PRELIMINARY CRUISE REPORT, W0111B
R/V WECOMA, 27-29 November 2001
GLOBEC NEP Long-Term Observations off Oregon

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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 the NE Pacific. In particular, to make 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 the 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 biochemical 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 27 November 2001. CTD sampling started at NH-1. At NH-3, the HTI (bio-acoustic system) was deployed, and MOCNESS tows were started. CTD sampling and net tows continued westward along the Newport line as the winds slowly shifted from east to south. Prior to station 8 at NH-35, the fluorometer was removed from the CTD since its pressure case was only rated to 500db. (Our deep fluorometer was at the manufacturer for repairs.) During the CTD cast at NH-35, the winds began to increase rapidly, and the sea state made it impossible to deploy the plankton nets safely. The HTI was recovered and the Wecoma hove to as the winds continued to increase to 50-60 kts out of the south (Figure 2). High, steep waves (Figure 3) during the night and into the

morning of November 28 made resuming sampling impossible. With the rough seas continuing during the day and the forecast of another front moving in, a decision was made in the afternoon to return to Newport as soon as possible. We made our way slowly SE to be able to approach Newport at a safer angle to the waves, should the Newport Bar be passable the next day during a break in the weather. We arrived alongside the pier at Newport at 1130 PST on 29 November 2001.

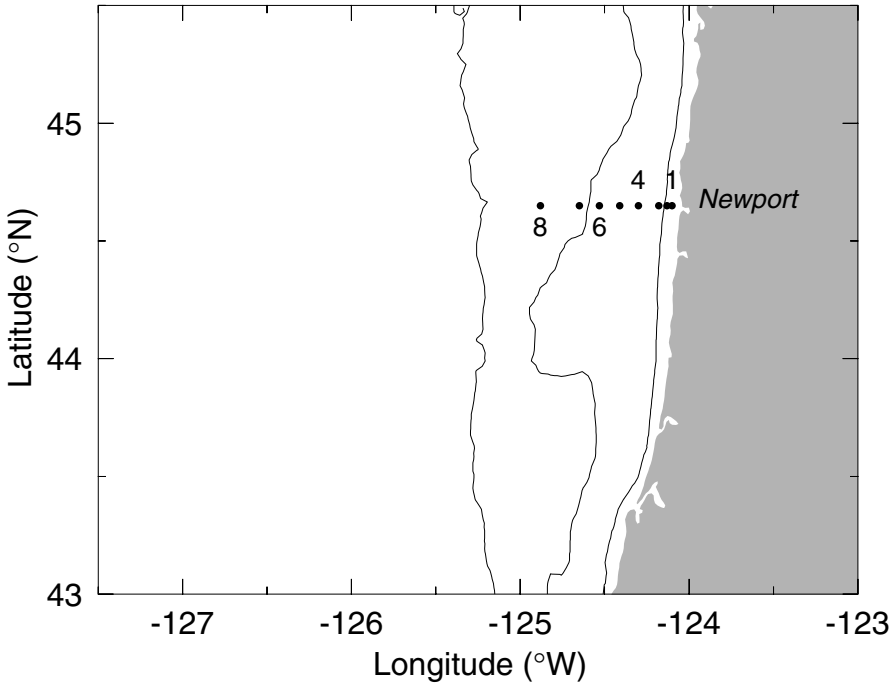
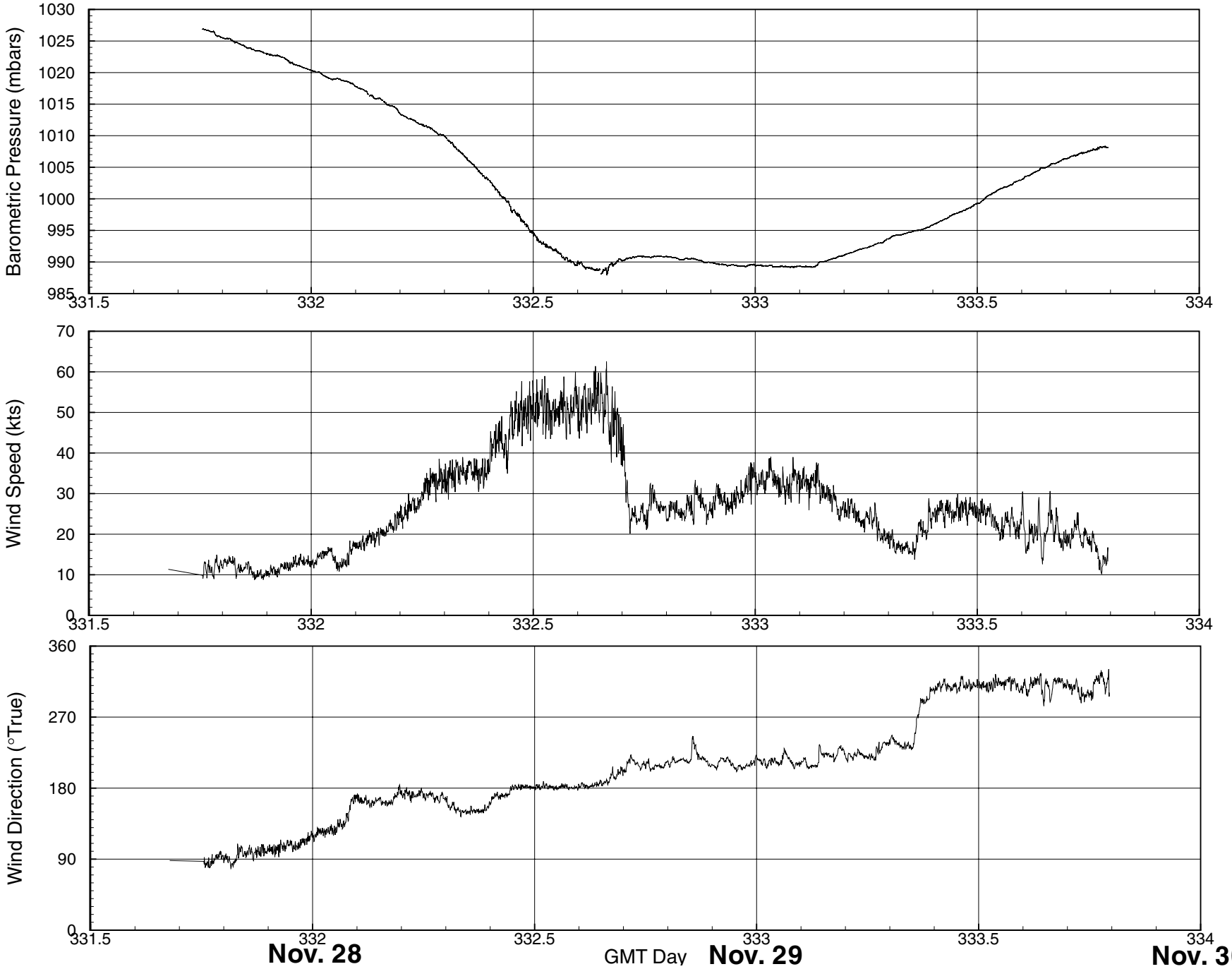


