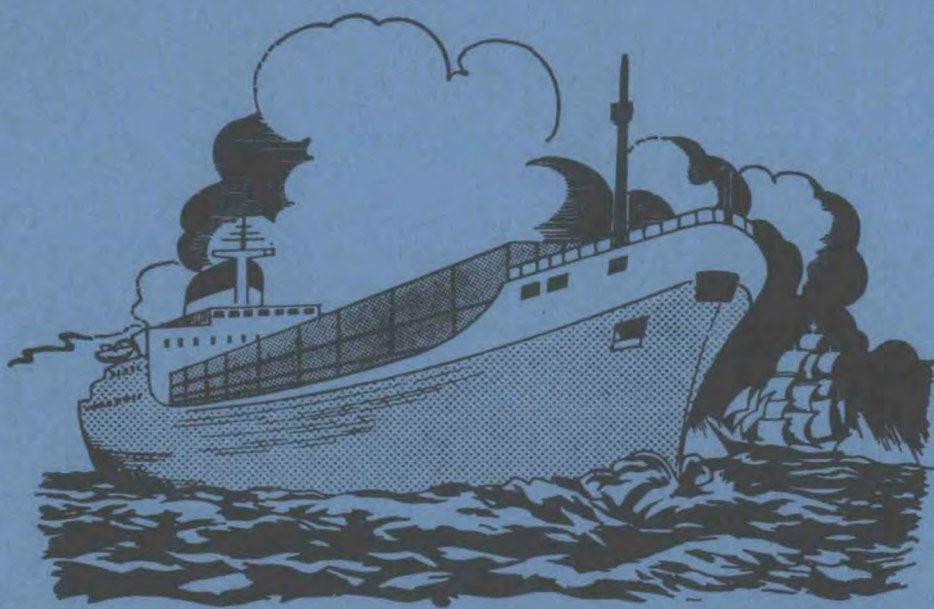


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The Marine Observer

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THE MARINE OBSERVER

A QUARTERLY JOURNAL OF MARITIME
METEOROLOGY PREPARED BY THE MARINE
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*Letters to the Editor, and books for review, should be sent to the Editor 'The Marine Observer',
Meteorological Office, Eastern Road, Bracknell, Berkshire RG12 2UR*

LONDON: HER MAJESTY'S STATIONERY OFFICE

Report of Work for 1985

(MARINE DIVISION OF THE METEOROLOGICAL OFFICE)

1. Voluntary Observing Fleet

At the end of 1985 the British Voluntary Observing Fleet (VOF) embraced the following groups:

- (a) 416 Selected Ships. These are supplied on loan with a comprehensive set of meteorological equipment and stationery with which to observe and transmit coded observations via coastal radio stations every 6 hours.
- (b) 9 Supplementary Ships, including 1 trawler, which carry out less detailed observations than Selected Ships, and are supplied on loan with a barometer, air thermometers and screen.
- (c) 54 'Marid' vessels which are short sea traders making sea-surface temperature observations in U.K. coastal waters and the North Sea. When they are on passage in the North Sea, these coasting ships are requested to include in their transmitted messages wind, weather and visibility data.
- (d) 9 Light-vessels and 1 light-tower which make observations of wind, waves, visibility, air temperature and sea temperature, sending their coded reports by R/T. Reports from *Channel*, *Dowsing* and *Varne* light-vessels, as well as the *Royal Sovereign* light-tower are included in the weather bulletins for shipping issued by the Met. Office and broadcast by BBC radio.
- (e) 4 Auxiliary Ships which make a valuable contribution by collecting data when on voyages through relatively data-sparse areas on an opportunity basis. These ships' own instruments are used to provide readings of air temperature and pressure, supplemented by visual observations of wind, weather and visibility.
- (f) 28 Oil rigs and platforms in the North Sea equipped as Selected Ships and providing data by telex using Ship Code FM 13-VII.

The observations and radio transmissions made aboard these Voluntary Observing Fleet ships continue to be carried out, as heretofore, by ships' officers under the guidance of masters on a voluntary basis. Merchant ships have been involved in this valuable task since 1854, the first recorded ship to be supplied with instruments having been the *Collinsburgh* of Leith on 10 November of that year. Most types of ship are still included in the VOF, including commercial cargo carriers, passenger ships, ferries, supply ships and oceanographic vessels. The Marine Division is also increasing the number of oil rigs and platforms using ship's code in order to obtain better returns from the North Sea and thereby augment the weather data supplied by the Met. Office for the offshore industry.

Port Meteorological Offices have been maintained at the 7 major ports of London, Liverpool, Southampton, Hull, Cardiff, Middlesbrough and Glasgow. The Officers stationed in these ports are available to attend on ships anywhere in the U.K., and have sustained their efforts to keep the VOF at a satisfactory level, despite the continued decline of the British merchant fleet. Port Meteorological Officers in the Commonwealth countries and overseas also earn our gratitude for their unstinting co-operation in answering calls to ships in need of replenishment or volunteering for recruitment. Further volunteers continue to be needed in order that data from the oceans can be extended to provide useful information both for the creation of shipping forecasts and for land use. Surface observations are as vital as they ever were for the purpose of providing ground truth for satellite data verification.

The finite number of observations received is also on the increase due to the greater sea time enjoyed by the majority of cargo carriers nowadays, as shown in Table 1 following.

Table 1. Average daily number of reports received at Bracknell from ships and sea stations and geographical breakdown of total daily number of reports received at Bracknell direct and via the Global Telecommunications System (GTS).													1984	1985
Direct reception from:														
British ships	..	..	..	..	..	..	..	..	..	..	..	..	175	203
Foreign ships	..	..	..	..	..	..	..	..	..	..	..	..	162	173
Rigs, platforms and buoys	..	..	..	..	..	..	..	..	..	..	..	..	92	180
Total													429	556
Total number of reports received by geographical location:														
Eastern North Atlantic	..	..	..	..	..	..	..	..	..	..	..	..	918	916
Western North Atlantic	..	..	..	..	..	..	..	..	..	..	..	..	653	723
Mediterranean	..	..	..	..	..	..	..	..	..	..	..	..	115	134
North Sea	..	..	..	..	..	..	..	..	..	..	..	..	329	479
Arctic Ocean	..	..	..	..	..	..	..	..	..	..	..	..	95	104
North Pacific	..	..	..	..	..	..	..	..	..	..	..	..	1055	1330
All other seas	..	..	..	..	..	..	..	..	..	..	..	..	578	670
Total													3743	4356

The 8 VOF ships fitted with the Meteorological Observing System for Ships (MOSS) are showing very good results after harmonisation of the systems following their installation in 1984. Automatic transmission of recorded data in real time ensures that observations entered into MOSS are of the utmost use to the weather men, and further co-operation by officers in recording alternate 3-hourly data on North Atlantic routes when east of 30° west longitude is proving invaluable.

These extra reports are reflected in the numbers shown in Table 1, and the total received from buoys has also increased markedly. The Marine Division is now involved in performance monitoring of the 7 fixed buoys around the U.K. coasts, gradually to be increased in number, and drifting meteorological buoys. These buoys usually transmit hourly data comprising wind, air temperature, sea temperature, atmospheric pressure, humidity, wave period and wave height, via Meteosat or System Argos automatically.

2. Ocean Weather Ship Programme

The U.K. Ocean Weather Ship (OWS) *Starella* continued to man station 'Lima' in position 57° 00'N, 20° 00'W throughout the year, alternating monthly with the Netherlands Ocean Station Vessel *Cumulus*. The Met. Office operated the ship, under the North Atlantic Ocean Station (NAOS) scheme, under charter from J. Marr and Son, Hull, carrying out hourly surface observations and 6-hourly upper-air soundings when on station. The *Starella* also recorded significant wave heights for the Institute of Oceanographic Sciences, Taunton, collected sea-water and salinity samples for the Ministry of Agriculture, Fisheries and Food and made deep water thermal soundings for the Admiralty. Whilst on passage from and to her home port of Fleetwood, she also towed a plankton recorder on behalf of the Institute for Marine Environmental research.

In April *Starella* undertook radio-sonde upper-air comparison trials in conjunction with the weather station at Stornoway airport to determine relative values of complimentary upper-air measurement systems.

Dr L. S. Austin of Plymouth Polytechnic was provided with free passage in the *Starella* in August and September to continue research into airborne material over the North Atlantic. He was particularly interested in measurements of atmospheric pollutants transported from the North American continent.

On 18 December, at a special ceremony at Hull, the Netherlands Secretary for Transport and Public Works handed over the *Cumulus* to the U.K. Under Secretary of State for Defence Procurement in exchange for the symbolic sum of £1.00. The *Cumulus* replaced the *Starella* as the sole ship manning station 'Lima' in January. (See report on page 98).

3. Ship Routeing

The Metroute Ship Routeing Service, operated by a team of master mariners with a wide experience in most types of vessel, continues to receive contracts for routeing on ocean passages around the world and in respect of towage and salvage operations. A new brochure was produced which included the latest details of ship routeing services available.

Particular routeing contracts included regular liner crossings of the North Atlantic, 3-day forecasts for oil rig moves in the Mediterranean Sea, tropical storm watch in the Indian Ocean and routeing a small motor yacht in the Atlantic.

The voyage assessment service continues to be in demand by shipowners and charterers in respect of voyage delays and claims for slow steaming.

Ice charts for pertinent areas of the North Atlantic and for the Baltic Sea have been issued weekly to regular and occasional clients.

4. Services to Shipping

Shipping forecasts, synopses and gale warnings continue to be promulgated for the shipping and fishing industries on a regular basis.

The 24-hour Met. Office inshore service provided by British Telecom ('Marineline') was extended from some south coast areas to cover all coasts of the United Kingdom.

NAVTEX coverage was adjusted after experience showed that signals from the Land's End station were not being fully received in the area intended, and accordingly Niton was used instead. This service for shipping, consisting of telex messages sent out for ships to receive on special equipment, concerning urgent navigational and weather information, is also broadcast from Cullercoats and Portpatrick radio stations.

5. Marine Enquiries and Consultancies

These activities continue to grow, with a wide variety of requests received from many sources. Meteorological information and analyses were provided in support of the design of offshore structures, planning of marine operations and litigation arising from accidents involving cargo damage, ship's damage or loss and in some cases loss of life. These enquiries referred to locations almost anywhere in the world.

In addition to statistical analysis of different types of data and provision of statements of weather conditions, forecasts and synopses applicable to events in the past, several studies of particular incidents were made in depth using all available information. Three such studies included an appearance before a Wreck Commissioner or High Court.

A major study involving the development of a simple computer model of

structural icing was undertaken. This formed part of a complete re-draft of the Department of Energy Guidance Notes (Meteorological Section) for designers of offshore structures. Support was also provided for a Global Wave Atlas produced by British Maritime Technology Ltd (formerly National Maritime Institute) using only wind and wave data originating from VOF ships.

6. Awards to Voluntary Observers

Long-service barograph awards were presented to four shipmasters who have been associated with voluntary observing for most of their seagoing life to date.

Excellent Award books were issued to 100 shipmasters, principal observing officers and radio officers in recognition of their superior efforts in compiling meteorological logbooks during the year. The special book chosen was *Great Rivers of the World* edited by Alexander Frater, other books awarded being *Philip's University Atlas* and *Chamber's Twentieth Century Dictionary*.

7. Port Meteorological Officers' Conference

The Met. Office Deputy Director of Observational Services, Dr P. Ryder, opened the Port Meteorological Officers' conference at Bracknell on 24 October with the good news that the acquisition of the Netherlands weathership at the end of the year would enable station 'Lima' to be manned until about 1988, and at great savings to the Met. Office, also resulting in an increase of U.K. seagoing employment. He also highlighted the continuing need for regular surface observations from ships of the VOF, particularly the overnight data from the eastern North Atlantic. A conference report is contained elsewhere in this edition.

THE MARINE OBSERVERS' LOG



April, May, June

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

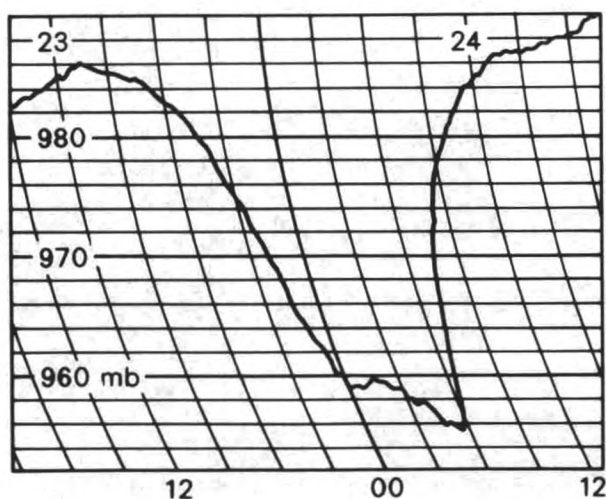
Observing officers are reminded that preserved samples of discoloured water, luminescent water, etc. considerably enhance the value of such an observation. Port Meteorological Officers in the UK will supply instructions on how to preserve and pack such samples on request.

