UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUSPENDED-SEDIMENT AND VELOCITY DATA, AMAZON RIVER AND ITS TRIBUTARIES, JUNE-JULY 1976 AND MAY-JUNE 1977

Open-File Report 79-515

UNITED STATES DEPARTMENT OF THE INTERIOR

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Robert H. Meade, Carl F. Nordin, Jr., William F. Curtis, Holly A. Mahoney, and Bruce M. Delaney

ABSTRACT

During the high-water seasons of June-July 1976 and May-June 1977, 325 samples of suspended sediment were collected from the Amazon River and its tributaries between Iquitos in Peru and the river mouth in Brazil. The suspended sediment was collected with a point sampler, a depth-integrating sampler, and a bucket or bottle dipped into the river. Concentrations were determined by weighing the sediment caught on sieves and membrane filters. Particle sizes were determined by wet sieving and, to a lesser extent, by pipette and visual-accumulation tube. Velocity data were collected with an Ott-type current meter and from the volume and fill time of our samples. The suspended-sediment data and associated velocity data are presented in tables.

INTRODUCTION

Suspended sediment was collected from the Amazon River and the lower reaches of some of its tributaries during the high-water seasons of 1976 and 1977. All the samples were collected during two cruises of Research Vessel Alpha Helix. Between June 10 and July 8, 1976, Alpha Helix proceeded upriver from Belém, near the mouth of the Amazon in Brazil, to Iquitos in Peru. Between May 18 and June 6, 1977, the ship traversed the same reach of the Amazon mainstem in the downstream direction.

This report describes our sediment-sampling equipment, procedures for measuring water velocity, shipboard procedures for separating suspended sediment from river water and preserving the samples, and laboratory procedures for determining the concentration and particle sizes of suspended sediment. The data on suspended sediment, with corresponding measurements of the velocity of the water, are listed in tables 1-6. Data on the bed material collected from the Amazon River during the same cruises are reported by Nordin and others (1977, 1979). Interpretive reports of these data are being published elsewhere.

ACKNOWLEDGMENTS

A number of people helped us obtain these data. J. P. Beverage, D. W. Hubbell, G. A. Lutz, J. V. Skinner, and H. H. Stevens of the Geological Survey designed and built the sampling equipment. We thank the crew of R. V. Alpha Helix, especially Captains Geoffrey Clark and A. H. Phinney, and Mates A. H. Huff, A. Pelz, and R. Shaw for their support and cooperation in confined and unfamiliar waters. Alpha Helix is operated by Scripps Institution of Oceanography and funded by the National Science Foundation. The crews of Hidrologia S. A. and Companhia de Pesquisa de Recursos Minerais (CPRM) tracked the ship by theodolite at Santo Antônio do Içá, Manacapuru, and Óbidos. We thank Chief Scientist J. M. Edmond and Barry Grant (Massachusetts Institute of Technology), Cdr. M. Perez (Marinha do Brasil), and Drs. P. M. B. Landim and N. J. Bósio (Universidade Estadual Paulista, Rio Claro) for their invaluable assistance during the river operations; and we thank Flávio M. Costa Rodrigues of Hidrologia S. A., Nelson da Franca Ribeiro dos Anjos of ELETROBRÁS, Marcello Bezerra and Sylvio Cristino da Conceição of CPRM, and Stelio da Silva Elleres de Sousa of Departamento Nacional de Águas e Energia Elétrica (DNAEE) for their unstinting support, courtesy, and hospitality.

The U.S. Geological Survey participation is a contribution to the International Hydrologic Program of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) under the guidance of the U.S. National Committee on Scientific Hydrology, Joseph S. Cragwall, Jr., Chief Hydrologist, U.S. Geological Survey, Chairman.

SAMPLING LOCATIONS

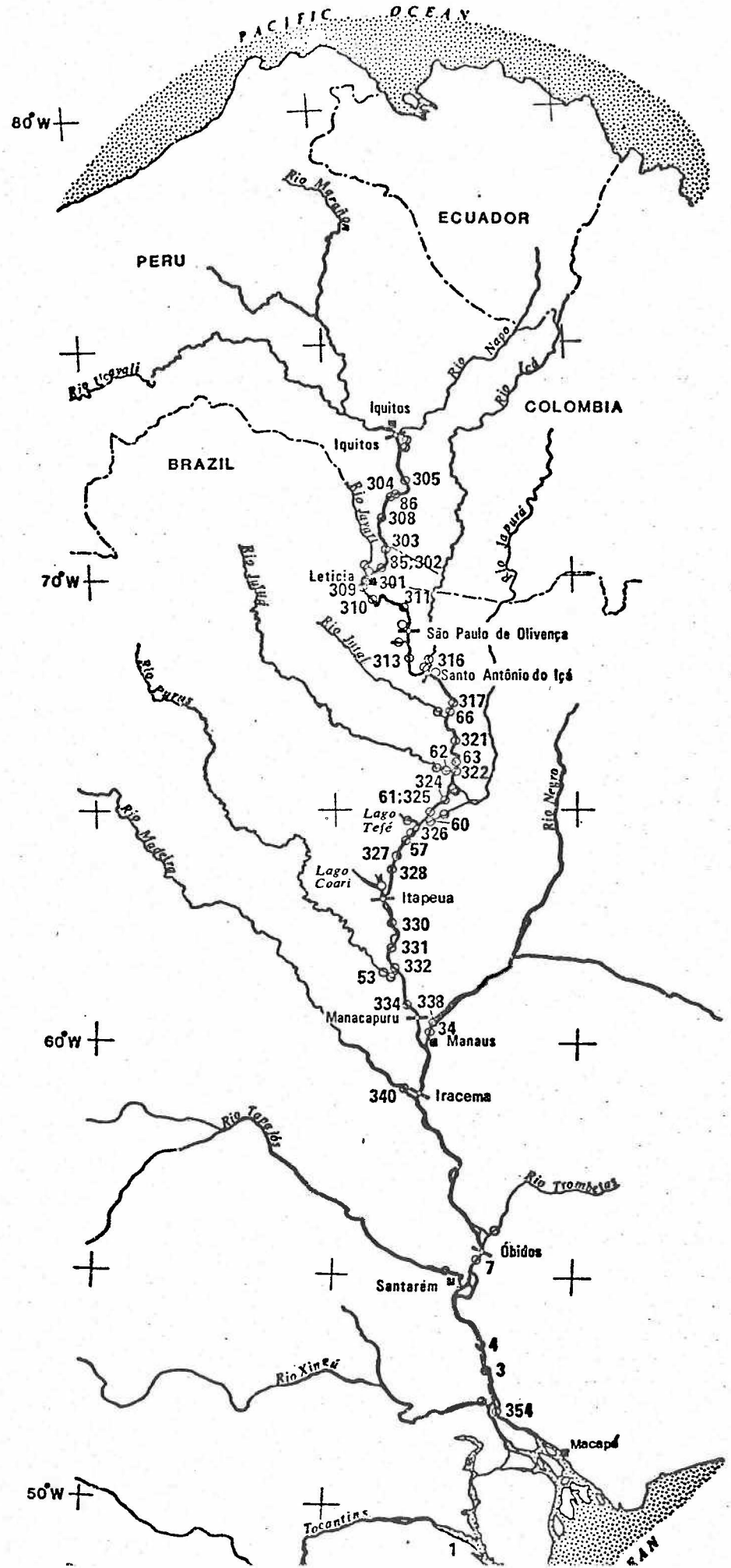
The locations where samples were collected from the Amazon River and its tributaries are shown in figure 1. The station numbers given to most of the sampling localities were also used by other investigators on the cruises. Some of the sampling localities on the tributaries are not numbered; they are identified in the tables by the name of the tributary. Other unnumbered samples were taken at gaging sections where streamflows are measured at regular intervals (usually monthly) by Hidrologia S. A. and CPRM, for Centrais Elétricas Brasileiras S. A. (ELETROBRÁS), and for the Divisão de Concessão de Recursos Hídricos of DNAEE. These principal measuring sections are:

Section	Location	Longitude (W) at Middle of section
São Paulo de Olivença	6 km below São Paulo 757 km below Iquitos	69° 00' (Chart P4 112 B)
Santo Antônio do Içá	9 km below Santo Antônio 909 km below Iquitos	68° 00' (Chart P4 112 A)
Itapeúa	12 km below Coari 1,745 km below Iquitos	63° 03' (Chart P4 108 B)
Manacapuru	6 km below Manacapuru 2,086 km below Iquitos	60° 34' (Chart P4 107 A)
Óbidos	2 km below Óbidos 2,827 km below Iquitos	55° 30.5' (Chart P4 104 A)

In addition, samples were collected at two other principal sections on the Amazon River (one in Peru, one in Brazil) where streamflow is not measured regularly:

Iquitos	25 km below Iquitos	73° 14.5' (Chart P4 116 A)
Iracema	7 km above mouth of Rio Madeira 2,315 km below Iquitos	58°49' (Chart P4 106 A)

When reporting a location on the Amazon in degrees and minutes of latitude and longitude, reference must be made to the map or chart from which the coordinates were taken. Different series of maps and charts (and even adjacent charts in the same series) often disagree by several kilometers on the latitudes and longitudes of specific localities such as towns.


PACIFIC OCEAN
80°W
Rio Marañon
ECUADOR
PERU
Rio Ucayali
Rio Napo
Rio Içá
COLOMBIA
Iquitos
Iquitos
BRAZIL
304
305
86
308
303
85;302
Rio Javari
Rio Jutaí
Rio Içá-Putumayo
70°W
Leticia
309
301
310
311
Rio Juruá
São Paulo de Olivença
313
316
Santo Antônio do Içá
Rio Purus
317
66
321
62
63
322
324
61;325
Lago Tefé
326
60
Rio Negro
Rio Madeira
327
57
Lago Coari
328
Itapeua
330
331
332
53
334
338
Manacapuru
34
Manaus
60°W
340
Iracema
Rio Tapajós
Rio Trombetas
Óbidos
7
Santarém
4
3
Rio Xingú
354
Macapá
50°W
Tocantins
1

