Met.O. 786

# The Marine Observer

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# THE MARINE OBSERVER

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# Editorial

"Plymouth, Portland, Wight: wind southerly, force 3, veering south-west and increasing to force 6. Mainly fair at first, rain later. Visibility good." Wording such as this is not uncommon in the forecasts for coastal waters broadcast by the BBC and by GPO coast stations, even during summer; such an increase in wind force, although of little significance to an ocean-going ship, might well be dangerous to a small yacht or pleasure craft.

Statistics obtained from the Chief Inspector, H.M. Coastguard in the United Kingdom show that during the period from August 1965 to July 1966 the Coastguard handled about 3,000 incidents, of which about 450 were major incidents involving the larger type of yacht and pleasure craft, for which lifeboat and/or helicopter assistance was needed, and about 300 similar incidents involving small boats. During the same twelve-month period there were about 400 minor incidents involving the larger type of yacht and pleasure craft and about 300 minor incidents involving small boats.

The Royal National Lifeboat Institution states that during 1966 their rescue craft were launched on service more often than in any other year since the RNLI was founded in 1824. Reports show that during 1966 lifeboats were launched on service 1,044 times and saved 485 lives, while inshore rescue boats, fast inflatable boats first introduced in 1963, were launched 729 times and saved 328 lives—a grand total of 1,773 incidents. The previous busiest year was 1965 when there was a total of 1,501 incidents. Detailed figures for 1966 are not yet available but the RNLI Annual Report for 1965 shows that, during that year, 22·9% of all the services provided by lifeboats involved sailing yachts, sailing boats, motor cruisers, etc. and 13·5% involved small boats, canoes, rubber dinghies, etc; thus rescue services to pleasure boats of all kinds accounted for 36·4% of all the lifeboat activities during the year. Included in these total activities of the lifeboats are services to aircraft, the use of lifeboats for landing sick persons, help to bathers and people cut off by the tide and miscellaneous duties such as emergency relief of light-vessel crews. If one takes into consideration only the shipping incidents that required lifeboat assistance, the services provided to the above two categories of pleasure boats amount to 55·8% of the total, a very high percentage indeed.

The national interest which is being shown in yachting nowadays by all classes of the community and the large year-by-year increase in the number of small pleasure craft of all kinds is healthy and does show that the spirit of adventure is still alive. The annual increase in the number of people attending the Boat Shows is evidence of this; and there is little doubt that this national interest in small boats and yachting helps our export trade in this direction.

This growing interest in private boats is an international one. Figures provided by the U.S. authorities at a recent meeting of the World Meteorological Organization show that in the United States there are approximately eight million small boat owners and that nearly forty million people participate annually in recreational boating. The same document mentions, however, that during the year 1964 these small boat groups "experienced damage amounting to about 500,000 dollars and suffered the loss of 216 lives".

These figures, whether they be for the United Kingdom or the U.S.A., are alarming, to say the least of it. Although no figures are available to verify this, it seems reasonable to suppose that most of these 'pleasure boat' casualties occurred because of some deterioration in the weather. The U.S. document, referred to above, reminds us that "the turbulent sea exacts its devastating toll from the unwary" and goes on to say that "the recreational boatman with a suitable radio receiver will always have the latest weather information for his area" and that "small recreational craft . . . are sensitive to minor changes in certain weather conditions". These quotations not only apply to waters of the U.S.A.: they apply internationally and are very pertinent to the activities of small craft around our coasts of Britain.

Every time a lifeboat has to be launched in rough weather there is some element of danger to her crew or to the boat herself and it is certain that appreciable expense is incurred. Many of the incidents referred to in the above statistics have involved the use of helicopters of the Royal Air Force or Royal Navy for rescue services; during 1966 RAF helicopters alone took part in 530 coastwise rescue incidents, of which about 50% involved small pleasure craft. The cost of operating a helicopter is very high, to say nothing of the possible danger to her crew. H.M. Coastguards keep constant watch, both visual and radio-listening, from various stations sited strategically around the coast, particularly in bad weather, and have a co-ordinating duty in all incidents involving safety of shipping and boats around the coasts. Not infrequently they are called upon to provide breeches-buoy rescue to vessels in distress close inshore and this may well involve the Coastguards themselves in danger.

Venturing into the open sea in a small craft, whether she be propelled by oars, sail or motor, calls for at least some elementary skill in seamanship, navigation (including some knowledge about the tides) and common sense. Assuming that the craft is seaworthy and that her basic navigational equipment is adequate for the job, it should be an elementary duty of her owner to ensure that reasonable precautions are taken to provide for emergency for this is, after all, part of elementary seamanship. And these precautions are not only for the safety of himself and his companions but also for the sake of those who may be called upon to incur danger and expense in trying to rescue him if he gets into difficulties.

Nobody can call himself a seaman unless he is weather-conscious and shows due respect for the sea in all her moods. If we accept the fact that unexpected bad weather is the chief enemy of the small craft, then it is the duty of the individual in charge of the craft to keep himself well-informed as to present and future weather—particularly wind force and direction. Almost everybody jokes about the accuracy of the weather forecasts. The facts are that in general terms the forecasts of the weather over the British Isles as a whole, covering a 24-hour period, are about 70% correct. The weather-conscious sailor will listen to the forecasts and write down at least those parts which apply to the sea area in which he is interested. Then, in the light of the latest available present weather data, he will be able to form a picture of what the weather is doing and follow it through from forecast to forecast. Incidentally, the shorter the period ahead the more accurate the forecast and, as these forecasts are amended if necessary at 6-hourly intervals, the man who listens to each bulletin when it is broadcast will have before him a reasonably accurate and up-to-date picture of the existing and anticipated wind and weather conditions. R/T bulletins embodying the forecasts are broadcast on the BBC Light Programme (1500 m) four times a day between 0200 and 1800 and by GPO coastal stations at about 0800 and 2000. Consequently there is a maximum gap of six hours between about 2000 and 0200 during which no R/T bulletins are broadcast, although there is the television broadcast of wind and weather around the coasts at 2300. In addition, gale warnings may be broadcast at any time. Details of these services are given in Met. O. Leaflet No. 3, which is available free of charge to anybody who wants it.

In view of all the above facilities every small craft owner, before venturing afloat into the open sea, should be in possession of the latest forecast for the area in which he is going to operate. If in any doubt, he has only to 'phone the nearest meteorological office to get more up-to-date information and advice. If he is going far from land it is essential that he has a radio-receiving set on board so that he can keep up-to-date with the weather forecasts. Preferably the set should be able to receive, in addition to the BBC Light Programme on 1500 metres, the broadcasts from GPO coastal radio stations on the maritime R/T band. Portable radio-receiving sets, suitable for use in small craft and capable of receiving all these bulletins, can be bought for as little as £25; no one who can afford to own a boat has any excuse for not being provided with such a radio set. If bad weather is forecast the person in charge of a small craft would be wise to seek shelter and take special precautions in case the bad weather catches up with him in the meantime and he should also keep his eyes open for visible signs of approaching bad weather.

Before embarking on an off-shore cruise a little homework in elementary meteorology might well be useful to the small craft owner and he might find it helpful to study the existing and forecast weather situation two or three days before sailing. In this way he can form a picture of what the weather is doing and make maximum use of the forecasts he hears when at sea. (See the article "The Yachtsman and the Shipping Forecast Broadcast by the BBC" by E. F. Haylock in *The Marine Observer*, January 1966.)

The meteorologist can only give warnings about bad weather, he cannot stop it coming. The small craft owner should, therefore, always have available certain minimum emergency equipment for the safety of all aboard his craft and to help ease the job of those who have to look for him and render assistance if he gets into difficulties. During a visit to the 1967 Boat Show it was seen that there is a very wide range of emergency equipment available nowadays for use aboard small craft—at a relatively modest cost. If she ventures into the open sea it seems reasonable to suggest that the minimum emergency equipment that should be aboard such a vessel (in addition to essential navigational equipment and a radio receiver) should be as follows, the approximate minimum price being given in brackets after each item:

1 life-jacket for each person on board. (50*s*. each)
1 box of distress flares and parachute rockets. (£5)
1 lifebuoy. (£4)
1 lifebuoy light. (£3)
1 emergency radio transmitter, for distress purposes only. (£65)

Assuming the craft carries four people, this would make a total of about £90—not a very great expense when safety of life is concerned.

RAF Coastal Command (Search and Rescue) distributed a little pamphlet at the Boat Show entitled "Help us to Help You", an extract from which reads: "But too many put to sea without any real knowledge in the dangerous belief that boating is merely 'marine motoring'. To people like these, the sea can be merciless, even fatal. Help us to help you by following a few basic rules." It seems that one cannot end this Editorial in a better way than to list some of these basic rules in the hope that at least somebody will learn something from them.

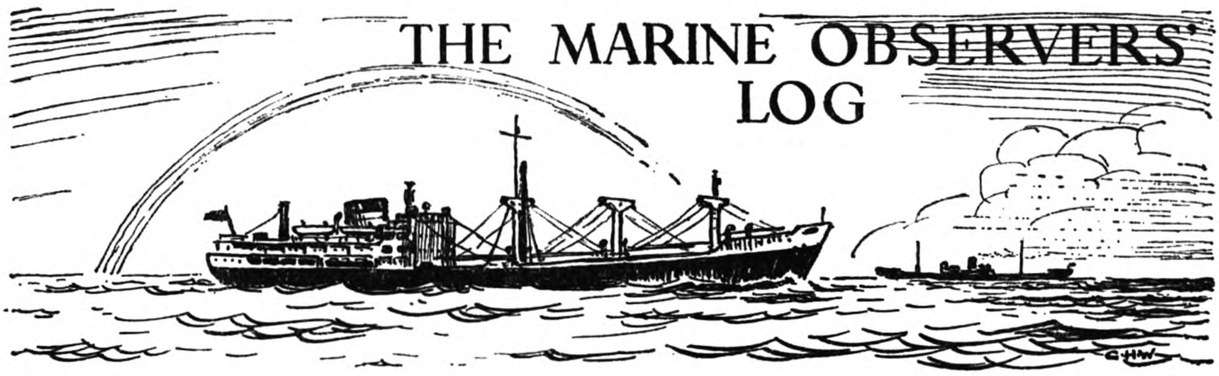
*The Marine Observer* is written primarily for the professional 'deep water' seaman—many of whom are, regrettably, not particularly good at small boat work. There is even reputed to be an incident when two Board of Trade Examiners of Masters and Mates—very experienced Master Mariners—chartered a small yacht for a weekend sailing trip up the east coast of England and got into difficulties fairly soon after sailing and had to be rescued! So we do not need to apologize for what is written here.

The basic rules written in the RAF pamphlet are as follows:

1. Take expert advice when buying a boat; follow this up with tuition on handling the craft; and learn about the sea and weather.
2. Equip your boat with proved and tested life-saving equipment, without any thought for economy. Be sure those life-jackets are instantly available and check them regularly.
3. Know the limitations of yourself, your crew, and your craft—and do not take boats designed for sheltered waters out on the open sea.
4. Be sure to carry a suitable anchor with sufficient warp or chain.
5. If the boat has no alternative means of propulsion, think of the result of engine failure or loss of sails. Don't rely on a tow home—you won't be on a main road.

6. Don't overload a boat—conditions can change rapidly with little warning.
7. Carry a good light to show to larger vessels after dark.
8. Know the tidal conditions (springs or neaps), currents, and likely weather before setting out.
9. Use the Meteorological Office and be a fanatic about listening to the BBC Shipping Forecasts.
10. Make use of the excellent U.K. port-to-port service offered by H.M. Coastguard. Before sailing inform the local Coastguard of your intended passage, including any possible diversions—and check-in with the Coastguard no matter where or when you arrive.

C. E. N. F.




# April, May, June

*The Marine Observers' Log* is a quarterly selection of observations of interest and value. The observations are derived from the logbooks of marine observers and from individual manuscripts. Responsibility for each observation rests with the contributor.

It sometimes happens that we are unable to offer an explanation for phenomena reported. In such cases we shall be very glad to hear from any reader who can put forward an authoritative or a possible explanation, which could be published in this journal. We should also be glad to hear from any reader who has witnessed a similar phenomenon in the past, but which had not previously been communicated to us.

## PASSAGE THROUGH FRONT

### North Atlantic Ocean

m.v. *Booker Venture*. Captain J. A. Carter. Greenock to Georgetown. Observers, the Master and Mr. E. J. Jones, Chief Officer.

23rd March 1966. At 2030 GMT a violent shift of wind was experienced, the direction changing suddenly from SE to NW. During the previous 8 hours the barometer had been falling steadily from 1018 to 1006 mb and there had been almost continuous moderate or heavy rain. Just before the shift of wind occurred a line squall was experienced with SE'ly winds of force 7–8; on coming out of the squall the wind about 3 miles ahead of the vessel was seen to be blowing strongly in the opposite direction.

On reaching this area, the change in direction was so abrupt that on the fo'c'sle head the wind was NW, force 6–7, while on the poop it was SE, force 5–6. The length of the vessel is 469 ft.

Position of ship: 30° 38'N, 39° 20'W.

## LARGE PRESSURE VARIATIONS

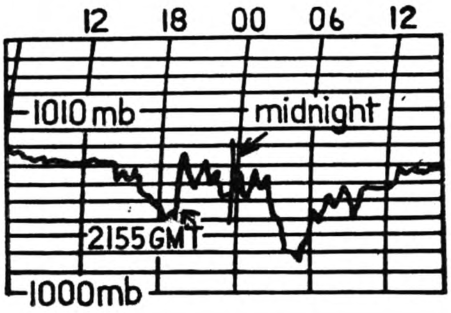
### Eastern Mediterranean Sea

m.v. *Glengarry*. Captain H. Owen. Suez to Genoa. Observers, Mr. J. A. C. MacGregor, 2nd Officer, Mr. P. M. Watt, 3rd Officer and Officer Cadet S.P.C. Saverimutto.

24th April 1966. At 2155 GMT the wind suddenly backed to SW'W, force 5, having previously been ENE, force 5, and the barograph simultaneously rose 3·8 mb. In the next hour and a half the following changes in direction and force were noted:

| | | |
|---|---|---|
| 2200: | Sudden veer to ENE, force 3. | Barograph falls. |
| 2206: | Sudden backing to SW'W, force 4. | Barograph rises. |
| 2214: | Sudden veer to ENE, force 4. | Barograph falls. |
| 2217: | Sudden backing to SW'W, force 4. | Barograph rises. |
| 2222: | Sudden veer to ENE, force 3. | Barograph falls. |
| 2227: | Sudden backing to SW'W, force 4. | Barograph rises. |
| 2230: | Sudden veer to ENE, force 3. | Barograph falls. |
| 2245: | Sudden backing to W'N, force 4. | Barograph rises. |
| 2250: | Sudden veer to N, force 3. | Barograph falls. |
| 2335: | Wind increases to N, force 5. | |

Position of ship: 33° 12'N, 27° 34'E.




*Note.* The synoptic weather chart for 00 GMT on 25th April, issued by the Meteorological Department of the United Arab Republic, shows that a slow moving occlusion, associated with a depression centred near Cairo, extended from El Alamein to 33°N, 25°E to about 34½°N, 21°E. The vessel, on course towards the Strait of Messina, was moving almost directly along the front. Since a front is seldom completely straight, the vessel was evidently crossing and recrossing from one side of the front to the other where slight bends occurred, thus accounting for the sudden wind shifts. The unstable air conditions at the front caused the numerous pressure changes seen in the accompanying barograph trace.

## DUST DEVIL

### Suez Canal

m.v. *Glengyle*. Captain J. K. Edmonds. Port Said to Suez. Observers, Mr. J. Carter, 2nd Officer and Mr. H. J. Jones, Officer Cadet.

22nd May 1966. A minor whirlwind was seen at 1030 GMT in the sandy region 3–4 miles SSW of El Cap Signal Station. It took the form of a column of sand, about 20 ft across, which was rotating clockwise and reached a height estimated to be about 100 ft. During the 10 min in which the whirlwind was observed it moved in a S'ly direction at a speed which varied between 2 and 10 kt. Air temp. 81°F, wet bulb 68·5°, dew point 61°. Wind N'E, force 2.

Position of ship: South of El Cap Signal Station.

*Note.* Intense heating of the desert sand causes convection currents to develop, resulting in the formation of small local areas of low pressure. Temperature differences also play a part—

in the present case a relatively cool N'ly wind was blowing from the Mediterranean. These influences, working together, can set up a rotary movement of the air in which sand is carried aloft to considerable heights.

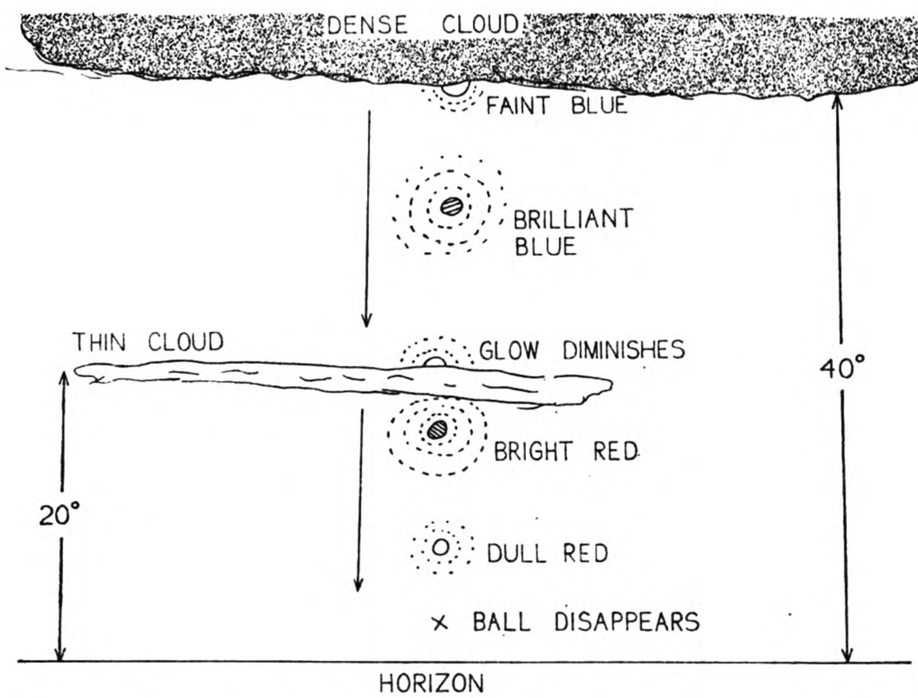
## BALL LIGHTNING

### off Victoria, S. Australia

s.s. *Suevic*. Captain G. S. Sheldon. Melbourne to Aden.

