Cruise Report:
USCGC Healy 12-01, August 9-25, 2012
Hanna Shoal - Northern Chukchi Sea

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BOEM
Bureau of Ocean Energy Management

Cover photo credit: "Evening View of Dutch Harbor with Healy Moored at Dock" by Deanna Wheeler, JC Parks Elementary School, Indian Head, MD.

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USCGC Healy Cruise HLY1201
August 9-25, 2012

Summary:

The northern Chukchi Shelf receives large inputs of organic matter advected from the highly productive shelf regions of the North Pacific and from in situ sources of primary production, including epontic ice algae, sediment microalgae and phytoplankton. These contributions of highly labile organic carbon, together with potential benthic sources of regenerated inorganic nitrogen, probably contribute to the high secondary production in various portions of this region. In particular, the relatively shallow depths (40-55 m) and appreciable bottom flow facilitate high standing stocks of biota, particularly in the benthos. These "hotspots" have been noted in the vicinity of Hanna Shoal, particularly along its southeastern and eastern margins. In recognition of the importance of the biological significance of this region and its importance for oil and gas exploration and development, this research cruise, supported by the Bureau of Ocean Energy Management, undertook a multidisciplinary investigation to examine the biological, chemical and physical properties that define this ecosystem. Our study focuses on the Hanna Shoal area of the northern Chukchi with respect to water column and benthic trophic structure, sediment parameters, inventories of anthropogenic chemicals (trace metals and organics), and inventories of plankton, benthic and epibenthic fauna. Coincidently, the physical oceanographic study addresses water mass movements through direct measurement of circulation, density fields, ice conditions and modeling. This cruise also facilitated the collection of important marine mammal and seabird surveys conducted from the bridge whenever viewing conditions permitted.

Acknowledgements:

We thank the US Coast Guard crew, officers and commanding officer onboard Healy for their hard work implementing the cruise objectives. We wish to specifically thank the entire Marine Science Technician team who assisted us aboard the ship during the research operations, led by MST Chief Kurt Stewart. Scott Hiller, Steve Roberts, and Toby Martin of the Ship-based Science Technical Support in the Arctic (STARC) project provided very effective logistical and ship system support before and during the cruise. Renee Crain of the National Science Foundation was instrumental in resolving ship scheduling issues and we thank Bureau of Ocean Energy Management program manager Heather Crowley for joining us aboard on the cruise. Support for our teacher at sea, Deanna Wheeler, was provided by the National Science Foundation through the PolarTREC program.

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United States Fish and Wildlife Service (USFWS)

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Introduction

The USCGC Healy left the port of Dutch Harbor on 9 August 2012 in support of the Healy Cruise 12-01. The departure on 9 August 2012 was delayed by four days from the originally scheduled date of 5 August because of a leaking shaft seal. This mechanical issue was known at the time of departure from Seattle, but could not be repaired prior to arrival in Dutch Harbor. Repairs to the seal were completed by early afternoon of August 9.

All scientific stations occupied are mapped on Figure 1 except for one additional station that was occupied in Bering Strait to test sampling systems. Activities undertaken at each station are tabulated in Table 1.

Figure 1. Detail of Core Stations within study area. Station numbers correspond to stations in Table 1. Stations in gold (CBL prefixes) are stations previously sampled during prior COMIDA sampling in 2009-2010. Red crosses are mooring deployment locations. Graphics courtesy of Johnny Sullivan.

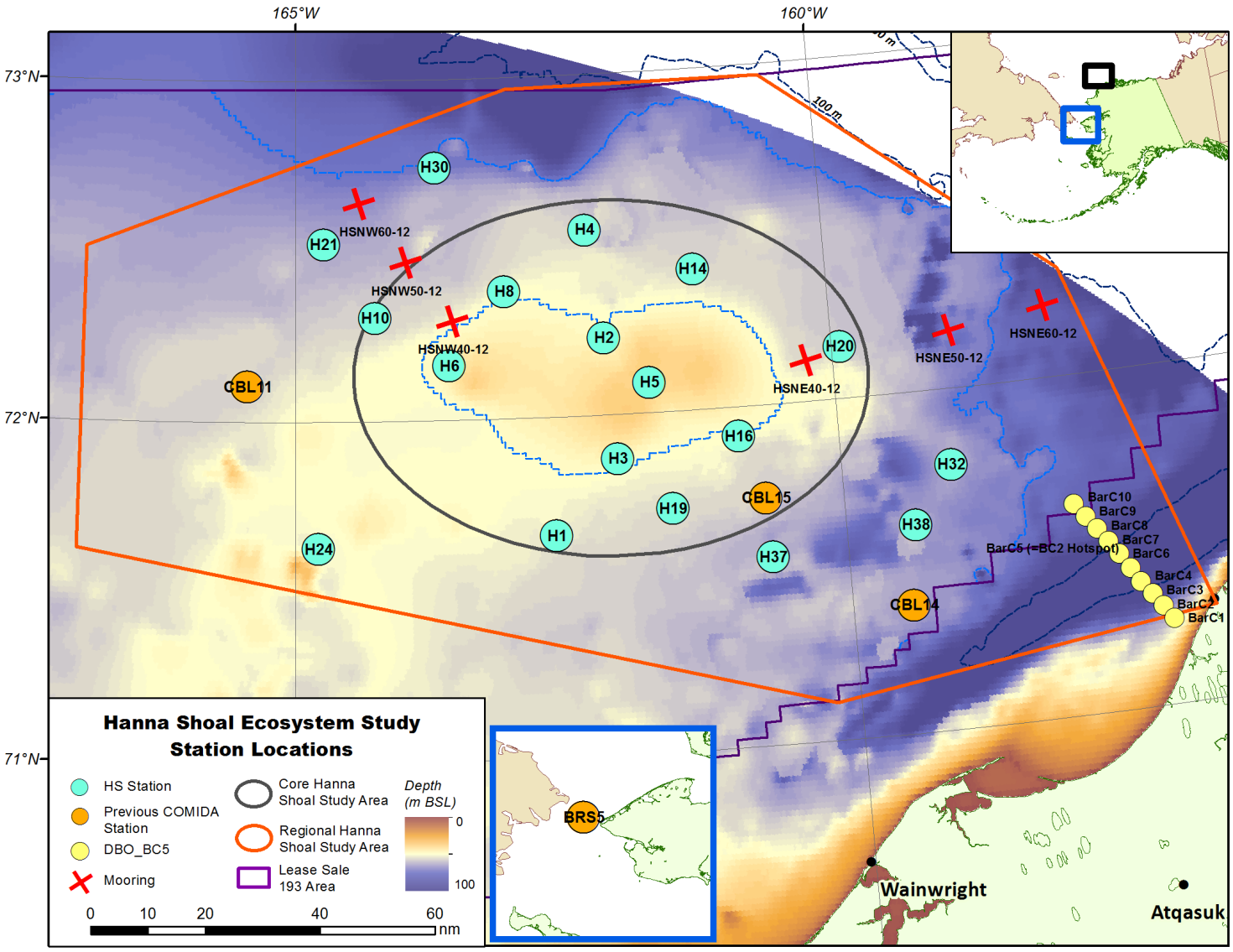

Table 1. Station numbers, names, dates, event codes, sampling times (CTD only), coordinates and water depth for stations sampled during HLY1201. Event code information shown in small table below.

Code	Full Event Name	Location Deployed
CTD	CTD/rosette	Starboard, CTD winch
BC	Benthic Camera	Starboard, hand-deployed
PPK	Net, Phytoplankton	Starboard, hand-deployed
BONGO	Net, Bongo	Stern winch, 3/8th
RING	Net, Ring	Stern winch, 3/8th
GRAB	Grab, van Veen	Stern winch, 3/8th
DGRAB	Grab, Double van Veen	Stern winch, 3/8th
HAPS	Corer, HAPS-single	Stern winch, 3/8th
XHAPS	Corer, Hap-multi	Stern winch, 3/8th
BOX	Corer, Box	Stern winch, 3/8th
GC	Corer, Gravity	Stern winch, 3/8th
BEAM	Trawl, beam	Stern winch, 9/16th
MOOR	Mooring	Stern winch, 3/8th
DRIFT	Drifters	Hand-deployed

Station	Official Station Name	Date (ADT)	Event Codes	Time IN (ADT)	Time OUT (ADT)	Latitude IN* (Dec. Deg.)	Longitude IN* (Dec. Deg.)	Depth* (m)
1	BRS5	8/11/2012	CTD,BC,PPK,BONGO,RING	18:47	19:01	65.712	-168.890	48.5
2	H24	8/13/2012	CTD,DRIFT	1:02	1:14	71.628	-164.806	42.0
3	H24W1	8/13/2012	CTD,BONGO	2:01	2:09	71.627	-164.068	41.0
4	H24W2	8/13/2012	CTD	3:11	3:18	71.626	-165.325	41.0
5	H24W3	8/13/2012	CTD,BONGO	4:01	4:11	71.626	-165.595	40.0
6	H24	8/13/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,BOX, HAPS,BEAM	6:02	6:14	71.625	-164.790	39.6
7	CBL11	8/13/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,XHAP S,GC,BEAM	16:38	16:52	72.105	-165.434	46.5
8	H21A	8/14/2012	CTD,BONGO	1:27	1:39	72.180	-165.310	45.0
9	H21	8/14/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,BOX, XHAPS,GC,BEAM	6:16	6:30	72.520	-164.727	50.9
10	H10	8/14/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BEAM	17:10	17:34	72.298	-164.253	45.5
11	H30	8/15/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,BOX, XHAPS,BEAM	9:57	10:12	72.741	-163.673	62.8
12	NSNW56-12	8/15/2012	CTD,BONGO,MOOR	18:54	19:05	72.698	-164.533	58.0
13	NW1	8/15/2012	CTD	20:54	21:01	72.638	-164.391	55.0
14	NW2	8/15/2012	CTD	22:11	22:16	72.583	-164.238	53.0
15	NSNW50-12	8/16/2012	CTD,MOOR	1:51	2:01	72.517	-164.108	52.0
16	NW3	8/16/2012	CTD,BONGO	3:34	3:43	72.445	-163.907	52.0
17	NW4	8/16/2012	CTD	5:25	5:32	72.365	-163.719	45.0
18	NSNW40-12	8/16/2012	CTD,MOOR	7:12	7:18	72.283	-163.523	40.0
19	H6	8/16/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,BOX, XHAPS,GC,BEAM	9:26	9:42	72.164	-163.603	38.6
20	H8	8/16/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BEAM	18:10	18:29	72.373	-163.067	41.0
21	H8A	8/17/2012	CTD	1:05	1:10	72.429	-162.771	40.0
22	H8B	8/17/2012	CTD,BONGO	2:31	2:38	72.488	-162.503	42.0
23	H4A	8/17/2012	CTD	5:19	5:28	72.602	-161.996	40.0
24	H4B	8/17/2012	CTD,BONGO	6:44	6:45	72.662	-161.716	45.0

Station	Official Station Name	Date (ADT)	Event Codes	Time IN (ADT)	Time OUT (ADT)	Latitude IN* (Dec. Deg.)	Longitude IN* (Dec. Deg.)	Depth* (m)
25	H4	8/17/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BOX,GC,BEAM	9:39	9:52	72.537	-162.248	43.3
26	H14	8/17/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BEAM	20:51	21:06	72.409	-161.252	43.1
27	H14A	8/18/2012	CTD,BONGO	2:25	2:29	72.471	-160.958	45.0
28	H2A	8/18/2012	CTD,RING	5:24	5:29	72.351	-161.545	42.0
29	H2B	8/18/2012	CTD	7:12	7:16	72.288	-161.832	40.0
30	H2	8/18/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,HAPS, BOX,BEAM	8:35	8:45	72.226	-162.115	30.6
31	H5	8/18/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB,BEAM	14:43	14:56	72.091	-161.742	28.6
32	H3	8/18/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BEAM	21:43	21:54	71.873	-162.028	41.2
33	H3A	8/19/2012	CTD	2:24	2:32	71.798	-162.217	40.0
34	H3B	8/19/2012	CTD,BONGO	3:45	3:50	71.731	-162.419	43.0
35	H1A	8/19/2012	CTD	5:49	5:55	71.585	-162.811	42.0
36	H1B	8/19/2012	CTD	6:45	6:51	71.518	-163.008	42.0
37	H1	8/19/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BOX,GC,BEAM	8:14	8:28	71.652	-162.633	41.8
38	H19	8/19/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,GC,BEAM	16:54	17:07	71.713	-161.552	47.0
39	H19D	8/19/2012	CTD	23:42	23:49	71.687	-161.251	45.0
40	H19E	8/20/2012	CTD	1:20	1:27	71.658	-160.910	48.0
41	H19F	8/20/2012	CTD	2:53	3:02	71.628	-160.589	48.0
42	H19G	8/20/2012	CTD,BONGO	4:13	4:20	71.601	-160.250	50.0
43	H19H	8/20/2012	CTD	5:42	5:53	71.702	-160.465	48.0
44	H19I	8/20/2012	CTD	7:12	7:18	71.806	-160.685	45.0
45	H16	8/20/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB ,XHAPS,BOX,BEAM	8:35	8:53	71.909	-160.926	38.1
46	H20	8/20/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,GC,BEAM	20:03	20:16	72.152	-159.949	44.6

Station	Official Station Name	Date (ADT)	Event Codes	Time IN (ADT)	Time OUT (ADT)	Latitude IN* (Dec. Deg.)	Longitude IN* (Dec. Deg.)	Depth* (m)
47	NSNE40-12	8/21/2012	CTD,MOOR	3:47	3:57	72.121	-160.497	40.0
48	NE1	8/21/2012	CTD	6:38	6:55	72.140	-159.704	45.0
49	NSNE50-12	8/21/2012	CTD,MOOR	9:35	9:42	72.164	-159.117	51.0
50	NE2	8/21/2012	CTD	11:03	11:10	72.178	-158.763	53.0
51	NSNE56-12	8/21/2012	CTD,BONGO,RING,MOOR	12:54	13:03	72.182	-158.556	56.0
52	H32	8/21/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BOX,GC,BEAM	18:11	18:24	71.782	-158.987	50.9
53	BarC1	8/22/2012	CTD,PPK,BONGO,GRAB	11:03	11:16	71.245	-157.190	49.4
54	BarC2	8/22/2012	CTD,GRAB	13:15	13:23	71.282	-157.256	55.3
55	BarC3	8/22/2012	CTD,PPK,BONGO,GRAB	14:39	14:51	71.305	-157.378	78.0
56	BarC4	8/22/2012	CTD,GRAB	16:38	16:54	71.366	-157.421	110.6
57	BarC5	8/22/2012	CTD,BC,PPK,BONGO, RING,GRAB,BOX	18:02	18:19	71.401	-157.536	118.4
58	BarC6	8/23/2012	CTD,GRAB	0:06	0:22	71.450	-157.609	109.5
59	BarC7	8/23/2012	CTD,PPK,BONGO,GRAB	1:22	1:37	71.493	-157.675	91.4
60	BarC8	8/23/2012	CTD,GRAB	3:21	3:36	71.534	-157.760	71.5
61	BarC9	8/23/2012	CTD,PPK,BONGO,GRAB	4:26	4:44	71.575	-157.839	69.3
62	BarC10	8/23/2012	CTD,GRAB,BEAM	5:52	6:02	71.613	-157.916	64.1
63	HB1	8/23/2012	CTD	8:21	8:27	71.609	-158.280	59.0
64	HB2	8/23/2012	CTD,BONGO	9:54	10:03	71.611	-158.656	57.0
65	HB3	8/23/2012	CTD	11:32	11:38	71.616	-158.054	53.9
66	H38	8/23/2012	CTD,BC,PPK,BONGO, RING,GRAB,DGRAB, XHAPS,BOX,GC,BEAM	12:45	13:04	71.611	-159.360	51.4
67	CBL14	8/23/2012	CTD,BC,PPK,BONGO, RING,GRAB,XHAPS,BEAM	20:30	20:43	71.373	-159.414	51.9
68	F1	8/24/2012	CTD	3:46	3:52	71.366	-160.642	48.0
69	F2	8/24/2012	CTD	4:53	5:00	71.454	-160.668	47.0
70	H37	8/24/2012	CTD,PPK,GRAB,DRIFT	6:05	6:10	71.547	-160.671	49.0
71	F3	8/24/2012	CTD	8:26	8:37	71.641	-160.701	50.0
72	CBL15	8/24/2012	CTD,GRAB,BEAM	9:29	9:42	71.722	-160.701	50.0
73	F4	8/24/2012	CTD	12:09	12:15	71.809	-160.723	44.0

* Note: values for time, position and depth correspond to first CTD cast at each station. Data courtesy of Johnny Sullivan.

Individual Project Reports

Physical Oceanographic Measurements

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Tom Weingartner, Dave Leech and Ying-Chih Fang, on-board team
University of Alaska Fairbanks (UAF)

The overall purpose of the physical oceanographic program is to improve our knowledge of the circulation and water mass properties in the Hanna Shoal region. This information, when combined with results from the biogeochemical sampling, will enhance the understanding the marine ecosystem of the Northeast Chukchi Sea. The particular goal of the physical component was to obtain measurements pertaining to the circulation around Hanna Shoal. Our governing hypothesis is that the circulation here is primarily associated with a clockwise flow around the Shoal, with at least some portion of that flow moving southward along the east side of the Shoal
From here, these waters should ultimately enter Barrow Canyon.

The various measurements undertaken in the physical oceanographic component included shipboard CTD and ADCP measurements, and the deployment of year-round oceanographic moorings and satellite-tracked drifters (Table 2).

Table 2. HLY1201 Current Meter Deployments.

Mooring	Date/time (GMT)	Latitude (° ' N)	Longitude (° ' W)	Depth* (m)	Instruments
[2]NSNW56-12	VIII/16/0237	72 41.745	164 31.935	56.2	ADCP/uCat
[1,2]NSNW50-12	VIII/16/0840	72 31.517	164 5.944	50.3	ADCP/uCat
[2]NSNW40-12	VIII/16/1500	72 16.85	163 32.034	40.7	ADCP/uCat
[3]NSNE40-12	VIII/21/1143	72 07.267	160 29.735	40.4	ADCP/uCat
[4]NSNE50-12	VIII/21/1723	72 09.749	159 07.346	49.7	ADCP/uCat/IC
[4]NSNE56-12	VIII//21/2043	72.10.88	158 33.092	56.2	ADCP/uCat/IC

*using Knudsen 3.5kHz Sounder and corrected for hull and applying a sound speed of 1439 ms^{-1} and not 1500 ms^{-1}.
[1] Mooring was to include ISCAT (IC), but this was snagged on ice and broke from mooring during deployment. ISCAT was recovered and was used on NE moorings.
[2]Moorings were deployed in rotting broken ice, with local concentrations of ~40 – 60%.
[3]Mooring was deployed in rotting broken ice, with regional concentrations of ~70%.
[4]Moorings were deployed in rotting broken ice, with regional concentrations of ~50%.
HSNE50 ISCAT is at 24.9 m below surface, or 24.8 mab

HSNE56 ISCAT is at 29.5 m below surface, or 26.7 mab

Satellite-Tracked Drifter Deployments

Satellite-tracked drifters were deployed to the southwest of Hanna Shoal and to the east of Hanna Shoal.

Drifter Release #1 08/13/2012 GMT Southwest of Hanna Shoal

Deployments began at 0814Z 71 37.692N, 164 41.677W

a) Six MicroStars (1-m drogue) were released with numbers: 1,9,7,4,6,5

b) Six SVP drifters (15-m drogue) were released with numbers: 5,6,2,3,10,8

c) Two ARGOS drifters (30-m drogue) were released with numbers: 119597, 119596

Deployments ended at 0831Z 71 37.697N, 164 43.245W

Drifter Release #2 08/13/2012 GMT Southeast of Hanna Shoal

Deployments began at 1533Z 71 33.934N, 160 41.913

a) Six MicroStars (1-m drogue) were released with numbers: 2, 3, 8, 10, 11, 12

b) Six SVP drifters (15-m drogue) were released with numbers: 12, 11, 9, 7, 4, 1

c) Two ARGOS drifters (30-m drogue) were released with numbers: 119593, 119599. Deployments ended at 1544Z.

