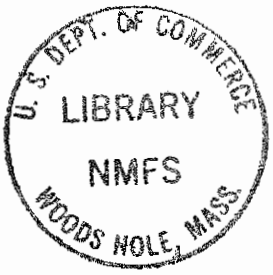
NOAA Technical Memorandum NMFS-F/NEC- 21



MARMAP

Plankton Survey

Manual

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole, Massachusetts

March 1983

NOAA TECHNICAL MEMORANDUM NMFS-F/NEC

The Northeast Fisheries Center (NEFC) conducts targeted research to provide needed information for fisheries resource and habitat managers in the Northwest Atlantic. The NEFC operates facilities in Gloucester and Woods Hole, Massachusetts; Narragansett, Rhode Island; Milford, Connecticut; Sandy Hook, New Jersey; and Oxford, Maryland. It also administers the NMFS's National Systematics Laboratory in Washington, D.C., and Atlantic Environmental Group in Narragansett, Rhode Island. This targeted research focuses on: (1) population sizes and replenishment rates of fisheries resources, (2) environmental quality and biological health of fisheries habitats, and (3) commercial aquaculture and commercial/recreational utilization of seafood species. Users of this information include federal and state agencies, private industry, and the general public.

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Copies of this and other *NOAA Technical Memorandums* are available from the National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161. Recent issues of *NOAA Technical Memorandum NMFS-F/NEC* are noted below:

7. ***Methodology for Identification and Analysis of Fishery Management Options.*** By Brian J. Rothschild, Richard C. Hennemuth, Jacob J. Dykstra, Leo C. Murphy, Jr., John C. Bryson, and James D. Ackert. December 1980. v + 10 p., 5 figs., 1 app. NTIS Access. No. PB81-200834.

8. ***Phytoplankton Community Structure in Northeastern Coastal Waters of the United States. I. October 1978.*** By Harold G. Marshall and Myra S. Cohn. August 1981. Revised and reprinted October 1981. v + 14 p., 4 figs., 1 app. NTIS Access. No. PB82-124561.

9. ***Phytoplankton Community Structure in Northeastern Coastal Waters of the United States. II. November 1978.*** By Harold G. Marshall and Myra S. Cohn. August 1981. Revised and reprinted October 1981. v + 14 p., 3 figs., 1 app. NTIS Access. No. PB82-124579.

10. ***Annual NEMP Report on the Health of the Northeast Coastal Waters of the United States, 1980.*** Northeast Monitoring Program Report No. NEMP IV 81 A-H 0043. August 1981. Revised and reprinted January 1982. xxi + 79 p., 23 figs., 4 tables, 5 app. NTIS Access. No. PB82-124587.

(continued on inside back cover)

NOAA Technical Memorandum NMFS-F/NEC-21

This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information; and has not received complete formal review, editorial control, or detailed editing.

MARMAP Plankton Survey Manual

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Woods Hole, Massachusetts

March 1983

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1. INTRODUCTION

The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program is a National Marine Fisheries Service program providing information in support of marine fishery resources management. MARMAP encompasses the collection and analysis of data to provide basic information on the composition, location, abundance, and condition of the commercial and recreational marine fishery resources of the United States (NMFS 1971 and 1973; TRW 1973a and 1973 b).

The principal elements of MARMAP include resource surveys, analyses of commercial and recreational fish catches and the environment of fish stocks, (fishery oceanography). Each of these elements is important for fisheries resource assessment. Data analysis tasks combine the results of surveys, catch statistics, biometric data (age, growth, fecundity, recruitment, and mortality rates) plus information on environmental and food chain conditions to produce updated stock assessments. MARMAP is presently being conducted from each of four strategically located NMFS Fisheries Centers headquartered at Woods Hole, Massachusetts; Miami, Florida where it is called SEAMAP for Southeastern Area Monitory Assessment and Prediction Program; La Jolla, California; and Seattle, Washington.

Resource Surveys--Three types of MARMAP surveys are conducted. The first (Survey I--Ichthyoplankton) assesses planktonic eggs and larvae of all fish species, pelagic and demersal, as well as other zooplankton which can be sampled with plankton nets. These survey operations have been conducted cooperatively in the Atlantic with the U.S.S.R., Poland, France, Canada, the Federal Republic of Germany, and the Democratic Republic of Germany and in the Pacific with the U.S.S.R., Mexico and Japan. Surveys are also conducted jointly with several state and private research institutions. A second type of survey (Survey II--Groundfish) focuses on the distribution and abundance of groundfish and shellfish species which live at or near the bottom when they

reach harvestable size (e.g. cod, flounder, hake, scallop, lobster, crab, and shrimp). Bottom survey operations are conducted with ICNAF (now NAFO) nations in the northwest Atlantic from Greenland to Cape Hatteras; under contract with the state of South Carolina from Cape Hatteras to the Florida Keys; in the Mississippi delta region; and in the northeast Pacific off California, Oregon, Washington, Alaska, and in the East Bering Sea. A third type of survey (Survey II Pelagic Fish) assesses species that live off the bottom (salmon, herring, mackerel, tuna, squid, menhaden, and others). Surveys of pelagic fish pose special problems. Effective stock assessment of these migratory species requires, among other things, the application of hydroacoustic and remote sensing techniques.

A high degree of uniformity and standardization in Survey I operations is essential to achievement of MARMAP objectives. Every effort must be made to insure data comparability. This document specifies procedures for the at-sea collection and laboratory analyses of MARMAP Survey I data.

The reader should also consult the following two manuscripts: "Collecting and processing data on fish eggs and larvae in the California Current region" by Kramer, Kalin, Stevens, and Thrailkill; and "Standard techniques for pelagic fish egg and larva surveys", by Smith and Richardson (see Section 5 for full citations), which were important to the development of this manual.

Additional details of the MARMAP Program may be obtained from the U.S. Department of Commerce, NOAA/NMFS, Woods Hole, Massachusetts.

2. AT-SEA DATA COLLECTION

2.1 INTRODUCTION

This section contains specifications and procedures for the at-sea acquisition of standardized MARMAP Survey I data. Log forms for the recording of data are included. Techniques for the quality control of all data are presented. Survey I methodology is described separately from that of Surveys II and III. In practice, however, these surveys are conducted simultaneously

whenever possible.

Certain specifications for the recording of observed data for the cruise in general are also given. These specifications are based on considerable experience in data acquisition and a long-term commitment to quality control. Deviations from these methods must be accompanied by thorough descriptions of methods and quantitative units employed.

NOTE: The log forms in this document are presented as a guide to those intending to do MARMAP Survey I. Researchers may find log forms of a different format more useful for their particular cases. However, regardless of the log form used, all the individual data fields mentioned herein must be logged for analyses required by MARMAP.

Considerable duplication can be found in the logging instructions particularly for coded items. This was deliberate to permit each section to be complete in itself and to be easily extracted and used separately from the Manual.

Logs have been reduced for inclusion in this manual. Actual sizes are 8½" X 11" or 14" with data entry blocks ¼" high.

2.2 THE MARMAP STATION

A MARMAP station is defined as any event from which data result that can be identified by time, date and position. It has, for most routine operations, one position but may involve a number of activities. Stations are numbered consecutively beginning with the first station of a cruise. The number assignment is made at the time of station occupation, not prior to the cruise. The latter practice does not provide for the unforeseen but sometimes necessary addition of stations and creates later difficulties and confusion during data processing and analysis. The policy of numbering bathythermograph (BT) lowerings

separately or not numbering between stations BT's is incompatible with a data base management approach. Therefore, BT lowerings should be considered a station and be assigned a station number. Underway observations which can be identified by a single position (latitude and longitude), e.g., bird or marine mammal observations, also should be assigned a station number. Data collection which involves multiple positions, e.g., drift buoy current measurements, should be assigned a station number and station position at the beginning of the collection, with multiple position data included with the data of the experiment--not the data of the station.

In order that the various types of data resulting from a station could subsequently be efficiently integrated and compared for ecological as well as quality control analyses, this integrated concept must be in evidence during all steps from data capture through data processing, and later analysis. A "master" station log containing information on the time and place of the station, the conditions existing there, and the types of experiments conducted, is the first requisite for conforming to this concept. One of these logs must be prepared for each numbered station. Logging may be done by the ship's bridge personnel to achieve uniformity at the very outset. In any case, this "master" station log is the only log sheet which lists the station position--this is done deliberately to prevent the proliferation of divergent data. Following each cruise these logs are used to produce an accepted list of station positions for the voyage. This list is made promptly available to all who are to be involved in the analyses of cruise data. Specifications for master station data are given in Section 6, Appendix I.

2.2.1 MARMAP Master Station Record

Figure 2.1 shows an example of a master station log, the MARMAP Master

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PAGE _____ OF _____

MARMAP MASTER STATION RECORD (MSR)

OPERATIONAL UNIT _____

Vessel ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Cruise ☐☐-☐☐☐

Station Number	ARRIVAL DATE (GMT) D D M M Y Y	Latitude D D M M H	Longitude D D D M M H	ARRIVAL TIME (GMT) H H M M	BOTTOM DEPTH (m)	WIND (KNOTS)	WIND DIRECTION	WIND T/M	AIR TEMP. (°C)	SURFACE TEMP (°C)	CLOUD TYP AMT	WAVE HEIGHT (m)

Position Check By:

CHECK	TYPE OF OBSERVATION	START TIME (GMT)	END TIME (GMT)
	MBT		
	XBT		
	STD		
	HYDRO - 1.7 L NISKIN		
	HYDRO - 50 L NISKIN		
	ROSETTE SAMPLER		
	NUTRIENTS		
	OXYGEN		
	PLANT PIGMENT		
	PLANT PRODUCTIVITY		
	BONGO 61 cm		
	BONGO 20 cm		
	NEUSTON		
	BOTTOM TRAWL		
	CPR		
	UOR		

OTHER TYPES OF OBSERVATIONS			

Remarks, Damage, or Loss:

Recorded by: _____ Reviewed by: _____

MARMAP MASTER STATION RECORD (MSR) FORM MSR (10/80)

Figure 2.1 The MARMAP Master Station Record

Station Record (MSR). Instructions for completion of the log form are presented below:

MARMAP Master Station Record (Form MSR, 10/80)

NOTE: In the event that data are not available due to equipment malfunction or other cause, enter an X in the appropriate space on the log, and give reason under "Remarks" area.

Operational Unit — Name of institution preparing this log, e.g., ZSOP, SWFC, U.S. Coast Guard.

Vessel — The full name of the vessel making the cruise.

Cruise — The last two digits of the year of the vessel's cruise, followed by a hyphen and the consecutive number of the voyage of that vessel in that year.

Station Number — The number of the station assigned consecutively beginning with the first station of the cruise.

Arrival Date — Greenwich date (day-month-year) of the arrival on station.

Latitude — The latitude of the station to the nearest whole degree and whole minute north or south.

Longitude — The longitude of the station to the nearest whole degree and whole minute east or west.

Position Check By: — Enter initials after having checked acceptability of position with bridge.

Arrival Time — The Greenwich Mean Time of arrival on station.

Bottom Depth — Depth to the bottom at this station to the nearest whole meter.

Wind Speed — Wind speed (sustained) at arrival on station to the nearest whole knot.

Wind Direction — Wind direction at arrival on station to the nearest whole degree, magnetic or true.

NOTE: Under the "Remarks" section, record any signigicant wind speed and/or direction deviations occurring subsequent to those existing at station arrival time.

If readings are taken while the vessel is dead in the water, the wind direction has to be corrected for the vessel heading. If the vessel is underway both the speed and direction of the wind have to be corrected using a wind vector computer, e.g., Felsenthal Instruments.[1]

Air Temp. — Air temperature (dry bulb) at arrival on station, to the nearest 0.1 degree Centigrade.

Surface Temp. — Temperature of the surface water at this station to the nearest 0.1 degree Centigrade.

Cloud Cover Type — Dominant cloud type present at arrival on station entered according to the table below and Figure 2.2.

HEIGHT GROUP (Average height to base)	CLOUD TYPE	ENTER
High Clouds	Cirrus	0
(16500-45000 ft)	Cirrocumulus	1
	Cirrostratus	2
Middle Clouds	Altocumulus	3
(6500-23000 ft)	Altostratus	4
Low Clouds	Nimbostratus	5
(0-6500 ft)	Stratocumulus	6

[1] Trade names referred to in this manuscript do not imply endorsement of commercial products.

CIRRUS

CIRROCUMULUS

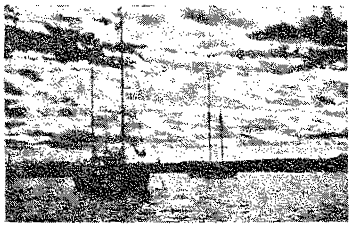
CIRROSTRATUS

ALTOCUMULUS

ALTOSTRATUS

Low, dark, shapeless cloud layer, usually nearly uniform, but sometimes with ragged, wet looking bases. Nimbostratus is the typical rain-cloud. The precipitation which falls from this cloud is steady or intermittent, but not showery.

NIMBOSTRATUS



STRATOCUMULUS

STRATUS

CUMULUS

CUMULONIMBUS

Figure 2.2 Basic Cloud Types (For more details see: Cloud Code Chart, U.S. Dept of Commerce - NOAA, National Weather Service, WS TA B-0-20, Revised 9/72.)

Stratus	7
Cumulus	8
Cumulonimbus	9
Cloud not visible owing to darkness, fog or other analogous phenomena	X

Cloud Cover Amount — Amount of celestial dome covered with clouds to the nearest OKTA (1/8) entered according to the list below:

CLOUD AMOUNT (OKTAS)	ENTER
0	0
1 OKTA or less, but not zero	1
2 OKTAS	2
3 OKTAS	3
4 OKTAS	4
5 OKTAS	5
6 OKTAS	6
7 OKTAS	7
8 OKTAS	8
Sky obscured, or cloud amount cannot be estimated.	9

Wave Height — The vertical distance between trough and crest of local wind generated waves, to the nearest 0.1 meter.

Type of Observation Check — Enter a check mark in front of the type of observation(s) made at this station.

Type of Observation Start Time and End Time — The Greenwich Mean Time of the beginning and ending of any type of observation at this station.

Other Types of Observations	The types and Greenwich Mean Times for observations not preprinted.
Remarks, Damage, or Loss	Enter any damage or loss of gear, and any other information useful to the interpretation of the data recorded on this log.
Recorded By	Name of individual filling out the log.
Reviewed By	Name of individual reviewing the log.

2.3 MARMAP SURVEY I (ICHTHYOPLANKTON)

2.3.1 Platforms and Equipment

2.3.1.1 Vessels

Generally, vessels utilized for these operations will be in the 30 to 60 meter (100 to 200 foot) length category. For example, the average length of an NMFS fisheries research vessel is 46 meters (151 feet). For inshore operations, a minimum length of 18 meters (60 feet) is usually necessary; however, small vessels may be acceptable under certain circumstances and provided that they can meet other Survey I requirements.

Minimum functional requirements and performance specifications for Survey I vessels are provided below.

2.3.1.1.1 Speed and maneuverability

The vessel shall have requisite sensitivity and response in speed adjustments to maintain a constant wire angle (measured from the vertical) of $47^{o} \pm 5^{o}$ for up to thirty minutes during the Bongo tows. The vessel shall have the capability of maintaining a constant selected speed between 1.0 and 2.0 knots, with variations about the constant selected speed not to exceed $\pm$ 0.25 knots.

NOTE: The speed and maneuverability requirement is a consequence of the more specific requirements that

the Bongo net shall sample equal volumes of water at all depths between the surface and 200 meters; that the speed of the net through the water shall be such that plankton avoidance and extrusion and sample damage are minimized; and that comparable data result to support the long term, standardized monitoring objectives of MARMAP.

In addition, the vessel must be capable of maintaining a minimum speed of 8 knots during transit for sustained periods amounting to several days.

NOTE: When arranging for vessel use by charter, preference will be given to qualified vessels capable of higher transit speed (>8 knots) in order that cost savings may be realized through reduction of transit time.

Each vessel shall be sufficiently instrumented so that its speed relative to the water may be determined to within $\pm$ 0.25 knots.

2.3.1.1.2 Range and endurance

Desired minimum endurance for Survey I vessels is 20 days at sea. Desired minimum range capability is 7450 km (4000 nm).

NOTE: Smaller vessels of more limited range and endurance may be used for conduct of Survey I activities nearer shore. Providing these vessels can meet other requirements, acceptable minimum range and endurance would be 1860 km (1000 nm) and 7 days at sea.

2.3.1.1.3 Deck area

Deck area for deployment and handling of biosampling and environmental gear shall be a minimum of 18.6 m^2 (200 ft^2). The area will be located such that: (1) sampling gear may be deployed from the side of the vessel; and (2) distance to the laboratory area is minimal.

Provision shall be made to safely secure all sampling gear on deck during vessel transit and during operations in heavy seas.

2.3.1.1.4 Laboratory area

Adequate laboratory area shall be provided aboard all MARMAP Survey I vessels to accommodate the specified procedures for preservation and labeling of biosamples.

Laboratory area shall be configured to separate the "wet" operations from "dry" operations (i.e., operations such as handling Nansen or Niskin bottles, rosette multi-bottle array, biosamples, etc., shall be separated from operations requiring a dry area such as data tabulation, data reduction, and on-board calculations and analysis). The "wet" laboratory shall be equipped with standard laboratory equipment, including workbenches, storage cabinets, drawers, racks, shelves, tables, sinks, and lighting. Configuration of laboratory areas may vary from ship to ship.

2.3.1.1.5 Storage area

Storage capacity shall be provided for the biological samples (minimum of 4 bottles per station, either 1 liter or 1 quart bottles). For a 30-day cruise, a minimum storage volume of 1.41 m^3 (50 ft^3) is required. In addition, approximately 0.28 m^3 (10 ft^3) are needed for storage of 4 and 8 liter (or gallon and 2-gallon) jars or cans (capacity for 12 to 24 of each) to preserve large nekton. A small amount of storage space (1.1 m^3 or 40 ft^3) is required for storage of jars to contain dried biomass samples. Racks of sufficient strength

to support the full sample bottles in heavy seas without breakage must be provided. Shelves shall be at least 0.3 m (1 ft) deep. The storage areas should be located in areas of the vessel where motion due to pitch and roll are minimal. Provision shall be made for securing individual containers to prevent their shifting with vessel motion.

The acceptable temperature range for storage of biosamples is 10^{o}C to 30^{o}C. On vessels operating in areas where it is possible for ambient climatic extremes to cause storage room temperatures to be outside these specified temperature limits, temperature control equipment is required to maintain the stated limits.

2.3.1.1.6 Deck equipment

Deck equipment shall include all equipment such as davit(s), boom(s), sheaves, etc., for deployment of sampling gear. Bongo and Neuston nets must be deployed from the side of the vessel. For Bongo and Neuston net sampling, the boom or davit shall be positioned such that the nets will enter the water forward of an imaginary line forming a 30^{o} angle (apex at propellors) with the ship's center line. Deployment aft of this line is not acceptable.

A hydrographic "cage" is required for crew safety and to enable the safe handling of sampling gear without danger of damage and loss of samples due to contact with the side of the vessel in heavy seas. Additional equipment requirements are:

a. Wire angle inclinometer.

b. Remote wire angle readout (in pilot house), to permit control of wire angle to $\pm$ 5^{o} (recommended).

c. Hose (connected to salt water bib) for wash-down on Bongo, Neuston, nekton nets. Water pressure shall be 10 psi minimum.

d. Reversible winch capable of variable speed controlled power hoisting, power lowering, and gravity lowering. The drum must have a cable length counter and level wind mechanism and shall accommodate at least 500 meters of 6.4 mm (1/4 inch) cable.

NOTE: The requirement for a drum capacity for 1/4 inch cable does not infer that 1/4 inch must be used. For instance, 3/16 inch hydrographic cable may be utilized. The winch will have sufficient power to produce a line pull of approximately 680 kg (1500 lbs) at approximately 122 m/min (400 ft/min) at mean drum layer. Winch will be located such that the operator has line of sight to the person handling the sampling gear.

2.3.1.1.7 Navigation

Vessels shall be equipped so that the position can be determined to no less than the nearest whole minute of longitude and latitude. The capability of measuring bottom depth to the nearest whole meter is required. Vessel masters shall be required to log measured position coordinates at beginning of each station, and to maneuver to maintain position ($\pm$ 0.5 nm) during the station.

2.3.1.1.8 Communications

Shipboard communications must be adequate to permit continuous contact between bridge and deck gear deployment area to ensure maintenance of correct wire angles, as well as to assure safety of personnel and gear.

2.3.1.2 Environmental Data Acquisition

In order to meet MARMAP program objectives environmental measurements concurrent with those for ichthyoplankton, groundfish, and pelagic fish must be made. Researchers working under auspices other than MARMAP are urged to

collect these related data whenever possible. They consist of physical oceanographic data, meteorological data, as well as data on phytoplankton standing crop and productivity.

Physical oceanographic measurements required break down into two basic categories: (1) those parameters needed to identify water mass characteristics associated with fish egg and larva distribution and abundance (temperature, salinity, nutrients, dissolved oxygen); and (2) those parameters needed for determination of upper-ocean circulation dynamics, both geostrophic and wind driven (temperature and salinity to the depth of no motion, and surface wind vector).

Phytoplankton standing crop (chlorophyll concentration) and productivity (rate of uptake of carbon-14) measurements are necessary to determine the potential of the areas under investigation to support higher trophic level resources.

Meteorological data requirements consist of standard maritime meteorological observations at synoptic hours (0000, 0600, 1200, 1800 G.M.T.).

Methods which will produce data comparable with those of MARMAP may be obtained from the U.S. Department of Commerce, NOAA/NMFS, Woods Hole, Massachusetts 02543.

2.3.2 MARMAP Bongo Sampler

The standard sampling gear for all MARMAP Ichthyoplankton (Survey I) operations is the Bongo net (Posgay and Marak, 1980)(Fig. 2.3). It consists of two cylindrical mouth openings in which flowmeters (General Oceanics, or equivalent) are fastened. The towing wire passes between the cylinders and is therefore not in the sampling path. To obtain flowmeter readings representative of the entire mouth the meter must not be closer to the wall than 6 times the wall thickness. The nets are of a cylinder-cone configuration,

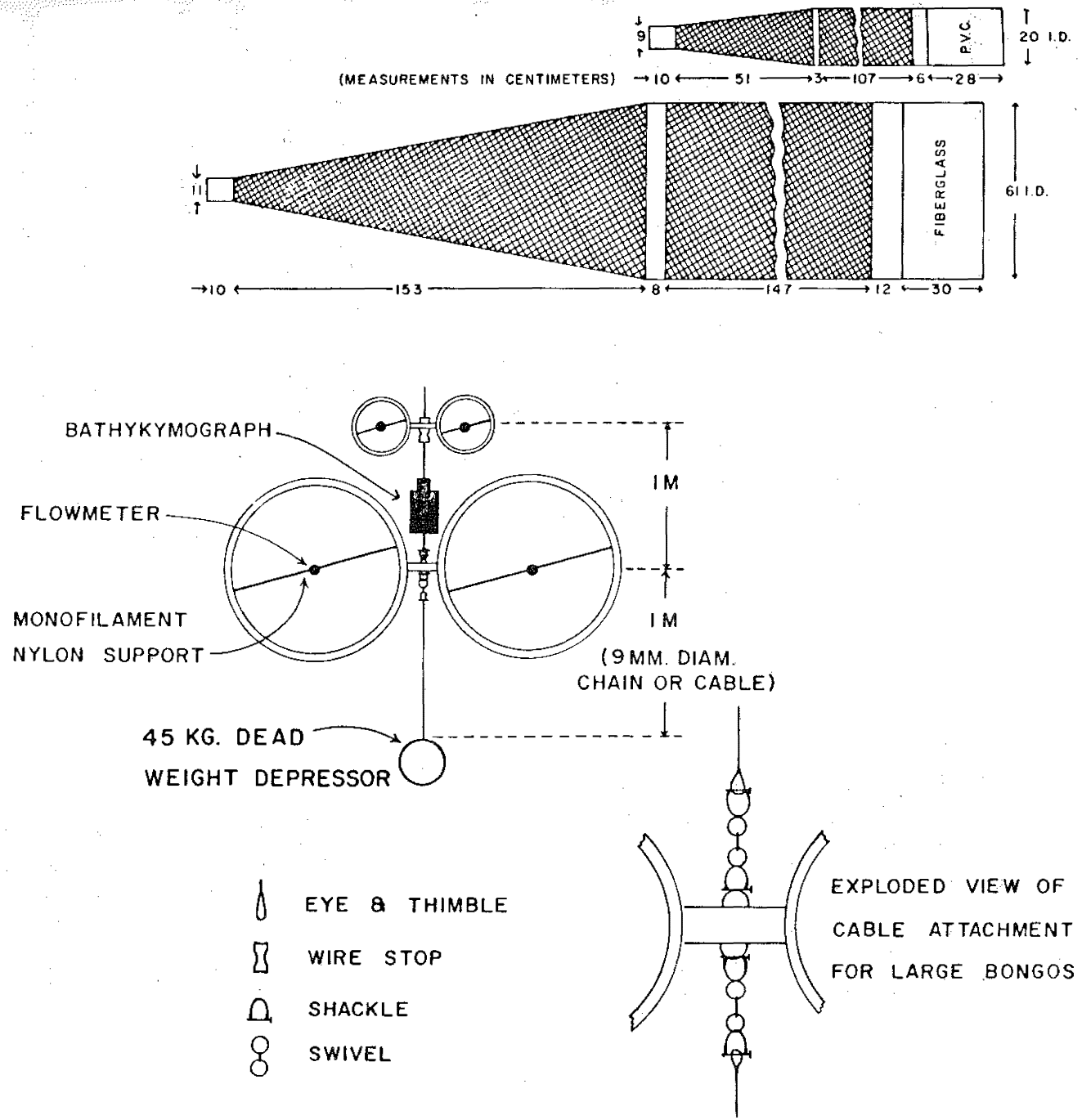


Figure 2.3 Arrangement of MARMAP Bongo Samplers on Tow Wire (after Posgay and Marak, 1980)

3.6 m long. The mesh aperture of one net is 0.333 mm and of the other net, 0.505 mm, and the ratios of their mouth areas to total netting aperture areas are 1:7.3 and 1:7.9, respectively. Cod end beakers or socks are recommended (Fig. 2.4).

A depressing force is necessary to achieve desired results. At towing speeds of 1.5-2.0 knots a 45 kg dead weight depressor is sufficient. Towing wire must be at least 4.8 mm (3/16 inch) diameter and of 300 m length plus that necessary for all rigging and a safe amount on the winch. Although tension during towing is about 250 kg (670 pounds) it may be as high as 1000 kg (2679) pounds) under dynamic loads. A Bendix Model T-1, or equivalent, time-depth recorder (to record tow profile) is attached to the towing wire just above the attachment of the net. Each instrument must be calibrated at sea at the beginning and end of its use.

For special studies a 20 cm mouth diameter Bongo sampler may be used in addition, or in place of, the 61 cm Bongo.

2.3.2.1. Double Oblique Tow

The standard tow for all MARMAP Ichthyoplankton (Survey I) operations is the double oblique. This is a tow during which the sampler describes an oblique path and samples during one descent and one ascent. Multiple oblique ("yoyo") tows results in data which are not comparable to double oblique tows. Therefore, "yoyo" tows constitute a different tow type.

There should be no time spent at depth (horizontal sampling), and all depth strata should be sampled equally (i.e., the paths of descent and ascent should be straight lines).

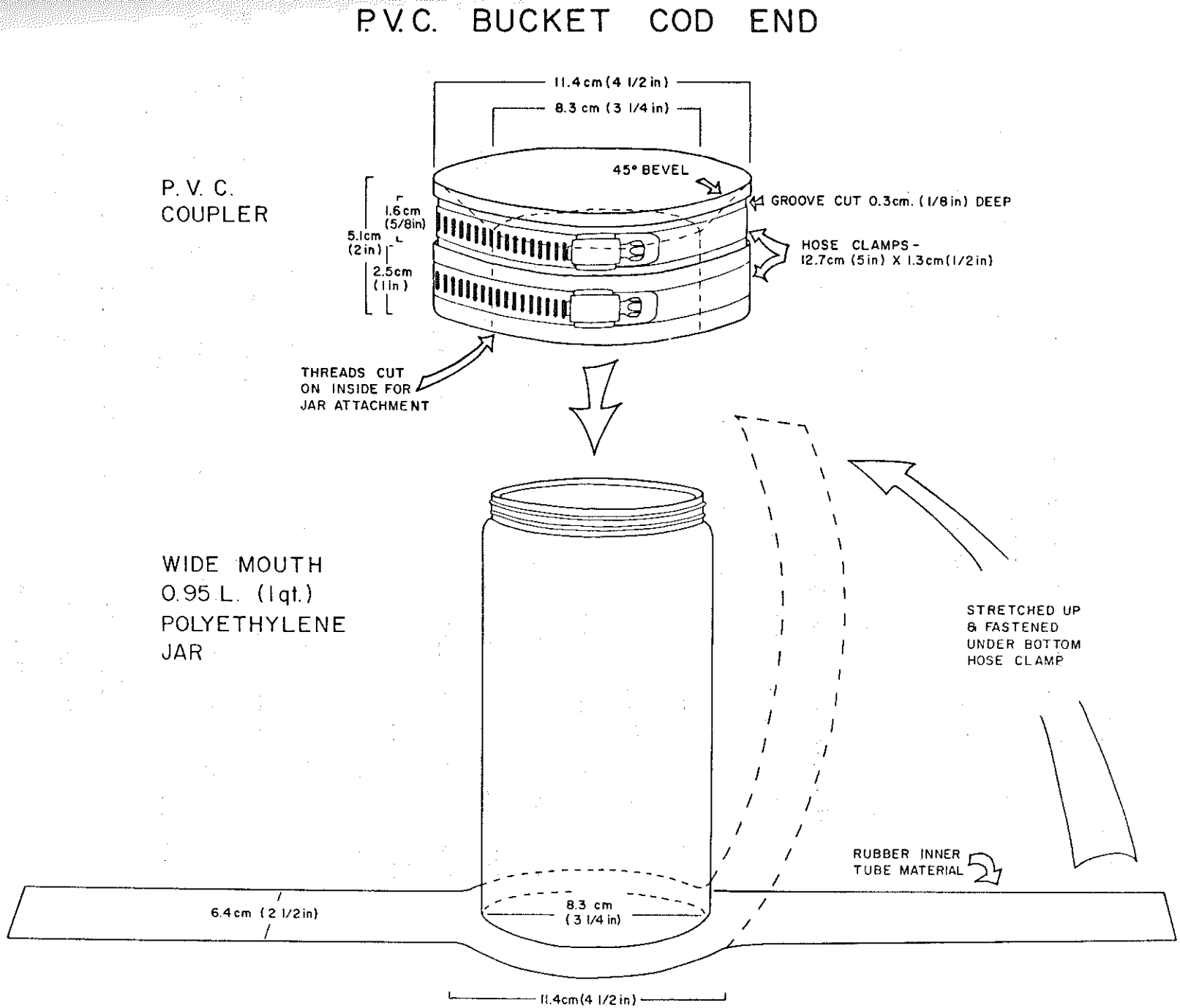


Figure 2.4 Cod end beaker for the MARMAP 61 cm Bongo net

2.3.2.2 Depth of Tow

The desired depth of the tow is to within 5 m of the bottom or to a maximum of 200 m. Figure 2.5 is presented to aid in initially determining the amount of wire out to achieve desired depths. It is based on several hundred tows made by different ships under a variety of conditions. However, routine checks of time-depth records must be made and wire out for desired depths adjusted accordingly.

2.3.2.3 Recording of Tow Times

Start and end times for a Bongo tow are measured at flowmeter entry into and exit from the water, respectively.

2.3.2.4 Towing Speed

Towing speed is between 1.5 and 2.0 knots. Higher speeds introduce variables, particularly extrusion, which make inclusion of the data with those from standard tows difficult. For vessels without means for measuring speed a valid tow may be achieved by monitoring wire angles during retrieval (Section 2.3.2.6).

2.3.2.5 Flowmeters

At the beginning of each tow both flowmeter readings are recorded ("Flowmeter Start") to the nearest whole revolution (see MARMAP Zooplankton Sample Log, Section 2.3.2.12). Care must be taken to prevent this reading from changing prior to the commencement of sampling, e.g., "windmilling".

NOTE: Flowmeters are calibrated at the beginning and ending of each cruise. Calibration can be done by towing the flowmeters (attached to a suitable frame) over a known distance at several towing speeds between 1.5 and 2.0 knots. For calibration in open water

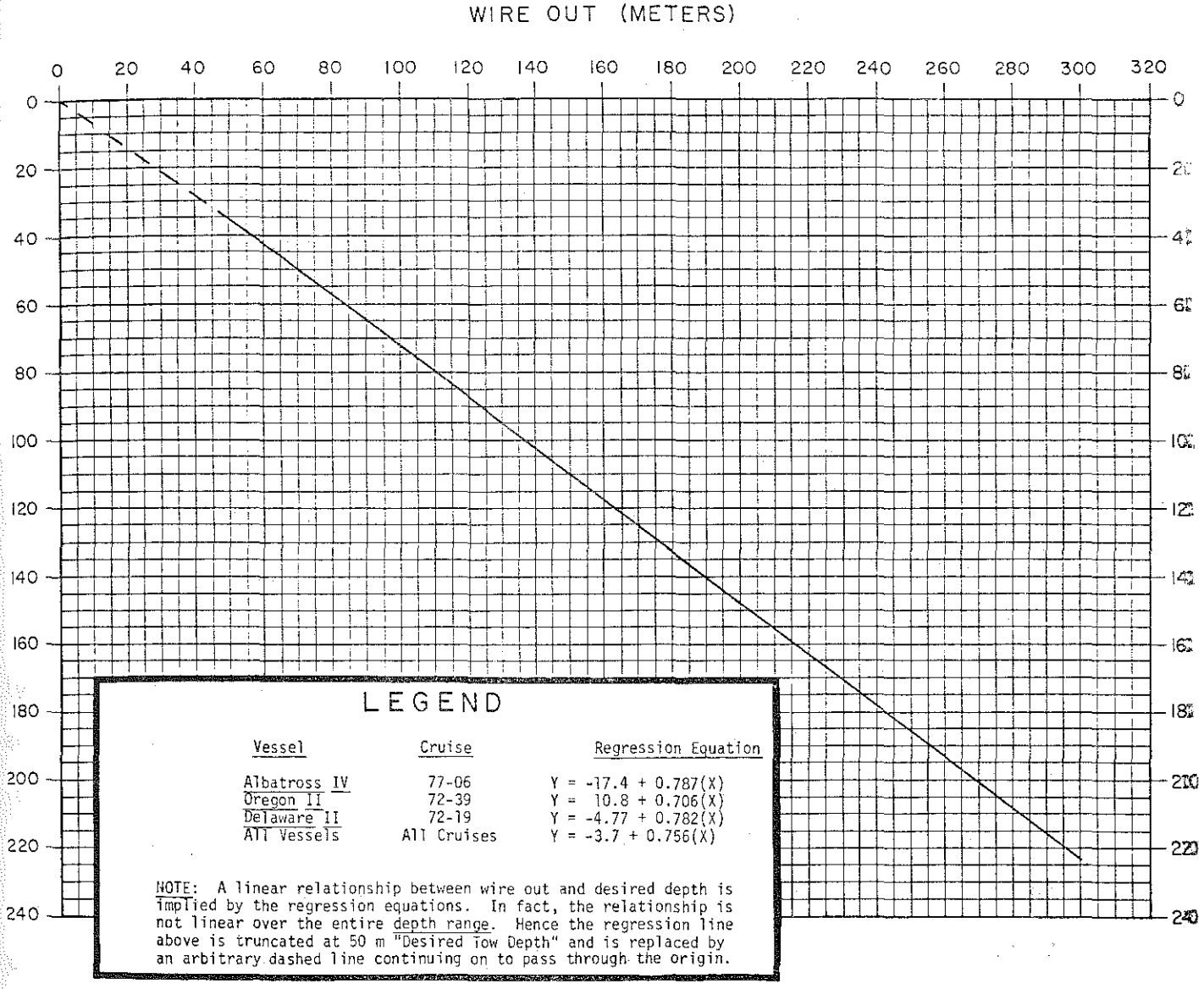


Figure 2.5 Graph of amount of wire out to achieve desired sampling depth for a standard MARMAP Bongo array

conditions where currents exist, at least 2 tows in opposite directions must be made. A calibration factor is calculated for the length of a column of water needed to affect one revolution of the flowmeter (meters per revolution) at each towing speed. The units of the factor (meters per revolution) were chosen so that the factor would be applicable to nets of different mouth area for obtaining volume of water filtered:

Volume Filtered = Flowmeter Revolutions x Calibration Factor x Mouth Area.

2.3.2.6 Towing Procedure

With the ship on course and steaming at 1.5-2.0 knots the Bongo array is launched. Start time for the tow is the time the flowmeter enters the water (note any "windmilling"). The towing wire is payed out at a rate of 50 m/min. For measuring elapsed times during the haul a stop watch is strongly recommended. As soon as the necessary wire length is reached retrieval begins. Retrieval rate is 20 m/min. Ship speed should be maintained in order to keep the towing wire close to an angle of 47° (measured from the vertical). Wire angle is measured by an inclinometer which may be of the telemetering or non-telemetering type. If a telemetering inclinometer is used, the angle of stray can be controlled from the bridge and, at least for large vessels, the response is likely to be more satisfactory. When a non-telemetering inclinometer is used the winch operator or the recorder observes the wire angles during the tow and signals the bridge if the desired angle is not being maintained. In either case an observer on deck records wire angles for each 10 meters of wire during retrieval. Both the "time going out" and the "time coming in" (to the

flowmeter's exit from water) are recorded. Standard tows result in zero "time at depth".

2.3.2.7 Time-Depth Recorder

After taking the sampler on board the TDR trace shall be examined to determine the tow's acceptability. Payout ("time going out") and retrieval ("time coming in") durations must be within $\pm$ 5% of those resulting from dividing the maximum wire out for the haul by the rates given in Section 2.3.2.6.

Ideally the lines of descent and ascent should be straight--indicating that descent and ascent rates have been constant. If no TDR was used, but wire angle measurements were taken during both pay out and retrieval, calculations of the rate of descent and ascent can be made by the formula:

$$\text{Rate}^* = \frac{[(L_1)\ (\cos\ \theta_1)\ ] - [(L_2)\ (\cos\ \theta_2)]}{t_2 - t_1^{**}}$$

where:

L_1 = wire out at start of increment

$\cos\ \theta_1$ = cosine of wire angle at start of increment

L_2 = wire out at end of increment

$\cos\ \theta_2$ = cosine of wire angle at end of increment

t_1 = time at start of increment

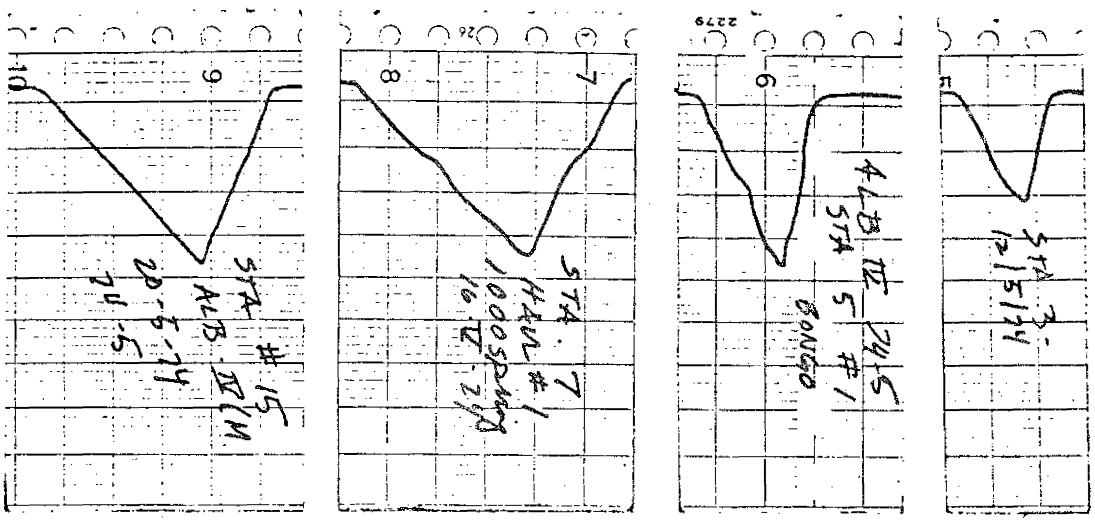
t_2 = time at end of increment

*Rate is positive (+) for ascent and negative (-) for descent.

** $t_2 - t_1$ should equal 12 sec for payout and 30 sec for retrieval.

Normally, however, a judgement must be made on the acceptability of the tow, and a small amount of variation from the ideal is tolerated (see Fig. 2.6.). If the tow profile is unacceptable, the tow must be repeated.

