

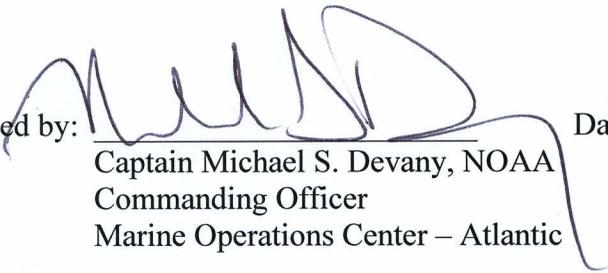
AUG 31 2010

Final Cruise Instructions

Date Submitted: August 29, 2010
Platform: NOAA Ship *Pisces*
Cruise Number: PC 10-06-DWH
Project Title: Deepwater Horizon CM252 Subsurface Monitoring Cruise
Cruise Dates: on or about 8 September to 17 September 2010

Approved by: _____
Captain Barry Choy, NOAA
Chief, SMU Operations

Date: _____

Approved by: 
Captain Michael S. Devany, NOAA
Commanding Officer
Marine Operations Center – Atlantic

Date: 9/31/10

COMMANDING OFFICER
NOAA Ship *Pisces*

CRUISE INSTRUCTIONS: PC 10-05, Deepwater Horizon CM252 Subsurface Monitoring Cruise

Cruise Dates: on or about 08 September to 17 September

Area of Operation: Waters in the vicinity of the Deepwater Horizon MC-252 Incident. (Figure 1).

Objectives: The principal objective of the survey is collect data relative to the dynamics of the subsurface oil originating from the Deepwater Horizon CM252 well and to evaluate the effect of dispersants on the oil. The survey is part of a larger, multi-ship project lead by the Subsurface Monitoring Unit. There are five primary cruise missions.

- 1) Perform conductivity, temperature, depth (CTD), dissolved oxygen (DO), and fluorometer profiles to map the subsurface plume and to provide near-real time guidance in the collection of water samples to study the plume.
- 2) Collect water from beneath, within, and above a high fluorescence-low dissolved oxygen layer at about 800-1200 m (Figure 2) for polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOC), dissolved oxygen, and natural gas (primarily methane) analyses. The natural gas analyzes consist of concentration, natural isotopic, and oxidation rate analyzes.
- 3) Conduct gas chromatograph analyses of water samples to measure in near-real time oil and natural gas concentrations.
- 4) Conduct acoustic surveys to monitor the well head using primarily the EK60.
- 5) Collect Acoustic-Doppler Current Profiler data to measure flow of oil away from the wellhead, both at depth and in the surface layer. The shipboard ADCP data will be integrated with from fixed ADCPs deployed in the surrounding area.

Owing to the changing situation in the Gulf, there will likely be changes to this cruise plan. These changes will be made by agreement between the Chief Scientist, the Subsurface Monitoring Unit, and the Ship's command.

Planned Itinerary: The cruise will be divided into two parts with potential to add additional parts:

- Depart Pascagoula Sept 8
- Tentative NRDA water sample pick-up date Sept13
- Arrive Pascagoula Sept 17 (water, stores as needed, crew transfer)

Operational Plans:

Daily operational guidance will be provided by the subsurface monitoring unit (SMU)'s science team. Mission guidance calls are held at 1500 CDT. The Field Party Chiefs from each SMU vessel will provide an update of their daily findings which is incorporated into the mission guidance issued that the same evening.

The guidance is issued daily at 1900 to all ships that are participating in the collaborative sampling effort. This is an adaptive science mission where daily results for all the ships will be used to provide daily guidance.

Time will also need to be given for taking on water and for offloading samples. The daily mission guidance plan will include these activities.