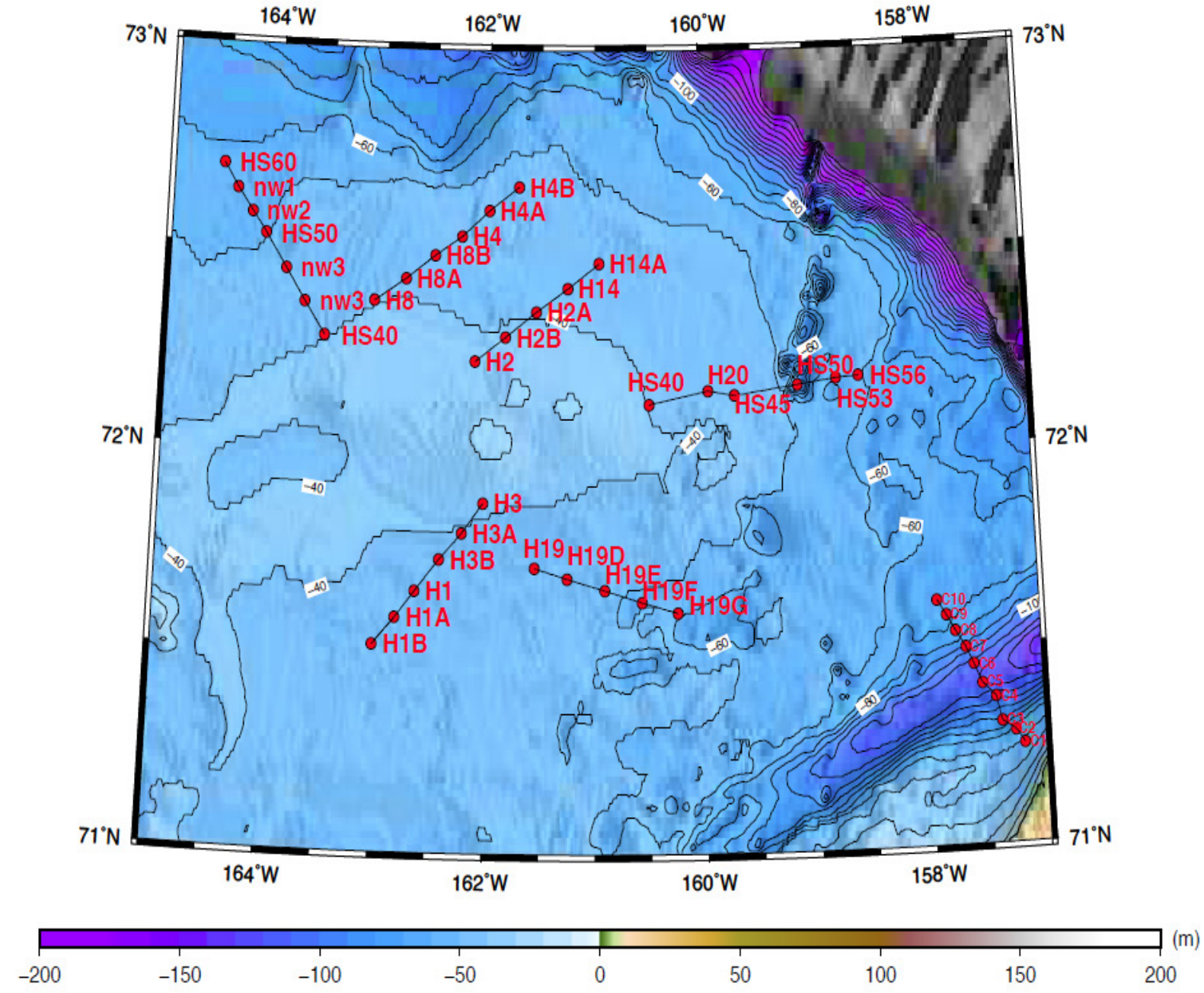
The ARGOS drifters were deployed on behalf of Phyllis Stabeno of NOAA-PMEL.

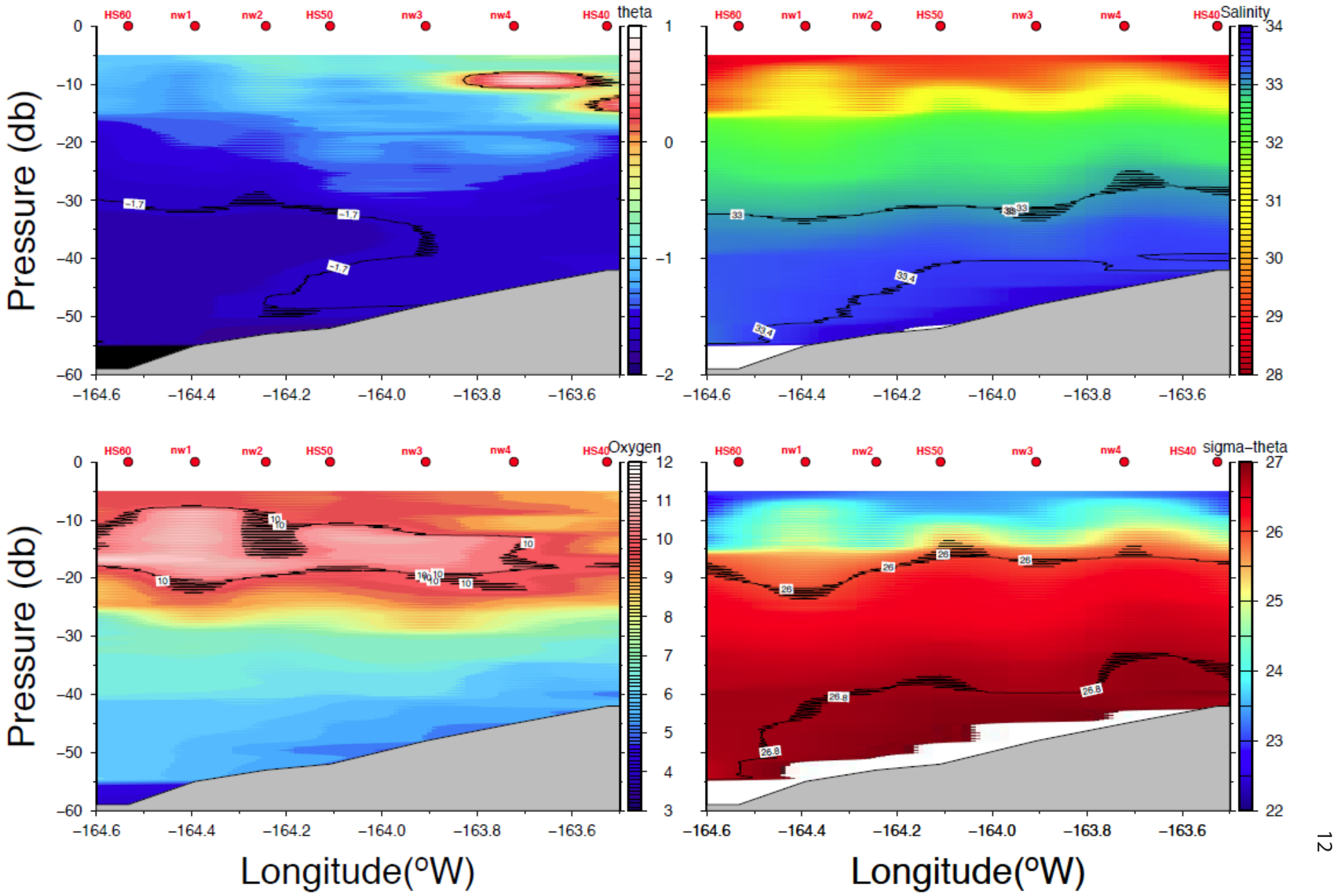
CTD Measurements

A total of 73 CTD stations were occupied. While many of the CTD casts were made as part of the multi-disciplinary sampling stations, the other stations were established to determine the regional hydrography. In particular these stations were established along transects approximately orthogonal to the Shoal. Over most of the area we found a two-layer structure that included cold (<0.5C), low-salinity (<30) within the upper 10 m and very cold (<-1.3C) and very salty (>32.7) water within 5 – 10 m of the bottom. Interestingly, it appears that the densest waters observed ($\geq$33.3) occurred nearest the Shoal and in water depths of $\leq$50m, whereas deeper waters farther from the Shoal were less dense. This suggests that there is a trapping mechanism associated with the circulation around the Shoal. The densest water may also have its origins on the Shoal. Conceivably, the extensive ice-grounding that apparently occurred on the Shoal through winter resulted in latent heat polynya formation in the lee of the grounded ice. These polynyas, forming over relatively shallow water are likely the source of the observed dense water.

The location of seven high resolution CTD lines are shown in Figure 2, follwed by water column profiles of salinity during those transects.

Figure 2. High resolution CTD transects (location map followed by depth interpolations).




HS60
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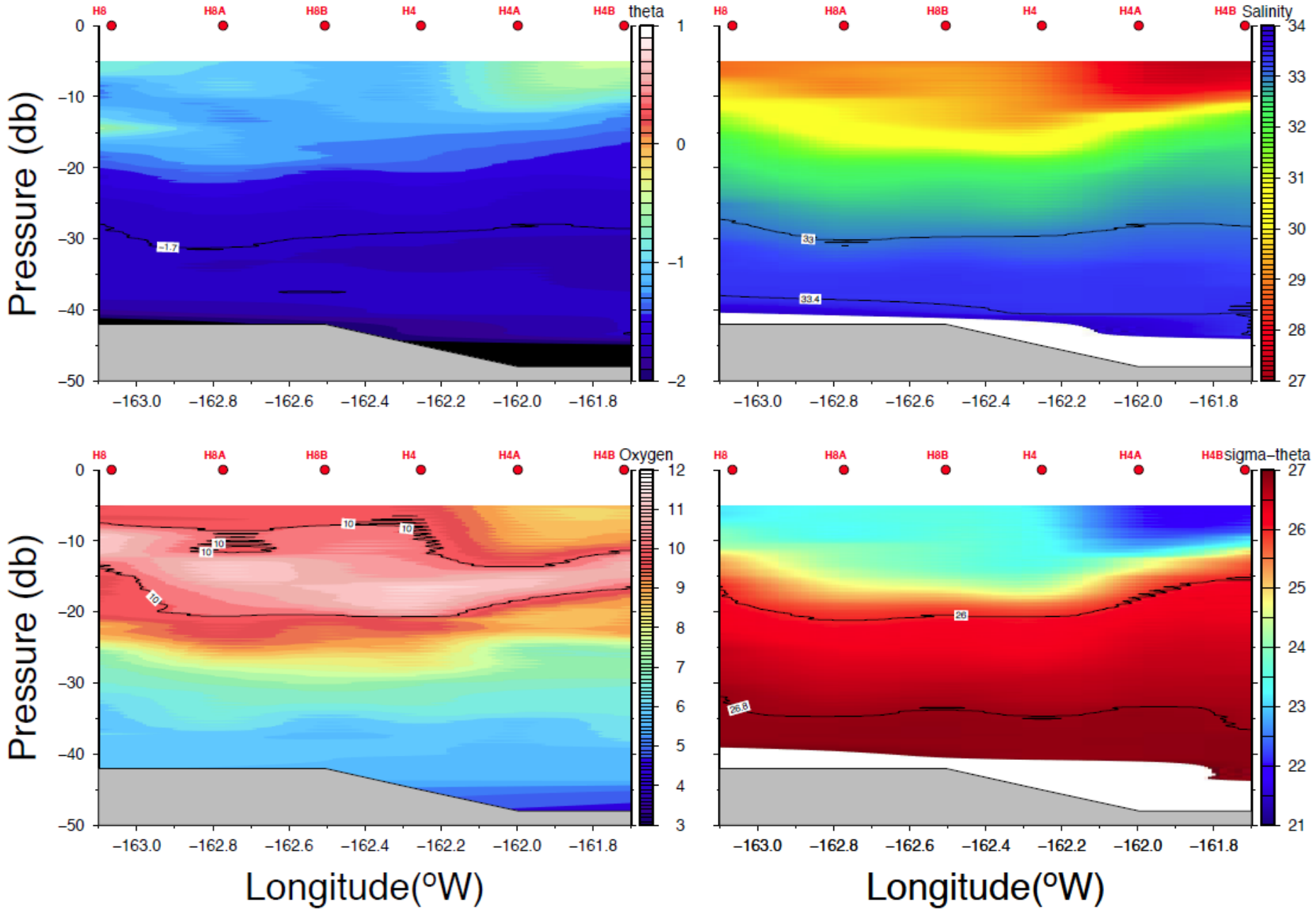
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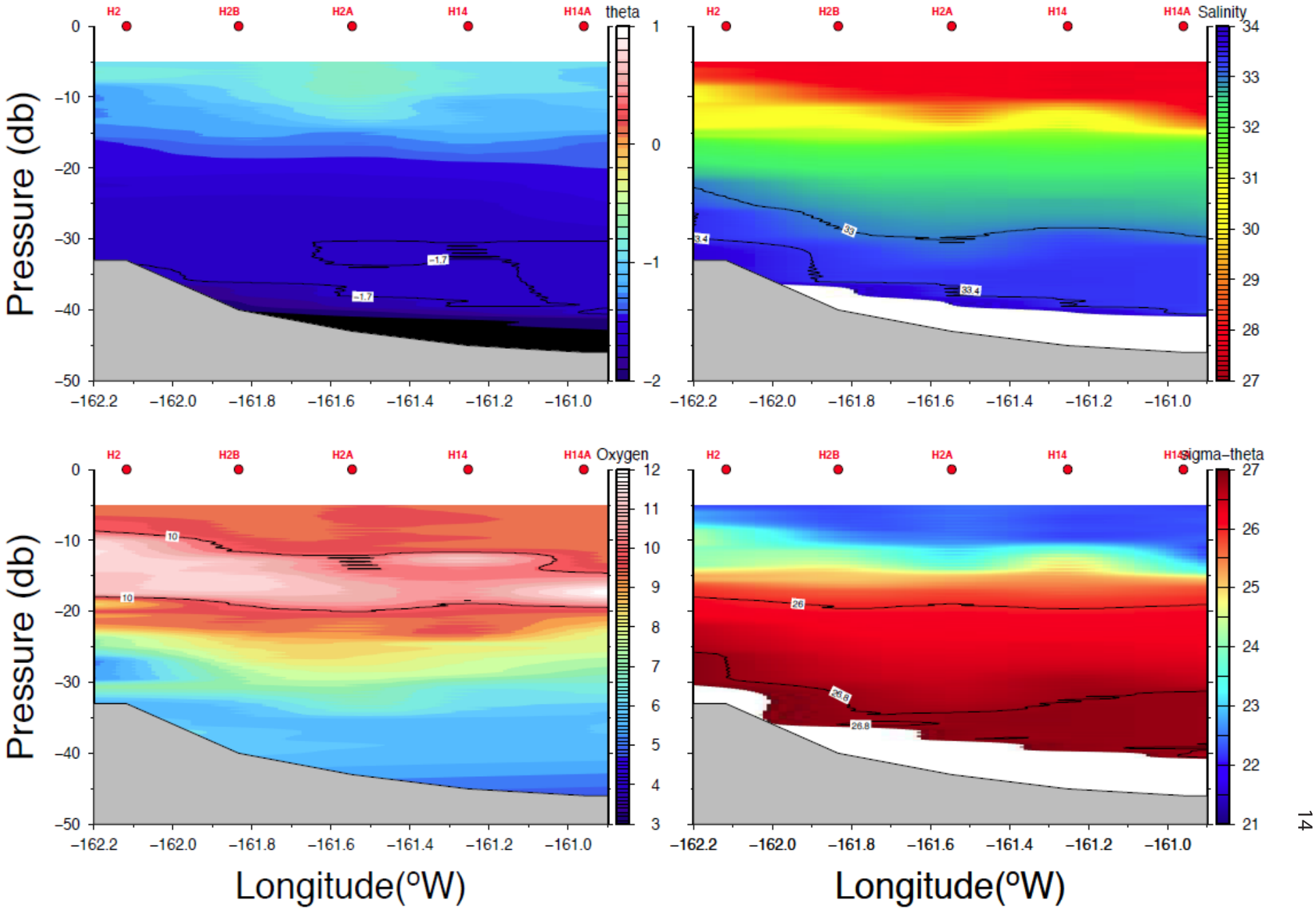
26.8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H2A
H14
H14A
theta
Salinity
Oxygen
sigma−theta
Pressure (db)
Longitude(°W)
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−30
−40
−50
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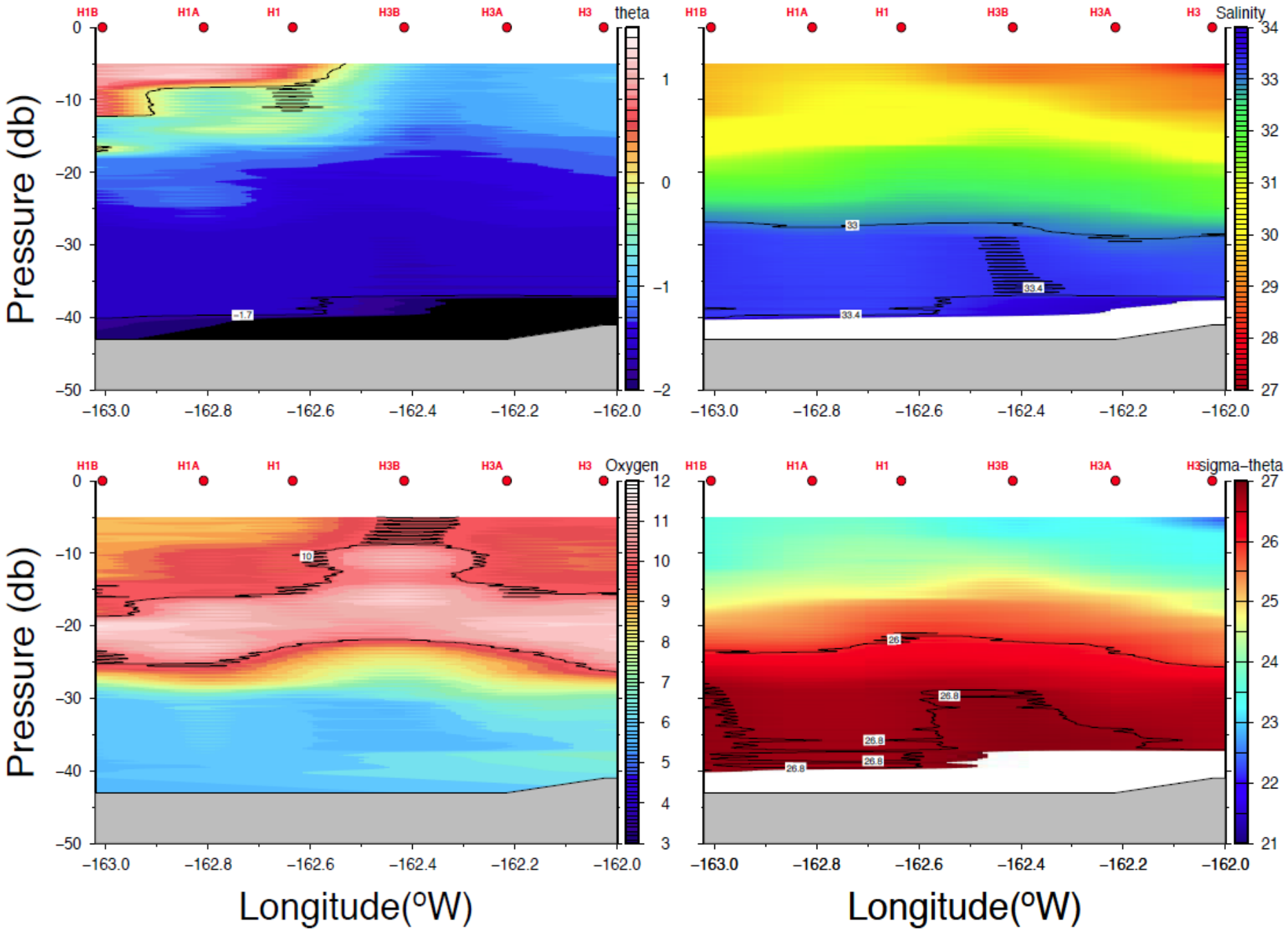
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H1A
H1
H3B
H3A
H3
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Salinity
Oxygen
sigma−theta
Pressure (db)
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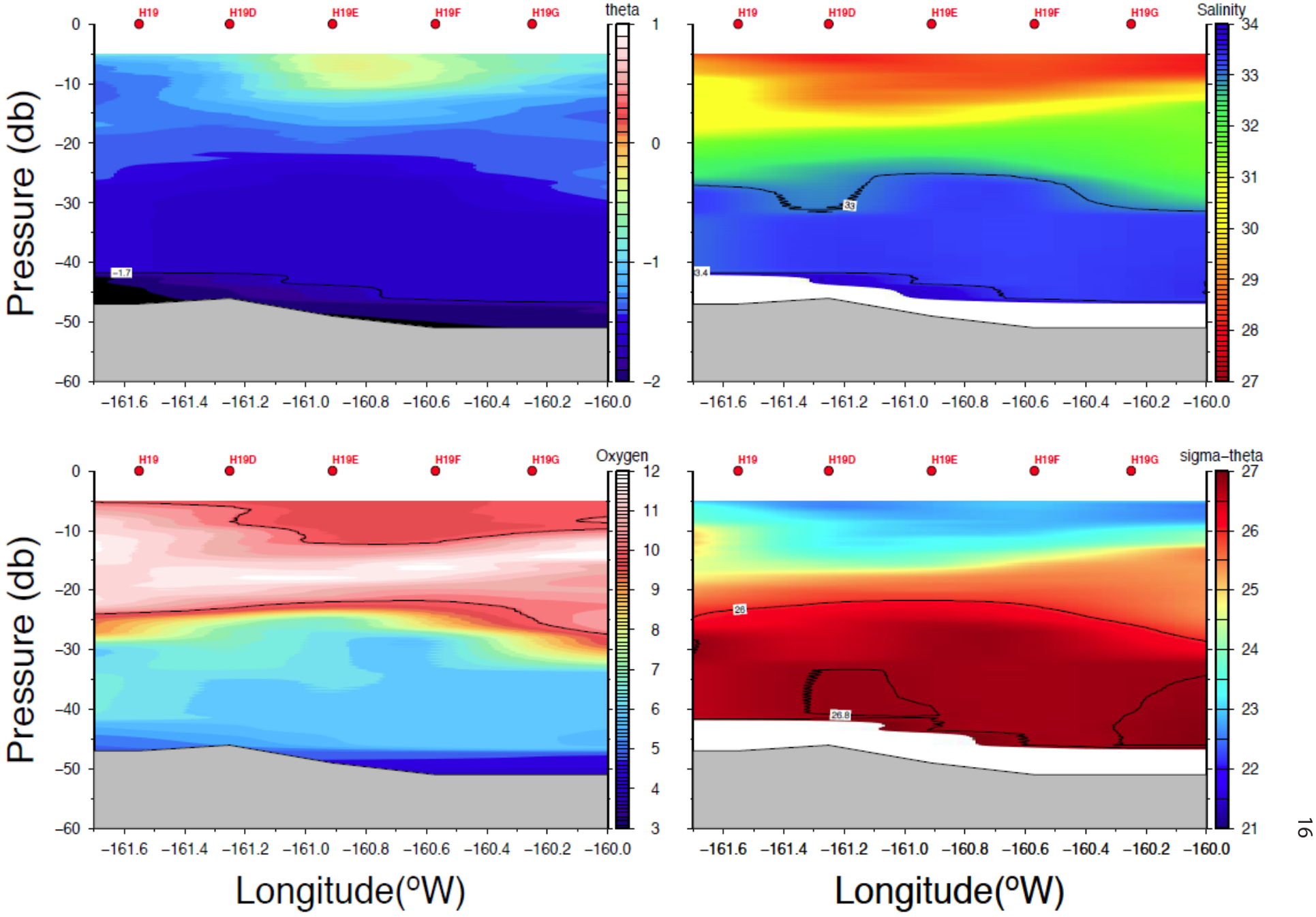
26.8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H19D
H19E
H19F
H19G
theta
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Oxygen
sigma−theta
Pressure (db)
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34.4
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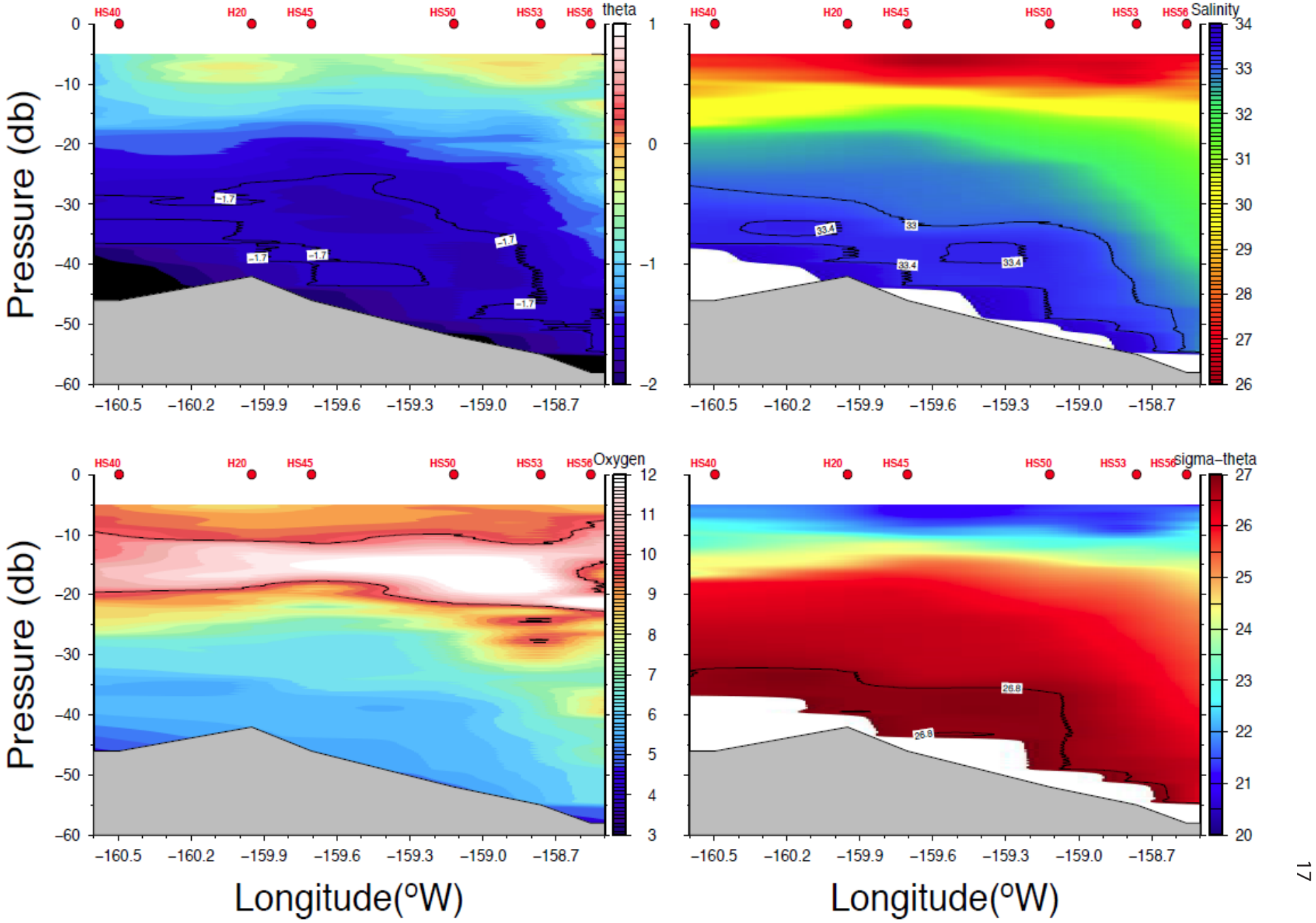
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H20
HS45
HS50
HS53
HS56
theta
Salinity
Oxygen
sigma−theta
Pressure (db)
Longitude(°W)
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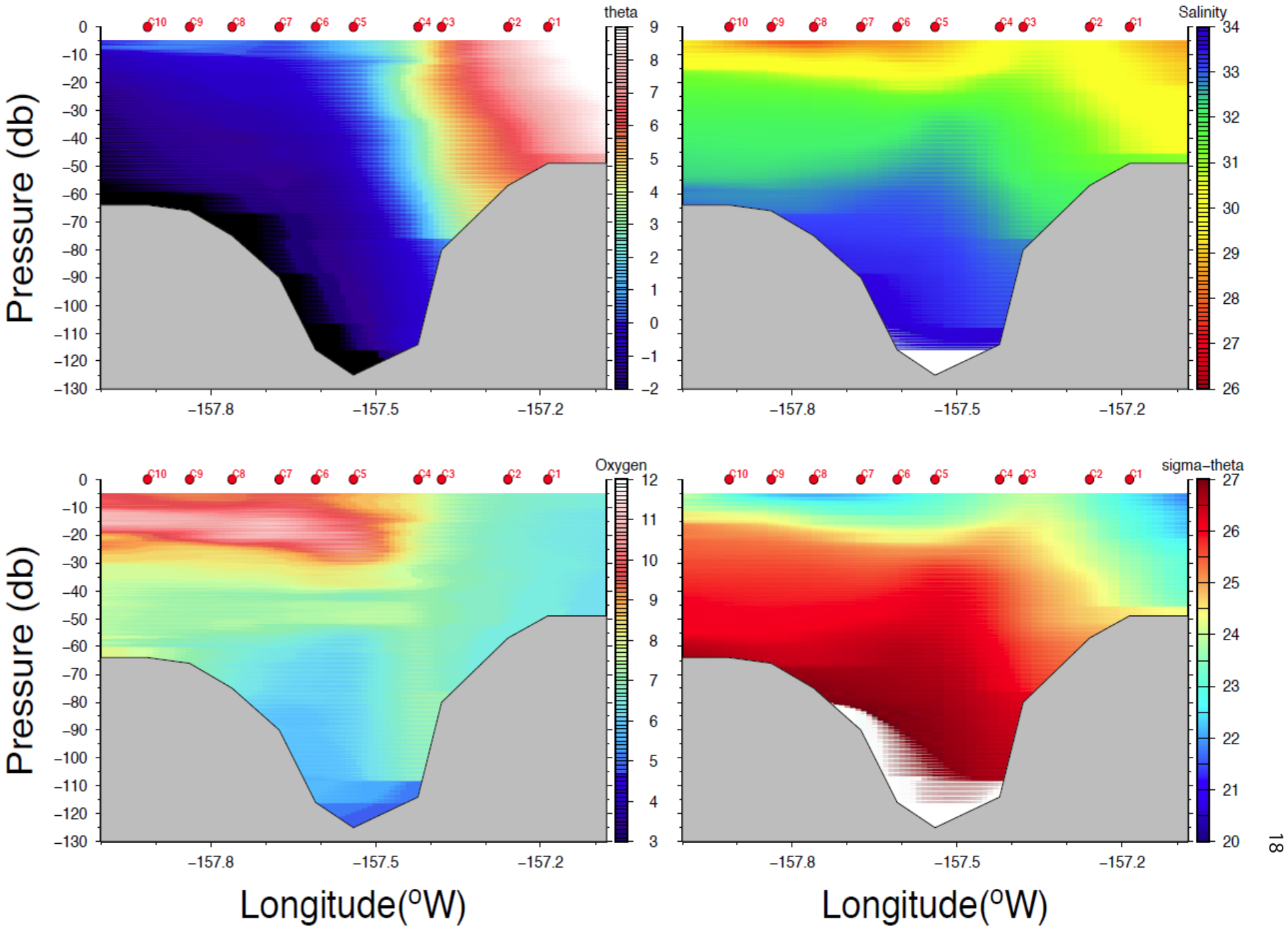
33
33.4
26.8