ACCEPTABLE



UNACCEPTABLE

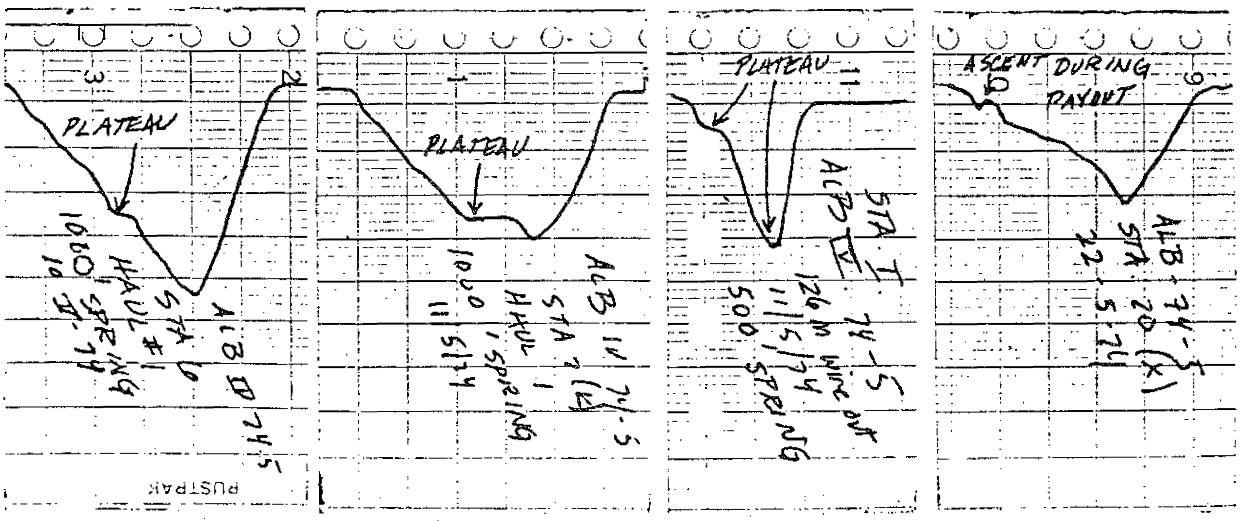


Figure 2.6 Examples of acceptable and unacceptable tow profiles for double oblique MARMAP Bongo tows

2.3.2.8 Performance of Flowmeters

Record the readings of both flowmeters ("flowmeter end") and note any observed or suspected reasons for questionable values (excess windmilling, damage, fouling of meter, or apparent clogging of meshes). Visual inspection of the net and/or the number of flowmeter revolutions for a particular duration and speed of deployment can, with experience, be indicative of clogging. Erratic readings are sometimes unavoidable. If clogging is the cause it probably would be unreasonable to repeat the tow.

2.3.2.9 Rinsing Net-Removing Sample

The nets are held off the deck by hand or by tackle and their contents are rinsed to their cod ends by a gentle spray of salt water directed from their outsides.

> NOTE: In warm waters the cod ends of the nets should be dipped into a 20% formalin and sea water solution as they come aboard to harden specimens prior to further handling.

The samples are then quantitatively transferred to appropriately labeled (for the 0.333 mm and 0.505 mm mesh apertures) buckets or, if sample volume is small enough, the cod end socks or beakers provide a means for separating the samples from the nets.

> NOTE: The buckets often contain a great deal more water than is desirable to preserve. This may be eliminated by the use of a draining pan with meshes smaller than those of the collecting net (see Table 2.1). A common brass geological sieve works very well for this operation. Also, on some

Table 2.1 Draining pan apertures to be used with various collecting nets.

Mesh Aperture of Collecting Net (μ)	Coarsest Acceptable Mesh Aperture of Draining Pan (μ)
947	333
505	333
333	253
254	153

occasions the sample may contain large quantities of jelly fish, salps, etc. They may be too large to fit into the sample jars available. On such occasions, as carefully and completely as possible, separate these organisms, rinse any small adhering organisms into the bucket containing the sample, log a description of the large organisms and estimated volume and discard them.

Quantitatively transfer the sample from the bucket or beaker to the draining pan. After the water has drained off, transfer the sample to a one quart sample jar(s) using a minimum of sea water from a rinse bottle directed at the under side of the mesh of the pan. Use extra jars when necessary so that no jar is more than 1/2 full of suspended, or 1/4 full of drained organisms. Add sea water to about 3/4 full before introducing the preservative, to avoid "burning" the delicate specimens.

2.3.2.10 Preservation of Sample

Add buffered, concentrated formalin to each sample jar and top off with sea water (see Table 2.2).

NOTE: Formalin is a saturated aqueous solution of formaldehyde gas, about 40% formaldehyde by weight. The preferred buffer is marble chips. These are added to the formalin supply container, not the sample container, in a quantity to produce an excess base. This results in a sample container receiving a preservative which is basic, but one which will not remain so indefinitely. Investigators working on samples containing delicate calcareous specimens may wish to alter the preservative they use. For

Table 2.2 Milliliters of concentrated formalin added to sample for various concentrations

SAMPLE JAR SIZE (oz)	CONCENTRATIONS					
	3%	4%	5% (PLANKTON)	6%	8%	10%
2	1.8	2.4	3.0	3.6	4.8	6.0
4	3.6	4.8	6.0	7.2	9.6	12.0
8	7.2	9.6	12.0	14.4	19.2	24.0
16	14.4	19.2	24.0	28.8	38.4	48.0
32 (1 qt)	28.8	38.4	48.0	57.8	76.8	96.0
128	115.2	153.6	192.0	230.4	307.2	384.0
640 (5 gal)	576.0	768.0	960.0	1152.0	1536.0	1920.0

further information about preservatives, see Steedman (1976).

Extreme caution should be exercised when formalin is being used as there are indications that it can cause serious health problems.

2.3.2.11 Specimen Jar Labels

Fill out and apply outside and inside jar labels. Inside labels are written with waterproof ink (Higgins Engrossing Ink, No. 892, which does not clog the pen--Kohinoor Rapidograph No. 1 or 0 --or equivalent). Outside labels, due to their oily surface texture, are written with ball point pen. Preprinting and color coding these labels for the gear and mesh used is helpful. Figure 2.7 shows examples of inside and outside labels of this kind.

Instructions for completion of these labels are presented below:

MARMAP Jar Labels (Form JAR, 9/78)

Jar labels are preprinted and color coded for the common gear and mesh used. Inside labels are written with waterproof ink (Higgins Engrossing Ink, No. 892, which does not clog the pen--Kohinoor Rapidograph No. 1 or 0 -- or equivalent). Outside labels, due to their oily surface texture, are written with ball point pen.

Date (GMT) — The date (Greenwich Mean Time) of the start of the haul.

Vessel — The full name of the vessel making the cruise.

Cruise — The last two digits of the year of the vessel's cruise followed by a hyphen and the consecutive number of the voyage of that vessel in that year.

Station — The number of the station assigned consecutively beginning with the first station of the cruise.

Haul — The consecutive time a particular type of tow was made at this station, e.g., if the 61 cm Bongo was towed three

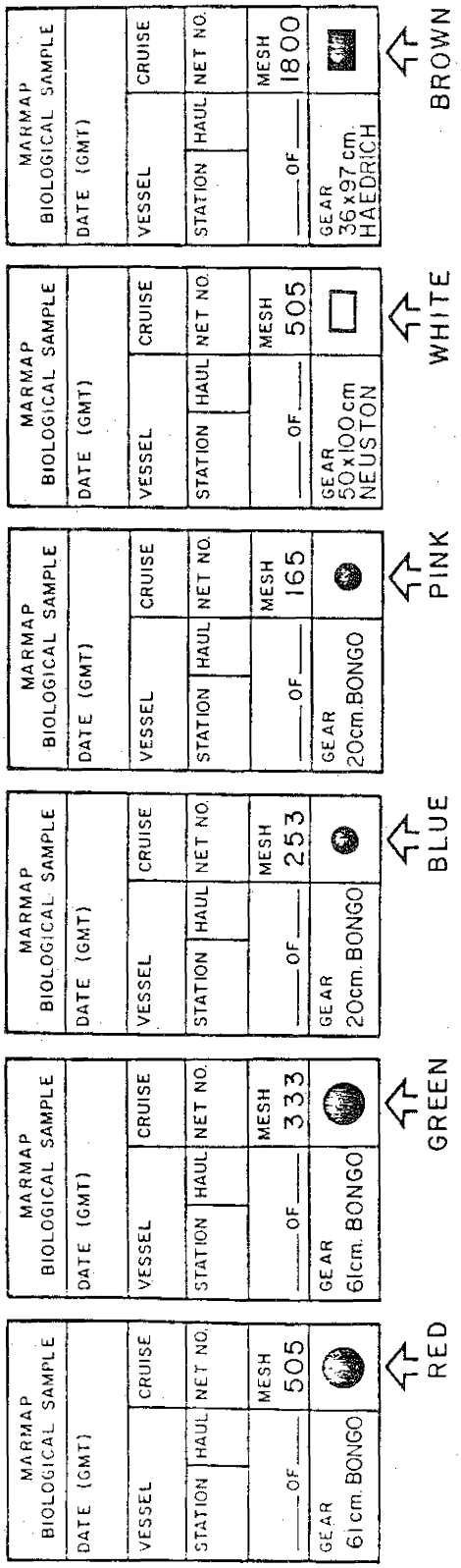


Figure 2.7. MARMAP specimen jar labels. Inside labels are printed with waterproof ink on 100% rag linen paper. Code for gear and mesh appears as colored symbol at lower right. Outside labels are also printed with waterproof ink but on adhesive tape rolls, e.g., "Time Tape", Professional Tape Co. Inc. The entire label is colored to indicate gear and mesh.

separate times at this station, three Zooplankton Sample Logs should be filled out for hauls 1, 2, and 3. Unsuccessful hauls which result in no sample, or a sample which will not be retained, are not assigned haul numbers. Note reasons for failure under "Remarks" on the Zooplankton Sample Log.

Gear No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

__ of __ — The consecutive number of the jar plus the total number of jars containing the sample from this haul.

Mesh — Enter the mesh aperture size in microns, e.g., 1800, 253, 333.

Gear — Enter the whole name of the gear used for the haul.

2.3.2.12 MARMAP Zooplankton Sample Log

Fill in appropriate parts of the Master Station Record and prepare a log sheet for the plankton experiment. Specifications for zooplankton tow data are given in Section 6, Appendix I. Figure 2.8 shows an example of the MARMAP Zooplankton Sample Log (ZSL).

Instructions for completion of the log form are presented below:

MARMAP Zooplankton Sample Log (Form ZSL, 10/80)

NOTE: In the event that data are not available due to equipment malfunction or other cause, enter an X

U.S. DEPT. OF COMMERCE NOAA
NATIONAL MARINE FISHERIES SERVICE

MARMAP ZOOPLANKTON SAMPLE LOG
(ZSL)

OPERATIONAL UNIT ______________________

Vessel [ ] Cruise [ ]-[ ]

MARMAP ZOOPLANKTON SAMPLE LOG (ZSL) FORM ZSL (10/80)

STATION NUMBER	HAUL NO.	START TIME (GMT)	START DATE (GMT) D D M M Y Y	SHIP SPEED(kt)	SHIP HEADING (Deg) (M/T)	MEAS. TOW DEP. (M)	TIME GOING OUT M M S S	TIME AT DEPTH M M S S	TIME COMING IN M M S S	DURATION OF TOW M M S S	DEPTH INSTRUMENT MAKE	SER. NO.	SPRING DEP.

Gear ID Number	Gear/ Mesh	BOTTLES FILLED	Flowmeter Start	Flowmeter End	FLOWMETER NO.	TYPE OF TOW	TDR TRACE	MAX WIRE OUT (M)	ANGLE AT M.W.O.

Gear ID Number	Gear/ Mesh	BOTTLES FILLED	Flowmeter Start	Flowmeter End	FLOWMETER NO.	TYPE OF TOW	TDR TRACE	MAX WIRE OUT (M)	ANGLE AT M.W.O.

Gear ID Number	Gear/ Mesh	BOTTLES FILLED	Flowmeter Start	Flowmeter End	FLOWMETER NO.	TYPE OF TOW	TDR TRACE	MAX WIRE OUT (M)	ANGLE AT M.W.O.

Gear ID Number	Gear/ Mesh	BOTTLES FILLED	Flowmeter Start	Flowmeter End	FLOWMETER NO.	TYPE OF TOW	TDR TRACE	MAX WIRE OUT (M)	ANGLE AT M.W.O.

Remarks:

WIRE ANGLES DURING RETRIEVAL WITH WIRE OUT =	300	290	280	270	260	250	240	230	220	210	200	190	180	170	160	150	140	130	120	110	100

90	80	70	60	50	40	30	20	10

Recorded by: ______________

Reviewed by: ______________

Figure 2.8 The MARMAP Zooplankton Sample Log

in the appropriate space on the log, and give reason under "Remarks" area.

Operational Unit — The name of institution preparing this log, e.g., ZSOP, SEFC, U.S. Coast Guard, NEFC, Woods Hole.

Vessel — The full name of the vessel making the cruise.

Cruise — The last two digits of the year of the vessel's cruise, followed by a hyphen and the consecutive number of the voyage of that vessel in that year.

Station Number — The number of the station assigned consecutively beginning with the first station of the cruise.

Haul No. — The consecutive time a particular gear type was used at this station, e.g., if Bongo net was towed three separate times at this station, three "Zooplankton Sample Logs" should be filled out for hauls 1, 2, and 3. "Unsuccessful" hauls which result in no sample, or sample which will not be retained are not assigned haul numbers. Note reasons for failure under "Remarks".

Start Time — The Greenwich Mean Time that the sampler(s') flowmeters(s) enter the water.

Start Date — Greenwich date (day-month-year) of the start of this haul.

Ship Speed — The average speed of the ship during the tow recorded to the nearest 0.1 knot.

NOTE: If these data are other than measured ships speed through the water, so indicate under "Remarks".

Ship Heading — The heading of the ship during the tow to the nearest whole degree, magnetic or true.

Measur. Tow Depth — The measured, maximum depth achieved by the net during the haul recorded to the nearest whole meter. If no measuring device was used, leave this field blank.

Time Going Out — The duration in whole minutes and seconds, from flowmeter entry to maximum wire pay-out.

Time at Depth — The duration, in whole minutes and seconds, during which the maximum towing wire was payed out. (For a double oblique tow this should be zero).

Time Coming In — The duration, in whole minutes and seconds, from beginning of towing wire retrieval to flowmeter exit.

Duration of Tow — The sum, in whole minutes and seconds, of the three operations, listed immediately above.

Depth Instrument

Make — The name of the manufacturer of the depth instrument used during this tow.

Ser. No. — Manufacturer's serial number for the instrument used during this tow.

Spring Depth — The depth range (0-300 feet, 0-1000 feet, etc.) of the spring used on certain depth instruments e.g., Bendix.

Gear I.D. Number — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the table below.

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out gear name plus mesh aperture in microns.

Bottles Filled — Enter the number of bottles in which the sample from each net was preserved.

Flowmeter Start — The flowmeter reading at the start of the haul recorded to the nearest whole revolution.

NOTE: For some General Oceanics meters the right hand digit is a "tenths" digit.

Flowmeter End — The flowmeter reading at the end of the haul recorded to the nearest whole revolution.

Flowmeter No. — The identification number of the flowmeter.

Type of Tow — The type of tow for this haul entered according to the table below:

TOW TYPE	ENTER
Double Oblique	1
Surface	2
Other	3

NOTE: "Double Oblique" is the standard MARMAP Bongo tow type. This is pay out at 50 m/min and retrieval at 20 m/min sampling to within 5 m of the bottom or a maximum depth of 200 m. Retrieval begins immediately following pay out (no "Time at Depth"). "Surface" refers to surface tows with the MARMAP 0.5 x 1.0 meter mouth, 0.505 mm mesh net. Tows with other gear or in other manners should be logged as "Other" and details should be entered under "Remarks".

TDR Trace — The results of the Time Depth Recorder Trace entered according to the table below (see Fig. 2.6):

TDR TRACE	ENTER
Acceptable	1
Not acceptable	2
Malfunction	3
Not used	6

Max. Wire Out — The maximum wire used during the haul, recorded to the nearest whole meter.

Angle at M.W.O. — The wire angle recorded to the nearest whole degree at the time of maximum wire out.

NOTE: Angles are measured from the vertical (Kramer, et. al., 1972 and Smith and Richardson, 1977).

Wire Angles during retrieval — The wire angles recorded to the nearest whole degree during retrieval for every 10 m of wire out.

Remarks — Loss, damage of gear, or any other information useful to the interpretation of the data recorded on this form.

Recorded By — Name of individual filling out the log.

Reviewed By — Name of individual reviewing the log.

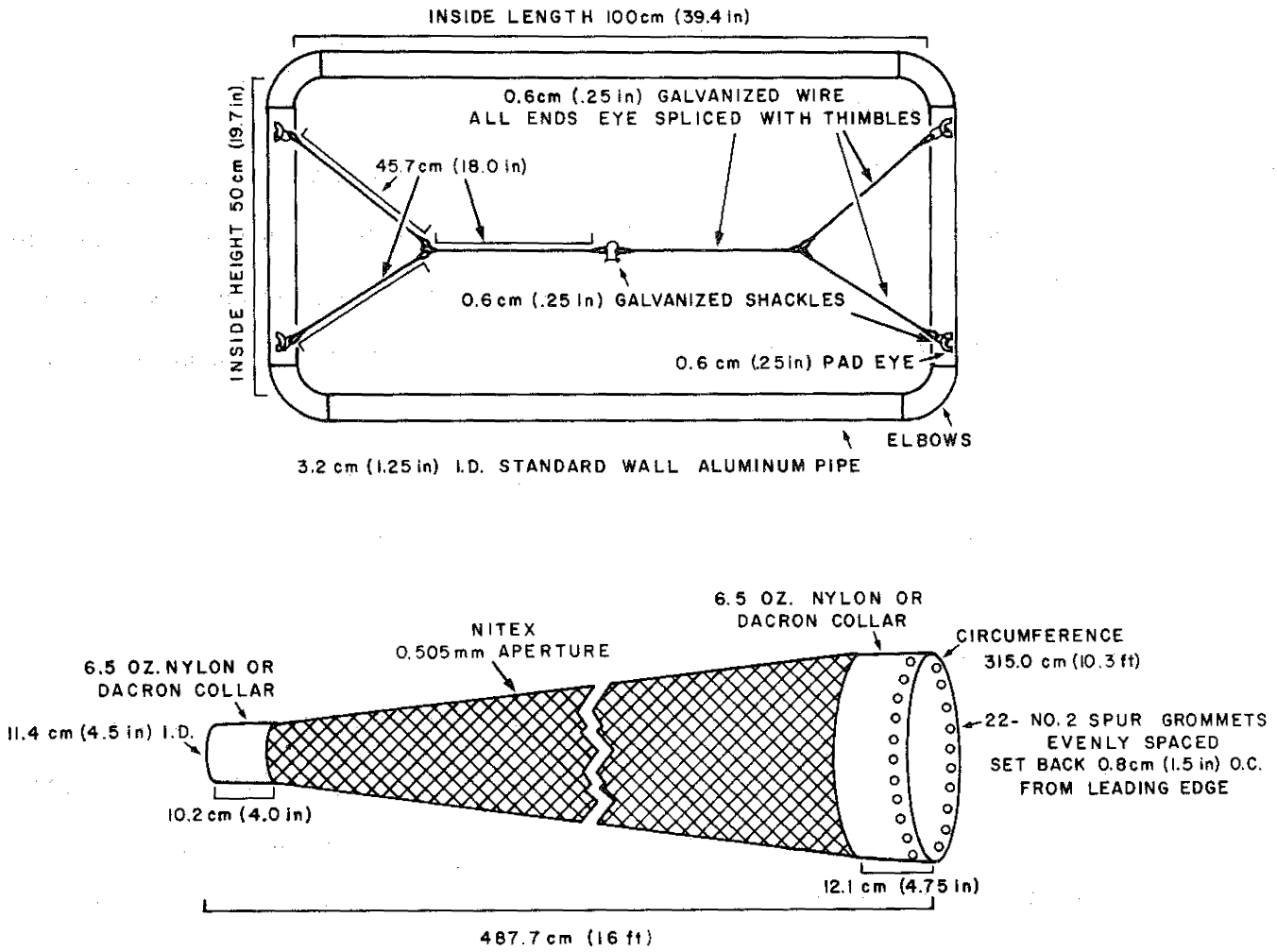
2.3.2.13 Net maintenance

The condition of the nets is vital to the quantitative validity of the samples. Regular examination between tows must be made to ensure that the net is free from any remains (organisms, tar, etc.) from the previous tow and that no tears are present. Details to accomplish the above may be found in Kramer et al. 1972, Page 18.

NOTE: In weather conditions where rapid drying of the net may occur, the samplers should be stored in a net bath between tows.

2.3.3 MARMAP Neuston Sampler

For neuston, near surface zooplankton, and contaminants such as tar and plastics the standard gear is the MARMAP neuston net (Figure 2.9). It consists of a rectangular mouth constructed of 3.2 cm (1-1/4") ID standard wall aluminum pipe with opening dimensions of 0.5 m high by 1 m wide. The net is of conical configuration, 4.9 m long. The mesh aperture is 0.505 mm, and the ratio of mouth area to total netting aperture area is 1:7.8. Presently the cod end is being folded and tied-off similar to the Bongo net cod ends. A cod end sock or beaker may be used if desired. A simple bridle, most of which is out of the water during fishing, precedes the net mouth. Towing wire must be at least 0.6 cm (1/4") diameter steel and of 40 m length plus that necessary for all rigging and a safe amount on the winch. Wire or 1.3 cm (1/2") diameter nylon line may also be used on a warping capstan if a regular winch setup is not available. Tension during towing is about 250 kg but may reach 1000 kg during dynamic loads.



NOTES:

- TOLERANCES ON DIMENSIONS - 1.3 cm (0.5 in)
- TOLERANCE ON MOUTH DIAMETER - 1.3 cm (0.5 in)
- TOLERANCE ON COD END COLLAR - 0

Figure 2.9 The MARMAP Neuston Sampler

2.3.3.1 Surface Tow

The standard MARMAP tow is made with the net mouth 1/2 submerged. Achievement of this is not absolutely possible due to such things as sea state. Nevertheless, a combination of towing wire rigging, wire out and ship speed must be sought by which the average position of the net mouth during the tow is 1/2 submerged and the variations of its position are minimized.

2.3.3.2 Recording of Tow Times

The start time for a neuston tow is taken when the net begins fishing 1/2 submerged. The end time is taken when the net exits the water. For a neuston tow the "time going out" and "time coming in" should both be zero. "Time at depth" is the elapsed time between "start" and "end" of the tow.

2.3.3.3 Towing Speed

Speed for a neuston tow is 2.0 knots for a duration of 10 minutes. In subtropical and tropical areas or for studies of species of relatively low abundance tows of longer duration may be made.

2.3.3.4 Towing Procedure

The vessel should be executing a slow turn in the same direction as the side of the ship from which the tow is being made. Tows made in the wake of the vessel are unsatisfactory. Also any ship discharges which may contaminate the sample must be secured during the tow.

2.3.3.5 Rinsing Net--Removing Sample

The sample is quantitatively transferred from the net to a sample jar(s) in a manner similar to the Bongo samples (Section 2.3.2.9).

NOTE: Tar balls may be encountered. If possible preserve them with the rest of the sample. If, however, the tar balls are too large for the sample jars, place them in plastic bags with an

inside "Jar Label" and place the bags in a freezer.

2.3.3.6 Preservation of Sample

Preservation is identical to that described for Bongo Samples (See Section 2.3.2.10).

2.3.3.7 Specimen Jar Labels

Fill out and apply outside and inside jar labels (Section 2.3.2.11 and Fig. 2.7) which are preprinted and color coded for the gear and mesh used.

2.3.3.8 Filling Out Log Sheets

Fill out appropriate parts of a Master Station Record and Zooplankton Sample Log according to the instructions given in Sections 2.2 and 2.3.2.12 above. No wire angle data need be recorded for neuston tows.

2.3.4 Hardy Continuous Plankton Recorder

For sampling in areas beyond the geographical range and especially revisit frequency capabilities of conventional research ships, the Hardy Continuous Plankton Recorder (Hardy 1939) is the standard MARMAP sampler. The Recorder has been used from research ships in a number of countries but its most extensive utilization has been in a long-term survey of the plankton in the North Sea and North Atlantic Ocean using ships of opportunity. It is designed for towing from a ship on her normal passage, preferably at between 10 and 18 knots, at which speeds it is convenient to sample at a depth of 10 meters below the surface. Records may be obtained for up to 500 continuous nautical miles. Water enters through a 1.27 cm (1/2 inch) square aperture at the front of the Recorder and the plankton is filtered onto a slowly moving band of bolting silk (60 meshes to the inch; aperture approximately 225 μ by 234 μ when wet). The plankton is held in place by a second band of silk, and the double roll with the plankton held firmly between the two layers, is wound onto a storage spool in a tank containing formalin. The mechanism which drives

the silk rolls is driven by a propeller turned by the passage of the Recorder through the water (Fig. 2.10). The instrument is 1.0 m (40 inches) long, has a maximum width across the diving plane of 0.51 m (20 inches), and weighs 86.2 kg (190 pounds).

Towing wire must be at least 7.9 mm (5/16 inch) diameter and of 110 m length.

2.3.4.1 Towing Instructions

The Recorder is more robust than most oceanographic instruments, and can be towed in weather which would normally prohibit the working of hydrographical and plankton stations. Nevertheless, it is suggested that under the following conditions the gear should be hauled or shooting delayed until an improvement develops:

a. In fog, or other circumstances of greatly reduced visibility, when the ship may have to proceed very slowly, stop, or go astern.

b. In ice conditions where the instrument or towing wire may be damaged.

c. In worsening weather conditions, when the sea is increasing so that if delayed, hauling would very likely result in damage when the Recorder was taken aboard.

d. In the presence of boats fishing with fixed or drifting gear, if it is not possible to avoid crossing such gear.

If the Recorder is hauled in the middle of a tow, before it is relaunched the inside mechanism should be removed and the silk marked (Section 2.3.4.2.2).

On vessels which regularly tow the Continuous Plankton Recorder, the wire is taken over the quarter or stern by means of a 7.6 cm (3 inch) diameter davit carrying a 25.4 cm (10 inch) towing block, and hauling is by winch or warping capstan. The tension on the wire during towing is approximately 454 kg

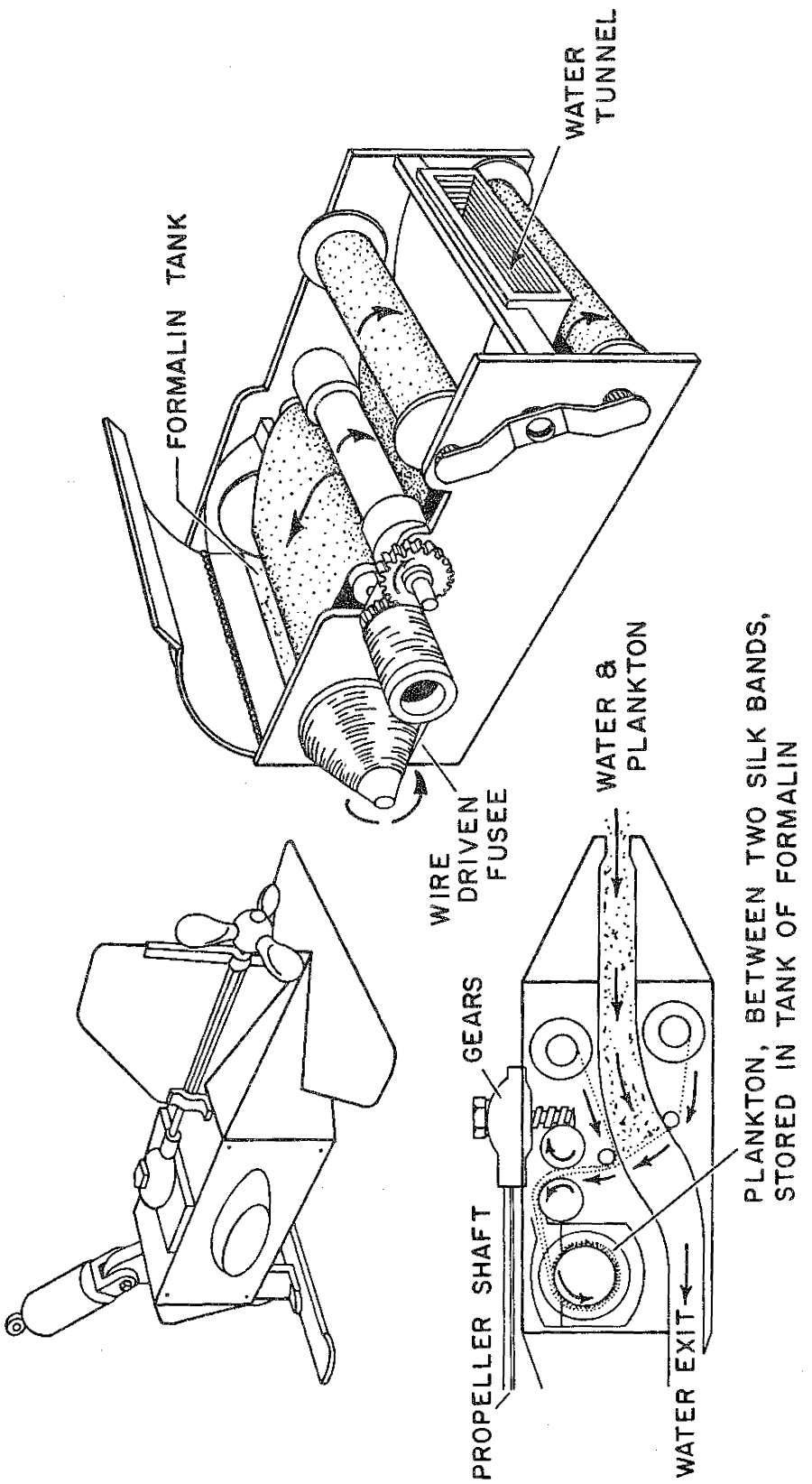


Figure 2.10 Simplified diagrams of the Hardy Continuous Plankton Recorder

(1000 pounds), and the instrument normally runs 10 m below the surface.

For towing from ships without a winch, a warping capstan may be used. The towing wire must be properly connected to the capstan (Fig. 2.11). Under these circumstances and those where no metering capability exists, a whipping should be applied 21.9 m from the outboard end of the wire to indicate the water line position when towing. It is most important that the cotter pin is securely fitted to the shackle bolt at the outboard (Recorder) end of the towing wire.

The instrument may be launched and hauled underway, but it is recommended that the ship slow down for hauling in bad weather. Launching should be done by lowering the instrument into the water steadily; dropping it with slack on the wire will put excessive strain on the gear. When the ship is steaming at her normal speed and the whipping on the towing wire is at the water surface, the wire should be made fast, and the gear can be left unattended.

Immediately after hauling the instrument on completion of the tow: (1) the inside mechanism is removed; (2) the silk marked; (3) the formalin tank opened; and (4) the liquid discarded and replaced by the formalin provided. Details of the method of doing this follow.

2.3.4.2 Instructions for Unloading on Completion of Tow

NOTE: Bracketed numbers below refer to labeled parts of Fig. 2.12 and 2.13:

2.3.4.2.1 Removal of inside mechanism

a. Remove four nuts on left side [1] with box wrench. Pull off side plate, using blister [4] as handle.

b. Swing locking tabs [2] on inside mechanism clear of bottom rail of casing.

c. Slide inside mechanism out of casing, using finger holes [3].

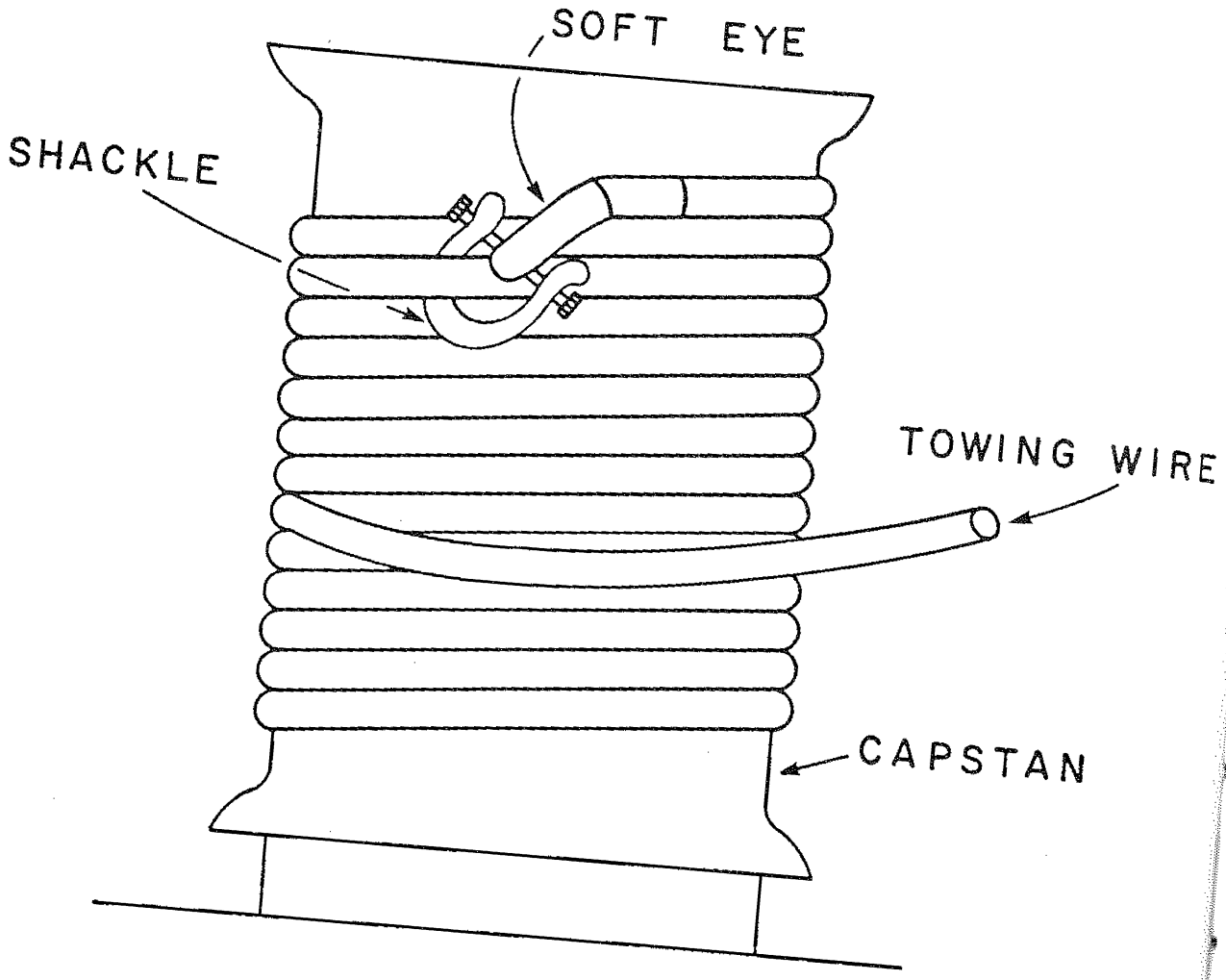
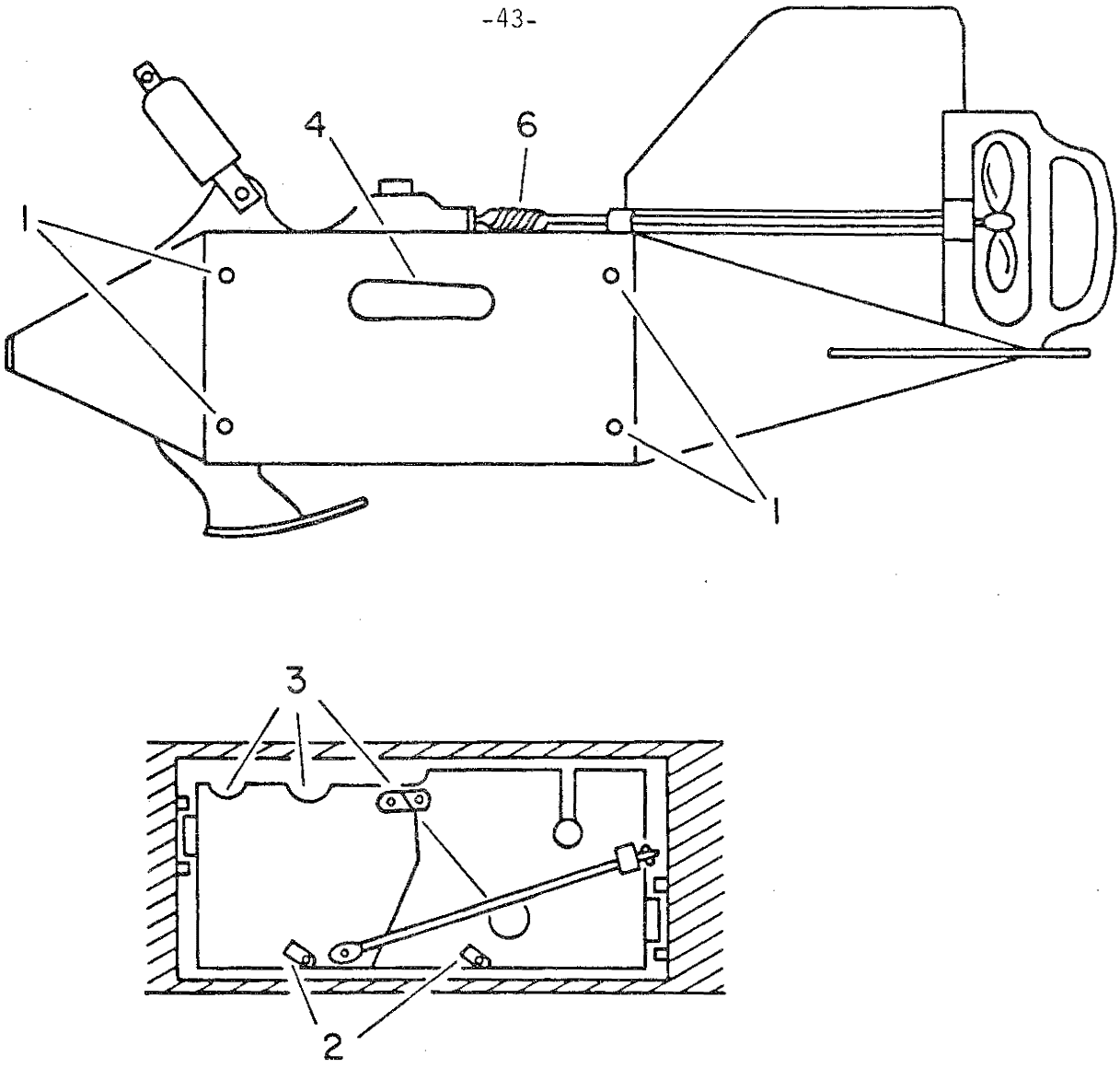


Figure 2.11 Diagram for attaching towing wire to warping capstan



LEGEND:

1 Nuts for securing side plate.

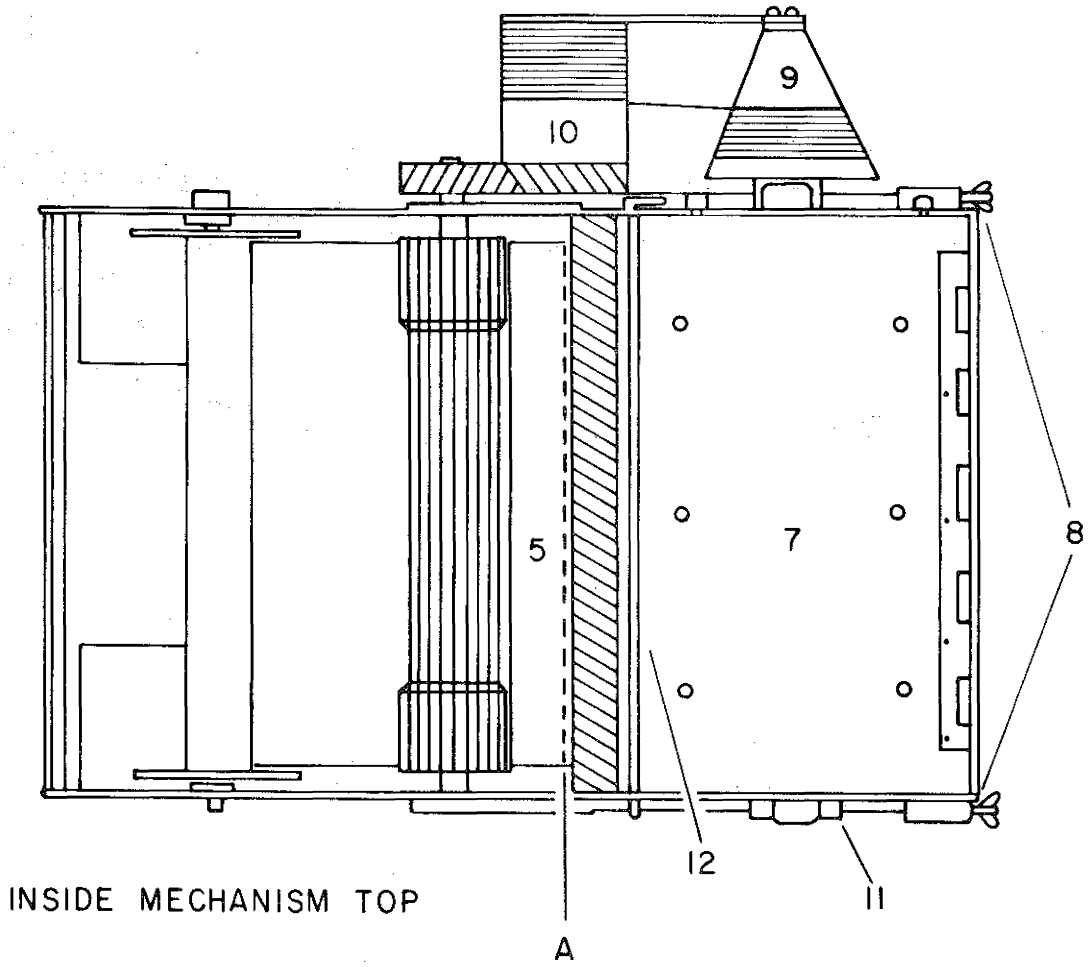
2 Locking tabs for securing inside mechanism.