Figure 1. Location of CTD stations during W0111B.

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).
Because of the very rough weather and high seas (Figures 2 and 3), we were unable to complete the offshore portion of the section. The inshore portion was completed before the storm. The effects of downwelling resulting from storms during the preceding week are obvious: the 10 C isotherm intersects the bottom at a depth of 100 m; the inshore end of the 8C isotherm (which lay at a depth of 40 m in September) intersects the bottom at 240 m. Surface salinities are lowest inshore, reflecting the local runoff due to the high rainfall of the preceding weeks. Light transmissivity is low inshore, and also low in the bottom boundary layer of the midshelf, suggesting resuspension of bottom sediments by long ocean swell.

Figure 2. W0111B Barometric Pressure and Wind Speed and Direction on R/V Wecoma.



The T-S diagram for all eight stations (Figure 4) shows the cool, low-salinity subsurface waters inshore. Waters in the upper portion of the permanent halocline (salinities ranging from 32.6 to 33.5) are cool at the shelf-break (at NH-25 and NH-35) but warm over most of the shelf (NH-5 to NH-20). These halocline temperatures presumably reflect alongshore advection: from the north by the coastal jet whose core has migrated offshore by autumn, and from the south by the inshore Davidson Current. The T-S curve for NH-25 in November 2001 shows the lower portion of the halocline (salinity of 33.4 to 33.9) is significantly warmer than the historical fall average (Figure 5); this is likely due to unusually strong poleward advection forced by the downwelling winds during the preceding weeks.

The attached zooplankton report was provided by Dr. Wm. Peterson, and the attached microzooplankton report was provided by Drs. Evelyn and Barry Sherr.

A note on the weather during the cruise (See Figures 2 and 3): We departed Newport at 1000 PST under gentle easterly winds and encountered relatively calm seas as expected from the forecast. The forecast issued at 0230 PST 27 November for the coastal waters from Cascade Head to Florence out to 60 N miles was 10 kt E (westward) winds and swell 5 ft, increasing to 40 kt SE winds after midnight and combined seas "building to 15 ft by morning". Winds during the day on 28 Wednesday were forecast to be S at 45 kt with combined seas building to 22 ft before subsiding on 29 November. We anticipated having to suspend work by morning of 28 November but the wind and sea increased rapidly and work was suspended at 2200 PST on 27 November when we were 35 nautical miles off Newport. By 0400 PST on 28 November sustained winds were 55 kts and significant wave heights > 10 m (33 ft). Both WECOMA and NOAA buoy 46050 (about 25 miles off Newport) reported similar conditions. The winds decreased to about 30 kts in early afternoon, and significant wave height decreased to 20 ft, but this was not sufficient to resume work and it was decided to return to Newport at the first available opportunity. We crossed the Newport bar, under observation by two Coast Guard vessels from Newport, at about 1100 PST 29 November. The NOAA buoy 46050 had broken loose from its mooring a few hours earlier.

Figure 3. Significant Wave Height measured at NOAA Buoy Station 46050 at 44.62 N., -124.53 W. from 0000Z November 26 to 0000Z November 30.