theta
Salinity
Oxygen
sigma–theta
C10 C9 C8 C7 C6 C5 C4 C3 C2 C1
Pressure (db)
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−157.8 −157.5 −157.2
9 8 7 6 5 4 3 2 1 0 −1 −2
34 33 32 31 30 29 28 27 26
12 11 10 9 8 7 6 5 4 3
27 26 25 24 23 22 21 20
Longitude(°W)

Vessel-Mounted ADCP Measurements

The VM-ADCP operated continuously throughout the cruise. In general the observed ADCP velocities are consistent with the hypothesized clockwise circulation around the Shoal. This corroborates numerical model findings. Moreover, the bulk of the VM-ADCP measurements were made under regionally mild to calm wind conditions, so that we tentatively conclude that the currents arise as a result of the large-scale pressure gradient between the Pacific and Arctic oceans. Moreover, the CTD transects suggest that the baroclinic component of the velocity field is weak (except in Barrow Canyon).

Zooplankton Abundance and Composition

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The overall goal of our component is to describe the abundance and community composition of the zooplankton on Hanna Shoal and the association of those distributions with physical oceanographic features such as water mass and circulation. Secondary objectives include differentiation of the congeneric copepod species *Calanus glacialis* and *C. marshallae* using molecular techniques and an assessment of the metabolic condition of *Calanus* spp. in late summer for comparison with previous studies and to expand our understanding of the life history of this species. (*C. marshallae* and *C. glaclialis* cannot be differentiated reliably using morphometrics). We are particularly interested in describing the abundances of the large bodied *Calanus* spp. and euphausiids (krill) as they are key prey species for the planktivorous bowhead whale. Plankton on Hanna Shoal may comprise species of both Arctic and Bering Sea origin, since the dominant currents in the Chukchi Sea may advect Bering Sea species to the region.

Samples were collected at all regular stations (mega stations and other) and at selected high-resolution samples in conjunction with CTD sampling during the night. Night sampling was intended to capture krill, since these animals can easily see the nets during daylight and also remain near the sea floor during daytime, ascending into the water column to feed at night (diel vertical migration). Zooplankton were collected with vertical tows of a paired Bongo net frame equipped with 150 and 500 µm black mesh nets, flow meters, and a time-depth recorder. Casts were conducted from surface to ~2 m off of the seafloor. Samples were preserved in 4% formalin seawater immediately following collection and will be enumerated in the laboratory for the abundance of the different taxa, species, and life stage once the samples are returned from Healy in November. Total biomass for each sample will be estimated using the non-destructive displacement volume method. At most locations, 1-2 additional net tows were conducted using a 1-m^2 ring net equipped with black 250 µm mesh, a time-depth recorder, and a large non-filtering cod end. At a subset of locations, *C. glacialis/marshallae* from these tows were selected using microscopy and preserved in alcohol for genetic analysis or photographed (for later size determination) and frozen at -80°C for measurement of the RNA/DNA (a measure of metabolic activity). Plankton from these net tows were used also by the Dunton and Trefry groups.

We conducted Bongo net tows at 38 locations and 39 Ring net tows at 23 locations (Tables 3 & 4). Based on qualitative examinations of the samples, *Calanus glacialis/marshallae* were ubiquitous on the Shoal, with elevated abundances seen at the stations located outside of the crest region in slightly deeper water. The proportion of different life stages seemed to vary with location, with the majority of the Shoal containing all late naupliar and copepodid life stages as well as adult females. Higher proportions of late stage copepodids were observed on the deeper portions of the southern and western Shoal. Barnacle nauplii were abundant on the crest of the shoal. Other observed copepod species included *Pseudocalanus* spp. and *Acartia*

spp. Non-copepod taxa included the naked pteropod *Clione* sp. and chaetognaths (*Sagitta* sp.). At some locations, small medusa or ctenophores were abundant. Despite our efforts, we were unsuccessful in collecting any significant quantity of krill except at Station 57 (BarC5), the deepest part of the DBO line across Barrow Canyon. Numbers of krill (*Thysanoessa raschii* and *T. inermis*) dropped off as we sampled the DBO line to the west. It is likely that most of our stations were located too high on Hanna Shoal to experience significant input of water of Bering Sea origin that would advect krill from a Bering Sea source into the Chukchi Sea. The deep-water Arctic copepod species *C. hyperboreus* was observed only at station 51 (HSNE56), on the NE corner of our study area and closest to the shelf break and Barrow Canyon. Plankton composition changed dramatically from the western side of Barrow Canyon to the south-eastern section of the shoal. The 150um net captured significant quantities of chain diatoms in a gelatinous matrix with few copepods. Since the CTD chlorophyll signal was low, this material could constitute a decaying colonial algal bloom together and chain diatoms.

Table 3. Stations at which Bongo Net tows were conducted during the cruise. TDR=Time Depth Recorder that was attached to the net to give the depth to which the net fished.

Station	Station Name	Date (Local)	Time (local) H	M	Lat. Deg. N	Long. Deg. W	Bottom Depth (m)	Wire Out (m)	TDR Depth (m)
1	BRS5	08/11/12	20	22	65.74	168.843	53	74	53
3	H24W1	08/13/12	2	18	71.63	165.075	44	39	39.4
5	H24W3	08/13/12	4	14	71.63	165.601	41	38	34.9
6	H24	08/13/12	6	46	71.63	165.804	40	37	36.1
7	CBL11/H23	08/13/12	1	1	72.17	165.438	47	43	37.2
8	H21A	08/14/12	1	53	72.18	165.308	48	44	na
9	H21	08/14/12	7	7	72.52	164.707	51	47	na
10	H10	08/14/12	19	16	72.32	164.230	46	43	na
11	H30	08/15/12	10	34	72.75	168.674	65	63	55
12	NSNW40-12	08/15/12	19	19	72.70	164.528	59	53	48.5
16	NW3	08/16/12	3	55	72.45	163.893	50	50	24.8
19	H6	08/16/12	10	5	72.17	163.566	41	38	30.4
20	H8	08/16/12	18	54	72.38	163.043	42	42	32
22	H8B	08/17/12	2	53	72.49	162.500	42	39	38.3
24	H4B	08/17/12	6	57	72.66	161.709	48	46	42.8
25	H4	08/17/12	10	26	72.54	162.221	45	42	40.6
26	H14	08/17/12	21	29	72.41	161.224	45	42	42
27	H14A	08/18/12	2	43	72.47	160.953	45.9	43	41.69
30	H2	08/18/12	9	12	72.23	162.105	34	31	28.2
31	H5	08/18/12	15	23	72.09	161.745	29	25	21
32	H3	08/18/12	22	25	71.87	162.037	41.5	39	39
34	H3B	08/19/12	3	58	71.73	162.433	43	40	n/a
37	H1	08/19/12	9	1	71.66	162.618	43.8	40	30.4

38	H19	08/19/12	17	35	71.71	161.573	46	43	35
42	H19G	08/20/12	4	28	71.60	160.252	52	49	44
45	H16	08/20/12	9	54	71.92	160.928	40.8	40	37.2
46	H20	08/20/12	20	45	72.15	159.93	46	42	38
51	HSNE56	08/21/12	13	12	72.18	158.56	58	56	52
52	H32	08/21/12	18	49	71.79	158.99	53.3	54	37.2
53	BARC1	08/22/12	11	34	71.27	157.15	49	47	31.6
55	BARC3	08/22/12	15	6	71.32	157.35	85	85	65.4
57	BARC5	08/22/12	19	8	71.41	157.48	131	129	126.2
59	BARC7	08/23/12	1	56	71.50	157.67	89	87	82.3
59	BARC7	08/23/12	2	12	71.50	157.66	89	120	65.2
61	BARC9	08/23/12	5	3	71.58	157.85	66	63	60.9
64	HB2	08/23/12	10	4	71.61	158.66	57	54	46.2
66	H38	08/23/12	13	28	71.61	159.37	52.7	50	40.6
67	CBL-14	08/23/12	21	15	71.38	159.43	53.4	51	45.1

Table 4. Stations at which Ring Net tows were conducted during the cruise. TDR=Time Depth Recorder that was attached to the net to give the depth to which the net fished.

Station	Station Name	Date (Local)	Time (local) H	M	Lat. Deg. N	Long. Deg. W	Bottom Depth (m)	Wire Out (m)	TDR Depth (m)
1	BRS5	08/08/12	21	13	65.76	168.81	53	28.8	N/A
6	H24	08/13/12	7	3	71.63	164.81	40	35	31.6
6	H24	08/13/12	7	3	71.63	164.81	40	37	N/A
7	CB11/H23	08/13/12	18	19	71.05	165.44	46	40	N/A
7	CB11/H23	08/13/12	18	28	71.10	165.44	46	40	N/A
9	H21	08/14/12	7	23	72.52	164.71	51	47	N/A
9	H21	08/14/12	7	31	72.52	164.71	51	47	N/A
10	H10	08/14/12	19	35	72.32	164.22	46	43	N/A
11	H30	08/15/12	10	56	72.76	163.68	65	63	N/A
11	H30	08/15/12	11	5	72.76	163.68	65	63	N/A
19	H6	08/16/12	10	16	72.16	163.55	41	40	N/A
19	H6	08/16/12	10	23	72.16	163.55	41	40	N/A
20	H8	08/16/12	19	13	72.39	163.03	42	39	28
20	H8	08/16/12	19	20	72.40	163.02	42	39	N/A
25	H4	08/17/12	10	44	72.54	162.22	45	42	N/A
25	H4	08/17/12	10	51	72.54	162.22	45	42	N/A
26	H14	08/17/12	21	45	72.41	161.21	44	41	N/A
26	H14	08/17/12	21	52	72.41	161.21	44	41	N/A
28	H2A	08/18/12	5	38	72.35	161.54	42	39	33.8
30	H2	08/18/12	9	25	72.23	162.10	34	31	25.9
30	H2	08/18/12	9	30	72.23	162.10	34	31	N/A

31	H5	08/18/12	15	39	72.09	161.75	28.6	24	N/A
32	H3	08/18/12	22	48	71.87	162.04	42	34	25.9
37	H1	08/19/12	9	28	71.65	162.64	43.8	40	34.9
37	H1	08/19/12	9	36	71.65	162.64	43.8	40	34.9
38	H19	08/19/12	17	47	71.71	161.58	46	43	32
38	H19	08/19/12	17	55	71.72	161.58	47	43	28
45	H16	08/20/12	10	8	71.92	160.93	40.8	38	33.8
45	H16	08/20/12	10	15	71.92	160.93	40.8	38	37.2
46	H20	08/20/12	21	3	72.14	159.92	47	42	36
46	H20	08/20/12	21	7	72.15	159.92	45.6	42	39
51	HSNE56	08/21/12	13	36	72.18	158.65	58	55	53
52	H32	08/21/12	19	2	71.79	158.99	53.3	52	41.7
52	H32	08/21/12	19	10	71.80	158.99	54	52	41.7
57	BARC5	08/22/12	22	44	71.43	157.46	125	122	111.6
57	BARC5	08/22/12	23	5	71.43	157.46	124	122	NA
66	H38	08/23/12	13	40	71.61	159.38	53	50	48.5
66	H38	08/23/12	13	50	71.61	159.38	53	50	48.5

Harvey Group Report

H. Rodger Harvey, PI
H. Rodger Harvery, Karen A. Taylor, Rachel Pleuthner, Tanya Muniak and Guoping Zhu on-board team

Organic Contaminants and Lipid Biomarkers

As part of the chemical analysis of the COMIDA-Hanna Shoal Ecosystem Study project, a suite of samples have been collected during HLY1201 cruise operations to continue our baseline analysis of organic contaminants (PAHs, n-alkanes) and lipid biomarkers of carbon flow in the Chukchi Sea. Multiple sample types have been obtained throughout the study area. The first are particulate organic material collected onto combusted GF/F filters at several water column depths from each of the "mega" stations. Typically three water column depths per "mega" station were collected that include near surface (5m), the chlorophyll maximum and near bottom water. CTD profiles were used to capture the chlorophyll maximum and allowed the distinction of major water masses to be accurately determined at each site and guide collections. Sample sites are described in Table 5.

