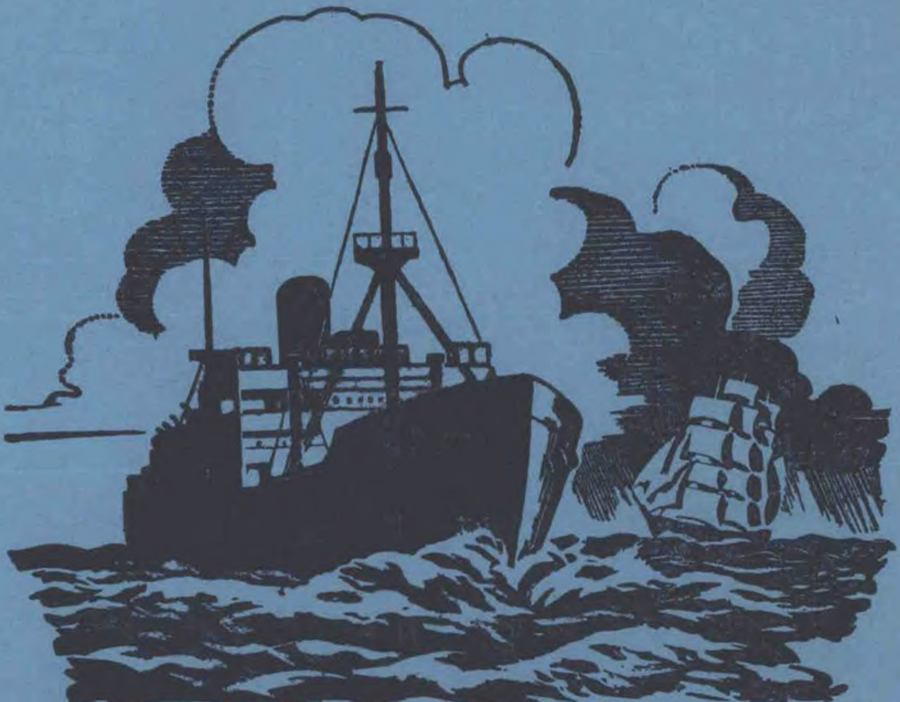
M.O. 579

The Marine Observer

A quarterly journal of Maritime Meteorology



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THE
MARINE OBSERVER

A Quarterly Journal of Maritime Meteorology prepared by the Marine Branch of the Meteorological Office

Vol. XXIV

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M.O. 579 AIR MINISTRY

THE MARINE OBSERVER

A QUARTERLY JOURNAL OF MARITIME METEOROLOGY PREPARED BY THE MARINE BRANCH OF THE METEOROLOGICAL OFFICE

VOL. XXIV No. 166 OCTOBER, 1954

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Letters to the editor, and books for review, should be sent to The Editor, "The Marine Observer," Meteorological Office, Headstone Drive, Harrow, Middlesex

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Editorial

From time to time articles have appeared in *The Marine Observer* about the application of meteorology to the care of cargo aboard ships. There seems to be little doubt that, quite apart from the technical advances which have been made in the shipbuilding sphere in the way of improved and mechanical ventilation of cargo holds (and in some cases, air conditioning of the holds), ship-owners, ships' officers, shippers, consignees and underwriters are tending to show more practical interest in this subject than in the past. As the world becomes more technically minded and as improved education spreads, the tendency is for all industries and businesses to be more efficient and more competitive and there is less excuse nowadays than there was in the past for waste occurring. Sweat or other moisture in cargo holds, no matter from what source, causes damage even if only to the appearance of the goods, and any reasonable steps which can be taken to prevent such damage occurring without involving a ship-owner in undue expense are all to the good. For quite a few years after the last war there was a shortage of shipping, but as the mercantile fleets of the world increase and as new countries enter the shipping business, so does the competition become keener, and it seems fairly obvious that the ships which can carry their cargo in the best condition will eventually be the most sought after. The more the ship's officer knows about the meteorological behaviour of air in enclosed spaces the better he is able to take sensible ventilation precautions when occasion demands.

The application of meteorology also has its bearing upon refrigeration and in particular upon care of fish.

The Department of Scientific and Industrial Research have published an instructive leaflet entitled *The Care of the Trawler's Fish*, which points out the considerable difficulties which are involved aboard long-distance trawlers in keeping their fish fresh. Climatological and other factors have made it necessary for British trawlers to go further afield recently than in previous years. For example, trawling is now carried out from time to time in the Davis Strait. The longer a trawler is at sea the more difficult it is to keep the fish in good condition and, as the pamphlet points out, " No matter how well treated, cod kept in crushed ice will not remain reasonably fresh for more than ten to twelve days ".

The speed with which the catch is handled as soon as it is hauled on deck, the temperature of the fish itself when caught, the air and sea temperature and weather conditions at the time, cleanliness and care of handling and the method of packing the fish in ice inside the fish-holds, are all factors which affect the eventual quality of the fish when landed. The air and sea temperature encountered throughout the period the vessel is engaged in fishing, and particularly during the voyage home, are also important factors. The pamphlet deals with such questions as insulation of fish-holds, the use of refrigeration " grids " along the deckhead and the introduction of CO_2 gas into the hold, all of which are adopted with the object of lengthening the time the fish can remain fresh aboard the trawler. For example, the use of CO_2, associated with controlled temperature in the hold, might keep the fish fresh for as long as 21 days after catching. It is noteworthy that simple refrigeration alone is not sufficient to keep fish aboard a trawler in good condition over a long period; deep freezing seems to be the eventual answer, but as this involves very low temperatures there are many practical difficulties about doing this aboard a trawler at sea.

The " meteorological " care of cargo aboard a merchant ship and the care of fish in a trawler's hold are subjects which are somewhat akin. Both of these imply some knowledge of practical meteorology on behalf of those who go down to the sea in ships. One sometimes hears a young ship's officer ask, " What is the value of teaching meteorology to a seaman ? " From the safety point of view the answer is fairly obvious, for if a ship's officer knows nothing about such matters as relationship between wind and pressure and the laws of storms, he is no seaman. In this modern age he also wants to know something about how to interpret a radio weather message. Care of cargo and care of the fish in a trawler's hold are admittedly not safety matters, but they undoubtedly have a bearing upon the prosperity of the owners of the vessel and hence upon the future of the seaman's livelihood. Thus it seems inevitable that if he is to be efficient at his job the trawlerman, as well as the Merchant Navy officer, needs to have some knowledge of elementary meteorology; as well as knowing about winds, storms and icebergs he should at least know something about the practical side of temperature and humidity and about the air and sea temperature he is likely to encounter during his voyage.

Problems concerning the care and handling of cargoes and fish are not only matters of national but also of international interest. When one considers the upward trend in world population, the reason for this is obvious. Under the Food and Agricultural Organisation of the United Nations, problems concerning trawler design and the care of fish were internationally discussed at Paris recently. A working group of the World Meteorological Organisation is investigating questions concerning the meteorological care of cargo, and is considering the preparation of an international pamphlet of this subject for issue to interested authorities. The International Cargo Handling Co-ordination Association has been very active recently in discussing various problems connected with the handling of cargo. It is perhaps worth mentioning that at one of the meetings of this last-named organisation, some criticism was levelled by one speaker about the lack of knowledge of ships' officers concerning cargo operations, and suggested that more training in cargo handling was needed generally. Whether this is true or not is a matter of opinion, but there is no doubt that in addition to having academic knowledge, modern requirements have not diminished the need for a ship's officer to be above all a seaman. Care of his cargo is basically one of the chief duties of a ship's officer, and anything which can be done to ensure that goods carried aboard ships, whether they be perishable or unperishable, is to the advantage of the community.

MARINE SUPERINTENDENT.

CHANGES IN THE INTERNATIONAL METEOROLOGICAL CODES

The existing international meteorological codes for use aboard ship (Code Forms FM 21, FM 22 and FM 23) have now been in force universally and without change since 1948.

At a recent meeting of the Commission for Synoptic Meteorology (World Meteorological Organisation) it was decided, for various practical reasons, that certain changes should be made in the composition of the meteorological codes for use ashore. As voluntary observers aboard ship have now got used to the present codes, it is very satisfactory to note that no changes in the composition of the codes for use at sea were recommended.

Some minor changes in the specification of some of the meteorological elements to which the code groups for use at sea refer, were recommended, however, and these will come into force on 1st January, 1955. These changes will be notified officially to all voluntary observers at sea well in advance of that date and are also being promulgated in Admiralty Notices to Mariners. The most important change is one affecting the specification of " characteristics of barometric tendency ", in which the code figures to be used are reduced in number from 10 to 9; the other changes are mainly in the nature of " editorial amendments ".

SPECIAL LONG-SERVICE AWARDS

Each year since 1948 the Director of the Meteorological Office has made a special award to the four voluntary marine observers whose long and meritorious work at sea on behalf of the Meteorological Office is considered as deserving special recognition. Each officer who qualifies for this award has carried out a minimum of 15 years' service as a voluntary marine observer. Considerable care is taken to check each officer's record, both as regards actual years of observing and the quality of his individual logbooks, to ensure that the award is made fairly. This year the Director is pleased to make the special awards to the following captains:

CAPTAIN A. E. LETTINGTON, O.B.E., D.F.C. (New Zealand Shipping Co.), whose first meteorological log was received here in 1926. In 17 years he has sent us 31 books, 20 of which have been classed excellent.

CAPTAIN P. MACMILLAN (Clan Line). A voluntary observer since 1926. In 15 years he has sent in 40 logbooks of which 33 have been classed excellent.

CAPTAIN J. W. CAUNCE, R.D., Commander R.N.R. (retired), of the Cunard Line. A voluntary observer since 1919 when he was serving in the Pacific Steam Navigation Co. Since then, in 17 years, he has sent us 84 logbooks, 28 of which have been classed excellent.

CAPTAIN H. E. REILLY, D.S.C., R.D., Commander R.N.R. (retired), of the New Zealand Shipping Co. Since 1924 he has, in 15 years, sent us 25 logbooks, 15 of which have been classed excellent.

The award will, as in past years, be in the form of a suitably inscribed barograph. We congratulate these captains on the recognition of their voluntary work over many years. They will be personally notified of the award and of the arrangements which will be made for its presentation.

Obituary

As announced in the July, 1954, number of *The Marine Observer*, COMMANDER J. HENNESSY, M.B.E., R.D., R.N.R., Deputy Marine Superintendent of the Meteorological Office, died suddenly at Sidcup, Kent, on 22nd May, 1954. His passing is mourned by all those who had the privilege of working with him.

Jack Hennessy was born in the west country in 1885, and he came from a naval family. An ancestor of his was purported to have served at Trafalgar. He served his apprenticeship in sail aboard the barques *Ancon* and *Serena*, and subsequently served as second mate and mate of the barque *Miniven*. He then transferred to steamships as Junior Officer in the P. & O. Company, and later joined the North-West Transport Company. He was in command of S.S. *Uranium* when war broke out in 1914. As a Lieutenant, R.N.R., he was mobilised and appointed navigator of the armed merchant cruiser *Carmania*, and took part in the famous battle with the German armed merchant cruiser *Cap Trafalgar* in the South Atlantic. He was serving as Executive Officer aboard H.M.S. *Hussar* at the Dardanelles landings and he commanded her during the subsequent operation in the Adriatic. At the end of the war he worked ashore for a while in the Second Sea Lord's office at the Admiralty.

Commander Hennessy joined the Marine Branch of the Meteorological Office in 1919. In association with the late Captain Brooke Smith, Hennessy played an active part in the creation and development of the modern "selected ship" system, whereby radio weather messages from merchant ships in all oceans are transmitted to various meteorological centres. The "selected ships" scheme, which was introduced in 1930, is a modern development of the scheme inspired by Maury and instituted in this country by FitzRoy in 1854, for the collection of meteorological information by voluntary observers in merchant ships. Hennessy had been a keen meteorological observer when he was at sea, and there was probably nobody who had a more intimate knowledge of this work and of the practical difficulties associated with some of the observations than he had, and he was thus always sympathetic towards the viewpoint of the observer aboard the ship.

Jack Hennessy played a prominent part in organising the statistical treatment of marine meteorological data in the Office. In 1921 the Marine Branch of the

Meteorological Office adopted the Hollerith system of punched-cards for the statistical treatment of the observations taken from ships' logbooks in order to facilitate analysis of the enormous amount of data which had accumulated during so many years and which had previously to be laboriously extracted by hand. Nobody had a more intimate knowledge of the capabilities and limitations of the system than he had. The changes from the old " climatological " logbook to the modern " synoptic " logbook for use aboard voluntary observing ships, as well as the rather frequent but unavoidable changes in meteorological codes, caused many complications and changes in the form of the cards. Commander Hennessy's experience and sound advice about such problems were invaluable. Without the punched-card system there is little doubt that the compilation of world-wide climatological statistics in all oceans and the subsequent resultant preparation of comprehensive meteorological atlases which was carried out during the Second World War under Hennessy's direction—in consultation with the Admiralty—would have been an almost impossible task.

During the Second World War the Marine Branch was moved from London to Stonehouse in Gloucestershire. From 1940–45, in the absence of the Marine Superintendent, who was called up for active service in the Royal Navy, Commander Hennessy was in sole charge of the Marine Branch, and it was thus that all the war-time work of the Branch fell upon his shoulders. He was thus responsible for the preparation of all the ocean atlases of maritime climatology, as well as those of surface currents and ice, which were produced in consultation with the Admiralty during the war—primarily for naval purposes but subsequently to be made available to all merchant shipping. The Marine Branch also did quite a lot of work in connection with Admiralty Pilots. In the course of all this work Commander Hennessy worked closely and harmoniously with the appropriate naval authorities —primarily the Naval Weather Service and the Hydrographer.

In 1945 the Marine Branch moved to its present headquarters at Harrow, and Hennessy resumed his post of deputy to the Marine Superintendent. The many and unavoidable absences of the Marine Superintendent at international conferences and on other duties brought much responsibility to Hennessy in connection with the post-war reorganisation of the "selected ships" and especially in connection with the initial fitting out of the British and Norwegian weather ships, which coincided with international conferences in Toronto and Washington which the Marine Superintendent had to attend. Commander Hennessy was a member of the Commission for Maritime Meteorology, and at the meeting of that Commission in London in 1952 his knowledge and practical experience proved very valuable. He was awarded the M.B.E. in the New Year's Honour's List for 1953.

Hennessy had great charm of manner and a remarkable facility for getting the best out of those who worked for him. He was extremely conscientious, had an intense sense of loyalty and considerable religious convictions. He was a generous and agreeable companion and had a fine sense of humour. He never lost his love for the sea and did a lot for the Sea Cadet movement when he was at Stonehouse.

He is survived by a widow and two sons.

C. E. N. F.

Dispatch by Radio of 0600 Observations by Selected Ships in the Eastern Atlantic

The 0600 observation from shipping in the eastern Atlantic is a very important one, as many of the important forecasts which are prepared at Dunstable are based upon the 0600 synoptic chart. It is realised that aboard ships carrying only one radio officer in the North Atlantic east of 30°W, the radio officer does not come on watch until 0800 G.M.T. At 0800 the synoptic chart in question is still in the process of being plotted. In view of the importance of these observations it is requested that aboard ships only carrying one radio officer this 0600 message be dispatched as soon as possible after the radio officer comes on watch at 0800.

INDIA METEOROLOGICAL DEPARTMENT

We have been informed by the Director of India Meteorological Department that the following list of ships of the India Voluntary Observing Fleet have gained Excellent Awards for their work during the period 1952-53. The award takes the form of an inscribed alarm timepiece and a book, *Touching the Adventures*, edited by J. Lennox Kerr. We congratulate the recipients of these awards.

Ship	Owners/Agents	Captain(s)	Observing Officers	Radio Officers
Bharatjal	Bharat Line, Ltd.	C. F. Morris G. E. Duffy	A. K. Modak M. A. Adam N. F. Kadir A. H. Lambay A. Ismail	J. Carneiro N. C. Engineer
Jalaganga	Scindia Steam Navigation Co., Ltd.	F. G. P. Mathews	J. L. Thomas Ved Sharma P. A. Moos J. C. Joseph	J. R. Mugasetti G. B. V. Lebe
Jalaprakash	Scindia Steam Navigation Co., Ltd.	A. T. Goodwin T. E. M. Rozario J. Y. Kerr	K. N. Rao I. D. Hyams M. D. Khatri V. K. Palsole D. K. Bhattacharya P. K. Malhotra A. Feiguiredo	K. P. A. Panikar B. S. Harindar
Jehangir	Mogul Lines, Ltd.	H. Morini E. W. Richards	G. T. Edwards A. A. Nazareth S. Sufi E. Dawes C. Clayton	J. Brown
Maharaja	Asiatic Steam Navigation Co., Ltd.	A. W. C. Jolly	M. W. DeSilva P. I. Morgan D. R. Connors A. B. Roy O. M. Morris E. P. J. Costelino E. Condliffe D. G. Barton Aung-Gyi I. G. Jolly	J. P. O'Harra J. Macdonald D. MacMillan R. W. G. Townsend Rose
Mozaffari	Mogul Lines, Ltd.	J. W. E. Cochrane	F. Lynn F. Hanson R. J. Ward A. A. Nambiar C. Clayton R. G. Coutinho W. I. Shirrefs	G. K. Embley
Rajula	British India Steam Navigation Co., Ltd.	Jamieson F. Mears	Webb V. A. H. Iles Bennett Mande Kells C. W. Jenkins T. E. Kelso	R. E. Steward P. Handerson L. Pye J. Evans
Santhia	British India Steam Navigation Co., Ltd.	J. W. Milne J. C. L. Hornor	D. A. C. Windle G. F. Bartley G. A. Brignall M. S. Gordon F. W. Perry J. E. Wills A. W. Lloyd Taylor	J. W. Hunter C. W. B. Stimpson
Subadar	Asiatic Steam Navigation Co., Ltd.	W. F. Munro	W. Alexander B. C. Milligan T. Hindmarch M. H. Major F. Ferinands	J. E. Lyton

THE MARINE OBSERVERS' LOG

October, November and December

The Marine Observers' Log is a quarterly record of the most unusual and significant observations made by mariners.

The observations are derived from the logbooks of marine observers and from individual manuscripts. Photographs or sketches are particularly desirable.

Responsibility for each observation rests with the contributor.

LOCUSTS

Off Cape Verde

M.V. *Carnarvon Castle*. Captain W. S. Byles, R.D., R.N.R. Southampton to Madeira. Observers, the Master and Mr. D. Witty, 4th Officer.

4th November, 1953. During the morning numerous locusts and praying mantis came aboard and alighted on various parts of the ship. They appeared to be quite exhausted and arrived individually, not in a swarm. Towards the evening most of them had died, but one or two appeared to survive for one to two days on the foremast rigging. The distance to the shore was approximately 50 miles. Wind NE, force 4, falling light and variable in evening.

Position of ship at 0600 G.M.T.: 12° 36'N, 17° 42'W.

Note. This observation has been forwarded to the Anti-Locust Research Centre.

ERUPTION OF DIDIKAS VOLCANO

Luzon Strait

M.V. *Cingalese Prince*. Captain B. R. Simons. Kowasaki to Djakarta. Observers, the Master and Mr. P. Norwood, 2nd Officer.

8th November, 1953. In the morning (ship's time) Didikas Volcano was observed to be still in eruption, a plume of steam or white smoke of only moderate density extending down-wind, broadening and disappearing at a short distance from the island. The ship did not pass closer than 25 miles from the island, but it seemed to be very steep on all sides, and the plume was not originating from a prominent cone. The island appeared to be composed of numerous peaks and hills, and the steam to rise from the centre of the island. Visibility was exceptional, land clearly visible at 50 miles.