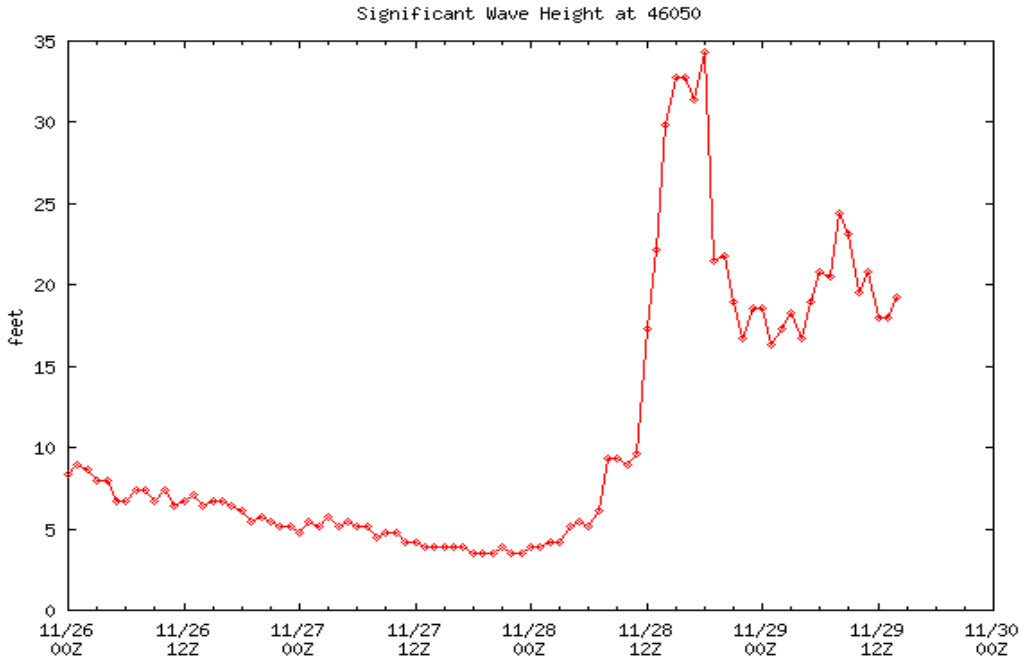


Figure 4. T-S Diagram of W0111b Newport Hydro Line.