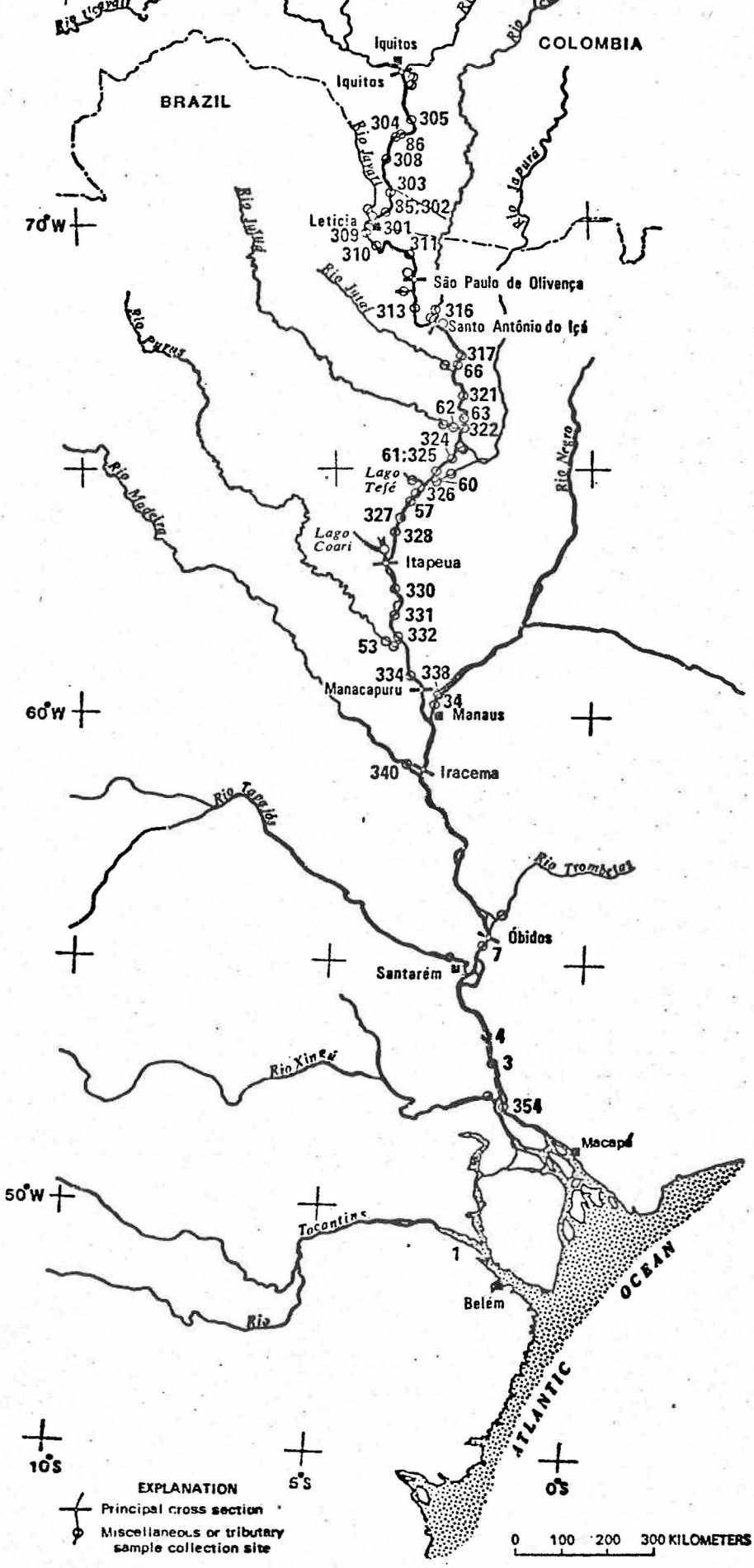


Figure 1.--Map of Amazon River mainstem showing locations where suspended sediment was sampled in 1976 and 1977.

The charts referred to in the series P4 101 A, and so forth, are the 1-to-100,000-scale piloting charts of the river, published by the Hydrography and Navigation office (Diretoria de Hidrografia e Navegação) of the Brazilian Navy under the name of Cartas de Practicagem da Flotilha do Amazonas--Marinha do Brasil. These charts cover the river from Macapá (near the mouth) to Iquitos, which is the part of the river that is generally navigated by ocean-going ships. The thalweg distances below Iquitos listed in some of the tables were scaled off these charts with a pair of dividers.

The maps referred to in the series SA-18, SA-19, and so forth, are parts of the 1-to-1,000,000-scale map of the world (1301 series), which are available from the U.S. Defense Mapping Agency.

Because the Amazon is an international river, the names applied to parts of its mainstem are not universally agreed upon. Below the confluence of Rios Marañon and Ucayali, the Peruvians and Colombians call the mainstem "Rio Amazonas". The Brazilians, however, call the river "Maranõn" upstream of the Peru-Brazil border, "Solimões" between the border and the mouth of Rio Negro, and "Amazônas" only below the Negro-Solimões confluence. In this report, we call the river below Iquitos (Marañon-Solimões-Amazônas) the "Amazon River mainstem."

SAMPLING EQUIPMENT

Alpha Helix is an oceanographic research vessel. It is 40.6 meters (m) long, which is a sufficient size to comfortably accommodate our operations. Of particular use to us was the hydraulically-operated A-frame on the stern from which we operated our heavy sampling equipment.

Two special arrays of equipment were used to sample the suspended sediment and measure the velocity in the Amazon. The great depths (to 75 m) and high velocities (to 3 m per second) at the sampling sites required modifications to the standard types of sampling equipment that are used in the much shallower rivers of the United States.

Point sampler

In 1976 and 1977, we used the specially designed point-sampling array shown in figure 2. The upper part of the array is a modified version of the US P-63 point sampler (Guy and Norman, 1970, p. 8). This sampler weighs about 90 kilograms (kg). It has an intake nozzle that is designed to admit water and suspended sediment at the velocity at which they are moving in the river, and it has a remotely-operated valve that opens and closes the intake after the sampler has been lowered to the desired depth in the river. The US P-63 sampler was modified for use in the Amazon by enlarging the inner cavity to accommodate a 1.5-liter (L) bottle (usual capacity is 1 quart). A separate 1.5-L bottle is placed into the cavity for each sample.

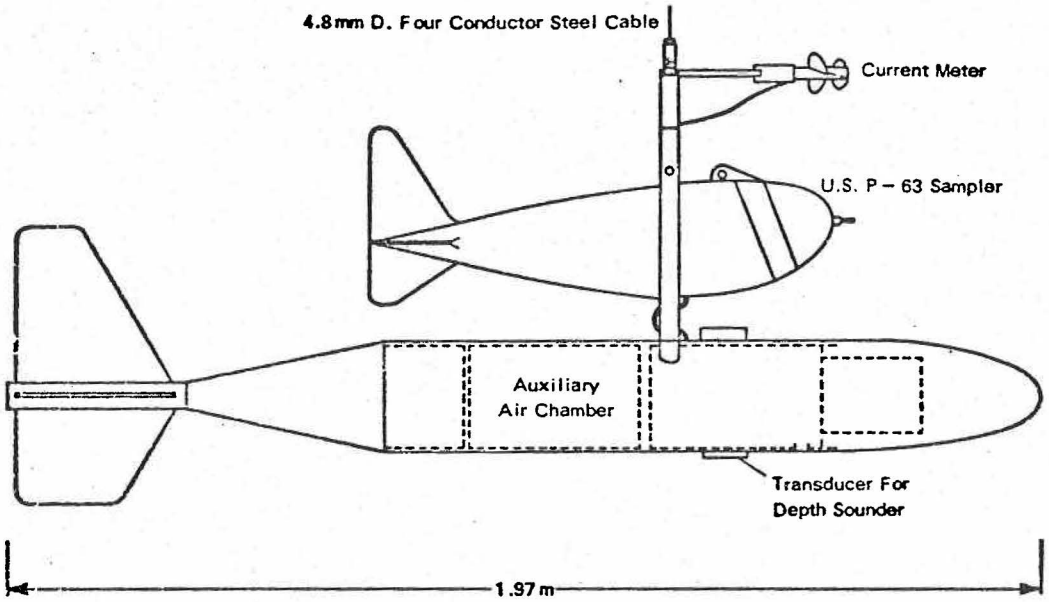


Figure 2.--Point-sampling equipment. Upper part is a modified US P-63 point sampler. Lower chamber provides extra air capacity and weight.

Hanging below the P-63 sampler is a cylindrical air chamber which is open to the river through small holes drilled in the bottom, and which is connected to the sampler by a plastic hose. This provides extra air capacity so the air pressure behind the sampler nozzle can remain in equilibrium with the ambient water pressure as the sampler is lowered into the river. Fore and aft of the lower cylinder are a nose and tail of solid metal that provide stability and extra weight.

A depth transducer is mounted in the small vertical well about a third of the distance back from the nose of the lower fish. This was connected through the cable to a recording chart in the ship's laboratory, where we hoped to get a clear indication of the distance between the sampler and the river bottom. The actual depth of the sampler was sometimes difficult to measure from the river surface in fast deep parts of the river where visible wire angles were nearly 40°. Although the sounder did indicate the distances of the array off the river bottom in some instances, this system proved to be unreliable.

We used the point sampler to sample at single fixed depths in the river, and, at some of the upriver sections in 1976, we used it (with the intake valve left open) as a depth-integrating sampler. The 1-m point samples listed for São Paulo de Olivença and Santo Antônio do Içá in 1977 were taken with the large-volume bag sampler described below; all other point samples were taken with the modified P-63 point sampler.

Depth-integrating sampler

In 1977, all depth-integrated samples were collected with a depth-integrating sampler that had been previously developed to obtain large-volume samples in the Columbia River estuary (H. H. Stevens, Jr. and G. A. Lutz, written communication, 1969). This sampler consists of a streamlined nose cone, into which standard sampling nozzles are fitted, and a rack holding a 2-gallon plastic jug (fig. 3). The jug is bored with a number of large holes to allow for equal pressures inside and out. Into the neck of the jug is placed a collapsed plastic bag from which all air has been removed.

As the sampler enters the river, the force of the water flowing into the nozzle opens the plastic bag to accept the sample. The sampler is lowered to the bottom of the river and raised to the surface at a uniform vertical rate. Because the water flows into the nozzle at ambient velocity, the resulting sample is weighted for differences in velocity. In our operation, we changed jugs with each new sample and left the plastic bags inside the capped jugs until we were able to process the samples.

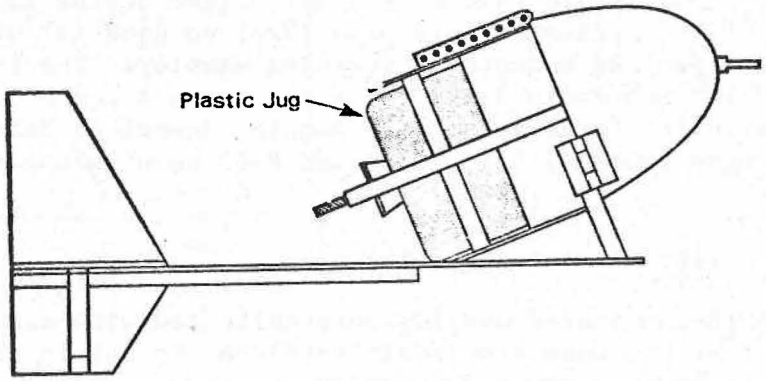


Figure 3.--Depth-integrating sampling equipment. Overall length, not including nozzle is 0.9 m. Large volume bag sampler is mounted in the sampling array in the position that was occupied by the P-63 sampler during point sampling.

With the depth-integrating bag sampler, we recovered samples as large as 6 L. The sampler is essentially trouble-free, because it has no moving parts or electrical circuitry, and it relies on the velocity of the river to impel water into the sampler. Furthermore, as with all depth-integrating samplers, the concentration of sediment in the sample, because it is already weighted for differences in velocity at different depths in the river, can be multiplied directly by the corresponding component of discharge to compute sediment load.

Bucket samples

At many stations, we sampled the suspended sediment in waters at the surface of the river by lowering a bucket over the side of the ship. At most of the stations we sampled in 1976, the bucket was dipped into the river, and a representative 1.5 L were poured into a plastic bottle and stored until it could be processed. At most of the stations we sampled in 1977, the bucket was dipped twice in rapid succession. A 1.5-L fraction was taken from each bucket, and the two fractions were combined and treated as a single sample in the laboratory procedure that followed.

Dip samples

Samples from most of the tributaries were collected by dipping two 1.5-L bottles directly into the river from the side of a small boat. The contents of the two bottles were combined and treated as a single sample in the subsequent laboratory procedure.

Ship's intake

A few samples were taken in 1976 from the ship's "saltwater" line that pumped water into pipes from an intake located about 1 m below the water line. Samples were collected in two or three 1.5-L bottles at a time; contents of the bottles were combined and treated as single samples in subsequent laboratory procedures. The samples that were collected from the ship's intake are somewhat suspect because silt particles collected in parts of the piping system (and had to be cleaned out of a silt trap occasionally). The silt particles may have either settled out or been added to some samples.

