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THE MARINE OBSERVER

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October, November, December

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.

TYPHOON 'CORA'

Western North Pacific

m.v. *British Avon*. Captain D. McCallum. Kawasaki to Singapore. Observer, Mr A. Heather, 2nd Officer.

3 October 1975. We sailed from Kawasaki having had warning that typhoon Cora was moving across our course, but was still some way off and moving NNW at 12 knots. At 0300 GMT on the 4th Cora was 300 n. mile to the south-west and moving north-east at 11 knots. It appeared that Cora had recurved and accordingly we altered course to 270°T in the hope that the storm would pass astern. The weather at this time was: barometer reading 1009·5 mb, wind SSW, force 5 and sea moderate.

At 0348 the vessel stopped to effect repairs; we were under way again at 0612.

At 0700 the barometer was reading 1008·3 mb, temp. 29°C, wind SE, force 4 and sea moderate.

The 0600 weather report received at 0918 from Tokyo indicated that Cora was heading NNE at 15 knots and was expected to maintain this track and accelerate. We altered course to 180°T to run past the storm and maintain a distance of about 120 n. mile. The weather at this time was: wind SE, force 4, sea moderate and temp. 27·5°C.

At 1323 the wind increased to force 6 and the barometer began to fall quickly; it was felt that Cora must have curved to the north-east and was approaching the vessel quite quickly. Course was altered to put the wind slightly on the starboard quarter as recommended in *Meteorology for Mariners*.

The 1200 weather report received at 1518 indicated that Cora was still running NNE and was expected to continue on this track and accelerate to 18 knots. In spite of local conditions it was decided to act on this information and at 1530 we altered course to 180°T. The wind was now SE, force 9, barometer reading 999·4 mb and sea very rough.

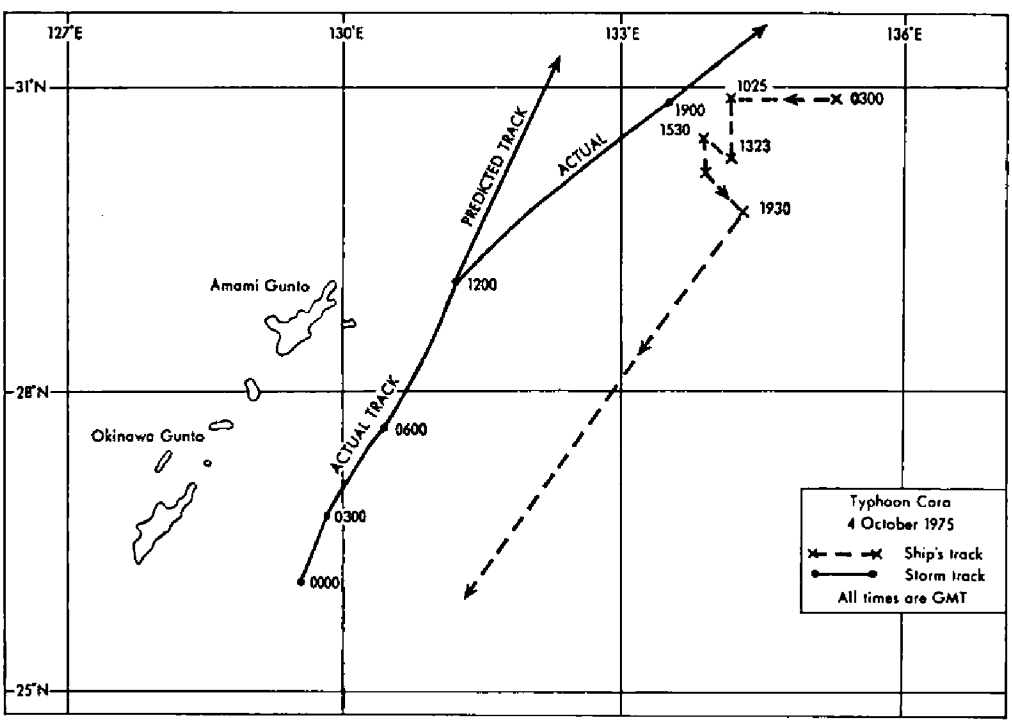
By 1700 it was realized that the storm had recurved once more and that we were probably slightly to starboard of its path. Course was set with the wind one to two points on the starboard bow. The vessel was now on reduced speed to prevent excessive pounding. Wind now SE'ly, force 10, barometer reading 984 mb, very heavy seas. The vessel was now rolling and pitching heavily.

As the wind veered slowly to starboard, course was altered to keep the wind two points on the starboard bow.

At 1845 the barometer reached its lowest reading, 957 mb, the wind was force 12 —strong enough to stop the large scanner and to cause the small scanner to go into reverse.

From 1835 the wind veered quickly and maintained a steady westerly while decreasing. The barometer began and maintained a gradual rise.

Position of ship at 0300 on the 4th: 30° 54′N, 135° 19′E.



Note. Typhoon Cora attained its maximum intensity on 5 October when winds near the centre reached 110 knots and gusts of 130 knots were reported on Hachijojima Island south of Tokyo, causing several deaths and considerable destruction of property. The storm remained active, even after becoming extra-tropical, until it crossed the Alaska Peninsula on the 13th. The chart shows the tracks of *British Avon* and typhoon Cora on 4 October.

TYPHOON 'FLOSSIE'

South China Sea

m.v. *Silverforth.* Captain R. Sidney. Singapore to Wakayama. Observers, the Master and ship's company.

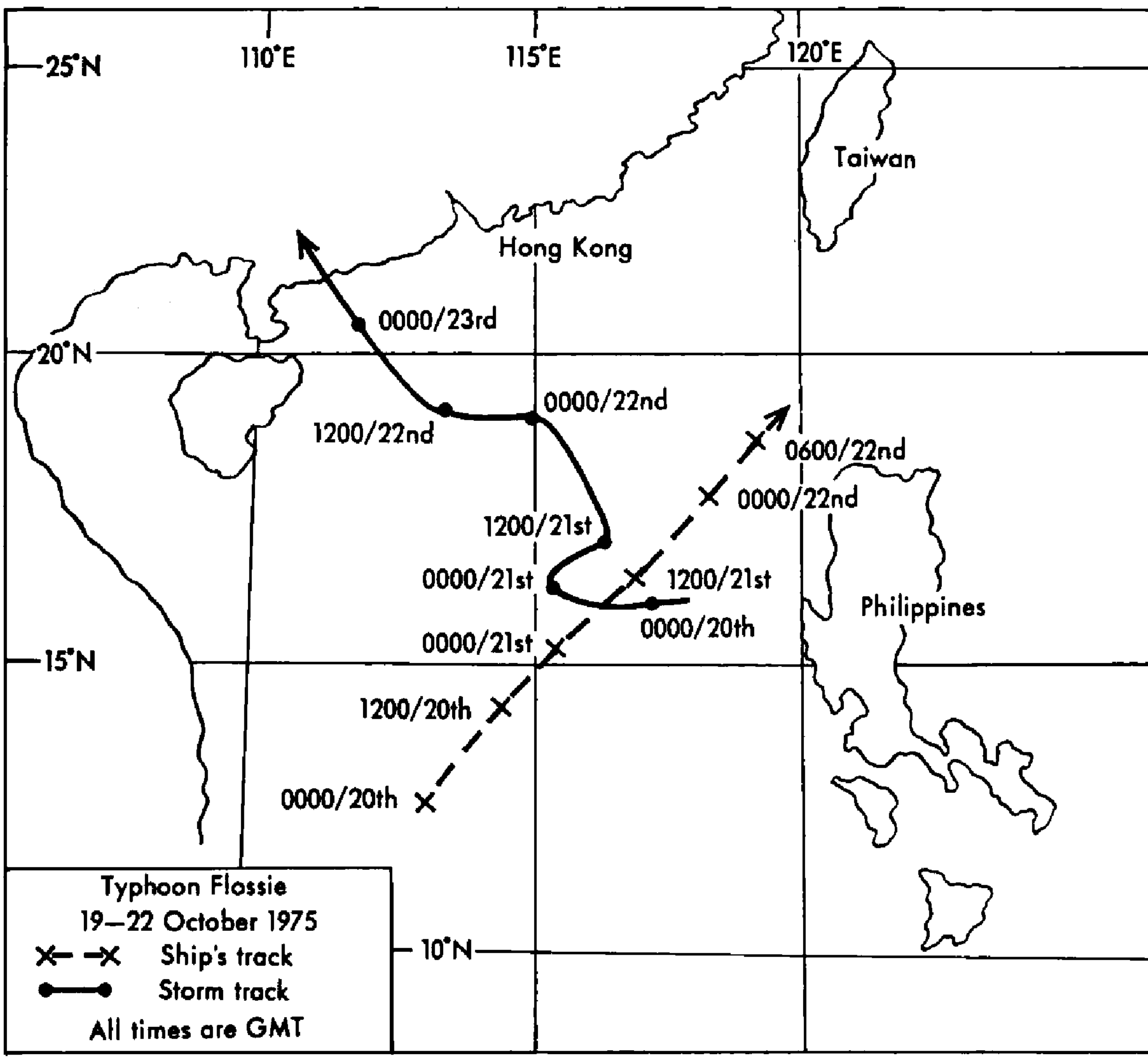
19–22 October 1975. During this period the vessel passed close by typhoon Flossie and the following are selected extracts from the logbook:

GMT

19th 2330: Wind WSW, force 6. Barometer reading 1004·8 mb. Sea rough, heavy swell. Vessel moving easily. Overcast with occasional rain showers.

20th 0730: Wind WSW, force 6. Barometer reading 1001·7 mb. Sea moderate, moderate head swell. Occasional rain showers.

1130: Wind WNW, force 6. Barometer reading 1002·6 mb. Sea rough, heavy swell. Vessel pitching moderately and shipping seas on the port side. Overcast with rain.
1530: Wind NW, force 7–8. Barometer reading 1001·7 mb. Sea rough, heavy swell. Vessel rolling and pitching moderately, heavily at times. Shipping seas on port side.
1930: Wind W'N, force 7. Barometer reading 1000·0 mb. Sea rough, heavy bow swell. Vessel continually shipping water on port main deck. Continuous heavy rain. Poor visibility. Department of Trade (DOT) Regulations observed.



21st 0330: Wind NW, force 6–7. Barometer reading 993·0 mb. Sea rough, heavy swell. Vessel rolling and pitching, heavily at times. Shipping seas on port side. Heavy rain showers.
0730: Wind SSW, force 9–10. Barometer reading 991·2 mb. Sea very rough, heavy swell. Continually shipping water over main deck. Continuous heavy rain. Very poor visibility. DOT Regulations observed.
0930: Wind SSW, force 12. Barometer reading 989·4 mb.
1030: Wind SSW, force 11. Barometer reading 991·2 mb.
1130: Wind SSW, force 11. Barometer reading 992·3 mb. Sea very rough, very heavy swell. Vessel rolling and pitching heavily. Shipping very heavy seas. Overcast with heavy rain. DOT Regulations observed.
1230: Wind SSW, force 9–10. Barometer reading 994·3 mb.
1430: Wind S'W, force 9. Barometer reading 997·4 mb.
1530: Wind SE'S, force 10. Barometer reading 996·9 mb. Sea very rough, very

heavy swell. Vessel rolling and pitching heavily. Shipping seas on main deck. Occasional heavy rain shows. Poor visibility. DOT Regulations observed.

2330: Wind SSE, force 9. Barometer reading 1003·8 mb. Sea rough, heavy beam swell. Vessel rolling and pitching heavily. Shipping water. Overcast.

22nd 0730: Wind SE, force 5–6. Barometer reading 1005·4 mb. Sea moderate to rough. Vessel rolling moderately and shipping seas on starboard side of main deck. Cloudy.

Position of ship at 0000 on the 20th: 12° 12′N, 113° 06′E.

Position of ship at 0600 on the 22nd: 18° 48′N, 119° 12′E.

Note. The accompanying chart shows the tracks of the *Silverforth* and typhoon Flossie. Flossie was short-lived, forming on the 19th and, after following an erratic course in a generally NW'ly direction, filled soon after crossing the coast of mainland China on the 23rd. Unfortunately for *Silverforth,* as the storm deepened to typhoon intensity on the morning of the 21st, it began temporarily to move ENE-wards, closing to within 60 n. mile of the ship.

DUST CLOUD

off Karachi

m.v. *Strathbrora.* Captain A. Dorkins. At anchor. Observers, the Master, Mr B. Bean, 2nd Officer and Mr A. Forbes, Radio Officer.

29 August 1975. At 0900 GMT whilst the vessel was at anchor off the port of Karachi, a dust cloud of considerable size could be seen approaching from a west-south-westerly direction reducing visibility to less than one n. mile. A strong line-echo was seen on the radar screen. Many insects of various species and sizes preceded the cloud. At 0925 the wind backed to south-east. Air temp. 29°C, wet bulb 25·5.

Position of ship: 23° 36′N, 67° 18′E.

Note 1. Although the *Strathbrora* observation rightly belongs to the July edition, it is included here as the following *Note* by Dr Johnson was received too late for publication in that edition.

Note 2. Dr L. R. Johnson, Department of Mineralogy, British Museum (Natural History), comments:

'Aeolian dust in the form of sea-haze most commonly occurs in the vicinity of the Cape Verde Islands off West Africa and has been reported by mariners over many centuries. In this case the dust originates from the regions of north-west Africa. Under rare climatic conditions Saharan dust has been transported well into Europe, and as you are probably aware, has been cited as the cause of "red dust-falls" or "red rains" in southern Britain. Reports of dust-falls off the deserts of north-west India are not as frequent, however, but this is probably due to its relative remoteness from Britain.

'May I draw your attention to two scientific papers which cover the area in question. The first paper by Goldberg, E. D. and Griffen, J. J. entitled "The sediments of the northern Indian Ocean" (*Deep-Sea Research,* 17, 1970, pp. 513–537). This paper describes a mineralogical study of the sediments of the northern Indian Ocean in relation to their possible origin, that is whether river-borne, airborne etc. The writers conclude that whereas in the Bay of Bengal Aeolian dust is of only minor importance to the deep-sea sediments, in the Arabian Sea, where the present report originates, Aeolian dust may well be of considerable importance.

'The second paper by Bryson, R. A. and Baerreis, D. A. entitled "Possibilities of major climatic modification and their implications: north-west India, a case for study" (*Bulletin of the American Meteorological Society*, **48**, 1967, pp. 136–142) is of a more general nature and discusses the implications on man of the migrations of the north-west Indian deserts, and, indeed, implies that these deserts were created by man himself due to the bad farming techniques practised by nomadic tribesmen. The creation of the Sahara Desert has also been attributed to this cause.

'Perhaps you could convey our thanks to Captain Dorkins for the report and we hope this brief reply may be of some use.'

HAIL

Persian Gulf

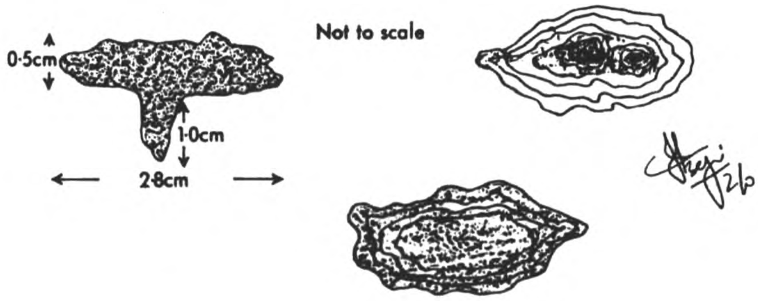
m.s. *Strathloyal*. Captain M. Robinson. At Bushire Anchorage. Observer, Mr G. S. Bajwa, 2nd Officer.

18 December 1975. At 2130 GMT a thunderstorm with heavy rain followed by hail was experienced. The hailstones were round or oval in shape and variable in size, the largest being about the size of a peanut. The wind at this time was NE'ly, force 4–5, the pressure had fallen sharply by 2·2 mb, the air temperature was 16°C.

After a short while the rain decreased in intensity, and by 2200 the wind had become N'ly, force 3; the pressure had risen by 2·2 mb.

At 2215 another thunderstorm was experienced—the hailstones this time were of both a peculiar shape and size (see drawings).

Position of ship: 28° 57′N, 50° 44′E.



Note 1. The *Strathloyal* is a non-Selected Ship.

Note 2. The following is an extract from the *Persian Gulf Pilot*, 1967:

'Thunderstorms are relatively infrequent. The average annual frequency of days with thunderstorms is between 5 and 10 on the Persian Gulf coast and about 5 on the coasts farther east. Hail is occasionally reported and is liable to be exceptionally large. Hailstones of 10–13 cm in diameter have been reported in April.'

PERIOD OF SWELL WAVES

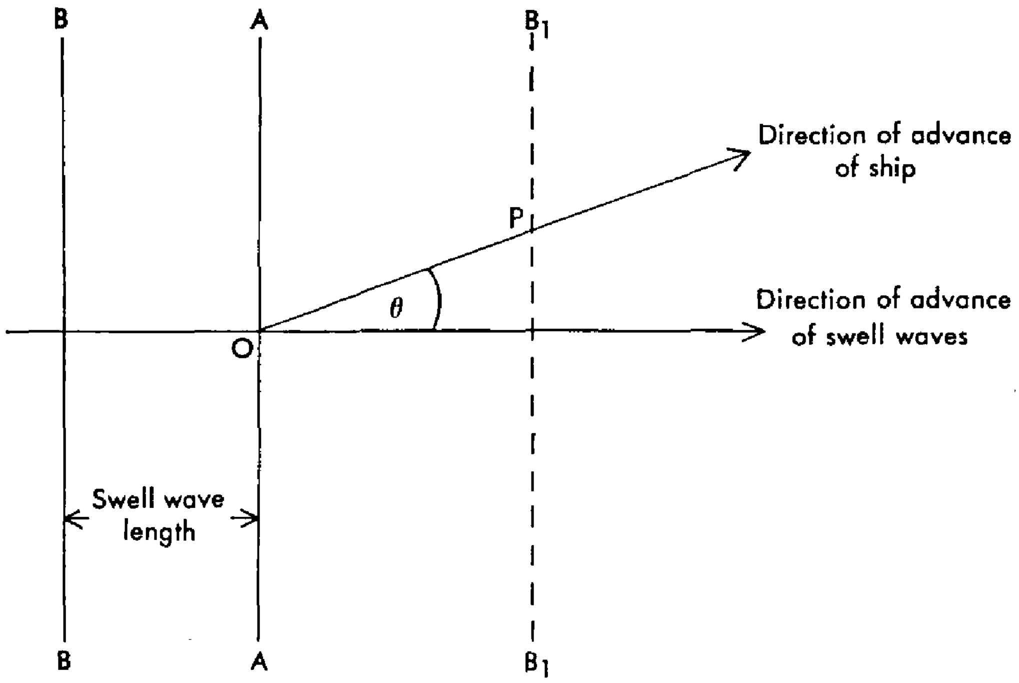
South Atlantic Ocean

m.v. *Sugar Refiner*. Captain C. N. L. Davies. Cape Town to London. Observer, Mr L. B. Piper, Chief Officer.

20 December 1975. A method of calculating the period of swell waves by radar observation was evolved. The radar showed the swell waves approaching from almost directly astern and overtaking the ship in quite distinct parallel bands. At the time there were no wind waves and the swell system was simple. The swell waves were clearly detectable on the radar screen up to 0·5 n. mile.

The 'period of encounter' was determined by timing the passage of ten swell waves by stop-watch past a fixed point on the radar screen and calculating the mean. On this occasion the period of encounter was found to be 20·1 seconds.

The 'wave length' was determined by counting the number of swell waves within a fixed distance and calculating the mean. On this occasion the wave length was found to be 128 metres.



