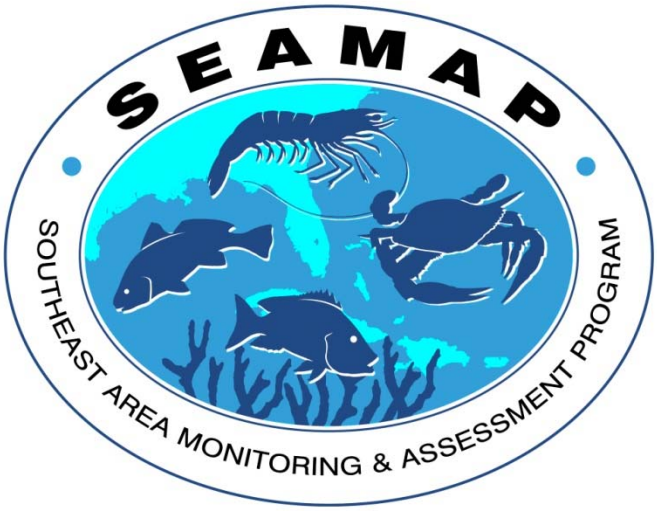
SEAMAP

Operations Manual for Trawl and Plankton Surveys



Gulf States Marine Fisheries Commission
2404 Government St
Ocean Springs, MS 39564

March 15, 2016

I. COLLECTING BIOLOGICAL DATA

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A. Introduction

SEAMAP surveys use trawling gear to collect biological data (i.e., finfish, shrimp, and other invertebrates). Prior to 1987 three types of SEAMAP trawling surveys were conducted: offshore butter-fish, summer shrimp (Texas Closure), and fall groundfish. The offshore butterfish surveys were discontinued in 1986. The same survey design for the summer shrimp (Texas Closure) and fall groundfish surveys has been used from 1987 to 2008. Survey changes in 2008 are detailed below.

B. Summer and Fall Trawl Surveys

1. Trawling - sampling will be conducted around the clock. (Note: Several of the state vessels will not be able to operate around the clock or at night due to size limitations and availability of personnel). All tows are to be conducted for 30 minutes in length. If a tow is greater or less than 30 minutes, do not change the method of towing (i.e., reduce vessel speed or drastically alter course) and explain the situation in the comments section. The station will still be considered a good sample unless the trawl fishes differently.

If the selected station is in an untrawlable area (bad bottom, artificial reef zone, etc.), proceed to the nearest trawlable location to perform the station. For stations located in areas that have known hard bottom, are a known sponge habitat (> 30 kg of sponges in previous trawls), or an otherwise sensitive habitat, drop the station and do not attempt it. If an artificial reef is in the area, avoid the artificial reef by moving the station no more than 1 nautical mile and trying to stay in the same depth zone and statistical zone.

Some stations may be located near the maximum depth for the depth zone the station is located in, and a 30 minute tow may exceed the maximum depth for that zone. If a 30 minute tow will exceed the maximum depth of the depth zone, the station should be moved approximately 1.5 nautical miles in a direction such that the entire tow will occur within the targeted statistical zone and depth zone.

Environmental data must be collected within 1 hour of a trawling event and must pass within ½ nautical mile of the SEAMAP sample site. In the event of a snag while trawling, the trawl station should be abandoned. The correct operations code should be entered into the database.

2. Survey strategy – In the fall of 2008, NMFS changed their method of selecting sampling sites. The states adopted this change beginning in 2010. Diurnal stratifications were dropped in the selection process, and geographic strata (which were mostly 2 to 3 statistical zone groupings) were changed to single zones. Both station selection methods, the old and the new, are probability based designs. With probability sampling, each element in the sampling universe has a known, positive probability of selection. This property of probability sampling avoids selection bias and enables one to use statistical theory to make valid inferences from the sample to the survey population. More specifically, the new method employs proportional allocation. In this type of

sampling, a unit's selection probability is proportional to its size measure which in this case is geographical surface area. For example, if Unit A has twice the surface area of Unit B, then Unit A will have twice the probability of having a sample selected from it than B. The end result is that Unit A will have about twice the number of samples as B. In addition, each statistical zone was divided into two depth zones, 2-20 and 21-60 fathoms with the exception of statistical zones off the coast of Texas (zones 18-21) where the NOAA Ship Oregon II cannot sample because of a 5-fm depth limitation. Locations inside of marine protected areas or habitat areas of particular concern were removed from the sampling universe prior to the selection process. Even though diurnal strata were dropped in the sampling site selection process, this information is not lost since samples can be post-stratified. The following is an example of how sampling sites are now selected.

Bathymetry data were downloaded from the National Geophysical Data Center (NGDC) web site (Divins, D.L., and D. Metzger, NGDC Coastal Relief Model, http://www.ngdc.noaa.gov/mgg/coastal/coastal.html). Because of the magnitude of data, they were downloaded by single Gulf Coast Shrimp Statistical Zones (the download process allows for the definition of a desired data block through user supplied latitude and longitude boundaries). Since the data definition process is controlled by latitude and longitude only, some undesired depths were included in downloads (i.e., for NMFS, depths less than five or greater than sixty fathoms). These records were deleted later through a Statistical Analysis System (SAS) program. Each bathymetric record represents a 3 arc-second element of data (≈ 0.05-by-0.05 minutes of latitude and longitude); therefore, the number of data records was used as a measure of surface area for each respective statistical zone. The bathymetry data were then used as input to a SAS program which performed three functions: defined the sampling universe, determined the sampling proportions according to surface areas of statistical zones/depths, and randomly selected the sample sites according to the defined proportions.

3. Sampling Catch

a. All organisms should be removed from the net for processing. Any gilled organisms and any organisms that fall out of the net onto the deck of the vessel should be processed with the catch also.

b. If the total weight of the catch is less than 22.7 kilos and is not excessively diverse in species composition, then it is recommended that the entire catch be processed. If a catch is especially diverse, then the watch leader may exercise the option of subsampling. Regardless of catch size, all penaeid shrimp, lionfish, and red snapper should be processed. Any species that the watch leader feels is not adequately represented in the subsample should be processed in its entirety. (i.e., sharks, skates, rays, large fish, or rare species). Also any species that the watch leader deems as a select species (shrimp during Summer Shrimp/Groundfish Survey, snapper, grouper, or lionfish) should be processed in its entirety.

c. Recommended Guidelines – If the total weight of the catch is between 22.7 and 45.4 kilos, obtain a sample equal to 50% of the total weight and process.

d. Recommended Guidelines – If the total weight of the catch is between 45.4 and 90.7 kilos, obtain a sample equal to 25% of the total weight and process.

e. Recommended Guidelines – If total weight of catch is between 90.7 and 136.0 kilos, obtain a sample equal to 18% of the total weight and process.

f. Recommended Guidelines – If the total weight of catch is greater than 136.0 kilos, obtain a sample equal to 12% of the total weight and process.

Note: If time allows, the watch leader should process the entire catch regardless of catch weight.

4. Processing Catch (Sample)

a. Separate entire catch or aliquot sample into its component species, then weigh (a species total weight) and count the number of individuals for each species.

b. Record species, weight, and number on the field data sheet (NMFS Pascagoula Station Sheet-Type II) or in the fishery scientific computing system (FSCS).

c. Measure up to 20 organisms that are identified to the species level except for red snapper, lionfish, and summer penaeid shrimp. At the discretion of the chief scientist, individuals identified to the genus or higher level can be measured either at the time of capture or upon subsequent laboratory identification. Record measurements on the General Length Frequency Form or in FSCS. Record individual weights and lengths for every 5th organism up to 20 except for red snapper, lionfish, and summer shrimp. Sex every 5th organism, but do not worry about staging.

d. Process shrimp species in the following prescribed manner:

1. **For the summer trawl survey only, to include: sex, length frequency, and weight**. *Farfantepenaeus aztecus* (brown shrimp), *F. duorarum* (pink shrimp) and *Litopenaeus setiferus* (white shrimp) will be separated from each trawl catch station. A random sample of up to 200 of each species from each trawl catch will be processed for sex and individual weights. Total number and total weight by sex will be recorded. Individual lengths will be recorded for all sexed shrimp. Individual weights should be recorded for every fifth sexed shrimp. Shrimp in excess of 200 individuals should be processed by species for total number and total weight. Shrimp data will be recorded only on the Shrimp Length Frequency Form or measured on the electronic measuring boards using FSCS. Do not record on the General Length Frequency Form.

2. **All red snapper and lionfish, regardless of survey, should be counted, measured, and weighed.**

3. **For non-Summer trawl surveys, shrimp are treated the same as finfish and other invertebrates. Only 20 shrimp lengths are recorded per station.**

e. Proceed to the next station.

C. SEAMAP Station Sheet Instructions

1. GENERAL COMMENTS - A SEAMAP Station Sheet (Appendix 1) or similar should be completed for every SEAMAP station. The top section (down to the heavy black line across page) should be completed for each station occupied, regardless of gear types(s) used.

Please use a lead pencil and make entries **DARK** enough and **LEGIBLE** enough so that the key entry operator can read them. All numeric fields are to be right justified or aligned with the decimal place. Leading zeros are not required, **but enter trailing zeros**.

2. Data Requirements for All Stations:

FIELD BY FIELD INSTRUCTIONS

VESSEL - Enter 2-digit numerical code from Appendix 2, Vessel Codes. If your vessel has not been assigned a code, notify NMFS Pascagoula to receive one.

PASCAGOULA STATION NUMBER - This is a unique sequential consecutive 5-digit number within each cruise, preferably starting with "00001." For state vessels enter the 2-digit vessel code followed by a 3-digit station number. Transfer this station number to the environmental or plankton sheet. Do not duplicate this station number for other stations on a cruise.

CRUISE - Enter 4-digit cruise number. Except for the *Oregon II* and other vessels having historically different cruise numbering conventions, the cruise number for **ALL VESSELS** shall be the calendar year of the survey followed by the cruise number for the year, e.g. "1201" first cruise for year 2012, "1202"- second cruise for year 2012, etc. Use this cruise number on all sheets during a cruise; do not change it.

START TIME - Obtain time zone code from Appendix 3, Time Zone Codes. **GMT should be used for all time fields.** Enter military time (0000-2359), HHMM, of start of station. For fishing stations, enter dog-off time or end of gear set. For environmental and plankton stations, enter the time data acquisition started.

START LATITUDE & LONGITUDE - Enter position occupied at start time in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

START DEPTH - Enter starting depth in meters and tenths.

SEAMAP/OTHER STATION NO. - Use for SEAMAP or other alternate station numbers. For SEAMAP Station numbers, use five alpha/numeric characters and right justify, but be consistent in field length - all numbers should be the same number of characters, T0065, W0102, E1106.

DATE - Enter station date (based on start time), in the format MMDDYY.

END TIME – Format same as for start time - fishing stations end at start of haulback, others when data acquisition ends.

END LATITUDE & LONGITUDE - Enter position occupied at end time in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

END DEPTH - Enter end depth in meters and tenths, observing the indicated decimal and entering a trailing zero.

GEAR TYPES USED AT THIS STATION - Enter codes for all gear types used- see Appendix 4, Gear Codes.

SURFACE AND BOTTOM TEMPERATURES - If taken, enter temperatures in degrees Celsius, observing 2 indicated decimals. Add trailing zeros if necessary. If more than one method is used, data entry precedence is 1) CTD, 2) XBT, and 3) bucket.

Use the actual time that all weather events are recorded. Wind speed and direction may be measured by either the ship's onboard instruments or handheld anemometers and a compass. Hand held anemometers and compasses are available from wildlife and fishery supply houses

AIR TEMPERATURE - Enter in degrees Celsius and tenths (dry bulb), observing 1 indicated decimal.

BAROMETRIC PRESSURE - Enter in millibars of mercury, observing 1 indicated decimal.

WIND SPEED - Enter wind speed in knots, no decimals.

WIND DIRECTION - Enter wind direction in compass degrees, 001-360.

WAVE HEIGHT - Enter wave height in meters, observing 1 indicated decimal.

SEA CONDITION - Enter Beaufort scale- see Appendix 5, Beaufort Sea Condition Table.

DATA SOURCE CODE - Enter code identifying data collecting entity – see Appendix 3.

VESSEL SPEED - Enter vessel speed, in knots, during the station, observing 1 indicated decimal.

STATISTICAL ZONE - Enter statistical zone from Figure 1-1. Leave blank if you are outside a statistical zone.

NET NO. - 1 = Port, 2 = Starboard and 3 = Stern Trawl.

The data above must be recorded regardless of type of station.

3. Data Requirements for Biological and Trawling stations:

FIELD BY FIELD INSTRUCTIONS

NMFS FAUNAL ZONE - Enter NMFS Faunal Zone from Figure 1-2.

GEAR SIZE - Enter gear size as the headrope length in feet

GEAR TYPE - Enter the code for fishing gear type used from Appendix 4, Gear Codes.

MESH SIZE - Enter stretched mesh size in inches for the cod end of the net:

a 40-ft trawl is 1.63 inches
a 65-ft trawl is 2.00 inches

OPERATION - Enter codes only for unsuccessful or abnormal stations from Appendix 6, Operation Codes.

MINUTES FISHED - Enter minutes actually fished (end set to start haulback).

TOTAL LIVE CATCH - Enter total **LIVE** catch in kilograms, observing 1 decimal. For extremely small catches, you **must** enter a minimum weight of 0.1 kg. **DO NOT** include weight of dead shell, mud, sand, wood, rocks, trash, etc. Such items should be mentioned in the comments section or with an operation code. Use an actual or estimated weight, but do make an entry.

The following two fields should be completed **ONLY** if the catch was sampled:

SELECT WEIGHT - Enter total weight of all species removed from the catch **IN THEIR ENTIRETY.** This will normally include commercial shrimp; some food or sport fish; sharks, skates, rays, or other large fish; or other species that are rare or poorly represented in the catch. Observe 3 decimal places. Do not record any weight data in this section if the catch was NOT sampled.

SAMPLE WEIGHT - Total weight of the sample, obtained by summing the various sample components. Be sure not to include any of the 'select' species in the sample. Observe 3 decimal places. **DO NOT** record data in this section if the catch was **NOT** sampled.

SPECIES DATA SECTION - Crustacea, other, finfish.

GENUS AND SPECIES - Locate organism in pre-printed species list. If not present, enter first seven characters of genus name and first six of species name, or, if not identified to species level, enter up to thirteen characters of genus, family, class, etc. Refer to Appendix 7, Alphabetic List of Length Frequency Codes, for genus and species names.

YOY - Make an entry from the codes below only if:

Two distinct size classes occur for a species (two entries would occur for this species, one for each size class); leave the larger size class entry code blank; use T entry code for smaller size class; samples were taken; organisms were counted, but no weight is available; the organism(s) weight was estimated; or if colonial organisms such as sponges, corals, or zoobotryon were weighed, but not counted. Otherwise, leave this field blank.

YOY Entry Codes:

T - denotes young of the year.

S - denotes specimens were retained frozen or preserved.

C - denotes counts were recorded without a weight.

E - denotes an estimated weight was recorded.

W - denotes a recorded weight, but individual numbers are unavailable for colonial organisms, sponges, corals, etc.

NUMBER - Enter number of individuals in SELECT or SAMPLE. For some colonial organisms, sponges and corals, enter the number of pieces.

SAMPLE WT. (kg) - Enter weight in kilos of organism in the SAMPLE column, observing three decimal places. Enter trailing zeros where needed.

SELECT WT. (kg) - Enter weight in kilos of organism in the SELECT column, observing three decimal places. Enter trailing zeros where needed. **IMPORTANT:** If the catch was worked up in its entirety (not sampled), **ALL** weight entries will be in the **SELECT** column. Do not list a species in both the sample and **SELECT** column.

Subtotal the sample and select weights columns for each category, then combine for total sample and select weights.

GEAR DATA - Detail gear used. If the same gear is to be used for the entire cruise, this section need be filled out only for the first station.

COMMENTS - Enter comments or observations, problems encountered, samples saved, etc.

RECORDER - Enter initials of person(s) completing form.

For SEAMAP partners who are not using the shipboard system for data entry, Appendix 8 outlines several examples calculating sub-sampling expansion factors for trawl catches with emphasize on catches that include trash.

Figure 1 – 1. NMFS Gulf Shrimp Landing Statistical Zones

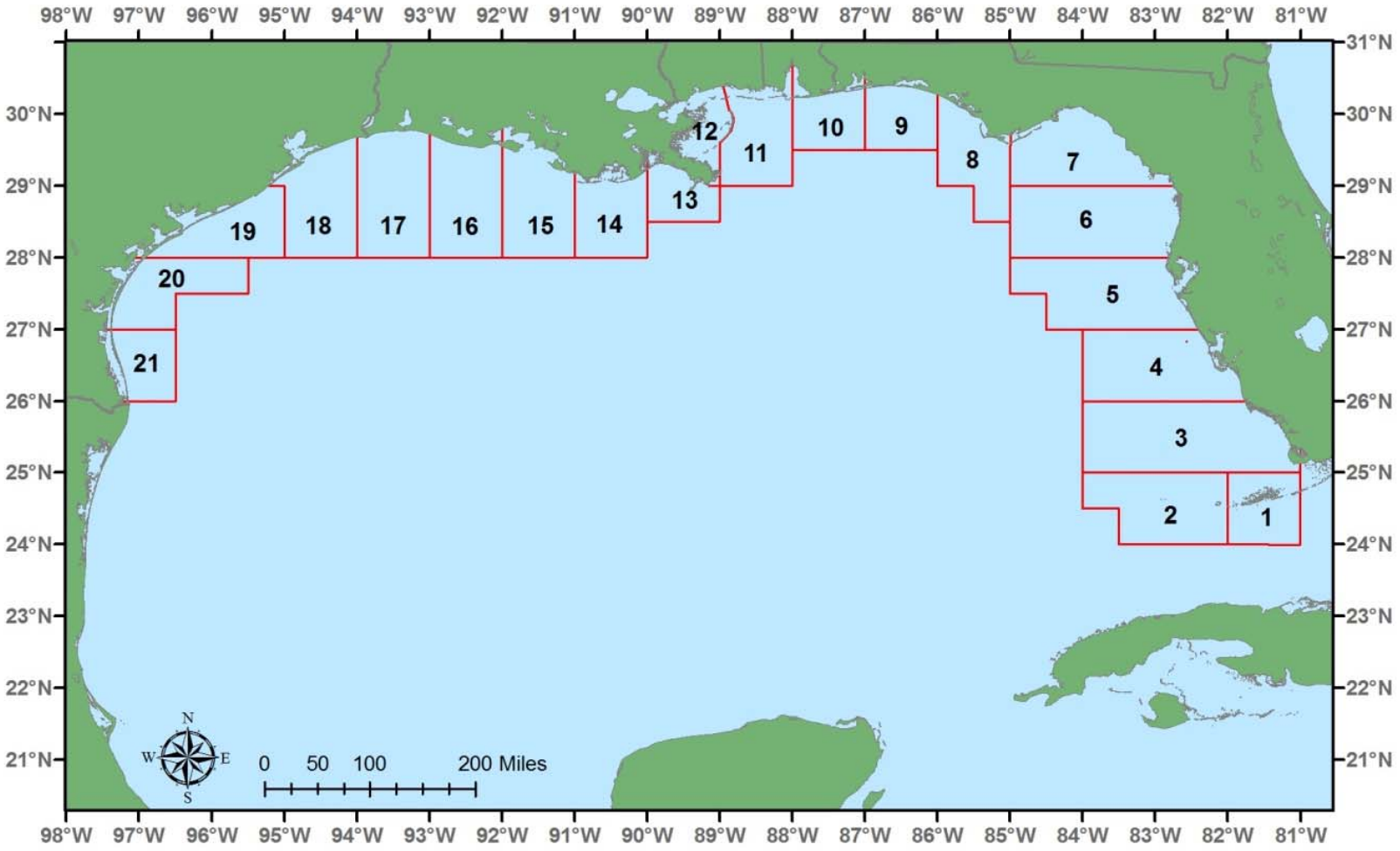
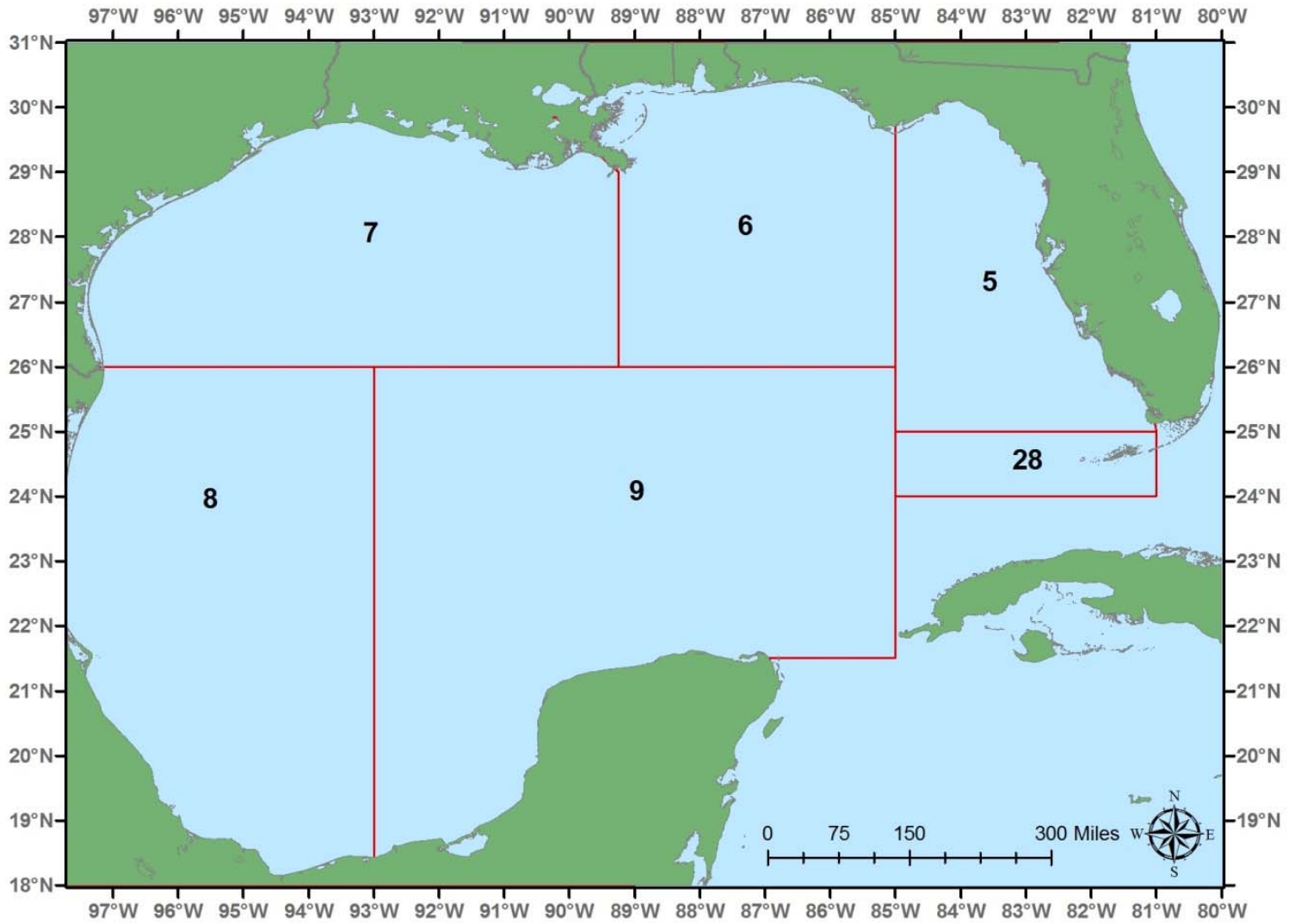


Figure 1 - 2. NMFS Faunal Zones



D. SEAMAP GROUNDFISH LENGTH FREQUENCY FORM INSTRUCTIONS

1. INTRODUCTION

Length frequency data can be collected using a measuring board with millimeter divisions or the electronic fish measuring boards.

Using the SEAMAP General Length Frequency Form (Appendix 1) at each station, randomly select a maximum of 20 specimens or less if present, for a given species and sex every fifth one.

The electronic fish measuring boards can be used in place of the SEAMAP General Length Frequency and SEAMAP Shrimp Length Frequency Form (Appendix 1).

2. SEAMAP GENERAL LENGTH FREQUENCY FORM INSTRUCTIONS

VES-STATION-CRUISE-DATA SOURCE - Transcribe from the SEAMAP Station Sheet.

GENUS-SPECIES - Record first seven characters of the genus and the first six of the species.

MEASUREMENT CODE - See Appendix 7, Alphabetic List of Species Length Frequency Measurement Codes, for species length measurement codes. For species not listed refer to Appendix 9, Length Frequency Measurement Code Finder List. Consult FPC if you are unsure of which measurement to use. A consistent measurement should be used for each species.

LENGTH - Enter measurement in millimeters.

SEX - Enter code:

U = Undetermined
M = Male
F = Female

3. SEAMAP SHRIMP LENGTH FREQUENCY FORM

The SEAMAP Shrimp Length Frequency Form (Appendix 1) will be used only during the Summer SEAMAP Shrimp/Groundfish Survey. Please use the SEAMAP General Length Frequency Form to measure shrimp during other SEAMAP Surveys. One SEAMAP Shrimp Length Frequency Form should be completed for each commercial shrimp species caught.

VESSEL, PASCAGOULA STATION NUMBER, CRUISE, DATA SOURCE CODES- Carry this data forward from the SEAMAP Trawl Station Sheet.

CATCHES (BROWN, PINK, WHITE) - Complete the detailed catch information below only for the first SEAMAP Shrimp Length Frequency Form sheet for a station. This information is automatically filled out by the data entry system for subsequent sheets for a station.

BROWN, PINK, WHITE - Enter weight of each species caught, in kilos, observing three indicated decimals.

SPECIES CODE - enter B (brown), P (pink), or W (white)

TOTAL NUMBER CAUGHT/SPECIES - Enter total number of shrimp caught by species, right justified.

MEASUREMENTS - Randomly select up to 200 shrimp per species for sex and individual weights. Measure total length from the tip of the rostrum to the tip of the telson in millimeters. Do not measure broken shrimp, substitute a similarly sexed shrimp from any excess over 200. Record and weigh by sex only the measured shrimp. The first block after each length is for tally marks, the second block is for a final number of tallies.

E. Fisheries Scientific Computer System

For instructions on the Fisheries Scientific Computer System (FSCS) for entering data, please see the four presentations and additional instructional sheet located in Appendix 20.

F. Collection of Real Time Data for the Summer Shrimp/Groundfish Survey

SEAMAP began distributing real time shrimp data during the summer of 1982. The purpose of the distribution is to inform recipients of the distribution and catch rate of shrimp caught during the annual Summer Shrimp/Groundfish Survey. The data from the survey are transmitted to the Gulf States Marine Fisheries Commission weekly as they are collected. Plots of station locations and catch rates of penaeid shrimp and total catch are prepared and edited for weekly distribution to management agencies, fishermen, processors and researchers. Six to seven weekly data summaries are produced each summer and distributed via email and posted to the Commission's web site.

The following data elements need to be collected and sent to the Commission as a spreadsheet or a delimited text file in the following format.

STATIONKEY – A concatenation of the vessel number, cruise number and station number. The format should be a long integer. An example for vessel 17 during cruise 1402 and the third station would be 171402003.

VESSEL – The SEAMAP assigned number for the vessel used during sampling.

CRUISE – The up to four digit cruise number for the survey.

STATION – This is the same as the Pascagoula Station Number.

SEAMAP – This is the same as the SEAMAP/OTHER STATION NO.

START_LAT – The starting latitude of the trawl station in DECIMAL DEGREES out to four decimal places.

START_LAT MIN – The starting latitude of the trawl station in degrees and minutes. Use the format 29.23 for a station located at 29 degrees and 23 minutes. You can round to the nearest minute.

START_LON – The starting longitude of the trawl station in DECIMAL DEGREES out to four decimal places. Make sure to include the minus sign before longitude (-89.7362).

START_LON MIN – The starting longitude of the trawl station in degrees and minutes. Use the format -89.54 for a station located at -89 degrees and 54 minutes. You can round to the nearest minute.

END_LAT – The ending latitude of the trawl station in DECIMAL DEGREES out to four decimal places.

END_LON – The ending longitude of the trawl station in DECIMAL DEGREES out to four decimal places. Make sure to include the minus sign before longitude (-89.7362).

START_DATE – The station start date and time (military time) in the format 7/1/2012 10:01.

END_DATE – The station start date and time (military time) in the format 7/1/2012 10:31.

TOWS – The number of tows performed. This should now be 1.

START_DEPTH – Starting depth in meters rounded to nearest whole number.

END_DEPTH – Ending depth in meters rounded to the nearest whole number.

SURF_TEMP – Surface water temperature in degrees Celsius.

SURF_SAL – Surface water salinity.

SURF_OX – Surface dissolved oxygen readings in parts per million, observing one indicated decimal place.

BOT_TEMP – Bottom water temperature in degrees Celsius.

BOT_SAL – Bottom water salinity.

BOT_OX – Bottom dissolved oxygen readings in parts per million, observing one indicated decimal place.

MIN_FISHED – Total number of minutes fished out to 2 decimal places.

TOT_LIVE – Total catch of all organisms caught during the trawl. The same as TOTAL LIVE CATCH.

NUM_BROWN – The number of brown shrimp caught during the trawl.

NUM_PINK – The number of pink shrimp caught during the trawl.

NUM_WHITE – The number of shrimp shrimp caught during the trawl.

WT_BROWN – The weight in kilograms of the brown shrimp catch. Weight should be out to three decimal places.

WT_PINK – The weight in kilograms of the pink shrimp catch. Weight should be out to three decimal places.

WT_WHITE – The weight in kilograms of the white shrimp catch. Weight should be out to three decimal places.

Sample format for the real time file that needs to be sent to the Gulf States Marine Fisheries Commission.