SHIPBOARD PROCESSING OF SAMPLES

In 1976, all the samples were collected or retained in 1.5-L plastic bottles. The entire contents of each bottle were filtered, under about 1 atmosphere of pressure, through a preweighed membrane (Millipore[1]) filter having a nominal pore diameter of 0.45 micrometer (μm). The filters were then dried in a shipboard oven at about 50°C, and sealed into individual Petri dishes for transfer to the laboratory in Denver.

In 1977, we followed a more detailed procedure aboard ship. All samples were first passed through a 0.053-millimeter (mm) sieve. The sand and coarse silt particles retained on the sieve were washed into plastic vials for transfer to Denver. The portions of the samples that passed the sieve were then filtered through the 0.45-μm membrane filters and treated as before.

If the sample volume that passed the sieve was so large that it was likely to clog the membrane filter before all the water had passed through (this applied to some of the large-volume samples taken with the depth-integrating bag sampler), it was split down to manageable size with a USGS churn-type sample splitter. The churn splitter is designed so the sample can be agitated at an uninterrupted steady rate at the same time that splits are withdrawn. The distributions of particle sizes of suspended sediment in the splits are representative of those in the complete sample.

From a selected group of large-volume samples (those listed in table 4), we made splits for detailed size analyses of the silt and clay. These splits had already been screened through the 0.053-mm sieve, but were not filtered further aboard ship. They were stored in plastic bottles and shipped back to the United States for pipette analysis.

LABORATORY PROCESSING OF SAMPLES

Weighing of filters

The amounts of material retained on the membrane filters were weighed in our laboratory in Denver. The filters had been preweighed individually in the same laboratory before the cruise. The filters and their attached sediment were heated overnight in an oven at 110°C to remove adsorbed water, were allowed to cool to room temperature in a desiccator, and were weighed to the nearest 0.1 milligram (mg). To

[1]The use of the brand name in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.

correct for changes in the weight of the filters themselves, a blank filter was paired with every fifth filter. The paired filters were weighed separately at the beginning, then stacked and treated as a single filter through the filtering and drying process; and they were weighed separately again at the end.

Size analysis of sand

The particle-size distribution of the suspended material coarser than 0.053 mm was analyzed by wet sieving, in two different sequences of steps. In 1976, when whole samples (including sand) were retained on membrane filters, we dried and weighed the filters as described above, and then we scraped the filters thoroughly with a rubber policeman. The material scraped off the filters was sieved wet through a nest of sieves having openings of 0.25, 0.125, 0.063, and 0.053 mm. In 1977, when we made preliminary separations of the fraction coarser than 0.053 mm aboard ship, we dried and weighed these fractions in the laboratory and then sieved them wet through the same nest of sizes we used in 1976. Selected samples were analyzed both by wet sieving and by the visual-accumulation tube (Guy, 1969, p. 30-38); the results of these comparative analyses are listed in table 5.

Size analysis of silt and clay

The distributions of particle sizes finer than 0.053 mm were determined in only a few selected samples that we were able to ship back to the United States in bottles in 1977. These samples had been screened through a 0.053-mm sieve, and portions of each had been split off for filtering through membrane filters, but they were otherwise untreated or unchanged. After the bottles had arrived in Denver, we allowed them to sit undisturbed for a week, so essentially all sediment would settle out of suspension. We then siphoned off most of the supernatant water and transferred the sediment and remaining water into small containers. Some samples had to be combined with similar samples from adjacent stations (point samples from the same depths, depth-integrated samples from similar depth intervals) to obtain enough sediment for analysis. The pipette analyses were made in the USGS laboratory in Albuquerque, following the procedures described by Guy (1969).

MEASUREMENT OF VELOCITY

Current meter

Most of our velocity measurements were made with a current meter (of the type described by Smoot and Novak, 1969) mounted just above the sediment sampler and connected through the cable to a recording chart in the ship's laboratory. This meter recorded point velocities where we took point samples of sediment, and depth-integrated velocities where we took depth-integrated samples.

This type of current meter proved to be less than completely satisfactory for routine measurement of velocity in the river. Because small sediment particles could lodge in the meter and render it inaccurate, we were obliged to disassemble and clean the meter more frequently than convenience allowed. In the future, we would recommend using a less sensitive instrument for these operating conditions.

Sample-bottle fill volumes

At times when the current meter was not operating satisfactorily, we were able to measure the velocity of the water from the amount of water recovered in a sample. Because the sampler nozzles we used are calibrated for velocity, we could compute the mean velocity over the sampling period (that is, the length of time for which the sampler was open in the water) by dividing the sample volume by the product of the nozzle area and the sampling time. The nozzles for the bag sampler were calibrated in the laboratory and the field; the calibration curve is shown in figure 4.

Correction for ship drift

Velocity was measured while the crew of Alpha Helix held the ship as steady as possible, relative to a fixed position on the river bed, in the moving current of the river. At some of the principal measuring sections--Santo Antônio do Içá in 1976, Manacapuru and Óbidos in both 1976 and 1977--the position and drift of the ship were tracked by surveying crews who measured theodolite angles from either end of a baseline of known length on shore. These angles allowed us to correct our velocity readings for the periods (usually 2 minutes each) during which we measured. Because the velocity corrections related to ship movement were almost always less (and usually substantially less) than 10 percent of the water velocity, we were confident of the crew's ability to hold the ship steady in the current.

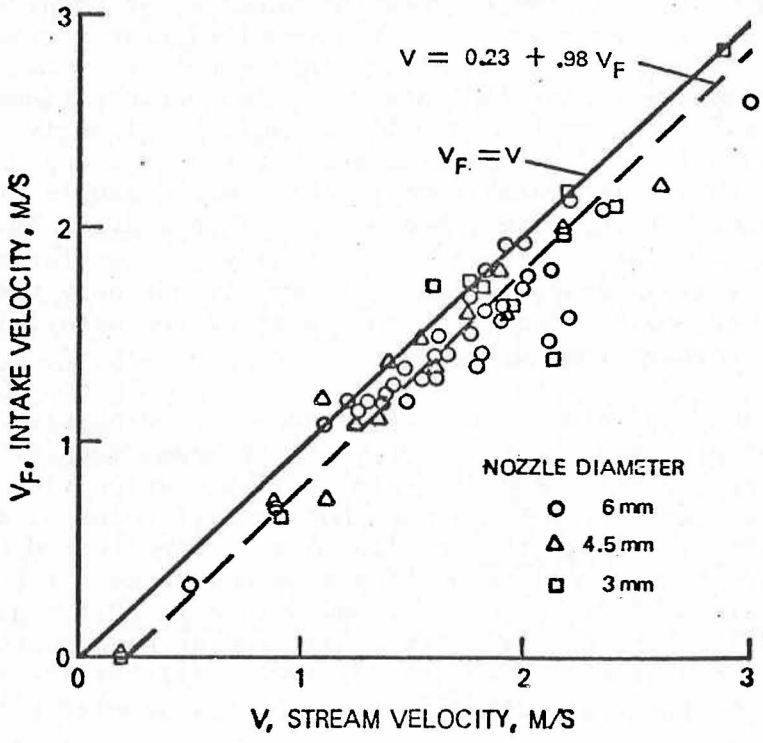


Figure 4.--Calibration of nozzle intake velocity against stream velocity for the bag sampler. Dashed line is least-squares regression line through all points.

RESULTS

Principal cross sections

Most of our samples, in both 1976 and 1977, were collected in the principal cross sections on the Amazon River mainstem between Iquitos and Óbidos. Data for these samples are listed in table 1.

Some of the headings and designations in table 1 require further explanation. The heading "cross-channel station" refers to the stationing used locally by the Brazilian groups (Hidrologia and CPRM) that measure the streamflow through these sections. In the "depth of sample" column, the odd depths listed for some of the depth-integrated samples taken in 1976 (0-10-8, 0-15-5, for example) represent samplings with the P-63 sampler where the intake had to be closed before the integration from the bottom of the sampled zone to the surface was complete, to avoid overfilling the sample bottle. This resulted from too slow a transit rate, and in those few cases listed in table 1, we were not able to resample because of time limitations. The concentrations in the sampled zone, for example, in 0-15-5, would be slightly higher than the concentration in 0-15-0. Point samples taken at a depth of 1 m off the stern of Alpha Helix probably represent a mixed sample of the upper several meters of the river, because the ship's draft is 3 m. The concentrations listed in each size category are cumulative: for example, the concentration "coarser than 0.063 mm" is not only the material between 0.063 and 0.125 mm, but the total of the material in all size categories coarser than 0.063 mm.

The last two columns of table 1 show the velocities associated with the samples and the types of velocity measurements. The designations "Meter," "Fill," and "Profile" indicate velocities obtained from current meter measurements, sample-bottle fill volumes, and plotted velocity profiles where the profile data were collected before the samples were taken. All velocities were corrected for ship drift at Santo Antônio do Içá, Manacapuru, and Óbidos in 1976. Also corrected for ship drift were the velocities measured at Manacapuru on May 27, 1977, (a.m. only) and at Óbidos on June 3, 1977. All "Fill" measurements were corrected for the hydraulic efficiency of the sampler nozzles (figure 4).

Some comments are necessary on the quality of the sediment data. The sediment samples were of uniformly good quality at Iquitos and Santo Antônio do Içá in both years, and at all the principal sections in 1977. In 1976, however, we had enough difficulty with the sampling equipment and procedures at São Paulo de Olivença, Manacapuru, and Óbidos to require that some of the data be discarded or adjusted. At São Paulo de Olivença in 1976, a partial blockage of the sampler intake coincided with an anomalously low recovery of suspended sand; only the minimum concentrations (that is, the amounts we actually recovered) of material coarser than 0.053 mm are reported in table 1. At Manacapuru, we had even more serious difficulties with our sampling procedure. Although we

collected about 40 point samples at Manacapuru in 1976, we had confidence in only the few that are reported in table 1. In 1977, by contrast, we made our most comprehensive collection of high-quality samples at Manacapuru. At Óbidos in 1976, we also had problems of undersampling the sand fraction, but we were able to make fairly reasonable corrections by comparing meter-measured velocities with the volumes of the recovered samples. The concentrations of sand sizes reported for Óbidos on June 15, 1976, in table 1 have all been adjusted to compensate for the sampling error; the concentrations of sediment finer than 0.053 mm needed no adjustment, and are reported as measured.

Miscellaneous stations on mainstem and tributaries

The samples of suspended sediment collected between the principal cross sections are listed in downstream order in table 2. Samples from the tributary rivers and lakes are listed in table 3. Included in this table are fairly complete measurements made in 1977 of the suspended sediment in one cross section each of Rio Negro and Rio Madeira.

Complete particle-size analyses

Table 4 contains the data from the samples of which we were able to make complete particle-size analyses. Sizes finer than 0.053 mm were analyzed by pipette; sizes coarser than 0.053 mm were analyzed by sieve. Where two or more samples had to be combined to provide enough sediment for the pipette analysis, the results of the sieve analyses of the sand fractions of the same samples were averaged and weighted for differences in concentration. Where the concentration of material finer than 0.053 mm determined during the pipette analysis disagreed significantly with the concentration determined from the filtering of a split of the same sample, the difference was noted in the "Remarks" column of table 4. In cases of disagreement, the concentration determined by filtering was assumed to be correct.

Table 5 contains the results of comparisons of two different methods of determining the size distribution of sands. The "sand" fractions referred to in the title and headings of the table are the fractions coarser than 0.053 mm that we separated in the ship's laboratory. When the sand sizes are expressed as percentages of the total sample, the two methods give results that agree closely with each other.

