I.O.S.

R R S CHALLENGER

CRUISES 5/78 Leg 1 : 22 March - 4 April 1978

~~8/78 Leg 2 : 12 May - 24 May 1978~~

Celtic Sea Observation Programme

CRUISE REPORT No 72

1978

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

Replacement page (table 2A) stuck in
RG 13/3/80

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Institute of Oceanographic Sciences
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Birkenhead
Merseyside L43 7RA

CONTENTS

NOTE: All times are in GMT.

DURATION

Deployment leg -	sailed from Barry	0730 22 March 1978
(5/78)	arrived at Barry	0630 4 April 1978
Recovery leg -	sailed from Barry	0900 12 May 1978
(8/78)	arrived at Barry	1930 24 May 1978

SCIENTIFIC STAFF

Leg 1	A.D. Banaszek	
	J. Casson	
	D. Flatt	
	P. Foden	
	I.D. James	
	A.G. Kerr	
	D.L. Leighton	
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	D.T. Pugh	(Principal scientist)
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	I.D. James	
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	D.L. Leighton	
	R.I.R. Palin	
	K. Taylor	
	J. Wolf	

SHIPS OFFICERS

Leg 1	G. Long	Master
	P. Coombs	Chief Officer
	S. Jones	Second Officer
	K. George	Third Officer
	R. Hagley	Extra Third Officer
	P. Stone	Chief Engineer
	J. Jack	Second Engineer
	J. Richardson	Third Engineer
	D. Hornsby	Fourth Engineer
Recovery leg	P. Maw	Master
	P. Coombs	Chief Officer
	S. Jones	Second Officer
	P. Pepler	Third Officer
	P. Stone	Chief Engineer
	I. McGill	Second Engineer
	J. O'Keeffe	Third Engineer
	J. Landry	Fourth Engineer

SUMMARY OF THE SCIENTIFIC OBJECTIVES OF THE CRUISE

The programme consisted of two cruises, the first to deploy tide gauges, current meters and thermistor chains in a pattern within the Celtic Sea, with an extension over the edge of the continental shelf, and the second to recover the equipment after a recording interval of some 50 days. Although the data is to be used for many purposes, the experiment was specifically designed to study:-

A. The coherence of non-tidal coastal water level changes around the Celtic Sea over a year, relating level changes to changes in the weather and to the water density. Also, the relationship between these coastal water levels and off-shore currents.

B. The details of tidal propagation from the deep Atlantic through the Celtic Sea, and in particular the region of anomalous tidal ageing and of the anomalous S_2/M_2 current amplitude ratio.

C. Internal tides near the continental margin (Station I)

D. Thermocline development (March-May is the critical time for establishing the Summer thermocline)

E. Fluxes of mass, momentum, energy, salt and heat into and through the Celtic Sea.

NARRATIVE, LEG 1

It was planned to deploy equipment at ten stations, as shown in Figure 1. Throughout the cruise, however, continuing heavy seas and bad weather made work difficult and resulted in many delays. Eventually equipment was deployed at all except Station K.

R.R.S. Challenger sailed from Barry at 0730 on Wednesday, 22 March, 1978. Following tests on the SIMRAD logging equipment course was set for Station A. The CTD pump was put outboard at 1100. Because of worsening weather course was altered for shelter in Lundy Roads. Thursday, 23 March, was spent behind Lundy in winds up to 50 kts. Challenger sailed from Lundy at 1300 on Friday 24 March and rigs were deployed at Station A during the afternoon. The current meter rig was found to have snagged the ship on first laying and it was necessary to recover and check the instruments before relaying. Rigs were deployed at Station B early on Saturday 25 March and, in worsening weather, rigs were laid at C during the afternoon. Challenger then returned to Lundy for shelter, where she remained until sailing for Station D at 1600 on Sunday 26 March.

On reaching Station D at first light on Monday 27 March conditions were too bad for rig deployment. Periodic CTD casts were made throughout the day while hove to, to observe the combined effects of strong insolation (measured) and strong winds on stratification. The rig at D was laid at first light on Tuesday 28 March and course was set for Station E. At E the sea was too rough for work and so Challenger hove to throughout Wednesday 29 March. The rig at E was laid at first light on Thursday 30 March and two rigs were laid at F during the afternoon, the tide gauge rig having the cruciform frame as ballast. Rigs at G were deployed at first light on Friday, 31 March.

Course was then set directly to Station I as this was given higher priority than H.

During the night of Saturday 1 April conditions again deteriorated to the extent that it became necessary to turn and set course back towards land and shelter. Fortunately, conditions improved slowly during the morning and deployment at H was possible during the afternoon; to make deployment easier, the current meter/thermistor chain rig was changed from a U-shaped mooring to a pop-up mooring. Course was again set for Station I as the weather continued to improve. Following a bathymetric survey, a suitable depth was found for working. Acoustic tests were made through the night on the deep tide gauge. The current meter rig was laid without difficulty before dawn. However, because the deep STD system was broken it was necessary to make two water bottle casts to determine the temperature/salinity profiles to 2000m. Following modifications as a result of the earlier tests the deep tide gauge was deployed at 1100 on Sunday 2 April.

Because of the time lost due to bad weather, it was not possible to proceed to Station K. Instead course was set for Barry. The CTD continuous surface sampler pump failed during the night of Monday 3 April. A final CTD cast was made at 1215 in calm conditions.

Challenger arrived in Barry at 0630 on Tuesday 4 April. Figure 2 shows approximate cruise tracks for this deployment leg.

NARRATIVE LEG 2

R.R.S. Challenger sailed from Barry at 0900 on Friday 12 May 1978 to recover 16 moorings which had been deployed previously on cruise 5/78, (See Fig. 1) and to carry out a CTD and surface water sampling survey. (See Table 2.)

With the ship clear of the harbour entrance the overside pump was installed and monitoring of surface water temperature and conductivity started at 1126 hours with a sampling interval of 3 minutes. A course was set for Station A which was eventually occupied at 1810 to find the surface buoy and pellet floats on position (see Fig. 4). Recovery started at 1845 and was complete by 1919 without difficulty. The ship then moved to the current meter/tide gauge location and the surface buoy was found on position. Recovery started at 1927 but when the surface buoy anchor was brought on board it was found that the ground line to the CM/TG had been detached at the anchor and was missing (see Fig. 5). The remaining shackles at this point had all been stripped of their seizing wire and were only hand-tight. An acoustic search of the area made no contact with the pinger on the mooring so the ship left station A at 2330 after carrying out CTD profile No. 21 and proceeded to station B which was eventually occupied at 0740 the following morning, Saturday 13 May. The current meter/tide gauge mooring was located with the surface buoy and pellet floats on position so recovery started at 0826 but again when the surface buoy anchor was brought on board the ground line was not attached. However on this occasion the pellets floats at the CM/TG end of the mooring could be grappled and so the recovery was successfully completed by 0906. When the ship moved to the lay position of the current meter mooring nothing was sighted, but the

acoustic pinger on the mooring was then located about 1 mile off position.

Dragging started at 0938 and by 1115 the mooring was successfully recovered including the sunken surface buoy. CTD profile no. 22 completed the work at this station and the ship left at 1120 heading for station C and on route CTD profile no. 23 was taken.

When station C was occupied at 1500 the tide gauge/thermistor mooring was located on position, recovery started at once and was successfully completed by 1600 with all the equipment in good condition. CTD profile no. 24 was taken, then the pop-up current meter mooring at this site released and subsequently recovered to find the top meter tangled in the meter wire. With the work completed at station C the ship left at 1750 heading for station E and taking CTD profiles Nos. 25, 26 and 27 along the way. The following morning, Sunday 14 May at 0615, station E was occupied and the tide gauge/current meter mooring sighted on position. Recovery started immediately and was completed without difficulty at 0655 except that the top current meter was again tangled in the meter wire. CTD profile no. 28 was carried out at 0800 then the ship left the site heading for station F taking CTD profiles Nos. 29, 30 and 31 on route. Station F was occupied at 1410 and the thermistor mooring sighted on position. CTD profile no. 32 was carried out and then recovery of the mooring was carried out without difficulty and eventually completed at 1515. A second CTD profile, No. 33 was then taken at 1615 prior to deploying an experimental mooring which was completed without difficulty at 1650. The pop-up current meter/ tide gauge mooring at this site was then located by means of its command pinger but all attempts to operate its release pinger failed.

At 1900 an attempt was made to drag the mooring but the drag caught on something first and the Gifford grapnel was lost. Transmission of the release signal continued thoughout the night and at 0110 the following morning, Monday 15 May the release finally operated and the mooring surfaced. Recovery got underway at first light and was successfully completed at 0630 when the ship left station F heading for station D.

At station D, which was occupied at 1155, there was no sign of the surface buoy making the tide gauge/current meter mooring (the sub-surface buoy and two current meters from this site had been recovered by a fisherman during April). An acoustic search using the PDR fish and dragging across the lay position failed to make contact with the mooring so the ship left station D heading for station G at 2000.

On Tuesday 16 May at 0740 in calm sea conditions station G was occupied and the pop-up TG pinger located. CTD profile no. 34 was taken then the TG released from the sea bed and recovered successfully at 0850. The pop-up current meter/thermistor mooring was also located and after release was recovered satisfactorily in good condition at 0942. The ship then left the site and headed for station H which was eventually occupied at 1515 and the pop-up TG recovered without difficulty at 1645. CTD profile no. 35 was carried out and then attempts were made to recover the pop-up current meter/thermistor mooring which had been located by its pinger, but after several operations of the release sequence the mooring failed to surface. Attempts were made to drag for the mooring but when no contact was made the pinger was switched off and the ship left the site heading for station I.

On the approach to the continental edge bathymetric recording started and continued throughout the deep water passage. At 0600 on Wednesday 17 May station I was occupied and a deep CTD profile no. 37 was carried out in 3800m (uncorrected) of water which was followed by a shallow CTD profile no. 38 to 300m depth. The pop-up TG at this site was released and recovered at 1104 followed by the deep pop-up current meter mooring which was recovered complete by 1547. A bathymetric survey of the site was carried out and also some of the scrap mooring wires were dumped at Austell Spur. The results of this and the survey on the previous leg are charted in Figure 11. The ship left station I at 1930 to start a CTD section through station H and carrying out profiles nos. 39 to 44 on route.

At 0550 on Thursday 18 May station H was re-occupied in a final attempt to recover the missing current meter mooring but after 12 hrs of dragging the mooring was abandoned and with the completion of CTD profile no. 45 the ship left the site and headed for station F via station G continuing the CTD section with profiles nos. 46 to 53 on route. Station F was re-occupied at 1040 on Friday 19 May to find the experimental mooring on position and in good condition, so the recovery was carried out at 1237 in calm sea conditions. The ship then left station F and continued the CTD section through station C to station A taking profiles Nos. 54 to 61 on route. When the ship re-occupied station A at 0130 on Saturday 20 May an acoustic box search was started to try to locate the missing CM/TG mooring but after 15 hrs when no contact had been made the search was called off and CTD profile no. 62 was taken before the ship left station A heading for station D which was eventually re-occupied at 2314 in thick fog. An acoustics box search started at once and quickly located the pinger on the tide gauge. Marker pellets were deployed to fix the

position which was about half a mile from the lay position and then the ship stood off until daylight the following morning, Sunday 21 May. Due to thick fog dragging was delayed until 1215. The mooring wires on the rig were grappled and recovered, but the remaining current meter and the tide gauge were not attached and evidence showed that they had been broken from the mooring and so remained on the sea bed. Dragging for the TG continued for the rest of the day using the TG pinger as a beacon but was ended at 2030 without success. CTD profile no. 66 was taken then the ship carried out two further CTD profiles Nos. 67 and 68 on a line towards station C before returning to station D at 0700 the following morning, Monday 22 May, to continue dragging. Several techniques were used throughout the day in an attempt to grapple the TG frame but all failed, so reluctantly, it was abandoned and the ship left station D at 2334 heading for station A. Similar dragging techniques were used at station A throughout Tuesday 23 May but no positive contact with the CM/TG was made.

