<u>RUSALCA - BERING STRAIT AON 2011 MOORING CRUISE REPORT</u> Russian Research Vessel Professor Khromov (also called Spirit of Enderby) *Nome, 12th July 2011 – Nome, 23rd July 2011*

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and the RUSALCA 2011 Science Team

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(Photo by Aleksey Ostrovskiy)

(Photo by R Woodgate)

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Science Coordinators: *Kathleen Crane, NOAA, USA, and Aleksey Ostrovskiy, Group Alliance, RF.*
Chief Scientist: *Rebecca Woodgate, University of Washington (UW), US.*

As part of the joint US-Russian RUSALCA (Russian US Long-term Census of the Arctic Ocean) Program and Bering Strait AON (Arctic Observing Network), a team of US and Russian scientists undertook a 11-day oceanographic cruise in July 2011 on board the Russian vessel 'Khromov', operated by Heritage Expeditions (under the name of Spirit of Enderby).

SUMMARY:

The major objective of the cruise was mooring work in the Bering Strait region, i.e., the recovery and redeployment of 8 moorings, a joint project by the University of Washington (UW), the University of Alaska, Fairbanks (UAF), and the Arctic and Antarctic Research Institute (AARI). The US portion of the mooring work is supported by an NSF-OPP AON (Arctic Observing Network) grant (PIs: Woodgate, Weingartner, Whitledge and Lindsay) with shiptime and logistical support from the NOAA RUSALCA (Russian-US Long-term Census of the Arctic) program. The moorings measure water velocity, temperature, salinity, ice motion, ice thickness (crudely) and some bio-optics.

During the 2011 cruise, the 5 moorings in US waters were successfully recovered. The 3 moorings in Russian waters were unable to be recovered and were left in the water recording data for recovery in 2012, likely by dragging. A total of 8 moorings were deployed on the 2011 cruise – 5 at the sites previously occupied in US waters, 2 at new mooring sites within the US channel of the strait and 1 ~ 4nm north of the Diomede Islands, in a region hypothesized to be an important eddying and mixing regime from analysis of satellite data.

The secondary objectives of the cruise were station work, primarily CTD work with sampling for nutrients, chlorophyll, DON (Dissolved Organic Nitrogen), and DIC (Dissolved Inorganic Carbon), pCO2, and total Alkalinity but also including primary productivity casts and net tows for zooplankton. Also, marine mammal observations were made from the bridge by dedicated observers.

Weather conditions were good for the majority of the cruise, although fog was common and CTD operations were suspended for ~ ¾ day due to sea state. Overall, the mooring operations went smoothly, leaving time for completing 11 CTD lines in a ~ 7 day period, as described below. To the best of our knowledge, this is the first extensive quasi-synoptic spatial survey of the Chukchi Sea in almost a decade (the last extensive surveys were in 2003 and 2004 from the Alpha Helix [*Woodgate*, 2003; *Woodgate*, 2004]). In addition to a large scale water mass survey of the region, the repeat of several lines (and several stations) will allow for quantification of variability. In particular, the CS line is a DBO (Distributed Biological Observatory) line and was run by the CCGC Laurier just prior to our occupation of it. This cruise also completed the first high resolution (~ 1nm) survey of the eddying region just north of the Diomede Islands. For full station coverage, see map and listings below.

Summary of CTD lines.

BS (US portion)– the main Bering Strait line, run at the start and at the end of the cruise. This line has been occupied by past RUSALCA mooring cruises. US portion only run here.

DI – a new high resolution line running north from the Diomede Islands to study the hypothesized eddy and mixing region north of the islands.

AL (US portion)– another previously-run line, just north of the Strait, running from the Russian coast, through the mooring site A3, to where the main channel of the strait shallows on the eastern (US) side. US portion only run here

AS – a new line, run from the eastern end of the AL line towards the NNW.

CS (US portion) - another cross strait line, run here from the convention line to Point Hope (US).

LIS – from Cape Lisburne towards the WNW, a previous RUSALCA line and close to the CP line occupied in previous Bering Strait cruises in 2003 and 2004

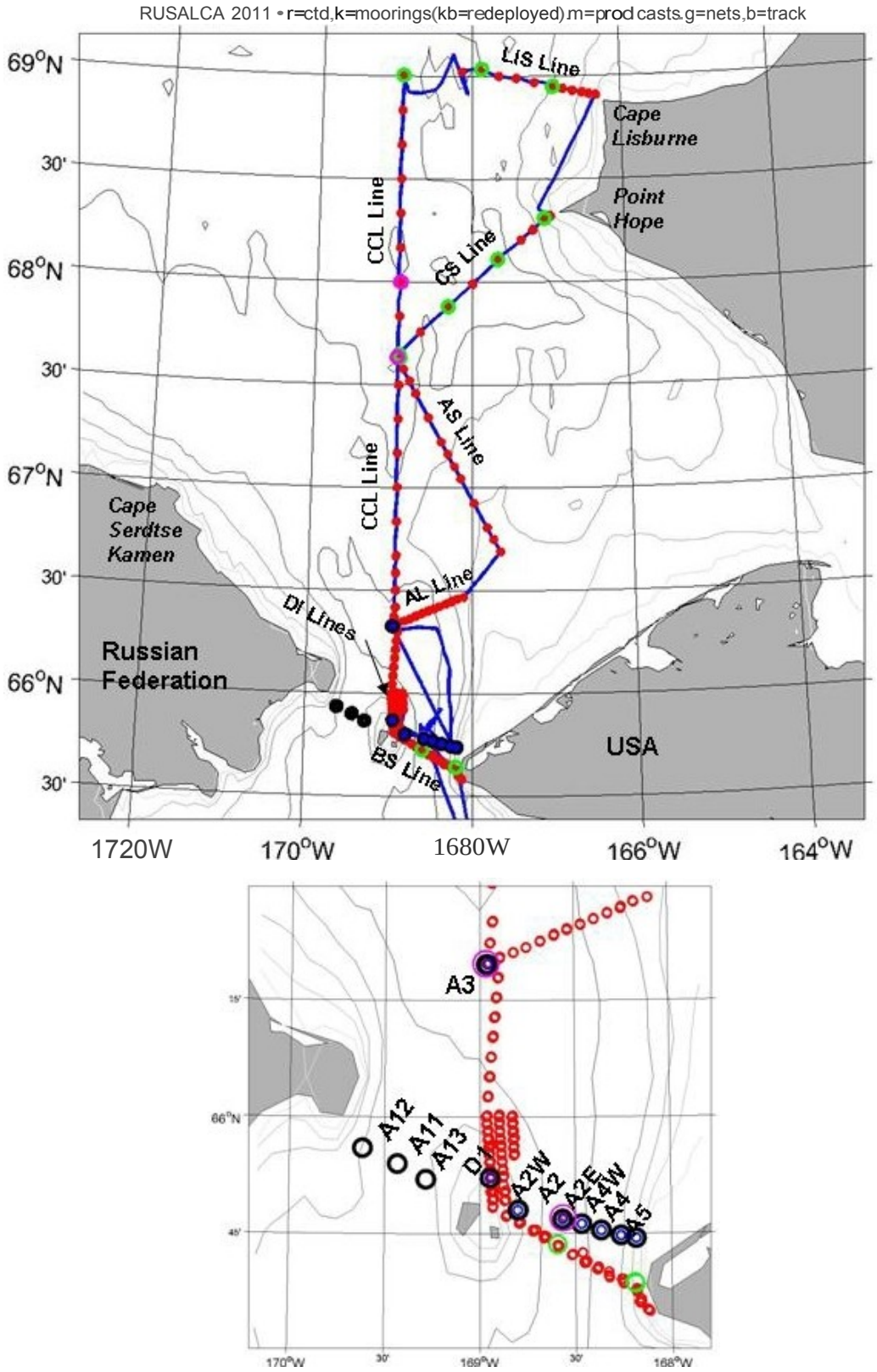
CCL – a line running down the convention line from the end of the LIS line towards the Diomedes (also run in 2003 and 2004) , incorporating a rerun of the high resolution DI line at the southern end.

DIa and DIb – two more new high resolution lines, mapping the eddying/mixing region.

Finally, the US portion of the BS line was rerun at the end of the cruise.

International links: Maintaining the time-series measurements in Bering is important to several national and international programs, e.g., the Arctic Observing Network (AON) started as part of the International Polar Year (IPY) effort; NSF's Freshwater Initiative (FWI) and Arctic Model Intercomparison Project (AOMIP), and the international Arctic SubArctic Ocean Fluxes (ASOF) program. The mooring work also supports regional studies in the area, by providing key boundary conditions for the Chukchi Shelf/Beaufort Sea region; a measure of integrated change in the Bering Sea, and an indicator of the role of Pacific Waters in the Arctic Ocean. Furthermore, the Bering Strait inflow may play a role in Arctic Ocean ice retreat [*Woodgate et al.*, 2010] and variability (especially in the freshwater flux) is considered important for the Atlantic overturning circulation and possibly world climate [*Woodgate et al.*, 2005].

RUSALCA 2011 MAP: *Ship-track, blue. Mooring sites, black. 2011 deployments, black with blue centers. CTD stations, red. Zooplankton nets, green Productivity casts, magenta Depth contours every 10m from the International Bathymetric Chart of the Arctic Ocean {Jakobsson eta/., 2000].*



RUSALCA 2011 SCIENCE PARTICIPANTS

1.	Kathleen Crane (F)	NOAA	*Program Manager, NOAA*
2.	Vladimir Bakhmutov (M)	SRNHI	*Expedition Leader*
3.	Aleksey Ostrovskiy (M)	GA	*Liaison and translator*
4.	Rebecca Woodgate (F)	UW	*US Chief Scientist*
5.	Jim Johnson (M)	UW	*UW Mooring lead*
6.	Cecilia Ferriz (F)	UW	*UW graduate student, CTD and moorings*
7.	Cynthia Travers (F)	UW	*UW graduate student, CTD and moorings*
8.	David Leech (M)	UAF	*UAF Mooring lead*
9.	Jonathan Whitefield (M)	UAF	*UAF graduate student, CTD lead*
10.	Jeremy Kasper (M)	WHOI/UAF	*UAF Moorings, water sampling*
11.	Dan Naber (M)	UAF	*UAF moored sampler, moorings, water sampling*
12.	Dean Stockwell (M)	UAF	*UAF water sampling*
13.	Fred Prahl (M)	OSU	*OSU pH pCO2 mooring and water sampling*
14.	Paul Walczak (M)	OSU	*OSU pH pCO2 mooring and water sampling*
15.	Nikita Kusse-Tiuz (M)	AARI	*AARI Moorings and CTD*
16.	Maria Pisarev (F)	SIO	*SIO student, CTD and moorings*
17.	Elizaveta Ershova (F)	UAF	UAF *Zooplankton Nets*
18.	Kate Stafford (F)	UW	*Marine Mammal & moored acoustic recorder*
19.	Sarah Mussoline (F)	WHOI	*Marine Mammal & moored acoustic recorder*
20.	Sergei Yarosh (M)	FERHRI	*Technical Support*
21.	Iouri Pashenko (M)	FERHRI	*Technical Support*
22.	Alexander Murayvev (M)	FERHRI	*Technical Support*

NOAA – National Ocean Atmosphere Administration, US
SRNHI – State Research Navigational Hydrographic Institute, RF
GA – Group Alliance, RF
UW – University of Washington, US
UAF – University of Alaska, Fairbanks, US
WHOI – Woods Hole Oceanographic Institute, US
OSU – Oregon State University, US
AARI – Arctic and Antarctic Research Institute, RF
SIO – Shirshov Institute of Oceanology, RF
FERHRI - Far Eastern Regional Hydrometeorological Research Institute, RF

RUSALCA 2011 CRUISE SCHEDULE (all times Alaskan Daylight Time)

Friday 8th July 2011	*UW mooring team (Rebecca, Jim, Cecila, Cindy) arrive Nome*
Saturday 9th July 2011	*UW Instrument prep, Dave L arrive Nome*
Sunday 10th July 2011	*UW Instrument prep, Fred, Paul, Jeremy, Maria, Jonathan, Kate arrive*
Monday 11th July 2011	*Rest of science party arrive. Ship docks late evening.*
Tuesday 12th July 2011	Start on-load ~ 830am, Leave around noon into bad weather Transit to A2, ship drill
Wednesday 13th July 2011	On site A2 at 925am, recover A2-10 On site A2W at 1110am, recover A2W-10 On site A4W at 130pm, recover A4W-10 On site A4 at 305pm, recover A4-10 (required 2nd release) Drift in night, then steam to A3 for am
Thursday 14th July 2011	On site A3 at 835am, A3-10 release confirmed but not released Recover A3-10 by dragging (once released, towed by small boat) Prep A3-11, Deploy at 2pm, steam south Deploy A4-11 at 630pm Deploy A2-11 at 830pm Drift in the night, then steam to A4W for am
Friday 15th July 2011	Deploy A4W-11 at 930am Deploy A2W-11 at 1130am Deploy D1-11 at 2pm Deploy A2E-11 at 330pm Deploy A5-11 at 440pm Drift while preparing CTD, then steam to A2 for am
Saturday 16th July 2011	Prod cast at A2 at 830am, steam to US end of BS line Run BS line east to west with nets at BS22 and BS16 1130am – 9pm Run DI line north starting 915pm
Sunday 17th July 2011	Finish DI line S of A3 at 730am Prod cast at A3 at 830am, Talk with CCGC Laurier. Run A3 line to the east, starting 915am ending 6pm. Steam to new AS line Run AS line NWN, starting 8pm
Monday 18th July 2011	Finish AS line at 715am Prod cast at CS10US at 830am, 2 Nets at CS10US (1 miscast) Run CS line to the east, starting 1020am, ending 9pm (last station in strong current and increasing wind) Steam to Cape Lisburne
Tuesday 19th July 2011	Run LIS line to the west, starting at 145am, steaming into wind with nets at LIS6 and LIS 10 Abort LIS line at LIS11 due to bad weather Steam S into wind to do CTD maintenance, drift waiting for weather.
Wednesday 20th July 2011	Run CCL line to the south starting from CCL22 at 3am, incl net Prod cast at CCL16 at 1:30pm, Net at CCL14

Thursday 21th July 2011	Complete CCL line at A3 at 545am at A3. Run DI line to south from 545am to 8pm Run DIa line to north starting at 815pm
Friday 22th July 2011	Finish DIa line at DIa12 at 0115am Run DIb line to south at 145am, break off at Dib7 at 5am, Steam to BS12 Run BS line to east from BS12 at 630am with excursion to A2 Finish BS line at BS24 at 6pm. Steam for Nome
Saturday 23th July 2011	Arrive off Nome ~ 7am. Dock at 9am Offload complete ~ 4pm.
Sunday 24th July 2011	*All science party off ship by ~ 9am. Some leave Nome*
Monday 25th July 2011	*Remaining science party leave Nome*

Days at sea (away from Nome): ~ 11 days at sea (11.5 counting on and offload)

Moorings recovered/ deployed:	***5/8***
CTD casts:	***157***
Primary Productivity stations:	***4***
Zooplankton Nets:	***11***

SCIENCE COMPONENTS OF CRUISE

The cruise comprised of the following science components:

- Mooring operations

Mooring operations were a joint UW, UAF, AARI operation, assisted by other cruise members.

- CTD operations

CTD operations were led by the UAF team, assisted by other cruise members.

-Water and Net sampling

Water samples were taken by UAF and OSU teams, assisted by other cruise members, at various sites for various components, as per the following table.

Line	**Nut.** *Naber*	**Chl** *Naber*	**DON** *Naber*	**PP** *Stockwell*	**Phyto** *Flint*	**DIC** *Bates*	**pCO2, DIC & Total Alk.** *Prahl*	**ZNet** *Ershova*
A2				A2				
BS (to west)	All	All	Half		Half	Half	Half (BS23,21, etc to 11)	BS22,16
DI (to north)	Half	-	-	-	-	-		-
AL (to east)	All	All	Half	A3	Half	Half	Half (A3; then AL13,15, etc to 23)	-
AS (to north)	Half	-	-	-	-	-	-	-
CS (to east)	All	All	Half	CS10US	Half	Half	-	CS10US (2x) CS12,14,17
LIS (to west)	All	All	-	-	Half	-	-	LIS6,10
CCL (to south	All	All	-	CCL 16	-	-	A3 (cast 103)	CCL22,14
DI (to south)	Half	-	-	-	-	-	-	-
DIa (to north)	Half	-	-	-	-	-	-	-
DIb (to south)	Half	-	-	-	-	-	-	-
BS (to east)	All	All	-	-	-	-	-	-
Total	**744**	**496**	**93**	**4**	**47**	**71**	**48**	**11**

From the CTD bottles:

Nutrients (Nut.), Chlorophyll (Chl), Dissolved Organic Nitrogen (DON), and Primary productivity (PP) were sampled by the UAF group, indicated here by Naber and Stockwell for PI Terry Whitledge, UAF.

Phytoplankton (Phyto) samples were taken by the UAF group for Michael Flint of SIO.

Dissolved Inorganic Carbon (DIC) samples were taken for 2 groups

– Nick Bates of Bermuda (in an on-going effort in the strait), and

– Fred Prahl, a new effort, combining also pCO2 and Total Alkalinity (Alk.) measurements.

Zooplankton net tows were taken during the CTD lines using Bongo nets as the thesis project of Elizaveta Ershova, for PI Russ Hopcroft, UAF.

- Whale Observations (including acoustic instruments on the moorings)

UW and WHOI whale observers on the ship took observations of marine mammal and birds and were responsible for the moored acoustic whale recorders.

MOORING OPERATIONS (Woodgate, Johnson, Leech, Kusse-Tiuz)

Background: The moorings serviced on this cruise are part of a multi-year time-series (started in 1990) of measurements of the flow through the Bering Strait. This flow acts as a drain for the Bering Sea shelf, dominates the Chukchi Sea, influences the Arctic Ocean, and can be traced across the Arctic Ocean to the Fram Strait and beyond. The long-term monitoring of the inflow into the Arctic Ocean via the Bering Strait is important for understanding climatic change both locally and in the Arctic. Data from 2001 to 2004 and 2007 suggest that heat and freshwater fluxes are increasing through the strait [*Woodgate et al.*, 2006; *Woodgate et al.*, 2010]. The work completed this summer should tell us if this is a continuing trend.

An overview of the Bering Strait mooring work (including access to mooring and CTD data) is available at http://psc.apl.washington.edu/BeringStrait.html.

Five moorings were recovered on this cruise. These moorings (all in US waters – A2W-10, A2-10, A4W10, A4-10, A3-10) were deployed from the Khromov in summer 2010. The other three moorings deployed by the Khromov in 2010 (A11-10, A12-10, A13-10) in Russian waters were unable to be recovered during this cruise, and remain in the water for recovery in 2012. We anticipate that several of the instruments on those moorings will continue to collect data for at least a portion of the coming year, however biofouling will undoubtedly complicate recovery, requiring dragging for the moorings, and may compromise the salinity data from the 2nd year.

Eight moorings were deployed on this cruise under funding from NSF-AON (Arctic Observing Network) (PIs: Woodgate, Weingartner, Whitledge, Lindsay, ARC-0855748) with ship-time and logistical support from RUSALCA-NOAA (Russian-American Long-term Census of the Arctic, http://www.arctic.noaa.gov/aro/russian-american/). Of these eight deployments, five moorings (A2W-11, A2-11, A4W-11, A4-11, A3-11) were replacements of recovered moorings. Three new sites were also occupied. Two are targeted at better observation of the Alaskan Coastal Current, viz A5-11, inshore of the exiting A4 site; A2E-11, between A2 and A4W. The final mooring D1-11 was placed ~ 4nm north of the Diomede Islands in a region hypothesized from previous ship's ADCP and CTD data and satellite imagery to be a dynamic eddying and mixing zone.

This is the highest resolution array ever placed in the Bering Strait (see map above). Three moorings remain in the western (Russian) channel of the strait (from west to east - A12, A11, A13), one mooring is just north of the islands (D1) and 6 moorings were deployed across the eastern (US) channel of the strait (from west to east - A2W, A2, A2E, A4W, A4, A5). A final 8th mooring (A3) was deployed ca. 35 nm north of the strait at a site proposed as a "climate" site, hypothesized to measure a useful average of the flow through both channels [*Woodgate et al.*, 2007]. Testing this hypothesis is one of the main aims of this work. Other science goals including understanding the physics forcing the flow, and quantifying fluxes of volume, heat, freshwater and nutrients.

All moorings (recovered and deployed) measure water velocity, temperature and salinity near bottom (as per historic measurements). Additionally, 7 of the total 11 moorings (i.e., all eastern channel moorings except A5 and D1; the climate site mooring A3; and the mooring central in the western channel, A11) also carried upward-looking ADCPs (measuring water velocity in 1-2 m bins up to the surface, ice motion, and medium quality ice-thickness) and Iscats (upper level temperature-salinity-pressure sensors in a trawl resistant housing designed to survive impact by ice keels). Bottom pressure gauges were also deployed on the moorings at the traditional east-west mooring extremes of the US channel of the strait (A2W-11 and A4-11), and remaining mooring A12-10 also carries a bottom pressure gauge). Two moorings (A2-11, central eastern channel; and A3-11, the climate site) also carry ISUS nitrate sensors and biowiper Fluorometer/turbidity instruments (as does remaining mooring A12-10). Biowiper Fluorometer/turbudity instruments are also included on moorings A4-11 and A2W-11. Moorings A2W-11 and A3-11 and D1-11 carry whale acoustic recorders. Mooring A3-11 also carries a suite of instruments to measure the inorganic carbon chemistry system in the strait, namely 1) SAMI-pH; 2) seapHox; 3) SAMI-pCO2; and 4) SBE-37. An AARI current meter, mounted in a converted UW seabird vane, was deployed on D1-11, in combination with an Aanderaa RCM. For a full instrument listing, see the table below.

This coverage should allow us to assess year-round stratification in the strait and also to study the physics of the Alaskan Coastal Current, a warm, fresh current present seasonally in the eastern

channel, and suggested to be a major part of the heat and freshwater fluxes [*Woodgate and Aagaard*, 2005; *Woodgate et al.*, 2006]. The current meters and ADCPs (which give an estimate of ice thickness and ice motion) allow the quantification of the movement of ice and water through the strait. The nutrient sampler, the transmissometer, fluorometer and whale recording time-series measurements should advance our understanding of the biological systems in the region. This year also marks the start of year-round measurements of pCO2 and pH in the strait.

2011 Recoveries and Deployments: Mooring operations went smoothly in 2011. For recoveries, the ship positioned ~ 200m away from the mooring such as to drift over the mooring site. Ranging was done from the aft-deck adjacent to the wet-lab. Without exception, acoustic ranges agreed to within 30m of the expected mooring position. Once the ship had drifted over the mooring and the acoustic ranges had increased to > 100m, the mooring was released. This procedure was followed to prevent the mooring being released too close (or underneath) the ship since in previous years the moorings have taken up to 15min to release.

With two exceptions (A4 and A3), all moorings released successfully on the first release attempt. On A4, the first release command was not confirmed acoustically by the instrument, and the mooring did not surface. The second release confirmed release but still the mooring did not surface. A resend of the release code to the first release was finally successful and the mooring was sighted immediately. On recovery, the second release was found to have activated, but the hook had not released and could not be pulled clear by hand. No clear explanation for the hang-up is available. Biofouling was present on recovery, possibly gaining sufficient mechanical advantage to have held the hook in place. Another possibility is that the pin that turns did not turn completely to straight and under certain lateral forces on the release (drag on the mooring) this may have caused it to hang up on the hook. ***Action item: repaint antifouling on releases. Recheck pin alignment on all releases.***

On A3 (a single release), release was confirmed but the mooring did not surface. A dragging operation was set up, laying a grappling anchor and line in a circle of radius ~ 200m around the mooring site, and then hauling in the line. The mooring was sighted about half way through the hauling in, and a small boat was dispatched to drag the mooring back to the ship to prevent the mooring drifting into Russian waters. (To avoid such complications in the future, the redeployed mooring A3-11 was placed 300m further away from the US-Russian convention line of 168 58.7'N). ***Action item: Note moving of A3 mooring position 300m towards the US.***

In all cases bar when the small boat was used, once the mooring was on the surface, the ship repositioned, bringing the mooring tightly down the starboard side of the ship. Two grapples and a pole with a quick releasing hook attached to a line were used to catch the mooring. The line from the hook was fastened onto an extension on the port-crane, and the mooring lifted aboard. If the pick was too long for the crane, a stopper chain on the starboard rail was used. Iscats (present on all recoveries except for A2) were recovered by hand while the top float was lifted clear of the water by the crane.