INTENSE DEPRESSION

South Pacific Ocean

m.v. *Resolution Bay*. Captain J. H. Hutson. Port Chalmers to Flushing. Observers: the Master, Mr. D. J. Robertson, Chief Officer, Mr B. Coupland, 2nd Officer, Mr J. Harlock, 3rd Officer and ship's company.

23–24 April 1985. During this period, an intense depression passed over the vessel. The following information has been extracted from the ship's deck and meteorological log books. The barogram illustrates the contours of the depression as experienced by the ship.



Date and time (GMT)	Wind Direction	Wind Force	Dry Bulb (°C)	Pressure (mb)	Remarks
23rd 0900	NW	7	5.2	983.0	Rough seas and moderate swell.
1300	NW	6	5.5	986.0	Rough seas, moderate swell. Occasional rain showers.
1700	NW	4	5.2	986.0	Moderate sea and swell.
1930–2030	—	—	—	—	Wind veered to SSE, force 4, pressure falling quickly.
2100	SSE	3	3.8	970.4	Slight sea. Moderate, confused swell. (Pressure fall of 10.5 mb between 1700 and 2100.)
24th 0000	SSE	8	2.5	965.9	Very rough sea. Moderate, confused swell. Overcast with continuous rain.
0400	N	8	6.2	960.5	Seas and weather as for 0000.
0600	—	—	—	957.8	Minimum pressure reached.
0645–0715	—	—	—	—	Wind backed quickly from N'ly, force 7, to W'ly, force 10–11. Pressure rising rapidly.
0730	W	12+	—	—	Radar scanner is stopped by wind force. Visibility seriously affected by driving spray. Sea completely white with foam.
0800	W	12	4.0	965.7	Phenomenal seas and moderate swell. Visibility obscured by driving rain and spray.
1200	W'N	10	6.0	983.8	Vessel rolling very heavily at times to high seas and heavy W'N'ly swell. Overcast with occasional heavy rain squalls.
1600	WNW	10	6.7	988.7	Vessel rolling to very high seas and heavy WNW'ly swell.
2000	WNW	6	7.9	991.0	Moderate seas, low swell. Cloudy, fine. Weather improving.

The wind remained NW'ly, force 6–7 until the afternoon of the 25th when it backed to w'ly, force 5.

Position of ship at 1700 GMT on 23rd: 56° 25's, 82° 37'w.

Position of ship at 1600 GMT on 24th: 56° 07's, 68° 57'w.

LUNAR RAINBOW

Moçambique Channel

m.v. *Bolnes*. Captain R. W. H. Dole. Jeddah to Richards Bay. Observers: Mr C. W. Milne, 3rd Officer and Mr R. W. P. Harris, SG 1a.

4 June 1985. At 1815 GMT, whilst on passage through the Moçambique Channel, a very vivid example of a lunar rainbow was sighted with a fairly clear supernumerary bow to the inside. The main rainbow showed the full range of colours vividly, except for yellow which could be seen very faintly with binoculars. The supernumerary bow had a blue colour to it and seemed to be more curved than the main bow; even with glasses, no other colours apart from a dark and a lighter blue could be seen.

The bows were observed in a direction of 265°, while the moon, being full and very bright was in the direction of 085° (this bearing could be slightly 'out' owing to the vessel rolling) at an altitude of 80–85°.

Weather conditions at the time were: air temperature 23.2° c, wet bulb 20.5, wind direction sw's, force 3, 4 oktas towering cumulus and showers in the area.

Position of ship: 23° 19's, 36° 32'E.

Southern Ocean

m.v. *Lloyd Australia*. Captain G. Alston. Durban to Sydney, Australia.

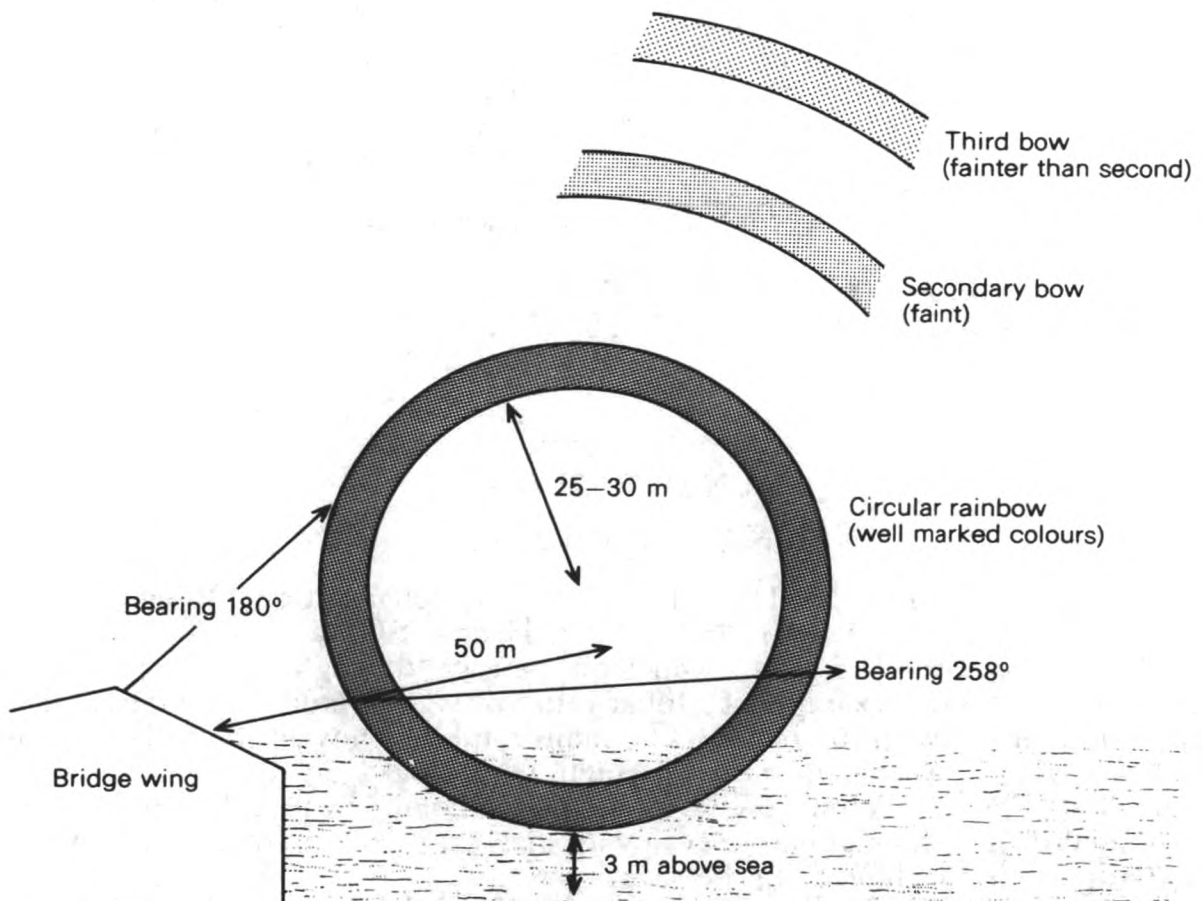
Observers: Mr K. Hope, Chief Officer, Mr P. Hancock, 3rd Officer and Mr M. C. Murphy, Radio Officer.

1–3 June 1985. The ship experienced fog throughout this period, visibility being less than 1 n. mile for most of the time. The wind was light and variable, and, as a result, the fog kept very low to the sea, but the sky was quite discernible for the greater part of the time. Rainbows were quite frequently observed both away from, and close to the ship. Of the bows observed, two were of outstanding note.

The first was on 1 June at 1110 GMT. On looking astern, a lunar bow was observed to be following the ship for a period of about 30 minutes. It curved over the stern of the ship at an approximate distance of 100 m. The bearing of the central part of the bow on the starboard quarter was 245° , and was 280° on the port side. The width of the bow was guessed to be about 1–2 m, and it was angled away from the ship. A bright full moon was shining at a bearing of 072° above the level of the fog.

Dry bulb 10.9°C , wet bulb 10.9 , sea temperature 12.4 .

The second bow was observed on 3 June at 0137 GMT. The ship had just experienced some very dense fog and had cleared this when a rainbow was observed on the starboard side very close to the bridge wing, so close that it was estimated to be only 50 m off the vessel. As shown in the sketch, this particular



one ended up being completely circular with two faint additional bows observed on the outer side of the top part. The bearing of the left-hand part of the bow was 180° , and that of the right-hand part was 258° . The radius of the circular

bow was estimated to be 25–30 m. This bow also angled away from the observer towards the sea. It managed to keep its circular shape for 10 minutes before widening out to form a bigger bow, normally shaped, and farther off the vessel. The two faint outer bows dissolved after the main one lost its shape. The sun had just risen above the fog level, both dry and wet bulbs were 8·9°C and the sea temperature was 10·6.

Position of ship on the 1st: 42° 21'S, 99° 59'E.

Position of ship on the 3rd: 43° 00'S, 112° 06'E.

DISCOLOURED WATER

Red Sea

m.v. *Providence Bay*. Captain A. M. Barker, Suez to Jeddah. Observer: Mr S. H. Pearce, 3rd Officer.

23 June 1985. At about 1000 GMT, discoloured water was sighted when approximately 2–3 n. mile from the ship. At this distance, it was thought to be pollution by oil, but as the phenomenon came closer, it was seen to be light brown in colour and was floating on the sea surface in streaks lying in the direction of the wind. The streaks were 1–2 n. mile in length and between 10 m and 0·25 n. mile in breadth. Several patches of the discolouration were seen during the following hour, and, whilst passing through one of the more densely coloured areas, a sample was taken for closer examination and preservation.

The sample did not appear discoloured as the sea, but it did contain numerous small fibre-like objects 1–2 mm in length.

Position of ship: 25° 00'N, 36° 00'E.

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

'The sample contains large numbers of the blue-green alga *Trichodesmium*. This plant is composed of unbranching filaments about 1 mm in length which occur aggregated into bundles, often containing ten or more filaments. It is sometimes described as looking like sawdust on the sea surface. It is very common in most warm water seas and oceans and often forms marked sandy or brownish streaks of discoloured water when the individual bundles accumulate in windrows. It is able to fix atmospheric nitrogen, and can therefore flourish in tropical waters whose layers are often very poor in other sources of nitrogen (such as nitrate or ammonia). One explanation of the name Red Sea is that it refers to the reddish-brown accumulations of *Trichodesmium* often visible there, as this report demonstrates.'

DOLPHINS

Eastern North Atlantic

m.v. *Lincolnbrook*. Captain C. T. Marchant. Ascension Island to Las Palmas. Observer: Mr P. G. Powell, Chief Officer.

11 June 1985. At 1330 GMT, a particularly interesting school of dolphins was noticed. The individuals had two very distinctive features, namely, a very long snout (longer than that of a Bottlenose Dolphin) which appeared to be black at the tip while lighter at the base, and a triangular (instead of a recurved) dorsal fin. Other physical features were the tail flukes which were more perpendicular to the body (looking more like an aircraft tail-plane) than those of a conventional dolphin, and the body shape which appeared to be more isometric, that is, the tail matched the head for bulk which gave the impression of a very streamlined head and a very powerful tail.

The dolphins were fairly long, estimated to be 2–3 m and had no predominant markings, being dark grey on top and a very light grey, possibly tinted, brown or green beneath. Although these dolphins approached close to the ship's side where the crew was working, they were not very active and appeared to be drawn by curiosity. However, they eventually left that area and raced out to the vessel's quarter wave where they started playing in a quite spectacular manner. Not only did they perform most of the aerobatics normally associated with dolphins, such as jumps and somersaults, but in about three out of every four jumps, they were spinning like tops. One dolphin which landed back in the water very nearly upright, left it again like a ballet dancer doing a pirouette and must have achieved at least five full turns.

They did not make any effort to keep pace with the vessel, but continued to play in the wake as it stretched out on the starboard quarter and could be seen with binoculars for some time afterwards still playing in the distance.

We estimated about thirty dolphins in the school.

Position of ship: 12° 07'N, 17° 40'W.

Note. Mr D. A. McBrearty, of the Department of Anatomy, University of Cambridge, comments:

'The description of a dolphin with a long snout, triangular dorsal fin and a deep caudal section together with the particular acrobatics of jumping and spinning longitudinally are all indicative of the so-called Long-beaked Spinner Dolphin (*Stenella longirostris*). Currently there are five recognised forms to which the common name "spinner" has been applied, four have long beaks and have been described from specimens found in the eastern and central Pacific (the "Hawaiian", "Eastern", "Costa Rican" and "Whitebelly"). The fifth is a short-beaked form (*S. clymene*) described from specimens found in the western tropical Atlantic. Long-beaked spinners also occur in both the Atlantic and Indian Oceans.

