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The Marine Observer

A quarterly journal of Maritime Meteorology

Volume XXXVIII No. 219

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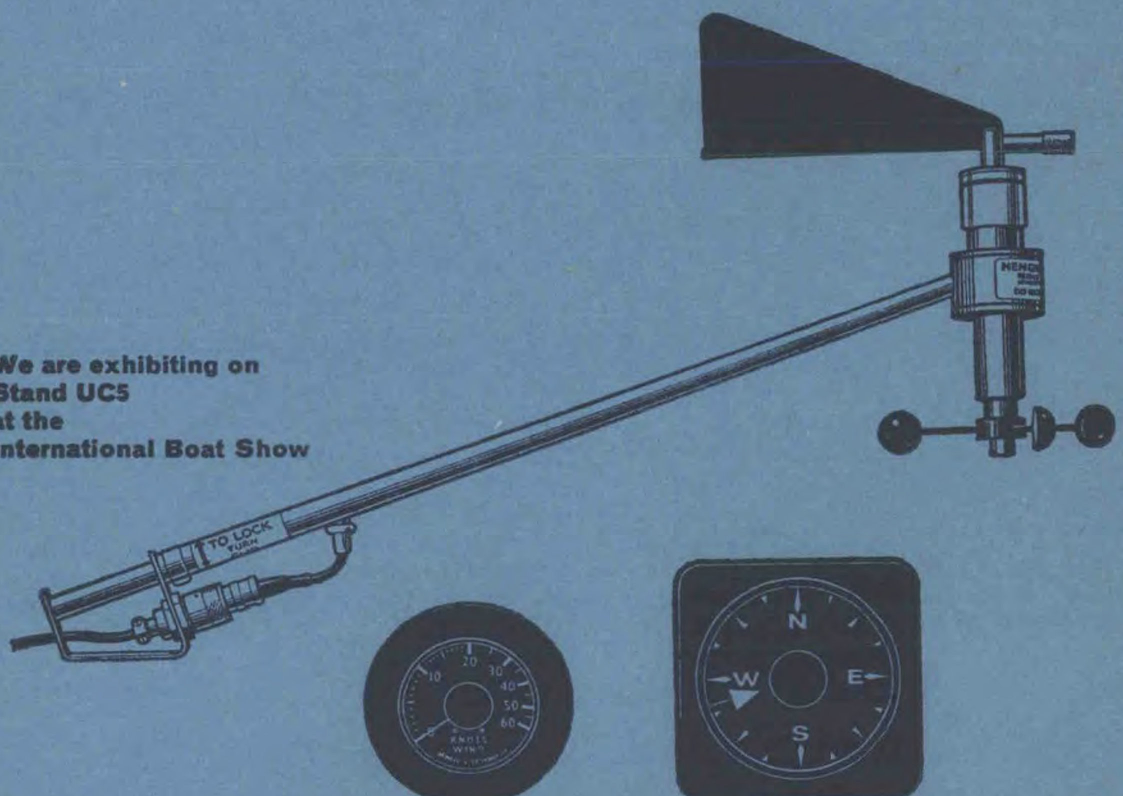

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THE MARINE OBSERVER

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

Vol. XXXVIII

1968

The Chief Meteorological Officer,
H.Q. Coastal Command,
R.A.F. Northwood, Middlesex.

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VOL. XXXVIII **No. 219** **JANUARY 1968**

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Editorial

"And all I ask is a tall ship
"And a star to steer her by."
Masefield, *Sea Fever.*

The pattern of life, especially life in the world of shipping, has changed vastly since Masefield wrote those words. Ships are not tall any more; each one that comes off the stocks seems to be stumpier than her predecessor, each one uglier and more rectangular, until one is tempted to regard them merely as floating warehouses, the only concession to streamlining being to enable them to be pushed faster through the water by bigger engines. Even the star seems in danger of being superseded by an electronic aid and, if one studies the statistics concerning the increasing number of young men who are coming ashore even before they have finished their apprenticeship and the decreasing number of candidates sitting for Master, one cannot but wonder if Sea Fever itself is not dead or, at best, confined to amateurs such as Anderson, Chichester and Tilman whose books we have sometimes reviewed in these pages.

But there is still room for challenge and excitement in sea life: new devices, new methods of loading and discharging and, even now, new routes to be opened up.

When the writer was serving at sea in a capacity which involved the correction of *Light Lists* he well remembers the long succession of weekly *Notices to Mariners* which gave particulars of lights being established along the Arctic coasts of the U.S.S.R. and the time and patience which he spent squeezing these particulars into the existing *Light Lists*, only to be told by a more senior officer "You're wasting your time lad; no one will ever take a ship through there, let alone one of this Company".

It has taken nearly 30 years for the lie to be given to that prophecy. On 25th August 1967 the Soviet cargo liner *Novovoronesh* of 3,726 gross tons arrived in Yokohama with 2,000 tons of general cargo, having made the northabout passage from Hamburg in 28 days at an average speed of 11 knots.

Many other Soviet ships followed the *Novovoronesh* and, currently with the writing of this Editorial, the *Darasun* is on her way with 5,000 tons of pig iron from Poland for the Mitsui organization whilst Japanese agents are advertising loading dates for Kobe, Osaka, Nagoya and Yokohama, with arrivals in west European ports a month later.

In 1967 this route, which is about 4,300 miles shorter than that through the Suez Canal and 9,700 miles shorter than that round the Cape, was to be used exclusively by ships of the U.S.S.R. but we understand that during 1968 it is to be thrown open to ships of all nationalities and we look forward to the appearance of the Red Ensign in those waters. It is virtually certain that the first British shipmaster to make the passage will, before he sails, be approached by one of our Port Meteorological Officers with a view to making his ship a Selected or Supplementary ship, if he has not already volunteered, for this is a part of the world which is substantially a closed book to the meteorologist. Meteorological, ice and ocean current observations from such a ship would enable us to open that book and to start a new chapter in the history of maritime meteorology and in our task of providing an adequate meteorological service for shipping to which we are committed under the International Convention for the Safety of Life at Sea.

One of the advertisements current in London's Underground trains is for an insurance company specializing in road transport insurance. It shows two pictures: one of a stage coach under way in the best Christmas card tradition, bearing the caption "We were there" and the other an impression of road transport of the future, in the best Jules Verne tradition, with the caption "We shall be there". Were it permissible for us to display an advertisement it could be of this nature. Our first picture would be of the barque *Collinsburgh*, Captain C. Hind, which, in Leith on 10th November 1854, was the first ever ship to take our instruments and to become a voluntary observing ship; this picture would bear the caption "We were there". The other would be of a ship flying the Red Ensign on the northern route and this one would be subscribed "We shall be there". For we have always been there, seeking new observations, whenever a new route has been opened. The Suez Canal, the Panama Canal, pit props from Archangel and soft woods from Igarka, the Churchill run and the distant-water trawler industry, the 'Crusader' run between New Zealand and Japan and the export of New Zealand primary products to Peru have all, with many other projects, put us in the way of gathering valuable data; even the closing of the Suez Canal last June and the consequent routeing round the Cape of Good Hope of ships on the Indian, Far Eastern and Australian runs, expensive and inconvenient as it is to most interests, is yet considerably widening our knowledge of the Indian Ocean. It may well be that same closure will stimulate interest in the new northern route but, whatever happens, we are confident that British ships using it will continue in the same tradition of loyalty which has characterized the Voluntary Observing Fleet ever since the *Collinsburgh*'s day.

During the past year or so, many harsh words have been spoken about Britain's Merchant Navy and its supporting services, many of them based only on prejudice, misinformation, lack of knowledge and lack of understanding. Let no young officer who is contemplating coming ashore think that by doing so he is automatically entering a life where every prospect pleases. The shore seems a very attractive place when contemplated from the bridge of a ship in a North Atlantic full gale; equally does the bridge of a ship seem an attractive place when contemplated from the wrong end of a rush-hour bus queue in storm or icing conditions. But there is one way in which we who came ashore have the edge on those who stayed at sea; we can at least be reasonably certain that year after year we will be able to spend Christmas and New Year with our own families in our own homes. We do not forget that Wind, Wave and Weather are not on holiday, neither are those members of the corps of voluntary marine observers who record them; in fact the coming into force of the revised code and the use of the bright yellow meteorological logbooks in the very first minutes of the New Year may well have given the observation of these elements and their companions a new significance in the minds of ships' officers. To you all we send our best wishes for your happiness and prosperity with reasonable weather and good landfalls throughout 1968.

L. B. P.

January, February, March

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

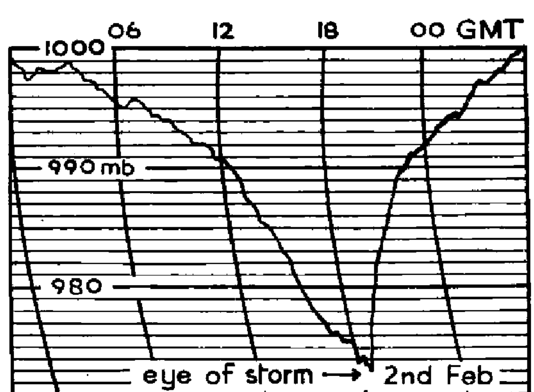
Observing officers are reminded that preserved samples of discoloured water, luminescent water, etc. considerably enhance the value of such an observation. Port Meteorological Officers in the U.K. will supply bottles, preservative and instructions on request.

CYCLONE 'DINAH'

New Zealand waters

m.v. *Ruahine*. Captain R. G. Hollingdale. Wellington to Papeete. Observer, Mr. J. Gibbard, Senior 3rd Officer.

2nd and 3rd February 1967. When the vessel departed from Wellington at 0100 GMT on the 2nd, continuous moderate rain was falling and the wind was SE, force 5. Course was 051° at 17 kt and at 0600 the vessel was in position 41° 12′S, 176° 24′E. Pressure then was 996·5 mb and falling rapidly. Light rain occurred at times and the wind was E′S, force 4. From 0600 to 1200 a considerable amount of drizzle was experienced which became thick and continuous towards the end of the period. The wind veered slowly towards SE′S, remaining fairly steady at about force 4. At 1200, pressure was 992·1 mb. The drizzle gave way to heavy rain at 1250 and the wind backed rapidly to N′W, increasing to force 6. By 1600 it had slowly veered to NE′N and risen to force 10; at 1830 it was force 11. The direction then began to back slowly and by 1900 the wind was N′E, force 10. Soon afterwards it backed quickly to W′N, force 10 as the centre of the storm passed across and the barometer,



which had fallen to 973 mb, began to rise suddenly and very rapidly. Although the continuous heavy drizzle and rain preceded the storm until 1815, none was experienced for several hours after it had passed. Between 1900 and 2000 there was a partial clearance of the sky. During the six hours after the wind backed towards the north, until the passage of the storm centre, the sea built up extremely quickly from about 6 ft to about 30 ft. The direction of the swell changed from ESE at noon to NNE by 1800 and to NW'N by midnight. It became necessary to heave to from 1830 to 2130 as frequent seas were being shipped and visibility was down to about 1,000 yd. During the next 24 hours the wind steadied at W'S, gradually decreasing from force 8 at 0000 on the 3rd to force 4 by 1800.

In addition to the weather messages transmitted at standard hours to OBS Weather Wellington, the following were also sent in plain language:

021630: 39° 23'S, 179° 02'E. Wind 030°, 50 kt. Sea very rough. Swell heavy NE'N. Bar. 977·4, falling. Air temp. 68°.

022000: 39° 17'S, 179° 20'E. Wind 280°, 45 kt gusting to 60 kt. Very rough sea. Heavy N'ly swell. Bar. 983·0. Air temp. 68°.

022200: 39° 06'S, 179° 31'E. Wind 40 kt gusting to 55 kt. Heavy NNW'ly swell. Bar. 987·3 rising rapidly. Air temp. 62°.

030300: 38° 22'S, 179° 12'W. Wind 270°, force 8. Bar. 996·9 rising steeply. Heavy NW'ly swell. Air temp. 65°.

It is interesting to note that in the *Atlas of Pilot Charts* published by the U.S. Hydrographic Office (H.O. Pub. No. 577), 1st January 1950 edition, the sheet for February shows a storm track almost identical to that of Dinah over New Zealand in 1936. It originated on 28th January and passed New Zealand on 2nd and 3rd February, as did Dinah.

m.v. *Canopic*. Captain M. Larrive. Wellington to Balboa.

The following observations, extracted from the vessel's meteorological logbook, show the weather changes experienced when she was in the vicinity of the cyclone.

2nd February 1967.

GMT

1200: Position of ship: 41° 18'S, 176° 48'E. Wind ESE, force 6. Visibility 12 n. miles. Pressure 993·5 mb. Sea waves 9–10 ft from ESE. Swell waves 5 ft from ESE. 1700–1730: Wind shifted SE to N. No wind during the change. Confused sea.

1800: Position of ship: 40° 36'S, 178° 36'E. Wind NNE, force 9. Visibility 1,500 yd. Moderate rain. Pressure 972·5 mb. Sea waves 15 ft from NNE. Swell waves 25–26 ft from NNE.

3rd

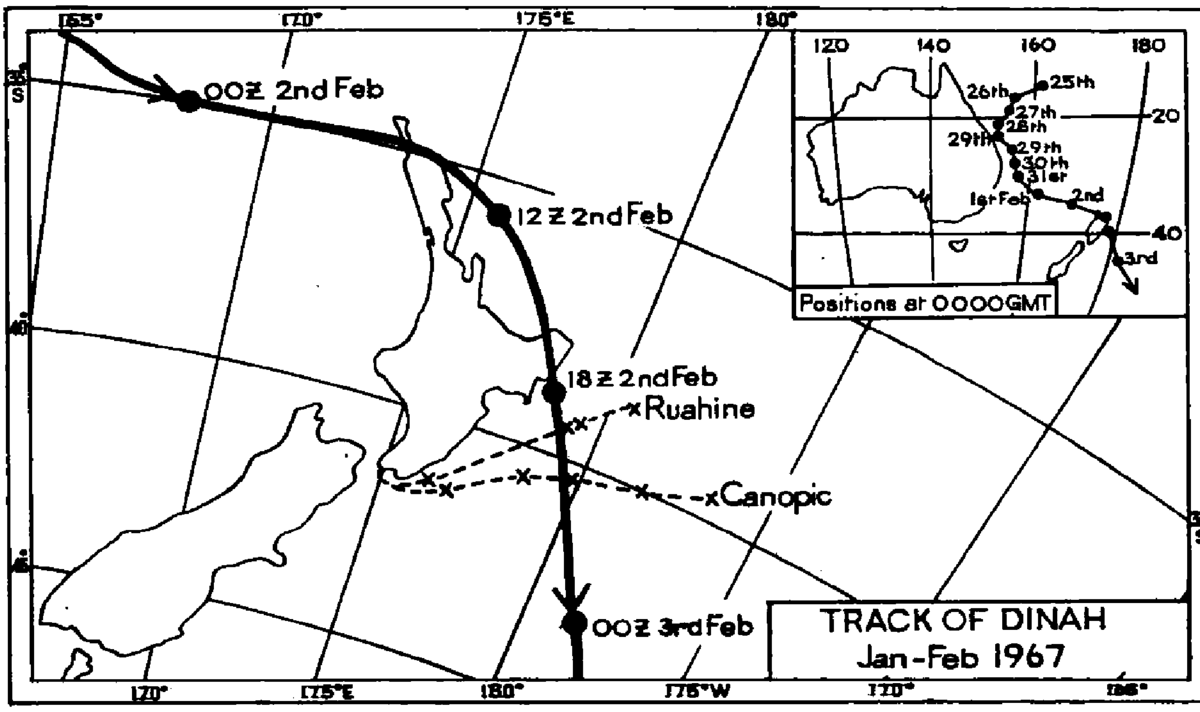
0000: Position of ship: 40° 24'S, 179° 54'E. Wind NW'N, force 8. Visibility 5½ n. miles. Pressure 978·8 mb. Sea waves 13 ft from NE'N. Swell waves 21 ft from NE'N.

0600: Position of ship: 40° 00'S, 178° 18'W. Wind NW'N, force 6, Visibility 5½ n. miles. Pressure 996·7 mb. Sea waves 13 ft from NW'N. Swell waves 19 ft from NE'N.

1200: Position of ship: 39° 30'S, 176° 30'W. Wind WNW, force 5. Visibility 11 n. miles. Fair. Pressure 1004·4 mb. Sea waves 9–10 ft from WNW. Swell waves 21 ft from NE'N.

Note. The following comments and plotted chart have been received from the New Zealand Meteorological Service. (The tracks of the *Ruahine* and the *Canopic* were added later.)

"Cyclone Dinah formed in the area south of the Solomon Islands during the period 20th–24th January 1967. Little movement was evident until 25th January, when a slow south-westward drift began, and the storm took 4 days to reach the coast of southern Queensland, some 600 miles from its area of formation. Estimated central pressure within the cyclone at the time of its closest approach to the coastline, 0600 GMT on the 29th, was 970 mb.



"After recurving from the Queensland coastline at about 25°s, the cyclone travelled south-east about 500 miles to pass near to Lord Howe Island (minimum pressure near 975 mb) two days later. It then slowed down for a period of 24 hours, between 0600 GMT on 31st January and 0600 on 1st February, before resuming on a more regular easterly course towards the northern tip of New Zealand at a speed of 20–25 kt.

"The cyclone reached northern New Zealand shortly after 0600 on 2nd February and at this time and position appeared to be continuing on its eastward path. Forecasts for both shipping and public were based on this assumption. However, from about this time, the cyclone turned south-eastwards, accelerated to 30–35 kt, and passed near the ships *Ruahine* and *Canopic* at about 1900 on the 2nd. The Warning to Shipping issued at 1400 gave this information and also contained mention of winds reaching 60 kt within 50 miles of the centre.

"During the passage of the cyclone across the north Tasman Sea its central pressure was difficult to determine and a weakening of the storm was suggested, but later analyses showed that the central pressure was lower than realized at the time, probably below 980 mb.

"Some deepening occurred following its passage across northern New Zealand and the lowest pressure recorded by a land station was 975 mb at East Cape (37° 41′s, 178° 37′E) at 1600 on the 2nd. The *Ruahine* was at this time about 100 miles to the SSE of East Cape reporting wind NE′E at 50 kt, very rough sea and heavy swell—a non-scheduled but valuable report. The lowest pressure recorded by the *Ruahine* was 973 mb at 1900 on 2nd February.

INTENSE DEPRESSION

North Atlantic Ocean

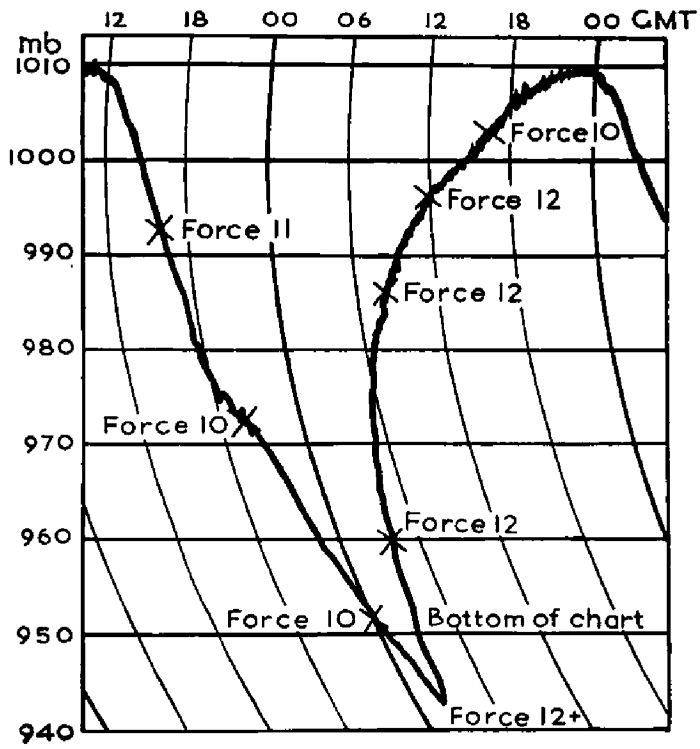
s.s. *New York City*. Captain F. W. Harris, R.D. Avonmouth to Halifax. Observer, Mr. C. O. Thomas, 2nd Officer.

20th January 1967. During the morning the wind, previously NW'ly, force 6, backed towards west and increased to force 8. It continued at this force for the rest of the day, accompanied at intervals by rain or sleet.

Position of ship at 1200 GMT: 50° 48′N, 27° 00′W.

21st January. Wind W, force 8 during the morning but decreased to force 6 by noon. At times there were heavy rain or sleet showers. During the afternoon the barometer fell extremely rapidly and the wind backed quickly, becoming SE′E, force 10 by 1800. Pressure which had been 1007·5 mb at midday was down to 985·0 mb by 1800 and still falling very quickly. There were frequent rain squalls and visibility was seriously reduced at times. Swell was very heavy and confused.

Position of ship at 1200: 50° 24′N, 30° 36′W.



22nd January. Pressure continued to fall very rapidly and reached a minimum of 940 mb (by precision aneroid) in the early morning, the pen going off the bottom of the barograph chart. Suddenly the barometer started to rise at a remarkable rate and by 0600 it was up to 976 mb. There was a sudden veer of wind direction from about S to WNW and an increase in strength from force 10 to 12. Skies remained overcast and violent rain squalls continued. The swell became mountainous from WNW and there was blinding spray. The vessel was hove to and steerage way was maintained only with considerable difficulty. At 1800: Wind NW, force 10 with heavy sleet.

Position of ship at 1800: 49° 30′N, 33° 30′W.