CTD Operations

- SeaBird 911 CTD and rosette is terminated to the hydro winch
- Oil will be cleared from surface using hoses prior to deployment
- Other de-fouling actions may be necessary and will be determined in the field
- Two ship crew members will deploy and retrieve the CTD on the deck. One member of the science party will run the computer associated with the CTD

Water Chemistry Measurements

- Dissolved Oxygen
 - Water samples will be collected using niskins bottles on the CTD
 - Water will be removed from each of the 12 bottles and carried into the Chemistry lab
 - All decontamination procedures will be followed at the threshold to the ship
 - Water samples will be analyzed for Dissolved oxygen in the Chemistry lab
 - NRDA water samples will be preserved and delivered in accordance NRDA procedures.
- Hydrocarbon Analysis
 - Water samples will be collected using niskins bottles on the CTD
 - Water will be removed from each of the 12 bottles and carried into the Chemistry lab
 - All decontamination procedures will be followed at the threshold to the ship
 - Gas chromatograph measurements will be performed on the vessel
 - Two samples shall be preserved for Volatile Aromatic Hydrocarbons (VAH), one sample shall be preserved for Total Hydrocarbon (THC), and one sample shall be preserved for polycyclic aromatic hydrocarbons (PAH).
 - Samples will be preserved for methane analysis ashore
 - Samples will be processed in the Chemistry Lab
 - Samples will then be moved to the walk-in refrigerator for storage until they can be transported off the ship
 - After sample collection niskin bottles will be washed with detergent and water prior to redeployment
- Summary Routine - Sampling Schedule: at each operations station the following samples will be taken and analyzed.

Action	Equipment
Water collection-CH4	GC-FID
Water collection-DO	Winkler Titrations
Water collection-CH4 oxidation rates	CRDS
Water collection-CH4 isotopes	Gas extraction boards

Acoustic Operations:

Based on daily mission guidance from SMU *Pisces* will conduct regular acoustic surveys of the wellhead at the Deepwater Horizon MC-252 site. The acoustic survey will be repeated on a 48 hr interval with potential adaptive modifications depending on the observed conditions.

- Will use primarily the EK60
- EK60 running (all frequencies) and data shall be recorded at all times
- Will be performed at 5 knots, for well monitoring only, with the keel down depending on weather conditions
- The one survey tech will work primarily with the acoustic systems and acoustic data collection and processing
- Acoustic data will be pre-processed and sent to shore for more detailed analysis

ADCP Operations

- Once acoustic operations are running, the acoustic team will evaluate the possibility of developing ADCP data in support of the project
- Initial efforts will occur during non-acoustic surveys to ensure acoustic data is not compromised

Other Operations

- Owing to changing conditions in the field, other operations may be added after consultation with the SMU and the ship's command.

Permissions to Enter Restricted Zone in Study Region – The Restricted Zone remains in place a 500 m diameter around MC252 wellhead. SIMOPS (Simultaneous Operations) coordinates with all vessel operating within 15 nm of well head. Access and acoustic operations in the area around the wellhead is restricted. Entrance and acoustic operations must be approved by SIMOPS (BP). All monitoring vessels are being coordinated through the Subsurface Monitoring Unit and represented by Chad Smith to SIMOPS (617-999-4163 and chad.smith@darkwatermarine.com). The Ship will work with SMU Operations to gain necessary approvals to work in the vicinity of the well head. 24 hours in advance the Chief Scientist will need to communicate the 24hr plan to the Ops Officer to ensure proper authorizations for entry and acoustics are obtained. Some acoustic restrictions may be frequency specific so close coordination is necessary between the Chief Scientists, the Ops Officer and SMU Operations.

NRDA Chain-of-Custody Procedures – A NRDA sampling representative has been requested through SMU Staffing. This person will be responsible for ensuring chain of custody procedures are followed during science operations. This person has not yet been identified by SMU Staffing.

Water Sample Pick-up – The samples collected for VOC and THC/PAH must be analyzed within a specific amount of time. To accomplish this, water samples will be picked up every 3-5 days. Pick-ups will be made within approximately 100 nm of the Louisiana coast. At least 24 hour notice is required to ensure sample pick-ups are possible. The Natural Resource Damage Assessment team coordinates these pick-ups: SMU Ops (ops.smu@noaa.gov), Tom Moore (Tom.Moore@noaa.gov), Chad Smith (chad.smith@darkwatermarine.com), and the Field Operation Team are the contacts (dwhnrdafieldops@gmail.com). The sample pick up vessel will comply with *Pisces* underway replenishment procedures.

Disposition of Samples and Data: All samples and data will be provided to the Subsurface Monitoring Unit. These data will be transmitted during the cruise and a compilation will be created and provided at the end of the cruise. The Data Manager will submit sampling data daily to the SMU FTP site per instruction from SMU Data Manager Training. A cruise report, and a completed Ship Operations Evaluation Form, will be submitted to the Chief Subsurface Monitoring Unit within 20 days following completion of the cruise.