STATIONKEY	VESSEL	CRUISE	STATION	SEAMAP	START_LAT	START_LAT MIN	START_LON	START_LON MIN	END_LAT	END_LON	START_DATE	END_DATE	TOWS	START_DEPTH	END_DEPTH
40299204	4	299	204	E0902	30.14	30.08	-86.992	-87	30.1233	-87.0085	7/1/2012 19:17	7/1/2012 19:47	1	15	17
40299205	4	299	205	E0903	30.1995	30.12	-86.8483	-86.51	30.1793	-86.861	7/1/2012 21:31	7/1/2012 22:01	1	16	18
40299208	4	299	208	E0907	29.9507	29.57	-86.3117	-86.19	29.947	-86.285	7/2/2012 9:28	7/2/2012 9:59	1	31	30
40299209	4	299	209	E0908	29.8498	29.51	-86.1677	-86.1	29.8328	-86.1495	7/2/2012 11:52	7/2/2012 12:22	1	25	24
40299210	4	299	210	E0909	29.8013	29.48	-86.093	-86.06	29.8205	-86.1083	7/2/2012 13:26	7/2/2012 13:56	1	24	23
40299211	4	299	211	E0906	29.9057	29.54	-86.1548	-86.09	29.9287	-86.1642	7/2/2012 15:53	7/2/2012 16:23	1	23	23
40299212	4	299	212	E0904	30.0958	30.06	-86.1935	-86.12	30.1133	-86.2062	7/2/2012 18:17	7/2/2012 18:47	1	19	17
40299216	4	299	216	E0910	29.7205	29.43	-86.0158	-86.01	29.6963	-86.0145	7/7/2012 9:30	7/7/2012 10:01	1	24	24
40299223	4	299	223	E0813	29.0263	29.02	-85.3077	-85.18	29.0368	-85.284	7/8/2012 1:23	7/8/2012 1:53	1	25	24
40299227	4	299	227	E0706	29.4842	29.29	-84.8003	-84.48	29.4627	-84.8112	7/8/2012 9:50	7/8/2012 10:20	1	13	13
40299228	4	299	228	E0708	29.3987	29.24	-84.7897	-84.47	29.4147	-84.8077	7/8/2012 11:20	7/8/2012 11:50	1	14	14
40299230	4	299	230	E0707	29.424	29.25	-84.5107	-84.31	29.4043	-84.5218	7/8/2012 15:30	7/8/2012 16:00	1	15	15

SURF_TEMP	SURF_SAL	SURF_OX	BOT_TEMP	BOT_SAL	BOT_OX	MIN_FISHED	TOT_LIVE	NUM_BROWN	NUM_PINK	NUM_WHITE	WT_BROWN	WT_PINK	WT_WHITE
28.8	33.8	6.4	26.1	36	6.4	30.25	15.889	0	0	0	0	0	0
28.4	34.6	6.4	26.4	36	6.4	30.183	64.367	0	0	0	0	0	0
27.9	35.5	6.3	24	36.2	6.3	30.733	20.861	0	0	0	0	0	0
27.7	35.8	6.4	26.2	35.9	6.2	30.183	7.36	0	0	0	0	0	0
27.9	35.8	6.4	26.7	35.9	6.2	30.267	7.708	0	0	0	0	0	0
28	35.7	6.4	26.2	35.8	6.4	30.217	8.969	0	0	0	0	0	0
27.9	35.6	6.4	26.8	35.8	6.4	30.45	19.254	0	0	0	0	0	0
28.5	35.4	6.3	24.3	36.2	5.9	30.45	22.493	0	0	0	0	0	0
29.2	35.3	6.3	24.6	36.3	6.5	30.217	33.271	0	41	0	0	0.701	0
28.5	35.6	6.3	27.2	36	5.9	30.3	80.034	0	0	0	0	0	0
29	35.5	6.4	27.2	36	6.1	30.3	43.603	0	0	0	0	0	0
29.2	35.1	6.3	27.1	36.1	6.1	30.217	436.404	1	0	0	0.01	0	0

II. STANDARD SEAMAP SHRIMP AND GROUNDFISH SAMPLING TRAWL GEAR SPECIFICATIONS

II. Standard SEAMAP Shrimp and Groundfish Sampling Trawl Gear Specifications

A. Introduction

The SEAMAP trawl surveys use a 42' semi-balloon trawl with 8'x40" chain doors towed at 2.5 knots. The complete trawl and door specifications, towing warp scope ratio, efficiency checks, and inspection schedule for this gear have been included as a guide for proper use.

B. SEAMAP 42' Semiballoon Trawl Specifications

Webbing (Nylon):

Bosom, wings and comers - 2" stretched x #18 twine.
Intermediate - 1-1/2" stretched x #24 twine.
Codend - 1-5/8" stretched x #42 twine w/1/4" x 2" galvanized rings.
Chaffing gear - 3-1/2" stretched x #90 polyethylene 60 x 40.

Hanging Cable:

Headrope and footrope - 9/16" diameter (6x6) polyethylene cover stainless steel combination net rope.
Leglines - 6 ft with heavy duty wire rope thimbles.

Weight:

Loop chain - 1/4" galvanized chain, 16 links per loop, tied every foot. Tickler chain should be 42” shorter than footrope as measured from trawl door to trawl door.

Mud Rollers:

17 mud rollers on a separate line (1/2" polypropylene) tied every 3 feet, with 3" of slack (top of roller to bottom of footrope). The mud rollers are a Biloxi Type and are 5" x 9" with ¾" center hole.

Floatation:

Floats – 6 – 3" x 4" spongex floats spaced 5 ft apart, across the middle of the headrope.

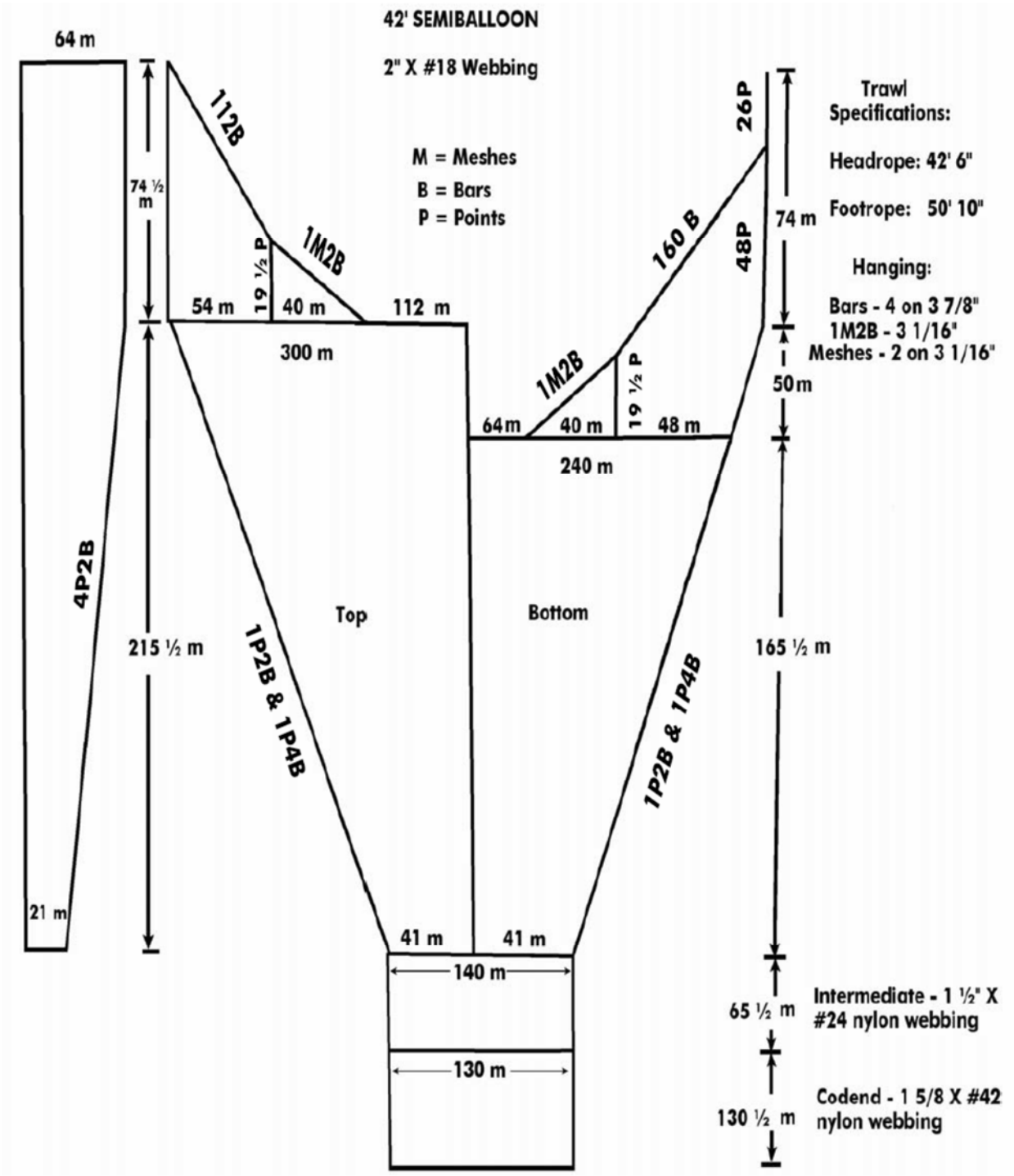
Lazyline:

18 fathoms of 3/4" polydacron.
Purse rope - 3/4" polydacron 16 ft. long.

Net Treatment:

Green plastic net coat.

Figure 2-1.Standard SEAMAP SEAMAP 42’ Trawl Schematic.



C. **Door Specifications:**
Length and Height 8’40”
Chain - 1/2" proof coil chain
Swivels - 1/2"
Bolts - 5/16"
Planking - 5/4 yellow pine, Grade 1
Stiffeners - 4"x4"
Uprights - 2"x10"
Shoe - 1"x6" stock
Lift pads in center
Bonded and bolted
Doors have 23-1/2" bridle (tow point to door face)

Tickler Chain Specifications:
Type - Standard free tickler
Size - 1/4" galvanized chain
Length - 42" shorter than the footrope including the leglines.

Bridle Specifications:
Wire Type - 6x19 strand marine lube
Diameter - 9/16"
Length - 30 fathoms

Total Trawl Twine Area:
240.2794 sq. ft.

Total Door Surface Area:
53.2 sq. ft. (per set)

Recommended Towing Speed:
2.5 knots

Figure 2-2. SEAMAP 8 Foot x 40 Inch Otter Door Design.

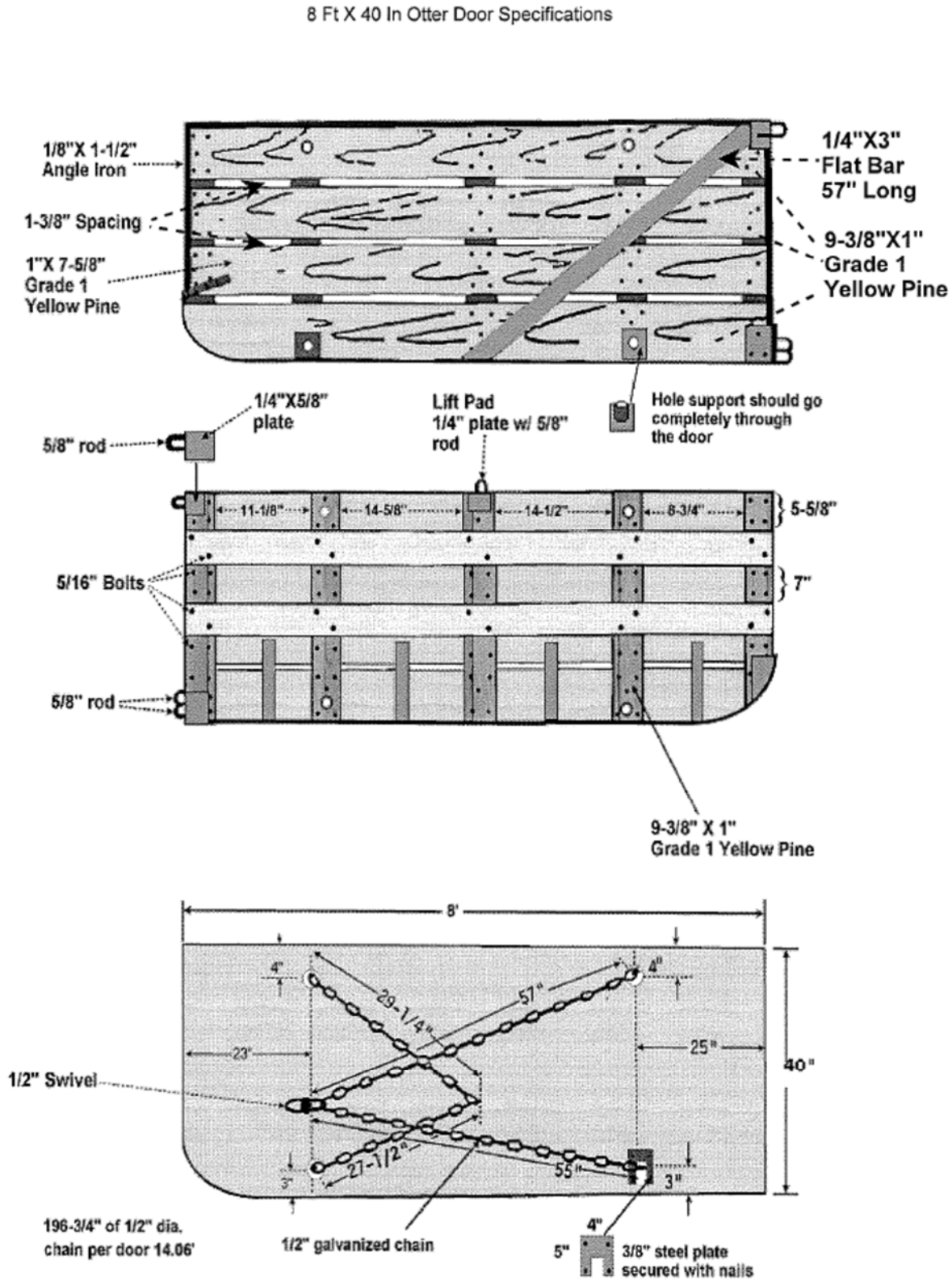
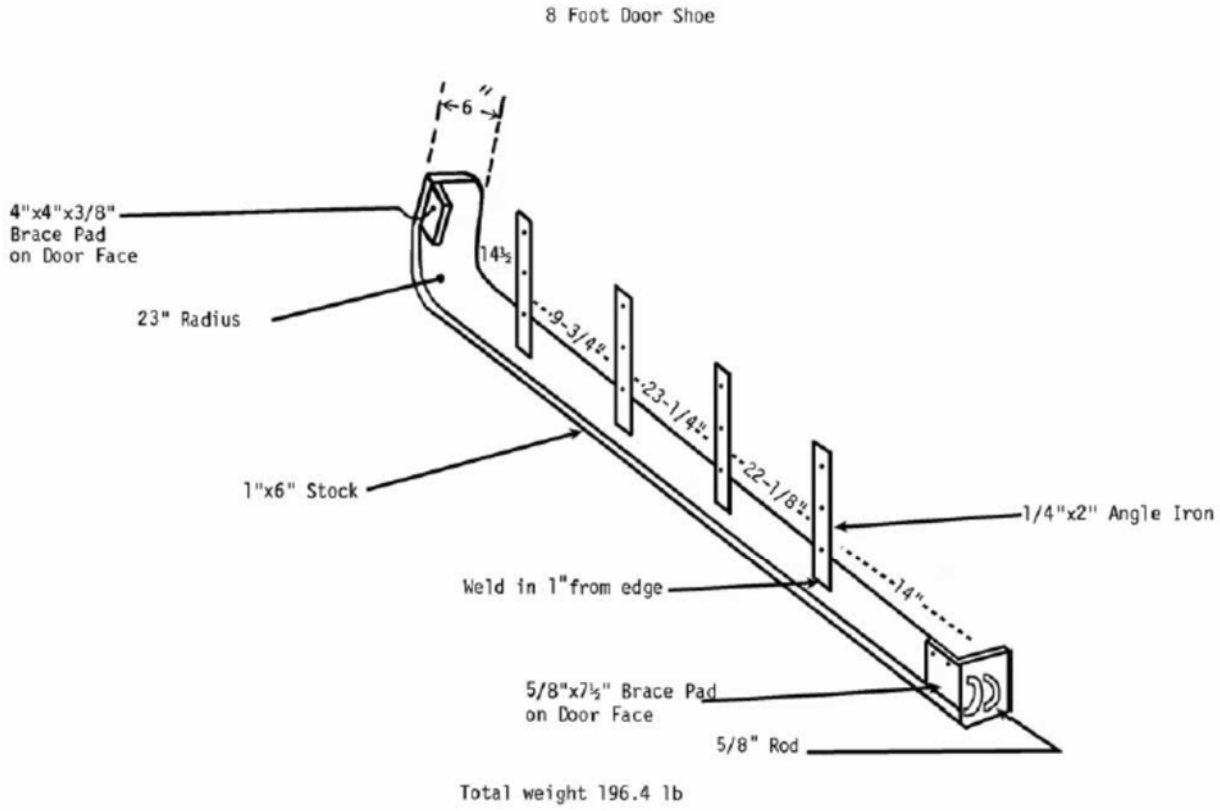


Figure 2-3. SEAMAP 8 Foot Door Shoe Design.



D. Recommended Towing Warp Scope Ratio Table

Water Depth Fathoms	Warp Fathoms	Scope Ratio	Water Depth Fathoms	Warp Fathoms	Scope Ratio
5	35	7.0	28	116	4.1
6	35	5.8	29	118	4.1
7	35	5.0	30	120	4.0
8	40	5.0	31	124	4.0
9	45	5.0	32	128	4.0
10	50	5.0	33	132	4.0
11	55	5.0	34	136	4.0
12	60	5.0	35	140	4.0
13	65	5.0	36	144	4.0
14	70	5.0	37	148	4.0
15	75	5.0	38	152	4.0
16	80	5.0	39	156	4.0
17	85	5.0	40	160	4.0
18	90	5.0	41	164	4.0
19	95	5.0	42	168	4.0
20	100	5.0	43	172	4.0
21	102	4.9	44	176	4.0
22	104	4.7	45	180	4.0
23	106	4.6	46	184	4.0
24	108	4.5	47	188	4.0
25	110	4.4	48	192	4.0
26	112	4.3	49	196	4.0
27	114	4.2	50	200	4.0

E. CHECKS TO DETERMINE TRAWL FISHING EFFICIENCY

1. SEAMAP Survey Trawl
   Door Shine - 8' x 40" Doors
   a. If the door is fishing properly, shine will be down the entire length of the leading edge and should taper to a point on the front of the shoe.
   b. Shine only on the back, or heel, of the shoe indicates improper tow cable scope ratio, improper door chain setting, or too much setback in the leglines.
   c. If shine is uniform across the entire shoe width, the scope ratio may be incorrect or tilt angle of the door inadequate.
   d. Shine on the nose or front portion of the shoe indicates improper door chaining, inadequate setback in the trawl footrope, inadequate weight on the footrope, or too short of a scope ratio.
   e. Door angle of attack can be determined by measuring the angle of the shine. For maximum efficiency the angle of attack should be approximately 36^{o}.

2. Footrope Loop Chain Shine
   a. Shine should be apparent on the middle 6 to 8 links of each loop of chain around the entire footrope length, indicating that the trawl is fishing at least 4 inches off the bottom.
   b. Hard bottom contact is indicated by shine on almost all links of the loops around the entire footrope length. This condition indicates the trawl is under spread or has too much weight on the footrope.
   c. No footrope-bottom contact is indicated by a lack of shine on any of the loop chain links. The trawl is overspread or has insufficient weight on the footrope.

3. Catch Composition and Consistency
   a. The amount of benthic invertebrates and debris in the catch indicates the degree of bottom contact and tickler chain efficiency.
   b. Variations in catch consistency can be an indication of possible gear adjustment problems.

GEAR AND RIGGING INSPECTION SCHEDULE

Gear or Rigging	Inspection	Interval
Doors	Shoe Shine	At least once a day.
Loop Chain	Shine	At least once a day.
Tickler Chain	Tangles, breaks, or stretching	Check for tangles or breaks every tow and stretch every fishing day
Trawl	Tears and holes	Every tow for obvious tears and holes. The trawl should be brought on board once a day to check for less obvious damage.
Bridle	Twists	If twists extend 25% or more of the bridle's length, the bridle should be untwisted.

III. COLLECTING ENVIRONMENTAL DATA

III. COLLECTING ENVIRONMENTAL DATA

A. INTRODUCTION

This section describes standard operational procedures for collecting environmental data at sea and establishes **primary measurements** (minimum requirements) for all SEAMAP cruises. Those measurements are: water temperature, salinity, dissolved oxygen, chlorophyll (plankton stations only), and Secchi disc depth. A full water column profile is preferred and is now the SEAMAP standard. In case of equipment malfunctions, minimum sampling depths include the surface, mid-water, and bottom (or 200 meters where depths are greater than 200 meters). Back up equipment for environmental information (water temperature, salinity, and dissolved oxygen) is mandatory and should allow you to gather data at the surface, mid and bottom water if the main CTD breaks down. Samples are to be taken in conjunction with each biological station, either immediately before (preferred) gear deployment or after gear retrieval. Additional measurements and more frequent sampling may be required depending on the type of SEAMAP survey.

Environmental data must be collected no more than 1 hour before any trawling or plankton event and must pass within ½ nautical mile of the SEAMAP sample site. If a second trawl is attempted after encountering a snag during the trawl, a second environmental sample should be taken if trawling away from the environmental sample point. Environmental data should be collected prior to the second trawl if the beginning of the second trawl is more than 1 hour from the initial collection of environmental data.

The SEAMAP is striving to acquire the most accurate data possible. A CTD or STD is primarily used to collect water temperature, salinity, dissolved oxygen, chlorophyll, and transmissivity. The preferred chlorophyll sampling method is extraction. Water samples can be collected with water collection bottles. Dissolved oxygen is measured with in-situ D.O. sensors, onboard the vessel with D.O. meters (laboratory probe), or by a titration method. Secchi depth is measured with a standard white matte finish, 30 cm or 52 cm diameter Secchi disc.

When a CTD or STD is unavailable or breaks down, hydrocasts with water collection bottles will be used to collect water samples for measurement of the parameters identified as minimal. Sampling depths will be calculated by using wire length and angle tables or by direct measurement, when possible. If no other method is available, then temperature of the water samples collected at the surface, mid-water and maximum depth will be determined by other acceptable methods. When salinity cannot be determined at sea, water samples should be collected and returned to shore for later analysis.

It is recommended that instrument QA/QC checks should be made on a daily basis for temperature and salinity. This means that a salinity sample should be taken for return to the laboratory and temperature should be measured independently of the CTD, STD, or other method. An XBT cast can be used to check sample depth and temperature against the CTD or STD. Calibration of chlorophyll measurements should be conducted prior to and after each cruise to ensure proper instrument functions. The dissolved oxygen instrument selected should be checked against Winkler or other water quality instrument determinations in the laboratory before, during, or after

each cruise. These quality assessment/quality control (QA/QC) checks are recorded on the data sheets and should be maintained for inclusion into the metadata.

Please use a lead pencil and make entries dark and legible to facilitate data entry. All numeric fields on the SEAMAP Environmental Data Sheet (Appendix 1) are to be right justified or aligned with the decimal place. Leading zeros are not required, but enter trailing zeros. On all SEAMAP surveys, a SEAMAP Environmental Data Sheet (Appendix 1) must be completed for every environmental station.

B. ENVIRONMENTAL FORM INSTRUCTIONS

The methods of collecting environmental data and the completion of the SEAMAP Environmental Data Sheet are as follows:

1. Required Data.

   VESSEL - Enter 2-digit numerical code from Appendix 2, Vessel Codes. If your vessel has not been assigned a code, notify NMFS Pascagoula to receive one.

   PASCAGOULA STATION NUMBER - This is a unique sequential consecutive 5-digit number within each cruise, preferably starting with "00001cf." For state vessels enter the 2-digit vessel code followed by a 3-digit station number. Transfer this station number to the environmental or plankton sheet. Do not duplicate this station number for other stations on a cruise.

   CRUISE - Enter 4-digit cruise number. Except for the *Oregon II* and other vessels having historically different cruise numbering conventions, the cruise number for **ALL VESSELS** shall be the calendar year of the survey followed by the cruise number for the year, e.g. "1201" first cruise for year 2012, "1202"- second cruise for year 2012, etc. Use this cruise number on all sheets during a cruise; do not change it.

   DATA SOURCE CODE - Enter data source code from Appendix 3.

   CTD LATITUDE - Enter latitude position occupied when deploying the CTD in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

   CTD LONGITUDE - Enter longitude position occupied when deploying the CTD in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

   CTD START TIME - Enter military time (0000-2359), HHMM, of start of CTD deployment.

   CTD END TIME - Enter military time (0000-2359), HHMM, when the CTD has been retrieved.

CLOUD TYPE - Cloud type is no longer collected on Gulf of Mexico SEAMAP cruises.

% CLOUD COVER - Circle percent cloud cover during daylight hours only. Cloud cover is determined for the entire sky, not just that portion overhead. Allowable values are 25%, 50%, 75% and 100%.

SECCHI DISC – Only take secchi readings if transmissivity is unavailable. Enter secchi disc reading in meters (see Tables 1, 2, and 3 for meter/feet/fathom conversion factors), observing one indicated decimal. Take readings only during daylight hours and from shady side of platform. See section C.1. below for transparency measurements with the Secchi disc.

STATION LOCATION CODE - Enter S (start) or E (end) for position location closest to where environmental data was actually collected. Enter U if location was unknown.

AIR TEMPERATURE - Enter in degrees Celsius and tenths (dry bulb), observing 1 indicated decimal.

BAROMETRIC PRESSURE - Enter in millibars of mercury, observing 1 indicated decimal.

WAVE HEIGHT - Enter wave height in meters, observing 1 indicated decimal.

SEA CONDITION - Enter Beaufort scale- see Appendix 5, Beaufort Sea Condition Table.

WATER COLOR - Enter the gross water color, daytime only, from Appendix 5, Water Color Codes.

PRECIPITATION - Enter code from Appendix 5. Record precipitation no matter when it occurred during the station.

SAMPLE DEPTHS - Enter midwater and maximum sample depths in whole meters. See section C.3. below for the hydrocast sampling procedure.

WATER DEPTH - Enter water depth in meters, observing one indicated decimal place, at the point where environmental data were taken. This should be equal to or greater than the maximum sample depth.

TEMPERATURES - Enter surface, midwater, and maximum sample depth temperatures in degrees Celsius (see Table 4 for conversion factors), observing two indicated decimals, adding trailing zeros if needed. If state vessels have additional equipment for measuring temperature, please document type of equipment. Thermometer readings should be entered in the blocks provided at the bottom of the data sheet.

SALINITIES - Enter surface, midwater, and maximum sample depth salinity measurements, observing three indicated decimals, adding trailing zeros if needed. If samples are taken for later analysis, record vessel code or name, cruise, station number, date, and sample depth on each sample. Indicate on the bottom of the form if samples were taken for later analysis. If salinity is determined with a refractometer, record the readings in the boxes provided at the bottom of the form. See Section C.3 below for collecting salinity samples from a hydrocast.

CHLOROPHYLL - Enter surface, chlorophyll maximum when taken, and maximum sample depth of chlorophyll measurements in milligrams per cubic meter observing four indicated decimals. If samples are taken for later analysis, document the number of samples taken at each depth on the bottom of the form. See Section C.4 below for chlorophyll sampling procedures.

OXYGEN - Enter surface, midwater and maximum sample depth dissolved oxygen readings in parts per million, observing one indicated decimal place. See Section C.5 below for Dissolved Oxygen (D.O.) sampling procedures.

TRANSMISSIVITY - Enter transmission as percent transmission for surface, midwater and maximum sample depth. No decimals are used. This is a measure of the amount of suspended material in the water. If a transmissometer is not available, be sure to collect secchi depth.

C. SAMPLE COLLECTION METHODOLOGY

1. MEASUREMENT OF TRANSPARENCY WITH SECCHI DISC

The Secchi disc is used to measure transparency of sea water (approximate index) and is dependent upon the available illumination, limiting measurements to daylight periods only. Daylight hours may be defined as being from one hour after sunrise to one hour before sunset. Either standard-sized Secchi disc can be used. For inshore stations, there is no difference in the readings depending on size. For very clear offshore water, the larger size disc should be used.

a. DO NOT wear sunglasses during the measurements.

b. Lower Secchi disc with a rope marked in meters on the shaded side of the ship.

c. Lower disc until it is just perceptible.

d. Note the depth of the disc in meters. The measurement is made from the water surface to the disc.

e. Continue lowering until the disc is no longer visible and again note the depth of the disc.

f. Average the two depths and record the resulting depth in the appropriate blocks on the data sheet, observing one indicated decimal place.

