HIGH SPEED PLANKTON SAMPLERS

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Explanatory Note

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United States Department of the Interior, Oscar L. Chapman, Secretary
Fish and Wildlife Service, Albert M. Day, Director

HIGH SPEED PLANKTON SAMPLERS

1. A High Speed Plankton Sampler (Model Gulf I-A)
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2. An All-metal Plankton Sampler (Model Gulf III)
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The Model Gulf I-A High Speed Plankton Sampler

The following report is preliminary in nature and is presented at this time, prior to comprehensive study, only to give other investigators an early opportunity to consider the possibilities of the sampler described in connection with their own plankton-collecting operations.

Realizing the limitations of conventional plankton-sampling gear, a new type high-speed sampler was designed and constructed for collecting operations of the Gulf Fishery Investigations. This sampler, Model Gulf I, consisted essentially of a marine plywood body housing a removable cylindrical wire-cloth plankton net with detachable bucket, and a current meter. Although lost after the completion of only six experimental tows averaging 3½ hours each, results seemed to justify construction of a similar model. To insure greater ease of handling at sea, to utilize a better current-measuring device, and to incorporate improvements from observations made on the original sampler, this new model was fabricated entirely of monel metal. Superficially resembling the Scripps high-speed plankton collector designed by John Isaacs, it differs markedly in many respects, especially in operational procedure.

During cruise I-2 and a special cruise (N-2) of the Fish and Wildlife Service research vessel Alaska, the new sampler was towed 62 times for a total of 202 hours or slightly more than 1800 miles. Used with a 15-pound depressor, 1/ the sampler towed true, and according to wire-angle observations, with little variation in depth, in spite of the rough weather encountered throughout most of Cruise I-2 and part of the special cruise. No difficulty was experienced in launching or retrieving the sampler while underway at speeds up to ten knots.

While detailed analysis has not been made, preliminary examination reveals that the samples obtained are composed of essentially the same forms normally taken by conventional silk nets, and, with few exceptions, the organisms are in surprisingly good condition. In addition, a small number of larger, more agile animals were captured, e.g., four Myctids 5.6, 3.8, 3.2, and 3.2 cm. in length, a 10.8 cm. leptocephalus, an unidentified deep-sea fish measuring 5.7 cm., and a squid 1.3 cm. in body length.

1/ This depressor is the type developed by John Isaacs of Scripps Institute of Oceanography, and is illustrated and discussed in the California Cooperative Sardine Research Program Progress Report, 1950, on page 19.

Description

The Model Gulf I-A high speed sampler is of relatively simple construction, the only moving parts being contained within the current meter. It consists of an outer cylinder, a detachable nosepiece and reducer, an inner wire-cloth cylindrical net with detachable bucket, and the current meter.

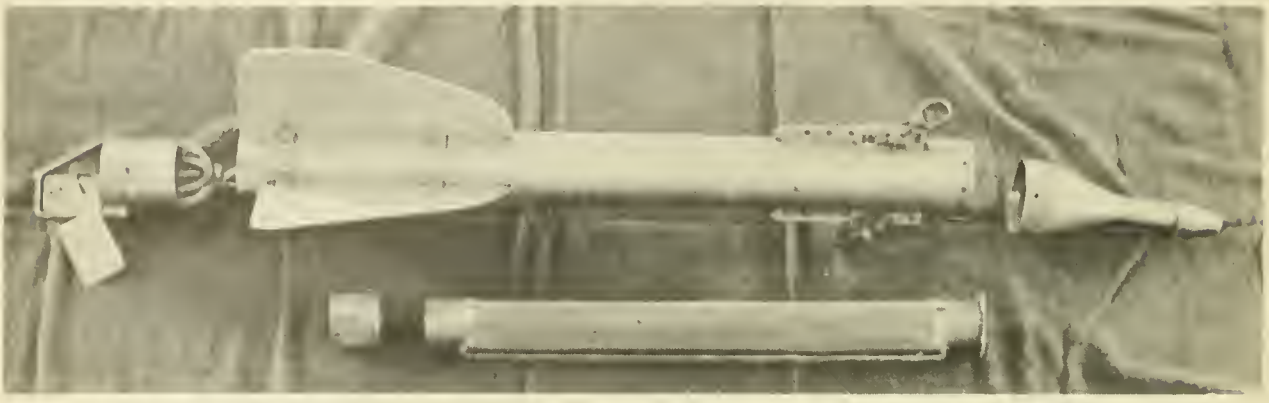


Figure 1. Exploded view of model gulf I-A high speed sampler.

