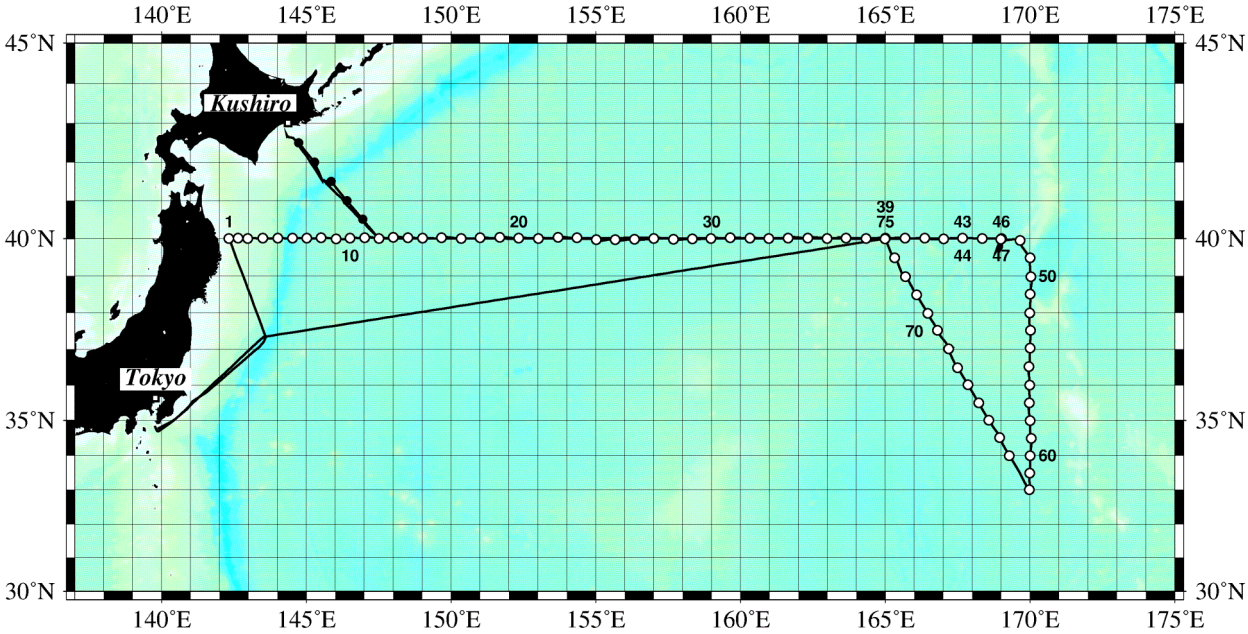
CRUISE REPORT: RF12-06

(Updated FEB 2014)



Highlights

Cruise Summary Information

WOCE Section Designation	**RF12-06**
Expedition designation (ExpoCodes)	**49RY20120726** (aka: 49UP20120726, 40N)
Chief Scientists	**Hitomi KAMIYA**
Dates	2012 JUL 26 - 2012 AUG 16 Leg 1 2012 AUG 21 - 2012 SEP 13 Leg 2
Ship	R/V Ryofu Maru
Ports of call	Tokyo - Kushiro - Tokyo
Geographic Boundaries	40° 04.31' N 142° 18.89' E 170° 04.51' E 32° 59.86' N
Stations	75
Floats and drifters deployed	1 bouy, 2 floats deployed
Moorings deployed or recovered	0

Contact Information:

Hitomi KAMIYA

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Links To Select Topics

Shaded sections are not relevant to this cruise or were not available when this report was compiled.

Cruise Summary Information	Hydrographic Measurements
Description of Scientific Program	CTD Data:
Geographic Boundaries	Acquisition
Cruise Track (Figure): PI CCHDO	Processing
Description of Stations	Calibration
Description of Parameters Sampled	Temperature Pressure
Bottle Depth Distributions (Figure)	Salinities Oxygens
Floats and Drifters Deployed	Bottle Data
Moorings Deployed or Recovered	Salinity
	Oxygen
Principal Investigators	Nutrients
Cruise Participants	Carbon System Parameters
	CFCs
Problems and Goals Not Achieved	Helium / Tritium
Other Incidents of Note	Radiocarbon
Underway Data Information	**References**
Navigation Bathymetry	
Acoustic Doppler Current Profiler (ADCP)	
Thermosalinograph	
XBT and/or XCTD	
Meteorological Observations	**Acknowledgments**
Atmospheric Chemistry Data	