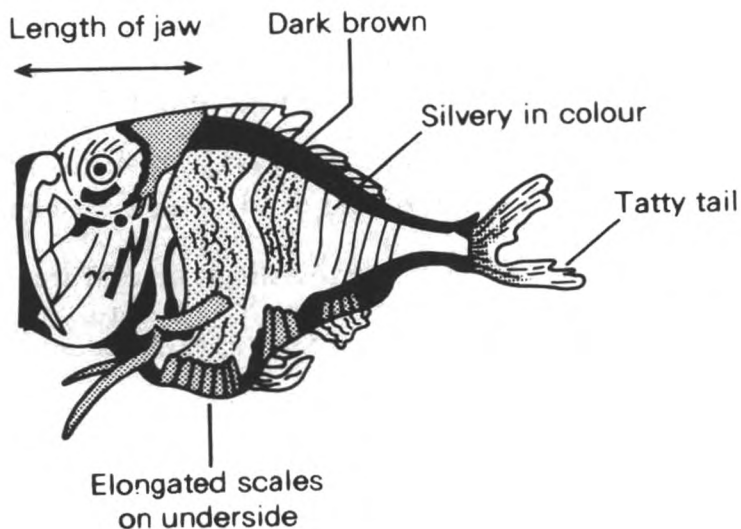
'The two photographs opposite page 69 show both the above-mentioned forms. The first one was taken off Brunei in May 1983 by Mr J. M. Allison (then serving in the P&O Company's *Pacific Coral*) and shows the very long beak of *S. longirostris*. The second shows what I believe to be the Short-beaked Spinner *S. clymene*. It was taken by Mr C. Woods (then serving in s.s. *Shoush* in 1978). Mr Woods believes, but is not absolutely sure, that he took the picture "in the Indian Ocean, probably north of Madagascar". What makes this interesting is that *S. clymene* has not been reliably reported from the Indian Ocean although it has been seen in the tropical Atlantic. At this time the *Shoush* was engaged in voyages around the Cape and there could be nothing significant about this picture but, and it is a very large "but", it could show that *S. clymene* can be found in the Indian Ocean.'

FISH

Bay of Biscay

m.v. *Myrmidon*. Captain P. A. Smith. Bremerhaven to Port Said. Observer: Mr K. P. Widdowson, 3rd Officer.

18 April 1985. During the morning 8–12 watch, whilst leaving the western approaches to the English Channel, a great number of seagulls were gliding over the ship, looking for fish and scraps of food. One of the seagulls made a catch, hovered over the accommodation, and then dropped the fish on deck. A strange-looking character as drawn opposite.



An unusual feature about this fish was that it glowed quite brightly in the dark.

Position of ship: Approximately 47° 00'N, 07° 00'W.

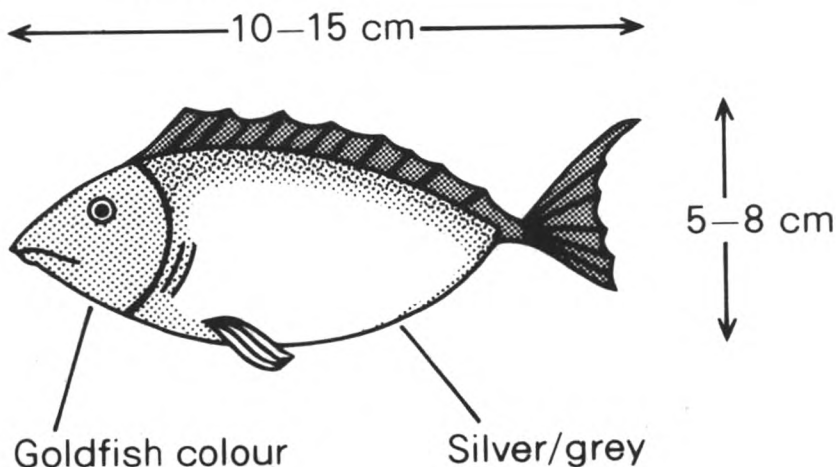
Note. Dr F. Evans, of the Dove Marine Laboratory, University of Newcastle upon Tyne, comments:

'At last we have an observation which confirms our speculation as to how these small fish get on to ships' decks! The fish is another example of a Hatchet Fish, *Argyropelecus offersi*, of which there have been quite a number of reports from this locality. In April 1979, the Lookout on the *Timaru Star* was hit on the head by a Hatchet Fish "fallen out of the sky". The fish are supposed to spend their days at depth and their nights at the surface, but clearly, they can be taken by seabirds around dawn. More reports please.'

Arabian Sea

m.v. *Cairnsmore*. Captain A. J. C. Berkeley. Helsinki to Singapore. Observers: the Master and ship's company.

3 June 1985. At 1000 LMT, I went to the bridge and from the wing noticed many thousands of dead fish on the sea surface. On closer examination, the fish were found to be of a single type as illustrated, and not long dead, as none were



bloated. There was no apparent pollution, no discolouration and no other types of dead fish, in fact, flying fish, porpoise and whales were sighted during the period.

Initially, I thought that it was a localized occurrence, but for the next twenty-four hours (312 n. miles) the dead fish were seen, even at night, as an almost full moon shone. Not until noon on the 4th did the decimation start to ease, and at 1400 cease altogether.

The dead fish lay mostly in long lines along the wind SW/NE, and as our course was ESE'ly, we saw only a fraction of the dead, which we cannot even begin to estimate.

Weather conditions at the time were: air temperature 28.0°C, sea 29.0, pressure 1003.0 mb, wind SW to SWW, force 8, sea state very rough.

At the first sighting, the ship was 15.5 n. mile from Socotra. Course 105°, speed 13 knots.

Position of ship at final sighting: 11° 30'N, 59° 00'E.

Note. Dr F. Evans comments:

'This report of the dead fish in the Arabian Sea is very interesting. A common reason for fish mortality is the blooming of a "red tide", that is, species of plant plankton which are toxic to fish. This seems not to be the cause of the present fish death. The fish in question are deep water fish, living in the darkness beyond the reach of the red tides which are surface phenomena and dependent on sunlight. Moreover, a red tide would have killed many more kinds of fish than these.

'Much more likely, they have suffocated from lack of oxygen. In the Arabian Sea is a layer of deep water which is highly saline, stagnant and with little oxygen. Although this deep water would make for a stressful environment, fish would normally live there quite well. However, if the small amount of oxygen were to be consumed by an unwonted input of organic material (which would rot) then the fish would die. The organic material could only come from surface waters and this in turn must have been due to exceptionally high primary production ("the grass grew well this year"). Please note that the huge mortality would not be due to pollution.

'It is not possible from the sketch to be sure of the fish's identity. At 13 knots in a force 8, the observers did well to draw the animal at all, but of course a preserved specimen would have been ideal. The best guess is that it was the Indo-Pacific Boar fish *Antigonia rubescens*. This fish grows to 22 cm and is demersal, that is, it lives not far from, but not on the bottom, in depths quoted in the literature as from 65 m to 600 m.

'It is reddish dorsally and has yellow fins, but these might not have been conspicuous. I am clear that the very large numbers of one species indicate a deep fish, from levels where variety is low, and not fish borne by currents from coastal waters. Moreover, in that area, coastal species would be a) less numerous but with more variety and b) well rotted. On the other hand, had they been near-surface oceanic fish they would not have been goldfish colour dorsally, but blue.

'This is the best explanation I can give of a very interesting observation.'

SEA SNAKE

Indian Ocean

m.v. *Appleby*. Captain C. B. Tingle. Port Dampier anchorage. Observers: the Master and Mr W. McElhaney, Bos'n.

2 April 1985. At 0632 GMT, while weighing anchor to shift from the outer anchorage to the inner off Port Dampier, a large sea snake was seen swimming past the anchor cable. The snake was about 2 m in length and was a yellowish-buff colour with several dark brown patches and bands on its body. These patches and bands were surrounded by a border of white.

The snake's head was a slightly-rounded wedge shape and was kept perfectly still and slightly raised above the surface of the water, with a ripple-like movement passing down through the length of the body to propel it. Near the tail end, the body appeared to flatten out vertically and take on a ribbon-like form, this can be seen in the sketch.



On passage between the anchorages, several more snakes of various sizes were seen, though none were as large as the original sighting. All the snakes were observed to be travelling seaward, that is, against the incoming tide.

The weather was fine and calm at the time, with just a very slight ripple on the sea surface.

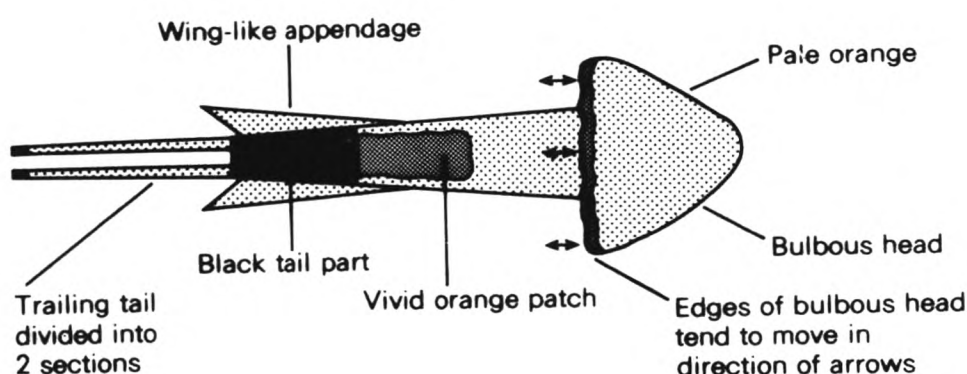
Position of ship: 20° 30's, 116° 30'E.

MARINE LIFE

Equatorial Atlantic

m.v. *Afric Star*. Captain J. C. Harris. Sheerness to Santos. Observers: the Master, Mr P. J. Cowing, 2nd Officer and Mr A. Richmond, 3rd Officer.

20 June 1985. At 2300 GMT, whilst the vessel was stopped, approximately eight sea creatures, as depicted in the sketch, were observed on the port side of the ship. They had large, bulbous heads and were predominantly pale orange in colour, each displaying a vivid orange patch adjoining a black tail part. The creatures had silver undersides and ranged in length from 20–35 cm.



Wing-like appendages protruded from their tapering abdomens, while their tails were divided into two trailing sections.

The creatures were attracted to the vessel's overside lights and were noticed to move at a startling speed. At times, they were observed to leave the water and travel approximately 3 m before re-entry.

Weather conditions at the time were: air temperature 24.0°C, wet bulb 23.2, sea temperature 28.4. Wind NE'ly, force 3.

Position of ship: 08° 46'N, 28° 48'W

Note. Dr F. Evans comments:

'This valuable account began by rather misleading me, since what was described as the head, is in fact the back end. The portion labelled "tail part" is the head, and the "trailing tail" represents two anterior tentacles. The creatures were, in fact, squid. Squid possess eight arms and the two longer

tentacles shown in the drawing. Frank Lane in his book *The Kingdom of the Octopus* declares that squid normally swim backwards when travelling fast, which doubtless deceived the observers as to which end was which.

'As to species, there is one well-known species of flying squid, *Onychoteuthis banksi*, which is known from the locality, and these were possibly them. There is another Selected Ship squid record from the same latitude in the Atlantic but 20 degrees farther west, published in *The Marine Observer*, January 1982. The description there strongly suggests the same species. However, squid colouring is highly variable, so some caution is required. With two observations to go on, I will now try further to identify the animals. By the way, flying squid have been known to fly aboard over 3 m bulwarks, which gives some indication of their power. They are the only flying molluscs.'

VELELLA

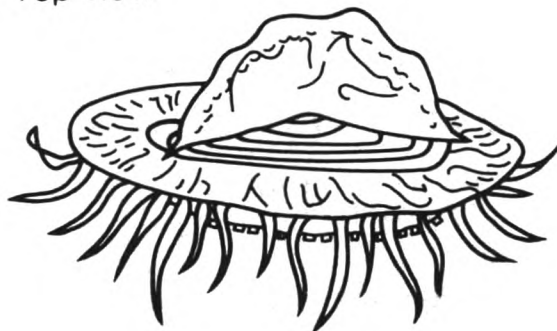
North Pacific Ocean

m.v. *Mosel Express*. Captain W. A. Murison. Kaohsiung to Oakland. Observers: the Master, Mr M. Barraclough, 3rd Officer, Mr S. J. Edge, 2nd Officer, Mr C. W. Hodgson, Radio Officer and Mr N. D. Bedford, LSM.