Position of ship, off Didikas Rocks: 19° 05'N, 122° 12'E.

Note. Two previous observations of this volcano and a note on its history will be found in pages 134 and 135 of the July, 1953, number of this journal.

LINES OF DEMARCATION AND RIPS

West African waters

S.S. *Clan Buchanan*. Captain J. A. Forster. Dakar to Cape Town. Observers, Mr. P. C. W. Hoblyn, 2nd Officer, and Mr. R. Ross Will, 3rd Officer.

28th October, 1953. During the forenoon and afternoon watches the vessel passed through a series of tide rips; the sea was of glassy appearance with irregular lines of ripples following no particular direction. The helmsman had difficulty in keeping a good course while passing through successive rips. The course recorder showed an erratic course such as might be expected in a heavy sea. During the period the vessel was frequently crossing and recrossing the 100-fathom line. Wind 260°, force 1–2. Course 143°.

Mean position of ship: 10° 25′N, 16° 50′W.

S.S. *Corinthic.* Captain A. C. Jones. Cape Town to Las Palmas. Observer, Mr. J. A. Wooler, 4th Officer.

16th December, 1953, 0645 G.M.T. Several pronounced lines of darker coloured water with lighter coloured water in between were observed parallel with each other, and stretching from horizon to horizon in a 290°–110° direction. The surface of the dark coloured lines was considerably rippled and confused, while elsewhere the sea was calm. The dark bands, about eight in all, were approximately 50 yd wide and spaced about 150 yd apart. On entering each of these lines the vessel sheered to starboard, and when leaving sheered to port, also making a slight list each way on every occasion. Air temp. 82°F, sea temp. 84°. Sky heavily overcast, visibility about 5 miles.

Position of ship: 08° 09′N, 15° 23′W.

Off South Coast of Ceylon

S.S. *Mahanada.* Captain H. C. Kinley. Vizagapatam to Colombo. Observer, Mr. D. L. Des Landes, 2nd Officer.

30th November, 1953, 0915 G.M.T. The vessel crossed a sharply defined line of foam containing numerous tree trunks, branches, etc., extending in a WNW–ESE direction. The water to NE was light green and that to SW dark blue. Sea temp. at 0600, 82·8°F, at 2130, 84°. Slight S'ly swell.

Position of ship: 5° 55′N, 80° 49′E.

CURRENT RIPS

Arabian Sea

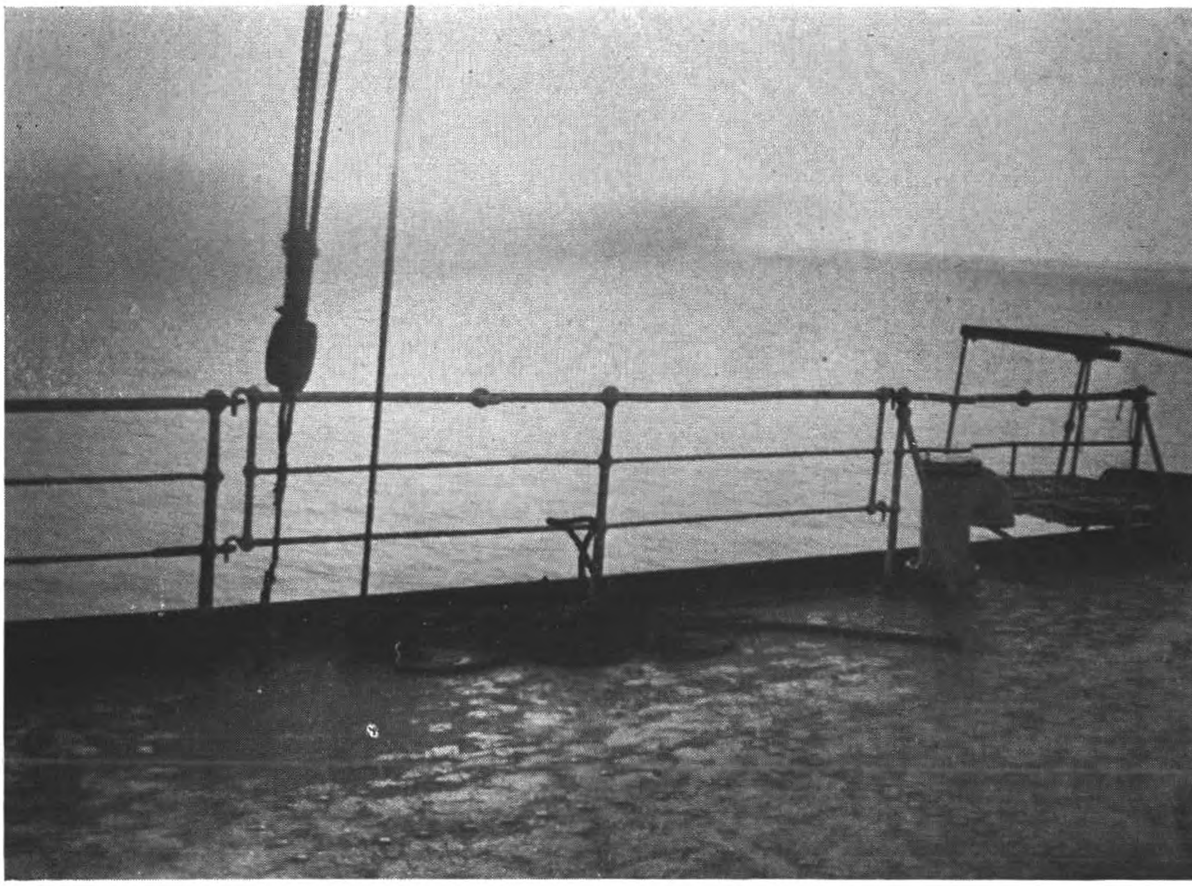
S.S. *Markhor.* Captain J. B. Newman. London to Calcutta. Observer, Mr. J. S. Munro, 2nd Officer.

26th October, 1953, 0945–1700 G.M.T. The vessel passed through an area of strong and, at first, confused current rips. Shortly after noon the confused water developed into bands about 2 miles apart and ½ mile wide in a N–S direction, and reaching from horizon to horizon in a E–W direction. Although the sea was calm with a moderate S'ly swell, a short steep sea was frequently observed near the N'ly edge of the current rips, as if a shoal of large fish were jumping or a force 3 wind blowing in a small area. The bands were moving north at about 5–7 kt. The vessel tended to sheer badly against the helm when passing into and out of the rips. Bearings were obtained every half-hour throughout the period, and a slight W'ly set was observed. Wind, calms and light variable airs. Sea smooth or rippled, moderate S'ly swell.

Position of ship at 0945: 11° 55′N, 51° 33′E; at 1700: 11° 31′N, 53° 07′E.

Note. The reversal of the east-going current of the SW monsoon period in the Gulf of Aden to the west-going current of the NE monsoon period is completed in the month of October. The north-going current along the east coast of Africa of the SW monsoon period, giving N'ly and NE'ly sets between Cape Guardafui and Socotra into the Arabian Sea, however, still persists in this month, and it is suggested that the rips experienced by S.S. *Markhor* near the entrance to the Gulf of Aden may have been produced by the meeting of these currents running in different directions.

Commander J. HENNESSY, M.B.E., R.D., R.N.R., in his office in the Marine Branch of the Meteorological Office, Harrow.



Sea fog in the Persian Gulf observed from S.S. *City of Delhi* on 4th December, 1953, 0330 G.M.T.

Abnormal refraction observed from M.V. *Hertford* (see page 209)

SAND DEPOSIT

North Atlantic Ocean

M.V. *Northia*. Captain C. McK. Young. Curaçao to Naples. Observer, Mr. A. Alexander, 2nd Officer.

10th December, 1953. It was observed at 0700 G.M.T. that a marked deposit of red sand had settled on the ship in the course of the night. Wind 100°, 11 kt; light surface haze.

Position of ship at 0600: 33° 30′N, 16° 42′W.

Note. The position of the ship during the above observation was somewhat to the N of the extensive area in which sand deposits are frequently experienced off the west coast of Africa. According to the diagram given by Schott in *Geographie des Atlantischen Ozeans*, the approximate northern limit includes all the Canary Islands and is in about lat. 29°–30°N.

LUMINOUS PHENOMENON

North Atlantic Ocean

S.S. *Caxton*. Captain J. G. Wilson. London to Newfoundland. Observer, Mr. R. L. Goodfellow, 3rd Officer.

11th November, 1953, 2330 G.M.T. This evening when the lookouts were relieving each other on the forecastle head, they noticed that an apparent phosphorescent substance, giving off a greenish glow, adhered to those parts of their clothing which were exposed to the wind, also to the apron of the forecastle head, the jackstaff and halyards. It could be readily brushed off or transferred to other objects. Wind N'ly, force 3. Weather slightly cloudy, good visibility.

Position of ship: 52° 54′N, 46° 42′W.

Note. The cause of this phenomenon cannot be assigned with certainty. In the January, 1954, number of this journal an observation of St. Elmo's fire, made by the same observer in the same ship, was published. On that occasion it was clearly stated that the minute balls of light on the cap of the lookout man could not be brushed off and this is what would be expected with St. Elmo's fire. In the present instance the luminosity was clearly stated to be transferable, which seems to rule out an electrical phenomenon. An alternative explanation is that spray containing minute phosphorescent organisms was blown on to the foredeck. The possibility of this cannot be fully judged as the logbook contains no information about the state of the sea at the time, but the recorded wind of force 3 does not appear to be strong enough. Also, while phosphorescence is not unknown in November in the North Atlantic, it is considerably less likely than during the summer months.

PHOSPHORESCENCE

South China Sea

S.S. *Peleus*. Captain R. E. Wilks. Hong Kong to Singapore. Observers, Mr. D. G. Peers, 2nd Officer, and Midshipman T. E. Lang.

9th November, 1953, 0120 a.m. Long straight bands of a greyish colour appeared on the surface of the sea, moving very quickly and passing the ship at the rate of 180 per minute. The first appeared from direction W'S, moving parallel to each other, and continuing past the ship until lost in the darkness. The direction of approach gradually changed from W'S to NW and the phenomenon finally faded away after 15 min. At 0200 a.m. the phenomenon occurred again, this time starting from WSW and gradually moving round through N to E. The bands appeared to be about 6 ft broad with a space of about 30 ft between them. There was no apparent disturbance to the line or passage of the bands caused by the ship. This occurrence, which was observed from the forecastle head, also lasted 15 min before fading away. Air temp. 80°F, sea 85°; bar. 29·84 in.; wind SSW, force 3. Sky overcast with occasional rain. Slight sea, no swell or moon.

Position of ship: 04° 35′N, 106° 17′E.

Note. These rapidly moving bands are sometimes the forerunner or the aftermath of a phosphorescent wheel, and we have only a few observations of them without association with the wheel. The above observation is therefore of interest, especially as it is almost identical with one made by S.S. *Naldera* on 19th November, 1928, in the same region (03° 20′N, 105° 35′E). In *Naldera*'s observation the rate of the bands passing the ship was the same as in that of S.S. *Peleus*, three per second, and the direction of the bands also changed during the period of observation in a clockwise direction.

Entrance to Hudson Strait

S.S. *Warkworth.* Captain N. Thompson. Port Churchill to Birkenhead. Observers, the Master and Mr. C. Harron, 3rd Officer.

9th October, 1953, 0200 G.M.T. Very marked phosphorescence observed on sea surface for about 30 min., then disappearing. It extended a considerable distance on either side of the vessel, each individual piece being unusually large and brilliant. Smooth sea, very slight S'ly swell. Sky overcast, wind variable, force 1. Air temp. 31° F, sea 33°. Strong currents and tide rips experienced in this area.

Position of ship: 60° 52′N, 64° 40′W, abeam of Resolution Island.

Note. This is a particularly interesting observation in view of the high north latitude and the coldness of the air and sea.

Great Australian Bight

S.S. *Kent.* Captain P. P. O. Harrison. Auckland to Liverpool via Suez. Observers, the Commander and Mr. B. Whelan, 3rd Officer.

5th October, 1953, 2100 S.M.T. The ship passed through patches of phosphorescence spread over an area of about 13 miles. The patches were 20 to 30 ft across and were made up of smaller blobs of about a foot. The patches were well under the surface and seemed to shimmer and move about as a school of fish might do. There was little wind. Sea temp. 54°F.

Position of ship: 38° 36′S, 138° 18′E.

Same ship and observers. Mediterranean Sea.

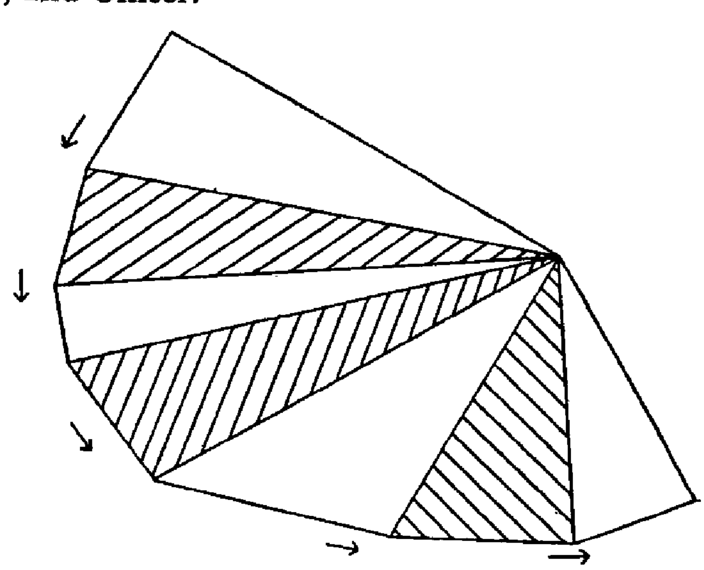
12th to 13th November, 1953. Shortly after 2118 G.M.T. Cap de Gata abeam (course 260°) the ship entered an area of phosphorescence which lasted till about 0400 when the dawn finally obscured it. It was continuous but there were periods of extreme brightness when the ship was partially lit by the glow.

Position of ship at 1200 on 12th: 37° 30′N, 00° 01′E.

PHOSPHORESCENT WHEEL

South China Sea

S.S. *Canton.* Captain J. C. W. Last, O.B.E. Singapore to Hong Kong. Observer, Mr. G. E. Howe, 2nd Officer.



12th November, 1953, 1815–1845 G.M.T. The centre of the rotating bands of a phosphorescent " wheel " was observed about ½ mile distant, 60° on the starboard bow, and remained in that position throughout the observation; extensions of the " wheel " were visible ¾ mile away on the port side. The bands were about 6–8 ft broad and passed the ship at intervals of about 3 sec. On closer attention to the " wheel ", it appeared that it was composed of bands close together, alternate bands lighting up and going out, giving the effect of rotation, although stationary. Wind NE, light. Sea rippled. Temp., dry 80°F, wet 76°, sea 84°. Cloud 3/8 Cu. Visibility 10–15 miles.

Position of ship: 4° 01′N, 106° 10′E.

Gulf of Siam

S.S. *Benalbanach*. Captain G. A. Naysmith. Singapore to Kohsichang. Observers, the Master and Mr. J. Ritchie, 2nd Officer.

30th October, 1953, 1840 G.M.T. A peculiar flickering was noticed on the sea ahead of the vessel, as if the clouds were scudding across the face of the moon and being reflected upon the surface of the sea. This was impossible as the moon at that time was low in the eastern sky and obscured by heavy cloud. As the vessel drew nearer, the light in the sea became brighter, and now appeared as great curved bars of phosphorescent lights, having a radius of about 2 miles and revolving about a bright centre about a mile off the starboard bow of the vessel. The scene appeared as if the light were coming from a revolving beacon just under the surface of the water, the beams being roughly 100 yd apart at approximately 1 mile from the centre and revolving in an anticlockwise manner; one could liken the speed to that of the radar scanner on board the ship, a rough estimate would be 20 revolutions per min. This phenomenon lasted about 10 min, and the vessel appeared to leave the catherine-wheel of light much faster than she had approached it. It is doubtful whether the disturbance ceased or the ship passed out of the area of its activity.

Soundings were taken and a depth of 34 fathoms was recorded on a reliable machine, but in the engine-room vibrations were felt and likened to those experienced when the vessel is known to be in shallow water. Weather at the time of observation was fair with four octants of the sky covered with cumulus cloud; a light W'ly wind was blowing and the sea slight. Well over to the eastward, covering the moon, a large rain squall was seen and lightning flashes were observed within it. The past weather up to one hour previously had been fresh W'ly wind with frequent heavy rain squalls.

Position of ship: 11° 20′N, 101° 20′E.

Note. These two new observations of the phosphorescent wheel form a valuable addition to our records of this phenomenon, particularly as in each case the centre of rotation was seen to be comparatively near the ship. This proves that the bands were rotating round a definite centre and were not merely moving parallel bands converging by perspective to a point on the horizon. The observation of S.S. *Canton* is also of particular interest, as it is the first that we have had where it could be actually seen that alternate bands were lighting up and going out, giving the effect of rotation, but not actually being a rotation of the water or of organisms in the water. This is very significant in relation to the opinion expressed in the note in page 75 of the April, 1954, number, namely, that the apparent movement is due to some form of stimulating process which can move rapidly over or through the water, the light of the organisms alternately flashing up and dying down as it passes. For further information about the phosphorescent wheel, as seen in the sea and in the air, see page 233 of the present number.

DISCOLOURED WATER

Caribbean Sea

S.S. *Akaroa*. Captain J. W. Hart. Cristobal to Curaçao. Observer, Mr. A. R. Stevenson, 2nd Officer.

8th October, 1953, 2000 zone time. The vessel passed through large patches of muddy brown water, extending about 5 miles in a line 070° to 250°. Sea temperature remained constant at 85°F.

Position of ship: 10° 21′N, 78° 00′W.

Same ship and observer.

11th October, 1953, 1655 zone time. The vessel passed several patches of light brown discoloration, which extended about 3 miles along the direction of the wind, 090°.

Position of ship: 14° 04′N, 67° 10′W.

LIGHTNING

North Atlantic Ocean

S.S. *Manistee*. Captain J. Kinsley. London to Kingston (Jamaica). Observer, Mr. D. Downing, 3rd Officer.

21st October, 1953, 0100 G.M.T. During a severe thunderstorm the docking telegraph on the wing of the bridge was struck by lightning. At that moment a crackling sound was heard and sparks were seen on the radio aerials and in the radio office. The magnetic compasses were unaffected.

Position of ship: 27° 10′N, 59° 20′W.

Note. This observation was sent to the Admiralty Compass Laboratory, who commented as follows:

" It is noted that this is the second occasion on which this vessel has been struck by lightning without any change in deviation of magnetic compasses having resulted. On the first occasion (in July, 1952) the strike seems to have been on the foremast, but on the second (in October, 1953) the bridge structure was involved. On a ship being struck by lightning, particularly in the neighbourhood of the bridge, experience has led to the expectation of a considerable change in deviation, which in extreme cases has rendered the compasses useless. The athwartship magnetic field of the ship is normally the most affected, and on occasion a reversal of the athwartship corrector magnets has been found necessary.

" Messrs. Elders and Fyffes have been consulted concerning the structural arrangements of the bridge of S.S. *Manistee*, and from information kindly furnished by them it is evident that she is one of the older types of merchant vessels, built in the days when bridges were constructed very largely of wood and when compass positions in these ships were almost ideal. It is likely that the fact that her compasses remained unaffected by the lightning is largely attributable to this. In the more modern design of merchant vessel, with steel bridges and prefabricated steel wheelhouses, it is probable that the results, on being struck by lightning, would have been considerably more serious from the compass aspect."