Data Processing Notes

A. Cruise narrative

1. Highlights

Cruise designation: RF12-06（40N）

a. EXPOCODE: 49UP20120726

b. Chief scientist: Hitomi KAMIYA (hkamiya@met.kishou.go.jp)

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c. Ship name: R/V Ryofu Maru

d. Ports of call: Leg 1: Tokyo - Kushiro, Leg 2: Kushiro - Tokyo

e. Cruise dates: Leg 1: 26 July 2012 - 16 August 2012

Leg 2: 21 August 2012 - 13 September 2012

f. Floats and drifters deployed: two profiling floats and one drifting ocean data buoy

2. *Cruise Summary Information*

RF12-06 cruise was carried out during the period from July 26 to September 13, 2012. The cruise started from the east of Honshu, Japan, and sailed towards east along 40°N. This line was not observed in the WOCE (World Ocean Circulation Experiment) Hydrographic Programme.

R/V Ryofu Maru departed Tokyo (Japan) on July 26, 2012. Before the observation at the first station, all watch standers were drilled in the method of sample drawing and CTD operations near Izu-Oshima (34°42'N, 139°52'E). The hydrographic cast of $CTDO_2$ was started at the first station (Stn.1 (40°00'N, 142°19'E; RF4461)) on June 28. Leg 1 consisted of 43 stations from Stn.1 to Stn.43 (40°01'N, 167°40'E; RF4498). She called for Kushiro on August 16, 2012 (Leg 1). She left Kushiro on August 21, 2012 for Tokyo and arrived on September 13, 2012 (Leg 2). Leg 2 consisted of 32 stations from Stn.44 (40°01'N, 167°41'E; RF4504) to Stn.75 (39°59'N, 164°59'E; RF4535). To examine consistency of data, we carried out the observation twice at 40°N, 165°E (Stn.39 and 75), 40°N, 167°40'E (Stn.43 and 44) and 40°N, 169°E (Stn.46 and 47). In order to ensure a controlled spooling of the armored cable, we rewound the cable three times at 37°20'N, 143°35'E (about 7000 m depth), 40°N, 154°20'E (about 5560 m depth) and 41°30'N, 145°35'E (about 6000 m depth). Cruise track and station location are shown in Figure 1.

A total of 75 stations was occupied using a Sea-Bird Electronics (SBE) 36 position carousel equipped with 10-liter Niskin water sample bottles, a CTD system (SBE911plus) equipped with SBE35 deep ocean standards thermometer, JFE Advantech oxygen sensor (RINKO III), Teledyne Benthos altimeter, and Teledyne RD Instruments Lowered Acoustic Doppler Current Profiler (L-ADCP).

At each station, full-depth $CTDO_2$ (temperature, conductivity (salinity) and dissolved oxygen) profile and up to 36 water samples were taken and analyzed. Water samples were obtained from 10 dbar to approximately 10 m above the bottom. In addition, surface water was sampled by a stainless steel bucket at each station. Sampling layer is designed as so-called staggered mesh as shown in Table 2 (*Swift*, 2010). The bottle depth diagram is shown in Figure 2.

Water samples were analyzed for salinity, dissolved oxygen, nutrients, dissolved inorganic carbon (DIC), total alkalinity (TA), pH, CFC-11, CFC-12 and phytopigment (chlorophyll-a and phaeopigments). Underway measurements of partial pressure of carbon dioxide (pCO_2), temperature, salinity, chlorophyll-a, subsurface current, bathymetry and meteorological parameters were conducted along the cruise track.

One drifting ocean data buoy (WMO number : 21636) was deployed at 38°45.947'N, 142°50.188'E on June 28, 2012. Two ARGO floats (PROVOR: nke Instrumentation, France) were deployed at the request of JAMSTEC along the cruise track. The information of deployed floats is listed in Table 1.