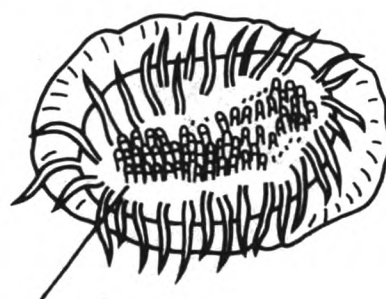
9 May 1985. At 1600 GMT numerous patches of what appeared to be grease were sighted ahead. As the vessel approached, we realized that it was not grease, but large clusters of small sea animals. These clusters varied in size from 40 mm by 20 mm, to 10 mm by 10 mm, there were also many animals floating individually.

We eventually caught three of them in a bucket. On inspection, it was found that they consisted of a large oval float around the main body, and a sail crossing the main part at an angle of approximately 40° to the main axis of the float, as shown in the sketch. From below, the outside of the body had large tentacles, while the centre section of it consisted of smaller suckers or tentacles.

Top view



Underside



Blue centre

The largest of the specimens caught was 4 cm long, 2.3 cm wide and the sail was 2 cm high. The longest tentacles measured 1.8 cm, while the shorter ones measured 5 mm. The sail and float had a waxy appearance and were capable of shedding water. Both the sail and main float seemed quite rigid whereas the body was spongy. During the morning, while it was overcast, the clusters appeared to be light yellow in colour, whilst in the afternoon when the sun was shining, they seemed to be a light green.

We observed clusters of these animals throughout the day.

Position of ship: 42° 24'N, 135° 32'W.

Note. Dr F. Evans comments:

'The animals observed were examples of *Velella velella*, the "By-the-wind-sailor". The excellent drawings give a fine impression of the creatures, which are related to sea-anemones although, of course, they are entirely pelagic and are never attached to rocks. The several reports I have received of velella in the North Pacific Ocean around this date suggest that they were quite exceptionally common. It also illustrates the value of merchant ship observations in this field; without them, the phenomenon would undoubtedly have been missed. I intend to make this, and similar observations known in the appropriate quarters.'

North Pacific Ocean

m.v. *Main Express*. Captain K. Owen. Kaohsiung to Oakland. Observers: the Master, Mr J. Dixon, 1st Officer, Mr R. Walker, 2nd Officer and Mr M. Elliot, 3rd Officer.

12–15 May 1985. Whilst on passage, sightings of numerous 'Men-of-War' were an everyday occurrence. At first sighting, what appeared to be a patch of discoloured water approximately 15 m by 30 m was seen. This was a yellow-greenish colour, and looked to be smooth, as though a film of oil was on the surface. As the vessel closed on this patch, it could be seen that it was a 'shoal' of Men-of-War (which we subsequently decided were *Velella*) so dense that no water could be seen between them. Similar sightings took place all day, and in the afternoon, long wind-blown streaks of yellowy-green could be seen stretching for thousands of metres, consisting of millions upon millions of organisms. On closer inspection from the main deck, the colour of the patches was the same, but when the vessel passed through a patch and scattered individual 'bubbles', the usual deep could be seen around the clear bubble. The average size was about 4–5 cm, but varied greatly as there were such vast amounts. See photograph opposite page 68.

The following day, these observations took on a different appearance. Vast numbers were still seen, but were not observed as discoloured patches. As it was now overcast, whereas the previous day had been sunny, it was assumed that the diffusion of light through the millions of bubbles had given the yellowy-green appearance. We travelled through the *Velella* for five days, by the end of which time, they had thinned out considerably from the solid patches observed on the 12th and 13th, but were still visible in large numbers. We had covered over 2000 n. mile since the very first sightings on the 10th. How far on either side of the ship did this near-solid mass stretch?

A specimen — only small in size unfortunately (originally packed in a container of spirit, which was smashed and replaced with one of gin) was obtained. Whilst the colour of the *Velella* was originally an azure blue, it changed to a brown/yellow colour shortly after immersion in the gin. It was oval in shape, and measured about 2 cm by 1 cm. Beneath the raft were short tentacles surrounding a central 'mouth', and there was a clear sail, roughly triangular in shape, set at an angle across the raft. This sail was about 2 cm high, and 2 cm wide across the oval. Also clearly visible when viewed from above, was a series of concentric rings.

Position of ship: 38° 00'N, 179° 54'W.

Note 1. Dr F. Evans comments:

'The specimen included with this report was the skeletal remains of *Velella velella* or "By-the-wind-sailor", confirming the shipboard identification in the best possible way, by the forwarding of the actual animal. I have never seen a report of such truly astronomical numbers and find it quite awe-inspiring. The intense blue colour is characteristic of many animals that live right at the surface in warmer seas, presumably as a camouflage. Polewards, such animals may appear greener. In the case of velella, this blue colour appears to be soluble in alcohol, hence the discolouration when immersed in gin!

'Velella is an animal whose anatomy and so on is very well known, but whose life history is not. We lack even knowledge of how long it lives, whether it is for a few months or many years. May I point out once more, that without the VOF, this immense outburst could well have gone unnoticed.'

Note 2. The *Main Express* is a Selected Ship of the Hong Kong voluntary observing fleet.

Note 3. We have also received reports of Velella from other ships on passage in the North Pacific Ocean, namely, the *Fort Providence* (22–25 April), the *Albright Explorer* (9–18 May), the *Pacific Crane* (13–23 May), the *Stolt Sceptre* (17 May), the *Pacific Teal* (18–20 May), the *Fort Victoria* (19–22 May, see photograph opposite), the *Valdivia* (26 May), and the *Galconda* (13–14 June).

CRABS

Western North Atlantic

m.v. *Lincolnshire*. Captain R. A. F. Edwards. at anchor Cape Henlopen, Observers: the Master, Mr I. D. Gordon, 3rd Officer, Mr G. J. Simpson, Radio Officer, Mr S. J. Austin, Chief Engineer Officer.

26 May 1985. Between 1200 and 1400 GMT, numerous individuals of the species shown in the photograph opposite page 97 were observed floating close by the ship on the southerly current flowing along the coast. Their posture whilst floating was vertical, with their tails pointing downwards.

All those seen appeared to be dead. Two individuals were hoisted on board using a drop-net, and were indeed, dead, their 'aroma' indicated that this had been their condition for some time!

The dimensions of the specimen in the picture were: tail 18 cm, length of main shell structure to tail 35 cm, whilst the 'beam' was 30 cm. Beneath the shell, on each side of the main body structure, four legs could be seen. In the sea, substantial amounts of vegetation had been seen close to the creatures. One school of thought was that these creatures were Horseshoe Crabs.

After they had been lying on the deck for some time, a clear liquid could be seen oozing from beneath the shell. Upon turning it over, thousands of small white eggs appeared around the fleshy tail end of the body.

Position of ship: 38° 38'N, 74° 57'W.

Note. Dr F. Evans comments:

'This is an example of the Atlantic Horseshoe Crab *Limulus polyphemus*. Horseshoe Crabs live largely on bivalve molluscs (clams and their relatives) which they find in the sediment. They breed on the tide line making a nest in the sand. The eggs described in the report could not have been fertilized, since the eggs of *Limulus* are laid into the sea before fertilization takes place, and the developing embryos are not carried about by the mother as in true crabs, but become immediately planktonic. Indeed, Horseshoe Crabs are not closely related to crabs, being nearer to spiders and scorpions. They are geologically very ancient. By the way, there are five pairs of walking legs, not four.'

BIOLUMINESCENCE

Equatorial Eastern Pacific

m.v. *Samaria*. Captain H. Evans. Balboa to Valparaiso. Observers: the Master, Mr I. W. Spikings, 2nd Officer, Mr M. K. Clark, 3rd Officer and Mr I. J. McMahon, Cadet.

13 April 1985. Shortly after dark, at 1130 GMT, intense bioluminescence was observed in the vessel's bow wave. By 0100 on 14 April, rings of bioluminescence were visible emitting a greenish-white light. On inspection through

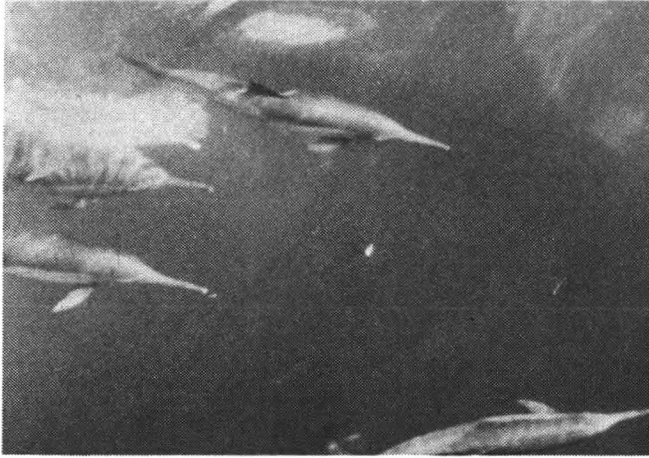


Massed Velella as photographed from m.v. *Main Express* (See page 67)

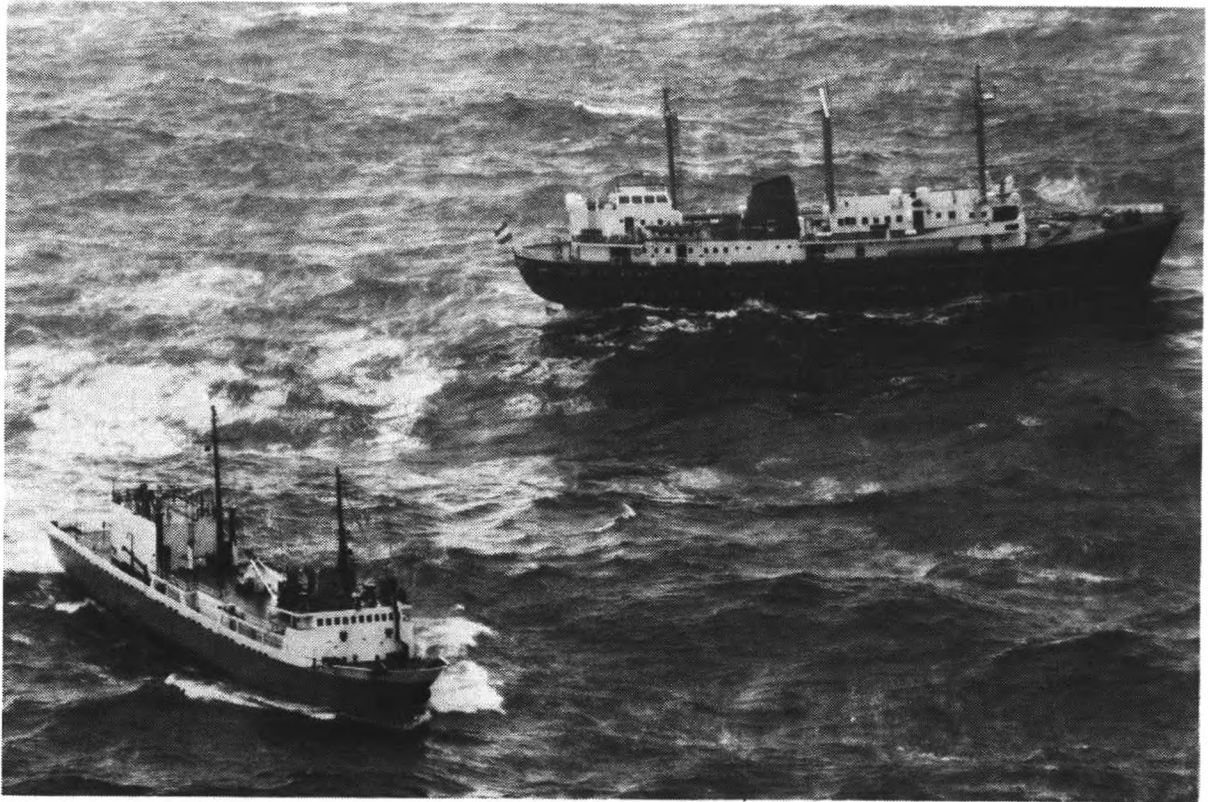


Photo by R. Tremlett

Velella brought on board m.v. *Fort Victoria* (See page 68)

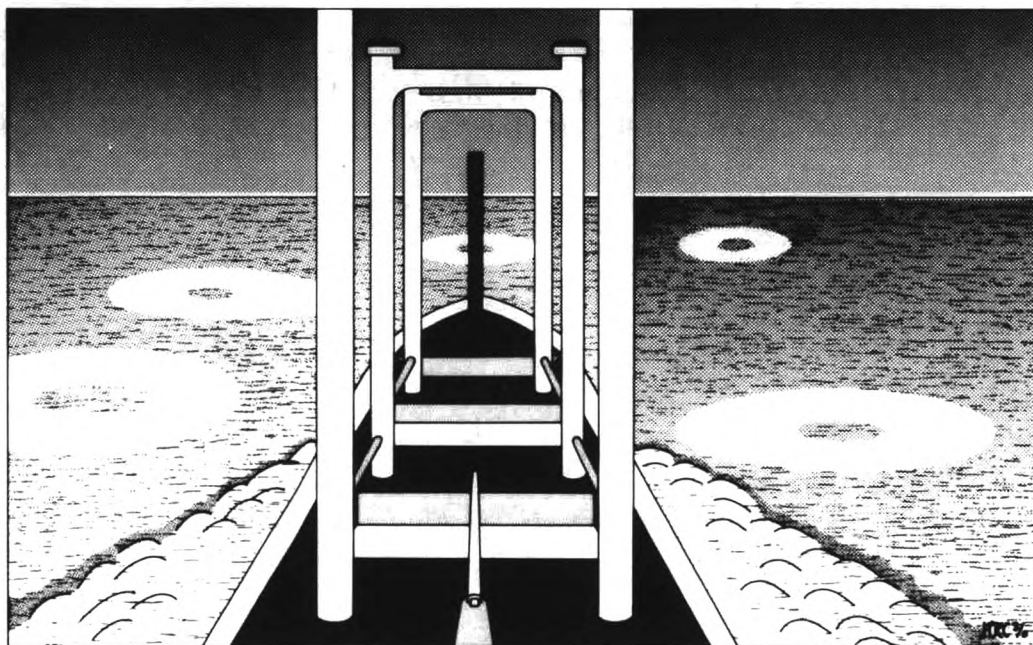


Long-beaked Spinner Dolphin (left), and Short-beaked Spinner Dolphin (right).
(See page 61)



The last daylight handover by the U.K. Ocean Weather Ship *Starella* to the Netherlands Ocean Station Vessel *Cumulus* at Ocean Station 'Lima' in position 55° 30'N, 17° 00'W at 1141 GMT on 18 November 1985. *Cumulus* is at top right and *Starella* at bottom left.
(See page 99).

binoculars, the rings seemed to result from balls of bioluminescence rising to the sea's surface. On breaking the surface, the rings spread out, quickly increasing in diameter before eventually fading away. The sketch shows the effect seen.