On Wednesday 24 May an acoustic search was carried out during the morning but nothing was found so this mooring was also abandoned when the ship left the site at 1128. Surface monitoring was ended at this time and the overside pump and PDR fish were brought inboard in preparation for docking at Barry which took place at 1930 the same day.

STATION REPORT. LEG 1 - DEPLOYMENT

Times in GMT throughout. Decca coordinates are for Chain 1B - S.W. British in sequence Red, Green, Purple.

Station A

Designated position : (51°16'N, 05°15'W)

Depth : 74m

Tide gauge and current meter (Figure 5)

Surface buoy : SELCO No. 10

Gauge position : (---, H43.1, H62.8)

Anchor position : (---, H43.1, H.62.8)

Deployment started 1515) 24.3.78
Deployment completed 1543)

Meters: CM/TG No. 2 (1507)

Current meter rig, second deployment. (first deployment recovered - see narrative) (Figure 4)

Surface buoy : SELCO No. 8
Subsurface buoy : 32" sphere, No. 7

Subsurface buoy position : (---, H45.20, H63.59)

Surface buoy profile : (---, H45.73, H.63.53)

Deployment started 1833) 24.3.78
Deployment finished 1849)

Meters : 2573 (35m)

Station B

Designated position : (51°45'N, 06°38'W)

Depth : 74m

Tide gauge and current meter (Figure 5)

Surface buoy : SELCO No. 7

Gauge position : (J23.94, B30.68, H76.08)

Anchor position : (J23.89, B30.07, H76.12)

Deployment started 0735) 25.3.78
Deployment finished 0802)

Meters : CM/TG No. 1 (1747)

Current meter rig (Figure 4)

Surface buoy : SELCO No. 3

Subsurface buoy : 32" sphere, No. 11

Subsurface buoy position : (J23.88, B30.95, H76.63)

Surface buoy position : (J23.90, B30.16, H76.54)

Deployment started 0900) 25.3.78
Deployment finished 0918)

Meters : 1139 (20m), 1508 (40m)

STATION C

Designated position : (51°21'N, 06°30'W)

Depth : 94m

Tide gauge and thermistor chain (Figure 6)

Surface buoy : SELCO No 11

Subsurface buoy : 32" sphere, No 3

Subsurface buoy position : (---, B41.75, G72.20)

Surface buoy position : (---, B41.16, G71.78)

Deployment started 1340)
) 25.3.78
Deployment finished 1438)

Meters : TG2A 64, Thermistor chain No 212, Logger No. 178 - first sample timed for 1230 4.4.78 (25m - 75m)

Pop-up current meter rig (Figure 10)

Subsurface buoy 32" sphere, No.2

Anchor position : (---, B44.86, G69.47)

Deployment started 1543)
) 25.3.78
Deployment finished 1551)

Meters: 1506 (15m), 3277 (40m), 567(60m)

STATION D

Designated position : (50°35'N, 06°10'W)

Depth : 94m

Tide gauge and current meters (Figure 6)

Surface buoy : SELCO No 1

Subsurface buoy : 32" sphere No 8

Subsurface buoy position : (A9.22, C45.36, E57,82)

Surface buoy position : (A9.28, C45.12, E58.16)

Deployment started : 0611) 28.3.78

Deployment finished : 0650)

Meters : Marconi logger no. 2 ; 2969 (15m), 568 (40m), 1750 (65m)

STATION E

Designated position : (51°26'N, 07°55'W)

Depth : 87m

Tide gauge and current meters (Figure 6)

Surface buoy : SELCO No 13

Subsurface buoy : 32" sphere No 4

Subsurface buoy position : (A2.96, D41.94, G66.50)

Surface buoy position : (A3.94, D42.18, G66.10)

Deployment started : 0605) 30.3.78

Deployment finished : 0633)

Meters : Marconi logger No 4; 2971 (15m), 1002 (40m), 1867 (60m)

STATION F

Designated position : (50°33'N, 7°26'W)

Depth : 111m

Pop-up tide gauge and current meters (Figure 9)

Subsurface buoy : 32" sphere No 1, cruciform ballast

Anchor position : (A17.03, F41.14, E61.93)

Deployment started : 1320) 30.3.78
Deployment finished : 1340)

Meters : Experimental strain gauge and Aanderaa 280 : 2576 (25m), 2757 (65m)

Thermistor chain (Figure 8)

Surface buoy : SELCO No 12

Subsurface buoy : 32" sphere No 9

Subsurface buoy position : (A17.57, F42.39, E61.07)

Surface buoy position : (A17.62, F42.51, E61.01)

Deployment started : 1421) 30.3.78
Deployment finished : 1445)

Meters : Thermistor chain No. 260, logger No. 245 - first sample timed for 1210 9.4.78 (45m - 95m)

STATION G

Designated position : (49°38'N, 08°30'W)

Depth : 144m

Pop-up current meters and thermistor chain rig (Figure 10)

Subsurface buoy : 32" sphere No 10

Anchor position : (B23.24, G45.42, D50.52)

Deployment started : 0614)
) 31.3.78
Deployment finished: 0622)

Meters : 1865 (30m), 2970 (104m) ; Thermistor chain No 220, logger No 206 - first sample timed for 1800 9.4.78, (52m - 102m).

Pop-up tide gauge

Position when gauge reaches sea floor : (B22.89, G45.48, D50.71)

Deployment started : 0540)
) 31.3.78
Deployment finished: 0551

Meter : Mark I, No 9.

STATION H

Designated position : (48°55'N, 09°19'W)

Depth : 164m

Pop-up current meters and thermistor chain rig (Figure 10)

Subsurface buoy : 40" sphere No 13

Anchor positions : (C20.06, G43.52, C62.32)

Deployment started : 1257) 1.4.78
Deployment finished : 1308)

Meters : 2574 (29m), 1746 (119m) ; Thermistor chain No 334, logger No 294 - no time delay, (43m - 118m)

Pop-up tide gauge

Position when gauge reaches sea floor : (C19.99, G42.55, C62.50) (SAT NAV. 48°54.8'N 9°22.3'W)

Deployment started : 1313) 1.4.78
Deployment finished : 1323)

Meter : Mark I, No 14

STATION I

Designated approximate position : 47°45'N 10°32'W, 3850m true depth

Pop-up current meter rig (Figure 10)

Subsurface buoy : 48" sphere no 16

Anchor position : (D23.23, G35.03, B74.77)
(SAT NAV 47°48.1'N, 10°18.3'W)

Actual depth : 3905m uncorrected
(3913m corrected)

Deployment started : 0400) 2.4.78
Deployment finished : 0547)

Meters : 3261 (260m), 3260 (760m), 3259 (1260m), 3258 (1960m), 3257 (2660m), 1749 (3360m)

Pop-up tide gauge

Position when gauge released : (D21.6, G35.5, B75.8)
(SAT NAV 47°51.1'N, 10°22.6'W)

Depth : 3855m uncorrected
(3862m corrected)

Gauge released : 1058 2.4.78

Meter : Deep sea tide gauge no 17 (Mk III with Mk IV inside)

STATION REPORT, LEG 2 - RECOVERY

Times given in GMT throughout

Decca coordinates for chain 1B - SW British,

in sequence Red, Green, Purple.

STATION A

Tide gauge and current meter

Current meter No 1507

Pressure sensor, Digiquartz S/No 275

Command pinger No 1

Deployed position (A1.00, H43.1, H62.8)

Only the surface buoy was recovered from this position.

Current meter rig

Current meter No 2573

Command pinger No 4

Deployment position	(A0.88, H45.20, H63.59)
Recovery position	(A1.05, H45.64, H63.62)
Recovery started at	1845 12 May 78
Surface buoy on deck	1855
Surface buoy anchor on deck	1905
CM on deck/acoustics	1916
Sat surface buoy on deck and recovery complete	1919

All equipment recovered in good condition and operating except for a bent CM spindle.

CTD profile no 21 carried out at 2115 12 May 1978

STATION B
Tide gauge and current meter

Rig No 1

Current meter No 1747

Pressure sensor, Digiquartz No 280

Command pinger No 2

Deployment position	(J23.94, B30.68, H76.08)	
Recovery position	(- , B30.01, H76.12)	
Recovery started at	0826	13 May 78
Surface buoy on deck	0833	
Surface buoy anchor on deck	0840	
Pellets grappled	0855	
CM/TG on deck	0900	
Ground line recovered and recovery complete	0906	

All equipment recovered in good condition and operating but the ground line had been detached from the surface buoy anchor.

Current meter rig

Current meter No 1508 top
1139 bottom

Command pinger No 5

Deployed position	(J23.88, B30.95, H76,63)	
Recovery position	(J23.99, B30.16, H76.14)	
Rig recovered by dragging		
Recovery started at	0938	13 May 78
Meter wire caught by grapnel	1018	
Bottom CM on deck	1023	
Top CM on deck and sub-surface buoy	1025	

surface buoy anchor on deck 1106

sunken surface buoy on deck
and recovery complete 1110

All equipment in good condition and operating except for wrecked surface buoy.

CTD profile No 22 carried out at 1115 13 May 78

STATION C

Tide gauge and thermistor chain rig

Aanderaa TG-2A No 64

Thermistor logger No 178, Chain No 212

Command pinger No 3

Deployment position	(AO.55, B41.75, G72.20)
Recovery position	(AO.68, B41.15, G72.03)
Recovery started at	1516 13 May 78
Surface buoy on deck	1523
Surface buoy anchor on deck	1531
TG on deck	1538
Subsurface buoy anchor on deck	1556
Subsurface buoy and thermistor chain on deck recovery complete	1600

All equipment recovered in good condition

Pop-up current meter rig

Current meters No 567 Top
3277 Mid
1506 Bottom

Release pinger No CR221

Deployment position	(AO.84, B44.86, G69.47)
Recovery position	(- , B44.83, G69.51)
Recovery started at	1720 13 May 78
Subsurface buoy on deck	1738
3 current meters on deck and recovery complete	1745

All equipment recovered in good condition except for top current meter which was tangled with the meter wire.

CTD profile No 24 carried out at 1655 13 May 78

STATION D

Mk II Off-shore tide gauge and current meter rig with 3 meters

Logger 002 Sensor 1/5 VIB

2/6 S.G.

2/11 S.G. (Exp)

2/12 S.G. (Exp)

6/2 DIG

Command pinger No CB220

Current meters No 1750 Top
568 Mid
2969 Bottom

Deployment position (A9.22, C45.36, E57.82)

Pinger located at (A9.22, C45.90, E59.00)

at 2342 on 20 May 1978 but no instruments were recovered from this station during the cruise. A fisherman recovered the sub-surface buoy and two current meters Nos. 1750 and 568 during April at position (A6.0, B46.10, E69.54)

The TG was recovered in good condition and complete at 0225 on 13 September 78 by Naval divers from the M.V. Seaforth Clansman on charter to the Royal Navy.