23rd January. The wind continued to blow all day at force 9 from between NW and SW. Position of ship at 1200: 49° 18′N, 36° 30′W.

24th January. Wind all day WSW–W, force 7–8. Position of ship at 1200: 48° 12′N, 41° 24′W.

25th January. Wind force 8 throughout. Veered from W to NW in the afternoon. Position of ship at 1200: 47° 00′N, 45° 06′W.

26th January. Wind NW'ly, force 8 early, decreased steadily, becoming light and variable by midnight. Position of ship at 1200: 45° 12′N, 50° 54′W.

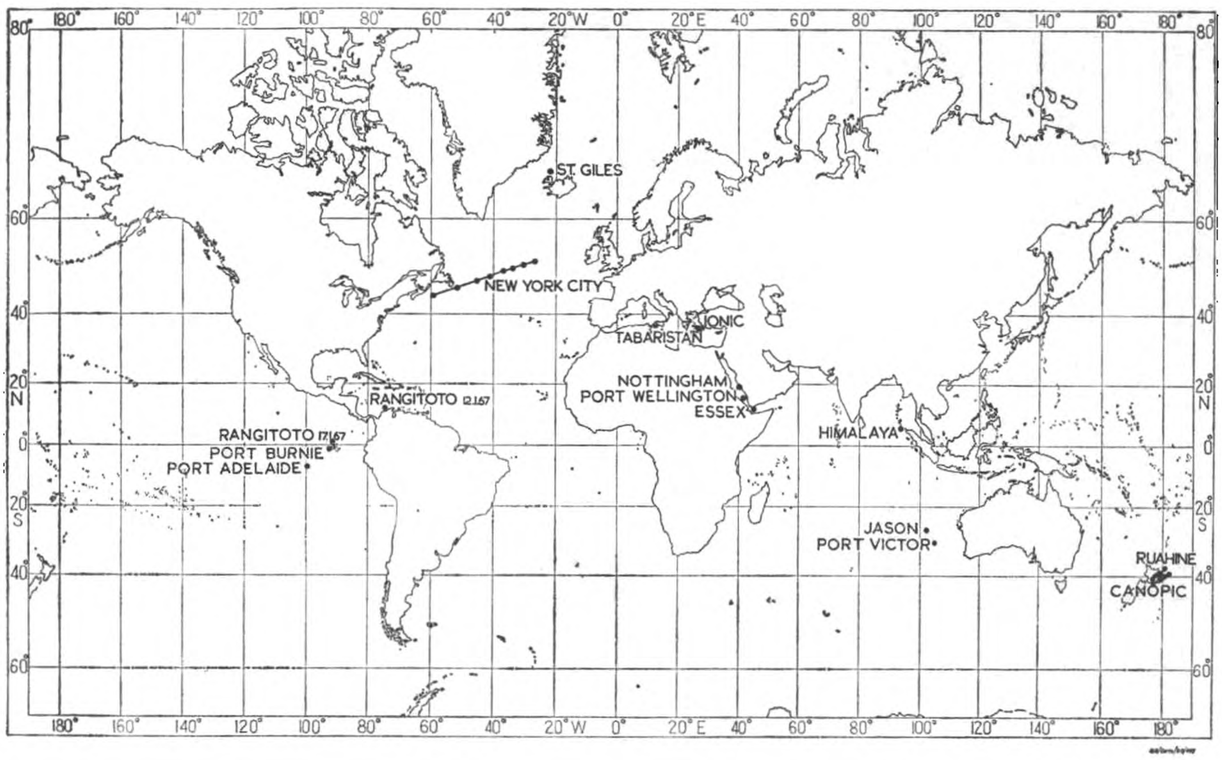
Note. The synoptic weather charts show that at 1800 GMT on 21st January a very intense and rapidly deepening depression was centred at 48° 30′N, 37° 00′W. By 0000 on the 22nd it lay at 50° 30′N, 32° 30′W. At about this time the centre of the depression passed to the north of the vessel at a distance estimated to be about 30–50 n. miles, thereby accounting for the very rapid pressure and wind changes observed.

OROGRAPHIC CLOUD

Archipiélago de Cólon

m.v. *Port Burnie.* Captain I. H. North. Brisbane to Panama. Observer, Mr. M. F. Bennett, 3rd Officer.

19th March 1967, 1900 GMT. The first indication of the presence of the islands was given by a band of cumulus cloud, covering about 20° of the NE horizon in an otherwise cloudless sky. The higher parts of the Isla Isabela became visible at a distance of 25 miles and it was seen that the cloud was above this part of the archipelago. The vessel passed within 7 miles of the island and it was noted that the cloud



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

base was about 500 ft above the highest part, that is at approximately 6,000 ft, with the top reaching to 7,000 ft. No rain was seen to fall on the island. At 2330, as the islands were left astern, the cloud was seen to be dissolving. At 1800: Air temp. 77·0°F, wet bulb 73·5°, sea 77·2°. Wind E'ly, force 3–4.

Position of ship: 1° 54′S, 92° 12′W.

Note. Orographic cloud is formed by the forced uplift of air over high ground. The air is cooled as it rises and condensation occurs if the air is sufficiently moist, resulting in the formation of cloud. As the air descends on the other side of the high ground it warms up by compression and becomes dry, thereby preventing the lateral extension of the cloud. Thus, although the air is in motion, the orographic cloud formed in it remains more or less *in situ* or only very slightly to leeward.

SEA SMOKE

Mediterranean Sea

m.v. *Ionic*. Captain B. B. Hinderwell. Famagusta to Piraeus. Observer, Mr. M. H. Murray, 3rd Officer.

17th January 1967. From 2040–2120 GMT, when the vessel was off the NE of Crete, dense sea smoke rising to a height of 1–2 ft was seen covering the whole surface of the water. It became denser as the wind speed increased but did not interfere with visibility. Air temp. 44°F, wet bulb 42°, sea 61°. Wind NNW, force 6–8.

Position of ship: 36° 15′N, 25° 26′E.

Note. The synoptic weather chart for 1800 GMT shows that a rather cold, unstable NE–N'ly airstream covered the Grecian Archipelago. Showers and isolated thunderstorms were reported.

The reason for the formation of sea smoke is given below in the note to the *St. Giles* observation.

off North Iceland

m.t. *St. Giles.* Skipper T. Sawyers. Fishing. Observer, Mr. K. C. Stone, Radio Officer.

27th February 1967. Sea smoke, which lay on the water to a height of 4 ft or more, was seen for much of the day. Also, as the waves broke in the strong to near-gale-force wind, the spindrift appeared to freeze immediately and to be borne along as shallow fog. Visibility was about 2,000 yd and moderate snow fell at times. It was thought that the ice-field could not be very far away and would probably soon move in if the NE wind persisted (ice was in fact seen during the afternoon of 2nd March). Air temp. 17°F, sea 32°. Wind N–NE, force 6 or 7.

Position of ship: 66° 50′N, 21° 55′W.

Note. Our synoptic weather charts show that a very cold NE'ly airstream covered the Denmark Strait on 27th February, with temperatures at noon down to 14°F at stations on the north and north-east coasts of Iceland. Sea smoke is liable to form when very cold air passes across a relatively warm sea surface. It is commonly thought that a temperature difference of at least 16 degF is necessary for this phenomenon to occur so the above case is somewhat unusual. Sea smoke develops because of the rapidity with which cold air becomes saturated by evaporation from the much warmer sea surface. A large amount of heat is also supplied to the air by the water and therefore a large air-sea temperature difference can persist only when strong or gale force winds continually renew the supply of cold air.

ABNORMAL CURRENT SET

off Punta Albemarle

m.v. *Rangitoto.* Captain H. N. Lawson. Balboa to Papeete. Observer, Mr. M. J. Sutherland, 3rd Officer.

17th January 1967, 0100–0240 GMT. When approaching Punta Albemarle at the northern end of Isla Isabela, the vessel experienced a strong SE–SSE'ly current, estimated strength 2 kt, instead of the expected NW'ly current of 2¾ kt as indicated on the chart and in the *Pilot.* On rounding Punta Albemarle a NNE'ly current was encountered for about 30 min. Wind SSE'ly, force 3. Sea temp: at 0220, 74°F; at 0400, 77°.

Position of ship: 0° 18′N, 90° 48′W.

Eastern Pacific Ocean

m.v. *Port Adelaide.* Captain E. R. Jenkins. Balboa to Wellington.

21st–22nd February 1967. While the vessel was traversing the area approximately 600 miles WSW of the Galápagos Islands, on a course of 240°, the westerly current set shown in the atlases was not experienced. The vessel's speed decreased from around 17 kt to 16¼ kt and did not return to 17 kt until 24 to 36 hours later. A similar occurrence was noted in the same area about a year ago when the Master was in command of the *Port Wyndham* bound from Panama to New Zealand.

Note. The NW'ly South Equatorial Current is normally found as far or even further north than the Galápagos Islands but from about 5°N the east-flowing Equatorial Counter-current is usually predominant. Due to unusual winds, the configuration of the ocean bottom and to the strong sea temperature gradient often experienced in these latitudes (and it could be inferred that the latter was encountered by the *Rangitoto*), surface eddies and up-welling do occur, the line of demarcation between the two main currents being considerably displaced. It was, perhaps, unusually so in the case of the *Port Adelaide.* These reports help to illustrate the importance of current roses in atlases. The Meteorological Office publication *Quarterly Surface Current Charts of the South Pacific Ocean*, 2nd Edition, 1967 shows clearly that sets between easterly and southerly have been found on nearly 5% of occasions, the strength averaging about 1 kt. Steps have been taken to include this information of extreme rates and rare sets in the next edition of the *Pilot.*

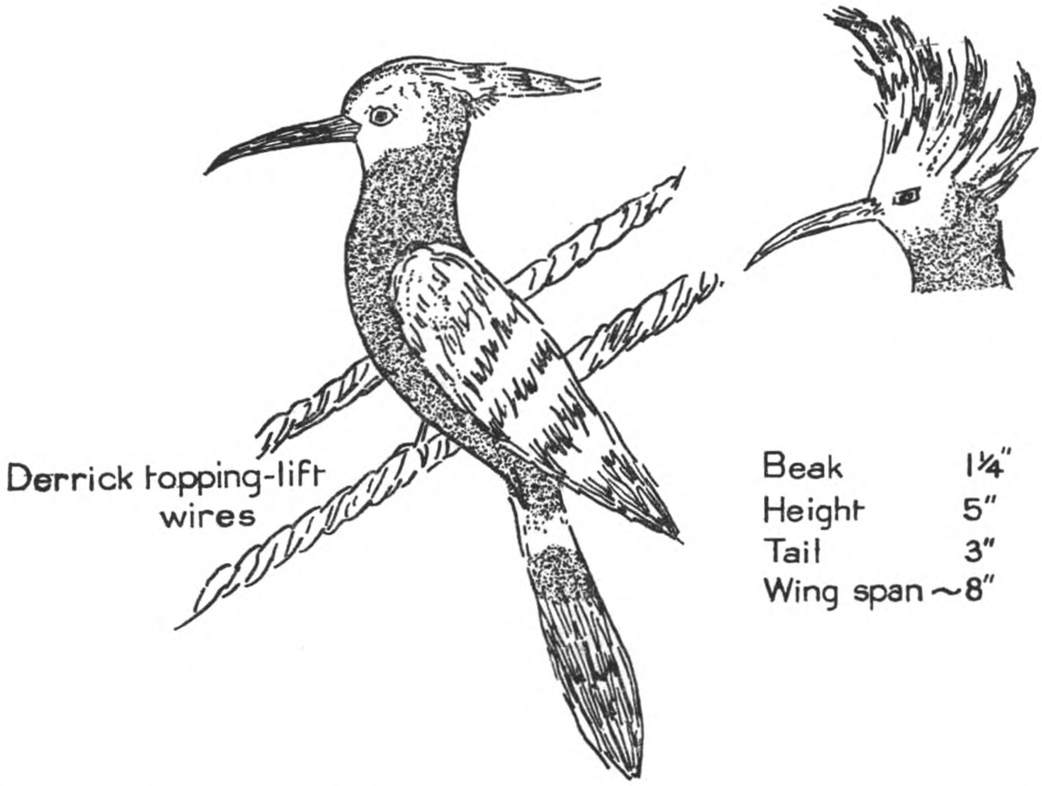
LONE BIRD

Red Sea

m.v. *Port Wellington.* Captain R. Holmes. Port Said to Aden. Observers, Mr. K. Speirs, 2nd Officer and Mr. C. Howard, Apprentice.

16th March 1967. At about 0600 SMT the lone bird, shown in the sketch, was seen to alight on a derrick topping-lift in front of the bridge. After alighting it remained practically motionless for about 6 min and appeared to be resting. Two hours later it was still seen about the ship. The visitor did not appear to have webbed feet but was similar to birds of the jay family. When taking off it was reminiscent of a magpie, with fast wing beat and the black tip to a white tail. The bird's predominant colour was fawn, light on the breast and darker on the back, with black bands on the wings and plume. When startled by the opening of a door the plume was raised as shown in the drawing. As the vessel was about 100 miles from the nearest land and in an area usually devoid of bird life this report may be of interest to the ornithologist. Wind NW'N, force 2, Visibility very good.

Position of ship: 17° 00'N, 40° 42'E.



Note. Captain G. S. Tuck, D.S.O., R.N., Chairman of the Royal Naval Birdwatching Society, comments:

"This observation calls attention to the frequency of other similar reports of this handsome bird from the Red Sea area.

"Hoopoes probably originated in Ethiopia and are now distributed generally throughout southern Europe, Africa and southern Asia. Numbers also migrate regularly northwards from Africa into Europe during early Spring, March–April, returning in the Autumn, one of their chief fly paths crossing the Red Sea. These confiding birds, with their slow undulating butter-fly-wing action in flight, no doubt enjoy resting onboard, although their call note 'Poo-Poo-Poo' is unlikely to be heard.

"Hoopoes pass through the British Isles in small numbers in April and May and usually create something of a sensation when seen foraging on a lawn, for they are ground feeders.

"The Hoopoe is quite unmistakable, with its pinkish-brown plumage, boldly barred black and white wings and lower back, and its remarkable fawn black-tipped crest which it will erect suddenly when excited or alarmed. It is about 11 inches in length with a long, slim, curved bill.

"Ships trading through the Mediterranean, Red Sea and Persian Gulf cross the migration routes of many other boldly and colourfully marked land birds and there is no better guide book to help in identifying these birds than *A Field Guide to the Birds of Britain and Europe*, published by Collins at 25*s*. and obtainable from any good bookshop. It is small and handy for the bridge and profusely illustrated in colour. The authors are Roger Peterson, Guy Montfort and P. A. Hollom."

DRAGONFLIES

Red Sea

m.v. *Nottingham*. Captain J. D. Hellings. Aden to Suez. Observers, the Master, Mr. S. N. A. Wells, 3rd Officer and the ship's company.

12th January 1967. When in the middle of the Red Sea numerous dragonflies settled on the vessel after sunset. After landing on the deck they seemed to have great difficulty in taking off again, many of them ending up on their backs after the attempt. In this position they looked helpless and apparently dying. The underside of the tail was divided longitudinally and, while the insects were on their backs, this space opened and closed rapidly with a pulsating movement. Wind ESE, force 5.

Position of ship: 18° 30′N, 40° 00′E.

Note. Mr. D. E. Kimmins of the Department of Entomology at the Natural History Museum comments:

"The dragonfly sent for identification is *Hemianax ephippiger* (Burmeister). This species is a well-known migrant; it normally inhabits the region from the Mediterranean to India and on migration penetrates northward into Europe."

LUMINESCENCE

Gulf of Aden

m.v. *Essex*. Captain A. B. Stalker. Aden to Suez. Observers, Mr. G. MacIver, Chief Officer, Mr. M. Handfield, 3rd Officer and Mr. P. Sawyer, Jnr. 3rd Officer.

5th February 1967, 1600–1900 GMT. When the vessel was between Ras Mujallab Haidi and Ras Kaau large amounts of luminescence were seen, of several different types.

(*a*) The ship's bow wave broke in brilliant emerald-green light, with occasional flashes which were bright enough to light up the ship's superstructure.

(*b*) Little spots of sparkling light which were visible up to 3 miles.

(*c*) The vessel passed through 3 or 4 long lines of luminescence which had the appearance of milk or white oil. In the darkness, at a distance of 2 miles or so, these looked alarmingly like lines of breakers.

The sea temperature bucket was used to get samples and, when brought back on deck, it and especially the rope were found to be covered with luminescent particles. Examination showed that the light was being emitted from semi-transparent egg-shaped objects about 1/16 inch long. Sea temp 77·3°F. Wind light and variable.

Position of ship at 1800: 12° 36′N, 44° 36′E.

ABNORMAL REFRACTION

Mediterranean Sea

s.s. *Tabaristan*. Captain W. Mackenzie. Port Said to Liverpool. Observer, Mr. R. W. Sawyers, 3rd Officer.

7th January 1967. The loom of Cape Bon light was seen at 2125 GMT at a distance of 41 miles, flashes being seen intermittently until 2150 when a heavy rain squall considerably reduced visibility. After the passing of the squall at 2200, the light

became visible at 36 miles but, due to abnormal refraction, it took the form of three lights, one above the other. The brightness was exceptional considering our distance from it. Air temp. 47·9°F, wet bulb 44·0, sea 56·1°. Wind W'N, force 7–8. Swell, 15 ft.
Position of ship at 2200: 36° 58'N, 11° 47'E.

Note. The Cape Bon light being 412 ft above sea level and the bridge of the *Tabaristan* 48 ft, the theoretical geographical range by direct vision would be 31·5 miles. That it was seen from a distance of 36 miles indicates abnormal refraction. The contrast between cold air and warm sea, as here reported, usually reduces the range but the explanation of the observed phenomenon lies in the fact that, with the proximity of a quasi-stationary front, air warmer than that at the surface had spread over the area at a height of a few hundred feet. This would have had the effect of deflecting light rays downwards, thereby effectively increasing the range of visibility. It is also likely that there were several marked discontinuities in the air mass which helped to produce the three observed images of the light. At least one of these was probably inverted, but this would not have been obvious under the circumstances.

LUNAR RAINBOW

Nicobar Islands

s.s. *Himalaya.* Captain M. R. Prowse. Singapore to Bombay. Observers, Mr. M. Bingham, 2nd Officer and Mr. M. Derrick, 4th Officer.

18th February 1967. After the passing of a heavy rain shower at 1700 GMT, a well-defined lunar rainbow was seen astern. The moon, in its third quarter, was at an elevation of about 30° and shining brightly, being clear of cloud. All the colours of the spectrum were plainly seen in the bow for about 5 min. The colours then began to fade and a few minutes later the bow disappeared. Air temp. 78°F, wet bulb 77°, sea 84°. Wind SE, force 4. Visibility excellent.
Position of ship: 5° 53'N, 94° 06'E.

Note. This is an interesting observation, since it is rather unusual to see a lunar rainbow in which all the colours of the spectrum are present and well-defined.

CREPUSCULAR RAYS

Indian Ocean

m.v. *Port Victor.* Captain R. A. Wight. Aden to Adelaide. Observers, Mr. J. E. Crowsley, 2nd Officer, Mr. D. N. Ford, 3rd Officer and Mr. J. E. B. Simpson, Jnr. 3rd Officer.

19th February 1967. Six broad beams of light were observed converging towards a point a little below the eastern horizon at 1134 GMT, 12 min before sunset. The beams, which were faint, were spaced three on each side of the point of convergence at angles of about 20°, 30° and 40° to the horizontal. They extended upwards to an altitude of approximately 30° to 40° and were visible for about 5 min only. At the point where the rays approached the horizon a faint whitish glow could be seen. The sun itself was obscured by 6/8 cloud, mainly Cu and Sc, but some Ac was also present. Air temp. 68°F, wet bulb 61°. Visibility very good.
Position of ship: 30° 15'S, 104° 24'E.

Note. Crepuscular rays are caused by sunbeams falling upon water or dust particles in the air and illuminating them. The sun's rays may either penetrate through gaps in the cloud or shine upwards from behind cloud banks or diverge from the sun when below the horizon. The bright rays are separated by dark streaks or bands which are the shadows of broken cloud or of hills or mountains. Often the rays lie across the sky, passing overhead to converge near the horizon opposite to the sun, as in the above case. The convergence is an optical illusion produced by perspective.

GREEN MOON

Caribbean Sea

m.v. *Rangitoto*. Captain H. N. Lawson. Curaçao to Cristobal. Observers, the Master, Mr. J. Jackson, 2nd Officer and Mr. P. Murdoch, Quartermaster.

12th January 1967, 2300 GMT. At sunset the new moon was seen to be a silvery green colour, the green tint being predominant. At 0000 on 13th: Air temp. 79·3°F, wet bulb 75·0°, sea 79·8°. Visibility very good. Small amount of Ci and Sc present.

Position of ship: 11° 31′N, 75° 59′W.

Note. Conflicting views are held about the reason for the occurrence of a green moon. One school of thought attributes it to physiological causes: the eyes, attuned to the yellowish pink of the sunset sky, see the complementary colour when looking at the white light of the moon. Another view is that the phenomenon is due to the scattering of the moon's light by extremely fine dust held in suspension in the atmosphere. During sandstorms the sun has been seen to assume a bluish tinge. The smoke carried aloft from forest fires in Canada caused the sun and moon to appear blue over much of western Europe between the 26th and 30th September 1950.

VENUS—COLOUR CHANGES

South Indian Ocean

s.s. *Jason*. Captain H. S. Clarke. Djibouti to Melbourne. Observer, Officer Cadet S. P. C. Saverimutto.