Fabricated of 16-gauge (0.06 inch) monel metal, the cylinder is four feet in length, with an inner diameter of 4-5/8 inches. This diameter exactly accomodates the Atlas current meter, which, after insertion into the cylinder, is secured by three lugs (set in fairings) and wing-nuts. Soldered 1/8" back from the rim of the fore-end of the cylinder is an inner band of monel, 3/4" by 3/4", to support the plankton net collar and to provide a seat for its flange, to furnish a medium for seating the machine screws used in securing the nosepiece, and to impart added strength to this portion of the cylinder. Three slots cut in this band permit passage of the screen support rods (see figs. 2 and 3). Stabilization when towing is affected by means of a vertical fin and two stabilizers (of 16-gauge monel), aided by the depressor. Two towing plates, ten inches in length, one inch in height and a half inch in thickness, are drilled with seven half-inch holes (see cut-away, side view, fig. 2) to achieve optimum towing performance by providing a selection in points of attachment for the towing and depressor cables.

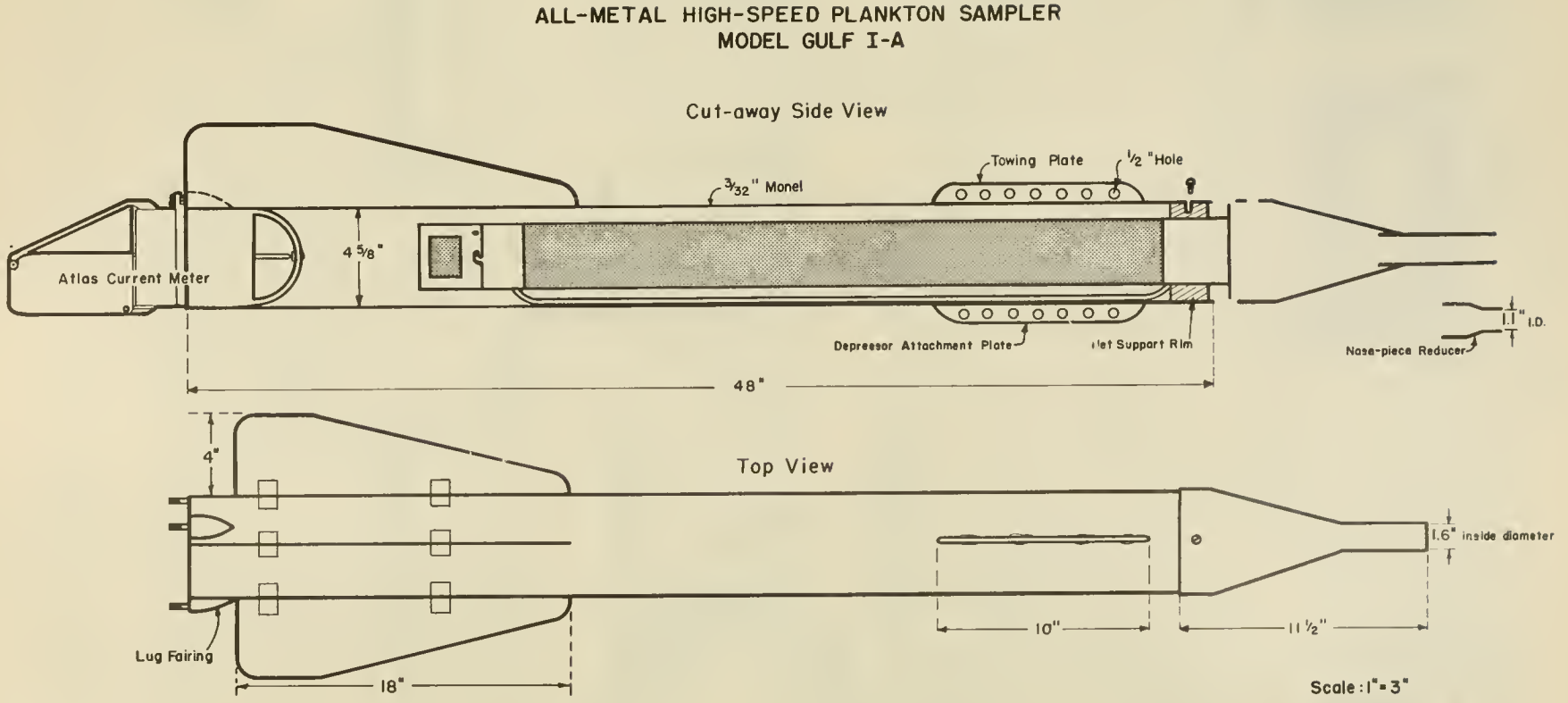


Figure 2. Side and top views. Model Gulf I-A.