CTD profiles No 66 carried out at 2104 21 May 78.

STATION E

Mk II off-shore tide gauge and current meter rig with 3 meters

Logger 004 Sensor : 1/4 VIB

2/7 S.G.

6/1 DIG

Command pinger No CB 231

Current meters No 1867 Top
1002 Mid
2971 Bottom

Deployment position	(A2.96, D41.94, G66.50)
Recovery position	(A3.19, D40.18, G66.40)
Recovery started at	0625 14 May 1978
Surface buoy on deck	0630
Surface buoy and anchor on deck	0635
Tide gauge on deck	0643
Sub-surface buoy on deck	0649
3 meters and sub-surface buoy on deck, recovery complete	0655

All equipment in good condition but top meter tangled in meter wire.

CTD profile No 28 carried out at 0700 14 May 78

STATION F

a) Thermistor chain rig

b) Pop-up current meter/tide gauge rig with 2 meters

c) Experimental bottom mounted current meter and tide gauge

Thermistor chain rig

Thermistor logger No 245

Chain No 260

Command pinger No 6

Deployment position	(A17.57, F42.39, E61.07)	
Recovery position	(A17.80, F42.79, E61.04)	
Recovery started at	1444	14 May 78
Surface buoy on deck	1447	
Surface buoy anchor on deck	1454	
Sub-surface buoy anchor on deck	1508	
Thermistor chain on deck	1512	
Sub-surface buoy on deck and recovery complete	1515	

Pop-up current meter/tide gauge rig

Current meter No 2575 Top
2576 Bottom

Release pinger No CR 223

Aanderaa SG/TG No 280

Aanderaa SG/TG No 281

Deployment position	A17.03, F41.14, E61.93
Recovery position	A16.81, F41.25, E62.10

Release operated	0105	15 May 78
Sub-surface buoy on sea surface	0110	
Recovery started at	0610	
Sub-surface buoy on deck	0620	
2 current meters on deck	0627	
Recovery complete	0628	

Experimental bottom mounted current meter and tide gauge

Current meter No EX 302

EXP Aanderaa SG/TG No 282

Deployment position	(A17.86, F42.91, E60.86)	
Deployment depth	110m	
Deployment started	1626	14 May 78
Deployment complete	1650	
Recovery started at	1200	19 May 78
Surface buoy on deck	1210	
Surface buoy anchor on deck	1216	
CM & TG on deck and	1230	
Recovery complete	1233	

All the equipment recovered from this station was in good condition and operational

CTD profile No 32 carried out at 1417 14 May 78
" " No 33 " " " 1615

STATION G

Mk I Pop-up tide gauge

TG No 9 in ALU sphere with SG pressure sensor No 1/19

" " sensor No 1/21

and platinum resistance temperature sensor No 1/T9

Deployment position	(B22.89, G45.48, D50.71)	
Recovery position	(B22.76, G45.38, D50.45)	
Release operated	0830	16 May 78
Recovery started	0845	
Recovery completed at	085	

Pop-up current meter/thermistor chain rig

Current meter No 2970 Top

1865 Bottom

Thermistor logger No 206, chain No 220

Release pinger No CR 227

Deployment position	(B23.24, G45.42, D50.52)	
Recovery position	(B22.95, - D50.44)	
Release operated	0903	16 May 78
Sub-surface buoy on surface	0914	
Recovery started at	0926	
Top CM & thermistor logger on deck	0937	
Bottom CM & Pinger on deck & recovery complete	0942	

All the equipment recovered from this station was in good condition and operational but the pellet line attached to the subsurface buoy on the CM rig was tangled with the meter wire below the subsurface buoy but not to the CM motor.

CTD profile No 34 carried out at 0805 16 May 78

STATION H

Mk I Pop-up tide gauge

TG No 14 in ALU sphere with SG pressure sensors No 1/13
" " " No 1/22
and platinum resistance temperature sensor No 1/T8

Deployment position	(C19.99,G42.55, C62.50)	
Recovery position	(C20.00, - C62.39)	
Release operated	1623	16 May 78
Recovery started	1635	
Recovery complete	1645	

The TG was in good condition and operational.

Pop-up current meter/thermistor chain rig

Current meter No 1746 Top
2574 Bottom

Thermistor logger No 294, chain 334

Release pinger No CR 230

Deployment position (C20.06, G43.52, C62.32)

Pinger located at the above position at 1717 16 May 78 but nothing was recovered during the cruise. A French fisherman later recovered the floating subsurface buoy and the top current meter.

CTD profile No 35 carried out 1652 16 May 78

STATION I

Pop-up tide gauge

TG No 17 in ALU sphere with SG pressure sensor No D1/78
" " " D2/78
" " " D3/78
DIG " " 2262
Platinum resistance temperature sensor 2/T10

Deployment position	(D21.6, G35.5, B75.8)
Recovery position	(D21.67, G35,38, B75.53)
	(SAT NAV 47°49.40'N, 10°20.46'W)
Release operated	0946 17 May 78
Recovery started	1058
Recovery complete	1104

Pop-up current meter rig

Current meter No 1749 Top
3257
3258
3259
3260
3261 Bottom

Release pinger No CR 228 and CB 235C

Deployment position	(D23.23, G35.03, B74.77)
Recovery position	(D23.11, G34.91, B74.43)
	(SAT NAV 47°46.95'N, 10°19.10'W)
Release operated	1348 17 May 78
Sub-surface buoy on surface	1354
Recovery started	1400
Recovery complete	1547

All the equipment was recovered in good condition and operational.

DEEP CTD profiles No 37 at 0700 17 May 1978

SHALLOW CTD profiles No 38 at 1020

SHALLOW CTD profiles No 39 at 1615

EQUIPMENT LOSSES

				STATION
Current meters	Aanderaa type RCM4	No.	1507	A
			2574	H
			2969	D
Thermistor chains	Aanderaa type TR-1	No.	294/334	H
Pressure sensor	Digiquartz	No.	275	A
Acoustic command pinger		No.	CR230	H
			CP1	A
Surface buoy	Selco	No.	1	D

COMMENTS ON THE SHIP

During the difficult conditions of LEG 1 Challenger proved suitable for our work in all but the most extreme seas.

This was the first cruise on this ship since the deck winches had been modified to take mooring wires and shackles. Both winches worked well and control from the console was satisfactory. However, the lack of spooling gear meant that the wire had to be guided on by hand and this led to problems at times.

Challenger is well suited to deployment and recovery of the type of mooring used during manoeuverability and control.

ACKNOWLEDGEMENT

We would like to thank the Masters, Officers and crew of the RRS Challenger for their cooperation and assistance during these cruises.

The role played by the MOD (Navy) and the SEAFORTH CLANSMAN in the recovery at station D is also gratefully acknowledged.

Table 1

Summary of Station positions and equipment deployed.

Station				Depth (m)	
A	CM/TG	57° 15.6'N	5° 14.3'N	74	
	CM	51° 17.3'N	5° 7.0'W	74	35
B	CM/TG	51° 45'N	6° 39'W	74	
	CM	51° 43.5'N	6° 37.8'W	74	20, 40
C	TG/TC	51° 19'N	6° 33'W	94	
	CM	51° 19.0'N	6° 34.8'W	94	15, 40, 60
D	CM/TG	50° 35.5'N	6° 8.1'W	94	15, 40, 65
E	CM/TG	51° 27.5'N	7° 50.4'W	87	15, 40, 60
F	TC	50° 31'N	7° 31'W	111	
	CM/TG	50° 32.0'N	7° 28.7'W	111	25, 65
G	TG	49° 39'W	8° 30'W	144	
	CM/TC	49° 37.3'N	8° 35.5'W	144	30, 104
H	TG	48° 55'N	9° 15'W	164	
	CM/TC	48° 55'N	9° 15'W	164	29, 119
I	TG	47° 50'N	10° 21.5'W	3848	
	CM	47° 47.2'N	10° 18.7'W	3897	260, 760, 1260, 1960, 2660, 3360

TABLE 2A. LIST OF CTD PROFILES

PROFILE NUMBER	DATE	TIME STARTED	POSITION LATITUDE	POSITION LONGITUDE	REG
1	24/ 3/78	19.30	N 51 17.6	W 5 18.1	A
2	24/ 3/78	22.10	N 51 24.7	W 5 23.2	
3	25/ 3/78	1.50	N 51 35.1	W 5 46.8	
4	25/ 3/78	5.20	N 51 59.8	W 6 44.3	
5	25/ 3/78	9.14	N 51 45.3	W 6 39.3	B
6	25/ 3/78	11.20	N 51 32.8	W 6 33.8	
7	26/ 3/78	21.35	N 50 55.5	W 5 16.3	
8	27/ 3/78	9.15	N 50 34.5	W 6 0.6	
9	27/ 3/78	12.50	N 50 25.9	W 6 27.9	D
10	27/ 3/78	16. 2	N 50 23.5	W 6 38.5	
11	27/ 3/78	18.41	N 50 23.6	W 6 38.4	
12	28/ 3/78	7.10	N 50 35.5	W 6 10.4	D
13	30/ 3/78	6.30	N 51 27.0	W 7 50.8	E
14	30/ 3/78	10.10	N 50 57.5	W 7 34.0	
15	30/ 3/78	14.50	N 50 31.1	W 7 30.5	F
16	30/ 3/78	18.20	N 50 13.9	W 8 1.0	
17	31/ 3/78	6.28	N 49 37.0	W 8 35.5	G
18	1/ 4/78	13.35	N 48 54.5	W 9 20.5	H
19	2/ 4/78	8.50	N 47 50.5	W10 23.6	I
20	3/ 4/78	12. 5	N 50 27.2	W 5 56.0	
21	12/ 5/78	20.57	N 51 16.7	W 5 15.5	A
22	13/ 5/78	11.10	N 51 44.7	W 6 37.4	B
23	13/ 5/78	13.16	N 51 30.0	W 6 33.3	
24	13/ 5/78	16.54	N 51 20.7	W 6 35.0	C
25	13/ 5/78	20. 9	N 51 20.7	W 6 50.0	
26	13/ 5/78	23. 3	N 51 22.4	W 7 13.3	
27	14/ 5/78	2.20	N 51 23.6	W 7 33.0	
28	14/ 5/78	6.55	N 51 25.4	W 7 48.0	E
29	14/ 5/78	8.40	N 51 14.9	W 7 43.1	
30	14/ 5/78	10.22	N 51 2.3	W 7 39.8	
31	14/ 5/78	12.16	N 50 16.8	W 7 33.9	
32	14/ 5/78	14.17	N 50 31.1	W 7 32.1	F
33	14/ 5/78	16. 4	N 50 30.1	W 7 29.8	F
34	16/ 5/78	8. 0	N 49 90.0	W 8 31.5	G
35	16/ 5/78	16.50	N 48 54.2	W 9 21.9	H
43	18/ 5/78	2.39	N 48 31.1	W 9 43.4	
44	18/ 5/78	4.56	N 48 43.5	W 9 30.0	
45	18/ 5/78	18.25	N 48 54.1	W 9 20.9	H
46	18/ 5/78	20.30	N 49 5.1	W 9 7.5	
47	18/ 5/78	22.20	N 49 15.5	W 8 56.1	
48	19/ 5/78	0. 5	N 49 26.8	W 8 44.0	
49	19/ 5/78	2. 5	N 49 38.7	W 8 36.2	G
50	19/ 5/78	4. 0	N 49 48.7	W 8 18.1	
51	19/ 5/78	6.28	N 50 5.2	W 7 59.9	
52	19/ 5/78	8.54	N 50 16.3	W 7 42.6	
53	19/ 5/78	10.45	N 50 29.3	W 7 31.7	F
54	19/ 5/78	14.18	N 50 42.8	W 7 15.0	
55	19/ 5/78	15.48	N 50 51.8	W 7 4.9	
56	19/ 5/78	17.15	N 51 1.3	W 6 53.9	
57	19/ 5/78	18.45	N 51 9.5	W 6 43.6	
58	19/ 5/78	20.22	N 51 19.5	W 6 30.0	C
59	19/ 5/78	22. 2	N 51 18.0	W 6 12.9	
60	19/ 5/78	23.42	N 51 18.0	W 5 53.1	
61	20/ 5/78	1. 0	N 51 17.3	W 5 35.3	
62	20/ 5/78	16.20	N 51 12.7	W 5 19.7	A
63	20/ 5/78	17.45	N 51 6.3	W 5 28.0	
64	20/ 5/78	19.28	N 50 56.6	W 5 39.8	
65	20/ 5/78	21. 7	N 50 47.4	W 5 54.1	
66	21/ 5/78	21.37	N 50 36.6	W 6 8.7	D
67	22/ 5/78	0. 5	N 50 47.8	W 6 12.8	
68	22/ 5/78	2. 8	N 51 0.3	W 6 20.0	