11th March 1967. From 1228 to 1233 GMT, Venus, bearing 278°, underwent unusual colour changes on nearing the horizon. When first observed, the planet was changing colour from yellow to a faint reddish tint and resembled a flashing red light on shore. As Venus sank towards the horizon, the red colour brightened and the similarity to an occulting light became more marked. Just before disappearing, the red colour became extremely strong. Air temp. 72·8°F, wet bulb 64·8°, sea 75·8°. Visibility excellent. Small amount of C_L1 present.

Position of ship: 27° 47′S, 101° 43′E.

Note. As Venus appeared to near the horizon the light from the planet had to pass through an increasingly long path in the earth's atmosphere. The more refrangible rays at the blue end of the spectrum were almost completely scattered and left only those at the red end to reach the observer. The flashing seen a little earlier was probably caused by variation in refraction due to alternations in temperature of the air resulting from eddies.

METEOR SHOWERS

Atlantic and Pacific Oceans

The reports from m.v. *Cardiff City*, m.v. *Hinakura* and m.v. *Dartwood* (published in *The Marine Observer*, October 1967) were forwarded to Mr. H. B. Ridley, Director of the Meteor Section, British Astronomical Association, who comments:

"These reports evidently refer to meteors of the Leonid shower which was active on 16th–18th November 1966. A brief and extraordinarily intense maximum was observed from Arizona, U.S.A., when the hourly rate exceeded 100,000, but this outburst only lasted for an hour so that, in general, ships in the North Atlantic and Pacific would have missed the main display."

An article on the Leonid Meteor Shower will appear in a later issue of *The Marine Observer* when it is hoped to include reports of any similar showers which occurred in 1967.

AURORA

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

"Auroral observations received at the Balfour Stewart Auroral Laboratory in the University of Edinburgh from British ships for the period January–March 1967 are listed briefly below and we thank all concerned for their help.

"Geomagnetic activity was greatest on 13–14th January, when aurora moved southwards to the extent that a steady glow was visible from *Haparangi* at latitude 41½°N in mid-Atlantic. This report compares with one received at the U.S. data collection centre from an observer in Nevada—roughly the same latitude. *Weather Adviser* at station 'India' had a brief glimpse of the activity and passed on a report from an aircraft flying above cloud that active aurora was still visible at 0800. There was good coverage of this display for the whole night over the British Isles and North Sea, and coronal forms were observed overhead in central Scotland.

"Mainly high latitude observations make up the remainder of the list and we acknowledge *Weather Reporter*'s excellent sketches which enable us to put on the maps an accurate representation of complicated forms.

"The accumulation of auroral data continues for an, as yet, unspecified period. For Atlantic areas we are quite dependent on reports from ships and aircraft to help build up a complete picture of auroral behaviour in the northern hemisphere. May we also remind those of you plying the southern oceans how valuable are your reports of aurora australis. Regular reporting in the southern hemisphere is possible only at the Antarctic bases—strictly limited in number—and additional information is most welcome. We hope our established helpers will continue to assist us in our work and we should be pleased to have many more reports from any who could find time to record an auroral sighting."

Date (1966–67)	Ship	Geographic Position	Λ	Φ	I	Time (GMT)	Forms
14th Dec.	*Scythia*	53°36'N 25°13'W	060	61	+70	2205	RR
4th Jan.	*Weather Reporter*	61°55'N 32°55'W	060	70	+76	0230–0310	RB
		62°05'N 33°05'W	060	70	+76	2245	N
5th	*Weather Reporter*	62°05'N 33°05'W	060	70	+76	0001, 0100	N
		62°10'N 32°35'W	060	70	+76	2345	N
7th	*Weather Adviser*	59°00'N 18°55'W	070	65	+72	1850–2350	N
	Weather Reporter	62°05'N 33°00'W	060	70	+76	2310–0700	All forms
8th	*Weather Adviser*	59°00'N 18°55'W	070	65	+72	2340	N
10th	*Weather Adviser*	59°00'N 18°48'W	070	65	+72	0155	N
11th	*Weather Adviser*	59°06'N 19°12'W	070	65	+72	0655–0800	N
13th	*Weather Adviser*	59°05'N 18°53'W	070	65	+72	0550	N
	Rosemary Everard	57°30'N 06°42'E	090	58	+71	2100–0310	RR, N
	Weather Adviser	59°08'N 18°49'W	070	65	+72	2250	RB
14th	*Cape Howe*	Off Flamborough Head	080	57	+69	0001–dawn	HA, RB, P
	Haparangi	41°35'N 33°10'W	040	50	+63	0001–0400	P, N
15th	*Weather Adviser*	59°10'N 18°48'W	070	65	+72	1850–0700	RA, RB, N
	Weather Reporter	62°20'N 32°50'W	060	70	+76	2245–0710	All forms
17th	*Weather Adviser*	58°52'N 18°36'W	070	65	+72	2335–2350	N
18th	*Weather Adviser*	59°00'N 18°54'W	070	65	+72	0250–0400	N
19th	*Weather Adviser*	59°00'N 19°05'W	070	65	+72	0350–0600	N
20th	*Weather Adviser*	59°00'N 19°00'W	070	65	+72	0655	N
28th	*British Workman*	69°25'N 15°43'E	110	67	+77	1925–2237	HA, HB, P
30th	*Weather Adviser*	56°23'N 09°47'W	080	61	+70	2345–0010	P
2nd Feb.	*Weather Surveyor*	62°05'N 32°55'W	060	70	+76	2350	P
3rd	*Weather Surveyor*	62°10'N 32°30'W	060	70	+76	2050, 2350	P, N
4th	*Weather Surveyor*	62°05'N 32°35'W	060	70	+76	2205–0200	RA, P, N
5th	*Weather Surveyor*	62°05'N 33°05'W	060	70	+76	0750	P
6th	*Weather Monitor*	58°55'N 19°25'W	070	65	+72	2300	N
7th	*Weather Monitor*	58°50'N 18°35'W	070	65	+72	2100–2145	RB, N
9th	*Weather Monitor*	59°00'N 18°25'W	070	65	+72	0001	N
10th	*Weather Surveyor*	61°55'N 32°50'W	060	70	+76	0050, 0450	N
16th	*Weather Monitor*	59°00'N 19°25'W	070	65	+72	2200	RR
17th	*Weather Monitor*	59°05'N 19°10'W	070	65	+72	0400	RB
	Weather Surveyor	61°25'N 32°10'W	060	70	+76	2210–2250	N
5th Mar.	*Bamburgh Castle*	62°17'N 04°01'E	100	63	+73	2145–2400	HA, RA
10th	*Bamburgh Castle*	65°00'N 06°30'E	100	66	+75	0001–0140	RR, P, N
	Redcar	67°00'N 12°22'E	110	66	+76	0100–0155	HB, P, N

KEY: Λ = geomagnetic longitude; Φ = geomagnetic latitude; I = inclination; HA = homogeneous arc; HB = homogeneous band; RA = rayed arc; RB = rayed band; R(R) = ray(s); P = patch; V = veil; N = unidentified auroral form.

(*Opposite page* 16)

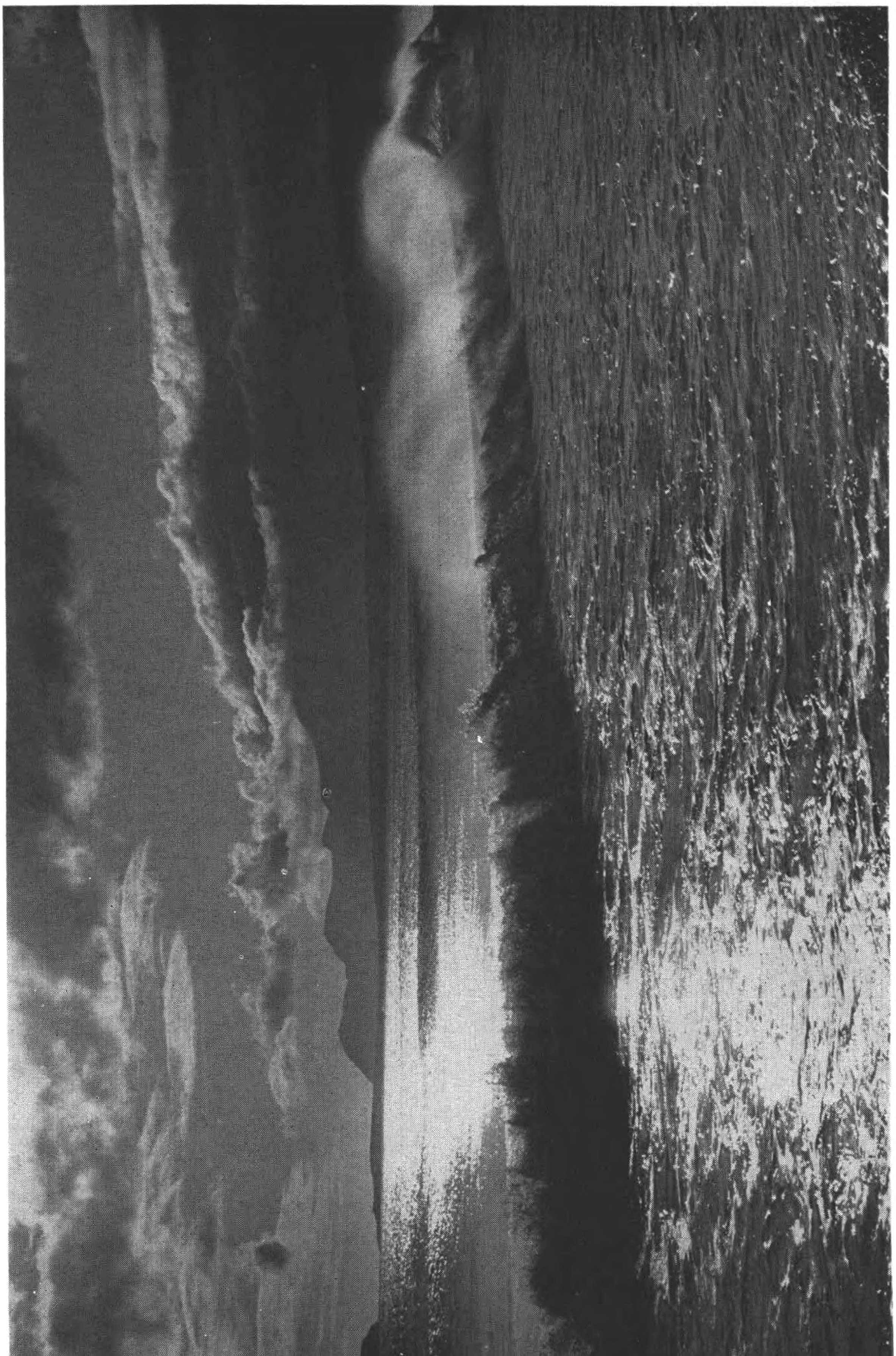


Photo by J. Bennett

Waves at Keel Bay, Achill Island (*see* page 49).

(*Opposite page* 17)

Photo by B. Goss

Waves at Scarborough (*see* page 49).

551.584.6:656.6

High Mean Temperatures in Ships' Holds

By P. C. Bowes

(Fire Research Station, Borehamwood, Herts.)

Rules for the carriage of liquefied gases on board ship[1] are based on a temperature of 65°C (149°F) as the maximum likely to be encountered on board ship in tropical zones and on 45°C (113°F) for temperate zones. Here a hazard arises from exposure to these high temperatures for short periods—say an hour or so when the daytime temperature is near its peak value.

For most commodities subject to self-ignition arising from slow self-heating, however, the situation is different. Such commodities (e.g. activated carbon, fish-meal, oilseed cake, etc.) have thermal diffusivities of order 10^{-3} cm²/sec and the minimum size of stow for self-ignition tends to be large. Attenuation coefficients, for the penetration by conduction, of 24-hour periodic changes of ambient temperature are about 0·2 cm^{-1}; whence an amplitude of 10 degC (18 degF) in the ambient temperature will be reduced to 1 degC at a depth of about 12 cm. Mielke[2] has reported, in fact, that the diurnal variations of temperature above the cargo in a ship's hold are not noticeable at a distance of 2 metres below the surface of the cargo. Under these conditions, the risk of self-ignition in a stow of given size will depend on the maximum value of the *mean* ambient temperature likely to be encountered on board ship for intervals of at least a few days rather than on daytime peak values.

An attempt is made in this note to derive a reasonable estimate for this maximum mean temperature. This is done by first of all estimating the maximum mean excess temperature in a ship's hold, from published observations, and then adding this to the mean air temperature for regions in which high temperatures commonly occur.

Published Temperature Measurements—Estimation of Excess Temperature

Continuous records of temperatures in ships' holds, suitable for the present purpose, have been published by Baumbach[3] and Höller[4] of the Deutscher Wetterdienst (Seewetteramt). The first (for August 1955) in m.s. *Steckelhorn*, covers the West African route from Biscay to Liberia and the second (February–May 1958) in t.s. *Dusseldorf*, the route from Hamburg to Valparaiso via Panama.

In general, the records show a pronounced fluctuation in the temperature of the air in the hold above the water-line associated with the daily cycle of direct sunshine or sky radiation. Near the weather deck and side plates these fluctuations can regularly cover a range of 10–20 degC (about 20–40 degF) in tropical waters, but the minima are usually within 1 or 2 degC of the temperature of the outside air. Below the water-line the hold temperature is related primarily to the sea temperature.

The detailed behaviour of the temperature at different points in the holds, which is most relevant to the present enquiry, may be summarized as follows:

1. During the outward voyage of t.s. *Dusseldorf*, the highest temperatures, and widest fluctuations, were recorded above the upper surface of the cargo in the spar-deck (upper 'tween-deck) of No. 3 hold. The point of measurement was ½ m (20 inches) below the steel weather deck exposed to the sun and adjacent to an intake ventilator.

   During an eleven-day period covering the passage of the Caribbean Sea, the Panama Canal and the north-west coast of South America to Guayaquil (roughly latitude 15°N to 3°S) the outside air temperature was within the limits 28°C ± 2 degC (82°F ± 4 degF) for most of the time and the mean temperature for the period at the above point in the hold was 33°C (91°F), i.e. 5 degC (9 degF) above the mean for the outside air. On two days in this period (in port at Guayaquil), when the daytime maximum in the hold reached 44° and 45·5°C (111° and 114°F), the 24-hour mean temperature was 35°–36°C (95°–97°F); this was 7–8 degC (13–14 degF) above the corresponding mean for the outside air.

In the Caribbean, Panama Canal and at Guayaquil deck temperatures of around 60°C (140°F) were measured.

2. For the passage of the Caribbean, temperature records were obtained also for the air in the exit ventilator of the spar-deck (which would be expected to give an indication of the spatial mean temperature of the air in the compartment), for a point above the cargo in the 'tween-deck (i.e. lower 'tween-deck) and another among items of cargo in the lower hold.*

The range of the diurnal fluctuation in the temperature of the air from the spar-deck did not exceed 6 degC (11 degF) and the mean value of the temperature for the period of 5 days was about 4 degC (7 degF) above the mean for the outside air; peak temperatures did not exceed 35°C (95°F).

Apart from one day, when a maximum of 36°C (97°F) occurred, the diurnal fluctuation of the temperature in the lower 'tween-deck was only 3–4 degC (5–7 degF) and the mean was about 2 degC above the mean for the outside air.

In the middle of the cargo in the lower hold the temperature fluctuations associated with the daily insolation were absent and the measured temperature, which was rising steadily, tended to be 1 or 2 degC below the mean for the outside air.

3. Records for the voyage of m.s. *Steckelhorn* show a mean temperature for the hold above the water-line of 3–6 degC (5–11 degF) higher than the daily mean for the outside air for a period when daily maxima in the hold, near to the side of the ship, were 35°–36°C. During this period, cloud cover varied from 25 to 75 per cent and rainfall occurred during the last half.

Summing up, it appears that the mean temperature over periods of several days in ships' holds, above the water-line, can frequently exceed the mean shade temperature of the outside air by up to about 5 degC (9 degF) in the tropics; an excess of 7–8 degC (13–14 degF) has been observed on two days.

These excess temperatures are found under the weather deck and near the sides of the ship; at the lower levels of the hold above the water-line the mean air temperature tends to be close to that for the outside air.

In addition to the deck temperatures of 60°C (140°F) observed in the Caribbean and elsewhere,[4] a value of 70°C (158°F) is quoted for a voyage of m.s. *Cap Ortegal*. Mielke,[2] as an example for a hot tropical day, quotes a deck temperature of 65°C (149°F); on this occasion the air temperature above the cargo in the ship's hold was 16 degC (29 degF) higher than that for the outside air. These deck temperatures are within the range of high temperatures observed on bare ground in locations such as the Sahara and Central Asia.[5] Even so, it is probable that the small number of observations made on board ship so far have not covered the most extreme conditions likely to be met; such as, for example, might conceivably occur in the hold of a ship in ports in the Red Sea or Persian Gulf—when a combination of reduced ventilation in the hold and hot winds off the land might lead to even higher deck temperatures and to a more widespread distribution of high temperatures in the hold.

It is therefore suggested that, for the time being, the highest observed excess of 7–8 degC (13–14 degF) might be rounded up to 10 degC (18 degF) as a reasonable estimate for the maximum amount by which the mean air temperature in a ship's hold (averaged over intervals of a few days) is likely to exceed the corresponding mean outside shade temperature.

Since night minimum temperatures in a ship's hold have been observed to be close to the corresponding minima for the outside air, an excess mean temperature of 10 degC (18 degF) implies a daytime peak temperature in a ship's hold of about 20 degC (36 degF) above the corresponding peak for the outside air. This is within the range of excess temperatures observed for some comparable situations on land.

* It appears that one or more of these points was in No. 4 hold, but it is not clear which.

Thus, some unpublished data[8] shows that in the hottest shelters on land the peak temperatures (obtained from the daily cycle of temperatures in the shelters—averaged over several days—in a cold spell in winter in one location and hot spells in summer in other locations) exceeded the corresponding shade temperatures by amounts between 17 and 24 degC (31 and 43 degF). Further,[9] under extreme conditions, the temperature under the roof of a standing steel box-car at Yuma, Arizona, exceeded the ambient air temperature (45·5°C, 112°F) by 22 degC (39 degF). It is understood that, in the former examples,[8] the shelters were unventilated (although not airtight); the degree of ventilation of the box-car is not stated but there is some indication that the doors were closed. It may be concluded that the estimate of 10 degC for the maximum excess mean temperature likely to occur in a ship's hold includes an adequate allowance for occasional poor ventilation.

As far as can be seen from an inspection of the temperature records (for t.s. *Dusseldorf* especially), the above estimate of the maximum excess for the time-mean temperature in the hold above the water-line is free from any marked bias due to the lag in the response of the cargo to long-term changes in the temperature of the outside air. The effect of this lag is most apparent during the passage from tropical zones to temperate zones and vice versa; for the former direction, in particular, this lag can increase the difference between temperatures measured in the hold and in the outside air but, since the actual values of the air temperature are then lower than in the tropics, the effect is unimportant for the present purpose.

High Mean Air Temperatures over the Sea

Charts showing the distribution of air temperatures over the sea for each month of the year have been published by the Meteorological Office.[6, 7] They are based on screen temperatures observed on board ship (windward side), at 00, 06, 12 and 18 hours GMT for a period of many years. The charts show isotherms at intervals of 3 degC (5 degF) for the upper and lower 5 percentiles (designated maximum and minimum), means and ranges for each month; these are derived from the highest and lowest temperatures recorded for each month during the period. The highest values occur in the Persian Gulf and the Red Sea in August and these are tabulated below.

	Max.		Min.		Mean		Range	
	°F	°C	°F	°C	°F	°C	degF	degC
Persian Gulf	95	35	85	29	90	32	8	5
Red Sea	90+	32+	85+	29+	90	32	8–12	5–7

The figures in the table (and below) refer to the highest isotherm over the sea in the given region and it is to be understood that temperatures of up to 3 degC (5 degF) higher may be encountered towards nearby land masses. As an indication of the upper limit to the air temperature over the sea, it is understood that peak values of 41°C (105°F) are very occasionally reported in the Red Sea; it is not known, however, to what extent these high values are influenced by the ship itself.

For separate days in a month, or a series of days, high day-time maximum temperatures may be expected to be associated with high night minimum temperatures. Hence the mean temperature for a few consecutive days in a given month may be expected on most occasions to fall between the mean and the upper 5 percentile for the month derived as above (where the highest day-time maximum is associated with the lowest minimum for a given month). For the present purpose, it is suggested that these upper 5 percentiles might be regarded as reasonable estimates for the maximum mean air temperatures likely to be encountered for periods of a few days. Further, 3 degC (5 degF) may be added to allow for proximity to land or periods in port.

On the above basis the estimate for the likely maximum mean air temperature, for a period of a few days, is 38°C (100°F) for the Persian Gulf and about 35°C (95°F) for the Red Sea. In view of the rarity of peak temperatures such as 41°C (105°F) it is probable that these estimates will usually err on the side of safety; the longer the period to which the estimates are applied the greater will the factor of safety be.

The corresponding estimate for the air temperature over the sea off the West Coast of Africa is 29°C (85°F) and 32°C (90°F) for the Caribbean Sea and Panama.

Conclusions and Comments

1. For purposes of assessing the risk of self-heating to ignition in commodities such as activated carbon, fishmeal, oilseed meals etc. carried on board ship in the tropics it is necessary to know the maximum mean temperature* likely to be encountered in the hold of the ship for periods of at least a few days.

2. Mean temperatures in the upper levels of a ship's hold above the water-line tend to be higher than the mean temperature of the outside air, due to a net absorption of solar radiation. It is estimated that the highest excess in the mean temperature for a period of a few days in a ship's hold, near deck and side plates exposed to the sun, is likely to be 10 degC (18 degF) above the corresponding mean for the outside air (shade temperature).