Mooring deployments were generally done through the aft A-frame, using the ship's trawl wire and block for lifting. The mooring was assembled completely within the A-frame. The ship positioned to steam slowly (~2 knots) into the wind/current. When the ship was approximately 600m from the mooring position, mooring deployment started. The Iscat was deployed by hand and streamed behind the ship. The top pick (usually float) was deployed using a quick release. Then the anchor was lifted into the water. When the ship arrived on site, the anchor was dropped using a mechanical quick release. Positions were taken using a hand-held GPS on the aft deck by the A-frame. As necessary, slip lines were used to lower equipment on the mooring between picks over the stern. For long picks, the crane was used instead of the A-frame to give a greater height to the pick.

Action items:

- design pick points into the moorings for recovery
- shorten BPG mount as the current length is very close to the A-frame reach
- put 2 rings on the anchors for tag lines

Consider

- using chain, not line for the moorings (saves on splicing and gives extra pick points)
- making a platform for the aft deck, to avoid the lip that hinders slipping equipment over the stern
- welding a cleat into the deck from which a line could slip equipment

Instrumentation issues: Most instrumentation was started in Nome or aboard ship in the days prior to sailing. All instrumentation was started successfully, although there was a learning curve in establishing the timing of the biowipers. This was corrected before deployment.

Overall, data recovery on the moorings was very good.

Of the 5 Iscats deployed on the recovered moorings, 4 top sensors were recovered, all with full data records. Reading of the logger on the lost Iscat (A2) showed that it had been lost between 4:30 and 5pm local on the 12th July, 2011, i.e. within 16hrs of the mooring being recovered! This was a time of a strong storm (winds from the south) which had complicated our operations in Nome. Oddly, the Iscat tether was broken just below the Iscat housing and above the final stopper – the weak link had not broken. We hypothesis a hit from something trawled by shipping traffic, perhaps a barge struggling in the strait in the storm, and we are checking with the CCGC Laurier who was in the vicinity as to other ships in the area at the time.

The loggers from the 5 recovered Iscat systems showed varying degrees of success. The logger from the lost Iscat (A2) had recorded all year, as had A4 and A2W. The other 2 loggers stopped recording due to low batteries on 16th December 2010 (A4W) and on 9th Oct 2010 (A3), despite in the A3 case the sampling having been set to 1hr rather than the usual 30min. This problem was evident in 2010 and the deployed loggers have been redesigned with a larger battery pack. Note that this year, as the Iscat tops were recovered this loss of battery does not result in loss of data. We hypothesized then that the issue arose from poor conductivity in the sea water return perhaps due to insufficient scratching of the Iscat tether, however our observations suggest that both poorly and well-scratched systems recorded all year in some cases. ***Revisit issue after 2012 recoveries.***

Of the 5 ADCPs recovered, 4 recorded full records. ADCP 2230 on A4W was recovered with 2 bolts missing from the head (presumably they had shaken free during deployment). As a result water had entered the instrument, including the memory card. At the time of writing is it not clear if data can still be recovered from the card.

The SBE16 and 37s (TS sensors) and 26 (bottom pressure gauge) returned complete data records, as did the Fluoresence/Turbidity FLNTU meters. As shown below, the turbidity at A4 exceeded the instrument's range for most of the deployment. ***Check ability to change turbidity range***.

Whale recorders returned data for 4-6 months – see full report below. The ISUS also returned a complete year of data.

Deployed instrumentation was set up as per last year. The AARI current meter was deployed mounted in a converted UW SBE vane, much in the style of the old Aanderaa meters. This allows for the load of the mooring to go through the vane axle and not through the AARI current meter. (In previous years, the AARI current meter has broken under the strain of the mooring, and only the presence of a safety line around the current meter has maintained the integrity of the mooring.)

Details of mooring positions and instrumentation are given below, along with schematics of the moorings, photos of the mooring fouling, and preliminary plots of the data as available.

RUSALCA 2011 BERING STRAIT MOORING POSITIONS AND INSTRUMENTATION

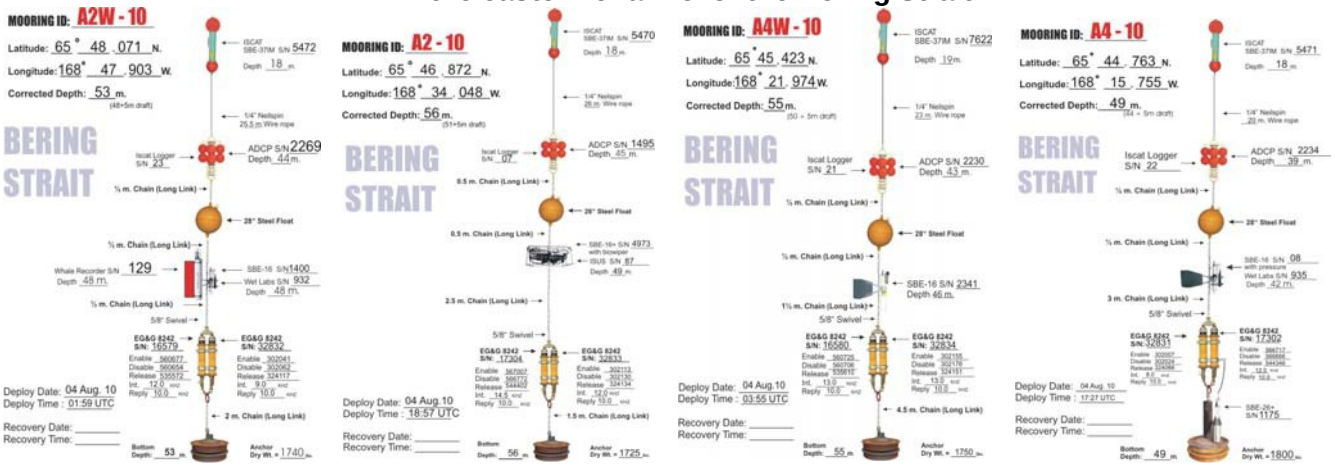
ID	LATITUDE (N) (WGS-84)	LONGITUDE (W) (WGS-84)	WATER DEPTH /m (corrected)	INST.
Recoveries of 2010 Moorings				
- US EEZ				
A2W-10	65 48.071	168 47.903	53	ISCAT, ADCP, SBE16, WR, FLT
A2-10	65 46.872	168 34.048	56	ISCAT, ADCP, SBE/TF, ISUS
A4W-10	65 45.423	168 21.974	55	ISCAT, ADCP, SBE16
A4-10	65 44.763	168 15.755	49	ISCAT, ADCP, SBE16, FLT ,BPG
A3-10	66 19.610	168 57.925	58	ISCAT, ADCP, SBE37, WR

ID	LATITUDE (N) (WGS-84)	LONGITUDE (W) (WGS-84)	WATER DEPTH /m (corrected)	INST.
2011 Mooring Deployments				
- US EEZ				
D1-11	65 52.173	168 56.807	47	AARI,RCM9,SBE37,WR
A2W-11	65 48.022	168 48.061	55	ISCAT, ADCP, SBE16, WR, FLT, BPG
A2-11	65 46.866	168 34.069	57	ISCAT, ADCP, SBE/TF, ISUS
A2E-11	65 46.254	168 28.064	57	ISCAT, ADCP, SBE37
A4W-11	65 45.423	168 21.954	56	ISCAT, ADCP, SBE16
A4-11	65 44.762	168 15.770	50	ISCAT, ADCP, SBE16, FLT ,BPG
A5-11	65 44.397	168 11.081	45	RCM9T,SBE16
2010 Moorings still in the water				
- Russian EEZ				
A11-10	65 54.001	169 25.985	52	ISCAT, ADCP, SBE37
A12-10	65 56.007	169 36.990	50	ISUS, SBE/TF, RCM9, BPG
A13-10	65 52.000	169 16.987	50	AARI, RCM9, SBE37

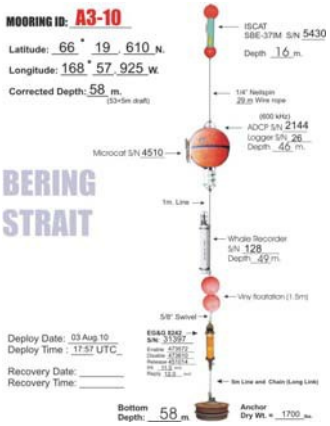
AARI = AARI Current meter ADCP = RDI Acoustic Doppler Current Profiler
BPG=Seabird Bottom Pressure Gauge FLT=Wetlabs Biowiper Fluoresence& Turbidity recorder
ISCAT = near-surface Seabird TS sensor in trawl resistant housing, with near-bottom data logger
ISUS= Nutrient Analyzer RCM9= Aanderaa Acoustic Recording Current Meter
RCM9T = Aanderaa Acoustic Recording Current Meter with Turbidity
pCO2 = SAMI pCO2 sensor pH = SAMI pH sensor Ox=SeapHox sensor
SBE/TF = Seabird CTD recorder with transmissometer and fluorometer
SBE16 = Seabird CTD recorder SBE37 = Seabird Microcat CTD recorder
WR=Whale Recorder

RUSALCA 2011 SCHEMATICS OF MOORING RECOVERED

= in the eastern channel of the Bering Strait

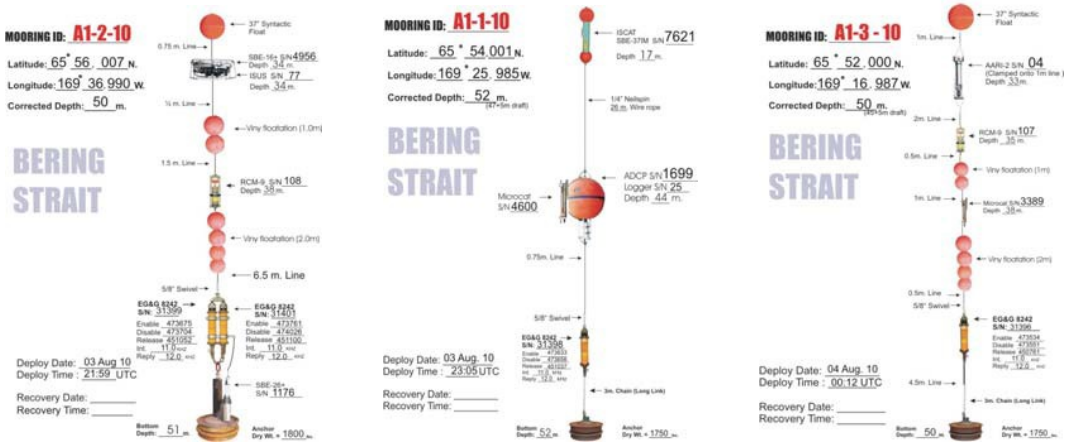


= at the climate site, ~ 60km north of the Strait



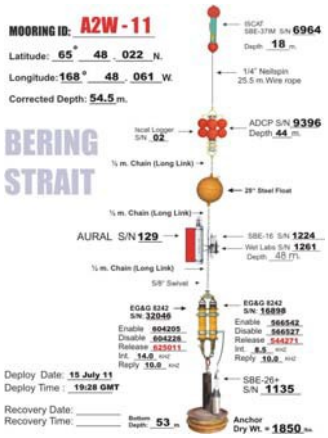
RUSALCA 2011 SCHEMATICS OF MOORINGS REMAINING SINCE 2010

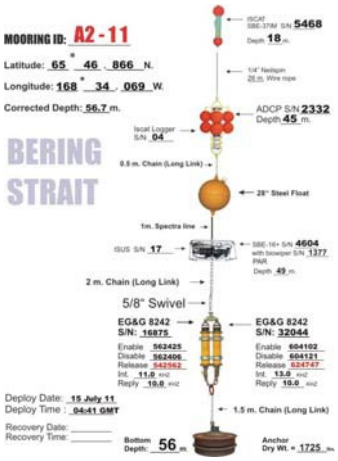
= in the western channel of the Bering Strait (remaining since 2010)

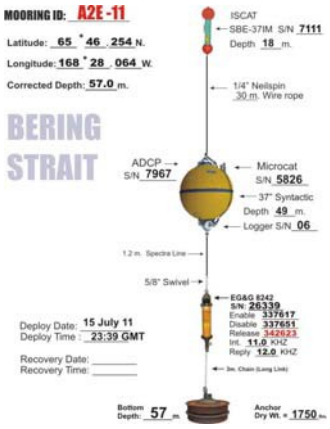


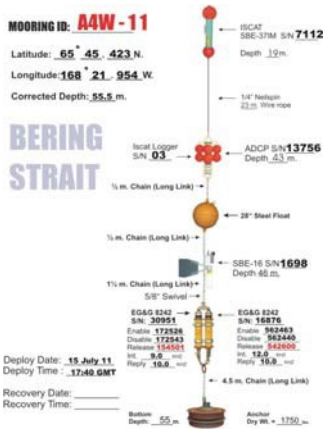
RUSALCA 2011 SCHEMATICS OF MOORING DEPLOYMENTS

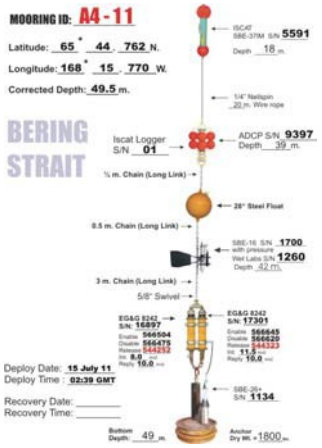
= in the eastern channel of the Bering Strait

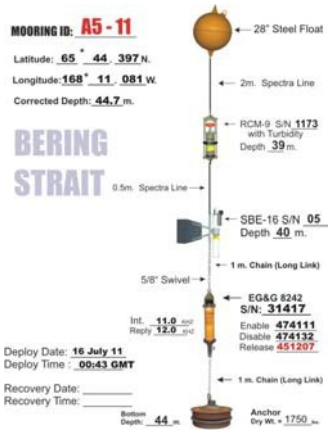




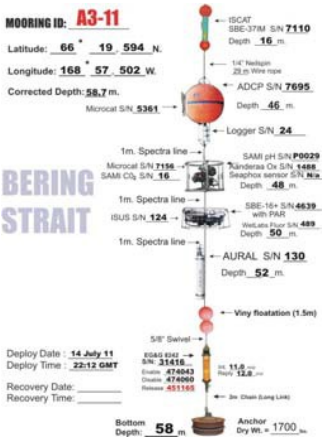




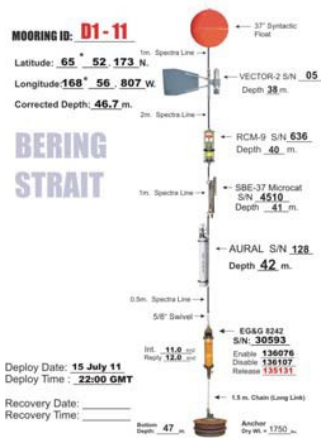




= at the climate site A3 north of the Strait



= at the mixing site north of the Diomede Islands



A2W-10 Recovery

A2-10 Recovery

ISCAT missing

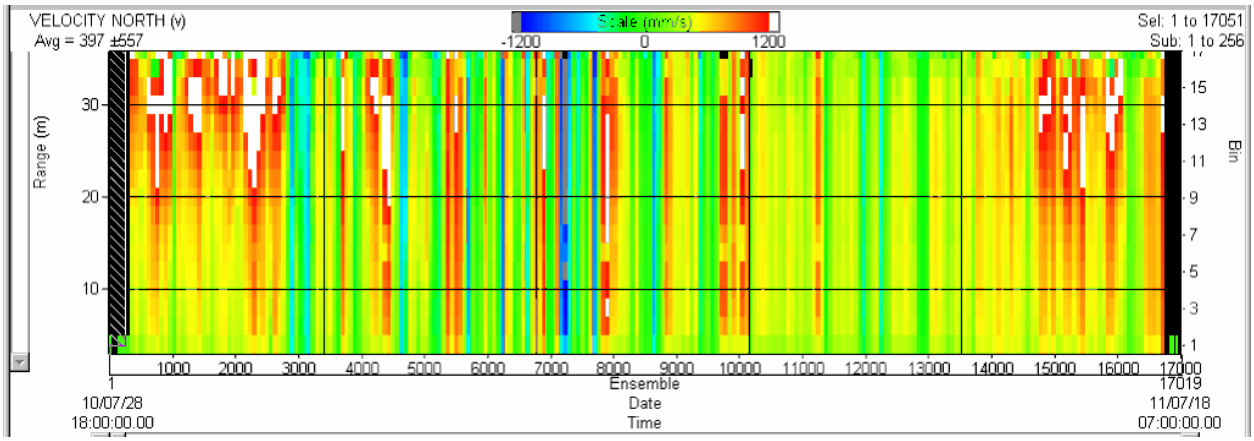
A4W-10 Recovery

A4-10 Recovery

A3-10 Recovery

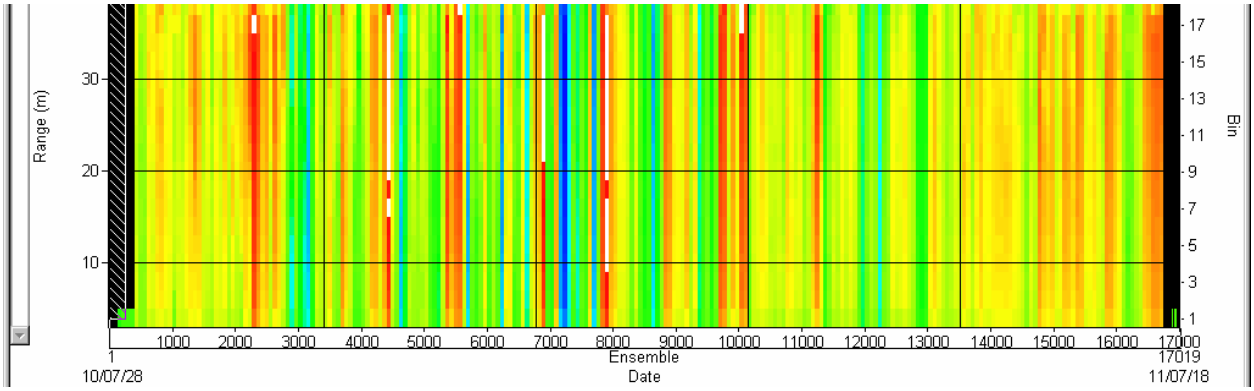
RUSALCA 2011 PRELIMINARY ADCP RESULTS – northward velocity

A4-10 SN2234

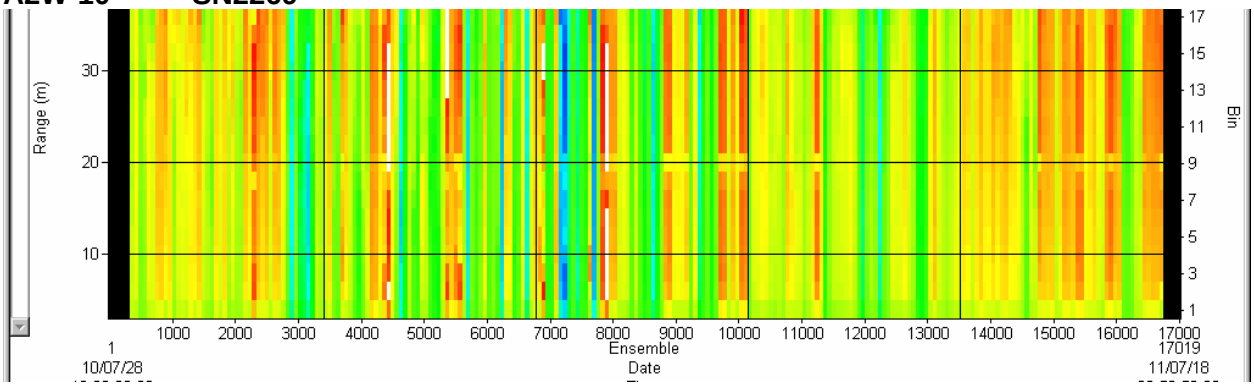


A4W-10 SN2230 – drowned

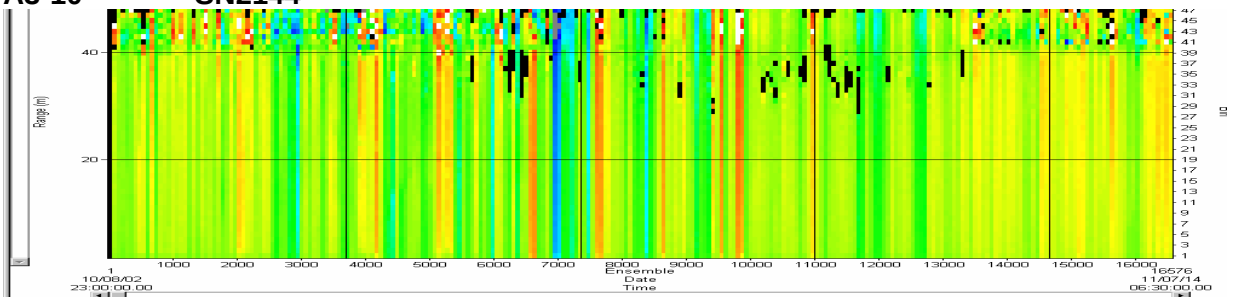
A2-10 SN1495



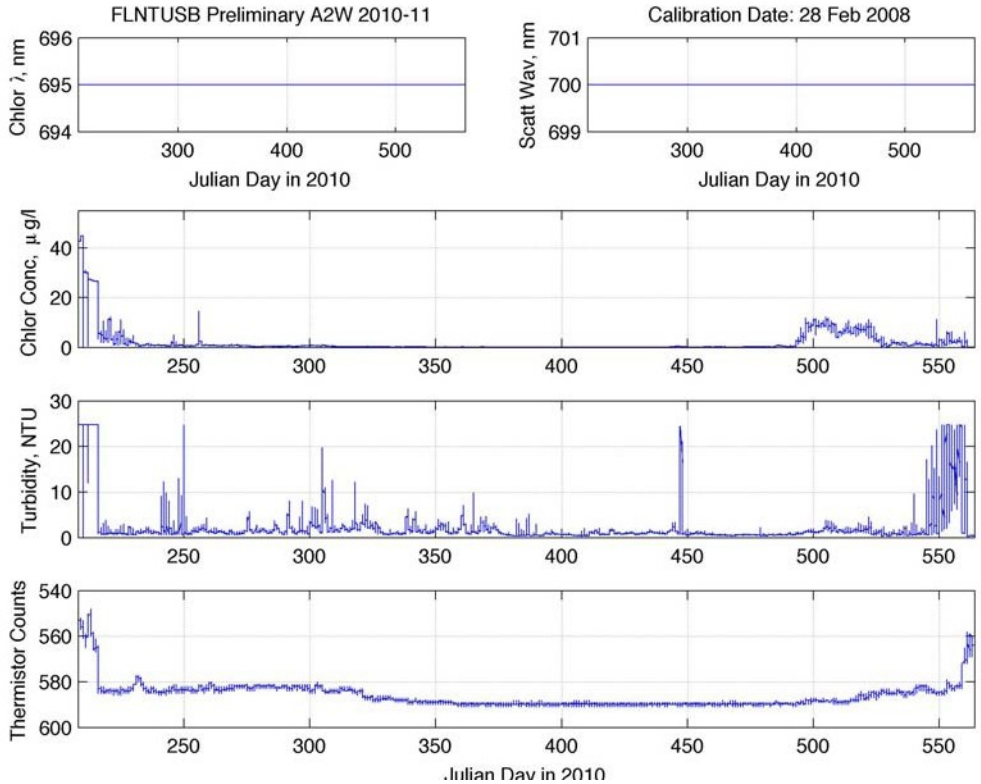
A2W-10 SN2269

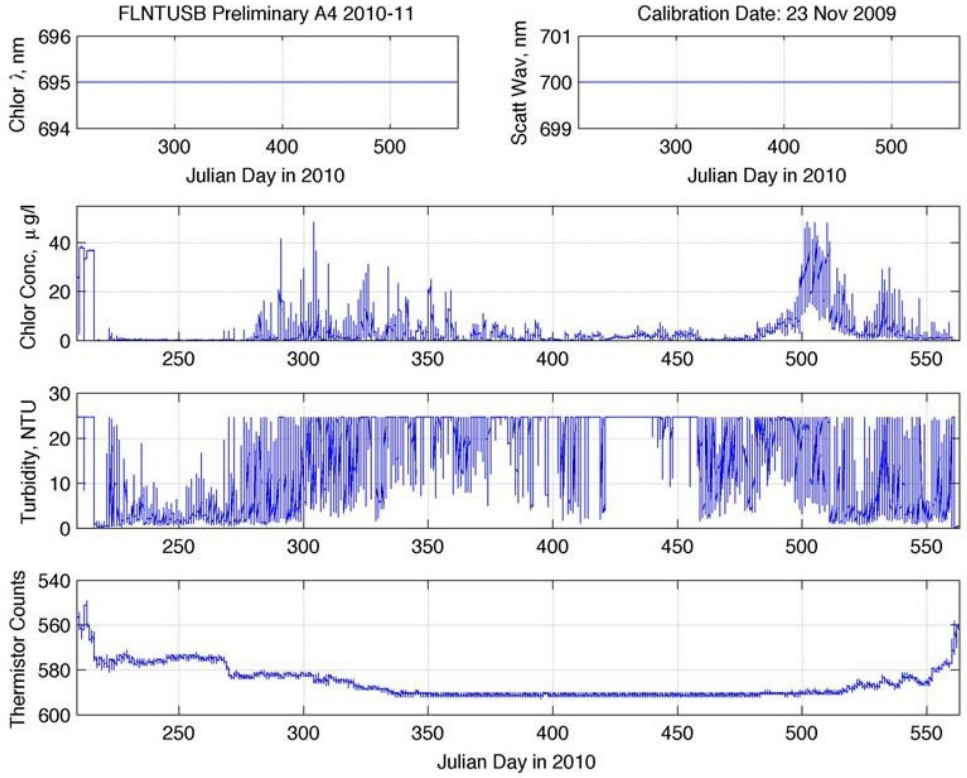


A3-10 SN2144



RUSALCA 2011 PRELIMINARY FLUORESENCE/TURBIDITY RESULTS – (Cynthia Travers)





RUSALCA 2011 CTD OPERATIONS (Whitefield, Travers, Peralta-Ferriz, Pisareva, Leech)

The moorings are usually supported by annual CTD sections, with water samples for various projects as described below.