At all "mega" stations where particles were collected, matching underlying sediment cores were also obtained using a box corer. The corer was highly successful with down core sections of sediment ranging from 18-30 cm below the sediment surface obtained. All were sectioned in 1 cm increments from 0-10 cm and 2 cm increments below. All down core samples were split with the Trefry group for parallel measures of trace elements in sediments and biota. Appropriate blanks (air, water) were also collected in parallel. Subsamples from double Van Veen grabs (0-1cm) were also obtained to intercalibrate with other measures and link to faunal distributions. Surface sediments were obtained from Van Veen grabs of Trefry at sites where box coring did not occur. A summary of all sediment samples collected is included in the summary.

We continued to sample for northern Neptune whelks (*Neptunea heros*), which were collected opportunistically from epibenthic trawls. Analysis of Neptunea foot muscle collected during the COMIDA 2009 and 2010 cruises revealed low concentrations of organic contaminants; yet natural product lipid biomarkers and compound-specific carbon isotope analysis suggested these organisms have a complex trophic status. These samples will expand the geographic range of comparisons. Their foot muscle will be extracted and pooled by shell size (i.e. 2-4 cm, 4-6 cm, 6-8 cm). Neptunea with shell size greater than 4 cm were previously targeted, but due to differences seen among size classes, organisms 2-4 cm were also collected during HLY1201. All Neptunea samples are summarized in the Table 5.

Phycoerythrin and Cyanobacteria

Chemical analysis of a subset of water column particles collected from below the chlorophyll maximum as well as the underlying surface sediments obtained during the COMIDA 2009 cruise revealed an abundance of cyanobacteria-specific biomarkers (C2-methylated and saturated bacteriohopanetetrol-pentose; BHPs) in the Chukchi Sea. While contributions of cyanobacteria

to the overall primary production in the Chukchi Sea are estimated to be low, their detection below the chlorophyll maximum suggests that they are more important in Arctic waters than previously thought, but it is not clear if they are long term residents previously unrecognized or more temperate species are moving northward as waters warm in summer. In order to further define and target cyanobacteria in the water column of the Chukchi Sea, a fluorometer that detects the cyanobacterial pigment, phycoerytherin was installed on the CTD during HLY1201. CTD profiles at all stations were monitored for phycoerythrin abundance throughout the water column. Water was collected from several non-"mega" stations at the depth of phycoerythrin maximum and filtered onto both GF/F and polycarbonate filters for chemical and genomics analysis, respectively. This water was also used to inoculate culture plates and liquid media to facilitate cyanobacterial growth at both freezing and room temperatures for additional genomics analysis.

Ice Algal Growth and Biomarkers of Ice extent

It's been proposed that specific species of diatoms which reside in ice (ice algae) synthesize a very specific group of lipids as highly branched isoprenoid (HBI) alkanes. These markers are very stable and should be retained in sediment and thus useful for paleo climatological reconstruction of seasonal ice coverage. Previous studies making this suggestion have been limited to the Canadian Arctic and one of our goals on HLY 1201 cruise was collection of sea ice, water column, and sediment samples for further analysis of HBIs to compare previously reported data to the Chukchi Sea signature. Using a homemade basket hung over the side, we collected sea ice from stations H10, H30, H6, H4, and H19. Most of the samples were melted followed by the transfer of the particular organic matter onto glass fiber filters (GF/F). A portion of the sample from the station H4 (800 mL) was melted in filtered sea water (1:7 ice:water ratio) and used for attempts to culture ice-inhabiting phytoplankton at zero degrees C. The ice/sea water combo was supplemented with F/2 diatom culturing medium and subjected to 20 uE/m2 of full sunlight spectrum (20/4 hrs light/dark cycle) over 6 days. Growth cultures were split, with portion collected on GF/F filters for hydrocarbon analysis, and small water samples returned for future culturing.

Euphausiid Dynamics in the Chukchi Sea

Euphausiids are a large component of the diet of many marine mammals, including bowhead whales, residing in the Chukchi Sea. Understanding the food resources that they utilize in this region could provide chemical evidence for overwintering strategies in the steadily changing Arctic environment. One series of experiments were designed to determine detrital contribution to euphausiid diet via chemical examination of specific biomarkers, but time constraints and an insufficient number of field samples did not allow for the conduction of these experiments. A single experiment was conducted with euphausiids collected in the deeper waters of Barrow Canyon for later analysis.

When collecting field samples in the future, we would suggest tow net obliquely as opposed to vertical drops, which were largely utilized to conduct biomass and abundance measurements with bongo and ring nets. Towing allows a larger volume of water to be filtered for krill and could reduce the probability of net avoidance, which may occur due to the use of black mesh nets during the twilight hours. An oblique tow of the bongo nets at station BarC7 (#59) amounted to

4-5x the number of euphausiids as a vertical tow using the same net at the same site.

Age and Diet History of Snow Crab Measurements

Snow crabs from the epibenthic trawls were sampled throughout the cruise for initial samples to determine dietary history and age analysis. Eyes were removed from all crab samples obtained and flash frozen in liquid nitrogen for lab analysis of lipofuscin, a protein oxidation product that accumulates in neural tissues over time. Normalization of lipofuscin to protein content results in a ratio we have developed called the lipofuscin index, which can subsequently be used as a proxy for age when a calibration curve is applied.

When possible, a claw and leg from each crab were removed, separated from the shell, and frozen in the -80°C chest freezer for analysis back in the lab. Extraction, identification, and quantification of lipid biomarkers found within the muscle can provide clues as to the dietary history of these benthic feeders over the range of stations sampled during the summer season.

Table 5. Harvey group sample collections.

Stn No.	Stn Name	Date	Sea Water			Sediment Collection		*Neptunea heros* foot muscle extraction	*Chionecetes opilio* (snow crab) tissue extraction	
			CTD Cast	Depth	Volume	Sampler	Depth	Shell Size	Carapice Length	Tissue
1	BSR-5	8/11/2012	_00101	5 m	19.9 L	n/a	n/a	n/a	n/a	n/a
				21 m	29.9 L					
				44 m	25.9 L					
			_00102	15 m	14.9 L					
6	H24	8/13/2012	_00601	5 m	32 L	Double Van Veen	0-1 cm	n/a	n/a	n/a
				25 m	31.5 L	Box Corer	0-20 cm			
				35 m	26.8 L					
7	OM37/CBL-1	8/13/2012	_00701	25 m	27.5 L	Double Van Veen	0-1 cm	3.74 cm	n/a	n/a
								3.71 cm		
								4.67 cm		
8	H21A	8/14/2012	_00801	28 m	17.5 L	n/a	n/a	n/a	n/a	n/a
9	H21	8/14/2012	_00901	5 m	32.5 L	Double Van Veen	0-1 cm	n/a	53.3 mm	eyes
				28 m	26.5 L	Box Corer	0-20 cm			
				47 m	20.8 L					
10	H10	8/14/2012	_01001	25 m	32.5 L	n/a	n/a	n/a	52.4 mm	eyes
									44.5 mm	eyes
									29.1 mm	eyes
									62.0 mm	eyes
11	H30	8/15/2012	_01101	5 m	34 L	Double Van Veen	0-0.5 cm	3.75 cm	49.9 mm	eyes, legs
				21 m	22.9 L	Box Corer	0-20 cm	4.20 cm	48.0 mm	eyes
				58 m	30 L			6.30 cm	46.1 mm	eyes
									46.0 mm	eyes
									59.0 mm	eyes
									49.9 mm	eyes
									59.5 mm	eyes
									63.5 mm	eyes
									53.3 mm	eyes
									65.0 mm	eyes
12	HSNW60_12	8/15/2012	_01201	25 m	33.5 L	n/a	n/a	n/a	n/a	n/a

Stn No.	Stn Name	Date	Sea Water			Sediment Collection		*Neptunea heros* foot muscle extraction	*Chionecetes opilio* (snow crab) tissue extraction	
			CTD Cast	Depth	Volume	Sampler	Depth	Shell Size	Carapice Length	Tissue
19	H6	8/16/2012	_01901	5 m	29.5 L	Double Van Veen	0-0.5 cm	4.72 cm	46.1 mm	eyes, legs
				22 m	25.05 L	Box Corer	0-24 cm		47.1 mm	eyes, legs
				36 m	20 L				56.4 mm	eyes, legs
									47.9 mm	eyes, legs
25	H4	8/17/2012	_02501	5 m	34 L	Double Van Veen	0-0.5 cm	2.70 cm	55.5 mm	eyes, legs
			_02501	29 m	25.2 L	Box Corer	0-30 cm	2.07 cm	50.7 mm	eyes, legs
			_02501	40 m	30.8 L			3.01 cm	46.8 mm	eyes, legs
								4.69 cm		
26	H14	8/18/2012	n/a	n/a	n/a	Double Van Veen	0-1 cm	n/a	47.5 mm	eyes, legs
									70.6 mm	eyes, legs
									55.1 mm	eyes, legs
									54.5 mm	eyes, legs
									59.6 mm	eyes, legs
									54.5 mm	eyes, legs
30	H2	8/18/2012	_03001	5 m	28 L	Double Van Veen	0-1 cm	n/a	n/a	n/a
				25 m	28.7 L					
				30 m	27.5 L					
31	H5	8/18/2012	n/a	n/a	n/a	Double Van Veen	0-1 cm	n/a	n/a	n/a
32	H3	8/18/2012	_03201	30 m	12 L	Double Van Veen	0-1 cm	n/a	n/a	n/a
37	H1	8/19/2012	_03701	5 m	34 L	Double Van Veen	0-0.5 cm	n/a	50.7 mm	eyes, legs
				23 m	27.5 L	Box Corer	0-18 cm		50.4 mm	eyes, legs
				40 m	16.5 L				49.5 mm	eyes, legs
38	H19	8/19/2012	n/a	n/a	n/a	Double Van Veen	0-1 cm	3.35 cm	56.4 mm	eyes, legs
								3.20 cm	47.2 mm	eyes, legs
								2.85 cm		
								2.40 cm		
								2.87 cm		
45	H16	8/20/2012	_04501	5 m	18 L	Double Van Veen	0-0.5 cm	2.98 cm	49.7 mm	eyes, legs
				23 m	21.5 L	Box Corer	0-22 cm	3.92 cm	46.1 mm	eyes, legs
				25 m	31.5 L			4.37 cm	32.9 mm	eyes, legs
				35 m	26.5 L			5.15 cm	30.2 mm	eyes, legs
46	H20	8/20/2012	_04601	25 m	43 L	Double Van Veen	0-1 cm	n/a	n/a	n/a
52	H32	8/21/2012	_05201	5 m	32.5 L	Double Van Veen	0-1 cm	4.42 cm	49.5 mm	eyes, legs

Stn No.	Stn Name	Date	Sea Water			Sediment Collection		*Neptunea heros* foot muscle extraction	*Chionecetes opilio* (snow crab) tissue extraction	
			CTD Cast	Depth	Volume	Sampler	Depth	Shell Size	Carapice Length	Tissue
				30 m	31.5 L	Box Corer	0-18 cm	4.92 cm	50.4 mm	eyes, legs
				48 m	35.5 L					
57	BarC-5	8/22/2012	_05701	5 m	32 L	Box Corer	0-30 cm	n/a	n/a	n/a
				30 m	34 L					
				116 m	34.5 L					
59	BarC-7	8/23/2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
61	BarC-9	8/23/2012	_06101	15 m	n/a	n/a	n/a	n/a	n/a	n/a
66	H38	8/23/2012	_06601	5 m	32 L	Box Corer	0-20 cm	5.6 cm	n/a	n/a
				32 m	31.5 L					
				49 m	28.2 L					

Stn No.	Stn Name	Date	Other animal tissue collections: Bivalves obtained from box corer and all others from epibenthic trawl					Sea Ice
			Scientific Name	Common Name	Sampler	Tissue Extracted	Size	Volume
1	BSR-5	8/11/2012	n/a	n/a	n/a	n/a	n/a	n/a
6	H24	8/13/2012	*Yoldia moesta*	Clam	Box corer	Body (minus gut)	2.13 cm	n/a
			Liocyma fluctuosa	Clam	Box corer	Body (minus gut)	2.19 cm	
			Serrites groenlandicus	Clam	Box corer	Body (minus gut)	2.91 cm	
7	COM37/CBL-1	8/13/2012	n/a	Box corer	Box corer	n/a	n/a	n/a
8	H21A	8/14/2012	n/a	n/a	n/a	n/a	n/a	n/a
9	H21	8/14/2012	*Yoldia hyperborea*	Clam	Box corer	Body (minus gut)	2.62 cm	n/a
			Yoldia hyperborea	Clam	Box corer	Body (minus gut)	2.87 cm	
			Yoldia hyperborea	Clam	Box corer	Body (minus gut)	2.72 cm	
			Yoldia hyperborea	Clam	Box corer	Body (minus gut)	2.52 cm	
			Yoldia hyperborea	Clam	Box corer	Body (minus gut)	2.88 cm	
			Yoldia hyperborea	Clam	Box corer	Body (minus gut)	2.92 cm	
			Nuculana pernula	Clam	Box corer	Body (minus gut)	2.09 cm	
10	H10	8/14/2012	n/a	n/a	n/a	n/a	n/a	1.5 L
11	H30	8/15/2012	*Buccinum sp.*	Whelk	Trawl	Foot muscle	9.80 cm	3 L
12	HSNW60_12	8/15/2012	n/a	n/a	n/a	n/a	n/a	n/a

Stn No.	Stn Name	Date	Other animal tissue collections: Bivalves obtained from box corer and all others from epibenthic trawl					Sea Ice
			Scientific Name	Common Name	Sampler	Tissue Extracted	Size	Volume
19	H6	8/16/2012	*Astarte montagui*	Clam	Box corer	Body (minus gut)	2.94 cm	9 L
25	H4	8/17/2012	*Macoma calcerea*	Clam	Box corer	Body (minus gut)	3.20 cm	6 L
			Macoma calcerea	Clam	Box corer	Body (minus gut)	3.34 cm	
			Macoma calcerea	Clam	Box corer	Body (minus gut)	3.17 cm	
			Boreogadus saida	Arctic cod	Trawl	Whole animals	3 total	
26	H14	8/18/2012	n/a	n/a	n/a	n/a	n/a	n/a
30	H2	8/18/2012	n/a	n/a	n/a	n/a	n/a	n/a
31	H5	8/18/2012	n/a	n/a	n/a	n/a	n/a	n/a
32	H3	8/18/2012	n/a	n/a	n/a	n/a	n/a	n/a
37	H1	8/19/2012	n/a	n/a	n/a	n/a	n/a	n/a
38	H19	8/19/2012	n/a	n/a	n/a	n/a	n/a	n/a
45	H16	8/20/2012	Macoma calcerea	Clam	Box corer	Body (minus gut)	3.09 cm	n/a
			Macoma calcerea	Clam	Box corer	Body (minus gut)	3.11 cm	
			Yoldia hyperborea	Clam	Box corer	Body (minus gut)	2.55 cm	
46	H20	8/20/2012	n/a	n/a	n/a	n/a	n/a	n/a
52	H32	8/21/2012	n/a	n/a	n/a	n/a	n/a	n/a

Stn No.	Stn Name	Date	Other animal tissue collections: Bivalves obtained from box corer and all others from epibenthic trawl					Sea Ice
			Scientific Name	Common Name	Sampler	Tissue Extracted	Size	Volume
57	BarC-5	8/22/2012	*Musculus discors*	Mussel	Box corer	Body (minus gut)	3.28 cm	n/a
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.84 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.73 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	3.13 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	3.25 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.95 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.85 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.43 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.91 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.17 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	3.27 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.91 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.55 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.71 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	3.29 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	3.00 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.86 cm	
			Musculus discors	Mussel	Box corer	Body (minus gut)	2.18 cm	
			n/a	Krill	Nets	Whole animals	14 total	
59	BarC-7	8/23/2012	n/a	Krill	Nets	Whole animals	20 total	n/a
61	BarC-9	8/23/2012	n/a	n/a		n/a	n/a	n/a
66	H38	8/23/2012	n/a	n/a	n/a	n/a	n/a	n/a

University of Maryland Center for Environmental Science (Chesapeake Biological Laboratory) Report

Jacqueline M. Grebmeier, PI, Chief Scientist
Lee W. Cooper, PI, Co-Chief Scientist
Jacqueline M. Grebmeier, Lee W. Cooper, Christian Johnson, Mengjie Zhang, Laura Gemery, Kathleen Marshall and Deanna Wheeler, on-board team

The Chesapeake Biological Laboratory (CBL) research group undertook both water column and sediment data and sample collections during the HLY12-01 cruise (Table 6). Water column collections included water sampling for chlorophyll from the rosette and inorganic nutrients. The water column chlorophyll was analyzed shipboard using a Turner Designs AU-20 fluorometer (non-acidification or Welschmeyer method) following a 24-hour in the dark incubation with 90% acetone at 4 °C.

Table 6. CBL sample collections.

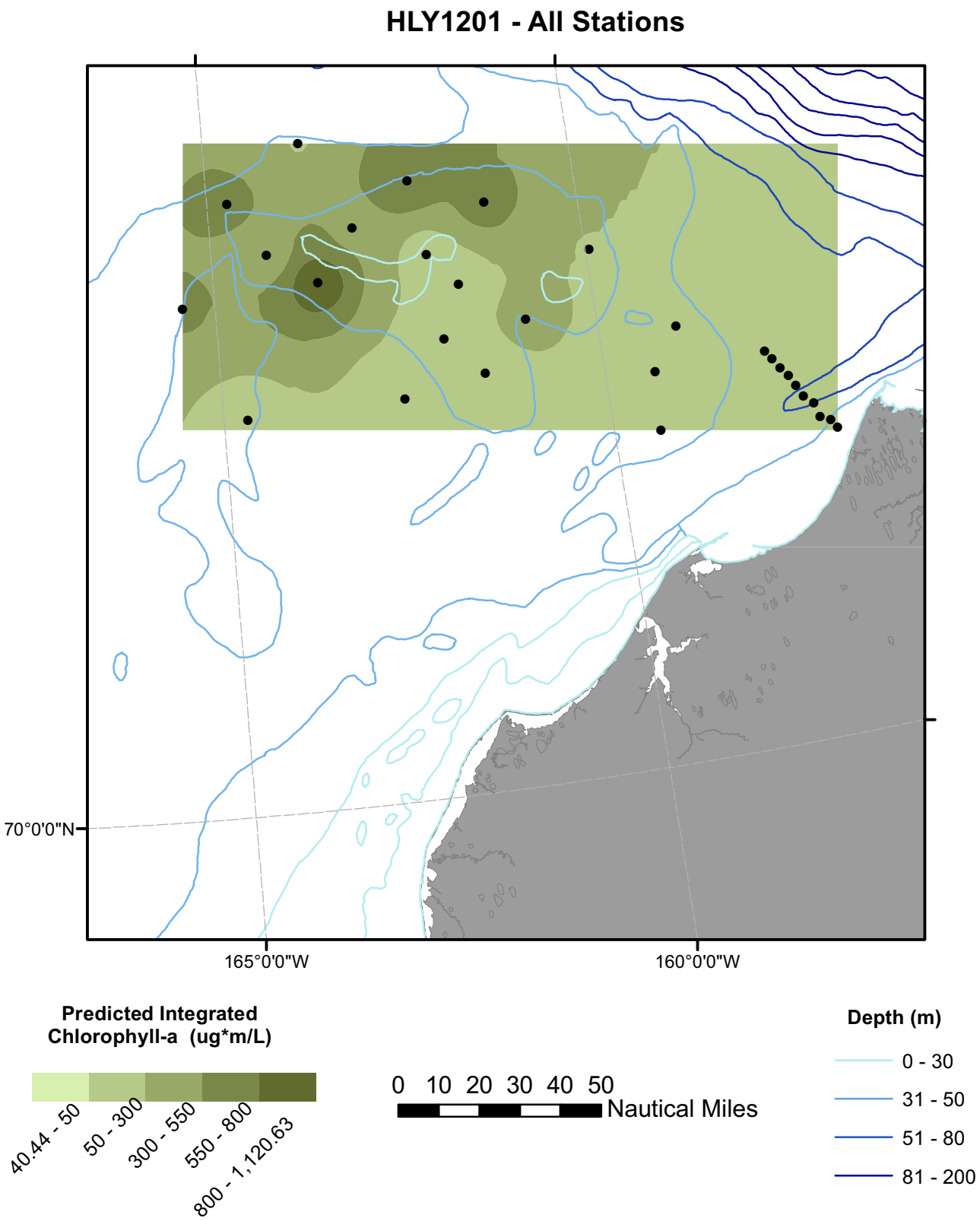
Stn#	Stn Name	Date	Water Chla	Water Nuts	Sed Chla	TOC/GS	Van Veens (4+1)	HAPS	Grav Core	Ben Cam	Surf Sed-LG	Bot Water-JG	Water-KM/LL	Sediment-KM/LL	Arctic Cod
1	BR5	8/11/2012	X	X						X		X			
6	H24	8/13/2012	X		X	X				X	X	X		X	
7	CBL11	8/13/2012			X	X	X	X		X	X	X	X	X	X
9	H21	8/14/2012	X	X	X	X	X	X	X	X	X	X	X	X	X
10	H10	8/14/2012	X	X	X		X	X		X	X	X	X	X	X
11	H30	8/14/2012	X		X	X	X	X		X		X	X		X
19	H6	8/16/2012	X		X	X	X	X		X	X	X	X	X	X
20	H8	8/16/2012	X		X	X	X	X		X	X	X	X	X	X
25	H4	8/17/2012	X		X	X	X	X	X	X	X	X	X	X	X
26	H14	8/17/2012	X		X	X	X			X	X	X	X	X	
30	H2	8/18/2012	X		X	X	X	X		X	X	X	X	X	
31	H5	8/18/2012	X		X	X	X			X	X		X	X	
32	H3	8/18/2012	X		X	X	X			X	X	X	X	X	
37	H1	8/19/2012	X		X	X	X			X	X	X	X	X	
38	H19	8/19/2012	X		X	X	X			X	X		X	X	
45	H16	8/20/2012	X		X	X	X	X	X	X	X	X	X	X	X
46	H20	8/20/2012	X		X	X	X	X	X	X	X	X	X	X	
52	H32	8/21/2012	X		X	X	X	X	X	X	X	X	X	X	X
53	BarC1	8/22/2012	X		X	X	X (1)				X		X		
54	BarC2	8/22/2012	X		X	X	X (1)				X		X		
55	BarC3	8/22/2012	X		X		X (1)						X		
56	BarC4	8/22/2012	X		X		X (1)						X		X
57	BarC5	8/22/2012	X		X		X (1)						X		
58	BarC6	8/22/2012	X		X		X			X			X		
59	BarC7	8/22/2012	X		X		X (1)						X		
60	BarC8	8/23/2012	X	X	X		X (1)						X		
61	BarC9	8/23/2012	X	X	X		X (1)						X		
62	BarC10	8/23/2012	X	X	X		X (1)						X		
66											X	X	X	X	
67	CBL14/H26	8/23/2012	X		X								X	X	
70	H37	8/24/2012			X					X					
71	F3	8/24/2012			X										
72	CBL15	8/24/2012			X										

Preliminary data have been analyzed and integrated concentrations over the whole water column are shown in Table 7 and plotted on Figure 3.