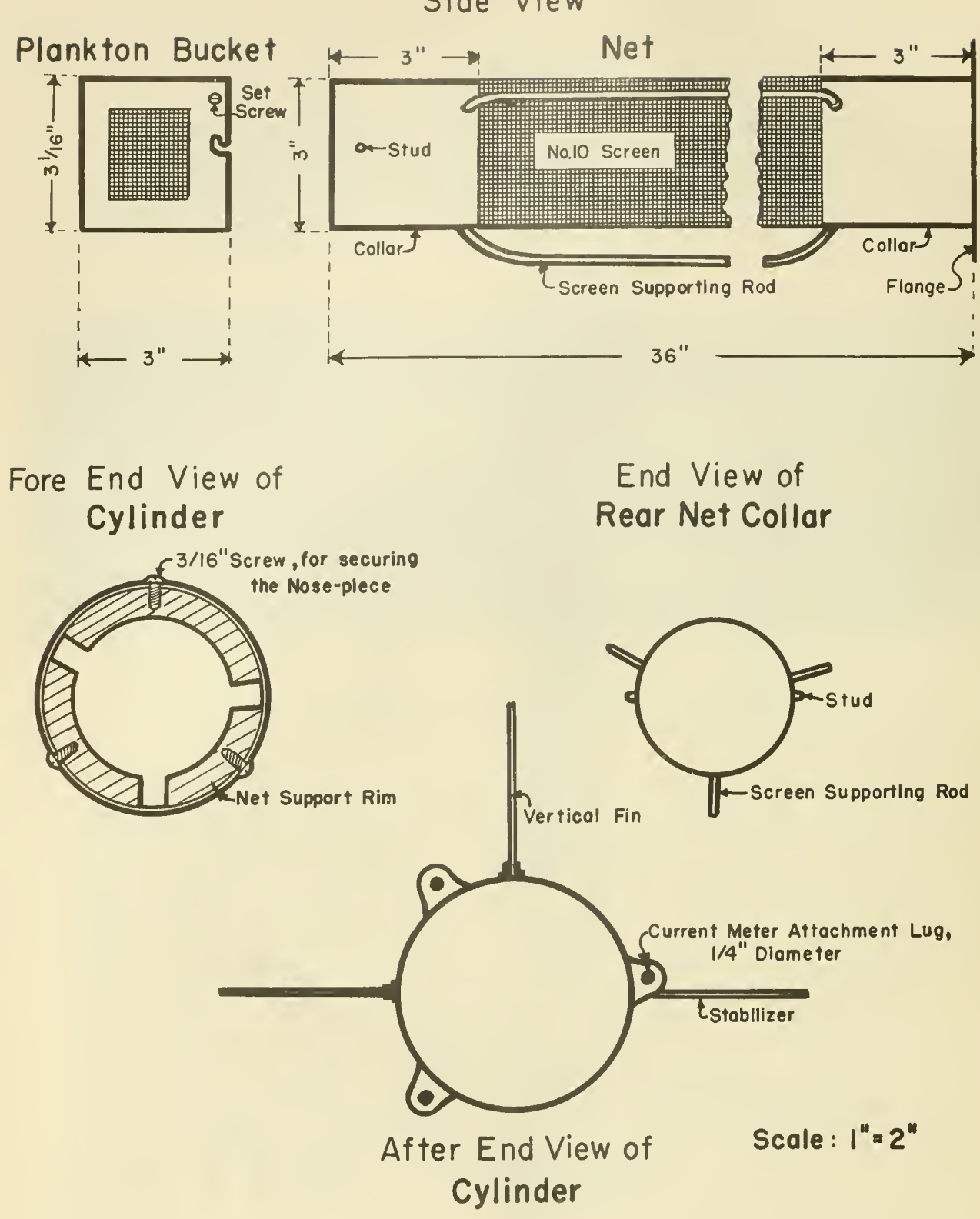


Figure 3. Details of side and ends. Model Gulf I-A.

The nosepiece, 11½" over-all length, fabricated of 16-gauge monel, fits snugly over the fore-end of the cylinder. It is secured for towing by three monel machine screws (see fig. 3). The 1.6" intake opening permits flow of a water column two square inches in cross section. A reducer with an intake opening of 1.1 inches (one square inch, X-section) is easily attached to the nosepiece by a set-screw, should this reduction in water flow be considered necessary.

The cylindrical plankton net is composed of two 16-gauge monel collars, 3" in length and 3" in diameter, connected by three monel rods of 3/16" diameter to form a "frame" for the monel wire-cloth screen. When the sampler is assembled, the net is kept in place by these rods and by the flange on the fore-collar. On the rear collar are two studs for securing the plankton bucket. Woven of wire 0.0075" in diameter and 50 meshes to the inch, the wire-cloth has a mesh opening of 0.015 inches. This corresponds approximately to the No. 1 mesh of silk nets and gives a straining (filtering) area of about 280 square inches. Fitting closely over the rear collar of the net, the plankton bucket is secured by a set screw and the studs already mentioned. Two wire-cloth "windows" of the same mesh as the net allow further straining and permit the plankton to settle into the bucket.