The CTD sections for RUSALCA 2011 were taken by a CTD rosette system with the setup described below, controlled by a SBE-11*plus* deck-unit, running the software package Seasave v7. The lowering and raising was done by the ship's conducting cable winch, at a rate of ~ 0.3 m/s. Bottles were fired by the operator at the deck-unit after modest pauses at stops on the up-cast. Data were recorded in standard hexadecimal SBE format, and preliminarily processed in to 2db averaged files using the Seabird data processing software.

Configuration Date: July 16 2011 – known instrument calibration dates in parentheses

- SBE 11*plus* Carousel Deck Unit
- SBE Carousel
- SBE 5T Pump
- Seapoint Flurometer SN:2460 (Voltage0)
- Biospherical QCP2300 SN:4497 (Voltage2)
- Teledyne Benthos PSA-916 Altimeter:SN688 (Voltage6)
- SBE Primary Temp 1771 (Frequency0; Feb 04 2011)
- SBE Secondary Temp 1772 (Frequency3; Feb 04 2011)
- SBE Primary Conductivity 2251 (Frequency1; Feb 04 2011)
- SBE Secondary Conductivity 2272 (Frequency4; Feb 04 2011)
- SBE Pressure 0438 (Frequency2; Jan 29 2004)
- SBE Oxygen 0503 (Voltage4; May 24 2011)
- Garmin 17xHVS GPS SN:1BN021515

The rosette carried twelve 5.0l bottles. The CTD was deployed through the stern A-frame using the ship's 01 starboard 9 mm EM conducting Cable, winch and slip rings. The positioning of a freezer container on the 01 deck, just aft of the winch controls made visibility of the A-frame difficult, but just workable.

Cameras were set up to give the CTD operator oversight of A-frame and winch operations. In future years, ***bringing more camera cable*** would allow this system to be extended to the bridge. CTDs were run using 5 people – 1 CTD operator, 1 winch driver, 1 A-frame driver, 2 persons on deck to assist catching the rosette. The 2 deck persons also assisted with water sampling. CTDs were run 24hrs using a 2 or 3 watch system. Pallets were stacked under the A-frame to bring the rosette to a comfortable height for sampling.

CTD operations generally went smoothly, and a total of 157 casts were made (see below for positions).

Generally the ship drifted during CTD operations, with screws still turning, but feathered for no thrust. Ship's draft is 5m, and this should be taken into account in viewing the data. On cast #72 at CS18, the ship was drifting at ~ 3knots due to wind and current, resulting in excessive wire angle and rubbing of the wire on the block. For the LIS line thus, casts were deployed with the ship steaming slowly into the wind. As the weather had worsened, this resulted in the CTD being towed near the surface while attempting to fire the surface bottle. Thus, from station #74 to #82 inclusive, a surface sample was taken with a bucket instead of holding the CTD near the surface. Substantial seas during this line resulted in the CTD cable stretching from the winch to the A-frame going repeatedly slack and taut due to the pitching of the ship. On station # 82 (LIS11), for an unknown reason (perhaps a combination of the pitching, a winch issue, and/or confusion about the movement of the ship versus the horizon), the CTD was pulled into the block on the A-frame. The terminating clamp above the eye of the cable prevented the eye being pulled into the block. The CTD was recovered by bringing the A-frame in (the winch-driver had emergency stopped the winch), and CTD operations were suspended until better weather. Damage was comparatively minor. The CTD bridle was bent, and one of the firing levers (bottle 9) was also bent such as to be unusable. The termination was redone and subsequently all other

systems appeared fully operational. ***Likely call off CTD operations when pitching is sufficiently bad to bring the CTD cable to almost slack on deck between pitches.***

In terms of data, the main problem identified with the CTD operations was the altimeter calibration – the altimeter reading (calibrated using coefficients of const=20) plus the CTD depth was significantly shallower (>10m) than the water depth reported from the bridge echo sounder and previous casts in the region. By inspection, better results were obtained using a calibration constant of 15, however even in this case, the altimeter seemed to be reading too low, especially near the bottom when its reading would frequently drop to zero at least 10m above the bottom. The altimeter data drop out appeared to be somewhat mitigated by moving the altimeter down lower on the CTD frame, such that the altimeter face was flush with the bottom of the CTD. We suspect interference from the frame, but we were unable to place the altimeter any lower as the CTD frame was placed directly on the pallets. Thus, the altimeter data was not used and the CTD was taken down to 3-4m above the bottom depth ascertained from the bridge echo sounder and an estimate of 5m for ship draft. It is thought on at least 2 casts the CTD touched bottom (see event log), but no apparent damage was sustained.

Another challenge on data processing will be the oxygen data, which showed significant hysteresis between the down and up casts. Unfortunately problems of airfreighting HazMat to Nome prevented us running bottle oxygens to assist in truthing the oxygen data.

Occasional bottle firing issues occurred. These were frequently solved by readjusting the tension of the lanyards and/or by washing the firing module with warm fresh water. Since two bottles were fired at each requested depth on most casts, this was not generally a problem.

Ship drift was at times substantial, particularly in the stations nearest to the US, and this might be investigated to get some idea of water velocity (combined with wind-driven drift of the ship).

As with last year, CTD work was 24 hr. No A-frame light was used during the work – given our latitude and time of year, there was always sufficient light/twilight to continue operations in safety without extra illumination.

Preliminary CTD sections are given below plotted by J. Whitefield from 2m averaged data. Vertical grid lines on contour plots represent station locations. The fresh warm Alaskan Coastal Current is evident near the US coast in several of the plots. The DI lines indicate remarkable variability on spatial resolutions of 1nm, and are indicative of eddying and mixing.

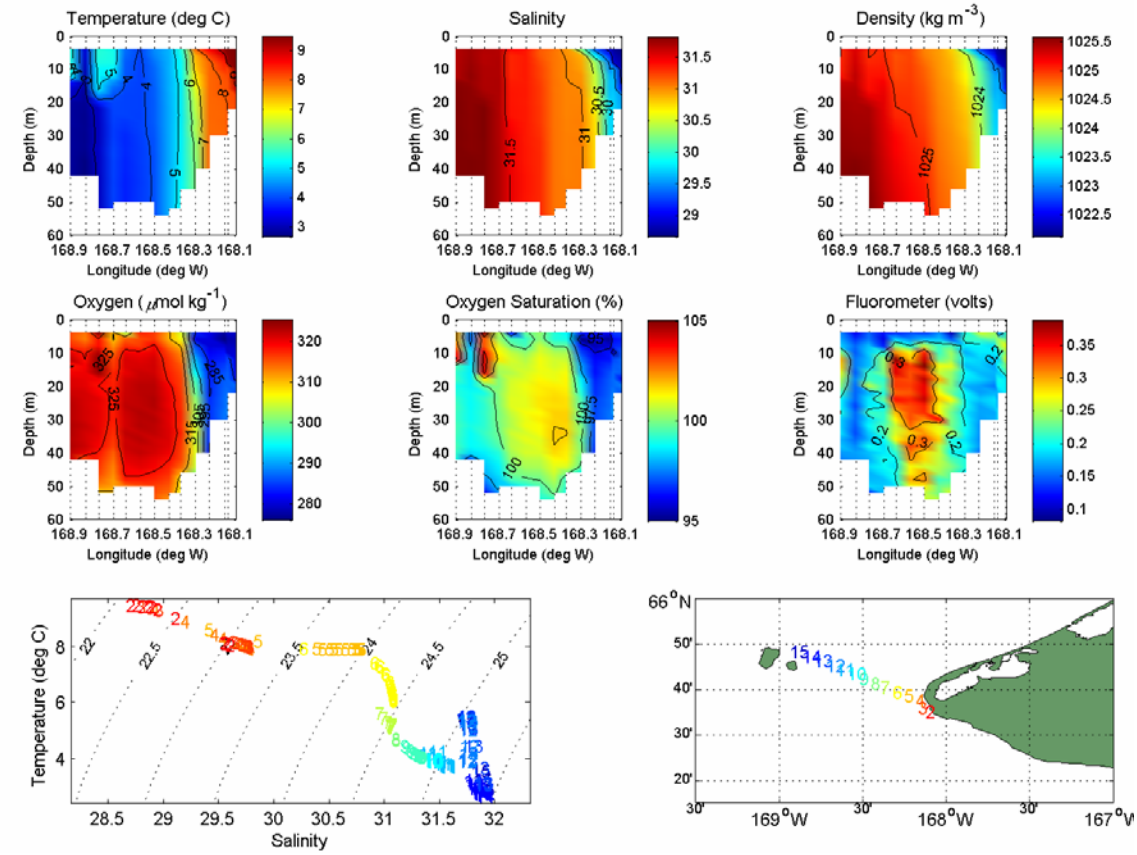
Three variability experiments were also performed.

a) The CCGC Laurier ran the CSL line starting ~ 13 hrs before and ending ~ 4 hrs before our occupation of the line. A comparison of these data sets will be informative as to short timescale variability in the region

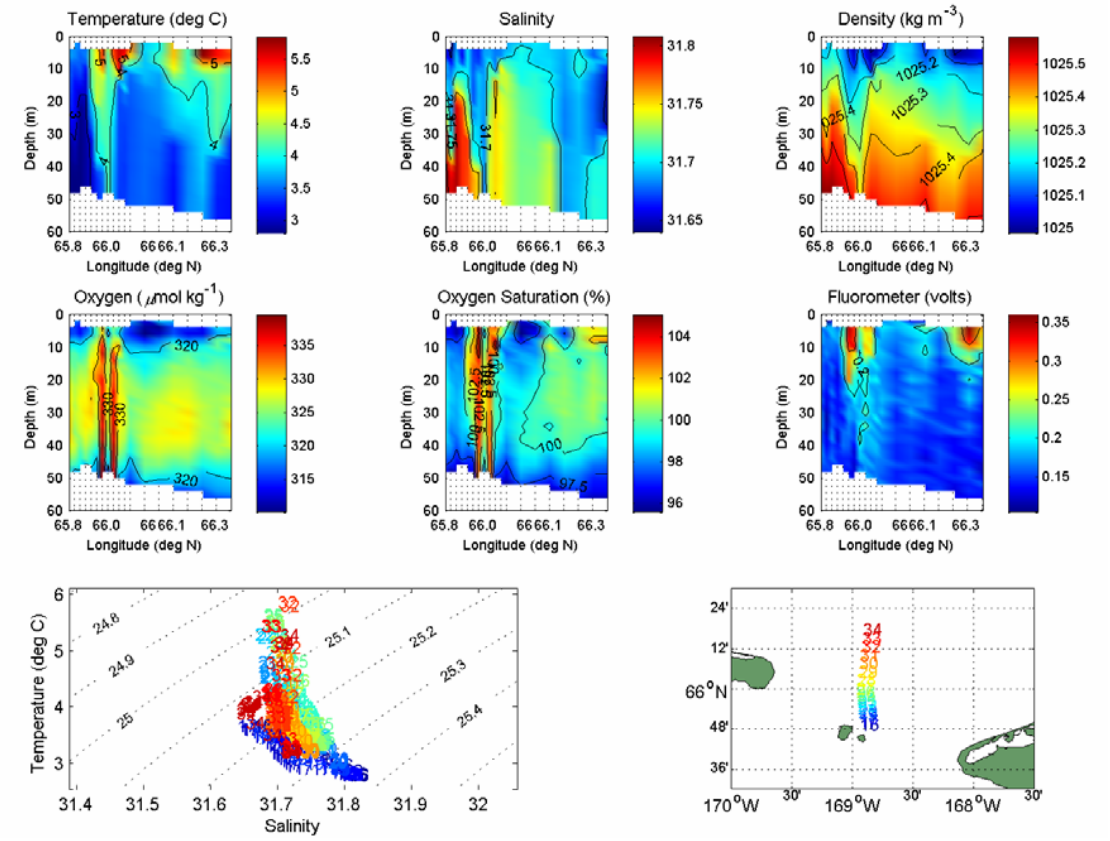
b) Station CS10US was cast 3 times (see below) – The first was for a productivity cast, the second for the standard CTD cast. Remarkable differences between these casts (related perhaps in part to the drift of the ship) provoked us to return to the exact site and make a 3rd cast within 1.5 hrs of the first cast. Preliminary analysis suggests significant differences especially in fluorescence, but also in water properties, perhaps indicative of a front. Note that this station is the first on the CS line (also the DBO – Distributed Biological Observatory - line) within US waters. Further analysis is necessary to interpret the implications of this result on repeat lines run only in US waters as part of the DBO.

c) During the final occupation of the BS line, a detour was made after BS15 to the mooring site A2, and then BS15 was recast almost 2 hours later. Comparison (see below) of these casts (and the intervening cast nearby at A2) will also yield a better understanding of temporal variability.

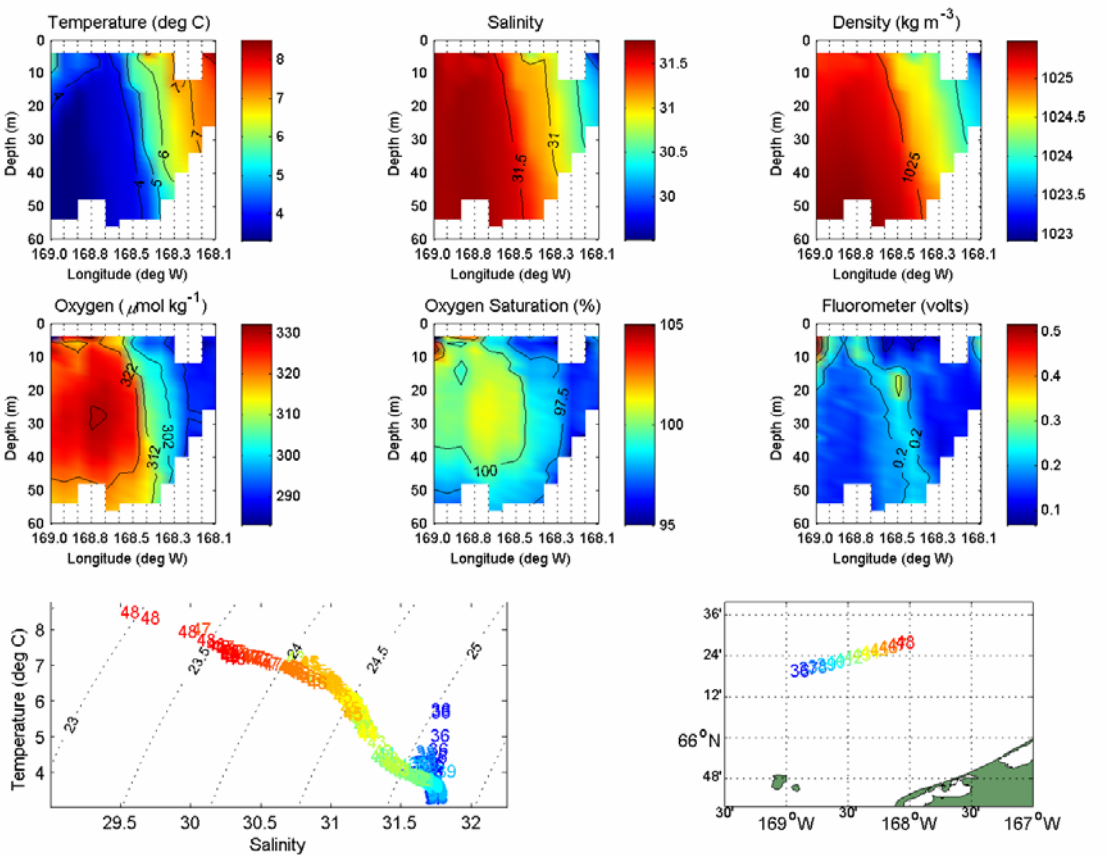
BS Line (First Occupation, run from US to Diomedes) started 16th July 2011 1937 GMT



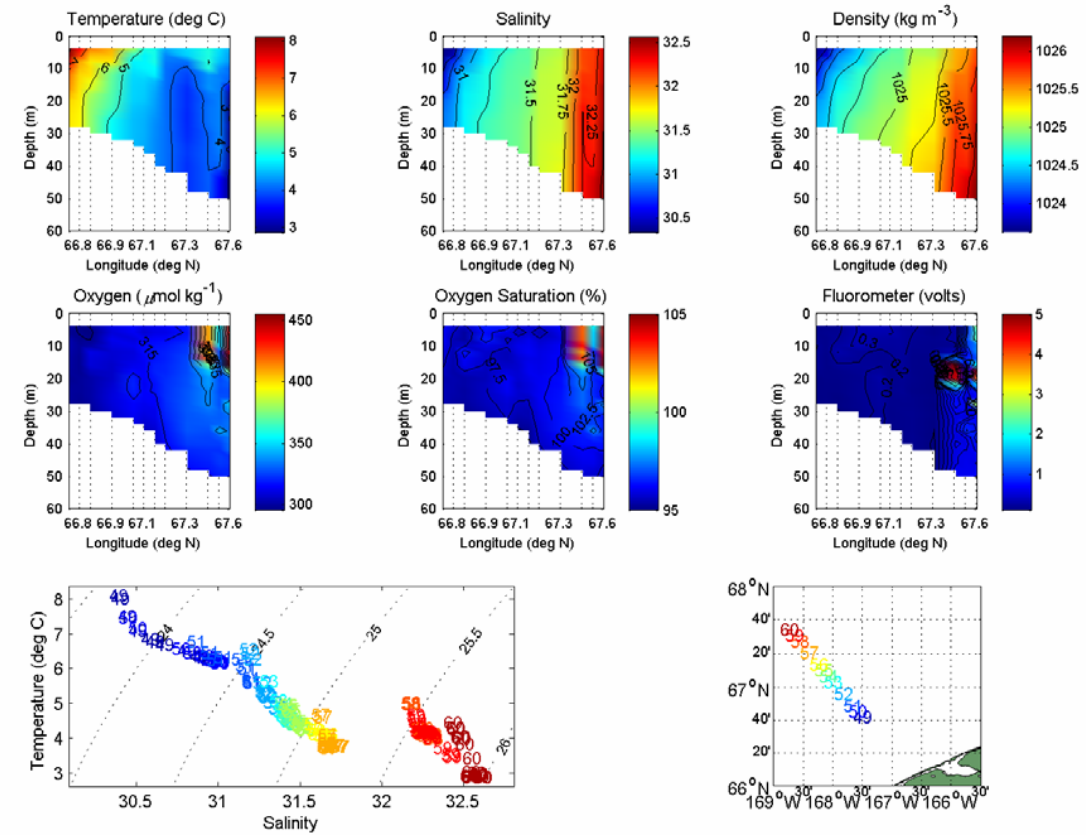
DI Line (First Occupation, run to the north) started 17th July 2011 0514 GMT



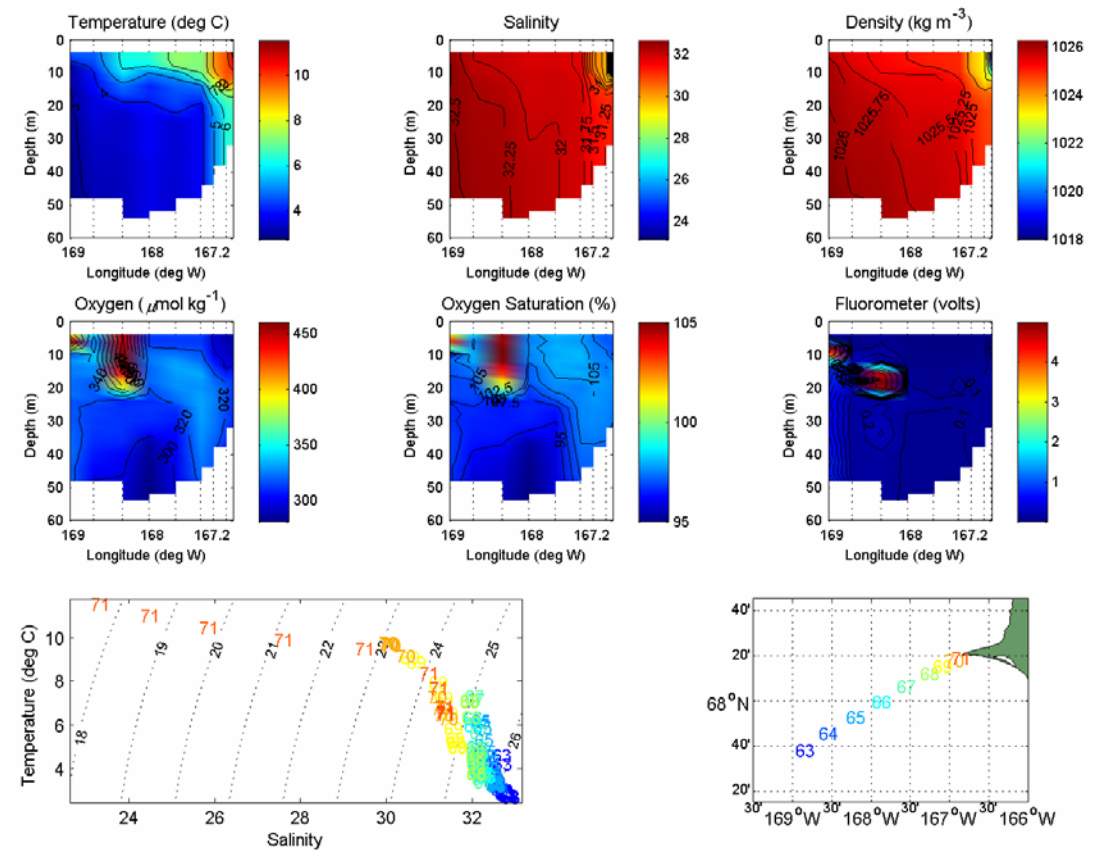
A3 Line (run towards the US) started 17th July 2011 1636 GMT



