001



Newport Hydro Line 44° 39'N

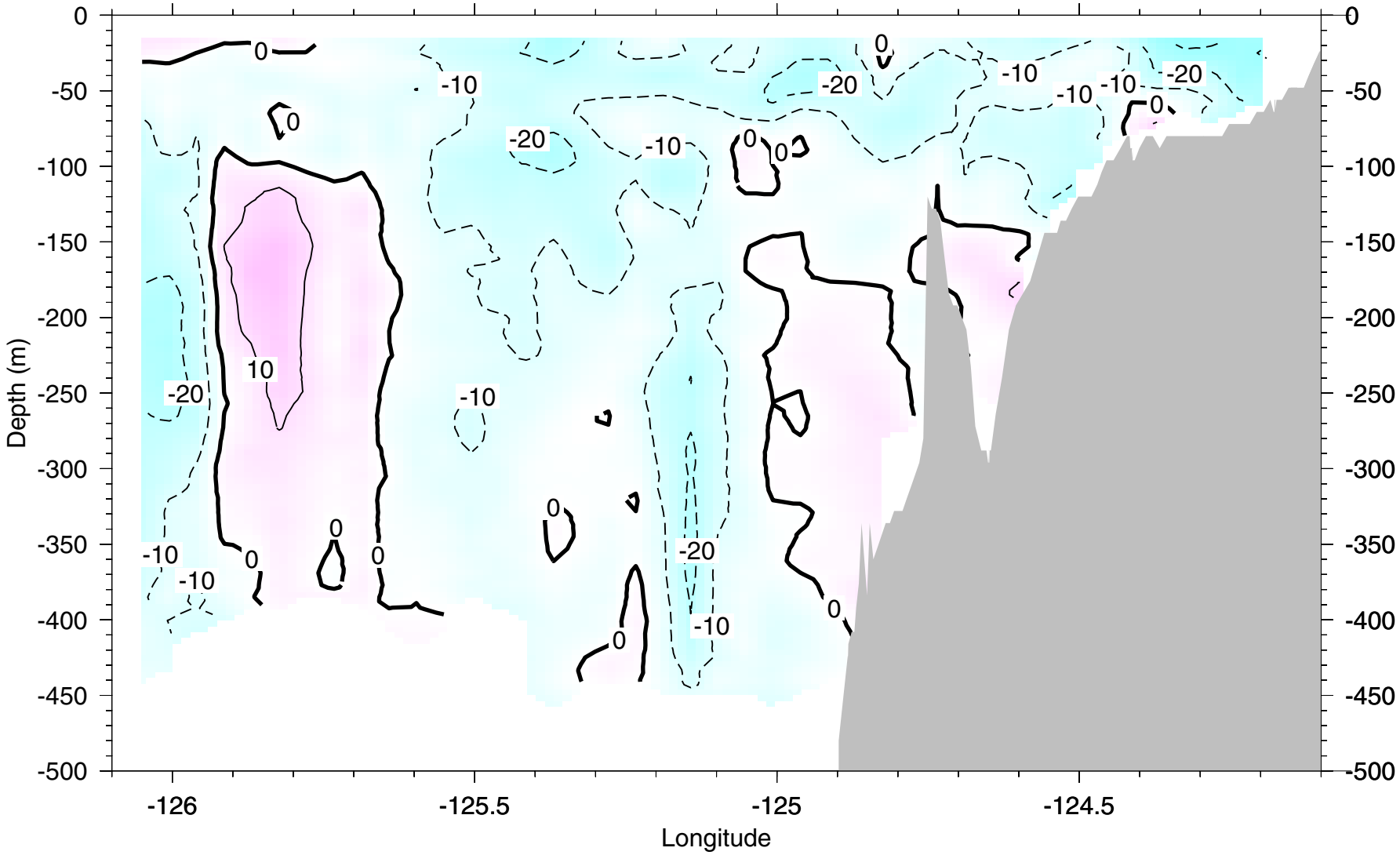
6-7 July 2001

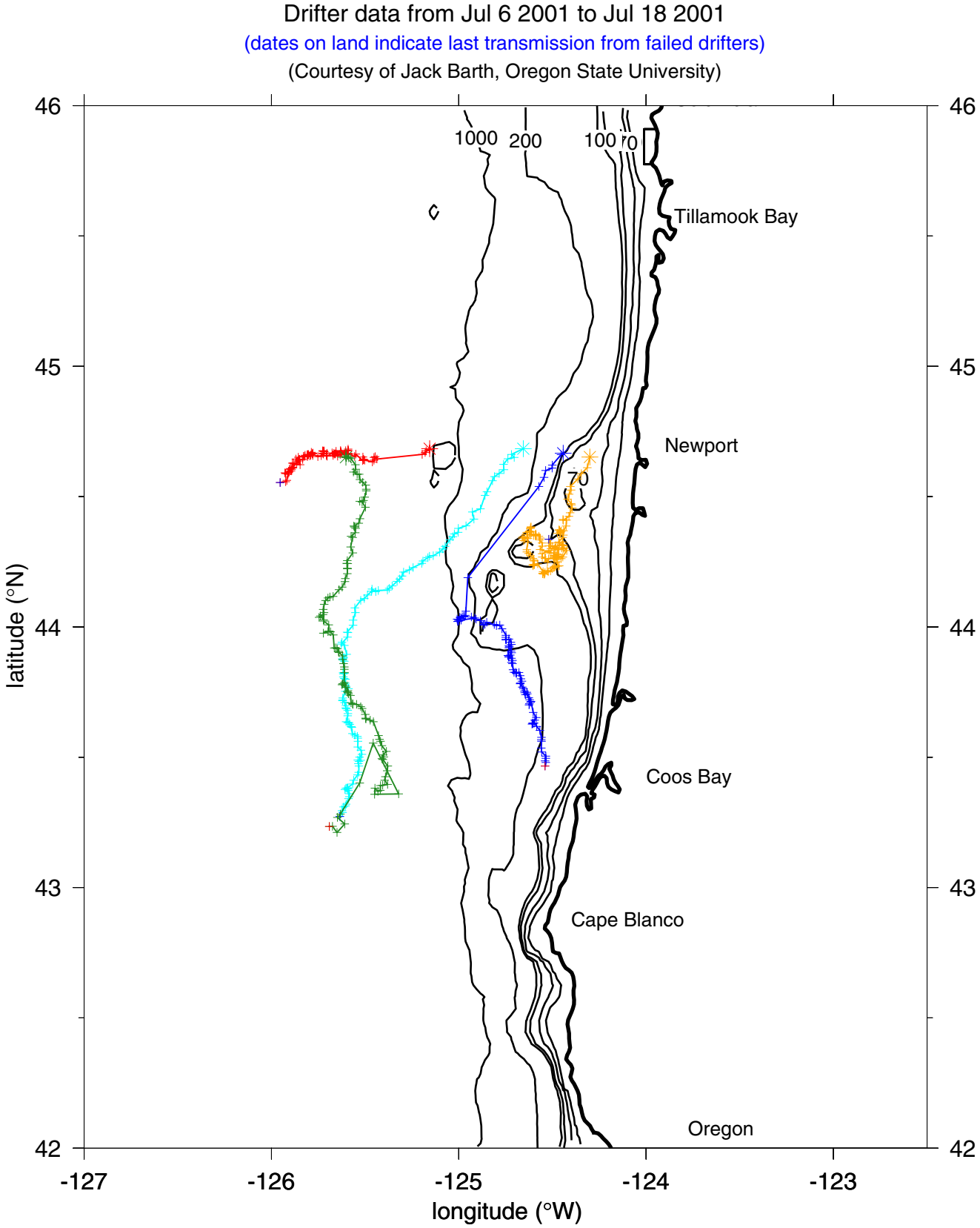


Newport Hydrographic Line 44.6°N

6-7 July 2001

ADCP: Northward current (cm/s)




Drifter data from Jul 6 2001 to Jul 18 2001
(dates on land indicate last transmission from failed drifters)
(Courtesy of Jack Barth, Oregon State University)
1000
200
100
70
Tillamook Bay
Newport
70
Coos Bay
Cape Blanco
Oregon
46
45
44
43
42
-127
-126
-125
-124
-123
latitude (°N)
longitude (°W)

Zooplankton Report

(Submitted by Dr. Wm. Peterson and Julie Keister, NOAA)