3 Finger holes for removing inside mechanism.

4 Blister useful in removing side plate.

6 Flexible coupling on drive shaft.

Figure 2.12 Diagram for removing and replacing Hardy Continuous Plankton Recorder internal mechanism



LEGEND:

5 FILTERING SILK BETWEEN DRIVE ROLLERS AND STORAGE TANK GASKET.

7 COVER FOR STORAGE TANK.

8 LOCKING RODS (NOT TO BE DISTURBED WHEN REMOVING OR REPLACING INSIDE MECHANISM).

9 CPR FUSEE.

10 CPR DRUM.

11 TAKE-UP SPINDLE CAP.

12 FRONT LOCKING ROD FOR SECURING STORAGE TANK LID.

Figure 2.13 Diagram for removing Hardy Continuous Plankton Recorder storage spool

2.3.2.4.2 Marking the silk

a. With colored pencil draw a line across the silk [5] along the edge of the storage tank gasket (line shown dotted at A).

b. If the machine is to be launched again with the same inside mechanism, do not disturb the wire on the fusee [9] and drum [10]. If this wire is displaced, do not tow again.

2.3.4.2.3 Addition of formalin to tank

a. Remove front locking rod [12] and open lid of storage tank.

b. Discard the liquid in the formalin tank.

c. Add 5% formalin to middle of storage spool.

d. Close lid and replace locking rod.

2.3.4.2.4

a. Slide mechanism into casing--but not right home.

b. Make sure locking tabs [2] are clear of bottom rail.

c. Press mechanism home, rotating propeller shaft if necessary to allow gears to mesh. (Spin shaft with hand on coupling [6] .)

d. When correctly home and meshed, drop locking tabs [2] , making sure that they are vertical.

e. Replace side plate (TOP is marked for correct assembly). Replace the four nuts, with slotted ends outward, and tighten. These are special "stiff" nuts, and must be run fully home, but without undue force.

2.3.4.3 MARMAP Ship of Opportunity Log

Information about times, dates, and positions of launching, altered courses, and hauling of the CPR must be logged. It is of considerable assistance if any unusual behavior of the instrument, which normally tows steadily astern

or on the quarter, is also logged. Specifications for Continuous Plankton Recorder data are given in Section 6, Appendix I. Figure 2.14 shows an example of the MARMAP Ship of Opportunity Log.

NOTE: This log form is used for recording information about not only the CPR tow but also expendable bathythermograph launches and Undulating Oceanographic Recorder tows. Hence, some of the log form data fields are unnecessary for a CPR experiment.

Instructions for completion of the log form are presented below:

MARMAP Ship of Opportunity Log (Form SOO, 6/80)

Page __ of __ — The consecutive page of the log plus the total number of pages of logs for any cruise.

Country — The country to which the collecting vessel is affiliated.

Operational Unit — Name of institution preparing this log, e.g., Atlantic Environmental Group, NEFC, U.S. Coast Guard.

Vessel — The full name of the vessel making the cruise.

Cruise — The last two digits of the year of the vessel's cruise followed by a hyphen and the consecutive number of the voyage of that vessel in that year.

Remarks — Any information useful to the interpretation of the data recorded on this log. Shaded areas of the logsheet are filled in either before or after the cruise by shoreside personnel.

Route — The consecutive number of the route's occupation (3 digits) and the two letter code for the route.

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NATIONAL MARINE FISHERIES SERVICE
ATLANTIC ENVIRONMENTAL GROUP

MARMAP SHIP OF OPPORTUNITY LOG (SOO)

PAGE _____ OF _____

COUNTRY: | OPERATIONAL UNIT: | VESSEL: | CRUISE:

REMARKS: SHADED AREAS TO BE FILLED IN ASHORE

CPR/UOR TOW DATA:
BODY NO. _____ IMPELLER _____
PSM NO. _____ SETTING _____
DATA ACQUISITION SYST. NO. _____
ROUTE _____

PSM TUNNEL READING	MARMAP STATION	CPR/UOR SHIP ALT HAUL —OR— BT LAUNCH NO.	DATE: DAY	DATE: MONTH	DATE: YEAR	TIME GMT: HOUR	TIME GMT: MIN.	LATITUDE: DEG.	LATITUDE: MIN.	LATITUDE: NS	LONGITUDE: DEG.	LONGITUDE: MIN.	LONGITUDE: EW	SURFACE TEMP(°C)	DEPTH TO BOTTOM (M)	SURFACE SALINITY BOTTLE NO.	SURFACE SALINITY ‰	WATER MASS CODE

MARMAP SHIP OF OPPORTUNITY LOG (SOO) FORM SOO (6/80)

RECORDED BY:

Figure 2.14 The MARMAP Ship of Opportunity Log

Body No. — The three digit number affixed to the body of the Continuous Plankton Recorder (1-199), the Fast Continuous Plankton Recorder (600-699), or the Undulating Oceanographic Recorder (800-899).

PSM No. — The five character number affixed to the Hardy Plankton Sampler Mechanism (PSM). PSM's are usually fitted to a particular body, e.g., PSM nos. 143/1 and 143/2 are used in body no. 143.

Data Acquisition System No. — The three character number affixed to the Data Acquisition System used in the CPR, FCPR, or the UOR. Characters 1-2 are the instrument number; character 3 is the modification number.

Impeller Setting — The pitch of the PSM drive impeller to the nearest whole degree (when prepared for the cruise).

PSM Tunnel Reading — The silk reading to the nearest 0.1 division, taken at the bottom of the PSM tunnel. The filtering silk is marked and numbered at 2 inch intervals, termed divisions.

MARMAP Station — The number of the station assigned consecutively beginning with the first station of the cruise.

NOTE: For the SOO Log a "Station" will be any shooting or hauling of a CPR, FCPR, or UOR; any altered course during towing of the above-mentioned recorders; an XBT launch; or any more conventional data collection to which a time, date, and position can be assigned.

CPR/UOR SHT, ALT, HAU or BT Launch No. — For CPR, FCPR, and UOR shooting enter SHT: for altered courses during the tow enter ALT; and for hauling enter HAU. For BT launches enter the consecutive number of the launch

beginning with the first launch of the cruise.

NOTE: The rows in these columns have been split in two to provide for entry of both SHT, ALT, HAU; and BT launch data which may happen at the same time.

Date	Greenwich date (day-month-year) of the operation identified immediately above.
Time	The Greenwich Mean Time of the beginning of the operation described above.
Latitude	The latitude of the station to the nearest 0.1 minute north or south.
Longitude	The longitude of the station to the nearest 0.1 minute east or west.
Surface Temp.	Temperature of the surface water at this station to the nearest 0.1 degree Centigrade.
Depth to Bottom	Depth to the bottom at this station to the nearest whole meter.
Surface Salinity Bottle No.	The four character number engraved on the salinity bottle used for collecting surface water at this station.
Water Mass Code	Two character surface water mass code (consult MARMAP Information System, System Code Table, group no. 17 for water mass codes).
Recorded By	Name of individual filling out the log.

NOTE: Data are to be entered into the shaded areas of the logsheet only in the laboratory.

2.3.4.4 Source of Further Information

Further details on the use of the Hardy Continuous Plankton Recorder may be obtained from: National Marine Fisheries Service, Atlantic Environmental Group, South Ferry Road, Narragansett, RI 02882.

2.3.5 The Undulating Oceanographic Recorder

Although the Continuous Plankton Recorders (CPR's) have produced a wealth of data on spatial and temporal variability of plankton, their use has also emphasized the difficulties of identifying the sources and mechanisms of biological variability because of the scarcity of physical and chemical data of adequate coverage and discrimination in time and space.

To alleviate this deficiency, and the CPR's fixed depth limitation, a new instrument, the Undulating Oceanographic Recorder (Fig. 2.15 and Table 2.3), has reached production stage. It is designed to take series of plankton samples, each covering the depth range of the euphotic zone, and to record chemical and physical variables as a function of depth. The instrument is self-contained, is towed by ordinary, non-conductor, 8 mm (5/16 inch) towing wire at speeds between 9 and 26 knots.

2.3.5.1 Towing Instructions

The method for towing the Undulating Oceanographic Recorder is similar to that described for the Hardy Continuous Plankton Recorder (Section 2.3.4.1) except that speeds during launching and hauling should be reduced to minimize potential damage to the instrument. Data logging is identical to that described in Section 2.3.4.3.

2.3.5.2 Additional Information about the Undulating Oceanographic Recorder

The Undulating Oceanographic Recorder began operational use in March 1979. Further details may be obtained from: National Marine Fisheries Service, Atlantic Environmental Group, South Ferry Road, Narragansett, RI 02882.

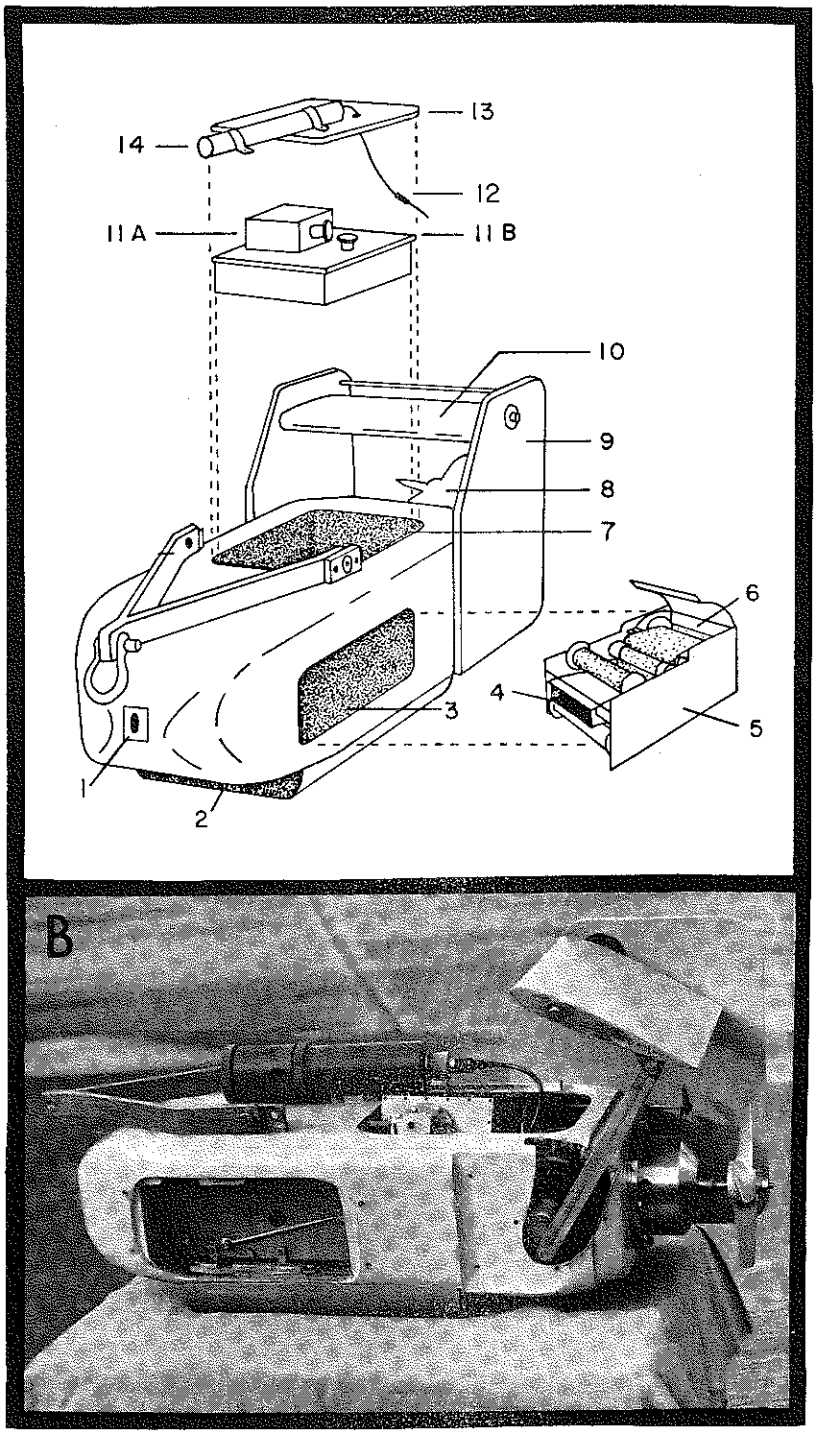


Figure 2.15 (A) Schematic representation of UOR Mark 2; 1, plankton aperture; 2, diving chute; 3, plankton sampler hold; 4, water tunnel; 5, plankton sampler; 6, formalin tank; 7, instrument hold; 8, alternator impeller; 9, tail fin; 10, tail plane; 11A, chlorophyll flash gun; 11B, chlorophyll detector/pressure sensor/tape recorder package; 12, connector cable; 13, instrument hatch cover; 14, temperature/salinity probe. (B) Cutaway view showing servo system, tail plane linkage, alternator power unit and impellers.
From: Aiken, Wood, and Jossi, 1980.

Table 2.3 Principal features of the Mark 2 Undulating Oceanographic Recorder

Item	Description
Main Body Shell	
Dimensions	Length, 0.94 m; maximum width, 0.36 m; tail height, 0.46 m; maximum body height, 0.23 m
Weight	100 kg in air; 61 kg in water
Depth Rating	300 m
Instrument Space	0.020 m^3
Towing Specification	
Towing Speed	7 to 26 knots (3.6 to 13.4 m/sec)
Towing Load	90 to 900 kgf depending on depth, speed and cable length
Towing Cable	Typically 250 to 300 m of unfaired 8 mm, 6 x 7 galvanized steel cable; minimum breaking strain 3830 kgf
Towing Modes	
Fixed Depth	Selectable to any constant depth to accuracy of ±1.0 m
Undulating	Follows a programmed saw-tooth pattern of selected wave length 0.8 km to 40 km (1.6 km, typical), between a minimum depth of 5 m and any preselected maximum in the range of 15 to 100 m
Plankton Sampling and Storage	Hardy CPR mechanism
Method of Filtering	Continuously moving band of silk gauze
Silk Movement	6 to 60 mm per km of tow
Range	300 to 3000 km
Volume of Sample	For 16 km of tow, ≅3 m^3 of water filtered
Intake Aperture	1.62 cm^2
Filtering Area	32 cm^2
Flow Velocity through Mesh	≅10 cm/sec
Filter Mesh Size	≅270 micrometer
Power	Mechanical, from impeller via 1800:1 gear box
Data Acquisition	
Sensors	
Depth	Potentiometric (model 3000, type 34896, Vernitron, Inc.) 0 to 100 m, ±0.5 m; time constant: 2 msec for 63% response
Temperature	Thermistor (YSI #44030) range 0 to 30°C, ±0.1°C interchangeable
Salinity	Toroid type (Braystoke, Ltd) range 32 to 37 o/oo, temperature compensated accuracy ±0.01 o/oo.
In Situ Chlorophyll *a*	Fluorometric type (16), range 0 to 100 mg/m^3 ±0.1 mg/m^3
Recorder	Oxford Medilog, Inc., Miniature Digital Type Recorder (MDTR); 4 track head records: (1) 8 channel multiplexed digital data, (2), (3), and (4) analog data; input range 0-1.023 volts; analog to digital conversion of all sensor data every 15 sec.; dimensions, 11 cm X 8.5 cm X 4.5 cm
Recording Medium	A good quality C-120 audio tape cassette
Recording Format	Continuously recorded, serial, digital; 8 channels multiplexed on a single track, each consisting of 3 bit channel identifier, 10 bit data word and 0.01 mm inter record gap
Data Capacity	46,000 measurements per tape
Recording Duration	24 hours
Power Supply	4 2x4 manganese alkaline cells 1800 mA hours @ ± 5 Vdc
Recorder Current Drain	≅30 mA

2.3.6 Further Details Concerning the Rationale Accounting for Survey I Methods

Further details concerning the rationale accounting for Survey I methods may be found in Smith and Richardson (1977).

2.4 AT-SEA QUALITY CONTROL

The most effective time at which quality control can be exercised on any data is at the time of initial collection. Too often this is the point in the data's history which receives the least attention as far as control of quality. The resulting difficulties and the eventual discarding of very expensive and temporally irreplaceable data make it imperative that all MARMAP Survey participants adhere to a valid quality control procedure.

2.4.1 Greenwich Mean Time and Greenwich Mean Date

Greenwich Mean Time (GMT) is the standard for all dates as well as times. Clocks in the scientific areas of the vessel should be set to GMT and so labeled. Activities which extend or occur past 2400 GMT should have times recorded as morning times in the usual fashion, e.g., 0100, 0200, etc., but with an entry in the "Remarks" block of the MSR to alert the data processors. The MSR will retain the date when the station began. Log sheets for individual experiments have actual dates of the start of the experiment.

2.4.2 Units for Data Recording

The metric system is the standard for all MARMAP data. Conversion tables such as the Naval Oceanographic Office, Handbook of Oceanographic Tables (Bialek, 1966) should be on each vessel. The significant figures of the data entries should be in accordance with the instructions for each type of log. Entering extra digits means costly time loss in data processing. For further details on data specifications consult Section 6, Appendix I.

2.4.3 Station Position

A MARMAP station has one position for all routine observations and the Master Station Record (MSR) is the only log which lists this position in order to avoid proliferation of divergent data. The position will be checked for finality with the bridge and this check will be indicated by initialing the "Position Check" on the MSR.

Multi-position experiments, e.g., drift buoys, will be assigned to the station at which they began. The particular log sheet for the multi-position experiment will list any multiple positions.

2.4.4 Review of Log Sheets

The oncoming watch will be responsible for checking the reasonableness and completeness of data entered by the offgoing watch. This must be done in timely manner so that reasons for unusual entries are still fresh in the recorders' minds.

2.4.5 Scientific Party Chief's Responsibilities

The Scientific Party Chief has the responsibility for the quality of all data collected, regardless of his particular area of scientific interest or the particular type of data. This is partially achieved through delegating certain duties to subordinates as in Section 2.4.4 above. The Scientific Party Chief must personally oversee that proper techniques are adhered to, that checks and reviews are being consistently made, and that the collection of data resulting from a cruise is consistent and complete. One way to achieve the latter two requirements is by having a conference prior to arriving at home port, or prior to the dispatching of any data to the laboratory during the cruise. One or more types of log sheets are given to each scientist--the Chief Scientist holds the MSR's. By reading data common to all types of logs, e.g., station number, date, type of activity, start time, etc., nearly all inconsistencies will be eliminated, as will be most of guesswork ashore.

3 LABORATORY PROCESSING

3.1 INTRODUCTION

Figures 3.1 and 3.2 show flow diagrams for a range of analyses of ichthyoplankton and zooplankton, respectively. Analyses of other constituents are also illustrated as are procedures for sample archiving and data flow. Steps are represented separately in the diagrams, but in reality, certain of these may be combined depending upon the nature of the plankton and the corresponding approach to the problem in each region. As an example, sorting and identification (and measurement) of key taxa may be performed as a single operation by personnel with adequate experience. Also, eggs and larvae may be enumerated together rather than in separate operations.

Processing of plankton is begun at the laboratory only upon completion of quality control of samples and logs and preparation of standardized products from the data base.

> NOTE: The log forms presented are those suggested for use within the MARMAP Program. For sake of space, in this section, the narrative refers to these logs as well as certain MARMAP Information System (Petersen and Jossi, 1978) products exclusively. However, other researchers may find log forms or listings of a different format more useful for their particular cases. Regardless of the format used, all the individual data fields mentioned herein must be logged for analyses required by MARMAP.

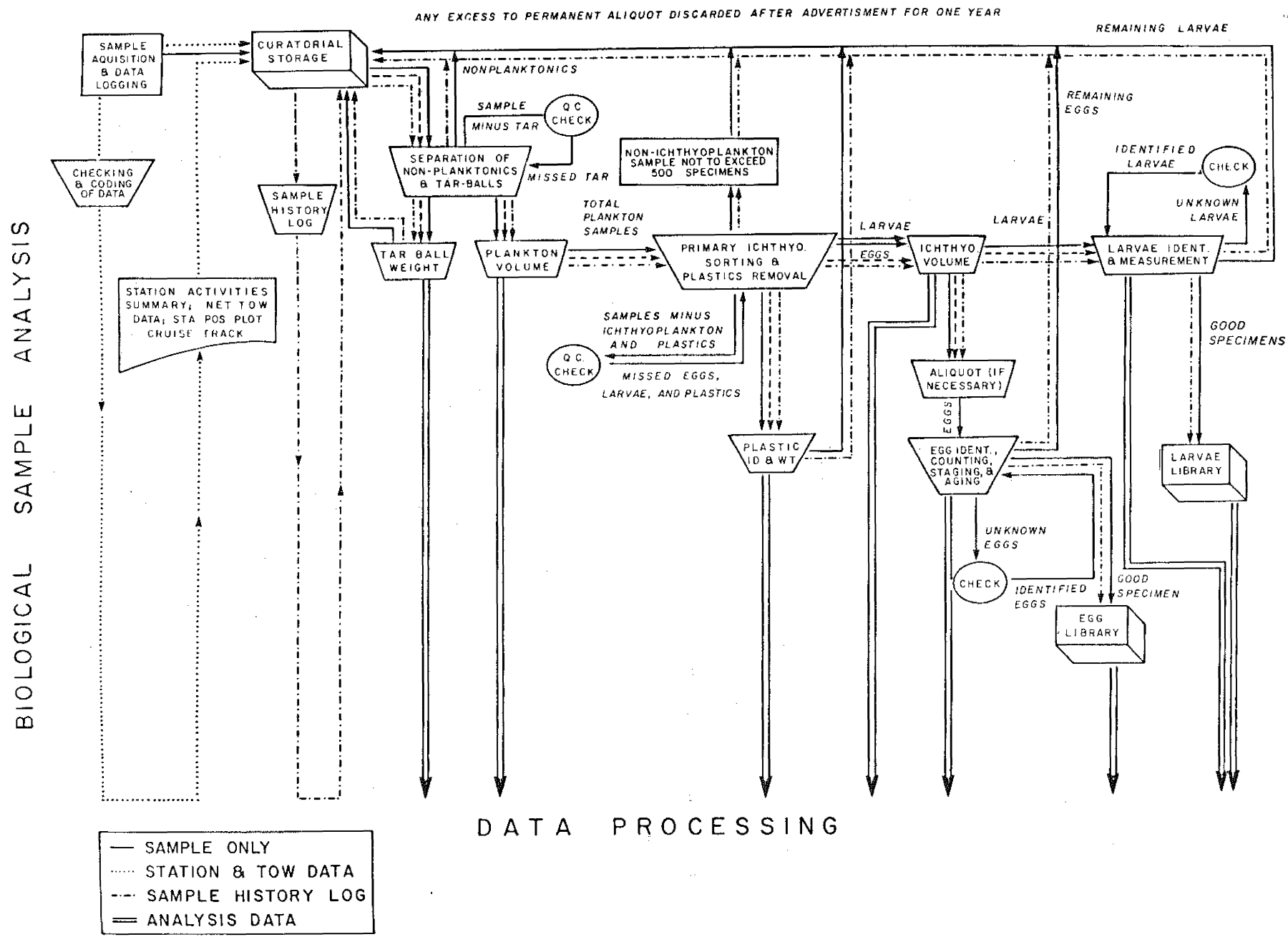


Figure 3.1 Sample and data flow for MARMAP ichthyoplankton analyses

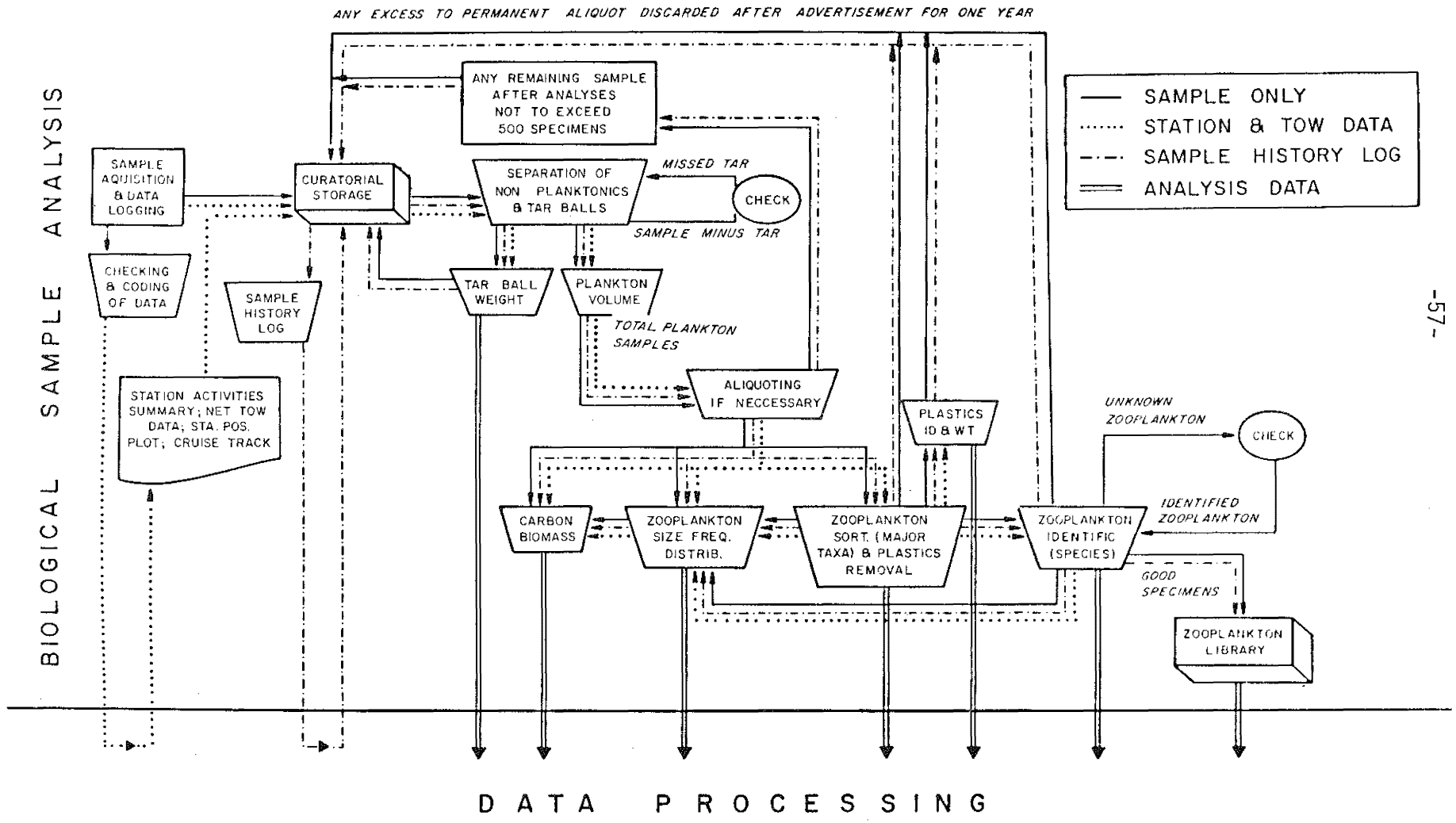


Figure 3.2 Sample and data flow for MARMAP zooplankton analyses

3.2 INITIAL QUALITY CONTROL OF DATA AND SAMPLES

Upon completion of a cruise, certain quality control procedures are conducted prior to the delivery of the samples to the analysts. The objectives are to prevent the dissemination of divergent data and to insure the comparability between the data on the logs and that on the sample jar labels.

3.2.1 Divergent Data and Consistency

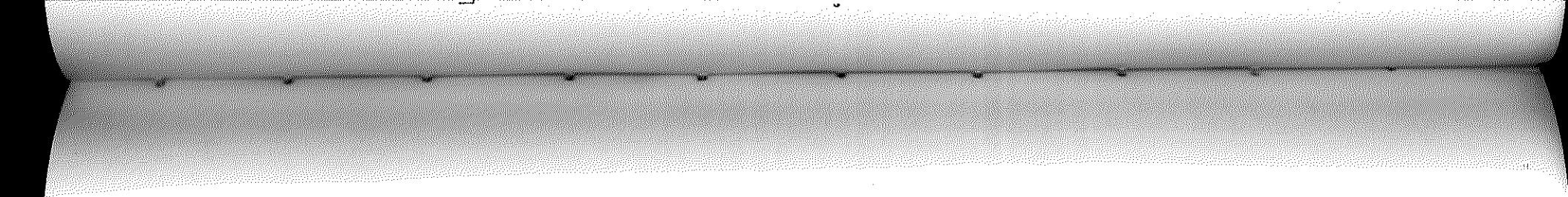
The first objective is met by confining the use of the original log forms to the production of the MARMAP Station Activities Summary (SAS), Net Tow Data Table (NTD), and Station Position Plot (SPP), (Fig. 3.3, 3.4 and 3.5). These data base products reflect the accepted station and tow data based on shipboard and computer executed quality control. Data on original log sheets often are in error, and although these logs must be retained as ultimate backup copies and for clarification purposes, they must not be distributed to analysts, thus proliferating conflicting and erroneous information.

The second objective is accomplished by separating the samples from a cruise into net type and mesh size. The number of jars from each station is then checked against the number entered on the Zooplankton Sample Log, where any discrepancies are noted. Also entries on the labels are checked and corrected if necessary. Any broken or lost samples are noted on the Zooplankton Sample Log.

Each resulting group is, if necessary, then repacked in boxes in numerical station order. The cruise, gear, mesh, and station numbers are written on the end of each box to be clearly visible during storage. All resulting boxes are consecutively numbered with individual box numbers plus number of boxes in each set.

3.2.2 The Archivist

Some operational units may require the services of a plankton archivist.



ISSUE: AUGUST 20, 1982

MARMAP INFORMATION SYSTEM - STATION ACTIVITIES SUMMARY

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

TIME IS EXPRESSED IN GMT AND DEPTH IN METERS.
S MEANS SURFACE AND C MEANS CONTINUOUS.
ZOOPLANKTON NET SIZES ARE EXPRESSED AS MOUTH DIMENSIONS IN CM (BONGO DIAMETER) OR METERS (NEUSTON OR HAEDRICH HEIGHT X WIDTH)/MESH IN MICRONS.
BONGO DEPTHS FROM TDR (A INDICATES DEPTH CALCULATED FROM WIRE ANGLES). ASTERISKS INDICATE DATA NOT AVAILABLE. E INDICATES AN ESTIMATE. T INDICATES MAXIMUM TOW DEPTH IS SHALLOWER THAN 10 M OF BOTTOM IN WATER DEPTHS LESS THAN 100 M OR GREATER THAN PLUS OR MINUS 10 M OF 100-M TOW DEPTH IF THE BOTTOM DEPTH IS GREATER THAN 100 M.

DELAWARE II: CRUISE 72-19
12 JULY 1972 - 13 AUGUST 1972

STATION	DATE	POSITION		OBSERVATIONS					
		LATITUDE	LONGITUDE	TYPE	BT	HAUL	START TIME	DURATION (MIN:SEC)	FREQUENCY/ MAX. DEPTH
1	12 07 72	42 00 00 N	070 00 00 W		5201				
				NEUSTON 1.0X2.0/947		1	1544	10:00	1/S
				BONGO 61/505		2	1651	5:25	1/18 A
				BONGO 61/333		2	1651	5:25	1/18 A
				STD					
				HYDRO					
				PLANT-PIGMENT					
				PHYTOPLANKTON					
				OXYGEN					
				NUTRIENTS					
				BT					
				XBT					
				STD CAST					
2	12 07 72	42 00 00 N	069 30 00 W		5201				
				NEUSTON 1.0X2.0/947		1	1838	10:00	1/S
				BONGO 61/333		1	1924	31:22	1/230 A
				BONGO 61/505		1	1924	31:22	1/230 A
				STD					
				HYDRO					
				PLANT-PIGMENT					
				PHYTOPLANKTON					

Figure 3.3 The MARMAP Station Activities Summary

NTRW VER 1.6 8/81

N E T T O W R E P O R T

PAGE# 1

WRITE-DATE : 20 AUG 82

DELAWARE II 72-19

BONGO 1 333 .61

STA #	SHIP HEADING	T OR M	SHIP SPEED	FLOW M.#	SHF BONGO M2	SHF BONGO M3	SHF NEUSTON	VOLUME FILTERED	AREA FILTERED	NET SPEED	TOW DEPTH	FLOW REV	CAL. FACTOR	TOW TIME	NETOW ERROR KEY
XXXX	XXXX	X	XXXXX	XXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXXXXX	XXXXX	XXXXXX	XXXX	XXXXXXXXXX
1	....	.	5.7	....	1.06	0.61	.....	162.78	.....	2.93	17.18	.....	0.2750	190	11?1?32X32
2	....	.	2.3	....	6.34	0.26	.....	382.35	.....	1.18	242.51	.....	0.2750	1106	11?1?32X32
3	....	.	2.0	....	3.84	0.93	.....	107.62	.....	1.03	41.33	.....	0.2750	358	11?1?32X32
4	....	.	1.8	....	1.66	1.26	.....	79.27	.....	0.93	13.15	.....	0.2750	293	11?1?32X32
5	....	.	1.3	....	8.86	1.23	.....	81.28	.....	0.67	72.01	.....	0.2750	416	11?1?32X32
6	....	.	1.0	....	12.35	0.98	.....	102.51	.....	0.51	126.58	.....	0.2750	682	11?1?32X32
7	....	.	1.7	....	8.26	0.33	.....	301.49	.....	0.87	249.01	.....	0.2750	1180	11?1?32X32
8	....	.	2.0	....	7.30	0.28	.....	354.73	.....	1.03	258.88	.....	0.2750	1180	11?1?32X32
9	....	.	3.1	....	4.56	0.19	.....	536.77	.....	1.59	244.73	.....	0.2750	1152	11?1?32X32
10	....	.	1.8	....	7.08	0.28	.....	357.12	.....	0.93	252.89	.....	0.2750	1320	11?1?32X32
11	....	.	2.0	....	6.61	0.27	.....	369.76	.....	1.03	244.33	.....	0.2750	1230	11?1?32X32
12	....	.	2.4	....	5.86	0.24	.....	419.52	.....	1.23	245.87	.....	0.2750	1163	11?1?32X32
13	....	.	2.7	....	5.29	0.21	.....	480.88	.....	1.39	254.50	.....	0.2750	1185	11?1?32X32
14	....	.	3.4	....	4.05	0.18	.....	568.77	.....	1.75	230.51	.....	0.2750	1113	11?1?32X32
15	....	.	1.1	....	12.83	0.53	.....	188.47	.....	0.57	241.75	.....	0.2750	1140	11?1?32X32
16	....	.	1.3	....	10.03	0.59	.....	169.99	.....	0.67	170.57	.....	0.2750	870	11?1?32X32
17	....	.	1.4	....	9.20	1.29	.....	77.64	.....	0.72	71.46	.....	0.2750	369	11?1?32X32
18	....	.	4.1	....	0.38	0.41	.....	241.57	.....	2.11	9.22	.....	0.2750	392	11?1?32X32
19	....	.	2.7	....	3.90	0.91	.....	109.57	.....	1.39	42.75	.....	0.2750	270	11?1?32X32
20	....	.	2.6	....	5.43	0.74	.....	134.82	.....	1.34	73.21	.....	0.2750	345	11?1?32X32
21	....	.	1.9	....	6.86	0.29	.....	339.54	.....	0.98	232.85	.....	0.2750	1189	11?1?32X32
22	....	.	2.2	....	0.01	0.25	.....	406.70	.....	1.13	0.50	.....	0.2750	1230	11?1?31X32
23	....	.	1.7	....	6.68	0.32	.....	314.52	.....	0.87	210.24	.....	0.2750	1231	11?1?32X32
24	....	.	3.2	....	2.73	0.17	.....	577.15	.....	1.65	157.29	.....	0.2750	1200	11?1?32X32
25	....	.	3.0	....	4.12	0.17	.....	588.45	.....	1.54	242.33	.....	0.2750	1305	11?1?32X32
26	....	.	1.2	....	10.93	0.44	.....	225.79	.....	0.62	246.71	.....	0.2750	1252	11?1?32X32
27	....	.	2.7	....	5.06	0.21	.....	469.52	.....	1.39	237.59	.....	0.2750	1157	11?1?32X32
28	....	.	1.2	....	10.31	0.44	.....	227.24	.....	0.62	234.36	.....	0.2750	1260	11?1?32X32
29	....	.	4.1	....	2.89	0.42	.....	240.34	.....	2.11	69.37	.....	0.2750	390	11?1?32X32
30	....	.	2.8	....	2.01	0.36	.....	276.08	.....	1.44	55.35	.....	0.2750	656	11?1?32X32
31	....	.	1.9	....	4.11	0.87	.....	114.80	.....	0.98	47.15	.....	0.2750	402	11?1?32X32
32	....	.	1.4	....	6.31	1.02	.....	97.84	.....	0.72	61.70	.....	0.2750	465	11?1?32X32
33	....	.	1.1	....	10.39	0.94	.....	106.64	.....	0.57	110.82	.....	0.2750	645	11?1?32X32
34	....	.	0.6	....	23.55	0.98	.....	101.90	.....	0.31	240.00	.....	0.2750	1130	11?1?32X32
35	....	.	1.3	....	9.91	0.46	.....	218.84	.....	0.67	216.79	.....	0.2750	1120	11?1?32X32

Figure 3.4 The MARMAP Net Tow Report

N E T O W R E P O R T W R I T E R NTRW VER 1.6 8/81

N E T O W E R R O R K E Y :

THE NETOW ERROR KEY CONTAINS THOSE VALUES WHICH WERE USED TO CALCULATE A GIVEN STANDARD HAUL FACTOR (SHF). THE VALUES IN THE KEY ARE TRANSLATED AS FOLLOWS:

0 = PRIMARY FORMULA USED IN CALCULATING SHF BUT NET SPEED IS OUTSIDE OF 0.5 TO 1.5 M/SEC RANGE
1 = PRIMARY FORMULAE USED IN CALCULATING SHF
2 = SECONDARY FORMULAE USED IN CALCULATING SHF
3 = TERTIARY FORMULAE USED IN CALCULATING SHF
X = INFORMATION REQUIRED FOR CALCULATING SHF NOT FOUND
? = DEFAULT IF INFORMATION FOR SHF NOT NEEDED OR NOT ACCESSED

FOR EXAMPLE, IF A SHF FOR NEUSTON WAS REQUESTED AND THE TERTIARY FORMULA WAS USED TO CALCULATE CALIBRATION FACTOR AND NET SPEED AND FLOW METER REV WASN'T FOUND, THE NETOW ERROR KEY WOULD CONTAIN THE FOLLOWING

??1?131X31

FROM LEFT TO RIGHT, THE VALUES REPRESENT THE FOLLOWING SHF VARIABLES:

SHF: SHF: SHF: VOL: AREA: NET: TOW :FLOW : CAL : TOW
B2 : B3 : N2 : FIL: FIL : SPD: TIME:M REV: FACT: TIME

IF A VALUE IN THE NETOW ERROR KEY CONTAINS AN "X" OR A "?", THEN THE CORRESPONDING FIELD ON THE DETAIL LINE IS BLANK AND IS, THEREFORE, FILLED WITH A SERIES OF DOTS (.....). THIS SERIES OF DOTS ALSO APPEARS FOR ALL OTHER BLANK FIELDS ON THE DETAIL LINE.

Figure 3.4 The MARMAP Net Tow Report (cont.)

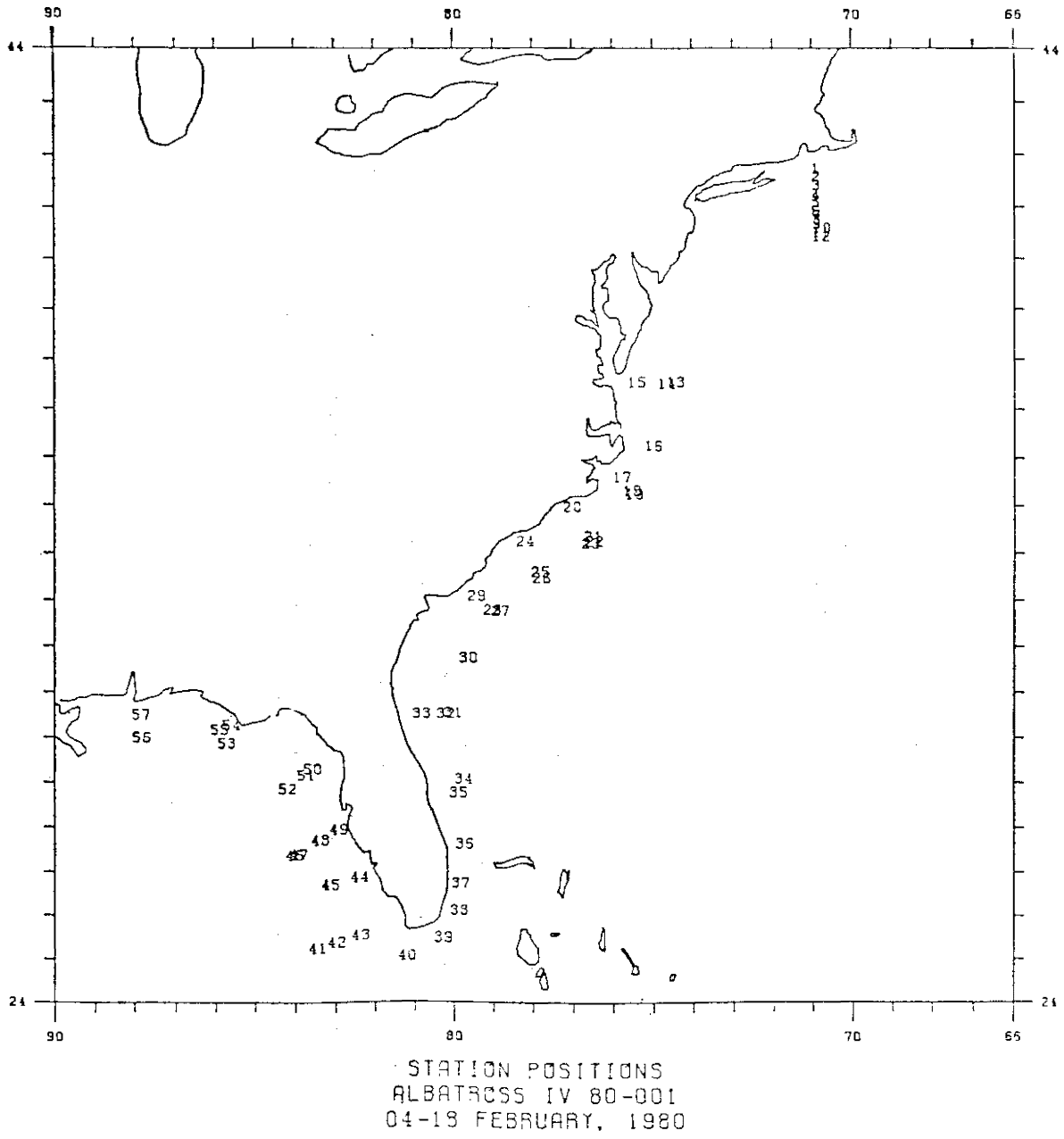


Figure 3.5 The MARMAP Station Position Plot

Also, all or part of the samples may be sent to other institutions for analyses. As the whereabouts and status of samples become more complex certain additional record keeping will become necessary. One such method has been devised using a MARMAP Sample History Log (SHL) (Fig. 3.6). These logs are initially filled out after checks mentioned in 3.2.1 above, and their contents are added to a computer file for automated query purposes.