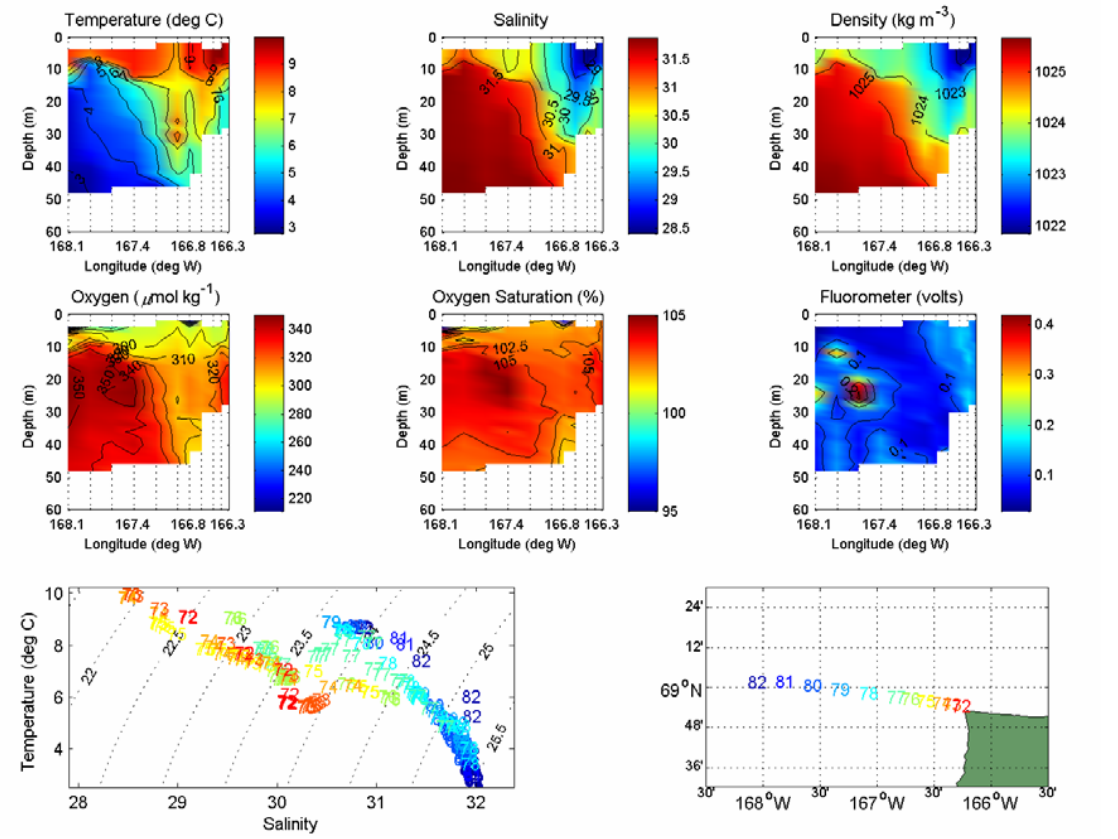
AS Line (run to the north) started 18th July 2011 0409GMT



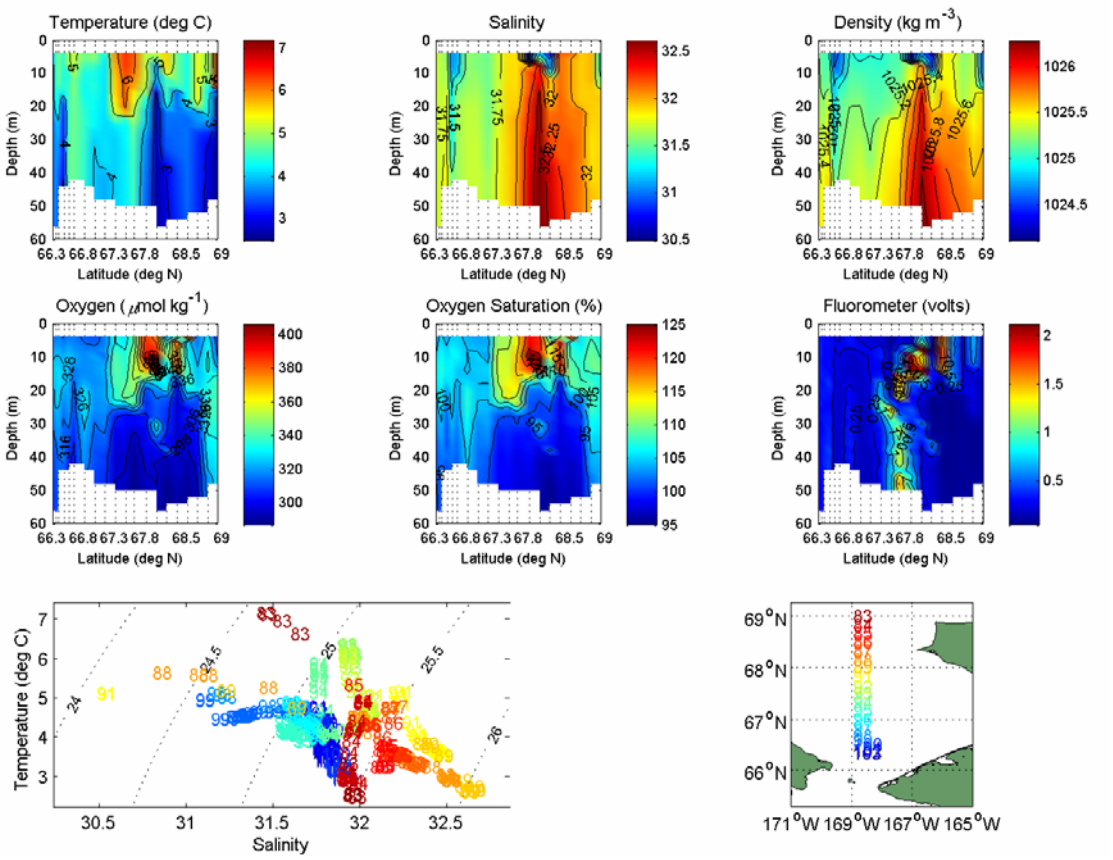
CS Line (run towards the US) started 18th July 2011 1820 GMT



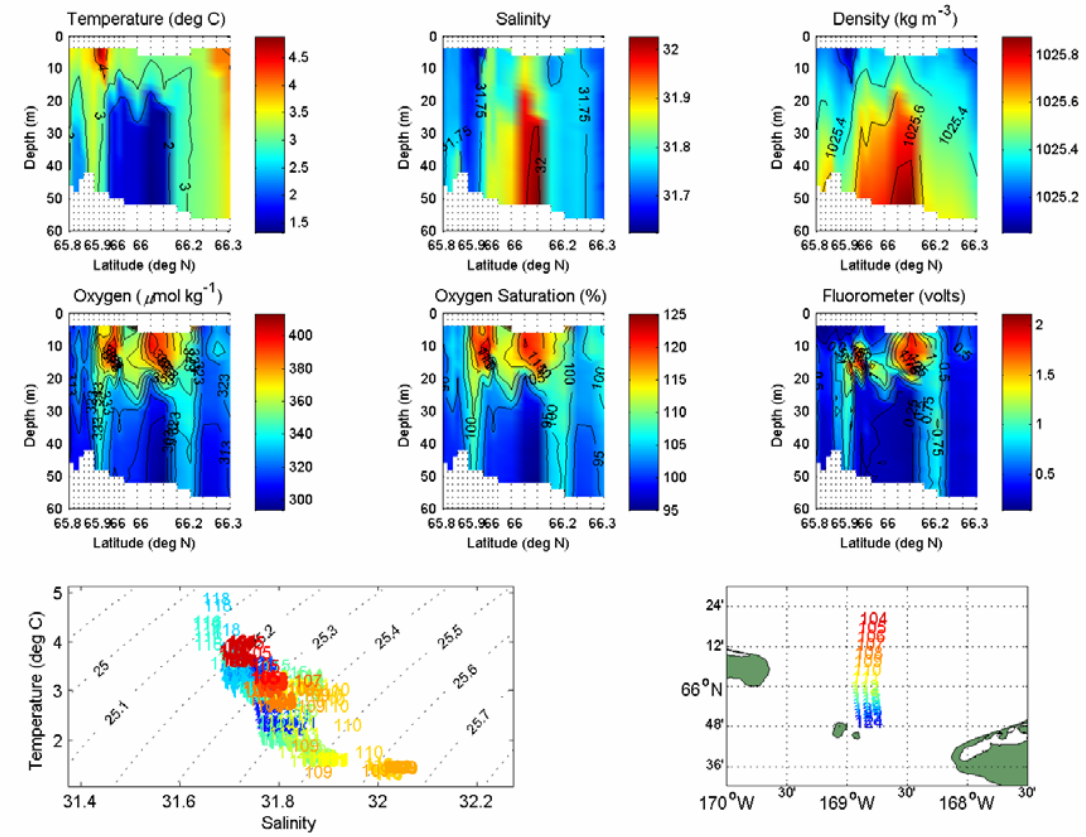
LIS Line (run away from the US) started 19th July 2011 0947 GMT



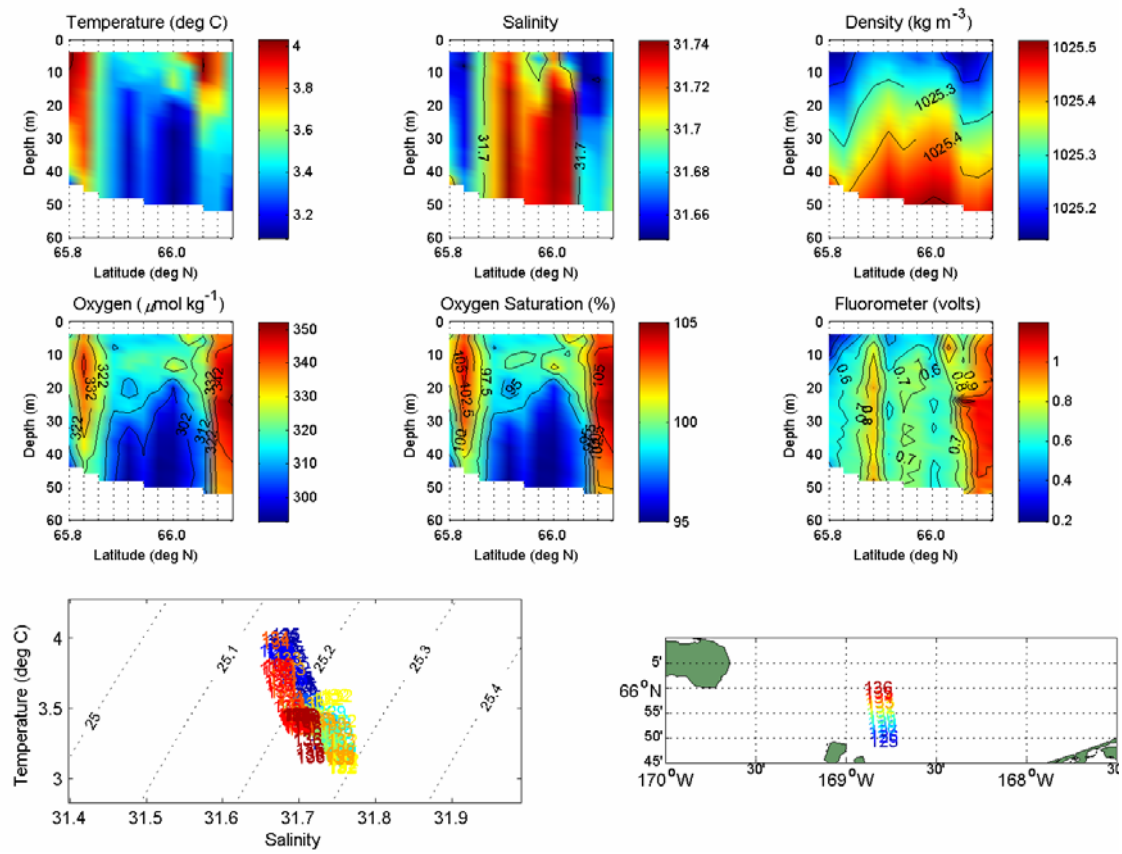
CCL Line (run to the south) started 20th July 2011 1059 GMT



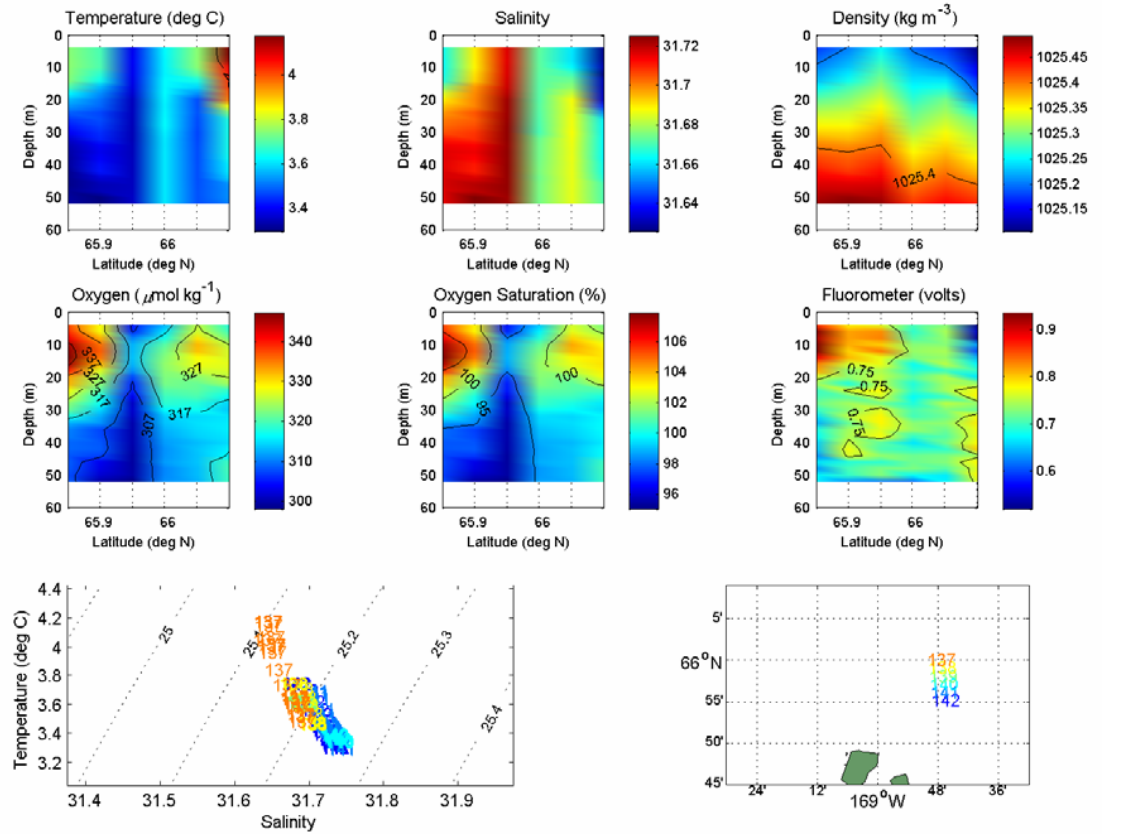
DI Line (Second occupation, run to the south) started 21st July 1421 GMT



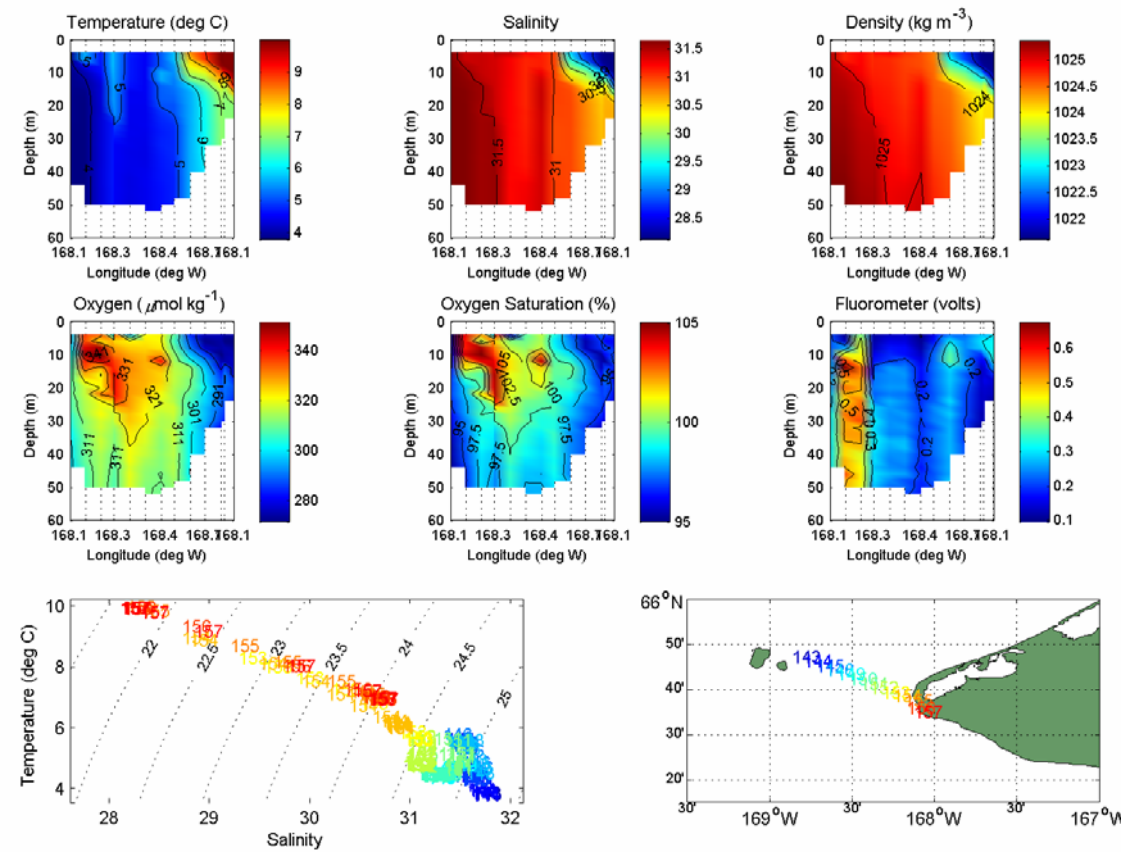
DIa Line (run to the north) started 22nd July 2011 0414 GMT



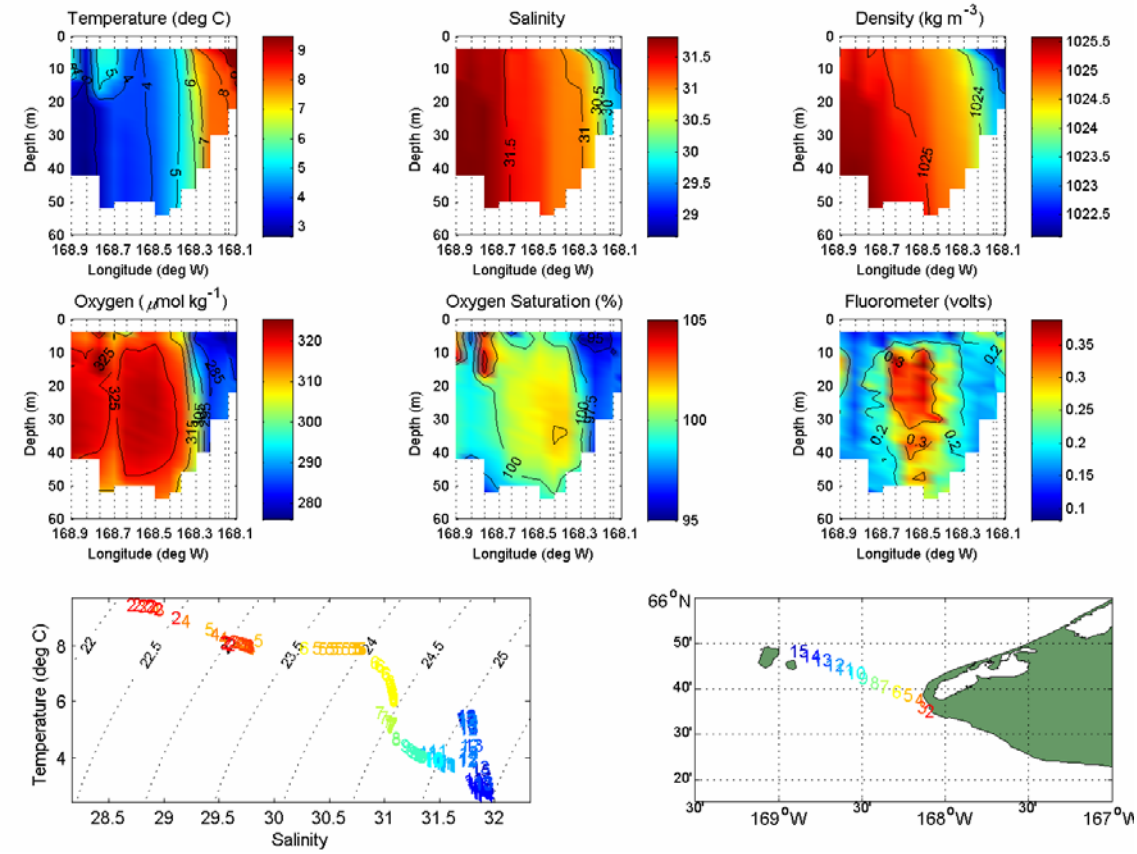
DIb Line (northern part only un to the south) started 22nd July 2011 0944 GMT



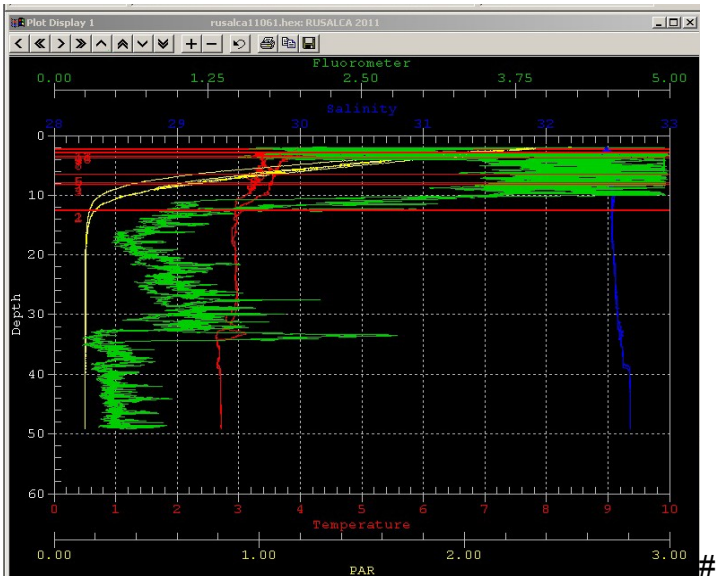
BS Line (Second occupation, run towards the US) started 22nd July 1426GMT



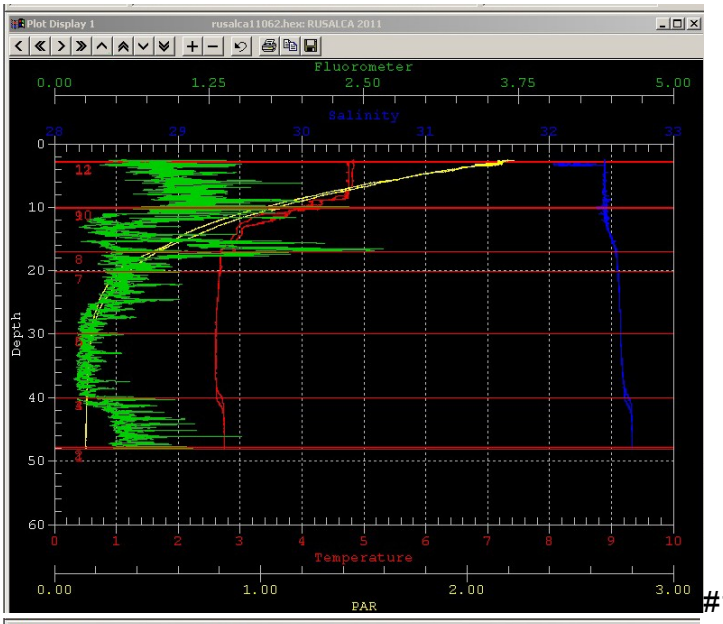
BS Line (First Occupation, run from US to Diomedes) started 16th July 2011 1937 GMT



