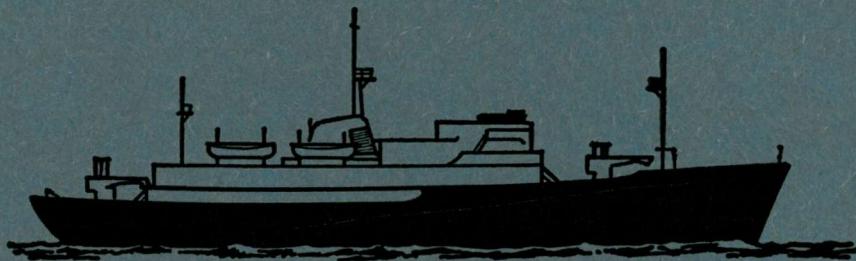


NATIONAL INSTITUTE OF OCEANOGRAPHY  
WORMLEY, GODALMING, SURREY



R. R. S. DISCOVERY  
CRUISE 22 REPORT

18th JUNE — 25th JULY 1968

TIDAL CURRENT ARRAY NEAR ST. KILDA

N. I. O. CRUISE REPORT No. 22  
(Issued November 1968)

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REPORT OF DISCOVERY CRUISE 22

Duration

18th June - 25 July 1968.

Area

Mostly on shelf edge near St. Kilda.

Scientific staff

(All N.I.O. staff except where indicated)

Both halves of cruise

D.E. Cartwright

Principal Scientist

D.I. Gaunt

Mrs. P. Edwards

C.A. Hunter

P.G. Ashbury

M.I. El Sabh

(U.N.E.S.C.O. Fellow, Institute of Oceanography  
Suez, U.A.R.)

A.J. Woods

(Kelvin-Hughes)

First half only (until 4 July)

N.H. Kenyon

C.H. Clayson

Second half only (after 6 July)

A.G.D. Watson

D.C. Boon

K. Birch

R. Soulsby

A.R. Stubbs, D.K. Fryer, and two engineers from English Electric Co., joined the cruise for the first 24 hours, on passage from Aberdeen to Stornoway.

Principal Objects

1. Tidal current array (Cartwright, Gaunt)

Part of a long-term project to study the tides on the edge of the Shelf N. and W. of Britain. A tide gauge had recently been installed in Village Bay, Hirta, (St. Kilda), as a convenient 'reference' for shorter term tidal records in the vicinity. A sea bed pressure sensor was still in course of preparation at N.I.O.; meanwhile the present study was to discover how much one can learn about tidal wave dynamics from measurements of current. To this end, 6 moorings were laid, each with sub-surface buoy and acoustic pop-up system bearing a Bergen current meter at 25m. and a Braincon current meter at 75m. from the bottom. The positions were at the corners of two adjacent 50km (27 mile) squares, Hirta being at the centre of the northern square. Each mooring was to remain for 28-30 days. In addition, current profiles were to be recorded halfhourly using the d.r.c.m., and tidal elevations measured by p.e.s., at an anchor station in the centre of the southern square, around spring tides for as many days as the weather permitted.

2. Asdic Survey (Kenyon - 1st half only)

Opportunity was taken wherever convenient to take Asdio records of the sea floor for geological study.

3. Measurements of vertical ship motion (Clayson - 1st half only)

A gyro-mounted accelerometer was placed at a position on the port side where a new controlled-velocity winch was to be installed eventually. Measurements were made in typical sea conditions in which the winch might be used, for use in design calculations.

4. Test of Spar Buoy (Watson Boon - 2nd half only)

A Spar Buoy, intended as a free-floating instrument carrier for air-sea interaction measurements, formed of two wooden poles projecting 30 feet above and below the water, supported by a submerged buoyant sphere and counter-balanced by a weighted free-flooding can at the bottom, was tested for launching ability, and general performance in waves.

4. In addition to the main programmes the shipborne wave recorder was switched on as the ship passed certain positions off the Scottish coast, for L. Draper's statistical work. Also, transparency (Secchi Disc) measurements were made when convenient, for Commander V.A. Lawford.

Narrative

'Discovery' sailed from Aberdeen as soon as possible after the "GLORIA" refit, on 18 June at 8h.