3. Adding this excess to estimates of maximum mean air temperature for periods of a few days over the sea, the following estimates are obtained for the maximum mean temperature for such periods likely to be encountered in ships' holds:

Persian Gulf	48°C (118°F)
Red Sea	45°C (113°F)
West coast of Africa	39°C (103°F)
Caribbean Sea and Panama	42°C (108°F)

4. The above estimates apply to the hottest parts of a ship's hold, i.e. within a distance of the order of 1 metre of steel deck and side plates exposed to the sun, and include an allowance for proximity to land and periods in port. Exceptionally, in a landlocked port such as Basra, they may be exceeded but, usually, they are likely to err on the side of safety.

5. The estimates are intended as a basis for assessing the probable behaviour of relatively small parcels of cargo (say of the order of 10 tons), susceptible to self-heating and which is stowed, for example, immediately below the weather deck or in a forecastle space. For materials which are relatively unreactive, such that the critical size for ignition occupies a large proportion of an upper hold space of a ship, these figures will be too high; for this case the average shade temperature over a period of the order of weeks will be more appropriate. For materials such as unstable chemical compounds, which are so reactive that the critical size is of the order of a single 10-gallon drum and less, the estimates will tend to be low. More precise assessment of the hazard in this region of small sizes must await a solution of the problem of self-heating and ignition in the presence of a periodically varying ambient temperature. For these reasons the temperature estimates must be applied with some care.

Acknowledgements

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The author is indebted to Commander C. E. N. Frankcom of the Meteorological Office and to members of his Panel on Climatic Hazards in the Transport and

* 'Mean temperature' here means the temperature averaged over a period of time at a given location in the hold. It refers only to temperatures determined by climatic factors and the initial temperature of the cargo, and no account is taken of proximity to engine-room bulkheads or refrigerated spaces.

Storage of Goods (British Standards Institution, P/192/1/1) for criticism of the first draft of this note and to Mr. N. Bradbury, Mr. R. Frost and Mr. G. M. Rattray of the Meteorological Office for discussion.

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551.515:629.12

Weather Routeing of Ships*

By G. Verploegh

(Mr. Verploegh, who is now a consultant at the WMO Secretariat in Geneva, was working on weather routeing when he was in the Royal Netherlands Meteorological Service)

Weather navigation is an art which, through the ages, has been practised with skill by seafarers, applying the knowledge that has been accumulated from generation to generation and using all meteorological information that is made available to them. About ten years ago, new types of forecast products were developed, but they were still so new that meteorologists had first to learn their use and applications themselves before shipmasters could be taught. The products are forecast wave charts and medium-range prognostic charts of the 500 mb level and the surface isobaric field. In 1956 trials were made in the U.S.A. to determine operationally the most favourable routes for ships over the oceans, on the basis of a combined use of these new forecast products. The results of these trials seemed very promising, although much had still to be learned, and it is not without hesitation that meteorologists and seamen, cautious as they both are in their work, appear to accept now the potential advantages of the new art of ship routeing.

Trials are now being made, on different scales and using different methods, in a number of countries: the Federal Republic of Germany, the Netherlands, Norway, U.S.A. and U.S.S.R. In some of these countries a regular ship-routeing service has been established.

Ship routeing was brought to the attention of the Commission for Maritime Meteorology at a very early date. Already in 1956 the scientific lectures at the second session of the commission were entirely dedicated to the topic of weather navigation of ships. In 1960 wave forecasting techniques were discussed, together with their application to ship navigation.

The present article reviews some aspects of the weather routeing of ships which have emerged from the trials so far made. They cover the fields of meteorology, oceanography, shipbuilding and navigation and one cannot help feeling that the combination of all this knowledge may gradually transform ship navigation from an art into a science.

Ship's speed in relation to waves

One of the major problems in the practice of weather routeing is knowing how to deduce the performance of the ship from the available weather and wave information. It is a well-established fact that the relationship between wave length and ship length as well as the height/length ratio or steepness of the waves themselves are vital factors in determining both loss of speed and severity of motion of the ship. Ocean waves which are set up by the wind are, however, never regular. A wave system is composed of wave trains having a large variety of lengths, heights and, to a lesser extent, also directions. Furthermore, practice has shown that the wind speed itself has also some influence on the captain's decision to ease the ship in a storm, in view of certain risks of damage.

It has been found most advantageous in wave forecasting to express a wave system by means of the height and the direction of the waves, the wave period being a parameter which cannot easily be charted in sufficient detail. Consequently the ship's speed is usually correlated to the height and the incident direction of the wave system encountered. Such empirical graphs show a large spread of points, but one may deduce a reasonable mean relation between the ship's speed and the wave height for a given type of vessel, if a distinction is made between the various incident wave directions and between cases of wind waves and a swell with little or no wind. The

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spread of points around the mean curves may then, however, still be appreciable in the *critical* interval between three and six metres height of head and beam waves, in which the speed of most ships is reduced rather abruptly because of a deliberate reduction of engine power. The captain's decision will in such cases of course be based also on the specific loading conditions of the vessel, its draught and, for instance, the risk of damage to deck cargo.

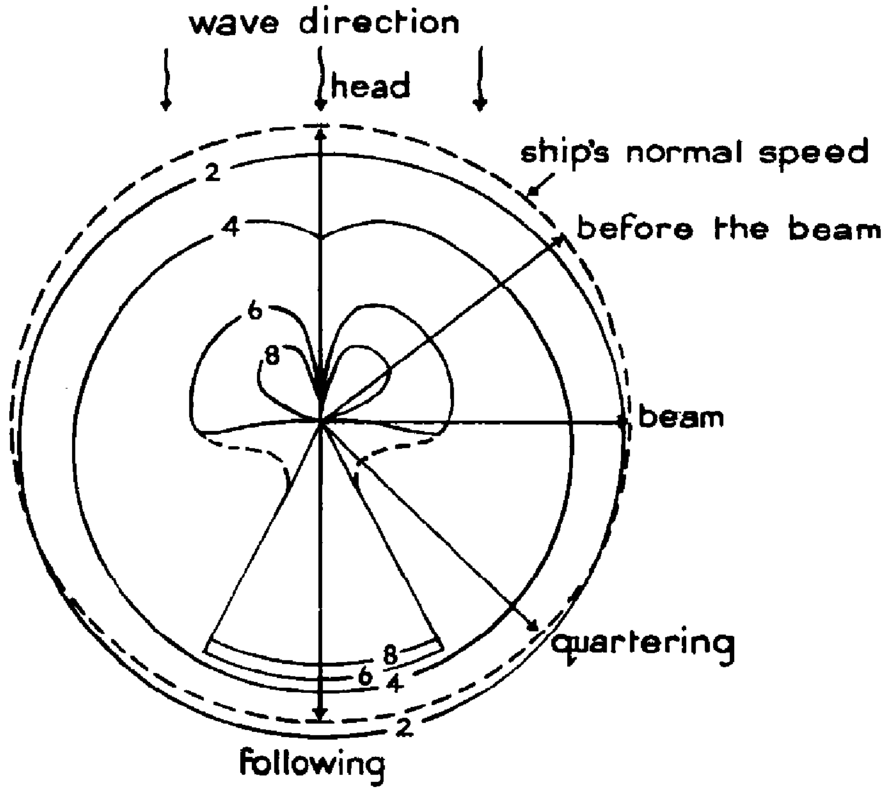


Fig. 1. Generalized diagram of the ship's speed indicated by the length of a radius, in relation to wave height (2–8 metres) and incident direction.

Fig. 1 gives a very generalized diagram of ship speeds related to height and incident direction of wind waves. Waves of a height of two metres or less do not normally affect the ship speed in a way important to weather routeing. At greater heights the speed is reduced, especially in head waves. When the height is about six metres or more, most ships will heave to, or at least change course so as to take the waves at an angle of 20 to 50 degrees from the bow, and at the same time reduce speed rather sharply. This behaviour is very important to weather routeing, as it shows that in certain wave conditions there is no longer the freedom to choose arbitrary courses. Another example of such restriction is found in conditions of quartering waves. Such conditions may create a heavy rolling of the ship, which may cause damage to the cargo of freighters and will certainly be most unpleasant to both passengers and crew. Freighters are normally not equipped with an anti-rolling device (i.e. a stabilizer) and the only way to avoid excessive rolling will be to change course and take the waves from astern. The critical wave parameter in this case is the wave period and one should make a rather accurate forecast of the wave period to be able to predict any such forced change of the ship's course.

The possibility of the two actions—heaving to and turning away—should be taken into account when planning a route on the basis of wave forecasts. In the first case the ship is likely to get into the full strength of the storm, being unable to apply any tactical deviation, while in the second case the forced deviation will often take the ship far from the original track.

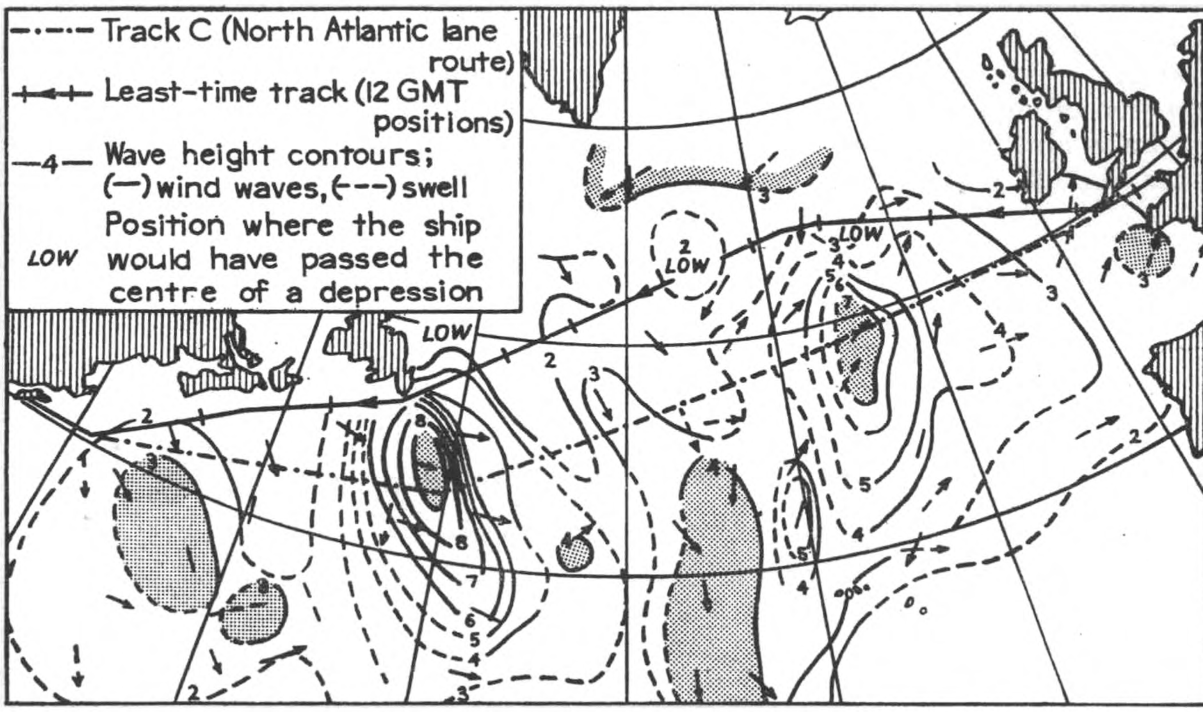


Fig. 2. Example of the hindcast (analysis) of a ship's crossing over the North Atlantic Ocean. The composite wave chart indicates the height and direction of wind waves and of swell which would have been encountered by the ship at the time of reaching the corresponding positions. Such composite charts provide a ready view of the advantages and disadvantages of alternative routes.

Mathematical approaches to the routeing problem

When the environmental wave conditions over the oceans are known, and also the ship's speed in relation to waves, it is possible to construct graphically a *least-time* track over the ocean (see Fig. 2), on the basis of the Huygens principle of the path of a light ray in a medium. The principle is also used in aeronautics in computing minimum flight paths. The ground speed of an aircraft may not be equal in all directions due to wind drift. In this respect the velocity diagram of an aircraft resembles the diagram for a ship, if we neglect the complication of certain forced changes of the ship's course. The similarity was used by R. W. James in 1957 when introducing a graphical method for the computation of the least-time track for ships.

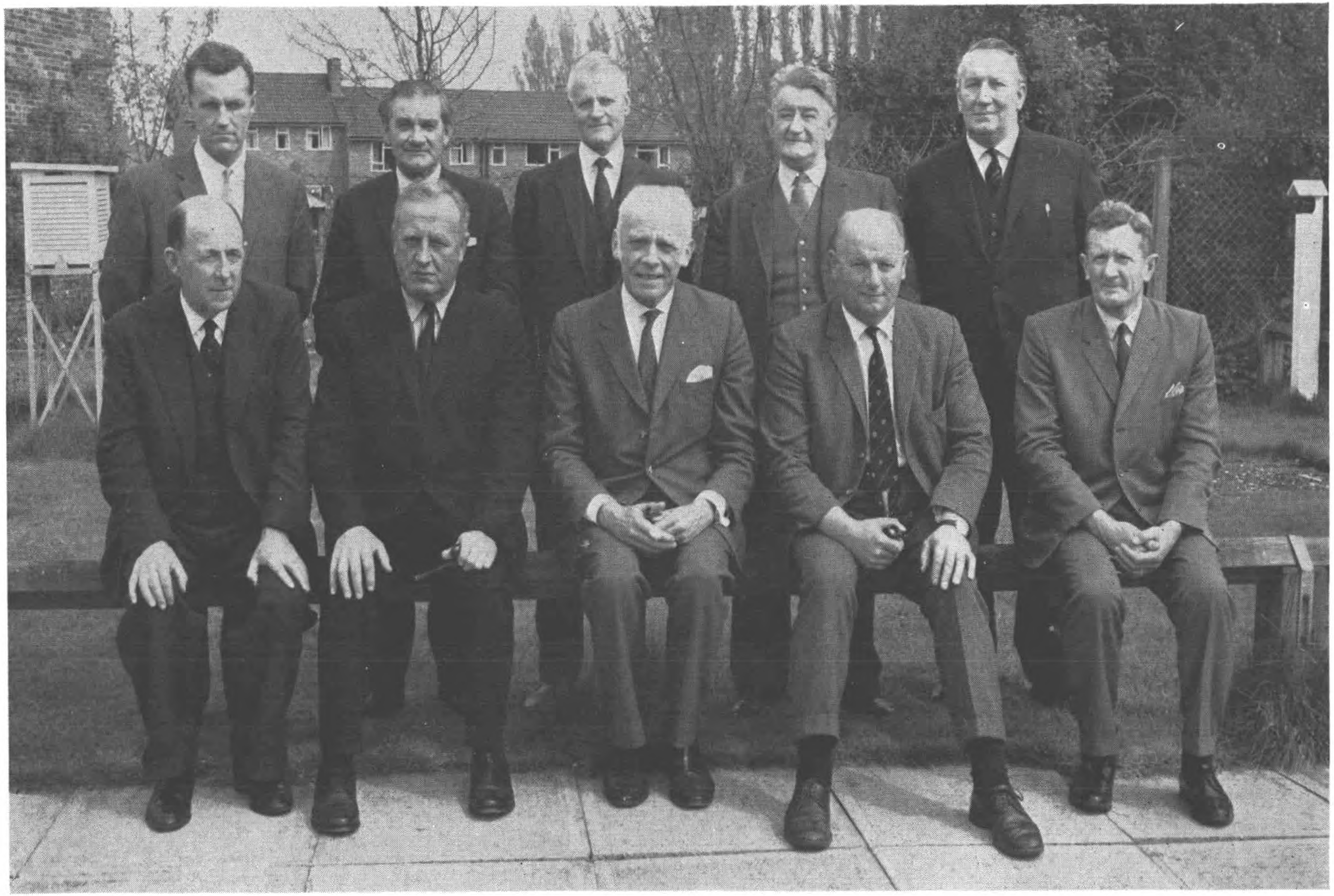
Since then mathematicians have been trying to derive methods for the numerical computation of least-time tracks. The method employed in the U.S.A., for instance, is based on the Huygens principle of determining a set of lines, marking successive positions reached by the ship after certain periods of time (24, 48, 72 hours, etc.), when setting out on different courses from the starting point. The path which would take the ship nearest to the point of destination after a certain length of time will be the least-time track. A solution seems to have been found for the case of a ship crossing a stationary field of higher waves. The next step, the introduction of changing wave conditions, is now being studied.

Another method is employed in the U.S.S.R. and seems to have been developed to meet operational needs more directly. There the time is computed in which the ship would reach a fixed position on various fixed courses from the starting point. The distances to these points are approximately equal to the distance normally covered by the ship in 24 hours. Each of these fixed positions serves also as a new starting point for another set of fixed courses. The electronic computer puts out the minimum time spent on the whole passage under forecast wave conditions, together with the co-ordinates of the points along the route.

These two methods do not yet take into account deliberate alterations of course which have to be put into effect by the master in order to ease the ship in bad wave

(Opposite page 24)

Waves at Porthcawl (*see* page 49). *Photo by J. I. Levi*



Photograph taken at Bracknell on 26th April 1967 during the Conference of Port Meteorological Officers and Agents. Standing, left to right: Mr. J. W. E. Thwaites (Southampton), Mr. R. A. Clements (Deputy Director, Meteorological Office), Captain A. D. White (Deputy Marine Superintendent), Captain R. Reid (Clyde), Captain F. G. C. Jones (Bristol Channel). Seated, left to right: Lt.-Cdr. L. B. Philpott (H.Q. Bracknell), Lt.-Cdr. E. R. Pullan (Humber), Cdr. C. E. N. Frankcom (Marine Superintendent), Mr. J. C. Matheson (Thames), Captain J. R. Radley (Mersey) conditions. The impossibility of keeping to certain courses, due to prevailing wind and waves, has a well-known application to sailing vessels which have to tack in a steady wind to reach their destination. In a regatta, for instance, one should know when to tack and how often in order to remain close to the required least-time track. The mathematics of the generalized problem is now being studied in the Netherlands.

The theoretical work is thus confined to first studying the way to handle mathematically the special ship's velocity diagram in the application to changing wave conditions, so that the time-consuming graphical construction can be replaced by numerical computation. The results of these studies can be used to compute, for analysing purposes, least-time tracks for ship voyages which have been completed and for which the wave conditions during the voyage are precisely known. Ship *navigation*, however, deals as an operational activity with the problems of assessing future probabilities of storms and other hazards along the route. The tactics and strategies to be applied really form the essential part of ship navigation and to find these out is one of the important aims of experimental ship routeing trials.

Operational weather navigation

Hurricane navigation is an art in which strategy plays a large role. As long as a tropical cyclone proceeds on a westward path, the question of when (or if) the cyclone is going to turn poleward and what its path will then be still gives a headache to forecasters and consequently also to ship captains. In the past two centuries several rules have been developed to advise the captain on the best strategy to be employed. All these rules aim at keeping the ship in a manœuvrable position, with respect to the cyclone, without losing too much time, that is, sufficient room should be kept between the ship and the danger area in order to get out of the way at any unexpected movement of the cyclone.

The general weather in these tropical and subtropical ocean areas is normally sufficiently good to enable the ship to take whatever strategic route is found necessary. At the higher latitudes quite a different situation is met. For instance, on the North Atlantic Ocean three depressions are encountered on an average by a westbound ship in winter. If, then, the wave field associated with the first depression is expected to be encountered two days after entering the ocean, and it is not certain if the ship should either keep to a great-circle course, or should, for instance, deviate rather boldly to the south, an intermediate course may be taken to begin with. Then, when a new forecast becomes available the next day, a final decision can still be made on the basis of this new information which would generally be more reliable as it is now related to a shorter range forecast. The routeing tests have shown that this cautious use of two and three day forecasts is often successful, since drastic changes of the ship's course are thus avoided.

It has also been found that longer-range forecasts are as yet generally too unreliable for this operational use. Climatological statistics should be taken into consideration, as is normally already being done by ship captains. A better knowledge of wave statistics may, however, lead to new strategies. One example may be quoted. On the North Atlantic Ocean an area of maximum frequency of higher waves is found in winter between Bermuda and Newfoundland. This area should be avoided in long-term planning. For ships sailing from the English Channel to the Gulf of Mexico, there are two possible routes. If the anticyclone normally centred near Bermuda should be well-developed at the time of arriving there, the great-circle route or a small southerly deviation could be taken. If, on the other hand, the development of storms could be expected in that area, the aim should be to reach Newfoundland and keep close to the American coastline, thus avoiding the risk of higher waves and, moreover, the adverse effect of the Gulf Stream drift. Long-term planning requires therefore that the ship be kept for as long as possible on an intermediate track, if wave conditions on the first part of the route permit, and deviate to the north or to the south on the basis of a two-day forecast of conditions in the Bermuda area. This principle of climatological planning seems to be quite new as ships heading for the Gulf of Mexico have seldom if ever before even tried to take a route via Newfoundland.

Tactics may also dictate a direct route through an area where higher waves may occur. This will be the case when a sufficiently detailed or reliable forecast cannot be made to advise any deviation from the direct route. Several tactical principles have already emerged from the ship routeing trials and proved their usefulness in the operational co-operation between meteorologist and shipmaster.

Some routeing results

The large majority of routeing tests have been made with ships crossing the North Atlantic Ocean. Six independent reports are now known in which the results of different tests, made by the Netherlands, the U.S.A. and the U.S.S.R., are discussed. The average gain in time of the routed vessel with respect to a ship normally following one of the standard routes appears to vary between 8 and 14 hours for winter crossings over this ocean.