Potable Water Storage and Usage: - The ship may not be able to make water while in the study region. This will either require resupply at port or UNREP water supply. The Subsurface Monitoring Unit may be able to provide the ship water on site. Coordination for water UNREP can be coordinated through SMU Operations (ops.smu@noaa.gov).

Hazardous Material: The Chief Scientist is responsible for complying with MOCDOC 15, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. Details regarding those requirements will be provided by the Chief of Operations, Marine Operations Center – Atlantic upon request and may be reached at 757-441-6842.

By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard and a chemical hygiene plan. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the Chief Scientist.

Medical Clearances: NOAA Fleet Medical Policy requires all personnel embarking on NOAA vessels to furnish a completed copy of the NOAA Health Services Questionnaire (NHSQ) to the Health Services Office of the Marine Operations Center. This form should be submitted 30 days in advance of sailing, but no later than 7 days in advance of sailing. The Chief Scientist is responsible for the timely submission of NHSQs for scientific personnel to the Health Services Office. In addition to the NHSQ, and a tuberculosis test are required.

Accident/Illness Reporting: Mishaps, injuries and near misses must be reported to the vessel's Executive Officer and Medical Person in Charge so that appropriate reporting can be made through the OMAO chain of command. In addition, all work-related mishaps involving scientific staff that result in an employee injury or illness, or any work related mishap or near miss, including those that do not require first aid or medical attention, must be reported within 24 hours of occurrence to the NOAA Fisheries Deputy Assistant Administrator for Operations. The reporting will be accomplished using a Mishap Reporting Form, via email, originating from the Chief Scientist, through the OMI Facility Operations and Safety (FOS) Branch (Jack.Emberg@noaa.gov with copies sent to Linda.Arlen@noaa.gov and Joseph.Finnegan@noaa.gov

Communications: Routine communications will be conducted between the *Pisces* and Subsurface Monitoring Unit via email. Satellite based voice communication are available (INMARSAT B, Iridium), VOIP, and cellular phone, if needed. There is also a regularly scheduled afternoon call (15:00) between the SMU and the Chief Scientist where science mission and objectives will be discussed. The science objectives may require moving large amounts of data during the cruise.

Email Contact: The following should be included as recipients of the daily e-mail message:

CO.Pisces@noaa.gov	Commanding Officer
Chief.SMU@noaa.gov	SMU Unit Chief
Ops.SMU@noaa.gov	SMU Operations
smu.missionplanning.smu@noaa.gov	SMU Mission Planning

IT Security: Any computer that will be hooked into the ship's network must be scanned for viruses by the ship's Electronics Technician before being used on the vessel. Such computers must also have a running virus-scan. Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking. Network connections are made via Ethernet.

Vessel Sensor and Logging Requirements: The *Pisces*'s SCS system is a PC-based server, which continuously collects and distributes scientific data from various navigational, oceanographic, meteorological, and sampling sensors throughout the cruise. Date and time for data collections from computers, instrumentation, and log sheet recordings will be synchronized using the vessel's GPS master clock and Dimension IV software. The *Pisces*'s ET are responsible for ensuring data collection.

The ship's Scientific Computer System (SCS) will be required for logging data on a routine basis and data requirements will be coordinated with the Commanding Officer and Electronics Technician at the

beginning of the cruise. **Any changes to the settings in the SCS system during the cruise should be immediately communicated to the Chief Scientist.**

Protected Resources:

Northern right whale protection: The vessel is requested to adhere to right whale protection regulations. Information on Seasonal Management Area (SMA) and Dynamic Management Area (DMA) regulations for protecting right whales from collisions with vessels are provided through the U.S. Coast Guard's "Notices To Mariners", NOAA weather radio, the NOAA Protected Resources website (<http://www.nmfs.noaa.gov/pr/shipstrike/>) and the Right Whale Sighting Advisory System (SAS) website (<http://rwhalesightings.nefsc.noaa.gov/>). The vessel is requested to use caution and proceed at speeds below 10 kts in areas used by right whales (as reported in the proceeding). Intentionally approaching within 500 yards of right whales is prohibited, unless the Chief Scientist is in possession of an ESA/MMPA permit allowing such approaches.