17th April 1966. When about 80 miles west of Cape Otway at about 0230 LMT a faint blue glow emerged from the underside of a layer of cloud whose base was at an elevation of 40° above the horizon. It was seen on a bearing of 320° from the ship. The glow brightened rapidly, becoming a ball of brilliant blue light as it fell. It dimmed as it passed behind a band of thin cloud but on reappearing it was seen as a ball of bright red light. The intensity of the colour diminished as the object fell and it disappeared when about 5° above the horizon. It was visible for 7 sec from first to last sighting. The sequence of events is shown in the accompanying diagram.

Position of ship at 1800 GMT on 16th: 37° 48′S, 135° 18′E.




*Note*. Dr. J. A. Chalmers, Department of Physics, University of Durham, considers that this is a most unusual example of this form of lightning.

## PROLONGED FOG

### Western North Atlantic

m.v. *Ripon*. Captain J. Parsloe. Seven Islands to Mumbles Roads. Observers, the Master and Mr. G. Hopkin, 2nd Officer.

25th–28th May 1966. The vessel entered fog on the 25th at 2100 SMT and finally cleared it on the 28th at 0900 SMT. The fog was thick and continuous for 60 hours. Air temp. varied between 37°F and 43°. Sea temp. in range 36°–43°.

Position of ship at 0000 GMT on 26th: 47° 00′N, 57° 36′W.

Position of ship at 1200 GMT on 28th: 48° 24′N, 44° 06′W.

*Note*. Our synoptic weather charts show that a very extensive area of fog covered the western North Atlantic on the 26th and 27th May. It was caused by the gradual movement of a rather warm, moist SW'ly air stream across the cooler sea, in typical wide 'warm sector' conditions.

## UNUSUAL SWELL

### Indian Ocean

m.v. *City of Johannesburg*. Captain L. R. Jones. Melbourne to Aden. Observers, Mr. K. L. Murray, Chief Officer, Mr. P. W. Jackson, 2nd Officer and Mr. P. M. Evans, 3rd Officer.

11th May 1966. Between 1100 and 1900 GMT an easterly swell of 7 sec period and 5 ft in height was experienced, causing the vessel to roll easily. There was also, at intervals, a heavy swell from SW's, the period being about 14 sec and the average height around 10 ft. This caused the vessel to roll heavily, taking water in the well decks at the extremity of the roll. From 1900 onwards the swell from SW's decreased to moderate. The wind was mainly SE'E, force 4, but after 1700 it backed slowly to E, force 4.

Position of ship at noon GMT: 15° 18'S, 77° 42'E.

*Note*. Tropical storms are liable to occur in southern latitudes of the Indian Ocean, especially in the period October to May, and the heavy swell from SW's—an unusual direction in this area—was probably caused by such a storm.

Unfortunately no synoptic weather maps are available for this part of the Indian Ocean and we can do no more than suggest the possible reason for the unusual swell experienced.

## DISTURBED WATER

### North Atlantic Ocean

s.s. *Mobil Apex*. Captain J. H. George. Lagos to Beaumont. Observers, Messrs G. A. Moffat and H. K. Hodgson, Deck Officers.

8th May 1966, 0900–1645 GMT. Numerous patches of confused sea and broken swell were observed. They lay in a general NW–SE direction and the average size was about 1000 yd wide and 2000 yd long. Within these confines the swell which was short and about 3 ft to 5 ft in height was completely broken up. There was also a slight to moderate sea raised by the prevailing NNE wind of force 3–4: the direction of the sea waves was reversed, giving the impression that the wind was blowing in the opposite direction. The peculiarities were the same in each of the disturbed patches. At the time, the vessel was traversing a submarine plateau shown on Admiralty Chart No. 3940.

Position of ship: 4° 33'N, 41° 37'W to 5° 21'N, 43° 35'W.

## TIDE RIPS: DISCOLOURED WATER

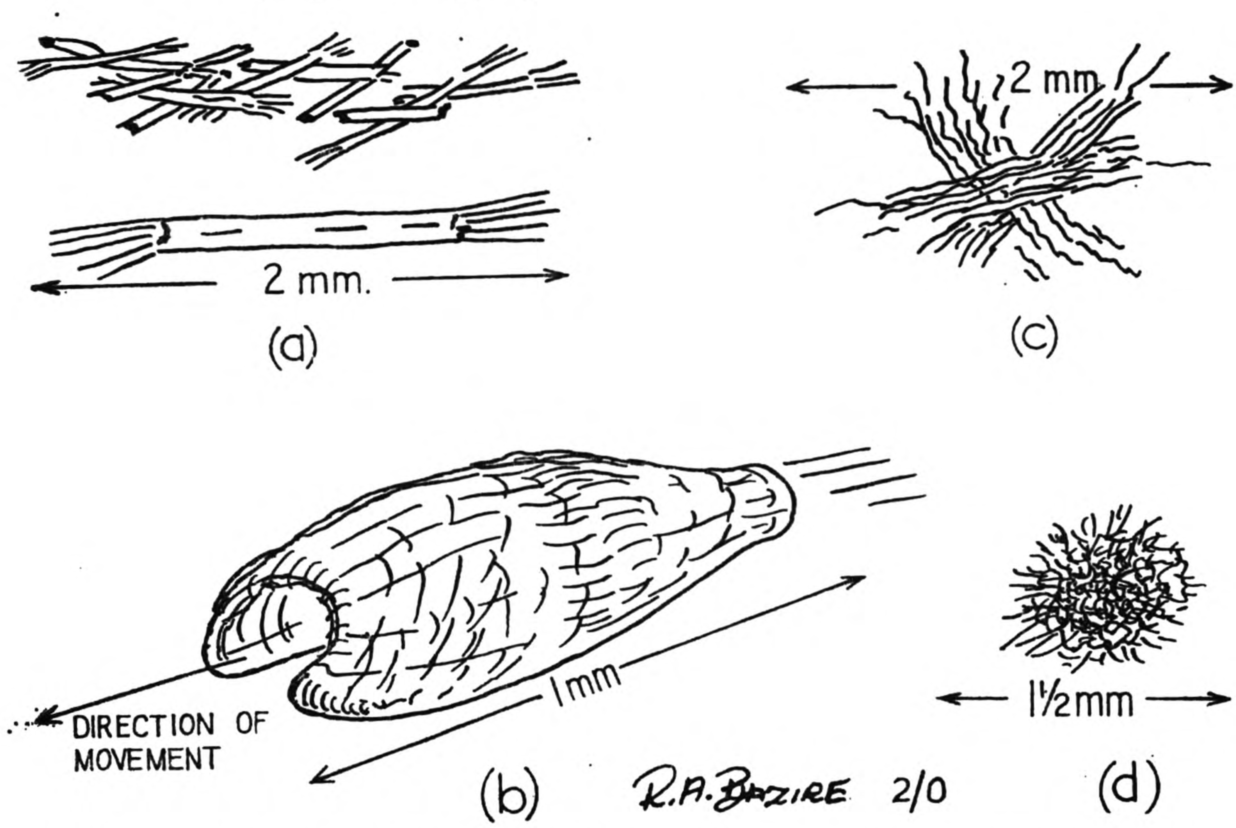
### Coral Sea

m.v. *Firbank*. Captain W. Watson. Mackay to the Tonga Islands. Observers, Mr. R. A. Bazire, 2nd Officer and Mr. D. Wilson, Radio Officer.

8th April 1966, 0400 GMT. Proceeding at 14 kt on course 092°, the vessel crossed strong tide rips lying in a N–S direction for a distance of about a mile. In the rips the sea was confused and breaking although the wind was very light. The breaking waves were at least 3 ft high and they could be seen 7 miles away. The ship at the time was 45 miles due south of the Great Barrier Reef. Strong tidal effects were experienced inside the Reef, and outside it a strong southerly set was found.

On each side of the rips referred to there were wide continuous bands of a sand-coloured substance, presumed to be plankton, lying in the same N–S direction as the rips, which were so dense at times that they prevented the vessel's wake from breaking. The sea for some 5 miles on either side of the bands was covered to a lesser extent. A few samples were obtained in the sea temperature bucket and poured into a glass for examination, but attempts to isolate some of the tiny organisms for sample purposes gave poor results. One of the observers, however, has tried to make a few rough drawings, using an improvised microscope made from two lenses from the ship's telescope.

Wind w'ly, force 1. Sea rippled (out of the disturbed water). Sea temp. 81°F. Position of ship: 23° 00's, 153° 05'w.




(a) Numerous, floating, sand-coloured with no movement. (b) One only: yellow-green, continuous movement at a brisk pace, always the same end leading. (c) Mass of loosely-knit filaments, sand-coloured. Few, all suspended in water drifting in convection currents. (d) Two only: solid core surrounded by fine filaments. Sand-coloured. Drifting in convection currents.

*Note.* Dr. T. J. Hart of the National Institute of Oceanography comments:

"The observer is to be congratulated on his sketches which are identifiable down to groups except for (b) which is a little doubtful. One cannot hope to see accurate detail without much higher magnifications than his improvised optics would provide. Observers should not be discouraged because a sample appears to contain little more than clear sea water. Provided that preservatives have been added, we can nearly always concentrate it sufficiently with the centrifuge to show up the dominant species, using full shore laboratory facilities (i.e. a good research microscope giving magnifications of roughly ×80→×450→×1000). Of course it is not practicable to use such gear at sea except on a few of the world's larger research ships.

"Sketches (a) and (c) would seem to be rafted *Trichodesmium* colonies, probably the main cause of the discoloration. Sketch (b) could be the larva of a polychoete worm and (d) looks to me like one of the larger colonial radiolaria, quite possibly *Coelodendron wapiticornis*, a name to conjure with!"

## INTERTROPICAL CONVERGENCE ZONE

### off North Senegal coast

m.v. *Richmond Castle*. Captain H. M. Walden. Las Palmas to Port Elizabeth. Observers, the Master, Mr. A. G. Dick, 3rd Officer and Cadet J. Strecker.

19th June 1966. An area of disturbed water was seen at 0845 GMT, two points on the port bow and half a mile away. A lot of spray was being thrown about in this disturbed patch which was apparently moving in a w'ly direction at about 10 kt. When the vessel passed through the area of the disturbance estimated to cover about a square mile, the wind shifted from NNE to E's and increased from force 3–4 to force 8. A few minutes later the vessel encountered another similar disturbed area. The barogram showed a sudden almost vertical rise of about 2·2 mb at this time.

After the disturbance passed, the wind became variable both in direction and force, but it finally settled at SW's, force 3 by 1100.

Position of ship: 17° 15'N, 17° 46'W.

*Note*. This is an interesting observation as it suggests very strongly that the vessel was passing through the Intertropical Convergence Zone when the disturbances were observed. The ITC is normally found in this approximate latitude off W. Africa in June. Strictly, it is the zone in which the NE Trades and SE Trades meet but, more broadly, it is the region where winds having a N'ly component meet winds with a S'ly component. The interaction of these air streams of different characteristics is the cause of local squalls and unsettled conditions.

## LARGE SEA TEMPERATURE CHANGES

### Western North Atlantic Ocean

m.v. *Dartwood*. Captain J. Elliott. Houston to Botwood. Observer, Mr. W. F. Whiting, 2nd Officer.

18th April 1966. The following variations in the sea surface temperature, as taken by rubber bucket, were noticed during the day. At 0000 GMT, 69·2°F; at 0600, 43·8°; at 1200, 53·1°; at 1800, 73·2°. There was thus a drop of 25·4° between midnight and 0600 and a rise of 29·4° between 0600 and 1800.

Position of ship at 0600: 36° 24'N, 72° 12'W.

Position of ship at 1800: 37° 48'N, 69° 48'W.

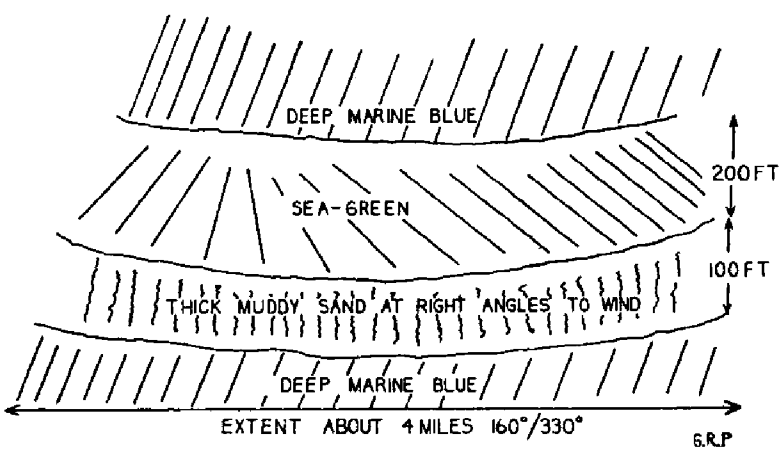
*Note*. The vessel was on the northern edge of the Gulf Stream. Just to the north of this there is a wide zone in which there is normally a large decrease of mean sea temperature with increasing latitude. In the present case the observations indicate that between 00 and 12 GMT the vessel passed through a tongue of cold water which was unusually far south for the month of April. Between 06 and 18 GMT an area was traversed in which the warm water of the Gulf Stream extended farther north than is normal.

## DISCOLOURED WATER

### Red Sea

H.M.T.S. *Monarch*. Captain O. R. Bates, O.B.E. Suez to Djibouti. Observers, the Master, Mr. G. R. Plummer, 4th Officer and Mr. J. Watson, Q.M.

7th May 1966, 0750 GMT. When 37 miles SE of Daedalus Reef a line of discoloured water was seen running along the port side, roughly in line with the ship's course, for approximately 4 miles. The general colour of the sea close to the vessel was a deep marine blue; farther away there was a band of sandy, mud-coloured water about 100 ft wide, lying in streaks at 90° to the wind. Next to this, lay a 200 ft wide band of sea-green water, on the far side of which was the normal deep blue colour of the sea.



The vessel was turned to run through the area and the sea temperature was found to be 78°F, one degree below the reading taken at 0600. Wind NW, force 3–4. Course 151°, speed 12·5 kt. Charted depth 600 fm.
Position of ship: 24° 30′N, 36° 25′E.

*Note.* Dr. T. J. Hart of the National Institute of Oceanography comments:
"This was an exceptionally concentrated algal bloom, almost certainly of *Trichodesmium erythraeum*, in which microscopic blue-green plankton alga has proved to be the dominant form in all samples from the Red Sea that I have been able to examine so far. The present R.R.S. *Discovery* made extensive observations on a bloom very near to this position on her voyage out to the Indian Ocean a few years ago. The bloom consisted almost entirely of the species mentioned. The 4th Officer's sketch strongly suggests that the banding was due to advection currents in the surface water layers as observed from R.R.S. *Discovery*.

## UNIDENTIFIED PHENOMENA

### North Atlantic Ocean

m.v. *Loch Loyal.* Captain G. Meldrum. Rotterdam to Cristobal. Observers, Mr. G. Coombe, 2nd Officer and Mr. M. Smith, Lookout.
5th May 1966. The weather at 0535 GMT was bright and clear with the moon overhead; the sea was slight and there was swell about 6–7 ft in height coming from SE′E. About ½ mile ahead of the ship the sea became very disturbed and the colour of the water changed rapidly from a medium blue to an extremely dark brown. At first the disturbance was no more than about 100 ft across, but the disturbed area increased very rapidly until finally it was about 1 mile wide by ¾ mile long. The surface appeared to be bubbling and it looked as if an underwater explosion had occurred. As the ship entered the area the disturbance died down and the bow wave rippled across the surface as though passing through very shallow water. A certain dragging effect was felt and on closer inspection the water seemed to be contaminated with a thick, dark brown sediment which, in the opinion of the observers, was neither weed nor oil. No noises or bumps were heard or felt, neither was there any divergence from course. The magnetic compasses were unaffected. Wind E′S, force 3–4. Sea temp. 76°F.
Position of ship: 23° 40′N, 58° 05′W.

*Note.* This observation was forwarded to Dr. L. H. N. Cooper of the Marine Biological Association of the United Kingdom at Plymouth.

## BIRD MIGRATION

### Peruvian waters

m.v. *Shropshire.* Captain T. Cooper, D.S.C. Callao to Matarani. Observers, the Master, Mr. D. Jones, Chief Officer, Mr. T. Hughes, 3rd Officer, Mr. M. Jones, 4th Officer and Cadet D. Flavin.
3rd April 1966. At 1530 GMT a long dark-brown line was observed just below the horizon line. Ten minutes later this was seen to be a very large formation of brown cormorant-type of birds flying south at heights of between 1 ft and 20 ft above the sea.
On approaching the ship the leaders of the formation flew across the bow but must have realized that they would not all pass across, so they turned back and flew due east.
Within seconds the ship was surrounded by the birds and, although there were literally thousands of them, not one attempted to fly over the vessel. After about 3 min the formation cleared the ship and then started turning due south again. On the radar the formation measured approximately 1 mile in length by ½ mile in


width. The echo had the appearance shown in the accompanying sketch. Wind SE'ly force 3. Sky cloudless. Visibility very good. Course 144°. Speed 15 kt.

Position of ship: 14° 22'S, 76° 15'W.

*Note.* This interesting observation was forwarded to the Royal Naval Birdwatching Society.

## FLYING FISH

### South China Sea

m.v. *Benarty*. Captain C. Donnelly. Hong Kong to Singapore. Observer, Mr. J. Edgar, 2nd Officer.