ABNORMAL REFRACTION

Bass Strait area

M.V. *Dominion Monarch*. Captain B. Forbes Moffatt. Sydney to Melbourne. Observers, Mr. G. Perry, 3rd Officer, and Mr. K. Brown, 4th Officer.

21st December, 1953, 0700 G.M.T. The sketches and notes give the appearance of a vessel at distances ranging from 17–5½ miles from 1700–1730 S.M.T. At 17 miles a half of an inverted ship could only be clearly seen with the aid of a telescope, and then only on the side nearest the sun. The line joining the refracted and the true images was at first thought to be smoke, but as it was later found there was no smoke it must have been caused by the funnel being very greatly elongated. When 16 miles distant the belt of apparent haze was 0° 10′ above the horizon. This superior mirage remained until the vessel was 12 miles distant. At this distance the vessel was seen as in Fig. 2, with the refracted hull no longer inverted.

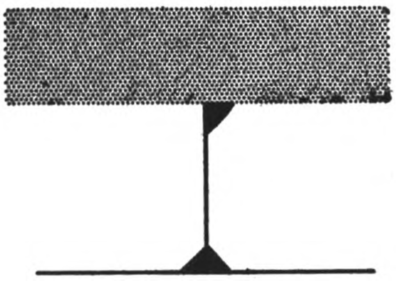


Fig. 1

Fig. 2

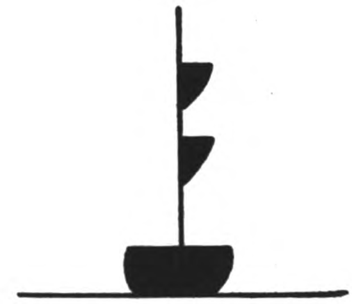


Fig. 3

The heat haze above had all but vanished and the impression given was of elongated masts with tables clearly defined. At 11½ miles an additional image was visible and the increase in size of the two refracted images showed that it was half of the whole ship structure visible and not any particular part of it. At 10 miles the vessel appeared normal apart from an exaggerated rising and falling of the funnel. An altitude taken gave the height of the top of the masts above the waterline as 425 ft. When 8 miles distant the masts still appeared very tall with the funnel alternately " looming " and " stooping ", but at 7 miles the vessel appeared as a solid block with three bridges, funnel and masts just visible above the superstructure. At 5½ miles the ship took on normal appearance which remained. Temp.: dry 71°F, wet 66°, sea 64°. Sun at 1730 S.M.T., bearing 260°, altitude 23°.

Position of ship at 1700 S.M.T.: 37° 01′S, 148° 11′E.

South Australian waters

M.V. *Hertford*. Captain E. R. Burton. Adelaide to Sydney. Observers, the Master, Mr. G. R. Naylor, Chief Officer, and Mr. J. T. Varney, 3rd Officer.

2nd December, 1953, 1830 G.M.T. On approaching Cape Jervis, fine on the port bow, the Macdonnell Peninsula on Kangaroo Island appeared to be merging into the mainland. The headland of the peninsula was repeated three times, clearly defined, across the opening of Backstair Passage, as shown in the sketch. At the same time a vessel on the starboard beam proceeding into the Gulf of St. Vincent appeared to be refracted into the sky. The phenomenon lasted about 20 min. Air temp. 68°F, which had fallen 24° in the previous three hours. Sea temp. 64°.

Position of ship: 35° 30′S, 138° 2′E.

M.V. *Port Victor*. Captain E. T. N. Lawrey. Melbourne to Aden. Observer, Mr. W. Duthie, 3rd Officer.

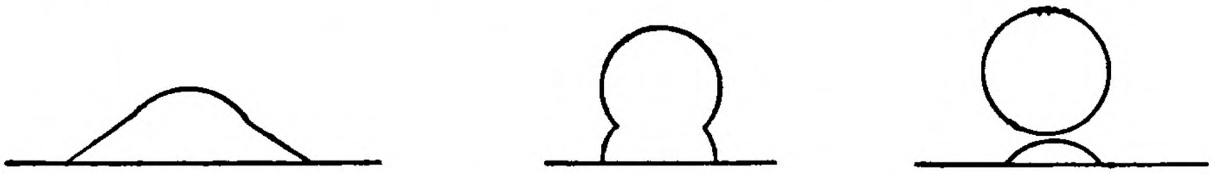
19th December, 1953, 1930 local time. Having just passed Cape Otway, abnormal refraction was observed all round the horizon. A heavy sw'ly swell was running and the sea, at the horizon, had a long drawn out appearance like heavy surf. The most marked effect was seen with two different types of vessels. The first, a tanker of about 10,000 tons, was approaching end on, and as she dipped to the swell appeared one moment like a thin vertical line and the next like a large rectangular block. The funnel, which could be seen at times, pumped in and out like a bellows as the ship rose and fell on the swell. This vessel passed about ¾ mile off, and when abeam there was no distortion apparent; when about 3 miles astern of us the effects began again. The other vessel was a three- or four-masted schooner; doubt as to the number of masts was caused by the unusual appearance and the distance off. She also appeared at one moment as a thin line but horizontal.

When riding atop the swell she appeared as though one ship was inverted beneath the other. Weather fine, slight haze, calm sea.

Position of ship: off Cape Otway.

Van Diemen Strait, Japanese waters

M.V. *City of Swansea.* Captain F. J. Vizer. Hong Kong to Kobe. Observers, Mr. E. G. O'Driscoll, Chief Officer, and Mr. F. G. Gurney, 4th Officer.



5th November, 1953, 2132 G.M.T. Over a period of about 2 min the sun was seen to rise with its base elongated on the horizon, and as it rose above the horizon a second " sun " disappeared below the horizon. Sky 3/8 fair weather Cu, height 2,000 ft.

Position of ship: 31° 51′N, 132° 06′E.

North Atlantic Ocean

M.V. *British Consul.* Captain G. R. MacKillican, M.B.E., Isle of Grain to Dakar. Observer, Mr. A. E. Williams, 3rd Officer.

23rd December, 1953, 2100 G.M.T. On rising the moon was distorted as shown in the sketches. The moon also appeared to be changing colour from the normal yellow to green and deep red, and then back again, with a frequency of about 5 sec for the complete cycle. The apparently jagged edges seemed to be moving in the same way as flames on a coal fire. The elongation at 2108 took place quite suddenly and the colour changing ceased at the same time. The moon appeared normal by 2110. Cloud, Cu 4/8.

Position of ship: 36° 30′N, 13° 10′W.

LUNAR HALO

South Pacific Ocean

S.S. *Captain Cook.* Captain J. Cook. Balboa to Wellington, N.Z. Observer, Mr. A. MacLean, 2nd Officer.

19th October, 1953, 0600 zone time. A double lunar halo was observed with radii 30° for the outer and 22° for the inner halo. The altitude of the moon was 85°.

Position of ship: 20° 54′S, 139° 30′W.

Note. A lunar halo of 30° radius was seen by the same observer in the same ship on 19th July, 1953, and was published, together with a note, on page 143 of the last number of this journal.

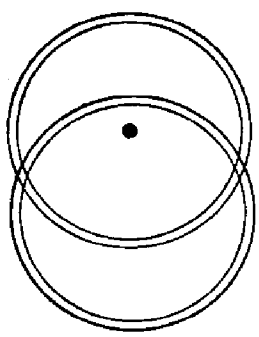
SOLAR HALO

Great Australian Bight

M.V. *Paringa*. Captain E. J. Kerridge. Melbourne to Aden. Observer, Mr. C. I. H. Greaves, 2nd Officer.

14th October, 1953, 0600 G.M.T. A solar halo, with colours, was observed, radius 23°. The sun's altitude was 49°. At 0620 a second and similar halo was observed, eccentric with the first and of the same radius, but southward of the sun. The width of both halos was 1½°. They attained greatest brilliancy at 0630, but finally disappeared at 0645. Visibility excellent. Cloud, 4/8 Cs, thin. The cloud within both halos appeared denser and darker than the cloud outside.

Position of ship at 0600: 35° 37′S, 12° 09′E.



Note. This is an interesting observation of a halo which is not among the recognised halo phenomena. Such anomalous halos are undoubtedly seen at times, sometimes quite distant from the sun or moon. The difficulty in explaining them lies in the fact that there is no central source of light, not even a mock sun, to provide light for the formation of the halo.

EARTH SHADOW

Eastern Pacific Ocean

S.S. *Pacific Reliance*. Captain P. F. Owens. Los Angeles to Panama. Observer, Mr. V. C. Jackson.

1st December, 1953. At sunset a dark-blue segment, giving the impression of a shadow, was observed to rise from the eastern horizon. The segment was well defined at the base with a distinct rose-coloured band stretching away on either side. On rising it broadened until it disappeared at the observer's zenith. It was visible for a considerable time after sunset, and an abnormal afterglow was also observed on the western horizon. Cloud, 1/8 Cu.

Position of ship: 11° 21′N, 93° 54′W.

Note. This phenomenon is described in page 77 of the *Marine Observer's Handbook*, Seventh Edition, 1950. The dark-blue segment is the shadow of the earth thrown by the sun on the earth's atmosphere. The rose-coloured band is a normal addition to the shadow and is known as the counterglow. The phenomenon is one of daily recurrence, providing the sky is cloudless and visibility good, but it has seldom been reported by ships. As the sun gets further below the horizon the shadow rises rather quickly in altitude, soon obliterating the counterglow. How long it remains visible before being merged in the darkening sky is a matter of atmospheric transparency; it has sometimes been traced right up to the zenith.

GREEN FLASH

Gulf of St. Lawrence

S.S. *Asia*. Captain F. E. Patchett. Le Havre to Montreal. Observer, Mr. L. Hamer, 3rd Officer.

23rd October, 1953. At sunset a greenish-purple flash was observed, bearing 251°. Visibility excellent, land sighted at 90 miles. Sky cloudless.

Position of ship: off West Point, Anticosti Island.

South Atlantic Ocean

S.S. *City of Paris*. Captain J. Armstrong White. Cape Town to London. Observer, Mr. F. B. Stewart, 2nd Officer.

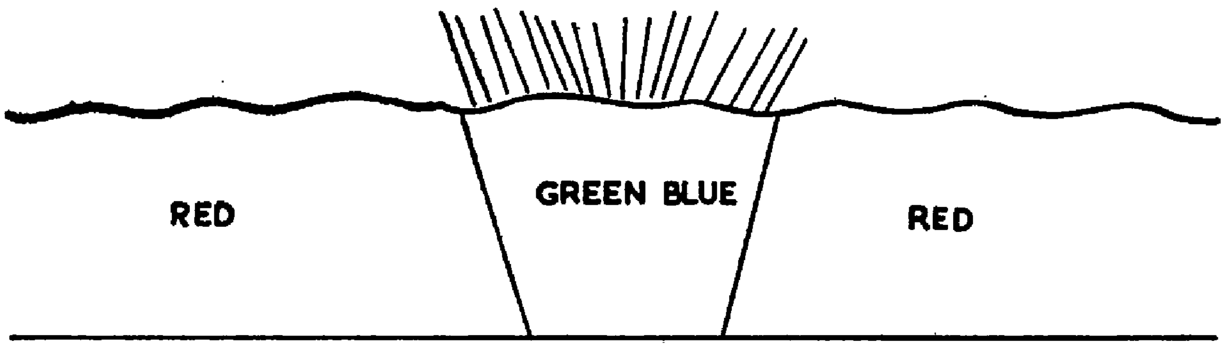
6th November, 1953, 1719 G.M.T. The green flash was observed as the last segment of the sun dipped below the horizon. The flash started at the left-hand side and moved rapidly along the segment which, at the beginning, was about 2½′ deep. Visibility very good, sky clear.

Position of ship: 28° 13′S, 13° 24′E.

Gulf of Aden

M.V. *Trevince*. Captain R. B. Oliver. Cairns to Port Said. Observers, the Master and Mr. E. F. Boyd, Chief Officer.

18th November, 1953. The sun set at 1415 G.M.T. with a vivid green flash.



Shortly afterwards a green-blue vertical ray formed over the region of sunset, interrupting the normal red glow of sunset, and subtending an azimuth of approximately 10°. The red glow continued for about 25° either side of this. Both clearly defined colours extended to a height of about 12°, above which was the darkening blue of the twilight. Into the twilight blue some blue-green and light-blue streaks extended from the main green-blue area, as shown in the sketch. By 1435 the red glow had closed in towards the blue ray, which was fast being absorbed into the evening twilight. The moon at this time was in the NE, 11½ days old, altitude 40°. Cloudless, fine and clear.

Position of ship: 12° 14′N, 49° 10′E.

S.S. *Tribesman*. Captain W. P. Baker. Aden to Calcutta. Observer, Mr. P. Moore, 3rd Officer.

23rd November, 1953. At 1410 G.M.T. the sun set at bearing 249°T on a sea horizon with a distinct cobalt blue flash. The sun was yellowish-orange in colour at the time and no abnormal distortion was apparent. Temp., air 77°F, wet 73°, sea 77°.

Position of ship: 12° 18′N, 49° 04′E.

Central American waters

S.S. *Loch Ryan*. Captain H. V. Todd, R.D., R.N.R. Balboa to Acajutla. Observers, the Master and Mr. R. L. Collins, 2nd Officer.

31st December, 1953, 1223 G.M.T. The small segment of the sun's upper limb at sunrise appeared first with a purple colour and then a most vivid green. Few clouds, fine and clear.

Position of ship: approaching Acajutla.

Note. The name of this phenomenon at sunset or sunrise is the "green flash", whatever the colour actually seen. A number of interesting observations were published in pages 141 and 144 to 145 of the previous number of this journal; these included four records of the blue flash and one of the bluish-purple or violet flash. In the observations above published we have another instance of the blue flash and two in which the purple flash was seen. Such observations have always been considered rare, that of the purple or violet flash extremely so. All these recent observations appear to show that visibility of colours beyond the green in the spectrum at sunset or sunrise is not so rare as was previously supposed; a possible explanation of this is that more observers are now watching for the phenomenon.

The observation of M.V. *Trevince* is in a different category, since after the green flash proper, a blue-green coloration remained in the sky above the point of sunset for some time. Occasional phenomena of this kind, but of varying aspect, have been published in this journal in past years; they are described on page 74 of the *Marine Observer's Handbook*, Seventh Edition, 1950. These observations are much less frequent than those of the normal green flash.

AURORA BOREALIS

North Atlantic Ocean

S.S. *Fanad Head*. Captain W. J. Leinster. Montreal to Belfast. Observer, Mr. F. McG. Graig.

1st October, 1953, 0300 G.M.T. A very brilliant display of aurora was observed, with bands and draperies coloured pink, green and yellow, all very active. The phenomenon took the form of a deep circle and apparently moved from W–E across the zenith. The display lasted for about 20 min, and for 15 min afterwards there was a pale glow in the sky.

Position of ship at 0000: 52° 48′N, 56° 36′W.

S.S. *Rialto*. Captain J. A. Etches, Montreal to Hull. Observers, Mr. J. A. Pettinger, 2nd Officer, and Mr. A. M. England, 3rd Officer.

3rd October, 1953, 2330 G.M.T. A display of aurora was observed to northward from bearing 320°–020°, in the form of a well-defined arch. The highest part of the lower rim reached to altitude 5°, from which position the arch extended upwards with less and less light until it was lost in the night sky. The colour was a whitish-grey and lasted till dawn. The star Arcturus was observed throughout.

Position of ship at 0000: 58° 17′N, 24° 50′W.

S.S. *Rialto*. Captain J. A. Etches. Immingham to Belle Isle. Observers, Mr. R. Cudbertson, Chief Officer and Mr. A. M. England, 3rd Officer.

27th October, 1953, 2000 G.M.T. A mild display of aurora was observed through a break in the cloud, but was not long enough a time to make a detailed observation.

Position of ship: 58° 45′N, 15° 00′W.

28th October, 1953, 0100 G.M.T. A bright display of aurora was observed lasting 15 min. to NNW. It formed a bright border to some low Cu, whitish in colour, and was finally obscured by cloud. Cloud 6/8 Cu and Sc.

Position of ship: 58° 20′N, 25° 00′W.

28th to 29th October, 1953. Aurora was observed from 1800 to 0200.

Position of ship: 58° 22′N, 29° 06′W.

30th to 31st October, 1953. Aurora was observed to northward from 250° to 030°, from 2200 to 0230.

Position of ship: 57° 16′N, 35° 12′W.

1st November, 1953. Aurora was observed from 0030 to 0300.

Position of ship: 56° 00′N, 41° 08′W.

3rd November, 1953. Aurora was observed from 0030 to 0115.

Position of ship: Belle Isle Strait.

O.W.S. *Weather Recorder*. Captain A. W. Ford. On Station "I". Observer, Mr. F. Metcalfe.

19th October, 1953. A brilliant aurora was observed from 0145–0200, also from 0330–0410 G.M.T. It extended from 340°–090°, with flame-like streamers shooting up to the zenith.

Position of ship: 61° 00′N, 15° 42′W.

T.E.S. *Theliconus*. Captain G. M. Jenkins. Port Alfred to Curaçao. Observer, Mr. W. S. Simpson, 3rd Officer.

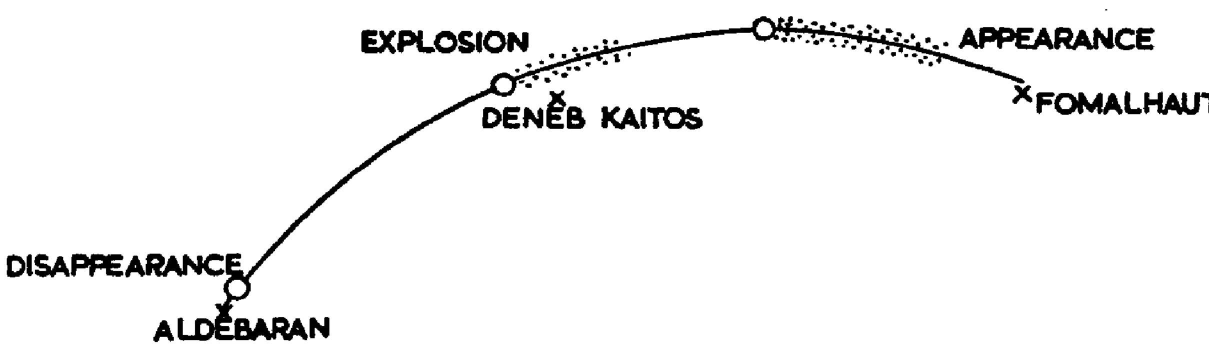
16th October, 1953, 0000–0400 G.M.T. From behind 1–2/8 Sc, bearing NNW, numerous rays of white light were observed pointing upwards towards the zenith. The rays were fan-shaped, of a continuously varying length. The altitude of the upper edge of the fan never exceeded 45°–50° and the altitude of the cloud was 25°–30°. In addition to the rays a faint glow could be distinguished. The phenomenon maintained maximum brilliance for the first 20 min and then began to die away.

Position of ship: 44° 00′N, 59° 00′W.

METEORS

Arabian Sea

M.V. *Trelevan*. Captain I. M. Price. Durban to Karachi. Observers, the Master and Mr. M. F. Kennett, 3rd Officer.