Miscellaneous velocity observations

Table 6 contains the data on measured velocities that were not already listed in table 1. Note in table 6 that the velocities are located vertically by their distance from the river bed rather than by their depth below the water surface. "Point" measurements were obtained

by holding the current meter in the flow and recording the velocity for 2 or more minutes. "Integrated" measurements were obtained from velocity profiles that were recorded by lowering the meter slowly to the river bed and back to the surface: the velocity reported at each selected depth is the mean of two measurements, one made as the meter was being lowered and the other as the meter was being raised. Corrections for ship drift were applied to velocities listed in table 6 for Santo Antônio do Içá and Manacapuru in 1976.

Miscellaneous temperature observations

Although the individual data are not tabulated in this report, we recorded the temperature of the water at the river surface at about 25 places in 1976 and about 40 places in 1977. All temperatures in the Amazon River mainstem in 1976 were within 1°, more or less, of 26°C; those in 1977 were within 1° of 27°C. Some higher temperatures (up to a maximum of 33°C) were recorded in the Rio Negro, Lago Tefé, and other tributaries that contained low concentrations of suspended sediment.

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Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections on Amazon River Mainstem*

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Iquitos, July 8, 1976												
240	-------	24	0	Bucket	174	165	9	5	1	----	----	-------
240	-------	24	0-10	Depth-Int.	251	202	49	38	18	3	1.82	Profile
240	-------	24	10	Point	320	268	52	32	5	0	1.76	Meter
240	-------	24	0-18	Depth-Int.	328	255	73	55	18	2	1.70	Profile
240	-------	24	20	Point	566	326	240	203	97	33	1.34	Meter
240	-------	24	23.5[a]	Point	812	386	426	375	201	38	.78	Meter
490	-------	23	0	Bucket	95	94	1	<1	---	-----	----	-------
490	-------	23	0-9	Depth-Int.	262	227	35	22	2	0	1.70	Profile
490	-------	23	0-10-8	Depth-Int.	356	276	80	58	19	<1	1.70	Profile
490	-------	23	0-23	Depth-Int.	404	310	94	68	20	2	1.62	Profile
730	-------	22	0	Bucket	142	133	9	7	5	1	----	-------
730	-------	22	0-9	Depth-Int.	218	191	27	17	7	2	2.12	Profile
730	-------	22	0-19	Depth-Int.	321	261	60	45	13	1	1.80	Profile
730	-------	22	21.5[a]	Point	592	296	296	267	175	21	.68	Meter
Iquitos, May 20, 1977												
160	-------	21	0	Bucket	115	111	4	2	---	-----	----	-------
160	-------	21	0-7-0	Depth-Int.	177	161	16	11	2	-----	1.76	Meter
160	-------	21	0-15-0	Depth-Int.	311	247[b]	64	43	6	1	1.98	Meter
160	-------	21	0-21-0	Depth-Int.	435	288[b]	147	115	36	2	1.94	Meter
400	-------	28	0	Bucket	100	99	1	---	---	-----	----	-------
400	-------	28	0-28-0	Depth-Int.[c]	362	234	128	112	67	14	2.35	Meter
400	-------	28	0-28-0	Depth-Int.[c]	359	244	115	98	54	9	1.84	Fill
600	-------	25	0	Bucket	146	140	6	2	---	-----	----	-------
600	-------	25	0-8-0	Depth-Int.	181	161	20	9	1	<1	2.20	Meter
600	-------	25	0-15-0	Depth-Int.	240	199[b]	41	31	13	2	1.92	Meter
550	-------	25	0-25-0	Depth-Int.	419	225[b]	194	179	122	31	1.84	Meter
830	-------	23	0	Bucket	137	132	5	2	---	-----	----	-------
830	-------	23	0-23-0	Depth-Int.	441	267	174	152	60	4	1.20	Meter
990	-------	22	0	Bucket	128	123	5	1	---	-----	----	-------
990	-------	22	0-7-0	Depth-Int.	238	202[b]	36	19	4	-----	2.00	Meter
990	-------	22	0-15-0	Depth-Int.	290	233[b]	57	42	10	2	1.85	Meter
990	-------	22	0-22-0	Depth-Int.	336	236[b]	100	84	34	2	1.66	Meter

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections on Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
São Paulo de Olivença, July 1, 1976												
240	1,200	32	0	Bucket	127	124	3	---	---	-----	----	-------
240	1,200	32	0-10-0	Depth-Int.	---	183	≥34	---	---	-----	1.54	Fill
240	1,200	32	15	Point	---	200	≥27	---	---	-----	1.82	Meter
240	1,200	32	20	Point	---	235	≥30	---	---	-----	1.85	Meter
240	1,200	32	25	Point	---	222	≥28	---	---	-----	1.70	Meter
240	1,200	32	30	Point	---	274	≥38	---	---	-----	1.21	Meter
700	740	36	0	Bucket	175	166	9	---	---	-----	----	-------
700	740	36	0-10-0	Depth-Int.	---	238	≥33	---	---	-----	2.18	Profile
700	740	36	0-20	Depth-Int.	---	241	≥33	---	---	-----	2.12	Profile
700	740	36	0-29	Depth-Int.	---	282	≥66	---	---	-----	2.38	Fill
700	740	36	0-33	Depth-Int.	---	284	≥68	---	---	-----	1.99	Fill
980	460	13	0	Bucket	195	185	10	---	---	-----	----	-------
980	460	13	0-10-0	Depth-Int.	---	237	≥55	---	---	-----	1.37	Fill
980	460	13	10	Point	---	246	≥31	---	---	-----	.88	Meter
980	460	13	12[a]	Point	---	241	≥51	---	---	-----	.78	Meter
São Paulo de Olivença, May 22, 1977												
70	1,330	25	0	Bucket	96	93	3	2	---	-----	----	-------
70	1,330	25	1	Point	142	132	10	6	1	<1	2.02	Fill
70	1,330	25	0-25-0	Depth-Int.	304	201	103	85	25	2	1.66	Fill
490	910	32	0	Bucket[d]	75	73[b]	2	2	---	-----	-----	-------
510	890	30	1	Point[d]	105	98[b]	7	5	2	<1	2.12	Meter
490	910	32	1	Point[d]	134	118[b]	16	10	3	<1	2.33	Fill
490	910	32	0-32-0	Depth-Int.	236	165[b]	71	60	29	6	2.19	Fill
810	590	27	0	Bucket	87	84[b]	3	2	---	-----	-----	-------
830	570	27	1	Point	168	142[b]	26	17	3	<1	1.97	Fill
810	590	27	0-27-0	Depth-Int.	312	176[b]	136	117	57	5	2.08	Fill
1,140	260	16	0	Bucket	129	116[b]	13	8	1	<1	----	-------
1,140	260	16	1	Point	157	124[b]	33	25	8	1	1.54	Fill
1,140	260	16	0-16-0	Depth-Int.	297	155[b]	142	132	104	29	1.81	Fill
1,350	50	16	0	Bucket	104	99[b]	9	5	1	<1	----	-------
1,350	50	16	1	Point	148	122[b]	26	19	3	<1	1.81	Fill
1,350	50	16	0-16-0	Depth-Int.	230	150[b]	80	65	26	4	1.45	Fill

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections on Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Santo Antônio do Içá, June 29, 1976												
330	330	26	0	Bucket	64	57	7	6	4	2[e/]	----	-------
310	310	26	0-10-1	Depth-Int.	116	90	26	19	6	2[e/]	2.60	Profile
300	300	26	0-10-3	Depth-Int.	144	120	24	18	4	0	2.60	Profile
320	320	26	0-17	Depth-Int.	181	129	52	41	14	2[e/]	2.58	Profile
330	330	26	24	Point	382	192	190	174	84	2	2.30	Meter
800	800	23	0	Bucket	122	113	9	6	3	1[e/]	----	-------
800	800	23	0-10-0	Depth-Int.	236	182	54	41	20	5	2.02	Profile
800	800	23	0-15-5	Depth-Int.	239	182	57	46	27	7	1.94	Profile
800	800	23	0-20	Depth-Int.	225	185	40	31	15	2	1.81	Profile
1,100	1,100	18	0	Bucket	156	144	12	8	4	2[e/]	----	-------
1,100	1,100	18	0-10-0	Depth-Int.	259	201	58	47	25	7	1.89	Profile
1,100	1,100	18	0-14	Depth-Int.	226	190	36	27	12	4	1.82	Profile
1,100	1,100	18	0-16-8	Depth-Int.	275	212	63	51	29	8	1.73	Profile
1,310	1,310	19	0	Bucket	167	157	10	6	1	0	----	-------
1,280	1,280	19	0-10-0	Depth-Int.	242	205	37	26	10	3[e/]	1.70	Profile
1,280	1,280	19	0-16-4	Depth-Int.	269	210	59	49	28	8	1.61	Profile
1,850	1,850	23.5	0	Bucket	86	82	4	4	2	----	----	-------
1,850	1,850	23.5	5	Point	193	170	23	16	5	<1	1.74	Meter
1,850	1,850	23.5	10	Point	199	170	29	22	9	2[e/]	1.73	Meter
1,850	1,850	23.5	15	Point	243	184	59	49	26	3	1.51	Meter
1,850	1,850	23.5	20	Point	381	234	147	129	82	9	1.24	Meter
1,850	1,850	23.5	22.5	Point	283	215	68	59	32	4	1.01	Meter
Santo Antônio do Içá, May 23, 1977												
150	150	27	0	Bucket	52	46[b/]	6	5	1	tr	----	-------
150	150	27	1	Point	70	58[b/]	12	9	2	<1	1.54	Meter
150	150	27	0-27-0	Depth-Int.	184	107[b/]	77	65	12	1	1.92	Meter
500	500	28	0	Bucket	53	51[b/]	2	1	--	---	----	-------
500	500	28	1	Point	101	89[b/]	12	9	2	<1	2.02	Meter
490	490	28	0-28-0	Depth-Int.	252	129[b/]	123	113	74	3	2.60	Meter
940	940	21	0	Bucket	132	121	11	7	tr	tr	----	-------
960	960	21	1	Point	170	140	30	22	6	<1	1.40	Meter
960	960	21	0-21-0	Depth-Int.	263	163	100	91	62	15	1.64	Meter

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections on Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Santo Antônio do Içá, May 23, 1977--Continued												
1,370	1,370	21	0	Bucket	90	87[b/]	3	2	1	---	----	-------
1,360	1,360	21	1	Point	185	153[b/]	32	25	8	1	1.81	Meter
1,370	1,370	21	0-21-0	Depth-Int.	231	142[b/]	89	79	51	7	2.00	Meter
1,700	1,700	24	0	Bucket	53	53[b/]	tr	---	--	---	----	-------
1,700	1,700	24	1	Point	90	82[b/]	8	5	1	0	2.01	Meter
1,700	1,700	24	0-24-0	Depth-Int.	285	167[b/]	118	103	45	2	1.76	Meter
Itapeúa, May 26, 1977												
280	720	52	0	Bucket	52	50	2	1	--	---	----	-------
280	720	52	0-52-0	Depth-Int.	195	131	64	53	17	2	1.95	Meter
500	500	60	0	Bucket	70	62	8	6	1	---	----	-------
500	500	60	0-60-0	Depth-Int.	129	103	26	20	4	<1	2.89	Meter
760	240	75	0	Bucket	51	49	2	1	--	---	----	------
760	240	75	0-75-0	Depth-Int.	144	104	40	33	13	8	2.42	Meter
Manacapuru, June 22, 1976												
-500	-2,800	24	1	Ship's Intake	28	26	2	1	<1	---	----	-------
690	2,640	28	10	Point	53	38	15	11	4	---	1.39	Meter
1,260	2,070	36	10	Point	66	45	21	18	8	---	2.10	Meter
-1,500	-1,800	51	1	Ship's Intake	35	31	4	3	<1	---	----	-------
1,700	1,630	39	10	Point	132	90	42	34	6	1	2.10	Meter
2,150	1,180	32	10	Point	132	55	45	36	7	1[e/]	2.30	Meter
2,170	1,160	32	20	Point	173	101	72	58	13	1[e/]	1.65	Meter
2,170	1,160	32	25	Point	178	108	70	56	13	1[e/]	1.50	Meter
2,170	1,160	32	29	Point	260	123	137	119	39	3	1.40	Meter
2,570	760	35	10	Point	81	46	35	31	15	1	1.43	Meter
-2,600	-700	38	1	Ship's Intake	30	28	2	1	<1	---	----	------