The amount of water that passes through the sampler can be calculated from the number of revolutions registered on the dials of the Atlas current meter. As all water passing through the sampler passes through this meter, reasonable accuracy can be expected. The Atlas meter was selected because of its nickel-plated brass construction, its durability, its easy-to-read dials that can be readily zeroed, and because no modifications were necessary in order to incorporate it as part of the sampler.

A decided advantage of the Model Gulf I-A sampler is its ease of assembly and disassembly. Once the current meter has been properly installed, it should not have to be removed for the duration of a cruise. Therefore, standard procedure for assembling the sampler on station would be to (1) attach plankton bucket to rear collar of net, (2) insert assembled net and bucket into cylinder, and (3) slide on and secure nosepiece. The 15-pound depressor, secured to an 8-foot length of 3/8" manila line, is shackled into the bottom towing plate. The ¼" stainless steel towing cable is shackled into the top towing plate. Experimental towing showed that the sampler towed best with the towing cable and the depressor line shackled into the second hole of their respective towing plates. The dials of the current meter are zeroed just prior to launching the sampler. The current meter, rigged for launching, is illustrated in figure 4.

Upon completing a tow, the sampler is brought inboard, the towing cable and depressor line are unshackled, and it is placed upright in a rack. Dial readings are taken immediately. The nosepiece is then detached, and the net removed. The net is thoroughly hosed down with salt water before detaching the plankton bucket. Any necessary cleaning is done with a nylon-bristle brush.