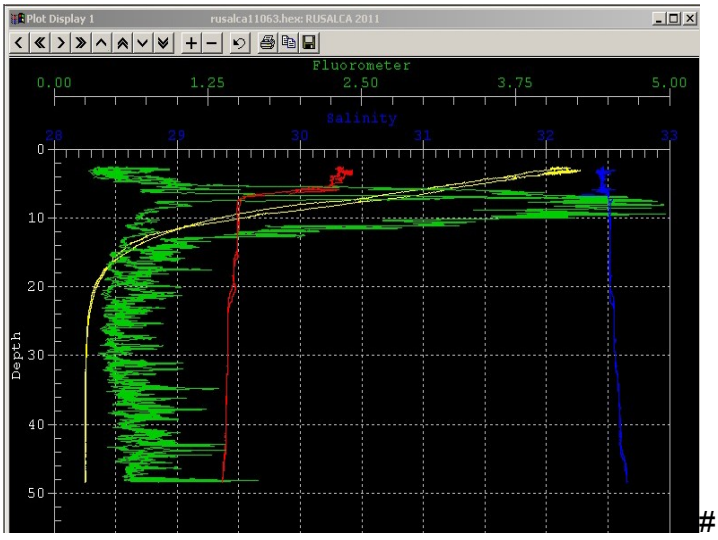
COMPARISON OF CASTS AT CS10US



#161 CS10US, 18 Jul'11 1637GMT

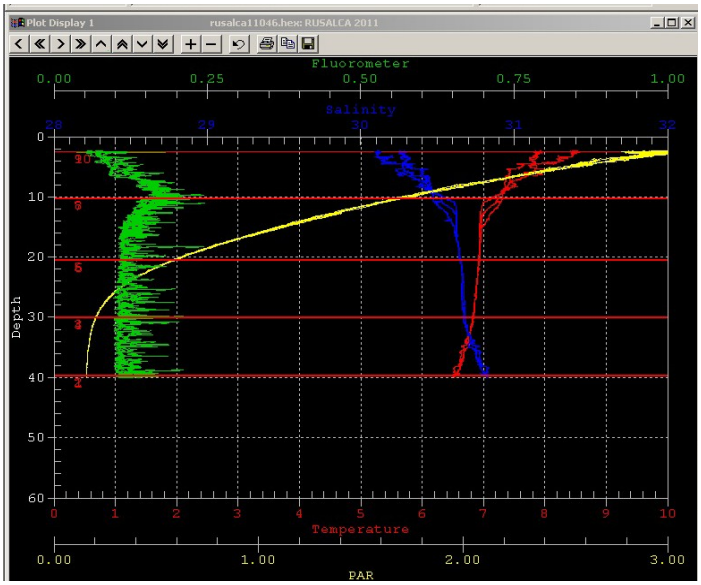


#162 CS10US, 18 Jul'11 1716GMT

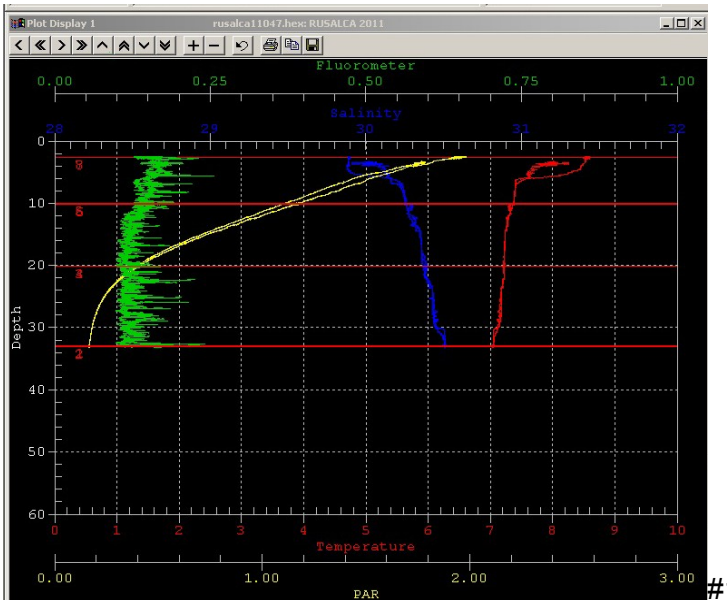


#163 CS10US, 18 Jul'11 1820GMT

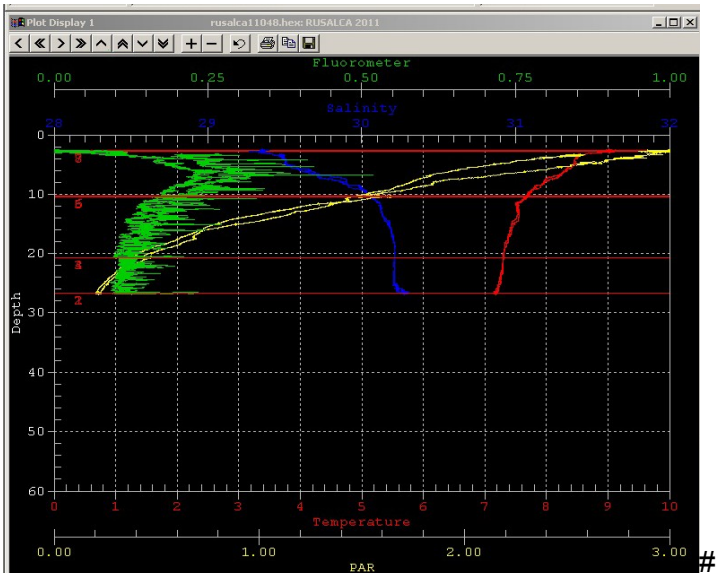
COMPARISON OF CASTS AT BS15 and A2



#146, BS15, 22 July '11 1631GMT



#147, A2, 22 July '11 1717GMT



#148, BS15, 22 July '11 1820GMT

RUSALCA 2011 TARGET CTD POSITIONS

The following lists give the target positions of the CTD lines. The full RUSALCA event log (as noted by the CTD operators) is included below.

%% Bering Strait Line
%==========
% - now 26 stations just north of the Bering Strait
% - ** added 2 stations near Russian Coast BS0.5 and BS1.5
% to measure SCC.
% - goal - 3 km resolution, to be run in 1 day
% - 26 stations = 3.4km spacing .. closer near Coast
% - total length BS0.5 to BS24 ~ 84km
%
% US Stations only
% Lat (N) Long (W) Lat (N) Long (W)
% deg min deg min
65.805 168.933 65 48.31 168 55.96 %*11 %BS11
65.788 168.860 65 47.26 168 51.62 %*12 %BS12
65.772 168.794 65 46.33 168 47.64 %*13 %BS13
65.755 168.721 65 45.28 168 43.29 %*14 %BS14
65.739 168.663 65 44.35 168 39.80 %*15 %BS15
65.722 168.591 65 43.29 168 35.46 %*16 %BS16 + net
65.704 168.521 65 42.23 168 31.28 %*17 %BS17
65.686 168.449 65 41.18 168 26.94 %*18 %BS18
65.672 168.391 65 40.35 168 23.44 %*19 %BS19
65.655 168.318 65 39.29 168 19.09 %*20 %BS20
65.642 168.250 65 38.53 168 14.97 %*21 %BS21
65.625 168.177 65 37.48 168 10.63 %*22 %BS22 + net
65.599 168.161 65 35.96 168 9.66 %*23 %BS23
65.582 168.117 65 34.91 168 7.00 %*24 %BS24

% DI line,... up from Diomedes to look at the eddies
%
DI1 65 49.28 168 56.14
DI2 65 50.26 168 56.32
DI3 65 51.23 168 56.49
DI4 65 52.21 168 56.67
% Beware mooring D1-11 at 65 52.173 N 168 56.807W
DI5 65 53.18 168 56.85
DI6 65 54.15 168 57.03
DI7 65 55.13 168 57.21
DI8 65 56.10 168 57.39
DI9 65 57.08 168 57.56
DI10 65 58.05 168 57.74
DI11 65 59.03 168 57.92
DI12 66 0.00 168 58.10
DI13 66 2.55 168 57.55
DI14 66 5.10 168 57.00
DI15 66 7.65 168 56.45
DI16 66 10.19 168 55.90
DI17 66 12.74 168 55.36
DI18 66 15.29 168 54.81
DI19 66 17.84 168 54.26
DI20 66 20.39 168 53.71

% A3L line
%=========

% - nominally 85km .. aiming at 3km resolution
% - extra station to give better resolution near Russian Coast
% - 13 on the Russian side, 12 on US side
% gives us about 3.4 km resolution
% - total listed here = 77 km

%US stations only
% Lat (N)   Long (W)   Latdeg   Lat min Lon deg   Lon min
  66.3398 168.8952   66.0000   20.3867 168.0000   53.7092 %*36 %AL13
  66.3516 168.8233   66.0000   21.0933 168.0000   49.3983 % 35 %AL14
  66.3633 168.7515   66.0000   21.8000 168.0000   45.0875 %*34 %AL15
  66.3751 168.6796   66.0000   22.5067 168.0000   40.7767 % 33 %AL16
  66.3869 168.6078   66.0000   23.2133 168.0000   36.4658 %*32 %AL17
  66.3987 168.5359   66.0000   23.9200 168.0000   32.1550 % 31 %AL18
  66.4104 168.4641   66.0000   24.6267 168.0000   27.8442 %*30 %AL19
  66.4222 168.3922   66.0000   25.3333 168.0000   23.5333 % 29 %AL20
  66.4340 168.3204   66.0000   26.0400 168.0000   19.2225 %*28 %AL21
  66.4458 168.2485   66.0000   26.7467 168.0000   14.9117 % 27 %AL22
  66.4576 168.1767   66.0000   27.4533 168.0000   10.6008 %*26 %AL23
  66.4693 168.1048   66.0000   28.1600 168.0000   6.2900 %*25 %AL24

% AS line
% ========
% (goes from A3L line to CS line)
%
% New line from the shallower water northeast in strait
% over to the southermost in the US side of the Convention
% line, (CS10 is in Russian EEZ so use new CS10US
% 1nm to to east which is then in US waters.)
%
% AS1-7 at ~ 4nm spacing.
% AS7-14 at 2nm spacing,
% A14 to end 4nm
%
% Sample for nutrients at standard depths as marked below
% (about half the casts). Skip about half to get to CS in time

% Lat(N,degmin) Lon(W,degmin)   Name
  66   41.47   167   38.86   % AS 1
  66   45.01   167   43.78   % AS 2(no bottles)
  66   48.55   167   48.70   % AS 3
% 66   52.09   167   53.62   % AS 4(no bottles)
  66   55.63   167   58.55   % AS 5
% 66   59.17   168   3.47   % AS 6(no bottles)
  67   2.71   168   8.39   % AS 7 (2nm spacing over slope)
% 67   4.48   168   10.85   % AS 8(no bottles)
  67   6.25   168   13.31   % AS 9
% 67   8.02   168   15.77   % AS 10(no bottles)
  67   9.78   168   18.23   % AS 11
% 67   11.55   168   20.69   % AS 12(no bottles)
  67   13.32   168   23.15   % AS 13
% 67   16.86   168   28.07   % AS 14 (back to 4nm spacing)
  67   20.40   168   32.99   % AS 15(no bottles)
% 67   23.94   168   37.92   % AS 16
  67   27.48   168   42.84   % AS 17(no bottles)
% 67   31.02   168   47.76   % AS 18
  67   34.56   168   52.68   % AS 19(no bottles)
  67   38.10   168   57.60   % CS10US

```
% Cape Serdtse Kamen to Point Hope
%=======================================
% = Now station list is 20 stations
% (including old Russian stations)
% has 4-5km spacing within 15km of the coast
% 20km spacing elsewhere
%%  Lat (N)   Long (W)   Latdeg    Lat min  Lon deg   Lon min
% R = old Rusalca stations

US Stations only(or CS10US)
   67    38.0     168  56.0 % CCL14 also called CS10US + Net perhaps
  67.7551  168.6652   67.0000   45.3030  168.0000   39.9110    % 59 %CS11
  67.8755  168.3136   67.0000   52.5280  168.0000   18.8160  %R%*60 %CS12 + net
  67.9887  167.9894   67.0000   59.3235  167.0000   59.3660    % 61 %CS13
  68.1020  167.6653   68.0000    6.1190  167.0000   39.9160  %R%*62 %CS14 + net
  68.2008  167.3568   68.0000   12.0470  167.0000   21.4080    % 63 %CS15
  68.2502  167.2026   68.0000   15.0110  167.0000   12.1540    % 64 %CS16
  68.2996  167.0483   68.0000   17.9750  167.0000    2.9000  %R%*65 %CS17 + net
  68.3156  166.9600   68.0000   18.9375  166.0000   57.6000    % 66 %CS18
  68.3317  166.8717   68.0000   19.9000  166.0000   52.3000    %*67 %CS19

% Line tending Northwest from Cape Lisburne
% ----------------------------------------
% Previously run in 2003 and 2004 from Helix
% a bit to the north of this. (4-11nm)
% .. but moved south to match with Russ's net line
%
%  LIS0 is same as CPL0 and is only in 16m of water.
  68   53.30    166   15.40 % LIS 0  % Note only 16m of water
  68   54.40    166   19.80 % LIS 1
  68   54.80    166   25.15 % LIS 2
  68   55.20    166   30.51 % LIS 3
  68   55.80    166   38.54 % LIS 4
  68   56.40    166   46.57 % LIS 5
  68   57.00    166   54.60 % LIS 6 + net
  68   58.20    167    9.30 % LIS 7
  68   59.40    167   24.00 % LIS 8
  69    0.60    167   38.70 % LIS 9
  69    1.80    167   53.40 % LIS 10 + net
  69    1.35    168    7.95 % LIS 11
%   69    0.90    168   22.50 % LIS 12
%   69    0.45    168   37.05 % LIS 13
%   69    0.00    168   51.60 % LIS 14 + net
% .. last 3 casts not done because of bad weather

% CCL line
% -----------
% Down the convention line from as far north
% as you get
% set 1 nm from the boundary

%  LAT(N,deg, min) LONG(W,deg,min)
   69     0.0     168  56.0 % CCL22  + Net
   68    50.0     168  56.0 % CCL21
   68    40.0     168  56.0 % CCL20
   68    30.0     168  56.0 % CCL19
   68    20.0     168  56.0 % CCL18
   68    10.0     168  56.0 % CCL17
   68    00.0     168  56.0 % CCL16
```

```
   67    50.0     168  56.0 % CCL15
   67    38.0     168  56.0 % CCL14 also called CS10US + Net perhaps
%
   67    30.0     168  56.0 % CCL13
   67    20.0     168  56.0 % CCL12
   67    10.0     168  56.0 % CCL11
   67    00.0     168  56.0 % CCL10
   66    50.0     168  56.0 % CCL9
   66    40.0     168  56.0 % CCL8
   66    35.0     168  56.0 % CCL7
   66    30.0     168  56.0 % CCL6
   66    25.0     168  56.0 % CCL5

% DI line coming down from the north
%---------------------------------
% After CCL 5 of the previous list
%  which was   66 25.0 N 168 56.0 W
% 1) add one station 2.5nm N of A3 - CCL4
% 2) then A3, but staying away from the mooring
% 3) then the high res line back to Diomede,

Thus:

1) CCL4 66 22.3 N 168 56.8 W

2) CTD at mooring site A3-11, but a
   safe distance away.
   Mooring at 66 19.594  168 57.502
%
% Then re run the DI line starting in the north.
% (nutrients samples every other)
%
DI20     66   20.39 168   53.71
DI19     66   17.84 168   54.26
DI18     66   15.29 168   54.81  Nutrients
DI17     66   12.74 168   55.36
DI16     66   10.19 168   55.90  Nutrients
DI15     66    7.65 168   56.45
DI14     66    5.10 168   57.00  Nutrients
DI13     66    2.55 168   57.55
DI12     66    0.00 168   58.10  Nutrients
DI11     65   59.03 168   57.92
DI10     65   58.05 168   57.74  Nutrients
DI9      65   57.08 168   57.56
DI8      65   56.10 168   57.39  Nutrients
DI7      65   55.13 168   57.21
DI6      65   54.15 168   57.03  Nutrients
DI5      65   53.18 168   56.85
DI4      65   52.21 168   56.67  Nutrients
% Beware mooring D1-11 at 65 52.173 N 168 56.807W
DI3      65   51.23 168   56.49  Nutrients
DI2      65   50.26 168   56.32  Nutrients
DI1      65   49.28 168   56.14  Nutrients

% Next .. a eddy grid behind  the Diomedes
% DIa going north, DIb coming south past A2W
% parallel to the DI line
%-----------------------------------
% Northbound leg
```

```
  65   49.30    168   52.10 % DIa 1
  65   50.27    168   52.28 % DIa 2
  65   51.25    168   52.46 % DIa 3
  65   52.22    168   52.65 % DIa 4
  65   53.19    168   52.83 % DIa 5
  65   54.16    168   53.01 % DIa 6
  65   55.14    168   53.19 % DIa 7
  65   56.11    168   53.37 % DIa 8
  65   57.08    168   53.55 % DIa 9
  65   58.05    168   53.74 % DIa 10
  65   59.03    168   53.92 % DIa 11
  66    0.00    168   54.10 % DIa 12
% Southbound leg
  66    0.00    168   50.00 % DIb 12
  65   59.03    168   49.83 % DIb 11
  65   58.05    168   49.65 % DIb 10
  65   57.08    168   49.48 % DIb 9
  65   56.11    168   49.31 % DIb 8
  65   55.14    168   49.14 % DIb 7

% only run this far .. then skipped to BS line
  65   54.16    168   48.96 % DIb 6
  65   53.19    168   48.79 % DIb 5
  65   52.22    168   48.62 % DIb 4
  65   51.25    168   48.45 % DIb 3
  65   50.27    168   48.27 % DIb 2
  65   49.30    168   48.10 % DIb 1
%
% Finally .. running the Bering Strait line, with
% A2 calibration cast in the middle
% ---------------------------------
% This line may start at BS12 or BS13.
% BS 23 and 24 included here, but may be excluded if
% time is short.
% Note diversion to A2 site after BS15 and then
%    repeat of BS15
%
% Lat (N) Long (W)   Lat (N)    Long (W)
%                deg min     deg   min
  65.788  168.860   65  47.26   168  51.62 %*12 %BS12
  65.772  168.794   65  46.33   168  47.64 %*13 %BS13
  65.755  168.721   65  45.28   168  43.29 %*14 %BS14
  65.739  168.663   65  44.35   168  39.80 %*15 %BS15
%   divert to run calibration cast at A2-11
                  65  47.02   168   33.9 %    %A2
   (staying away from mooring A2-11 at 65 46.866  168 34.069)
% then repeat BS15
  65.739  168.663   65  44.35   168  39.80 %*15 %BS15
  65.722  168.591   65  43.29   168  35.46 %*16 %BS16
  65.704  168.521   65  42.23   168  31.28 %*17 %BS17
  65.686  168.449   65  41.18   168  26.94 %*18 %BS18
  65.672  168.391   65  40.35   168  23.44 %*19 %BS19
  65.655  168.318   65  39.29   168  19.09 %*20 %BS20
  65.642  168.250   65  38.53   168  14.97 %*21 %BS21
  65.625  168.177   65  37.48   168  10.63 %*22 %BS22
  65.599  168.161   65  35.96   168   9.66 %*23 %BS23
  65.582  168.117   65  34.91   168   7.00 %*24 %BS24
```

Reports from Water Sampling Teams

Preliminary RUSALCA 2011 Cruise Report--Water Sampling

-Daniel Naber, Dean Stockwell and Terry Whitledge--University of Alaska, Fairbanks

The group from the University of Alaska, Fairbanks were responsible for a suite of different water samples. These samples consisted of the following: Dissolved Inorganic Carbon (DIC), Dissolved Organic Nitrogen (DON), Nutrients (nitrate, nitrite, ammonium, urea, phosphate and silica) and total chlorophyll *a*. All samples were taken at the following standard depths: 0 m, 10 m, 20 m, 30 m, 40 m and bottom. In the case of DON, nutrients and total chlorophyll *a*, additional samples were drawn at the subsurface chlorophyll max (if present).

Dissolved Inorganic Carbon

DIC samples were taken at every other station in the Bering Strait line beginning with station BS24, and on the AL and CS lines. All DIC samples were taken at standard depths and transferred directly into 225 ml glass bottles. Each sample was subsequently spiked with 100 µl of mercuric chloride ($HgCl_2$) to halt biological activity. A total of 71 samples were taken. Samples were sent to Nicolas Bates (Bermuda Institute of Ocean Sciences) for analysis.

Dissolved Organic Nitrogen

DON samples were taken at every other station on the Bering Strait, AL and CS lines. DON samples were taken at standard depths and filtered directly from the rosette into 60 ml polycarbonate bottles using 47 mm Whatman GF/F microfibre glass filters. A total of 93 samples were taken from the combined lines. Samples were frozen and sent to the University of Alaska, Fairbanks for analysis.

Nutrients

Nutrient samples were taken at almost every station during the duration of the cruise. Nutrient samples were taken at standard depths and transferred into 20 ml scintillation vials. A total of 744 samples were taken. Samples were immediately frozen and sent to the University of Alaska, Fairbanks for analysis.

Total Chlorophyll a

Total Chlorophyll *a* samples were taken at every station on the BS, AL, CS, LIS and CCL lines. Samples were taken at standard depths and, depending on the fluorometric trace, transferred to either 125 or 250 ml polycarbonate bottles. Samples were immediately filtered using 25mm Whatman GF/F microfibre glass filters. A total of 496 samples were taken. Filters were stored in 10 ml glass test tubes, frozen and sent to the University of Alaska, Fairbanks for analysis.

Preliminary RUSALCA 2011 Cruise Report--Primary Productivity

- Dan Naber, Dean Stockwell and Terry Whitledge--University of Alaska, Fairbanks

Dual isotope primary productivity experiments were run on four days during the research cruise. Primary productivity station names and locations are as follows:

Station	Cast #	Date	Latitude	Longitude
A2	1	16th July 2011	65°47.0N	168°33.9W
A3	35	17th July 2011	66°19.7N	168°58.1W
CS10US	61	18th July 2011	67°38.1N	168°57.3 W
CCL16	90	20th July 2011	68°0.0N	168°55.8 W

The following illustrates the amount and purpose of primary productivity water samples:

Sample	Amount (ml)	Purpose
$^{13}C + {}^{15}NO_3^-$	1000 per sample depth	Productivity incubation
$^{13}C + {}^{15}NH_4^-$	1000 per sample depth	Productivity incubation
Particulate Organic Carbon (POC)	250 per sample depth	Natural abundance of stable isotopes
Total Chlorophyll *a*	125 per sample depth	Chlorophyll biomass
Nutrients	20 per sample depth	Nutrient concentration at sample depths

Sample depths corresponded to the following light levels: 100%, 50%, 30%, 12%, 5% and 1%. These light depths were determined via the photosynthetically available radiation (PAR) trace. Water was sampled in 1000 ml polycarbonate bottles covered in metal screens corresponding to the above light levels. Samples were spiked with 1 ml of ^{13}C stable isotope solution and, depending on the treatment, either 0.5 ml of $^{15}NO_3^-$ or $^{15}NH_4^+$ stable isotope solution. In total, two sets (one set constitutes six bottles--one for each light depth) of screened bottles were used for the productivity experiments: one for $^{15}NO_3^-$ experiments and one for $^{15}NH_4^+$ experiments. Each set was placed into a deck incubator filled with cold flowing seawater for approximately four to six hours (depending on cloudiness). After incubation, 500 ml of each sample were filtered through 25mm Whatman GF/F microfibre glass filters. The samples were placed in 47 mm petri dishes, frozen and sent to the University of Alaska, Fairbanks for analysis.

POC samples were filtered through 25mm Whatman GF/F microfibre glass filters, placed in 47 mm petri dishes, frozen and sent to the University of Alaska, Fairbanks for analysis. Total chlorophyll and nutrient samples were treated in the same manner as described in the "water sampling" section.

OSU RUSALCA 2011 REPORT – Moored and section work for pCO2, pH and Oxygen.

Fred Prahl and Paul Walczak participated on RUSALCA11 cruise (July 12-23, 2011) to deploy for a one-year period a set of sensors at ~48m water depth on the A3 mooring. These sensors, collectively contained within a cylindrical metal cage (30" x 34" dia.) were: 1) SAMI-pH; 2) seapHox; 3) SAMI-pCO2; and 4) SBE-37. All sensors were setup to acquire data at a rate of one measurement every 3 hours until the mooring is recovered in the summer of 2012. The seapHox was included on the package as an independent check on pH measurements by the SAMI-pH sensor. The SAMI-pCO2 was included as a measure of dissolved carbon dioxide (pCO2). The pH and pCO2 measurements, combined with temperature (T) and salinity (S) measurements obtained by the SBE-37, will allow unique definition of time variability in the speciation of the inorganic carbon chemistry system in the Bering Strait water represented by the A3 mooring. The A3-11 mooring with this package of sensors was deployed successfully at ~noon (ADT) on July 14, 2011.

Samples for measurement of dissolved carbon dioxide concentration (pCO2), total dissolved inorganic carbon (DIC) and total alkalinity were collected using a rosette sampler attached to a CTD package at three depths along two sampling transects (BS and AL lines). Samples were also taken at two different times at the A3 mooring site in order to check the calibration on the in situ SAMI-pCO2, SAMI-pH and seapHox sensors. Information about each water sample (latitude, longitude and water column depth of collection) is provided in the attached table. pCO2, DIC and total alkalinity analyses will be made as soon as possible after the cruise once the samples have been transport from Nome AK (end point of the cruise) to Oregon State University (OSU).