Table 2(b)

Expendable bathythermographs

1	1020	31.3.78	49°15'N	8°57'W	
2	1020		"	"	
3	0745	1.4.78	48°52'N	8°51'N	
4	0910	2.4.78	47 52'N	10°25'W	Station I
5	0915		"	"	"

Water bottling

STATION F

CAST A Sample depths, 600m, 900m, 1200m, 1500m, 1800m

CAST B Sample depths 450m, 750m, 1050m

TABLE 2A. LIST OF CTD PROFILES.

PROFILE NUMBER	DATE	TIME STARTED	POSITION LATITUDE	POSITION LONGITUDE	RIG
1	24/ 3/78	19.30	N 51 17.6	W 5 18.1	A
2	24/ 3/78	22.10	N 51 24.7	W 5 23.2	
3	25/ 3/78	1.50	N 51 35.1	W 5 46.8	
4	25/ 3/78	5.20	N 51 59.8	W 6 44.3	
5	25/ 3/78	9.14	N 51 45.3	W 6 39.3	B
6	25/ 3/78	11.20	N 51 32.8	W 6 33.8	
7	26/ 3/78	21.35	N 50 55.5	W 5 16.3	
8	27/ 3/78	9.15	N 50 34.5	W 6 0.6	
9	27/ 3/78	12.50	N 50 25.9	W 6 27.9	D
10	27/ 3/78	16. 2	N 50 23.5	W 6 38.5	
11	27/ 3/78	18.41	N 50 23.6	W 6 38.4	
12	28/ 3/78	7.10	N 50 35.5	W 6 10.4	D
13	30/ 3/78	6.30	N 51 27.0	W 7 50.8	E
14	30/ 3/78	10.10	N 50 57.5	W 7 34.0	
15	30/ 3/78	14.50	N 50 31.1	W 7 30.5	F
16	30/ 3/78	18.20	N 50 13.9	W 8 1.0	
17	31/ 3/78	6.28	N 49 37.0	W 8 35.5	G
18	1/ 4/78	13.35	N 48 54.5	W 9 20.5	H
19	2/ 4/78	8.50	N 47 50.5	W10 23.6	I
20	3/ 4/78	12. 5	N 50 27.2	W 5 56.0	
21	12/ 5/78	20.57	N 51 16.7	W 5 15.5	A
22	13/ 5/78	11.10	N 51 44.7	W 6 37.4	B
23	13/ 5/78	13.16	N 51 30.0	W 6 33.3	
24	13/ 5/78	16.54	N 51 20.7	W 6 35.0	C
25	13/ 5/78	20. 9	N 51 20.7	W 6 50.0	
26	13/ 5/78	23. 3	N 51 22.4	W 7 13.3	
27	14/ 5/78	2.20	N 51 23.6	W 7 33.0	
28	14/ 5/78	6.55	N 51 25.4	W 7 48.0	E
29	14/ 5/78	8.40	N 51 14.9	W 7 43.1	
30	14/ 5/78	10.22	N 51 2.3	W 7 39.8	
31	14/ 5/78	12.16	N 50 16.8	W 7 33.9	
32	14/ 5/78	14.17	N 50 31.1	W 7 32.1	F
33	14/ 5/78	16. 4	N 50 30.1	W 7 29.8	F
34	16/ 5/78	8. 0	N 49 90.0	W 8 31.5	G
35	16/ 5/78	16.50	N 48 54.2	W 9 21.9	H
37	17/ 5/78	6.55	N 47 50.0	W10 20.2	I
38	17/ 5/78	10.16	N 47 49.4	W10 20.6	I
39	17/ 5/78	19.30	N 47 45.8	W10 23.3	
40	17/ 5/78	21.20	N 47 56.1	W10 11.8	
41	17/ 5/78	23. 9	N 48 8.1	W10 2.3	
42	18/ 5/78	0.49	N 48 16.9	W10 2.1	
43	18/ 5/78	2.39	N 48 31.1	W 9 43.4	
44	18/ 5/78	4.56	N 48 43.5	W 9 30.0	
45	18/ 5/78	18.25	N 48 54.1	W 9 20.9	H
46	18/ 5/78	20.30	N 49 5.1	W 9 7.5	
47	18/ 5/78	22.20	N 49 15.5	W 8 56.1	
48	19/ 5/78	0. 5	N 49 26.8	W 8 44.0	
49	19/ 5/78	2. 5	N 49 38.7	W 8 36.2	G
50	19/ 5/78	4. 0	N 49 48.7	W 8 18.1	
51	19/ 5/78	6.28	N 50 5.2	W 7 59.9	
52	19/ 5/78	8.54	N 50 16.3	W 7 42.6	
53	19/ 5/78	10.45	N 50 29.3	W 7 31.7	F
54	19/ 5/78	14.18	N 50 42.8	W 7 15.0	
55	19/ 5/78	15.48	N 50 51.8	W 7 4.9	
56	19/ 5/78	17.15	N 51 1.3	W 6 53.9	
57	19/ 5/78	18.45	N 51 9.5	W 6 43.6	
58	19/ 5/78	20.22	N 51 19.5	W 6 30.0	C
59	19/ 5/78	22. 2	N 51 18.0	W 6 12.9	
60	19/ 5/78	23.42	N 51 18.0	W 5 53.1	
61	20/ 5/78	1. 0	N 51 17.3	W 5 35.3	
62	20/ 5/78	16.20	N 51 12.7	W 5 19.7	A
63	20/ 5/78	17.45	N 51 6.3	W 5 28.0	
64	20/ 5/78	19.28	N 50 56.6	W 5 39.8	
65	20/ 5/78	21. 7	N 50 47.4	W 5 54.1	
66	21/ 5/78	21.37	N 50 36.6	W 6 8.7	D
67	22/ 5/78	0. 5	N 50 47.8	W 6 12.8	
68	22/ 5/78	2. 8	N 51 0.3	W 6 20.0	

REPLACEMENT PAGE FOR IOS CRUISE REPORT NO. 72, 1978.
Celtic Sea Observation Programme.

TABLE 3

List of Equipment Deployed

1.	Surface buoys	
	SELCO No. 1, 3, 7, 10, 12, 13 (fitted with flashing light)	Manufactured by Selco, Oslo, Norway.
2.	Sub-surface buoys	
	Hollow steel sphere 32" diameter No. 1, 4, 7, 8, 9, 10, 11	Manufactured to IOS design 175kg buoyancy
	40" diameter No. 13	
	48" diameter No 16	
3.	Current Meters	
	No. 567, 568, 1002, 1139, 1506, 1508, 1746, 1749, 1750, 1865, 1867, 2573, 2574, 2575, 2576, 2969, 2970, 2971, 3257, 3258, 3259, 3260, 3261, 3277.	Manufactured by Aanderaa, Bergen, Norway. Type RCM4.
4.	Thermistor Chain/Logger	
	No. 212/178 220/206 260/245 334/294	Manufactured by Aanderaa, Bergen, Norway. Type TR-1.
5.	Off-Shore tide gauges	
	a) MkI Pop-up TG consisting of a data logger, acoustic release system, 2 pressure sensors and 1 temperature sensor	IOS, Bidston
	Logger TYPE 1020	Manufactured by N.G.L.
	Pressure transducer element Strain gauge	Manufactured by Bell & Howell, Basingstoke, UK.
	b) MkII Moored TG consisting of a data logger with 3 or 5 pressure/temperature sensors	IOS, Bidston

	Logger 002, 004	Manufactured by Marconi Space & Defence
	Pressure Transducer elements VIB (Vibratory wire)	Manufactured by Sundstrand Data Control Washington USA
	S.G. (strain gauge)	Manufactured by Bell & Howell Basingstoke, UK
	Digiquartz Depth sensor (quartz crystal)	Manufactured by Paroscientific Washington, USA
c)	Mk III Pop-up TG consisting of a data logger, 4 pressure sensors and 1 temp. sensor	IOS Bidston
d)	Moored TG incorporating Aanderaa Water Level recorder TG-2A S/No. 64	Manufactured by Aanderaa Instruments, Victoria Canada
	Logger Type 610	Sea data Corporation Massachusetts, USA
	Pressure transducer elements	
	Strain gauge	Manufactured by Bell & Howell, Basingstoke, UK
	Digiquartz (quartz crystal) S/No. 2262	Manufactured by Paroscientific Washington, USA Model 75K-002