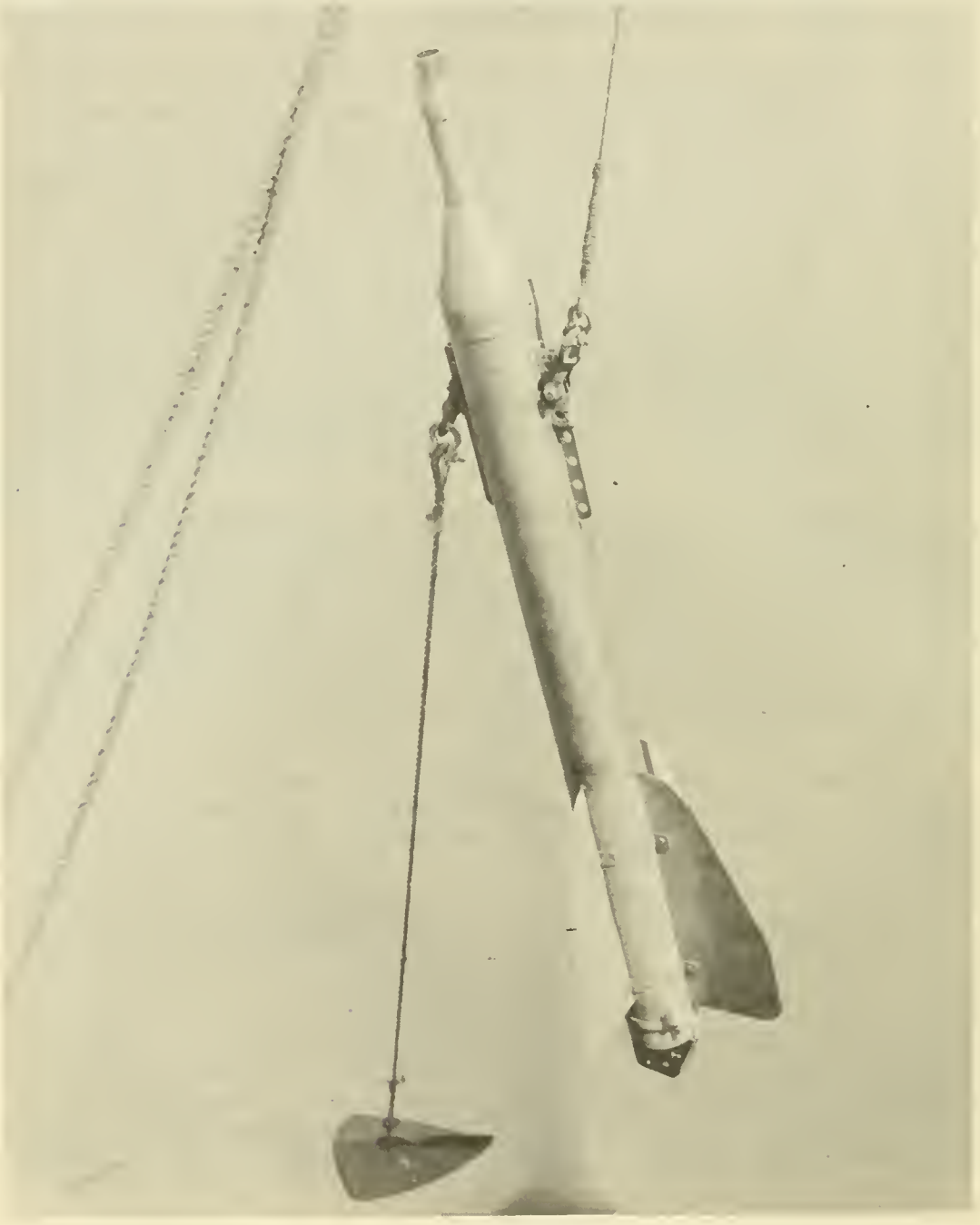


Figure 4. Model Gulf I-A high speed plankton sampler rigged in position for lowering.

The Model Gulf III All-metal Plankton Sampler

The following report of an all-metal, modified 1/2-meter plankton net is a preliminary presentation of the construction plans, operational procedure, and trial results of the Model Gulf III plankton sampler. To date an inadequate number of tows has been made with the net to present tested analysis but preliminary results indicate good possibilities.

The towing cable, $\frac{1}{4}$" wire rope, is attached by means of a shackle and swivel to the upper attachment ring of the sampler. A 40-pound depressor 1/ is attached to the lower attachment ring by means of a shackle, a swivel, and a 7-foot length of 1" diameter manila line. (See fig. 5.) The 7-foot length permits the depressor to swing free of the after end of the sampler during handling operations. The 1" line is of such size and flexibility as to provide easy handling of the depressor.