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections on Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Manacapuru, May 27, 1977 (a.m.)												
100	3,230	28	1	Point	38	34	4	4	3	0	1.35	Meter
110	3,220	28	10	Point	70	60	10	8	3	3	1.20	Meter
120	3,210	28	20	Point	139	101	38	29	9	<1	.68	Meter
110	3,220	28	25	Point	178	111	67	57	25	<1	.43	Meter
780	2,550	26	1	Point	112	93	19	16	5	<1	.99	Fill
800	2,530	26	10	Point	112	94	18	14	3	<1	1.37	Fill
800	2,530	26	20	Point	167	114	53	46	21	3	1.03	Fill
790	2,540	26	25.5[a]	Point	384	116	268	258	221	71	.79	Fill
1,240	2,090	34	1	Point	101	83	18	14	3	<1	2.20	Meter
1,240	2,090	34	10	Point	131	96	35	30	11	1	1.99	Meter
1,230	2,100	34	20	Point	180	104	76	70	43	8	1.82	Meter
1,230	2,100	34	30	Point	265	119	146	138	105	19	1.57	Meter
1,230	2,100	34	33.5[a]	Point	822	116	706	691	643	202	1.04	Meter
1,570	1,760	44	1	Point	167	125	42	33	8	3	1.52	Fill
1,560	1,770	44	10	Point	206	144	62	51	15	4	1.58	Fill
1,560	1,770	44	20	Point	199	133	66	54	17	3	1.34	Meter
1,560	1,770	44	29	Point	235	150	85	72	25	3	1.27	Meter
1,560	1,770	44	38	Point	280	163	117	103	47	11	.97	Meter
1,560	1,770	44	43.5[a]	Point	278	132	146	133	73	19	.59	Fill
1,950	1,380	30	1	Point	230	122	108	100	79	17	2.22	Meter
1,920	1,410	30	10	Point	261	182	79	64	25	2	2.09	Meter
1,870	1,460	30	20	Point	306	201	105	88	39	6	1.80	Meter
1,860	1,470	30	25	Point	368	215	153	134	71	12	1.63	Meter
1,880	1,450	30	29.5[a]	Point	619	261	358	334	224	67	.73	Meter
2,460	870	35	1	Point	~60	50	~10[f]	---	----	---	1.32	Meter
2,500	830	35	10	Point	112	89	23	18	4	1	1.24	Meter
2,530	800	35	20	Point	148	105	43	35	11	2	1.17	Meter
2,510	820	35	30	Point	241	118	123	111	55	7	.79	Meter
2,490	840	35	34.5[a]	Point	294	122	172	159	108	23	.55	Meter
2,960	370	23	1	Point	101	64	37	34	19	5	1.43	Meter
2,970	360	23	10	Point	145	109	36	29	6	<1	1.30	Meter
2,940	390	23	20	Point	316	179	137	114	44	6	.77	Meter
2,930	400	23	22.5[a]	Point	636	200	436	406	283	41	.47	Meter

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections On Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Manacapuru, May 27, 1977 (p.m.)												
190	3,140	27	0	Bucket	34	33	1	---	---	---	----	-------
190	3,140	27	0-27-0	Depth-Int.	95	75	20	16	6	1	1.08	Meter
890	2,440	25	0	Bucket	56	53	3	2	---	---	----	------
890	2,440	25	0-25-0	Depth-Int.	121	88	33	28	17	4	1.12	Meter
1,300	2,030	32	0	Bucket	70	64	6	4	---	---	----	-------
1,300	2,030	32	0-32-0	Depth-Int.	243	158	85	76	54	11	1.62	Meter
1,630	1,700	44	0	Bucket	126	111	15	11	3	1	----	-------
1,630	1,700	44	0-44-0	Depth-Int.	213	141	72	62	23	4	1.42	Meter
2,000	1,330	32	0	Bucket	247	181	66	55	18	4	----	------
2,000	1,330	32	0-32-0	Depth-Int.	270	170	100	87	40	5	2.20	Meter
2,520	810	34	0	Bucket	32	31	1	---	----	---	----	-------
2,520	810	34	0-34-0	Depth-Int.	132	93	39	32	13	2	1.25	Meter
2,970	360	23	0	Bucket	38	37	1	---	----	---	----	-------
2,970	360	23	0-23-0	Depth-Int.	194	125	69	58	20	2	1.10	Meter
Iracema, June 1, 1977												
600	-----	25	0	Bucket	43	40	3	2	----	---	----	-------
600	-----	25	0-25-0	Depth-Int.	91	71	20	17	7	2	1.47	Meter
1,300	-----	50	0	Bucket	28	28	<1	---	----	---	----	-------
1,300	-----	50	0-50-0	Depth-Int.	165	115	50	43	20	5	1.24	Meter
1,800	-----	60	0	Bucket	39	38	1	---	----	---	----	-------
1,800	-----	60	0-60-0	Depth-Int.	196	150	46	38	11	1	1.60	Meter
Óbidos, June 15, 1976												
440	1,910	65	10	Point	76	51	25	18	6	1	1.61	Meter
460	1,890	66	30	Point	90	56	34	25	7	2	1.79	Meter
450	1,900	63	50	Point	123	61	62	47	22	5	1.69	Meter
480	1,870	67	55	Point	126	69	57	43	18	4[e/]	1.80	Meter
670	1,680	63	10	Point	82	66	16	11	3	---	2.54	Meter
680	1,670	64	30	Point	113	81	32	26	9	---	3.00	Meter
720	1,630	65	44	Point[c/]	190	100	90	69	33	2	2.14	Meter
740	1,610	65	44	Point[c/]	217	106	111	89	45	5	2.30	Meter

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections On Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Óbidos, June 15, 1976--Continued												
890	1,460	67	10	Point	96	70	26	20	4	---	2.19	Meter
910	1,440	66	30	Point	204	102	102	78	25	3	2.13	Meter
870	1,480	65	44	Point	152	98	54	39	15	---	2.02	Meter
890	1,460	65	53	Point	167	110	57	42	7	2	1.99	Meter
900	1,450	65	58	Point	116	71	45	32	8	4	1.93	Meter
1,130	1,220	67	10	Point	80	61	19	13	2	---	1.78	Meter
1,130	1,220	66	11	Point	76	53	23	17	4	---	2.83	Meter
1,100	1,250	65	25	Point	99	71	28	22	5	---	2.79	Meter
1,090	1,260	62	42	Point[d/]	145	76	69	52	13	---	2.20	Meter
1,190	1,160	67	52	Point[d/]	231	100	131	95	25	3	2.95	Meter
1,170	1,180	66	52	Point[d/]	229	121	108	91	40	1[e/]	2.21	Meter
1,310	1,040	63	30	Point	189	115	74	55	14	---	1.68	Meter
1,230	1,120	64	39	Point	149	103	46	32	8	1	2.18	Meter
1,240	1,110	64	62	Point	248	87	161	145	72	5	.57	Meter
1,610	740	57	10	Point	110	79	31	24	3	---[e/]	2.26	Meter
1,580	770	57	25	Point	163	100	63	47	11	5[e/]	2.29	Meter
1,560	790	55	39	Point	226	121	105	82	22	3	2.33	Meter
1,530	820	54	48	Point	288	146	142	111	25	2	2.73	Meter
1,580	770	54	50	Point	308	130	178	129	25	2	2.88	Meter
1,760	590	63	10	Point	168	123	45	33	5	---[e/]	3.08	Meter
1,830	520	62	30	Point	230	155	75	54	6	1[e/]	2.62	Meter
1,790	560	64	38	Point	389	199	190	144	22	1	2.31	Meter
1,760	590	63	52	Point	503	253	250	197	33	3	2.04	Meter
1,780	570	65	59.5	Point	503	212	291	228	43	4	1.18	Meter
2,160	190	42	10	Point	221	153	68	51	9	1[e/]	1.98	Meter
2,170	180	42	20	Point	361	201	160	121	16	3[e/]	1.92	Meter
2,190	160	41	30	Point	331	193	138	104	15	3[e/]	1.72	Meter
2,130	220	42	34	Point	490	256	234	174	21	2	1.67	Meter
2,030	320	49	46	Point	292	182	110	76	8	2	1.38	Meter

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections On Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Óbidos, June 2, 1977												
90	2,260	45	0	Bucket	57	54	3	---	---	---	-----	------
90	2,260	45	0-45-0	Depth-Int.	122	105	17	13	2	1	.51	Meter
370	1,980	62	0	Bucket[d/]	70	67	3	---	---	---	-----	-------
440	1,910	64	0	Bucket[d/]	67	64	3	---	---	---	-----	-------
370	1,980	62	0-62-0	Depth-Int.[d/]	125	99[b/]	26	22	10	3	1.76	Meter
440	1,910	64	0-64-0	Depth-Int.[d/]	118	94[b/]	24	21	10	2	1.76	Meter
930	1,420	65	0	Bucket	53	52	1	---	---	---	-----	-------
930	1,420	65	0-65-0	Depth-Int.	159	128	31	27	13	6	1.81	Meter
1,200	1,150	65	0	Bucket[d/]	58	57	1	---	---	---	-----	-------
1,240	1,110	68	0	Bucket[d/]	56	53	3	---	---	---	-----	-------
1,200	1,150	65	0-65-0	Depth-Int.[d/]	196	139[b/]	57	49	16	2	2.14	Meter
1,240	1,110	68	0-68-0	Depth-Int.[d/]	169	125[b/]	44	39	11	1	1.88	Meter
1,610	740	63	0	Bucket	73	69	4	2	---	---	-----	-------
1,610	740	63	0-63-0	Depth-Int.	293	212	81	66	13	1	2.20	Meter
1,910	440	50	0	Bucket	60	59	1	---	---	---	-----	-------
1,910	440	50	0-50-0	Depth-Int.	433	306	127	104	14	<1	1.86	Meter
2,250	100	36	0	Bucket	80	76	4	2	---	---	-----	-------
2,250	100	36	0-36-0	Depth-Int.	333	258	75	58	5	<1	1.33	Meter
Óbidos, June 3, 1977												
240	2,110	51	1	Point	96	76	20	15	---	---	.55	Fill
260	2,090	52	30	Point	110	88	22	17	---	---	.52	Fill
290	2,060	55	50	Point	122	96	26	19	---	---	.47	Fill
510	1,840	62	1	Point	112	86	26	22	5	1	1.45	Fill
450	1,900	60	25	Point	218	133	85	73	14	2	1.64	Fill
410	1,940	59	49	Point	486	223	263	226	27	1	2.24	Fill
450	1,900	60	57	Point	905	363	542	474	64	7	1.35	Fill
470	1,880	60	59.5[a/]	Point	726	250	476	424	57	5	1.32	Fill
1,320	1,030	66	1	Point	81	74	7	4	---	---	2.10	Meter
1,210	1,140	65	24	Point	135	112	23	19	3	---	1.99	Meter
1,200	1,150	67	45	Point	188	144	44	37	7	1	2.00	Meter
1,210	1,140	66	55	Point	283	195	88	76	16	2	1.68	Meter
1,200	1,150	66	65.5[a/]	Point	803	365	438	396	83	5	1.27	Meter