NOTE: The discussion which follows assumes that an archivist will be available and that sample history data will be stored in a computer file.

The data base products mentioned in Section 3.2.1 above and the Sample History Log then accompany the samples to the analysts. Again, original station and tow log sheets are not delivered to the analysts. The data base products stop with the analysts, but the Sample History Log(s) accompanies the samples, or their derivatives through the entire flow shown in Figures 3.1 and 3.2. Copies of updates to the SHL are delivered to the plankton archivist for inclusion in the sample history file.

3.2.3 MARMAP Sample History Log

Instructions for completion of the log form are presented below:

MARMAP Sample History Log (Form SHL, 12/79)

General Instructions — A Sample History Log (SHL) listing the information described below must be prepared by the operational unit collecting any samples. The SHL is filed by them and a copy of it accompanies samples or portions thereof. Information on subsequent sample disposition is communicated back to the plankton archivist for computer file updating.

Operational Unit — Name of institution preparing this log, e.g., NEFC, SUSIO-FSU.

Vessel/Cruise — As recorded on the Station Activities Summary.

Figure 3.6 The MARMAP Sample History Log

U.S. DEPT. OF COMMERCE NOAA
NATIONAL MARINE FISHERIES SERVICE

MARMAP SAMPLE HISTORY LOG (SHL)

OPERATIONAL UNIT ____________

Vessel [ ] Cruise [ ]-[ ]

Station-Haul:Gear ID No. (No. of containers) [Aliquot Fraction]/Vial Numbers						GEAR/ MESH	Container/ Contents	Sample Disposition			Remarks	
								Date D - M - Y	Delivered to, or Altered			
Check when additional sheet is required ☐												

MARMAP SAMPLE HISTORY LOG (SHL) FORM SHL (12/79)

Station	As recorded on the Station Activities Summary.
Haul	Following a hyphen the haul number as recorded on the Station Activities Summary. NOTE: Only haul numbers other than one need to be logged.
Gear I.D. No.	Following a colon the identification number of the gear used in collecting the sample whose history is being described on this line.
No. of Containers	Enclosed in parenthesis the number of containers of a particular size whose history is being described on this line. NOTE: Only number of containers other than one need to be logged.
Aliquot Fraction	Enclosed in brackets the aliquot fractions describing the contents in the above containers. NOTE: Only fractions other than 1/1 need to be logged.
Vial Numbers	Following a slash the number of the specimen vials whose history is being described on this line. Specimen vials are assigned numbers as recorded on the Ichthyoplankton Data Records or the Zooplankton Data Record (Sections 3.5.3.1.3, and 3.5.3.2.4, and 3.6.4.3 respectively). NOTE: Larval fish vial numbers should be 01 to 99; fish eggs, 100-199; and invertebrates, 200-upwards.
Gear/Mesh	The gear and the mesh size used in collecting the sample entered according to the table below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out gear name plus mesh aperture in microns.

Container/Contents Size of the containers listed on this line and, following a slash, contents of those containers entered according to the table below:

CONTAINER	ENTER	CONTENTS	ENTER
Gallon	G	Unsorted Plankton	U
Quart	Q	Unsorted Invertebrates & Fish Eggs	G
Pint	P	Unsorted Invertebrate Zooplankton	A
Half-Pint	H	Sorted Fish Eggs	E
		Sorted Fish Larvae	L
Vial	V	Sorted Invertebrate Zooplankton	B

Identified Fish Eggs	I
Identified Fish Larvae	F
Identified Invertebrate Zooplankton	C
Tar	T
Plastics	P
Unspecified Debris	D
Broken/Lost	Z

Sample Disposition

Date	Date of delivery or alteration to samples entered as follows: day - month - year.
Delivered To	The operational unit or individual to which samples are delivered. If other than the plankton archivist forward copy to the archivist.
Altered	A check mark if the characteristics of a sample have been altered, even though it has not been sent anywhere, e.g., sorted, aliquoted, identified.
Remarks	Any information useful to describing the history of a MARMAP sample.
Recorded By	Name of individual filling out the log.
Check when additional sheet is required	Enter a check to indicate the existence of additional Sample History Logs for a particular cruise.

3.3 PROCESSING OF CONTAMINANTS

3.3.1 Tar Contaminants Determination

3.3.1.1 Separation of Tar Contaminants

The plankton samples are removed from their boxes and readied for

analysis by arranging them in numerical order of stations. Each sample and its preservative are poured into a white tray approximately 40 X 30 X 5 cm. Any tar contaminants present in the tray are removed, placed in jars, and labeled for analysis as described below.

NOTE: MARMAP is a participant in the IOC/WMO/IGOSS Marine Pollution Monitoring Pilot Project. Figure 3.7 is the standard form for this project. MARMAP Information System (MIS) users can avoid transposing data to this log by running this MIS program TARREP which produces a printout of tar data similar in format to the above log form (see Fig. 3.8). To avoid not only the transposing but also the data re-entry by the Pilot Project staff, MIS users can run the program TARCRD which creates eighty-character records of tar ball information according to the data format of IOC/WMO/IGOSS. A tape file of these records can then be sent to the Pilot Project staff.

Plastic contaminants are usually removed during a subsequent analysis (Section 3.5.2.9).

3.3.1.2 Drying and Weighing Tar Balls

Tar contaminants are placed on a piece of pre-weighted wax paper and allowed to air dry (12 hours) and are then weighed. The weight of the paper is subtracted from the weight of the tar plus the paper to obtain the tar weight.

3.3.1.3. MARMAP Tar and Plastics Log

The resulting weight of the tar is recorded on MARMAP Tar and Plastic

IOC/WMO IGOSS MARINE POLLUTION MONITORING PILOT PROJECT

NOAA FORM 72-9 (1-75) — U. S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Form Approved O.M.B. No. 41R2836 Expires December, 1979

LOG FOR SAMPLING AND REPORTING PARTICULATE PETROLEUM RESIDUES (TAR BALLS)

PLATFORM/SHIP TYPE	PLATFORM/SHIP NAME *	PLATFORM/SHIP CALL SIGN #
1	Westward	WZL

COUNTRY	INSTITUTE	CRUISE NO. *	SAMPLING DEVICE	MESH SIZE
United States	NOAA, AOML, PHOL	W26	neuston	.505

STATION NUMBER	SAMPLE NUMBER * (1)	WIDTH OF NET (CM)	DISTANCE TOWED (N.M.)	TO BE FILLED BY LABORATORY: WEIGHT OF TAR (g)	TO BE FILLED BY LABORATORY: TAR CONC. (mg/m²)	DATE * (GMT): DAY	DATE * (GMT): MO.	DATE * (GMT): YR.	TIME * (GMT): HR.	TIME * (GMT): MIN.	POSITION *: QUAD	POSITION *: LAT. DEG.	POSITION *: LAT. MIN.	POSITION *: LONG. DEG.	POSITION *: LONG. MIN.	OPTIONAL ENVIRONMENTAL INFORMATION: WIND DIR.	WIND SP.	WAVE PER	WAVE HT.	TEMP. °C: AIR	TEMP. °C: WATER
	4 0 0 0 1	1 0 0	0 1	0.2658		10	02	76	2017		7	25	04	085	35	135	01	00	00		206
	6 0 0 0 2	1 0 0	0 1	2.2571		11	02	76	1428		7	24	53	086	41						
	10 0 0 0 3	1 0 0	0 1	.2366		12	02	76	1804		7	25	00	087	56	311	07	08	02	022	235
	13 0 0 0 4	1 0 0	0 1	.1350		13	02	76	1825		7	26	28	086	53				01		210
	20 0 0 0 9	1 0 0	0 1	trace		15	02	76	1830		7	27	40	084	38		06		00		195
	23 0 0 1 0	1 0 0	0 1	trace		16	02	76	1530		7	26	29	084	53						205
	16 0 0 0 5	1 0 0	0 1	20.4815		14	02	76	1600		7	27	08	086	51						210
	27 0 0 0 6	1 0 0	.7	1.1313		17	02	76	1630		7	26	04	086	37						240
	30 0 0 0 7	1 0 0	0 1	8.2897		19	02	76	0040		7	25	51	086	15	156	10	04	03		245
	32 0 0 0 8	1 0 0	0 1	0.4251		19	02	76	1700		7	25	14	085	41						

NAME AND ADDRESS (Individual/Office to contact reference this report.)

Dr. Robert Molinari
NOAA, AOML,
15 Rickenbacker Causeway
Miami, Fla. 33149

* NOTE: — Include items marked with an asterisk on bottle label.

trace entered as .0001 gm.

(1) Mark SAMPLE NUMBER on both sample bottle and bottle cap.

Figure 3.7 The IOC/WMO/IGOSS Tar Ball Log

MARMAP INFORMATION SYSTEM - TAR DATA

IOC/WMO IGOSS MARINE POLLUTION MONITORING PILOT PROJECT

PLATFORM/SHIP		NOAA FORM 72-9 (1-75)	U.S. DEPARTMENT OF COMMERCE	
TYPE	NAME	CALL SIGN	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	FORM APPROVED O.M.B. NO. 41R2836 EXPIRES DECEMBER,1979
1	ALBATROSS IV	N/A	LOG FOR SAMPLING AND REPORTING PARTICULATE PETROLEUM RESIDUES (TAR BALLS)	

COUNTRY	INSTITUTE	CRUISE NO.	SAMPLING DEVICE	MESH SIZE
USA	NMFS	73-02	NEUSTON	0.947 MM

STATION NUMBER	SAMPLE NUMBER	OF NET (CM)	DISTANCE (M)	TO BE FILLED BY LABORATORY: WEIGHT OF TAR (G)	TO BE FILLED BY LABORATORY: TAR CONC. (MG/M2)	DATE (GMT) DAY	DATE (GMT) MO.	DATE (GMT) YR.	TIME (GMT) HR.	TIME (GMT) MIN	POSITION QUAD	POSITION LAT. DEG	POSITION LAT. MIN	POSITION LONG. DEG	POSITION LONG. MIN	OPTIONAL ENVIRONMENTAL INFORMATION: WIND DIR	WIND SP.	WAVE PER	WAVE HT.	TEMP oC AIR	TEMP oC WATER
000001	N/A	200	1543.2	0.1576	0.0511	22	01	73	10	04	7	29	07	81	81	//	//	//	02	2.4	2.5
000002	N/A	200	1543.2	0.4721	0.1530	22	01	73	18	45	7	28	07	81	61	//	//	//	02	2.4	3.3
000003	N/A	200	1543.2	1.2157	0.3939	23	01	73	03	45	7	27	07	81	21	//	//	//	02	3.4	4.2
000004	N/A	200	1543.2	0.6770	0.2193	23	01	73	12	45	7	26	07	81	61	//	//	//	02	2.3	4.1
000005	N/A	200	1543.2	4.2134	1.3651	23	01	73	22	15	7	25	07	81	31	//	//	//	01	7.6	4.8
000006	N/A	200	1543.2	2.0132	0.6523	24	01	73	05	40	7	24	07	81	01	//	//	//	0		5.2
000007	N/A	200	1543.2	0.5738	0.1859	24	01	73	13	40	7	23	07	81	11	//	//	//	02	5.0	5.2
000008	N/A	200	1646.1	0.6769	0.2056	24	01	73	20	15	7	22	07	81	41	//	//	//	02	6.1	6.1
000009	N/A	200	1543.2	0.8631	0.2796	25	01	73	20	15	7	20	07	81	51	//	//	//	02	5.4	6.2
000010	N/A	200	1543.2	0.0000	0.0000	25	01	73	12	50	7	20	07	82	01	//	//	//	01	5.1	6.6
000011	N/A	200	1543.2	3.3118	1.0730	25	01	73	19	10	7	21	07	82	95	//	//	//	02	6.2	6.2
000012	N/A	200	1543.2	0.1336	0.0434	26	01	73	02	25	7	22	07	82	47	09	11	01	01	5.3	5.8
000013	N/A	200	1543.2	3.0806	0.9981	26	01	73	11	10	7	23	07	83	00	06	20	//	02	3.5	5.4
000014	N/A	200	1543.2	2.9650	0.9607	26	01	73	21	20	7	24	07	83	00	07	13	//	02	2.6	4.8
000015	N/A	200	1543.2	29.7611	9.6427	27	01	73	05	20	7	25	07	83	00	07	08	//	02	2.4	4.4
000016	N/A	200	1543.2	33.8037	10.9525	27	01	73	12	55	7	26	07	83	00	09	10	//	02	2.6	4.0
000017	N/A	200	1543.2	3.8783	1.2566	27	01	73	20	00	7	27	07	83	00	17	10	//	02	3.0	3.4
000018	N/A	200	1543.2	30.0248	9.7281	28	01	73	03	35	7	28	07	83	00	19	14	//	02	3.1	2.9

Figure 3.8 Output of the MARMAP Information System program TARREP.

Logs (TPT) (Fig. 3.9) beginning with data from the Station Activities Summary. Further specifications for tar and plastics data are given in Section 6, Appendix I. Instructions for completion of the log form are presented below:

MARMAP Tar and Plastics Log (Form TPT, 10/80)

Page of ___ — The consecutive page of this log plus the total number of pages of logs for any cruise.

Operational Unit — Name of institution preparing this log, e.g., ZSOP, NEFC, NWAFC.

Vessel — As recorded on the Station Activities Summary.

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the table below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out gear name plus mesh aperture in microns.

Figure 3.9 The MARMAP Tar and Plastics Log

U.S. DEPT. OF COMMERCE NOAA
NATIONAL MARINE FISHERIES SERVICE

MARMAP TAR AND PLASTICS LOG (TPT)

OPERATIONAL UNIT ____________

Vessel [| | | | | | | | | | | | | | | | | | | | |] Cruise [| | | | | |] Gear/Mesh [| |]

STATION NUMBER	HAUL NUMBER	GEAR ID NUMBER	SAMPLE DATE D D M M Y Y	ALIQUOT CODE	NO. JARS	TAR WEIGHT (gm)	PLASTIC TYPES	WEIGHT (gm)	TYPES	WEIGHT (gm)	TYPES	WEIGHT (gm)
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	
							1		2		3	
							4		5		6	

REMARKS:

MARMAP TAR AND PLASTICS LOG FORM TPT (10/80)

Recorded by: ____________ Date: ____________

Station Number — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Gear I.D. No. — The number assigned to each net used during the haul. This is necessary when gear of identical chararcteristics are displayed on the same haul.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample (list below).

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

No. Jars — As recorded on the Zooplankton Sample Log.

Tar Weight — The weight of the air dried tar recorded to the nearest 0.1 gm.

Plastics Weights — The weight of each type of air dried plastic recorded to the nearest 0.1 gm. The six types, preprinted for each station are as follows:

Type 1	Opaque polystyrene spherules
Type 2	Clear and translucent polystyrene spherules
Type 3	Opaque and translucent polyethylene cylinders
Type 4	Styrofoam
Type 5	Plastics sheets
Type 6	Plastic pieces and paint chips

Recorded By — Initials or name of person entering data on the log.

Date — Date (day-month-year) that data are entered on the log.

Remarks — Any information useful in subsequent analyses of these samples.

3.3.2 Plastics Contaminants Determination

3.3.2.1 Separation of Plastics Contaminants

Plastic contaminants in the samples usually are removed during the sorting for fish eggs and larvae (Section 3.5.2.1). It is a helpful practice to arrange and analyze the samples and log the results in numerical order of stations.

3.3.2.2 Categorizing Plastics

Floating plastic contaminants usually fall into the classifications of white opaque polystyrene spherules, translucent to clear polystyrene spherules, opaque to translucent polyethlene cylinders or disks, styrofoam pieces, thin flexible wrapping material, and fragments of containers, toys, etc. (see Colton, Knapp, and Burns, 1974).

3.3.2.3 Drying and Weighing Plastics

Plastic contaminants are placed on a piece of pre-weighed wax paper and allowed to air dry (12 hours) and are then weighed. The weight of the paper is subtracted from the weight of the plastic plus the paper to obtain the plastic weight.

3.3.2.4 Filling Out Log Sheet

The resulting weights are recorded on the MARMAP Tar and Plastics Log (Section 3.3.1.3).

3.4 PROCESSING FOR BIOMASS

Displacement volume, dry weight, and total carbon determinations have as their aim the measurement of zooplankton biomass. For comparability of these methods see Wiebe, Boyd and Cox (1975), and Kane (in press).

3.4.1 Displacement Volume Determination

The information gained from volume determination is limited. Ahlstrom and Thrailkill (1963) have shown that there is a variation in plankton volume as a function of preservation time in formalin and as a function of species composition. Wiebe, Boyd and Cox (1975) show data partly in contradiction to the above, but there is little doubt that attempts to measure plankton biomass by displacement volume have limitations. Nonetheless, this technique is relatively simple, inexpensive and rapid, and within its limitations can provide useful data.

Plankton volumes are determined by displacement, (sometimes termed "wet volumes") and recorded to the nearest milliliter. Two volumes are routinely recorded for each sample:

Volume of Large Organisms - displacement volume of those planktonic organisms >2.5 cm in longest dimension

Volume of Small Organisms - displacement volume of those planktonic organisms <2.5 cm in longest dimension

Ichthyoplankton volumes may also be determined.

The plankton samples are removed from their boxes and readied for volume measurements by arranging them in the numerical order of stations.

The procedure for determining volumes is as follows:

3.4.1.1 Removal of Non-Planktonics

Each sample and its preservative are poured into a white tray approximately 40 x 30 x 5 cm. All non-zooplanktonic organisms, i.e., small adult fishes, juvenile fishes, squids, octopi, adult pelagic crabs, and seaweed are removed, placed in a jar of adequate size and appropriately labeled inside and outside. The names and quantities (number or volume) of these organisms are recorded on the Zooplankton Volume Log (Section 3.4.1.7). Data are also recorded for any specimens which were removed at sea and recorded on the Zooplankton Sample Log (Section 2.3.2.12).

NOTE: As mentioned earlier, data on original field logs such as the ZSL undergo extensive quality control. Use caution in dealing with these data.

3.4.1.2 Separation of "Small" and "Large" Organisms

All organisms with longest dimension approx. > 2.5 cm are removed, washed, and placed in a graduated cylinder (size depending on volume of sample) containing a known volume of 3-5% buffered formalin (Section 2.3.2.10). The difference in the resulting reading and the known volume of formalin is the volume of the large (> 2.5 cm) organisms.

3.4.1.3 Transfer of Sample to Graduated Cylinder

The remainder of the sample and its preservative are poured from the tray into a 1000 ml graduated cylinder and enough preservative is added or subtracted to bring the level of the liquid to an even milliliter. This volume (to the nearest whole milliliter) is retained for subsequent computations (Section 3.4.1.6)

3.4.1.4 Funnel and Draining Cone

A funnel is placed in another clean graduated cylinder.

NOTE: This cylinder is plastic tubing, 3.8 cm I.D. x 86.4 cm long (1.5 in x 34 in) with graduations etched on the cylinder or on a grooved board fastened to the back side of the cylinder. The graduations on the cylinder or on the board are 5-ml increments from 0-600 ml and 2-ml increments from 600-910 ml (see Kramer, et. al., 1972, p. 24)

A draining cone is placed in the funnel (see Table 2.1).

3.4.1.5 Standardization of Draining

The plankton and preservative from Step 3.4.1.3 are poured into the draining cone. The plankton is retained in the cone while the liquid drains into the cylinder. The plankton is considered drained when the interval between drops from the bottom of the cone increases to 15 seconds. Draining times very with the size and composition of the sample.

3.4.1.6 Calculations

The volume of the drained liquid in the cylinder is subtracted from the initial volume of plankton plus liquid (Step 3.4.1.3). The difference is the volume of the organisms approx. < 2.5 cm. Return both of the size groups of plankton to the jar with preservative in preparation for sorting.

3.4.1.7 MARMAP Zooplankton Volume Log

The plankton volumes are recorded on MARMAP Zooplankton Volume Logs (ZVL) (Fig. 3.10) beginning with data from the Station Activities Summary. Further specifications for zooplankton displacement volume data are given in Section 6, Appendix I.

Figure 3.10 The MARMAP Zooplankton Volume Log

U.S. DEPT. OF COMMERCE NOAA
NATIONAL MARINE FISHERIES SERVICE

PAGE ___ OF ___

MARMAP ZOOPLANKTON VOLUME LOG
(ZVL)

OPERATIONAL UNIT ____________________

Vessel [| | | | | | | | | | | | | | | | | | | | |] Cruise [| | - | | |] Gear/Mesh [| |]

STATION NUMBER	HAUL NO.	GEAR ID NO.	SAMPLE DATE D D M M Y Y	ANALYSIS DATE D D M M Y Y	ALIQUOT CODE	No. Jars	NON-PLANKTONIC ORGS. AND SEAWEED REMOVED		Vol. Large Orgs. (ml)	Vol. Orgs. <2.5 cm (ml)	ICHTHYO-PLANKTON VOL. (ml)	Remarks
							Organisms	Quantity				

Recorded by: ____________________

MARMAP ZOOPLANKTON VOLUME LOG (ZVL) FORM ZVL (10/80)

Instructions for completion of the log form are presented below:

MARMAP Zooplankton Volume Log (Form ZVL, 10/80)

Page of ___ — The consective page of the log plus the total number of pages of logs for any cruise.

Operational Unit — Name of institution preparing this log, e.g., ZSOP, SWFC, NWAFC, SEFC.

Vessel — As recorded on the Station Activities Summary.

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The abbreviation for the name of the gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other gear		Write out gear name plus mesh aperture in microns.

Station Number — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Recorded by: _____

Gear I.D. No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are displayed on the same haul.

Analysis Date — Local date (day-month-year) when volume analysis was performed.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample (list below).

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

NOTE: Aliquot factor should rarely be other than 1 for this analysis. If aliquoting is necessary, see Section 3.6.1 for details.

No. Jars — As recorded on the Zooplankton Sample Log.

Non-Planktonic Organisms and Seaweed removed — Name and quantity (number or volume). Under "Remarks enter data for any of these organisms discarded at sea as recorded on the Zooplankton Sample Log.

Vol. Large Orgs.	Displacement volume of organisms approx. > 2.5 cm in longest dimension recorded to the nearest whole milliliter. Under "Remarks" add data for any of these organisms discarded at sea as recorded on the Zooplankton Sample Log.
Vol. Orgs. 2.5 cm	Displacement volume of organisms approx. < 2.5 cm in longest dimension recorded to the nearest whole milliliter.
Ichthyoplankton Vol.	Displacement volume of ichthyoplankton recorded to the nearest 0.1 milliliter.
Remarks	Any information useful in subsequent analyses of these samples.
Recorded By	Initials or name of person entering data on the log.

3.4.1.8 Displacement Volume of Individual Specimens

Displacement volume determination of individual specimens of ichthyoplankton and other zooplankton requires apparatus of smaller scale and greater accuracy. As the displacement volumes involved become smaller the error due to interstitial water becomes more significant. The mercury immersion method of Yentsch and Hebard (1957) offers an improvement to the interstitial water problem. The modification of the plankton volume gauge for use aboard ship described by Tashiro and Hebard (1969) deals similarly with the interstitial water but avoids the use of mercury.

The authors had a glass blower construct a much reduced model of the Tashiro-Hebard gauge (Fig. 3.11) with

crucible dimensions of:

I.D. = 2.0 cm

height = 1.5 cm

volume = 4.71 cm^3

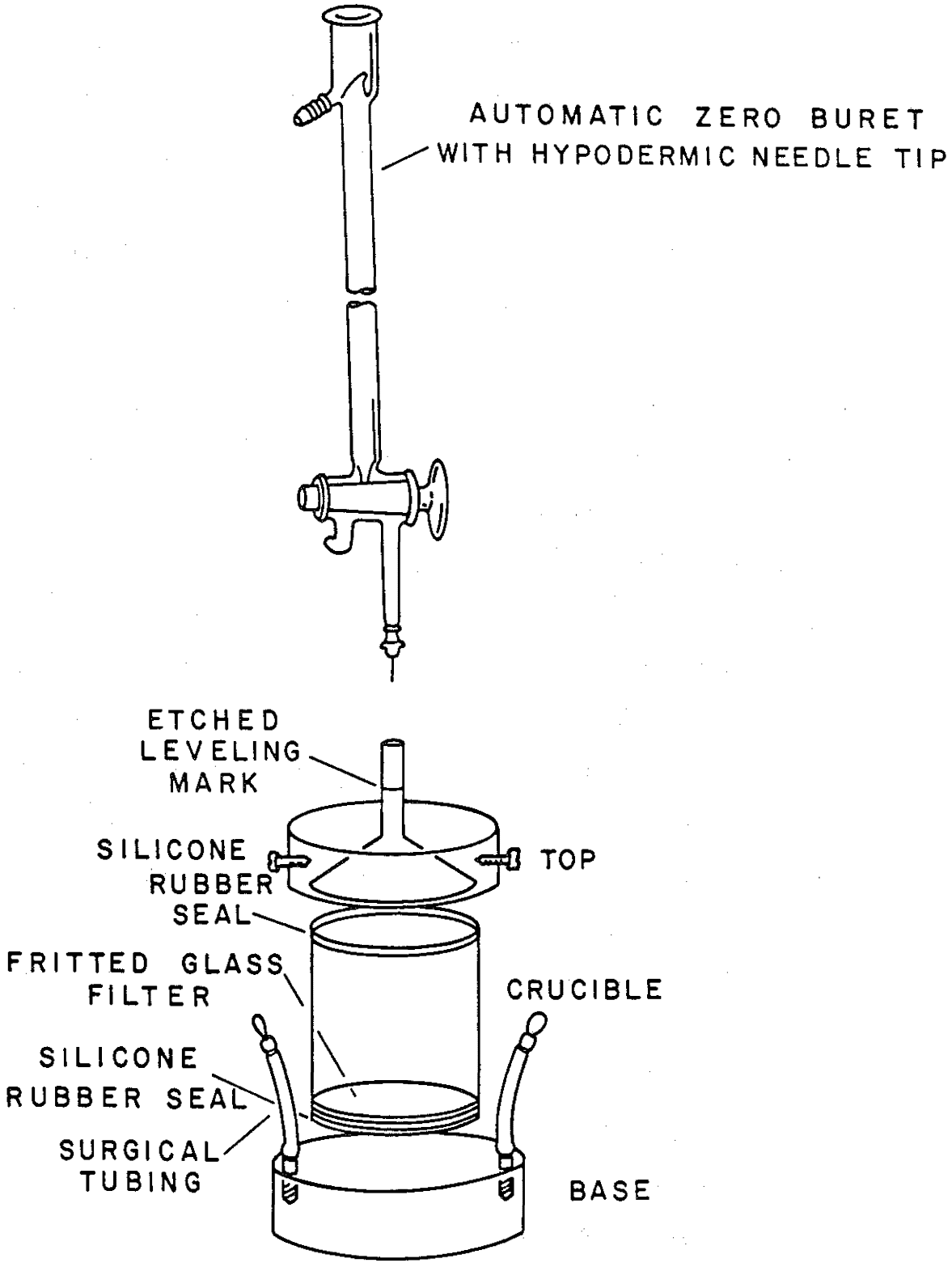


Figure 3.11 A modification of the Tashiro-Hebard plankton volume gauge

top dimensions of:

I. D. (bottom) = 2.0 cm

I. D. (capillary) = 0.2 cm

height = 3.0 cm

volume = 2.41 cm^3

empty gauge volume of:

= 7.12 cm^3

By using a micro, precision bore buret of 10 ml capacity and graduations at 0.01 ml intervals it was possible to measure the displacement volume of samples or single specimens $\leq$ 5 ml to $\pm$ 0.01 ml accuracy.

Emerging technologies, e.g., image analysis may prove to be superior to the above method, although they will surely require a substantially greater initial cost. For a simple, low cost, reasonably accurate determination of plankton biomass the above method has obvious application.

3.4.2 Total Carbon Biomass Determination

A determination of carbon biomass is the preferred method for obtaining zooplankton standing stock. The method to be used for MARMAP samples was prepared by Frederick D. Knapp and is based on the method of Curl (1962a). It involves the determination of organic carbon in an induction furnace and measurement of the resulting CO_2. Following is an outline of the method, but researchers should consult Curl's work as well as Lovegrove (1961) and Platt, Brown, and Irwin (1969) for further details.

NOTE: Since the sample is destroyed by this technique, a separate sample must be taken or obtained by aliquoting for other analyses.

3.4.2.1 At-Sea Procedure

The carbon biomass determination is usually composed of two somewhat separate operations (Fig. 3.12). Aboard ship a 0.333 mm mesh net sample is aliquoted if necessary and/or possible (see Section 3.6.1). Then the sample is placed in a draining pan of mesh aperture no larger than 253 microns, and rinsed with a liter of tap water to dilute interstitial sea salts. Depending upon the preservation method available, the drained sample is either 1) transferred to a numbered pre-weighted jar for drying at 60°C for 24 hours and preserved by desiccation or freezing, or 2) transferred to a graduated cylinder, brought to known volume in fresh water, homogenized for 90 sec and preserved in a lyophilizer.

> NOTE: Preservation of homogenized samples by freezing is permissible but leads to odor problems if the samples are also to be used for dry weight determination.
>
> Various rinsing and preserving techniques are in common practice. Until the effect of these differences has been established the actual method used must be documented on the log sheet.

3.4.2.2 On-Shore Procedure

At the shore laboratory the preserved sample is re-dried at 60°C to constant weight, cooled to room temperature in a desiccator, and the dry weight is determined. (See Section 3.4.3 for further details on the dry weight determination.) Approximately 100 mg of dry material is placed in a clay crucible and burned in an induction furnace, e.g., LECO Model 521-300. This furnace reaches a temperature of 1650 degrees C in about 15 sec, burning all carbon to CO_2, and then the gases are conducted to a LECO WR-12 Carbon

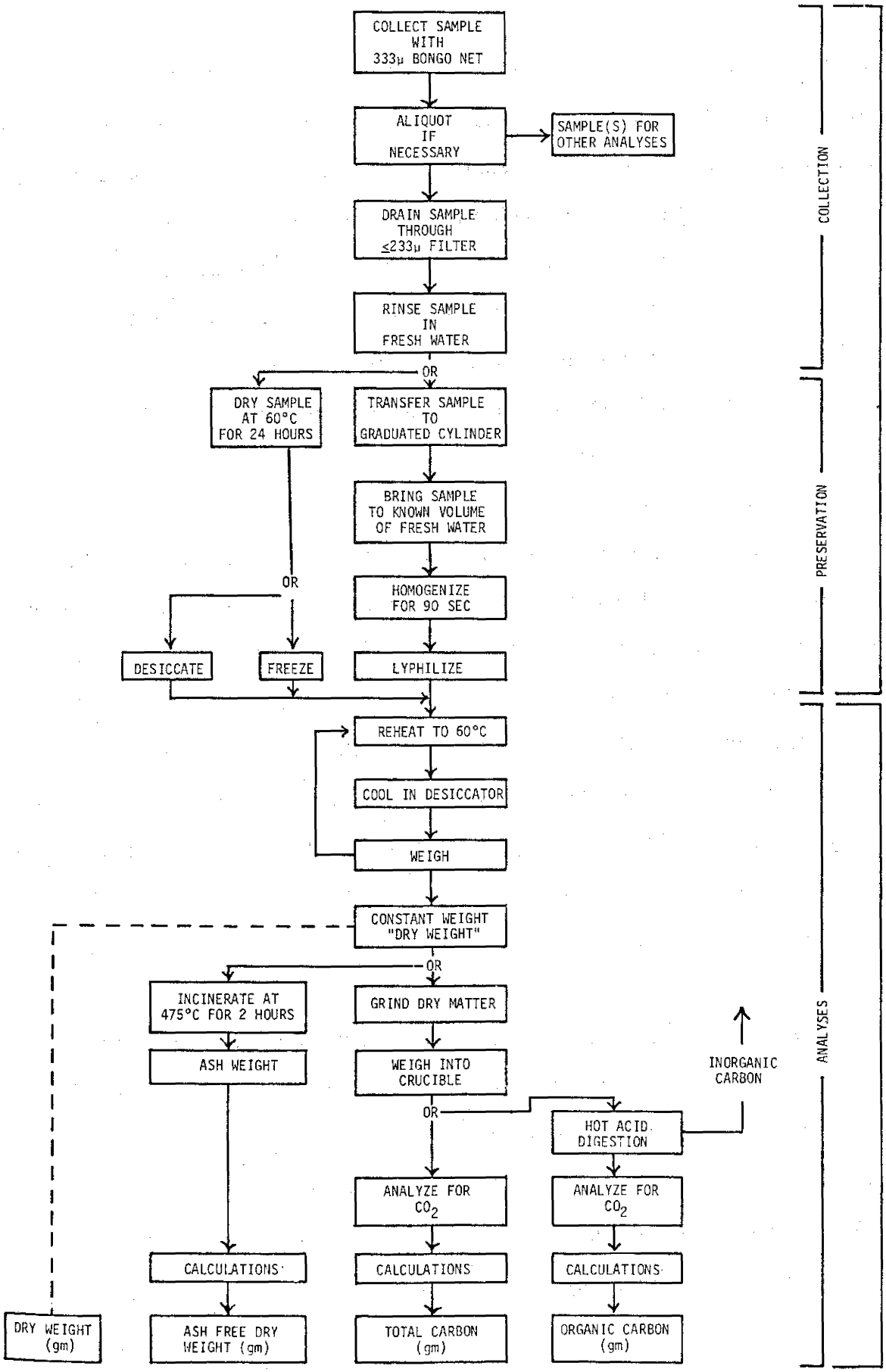


Figure 3.12 Sample flow for dry weight and carbon biomass determinations

Determinator. The Determinator selectively traps CO_2 which is measured via thermal conductivity. Appropriate correction factors are applied to give the mg of carbon in the original plankton sample (see Section 7, Appendix II).

NOTE: Since differences in rinsing and preservation procedures and carbon analysis equipment may alter the resulting data and since standards for these operations/equipment are not yet available, details about them must be logged for later data comparability.

3.4.2.3 Organic Carbon

This method measures total carbon, whereas organic carbon is the desired quantity. It appears that often there is no appreciable inorganic carbon in the zooplankton community. Curl (1962a) utilized the above method to analyze for carbon in zooplankton. For numerous individual plankton groups and for mixed plankton samples, only three test samples showed that inorganic carbon was present in appreciable amounts; these were the isopod, Idotea metallica; the mollusc, Limacina; and a mixed sample of phytoplankton and fish. However, other studies (Raymont, et al., 1967; Curl 1962b; and Harris and Riley, 1956) report ash weight to exceed 20 percent of dry weight.

Until and perhaps after the question is resolved, a simple addition to the method can give organic carbon. An aliquot, in addition to the one used for total carbon, is required. A portion of dry material is weighed out into a clay crucible, and then treated with a hot acid digestion to break down carbonates, releasing inorganic CO_2. Then the sample is burned in the normal fashion with the results representing only the organic carbon in the sample.

3.4.2.4 Utilizable Carbon

Also this method may not provide data which indicates that portion of the total carbon which is utilizable as a food energy source by consumers. Carbon tied up in calcareous or chitinous material may not be available to certain organisms. Corrections involve biochemical determinations which require special sample handling (Raymont, et al., 1964).

3.4.2.5 MARMAP Carbon Biomass Log

The weight of the carbon from the entire sample is calculated and entered on the MARMAP Carbon Biomass Log (TCB) (Fig. 3.13). Further specifications for carbon biomass data are given in Section 6, Appendix I. Instructions for completion of the log are presented below:

MARMAP Carbon Biomass Log (Form TCB, 10/80)

Page of ___ The consecutive page of the log plus the total number of pages of logs for any cruise.

Operational Unit Name of the institution preparing this log, e.g., NWAFC, NEFC.

Vessel As recorded on the Station Activities Summary.

Cruise As recorded on the Station Activities Summary.

Gear/Mesh The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2

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MARMAP CARBON BIOMASS LOG
(T C B)

OPERATIONAL UNIT ______________

Vessel [ ]

Cruise [ ]-[ ]

Gear/Mesh [ ]

STATION NUMBER	HAUL NO.	GEAR ID NO.	SAMPLE DATE	ALIQUOT CODE	TOTAL CARBON IN ORIGINAL SAMPLE (GM)	ORGANIC CARBON IN ORIGINAL SAMPLE (GM)

Remarks:

Rinsing Technique:

Preservation Technique:

Analyzer - Make/Model:

Recorded By ______________

MARMAP CARBON BIOMASS LOG FORM TCB (10/80)

Figure 3.13 The MARMAP Carbon Biomass Log

50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out gear name plus mesh aperture in microns.

Station Number — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample (list below)

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

NOTE: The aliquot factor for data on this log should always be 1 (aliquot code = 01) since data for dry weight and ash-free dry weight fields have already taken aliquot into account. Although constant, the aliquot data are processed into master files to simplify subsequent normalization calculations.

Total Carbon in Original Sample — The weight of the total (organic and inorganic) carbon contained in the plankton captured in this haul, recorded to the nearest 0.0001 gm.

Organic Carbon in Original Sample — The weight of the organic carbon contained in the plankton captured by this haul, recorded to the nearest 0.0001 gm.

Remarks — Any information useful in subsequent analyses of these samples. Until the effects of differing methods of rinsing and preservation, and possibly of different analysis equipment are known, details of these components of the determination must be logged.

Recorded By — Initials or name of person entering data on the log.

3.4.3 Dry Weight Biomass Determination

When carbon analysis equipment is not available the determination of zooplankton standing stock for MARMAP samples can be made by measuring dry weight and ash-free dry weight.

3.4.3.1 At-Sea Procedure

Methods of collection and preservation at sea are identical to those described in Section 3.4.2 for carbon biomass (Fig. 3.12).

NOTE: Various rinsing and preserving techniques are in common practice. Until the effect of these differences has been established, the actual method used must be documented on the log sheet.

3.4.3.2 On-Shore Procedure

At the shore laboratory the preserved samples are redried in an oven at 60°C for a period (quite variable, from approximately one day to several weeks) expected to bring it to constant weight. The sample is cooled in a desiccator and then weighed. Drying, cooling, and weighing is repeated, usually at one day intervals until successive weights vary by less than 5 percent. The lowest weight obtained is considered the "dry weight". Exposure time from desiccator to weight determination for a single sample must not exceed 5 minutes. However, when many samples must be analyzed, removing single samples from the desiccator every few minutes negates the desiccating process. A technique has been devised by Joseph Kane[2] whereby large numbers of samples can be processed and corrections for air exposure can be applied. All samples plus an empty blank sample container are removed at once from the desiccator on a tray. Caps are immediately applied and tightened. The blank is weighed first, then all the samples are weighed, and finally the blank is reweighed. Any variation of the blank's weight is applied incrementally as a linearly interpolated correction to the samples (see Section 7, Appendix II).

3.4.3.3 Ash-Free Dry Weight

To determine the amount of dry weight which was organic matter, the sample is incinerated at 475°C for 2 hours. The remaining ash is weighed and the ash-free dry weight is calculated by difference from the dry weight described above. For further details see Lovegrove (1961, 1966).

[2] Joseph Kane, NOAA, NMFS, Northeast Fisheries Center, Narragansett, RI, pers. comm. January 1981.

3.4.3.4 MARMAP Dry Weight Biomass Log

The dry weight and ash-free dry weight are entered on the MARMAP Dry Weight Biomass Log (DWB) (Fig. 3.14). Further specifications for dry weight biomass data are given in Section 6, Appendix I. Instructions for completion of the log are presented below:

MARMAP Dry Weight Biomass Log (Form DWB 10/80)

Page of ___ — The consecutive page of the log plus the total number of pages of logs for any cruise.

Operational Unit — Name of the institution preparing this log, e.g., ZSOP, NEFC, SWFC.

Vessel — As recorded on the Station Activities Summary.

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out gear name plus mesh aperture in microns.

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MARMAP DRY WEIGHT BIOMASS LOG (DWB)

OPERATIONAL UNIT ______________

Vessel [ ] Cruise [ ]

Gear Mesh [ ]

Blank Corrections	Dry Wt	Ash Free Dry Wt
Final Wt.		
Initial Wt.		

STATION NUMBER	HAUL NUMBER	GEAR ID NUMBER	SAMPLE DATE D D M M Y Y	ALIQUOT CODE	Uncorrected Dry Wt. (gm)	Air Exposure Correction (gm)	Corrected Dry Wt. (gm)	Uncorrected Ash Wt. (gm)	Air Exposure Correction (gm)	Corrected Ash Wt. (gm)	Corrected Ash-Free Dry Wt. (gm)	Weighing Sequence
INITIAL BLANK →												B_i
FINAL BLANK →												B_f

Remarks:

Rinsing Technique:

Preservation Technique:

Recorded by ______________

MARMAP DRY WEIGHT BIOMASS LOG FORM DWB (10/80)

Figure 3.14 The MARMAP Dry Weight Biomass Log

Station Number — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample (list below)

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

Uncorrected Dry Weight — The weight, uncorrected for air exposure, of the dried plankton sample recorded to the nearest 0.1 gm.