6. Bottom mounted CM/TG

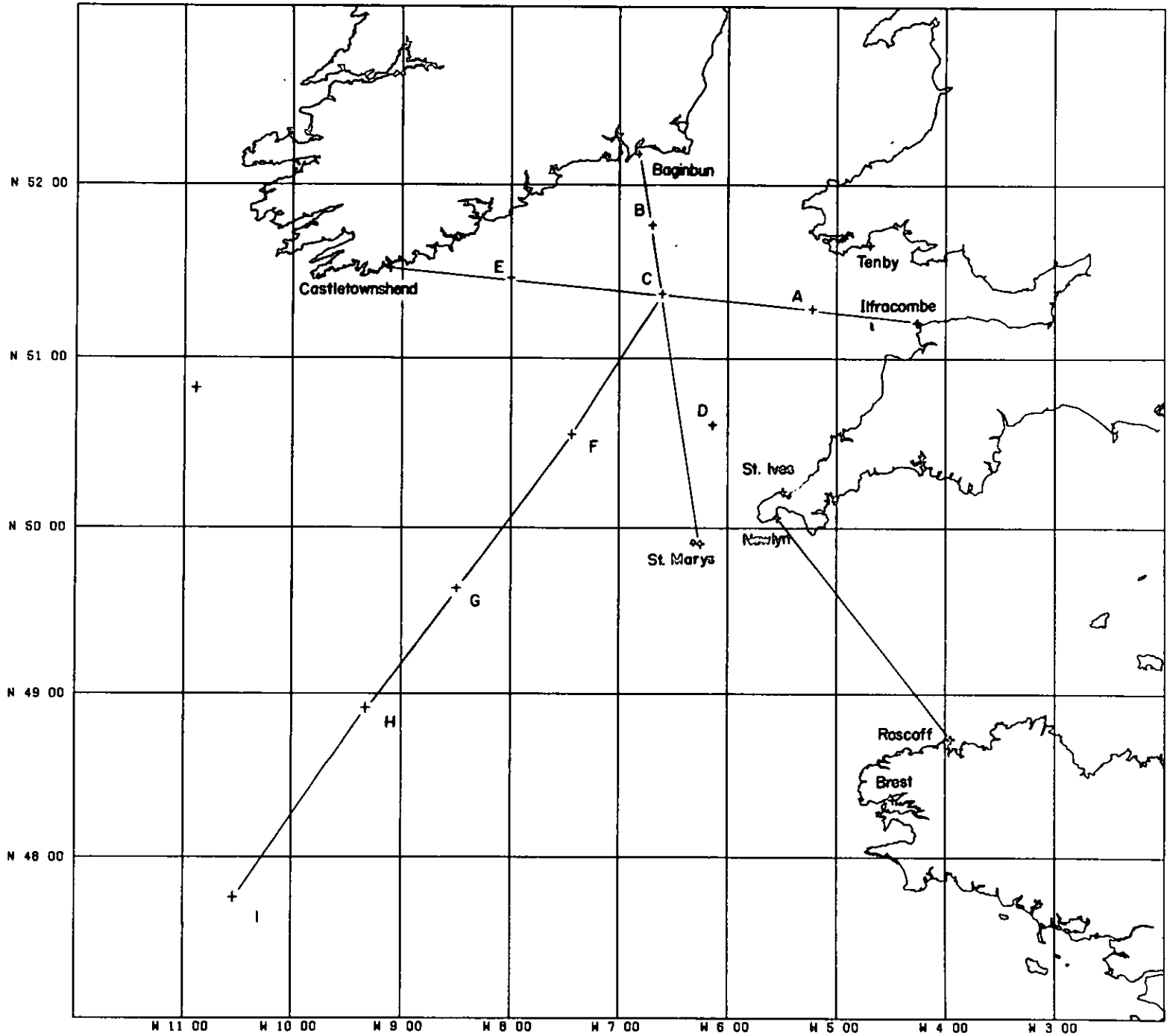
Moored CM/TG system consisting of a current meter, direction vane and pressure sensor	IOS Bidston
Current meter No 1507, 1747	Manufactured by Aanderaa Norway, Type RCM4
Pressure sensor element Digiquartz (quartz crystal) No. 275, 280	Manufactured by Paroscientific Washington, USA Model 2400A.

7. Acoustic Command Pinger

Pinger Nos. CP 1, 2, 3, 4, 5, 6 CB 220, CR 221, CR 223 CR 227, CR 228, CR 230 CB 231, CB 235C.	IOS Bidston/Wormley

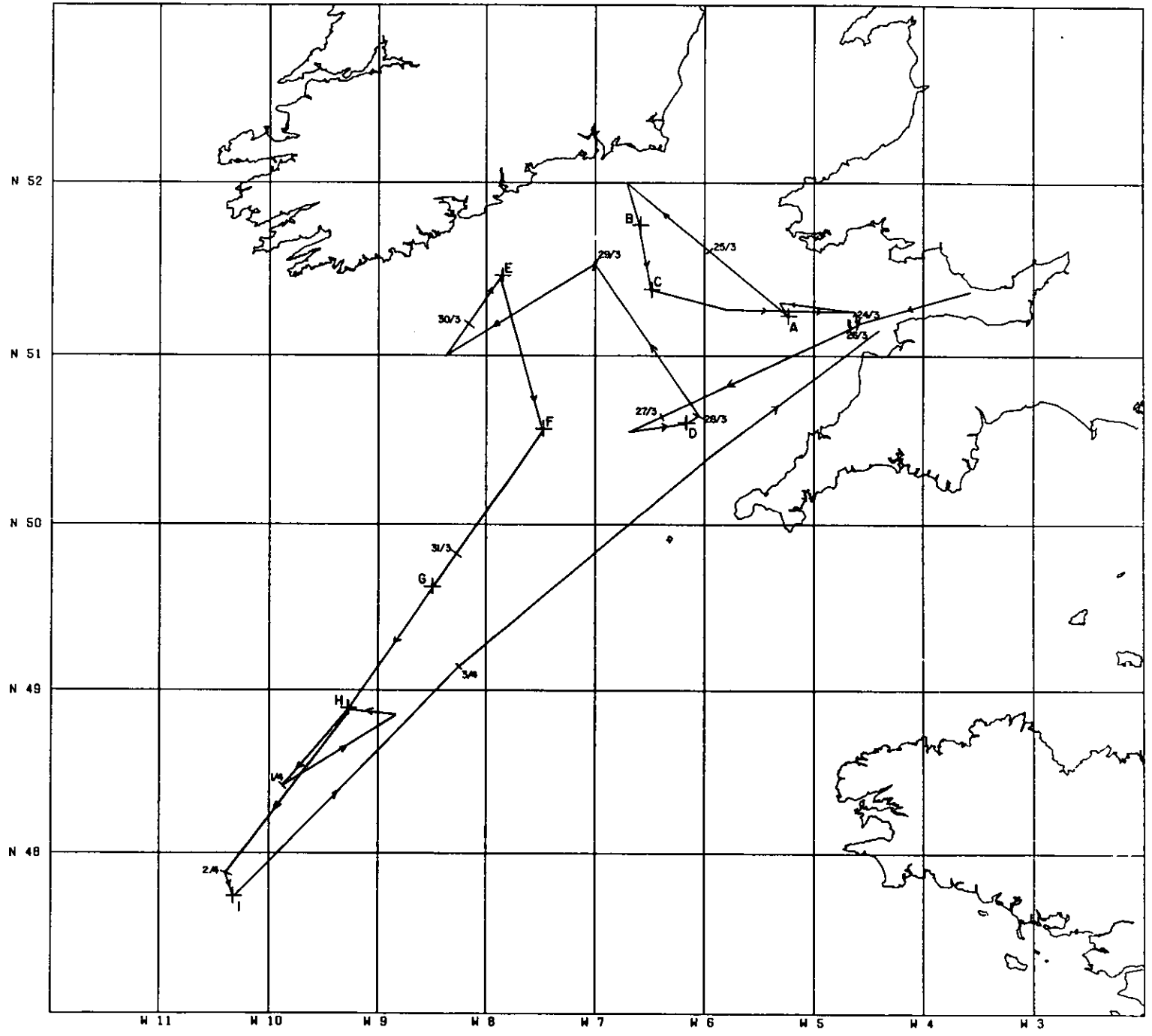
Abbreviations

IOS	Institute of Oceanographic Sciences
CM	Current meter
CM/TG	Current meter/tide gauge
TG	Tide gauge
S/S	Sub-surface buoy
T/C	Temperature/conductivity
CTD	Conductivity, Temperature, Depth
TC	Thermistor chain



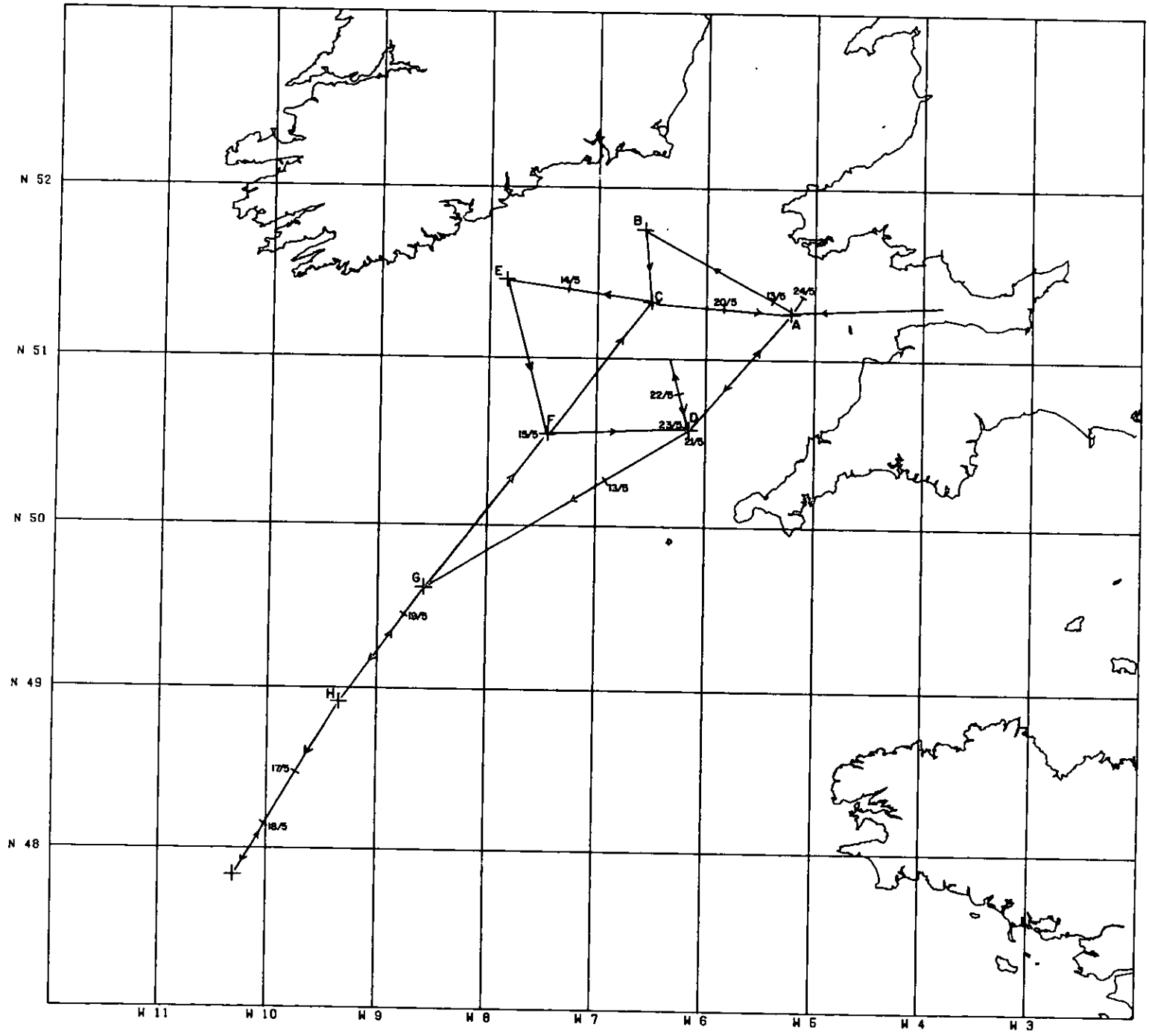
1977-78 CELTIC SEA OBSERVATIONAL PROGRAMME

FIGURE 1.



IOS BIDSTON CELTIC SEA

FIGURE 2.