Since the six current meter moorings had to be left for 28-30 days before recovery, it was important to get to the area and start laying them immediately. In fact the first few days were notable for the number of delays caused by the ship's ordinary equipment being in a state of neglect. The Asdic plate took 5 hours to lower into position. The forward crane broke down for several hours due to foreign matter in the fuel tank. The after deck lights were found at midnight to be short-circuited so that work had to stop until daylight. Two hydrographic winches were found to have their traverses jammed and to be in a generally poor state of lubrication.

However, despite all this, and a necessary call at Stornoway on 19th June to drop various people, all six sub-surface moorings were laid and checked acoustically by 22 June, 10h, thanks to calm weather. The six positions were Station nos. 6723-6728 (see Station list for latitude and longitude), also referred to as 'Positions 1-6', for convenience. They were re-locatable without much difficulty by use of Radar bearings on the islands, and in some cases by Decca.

Each mooring was accompanied by an ordinary dahn buoy, brought specially for the purpose, moored separately at about 3 cables distance, in order to warn trawlers to avoid the moorings. (A 'Notice to Mariners' had been sent to 10 authorities responsible for broadcasting them, about a month previously). The dahn buoys were moored on hydrographic wire (depths 130-180m) according to standard practice, but by 26 June they had all vanished. One on 25 June, and one laid later at another station (6729) in the vicinity, were observed to have drifted rather easily, which might account for their loss, but vandalism by fishermen, of which there were always large numbers, is a strong possibility. Apart from vandalism, it is probable that the general rule for length of wire, '1.1 x actual depth', is too short for these small depths, unless a much heavier anchor is used.

Station 6729, near the centre of the southern square, was located on 22 June by steaming along the diagonal until the p.e.s. showed a very level bottom, then re-crossing the flattest part at 90° to locate the point of true local maximum depth. The Asdic record helped in showing the local rarity of rock outcrops in the basin of generally fine sand (sampled by grab). The reason for this requirement was so that the true tidal variation was measurable from the P.E.S. record with the ship

anchor, however much it swung. The depth at the final position chosen was 147m. Before anchoring, there being a moderate sea and swell, vertical motion records were taken by Clayson and Mrs. Edwards. A temperature profile was taken with the Bergen c/m, in absence of any more suitable equipment.

23 June was mostly spent in preparation for halfhourly current-profile measurements by d.r.c.m. For this purpose, about 500m of very old and corroded plastic coated wire was unwound from the smaller mid-ships winch and dumped. It was replaced by a similar length of black terylene cord, which was quite serviceable for handling the small weight of the d.r.c.m. etc. Another d.r.c.m. was suspended at constant 10m depth on the port side, but the supplementary information derived from it was found not to be very useful, so it was abandoned after the first few hours.

At 19h on 23 June the station had to be abandoned to take an injured engineer to hospital in Stornoway. The few serious measurements made during the day were of little value on their own, but the occasion was useful as a trial period, leading to improvement in later technique.

On the way to and from Stornoway, opportunity was taken to 'listen' to all six moorings acoustically as a check on positions and instrumental functioning. All were satisfactory, with no sign of drift.

When we finally returned to station 6729 on 26 June, the weather was too rough for re-commencing d.r.c.m. measurements, so after more vertical motion records, we decided to take a course out to Rockall and back for the purpose of p.e.s. and Asdic records required by Kenyon. A point about 2 miles east of the Rock was reached 0930 on 27 June. A Secchi Disc measurement there (transparency depth 15m) confirmed that small values of order 5m measured at station 6729 were due to a local opacity, not typical of the deep ocean. (Later Secchi Disc measurements at station 6729 showed that the opacity also varied in time - depths up to 10m being recorded towards the end of the cruise).

By 06h on 28 June we were back at station 6729 in calm conditions with anchor out - 7 shackles. The anchor held very firm on this and subsequent occasions, even in winds up to 25 knots. A fairly good series of halfhourly current profiles was started, but had to be stopped about midday of 29 June because rising sea made ship swing too much. The p.e.s. was kept going however, and provided a good 25 hour tidal record, when the trace was measured later with very great care.

30 June to 4 July were spent mostly in a tour of the six moorings for acoustic interrogation, followed by a devious course for Asdic records ending at Stornoway. All moorings were contacted successfully except

for no. 5. (Several hours were later spent in search of no. 5 mooring, on 7, 8, and 14 July. It was finally thought either to have been wrecked by a trawler or to have surfaced accidentally and drifted right out of the area). No. 2 mooring was behaving suspiciously, so was surfaced 2 July and re-layed immediately with a fresh acoustic system.