1st October, 1953, 1840 G.M.T. A meteor was observed near to Fomalhaut, bearing 124°, altitude 55°. It travelled at great speed on a curved path towards Aldebaran, bearing 075°, altitude 8°, near to which it disappeared about 5 sec later. During the greater part of its flight it appeared to have a whitish trail 25° long. The meteor appeared to explode with a bluish-white flash near Deneb Kaitos, altitude 20°, and numerous particles were seen to fall. The trail then disappeared, and towards the end of the flight only the amber-coloured head was visible.

Position of ship: 4° 14′N, 49° 16′E.

Red Sea

S.S. *Kent*. Captain P. P. O. Harrison. Auckland to Liverpool via Suez. Observer, Mr. B. Whelan, 3rd Officer.

30th October, 1953, 2050 G.M.T. A very bright meteor was seen heading NW at an angle of 20° to the horizontal. It was first seen just below Sirius (altitude 40°) and last seen bursting about 4° below the Pole Star (altitude 21°). The trail appeared bright orange and extended for about 15°–20°. The meteor exploded in a bright white flash, the whole looking like the flight of a rocket. The duration of flight, 4–5 sec, and the length of the trail both seemed exceptional.

Position of ship: 21° 04′N, 38° 11′E.

Gulf of Mexico

M.V. *King William*. Captain J. C. Davies. Colon to Houston. Observer, Mr. D. W. Henderson, 3rd Officer.

27th November, 1953. At 0315 G.M.T. an extremely bright meteor, roughly twice the size of Jupiter and about four times as bright, was observed about midway between Rigel and Canopus (bearing 160°) at an altitude of 30°. It moved SW and finally disappeared over the horizon. The meteor was coloured white, pale green and red successively, and just before reaching the horizon it flared up and lighted the vessel with a reddish glare. The duration of flight was about 3 sec, the trail was white with a reddish tinge about 5° in length, which was visible for about 6 sec. Cloud 1/8 Cu.

Position of ship: 22° 17'N, 86° 18'W.

RADAR PHOTOGRAPH

North Atlantic Ocean

O.W.S. *Weather Recorder*. Captain A. W. Ford. Station Juliett.

On 1st December, 1953, at 1100 G.M.T., a well-defined cold front was visible on P.P.I. The leading edge was 12 miles to NW, with the front running NE–SW. Sixty miles of it were visible with a fairly broad trace and the apparent speed of approach was 20 kt. Mr. Foord (meteorological officer) took some photographs on his personal camera, and one of these is reproduced here. The photograph was taken with a Baldinette 35 mm camera, mounted on a tripod about 3 ft away from the radar screen, from which the orange filter had been removed. The exposure lasted for four sweeps of the radar scanner, at stop f11. A copy of this photograph was forwarded to the Director of the Naval Weather Service, who remarks that it is particularly interesting.

ERRATUM

The Marine Observer, April, 1954 (Vol. XXIV, No. 164)

" The Marine Observers' Log ", page 80. The observation of a meteor in the Gulf of Guinea was from the S.S. *Arundel Castle*, not the M.V. *Apapa* as printed. We apologise to all concerned for this error.

Personalities

RETIREMENT.—CAPTAIN B. C. DODDS, O.B.E., has retired from the sea after 40 years with the Royal Mail Line, with the arrival of the *Alcantara* in Southampton in March last.

After serving two years on the *Conway*, Captain Dodds first went to sea in 1911, serving his apprenticeship in sail, his first ship being the barque *Inveramsay*, belonging to George Milne of Aberdeen.

On passing for second mate in 1914, Captain Dodds joined the Royal Mail Line as 4th Officer of the *Carnarvonshire*. He was promoted to his first command, the *Culebra*, in 1939, and subsequently commanded many Royal Mail ships, including the *Highland Monarch*, *Asturias* and *Alcantara*.

During the Second World War Captain Dodds was twice torpedoed, on the first occasion in the *Nariva* when sailing in convoy in the North Atlantic, all survivors being picked up by the escort. The second occasion was whilst in command of the *Nebraska*, sailing independently in the South Atlantic. Apart from two killed in the engine-room, the whole of the crew got away in three lifeboats. A boat in charge of the 2nd Officer was picked up after three days, but the other two boats both sailed to the coast of Brazil, that in charge of the Chief Officer in 15 days and Captain Dodds's boat sailed into Recife (Pernambuco) after 14 days. Captain Dodds was awarded the O.B.E. after this incident.

Captain Dodds has been a member of the Corps of Voluntary Marine Observers since 1921, when 2nd Officer of the *Silarus*. In all he contributed 36 logbooks to this Office, 10 of which were classed as excellent.

We wish him health and happiness in his retirement.

J. R. R.

Meteorological Aspects of Marine Drilling in the South China Sea

(This article was specially prepared for *The Marine Observer* by the Press Division of the oil company concerned)

Summary

In December, 1947, engineers of an oil company started to study the possibility of submarine oil drilling for exploration purposes in the South China Sea, about one mile off the Seria coast of British Borneo. It took five years to realise the possibilities, as by the end of 1952 drilling operations were started from a platform fixed on the sea bed in about 30 ft of water. Wind, wave and tidal observations required for the design of the 110×45 ft platform and its construction work at sea are described in this article, as well as a method employed to estimate the number of workable days. When designing a drilling platform and its foundation in this sea, which at the proposed location is approximately 30 ft deep at high water, with a maximum range of some 7 ft, it had to be taken into consideration that the placing of the main structures would have to be performed within the 12 daylight hours of one day. The possibility of working at sea can only be predicted in the early morning of each day, and forecasting even for the next day is practically impossible.

Introduction

The Seria oilfield is situated on the north-western side of the island of Borneo, and now produces 5,000,000 tons of crude oil annually. The under-water extension of the field has so far been explored only by deviated wells drilled from the land and from platforms erected in shallow waters near the shore. To appraise the prospects of a further extension a marine drilling location was planned some 5,000 ft from the shore opposite the land portion of the field.

The beach, running roughly E–W, is very exposed, the sea being open to the N for approximately 1,000 miles. There is surf practically all the year round, with the possibility of isolated very calm days during April and May. During the first part of the SW monsoon, approximately from April to June, the sea is generally calm, with a varying swell; usually there are only light breezes which normally blow from the sea during the day, and from the shore at night. From June to October there are periods of calm weather, interrupted by fierce waves and various winds from the SW and NW, sometimes up to 40 m.p.h. in velocity for short periods, and slackening off to a steady breeze. During the NE monsoon from October to April, there are usually heavy waves and steady winds with an average velocity of 10 m.p.h. Storms of a week's duration with a mean wind velocity of 35 m.p.h. sometimes occur. There is the possibility of tail-ends of typhoons with wind velocities of 60 m.p.h.

To be independent of the waves and the weather conditions, the first plan was to construct a boardwalk from the shore to the location and subsequently to erect at the end of this a drilling platform. A beginning with this boardwalk was made in 1949. Inadequacy of the equipment locally available for constructing the boardwalk, better prospects indicated by land exploration and economic reasons led to the decision to study the possibility of erecting, in the open sea, a platform connected with the shore by a cable road supported by intermediate trestles some 900 ft apart. The Group's experience of drilling foundations in the deep waters of Lake Maracaibo in Venezuela led to the belief that the platform as well as the intermediate piers could be constructed by using prefabricated steel templets or pipe jackets. These jackets would have to be placed in the sea during calm weather and pinned down immediately with steel piles to the required depth by using a steam-driven automatic pile-hammer.

Only very scanty knowledge of the marine conditions of the frequently turbulent China Sea was available. More detailed information about wind, rain, barometric pressure and temperature were known from the Labuan airfield, situated some

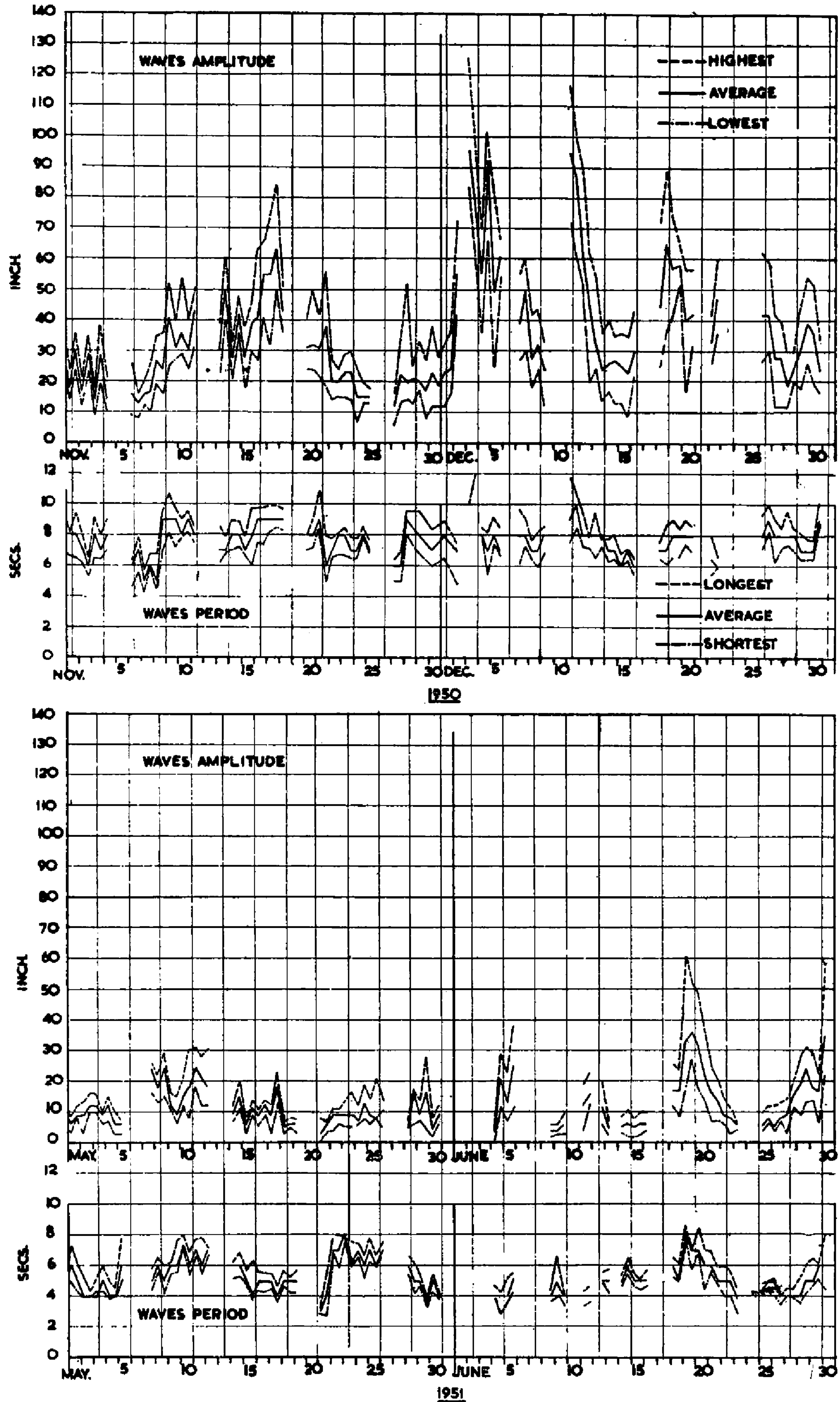


Fig. 1. Amplitude and period of waves.

80 miles NE of Seria. Observations of the tides, tidal streams, sand transport, salinity and bottom samples had been carried out by the Group's hydrographic survey party near Muara, situated some 70 miles NE of Seria, mainly in relation to coast protection and jetty facilities. This party also made very concise wave observations during a period of a fortnight.

For the design of the platform and the intermediate piers, the maximum wave action on them had to be known, requiring knowledge of the maximum height, period and direction of the waves. Also for the proper execution of the constructional work at sea a thorough knowledge was required of the duration of calm sea periods, which depend on wave amplitude, wave length and wind velocity. Therefore a programme was drawn up for daily observations of wave period, height and direction, local wind direction and velocity, tides and rainfall. To fulfil this programme the observations were carried out from a drilling rig situated four miles NE of the proposed location and erected in the shallow waters of the sea 650 ft from high-water shoreline and connected to shore with a boardwalk. An observation cabin was erected on the handling platform in the derrick, situated about 100 ft above sea level. The observations started in August, 1950, and are still being continued.

Wave observations

For the wave observations two local staff observers were continuously employed on readings taken during daylight hours, except during the week-end. The height of the highest crest and the lowest trough was observed on an observation pole from the observation cabin over a period of one minute every half-hour, using a theodolite. The observation pole was erected 1,000 ft seaward from the drilling rig in about 15 ft depth of water. The period of the waves was evaluated by noting the time taken for 10 successive wave crests to pass the observation pole and by dividing the results by ten. The wave length was estimated by using marks painted on the boardwalk at intervals of 50 ft. The position of the breaking point of the waves was also estimated by referring to the figures painted on the boardwalk. Wave crest directions were found by aligning the bar prolonging the horizontal axis of the theodolite to the line of the crest, a method described in *The Bulletin of the Beach Erosion Board*, Vol. 4, No. 2, of 1950.

The maximum amplitude observed was 10½ ft. The wave length generally varied between 40 ft and 100 ft, the period between 4 sec and 10 sec. The maximum wave length observed was 200 ft, the maximum period 12 sec and the furthest breaking point of the waves 1,570 ft from shore. The direction of the waves with an amplitude exceeding 6 ft in height varied between 338° and 353°, the normal of the coastline having locally a direction of 341°. A graph showing amplitude and period during a calm spell and a rough spell is given in Fig. 1.

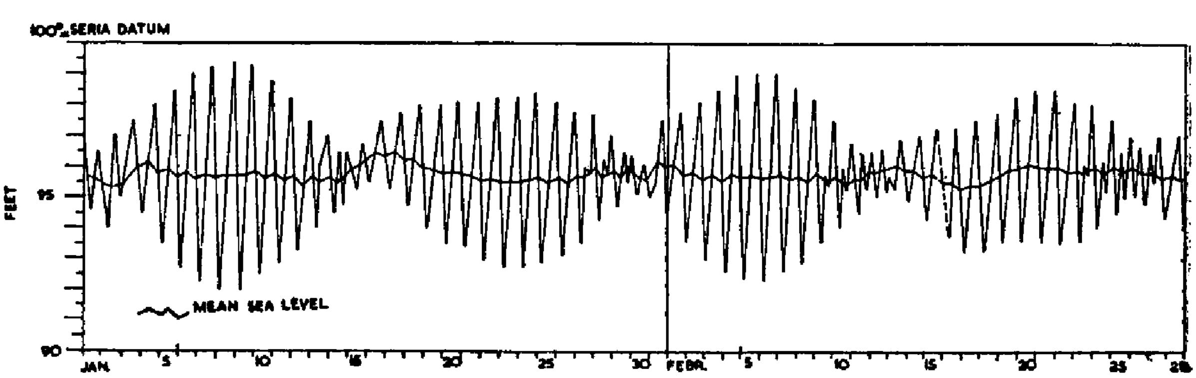


Fig. 2. Graph of high-water and low-water sea level.

Tidal gauge observations

The mean level was found by averaging the height of the lowest trough and the highest crest. During two years' observation this level fluctuated between +95 ft and +97½ ft, taking Seria datum as +100 ft, which equals high-water spring tide. The tidal observations were made by an Esdale automatic tide gauge, which was installed close to the base of the derrick. The graphs show very clearly the spring-tides and the double neap-tide. The maximum level shown during two years' observation was +100 ft and the minimum level +92 ft. In Fig. 2 a graph is shown of maximum and minimum sea level as observed during a two months' period.

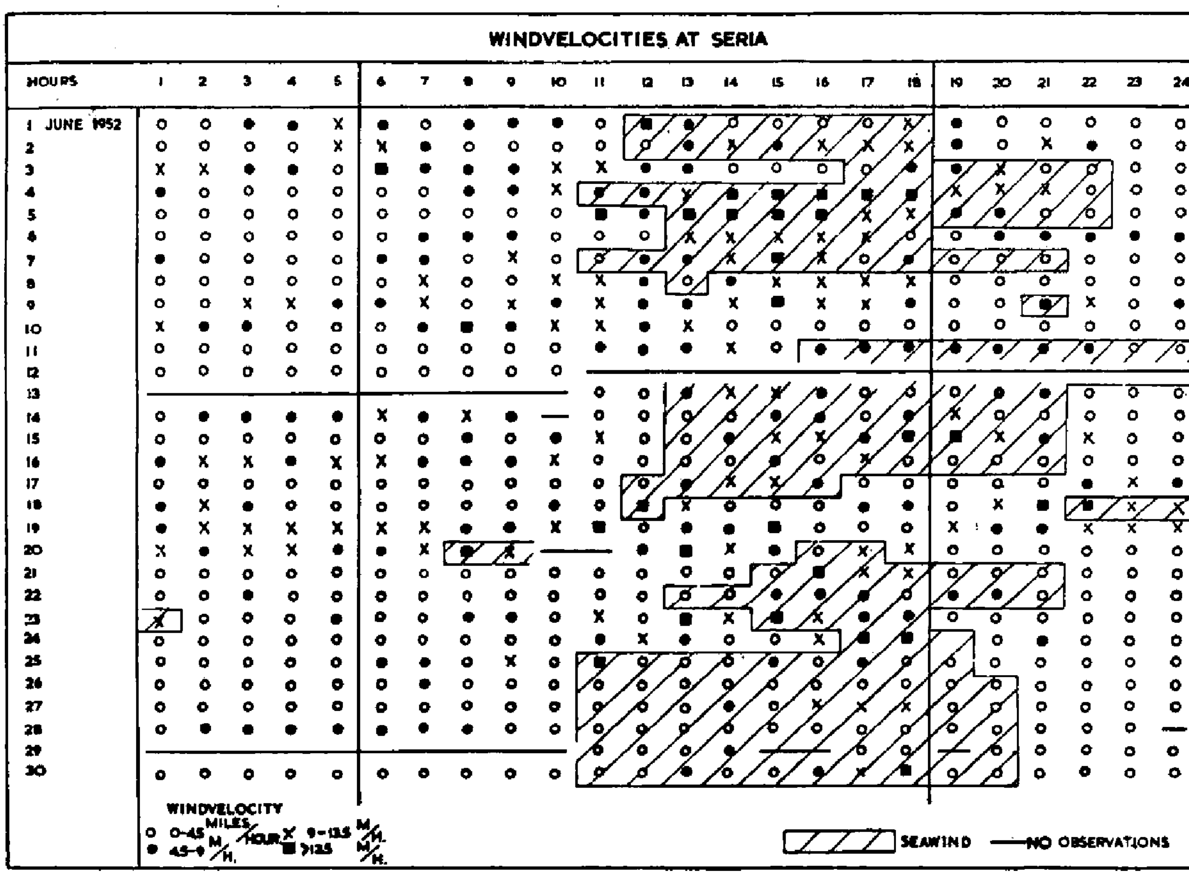


Fig. 3. Tabulated wind velocities, June, 1952.

Wind observations

Wind velocities and direction were measured by a Dines self-recording anemometer. For easier interpretation when estimating the workable hours during each month these records were tabulated as shown in Fig. 3 for a month during the calm period in the SW monsoon. To prove the changeableness of the winds, wind roses were made for each month showing for each direction the monthly average wind velocity and its frequency. How the wind in a certain month of one year can deviate from the wind in the corresponding month of another year is shown by comparing the wind roses of June, 1951, and June, 1952, which are given in Fig. 4. Under these conditions long-term forecasting is very unreliable, so that continuation of the observations for the future operations is required.

The maximum wind velocity and its direction was observed during every day of the period. The wind velocity of 55 m.p.h., observed on 9th June, was the maximum velocity observed since the wind observations in Seria were started.