2. HYDROCAST SAMPLING PROCEDURES

Water samples need to be collected for **QA/QC purposes** and to obtain temperature, salinity, D.O., and chlorophyll when a CTD, STD or XBT is unavailable. Water samples are collected with the aid of water collection bottles (Niskin) attached to a hydrowire at the surface, mid and bottom depths or at the surface, 100 meters and 200 meters for stations with depths greater than 200 meters. The procedure for a hydrocast with water collection bottles is as follows:

a. Verify (by communication with the bridge) that ship is on station, is "dead" in the water and oriented so cast is on weather side of ship.

b. Obtain bottom depth from bridge for proper bottle placement on the hydrowire.

c. Attach the deepest water collection bottle to the hydrowire above a hydroweight as follows:
   1. Ensure air vent and drain valve are closed.
   2. Attach the loop in the top stopper wire to the left release mechanism. The bottom stopper wire is clipped below the ball on the top stopper wire.
   3. Clamp the **water collection** bottle to the cable finger tight, top clamp first, then bottom clamp.

d. When the first bottle is ready for lowering (just below the sea surface), zero the meter wheel.

e. Lower this bottle until the meter wheel reads the equivalent of the desired depth. If you have a strong wire angle make sure to use an inclinometer to adjust your water depth. Take into account the distance from the deck of the ship to the water surface before attaching the next bottle.

f. Calculate the length of wire required to reach desired depth of each bottle (see wire angle Table 8) or compute the depth by using the following formulas for computing wire required, depth of bottom bottle or COS angle:

   depth of bottle = wire out x COS angle
   wire required = depth ÷ COS angle
   COS angle = depth ÷ wire out
   (1 fathom = 1.83 meter = 6 feet)

   At shallow water stations an alternative to Steps D and E is to initially "bump" the sea floor with the hydro-weight. Use the wire length to determine placement of the mid-water sample bottle. Retrieve the hydroweight and attach the midwater bottle.

g. Haul back or pay out wire until the meter wheel reads required wire length for second bottle.

h. Clamp a second water collection bottle to hydrowire and set stoppers.

i. Attach a messenger lanyard to the bottle at the right release mechanism and **CLIP THE MESSENGER TO THE HYDROWIRE** below the bottle.

j. Pay-out the wire and attach remaining bottles and messengers at the calculated wire length.

k. End cast preparation with a water collection bottle and attached messenger just below the surface. Record sample depths in appropriate boxes on data sheet.

l. **CLIP A MESSENGER** to the wire and release to trip the cast, allowing approximately 1 minute per 100 meters of wire length for messenger travel.

m. Retrieve the cast, observing ascending cable, and warning winch operator when each bottle is first visible.

n. Remove the bottle from the wire by loosening the bottom clamp first. Care should be taken so as to not shake the bottle or otherwise disturb the water sample before taking the D.O. samples.

o. Take temperature measurements by opening top stopper and immersing hand held thermometer or use a YSI. Record temperature in appropriate boxes on data sheet.

p. Immediately after taking temperature, draw dissolved oxygen samples before retrieving salinity samples. You can also use a YSI.

3. COLLECTING WATER SAMPLES FOR SALINITY

a. Salinity samples are to be drawn after all the oxygen samples are collected.

b. Rinse the sample bottles three times, using about one-fourth bottle of water for each rinse.

c. Shake the bottles vigorously during each rinse and pour the rinse water inside the bottle cap to rinse it also.

d. Draw the salinity samples directly from the drain spigot, filling the sample bottle to within one-half (½) inch of the top.

e. Do not force the cap on the sample bottle too tightly. Pressure supplied between thumb and forefinger is sufficient.

f. Label each bottle with the vessel name, cruise number, station number, date, and depth (surface, mid-water, or bottom).

4. CHLOROPHYLL SAMPLING PROCEDURES

A surface and bottom chlorophyll water sample, sufficient for three replicate filters, must be collected at all SEAMAP plankton stations. If possible, a chlorophyll maximum water sample should be collected if present in the water column. In order to determine if a chlorophyll maximum peak is present, observations must be made during the down cast of the CTD. If a fluorescence peak occurs in the water column, a water sample should be collected for processing at that depth. In shallower waters, the chlorophyll maximum peak can occur near the bottom. If this is the case only a surface and bottom sample are needed.

Samples should remain in the dark until the filtration step, which should be done in as low light as is realistic. **Always use a forceps to handle the filters.**

a. Obtain a 10 liter water sample at surface.

b. Filter three replicate samples up to 1000 ml each through the 25mm GF/F or GF/C filter or as much as possible in 3-5 minutes. (In rich coastal waters, 50 ml is sufficient.)

c. Do not exceed a setting on the vacuum pump of 10 psi in GE vacuum.

d. Using the forceps, fold each sample filter in half twice so it resembles a pie wedge and place all three samples in a labeled plastic petri dish, wrap in aluminum foil, and label.

e. Record the following information on the petri dish, label, and environmental station sheets:
   1) Sample depth (S, M, B, or actual depth)
   2) Station number
   3) Filter type
   4) Volume filtered
   5) Vessel
   6) Cruise
   7) Date

f. Check the appropriate boxes at the bottom of the data sheet if chlorophyll samples were obtained.

g. Place the samples in a low temperature (-80°C) freezer or in a liquid nitrogen dewer flask for storage until processing.

There are several points that need to be kept in mind when taking chlorophyll samples. The damaging or breaking of algal cells is a problem because when the cell ruptures the chlorophyll escapes and ends up passing through the filter. Using too high a vacuum pressure will damage the cells and should therefore be avoided. Acidity is a

major problem because it also causes the algal cells to disintegrate with a consequent loss of chlorophyll. This is the reason that filters should never be touched with your fingers. **Always use a forceps to handle the filters.** While the samples are in storage, they get banged around and some of the algal cells may be knocked off the filters. To minimize this problem, **fold the filter in half before placing it in the petri dis**h, preferably folded twice so it resembles a pie slice. At some locations there is occasionally a very high sediment load that makes it impossible to filter the optimal amount of water. In such a situation a smaller quantity of water can be filtered but this always creates some problems. Never pour unfiltered water off the filter. This will result in algal cells that should have been on the filter being dumped out as well. Generally one will realize after a few minutes that there is no way to filter the optimal amount. At that point it is recommended that you start over. Discard the filter and water sample that is over the filter. Put on a new filter and measure out a quantity of the sample water that you are certain will go through the filter. Light will cause chlorophyll to break down. Never leave samples standing for long periods before filtering and once the filtration is finished the samples should be kept in the dark. That is the reason for wrapping samples in aluminum foil. Lastly, freeze the samples as soon as possible to prevent spoilage, at which time the cells break down and the chlorophyll escapes.

5. COLLECTING DISSOLVED OXYGEN (DO) PROCEDURES

Water samples for dissolved oxygen determination should be drawn from the water collection bottles as soon as the bottles are retrieved and before any other samples are taken.

a. Collecting the Water Sample

1. Attach a clear plastic tube of the proper diameter, about 25 cm in length, to the spigot at the bottom of the water collection bottle. Lift the free end of the tubing to near the level of the air vent, and then open the air vent and the spigot, letting the tubing fill with water. There should be no air trapped in the tubing. If air bubbles are observed, let the water flow out slowly by slightly lowering the free end of the tubing and tapping on the tubing until the bubbles are cleared.

2. Place the free end of the tube deep into the B.O.D. bottle (biochemical oxygen demand) and fill approximately 1/4 full.

3. Close the drain valve, swirl the water around in the bottle to rinse it, and discard the water.

4. Reinsert the tube into the bottle near the bottom and allow water to flow.

5. Count the number of seconds it takes for the bottle to fill and begin to overflow the B.O.D. bottle.

6. Continue counting and allow the water to overflow until the bottle has filled at least three times. For example: If it takes a count of 7 to fill the bottle, continue letting the water overflow and count to 21.

7. Place the ground glass stopper in the top of the B.O.D. bottle and as you do so, twist it gently. Leave the excess water on top of the bottle. This provides an additional air seal. Draw samples from the remaining water collection bottles following the same procedure.

8. Samples are now ready to be measured with an oxygen meter or by the Winkler titration method within 30 minutes of collection.

b. Measuring Dissolved Oxygen with the YSI Meter

1. Adjust the SALINITY knob on the YSI meter to the salinity of the sample (use a refractometer to determine salinity if a CTD is unavailable. If your refractometer measures in Brix, make sure to convert to salinity).

2. Place probe and stirrer in the sample and switch on stirrer (toggle switch on top of probe).

3. When the meter has stabilized, read D.O. The reading should be taken within 30 seconds of immersion of the probe.

4. Leave the instrument on (switch at RED LINE) between measurements to avoid the necessity for repolarizing the probe.

5. Record D.O. measurements in the appropriate blocks on the station sheet.

6. A calibration check of the oxygen meter should be performed during the first hydrocast each day.

7. If this is the first hydrocast of the day, draw a second water sample (Steps a.1-8 above) from each Niskin bottle and measure dissolved oxygen with a SECOND calibrated dissolved oxygen meter and probe.

8. Record the second D.O. measurements just ABOVE the previously recorded measurements on the station sheet.

9. Occasionally dissolved oxygen readings will appear lower or higher than expected, and may indicate conditions of hypoxia or supersaturation respectively. These readings should be substantiated when below 2 ppm or above saturation levels for the existing temperature and salinity of the sample. Water samples with questionable readings should be checked by both of the following methods.
   a - Run water sample for determination of dissolved oxygen using a SECOND calibrated meter.

b - Water sample should be titrated using the field titration kit (Hach) supplied.

c. Calibrating the YSI Oxygen Meter

While these instructions are specific to a YSI meter, each type of oxygen meter should come with instructions on how to calibrate it and how often to calibrate. If you don't have calibration information for your instrument, contact the manufacturer for instructions. Air calibration of the YSI oxygen meter is straightforward and requires only a few minutes to accomplish once the meter and probe have been prepared and the instrument stabilizes. Preparing the instrument prior to making the hydrocast allows optimum time (30 minutes) for stabilization and reduces the time between drawing the samples and taking measurements. Procedures for air calibration follow:

1. Turn on the meter to Redline 30 minutes before calibration or use. Check probe membrane for tears and bubbles in the electrolyte. Replace membrane if necessary and refill probe with fresh electrolyte.

2. Place the probe in moisture saturated air. Use a B.O.D. bottle partially filled (about 1") with FRESH water.

3. Switch meter to RED LINE and adjust.

4. Switch meter to ZERO and adjust.

5. Adjust SALINITY knob to FRESH, i.e., fully counter clock-wise.

6. Switch meter to TEMPERATURE and read.

7. Use probe temperature to determine calibration value from the "Solubility of Oxygen in Fresh Water," table in the instruction manual.

8. Switch to the desired dissolved oxygen range 0-5, 0-10, 4-14 or 0-20, and adjust CALIBRATE knob until meter reads the correct calibration value from Step 7. Verify calibration stability. Readjust if necessary.

The meter/probe is now calibrated and should be recalibrated before each use or hydro station.

IV. COLLECTING ICHTHYOPLANKTON DATA

INTRODUCTION

The following is a SEAMAP operation manual for use aboard all designated SEAMAP plankton surveys. These procedures are to be followed on each SEAMAP plankton station. All vessels may not adhere to these rigidly as they may not be able to conduct SEAMAP operations strictly as described herein. If for some reason procedures in this manual are not followed, please take the time to document the procedures used for your particular survey.

This manual is the full ichthyoplankton section and only an abbreviated environmental section. New material has been included for tracking amounts of *Sargassum* collected, SCS (Scientific Computer System) operations, and database entry for plankton sampling.

On all SEAMAP surveys, specific data must be collected. There are two primary ways to record this data: NMFS Pascagoula Station and data sheets; or an Access database via the SCS. If datasheets are used, please use a soft lead pencil and make entries DARK and LEGIBLE enough so that the data entry operator can read them. All numeric fields are to be right justified or aligned with the decimal place. Include leading and especially trailing zeros.

Instructions for the SEAMAP Plankton Station Sheet

These data sheet instructions are for participating vessels that are not using the electronic SCS event system, or when that system is not functioning properly. Data sheets are provided as a backup. A copy of the SEAMAP Plankton Station Sheet, can be found in Appendix 1.

FIELD BY FIELD INSTRUCTIONS

VESSEL - Enter 2-digit numerical code from Appendix 2, Vessel Codes. If your vessel has not been assigned a code, notify NMFS Pascagoula to receive one.

PASCAGOULA STATION NUMBER - This is a unique sequential consecutive 5-digit number within each cruise, preferably starting with "00001". For state vessels enter the 2-digit vessel code followed by a 3-digit station number. Transfer this station number to the environmental or plankton sheet. Do not duplicate this station number for other stations on a cruise.

SEAMAP/OTHER STATION NO. - Use for SEAMAP or other alternate station numbers. For SEAMAP Plankton Station numbers, use four alpha/numeric characters and right justify, but be consistent in field length - all numbers should be the same number of characters, B002, NOT B2.

CRUISE - Enter 4-digit cruise number. Except for the Oregon II and other vessels having historically different cruise numbering conventions, the cruise number for ALL VESSELS shall be the calendar year of the survey followed by the cruise number for the year, e.g. "1201" first cruise for year 2012, "1202"- second cruise for year 2012, etc. The leading zero is required. Use this cruise number on all sheets during a cruise; do not change it.

DATA SOURCE CODE - Enter code identifying data collecting entity- see Appendix 3, Data Source Codes.

DATE - Enter station date (based on start time), in the format MMDDYY.

STATISTICAL ZONE - Enter GCSD statistical zone from Figure 1-1. Leave blank if you are outside a statistical zone.

NMFS FAUNAL ZONE - Enter NMFS Faunal Zone from Figure 1-2.

TIME ZONE - Obtain time zone code from Appendix 3, Time Zone Codes.

START TIME - Enter military time (0000-2359), HHMM, of start of station. For environmental and plankton stations, enter the time data acquisition started. A separate start time should be recorded for both bongo net and neuston net deployment.

START LATITUDE & LONGITUDE - Enter position occupied at start time in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros. A separate starting position should be recorded for both bongo net and neuston net deployments.

ACTUAL WATER DEPTH - Enter end depth in meters and tenths, observing the indicated decimal and entering a trailing zero.

END TIME - Enter as for start time - when data acquisition ends. A separate end time should be recorded for both bongo net and neuston net retrieval.

END LATITUDE & LONGITUDE - Enter position occupied at end time in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros. A separate ending position should be recorded for both bongo net and neuston net retrievals.

SARGASSUM – If *Sargassum* is present in the area, circle the appropriate *Sargassum* description from Appendix 10.

GEAR TYPES USED AT THIS STATION - Enter codes for all gear types used- see Appendix 4, Gear Codes.

Introductory Instructions for Scientific Computer System (SCS) Data Entries

The large NOAA vessels no longer use the paper datasheets after years of reliability with the Scientific Computer System (SCS). All of the required SEAMAP data is collected and recorded using this system in conjunction with an Access database. The information entered into this system is then ingested directly into the NMFS MS Labs database thereby reducing entry time and errors. Each operation during a station has a separate SCS "event". These events are custom built for consistency and reliability with data collection between the various NMFS SEAMAP surveys. At sea, scientists should follow the detailed written instructions for the various events provided by the MS Labs Pascagoula IT department. Following is a shortened synopsis for this partial environmental section of the manual.

PRIOR TO ARRIVING AT FIRST STATION FOR SURVEY, the Field Party Chief (FPC) must confirm that all SCS events are loaded onto the computer and test run properly, and to check all settings in the Seabird Seasave program. These programs are prepared by the IT department prior to sailing, however, sometimes the ship's personnel make computer changes which default these settings back to their original setup. The FPC needs to make sure:

1) SCS computer contains:
    a. Bongo Event
    b. Neuston Event
    c. CTD Event
    d. Others – any other events for other gears to be used
2) CTD computer:
    a. Seasave setup to check
        i. Mark File set to capture:
            1. Scan Number
            2. Depth
            3. Temperature
            4. Salinity
            5. Fluorescence
        ii. Bottle Firing Sequence
            1. Set to "Table Driven"
            2. Table set to locations of bottles (typically 1,5,9)
    b. Data folders setup for CTD and Seacat data files

PRIOR TO ARRIVAL ON STATION:

1) Lab Scientist will begin preparing computers for CTD cast by:
    a. Log on to the SCS Computer:
    b. Launch the CTD Event file using the SCS Menu.
    c. Enter data in the *Header Tab* in any fields which can be filled prior to arrival on station
        i. Vessel – should be hard coded prior to cruise (e.g., Gordon Gunter)
        ii. Cruise – should be hard coded (4 digit: YYNN; e.g., 1102 for the second cruise of 2011)
        iii. Pasc. Station No. (3 digit station number – e.g., 001)
        iv. SEAMAP Station No. (e.g., B002, if N/A leave blank)

v. Cast No. (should be 01, unless redo cast at same station)
vi. Local Time Zone (e.g., CDT)
vii. Local Date (format – MM/DD/YYYY)
viii. Local Hours (military time)
ix. Event No (should be 1, unless redo cast at same station)

d. Log on to the CTD Computer:
e. Launch the Seasave program for SBE 9/11*plus* file
f. Enter the data into the Header fields
i. Ship (vessel name – e.g., Gordon Gunter…set prior to sailing)
ii. Cruise (YYNN – set prior to sailing, 4 digit cruise number)
iii. Station (3 digit station number)
iv. Latitude (Format – DD MM.MM N – e.g., 25 33.40 N)
v. Longitude (Format – DD MM.MM W – e.g., 88 02.22 W)
vi. SEAMAP Station Number (e.g., B002, if N/A leave blank)
vii. Operator's Initials – enter your initials
viii. Depth (meters) – enter the station's depth in meters
ix. Notes – enter items such as reference to con file changes, or sensor failures (no commas or other punctuation)

2) Deck Scientist will begin preparing the CTD unit for deployment by:
a. Visually inspecting unit for loose hoses, wires, or connectors
b. Make sure the Y-connector is not clogged
c. Manually cock the Niskin bottles ready for use
d. Make sure air vents and stop cocks are closed on Niskin bottles

ARRIVAL ON STATION:

3) Verify with the bridge that the ship is on station, "dead" in the water and ready to begin station ops.
4) Determine sampling depth from electronic readout or chart depth from bridge.
5) Deploy the unit to just below the surface of the water
a. Turn on the deck box <u>after</u> the unit is overboard and out of reach
b. After unit is sitting below the surface of the water, Click "OK" on the Start Acquisition box
c. Data will begin to scroll on the visual displays
d. Keep unit at surface to equilibrate to the water temperature for 3 minutes
e. After 3 minute soak, click the MARK button and begin downcast
6) Fill in all data boxes as the information becomes available during cast
a. Visual Tab
i. SECCHI – see Envir. Section of full Ops manual
ii. Water Color – leave blank on plankton surveys
iii. % Cloud Cover – 0%, 25%, 50%, 75%, 100%
iv. Precipitation – use the dropdown menu
v. Mid Sample Depth (meters)
vi. Max Sample Depth (meters)
vii. Thermocline - not used, leave blank
viii. Water Depth (meters)

ix. EQ-50 Water Depth (m) – edit this if data comes in wrong, for example when station depth exceeds instrument reading; use chart depth in this case
x. Ray Water Depth (m) – edit this if data comes in wrong
xi. Wave Height (m)
xii. Sea Condition (Beaufort) – Appendix 5

b. Station Tab
i. Start EQ50 Depth meters – edit if the data comes in wrong
ii. End EQ50 Depth meters – edit if the data comes in wrong

HYDROCAST SAMPLING PROCEDURES

Water samples may be collected on all primary plankton surveys and select trawl surveys. Niskin bottles are evenly spaced and attached to the carousel frame. The Seasave program is set to Table Driven bottle firing sequence (typically 1, 5, and 9) and bottles are fired electronically by the watch leader during the CTD cast.

Water samples are not collected during the downcast of the unit, however, the watch leader will press the MARK button when the downcast begins. Once at max depth, the watch leader will have the unit stopped and let it rest at that depth for 1 minute. At the end of the minute, the watch leader will press the MARK button in the Seasave program capturing the data into a pre-set "Mark" file. Then the FIRE button will be pressed, closing the first bottle at that depth. The upcast is continued until reaching either the mid-depth or the peak fluorescence observed depth (observed and noted during downcast). After another 1 minute wait at this depth, the MARK and FIRE buttons are again pressed collecting the water sample in the second bottle (typically in position 5). The upcast is then re-started and continued to just below the surface of the water. The third bottle is fired and marked after the 1 minute rest period. Weather and ocean conditions (high currents or high seas) may make the full 1 minute wait difficult to achieve. Try to wait the full minute, but adjust this time as needed.

CHLOROPHYLL SAMPLING PROCEDURES

During dedicated plankton surveys, chlorophyll analysis is conducted at sea using a benchtop fluorometer and the Welschmeyer extraction technique (Appendix 11). Water samples sufficient for three replicate filters (200 mL per filter) per sampling depth are collected from the surface, peak fluorescence and bottom depths. Samples should remain in the dark until the filtration step, which should be done in as low light as is realistic. Always use a forceps to handle the filters. Step by step procedures for chlorophyll extraction using the Welschmeyer method can be found in Appendix 11.

There are several points that need to be kept in mind when taking chlorophyll samples. The damaging or breaking of algal cells is a problem because when the cell ruptures the chlorophyll escapes and ends up passing through the filter. Using too high a vacuum pressure will damage the cells and should therefore be avoided. Acidity is a major problem because it also causes the algal cells to disintegrate with a consequent loss of chlorophyll. This is the reason that filters should never be touched with your fingers. Always use a forceps to handle the filters. At some locations there is occasionally a very high sediment load that makes it impossible to filter the optimal amount of water. In such a situation a smaller quantity of water can be filtered but this always creates some

problems. Never pour unfiltered water off the filter. This will result in algal cells that should have been on the filter being dumped out as well resulting in an erroneous data point. Generally one will realize after a few minutes that there is no way to filter the optimal amount. At that point it is recommended that you start over. Discard the filter and water sample that is over the filter. Put on a new filter and measure out a quantity of the sample water that you are certain will completely pass through the filter.

CTD PROCEDURES (in part)

The CTD unit is the preferred method for collecting the various environmental measurements required by the SEAMAP. It is a delicate piece of equipment and requires care in handling. The CTD manufacturer's recommendations for a CTD/computer interface should be considered the minimal requirement for computer capabilities. A computer of lesser capabilities will be slow processing data.

NOTE: Field operation instructions for the NMFS CTD have undergone major revision. Full instructions are not included in this version, but can be obtained from the NMFS Pascagoula IT department (Charles.Schroeder@noaa.gov). SEAMAP members using various CTD instruments will have to compile their own detailed operational instructions. Please study and follow the operational instructions furnished by the manufacturer. The CTD operator should be familiar with the CTD unit hardware and software. As a minimum the operator should be able to identify all sensors, understand the plumbing arrangement, and know how to use programs required to make a cast.

SEAMAP ICHTHYOPLANKTON SAMPLING: General Comments

Important changes have been made, so please review these procedures for collecting SEAMAP ichthyoplankton samples.

Some confusion has arisen over when weather conditions prohibit sampling. This is truly a subjective decision based on boat stability and personnel capabilities. In general, when wind speed approaches 15-20 knots (kts), it is time to begin appraising the situation. In some cases, with larger ships and experienced crew, it is possible for operators to maneuver the boat into a lee position so that work can continue in winds over 20 kts. At other times, specific sea conditions and/or inexperienced personnel may warrant stopping operations in 20 kt winds. Remember that high winds will cause the flowmeters to turn prior to submergence. When that becomes a problem, try to deploy the bongo net as quickly as possible or put a Styrofoam cup gently over the flowmeter rotor. Once the net begins to enter the water the cup will fall off the rotors and will be recovered from the sample prior to preservation. Holding cod ends until the mouth of the bongo frame is submerged will reduce breakage of cod ends that are blown into the side of the ship in strong winds. Plankton collections are taken around the clock regardless of daylight available.

When filling out station sheets or inside labels, please use a lead pencil and make entries dark and legible. A SEAMAP Plankton Station Sheet or similar sheet must be completed for all plankton stations on all surveys, excluding NOAA vessels running up-to-date SCS events. All NOAA vessels should run SCS events as per prescribed methodology provided by the MS Labs IT department.

All numeric fields on field data sheets are to be right justified or aligned with the decimal place. On all NOAA vessels equipped with the SCS Watch Leaders should, prior to the first plankton station, confer with the Field Party Chief (FPC) on the selection of the most appropriate data to be collected during SCS plankton events.

A checklist of sampling equipment and supplies is listed in Appendix 12. Prior to a cruise the FPC should determine the equipment (types of collecting gear) and supplies (number of sample jars, approximate amount of formalin and alcohol etc.) that will be required for the cruise and submit those requirements to ichthyoplankton personnel for placement on the vessel.

If something goes wrong while sampling with the bongo or neuston nets, include an operations code = M for miscellaneous with details in the comment section stating what went wrong with the tow.

PROCEDURES FOR ICHTHYOPLANKTON STATION OPERATION

a) Bongo Sampling

When conducting bongo tows using the standard SEAMAP bongo configuration, without a **monitored depth sensing device** (SBE-19 or similar device), follow directions outlined in **Station Operation I**. If a **monitored depth sensing device** (SBE-19 or other) is used, follow the outlined protocols for use of that device in **Station Operation II**. Some instructions are not duplicated, so check Station Operation I for any instructions not listed in Station Operation II. Prior to the first station, bongo nets should be mounted to the frame and prepared for sampling by the scientific party. One flowmeter should be mounted off center in each bongo frame. Be sure the rotors will not bang against the frame.

Before and after each cast, **check bongo array for**:

1. Cod ends are secure
2. No major rips or holes in the mesh, especially in the lower 1/3 of the net. If holes are detected, repair them or replace the net.
3. No air bubbles in the flowmeters. If needed, fill with silicone oil. Tap water (NOT distilled or salt water!) can be substituted in an emergency.
4. Ensure the flowmeter rotor spins freely and does not wobble, e.g.,, the shaft is not bent. If the flowmeter does not spin freely or a wobble is detected, replace the meter. Also confirm the numbers are advancing properly while the rotor spins.

STATION OPERATION I

The following procedure should be used **when no monitored depth sensing device (SBE-19) is being used**.

(1) Record station information on SEAMAP Plankton Station Sheet.
See SEAMAP Plankton Station Sheet instructions.

(2) Record flowmeter serial number and start readings on Flowmeter Performance Tracking Form (Appendix 13).

(3) Upon notification that the Bridge and Deck are ready and upon your command, gear is lowered to just above water surface; check that nets are streamed out straight. Zero winch meter wheel (if applicable).

(4) Ship should be moving at 1.5-2.0 knots.

(5) Deploy gear. Record starting latitude and longitude. When nets enter water and **flowmeters start to turn**, record the time to nearest second **(Gear in)** using a wristwatch displaying seconds in military time. **Watches should be synchronized with the ship's time.**

(6) Payout wire using **Table 1** as a guide until the amount of wire is delivered to reach the target tow depth. Target tow depth is generally 1 to 2 m off the bottom or 200 m where station depth exceeds 200 m. Target minimum tow time should be 3 minutes.

(7) Use the table in Appendix 15 to adjust amount of wire needed for net to actually reach target depth at the observed wire angle.

(8) Adjust ship speed to maintain a uniform wire angle, preferably 45 º, during wire payout.

(9) At maximum depth**, stop payout of cable and immediately start retrieval (do not allow net to settle)**. Record time to the second, wire angle, amount of wire out and the calculated depth (see ***** below) the net reached. Please indicate in the remarks section that the standard ***calculated depth** was recorded in the **maximum depth field** of the Ichthyoplankton Station Sheet.

***Calculated max depth = max wire out x cosine of wire angle when max depth is reached**

EXAMPLE : 200 m = 283 x COS (45)

(10) Retrieve net at a rate commensurate with the amount of wire out using Table 1 as a guide while maintaining a 45 º wire angle. It is EXTREMELY IMPORTANT that the wire angle be as close to 45 º as possible during retrieval. Target minimum tow time should be 3 minutes. If you cannot achieve the three minute minimum on a straight tow, then lower the net again and then retrieve to achieve the 3 minute minimum. Be sure to record the wire angle and bottom time on both maximum depths.

If angle exceeds 55º, falls to 35 º OR if combined variation exceeds 15 º, then the tow should be repeated (save the sample until a better tow is completed).

TABLE 1. **Approximate** Rates of Wire Payout and Retrieval for SEAMAP Bongo Net Collections. (**Actual rates will depend on winch capabilities).

Target fishing DEPTH (m)	Total amount WIRE OUT (m)	PAYOUT RATE	RETRIEVAL RATE
0 - 19	< 27	5 - 10m/min	5 - 10m/min
20 - 69	28 - 97	15m/min	15m/min
70 - 100	> 99	20 - 30m/min	20m/min
101-200	> 143	**50m/min	20m/min

(11) Record time to the second **(Gear out)** when net breaks surface and flowmeters stop turning while an assistant or the winch operator immediately pulls the frame from the water; do not let the bongo array continue to fish once it breaks the surface. Record the ending latitude and longitude.

(12) When possible, rinse plankton into cod end of net with seawater hose while the net hangs over the side. In high winds, bring net directly on board and rinse down completely on deck. If using the **ring bongo frame**, **record the flowmeter readings before rinsing down the ichthyoplankton net.** If using the standard **MARMAP bongo frame or collar bongo, take care not to wash or spin the flowmeter rotor before the tow readings are taken.**

(13) Put bongo frame and net on deck (take care not to rest frame on net or scrape net with frame on the deck!) and record flowmeter readings. After taking readings, check that the flowmeter shaft is not bent by spinning the flowmeter rotor gently.

(14) Gently rinse the lower portion of net into cod ends. Visually check that no plankton is left in net, especially check seams and cod end sleeves. If more than 2 tablespoons of mud or sand is present in both samples, the tow must be repeated. Save any marginal sample until completion of the next tow. These "mud samples" can be discarded overboard after a good tow is completed. If mud (no more than 2 tablespoons) is present in only one sample the tow need not be repeated. Save both samples and record the presence of mud in the sample in the remarks section of the Ichthyoplankton Station Sheet and the Plankton Transfer Record (Appendix 14).

(15) Remove cod ends and place cod ends into bucket. **It is imperative that samples be preserved immediately upon collection.**

Note: Sometimes extremely fine phytoplankton material will be difficult to rinse out. It is not necessary to save this phytoplankton, if you are completely sure you have rinsed down all the zooplankton. ***(when in doubt, SAVE IT ALL!!!)*** *However, dense accumulation of phytoplankton will clog the net and so remaining phytoplankton should be cleaned out of the net before it dries in the net. Rinse net with your usual effort to obtain sample, preserve, then scrub net afterwards as needed.*

(16) Transfer plankton from sieve to sample jars with a seawater (for formalin preservation) or Ethanol (for ETOH preservation) filled rinse bottle. If necessary, use a plastic spoon to transfer a larger quantity of sample at one time into the jar. Never scrape plankton from the mesh cone or sieve with the spoon. This mutilates larvae and makes them impossible to identify. Plankton samples that exceed 7 quarts in volume should not be retained (i.e., discard the entire sample). If this was a neuston tow, redo the tow either shortening the tow time or moving the station slightly.