CTD Filename	Sample #	Station Name	Lat (N)	Lon (W)	Date	ADT	Depth (m)	CTD Btl#
RUSALCA11003	1	BS23	65.5842	168.1650	16-Jul	12:00	30	2
	2						20	3
	3						0	7
RUSALCA11005	4	BS21	65.6458	168.2538	16-Jul	13:30	40	2
	5						30	3
	6						0	11
RUSALCA11007	7	BS19	65.6730	168.3863	16-Jul	15:15	49	1
	8						40	3
	9						0	11
RUSALCA11009	10	BS17	65.7053	168.5210	16-Jul	16:15	54	1
	11						40	5
	12						0	11
RUSALCA11011	13	BS15	65.7405	168.6623	16-Jul	18:00	50	1
	14						40	4
	15						0	11
RUSALCA11013	16	BS13	65.7725	168.7925	16-Jul	19:40	51	1
	17						40	3
	18						0	11
RUSALCA11015	19	BS11	65.8060	168.9323	16-Jul	21:00	47	2
	20						40	4
	21						0	12

RUSALCA11035	22	A3-11	66.3282	168.9607	17-Jul	17:15	50	2
	23						48	5
	24						48	5
	25						0	11
RUSALCA11037	26	AL13	66.3402	168.8953	17-Jul	10:00	55	1
	27						30	6
	28						0	11
RUSALCA11039	29	AL15	66.3627	168.7540	17-Jul	0:00	47	1
	30						40	3
	31						0	11
RUSALCA11041	32	AL17	66.3883	168.6062	17-Jul	13:00	55	1
	33						40	5
	34						0	12
RUSALCA11043	35	AL19	66.4115	168.4638	17-Jul	14:30	50	3
	36						40	5
	37						0	12
RUSALCA11045	38	AL21	66.4355	168.3197	17-Jul	15:45	48	2
	39						40	4
	40						0	12
RUSALCA11047	41	AL23	66.4602	168.1790	17-Jul	17:00	33	1
	42						33	1
	43						20	3
	44						0	7
RUSALCA11103	46	A3-11	66.3278	168.9578	21-Jul	5:45	48	5
	47						48	5
	48						40	7
	49						10	10

Zooplankton Net Sampling for RUSALCA 2011 - Elizaveta Ershova

Zooplankton sampling during the RUSALCA-2011 cruise was conducted by Elizaveta Ershova, a PhD student from UAF, as part of her doctoral research. Sampling was conducted on three lines, which have been repeatedly sampled during the previous years within this project: one line through the Bering Strait, one line through the southern Chukchi Sea and one line to the west of Cape Lisburne in the northern Chukchi Sea.

The main objective of the collection of these samples was the continuation of the long-term time series describing pelagic ecosystems of the Chukchi Sea and Bering Strait. This was an intermediate cruise for zooplankton collection in the sense that it was meant to provide us with some additional information on composition and distribution of zooplankton of this area between the main sampling years (2004, 2009, 2012).

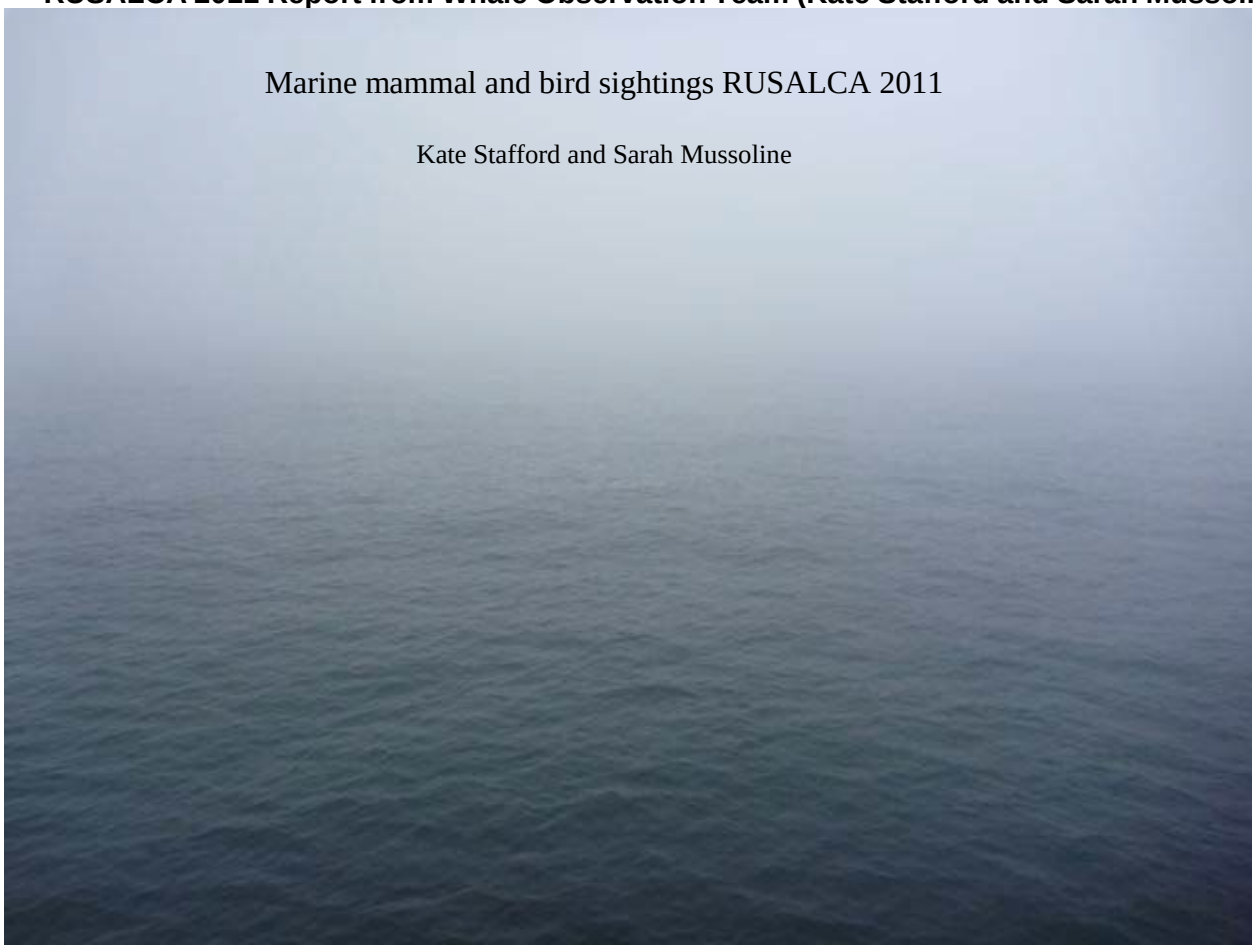
% Date	Time GMT	#	In/Out	Stn_depth Corr m.	Lat_deg N	Lat_min	Lon_deg W	Lon_min	Stn_name
20110716	2103	**1**	1	31	65	38.541	168	11.389	BS22
20110716	2109	**1**	2	31	65	38.740	168	11.639	
20110717	0111	**2**	1	53	65	43.592	168	35.622	BS16
20110717	0117	**2**	2	53	65	43.653	168	35.645	
20110718	1651	**3**	1	51	67	38.250	168	57.141	CS10US
20110718	1659	**3**	2	51	67	38.369	168	56.943	(hit bottom)
20110718	1735	**4**	1	51	67	38.885	168	56.078	CS10US
20110718	1739	**4**	2	51	67	38.951	168	55.97	
20110718	2129	**5**	1	57	67	52.841	168	18.424	CS12
20110718	2135	**5**	2	57	67	52.923	168	18.312	
20110719	0043	**6**	1	54	68	6.604	167	39.887	CS14
20110719	0050	**6**	2	54	68	6.755	167	39.805	
20110719	0419	**7**	1	40	68	18.486	167	2.959	CS17
20110719	0422	**7**	2	40	68	18.642	167	3.069	
20110719	1337	**8**	1	47	68	56.835	166	54.861	LIS6
20110719	1342	**8**	2	47	68	56.976	166	54.588	
20110719	1807	**9**	1	50	69	1.974	167	52.381	LIS10
20110719	1812	**9**	2	50	69	2.111	167	52.11	
20110720	1116	**10**	1	55	69	0.244	168	55.42	CCL22
20110720	1123	**10**	2	55	69	0.335	168	55.212	
20110721	0054	**11**	1	52	67	37.935	168	55.156	CCL14
20110721	0058	**11**	2	52	67	37.924	168	55.034	

Methods.

Quantitative samples of mesozooplankton were collected using paired standard Bongo nets with a mesh size of 150 μm and opening diameter of 60 cm (pic.1). Use of this type of net allows us to compare data collected during this cruise with data collected during other years of the RUSALCA project, and other programs which conduct zooplankton surveys of the area, such as SBI and OE, as well as earlier databases. The described arrangement of paired net was towed vertically from the sea floor to the surface on each station. The wire speed for lowering and raising the net was 0.5m/sec. Since only the US side of the previously sampled transects was available to us this year, we collected a total of only 10 samples. All samples were preserved using 3.7% formalin. They will later be processed for taxonomic composition of zooplankton and biomass.

Paired Bongo 150 µm nets

RUSALCA 2011 Report from Whale Observation Team (Kate Stafford and Sarah Mussoline)



In order to document marine mammal species seen along the trackline of the Professor Khromov during the 2011 Rusalca mooring cruise, a marine mammal watch was kept on the bridge from ~0600-2300 daily. The watch was halted during mooring operations, some meals, heavy fog and when the ship was not actively moving forward (on station for CTDs, drifting at night). Watches consisted of one person stationed primarily on the port side of the bridge (to stay out of the way of bridge operations), scanning roughly 60° to either side of the bow with a pair of Steiner 7 x 50 binoculars. When sightings were made the time, location, species and number of animals as well as any notes on observations were logged (Tables 1 and 2). A list of all bird species (but not abundance) seen was noted daily as well (Table 3). When possible photographs were taken of mammals to confirm identification. The assistance of the officers and crew of the Khromov in sighting animals was greatly appreciated.

The first few days of the cruise coverage was spotty as mooring operations were in full swing and high sea states and fog were prevalent. Once the marine mammal hydrophones were recovered and redeployed, the visual survey was conducted from 0600-~2300 daily. A total of 39 sightings of 55-58 individual animals were obtained representing 9 species (Table 1).

Sightings for each species are shown in Figure 1.

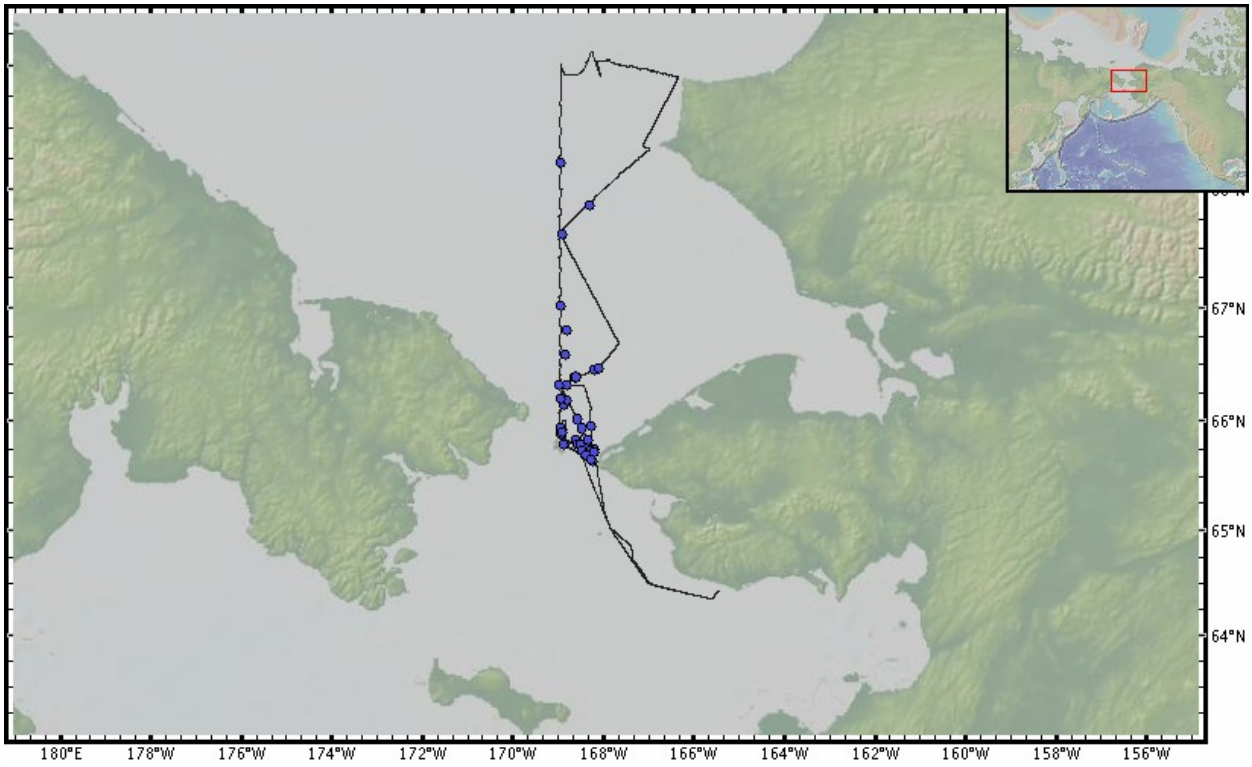


Figure 1. Trackline and marine mammal sightings from RUSALCA 2011

Overall, there were many fewer marine mammal sightings and species seen on the 2011 cruise than on the 2010 cruise. Sea bird abundance was down as well. Part of the interannual discrepancy is likely due to the area surveyed. The majority of sightings from 2010 were in Russian waters but there were more sightings in US waters in 2010 versus 2011.

Table 1. Marine mammal sightings by species. *Sperm whale seen by crew, with drawing of the animal to confirm species ID.

Species	#sightings	number animals
harbor porpoise	9	11
minke	5	5
killer whale	1	6-8
Dall's porpoise	1	1
Phoca spp	6	6
Sperm whale*	1	1
gray whale	5	14-16
Ringed seal	8	8
Bearded seal	1	1
Spotted seal	2	2
sum	39	55-58

Table 2. Locations, times and counts for all marine mammal sightings.

event	date	time (local)	declat	declon	SS	vis	spp	#
1	7/13/11	06:30	65.833	-168.6	4	foggy	Bearded seal	1
2	7/13/11	08:42	65.783	-168.567	5	foggy	Minke whale	1
3	7/13/11	13:19	65.7	-168.38	5	fog	Killer whale	5-8
4	7/13/11	19:36	65.95	-168.267	4	clear	Harbor porpoise	1
5	7/13/11	20:06	65.95	-168.267	4	clear	Harbor porpoise	1
6	7/14/11	07:06	66.32	-168.783	1	fog	Sperm whale	1
7	7/14/11	08:30	66.317	-168.95	2	Lt fog	Harbor porpoise	1
8	7/14/11	09:12	66.317	-168.97	2	Lt fog	Phoca spp	1
9	7/14/11	14:48	66.150	-168.86	1	Lt fog	Phoca spp	1
10	7/14/11	15:17	66.183	-168.783	1	Lt fog	Gray whale	1
11	7/14/11	16:30	66.016	-168.567	3	Lt fog	Harbor porpoise	1
12	7/14/11	17:01	65.933	-168.467	3	fog	Harbor porpoise	2
13	7/14/11	17:39	65.833	-168.334	3	fog	Dall's porpoise	1
14	7/14/11	19:16	65.75	-168.2	3	fog	Harbor porpoise	1
15	7/14/11	19:49	65.76	-168.4	3	fog	Harbor porpoise whale	1
16	7/14/11	20:02	65.783	-168.483	3	fog	Harbor porpoise	2
17	7/14/11	23:00	65.733	-168.250	3	fog	Harbor porpoise	1
18	7/14/11	23:00	65.733	-168.250	3	fog	Spotted seal	1
19	7/15/11	16:30	65.716	-168.183	5	fog	Ringed seal	1
20	7/16/11	09:38	65.728	-168.445	3	fog	Ringed seal	1
21	7/16/11	10:00	65.697	-168.373	3	fog	Ringed seal	1
22	7/16/11	13:21	65.642	-168.225	3	fog	Harbor porpoise	1
23	7/17/11	08:46	66.317	-168.967	2	rain	Ringed seal	1
24	7/17/11	12:39	66.385	-168.630	2	Rain fog	Ringed seal	1
25	7/17/11	12:57	66.393	-168.598	2	fog	Minke whale	1
26	7/17/11	17:20	66.450	-168.183	2	clear	Phoca spp	1
27	7/17/11	18:00	66.467	-168.100	2	OV	Phoca spp	1
28	7/17/11	19;07	66.583	-168.833	2	OV	Minke whale	1
29	7/17/11	21:57	66.800	-168.800	2	fog	Spotted seal	1
30	7/18/11	13:34	67.867	-168.300	3	clear	gray whale	1
31	7/20/11	11:20	68.217	-168.933	3	fog	Minke whale	1
32	7/20/11	16:57	67.617	-168.900	3	fog	Ringed seal	1
33	7/20/11	21:49	67.017	-168.933	2	Clear	gray whale	10-12
34	7/21/11	08:33	66.200	-168.917	2	clear	Minke whale	1
35	7/21/11	15:15	65.933	-168.933	3	OV	Ringed seal	1
36	7/21/11	17:14	65.883	-168.933	4	OV	gray whale	1
37	7/21/11	22:37	65.900	-168.883	4	OV	Ringed seal	1
38	7/22/11	06:10	65.783	-168.867	3	Clear	gray whale	1
39	7/22/11	15:23	65.650	-168.250	4	OV	Phoca spp	1

Table 3. Seabird species seen by day.

Species	7/13 2011	7/14 2011	7/15 2011	7/16 2011	7/17 2011	7/18 2011	7/19 2011	7/20 2011	7/21 2011	7/22 2011
Thick-billed murre			X			X			X	X
Common murre	X	X	X	X	X	X	X	X	X	X
Short-tailed shearwater	X	X	X	X			X	X	X	X
Tufted puffin	X	X	X	X	X	X	X	X	X	X
Horned puffin	X	X	X	X	X	X		X	X	X
Northern fulmar	X	X	X	X	X	X	X	X	X	X
Black legged kittiwake	X	X	X	X	X	X	X	X	X	X
Glaucous gull		X	X	X	X	X	X	X	X	X
Crested auklet		X	X					X		X
Least auklet		X	X						X	X
Parakeet auklet			X							X
Herring gull			X	X					X	
Sabine's gull		X			X		X			
Red-necked phalarope		X			X	X		X	X	
Pelagic cormorant	X	X	X	X					X	X
Unid loon				X						
Parasitic jaeger					X				X	
Long-tailed jaeger	X									
Pomarine jaegar	X				X	X	X	X	X	X
Long-tailed ducks										
Black guillemot									X	X
Pectoral sandpiper										
Pigeon guillemot				X	X					
Common eider				X						
Arctic tern									X	
Glaucous winged gull									X	X

Marine mammal hydrophones

During RUSALCA 2011, 2 Aural marine mammal hydrophone packages were recovered (from A2W-10 and A3-10) and 3 deployed at sites A2W-11 (65.80N 168.798W) and A3-11 (66.327N 168.965W) and D1-11 (65.869N 168.945). Both recovered instruments stopped recording earlier than expected due to battery drain. The instrument at A2W-10 ran from 11 Aug 2010 to 8 Dec 2010 while the instrument at A3-10 lasted 6 weeks longer, from 11 Aug 2010 to 19 Feb 2011. Each instrument was on a duty cycle whereby the first 15 minutes of every hour were recorded at a sample rate of 16384 (10-8192 Hz bandwidth). No analysis of these data has occurred to date but a cursory exam of both instruments showed that the following species were recorded on each: humpback whale, killer whale, bowhead whale, beluga whale, walrus, and bearded seal. To ensure a full year's coverage for this year's deployments, each of the three instruments was set to sample at 8192 Hz for 10 minutes every hour starting 1 October 2011

A few photos of the few animals seen

Top row: transient killer whales (L) and harbor porpoise (R)
Bottom row: Gray whale (L) and minke whale (R)

Weather logs from Marine Mammal Observers

date	time local	datetime	SS	vis	comments
7/12/11	12:00:00 AM	7/12/11 0:00			
7/12/11	1:00:00 AM	7/12/11 1:00			
7/12/11	2:00:00 AM	7/12/11 2:00			
7/12/11	3:00:00 AM	7/12/11 3:00			
7/12/11	4:00:00 AM	7/12/11 4:00			
7/12/11	5:00:00 AM	7/12/11 5:00			
7/12/11	6:00:00 AM	7/12/11 6:00			
7/12/11	7:00:00 AM	7/12/11 7:00			
7/12/11	8:00:00 AM	7/12/11 8:00			
7/12/11	9:00:00 AM	7/12/11 9:00			
7/12/11	10:00:00 AM	7/12/11 10:00			
7/12/11	11:00:00 AM	7/12/11 11:00			
7/12/11	12:00:00 PM	7/12/11 12:00	7-8		depart Nome in Gale
7/12/11	1:00:00 PM	7/12/11 13:00	7-8	Overcast	
7/12/11	2:00:00 PM	7/12/11 14:00	7-8	Overcast	
7/12/11	3:00:00 PM	7/12/11 15:00	7-8	Overcast	
7/12/11	4:00:00 PM	7/12/11 16:00	7-8	Overcast	
7/12/11	5:00:00 PM	7/12/11 17:00	7-8	Overcast	
7/12/11	6:00:00 PM	7/12/11 18:00	7-8	Overcast	
7/12/11	7:00:00 PM	7/12/11 19:00	7-8	Overcast	
7/12/11	8:00:00 PM	7/12/11 20:00	7-8	Overcast	
7/12/11	9:00:00 PM	7/12/11 21:00	7-8	Overcast	
7/12/11	10:00:00 PM	7/12/11 22:00			
7/12/11	11:00:00 PM	7/12/11 23:00			
7/13/11	12:00:00 AM	7/13/11 0:00			
7/13/11	1:00:00 AM	7/13/11 1:00			
7/13/11	2:00:00 AM	7/13/11 2:00			
7/13/11	3:00:00 AM	7/13/11 3:00			
7/13/11	4:00:00 AM	7/13/11 4:00			
7/13/11	5:00:00 AM	7/13/11 5:00			
7/13/11	6:00:00 AM	7/13/11 6:00	4-5	fog	
7/13/11	7:00:00 AM	7/13/11 7:00		fog	"mooring recovery day, less visual effort"
7/13/11	8:00:00 AM	7/13/11 8:00		fog	
7/13/11	9:00:00 AM	7/13/11 9:00		fog	
7/13/11	10:00:00 AM	7/13/11 10:00	5	fog	
7/13/11	11:00:00 AM	7/13/11 11:00	5	fog	
7/13/11	12:00:00 PM	7/13/11 12:00	5	fog	
7/13/11	1:00:00 PM	7/13/11 13:00	5	fog	
7/13/11	2:00:00 PM	7/13/11 14:00	5	fog	
7/13/11	3:00:00 PM	7/13/11 15:00	5	fog	
7/13/11	4:00:00 PM	7/13/11 16:00	5	fog	
7/13/11	5:00:00 PM	7/13/11 17:00	5	fog	
7/13/11	6:00:00 PM	7/13/11 18:00	5	fog	
7/13/11	7:00:00 PM	7/13/11 19:00	4	Overcast	
7/13/11	8:00:00 PM	7/13/11 20:00	4	Overcast	
7/13/11	9:00:00 PM	7/13/11 21:00	4	Overcast	
7/13/11	10:00:00 PM	7/13/11 22:00	4	Overcast	
7/13/11	11:00:00 PM	7/13/11 23:00			
7/14/11	12:00:00 AM	7/14/11 0:00			
7/14/11	1:00:00 AM	7/14/11 1:00			
7/14/11	2:00:00 AM	7/14/11 2:00			
7/14/11	3:00:00 AM	7/14/11 3:00			
7/14/11	4:00:00 AM	7/14/11 4:00			
7/14/11	5:00:00 AM	7/14/11 5:00			
7/14/11	6:00:00 AM	7/14/11 6:00			