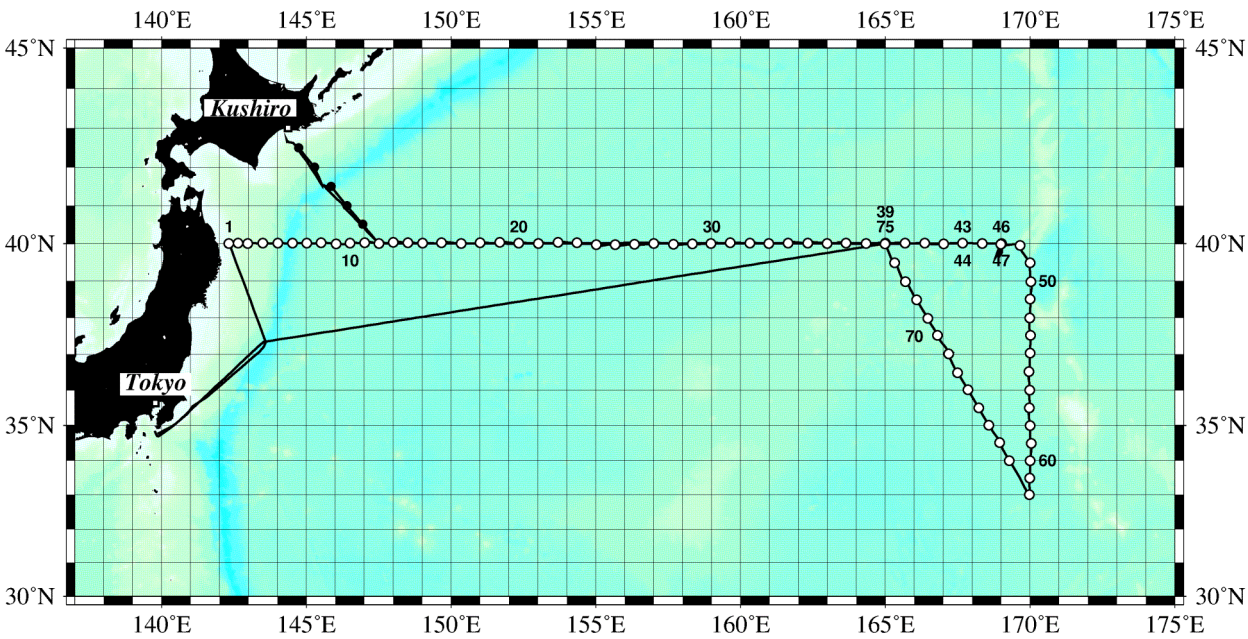

***Figure 1**: Cruise track of RF12-06. Open and closed circles indicate CTD station and X-BT station, respectively.*

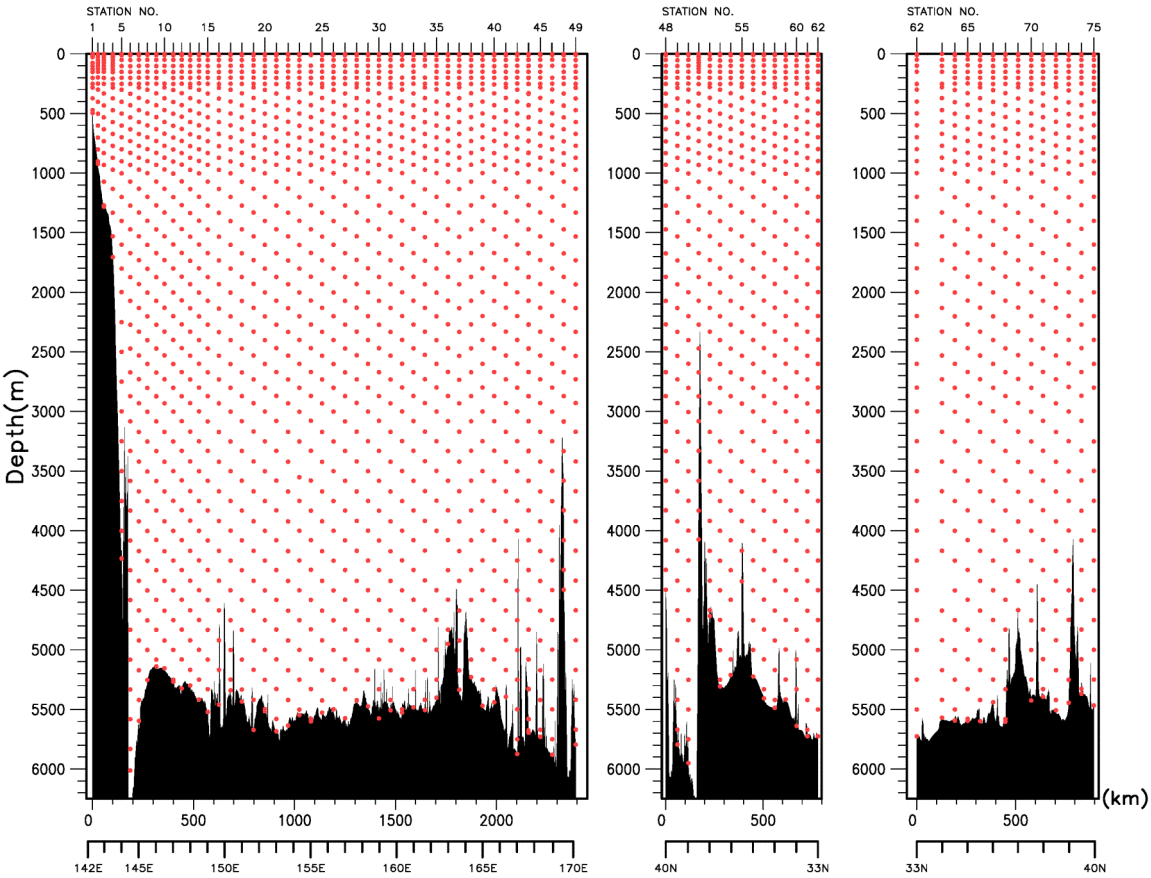

***Figure 2**: The bottle depth diagram for RF12-06 cruise.*

Table 1: *Information of deployed floats in RF12-06.*

ARGOS ID	***Date and Time of System Reset (UTC)***	***Date and Time of Deployment (UTC)***	***Position of deployment***	***PI***	***Remark***
97946	August 9, 17:53	August 9, 19:00	39-58.531 N, 167-01.768 E	JAMSTEC	Stn. 42 (RF4499)
97912	Sept. 3, 17:40	Sept. 3, 18:59	37-01.347N, 167-14.029E	JAMSTEC	Stn.69 (RF4529)

Table 2: *The scheme of sampling layer in meters.*

Bottle count	***scheme1***	***scheme2***	***scheme3***
1	10	10	10
2	50	50	50
3	100	100	100
4	150	150	150
5	200	200	200
6	250	250	250
7	300	330	280
8	400	430	370
9	500	530	470
10	600	630	570
11	700	730	670
12	800	830	770
13	900	930	870
14	1000	1070	970
15	1200	1270	1130
16	1400	1470	1330
17	1600	1670	1530
18	1800	1870	1730
19	2000	2070	1930
20	2200	2270	2130
21	2400	2470	2330
22	2600	2670	2530
23	2800	2870	2730
24	3000	3080	2930
25	3250	3330	3170
26	3500	3580	3420
27	3750	3830	3670
28	4000	4080	3920
29	4250	4330	4170
30	4500	4580	4420
31	4750	4830	4670
32	5000	5080	4920
33	5250	5330	5170
34	5500	5580	5420
35	5750	5830	5670
36	Bottom	Bottom	Bottom

Table 3: *Station data of RF12-06 cruise. The 'RF' column indicates the JMA station identification number.*