IOS BIDSTON CELTIC SEA

FIGURE 3.

CURRENT METER MOORING SYSTEM

INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON

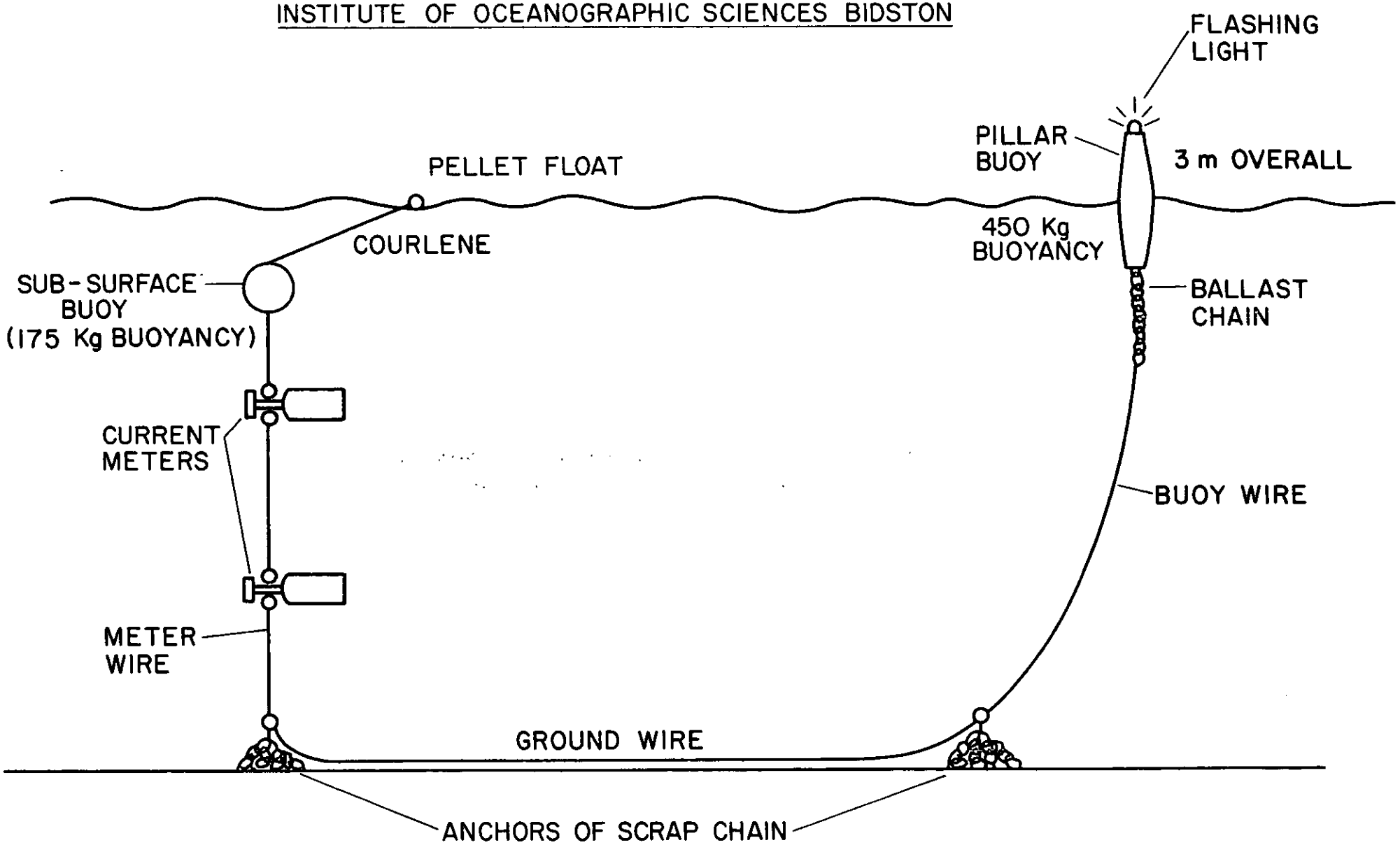


FIGURE 4

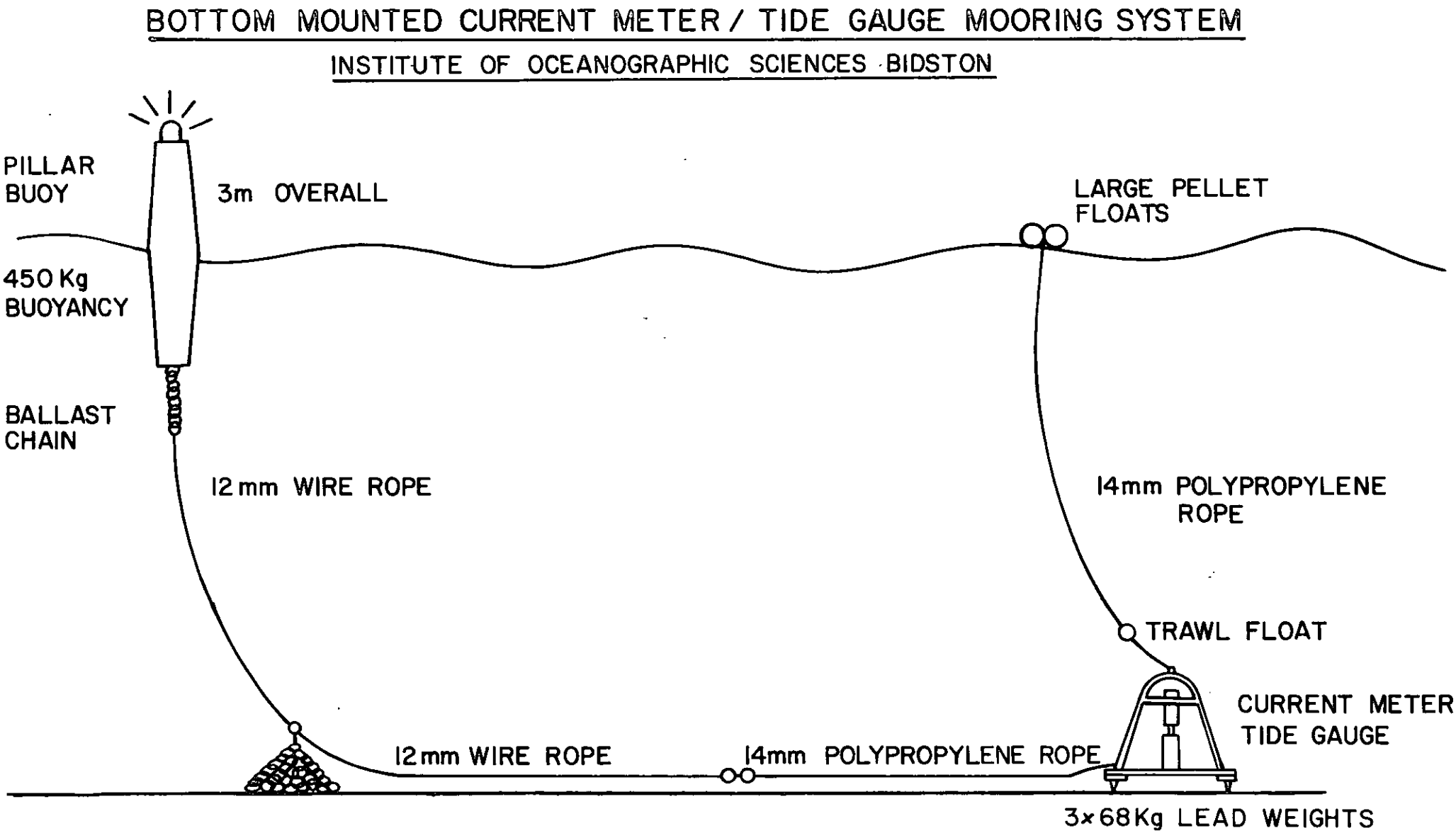

BOTTOM MOUNTED CURRENT METER / TIDE GAUGE MOORING SYSTEM
INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON
PILLAR BUOY
3m OVERALL
450 Kg BUOYANCY
BALLAST CHAIN
12 mm WIRE ROPE
LARGE PELLET FLOATS
14mm POLYPROPYLENE ROPE
TRAWL FLOAT
CURRENT METER TIDE GAUGE
12 mm WIRE ROPE
14mm POLYPROPYLENE ROPE
3×68Kg LEAD WEIGHTS