Whale sightings: Sightings of right whales, or dead or entangled whales of any species, are extremely valuable and reports are urgently requested. Protocols for reporting sightings are described in the Guide to Reporting Whale Sightings placard. The placard is available online (http://www.nero.noaa.gov/whaletrp/plan/disent/Guide%20to%20reporting%20Whale%20Sightings%20FINAL%20complete_8.7.07.pdf) and laminated copies will be provided by the Protected Species Branch. It is requested that this placard be kept on the bridge for quick reference and to facilitate rapid reporting (via satellite phone if necessary). Opportunistic sightings of other marine mammal species that are live and well may be reported using the Platforms of Opportunity (POP) forms and protocols.

Endangered Species Act and Marine Mammal Protection Act reporting requirements: This reporting is required and is in addition to the reports in the above two sections. If the ship has an interaction with a whale, dolphin, porpoise, marine turtle or seal (e.g., collision with a whale or bycatch of a sea turtle), the NMFS Northeast Regional Office must be notified by telephone or e-mail within 24 hours of the interaction. For interactions with marine turtles or large whales contact Pasquale Scida (978-281-9208 or Pasquale.Scida@noaa.gov); for interactions with other species contact David Gouveia (978-281-9280 or David.Gouveia@noaa.gov). In addition, if any large whale is struck, the Science and Research Director must be notified as soon as possible, but in all cases the Director shall be notified within 24 hours of the strike.

Foreign National Access and Deemed Export Controls: (No foreign nationals are expected for this leg) All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo (<http://deemedexports.noaa.gov>). The foreign national's sponsor is responsible for obtaining clearances and export licenses required and for providing for required escorts by the NAO. Programs sponsoring foreign nationals should consult with their designated line office personnel to assist with the process (<http://deemedexports.noaa.gov/contacts.html>).

The following are basic requirements. Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist: Ensure the following is provided to the Commanding Officer before any foreign national will be allowed on board for any reason:

1. Written notification identifying the NOAA Program individual who is responsible for ensuring compliance with NOAA and export regulations for the foreign national (see Foreign National Sponsor responsibilities below).

2. A copy of the DOC/OSY clearance authorization for access by the foreign national.
3. A copy of Appendix B of NAO 207-12 with NOAA Chief Administrative Officer concurrence endorsement.
4. Written notification that the foreign national has been cleared against the State, Commerce and Treasury departments' Lists to Check.
<http://www.bis.doc.gov/ComplianceAndEnforcement/ListsToCheck.htm>
5. Provide the NOAA Foreign National List spreadsheet for each foreign national in the scientific party.
6. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
7. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.
8. Export Control - The Chief Scientist is responsible for complying with NAO 207-12 and the development of Technology Access Control Plans for items they bring aboard. The Chief Scientist must notify the Commanding Officer of any export controlled items they bring aboard and any access restrictions associated with these items. [*NOTE: The NEFSC currently neither possesses nor utilizes technologies that are subject to Export Administration Regulations (EAR).*]

The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.
3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Chief Scientist of the NOAA Foreign National List spreadsheet for each foreign national in the scientific party.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the cruise, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
2. The Departmental Sponsor/NOAA of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen, NOAA (or DOC) employee. According to DOC/OSY, this

requirement cannot be altered.

3. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National Guest) as required by NAO 207-12 Section 5.03.h.

Watches: Vessel operations will be conducted 24 hours per day. The acoustic and CTD and water chemistry watches will work on standard sea watch rotation. Scientific personnel will be on duty for up to 12 hour each day depending on roles.

Meals and Berthing: Meals and berthing are required for up to 15 scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after the termination of the cruise. Berthing requirements, including number and gender of the science crew, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. **To maximize the efficiency of the scientific mission, the vessel command shall consider the scientific party's need to distribute personnel numbers equally between day and night watches when assigning shared berthing between scientists and crew members.**

All NOAA Scientists will have proper travel orders when assigned to a NOAA ship. The Chief Scientist will ensure that all non-NOAA and/or non-Federal employee scientists aboard will also have proper orders or the means to support themselves in the event that the ship becomes uninhabitable and/or the galley is closed during a port call during any part of the scheduled project.

Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey.