In the diagram the ship is originally on wave crest AA at **O**. After some time when the ship is at **P** she is on the crest of swell wave B_1B_1 which was originally at BB but has overtaken the ship. The ship's course makes some angle θ to the direction of advance of the swell waves. On this occasion $\theta = 20°$.

It can be shown that the speed of the swell waves (V_w) is equal to $\frac{L + V_s t_e \cos\theta}{t_e}$

where L = wave length
V_s = speed of ship (m sec^{-1})
t_e = period of encounter

and on this occasion this was calculated to be 13·62 m sec^{-1}. The speed of the ship being 7·72 m sec^{-1} and the wave length 128 m as above.

The period of the swell waves is then given by the equation:

$$\text{period} = t_e[1 - \frac{V_s}{V_w}\cos\theta]$$

and, on this occasion, is

$$20{\cdot}1[1 - \frac{7{\cdot}72}{13{\cdot}62}\cos 20°] = 9{\cdot}4 \text{ seconds}$$

which agreed reasonably well with the visual estimation of 9–10 seconds.

It is therefore concluded that, in simple wave-pattern conditions, radar may provide a useful means of determining wave period. It may prove particularly useful in relatively calm conditions where no white broken water patches are present to provide points of reference.

Position of ship at 0600 GMT: 20° 36′S, 6° 36′E.

SEA-TEMPERATURE FLUCTUATIONS

South Atlantic Ocean

R.R.S. *John Biscoe*. Captain C. Elliott. Montevideo to Stanley (Falkland Islands). Observers, the Master and ship's company.

27–28 October 1975. At 1200 GMT October 27 in position 39° 12′S, 56° 24′W the sea temperature began to fall from 12°C and by 0000 on the 28th was reading 8°. It then remained constant throughout the night and until 1000, in position 43° 12′S, 56° 24′W when it rose very rapidly to 12·5°; it then fell just as rapidly to 10° by 1200 in position 43° 30′S, 56° 30′W. This was followed by another sharp rise to 15° by 1330 in position 43° 48′S, 56° 30′W and yet another sharp fall to 10° by 1500 in position 44° 00′S, 56° 36′W. From this time until 1830 in position 44° 42′S, 56′ 36′W there were fluctuations between 10 and 12·5°. At 1830 there was a final sharp fall to 8° where it remained steady.

Position of ship at 1200 on 28 October: 43° 30′S, 56° 30′W.

Note. The *John Biscoe* was crossing the region of confluence between the SSW-going Brazil Current and the colder NNE-setting Falkland Current (*South American Pilot* Vol. 1, NP5, p. 27). The temperature fluctuations may be accounted for by mixing of the waters of these currents as the combined flow is turned eastwards.

DISCOLOURED WATER

South African waters

m.v. *City of Liverpool*. Captain J. I. Owen. Observers, the Master and ship's company.

Date and time not recorded. The discoloured water (see photograph opposite page 164) is the fresh-water outflow from the River Umzimvuba in full spate off Port Saint John's, Cape Province. This could be very alarming to a mariner who does not know the area.

Note. The following is extracted from *African Pilot* Volume 3 (NP 3).

The rainy season in this area extends from October through to April. During freshets there is a considerable flow of water from the St John's or Umzimvuba river. The bar of the river is continually changing and depths over it are entirely dependent on the rainfall. Freshets, which may occur at any time without warning, can be a great danger to small craft.

UNDERWATER DISTURBANCE

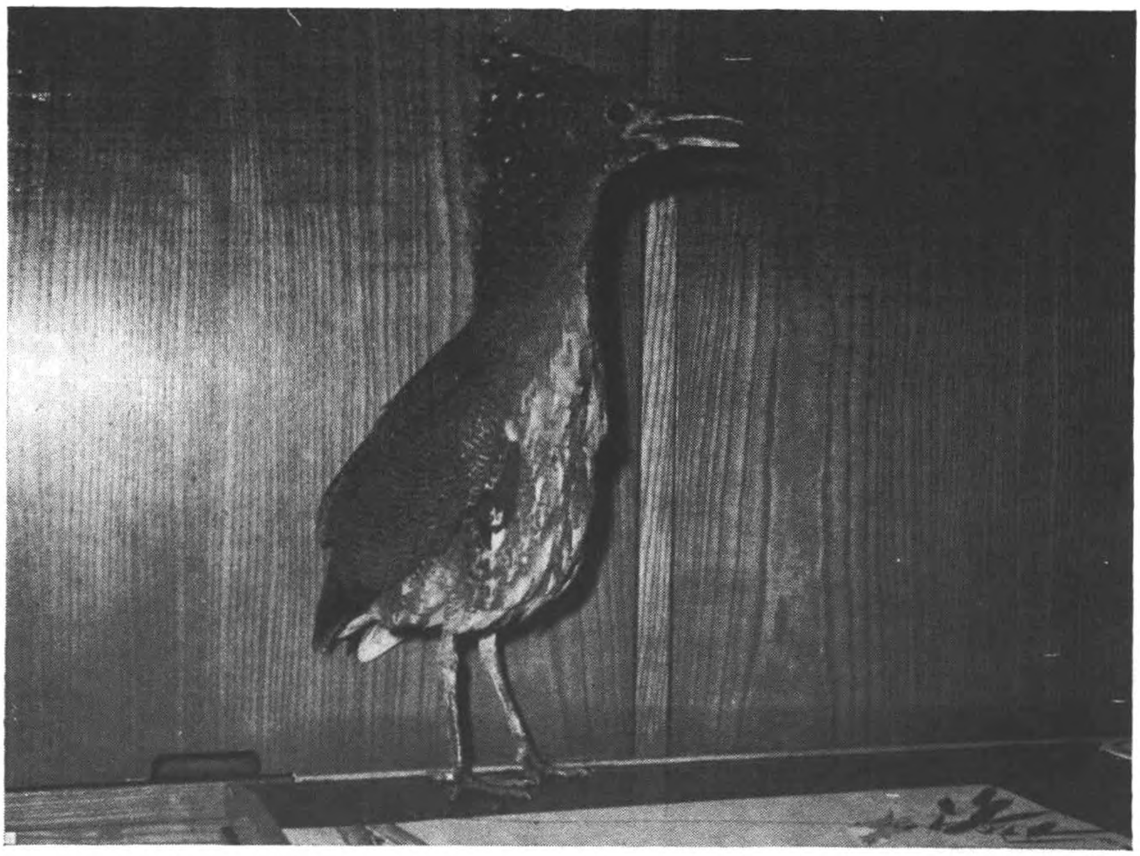
North Pacific Ocean

m.v. *Icenic*. Captain F. G. Boize. Balboa to Suva (Fiji Islands). Observer, the Master.

5 October 1975. At 0013 GMT with a slight sea and wind W'ly, force 4, a series of heavy vibrations were felt for about 90 seconds throughout the vessel. The course was 253° T, speed 15·5 knots and the depth of water shown on the B.A. chart 3318 was 1600 fathoms. No shoal water is shown anywhere in the vicinity and none was shown on the echo-sounding machine which was operated as soon as the vibrations commenced. It was daylight and clear. There were no signs of turbulence, discoloration of the water or any signs that the vessel had struck any marine or other object. Inspection showed that no damage to or marks on the hull could be seen.

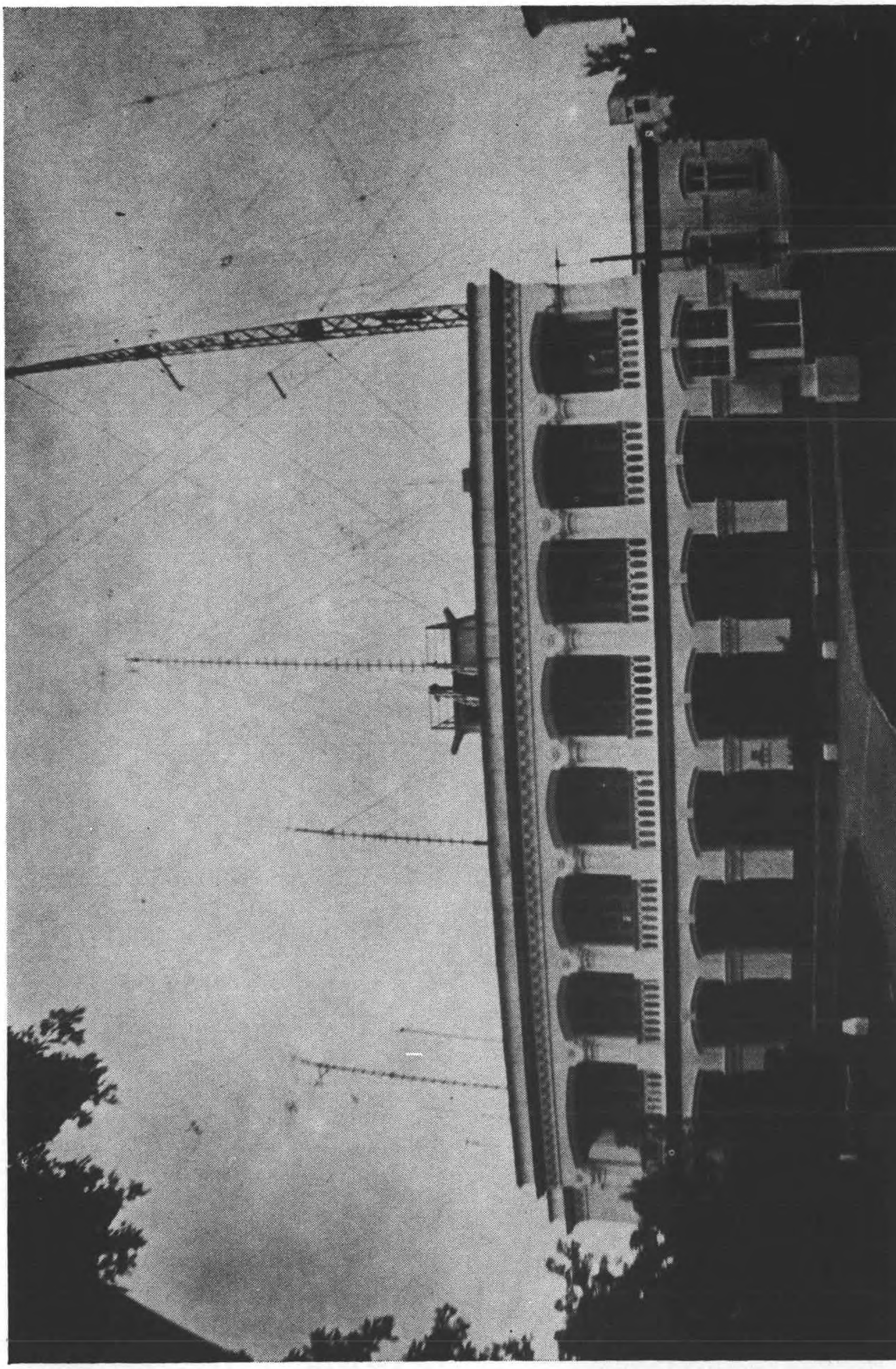
(*Opposite page* 164)

Discoloured water from River Umzimvuba (*see* page 164).



Malayan Night Heron 'Clarence' aboard m.v. *Peisander* (*see* page 168).

(*Opposite page* 165)



Royal Observatory, Hong Kong (*see* p. 32 in January 1976 issue of *The Marine Observer*).

There was no listing of the vessel or any reduction either to speed or the engine revolutions, or any effect on the steering during the period of the vibrations. Soundings of peaks and hold bilges immediately after, and subsequently, showed no significant change. There was no evidence of the vessel having sustained any leaks through strained plating.

It was concluded that the vessel had received a series of shock waves from a violent underwater disturbance, possibly an earthquake. The oscillations of the barograph show similarity to those recorded by a seismograph during an earth tremor.

Position of ship: 06° 30′N, 82° 16′W.

Note. Mr Graham Neilson of the Global Seismology Unit comments:

'At present we have only very inexact data on the earthquake which gave rise to this report. It seems to have been one of a number of shocks in the south of Panama. The NORSAR (Norwegian Seismic Array) time and location for this event is 23 hours, 12 minutes and 18 seconds UT, south of Panama, 4°N, 83°W. M_B = 5·3 (Richter Body Wave Magnitude).'

WHALES

Strait of Gibraltar

m.v. *Summity.* Captain W. G. Hunt. Fowey to Gaeta (Italy), Observers, the Master, Mr A. MacIntyre, Chief Officer and Mr J. Kendall, 2nd Officer.

31 October 1975. At 0900 GMT, 5 n. mile south of Tarifa, 12 whales, in groups of 4, were observed close to the vessel. They were just basking on the surface and did not seem at all perturbed by the vessel passing close to them. A similar number were observed at greater distances from the ship as she passed between Gibraltar and Punta Almina, and at 1330, in position 36° 08′N, 4° 27′W, 44 n. mile east of Gibraltar, about 30–40 whales were sighted about half a n. mile south of the ship. All the whales appeared to be completely black in colour and to have a high backward-curving dorsal fin. Those whose length we were able to estimate appeared to be between two and three metres. The sea temperature was 21·2°C.

Position of ship at 0900: 35° 55′N, 5° 36′W.

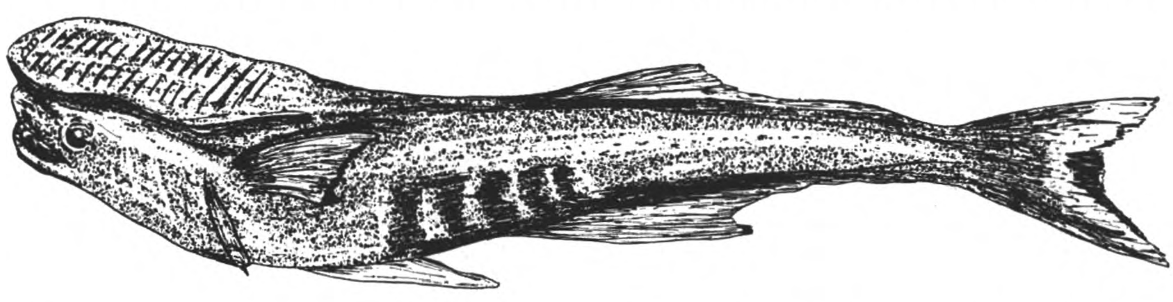
FISH

Persian Gulf

m.v. *Strathnaver.* Captain P. Lay. At anchor at Sitra Roads. Observers, the Master and crew.

The fish shown in the sketch was caught on the morning of 4 December 1975.

It is obviously a pilot-fish of some sort and it surprised us to see so many swimming around the ship (frequently 10–15 were seen swimming together). They were dark-brown in colour, the skin was thick, leathery and slightly slimy to touch, and



they were rather unpleasant in appearance. One noticeable feature (other than the sucker-pad) was a deep groove on the belly of the fish into which the ventral fin retracted. The fish was caught with a single hook and line.

Details of the fish were as follows: length 72 cm, height 9 cm, width 7·5 cm, girth 22 cm and weight 1·4 kg.

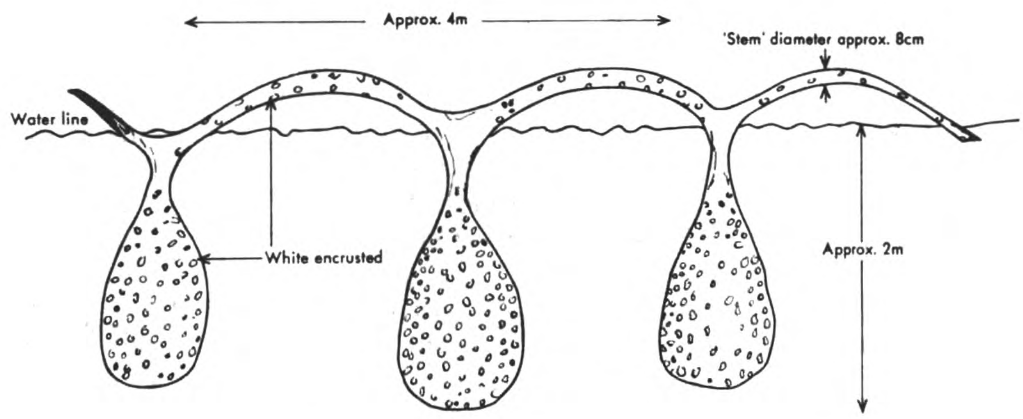
Position of ship: 26° 12'N, 50° 42'E.

MARINE LIFE

South Atlantic Ocean

m.v. *Sugar Refiner*. Captain C. N. L. Davies. Cape Town to London. Observer, Mr L. B. Piper, Chief Officer.

19 December 1975. At 0500 GMT five unusual objects were sighted floating almost totally submerged in the water. They appeared to be large pear-shaped objects hanging from a main branch which was arched 'Loch Ness Monsterwise' such that the loops broke the surface. They appeared either individually or in strings of two or three.



A close examination was not possible, they appeared to be vegetable in origin and were quite heavily encrusted with a white marine-growth which gave them a rather disgusting organic look. The branch ends appeared to be withered and the main body colour was seaweed-brown spotted with a white crustacean-like growth.

The objects were sighted from the bridge wing at a distance of about 15 metres and in full daylight. The sea temperature was 17·8°C. The state of sea was very slight and transparent for several metres downwards.

Whatever the objects were they would undoubtedly have constituted a hazard to small craft. Unfortunately there was no opportunity to stop and examine them more closely.

Position of ship: 25° 36'S, 11° 00'E.

Gulf of Siam

m.v. *Erawan*. Captain J. R. Kidd. Bangkok to Hong Kong. Observer, Mr J. A. Hamilton, Chief Officer.

8 October 1975. At 1000 GMT a sea snake was observed about 18 metres from the ship. It was over one metre long and pale yellow in colour with dark-brown or black bands of equal width over the body.

When it was first observed its head was out of the water. It dived, however, when the ship was almost past it.

'In previous years', the observer comments, 'I have seen many sea snakes of this type and also of a reddish-brown variety in this area, but none of this size'.

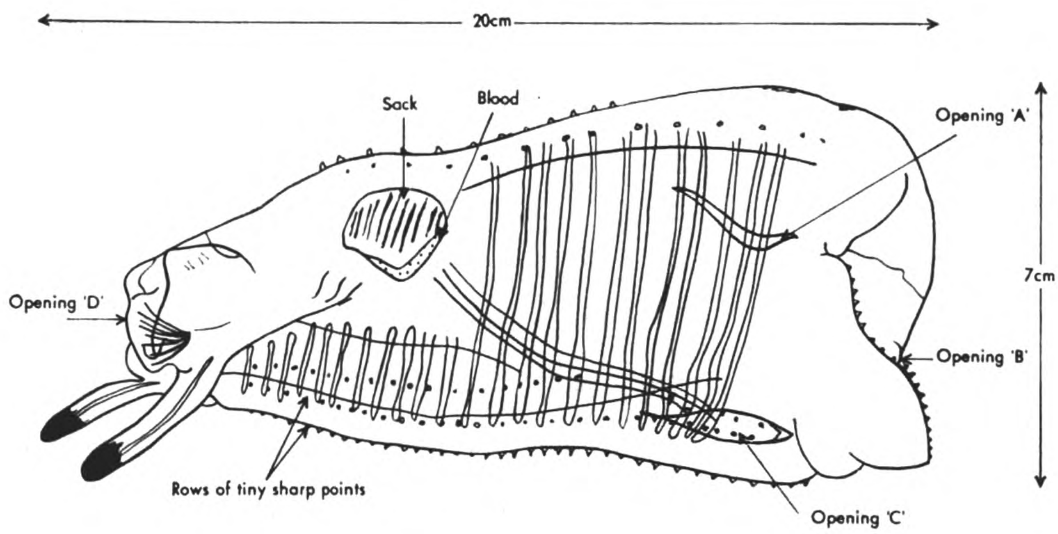
Weather details at time of observation: overcast, wind w'ly, force 2, air temp. 28·0°C, sea temp. 29·2.