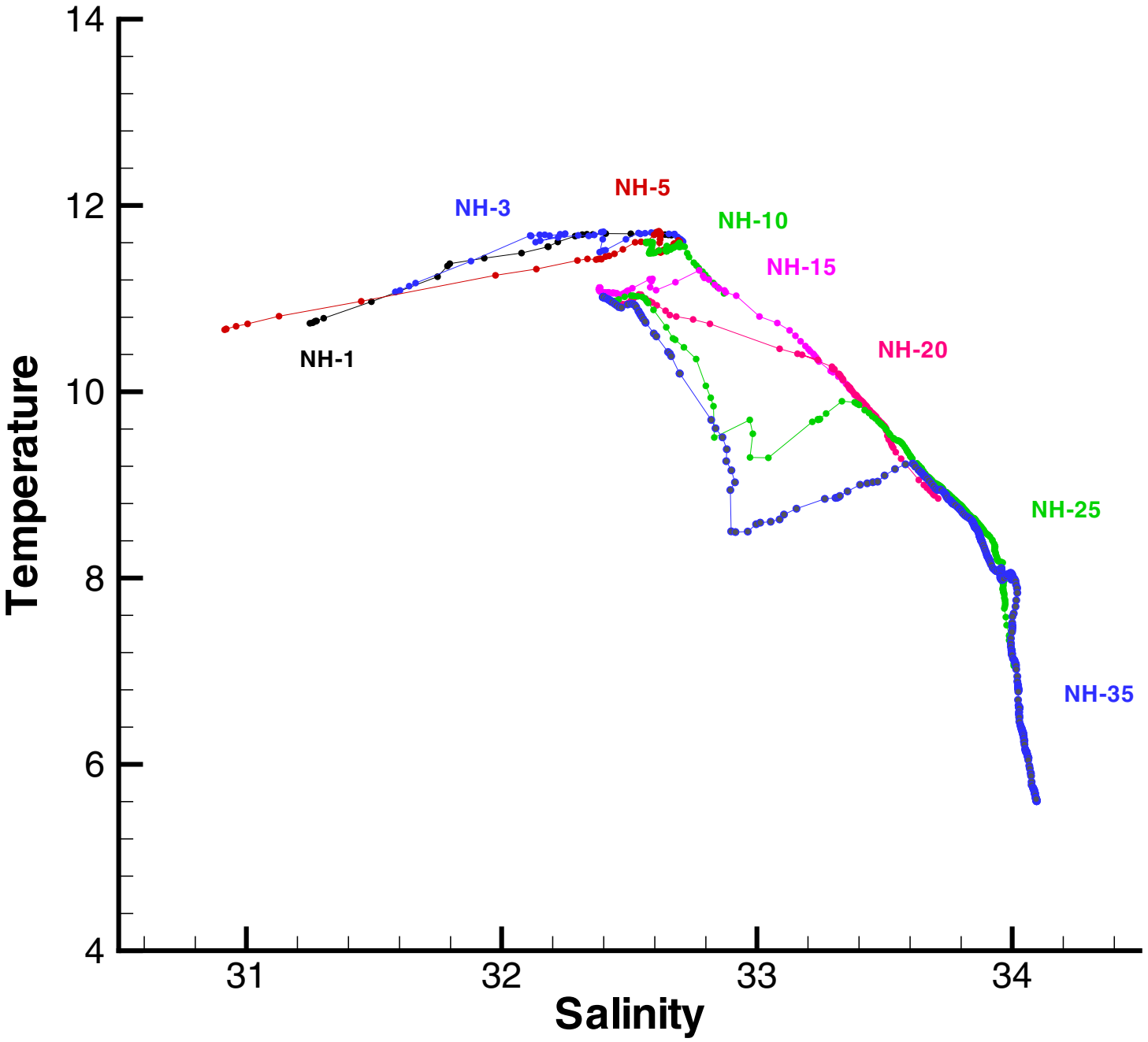


Figure 5. The T-S curve for the 28 November CTD station at NH-25, compared to the historical average for autumn (1 Nov to 21 Dec, 1961-1971) values at standard depths. Vertical and horizontal bars represent plus and minus one standard deviation of temperature and salinity.

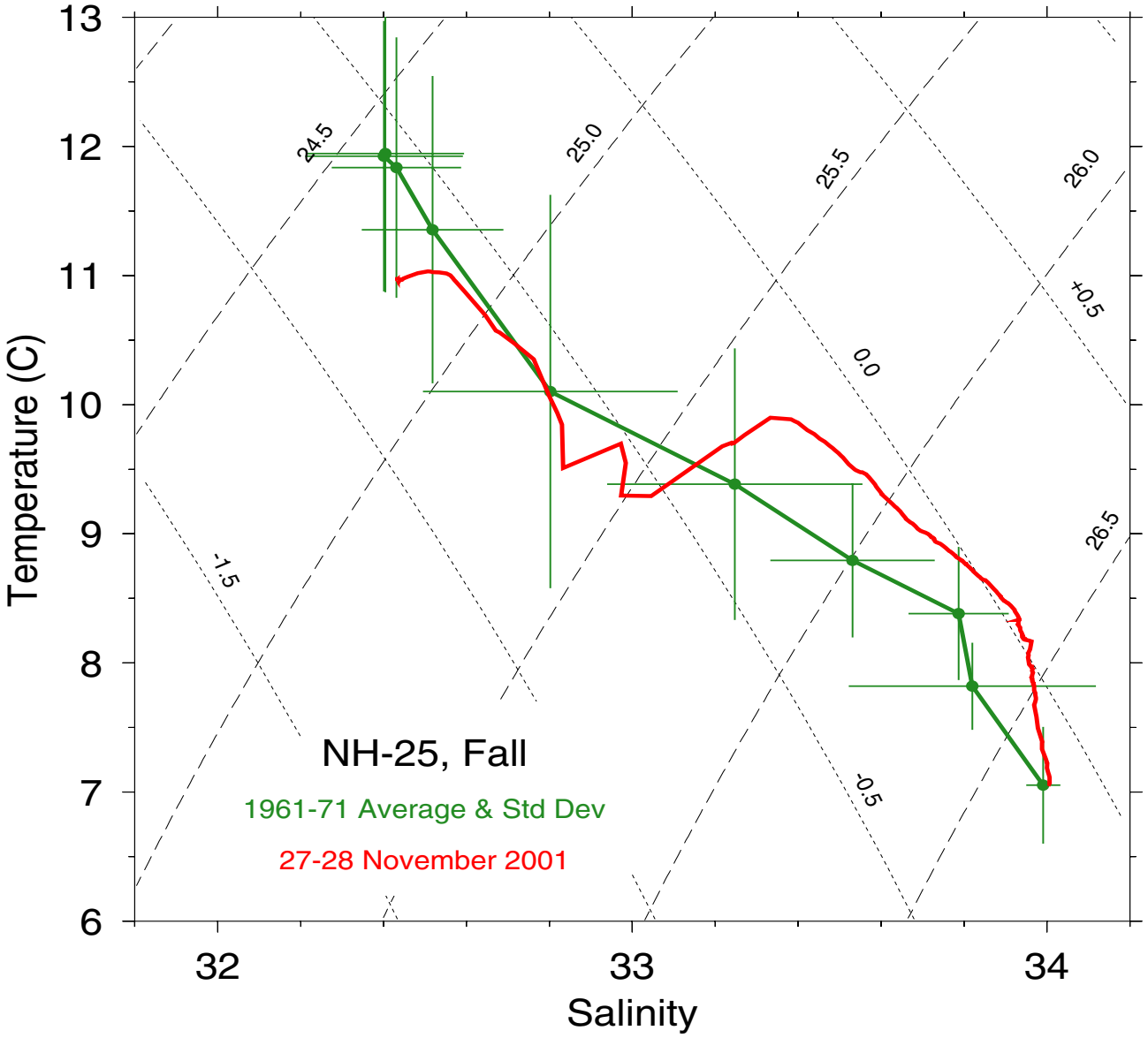


Table 1. CTD station positions during W0111B, and sampling at each station (C: Bio/Chem bottle sampling, N:half-meter vertical net tows, M:Mocness,, Z:Microzooplankton bottle sampling).