Pre-Cruise Meeting: Prior to departure the Chief Scientist will conduct a meeting of the scientific party to train them in sample collection and inform them of cruise objectives. Some vessel protocols, e.g., meals, watches, etiquette, etc., will be presented by the ship's Operations Officer.

Post Cruise Reporting Requirements: Within 20 days of the completion of each cruise leg, a Ship Operation Evaluation form is to be completed by the Chief Scientist. The preferred method of transmittal of this form is via email to OMAO.Customer.Satisfaction@noaa.gov . If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Road, Suite 500
Silver Spring, MD 20910

Upon completion of the cruise, a post-cruise meeting will normally be held at 10:15 (unless prior alternate arrangements are made) and attended by the ship's officers, the Chief Scientist and members of the scientific party, the Vessel Coordinator and the Port Captain to review the cruise. Concerns regarding safety, efficiency, and suggestions for improvements for future cruises should be discussed. Minutes of the post-cruise meeting will be distributed to all participants with email to the CO.MOC.Atlantic@noaa.gov and ChiefOps.MOA@noaa.gov

Scientific Personnel:

Name	Position	Affiliation	Male/ Female	Arrival Date	Dep. Date	Med Clear Status	FN Clear. Status	Allergies/ Food Restrictions
John Kessler	Chief Sci.	TAMU	Male	9/6/2010	9/19/2010	Complete	N/A	None
David Valentine	Sr. Sci.	UCSB	Male	9/6/2010	9/19/2010	In proc.	N/A	None
Eric Chan	Scientist	TAMU	Male	9/6/2010	9/19/2010	Complete	N/A	None
Lindsay M. Werra	Scientist	UCSB	Female	9/6/2010	9/19/2010	Complete	N/A	Vegetarian
Christie Villanueva	Scientist	UCSB	Female	9/6/2010	9/19/2010	Complete	N/A	None
Stephanie Mendes	Scientist	UCSB	Female	9/6/2010	9/19/2010	Complete	N/A	None
Molly Redmond	Scientist	UCSB	Female	9/6/2010	9/19/2010	Complete	N/A	Vegetarian
Stephani Shusta	Scientist	UCSB	Female	9/6/2010	9/19/2010	Complete	N/A	None
Erik Quiroz	Scientist	GERG	Male	9/6/2010	9/19/2010	Complete	N/A	None
LT Liz Crapo	Media Officer	NOAA	Female	9/7/2010		Complete	N/A	None
Ahnnie Lee	Data Manager	SMU/ CSS	Female	On Board	10/1/2010	Complete	N/A	None
John Nugent	NRDA Rep					Complete		None
Mason Foret	Water Sampler							
Brennan Pierce	Water Sampler							
Entrix Rep	TBD							

There are a number of cruise personnel requested from the SMU that have not yet been identified. Delays in identifying these personnel could result in delays in sailing, since all these personnel are required under the guidance provided by the SMU to the Chief Scientist. All personnel will contact the Officer of the Day (OOD) upon arrival to the ship to be logged aboard. The contact number for the OOD is (228) 369-5405.

Equipment and Supply List:

The following sampling and scientific equipment will be placed aboard the *Pisces* prior to departure:

Acoustic Operations:

Ship provided EK60, ME70, and ADCP
 SMU Provided Computers and software for processing and developing products

CTD Operations

Ship provided winch and termination
 Seabird 911 CTD with rosette
 altimeter
 SMU Provided CDOM fluorometer
 Chelsea UV Aquatracka fluorometer (onboard –SMU leased equip.)
 Transmissometer
 12 5L Teflon lined niskin bottles
 dO2 sensor
 CTD supplies

Dissolved Oxygen

SMU Provided

Supplies and chemical list to be provided as an addendum

Hydrocarbon Analysis

This is an incomplete list of the equipment and supplies that will be brought on board by the scientific party:

Item	Data interface specifications (SCS yes or no)	Power Supply	Date of Arrival	Owner	Supplies/ Consumables
GC-FID (x2)	No	Standard 120 Vac	Monday, 9/6/2010	Kessler	
CRDS (x4)					
Gas extraction boards					
Niskin Bottle Rosette and sled (24 bottles each 10 L)	Must interface with the CTD SeaBird system			Kessler	
TBD					

Remaining items to be acquired by SMU or Chief Scientist, will be listed as soon as possible. The Scientific Party will be storing samples in the scientific freezers (-80 chest freezer, Fish lab Freezer)

Transportation: (equipment and personnel)

SMU/Chief Scientist is coordinating equipment and personnel transfer. This will be a combination of ground shipment, UHaul, Hot shipping, and airplane flights.