Air Exposure Correction	Weight change due to air exposure, applied to the series of weighed samples as linearly interpolated correction and recorded to the nearest 0.01 gm.
Corrected Dry Weight	"Uncorrected Dry Weight" minus "Air Exposure Correction" recorded to the nearest 0.1 gm.
Uncorrected Ash Weight	The weight, uncorrected for air exposure, of the incinerated plankton sample recorded to the nearest 0.1 gm.
Air Exposure Correction	As above.
Corrected Ash Weight	"Uncorrected Ash Weight" minus "Air Exposure Correction" recorded to the nearest 0.1 gm.
Corrected Ash-Free Dry Weight	"Corrected Dry Weight" minus "Corrected Ash Weight" recorded to the nearest 0.1 gm.
Weighing Sequence	The sequential number for the order in which the samples (excluding the blanks) were weighed.
Blank Corrections	For dry weights and/or ash weights:
Final Wt.	Weight of the blank sample container at the end of the sample weighing operation, recorded to the nearest 0.01 gm.
Init. Wt.	Weight of the blank sample container at the beginning of the sample weighing operation, recorded to the nearest 0.01 gm.
Remarks	Any information useful in subsequent analyses of these samples. Until the effects of differing methods of rinsing and preservation are known, details of these components of the determination must be logged.
Recorded By	Initials or name of person entering data on the log.

3.5 PROCESSING OF ICHTHYOPLANKTON

The processing is carried out in several steps: removal of tar and plastics contaminants (Sections 3.3.1 and 3.3.2); measuring the volume of the plankton in each sample (Section 3.4.1); sorting out and enumerating all fish larvae and eggs; identifying all larvae; measuring certain larvae; identifying certain fish eggs and staging (aging) some; and curating all fish eggs and larvae.

3.5.1 Sorting-Density Gradient Fractionation Method

A means of sorting plankton samples, density gradient fractionation, is currently being put into experimental use. The drained sample is overlaid on a colloidal silica gradient of about 1.00 to 1.09 g/cc. Fish eggs band tightly at about 1.02 g/cc and fish larvae more braodly at $\geq$ 1.05, while invertebrates (with the exception of those having calcareous shells) tend to be in-between. The technique is somewhat limited in that only samples free of mucilaginous and fibrous algae can be used, but this drawback is more than compensated for by the saving in sorting time. It is estimated that the technique could reduce the time spent processing samples by up to a factor of 10. The hardware for a large-scale system is currently being assembled, and variations in the composition of the gradient are being investigated, in order to affect better separation.

For further information contact: Mr. John B. Colton
NOAA/NMFS
South Ferry Road
Narragansett, RI 02882

3.5.2 Sorting-Traditional Method

Each sample delivered to the sorting laboratory is sorted for fish eggs (whole sample or aliquot--no less than 500 eggs--the decision to aliquot should be made by a senior staff member) and all larvae. It is recommended that each sample is examined by only one sorter. The samples are assigned in a random manner to prevent any one sorter from receiving more than his share of "difficult" or "easy" samples.

The level to which identifications of fish eggs and larvae are carried out by the sorters is dependent on their experience. Until experience is gained by the sorters it is advisable to have all the fish eggs placed in one vial and all the fish larvae in another.

3.5.2.1 Procedure for Sorting Eggs and Larvae

Although techniques may vary with individual sorters, the general method for sorting is as follows: The plankton is separated from its preservative by straining it through a nylon draining cone (mesh to be according to Table 2.1). The cone containing the inside jar label and the plankton is rinsed gently and then suspended in a one-liter beaker filled over 1/2 the way up the cone with fresh water containing a few drops of concentrated formalin. Fresh water is used because it has been found that prolonged exposure to concentrations of formalin (even 3 to 5%) in handling, stirring and under their eyes may cause sorters to become sensitive and allergic to the fumes and liquid. A sample can be kept as long as 1 month in the weak solution of fresh water with formalin. This does not imply that such length of time is necessary for sorting any single sample. The sorting is highly variable; however, the average time is about one sample (100 ml plankton) per day per sorter.

A small amount of plankton is removed with a plastic spoon, about 1/2 teaspoon or less, and placed in a petri dish. Any plankton removed from the labeled sample should be accompanied by a temporary label containing vessel, cruise and station number. Add enough fresh water to float the organisms freely. Gently swirl the dish for even distribution of organisms. Have a number of petri dishes next to the microscope, each labeled with the station data, and the name of the organism which will be transferred to it when sorted. Each of the labeled dishes should be about half full of 3% to 5% buffered formalin (in this instance, the few dishes of such formalin are not enough to affect the sorters adversely). All fish eggs and larvae are picked out with pipettes and/or fine quality (stainless steel) "soft touch" forceps and transferred to their appropriately labeled dishes. A recheck (2 additional scans) of the sorting dish should be made by the original sorter to ensure all fish eggs and larvae have been removed.

NOTE: Generally a binocular, dissecting microscope, at a total of 10X magnification, with transmitted light is used. Research quality microscopes are necessary because those of inferior quality would be detrimental to the eyesight of persons engaged in this type of work for 6 to 8 hours per day.

When the fish eggs and larvae have been sorted and checked, the remaining contents of the dish are poured into a "sorted" 1.5 liter beaker containing fresh water with a few drops of concentrated formalin. If any samples are to set for any length of time (lunch-overnight), the dishes (unsorted and sorted) and the sample in the cone must be covered to prevent drying out.

The above procedure is repeated until the entire sample has been examined.

3.5.2.2 MARMAP Plankton Sorter's Worksheet

The contents of each dish of sorted organisms are enumerated and the data entered on the MARMAP Plankton Sorter's Worksheet (Fig. 3.15) beginning with data from the Station Activities Summary. Instructions for completion of the log form are presented below:

MARMAP Plankton Sorter's Worksheet (Form PSW, 9/74)

Page ___ of ___ — The consecutive page of the log plus the total number of pages of logs for any station.

Operational Unit — Name of institution preparing this log, e.g., NEFC, ZSOP, SWFC.

Vessel/Cruise — As recorded on the Station Activities Summary.

Station-Haul No. — As recorded on the Station Activities Summary.

Sample Date — Date (day-month-year) that sample was collected; from the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9

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MARMAP Plankton Sorter's Worksheet

(PSW)

Operational Unit_____

Vessel/Cruise_____ Station - Haul No. _____ Sample Date _____
Day Month Year

Gear/Mesh_____ Gear ID No. _____ Original Examination_____

Re-examination_____

Sorter_____

	Remarks
Total Original Volume_____	
Total Orig. Vol. minus Lg. Orgs._____	
Fractioned Yes_____	
No_____	
Aliquot Factor _____	
Date Start_____	
Date Finished_____	
Larvae Removed_____	
No. of Heads_____	
No. of Tails_____	
No. of Disintegrated_____	
Eggs Removed_____	

MARMAP PLANKTON SORTERS WORKSHEET (PSW) FORM PSW (9/74)

Figure 3.15 The MARMAP Plankton Sorter's Worksheet

NAME	MESH	ENTER
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out full name plus mesh aperture in microns.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Original Examination Re-examination — Check the appropriate box as to whether this log contains data from an original sort or a re-examination (checking) sort.

Sorter — The initials or name of the sorter entering data on the log.

Total Original Volume — The sum of "Vol. Large Orgs." and "Vol. Orgs. <2.5 cm" as recorded on the Zooplankton Volume Log.

Total Orig. Vol. less Large Orgs. — The "Vol Orgs. <2.5 cm" from the Zooplankton Volume Log.

Fractioned — Check whether the sample to be sorted has been split into smaller fractions.

Aliquot Factor — The factor by which counts from an aliquot can be converted to numbers for the whole sample, e.g., for a 1/2 aliquot the aliquot factor is 2.

NOTE: Aliquot factor should rarely be other than 1 for this analysis. If aliquoting is necessary, see Section 3.6.1 for details.

Date Start — Date (day-month-year) that sorting of each sample begins.

Date Finished — Date (as above) that sorting of each sample is complete.

Larvae Removed — The total number (not including heads, tails, and disintegrated) of larvae removed from each sample and placed in a vial(s).

No. of Heads	The total number of larvae head sections removed from each sample.
No. of Tails	The total number of larvae tail sections removed from each sample.
No. of Disintegrated	The total number of disintegrated larvae removed from each sample
Eggs Removed	The total number of eggs removed from each sample and placed in a vial(s).
Remarks	Any information useful in subsequent analyses of these examples.

3.5.2.3. Verification of Sorting

During a training phase all samples are re-examined, but for experienced sorters only a random selection of sorted samples are subsequently re-examined, by a sorter other than the original sorter, for the presence of any eggs or larvae. Data from the re-examinations are entered on an additional Plankton Sorter's Worksheet which is attached to the original of such log. The percentage of samples to be re-examined by any sorter will be up to the discretion of the senior sorter.

3.5.2.4. Identification during Sorting

If during sorting it is possible to identify the fish larvae to species then follow procedures for "Identification of Fish Eggs and Larvae" (Section 3.5.3).

3.5.2.5. MARMAP Ichthyoplankton Sorting Record

The combined results from the Plankton Sorter's Worksheets (examination and re-examination) are entered on the MARMAP Ichthyoplankton Sorting Record (Fig. 3.16) beginning with data from the Station Activities Summary.

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MARMAP
ICHTHYOPLANKTON SORTING RECORD
(ISR)

Operational Unit ____________________

Vessel ____________________ Cruise ______________ Gear/Mesh ____________

MARMAP ICHTHYOPLANKTON SORTING RECORD (ISR) FORM ISR (10/80)

Sta. Haul No.	Gear ID No.	Sample Date D - M - Y	No. of Jars	Aliquot Factor	Date Start D - M - Y	Eggs Removed	No. of Vials	Larvae Removed	No. of Vials	Date Finished D - M - Y	Sorter	Remarks

Checked By: Date:

Figure 3.16 The MARMAP Ichthyoplankton Sorting Record

NOTE: The Plankton Sorter's Worksheet is useful when the sorting operation involves distributing the samples from a cruise among numerous sorters. The results from each station are logged on the PSW by the individual sorting that station and when all stations are sorted, the data from all PSW's are combined on the Ichthyoplankton Sorting Record. It is important to realize that transposing of data increases the potential for error, so that in operations where one sorter examines an entire cruise or where the logging can otherwise be satisfactorily performed, use of the PSW and transposing of data should be avoided.

Following are the instructions for completion of the log form:

MARMAP Ichthyoplankton Sorting Record (Form ISR, 10/80)

Page of — The consecutive page of the log plus the total number of pages of logs for any cruise.

Operational Unit — Name of institution preparing this log, e.g., NEFC, ZSOP, SWFC.

Vessel — As recorded on the Station Activities Summary

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5

20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other gear		Write out full name plus mesh aperture in microns.

Sta.-Haul No. — As recorded on the Station Activities Summary.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Sample Date — Date (day-month-year) that sample was collected; from the Station Activities Summary.

No. of Jars — As recorded on the Zooplankton Sample Log.

Aliquot Factor — The factor by which counts from an aliquot can be converted to numbers for the whole sample, e.g., for a 1/2 aliquot the aliquot factor is 2.

NOTE: Aliquot factor should rarely be other than 1 for this analysis. If aliquoting is necessary, see Section 3.6.1 for details.

Date Start — Date (day-month-year) that sorting of each sample began.

Eggs Removed — The total number of eggs removed from each sample and placed in a vial(s).

No. of Vials	The number of vials necessary to contain the sorted eggs.
Larvae Removed	The total number (not including heads and tails) of larve removed from each sample and placed in a vial(s).
No. of Vials	The number of vials necessary to contain the sorted larvae.
Date Finished	Date (as above) that sorting of each sample was completed.
Sorter	Initials or name of person sorting each sample.
Remarks	Any information useful in subsequent analyses of these samples.
Checked By	Initials or name of person checking data on the log.
Date	Date (day-month-year) that log is checked.

As stated in the instructions the number of "larvae removed" does not include the head and tail sections which may have been sorted, but these latter specimens are placed in the vials with the larvae and are re-examined during the identification phase.

3.5.2.6 MARMAP Vial Labels

Each group of organisms is placed in one or more 18 ml vials. Labels are placed in, and on the cap of each vial, and the vial is capped.

NOTE: The selection of standard sizes and configurations of sample jars and vials is a great aid to sample archiving. The preferred type of screw cap to be used is plastic with a vinyl insert that is "self-sealing" when screwed tightly on the vial, thus preventing evaporation for long periods of time and decreasing amount of curating time needed to replenish evaporated preservative (see Section 3.8). This is much preferred over corks, rubber stoppers, or screw caps with paper liners. Inside labels are written with waterproof ink (Higgins Engrossing Ink, No. 892, which does not clog the pen--Kohinoor Rapidograph No. 0 or 00--or equivalent. Paper for labels should be

100% rag content, e.g., Keuffel & Esser Co., "Albanene" tracing paper. Inferior quality paper eventually deteriorates in formalin or loses legibility.

Figure 3.17 shows inside and outside labels, for sorted and identified specimens, and explains the entries thereon.

3.5.2.7. Vial Storage

The vials of each station are arranged in numerical order in small cardboard boxes with vial dividers, for delivery to the identification group.

3.5.2.8. Ichthyoplankton Displacement Volume

A volume determination of this ichthyoplankton component may be performed. Since this volume is usually small it necessitates the use of a more precise, direct volume measurement than that used on the entire sample. See Section 3.4.1.8 for more details.

3.5.2.9. Plastics Removal

Any plastics contaminants removed during sorting should be analyzed according to the method described in Section 3.3.2.

3.5.2.10. Rebottle Invertebrates

The sorted plankton (invertebrates) is poured from the 1.5 liter beaker into the mesh cone to drain off the water, and the plankton is returned with the original label to its original jar which is then filled with fresh 3-5% formalin. The original label remains with the sample unless it has disintegrated or is illegible, in which case a fresh label is prepared.

3.5.3. Identification of Fish Eggs and Larvae

NOTE: The identification of fish eggs and larvae, as well as

MARMAP Vial Labels

A. Inside Labels

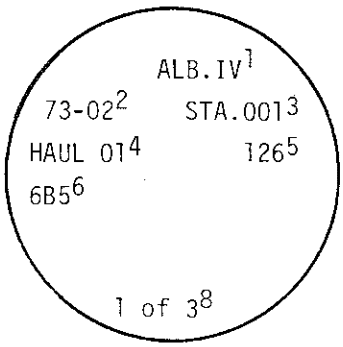
ALB.IV[1]	73-02[2]	ST 001[3]
HAUL 01[4]		126[5]
6B5[6]		1 of 3[8]

Sorted Specimens

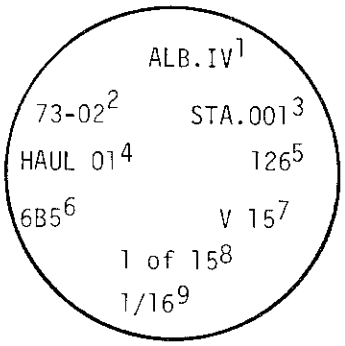
ALB.IV[1]	73-02[2]	ST 001[3]
HAUL 01[4]		126[5]
TRICHIURIDAE[10]		V 15[7]
6B5[6]		1 of 15[8]

Identified Specimens

B. Cap Labels



Sorted Specimens



Identified Specimens

LEGEND:

1 VESSEL
2 CRUISE
3 STATION
4 HAUL NO.
5 GEAR ID NO.
6 GEAR CODE (AS IN SECTION 3.5.2.5)
7 VIAL (FROM ICHTHYOPLANKTON DATA RECORD)
8 VIAL NUMBER PLUS TOTAL VIALS PER TAXON
9 ALIQUOT FRACTION
10 TAXON (FROM ICHTHYOPLANKTON DATA RECORD OR ZOOPLANKTON DATA LOG)

Figure 3.17 MARMAP Specimen Vial Labels

invertebrates, sometimes requires the temporary recording of data which are not retained in the final data files. Therefore, various worksheets are often useful or even necessary. Although the style and number of these is left to the individual investigator, certain minimum logging must take place (i.e., see Fig. 3.19, 2.21, and 3.25). If the use of a worksheet results in transposing of data to a more formal logsheet great care must be exercised to avoid error introduction. Operational procedures should be designed to eliminate the need for transposing whenever possible.

When the identifiers receive the vials, the Ichthyoplankton Sorting Records, and the Planton Sorter's Worksheet from the sorting laboratory, their procedures are generally as follows:

3.5.3.1. Fish Larvae

Identifications and measurements of fish larvae may have been made by trained sorters for certain commonly occurring species. After checks by senior staff members, these data will be combined with those from the full identification described below.

3.5.3.1.1. Naming Convention

The identifier will assign each specimen to the lowest taxomic level possible. Those specimens which cannot be taken to at least the Order level, but which are in identifiable condition, will be classified as "unknown" fish". Those larvae in such a poor state that they are impossible to identify are put into a "disintegrated fish" category. Head and tail sections are sometimes present and may possibly be identified. However, these data should not be included in the total for whole specimens but are entered separately.

Except for "unknown and disintegrated fish", specimens are named according

to the American Fisheries Society Special Publication (Bailey, et al, 1970) and assigned a 9-digit numerical code (Bullis, Roe and Gatlin, 1972). Request from MARMAP Information System (MIS) users for listings or for additions or corrections to these bionumeric codes should be made to:

Mr. Jack W. Jossi
NOAA/NMFS
Atlantic Environmental Group
South Ferry Road
Narragansett, RI 02882

Similar requests from non-MIS users should be addressed to:

Mr. Frederick C. Minkler
NOAA/NMFS
P.O. Box Drawer 1207
Pascagoula, MS 39567

See Section 6, Appendix 1 for further details on ichthyoplankton larvae data.

NOTE: MARMAP Information System users may obtain a current listing of the bionumeric codes by running the MIS program A9SRT.

Each group of specimens thus categorized is placed in spearate petri dishes with appropriate temporary labels.

3.5.3.1.2. Enumeration and Measuring

All larvae are counted, and if identified to species, measured for standard length (Fig. 3.18). Individual specimens of a species are arranged in rows in a plain petri dish. The dish is moved under the microscope each specimen is aligned, and then measured with the eyepiece micrometer to the nearest 0.1 mm. Measurements are usually done by members of the sorting staff.

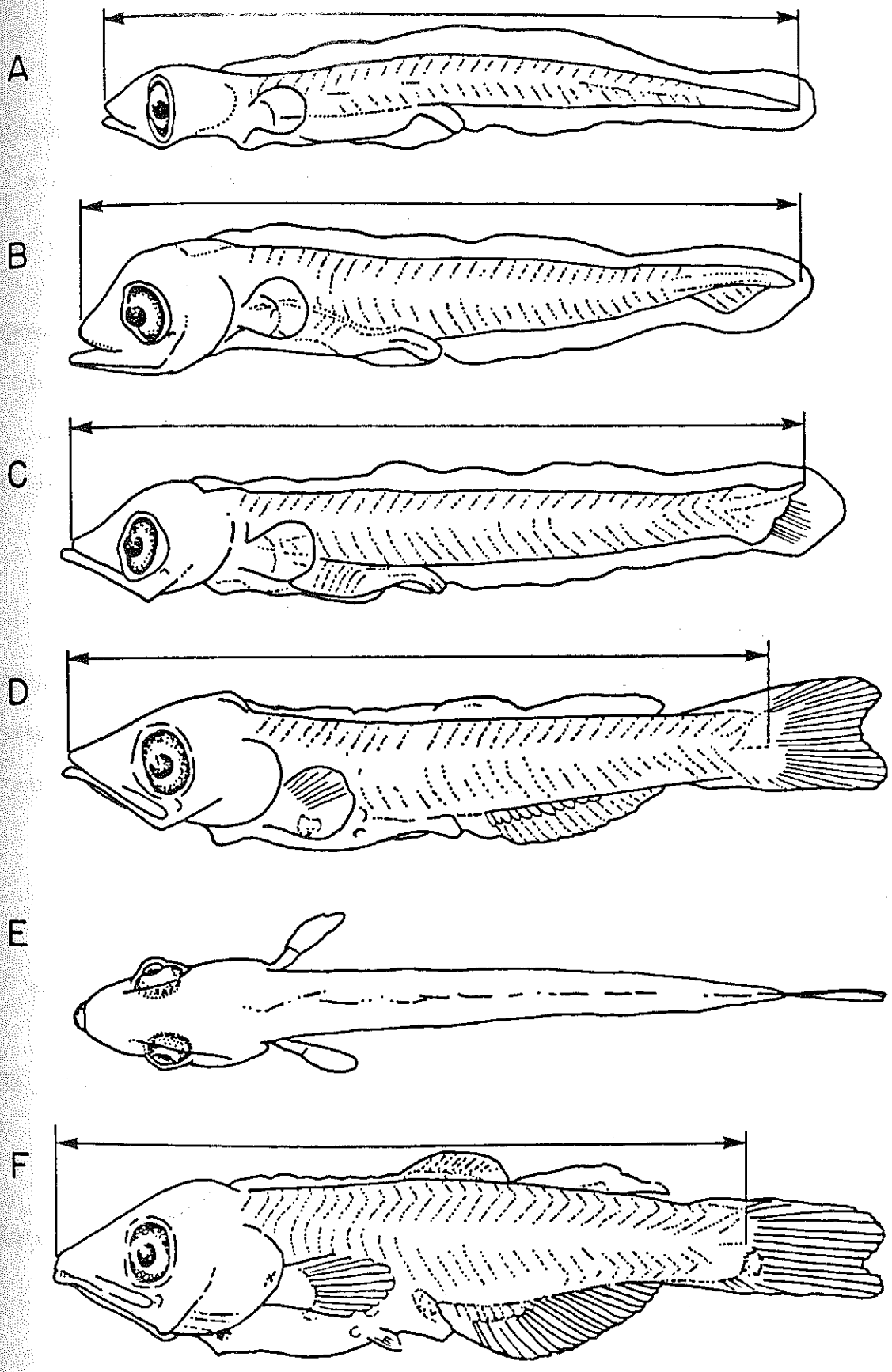


Figure 3.18 Examples of standard length larval fish measurements

Up to 100 randomly selected specimens of a species will be measured from any sample. It is seldom necessary to measure more than 100 specimens of a species; however, if there is doubt that these data are representative of the length frequency distribution of the specimens in the entire sample, then more measurements must be made.

NOTE: Subsequent re-identifications of larvae may be performed. The resulting information, including data from any counts and length measurements, and resulting vial number and contents alterations must be processed in such a way as to not invalidate the quantitative aspects of existing data files.

3.5.3.1.3. MARMAP Ichthyoplankton Data Record-Larvae

Specimens from each category are then placed in a labeled vial (Fig. 3.17), numbered consecutively as the taxa are entered on the MARMAP Ichthyoplankton Data Record-Larvae (IDL) (Fig. 3.19) beginning with data from the Station Activities Summary. Further specifications for ichthyoplankton larvae data are given in Section 6, Appendix I.

Instructions for completion of the log form are presented below:

MARMAP Ichthyoplankton Data Record-Larvae (Form IDL, 10/80)

Page of — The consecutive page of the log plus the total number of pages of logs for this station.

Operational Unit — Name of institution preparing this log, e.g., NWAFC, NEFC.

Vessel — As recorded on the Station Activities Summary.

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5

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MARMAP ICHTHYOPLANKTON DATA RECORD - LARVAE (IDL)

OPERATIONAL UNIT _____

Vessel ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Cruise ☐☐☐☐☐ Gear/Mesh ☐☐ Station No. ☐☐☐ Haul No. ☐☐

Gear ID No. ☐☐☐ Sample Date ☐☐☐☐ Vials Sorted Larvae ☐ Total Whole Larvae ☐☐☐ Aliquot Code ☐☐

TAXON: NUMBER NAME	VIAL NO.	STANDARD LENGTHS (mm) 1 2 3 4 5 6 7 8 9 10	NO. NOT MEASURED	NO. OF HEADS	NO. OF TAILS	I.D. BY

Remarks:

MARMAP ICHTHYOPLANKTON DATA RECORD-LARVAE FORM IDL (10/80)

Figure 3.19 The MARMAP Ichthyoplankton Data Record--Larvae

GEAR	MESH	ENTER
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out full name plus mesh aperture in microns.

Station Number — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on a haul.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Vials Sorted Larvae — The number of vials of larvae resulting from the sort; from the Ichthoplankton Sorting Record.

Total Whole Larvae — The number of whole larvae resulting from the sort; from the Ichthyoplankton Sorting Record.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04

ALIIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

NOTE: Aliquot factors other than 1 should be extremely rare and result only after review by a senior staff member. See Section 3.6.1 for details.

Taxon Number — The 9 digit Southeast Fisheries Center Bionumeric Code for Fishes (Bullis, et al., 1972).

NOTE: Ten boxes are provided for researchers who may be using the more universal National Oceanographic Data Center (NODC) Taxonomic Code. A current list of names and codes is available, upon request from the authors, or for MARMAP Information System users, by running the MIS program A9SRT. See Section 6, Appendix I for further comments on this log sheet field.

Taxon Name — The scientific name according to the American Fisheries Society (Bailey et al, 1970) for the following taxonomic levels:

Order

Family

Genus

Species

Vial No. Vials are numbered sequentially as taxa for each station/haul/gear are identified. Numbers must be confined to the range 001-099.

Standard Lengths The standard length(s) to the nearest 0.1 mm for the larvae of each taxon identified to the species level (see Fig. 3.11).

No. not Measured The number of whole larvae of each logged taxon which were not measured.

No. of Heads Number of larval head sections for each taxon logged.

No. of Tails Number of larval tail sections for each taxon logged.

I.D. By Initails of individual identifying each taxon.

Remarks Any information useful in subsequent analyses of these samples.

3.5.3.2 Fish Eggs

Although many species have characteristiceggs that pose no problem in identification (as for example, eggs of the northern anchovy, Engraulis mordax; sprat, Sprattus sprattus; or the Pacific saury, Cololabis saira), some species have eggs that are difficult to identify because of similarity in size and appearance to eggs of co-occurring species. In some fishes late-state eggs can be identified readily, but not newly spawned (early-stage) eggs. In some cases artificially fertilized eggs (from known parents) can provide data which would permit the positive identification of eggs from plankton samples.

Identification, measurement, and staging of fish eggs may have been performed by trained sorters for certain commonly occurring species. After checks by senior staff members, these data will be combined with those from the full identification described below.

The manipulation of the specimens, their temporary labeling, and the microscopic techniques for measurement are similar to those used for larvae (Section 3.5.3.1). Aliquoting, which is rarely used for larvae, may be employed more often when analyzing eggs (Section 3.6.1).

3.5.3.2.1 Naming Convention

The identifier will assign each specimen to the lowest taxonomic level possible. Those specimens which cannot be taken to at least the Order level but which are in identifiable condition will be classified as "unknown eggs". Those eggs in such a poor state that they are impossible to identify are put into a "disintegrated eggs" category.

Except for "unknown and disintegrated eggs" specimens are named according to the American Fisheries Society Special Publication (Bailey et al, 1970) and assigned a 9-digit numerical code (Bullis, et al, 1972). Requests from MARMAP Information System users for listings or for additions or corrections to these bionumeric codes should be made as indicated in Section 3.5.3.1.1.

3.5.3.2.2 Measuring

Measurement of the egg diameter and the oil globule diameter is often necessary in order to identify the egg. Both these diameters should be measured with the eyepiece micrometer to the nearest 0.01 mm.

3.5.3.2.3 Staging

Stages of development of the eggs have been categorized by several workers (Marak and Colton, 1961; Masueti and Hardy, 1967; E. H. Ahlstrom[3/]; and A. Naplin and P. Barrien[4/].

[3] Elbert H. Ahlstrom, deceased, NOAA/NMFS, Southeast Fisheries Center, LaJolla, CA pers. commun. January 1978.

[4] Ann Naplin and Peter Berrien, fishery biologists, NOAA/NMFS, Northeast Fisheries Center, Highland, NJ, pers. commun., January 1978.

Those of Marak and Colton are shown in Figure 3.20. The number of categories varies between investigators and among taxa. A composite of the various lists of stages has been prepared for investigators storing data in the MARMAP Information System. A three digit numerical code has been assigned to each stage. The first "word" (characters separated by blanks) of the stage name is actually an abbreviation for the authority from whom the name was taken (See Section 3.5.3.2.4 for list of stages and codes).

NOTE: Subsequent re-identifications of eggs may be performed. The resulting information, including data from any counts and measurements, and resulting vial numbers and contents alterations must be processed in such a way as to not invalidate the quantitative aspects of existing data files.

3.5.3.2.4 MARMAP Ichthyoplankton Data Record-Eggs

Specimens from each analyzed category are then placed in a labeled vial (Fig. 3.17), numbered consecutively as the taxa are entered on the MARMAP Ichthyoplankton Data Record-Eggs (IDE) (Fig. 3.21) beginning with data from the Station Activities Summary. Further specifications for ichthyoplankton egg data are given in Section 6, Appendix I.

Instructions for completion of the log are presented below:

MARMAP Ichthyoplankton Data Record - Eggs (Form IDE, 10/80)

Page of — The consecutive page of the log plus the total number of pages of logs for this station.

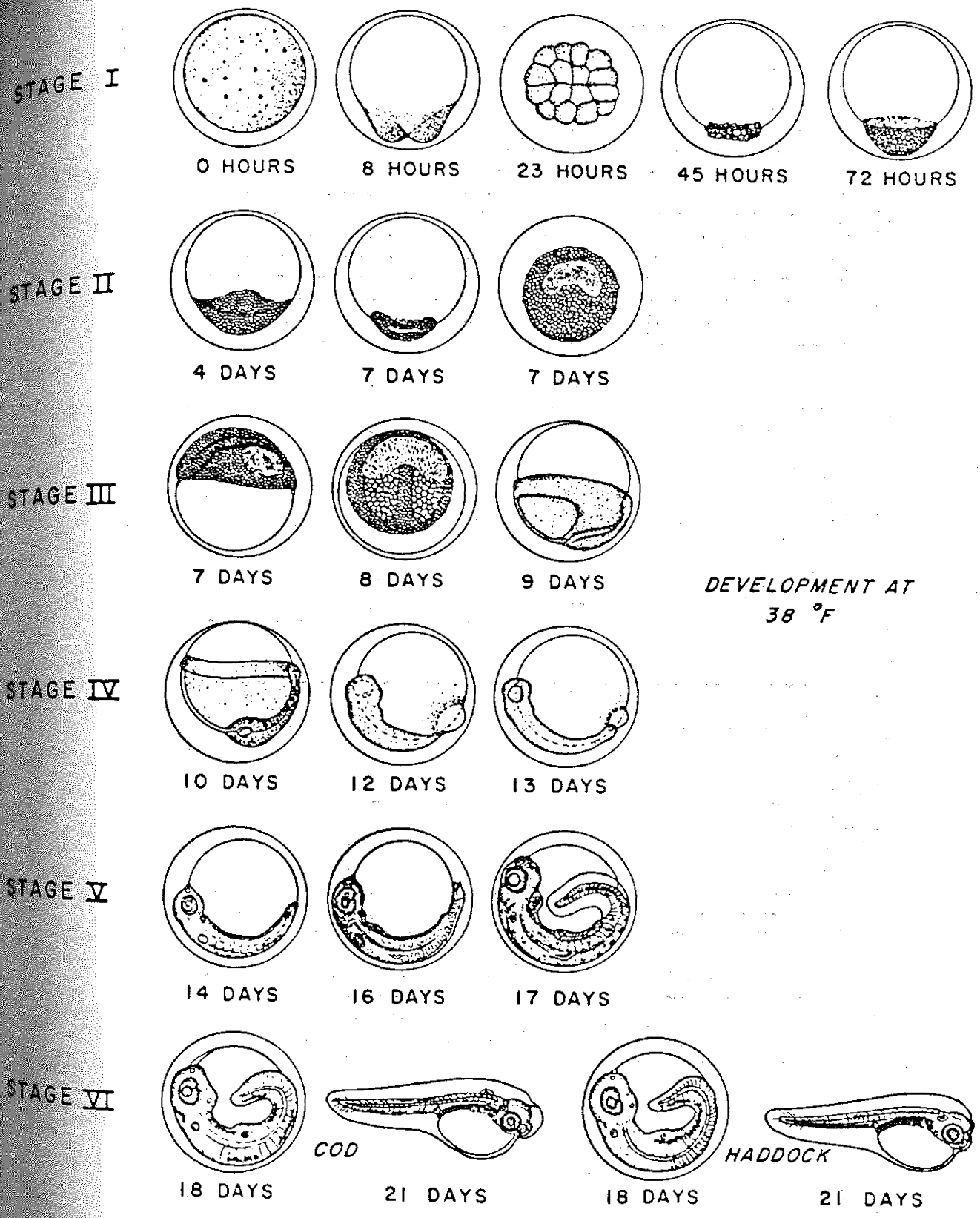

Figure 3.20 Fish egg development stages (from Marak and Colton, 1961).

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MARMAP ICHTHYOPLANKTON DATA RECORD – EGGS
(IDE)

OPERATIONAL UNIT _____

Vessel ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Cruise ☐☐☐☐☐ Gear/Mesh ☐☐☐ Station No. ☐☐☐

Haul No. ☐☐ Gear ID No. ☐☐☐ Sample Date ☐☐☐☐☐☐ Vials Sorted Eggs ☐ Total Whole Eggs ☐☐☐☐ Aliquot Code ☐☐

FORM IDE (10/80) MARMAP ICHTHYOPLANKTON RECORD – EGGS

TAXON NUMBER TAXON NAME	VIAL NO.	STAGE	EGG DIAM. (mm)	OIL GLOB DIAM. (mm)	NO. NOT ANALYZED	I.D. BY
1						
2						
3						

TAXON NUMBER TAXON NAME	VIAL NO.	STAGE	EGG DIAM. (mm)	OIL GLOB DIAM. (mm)	NO. NOT ANALYZED	I.D. BY
4						
5						
6						

Figure 3.21 The MARMAP Icythyoplankton Data Record--Eggs

Operational Unit — Name of the institution preparing this log, e.g., NEFC, NWAFC, ZSOP.

Vessel — As recroded on the Station Activities Summary.

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other gear		Write out gear name plus mesh aperture in microns.

Station Number — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Vials Sorted Eggs — The number of vials of eggs resulting from the sort; from the Ichthyoplankton Sorting Record.

Total Whole Eggs — The number of whole eggs resulting from the sort; from the Ichthyoplankton Sorting Record.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample.

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

NOTE: Aliquot factor may be other than 1 for this analysis. If aliquoting is necessary, see Section 3.6.1 for details.

Taxon Number — The 9 digit Southeast Fisheries Center Bionumeric Code for Fishes (Bullis, et al., 1972).

NOTE: Ten boxes are provided for researchers who may

be using the National Oceanographic Data Center (NOCD) Taxonomic Code. A current list of names and codes is available upon request from the authors, or for MARMAP Information System users, by running the MIS program A9SRT. See Section 6 Appendix I for further comments on these log sheet fields.

Taxon Name — The scientific name according to the American Fisheries Society (Bailey et al, 1970) for the following taxonomic levels:

Order

Family

Genus

Species

Vial No. — Vials are numbered sequentially as taxa from each station are identified. Identified egg vials must be numbered in the range 100-199. The hundreds digit is preprinted on the log. This is to avoid identical vail numbers for eggs, larvae, and zooplankton from the same station, gear and haul. Be sure to include the preprinted digit on any vial labels.

Stage — The developmental stage of eggs of a particular taxon according to the list below (See Section 3.5.3.2.3 for further explanation):

	NAME	ENTER
PB	Unstaged	000
PB	Through Blastopore Almost Closed	001
PB	Blastopore Closed to Tail Tip Almost Free	002

PB Tail Tip Free to Hatching	003
PB Dead at Capture	004
PB Abnormal	005
EHA Prefertilization or Precleavage	010
M&C Stage One 0 hr	020
AN Precell 0 Hr	030
M&H Early Cleavage	040
M&C Stage One 8 hr	050
AN Two Cell	060
AN Four Cell	070
AN Eight Cell	080
AN Sixteen Cell	090
M&C Stage One 23 hr	100
AN Cell Stage	110
M&C Stage One 45 hr	120
M&C Stage One 72 Hr	130
M&H Morula	140
EHA Morula	150
AN Early Blastula	160
AN Blastodermal Cap	170
M&C Stage Two 4 Days	180
M&C Stage Two 7 Days	190
M&H Blastula	200
EHA Blastula Part of Gastrula	210
M&C Stage Three 7 days	220

NAME	ENTER
M&C Stage Three 8 Days	230
M&C Stage Three 9 Days	240
M&H Gastrula	250
AN Early Germ Ring	260
AN Germ Ring 1/2 Down	270
M&C Stage Four 10 Days	280
AN Germ Ring 3/4 Down	290
M&C Stage Four 12 Days	300
M&H Early Embryo	310
EHA Gastrula Early Embryo	320
M&C Stage Four 13 Days	330
AN Blastopore Almost Closed	340
AN Ruptured Germ Ring	350
AN Ruptured late germ ring or early middle	360
AN Early Middle	370
EHA Early Embryo to Blastopore Closure	380
EHA Blastopore Closure to Tail Bud	390
M&C Stage Five 14 Days	400
M&H Tail Bud Stage	410
AN Middle Middle	420
AN Late Middle	430
AN Ruptured late middle or early late	440
M&C Stage Five 16 days	450
EHA Early Tail Free	460
AN Early Late	470

NAME	ENTER
M&H Tail Free Stage	480
EHA 1/3 Embryo Tail Free	490
AN Tail 1/2 Yolk	500
AN Tail 5/8 Yolk	510
EHA Tail Leaves Plane of Embryo	520
M&C Stage Five 17 Days	530
AN Tail 3/4 Yolk	540
AN Tail 7/8 Yolk	550
AN Full Circle	560
AN Tail 1 1/8 Yolk	570
AN Tail 1 1/4 Yolk	580
AN Tail 1 3/8 Yolk	590
AN Tail 1 1/2 Yolk	600
M&C Stage Six 18 Days	610
M&H Late Embryo	620
EHA Late Embryo	630
EHA Prehatching	640
AN Ruptured Early	700
AN Early Stages 030 through 350 and 700	730
AN Early Stages 030 through 270 and 700	760
AN Middle Stages 370 through 430	790
AN Later than Full Circle	820
AN Abnormal Usually Late	850
JJ Stage Unknown	900

Egg Diameter	The diameter(s) to the nearest 0.01 mm for the measured eggs of each taxon logged.
Oil Globule Diameter	The oil globule diameter(s) to the nearest 0.01 mm for the measured eggs of such taxon logged.
No. Not Analyzed	The number of eggs of each logged taxon for which no analysis (staging or measuring) was performed.
I.D. By	Initials of individual identifying each taxon.
1 2 3 4 5 6	The order in which the blocks of log sheet fields are to be filled in, one or more for each taxon.

3.5.3.2.5 Further Information About Fish Eggs

More Information on the analyses of fish eggs may be obtained as follows:

Image Analysis	Mr. Raymond Maurer NOAA/NMFS Narragansett Laboratory South Ferry Road Narragansett, RI 02882
Atlantic Taxa:	Mr. Peter Berrien NOAA/NMFS Sandy Hook Laboratory Highlands, NJ 00732
Pacific Taxa:	Dr. Reuben Lasker NOAA/NMFS P. O. Box 271 LaJolla, CA 92037

3.6 PROCESSING OF INVERTEBRATE ZOOPLANKTON

The processing is carried out in several steps: removal of tar and plastics contaminants (Sections 3.3.1 and 3.3.2); measuring the volume of the plankton in each sample (Section 3.4.1); aliquoting sample; determining size frequency distribution; sorting and enumerating of major taxa; and identifying, staging, measuring and sexing taxa.

3.6.1 Aliquoting

Aliquoting of samples would not be performed in the ideal analysis situation since several commonly occurring factors can act to cause variations between splits and/or between the results of different splitter operators, e.g., 1) aliquoting by a factor sufficient to reduce abundant forms to reasonable numbers usually results in an aliquot factor which exceeds the number of many taxa present in the original sample -- an aliquot level satisfactory for one taxon is unsatisfactory for many others; 2) it is not always possible to get the organisms randomly distributed in the undivided chamber before performing the split; 3) much of the skill and the techniques applied by splitter operators are difficult to document and therefore difficult to standardize between operators (Longhurst and Seibert, 1967; Miller, 1975; Green, 1976).

There are, however, practical requirements that result in the need for aliquoting samples. First, the samples must be reduced to a reasonable (~500 specimens) size for microscopic examination, and second, enough samples must be obtained for the different analyses which may be desired. The size of these latter aliquots will be determined by the requirements of each analysis.

3.6.1.1 Folsom Plankton Splitter

A "satisfactory" instrument for aliquoting MARMAP Zooplankton samples is the Folson Plankton Sample Splitter (McEwen, et al., 1954) as modified by Longhurst and Seibert (1967) to uniformly distribute the specimens prior to splitting through the use of an air manifold (Fig. 3.22).

3.6.1.2 Bourne Plankton Splitter

Another splitter that compares favorably with the Folsom Splitter is a modification of Motoda's (1959) box type plankton splitter and is called the Bourne Plankton Splitter (Betelho and Donnelly, 1978) (Fig. 3.23). This device relies on user skill rather than the air manifold for random mixing, but does have an emptying and continued splitting feature which speeds up the operation.

3.6.1.3 Splitting Procedure

Regardless of which of these splitters is used, the following two steps must be performed prior to the operation: 1) the splitter must be leveled using the leveling screws and a mechanics level attached to the base plate to insure that identical fractions result, and 2) for a new instrument a comparison of the geometry of the two parts of the chamber must be made. This can be done by measuring the volumes of water resulting from splitting operation. The allowable difference depends on the volume being split and the abundance of those organisms to be studied in the split. Non-allowable differences should result in rejection or rebuilding of the splitter rather than carrying awkward correction factors through the processing of these data.