It was noted that the sea-water temperature had fallen from 22.4°C at 1800 on the 12th, to 20.5 by 0000 on the 13th and to 19.0 by 0140. By 1800 on the 13th it had risen once more to 22.2. On consulting the Admiralty Sailing Directions for the area, it seems we passed through an area of upwelling, so we suspect this phenomenon may have been connected somehow.

The rings ceased appearing at around 0150, but were again observed at approximately 0300, and continued in a reduced fashion until about 0900. From the bridge wing some 19 m above the water, the rings reached a maximum diameter of about 150 m.

On referring to the April 1984 edition of *The Marine Observer*, and Mr Savage's report of bioluminescence in the Straits of Hormuz aboard the *Australia Star*, we decided that no 'revolving blades' had been evident, merely rings increasing in diameter. However, at around 0600, a school of dolphins was observed producing long, luminous, weaving trails of the type referred to by Mr Swinney on board the *Wild Flamingo* on this same coast.

Shining the Aldis lamp upon the sea's surface, and running the echosounder had no discernible effect upon the phenomenon and no luminescence was observed in the sample taken with the sea temperature bucket.

Weather conditions at 0140 on the 13th were: air temperature 19.8°C, wet bulb 19.4, sea 19.0, wind s'ly, force 2.

Position of ship at 0100 GMT on the 13th: 07° 00's, 81° 06'w.

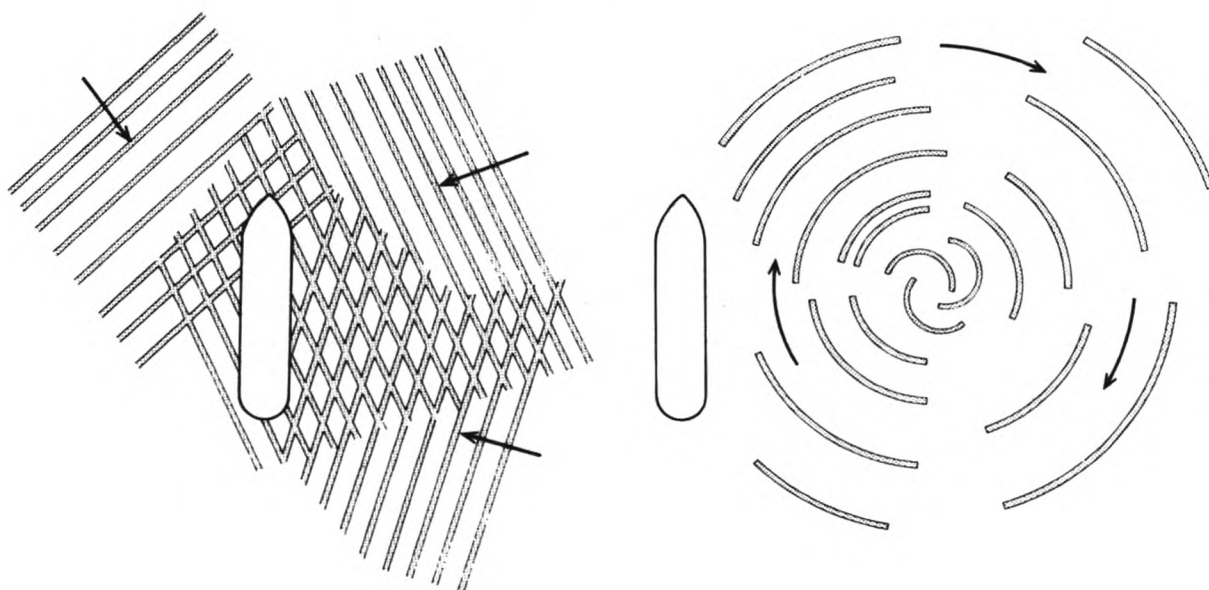
Java Sea

m.v. *Entalina*. Captain J. D. Lakeman. Singapore to Darwin. Observer: Mr S. Gallaway, Chief Officer.

29 May 1985. At 0210 LMT I witnessed the start of a bioluminescence display. My first impression was that the ship was being 'attacked' on all sides from different directions by pulsing light-bands. A dull 'strobe-light' effect flashed through a mist, giving the bands a dirty white to grey colouration which was not a 'smooth' colour, but rather grainy in appearance. The bands were about 2 m wide and about 2 m apart and moving at speed. At first it was difficult to discern

whether or not the bands were in the water or just above the surface, as no form of reflection or distortion was visible off the hull. In the end, I decided that the effect must be waterborne if only because nothing was visible in the vessel's wake.

The most intense activity was observed on the starboard side of the ship where the phenomenon appeared to stretch as far as the horizon. At this stage, it did not appear localized, just a mass of high-speed interacting bands of light. The effect is shown in the first sketch. As is usual on an 'all aft' ship, you



become 'deaf' to the constant background noises, but I gradually became aware that the pulses of light seemed to match those of the main engine's throb, that is, about two per second. The radar (3-cm radar, running on the 24-n. mile range), and the echosounder (indicating a water-depth of 35 fathoms), were switched off in turn to see if any change was discernible, but there was not.

However, at about this time, the ship passed a localized revolving system, distance off appeared to be about 150 m. My impression was that of a catherine wheel revolving and casting out waves in an angular motion, as shown in the second sketch. How many spokes it had I'm not sure owing to the speed of the pulsations, but I think that there were at least three. If viewed from above, the system rotated in a clockwise direction, wheeling itself along the ship's track. No central hub was visible, just a dark area devoid of activity. One or two systems were visible farther out to starboard.

Once the closer system had passed, the whole phenomenon diminished in intensity very quickly and disappeared. It was also interesting to note that this little display had no effect whatsoever on my Chinese watchman, who appeared totally unmoved.

The display lasted for about ten minutes. The weather conditions were: dry bulb 27.5°C , pressure 1007.5 mb , wind SE'E, force 4, sea state 3, with a negligible swell. The sky was totally overcast.

Position of ship: $06^{\circ} 51'\text{S}$, $114^{\circ} 54'\text{E}$.

Note 1. Dr P. J. Herring, comments:

'This report has almost all the typical features of a "phosphorescent wheel" phenomenon. The high speed of the moving parallel bands, changing into a rotating system travelling with the vessel, the uncertainty as to whether the light was above or on the surface, the lack of a central hub and the shallow water are all frequent features of this phenomenon. There is no certain explanation for

them, but two characteristics are likely. Firstly, the rotary wheel-like motion is probably an illusion of the perspective effects of the parallel bands, and secondly, the bands often have a frequency of about two per second. As the observer very helpfully notes, there is a probable correlation with the engine's r.p.m. and the vessel may itself induce some aspects of the phenomenon. It is not understood why they are particularly frequent in certain regions of the Indo-Pacific and Persian Gulf. I know of four other reports from this area north-east of Java.'

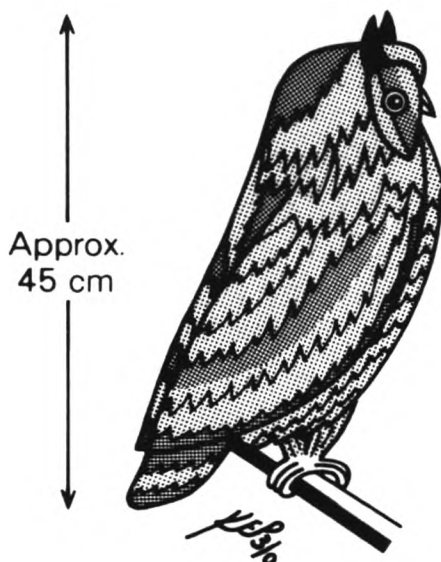
Note 2. An article by Dr Herring and P. Horsman, entitled 'Phosphorescent Wheels: Fact or Fiction?' was published in the October 1985 edition of this journal.

BIRDS

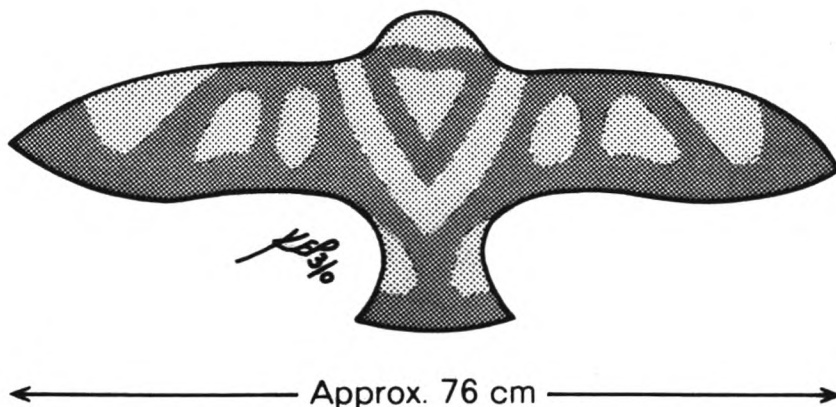
Baltic Sea

m.v. *British Tenacity*. Captain F. A. Smith. At anchor, Klaipeda. Observers: Mr K. E. Powell, 3rd Officer and members of the ship's company.

20 April 1985. The vessel came to anchor at 0100 LMT, and during the first hours of daylight, the owl pictured below, was observed hovering around it.



As the day progressed, it remained with the ship, often perching on railings, pipelines and tank valves. If disturbed at all, it would fly off, only to return later on, and as the evening drew in, it ventured from the ship less and less. Many of the ship's officers and crew observed the bird during the course of the day.



Thought to be a Short-eared Owl, it was predominantly brown with flecks of light and dark on the wings (giving a 'V' appearance when seen from the back) and head. Its breast was cream with mottled brown flecks and occasional orange or brown tinges, depending on the light. It stood approximately 45 cm high and had a basic 'V'-shaped face with large, deep-set, bright orange eyes; there were also dark brown tufts giving the appearance of ears. The beak was small and hooked, and the talons were long. Its wing-span was approximately 76 cm, and when on the wing, the owl tended to glide on air currents as opposed to flapping.

This was the vessel's third visit to Klaipeda in the course of two weeks, and the weather had noticeably changed during this time. The temperature had increased by 10°C and conditions had become much more hazy. The wind had veered from a generally E'ly direction to S'ly or SW'ly. There were noticeably more small birds and insects in the environment, and a dead bird stripped of feathers and half eaten, was observed.

Position of ship: 55° 43'N, 21° 07'E.

Note. Commander M. B. Casement, Chairman of the Royal Naval Birdwatching Society, comments:

'This was probably a Short-eared Owl *Asio flammeus*, which migrates across the sea in many oceans of the world. It would have been on its way north to breed in Scandinavia/northern Russia. An interesting record, as not many observations are received from the Baltic.'

East China Sea

m.v. *Fort Victoria*. Captain M. Caine. Shanghai to the Columbia River. Observers: Mr R. Tremlett, 3rd Officer and members of the ship's company.

15–16 April 1985. Shortly after nightfall in both dates, approximately 400 small birds settled down for the night on the ship's superstructure, rails and cranes.