Position of ship: 12° 34'N, 101° 32'E.

Tasman Sea

m.v. *British Cygnet.* Captain R. Towell. Kwinana (Western Australia) to Auckland. Observer Mr D. Day, 3rd Officer.

7 October 1975. The sea creature as shown in the sketch was found washed up on deck as the vessel approached the North Cape of New Zealand. The vessel had been shipping seas since leaving the Bass Strait and it was impossible to log a time and position when the creature was landed aboard. The seas, being moderate, may have caused opening 'A' which appeared to be a gash. When the creature was found it was full of air bubbles.



The creature was entirely transparent and jelly-like. It smelt strongly of fish and had two green-tipped feelers and a row of vertebrae which could be felt through its flesh. A sack of brown-coloured matter, together with a pouch of blood, seemed to be joined by a white tube or vein to opening 'C'. Opening 'B', unlike openings 'A', 'C' and 'D', was lined with tiny points.

The creature was sent via the Meteorological Office in Auckland to the Zoological Department of Auckland University for analysis, but since the creature had dried out, shrunk and flattened in a refrigerator, we doubt if much will be learned from the decomposing flesh.

The dimensions in the sketch are approximate since the creature had shrunk before it was measured.

Position of ship at 0000 GMT: 34° 24'S, 172° 18'E.

BIRDS

Indian Ocean

m.v. *Peisander*. Captain L. H. Pound. Suez to Arun, Sumatra. Observers, the Master, Mr K. Campbell, 2nd Officer, Mr Rudrakamur, 3rd Officer and Mr E. Emmett, Radio Officer.

12 November 1975. 'Clarence' (see photograph opposite page 164) joined us 10 n. mile south of the Sri Lanka coast. The bird flew into a bulkhead during the night and was temporarily stunned. Mr E. Henley Smith, Senior Electrical Officer took him under his wing and tried to feed him offering breakfast cereal, raw meat and fish. All these were refused for 3 days although he did take a little water.

With all the signs that he was a land-bird, we kept him on board until we reached Arun 3 days later. Here we launched him and he made straight for the land.

Clarence was reasonably tame in so far as he seemed to like his breast being stroked; he did, however, get his hackles up peacock-fashion when his beak was approached.

He stood about 46 cm in height and had a wing-span of about 90 cm, his beak was about 3 cm long. The feathers were sand-brown in colour with white freckles. What was it?

Approximate position of ship: 6° 00'N, 81° 00'E.

Note. Captain G. S. Tuck, Chairman of the Royal Naval Birdwatching Society, comments: 'The photograph shows an immature Malayan Night Heron to be found in India, the Nicobar Islands and SE Asia. This heron is distinguished by some white bars on a dark "cap". It has a much shorter bill than the bittern and has white tips to its primary flight feathers. Its scientific title is *Gorsachius melanolophus*.'

PRAYING MANTIS

Southern North Atlantic

s.s. *Liverpool Bay*. Captain R. J. Paterson. Southampton to Port Kelang. Observer, Mr D. M. Illingworth, 2nd Officer.

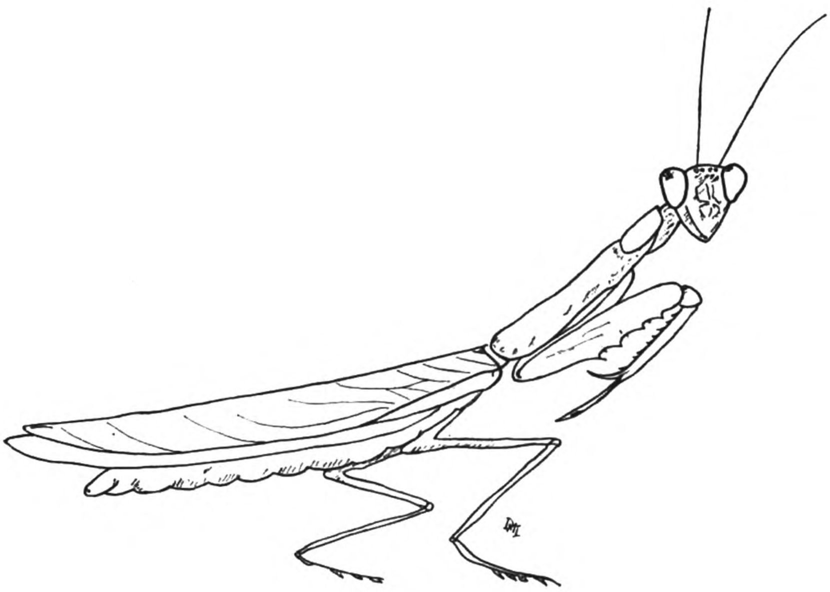
6 November 1975. A praying mantis flew into the wheel-house of the vessel. For the first few days it roamed around the bridge until it finally settled down on the forward end apparently on look-out. We were not sure of the sex of the mantis but we gave it the name 'Mildred'. Mildred soon became popular with the crew and believe it or not she would perch on the shoulders of some crew members.

At first we thought that food might present a problem since live insects were very hard to come by. Mildred, however, seemed quite happy on a diet of milk and raw meat from the galley. Pork proved to be a favourite but fillet steak was refused. Now and again an insect was found and this was eaten with relish.

When we arrived at Port Kelang we tried to persuade Mildred to fly off ashore where she would have a better chance of survival; she refused to leave us however, and when the time came to leave Port Kelang, she was still perched on the wing of the bridge where she had been on our arrival.

In Taiwan there was an abundance of insects which resembled grasshoppers; these kept Mildred going for a few days.

On our way to Japan her under-belly increased in size until she could no longer keep it clear of the 'ground'. As we steamed into more northerly latitudes she was taken below in order to keep her warm.



On 8 December whilst in Japan she excreted a mass of substance resembling pale-green foam. After a short time the substance became hard and Mildred's body returned to its normal size.

We returned to Europe via Panama and on 8 January when we were near the European coast, she excreted a second mass of green substance after another enlargement of the belly.

Mildred completed a second trip to the Far East and on 8 February she produced the green substance once again.

To our sorrow she died on 8 February having circumnavigated the globe one and a half times.

Position of ship at 0600 GMT 6 November: 13° 54′N, 18° 00′W.

Note. Mrs Judith Marshall, Department of Entomology, British Museum (Natural History)—to whom Mildred's body was sent—comments:

'The mantis specimen from the *Liverpool Bay* was *Polyspitola aeruginosa* Goeze, a fairly widespread African species.

'The green foam-like mass produced by the mantis was an oothecae, or egg-mass. Many eggs are contained inside oothecae, protected by the outer coating. It is possible that the mantis was fertilized before boarding the ship, in which case many babies of the species should emerge from each oothecae.

'Mildred obviously lived very contentedly on board ship. The mantis usually requires live insect food, so the crew are to be congratulated on rearing her for so long on a meat diet.'

MOTH

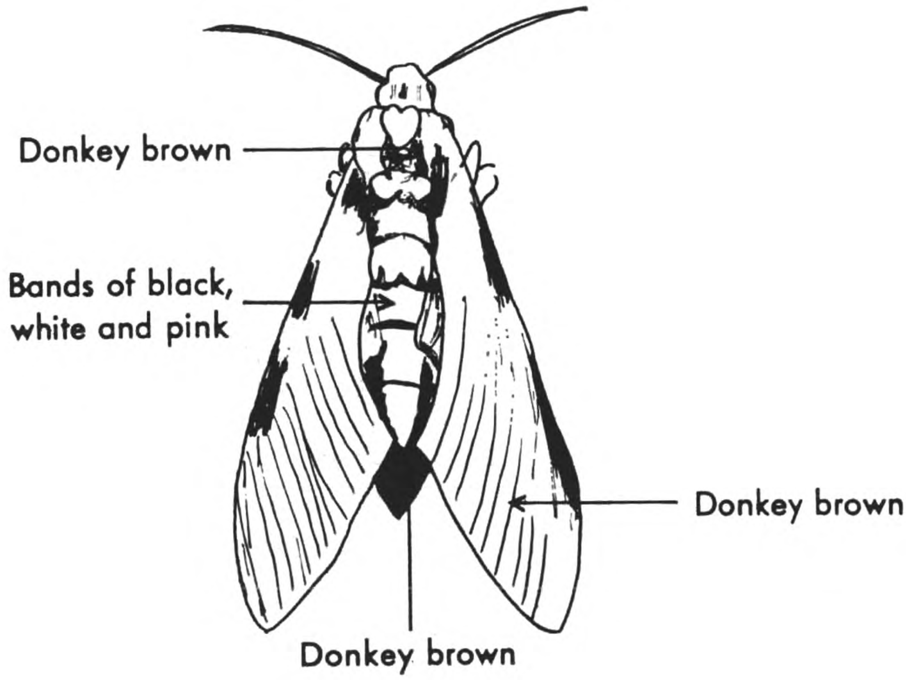
Indian Ocean

s.s. *Kowloon Bay*. Captain C. S. MacKinnon. Port Kelang to Southampton. Observers, the Master and Mr S. T. Houldsworth, 2nd Officer.

16 December 1975. At 0930 GMT the moth shown in the sketch was found on the deck of the vessel. We had left Port Kelang only a few hours earlier and it was assumed it came aboard there.

The specimen has been forwarded for identification.

Position of ship: 05° 35′N, 96° 30′E.



Note. Mr A. H. Hayes of the Department of Entomology, British Museum (Natural History), comments:

'This is identified as a specimen of the Convolvulus hawk-moth, *Agrius convolvuli* Linn of the family of Sphingidae. A migrant to this country, it is a common species throughout the Old World Tropics.'

BUTTERFLIES

Bass Strait

s.s. *Act 1*. Captain C. P. Leighton. Approaches to Port Phillip, Melbourne. Observers, the Master and ship's company.

19 November 1975. At 0930 GMT whilst we were awaiting a Melbourne pilot three n. mile off Point Lonsdale, the sky became 'black' with butterflies and an extremely large number descended upon the ship. The less fortunate were still found to be littered around the decks upon leaving the coast of Australia.

The following is a description of the butterflies: wing-span 6 cm, the back of the wings mainly white with white-spotted black fringe around the outer edge, the underside mainly black with white patches and yellow dots near the body which was off-white in colour.

Some specimens did not have the yellow dots on the underside and it was thought that they were the distinguishing marks of the male or female of the species.

The weather at the time: wind N'ly, force 2, barometer reading 1007·5 mb, dry-bulb temp. 17·6°C, sea temp. 15·0, cloudy.

Position of ship at 0930: 38° 20'S, 144° 35'E.

Note. Mr P. R. Ackery, Department of Entomology, British Museum (Natural History), comments:

'I have now identified the butterflies captured three n. mile off Melbourne. They appear to be specimens of *Anapheis java teutonia Fabricius*, apparently a regular migratory butterfly commonly recorded over much of continental Australia.'

CORPOSANTS AND BIOLUMINESCENCE

Strait of Malacca

s.s. *Kowloon Bay*. Captain C. S. MacKinnon. Southampton to Port Kelang. Observers, the Master and Mr C. D. Grahame, 2nd Officer.

27 November 1975. At 1850 GMT, as the vessel was steaming south-easterly at 25 knots down the Malacca Strait, we passed through numerous patches of bioluminescence. The patches were irregular in shape but all were about 60 cm in diameter and separated from each other by about 4–6 metres. They were observed to flash at regular intervals of half a second. Each patch remained illuminated for about one-quarter to one-third of the interval between flashes. None of the patches seemed to be synchronized with its neighbour. No rotational pattern was observed. The patches were of a white to pale-green colour.

At 1858 corposants were observed on the tips of the VHF, RT and TV aerials. The topmost 10–15 mm of each aerial was glowing with a white to pale-green colour. By this time the bioluminescence had disappeared.

At 1905 the vessel entered a heavy rain shower, and by 1909 the corposants were no longer visible.

The weather details at the time of the observation were as follows: wind ENE, force 2–3, pressure 1009·6 mb, air temp. 24·6°C, wet bulb 22·1, sea temp. 28·5. Sheet lightning was observed in adjacent rain showers, but no thunder was heard.

Position of ship: 04° 52′N, 98° 31′E.

Note. Dr P. J. Herring of the Institute of Oceanographic Sciences comments:

'The regular flashing of separate patches of luminescence is an infrequent occurrence and the asynchronism of adjacent patches implies that they were not all simply stimulated by an outside source (e.g. the ship's engines). The appearance and small size of the patches suggest that marine worms may have been responsible. In relatively shallow waters certain marine worms come up to the surface in mating swarms or pairs. Males and females flash rapidly at each other, often swimming in tight circles around each other at the same time. The observed appearance is very like that described by the *Kowloon Bay*, namely, of regularly (but independently) flashing small patches. The animals usually only appear on the nights of, or just prior to, the new moon (as in this observation) and remain at the surface for only 30–60 minutes. These fireworms, as they are sometimes known, occur in many areas (e.g. Bermuda, Jamaica, California and the Mediterranean Sea) and are abundant in the East Indies.

'The almost simultaneous appearance of St Elmo's fire (or corposants) would have been coincidental, and related to electrical phenomena such as the observed sheet lightning. Corposants are physical phenomena while luminescence of the sea is biological in origin.'

BIOLUMINESCENCE

Southern North Atlantic

m.v. *Clan Macgregor*. Captain T. N. V. Rewell. Ascension Island to Dublin. Observer, Mr I. M. Ward, 3rd Officer.

7 October 1975. At 2200 GMT bright pin-points of light were noticed on the surface of the water when the light from the Aldis lamp was shining on it. Attempts to obtain a specimen in the sea-water bucket were to no avail so the Aldis was directed on to the water again. This time it was noticed that these points of light (yellowish in colour) sometimes moved quite rapidly for a short distance whilst others remained stationary. There was no indication of the presence of bioluminesence while the light was off.

Weather details at the time of the observation were as follows: air temp. 27°C, sea temp. 27·4, wind light variable, cloudless, fine and clear.

Position of ship: 4° 17′N, 16° 24′W.

Note. Dr P. J. Herring of the Institute of Oceanographic Sciences comments:

'I doubt whether this was true bioluminescence, I think it likely that Mr Ward was observing the oceanic "skater", the bug *Halobates.* Its back is white and very reflective and it would quite readily show up at night in the light of the Aldis lamp as a pin-point of light. The animals can move very rapidly over the sea-surface just like the fresh-water pond skater.'

North Atlantic Ocean

m.v. *Sugar Crystal.* Captain D. N. L. Thomson. Fremantle to Immingham. Observer, Mr D. Buck, 2nd Officer.

11 October 1975. At 0400 GMT the vessel entered an area of considerable bioluminescence consisting of green flashes. The visibility had improved to 10 n. mile a little earlier having been moderate during the previous few days, the horizon was noticeably lighter also.

When the Aldis lamp was directed on to the sea surface, small red lights were observed with an occasional green or white flash.

Position of ship at 0600: 22° 48'N, 17° 42'W.

Note. Dr P. J. Herring of the Institute of Oceanographic Sciences comments:

'These observations could have been caused by lantern-fish at the surface. These fishes can flash quite brightly, and reflections from their eyes in the light of the Aldis lamp might provide the "small red lights" which were observed. Small luminous squid could produce a similar appearance.'

Arabian Sea

s.s. *Bencruachan.* Captain O. Tucker. Colombo to Suez. Observers, Mr I. Steele, 1st Officer and Mr A. Simpson, Cadet.

11 November 1975. At 0130 GMT whilst rounding Cape Guardafui extremely bright bioluminescence was observed.

The vessel had earlier been experiencing a strong NW'ly current, which, after passing the Cape, was lost. The sea temperature also fell within a period of half an hour from 27·8°C to 23·9. It was at this point that bioluminescence was observed.

The light from the Aldis lamp was directed on to the sea, but without effect. There was a strong smell of fish and it was noted that clutter-echoes on the radar screen appeared to increase.

Position of ship at 0000 GMT: 11° 45'N, 51° 36'E.

Note. Dr P. J. Herring of the Institute of Oceanographic Sciences comments:

'This report probably describes dinoflagellate luminescence. The denser patches of these organisms are often associated with a "fishy" smell as described.'

ABNORMAL REFRACTION

South Pacific Ocean

m.v. *Illyric.* Captain J. Richmond. Balboa to New Zealand. Observers, the Master, Mr W. Downing, Chief Officer, Mr R. Jones and Mr R. C. Corbett, 3rd Officers and Mr R. Bush, Cadet.

6 November 1975. At 0240 GMT two moons were observed at an altitude of 12° 30'. The lower moon was lying on its back and there was an exact replica of

this moon above it. The distance between the two moons was approximately the semi-diameter of a full moon.

At first the observers thought they might be suffering from double vision and most of those who were looking on were of the same opinion. It was noticed that by moving the head from side to side in a negative manner, the higher of the two moons swung to and fro in a pendulum-like action.

Definite colours of red, blue and green were observed (see Figure 1). It was also found that the separation distance of the two moons could be increased or decreased by moving the hand across the face or by bringing down the eye level of the observer so that the moon 'sat' on the edge of the superstructure; no sooner was this done however, than the moon appeared to jump away from the object.

This phenomenon could not be observed through binoculars or a telescope, it was, however, seen through 'Polaroid' sunglasses. The phenomenon was also observed, though to a lesser degree, on the next five nights.

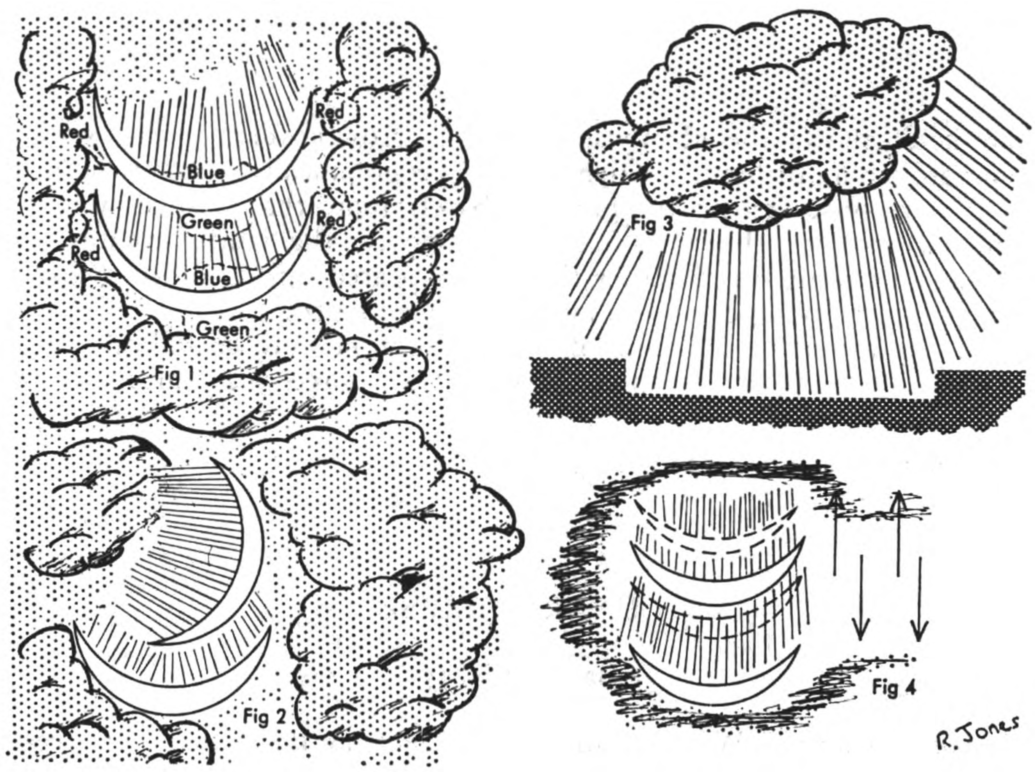


Figure 1. Shows general appearance.

Figure 2. When head turned to right and moon observed from corner of eye. This was reversed when head turned to left.