Table 1.--*Concentration and Partial Particle-size Analysis of Suspended Sediment, and Velocity of Water, In Principal Cross Sections On Amazon River Mainstem*--Continued

Distance from left bank (m)	Cross channel station (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Velocity (m/s)	Type of velocity measurement
					Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm		
Óbidos, June 3, 1977--Continued												
1,960	390	51	1	Point	130	107	23	17	3	---	1.49	Fill
1,960	390	51	20	Point	221	173	48	39	7	3	2.02	Fill
1,940	410	52	39	Point[c/]	433	271	162	137	26	1	2.19	Fill
1,970	380	51	39	Point[c/]	614	375	239	203	32	1	1.67	Fill
1,970	380	51	43	Point	537	336	201	171	25	1	1.73	Fill
1,970	380	51	50.5[a/]	Point	1,053	501	552	499	105	3	1.12	Fill

[a/] Sampler resting on streambed.
[b/] See Table 4 for detailed size analysis of particles <0.053 mm.
[c/] Duplicate samples collected several minutes apart.
[d/] Duplicate samples collected several hours apart.
[e/] Fraction coarser than 0.25 mm mostly organic.
[f/] Weighing error of ±5 mg/L in fraction coarser than 0.053 mm.

Table 2.--*Concentration and Partial Particle-Size Analysis of Suspended Sediment at Miscellaneous Stations on Amazon River Mainstem*

Cruise station	Latitude (S)	Longitude (W)	Chart	Date (mo/d/yr)	Thalweg distance below Iquitos (km)	Width of river (m)	Sample distance from left bank (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)					
											Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm
305	3°38.8'	72°06.4'	P4115A	5/19/77	171	1,700	1,100	28	0	Bucket	123	117	6	3	1	--
305	3°38.8'	72°06.4'	P4115A	5/19/77	171	1,700	1,100	28	0-28-0	Depth-Int.[a]	389	267	122	106	45	9
305	3°38.8'	72°06.4'	P4115A	5/19/77	171	1,700	1,100	28	0-28-0	Depth-Int.[a]	366	254	112	95	35	5
305	3°38.8'	72°06.4'	P4115A	5/19/77	171	1,700	1,100	28	0-28-0	Depth-Int.[a]	422	269	153	133	66	14
304	3°51.1'	71°46.2'	P4115A	5/19/77	248	1,000	500	37	0	Bucket	96	94	2	1	tr	--
86	3°51.7'	71°43.7'	P4115A	7/7/76	253	1,100	600	30	0	Bucket[a]	132	---	---	---	--	--
86	3°51.7'	71°43.7'	P4115A	7/7/76	253	1,100	600	30	0	Bucket[a]	186	---	---	---	--	--
308	4°02.7'	71°16.3'	P4114B	5/21/77	322	1,500	1,100	37	0	Bucket	110	106	4	2	--	--
303	3°54.6'	70°34.5'	P4114A	5/18/77	411	1,500	700	30	0	Bucket	124	116	8	3	<1	<1
302	3°59.2'	70°12.9'	P4114A	5/18/77	465	1,800	400	21	0	Bucket	129	119	10	4	1	<1
85	3°59.4'	70°13.2'	P4114A	7/6/76	465	1,900	1,000	20	0	Bucket	162	---	---	---	--	--
301	4°12.2'	69°57.0'	P4114A	5/18/77	507	~2,000	150	~20	10	Point	132	120	12	7	2	--
301	4°12.2'	69°57.0'	P4114A	5/18/77	507	~2,000	150	~20	15	Point	307	228	79	36	6	2
309	4°28.0'	70°03.2'	P4113B	5/21/77	518	1,800	900	20-23	0	Bucket	185	165	20	12	2	1
310	4°19.4'	69°30.5'	P4113B	5/21/77	593	1,600	600	25	0	Bucket	248	192	56	43	12	1
311	3°46.2'	69°27.0'	P4113A	5/21/77	691	1,300	800	28-32	0	Bucket	68	67	1	---	--	--
313	3°27.6'	68°26.5'	P4112B	5/22/77	825	1,600	800	18-22	0	Bucket	200	169	31	21	3	<1
317	2°40.2'	67°23.2'	P4111B	5/23/77	1,010	2,100	1,000	32	0	Bucket	59	58	1	---	--	--
66	2°44.7'	67°10.4'	P4111B	6/28/76	1,043	1,200	800	30	0	Bucket	124	---	---	---	--	--
66	2°44.7'	67°10.4'	P4111B	6/28/76	1,043	1,200	800	30	1	Ship's intake	178	---	---	---	--	--
321	2°29.7'	66°28.4'	P4111A	5/24/77	1,168	1,800	500	~30	0	Bucket	95	87	8	5	<1	--
63	2°24.5'	65°52.7'	P4110B	6/27/76	1,266	2,000	500	30	0	Bucket[a]	140	---	---	---	--	--
63	2°24.5'	65°52.7'	P4110B	6/27/76	1,266	2,000	500	28	0	Bucket[a]	174	---	---	---	--	--
63	2°24.8'	65°52.7'	P4110B	6/27/76	1,266	2,000	1,000	32	0	Bucket	125	---	---	---	--	--
63	2°24.8'	65°52.7'	P4110B	6/27/76	1,266	2,000	1,000	32	15	Point	271	---	---	---	--	--
63	2°25.1'	65°52.8'	P4110B	6/27/76	1,266	2,000	1,500	30	0	Bucket[a]	97	---	---	---	--	--
63	2°25.1'	65°52.8'	P4110B	6/27/76	1,266	2,000	1,500	30	0	Bucket[a]	123	---	---	---	--	--
63	2°25.1'	65°52.8'	P4110B	6/27/76	1,266	2,000	1,500	31	0-20	Depth-Int.	253	---	---	---	--	--

Table 2.--*Concentration and Partial Particle-Size Analysis of Suspended Sediment at Miscellaneous Stations on Amazon River Mainstem*--Continued

Cruise station	Latitude (S)	Longitude (W)	Chart	Date (mo/d/yr)	Thalweg distance below Iquitos (km)	Width of river (m)	Sample distance from left bank (m)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)					
											Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm
322	2°30.5'	65°47.3'	P4110B	5/24/77	1,280	2,000	1,100	25	0	Bucket	100	93	7	4	tr	--
324	2°33.0'	65°22.0'	P4110B	5/24/77	1,371	1,900	1,500	30	0	Bucket	75	70	5	3	<1	--
325	3°05.1'	64°56.1'	P4110A	5/25/77	1,472	1,700	500	25	0	Bucket	101	91	10	6	1	tr
61	3°05.5'	64°55.6'	P4110A	6/26/76	1,473	1,600	900	30	1	Ship's intake	127	---	---	---	--	--
326	3°26.9'	64°27.4'	P4109B	5/25/77	1,546	3,100	1,500	28	0	Bucket	41	40	1	---	--	--
57	3°31.1'	64°25.2'	P4109B	6/25/76	1,555	2,900	2,300	23	0-10	Depth-Int.	124	---	---	---	--	--
327	3°48.8'	63°56.4'	P4109A	5/25/77	1,621	1,600	900	40	0	Bucket	38	37	1	---	--	--
328	3°54.5'	63°23.2'	P4109A	5/25/77	1,692	1,900	1,000	34-38	0	Bucket	38	37	1	---	--	--
330	3°51.6'	62°27.8'	P4108B	5/26/77	1,819	4,000	3,300	27	0	Bucket	108	95	13	9	<1	tr
331	3°55.3'	61°57.0'	P4108A	5/26/77	1,895	3,700	900	32	0	Bucket	68	64	4	3	1	--
332	3°41.0'	61°29.4'	P4107B	5/26/77	1,964	1,500	1,100	36-40	0	Bucket	43	41	2	1	--	--
334	3°31.7'	60°47.9'	P4107B	5/26/77	2,048	2,600	1.400	40	0	Bucket	52	47	5	4	<1	--
7	2°03'	55°23'	P4104A	6/13/76	2,845	4,100	2,900	40	5	Point	100	---	---	---	--	--
7	2°03'	55°23'	P4104A	6/13/76	2,845	4,100	2,900	40	15	Point	123	---	---	---	--	--
4	1°51.7'	53°31.9'	P4103A	6/12/76	3,117	8,500	5,000	34	20	Point	145	---	---	---	--	--
3	1°38.5'	52°52.5'	P4102B	6/12/76	3,202	2,300	900	26	12	Point	212	---	---	---	--	--
354	1°25.6'	52°02.0'	P4102A	6/5/77	3,300	3,700	1,100	32-34	0	Bucket	70	68	2	---	--	--
354	1°26.1'	52°01.9'	P4102A	6/5/77	3,300	3,700	2,000	47-50	0	Bucket	65	64	1	---	--	--
354	1°26.6'	52°01.8'	P4102A	6/5/77	3,300	3,700	2,900	43-45	0	Bucket	68	67	1	---	--	--

[a] Duplicate (or triplicate) samples taken a few minutes apart.

Table 3.--*Concentration and Partial Particle-Size Analysis of Suspended Sediment in Rivers and Lakes Tributary to Amazon River*