The birds were about 10–12 cm long, dark in colour with a blue patch on the head, and flashes of blue on the wings and tail which was very much like that of a swift. A photograph of the birds was taken, and appears opposite page 97. It was assumed that the birds were migrating north to China, using the ship as a resting post on the way.

On both occasions, the birds left the ship at daybreak.

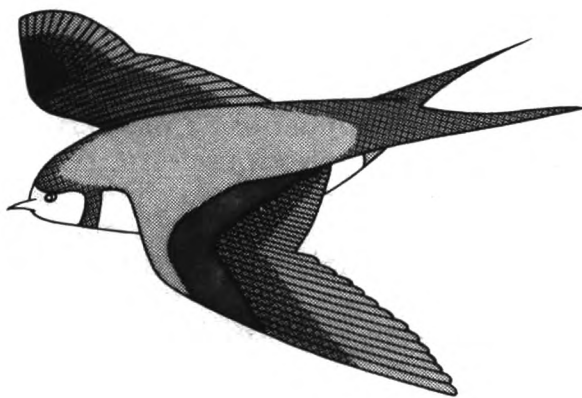
Position of ship: 30° 35'N, 127° 36'E.

m.v. *Kowloon Bay*. Captain A. A. Railton. Nagoya to Suez. Observers: the Master and ship's company.

16 April 1985. During the morning, approximately nine small birds were seen sitting on one of the ship's rails near an engine room exhaust vent. There had been moderate drizzle before the observation, so it was assumed that the birds were drying out.

The head of each around the bill was a rusty red colour, whilst the crown was a soft brown. There was a black collar and, as shown in the sketch, the undersides of their bodies were white. The leading wing edge was blue merging into black, whereas the remainder of the wing was brown. The birds had forked tails and a darting, swooping flight as they folded and opened their wings.

At 0800 GMT, one of them visited the wheel-house, sitting on warm items such as the 2182 RT and VHF unit. Presumably owing to its state of fatigue, the bird could be approached to about 1.5 m before it moved. An hour later, it flew into



one of the windows, it was obviously stunned which made it possible to pick the bird up. We could now measure it and the length of body was 14 cm from head to tail.

Having recovered its senses, the bird found the door and made its exit. The number of birds became fewer gradually, and by late on the 17th no more could be seen.

Position of ship: 27° 06'N, 129° 06'E.

Note. Commander M. B. Casement comments:

'The sighting on board the *Fort Victoria* is a spectacular and interesting record. These birds, and almost certainly those seen on the *Kowloon Bay*, are Barn Swallows (*Hirundo rustica*), the same species as in the United Kingdom, Europe, Asia and North America. They make long journeys (e.g., to South Africa and back) in spring and autumn migrations and are regularly reported resting on board ships. At this time of year, they would have been heading north to China.'

North Pacific Ocean

m.v. *Fort Resolution*. Captain P. Moore. Longbeach to Kaohsiung. Observers: the Master, Mr A. M. P. Henderson, Chief Officer, Mr A. Graveson, 2nd Officer and Mr I. R. Philips, 3rd Officer.

7 May 1985. On this day, the vessel was joined by a number of large seabirds. Consultation with *A Field Guide to the Seabirds of Britain and the World* by Tuck and Heinzel showed they were 10 Laysan Albatrosses (all adult), and 6 Black-footed Albatrosses (four adults and two immature). The Black-footed Albatrosses were content to sweep back and forth across the ship's wake, but the others gave a display of flying around and across the foredeck and accommodation, coming within 2 m of observers on the bridge wing. Some landed for a while on the hatches, or on the water. Two of those that landed on No. 6 hatch spent a day entertaining us with their mating rituals, both on top of the hatch and on the adjacent deck.

The ritual consisted of standing facing each other, rapidly clacking their beaks, and then 'fencing' each other with them. They would also bob their heads rapidly, in time with each other, and then one or the other would break off this activity, touch itself under a raised wing, and immediately afterwards, throw its head right back while making a high-pitched keening sound. The head-bobbing would then continue. At times they would just sit or stand quietly together, occasionally touching one another with their beaks. It was at times like this, that the male (presumably) would manoeuvre itself round to the back of the female. She however, would move farther away, but not too far. This continued until darkness when the two birds settled down close together on deck to sleep.

The next morning, after a bit of preening, the two flew off to join their fellows, apparently without consummating their 'marriage'. Throughout the day, the other Laysan Albatrosses had wheeled round and round over the pair, passing in turn over their heads, almost like a protective air umbrella. With the wind being force 5 for most of the period, the birds seemed to have no difficulty taking off from the ship's hatches or the sea. The Laysan Albatrosses stayed with us for two or three days, but the others remained for a couple of days longer and took over the flying displays around the ship, no longer content to stay back over the wake.

Position of ship: approximately 33° 00'N, 140° 00'W.

Note. Captain A. S. Young, of the Royal Naval Birdwatching Society, comments:

'This is a most interesting, and I might venture, quite unique report. While I have had a few reports recently of albatross landings on board, none have been of this character. My own experience has always shown the Black-footed Albatross (*Diomedea nigripes*) to be the more venturesome, closing alongside in a beam wind while the Laysan Albatross (*D. immutabilis*) would stand off. The numbers purposely landing on board is in itself rather unusual, and the behaviour as I say, quite unique.

'The "mating ritual" or rather "courtship display" per ornithological phraseology, is most interesting and I'm quite surprised at this obvious exhibition in such an unusual situation. The clacking, fencing and mutual touching is very characteristic of the display procedure, and also the "hard to get" tactics of the female. The obvious interest displayed by the other birds of the species is also of considerable interest in showing a quite positive relationship between them. In spite of the fact that they did not go "the whole hog", you can consider yourselves very favoured in witnessing this unusual episode gentlemen.

'What an opportunity for a photographic enthusiast – !!'

INSECTS

Eastern South Atlantic

m.v. *Servia*. Captain D. M. Kissane. Cape Town to Sheerness. Observer: Mr A. Willard, 3rd Officer.

3 May 1985. A moth was found on the boat deck on the second day out of Cape Town. The deck had been painted whilst the vessel was alongside, and I believe the moth landed on the deck while the paint was tacky, as it was very slightly stuck down. By carefully prizing it from the deck, I found that the moth was reasonably intact, however, it had lost an antenna.

At this stage, the wings were folded right back, and the 'eyes' on the lower wings were not visible, but I was not too keen to force the brittle fore-wings forward lest they snap off. By injecting the body with a strong solution of washing-up liquid (one part washing-up liquid to four parts water), using a hypodermic syringe, the muscles were relaxed and the wings could be brought forward ready to be photographed. The moth is pictured opposite page 97.

This method works with all butterflies and moths, the length of time between injection and pliability varying with the body size. If the body is large (as with this moth), then it will take about fifteen minutes, down to a couple of minutes for small insects. If left to dry out again, the wings become rigid once more.

Position of ship at 0600 GMT: 23° 06'S, 09° 54'E.

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

'This moth is a native of South Africa and is an occasional pest of pine trees. It is *Nudaurelia cytherea*, the Pine Emperor.'

Gulf of Aqaba

m.v. *Benhope*. Captain T. Fyfe. At anchor Aqaba. Observers: the Master, Mr D. J. Rennie, 3rd Officer and Mr G. A. Szulc, Cadet.

8 June 1985. An insect was found on the bridge wing of the ship. It made no attempt to fly although it appeared to have wings which were protected by a shell, much the same as a ladybird.

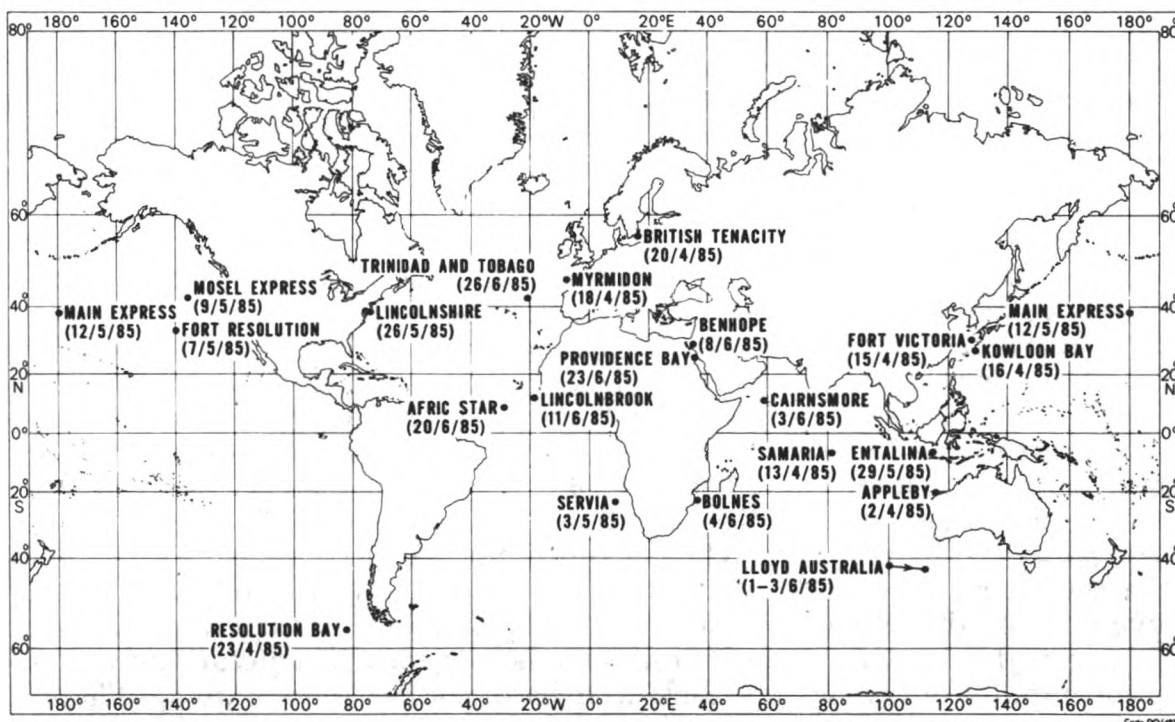
The body of the insect was about 10 mm long and 4 mm broad. The 'shell' on the back was red with black markings, and the underside of the body was black with red markings. There were red markings at the joints of the legs.

At the time the insect was found, there was a northerly wind, force 4-5, blowing from the land, and it was thought that the insect had been blown onto the ship from there.

Position of ship: 29° 31' N, 35° 01' E.

Note. Mr M. D. Webb, of the Department of Entomology, British Museum (Natural History) comments:

'I have identified the insect as *Pyrrhocoris apterus* Linn. (Hemiptera, Heteroptera, Pyrrhocoridae).'



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

An Introduction to the Aurora*

By D. A. R. SIMMONS

The aurora is an upper atmospheric phenomenon of compelling interest and outstanding natural beauty. Its characteristic arcs and rays are most frequently observed from those polar and sub-polar regions that lie under the auroral zones but they are also visible from time-to-time at lower latitudes during geomagnetic substorms. Auroral displays of the substorm variety are quite frequently seen over Scotland but usually as pallid relatives of their more brilliant polar cousins. The light of the aurora is emitted by the rarified upper atmosphere following its bombardment and excitation by solar particles preferentially guided into the auroral zones along the earth's magnetic field lines. To the casual observer, the resulting auroral forms seem to take on an infinite variety of exquisite shapes and delicate colours in a totally random manner. However, this semblance of chaos is more apparent than real, as the experienced auroral observer can readily discern a pattern to the development of a typical auroral substorm. It progresses more or less sequentially through the stages detailed below.

Visual appearance and development of a typical auroral (substorm) display

Stage 1: the quiescent arc. As observed from the British Isles, the first visual evidence of an impending auroral display is usually the appearance of a quiescent homogeneous arc in the northern sky soon after sunset (Figure 1). This arc is, in fact, a vertical sheet or curtain of light formed by primary auroral electrons passing downwards along the earth's magnetic field lines into the upper atmosphere. The arc, which is only a few hundred metres thick, may extend along a front of hundreds or even thousands of kilometres. It tends to be orientated along a line of geomagnetic latitude and therefore to lie roughly in a west-south-west to east-north-east direction when north of Scotland. Its lower border, lying close to a height of 110 km, is well defined as the incoming electrons are cut off rather sharply because of the exponential increase in atmospheric density. In contrast, the upper border (which rises to heights of 200–300 km or more) is diffuse and ill-defined. The light of the arc normally has a distinctive 'auroral green' colour from the monatomic oxygen emission at 557.7 nanometres (nm). When the lower border of the arc lies below the northern horizon, a 'false dawn' is observed. Indeed, it is this characteristic appearance which has given the phenomenon its name, aurora borealis or northern dawn. Quiescent homogeneous auroral arcs quite commonly persist for an hour or more along the northern horizon with little change or movement apart from their well-recognized tendency to drift south before midnight and north thereafter. Their usual fate is to fade with passing of the magnetic disturbance but, should that disturbance intensify, the display enters its second phase which is characterized by activation of the quiescent arc.