FIGURE 5

TIDE GAUGE/CURRENT METER MOORING SYSTEM

INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON

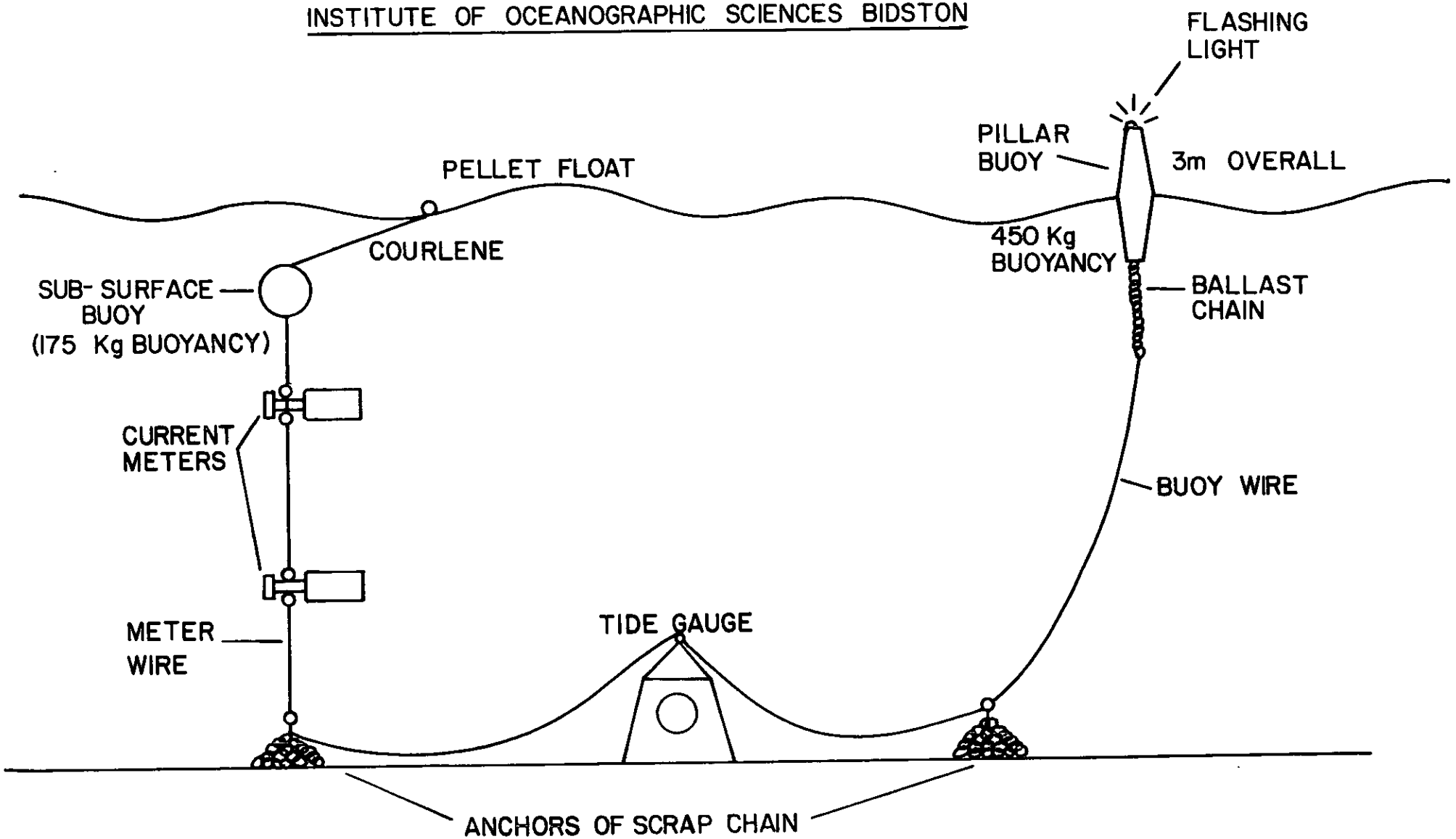


FIGURE 6

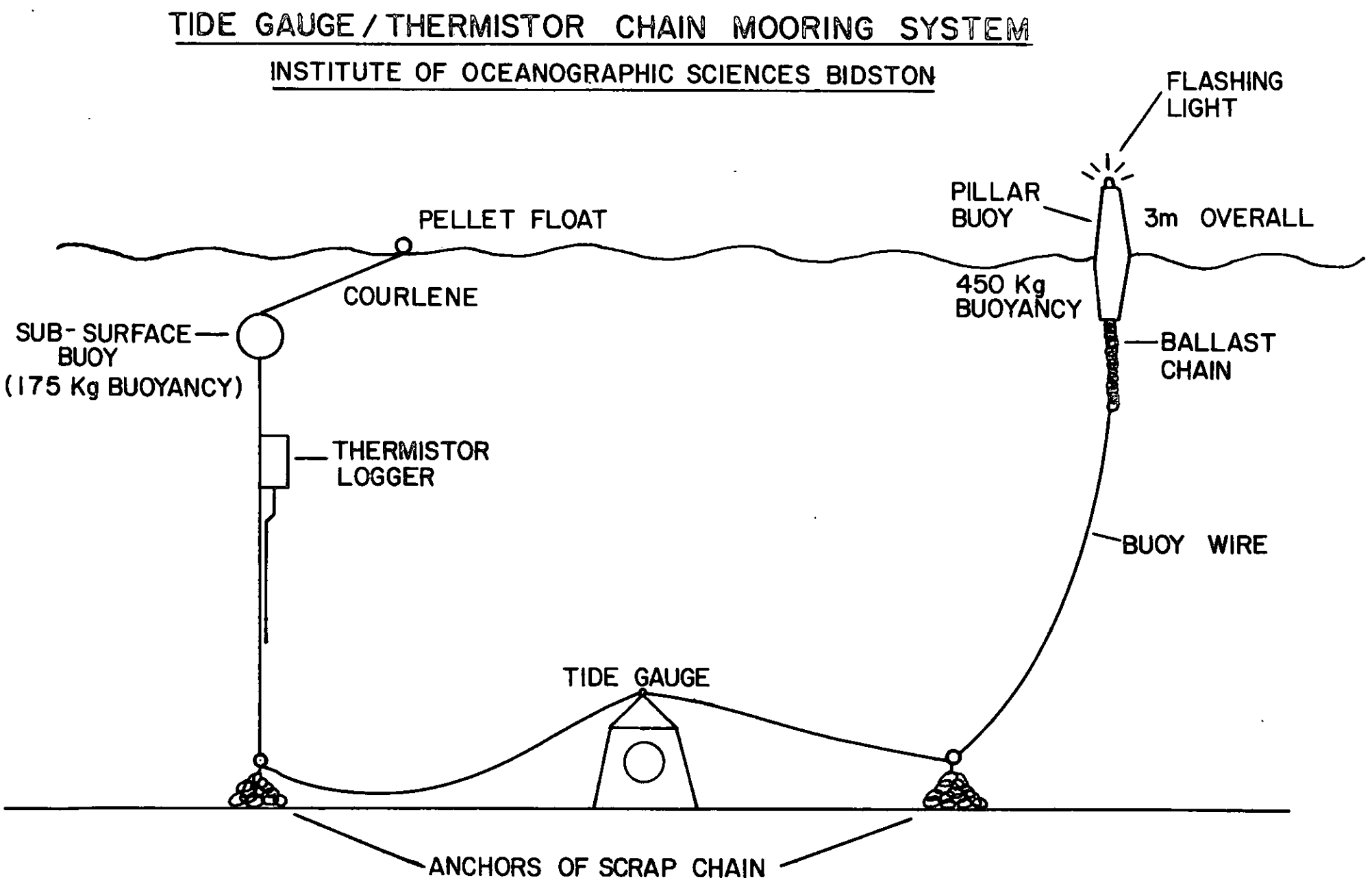

TIDE GAUGE / THERMISTOR CHAIN MOORING SYSTEM
INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON
FLASHING LIGHT
PILLAR BUOY
3m OVERALL
PELLET FLOAT
COURLENE
450 Kg BUOYANCY
SUB-SURFACE BUOY (175 Kg BUOYANCY)
BALLAST CHAIN
THERMISTOR LOGGER
BUOY WIRE
TIDE GAUGE
ANCHORS OF SCRAP CHAIN