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	26	N
NH-3	2	5.4	44.65	-124.13	48	43	
NH-5	3	8.9	44.65	-124.18	58	54	C,Z,N,M
NH-10	4	18.3	44.65	-124.29	81	75	N
NH-15	5	27.6	44.65	-124.41	95	81	C,Z,N,M
NH-20	6	36.9	44.65	-124.53	142	135	N
NH-25	7	46.5	44.65	-124.65	294	294	C,Z,N,M
NH-35	8	65.0	44.65	-124.88	441	441	C,Z,N,M

Table 2: Actual sample depths and types of sub samples for biochemical sampling during the November 01 LTOP GLOBEC cruise.

Station, Depth, Dist. From Shore	Sample Collection Depths (m)	Type of Sample Collected
NH-05, 58m, 9km	53, 50, 40, 30, 25, 21, 15, 10, 5, 3	TOC (all depths), Nutrients, TN (all depths), Chl, POC/PON
NH-15, 95m, 28km	85, 70, 60, 50, 40, 34, 30, 20, 10, 6, 2	TOC (all depths), Nutrients, TN (all depths), Chl, POC/PON
NH-25, 294m, 46km	250, 200, 149, 100, 70, 50, 40, 30, 20, 10, 2	TOC (all depths), Nutrients, TN (all depths), Chl (except 250, 200), POC/PON (except 250, 200)
NH-35, 441m, 65km	420, 150, 100, 70, 51, 40, 30, 25, 20, 10, 3	TOC (surface), Nutrients, TN (surface), Chl (except 420, 150), POC/PON (except 420)

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

Table 3. R/V WECOMA Cruise W0111B

	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)		
27_Nov	1800												Depart Newport	
	1805												Start echosounder	
	1805												Start DAS	
	1807												Start ADCP	
	1811										`		Restart ADCP	
	1830												air calibration of transmissometer	
	1833												Start flo-thru	
	1924		1	NH-1	44	39.1	-124	06.0	29	1026.1	090	13	CTD	WE33101.1
	1939	1941			44	39.1	-124	06.0					vertical net tow, 20 m	WE33101.2
	2009		2	NH-3	44	39.2	-124	07.8	48	1026.0	085	13	CTD	WE33101.3
	2023				44	39.2	-124	07.8					HTI deployed	WE33101.4
	2058		3	NH-5	44	39.2	-124	10.5	58	1026.0	100	12	CTD with biochem, mzp	WE33101.5
	2112	2115			44	39.2	-124	10.5					vertical net tow, 55 m	WE33101.6
	2128				44	39.2	-124	10.5					Mocness deployed	WE33101.7
		2152			44	40.2	-124	10.7					Mocness aboard	WE33101.8
	2241		4	NH-10	44	39.0	-124	17.6	81	1023.0	110	11	CTD	WE33101.9
	2253	2258		NH-10	44	39.0	-124	17.6					vertical net tow, 75 m	WE33101.10
	2349		5	NH-15	44	39.1	-124	24.6	95	1022.1	105	14	CTD with biochem, mzp	WE33101.11
	0008	0013			44	39.1	-124	24.6					vertical net tow, 95 m	WE33201.1
	0021				44	39.1	-124	24.8					Mocness deployed	WE33201.2
		0052			44	39.4	-124	26.4					Mocness aboard	WE33201.3
28-Nov	0132		6	NH-20	44	39.1	-124	31.7	142	1020.0	135	16	CTD	WE33201.4
	0051	0057			44	39.1	-124	31.7					vertical net tow, 100 m	WE33201.5
	0248	0309	7	NH-25	44	39.1	-124	39.0	296	1019.2	150	12	CTD with biochem, mzp	WE33201.6
	0312	0319			44	39.1	-124	39.0					vertical net tow, 100 m	WE33201.7
	0329				44	39.2	-125	38.9					Mocness deployed	WE33201.8
	0400												shallow fluorometer removed from CTD	
		0433			44	41.7	-124	39.4					Mocness aboard	WE33201.9
	0614	0648	8	NH-35	44	39.2	-124	53.0	441	1012.6	170	33	CTD with biochem, mzp	WE33201.10
					44	39.2	-124	53.0					HTI recovered	WE33201.11
	0700												hove to, SE winds increasing to 40 kts	
	1100	1600											still hove to, S winds of 50-60 kts	
	1600	1700											winds veer to SW, fall to 25 kts	
	1700	0000											SW winds of 25-30 kts	
29-Nov	0000	0300											SW winds steady at 35 kts	
	0300	0800											SW winds falling to 20 kts	

Table 3. cont.