28th May 1966. Large numbers of flying fish were seen emerging from the ship's bow wave. They were attacked by eight birds which appeared to be of the cormorant type, having a hooked bill, white feathers with grey-brown running through them and a wing span of about 3½ ft. The birds dived down from a height of about 30 ft above the ship's rail and, levelling off some 3 to 12 inches from the sea surface, they caught the flying fish as they came out of the bow wave. When they could not catch the fish in flight, the birds dived straight into the sea after them. Between 0730 and 0800, 40 to 50 fish were seen to be caught, the birds alighting on the sea surface to eat their victims. Soon after, they flew off apparently well satisfied. Sea temp. 85°F.

Position of ship: 16° 13'N, 113° 12'E.

## GULF WEED

### North Atlantic Ocean

m.v. *Rangitoto*. Captain L. W. Fulcher. Tilbury to Curaçao. Observers, the Master and Mr. M. C. Payze, 3rd Officer.

7th–9th April 1966. Large quantities of gulf weed were seen between the positions shown below. On the 8th, the amount was so great that, with a force 3 wind blowing, the weed produced a lee of about 6 ft wide, something which had not previously been seen by any of the ship's observers. The top of the weed seemed to be growing to a height of about 3 or 4 inches above the sea in the centre of the larger patches. Sea temp. 69°F, rising to 79°.

Position of ship at noon on 7th: 30° 25'N, 38° 25'W.
Position of ship at noon on 8th: 26° 31'N, 44° 40'W.
Position of ship at noon on 9th: 23° 05'N, 51° 03'W.

## LUMINESCENCE

### Indian Ocean

s.s. *Manipur*. Captain W. H. Hicks. Mukalla to the Seychelles. Observers, Mr. B. Shawcross, 2nd Officer, Mr. T. R. Scarrott, 3rd Officer and Mr. H. McNeil, Q.M.

13th April 1966. Small bluish-green patches of luminescence about 6 inches in diameter, also others of the same colour about 2 to 3 ft in diameter, were seen at 1800 GMT close to the ship. When the Aldis lamp (60W) was shone on these they disappeared. However, during experiments with the Aldis, another type of luminescence appeared, in the form of tiny golden dots which flickered on and off as the lamp was trained on them. This type disappeared immediately the light was switched off. Sea temp. 86°F. Wind E'ly, force 3.

Position of ship: 7° 50'N, 52° 25'E.

## ABNORMAL REFRACTION

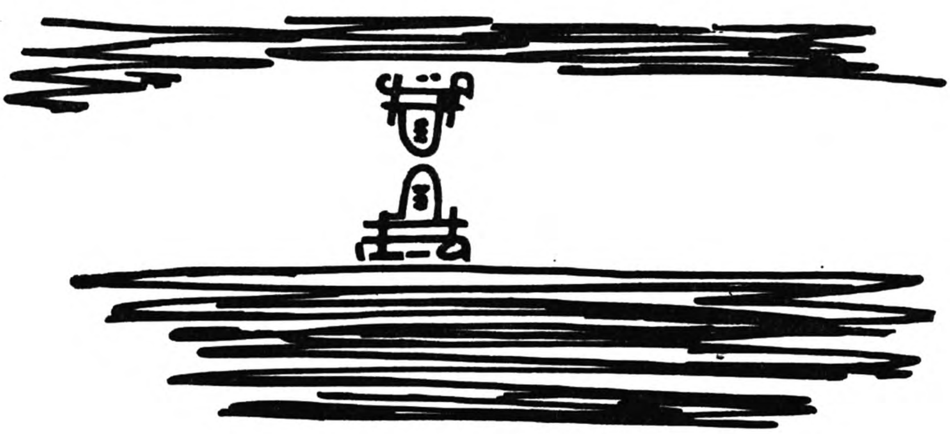
### off Cape of Good Hope

m.v. *Clan Macnair*. Captain C. C. Atkinson. Lobito Bay to Durban. Observers, Mr. S. M. Grant, Chief Officer, Mr. M. J. Kemp, 2nd Officer and Mr. I. W. Ferguson, 3rd Officer.

21st April 1966. Approaching the Cape of Good Hope, visibility was exceptionally good, Table Mountain being sighted at 80 miles. However, on closing the land in the vicinity of Table Bay at about 0830 GMT, the coast was seen to be obscured by a layer of fog, estimated at 300–400 ft in thickness. Off shore the fog had lifted off the water and was estimated to be at a height of about 300 ft.

At about 0930 a vessel was seen to leave Table Bay and set course for the Cape of Good Hope; at this time, although the coast was obscured by fog, visibility to seaward was still excellent and the vessel remained in sight until about 1020 GMT when she slipped below the horizon, bearing approximately 180° at a range of about 16 miles. Half an hour later the funnel and upperworks of the same vessel came into view again above the horizon, accompanied by an inverted image as shown in the accompanying sketch. The mirage lasted for approximately 20 min. Air temp. 66°F, sea 64°. Wind SE, force 1–2.

Position of ship: 6 miles WSW of Duiker Point.




*Note.* The presence of the fog bank and the layer of low stratus are indications that there was a temperature inversion over the area or, in other words, that the temperature increased with height above the surface up to the top of the low cloud layer. The temperature readings at the ship also show that the air was warmer than the sea beneath it. This kind of temperature distribution causes the rays of light from an object out of sight beyond the horizon to follow more or less the curvature of the earth, thereby making it visible to the observer. The warm air over the cold sea also favours the formation of the inverted image which was seen. In such conditions the light rays from an object suffer unequal amounts of refraction and when they cross each other they give rise to an inverted image of the original, as do rays of light passing through a camera lens.

## BROCKEN SPECTRE

### New Zealand waters

m.v. *Cornwall*. Captain G. W. McCathie. Suva to Lyttelton. Observers Mr. M. R. Doyland, 3rd Officer, Mr. R. P. Irving, Junior 3rd Officer and Mr. R. Payn, Apprentice.

17th February 1966. Whilst navigating in fog prior to making a landfall off Cape Reinga, with the sun rising on the port quarter, a coloured bow was observed about 40 ft in diameter extending apparently from the sides of the ship. When the observers leaned on the bridge wing rail their shadows were projected on to the surface and these, too, had a small coloured bow around them, about 2 ft in diameter. The inside colour of the bows was white with colours on the outside but fainter.

Air temp. 70·9°F, wet bulb 70·9°. Wind ENE, force 2.

Position of ship: 34° 05′S, 172° 44′E.

*Note.* This phenomenon was first noted on the Brocken mountain in Germany and it is most common in Arctic conditions where it is seen on every occasion of simultaneous sunshine and fog. The coloured rings are now usually known as a 'glory'. A typical series of colours seen in a well-formed one is as follows. There is a general whitish-yellow colour around the shadow, surrounded by rings of colour in order outwards: dull red, bluish-green, reddish-violet, blue, green, red, green, red. A white rainbow at a considerable distance outside the glory is sometimes also seen.

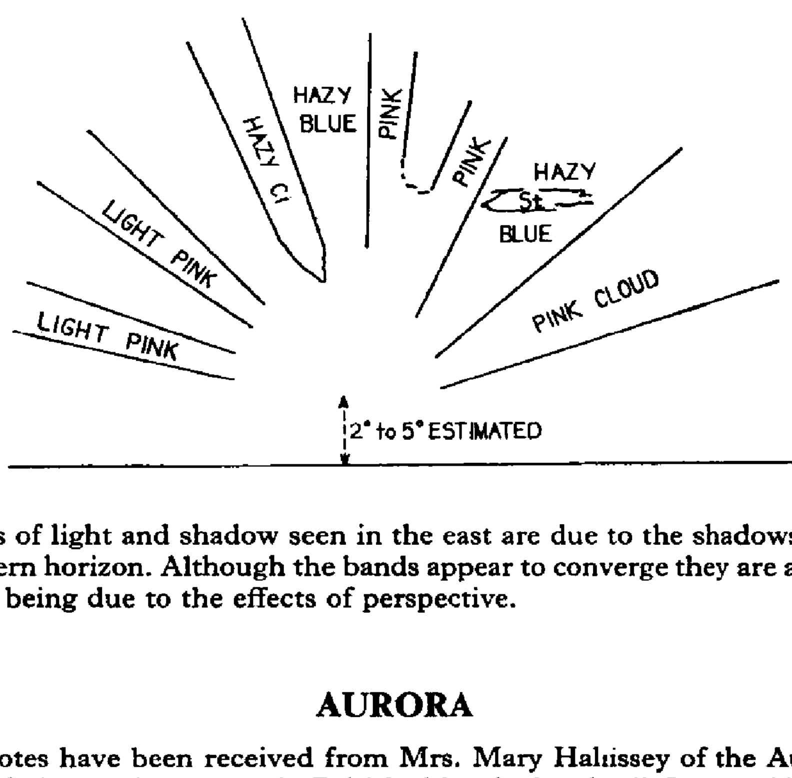
## CREPUSCULAR RAYS

### off Maceió, S. America

R.R.S. *Shackleton.* Captain D. H. Turnbull. Montevideo to Southampton. Observers, the Master and Mr. M. J. Cole, Chief Officer.

26th April 1966. At 2015 GMT, just after sunset, rays of light were seen in the eastern sky emanating from a bearing opposite to that of the sun. The point from which the rays issued rose above the horizon at the same rate as the sun descended below it. The display was seen for 15 min. Cloud, 6/8 very light high Ci, and ⅛ Cu over land about 15 miles to the west.

Position of ship: 9° 30′S, 35° 20′W.




*Note.* The bands of light and shadow seen in the east are due to the shadows cast by clouds beyond the western horizon. Although the bands appear to converge they are actually parallel, the convergence being due to the effects of perspective.

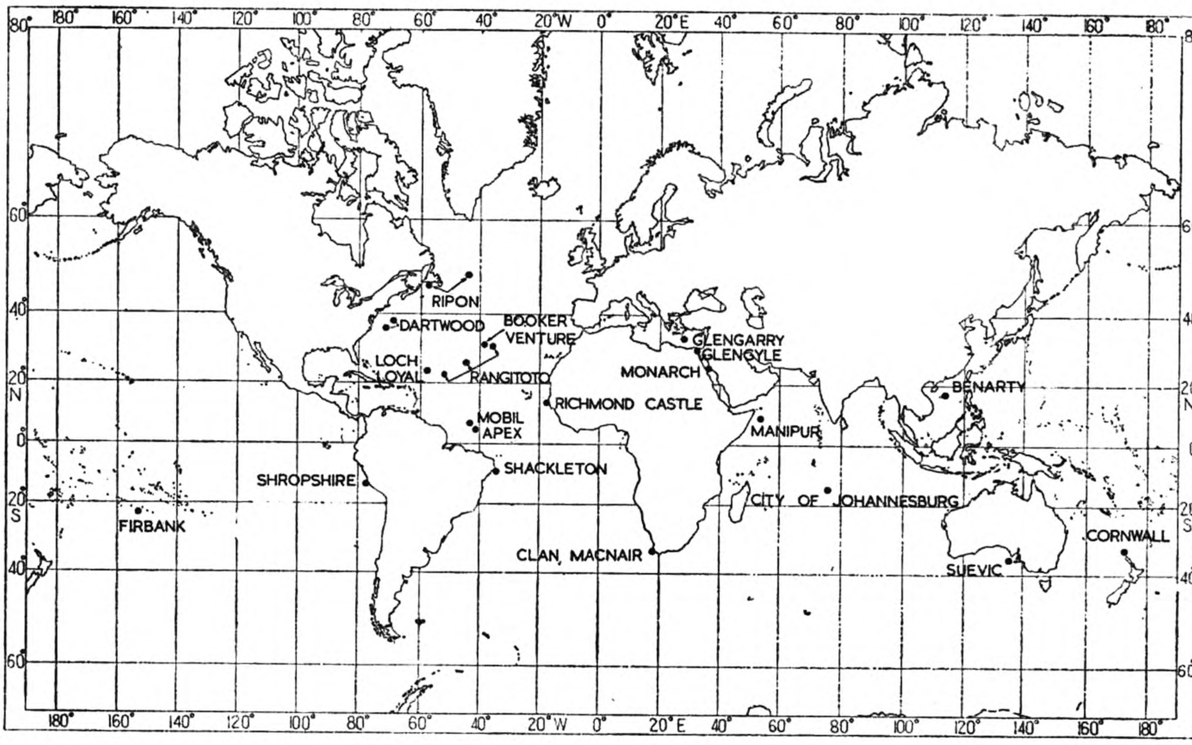
## AURORA

The following notes have been received from Mrs. Mary Hallissey of the Aurora Survey:

"Visual auroral observations made in British ships during April–June 1966, and a recently received one for March, are noted briefly in the accompanying list. We note with appreciation more new names—*St. Margaret*, *Sea Captain* and *Ramon de Larrinaga.* There are understandably few reports due to lack of darkness in latitudes where aurora may be observed and to the fact that there were only two periods of slightly increased geomagnetic activity during these months (26th and 31st May). Although the sunspot chart shows a decided upward trend, there is still no marked increase in auroral activity.

"The report from *Sea Captain* when the ship was off the west coast of India does not refer to aurora, but at the moment we cannot offer an explanation.

"Reports of noctilucent cloud observations began to come in during this period and it was thought that the observation made on the night of 16th–17th June by observers in *Ramon de*




Position of ships whose reports appear in "The Marine Observers' Log".

*Larrinaga*, positioned in the Mediterranean, referred to noctilucent cloud. Two other reports—from an observer in Gozo, Malta, and from the captain of a B.O.A.C. aircraft over Greece—gave identical times and details and it seemed likely that a new southern extent for the clouds could be charted. A check on rocket firings showed that none had been fired on the night; but, just as the data were about to be sent to the printers, a further 'phone call shattered all illusions. A rocket had in fact been fired from Sardinia at the time of the reports, releasing at great height a cloud of barium.* This noctilucent cloud was a local product!

"We are most grateful to all involved in providing us at the Balfour Stewart Auroral Laboratory, The University, Drummond Street, Edinburgh 8, with reports of aurora and noctilucent cloud, whether identified or only suspected, and hope you will continue to help us in our work of accumulating all possible data."

| Date (1966) | Ship | Geographic Position | $\Lambda$ | $\Phi$ | I | Time (GMT) | Forms |
|---|---|---|---|---|---|---|---|
| 14th Mar. | *Lismoria* | 47°00'N 41°20'W | 040 | 57 | +69 | 0430–0530 | HA, N |
| 4th Apr. | *St. Margaret* | 68°55'N 14°11'E | 110 | 67 | +77 | 2045 | HB, RA |
| 7th | *Ross Leonis* | 68°45'N 13°40'E | 110 | 67 | +77 | 2350–0010 | HA |
| 14th | *Cape Howe* | 49°05'N 63°30'W | 010 | 61 | +74 | 0430–0700 | HA, HB, R |
| 24th | *Weather Surveyor* | 59°00'N 18°10'W | 070 | 65 | +72 | 2350 | N |
| 25th | *Weather Surveyor* | 58°50'N 18°50'W | 070 | 65 | +72 | 2350 | N |
| 26th | *Weather Surveyor* | 59°00'N 18°40'W | 070 | 65 | +72 | 0250 | N |
| 25th May | *Manchester Regiment* | 50°40'N 34°15'W | 050 | 59 | +69 | 2355–0010 | N |

Key: $\Lambda$ = geomagnetic longitude; $\Phi$ = geomagnetic latitude; I = inclination; HA = homogeneous arc; HB = homogeneous band; RA = rayed arc; R = ray; N = unidentified auroral form.

## REMINDER

Observing officers are reminded of the amended Ships' Meteorological Code which comes into force at 0000 GMT on 1st January 1968.

These changes were promulgated in an article in the January 1967 number of *The Marine Observer* and reprints of the article are available from any Port Meteorological Officer in the U.K.

* See the article on p. 74.

551.507.23: 523.9

# Comet Ikeya-Seki 1965 f

By H. B. RIDLEY, F.R.A.S.
(Director of the Meteor Section, British Astronomical Association)

This comet was discovered independently by two Japanese observers, K. Ikeya and T. Seki, on 18th September 1965. At that time it was an eighth-magnitude object, a round fuzzy patch of light near the star Alpha Hydrae. It eventually became one of the most brilliant comets of this century, possibly unexcelled since the Great Comet of 1882. Unfortunately the circumstances of its apparition were such that it was never possible to see it in its full splendour but, even so, it was a memorable sight for those well placed to see it; for those situated north of about latitude 35°N it was a source of disappointment and frustration.

As soon as a preliminary orbit for the comet had been computed it became apparent that it was going to be a spectacular object—it was, in fact, a 'Sun-grazer'. This name derives from the fact that comets occasionally swing round the Sun so closely that they practically collide with it. Russian astronomers were at first of the opinion that Ikeya-Seki would plunge into the Sun, but the American prediction of a very close passage proved to be correct. In the event, the comet at its nearest approach was only 290,000 miles above the photosphere and it ploughed through the inner corona at a velocity approaching 500 km/sec (112,500 m.p.h.), swinging through an arc of 250° in six hours.

Another interesting fact that emerged from a study of the orbital elements was that this comet was one more of a well-known 'family' of Sun-grazing objects of which the comet of 1882, mentioned above, was also a member. The following table lists the orbital elements of the known members of this group; their mutual similarity is clearly shown, particularly in the co-ordinates of the direction of aphelion (λ, β)—the point of the orbit farthest from the Sun and therefore the direction from which the comet appears to come.

**Table 1**

**The Sun-grazing family of Comets**

| Comet | $T$ | $q$ | $\omega$ | $\Omega$ | $i$ | $\lambda$ | $\beta$ | $H_{10}$ |
|---|---|---|---|---|---|---|---|---|
| | | | ° | ° | ° | ° | ° | |
| 1668 | Feb. 28 | 0·0666 | 110 | 359 | 144 | 102 | -55 | 6·0 |
| 1843 I | Feb. 27 | 0·0055 | 83 | 1 | 144 | 101 | -55 | 4·9 |
| 1880 I | Jan. 28 | 0·0055 | 86 | 6 | 145 | 101 | -55 | 7·1–8·9 |
| 1882 II | Sept. 17 | 0·0078 | 70 | 344 | 142 | 102 | -55 | 0·8 |
| 1887 I | Jan. 11 | 0·0097 | 58 | 324 | 128 | 102 | -52 | 6·3 |
| 1945 VII | Dec. 28 | 0·0063 | 51 | 322 | 137 | 100 | -58 | 10·8 |
| 1963 V | Aug. 24 | 0·0054 | 85 | 6 | 144 | 101 | -55 | 5·5 |
| 1965 f | Oct. 21 | 0·0077 | 69 | 346 | 142 | 102 | -55 | 6·5 |
| | | 0·0046 = Radius of the Sun in a.u. | | | | | | |

$T$ = Date of perihelion passage.
$q$ = Perihelion distance in a.u.
$\omega$ = Argument of perihelion.*
$\Omega$ = Longitude of ascending node.
$i$ = Inclination of plane of orbit to ecliptic.
$\lambda$, $\beta$ = Heliocentric longitude and latitude of aphelion.
$H_{10}$ = Stellar magnitude at standard distance.
1 a.u. = 1 astronomical unit = 93,000,000 miles.