Table 7. CBL chlorophyll data.

Date of Collection (PDT)	Station Number	Station Name	Latitude Dec. Deg.	Longitude Dec. Deg.	Integrated Chl-a [(ug*m)/L]	Sed Chl mean mg/m2
8/11/2012	1	BR55	65.712	-168.890	1217.79	water chl only
8/13/2012	6	H24	71.628	-164.695	105.93	16.79
8/13/2012	7	CBL11	72.105	-165.434	579.05	13.83
8/14/2012	9	H21	72.520	-164.727	608.44	9.71
8/14/2012	10	H10	72.298	-164.253	382.83	7.27
8/15/2012	11	H30	72.741	-163.673	286.37	10.13
8/16/2012	19	H6	72.164	-163.603	1120.63	17.47
8/16/2012	20	H8	72.373	-163.067	484.52	12.44
8/17/2012	25	H4	72.537	-162.248	809.17	6.37
8/17/2012	26	H14	72.409	-161.252	715.89	9.38
8/18/2012	30	H2	72.226	-162.115	120.30	10.19
8/18/2012	31	H5	72.091	-161.742	105.60	12.92
8/18/2012	32	H3	71.873	-162.028	90.92	14.87
8/19/2012	37	H1	71.652	-162.633	114.56	13.83
8/19/2012	38	H19	71.713	-161.552	84.82	12.86
8/20/2012	45	H16	71.909	-160.926	457.45	8.27
8/20/2012	46	H20	72.152	-159.949	295.13	5.55
8/21/2012	52	H32	71.782	-158.987	116.60	7.09
8/22/2012	53	BarC1	71.245	-157.190	109.27	4.34
8/22/2012	54	BarC2	71.282	-157.256	52.62	4.62
8/22/2012	55	BarC3	71.305	-157.378	93.74	5.92
8/22/2012	56	BarcC4	71.366	-157.421	265.72	3.82
8/22/2012	57	BarC5	71.401	-157.536	79.25	9.97
8/23/2012	58	BarC6	71.450	-157.609	128.69	19.45
8/23/2012	59	BarC7	71.493	-157.675	140.62	14.35
8/23/2012	60	BarC8	71.534	-157.760	63.59	
8/23/2012	61	BarC9	71.575	-157.839	40.44	
8/23/2012	62	BarC10	71.613	-157.916	85.86	5.81
8/23/2012	66	H38	71.611	-159.360	219.16	10.84
8/23/2012	67	CBL14	71.373	-159.414	55.50	16.88
8/23/2012	70	H37	71.547	-160.671	sediment chl only	15.88
8/23/2012	71	CBL15	71.722	-160.701	sediment chl only	9.03

Figure 3. Integrated chlorophyll data.



Inorganic nutrients were also collected from the CTD rosette and filtered shipboard. These samples were returned to CBL, and nutrient analysis is now underway. Water samples for $^{18}O/^{16}O$ ratios were also collected on a sub-set of stations on the Distributed Biological Observatory transect line across Barrow Canyon and will be analyzed at CBL using a stable isotope mass spectrometer. Sampling for water column methane was also undertaken from the rosette bottles by Katherine Marshall.

Surface sediments were collected throughout the cruise from the top of the van Veen grab before it was opened to minimize disturbance of surface sediments. These collections included determinations of inventories of chlorophyll a in surface sediments (Figure 4) shipboard, using a 12 hour incubation in the dark at 4°C and similar measurement as with water column measurement described above. Other sediments were collected were collected to determine C/N ratios and grain size. A separate sediment sample was collected to assay surface sediments for ostracod abundance (see Laura Gemery sub-report).

Organisms in each grab from which surface sediments were collected were also returned to CBL for a Ph.D. thesis (Mengjie Zhang) project that involves food web analysis using amino acids extracted from various food web components. Additionally four quantitative grabs were collected and sieved for determinations of species composition and biomass. These infaunal organisms were preserved in formalin and will be returned to CBL for taxonomic and biomass analysis after the Healy returns to Seattle.

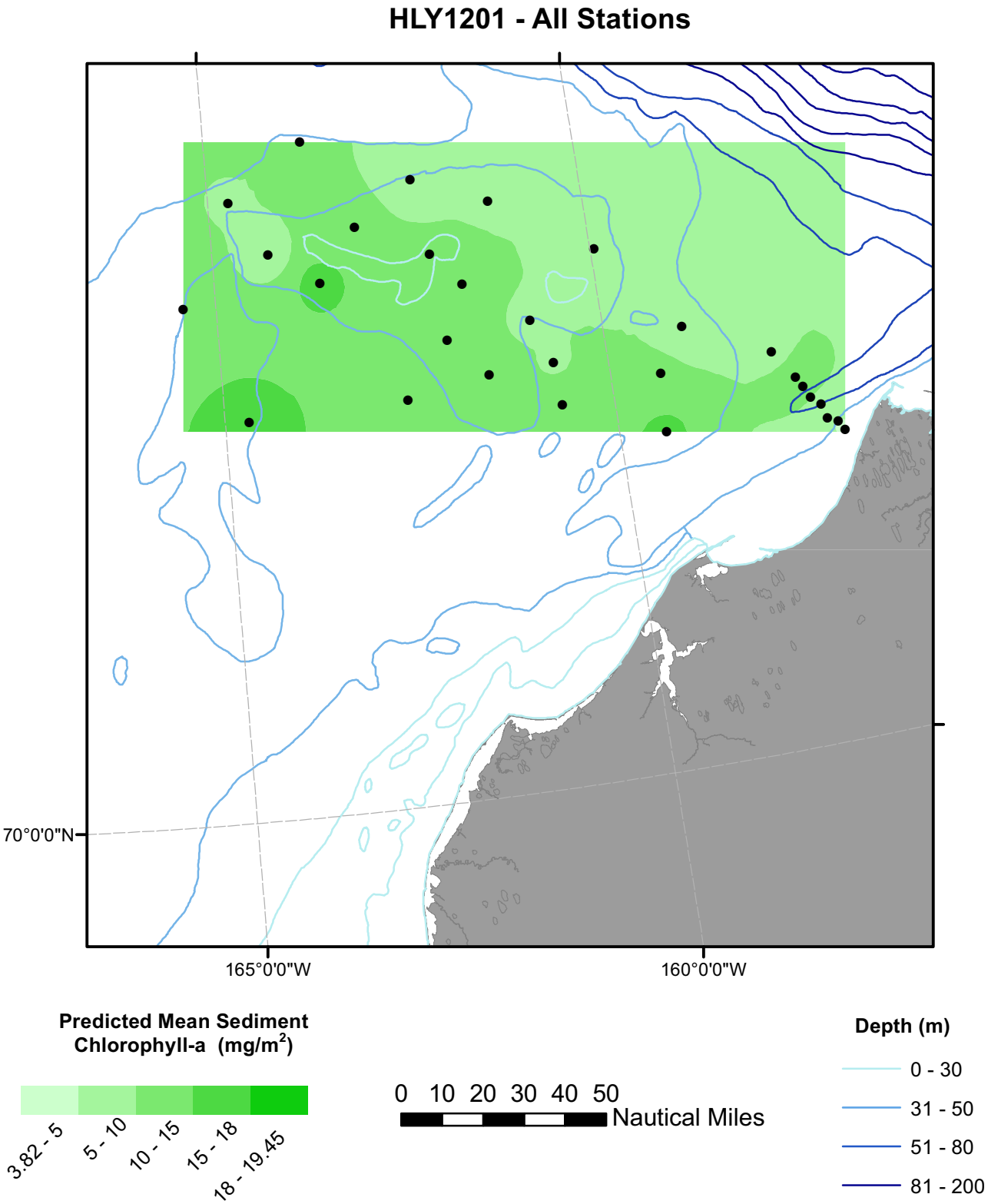
Replicate sediment cores were collected by the single or multiple HAPS coring systems and used for shipboard incubations in the dark and at in-situ bottom water temperatures using one of the temperature controlled chamber rooms on Healy. Oxygen utilization, as well as inorganic nutrient and inorganic carbon exchange were all measured during these incubations.

HAPS core and gravity core collections were used to support measurements of sedimentation rates. Cores were sectioned and canned in calibrated geometric containers and will be returned to CBL after Healy returns to Seattle. Radiogenic isotopes such as ^{137}Cs and ^{210}Pb will be counted at CBL using two low background gamma spectometers in order to determine sedimentation rates. Cores were also used to determine pore water methane concentrations by Katherine Marshall.

At each station where it was practical, and dependent upon sea state and ice conditions, a submersible video camera system was lowered to the seafloor to document the epibenthic communities at each station. These video clips were used by the University of Alaska Fairbanks research trawling team, and will also be analyzed on a semi-quantitative basis to estimate organisms per square meter and/or to characterize the epibenthic communities at each location sampled.

Finally, we thank the PolarTREC program and teacher Deanna Wheeler for the invaluable help to the CBL research group throughout the cruise. She provides provides an account of her educational outreach activities in a separate part of the cruise report.

Figure 4. Integrated sediment chlorophyll data.



USGS

Laura Gemery, PI (on-board team)
U.S. Geological Survey at Reston, Virginia, U.S.A.

This USGS project, in collaboration with several institutions (University of Maryland, Ohio State University), are using ostracodes and other microfauna found in surface sediment samples and Arctic sediment core records to assess 1.) shelf ecosystem response to changing oceanographic conditions the last century and 2.) climatic impacts on Arctic Ocean circulation, sea level, temperature and sea ice.

During HLY1201, 48 Van Veen grabs and 3 HAPS core tops (top few centimeters) were collected from sites on the Chukchi continental shelf (see table of sample locations below). Samples were immediately frozen for future processing and analysis at the USGS lab. Ostracodes present in these grabs and coretops will be quantitatively analyzed using multivariate quantitative and clustering techniques.

Ostracodes are small, bivalved crustaceans whose shells, or valves, are made up of calcium carbonate in the form of the mineral calcite, which also contains minor amounts of magnesium. Continental shelf seafloor sediments of the Chukchi Sea contain primarily one type of ostracode: Podocopids. Podocopid ostracodes are bottom-dwelling species, some living at the sediment–seawater interface (epifaunal) and others living in the substrate just below the interface (infaunal).

Many marine ostracode species live within narrowly defined environmental tolerance limits, and their distribution on the seafloor is governed by variables such as the temperature, salinity, oxygen concentration and nutrients in the water column and the type of sediments on the seafloor.

Another objective is to study ostracodes in gravity core sections, which were collected by Dr. Lee Cooper on this cruise. When samples become available, and if ostracodes are found downcore, they can aid in paleoceanographic reconstruction of this area over the last few centuries, depending on the sedimentation rate and chronology established for these cores.

Sample list:

Station Number	Station Name	Date	Type
6	H24	8/13/12	GRAB
6	H24	8/13/12	DGRAB
7	CBL11	8/13/12	GRAB
7	CBL11	8/13/12	DGRAB
9	H21	8/14/12	GRAB
9	H21	8/14/12	DGRAB
10	H10	8/14/12	GRAB

10	H10	8/14/12	DGRAB
11	H30	8/15/12	GRAB
11	H30	8/15/12	DGRAB
11	H30	8/15/12	XHAPS
19	H6	8/16/12	GRAB
19	H6	8/16/12	DGRAB
20	H8	8/16/12	GRAB
20	H8	8/16/12	DGRAB
25	H4	8/17/12	GRAB
25	H4	8/17/12	DGRAB
26	H14	8/17/12	GRAB
26	H14	8/17/12	DGRAB
30	H2	8/18/12	GRAB
30	H2	8/18/12	DGRAB
31	H5	8/18/12	GRAB
32	H3	8/18/12	GRAB
32	H3	8/19/12	DGRAB
37	H1	8/19/12	GRAB
37	H1	8/19/12	DGRAB
38	H19	8/19/12	GRAB
38	H19	8/19/12	DGRAB
45	H16	8/20/12	GRAB
45	H16	8/20/12	DGRAB
45	H16	8/20/12	XHAPS
46	H20	8/20/12	GRAB
46	H20	8/20/12	DGRAB
52	CBL11	8/21/12	GRAB
52	CBL11	8/21/12	DGRAB
53	BarC1	8/22/12	GRAB
54	BarC2	8/22/12	GRAB
55	BarC3	8/22/12	GRAB
56	BarC4	8/22/12	GRAB
57	BarC5	8/22/12	GRAB
58	BarC6	8/23/12	GRAB
59	BarC7	8/23/12	GRAB
60	BarC8	8/23/12	GRAB
61	BarC9	8/23/12	GRAB
62	BarC10	8/23/12	GRAB
66	H38	8/23/12	GRAB
66	H38	8/23/12	DGRAB

67	CBL14	8/23/12	GRAB
67	CBL14	8/23/12	XHAPS
70	H37	8/24/12	GRAB
72	CBL15	8/24/12	GRAB

Epibenthic Communities of Hannah Shoals

Brenda Konar, PI
Brenda Konar, Alexandra Ravelo and Kimberly Powell on-board team
University of Alaska Fairbanks

The epibenthic component of the Hannah Shoals study had a very successful first cruise. The goal of this component is to describe the community structure of the organisms that inhabit the surface of the substrate within the Hannah Shoals study area. To accomplish this goal, epibenthic trawls were completed with a plumb staff beam trawl at 21 stations within the study area between Aug 13 and 24, 2012 (Table 8). Water depths ranged from 28.6 to 65 m. Most trawls dragged the bottom for 2.5 minutes, although some had shorter trawls (1 minute 15 seconds) due to anticipated rich epibenthic communities and thick mud or gravel. Eleven trawls were subsampled due to high catches. Trawl distances were calculated from latitude and longitude and ranged from 9.45 to 0.89 km. While ship speed can be kept consistent, wind and currents cannot. Because of this, trawl catches will be standardized by distance trawled. Photographs were taken of most catches.

All epibenthic organisms within each trawl were identified to the lowest possible taxa (usually species), weighed, and counted. For organisms that can be measured (length), size frequencies were also recorded. True crabs (snow and lyre crabs) were sexed and all data collected were recorded by sex. Gravid females were also noted. A total of 93 taxa were identified during the cruise. The number of taxa will likely change as some organisms, particularly gastropods, were vouchered and will be brought back to UAF for further identification.

Of the stations trawled, three were sampled during the previous COMIDA study of the Chukchi Sea. These resampled stations will allow for a preliminary investigation of inter-annual variation and can be considered to be the beginning of a long-term data set for these types of data in this region.

The trawl team would like to thank the ship's crew. We particularly appreciate the assistance provided by the MSTs. Specifically, Kurt, Liz, and Jeremy were a pleasure to work with. We found them extremely competent and very hard working. It was a delight coming out to the back deck to trawl when they were on duty. I would like to mention that this was the first cruise (out of the last three) where I was deploying this gear and no spreader bars were bent and no net was lost. Thank you.

Table 8. Stations sampled by date.

Station number	Station name	new vs repeat	date	water depth (m)	Distance trawled	subsample?	photo?
6	H24	new	8/13/2012	41.3	9.45 km	no	yes
7	CBL11	repeat	8/13/2012	46.6	3.9 km	no	yes
9	H21	new	8/14/2012	52.6	4.77 km	no	yes
10	H10	new	8/14/2012	45.6	6.87 km	no	yes
11	H30	new	8/15/2012	65	2.51 km	yes: 1/3	yes
19	H6	new	8/16/2012	41	2.18 km	no	yes
20	H8	new	8/16/2012	42	0.98 km	no	yes
25	H4	new	8/17/2012	45.3	5.89 km	yes: 1/2	no
26	H14	new	8/17/2012	46	2.08 km	yes: 1/4	yes
28	H2	new	8/18/2012	33.5	.89 km	no	yes
31	H5	new	8/18/2012	28.6	2.24 km	yes: 1/2	no
32	H3	new	8/18/2012	42.4	1.31 km	yes: 1/3	yes
37	H1	new	8/19/2012	43.8	1.0 km	no	yes
38	H19	new	8/19/2012	45.8	1.07 km	yes: 1/3	yes
45	H16	new	8/20/2012	41.4	1.12 km	yes: 1/2	yes
46	H20	new	8/20/2012	46.2	8.39 km	no	no
52	H32	new	8/21/2012	54	1.48 km	no	yes
62	BarC10	new	8/22/2012	65	.89 km	yes: 1/2	yes
66	H38	new	8/23/2012	53	.97 km	yes: 1/2	yes
67	CBL14	repeat	8/23/2012	51.7	1.05 km	yes: 1/6	yes
72	CBL15	repeat	8/24/2012	46	8.12 km	yes: 1/2	yes

Trophic Structure and Carbon Flow in Benthic and Pelagic Food Webs

Ken Dunton, PI
Ken Dunton, Philip Bucolo, Susan Schonberg, Jordann Young and Susan Saupe, on-board team
University of Texas at Austin Marine Science Institute, UTMSI

During the HEALY1201 COMIDA cruise, the University of Texas at Austin Marine Science Institute (UTMSI) contingent, Ken Dunton, Susan Shonberg, Philip Bucolo, Jordann Young and Susan Saupe of Cook Inlet Regional Citizens Advisory Council, Anchorage AK, sampled physical, chemical, and biological parameters of water column, surface sediments, and the associated fauna of the eastern Chukchi Sea. The primary focus of these efforts was to elucidate the trophic structure of the system while identifying benthic infauna to the lowest possible taxonomic level and to define the carbon budgets of the benthic and pelagic communities. This was largely accomplished through the collection of primary producers (phytoplankton and sediment associated microalgae), primary and higher trophic level consumers, and the analysis of their $\delta^{13}C$ and $\delta^{15}N$ isotopic signatures. Additionally, the respiration rates and possible photosynthetic rates of the benthic community was measured to provide an estimate of oxygen production of microphytobenthos and the overall carbon demand of the community. These results will serve as a baseline to assess the current state of the Chukchi system and future ecological changes resulting from natural and/or anthropogenic sources:

Collections and analysis of pelagic hydrology, phytoplankton and zooplankton

Vertical profiles of station hydrography measuring salinity, temperature, dissolved oxygen, turbidity, chlorophyll *a* and pH were recorded from 22 stations (Table 9) using a YSI SONDE 6600 during CTD water column collection casts. During these casts, we also collected water from 5 m below the surface, the depth of chlorophyll *a* maximum concentration, and 5 m above benthos. Water was filtered onto three 25mm GF/F filters per depth and immediately frozen to assess:

1) Particulate organic carbon and nitrogen (C:N) to quantify natural abundances of water column $\delta^{13}C$ and $\delta^{15}N$.
2) Water column chl *a* concentrations quantifying pigment concentrations at these depths across the region.
3) Phaeophytin, and phaeophorbide indicative of chl *a* senescence in the water column.