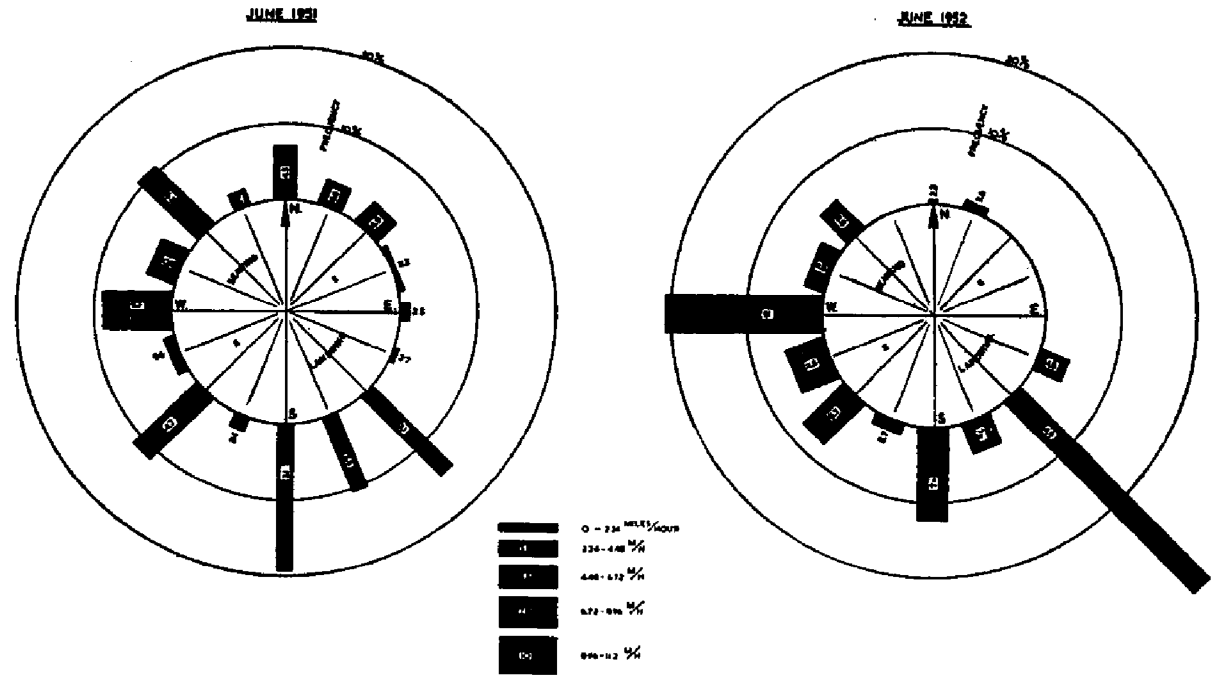


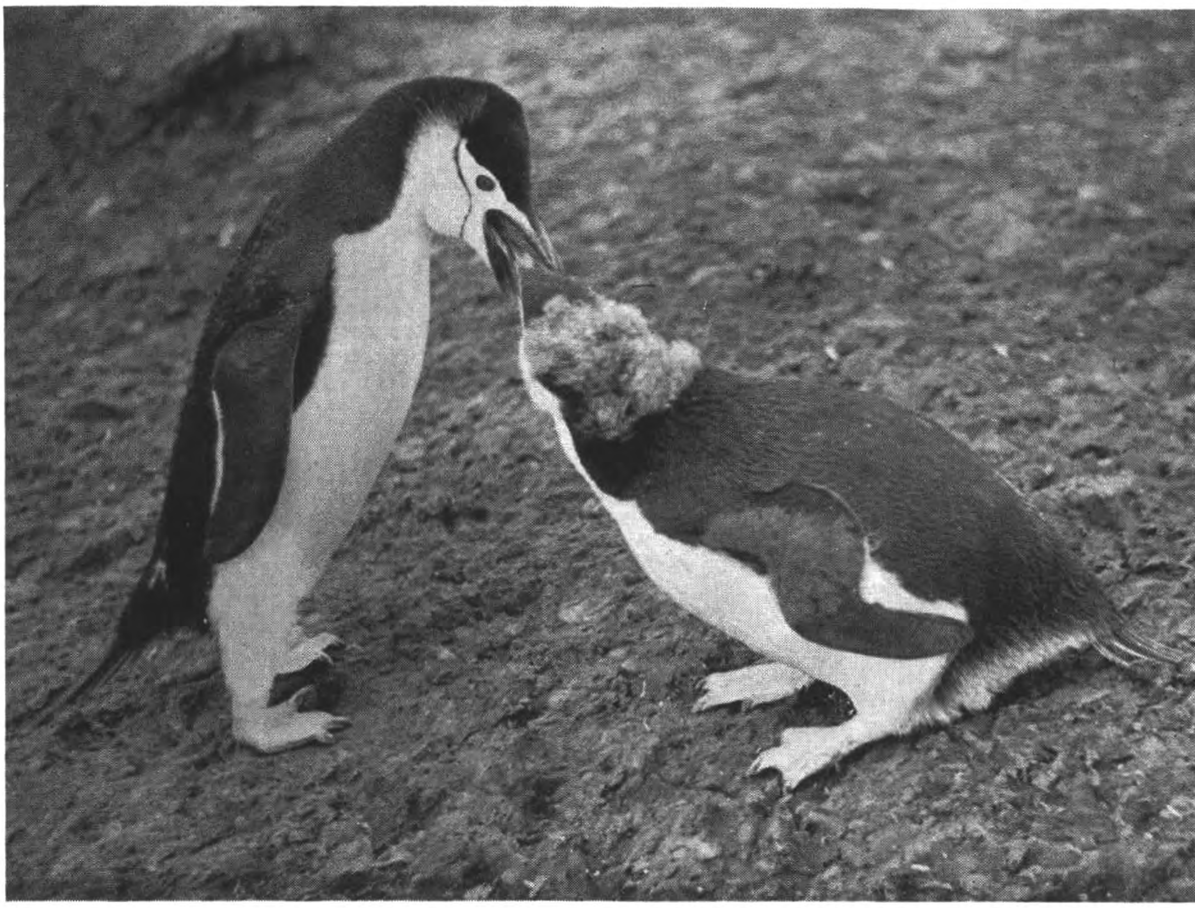
Fig. 4. Wind roses for June, 1951, and June, 1952.

Workability

To have some idea about the workability at sea for the erection of the platform which had to be executed during the calm periods of 1952, a study was made of the observations of 1951. Experiences in Maracaibo had shown that with a wind velocity above six miles per hour the sea was already too choppy for a trailing suction dredge. For this reason the hours of wind were grouped from 0–4½ m.p.h., 4½–9 m.p.h., 9–13½ m.p.h. and over 13½ m.p.h., as shown in Fig. 3. Then the open o's were counted for each day between daylight hours from 5.30 a.m. to 6.30 p.m., giving the number of workable hours for that day. If the series of open o's was interrupted by one or two black spots (4½–9 m.p.h.), these spots were counted for open o's. If, however, three or more black spots followed a first series of open o's, the black spots were not counted and the number of open o's before this interruption was counted as the number of open o's for that day. The influence of the wind of the previous afternoon and night, however, had to be included, which is expressed in the height of the waves. So days with a wave amplitude exceeding 20 in. were not counted as workable. For days without wave observations the study of the winds in the hours of darkness in connection with the past and following wind forces gave indications for a probable workability.

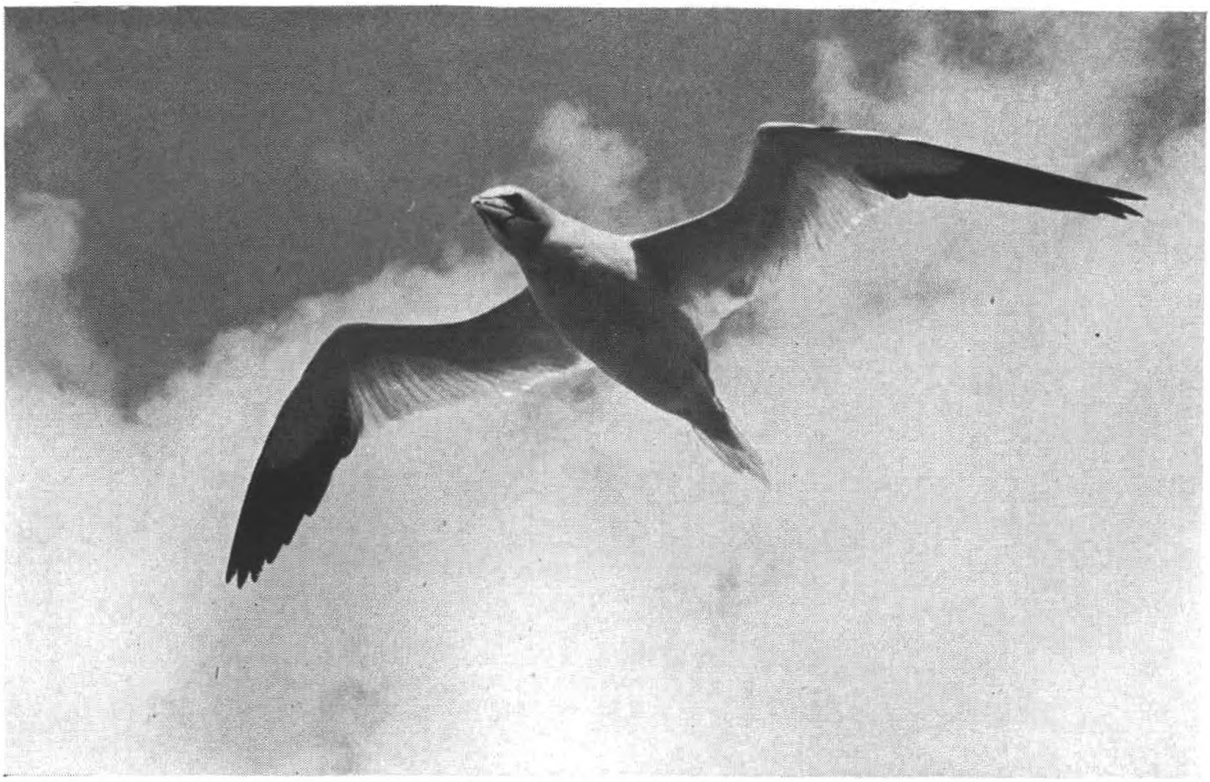
The number of days with seven, eight or nine workable hours during the months of April, May, June, July and August, 1951, were calculated as described, on which figures the erection programme for 1952 was based. It proved, however, that the calm period in 1952 came earlier and was shorter than in 1951, which led to some delay in the programme and can be demonstrated from the numbers of days with at least eight workable hours which, for the months under consideration, were 4, 6, 12, 12 and 8 in 1951, and 6, 14, 6, 9 and 3 for 1952 respectively.

Work at sea started on 15th April and lasted until the end of September, 1952. As rough weather affected various sections of the work to different degrees, it was very difficult to make an exact comparison between theoretical and practical workability. Besides, the most difficult weather in which to work was the heavy swell resulting from storms some 100 miles away, so that local squalls of wind and rain, though unpleasant at the time, were sometimes beneficial in that they converted the swell into a chop, a condition giving much less movement to the floating



Ringed Penguin (*Pygoscelis antarctica*). Distinguished by the black transverse line across the throat from one ear to the other. Bill is black, feet orange. Breeds on islands of Antarctic continent.

P.P.I. photograph of a cold front taken aboard O.W.S. *Weather Recorder* at station Juliett. (See page 215.)



Photograph by John Barlee

NORTHERN GANNET (*Sula bassaua*). Common in the North Atlantic. The boobies of the tropical seas are of the same family. Distinguished by its goose size, cigar-shaped body, black tips to long, narrow white wings and pointed tail. It has a long, powerful, pointed beak. The young have dusky plumage.

Photograph by John Barlee

COMMON or MEW GULL (*Larus canus*). Has the same pale-grey upper parts and black-and-white wing tips as the herring gull, but is much slenderer in build and has greenish-yellow beak and feet. Immature birds have mottled plumage and narrow black bar at outer end of tail feathers.

crane which had to be used during the greater part of the work. It has proved, however, that the method of calculating the workable hours as described can be regarded as being on the safe side, which is certainly required when weather conditions show such great variations as were experienced.

DRIFT OF THE SAN ERNESTO

Following the publication of this article in *The Marine Observer* (Vol. XXIV, page 82), new information about this drift has come to light. A letter has been received from the Shipping Editor of Lloyd's, an extract from which is as follows:

" I have read with interest the article in *The Marine Observer* of the " Drift of the *San Ernesto*, 1943–49 ", but feel I should point out that some of the facts mentioned are at variance with those recorded at Lloyd's.

" The article states that the wreck of *San Ernesto* was reported by aircraft a few weeks after being torpedoed on 15th June, 1943, but from then onwards no report of her being sighted was received until June, 1949, when she was reported aground on Pulau Nias. According to Lloyd's records this is not so, as the following reports show:

Steamer *David E. Hughes*, while on passage Hobart for Colombo, sighted derelict tanker with stern blown off in approx. 1° 25′N, 78° 31′E, at 5 p.m. G (16th August) = 10 a.m. G.M.T., 16th August, 1943. (This may possibly be the *San Ernesto*.)

A Catalina aircraft flying from Ceylon to Australia sighted a vessel apparently drifting at 6.15 a.m. G.M.T., 30th August, 1943, in 1° 9′N, 87° 39′E. Naval authorities Ceylon state this must be *San Ernesto*, but are unable to attempt salvage.

Extract from *Perak Times*, Wednesday, No. 17, 2603 (eighteenth year of Syowa): A Nippon base in the Indian Ocean, 16th November (Domei): While engaging in a usual reconnaissance flight recently in the vicinity of a certain island located to the " east " (? west) of Sumatra, a Nippon naval plane spotted a large tanker of the 10,000 class drifting. A Nippon ship was immediately dispatched to the scene only to find the tanker grounded and listing at a 45° angle. Investigation of the grounded ship found the machinery from near the engine-room to the stern had been smashed and the pontoon bridge burnt. The investigation party also found a brass plate on which was engraved the name of the ship *San Ernesto*, of British registry. After removing the machine-guns and other guns from the tanker, the Nippon seamen are making further investigation to see whether there is a possibility of towing it to a Nippon base.

" It would appear, therefore, that *San Ernesto* grounded in November 1943, and the fact that she was already aground would explain why she was not sighted. The only point not established is the position of grounding, but there is no reason to suppose that it is any other than that on Pulau Nias."

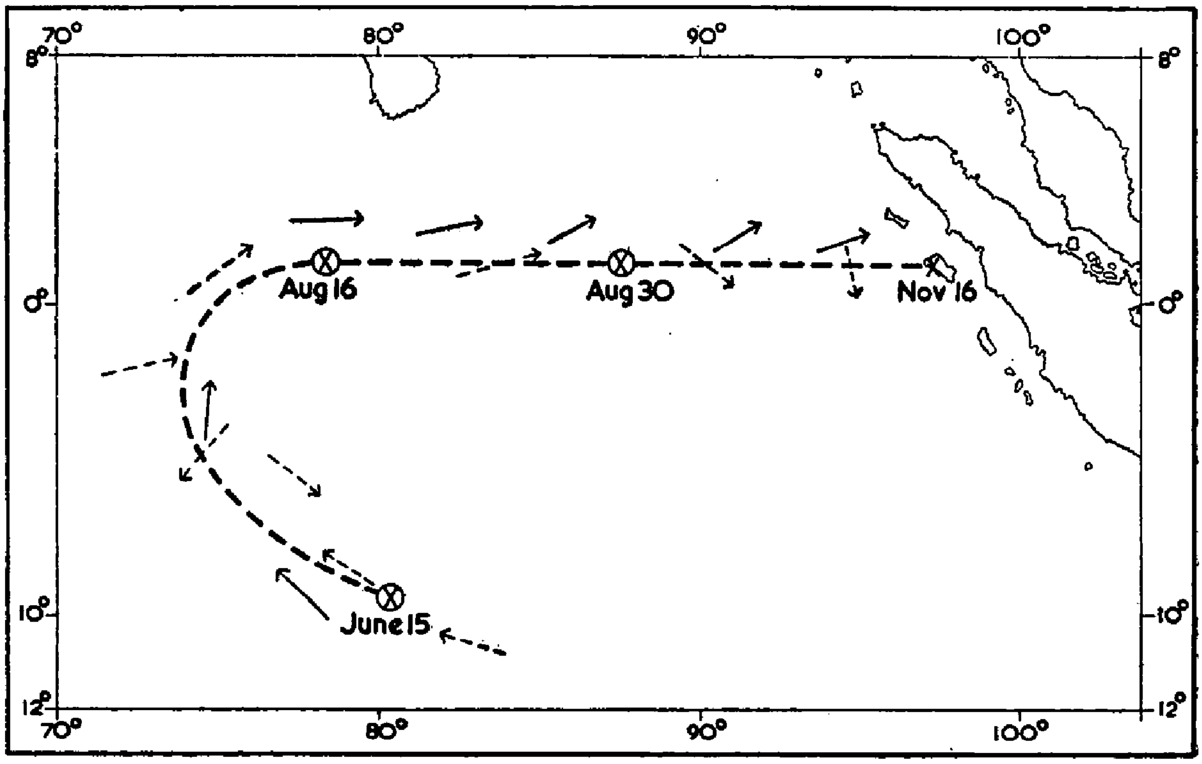
Note. The new information given by Loyd's necessitates an entirely new consideration of the probable track. Taking both wind and current into account it is considered that the track shown on page 222 is quite a feasible one. The track shown in the previous article only took into account the current, and the accompanying note pointed out that the time could have been anything between 18 months and 6 years. The following notes give a possible explanation of the shorter drift period of about 5 months.

Considering the three sections of the track:

(i) 15th June to 16th August, 62 days, approximately 1,020 miles, gives an average rate of 16½ miles per day. The SE trade wind, becoming S'ly and then passing into the SW monsoon, would take the ship along the track indicated. On the data available the currents south of the Equator are partly favourable and partly adverse. Even if we assume that, on the average, the current effect is roughly cancelled out, a rate of 16½ miles per day seems quite reasonable from wind influence alone. On, the average wind speed, Beaufort 2–3, this would mean that the vessel was carried along at one-tenth of the wind speed but she may have had much stronger winds since between latitudes 10°S and 5°S and again N of the Equator, there is a fairly high percentage of winds of Beaufort 4–6.

(ii) 17th–30th August, 14 days, approximately 548 miles, gives an average rate of 39 miles per day. This seems a high rate of travel, but wind and current are here acting together. There are many currents of 1–2 kt at this time in this region, with a few exceeding 2 kt. Wind speeds of Beaufort 4–6 comprise the majority of the observations for August in this region, so that the rate of drift seems to be quite possible.

(iii) 31st August to a date after 16th November, approximately 600 miles. Wind and current less strong than for (ii), but ample time for the journey to be made. The mean wind being directed towards NE and the mean current towards SE would tend to keep the vessel on a more or less due E'ly track.



Revised possible drift of the *San Ernesto.*

Full arrows, mean wind; pecked arrows, vector mean current (quarterly).

After a copy of the letter from Lloyd's and the above remarks, giving a suggested shorter track, had been sent to Captain J. P. Thomson, the author of the article, he made the following statement:

" The publicity given in *The Marine Observer* has brought to light the interesting information from Lloyd's, for which I am grateful. There can be little doubt that the ship reported in the *Perak Times* of 17th November, 1943, was the *San Ernesto*, and the period of drift is therefore about four or five months and not six years.