* See *Note 2* on p. 70.

The tail of a comet is not generated until it approaches the Sun to a distance of the order of one hundred million miles or so, and the closer the approach the greater the development of the tail. This is because the tail material is released from the head of the comet, and repelled into space, by the pressure of electro-magnetic and corpuscular radiation from the Sun, and of course the nearer the Sun the more intense is the radiation. It follows that the Sun-grazing comets will be characterized by the possession of immense bright tails; in the present case the tail stretched away from the Sun to a distance of about 75 million miles.

When the comet passed its perihelion point (nearest to Sun) on 21st October 1965 its brightness reached a stellar magnitude of somewhere between −8 and −10; this may be compared with Sirius (−1·5), Jupiter (−2·2) and Venus at its brightest (−4·4). The comet was visible in the daytime sky, a degree or two from the Sun, but of course its brilliance was largely drowned by the glare of the latter.

The Sun-grazing comets, when at perihelion, are subjected to tremendous disruptive gravitational and radiation forces and it is not surprising that many of them have broken up as a result. The head of the Great Comet of 1882 showed four or more distinct condensations after its perihelion passage, and as soon as Ikeya-Seki could be observed in a reasonably dark sky it was found that the head had split in two. The orbital similarity of this comet family tempts the speculation that they may all have been derived from the break-up of a single giant ancestor as the result of a close solar approach in the remote past.

Once the comet began to recede from the Sun it was visible in the dawn sky as a splendid object, the beautifully curved tail extending for as much as 30°. It moved through Virgo, Corvus and Hydra and on into Antlia and Puppis towards the end of November, by which time it had once more become a telescopic object. We shall never see it again but our distant descendants might, for although the period of revolution is not accurately known at the moment it is certainly of the order of 1,000 years and may be considerably more.

Comet 1965 f will enjoy a permanent place in astronomical annals not only because of its spectacular beauty but because it was the first really bright comet to be observed with modern instruments and techniques, and a vast amount of valuable information has been derived from it—particularly in the field of spectroscopy.

To one who was denied the opportunity of seeing the comet with the naked eye it has been a great privilege and immensely interesting to read the many reports from ships' officers describing the appearance of this remarkable phenomenon. These reports form an invaluable day-by-day (or night-by-night) chronicle of the changing visual aspect of the comet, and it is a tribute to the vigilance of many Officers of the Watch that they perceived and described the comet under conditions of marginal visibility and without foreknowledge of its nature or expectation of its apparition.

It may be invidious to single out individual ships for commendation, but it should be mentioned that the first report received from a merchant ship was that of *Braemar Castle* of 16th October.

*Cardiganshire* was next on 24th October, followed by seven others on 25th October. H.M.S. *Jaguar* was first in the field on 15th October, but it may be that this ship had prior knowledge.

The last reports received were from *Cilicia* on 19th–21st November. Many excellent sketches, diagrams and charts were received; several of them show details of tail structure that are photographically confirmed. The drawing are too numerous to mention all of them individually, but those from *Devon City*, *Pipiriki*, *British Resource* and *Esso Canterbury* were particularly appreciated. The photograph opposite page 80 was taken by Elizabeth Roemer, U.S. Naval Observatory, Flagstaff, Arizona, on 1st November 1965.

One of the attractive qualities of these brilliant comets is their complete unexpectedness. They are quite unpredictable—they come more or less at random from the confines of the solar system and although we may have to wait a long time for the equal of 1965 f it could come this year. Predictable bright comets are rare and we have another 19 years to wait before the next one appears: the famous comet of Halley, depicted on the Bayeux Tapestry, last seen in 1910, and due again in February of 1986.

*Note.* Reports of the Ikeya-Seki Comet were received here from the following 92 ships, either in their meteorological logbooks or in manuscript:

*Aden, Alinda, Andes, Anshun, Apapa, Araluen. Baltistan, Baron Ardrossan, Benarty, Black Prince, Booker Venture, Braemar Castle, British Bombardier, British Destiny, British Energy, British Freedom, British Resource.*

*Caltex Southampton, Canopic, Cape Sable, Cardiganshire, Ceramic, Chakdina, Chindwara, Cilicia, Circassia, City of Khartoum, City of Liverpool, Clan Macdougall, Clan Macgowan, Clan Macnair, Cotopaxi, Cretic, Crystal Diamond, Cumberland.*

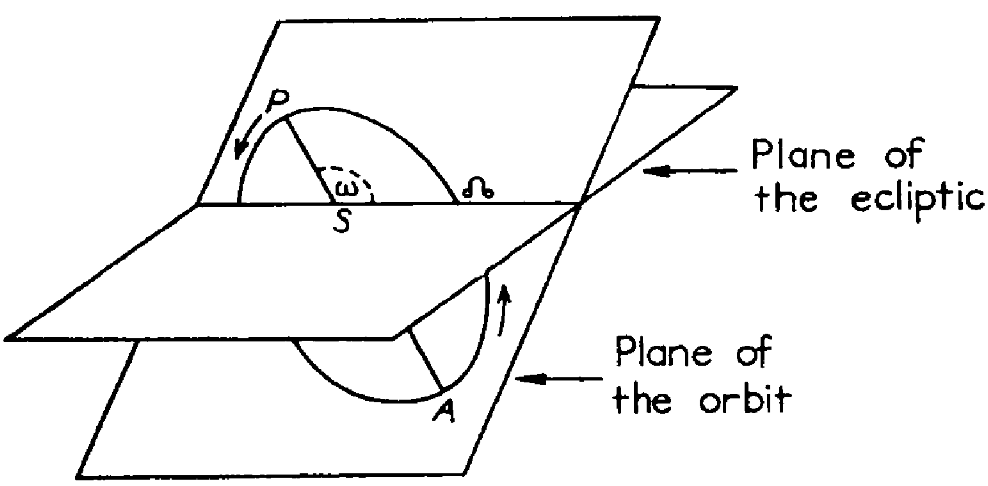
*Devon City, Discovery. Eastern Argosy, Esso Cambridge, Esso Canterbury, Esso Lancashire, Esso Pembrokeshire. Flintshire. Glenfalloch, Glenroy, Gloucester, Gothland. Hertford, Hororata. Inverbank, Iron Crown, Ixion.*

*Jaguar* (H.M.S.), *Jason. Kenya. Leeds City. Mahanada, Mahout, Mahseer, Maron, Mercury, Middlesex, Mobil Endeavour, Mobil Enterprise. Neleus, Newcastle Star, Norman. Pacific Envoy, Piako, Pipiriki, Port Jackson, Port Launceston, Port Lincoln, Port Wellington.*

*Rakaia, Richard de Larrinaga, Ripon, Ruahine, Runswick. Scottish Star, Serenia, Sinkiang, Southern Cross, Sugar Carrier, Sugar Transporter. Tabaristan, Trevalgan. Venassa. Waiwera, Welsh City, Wharanui.*

All the observations were sent to Mr. Ridley; many ships reported the comet on several successive mornings. Longitudinally, the observations were made right around the world and ranged in latitude between 37° 17′N (*Esso Lancashire* on 3rd November 1965) to 44° 18′S (*Cumberland* on 29th October 1965).

*Note* 2. Argument of perihelion is best described in the following way:




S = The Sun.
P = Perihelion (or pericentre) of the orbit of comet or planet.
A = Aphelion (point farthest from the Sun) of the orbit of comet or planet.
Ω = Where the orbit intersects the plane of the ecliptic on its approach to P.
Then angle ΩSP is the 'argument of perihelion' which astronomers denote by ω.

(This diagram is based on Fig. 45 in *Meteor Astronomy* by A. C. B. Lovell, to whom ackowledgement is made.)

551.46.062.7(261): 551.46.07(261)

# INTERNATIONAL ICE PATROL, 1966

(The following account has been received from the Commander, U.S. Coast Guard)

On 1st March 1966 the International Ice Patrol, operated by the United States Coast Guard, entered into its 47th season. It was an exceptional season, marked by great variations from the predominant surface weather patterns, preceded by intensive hurricane-force winds in the Newfoundland area and by a radical departure from the normal oceanographic régime. It concluded as the shortest season on record without one iceberg having drifted south of latitude 48°N.

In accordance with the terms of the International Convention of Safety of Life at Sea, London, 1960, the International Ice Patrol operated from 1st March to 28th April 1966 for the primary purpose of guarding the south-eastern, southern and south-western limits of ice in the vicinity of the Grand Banks. This year, as the year before, the Commander, International Ice Patrol, directed the operations from Argentia, Newfoundland. Operating forces included the U.S. Coast Guard Air Station, Radio Station NIK at Argentia, the U.S. Coast Guard Cutter *Evergreen*, an oceanographic vessel, and the U.S. Coast Guard Cutters *Acushnet*, *Tamaroa* and *Chilula*. No surface patrol was instituted nor was it expected to be necessary, but the possibility still existed, however scarce, that bergs might drift in menacing numbers into the North Atlantic Tracks.

Aerial ice-reconnaissance flights were the primary means of guarding the south-eastern, southern and south-western limits of ice. Lockheed HC-130B four-engined turbo-prop, long-range, land-based monoplanes were used for these flights. Weather permitting, flight schedules were normally planned at two- to three-day intervals over those areas close to the shipping lanes and at four- to five-day intervals for the areas northward. Since observations made before the beginning of the ice season showed no icebergs and below-normal ice conditions on the Grand Banks, it was not necessary to overfly the shipping lane areas. All icebergs were well north and located in Newfoundland and Labrador coastal waters. Hence, ice-observation flights were planned to track and account for these icebergs as well as those located to the north that could eventually drift south to the Banks.

As no surface patrol was necessary the vessels assigned to that task were released prior to the end of the season. The oceanographic vessel *Evergreen* conducted only one oceanographic survey on the slope of the Banks. A well-defined Labrador Current was not located. Sea-water temperatures were found to be well above normal. A possible explanation for this is presented in a later paragraph. As no strong, well-defined southward flow along the slope of the Banks was observed and as there was a scarcity of icebergs, the oceanographic vessel was released to conduct oceanographic surveys that might provide some scientific insight into this unusual condition.

Over the past several years a number of techniques of value to the Ice Patrol have been investigated and instituted by the Coast Guard to attempt to solve several problems. These techniques have been primarily aimed at improving means of forecasting, locating and identifying field-ice and icebergs. For example, a microwave radiometer was installed on one aircraft to test its ability to detect and differentiate between icebergs and ships under conditions of restricted visibility. However, aerodynamic problems, which caused buffeting on the tail surface, prevented any conclusive tests. For mapping ice fields the radiometer was quite successful; as a device to differentiate between ice and certain classes of vessels, particularly wooden hulls, the results were incomplete and inconclusive. It is believed that the discrete radiometric temperature curves traced by the analog computer may eventually be analyzed to differentiate between an iceberg and a vessel of similar radiometric characteristics. Extensive testing is planned.

Other devices or techniques used were a Barnes infra-red radiometer for sea-surface temperature mapping; Loran-C for precise and positive positioning;

ESSA I Satellite photographs for maps of sea ice of the Grand Banks, Labrador Sea and Baffin Bay areas; and the Rhodamine BX dye to mark icebergs for positive identification (see photographs opposite and overleaf). The use of this dye was quite rewarding. One berg was identified and tracked for several weeks without having to be re-dyed. Other tests indicated that the dye, a mixture with 80% calcium chloride flake 8-mesh, had excellent retentive characteristics on icebergs. The aerial dye-marking of icebergs is to be instituted in full force during the 1967 ice season.

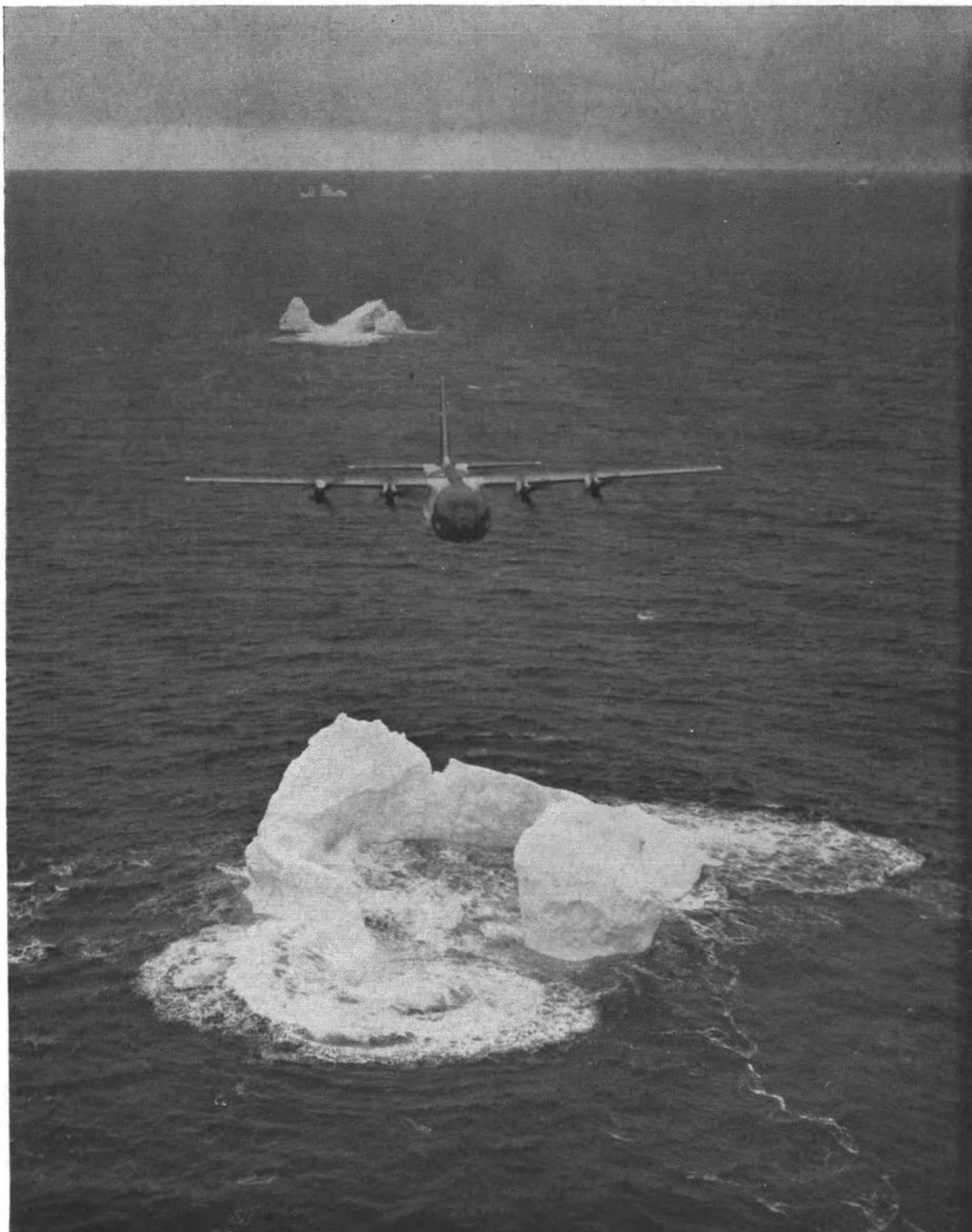
Aerial ice-reconnaissance flights over the coastal waters of Labrador and the western Baffin Bay were continued. Valuable information on the distribution as to the size and position of icebergs was obtained. During the ice season aerial reconnaissances to Cape Chidley, Labrador were made at least monthly. These latter flights, with the use of the dye technique, will eventually provide excellent information on the drift and deterioration of icebergs moving southward along the Labrador Coast.

Northern ice-observation flights from Argentia, past Labrador and Baffin Island to the area just south of Thule, Greenland, in October and December 1965 showed the iceberg supply to be less than normal. 73% of the bergs were evaluated small in 1964, while only 49% were small in 1965 and, since the total counts were approximately equal, the forecast for bergs south of latitude 48°N for the 1966 season could be expected to be not more than half of that observed in 1965. The proviso that comparable oceanographic and meteorological conditions would prevail had to be made. It was also forecast, at the same time (see *Report of the International Ice Patrol Services in the North Atlantic* for 1965) that, under unfavourable conditions, as few as 20 icebergs could be expected to survive the journey south to the Grand Banks. On 4th January 1966 strong cyclonic activity passed over Newfoundland, causing icebergs to drift westward against the coast line and accelerate deterioration due to wave action. The intense hurricane of 29th January did immense damage to property and wreaked havoc with coastal Newfoundland towns. This same hurricane completely destroyed all the icebergs south of latitude 54° 50′N. So destructive were these storms to icebergs that a revised forecast, based on the distribution and size of icebergs to Hudson Straits, was made. It estimated that not one iceberg would drift south of latitude 48°N. Continued cyclonic activity passing over or south of Newfoundland in February and March materially assisted in supporting this conclusion.

It was mentioned that a well-defined Labrador Current on the slope of the Banks was not located. An explanation for this was made prior to the ice season. During December 1965 and January 1966 it was observed that the surface-pressure charts of the North Atlantic placed the passage of most low-pressure systems well to the south of their normal path. Inspection of earlier and later charts indicated similar, but more poorly defined, conditions. The surface winds over the mid North Atlantic were conducive to reinforcing strong wind-driven oceanic circulation and volume transport of warm water into the Labrador Sea. It appeared that the West Greenland Current would be reinforced and that a shallow gyre of relatively warm water would develop in the Labrador Sea. Lateral mixing of this gyre with the Labrador Current would appreciably warm the latter. Higher than average sea-water temperatures observed at Ocean Weather Station 'Bravo' (56° 30′N, 51° 00′W) supports this hypothesis.