Figure 3. Shows step in horizon when moon behind cloud.

Figure 4. Shows vertical movement when object brought to just under eye level.

We observed the phenomenon for a period of one hour, until cloud made further observation impossible. This was disappointing because it was thought it might become more interesting as the moon neared the horizon.

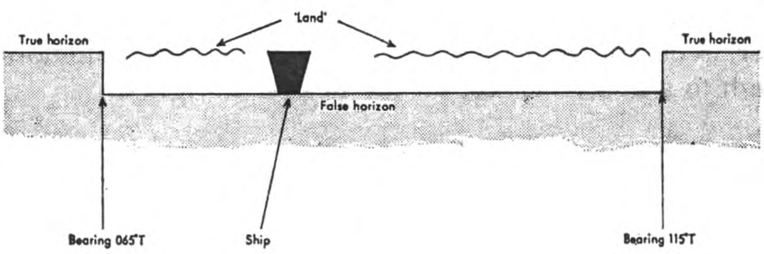
The weather conditions were as follows: air temp. 22·0°C, wet bulb 20·5, sea temp. 22·6, barometer reading 1016·7 mb, wind ESE, force 3 and 7 oktas of cloud.

Position of ship: 14° 55'S, 110° 15'W.

New Zealand waters

m.v. *Illyric*. Captain J. Richmond. At anchor in Pegasus Bay. Observers, Mr M. Scanlan, 2nd Officer, Mr R. Jones, 3rd Officer and Mr N. S. Henderson, Cadet.

25 November 1975. At 2305 GMT a mirage effect was observed for about 15 minutes within an arc of approximately 50° (065°T to 115°T) of the horizon. During the period of observation a ship was observed on the radar screen bearing 082°T and at a distance of 19·8 n. mile.



As the sketch shows, the effect was of a false horizon lower than the existing one. Two separate sights of 'land' (which did not geographically exist in the direction indicated) were observed on the horizon, barely more than a shadow across the top of the false horizon. The ship was sighted between the 'land' formations. It was not possible to distinguish whether the ship appeared upside-down owing to the shimmering and rippling effect the false horizon produced.

Weather conditions at the time of the observation were as follows: air temp. 18·6°C, wet bulb 14·6, sea temp. 15·6, wind NNE, force 3–4, barometer reading 996·5 mb.

Position of ship: 43° 22·5′S, 173° 02·5′E.

LUNAR ECLIPSE

Bay of Biscay

m.v. *Summity*. Captain W. G. Hunt. Casablanca to Bordeaux. Observers, the Master, Mr A. MacIntyre, Chief Officer and Mr J. Kendall, 2nd Officer.

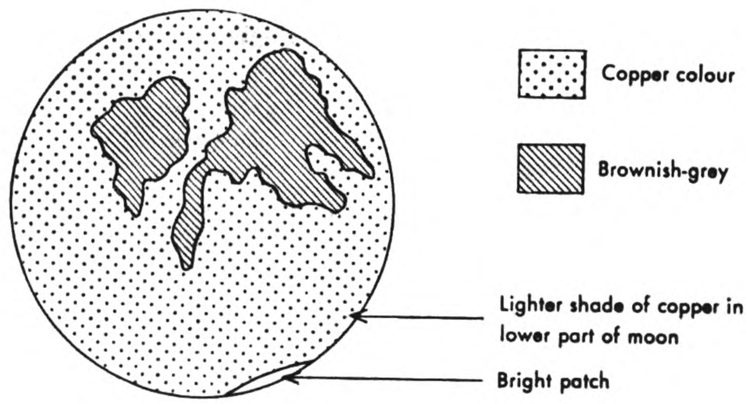
18 November 1975. At 2035 GMT a dark shadow was observed on the left side of the moon and on checking in the *Nautical Almanac* it was found that a total eclipse of the moon was just commencing. The whole eclipse was observed under perfect conditions with hardly any cloud to obscure it. The last of the earth's shadow finally cleared the moon at 0009 on the 19th.

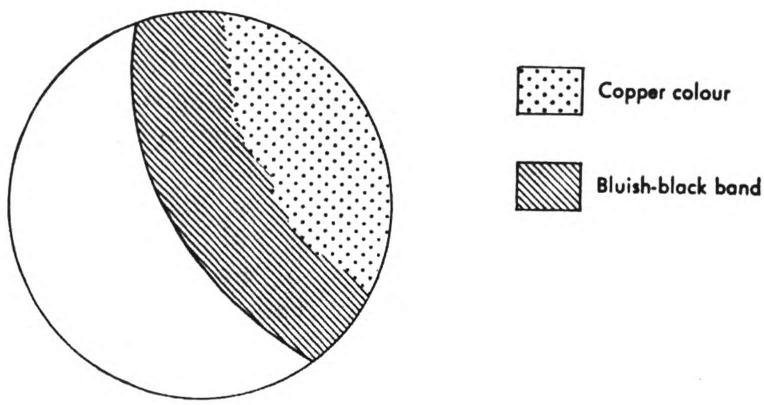
It was not quite a total eclipse as at the time of maximum obscurity at 2240, a small arc of the lower limb was still showing some brightness.

The eclipsed part of the moon was a reddish-brown or copper colour and was perfectly visible with the markings showing a darker shade of brown (see sketch). After totality, as more of the moon began to show, there seemed to be a broad bluish-black band between the bright part of the moon and the copper-coloured part, and from 2300 to 2330 there was a 5° halo around the moon. During the eclipse the surrounding stars and planets seemed to be very bright and the copper-coloured part of the moon seemed about half as bright as Aldebaran.

Position of ship at 2240: 46° 03′N, 4° 56′W.

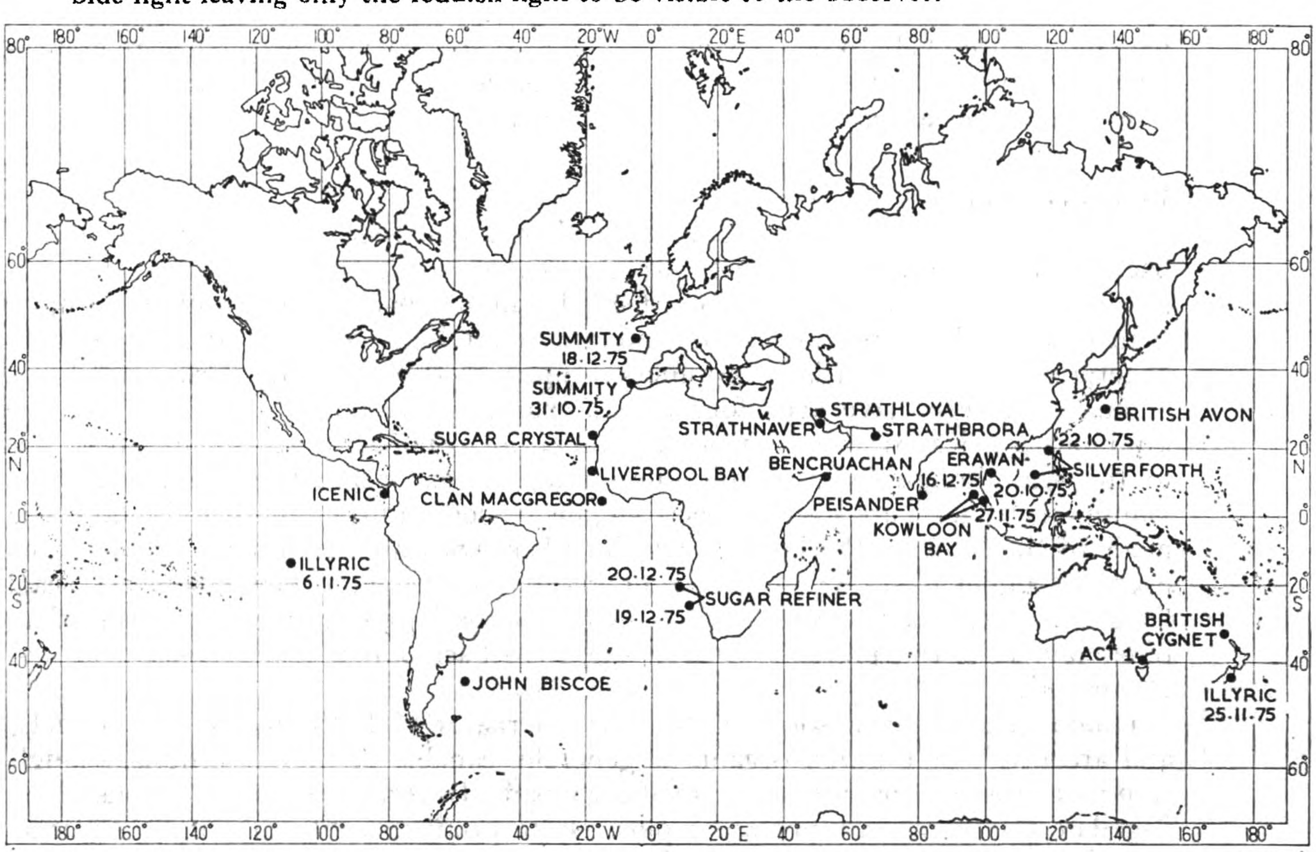
AT TOTALITY





AFTER TOTALITY

Note. The reddish-brown or copper colouring described above is caused by the refraction of the sun's rays into the shadow by the atmosphere of the earth. Those rays which are most strongly refracted have passed through a large mass of air and, in consequence, have lost their blue light leaving only the reddish light to be visible to the observer.



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

535.37:577.413

Observations of Bioluminescence at Sea

By Peter J. Herring
(Institute of Oceanographic Sciences.)

The emission of light by living organisms is known as bioluminescence. Although the best-known examples are probably the luminous beetles, which include both the glow-worms of temperate regions and the fire-flies of warmer climes, the phenomenon is nevertheless most widespread amongst marine organisms. Most reports of marine bioluminescence refer not to individual organisms but to areas of luminescence. The various observed phenomena included under the general heading of bioluminescence, or phosphorescence, of the sea are attributable to the luminescence of marine organisms in response to a variety of stimuli. Reports of bioluminescence have for many years been sent in by observers of the Voluntary Observing Fleet (VOF) and provide an unrivalled fund of information on the often puzzling nature of these displays. Marine biologists receiving these reports are involved in the detective work of identifying the causative organisms, the clues to which lie in the eye-witness accounts.

The appearance of marine bioluminescence may take a variety of forms, and Mr R. J. Turner (1966) did both seafarers and biologists a signal service when he collated the large number of reports from the VOF into a few main categories. I have reproduced his classification in Table 1, with only minor changes. This work was complemented by a parallel but independent report by R. F. Staples (1966), of the US Naval Hydrographic Office, on the seasonal distribution and characteristics of surface bioluminescence in different regions of the oceans. In the subsequent decade there have been few real advances in our knowledge of most of the observed phenomena classified in the table, despite the continuous flow of reports from sea-going observers. However, considerably more is now known about the luminescent capabilities of many of the organisms concerned, and some account of those most frequently to be seen may assist observers in recognizing which ones are likely to be responsible in at least some of the cases. Most references which are included are to reports in *The Marine Observer* from particular vessels, other references appear at the end of the account.

Luminous plants

Luminous fungi are known on land but there are no marine examples. Luminous bacteria on the other hand are known only from marine or other highly saline environments (e.g. decaying meat and fish). Luminous bacteria are minute, no more than 0·005 millimetres in length, and they emit light continuously. Bacteria in general do not occur in large numbers in open ocean waters. High concentrations of mixed bacteria have been found in the surface film, but it is unlikely that the luminous species are ever sufficiently numerous to impart a general luminescence to the sea, though 'white-water' luminescence has been attributed to bacteria. Luminous bacteria are kept in special organs by certain fishes and squids and use is made of the light by the host animal. The best-known examples are probably the deep-sea angler fishes whose lures contain luminous bacteria. Many tropical coastal fishes have bacterial luminous organs, including the Japanese knight fish, Australian pine-cone fish, the pony fishes and the Indo-Pacific reef fishes *Anomalops* and *Photoblepharon*.

Dinoflagellates have some of the characteristics of both plants and animals, and are tiny single-celled organisms generally capable of photosynthesis, though some are able to consume other small organisms. In certain water conditions dinoflagellate numbers may increase explosively to produce a 'bloom' with concentrations in excess of 10 000 cells per millilitre. Blooms such as these may discolour the water and are responsible for the 'red tides' in some coastal regions. Where such blooms are composed of luminous species spectacular displays may be observed. Bahia Fosforescente in Puerto Rico, and Falmouth Harbour in Jamaica, are among the best known localities. Dinoflagellate concentrations are undoubtedly responsible for many, probably most, widespread displays of luminescence observed in the open ocean. Although they are particularly common in tropical waters dinoflagellate blooms also occur in temperate regions. One particular type, *Noctiluca*, is a common cause of surface luminescence in waters as far apart as Britain and Japan. It is one of the larger dinoflagellates, up to 0·5 millimetres in diameter, and is almost colourless, looking to the naked eye very like a tiny fish-egg (e.g. m.v. *Essex*, **38**, 1968, p. 13; s.s. *Titan*, **45**, 1975, pp. 159–60). Indeed it is often described as 'fish spawn'. Dinoflagellate blooms often occur mingled with other microscopic plants (or phytoplankton) and in such conditions of dense plant growth the water often has a characteristic 'fishy' smell. The luminescence of dinoflagellates is usually in the form of short flashes when the organisms are agitated, but at any distance the appearance is of a uniform diffuse light in the water. It is these organisms whose light so often outlines the path of a school of fish (m.v. *Clan Macdougall*, **39**, 1969, p. 13) and even airborne flying fish (s.s. *Titan*, **45**, 1975, p. 159). In wartime their light has given many a vessel valuable warning of approaching torpedoes, though they were also often confused with dolphin trails. Fishermen have long used the luminescence caused by schools of fish as an aid to their detection and capture, and attempts are now being made to do this on a wider scale by using spotter planes equipped with image-intensifier systems, to assess the size and nature of fish shoals by their luminous 'footprints'. Dinoflagellate luminescence is inhibited by exposure of the organisms to light, and some types show precise daily rhythms of luminescence when grown in the laboratory.

Marine animals

Bloom conditions provide copious plant food for many small herbivorous marine animals, and their accumulation in turn attracts larger predators such as fishes and squid. Thus areas of dinoflagellate luminescence usually also contain a variety of marine animals, both small and large, many of which migrate up into the surface waters at night to feed. Of the small crustaceans the copepod, ostracods and euphausiid shrimps are usually particularly abundant. Copepods may grow to 5 millimetres or so in length and usually bear a pair of long antennae extended at right angles to the body. Ostracods are generally not more than 2–3 millimetres in length and have most of the body enclosed in a bivalved shell. Both groups contain many species capable of bright luminescence. When disturbed the animals squirt a luminous fluid into the water around them. One particularly common luminous copepod, *Metridia*, has been identified as the cause of luminous displays in regions as far apart as the Orkneys and the Aleutians. Ostracods come to the surface at night in vast numbers at certain seasons in regions of the Indian Ocean and Indo-Pacific, and their luminescence may illuminate the whole sea (Tett & Kelly, 1973). Luminous material lingering after the animals have departed may account for some reports of 'milky water'. Their luminescence may be stimulated by torchlight or an Aldis lamp, and it is possible to 'write on the water' with a beam of light in regions where these animals are abundant. Luminous ostracods caught in large numbers and then dried were distributed to Japanese soldiers in World War II. When a few of the animals were moistened in the palm of the hand they luminesced steadily, providing a light bright enough to read a map or compass but too dim to be seen from a distance.

Euphausiid shrimps (the 'krill' of Antarctic waters) may occur in dense swarms at the surface at night. Unlike the small ostracods and copepods they do not squirt luminous material into the sea but emit light either steadily or as flashes from special luminous organs on their underside. In certain circumstances they too may be stimulated by a light beam. They are active animals and difficult to capture, but have occasionally been taken by ships on passage (m.v. *Empire Star*, **37**, 1967, p. 172). Swarms at the surface at night may be thick enough to clog sea-water intakes, and impart a general luminescence to the sea. These displays have been seen in many waters including the Faeroes Straits, Mediterranean Sea and South Pacific. Commercial attempts are now being made to harvest the vast shoals of krill in the Antarctic and use will probably be made of their luminescence to assist in the recognition of the shoals at night.

Some of the decapod prawns are also able to pour a luminous fluid into the sea. Most luminous prawns are deep-water species and rarely seen at the surface. However, in both oceanic and coastal regions of the Indo-Pacific there is a small (5–15 millimetres) prawn (*Thalassocaris*) which, when suddenly illuminated at night, squirts out of a puff of luminescence, and may be responsible for some reports of light-stimulated luminescence.

The coelenterates are probably the most often observed luminous animals. This group includes jelly-fish, comb-jellies (ctenophores) and siphonophores as well as the sedentary corals and sea anemones. A great many jelly-fish, comb-jellies and siphonophores become brightly luminous when disturbed. Thus the mechanical disturbance caused by the bow-wave, normal turbulence or contact with another animal may trigger off a bright flash or flashes from any of these animals. Many luminous cœlenterates are large animals (some of the luminous jelly-fish reach at least 25 centimetres in diameter) and are capable of producing very bright flashes. Indeed the flashes of some comb-jellies are among the brightest of any that have yet been measured. The transparency of many species renders them particularly difficult to identify, but without doubt many of the most brilliant individual flashes, 'blobs' and 'balls' seen by seafarers are produced by jelly-fish. Characteristic of many siphonophores and comb-jellies is their tendency to shatter into a myriad pieces when suddenly struck by a bow wave or propeller—with a simultaneous spectacular firework display. The comb-jelly *Pleurobrachia* (sea-gooseberry) has been identified in luminous displays in the Skaggerak, and great swarms of the luminous jelly-fish *Pelagia* sometimes occur in the western Mediterranean and north-eastern Atlantic. This latter species not only flashes brilliantly but also produces large quantities of luminous slime.

The marine worms include a number of bottom-living luminous species but relatively few are to be seen at the surface. Nevertheless a few come to the surface in breeding swarms to produce some most spectacular displays. The animals may either flash brilliantly in pairs or secrete a luminous fluid into the water as they swim about, creating an effect akin to skywriting in greenish fire on the sea surface. These swarms are usually linked to a precise lunar rhythm, and are restricted to relatively shallow water. Among the best-known displays are those of the Bermudan fire-worm, but they also occur in many other coastal waters including those of Vancouver, Jamaica and the East Indies.

There are many luminous salps, relatives of the sedentary sea-squirts, but the most widely observed one is the colonial species *Pyrosoma*. It is a hollow cylindrical colony whose walls are made up of the individuals. It occasionally occurs in vast numbers at the surface of the Atlantic, Indian and Pacific Oceans and though the colonies may be of almost any size (up to 10 metres in some tropical species) they are most often observed from 5 to 25 centimetres in length and 2–5 centimetres in diameter. At night they appear as white cigar-shaped objects in the light of an Aldis lamp (m.v. *Crystal Sapphire*, **38**, 1968, p. 180; m.v. *Sagamore*, **35**, 1965, p. 120). When a colony is touched, a wave of light spreads over its entire length, and in the laboratory a colony will readily 'answer' a torch flash with a slow (5–10 second) pulse of luminescence. Indeed the light from one colony will cause an adjacent one to respond, and perhaps these animals produce some of the observed light-stimulated responses. Their visible response to a blow from the propeller is often akin to an underwater fire-bomb. One report describing millions at the surface notes that the 'sea surface appeared as if fireworks were going off' (Staples, 1966, p. 16).