(17) Most SEAMAP plankton samples are initially preserved in 10% formalin. For some SEAMAP partners, currently only the left bongo is preserved in formalin. It is preferred that right bongo samples are preserved in 95% ethanol. **NO FORMALIN** for right bongo samples. Add 50 ml of formalin to the 0.5 liter jar or 100 ml of formalin to the 1 liter jar containing the plankton sample seawater mixture (jar should be at least half filled with seawater prior to adding formaldehyde), then top off the jar with seawater. **Do not fill jars more than 1/3 full with plankton**, **use more jars and label each jar accordingly, e.g., 1 of 2, 2 of 2, etc.** Remember to use the same size jars for multiple jar samples (not 1 pint and 1 quart for a 2 jar sample).

All formalin preserved samples should be transferred to 95% ethanol solution 36 hours (+/- 2 hrs) after initial preservations. Ethanol to ethanol transfers should be done within 24 hours. **It is very**

important to not mix water into the sample at this stage! Unless there is precipitate, it is not necessary to rinse sample, just drain and add ethanol. If you need to rinse, use ethanol and NOT seawater. If sample has spoiled, rinse it lightly, subdivide into more jars, and again fill with 10% formalin solution. After another 36 hours, transfer into 95% ethanol as usual. **Note preservation problems on the Ichthyoplankton Station Sheet, the Pascagoula Station Sheet and the Plankton Transfer Record.**

Sometimes SEAMAP samples are initially preserved in 95% ethanol, check with the FPC and Watch Leader to determine when this is to be the case. Initial preservative information should be recorded in the remarks section on the Ichthyoplankton station sheet. This information should also be written in the Initial Pres. section of the inside label and the gear section of the outside sample label. When the sample is to be initially preserved in ethanol, as much sea water as possible must be drained prior to preservation. Then use an ethanol filled squeeze bottle to wash sample into jar and fill jar completely with 95% ethanol. Samples initially preserved in Ethanol are transferred to new 95% Ethanol 24 hours (+/- 2 hrs) after initial preservation.

(18) Follow instructions for labeling sample jars detailed later in this section.

(19) After the station is completed, fill in appropriate information on the **Flowmeter Performance Tracking Form** and the **Plankton Transfer Record** as instructed beginning on page 24 and Appendices 12a and 12b.

STATION OPERATION II

The following procedure should be used when a monitored depth sensing device (SBE-19 or similar) is used on the bongo.

> 1a. *Deck Scientist*: Inspect underwater depth sensing device (SBE-19) by making sure the device is properly secured to the wire, connections are secure, Tygon tube is filled with water, magnetic switch is off and wires are not damaged. Report findings to Lab Scientist. Any damages found should be relayed to the FPC who will report damages to the Electronics Technician (ET).

IMPORTANT: Measure the distance from the bottom of the SBE-19 to the bottom of the bongo frame for use as a depth correction factor (DCF) when deciding on targeted max tow depth. <u>This should be done by the FPC/Chief Ichthyoplankton Scientist prior to the first bongo tow, and that number should be given to the Watch Leaders and displayed in the Lab where the SBE-19 operations will be conducted</u>. Also record this value on the Pascagoula Station sheet in the Comments section.

> 1b. *Lab Scientist*: Follow SBE-19 (SEACAT) Programming instructions. Select and follow appropriate instructions:
>
> turn deck box on
> double click on SEATERM icon and hit <Enter>
> at S> type “DS" hit <Enter> or just hit F3 to display status

check vmain (should be greater than 11 or 12 to run)
at S> type "QS" hit Enter then press F10 to exit
double click on Seasave Bongo icon
go to "Realtime Data" on the menu bar and choose "Start Acquisition"
hit "Output data file" button
Click on data folder and enter station number as the file name
Hit Green **Start Acquire** button - A header form will come up. Fill it in.
(See Appendix 17 for a quick reference guide)

Make sure the bridge and deck are ready to deploy before you hit "Ok" at the bottom of the window because you will have only 60 seconds to turn on the magnetic switch after hitting "Ok" or you will have to repeat the setup process.

When data appears in the display, have the *Deck Scientist* and crew deploy the bongo.

2. On the *Lab Scientist'*s command, *Deck Scientist* should remove Tygon tubing, turn on magnetic switch and deploy. Submerge the bongo array and report the time of entry into the water to the *Lab Scientist*.

3. *Lab Scientist*: Monitor net depth on computer constantly. *Deck Scientist* reports wire angles periodically during cast using a handheld angle inclinometer.

4. *Lab Scientist* : For stations 100 m or less, have winch operator pay out cable slowly **(Table 1)**, until desired wire payout for fishing depth is reached. For stations greater than 100 m, pay out cable at 50 m per minute. **Remember to add the depth correction factor (DCF) to the observed depth to account for the distance from the SBE-19 to the bottom of the bongo frame.**

5. On *the Lab Scientist'*s command **at maximum depth, stop payout of cable and immediately start retrieval (do not allow net to settle)**. At that time the *Deck Scientist* will report **wire angle** and **wire out** to the *Lab Scientist*.

6. *Lab Scientist*: At the top of the Ichthyoplankton station sheet, record **wire angle**, **time, wire out** and **observed maximum depth** (remember to account for DCF) at **maximum depth**. Do not allow the bongo array to settle. Please indicate in the remarks section of the Ichthyoplankton station form that the **observed depth** from the SBE-19 profile was recorded in the maximum depth field. **If the SEACAT (SBE-19) malfunctions, conduct the tow using the instructions given in Standard Operation I.**

7. *Lab Scientist*: In the first block of the middle section of the field sheet, record **wire angle** and meters of **wire out**.

8. *Lab Scientist*: Tell the winch operator to slowly retrieve the bongo array at 20 m per minute for tow depths of 100 m or deeper; for shallower stations refer to **Table 1** for recommended retrieval rates.

Deck Scientist: must report wire angle and remaining wire out to *Lab Scientist*.

9. *Deck Scientist* should report when the bongo array breaks the surface.

10. *Lab Scientist:* Record beginning and end tow times to the second, (e.g., HH MM SS). When the tow is completed, go to Realtime Data on the menu bar and choose "Stop Acquisition", then turn off the deck box and have the deck turn off the magnetic switch. Exit program.

11. *Deck Scientist:* If marginal weather conditions exist, land the bongo array, report flowmeter readings to the *Lab Scientist* and carefully wash the net down on deck. Otherwise, thoroughly wash bongo array before landing, then report flowmeter readings to the Lab.

12. *Deck Scientist:* Collect samples for preservation following procedures outlined for bongo collections later in this section.

b) Neuston Sampling

(1) Check to make sure cod end is securely tied (or cod-end bucket attached). Deploy net so that it is half submerged. Record the starting latitude and longitude.

(2) Tow at 1.5-2.0 kts for 10 minutes (min). Record beginning (start) and ending (stop) times to the second on the Ichthyoplankton station sheet. **Start time** occurs when the gear is in the water half submerged and is fishing properly. End time occurs when the net is out of the water. See Appendix 18 for the Neuston Sampling Quick Reference Guide for SCS.

The duration of a neuston tow may be shortened to no less than five minutes total tow time when there are high concentrations of jellyfish, ctenophores, *Sargassum*, floating weed and/or debris entering the net. **It is very important to keep accurate tow times, because tow duration is the only measure of fishing effort for neuston samples.**

(3) Retrieve net. Record the ending latitude and longitude. Rinse plankton into cod end with saltwater while net hangs over side (if windy, bring net directly on board and rinse entire length of net on deck).

(4) Gently rinse the lower portion of net into the end. Untie sleeve of net and carefully rinse plankton into bucket or remove cod end (if used) as with bongo nets and place in bucket. Visually check that no plankton is left in net especially check seams and cod end sleeves. **It is imperative that samples be preserved immediately upon collection.**

Note: Sometimes extremely fine phytoplankton material will be difficult to rinse out. It is not necessary to save this phytoplankton, if you are completely sure you have rinsed down all the zooplankton. ***(when in doubt, SAVE IT ALL!!!)*** *However, dense accumulation of phytoplankton will clog net and should be cleaned before it dries. Rinse net with your usual effort to obtain sample, preserve, then scrub net afterwards as needed.*

Rinse off any *Sargassum*, grass or other extraneous material. Note the approximate type and volume of material (e.g., ≤ 0.5 cup, 1 cup, # of pints, # of quarts, a gallon, # of gallons, etc.) on the comment section of the Pascagoula data sheet (or on the Ichthyoplankton Station Sheet on cruises/stations where plankton is secondary), then discard after checking carefully for any clinging plankton material. Notify lab scientist of amount of *Sargassum* collected for inclusion in database (see Appendix 16 for procedures). Small adult fish and invertebrates that can easily fit in the sample jar should be saved. Larger fish may be discarded (note size and ID on data sheets) unless needed for another purpose. (Freeze any unusual or rare specimens if at all possible, or if ID is unknown freeze for later identification!). Concentrate plankton using a fine mesh cone or sieve (careful to use proper sieve mesh size). Some samples are slow to filter, concentrate smaller quantities at a time and use a vigorous swirling motion (or a light touch on the bottom of the sieve netting with fingers). Jellyfish slime can be cut with a small amount (1-2 tsp) of ethanol (NOT formalin!!). If needed, formalin preserved samples can be preserved "as-is", liquid and all with correct amount of formaldehyde added to the top. You may be able to condense the sample later when transferring to ethanol. On dedicated NOAA Plankton surveys additional jellyfish data is being collected (e.g., species ID, number of specimens, bell diameter, and wet volume).

(5) Transfer plankton to sample jars with a seawater rinse bottle if you find it necessary to rinse (for formalin preservation) or Ethanol (for ETOH preservation) filled rinse bottle. If necessary, use a plastic spoon to transfer a larger quantity of sample at one time into the jar. Never scrape plankton from the mesh cone or sieve with the spoon. This mutilates larvae and makes them impossible to identify.

(6) It is preferred that neuston samples be preserved in 95% ethanol. Otherwise formalin preserved samples should add 50 ml of formalin to the 0.5 liter jar or 100 ml of formalin to the 1 liter jar containing the plankton and seawater sample mixture (jar should be at least half filled with seawater) then top off the jar with seawater. **Do not fill jars more than 1/3 full with plankton**, **use more jars and label jar accordingly, i.e., 1 of 2, 2 of 2, etc.**

All formalin preserved samples should be transferred to 95% ethanol solution 36 hours (+/- 2 hrs) after initial preservation. Ethanol to ethanol transfers should be done within 24 hours. **It is very important not to mix the sample with water at this stage.** Unless there is precipitate, it is not necessary to rinse sample, just drain and add ethanol. If you need to rinse, use ethanol and NOT seawater. If sample has spoiled, rinse it lightly, subdivide into more jars, and again fill with formalin solution. After another 36 hours, transfer into 95% ethanol as usual. **Note preservation problems on BOTH the Ichthyoplankton data sheet and the Pascagoula station sheet and the Plankton Transfer Record.**

Sometimes SEAMAP samples are initially preserved in 95% ethanol, check with the FPC and Watch Leader to determine when this is to be the case. Initial preservative information should be recorded in the remarks section on the Ichthyoplankton station sheet. This information should be written in the comments section on the inside and outside labels. Remember to get as much water out of the sample as possible before adding 95% ethanol

to plankton during initial preservation. Samples initially preserved in Ethanol should be transferred to new 95% Ethanol 24 hours (+/- 2 hrs) after initial preservation.

(7) Follow instructions for labeling sample jars detailed later in this section.

(8) After the station is completed fill in appropriate information on the **Plankton Transfer Record**: *See Appendix 14.*

SEAMAP PLANKTON TOW SHEET INSTRUCTIONS

VESSEL - Enter 2-digit numeric code from Appendix 2.

CRUISE - Enter 4-digit cruise number. Except for the Oregon II and other vessels having historically different cruise numbering conventions, the cruise number for ALL VESSELS shall be the calendar year of the survey followed by the cruise number for the year, e.g. "1201" first cruise for year 2012, "1202"- second cruise for year 2012, etc. The leading zero is required. Use this cruise number on all sheets during a cruise; do not change it.

DATA SOURCE CODE - Enter code identifying data collecting entity- see Appendix 3, Data Source Codes.

PASCAGOULA STATION NUMBER - This is a unique sequential consecutive 5-digit number within each cruise, preferably starting with "00001". For state vessels enter the 2-digit vessel code followed by a 3-digit station number. Transfer this station number to the environmental or plankton sheet. Do not duplicate this station number for other stations on a cruise.

SEAMAP/OTHER STATION NO. - Use for SEAMAP or other alternate station numbers. For SEAMAP Plankton Station numbers, use four alpha/numeric characters and right justify, but be consistent in field length - all numbers should be the same number of characters, B002, NOT B2.

DATE - Enter station date (based on start time), in the format MMDDYY.

RECORDER – Enter the initials of the person recording the data.

TOW SPEED (KTS) - Record towing speed in knots and tenths. Should be approximately 1.5 - 2.0 knots to maintain a 45^{o} wire angle with the bongo or half the neuston frame submerged. This is speed over the ground.

BONGO

DEPTH CODE – Record whether the max tow depth was **calculated** (C) using wire out and wire angle OR max depth was **observed** (O) from the a depth sensing device (SBE-19).

MESH CODE - Enter mesh code (refer to Appendix 4).

GEAR CODE - Enter gear code (refer to Appendix 4).

NET # - Location that the bongo nets are deployed from. 1 = Port, 2 = Starboard, and 3 = Stern.

MIN DEPTH (m) - Enter minimum depth bongo reached in the water in meters (usually zero).

MAX DEPTH (m) - Enter calculated or observed maximum depth bongo reached in the water in meters, normally should not exceed 200 m. **Remember to note on the SEAMAP Plankton Tow Sheet whether the max tow depth was calculated using wire out and wire angle OR max depth was taken from the depth sensing device (SBE-19).**

TIME AT MAX DEPTH - Enter military time (24 hours) when the bongo net reaches maximum depth to the nearest minute just prior to haulback.

ANGLE - Enter wire angle at maximum depth just prior to haulback.

WIRE OUT - Record the amount of wire required to reach the targeted maximum tow depth with the 45º wire angle using the table in Appendix 15. Before the tow begins, get an estimate of total wire out needed to reach max. depth with a 45º wire angle. Please note that if during wire payout it appears that the wire angle upon reaching your targeted maximum depth will differ by more than 5º from 45º, reduce or increase accordingly the amount of wire ultimately paid out using the table in Appendix 15. **Record wire out for actual wire angle achieved at max depth.** Start recording amount of wire out in meters one minute (60 seconds) after commencing haulback. Note wire and angle every minute thereafter until tow is completed.

TIME IN (bongo) - Enter time when gear enters water and flowmeters start to turn (military time).

TIME OUT (bongo) - Enter time when gear is completely out of the water and is no longer fishing (military time).

STARTING LATITUDE - Enter latitude position occupied when deploying the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

STARTING LONGITUDE - Enter longitude position occupied when deploying the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

ENDING LATITUDE - Enter latitude position occupied when finished retrieving the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

ENDING LONGITUDE - Enter longitude position occupied when finished retrieving the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

FLOWMETER SERIAL # - **Record serial number for left and right flowmeters at every station**.

FLOWMETER START - Enter beginning flowmeter reading (double check readings) left to right. Point the rotor end of the flowmeter to the right; an unobstructed view of the values should be observable through the window of the meter. Read and record these values from left to right. *CAUTION: It is critical to read the series of numbers located in the rounded viewing chamber!!*
When recording flowmeter readings, be mindful of:

1. **Backward readings**
2. **Numbers out of sequence**

3. The recording of less than six (6) numbers

FLOWMETER END - Enter flowmeter reading (double check readings) when tow is finished and net is not fishing or it is on deck.

BONGO TOW SPEED – Speed in knots that the vessel is travelling during the tow. Make sure to include a trailing zero if needed. This is speed over the ground.

PERSERVATIVE USED – Circle the preservative that was used for initial and final preservation of the right bongo and left bongo sample. See the Station Operation Section I above for how to preserve the samples.

SEAMAP Sample # - Leave blank. **These identifying numbers are assigned at the Pascagoula Lab.**

NEUSTON OR OTHER - If other gear type, specify.

DEPTH CODE – Record whether the max tow depth was **calculated** (C) using wire out and wire angle OR max depth was **observed** (O) from the a depth sensing device (SBE-19).

MESH CODE - Enter mesh code (refer to Appendix 4).

GEAR CODE - Enter gear code (refer to Appendix 4).

NET # - Location that the neuston net is deployed from. 1 = Port, 2 = Starboard, and 3 = Stern.

TIME IN (neuston) - Enter military time down to seconds when **the gear is in the water half submerged and is fishing properly**. If there is only a neuston tow conducted at a station, record that value in the time at max depth field at top of station.

TIME OUT (neuston) - Enter military time when gear is out of the water down to seconds.

MIN DEPTH (m) - Enter minimum depth gear is in the water in meters (**0.5 m**).

MAX DEPTH (m) - Enter maximum depth gear is in the water in meters **(0.5 m)**. **It is important that min and max depths are identical for gear like the neuston net that is hauled at the same depth throughout the tow.**

STARTING LATITUDE - Enter latitude position occupied when deploying the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

STARTING LONGITUDE - Enter longitude position occupied when deploying the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

ENDING LATITUDE - Enter latitude position occupied when finished retrieving the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

ENDING LONGITUDE - Enter longitude position occupied when finished retrieving the plankton gear in degrees, minutes, and hundredths of minutes, observing indicated decimals and entering trailing zeros.

JELLYFISH – Note if jellyfish were present in the neuston net and estimate the amount (in liters) of jellyfish if present.

SARGASSUM – Note if *Sargassum* was present in the neuston net and estimate the amount (in liters) of *Sargassum* in the net if present.

NEUSTON TOW SPEED – Speed in knots that the vessel is travelling during the tow. Make sure to include a trailing zero if needed. This is speed over the ground.

PERSERVATIVE USED – Circle the preservative that was used for initial and final preservation of the right bongo and left bongo sample. See the Station Operation Section I above for how to preserve the samples.

SEAMAP Sample # - Leave blank

INSTRUCTIONS FOR COMPLETING ICHTHYOPLANKTON SAMPLE LABELS

Label accuracy and completeness is essential but **never delay** preserving the samples just for station position and station time. The most important sample identifiers recorded on the inside and outside jar labels are Vessel, Cruise, Station number and gear (APPENDIX 19). Station latitude, longitude and time correspond to the start position and time but if exact position cannot be received from the Bridge in a timely manner then use the targeted station position and a good approximate estimate of station time. **Always double check inside sample labels before placing them in the jars.**

OUTSIDE SAMPLE LABEL

1. Serial number (or Sample number) - Leave blank, this is reserved for **SEAMAP** sample number assignment at the NMFS Pascagoula Laboratory, but please do not cut this section off the label. Contact Connie.Cowan@noaa.gov at NMFS for the sample numbers. Please use the provided Excel spreadsheet.

2. Vessel - Use approved vessel name (e.g., “G. Gunter” or “Oregon II”).

3. Cruise - SEAMAP cruise number. (4 digit cruise number YYNN)

4. Station - Use Pascagoula station number.

5. Haul - Fill in only if multiple net systems are used at this station, e.g., Tucker trawl, MOCNESS, or if multiple deployments of the same gear are made.

6. Mesh - mesh size of net used to collect the sample.

7. Number of jars - **This information is critical to post cruise sample inventory.** Write in the jar number of the total number of jars used to contain the sample; i.e., "1 of 1" if only one jar was used, 1 of 2 and 2 of 2 if two jars were used, etc.

8. Vol. - Unless otherwise instructed, leave blank.

9. Gear - Fill in with gear type used and other pertinent information; e.g., Left, right, or single/double neuston; gear size.

10. Sort 1 - Leave blank.

11. Sort 2 - Leave blank.

INSIDE SAMPLE LABEL

(Use pencil for inside labels, write dark and legible)

FRONT:

1. Station # - Use Pascagoula station number.

2. Vessel - Use approved vessel name. (e.g., G. Gunter; Oregon II)

3. Cruise - SEAMAP cruise number. (4 digit number; YYNN)

4. Comments - Write in the **SEAMAP** (or other) station number (B numbers) and the initial preservative used (e.g., Form or Ethanol).

New labels at NOAA have separate boxes for B# and preservative, enter data where appropriate.

BACK:

5. Sample # - Leave blank. Reserved for **SEAMAP** sample number assignment.

6. Latitude - Record gear actual starting position (degrees and decimal minutes).

7. Longitude - Record gear actual starting position (degrees and decimal minutes).

8. Zone - Record time zone being used on the vessel collecting the samples (eg. NOAA vessels use zone 8 for GMT). *This is not necessarily the time zone in which the station is located and the sample is taken.*)

9. GMT date/time - Use time at preservation and at the request of the Polish Sorting Center, do **not use a numeric format for date**, e.g., 2/1/11, use **1 Feb11 instead**. New labels at NOAA have separate boxes for date and time, enter data where appropriate.

10. Haul - Fill only if a multiple net system is used at this station; e.g., Tucker trawl, MOCNESS.

11. MESH - Fill in with appropriate mesh size of net used to collect the sample.

12. GEAR - Write in gear type used and other pertinent information; e.g., left bongo, right bongo, net 1 tucker trawl, left neuston, right neuston or just neuston.

13. NUMBER OF JARS - **This information is critical to postcruise sample inventory**. Write in the jar number of the total number of jars used to contain the sample; e.g., 1 of 1 if only one jar was used, 1 of 2 and 2 of 2 if two jars were used etc. Always use the same size jars for multiple jar samples! For example, do not use a quart and a pint to contain a single multi-jar sample.

FLOWMETER PERFORMANCE TRACKING FORM

We have introduced the **Flowmeter Performance Tracking Form** (**FPT**, APPENDIX 13) because malfunctioning flowmeters and incorrect flowmeter readings are the single most serious error found in SEAMAP field data. Completion of this form is required of Watch Leaders. Field Party Chiefs are asked to make sure the form is filled out consistently throughout the cruise and is used by the Watch Leaders for early detection of failing flowmeters and erroneous flowmeter readings.

1. Record the **Pascagoula station number**, **flowmeter serial number** and the **position** of the flowmeter in the bongo frame (**L**eft or **R**ight).

2. Record **start** and **finish** flowmeter readings.

3. Calculate the **Total counts** column, which is the difference between the **finish** and **start flowmeter readings** for a given tow.

4. **Tow depth** is the maximum depth the gear was fished in meters, i.e, the maximum depth as noted on the Ichthyoplankton station sheet.

5. **Total tow time** is the elapsed time in **minutes** (include seconds as the fraction of a minute, eg. 1' 30" = 1.5') between the recorded values for **gear out** and **gear in.**

6. Number of counts per minute **(Counts/min)** is the **total counts** divided by the **total tow time.**

7. The Watch Leader and FPC should review the FPT form regularly, first to make sure it is being filled out in its entirety and secondly, to check if flowmeters are performing consistently. The counts/min values within a cruise should be relatively uniform among tows to similar maximum tow depths.

PLANKTON TRANSFER RECORD

Fill out the **Plankton Transfer Record** after each station (**PTR**, APPENDIX 14). This will provide the Field Party Chief and the Ichthyoplankton Team with information required to track and inventory plankton samples after the cruise.

PASCAGOULA STATION #

DATE / TIME Preserved

RIGHT BONGO*
F or E
Date due
Time due
Done
INI

LEFT BONGO*
F or E
Date due
Time due
Done
INI

NEUSTON*
F or E
Date due
Time due
Done
INI

The fields in **bold italics** with an **asterisk**, should be filled in with the **actual number of jars** used for **each gear type**. "F or E" refers to the initial preservative (F=Formalin; E=Ethanol). "Date due" is the date the sample is due to be transferred. "Time due" is the time the sample is due to be transferred. "Done" should be marked with the actual date and time the sample was preserved. "INI" should be those of the individual responsible for the transfer. If the number of jars changes during transfer, note this on this form. During transfer, samples may be found to have been initially placed in too few or too many jars. This situation can be rectified during the transfer process. **Place right bongo, left bongo and neuston samples into separate boxes and label. Do NOT split multiple jar samples between two boxes. It is better to have all the jars for a single sample in the same box even if samples are then out of order within the box. Never use different sized jars for the same sample. If more than 1 jar is needed for a sample, split it between the appropriate number of the same size jars.**

HANDLING AND STORAGE OF PLANKTON GEAR DURING CRUISES

a) Bongo Net 0.335[1] mm mesh 0.61 m MARMAP frame

The bongo nets are fragile and easily torn. They should be handled with care and not be stepped on. The bongo frame is a sturdy piece of equipment but care should be taken when putting it over the side of the ship and retrieving it. Try not to bang it against the side of the ship. Be sure the frame is not leaning on the net. When the nets are not in use (entering port) they should be cleaned, dried out and stored in the net box on board ship. Check the nets frequently for holes and tears. **Holes in the lower half of the net must be repaired immediately when found before another sample is collected. Use the tube of silicone sealant in the gear box to repair holes and small rips. Ask the FPC if uncertain about net repair. Replace entire nets when damage is extensive.** Make sure no person is smoking near nets. The hot ash from a cigarette will burn holes into the mesh upon contact!!

b) Neuston Net 0.950[1] mm mesh 1x2 m frames

These nets are just as fragile as the bongo net. While not in use, make sure that the net is not being chafed or abraded by the frame and deck or other ship's surface. If oil or tar should get caught up in the net, scrub as much as possible off the net using detergent then store and inform the person in charge of gear of the net condition.

c) 2030R General Oceanics Mechanical Flowmeter

The flowmeter should be **handled with care**. Take extreme care when reinserting the screw. Do not force as it will easily strip the screw. When in use, the flowmeter should be filled with silicone oil or plain tap water - not distilled water. When not in use (at the end of the survey), the flowmeter should be taken off the bongo frame, cleaned and stored according to the manufacture's guidelines. For silicone filled flowmeters, the silicone is drained and the screw replaced. For tap water filled flowmeters, they should be washed out with a 50% white vinegar and water solution in order to remove any salt and debris from the inside chamber. Flowmeters should be stored empty, but do not leave the screw out to let dry. Calibration is done by General Oceanics personnel after each NOAA vessel plankton cruise.

d) Cod Ends

Cod ends (collecting buckets) consist of two pieces of PVC pipe that can be easily damaged so please take care to prevent the cod ends from hitting the side of the ship when deploying/retrieving plankton gear. Rinse both sections of the cod ends thoroughly after each station. At the end of a survey, wash the bucket and spray WD-40 on hose clamps and quick-release mechanisms before storage.

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[1] The mesh sizes reported here do not constitute a change in previously reported mesh sizes (0.333 and 0.947 mm) but reflect only a change in the accuracy at which mesh aperture size can be measured by the manufacturer

DISPOSITION OF SAMPLES

After each survey give the samples, PTR sheets, FPT sheets and the Ichthyoplankton station sheets to a **Plankton Team Member**. When the samples are in the ichthyoplankton laboratory, count the boxes, inventory the samples, request and receive assigned SEAMAP sample numbers from NMFS Pascagoula and store in a cool place before transport. The **right bongo and neuston** samples should be boxed and sent to the **Pascagoula** Laboratory which has the responsibility for preparation of samples for shipment to the Polish Sorting and Identification Center. The current (Feb. 2012) contact is **Consuela Cowan**, **National Marine Fisheries Service**, **3209 Frederic St., Pascagoula, MS 39567; e-mail: Consuela.Cowan@noaa.gov.** Contact **Ms. Cowan (228-762-4591 ext. 1647)** to inform her of what you are sending and when they should arrive. At the same time you send the samples, please also send the original Ichthyoplankton sheets (keep copies) and copies of all other SEAMAP field data sheets (Type I or II and the environmental). Left bongo samples should be sent to **Sara LeCroy**, **USM/Gulf Coast Research Laboratory, P. O. Box 7000, 703 East Beach Drive, Ocean Springs, MS 39564**; **e-mail: sara.lecroy@usm.edu** (Current, July 2014). Contact **Ms. LeCroy (228-872-4238)** to inform her of what you are sending and when it should arrive.

APPENDICES

APPENDIX 1. **SEAMAP TRAWL STATION SHEET**

START

VESSEL NO. | PASCAGOULA STATION NO. | CRUISE NO. | TIME ZN HH MM | LATITUDE DD MM MM | LONGITUDE DD MM MM | DEPTH (M)

END

SEAMAP / OTHER STATION NO. | DATE MO DY YR | TIME HH MM | LATITUDE DD MM.MM | LONGITUDE DD MM.MM | DEPTH (M)

GEAR TYPES USED AT THIS STATION

TEMPERATURES (°C): SURFACE | BOTTOM | AIR

BAROMETRIC PRESSURE (MB) | WIND SPEED (KN) | WIND DIRECT. (DEGREES) | WAVE HEIGHT (M) | SEA CONDITION (BEAUFORT) | DATA SOURCE CODE | VESSEL SPEED (KN) | STATISTICAL ZONE | NET NO.