Aerial reconnaissance flights in late March and early April showed a scarcity of field-ice south of Hamilton Inlet, Labrador. What ice remained was contained along the coast by the prevailing easterlies. Except for a few icebergs trapped in Notre Dame Bay, Newfoundland, all other icebergs were located north of Belle Isle and close inshore along the Labrador Coast. With the absence of a well-defined Labrador Current and the existence of higher than normal sea-surface temperature it was concluded that the Ice Patrol could safely be terminated. Therefore, on 28th April, after suitable time had been allowed to notify shipping, the 1966 International Ice Patrol ended.

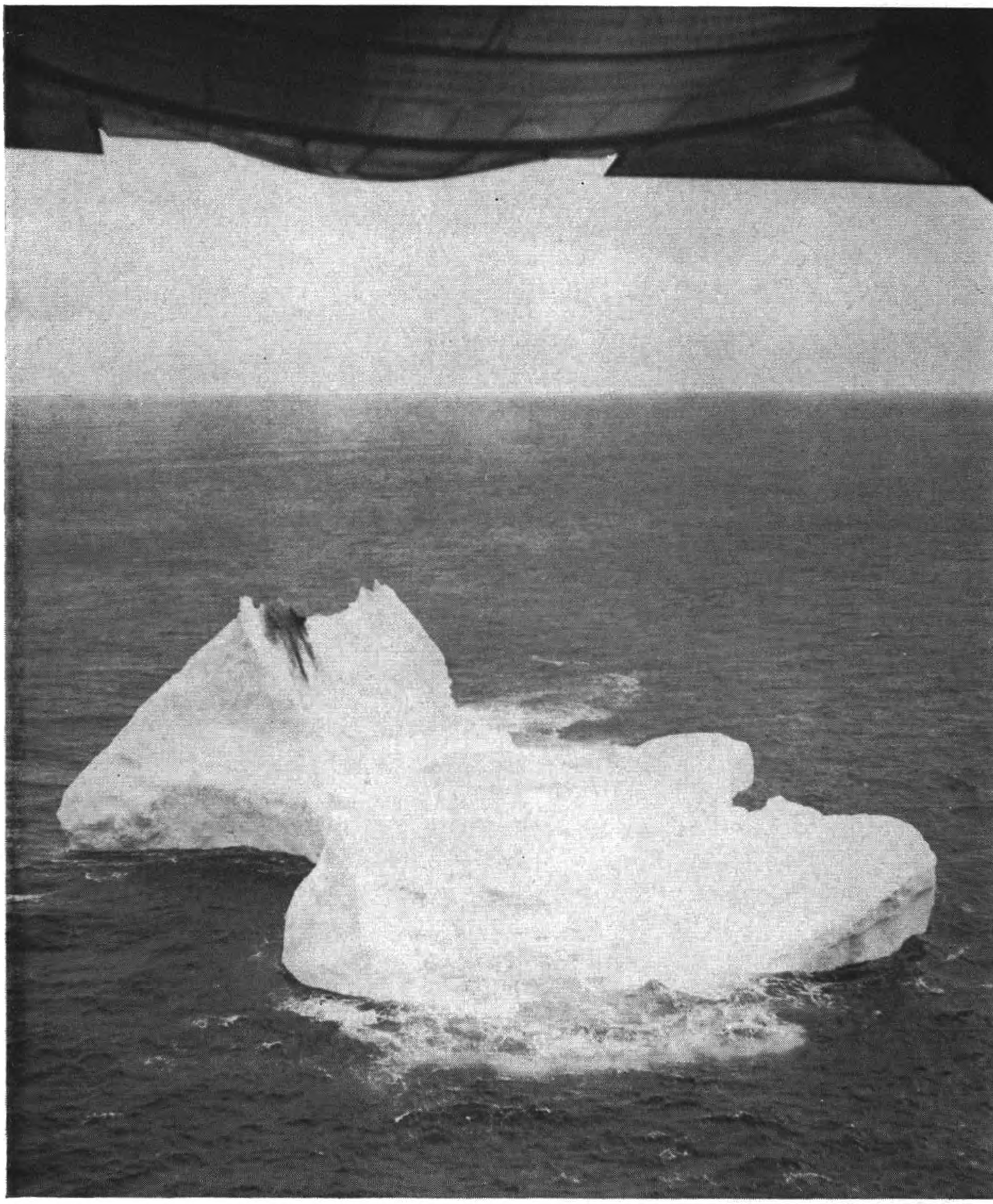
(*Opposite page 72*)



*Official U.S. Coast Guard photo*

A U.S. Coast Guard Ice Patrol aircraft 'hedge-hopping' over a row of icebergs off the coast of Labrador while selecting bergs for dye-marking for future identification and tracking.

(Opposite page 73)



*Official U.S. Coast Guard photo*

An iceberg off the coast of Labrador with large streaks of bright vermilion dye dropped in a one-gallon glass jug from a U.S. Coast Guard Ice Patrol aircraft.

The summary of Ice Patrol operations is as follows:

1. Five pre-season reconnaissance flights to track and plot ice conditions and to prepare for the forthcoming season.
2. Ten in-season reconnaissance flights for the main purpose of guarding the limits of ice and to determine ice conditions in the vicinity of the Grand Banks.
3. Four northern ice-reconnaissance flights to Hudson Straits to determine the in-season iceberg potential.
4. Two post-season reconnaissance flights to guard against the unexpected drift of icebergs into the vicinity of the Grand Banks.
5. Ice reports were collected from ship, aircraft and other ice observation agencies.
6. Pertinent ice information was plotted and analyzed.
7. Ice conditions in the vicinity of the Grand Banks were forecast twice daily during periods between observed ice conditions.
8. Ice advisory bulletins were broadcast twice daily to shipping and were passed twice daily to other interested agencies via teletype.
9. Special ice information was provided on request to shipping.
10. Weather reports including sea temperatures were collected by radio from ships traversing the area for the purpose of evaluating ice location, drift and deterioration.
11. Position plots were maintained of all reporting ships in the Ice Patrol areas.
12. One oceanographic survey was conducted for the collection of ice information affecting the drift and deterioration of ice in the Grand Banks area.
13. A special iceberg-dyeing program was conducted to assist in tracking icebergs.
14. The ice bulletins broadcast by the Canadian Department of Transport and Ice Central Halifax were closely monitored. The information received on the Cabot Straits area was included in our twice-daily ice broadcasts and teletyped ice bulletins.

Merchant ships' reports of ice and weather in the Grand Banks area were an indispensable source of data and materially assisted the International Ice Patrol in determining ice conditions and in disseminating pertinent ice information to shipping. When reporting icebergs, ships are requested to describe the shape and give an estimate of size. The berg description is required to identify and track individual bergs, while the size assists in estimating their eventual deterioration.

Annually, after termination of the International Ice Patrol and until commencement the following year, ships are requested to transmit ice reports to the U.S. Naval Oceanographic Office, Washington, D.C. for further dissemination.

In addition to ice-sighting reports all ships are urged to make regular four-hourly reports to Radio Station NIK during the ice season when within latitudes 40°N and 50°N and longitudes 42°W and 60°W, including ship's position, course, speed, visibility, sea temperatures and wind. The importance of these reports cannot be overemphasized. The visibility reports are especially valuable in planning ice observation flights.

Sea temperatures are used to construct isotherm charts employed in estimating ice deterioration and detecting shifts in the branches of the Labrador Current. Wind data are useful in estimating set and drift of ice and in forecasting weather for the purpose of planning ice-observation flights. An up-to-date plot is maintained for all reporting ships. These ships can be warned directly when approaching dangerous ice.

The International Ice Patrol will once again begin full services about 1st March 1967 depending on ice conditions at the time. Ice Bulletins will be broadcast twice daily, at 0048 and 1248 GMT, by U.S. Coast Guard Radio Argentia (NIK); (details are given in *Admiralty List of Radio Signals*, Vol. V). The format of the ice bulletin will generally be the limits of all known ice, the areas and limits of heavy concentrations, and the positions of individual bergs and growlers between the limits and heavy concentrations. The ice conditions broadcasted will be as observed or reported during the date of the broadcast or estimated up to the broadcast time.

Ice conditions will be transmitted daily by facsimile at 1330Z; these charts were broadcast successfully during the 1963–1966 seasons as a regular daily service. Several ships with facsimile receivers copied Ice Patrol charts as far as the United States east coast and up to 1,200 miles east of Newfoundland. The facsimile ice information is very reliable as human transmission and reception errors are eliminated and considerably more information can be transmitted by facsimile than by CW in a given amount of time.

Duplex operation will be used between NIK and merchant ships during the ice season for general radio communications such as requests for special information, reports made by merchant ships of ice sighted, sea temperatures, visibility and weather conditions.

Merchant ships may call NIK on 500 kc/s and the 8 and 12 mc/s maritime calling bands. The surface patrol vessel (radio call sign NIDK), when on station, will relay between NIK and ships when necessary. There is no charge for these services.

The International Ice Patrol's eventful tour at Argentia, Newfoundland has been terminated. An agreement between Canada and the United States has resulted in Canada assuming search and rescue responsibilities over the maritime areas. As the Coast Guard Air Station Argentia's dual responsibility was to provide these search and rescue services, as well as Ice Patrol services, there no longer exists a requirement for a permanent Coast Guard Air Station at Argentia. Instead, the Commander International Ice Patrol, Governors Island, New York, N.Y. will continue to direct the same basic functions previously performed but with the use of deployed forces. Northerly, pre-season and post-season ice-reconnaissance surveys will continue to be performed by HC-130B aircraft. Just prior to the initiation of the Ice Patrol, the staff and aircraft will arrive at Argentia to initiate the normal operations. The Ice Patrol Officer will then return to New York to direct operations where special communications have been installed to insure communications with Argentia.

Communications with the Ice Patrol will continue to be handled by Coast Guard Radio Station Argentia as in the manner described in previous paragraphs.

With the availability of information not previously easily obtainable, and with added sources of information on hand, an effective and efficient Ice Patrol will continue in force.

551.507.362.1 : 551.507.362.2

## ARTIFICIAL SATELLITES, RESEARCH ROCKETS AND ALLIED PHENOMENA

During the past two or three years many ships have reported, in their meteorological logbooks, sightings of unusual phenomena in the sky. A good example was the early life of the American rocket *Centaur 2* which was observed by the *British Oak*, *Ripon*, *Pennyworth* and *Wendover* whose observations were published in the October 1964 and January 1965 numbers of *The Marine Observer*. During the summer of 1966 we received many similar perplexing observations from ships in the Mediterranean (one of which was even described as 'frightening'), these being subsequently identified as rocket launchings from the European Space Research Organization Rocket Range in Sardinia and, more recently, ships have reported these phenomena from other parts of the world.

As such sightings are likely to become more common as the years go on and in order to set at rest the minds of officers making them, it is thought timely to publish a short description of some of the forms which may be seen. We are indebted to the Director of the Radio and Space Research Station at Slough, to Professor D. R. Bates of the Queen's University of Belfast and to Dr. G. V. Groves of University College, London for the following information which will later be published as an addition to Chapter 10 (Phenomena of the High Atmosphere) of the *Marine Observer's Handbook*, now in course of revision.

ARTIFICIAL SATELLITES In December 1966 there were approximately 1,200 satellites in orbit about the earth of which about 100 were observable with the unaided eye by the sunlight reflected from them at times when the observer was in darkness or twilight. A satellite can normally be distinguished from a planet or meteor by its angular velocity across the sky, which is much greater than the former and much less than the latter. In addition, the length of time for which a meteor can be seen is seldom greater than 3 or 4 seconds, while a satellite may be visible for up to about 45 minutes and a planet up to about 12 hours. So long as they behave in a normal manner, i.e. steady course and speed, the passages of satellites are not of great importance and need not be recorded in the meteorological logbook. A special case, however, is the re-entry of a satellite into the earth's atmosphere and its burning up. The accurate observation of this event may yield information about the density of the atmosphere through which the satellite is travelling.

Re-entry occurs when a satellite, due for example to the cumulative effect of small drag forces throughout its lifetime, descends into the denser regions of the high atmosphere. The frictional effects increase as a consequence, it descends still farther and its path about the earth rapidly degenerates into a spiral. During the final stages of this process the satellite becomes incandescent because of its extremely high temperature and eventually it disintegrates and burns up.

In appearance, a re-entering satellite is similar to the passage of a meteor but it is brighter, moves more slowly across the sky and may be visible for several minutes. A re-entry can happen in any part of the world and, when seen, should be recorded by following the general rule outlined in Chapter 8 of the *Marine Observer's Handbook*. When recording a possible sighting of a re-entering satellite it is important to note as accurately as possible the direction of travel of the object across the sky, its brightness compared with known stars, the time, bearing and elevation angle when first and last seen, together with any extraneous circumstances such as intervening cloud which may have curtailed or otherwise limited the observations.

RESEARCH ROCKETS These are launched from various ranges such as Thumba in 8° 32′N, 76° 52′E and carry equipment for research into the environment of the earth, including its high atmosphere, or for astronomical observations. They are usually projected vertically or nearly so and, after attaining their maximum height which may be 100 miles or more, fall back to the earth's surface. The direct light from the burning propellent during the upward leg of the flight will be readily identified but some of the experiments carried by the rockets may themselves give rise to effects which are visible at night. For example, equipment may be carried which releases chemicals into the high atmosphere.

Some chemical vapours are ejected in the form of a long bright trail on the upleg or downleg of the rocket path. Night-time trails usually appear white but at twilight, about 30 minutes after sunset or before sunrise, the trails are generally yellow, red or greenish-blue. Although their size depends on the altitude at which they are released and, of course, on the position of the observer, it is not unusual for a trail to be as much as 40° long and from 1° to 5° wide. These vapour trails, which may remain visible for more than 20 minutes, are generally distorted by winds in the upper atmosphere.

Sometimes 'grenades' are ejected from the rocket during the upward flight, generating acoustic waves whose reception at the ground enables the wind and temperature structure of the upper atmosphere to be calculated. At night a grenade burst would appear similar to an AA shell burst, being much brighter than a planet but of very short duration. After 2 or 3 seconds another burst would appear displaced in the direction of flight. The number of bursts may total about 20. No sounds are likely to be heard as the acoustic waves are generated at sub-audible frequencies and are very weak in intensity on reaching the ground. In some rocket firings the grenade ejections are extended above 60 miles altitude and the gas products of the explosion then react chemically with the atmosphere, producing a faintly luminous spherical cloud about the size of the full moon although very much fainter. Such clouds may last for 5–10 minutes before diffusing and disappearing and during this time the wind speed and direction can be found from their drift. On other occasions a faintly luminous trail may be produced for the same purpose by the release of a certain chemical from the rocket. The trail, like the grenade clouds, is a soft white in colour. Such experiments are often held under twilight conditions with sunlight falling on the releases against a still dark sky. The sunlight is re-radiated in certain parts of the spectrum from the cloud or trail providing a spectacular blue-green hue, or the well-known yellow coloration of sodium light, if sodium vapour has been released.

## A CENTURY OF VOLUNTARY OBSERVING—THE P. & O. LINE

Opposite page 81 we continue our annual pictorial series of ships of one ownership covering a century of voluntary observing for us with pictures of three observing ships belonging to the P. & O. Line.

One of their first observing ships and the subject of our first picture was the *Colombo*, an iron screw steamer, barque-rigged with a single funnel, built in 1853 by Robert Napier on the Clyde. On her homeward maiden voyage in January 1854 she carried the Indian mail on the first occasion that it had come the whole way to Suez by screw steamer; previously the mail contract had required that paddle steamers should be used. In July 1854 she was requisitioned as a Crimean War transport and the picture was made during this phase of her career as she arrived off Sebastopol on 24th December 1854 with provisions for the wounded of that war.

In 1859 she was lengthened by 30 feet amidships (an early example of jumbo-izing, a practice which is not uncommon today) and was at the same time changed to a two-funnelled brig and with new engine and boilers she was worked up to 12½ knots. She was put on the Calcutta–Suez service and it was on this run, in November 1862, that she was wrecked on the island of Minicoy, all passengers and the bulk of her cargo and mails being saved.

The *Colombo*'s first meteorological logbook covered the period 6th September 1855 to 31st December 1855 when she was on the Black Sea run but this book does not appear to have been received in this office until 6th April 1858.

Our second picture is of the s.s. *Mooltan*, built in 1905 by Caird & Company of Greenock. She was a two-masted schooner-rigged steel twin-screw steamer with all her accommodation above the main deck and carrying about 350 first-class and 160 second-class passengers. Her speed of 18 knots was well above the requirements of the mail contract. She first served on the Bombay run and then went regularly into the Australian service. She was torpedoed in the Mediterranean on 26th July 1917.

The *Mooltan*'s first meteorological logbook was received here on 1st May 1907 and covered the period 21st January 1907 to 26th April 1907, an Australian voyage. Thereafter she was a regular observer right up to her untimely end and her last book which covered the period 29th October 1916 to 12th February 1917, also an Australian voyage, was received here on 28th March 1917.

The latest P. & O. ship to join the Voluntary Observing Fleet is the m.v. *Cannanore*, the subject of our third picture. Of 7065 gross tons, she was built in 1949 by Barclay Curle & Co. of Glasgow and joined the Voluntary Observing Fleet in May 1963.

The P. & O. Line has been with us substantially during the whole of our life and we would like to take the opportunity of paying tribute to the services which the masters and officers of their ships have given us voluntarily for well over a century; today we have eight of their ships on our Voluntary Observing List whilst three more are performing a like service for the Canadian Meteorological Office.

L. B. P.

551.584.6: 628.8: 656.6

# THE CARE OF CARGOES IN THE RED SEA AND GULF OF ADEN

(A translation by B. F. Bulmer (Meteorological Office) of the article on pp. 84–86 of *Handbuch für das Rote Meer und den Golf von Aden*, Hamburg, D. Hydrog. Inst., No. 2034, 1963.)