When the current meters have been placed, the two meter dials are zeroed and rags placed in the meters to prevent flow wheels from turning. Just as the sampler is being lowered into the water by means of a davit, the meter rags are removed. The sampler has been lowered into and removed from the water while the ship was underway, at about 6 knots.

After the towing time has elapsed, the sampler is brought in, the meter rags replaced, and the nosepiece and net removed. The fore meter is removed and meter readings are recorded. The net is hosed down with salt water to wash all plankters into the plankton bucket. After removal of the bucket the entire net is washed with fresh water and scrubbed inside and out with a nylon bristle brush to remove any foreign matter and salt. If this cleaning operation is done thoroughly after each tow, a uniform mesh area is maintained for successive tows. The housing, net, bucket, and current meter are illustrated in figure 6.

1/ The depressor developed by John Isaacs is illustrated and discussed in the California Cooperative Sardine Research Program Progress Report, 1950, on page 19.

Figure 5. Model Gulf III plankton sampler rigged for lowering.

Figure 6. Exploded view of Model Gulf III plankton sampler.

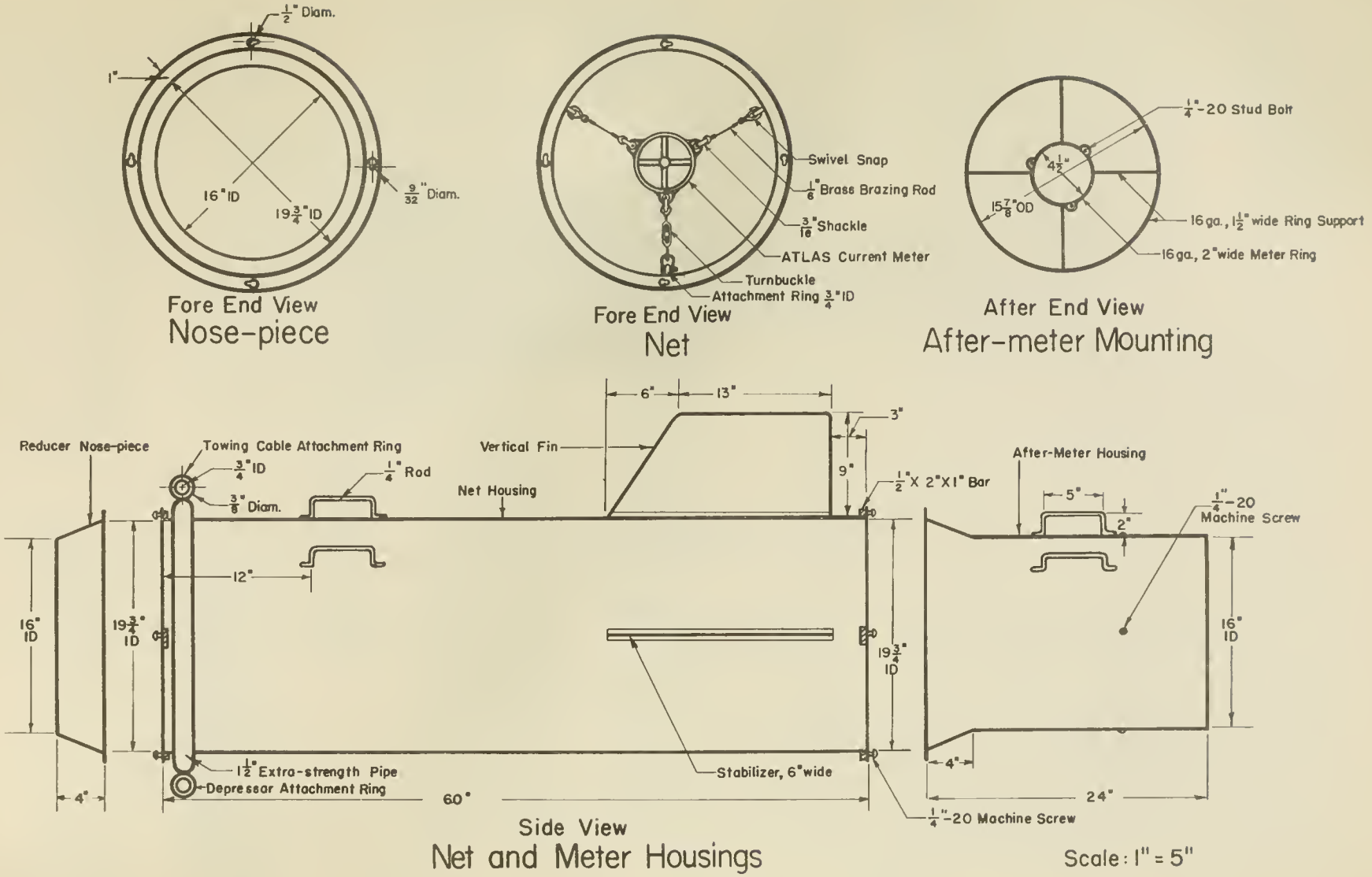
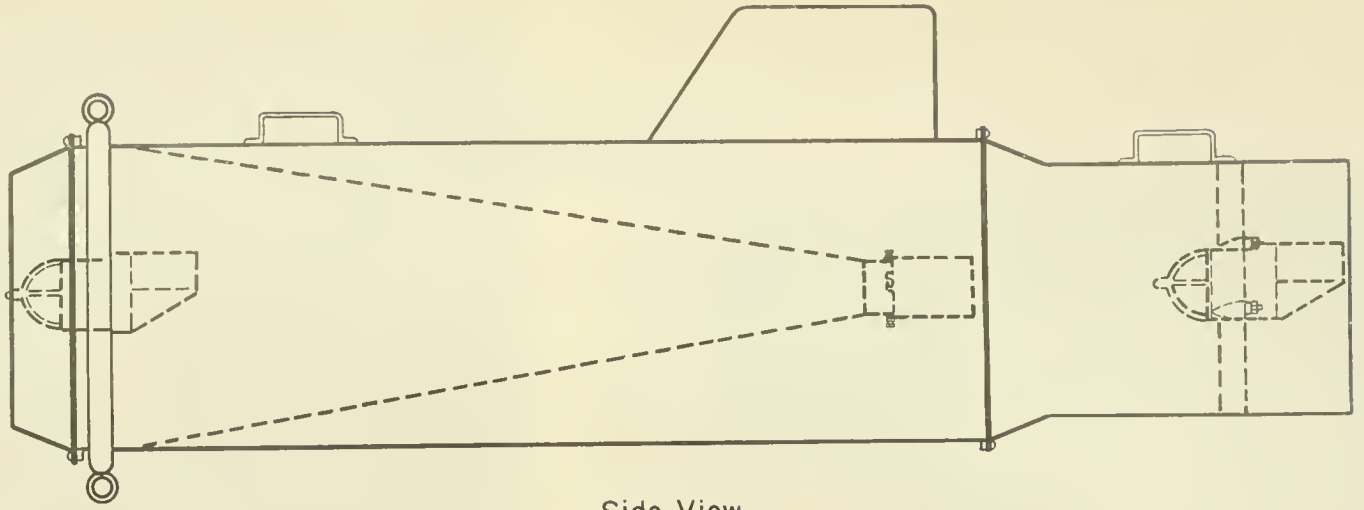
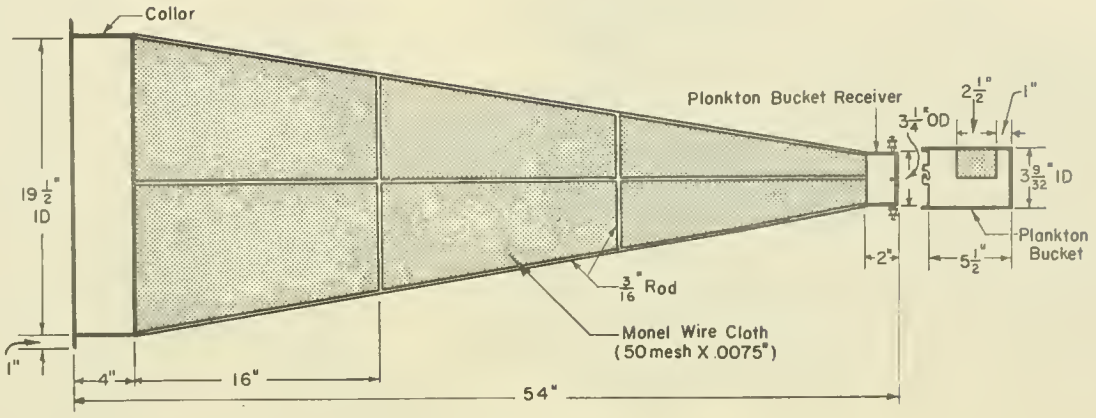