NMFS FAUNAL ZONE | GEAR SIZE | GEAR TYPE | MESH SIZE (IN) | OPERATION CODE | MINUTES FISHED | WATER COLOR | TOTAL LIVE CATCH (KG)

FILL IN ONLY IF CATCH WAS SAMPLED

SELECT | SAMPLE

CRUSTACEANS YOY

GENUS	SPECIES	X	NUMBER	SAMPLE WEIGHT (KG)	SELECT WEIGHT (KG)
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
TOTAL CRUSTACEAN WEIGHTS					

OTHER LIVE ANIMALS YOY

GENUS	SPECIES	X	NUMBER	SAMPLE WEIGHT (KG)	SELECT WEIGHT (KG)
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
				4	5
TOTAL OTHER LIVE ANIMAL WEIGHTS					

GEAR DATA:

COMMENTS:

RECORDER:

FINFISH YOY

GENUS	SPECIES	X	NUMBER	SAMPLE WEIGHT (KG)		SELECT WEIGHT (KG)	
					4		5
					4		5
					4		5
					4		5
					4		5
					4		5
					4		5
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					4		5
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					4		5
					4		5
					4		5
			TOTAL FINFISH WEIGHTS				

GENERAL LENGTH FREQUENCY FORM

VESSEL NO. | PASCAGOULA STATION NO. | CRUISE NO. | DATA SOURCE CODE | SEAMAP / OTHER STATION NO. | DATE MO DAY YR

GENUS / SPECIES / MEAS CODE

	LENGTH (MM)	WT (KG)	SEX	LENGTH (MM)	WT (KG)	SEX	LENGTH (MM)	WT (KG)	SEX	LENGTH (MM)	WT (KG)	SEX
1												
2												
3												
4												
5												
1												
2												
3												
4												
10												
1												
2												
3												
4												
15												
1												
2												
3												
4												
20												
1												
2												
3												
4												
25												
1												
2												
3												
4												
30												
1												
2												
3												
4												
35												
1												
2												
3												
4												
40												
1												
2												
3												
4												
45												
1												
2												
3												
4												
50												

MEASUREMENT CODES

51 FORK LENGTH
52 STANDARD LENGTH
53 TOTAL LENGTH
54 WIDTH
55 MANTLE LENGTH
56 RADIAL DIAMETER
57 OTHER
58 SNOUT-ANUS
59 CURVILINEAR LENGTH
60 CURVILINEAR WIDTH

SEX CODES

U UNDETERMINED
M MALE
F FEMALE

SHRIMP LENGTH FREQUENCY FORM

VESSEL | PASCAGOULA STATION NO. | CRUISE | DATA SOURCE CODE | GEAR TYPE | SEAMAP / OTHER STATION NO. | DATE MO DY YR

SPECIES
BROWN = B
PINK = P
WHITE = W

SPECIES

BROWN SHRIMP (KG) | PINK SHRIMP (KG) | WHITE SHRIMP (KG)

TOTAL NO. CAUGHT / SPECIES

FEMALE									MALE								
	TL (MM)	WT (KG)		TL (MM)	WT (KG)		TL (MM)	WT (KG)		TL (MM)	WT (KG)		TL (MM)	WT (KG)		TL (MM)	WT (KG)
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
55			105			155			55			105			155		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
60			110			160			60			110			160		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
65			115			165			65			115			165		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
70			120			170			70			120			170		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
75			125			175			75			125			175		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
80			130			180			80			130			180		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
85			135			185			85			135			185		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
90			140			190			90			140			190		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
95			145			195			95			145			195		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
100			150			200			100			150			200		

TOTAL WT OF MEASURED SHRIMP

TOTAL WT OF MEASURED SHRIMP

SEAMAP ENVIRONMENTAL DATA SHEET

Shift Leader Initials_____

VESSEL | CRUISE | SOURCE

PASCAGOULA # | SEAMAP STATION # | MON | DAY | YR

ZONES: STATISTICAL | FAUNAL | TIME

WAVE HT. (M) | WIND DEGREES | KNOTS | STAT. LOCATION | PRECIPITATION | AIR TEMP (°C) | BAROMETRIC PRESSURE (mbar)

SEA CONDITION (BEAUFORT SCALE) | DAYLIGHT ONLY: | WATER COLOR | % CLOUD COVER (0, 25, 50, 75, 100) | SECCHI DISC (M)

WATER DATA FROM CTD CAST

	DEPTH (M)	CONDUCTIVITY (RATIO)	SALINITY	TEMPERATURE (°c)	DISSOLVED OXYGEN
TOP					
MID					
BOT					

	TRANSMISSIVITY
TOP	
MID	
BOT	

CTD Coordinates: LATITUDE DEG MINUTES | LONGITUDE DEG MINUTES

CTD START HH MM | CTD END HH MM

FILE ID_____

	SURFACE	MIDWATER	BOTTOM
CHLOROPHYLL *FROM LAB (Mg/M^{3})			
CHLOROPHYLL *FROM CTD (Mg/M^{3})			

COMMENTS:

Type of CTD used:

SEAMAP PLANKTON STATION SHEET

Shift Leader Initials_____ VESSEL CRUISE SOURCE

PASCAGOULA # SEAMAP STATION # MON DAY YR

ZONES: STATISTICAL FAUNAL TIME

ON STATION TIME

START HH MM END HH MM

PLANKTON ACTUAL BEGINNING COORDINATES

LATITUDE DEG MINUTES LONGITUDE DEG MINUTES

ACTUAL WATER DEPTH (M)

PLANKTON ACTUAL ENDING COORDINATES

LATITUDE DEG MINUTES LONGITUDE DEG MINUTES

Sargassum in area? If so, circle one:
Current-driven Windrow, Wind-driven Windrow, Oceanic Frontal Zone (OFZ), Large Mats, Scattered Clumps, Scattered Mats/Clumps along OFZ

GEAR TYPES USED AT THIS STATION (CIRCLE GEAR TYPES USED OR ADD ADDITIONAL GEARS USED):

BG BC PN NN SE CA SX OX TC

SEAMAP PLANKTON TOW SHEET

Shift Leader Initials_____

VESSEL | CRUISE | SOURCE

PASCAGOULA # | SEAMAP STATION #

MON | DAY | YR

RECORDER (INITIALS)

BONGO

DEPTH CODE (C / O) | MESH | GEAR | NET #

MIN TOW DEPTH (M) | MAX TOW DEPTH (M)

AT MAX DEPTH

HH | MM | ANGLE | WIRE OUT

IN TIME OUT

HH MM SS | HH MM SS

BONGO ACTUAL BEGINNING COORDINATES

LATITUDE DEG MINUTES | LONGITUDE DEG MINUTES

BONGO ACTUAL ENDING COORDINATES

LATITUDE DEG MINUTES | LONGITUDE DEG MINUTES

FLOWMETER

LEFT METER ID # | RIGHT METER ID #

START | START

END | END

BONGO TOW SPEED (KT)

PRESERVATIVE USED: RIGHT BONGO

FORMALIN (INITIAL) / ETHANOL (FINAL)

PRESERVATIVE USED: LEFT BONGO

ETHANOL (INITIAL) / ETHANOL (FINAL)

NEUSTON

DEPTH CODE (C / O) | MESH | GEAR | NET #

MIN TOW DEPTH (M) | MAX TOW DEPTH (M)

IN TIME OUT

HH MM SS | HH MM SS

NEUSTON ACTUAL BEGINNING COORDINATES

LATITUDE DEG MINUTES | LONGITUDE DEG MINUTES

NEUSTON ACTUAL ENDING COORDINATES

LATITUDE DEG MINUTES | LONGITUDE DEG MINUTES

JELLYFISH PRESENT IN NET?

Y / N , IF YES, AMT (L):

SARGASSUM PRESENT IN NET?

Y / N , IF YES, AMT (L):

NEUSTON TOW SPEED (KT)

PRESERVATIVE USED: NEUSTON

ETHANOL (INITIAL) / ETHANOL (FINAL)

BONGO SEAMAP SAMPLE NUMBERS

LEFT | RIGHT

NEUSTON SEAMAP SAMPLE NUMBER

COMMENTS:

Wire Out: _____ m, _____ ft

Calculated Max Tow Depth = =cos( ) * ____

Jars: ___ L Bongo
___ R Bongo
___ Neuston

APPENDIX 2: VESSEL CODES

VESSEL CODES

01---OREGON
02---SILVER BAY
03---GEORGE M. BOWERS
04---OREGON II
05---COMBAT
06---PELICAN
07---FRIGATA
08---KINGFISHER
09---HERNAN CORTEZ
10---GERONIMO
11---UNDAUNTED
12---ANTILLAS
13---CALAMAR
14---ALCYON
15---GULF RANGER
16---WESTERN GULF
17---TOMMY MUNRO
18---TANYA & JOE
19---ONJUNKU
20---JEFF & TINA
21---DELAWARE II
22---OSV ANTELOPE
23---A.E. VERRILL
24---FLORENCE MAY
25---LOUISIANA INSHORE VESSELS
26---SUNCOASTER
27---MISSISSIPPI INSHORE VESSELS
28---CHAPMAN
29---NISSIHINO MARU #201
30---R/V BELLOWS
31---R.J. KEMP (ARANSAS BAY)
32---MATAGORDA BAY
33---LAGUNA MADRE
34---GALVESTON BAY
35---LUMCON PELICAN
36---HERNAN CORTEZ II (CORAL SEA)
37---OLD COLONY
38---SEAWOLF
39---ATLANTIC HARVESTER
40---SABINE
41---PERSISTANCE
42---CAPTAIN GRUMPY
43---GULF STREAM
44---KELCY ANN
45---MR. JUG
46---CALANUS
47---A. NEEDLER
48---B.I.P.
49---ALBATROSS IV
50---MOLLY M.
51---LADY LISA
52---MISS CARRIE
53---CSS HUDSON
54---CORAL SEA
55---CARETTA
56---R/V ABREU
57---R/V GUAY ANILLA
58---SEAHORSE
59---LINDSAY
60---TEDDY♠S SCOW
61---RELENTLESS
62---RAFFIELD VESSELS
63---GORDON GUNTER
64---FERREL
65---TRINITY BAY
66---ALABAMA 38 ft BERTRAM
67---NUECES BAY
68---MCARTHUR
69---SAN JACINTO
70---R/V SARINNA
71---HARVESTING SYSTEM TECH/HST
72---GANDY
73---E.O. WILSON
74---THE MCILWAIN
75---WEATHERBIRD II
76---PISCES
77---ALABAMA DISCOVERY
87---SAN ANTONIO BAY
88---BLAZING SEVEN
90---SABINE
92---COPANO BAY
93---ACADIANA
95---POINT SUR
99---OTHER VESSELS

APPENDIX 3: DATA SOURCE AND TIME ZONE CODES

DATA SOURCE CODES

FL - - Florida
AL - - Alabama
MS - - Mississippi
LA - - Louisiana
TX - - Texas

US - - National Marine Fisheries Service
99 - - Other

TIME ZONE CODES

1……Eastern Standard Time
2……Eastern Daylight Savings Time
3……Central Standard Time
4……Central Daylight Savings Time
8……Greenwich Mean Time
9……Other - Explain in Comments Section

APPENDIX 4: GEAR CODES

CODE	GEAR TYPE
*T	TRAWL, STAR
01	COMBINATION--SS+CC
02	COMBINATION--SS+PR
03	COMBINATION--CC+PR
04	COMBINATION--SS+CC+PR
05	COMBINATION--FM+SS
06	COMBINATION--FM+SS+PR
07	COMBINATION--FM+PR
A	ASSORTED
AC	BIOSONICS ACOUSTIC SYSTEM
BB	TRAWL, BIB
BC	BOTTLE CAST
BG	BATHYTHERMOGRAPH (CTD, STD)
BL	LONGLINE , BOTTOM
BS	SEINE, BEACH
BT	TRAWL, BEAM
CA	CHLOROPHYLL, EXTRACTION
CC	CAMERA, CLOSED CIRCUIT TELEVISION
CD	DREDGE, CLAM
CM	CURRENT DOPPLER
CR	CORAL REEF MODUAL
CS	CONTINUOUS FLOW SYSTEM
CT	TRAP, CRAB
DL	DEEP LINE
DN	PLANKTON, DOUBLE NEUSTON
OR	NEKTON
DR	SURFACE DRIFTER
DV	DIVING
EF	TRAWL, FISH, EXPERIMENTAL
ES	TRAWL, SHRIMP, EXPERIMENTAL
FD	TRAWL, FISH DEFLECTOR
FE	TRAWL, FISH EXCLUDER
FL	FLUORESCENCE, CONTINUOUS FLOW SYSTEM
FM	FATHOMETER
FP	FISH PUMP
FT	TRAWL, FISH
FX	FLUORESCENCE, IN SITU
GN	GILL NET
GR	BOTTOM GRAB OR CORE SAMPLER
HL	HANDLINE
HO	TRAWL, HIGH OPENING BOTTOM
IT	TRAP, ICHTHYOPLANKTON, ILLUMINATED
JP	JACKPOLE
KP	LONGLINE, KALI POLE
MO	PLANKTON, MOCNESS
MQ	MARQUESETTE
MS	TRANSMISSIVITY
MT	TRAWL, MIDWATER
NN	PLANKTON, SINGLE NEUSTON OR NEKTON
NS	NETSONDE
OB	LONGLINE, OFF-BOTTOM
OD	ODOMETER
OF	OVERFLIGHT
OH	OXYGEN, TITRATION, HACH KIT
OI	OXYGEN, SENSOR, IN SITU
OO	OXYGEN, SENSOR, ON DECK
OR	OYSTER RAKE
OW	OXYGEN, TITRATION, WINKLER
OX	OXYGEN, SENSOR, CTD
OY	OXYGEN, SENSOR, YSI
PN	PLANKTON, GENERAL (BONGO, ETC.)
PR	PROFILER, 3.5 KHZ SUB-BOTTOM
PS	SEINE, PURSE
PT	TRAWL, SCALLOP
QD	DREDGE, QUAHOG
RE	SALINITY, REFRACTOMETER
RF	RECORDING FATHOMETER
RG	PLANKTON, RING NET
RL	TAG RELEASE
RN	ROUND NET
RR	ROD AND REEL
RS	TRAWL, NON-STANDARD
RT	ROTENONE
RV	REMOTELY OPERATED VEHICLE (ROV)
S5	TRAWL, MONGOOSE
S6	TRAWL MONGOOSE
SA	SALINITY, AUTOSAL
SB	SALINITY, BECKMAN RS5
SC	CAMERA, STILL
SD	DREDGE, SCALLOP
SE	SECCHI DISC
SF	SALINITY, CONTINUOUS FLOW SYSTEM
SH	TRAWL, SHUMAN
SI	SALINITY, SENSOR, IN SITU
SL	SALINITY, BENCH TOP/LABORATORY
SJ	SQUID JIG
SM	TRAWL, STANDARD MONGOOSE
SN	TRAWL, SEPARATOR
SO	SONAR
SS	SONAR, SIDE SCAN
ST	TRAWL, SHRIMP

KT TRAWL, WING
LL LONGLINE, SURFACE
LN LIFT NET
LP SEINE, LAMPARA
LR TRAP, LOBSTER, REED
LT NIGHT LIGHT
LW TRAP, LOBSTER, WIRE
MC CAMERA, MOVIE
ML MISCELLANEOUS- DETAIL IN COMMENTS
MN MICRONEKTON
SX SALINITY, CTD
SY SALINITY,YSI
T3 TEMPERATURE SCS
TA TEMPERATURE, CONTINUOUS FLOW SYSTEM
TB TEMPERATURE, BECKMAN RS5
TC TEMPERATURE, CTD
TD DREDGE, TUMBLER
TE TRAWL, TURTLE EXCLUDER
TF TEMPERATURE, FLUKE
TG TROLLING GEAR
TH TEMPERATURE, THERMOMETER

TI TEMPERATURE, SENSOR, IN SITU
TM TEMPERATURE, BUCKET
TN TRAWL, TRY NET
TO TEMPERATURE, SENSOR, ON DECK
TR TRAP, FISH
TS SEINE, PURSE, TURTLE
TT TRAWL, TWIN
TU PLANKTON, TUCKER TRAWL
TV TRAP VIDEO
TY TEMPERATURE, YSI
UD DREDGE, UNSPECIFIED
VC CAMERA, VIDEO
VD VERTICAL DRIFTLINE
VJ VISUAL OBSERVATION
VL VERTICAL LINE
V2 VERTICAL LONGLINE WHERE EACH FISH IS IDENTIFIED TO HOOK
VP VERTICAL PROFILE
WI WEATHER INSTRUMENT
WT TRAP, LOBSTER, WOOD
XB EXPENDABLE BATHYTHERMOGRAPH (XBT)

Highlighted codes are the most common types of gear codes used during trawling operations.

SEAMAP Examples of Gear Code Use

For Chlorophyll - Sample obtained from bottle cast for extraction BC, CA

For Salinity - Reading obtained by CTD: BG, SX

Sample obtained from bottle cast for AUTOSAL analysis BC, SL

For - Oxygen reading obtained by CTD: BG, OX

Sample obtained from bottle cast for titration by the Winkler method BC, OW

For Temperature - Reading obtained by CTD: BG, TC

Scenario Example -

Procedures at a SEAMAP station included a CTD profile, a Secchi disc reading, a bottle cast for water samples, a sediment grab, and a trawl.

BG, BC, TC, SX, SE, OX, CA, GR, and ST

There are only seven spaces on the data sheet to enter the nine listed gear types used. Record in the Comment section the additional two gear types used.

GEAR CODES FOR PLANKTON

01……61 cm Bongo	09……..1m^2 MOCNESS
02……1 Meter Ring Net	10……..4m^2 MOCNESS
03……1x2 Meter Neuston	11……..60cm o/c Bongo
04……. Meter Ring Set	12……..20cm o/c Bongo
05……20 cm Bongo	13……..60cm BNF1
06……Open or Blank	14……..70cm Bongo
07……1m^2 Tucker Trawl	15……..Spanish Bongo
08……Double 1x4m Neuston	16……..2.32 x 2.24 m Methot

PLANKTON GEAR TYPE CODES

BC = BOTTLE CAST
BG = BATHYTHERMOGRAPH (CTD, STD)
CM = CURRENT DOPPLER
CS = CONTINUOUS FLOW SYSTEM
DN = DOUBLE NEUSTON
DR = SURFACE DRIFTER
LT = NIGHT LIGHT
MJ = METHOT JUVENILE TRAWL
MN = MICRO NEKTON
MO = PLANKTON, MOCNESS
NN = PLANKTON, NEUSTON OR NEKTON
OF = OVERFLIGHT
PN = PLANKTON, GENERAL (BONGO, ETC.)
RG = PLANKTON, RING NET
RV = REMOTELY OPERATED VEHICLE (ROV)
SO = SONAR
TU = TRAWL, TUCKER
XB = EXPENDABLE BATHYTHERMOGRAPH

MESH CODES

01 = 0.300/0.303
02 = 0.999
03 = 0.333/0.335
04 = 0.253
05 = 0.500/0.505
06 = Unknown
09 = 0.947/0.950
10 = 0.363
11 = 0.153
12 = 0.202
13 = 0.760
14 = 0.64
15 = 0.100
16 = 0.707
17 = 3 mm
18 = 0.022

APPENDIX 5: PRECIPITATION CODES, BEAUFORT SEA STATE, AND WATER COLOR

PRECIPITATION CODES

0 None
1 Light Rain
2 Moderate Rain
3 Heavy Rain
4 Snow
5 Sleet
6 Sleet/Rain
7 Hail
8 Fog

BEAUFORT SEA CONDITION TABLE

Sea Condition	Description
0	Wind speed under 1 knot, sea like a mirror.
1	Wind speed 1-3 knots; small ripples on surface with the appearance of scales.
2	Wind speed 4-6 knots; small wavelets with glassy appearance.
3	Wind speed 7-10 knots; large wavelets; crests begin to break; scattered whitecaps.
4	Wind speed 11-16 knots; small waves becoming longer; numerous whitecaps.
5	Wind speed 17-21 knots; moderate waves taking longer to form; many whitecaps; some spray.
6	Wind speed 22-27 knots; larger waves forming; whitecaps everywhere; more spray.
7	Wind speed 28-33 knots; sea heaps up; white foam from breaking waves begins to be blown in streaks.
8	Wind speed 34-40 knots; moderately high waves of greater length; edges of crests begin to break into spin-drift; foam is blown in well marked streaks.
9	Wind speed 41-47 knots; high waves; sea begins to roll; dense streaks of foam; spray may reduce visibility.

WATER COLOR CODES

Record as follows:

Blue or clear = B
Green = G
Blue green = T
Yellow = Y
Muddy or brown = M

APPENDIX 6. OPERATION CODES

A = Net not spread
B = Gear bogged
C = Bag choked
D = Gear not digging
E = Twisted warp or line
F = Gear fouled
G = Bag untied
H = Hooks or traps lost
I = Fish not attracted
K = Bad weather stopped operation
L = Lost whole rig
M = Miscellaneous (detail in comments)
N = Shark damage
O = Gear off bottom
P = Vessel off position
T = Torn webbing
U = Unknown
W = Water haul
X = Lost fish
Z = Hangup

APPENDIX 7. ALPHABETIC LIST OF SPECIES LENGTH FREQUENCY MEASUREMENT CODES

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
ABLENNEHIANS	51	368	147010101	ANTENNASTRIAT	53	236	195020103
ABRALIAREDFIE	55		348030203	ANTHENOPEIRCE	56		691060501
ABRALIAVERANY	55		348030204	ANTIGONCAPROS	51		162030101
ABUDEFDSAXATI	51		170270101	ANTIGONCOMBAT	51		162030102
ACANTHEARMATA	53		228290102	APHRODIOBTECT	53		649030101
ACANTHOALEXAN	54		229260301	APLATOPCHAULI	53	365	143150601
ACETES AMERIC	53		228020105	APLYSIAWILLCO	53		316020104
ACHIRUSLINEAT	53	196	183040105	APOGON AFFINI	51		170060204
AEQUIPEGLYPTU	53	352	330231101	APOGON AUROLI	51	268	170060201
AEQUIPEMUSCOS	53		330231106	APOGON MACULA	51		170060203
AETOBATNARINA	54		110070101	APOGON PSEUDO	51	248	170060207
AGRIOPOTEXASI	53		335641601	ARBACIAPUNCTU	54		693050101
ALBUNEAPARETI	53		229310102	ARCHITENOBILI	54	343	307310102
ALECTISCILIAR	51	214	170110101	ARCHOSAPROBAT	51		170213601
ALLOTHYMEXICA	53		694040301	ARCINELCORNUT	53		334020402
ALOSA ALABAM	51		121050101	ARENAEUCRIBRA	54	140	229110101
ALOSA CHRYSO	51		121050106	ARGENTISTRIAT	51		121110101
ALOSA SAPIDI	51		121050105	ARGONAUARGO	54		350110101
ALPHEUSFORMOS	53		228150102	ARGOPECGIBBUS	53	199	330231201
ALUTERUHEUDEL	53	290	189040401	ARIOMMABONDI	51	221	170530101
ALUTERUMONOCE	53	230	189040402	ARIOMMAMELANU	51	420	170530102
ALUTERUSCHOEP	53	150	189040403	ARIOMMAREGULU	51	406	170530104
ALUTERUSCRIPT	53	250	189040404	ARIUS FELIS	51	40	141020101
AMUSIUMDALLI	53		330234401	ASTARTEGLOBUL	53		335260104
AMUSIUMPAPYRA	53	49	330234402	ASTEROPANNULA	54	329	692050202
ANACANTLONGIR	54	377	110100202	ASTRAEAPHOEBI	54		306110104
ANADARABAUGHM	53	175	328043602	ASTRAPOALUTUS	51		170060101
ANADARABRASIL	53	336	328043601	ASTROCYCAECIL	54		692050501
ANADARALIENOS	53		328043604	ASTROGOCACAOT	54		692050401
ANADARAOVALIS	53	338	328043607	ASTROPEALLIGA	56		691010109
ANADARATRANSV	53		328043608	ASTROPEAMERIC	56	179	691010101
ANASIMULATUS	53	103	229210601	ASTROPEANTILL	56		691010108
ANCHOA CUBANA	51	253	121060104	ASTROPEARTICU	56		691010102
ANCHOA HEPSET	51	32	121060101	ASTROPECINGUL	56	422	691010106
ANCHOA LAMPRO	51	317	121060102	ASTROPEDUPLIC	56	148	691010105
ANCHOA LYOLEP	51	136	121060105	ASTROPHMURICA	54		692050301
ANCHOA MITCHI	51	76	121060103	ASTROSCY-GRAE	53	210	170340102
ANCHOA NASUTA	51	244	121060106	ATRINA SEMINU	53	339	329020103
ANCHOVIPERFAS	51	152	121060302	ATRINA SERRAT	53		329020102
ANCYLOPDILECT	53	80	183012102	AULOSTOMACULA	52		151010101
ANCYLOPQUADRO	53	85	183012105	AURELIAAURITA	54		616010201
ANOMIA SIMPLE	53		330390102	AXIANASARENAR	53		229180101
ANTENNAOCELLA	53		195020101	BAGRE MARINU	51	120	141020401
ANTENNARADIOS	53	115	195020102	BAIRDIECHRYSO	53	186	170200502

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
BALANUSTRIGON	57		213010101	CANTHARCANCEL	53		308040502
BALISTECAPRIS	51	44	189030502	CANTHERMACROC	53		189040101
BARBATICANCEL	53	337	328040702	CANTHIDSUFFLA	51	380	189030402
BARBATICANDID	53		328040701	CANTHIGROSTRA	51		189080101
BARNEA TRUNCA	53		337010102	CARANX BARTHO	51		170110801
BATHYANMEXICA	51	151	170023102	CARANX CRYSOS	51	62	170110803
BELLATOBRACHY	53		168020801	CARANX HIPPOS	51	184	170110804
BELLATOEGRETT	53		168020802	CARANX LATUS	51		170110805
BELLATOMILITA	53	94	168020803	CARANX RUBER	51		170110807
BEMBROPANATIR	53		170320201	CARCHARACRONO	53	192	108020201
BEMBROPGOBIOI	53	241	170320202	CARCHARBREVIP	53	305	108020207
BENTHODTENUIS	51		170460503	CARCHARFALCIF	53	301	108020202
BOLLMANCOMMUN	53	90	170554301	CARCHARISODON	53		108020215
BOTHUS LUNATU	53		183012202	CARCHARLEUCAS	53		108020204
BOTHUS OCELLA	53	381	183012203	CARCHARLIMBAT	53	234	108020205
BOTHUS ROBINS	53	291	183012204	CARCHAROBSCUR	53		108020209
BRACHIDEXUSTU	53		329011202	CARCHARPLUMBE	53		108020208
BREGMACATLANT	53	122	148030101	CARCHARPOROSU	53		108020210
BREVOORGUNTER	51	310	121050301	CARDITAFLORID	53	349	335200202
BREVOORPATRON	51	64	121050302	CARETTACARETT	53	325	531070201
BREVOORSMITHI	51		121050303	CAULOLACYANOP	53		170070101
BRISSOPATLANT	54		693110102	CAULOLAINTERM	53	89	170070102
BROSMICIMBERB	53		148020301	CAULOLAMICROP	53	269	170070103
BROTULABARBAT	53	70	170390301	CENTROPOCYURA	52	111	170024804
BUSYCONCANDEL	53		308070109	CENTROPPHILAD	52	6	170024805
BUSYCONCOARCT	53		308070104	CENTROSLONGIS	54		693010201
BUSYCONCONTRA	53	283	308070103	CHAETODAYA	52	298	170260301
BUSYCONPERVER	53		308070105	CHAETODCAPIST	52		170260302
BUSYCONPULLEY	53		308070113	CHAETODFABER	52	50	170250101
BUSYCONSPIRAT	53	335	308070107	CHAETODOCELLA	52	419	170260307
CAELORICARIBB	53		148061201	CHAETODSEDENT	52		170260309
CALAMUSARCTIF	51	411	170210601	CHAMA CONGRE	53		334020201
CALAMUSBAJONA	51		170210602	CHASCANLUGUBR	53	331	183010201
CALAMUSCALAMU	51	256	170210603	CHICOREFLORIF	53		308012701
CALAMUSLEUCOS	51	201	170210604	CHILOMYATINGA	53	319	189090202
CALAMUSNODOSU	51	246	170210608	CHILOMYSCHOEP	53	153	189090203
CALAMUSPENNA	51	260	170210610	CHIONE CLENCH	53	300	335643609
CALAPPAFLAMME	54	191	229260102	CHIONE LATILI	53		335643605
CALAPPASULCAT	54	52	229260105	CHIROPSQUADRU	54		618050101
CALLIACTRICOL	54		619380301	CHLAMYSBENEDI	53		330231601
CALLIANLATISP	53		229040101	CHLOEIAVIRIDI	53	347	649110101
CALLINEMARGIN	54		229110205	CHLOROSCHRYSU	51	14	170110902
CALLINESAPIDU	54	57	229110203	CHROMISENCHRY	51	286	170270302
CALLINESIMILI	54	4	229110206	CHROMISSCOTTI	51		170270303
CALLIONHIMANT	52		170420101	CHRYSAOQUINQU	54		616010101
CALOCARHIRSUT	53		229170101	CIRCOMPSTRIGI	53		335640201
CANCELLRETICU	53		308150101	CIRRHIPLEUTKE	54		619420101