*Note.* This article was translated by Mr. Bulmer when he was preparing a revised meteorological text of the *Red Sea and Gulf of Aden Pilot*. The publication from which it was taken is the German equivalent of this *Pilot* and this edited version is reproduced here, by kind permission of the German Hydrographic Institute, in view of the special meteorological conditions in this area and of its obvious interest to all mariners likely to be engaged in this trade. This article brings home the fact that you cannot have any hard and fast rules about cargo ventilation; it is a problem that calls for seamanship, knowledge of elementary meteorology and discretion.

The temperatures obtaining in the Red Sea and in the Gulf of Aden make this region a danger zone as regards the well-being of cargoes aboard ships. There is a danger, here, of spontaneous combustion and of damage by fire or explosion when carrying goods having a low flash-point. Also one must reckon with damage from 'sweating' due to the condensation of moisture from the air in the holds. This may be either as 'ship sweat' on the sides, decks and deck-heads of the holds, or as 'cargo sweat' on the cargo itself.

The following example illustrates the danger to the cargo, and even in extreme cases to the ship and her crew, which can arise from the effects of intense solar heating. In 1952 a British vessel carrying chemicals to India, stored in the 'tween decks, was lost with many of her crew. It is to be assumed that the surface temperature of some of the goods rose above the critical value, especially as witnesses established that the oft-repeated warning to ventilate little, if at all, on a passage from a temperate zone to the tropics, had been followed on this occasion. In most cases this warning is not valid for a south-bound passage through the Suez Canal; ventilation should in this case be applied as much as possible unless there are very good reasons against it such as, for example, the rare event of exceptionally high humidity in the outside air.

Measurements taken on research voyages investigating meteorological conditions in ships' holds have shown that, with the sun at its zenith, the temperature of the exposed steel deck of a vessel may rise to as much as 70–75°C (158–167°F). The temperature of the air in the upper hold, within ½ to ¾ metres (about 1 ft 8 in to 2 ft 5 in) of the heated deck, is then just over 50°C (122°F), while at the surface of goods stored in this position the value may be as high as 60°C (140°F). This higher temperature results from downward radiation from the heated deck. Such temperatures may be disastrous for many chemical substances. Such goods should not be carried as deck cargo and are best not carried in the upper 'tween deck. At a few metres' distance from the sides or deckhead the temperatures in the 'tween deck would be about 10°C (or 18°F) lower than those just mentioned. In the lower hold, however, the temperature is primarily controlled by the sea temperature which, even in exceptional circumstances, rarely exceeds 35°C (95°F). If heat-sensitive goods are stowed close under the deck, ventilation is absolutely necessary and can be effectively carried out even in moist, tropical air if all the goods are so packed as to be protected from water arising from condensation.

With deck cargo it should be borne in mind that a cover to give protection against the heat of the sun is of no great value if it lies directly in contact with the cargo. If possible the cover should be so arranged as to leave an air space between it and the surface of the goods to be protected. Tests have shown that, with strong sunshine, a gap of about 10 cm (about 4 in) between the goods and an overlying canvas protection is sufficient to reduce the temperature of casks carrying explosive chemicals from 69°C (156°F) to 42°C (108°F).

The danger of 'ship sweat' occurs chiefly in the regions of cold up-welling water in the approaches to and in the Gulf of Aden, but it also occurs sometimes in the winter half-year in the northern Red Sea. Ship sweat is most likely to occur, usually when homeward bound from the tropics, when the sides, decks and deck-heads of the hold laden with warm moist cargo, e.g. vegetable matter loaded within the tropics, are cooled below the dew-point of the air in the hold. Experience has shown that this dew-point may be above 20°C (68°F) and frequently around 24°C (75°F) in the case of a vessel leaving the Indian Ocean. The water condensed on the deck-heads of the hold then drips on to the cargo. The water content of the air in the hold, which circulates automatically, is constantly replenished by further evaporation from the cargo. The circulation is kept going by the sinking of the air cooled against the ship's sides and by the rising of the air reheated and made lighter by contact with the cargo.

'Cargo sweat' forms through condensation from moist, warm air on to a cargo whose temperature is below the dew-point of the surrounding air. This state of affairs occurs chiefly during the cooler part of the year when a ship is bound towards the tropics from higher latitudes. On a passage from the Gulf of Suez to the southern Red Sea the dew-point can rise by more than 10°C (or 18°F) to over 20°C (68°F) within 24 hours, the air and sea temperatures being about 25°C (77°F) in the coolest month and frequently above 30°C (86°F) in summer. Before leaving Europe, in winter, the cargo is normally quite cold when taken aboard, with temperatures below 7°C (45°F) and not infrequently near freezing. During the passage through the Mediterranean its temperature lags behind the gradually-rising outside temperature which reaches 15–18°C (59–64°F) off Egypt. This is especially so when large elements of the cargo are also good conductors of heat (e.g. metal).

The big increase in the temperature of the surrounding air, and of the sea, which may be expected during the further passage through the Red Sea, is all the more noticeable if the temperatures are low during the passage through the Mediterranean. The temperature of the cargo cannot keep up with such a rise in temperature and in many cases remains below the progressively rising values of the dew-point which, in the further journey through tropical waters, varies around 24°C (75°F). Considerable cargo sweat then results and is especially abundant if the cargo is strongly ventilated while the vessel is in regions where both temperature and humidity are high. This danger is generally less in the upper holds and in the 'tween deck than in the lower holds. This is because the cargo in the former more easily participates in the warming of the surrounding air and sea on account of the greater ease of ventilation and the greater exposure to the heating effects of the sun during the passage through the Mediterranean.

Favourable opportunities for increasing the temperature of the cargo occur while waiting at Alexandria or Port Said, or during the passage through the Suez Canal. In the Canal Zone the absolute humidity (water content) of the air is mostly very low—the winter dew-point being below 10°C (50°F) in the vast majority of cases and thus normally lower than the cargo temperature. The more the entire cargo is heated in these regions of low humidity by intensive ventilation, the smaller is the danger of cargo sweat which would otherwise be highly probable in the course of the passage through the Red Sea and the Indian Ocean. The passage through the Canal is thus the last opportunity of warming the cargo as much as possible above the dew-point temperatures (mostly around 24°C or 75°F) to be expected in the tropics, without causing cargo sweat. If the cargo is loaded in relatively warm weather the threat of sweating is less because the cargo is already at a higher temperature when loaded.

## NOTES ON ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM OCTOBER TO DECEMBER 1966

OCTOBER

The circulation over Arctic regions during the month was dominated by an intense and quite anomalous ridge of high pressure which was aligned over the eastern half of Greenland. This extended to the east of Cape Farewell where normally in October there is a depression.

As a result, west of 40°W, it was generally much milder than usual but east of this meridian a strong easterly or north-easterly airflow kept temperatures exceptionally low over a very wide area extending to eastern Siberia.

*Canadian Arctic Archipelago.* Moderate to strong winds from a mainly easterly direction covered most of this region although for a time strong northerlies blew over Jones Sound to the east. Temperatures over the northern islands and surrounding seas were abnormally low by as much as 6 or 7°C and here, as could be expected, the development of 10/10 fast-ice was well ahead of the calendar. South of 75°N, however, it was slow to freeze, particularly in the east, the relative mildness of the summer persisting over this area. At the end of the month, however, there were signs, particularly in the Amundsen and Coronation Gulfs, of winter setting in, albeit slowly.

*Baffin Bay.* Strong north-easterly winds succeeded moderate south-easterlies but nevertheless air temperatures were far higher than usual—by 4–5°C—and sea temperatures showed that the water, too, was abnormally warm. Although there was, by the end of the month, a gradual but not rapid freezing north of the line connecting Bylot Island and Thule, generally speaking there was a marked deficiency of pack in this area.

*Hudson Bay.* Winds here were mainly light north-easterly with some variation over the eastern half but temperatures still remained much higher than normal. From aerial ice reconnaissance it could be inferred that, even in the shallow inlets, no ice was developing. This is quite unusual for October.

*Foxe Basin.* An easterly air stream, oscillating between north-east and south-east, failed to lower, significantly, the temperatures which persisted up to 6°C above normal. In consequence this sea remained, quite exceptionally, unfrozen except for relatively small patches of new ice in the extreme north.

*Hudson Strait and Davis Strait.* Here winds were mainly from a south-easterly direction, moderate to strong; air temperatures were generally 2–4°C (6° in a few places) above normal and the sea up to 2°C warmer than usual. Early in the month there was a little pack, very open, near the Cumberland Peninsula but this did not last. Otherwise the whole of these seas were, apart from a very few scattered icebergs, ice free.

*Labrador Sea, Great Bank, Newfoundland Sea, Gulf of St. Lawrence and St. Lawrence River.* Winds over these areas were, on the whole, very variable but with a mainly westerly bias. Air temperature, too, was variable but generally a little on the high side as was that of the seas. There was, however, an exception to this along the coastal strip round Hamilton Inlet in southern Labrador where a relatively cool patch of water, an anomaly noted in the previous month, remained. There was no pack-ice at all, which is quite the normal state of affairs, and icebergs along the Atlantic coastline were far fewer than usual.

*Greenland Sea.* Cold moderate to strong north-easterly winds prevailed, at least north of 65°N. Air temperature was as much as 6°C below average and the sea was also on the cool side. Pack, much of it 10/10, was much more extended than usual—up to 100 miles farther east—and also encroached southward as far as 67°N. Satellite pictures indicated that the northern part of the Denmark Strait was more than half covered. South of 65°N, where the influence of a southerly component in the wind was just felt, sea remained warm and there was an absence of pack, the glacier ice noted last month no longer being reported. Relatively few icebergs and growlers were seen.

*Spitsbergen* (Svalbard). This area was greatly affected by the persistent north-easterlies, air temperatures being as much as 8°C lower than usual and the sea about 1°C below normal. An aerial reconnaissance report from Japan Air Lines showed that to the west of Svalbard the Greenland ice pack extended into the area. There was also an unusual amount of new ice in the fjords while close pack was seen to the south of Spitsbergen as far south as 75½°N.

*Barents Sea.* The northern half of this sea experienced very severe conditions for the time of year, strong north-easterly or south-easterly winds lowering air temperatures to about 8°C below average. Sea temperatures, so far as could be ascertained, were 2°C below normal. Consequently the pack between Spitsbergen and the north-west of Novaya Zemlya extended, in some places, south of the usual limits by about 150 miles. There was much land-fast ice along the coasts of Novaya Zemlya and some new ice along the Siberian coast eastward of Cheshskaya Guba.

*White Sea.* In spite of its being on the cool side there was no ice reported from the White Sea.

*Baltic.* Although there was a generally south-westerly air stream—this area was one of the few to experience winds from this direction—temperature in the Gulf of Bothnia was a degree or so below average while that of the water was as much as 2°C sub-normal, even well below the surface. In spite of there being, as yet, no reports of ice there were signs that freezing might take place quite rapidly if any cold snap became established. Farther south, in the Gulf of Finland and in the Southern Baltic, both air and sea were relatively warm.

NOVEMBER

There was a tendency during the month for conditions, which earlier had been quite unseasonal, to return to normal. This was particularly noticeable over eastern Canada and adjacent waters where, at the end of the period, a rapid cooling and consequent freezing took place.

*Canadian Arctic Archipelago.* Strong north to north-easterly winds gradually moderated while the air, initially as much as 6°C below, finished the month at about normal temperature. Ice conditions were very much as usual, all the waterways being completely covered. There were also a few areas, such as the Gulf of Boothia and Lancaster Sound, where expected leads were frozen over.

*Baffin Bay.* Apart from a short spell of south-easterlies in the middle of the period mainly moderate north-easterlies blew throughout the month and air temperatures, generally high at first, fell to about 2°C below average. There was little evidence as to water temperature but ice, deficient early on, rapidly increased so that by the end of the month there was more than usual, especially in the middle of the Bay. At about 73°N the edge of the pack was 60 miles farther out than normal, one striking example of the rapid changes mentioned earlier.

*Hudson Bay and Foxe Basin.* Over these areas steady and moderately strong north-westerlies brought in polar air with the result that the relatively mild régime of the previous month was completely cancelled out, November ending with temperatures 6–10°C below normal. Extremely rapid freezing took place, Foxe Basin was completely sealed off (as is customary at this time of year) and much of Hudson Bay, too, became ice-bound.

*Hudson Strait.* Here again rapid cooling took place, the fall being from about 6°C above to 4°C below average. It seemed probable, however, that the water retained some of its summer excess heat so there was little evidence of icing and the strait remained open.

*Davis Strait.* Moderate south-westerly winds, bringing in air 4°C warmer than average at the beginning of the month, veered later to north-west and temperatures fell to round about normal. Nevertheless the sea remained relatively warm over the whole area except for a narrow strip along the south-west coast of Greenland. Over the eastern half of the Strait there was no pack-ice and only few icebergs. In the area off Cumberland Peninsula, Cumberland Sound and Frobisher Bay, however, where in the first half of the period it was clear, extensive ice was reported during the last few days by air reconnaissance flights. The opening to Hudson Strait nevertheless remained clear.

*Labrador Sea.* Here again there was a veer in the air stream from south-westerly to north-westerly with a resulting fall in air temperatures from about 2°C above down to normal. There was a fairly rapid growth of new ice in the shallow water along the coast as far south as and in Hamilton Inlet.

*Great Bank, Newfoundland Sea, St. Lawrence River and Gulf.* Mainly light westerly winds maintained fairly warm conditions and, with the sea remaining warm, there was no question of any ice formation.

*Greenland Sea.* North of 70°N strong north-north-easterly winds bringing in polar air, in some places 8°C cooler than average, ensured an excess of pack. Land-fast ice, too, was more extensive than usual and close pack stretched 50 to 70 miles farther out than normal. South of Scoresby Sound the wind was more variable in direction and generally not very strong. North of Iceland and in the Denmark Strait both air and sea were cooler than average. Pack-ice, in consequence, covered much more of the sea than usual but seemed to be quite mobile. Along the Greenland coast it was reported as far south as 64½°N and between this point and Cape Farewell there was about three-tenths of glacier ice.

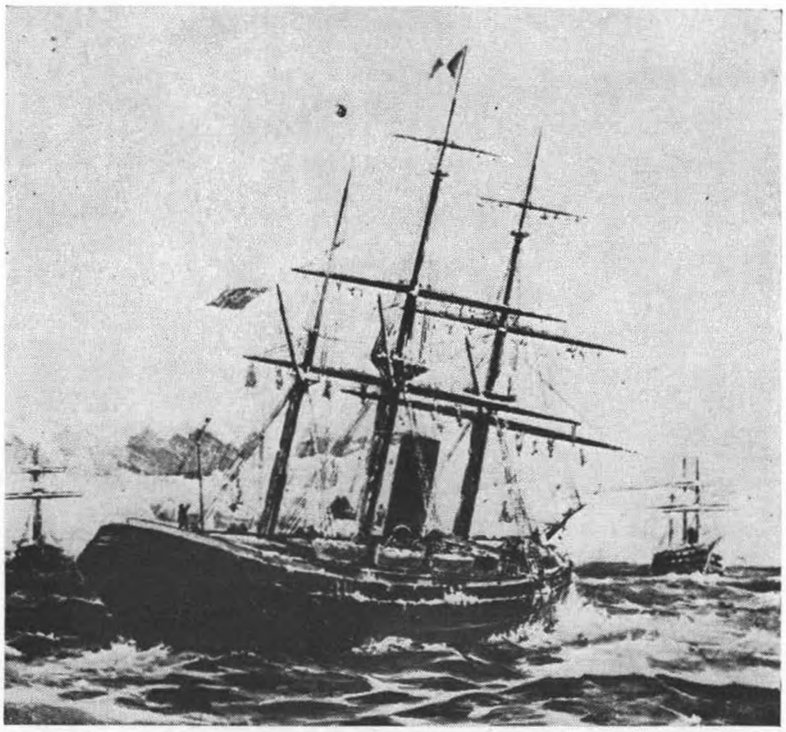
*Spitsbergen* (Svalbard). Near Spitsbergen itself cold north-easterly winds helped to cool the sea down from above to below normal temperature. Fast ice in the fjords and pack south of the Islands were both in excess of average. Farther south there was the usual absence of ice, south-westerly winds tending to raise both air and sea temperatures.

*Barents Sea.* Moderate to strong east or east-south-easterly winds blowing north of latitude 70°N kept air temperatures low—at times 10°C below normal—with the result that in places the limit of pack-ice was found well south of its usual position. This was particularly noticeable just to the south-east of Spitsbergen. South of 70°N moderate west-south-westerlies brought in warmer air and also restored to normal level the sea temperature. Except for a southerly and abnormal extension of the polar pack round about 74°N 25°E and along the Siberian coastline there was no ice.

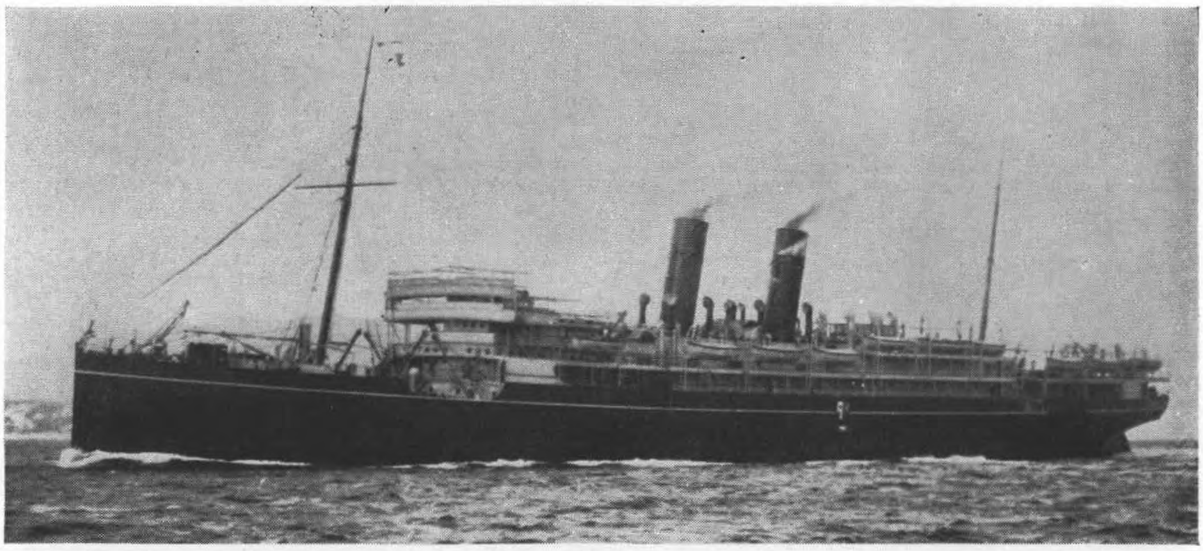
(*Opposite page* 80)

Comet Ikeya-Seki 1965 f photographed by Miss Elizabeth Roemer, U.S. Naval Observatory, Flagstaff, Arizona, at 1220–1223 GMT on 1st November 1965 (*see* page 68.)