During the break at Stornoway, 4-6 July, the Spar-Buoy was loaded on the ship, having travelled by road from N.I.O. via two car ferries. During the second half of the cruise it was launched four times (10/7 at station 6729, 15/7 at Village Bay, St. Kilda, 17/7 at station 6730, and 22/7 at station 6725) for tests of its handling and behaviour in the sea. It was launched and recovered on the port side aft, using both the crane and the A-Frame. On the first and fourth launches it was damaged on recovery. On the first occasion, with a wind of 21-25 kt, with an anemometer at the top and while on a long line, the spar showed a mean tilt of  $16^{\circ}$  away from the wind. Useful records of the movements of the spar from a gyro unit with associated compass, accelerometers and inclinometers, were obtained on the first and third occasions.

'Discovery' left Stornoway 1330 on 6 July. After a further check on mooring no. 2 and another search for no. 5, we reached the station 6729 again and dropped anchor 07h on 8 July. There followed a prolonged continuous series of current profiles and tidal p.e.s. records lasting until 20h on 13th. The occasion was most suitable, since spring tides occurred on the 11th, and it was important to have the largest possible amplitudes in current and elevation in order to resolve them against various background errors. The weather was mostly very calm except for a period of about 12 hours on the 10th when the wind occasionally reached 22 knots. Swinging of the ship about its anchor was the greatest nuisance but this was moderated by use of the bow propellor. The spar buoy tests on the afternoon of the 10th were done simultaneously without interfering with the halfhourly current profiles. Since the spar broke in two on recovery, several days had to be spent on repair work before re-testing.

14 July was mostly spent in a final extensive search for mooring no. 5, including visual scanning of a wide area, and three drags with grappling hooks, as well as the usual acoustic listening.

On 15 July the ship anchored in Village Bay, St. Kilda, to enable the Principal Scientist to check his tide gauge installation near the jetty. Meanwhile, the spar buoy was tested without mishap in the partly sheltered conditions of the bay. The 16th and 17th were spent in another successful acoustic tour of moorings 1-4 and 6 and a further spar buoy test.

On 18 July we decided to start popping the moorings up, because although only the minimum of 28 days had elapsed for mooring no. 1, the weather maps showed a large depression in the West Atlantic which might have come our way. As it turned out, the weather stayed calm, with fog as the chief nuisance, but it took over 4 days to complete the recovery operation. Only moorings nos. 2 and 6 'popped up' on the appropriate signal. The 'Command Pingers' of nos. 1 and 4 were transmitting clearly, but their 'Acoustic Release' mechanism failed. Both had to be recovered by various sorts of drag lines. In the course of this, several grappling hooks and small anchors and over 3 km. of trawl warp were lost, because of the very rugged bottom. (No. 4 was finally recovered in rather a novel way, by trailing a loop of 6 mm. wire at mid depth with one end attached to a free floating buoy.) No trace of mooring no. 3 was heard despite an exhaustive search, even though it had been located clearly only 3 days previously. Trawlers were seen in large numbers around the site, and seem very likely to have caused the loss.

The ship left the area at 20h on 22 July and sailed directly to Plymouth via the Irish Sea, arriving on the 25th as per schedule.

#### Station list

Station no.	6723	58°01.8'N	8°09.0'W	(Position 1)
	6724	58°01.2'N	8°58.5'W	( " 2)
	6725	57°33.6'N	9°00.0'W	( " 3)
	6726	57°35.5'N	8°09.6'W	( " 4)
	6727	57°08.1'N	8°09.5'W	( " 5)
	6728	57°07.4'N	9°00.8'W	( " 6)
	6729	57°20.7'N	8°34.9'W	(Anchor)

#### Track chart

Positions 1-6 (above) define the corners of a rectangular S-shape of dimension 50 km EW x 100 km NS, with the St. Kilda island group in the upper half of the rectangle and station 6729 is in the centre of the lower half.

Most tracks were either to and fro between these stations, or following conventional coastal routes between them and Aberdeen, Stornoway, and Plymouth. The one exception was the straight pair of tracks between 6729 and Rockall Bank.