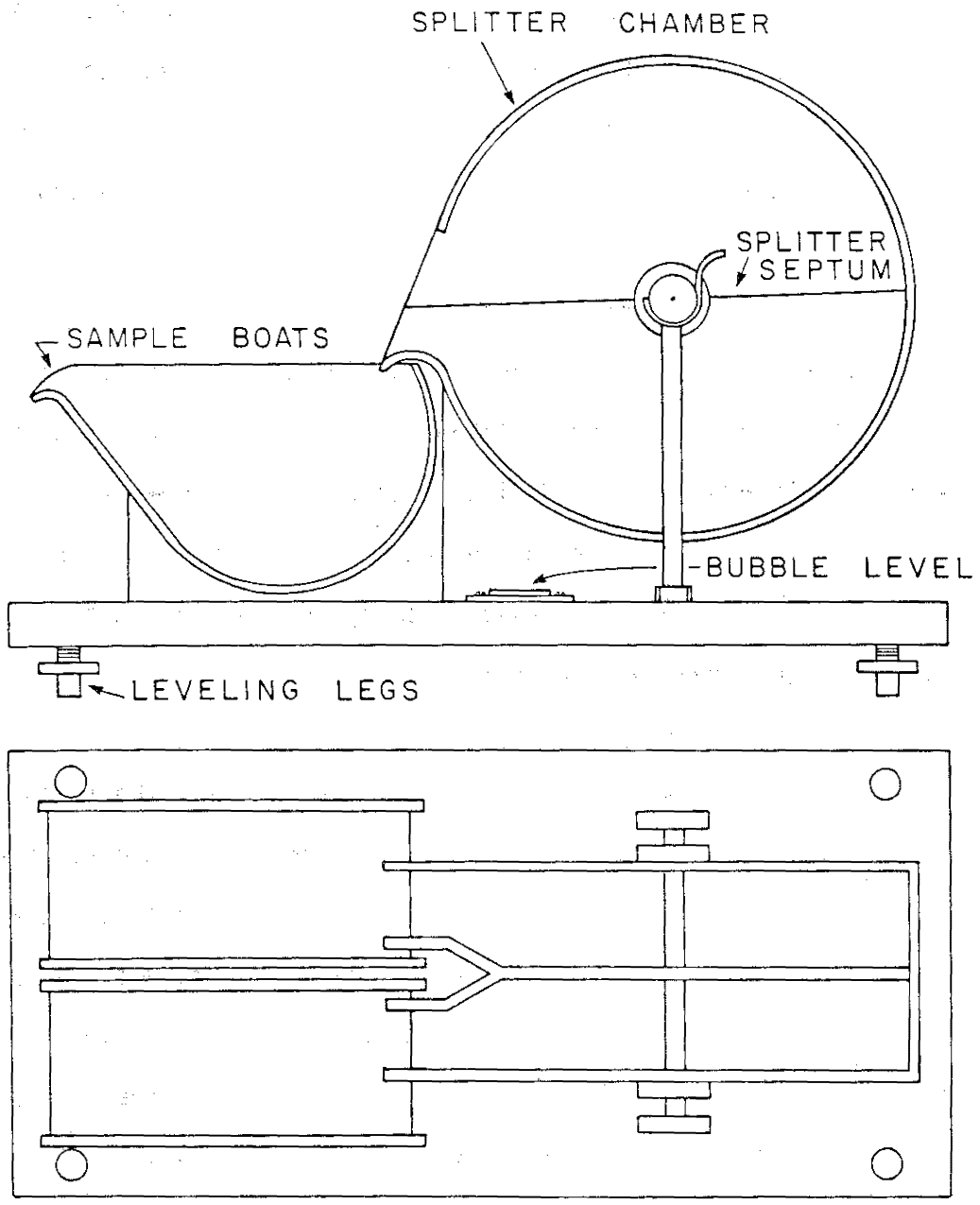

Figure 3.22 The Folsom Plankton Sample Splitter

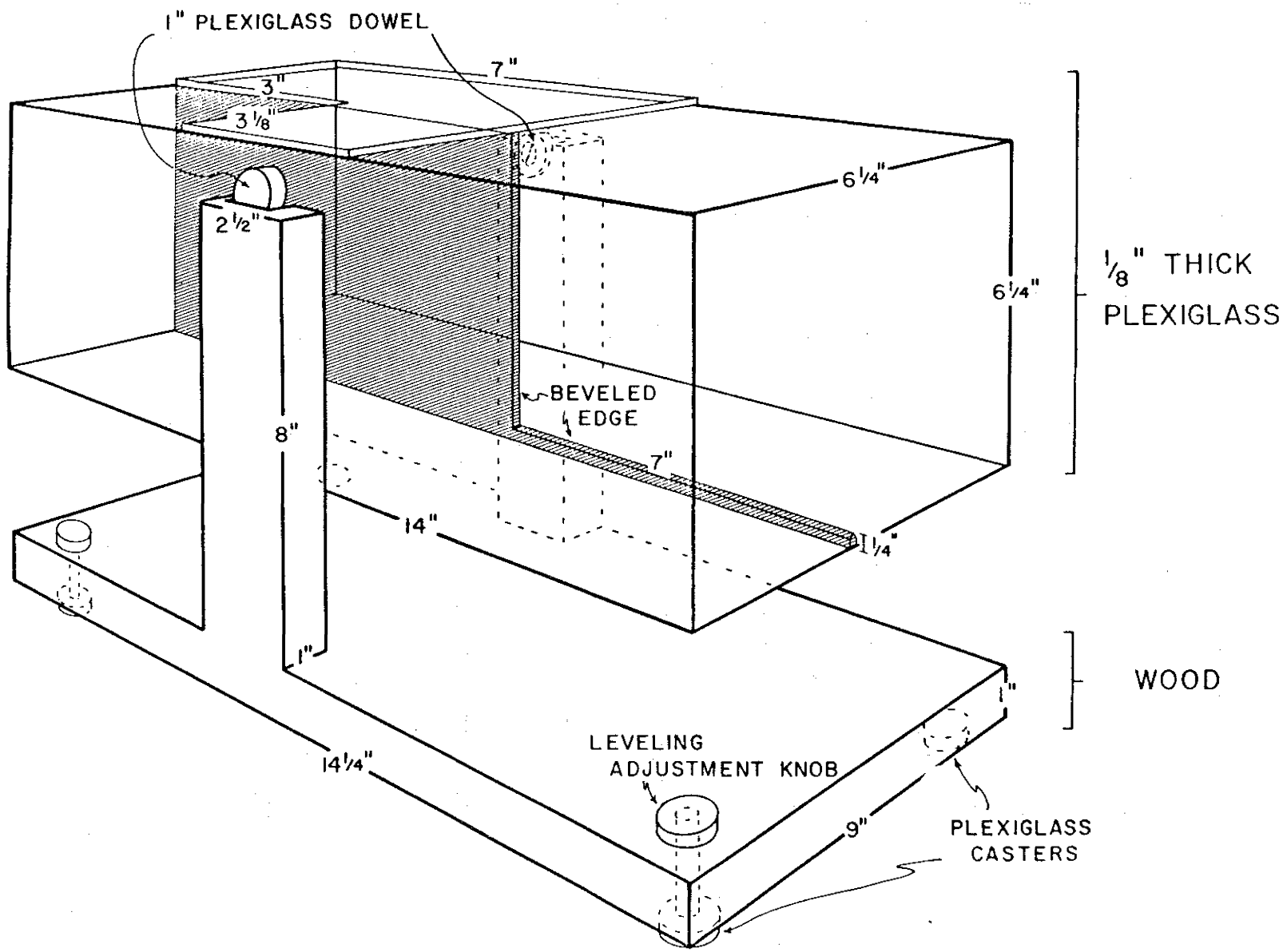

Figure 3.23 The Bourne Plankton Sample Splitter

The following procedure assumes that the modified Folsom splitter will be used: The splitting is done on a sample after removal of any large organisms (>2.5 cm). At this point air is introduced into the drum through numerous small holes connected to a manifold. Air pressure is regulated based on a prior test to determine homogeneous distribution of the specimens. The sample is then poured into the undivided portion of the drum and allowed to mix for approximately 10 seconds. The drum is then rotated until the septem splits the sample. Lifting the drum and rotating a little more, the two separated samples are completely transferred into the "plastic boats". Smaller samples are obtained by returning the contents of one "boat" to the drum. Thus aliquot portions of approximately 1/2, 1/4, 1/8, etc., of the original are obtained, and the process is continued until the sample is small enough for counting. One member of all intermediate splits is temporarily retained and labeled until the final aliquot is obtained, and decisions for all desired analyses are made. The retained aliquots are labeled according to Figure 3.17.

The remainder of the sample is returned to the original sample jar with fresh preservative, and an additional label, stating the total aliquot removed, is included. The sample is then archived according to Section 3.8.

3.6.2 Sorting - Automated Methods

At present an automatic image analysis technique is nearing operational status for obtaining data (Jeffries et al., 1980). Also particle size separation using an elutriation technique holds promise. The resulting size groups could be enumerated and then sacrificed for total carbon determination. These two determinations would greatly reduce the effort presently expended during traditional microscopic examination. In order to describe the species contribution to these above data, at least a random selection of samples should be examined in the traditional manner prior to carbon analysis.

For further details see the cited manuscript or contact:

Mr. Raymond Maurer
NOAA/NMFS
Narragansett Laboratory
South Ferry Road
Narragansett, RI 02882

3.6.3 Sorting - Traditional Methods

Until such improved methods are made fully operational, sorting and identification of zooplankton are done under the microscope. Techniques and equipment necessary for sorting zooplankton are generally similar to those described for ichthyoplankton sorting (Section 3.5.2).

3.6.3.1 Major Taxa

For determining the major taxa present in a plankton sample, an approximately 500 specimen aliquot (Section 3.6.1) is sorted for the italicized groups below:

Protozoa

Radiolaria

Cnidaria

Siphonophora

Ctenophora

Annelida

Polychaeta

Anthropoda

Cladocera

Ostracoda

Copepoda

Cirripedia

Amphipoda

Mysidacea

Euphausiacea

Decapoda

Macrura

Anomura

Brachyura

Mollusca

Gastropoda

Heteropoda

Thecosomata (Pteropoda, shelled)

Pelecypoda

Cephalopoda

Decapoda

Octopoda

Echinodermata

Chaetognatha

Tunicata

Thaliacea

Larvacea

Invertebrate eggs

3.6.4 Identification of Zooplankton

To characterize the community structure and monitor changes in the composition and relative abundance of lower trophic level organisms, identification will be made for all specimens in selected aliquots.

Species identification techniques and necessary equipment are generally similar to those employed during ichthyoplankton identification (Section 3.5.3).

3.6.4.1 Naming Convention

The identifier will assign each specimen to the lowest taxonomic level possible. A great deal more variety exists in the naming conventions for invertebrate zooplankton than is the case for ichthyoplankton. MARMAP has generally made taxonomic codes available for two or more taxa which some workers believe to be synonymous, thus retaining the detail and the ability for later "lumping". Specimens are assigned a 4-digit numerical code. Requests from MARMAP Information System users for listings or for additions or corrections to these codes should be made to:

Mr. Jack W. Jossi

NOAA/NMFS

Atlantic Environmental Group

South Ferry Road

Narragansett, RI 02882

NOTE: MARMAP Information System users may obtain a current listing of these codes by running the MIS program A4SRT.

3.6.3.2 Staging, Measuring, and Sexing

Developmental stages are determined (See listing of life stages in Section 3.6.4.3). Standard length measurements are made as indicated in Figure 3.24. These measurements are modified from Isaacs, Fleminger, and Miller (1971) to be more comparable with measurements made during automatic image analysis. When measuring taxa other than those shown in Figure 3.24, the logged data must include the published source, or a written description, of the technique used. The sex of each specimen should be determined, i.e., male, female, ovigerous female, or sex unknown.

3.6.4.3 Labelling

Labelling of all resulting specimen containers should be done as in Figure 3.17.

3.6.4.4 MARMAP Zooplankton Data Log

Results of these analyses are tabulated and entered on the Zooplankton Data Log (Fig. 3.25). Further specifications for zooplankton data are given in Section 6, Appendix I.

Instructions for completion of the log are presented below:

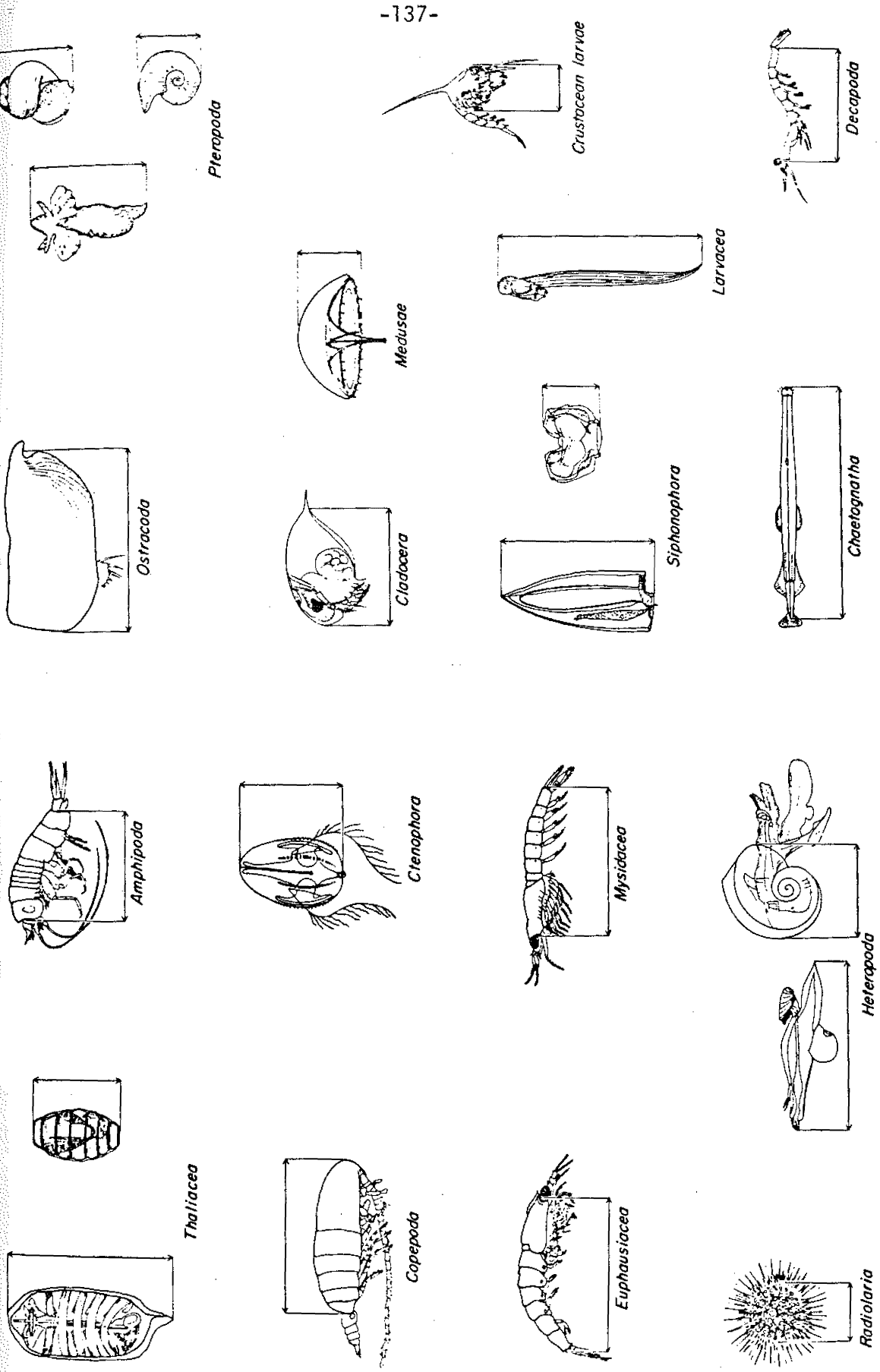

Figure 3.24 Standard MARMAP length measurements for various taxa

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U.S. DEPT. OF COMMERCE – NOAA
NATIONAL MARINE FISHERIES SERVICE

PAGE ____ OF ____

MARMAP ZOOPLANKTON DATA LOG
(ZDL)

OPERATIONAL UNIT _____

Vessel ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Cruise ☐☐–☐☐☐ Gear/Mesh ☐☐☐

Station No. ☐☐☐ Haul No. ☐☐ Gear ID No. ☐☐☐ Sample Date ☐☐☐☐☐☐ Aliquot Code ☐☐

TAXON NUMBER TAXON NAME	VIAL NO.	LENGTH (mm)	SEX	LIFE STAGE	N.N.A.
1	2				
2	2				
3	2				

TAXON NUMBER TAXON NAME	VIAL NO.	LENGTH (mm)	SEX	LIFE STAGE	N.N.A.
4	2				
5	2				
6	2				

Remarks:

Recorded By: _____

MARMAP ZOOPLANKTON DATA LOG FORM ZDL (10/80)

Figure 3.25 The MARMAP Zooplankton Data Log

MARMAP Zooplankton Data Log (Form ZDL, 10/80)

Page of — The consecutive page of the log plus the total number of pages of logs for any station.

Operational Unit — Name of the institution preparing this log, e.g., NWAFC, ZSOP, NEFC.

Vessel — As recorded on the Station Activities Summary.

Cruise — As recorded on the Station Activities Summary.

Gear/Mesh — The gear and the mesh size used in collecting the sample entered according to the list below:

GEAR	MESH	ENTER
61 cm Bongo	333	6B3
61 cm Bongo	505	6B5
20 cm Bongo	333	2B3
20 cm Bongo	505	2B5
20 cm Bongo	165	2B1
20 cm Bongo	253	2B2
50 x 100 cm Neuston	505	1N5
100 x 200 cm Neuston	947	2N9
36 x 97 cm Haedrich	706	3H7
36 x 97 cm Haedrich	1800	3H1
Other Gear		Write out gear name plus mesh aperture in microns

Station No. — As recorded on the Station Activities Summary.

Haul No. — As recorded on the Station Activities Summary.

Gear ID No. — The number assigned to each net used during the haul. This is necessary when gear of identical characteristics are deployed on the same haul.

Sample Date — Date (day-month-year) when sample was collected; from the Station Activities Summary.

Aliquot Code — The code for the factor by which counts from an aliquot can be converted to numbers for the whole sample (list below)

ALIQUOT FRACTION	ALIQUOT FACTOR	ENTER
1/1	1	01
1/2	2	02
1/4	4	04
1/8	8	08
1/16	16	16
1/32	32	32
1/64	64	64
1/128	128	12
1/256	256	25
1/512	512	51
1/1024	1024	10
1/2048	2048	20
1/4096	4096	40

Taxon Number — The four-digit "Interim Code for MARMAP Zooplankton Data".

NOTE: Ten boxes are provided for researchers who may be using the National Oceanographic Data Center (NODC) Taxonomic Code. A current list of names and codes is available upon request from the authors or for MARMAP Information System users by running the MIS program A4SRT See, Section 6, Appendix I for further comments on this and the subsequent log sheet fields.

Taxon Name — The scientific name of the specimen.

Length — The standard length of each specimen measured to the nearest 0.1 mm. See Figure 3.24 for standard length measuring methods to be used for various taxa. For taxa not found in Figure 3.24, enter standard length description under Remarks.

Sex — The sex of each specimen entered according to the table below:

SEX	ENTER
Male	1
Female	2
Ovigerous female	3
Unknown	4

Life Stage — The developmental stage of each specimen entered according to the table below:

LIFE STAGE	ENTER
Adult	000
Planula	001
Actinula	002
Medusa	003
Polyp	004
Ephyra	005
Scyphistoma	006
Cydippid	007
Epitoke	008
Atoke	009
Trochophore	010

LIFE STAGE	ENTER
Veliger	011
Protonymphon	012
Nauplius	013
Nauplius I	014
Nauplius II	015
Nauplius III	016
Nauplius IV	017
Nauplius V	018
Nauplius VI	019
Copepodite I	020
Copepodite II	021
Copepodite III	022
Copepodite IV	023
Copepodite V	024
Cypris	025
Manca (Postlarva)	026
Calyptopis (Protozoea)	028
Furcilia (Zoea)	029
Cyrtopia (Postlarva)	030
Protozoea	031
Mysis (Zoea)	032
Mastigopus (Postlarva)	033
Elaphocaris (Protozoea)	034
Acanthosoma (Zoea)	035

Zoea	036
Parva (Postlarva)	037
Postlarva	038
Phyllosoma (Zoea)	039
Puerulus, Nisto, or Pseudobaccus (Postlarva)	041
Glaucothoe (Postlarva)	042
Megalopa (Postlarva)	043
Bipinnaria	044
Branchiolaria	045
Ophiopluteus	046
Echinopluteus	047
Auricularia	048
Doliolaria	049
Egg	050
Larva	051
Copepodite	052
Metatrochophore	053
Immature (Sexually) or Juvenile	054
Strobila	055
Vitellaria	056
Molt	057
Cyphonauntes	058
Unknown	999

N.N.A. The number of specimens of each logged taxon for which no analysis (measuring, sexing, or staging) was performed.

Vial Number Vials are numbered sequentially as taxa from each station are identified. Identified zooplankton (non-ichthyoplankton) vials must be numbered in the range 201-299. The hundreds digit is preprinted on the log. This is to avoid identical vial numbers for eggs, larvae and zooplankton from the same station, gear, and haul. If more than 99 taxa are identified at a single station, assign 301, 302, 303, etc., vial numbers to them and alert the data processing unit of this situation. Be sure to include the preprinted digits on any vial labels.

Remarks Any information useful in subsequent analyses of these samples.

Recorded By Initials or name of person entering data on the log.

1 2 3 4 5 6 The order in which the blocks of log sheet fields are to be filled in.

3.7 REFERENCE COLLECTION

Special reference collections of ichthyoplankton larvae, eggs, and of zooplankton are kept adjacent to the identification laboratory. The specimens in this collection are the "best of a kind" and used for reference in identifying questionable material or rare specimens. The material is also used occasionally to train identifiers.

3.8 CURATING

Following analyses and the removal of samples for reference collections, any remaining sample is returned to storage according to the following:

1) If the remaining sample contains <500 specimens, it is permanently retained in storage.
2) If the remaining sample is large enough that it can be split into an ≈500 specimen aliquot, this is done and the aliquot is permanently retained in storage.
3) Any subsample in excess of that stored according to item 2 above will be retained only until it has been advertised to the scientific community for a period of one year.

The general and reference collections are periodically checked to assess the evaporation of preservative from the sample containers. The screw-top lid with the vinyl liner now used on our vials is virtually evaporation-proof if well tightened when stored. However, periodic checks (not greater than 6 months) must be made. Occasionally some vials with loose caps may lose liquid by evaporation in which case preservative is added, the cap tightened properly, and the vial stored again.

4. ACKNOWLEDMENTS

We wish to express our appreciation to the many people who have helped in the preparation of this manual. Thanks are expecially due to the MARMAP associated staffs at the National Marine Fisheries Service's Southwest, Northwest and Alaska, Northeast, and Southeast Fisheries Centers; the Plankton Sorting Center, Szczecin, Poland; the Smithsonian Oceanographic Sorting Center; the State of South Carolina Wildlife and Marine Resources Department, Marine Research Laboratory; to Gertrude Kavanagh, Gail Santoro, Marilyn Brennan, Elinor Werberger, Jennie Dunnington, and Karen Heise for typing the manuscript; and to Lianne Armstrong and Joanne Rose for preparation of the figures.

The manual has been widely used since 1972. As a result we are also deeply indebted to the scientists, technicians, vessel officers, and crews who have made numerous valuable suggestions.

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6.2.1
6.2.1

6. APPENDIX I - SPECIFICATIONS FOR MARMAP DATA RECORD TYPES

6.1 INTRODUCTION

Logsheet data field specifications are applicable to all MARMAP Survey I operations.

Master file specifications and comments mostly apply to MARMAP Information System (MIS) users. Their master files are heirarchical in format. Category definitions frequently include parenthetical entries where the first entry indicates data-word(s) content and/or accuracy and/or data units, and the second entry (when necessary) further defines data units.

6.2 RECORD TYPES

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT MASTER STATION RECORD

RECORD CODE MSR

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)
1	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
2	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
3	CRUISE	year	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen: na	na							
			cruise: 001-999	na							
4	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
5	ARRIVAL DATE	day (GMT) 3)	01-31	±0.5 min	na	STA DATE (DD MM YY) (GMT):	103	01	01	2	N
		month (GMT)	01-12	±0.5 min			103	01	02	2	N
		year (GMT)	00-99	±0.5 min			103	01	03	2	N
6	LATITUDE	degree	00-90	±0.5 min	na	LATITUDE (DD MM H):	136	01	01	2	N
		minute	00-60	±0.5 min			136	01	02	2	N
		hemisphere	na	±0.5 min			136	01	03	1	A
7	LONGITUDE	degree	000-180	±0.5 min	na	LONGITUDE (DDD MM H):	138	01	01	3	N
		minute	00-60	±0.5 min			138	01	02	2	N
		hemisphere	na	±0.5 min			138	01	03	1	A
8	POSITION CHECK BY:	na	na	na	na	na	na	na	na	na	na

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT MASTER STATION RECORD

RECORD CODE MSR

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	ARRIVAL TIME	hour (GMT)	00-24	±0.5 min	na	STATION TIME (HHMM) (GMT):	146	01	01	4	N
		min (GMT)	00-60	±0.5 min							
10	BOTTOM DEPTH	meter	0001-9999	±0.5 m	na	BOTTOM DEPTH (METERS):	112	01	01	4	N
11	WIND SPEED (KNOTS):	knot	01-99	±0.5 kt	na	WIND SPEED (KNOTS):	148	01	01	2	N
12	WIND DIRECTION	degree	000-360	±0.5 deg	na	WIND DIRECTION (DDD M/T):	150	01	01	3	N
		magnetic or true	na	na	na	na	150	01	02	1	A
13	AIR TEMP.	centrigrade degree	-20.0 - 50.0	±0.5 deg	na	AIR TEMP (DEG C):	124	01	01	4	C
14	SURFACE TEMP.	centrigrade degree	-02.0 - 40.0	±0.5 deg	na	SURFACE TEMP (DEG C):	120	01	01	4	C
15	CLOUD COVER TYPE	na	na	na	18	CLOUD TYPE:	114	01	01 02	15	A
16	CLOUD COVER AMT.	Okta (1/8 of Celestial dome)	0-8	±0.5 okta	20	CLOUD COVER (%):	116	01	01	3	N
17	WAVE HEIGHT	meter	00.0 - 15.0	±0.5 m	na	WAVE HGT (DD.D)(METERS):	156	01	01	4	C
18	TYPE OF OBSERVATION	na	na	na	25	STA EXPERIMENTS & TIMES:	128	01-13	01	21	C
19	TYPE OF OBSERVATION - START TIME	hour (GMT)	00-24	±0.5 min	na	(start)	128	01-13	02	4	N
		minute (GMT)	00-60	±0.5 min							
	END TIME	hour (GMT)	00-24	±0.5 min	na	(finish)	128	01-13	03	4	N
		minute (GMT)	00-60	±0.5 min							

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT MASTER STATION RECORD

RECORD CODE MSR

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
20	OTHER TYPES OF OBSERVATIONS	na	na	na	na	(same as items 18 and 19 above)					
21	REMARKS DAMAGE OR LOSS	na	na	na	na	STATION REMARKS:	109	01-99	na	na	C
22	RECORDED BY	na	na	na	na	na	na	na	na	na	na
23	REVIEWED BY	na	na	na	na	na	na	na	na	na	na

6.2.1.2 Comments on: Master Station Data

A. Footnotes

1) Word length for data resulting from a code qroup substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type:

Code	Meaning
A	Strictly an alphabetic field.
N	Strictly a numeric field.
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1. This log sheet field is not exposed to automatic data processing.

2-3. The cruise numbering convention specified for this log sheet field would be expected to rarely require more than five digits, since more than 99 cruises by the same vessel in one year would be unusual. However, data are stored within the MIS originating from operational units other than those of MARMAP and for which other conventions have been used. Hence, an additional digit is provided to accommodate these larger cruise numbers.
These fields are provided by the user when running the MIS program SETUPCNV. See MIS Documentation Vol. 2, STC p. Ø5, and Vol. 1, Aiv p. Ø7.

5. For special processing on arrival date field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 4.

6. For special processing on latitude field, see MIS Documentation Vol. 7, FCV p. 1Ø, TRNVAL Code 17.

7. For special processing on longitude field, see MIS Documentation Vol. 7, FCV p. 1Ø, TRNVAL Code 18.

8. This log sheet field is not exposed to automatic data processing.

12. For special processing on wind direction field, see MIS Documentation Vol. 7, FCV p. 1Ø, TRNVAL Code 19.

13-14. For negative air and sea surface temperatures, the measured values are algebraically subtracted from 50°C and the resulting differences entered into the MIS, e.g., -2.0°C is entered as 52.0°C.

15. For special processing on cloud cover type field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 1.

15-16. When cloud amount equals zero or the amount cannot be determined (coded 0 or 9 respectively) the cloud type should be logged as X and no data for cloud entered into the MIS.

18-19. Data on the types of station observations usually reach a master file when the results of the particular experiments are merged into the master file. The experiment type is stored in category 300 while the experiment details are stored in categories below 300 in the file hierarchy. Since details from some experiments are not available until months after the original station data are processed, a means for storing general information about the station's experiments at the outset was instituted. This information is placed in category 128 using the MIS program KEYDATA and the OEXØ1 segment of the SDT Table. Thus, a complete Station Activities Summary can be prepared shortly after a cruise. For an example, see data file where DSN = URI.EXQ1.MODEL.AL8001.

21. Narrative data about the station are provided by the user through the MIS program KEYDATA and the COMØ1 segment of the SDT table.

They are merged into category 109 of a master file. See MIS Documentation Vol. 1, Aiv p. 26, and Vol. 7, FCV p. 1Ø, TRNVAL Code 31.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR BONGO NETS

RECORD CODE ZSB

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	(1) MAXIMUM WORD LENGTH	(2) DATUM TYPE
1	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
2	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
3	CRUISE	year (GMT) [3]	year: 00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
		na	hyphen: na	na							
		na	cruise: 001-999	na							
4	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
5	HAUL NUMBER	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
6	START TIME	hour (GMT)	00-24	±0.5 min	na	EXP TIME (HHMM)(GMT):	303	01	01	4	N
		minute (GMT)	00-60	±0.5 min							
7	START DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD MM YY)(GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	02	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N
8	SHIP SPEED	knots	00.1-03.5	±0.5 kt	na	SHIP'S SPEED (KNOTS):	308	01	01	4	C
9	SHIP HEADING	degree	000-360	±0.5 deg	na	SHIP'S HEADING (DDD M/T):	309	01	01	3	N
		magnetic or true	na	na			309	01	02	1	A
10	MEASUR. TOW DEPTH	meter	000-999	±0.5 m	na	MEASUR TOW DEPTH (METERS):	348	01	01	3	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR BONGO NETS

RECORD CODE ZSB

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
11	TIME GOING OUT	minute	00-99	±0.5 sec	na	TIME GOING OUT (MMSS):	320	01	01	4	N
		second	00-60	±0.5 sec							
12	TIME AT DEPTH	minute	00-99	±0.5 sec	na	TIME AT DEPTH (MMSS):	322	01	01	4	N
		second	00-60	±0.5 sec							
13	TIME COMING IN	minute	00-99	±0.5 sec	na	TIME COMING IN (MMSS):	324	01	01	4	N
		second	00-60	±0.5 sec							
14	DURATION OF TOW	minute	000-999	±0.5 sec	na	na	na	na	na	na	na
		second	00-60	±0.5 sec							
15	DEPTH INSTRUMENT	na	na	na	na	na	na	na	na	na	na
	Make	na	na	na	na	na	na	na	na	na	na
	Ser. No.	na	na	na	na	na	na	na	na	na	na
	Spring Depth	foot	0000-1000	±1.5 ft	na	na	na	na	na	na	na
			0000-0500								
			0000-0300								
			0000-0200								
			0000-0100								

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR BONGO NETS

RECORD CODE ZSB

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
15			0000-0050								
16	GEAR ID NUMBER	na	1-4	na	na	[See Comments]	400	01	02	1	N
17	GEAR/MESH	na	na	na	na	na	na	na	na	na	na
	Gear	na	na	na	10	GEAR:	400	01	01	[See Comments]	Co s]
	Aperture Size	micron	005-999	±0.5 micron	3	GEAR:	400	01	03	[See Comments]	Co s]
	Mouth Diameter	meter	0.10-2.00	±0.005 m	11	GEAR:	400	01	04	[See Comments]	Co s]
	Mouth Height	na	na	na	na	[See Appendix Entry for Record Code, 'ZSN']					
	Mouth Width	na	na	na	na	[See Appendix Entry for Record Code, 'ZSN']					
18	BOTTLES FILLED	na	1-9	na	14	BOTTLES FILLED:	406	01	01	1	N
19	FLOWMETER START	revolution	00001-99999	±0.5 rev	na	FLOWMETER START:	402	02	01	5	N
20	FLOWMETER END	revolution	00001-99999	±0.5 rev	na	FLOWMETER END:	402	03	01	5	N
21	FLOWMETER NO.	na	001-999	na	na	FLOWMTR NO & CALIB FACTOR:					
						[Number]	402	01	01	3	C
						[Factor]	402	01	02	5	C
22	TYPE OF TOW	na	na	na	15	TYPE OF TOW:	302	01	01	20	A
23	TDR TRACE	na	na	na	16	TDR TRACE:	372	01	01	15	A

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR BONGO NETS

RECORD CODE ZSB

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
24	MAX. WIRE OUT	meter	000-999	±0.5 m	na	MAX WIRE OUT (METERS):	312	01	01	3	N
25	ANGLE AT M.W.O.	degree	20-70	±0.5 deg	na	ANGLE @ MAX WIRE OUT (DD):	316	01	01	2	N
26	WIRE ANGLES DURING RETRIEVAL . . .	degree	20-70	±0.5 deg	na	WIRE OUT (METERS):	314	01-02	na	3	N
					na	WIRE ANGLE (DD):	315	01-02	na	2	N
27	REMARKS	na	na	na	na	EXPERIMENT-REMARKS:	319	01-99	na	C	na
28	RECORDED BY	na	na	na	na	na	na	na	na	na	na
29	REVIEWED BY	na	na	na	na	na	na	na	na	na	na

6.2.2.2 Comments on: Bongo Net Tow Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type:

Code	Meaning
A	Strictly an alphabetic field.
N	Strictly a numeric field.
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1. This log sheet field is not exposed to automatic data processing.

2-3. These fields are provided by the user when running the MIS program SETUPCNV. See MIS Documentation, Vol. 2, STC p. Ø5, and Vol. 1, Aiv p. Ø7.

5. For special processing on haul number field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 7.

7. For special processing on date field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 4.

9. For special processing on ship's heading field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 8.

14. This log sheet field is derived and therefore not added to the master file. Fields in items 11 through 13 are sufficient.

15. This log sheet field is not exposed to automatic data processing. Logsheet specifications for item 15 (spring depth) are for a Bendix Model T-1 Time Depth Recorder.

16. This data field has been used to designate each of the four nets which can be recorded on a MARMAP Zooplankton Sample Log, and used during any one haul. See MIS Documentation Vol. 7, FCV p. 10, TRNVAL Codes 21-24.

    In the future a 3 character "Gear ID Number" will be logged to distinguish between otherwise identical gear deployed on the same haul.

17. A 3 character code is logged on the ZSB to describe the type(s) of gear used. This description is divided into parts as follows:
    The code groups indicated apply to the three parts of the gear description. They are involved with the MIS programs OPREAD and OPEDIT and to a lesser degree with the program KEYDATA. Currently, however, entry of most Bongo data involves the use of a 6 character gear code found in code group 46 with further processing involving code group 2, 3, and 4.

    (Mouth Height & Mouth Width) These data fields are used only for Neuston nets (See Record Code ZSN immediately following in Appendix I.).

17-26. These data fields receive special processing. Familiarity with the MARMAST and SDT Tables and the MIS program FILECONV is essential. Explanations specific to these fields can be found in MIS Documentation Vol. 6, SDT p. 04-07 (Mnemonic Code items RGRP, NGRP, GRPD, GETR), p. 12-13 (TRNS Code 13) and Vol. 7, FVC p. 04 (Utility Flag Value 4) and p. 06-11 (TRNVAL Code Nos. 3, 21, 22, 23, and 24).

21. Master file category 402, line 1, word 1 contains flowmeter numbers. Word 2 has been used for flowmeter calibration factor, (starting position = 18, field length = 5). MIS programs which calculate

volume of water filtered first look for the existence of this word and if not found use a mean factor for "General Oceanics" flowmeters.

27. Narrative data about the bongo experiment may be provided by the user by running the MIS program KEYDATA and are merged into category 319 of a master file. See MIS Documentation Vol. 1, Aiv p. 26, and Vol. 7, FCV p. 1Ø, TRNVAL Code 32.

28-29. These log sheet fields are not exposed to automatic data processing.

General: One policy of the MIS is to store only raw data in the master files. The major reason for this is to avoid the difficult process of making updates to the diverse, derived data if errors are subsequently discovered in the raw data. On a very few occasions, when raw data were simply not available, new master file categories have been created to store derived data, e.g., Category 349 "Calculated Tow Depth (M)" instead of Category 348 "Measured Tow Depth (M)".

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR NEUSTON NETS

RECORD CODE ZSN

LOG SHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH [1]	DATUM TYPE [2]
1	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
2	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
3	CRUISE	year (GMT) [3]	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
		na	hyphen:na	na							
		na	cruise:001-999	na							
4	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
5	HAUL NUMBER	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
6	START TIME	hour (GMT)	00-24	±0.5 min	na	EXP TIME (HHMM) (GMT):	303	01	01	4	N
		minute (GMT)	00-60	±0.5 min							
7	START DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DDMMYY) (GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	02	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N
8	SHIP SPEED	knot	00.1-05.0	±0.05 kn	na	SHIP'S SPEED (KNOTS):	308	01	01	4	C
9	SHIP HEADING	degree	000-360	±0.5 deg	na	SHIP'S HEADING (DDD M/T):	309	01	01	3	N
		magnetic or true	na	na			309	01	02	1	A
10	MEASUR. TOW DEPTH	meter	000-999	±0.5 m	na	na	na	na	na	na	na

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR NEUSTON NETS

RECORD CODE ZSN

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
11	TIME GOING OUT	minute	00-99	±0.5 sec	na	na	na	na	na	na	na
		second	00-60	±0.5 sec	na	na	na	na	na	na	na
12	TIME AT DEPTH	minute	00-99	±0.5 sec	na	TIME AT DEPTH (MMSS):	322	01	01	4	N
		second	00-60	±0.5 sec							
13	TIME COMING IN	minute	00-99	±0.5 sec	na	na	na	na	na	na	na
		second	00-60	±0.5 sec	na	na	na	na	na	na	na
14	DURATION OF TOW	minute	000-999	±0.5 sec	na	na	na	na	na	na	na
		second	00-60	±0.5 sec	na	na	na	na	na	na	na
15	DEPTH INSTRUMENT	na	na	na	na	na	na	na	na	na	na
	Make	na	na	na	na	na	na	na	na	na	na
	Serial No.	na	na	na	na	na	na	na	na	na	na
	Spring Depth	foot	0000-1000	±1.5 ft	na	na	na	na	na	na	na
16	GEAR ID NUMBER	na	1-4	na	na	(See Comments)	400	01	02	1	N
17	GEAR/MESH										
	Gear	na	na	na	10	GEAR:	400	01	01	(See Comments)	
	Aperture Size	micron	0005-1800	0.5 micron	13	GEAR:	400	01	03	(See Comments)	

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON SAMPLE LOG FOR NEUSTON NETS

RECORD CODE ZSN

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
17	GEAR/MESH (Cont.)										
	Mouth Diameter	na	na	na	na	na	na	na	na	na	na
	Mouth Height	meter	0.1-2.0	±0.05 m	12	GEAR:	400	01	04	(See Comments)	
	Mouth Width	meter	0.1-2.0	±0.05 m	13	GEAR:	400	01	05	(See Comments)	
18	BOTTLES FILLED	na	1-9	na	14	BOTTLES FILLED:	406	01	01	1	N
19	FLOWMETER START	na	na	na	na	na	na	na	na	na	na
20	FLOWMETER END	na	na	na	na	na	na	na	na	na	na
21	FLOWMETER NO.	na	na	na	na	na	na	na	na	na	na
22	TYPE OF TOW	na	na	na	15	TYPE OF TOW:	302	01	01	20	A
23	TDR TRACE	na	na	na	16	TDR TRACE:	372	01	01	15	A
24	MAX. WIRE OUT	meter	000-999	±0.5 m	na	na	na	na	na	na	na
25	ANGLE AT M.W.O.	degree	20-70	±0.5 deg	na	na	na	na	na	na	na
26	WIRE ANGLES DURING RETRIEVAL	degree	20-70	±0.5 deg	na	na	na	na	na	na	na
27	REMARKS	na	na	na	na	EXPERIMENT REMARKS:	319	01-99	na	na	C
28	RECORDED BY	na	na	na	na	na	na	na	na	na	na
29	REVIEWED BY	na	na	na	na	na	na	na	na	na	na

6.2.3.2 Comments on: Neuston Net Tow Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1. This log sheet field is not exposed to automatic data processing.

1-3. These fields are provided by the user when running the MIS program SETUPCNV (See MIS Documentation Vol. 2, STC p. Ø5, and Vol. 1, Aiv p. Ø7).

5. For special processing on the haul number field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 7.

7. For special processing on date field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 4.

9. For special processing on ship's heading field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 8.

10. This field is required to be 0 meters for a valid neuston tow and therefore need not be stored in a master file.

11-13. These Logsheet fields should be zero for a valid neuston tow.

14. This Logsheet field is derived and therefore not added to the master file. The Time at Depth field is sufficient for a neuston tow.

15. These data fields are unnecessary for a neuston tow and therefore are not included in the master file.

16. This data field has been used to designate each of the four nets which can be recorded on a MARMAP Zooplankton Sample Log, and used during any one haul. See MIS Documentation Vol. 7, FCV p. 10, TRNVAL Codes 21-24.

