BML/GFNMS Thermistor Mooring (Onset Tidbit V2) Protocol

Locations
Temperature strings are located at the sites: Southeast Farallon Island (SEF), Bodega Head (BOD), and Double Point (DOU). Sites span the area from San Francisco Bay to Bodega Head, CA, in the Gulf of the Farallones.

Design
The moorings consist of a surface float (yellow, labeled, cylindrical, from Walsh Marine Cat# W961R), that is then connected to a subsurface float (12 in diameter trawl float) via 5/16" Samson amsteel line. This extends all of the way down to a combination concrete/steel anchor. The subsurface float serves to keep the mooring line taut, so that all loggers below this float remain at a consistent depth. One surface logger (Onset Tidbit V2) is attached to the surface buoy, and is therefore subject to tides/swell. It logs at an interval of 4 mins. Loggers are then placed at discrete depths, 2 per depth, logging at intervals of 2 mins. All are attached with stainless steel longline clips. One logger starts immediately, the other is set to a delayed start of 2 months following deployment.

SEF- loggers are stationed at 1m (surface), 4m, 13m, and 22m.
BOD-loggers stationed at 1m (surface), 4m, 11m, 21m, and 31m.
DOU- loggers stationed at 1m (surface), 4m, 12m, 20m, 28m, 36m

General Maintenance & Quality Assurance
-Make note of UDAS values and perform CTD profile when on site for comparisons to tidbit data

-*Tidbits* are swapped out every 3 months. Tidbit batteries are not replaceable, and last for five years in the field. Care should be taken to keep note of service time for each tidbit. Manual:
http://www.onsetcomp.com/files/manual_pdfs/10385_C_MAN_UTBI_001.pdf

-*Buoy* surface hardware should be checked every trip for corrosion or other defects. Anchor is pulled up every 3 months, and checked for damage or corrosion. All hardware should be replaced as needed. Annually: mooring should be swapped for new mooring with all new hardware, regardless of appearance. Surface buoy and anchor should also be replaced (subsurface may be okay to leave).

Recovery From Field
1. Loggers are recovered and replaced using Bodega Marine Laboratory's R/V Mussel Point.

SEF- Pull up using the lifting tackle on the R/V MP. Take care to make sure that logger positions are marked. Remove loggers as the mooring is pulled up, and replace them as it is lowered back down. Check all mooring hardware carefully when removed, and replace all components yearly, or on an as-needed basis. Logger pairs are equipped with small

pieces of flotation. Also, if a logger is stationed at the wrong depth completely (21m instead of 31m), make a note of it, and note it in the logs on the network.

DOU- same as SEF

BOD (Bodega Head)- Mooring is typically serviced using divers, when mooring needs replacement, or heavy service, it is recovered using the R/V MP. As a diver, descend down the line, and then ascend slowly, replacing loggers as you go. Loggers are not equipped with flotation. Checked mooring hardware carefully, and if corrective measures can be taken safely, try to do so. Otherwise the mooring should be recovered with the R/V MP. Check logger depths against depth gauges to ensure proper reporting. Also, if a logger is stationed at the wrong depth completely (21m instead of 31m), note that in the logs.

2. Be sure to note recovery details (i.e. missing/damaged loggers, damaged hardware, misplaced loggers, etc) in the logs on the network.

Post-Recovery from Field
1. Clean the outside of the loggers with a toothbrush, or similar instrument. Be careful not to damage the optical eyes on the logger, or to remove file/site name written on logger.

Download Tidbits
1. As you download, check that what is written on the logger matches the filename entered when the logger was launched. If they do not match, the correct filename is most likely what is written on the logger (check log for notes to be sure), as this is where the crew would have deployed it.

2. Connect tidbit to a PC computer using USB shuttle/base station.

3. Open Onset "Boxcar Pro" (for old loggers) or "Hoboware" (for V2 loggers) on a PC. We have copies of both of these on CD. At this point, all of our loggers are V2, so that is what will be described below

4. Go to "Device" menu and select "Readout." Or use the quick button with the arrow pointing to the left.

5. Hoboware should announce it has found the logger and the download should begin. If Hoboware announces that it cannot find the logger, reconnect the logger to the base station and try "Readout" again. If this fails again, check the optical eyes for damage. If they are damaged, or it continues to fail, contact Onset for details about how to ship the logger back for manual offload. The fee is ~$25, and the logger will be sacrificed.