Leg	***Station***		***Position***	
	Stn.	*RF*	*Latitude*	*Longitude*
1	1	4461	39-59.97 N	142-19.33 E
1	2	4462	40-00.95 N	142-38.12 E
1	3	4463	40-00.23 N	142-58.65 E
1	4	4464	40-00.53 N	143-29.88 E
1	5	4465	40-00.53 N	144-00.60 E
1	6	4466	40-01.02 N	144-30.91 E
1	7	4467	40-00.48 N	145-01.15 E
1	8	4468	40-01.06 N	145-30.62 E
1	9	4469	39-59.20 N	146-01.73 E
1	10	4470	40-00.66 N	146-30.13 E
1	11	4471	40-01.44 N	147-00.81 E
1	12	4472	40-00.10 N	147-30.32 E
1	13	4473	40-01.75 N	147-59.66 E
1	14	4474	40-01.25 N	148-30.73 E
1	15	4475	40-00.88 N	149-01.07 E
1	16	4476	40-01.46 N	149-40.02 E
1	17	4477	40-00.21 N	150-20.61 E
1	18	4478	40-01.08 N	151-00.04 E
1	19	4479	40-01.82 N	151-40.85 E
1	20	4480	40-00.84 N	152-20.37 E
1	21	4481	40-00.28 N	153-00.46 E
1	22	4482	40-01.68 N	153-41.55 E
1	23	4483	40-01.06 N	154-20.87 E
1	24	4484	39-58.09 N	155-00.94 E
1	25	4485	39-58.26 N	155-40.07 E
1	26	4486	39-58.94 N	156-19.75 E
1	27	4487	40-00.36 N	157-00.14 E
1	28	4488	39-58.88 N	157-40.48 E
1	29	4489	39-59.33 N	158-20.16 E
1	30	4490	40-00.41 N	158-58.47 E
1	31	4491	40-01.09 N	159-38.59 E
1	32	4492	40-00.93 N	160-19.04 E
1	33	4493	39-59.98 N	160-58.68 E
1	34	4494	40-00.82 N	161-38.65 E
1	35	4495	40-00.62 N	162-19.37 E
1	36	4496	40-00.30 N	162-59.27 E
1	37	4497	40-00.96 N	163-38.49 E
1	38	4503	40-00.29 N	164-20.07 E
1	39	4502	40-00.88 N	164-59.83 E
1	40	4501	40-00.75 N	165-40.62 E
1	41	4500	40-00.77 N	166-21.27 E
1	42	4499	39-59.39 N	167-00.98 E
1	43	4498	40-00.77 N	167-39.80 E
2	44	4504	40-00.58 N	167-40.70 E
2	45	4505	40-00.39 N	168-21.18 E
2	46	4506	39-59.86 N	169-00.81 E
2	47	4507	39-58.64 N	168-59.30 E
2	48	4508	39-57.26 N	169-39.23 E
2	49	4509	39-29.27 N	169-59.80 E
2	50	4510	38-58.61 N	170-01.62 E
2	51	4511	38-30.30 N	169-59.91 E
2	52	4512	37-59.41 N	169-58.98 E
2	53	4513	37-31.18 N	170-00.47 E
2	54	4514	37-01.50 N	169-59.99 E
2	55	4515	36-30.70 N	169-57.52 E
2	56	4516	35-59.50 N	169-59.26 E
2	57	4517	35-29.65 N	169-58.38 E
2	58	4518	34-59.50 N	170-00.06 E
2	59	4519	34-29.33 N	170-02.11 E
2	60	4520	33-59.33 N	169-59.95 E
2	61	4521	33-29.35 N	169-59.09 E
2	62	4522	33-00.03 N	169-58.53 E
2	63	4523	33-59.55 N	169-16.96 E
2	64	4524	34-30.31 N	168-56.76 E
2	65	4525	35-00.12 N	168-34.54 E
2	66	4526	35-29.61 N	168-13.44 E
2	67	4527	36-00.30 N	167-51.49 E
2	68	4528	36-28.99 N	167-29.88 E
2	69	4529	37-00.32 N	167-10.85 E
2	70	4530	37-31.04 N	166-47.84 E
2	71	4531	37-58.97 N	166-27.71 E
2	72	4532	38-29.23 N	166-04.53 E
2	73	4533	38-59.03 N	165-41.40 E
2	74	4534	39-29.11 N	165-18.94 E
2	75	4535	39-59.48 N	164-59.32 E

List of Principal Investigators for all Measurements

The principal investigator (PI) and the person in charge responsible for major parameters measured on the cruise are listed in Table 3.

Table 4: *List of principal investigator and the person in charge on the ship for RF12-06.*

Item	Principal Investigator（PI）	Person in charge on the ship
Hydrography		
$CTDO_2$ / LADCP	Kazuhiro NEMOTO	Keizo SHUTTA
Salinity	Kazuhiro NEMOTO	Keizo SHUTTA
Dissolve oxygen	Kazuhiro NEMOTO	Chihiro KAWAMURA
Nutrients	Kazuhiro NEMOTO	Takashi MIYAO
Phytopigment	Kazuhiro NEMOTO	Takashi MIYAO
DIC	Kazuhiro NEMOTO	Shu SAITO
Total Alkalinity	Kazuhiro NEMOTO	Shu SAITO
pH	Kazuhiro NEMOTO	Shu SAITO
CFCs	Kazuhiro NEMOTO	Etsuro ONO
Underway		
Meteorology	Kazuhiro NEMOTO	Keizo SHUTTA
Thermo-Salinograph	Kazuhiro NEMOTO	Shu SAITO
pCO_2	Kazuhiro NEMOTO	Shu SAITO
Chlorophyll-a	Kazuhiro NEMOTO	Takashi MIYAO
ADCP	Kazuhiro NEMOTO	Keizo SHUTTA
Bathymetry	Kazuhiro NEMOTO	Keizo SHUTTA
Floats		
ARGO float	Toshio SUGA	Hitomi KAMIYA