Loading: (Technical, deck equipment i.e., crane lift; engineering, electrical or plumbing needs)

SMU/Chief Scientist are coordinating the transfer of a 24 bottle rosette with each bottle being 10L.

Chief Scientist will bring approximately 4 pallets of equipment from California. Additionally there will be a 14' U-Haul filled with scientific equipment.

We will be bringing 6-12 compressed gas cylinders needed for our analytical equipment.

Miscellaneous:

All MSDS forms will be provided before boarding the ship. Updated versions of this form will be provided in the coming days.

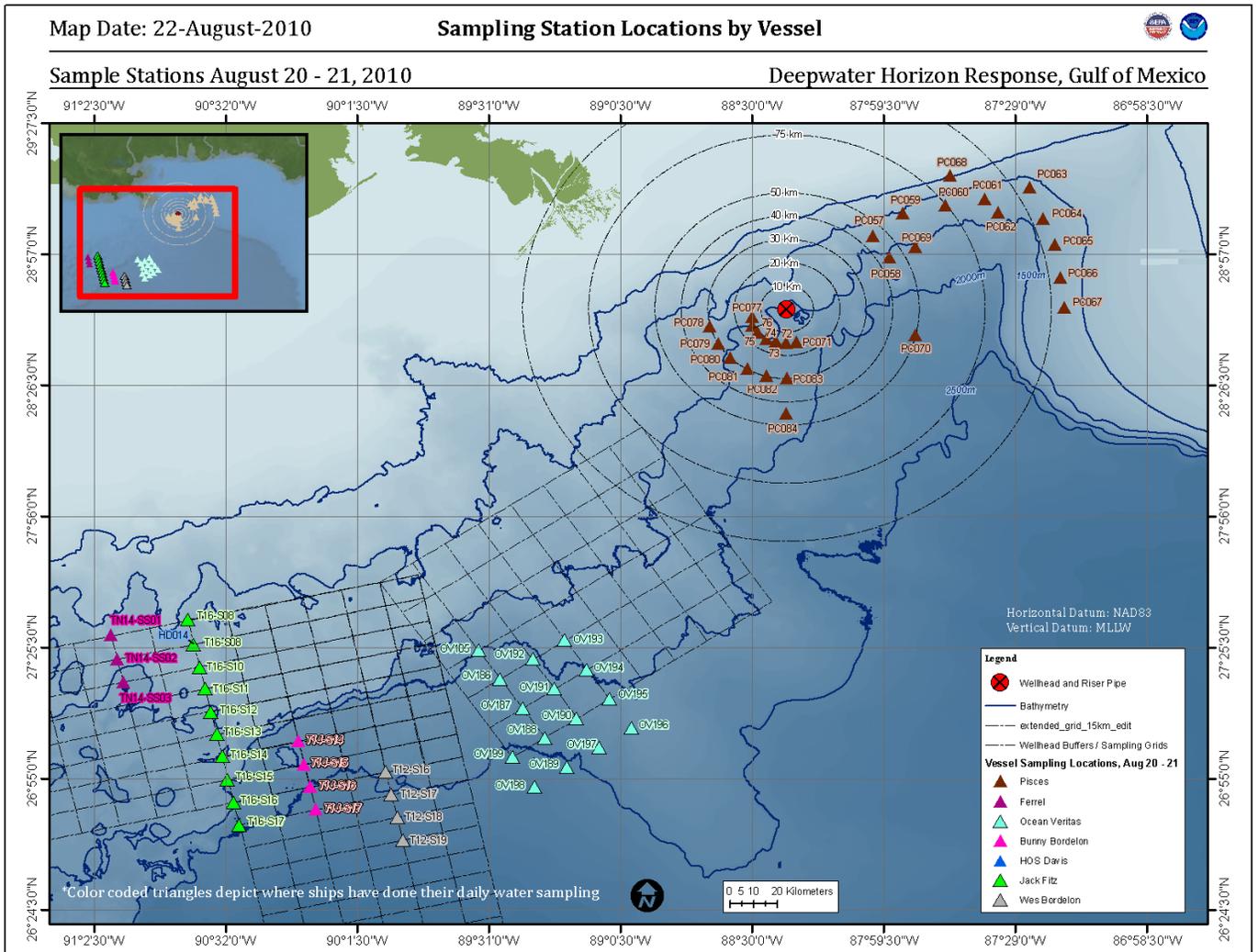


Figure 1. Area of operations

RV Brooks McCall Cruise 5 Station 57

May 31, 2010 (28 42.30558 N 88 24.099 W)