Stage 2: the active arc. When a quiescent arc becomes active there is a dramatic sharpening and brightening of its lower border followed by rapid movement of the whole arc in a southerly direction. This rapid advance is accompanied by break-up of its formerly homogeneous structure into parallel rays or bundles of rays which reach up towards the zenith (Figure 2). There is a

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tendency for such rays to drift westward along the arc but counter-movements are also seen from time to time. Throughout these changes, the predominant colours of the auroral structures remain green and blue from monatomic oxygen and molecular emissions respectively. If the display continues to intensify, the third stage of corona formation follows.

Stage 3: corona formation. In some respects, corona formation is the climax of an auroral display. It is a perspective effect observed when one is standing under the auroral arc with its rays stretching up from all quadrants of the sky to an apparent focus in the magnetic zenith. However, the rays seldom pass through a single point but commonly give rise to a circular, crown-like structure, hence the term corona. Sometimes the corona is incomplete in which case it has a fan-shaped or bow-shaped structure that arches across the sky. Even more rarely, the corona pulsates rapidly, discharging thousands of arrow-like rays instantaneously in synchronized showers to all quarters of the horizon. Such activity makes breath-taking viewing but, like most coronal phenomena, it is short-lived and soon gives way to the fourth stage of erratic auroral activity.

Stage 4: erratic auroral activity. By the time the corona fades, the original arc has disintegrated completely. The sky then contains randomly distributed auroral elements mainly in the form of bands, curtains or patches which may be homogeneous or rayed (Figure 3). The patches tend to fade and re-appear sometimes in an irregular, and sometimes in a pulsed manner. Such pulsations may be slow or of a rapid, flickering nature. Other rapid types of movement associated with this stage of the auroral substorm include streaming and flaming. In the former, the rays in an arc or band run laterally along its length at very high speed. In flaming, which can be the most spectacular of auroral features, pulsed waves of light flash up from below the northern horizon sometimes re-illuminating old auroral structures that had already faded. These rapid movements are the origin of the name 'Merry Dancers', a term still widely used in the Shetlands and other areas of northern Scotland where such activity is quite frequently observed. Another outstanding feature of this stage is the development of brilliant colours particularly fiery-red patches from monatomic oxygen emissions (Figure 4). On a number of well-documented occasions intense glows of this type have had fire-brigades out in search of non-existent conflagrations.

In late spring and early autumn when the earth's shadow lies in the atmosphere at high latitudes, high altitude aurorae lying in sunlight are often blue or violet in colour. Such aurorae are observed fairly frequently from Scotland, two good examples being the display of 1/2 May 1978 and the more recent substorm event of 25/26 April 1984. In my experience, there is a tendency for those infra-red and ultra-violet emissions that are close to the limit of the visible range to be more readily observed toward the end of auroral arcs. Such emissions seem more intense in these directions as the observer is looking tangentially along the arc and therefore through a greater depth of excited gas. When these auroral forms fade in due course, they give way to the fifth and final stage of the display.

Stage 5: the stage of decay. This phase is characterised by a diffuse auroral green glow of varying intensity covering most of the sky. Like its forerunners, it also fades in time leaving a clear sky or a residual quiescent homogeneous arc along the northern horizon.

In a classical auroral display the above sequence of events normally runs its course in an hour or thereabouts. However, the display may decay at any stage or some stages may be replayed. During times of great magnetic disturbance the whole cycle may be regenerated several times from the residual arc remaining at the end of the previous cycle. At such times auroral activity may be observed in one form or another throughout the whole night.

The cause of auroral light

Auroral light is the consequence of bombardment of the rarified upper atmosphere by charged particles of solar origin. The bombarding particles are mainly electrons while the excited atmospheric molecules are principally N_2 , O, O_2 and N in that order of importance. Such excited molecules rapidly revert to stable or metastable states with the emission of auroral light of a wavelength that corresponds to the energy change in the particular transition involved. Some of these transitions conform to the 'general selection rules' that govern transitional changes and are therefore referred to as 'permitted' or 'allowed'. However, many auroral transitions transgress these selection rules and have not been observed outside the laboratory except under the low pressure conditions that exist at auroral heights: these are therefore termed 'forbidden'. Although very many auroral lines, both permitted and forbidden, have now been characterised, most of the light of the aurora is emitted through a relatively small number of bright lines. A few of those that are of special interest and importance will now be considered but it should be stressed again that these represent a very small number of the observed and predicted emissions.

The first auroral emission to be characterised was the famous auroral green line due to forbidden monatomic oxygen (OI) emission at 557.7 nm. The common auroral structures such as arcs, rays and curtains owe much of their brightness and colour to this emission and, in some displays, it accounts for more than 50 per cent of the total light emitted. According to the International Auroral Atlas (IAA) colour classification, aurorae of this colour are assigned to colour class type *c*.

Red aurorae stem from two main sources. The first is the forbidden monatomic oxygen (OI) emission from the doublet at 630.0 and 636.4 nm. These emissions are usually observed above green arcs, have an ill-defined lower border in the region of 200–250 km, and can extend up to heights of many hundreds of kilometres. This height distribution is explained by the long spontaneous emission time (200 seconds) of light of this wavelength from monatomic oxygen. At lower, denser levels in the atmosphere, the excited oxygen atoms lose their energy by collision with other molecules in less than 200 seconds, so they do not survive long enough for emission to occur. Aurorae of this type which are assigned to IAA colour class type *a*, and are among the highest of auroral structures.

The second type of red aurora is caused by a series of molecular nitrogen (N_2) emissions of which those at 661.1, 669.6 and 686.1 nm are among the brightest. These emissions are produced by relatively high energy electrons that penetrate deeply into the atmosphere reaching down to heights of only 80 km. Aurorae of this type therefore appear as a red lower border to green arcs and have been assigned to IAA colour class type *b*.

Red and green aurora alternating along an arc or band (in which the red component is due to the N_2 emissions listed above) and 'red-overall' aurora (due to monatomic oxygen emissions at 630.0 and 636.4 nm) have been designated IAA types *e* and *d* respectively.

Blue and violet aurorae arise mainly from a series of lines and bands due to ionised nitrogen (N_2^+) emissions of which the brightest are at 391.4 and 427.8 nm. These N_2^+ emissions make a significant contribution to the light of the common auroral structures but are particularly associated with sunlit aurorae. They belong to IAA colour class type *f*.

All the above emissions are the consequence of electron bombardment and are referred to as electron aurora. Solar protons, however, also contribute to auroral processes by electron capture leading principally to red $\text{H}\alpha$ emission at 656.3 nm. This light, which is usually very weak and diffuse, may be detected

spectrophotometrically but is rarely visible to the naked eye except during massive displays of which the aurora of 25/26 January 1938 is an exceptionally good example.

From the above resumé, it will be clear that the bright line emission spectrum of the aurora contains light of many wavelengths. It follows that auroral structures can, and do, occur in a wide range of shades and hues depending on the number, strength and type of emission lines contributing to the light. Moreover, it will also be apparent that spectroscopic studies will always be of interest to the auroral scientist as they specify emitters, the transitional changes involved and the energy spectra of the exciting auroral electrons.

The aurora and the magnetosphere

As noted above, the electrons and protons involved in auroral processes are of solar origin. They reach the earth via the solar wind and the magnetosphere but their journey is not a simple one as may be seen from the accompanying diagram (Figure 5). Here the earth is depicted as a magnetic dipole which carves out a magnetic cavity in the solar wind. The boundary to this cavity is well-defined

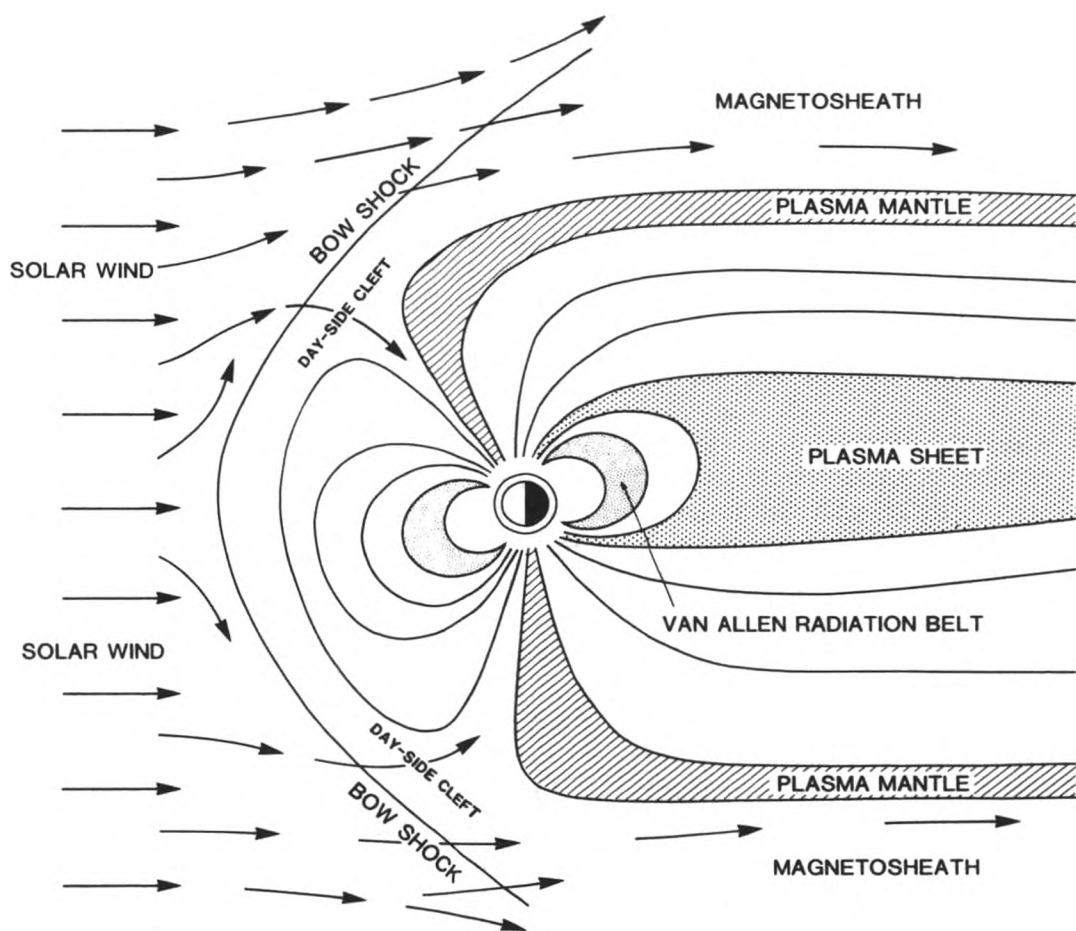


Figure 5. A schematic representation of the magnetosphere (not to scale) showing the principal regions that are important in aurora production and the entry-routes of primary auroral particles from the solar wind.

and represented by the bow shock. However, the earth's magnetic field is not symmetrical within the magnetosphere. It is compressed by the solar wind on the sunward side where the field lines are closed, but drawn out into a long 'tail' on the night-side where the field lines are normally open. Most of the electrons in the solar wind are diverted round the magnetosphere but a few cross the boundary on the dayside. These electrons are not subjected to acceleration and have, in consequence, relatively weak energies. However, they do have easy access to the upper atmosphere through the dayside cleft where they give rise to type *a* red aurora. Such aurorae are only visible from those very limited areas on the earth that enjoy darkness during daytime i.e., during the 'daytime' hours of the polar night. They are most readily observed from sites such as Spitzbergen and the south geographical pole for a few weeks on either side of the winter solstice.

However, most of the solar particles that gain entry to the magnetosphere do so by an entirely different mechanism. They are drawn across the boundary layer of the downstream mantle into the magnetosheath and plasma mantle. These latter structures are relatively fixed in relation to the solar wind but the earth and its magnetic field rotate within the magnetosphere thus constituting a massive magneto-hydrodynamic dynamo with complex current systems. If one imagines a cross-section of the 'tail', it has a θ -shaped structure in which the more-or-less hemispherical elements are the plasma mantle and the horizontal bar the plasma sheet. Looking toward the earth, the currents in this system move clockwise in the northern hemisphere and anti-clockwise in the southern thus feeding charged particles from the magnetosheath and plasma mantle into the central plasma sheet until an equilibrium is established. This input mechanism is balanced by the loss of charged particles in a number of ways, chief of which is their conduction earthwards along the plasma sheet under the guidance of the earth's magnetic field to the auroral zones where they are responsible for the diffuse or continuous aurora.