In the future a 3 character "Gear ID Number" will be logged to distinguish between otherwise identical gear deployed on the same haul.

17. A three character code is logged on the ZSL to describe the type of gear used. This description is divided into parts as follows: The code groups indicated apply to the four parts of the gear description. They are involved with the MIS programs OPREAD and OPEDIT and to a lesser degree with the MIS program KEYDATA. Currently, however, entry of most neuston data involves the use of a six character code found in code group 46 with further processing involving groups 2,3,4, and 5.

17. (Mouth Diameter) This data field is used only for Bongo nets (See Record Code ZSB immediately preceding in Appendix I.)

19-21. Flowmeters are not required for a MARMAP neuston tow.

23-26. These fields are unnecessary for a neuston tow and therefore are not included in the master file.

27. Narrative data about the neuston experiment may be provided by the user when running the MIS program KEYDATA and are merged into category 319 of a master file (See MIS Documentation Vol. 1, Aiv p. 26, and Vol. 7, FCV p. 11, TRNVAL Code 33.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT SHIP OF OPPORTUNITY LOG

RECORD CODE S00

LOGSHEET

MARMAP INFORMATION SYSTEM MASTER FILE

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	(1) MAXIMUM WORD LENGTH	(2) DATUM TYPE
1	PAGE ___ OF ___	na	na	na	na	na	na	na	na	na	na
2	COUNTRY	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	na	na	35	VESSEL:	002	01	01	21	C
4	CRUISE	year (GMT)[3]	year:00-09	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen:na	na							
			cruise:001-999	°0.5 min							
5	REMARKS:	na	na	na	na	STATION REMARKS:	109	01-99	na	na	C
						EXPERIMENT REMARKS:	319	01-99	na	na	C
6	ROUTE	na	number:001-999	na	na	na	na	na	na	na	na
			name:MA-MZ	na	na	SOOP ROUTE NAME:	017	01	01	2	A
7	BODY NO. (GEAR ID NUMBER)	na	001-999	na	na	na	na	na	na	na	na
8	PSM NO.	na	001/1-999/9	na	na	na	na	na	na	na	na
9	DATA ACQUISITION SYST. NO.	na	001-999	na	na	na	na	na	na	na	na
10	IMPELLER SETTING	degree	40-80	±0.5 deg	na	na	na	na	na	na	na
11	PSM TUNNEL READING	PSM divisions	000.1-999.9	±0.5 div	na	na	na	na	na	na	na
12	MARMAP STATION	na	001-999	na	na	STATION NUMBER	100	01	01	3	na

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT SHIP OF OPPORTUNITY LOG

RECORD CODE S00

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
13	CPR/UOR OPERATION	na	SHT ALT HAU	na	na	na	na	na	na	na	na
	OR BT LAUNCH NO.	na	001-999	na	na	CONSECUTIVE NUMBER:	371	01	01	3	N
14	DATE	day (GMT)	01-31	±0.5 min	na	STA DATE (DD MM YY):	103	01	01	2	N
		month (GMT)	01-12	±0.5 min			103	01	02	2	N
		year (GMT)	00-99	±0.5 min			103	01	03	2	N
15	TIME	hour (GMT)	00-24	±0.5 min	na	STATION TIME (HHMM) (GMT):	146	01	01	4	N
		minute (GMT)	00-60	±0.5 min							
16	LATITUDE	degrees	00-90	±0.05 min	na	LATITUDE (DD MM H):	136	01	01	2	N
		minutes	00-60	±0.05 min			136	01	02	2	N
		1/10 minutes	0-9	±0.05 min			na	na	na	na	na
		hemisphere	na	±0.05 min			136	01	03	1	A
17	LONGITUDE	degrees	000-180	±0.05 min	na	LONGITUDE (DDD MM H):	138	01	01	3	N
		minutes	00-60	±0.05 min			138	01	02	2	N
		1/10 minutes	0-9	±0.05 min			na	na	na	na	na
		hemisphere	na	±0.05 min			138	01	03	1	A
18	SURFACE TEMP.	centigrade degrees	-2.0-40.0	±0.05 deg	na	SURFACE TEMP (DEG C):	120	01	01	4	C

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT SHIP OF OPPORTUNITY LOG

RECORD CODE S00

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
19	DEPTH TO BOTTOM	meters	0001-9999	0.5 m	na	BOTTOM DEPTH (METERS):	112	01	01	4	N
20	SURFACE SALINITY BOTTLE NO.	na	cccc	na	na	na	na	na	na	na	na
21	SURFACE SALINITY	parts/thous	00.000-40.000	0.0005 °/oo	na	SURFACE SAL (PARTS/THOUS):	121	01	01	6	N
22	WATER MASS CODE	na	nn	na	17	WATER MASS	164	01	na	na	A
23	RECORDED BY	na	na	na	na	na	na	na	na	na	na

6.2.4.2 Comments on: Ship of Opportunity Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. General

Unlike most logsheets described in this manual the SOO log contains data pertinent to the station and to several experiments. During data processing the SOO log information is split up into an MSR (Master Station Record) file, an NBT (Expendable Bathythermograph) file, a ZSR (Hardy Plankton Tow) file, an EDA (Environmental Data) file, and the HED and COM record types common to other logsheets.

The table below lists the disposition of the logsheet fields with respect to the above record types:

SOO Log Sheet Field	Record Codes					
Item No.	MSR	NBT	EDA	ZSR	COM	HED
1						
2						
3						
4						X
5						X
6						X
7						X

SOO Log Sheet Field	Record Codes					
Item No.	MSR	NBT	EDA	ZSR	COM	HED
8					X	
9 (Name)						X
10				X		
11				X		
12			X			
13				X		
14	X	X	X	X		
15 (BT Launch No.)		X				
16	X					
17	X					
18	X					
19	X					
20	X					
21	X	X				
22	X					
23	X					
24	X					
25	X					

C. Items

1-2. These log sheet fields are not exposed to automatic data processing.

3-4. These fields are provided by the user when running the MIS program SETUPCNV (See MIS Documentation Vol. 2, STC p. Ø5, and Vol. 1, Aiv p. Ø7).

4. The cruise numbering convention specified for this log sheet would be expected to rarely require more than five digits, since more than 99 cruises by the same vessel in one year would be unusual. However, data are stored within the MIS originating from operational units other than those of MARMAP and for which other conventions have been used. Hence, an additional digit is provided to accommodate these large cruise numbers. These fields are provided by the user when running the MIS program SETUPCNV (See MIS Documentation Vol. 2, STC p. Ø5, and Vol. 1, Aiv p. Ø7.

5. Narrative data about a station are provided by the user using the MIS program KEYDATA and the COMØ1 segment of the SDT Table. They are merged into category 109 of a master file. Narrative data about any experiment are entered similarly, but are merged into category 319 of a master file. See MIS Documentation Vol. 1, Aiv p. 26, and Vol. 7, FCV p. 1Ø, TRNVAL Codes 31-39.

6. The route number is provided by the user when running the MIS program SOOTOZSR. See MIS Documentation, Vol. 9, p. ZSR Ø1. The route name is provided by the user when running the MIS program SETUPCNV. See references in items 3-4 above.

13. CPR/UOR operation data are used by the MIS program SOOTOZSR to generate tow data for the Hardy Continuous Plankton Recorder, e.g., number of 10-mile blocks, times, dates and positions of blocks, silk cutting points.
BT Launch No. data are processed as part of an NBT file type.

14. For special processing on data field, see MIS Documentation Vol. 7, FCV p. Ø9, TRNVAL Code 4.

16. For special processing on latitude field, see MIS Documentation Vol. 7, FCV p. 1Ø, TRNVAL Code 17.

17. For special processing on longitude field, see MIS Documentation Vol. 7, FCV p. 1Ø, TRNVAL Code 18.

21-23. These log sheet fields are not exposed to automatic data processing.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT SAMPLE HISTORY LOG

RECORD CODE na

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY
1	OPERATIONAL UNIT	na	na	na
2	VESSEL	na	21 char	na
3	CRUISE	year (GMT) 3)	year:00-99	0.5 min
			hyphen:na	na
			cruise:001-999	na
4	STATION	na	001-999	na
5	HAUL	na	01-99	na
6	NO. OF CONTAINERS	na	gallon:001-005 1)	na
			quart:001-006 2)	na
			pint:001-011 3)	na
			half pint:001-011 3)	na
			vial:001->100	na
7	ALIQUOT FRACTION	na	1/1 to 1/2048	na
8	VIAL NUMBER	na	fish larvae: 001-099	na
			fish eggs:100-199	na
			inverts:200-299	na

MARMAP INFORMATION SYSTEM MASTER FILE

CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)

NOTE: No master file format has as yet been developed.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT SAMPLE HISTORY LOG

RECORD CODE na

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY
9	GEAR/MESH	na	3 character	na
10	CONTAINER	na	1 character	na
11	CONTENTS	na	1 character	na
12	SAMPLE DISPOSITION DATE (LOCAL)	day	01-31	±0.5 min
		month	01-12	±0.5 min
		year	00-99	±0.5 min
13	DELIVERED TO	na	40 characters	na
14	ALTERED	na	na	na
15	REMARKS	na	na	na
16	RECORD BY	na	na	na
17	CHECK WHEN ADDITIONAL SHEET IS REQUIRED	na	na	na
5a	GEAR ID NUMBER	na	001-999	na

MARMAP INFORMATION SYSTEM MASTER FILE

CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
	NOTE: No master file format has as yet been developed					
na	na	na	na	na	na	na

6.2.5.2 Comments on: Sample History Data

A. Footnotes

1) Gallon jars would be used only for special studies where coelenterates, siphonophores, sargassum weed, etc., were being retained.

2) Quart jars are the standard size for Bongo, Neuston and Hardy plankton samples.

3) When aliquoting, pints and half-pints may be used to retain one member of each split. If a sample was split to 1/2048 eleven containers would be necessary.

B. Items

9. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT TAR AND PLASTICS LOG

RECORD CODE TPT

LOG SHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
1	PAGE ___ OF ___	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT) 3)	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	ccc	na	2	GEAR:	400	01	01	(See Comments)	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments)	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments)	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments)	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments)	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NO.	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD-MM-YY) (GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min	na		305	01	02	2	N
		year (GMT)	00-99	±0.5 min	na		305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT TAR AND PLASTICS LOG

RECORD CODE TPT

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR:	452	01	01	7	C
10	NO. JARS	na	1-9	na	na	BOTTLES FILLED:	406	01	01	1	N
11	TAR WEIGHT	gram	000.1-999.9	0.05 gm 4)	na	TAR WEIGHT (GM):	447	01	01	6	C
12	PLASTIC WEIGHTS	gram	0.1-9.9	0.05 gm 4)	na	PLASTIC WEIGHT (GM):	446	01	01-05	6	C
13	RECORDED BY	na	na	na	na	na	na	na	na	na	na
14	DATE	day (local)	01-31	0.5 min	na	na	na	na	na	na	na
		month (local)	01-12	0.5 min	na	na	na	na	na	na	na
		year (local)	00-99	0.5 min	na	na	na	na	na	na	na
15	CHECKED BY	na	na	na	na	na	na	na	na	na	na
16	DATE	day (local)	01-31	0.5 min	na	na	na	na	na	na	na
		month (local)	01-12	0.5 min	na	na	na	na	na	na	na
		year (local)	00-99	0.5 min	na	na	na	na	na	na	na
17	REMARKS	na	na	na	na	ANALYSIS REMARKS:	441	01-99	na	na	C
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.6.2 Comments on: Tar and Plastics Data

A. Footnotes

1) Word length for data resulting from a code-group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

4) The analytical procedure does not warrant the accuracy implied by the intermediate and master file field length. Until this is corrected users should report these data with accuracy not exceeding ±0.05 gm.

B. Items

1-2. These logsheet fields are not exposed to automatic data processing.

3-4. Vessel and cruise would already exist in the master file to which the tar and plastics data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM p. Ø1-13 and Vol. 1, Aiv p. 13a and 33a).

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

13-16. These log sheet fields are not exposed to automatic data processing.

17. Narrative data about this analysis currently must be entered into Master File category 441 using the MIS program MASTUPD (See MIS Documentation Vol. 2, UPD, p. Ø1-18).

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON VOLUME LOG

RECORD CODE ZVL

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)
1	PAGE ___ OF ___	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT) 3)	year:00-99	±0.5 min	na	CRUISE (YY CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	ccc	na	2	GEAR:	400	01	01	(See Comments)	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments)	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments)	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments)	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments)	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NO.	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP. DATE (DD MM YY) (GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	02	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON VOLUME LOG

RECORD CODE ZVL

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	ANALYSIS DATE	day (local)	01-31	±0.5 min	na	na	na	na	na	na	na
		month (local)	01-12	±0.5 min							
		year (local)	00-99	±0.5 min							
10	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR:	452	01	01	7	C
11	NO. JARS	na	1-9	na	na	BOTTLES FILLED:	406	01	01	1	N
12	NON-PLANKTON ORGS. AND SEAWEED										
	REMOVED	na	na	na	na	na	na	na	na	na	na
13	VOL. LARGE ORGS.	milliliter	0001-9999	±0.5 ml	na	VOL ORGS >2.5 CM (ML):	458	01	01	4	N
14	VOL. ORGS. <2.5 CM	milliliter	001-999	±0.5 ml	na	VOL ORGS <2.5 CM (ML):	460	01	01	3	N
15	ICHTHYOPLANKTON VOL.	milliliter	00.1-99.9	±0.05 ml	na	VOL ICHTHYOPLANKTON (ML):	462	01	01	4	C
16	REMARKS	na	na	na	na	ANALYSIS REMARKS:	441	01-09	na	na	C
17	RECORDED BY	na	na	na	na	na	na	na	na	na	na
18	DATE	day (local)	01-31	±0.5 min	na	na	na	na	na	na	na
		month (local)	01-12	±0.5 min							
		year (local)	00-99	±0.5 min							
19	CHECKED BY	na	na	na	na		na	na	na	na	na

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON VOLUME LOG

RECORD CODE ZVL

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	MARMAP INFORMATION SYSTEM MASTER FILE: CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
20	DATE	day (local)	01-31	±0.5 min	na	na	na	na	na	na	na
		month (local)	01-12	±0.5 min							
		year (local)	00-99	±0.5 min							
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.7.2 Comments on: Zooplankton Displacement Volume Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1-2. These log sheet fields are not exposed to automatic data processing.

3-4. Vessel and cruise would already exist in the master file to which the volume data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM p. Ø1-13 and Vol. 1, Aiv p. 13a and 33a).

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are

millimeters. Work is underway to standardize all mesh apertures to units of microns.

9. The analysis date is important when determining possible changes in volume due to preservation time in formalin. These data are not currently entered into the MIS.

10. The master file contains a decimal equivalent of the inverse of the aliquot factor, e.g., an aliquot factor of 2 is stored in a master file as 0.50000. For researchers more accustomed to aliquot fractions the values found in the master file are decimal equivalents of the aliquot fraction. See MIS Documentation Vol. 6, SDT p. 11, INST Code 2 and p. 12 TRNS Code 6.

12. This log sheet field is not exposed to automatic data processing.

16. Narrative data about this analysis currently must be entered into master file category 441 using the MIS program MASTUPD (See MIS Documentation Vol. 2, UPD p. Ø1-18).

17-21. These log sheet fields are not exposed to automatic data processing.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT CARBON BIOMASS LOG

RECORD CODE TCB

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)
1	PAGE OF	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT) 3)	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	ccc	na	2	GEAR	400	01	01	(See Comments)	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments)	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments)	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments)	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments)	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NO.	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD MM YY)(GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min	na		305	01	02	2	N
		year (GMT)	00-99	±0.5 min	na		305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT: CARBON BIOMASS LOG

RECORD CODE: TCB

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR	452	01	01	7	C
10	TOTAL CARBON IN ORIGINAL SAMPLE	gram	00.0001-99.9999	0.00005 gm	na	TOTAL CARBON (GM)	444	01	01	7	C
11	ORGANIC CARBON IN ORIGINAL SAMPLE	gram	00.0001-99.9999	0.00005 gm	na	ORGANIC CARBON (GM):	na	na	na	na	na
12	REMARKS	na	na	na	na	ANALYSIS REMARKS:	441	01-99	na	na	C
13	RECORDED BY	na	na	na	na	na	na	na	na	na	na
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.8.2 Comments on: Carbon Biomass Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GTM = Greenwich Mean Time

B. Items

1-2-12. These log sheet fields are not exposed to automatic data processing.

3-4. Vessel and cruise would already exist in the master file to which the carbon biomass data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM. p. Ø1-13 and Vol. 1, Aiv p. 13a and 33a).

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

9. The master file contains a decimal equivalent of the inverse of the aliquot factor, e.g., an aliquot factor of 2 is stored in a master file as 0.50000. For researchers more accustomed to aliquot fractions the values found in the master file are decimal equivalents of the aliquot fraction. See MIS Documentation Vol. 6, SDT p. 11, INST Code 2 and p. 12, TRNS Code 6.

10-11. Calculations involved in obtaining weight of carbon in the original sample are shown in Section 7, Appendix II. Organic carbon values from this determination are not presently stored in the MIS.

12. Narrative data about this analysis currently must be entered into master file category 441 using the MIS program MASTUPD (See MIS Documentation Vol. 2, UPD p. Ø1-18). "Rinsing Technique", "Preservation Technique", and "Analyzer-Make/Model" are preprinted under Remarks. This is to provide a place to log these details until such time as standard procedures/equipment are established.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT DRY WEIGHT BIOMASS LOG

RECORD CODE DWB

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)
1	PAGE OF	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT)[3]	year:00-99	±0.5 min	na	CRUISE (YY CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	3 char	na	2	GEAR:	400	01	01	(See Comments)	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments)	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments)	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments)	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments)	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NO.	na	01-99	na	na	HAUL NUMBER	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD MM YY)(GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	02	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT DRY WEIGHT BIOMASS LOG

RECORD CODE DWB

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR:	452	01	01	7	C
10	UNCORRECTED DRY WEIGHT	gram	0.1-9.9	0.05 gm 4)	na	na	na	na	na	na	na
11	AIR EXPOSURE CORRECTION	gram	0.01-9.99	0.005 gm	na	na	na	na	na	na	na
12	CORRECTED DRY WEIGHT	gram	0.1-9.9	0.05 mg 4)	na	DRY WEIGHT (GM):	449	01	01	6	C
13	UNCORRECTED ASH WEIGHT	gram	0.1-9.9	0.05 gm 4)	na	na	na	na	na	na	na
14	AIR EXPOSURE CORRECTION	gram	0.01-9.99	0.005 gm	na	na	na	na	na	na	na
15	CORRECTED ASH WEIGHT	gram	0.1-9.9	0.05 gm 4)	na	na	na	na	na	na	na
16	CORRECTED ASH FREE DRY WEIGHT	gram	0.1-9.9	0.05 gm 4)	na	ASH FREE DRY WEIGHT (GM):	450	01	01	6	C
17	WEIGHING SEQUENCE	na	01-99	na	na	na	na	na	na	na	na
18	BLANK CORRECTION										
	(Final Wt.)	gram	0.1-9.9	0.05 gm	na	na	na	na	na	na	na
	(Init. Wt.)	gram	0.1-9.9	0.05 gm	na	na	na	na	na	na	na
	(Diff.)	gram	0.1-9.9	0.05 gm	na	na	na	na	na	na	na
	(t)	na	01-99	na	na	na	na	na	na	na	na
	(Diff./t)	na	01-99	na	na	na	na	na	na	na	na
19	REMARKS	na	na	na	na	ANALYSIS REMARKS:	441	01-99	na	na	C

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT DRY WEIGHT BIOMASS LOG

RECORD CODE DWB

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY
20	RECORDED BY	na	na	na
7a	GEAR ID NUMBER	na	001,999	na

MARMAP INFORMATION SYSTEM MASTER FILE

CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
na	na	na	na	na	na	na
na	na	na	na	na	na	na

6.2.9.2. Comments on: Dry Weight Biomass Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

4) The analytical procedure does not warrant the accuracy implied by the intermediate and master file field length. Until this is corrected users should report these data with accuracy not exceeding ± 0.05 gm.

B. Items

1, 2, 8, 10, 11, 13-15, 17, 18, 20. These log sheet fields are not exposed to automatic data processing.

3-4. Vessel and cruise would already exist in the master file to which the dry weight biomass data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM p. Ø1-13 and Vol. 1,

Aiv p. 13a and 33a.

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character work, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

9. The master file contains a decimal equivalent of the inverse of the aliquot factor, e.g., an aliquot factor of 2 is stored in a master file as 0.50000. For researchers more accustomed to aliquot fractions the values found in the master file are decimal equivalents of the aliquot fraction. See MIS Documentation Vol.6, SDT p. 11, INST Code 2 and p. 12, TRNS Code 6.

19. Narrative data about this analysis currently must be entered into master file category 441 using the MIS program MASTUPD (See MIS Documentation Vol. 2, UPD, p. Ø1-18). "Rinsing Techniques" and "Preservation Techniques" are preprinted under Remarks. This is to provide a place to log these details until such time as standard procedures are established.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT PLANKTON SORTERS WORKSHEET

RECORD CODE na

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY
1	PAGE __ OF __	na	na	na
2	OPERATIONAL UNIT	na	na	na
3	VESSEL	na	21 char	na
4	CRUISE	year (GMT)[1)]	year:00-99	±0.5 min
			hyphen:na	
			cruise:001-999	
5	STATION	na	001-999	na
6	SAMPLE DATE	day (GMT)	01-31	±0.5 min
		month (GMT)	01-12	±0.5 min
		year (GMT)	00-99	±0.5 min
7	GEAR/MESH	na	3 char	na
	(mesh aperture)	micron	0005-1800	±0.5 micron
	(mouth diameter)	meter	0.10-2.00	±0.005 m
	(mouth height)	meter	0.1-2.0	±0.05 m
	(mouth width)	meter	0.1-2.0	±0.05 m
8	ORIGINAL EXAMINATION	na	na	na

MARMAP INFORMATION SYSTEM MASTER FILE

CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)

NOTE: No master file format has as yet been developed.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT PLANKTON SORTERS WORKSHOP

RECORD CODE na

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH	DATUM TYPE
9	RE-EXAMINATION	na	na	na							
10	SORTER	na	na	na							
11	TOTAL ORIGINAL VOLUME	milliliter	000.1-999.9	±0.05 ml							
12	TOTAL ORIG. VOL. MINUS LG. ORGS.	milliliter	000.1-999.9	±0.05 ml							
13	FRACTIONED	na	na	na							
14	ALIQUOT FACTOR	na	0001-4096	na							
15	DATE START	day (local)	01-31	±0.5 min							
		month (local)	01-12	±0.5 min		NOTE: No master file format has as yet been developed.					
		year (local)	00-99	±0.5 min							
16	DATE FINISHED	day (local)	01-31	±0.5 min							
		month (local)	01-12	±0.5 min							
		year (local)	00-99	±0.5 min							
17	LARVAE REMOVED	na	0001-9999	na							
18	NO. OF HEADS	na	01-99	na							
19	NO. OF TAILS	na	01-99	na							
20	NO. OF DISINTEGRATED	na	01-99	na							

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT PLANKTON SORTERS WORKSHEET

RECORD CODE na

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH	DATUM TYPE
21	EGGS REMOVED	na	000001-999999	na	NOTE: No master file format has as yet been developed.						
22	REMARKS	na	na	na							
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.10.2 Comments on: Plankton Sorters Worksheet

A. Footnotes

1) GMT = Greenwich Mean Time

B. Items

6. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

C. General: Data from this log form are not exposed to automatic data processing.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON SORTING RECORD

RECORD CODE na

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY
1	PAGE ___ OF ___	na	na	na
2	OPERATIONAL UNIT	na	na	na
3	VESSEL	na	21 char	na
4	CRUISE	year (GMT) 1)	year:00-99	±0.5 min
			hyphen:na	
			cruise:001-999	
5	GEAR/MESH	na	ccc	na
	(mesh aperture)	micron	0005-1800	±0.5 micron
	(mouth diameter)	meter	0.10-2.00	±0.005 m
	(mouth height)	meter	0.1-2.0	±0.05 m
	(mouth width)	meter	0.1-2.0	±0.05 m
6	STATION	na	001-999	na
7	HAUL	na	01-99	na
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min
		month (GMT)	01-12	±0.5 min
		year (GMT)	00-99	±0.5 min

MARMAP INFORMATION SYSTEM MASTER FILE

CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH	DATUM TYPE
	NOTE: No master file format has as yet been developed					

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON SORTING RECORD

RECORD CODE na

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE					
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH	DATUM TYPE
9	NO. OF JARS	na	1-9	na							
10	ALIQUOT FACTOR	na	0001-4096	na							
11	DATE START	day (local)	01-31	±0.5 min							
		month (local)	01-12	±0.5 min							
		year (local)	00-99	±0.5 min							
12	EGGS REMOVED	na	000001-999999	na							
13	NO. OF VIALS	na	1-9	na							
14	LARVAE REMOVED	na	0001-9999	na	NOTE: No master file format has as yet been developed.						
15	DATE FINISHED	day (local)	01-31	±0.5 min							
		month (local)	01-12	±0.5 min							
		year (local)	00-99	±0.5 min							
16	SORTER	na	na	na							
17	REMARKS	na	na	na							
18	CHECKED BY	na	na	na							
19	DATE	day (local)	01-31	±0.5 min							
		month (local	01-12	±0.5 min							

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON SORTING RECORD

RECORD CODE na

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH	DATUM TYPE
19	DATE	year (local)	99-99	±0.5 min							
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.11.2 Comments on: Ichthyoplankton SortinO Record

A. Footnotes

1) GMT = Greenwich Mean Time

B. Items

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

C. General: Data from this log form are not exposed to automatic data processing.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - LARVAE

RECORD CODE IDL

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
1	PAGE ___ OF ___	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT) 3)	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	3 char	na	2	GEAR:	400	01	01	(See Comments)	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments)	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments)	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments)	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments)	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NUMBER	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD MM YY)(GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	03	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - LARVAE

RECORD CODE IDL

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	VIALS, SORTED LARVAE	na	1-9	na	na	na	na	na	na	na	na
10	TOTAL WHOLE LARVAE	na	0001-9999	na	na	na	na	na	na	na	na
11	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR: (Order/Other)	514	01	01	7	C
						(Family)	544	01	01	7	C
						(Genus)	574	01	01	7	C
						(Species)	635	01	01	7	C
12	TAXON NUMBER	na	100000000-199999999	na	23	ORDER / OTHER CODE & NAME:	510	01	01	9	N
					23	FAMILY CODE & NAME:	540	01	01	9	N
					23	GENUS CODE & NAME:	570	01	01	9	N
					23	SPECIES CODE & NAME:	600	01	01	9	N
13	TAXON NAME	na	60 char	na	23	ORDER / OTHER CODE & NAME:	510	01	02	na	A
					23	FAMILY CODE & NAME:	540	01	02	na	A
					23	GENUS CODE & NAME:	570	01	02	na	A
					23	SPECIES CODE & NAME:	600	01	02	na	A
14	VIAL NO.	na	01-99	na	na	VIAL NUMBER: (Order/Other)	513	01	01	2	N
						(Family)	543	01	01	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - LARVAE

RECORD CODE IDL

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
14	VIAL NO.	na	01-99	na	na	VIAL NUMBER: (Genus)	573	01	01	2	N
						(Species)	604	01	01	2	N
15	STANDARD LENGTHS	millimeter	000.1-999.9	±0.05 MM	na	ORDER/OTHER LENGTH (.1 MM):	534	01-99	01-13	≤4	N
						FAMILY LENGTHS (.1 MM):	564	01-99	01-13	≤4	N
						GENUS LENGTHS (.1 MM):	594	01-99	01-13	≤4	N
						SPECIES LENGTHS (.1 MM):	606	01-99	01-13	≤4	N
						ORDER/OTHER FREQUENCIES:	536	01-99	01-13	3	N
						FAMILY FREQUENCIES:	566	01-99	01-13	3	N
						GENUS FREQUENCIES:	596	01-99	01-13	3	N
						SPECIES FREQUENCIES	608	01-99	01-13	3	N
16	NUMBER NOT MEASURED	na	0000-9999	na	na	NUMBER NOT MEASURED: (Order/Other)	525	01	01	4	N
						(Family)	555	01	01	4	N
						(Genus)	585	01	01	4	N
						(Species)	636	01	01	4	N
17	NUMBER OF HEADS	na	00-99	na	na	NUMBER OF HEADS: (Order/Other)	528	01	01	2	N
						(Family)	558	01	01	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - LARVAE

RECORD CODE IDL

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
17	NO. OF HEADS	na	00-99	na	na	NUMBER OF HEADS: (Genus)	588	01	01	2	N
						(Species)	637	01	01	2	N
18	NO. OF TAILS	na	00-99	na	na	NUMBER OF TAILS: (Order/Other)	531	01	01	2	N
						(Family)	561	01	01	2	N
						(Genus)	591	01	01	2	N
						(Species)	638	01	01	2	N
19	ID BY	na	na	na	na	na	na	na	na	na	na
20	REMARKS	na	na	na	na	ANALYSIS REMARKS:	441	01-99	na	na	C
7a	GEAR ID NUMBER	na	001-999	na	na		na	na	na	na	na

6.2.12.2 Comments on: Ichthyoplankton Larvae Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1 - 2. These log sheet fields are not exposed to automatic data processing.

3 - 4. Vessel and cruise would already exist in the master file to which the larval data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM p. Ø1-13 and Vol. 1, Aiv p. 13a and 33a).

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are millimeters. Work is

underway to standardize all mesh apertures to units of microns.

9 - 10. These log sheet fields are not exposed to automatic data processing. Rather they provide a means for accounting for all specimens as the samples change hands.

11. The master file contains a decimal equivalent of the inverse of the aliquot factor, e.g., an aliquot factor of 2 is stored in a master file as 0.50000. For researchers more accustomed to aliquot fractions the values found in the master file are decimal equivalents of the aliquot fraction. See MIS Documentation Vol. 6, SDT p. 11, INST Code 2 and p. 12, TRNS Code 6.

12 - 13. These log sheet fields receive special processing.

a. During data entry the 9 digit taxonomic number alone is entered. Through special processing (See MIS Documentation Vol. 6, SDT p. Ø9, Mnemonic Code COPY) this number appears twice in the MIS Intermediate File. The MIS program LOGLIST is used to list this file for editing purposes. One occurrence of the number is listed as is, but the taxonomic name is substituted in the listing for the other occurrence of the number. During verification of data entry, only the listed name need be compared to the taxonomic name on the log sheet. Spelling need not be checked since LOGLIST has provided the taxonomic name from the System Code Table. Any errors must be corrected for both Intermediate File occurrences, i.e., in fields TAX and TXC.

b. When these data are merged into a master file more special processing takes place. The taxon is assigned to a different

master file category depending on its taxonomic level (Order = category 510; Family = category 540; Genus = category 570; Species = category 600). See MIS Documentation Vol. 6, SDT p. Ø2 and Ø3, Mnemonic Code CFLD. Also through TRNS Code 4 (MIS Documentation Vol. 6, SDT p. 12) both the number and name are placed in words 1 and 2, respectively, of the appropriate category of the master file.

c. Taxonomic levels other than the above four "standard" levels have been accommodated and are all treated as "Order/Other" by the MIS. These have thus far resulted in the following types:

1. Special Fish Name Type 1 - Taxonomic Levels Intermediate to the Four Standard Levels, e.g., Sub Family. The "taxonomic name" is composed of two words -- the first is the taxonomic name itself, e.g., Serraninae, and the second is the 9-digit taxonomic code of the next higher "standard" level to which this name belongs. The purpose of the second word is to allow inclusions of, for example, subfamily specimens in family summaries. Due to the special processing of TRNS Code 4 described above a master file with data about the taxon Serraninae would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000007	Taxonomic number
2	SERRANINAE	Subfamily name
3	170020000	Taxonomic number of "standard" level (Family) to which Serraninae belongs

2. Special Fish Name Type 2 - Multitaxa which are indistinguishable from each other, e.g., Labridae and Scaridae. The "taxonomic name" is composed of two words -- the first consists of the two or more scientific names connected by slashes (so as to appear to the MIS as one word); and the second is the 9-digit taxonomic code of the next higher "standard" level to which these names belong. Due to the special processing of TRNS Code 4 described above a master file with data about the taxa Labridae and Scaridae would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000002	Taxonomic Number
2	LABRIDAE/SCARIDAE	Multitaxa Name
3	170000000	Taxonomic Number of "standard" level (Order) to which Labridae and Scaridae belong.

3. Special Fish Name Type 3 - Disintegrated (unidentifiable) Specimens. Due to special processing of TRNS Code 4 described above a master file with data about disintegrated specimens would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000001	Taxonomic Number
2	DISINTEGRATED/FISH/EGGS	Specimen Name

4. Special Fish Name Type 4 - Recurring Unknown Specimens which are Expected to Eventually be Identified. If specimens of a single taxon cannot be identified, but the investigator desires to distinguish them from any other unknowns and expects eventually to identify them, a "taxonomic name" and number can be assigned. Since it is common that such unknowns are assigned letters or numbers until they are identified and that, e.g., unknown #1 at one institution may not be the same taxon as unknown #1 at another institution, the assignment of "taxonomic name' and number must account for these situations. The method used by the MIS is as follows:

Each separate institution identifying plankton and using the MIS for data processing must maintain one list of in-house unknowns preferably labeled numerically and including sufficient descriptions (narrative and/or graphic) to keep each unknown separate. All

investigators at the institution will use this list. The "taxonomic name" assigned to each unknown is composed of two words -- the first word identifies the kind of unknown, e.g., UNKNOWN/FISH/14; and the second is the initials of the institution from which the unknown originated, e.g., HL = Highlands Laboratory; ZSOP = Polish Sorting Center; NA = Narragansett Laboratory. Due to the special processing of TRNS Code 4 described above a master file with data about temporarily unknown specimens would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000023	Taxonomic Number
2	UNKNOWN/EGG/106*	Specimen Name
3	HL	Initials for Highlands Laboratory

*No unknown larvae have been assigned codes as yet.

5. Special Fish Name Type 5 - "Preferred" vs "Secondary" Names. Disputes over the naming of organisms are constantly occurring and affect some of the names to which the MIS has assigned codes. The determination of preferred names is a process which is taxonomist-dependent and isn't compatible with stable and efficient data processing. Thus the MIS has somewhat arbitrarily determined "preferred" vs "secondary" status for taxa

names. In the large majority of cases only the preferred name is used by the MIS. In cases where a second name is also in common use the MIS contains both names. Using Lophius americanus as an example of a preferred name, Lophius piscatorius as a secondary name, the MIS will contain the following:

The System Code Table (SYSCODES) group No. 23 will contain the nine digit code of 195010202 and the code substitution of AMERICANUS (PISCATORIUS).

The pertinent section of the output of the application program A9SRT (See MIS Documentation Vol. 6, A9S, p. Ø1-1Ø) which alphabetically lists the taxa names preceded by their codes, will appear as:

195010200	LOPHIUS
195010202	LOPHIUS AMERICANUS
195010201	LOPHIUS GASTROPHYSUS
	LOPHIUS PISCATORIUS - See LOPHIUS AMERICANUS
170070200	LOPHOLATILUS

Thus the person using the secondary name can find it when scanning A9SRT, but instead of finding a code, will be referred to the "MIS preferred name" where the 9-digit code is given.

The pertinent section of the output of the applications program CDGPLIST (See MIS Documentation Vol 6, CDL, p. Ø1-Ø9) will appear as:

Bionumeric Code	Order/Other	Family	Genus	Species
195000000	LOPHIIFORMES			
195010000		LOPHIIDÆ		
195010100			LOPHIOMUS	
195010200			LOPHIUS	
195010201				GASTROPHYSUS
195010202				AMERICANUS (PISCATORIUS)

NOTE: The important factor to remember about Special Name Type 5 is that if a user believes that a preferred and secondary name(s) really represent more than one taxon, that the user immediately request a separate code for the additional name(s). For those who disagree with this splitting the MIS can summarize what they may consider to be synonymous taxa. But, without separate codes the MIS cannot provide data except for the lumped taxon.

The Master File category 510, 540, 570 or 600 (depending on the taxonomic level of the name) will appear as:

Master File Word	Word Content	Word Meaning
1	195010202	Taxonomic Number
2	AMERICANUS	Preferred Name
3 & 5	( )	Cue to Secondary Name
4	PISCATORIUS	Secondary Name

d. Taxonomic Numbers for the unknown larvae (not expected to be eventually identified) and for larvae of the four "standard"

taxonomic levels are assigned according to Bullis, Roe and Gatlin (1972). Assignments for non-"standard" specimens described in c. 1-4 above are made from a block of numbers, 100000001-100999999, and are assigned consecutively as requested. The non-"standard" numbers have no taxonomic "sense" as compared to the "standard" numbers.

Insertions, deletions, and changes to the 9 digit bionumeric code are under strict System control. Any such requests should be directed as indicated in Section 3.5.3.1.1.

The following programs are available for displaying or listing the codes: CODECHK, CODELIST, CDGPLIST, and A9SRT. These are all described in MIS Documentation Vol. 6.

15. Standard length data for fish larvae in an MIS master file are unusual compared to most other scalar data. Larvae length data are stored to the nearest 0.1 millimeter but the decimal point is implied -- for most other scalar data the decimal point is explicitly stored.

This data log field receives special processing. During data entry a variety of lengths may be entered along with their corresponding frequencies. During the merge into a master file the frequencies for similar lengths are summed. Each resulting pair of values is stored in identical words of adjacent master file categories, e.g., if species standard lengths are involved, the first length is stored in word one of category 606 and the frequency of that length is stored in word one of category 608. The pair of values for the second occurring length would be stored in words two of the respective categories. For a complete

description of the special processing done on these data, see MIS Documentation Vol. 6, SDT, p. Ø1-17, Mnemonic Codes ADPN, REPT, INCD, RGRP, NGRP, GRPD, GETR, SLIN, INST, and MORA.

16-18. These log sheet fields receive special processing. See MIS Documentation Vol. 6, SDT, p. 1Ø-11, Mnemonic Code INST.

20. Narrative data about this analysis currently must be entered into master file category 441 using the MIS program UPDATE (See MIS Documentation, Vol. 2, UPD p. Ø1-18).

C. General

Items 11-18 all receive special processing described in MIS Documentation Vol. 6, SDT p. Ø2-Ø3, Directory Syntax Code CFLD.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - EGGS

RECORD CODE IDE

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)
1	PAGE OF	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT) 3)	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	3 char	na	2	GEAR:	400	01	01	(See Comments	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NO.	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD MM YY)(GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	02	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - EGGS

RECORD CODE IDE

LOGSHEET					MARMAP INFORMATION SYSTEM MASTER FILE						
ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH [1]	DATUM TYPE [2]
9	VIALS SORTED EGGS	na	1-9	na	na	na	na	na	na	na	na
10	TOTAL WHOLE EGGS	na	0001-9999	na	na	na	na	na	na	na	na
11	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR: (Order/Other)	514	01	01	7	C
						(Family)	544	01	01	7	C
						(Genus)	574	01	01	7	C
						(Species)	635	01	01	7	C
12	TAXON NUMBER	na	100000000-199999999	na	23	ORDER / OTHER CODE & NAME:	510	01	01	9	N
					23	FAMILY CODE & NAME:	540	01	01	9	N
					23	GENUS CODE & NAME:	570	01	01	9	N
					23	SPECIES CODE & NAME:	600	01	01	9	N
13	TAXON NAME	na	60 char	na	23	ORDER / OTHER CODE & NAME:	510	01	02	na	A
					23	FAMILY CODE & NAME:	540	01	02	na	A
					23	GENUS CODE & NAME:	570	01	02	na	A
					23	SPECIES CODE & NAME:	600	01	02	na	A
14	NO. NOT ANALYZED	na	000000-999999	na	na	NUMBER NOT ANALYZED: (Order/Other)	526	01	01	6	N
						(Family)	556	01	01	6	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - EGGS

RECORD CODE IDE

LOG SHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
14	NO. NOT ANALYZED	na	000000-999999	na	na	NUMBER NOT ANALYZED:(Genus)	586	01	01	6	N
						(Species)	672	01	01	6	N
15	VIAL NO.	na	101-199	na	na	VIAL NUMBER:(Order/Other)	513	01	01	3	N
						(Family)	543	01	01	3	N
						(Genus)	573	01	01	3	N
						(Species)	604	01	01	3	N
16	STAGE	na	001-999	na	40	EGG STAGE CODE:(Order/Other)	519	01-99	01-12	3	N
						(Family)	549	01-99	01-12	3	N
						(Genus)	579	01-99	01-12	3	N
						(Species)	670	01-99	01-12	3	N
17	EGG DIAMETER	millimeter	0.01-9.99	±0.005 mm	na	EGG DIAMETER (MM):(Order/Other)	520	01-99	01-12	4	C
						(Family)	550	01-99	01-12	4	C
						(Genus)	580	01-99	01-12	4	C
						(Species)	674	01-99	01-12	4	C
18	OIL GLOBULE DIAMETER	millimeter	0.01-9.99	±0.005 mm	na	OIL GLOBULE DIAMETER (MM):					
						(Order/Other)	521	01-99	01-12	4	C

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ICHTHYOPLANKTON DATA RECORD - EGGS

RECORD CODE IDE

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	1) MAXIMUM WORD LENGTH	2) DATUM TYPE
18	OIL GLOBULE DIAMETER	millimeter	0.01-9.99	0.005 mm	na	OIL GLOBULE DIAMETER (MM):					
						(Family)	551	01-99	01-12	4	C
						(Genus)	581	01-99	01-12	4	C
						(Species)	676	01-99	01-12	4	C
19	ID BY	na	na	na	na	na	na	na	na	na	na
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.13.2 Comments: Ichthyoplankton Egg Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1-2. These log sheet fields are not exposed to automatic data processing.