" Whilst it is a pity that this information was not known when the article was written, it does not lessen the interest in the subject. Pulau Nias island is remote, and the territory was under enemy occupation, and secrecy appears to account for the long period which elapsed before the vessel was found by the Dutch reconnaissance vessel, and of course the vessel being ashore would account for no reports of sighting by other vessels. After the discovery of the wreck by the Dutch officer, it was inspected on behalf of underwriters and owners, and found to be damaged to such an extent as to be classed as constructive total loss, which confirmed the master's report.

" The further information in Lloyd's of the two sightings at sea indicate that the vessel was influenced by a strong cross-current, which carried her across the Equator. The three boats appear also to have experienced a strong NW set, as they were found well to the west of the course for Colombo."

E. W. B.

Observation and Study of Ocean Birds

By Capt. G. S. Tuck, D.S.O., R.N. (Retd.)
(Captain Tuck is Chairman of the Royal Naval Bird Watching Society).

Royal Naval Bird Watching Society

Readers will have noticed in recent issues occasional comments on reports of bird life published in the " Marine Observer's Log ". Many of these comments have been provided by the Royal Naval Bird Watching Society.

During December 1953, members of this society arranged a display of bird photographs and paintings of their own making in the Admiralty. The display disclosed the great opportunities available to all who follow the sea, not only to indulge in a fascinating hobby, but also to build up much-needed information of the habits and distribution of the sea birds of the world. Some 200 photographs were on view—penguin colonies in the South Shetland Islands, brown pelicans in the West Indies, fulmar petrels in the North Atlantic, gannets, terns, auks, skuas and gulls. There were some fine water-colour paintings, too—wildfowl in the River Elbe, birds on the sand dunes of Borkum Island, red-backed woodpeckers in Ceylon, birds from Scandinavia, Macedonia and so on.

Here, too, was a chart of the world's oceans dotted with positions of identified reports of ocean birds, giving an insight into one of the Society's long-term investigations. Slowly, as a result of plotting these " sea reports ", an up-to-date picture of the winter and summer distribution of the ocean birds is being built up. Already on certain sea routes the first " Sea Passage Bird Lists " have been published to give the voyager details and the means of identifying the sea birds likely to be met on the passage. These lists are clearly not yet comprehensive, but provide an interesting check list in which the observer may be able to fill in further species.

With the knowledge of the interest shown by the Royal Naval Bird Watching Society in offering its help to encourage the study of birds amongst officers and men of the Merchant Navy we have felt that some initial hints on bird watching at sea would be of interest to many. During an ocean passage the seaman rightly and properly keeps a keen watch for signs of changing weather conditions. What an added interest can be obtained by keeping an eye lifted for any bird that passes, and having seen it, if he can recognise it and know something of its habits and distribution. The first essential, and basis of ornithology, is to recognise your bird. It is hoped that the following general hints will help the amateur in identifying birds met with at sea.

Hints on identifying birds

It is not easy to identify many of the ocean birds with certainty, and much will depend on observing slight variations in colour markings on flight feathers, back, belly, rump, crown, throat and so on. Do not rely on memory; always carry a rough notebook in your pocket, and write down all the details you can on the spot. It is a useful tip for the amateur to have a standard sketch of a bird in the flyleaf with arrows showing the names of the different parts of a bird's anatomy and plumage. Field-glasses are essential for picking out detail; a good field and medium magnification, say 7×50 or 8×30, are the chief requirements.

A bird may disclose its identify in at least one of three different ways:

(*a*) By its attitude at rest.
(*b*) By its attitude in flight.
(*c*) By its call note and/or song.

At sea the opportunity to observe sea birds at rest is rare, but the observer should always be on the alert to note all aspects. Land birds often settle on board.

Good reference books, which I will refer to later, and visits to museums are all excellent aids to bird identification, but practice in the field (if possible with some-one who knows more than you do!) is the best way to improve your skill. One of the most unsatisfactory ways of attempting to identify a bird is to view it without writing down sufficient notes, or without taking any notes, and then finding its supposed portrait or description in a book later on, to proceed to work up an account of what was seen. This leads to wishful thinking. Here are eight guides in taking field notes. Try to record:

(*a*) Distance of bird from you, nature and direction of light, and whether using field-glasses or not.

(*b*) Nature of ground (surroundings) and what other birds were present.

(*c*) Whether seen at rest or in flight.

(*d*) What were its actions or characteristics of flight compared with other birds (soaring, gliding, skimming wave tops, fluttering, flying with strong wing beats, etc.).

(*e*) Its size and form compared with other birds; what birds at all like it are known to you; how does it differ from them ?

(*f*) Particular points in its structure compared with other birds, such as size and shape of bill, length of legs and feet, length and shape of tail, shape of wing (broad, narrow, short, long, etc.).

(*g*) Colour of bill, legs and feet. Any distinctive white or coloured patches or markings and their *exact* positions. General colour above and below If possible make a sketch showing colour pattern, distinctive marks and shapes.

(*h*) Any call notes, giving quality of sound (harsh, rattling, shrill, hoarse, liquid).

Reference books

For fuller details on the practical side of bird watching I would recommend observers to read *Watching Birds* by James Fisher (Penguin Series), and *Bird Recognition* in three volumes by the same author (Pelican Books).

There is no room here to list the best reference books covering the birds of different countries abroad, but there are three books which I would refer to specially. The first is to my mind unique in its world-wide coverage of ocean birds and should be in the cabin bookshelf of every ocean bird watcher. This is W. B. Alexander's *Birds of the Ocean*, which describes in detail every known ocean bird, and the oceans in which various species are likely to be met. It has the advantage of being a handy size which can be stowed in a coat pocket. The publishers are Putnam & Co., Ltd., 42 Great Russell Street, London, W.C.1.

The second book, which is a new work, combines in one volume the birds of the British Isles and other European countries, including all the birds likely to be seen by the voyager through the Mediterranean. This is *A field guide to the birds of Britain and Europe* by Roger Peterson, Guy Montford and P. A. D. Hollam. A R.N.B.W.S. member, Colonel A. J. S. Tuke, in reviewing this work, writes: " Not only are the many illustrations artistic as well as accurate but those on the same pages are all drawn to scale, so that the relative sizes of different species can be seen at a glance. The authors have thought of the additional ingenious device of drawing a small line pointing to the bird's chief characteristic. This is particularly helpful in such birds as the ringed, little ringed and Kentish plovers, for example, all of which can often be seen consorting together at the mouths of rivers in France and Spain. A most useful feature are the sketches of birds of prey as viewed from below, and the authors have introduced a novel feature in accompanying the description of many birds with a map of Europe with districts shaded in in which the birds are likely to be found." The book is published by Collins at 25s.

The third book, an entirely new work, by James Fisher and R. M. Lockley, also published by Collins at 25s., entitled *Sea Birds*, is in the New Naturalist Series. Covering essentially the North Atlantic Ocean from Equator to Pole the book does far more than merely list and describe the sea birds. It embodies an immense amount of research and detail. Not only is it profusely illustrated with colour and natural photographs, but the world breeding distribution of all these sea birds is shown on newly devised maps. The structure of the Atlantic Ocean, its tidal streams and winds in relation to the sea birds, the evolution, numbers, movements and social behaviour of sea birds are all dealt with. Notes on non-breeding and casual wanderers besides many anecdotes are included. For the serious student it is a book crammed with information.

Sea report sheets

The R.N.B.W.S. is particularly interested in receiving reports from sea and makes use of standard sheets for this purpose. Apart from the name of the reporter and his ship the report is made up of seven columns as follows:

- Col. I. Serial number of observation (each observation is given a separate number).
- Col. II. Date/time/route group.
- Col. III. Ship's position, course and speed.
- Col. IV. Details of bird or flock of birds described as accurately as possible.
- Col. V. Height and course flight of birds.
- Col. VI. Weather.
- Col. VII. Remarks, always to include either letter P = positively identified, or U = identity uncertain.

The R.N.B.W.S. is always glad to receive such reports from non-members as well as members, and they should be forwarded to me (Capt. G. S. Tuck, D.S.O., R.N. (retd.), Prattenden's Cottage, Bury, near Pulborough, Sussex), or entered in the meteorological logbooks.

Conclusion

The study of birds at sea can throw much light on seasonal migration, hitherto unknown distributions, the discovery of " ringed " birds and many other interesting problems, besides proving an absorbing recreation and hobby.

I hope that the above simple hints on identification may stimulate some readers to " have a go ".

Note. An excellent example of the help which may be given to the study of birds by observations from ships at sea is shown in the two following observations, which were each recorded in the ship's meteorological logbook. These observations were almost unique, and it will be seen that they are closely related, having been made within a space of nine days and within a distance of some 700 miles of each other.

The first observation was made by M.V. *Armadale*, Captain I. S. Maclean, on 14th May, 1953, as follows:

" Latitude 40°N, longitude 35°W. A large bird similar in size and appearance to an albatross, except for its colouring, observed following the ship. First sighted at daylight, it made attempts to land on the poop but was unable to do so owing to its size. It flew off during the forenoon watch and has not been seen since.

Wings: upperside, dark brown.

Body: upperside slightly lighter shade of brown than the wings.

Wings: underside, white with dark-brown tips.

Body: underside, white except forward of the wings, where a collar of light brown encircled its neck.

Tail: dark brown.

Head: speckled white, long beak, curved down at end and pale pink in colour.

The wings were 5 ft to 6 ft in span and narrow like those of the albatross, and just where the neck joins the body was the " hump " also a feature of the albatross. This bird has previously been seen following vessels in high southern latitudes but, I understood, does not venture into the Northern Hemisphere. The bird was seen by the majority of the crew."

(continued on page 238.)

A Verification of Ekman's Theory relating wind and ocean current directions using ocean weather ships' data

By R. F. M. Hay, M.A.

(Marine Branch, Meteorological Office)

As five-day mean values of vector winds and mean ocean currents at the ocean weather stations " I " and " J " had been obtained for use in a separate investigation, it seemed worth while examining the data to see whether Ekman's relation between ocean current and wind which had been verified by Durst[1] would also hold for vector currents and winds prevailing through such a long period as five days. Durst used 509 ships' observations for the period 1909–20 for an area of the North Atlantic lying between 47°N and 53°N and 10°W and 30°W. His results were expressed as the frequency of set in relation to wind. For wind force 3 and above he found the relationship to be very marked, with 21 per cent of observations lying within a point of the angle of 45° to right of the wind and nearly half the observations lying within three points on either side of this angle.

Five-day mean values of vector winds were available for the four years 1948–51 for each ocean weather station. Each vector mean was based upon four observation of wind daily at 0000, 0600, 1200 and 1800 G.M.T., making 20 observations in each period. At first sight it would be expected that roughly 280 separate means might be available at each station. In practice, owing to a number of reasons the number available was less than 30 for each station. In the first place the current observations are determined over periods of up to 24 hours. These observations are, however, not considered to be reliable whenever the surface wind exceeds Beaufort force 5, owing to the difficulty of estimating the leeway made by the ship in these conditions. Thus a current observation is not available on any day when the wind speed exceeds this value. In addition current measurements at the ocean weather stations have hitherto been made only for periods when the ship's positions at the beginning and end of the periods had been determined by sextant observations. The reason for this is that both stations " I " and " J " are far from land, and are located at the limit of the coverage provided by the nearest Loran and Consol stations. In consequence, a very large number of occasions when positions were fixed by these electronic aids were omitted when computing the results given here, particularly in 1950 and 1951 when there were very few occasions with complete sextant observations through five consecutive days. It was found that reliable values of vector mean currents could not be obtained unless a current observation was available on each of the five days comprising any five-day period. On account of these factors very few reliable values of vector mean currents were available outside the summer months. It was also found necessary to reduce this number still further by eliminating those periods in which the mean vector wind was 5 kt or less. The drift of a British ocean weather ship is considered to depend upon the current at an average depth of 7 ft below the surface.

On 25th March, 1950, the positions of the ocean weather stations were altered in the case of " I " from 60° 00'N, 20° 00'W, to 59° 00'N, 19° 00'W, and of " J " from 53° 50'N, 18° 40'W, to 52° 30'N, 20° 00'W. As the great majority of the observations at both stations refer to the period before March, 1950, and as the new positions were within 100 miles of the old positions, the results in Table I have been computed for the whole period for both ocean weather stations and the changes of position have been ignored. Table I gives the values of the difference between the directions of the vector mean current and vector mean winds for all the five-day periods available. Positive values denote a deflection of the current to the right relative to the wind direction, in accordance with Ekman's theory. The table also shows the mean values of all the deflections and the standard deviations. Table II gives values corresponding to those in Table I for the deflection of the

Table I

Angle between five-day vector mean winds and five-day vector mean currents for the same periods
(Positive values denote current directions to the right of the wind in accordance with Ekman's theory)

Station I

Date	Angle between current and wind +	Angle between current and wind −	Direction and distance moved by water in five days: Dir.	Distance	Mean vector wind Dir. (°true + 180°)	Speed kt
1948						
5th–9th July	1		083	11	082	8
9th–13th August	47		116	13	069	8
1949						
22nd–26th March		5	054	43	059	15
27th–31st March	57		007	73	310	9
20th–24th June	106		061	18	315	11
5th–9th July	113		144	94	031	10
25th–29th July	72		141	44	069	10
30th July–3rd August		35	162	35	197	8
9th–13th August	95		140	129	045	12
14th–18th August	38		106	122	068	9
19th–23rd August	24		079	79	055	12
24th–28th August	54		072	82	018	12
18th–22nd September	53		013	39	320	9
3rd–7th October		6	248	17	254	13
8th–12th October	88		026	19	298	11
17th–21st November	27		313	36	286	6
22nd–26th November	16		218	46	202	10
1950						
4th–8th August	7		032	38	025	6
1951	*No cases					

Station J

Date	Angle between current and wind +	Angle between current and wind −	Direction and distance moved by water in five days: Dir.	Distance	Mean vector wind Dir. (°true + 180°)	Speed kt
1948						
2nd–6th March	10		002	107	352	15
21st–25th April		11	044	71	055	6
5th–9th July	38		155	64	117	8
10th–14th July	24		159	104	135	12
15th–19th July		11	070	48	081	12
17th–21st December	46		036	12	350	17
1949						
6th–10th May		13	017	43	030	7
11th–15th May	62		115	44	053	10
31st May–4th June	54		175	36	121	8
10th–14th June	33		109	31	076	7
20th–24th June	101		063	16	322	11
20th–24th July	48		080	67	032	11
29th Aug.–2nd Sept.	41		130	32	089	14
13th–17th September	88		018	27	290	6
18th–22nd September	16		291	86	275	10
3rd–7th October	41		007	51	326	11
1950						
20th–24th July	28		110	110	082	14
1951						
15th–19th June	3		103	68	100	14
20th–24th June		53	073	71	126	12

Angle between current and winds (Station I)
(Cases with mean vector winds)

	>5 kt	$\geqslant 10$ kt	$\geqslant 15$ kt
Means	+42	+56	—
Standard deviations ..	42	43	—
Number of cases ..	18	10	1

Angle between current and winds (Station J)
(Cases with mean vector winds)

	>5 kt	$\geqslant 10$ kt	$\geqslant 15$ kt
Means	+29	+27	—
Standard deviations ..	37	37	—
Number of cases ..	19	13	2

*Only cases with mean vector winds >5 kt have been included in these tables.

Table II

Angle between five-day vector mean winds and five-day vector mean currents of the following five-day period

(Positive values denote current directions to the right of the wind)

Station I

Date	Angle between current and wind +	−	Direction and distance moved by water in five days		Mean vector wind Dir. (°true + 180°)	Speed kt
1948						
30th June–4th July	2		083	11	081	14
4th–8th August		146	116	13	262	10
1949						
17th–21st March		8	054	43	062	17
22nd–26th March		52	007	73	059	15
15th–19th June	110		061	18	311	18
30th June–4th July		107	144	94	037	17
20th–24th July	149		141	44	352	11
25th–29th July	93		162	35	069	10
4th–8th August		74	140	129	214	15
9th–13th August	61		106	122	045	12
14th–18th August	11		079	79	068	9
19th–23rd August	17		072	82	055	12
28th Sept.–2nd Oct.		175	248	17	063	19
3rd–7th October	132		026	19	254	13
12th–16th November		31	313	36	344	17
17th–21st November		68	218	46	286	6
1950	*No cases					
1951	*No cases					

Station J

Date	Angle between current and wind +	−	Direction and distance moved by water in five days		Mean vector wind Dir. (°true + 180°)	Speed kt
1948						
16th–20th April		150	044	71	194	10
30th June–4th July	83		155	64	072	11
5th–9th July	41		159	104	118	8
10th–14th July		65	070	48	135	12
12th–16th December		40	036	12	076	15
1949						
1st–5th May		52	017	43	069	10
6th–10th May	85		115	44	030	7
26th–30th May	54		175	36	121	16
5th–9th June	64		109	31	045	5
15th–19th June	101		063	16	322	21
24th–28th August	101		130	32	029	8
13th–17th September	1		291	86	290	6
28th Sept.–2nd Oct.		67	007	51	074	11
1950						
15th–19th July	9		110	110	101	13
1951						
15th–19th June		27	073	71	100	14

Station I — Angle between current and wind (Cases with mean vector winds)

	> 5 kt	⩾ 10 kt	⩾ 15 kt
Means	−5	−2	−27
Standard deviations ..	97	103	75
Number of cases ..	16	14	6

Station J — Angle between current and wind (Cases with mean vector winds)

	> 5 kt	⩾ 10 kt	⩾ 15 kt
Means	+9	−15	+38
Standard deviations ..	75	77	(72)
Number of cases ..	15	10	3

*Only cases with mean vector winds > 5 kt have been included in these tables.

current relative to the wind direction when the current in each five-day period refers to the five-day period following the respective period for which the wind direction is considered. It can be seen that the direction of the mean deflection agrees with Ekman's result at both stations, and that the values for all observations of 42° at station " I " and 29° at station " J " are also in fair agreement with theory. The values are not substantially altered (56° at station " I " and 27° at station " J ") when five-day periods with mean vector winds over 10 kt are considered; however, the number of cases is now rather too small to allow of much weight being attached to these figures. An indication of the agreement of the figures in Table I with Ekman's result is given by an evaluation of similar figures relating five-day mean vector wind directions with five-day mean vector currents for the following five-day period, which is given in Table II. The mean values themselves probably have little significance, as inspection of the table readily shows. However, the lack of relationship between the non-simultaneous wind and current directions shows in the standard deviations of the angular differences between wind and current (97° at " I " and 75° at " J ") which are much larger than the standard deviations of the angular difference between wind and current (42° at " I " and 37° at " J ") obtained for simultaneous five-day wind and current vector means.

The data in Table I were used to evaluate the mean vector current and wind speeds (u_s and u_a) for stations " I " and " J " separately. These were:

		u_s	u_a
		kt	kt
Station " I "	..	0·433	9·9
Station " J "	..	0·458	10·7

From this we obtain the relationships for the wind factor first studied by Thorade[a] in 1914:

$$u_s = \frac{\cdot 0407\, u_a}{(\sin \varphi_I)^{\frac{1}{2}}} \text{ for station " I " (where } \varphi_I \text{ is the latitude of the station)}$$

and, $$u_s = \frac{\cdot 0398\, u_a}{(\sin \varphi_J)^{\frac{1}{2}}} \text{ for station " J " (where } \varphi_J \text{ is the latitude of the station).}$$

These values of the factor compare with Ekman's value of ·019 and Durst's value of ·0079 found in the paper referred to above. The value of the " wind factor " found here is thus about five times greater than Durst's value. The difference can probably be explained, in terms of the different conditions in which the data were obtained. The data used here refer to periods of five days at a fixed position, in place of intervals of one day used by Durst. The effect of a wind from a different direction in the previous few hours would thus be less noticeable for the longer period and would lead to the conclusion that the wind factor would be larger when a longer period was considered. The currents measured by the ocean weather ships (average draught 14 ft) would refer to a layer nearer the surface than those used by Durst which were based upon ships of all sizes. Also the observations used here mostly referred to the summer months when the existence of a shallow warm layer at the surface was probable. The existence of this layer would make some difference to the value of the eddy viscosity as compared with the values in winter in the same region, some of which were included in the earlier work to which reference has been made.