Figure 7. Details of Model Gulf III.



Side View

Model Gulf III Plankton Sampler



Side View

Net

Figure 8. Side view, Model Gulf III.

The sampler is then assembled and is ready for the next towing operation. The after meter remains in the unit at all times.

Discussion

The Model Gulf III plankton sampler has been used for only a limited number of tows so final judgment will be reserved until adequate testing has been completed. At this time, however, it can be said that the sampler indicates good possibilities. Specimen condition is good and compares favorably with silk net collections at slower speeds. The sampler tows very well, with the aid of the 40-pound depressor, at speeds to 6 knots. The wire cloth used (50 mesh x .0075") duplicates very nearly No. 1 silk mesh. Coarser meshes would undoubtedly improve the effectiveness with the larger marine forms. Performance at higher speeds and with a variety of meshes will be studied in the near future.

Figures 7 and 8 illustrate the construction of the Gulf Model III plankton sampler. The line drawings describe the suspension of the Atlas current meter in the forward end of the plankton sampler and illustrate the orientation of the net and bucket with respect to the housing and the current meter.

Preliminary examination of samples taken reveal several deep sea forms not previously recorded in our silk net tows. Tentatively identified are these: Diplophos 7.0 cm., 4.5 cm., 3.9 cm., and Stomias 5.3 cm. Several squid were taken, the largest being 4 cm. in overall length. No squid have been recorded from our previous silk net samples.

The chief disadvantages of the sampler are: initial high cost, and because of the large size, awkwardness for handling the unit in rough weather. Though the initial cost is high it should outlast many silk nets because of its construction and non-deteriorating materials. Handling difficulties can be overcome with adequate gear. A special cradle on the ship deck provides safe, secure storage.

Construction and Operation Advantages of the Model Gulf III Plankton Sampler over the Conventional ½-meter Silk Net

Conventional ½-Meter Silk Net	Model Gulf III Plankton Sampler
1. Net tears when towed at high speeds.	1. Wire cloth net will not tear when the sampler is towed at high speeds.
2. Many of the more agile forms evade the net when it is towed at slow speeds.	2. At high speeds possible with the metal sampler some of the more agile forms may conceivably be captured.

Conventional ½-Meter Silk Net	Model Gulf III Plankton Sampler
3. Clogging results when spines of some of the plankters tangle with the soft fibers of silk net.	3. Clogging resulting from tangling of plankter spines with wire meshes is less than with soft fibers of silk net because of rigidity of the wire meshes.
4. Net is difficult to clean because of softness of silk fibers which hold plankter spines. Silk net is too fragile to scrub properly.	4. Cleaning can be quickly and easily accomplished by scrubbing with a brush.
5. Special care is necessary to prevent excessive deterioration.	5. No special care is necessary to prevent excessive deterioration since monel is one of the more corrosive-resistant metals.
6. Conventional towing bridle disturbs water immediately ahead of net which very likely results in many organisms evading the net.	6. The towing and depressor cables are attached to the sampler behind the mouth of the net, hence they do not disturb the water ahead of the net.
7. Flow as determined by current meter in the mouth of the net is of questionable accuracy.	7. Two current meters are used, one in the mouth of the net and one in the housing behind the net, to determine the volume of water which passes through the net.

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