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3. *Scientific Program and Methods*

In recent years, the global environmental issues such as global warming and climate change have become one of the major socio-economic concerns, and it has become apparent that the ocean plays a key role in the climate system. For the better understanding and assessment of global environmental conditions, continuous monitoring of climate variables, concentrations of greenhouse gases both in the ocean and in the atmosphere. To meet those requirements, JMA has been conducting operational oceanographic observations by research vessels in the western North Pacific on a seasonal basis. RF12-06 cruise is one of these activities. The purposes of this cruise are as follows:

(1) To observe profiles of seawater temperature, salinity, dissolved oxygen, nutrients and carbon parameters, as well as upper ocean current;

(2) To observe concentrations of greenhouse gases both in the ocean and in the atmosphere;

(3) To observe bio-geochemical parameters to study carbon cycle in the ocean.

These activities are expected to contribute to international projects related to global environmental issues such as the World Climate Research Programme (WCRP), IOCCP (International Ocean Carbon Coordination Project) and the Global Atmosphere Watch (GAW).

4. *Major Problems and Goals not Achieved*

In order to repair and align of the winch system, she stopped after CTD cast of Stn. 45 (RF4505) on August 25 and after CTD cast of Stn.46 (RF4506) on August 26.

5. *List of Cruise Participants*

The cruise participants of the cruise are listed in Table 5.

Table 5: *List of cruise participants for RF12-06.*

Name	Responsibility	Affiliation
Hiroyuki FUJIWARA	Nutrients	GEMD / JMA
Minoru HAMANA (leg 1)	Nutrients	GEMD / JMA
Hiroyuki HATAKEYAMA	CFCs	GEMD / JMA
Sho HIBINO	Dissolved Oxygen	GEMD / JMA
Hitomi KAMIYA	Chief Scientist / Meteorology	GEMD / JMA
Nobumi KATO	CTDO / ADCP / LADCP	GEMD / JMA
Chihiro KAWAMURA	Dissolved Oxygen	GEMD / JMA
Takashi MIYAO (leg 2)	Nutrients	GEMD / JMA
Noriyuki OKUNO	CTDO / ADCP / LADCP	GEMD / JMA
Etsuro ONO	CFCs	GEMD / JMA
Hisashi ONO	Carbon Items	GEMD / JMA
Kazuhiro SAITO	Nutrients	GEMD / JMA
Shu SAITO	Carbon Items	GEMD / JMA
Naoaki SAKAMOTO	Carbon Items	GEMD / JMA
Yasunori SASAKI	CTDO / ADCP / LADCP	GEMD / JMA
Seikou SHIMOJI	Salinity	GEMD / JMA
Hiroki SHIOZURU	Dissolved Oxygen	GEMD / JMA
Keizo SHUTTA	Salinity / Bathymetry	GEMD / JMA
Haruka SUEMATSU	CFCs	GEMD / JMA
Koichi WADA	Salinity	GEMD / JMA

GEMD / JMA: Marine Division, Global Environment and Marine Department, JMA

Reference

Swift, J. H. (2010): Reference-quality water sample data: Notes on acquisition, record keeping, and evaluation. *IOCCP Report No.**14**, ICPO Pub. 134, 2010 ver.1*

CCHDO Data Processing Notes

Date	Person	Data Type	Action	Summary
2013-12-05	Nakano, Toshiya	CTD/BTL/SUM/CrsRpt	Submitted	to go online
2013-12-10	Shen, Matt	ExpoCode	Website Update	ExpoCode changed

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49RY20120726 processing

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2013-12-10

M Shen

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Process

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ExpoCode changed from 49UP20120726 to 49RY20120726. 49UP20120726 added as an alias for the cruise.

2014-02-06	Kappa, Jerry	CrsRpt	Website Update	PDF version online

I've placed a new PDF version of the cruise report:

49RY20120726do.pdf

into the directory: http://cchdo.ucsd.edu/data/co2clivar/pacific/49RY20120726_RF1206 .

It includes all the reports provided by the cruise PIs, summary pages and CCHDO data processing notes, as well as a linked Table of Contents and links to figures and tables.