The squids have some of the most elaborate sets of luminous organs of any animals, but most luminous species are denizens of the deep and are not seen at the sea surface. However, one family of squids in particular is commonly attracted to ships' lights at night and includes several luminous species, commonest in warmer waters. Several of these have a large yellowish luminous patch on their backs which is sometimes seen to flash very brightly. These spectacular red-brown animals are easily identified in the lights when close to the ship's side, but are hard to recognize at a distance. Some luminous species grow very large, certainly up to 3 metres in length in South American waters, but those usually seen at night, often in shoals, are generally much smaller, from about 10 centimetres to perhaps 1 metre (m.v. *Australia Star*, **34**, 1964, p. 14). Madeiran fishermen use the luminous tissue from squid of this type as luminous bait on the hooks of their deep long-lines. A much smaller squid, the fire-fly squid *Watasenia*, is found in large numbers in restricted localities around Japan, and may also produce an impressive luminous display in these areas.

Only the fishes can match the squids in the diversity and elaboration of their luminous tissues, but again most luminous species are deep-sea animals, rarely, if ever, occurring at the surface. Of those that do migrate upwards into the surface waters at night the most abundant and ubiquitous are the lantern-fishes (or myctophid fishes), species of which occur in all the world's oceans. These animals have lines of small luminous organs along their undersides, and often also have additional larger patches of luminous tissue, particularly near the base of the tail. These latter organs produce very fast flashes of brilliant blue light, and their activity may be stimulated by another light. Beebe (1926) describes one such animal in an aquarium tank which flashed when presented with the luminous dial of his watch! Lantern-fishes are generally rather small (usually not more than about 15 centimetres long) dark in colour, and difficult to distinguish in the water. What is often noticed when a beam of light is directed on them is the shine from their eyes, which have silvery reflectors and shine like those of a cat (m.v. *Sunprincess*, **33**, 1963, p. 186; s.s. *Mobil Enterprise*, **36**, 1966, p. 180). Many reports of apparent luminescence probably arise from eye-shine of this type, often reddish in colour (H.M.S. *Owen*, **34**, 1964, p. 122). Other deeper-water species occasionally come close to the surface particularly in higher latitudes, but will be seen only rarely. They too bear serried rows of luminous organs along their flanks and bellies, and often have a particularly large organ beneath each eye. In the tropical coastal regions, particularly in the Indo-Pacific, many fishes have bacterial luminous organs. Among the most spectacular of these are the reef fishes *Anomalops* and *Photoblepharon*, whose lights are easily seen as they cruise over the reefs at night. The fishermen in some Indonesian islands use the luminous organs of these fishes as bait in a manner closely analogous to that of their Madeiran counterparts.

These then are some of the organisms most likely to be encountered. In observations of luminescence from a moving ship, with the observer often a considerable distance from the water, it is inevitably difficult and often impossible to identify the organism responsible with any certainty. In these circumstances the more information that is available about the characteristics of the luminescence the more chance there is of a reasonable subsequent attempt at identification. The prime features of the luminescence to be noted are the physical appearance, the 'behaviour' and any responses.

The physical appearance includes the brightness, colour and extent of the luminescence. Unfortunately both brightness and colour are rather subjective characteristics. Apparent brightness is very dependent upon the degree of dark adaptation of the observer, and the human eye cannot accurately distinguish colour differences at the low intensities characteristic of much luminescence. Most marine bioluminescence is blue, blue-green or green, whereas fire-flies have a much yellower light. There are many reports of other colours, including orange and red. So far only three rare, deep-water fishes are known to be able to emit red bioluminescence. Reports of red bioluminescence at the surface are therefore particularly puzzling (m.v. *Weybridge*, **34**, 1964, p. 123; m.v. *Ronsard*, **41**, 1971, p. 168). Many such reports can be ascribed to reddish reflections from the eyes of lantern-fishes or other animals (m.v. *Diomed*, **34**, 1964, p. 178), but not all are so easily explained. The extent of the luminescence should include whether it occurs uniformly or in patches, and whether any such patches are randomly distributed or more regular. Very often regularly arranged streaks of luminescence are seen, probably formed by the accumulation of luminous organisms into windrows. If possible an estimate of the depth of flashes or 'balls' and 'blobs' of luminescence should be given. In the case of flashes how quick are they; are they regular or random; are they moving? Do the patches of luminescence move, pulsate or circle; if so, how fast? The most dramatic phenomena are often the moving patches, either in the form of 'phosphorescent wheels', waves of light, or erupting 'balls' of light coming up to the surface. The most generally accepted explanation for this type of phenomenon is that shock waves from a submarine earthquake are responsible. 'Phosphorescent wheels' are usually observed in relatively shallow water and their patterns can be explained as the interference patterns produced by multiple reflections of the shock waves from the surface and the bottom. Erupting balls of fire are only observed over relatively deep water where no such reflections are likely (Kalle, 1960).

An extension of the 'behaviour' of the luminescence is its response to other stimuli, either natural or artificial. There are reports of luminescence stimulated by rainfall (m.v. *Trevince*, **30**, 1960, p. 64), by lightning (m.v. *Kweichow*, **42**, 1972, p. 112), by the pulsation of a ship's engines (m.v. *Malaita*, **31**, 1961, p. 184) and by the repetitive firing of a seismic research gun (R.R.S. *Discovery*, **37**, 1967, p. 114). Other accounts describe the great luminous displays produced in coastal waters by earthquakes (Staples, 1966). There are occasional, very puzzling, reports of radar-induced luminescence (m.v. *British Premier*, **22**, 1952, p. 190) though more often the radar appears to have no effect. In recent years, particularly following reports in *The Marine Observer*, a number of experiments on the responses of luminescence to an Aldis lamp have been reported. Luminescence may be stimulated by a lamp, or it may be inhibited (m.v. *Derbyshire*, **40**, 1970, pp. 171–72). Dr R. H. Kay, in comments on some reports of luminescence, outlined the sorts of observations which would be particularly interesting if time and opportunity allowed (s.s. *Caltex Glasgow*, **35**, 1965, p. 15). Such responses can be confusing. If the response is visible only when the Aldis lamp is on, it is probably a reflection, not a true luminescence. Similarly many non-luminous silvery animals (including the little bug *Halobates*, the ocean strider) may appear as flashes in the beam of an Aldis lamp and give a very erroneous impression. Some animals, such as squid, are often attracted to a light, whereas others may flee from it. m.v. *Sugar Producer* (**39**, 1969, p. 110) reported chasing luminous sources with the beam. If the response to illumination is long-lasting (more than 10–15 seconds) it is probably a luminous secretion poured into the water by one of the crustaceans which respond in this way. A slow flash (several seconds) is more characteristic of *Pyrosoma*, whereas rapid flashes (less than 1–2 seconds) suggest fish or squid (m.t. *Stella Leonis*, **36**, 1966, p. 123). Any observations of this sort made from a stationary vessel are often even more informative than those from one under way.

The only incontrovertible identification of the luminous organism is provided by its capture. This is obviously impracticable in most instances though cases are known of dinoflagellates, ostracods (m.v. *British Consul*, **31**, 1961, p. 65; s.s. *Esso Cambridge*, **32**, 1962, p. 119), copepods and euphausiids taken in buckets or washed aboard, and even of fire-flies flying aboard (m.v. *Nottingham*, **36**, 1966, p. 60). Dinoflagellates may be readily identified by their luminous characteristics in bucket samples. Sea-water containing luminous dinoflagellates will give a multitude of tiny sparks of light if stirred or agitated. This is best seen in a darkened wheel-house

(*Opposite page* 180)

The presentation of a barograph to Captain J. M. Burn; left to right: Captain A. Britain, Captain J. M. Burn, Dr B. J. Mason and Mr F. C. Murphy (*see* page 190).

(*Opposite page* 181)

Exterior view

Interior view

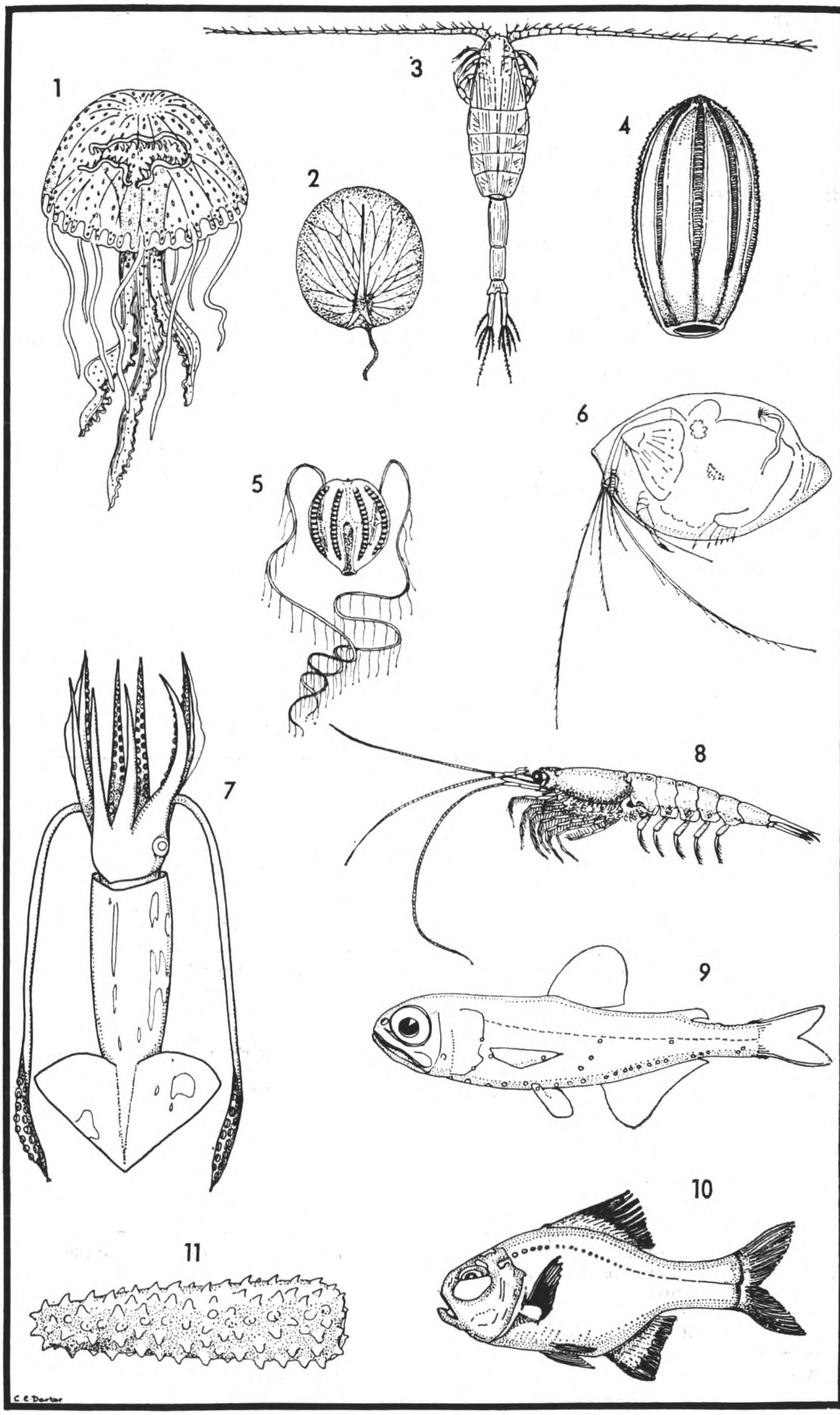
THE NEW PORT METEOROLOGICAL OFFICE, TYNE (*see* page 198).

after the sample has been allowed to stand for at least several minutes to allow the organisms to recover from the shock of capture (s.s. *Titan*, 45, 1975, p. 159). In normal lighting the larger dinoflagellates such as *Noctiluca* may sometimes be seen as tiny colourless spherules suspended in the water or floating at the surface. Many species are too small to recognize in this way, and if possible a sample of the sea-water should be preserved with formalin (formaldehyde) to enable an expert to identify the organisms later. Ships passing through dense concentrations of luminous dinoflagellates will inevitably take them into the ship's sea-water supplies, where they may produce spectacular if unexpected displays in such unlikely situations as the toilets (s.s. *Titan*, 45, 1975, p. 159). In areas of concentrated luminescence the examination (and if possible preservation) of samples from the filters in sea-water intakes may also prove rewarding. Dense swarms of euphausiids or jelly-fish may sometimes be identified in this way.

In addition to the observations of the luminescence any ancillary information may also be relevant. Changes in water temperature may be associated with luminescent areas; phytoplankton blooms are often associated with particular smells, and sometimes with an 'oiliness' of the water. No matter how trivial the detail may appear to be, anything that can add to the observation is always greatly appreciated. The effort of the Voluntary Observing Fleet provides observers in the right places at the right times more often than could be achieved by any other means.

Table 1. Classification of marine bioluminescent phenomena (after Turner 1966)

Site	Organisms	Stimulus	Appearance
1. Sea	Bacteria (?)	None	'White water'
	Dinoflagellates Copepods Ostracods Euphausiids Prawns Worms etc.	1. Mechanical	1. Apparently constant illumination a) Extended bands b) Blooms over large areas c) Limited patches
			2. Flashing patches
			3. Fluctuating patches
			4. Disturbed-water luminescence
		2. Seismic	1. Erupting luminescence
			2. Phosphorescent wheels
		3. Photic	Light-stimulated luminescence
		4. Miscellaneous	Travelling luminescence
	Jelly-fish Ctenophores Pyrosoma Fish Squid etc.		Luminescence of larger animals
2. Air			Aerial luminescence


1
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11
C. E. Dexter

The following examples of some luminous marine organisms which are mentioned in the text, are illustrated on the page opposite.

1. The jelly-fish *Pelagia* (7 cm diamter).
2. The dinoflagellate *Noctiluca* (0·5 mm).
3. The copepod *Metridia* (4 mm).
4. The comb-jelly or ctenophore *Beroe* (3 cm diameter).
5. The comb-jelly *Pleurobrachia* (1–2 cm diameter).
6. The ostracod *Cypridina* (2 mm).
7. The squid *Ommastrephes* (up to 1 m in length).
8. The euphausiid shrimp *Meganyctiphanes* (3 cm).
9. The lantern-fish *Myctophum* (10 cm).
10. The reef fish *Photoblepharon* (the large white patch beneath each eye is its bacterial luminous organ).
11. A colony of the tunicate *Pyrosoma* (10 cm).

ILLUSTRATIONS

Prepared by Mrs C. E. Darter.

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Thermals over the Sea and Gull Flight Behaviour

By Alfred H. Woodcock

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Abstract. The flight performance of Herring-Gulls relative to specific atmosphere and ocean conditions over the western North Atlantic indicates that large groups of gulls are able, through co-operative flight manœuvres, to induce ascending convective flow (thermals) in which they make extended soaring flights. These group-flights in gull-induced thermals are limited to winds of 0 to ≈ 1 m s^{-1} and to sea-minus-air temperature differences (ΔT) of ≈ 3 to 6°c.

As wind speed increases from ≈ 2 to 5 m s^{-1}, thermals are naturally induced, and the minimum ΔT required for soaring is inversely related to wind speed. At higher winds (≈ 5 to 13 m s^{-1}), the minimum positive ΔT and minimum wind speed required for thermal soaring are directly related, thus indicating an apparent maximum efficiency for the natural production of thermals at wind speeds of about 5 m s^{-1} and ΔT of 1 to 2°c.

Introduction

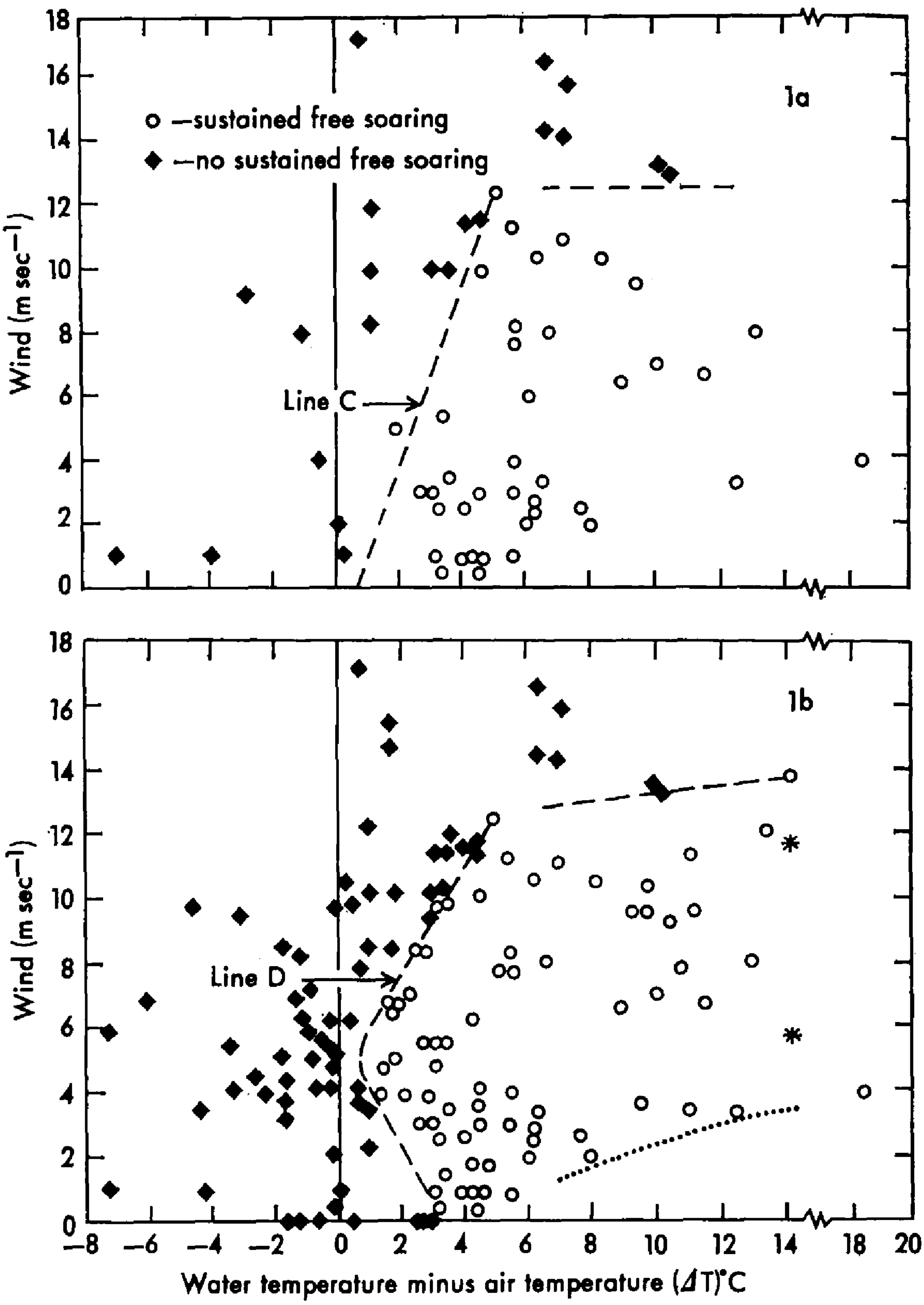
Thirty-five years ago I published observations on the flight behaviour of Herring-Gulls (*Larus argentatus*) at sea over the western North Atlantic (Woodcock, 1940) from the USA east coast north of Cape Hatteras to 65°w. Differences in gull flight behaviour were shown to be associated with certain wind-speed and sea–air temperature conditions, suggesting the presence of cell-like ascending convective motions (hereafter usually referred to as thermals). The results were interesting to ornithologists and to those concerned with exchange processes between the sea and the atmosphere.

Subsequent studies of these thermals over the sea have been made using as exploratory tools smoke-screens, clouds as viewed from orbiting satellites, radar, and migrating land-birds (Woodcock and Wyman, 1947; Krueger and Fritz, 1961; Hubert, 1966; Konrad and Kropfli, 1968; Griffin, 1969). Of these, radar now seems to be the most effective tool for disclosing the thermals in clear air over the sea. Differences in refractive index of the air associated with these thermals make them visible on the radar scope, revealing the transitions that occur in their form as winds and ΔT vary. However, radar has not entirely displaced the usefulness of direct observation of the flight of sea-birds. Gulls were probably the first to 'discover' the thermals over the sea, and I think they have more to tell us about them.