A 20 µm plankton tow and 250 µm zooplankton ring net tow were deployed at 23 and 26 stations respectively (Table 9). Phytoplankton was filtered and immediately frozen for isotopic $\delta^{13}C$ and $\delta^{15}N$ analysis at UTMSI. Zooplankton samples were sorted, identified, and frozen for isotopic $\delta^{13}C$ and $\delta^{15}N$ analysis at UTMSI.

Collection and analysis of surface sediments

Surface sediments (1-2 cm) were subsampled via 20 cc or 60 cc syringe core from double van Veen grabs deployed at 20 stations (table 9). Cores targeted:

1) sediment chl *a* concentrations (20 cc)
2) C:N for $\delta^{13}C$ and $\delta^{15}N$ isotopic analysis (20 cc)

3) sediment NH_4^+ (60 cc)
4) chl *a* breakdown products phaeophytin, and phaeophorbide indicative of chl *a* senescence of the benthos (20 cc)

Two replicate samples for each parameter were collected at all 20 stations (Table 9) and immediately frozen for future analysis. Multi Happs Cores were collected at 4 stations (Table 9) and incubated to quantify respiration and possible photosynthetic rates of the microphytobenthos at a series of PAR treatments.

Benthic infaunal and epifaunal invertebrate collections

Benthic infaunal invertebrates were collected from three replicate van Veen grabs from 20 stations (Table 1). Samples were sieved using a low-flow sieve table to ensure gentle handling of soft-tissue invertebrates (*i.e*. polychaetes) to aid in taxonomy. Soft-tissue organisms were identified to lowest possible taxonomic level onboard the Healy. All sorted and identified samples were preserved in 10% ethanol. Relatively hard-bodied organisms (*e.g*. bivalves and amphipods) were preserved in 10% ethanol to be identified later at UTMSI. All samples will be used to create an inventory of species occurrence and to develop a quantitative assessment of spatial patterns of abundance, biomass and diversity of the benthic infaunal communities. One additional van Veen grab was collected and sieved to provide infaunal invertebrates for isotopic analyses. Samples were sorted, identified, dried at 60°C, and transported to UTMSI for future $\delta^{13}C$ and $\delta^{15}N$ analyses.

In collaboration with Dr. Konar's team, invertebrate samples were collected from each 3m beam trawl. A selection of organisms were collected from each trawl based on several factors such as their ubiquity across the study area, their trophic level and/or feeding mode, their uniqueness within the study area, and their inclusion in previous Arctic studies. Organisms were sorted, identified, dried at 60°C, and transported to UTMSI for future $\delta^{13}C$ and $\delta^{15}N$ analyses.

Benthic Fish Collections

Separate fish trawls were not conducted for this survey. However, all fish caught in the 3m beam trawl by Dr. Konar's epibenthic invertebrate component were separated and immediately sorted by species, measured, and frozen for future examination. For some species, subsamples were provided from the catch to other researchers as part of the overall Hanna Shoal COMIDA project (e.g. for metals and organic chemical contaminants and for stable isotope analyses).

Fish were collected from each of the beam trawls. Although fish caught were small (mainly < 100mm) and sparse (often less than 20 fish per catch), each catch was relatively diverse. Eelblennys (*Anisarchus medius* and *Lumpenus fabricii*), eelpouts (mainly *Lycodes polaris*), snail fish (*Liparis tunicatus*), and arctic cod (*Boreogadus saida*) were fairly ubiquitous across the study area. Other relatively common fish were sculpins (mainly *Gymnocanthus tricuspis),* Bering Flounder (*Hippoglossoides robustus*), and Arctic alligatorfish (*Ulcina orlikii*). At one shallow site where sand dominated the benthic sediments, Pacific sandlance (*Ammodytes hexapteras*) dominated the catch.

Table 9: Station listings and parameters collected at each station for UTMSI while aboard USCGV Healy during COMIDA 2012, Healy cruise 1201.

Station designation	CTD vertical profiles	H_2O filtered: chl a, HPLC, POM at surface, chl peak, 5	Plankton tow (20µ net)	Zooplankton tow (250µ net)	Double van Veen Grab sediment infauna ID, $\delta^{13}C$ and	Multi- Happs Core for sediment O^2 incubation exps	Epibenthic trawl for invert ID, $\delta^{13}C$ and $\delta^{15}N$ and for fish ID, length
1-BRS5	x	x	x	x			x
6-H24	x	x	x	x	x	x	x
7-CBL11	x	x	x	x	x	x	x
9-H21	x	x	x	x	x		x
10-H10	x	x	x	x	x		x
11-H30	x	x	x	x	x		x
19-H6	x	x	x	x	x	x	x
20-H8	x	x	x	x	x		x
25-H4	x	x	x	x	x		x
26-H14	x	x	x	x	x		x
30-H2	x	x	x	x	x		x
31-H5	x	x	x	x	x		x
32-H3	x	x	x	x	x		x
37-H1	x	x	x	x	x		x
38-H19	x	x	x	x	x	x	x
45-H16	x	x	x	x	x		x
46-H20	x	x	x	x	x	x	x
52-H32	x	x	x	x	x		x
53-BARC1				x			
55-BARC3				x			
57-BARC5	x	x	x	x	x		
59-BARC7				x			
61-BARC9				x			
BARC10							x
H37			x		x		
66-H38	x	x	x	x	x		x
67-CBL-14	x	x	x	x			x
71-F3	x	x	x	x			x
CBL15							x

Trace Metal Chemistry

John Trefry, PI
John Trefry, Bob Trocine, Austin Fox and Brenna O'Neill, on-board team
Florida Institute of Technology

Samples of water, suspended matter, bottom sediments and biota were collected to investigate the biogeochemical cycles of several trace metals in the Chukchi Sea. A total of 81 water samples were collected using GO-FLO Niskin bottles at 11 stations (5-10 samples/station, Table 10). The water samples were filtered aboard ship in a laminar flow hood to obtain samples for dissolved and particulate metals and particulate organic carbon. Water samples were collected at the Bering Strait to determine concentrations of dissolved and particulate metals for inflowing water to the Chukchi Sea. The remaining stations were all within the area of Hanna Shoal.

A series of shipboard incubation experiments were carried using water, plankton and bottom sediments collected at 7 stations. Samples for particulate metals (Cd, Cu, Ni, Zn) and inorganic and organic P were collected over a 72-hour period to determine regeneration rates for metals and P.

Surface sediments (0-1 cm) were collected for metal analysis from Van Veen grab samples at 19 stations (Table 10). Sediment box cores were obtained for metal analysis at 9 stations and gravity cores were collected 4 stations (Table 10). The cores were sub-sectioned aboard ship in 1-cm thick layers over the top 10 cm and in 2-cm thick layers at depths >10 cm. These sediments will be analyzed for selected trace metals and some core will be age-dated using ^{137}Cs and excess ^{210}Pb geochronology.

A total of 121 biota samples were collected throughout the study area (Table 10). Samples of muscle tissue from the gastropod *Neptunea heroes* were obtained by collecting pooled samples and grouped by length into the following categories: 2-4 cm, 4-6, 6-8 cm, 8-10 cm and 10-12 cm. Other gastropods were collected from 8 stations. Samples of clam were collected at 28 locations. Samples of whole fish and fish muscle for Arctic cod (*Boreogadus saida)* were collected from 12 stations and samples of claw tissue were collected from the snow crab (*Chinocetes opilio*) were collected at 26 stations. These samples will be analyzed for total and methyl Hg and several other metals.

Table 10. Summary of samples collected in the Chukchi Sea for trace metal analysis during 2012.

Station Name	Station Number	Date	Water	Exp. Water	Zoop	Surface Sed	Sed Core	Sed Core*	Fish Cod	Crabs	Nept	Other Gastro	Bivalve	Anem	Shrimp	Amph
BSR5	1	8/12/2012	8	1												
H24	6	8/13/2012	7		1	1	1	BC_{20}	1	2	1	1	3		1	1
H23	7	8/13/2012		1	1	1			1	2	11		1		1	
H22	8	8/13/2012				1										
H21	9	8/14/2012	8		1	1	2	BC_{20} GC_{80}	1	1	1			1	1	
H10	10	8/14/2012		1	1	1			1	2	1		1			
H30	11	8/15/2012	10		1	1	1	BC_{20}		2	1	1	2	1		
H6	19	8/16/2012	8		1	1	1	BC_{20}	1	2	1	1	1		1	1
H8	20	8/16/2012		1	1	1			1	2	1		2	1	1	
H4	25	8/17/2012	7		1	1	1	BC_{30}	1	2	1		2			1
H14	26	8/17/2012		1	1	1				2			2			1
H2	30	8/18/2012	5		1	1	1	BC_{20}		1			2		1	1
H5	31	8/18/2012				1				1					1	1
H1	37	8/19/2012	7		1	1			1	1	1	1	2		1	1
H19	38	8/19/2012		1	1	1	1	GC_{68}	1	1	1	1	2			1
H16	45	8/20/2012	5		1	1				1	1	1	2		1	1
H20	46	8/20/2012		1	1	1				1					1	1
H32	52	8/21/2012	8		1	1	2	BC_{30} GC_{80}	1	2		1	2			
BC5	57	8/22/2012	8		1	1	1	BC_{20}	1	1			2			
H38	66	8/23/2012				1	2	BC_{20} GC_{76}	1		1	1	2		1	1
		TOTAL	81	7	16	19	13		12	26	22	8	28	3	11	11

* BC = box core. GC = gravity core. Subscripts with BC and GC show core length.

Center for Research in Water Resources Report

David R. Maidment, PI
Johnny Sullivan, on-board team
University of Texas at Austin

The University of Texas at Austin's Center for Research in Water Resources (CRWR) is responsible for coordination of data management for the 2012 COMIDA-Hanna Shoal project. This arm of the project consists of two separate components: data recording during the cruise followed later by processing and archiving of the data. For the former, the principal effort is the maintenance of an event log in which is recorded the category, time into and out of the water, geographic coordinates, and bottom depth of each sampling event that took place during the cruise. This geospatial information is critical for analysis of all data collected, and having it managed by a single entity prevents errors inherent in the keeping of multiple records.

Additionally, the temporal component facilitates an examination of the efficiency with which operations were carried out, an aspect critical to preparation for future cruises. From the data collected in the event log, the average time required for each sampling event was calculated (Table 11). This is only the time that the sampling apparatus was actually submerged in the water and includes neither any setup time before sampling nor processing time after the sample was collected. These additional amounts of time are significant but could not be calculated because the times were not part of the event log recordings.

Table 11. Average time in minutes that each sampling event was in the water during the 2012 Hanna Shoal cruise.

Event	Average Time in Water (min)
CTD	10.6
Benthic Camera	11.8
Phytoplankton Net	6.9
Bongo Net	6.2
Ring Net	5.2
van Veen Grab	3.7
Double van Veen Grab	3.9
HAPS Core	3.3
Multi-HAPS Core	4.6
Box Core	5.9
Gravity Core	4.5
Beam Trawl	23.7

It is also useful to look at the total time each station was occupied. The stations were categorized as either "full" stations, which included either all or nearly all sampling events, and "minor" stations, which typically consisted of only a CTD and Bongo net (see the event

log 'Time Analysis' worksheet for a complete list of the station types). The minor stations were completed quickly, with an average occupation time of 30 minutes. The full stations, on the other hand, were significantly longer. The average occupation time of a full station was 331 minutes, or approximately 5.5 hours. Much of that time was comprised of setup, processing, or repositioning of the ship; the wind and current were constantly influencing the ship's position, and it had to be repositioned periodically to ensure it was within an acceptable distance from the station center: 2 nm for water sampling events and 0.5 nm for sediment events. Figure 5 shows the total occupation time of each full station. The blue portion of the bar accounts for the total time sampling events were in the water, and the red portion accounts for all other periods of time.

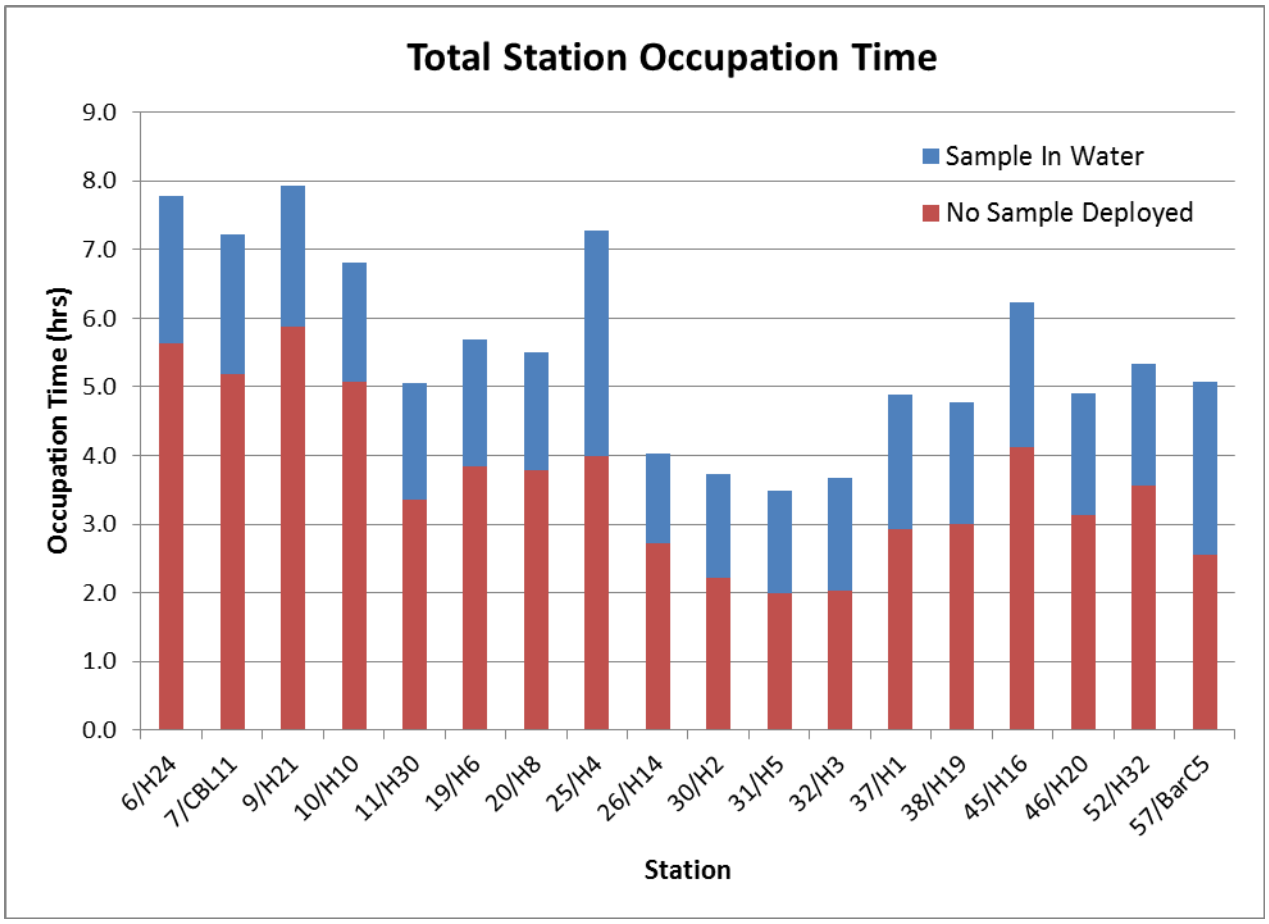


Figure 5. Total occupation time in hours for each full station during the 2012 Hanna Shoal cruise.

This figure makes clear that a substantial portion of the time spent at each station is taken up not by sampling, but instead by secondary processes (shown in red). Although it is unknown exactly what portion of this secondary process time is due to repositioning of the ship, two repositions per station was typically the minimum, usually taking at least 30 minutes each. It is unlikely that either the in-water or setup/processing time for each sampling event can be

improved to any significant extent. As such, the potential for time savings exists in reducing the number of sampling events and the time spent on ship logistics, like repositioning.

After the cruise is complete and the PIs have organized their data, it is sent to CRWR for processing and archival. The data is first transformed from the PI-submitted Excel files into a format compatible with the Observation Data Model (ODM) database. ODM is a relational database model developed by the Consortium of Universities for the Advancement of Hydrologic Science Information (CUAHSI) to enable the streamlined organization of observed data. It is based on various controlled vocabularies, also developed by CUAHSI, which ensure that all researchers use the same terminology. Certain metadata required by the ODM is also added to the Excel files at this stage. When this is complete, the data is loaded into the ODM database, exported to spreadsheets, and these files are sent to the PIs for review. If errors are found, these are corrected and the process is repeated. Once the data files are finalized, they are submitted to the National Oceanographic Data Center (NODC) for permanent archival. Also, CRWR uses the data to create various maps that display key findings by the Hanna Shoal researchers. Figure 6 summarizes this component of the data management process.

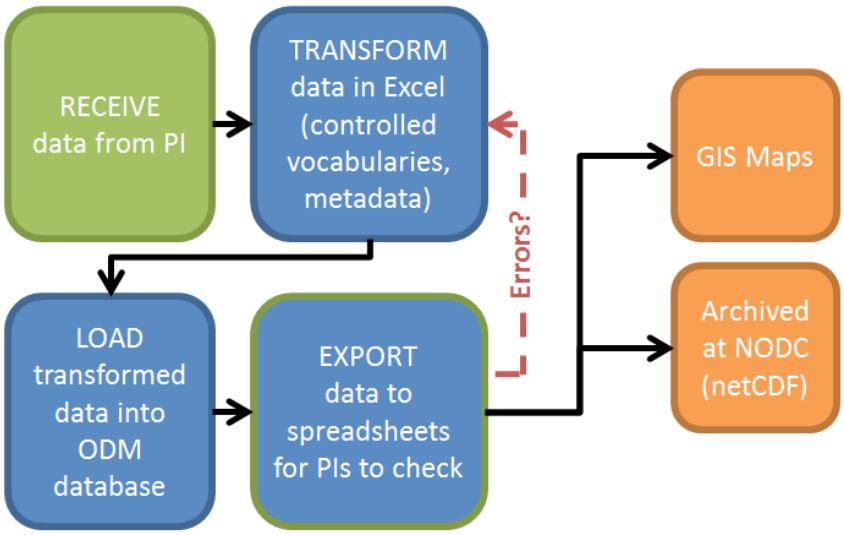


Figure 6. Summary of data processing and archival process conducted by CRWR.

Marine Mammal Watch Summary

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National Oceanic and Atmospheric Administration

A watch for marine mammals was conducted from the bridge of the HEALY (height = 18.3m) during transits between sampling stations, whenever viewing conditions permitted. Most watches were conducted between 0730 and 2130, and included scans around the ship at ~hourly intervals when the ship was on station. The lone marine mammal watch stander was aided in spotting mammals by seabird observers, as well as the ship's crew. The purpose of the marine mammal watch is to detect marine mammals and identify sightings to species at a temporal and spatial sampling scale coincident with the oceanographic sampling. The overarching goal is to improve integration of higher-trophic species with measures of biophysical variability in the Pacific Arctic marine ecosystem.

A total of 81.5 hours of watch effort was completed, with roughly 60 hours in the Hanna Shoal study area. Watch effort was curtailed by fog, which frequently reduced viewing range to < 1km, a distance where visual surveys are usually suspended. In addition, the Hanna Shoal study required long on-station sampling periods, when only short around-the-ship scan sampling could be conducted.

A marine mammal sighting summary provides totals of the number of sightings/number of animals seen, by species (Table 12) and general maps are shown in Figures 7. Highlights included observations of eight polar bears, including two sow-cub pairs and one large male feasting on a bearded seal (21 August). Walruses were the principal species detected, due largely to the prevalence of sea ice over Hanna Shoal. Most walrus were seen resting on sea ice extending from the Hanna Shoal 'cap' and along the south and southeastern flank of the shoal. In addition to resting walrus, there were several observations of very dense in-water surface-active groups (dubbed 'walrus spas'); also noted, the synchronous diving of 'braces' of 3-5 walrus females with calves 'tucked' between their shoulders. Bearded seals were seen throughout the study area, but were especially prevalent near the Hanna Shoal 'cap' (18 August) and along the trackline connecting the eastern-set of three oceanographic moorings (21 August). Ringed seals and unidentified pinnipeds were also noted throughout the study area.