Apart from a gain in time one wishes also to know if the routed vessel has indeed succeeded in avoiding rough weather more than a non-routed vessel would have done. To investigate this question, the Netherlands ship routeing programme included an analysis of all routed voyages as regards the time spent in higher waves on the actual route and on an alternative standard route. The analysis showed that ship routeing led to a significant reduction of time spent in head and beam waves of four metres or higher. In addition to this, *hindcasts* of the ideal least-time track, which were regularly made for each of the routed voyages over a period of six years, indicated that one to four hours on an average could theoretically still be gained additionally on crossings to the respective harbours. As actual navigation will always have to deal with forecasts of varying reliability, this theoretical limit will never be reached. The results however indicate how much can already be achieved with the present skill of routeing ships.

Organizational questions

It should not be forgotten that, apart from economic gains, weather routeing is in the first instance applied to the avoidance of serious damage due to the destructive action of wind and waves on the ship. It is therefore beyond any doubt that the shipmaster must maintain full responsibility for the navigation. Serious thought has been given to the question of how ship routeing is likely to develop in future, once the present transitional stage of studying and learning, which is already proving profitable to ships and shipping companies, is over, and a general practice, applicable to all oceans, is established. Obviously, shipmasters will benefit from all improved information that can be given in the form of general broadcasts, preferably by means of facsimile. Satellite data on the precise position of tropical cyclones, wave charts which show the detailed structure of wave fields in storms and of swell systems elsewhere, prognostic weather charts and related wave charts will be indispensable aids to navigation. The big question remains how shipmasters could be given the means to use in a cautious way medium range forecasts. In this regard we may look upon the ship routeing officer who works in a meteorological centre as a nautical specialist well trained in wave forecasting and meteorology. He has moreover gained an expert knowledge of the climatological conditions, sea currents and the strategic significance of certain route deviations over the ocean with which his work is concerned. Shipmasters can and should be trained in the use of wave charts and the significance of medium-range weather forecasts. They need not become specialists, but an understanding of these new products of information certainly helps their own planning of a route. It often occurs, however, that the master just cannot find the time for long-range planning, as he will have to devote all his attention to immediate problems, for instance when caught by a storm, or in fog or in dense traffic. He will be happy to be able to fall back on a regular office on shore for all information for his specific needs. It seems, therefore, and the reactions of captains to ship routeing tests seem to confirm this, that there will remain a need for an office on shore which is specialized in the meteorological needs for ship navigation and which serves as an intermediate body between the meteorological centres issuing general information and the shipmaster himself.

Conclusions

The weather navigation of ships is a fascinating study because it means pioneering in a new field of applied meteorology. Ship routeing tests have revealed the need for the meteorologist to obtain empirical data of the ship's behaviour in a seaway and to learn from the experience of captains the tactics and strategies of the practice of weather navigation. With this knowledge attempts are made to investigate the problem of determining the most favourable routes both mathematically with a view to the numerical computation of routes and also in a practical way to find out the full significance of prognostic wave charts and numerical weather charts for this operational use.

On the other hand, shipmasters participating in a ship routeing scheme become more weather-conscious and are then able to point out their specific needs for meteorological information to be given both on a general scale and as an individual service. To be "skipper next to God" is a privilege; to lessen the lonely burden, a challenge.

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Turtles

By L. D. Brongersma, D.Sc.
(Director, Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands)

It is well known that turtles do travel over great distances, not only in coastal waters, but also across the open ocean. Many examples of the travelling of turtles can be given. Turtles appear every year in February at the island of Ascension, where the females go ashore to lay their eggs in the sandy beaches. When towards June the nesting season is over the turtles disappear from the area. Turtles which had been marked on Ascension, with a tag attached to a front flipper, have been recaptured in Brazilian coastal waters, and from this it is assumed that there is a regular migration of turtles from Brazil to Ascension and back. Turtles, tagged at Tortuguero, Costa Rica, have been recaptured in the Bay of Campèche, near the Florida Keys, in Cuban waters, on the Mosquito Bank off Nicaragua, but also on the coast of Colombia. Repeatedly turtles have been observed along the Atlantic coasts of Europe, as far as Murmansk in northern Russia, and the Leathery Turtle has been recorded from the north coast of Iceland. Presumably the turtles found in European Atlantic waters do come from the Western Atlantic region, from the Gulf of Mexico and the Caribbean. In all these instances we know (or believe to know) the area where the journey starts and where it ends, but little or nothing about the actual route by which the turtle travelled.

There is one snag in the experiments with tagged turtles. The fact that a tagged turtle is reported to have been captured away from the nesting beaches means also the end of the experiment, because a turtle captured by a fisherman will not be released but it will be slaughtered. In regions (e.g. Malaysia) where turtles are not eaten no attempt is made to catch them and reports on recaptured turtles are exceedingly scarce. A further difficulty is that there is as yet no method of marking the hatchling turtles in such a way that the individual turtle can be recognized after years and after it has grown considerably. Therefore, the tagging experiments give us only very limited information (interesting though this may be) about the travels of adult turtles, but not about the movements of hatchlings.

When hatchling turtles enter the sea they disappear from view, to be found once more after they have grown considerably. Where they spend the first part of their life, hidden in shallow coastal waters, or far out at sea, is not yet known. However, I believe that there is an indication of the young turtles moving out to sea, at least as far as Loggerheads and Leathery Turtles are concerned.

The majority of the Loggerheads found on British, Irish, and French coasts are juveniles, or at most half-grown specimens. During his scientific cruises in the Azores region (1885–1913), Prince Albert I of Monaco observed and captured many Loggerheads and, from the published data, it is clear that these too were young or half-grown specimens. The interesting feature of so many young Loggerheads in the Azores region is that turtles do not breed in these islands. Hence, these young Loggerheads must have come from elsewhere. The nesting sites closest to the Azores are found on the African coast, northwards to about 35°N in Morocco. However, it seems unlikely the young turtles found around the Azores came from there, for this would mean that the still feeble hatchlings would have to swim across the current that flows southwards off the African coast, and to reach waters to the north of the Azores they might have to swim part of the way against current. It is felt that the hatchlings will not be strong enough to overcome the force of the current and that rather they will be displaced in the direction of the currents, not reaching the Azores. The only other solution is that the Loggerheads of the Azores region, just as those found further to the north in British waters, do come from the Western Atlantic area. There is one strong argument in favour of this. On British coasts Loggerheads sometimes (e.g. between September 1938 and January 1939) are found more or less together with Kemp's Ridleys. The only known nesting beaches of Kemp's Ridley are found on the western shores of the Gulf of Mexico, and from these nesting beaches the whole population of this species derives, the majority staying in the Gulf of Mexico, a number of them passing through the Florida Strait into the Atlantic Ocean. Most of the last-named wander northwards along the American coast as far as Nova Scotia, some wandering to Bermuda, Ireland, Great Britain and the Netherlands, and once a juvenile has been recorded in the Azores. As all these specimens must have come from the Gulf of Mexico by way of the Western Atlantic it seems plausible to assume that the Loggerheads that are found in the same areas (Europe, Azores) also do come from the same general region, be it from the Gulf of Mexico or from the nesting sites on the Atlantic coast of U.S.A. (up to 35°N).

In the open sea the young turtles will find an ample supply of food in the shape of planktonic organisms like jellyfish, salpae and pteropods (planktonic marine snails). To us this may appear to be a not very nutritious kind of food, but apparently turtles do well upon it. Jellyfish, Portuguese-Men-of-War and salpae even form most of the diet of the large Leathery Turtle. When the Loggerheads grow older and stronger, other harder preys may be added to the menu, such as goose-barnacles (attached to floating objects, or attached to the shells of other turtles), squids, pelagic crabs, needle-fish, etc.

Eventually, the Loggerheads will have to return to the area where the nesting beaches are to be found and they will have to move back to the Western Atlantic waters where, in the coastal waters, they will feed on crabs, hermit crabs, conchs, sponges, etc. For the return journey they will either have to swim back the whole way against the current, or they may move through the Sargasso Sea where the currents are less stable, or they may travel with the current that flows westward south of the Sargasso Sea.

It is usually assumed that the turtles that come to European Atlantic waters are just strays that have lost their bearings, and which are carried along by the current, pushed along by prevailing winds and perhaps speeding up their crossing by swimming with the run of the sea. Very probably they come to us by the means mentioned, but it is still doubtful whether they have lost their bearings. I rather suppose that these ocean voyages of young turtles form a normal part of their life, at least for Loggerheads. Many Loggerheads may go to the Azores, others will get into ramifications of the currents that bring them to European waters. In some years and periods the surface temperature of the sea will be higher than in others, in northern waters. Even a very slight rise may make all the difference to a turtle, greatly enlarging the area in which it can live and survive at least for some months. In such warmer years or periods turtles will be able to move much further to the north. Live Leathery Turtles have been recorded in British, Irish and Norwegian waters in the months of June to November and all these records are based upon specimens sighted or captured at sea. In winter no live specimens are seen; a few dead specimens have been seen drifting on the surface or have been found washed ashore. It may be that these have not succeeded in turning back to warmer waters in time; some of them may have met with accidental death (e.g. having been killed by a ship's propeller). The number of dead specimens observed stands in no relation to the number of live specimens sighted from June to November and it seems likely that most Leathery Turtles succeed in moving back to warmer parts of the sea in good time. The much smaller, young Loggerheads and Kemp's Ridleys will easily escape notice at sea. We know of their presence only when they are washed ashore, alive or dead. The fact that live Loggerheads are found even throughout winter, and live Kemp's Ridleys still towards the end of December, suggests that they are hardier species. Being less sensitive to low temperatures than the Leathery Turtle they may remain longer in the area and those that do not leave northern waters in time may suffer from the cold after all. When the temperature drops in winter this may make the turtles less active and, when gales start driving the Loggerheads and Kemp's Ridleys towards the coast, they may not have enough strength to stay off-shore. However, as we do not know how many of these turtles are present in our waters in summer, it may well be that many more than are stranded here have wandered southwards to more clement parts when winter sets in.

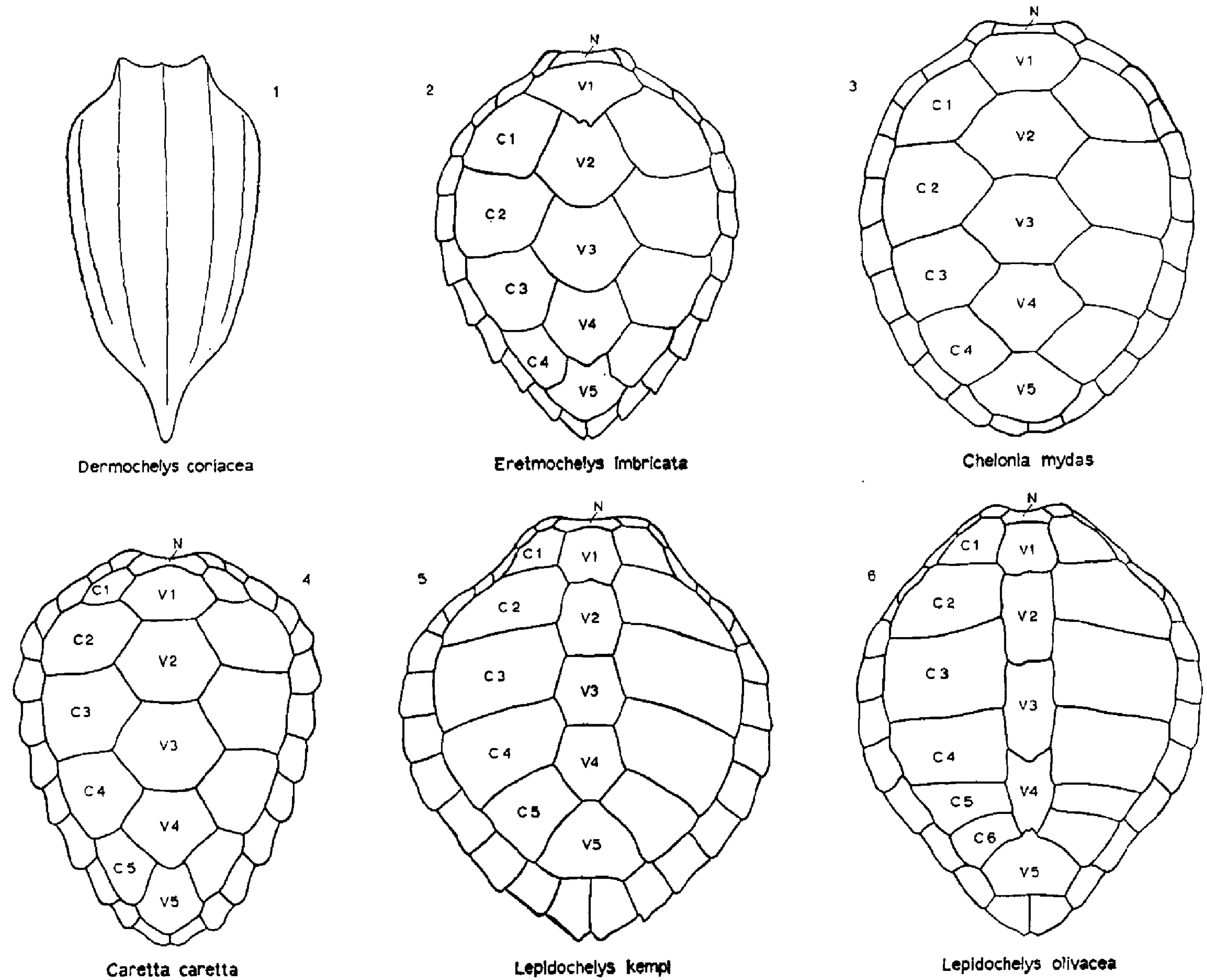
Much of what has been said above about the travels of turtles is sheer conjecture and, of course, we would like to have more evidence. If every year Green Turtles migrate from Brazil to Ascension in January and February, to go back in May and June, one wonders whether nothing of this has ever been observed by ships passing between Ascension and Brazil. The turtles will not necessarily travel all at the same time and close together, but it would be interesting to know if turtles are observed in one month, while none are seen in the same area in other months. The same applies to the supposed movement of turtles from the Western Atlantic to the Azores and back. If turtles cross the Atlantic from America to Europe, helped along by the current, do other turtles travel with the current from Africa to South America? It will be of great interest if ships' officers would send in reports of observations on turtles sighted at sea, be it close to the coast or far out in the ocean. The report should mention the position where and the date on which the observation was made, and as much of a description of the turtles as possible (e.g. whether horny scutes were present, the estimated size of the shell, its colour, the direction in which the turtle was moving, whether there is any relation between this direction and that of the wind and the run of the sea; in northern waters an indication of the surface temperature will be of interest).

Reports on sighted turtles have been mentioned in the *Marine Observers' Log* at various times and it may sometimes be disheartening to those who sent in reports when the postscript states that the specialist was unable to make an identification. When a partially-submerged turtle is seen from some distance, the observer will not be able to note all those characteristics that the zoologist uses to distinguish between the species, and a definite identification may not be possible. However, the fact in itself that a turtle was sighted at a certain date in a certain position is valuable information, for it will help to fill in gaps in our knowledge about the distribution of turtles at sea. It may well be that ships' officers, who pass through an area where they often have observed turtles, will believe it to be unnecessary to report their presence, but it is equally well possible that far away a zoologist is wondering why there are no observations on turtles from that area. If ships' officers passing regularly through an area do observe turtles in one month, while none are seen in another month, the information about absence of turtles may be just as important as that about their presence at other times.

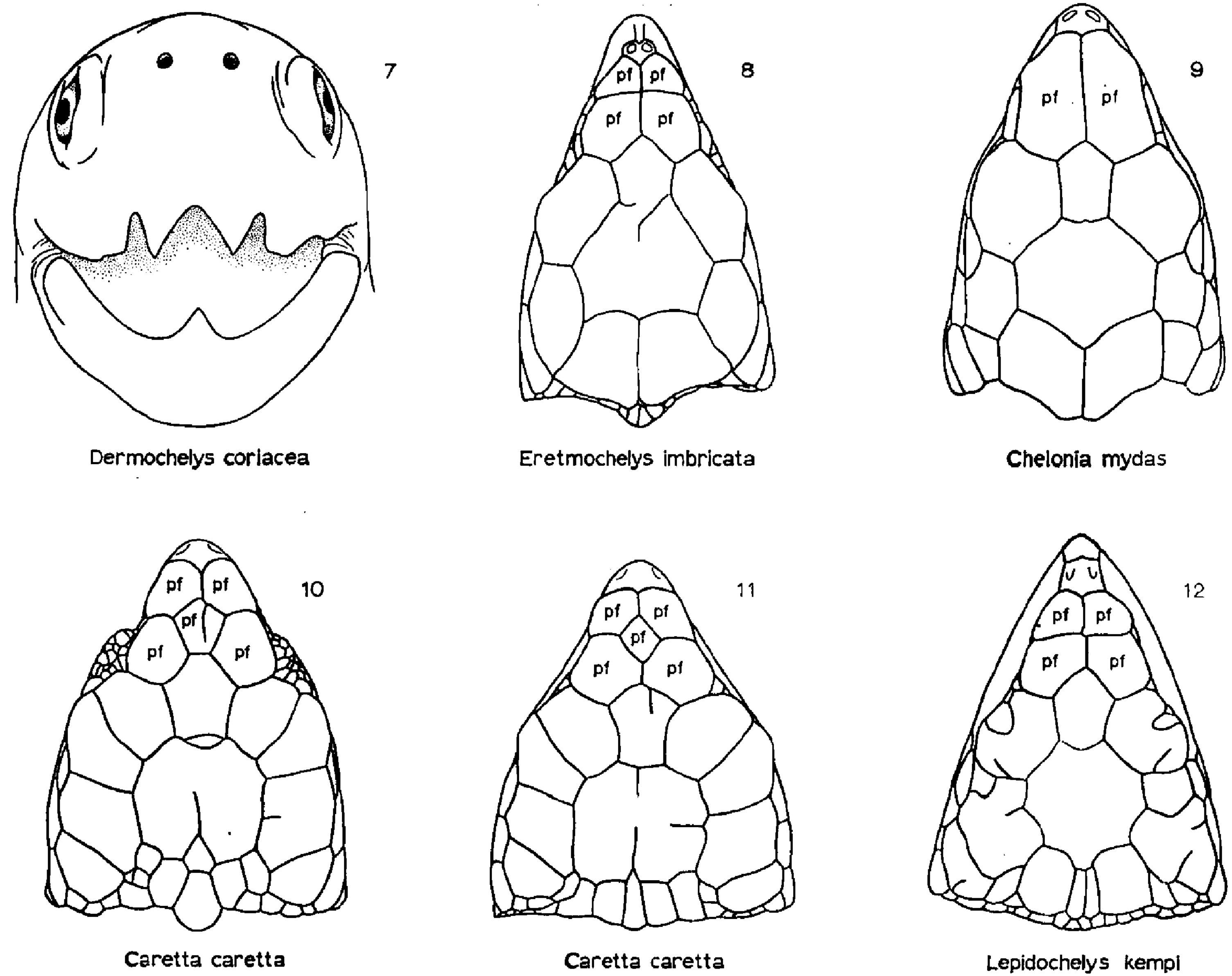
Mass migrations of turtles have been observed at various times off the west coast of Central America and more data about these migrations will be very welcome. There is one report of a mass migration in the Mediterranean. Passengers in the *Orion*, Port Said to England, on 17th September 1947, over a distance of about 60 miles (350–410 miles west of Port Said) observed large numbers of turtles, about 200 yards apart, swimming in the direction of Port Said. It would be of great interest to know whether such migrations have been seen more often.

Little is known of the behaviour of turtles at sea. Some recent reports on the Leathery Turtle state that it may swim with its head raised well above the surface. This may have led observers, who are not familiar with this kind of turtle and who overestimated its size, to report such a turtle as a 'horrifying sea monster' (e.g. the 'Soay Beast' sighted in Scottish waters in September 1959).

In the foregoing I have mainly dealt with the turtles of the Atlantic Ocean, but those of the Indian and Pacific Oceans offer equally interesting problems and any observations from the Indo–Pacific area will be just as valuable.



Figs. 1–6. Forms of carapace (upper shell).



Figs. 7-12. Forms of heads of turtles (Fig. 7: front view; Figs. 8-12: upper views).

Six species of turtle are known from the Atlantic Ocean and these may be distinguished as follows:

I. Shell strongly tapering behind (Fig. 1), covered with a thick leathery skin, without horny scutes. Seven keels lengthwise over the shell; when the turtle is swimming at the surface, three of these keels may be seen. The keels are often notched, giving the impression of a row of spines or small fins being present. Upper jaw deeply notched in front and at the sides, giving the impression of two large teeth being present (Fig. 7). General colour of upper parts blackish or brownish, often with scattered, small, irregular, whitish or pinkish spots; lower parts whitish, those of the shell with black markings. Large turtles, total length up to 9 feet; shell up to 6 feet.

Leathery Turtle (*Dermochelys coriacea*) (Figs. 1, 7).

II. Shell covered with horny scutes (tortoise-shell).

A. On either side four costal scutes (Figs. 2, 3: C1–C4); nuchal shield (N) separated from first costal (C1) by first vertebral scute (V1).

1. Two pairs of prefrontals (Fig. 8: pf); the scutes of the shell strongly overlapping like the tiles on a roof (except in very old specimens). Colour of shell: amber, with streaks and markings of reddish-brown, blackish-brown, and yellow. Length of shell (measured between perpendiculars) up to 36 inches.

Hawksbill (*Eretmochelys imbricata*) (Figs. 2, 8).