Tributary	Cruise station	Latitude (S)	Longitude (W)	Chart or map	Date (mo/d/yr)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Remarks
									Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm	
Rio Napo------	---	3°19'	72°39'	SA18	7/8/76	7-8	0	Dip	120	---	---	---	---	--	15 km above mouth.
Rio Napo------	---	3°16'	72°39'	SA18	5/20/77	22-23	0	Dip	208	205	3	---	---	--	20 km above mouth.
Rio Javarí----	---	4°14'	70°05'	SB19	5/17/77	-----	0	Dip	25	24	1	<1	0	--	15 km above mouth.
Lago Canatiãn	---	3°29'	68°49'	SA19	5/22/77	-----	0	Dip	6	6	tr	---	---	--	Lake behind town of São Paulo de Olivença; discharging water into Amazon.
Rio Jandiatuba	---	3°40'	68°55'[a]	P4112B	5/22/77	14	0	Dip	38	38	tr	---	---	--	10 km above mouth.
Rio Içá-------	---	3°02'	68°05'	SA19	6/30/76	6-7	0	Dip	9	---	---	---	---	--	20 km above mouth.
Rio Içá-------	316	3°00'	68°12'	SA19	5/23/77	28	0	Bucket	13	12	1	<1	---	--	40 km above mouth.
Rio Içá-------	316	3°00'	68°12'	SA19	5/23/77	28	0-28-0	Depth-Int.	38	20	18	16	11	2	
Lago Tonantins	---	2°47'	67°43'	SA19	5/23/77	-----	0	Dip	107	94	13	10	1	tr	Amazon flowing into lak
Rio Jutaí-----	---	2°49'	67°07'	SA19	5/24/77	14	0	Dip	7	7	tr	---	---	--	30 km above mouth.
Rio Juruá-----	62	2°32.0'	65°48.2'	P4110B	6/27/76	20	1	Ship's intake	36	---	---	---	---	--	3 km above mouth.
Rio Juruá-----	---	2°43'	65°49'	SA20	5/24/77	24	0	Dip	50	47	3	2	---	--	20 km above mouth.
Rio Japurá----	60	3°09.1'	64°44.9'	P4110A	6/26/76	32	0-15	Depth-int.	50	---	---	---	---	--	15 km above mouth.
Rio Japurá----	---	2°58.8'	64°47.3'	P4110A	5/25/77	21	0	Dip	44	38	6	4	<1	--	40 km above mouth.
Lago Tefé-----	---	3°30'	64°46'	SA20	5/25/77	11	0	Dip	6	6	tr	---	---	--	Lake discharging water into Amazon.
Lago Coari----	---	4°01.5'	63°17'	P4109A	5/26/77	-----	0	Dip	7	7	tr	---	---	--	Lake discharging water into Amazon.
Rio Purus-----	53	3°51.1'	61°23.0'	P4107B	6/23/76	45	1	Ship's intake	18	---	---	---	---	--	15 km above mouth.
Rio Purus-----	---	3°57'	61°27'	SA20	5/26/77	---	0	Dip	23	22	1	---	---	--	20 km above mouth.
Rio Negro-----	34	3°06.8'	60°05.4'	P4106B	6/21/76	25	1	Ship's intake	5	---	---	---	---	--	
Rio Negro-----	34	3°06.8'	60°05.4'	P4106B	6/21/76	25	20	Point	9	---	---	---	---	--	5 km above Manaus.
Rio Negro-----	34	3°06.8'	60°05.4'	P4106B	6/21/76	25	23	Point	12	---	---	---	---	--	
Rio Negro-----	338	3°02.7'	60°22.5'	P4106B[b]	5/28/77	29	0	Bucket	3	3	tr	---	---	--	40 km above Manaus;
Rio Negro-----	338	3°02.7'	60°25.5'	P4106B[b]	5/28/77	29	0-29-0	Depth-Int.	3	2	1	1	---	--	1,600 m from left ba
Rio Negro-----	338	3°03.8'	60°22.5'	P4106B[b]	5/28/77	17	0	Bucket	4	4	tr	---	---	--	40 km above Manaus;
Rio Negro-----	338	3°03.8'	60°22.5'	P4106B[b]	5/28/77	17	0-17-0	Depth-Int.	7[c]	2[c]	5	4	---	--	3,700 m from left ba
Rio Negro-----	338	3°04.8'	60°22.5'	P4106B[b]	5/28/77	25	0	Bucket	4	4	tr	---	---	--	40 km above Manaus;
Rio Negro-----	338	3°04.8'	60°22.5'	P4106B[b]	5/28/77	25	0-25-0	Depth-Int.	6	5	1	<1	---	--	5,600 m from left ba

Table 3.--*Concentration and Partial Particle-Size Analysis of Suspended Sediment in Rivers and Lakes Tributary to Amazon River*--Continued

Tributary	Cruise station	Latitude (S)	Longitude (W)	Chart or map	Date (mo/d/yr)	Depth of water (m)	Depth of sample (m)	Type of sample	Concentration of suspended matter (mg/L)						Remarks
									Total	Finer than 0.053 mm	Coarser than 0.053 mm	Coarser than 0.063 mm	Coarser than 0.125 mm	Coarser than 0.25 mm	
Rio Madeira---	340	3°39'	59°03'	SA21	6/1/77	20	0	Bucket	158	155	3	2	---	--	50 km above mouth;
Rio Madeira---	340	3°39'	59°03'	SA21	6/1/77	20	0-20-0	Depth-Int.	251	216[d]	35	28	9	2	375 m from left bank.
Rio Madeira---	340	3°39'	59°03'	SA21	6/1/77	22	0	Bucket	99	99	<1	---	---	--	50 km above mouth;
Rio Madeira---	340	3°39'	59°03'	SA21	6/1/77	22	0-22-0	Depth-Int.	350	259[d]	91	80	33	1	750 m from left bank.
Rio Madeira---	340	3°39'	59°03'	SA21	6/1/77	21	0	Bucket	176	171	5	3	---	--	50 km above mouth;
Rio Madeira---	340	3°39'	59°03'	SA21	6/1/77	21	0-21-0	Depth-Int.	399	275[d]	124	111	62	2	1,125 m from left bank.
Rio Trombetas	---	1°42'	55°53'	SA21	6/3/77	15	0	Dip	8	8	0	---	---	--	35 km above mouth.
Rio Tapajós---	---	2°34'	54°59'	SA21	6/4/77	---	0	Dip	3	3	tr	---	---	--	40 km above Santarém
Rio Xingu-----	---	1°45'	52°15'	SA22	6/5/77	20	0	Dip	5	5	tr	---	---	--	60 km above mouth.
Rio Tocantins	1	1°38'	49°02.5'	-----	6/10/76	14	4	Point	32	---	---	---	---	--	

[a] 68°42' on map SA19.

[b] Extrapolated off western edge of chart P4106B.

[c] Concentration finer than 0.053 mm estimated by visual comparison with other filters; large blank correction for filter gave negative weight.

[d] See table 4 for detailed analysis of particle size <0.053 mm.

Table 4.--*Complete Particle-Size Distributions of Selected Suspended-Sediment Samples from Amazon River Mainstem and Rio Madeira*

Measuring Section	Distance from left bank (m)	Depth of sample (m)	Type of sample	Total concentration (mg/L)	Concentration (in mg/L) finer than indicated size Percent finer than indicated size											Remarks
					0.001 mm	0.002 mm	0.0039 mm	0.0078 mm	0.0156 mm	0.0312 mm	0.053 mm	0.063 mm	0.125 mm	0.25 mm	0.50 mm	
Iquitos----------	160	0-21-0	Depth-Int.	435	59 14	71 16	98 23	123 28	148 34	223 51	288 66	320 74	399 92	433 99.5	435 100	
Iquitos----------	550	0-25-0	Depth-Int.	419	41 10	65 16	88 21	106 25	142 34	191 46	225 54	240 57	297 71	388 93	419 100	
Iquitos----------	990	0-15-0	Depth-Int.	290	32 11	81 28	101 35	125 43	129 44	183 63	233 80	248 86	280 97	288 99.3	290 100	
Iquitos----------	990	0-22-0	Depth-Int.	336	47 14	70 21	95 28	120 36	142 42	196 58	236 70	252 75	302 90	334 99.4	336 100	
São Paulo de Olivença	490 510 830	1 1 1	Point	139	30 22	44 32	56 40	66 47	82 59	106 76	122 88	128 92	137 99	138.7 99.8	139 100	3 samples combined to yield enough material for pipette analysis.
São Paulo de Olivença	490 810	0-32-0 0-27-0	Depth-Int.	274	37 13	48 17	62 23	76 28	101 37	137 50	170 62	185 67	231 84	268 98	274 100	2 samples combined to yield enough material for pipette analysis.
São Paulo de Olivença	1,140 1,350	1 1	Point	153	30 20	39 25	53 35	64 42	80 52	104 68	123 80	130 85	147 96	152.7 99.8	153 100	Do.
São Paulo de Olivença	1,140 1,350	0-16-0 0-16-0	Depth-Int.	263	27 10	41 16	57 22	70 27	87 33	123 47	152 58	165 63	199 76	247 94	263 100	Do.
Santo Antônio do Içá	150 500	1 1	Point	89	15 17	24 27	33 37	40 45	48 54	69 78	77 87	80 90	87 98	88.8 99.8	89 100	Do.
Santo Antônio do Içá	150 490	0-27-0 0-28-0	Depth-Int.	218	15 7	31 14	41 20	49 22	64 29	89 41	118 54	129 59	175 80	216 99	218 100	Do.
Santo Antônio do Içá	1,360 1,700	1 1	Point	128	4 3	14 11	27 21	59 46	72 56	95 74	110 86	117 91	124 97	127.6 99.7	128 100	Do.
Santo Antônio do Içá	1,370 1,700	0-21-0 0-24-0	Depth-Int.	258	-- --	11 4	27 10	41 16	74 29	119 46	154 60	167 65	210 81	253 98	258 100	2 samples combined to yield enough material for pipette analysis; large difference (37 percent) between concentrations finer than 0.053 mm determined by two methods.
Óbidos----------	440	0-64-0	Depth-Int.	118	6 5	28 24	39 33	45 38	55 47	77 65	94 80	97 82	108 92	116 98	118 100	Only about 300 mg available for pipette analysis.

Table 4.--*Complete Particle-Size Distributions of Selected Suspended-Sediment Samples from Amazon River Mainstem and Rio Madeira*--Continued

Measuring Section	Distance from left bank (m)	Depth of sample (m)	Type of sample	Total concentration (mg/L)	Concentration (in mg/L) finer than indicated size Percent finer than indicated size											Remarks
					0.001 mm	0.002 mm	0.0039 mm	0.0078 mm	0.0156 mm	0.0312 mm	0.053 mm	0.063 mm	0.125 mm	0.25 mm	0.50 mm	
Óbidos----------	1,240	0-68-0	Depth-Int.	169	19 11	33 20	41 24	52 31	71 42	101 60	125 74	130 77	158 93	168 99	169 100	
Rio Madeira below Rosarinho----------	375 1,125	0-20-0 0-21-0	Depth-Int.	325	33 10	68 21	92 28	113 35	169 52	214 66	245 75	255 78	289 89	323 99	325 100	2 samples combined to yield enough material for pipette analysis. Fairly large difference (23 percent) between concentrations <0.053 mm determined by two methods.
Rio Madeira below Rosarinho----------	750	0-22-0	Depth-Int.	350	38 11	-- --	68 19	97 28	130 37	--- ---	259 74	270 77	317 91	349 99.7	350 100	

Table 5.--*Comparison of Particle-Size Analyses by Visual-Accumulation (VA) Tube and Sieves In "Sand" Fractions of Selected Suspended-Sediment Samples from Amazon River Mainstem and Rio Madeira*

Measuring section	Distance from left bank (m)	Depth of sample (m)	Method of size analysis	Percent of "sand" fraction finer than indicated size			Percent of total sample finer than indicated size		
				0.063 mm	0.125 mm	0.25 mm	0.063 mm	0.125 mm	0.25 mm
Iquitos----------	160	0-21-0	VA	20	80	100	73	93	100
			Sieve	22	77	100	74	92	100
Iquitos----------	550	0-25-0	VA	7	42	92	57	73	96
			Sieve	7	37	85	57	71	93
Iquitos----------	990	0-15-0	VA	28	86	100	86	97	100
			Sieve	27	84	99	86	97	99
Iquitos----------	990	0-22-0	VA	21	74	100	76	92	100
			Sieve	16	67	99	75	90	99
São Paulo de Olivença-----	490	0-32-0	VA	20	65	98	74	88	99
			Sieve	24	64	94	75	88	97
São Paulo de Olivença-----	830	1	VA	38	91	100	89	97	100
			Sieve	43	93	99	90	98	100
São Paulo de Olivença-----	810	0-27-0	VA	19	67	100	62	84	100
			Sieve	21	62	98	63	82	98
São Paulo de Olivença-----	1,140	1	VA	29	81	100	82	95	100
			Sieve	36	80	98	84	95	100
São Paulo de Olivença-----	1,140	0-16-0	VA	10	31	97	56	66	98
			Sieve	11	29	82	56	65	90
São Paulo de Olivença-----	1,350	1	VA	39	85	100	87	97	100
			Sieve	40	91	100	87	98	100
São Paulo de Olivença-----	1,350	0-16-0	VA	18	71	100	69	89	100
			Sieve	26	71	97	72	89	97
Santo Antônio do Içá------	150	0-27-0	VA	19	90	100	64	95	100
			Sieve	22	85	98	65	93	100
Santo Antônio do Içá-------	490	0-28-0	VA	10	49	100	54	74	100
			Sieve	11	42	98	55	71	99
Santo Antônio do Içá------	1,360	1	VA	32	76	100	87	96	100
			Sieve	28	76	98	86	96	100
Santo Antônio do Içá------	1,370	0-21-0	VA	15	50	99	65	80	100
			Sieve	17	46	92	66	78	97
Santo Antônio do Içá------	1,700	0-24-0	VA	17	71	99	64	87	100
			Sieve	17	63	98	64	84	99
Óbidos----------	440	0-64-0	VA	16	44	90	81	87	97
			Sieve	22	65	92	82	92	98
Óbidos----------	1,240	0-68-0	VA	19	78	100	76	93	100
			Sieve	22	77	99	77	93	100
Rio Madeira below Rosarinho	375	0-20-0	VA	18	65	99	88	95	100
			Sieve	22	74	95	89	96	99
Rio Madeira below Rosarinho	750	0-22-0	VA	11	66	100	76	91	100
			Sieve	15	65	99	77	91	100
Rio Madeira below Rosarinho	1,125	0-21-0	VA	3	41	98	69	81	99
			Sieve	12	50	98	72	84	99