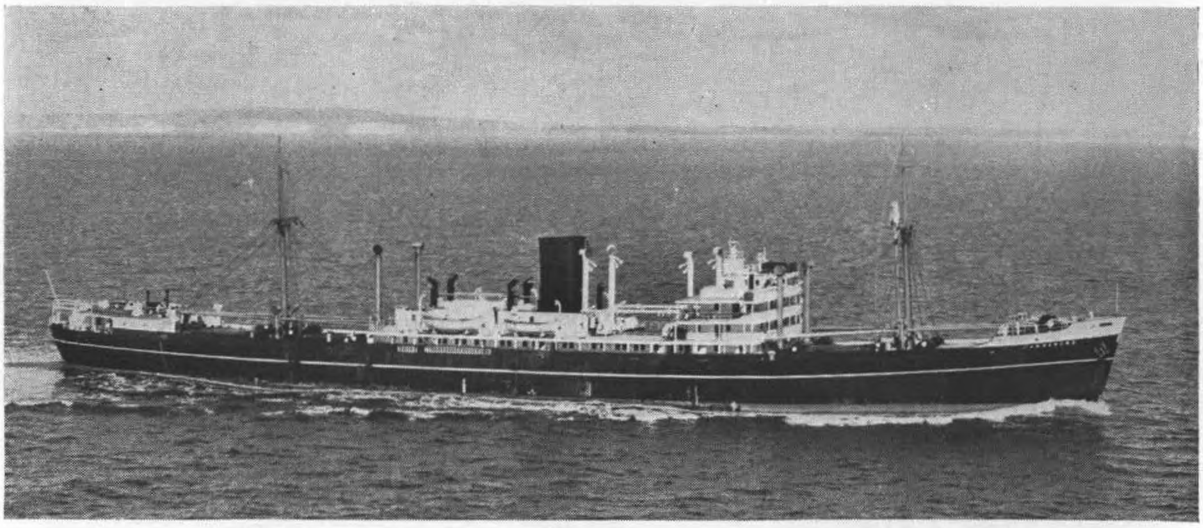
(*Opposite page* 81)



*Colombo*



*Mooltan*



*Cannanore*

*Photos by courtesy of P. & O. Line*

THREE SHIPS OWNED BY P. & O. LINES (*see* page 76)

**Table 1. Icebergs sighted by aircraft and merchant ships within latitudes 40°N–65°N and longitudes 40°W–65°W**

*(This does not include growlers or radar targets)*

| Limits of Latitude and Longitude | | Degrees North and West | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 66 | 64 | 62 | 60 | 58 | 56 | 54 | 52 | 50 | 48 | 46 | 44 | 42 |
| Number of bergs reported south of limit | Oct | > 134 | > 105 | > 53 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Nov. | > 8 | > 8 | > 8 | > 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dec. | Incomplete Data | | | | | | | | | | | | |
| | Total | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Number of bergs reported east of limit | Oct. | > 134 | > 134 | > 134 | > 134 | > 134 | > 134 | > 134 | · > 88 | > 44 | > 39 | 13 | 6 | 0 |
| | Nov. | > 8 | > 8 | > 8 | > 8 | > 8 | > 8 | > 8 | > 8 | > 8 | > 8 | > 5 | > 4 | 2 |
| | Dec. | Incomplete Data | | | | | | | | | | | | |
| | Total | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Extreme southern limit | Oct. | 59° 30′N, 43°42′W on 20.10.66 | | | | | | | | | | | | |
| | Nov. | 59° 36′N, 43° 42′W on 27.11.66 | | | | | | | | | | | | |
| | Dec. | Incomplete Data | | | | | | | | | | | | |
| Extreme eastern limit | Oct. | 59° 54′N, 42° 54′W on 20.10.66 | | | | | | | | | | | | |
| | Nov. | 59° 42′N, 42° 30′W on 27.11.66 | | | | | | | | | | | | |
| | Dec. | Incomplete Data | | | | | | | | | | | | |

> ("greater than") has been inserted where there is some doubt as to the actual number of icebergs at some of the sightings, but the true value is probably greater than the value given.

Extreme limits during the 3-month period are underlined.

*White Sea.* The strong westerly winds throughout the month helped to raise temperatures from 3°C below to 4°C above normal. There was a deficiency in ice amounts, only a little land-fast ice being reported.

*Baltic.* Thin frazil ice formed early in the month in northern parts of the Gulf of Bothnia and was reported to be interfering with ships' intakes. Under the influence of strong and warm south-westerly winds, however, this hazard quickly disappeared. By the end of the month only small amounts of new ice among the skerries round about Luleå remained and it seemed that even at depth the water had recovered from last winter and the late spring and was, surprisingly, warmer than usual. There was no danger of ice in other parts of the Baltic.

## December

The atmospheric circulation was dominated during most of the month by a deep depression centred over the Norwegian Sea which resulted in intensified north-easterlies along the Greenland Sea and unusually strong south-westerlies over the eastern half of the Barents Sea. Ice concentrations reflected this abnormality. Farther west the return to normal conditions, mentioned in November, continued.

*Canadian Arctic Archipelago.* Strong north-westerlies alternated with light to moderate winds with a southerly component. Air temperatures accordingly fluctuated, especially in the south of the area where it was at times 11°C less cool than usual. Temperatures overall, however, could be considered as not far from average. Ice conditions, in consequence, were quite normal except, perhaps, for the fact that in some places there was overmuch 10/10 land-fast ice.

*Baffin Bay.* Mainly northerly winds of moderate strength tended to lower air temperatures over much of the area to well below average although, at times, the area immediately north-east of Baffin Island was warmer than usual by up to 6°C, and along the west Greenland coast between latitude 70° and 75°N temperatures varied about 6°C either side of normal. In most places ice conditions were much as usual although there was, exceptionally, open water close to the coastline for 150 miles north of 70°N.

*Hudson Bay and Foxe Basin.* Fairly steady and moderate northerly or north-westerly winds prevailed over these areas; it was generally cooler than usual by about 2°C, but at times by as much as 4–5°C and both seas were completely frozen over with few, if any, cracks.

*Hudson Strait.* Here again winds were mainly from the north or north-west, moderate in strength, and it was mostly cool. Rapid freezing took place in the first week or so of the month—it will be recalled that earlier the season had been delayed—and by the end of this period it had caught up and the whole strait was ice-bound.

## Table 2. Baltic Ice Summary: October–December 1966

No ice was reported at the following stations during the period: Kiel, Tönning, Husum, Emden, Lübeck, Gluckstadt, Bremerhaven, Flensburg, Aarhus, Copenhagen, Oslo, Kristiansandsfjord.

No ice was reported at any of the stations during October

| Station | November 1966 | | | | | | | | | December 1966 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length of Season | | Ice Days | | | Navigation Conditions | | | Accumulated Degree Days | Length of Season | | Ice Days | | | Navigation Conditions | | | Accumulated Degree Days |
| | A | B | C | D | E | F | G | H | I | A | B | C | D | E | F | G | H | I |
| Leningrad .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 7 | 31 | 25 | 25 | 0 | 9 | 16 | 0 | 286 |
| Riga .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 30 | 16 | 0 | 0 | 2 | 0 | 0 | 116 |
| Pyarnu .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 31 | 23 | 22 | 0 | 22 | 0 | 0 | 144 |
| Viborg .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 7 | 31 | 25 | 25 | 0 | 9 | 16 | 0 | — |
| Stettin .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 829 |
| Gdansk .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Klaipeda .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 31 | 7 | 0 | 0 | 5 | 0 | 0 | 66 |
| Ventspils .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 16 | 30 | 7 | 0 | 0 | 0 | 0 | 0 | — |
| Tallin .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — |
| Helsinki .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 31 | 17 | 11 | 0 | 16 | 0 | 0 | 143 |
| Mariehamn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| W. Norrskar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — |
| Turku .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 110 |
| Mantyluoto | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 16 | 19 | 4 | 0 | 0 | 0 | 0 | 0 | — |
| Vaasa .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 13 | 31 | 19 | 17 | 0 | 10 | 9 | 0 | 157 |
| Oulu .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 12 | 31 | 20 | 20 | 0 | 0 | 20 | 0 | 244 |
| Roytaa .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 12 | 31 | 20 | 20 | 0 | 0 | 18 | 2 | — |
| Lulea .. | 23 | 30 | 8 | 8 | 0 | 8 | 0 | 0 | 69 | 1 | 31 | 31 | 27 | 0 | 14 | 17 | 0 | 242 |
| Bredskar .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 14 | 31 | 17 | 0 | 1 | 7 | 0 | 0 | — |
| Alnosund .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 16 | 31 | 16 | 0 | 0 | 16 | 0 | 0 | 81 |
| Stockholm .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| Kalmar .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| Visby .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Göteborg .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| Skellefteå .. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | — | 14 | 31 | 17 | 4 | 0 | 14 | 0 | 0 | — |

CODE:
A First day ice reported.
B Last day ice reported.
C No. of days that ice was reported.
D No. of days continuous land-fast ice.
E No. of days of pack-ice.
F No. of days dangerous to navigation, but assistance not required.
G No. of days assistance required.
H No. of days closed to navigation.
I Accumulated degree-days of air temperature (°C) where known.*

* These figures give a rough measure of first the probability of the formation of sea ice, and later the progress of the growth and its thickness. They are derived from daily averages of temperature (00+06+12+18 GMT) and are the sum of the number of the degrees Celsius below zero experienced each day during the period of sustained frost.

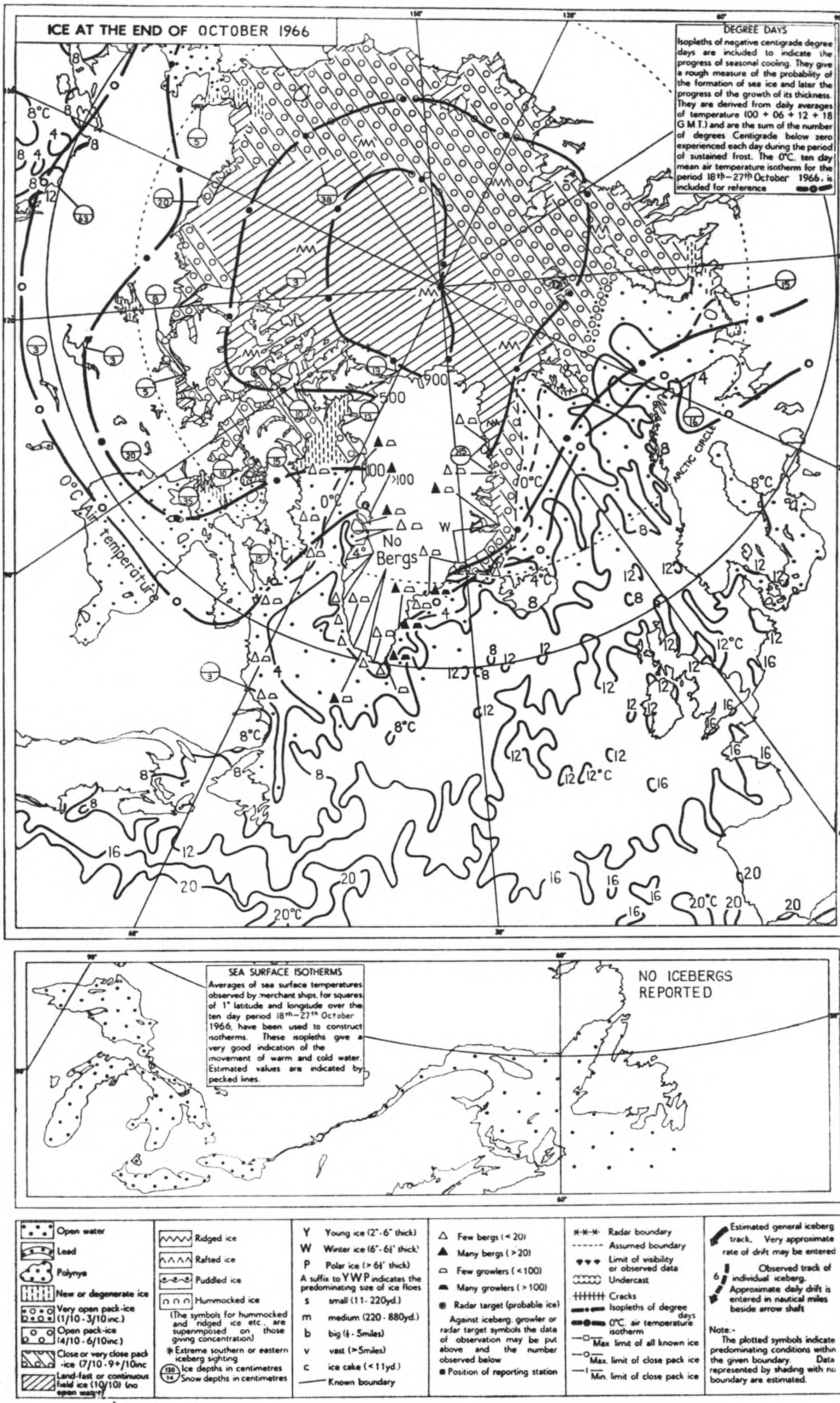
*Davis Strait.* For most of the month moderate north-westerly winds were blowing although at times these were interrupted, at least along the Greenland coast, by light south-westerlies. Air temperature ranged from 4°C above to 3°C below normal but, judging from ship reports received, sea temperatures seemed, particularly over the eastern half of the Strait, to be a degree or so higher than usual, a significant amount at this time of year. Ice amounts were roughly normal. Over the western half there was, in and around the Cumberland Sound, more total cover than expected, but over the eastern side there was a marked deficiency: in fact, practically no ice at all.

*Labrador Sea.* Winds over this area were very variable, mainly westerly at the beginning of the month but later becoming north-easterly. Both air and sea were relatively warm—by about 2°C—and in consequence there was little ice for the time of year. The extent of pack, much of it open, was much less than usual—south of Hamilton Inlet, for example, there being only thin new ice. An isolated iceberg, 88 ft above water, was reported at 52½°N 53½°W on the 18th.

*Great Bank and South Newfoundland Sea.* Again variable winds but in directions such as to keep air temperatures very high—4°C above normal. The sea, too, was exceptionally warm, in places by as much as 5°C. Understandably there was no ice except for a small amount of new ice, so far not a serious hindrance to navigation, near Belle Isle.

*Gulf of St. Lawrence.* In spite of light northerly winds both air and water temperatures were relatively high and ice development very backward. Some new ice and a little fast-ice was found on shallow water in the Baie de Chaleur and near Miscou Island.

*River St. Lawrence.* Here, too, the ice season was late, in terms of degree-days, by about a fortnight. Close pack was reported west of about 70°W with small amounts of fast ice in the various inlets.



ICE AT THE END OF OCTOBER 1966
DEGREE DAYS
Isopleths of negative centigrade degree days are included to indicate the progress of seasonal cooling. They give a rough measure of the probability of the formation of sea ice and later the progress of the growth of its thickness. They are derived from daily averages of temperature (00 + 06 + 12 + 18 G.M.T.) and are the sum of the number of degrees Centigrade below zero experienced each day during the period of sustained frost. The 0°C. ten day mean air temperature isotherm for the period 18th–27th October 1966. is included for reference
0°C Air temperature
ARCTIC CIRCLE
No Bergs
900
500
100
>100
SEA SURFACE ISOTHERMS
Averages of sea surface temperatures observed by merchant ships, for squares of 1° latitude and longitude over the ten day period 18th–27th October 1966, have been used to construct isotherms. These isopleths give a very good indication of the movement of warm and cold water. Estimated values are indicated by pecked lines.
NO ICEBERGS
REPORTED
Open water
Lead
Polynya
New or degenerate ice
Very open pack-ice (1/10 - 3/10 inc.)
Open pack-ice (4/10 - 6/10inc.)
Close or very close pack -ice (7/10 - 9+/10inc
Land-fast or continuous field ice (10/10) (no open water)
Ridged ice
Rafted ice
Puddled ice
Hummocked ice
(The symbols for hummocked and ridged ice etc., are superimposed on those giving concentration)
Extreme southern or eastern iceberg sighting
Ice depths in centimetres
Snow depths in centimetres
Y Young ice (2"-6" thick)
W Winter ice (6"-6½' thick)
P Polar ice (> 6½' thick)
A suffix to YWP indicates the predominating size of ice floes
s small (11-220yd.)
m medium (220-880yd.)
b big (½-5miles)
v vast (>5miles)
c ice cake (<11yd.)
Known boundary
Few bergs (<20)
Many bergs (>20)
Few growlers (<100)
Many growlers (>100)
Radar target (probable ice)
Against iceberg, growler or radar target symbols the data of observation may be put above and the number observed below
Position of reporting station
Radar boundary
Assumed boundary
Limit of visibility or observed data
Undercast
Cracks
Isopleths of degree days
0°C. air temperature isotherm
Max limit of all known ice
Max. limit of close pack ice
Min. limit of close pack ice
Estimated general iceberg track. Very approximate rate of drift may be entered
Observed track of individual iceberg. Approximate daily drift is entered in nautical miles beside arrow shaft
Note:-
The plotted symbols indicate predominating conditions within the given boundary. Data represented by shading with no boundary are estimated.