MOCNESS DESCRIPTIONS

NH5 1400 h water depth=60m

50-20 m	small copepods, jellies, amphipods, *Pleurobrachia*
20-10 m	small copepods, *Pleurobrachia*, euphausiid furcilia, jellies
10-0 m	~20 *Pleurobrachia* , small copepods

NH15 1730 h water depth=90m

80-50	Furcilia, small copepods, algae
50-20	Furcilia, small copepods, algae, amphipods
20-10	small copepods, furcilia, large copepods, algae
10-0	small copepods, furcilia, amphipods, algae
surface	large copepods, furcilia, 1 adult euphausiid

NH25 2050 h water depth=300m

280-250	1 phronemid amphipod, 100 chaetognaths, 10 *Pleurobrachia*, fish larvae
250-200	1 squid, chaetognaths, few euphausiids, amphipods, copepods, *Neocalanus*
200-150	4 shrimp, 8 squid, 1 crab megalope, chaetognaths, copepods
150-100	5 sergestid shrimp, ~10 squid, megalope, copepods
100-50	~150 euphausiids, 6 sergestids, 1 myctophid, copepods, small squid
50-20	many euphausiids, amphipods, few gastropods
20-10	euphausiids, small copepods, amphipods, chaetognaths
10-0	small copepods, euphausiids eggs, a few euphausiids

NH35 0020 h water depth=480m

350-300	chaetognaths, amphipods, 2 sergestids, copepods, jellies
300-200	small copepods, 1 squid, chaetognaths, ~25 euphausiids
200-150	50 euphausiids, 2 squid, 4 sergestids
150-100	~100 adult euphausiids, small copepods, 4 sergestids
100-50	5 sergestid shrimp, 1 myctophid, larval fish, ~1000 juvy euphausiids, copepods, chaetognaths
50-20	~5000 euphausiids, 6 myctophids, ~200 fish larvae, amphipods
20-10	pteropods, small copepods, furcilia, 1 jelly, 1 Pleurobrachia
10-0	small amphipods, 2 crab megalope

NH45 0400 h water depth=660m

350-200	1 Praya, 2 myctophids, euphausiids, shrimp
200-150	~100 euphausiids, ~20 Muggiaea, 3 sergestids
150-100	1 jelly, small euphausiids, amphipods, 4 sergestids, copepods, Muggiaea

100-50	euphausiid furcilia, amphipods, fish larvae, jellies
50-30	1 Corolla, 100s of juvy euphausiids, amphipods, copepods, fish larvae
30-20	salp city
20-10	2 Corolla, jelly ooze, amphipods
10-0	small amphipods, 2 crab megalope

Other zooplankton sampling:

Vertical tows (200µm mesh) from 100m to the surface completed at stations NH1, NH5, NH10, NH15, NH20, NH25, NH35, NH45, and NH65.

Euphausiids from station NH25 were incubated for molting rates.
Euphausiids from station NH25 were preserved for gut-content evaluation.

Microzooplankton Sampling

(submitted by Drs. E. And B. Sherr, Oregon State University)

Primary goal: MICROZOOPLANKTON ABUNDANCE, BIOMASS, AND GENERAL TAXONOMIC COMPOSITION:

MICROPROTIST (10 – 200 μm sized) BIOMASS -

A) Epifluorescence samples: preserve with Lugol's +Na thiosulfate+ formalin, filter 100 ml subsamples onto 3 μm black filters, stain with DAPI, mount on labeled slide, freeze in slide box.

B) Settling samples: Add 23 ml acid Lugol solution to 240 ml (8 oz) labeled amber bottle, add 207 ml seawater sample, gently mix, cap tightly, store in boxes.

Secondary goal: ABUNDANCE OF PICOEUKARYOTES AND BACTERIA

Flow cytometry samples: pipette 3 ml of sample into 4 ml labeled cryovial, add 120 μl of unfrozen, 25% glutaraldehyde (0.5% final conc), cap & mix using vortex mixer, store in liquid nitrogen shipper.

SAMPLING STRATEGY:

Focus on upper 100 m, with emphasis on 0-50 m depth zone, including chlorophyll-a maximum.