The rationale and utility of gull flight behaviour as indicators of the nature of air motion over the sea has been discussed in some detail in the earlier publication and therefore is not repeated here. The purpose of this paper is to present, and to attempt to interpret, modifications to the original (1940) flight diagram (Figure 1a). These modifications have been derived from many later hitherto unreported observations. The combined data are shown in Figure 1b.

Old and New Observations

Note that the data points on Figure 1b are more than double the number on Figure 1a. Inclusion of data collected during R.V. *Atlantis* cruises between 1940 and 1943 has resulted in significant differences in the interpretation of Figures 1a and 1b. To clarify these differences for the reader who may be unfamiliar with the first paper, a brief explanation of Figure 1a follows.



(a) Closed squares mark wind-speed and ΔT conditions during which the gulls were not observed in sustained-soaring flight; the gulls were seen using only wing-flapping flight. Apparently no thermals were present that were capable of supporting the birds in sustained-soaring flight.

(b) Open circles mark wind and ΔT conditions during which the gulls were observed in sustained-soaring flight.

(c) From the slope of demarcation line C, I concluded that a direct relationship exists between wind speed and the minimum ΔT required to produce thermals capable of supporting the gulls in sustained-soaring flight.

The additional data on Figure 1b reveal that conclusion (c) is only partially true. Line C of Figure 1a now changes direction at wind speeds between 4 and 6 m s^{-1} (line D of Figure 1b), so that with wind speeds < ≈ 5 m s^{-1}, the minimum positive ΔT values at which soaring was observed is now inversely related to wind speed. Thus wind speeds between 4 and 6 m s^{-1} are optimal for the formation of the thermals used for soaring at minimal values of positive ΔT (i.e. ≈ 1°C). At wind speeds of ≈ 5 to 0 m s^{-1}, this initiation efficiency is apparently reduced, so that higher positive ΔT values (i.e. ≈ 3 to 6°C in near-calm winds) are required to set up the needed ascending motions.

During near-calm conditions (0 to ≈ 1 m s^{-1}) the gulls are seen to perform a flight routine which strongly suggests that through group co-operative action, they produce a disturbance in the unstable surface boundary layer that is sufficient to induce thermals. For example, on 8 and 10 January 1940, at latitude 41° 40′N, longitude 66° 30′W, and while prevailing local weather was dominated by large high-pressure systems (*see Northern Hemisphere Synoptic Weather Maps*), I observed groups of soaring gulls. This is of course a common sight, except that in that instance the groups were very large (20 to an estimated 100 birds), and their preliminary flight procedure was unusual. Always before, the birds had seemed to search individually for thermals in the lower air, using wing-flapping. When one bird found a thermal and began to soar, nearby birds would converge on the area to take advantage of the lift. However, on those January days, with a positive ΔT of 4°C, and winds of 0 to 1 m s^{-1} (see closed circles on Figure 1b), the gulls' flight routine was as follows.

The gulls gathered in a flock on the sea surface. Then they all took flight together, ascending in a large whirling white vortex, flapping their wings vigorously, to a height above the sea somewhat greater than that of our ship's mainmast head (≈ 45 m). There the birds circled for a minute or two, using continuous wing-flapping but gaining no altitude. Now first one gull, then another, and another, began to soar until the entire flock was spiraling upward. After ascending to heights and distances often requiring binoculars to follow, the gulls detached themselves from the thermal and descended in long easy glides to the sea surface near the ship. After an interval of regrouping, the gulls repeated this flight pattern. For two days I observed these remarkable performances many times.

Discussion

I have been unable to explain this type of group-flight activity without assuming that the gulls were initiating a thermal by co-operatively disturbing an unstable boundary layer not far above the sea surface. Apparently no other seafarers have recorded observations of such flight behaviour by groups of birds over the ocean. However, the idea that birds may be able to create their own thermals is not an entirely new one. Huffakers (1897, pp. 191–193) made observations of the flight of buzzards over land and suggested that the buzzards were able to initiate thermals. Unfortunately, Huffakers gave little information about the temperature and wind conditions at the time of the flights.

The relative uniformity of surface conditions at sea, in contrast to those ashore, might be expected to allow more readily the accumulation of unstable air near the surface during light winds and superadiabatic conditions. Webb has suggested (personal communication, 1966) from his studies of unstable air (Webb, 1965) that, under light-to-calm winds, the influence of wind-shear turbulence will virtually disappear and free convection will prevail. Under these conditions the initiation of thermals would be expected to be sensitive to disturbances such as the vigorous wing-flapping of groups of gulls.

Other disturbances of the lower air, such as those caused by the passage of ships, are known to produce extensive ascending air motions which often reach the lifting condensation level and cause cloud formation. However, such ship-induced air motions are thought to be largely due to heat released to the lower air by the ship (Lawrence, 1963; Conover, 1969). The important idea which the gull-flight data emphasizes is that, under the thermal and wind conditions in the area of Figure 1b marked by the large closed dots, slight disturbances of the air a short distance above the sea surface produce thermals.

The apparent thermal-inducing behaviour of the gulls was observed on only two days during my many cruises on R.V. *Atlantis* during 1938 to 1943. This sparsity of observation may mean that, as the positive ΔT increases, calm or light wind conditions are relatively rare at sea over the western North Atlantic (see dotted line on Figure 1b). We may also interpret this sparsity of observation to mean that the conditions were by chance seldom encountered. I rather suspect, however, that this metastable state of the lower air is not rare, for if it were, the chances that the gulls would discover and utilize it for inducing thermals would have been less likely. I suspect also that all of the soaring flights observed during winds of $< \approx 1$ m s^{-1}, and ΔT of ≈ 3 to 6°C were actually in bird-induced thermals.

Most of the flight observations were made while the ship was under way, which would make it unlikely that I would have witnessed the complete flight cycle involved in these co-operative performances. On the two days previously mentioned however, the ship chanced to be lying-to on station for many hours when the wind and ΔT conditions were favourable. The birds were therefore readily observable throughout the flight cycle as they assembled on the sea near the ship in each case before and for the start of their group efforts. They were there apparently seeking an opportunity to feed on galley scraps periodically dumped over the side. Herring-Gulls are well-known scavengers and tend to remain near and to follow ships.

Future studies, perhaps utilizing comparative radar returns both from birds (Bonham and Blake, 1956; Eastwood, 1967) and from variations in refractive index associated with thermals (Konrad and Kropfli, 1968), should be able to test rapidly various interpretations of the flight diagrams. As a first simple test, the asterisk (*) symbols introduced on Figure 1b mark the winds and the ΔT values taken from the 16 November 1967 observations of Konrad and Kropfli (1968, pp. 263–264) when, on two occasions, their radar showed well-developed thermals in the lower atmosphere over the sea east of Wallops Island, Virginia. Thus both the gulls and the radar indicate the presence of thermals under these conditions.

To what extent will radar support other questions and interpretations of differences in gull flight behaviour and in the associated wind and ΔT conditions?

(1) Are the bird-induced thermals a sustained air flow or are they brief in duration and bubble-like in character?

(2) Does the radar also indicate an optimum wind speed for thermal formation at ≈ 5 m s^{-1}, as suggested by the change in slope of line D?

(3) Does the entire dashed line D really mark the lower limit of ΔT for thermals, or is it in most cases simply a condition below which the ascending air motions are too slow or too disorganized to support soaring gulls?

(4) What happens at wind speeds $> \approx 13$ m s^{-1} apparently to stop the gulls from soaring (see upper dashed lines)?

Conclusions

During winds of 0 to ≈ 1 m s^{-1} and excesses of sea-over-air temperatures of 3 to 6°C, large groups of Herring-Gulls produce thermals at an altitude of about ≈ 50 m over the sea, which they then use for support in extended soaring flights to much higher altitudes.

The minimum ΔT required for the natural production of thermals for gull soaring is inversely related to wind up to an optimum value of ≈ 5 m s^{-1}. Between

≈ 5 and 12 m s^{-1}, wind and the minimum ΔT for thermal soaring are directly related.

Acknowledgments

I wish to recognize belatedly the help and encouragement of R. B. Montgomery in the presentation of the first Herring-Gull flight observations in 1940. At a critical point in the study, he supported my developing conviction that it was possible to learn much about the sea and the air by observing the behaviour of the organisms living there. Suggestions for improving the text, by Ethel McAfee of the Hawaii Institute of Geophysics, are appreciated. This work was supported in part by the Office of Naval Research under contract N00014-73-C-0371.

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Figures 1a and 1b. Symbols representing gull flight behaviour over the sea, with associated ΔT and wind speeds. 'Sustained soaring' means flights of sufficient duration (many minutes) to show that the birds are not soaring by merely losing altitude. The term 'free' indicates soaring free of the influence of surface obstructions such as ships or ocean waves. Figure 1a is the original diagram (Woodcock, 1940), slightly altered for present purposes. Figure 1b shows modifications of Figure 1a resulting from the inclusion of many more observations. See text for explanations of the dashed and dotted lines and the solid dots and asterisks.

INDIAN EXCELLENT AWARDS

(From the Deputy Director-General of Observatories (Forecasting), India)

The year 1974–75 has been yet another year of active co-operation between the ships of the Indian Voluntary Observing Fleet (VOF) and the Indian Meteorological Department for collecting meteorological information from the high seas. Year by year the ships traversing the oceans have a greater part to play in their contribution to the progress of science, we look forward to more co-operation in the collection of more and more data from the oceans. The national activities in exploring the marine resources has already called upon the active development of marine meteorology; the co-operation of the Indian VOF would also be welcome for affording weather and oceanographic observations for off-shore drilling and other marine exploration.

During the year ending 31 March 1975, 25 new ships were added to the strength of the Indian VOF, and 7 ships were decommissioned. At the end of the year there were 233 ships on the VOF list consisting of 43 Selected Ships, 160 Supplementary Ships and 30 Auxiliary Ships. These ships rendered commendable service by recording and reporting valuable meteorological observations from their routes. Meteorological logs received from these ships during the year contained 18 313 meteorological observations. It may however be mentioned that although the number of ships of the VOF increased during the year, there was a decline in the number of ships' observations.

This department undertakes periodical studies of the in-transit delays of the weather messages from the ships to the coastal radio station and to the forecasting offices and takes remedial measures to eliminate delays whenever possible, since such observations provide information on real-time basis for forecasting purposes. Special encouragement is given to those of our ships which send crucial observations, in particular when a depression or a cyclonic storm is in its formative stage or when it is intensifying into a severe cyclonic storm. Due recognition is also given to other ships which transmit such important and very useful observations even though they do not belong to our VOF.

The meteorological work of the ships of the Indian VOF during 1974–75 has been assessed, taking into account the quality and quantity of observations and also the percentage of recorded observations which have been actually transmitted to coastal radio stations. Allowance has been given to individual ships for the actual number of days spent at sea. The number of ships so selected to receive Excellent Awards in the form of books is 15 while another 10 ships will receive Certificates of Merit. The captains and other officers who have served for at least six months on board these ships during 1974–75 are awarded the books/certificates. The names of the ships to receive Excellent Awards are as follows.

Name of Ship	Owner
B. R. Ambedkar	Shipping Corporation of India Ltd
State of Haryana	Shipping Corporation of India Ltd
State of Tamil Nadu	Shipping Corporation of India Ltd
Vishva Jyoti	Shipping Corporation of India Ltd
Vishva Mangal	Shipping Corporation of India Ltd
Vishva Vir	Shipping Corporation of India Ltd
Jaladharma	Scindia Steam Navigation Co. Ltd
Jalaganga	Scindia Steam Navigation Co. Ltd
Jalagirija	Scindia Steam Navigation Co. Ltd
Jalagomati	Scindia Steam Navigation Co. Ltd
Jala Mangala	Scindia Steam Navigation Co. Ltd
Jalamoti	Scindia Steam Navigation Co. Ltd
Jag Kisan	Great Eastern Shipping Co. Ltd
Jag Manek	Great Eastern Shipping Co. Ltd
Maratha Providence	Chowgule Steamships Ltd

Certificates of Merit have been awarded to the following ships:

Dumra — *State of Mysore*
Jag Jawan — *Vishva Bhakti*
Jaladhruv — *Vishva Prayas*
Jalamatsya — *Vishva Raksha*
Samudra Gupta — *Vishva Shakti*

BAROGRAPH PRESENTATION

On 18 May 1976 Captain J. M. Burn, Peninsular and Oriental Steam Navigation Co., the fourth and final recipient of the 1974 long-service awards was able to be present at Meteorological Headquarters, Bracknell to receive his barograph from Dr B. J. Mason, Director-General of the Meteorological Office. It was also our privilege and pleasure to welcome Mrs Burn and two representatives of the P & O Management, Mr F. C. Murphy, Fleet Manager and Captain A. Britain, Assistant Marine Manager.

After expressing once again the importance of ships' observations, Dr Mason gave a brief history of the Meteorological Office summarizing the reasons why the Office was first established in 1854 and the subsequent appointment of Admiral FitzRoy in 1855 as Superintendent of the Meteorological Department of the Board of Trade as the Meteorological Office was then named.

Following the presentation the party took luncheon with Dr Mason and senior officers of the Meteorological Office after which the visitors were conducted round the Central Forecasting Office, Telecommunication Centre and the Computer Laboratory.

A photograph taken at the presentation is reproduced opposite page 180.

J. D. B.

ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM APRIL TO JUNE 1976

The charts on pages 192 to 194 display the actual and normal ice edges (4/10 cover), sea-surface and air temperatures and surface-pressure anomalies (departures from the mean) so that the abnormality of any month may be readily observed. (The wind anomaly bears the same relationship to lines of equal pressure anomaly as wind does to isobars. Buys Ballot's law can therefore be applied to determine the direction of the wind anomaly.) Southern and eastern iceberg limits will be displayed during the iceberg season (roughly February to July). In any month when sightings have been abnormally frequent (or infrequent) this will be discussed briefly in the text.

The periods used for the normals are as follows. Ice: 1966–73 (Meteorological Office). Surface pressure: 1951–70 (Meteorological Office). Air temperature: 1951–60 (U.S. Department of Commerce, 1965). Sea-surface temperature: area north of 68°N, 1854–1914 and 1920–50 (Meteorological Office, 1966), area south of 68°N, 1854–1958 (U.S. Navy, 1967).

April

The pressure anomalies were not so pronounced as they had been in March and as a result the ice edge in most seas reverted to nearer the average seasonal position. In particular the large deficits of ice at the end of March in the Greenland Sea were much reduced by the end of April since a strong anomaly for southerly winds had been replaced by a slight anomalous drift off the ice pack. West of southern Greenland the large excess of ice disappeared and by the end of April the ice edge in the Davis Strait was close to the position to be expected at this time of year. However, marked anomalies of ice did persist in the Barents Sea, where ice remained less extensive than normal, and in the White Sea and Baltic where melting was almost completed by the end of April.

May

Although the pressure anomalies were again weak on the whole, they were to a large extent in the opposite sense to those of April. Thus the pressure became lower instead of higher than normal to the south-east of Greenland, resulting in anomalies for southerly winds in the vicinity of Jan Mayen and Spitzbergen and a faster recession of the ice edge there than usual during May. Deficits of ice persisted in the Barents Sea. Off western Greenland and eastern Canada the ice edges were mostly near the normal positions for the end of May; however, there was an unusually pronounced protrusion of ice westwards around the southern coast of Greenland (the 'storis') and ice off Labrador persisted farther south than is normal by the end of May. In Hudson Bay the break-up to very open pack-ice was ahead of normal.

June

Pressure anomalies were again weak and in many areas the ice edge lay fairly close to its normal position by the end of June. However, there was persistence from May of some anomalous features of ice distribution: the deficit to the west of Jan Mayen (associated with a tendency for south-easterly winds); the slower-than-normal melting of ice off Labrador where by the end of May ice persisted several degrees farther south than is normal. There was rather less clearance of ice in the south-east of Hudson Bay than usually occurs during June.

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Baltic Ice Summary: April–June 1976

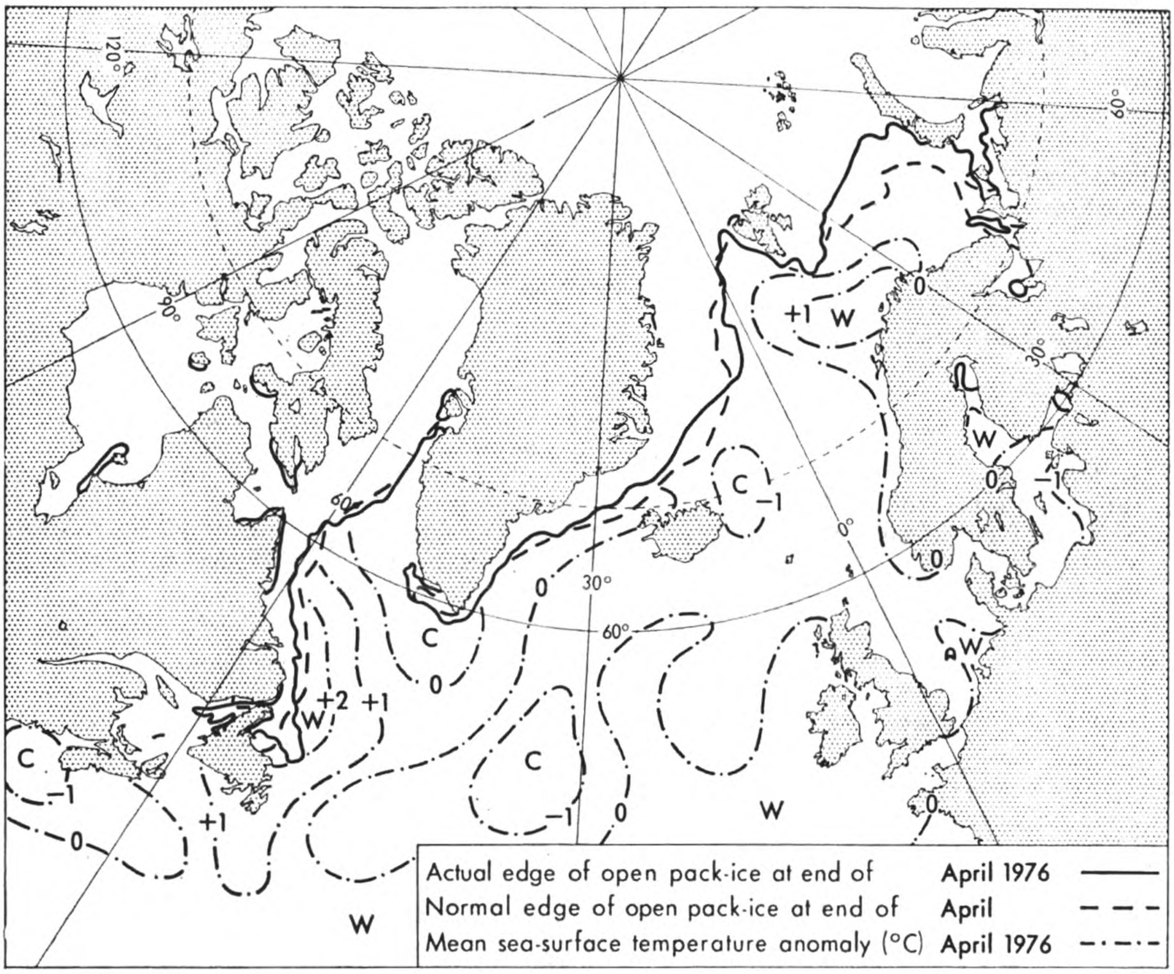
No ice was reported at the following stations during the period: Klaipeda, Ventspils, Kalmar, Göteborg, Visby Emden, Lübeck, Hamburg, Bremerhaven, Kiel, Flensburg, Stettin, Gdansk, Stralsund, Rostock, Aarhus Copenhagen, Oslo, Kristiansandfjord.
No ice was reported at any of the stations during June.