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
CITHARIARCTIF	53		183010301	DIAPHUSSPLEND	53		131010219
CITHARIARENAC	53		183010308	DIBRANCATLANT	53		195050301
CITHARICORNUT	53	247	183010303	DICROLEINTRON	53		170390701
CITHARIMACROP	53	129	183010304	DINOCARROBUST	53	350	335291001
CITHARISPILOP	53	61	183010305	DIODON HYSTRI	53	384	189090302
CLYPEASPROSTR	54	424	693100103	DIOPATRCUPREA	53		649090101
CLYPEASRAVENE	54	373	693100104	DIPLECTBIVITT	52	15	170020905
COELOCESPINOS	53	394	229211301	DIPLECTFORMOS	52	96	170020903
COLLODELEPTOC	53		229210801	DIPLOGRPAUCIR	53	404	170420401
COLLODEROBUST	53		229210803	DISTAPLBERMUD			596050201
COMACTIMERIDI	57		690020101	DISTORSCLATHR	53	334	307780401
CONGER OCEANI	53	281	143130501	DOROSOMPETENE	51	372	121051202
CONGER TRIPOR	53		143130502	DROMIDIANTILL	54		229250301
CONODONNOBILI	51	416	170190601	DRYMONEDALMAT	54		618020201
CONUS AUSTIN	53	274	308190101	DYSOMMAAPHODO	53		143170101
CONUS CLARKI	53		308190110	DYSPANOTEXANA	54		229030102
CONUS STIMPS	53		308190135	ECHENEINAUCRA	53	145	170090101
COOKEOLBOOPS	51		170050301	ECHENEINEUCRA	53		170090102
CORNIGESPINOS	51		161110701	ECHINASSERPEN	56		691030104
CORYPHAHIPPUR	51		170130202	ECHIOPHINTERT	53	263	143150302
CRASSOSVIRGIN	53		330410101	ECHIOPHMORDAX	53	366	143150301
CREPIDUCONVEX	53		307640302	ECHIOPHPUNCTI	53		143150303
CRUCIBUAURICU	53		307640201	ELOPS SAURUS	51	378	124010101
CYCLOPSCHITTE	53	45	183010401	ENCOPE ABERRA	54		693030303
CYCLOPSFIMBRI	53	226	183010403	ENCOPE MICHEL	54		693030302
CYMATIUPARTHE	53		307780119	ENGRAULEURYST	51	131	121060201
CYMATIUPILEAR	53		307780109	ENGYOPHSENTA	53	97	183011401
CYNOSCIARENAR	53	8	170200901	EPIGONUPANDIO	53		170760101
CYNOSCINEBULO	53		170200903	EPINEPHADSCEN	51		170021203
CYNOSCINOTHUS	53	25	170200904	EPINEPHFLAVOL	51	181	170021206
CYPSELUCYANOP	51		147040703	EPINEPHGUTTAT	51	356	170021208
CYPSELUEXSILI	51	370	147040704	EPINEPHMORIO	51		170021211
CYPSELUFURCAT	51		147040705	EPINEPHNIGRIT	51	359	170021202
CYPSELUHETERU	51		147040706	EPINEPHNIVEAT	51		170021201
DACTYLOQUINQU	54		618030101	EPINNULMAGIST	51		170450102
DACTYLOVOLITA	53		179010301	EPINNULORIENT	51	405	170450103
DANIELUIXBAUC	54		229102601	EQUETUSACUMIN	53	142	170201103
DARDANUFUCOSU	53		229450102	EQUETUSIWAMOT	53	183	170201108
DARDANUINSIGN	53	425	229450101	EQUETUSLANCEO	53	417	170201104
DASYATIAMERIC	54	190	110050201	EQUETUSPULCHE	53		170201101
DASYATICENTRO	54		110050202	EQUETUSPUNCTA	53		170201107
DASYATISABINA	54	235	110050204	EQUETUSUMBROS	53	107	170201105
DASYATISAY	54	273	110050205	EROTELISMARAG	51		170541201
DECAPTEMACARE	51	415	170111201	ETELIS OCULAT	51		170150501
DECAPTEPUNCTA	51	104	170111202	ETHUSA MICROP	53	340	229370301
DECAPTETABL	51		170111203	ETROPUSCROSSO	53	38	183010602
DECODONPUELLA	52	144	170283001	ETROPUSCYCLOS	53	137	183010607

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
ETROPUSINTERM	53	259	183010603	GYMNOTHSAXICO	53	146	143060205
ETROPUSMICROS	53	188	183010605	GYMNOTHVICINU	53		143060206
ETROPUSRIMOSU	53	164	183010606	GYMNURAALTAVE	54		110050401
ETRUMEUTERES	51	77	121051602	GYMNURAMICRUR	54		110050402
EUCIDARTRIBUL	54		693060201	HAEMULOAUROLI	51	102	170191003
EUCINOSARGENT	51	282	170180301	HAEMULOCARBON	51		170191018
EUCINOSGULA	51	41	170180303	HAEMULOCHRYSA	51		170191015
EUCRASSSPECIO	53		335270501	HAEMULOPARRAI	51		170191014
EULEPTOVELOX	51		147040401	HAEMULOPLUMIE	51		170191008
EUPHROSCLAUSA	54		229381201	HAEMULOSTRIAT	51		170191013
EURYPANDEPRES	54		229030301	HALICHOBATHYP	52	409	170281201
EUTHYNNALLETT	51	314	170440201	HALICHOBIVITT	52		170281202
EXHIPPOOPLOPH	53		228170201	HALICHOGARNOT	52		170281205
EXOCOETOBTUSI	51		147040301	HALICHOPICTUS	52		170281206
FASCIOLHUNTER	53		308100101	HALIEUTACULEA	53	36	195050401
FASCIOLLILIUM	53		308100107	HARENGUJAGUAN	51	26	121052004
FASCIOLTULIPA	53		308100103	HEILPRITIMESS	53		308100701
FICUS COMMUN	53		307810104	HEMANTHAUREOR	51	280	170025003
FISTULAPETIMB	52	361	151020101	HEMANTHLEPTUS	51	285	170025002
FISTULATABACA	52	328	151020102	HEMANTHVIVANU	51	303	170025001
FOETOREAGASSI	52		170420501	HEMICARAMBLYR	51	162	170111501
FUSINUSCOUEI	53		308100301	HEMIPTEMARTIN	52		170282902
GALATHEROSTRA	53		229190201	HEMIPTENOVACU	52	239	170282903
GALEOCECUVIER	53		108022201	HEMIRAMBRASIL	51	369	147040502
GASTROPFRONTA	53		183011501	HEPATUSEPHELI	54	117	229260201
GERRES CINERE	51		170180601	HEPATUSPUDIBU	54		229260203
GINGLYMCIRRAT	53	320	113010101	HEPTRANPERLO	53		105020101
GLYCERAABRANC	53		649050101	HERMODICARUNC	53	324	649110201
GNATHAGEGREGI	53		170340901	HEXAPANANGUST	54		229030501
GOBIOIDBROUSS	53	407	170550301	HEXAPANPAULEN	54		229030503
GOBIONEBOLEOS	53		170552304	HILDEBRFLAVA	53	81	143132401
GOBIONEHASTAT	53	267	170552303	HILDEBRGRACIL	53	313	143132402
GOBIONEOCEANI	53		170552301	HIPPOCAERECTU	53	304	151060601
GOBIONESMARAG	53		170552309	HIPPOCAREIDI	53		151060604
GOBIONESTIGMA	53		170552302	HIPPOCAZOSTER	53		151060606
GOBIOSOOCEANO	53		170550208	HIRUNDIAFFINI	51		147040901
GONEPLAHIRSUT	54		229380302	HIRUNDIRONDEL	51	321	147040903
GONIASTTESSEL	56		691060103	HISTRIOHISTRI	53		195020301
GUNTERILONGIP	53		171010601	HOLACANBERMUD	51		170290102
GYMNACHMELAS	53	198	183040802	HOLACANCILIAR	51		170290103
GYMNACHNUDUS	53		183040803	HOLANTHMARTIN	51		170025101
GYMNACHTEXAE	53	95	183040804	HOLOCENADSCEN	51	363	161110201
GYMNOTHFUNEBR	53		143060201	HOLOCENRUFUS	51		161110202
GYMNOTHKOLPOS	53	233	143060209	HOMOLA BARBAT	54		229430101
GYMNOTHMORING	53		143060202	HOPLOSTOCCIDE	51		161050103
GYMNOTHNIGROM	53	127	143060203	HOPLUNNDIOMED	53	207	143090301
GYMNOTHOCELLA	53	258	143060204	HOPLUNNMACRUR	53	84	143090302

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
HOPLUNNTENUIS	53		143090303	LYSMATAWURDEM	53		228170101
HYPOCONARCUAT	54		229250101	MACOMA BREVIF	53	327	335441008
HYPOCONSPINOS	54		229250103	MACOMA CONSTR	53	277	335441001
HYPORHAUNIFAS	51		147041201	MACOMA PULLEY	53		335441007
ILIACANLIODAC	53	389	229070202	MACROCAMACULA	53		335644702
ILLEX COINDE	55		348100102	MACROCOCAMPTO	53	397	229211601
ILLEX ILLECE	55		348100101	MACRORHSCOLOP	53		151030201
KATHETOALBIGU	53	93	170340501	MANTA BIROST	54		110080201
LACTOPHBICAUD	53		189070201	MANUCOMUNGULA	53		229052702
LACTOPHPOLYGO	53	382	189070202	MAUROLIMUELLE	51		121140801
LACTOPHQUADRI	53	158	189070203	MELLITAQUINQU	54		693030203
LACTOPHTRIQUE	53	330	189070206	MENIDIABERYLL	51		165022202
LAEVICALAEVIG	53		335291201	MENIPPEADINA	54	294	229100303
LAEVICAPICTUM	53	351	335291203	MENIPPEMERCEN	54	265	229100302
LAEVICASYBARI	53	353	335291204	MENTICIAMERIC	53	60	170201801
LAGOCEPLAEVIG	53	31	189080501	MENTICILITTOR	53	177	170201803
LAGODONRHOMBO	51	12	170211601	MENTICISAXATI	53	261	170201806
LARIMUSFASCIA	53	92	170201604	MERCENACAMPEC	53		335644101
LEANDERTENUIC	53		228121101	MERCENAMERCEN	53	323	335644102
LEIOLAMNITIDU	54	215	229400101	MERLUCCALBIDU	53		148041401
LEIOSTOXANTHU	53	13	170201701	METAPENGOODEI	53		228011701
LEPIDOCKEMPI	53		531070301	METOPORCALCAR	53	302	229212801
LEPOPHIBREVIB	53	37	171010202	MICROGOGULOSU	53		170553001
LEPOPHIJEANNA	53	123	171010205	MICROPASCULPT	54		229030602
LEPTOGOVIRGUL	57		619170301	MICROPOUNDULA	53	3	170201902
LIBINIADUBIA	53	197	229080102	MICROSPCHRYSU	51		170270201
LIBINIAEMARGI	53	139	229080101	MITHRAXACUTIC	53		229211706
LIMULUSPOLYPH	57		655010101	MITSUKUOWSTON	53		107010101
LOBOPILAGASSI	54		229100801	MOBULA HYPOST	54		110080301
LOLIGO PEALEI	55	17	347020201	MODIOLUAMERIC	53		329014301
LOLIGO PLEII	55	88	347020202	MOIRA ATROPU	54		693080301
LOLLIGUBREVIS	55	27	347020101	MOLGULAMANHAT	53		596100102
LONCHOPMICROG	53	222	170310103	MOLPADIBARBOU	53		694050102
LOPHIODBEROE	53	386	195010303	MOLPADICUBANA	57	423	694050101
LOPHIODMONODI	53		195010301	MONACANCILIAT	53	289	189040201
LOPHIODRETICU	53		195010302	MONACANHISPID	53	68	189040204
LOPHIUSAMERIC	53		195010202	MONACANSETIFE	53	194	189040205
LOPHIUSGASTRO	53		195010201	MONOLENATRIMA	53		183011602
LOPHOLACHAMAE	53		170070201	MONOLENMEGALE	53		183011603
LUIDIA ALTERN	54	309	691010201	MONOLENSESSIL	53	296	183011604
LUIDIA CLATHR	54	176	691010203	MUGIL CEPHAL	51	228	165010801
LUTJANUCAMPEC	51	10	170151107	MUGIL CUREMA	51	364	165010802
LUTJANUGRISEU	51	299	170151109	MULLOIDMARTIN	51	418	170220101
LUTJANUSYNAGR	51	46	170151113	MULLUS AURATU	51	66	170220203
LUTJANUVIVANU	51		170151114	MUNIDA FORCEP	53	392	229190303
LYROPECNODOSU	53		330233102	MUNIDA IRIS	53		229190304
LYSIOSQSCABRI	53	242	225030101	MUREX CABRIT	53		308010513

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
MUREX DONMOO	53		308010523	OLIGOPLSAURUS	51	187	170112201
MUREX FLORIF	53		308010502	OLIVA SAYANA	53		308110205
MURICANFULVES	53	254	308011501	OPHICHTGOMESI	53	155	143150401
MUSTELUCANIS	53	125	108031101	OPHICHTOPHIS	53		143150405
MUSTELUNORRIS	53	157	108031103	OPHICHTPUNCTI	53	262	143150402
MYCTEROBONACI	53		170022101	OPHICHTREX	53		143150407
MYCTEROMICROL	51	357	170022104	OPHICHTSPINIC	53		143150406
MYCTEROPHENAX	51	358	170022105	OPHIDIOGRAYI	53	166	171010302
MYLIOBAFREMIN	54	249	110070301	OPHIDIOHOLBRO	53	138	171010303
MYLIOBAGOODEI	54	376	110070302	OPHIDIOMARGIN	53	403	171010306
MYROPHIPUNCTA	53	367	143151902	OPHIDIOSELENO	53		171010304
MYROPSIQUINQU	53	220	229070301	OPHIDIOWELSHI	53	91	171010305
NARCINEBRASIL	54	252	111010201	OPHIODEBREVIS	54	312	692040101
NARCISSTRIGON	56		307080201	OPHIODEDEVANE	54		692040102
NATICA MAROCH	53		307760408	OPHIOLEELEGAN	54	426	692030101
NEALOTUTRIPES	51		170450401	OPHIONERETICU	54		692100101
NEMOCARTRANSV	53		335291503	OPHIOTHANGULA	54		692110101
NEOBYTHGILLII	53	163	170391001	OPISTHOOGLINU	51	48	121053002
NEOBYTHMARGIN	53		170391002	OPSANUSBETA	53	270	193010601
NEOCONGMUCRON	53		143081601	OPSANUSPARDUS	53	288	193010602
NEOEPINAMERIC	51		170450201	OPSANUSTAU	53	385	193010603
NEOMERIHEMING	53	126	168011403	ORNITHOANTILL	55		348100301
NEPHROPACULEA	53		229020201	ORTHOPRCHRYSO	51	59	170191702
NEROCILACUMIN	53		223040101	OSTREA EQUEST	53	348	330410302
NES LONGUS	53		170551401	OTOPHIDDORMIT	53		171010403
NEVERITDUPLIC	53	264	307761101	OTOPHIDOMOSTI	53		171010402
NEZUMIABAIRDI	53		148061501	OVALIPEFLORID	54	204	229110603
NIBILIAANTILO	53	395	229211401	OVALIPEOCELLA	54	232	229110602
NOMEUS GRONOV	51		170510301	PAGRUS PAGRUS	51	156	170212302
NOTOMASLOBATU	53		650120101	PAGURISHUMMI	53		229450202
OCTOPUSBRIARE	55		350020101	PAGURISLYMANI	53		229450209
OCTOPUSBURRYI	55		350020102	PAGURISSERICE	53		229450205
OCTOPUSMACROP	55		350020105	PAGURISTRIANG	53		229450208
OCTOPUSVULGAR	55	308	350020106	PAGURUSBULLIS	53		229050601
OCYPODEQUADRA	54	393	229140101	PAGURUSIMPRES	53		229050606
OCYURUSCHRYSU	51		170151501	PAGURUSPOLLIC	53		229050611
ODONTASTAURUS	53		107080101	PALICUSALTERN	54		229390102
ODONTOSDENTEX	53	297	170202201	PALICUSOBESA	54		229390104
OGCOCEPCORNIG	53	225	195050209	PANOPEUBERMUD	54	388	229030402
OGCOCEPDECLIV	53	110	195050204	PANOPEUHERBST	54		229030403
OGCOCEPNASUTU	53	387	195050203	PANULIRARGUS	53		229010301
OGCOCEPPANTOS	53	169	195050205	PARACAUCHILEN	53		694050201
OGCOCEPPARVUS	53	287	195050206	PARACONCAUDIL	53	224	143131502
OGCOCEPPUMILU	53	257	195050201	PARAHOLLINEAT	53		189020301
OGCOCEPRADIAT	53	237	195050207	PARALICALBIGU	53	159	183012401
OGCOCEPVESPER	53		195050208	PARALICDENTAT	53		183012403
OLENCIRPRAEGU	53		223040301	PARALICLETHOS	53	58	183012404

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
PARALICSQUAMI	53	180	183012407	PLEUROPGIGANT	53		308100201
PARANTHFURCIF	54		170022701	PODOCHERIISEI	53		229210904
PARANTHRAPIFO	54		619090101	PODOCHESIDNEY	53	206	229210905
PARAPENPOLITU	53	178	228010503	POGONIACROMIS	53	185	170203101
PARASQUCOCCIN	53	391	225020401	POLYDACOCTONE	51	55	166010401
PAREXOCBRACHY	51		147040601	POLYMIXLOWEI	51		161010101
PARTHENAGONUS	54		229400201	POLYSTIALBIDA	53	213	308181701
PARTHENGRANUL	54	342	229400206	POLYSTITELLEA	53	307	308181702
PARTHENPOURTA	54		229400203	POMACENPICTUS	51		170270503
PARTHENSERRAT	54	227	229400205	POMACENPLANIF	51		170270506
PECTEN RAVENE	53		330230703	POMACENVARIAB	51		170270504
PECTEN ZICZAC	53		330230705	POMATOMSALTAT	51	121	170080101
PENAEOPSERRAT	53		228011602	PONTINULONGIS	53	124	168010502
PENAEUAZTECUS			228010701	PONTINURATHBU	53	332	168010504
PENAEUDUORAR	53	78	228010703	PORCELLSAYANA	53	231	229240602
PENAEUSETIFER	53	28	228010705	PORCELLSIGSBE	53		229240601
PENOPUSMICROP	53		170391201	PORICHTPLECTR	53	29	193010806
PENTAMEPULCHE	53		694040201	PORTUNUGIBBES	54	20	229110803
PEPRILUALEPID	51	42	170511101	PORTUNUORDWAY	54		229110806
PEPRILUBURTI	51	5	170511103	PORTUNUSAYI	54		229110811
PERIPLOFRAGIL	53		338110406	PORTUNUSPINIC	54	34	229110808
PERISTEGRACIL	53	170	168020402	PORTUNUSPINIM	54	65	229110809
PERISTEMINIAT	53		168020405	PRIACANARENAT	51	83	170050101
PERISTETRUNCA	53		168020410	PRIACANCRUENT	51	200	170050102
PERSEPHCRINIT	53	295	229070405	PRIONOTALATUS	53	275	168020501
PERSEPHMEDITE	53	251	229070406	PRIONOTCAROLI	53	333	168020503
PETROCHDIOGEN	53	271	229051403	PRIONOTLONGIS	53	9	168020519
PHAEOPTCONKLI	53		170060801	PRIONOTMARTIS	53	195	168020509
PHAEOPTXENUS	53		170060802	PRIONOTOPHRYA	53	99	168020512
PHALIUMGRANUL	53		307770702	PRIONOTPARALA	53	30	168020513
PHIMOCHHOLTHU	53		229052801	PRIONOTPUNCTA	53		168020517
PHYLLONPOMUM	53		308012901	PRIONOTROSEUS	53	98	168020518
PHYLLORPUNCTA	54		618040301	PRIONOTRUBIO	53	63	168020528
PHYSALIPHYSAL	54		616030101	PRIONOTSCITUL	53	108	168020521
PHYSICUFULVUS	53	216	148020201	PRIONOTSTEARN	53	35	168020523
PILUMNUDASYPO	54		229100901	PRIONOTTRIBUL	53	51	168020525
PILUMNUSAYI	54		229100905	PRISTIGALTA	51	173	170050401
PINNA CARNEA	53		329020601	PRISTIPAQUILO	51	24	170151802
PITAR CORDAT	53	171	335644904	PRISTIPMACROP	51		170151801
PLAGUSIDEPRES	54		229131401	PROGNICGIBBIF	51	371	147041001
PLANES MINUTU	54		229130801	PROMETHPROMET	51		170450901
PLATYBEARGALU	51		147010201	PROTANKGRAYI	53	427	694060101
PLESIONEDWARD	53		228190502	PSENES MACULA	51		170510203
PLESIONENSIS	53		228190503	PSEUDOCRADIAN	53		334020301
PLESIONLONGIC	53	219	228190509	PSEUDOMAGASSI	54		229100701
PLESIONLONGIP	53	390	228190504	PSEUDORQUADRI	54		229380901
PLESIONTENUIP	53		228190507	PSEUDUPMACULA	51	408	170220701

GENUS/SPECIES	MC	FMB	BIOCODE	GENUS/SPECIES	MC	FMB	BIOCODE
PTERIA COLYMB	53	306	330070601	SCYLLARCHACEI	53	211	229150204
PYROMAICUSPID	53		229211002	SCYLLARDEPRES	53	255	229150206
RACHYCECANADU	51	147	170100101	SCYLLARNODIFE	53	229	229150102
RAJA EGLANT	54	149	110040205	SELAR CRUMEN	51	82	170112801
RAJA LAEVIS	54		110040211	SELENE SETAPI	51	47	170113004
RAJA LENTIG	54		110040212	SELENE VOMER	51	109	170113003
RAJA OLSENI	54	238	110040213	SEMIROSEQUALI	55		345040901
RAJA OREGON	54		110040214	SEMIROSTENERA	55		345040902
RAJA TEEVAN	54	374	110040217	SERIOLADUMERI	51	130	170113101
RAJA TEXANA	54	87	110040218	SERIOLAFASCIA	51	240	170113103
RANGIA CUNEAT	53		335331101	SERIOLARIVOLI	51	414	170113105
RANINOILOEVIS	53	346	229350202	SERIOLAZONATA	51	413	170113106
RANINOILOUISI	53	118	229350203	SERRANIPUMILI	51	154	170025401
REMORA AUSTRA	51		170090302	SERRANUATROBR	51	19	170024202
REMORA REMORA	51	189	170090301	SERRANUNOTOSP	51		170024207
RENILLAMULLER	54	113	619310101	SERRANUPHOEBE	51	218	170024208
RENILLARENIFO	54	326	619310102	SERRANUSUBLIG	51		170024209
RHECHIAVICINA	57		143130701	SETARCHGUENTH	53		168011601
RHINOBALENTIG	53	375	110010201	SICYONIBREVIR	53	23	228320101
RHINOPTBONASU	54	223	110120101	SICYONIBURKEN	53	160	228320106
RHIZOPRTERRAE	53	79	108021802	SICYONIDORSAL	53	43	228320102
RHOMBOPAURORU	51	106	170152001	SICYONILAEVIG	53		228320107
ROCHINICRASSA	53	396	229211501	SICYONIPARRI	53		228320108
ROCHINITANNER	53		229211505	SICYONISTIMPS	53	182	228320104
RYPTICUMACULA	53	165	170030106	SICYONITYPICA	53		228320105
RYPTICUSAPONA	53	360	170030104	SINUM PERSPE	53	345	307760702
SARDA SARDA	51		170440701	SIRATUSBEAUII	53		308012801
SARDINEAURITA	51	86	121053801	SOLECURCUMING	53		335460301
SAURIDABRASIL	51	22	129040201	SOLENOCATLANT	53		228300401
SAURIDACARIBB	51	116	129040202	SOLENOCNECOPI	53	316	228300402
SAURIDANORMAN	51	284	129040203	SOLENOCVIOSCA	53	134	228300403
SCAPHELDUBIA	53		308140903	SPEOCARLOBATU	54		229380601
SCHIZASORBIGN	54	428	691120101	SPHOERODORSAL	53	119	189080603
SCIAENOOCELLA	53	205	170203701	SPHOERONEPHEL	53	383	189080607
SCOMBERCAVALL	51	100	170440801	SPHOEROPACHYG	53		189080608
SCOMBERJAPONI	51	101	170440603	SPHOEROPARVUS	53	33	189080611
SCOMBERMACULA	51	75	170440803	SPHOEROSPENGL	53	172	189080610
SCONSIASTRIAT	53	341	307770801	SPHOEROTESTUD	53	243	189080609
SCORPAEAGASSI	53	401	168010701	SPHYRAEBARRAC	51		165030101
SCORPAEBRASIL	53	193	168010703	SPHYRAEBOREAL	51	279	165030102
SCORPAECALCAR	53	69	168010704	SPHYRAEGUACHA	51	71	165030103
SCORPAEDISPAR	53	174	168010705	SPHYRAEPICUDI	51	322	165030105
SCORPAEINERMI	53		168010709	SPHYRNALEWINI	53	209	108040102
SCORPAEPLUMIE	53	402	168010712	SPHYRNAMOKARR	53		108040103
SCYLIORRETIFE	53		108011104	SPHYRNATIBURO	53	133	108040104
SCYLLARAEQUIN	53		229150101	SQUALUSCUBENS	53		109011503
SCYLLARAMERIC	53		229150202	SQUATINDUMERI	53	161	106010101

GENUS/SPECIES	MC	FMB	BIOCODE
SQUILLACHYDAE	53	72	225010112
SQUILLAEDENTA	53		225010102
SQUILLAEMPUSA	53	16	225010103
SQUILLANEGLEC	53	245	225010108
STEINDAARGENT	53	132	148041501
STELLIFLANCEO	53	112	170203902
STENOCICOELAT	53	398	229211801
STENOCIFURCAT	53	399	229211802
STENOCISPINIM	53	293	229211803
STENOCISPINOS	53	272	229211804
STENOPUSCUTEL	53	292	228240201
STENORHSETICO	53	141	229211101
STENOTOCAPRIN	51	2	170213403
STOMOLOMELEAG	54		618040201
STROMBUALATUS	53	344	307580101
STYELA PLICAT	57		596080101
STYLOCIAFFINI	54		693060501
SYACIUMGUNTER	53	39	183011001
SYACIUMMICRUR	53	203	183011002
SYACIUMPAPILL	53	56	183011003
SYMPHURCIVITA	53	212	183050701
SYMPHURDIOMED	53	114	183050702
SYMPHURPARVUS	53		183050712
SYMPHURPELICA	53	379	183050705
SYMPHURPLAGIU	53	73	183050707
SYMPHUROSPI	53		183050709
SYNAGROBELLA	51	315	170060701
SYNAGROSPINOS	51	208	170060704
SYNGNATFLORID	53		151061508
SYNGNATLOUISI	53	362	151061506
SYNGNATSCOVEL	53		151061510
SYNGNATSPRING	53		151061504
SYNODUSFOETEN	51	1	129040302
SYNODUSINTERM	51	217	129040303
SYNODUSPOEYI	51	54	129040304
SYNODUSSYNODU	51		129040306
TAGELUSPLEBEI	53		335460403
TAMOYA HAPLON	54		616040201
TELLINAALTERN	53	311	335441403
TEREBRAFLORID	53		308200104
TETHYASGRANDI	56		691010901
TETRAXABIDENT	54	400	229101002
TETRAXARATHBU	54	421	229101001
THAIS HAEMAS	53		308011003
THYONELGEMMAT	53		694020302
TONNA GALEA	53		307800201
TORPEDONOBILI	54		111010403
TRACHINCAROLI	51	202	170113601
TRACHINFALCAT	51	412	170113603
TRACHINMYOPS	51	135	129040101
TRACHURLATHAM	51	18	170113802
TRACHYPCONSTR	53	128	228011801
TRACHYPSIMILI	53	67	228011802
TRICHIULEPTUR	58	21	170460402
TRICHOPVENTRA	53	53	183011801
TRINECTINSCRI	53	266	183040202
TRINECTMACULA	53	167	183040201
UMBRINACOROID	53	410	170204001
UPENEUSPARVUS	51	11	170220605
UPOGEBIAFFINI	53		229040301
URASPISSECUND	51		170114202
UROCONGSYRING	53		143131401
UROPHYCCIRRAT	53	105	148010102
UROPHYCFLORID	53	74	148010103
UROPHYCREGIA	53	278	148010105
UROSALPCINERE	53		308011401
UROSALPPERRUG	53		308011402
VENTRICRIGIDA	53	355	335640501
VERMICUKNORRI	53		307350502
VESICOMVENUST	53	354	335600402
VIRGULAPRESBY	57		619070101
XENOPHOCONCHY	53		307650202
XIPHOPEKROYER	53	168	228010901
ZALIEUTMCGINT	53	318	195050501
ZENOPSICONCHI	51		162010201
ZENOPSIOCELLA	51		162010202
ZOOBOTRPELLUC	57		642060101

APPENDIX 8

The following outlines several examples calculating sub-sampling expansion factors for trawl catches with emphasize on catches that include trash. The terms of reference for the entire trawl and individual taxonomic component is outline in alternate terminology than the original SEAMAP manual in hopes of clarifying where values are coming from. Of course the process by which these values are arrived may be different.

Terms for Entire Trawl

Total_Trawl_Weight = Total weight of all items removed from trawl including trash. Note: This is probably not even being recorded in most cases.

Select_Trash_Weight = Total weight of trash (tires etc.) removed from Total_Trawl_Weight prior to sub-sampling. Note: This is probably not even being recorded in most cases.

Working_Catch_Weight = Total weight of trawl catch after large trash has been removed (TOTAL_TRAWL_WEIGHT - SELECT_TRASH_WEIGHT) prior to sub-sampling. This should be equivalent to Total_Live_Weight when no trash is taken in the trawl.

Total_Live_Weight = Total weight of biological catch from trawl.

Select_Weight = Total weight of biological catch removed from trawl prior to sub-sampling.

Sample_Weight = Total weight of sub-sampled portion of the catch which may include trash.

Sample_Trash_Weight = Total weight of trash found in sub-sample (SAMPLE_WEIGHT).

Expansion_Factor = (TOTAL_LIVE_WEIGHT – SELECT_WEIGHT)/SAMPLE_WEIGHT or alternately (Working_Catch_Weight – Select_Weight)/Sample_Weight.

Expanded_Trash_Weight (EXPANDED_TRASH_WEIGHT) = expanded total weight of trash found in the sub-sample taken from (Working_Catch_Weight – Select_Weight) or the total weight of catch from from which the sub-sample was taken.

Terms for Individual Counts and Weights

CNT = Total count of a processed organism.

CNTEPX = Expanded total count of a processed organism accounting for sub-sampling.

SAMPLE_BGS = Total weight of a processed organism.

SELECT_BGS = Expanded total weight of a processed organism accounting for sub-sampling.

Example 1.

Example 1 represents a clean 100 kg trawl without trash and no sub-sampling.