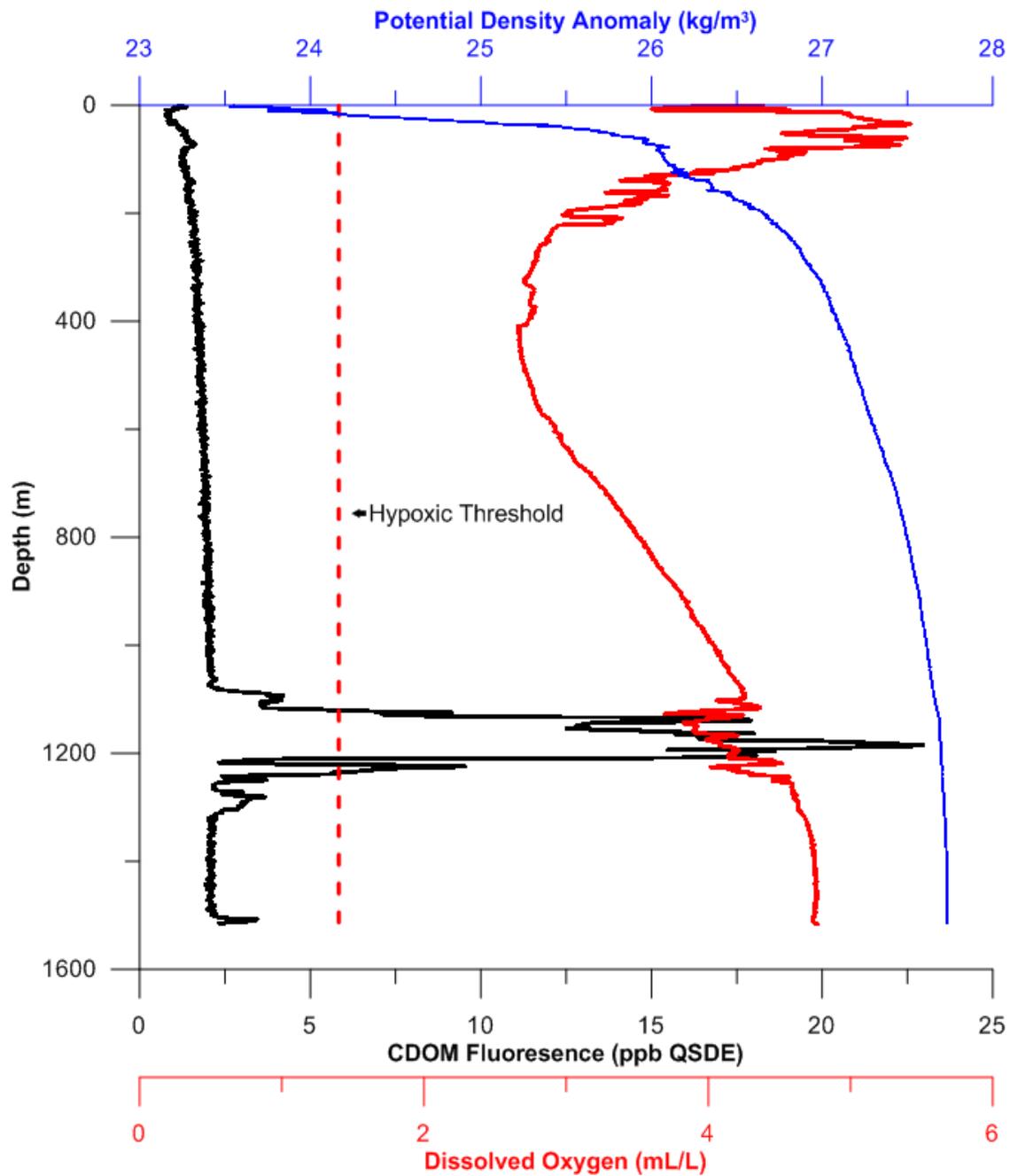


Figure 2 Vertical profile show DO₂ depression coincident with fluorescence peaks between 1100 and 1200m

Table 1. Scientific Computer Sensors, and logging rates of those sensors, required during the *Pisces* cruise 10-06. Additional sensors may be requested.