Table 6.--*Miscellaneous Velocity Observations*

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
Iquitos	7/8/76	240	24	19	1.86	Point
				14	1.76	
				9	1.54	
				4	1.34	
				.7	.78	
		490	23	18	2.18	Point
				13	2.02	
				8	1.86	
				5	1.32	
				2	1.12	
				1	.90	
		730	22	17	2.12	Point
				12	1.98	
				9	1.75	
				3	1.44	
				1	1.22	
306 Iquitos	5/20/77	160	24	18	2.14	Point
				13	2.25	
				8	2.30	
				3	2.28	
				1	1.97	
		400	28	22	2.84	Point
				17	3.00	
				12	2.86	
				7	2.75	
				2	1.86	
		600	26	21	1.85	Point
				16	1.72	
				11	1.43	
				6	1.23	
				.5	.57	
		830	25	20	1.86	Point
				15	1.65	
				10	1.50	
				5	1.32	
				.5	.90	

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
306 Iquitos--Continued	5/20/77	990	22	17	1.92	Point
				12	1.64	
				7	1.54	
				3	1.44	
				1	1.30	
		400	28	26	2.83	Integrated
				22	2.90	
				18	2.70	
				14	2.62	
				10	2.26	
				6	2.10	
				2	1.92	
				.5	.55	
		600	26	22.5	2.42	Integrated
				17.5	2.18	
				12.5	2.10	
				7.5	1.48	
				.5	.62	
		830	23	22.5	1.64	Integrated
				17.5	1.53	
				16.5	1.32	
				7.5	1.08	
				2.5	.73	
				.5	.45	
São Paulo de Olivença	7/1/76	240	32	27	2.35	Point
				22	2.25	
				17	2.18	
				12	2.22	
				8	1.96	
				4	1.82	
				1	1.27	
		700	36	26	2.14	Point
				21	2.14	
				16	2.08	
				10	1.92	
				6	2.18	
				1	1.40	
		980	13	8	1.22	Point
				4	1.18	
				1	.78	

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
312 São Paulo de Olivença	5/22/77	510	30	27.5	2.37	Integrated
				22.5	2.20	
				17.5	2.08	
				12.5	1.90	
				7.5	1.56	
				3.2	1.11	
Santo Antônio do Içá	6/29/76	300	25	15	2.59	Point
				10	2.56	
				5	2.45	
		800	25	20	2.01	Point
				15	1.94	
				10	1.82	
				5	1.58	
				3	1.38	
		1,100	18	13	1.92	Point
				8	1.74	
				3	1.45	
		1,280	19	10	1.63	Point
				5	1.45	
				4	1.41	
				2	1.26	
315 Santo Antônio do Içá	5/23/77	150	27	24	2.12	Integrated
				16	1.87	
				8	1.78	
				4	1.64	
				2	1.28	
				1	1.16	
		500	28	24	2.96	Integrated[1]
				16	2.74	
				8	2.35	
				4	2.00	
				2	1.65	
				1	1.50	

[1]Duplicate measurements collected several minutes apart.

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
315 Santo Antônio do Içá--Cont.	5/23/77	500	28	24	3.00	Integrated[1]
				16	2.74	
				8	2.50	
				4	2.25	
				2	2.03	
				1	1.64	
		960	20	16	1.66	Integrated
				8	1.50	
				4	1.36	
				2	1.22	
				1	1.00	
		1,360	21	16	1.96	Integrated
				8	1.55	
				4	1.43	
				2	1.42	
				1	1.28	
		1,700	24	21	2.00	Integrated
				16	1.90	
				8	1.52	
				4	1.34	
				2	1.00	
				1	.84	
329 Itapeúa	5/26/77	280	52	48	1.88	Integrated
				42	2.04	
				32	2.21	
				16	1.83	
				8	1.45	
				4	.89	
				2	.67	
				1	.35	
		500	60	48	2.99	Integrated[1]
				32	3.01	
				16	2.75	
				8	2.66	
				4	2.18	
				2	1.59	
				1	1.42	

[1]Duplicate measurements collected several minutes apart.

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
329 Itapeúa--Continued	5/26/77	500	60	48	2.96	Integrated[1]
				32	2.91	
				16	2.64	
				8	2.50	
				4	2.26	
				2	1.99	
				1	1.86	
		760	75	64	3.04	Integrated
				48	2.91	
				32	2.61	
				16	1.64	
				8	1.13	
				4	.78	
				2	.86	
				1	.57	
Manacapuru	6/22/76	890	28	24	1.41	Point
		890	28	19	1.54	
		910	28	14	1.43	
		930	28	8	1.24	
		930	28	3	1.15	
		940	28	2	.97	
		940	28	1	.80	
		1,460	36	26	2.12	Point
		1,420	36	16	1.82	
		1,350	36	11	1.67	
		1,340	36	6	1.10	
		1,750	44	40	1.92	Point
		1,730	44	35	2.08	
		1,750	44	25	2.04	
		1,730	44	15	1.60	
		1,900	39	29	2.27	Point
		1,780	45	25	1.37	
		1,720	43	13	1.70	
		1,750	43	7	1.38	

[1]Duplicate measurements collected several minutes apart.

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
Manacapuru--Continued	6/22/76	2,350	32	23	2.36	Point
		2,370	32	13	1.64	
		2,370	32	8	1.50	
		2,370	32	4	1.54	
		2,370	32	2	1.33	
		2,770	35	25	1.55	Point
		2,750	35	15	1.39	
		2,740	34	6	1.20	
		2,690	34	4	1.19	
		2,710	34	2	1.00	
335 Manacapuru	5/27/77	800	34	30	1.38	Integrated
				24	1.30	
				16	.97	
				8	.54	
				4	.27	
				2	.13	
		1,230	34	30	1.64	Integrated
				24	1.53	
				16	1.18	
				8	.84	
				4	.37	
		1,560	44	32	1.28	Integrated
				16	1.40	
				8	.25	
		1,900	32	24	1.15	Integrated
				16	1.22	
				8	.76	
				4	.25	
341 Iracema	6/1/77	600	27	16	1.45	Integrated
				8	1.54	
				4	1.28	
				2	1.12	
				1	.78	
		1,300	50	32	1.40	Integrated
				16	1.08	
				8	.90	
				4	.68	
				2	.46	
				1	.35	

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
341 Iracema--Continued	6/1/77	1,800	60	48	1.84	Integrated
				32	1.78	
				16	1.45	
				8	1.17	
				4	.90	
				2	.65	
				1	.59	
Óbidos	6/14/76	800-1,000[a/]	63	56	2.29	Point
				50	2.11	
				29	2.28	
				7	2.40	
				2	1.85	
347 Óbidos	6/2/77	370	62	48	1.98	Integrated
				32	1.94	
				16	1.50	
				8	1.36	
				4	1.12	
				2	.95	
				1	.67	
		440	64	60	1.99	Integrated
				48	1.99	
				32	1.99	
				16	1.46	
				8	1.18	
				4	.94	
				2	.86	
				1	.51	
		930	65	60	1.96	Integrated
				48	2.00	
				32	1.86	
				16	1.50	
				8	1.38	
				4	1.25	
				2	.90	
				1	.62	

[a/] Distance estimated.

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
347 Óbidos--Continued	6/2/77	1,200	65	60	2.25	Integrated
				48	2.25	
				32	2.25	
				16	2.16	
				8	1.82	
				4	1.64	
				2	1.56	
				1	1.22	
		1,240	68	54	2.13	Integrated
				32	1.88	
				16	1.72	
				8	1.42	
				4	1.05	
				2	.97	
				1	.45	
		1,610	62	54	2.42	Integrated
				32	2.14	
				16	1.88	
				8	1.54	
				4	.98	
				2	.70	
				1	.46	
		1,910	50	45	1.83	Integrated
				32	1.99	
				16	1.88	
				8	1.37	
				4	1.16	
				2	.94	
				1	.78	
		2,250	36	32	1.40	Integrated
				16	1.45	
				8	1.21	
				4	1.13	
				2	.86	
				1	.78	

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
305	5/19/77	1,360	28	23	2.55	Point
				18	2.35	
				8	2.08	
				3	1.49	
				.7	.90	
63	6/27/76	500	30	20	1.64	Point
				15	1.42	
				10	1.37	
				5	1.32	
63	6/27/76	1,000	30	18	2.90	Point
				6	1.96	
				5	1.75	
61	6/26/76	900	30	15	1.44	Point
				10	1.38	
				5	1.26	
57	6/25/76	2,300	28	24	1.51	Point
				18	1.34	
				14	1.28	
				9	1.21	
				4	.69	
7	6/13/76	2,900	40	29	1.34	Point
				18	1.25	
				11	1.12	
				4	.78	
				2	.60	
4	6/12/76	5,000	34	23	1.27	Point
				13	1.20	
				10	1.06	
				7	.86	
316 Rio Içá	5/23/77	300	25	20	1.38	Integrated[1]
				16	1.30	
				8	1.24	
				4	1.12	
				2	.97	
				1	.73	

[1]Ship moving upriver at about 0.2 m/s, so recorded velocites are probably 0.2 m/s too large.

Table 6.--*Miscellaneous Velocity Observations*--Continued

Cross section or station	Date mo/d/yr	Distance from left bank (m)	Depth of water (m)	Distance from bed (m)	Velocity (m/s)	Type of velocity measurement
338 Rio Negro	5/28/77	1,600	29	24	1.38	Integrated[1]
				16	1.36	
				8	1.36	
				4	1.31	
				2	1.12	
				1	.35	
		5,600	25	20	1.47	Integrated[1]
				16	1.34	
				8	1.50	
				4	1.44	
				2	1.14	
				1	.29	
Rio Madeira	6/17/76	750	31	26	1.32	Point
				16	1.32	
				7	1.12	
				5	1.07	
				3	1.00	
340 Rio Madeira	6/1/77	375	20	16	1.64	Integrated
				8	1.46	
				4	1.30	
				2	.98	
				1	.73	
		700	22	16	2.08	Integrated
				8	1.76	
				4	1.64	
				2	1.43	
				1	1.27	
		1,125	21	16	1.50	Integrated
				8	1.24	
				4	1.17	
				2	1.02	
				1	.89	

[1]Ship may have drifted off station during measurements.