Conclusions

1. Using five-day vector means of ocean currents and winds the direction of the current deflections agrees with Ekman's result, while the magnitude of the deflections (42° at station " I ", 29° at station " J ") are in fair agreement with theory.

2. Some indication of the internal consistency of these results is given by the fact that the mean values of the deflections show a small increase at both stations,

when the cases of large values of mean vector winds are considered separately. This agrees with the results found by Rossby and Montgomery, although Ekman's work led him to anticipate that the value of the angle should be independent of wind speed. The magnitudes of the standard deviations of the angular deflections are also in good agreement.

3. Ekman's relation ceases to have validity when vector mean winds are compared with vector mean currents for the five-day period following each respective period for which vector mean wind was determined. The magnitudes of the current deflections are inconsistent between the two ocean weather stations, and for different wind speeds. Also the magnitudes of the standard deviations of the angular deflections are approximately twice as large as the values obtained for the cases where simultaneous values of vector mean winds and currents were considered.

4. The magnitude of the " wind factor " derived from these cases is about five times greater than Durst's value. In the cases considered by Durst his current measurements referred to periods of one day. This result is to be expected when account is taken of the greater effect of wind from a different direction, preceding or during part of the shorter period, together with the ship's movement in 24 hours in the cases considered by Durst.

REFERENCES

[1] DURST, C. S., Q.J., Vol. 50, No. 209, April, 1924, page 113, *The relationship between current and wind.*

[2] PROUDMAN, J., *Dynamic Oceanography*, page 176.

Note. The theory which is referred to in this note was first advanced by Ekman in 1905. By making some assumptions which simplified the mathematics of the problem he concluded that a steady wind blowing over the sea would produce a current at the surface whose direction would always be inclined at an angle of 45° to the right of the wind direction in the Northern Hemisphere, and 45° to the left of the wind direction in the Southern Hemisphere. Making slightly different assumptions, Rossby and Montgomery concluded that the angle would depend upon latitude and wind speed: at latitude 5° the angle would be 35° for a 10 kt wind and 43° for a 39 kt wind; at latitude 60° the angle would become 42° for a 10 kt wind and 53° for a 39 kt wind. The " wind factor " studied by Thorade is the ratio between the velocity of the wind and that of the surface current. The theory due to Ekman and later workers, correctly predicted that the angle of deflection of the current increases regularly with depth, also that the current velocity and " wind factor " decrease with increasing depth. The deviation of the drift of icebergs from the direction of the wind is in the same direction as the Ekman theory but of smaller magnitude (about 30°), the discrepancy being due to the resistance to motion offered by the ice itself.

R. F. M. H.

BICENTENARY OF THE ROYAL SOCIETY OF ARTS

There are probably few voluntary meteorological observers in British ships who have not heard of the Thomas Gray Memorial Trust, under which the Council of the Royal Society of Arts offer annual awards for objects likely to assist the science of navigation and to promote education for the Merchant Navy. This Trust was founded in 1925, thanks to a legacy left to the Society by Thomas Gray, who was formerly Assistant Secretary to the Board of Trade and author of the famous rhyming " Rules of the Road at Sea ". The object of the Trust was " the advancement of the science of navigation and the scientific and educational interest of the British Mercantile Marine ". Prizes are given for, among other objects, navigational inventions, outstanding deeds of professional merit and the best results in the examinations of the Merchant Navy Training Board. An annual prize is also offered for essays on various set subjects and scholarships are financed, through the Seafarers' Education Service, for deck boys and seamen who wish to study for their Second Mate's Certificate.

The Royal Society of Arts, which sponsors the Thomas Gray Memorial Trust, is one of the oldest learned societies in the country, being surpassed only by the Royal Society, founded in 1660, and the Society of Antiquaries, founded in 1707.

The Royal Society of Arts was founded in 1754 " for the encouragement of arts, manufactures and commerce in Great Britain ", and it thus celebrates its bicentenary in 1954. It owed its origin to the enthusiasm of William Shipley, and among its most important founder-members were Viscount Folkestone and Lord Romney; by 1762 its members included such famous men as Horace Walpole, Joshua Reynolds, Robert Clive, William Hogarth and Samuel Johnson. Shipley's idea was that " Encouragement is much the same to Arts and Sciences as culture is to Vegetables: they always advance and flourish in proportion to the rewards they acquire and the honours they obtain ". The Society adopted a method of awarding " premiums " for various activities and its annual prize-giving became one of the major social events of the season. The Society has always been remarkably versatile in its activities and in the early days of its life it filled an extremely important function, because at that time there were no Departments of State or other institutions to deal with such affairs as public health, agriculture, forestry, Colonies, trade and many other public matters, and the Society went into such matters with enthusiasm.

Throughout its history the Royal Society of Arts has done its best to encourage various commercial activities in the Colonies. For example, the famous expedition of the *Bounty* originated from the Society's offer of a prize for the successful transplanting of the breadfruit tree in the West Indies. The Society also did much to encourage the production of wool in Australia, the wine industries of South Africa and Australia and tea cultivation in India.

In addition to thus fostering trade in the Empire, the Society has always taken a direct interest in shipping, and one of the earliest technical matters it discussed was an ingenious design for a ship's pump " for emptying ships which spring a leak at sea ", which was submitted in 1764 by an Italian inventor by the name of Pigri. In 1757 steps were taken by the Society to prevent the destruction of the timbers in ships' bottoms by worms; a prize was offered " for a model of a ship's bottom which may soonest pass through a given space of water drawn by a given weight ", and another investigation was carried out concerning the " stiffness " of ships. None of these investigations were very conclusive. In the early nineteenth century the Society issued awards for improvements in navigational instruments, such as chronometers, sextants, compasses, etc.; for ships' pumps; and for methods of preserving food and keeping water sweet aboard ship. From its very early days the Society took an active interest in safety of life at sea and offered prizes for life-saving jackets and for lifeboat designs and line-throwing apparatus. The preservation and curing of fish as well as general refrigeration were other activities which the Society encouraged by the issue of prizes. It also took great interest in the question of canals in Britain. Between 1860 and 1880 the Society was active in work connected with life-saving appliances at sea, lighthouse illumination, testing of cables and the use of sound signalling and gale warnings. It also did much to encourage shipowners to do something about improving comfort for passengers aboard ship, for whom, in those days, life at sea was an extremely uncomfortable and hazardous business.

For the last century the Society has concentrated mainly on arranging lectures, publishing a journal, organising exhibitions and conducting a very large system of commercial examinations.

The Society's present activities in connection with shipping are primarily in connection with the Thomas Gray Memorial Trust, and there is no doubt that this does much to encourage efficiency at sea. Recent awards made under this Trust for inventions in connection with shipping have included one to the inventor of a system to estimate distance from a lighthouse by comparing the time of receipt of sound signals with that of radio signals; and another one was " for a valuable invention in connection with radio location " which was in fact the cavity magnetron.

Since 1942 the Society has made an annual award to seafarers for "an outstanding deed of professional merit". A series of lectures on professional subjects is held each year under the Thomas Gray Memorial Trust at the Society's headquarters, and recent subjects discussed at these lectures have included "Safety at Sea" and "Meteorology in the British Commonwealth".

The headquarters of the Royal Society of Arts are in a beautiful building in John Adam Street, Adelphi, London, erected in 1774 by the famous Adam brothers.

C. E. N. F.

Lindi Cyclone of 15th April, 1952

An interesting description has been received from British East Africa* regarding a tropical cyclone which struck the coast of southern Tanganyika on 15th April, 1952. The storm caused extensive damage to buildings and property and a considerable loss of life amongst the African population to an extent hitherto unprecedented in East Africa. The devastated area was confined to a relatively narrow strip of the coast near Lindi, and there is no evidence that appreciable damage was caused by the cyclone after it had moved inland. This note consists of a short extract from the original report prepared by the East African Meteorological Department. In the report it is stated that such a full summary of the history of the storm and the damage done would not have been possible without the co-operation of numerous people, including officers of the Meteorological Department at Dar-es-Salaam and Lindi and other Government officials, also mariners who had experience of the storm, and the President of the Maritime Commission of the World Meteorological Organisation.

There appears to be no doubt that this storm of 15th April, 1952, was a true tropical revolving storm. Its size was very small compared with the normal Indian Ocean cyclones, but the wind speeds near the centre were probably quite as high as those usually associated with larger cyclones. It formed at approximately 09°S, 44°E, during the morning of 14th April, and the centre moved westwards at about 15 m.p.h., crossing the coast slightly north of Lindi at about 0700 hours (0400 G.M.T.) on 15th April. Its intensity decreased quickly as it moved inland and it appears to have died out in the extreme south of Tanganyika (approximately 11½°S, 38°E) by the afternoon of 16th April, so that its total life probably did not exceed 48 hours. Although cyclones are not uncommon further to the SE in the Indian Ocean, the occurrence of a cyclone over the mainland of Tanganyika is a very rare phenomenon. The storm occurred towards the end of the normal cyclone season in the western Indian Ocean and did not follow the usual track, which is well to the SE of the Tanganyika coast. In fact there is no well authenticated record of a cyclone affecting the mainland of East Africa since 1872, when a cyclone that struck Zanzibar caused considerable damage on the Tanganyika coast at Bagamoyo in latitude 06½°S. Thus, when the unusual track, the small size, short life and violence of the storm are taken into account, the Lindi cyclone could almost be described as a freak.

A vivid description of the storm was given by Capt. Kruisinga, master of M.V. *Tayari*. The cyclone passed directly over his ship and in the calm central "eye" the lowest reading of the barometer was 958 mbs. A reproduction of the ship's barogram trace is included in the report. Although Capt. Kruisinga had had a good deal of experience with winds up to force 12 in the Atlantic, he stated that the winds encountered near the centre of this cyclone far surpassed anything in his experience. The report states that the fact that the ship survived was doubtless due in a large measure to Capt. Kruisinga's seamanship and meteorological knowledge, though his own description modestly omitted this point.

*East African Meteorological Department, *Memoirs*, Vol. III, No. 1, 1953.

The report concludes by considering the possibility of giving warning of such storms, pointing out that the development of storms over the Indian Ocean can only be detected from weather reports from the relatively few islands and from ships in the area. In the case of this storm, it is certain that a knowledge of its existence at the early stages could only have been obtained from ships' observations, and in its concluding paragraph the writer of the report is careful to reiterate the point which had been explained earlier, namely, that no ships' reports were received at any forecast offices in East Africa in time to be of any value. Lastly, it adds that, were such devastating storms of frequent occurrence, the need for fixed ocean weather ships might be essential to give the necessary warning; and concludes by saying: " Nevertheless any mariners who may read this report are adjured to do everything they can to send regular meteorological reports to the appropriate shore station in accordance with the international organisation for this purpose maintained by the Commission for Maritime Meteorology of the World Meteorological Organisation."

R. F. M. H.

Letter to the Editor

PHOSPHORESCENT WHEEL

SIR,—This letter is in reference to the two reports on the bands and wheels of light which were published in *The Marine Observer* for April 1954. I was the more interested in these reports as I had got a similar report from the Gulf of Oman last year. It runs as follows:

" WMS. *Olympic Challenger*. Captain W. Reichert. Observer, Mr. Armin Roth, 2nd Officer.

5th November, 1953, 2155 G.M.T.

Position of ship: 26° 10'N, 56° 46'E (Gulf of Oman).

Air temp. 28½°C, sea temp. 28½°C.

Wind, SE, force 2. Weather, clear. Visibility, very good.

" In about 1 metre above the surface of the water there are suddenly appearing quickly moving bands of light (similar to fog). They have an extension of about two nautical miles and they are in a rotating motion, wheeling round from the right to the left (clockwise) and passing the ship at rather regular intervals. The centre of motion seems to be at a distance of about one nautical mile from the ship. The nearest analogy of the whole pattern is that of visible sound waves. The phenomenon lasted about two minutes. It was seen increasing to a clear visibility and then fading out gradually. The night was very dark, but with clear visibility."

I beg to add that I had the opportunity to speak to the observer and that, according to him, the effect of the phenomenon was one of weirdness throughout, especially on the two other men of the crew observing it from the bridge. The observer had seen phosphorescence of the sea on many occasions but in his opinion this phenomenon was quite different, taking place in the air layer above the surface of the sea. I am not sure whether this is an erroneous localisation due to an optical effect or whether the light-producing micro-organisms could have left the sea surface (in spite of gravity and surface tension).

Though there may be no meteorological influence on the phenomenon, I have made an extract from the ship's observations in the following table:

Date	G.M.T.	Lat.	Long.	Wind (°+Bft)		Bar.	Air Temp.	Dew Point	Sea Temp.	Rel. Hum.
Nov.		°	°				°C	°C	°C	
4th	1300	28·4	49·6	360	2	14·7	25·4	15·6	29·0	55
5th	0100	27·0	52·2	330	2	13·7	27·0	18·2	28·5	58
5th	1300	26·3	54·9	**330**	3	**11·7**	**29·4**	20·0	28·8	57
***5th**	**2155**	**26·2**	**56·8**	**140**	2	—	28·5	—	28·5	—
6th	0100	25·6	57·2	180	2	**11·7**	27·0	**23·3**	**29·0**	80
6th	1300	23·6	59·0	160	2	12·2	25·0	**23·6**	28·4	**02**
7th	0100	21·3	59·4	200	2	12·9	25·5	22·0	27·0	81
7th	1300	19·1	58·2	180	2	13·7	28·5	22·2	26·2	69
8th	0100	17·5	56·5	180	1	14·2	24·5	21·6	27·7	84
8th	1300	16·2	54·0	180	1	13·7	26·0	21·0	28·3	74

The ship was going from the Persian Gulf to the Red Sea. Some points seem to be noteworthy. The phenomenon (*) took place in an area of barometric depression, shortly after the transition from a NW'ly wind system to a S'ly one. The dew point was definitely rising, perhaps reaching its maximum value about the time of the phenomenon. With regard to the time of the day, the air temperature also seems to have been at a maximum at the time of the phenomenon. The relative humidity, however, should not have exceeded about 70 per cent at this time.

The circumstances of a single case are insufficient to prove a meteorological connection, but it would be useful to compare the meteorological facts of a majority of cases such as described or mentioned in *The Marine Observer*. (Your three cases mentioned are all during April, the one of *Olympic Challenger* in the beginning of November: is there perhaps a seasonal distribution, the time between the monsoons being favoured ?)

If some meteorological feature could be found favouring the development of the phenomenon, this would be a little step at least to the solution of the mystery.

Seewetteramt, Hamburg. Dr. M. RODEWALD,
Meteorologist.

Note. As stated in the note appended to the observations of the phosphorescent wheel, as seen in the sea, in the April 1954 number, a satisfactory explanation of this phenomenon has not yet been worked out, especially as the wheel shows variation of form and behaviour on different occasions. It is obviously still more difficult to explain a luminous rotating wheel seen in the air above the sea surface, except when it is merely a reflection from a layer of low-lying mist of a wheel taking place in the water.

The above observation of a wheel seen in the air is of very great interest, since every new independent observation of a rare phenomenon helps to confirm that it is a real appearance and not an illusion. The reality of the phenomenon, as seen in the air alone and not merely as a reflection from a wheel in the water, seems now to be clearly established, since we had already collected five similar observations. Three of these five were seen in the Gulf of Siam, the other two being in the southern part of the China Sea, between latitudes 4° and 5°N. The observation of *Olympic Challenger* therefore extends the range of the phenomenon from the above rather restricted region. In none of the six observations is there any mention of the wheel being seen in the sea at the same time and in three of them it is clearly stated that there was no luminescence seen in the water.

As the five other observations are from foreign ships we are unable to examine in detail the meteorological circumstances at the time. The months of occurrence are, however, interesting. Including the *Olympic Challenger*'s observation, they are distributed as follows, one in March, one in May, two in November and two in December, and therefore, as far as we know at present, the phenomenon in the air appears to be confined to the transition period before the onset of the SW monsoon and to the earlier part of the NE monsoon period. This led me to examine the months of occurrence of all the observations of the phosphorescent wheel seen in the sea which are available without an extended search into old logbooks. There are twenty-five of these, including the two published in the present number, and the phenomenon has been seen in every month of the year, least frequently in January, June and

July, which have only one observation each. Adding in the six observations of the wheel seen in the air above the sea, however, it still remains true that the greatest number of observations is in March to April (eight observations) and in October to December (twelve observations). April and December are the months of greatest frequency, with five observations each.

There is an allied phenomenon, the rapid movement of parallel bands of light past the ship. On more than one occasion these have been seen as a preliminary stage in the formation of the wheel, and sometimes the wheel finishes by changing back into the parallel bands. In the above monthly distribution these have all been included in observations of the wheel. We have, however, five observations of moving parallel bands not associated with a wheel, all made during the period September to November; one of these is published in the present number. Adding these to the monthly distribution, the second period of greatest frequency, October to December, is extended to September to December.

In a letter subsequent to that published above, Dr. Rodewald has made two very interesting suggestions. The first is that the stimulating process producing the rotating wheel may lie in the ship itself, in the waves of sound and vibration coming through air and water from the moving ship. If, therefore, a ship passing through the area of a phosphorescent wheel were to stop for a few minutes it might be found that the wheel stopped, either disappearing altogether or turning into a more static form of phosphorescence. If this were so, the wheel might appear again on restarting the ship, say, after a lapse of five minutes or so. As far as we know this experiment has never been made, and if it could be carried out on some future occasion the result, whether positive or negative, would be of great value in helping us to find the explanation of this mysterious phenomenon.

Dr. Rodewald's other suggestion was that if the phosphorescence is due to bacteria of microscopic size, considerable numbers of these might be taken up into the air during the process of evaporation, and so with appropriate stimulation produce luminous phenomena in the air above the sea. The type of phosphorescence which appears as a uniform white illumination in the sea, known as " white water ", many observations of which have been published in this journal, is probably caused by such luminescent bacteria of microscopic size. On the other hand, the blue-green type of phosphorescence in which sparkling points of light are frequently seen, must be due to the light given by larger organisms of the plankton. It would be of great assistance if in future observations of the wheel in the sea, observers would note the nature and colour of the rotating beams. As is only natural with such a remarkable phenomenon, attention in past observations has been mainly concentrated on the general form and rate of rotation of the wheel. E. W. B.

Book Reviews

Teach Yourself Seamanship. By T. F. Wickham. 7¼ in. × 4½ in. pp. 192. *Illus.* English Universities Press, Ltd., 1954. 6*s.*

A preliminary glance through this book struck the reviewer with the thought of how much embarrassment he might have been saved through not having to ask elementary questions and unnecessarily displaying his land-born ignorance to harassed officers, had it been in existence when he went to sea thirty years ago.