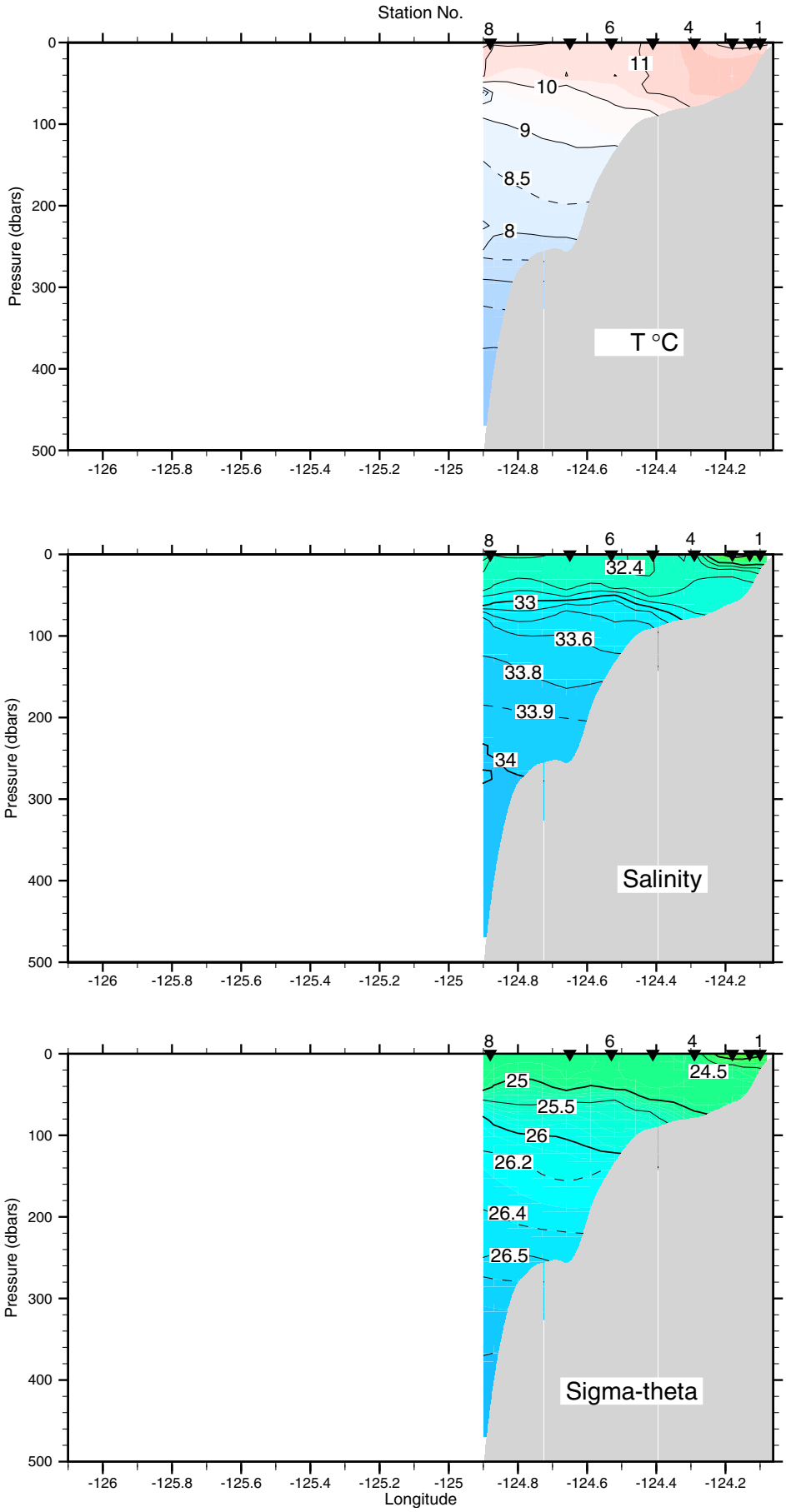
	Start	End	Sta.	Sta.	Latitude		Longitude		Bottom	Atmos	Wind	Wind	Event	Event ID
(UT)	Time	Time	No.	Name	(deg)	(min)	(deg)	(min)	Depth	Press	Dir.	Speed		
	(UT)	(UT)							(m)	(mbar)	(deg T)	(kts)		
	0800												winds veer to NW	
	0900	1300											NW winds 20-30 kts	
	1300	1800											NW winds 15-25 kts	
	1845												shut down flow through system	
	1900												shut down echosounder	
	1903												shut down ADCP	
	1903												shut down DAS	
	1930												arrive at pier in Newport	

Table 4. Names, affiliations, and responsibilities of scientific personnel participating on W0111B.