5. The download should take about 15 sec to complete.

6. When the download is complete, Hoboware will prompt you for a filename and directory path to save the data. Enter the appropriate names. Raw temperature files should eventually be placed in Seastar/Ocean Group/Data/GFNMS/raw hoboware files/XXX (BOD or SEF)

Prepare Tidbits for Deployment
Temp logger deployments are usually doubled at each mooring to reduce the physical servicing of the mooring. This means a second set of loggers starts after the first set finishes recording. The loggers are physically swapped when the second set finishes. Remember to program both sets at the same time. Give each set a different deployment number, and remember the second set must start just before the first set finishes. For two-minute sampling, the first set will expire after 60 days. Start the first set at 12 local time (but in UTC, so either 1700 or 1800 hours UTC) and the second set 59 days later at the same time. This will give a day of overlap between sets. A day is quite a bit, but just to be on the safe side.

1. Remove old filename from tidbit with alcohol. Write new deployment's full filename on tidbit with a Sharpie. See the document, Seastar\Ocean Group\Data\GFNMSTherms\Documents\BML_WCOS_PO_File_Naming_Convention.doc for an explanation of the naming scheme and Seastar\Ocean Group\Data\GFNMSTherms\Documents\GFNMS_Waypoints.doc for the appropriate depths. Note, this naming scheme is different from the one used for the processed data which gets uploaded to PISCO's Metacat data catalog.

2. Note new deployment times, filename and Tidbit serial # in the GFNMS Thermistor log (Seastar/Ocean Group/Data/GFNMSTherms/Documents/Logs/GFNMS_Thermistor_Log.xls)

4. Connect Tidbit to a PC computer using USB base station w/ cable.

5. Open "Hoboware" software on computer.

6. Go to "Devices" menu and select "Launch."

7. A "Launch" dialogue box will open. Enter the following parameters:

Description: full file name
Data Channels: Temperature and Battery
Interval: 2 min.
Units: Celsius
Start Mode: **Now**, **At Interval**, **Delayed**, **Trigger** (button or coupler, if available),
Multiple Sampling Box: not checked
Wraparound: not checked

*To verify that the sensors are working correctly or to review settings from the previous launch, click the Status button.

8. Set start date and time. Ensure the programming computer is set GMT (uncheck "automatically adjust clock for daylight savings time"). This will ensure the logger is also on GMT. Remember for doubled deployments, the second set of loggers (second deployment) must start just before the first set finishes (see above).

9. Record current temperature on paper log.

10. Click the **Launch** button. HOBOware Pro displays the progress of the launch and warns you not to unplug the logger while it is being configured.

11. Unplug XTI from communication cable.

12. Ensure the red LED on XTI is flashing. This indicates the logger has been programmed. Delayed loggers will flash less frequently than those that are actively logging.

13. Attach appropriate pairs to longline snaps and flotation (if applicable), using cable ties. Label flotation if helpful.

14. Tidbits are ready to go. Keep all loggers from the same mooring together with cable ties.

Data Processing

Run data through GFNMS matlab scripts. The scripts will:

-Check data interval
-Verify that data is in UTC
-Allow user to graphically check for any missing, suspicious, or obviously bad data, and flag accordingly. Data for each column of the data file are flagged with a single alpha-numeric code such that the first digit holds the first data column flag, the second digit holds the second data column flag, etc. Possible flags are 0-9, A-Z, a-z; however flag definitions are currently as follows: 0 - No known bad data; 1 - Known bad data: instrument malfunction/failure, loss of memory, loss of power, bio-fouling, electronic malfunction; 2 - Suspicious data (looks bad, but no known cause); 9 - Missing data (data column has a missing value code as defined in the metadata)
-Output data in an ascii file with format:

```
date time yearday temp_c flag
2008-04-23 20:09:01Z 0113.8396060 10.2245 0000
2008-04-23 20:10:02Z 0113.8403010 10.2243 0000
2008-04-23 20:11:01Z 0113.8409950 10.2245 0000
2008-04-23 20:12:02Z 0113.8416900 10.2253 0000
```

Data is then associated with appropriate metadata, converted to NetCDF and automatically transferred via OPeNDAP to the NODC. Data can be accessed directly via NODC and the BOON data query page.