2. One pair of elongate prefrontals (Fig. 9: pf); the scutes of the shell not overlapping. Colour of shell: light brown to dark brown, sometimes with a tinge of olive; the scutes marked with radiated or mottled darker markings, or with large dark brown blotches. Length of shell up to 55 inches.

Green Turtle (*Chelonia mydas*) (Figs. 3, 9).

B. Five or more costal shields on either side (Figs. 4, 5: C1–C5; Fig. 6: C1–C6); two pairs of prefrontals (Fig. 12: pf), or a group of five or more shields and scales on the prefrontal region (Figs. 10, 11: pf).

1. Five (rarely six) costals on either side (Figs. 4, 5: C1–C5).

(*a*) Shell always distinctly longer than wide; head relatively large. Colour of shell in young and half-grown: reddish-brown, streaked with darker brown; in the fully adult specimens: more or less uniformly dull-brown. Length of shell up to 40 inches.

Loggerhead (*Caretta caretta*) (Figs. 4, 10, 11).

(*b*) Shell relatively broad, more roundish, its width sometimes slightly greater than its length. Colour of shell: grey, brownish-grey, or olive-green to blackish. Length of shell up to 27½ inches.

Kemp's Ridley (*Lepidochelys kempi*) (Figs. 5, 12).

2. Six to nine costals (Fig. 6: C1–C6), the numbers on the right and left sides often being different. Shell relatively broad (as in the preceding species). Colour of shell: olive-green or blackish-brown. Length of shell up to 30 inches.

Olive Ridley (*Lepidochelys olivacea*) (Fig. 6).

Young Loggerheads and young Ridleys may have a keel, ending in a distinct knob or spine, on each of the scutes of the middle row (Figs. 5–6: V1–V5); these keels disappear with age. If a specimen is captured a further check can be made to see whether it is one of the Ridley species or a Loggerhead. On the lower surface of the shell a series of three or four scutes is present, joining this part of the shell to the upper part; in the Ridleys each of these scutes shows a minute opening or pore at its hind border. Kemp's Ridley and the Olive Ridley are closely related; the main difference between the two being that the number of costals in the Olive Ridley usually is six or higher, whilst in Kemp's Ridley specimens with six costals on one or both sides are rare. The two species are also separated geographically. Kemp's Ridley is found in the Gulf of Mexico, on the east coast of North America, and it has been recorded from Bermuda, the Azores, Ireland, Great Britain, and the Netherlands. The Olive Ridley is found in the Indian and Pacific Oceans, on the west coast of Africa and in South America (the Guianas, Guyana, Venezuela, Trinidad).

Green Turtles and Hawksbills usually keep to the warmer seas. Loggerheads are more numerous in more temperate seas, their nesting beaches being further away from the equator (both in the north and in the south).

The Leathery Turtle is known to breed in the West Indies, in Florida, in South America (e.g. in the Guianas and Guyana), and on the west coast of Africa, but exact data on the numbers of individuals using the nesting beaches are scarce. This turtle seems usually to avoid coastal waters and it is supposed to wander about in the open sea. Records confirming this are of great importance.

Except for Kemp's Ridley, the species are also found in the Indian and Pacific Oceans. From northern Australian waters a turtle has been reported which may be a distinct species, related to the Green Turtle, but until a more complete description of it becomes available it cannot be included in a key.

One of the difficulties with the study of turtles is that the fully-adult specimens are often very large and difficult to handle. In consequence of this most museums have collections of hatchlings and half-grown specimens, but only very few adult turtles. Moreover, turtles used to be taken on the nesting beaches and, therefore, the adults in collections are nearly always females. Today, transportation of turtles is made easier because they can be shipped in a frozen state, but the harvesting of enormous quantities of eggs for human consumption has so much reduced the stocks of turtles that they are not only becoming rare in some parts of the world but it has also become more difficult to obtain specimens for research.

NOTES ON ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM JULY TO SEPTEMBER 1967

JULY

The pressure distribution of the previous month persisted throughout most of July, there being a depression near the Canadian Arctic Archipelago and an anticyclone over the Laptev Sea, north of Siberia. Consequently, as in June, it remained colder than usual over the Beaufort Sea and north-west Canada but relatively mild over the Kara Sea and eastern Barents Sea. Only a small area of the Arctic Ocean itself, between the Pole and northern Canada, remained below freezing point.

Canadian Arctic Archipelago. At first the winds were mainly light and from the west but over most of this area they tended gradually to freshen from the north-west, bringing in cold polar air. Temperature was generally on the low side—by 2 degC—but in the extreme west the negative anomaly was as much as 5°C. Break-up of the ice was consequently delayed, in some parts by as much as a month.

Baffin Bay. Mainly south-westerly winds had the effect of raising the air temperature from 2 degC below to almost the seasonal average or even a little above. There was still generally an excess of ice but, as might be expected from the wind direction, there were rather more breaks than usual along Baffin Island. The Greenland coast, on the other hand, was more than usually congested.

Foxe Basin. Southerly winds completely reversed the flow of the previous month and leads in the north tended to close. New openings, however, appeared in the south and south-east.

Hudson Bay. Winds, on the whole rather light, were again extremely variable in direction and therefore probably had little effect on the existing pattern of the ice field. Temperatures, too, were variable but tended to rise slightly more than usual. The north-west of the Bay was, as in June, practically ice-free but in the south and east melting was several weeks behindhand.

Hudson Strait. With south-easterly winds the temperatures, initially on the low side, rose and by the end of the month were about 1 degC above normal. There was little or no ice at the eastern end of the Strait but at the western end there was a little more pack than usual, especially just south of the Foxe Peninsula.

Davis Strait. Here again winds were variable and, in spite of periods of southerlies, occasional bursts from the north effectively lowered the air temperature to more than 1 degC below normal. Nevertheless the sea tended to warm up rather more than usual, especially in the west. There was therefore a deficiency of ice over the western half of the sea but rather more than usual in the east just off Julianhaab and the adjoining coastline.

Labrador Sea, Great Bank and South Newfoundland Sea, River and Gulf of St. Lawrence. Over the whole of this extensive area persistent south-westerly winds kept both air and sea much warmer than normal, the sea temperature, in particular, being three or four degrees higher than usual at this time of year. There was no ice apart from very few scattered icebergs. The International Ice Patrol ceased operations on 14th July.

Greenland Sea. North of 75°N, barely affected by the light north-westerly winds, air temperatures were roughly as usual but the sea slightly warmer than average. Satellite pictures showed the ice edge to be very irregular, but, generally speaking, in its normal position. Further south, winds were mainly north-easterly, moderate to strong at times, sea and temperature rather variable but, on the whole, not far from average. Probably due to mobility earlier in the year, however, the amount of pack-ice was excessive, especially to the west of Jan Mayen where, towards the end of the month, it extended 100 miles beyond its usual limit.

Spitsbergen. Winds were mainly from the east and generally light. Air temperatures varied little from normal but, as in previous months, the sea was on the warm side. There was a continued deficiency of ice.

Barents Sea. Although there were occasional northerlies, southerly winds, sometimes strong, dominated in this area and so both air and sea were a few degrees warmer than usual. The pack edge, especially between 30° and 50°E, was well back from normal and had almost completely cleared from the west coast of Novaya Zemlya.

AUGUST

The pressure pattern during the month bore a marked similarity to that of July and so previous temperature anomalies were largely repeated. Nevertheless over the Arctic it became, as expected in August, generally cooler, the régime of freezing rapidly increasing and extending in several places well beyond the normal limits.

Canadian Arctic Archipelago. Although winds were extremely variable the general tendency was for cold air from the pole to be brought in and temperatures were, at times, as much as 5 degC below normal. Ice concentrations were greater than usual and it was estimated that the break-up was at least three weeks behindhand.

Baffin Bay. Almost uniform south-easterly winds covered this sea but temperatures were variable, though mainly on the low side. North of about 75°N the sea, too, was cool—by about 2 degC—but south of this parallel it was on the warm side. In the extreme north, especially in Smith Sound, ice was in excess of average but along the east coast of Baffin Island much less than usual, disintegration of the pack being about a fortnight in advance of normal.

Foxe Basin. With an almost complete absence of southerly winds (a change from July) it was cooler and there was much more pack than usual.

Hudson Bay. Winds were mainly from the north-west and kept temperatures, on the whole, from 1 degC to 3 degC below normal. In consequence the remaining patches of ice were very slow to clear but had disappeared by the end of the month.

Hudson Strait. Rather variable winds caused temperatures to fluctuate, generally about or below the average. Possibly due to an abnormal westbound offshoot from the Baffin Land current, however, the sea surface in parts of the Strait was warmer than usual, by as much as 3 degC, and so most, if not all, of the field ice melted during the period.

Davis Strait. Here again winds were variable but in this case with an overall southerly component. Air temperature also varied but not widely from the seasonal normal. In the west and north the sea temperatures were on the high side, by about 3 degC, but in the south-east, from Cape Farewell to Godthaab, there was a relatively cool pool in which temperatures fell to about 3 degC below average. Sea ice cleared, however, from all parts of the Davis Strait by the middle of the month and the numbers of icebergs were much less than usual.

Labrador Sea. Moderate south-westerlies prevailed and kept both air and sea over most of the area about 2 degC warmer than average, the only exception to this generalization being in the north-east near Greenland where sea temperature was low. There was no sea ice and relatively few icebergs.

Great Bank, South Newfoundland Sea, River and Gulf of St. Lawrence. As in July persistent south-westerly winds forced temperatures higher than usual, the sea surface positive anomaly being as much as 5 degC. There was no ice. It will be interesting to see how long the effects of the excess of heat in the water will control ice formation as the season advances.

Greenland Sea. North of the Denmark Strait the normal north or north-easterly winds were, for most of the month, completely reversed and so the air, initially cool, tended to warm up and finished 2 degC higher than average. Sea temperatures, curiously enough, exhibited the opposite trend and fell from about 2 degC above to 2–3 degC below average. Ice cover was generally much greater than usual; in one place near Jan Mayen it even extended up to 150 miles beyond the normal limit. Satellite photographs, as previously a great help in delineating the ice edge, showed that near the coast the leads were wider than atlases indicated. South of 65°N the usual north-easterlies were experienced, air and sea were both 2 or 3 degC cooler than usual and, quite exceptionally, patches of ice remained unmelted along the Greenland coast as far south as 62½°N.

Spitsbergen. The air, cool at first but under the influence of mainly southerly winds, warmed up to normal while the sea was consistently on the warm side. There was little ice except well to the west of Spitsbergen where amounts were small on the whole.

Barents Sea. North of 75°N winds were variable with a general slight westerly tendency. In the north-west near Spitsbergen the air was cool and there was a slight excess of ice but elsewhere, especially towards Novaya Zemlya, air and sea were both warmer than usual and ice was deficient. In the southern and eastern sections of the Barents Sea and over the White Sea the moderately strong southerly winds blowing from the still-warm European Russia kept the sea and air temperatures as much as 5 degC above normal. There was, of course, no ice. Two U.S. Coastguard vessels, the *Edisto* and *Eastwind*, were operating during the month in the Barents Sea and to the east, hoping to circumnavigate the North Pole. Unfortunately, north of Severnaya Zemlya, the pack proved to be impenetrable and as an alternative route was not approved by the Russian authorities the voyage was broken off. However, useful bathythermograph messages were received and utilized.

White Sea. As over the southern Barents Sea, atmospheric conditions were abnormally mild and it seems that the sea was also quite exceptionally warm for the time of year.

SEPTEMBER

Although the area immediately round the North Pole was slightly less cold than usual much of the Arctic showed signs of early freezing, especially in the Canadian sector.

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

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

Limits of Latitude and Longitude		Degrees North and West													
		68	66	64	62	60	58	56	54	52	50	48	46	44	42
Number of bergs reported south of limit	July	>98	>98	>98	>98	>96	>96	>95	>84	60	42	15	3	0	0
	Aug.	>38	>38	>34	>17	>17	>17	15	13	0	0	0	0	0	0
	Sept.	8	8	8	8	8	5	5	5	0	0	0	0	0	0
	Total	>144	>144	>140	>123	>121	>118	>115	>102	60	42	15	3	0	0
Number of bergs reported east of limit	July	>98	>98	>98	>98	>98	>98	>97	>67	39	16	13	1	0	0
	Aug.	>38	>38	>38	>38	>38	>38	>38	>31	>10	>2	>1	0	0	0
	Sept.	8	8	8	8	8	8	8	8	7	3	3	3	3	1
	Total	>144	>144	>144	>144	>144	>144	>143	>106	>56	>21	>17	4	3	1
Extreme southern limit	July	45° 38′N, 47° 39′W on 8.7.67													
	Aug.	52° 00′N, 51° 25′W on 7.8.67													
	Sept	52° 14′N, 51° 29′W on 5.9.67													
Extreme eastern limit	July	48° 10′N, 45° 52′W on 1.7.67													
	Aug.	65° 30′N, 32° 30′W on 4.8.67													
	Sept.	58° 42′N, 41° 42′W on 10.9.67													

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

Extreme limits during the 3-month period are underlined.

Canadian Arctic Archipelago. As in August the main wind direction was from the north with lower than normal temperatures. New ice was beginning to form in many places, the season being well in advance.

Baffin Bay. There were variable winds, often from the south-east, but both air and sea temperatures were on the low side, between Baffin Island and the Disko coast of Greenland by as much as 5 degC. Ice cover significantly increased towards the extreme north, in the Smith Sound area, but elsewhere there was none.

Foxe Basin. With consistent moderate north-westerlies the air was between 2 and 4 degC cooler than usual and ice, particularly in the north and also in the extreme south-west along the coast of Southampton Island, reforming very quickly, was roughly a fortnight ahead of season.

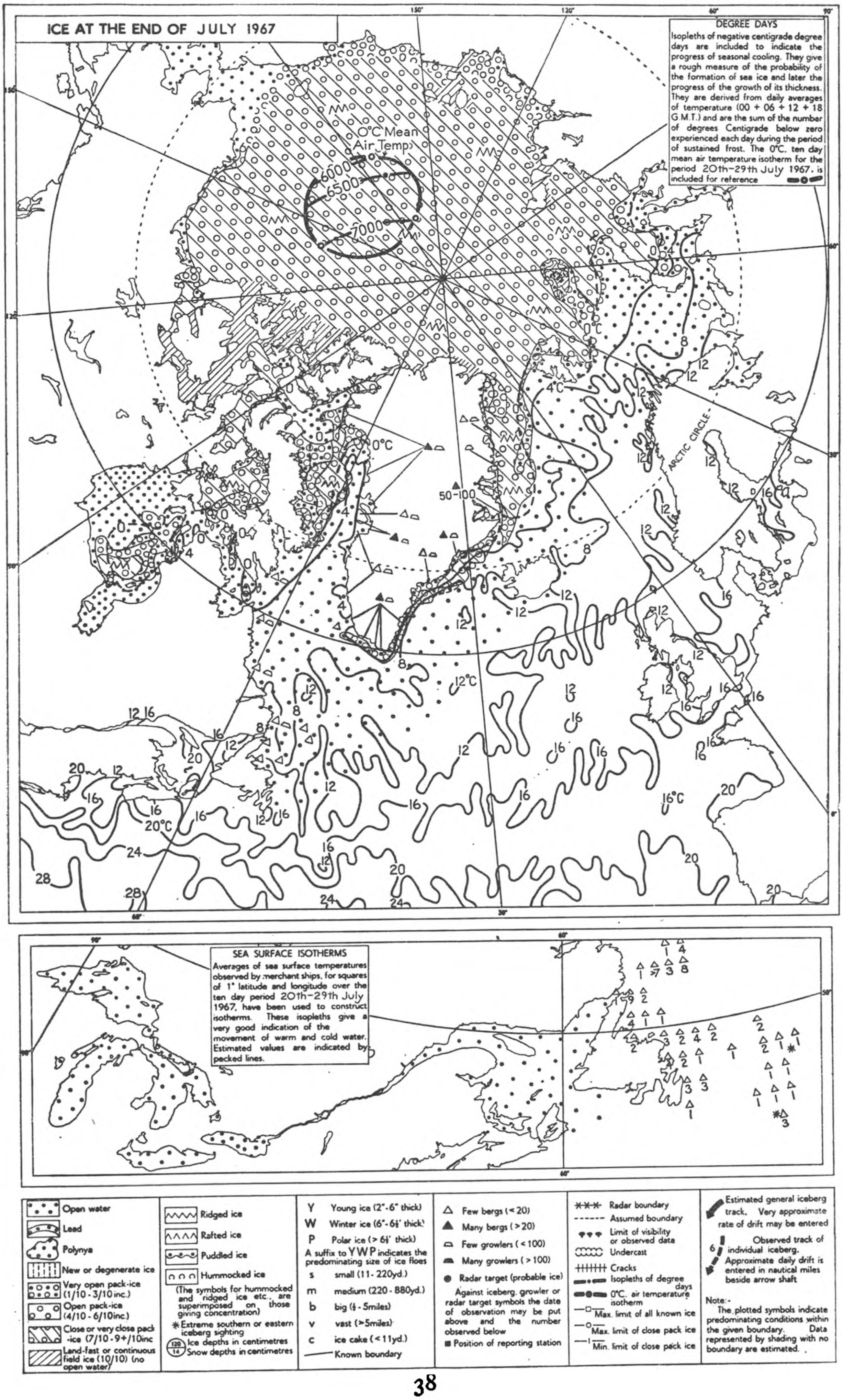
Hudson Bay. Winds from between west to north-west had the effect of maintaining air temperatures on the western side of the Bay somewhat higher than normal whilst those to the east were lower. Some open pack from Foxe Basin drifted into the north-east near Coats Island, rather rare in September, but this had all melted before the end of the month.

Hudson Strait. Here the steady, moderate to strong west-north-westerlies lowered the air temperature 1 or 2 degC below seasonal average and probably also had the effect of nullifying the positive anomaly in sea surface temperature of the previous month. Nevertheless, as is customary at this time of year, there was no ice in the Strait.

Davis Strait. Winds were mainly from the north-west but towards the end of the period moderate to strong southerlies developed along the Greenland coast. Air temperatures varied 1 or 2 degC either side of normal but that of the sea was, on the whole, slightly higher than usual. There was no ice.

Labrador Sea. Early in the month moderate north-west winds kept air temperatures lower than normal but a backing to south-west raised them again to about 1 degC above average. In contrast to last month, sea temperature was low, being as much as 4 degC below that expected in September. There was no ice and few icebergs.

Great Bank, South Newfoundland Sea, River and Gulf of St. Lawrence. Mainly south-west to north-westerly winds covered the whole of this area and air temperatures, starting low, finished a degree or so above normal. Sea temperature, however, was consistently high, generally by about 2 to 4 degC, and in one place just south-east of Cape Race by as much as 7 degC. It seems clear that throughout the summer the Gulf Stream has tracked further north than usual with the Labrador current being forced back and, as a result, rather weak. There was no ice


ICE AT THE END OF JULY 1967
DEGREE DAYS
Isopleths of negative centigrade degree days are included to indicate the progress of seasonal cooling. They give a rough measure of the probability of the formation of sea ice and later the progress of the growth of its thickness. They are derived from daily averages of temperature (00 + 06 + 12 + 18 G.M.T.) and are the sum of the number of degrees Centigrade below zero experienced each day during the period of sustained frost. The 0°C. ten day mean air temperature isotherm for the period 20th–29th July 1967, is included for reference
0°C Mean Air Temp.
6000
6500
7000
ARCTIC CIRCLE
50-100
SEA SURFACE ISOTHERMS
Averages of sea surface temperatures observed by merchant ships, for squares of 1° latitude and longitude over the ten day period 20th–29th July 1967, have been used to construct isotherms. These isopleths give a very good indication of the movement of warm and cold water. Estimated values are indicated by pecked lines.
Open water
Lead
Polynya
New or degenerate ice
Very open pack-ice (1/10 - 3/10 inc.)
Open pack-ice (4/10 - 6/10inc.)
Close or very close pack -ice (7/10 - 9+/10inc
Land-fast or continuous field ice (10/10) (no open water)
Ridged ice
Rafted ice
Puddled ice
Hummocked ice
(The symbols for hummocked and ridged ice etc., are superimposed on those giving concentration)
✳ Extreme southern or eastern iceberg sighting
120/14 Ice depths in centimetres / Snow depths in centimetres
Y Young ice (2"-6" thick)
W Winter ice (6"-6½' thick)
P Polar ice (> 6½' thick)
A suffix to YWP indicates the predominating size of ice floes
s small (11 - 220yd.)
m medium (220 - 880yd.)
b big (½ - 5miles)
v vast (>5miles)
c ice cake (< 11yd.)
Known boundary
Few bergs (< 20)
Many bergs (> 20)
Few growlers (< 100)
Many growlers (> 100)
Radar target (probable ice)
Against iceberg, growler or radar target symbols the date of observation may be put above and the number observed below
Position of reporting station
Radar boundary
Assumed boundary
Limit of visibility or observed data
Undercast
Cracks
Isopleths of degree days
0°C. air temperature isotherm
Max. limit of all known ice
Max. limit of close pack ice
Min. limit of close pack ice
Estimated general iceberg track. Very approximate rate of drift may be entered
Observed track of individual iceberg. Approximate daily drift is entered in nautical miles beside arrow shaft
Note:-
The plotted symbols indicate predominating conditions within the given boundary. Data represented by shading with no boundary are estimated.