TOTAL_TRAWL_WEIGHT=100, SELECT_TRASH_WEIGHT = 0, WORKING_CATCH_WEIGHT = 100, TOTAL_LIVE_WEIGHT = 100, SELECT_WEIGHT = 0, and SAMPLE_WEIGHT = 0.

No expansion factor (EXPANSION FACTOR) is generated.

CNTEXP = CNT and SELECT_BGS = SAMPE_BGS.

Example 2.

Example 2 represents a 100 kg trawl with a single large piece of trash (25 kg) and no sub-sampling.

TOTAL_TRAWL_WEIGHT=100, SELECT_TRASH_WEIGHT = 25, WORKING_CATCH_WEIGHT = 75, TOTAL_LIVE_WEIGHT = 75, SELECT_WEIGHT=0 AND SAMPLE_WEIGHT = 0.

No expansion factor (EXPANSION FACTOR) is generated.

CNTEXP = CNT and SELECT_BGS = SAMPE_BGS.

Example 3.

Example 3 represents a 100 kg trawl with a combinations of 25 kg of select taxa and a sub-sample of 25 kg and no trash.

TOTAL_TRAWL_WEIGHT=100, SELECT_TRASH_WEIGHT = 0, WORKING_CATCH_WEIGHT = 100, TOTAL_LIVE_WEIGHT = 100, SELECT_WEIGHT=25 AND SAMPLE_WEIGHT = 25.

Expansion factor EXPANSION FACTOR is equal to (TOTAL_LIVE_WEIGHT – SELECT_WEIGHT)/SAMPLE_WEIGHT = (100-25)/25 = 3.

CNTEXP = (CNT x EXPANSION FACTOR) and SELECT_BGS = (SAMPE_BGS x EXPANSION FACTOR) for only for organisms that were subsampled. CNT and CNTEXP should be a minimum of 1 or be rounded to the nearest whole number.

SAMPLE_BGS and SELECT_BGS should be a minimum of 0.001 or be rounded to the nearest 0.0001 kg.

Example 4.

Example 4 represents a 100 kg trawl with a combination of 25 kg of select taxa, a sub-sample of 25 kg and 1 kg of trash found in the sub-sample during processing.

TOTAL_TRAWL_WEIGHT=100, SELECT_TRASH_WEIGHT = 0, WORKING_CATCH_WEIGHT = 100, TOTAL_LIVE_WEIGHT = ?, SELECT_WEIGHT=25, SAMPLE_WEIGHT = 25 AND SAMPLE_TRASH_WEIGHT = 1.

Expansion factor EXPANSION FACTOR is equal to (WORKING_CATCH_WEIGHT – SELECT_WEIGHT)/SAMPLE_WEIGHT = (100-25)/25 = 3.

Since 1 kg of trash (SAMPLE_TRASH_WEIGHT) was found in the 25 kg sub-sample (SAMPLE_WEIGHT) of the 75 kg (Working_Catcht_Weight – Select_Weight) from which the subsample was taken, the Expanded_Trash_Weight is then (SAMPLE_TRASH_WEIGHT x EXPANSION FACTOR) = 3 kg.

Total_Live_Weight (TOTAL_LIVE_WEIGHT) is then (Working_Catch_Weight – Expanded_Trash_Weight) or (100 - 3) = 97.

Alternately the Expansion_Factor is (Total_Live_Weight – Select_Weight)/(Sample_Weight – Sample_Trash_Weight) is (97 – 25)/(25-1) = (72/24) = 3.

CNTEXP = (CNT x EXPANSION FACTOR) and SELECT_BGS = (SAMPE_BGS x EXPANSION FACTOR) for only for organisms that were subsampled. CNT and CNTEXP should be a minimum of 1 or be rounded to the nearest whole number.

SAMPLE_BGS and SELECT_BGS should be a minimum of 0.001 or be rounded to the nearest 0.0001 kg.

APPENDIX 9. LENGTH FREQUENCY MEASUREMENT CODE FINDER LIST

See Appendix 7 for the appropriate measurement code for the species being measured. Make sure to use the new measurement codes. The old measurement codes are for reference only.

Measurement Type	Old Measurement Codes	New Measurement Codes
fork length	01	51
standard length	02	52
total length	03,04,06,08,11,12,17,18,21,25,29,32	53
width	05,10,14,16,22,24,26,30,31	54
mantle length	13	55
radial diameter	15	56
other	20	57
snout-anus	23	58
curvilinear length	27	59
curvilinear width	28	60

Code No.	Type measurement	Species (List in Appendix 7)
51	Fish, fork length	Alphabetical list
52	Fish, standard length	Alphabetical list
53	Fish, total length • if fish has produced caudal ray elements at the fork or upper and/or lower caudal lobes take standard length, Code 02 measurement	Alphabetical list
54	Skates and rays, disc width	Alphabetical list
57	Other - specify and check with Field party Chief for special Code no.	
58	Fish, snout/anal length	Alphabetical list

CRUSTACEANS

Code No.	Type measurement	Species (List in Appendix 7)
53	Shrimp, total length (Default Measurement)	Alphabetical list
53	Shrimp, carapace length (measure when requested)	Alphabetical list
53	Crab, carapace length (Default measurement) If carapace length exceeds carapace width (measure when requested other wise)	Alphabetical list
53	Lobster, total length (rostral tip to end of telson) (Measure when requested)	Alphabetical list
54	Crab, carapace width (lateral measurement) If carapace length exceeds carapace width-measure carapace length instead (code 06)	Alphabetical list

OTHER SPECIES
(Exclusive of fish and crustaceans)

Code No.	Type measurement	Species (List in Appendix 7)
53	Bivalve, total length (clams) (All bivalves except scallops) Parallel to hinge joint, umbo to bill edge	
53	Scallop, total length (All scallops) (hinge to bill length)	
53	Univalve snails (most univalves): total length- point to point; Shelled - Columella total length (apex to tip of anterior canal - Spire axis); for Abalones and Chitons use maximum total length of shell; for sea hares use total length.	
53	Sea turtles - maximum linear carapace total length	
53	Worm, total length	
54	Disc width anemones and corals (solitary)	
54	Starfish - disc width(between arm bases-default measurement);	

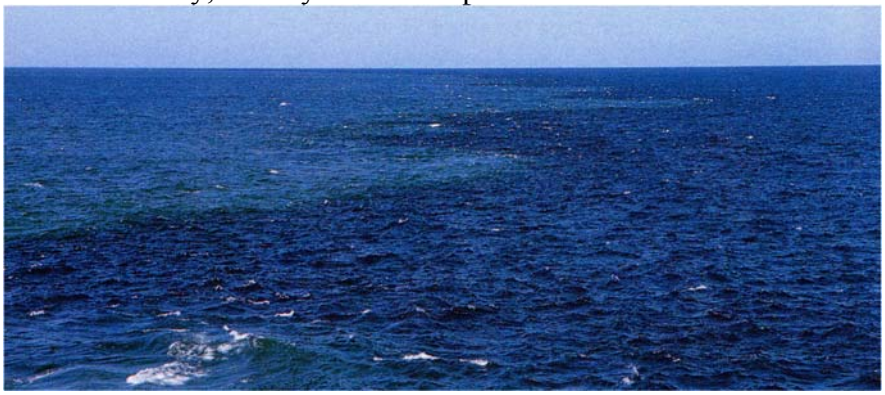
	Sand dollars, sea biscuits, heart urchins, etc.- greatest linear distance
54	Sea pansy and other colonial invertebrates, maximum disc width; Jellyfish- bell diameter
54	Univalve snails, spiral width (includes Argonauts)
55	Squid, mantle length
56	Starfish, total radial diameter (measure when requested)

APPENDIX 10. SARGASSUM CATEGORIES FOR SEAMAP PLANKTON STATION CHARACTERIZATIONS

1) Current-driven *Sargassum* Windrow – strong and generally linear aggregation of *Sargassum* at the boundary of an oceanic frontal zone; distinct water masses on either side of the windrow, as evident by differences in water color/clarity, salinity and/or temperature

2) Wind-driven *Sargassum* Windrow – strong and generally linear aggregation of *Sargassum* not associated with an oceanic frontal zone; water properties consistent on both sides of the windrow

3) Oceanic Frontal Zone – no *Sargassum* present, but two water masses exist as evidenced by distinct color differences on either side of the boundary; boundary sometimes characterized by a line of "foam"; differences in water color/clarity, salinity and/or temperature exist between the two water masses

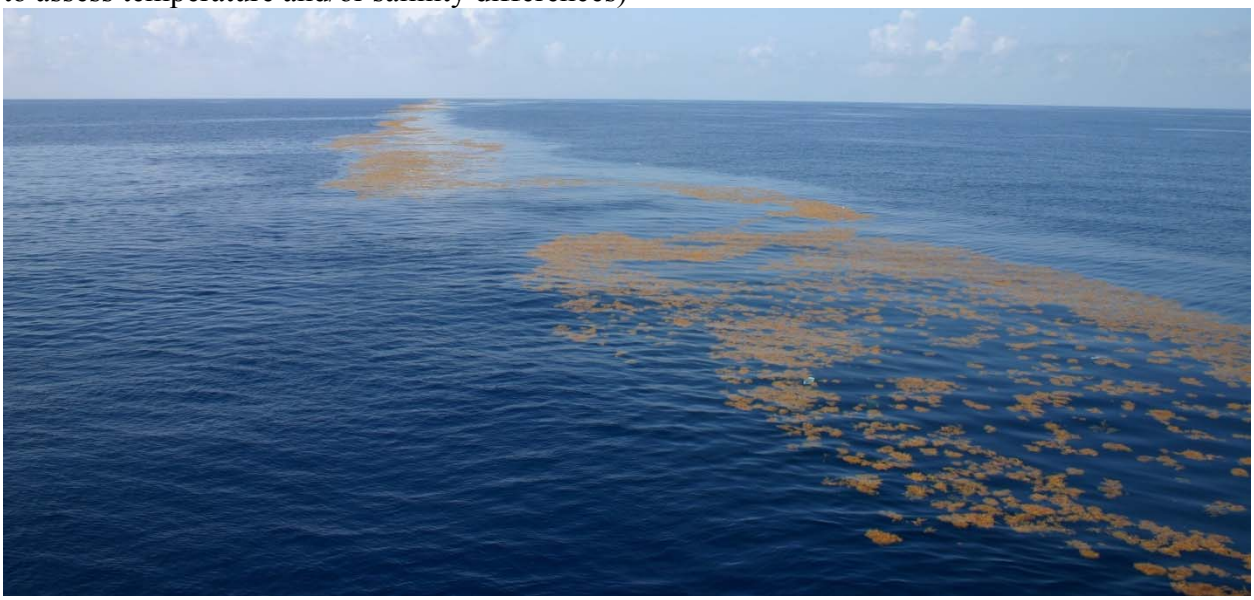


4) Large Mats – large (> 100 m^2) mats of *Sargassum*, generally not associated with a frontal feature

5) Small Mats – small (2 - 100 m^2) mats of *Sargassum*, generally not associated with a frontal feature

6) Scattered Clumps – small scattered clumps (< 2 m^2) of *Sargassum* not associated with a frontal feature

7) Scattered Mats/Clumps along Oceanic Frontal Zone – scattered mats and clumps that are associated with a frontal feature; *Sargassum* was likely recently aggregated as part of a current-driven windrow which has now begun to break apart, often due to strong winds; differences in water color/clarity, salinity and/or temperature exist between the two water masses (higher winds that break apart windrow may mask differences in water color, so water samples should be taken along both sides of the boundary to assess temperature and/or salinity differences)



APPENDIX 11. STANDARD OPERATING PROCEDURE FOR CHLOROPHYLL A EXTRACTION AT SEA USING THE WELSCHMEYER METHOD

The determination of chlorophyll *a* is used as an estimate of phytoplankton biomass. It is not indicative of species composition or the physiological state of the population. Chlorophyll *a* is extremely sensitive to light and heat. Therefore all chlorophyll determinations should be performed in subdued light and a cool room, including extracting in a refrigerator. There are various methods for determining the chlorophyll *a* content of phytoplankton. The method below is a modification of Welschmeyer, N.A. (1994).

Materials and Equipment:

* Turner Designs model 10-AU-005 fluorometer with optical kit 10-040R
* fluorometer manual
* fluorometer accessories (spare lamps, filters, etc.)
* 13 x 100 cuvettes
* cuvette rack
* refrigerator
* centrifuge
* 15 ml centrifuge tubes (preferably disposable polypropylene)
* test tube rack for centrifuge tubes
* filtering manifold equipped with 25 mm filter funnels
* vacuum pump
* 25 mm GF/F filters
* large vacuum reservoir
* forceps, flat blade
* vortex mixer
* methanol
* waste methanol container
* waste MEOH funnel
* MeOH squirt bottle
* Di water
* plastic funnel w/ 153 um mesh netting
* 1-10 ml Brinkmann Dispensette
* aluminum foil
* test tube brushes
* assorted beakers: 50, 100, 250, 500 ml
* assorted grad cylinders: 100, 250, 500, 1000 ml
* graduated cylinders cut for chl: 50 and 100 ml
* Kimwpipes
* Nitrile gloves
* data sheets

<u>CHLOROPHYLL a PROCEDURE</u>:

(1) Perform the entire procedure in **subdued light** and let fluorometer warm up for at least 2 hours.

(2) Place a 25mm GF/F filter on each filter base and attach the funnels.

(3) Rinse the graduated cylinders with 10-20 mL of prescreened sample, screen water sample through 153 µm mesh screening.

(4) Prescreen 600 mL of the raw water sample through 153 µm mesh screening .

(5) Fill the grad cylinder with 200 mls of the prescreened sample and pour into a filtering funnel.

(6) Repeat step 5 three times for each sample producing triplicates for each sample until all 6 funnels are used (2 samples x 3 reps).

(7) Turn the vacuum pump on and set vacuum to approximately 10 inches Hg or less.

(8) Open the ball valves on the manifold.

(9) When the sample has completely passed through the filter, remove the funnel and use forceps to fold filters in half with the pigmented portion inside. Place filter in a numbered plastic centrifuge tube with the side of the filter holding material exposed to the inside of the tube.

(10) Record tube # and sample information on the chl data sheet.

(11) Dispense 10 mL of methanol into the tube using the dispensette on the methanol bottle.

(12) Mix the tube well on the tube buzzer and put in a covered tube rack.

(13) Process all samples as above, and place rack in the refrigerator remembering to **record the initial time.**

(14) Extract for 18-20 hours.

(15) Remove tubes from refrig and allow to warm up for 10 minutes.

(16) Mix tubes well on buzzer and centrifuge for 10 minutes at 2000-3000 rpm (setting 3 on the centrifuge).

(17) Meanwhile, prepare 6-8 clean cuvettes in a rack by the fluorometer.

(18) Rinse a clean cuvette with a small amount (<1 ml) of the sample and discard rinse into waste methanol jug.

(19) Pour enough sample into the cuvette to fill 3/4 full, but not enough to disturb the pellet.

(20) Carefully clean the exterior of the cuvette with a Kimwipe to remove fingerprints, dirt, etc.

(21) Place cuvette in fluorometer and replace cover.

(22) The fluorometer should be set to Auto-range. At this point, the fluorometer will beep as it adjusts the scale.

(23) When the auto-ranging is finished, press the asterisk (*) to begin the discrete sample averaging sequence. Record the chl a concentration when "**Done**" appears on the screen. Actual Chl a in your sample is calculated by performing a volume correction.

(25) Remove sample and discard into the waste methanol jug.

(26) Rinse cuvette 3 times with methanol.

(28) Put cuvette upside down in a test tube rack lined with Kimwipes to dry. It is important not to have any water in cuvette.

(29) Use next cuvette for next sample.

(30) While reading this batch, centrifuge the next 12 samples.

Chlorophyll *a* and phaeopigments: The chlorophyll *a* content of phytoplankton is measured by vacuum filtering a water sample through a 25 mm GF/F filter, then extracting the pigment on the filter in methanol. Sample processing should begin as soon as possible or within 6 hours of collection and duplicate filters are extracted for each water sample. Chlorophyll *a* is extremely sensitive to light and heat. Therefore, all chlorophyll *a* determinations should be performed in **subdued light** and a cool room. Furthermore, extraction should also take place under dark, cool conditions such as in a refrigerator. There are various methods for determining the chlorophyll *a* content of phytoplankton. The method presented here is a modification of Welschmeyer (1994). This method measures chl *a* without interference from chl b and phaeopigments by the use of a different lamp and filter set than in the acidification method of Holm-Hansen and Riemann (1978). The fluorometer is calibrated at least every 6 months or as required with chlorophyll *a* derived from spinach (Sigma Chemical Co #C-5753). The calibration is checked before each sampling trip against a coproporphyrin standard measured at the time of calibration. Refer to the attached Standard Operating Procedure for chlorophyll *a* for the full method. The determination of chlorophyll *a* is used only as an estimate of the biomass of phytoplankton. It is not indicative of species composition nor the physiological state of the population. The amount of chlorophyll in a body of water is often a defining parameter in describing eutrophication or water quality.

APPENDIX 12. MINIMUM REQUIREMENTS CHECKLIST FOR ICHTHYOPLANKTON CRUISES

Angle Indicator
Angle/Wire out Charts
Batteries for CTD & Bongo
Bongo Frames
Bongo nets
Bongo Frame Hose Clamps
Bridge Log
Cable Ties
Carboys
Chemical Pumps
Clip Boards
Cod End Buckets (Bongo/Neuston)
Cod End Hose Clamps (Bongo/Neuston)
Concentrators (Sieves)
Crimping Tool
Cruise Chart
Detergent
Drum wrench
Duct Tape
Ethyl Alcohol Preservative
Environmental Station Sheets
Flowmeters
Flowmeter Performance Tracking Log
Formaldehyde Preservative
Formaldehyde Dispenser
Hoses w/ Nozzles
Hose Y- Connector
Ichthyoplankton Station Sheets
Labels (Inside / Outside)
Knife
Depressor or Lead Weight (80 lbs.)
Monofiliment and A-11 Sleeves
Net Repair Material
Neuston Frames
Neuston Nets
Neuston Cod End
Pascagoula Station Sheets TYPE I or II
Pencils
Permanent Markers Fine Point
Plastic Buckets
Plastic Spoons
Plastic Syringe (for flowmeters)
Rope or line
Sample Jars & Lids
Sample Table
Sample Transfer Log Sheets
Scissors
Screwdrivers
Silicone Oil
Silicone Spray
Stop watch / Timer
Styrofoam Cups
Squeeze Bottles
Twine
Wide Mouth Funnels
WD 40

APPENDIX 13: FLOWMETER PERFORMANCE TRACKING FORM

Project:_____ CRUISE:_____

PASCAGOULA STATION NO.	SERIAL NUMBER	POSITION (Left or Right Bongo)	FLOWMETER COUNTS			TOW DEPTH	TOTAL TOW TIME	COUNTS/ MINUTE
			START	FINISH	TOTAL			

Counts = Actual numbers read on flowmeter.

APPENDIX 14: PLANKTON TRANSFER RECORD.
PROJECT___________________________
CRUISE__________________________

PASC STA #	DATE / TIME Preserved	SAMPLES: Record number and types of jars used.																	
		RIGHT BONGO	F or E	Date due	Time due	Done	INI	LEFT BONGO	F or E	Date due	Time due	Done	INI	NEUSTON	F or E	Date due	Time due	Done	INI

APPENDIX 15. TOWING WIRE REQUIRED TO REACH DEPTHS OF 1-500 M WITH WIRE ANGLES FROM 30º TO 60º.

	WIRE ANGLE						
	30 º	35 º	40 º	**45 º**	50 º	55 º	60 º
DEPTH (m)	WIRE OUT IN METERS						
1	1.15	1.22	1.31	**1.41**	1.56	1.74	2.00
2	2.31	2.44	2.61	**2.83**	3.11	3.49	4.00
3	3.46	3.66	3.92	**4.24**	4.67	5.23	6.00
4	4.62	4.88	5.22	**5.66**	6.22	6.97	8.00
5	**5.77**	**6.10**	**6.53**	**7.07**	**7.78**	**8.72**	**10.00**
6	6.93	7.32	7.83	**8.49**	9.33	10.46	12.00
7	8.08	8.55	9.14	**9.90**	10.89	12.20	14.00
8	9.24	9.77	10.44	**11.31**	12.45	13.95	16.00
9	10.39	10.99	11.75	**12.73**	14.00	15.69	18.00
10	**11.55**	**12.21**	**13.05**	**14.14**	**15.56**	**17.43**	**20.00**
11	12.70	13.43	14.36	**15.56**	17.11	19.18	22.00
12	13.86	14.65	15.66	**16.97**	18.67	20.92	24.00
13	15.01	15.87	16.97	**18.38**	20.22	22.66	26.00
14	16.17	17.09	18.28	**19.80**	21.78	24.41	28.00
15	**17.32**	**18.31**	**19.58**	**21.21**	**23.34**	**26.15**	**30.00**
16	18.48	19.53	20.89	**22.63**	24.89	27.90	32.00
17	19.63	20.75	22.19	**24.04**	26.45	29.64	34.00
18	20.78	21.97	23.50	**25.46**	28.00	31.38	36.00
19	21.94	23.19	24.80	**26.87**	29.56	33.13	38.00
20	**23.09**	**24.42**	**26.11**	**28.28**	**31.11**	**34.87**	**40.00**
21	24.25	25.64	27.41	**29.70**	32.67	36.61	42.00
22	25.40	26.86	28.72	**31.11**	34.23	38.36	44.00
23	26.56	28.08	30.02	**32.53**	35.78	40.10	46.00
24	27.71	29.30	31.33	**33.94**	37.34	41.84	48.00
25	**28.87**	**30.52**	**32.64**	**35.36**	**38.89**	**43.59**	**50.00**
26	30.02	31.74	33.94	**36.77**	40.45	45.33	52.00
27	31.18	32.96	35.25	**38.18**	42.00	47.07	54.00
28	32.33	34.18	36.55	**39.60**	43.56	48.82	56.00
29	33.49	35.40	37.86	**41.01**	45.12	50.56	58.00
30	**34.64**	**36.62**	**39.16**	**42.43**	**46.67**	**52.30**	**60.00**
31	35.80	37.84	40.47	**43.84**	48.23	54.05	62.00
32	36.95	39.06	41.77	**45.25**	49.78	55.79	64.00
33	38.11	40.29	43.08	**46.67**	51.34	57.53	66.00
34	39.26	41.51	44.38	**48.08**	52.89	59.28	68.00
35	**40.41**	**42.73**	**45.69**	**49.50**	**54.45**	**61.02**	**70.00**
36	41.57	43.95	46.99	**50.91**	56.01	62.76	72.00
37	42.72	45.17	48.30	**52.33**	57.56	64.51	74.00
38	43.88	46.39	49.61	**53.74**	59.12	66.25	76.00
39	45.03	47.61	50.91	**55.15**	60.67	67.99	78.00
40	**46.19**	**48.83**	**52.22**	**56.57**	**62.23**	**69.74**	**80.00**
41	47.34	50.05	53.52	**57.98**	63.78	71.48	82.00
42	48.50	51.27	54.83	**59.40**	65.34	73.22	84.00
43	49.65	52.49	56.13	**60.81**	66.90	74.97	86.00

APPENDIX 15 (cont).

	WIRE ANGLE						
	30 º	35 º	40 º	**45 º**	50 º	55 º	60 º
DEPTH (m)	WIRE OUT IN METERS						
44	50.81	53.71	57.44	**62.23**	68.45	76.71	88.00
45	**51.96**	**54.93**	**58.74**	**63.64**	**70.01**	**78.46**	**90.00**
46	53.12	56.16	60.05	**65.05**	71.56	80.20	92.00
47	54.27	57.38	61.35	**66.47**	73.12	81.94	94.00
48	55.43	58.60	62.66	**67.88**	74.67	83.69	96.00
49	56.58	59.82	63.96	**69.30**	76.23	85.43	98.00
50	**57.74**	**61.04**	**65.27**	**70.71**	**77.79**	**87.17**	**100.00**
51	58.89	62.26	66.58	**72.12**	79.34	88.92	102.00
52	60.04	63.48	67.88	**73.54**	80.90	90.66	104.00
53	61.20	64.70	69.19	**74.95**	82.45	92.40	106.00
54	62.35	65.92	70.49	**76.37**	84.01	94.15	108.00
55	**63.51**	**67.14**	**71.80**	**77.78**	**85.56**	**95.89**	**110.00**
56	64.66	68.36	73.10	**79.20**	87.12	97.63	112.00
57	65.82	69.58	74.41	**80.61**	88.68	99.38	114.00
58	66.97	70.80	75.71	**82.02**	90.23	101.12	116.00
59	68.13	72.03	77.02	**83.44**	91.79	102.86	118.00
60	**69.28**	**73.25**	**78.32**	**84.85**	**93.34**	**104.61**	**120.00**
61	70.44	74.47	79.63	**86.27**	94.90	106.35	122.00
62	71.59	75.69	80.94	**87.68**	96.45	108.09	124.00
63	72.75	76.91	82.24	**89.10**	98.01	109.84	126.00
64	73.90	78.13	83.55	**90.51**	99.57	111.58	128.00
65	**75.06**	**79.35**	**84.85**	**91.92**	**101.12**	**113.32**	**130.00**
66	76.21	80.57	86.16	**93.34**	102.68	115.07	132.00
67	77.36	81.79	87.46	**94.75**	104.23	116.81	134.00
68	78.52	83.01	88.77	**96.17**	105.79	118.55	136.00
69	79.67	84.23	90.07	**97.58**	107.34	120.30	138.00
70	**80.83**	**85.45**	**91.38**	**98.99**	**108.90**	**122.04**	**140.00**
71	81.98	86.67	92.68	**100.41**	110.46	123.78	142.00
72	83.14	87.90	93.99	**101.82**	112.01	125.53	144.00
73	84.29	89.12	95.29	**103.24**	113.57	127.27	146.00
74	85.45	90.34	96.60	**104.65**	115.12	129.02	148.00
75	**86.60**	**91.56**	**97.91**	**106.07**	**116.68**	**130.76**	**150.00**
76	87.76	92.78	99.21	**107.48**	118.24	132.50	152.00
77	88.91	94.00	100.52	**108.89**	119.79	134.25	154.00
78	90.07	95.22	101.82	**110.31**	121.35	135.99	156.00
79	91.22	96.44	103.13	**111.72**	122.90	137.73	158.00
80	**92.38**	**97.66**	**104.43**	**113.14**	**124.46**	**139.48**	**160.00**
81	93.53	98.88	105.74	**114.55**	126.01	141.22	162.00
82	94.69	100.10	107.04	**115.97**	127.57	142.96	164.00
83	95.84	101.32	108.35	**117.38**	129.13	144.71	166.00
84	96.99	102.55	109.65	**118.79**	130.68	146.45	168.00
85	**98.15**	**103.77**	**110.96**	**120.21**	**132.24**	**148.19**	**170.00**
86	99.30	104.99	112.27	**121.62**	133.79	149.94	172.00

APPENDIX 15 (cont).

	WIRE ANGLE						
	30 º	35 º	40 º	**45 º**	50 º	55 º	60 º
DEPTH (m)	WIRE OUT IN METERS						
87	100.46	106.21	113.57	**123.04**	135.35	151.68	174.00
88	101.61	107.43	114.88	**124.45**	136.90	153.42	176.00
89	102.77	108.65	116.18	**125.87**	138.46	155.17	178.00
90	**103.92**	**109.87**	**117.49**	**127.28**	**140.02**	**156.91**	**180.00**
91	105.08	111.09	118.79	**128.69**	141.57	158.65	182.00
92	106.23	112.31	120.10	**130.11**	143.13	160.40	184.00
93	107.39	113.53	121.40	**131.52**	144.68	162.14	186.00
94	108.54	114.75	122.71	**132.94**	146.24	163.88	188.00
95	**109.70**	**115.97**	**124.01**	**134.35**	**147.79**	**165.63**	**190.00**
96	110.85	117.19	125.32	**135.76**	149.35	167.37	192.00
97	112.01	118.42	126.62	**137.18**	150.91	169.11	194.00
98	113.16	119.64	127.93	**138.59**	152.46	170.86	196.00
99	114.32	120.86	129.24	**140.01**	154.02	172.60	198.00
100	**115.47**	**122.08**	**130.54**	**141.42**	**155.57**	**174.34**	**200.00**
101	116.62	123.30	131.85	**142.84**	157.13	176.09	202.00
102	117.78	124.52	133.15	**144.25**	158.68	177.83	204.00
103	118.93	125.74	134.46	**145.66**	160.24	179.58	206.00
104	120.09	126.96	135.76	**147.08**	161.80	181.32	208.00
105	**121.24**	**128.18**	**137.07**	**148.49**	**163.35**	**183.06**	**210.00**
106	122.40	129.40	138.37	**149.91**	164.91	184.81	212.00
107	123.55	130.62	139.68	**151.32**	166.46	186.55	214.00
108	124.71	131.84	140.98	**152.74**	168.02	188.29	216.00
109	125.86	133.06	142.29	**154.15**	169.57	190.04	218.00
110	**127.02**	**134.29**	**143.59**	**155.56**	**171.13**	**191.78**	**220.00**
111	128.17	135.51	144.90	**156.98**	172.69	193.52	222.00
112	129.33	136.73	146.21	**158.39**	174.24	195.27	224.00
113	130.48	137.95	147.51	**159.81**	175.80	197.01	226.00
114	131.64	139.17	148.82	**161.22**	177.35	198.75	228.00
115	**132.79**	**140.39**	**150.12**	**162.63**	**178.91**	**200.50**	**230.00**
116	133.95	141.61	151.43	**164.05**	180.46	202.24	232.00
117	135.10	142.83	152.73	**165.46**	182.02	203.98	234.00
118	136.25	144.05	154.04	**166.88**	183.58	205.73	236.00
119	137.41	145.27	155.34	**168.29**	185.13	207.47	238.00
120	**138.56**	**146.49**	**156.65**	**169.71**	**186.69**	**209.21**	**240.00**
121	139.72	147.71	157.95	**171.12**	188.24	210.96	242.00
122	140.87	148.93	159.26	**172.53**	189.80	212.70	244.00
123	142.03	150.16	160.57	**173.95**	191.35	214.44	246.00
124	143.18	151.38	161.87	**175.36**	192.91	216.19	248.00
125	**144.34**	**152.60**	**163.18**	**176.78**	**194.47**	**217.93**	**250.00**
126	145.49	153.82	164.48	**178.19**	196.02	219.67	252.00
127	146.65	155.04	165.79	**179.61**	197.58	221.42	254.00
128	147.80	156.26	167.09	**181.02**	199.13	223.16	256.00
129	148.96	157.48	168.40	**182.43**	200.69	224.90	258.00

APPENDIX 15 (cont).