3-4. Vessel and cruise would already exist in the master file to which the egg data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM p. Ø1-13 and Vol. 1, Aiv p. 13a and 33a).

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a 3 character word, but its units are milli-

meters. Work is underway to standardize all mesh apertures to units of microns.

9-10. These log sheet fields are not exposed to automatic data processing.

11. The master file contains a decimal equivalent of the inverse of the aliquot factor, e.g., an aliquot factor of 2 is stored in a master file as 0.50000. For researchers more accustomed to aliquot fractions the values found in the master file are decimal equivalents of the aliquot fraction. See MIS Documentation Vol. 6, SDT p. 11, INST Code 2 and p. 12, TRNS Code 6.

14-15. These log sheet fields receive special processing. See MIS Documentation Vol. 6, SDT p. 1Ø & 11, Mnemonic Code INST.

12-13. These log sheet fields receive special processing.

a. During data entry the 9 digit taxonomic number alone is entered. Through special processing (See MIS Documentation Vol. 6, SDT p. Ø9, Mnemonic Code COPY), this number appears twice in the MIS Intermediate File. The MIS program LOGLIST is used to list this file for editing purposes. One occurrence of the number is listed as is, but the taxonomic name is substituted in the listing for the other occurrence of the number. During verification of data entry, only the listed name need be compared to the taxonomic name on the log sheet. Spelling need not be checked since LOGLIST has provided the taxonomic name from the System Code Table. Any errors must be corrected for both Intermediate File occurrences, i.e., in fields TAX and TXC.

b. When these data are merged into a master file more special processing takes place. The taxon is assigned to a different master file category depending on its taxonomic level (Order = category 510; Family = category 540; Genus = category 570; Species - category 600). See MIS Documentation Vol. 6, SDT p. Ø2 and Ø3, Mnemonic code CFLD. Also through TRNS Code 4 (MIS Documentation Vol. 6, SDT, p. 12) both the number and name are placed in words 1 and 2, respectively, of the appropriate category of the master file.

c. Taxonomic levels other than the four "standard" levels have been accommodated and are all treated as "Order/Other" by the MIS. These have thus far resulted in the following types:

1. Special Egg Name Type 1 - Taxonomic Levels Intermediate to the Four Standard Levels, e.g., Sub Family. The "taxonomic name" is composed of two words -- the first is the taxonomic name itself, e.g., Serraninae and the second is the 9-digit taxonomic code of the next higher "standard" level to which this name belongs. The purpose of the second word is to allow inclusions of, for example, subfamily specimens in family summaries. Due to the special processing of TRNS Code 4 described above a master file with data about the taxon Serraninae would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000007	Taxonomic number
2	SERRANINAE	Subfamily name
3	170020000	Taxonomic number of "standard" level (Family) to which Serraninae belongs

2. Special Egg Name Type 2 - Multaxa which are indistinguishable from each other, e.g., Labridae and Scaridae. The "taxonomic name" is composed of two words -- the first consists of the two or more scientific names connected by slashes (so as to appear to the MIS as one word); and the second is the 9-digit taxonomic code of the next higher "standard" level to which these names belong. Due to the special processing of TRNS Code 4 described above a master file with data about the taxa Labridae and Scaridae would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000002	Taxonomic Number
2	LABRIDAE/SCARIDAE	Multitaxa Name
3	170000000	Taxonomic Number of "standard" level (Order) to which Labridae and Scaridae belong.

3. Special Egg Name Type 3 - Disintegrated (unidentifiable) Specimens. Due to special processing of TRNS Code 4 described above a master file with data about disintegrated specimens would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000001	Taxonomic Number
2	DISINTEGRATED/FISH/EGG	Specimen Name

4. Special Egg Name Type 4 - Recurring Unknown Specimens which are Expected to Eventually be Identified.
If specimens of a single taxon cannot be identified, but the investigator desires to distinguish them from any other unknows and expects eventually to identify them, a "taxonomic name" and number can be assigned. Since it is common that such unknowns are assigned letters or numbers until they are identified and that, e.g., unknown #1 at one institution may not be the same taxon as unknown #1 at another institution, the assignment of "taxonomic name" and number must account for these situations. The method used by the MIS is as follows:
Each separate institution identifying plankton and using the MIS for data processing must maintain one list of in-house unknowns preferably labeled numerically and including sufficient descriptions (narrative

and/or graphic) to keep each unknown separate. All investigators at the institution will use this list. The "taxonomic name" assigned to each unknown is composed of two words -- the first word identifies the kind of unknown, e.g., UNKNOWN/EGG/14; and the second is the initials of the institution from which the unknown originated, e.g., HL = Highlands Laboratory; ZSOP = Polish Sorting Center; NA = Narragansett Laboratory. Due to the special processing of TRNS Code 4 described above a master file with data about temporarily unknown specimens would have data in category 510 as follows:

Master File Word	Word Content	Word Meaning
1	100000023	Taxonomic Number
2	UNKNOWN/EGG/106	Specimen Name
3	HL	Initials for Highlands Laboratory

5. Special Egg Name Type 5 - "Preferred" vs "Secondary" Names. Disputes over the naming of organisms are constantly occurring and affect some of the names to which the MIS has assigned codes. The determination of preferred names is a process which is taxonomist-dependent and isn't compatible with stable and efficient data processing. Thus the MIS has somewhat arbitrarily determined "preferred" vs "secondary" status for taxa

names. In the large majority of cases only the preferred name is used by the MIS. In cases where a second name is also in common use the MIS contains both names. Using Lophius americanus as an example of a preferred name, Lophius piscatorius as a secondary name, the MIS will contain the following:

The System Code Table (SYSCODES) group no. 23 will contain the nine digit code of 195010202 and the code substitution of AMERICANUS (PISCATORIUS).

The pertinent section of the output of the application program A9SRT (See MIS Documentation Vol. 6, A9S, p. Ø1-1Ø) which alphabetically lists the taxa names preceded by their codes, will appear as:

195010200	LOPHIUS
195010202	LOPHIUS AMERICANUS
195010201	LOPHIUS GASTROPHYSUS
	LOPHUS PISCATORIUS _ See LOPHIUS AMERICANUS
170070200	LOPHOLATILUS

Thus the person using the secondary name can find it when scanning A9SRT, but instead of finding a code, will be referred to the "MIS preferred name" where the 9-digit code is given.

The pertinent section of the output of the applications program CDGPLIST (See MIS Documentation Vol. 6, CDL, p. Ø1-Ø9) will appear as:

Bionumeric Code	Order/Other	Family	Genus	Species
195000000	LOPHIIFORMES			
195010000		LOPHIIDAE		
195010100			LOPHIOMUS	
195010200			LOPHIUS	
195010201				GASTROPHYSUS
195010202				AMERICANUS (PISCATORIUS)

NOTE: The important factor to remember about Special Name Type 5 is that if a user believes that a preferred and secondary name(s) really represent more than one taxon, that the user immediately request a separate code for the additional name(s). For those who disagree with this splitting the MIS can summarize what they may consider to be synonymous taxa. But, without separate codes the MIS cannot provide data except for the lumped taxon.

The Master File category 510, 540, 570 or 600 (depending on the taxonomic level of the name) will appear as:

Master File Word	Word Content	Word Meaning
1	195010202	Taxonomic Number
2	AMERICANUS	Preferred Name
3 & 5	( )	Cue to Secondary Name
4	PISCATORIUS	Secondary Name

d. Taxonomic Numbers for the unknown eggs (not expected to be eventually identified) and for eggs of the four "standard" taxonomic levels are assigned according to Bullis, Roe and Gatlin (1972). Assignments for non-"standard" specimens described in c. 1-4 above are made from a block of numbers, 100000001-100999999, and are assigned consecutively as requested. The non-"standard" numbers have no taxonomic "sense" as compared to the "standard" numbers.

Insertions, deletions, and changes to the 9 digit bionumeric code are under strict System control. Any such requests should be directed as indicated in Section 3.5.3.1.1.

The following programs are available for displaying or listing the codes: CODECHK, CODELIST, CDGPLIST, and A9SRT. These are all described in MIS Documentation Vol. 6.

16-18. These log sheet fields receive special processing. When an egg is analyzed for stage, egg diameter, and oil globule diameter the resulting triplet of values is stored in identical words of adjacent master file categories; e.g., if a specimen of egg is identified to genus, its stage is stored in word one of category 579, its diameter is word one of category 580, and its oil globule diameter in word one of category 581. The triplet of values for the second specimen would be stored in words two of the respective categories.

For a complete description of the processing done on these data see MIS Documentation Vol. 6, SDT Ø1-Ø7, Mnemonic Codes ADPN, REPT, INCD, RGRP, NGRP, GRPD, and GETR.

C. General. Items 11-18 all receive special processing described in MIS Documentation Vol. 6, SDT p. Ø2-Ø3, Directory Syntax Code CFLD.

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON DATA LOG

RECORD CODE ZDL

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH (1)	DATUM TYPE (2)
1	PAGE OF	na	na	na	na	na	na	na	na	na	na
2	OPERATIONAL UNIT	na	na	na	na	na	na	na	na	na	na
3	VESSEL	na	21 char	na	35	VESSEL:	002	01	na	21	C
4	CRUISE	year (GMT) 3)	year:00-99	±0.5 min	na	CRUISE (YY-CCC):	004	01	01	6	C
			hyphen:na								
			cruise:001-999								
5	GEAR/MESH	na	3 char	na	2	GEAR:	400	01	01	(See Comments)	
	(mesh aperture)	micron	0005-1800	±0.5 micron	3	GEAR:	400	01	03	(See Comments)	
	(mouth diameter)	meter	0.10-2.00	±0.005 m	4	GEAR:	400	01	04	(See Comments)	
	(mouth height)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	04	(See Comments)	
	(mouth width)	meter	0.1-2.0	±0.05 m	5	GEAR:	400	01	05	(See Comments)	
6	STATION NUMBER	na	001-999	na	na	STATION NUMBER:	100	01	01	3	N
7	HAUL NO.	na	01-99	na	na	HAUL NUMBER:	301	01	01	2	N
8	SAMPLE DATE	day (GMT)	01-31	±0.5 min	na	EXP DATE (DD MM YY)(GMT):	305	01	01	2	N
		month (GMT)	01-12	±0.5 min			305	01	02	2	N
		year (GMT)	00-99	±0.5 min			305	01	03	2	N

MARMAP PLANKTON SURVEY DATA

RECORD CONTENT ZOOPLANKTON DATA LOG

RECORD CODE ZDL

LOGSHEET

ITEM	DATA FIELD DEFINITION	DATA UNITS	ANTICIPATED RANGE	REQUIRED ACCURACY	CODE GROUP NO.	MARMAP INFORMATION SYSTEM MASTER FILE: RECOMMENDED CATEGORY DEFINITION	CAT. NO.	LINE NO.	WORD NO.	MAXIMUM WORD LENGTH 1)	DATUM TYPE 2)
9	ALIQUOT CODE	na	01-40	na	6	ALIQUOT FACTOR:	514	01	01	7	C
10	TAXON NUMBER	na	0001-9999	na	23	ORDER / OTHER CODE & NAME:	510	01	01	4	N
11	TAXON NAME	na	60 char	na	23	ORDER / OTHER CODE & NAME:	510	01	02	na	C
12	NO. NOT ANALYZED	na	001-999	na	na	NUMBER NOT ANALYZED:	526	01	01	6	N
13	VIAL NUMBER	na	201-299	na	na	VIAL NUMBER:	513	01	01	3	N
14	LENGTH	millimeter	00.1-99.9	±0.05 min	na	ORDER / OTHER LENGTH (.1 MM):	534	01-99	01-12	4	C
15	SEX	na	1-4	na	na	SEX CODE:	532	01-99	01-12	1	N
16	LIFE STAGE	na	000-999	na	38	LIFE STAGE CODE:	519	01-99	01-12	3	N
17	REMARKS	na	na	na	na	ANALYSIS REMARKS:	441	01-99	na	na	C
18	RECORDED BY	na	na	na	na	na	na	na	na	na	na
7a	GEAR ID NUMBER	na	001-999	na	na	na	na	na	na	na	na

6.2.14.2 Comments on: Zooplankton Data

A. Footnotes

1) Word length for data resulting from a code group substitution is, in fact, the maximum length of the substitution element rather than the length of any word(s).

2) Datum Type

Code	Meaning
A	Strictly an alphabetic field
N	Strictly a numeric field
C	A field that can contain any combination of characters.

3) GMT = Greenwich Mean Time

B. Items

1-2. These log sheet fields are not exposed to automatic data processing.

3-4. Vessel and cruise data would already exist in the master file to which the zooplankton data were to be merged. However, some master files may contain data from several vessels and/or cruises. In these latter circumstances "super category" information about which vessel and cruise has to be supplied when running the MIS program SETUPMRG (See MIS Documentation Vol. 2, STM, p. Ø1-13 and Vol. 1, Aiv p. 13a and 33a).

5. Currently the MIS stores only 3 character data for mesh aperture. The units are microns. One net has been used, however, with mesh of 1800 microns. It will be found in master files as a

3 character word, but its units are millimeters. Work is underway to standardize all mesh apertures to units of microns.

9. The master file contains a decimal equivalent of the inverse of the aliquot factor, e.g., an aliquot factor of 2 is stored in a master file as 0.50000. For researchers more accustomed to aliquot fractions the values found in the master file are decimal equivalents of the aliquot fraction. See MIS Documentation Vol. 6, SDT p. 11, INST Code 2 and p. 12, TRNS Code 6.

10-11. a. The "Four-Digit Interim Code for MARMAP Zooplankton Data" was inherited by the MIS. It is, in fact, a nine-digit code -- the first five characters being blanks. Thus it fits into the MIS format for the standard code also used for fishes. (See Bullis et al. 1972, in Section 3.5.3.1.1). Unlike the fish codes the zooplankton code numbers do not fit into a hierarchy which reflects the phylogenetic order. Rather, blocks of numbers have randomly been set aside for taxonomic groups as needed.

NOAA's National Oceanographic Data Center has developed and satisfactorily tested a "universal" organism code. Steps have been taken to get NODC code assignments for both the 9- and 4-digit MIS code organisms, but no conversion of the MIS to the NODC codes has begun. Non-MIS users should give serious consideration to the NODC code.

b. During data entry the 9 digit taxonomic number alone is entered. Through special processing (See MIS Documentation Vol. 6, SDT p. Ø9, Mnemonic Code COPY) this number appears

twice in the MIS Intermediate File. The MIS program LOGLIST is used to list this file for editing purposes. One occurrence of the number is listed as is, but the taxonomic name is substituted in the listing for the other occurrence of the number. During verification of data entry, only the listed name need be compared to the taxonomic name on the log sheet. Spelling need not be checked since LOGLIST has provided the taxonomic name from the System Code Table. Any errors must be corrected for both Intermediate File occurrences, i.e., in fields TAX and TXC.

c. Since the 4 digit codes make no phylogenetic "sense" zooplankton data could not conveniently be sorted into taxonomic levels. Master file category 510 contains all zooplankton names regardless of taxonomic level, hence the category definition "Order/Other Code & Name"

d. When these data are merged into a master file more special processing takes place. Through TRNS Code 4 (MIS Documentation, Vol. 6, SDT p. 12) the number and name are placed in words 1 and 2, respectively, of category 510 of the master file.

e. Special taxonomic names have received 4 digit code assignments. These have thus far resulted in the following types:

1. Special Zooplankton Name Type 1 - Multitaxa which at some Life Stages are Indistinguishable from each other, e.g., "Paracalanus and Clausocalanus"; "Pseudocalanus minutus or Paracalanus parvus". The first example would appear in category 510 of a master file as follows:

Master File Word	Word Content	Word Meaning
1	4031	Taxonomic Number
2	PARACALANUS	First of the multi-taxa names
3	AND	Multitaxa indicator
4	CLAUSOCALANUS	Second of the multi-taxa names

2. Special Zooplankton Name Type 2 - Recurring unknown Specimens which are Expected to eventually be Identified. If specimens of a single taxon cannot be identified, but the investigator desires to distinguish them from any other unknowns and expects eventually to identify them, a "taxonomic name" and number can be assigned. Since it is common that such unknowns are assigned letter or numbers until they are identified and that, e.g., unknown #1 at one institution may not be the same taxon as unknown #1 at another institution, the assignment of "taxonomic name" and number must account for these situations. The method used by the MIS is as follows: Each separate institution identifying plankton and using the MIS for data processing must maintain one list of in-house unknowns preferably labeled numerically and including sufficient descriptions (narrative and/or graphic) to keep each unknown separate. All investigators at the institution will use this list. The "taxonomic name" assigned to each of these unknowns

includes the unknown and institution name, as well as any taxonomic name which is known. An example of such data would appear in category 510 of a master file as follows:

Master File Word	Word Content	Word Meaning
1	0208	Taxonomic Number
2	Sagitta/unknown/1*	Specimen Name
3	NYOSL	Initials of Institution

* The use of slashes to make the specimen name one word has not been consistently used in the MIS.

3. Special Zooplankton Name Type 3 - "Preferred" vs "Secondary" Names. Disputes over the naming of organisms are constantly occurring and affect some of the names to which the MIS has assigned codes. The determination of preferred names is a process which is taxonomist-dependent and isn't compatible with stable and efficient data processing. Thus the MIS has somewhat arbitrarily determined "preferred" vs "secondary" status for taxa names. In the large majority of cases only the preferred name is used by the MIS. In cases where a second name is also in common use the MIS contains both names. Using Spiratella retroversa as an example of a preferred name, and Limacina retroversa as a secondary, the MIS will contain

the following:

The System Code Table (SYSCODES) group no. 23 will contain the four digit code of 0301 and the code substitution of SPIRATELLA RETROVERSA (LIMACINA RETROVERSA).

A listing of the MIS program A4SRT (See MIS documentation Vol. 6, A4S, p.Ø1-Ø8), which alphabetically lists the taxa names preceded by their codes, will appear as:

0446 LESTRIGONUS SP.

LIMACINA INFLATA - SEE SPIRATELLA INFLATA

LIMACINA RETROVERSA - SEE SPIRATELLA RETROVERSA

.....

0303 SPIRATELLA INFLATA

0301 SPIRATELLA RETROVERSA

Thus the person using the secondary name can find it when scanning A4ST, but instead of finding a code will be referred to the "MIS preferred name" where a 4 digit code is given.

The Master File category 510 will appear as:

Master File Word	Word Content	Word Meaning
1	0301	Taxonomic Number
2 & 3	SPIRATELLA RETRO-VERSA	Preferred Name
4 & 7	( )	Cues to Secondary Name
5 & 6	LIMACINA RETRO-VERSA	Secondary Name

NOTE: The important factor to be remembered about Special Zooplankton Name Type 3 is that if a user believes that a preferred and secondary

names (s) really represents more than one taxon that the user immediately request a separate code for the additional names(s). For those who disagree with this splitting the MIS can summarize what they may consider to be synonymous taxa. But, without separate codes the MIS cannot provide data except for the lumped taxon.

f. Insertions, deletions, and changes to the 4 digit interim code for zooplankton data are under strict System control. Any such requests should be directed as indicated in Section 3.6.4.1. The following programs are available for listing the codes: CODECHK, CODELIST, CDGPLIST, and A4SRT.

14-15-16. These log sheet fields receive special processing. During data entry a variety of lengths may be centered along with the corresponding sex and life stage for each specimen. The frequency of lengths is assumed to be one. Constant data (e.g., the adult life stage code or sex unknown code) or a no data value (e.g., when lengths were not measured) may be entered. Each resulting triplet of data is stored in identical words of adjacent master file categories, e.g., the first specimen's length would be stored in category 534, word 01, its sex in category 532, word 01, and its life stage in category 519, word 01. The triplet of values for second specimen would be sorted in words 02 of the respective categories. No substitutions are made for sex or life stage, nevertheless the list of these codes is stored in the MIS

SYSCODES for System security. For a complete description of the special processing done on these data, see MIS Documentation Vol. 6, SDT p. Ø1-17, Mnemonic Codes, ADPN, REPT, INCD, RGRP, NGRP, GRPD, GETR, AND MORA.

17. Narrative data about this analysis currently must be entered into master file category 441 using the MIS program UPDATE (See MIS Documentation, Vol. 2, UPD p. Ø1-18).

18. This log sheet field is not exposed to automatic data processing.

7. APPENDIX II - CALCULATIONS USED FOR MARMAP SURVEY I DATA

7.1 CABLE CAPACITY OF A WINCH DRUM

Figure 7.1 shows the dimensions of a winch drum which are necessary when calculating the drum's cable capacity. Those dimensions are used in the formula below:

$$J = (d_d + M) \times M \times E \times K$$

WHERE:

J = drum capacity (in feet) for cable diameters as determined by the value of K used.

d_d = drum diameter (in inches)

M = depth of drum flange (in inches)

E = length between drum flanges (in inches)

K = factor to be applied for the cable size under consideration (see Table of Factors below):

Cable Diameter (in)	Factor (K)
1/4	4.16
5/16	3.02
3/8	1.86
7/16	1.37
1/2	1.05
9/16	.828
5/8	.672
3/4	.465
7/8	.342
1-	.262
1-1/8	.207
1-1/4	.167
1-3/8	.138
1-1/2	.116
1-5/8	.099
1-3/4	.085
1-7/8	.074
2-	.066
2-1/8	.058
2-1/4	.052
2-3/8	.046
2-1/2	.042

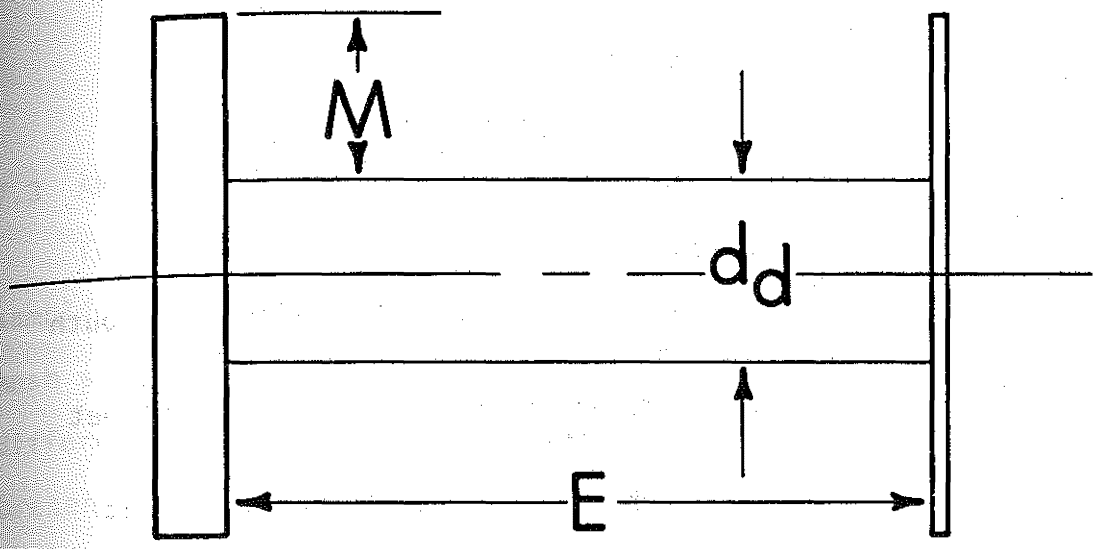

Figure 7.1 Winch drum dimensions necessary when calculating drum cable capacity

NOTE: To obtain chain length in place of cable length multiply cable length by .10 (applicable only when chain size = cable diameter. Example: 5/8" chain = 5/8" diameter cable.)

7.2 RATIO OF NETTING APERTURE AREA TO MOUTH AREA FOR A PLANKTON NET

7.2.1 MARMAP Bongo Net

$$I = \frac{\left[d_c x h_c + \frac{(d_1+d_2)h_f}{2}\right] P}{(r_m)^2}$$

WHERE:

I = ratio of netting aperture area to mouth area

d_c = diameter of cylindrical portion of net (in meters)

h_c = height of cylindrical portion of net (in meters)

d_1 = diameter of base of frustumal portion of net (in meters)

d_2 = diameter of top of frustumal portion of net (in meters)

h_f = height of frustumal portion of net (in meters)

P = decimal equivalent of percent open area of netting, e.g., for NITEX333, P = 0.46

r_m = radius of net mouth (in meters)

7.2.2 MARMAP Neuston Net

$$I = \frac{\left[\left(\frac{d_1+d_2}{2}\right) h_f\right] P}{h \times w}$$

WHERE:

I = ratio of netting aperture area to mouth area

d_1 = diameter of base of frustumal net (in meters)

7.2.2 MARMAP Neuston Net (cont.)

d_2 = diameter of top of frustumal net (in meters)

h_f = height of frustumal net (in meters)

P = decimal equivalent of percent open area of netting, e.g., for NITEX505, P = 0.50

h = height of net mouth (in meters)

w = width of net mouth (in meters)

7.3 AMOUNT OF WIRE OUT FOR DESIRED MAXIMUM TOW DEPTH

The length of the towing wire is only one factor involved in the maximum sampling depth achieved by a plankton net. Also involved are towing speed, mesh size and net configuration, payout and retrieval rates, and vertical differences in subsurface currents. Thus, the formulae given below are presented only as an initial aid for determining wire length. After actual sampling depth measurements are examined appropriate adjustments must be made.

7.3.1 General Formula

$$L = \frac{Z}{\cos \theta}$$

WHERE:

L = wire length to achieve desired maximum tow depth (in meters)

Z = desired maximum tow depth (in meters)

$\cos \theta$ = cosine of the anticipated wire angle at maximum wire out. Wire angle is measured between the towing wire and the vertical.

7.3.2 61 cm Bongo Array Formula

$$L = \frac{Z + 3.7}{0.756}$$

WHERE:

L = wire out to achieve desired maximum tow depth (in meters)

Z = desired maximum tow depth (in meters)

NOTE: This formula is the result of several hundred tows from a variety of ships and conditions during which actual maximum tow depths were measured. It should be used only for desired depth >50 meters (see Figure 2.5).

7.4 MAXIMUM DEPTH SAMPLED FOR A 61 CM BONGO ARRAY

Tow depths should be obtained from actual measurements. However, failure or loss of the recorders may occur. If so, tow depths may sometimes be calculated. Listed below is a heirarchy of formulae leading from the most preferred to the least preferred methods. Use of any of the calculations may affect data quality.

7.4.1 Measured Depth from Bathykymograph

7.4.2 Cosine of the Average Arctangent Method - appropriate for tow depths >50 meters and in areas of no current gradient in the water column to be sampled.

$$Z = \left\{\cos\left[\arctan\left(\frac{\tan\theta_1 + \tan\theta_2 + \ldots + \tan\theta_n}{n}\right)\right]\right\}\{L\}$$

WHERE:

Z = calculated tow depth (in meters)

$\tan\theta_1$, $\tan\theta_2$, etc. = tangent of wire angles measured during retrieval. Wire angles are measured between towing wire and the vertical.

n = number of wire angles measured during retrieval

L = maximum wire out (in meters)

7.4.3 Straight Cosine Law - appropriate for tow depths <50 meters and in areas of no current gradients in the water column to be sampled.

$$Z = L \cos \theta$$

WHERE:

Z = calculated tow depth (in meters)

L = maximum wire out (in meters)

$\cos \Theta$ = cosine of the wire angle at maximum wire out. Wire angle is measured between towing wire and the vertical.

7.4.4 Regression Equation - appropriate for tow depths >50 meters and in areas of no current gradients in the water column to be sampled.

$$Z = \frac{-3.7 + 0.756}{L}$$

WHERE:

Z = calculated tow depth (in meters)

L = maximum wire out (in meters)

7.5 SAMPLER DESCENT OR ASCENT RATE FOR A DOUBLE OBLIQUE TOW

$$U = \frac{\{(L_1)\ (\cos \Theta_1)\} - \{(L_2)\ (\cos \Theta_2)\}}{t_2 - t_1}$$

WHERE:

U = descent (if negative) rate or ascent (if positive) rate (in meters/second)

L_1 = wire out at start of time increment (in meters)

$\cos \Theta_1$ = cosine of wire angle at start of time increment. Wire angles are measured between the towing wire and the vertical.

L_2 = wire out at end of time increment (in meters)

$\cos \Theta_2$ = cosine of wire angle at end of time increment

$t_2 - t_1$ = duration of time increment (in seconds)

7.6 FORMALIN CONCENTRATION

Formalin is a saturated aqueous solution of formaldehyde gas, about 40% formaldehyde by weight, i.e., 100% formalin $\approx$ 40% formaldehyde.

$$\text{Formalin Concentration (\%)} = \frac{\text{volume of 100\% formalin}}{\text{volume of 100\% formalin + volume of sea water}} \times 100$$

7.7 FLOWMETER CALIBRATION

Since flowmeters may not exhibit a linear response to changing flow speeds, they must be calibrated at several different speeds within the range of intended use.

Some investigators calibrate flowmeters for a particular net so that the calibration factor has units of volume per revolution. The equation below yields a factor which has the units of length per revolution, and which must be multiplied by the area of the mouth of the net in which it is used in order to obtain volume per revolution.

$$F = \frac{D}{R}$$

WHERE:

F = flowmeter calibration factor (in meters per revolution) at a specific flow speed

D = distance necessary to produce one flowmeter impeller revolution (in meters)

R = one flowmeter revolution

7.8 VOLUME OF WATER FILTERED

7.8.1 Standard MARMAP Neuston Net

The assumption is made that the net fishes with the mouth opening one-half submerged during the tow. Also the standard array does not include a flowmeter so distance towed is derived from tow speed and duration. Were a flowmeter to be employed, distance would be measured as in Sections 7.9.1.1 (1-3), below.

$$V = (0.5h)\ (w) \times (D/t)\ (t)$$

WHERE:

V = volume of water filtered (in meters cubed)

h = height of the mouth of the neuston net (in meters)

w = width of the mouth of the neuston net (in meters)

D/t = towing speed (in meters/second)

t = duration of tow (in seconds)

7.8.2 Circular Mouth Net for Water Column Sampling, e.g., Bongo.

Calculations of volume filtered should be based on calibrated flowmeter data. However, failure or loss of the meters may occur. If so, less preferred methods of volume calculation may sometimes be employed. Listed below is a hierarchy of formulae beginning with the most preferred and leading to the least preferred. Use of other than the first of these may affect data quality.

7.8.2.1 All Data Available

$$V = R \times F \times A$$

WHERE:

V = calculated volume of water filtered (in meters cubed)

R = number of flowmeter revolutions during tow

F = mean of the calibration factors determined before and after each cruise (in meters per revolution)

A = area of net mouth (in meters squared)

7.8.2.2 Current Flowmeter Calibrations Not Available - use factory calibration data

$$V = R \times F_f \times A$$

WHERE:

V = calculated volume of water filtered (in meters cubed)

R = number of flowmeter revolutions during tow

F_f = factory calibration factor (in meters per revolution)

A = area of net mouth (in meters squared)

7.8.2.3 Flowmeters Lost or Malfunctioned - derive distance towed from ship speed and duration of tow

$$V = A \times t \times S$$

WHERE:

V = calculated volume of water filtered (in meters cubed)

A = area of net mouth (in meters squared)

t = duration of tow (in seconds)

S = ship speed during tow (in meters per second). Speed is obtained from different methods listed below in order of preference:

(1) currently calibrated flowmeter data available from most other tows during the cruise

$$S_a = \frac{\frac{R_1 \times F_1}{t_1} + \frac{R_2 \times F_2}{t_2} + \ldots + \frac{R_n \times F_n}{t_n}}{n}$$

WHERE:

S_a = average speed calculated from other tows during the cruise where currently calibrated meters functioned properly (in meters per second)

R_1, R_n = revolutions for flowmeters 1-n used in the calculation

F_1, F_n = calibration factors for meters 1-n used in the calculation (in meters per revolution)

t_1, t_n = duration of tows 1-n used in the calculation (in seconds)

n = number of tows used in the calculation.

(2) Factory calibrated flowmeter data available for most other tows during the cruise - use equation in section 7.8.2.3 (1), above, where F_1, F_n = factory calibration factors.

(3) No flowmeter data available for the cruise - use measured ship speed.

(4) No flowmeter data available; no measured ship speed data available - use estimated ship speed.

7.9 STANDARD HAUL FACTOR

Plankton tows differ with respect to volume of water filtered and maximum tow depth. In order to make data values from them comparable these values must be normalized through the use of a standard haul factor:

value per tow = (count in aliquot) x (aliquot factor)

normalized value = (count in aliquot) x (aliquot factor) x (standard haul factor)

7.9.1. Surface Tows

7.9.1.1 Factor for value/1000 m^2

$$H = \frac{1000}{w \times D}$$

WHERE:

H = surface standard haul factor (for values per 1000 meters squared)

w = width of the mouth of the net (in meters)

D = distance towed (in meters). Distance is obtained from different methods listed below in order of preference:

(1) $D = R \times F$

WHERE:

R = number of flowmeter revolutions during the tow

F = mean of the flowmeter calibration factors determined before and after the cruise (in meters per revolution)

(2) $D = R \times F_f$

WHERE:

R = number of flowmeter revolutions during the tow

F_f = factory calibration factor (in meters per revolution)

(3) $D = S \times t$

WHERE:

S = speed of ship during tow (in meters per second) calculated according to Section 7.8.2.3 (1-4) above

t = duration of tow (in seconds)

7.9.1.2 Factor for value/1000 m^3

$$H = \frac{1000}{A \times D}$$

WHERE:

H = surface standard haul factor (for value per 1000 meters cubed)

A = area of the mouth of the net (in meters squared), which was actually sampling (only ½ total mouth area for a standard MARMAP neuston tow)

D = distance towed (in meters) calculated according to Section 7.9.1.1 (1-3) above

7.9.2 Water Column Tows

7.9.2.1 Factor for value/10 m^2

$$H = \frac{Z \times 10}{V}$$

WHERE:

H = water column standard haul factor (for value beneath 10 square meters of sea surface)

Z = maximum tow depth (in meters) calculated according to Section 7.4 above

V = volume of water filtered (in meters cubed) calculated according to Section 7.8 above

7.9.2.2 Factor for value/100 m^3

$$H = \frac{100}{V}$$

WHERE:

H = water column standard haul factor (for value per 100 meters cubed)

V = volume of water filtered (in meters cubed) calculated according to Section 7.8 above

7.10 NORMALIZED ABUNDANCE OF ORGANISMS

7.10.1 Total Organisms

$$N_t = C \times Q \times H$$

WHERE:

N_t = normalized abundance of total organisms (in number per 1000 meters squared, number per 10 meters squared, or number per 100 meters cubed--depending on the value of H used)

C = number of organisms counted in the aliquot

Q = Aliquot factor (usually = 1 for fish larvae)

H = standard haul factor--see Section 7.9 above

7.10.2 Organisms of Particular Length, Stage, etc.

$$N_i = [C_i + (\frac{C_t}{C} \times C_n)] \times Q \times H$$

WHERE:

N_i = normalized abundance of organisms of a particular length range, sex, stage, etc. (in number per 1000 meters squared, number per 10 meters squared, or number per 100 meters cubed--depending on the value of H used)

C_i = number of organisms in the aliquot which fell within the length, sex, stage, etc., range

C_t = total number of organisms in the aliquot

C_n= number of organisms in the aliquot, not analyzed for length, sex, or stage, etc.

Q = aliquot factor (usually = 1 for fish larvae)

H = standard haul factor--see Section 7.9 above

7.11 NORMALIZED CONCENTRATION OF TAR OR PLASTIC

$$N_p = (G - P) \times Q \times H$$

WHERE:

N_p= normalized concentration (in grams per 1000 meters squared. Use of other standard haul factors for this concentration would be inappropriate.)

G = combined weight of air-dried paper and tar or plastic in aliquot (in grams)

P = weight of air-dried paper (in grams)

Q = aliquot factor (usually = 1 for tar and plastics)

H = standard haul factor--see Section 7.9 above

7.12 NORMALIZED ZOOPLANKTON DISPLACEMENT VOLUME

$$N_v = (V_c - V_l) \times Q \times H$$

WHERE:

N_v= normalized displacement volume (in milliliters per 1000 meters squared, ml per 10 meters squared, or ml per 100 meters cubed--depending on the value of H used)

V_c= combined volume of plankton and liquid (in milliliters)

V_l= volume of filtrate liquid (in milliliters)

Q = aliquot factor (usually = 1 for displacement volume)

H = standard haul factor--see Section 7.9 above

7.13 NORMALIZED DRY WEIGHT BIOMASS

$$N_d = [N_n - (B_f - B_i)(\frac{n}{T + T})] \times Q_n \times H$$

WHERE:

N_d = normalized dry weight (in grams per 1000 meters squared, grams per 10 meters squared, or grams per 100 meters cubed--depending on the value of H used) of the nth sample weighed when a large number of samples are being processed. See Section 3.4.3.2 above

N_n = dry weight (in grams), uncorrected for air exposure, for the nth sample weighed

B_f = weight of the "blank" container (in grams) measured after the final sample is weighed

B_i = weight of the "blank" container (in grams) measured at the initiation of sample weighing

T = total number of samples being weighed (excluding blank samples)

n = the nth sample sequence number (excluding blank samples)

Q_n = aliquot factor for the nth sample

H = standard haul factor--see Section 7.9 above

7.14 NORMALIZED ASH-FREE DRY WEIGHT BIOMASS

$$N_f = \{[N_n - (B_f - B_i)(\frac{n}{T+1})]\} - \{Y_n - [(B_f - B_i)(\frac{n}{T+1})] \times Q_n \times H\}$$

WHERE:

N_f = normalized ash-free dry weight biomass (in grams per 1000 meters squared, grams per 10 meters squared, or grams per 100 meters cubed--depending on the value of H used) of the nth sample weighed when a large number of samples are being processed. See Section 3.4.3.2 above

{} = This bracketed expression, defined in Section 7.13 above is the dry weight (in grams) corrected for air exposure

Y_n = ash weight (in grams) uncorrected for air exposure, for the nth sample weighed (excluding blank samples)

NOTE: Remaining terms are as defined in Section 7.13 above

7.15 NORMALIZED CARBON BIOMASS

$$N_C = \frac{O \times F_O}{W} \times W_C \times Q \times H$$

WHERE:

N_C = normalized carbon concentration (in grams per 1000 meters squared, grams per 10 meters squared, or grams per 100 meters cubed--depending on the value of H used)

O = carbon analyzer sensor output, e.g., thermocouple counts

F_O = carbon analyzer calibration factor based on known carbon dioxide standards, i.e., grams carbon per sensor output

W = weight of sample in crucible (in grams)

W_C = constant weight of dried material in aliquot

Q = aliquot factor

H = standard haul factor--see Section 7.9 above

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(continued from inside front cover)

11. ***Proceedings of the Summer Flounder (***Paralichthys dentatus***) Age and Growth Workshop, 20-21 May 1980, Northeast Fisheries Center, Woods Hole, Massachusetts.*** By Ronal W. Smith, Louise M. Dery, Paul G. Scarlett, and Ambrose Jearld, Jr. December 1981. iv + 14 p., 10 figs., 6 tables. NTIS Access. No. PB82-174921.

12. ***Status of the Fishery Resources Off the Northeastern United States for 1981.*** By Resource Assessment Division, Northeast Fisheries Center. January 1982. iii + 114 p., 44 figs., 44 tables. NTIS Access. No. PB82-184946.

13. ***Gulf and Atlantic Survey for Selected Organic Pollutants in Finfish.*** By Paul D. Boehm and Pam Hirtzer. April 1982. vii + 111 p., 46 figs., 31 tables, 2 app. NTIS Access. No. PB82-254111.

14. ***Ecosystem Definition and Community Structure of the Macrobenthos of the NEMP Monitoring Station at Pigeon Hill in the Gulf of Maine.*** By Alan W. Hulbert, Kenneth J. Pecci, Jonathan D. Witman, Larry G. Harris, James R. Sears, and Richard A. Cooper. May 1982. xii + 143 p., 16 figs., 10 tables, 9 app. NTIS Access. No. PB83-112474.

15. ***Seasonal Phytoplankton Assemblages in Northeastern Coastal Waters of the United States.*** By Harold G. Marshall and Myra S. Cohn. July 1982. vi + 31 p., 8 figs., 2 tables. NTIS Access. No. PB83-116715.

16. ***Contaminants in New York Bight and Long Island Sediments and Demersal Species, and Contaminant Effects on Benthos, Summer 1980.*** By Robert N. Reid, John E. O'Reilly, and Vincent S. Zdanowicz, eds. September 1982. x + 96 p., 36 figs., 21 tables. NTIS Access. No. PB83-152116.

17. ***Summary of the Physical Oceanographic Processes and Features Pertinent to Pollution Distribution in the Coastal and Offshore Waters of the Northeastern United States, Virginia to Maine.*** By Merton C. Ingham (ed.), Reed S. Armstrong, J. Lockwood Chamberlin, Steven K. Cook, David G. Mountain, Ronald J. Schlitz, James P. Thomas, James J. Bisagni, John F. Paul, and Catherine E. Warsh. December 1982. vi + 166 p., 21 figs., 2 tables. NTIS Access. No. PB83-156364.

18. ***Stock Discrimination of Summer Flounder (***Paralichthys dentatus***) in the Middle and South Atlantic Bights: Results of a Workshop.*** By Michael J. Fogarty, Glenn DeLaney, John W. Gillikin, Jr., John C. Poole, Daniel E. Ralph, Paul G. Scarlett, Ronal W. Smith, and Stuart J. Wilk. January 1983. iii + 14 p., 2 figs., 3 tables. NTIS Access. No. PB83-168856.

19. ***Environmental Benchmark Studies in Casco Bay - Portland Harbor, Maine, April 1980.*** By Peter F. Larsen, Anne C. Johnson, and Lee F. Doggett. January 1983. xi + 173 p., 39 figs., 12 tables, 2 app. NTIS Access. No. PB83-184069.

20. ***Annual NEMP Report on the Health of the Northeast Coastal Waters of the United States, 1981.*** Northeast Monitoring Program Report No. NEMP-IV-82-65. February 1983. xii + 86 p., 21 figs., 15 tables, 1 app.

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