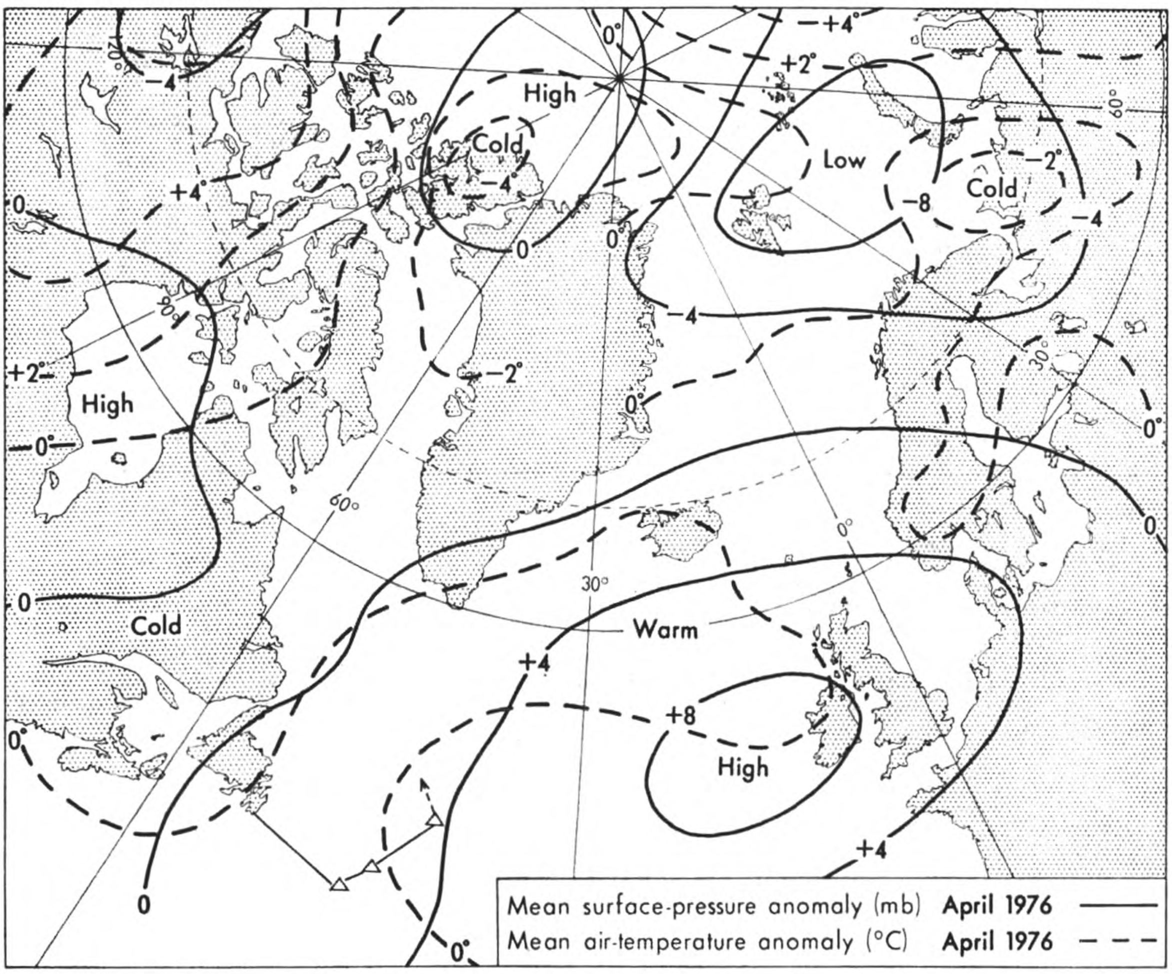
Station	April: Length of Season		April: Ice Days			April: Navigation Conditions			April: Accumulated Negative Degree Days	May: Length of Season		May: Ice Days			May: Navigation Conditions			May: Accumulated Negative Degree Days
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Leningrad ..	1	30	21	0	9	16	0	0	871	1	9	7	0	2	6	0	0	—
Riga ..	1	4	4	0	0	1	0	0	302	0	0	0	0	0	0	0	0	—
Pyarnu ..	1	28	28	17	1	3	0	18	—	6	6	1	0	0	0	0	0	—
Viborg ..	1	30	30	29	1	0	15	15	—	1	10	10	2	0	6	2	0	—
Tallin ..	1	19	19	0	6	15	0	0	—	0	0	0	0	0	0	0	0	—
Helsinki ..	1	19	19	6	10	0	16	0	—	0	0	0	0	0	0	0	0	—
Mariehamn	1	15	15	0	0	7	0	0	—	0	0	0	0	0	0	0	0	—
Turku ..	1	19	19	14	2	0	16	0	—	0	0	0	0	0	0	0	0	—
Mantyluoto	1	16	10	0	0	3	5	0	—	0	0	0	0	0	0	0	0	—
Vaasa ..	1	30	30	29	0	0	30	0	—	1	2	0	0	0	0	2	0	—
Oulu ..	1	30	30	30	0	0	30	0	—	1	20	17	14	0	0	20	0	—
Roytaa ..	1	30	30	21	9	0	30	0	—	1	27	27	22	0	0	25	0	—
Lulea ..	1	30	30	28	2	0	30	0	1254	1	13	13	1	0	4	5	0	—
Bredskar ..	1	18	18	0	0	15	1	0	—	0	0	0	0	0	0	0	0	—
Sundsvall ..	1	14	14	0	0	14	0	0	—	0	0	0	0	0	0	0	0	—
Stockholm ..	1	25	25	0	10	15	0	0	—	0	0	0	0	0	0	0	0	—
Skellefteå ..	1	30	19	14	0	0	30	0	—	1	9	0	0	0	0	9	0	—

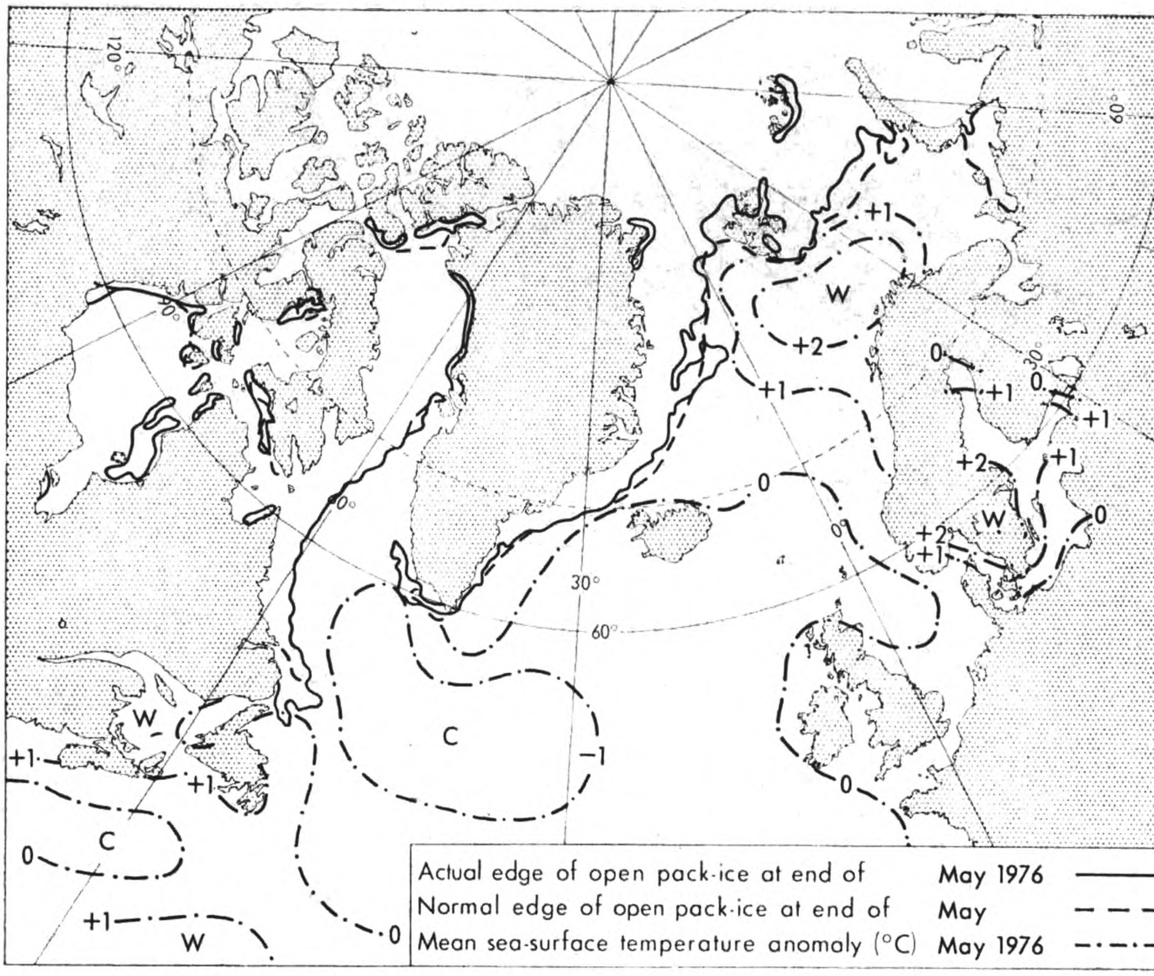
CODE:

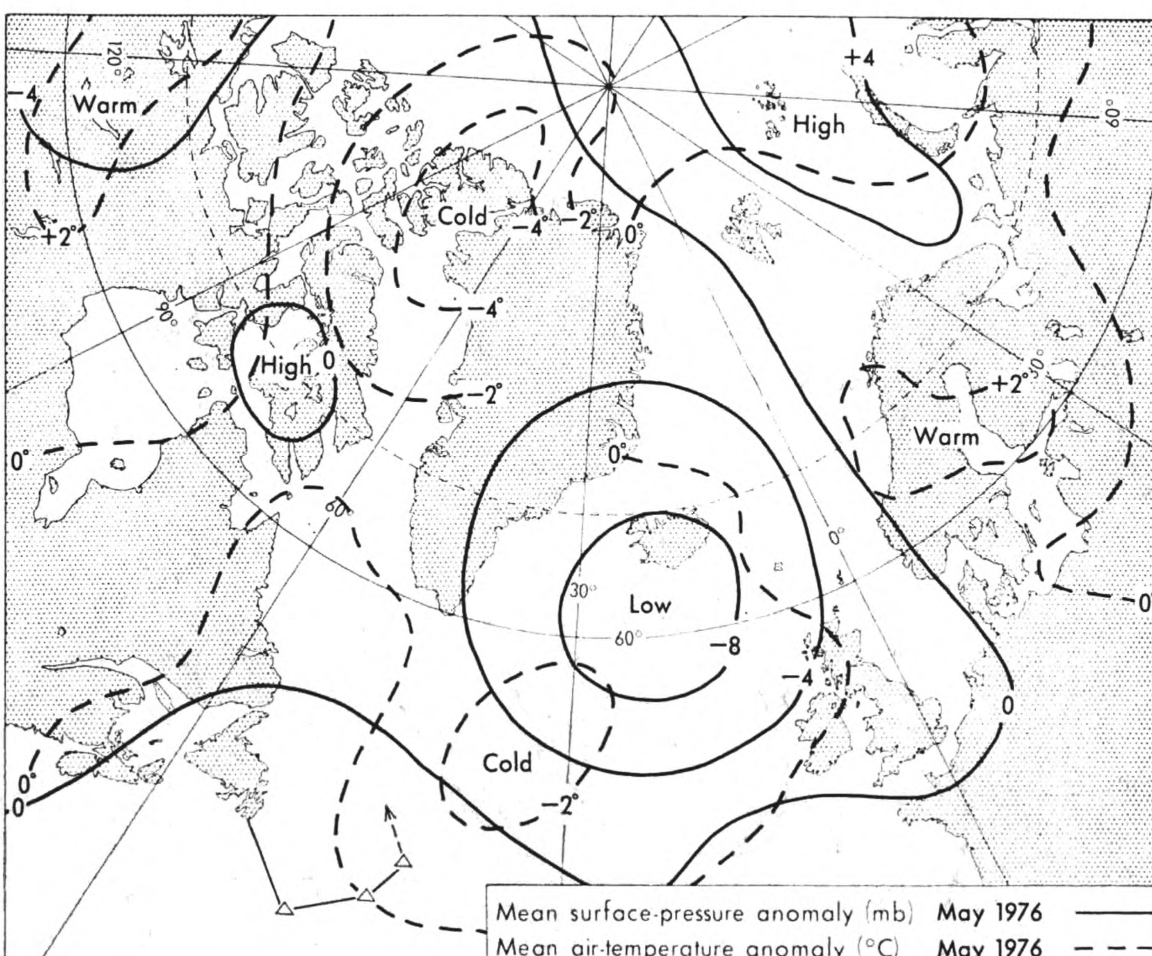
A First day ice reported.
B Last day ice reported.
C No. of days when ice was reported.
D No. of days continuous land-fast ice.
E No. of days of pack-ice.
F No. of days dangerous to navigation, but assistance not required.
G No. of days assistance required.
H No. of days closed to navigation.
I Accumulated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

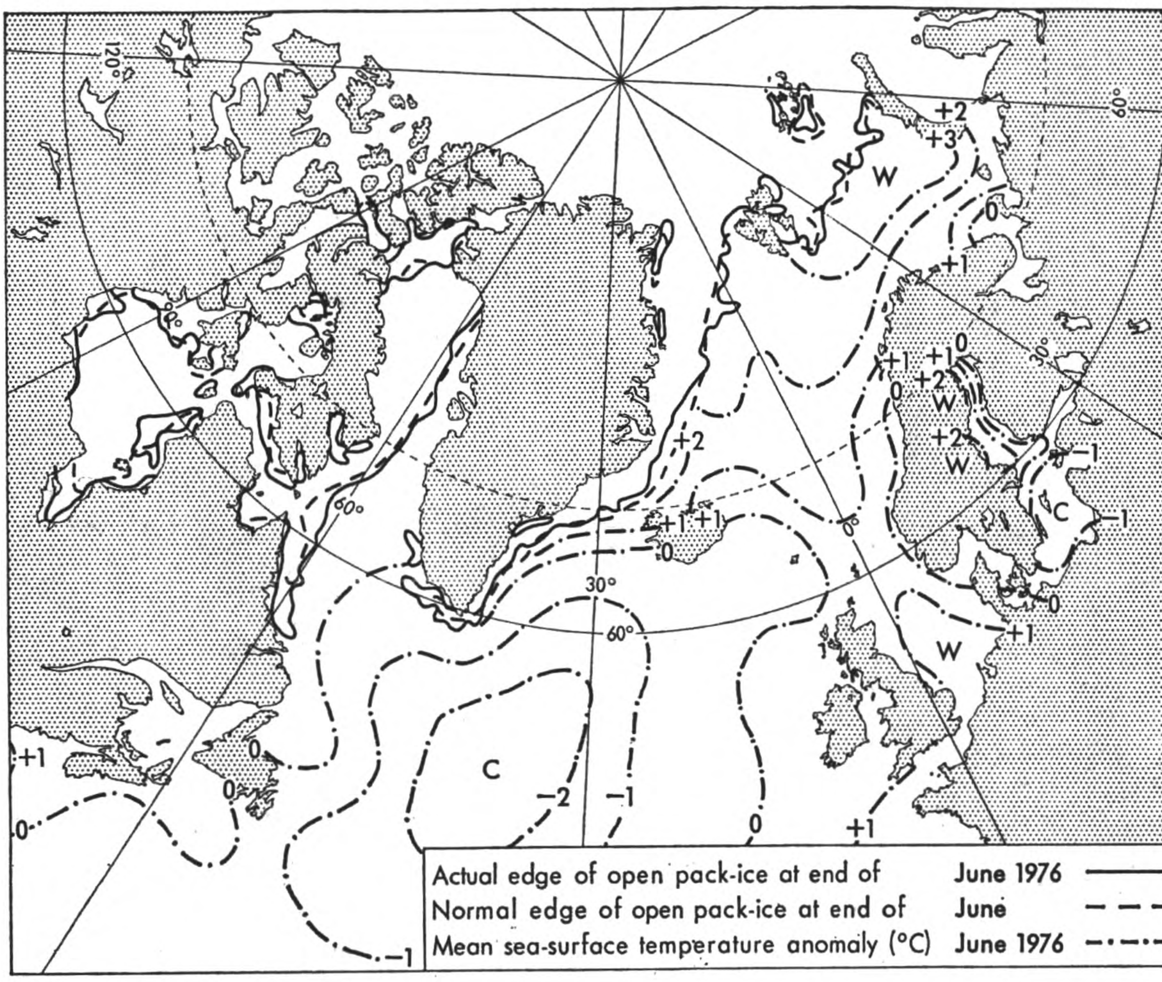
* These figures give a rough measure of the first probability of the formation of sea ice, and later the progress of the growth and its thickness. They are derived from daily averages of temperature (00 + 06 + 12 + 18 GMT) and are the sum of the number of the degrees Celsius below zero experienced each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

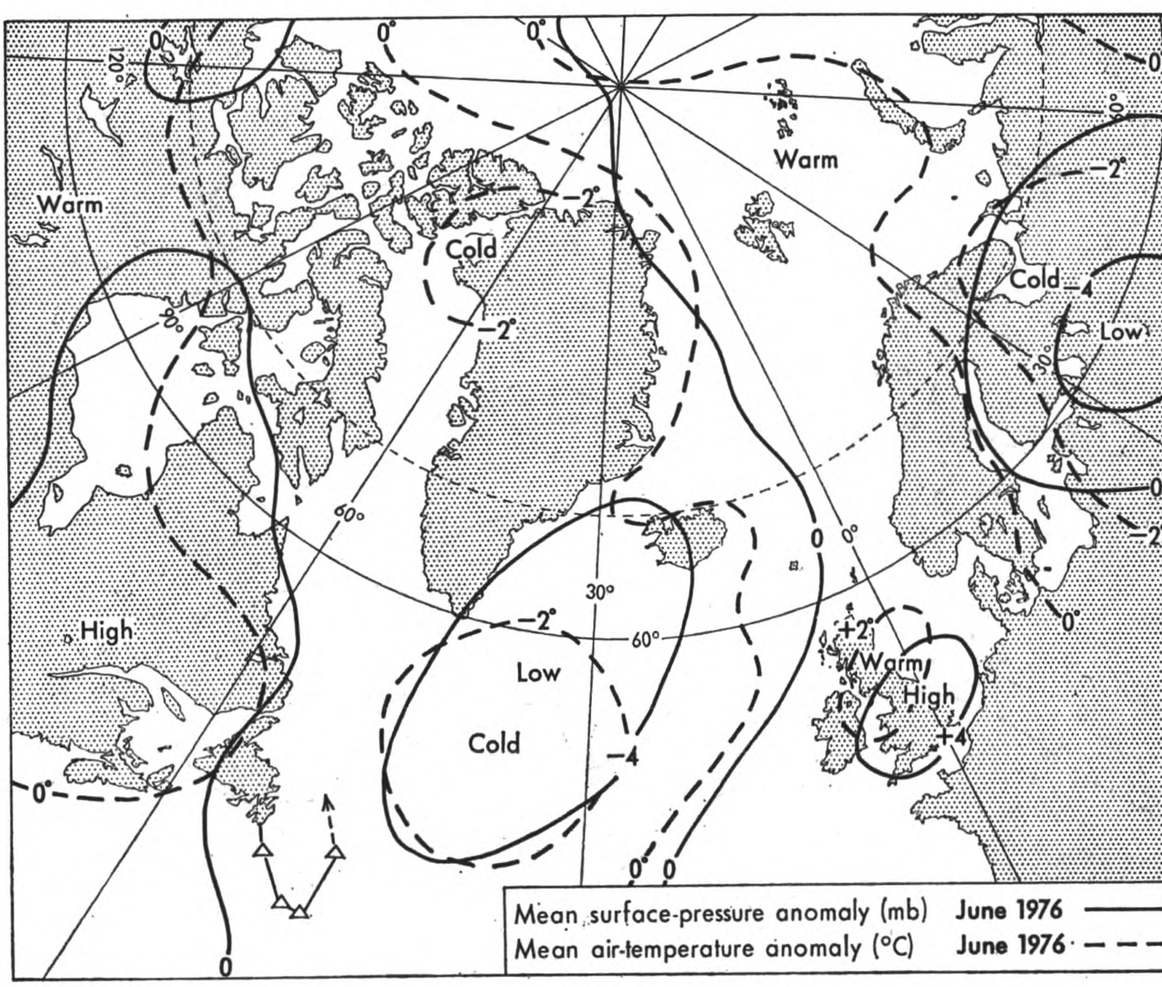

Actual edge of open pack-ice at end of April 1976
Normal edge of open pack-ice at end of April
Mean sea-surface temperature anomaly (°C) April 1976
W
C
+1
+2
-1
0


Mean surface-pressure anomaly (mb) April 1976
Mean air-temperature anomaly (°C) April 1976
High
Low
Cold
Warm
+8
+4
-8
-4
+2°
-2°
0°


Actual edge of open pack-ice at end of May 1976
Normal edge of open pack-ice at end of May
Mean sea-surface temperature anomaly (°C) May 1976
W
C
+1
+2
0
−1
30°
60°
120°


Mean surface-pressure anomaly (mb) May 1976
Mean air-temperature anomaly (°C) May 1976
Warm
Cold
High
Low
−8
−4
0
+4
+2°
−2°
−4°
0°
30°
60°
90°
120°


Actual edge of open pack-ice at end of June 1976
Normal edge of open pack-ice at end of June
Mean sea-surface temperature anomaly (°C) June 1976
W
C
+2
+3
+1
0
-1
-2
120°
60°
30°
0°


Mean surface-pressure anomaly (mb) June 1976
Mean air-temperature anomaly (°C) June 1976
Warm
Cold
High
Low
-2°
-4
+2
+4
0°
120°
60°
30°

Book Review

Four Captains, by Captain George V. Clark. 245 mm × 180 mm, pp. 260, *illus.* Brown Son and Ferguson Ltd, 52 Darnley Street, Glasgow G41 2SG. Price: £7·80.