Depths to sample: 6 depths per cast

- Depth of Chlorophyll-a maximum (will vary from cast to cast)
- 70 m depth
- 4 other depths in upper 50 m, <u>don't sample</u> the 1 m depth, more or less evenly spaced; may want to sample the depth nearest the chlorophyll maximum depth

Transect lines: top priority is the NH line, second priorities are the FM and CR lines, tertiary priority for the HH and RR lines

PROTOCOL FOR EPIFLUORESCENCE SAMPLES

1) Preserve the sample: **to each 230 ml seawater sample :**

- **add 3 drops of alkaline Lugol solution, gently mix by capping & inverting bottle**
- **add 6 drops of 3% sodium thiosulfate, gently mix** (sample color should go from pale golden to clear)

- **add 6 ml of formalin (2 squirts from the 3-ml Oxford dispensor**
- **refrigerate for 6-12 hours before filtration to harden and shrink cells (probably can let the samples sit 24+ hours, but its best to stain, settle on filters, mount & freeze as soon after ~ 6 hours as possible**

2) **Filter and stain with DAPI:** Prepare filtration bases with 0.45 µm backing filters, wetted, lay on top a 3.0 µm black membrane filter, and clamp tower over the filters on the base. (Note: *If the filtration clamp isn't on securely, the sample will leak out of the tower down the side of the base - check for leaks after pouring the sample into the tower).* Filter appropriate volume of preserved sample (usually 100 ml). *Filter down to about 5 ml* of sample, relieve the vacuum by turning the manifold valve to the off position, quickly taking off and then replacing the filtration unit (including the stopper) on, the manifold, (if you don't do this, there will be enough residual vacuum for the sample to keep dripping into the manifold during the staining procedure). Turn off pump and relieve all vacuum when last sample is down to 5 ml.

Note: A problem with filtration of multiple samples at a time is that usually some samples filter more quickly than others. You'll have to keep a sharp watch on the samples, and when each sample in turn reaches the 5 ml mark on the tower, turn the valve for the filtration unit to the off position and then remove & replace the stopper to ensure all the vacuum in that filtration unit is relieved. When all of the samples have gone down to 5 ml, then turn off the pump and relieve all the vacuum in the system by taking off & replacing one of the tower stoppers, or the stopper on the first vacuum trap.

2) Add 30 µl of 500 µg/ml DAPI to each of the samples in the towers, let sit ~ 7 minutes (longer is OK).

3) Prepare labeled slides: While waiting for the samples to incubate with the DAPI stain, prepare the glass slides for mounting the samples. Use consecutive slide numbers with number codes listed in log sheets with sample information. Mount two replicate filters onto each slide. Put a drop of immersion oil onto the slide and smear flat with the edge of a cover slip.

4) Filter samples down, mount onto glass slides and freeze: Turn on the pump, open all the manifold valves, and filter down the stained samples to dryness. *Remove the filters while vacuum is still on.* Lay duplicate filters side by side on the glass slide, put a drop of immersion oil on each, put a glass cover slip on top of each filter, put in a labeled slide box and store in -20oC freezer until returned to COAS (on ice to keep cold).

PROTOCOL for Utermohl inverted microscopy method

Settle 50 mls of acid Lugol's preserved sample in a graduate cylinder for 24 hrs. Pipette off the top 30 mls and then pour the rest into an Utermohl settling chamber followed by 5 mls of acid Lugol's containing filtered seawater used to rinse the graduate cylinder. Let the sample settle for another 12 hrs. Then prepare the bottom portion of the chamber for enumerating ciliates using DIC or brightfield inverted microscopy.

Station and Depths sampled are listed in Table 1 below:

Table 1: Actual sample depths for microzooplankton samples (epifluorescence slide preparations and acid Lugol-fixed samples) during the July-'01 LTOP GLOBEC cruise. W0107a.

Station, Depth, Dist. From Shore	Sample Collection Depths (m)
NH-05, 61m, 10km	50, 40, 30, 20, 15, 5
NH-15, 83m, 28km	60, 40, 24, 12, 10, 5
NH-25, 296m, 46km	70, 50, 30, 20, 15, 10
NH-35, 450m, 65km	70, 55, 40, 30, 20, 10
NH-45, 694m, 83km	100, 70, 55, 40, 20, 10
NH-65, 2861m, 121km	70, 56, 40, 30, 20, 10
NH-85, 2883m, 157km	101, 70, 58, 40, 20, 10