Greenland Sea. North of 70°N there was an excess of ice, the edge being between 50 and 100 miles to the east of its normal September position. Both air and sea were unusually warm so the reason for this probably lies in the predominance of westerly winds. The ice fields were also more extensive than usual south of 70°N and at one time stretched along the Greenland coast as far south as 62°N; even at the end of the month there was still, exceptionally, pack at about 65°N. Winds in this area were variable, mainly from an easterly direction, and air temperature oscillated not more than 1 degC or so above or below normal. Sea surface temperatures generally also varied a little either side of average but just off Cape Farewell it was unusually warm. The number of icebergs reported from the Greenland coast was higher than normal.

Spitsbergen. Reports from vessels in the area showed great variation in temperature, particularly that of the sea, but generally it was warm. Due, however, to the mainly westerly winds, the pack-ice off the Greenland coast drifted into the Spitsbergen area and in places intruded up to 50 miles further east than normal.

Barents Sea. At first there were moderate to strong south-south-westerlies and consequently both air and sea were relatively warm, in some areas by as much as 6 degC. However, a general veer in the wind, still strong, to north-west, lowered the temperatures considerably and in north-western and north-eastern areas they fell below normal. Ice was slightly in excess to the immediate east of Spitsbergen and between Franz Josef Land and Novaya Zemlya. South of 75°N there was no ice reported.

White Sea. The abnormally mild conditions noted previously in the summer continued into September but towards the end of the month veering winds brought in a cool north-westerly airstream and temperatures fell to normal. There was no ice.

Baltic. There was naturally no ice but it should be noted that, as could be expected with overall southerly winds, the temperature of the air was 2 or 3 degC higher than usual and that of the sea surface as much as 3 degC above normal. Of special significance, too, is the fact that the sea, at depth, both in the Gulf of Bothnia and further south, was very much warmer than last year.

N. B. M.

Note. The notes in this article are based on information plotted on ice charts similar to the map shown opposite but on a much larger scale (39 in × 27 in). These charts are published at ten-day intervals and are available at the price of reproduction on application to the Director General, Meteorological Office (Met.O.1), Eastern Road, Bracknell, Berks. Alternatively, they may be seen at any Port Meteorological Office or Merchant Navy Agency. Up-to-date ice charts are broadcast daily by facsimile.

CANADIAN EXCELLENT AWARDS

(The following statement has been received from the Director of the Canadian Meteorological Branch)

The winners of the annual Canadian Excellent Awards for marine weather observing in 1966 have been announced and are listed on page 40.

Fifty awards, in the form of suitably inscribed books, detailed below, were presented in 1967 to Captains, Principal Observing Officers and Radio Officers.

A 'Ship Award' was presented to the captains of the 20 ships which had returned the best logbooks, in regard to both quantity and quality of observations, in 1966. The book chosen for this award was *Patterns of Canada*, edited by W. J. Megill. This award is not for individual achievement and is usually placed in the ship's library for the benefit of all.

The 15 Principal Observing Officers whose records were considered the best during the year have received a copy of *Birds of Canada* by W. Earl Godfrey. Awards were presented to the 15 Radio Officers who made the greatest number of transmissions. The book chosen was *From Semaphore to Satellite*, published by the International Telecommunications Union.

The Canadian Meteorological Branch congratulates all award-winning ships and officers and extend their thanks for the splendid work done by all the officers of the marine weather observing vessels.

Recipients of Canadian Excellent Awards—1966

Name of Vessel	Captain(s)	Principal Observing Officers	Radio Officer	Owner/Agent
Acadia	J. W. C. Taylor	F. W. Sheppard	J. E. Furness	Government of Canada
Baffin	W. N. Kettle, M. Wagner, P. Brick	—	—	Government of Canada
Bluenose	—	D. Vale, H. Whitehead	—	Government of Canada
Brandal	—	E. D. Brignell	—	Government of Canada
Bridgepool	T. W. Cameron	—	—	Pacific Export Lines Ltd.
Camsell	—	—	W. W. Schulz	Government of Canada
Canberra	E. G. Riddelsdell	A. H. Falkner	R. Hawkins	P. & O.-Orient Line
Cygnus	R. N. Townsend	M. C. Blagdon	—	Government of Canada
d'Iberville	—	—	E. R. Bonneau	Government of Canada
Droxford	W. A. Ross	F. W. Watts	H. R. Bates	Risdon Beazley Ltd.
Emerillon	C. Bradshaw	—	—	Shell Canada Ltd.
Gypsum Countess	R. T. Luckey	—	E. Munro, C. Orchard	Fundy Gypsum Co. Ltd.
Gypsum Prince	R. S. Kelly, N. Crowe	E. Apesland	—	Fundy Gypsum Co. Ltd.
Gypsum Queen	J. R. Blinn	—	C. Orchard, M. Cornect	Fundy Gypsum Co. Ltd.
Harengus	H. H. Butler	E. Fevens	—	Government of Canada
Hudson	V. J. Vieau, W. N. Kettle	—	F. A. Webb	Government of Canada
Imperial St. Lawrence	W. R. Murphy, D. E. Fournier	—	V. M. Dykeman	Imperial Oil Ltd.
John A. Macdonald	—	—	N. T. Kristensen	Government of Canada
Kapuskasing	W. Thorne	G. K. Zinck	—	Government of Canada
Labrador	—	—	S. A. Greer	Government of Canada
Lakemba	G. L. Cleveland	—	—	Pacific Shipowners Ltd.
Lynton	D. S. Sapp	M. England	H. Foster	Anglo Canadian Shipping Co. Ltd.
Narwhal	M. C. Lever	—	—	Government of Canada
Oriana	C. Edgecombe, J. Dunkley	I. Gibb, R. L. Jackson	E. R. LeGear	P. & O.-Orient Line
Princess of Acadia	J. A. Blinn	P. Petrovitch	W. E. Fontaine	Canadian Pacific Railways
R. B. Angus	J. Richardson, J. Escolme	—	—	Anglo Canadian Shipping Co. Ltd.
Sir Humphrey Gilbert	—	D. Daly	—	Government of Canada

HONG KONG EXCELLENT AWARDS

(List supplied by the Marine Liaison Officer, Royal Observatory, Hong Kong)

Ten meteorological logbooks classified as 'excellent' have been returned by the masters of Hong Kong voluntary observing ships in the year ending 31st May 1967. Their names, together with the names of their ships and of the deck and radio officers who have thereby qualified for awards, are listed on page 42.

Book Reviews

The Galápagos. Proceedings of the Galápagos International Scientific Project of 1964, edited by Robert I. Bowman. $10\frac{3}{4}$ in × $8\frac{1}{4}$ in, pp. xvii+318, *illus*. University of California Press, Berkeley and Los Angeles (British agents: Cambridge University Press, Bentley House, 200 Euston Road, London, W.1), 1967. Price: 80*s*.

The Galápagos Islands are a remarkable place. They consist of a group of, geologically speaking, young and still active volcanoes which rise 2,000 to 3,000 metres from the bed of the Pacific, the highest to 1,700 metres above the sea surface, 600 miles west of Ecuador and a little more than that south-west of Panama. The main group lies between the equator and $1\frac{1}{2}$°s at 89–92°w. There is little doubt that the volcanic activity which produced them, like the Hawaiian islands which are of similar age, belongs to the mid-ocean ridge system; though the pattern of these ocean-bottom ridges is much more complex in the Pacific than in the Atlantic. The theory of continental drift suggests that volcanic islands form in the mid-ocean ridges and drift away to either side. If this is true, the Galápagos should be drifting east-south-east at a rate of about 3·5 cm/year: so they may have been at least 50% further from South America when they first began to form. The narrowing of the distance may have been greater even than that, because South America is thought to be drifting westwards as part of the same general process, one implied locus of upper-surface convergence and 'down-welling' in the convection system of the Earth's mantle being between Galápagos and South America. (The Hawaiian Islands, being on the other side of the mid-Pacific ridges, are believed to be drifting westwards.)

Outwardly, the Galápagos scene is very much like the Cape Verde Islands, and the climates have obvious points of similarity, but a closer look discovers differences that may fascinate and amaze. The faunas and floras of the two groups are quite different. It was this point that struck the young Charles Darwin on his visit in 1835 on the famous *Beagle* voyage and set him thinking about the course of evolution in Nature. Clearly, the old idea that the plants and animals were just divinely created right for each environment was not the whole story. The Galápagos Islands, in fact, offer not just one but a number of isolated environments in which distinct differences of local species have evolved—and all without the interference of Man. The area might be regarded as a great laboratory in which we may watch the unfolding of a number of experiments which Nature herself has arranged. Moreover, the subjects of interest are not limited to the various branches of biology but extend to meteorology, oceanography and, as already explained, the physics of the Earth's crust and underlying mantle.

Hence arises the special interest of scientists and conservationists in the Galápagos. Hence, also, the establishment of a permanent Charles Darwin Research Station on the Galápagos in January 1964 and the operation of an eleven-week observation programme, the 'Galápagos International Scientific Project', in the first months of that year with a preliminary symposium for the outward-bound scientists beginning at Berkeley, California and continued on board ship on passage to the Galápagos.

This book is the book of that symposium. It consists of 40 short essays on a wide

Recipients of Hong Kong Excellent Awards—1966–67

Name of Vessel	Captain	Observing Officers	Radio Officers	Owner/Manager
Eastern Rover	G. Kinley	R. G. Macdonald, P. Murphey	—	Indo-China S.N. Co. Ltd.
Kweichow	R. E. Brooks	G. M. Adams, W. J. B. Hibberdine, J. P. G. Kelly, P. R. Ringe	Kwok Man Wai	China Navigation Co. Ltd.
Eastern Moon	T. C. Wills-Marr	R. G. Macdonald, I. J. H. Alexander, J. M. Joyce	—	Indo-China S.N. Co. Ltd.
Eastern Muse	P. J. Sulivan	P. M. Wheeler, P. R. Thompson, D. M. Healey	F. McGuckin	Indo-China S.N. Co. Ltd.
Kweichow	R. J. Shipp	D. A. Daish, W. J. B. Hibberdine, S. K. Toon	Tsui See Man	China Navigation Co. Ltd.
Eastern Moon	T. C. Wills-Marr	R. G. Macdonald, J. M. Joyce	—	Indo-China S.N. Co. Ltd.
Kuala Lumpur	R. C. W. Gorman	W. J. B. Hibberdine, D. A. Roche, P. Gardener	—	China Navigation Co. Ltd.

range of problems and representing many branches of science, essentially an assessment of the state of knowledge just prior to the 1964 expedition. It differs from most of the modern spate of books of this or that symposium in the breadth of range and interest of the topics presented, in the readability of the style (at least in those articles which the reviewer read thoroughly) and in possessing a good index. There are plenty of maps, diagrams and tables of data too, and a few highly attractive photographs in colour. But one misses, oddly, any good map or topographical description of the islands themselves.

Most enthralling of all the articles is probably the first one, by Sir Julian Huxley, relating historically and by clear logical steps the development of Darwin's theory of evolution in the mind of its discoverer and since, with mutation of species and selection of successful variants and successful ways of life in different environments playing their distinctive parts. The theory readily comprehends and interprets the effects of migration into new habitats and of the environment itself changing with time, as when the climate changes. This has been a whole new way of looking at the world and at life, perhaps as Huxley claims, a greater revolution of thought even than Newton's, Einstein's or Freud's. But not everyone will accept the humanist conclusion which Huxley presses, that though the Earth has been dethroned from the centre of the universe by modern science, the human mind has been crowned as its king. We can accept that "whether he likes it or not, he [Man] has the responsibility for the whole future course of evolution on this planet, including his own" but we may doubt the implied absoluteness of Man's control and most of all his capability of controlling himself and his fellows. The need for humility (some would call it the fear of God) in relation to human perfectibility is not lessened by the greatest achievements of the human mind, especially if one recognizes, with Huxley, that "since he became biologically dominant, Man has radically changed the ecology of the world, mostly for the worse".

After this, one might expect an anticlimax in turning to the meteorological article, but to readers of *The Marine Observer* this chapter will be as interesting as any. The Galápagos Islands lie within a generally 5 to 10° latitude-wide zone of the equatorial Pacific which (at least in the long run) has such a low (though variable) rainfall that enough water to support human life cannot be depended on. The dry zone at present stretches over 90° of longitude to 170°W or beyond, and the islands in it were uninhabited when first discovered by European explorers. The meteorology of this desert zone in the midst of the world's widest ocean (and where equatorial rains might, at first sight, have been expected) is indeed remarkable. The annual rainfall is probably the most variable in the world, ranging at Chatham Island, Galápagos from 1·4 inch in 1950 to 55·9 inches in 1953 and at Malden Island (156°W) from about 3 inches in 1906–1908 to over 100 inches in 1914–1915. The general dryness is associated with the anomalously cold water, maintained in part by upwelling, which is in its turn related to the pattern of the winds and their drag upon the surface; but the variability seems to be an extension far out across the Pacific of the El Niño phenomenon of the Peruvian coast. An essential element in the understanding of this is the tremendous gradient of increasing rainfall northwards and, to a less extent, southwards from near the equator that exists in this area on average and probably, from a slightly different axial latitude, in each individual year. The towering cumulonimbi along the fronts in the intertropical convergence zone are liable to yield their rain, in any given year, repeatedly along some narrow strip of latitudes and never reach places only a degree or two further south and sometimes within sight of the rain. The rainy El Niño seasons appear to be associated with penetration of the north-easterly trade wind stream abnormally far south. Nor is this the end of the story: for certain rock deposits on islands in the western Pacific suggest that the dry zone had a still greater extent at some former time. Further studies there and on the Galápagos should make it possible to date any prolonged occurrences of drier or wetter régimes and see whether they can be related to warm epochs and ice ages in higher latitudes.

Other chapters deal with different specialized studies, ranging from the soils to plant and animal relationships, the insects, the lizards and the tortoises, and so on. Finally, there is a chapter on the possible development of the use of solar energy on Galápagos for simply-operated plastic stills to produce fresh water, and for operating cookers, refrigerators, etc.

This book will be valued by many specialists as an attractive introduction to the scientific problems of the equatorial Pacific. It will also be treasured by many laymen awakened by it to the wonder of natural history—a sense which is only heightened by our efforts to analyse and understand.

H. H. L.

The Sea, by Robert C. Miller. 11¼ in × 8⅝ in, pp. 316, *illus*. Thomas Nelson & Sons Ltd., 36 Park Street, London, W.1, 1967. Price: 84*s*.

This is truly a luxurious and unusually well-written book illustrated with a wealth of magnificent photographs. Although it deals with almost every aspect of the sea it is written in such simple language that almost anybody can understand it and it can be recommended unreservedly to anyone interested in the sea and all its moods. The author reminds us in the introduction that "man is a creature of the land who finds within himself an irresistible urge towards the sea", so it seems that it should have a lot of readers.

Primarily this is a book of oceanography and the author mentions that Edward Forbes, a British marine biologist who died in 1854, and Matthew Fontaine Maury, an American Naval Officer who died in 1873, have each been called the "founder of oceanography". He also reminds us that the first major oceanographic expedition was the British *Challenger* expedition (1872–76). It is good to know that Britain and the U.S.A. are still active collaborators in oceanographic work.

This book is conveniently divided into four parts entitled "Of Time and the Waters"; "The World of Water"; "The Life of the Sea"; and "Man and the Sea".

Part I deals mainly with the historical aspect of the sea itself, its inhabitants and bottom deposits; it includes the story of the geology and geography of the world beneath and bordering the oceans. In addition it delves deeply into the geophysics of the interior of the earth itself. It is not surprising that the inhabitants discussed here include the penguin and the whale.

In Part 2 we find a description of the physics of the sea itself, its waves, its currents and its tides, and it is here that maritime meteorology finds its place. The meteorological section includes an adequate discussion about the effect of the oceans on world climate. The description of the ocean currents and tides is really excellent and is told with the minimum of words and with good diagrams.

Part 3 brings home to the reader the almost incredible variety of animal and vegetable life in the oceans—extending from the tidal area to the depths. It includes a fascinating account of the food cycle and of the precarious life that almost all fishes must have, being preyed upon constantly by their larger or more ferocious neighbours.

When man comes into the picture we learn first of all about the history of his adventures afloat from prehistoric times up to the present. We then turn to man's efforts in the harvest of the sea, followed by a discussion about underwater exploration. The final chapter discusses the relationship between the sea—and all the wealth and beauty that lies in it and under it—and man's future. The author reaches the general conclusion that extermination of fish population by over-fishing is not very likely and he discusses the attempts made by man to increase the productivity of the sea. He also goes into the important question of large-scale production of fresh water from sea water.

The final paragraph is a warning. "We can no longer think of the sea as a vast, illimitable dumping ground for products that man does not know what to do with on land. It must instead be recognized as our greatest natural resource, and one to be conserved in every possible way. So regarded, and wisely used, it can be a permanent source of raw materials, of food, of life-giving water and of recreation, enjoyment and adventure."

C. E. N. F.

Progress in Oceanography, Vol. 3, edited by M. Sears. 9½ in × 6¼ in, pp. xxiii+409, *illus.* Pergamon Press Ltd., Headington Hall, Oxford, 1965. Price: 105*s.*

This is the third volume of a series dealing with significant advances in oceanography. This present volume, however, differs from the two previous ones in that the numbers of papers and authors are much greater (there are thirty articles).

It is a collection of contributions of former students of Professor Dr. Hans Pettersson, compiled by Fritz Koczy and presented to the distinguished Swedish oceanographer on his 75th birthday. The book opens with an appreciation of Dr. Pettersson who has been actively engaged in experimental physical oceanographic studies from the beginning of World War I. For a time, however, he was actively engaged in radioactive research during the period of expansion associated with Lord Rutherford, and Dr. Pettersson applied these studies to physical and geological investigations of the oceans. Dr. Hans Pettersson has travelled widely in the pursuit of knowledge; he worked in England, Monaco, and for several years in Vienna. He worked at the Vienna Institute for Radium Research directed by Professor Meyer.

After holding a professorial Chair at the University of Göteborg in the early thirties, he started the Swedish Oceanographic Institute in 1939 and largely inspired the long voyage of the *Albatross* in 1947 and 1948 (i.e. the Swedish Deep Sea Expedition).

The book includes a 'Hans Pettersson' bibliography which covers papers on a wide range of subjects and published in the journals of many countries. Hans Pettersson had a scientist father, Otto Pettersson, who founded in 1902 the oceanographic station at Bornö, Gullmarfjord. Hans Pattersson did pioneering work at this station on internal waves; he also pioneered work in estimating the age of marine sediments by radioactive chemistry. He pioneered marine optics and photometry, and work in the flow of heat at the sea bottom. He has been an international scientist using his friendly and enthusiastic personality to advance scientific work.

The papers published in the book are each somewhat specialized and are not all of interest to lay readers.

Selecting a few subjects at random, the following comments illustrate the wide scope of the papers. A. Ångström discusses the solar constant and atmospheric temperatures. He concludes that organic life cannot last on this planet more than 2 to 3 billion years.

G. R. Berrit discusses the hydrology of the Gulf of Guinea.

An American, D. Merriman has written a most interesting biography of a remarkable, creative and gentle Manxman, Edward Forbes. Forbes was born in 1815 at Douglas and he died in 1854. He seemed to have had little formal scientific education but he was professor of Natural History at King's College, London, and at Edinburgh and was President of the Geological Society.

E. Olausson describes analysis of deep sea cores which give evidence of climatic change.

In the last paper Tor Bergeron suggests that snow drift is vitally necessary to maintain the Greenland Ice Cap because directly precipitated snow over the central ridge is insufficient.

Diagrams, photographs (some in colour) and tables are all of the high standard usual in this series of volumes.

G. A. T.

Personalities

OBITUARY.—We regret to record the death of DR. HAROLD JAMESON who worked in the Marine Branch of the Meteorological Office from 1940 to 1951 during which time he was largely responsible for the scientific work in preparing the British climatological atlases for all oceans.

A retirement notice, which included a summary of his career, appeared in the October 1951 number of *The Marine Observer*.

While in the Marine Branch, in addition to his monumental work with the climatological atlases (a job which entailed the analysis of over 5,000,000 observations from ships), he did research work on the diurnal range of barometric pressure in the tropics and in the Mediterranean, diurnal range of fog at sea and the relationship between wind and pressure gradients at sea.

He was very loyal and hard-working, had good judgement and never hesitated to say what he thought; he was very much liked and respected by his colleagues.

We offer our sympathy to his widow and his daughter.

C. E. N. F.

RETIREMENT.—CAPTAIN W. S. BYLES, R.D.*, R.N.R. retired from the service of the Union-Castle Line on the 1st October.

William Snowden Byles was born in Bradford in 1904, a descendant of William Byles, founder of the *Bradford Observer*.

Captain Byles was trained for the sea in H.M.S. *Worcester*, passing out top of the ship in both navigation and seamanship. He was appointed a midshipman in the Royal Naval Reserve and performed his midshipman's training in H.M.S. *Argus* and H.M.S. *Wyvern* before joining the Union-Castle Line in 1922 as a cadet, making his first voyage in the Company's service on the maiden voyage of the *Sandgate Castle* to Mauritius, via the Cape.

After passing for 2nd Mate in 1925 he was appointed 4th Officer of the *Llandovery Castle* on her maiden voyage round Africa.

In 1930 he passed for Master, and in 1932 for Extra Master.

While serving as a Lieutenant R.N.R. in H.M.S. *Hood* undergoing 12 months' naval training he was present at the Invergordon mutiny.

In 1938 he gained his first command—the Union-Castle Line's s.s. *Rovuma*—a coasting vessel trading between Portuguese East African ports.