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
Mike Wetz	Graduate Student	OSU	nuts, chl
Jennifer Crane	Technician	OSU	nuts, chl
Carlos López	Technician	OSU	microzooplankton
Carolyn Tracy Shaw	Technician	HMSC	zooplankton
Julie Keister	Technician	HMSC	zooplankton
Mitch Vance	Technician	HMSC	zooplankton
Anders Roestad	Technician	ODFW	zooplankton
Linda Fayler	Technician	OSU	martec
Daryl Swensen	Technician	OSU	martec

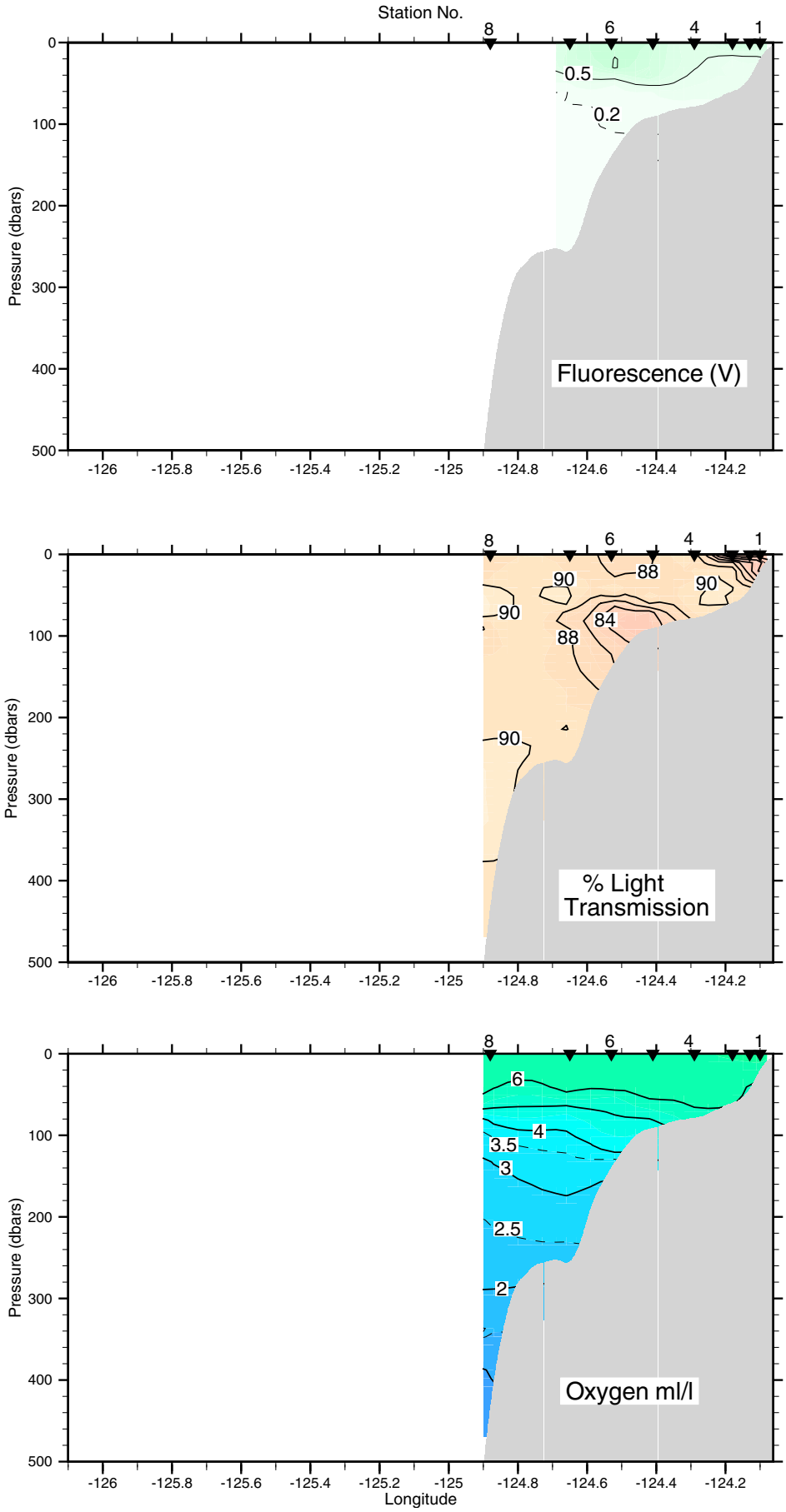
Newport Hydro Line 44° 39'N

27-28 November 2001



Newport Hydro Line 44° 39'N

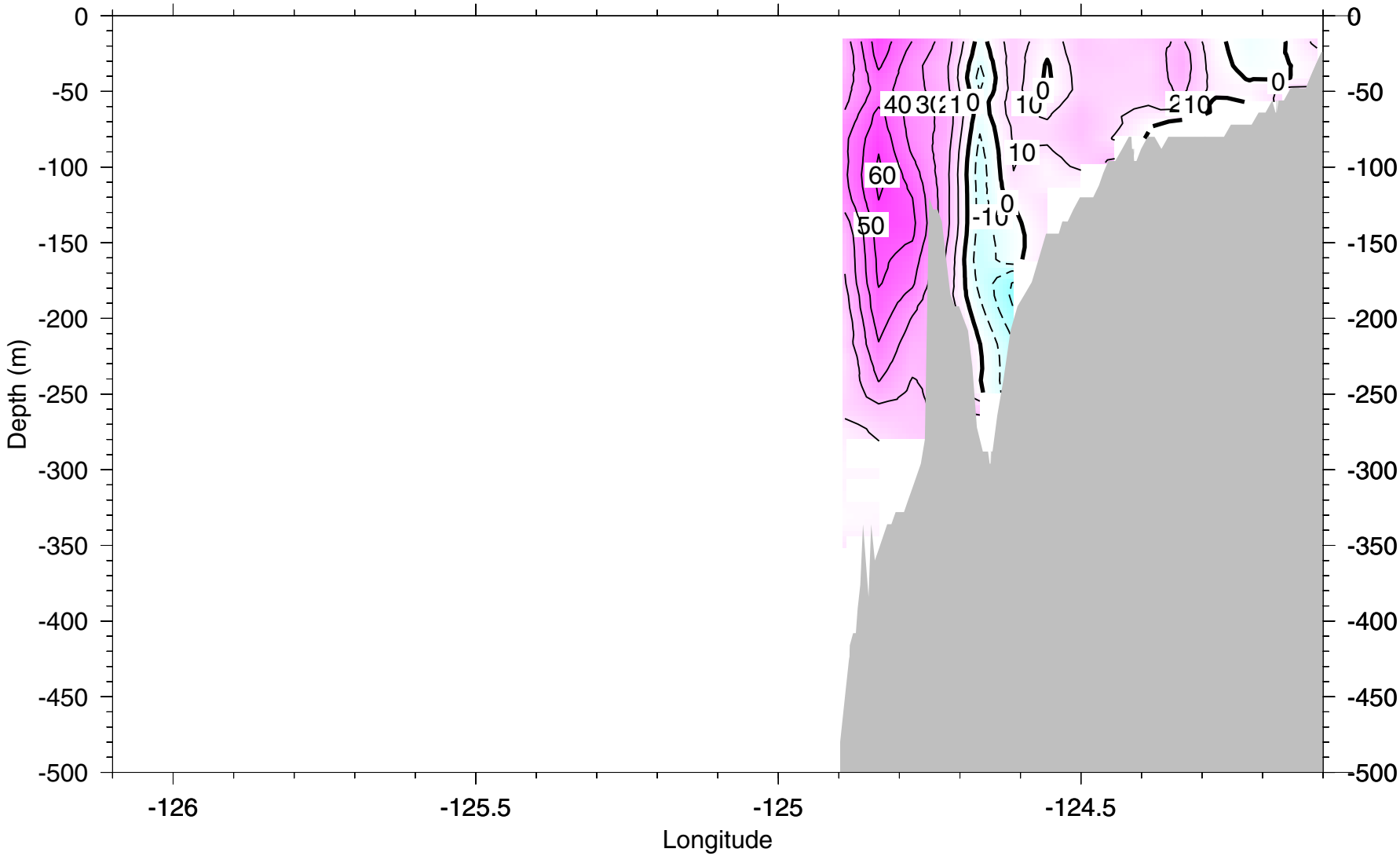
26-27 November 2001



Newport Hydrographic Line 44.6°N

27-28 Nov 2001

ADCP: Northward current (cm/s)



Zooplankton Report

(submitted by Julie Keister, Oregon State University)

MOCNESS DESCRIPTIONS:

NH05 13:28 h (local time) water depth = 59m

50-20m	copepods, euphausiid furcilia, *Limacina*, amphipods
20-10m	1 Chrysaora (15cm bell diameter), copepods, euphausiid furcilia, amphipods, *Limacina*
10-0m	1 Chrysaora (17cm bell diameter), copepods, euphausiid furcilia, amphipods, *Limacina*

NH15 1622 h water depth = 90m

85-50m	*Corolla*, ~8 small shrimp, small copepods, euphausiid furcilia
50-20m	many *Corolla*, few euphausiid furcilia
20-10m	copepods, furcilia, *Corolla*, pteropods
10-0m	*Corolla*, few furcilia, small copepods