At the outset of the cruise, tens of humpback whales and six Dall's porpoise were seen north of Unimak Pass (9 August), and tens of gray whales were seen in northern Chirikov Basin (11 August) in the Bering Sea. However, few whales were seen in the Hanna Shoal study area. One bowhead whale was seen (13 August) on the western side of the study area near station H 23 (CBL 11). Gray whale sightings were most prevalent along the coast at and south of Barrow (22 August), as has been reported by aerial survey crews. In addition 3 gray whales were seen

offshore Pt. Hope (12 August) and there was one sighting of three gray whales on the eastern side of Hanna Shoal (21 August). One dead cetacean was seen in the south-central Chukchi Sea on 12 August (69 43.6N, 166 41.2W). The dead whale was bloated and quite decomposed, but was judged to be a minke from overall size and the shape of the head and tail stock. The carcass appeared to be missing it's lower jaw, indicative of orca predation. Of note, two dead gray whales were seen on 12 August and 16 August, during aerial surveys west of Barrow. Both of these whales appeared to be killed by orca, w/ lower jaws missing and stripped of blubber. Subsequently, 13 orca were seen on 21 August, during aerial surveys northeast of Barrow; this is notable due to interest in the role of orca predation on cetacean populations as reduced sea ice provides greater access for the predators.

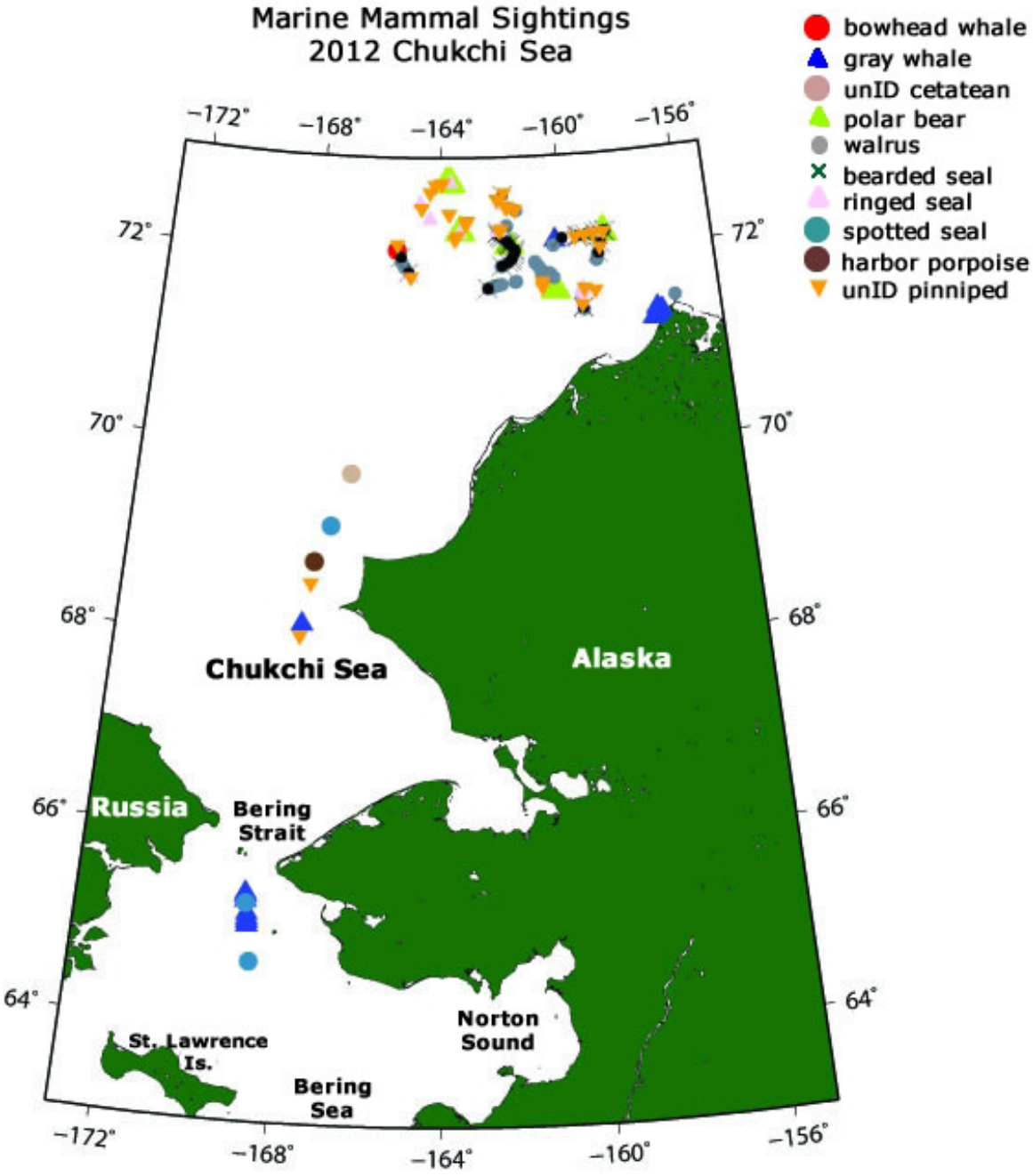
Table 12. HEALY 1201: Marine Mammal Watch Summary

Hours of watch effort (EFT) and number of sightings/number of animals, by species

KEY: BH=bowhead whale; GW=gray whale; HW=humpback whale; FW=fin whales; KW=killer whale; HP=harbor porpoise; DP=Dall's porpoise; CT-unID Cetacean [dead]; WS=walrus; BS=bearded seal; RS=ringed seal; SP=spotted seal; PN=unID Pinniped; PB=polar bear

DATE	EFT	BH	GW	HW	HP	DP	CT	WS	BS	RS	SP	PN	PB
8/9	3.8			4/57		1/6						1/1	
8/10	3.5			*likely			1/1					1/ 2	
8/11	9.2		7/21								2/2		
8/12	5.2		1/3		1/1		1/1				1/2	2/2	
8/13	2.5	1/1						2/90	2/2			2/2	
8/14	3.2									2/2		1/1	
8/15	5.5									1/1		5/5	2/2
8/16	3.7									1/1		5/6	1/1
8/17	5.0							1/7	1/1	1/1		5/8	
8/18	9.8							11/326	14/24	3/3		2/3	1/2
8/19	3.1								1/1				
8/20	4.7							7/331	1/1				1/2
8/21	7.7		1/3					3/40	10/16	1/1		5/8	1/1
8/22	5.5		9/55										

Figure 7. Marine mammal sightings.



Marine Bird and Mammal Surveys

Dr. Kathy Kuletz, PI
Kathy Kuletz and Martin Reedy, on-board team
Maps by Elizabeth Labunski
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Background

In conjunction with the COMIDA project, M. Reedy and K. Kuletz surveyed marine birds and mammals concurrent with oceanographic and biological sampling conducted onboard the *USCGC Healy*. Surveys were conducted while the ship transited from Dutch Harbor, through the Bering Strait, during COMIDA sampling of the Hanna Shoal study area, and final transit to Barrow. Processed data will be archived in the North Pacific Pelagic Seabird Database (USFWS and USGS, Anchorage, Alaska) and with the Bureau of Ocean Energy Management (BOEM). These surveys were funded by BOEM under project title 'Seabird Distribution and Abundance in the Offshore Environment'.

Methods

Surveys were conducted using U.S. Fish and Wildlife Service North Pacific Pelagic Seabird Observer Protocols. Observations were made from the port side of the bridge during daylight hours while the ship was underway. An observer scanned the water ahead of the ship using hand-held 10x binoculars when necessary for identification and recorded all birds and mammals within a 300-m, 90° arc from the bow to the beam. We used strip transect methodology and three distance bins extending from the vessel: 0-100 m, 101-200 m, and 201-300 m. During this cruise we frequently had to reduce the transect window to 200 m or 100 m due to heavy fog, and in some cases could not survey at all. Unusual sightings beyond 300 m or on the starboard side ('off transect') were recorded for rare birds, large bird flocks, and mammals. We recorded the animal's behavior (flying, on water, on ice). Birds on the water were counted continuously, whereas flying birds were recorded during quick 'Scans' of the transect window, with scan intervals based on ship speed. Observations were entered directly into a GPS-integrated laptop computer using the program DLOG3 (Ford Ecological Consultants, Inc.). Location data was also recorded automatically at 20 second intervals, and included continuous records on weather, Beaufort Sea State, ice coverage, glare, and observation conditions. For this report we divided the surveys into three areas: the Bering Sea (Dutch Harbor to St. Lawrence Island), the Bering Strait (north side of St. Lawrence Island and through the Bering Strait) and Hanna Shoal (transits among Hanna Shoal stations and the Barrow DBO line).

Preliminary Results

We conducted surveys 9 – 24 August 2012, although this report only summarizes surveys through 22 August. During this time we completed 60 transects covering approximately 1540 km, of which 523 km were in waters with some ice. We recorded a total of 25,085 birds on transect and an additional 45,845 birds off transect, with short-tailed shearwaters accounting for 88% of all birds on transect (Table 13). We identified a total of 27 species, with the highest species richness in the Bering Sea (27 spp). The Bering Strait and Hanna Shoal regions had 17 species each (Table 14). Based on a rough approximation of density using linear km surveyed, the Bering Sea was exceptionally high (~52 birds/km) due to shearwaters, which accounted

for 95% of all identified birds in that region. If shearwaters were not included, the remaining species in the Bering Sea had ~ 0.6 birds/km surveyed. The Bering Strait had ~ 3 birds/km and the Hanna Shoal region ~ 1 birds/km surveyed.

Large numbers of shearwaters (all identified were short-tailed shearwaters) predominated near Dutch Harbor, and were dispersed in low numbers throughout the cruise, with high numbers also observed where we crossed the Barrow Canyon near Barrow (Fig. 8). Northern Fulmars, common murres and thick-billed murres were also ubiquitous, with highest murre counts in the Bering Strait region (Fig. 9). The *Aethia* auklets were abundant, with least and parakeet auklets primarily in the Bering Strait region and crested auklets more common in the Bering Sea and Hanna Shoal regions (Table 14, Fig. 10). Black-legged kittiwakes, while ubiquitous, were most common in the Hanna Shoal area (Table 14), where they appeared to be primarily immature birds and were often associated with ice floes, walrus, and polar bears. The auklets and shearwaters are primarily planktivorous and the kittiwakes and murres are primarily piscivorous, although euphausiids can comprise a large proportion of the diet of thick-billed murres, kittiwakes, and shearwaters.

The relatively high densities of murres and *Aethia* auklets in the Bering Strait region were likely due to large seabird colonies on St. Lawrence Island, the Diomede islands and coastal bluffs from Cape Thompson to Cape Lisburne. In the Bering Strait region many of the murres were observed carrying fish in their bills, indicating they were still provisioning chicks at the colonies. On August 13, in the northern portion of the Bering Strait region we encountered a high proportion of *Aethia* auklets, mainly crested auklets, which did not appear able to fly and may have been molting. This potential auklet molting area was about 150 km NW of Icy Cape (Fig. 10).

Glaucous gulls, black-legged kittiwakes, Sabine's gulls, and fulmars were observed taking advantage of Arctic cod dislodged from under ice floes by passage of the Healy, and we made a concerted effort to avoid counting birds following or attracted to the vessel, but their habits may have resulted in higher counts for these species.

We recorded 12 species of marine mammals, with 218 animals on transect, primarily walrus. Another 3,125 mammals were recorded off transect, with 2,983 of those being walrus (Table 15). The 'off transect' walrus counts were augmented by observations contributed by Sue Moore, who was conducting marine mammal watches from the bridge. The walrus were all observed among and on ice floes in the Hanna Shoal area, particularly on the southern edge of the shoal (Fig. 11). Six polar bears were recorded, with two on transect and four (including two large cubs) recorded off transect. In two instances the polar bears were feeding on seal kills. An additional unattended seal kill was observed on an ice floe.

Non-marine birds that landed on the ship included a northern wheatear (which died and was salvaged), an eastern yellow wagtail, and four snow buntings. We salvaged an arctic tern near Barrow; the tern flew to the ship with an injured wing and died the following day.

Table 13. Total marine birds counted on and off transect during HLY1201 COMIDA (9 – 22 August, 2012).

Group	Common Name	*Latin Name*	Total on Transect			Total off Transect
				with shearwaters	without shearwaters	
			N	**Percent**	**Percent**	**N**
Loons	Unid. Loon	*Gavia spp*	1	0.00	0.05	3
Procilarids	Northern Fulmar	*Fulmaris glacialis*	106	0.42	5.14	2
	Short-tailed Shearwater	*Puffinus tenuirostris*	22,082	88.03		26,135
	Unid. dark shearwater	*Puffinus spp.*	941	3.75		18,545
	Fork-tailed Storm-petrel	*Oceanodroma furcata*	22	0.09	1.07	
	Unid. Storm-petrel	*Oceanodroma spp.*		0.00	0.00	2
Seaducks	Black Brant	*Branta bernicla*	40	0.16	1.94	62
	Unid. Eider	*Somateria spp.*		0.00	0.00	644
	White-winged Scoter	*Melanitta fusca*	8	0.03	0.39	39
Shorebirds	Ruddy Turnstone	*Arenaria interpres*	6	0.02	0.29	
	Rock Sandpiper	*Calidris ptilocnemis*	42	0.17	2.04	
	Western Sandpiper	*Calidris mauri*	7	0.03	0.34	
	Red-necked Phalarope	*Phalaropus lobatus*	18	0.07	0.87	8
	Unid. Phalarope	*Phalaropus spp.*	36	0.14	1.75	2
	Unidentified Shorebird	*Charadrii (suborder)*	36	0.14	1.75	9
Jaegers	Parasitic Jaeger	*Stercorarius parasiticus*	7	0.03	0.34	2
	Pomarine Jaeger	*Stercorarius pomarinus*	3	0.01	0.15	2
	Long-tailed Jaeger	*Stercorarius longicaudus*	1	0.00	0.05	2
	Unid. Jaeger	*Stercorarius spp.*	4	0.02	0.19	16
Larids	Glaucous Gull	*Larus hyperboreus*	27	0.11	1.31	6
	Glaucous-winged Gull	*Larus glaucescens*	6	0.02	0.29	1
	Unidentified Gull	*Family Laridae*	1	0.00	0.05	7
	Black-legged Kittiwake	*Rissa tridactyla*	158	0.63	7.66	75
	Red-legged Kittiwake	*Rissa brevirostris*	1	0.00	0.05	
	Sabine's Gull	*Xema sabini*	13	0.05	0.63	5
	Arctic Tern	*Sterna paradisaea*	3	0.01	0.15	
Alcids	Common Murre	*Uria aalge*	308	1.23	14.94	
	Thick-billed Murre	*Uria lomvia*	103	0.41	5.00	
	Unidentified Murre	*Uria spp.*	59	0.24	2.86	2
	Pigeon Guillemot	*Cepphus columba*	14	0.06	0.68	
	Ancient Murrelet	*Synthliboramphus antiquus*	2	0.01	0.10	
	Parakeet Auklet	*Aethia psittacula*	122	0.49	5.92	1
	Crested Auklet	*Aethia cristatella*	264	1.05	12.80	60
	Least Auklet	*Aethia pusilla*	467	1.86	22.65	
	Unid. Small Dark Alcid	*Aethia spp.*	47	0.19	2.28	210
	Horned Puffin	*Fratercula corniculata*	37	0.15	1.79	2
	Tufted Puffin	*Fratercula cirrhata*	60	0.24	2.91	
	Unid. Puffin	*Fratercula spp.*	2	0.01	0.10	
	Unid. Alcid	*Family Alcidae*	31	0.12	1.50	
	Total Birds		**25,085**			**45,842**

Table 14. Marine bird observations, on transect only, for the three sub-regions used for seabird surveys during the HLY1201 COMIDA cruise, 9 – 22 August 2012.

		Dutch Harbor to St. Lawrence Is.		North St. Lawrence through Bering Strait		Hanna Shoal study area	
Common Name	***Latin Name***	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Unid. Loon	*Gavia spp*		0.00		0.00	1	0.15
Northern Fulmar	*Fulmaris glacialis*	58	0.25	27	1.86	21	3.05
Short-tailed Shearwater	*Puffinus tenuirostris*	21,765	94.85	38	2.62	279	40.55
Unid. dark shearwater	*Puffinus spp.*	934	4.07	7	0.48		0.00
Fork-tailed Storm-petrel	*Oceanodroma furcata*	22	0.10		0.00		0.00
Black Brant	*Branta bernicla*		0.00		0.00	40	5.81
White-winged Scoter	*Melanitta fusca*		0.00	8	0.55		0.00
Ruddy Turnstone	*Arenaria interpres*	6	0.03		0.00		0.00
Rock Sandpiper	*Calidris ptilocnemis*		0.00	42	2.89		0.00
Western Sandpiper	*Calidris mauri*		0.00	1	0.07	6	0.87
Red-necked Phalarope	*Phalaropus lobatus*	8	0.03		0.00	10	1.45
Unid. Phalarope	*Phalaropus spp.*		0.00	4	0.28	32	4.65
Unidentified Shorebird	*Charadrii (suborder)*	35	0.15	1	0.07		0.00
Parasitic Jaeger	*Stercorarius parasiticus*	3	0.01	1	0.07	3	0.44
Pomarine Jaeger	*Stercorarius pomarinus*		0.00	3	0.21		0.00
Long-tailed Jaeger	*Stercorarius longicaudus*	1	0.00		0.00		0.00
Unid. Jaeger	*Stercorarius spp.*	1	0.00	1	0.07	2	0.29
Glaucous Gull	*Larus hyperboreus*		0.00	1	0.07	26	3.78
Glaucous-winged Gull	*Larus glaucescens*	6	0.03		0.00		0.00
Unidentified Gull	*Family Laridae*		0.00		0.00	1	0.15
Black-legged Kittiwake	*Rissa tridactyla*	24	0.10	20	1.38	114	16.57
Red-legged Kittiwake	*Rissa brevirostris*	1	0.00		0.00		0.00
Sabine's Gull	*Xema sabini*	5	0.02		0.00	8	1.16
Arctic Tern	*Sterna paradisaea*	2	0.01		0.00	1	0.15
Common Murre	*Uria aalge*	28	0.12	265	18.26	15	2.18
Thick-billed Murre	*Uria lomvia*	9	0.04	90	6.20	4	0.58
Unidentified Murre	*Uria spp.*	4	0.02	52	3.58	3	0.44
Pigeon Guillemot	*Cepphus columba*		0.00	14	0.96		0.00
Ancient Murrelet	*Synthliboramphus antiquus*	2	0.01		0.00		0.00
Parakeet Auklet	*Aethia psittacula*	2	0.01	116	7.99	4	0.58
Crested Auklet	*Aethia cristatella*	2	0.01	156	10.75	106	15.41
Least Auklet	*Aethia pusilla*		0.00	466	32.12	1	0.15
Unid. Auklet	*Genus Aethia*	2	0.01	43	2.96	5	0.73
Horned Puffin	*Fratercula corniculata*	6	0.03	30	2.07	1	0.15
Tufted Puffin	*Fratercula cirrhata*	19	0.08	40	2.76	1	0.15
Unid. Puffin	*Fratercula spp.*		0.00	2	0.14		0.00
Unid. Alcid	*Family Alcidae*	1	0.00	23	1.59	4	0.58
Total Birds on Transect		**22,946**		**1,451**		**688**	**25,085**

Table 15. Numbers of marine mammals recorded on and off transect for three sub-regions during seabird surveys on the HLY1201 COMIDA cruise, 9 – 22 August 2012.