This book sets out to be a presentation of the basic aspects of the art of seamanship, and the author has presented his facts in an admirable manner. The first chapter is devoted to some very elementary facts about ships and ships' routine. It presupposes no previous knowledge of the subject whatever, even to the extent of telling the reader that " a floor upon which one can walk is termed a deck, the walls of any compartment, however large or small, are bulkheads . . . the right-hand side of the ship is the starboard side . . . ", etc. If we have any criticism of this chapter it is the natural one of a deck officer, that the departments have been described in the order engine, catering and deck. The body of the work is made up of very well written and friendly chapters on Rope Work, Compass and Steering, Rule of the Road (wherein all the 32 articles, later given in full in the Appendix, are taken individually, paraphrased and explained), Tides and Buoyage, Flags and Signals, Anchors and Cables, Mooring and Berthing, Cargo Work and finally, appropriately perhaps, the longest chapter in the book, Ship's Lifeboats.

There are a few minor errors and omissions; perhaps these are inevitable in a small work covering such a large field. We notice that, though magnetic and gyro compasses are dealt with at some length, there is no mention of the dry-card compass, whilst in the chapters on anchors, cables, mooring and berthing there is no mention of the mooring swivel. The reviewer would also question the writer's method (Fig. 49, page 119) of belaying a hawser to a twin bollard without taking a round turn on the leading bollard before forming the figure-of-eights, though this is a subject on which the Royal and Merchant Navies have never quite agreed. The Royal Mail pennant is erroneously described as a long blue pennant with the words Royal Mail on it in white, whilst we are told that the courtesy flag is flown from the mainmast. We would also question the statement that rolls of paper and newsprint should be stowed on end. This indeed is the accepted method in Canada and the United States, where the ends are specially built up and protected, but in United Kingdom ports reels of paper are not so protected and must be stowed on the bilge.

We are glad to notice that the writer has made appropriate mention of the need for keeping the main engines available for immediate use when at anchor, in the event of a worsening of the weather, and that he has also given some attention to the ventilation of cargo. Altogether this is a very nice little book, one from which any young gentleman going to sea would profit, whilst even the shipmaster might well be glad to have in such accessible form some of that information which one so easily forgets.

L. B. P.

Spare Time at Sea. By Dr. Ronald Hope. $8\frac{3}{4}$ in. × 6 in. pp. 176. *Illus.* Maritime Press, 1954. 12*s.* 6*d.*

In the days of the sailing ship, and indeed in the early days of steamships, owing to the " watch and watch " system which involved officers as well as men, spare time at sea scarcely existed. When off duty sleep was the order of the day apart from essential chores such as dhobying.

The life of the merchant seaman has improved out of all recognition in recent years, and with the existing three-watch system officers and men have considerable leisure time and comfortable accommodation in which to enjoy it.

Dr. Ronald Hope, who is Director of the Seafarers' Education Service and College of the Sea, in this new book *Spare Time at Sea*, provides a very comprehensive and interesting guide for all those who are interested in this important subject. There is little doubt that the provision of plenty of recreational activities makes a happy ship, and there are few of us who have served at sea who have not some pleasant recollections of the fun to be had in a home-made swimming pool on deck, or in playing deck tennis or the delightfully provocative game of deck golf. Dr. Hope delves very deeply into the question of spare-time activities and displays before the reader a surprisingly comprehensive and varied menu.

On the subject of deck games the author provides a wide choice, including exercises to keep fit—strenuous games such as judo, fencing, squash rackets, cricket and deck hockey, deck tennis and swimming. Most of these games are only applicable to the larger type of ship, but others of the less strenuous type, such as bull board, deck croquet, quoits and deck golf can be played in almost any ship. A swimming pool also can be rigged aboard any average-sized foreign-going cargo ship with a little ingenuity.

Dr. Hope also describes many indoor games including tombola, cards, table tennis and board games, and then goes on to such entertainments as " brains' trust ", quizzes, ships' concerts and mock trials. Mention is also made of the possibilities aboard ship of play-reading and the production of plays aboard the ship and the great fun and mental stimulus that is to be gained from this.

Dr. Hope discusses the art of reading and writing and gives tips for the production of a ship's magazine. After dealing with ship adoption, which he shows has been advantageous to the seafarer and the schoolchild, he deals with photography and weather observation: he describes how the Meteorological Office is anxious to receive from mariners reports of anything of scientific interest, which, if necessary, it will forward to the authorities most interested. The study of marine life and bird watching naturally link up with meteorology, and the author emphasises how varied are the interests which spring from such studies.

After describing other hobbies, such as sketching and painting and fishing, the author goes on to give hints about numerous indoor hobbies, including model and toy-making, rug-making, bookbinding, philately and music.

Dr. Hope devotes a chapter to the work of the Seafarers' Education Service and College of the Sea, which provide widespread services for mariners, especially tutorial services; the lending and buying of books and advice on hobbies.

There are many photographs, several diagrams and good appendices containing a bibliography on many subjects of interest to the mariner, both from the professional and hobby point of view, some suggested quizzes and a list of useful addresses.

Spare Time at Sea can be confidently recommended for inclusion in any ship's library.

C. E. N. F.

P. R. B.

Reports from Hong Kong and Mauritius Observatories

HONG KONG.—A note on the value of ships' radio weather messages is taken from a letter written by the Director of the Royal Observatory, Hong Kong.

The greater part of the South China Sea and the coastal waters of China are subject in summer and autumn to typhoons, and in winter to strong monsoon winds sometimes reaching gale force. Several busy shipping routes cross these seas, and it is obvious that radio weather reports from ships can provide information of the utmost value; without them it would be impossible to provide reliable forecasts and storm warnings for the ships themselves or for the seaports in this area. In Hong Kong the Royal Observatory is responsible for providing weather services for the Colony and for shipping and aircraft in the neighbourhood, and since the end of the Japanese war strenuous efforts have been made to enlist the co-operation of ships using the port. A Marine Liaison Officer was appointed, whose duties are similar to those of a Port Meteorological Officer at home, and a fleet of Hong Kong Voluntary Observing Ships has been built up and is being gradually equipped with meteorological instruments to the standard of selected or supplementary ships.

These efforts have met with a very encouraging response from shipping companies and ships' officers alike, who were quick to realize the value of regular weather reporting by ships at sea. The voluntary observing fleet now consists of 59 ships, of which 43 are of British, 10 of Norwegian, 2 of Danish and 4 of Panamanian registration. The number of reports received in Hong Kong from ships at sea has steadily increased, and reached the record total of 8,210 during the last quarter of 1953. This total is not far short of the number received at Dunstable from the Eastern Atlantic and European coastal waters during a similar period. Of these reports about 12 per cent are from British Selected Ships trading in the Far East, 17 per cent from H.M. Ships, 27 per cent from foreign ships, and 44 per cent from Hong Kong Voluntary Observing Ships. All ships' reports received are, of course, re-broadcast for the benefit of other weather services.

In return, the Observatory issues forecasts every 12 hours for the coastal waters of China and the China Seas as far south as 10°N. These, together with synoptic information, storm warnings when necessary, and time signals are regularly broadcast to ships at sea. During 1953, the Marine Liaison Officer made 220 visits to ships in port in Hong Kong; 197 ships' barometers were checked and 88 ships' officers visited the Observatory.

MAURITIUS.—The following are extracts from the Annual Report of the Director of the Observatory Department of Mauritius for 1952.

Weather Services. Throughout the year observations from Mauritius, Rodriques, Agalega, St. Brandon, and Diego Garcia were broadcast for shipping, supplemented by a selection of reports received from ships. During cyclonic weather the number of broadcasts were increased from two to six a day, and in addition two messages for ships were issued each day outlining the weather situation and including all information about cyclones. Individual requests from ships were also dealt with as received. Between 300 and 400 wireless weather reports have been received from ships each month. This information was supplemented by the copying of the weather logs of ships coming into Port Louis Harbour.

Synoptic observations and ships observations were transmitted to Tananarive and Nairobi, and during the cyclone season a daily inference was also transmitted. More frequent cyclone warnings were also sent to these stations and to Colombo, Perth and Johannesburg as necessary. Daily weather reports from Mauritius and the Dependencies and from ships in the area were sent to the United States Weather Bureau to assist in the preparation of their daily synoptic charts of the southern hemisphere.

Tropical Cyclones and Cyclonic Depressions. There were 13 tropical cyclones or cyclonic depressions in 1952, the severest being the one in April which crossed the coast of Tanganyika north of Lindi (and is described on page 232). Reports from a ship helped to plot the direction of movement of a storm in January which moved southward down to Mozambique Channel. In March a cyclone of small diameter followed a very open curved trajectory between Madagascar and Mascareignes. On the 18th it passed 100 miles west of Reunion, where the winds were not very strong, but extremely heavy rain caused damage, but it was of considerable intensity near the centre where a ship reported hurricane force winds and a pressure of 985 mb.

MERCHANT NAVY AGENT, FORTH

We announce the appointment of Captain A. Wilson, O.B.E., as Meteorological Office Merchant Navy Agent for the Forth area. This post has been administered by the Port Meteorological officer at Glasgow since the death of Captain More in July, 1953. Captain Wilson's address and telephone number will be found under Notices to Marine Observers on page 241.

(continued from page 225)

Nine days later, on 23rd May, 1953, the following observation was made by M.V. *Britannic* Captain J. W. Caunce, R.D., R.N.R.

"In position 40° 26'N, 50° 09'W. Observed a very large seabird flying around ship. Wing span over 10 ft (by comparison with known distance). Mandible long and hooked with prominent vent near its base. Flew with gliding motion. White head, slaty upper surfaces, whitish underneath with yellow legs. Possibly a yellow-nosed albatross."

On these two observations Captain Tuck commented as follows:

"After discussing these reports at the British Museum (Natural History) and examining skins, I am of the opinion that this bird was certainly an albatross, and most probably a black-browed albatross. The appearance of this bird in the North Atlantic is most unusual, but is not unique. James Fisher and R. M. Lockley in their new book *Sea Birds*, published by Collins, quote nine records dating from 1878. In the first case the bird was shot in latitude 80°N, further north than it ever strays south in its own hemisphere, a most remarkable occurrence. The most recent record is of one picked up alive in Derbyshire in 1952."

Southern Ice Reports

During the year 1953

Date	Position Lat. ° ′	Position Long. ° ′	Description

OCTOBER

No reports received

NOVEMBER

R.R.S. *John Biscoe*

Date	Lat. ° ′	Long. ° ′	Description
12	61 30S	57 00W	Few scattered bergs, bergy bits, growlers and brash.
17	63 00S	59 00W	Many large bergs, occasional bergy bits and light brash.
30	63 00S	61 00W	Many large bergs and bits. Occasional strips loose pack running E–W.

DECEMBER

S.S. *Thule*

Date	Lat. ° ′	Long. ° ′	Description
16	55 35S	36 02E	Bergs of medium size.

M.V. *Biscoe*

Date	Lat. ° ′	Long. ° ′	Description
30	60 18S	55 00E	Berg and brash, estimated 500 ft by 150 ft in a state of decay.
31	61 36S	61 00E	Berg and brash, estimated 500 ft by 200 ft in a state of decay.

S.S. *Southern Harvester*

Date	Lat. ° ′	Long. ° ′	Description
21	58 24S	14 12W	9 bergs.
22	58 30S	13 12W	3 bergs.
23	57 54S	11 06W	52 bergs.
24	57 12S	06 42W	5 bergs.
26	57 24S	11 24W	6 bergs.
27	57 18S	13 54W	2 bergs.
	57 42S	15 42W	2 bergs.
28	58 18S	17 30W	5 bergs.
31	58 06S	24 54W	4 bergs.

S.S. *Bransfield*

Date	Lat. ° ′	Long. ° ′	Description
18	54 12S	30 54E	First berg sighted.
	57 24S	33 42E	3 bergs.
19	58 24S	30 42E	Many bergs.
	60 24S	26 00E	Many bergs and growlers.
20	60 12S	25 12E	Belts of small pack ice.
	60 30S	23 30E	Belts of pack ice extending E–W.

R.R.S. *John Biscoe*

Date	Lat. ° ′	Long. ° ′	Description
2	64 00S	59 00W	Vast number of bergs in vicinity of Tower Island.
8	61 12S	51 00W	Heavy pack with many massive bergs. Not possible to ascertain depth of field. Long arms extended in N'ly direction.
9	60 35S	46 43W	Heavy concentration of massive bergs.
13	55 10S	36 00W	3 bergs.

Reports of ice for October, November and December, 1952, will be found in *The Marine Observer*, Vol. XXIII, No. 162, page 235.

Note.—By agreement with the interested authorities this is the last occasion that Southern Ice Reports will appear in *The Marine Observer*. In future the information will be held in the Marine Branch of the Meteorological Office, and will be supplied on request.

Notices to Marine Observers

Postal Arrangements

The quarterly numbers of *The Marine Observer* are published on the last Wednesdays of December, March, June and September.

The Marine Observer is addressed to the Captain, S.S./M.V. ...., c/o the owners, and captains are requested to make their own arrangements for forwarding.

Shipowners, Marine Superintendents and all concerned in the despatch of mails to ships are asked to kindly facilitate the despatch and delivery of mail received at their offices from the Meteorological Office and "Air Publications and Forms Stores" to their ships abroad. Addressed to the captains of ships, this contains information required for the conduct of meteorological work at sea, and is most effective if received by the captains at the earliest possible date.

Ice Observation

Drifting ice, derelicts and other floating dangers to navigation are reported by all means of communication at the disposal of the master.

See Chapter 12, pages 96–98 of the *Marine Observer's Handbook*, Seventh Edition.

It is also desirable that more detailed information than can be given in a TTT wireless message should be available to the Meteorological Office for the purpose of research, and for Admiralty Charts and Sailing Directions.

Marine observers will greatly assist by noting the conditions of ice, either drifting or fast, in the pages provided at the end of the logbook (Form 911), or on Form 912, which may be supplied to the captain of any British ship on application to a Port Meteorological Officer or Merchant Navy Agent.

Observing ships using the trans-North Atlantic tracks are requested to record not only when ice is encountered, but also when they have passed through the ice region during the ice season without encountering ice. In this case a "nil" report should be returned, since it is desirable as far as possible to determine when tracks have been clear of ice.

Radio Weather Messages

The master of any ship which experiences frequent difficulties in clearing radio weather messages to coast radio stations in any part of the world is requested to make a note in the ship's meteorological logbook, mentioning the time and date of the occurrence and to give any other information which it is thought might be helpful. The complaint will then be forwarded by the Meteorological Office to the Director of the Meteorological Service to which the message was addressed, with a view to the circumstances being investigated and of improving if possible the reception conditions at the radio station concerned.

It is only by receiving reports of this nature that we are able to know of the difficulties the radio officers aboard the selected ships experience in this respect. In receipt of all such reports we will do our best to rectify matters. Generalised reports merely stating that difficulty was experienced from time to time in clearing a message to such-and-such a station are not sufficiently explicit to enable us to take remedial action.

Radio Weather Messages in African Areas

If the radio officer aboard any ship in African waters has difficulty in contacting a specific coast radio station in a certain area, weather messages may be transmitted to any convenient station in any other African area. (See map in *Marine Observers' Guide*, Part IV.) In each case the message should be addressed to the meteorological authority in that area. For example, if a ship in the area allotted to British West Africa cannot raise any station in that area she could transmit to, say, Dakar addressed Meteo Dakar. The French authorities would then retransmit to all African areas in a collective message.

Inspection of Instruments

Principal observing officers are requested to see that when the ship arrives in a home port all Meteorological Office instruments, books, atlases, stationery, etc., are readily available for muster by a Port Meteorological Officer or Agent. If the observing officer himself is unlikely to be aboard or free to attend the muster it would greatly help if he would leave a note as to the whereabouts of the various items (including the spare thermometer and remains of any broken instruments).

NAUTICAL OFFICERS AND AGENTS OF THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE, GREAT BRITAIN

Headquarters.—Commander C. E. N. Frankcom, O.B.E., R.D., R.N.R., Marine Superintendent, Meteorological Office, Air Ministry, Headstone Drive, Harrow, Middlesex. (Telephone: Harrow 4331, Ext. 324.)

Lieut.-Commander L. B. Philpott, D.S.C., R.D., R.N.R., Nautical Officer. (Telephone: Harrow 4331, Ext. 31.)

Mersey.—Commander M. Cresswell, R.N.R., Port Meteorological Officer, Room 617, Royal Liver Building, Liverpool, 3. (Telephone: Central 6565.)

Thames.—Commander C. H. Williams, R.D., R.N.R., Port Meteorological Officer, Room 1, Second Floor, Adelaide House, London Bridge, London, E.C.4. (Telephone: Mincing Lane 8232.)

Bristol Channel.—Mr. J. C. Matheson, Port Meteorological Officer, 2 Bute Crescent, Cardiff. (Telephone: Cardiff 21423.)

Southampton.—Captain J. R. Radley, Port Meteorological Officer, 50 Berth, Old Docks, Southampton. (Telephone: Southampton 24295.)

Clyde.—Captain R. Reid, Port Meteorological Officer, 53 Bothwell Street, Glasgow. (Telephone: Glasgow Central 2558.)

Forth.—Captain A. Wilson, 9 Rosslyn Crescent, Edinburgh, 6. (Telephone: Leith 35788.)

Humber.—Captain R. E. Dunn, c/o Principal Officer, Ministry of Transport, Trinity House Yard, Hull. (Telephone: Hull 36813.)

Tyne.—Captain F. B. West, Custom House Chambers, Quayside, Newcastle upon Tyne. (Telephone: Newcastle 23203.)

SOME ATLASES PREPARED IN THE MARINE BRANCH OF THE METEOROLOGICAL OFFICE AND PUBLISHED BY HER MAJESTY'S STATIONERY OFFICE

Atlantic Ocean

Monthly Meteorological Charts of the Atlantic Ocean (M.O. 483, 1948). 19¾ in. × 24 in. £2 15s. (1s. 1d.).

Monthly Sea Surface Temperatures of the North Atlantic Ocean (M.O. 527, 1949). 19¾ in. × 12¼ in. 10s. (3d.).

Quarterly Surface Current Charts of the Atlantic Ocean (M.O. 466, 1945). 22½ in. × 17¾ in. 12s. (6d.).

Monthly Ice Charts of Western North Atlantic (M.O. 478, 1944). 12 in. × 7½ in. 4s. (2d.).

Indian Ocean

Monthly Meteorological Charts of the Indian Ocean (M.O. 519, 1949). 15½ in. × 22 in. £3 3s. (11d.).

Indian Ocean Currents (M.O. 392, Second Edition 1939, reprinted 1950). 30 in. × 20 in. 10s. (3d.).

Pacific Ocean

Monthly Meteorological Charts of the Eastern Pacific (M.O. 518, 1950). 17 in. × 23½ in. £4 4s. (1s. 4d.).

Monthly Meteorological Charts of the Western Pacific (M.O. 484, 1947). 16¾ in. × 24 in. £2 2s. (1s.).

Monthly Sea Surface Temperatures of Australian and New Zealand Waters (M.O. 516, 1949). 19¾ in. × 12½ in. 10s. (3d.).

Quarterly Surface Current Charts of the Western North Pacific Ocean, westward of long. 160°W, with Monthly Chartlets of the China Seas (M.O. 485, 1949). 21 in × 16 in. £1 5s. (5d.).

South Pacific Ocean Currents (M.O. 435, 1938, reprinted 1944). 34½ in. × 24 in. 7s. 6d. (6d.).

Arctic Ocean

Monthly Ice Charts of the Arctic Seas (M.O.M. 390A, revised 1944). 12 in. × 7 in. 3s. 6d. (2d.).

Prices in brackets give postage (inland)

Publications in this list are obtainable direct from H.M. Stationery Office at the addresses shown on the title page, or from any bookseller.

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1952 Edition

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