NH25 1928 h water depth = 298m

285-295-285m (acoustic target)	shrimp, copepods, some furcilia
285-200m	20 sergestid shrimp, ~55 adult euphausiids, furcilia, 2 myctophids
200-150m	4 shrimp, ~25 adult euphausiids, 2 siphonophores
150-100m	~50 euphausiids, 1 myctophid, radiolarians
100-50m	~400 adult euphausiids, 20 sergestids
50-20m	100's of adult/juvenile euphausiids, ~8 siphonophores, myctophids
20-10m	*Corolla*, juvenile euphausiids
10-0m	*Corolla*, ~200 euphausiids

VERTICAL NET SAMPLING:

Vertical net tows (200μm mesh, 0.5m diameter, towed from 100m or just above bottom to surface) from were made at NH01, NH05, NH10, NH15, NH20, and NH25.

Microzooplankton Sampling

(Submitted by Drs. E. and B. Sherr, Oregon State University)

November 2001 GLOBEC CRUISE W0111B:

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 l μof 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

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 l μof 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 November-'01 LTOP GLOBEC cruise: W0111b.

Station, Depth, Dist. From Shore	Cast no	Sample Collection Depths (m)
NH-05, 58m, 10km	3	53, 40, 30, 20, 15, 10, 5, 2
NH-15, 95m, 28km	5	85, 60, 50, 40, 20, 10, 5, 2.6
NH-25, 296m, 46km	7	100, 70, 50, 40, 30, 20, 10, 3
NH-35, 445m, 65km	8	100, 70, 50, 40, 30, 20, 10, 3.7