On the declaration of hostilities in September 1939, as a Lieutenant Commander R.N.R. he was called up in Cape Town for active service in the Royal Navy and served in a number of H.M. ships and one shore establishment. From 1941 until demobilized in January 1946 all his service was in combined operations. He was twice Mentioned in Despatches, the first for his part in blocking Dieppe Harbour when the Germans overran France on 10th June 1940, and the second for the part his ship, H.M.S. *Prince Leopold*, played in the raid on Vågsøy Island in occupied Norway on 26th December 1941. In the same ship he also took part in the raid in force on Dieppe on 19th August 1942. For his services in command of H.M.S. *Tormentor* preparing for operation Overlord he received the Commander-in-Chief's Special Commendation.

When he returned to the Union-Castle Line in 1946 he was appointed Master of s.s. *Frank A. Vanderlip*, a Liberty ship managed for the Admiralty by Union-Castle.

After a period in command of the cargo ship *Good Hope Castle* he was appointed Master of the passenger ship *Llanstephan Castle*, and subsequently commanded seven of the Company's passenger ships including such fine ships as the *Pretoria Castle* and *Edinburgh Castle*.

In 1953 he was promoted Captain in the Royal Naval Reserve, and in 1965 Commodore Master of the British and Commonwealth Shipping Company of which the Union-Castle Line is a subsidiary.

Captain Byles' association with the Meteorological Office commenced in 1926 when he was serving as a junior officer in the *Dundrum Castle*, since then 41 meteorological logbooks bearing his name have been received covering a period of 22 years of observing. Eleven of these books have been assessed as Excellent. He received an Excellent Award in 1955.

We wish him good health and happiness in his retirement.

A. D. W.

RETIREMENT.—COMMODORE H. N. LAWSON completed his last voyage when the *Rangitoto* docked in London in September 1967.

Hamish Napier Lawson was born in London in 1907 and entered H.M.S. *Worcester* in 1921. He served his apprenticeship with the Commonwealth and Dominion Line from 1923 until 1926 when he joined the New Zealand Shipping Company. In 1948 he was appointed to his first command, the *Leicester* and was appointed Commodore of the combined New Zealand Shipping Company and Federal Line Fleets in September 1964.

He joined the Royal Naval Reserve as midshipman in 1925 and was promoted Captain R.N.R. in 1956. During the Palestine and Abyssinian troubles between 1935 and 1936 he served with the Royal Navy as a Unit Commander in the 2nd Anti-Submarine Flotilla and was again mobilized in 1939 for the second world war in which he commanded various anti-submarine escort vessels. He took part in the destruction of seven U-boats and was mentioned in despatches for his part in the sinking of U.385 by gun-fire in the Bay of Biscay.

In 1948, when in command of the *Leicester* at the height of a hurricane in the North Atlantic, Commodore Lawson was washed overboard from the bridge by a gigantic wave and carried back on board again by a second wave which deposited him on the boat deck 30 feet abaft the bridge. The condition of the *Leicester* became so bad that she had to be abandoned and he was picked up after half an hour in the water by U.S.S. *Tropero*. The *Leicester* was eventually salved and, at his own request, Commodore Lawson resumed command for a further voyage.

In October 1957, when in command of the *Rakaia*, the ship sustained a major engine breakdown in the North Atlantic which could not be repaired because of bad weather; it was decided to rig some form of jury sails in an attempt to steady her and the experiments using canvas awnings were so successful that repairs were completed in two days and the ship was able to proceed under reduced power. Other sails were made out of hatch tarpaulins and were rigged, using samson posts forward and topping the derricks aft, giving a total sail area of about 2,500 square feet and, with a favourable wind, the *Rakaia* reached Liverpool under sail and reduced power.

Commodore Lawson's association with the Meteorological Office goes back to 1927 when his first meteorological logbook was received from the *Piako*. In 26 years he has sent in 50 logbooks of which 38 were classed Excellent; he received Excellent Awards in 1930, 1931, 1932, 1958, 1959, 1960 and 1965, whilst in 1959 he was presented with a special award, a barograph, for good voluntary observing over a long period of years.

We wish him health and happiness in his retirement at Crosthwaite, Westmorland.

J. C. M.

RETIREMENT.—CAPTAIN J. R. RADLEY, Port Meteorological Officer at Liverpool, retired on 31st August 1967.

Joseph Reginald Radley served his apprenticeship with the Elder Dempster Line, joining his first ship, the *Akabo*, in 1920.

After passing for 2nd Mate in 1924 he was appointed 4th Officer of the Elder Dempster ship *Elmina* and continued to serve with the same company until 1931.

He passed for Master in 1930 and served on the West African coast as Chief Officer for 12 months.

With rising unemployment and poor prospects for British ships' officers resulting from the trade recession in the early 1930s, Joseph Radley decided to go 'out east' and joined the China Navigation Company, serving with this company for a year. Then he joined the Chinese Maritime Customs which at that time were increasing their fleet of Preventive Cruisers. He remained in this service for five years, four of which were in command.

In 1938, with the increasing hostility between China and Japan, the future of the Chinese Maritime Customs appeared uncertain and he decided to return to this country where conditions in the shipping industry had considerably improved since his departure in 1932.

Shortly after his return to the U.K. he joined the Admiralty Boom Defence Service and was appointed Master of the *Falconet*, stationed at Dover.

With the declaration of hostilities in 1939 the Boom Service ceased to be civilian and became part of the Royal Navy. Captain Radley was commissioned as a Lieutenant R.N.R. and remained in the Boom Defence Service throughout the war. He was present at the Sicily landing in 1943 and the Normandy landing in 1944. On promotion to Lieutenant-Commander in 1945 he was appointed Assistant Boom Defence Officer in charge of moorings at Trincomalee where he spent the next two years.

In 1948 he returned to the civilian side of the Boom Defence and Salvage Service and was appointed Master of the salvage vessel *Kingbrace* where he remained until he joined the Meteorological Office in 1949 as Port Meteorological Officer in Southampton, transferring to Liverpool on promotion to Senior Nautical Officer in 1956.

During his eighteen years' service as a Port Meteorological Officer, Captain Radley must have instructed many hundreds of ships' officers in the duties of a voluntary observer. Many became personal friends and will miss his familiar, jovial figure waylaying them on his lawful occasions.

We wish him and Mrs. Radley every happiness in their retirement to Norfolk.

Lieutenant-Commander E. R. Pullan R.N.R., Port Meteorological Officer at Hull since 1964, has relieved Captain Radley at Liverpool.

A. D. W.

OFFICIAL PUBLICATION

Meteorology for Mariners (Met.O.593), 2nd Edition. Her Majesty's Stationery Office, London, 1967. Price: 32*s*. 6*d*.

In this new edition most of the material is broadly the same as in the last edition but various additions have been made to bring it up to date. In particular, information about facsimile maps, the weather routeing of ships and further advice about the application of meteorology to the care of cargo have been added. Advice is also given about estimating wind force from a weather map. The aim of this book is to present the elementary theory of modern meteorology and its allied science, oceanography, in a simple and straightforward manner for the benefit of all seamen and to show how a knowledge of these subjects can be applied in a practical way to the duties of a ship's officer. This book will be issued to voluntary observing ships as and when replacement of the earlier edition is necessary.

ADDENDA

The Marine Observer, July 1967, p. 122, SHIP-BORNE FACSIMILE:

In order to avoid any misunderstanding about the reference to a direct method of facsimile transmission between ships and their Companies' offices ashore, we have been asked by the G.P.O. to say that any transmission of this type would, of course, have to be routed through an intermediate Coast Radio Station.

Notices to Mariners

ATLANTIC WEATHER BULLETIN

With effect from 1st January 1968, when the new ships' code forms are introduced, both wind and swell wave groups ($3P_wP_wH_wH_w$ and $d_wd_wP_wH_wH_w$) will be included in Part V (Ships' Reports) of the Atlantic Weather Bulletin. These two groups will be added to the six groups shown on pages 33 and 35 of the new edition of the *Ships' Code and Decode Book* (Met.O.509) and have been added in response to requests from mariners for actual wave conditions in the Atlantic.

The new form of ships' reports in the broadcast will therefore be:

$$99L_aL_aL_a \quad Q_cL_oL_oL_oL_o \quad YYGGi_w \quad Nddff \quad VVwwW$$
$$PPPTT \quad 3P_wP_wH_wH_w \quad d_wd_wP_wH_wH_w$$

From 1st January 1968, 22 ships' reports will be given in the Atlantic Weather Bulletin, including all the Ocean Weather Ships.

OCEAN WAVE PHOTOGRAPHIC COMPETITION

The National Institute of Oceanography have announced the results of their photographic competition which was advertised in the October 1965 number of *The Marine Observer*.

The first prize was awarded jointly to Mr. J. Bennett of Belfast and Mr. B. Goss of Grays, Essex. Their photographs are reproduced opposite pages 16 and 17.

The second prize was shared by Mr. J. R. Hide of Skipton, Dr. P. H. Kemp of London, Mr. J. H. Wilkins of Birmingham and Mr. J. I. Levi of Swansea. Mr. Levi's photograph is shown opposite page 24.

Notices to Marine Observers

FACSIMILE MAPS

Officers aboard ships fitted with facsimile receivers sometimes ask why the surface analysis and surface prognostic maps do not contain arrows showing direction and movement of pressure systems. The reason is that the facsimile user will first of all receive the analysis, which shows the positions of centres and fronts at a given time, and he will then receive the prognostic map which will show the positions of these features at a later time. The anticipated movement of the system is therefore obvious and more explicit than would be indicated in any other way. Also, in addition to the 24-hour prognostic maps, those for 48 and 72 hours are broadcast, so that the officers aboard the ship should be in a position to have a fairly good idea about the anticipated movement of the system. As an additional aid, movement groups are included in the coded analysis broadcast in the Atlantic bulletins. One reason for not wishing to put movement arrows on the facsimile maps is to avoid cluttering up the map with too much detail.

A suggestion has also been made that occasional wind arrows would obviate the need of the observer having to estimate wind force from the barometric gradient shown on the maps. It has now been arranged that a selection of wind arrows from ship observations indicating 28 knots or more will be plotted on the maps in the conventional manner. It is hoped that this will prove helpful.

REVISED CODES—PUBLICATIONS AND FORMS

Every effort has been made by our Port Meteorological Officers and Agents to supply each observing ship with the new yellow logbooks and associated publications, either by visiting the ships or by posting stocks abroad to known ports of call.

In addition, stocks have been sent abroad for distribution to British ships and are obtainable at the following ports:

Auckland, Bombay, Calcutta, Cape Town, Chittagong, Halifax N.S., Karachi, Kingston (Jamaica), Kowloon, Madras, Melbourne, Mombasa, Montreal, Port of Spain, St. John N.B., Singapore, Sydney N.S.W., Vancouver, Wellington, Yokohama.

Fleet Lists

Corrections to the list published in the July 1967 number of *The Marine Observer*

Information regarding these corrections is required by 20th October each year. Information for the July lists is required by 20th April each year.

GREAT BRITAIN (Information dated 12.10.67)

The following coasting vessels ('Marid' Ships) have been recruited:

NAME OF VESSEL	CAPTAIN	OWNER/MANAGER
Corkbrook	R. Alexander	Comben, Longstaff & Co. Ltd.
Fallowfield	R. Saunders	Coast Lines Ltd.
St. Britwin	A. Weatherill	T. Hamling & Co. Ltd.
St. Leger	J. Humphrey	T. Hamling & Co. Ltd.
Ulster Queen	W. Lucas	Belfast S.S. Co. Ltd.

The following vessels have been deleted:

Angularity, B.P. Manager, Hibernian Coast, Jersey Coast, St. Magnus, Southern Coast.

The following skippers and radio operators have been added to the Trawler Fleet List:

SKIPPER	RADIO OPERATOR	TRAWLER OWNER/MANAGER
J. Brocklesby	E. D'Constantine	Newington Steam Fishing Co. Ltd.
R. King	B. E. K. Robinson	Newington Steam Fishing Co. Ltd.
H. Patmore	B. E. K. Robinson	Newington Steam Fishing Co. Ltd.
J. Nelson	B. C. Jones	T. Hamling & Co. Ltd.
R. Taylor	J. Blake	Ross Trawlers Ltd.
R. Wilson	C. Hodder	Hellyer Bros. Ltd.
E. Wooldridge ..	J. Blake	Newington Steam Fishing Co. Ltd.

BRITISH COMMONWEALTH

INDIA (Information dated 1.9.67)

The following ships have been recruited as Selected Ships:

Chanakya Jayanti (Jayanti Shipping Co. Ltd.)
Jalajyoti (Scindia S.N. Co. Ltd.)
Jalarashmi (Scindia S.N. Co. Ltd.)
State of Mysore (Shipping Corporation of India Ltd.)
Sushma (Apeejay Lines Ltd.)

The following ship has changed her name:

Maha Jag Tara is now *Maha Vikram* (South East Asia Shipping Co. Ltd.)

The following ships have been deleted:

Gargi Jayanti, Islami, Jag Ketu, Jalaprakash, Pradeep.

GREAT BRITAIN (*contd.*)

The following ships have been recruited as Selected Ships:

Name of Vessel	Date of Recruitment	Captain	Observing Officers	Senior Radio Officer	Owner/Manager
Baharistan	21.6.67	S. Booker	W. C. Johnston, J. Holtz, B. Baker		F. C. Strick & Co. Ltd.
Benalbanach	11.7.67	S. Murray	G. Byers, P. Ewart, J. Muir, C. Burt	B. J. G. Saltwell	Ben Line Steamers Ltd.
Huntsland	11.5.67	F. B. Cocking	R. S. James, B. Wright	J. Mathers	O. Gross & Son, Ltd.
Hyala	2.4.67	J. S. Rodger	G. Young, P. Graham, C. J. Sutton		Shell Tankers (U.K.) Ltd.
Iron Horse	4.5.67	G. Black	J. M. Allison, R. Childerston, D. Faulkner	K. Reynolds	Common Bros. Ltd.
Iron Ore	31.5.67	I. S. Taylor	J. B. Anderson, R. B. Crosby, W. Graham	B. Jones	Common Bros. Ltd.
John Murray	17.4.67	M. J. Perry	P. H. Marr, J. E. Higham, R. P. Davies		Natural Environment Research Council
Jumna	4.8.67	M. Ryan	M. T. Barwell, D. Daniel, A. J. Bettles	A. Dobson	Hain-Nourse Ltd.
Peisander	4.4.67	M. Auchterlonie	H. Ross, I. Home, J. C. Ray	A. White	Ocean Fleets Ltd.
Prometheus	21.6.67	—. Boyd	A. Wilkinson, J. Bennion, H. Palmer, B. Lough	E. Roberts	Ocean Fleets Ltd.
Queen Elizabeth	7.4.67	G. T. Marr, D.S.C.	R. Griffin, J. M. Corlett, D. I. Roberts, R. Dootson, D. B. Gunn	I. MacDonald	Cunard S.S. Co. Ltd.
Serbistan	4.4.67	L. Seddon	J. C. Jones, G. Andrews, P. W. Huxham	T. Osbourne	F. C. Strick & Co. Ltd.
Sheaf Tyne	21.7.67	J. Walker	B. MacLean, I. D. Pattison, R. Wilson	G. Gray	W. A. Souter Co. Ltd.
Tongariro	16.5.67	J. D. Bennett	R. I. Duce, J. Hook, A. Chisholm	A. Harris	New Zealand Shipping Co.
Tourmaline	1.6.67	T. Barry	A. Brines, I. McInnes		Gem Line Ltd.
Warwickshire	5.10.67	A. D. Butterworth	P. D. Gow, C. R. Tiller, R. J. E. Clarkson	B. A. Mullan	Bibby Bros. & Co.

The following ships have been recruited as Supplementary Ships:

Name of Vessel	Date of Recruitment	Captain	Observing Officers	Senior Radio Officer	Owner/Manager
St. Gerontius	9.5.67	E. Johnson	R. Murphy	R. Murphy	T. Hamling & Co. Ltd.
Swanella	9.8.67	L. Fewster	W. Davies	W. Davies	J. Marr & Sons Ltd.

The following Selected and Supplementary ships have been deleted:

Aden, Athelbeach, Bassano, British Workman, Caltex London, Capetown Castle, City of Brooklyn, City of Coventry, City of Liverpool, City of New York, Colina, Corinaldo, Cornwall, Croydon, Darro, Good Hope Castle, Hororata, Livorno, Loch Avon, Loch Garth, Mahanada, Manchester Merchant, Manchester Regiment, Marengo, New Zealand Star, Perim, Rhodesia Castle, Ruthenic, Salaverry, Sarmiento, Sidonia, Sneaton, Sugar Refiner, Waiwera, Weybridge, Willowpool, Wimbledon.

The following ships have been recruited:

HONG KONG (Information dated 11.9.67)

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owner/Manager
Carl Offerson	R. Feldtman	J. I. Toennesen, F. Nolte, G. Flems	R. N. D'Souza	Jebson & Co.
Eastern Cape	R. M. F. Bertram	M. Irish, P. McGovern, M. S. Andrews	M. R. Weaver	Indo-China S.N. Co. Ltd.
Eastern Cliff	G. Kinley	G. T. Colbeck, D. J. Rayner, G. Bell, T. L. Casey	J. B. Hands	Indo-China S.N. Co. Ltd.

SINGAPORE (Information dated 23.10.67)

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owner/Manager
Bidor	Yahya bin Bachok	R. Gomez, W. K. Teh	Saat bin Sutiman	Straits S.S. & Co. Ltd.
Cable Enterprise	G. Robinson	J. G. Paterson, D. E. Richards, G. R. Plummer	P. P. Bennett	Guthrie Boustead Shipping Agencies Ltd.
Golden Wonder	S. Hoskins	T. A. Sheppard, Lim Ong Tong, Jerry Low, Simon Lim	Chua	Guan Guan Shipping Ltd.
Kah Poh	Budin bin Ahmad	Wan Ahmad bin Dollah, Noor bin Lanang	Nik Ismail bin Nik Sar	Ho Chiang Shipping Co. Ltd.
Katong	G. C. Carter	A. J. Phillips	Yue Fook Wing	Straits S.S. & Co. Ltd.
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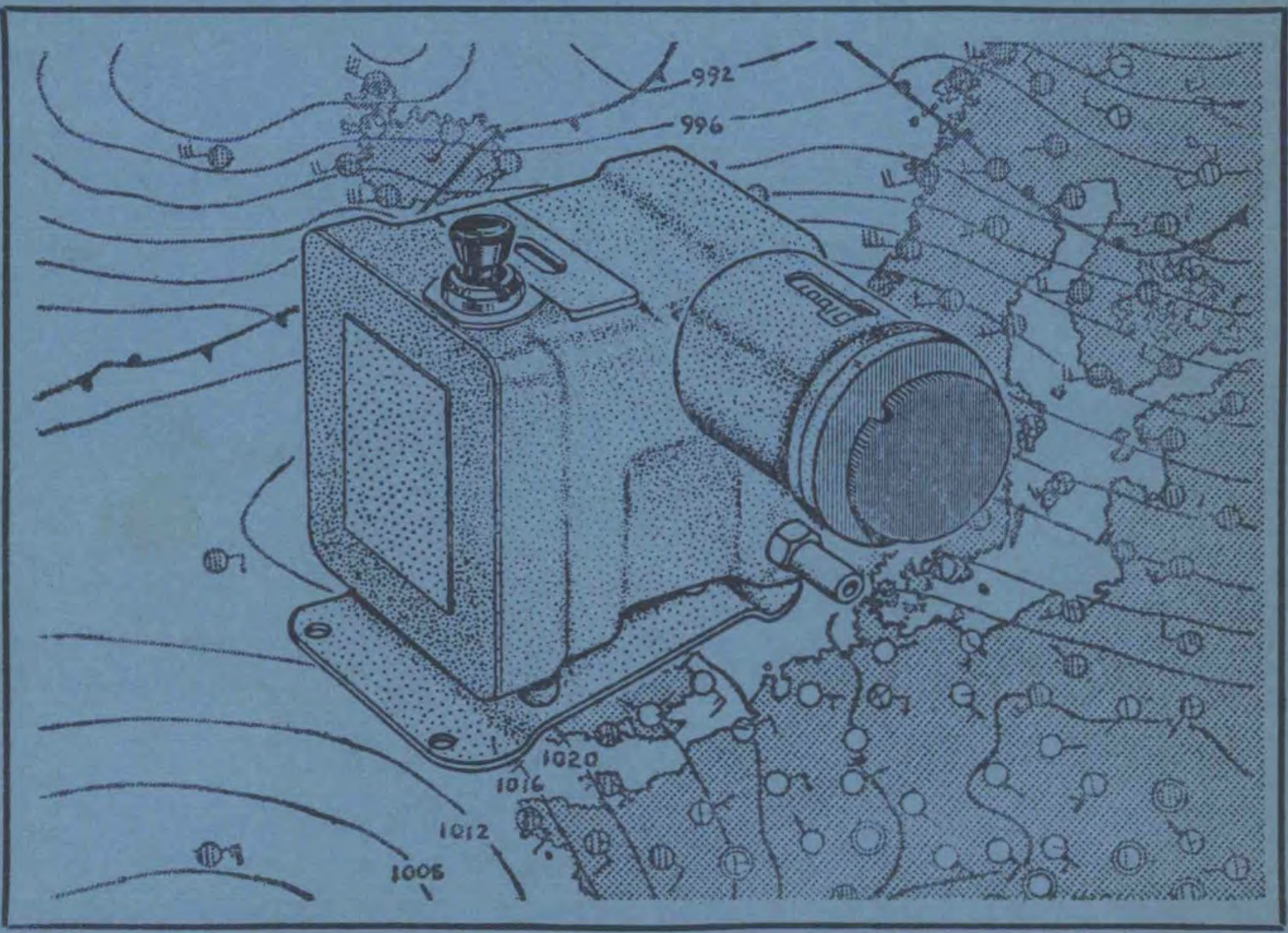

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