This book recounts the reminiscences of four sailing-ship Masters of the declining years of Sail from the 1880s to shortly after the end of the First World War. Although it was apparent to most shipowners as early as 1838 that with the commencement of the first regular steamship service across the North Atlantic, steamships would eventually drive large commercial sailing-vessels off the Seven Seas, many such vessels continued to trade, particularly on the bulk-cargo routes, right up until the early 1920s.

Soon after the Second World War Captain Clark realized that not many of the men who sailed in such ships remained. He appreciated that those who were still living would retain excellent memories of the hard life in the 'wind-ships' and he set himself the task to seek out those few, then well into their 80s, and write down their recollections. This he has accomplished with his book and we must be grateful to Captain Clark for his forethought, zeal and effort since without him, these stories would have been lost for all time.

The 'Four Captains' whose experiences are recalled in this volume are:

Captain John Pearson, whose career at sea spanned the years 1879 to 1924, all of which were spent in Sail,

Captain John Thomson, who was at sea from 1881 to 1929 whose service culminated with command of the *Garthpool*—the last big sailing-ship under the British flag,

Captain William Wright, at sea from 1884 to 1935 and

Captain James Simpson, D.S.C., who first signed Indentures in 1890, remained in Sail until 1922 and finally retired in 1936.

The careers in Sail of these four gentlemen add up to the impressive total of 176 years and despite their age when Captain Clark met them, their recollections were not dimmed by the passage of time. Frequently, within the stories of the ships in which they sailed, the masters mentioned other ships met up with at sea or in harbour. This leads to an Index containing, at a rough count, some 625 ships' names, and to the thought that the book might be of use as a Reference source by students of the era.

The book also contains 20 excellent photographs of the vessels in which these masters sailed and readers will no doubt compare the stately lines of these handsome vessels to modern-day functional container ships.

The reviewer has but one small criticism of what is otherwise an excellent book. The addition of a sail and rigging plan for a typical sailing-vessel of the period would help the modern younger seafarer to understand the more technical terms used.

Whilst it would be inaccurate to describe this book as being about 'wooden ships and iron men', it is undoubtedly true to say that it is about men of a calibre and character seldom encountered in this present day and their ships which plied the Seven Seas in the declining years of Sail.

C. R. D.

Personalities

RETIREMENT.—CAPTAIN A. L. DALES retired last May after serving 35 years at sea, 29 of which he spent with Shell Tankers Limited.

Alan Louis Dales signed Indentures and joined Anglo-Saxon Petroleum Company in 1941. He left the Company in 1945 at the end of his apprenticeship in order to gain general cargo experience but rejoined in 1951 as 2nd Officer. He obtained his Master's Certificate later that year.

In 1961 he transferred to the Shell Company in Qatar to work on offshore installations. He returned to fleet service in 1962.

He was promoted Master in 1966 and appointed to command of the *Haminella.* Thereafter he commanded several ships of the Shell Fleet, his last vessel being the *Donacilla.*

Captain Dales sent us his first meteorological logbook in 1947 from the *Pacific Enterprise.* Since then we have received a further 21 logbooks bearing his name.

We wish him health and happiness in his retirement.

RETIREMENT.—CAPTAIN J. K. LISTON retired last April after 45 years' sea service.

John Liston commenced his career at sea as a cadet with Ben Line in 1931. In 1934 whilst a cadet in s.s. *Benlawers*, on passage from Portland, Oregon to Japan with a deck cargo of logs up to 25 metres in length, the ship was struck by a heavy sea on the port side. The whole of the deck cargo was swept overboard taking with it both masts and three winches. The ship put back to Vancouver Island for repairs to the damage which took some six weeks to complete.

Having obtained his Master's Certificate in 1941, Captain Liston remained with Ben Line until 1943 when he transferred to Currie Line. From 1944 to the end of the war he served as Chief Officer of the *Sutherland* which was then operating as an ammunition supply ship to the Royal Navy and which took part in the invasions of North Africa and southern France.

Captain Liston was promoted to Master in 1949 and appointed to command s.s. *Pineland.* In 1964, whilst in command of the *Gothland*, he was directed to load iron ore at Santana, approximately 200 n. mile up the River Amazon. In order to save time he was requested by his Owners to enter the river by the North Channel. Since no pilots or tugs were available, this operation necessitated Captain Liston to pilot and berth the ship, of 25 000 tonnes deadweight, without local aid.

Anchor Line took over the Currie Line in 1970 and Captain Liston continued to serve as Master in command of various ships until his retirement last April from the *Gothland*—the only remaining vessel of the Currie Line fleet.

We received the first meteorological logbook bearing Captain Liston's name from the *Iceland* in 1951. Since then he has sent a further 17 logbooks.

We wish him health and happiness in his retirement.

RETIREMENT.—CAPTAIN W. MACVICAR retired last May from Anchor Line Ltd after 45 years at sea.

William MacVicar was born at Southend in Argyllshire in 1914 and was indentured as an apprentice with Anchor Line in 1931. He obtained his 2nd Mate's Certificate in 1935 and was appointed 3rd Officer of s.s. *California.* From 1939 to 1941 he served as Sub Lieutenant R.N.R. in the *Circassia*, then an Armed Merchant Cruiser on the Northern Patrol.

Whilst serving as 3rd Officer in s.s. *Britannia* in March 1941 the vessel was sunk by a German surface raider in the South Atlantic. Captain MacVicar abandoned ship in charge of No. 7 lifeboat with 82 persons on board and, after sailing 1535 miles in 23 days, landed in Brazil with 38 survivors. For this outstanding service he was awarded the M.B.E.

After obtaining his Master's Certificate in 1942, Captain MacVicar was promoted 2nd Officer and in 1943 he was again sunk, this time by enemy aircraft, west of Cape Finisterre whilst serving in s.s. *California.*

Captain MacVicar was promoted Master in 1946 and appointed to command of s.s. *Samvannah*. Thereafter he commanded various ships of the Anchor Line until his recent retirement.

Captain MacVicar sent us his first meteorological logbook from the *Transylvania* in 1938. Since then we have received a further 44 logbooks bearing his name. He received Excellent Awards in 1955 and 1956 and was presented with a barograph in 1974.

We wish him a long, healthy and happy retirement.

RETIREMENT.—CAPTAIN T. J. MAGEE retired last April from the service of Shell Tankers (UK) Limited.

Terence Magee joined Eagle Oil and Shipping Company in 1941 as 3rd Officer. His first vessel was the *San Emiliano* which, in the very month he joined her, survived two dive-bomber attacks whilst in the Mersey Docks. Fifteen months later the *San Emiliano* was torpedoed and sunk two days out from Trinidad with a cargo of petroleum spirit. Captain Magee's first command was the *San Eliseo* in 1958.

Captain Magee sent us his first meteorological logbook in 1949 from the *San Adolpho*. Since then we have received a further 15 logbooks from him of which 7 were classed as Excellent. He received an Excellent Award for his voluntary services to the Meteorological Office in 1968.

We wish Captain Magee a long, healthy and happy retirement.

RETIREMENT.—MR J. D. MASTERMAN, Radio Officer, retired on 15 April from Marconi International Marine Company after serving nearly 47 years at sea.

John Deane Masterman joined Marconi as Radio Officer in July 1929 and was appointed to the *Minnetonka*. Thereafter he sailed on various foreign-going vessels until 6 July 1951 when he joined s.s. *Kenya* and remained on her until 7 June 1969. He then reverted to various vessels sailing world-wide.

We received the first meteorological logbook bearing Mr Masterman's name from the *Kenya* in 1959. Since then we have received a further 31 logbooks with which he has been associated. He received Excellent Awards for his services in 1960, 1962 and 1969.

We wish Mr Masterman health and happiness in his retirement.

RETIREMENT.—MR W. PARKINSON, M.B.E., Radio Officer, retired last April from Marconi International Marine Company after 48 years' service at sea.

Wilfred Parkinson joined Marconi as Radio Officer in 1927 and after service in various vessels was appointed to s.s. *Cardita* in November 1935. On 31 December 1941 the *Cardita* was sunk by enemy action and Mr Parkinson was awarded the M.B.E. for courage shown in the face of the enemy. In 1947 he was appointed to s.s. *Benalbanach* and remained with vessels of the Ben Line fleet until his retirement.

We received the first meteorological logbook bearing Mr Parkinson's name from the *Benrinnes* in 1964 and since then he has been associated with a further 26 logbooks. He received an Excellent Award in 1974.

We wish him health and happiness in his retirement.

RETIREMENT.—CAPTAIN D. H. RUTHERFORD retired on 31 May on medical grounds after completing over 32 years' service with Shell Tankers Limited.

Derek Harrison Rutherford joined Anglo-Saxon Petroleum Company in February 1944 as an apprentice and was appointed to m.v. *Cardium*. On gaining his 2nd Mate's Certificate he was promoted to 3rd Officer in 1947.

Captain Rutherford obtained his Master's Certificate in October 1952 and was promoted Master in 1956, his first command being the *Drupa*. His early commands were mainly in the H-, A- and V-class vessels and his more recent appointments have been M-class, the last being s.s. *Melo*.

We received the first meteorological logbook bearing Captain Rutherford's name from the *Velletia* in 1958. Since then he has sent us a further 12 logbooks of which 2 have been classed as Excellent.

We wish Captain Rutherford a speedy recovery in health and much happiness in his retirement.

RETIREMENT.—CAPTAIN T. G. W. WORMALD retired last April from the service of Shell Tankers (UK) Limited after 36 years at sea.

Thomas Wormald joined Anglo-Saxon Petroleum Company in 1940 as an apprentice and was appointed to the *Liseta*. He was promoted to Master in command of s.s. *Fusinus* in 1956 and his last command was the *Hemitrochus*.

Captain Wormald sent us his first meteorological logbook in 1946 from the *Empire Law*. Since then we have received a further 17 logbooks bearing his name of which 5 were classed as Excellent.

We wish him health and happiness in his retirement.

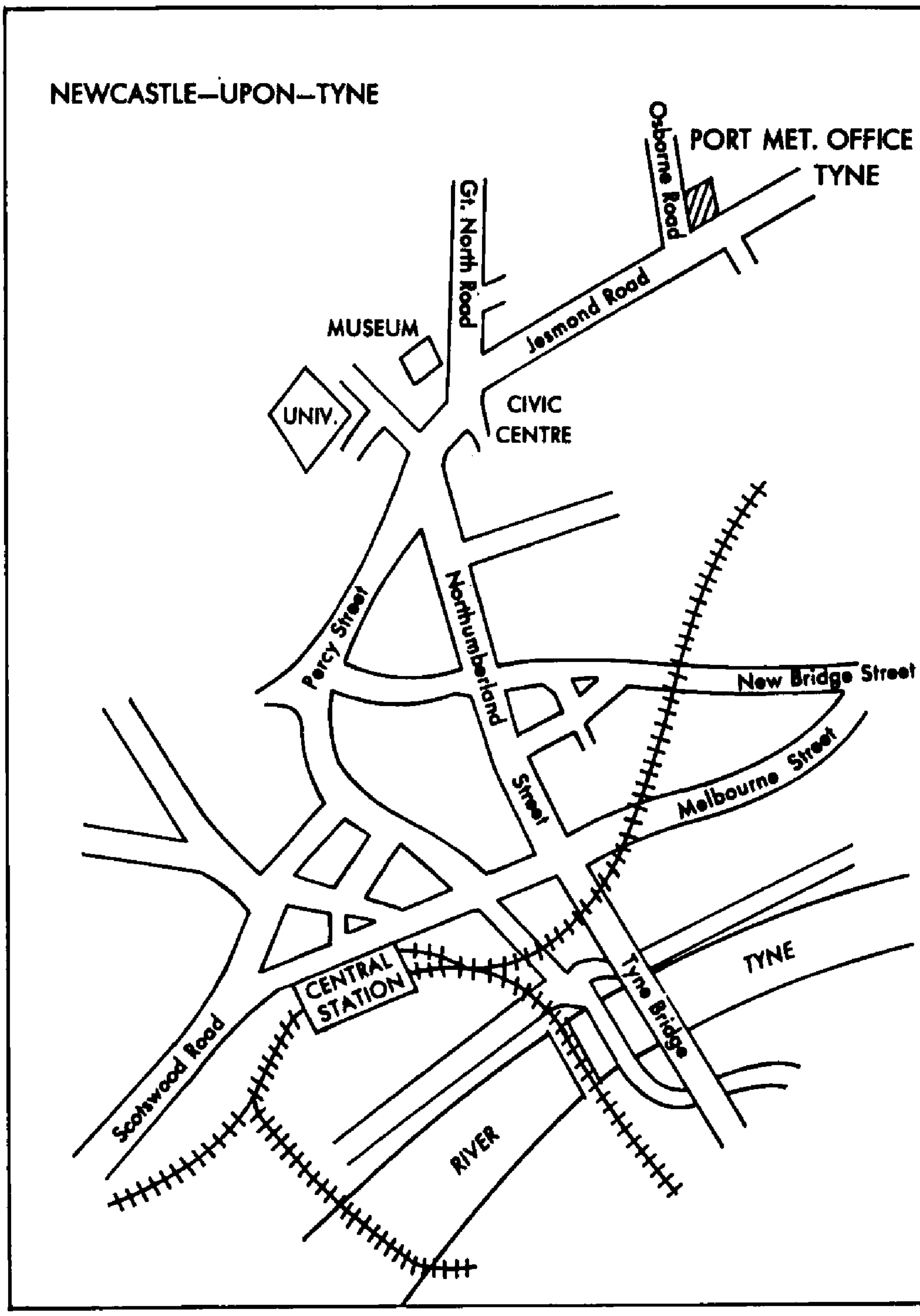
Notice to Marine Observers

PORT METEOROLOGICAL OFFICE, TYNE

On 1 June 1976 a new Port Meteorological Office was opened at Newcastle upon Tyne.

For a considerable number of years up until May 1973 liaison between the Marine Division of the Meteorological Office and merchant shipping in the Tyne area was very capably maintained by various Merchant Navy Agents. Since then the area, of necessity, has been rather spasmodically served by the Liverpool Port Meteorological Office. With increased shipping activity on the north-east coast, both in regard to shipbuilding and the offshore oil industry, it was decided that this service was inadequate and that a new office be established in Newcastle to cover the coastal area between Berwick and Flamborough Head. The office is situated at 1–2 Osborne Road, Newcastle upon Tyne, NE2 2AA (Tel: 0632 811616) and the Port Meteorological Officer is Mr D. J. F. Southon who has been transferred from Cardiff. All the normal services obtainable at a Port Meteorological Office are available and Mr Southon extends a sincere invitation to all mariners to call in at the new office whenever they are in the vicinity, whether it be a business or simply a social call.

A photograph of the new office appears opposite page 181.


NEWCASTLE–UPON–TYNE
PORT MET. OFFICE
TYNE
Osborne Road
Gt. North Road
Jesmond Road
MUSEUM
UNIV.
CIVIC
CENTRE
Percy Street
Northumberland
Street
New Bridge Street
Melbourne Street
CENTRAL
STATION
Tyne Bridge
TYNE
RIVER
Scotswood Road

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

Headquarters.—Captain G. A. White, Marine Superintendent, Meteorological Office (Met.O.1a), Eastern Road, Bracknell, Berks. RG12 2UR. (Telephone: Bracknell 20242, ext. 2456.)
Captain G. V. Mackie, Deputy Marine Superintendent. (Telephone: Bracknell 20242, ext. 2543.)
Mr J. D. Brown, Nautical Officer. (Telephone: Bracknell 20242, ext. 2461.)
Captain C. R. Downes, Nautical Officer. (Telephone: Bracknell 20242, ext. 2738.)

Mersey.—Mr W. G. Cullen, Master Mariner, Port Meteorological Officer, Room 709, Royal Liver Building, Liverpool L3 1HN. (Telephone: 051-236 6565.)

Thames.—Captain R. C. Cameron, Port Meteorological Officer, Movement Control Building, South Side, Victoria Dock, London E16 1AS. (Telephone: 01-476 3931.)

Bristol Channel.—Captain J. H. Jones, Port Meteorological Officer, 33 The Hayes, Cardiff CF1 6NU. (Telephone: Cardiff 21423.)

Humber.—Mr P. M. Swan, Master Mariner, Port Meteorological Officer, c/o Principal Officer, Dept. of Trade, Trinity House Yard, Hull HU1 2LN. (Telephone: Hull 223066, ext. 27.)

Clyde.—Mr H. M. Keenan, Master Mariner, Port Meteorological Officer, 118 Waterloo Street, Glasgow G2 7DN. (Telephone: 041-248 4379.)

Forth.—All enquiries to Mr H. M. Keenan above.

Southampton.—Captain D. R. McWhan, Port Meteorological Officer, Southampton Weather Centre, 160 High Street below Bar, Southampton SO1 0BT. (Telephone: Southampton 20632.)

Tyne.—Mr D. J. F. Southon, Master Mariner, Port Meteorological Officer, 1–2 Osborne Road, Newcastle upon Tyne NE2 2AA. (Telephone: 0632 811616.)

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[*Subjects of* Books Reviews, Editorial, Notices to Marine Observers, Notices to Mariners, Photographs *and persons named in* Retirement *and* Obituary *notices are indexed under these general headings.*]

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