Sensor Name	Units	Log Rate (secs)
ADCP-Depth	(Meters)	1
ADCP-F/A-GroundSpeed	(Knots)	1
ADCP-F/A-WaterSpeed	(Knots)	1
ADCP-P/S-GroundSpeed	(Knots)	1
ADCP-P/S-WaterSpeed	(Knots)	1
Air-Temp	(Degrees C)	1
Baro-Press	(Millibars)	1
CenterBoardPos-Value	(Position)	1
Date	(Date)	1
Doppler-Depth	(Meters)	1
Doppler-KeelOffset	(Meters)	1
Doppler-P/S-BottomSpeed	(Knots)	1
Doppler-P/S-WaterSpeed	(Knots)	1
EK60-18kHz-Depth	(Meters)	1
EK60-38kHz-Depth	(Meters)	1
ES60-200hz-Depth	(Meters)	1
ES60-50hz-Depth	(Meters)	1
GYRO	(Degrees)	1
ITI-BearingToTarget	(Degrees)	1
ITI-Depth	(Meters)	1
ITI-DoorSpread	(Meters)	1
ITI-HdRopeBottomDist	(Meters)	1
ITI-HdRopeFtRopeDist	(Meters)	1
ITI-HorizRange	(Meters)	1
ITI-RangeToTarget	(Meters)	1
ITI-SlantRange	(Meters)	1
ITI-Time	(Time)	1
ITI-TrawlDepth	(Meters)	1
ITI-TrawlWaterTemp	(Degrees C)	1
ME70-Depth	(Meters)	1
Mid-SeaTemp-C	(Degrees C)	1
MX420-COG	(Degrees)	1
MX420-Lat	(DEGMIN)	1
MX420-Lon	(DEGMIN)	1
MX420-SOG	(Knots)	1
MX420-Time	(Time)	1

PASHR-Hdg-Qual	(Value)	1
PASHR-Hdg-True	(Degrees)	1
PASHR-Heave	(Centimeters)	1
PASHR-Pitch	(Degrees)	1
PASHR-Pitch-Qual	(Value)	1
PASHR-Roll	(Degrees)	1
PASHR-Roll-Qual	(Value)	1
PASHR-Time	(Time)	1
PI32-Depth1000-VAL	(Meters)	1
PI32-DEPTH300-VAL	(Meters)	1
PI32-DS-VAL	(Meters)	1
PI32-HR-VAL	(Meters)	1
PI32-WS-VAL	(Meters)	1
PORTTrawlWinchLineOut	(Meters)	1
PORTTrawlWinchLinespeed	(Meters/sec)	1
PORTTrawlWinchTension	(Kilos)	1
POSMV-COG	(Degrees)	1
POSMV-Elevation	(Value)	1
POSMV-hdops	(Value)	1
POSMV-Heading	(Degrees)	1
POSMV-Lat	(DEGMIN)	1
POSMV-Lon	(DEGMIN)	1
POSMV-Quality	(Value)	1
POSMV-Sats	(Value)	1
POSMV-SOG	(Knots)	1
POSMV-Time	(Time)	1
SAMOS-AirTemp-Value	(Degrees C)	1
SAMOS-TRUE-WIND-DIR-Value	(Degrees)	1
SAMOS-TRUE-WIND-Spd-Value	(Knots)	1
SCANMAR-DEPTH-VAL	(Meters)	1
SCANMAR-DOOR-SPREAD	(Meters)	1
SCANMAR-Height	(Meters)	1
SCANMAR-WING-SPREAD	(Meters)	1
Shaft-RPM-Value	(Value)	1
STBDTrawlWinchLineOut	(Meters)	1
STBDTrawlWinchLinespeed	(Meters/sec)	1
STBDTrawlWinchTension	(Kilos)	1
YOUNG-TWIND-Direction	(Degrees)	1
YOUNG-TWIND-Speed	(Knots)	1