		Dutch Harbor to St. Lawrence Is.		St. Lawrence Is. through Bering Strait		Hanna Shoal study area	
		Number		Number		Number	
Common Name	***Latin Name***	**on**	**off**	**on**	**off**	**on**	**off**
Dahl Porpoise	*Phocoenoides dalli*	3	8				
Harbor Porpoise	*Phocoena phocoena*				1		
Beluga Whale	*Delphinapterus leucas*				1		
Bowhead Whale	*Balaena mysticetus*						1
Fin Whale	*Balaenoptera physalus*						
Grey Whale	*Eschrichtius robustus*			3	11	3	39
Humpback Whale	*Megaptera novaeangliae*	1	5				
Northern Fur Seal	*Callorhinus ursinus*	1					
Ringed Seal	*Phoca hispida*					7	8
Spotted Seal	*Phoca largha*			1			
Bearded Seal	*Erignathus barbatus*					6	37
Unidentified Seal	*Family Phocidae*			2	1	14	13
Unidentified Pinniped	*Pinnipedia spp.*	1	1			9	12
Walrus	*Odobenus rosmarus*					165	2,983
Polar Bear	*Ursus maritimus*					2	4
Total marine mammals		**6**	**14**	**6**	**14**	**206**	**3,097**

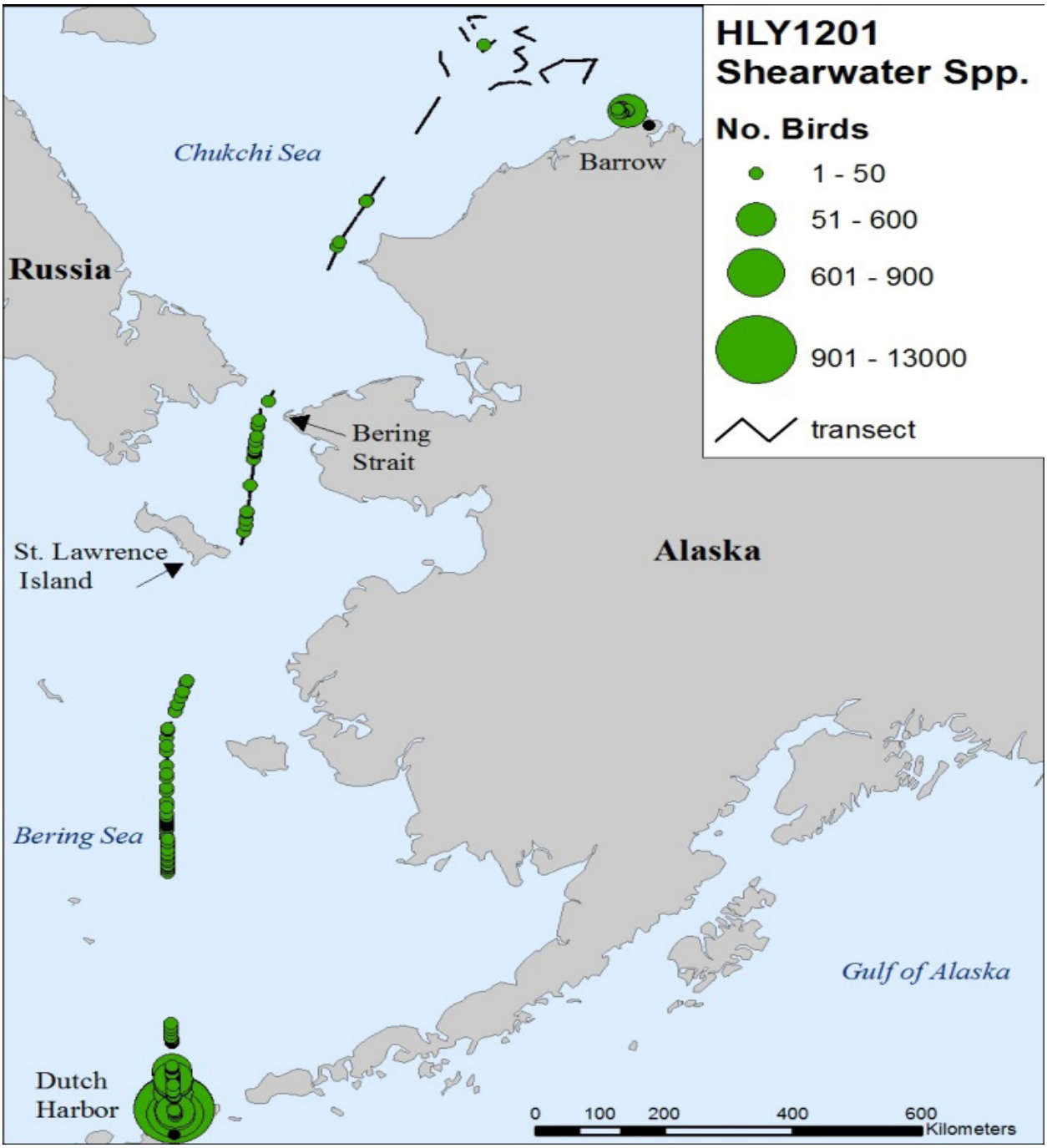

Fig. 8. Shearwater observations during HLY1201. Black lines indicate transects.

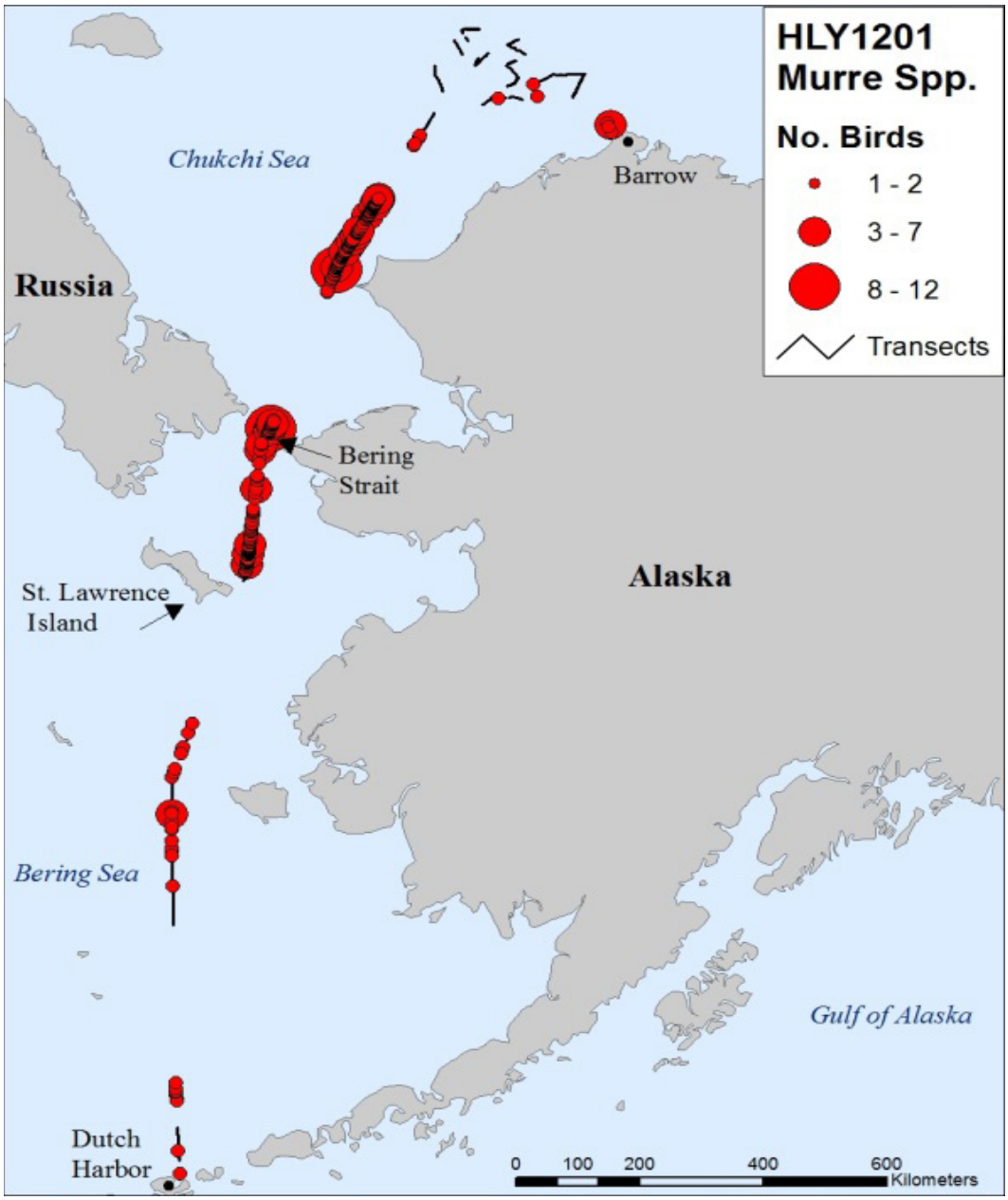

Fig. 9. Common and thick-billed murre observations during HLY1201.

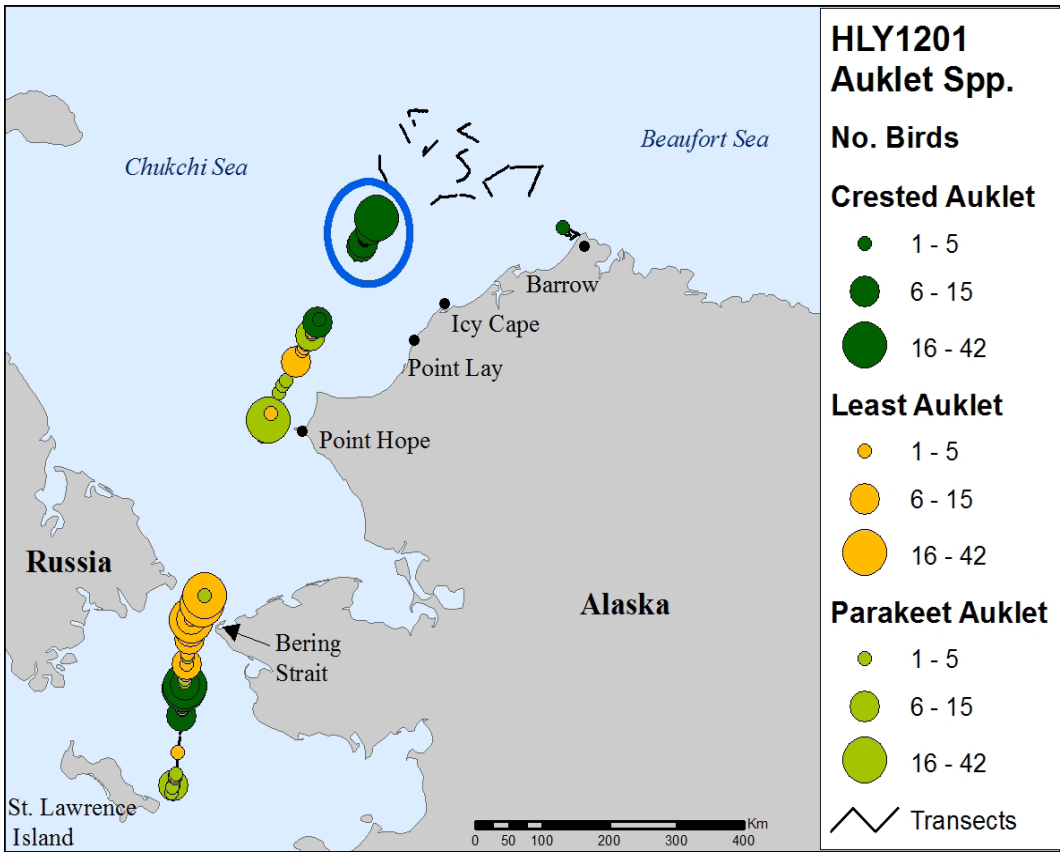

Fig. 10. Observations of Aethia auklets, on transect, during the HLY1201 cruise, for the Bering Strait and Hanna Shoal areas. The blue oval marks the area where many auklets appeared to be flightless and may have been molting.

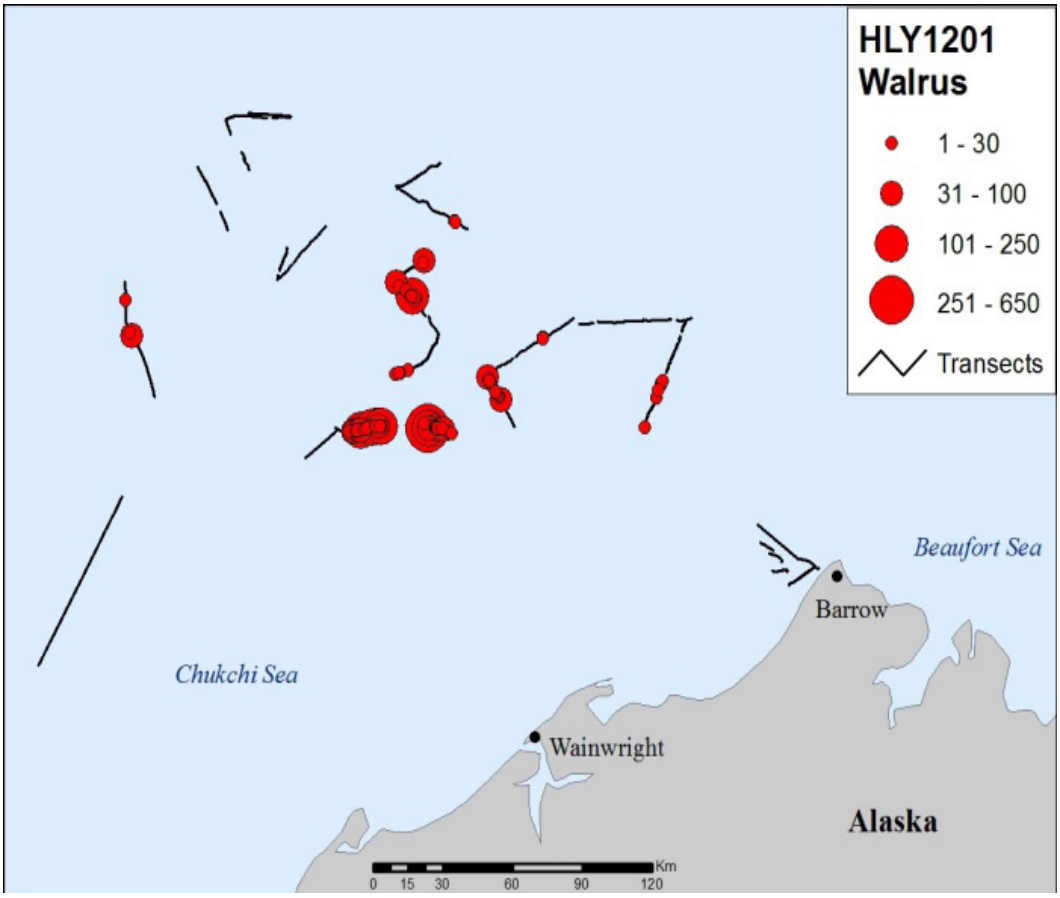

Fig. 11. Walrus observations, on and off transect, during HLY1201.

PolarTREC Teacher Final Report

Deanna Wheeler, Teacher, on-board team

Throughout the Healy 1201 expedition, I was able to participate in the ongoing research. Direct participation included work in the following areas: marine mammal observations, benthos, plankton, optics, and epi-benthos. The opportunity to spend extended amounts of time with each project area assisted me with public outreach.

Public outreach about the expedition started in June 2012, which included email notifications with press releases to groups in southern Maryland. The groups included area watershed groups, Sierra Club, The Nature Conservancy, Southern Maryland Audubon Society, and Maryland DNR. The Charles County Public Schools publicized the expedition in its newsletters with follow-up system-wide emails each week. The Maryland Independent and the Massillon (Ohio) Evening Independent published articles about the expedition. In addition, 19 presentations were given prior to the expedition in schools and at a senior center.

Onboard the Healy, public outreach occurred via the Internet. The science aboard the ship was reported in journal form at http://www.polartrec.com/expeditions/ecosystem-study-of-the-chukchi-shoal. 25 journals were posted that include 115 photos and 18 videos. The PolarTREC website was visited by individuals, schools, and Coast Guard families. Expedition updates were posted on Facebook and Polar Educators International.

Additional outreach programs include visitations to schools and classrooms and several public presentations as well as collaborative events with J. C. Parks and Drs. Cooper and Grebmeier.

The Board of Lies

Sun Aug 12 06:02:01 UTC 2012

Updated every two minutes

Screen shots from Polar Trec online journal (http://www.polartrec.com/expeditions/ecosystem-study-of-the-chukchi-shoal).

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POLAR TREC TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

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Expeditions

Ecosystem Study of the Chukchi Shoal

Overview | Ask the Team | Journals | Photos | Resources

Meet the Team

Open All | Close All

Teacher - Deanna Wheeler

J. C. Parks Elementary School
Indian Head, Maryland
United States

Passionate about land and water, Deanna Wheeler is inspired to make sure that "no child is left inside". Hands on, real science is her priority. From hatching, raising, and releasing yellow perch and horseshoe crabs to participating in a pilot sturgeon project, her students discover how connected they are to the world around them. Ms. Wheeler's love of learning and the outdoors meld together in her professional and personal life. She is dedicated as a teacher and as a citizen to better understand and protect the environment for positive impacts on individuals, the community, and the health of our environment. Ms. Wheeler cherishes time spent with her family, exploring, camping, kayaking, reading, and just having fun.

Researcher - Lee Cooper

Journals

August 27, 2012 Wake Up! Was it a Dream?

Arctic – Homebound- Was I just in the Arctic on Saturday and now I am at home on the couch with the family and dog? Traveling by air can make the sense of time and place surreal. I can imagine that before air travel, people had a connection to the land and changes in the landscape as they...

Read Full Journal

August 23, 2012 A Piece of the Bottom-- A Picture of the Past

Gravity Cores by Dr Lee Cooper Dr. Lee Cooper The gravity core is an instrument shaped like a missile. It is designed to forcibly enter a meter or more into the sediments. We are primarily using it to collect long, small diameter cores that are suitable for measuring sedimentation rates.

Read Full Journal

August 22, 2012 Going to the Zoo—the Copepod Zoo with Carin Ashjian

Zooplankton Project by Dr. Ashjian- Dr. Carin Ashjian, scientist at Woods Hole Institute of Oceanography, at her microscope Zooplankton are small animals that live in the water and that swim so slowly that they cannot swim against the ocean currents.

Read Full Journal

August 21, 2012 Haps! You've got it!

Coring the bottom- Let's see if you can shout "Haps" after reading this journal. The Haps Corer is the instrument used by teams studying the bottom of the Chukchi Sea. Simply, it is a tube that is forced into the bottom and removes a cylinder of sediment, which is called a core. On Team Benthos,...

Project Information

Funded Title: Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) Hanna Shoal Ecosystem Study
Location: USCGC Healy, Hanna Shoal, northwest of Barrow, Alaska on the Chukchi Sea
Start: 3 August 2012
End: 25 August 2012

Where are They?

The Healy icebreaker crosses the Chukchi Sea

The team will live and work from the United States Coast Guard Icebreaker Healy. The USCGC Healy is a research vessel designed to conduct a wide range of research activities and can break through 4 ½ feet of ice continuously. The team will travel to the Hanna Shoal, northwest of Barrow, Alaska in the Chukchi Sea, which may be a sensitive ecological system close to areas planned to be exploited for oil and gas exploration.

What are they Doing?

Raising a Conductivity, Temperature and Depth (CTD) Sensor

The northern Chukchi Shelf receives large inputs of organic matter from the highly productive shelf regions of the North Pacific and from local sources of primary production, including algae in the ice and sediment and phytoplankton in the water column. As a result, highly productive biological "hotspots" have been documented in the vicinity of Hanna Shoal. Because of the biological significance of this region and its importance for oil and gas exploration and development, the team is planning a multi-disciplinary investigation to examine the biological, chemical and physical properties that define this ecosystem.

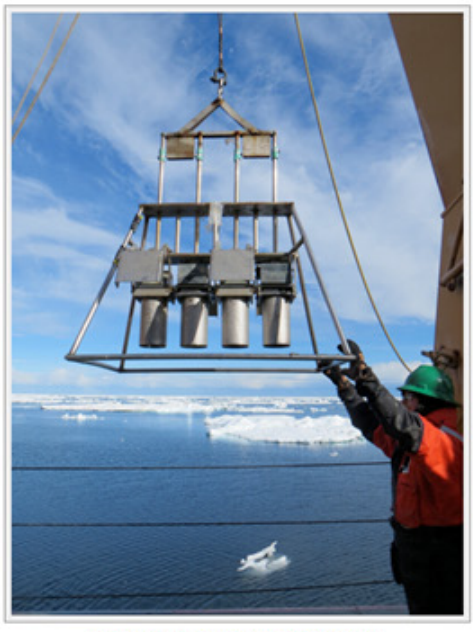
Previous work in the area has profiled the biogeochemistry of the northern Chuckhi sea but this study will focus more particularly on the Hanna Shoal region, looking at phytoplankton and zooplankton in the open ocean as well as the physical oceanography through direct measurement of circulation, density fields and ice conditions.

August 21, 2012 Haps! You've got it!

Coring the bottom-

Let's see if you can shout "Haps" after reading this journal. The Haps Corer is the instrument used by teams studying the bottom of the Chukchi Sea. Simply, it is a tube that is forced into the bottom and removes a cylinder of sediment, which is called a core. On Team Benthos, we use 2 different types of Haps Corer, a single and a 4-cylinder multi corer.

Cores of the bottom can be used for a many experiments including:
- what types of organisms live in the sediment and where in the sediment
- how many of each organism are living in the sediments
- if micro algae are producing oxygen
- what trace metals are in the sediments and quantity
- what isotopes and and quantity
- how much carbon there is
- other analysis such as nitrogen, methane, and other chemicals



MST deploys the 4-cylinder Multi-Haps Corer

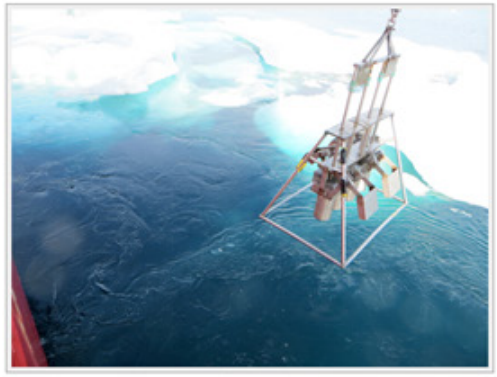
Details

Author: Deanna Wheeler
Expedition: Ecosystem Study of the Chukchi Shoal
Location: Chukchi Sea
Latitude: 72.0369
Longitude: -159.167
Weather Summary: Partly sunny turning to overcast and rain
Temperature: 40.0° F
Wind Chill: 31° F
Wind Speed: 9mph

‹ PREVIOUS 22 of 25 NEXT ›

- Choose a Journal -

Lee and the MST watch the 4-cylinder Multi-Haps corer over the life lines



4-cylinder Multi-Haps Corer hovering over the water