7/14/11	7:00:00 AM	7/14/11	7:00	1	fog "mooring deploy and recover day, less visual effort"
7/14/11	8:00:00 AM	7/14/11	8:00	2	fog
7/14/11	9:00:00 AM	7/14/11	9:00	2	fog
7/14/11	10:00:00 AM	7/14/11	10:00	2	fog
7/14/11	11:00:00 AM	7/14/11	11:00	2	fog
7/14/11	12:00:00 PM	7/14/11	12:00	2	fog
7/14/11	1:00:00 PM	7/14/11	13:00	2	fog
7/14/11	2:00:00 PM	7/14/11	14:00	1	light fog
7/14/11	3:00:00 PM	7/14/11	15:00	1	Overcast
7/14/11	4:00:00 PM	7/14/11	16:00	2	Overcast
7/14/11	5:00:00 PM	7/14/11	17:00	3	Overcast
7/14/11	6:00:00 PM	7/14/11	18:00	3	light fog
7/14/11	7:00:00 PM	7/14/11	19:00	3	fog
7/14/11	8:00:00 PM	7/14/11	20:00	3	fog
7/14/11	9:00:00 PM	7/14/11	21:00	3	fog
7/14/11	10:00:00 PM	7/14/11	22:00		
7/14/11	11:00:00 PM	7/14/11	23:00		
7/15/11	12:00:00 AM	7/15/11	0:00		
7/15/11	1:00:00 AM	7/15/11	1:00		
7/15/11	2:00:00 AM	7/15/11	2:00		
7/15/11	3:00:00 AM	7/15/11	3:00		
7/15/11	4:00:00 AM	7/15/11	4:00		
7/15/11	5:00:00 AM	7/15/11	5:00		
7/15/11	6:00:00 AM	7/15/11	6:00		
7/15/11	7:00:00 AM	7/15/11	7:00	4	fog "mooring deploy, drifting all night"
7/15/11	8:00:00 AM	7/15/11	8:00	4	fog
7/15/11	9:00:00 AM	7/15/11	9:00	4	fog
7/15/11	10:00:00 AM	7/15/11	10:00	4	fog
7/15/11	11:00:00 AM	7/15/11	11:00	4	fog
7/15/11	12:00:00 PM	7/15/11	12:00	4	fog
7/15/11	1:00:00 PM	7/15/11	13:00	4	fog
7/15/11	2:00:00 PM	7/15/11	14:00	5	fog
7/15/11	3:00:00 PM	7/15/11	15:00	5	fog
7/15/11	4:00:00 PM	7/15/11	16:00	5	fog
7/15/11	5:00:00 PM	7/15/11	17:00	5	fog
7/15/11	6:00:00 PM	7/15/11	18:00	5	fog
7/15/11	7:00:00 PM	7/15/11	19:00	5	clear
7/15/11	8:00:00 PM	7/15/11	20:00		
7/15/11	9:00:00 PM	7/15/11	21:00		
7/15/11	10:00:00 PM	7/15/11	22:00		
7/15/11	11:00:00 PM	7/15/11	23:00		
7/16/11	12:00:00 AM	7/16/11	0:00		
7/16/11	1:00:00 AM	7/16/11	1:00		
7/16/11	2:00:00 AM	7/16/11	2:00		
7/16/11	3:00:00 AM	7/16/11	3:00		
7/16/11	4:00:00 AM	7/16/11	4:00		
7/16/11	5:00:00 AM	7/16/11	5:00		
7/16/11	6:00:00 AM	7/16/11	6:00	3	fog
7/16/11	7:00:00 AM	7/16/11	7:00	3	fog
7/16/11	8:00:00 AM	7/16/11	8:00	3	fog
7/16/11	9:00:00 AM	7/16/11	9:00	3	fog
7/16/11	10:00:00 AM	7/16/11	10:00	3	fog
7/16/11	11:00:00 AM	7/16/11	11:00	2	clearing
7/16/11	12:00:00 PM	7/16/11	12:00	2	clear
7/16/11	1:00:00 PM	7/16/11	13:00	2	clear
7/16/11	2:00:00 PM	7/16/11	14:00	3	fog
7/16/11	3:00:00 PM	7/16/11	15:00	3	fog
7/16/11	4:00:00 PM	7/16/11	16:00	3	fog

7/16/11	5:00:00 PM	7/16/11	17:00	3	fog
7/16/11	6:00:00 PM	7/16/11	18:00	2	fog
7/16/11	7:00:00 PM	7/16/11	19:00	2	fog
7/16/11	8:00:00 PM	7/16/11	20:00	2	fog
7/16/11	9:00:00 PM	7/16/11	21:00	2	fog
7/16/11	10:00:00 PM	7/16/11	22:00	2	fog
7/16/11	11:00:00 PM	7/16/11	23:00		
7/17/11	12:00:00 AM	7/17/11	0:00		
7/17/11	1:00:00 AM	7/17/11	1:00		
7/17/11	2:00:00 AM	7/17/11	2:00		
7/17/11	3:00:00 AM	7/17/11	3:00		
7/17/11	4:00:00 AM	7/17/11	4:00		
7/17/11	5:00:00 AM	7/17/11	5:00		
7/17/11	6:00:00 AM	7/17/11	6:00	2	rain and fog
7/17/11	7:00:00 AM	7/17/11	7:00	2	rain and fog
7/17/11	8:00:00 AM	7/17/11	8:00	2	rain and fog
7/17/11	9:00:00 AM	7/17/11	9:00	2	clearing
7/17/11	10:00:00 AM	7/17/11	10:00	2	clear
7/17/11	11:00:00 AM	7/17/11	11:00	2	Overcast
7/17/11	12:00:00 PM	7/17/11	12:00	2	Overcast
7/17/11	1:00:00 PM	7/17/11	13:00	2	Overcast
7/17/11	2:00:00 PM	7/17/11	14:00	2	fog
7/17/11	3:00:00 PM	7/17/11	15:00	2	fog
7/17/11	4:00:00 PM	7/17/11	16:00	2	clear
7/17/11	5:00:00 PM	7/17/11	17:00	2	clear
7/17/11	6:00:00 PM	7/17/11	18:00	2	clear
7/17/11	7:00:00 PM	7/17/11	19:00	2	intermittent fog
7/17/11	8:00:00 PM	7/17/11	20:00	2	fog
7/17/11	9:00:00 PM	7/17/11	21:00	2	fog
7/17/11	10:00:00 PM	7/17/11	22:00	2	fog
7/17/11	11:00:00 PM	7/17/11	23:00		
7/18/11	12:00:00 AM	7/18/11	0:00		
7/18/11	1:00:00 AM	7/18/11	1:00		
7/18/11	2:00:00 AM	7/18/11	2:00		
7/18/11	3:00:00 AM	7/18/11	3:00		
7/18/11	4:00:00 AM	7/18/11	4:00		
7/18/11	5:00:00 AM	7/18/11	5:00		
7/18/11	6:00:00 AM	7/18/11	6:00	1	fog
7/18/11	7:00:00 AM	7/18/11	7:00	1	fog
7/18/11	8:00:00 AM	7/18/11	8:00	1	fog
7/18/11	9:00:00 AM	7/18/11	9:00	1	fog
7/18/11	10:00:00 AM	7/18/11	10:00	1	fog
7/18/11	11:00:00 AM	7/18/11	11:00	2	fog
7/18/11	12:00:00 PM	7/18/11	12:00	3	fog
7/18/11	1:00:00 PM	7/18/11	13:00	3	clear
7/18/11	2:00:00 PM	7/18/11	14:00	3	clear
7/18/11	3:00:00 PM	7/18/11	15:00	3	clear
7/18/11	4:00:00 PM	7/18/11	16:00	3	clear
7/18/11	5:00:00 PM	7/18/11	17:00	3	clear
7/18/11	6:00:00 PM	7/18/11	18:00	4	clear
7/18/11	7:00:00 PM	7/18/11	19:00	4	clear
7/18/11	8:00:00 PM	7/18/11	20:00	4	clear
7/18/11	9:00:00 PM	7/18/11	21:00	4	clear
7/18/11	10:00:00 PM	7/18/11	22:00	4	clear
7/18/11	11:00:00 PM	7/18/11	23:00		
7/19/11	12:00:00 AM	7/19/11	0:00		
7/19/11	1:00:00 AM	7/19/11	1:00		
7/19/11	2:00:00 AM	7/19/11	2:00		
7/19/11	3:00:00 AM	7/19/11	3:00		
7/19/11	4:00:00 AM	7/19/11	4:00		

7/19/11	5:00:00 AM	7/19/11	5:00		
7/19/11	6:00:00 AM	7/19/11	6:00	5-6	clear gale
7/19/11	7:00:00 AM	7/19/11	7:00	6-7	clear
7/19/11	8:00:00 AM	7/19/11	8:00	7	clear
7/19/11	9:00:00 AM	7/19/11	9:00	7	clear
7/19/11	10:00:00 AM	7/19/11	10:00	7	clear
7/19/11	11:00:00 AM	7/19/11	11:00	7	clear
7/19/11	12:00:00 PM	7/19/11	12:00	7	clear
7/19/11	1:00:00 PM	7/19/11	13:00	7	clear
7/19/11	2:00:00 PM	7/19/11	14:00	7	clear CTD retermination
7/19/11	3:00:00 PM	7/19/11	15:00	7	clear
7/19/11	4:00:00 PM	7/19/11	16:00	7	clear
7/19/11	5:00:00 PM	7/19/11	17:00	7	clear
7/19/11	6:00:00 PM	7/19/11	18:00	7	clear
7/19/11	7:00:00 PM	7/19/11	19:00	7	clear
7/19/11	8:00:00 PM	7/19/11	20:00	7	clear
7/19/11	9:00:00 PM	7/19/11	21:00	7	clear
7/19/11	10:00:00 PM	7/19/11	22:00	7	clear
7/19/11	11:00:00 PM	7/19/11	23:00		
7/20/11	12:00:00 AM	7/20/11	0:00		
7/20/11	1:00:00 AM	7/20/11	1:00		
7/20/11	2:00:00 AM	7/20/11	2:00		
7/20/11	3:00:00 AM	7/20/11	3:00		
7/20/11	4:00:00 AM	7/20/11	4:00		
7/20/11	5:00:00 AM	7/20/11	5:00		
7/20/11	6:00:00 AM	7/20/11	6:00	3	fog
7/20/11	7:00:00 AM	7/20/11	7:00	3	fog
7/20/11	8:00:00 AM	7/20/11	8:00	3	fog
7/20/11	9:00:00 AM	7/20/11	9:00	2	fog
7/20/11	10:00:00 AM	7/20/11	10:00	2	fog
7/20/11	11:00:00 AM	7/20/11	11:00	2	fog
7/20/11	12:00:00 PM	7/20/11	12:00	2	fog
7/20/11	1:00:00 PM	7/20/11	13:00	2	fog
7/20/11	2:00:00 PM	7/20/11	14:00	2	fog
7/20/11	3:00:00 PM	7/20/11	15:00	2	fog
7/20/11	4:00:00 PM	7/20/11	16:00	2	fog
7/20/11	5:00:00 PM	7/20/11	17:00	2	patchy fog
7/20/11	6:00:00 PM	7/20/11	18:00	2	patchy fog
7/20/11	7:00:00 PM	7/20/11	19:00	1	fog
7/20/11	8:00:00 PM	7/20/11	20:00	1	fog
7/20/11	9:00:00 PM	7/20/11	21:00	1	clearing
7/20/11	10:00:00 PM	7/20/11	22:00	1	clear
7/20/11	11:00:00 PM	7/20/11	23:00	1	clear Russian CG parallel
7/21/11	12:00:00 AM	7/21/11	0:00		
7/21/11	1:00:00 AM	7/21/11	1:00		
7/21/11	2:00:00 AM	7/21/11	2:00		
7/21/11	3:00:00 AM	7/21/11	3:00		
7/21/11	4:00:00 AM	7/21/11	4:00		
7/21/11	5:00:00 AM	7/21/11	5:00		
7/21/11	6:00:00 AM	7/21/11	6:00	2	clear
7/21/11	7:00:00 AM	7/21/11	7:00	2	clear
7/21/11	8:00:00 AM	7/21/11	8:00	2	clear
7/21/11	9:00:00 AM	7/21/11	9:00	2	clear
7/21/11	10:00:00 AM	7/21/11	10:00	2	clear
7/21/11	11:00:00 AM	7/21/11	11:00	2	clear
7/21/11	12:00:00 PM	7/21/11	12:00	2	clear
7/21/11	1:00:00 PM	7/21/11	13:00	2	clear
7/21/11	2:00:00 PM	7/21/11	14:00	2	clear
7/21/11	3:00:00 PM	7/21/11	15:00	3	clear
7/21/11	4:00:00 PM	7/21/11	16:00	3	clear

7/21/11	5:00:00 PM	7/21/11	17:00	4	clear
7/21/11	6:00:00 PM	7/21/11	18:00	4	clear
7/21/11	7:00:00 PM	7/21/11	19:00	4	clear
7/21/11	8:00:00 PM	7/21/11	20:00	4	clear
7/21/11	9:00:00 PM	7/21/11	21:00	4	clear
7/21/11	10:00:00 PM	7/21/11	22:00	4	clear
7/21/11	11:00:00 PM	7/21/11	23:00	4	clear
7/22/11	12:00:00 AM	7/22/11	0:00		
7/22/11	1:00:00 AM	7/22/11	1:00		
7/22/11	2:00:00 AM	7/22/11	2:00		
7/22/11	3:00:00 AM	7/22/11	3:00		
7/22/11	4:00:00 AM	7/22/11	4:00		
7/22/11	5:00:00 AM	7/22/11	5:00		
7/22/11	6:00:00 AM	7/22/11	6:00		
7/22/11	7:00:00 AM	7/22/11	7:00		
7/22/11	8:00:00 AM	7/22/11	8:00		
7/22/11	9:00:00 AM	7/22/11	9:00		
7/22/11	10:00:00 AM	7/22/11	10:00		
7/22/11	11:00:00 AM	7/22/11	11:00		
7/22/11	12:00:00 PM	7/22/11	12:00		
7/22/11	1:00:00 PM	7/22/11	13:00		
7/22/11	2:00:00 PM	7/22/11	14:00		
7/22/11	3:00:00 PM	7/22/11	15:00		
7/22/11	4:00:00 PM	7/22/11	16:00		
7/22/11	5:00:00 PM	7/22/11	17:00		
7/22/11	6:00:00 PM	7/22/11	18:00		
7/22/11	7:00:00 PM	7/22/11	19:00		
7/22/11	8:00:00 PM	7/22/11	20:00		
7/22/11	9:00:00 PM	7/22/11	21:00		
7/22/11	10:00:00 PM	7/22/11	22:00		
7/22/11	11:00:00 PM	7/22/11	23:00		

REFERENCES

Jakobsson, M., C.Norman, J.Woodward, R. MacNab, and B.Coakley (2000), New grid of Arctic bathymetry aids scientists and map makers, *Eos Trans.*, *81*, 89, 93, 96.

Woodgate, R. A. (2003), Alpha Helix HX274 Cruise Report, Bering Strait Mooring Cruise June-July 2003, available at http://psc.apl.washington.edu/BeringStrait.html, University of Washington, Seattle.

Woodgate, R. A. (2004), Alpha Helix HX290 Cruise Report, Bering Strait Mooring Cruise August-September 2004, available at http://psc.apl.washington.edu/BeringStrait.html, University of Washington, Seattle.

Woodgate, R. A., and K. Aagaard (2005), Revising the Bering Strait freshwater flux into the Arctic Ocean, *Geophys. Res. Lett.*, *32*, L02602, doi:10.1029/2004GL021747.

Woodgate, R. A., K. Aagaard, and T. J. Weingartner (2005), Monthly temperature, salinity, and transport variability of the Bering Strait throughflow, *Geophys. Res. Lett.*, *32*, L04601, doi:10.1029/2004GL021880.

Woodgate, R. A., K. Aagaard, and T. J. Weingartner (2006), Interannual Changes in the Bering Strait Fluxes of Volume, Heat and Freshwater between 1991 and 2004, *Geophys. Res. Lett.*, *33*, L15609, doi:10.1029/2006GL026931.

Woodgate, R. A., K. Aagaard, and T. J. Weingartner (2007), First steps in calibrating the Bering Strait throughflow: Preliminary study of how measurements at a proposed climate site (A3) compare to measurements within the two channels of the strait (A1 and A2). 20 pp, University of Washington.

Woodgate, R. A., T. J. Weingartner, and R. W. Lindsay (2010), The 2007 Bering Strait Oceanic Heat Flux and anomalous Arctic Sea-ice Retreat, *Geophys. Res. Lett.*, *37*, L01602, doi:10.1029/2009GL041621.

%RUSALCA 2011 CTD log

%Please fill in all data for every event (CTD/net tow)
%There should be one line for the beginning of the event and one line for the end
%Date is GMT and has the format yyyymmdd
%Time is GMT and has the format hhmm
%Type: 1=CTD / 2=Net tow 0=messenger bottle, 4=prodcast
%Number is consecutive for that event type
%In/out: 1=In / 2=Out
%Lat_deg and Lat_min are positive N
%Lon_deg and Lon_min are positive W
%Stn_name is the name of the station (Line ID then station number)
%Fill in any comments if needed.

%NOTE: UNTIL FURTHER NOTICE ALTIMETER+CTD DEPTH DOES NOT EQUAL WATER DEPTH

% Date	Time	Type	#	In/Out	Depth corr m	Lat degN	Lat min	Lon degW	Lon min	Stn_name	Operato	Comments
%		2 casts for Dan for water samples at A2 pre recovery and A2 post deployment										
20110713	1749	0	**1**	1	0	65	46.950	168	34.05	BotsampleA2	DN	messenger bottle sample for ISUS
20110713	1752	0	**1**	1.5	0	65	47.000	168	34.09	pre recovery	DN	bottle fired
20110713	1753	0	**1**	2	0	65	47.060	168	34.13		DN	recovered
20110715	0453	0	**2**	1	0	65	46.690	168	33.82	BotsampleA2	DN	messenger bottle sample for ISUS
20110715	0454	0	**2**	1.5	0	65	46.700	168	33.79	post recovery	DN	bottle fired
%												
20110716	1635	4	**1**	1	57	65	47.020	168	33.92	A2Prod	ACPF	Altimeter problem, so cast not to bottom
20110716	1635	4	**1**	2	57	65	47.020	168	33.92		ACPF	end time and position not recorded
20110716	1937	1	**2**	1	28	65	35.090	168	7.31	BS24	ACPF	Bridge reported 28 m but depth during deployment was 23 m
20110716	1944	1	**2**	2	28	65	35.230	168	7.54		ACPF	since pressure did not increase beyond 23 db.
20110716	2010	1	**3**	1	33	65	36.050	168	9.9	BS23	ACPF	
20110716	2017	1	**3**	2	33	65	36.190	168	10.21		ACPF	
20110716	2041	1	**4**	1	34	65	37.660	168	10.81	BS22	MNP	
20110716	2049	1	**4**	2	34	65	37.877	168	11.032		MNP	
20110716	2103	2	**1**	1	31	65	38.541	168	11.389	BS22	MNP	net
20110716	2109	2	**1**	2	31	65	38.740	168	11.639		MNP	
20110716	2137	1	**5**	1	44	65	38.750	168	15.23	BS21	MNP	
20110716	2146	1	**5**	2	44	65	39.133	168	15.651		MNP	
20110716	2213	1	**6**	1	49	65	39.350	168	19.44	BS20	MNP	
20110716	2222	1	**6**	2	49	65	39.614	168	19.638		MNP	
20110716	2249	1	**7**	1	54	65	40.380	168	23.18	BS19	MNP	
20110716	2301	1	**7**	2	54	65	40.553	168	23.245		MNP	
20110716	2329	1	**8**	1	56	65	41.220	168	27.15	BS18	MNP	
20110716	2341	1	**8**	2	56	65	41.342	168	27.312		MNP	
20110717	0009	1	**9**	1	57	65	42.269	168	31.15	BS17	CST	
20110717	0026	1	**9**	2	57	65	42.538	168	27.8		CST	
20110717	0049	1	**10**	1	53	65	43.323	168	35.515	BS16	CST	
20110717	0106	1	**10**	2	53	65	43.533	168	35.605		CST	
20110717	0111	2	**2**	1	53	65	43.592	168	35.622	BS16	CST	Did not have separate depth measurement for net cast; 53 m
20110717	0117	2	**2**	2	53	65	43.653	168	35.645		CST	depth was from CTD deployment.
20110717	0146	1	**11**	1	53	65	44.425	168	39.741	BS15	CST	

20110717 0202	1	**11**	2	53	65	44.741	168	39.786		CST	
20110717 0232	1	**12**	1	54	65	45.330	168	43.27	BS14	ACPF	
20110717 0245	1	**12**	2	54	65	45.510	168	43.3		ACPF	
20110717 0319	1	**13**	1	54	65	46.353	168	47.552	BS13	CST	
20110717 0338	1	**13**	2	54	65	46.627	168	47.576		CST	
20110717 0402	1	**14**	1	45	65	47.300	168	51.61	BS12	CST	
20110717 0418	1	**14**	2	45	65	47.342	168	51.727		CST	
20110717 0445	1	**15**	1	49	65	48.364	168	55.94	BS11	JW	End of BS line. Move ~1nm N to DI line
20110717 0457	1	**15**	2	49	65	48.547	168	55.823		JW	
20110717 0514	1	**16**	1	49	65	49.305	168	56.045	DI1	JW	Line from Diomedes N to A3 for eddies behind islands
20110717 0524	1	**16**	2	49	65	49.336	168	55.822		JW	
20110717 0542	1	**17**	1	49	65	50.354	168	56.45	DI2	JW	
20110717 0553	1	**17**	2	49	65	50.384	168	56.561		JW	
20110717 0615	1	**18**	1	51	65	51.172	168	56.424	DI3	JW	
20110717 0626	1	**18**	2	51	65	51.196	168	56.411		JW	
20110717 0646	1	**19**	1	47	65	52.217	168	56.629	DI4	JW	Out of fog. Lots of birds
20110717 0657	1	**19**	2	47	65	52.250	168	56.58		JW	
20110717 0719	1	**20**	1	50	65	53.174	168	56.887	DI5	JW	No bottles fired
20110717 0727	1	**20**	2	50	65	53.163	168	56.906		JW	
20110717 0751	1	**21**	1	51	65	54.181	168	56.932	DI6	JW	
20110717 0805	1	**21**	2	51	65	54.206	168	56.662		JW	
20110717 0828	1	**22**	1	51	65	55.130	168	57.131	DI7	JW	No bottles fired
20110717 0835	1	**22**	2	51	65	55.160	168	57.093		JW	
20110717 0855	1	**23**	1	52	65	56.132	168	57.277	DI8	JW	
20110717 0907	1	**23**	2	52	65	56.174	168	56.92		JW	
20110717 0931	1	**24**	1	53	65	57.087	168	57.49	DI9	JW	No bottles fired
20110717 0937	1	**24**	2	53	65	57.122	168	57.468		JW	
20110717 0958	1	**25**	1	54	65	58.108	168	57.592	DI10	JW	
20110717 1007	1	**25**	2	54	65	58.160	168	57.431		JW	
20110717 1026	1	**26**	1	54	65	59.048	168	57.854	DI11	JW	No bottles fired
20110717 1028	1	**26**	2	54	65	59.117	168	57.772		JW	
20110717 1053	1	**27**	1	55	66	0.022	168	58.031	DI12	JW	
20110717 1103	1	**27**	2	55	66	0.083	168	57.86		JW	
20110717 1134	1	**28**	1	55	66	2.570	168	57.441	DI13	JW	No bottles fired
20110717 1141	1	**28**	2	55	66	2.600	168	57.296		JW	
20110717 1210	1	**29**	1	56	66	5.123	168	56.941	DI14	JW	
20110717 1220	1	**29**	2	56	66	5.157	168	56.696		JW	
20110717 1250	1	**30**	1	56	66	7.660	168	56.484	DI15	JW	No bottles fired
20110717 1258	1	**30**	2	56	66	7.688	168	56.421		JW	
20110717 1330	1	**31**	1	57	66	10.203	168	55.898	DI16	JW	
20110717 1341	1	**31**	2	57	66	10.260	168	55.774		JW	
20110717 1411	1	**32**	1	59	66	12.754	168	55.395	DI17	JW	No bottles fired
20110717 1418	1	**32**	2	59	66	12.814	168	55.397		JW	
20110717 1448	1	**33**	1	59	66	15.308	168	54.812	DI18	JW	
20110717 1459	1	**33**	2	59	66	15.462	168	54.663		JW	
20110717 1529	1	**34**	1	58	66	17.841	168	54.284	DI19	JW	No bottles fired
20110717 1537	1	**34**	2	58	66	17.873	168	54.258		JW	End of DL line - move to AL12 (A3 mooring),wait for light
20110717 1636	4	**35**	1	58	66	19.680	168	58.05	A3Prod	ACPF	
20110717 1646	4	**35**	2	58	66	19.730	168	58.05		ACPF	