FIGURE 7

THERMISTOR CHAIN MOORING SYSTEM

INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON

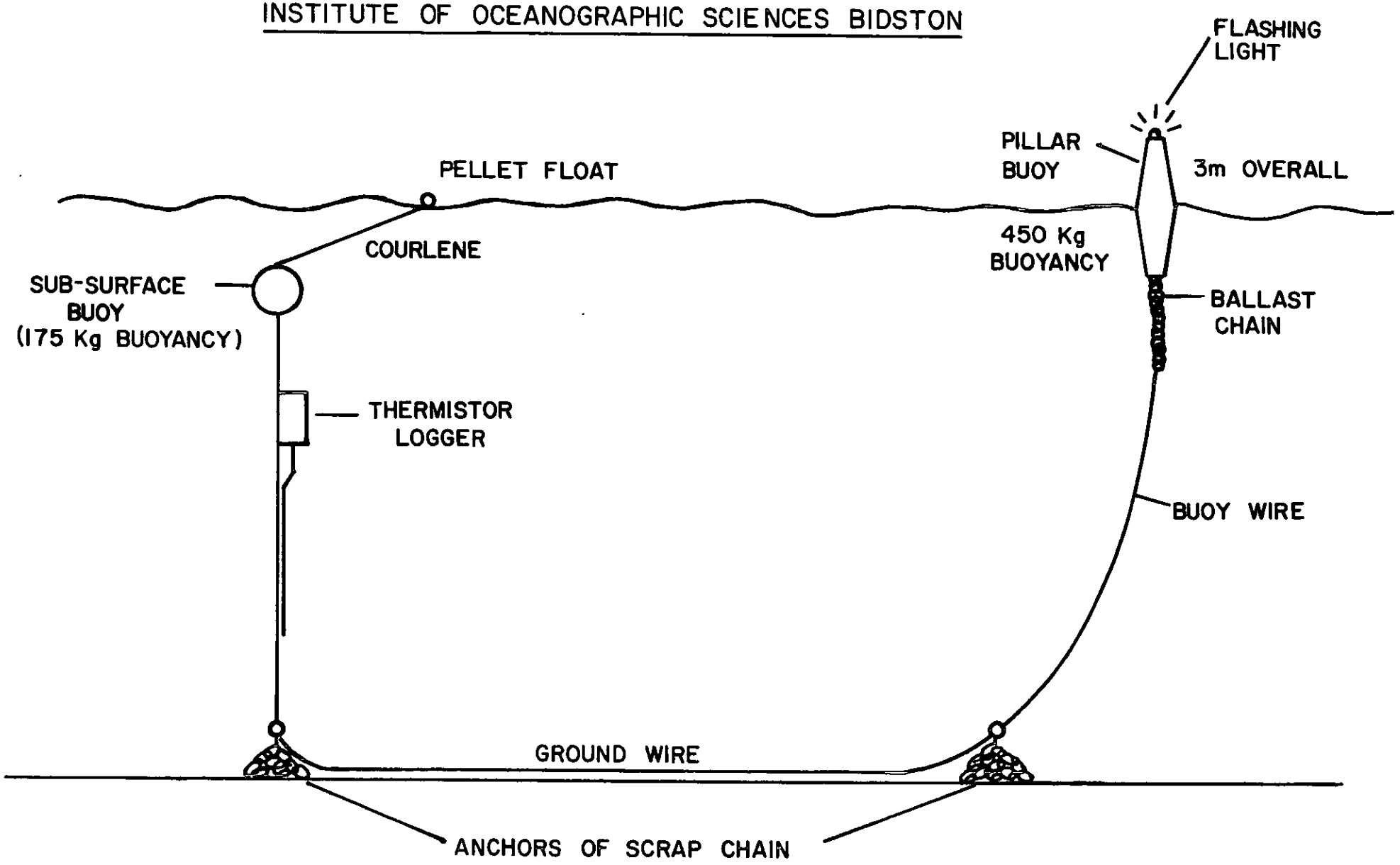


FIGURE 8

POP-UP CURRENT METER/TIDE GAUGE MOORING SYSTEM

INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON

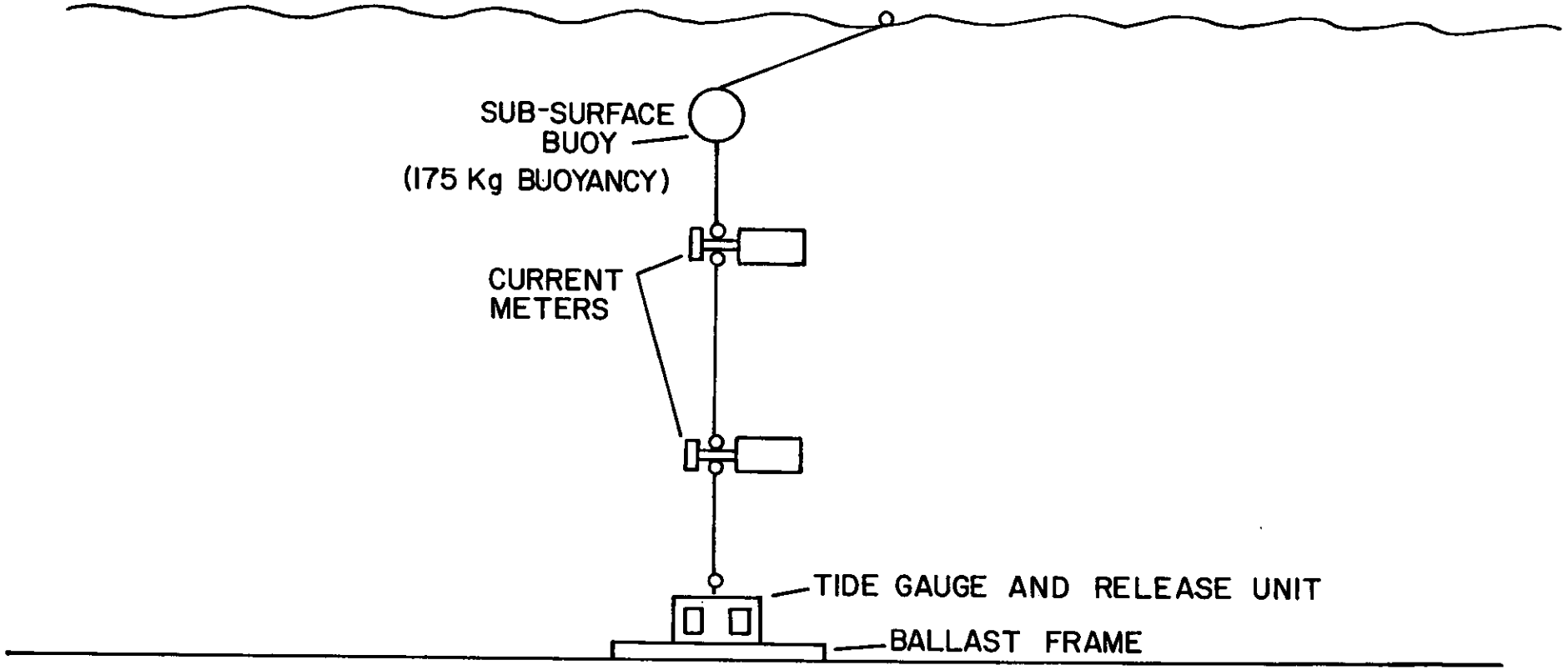


FIGURE 9

POP-UP CURRENT METER MOORING SYSTEM

INSTITUTE OF OCEANOGRAPHIC SCIENCES BIDSTON

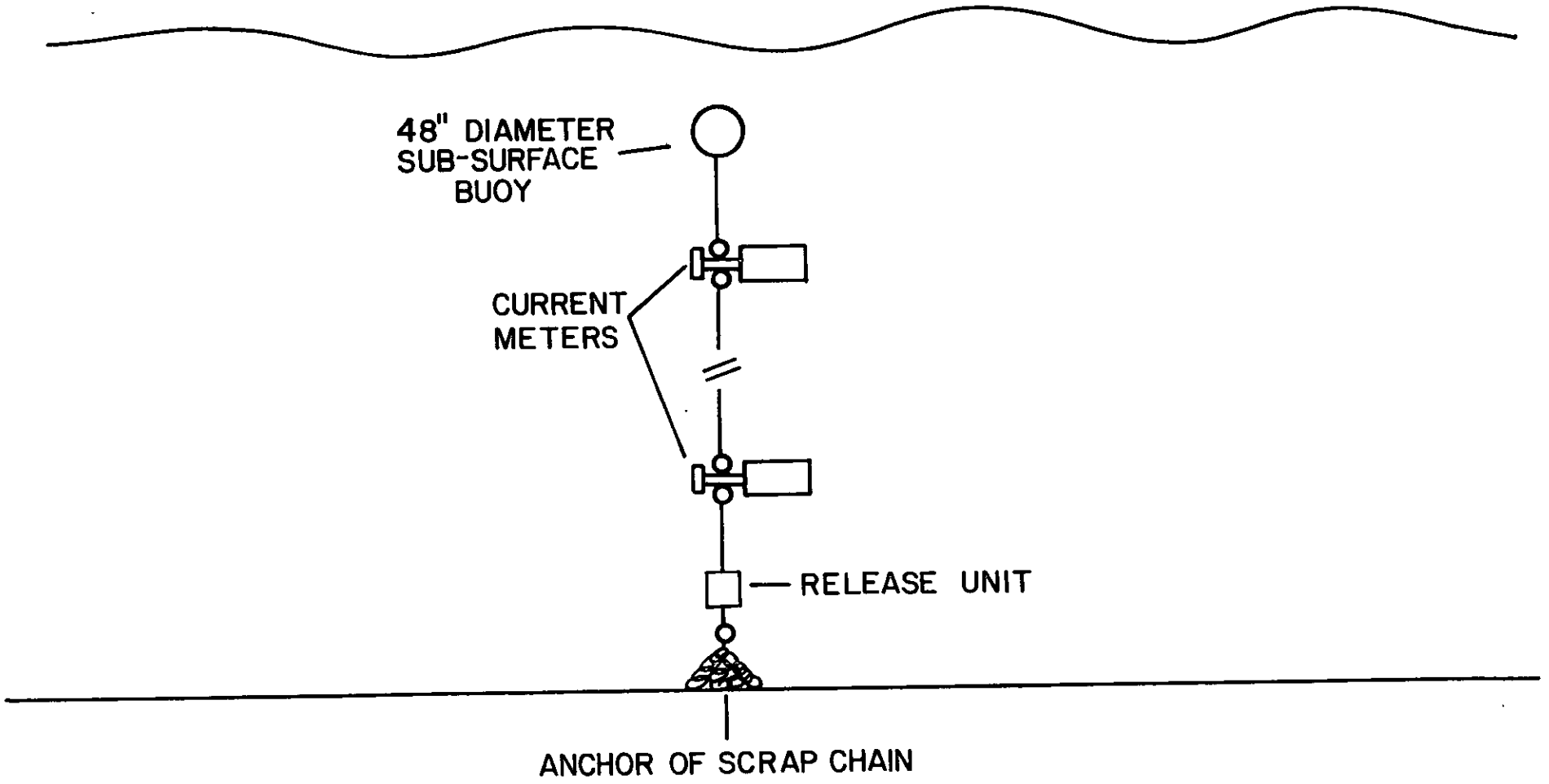


FIGURE 10

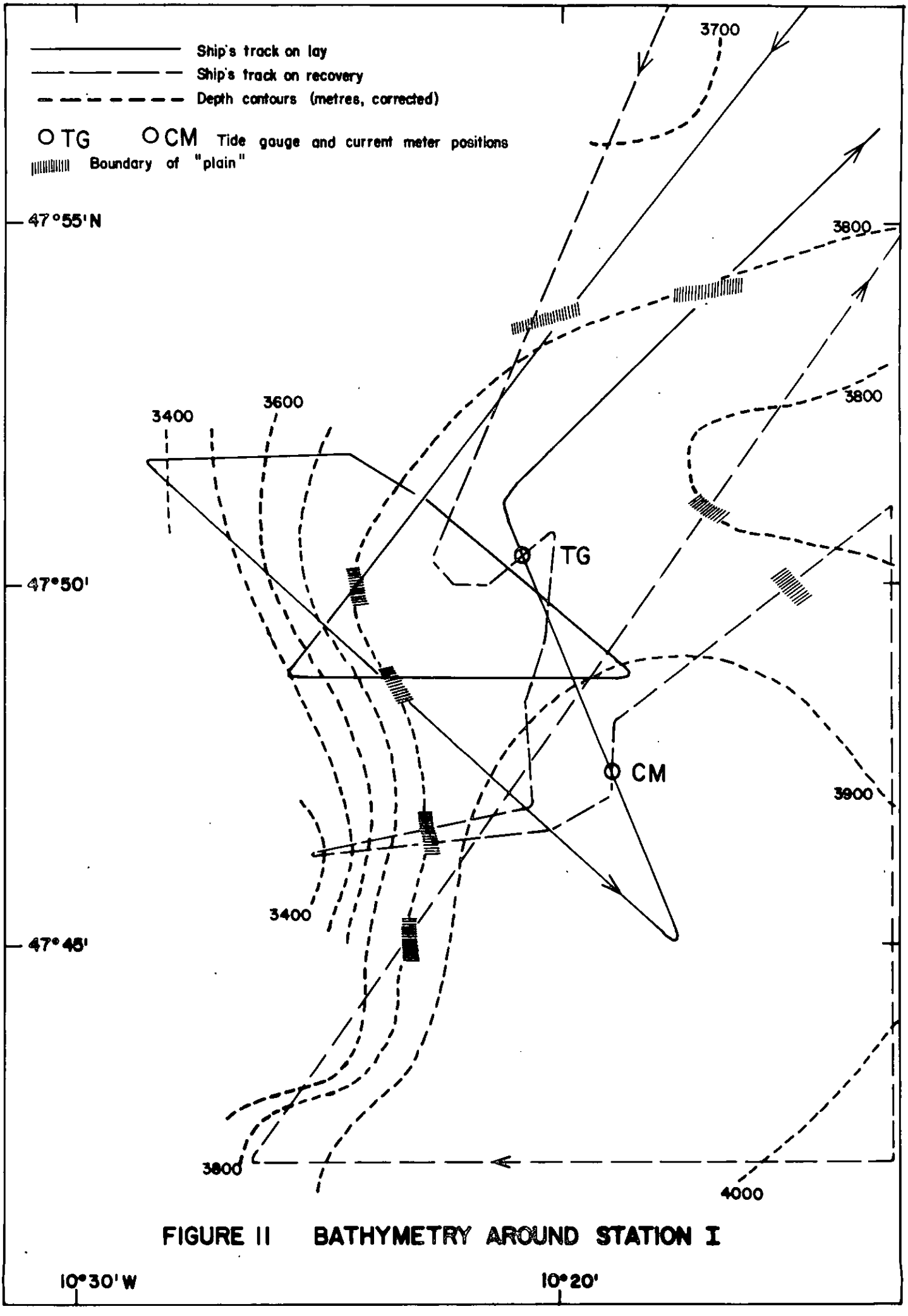


FIGURE II BATHYMETRY AROUND STATION I

CRUISE REPORTS

RRS DISCOVERY

CRUISE NO		REPORT NO
1	JUN - AUG 1963	1*
2	AUG - DEC 1963	2*
3	DEC 1963 - SEP 1964	3*
		NIO CR**
4	FEB - MAR 1965	4
TO	TO	TO
37	NOV - DEC 1970	37
38	JAN - APR 1971	41
39	APR - JUN 1971	40
40	JUN - JUL 1971	48
41	AUG - SEP 1971	45
42	SEP 1971	49
43	OCT - NOV 1971	47
44	DEC 1971	46
45	FEB - APR 1972	50
46	APR - MAY 1972	55
47	JUN - JUL 1972	52
48	JUL - AUG 1972	53
49	AUG - OCT 1972	57
50	OCT 1972	56
51	NOV - DEC 1972	54
52	FEB - MAR 1973	59
53	APR - JUN 1973	58
		IOS CR***
54	JUN - AUG 1973	2
55	SEP - OCT 1973	5
56	OCT - NOV 1973	4
57	NOV - DEC 1973	6
58	DEC 1973	4
59	FEB 1974	14
60	FEB - MAR 1974	8
61	MAR - MAY 1974	10
62	MAY - JUN 1974	11
63	JUN - JUL 1974	12
64	JUL - AUG 1974	13
65	AUG 1974	17
66	AUG - SEP 1974	20
68	NOV - DEC 1974	16
69	JAN - MAR 1975	51
73	JUL - AUG 1975	34
74/1+3	SEP - OCT 1975	35
74/2		33
75	OCT - NOV 1975	43
77	JUL - AUG 1976	46
78	SEP - OCT 1976	52
79	OCT - NOV 1976	54
82	MAR - MAY 1977	59
83	MAY - JUN 1977	61
84	JUN - JUL 1977	60
86	SEP 1977	57
87	OCT 1977	58
88	OCT - NOV 1977	65
89	NOV - DEC 1977	67
90	JAN - MAR 1978	68
91	MAR 1978	69
92	APR - MAY 1978	70

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