*Greenland Sea.* North of the Denmark Strait very strong north-easterly winds persisted throughout most of the period and, except for a spell in the middle of the month when there was a relatively mild respite, temperatures were very low, by at least 4°C and in some places by as much as 6°C below normal. Air (by S.A.S. on 13th) and sea reconnaissance helped to define the extent of the ice fields which stretched, in the main, about 100 miles more than usual. Between Greenland and Iceland most of the Strait was ice covered, either with close or open pack, the latter reaching to within 30 miles of the Isafjord—almost an extreme position for December. This pack was, however, fairly mobile and had clearly come from farther north. South of 65°N the situation was quite different with strong north-westerly winds being maintained early in the month; air temperatures varied from 4°C below to at least 2°C above mean values and, except for a very narrow coastal strip north of Cape Farewell where it was relatively cool, the sea was warm. There seemed to be a slight deficiency of ice in this southern area although one iceberg was reported on 10th December by O.W.S. 'Alpha' at 61° 41'N, 32° 30'W—a most unusual position. Then on 20th December a large iceberg, 140 ft above the water line, was reported even farther south—at 58° 00'N, 35° 25'W—by m.v. *Gothland* while on passage from Pentland Firth to Belle Isle.

*Spitsbergen* (Svalbard). Round Spitsbergen itself the winds, although strong to very strong, were variable in direction and air temperatures ranged from 4°C above average to 4°C below. The sea was probably on the cool side. To the west of Spitsbergen there was much more pack than usual, that of north-eastern Greenland extending into the area. Along the coast of West Spitsbergen itself the pack was, under the influence of short-lived strong easterly winds, blown away from the land, thus opening up shore leads. South of about 75°N strong south-south-westerlies helped keep the temperature above normal and ice did not penetrate.

*Barents Sea.* Abnormally strong winds, mainly from a southerly direction, resulted in relatively high temperatures which were generally at least 2°C above average and, in the extreme east, as much as 12°C higher. In the area to the south-east of Spitsbergen there was an excess of ice, notably between 30°E and 40°E where it came, unusually, as far south as 74½°N. Elsewhere, however, ice was markedly deficient especially in Chesha Bay, in the Gulf of Pechora and along the coast of Novaya Zemlya.

*White Sea.* Although winds reached here as southerlies they brought very cold air from Siberia and temperatures, starting high from the previous month, dropped sharply and at one time reached 8°C below the mean. There was probably more fast-ice than usual in the southern half of this Sea but in the north, in the opening to the Barents Sea itself, the pack was less concentrated than normal.

*Baltic.* Winds were generally southerly but tended to bring in cold air from Russia and so, although both air and sea were relatively warm at the beginning of December, by the end of the month temperatures had fallen to below average. Ice amounts were extremely variable, development along the various coastlines proceeding with fits and starts. During the last few days ice was probably a little deficient over much of the Gulf of Bothnia and in the Gulf of Finland. The western Baltic, too, was clear but along the coasts of Poland, Lithuania, Latvia and Estonia there was more fast-ice than is usually found in December.

*North Sea.* Sea and air temperatures were not far from normal for the time of year and so there was no ice.

*Note.* The notes in this article are based on information plotted on ice charts each month, similar to the map overleaf, but on a much larger scale (39 in × 27 in). They are available at the price of reproduction on application to the Director-General, Meteorological Office (Met.O.1), Eastern Road, Bracknell, Berks. Alternatively, they may be seen at any Port Meteorological Office or Merchant Navy Agency.

N. B. M.

# Book Reviews

*Wind Waves*, by Blair Kinsman. 9½ in × 6¾ in, pp. 676, *illus.*, Prentice Hall International, Pegasus House, Golden Lane, London, E.C.1, 1965. Price: 140*s.*

Waves on the water surface fascinate everyone who looks at them and have done from time immemorial when men first ventured out to sea. Here is a clear regularity which on closer examination turns out to be much more irregular than appears at first. Observation and experience of the way in which the water behaves quickly became essential to the earliest sailors who must have bought dearly their knowledge by many casualties. Such vital experience cannot be bought by each generation and hence the craft of the sailor was handed on and certainly extends back many thousands of years. One of the first observations must have been the association of waves with the wind and indeed it precedes by far the Phoenicians and Carthaginians who were such excellent sailors. There was no corresponding science which gave a tolerable explanation of the dependence of the waves on the wind and in fact the foundations of hydrodynamics were not laid until after Newton, so that only comparatively recently in the history of the seaman have the mathematician and physicist been able to concern themselves with wave motion and attempt to explain what effect the wind has on the sea.

Dr. Kinsman's book is concerned with this last period when scientists were able to devote their attention to surface waves. It is a very fascinating book indeed and written in a style quite different from the ordinary textbook, almost as his lectures, copied verbatim, might have read; a vivid, racy American style which is most readable. The foundations are carefully laid. Waves occur not only on the surface of the sea but there are many other different kinds of waves, such as sound waves and light waves, which have many properties in common with wind waves, so the author investigates wave motion in general when the waves are small enough for us to forget about the non-linear effects. He is able to differentiate between waves on deep and shallow water and to find the rate at which the waves progress; in the first case the bottom of the ocean is so far away that the depth does not vitally affect the waves on the surface while in the second case the water depth is of vital importance to the way the waves move. The recognition of these two different kinds of water waves gives an explanation of many of the wave effects, especially in the shallow water near the shore.

As the author is careful to point out, wind waves are not simple waves but are made up of waves of many different wave-lengths and heights so that any explanation of the observed waves must take into account some method of combining many waves together. The mathematical way of doing this was developed in the last century so the tools are at hand. The next step to take is to remove, if possible, the restriction that the waves are small and to deal with a few special cases when the waves are not necessarily small to see how this affects the explanation that we are building up. So far the author has dealt with waves on the surface of the sea without saying how they are connected with the wind, which is their cause. A link-up is necessary and was partially provided during the Second World War when it became imperative to forecast wave properties for operational purposes; the basic knowledge about the wind for making such a forecast would come from the meteorologist. If the wind, by its tangential stress on the water, causes waves which move away from the region where they are formed then it is clear that at any particular point in the open sea there will be waves from many directions and with many wave lengths and wave heights all interacting with one another and so all that is possible is to indicate the properties of the more outstanding waves.

Now, Dr. Kinsman says, the waves that we have created in our minds are not very much like the waves of the ocean because they are still far too simple and we have to recognize that we cannot precisely describe what the ocean surface is like at any particular time, not only because there are few measurements but also because we do not know what to measure to give a complete description. We will have to be satisfied with a statistical description in which we do not attempt to say what the wave heights will be exactly, but what the average wave height will be and the probability of getting wave heights of different sizes. Other wave properties, such as propagation and rates of decay, will also only be described in a statistical way. The author devotes the second half of his book to explaining the statistical theories of the formation of waves in storm areas where the winds are high and a lot of energy is transferred from the atmosphere to the surface water, the way that these waves travel over the ocean interacting with other trains of waves, and the way that they decay or finally lose their energy in shallow waters at beaches. The predictions of the theories are compared with the few observations that are available.

Statistical theories are not new in physics. The trouble is that in them the mathematics gets harder because instead of defining and dealing with something fairly exact, like a bee, we are trying to define and deal with something blurred or smudged, like a swarm of bees. The author guides us through these difficulties with skill but the going is hard for non-professionals.

Anyone who is interested in sea waves should get hold of this book and read it as far as they can. If the mathematics gets too difficult, ignore it and read on for this is not a book about mathematics, which is only used to quantify the physical ideas, but a book about waves on the sea. The reader is considerably aided in his reading by the frequent reviews of the significance of what has gone before and also by the many warnings to distinguish between what is observed fact and what is theory. Surely anyone who reads this book will look with new eyes at the ocean surface.

E. K.

*The Preparation and Use of Weather Maps by Mariners:* Technical Note No. 72. 10¾ in × 8½ in, pp. 89, *illus.*, World Meteorological Organization, Geneva, Switzerland. Price: 18 *Sw.fr.*

As explained in English, French, Russian and Spanish in the Summary of this useful publication it is really a practical handbook of meteorology tailored to the special needs of mariners. It sets out the various steps to the construction of a weather map and provides the mariner with the techniques for its analysis should an immediate forecast be required.

Part I deals with the rôle of shipping in the collecting of meteorological observations and explains the way in which they are encoded, the method of plotting and the drawing of isobars. It also gives suitably detailed answers, for different climatic regions, to questions about weather systems such as fronts.

Part II discusses the various ways in which weather maps can be used in differing conditions, examining a number of weather situations which are particularly dangerous to shipping, together with some relevant forecasting rules.

The authors—a working group appointed by the WMO Commission for Maritime Meteorology (CMM) under the capable chairmanship of Dr. M. Rodewald (Federal Republic of Germany)—have performed a very useful task in producing such a comprehensive and concise treatise, divested of all obscure technical terms unfamiliar to ships' officers.

The text is well illustrated with maps and a very complete table of contents is provided.

At the end is a coloured map of the world showing the ocean areas where the number of meteorological observations is inadequate, and the coastal radio stations to which weather observations can be sent.

It is certainly a book which can be recommended without reservation to every Deck Officer, both to assist him in passing his professional examinations in meteorology and for practical use at sea.

Unfortunately it can be purchased only from the World Meteorological Organization in Geneva.

A. D. W.

*The Mathematical Practitioners of Hanoverian England 1714–1840*, by E. G. R. Taylor. 8¾ in × 5½ in, pp. 503, *illus.*, Cambridge University Press (for the Institute of Navigation), Bentley House, 200 Euston Road, London, N.W.1, 1966. Price: 84*s.*

Eva Taylor, the author of this book, was Emeritus Professor of Geography in the University of London and was, before her death in July 1966, for many years an

Honorary Member (of which there are only eight) and a very loyal friend of the Institute of Navigation. She often lectured there, very entertainingly, about the history of navigation.

The book is a sequel to *The Mathematical Practitioners of Tudor and Stuart England*, by the same author, which was reviewed in the April 1955 number of *The Marine Observer*. Like its predecessor, the book is divided into two main sections: Part 1—the Narrative, and Part 2—Biographies of the individuals concerned. There are also a couple of pages devoted to sources and references. The Foreword is written by D. H. Sadler, Superintendent of the Nautical Almanac Office, appropriately enough, because that Almanac celebrated its bi-centenary in 1966. This Foreword suggests that astronomical navigation plays a relatively minor rôle in modern practice; one wonders how true this really is at sea. Whatever electronic aids are at his disposal (and many of them are still in their infancy), the prudent navigator will still practise this ancient art, associated with lead, log and lookout—assisted by whatever modern instruments are available. It is the men who led the way to modern navigational practice that this book is about.

The narrative is divided into seven convenient periods covering a maximum of 20 years—a chapter being devoted to each; for the period 1760–80 there are two chapters, one of which deals entirely with the instrument makers of that period, because of the high standard and international esteem that these English instruments had at that time. The biographies, which contain summarized notes about the activities of over 2,200 individuals, are similarly divided into 14 separate periods; the names appear alphabetically in each period. Both the narrative and biographies are written in the attractive style that one expects from this author; and humour is not lacking.

In her introduction the author reminds us that 1714, where the book opens, was the year in which Parliament offered £20,000 to whomsoever discovered a practical means of finding longitude at sea. The closing date, 1840, the year of Queen Victoria's wedding, was chosen because it was the date by which it had become "virtually impossible to pick out the mathematical practitioners as a distinct professional group". Prior to this date, astronomers, surveyors, computers of tables, navigators and instructors all worked closely with instrument makers and "there was an exchange of ideas on equal terms"; the Fellowship of the Royal Society was opened to the most distinguished of all these categories of people. By 1840 "the scientist had disappeared into the laboratory, craftsmen into the factory. . . . All had parted company, and the work of a majority was anonymous."

Most of the characters in this book have contributed directly or indirectly towards navigation—astronomers, surveyors, mathematicians or instrument makers. It is largely a male world, but two women figure in the narrative—Jane Squire (*c.* 1731) who devised "a fantastic scheme" for solving the longitude problem and worried the authorities for ten years about it, and Janet Taylor (*c.* 1833) who operated a navigation warehouse and nautical academy in the Minories and wrote a navigation textbook which went into an 11th edition. One wonders how many women have ventured into this particular world since then.

From the mariner's viewpoint the hero of this book is probably John Harrison (1693–1776) who gained the Award from the Board of Longitude for his chronometer—after many trials and lengthy argument. Among others who appear in this book and have left a permanent mark aboard ship we find Gowin Knight (1713–72) who made the first artificial bar magnet, Murdoch Mackenzie (1749–97) who invented the station pointer, John Bird (1709–86) who seems to have made the first sextant in succession to the quadrant, and Thomas Sumner (*c.* 1841) a Master Mariner who introduced the position-line method of determining position at sea. Also we read about *The Nautical Almanac*, first published in 1766, and of the various men who contributed in some way or other to improve logs, sounding apparatus, compasses, charts and telescopes. It is not surprising that Captain Cook figures prominently as a skilled observer and surveyor.

As in the earlier book, meteorological instruments find their place and oceanography now comes into the picture. We read that in one of Cook's voyages (1768), in addition to detailed navigation work, there were daily readings of the thermometer and barometer, wind observations by a wind gauge and experiments to find the temperature and salinity of sea water at depth.

There are a number of attractive plates; it seems a pity that there is not one of John Harrison.

The grouping of the names in 14 separate periods in the biographies and the two methods of indexing the names are a bit inconvenient to the reader—but this is a minor criticism of an admirable book of reference.

C. E. N. F.

# Personalities

OBITUARY.—We regret to record the death on 26th November 1966, at his home in Glasgow, of Captain J. W. CLARK, Master of the British Ocean Weather Ship *Weather Reporter.*

James Wauchope Clark was born in Glasgow in 1923 and served his apprenticeship with the Strick Line and Hogarth's. In 1943 he joined the RAF as an aircraftsman and subsequently flew as a pilot; he was demobilized in 1946 and obtained his 2nd Mate's Certificate.

From 1946 to 1952 he served as 3rd Officer and 2nd Officer in ships of Paddy Henderson, the Donaldson Line and the British Tanker Company and, in January 1953, joined the British Weather Ship *Weather Watcher* as 3rd Officer. In 1954 he obtained his Master's Certificate and was promoted to Chief Officer. During the years 1960 to 1963 he did seven voyages as acting Master of Ocean Weather Ships and in 1963 he was officially promoted Master of *Weather Reporter* and remained in command of that ship until July 1966, when he had to come ashore due to ill health and was shortly afterwards admitted to hospital.

Captain Clark was one of those rare people who never had a bad word to say about anyone, and was very much respected by all who worked with him, both in the Service and outside. This was particularly noticeable when he was 'standing by' the conversion of the *Weather Reporter.* His relationship with all involved in the conversion was excellent as he had the gift of being quiet and tolerant, but absolutely firm when necessary.

The high standard of his work and his interest in those serving with him will make his loss keenly felt throughout the Service.

We offer our sympathy to his widow and his four children.

C. E. N. F. & F. A. E.

RETIREMENT.—CAPTAIN L. J. HOPKINS retired from the sea in December last when he brought the *Southern Cross* into Southampton.

Leopold James Hopkins was born in 1901 and received his pre-sea training in H.M.S. *Worcester* during the First World War. On leaving her in 1917 he joined the Royal Naval Reserve as a temporary midshipman and served in H.M.S. *Shannon* in the 2nd Cruiser Squadron.

On release from Naval service in June 1919 he became a cadet in the *Koningin Louise*, a former German vessel owned by the Ministry of Shipping and operated by the Orient Line.

In 1921 he obtained his 2nd Mate's Certificate and served with Messrs. Easton Craig & Co. of Glasgow as 3rd Officer.

In 1927 he passed for Master and joined the Shaw Savill Company as 4th Officer of the *Tainui.* He was appointed to his first command, the *Waimana*, in 1948.

Captain Hopkins's association with the Meteorological Office goes back to 1928 when he sent us his first meteorological logbook from the *Tainui*; thereafter, in 23 years, he sent us 58 meteorological logbooks and received Excellent Awards in every year from 1951 with the exception of 1954 and 1956—a nice little library of 14 books. In 1959 he was presented with our special long-service award of an inscribed barograph.

We wish him health and happiness in his retirement.

L. B. P.

# Notices to Marine Observers

## PORT METEOROLOGICAL OFFICER—MOMBASA

The East African Meteorological Department has appointed Mr. B. Ramsey as their Port Meteorological Officer in Mombasa. His office is in Room 45, Public Office Block, Port of Mombasa, Kilindini (postal address: P.O. Box 8512, Mombasa, Kenya) and his telephone number is Mombasa 5685 or, if no reply, contact Mombasa 73440.

## OCEANOGRAPHIC SURVEY—EASTERN PACIFIC

The Eastern Pacific Oceanographic Commission has arranged a co-operative oceanographic survey of eastern tropical Pacific waters from February 1967 to September 1968. The area to be covered extends from approximately lat. 30°N to 20°S and from long. 125°W eastward to the Central and South American coasts.

During this period Selected, Supplementary and Auxiliary reporting ships traversing the area are requested to send as many meteorological reports as possible to the appropriate shore stations.

## ERRATUM

*The Marine Observer*, January 1967, p. 35, wind indicator ($i_w$) code figures:

*for* 1, 2, 3, 4 *read* 0, 1, 3, 4.

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# Selected Meteorological Office Publications

## Scientific Papers

No. 21 Estimation of rainfall using radar—a critical review.
By T. W. Harrold, B.Sc., D.I.C. **7s.** (7s. 6d.)

No. 22 The solution of atmospheric diffusion equations by electrical methods.
By J. B. Tyldesley, B.A. **4s. 6d.** (4s. 11d.)

No. 23 Surface and 900 mb wind relationships.
By J. Findlater, T. N. S. Harrower, M.A., B.Sc., G. A. Howkins, M.B.E., B.Sc., and H. L. Wright, M.A. **5s. 6d.** (6s.)

No. 24 An atmospheric diffusion slide-rule.
By C. E. Wallington, M.Sc. **5s. 6d.** (5s. 11d.)

No. 25 The relation between Beaufort force wind speed and wave height.
By R. Frost, B.A. **3s. 6d.** (3s. 9d.)

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