20110717 1716	1	**36**	1	58	66	19.690	168	57.64	A3_11	ACPF	Mooring station, also called AL12. Start of line AL
20110717 1728	1	**36**	2	58	66	19.650	168	57.75		ACPF	
20110717 1806	1	**37**	1	58	66	20.410	168	53.72	AL13	ACPF	
20110717 1817	1	**37**	2	58	66	20.470	168	53.7		ACPF	
20110717 1850	1	**38**	1	57	66	21.120	168	49.34	AL14	ACPF	
20110717 1901	1	**38**	2	57	66	21.160	168	49.27		ACPF	
20110717 1930	1	**39**	1	50	66	21.758	168	45.24	AL15	ACPF	
20110717 1940	1	**39**	2	50	66	21.799	168	45.215		ACPF	
20110717 2013	1	**40**	1	60	66	22.556	168	40.763	AL16	MNP	
20110717 2024	1	**40**	2	60	66	22.646	168	40.688		MNP	
20110717 2053	1	**41**	1	58	66	23.298	168	36.366	AL17	MNP	
20110717 2103	1	**41**	2	58	66	23.489	168	36.224		MNP	
20110717 2131	1	**42**	1	56	66	24.021	168	32.159	AL18	MNP	
20110717 2142	1	**42**	2	56	66	24.217	168	32.104		MNP	
20110717 2213	1	**43**	1	56	66	24.686	168	27.834	AL19	MNP	
20110717 2224	1	**43**	2	56	66	24.797	168	27.815		MNP	
20110717 2253	1	**44**	1	55	66	25.403	168	23.562	AL20	MNP	
20110717 2304	1	**44**	2	55	66	25.488	168	23.555		MNP	
20110717 2331	1	**45**	1	50	66	26.125	168	19.176	AL21	MNP	
20110717 2341	1	**45**	2	50	66	26.244	168	19.135		MNP	
20110718 0016	1	**46**	1	43	66	26.780	168	14.946	AL22	CST	CTD brought back to surface for restart due to delayed start
20110718 0026	1	**46**	2	43	66	27.022	168	14.747		CST	of deck unit recording
20110718 0105	1	**47**	1	36	66	27.610	168	10.744	AL23	CST	
20110718 0115	1	**47**	2	36	66	27.728	168	10.896		CST	
20110718 0152	1	**48**	1	30	66	28.175	168	6.279	AL24	CST	
20110718 0200	1	**48**	2	30	66	28.193	168	6.183		CST	End of AL line - start transit to AS1
20110718 0409	1	**49**	1	31	66	41.446	167	38.895	AS1	JW	Start of AS line
20110718 0417	1	**49**	2	31	66	41.440	167	38.752		JW	
20110718 0501	1	**50**	1	31	66	45.002	167	43.765	AS2	JW	No bottles fired
20110718 0508	1	**50**	2	31	66	44.981	167	43.856		JW	
20110718 0554	1	**51**	1	32	66	48.540	167	48.641	AS3	JW	
20110718 0602	1	**51**	2	32	66	48.466	167	48.519		JW	
20110718 0714	1	**52**	1	35	66	55.620	167	58.524	AS5	JW	Skipping even stations… No bottles fired
20110718 0721	1	**52**	2	35	66	55.627	167	58.523		JW	
20110718 0829	1	**53**	1	44	67	2.721	168	8.364	AS7	JW	
20110718 0838	1	**53**	2	44	67	2.785	168	8.311		JW	
20110718 0919	1	**54**	1	39	67	6.255	168	13.3	AS9	JW	No bottles fired
20110718 0927	1	**54**	2	39	67	6.292	168	13.316		JW	
20110718 1005	1	**55**	1	42	67	9.800	168	18.188	AS11	JW	
20110718 1014	1	**55**	2	42	67	9.862	168	18.099		JW	
20110718 1054	1	**56**	1	45	67	13.351	168	23.139	AS13	JW	No bottles fired
20110718 1102	1	**56**	2	45	67	13.439	168	23.096		JW	
20110718 1207	1	**57**	1	49	67	20.399	168	32.945	AS15	JW	
20110718 1215	1	**57**	2	49	67	20.498	168	32.914		JW	
20110718 1319	1	**58**	1	51	67	27.485	168	42.792	AS17	JW	No bottles fired
20110718 1327	1	**58**	2	51	67	27.584	168	42.697		JW	
20110718 1407	1	**59**	1	52	67	31.023	168	47.741	AS18	JW	
20110718 1417	1	**59**	2	52	67	31.156	168	47.685		JW	
20110718 1459	1	**60**	1	52	67	34.572	168	52.597	AS19	JW	No bottles fired

20110718 1513	1	**60**	2	52	67	34.714	168	52.378		JW	
20110718 1637	4	**61**	1	51	67	38.036	168	57.426	CS10USProd	ACPF	Bottle #4 misfired. Top of rossette was rinsed with warm
20110718 1647	4	**61**	2	51	67	38.203	168	57.238		ACPF	water
20110718 1651	2	**3**	1	51	67	38.250	168	57.141	CS10US	ACPF	Net. Counter broke, hit bottom. Net sample will be repeated
20110718 1659	2	**3**	2	51	67	38.369	168	56.943		ACPF	
20110718 1716	1	**62**	1	51	67	38.623	168	56.54	CS10US	ACPF	CTD profiles different than Cast #062 at the same position
20110718 1726	1	**62**	2	51	67	38.756	168	56.298		ACPF	A third CTD cast will be done.
20110718 1735	2	**4**	1	51	67	38.885	168	56.078	CS10US	ACPF	Net
20110718 1739	2	**4**	2	51	67	38.951	168	55.97		ACPF	
20110718 1820	1	**63**	1	51	67	38.131	168	57.679	CS10US	ACPF	No bottles fired
20110718 1826	1	**63**	2	51	67	38.178	168	57.787		ACPF	Repeated position as for cast # 62 and cast # 61
20110718 1943	1	**64**	1	51	67	45.340	168	39.857	CS11	ACPF	
20110718 1952	1	**64**	2	51	67	45.457	168	39.636		ACPF	
20110718 2114	1	**65**	1	57	67	52.620	168	18.737	CS12	MNP	
20110718 2125	1	**65**	2	57	67	52.771	168	18.527		MNP	
20110718 2129	2	**5**	1	57	67	52.841	168	18.424	CS12	MNP	
20110718 2135	2	**5**	2	57	67	52.923	168	18.312		MNP	
20110718 2255	1	**66**	1	56	67	59.411	167	59.461	CS13	MNP	
20110718 2305	1	**66**	2	56	67	59.609	167	59.525		MNP	
20110719 0025	1	**67**	1	54	68	6.203	167	40.001	CS14	CST	
20110719 0039	1	**67**	2	54	68	6.505	167	39.935		CST	
20110719 0043	2	**6**	1	54	68	6.604	167	39.887	CS14	CST	
20110719 0050	2	**6**	2	54	68	6.755	167	39.805		CST	
20110719 0207	1	**68**	1	50	68	12.148	167	21.358	CS15	CST	
20110719 0219	1	**68**	2	50	68	12.472	167	21.149		CST	
20110719 0306	1	**69**	1	46	68	15.078	167	12.08	CS16	CST	
20110719 0317	1	**69**	2	46	68	15.408	167	11.959		CST	
20110719 0402	1	**70**	1	40	68	18.079	167	2.898	CS17	CST	
20110719 0413	1	**70**	2	40	68	18.358	167	2.898		CST	
20110719 0419	2	**7**	1	40	68	18.486	167	2.959	CS17	JW	CS17 Net
20110719 0422	2	**7**	2	40	68	18.642	167	3.069		JW	
20110719 0503	1	**71**	1	36	68	19.046	166	57.781	CS18	JW	Drifting at ~3kts according to Nobeltec
20110719 0513	1	**71**	2	36	68	19.435	166	58.23		JW	
20110719 0947	1	**72**	1	30	68	54.465	166	19.829	LIS1	JW	1.5-2kts drift. Lot of towing at sfc.
20110719 0956	1	**72**	2	30	68	54.280	166	20.027		JW	Somes issue getting to depth to fire btls and 7 was leaking
20110719 1025	1	**73**	1	35	68	54.801	166	25.482	LIS2	JW	
20110719 1034	1	**73**	2	35	68	54.641	166	25.573		JW	
20110719 1100	1	**74**	1	36	68	55.303	166	30.448	LIS3	JW	Start taking sfc samples with bucket due to bad weather
20110719 1111	1	**74**	2	36	68	55.155	166	31.193		JW	
20110719 1144	1	**75**	1	45	68	55.796	166	38.608	LIS4	JW	
20110719 1154	1	**75**	2	45	68	55.535	166	38.732		JW	
20110719 1232	1	**76**	1	47	68	56.403	166	46.602	LIS5	JW	
20110719 1242	1	**76**	2	47	68	56.211	166	46.769		JW	
20110719 1320	1	**77**	1	47	68	57.004	166	54.641	LIS6	JW	
20110719 1329	1	**77**	2	47	68	56.874	166	54.921		JW	
20110719 1337	2	**8**	1	47	68	56.835	166	54.861	LIS6	JW	Net
20110719 1342	2	**8**	2	47	68	56.976	166	54.588		JW	
20110719 1443	1	**78**	1	48	68	58.214	167	9.295	LIS7	JW	
20110719 1452	1	**78**	2	48	68	58.054	167	9.462		JW	

20110719	1543	1	**79**	1	49	68	59.404	167	23.873	LIS8	JW	
20110719	1554	1	**79**	2	49	68	59.281	167	24.121		JW	
20110719	1645	1	**80**	1	50	69	0.049	167	38.377	LIS9	ACPF	Altimeter moved down, it was fixed (moved up) soon after
20110719	1655	1	**80**	2	50	69	0.019	167	38.105		ACPF	the recovery.
20110719	1748	1	**81**	1	50	69	1.847	167	53.408	LIS10	ACPF	
20110719	1758	1	**81**	2	50	69	1.750	167	53.191		ACPF	
20110719	1807	2	**9**	1	50	69	1.974	167	52.381	LIS10	ACPF	Net
20110719	1812	2	**9**	2	50	69	2.111	167	52.11		ACPF	
20110719	1916	1	**82**	1	51	69	1.364	168	7.964	LIS11	ACPF	CTD rossette hit and got stuck on winch at recovery.
20110719	1924	1	**82**	2	51	69	1.292	168	7.895		ACPF	Bottle 9 removed. All else is fixed and working well.
20110720	1059	1	**83**	1	55	68	59.996	168	55.992	CCL22	JW	Btl 9 'fired' tho no B9 on rosette to use sequential fire GUI.
20110720	1111	1	**83**	2	55	69	0.167	168	55.593		JW	Btl 5 did not fire.
20110720	1116	2	**10**	1	55	69	0.244	168	55.42	CCL22	JW	
20110720	1123	2	**10**	2	55	69	0.335	168	55.212		JW	
20110720	1302	1	**84**	1	55	68	49.993	168	55.948	CCL21	JW	
20110720	1312	1	**84**	2	55	68	50.077	168	55.494		JW	
20110720	1445	1	**85**	1	54	68	40.031	168	56.02	CCL20	JW	
20110720	1454	1	**85**	2	54	68	40.084	168	55.735		JW	
20110720	1628	1	**86**	1	56	68	30.011	168	56.041	CCL19	ACPF	
20110720	1638	1	**86**	2	56	68	30.073	168	55.83		ACPF	
20110720	1813	1	**87**	1	57	68	19.997	168	56.084	CCL18	ACPF	
20110720	1824	1	**87**	2	57	68	20.035	168	55.907		ACPF	
20110720	1951	1	**88**	1	59	68	9.978	168	55.998	CCL17	ACPF	Bottle 6 did not fire.
20110720	2002	1	**88**	2	59	68	9.943	168	55.676		ACPF	
20110720	2114	1	**89**	1	58	68	0.010	168	56.087	CCL16	MNP	
20110720	2123	1	**89**	2	58	67	59.982	168	55.795		MNP	
20110720	2137	4	**90**	1	58	67	59.982	168	55.795	CCL16Prod	MNP	
20110720	2149	4	**90**	2	58	67	59.951	168	54.973		MNP	
20110720	2300	1	**91**	1	52	67	50.035	168	55.982	CCL15	MNP	
20110720	2308	1	**91**	2	52	67	50.028	168	55.687		MNP	
20110721	0037	1	**92**	1	52	67	37.982	168	55.808	CCL14	CST	
20110721	0047	1	**92**	2	52	67	37.952	168	55.393		CST	
20110721	0054	2	**11**	1	52	67	37.935	168	55.156	CCL14	CST	
20110721	0058	2	**11**	2	52	67	37.924	168	55.034		CST	
20110721	0206	1	**93**	1	52	67	30.008	168	55.931	CCL13	CST	CTD perhaps fouled with mud at bottom (cf S trace on plot).
20110721	0217	1	**93**	2	52	67	29.998	168	55.573		CST	Winch stopped at approx. 50 m depth.
20110721	0332	1	**94**	1	51	67	19.991	168	55.935	CCL12	CST	
20110721	0342	1	**94**	2	51	67	19.980	168	55.856		CST	
20110721	0447	1	**95**	1	50	67	10.043	168	56.017	CCL11	JW	
20110721	0457	1	**95**	2	50	67	10.153	168	56.024		JW	
20110721	0609	1	**96**	1	50	67	0.054	168	56.016	CCL10	JW	
20110721	0621	1	**96**	2	50	67	0.233	168	55.672		JW	
20110721	0741	1	**97**	1	46	66	50.047	168	56.119	CCL9	JW	
20110721	0752	1	**97**	2	46	66	50.229	168	55.886		JW	
20110721	0908	1	**98**	1	45	66	40.049	168	56.002	CCL8	JW	
20110721	0919	1	**98**	2	45	66	40.302	168	55.775		JW	
20110721	1011	1	**99**	1	48	66	35.029	168	56.036	CCL7	JW	
20110721	1021	1	**99**	2	48	66	35.259	168	55.91		JW	
20110721	1113	1	**100**	1	48	66	30.012	168	56.045	CCL6	JW	

20110721	1124	1	**100**	2	48	66	30.211	168	55.997		JW	
20110721	1213	1	**101**	1	58	66	25.034	168	56.035	CCL5	JW	
20110721	1225	1	**101**	2	58	66	25.198	168	55.818		JW	
20110721	1300	1	**102**	1	57	66	22.316	168	56.835	CCL4	JW	
20110721	1312	1	**102**	2	57	66	22.416	168	56.604		JW	
20110721	1345	1	**103**	1	57	66	19.673	168	57.465	A3_11	JW	
20110721	1359	1	**103**	2	57	66	19.835	168	57.088		JW	
20110721	1421	1	**104**	1	57	66	20.438	168	53.721	DI20	JW	aka AL13… No bottles fired
20110721	1429	1	**104**	2	57	66	20.595	168	53.55		JW	
20110721	1509	1	**105**	1	57	66	17.875	168	54.249	DI19	JW	No bottles fired
20110721	1515	1	**105**	2	57	66	17.969	168	53.996		JW	
20110721	1556	1	**106**	1	58	66	15.300	168	54.784	DI18	JW	
20110721	1606	1	**106**	2	58	66	15.406	168	54.501		JW	
20110721	1641	1	**107**	1	58	66	12.796	168	55.224	DI17	ACPF	No bottles fired
20110721	1648	1	**107**	2	58	66	12.924	168	55.052		ACPF	
20110721	1728	1	**108**	1	56	66	10.271	168	55.914	DI16	ACPF	
20110721	1738	1	**108**	2	56	66	10.445	168	55.669		ACPF	
20110721	1816	1	**109**	1	55	66	7.682	168	56.401	DI15	ACPF	No bottles fired
20110721	1822	1	**109**	2	55	66	7.770	168	56.302		ACPF	
20110721	1858	1	**110**	1	55	66	5.147	168	57.035	DI14	ACPF	Bottle #6 malfunctioned. Bucket for surface sample was used
20110721	1907	1	**110**	2	55	66	5.280	168	56.8		ACPF	
20110721	1942	1	**111**	1	54	66	2.621	168	57.479	DI13	ACPF	No bottles fired
20110721	1948	1	**111**	2	54	66	2.724	168	57.288		ACPF	
20110721	2026	1	**112**	1	54	66	0.059	168	57.928	DI12	MNP	
20110721	2035	1	**112**	2	54	66	0.194	168	57.588		MNP	
20110721	2102	1	**113**	1	53	65	59.092	168	57.816	DI11	MNP	
20110721	2108	1	**113**	2	53	65	59.189	168	57.648		MNP	
20110721	2137	1	**114**	1	53	65	58.145	168	57.613	DI10	MNP	
20110721	2145	1	**114**	2	53	65	58.294	168	57.3		MNP	
20110721	2214	1	**115**	1	52	65	57.173	168	57.337	DI9	MNP	
20110721	2219	1	**115**	2	52	65	57.284	168	57.088		MNP	
20110721	2250	1	**116**	1	52	65	56.114	168	57.31	DI8	MNP	Bottle 5 didn't close, 6 leaked
20110721	2259	1	**116**	2	52	65	56.239	168	56.911		MNP	
20110721	2307	1	**117**	1	52	65	56.390	168	56.35	DI8	MNP	Repeats the previous one
20110721	2316	1	**117**	2	52	65	56.456	168	56.104		MNP	
20110721	2349	1	**118**	1	51	65	55.174	168	57.068	DI7	MNP	
20110721	2354	1	**118**	2	51	65	55.256	168	56.857		MNP	
20110722	0023	1	**119**	1	51	65	54.166	168	56.985	DI6	CST	
20110722	0034	1	**119**	2	51	65	54.347	168	56.598		CST	
20110722	0100	1	**120**	1	45	65	53.194	168	56.826	DI5	CST	No bottles fired
20110722	0108	1	**120**	2	45	65	53.286	168	56.552		CST	
20110722	0138	1	**121**	1	47	65	52.213	168	56.651	DI4	CST	
20110722	0148	1	**121**	2	47	65	52.324	168	56.233		CST	
20110722	0214	1	**122**	1	50	65	51.224	168	56.465	DI3	CST	
20110722	0225	1	**122**	2	50	65	51.342	168	56.029		CST	
20110722	0300	1	**123**	1	50	65	50.405	168	55.913	DI2	CST	
20110722	0311	1	**123**	2	50	65	50.555	168	55.405		CST	
20110722	0344	1	**124**	1	49	65	49.329	168	56.053	DI1	CST	
20110722	0355	1	**124**	2	49	65	49.545	168	55.515		CST	

20110722	0414	1	**125**	1	47	65	49.244	168	52.202	DIa 1	JW	
20110722	0424	1	**125**	2	47	65	49.375	168	51.782		JW	
20110722	0442	1	**126**	1	50	65	50.274	168	52.223	DIa2	JW	sponge from bottom
20110722	0454	1	**126**	2	50	65	50.550	168	51.88		JW	
20110722	0508	1	**127**	1	51	65	51.248	168	52.552	DIa3	JW	
20110722	0519	1	**127**	2	51	65	52.435	168	52.434		JW	
20110722	0533	1	**128**	1	51	65	52.239	168	52.619	DIa4	JW	
20110722	0543	1	**128**	2	51	65	52.447	168	52.452		JW	
20110722	0557	1	**129**	1	51	65	53.123	168	52.859	DIa5	JW	No bottles fired
20110722	0606	1	**129**	2	51	65	53.29	168	52.663		JW	
20110722	0623	1	**130**	1	52	65	54.161	168	52.967	DIa6	JW	Seal
20110722	0635	1	**130**	2	52	65	54.386	168	52.893		JW	
20110722	0652	1	**131**	1	53	65	55.150	168	53.196	DIa7	JW	No bottles fired - Seal again
20110722	0702	1	**131**	2	53	65	55.405	168	53.134		JW	
20110722	0717	1	**132**	1	53	65	56.137	168	53.32	DIa8	JW	seal again, puffins, dead bird and feathers
20110722	0729	1	**132**	2	53	65	56.437	168	53.229		JW	
20110722	0743	1	**133**	1	53	65	57.091	168	53.524	DIa9	JW	No bottles fired
20110722	0754	1	**133**	2	53	65	57.285	168	53.456		JW	Arny is still here. He'll be back
20110722	0811	1	**134**	1	54	65	58.031	168	53.77	DIa10	JW	He wasn't back…
20110722	0823	1	**134**	2	54	65	58.305	168	53.66		JW	
20110722	0838	1	**135**	1	54	65	59.071	168	53.876	DIa11	JW	No bottles fired
20110722	0848	1	**135**	2	54	65	59.326	168	53.715		JW	
20110722	0903	1	**136**	1	55	66	0.015	168	54.017	DIa12	JW	
20110722	0913	1	**136**	2	55	66	0.315	168	53.795		JW	
20110722	0944	1	**137**	1	56	65	59.978	168	50.003	DIb12	JW	
20110722	0956	1	**137**	2	56	66	0.172	168	49.639		JW	
20110722	1021	1	**138**	1	55	65	59.057	168	49.804	DIb11	JW	
20110722	1030	1	**138**	2	55	65	59.284	168	49.46		JW	
20110722	1057	1	**139**	1	55	65	58.021	168	49.694	DIb10	JW	Sfc btl not register in SeaSave. Acquisit. stopped w/out sfc btl.
20110722	1110	1	**139**	2	55	65	58.262	168	49.268		JW	Bucket sample taken for surface
20110722	1136	1	**140**	1	55	65	57.066	168	49.509	DIb9	JW	
20110722	1148	1	**140**	2	55	65	57.361	168	49.042		JW	
20110722	1214	1	**141**	1	54	65	56.023	168	49.477	DIb8	JW	
20110722	1224	1	**141**	2	54	65	56.281	168	49.18		JW	
20110722	1254	1	**142**	1	54	65	55.086	168	49.292	DIb7	JW	
20110722	1304	1	**142**	2	54	65	55.311	168	48.96		JW	
20110722	1426	1	**143**	1	46	65	47.218	168	51.767	BS12	JW	>15 minutes for ship to set up for cast…
20110722	1435	1	**143**	2	46	65	47.428	168	51.45		JW	Whales sighted close to station.
20110722	1506	1	**144**	1	54	65	46.322	168	47.672	BS13	JW	
20110722	1518	1	**144**	2	54	65	46.439	168	47.135		JW	
20110722	1549	1	**145**	1	54	65	45.303	168	43.214	BS14	JW	
20110722	1600	1	**145**	2	54	65	45.495	168	42.425		JW	
20110722	1631	1	**146**	1	53	65	44.440	168	39.628	BS15	ACPF	Bottle #6 did not fire. Bottle #5 DID fire.
20110722	1641	1	**146**	2	53	65	44.612	168	39.179		ACPF	
20110722	1717	1	**147**	1	56	65	47.080	168	33.941	A2	ACPF	Calibration cast near mooring site A2-11
20110722	1729	1	**147**	2	56	65	47.294	168	33.505		ACPF	Again, bottle #6 did not fire. Bottle #5 DID fire.
20110722	1820	1	**148**	1	53	65	44.411	168	39.842	BS15	ACPF	Repeated station after calibration cast near mooring site A2-11
20110722	1829	1	**148**	2	53	65	44.612	168	39.919		ACPF	Bottle #5 did not fire. Bottle #6 DID fire this time.
20110722	1913	1	**149**	1	53	65	43.333	168	35.476	BS16	ACPF	Bottle #7 was leaking. Sample from this bottle was not taken.

20110722	1923	1	**149**	2	53	65	43.487	168	35.194		ACPF	Bottle #6 did not fire. Bottle #5 DID fire.
20110722	1958	1	**150**	1	55	65	42.228	168	31.165	BS17	ACPF	
20110722	2007	1	**150**	2	55	65	42.348	168	30.834		ACPF	
20110722	2038	1	**151**	1	55	65	41.246	168	26.832	BS18	MNP	
20110722	2048	1	**151**	2	55	65	41.468	168	26.478		MNP	
20110722	2122	1	**152**	1	53	65	40.420	168	23.352	BS19	MNP	
20110722	2132	1	**152**	2	53	65	40.699	168	22.908		MNP	
20110722	2206	1	**153**	1	50	65	39.462	168	19.435	BS20	MNP	
20110722	2218	1	**153**	2	50	65	40.058	168	19.663		MNP	
20110722	2307	1	**154**	1	44	65	38.560	168	15.054	BS21	MNP	
20110722	2316	1	**154**	2	44	65	39.119	168	15.245		MNP	
20110723	0003	1	**155**	1	34	65	37.431	168	10.891	BS22	CST	
20110723	0009	1	**155**	2	34	65	37.769	168	11.234		CST	
20110723	0049	1	**156**	1	32	65	36.203	168	9.595	BS23	CST	Drifted halfway back to BS22.
20110723	0056	1	**156**	2	32	65	36.554	168	9.677		CST	
20110723	0141	1	**157**	1	26	65	34.966	168	7.016	BS24	CST	
20110723	0148	1	**157**	2	26	65	35.212	168	7.585		CST	