	WIRE ANGLE						
	30 º	35 º	40 º	**45 º**	50 º	55 º	60 º
DEPTH (m)	WIRE OUT IN METERS						
130	**150.11**	**158.70**	**169.70**	**183.85**	**202.24**	**226.65**	**260.00**
131	151.27	159.92	171.01	**185.26**	203.80	228.39	262.00
132	152.42	161.14	172.31	**186.68**	205.36	230.13	264.00
133	153.58	162.36	173.62	**188.09**	206.91	231.88	266.00
134	154.73	163.58	174.92	**189.50**	208.47	233.62	268.00
135	**155.88**	**164.80**	**176.23**	**190.92**	**210.02**	**235.37**	**270.00**
136	157.04	166.03	177.54	**192.33**	211.58	237.11	272.00
137	158.19	167.25	178.84	**193.75**	213.13	238.85	274.00
138	159.35	168.47	180.15	**195.16**	214.69	240.60	276.00
139	160.50	169.69	181.45	**196.58**	216.25	242.34	278.00
140	**161.66**	**170.91**	**182.76**	**197.99**	**217.80**	**244.08**	**280.00**
141	162.81	172.13	184.06	**199.40**	219.36	245.83	282.00
142	163.97	173.35	185.37	**200.82**	220.91	247.57	284.00
143	165.12	174.57	186.67	**202.23**	222.47	249.31	286.00
144	166.28	175.79	187.98	**203.65**	224.02	251.06	288.00
145	**167.43**	**177.01**	**189.28**	**205.06**	**225.58**	**252.80**	**290.00**
146	168.59	178.23	190.59	**206.48**	227.14	254.54	292.00
147	169.74	179.45	191.89	**207.89**	228.69	256.29	294.00
148	170.90	180.67	193.20	**209.30**	230.25	258.03	296.00
149	172.05	181.90	194.51	**210.72**	231.80	259.77	298.00
150	**173.21**	**183.12**	**195.81**	**212.13**	**233.36**	**261.52**	**300.00**
151	174.36	184.34	197.12	**213.55**	234.91	263.26	302.00
152	175.51	185.56	198.42	**214.96**	236.47	265.00	304.00
153	176.67	186.78	199.73	**216.37**	238.03	266.75	306.00
154	177.82	188.00	201.03	**217.79**	239.58	268.49	308.00
155	**178.98**	**189.22**	**202.34**	**219.20**	**241.14**	**270.23**	**310.00**
156	180.13	190.44	203.64	**220.62**	242.69	271.98	312.00
157	181.29	191.66	204.95	**222.03**	244.25	273.72	314.00
158	182.44	192.88	206.25	**223.45**	245.80	275.46	316.00
159	183.60	194.10	207.56	**224.86**	247.36	277.21	318.00
160	**184.75**	**195.32**	**208.87**	**226.27**	**248.92**	**278.95**	**320.00**
161	185.91	196.54	210.17	**227.69**	250.47	280.69	322.00
162	187.06	197.77	211.48	**229.10**	252.03	282.44	324.00
163	188.22	198.99	212.78	**230.52**	253.58	284.18	326.00
164	189.37	200.21	214.09	**231.93**	255.14	285.93	328.00
165	**190.53**	**201.43**	**215.39**	**233.35**	**256.69**	**287.67**	**330.00**
166	191.68	202.65	216.70	**234.76**	258.25	289.41	332.00
167	192.83	203.87	218.00	**236.17**	259.81	291.16	334.00
168	193.99	205.09	219.31	**237.59**	261.36	292.90	336.00
169	195.14	206.31	220.61	**239.00**	262.92	294.64	338.00
170	**196.30**	**207.53**	**221.92**	**240.42**	**264.47**	**296.39**	**340.00**
171	197.45	208.75	223.22	**241.83**	266.03	298.13	342.00
172	198.61	209.97	224.53	**243.24**	267.58	299.87	344.00

APPENDIX 15 (cont).

	WIRE ANGLE						
	30 º	35 º	40 º	**45 º**	50 º	55 º	60 º
DEPTH (m)	WIRE OUT IN METERS						
173	199.76	211.19	225.84	**244.66**	269.14	301.62	346.00
174	200.92	212.41	227.14	**246.07**	270.70	303.36	348.00
175	**202.07**	**213.64**	**228.45**	**247.49**	**272.25**	**305.10**	**350.00**
176	203.23	214.86	229.75	**248.90**	273.81	306.85	352.00
177	204.38	216.08	231.06	**250.32**	275.36	308.59	354.00
178	205.54	217.30	232.36	**251.73**	276.92	310.33	356.00
179	206.69	218.52	233.67	**253.14**	278.47	312.08	358.00
180	**207.85**	**219.74**	**234.97**	**254.56**	**280.03**	**313.82**	**360.00**
181	209.00	220.96	236.28	**255.97**	281.59	315.56	362.00
182	210.16	222.18	237.58	**257.39**	283.14	317.31	364.00
183	211.31	223.40	238.89	**258.80**	284.70	319.05	366.00
184	212.46	224.62	240.19	**260.22**	286.25	320.79	368.00
185	**213.62**	**225.84**	**241.50**	**261.63**	**287.81**	**322.54**	**370.00**
186	214.77	227.06	242.81	**263.04**	289.36	324.28	372.00
187	215.93	228.28	244.11	**264.46**	290.92	326.02	374.00
188	217.08	229.51	245.42	**265.87**	292.48	327.77	376.00
189	218.24	230.73	246.72	**267.29**	294.03	329.51	378.00
190	**219.39**	**231.95**	**248.03**	**268.70**	**295.59**	**331.25**	**380.00**
191	220.55	233.17	249.33	**270.11**	297.14	333.00	382.00
192	221.70	234.39	250.64	**271.53**	298.70	334.74	384.00
193	222.86	235.61	251.94	**272.94**	300.25	336.49	386.00
194	224.01	236.83	253.25	**274.36**	301.81	338.23	388.00
195	**225.17**	**238.05**	**254.55**	**275.77**	**303.37**	**339.97**	**390.00**
196	226.32	239.27	255.86	**277.19**	304.92	341.72	392.00
197	227.48	240.49	257.17	**278.60**	306.48	343.46	394.00
198	228.63	241.71	258.47	**280.01**	308.03	345.20	396.00
199	229.79	242.93	259.78	**281.43**	309.59	346.95	398.00
200	**230.94**	**244.15**	**261.08**	**282.84**	**311.14**	**348.69**	**400.00**
201	232.09	245.38	262.39	**284.26**	312.70	350.43	402.00
202	233.25	246.60	263.69	**285.67**	314.26	352.18	404.00
203	234.40	247.82	265.00	**287.09**	315.81	353.92	406.00
204	235.56	249.04	266.30	**288.50**	317.37	355.66	408.00
205	**236.71**	**250.26**	**267.61**	**289.91**	**318.92**	**357.41**	**410.00**
206	237.87	251.48	268.91	**291.33**	320.48	359.15	412.00
207	239.02	252.70	270.22	**292.74**	322.03	360.89	414.00
208	240.18	253.92	271.52	**294.16**	323.59	362.64	416.00
209	241.33	255.14	272.83	**295.57**	325.15	364.38	418.00
210	**242.49**	**256.36**	**274.14**	**296.98**	**326.70**	**366.12**	**420.00**
211	243.64	257.58	275.44	**298.40**	328.26	367.87	422.00
212	244.80	258.80	276.75	**299.81**	329.81	369.61	424.00
213	245.95	260.02	278.05	**301.23**	331.37	371.35	426.00
214	247.11	261.25	279.36	**302.64**	332.92	373.10	428.00
215	**248.26**	**262.47**	**280.66**	**304.06**	**334.48**	**374.84**	**430.00**

APPENDIX 15 (cont).

	WIRE ANGLE						
	30 º	35 º	40 º	**45 º**	50 º	55 º	60 º
DEPTH (m)	WIRE OUT IN METERS						
216	249.42	263.69	281.97	**305.47**	336.04	376.58	432.00
217	250.57	264.91	283.27	**306.88**	337.59	378.33	434.00
218	251.72	266.13	284.58	**308.30**	339.15	380.07	436.00
219	252.88	267.35	285.88	**309.71**	340.70	381.81	438.00
220	**254.03**	**268.57**	**287.19**	**311.13**	**342.26**	**383.56**	**440.00**
221	255.19	269.79	288.50	**312.54**	343.81	385.30	442.00
222	256.34	271.01	289.80	**313.96**	345.37	387.05	444.00
223	257.50	272.23	291.11	**315.37**	346.93	388.79	446.00
224	258.65	273.45	292.41	**316.78**	348.48	390.53	448.00
225	**259.81**	**274.67**	**293.72**	**318.20**	**350.04**	**392.28**	**450.00**
226	260.96	275.90	295.02	**319.61**	351.59	394.02	452.00
227	262.12	277.12	296.33	**321.03**	353.15	395.76	454.00
228	263.27	278.34	297.63	**322.44**	354.71	397.51	456.00
229	264.43	279.56	298.94	**323.85**	356.26	399.25	458.00
230	**265.58**	**280.78**	**300.24**	**325.27**	**357.82**	**400.99**	**460.00**
231	266.74	282.00	301.55	**326.68**	359.37	402.74	462.00
232	267.89	283.22	302.85	**328.10**	360.93	404.48	464.00
233	269.05	284.44	304.16	**329.51**	362.48	406.22	466.00
234	270.20	285.66	305.47	**330.93**	364.04	407.97	468.00
235	**271.35**	**286.88**	**306.77**	**332.34**	**365.60**	**409.71**	**470.00**
236	272.51	288.10	308.08	**333.75**	367.15	411.45	472.00
237	273.66	289.32	309.38	**335.17**	368.71	413.20	474.00
238	274.82	290.54	310.69	**336.58**	370.26	414.94	476.00
239	275.97	291.77	311.99	**338.00**	371.82	416.68	478.00
240	**277.13**	**292.99**	**313.30**	**339.41**	**373.37**	**418.43**	**480.00**
241	278.28	294.21	314.60	**340.83**	374.93	420.17	482.00
242	279.44	295.43	315.91	**342.24**	376.49	421.91	484.00
243	280.59	296.65	317.21	**343.65**	378.04	423.66	486.00
244	281.75	297.87	318.52	**345.07**	379.60	425.40	488.00
245	**282.90**	**299.09**	**319.82**	**346.48**	**381.15**	**427.14**	**490.00**
246	284.06	300.31	321.13	**347.90**	382.71	428.89	492.00
247	285.21	301.53	322.44	**349.31**	384.26	430.63	494.00
248	286.37	302.75	323.74	**350.72**	385.82	432.37	496.00
249	287.52	303.97	325.05	**352.14**	387.38	434.12	498.00
250	**288.68**	**305.19**	**326.35**	**353.55**	**388.93**	**435.86**	**500.00**
251	289.83	306.41	327.66	**354.97**	390.49	437.61	502.00
252	290.98	307.64	328.96	**356.38**	392.04	439.35	504.00
253	292.14	308.86	330.27	**357.80**	393.60	441.09	506.00
254	293.29	310.08	331.57	**359.21**	395.15	442.84	508.00
255	**294.45**	**311.30**	**332.88**	**360.62**	**396.71**	**444.58**	**510.00**
256	295.60	312.52	334.18	**362.04**	398.27	446.32	512.00
257	296.76	313.74	335.49	**363.45**	399.82	448.07	514.00

APPENDIX 16.

Conversions to be used when entering the amount of *Sargassum* collected in neuston and bongo nets during SEAMAP cruises. **A zero must be entered into the database if no *Sargassum* is collected.** Small amounts, such as a small clump or a few strands, should be considered to equal ≤ 0.5 cup. If there is more than 10 gallons present in the net, the amount (in gallons) should be multiplied by 3.79 to convert to liters. * For ½ gallon increments, add 1.90 liters to the tabled value

Amount in Net	Converted Amount (Liters)
<Blank>	Null (No Observation Made)
None	0
≤ 0.5 cup	0.12
1 cup	0.24
1 pint (2 cups)	0.47
1.5 pint	0.71
1 quart (2 pints)	0.95
1.5 quarts	1.43
2.0 quarts	1.90
2.5 quarts	2.38
3.0 quarts	2.85
3.5 quarts	3.33
* ½ gallon	1.90
1 gallon (4 quarts)	3.79
2 gallons	7.58
3 gallons	11.37
4 gallons	15.16
5 gallons	18.95
6 gallons	22.74
7 gallons	26.53
8 gallons	30.32
9 gallons	34.11
10 gallons	37.90
>10 gallons	# of Gallons x 3.79

Procedures for measuring *Sargassum* in SEAMAP samples

Sargassum patches are encountered in the northern Gulf of Mexico throughout the sampling year and are readily collected in the neuston net. In the past, a less precise measurement of the *Sargassum* collected in the nets has been recorded. A new procedure will allow us to obtain a more quantitative record of *Sargassum* collected in samples. A consistent quantification of the amount of *Sargassum* collected will improve our investigation of the relationship between larval/juvenile fish and *Sargassum* as measued in SEAMAP samples. The procedures for a neuston tow will remain the same according to the SEAMAP manual. Tow time for the neuston is normally 10 minutes, but if large amounts of *Sargassum* begin to accumulate in the net, the tow may be shortened to no less than 5 minutes. Once the net is rinsed down and brought on board, the sample can be removed from the net and placed in a bucket. Several buckets or a larger container can be used to hold the *Sargassum* for processing if a large amount is collected in the net. Once the *Sargassum* is pulled out, rinse the net into a bucket to insure all plankton is removed from the neuston. Each *Sargassum* clump must be rinsed off into a bucket so that all larvae are collected in the sample. Care should be taken to remove all larvae stuck to the clumps and tangled in the *Sargassum* branches. If the rinse bucket gets too full, the sample may be poured through the mesh sieve to collect the larvae. The sample should be processed as soon as possible, but keeping the *Sargassum* wet will help prevent larvae from drying out. The sample can be preserved once all the *Sargassum* is rinsed and the sample drained through the mesh sieve. After the sample has been processed, a close estimation of the amount of *Sargassum* should be made using pint and quart jars. Larger amounts should be estimated using a 5 gallon bucket. The *Sargassum* should be placed loosely in the container and not packed down. Small amounts, such as a small clump or a few strands, will be recorded as the smallest category (e.g., ≤ 0.5 cup). The final amount should be reported to the watchleader who will convert the amount into liters (Table 1) and then record it in the database. The amount of *Sargassum* should also be entered into the comment field of the database in order to serve as an error check. Most importantly, if no *Sargassum* is collected a 0 must be entered into the database, otherwise a null value, ie. a blank, will be assigned. A null value indicates that no observation of the presence or absence of *Sargassum* was made. *Sargassum* collected during bongo tows should be processed and estimated for each net (left and right) in the same way as for neuston.

APPENDIX 17: BONGO SAMPLING QUICK REFERENCE GUIDE

1. *BEFORE STATION*
2. Ensure Bongo array is ready for deployment
   - Cod ends securely attached
   - Flowmeters installed, filled with fluid and run properly
   - Check for holes or rips in mesh, especially the lower 1/3 of net. Repair or replace as needed.
   - Ensure buckets, sample jars, sieve, funnel, squeeze bottles, formaldehyde pump bottle, and ETOH carboys are ready.
3. Relay flowmeter numbers to the lab scientist BEFORE arrival on station.
4. Check SBE 19 Seacat (secure to wire, connections secure, magnetic switch is off and wires not damaged).
   - Remove Tygon tubing
   - Replace Y tubing for sampling (if applicable)
5. Ensure CTD computer is running and logged on.
6. Ensure SCS computer is running, logged on, and currently running a realtime display.
7. Launch the **Bongo_Event** on the SCS computer.
8. Launch **SEASAVE** by clicking on the **Bongo SBE 19** icon on the desktop on the CTD computer.
   - Select the proper display for the depth of the station (right click the display screen to change).
   - Ensure Depth, Temperature, Conductivity, and Pump Status are on the lower display.
   - Turn **ON** the deck box (the smaller one).
9. On the **SEASAVE** menu bar, click on **Realtime Data** to reveal its choices.
10. Click on **Start Acquisition**.
11. Ensure proper con file is selected for your cruise. If unsure, ASK the ET or FPC.
12. Input the proper filename for the output file.
    - If unsure of the Pascagoula Station Number, ask FPC or call bridge.
    - Use 3-digits for the station number (ie. 001 for the first station)
13. Click on **Start Acquire** button.
14. Enter / verify the following header information:

For the **Gordon Gunter:**

For the **Oregon II:**

Ship: Gordon Gunter (set prior to sailing – do not enter anything)

Ship: Oregon II (set prior to sailing – do not enter anything)

Cruise: YYNN (Y=Year, N=cruise # set prior to sailing – do not enter anything)

Cruise: 4-digit sequential cruise number (set prior to sailing - do not enter)

Station: 3-digit station number (include leading zeros)

Station: 3-digit station number (include leading zeros)

Latitude: DD MM.MM N (ex. 25 33.40 N)

Latitude: DD MM.MM N (ex. 25 33.40 N)

Longitude: DD MM.MM W (ex. 88 02.22 W)

Longitude: DD MM.MM W (ex. 88 02.22 W)

SEAMAP Station Number: B # (ex. B030)

SEAMAP Station Number: B # (ex. B176)

Operator's Initials: Enter your initials

Operator's Initials: Enter your initials

Depth (meters): Station's depth in meters

Depth (meters): Station's depth in meters

Notes: Enter items such as reference to con file changes, sensor failure (no commas or other punctuation please).

15. WAIT for bridge and deck to relay that they are both ready **BEFORE** you press the "OK". See *On station* below.
16. Fill data into the SCS Bongo event that you can prior to station.
17. **HEADER TAB**:
    - **Vessel:** Should be set prior to sailing (make sure correct)

- **Cruise:** Should be set prior to sailing (make sure correct)
- **Pasc Station number:** 3-digit sequential station number (ex. 001 for first station)
- **SEAMAP Station Number:** B numbered station number (ex. B062); use leading zeros.
- **Time:** Should appear as GMT.
- **Gear:** Should appear as PN (for bongo).
- **Event:** leave blank or enter a 01, unless a second bongo tow is done at the same station.
- **Tow Pattern:** Should be O (means Oblique) for all normal bongo tows.
- **Manual Depth (M):** Depth read on EQ50 or Chart Depth for deep stations.
- **Comments:** Any pertinent information for this tow (ex. Chart depth used with units, high winds, rough seas, etc.)

18. **BONGO GEAR TAB:**
    - **Rt. Flow Serial #:** Use drop down list, make sure correct each station. Change if flowmeter changed.
    - **Rt. Flow Start:** Reading received from deck scientist prior to tow. ALWAYS 6 DIGITS, include leading zeros. Record on tracking form too. Watch for problems. The number should be close to the number recorded for the previous stations *end* readings.
    - **Rt. Flow End:** Reading received after completion of tow (6 digits).
    - **Rt. Mesh:** Should be 03 – .333 m, use drop down menu if different
    - **Rt. Gearcode:** Should be 01 – 60 cm Bongo, use drop down menu if different
    - **Lt. Flow Serial #:** Use drop down list, make sure correct each station. Change if flowmeter changed.
    - **Lt. Flow Start:** Reading received from deck scientist prior to tow. ALWAYS 6 DIGITS. Record on tracking form too. Watch for problems. The number should be close to the number recorded for the previous stations end readings.
    - **Lt. Flow End:** Reading received after completion of tow (6 digits).
    - **Lt. Mesh:** Should be 03 – .333 m, use drop down menu if different
    - **Lt. Gearcode:** Should be 01 – 60 cm Bongo, use drop down menu if different.
19. **STATION TAB:** This information is filled in automatically as the start bongo and stop bongo buttons are pressed. Only change the EQ50 depths to the correct chart depth when necessary. Use the START time, latitude and longitude for filling in the inside labels.
20. **SUMMARY TAB:** Most filled out by the SCS system. The four boxes to fill in must wait until max depth is reached.

Target fishing DEPTH (m)	Total amount WIRE OUT (m)	PAYOUT RATE	RETRIEVAL RATE
0 - 19	< 27	10m/min	10m/min
20 - 69	28 - 97	15m/min	15m/min
70 - 100	> 99	20 - 30m/min	20m/min
101-200	> 143	50m/min	20m/min

21. *ON STATION*
22. Click **Start Event** on SCS computer Bongo event.
23. When both BRIDGE and DECK are ready, hit **OK** on the SEASAVE program.
24. Have Deck **Turn on switch** on the SEACAT when the box comes up in the program (you have 60 seconds).

25. Deploy bongo array when numbers begin scrolling on display.
26. Click **Bongo Start** button when bongo frame enters the water and flowmeters begin turning.
27. Payout net at speed appropriate for depth. (See table at right)
28. Monitor relayed wire angles from deck and depth displayed on SEASAVE display. REMEMBER to monitor EQ50 depth for change during payout, especially prior to Bongo Bottom.
29. **All Stop** when the display reaches 1.5 – 2 m above target depth to adjust for the offset from the bottom of the frame to the depth sensor in the SBE 19 (2 m above bottom or 200 m), begin retrieval immediately.
30. Click **Bongo BOTTOM** button (careful not to click the wrong button).
31. Record relayed **Wire Angle, Wire Out,** and **Max. Depth** displayed on SEASAVE display (remember to add the offset back in). Enter these values into Bongo Event.
32. Retrieve bongo at speed appropriate for depth (See table above) and monitor wire angles received from deck.
33. Click **Bongo STOP** button when bongo frame leaves the water (watch camera in case deck personnel are busy).
34. On SEASAVE program: Click **Realtime data**, then **Stop Acquisition**. TURN OFF deck box.
35. Close SEASAVE program.
36. Correct EQ50 depths for start and end, if chart depth being used.
37. LISTEN and make sure deck relays that the SWITCH IS OFF, if not ask.
38. Record **Rt. and Lt. Flowmeter** readings, when relayed from deck, in SCS event and on tracking form (6 digits). Getting these numbers from deck personnel can wait until the neuston is deployed. The timer on the tow was stopped (though the display still runs) when the Bongo Stop button was pressed.
39. Check through all tabs in Bongo event for completeness and correctness. Make any necessary changes prior to pressing Stop Event. Once Stop Event is pressed, no more information can be entered in the event (any missed information can be added in Access database).
40. Click **Stop Event**. Click on the Summary Tab and the **Tow Time** is now displayed. This is the easy way to get the correct elapsed time of tow for the flowmeter tracking form calculations.
41. Click **Exit Event**.
42. Finish calculating numbers on flowmeter tracking form and make sure they look right.
43. Check with deck scientist for presence of mud, *Sargassum*, or jelly fish in bongos.
44. If **MUD** is present in BOTH bongos, tow MUST BE REPEATED. Save samples from first tow until new good samples collected. Enter 02 into the **Event** box in the second bongo tow event for the second tow.
45. If **MUD** is present in only ONE bongo, but >2 Tablespoons, tow MUST BE REPEATED. Same procedure as above.
46. If **MUD** in only ONE bongo, but LESS THAN 2 tablespoons, tow is ok and the samples can be preserved.
47. No more than ½ full of settled plankton in jar for formalin samples, 1/3 of plankton for ETOH preserved samples (use more jars if needed); fill jar 2/3 with sea water before putting in formaldehyde from pump (formalin preserved samples), then ***2 pumps of Formaldehyde per Pint and 4 pumps per Quart***; invert jar at least3-4 times to mix. If plankton does not settle into less than ½ jar, split sample into more jars. Use same size jars for multiple jar samples (all pints or all quarts, do not mix jar sizes for same sample).
48. Inside Labels: PENCIL ONLY! Write very clearly and darkly, labels read next by sorters in Poland. Do NOT use vessel codes, write out vessel name.

49. Top Labels: Use ULTRA FINE POINT *SHARPIE* (in Plankton tackle box). Mark *transferred* slash so it does NOT mark out the cruise or station number! If light color used for this slash, it won't matter as much.

APPENDIX 18: NEUSTON SAMPLING QUICK REFERENCE GUIDE

1. *BEFORE STATION*
2. Ensure neuston is ready for deployment
   - Net is securely tied to frame (check for frayed or breaks in the line)
   - Check for holes or rips in mesh, especially in lower 1/3 of net. Repair or replace as needed.
   - Cod end securely attached OR tied off tightly if cod end not used.
   - Ensure buckets, jars, sieve, funnel, squeeze bottles, formaldehyde pump bottle, and ETOH carboys are ready.
3. Launch the **Neuston Event** on the SCS computer.
4. Fill data into the SCS Neuston event that you can prior to station.
5. **HEADER TAB:**
   - **Vessel:** Should be set prior to sailing (make sure correct).
   - **Cruise:** Should be set prior to sailing (make sure correct).
   - **Pascagoula Station Number:** 3-digit sequential station number (ex. 001 for first station)
   - **SEAMAP Station Number:** B numbered station number (ex. B062), use leading zeros.
   - **Time Zone:** Should appear as GMT.
   - **Gear:** Should appear as NN (for neuston).
   - **Event:** leave blank or a 01 unless a second neuston tow is done at the same station (e.g., Cod end off, had to redo)
   - **Tow Pattern:** This value should be H (Horizontal) for normal neuston tows.
   - **Manual Depth (m):** Depth read on EQ50 or chart depth for deep stations.
   - **Mesh:** Should appear as 09 - .946 m, use drop down if different.
   - **Gearcode:** Should appear as 03 – 1x2 m Neuston, use drop down if different.
   - **Comments:** Any pertinent information for this tow (ex. Chart depth used with unit, rough seas, tow cut short due to *Sargassum*, etc.).
6. **STATION TAB:** This information is filled in automatically as the start neuston and stop neuston buttons are pressed. Only change the EQ50 depths to the correct CHART DEPTH when necessary. Use the START time, latitude and longitude for filling in the inside labels.
7. **SUMMARY TAB:** There is no information to be filled out on this tab. They are all automatic.

8. *ON STATION*
9. Click **Start Event** on SCS computer Neuston Event.
10. When both BRIDGE and DECK are ready, have them deploy the neuston. Watch the camera for entry into water.
11. Click **Neuston Start** when net enters water and water is flowing through frame.
12. Change timer on event to read time from when NEUSTON START was pressed. This is your timer.
13. Watch the camera or have deck personnel to monitor tow for *Sargassum*, tow may be shortened to a minimum of 5 min. when *Sargassum* or jellyfish are being caught abundantly.
14. Tell the deck when there are **2 minutes remaining**.
15. **Haul back** when time is up.
16. Click **Neuston Stop** button when neuston clears the water.
17. Correct EQ50 start and end depths if Chart depth is being used.
18. Check through all tabs in the Neuston event for completeness and correctness. Make any necessary changes prior to pressing Stop Event. Once Stop Event is

pressed, no more information can be entered into the event (any missed information can be added in Access).

19. Click **Stop Event**.
20. Click **Exit Event**.
21. No more than ½ full of plankton in jar (use more jars if needed); fill jar 2/3 with sea water before putting in formaldehyde from pump (formalin preserved samples), then ***2 pumps of Form. Bottle per Pint and 4 pumps per Quart***; invert jar 3-4 times to mix. After mixing, make sure settled volume is not more than ½ a jar of plankton. If plankton does not settle into less than ½ jar, split sample into more jars. Use same size jars for multiple jar samples (all pints or all quarts, do not mix jar sizes for same sample).

See instructions above for labels with the following changes:

Mesh: 0.947
Gear: 1 x 2 m neuston
Form to ETOH (use an arrow to show "to" between form and etoh)

APPENDIX 19: SAMPLE INSIDE AND OUTSIDE LABELS

INSIDE LABEL

FRONT

NOAA
NATIONAL MARINE
FISHERIES SERVICE
MISSISSIPPI LABS

STATION #

VESSEL

CRUISE

COMMENTS | B#

INITIAL PRES. → FINAL PRES.

New Label

NOAA
NATIONAL MARINE
FISHERIES SERVICE
MISSISSIPPI LABS

STATION # **001**

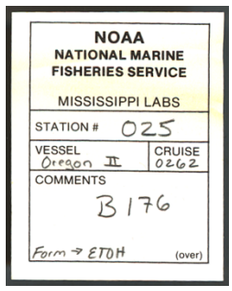
VESSEL **G. Gunter**

CRUISE **0902**

COMMENTS | B# **006**

INITIAL PRES. → FINAL PRES. **Form to ETOH**

Old Label



BACK

SAMPLE #

LATITUDE

LONGITUDE

GMT DATE

GMT TIME | ZONE

GEAR | MESH

HAUL | _____ OF _____

New Label

SAMPLE # ***(Assigned by Plankton Group)***

LATITUDE **30º 00.18 N**

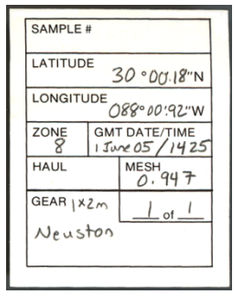
LONGITUDE **088º 00.92 W**

GMT DATE **01 June 09**

GMT TIME **1425** | ZONE **8**

GEAR **1x2 m Neuston** | MESH **0.333**

HAUL **_1_** OF **_1_**



OUTSIDE LABEL

APPENDIX 20: INSTRUCTIONS FOR THE USE AND OPERATION OF THE FISHERIES SCIENTIFIC COMPUTER SYSTEM (FSCS)