The above equilibrium model for the magnetosphere is probably valid for magnetically quiet periods but it does not account for the polar aurora. At times magnetic disturbance associated with auroral substorms, two other factors have to be considered, namely the interplanetary magnetic field and the potential instability of a magnetosphere containing open field lines in its 'tail'. A generally accepted view is that the interplanetary magnetic field is very variable in direction and that, when it sweeps from north to south over the magnetosphere, it forces reconnection between the interplanetary and geomagnetic field lines. This reconnection allows the solar wind to flood into the magnetosphere with closure of the field lines and the formation of a 'neutral spot' in the 'tail'. This 'neutral spot' which rushes up the 'tail' as the field lines assume a more symmetrical dipole structure carries the plasma sheet before it, injecting it into the auroral zones after near-earth acceleration of the particles involved. It is these accelerated plasma particles that are responsible for the polar aurora.

At the same time as these events take place, there are changes in the complex current systems in the magnetosphere. Although a detailed description of these is beyond the scope of this introduction, it is necessary to make some reference to the important westward-travelling current or electrojet that arises in the auroral oval during substorms. This current has an electric field with a strong southward component which intensifies as the electron flux increases with the progress of the display. It is this increase in the southward component that leads to the expansion of the oval and the appearance of the aurora at sub-auroral latitudes. So far as the British observer is concerned, these westward-travelling surges are most likely to occur during the evening sector of the auroral oval.

The above model of the magnetosphere is not only of value in understanding the mechanisms of auroral production, but also accounts for some of its observed features. The injection of the plasma sheet along the earth's magnetic



Staff of the Marine Division of the Meteorological Office attending the Port Meteorological Officers' conference at Bracknell Headquarters, 24 October 1985. Left to right, standing: Captain M. L. McN. Coombs (Headquarters); Captain C. A. S. Borthwick (Metroute); Captain A. F. Ashton (Bristol Channel); Captain A. Phillips (Metroute); Captain P. Hall (Metroute); Mr W. G. Cullen (NW England); Mr J. D. Lankester (Ocean Currents) Conference Secretary; Captain D. H. Rutherford (NE England); Captain S. M. Norwell (Scotland and Northern Ireland); Miss J. G. Caudrelier (Scientific Officer, Instruments); Captain J. F. T. Houghton (Headquarters). Seated: Miss J. Mitchell (Publications) Conference Secretary; Captain R. C. Cameron (Deputy Marine Superintendent); Captain G. V. Mackie (Marine Superintendent); Dr P. Ryder, PhD (Deputy Director, Observational Services); Mr R. J. Shearman (Marine Advisory, Consultancy and Data Services); Captain C. R. Downes (SE England); Captain J. Bentley (E England); Captain A. Britain (Ocean Weather Ship Officer); Captain D. R. McWhan (SW England). (See page 97).

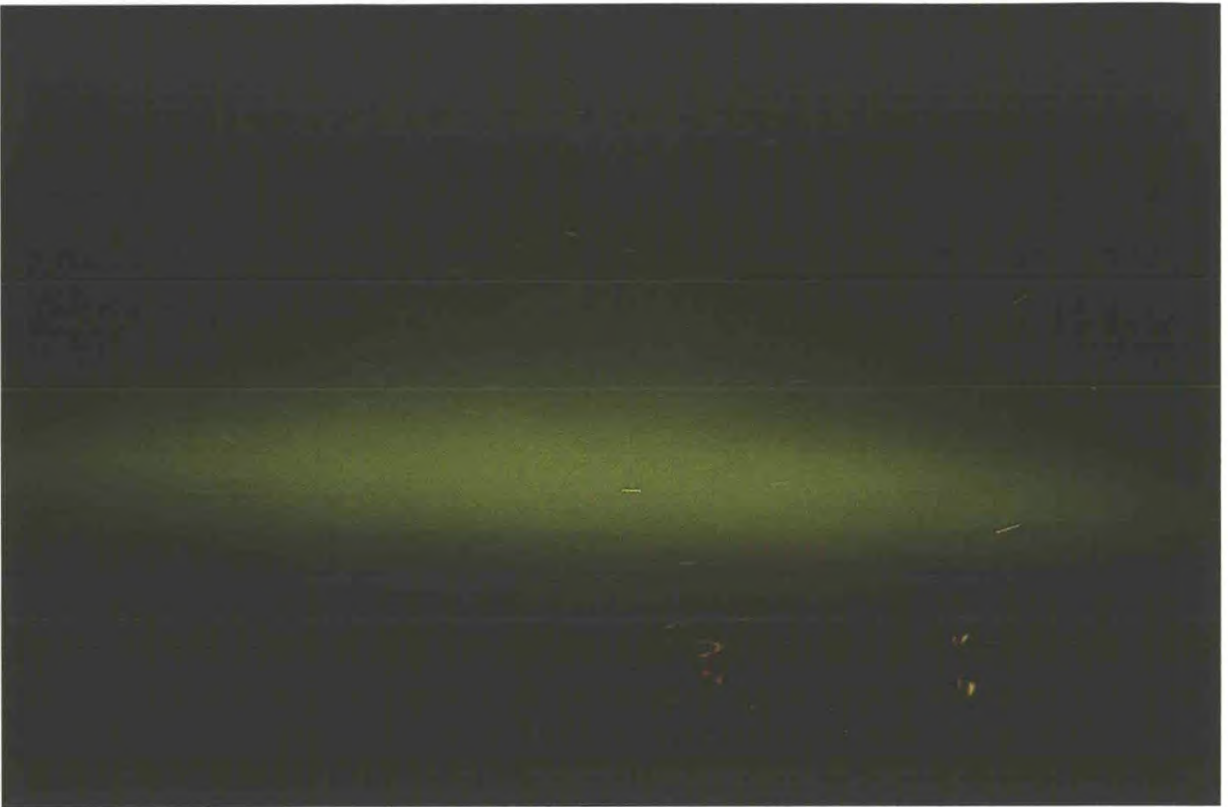


Figure 1. A quiescent, homogeneous auroral arc of classical appearance lying along the northern horizon. The photograph was taken from Mugdock Reservoir, Milngavie on Kodak Ektachrome 200 using a Canon camera with a 24 mm lens at f2.8. The exposure was for 5 minutes from 1930 to 1935 GMT on 8 March 1978.



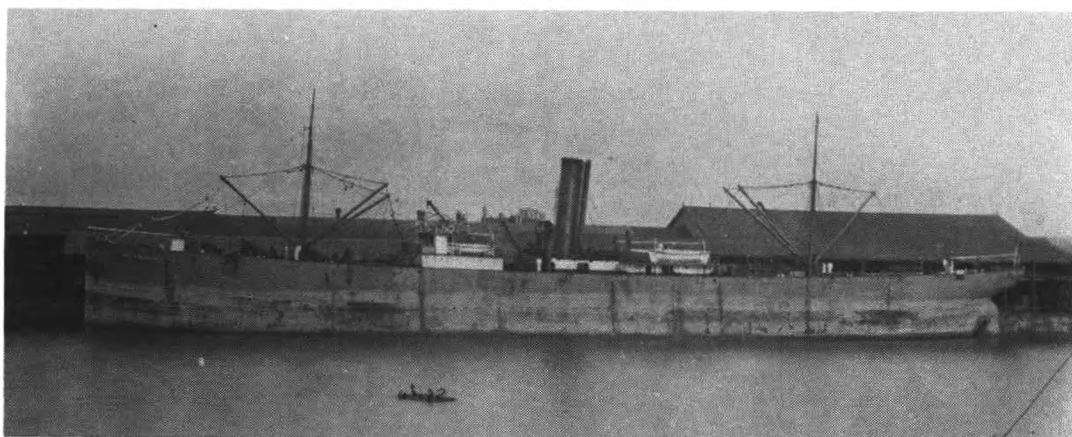
Figure 2. A rayed arc showing the typical green and blue colours associated with monatomic oxygen and molecular nitrogen emissions respectively. The photograph was taken from Skibotn, Norway on Kodak Ektachrome 400 using a Canon camera with a 50 mm lens at f1.4. The exposure was three seconds at 2110 GMT on 22 January 1982.



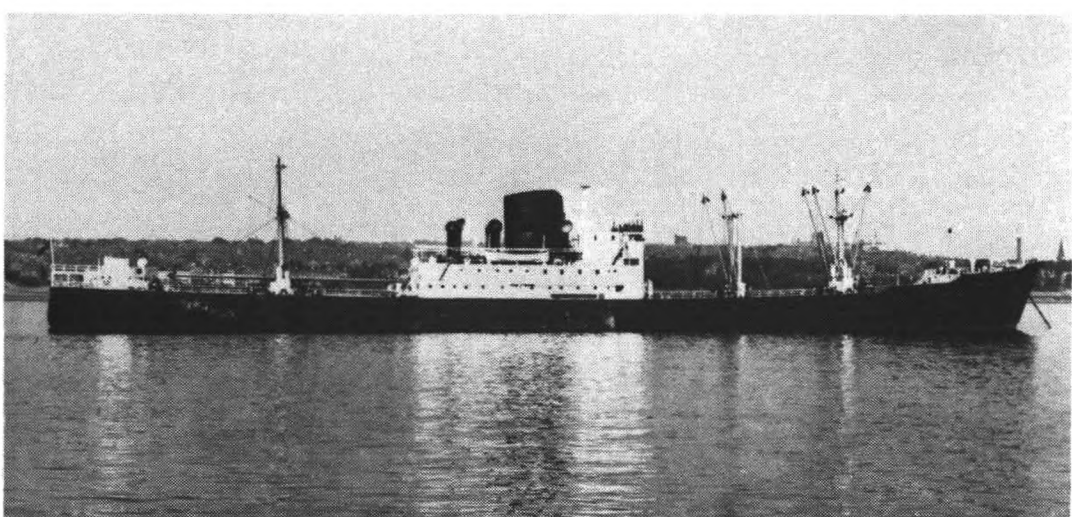
Figure 3. Isolated bundles of rays against the stars of Gemini: predominantly 'auroral green' in colour but with a suggestion of nitrogen (N_2) red emission. The photograph was taken from Skibotn, Norway on Kodak Ektachrome 400 using a Canon camera with a 50 mm lens at f1.4. The exposure was five seconds at 1827 GMT on 21 January 1982.



Figure 4. An active auroral arc photographed from Milngavie on Kodak Ektachrome 200 using a Canon camera with a 50 mm lens at f1.4. The exposure was 30 seconds starting at 2147 GMT on 20 October 1981. The green structures due to forbidden monatomic oxygen emission at 557.7 nm have sharp lower borders and are surmounted by diffuse red emissions from the oxygen doublet at 630.0 and 636.4 nm.



s.s. *Reynolds I* (1898), 5 116 tons deadweight.



s.s. *Reynolds IV* (1953), 10 220 tons deadweight.



m.v. *Reynolds V* (1973), 29 811 tons deadweight.

VESSELS OF BOLTON MARITIME SHIP MANAGEMENT LIMITED (See page 88)

field lines explains the occurrence of the auroral ovals around the polar caps. The oval is not centred on the geographical or magnetic pole which lies in the extreme north-west of Greenland a little north of Thule. The average position of the midnight sector of this oval traces out the auroral zone which may be defined as that region where the statistical chance of seeing the aurora is highest. Its geomagnetic latitude is 67° North or South. On its equator-side, the average incidence of aurora falls off semi-exponentially from, for example, 60 events per annum at Lerwick to 30, 6 and 1 at Edinburgh, London and Madrid respectively. Another observed consequence of the injection of charged particles from a single plasma sheet into both auroral ovals is the simultaneous occurrence of identical auroral structures at the conjugate points in northern and southern hemispheres.

The aurora and solar activity

The foregoing account summarises the behaviour of primary auroral particles in the magnetosphere and upper atmosphere and hints at their solar origin. This section outlines briefly the ways in which the sun generates these particles and relates these different mechanisms to the different types of aurora produced.

Even when the sun is quiet, the chromospheric spicules that cover the solar surface pour protons and electrons into the solar corona and solar wind at a prodigious rate. Indeed, their contribution to the solar wind far exceeds that of the more dramatic chromospheric events such as eruptive prominences and solar flares. As we have seen, such particles are drawn into the earth's magnetosphere, concentrated in the plasma sheet and ultimately conducted to the auroral zones where they give rise to the continuous aurora. At times of geomagnetic disturbance, the particles in the plasma sheet also make an important contribution to the matter injected into the auroral ovals during substorm events.

A second source of auroral particles is solar flares which are associated with discrete, active areas on the sun's surface. Such active regions are characterised by intense magnetic fields, complex sunspot groups and recurrent flare activity. The flare is a short-lived, high-temperature, chromospheric, emission phenomenon characterised by the transfer of vast amounts of energy to the protons and electrons involved. These are injected at high velocity along the solar magnetic field lines and therefore remain highly directional giving rise to the so-called 'hose-pipe' effect. Such a narrow beam can pass relatively close to the earth without producing observable effects but, if an encounter does take place, a brilliant, all-sky aurora running the full gamut of the substorm pattern usually follows. Clearly, auroral activity of this flare type will vary with the 11 year cycle in solar activity. However, there is a general tendency for the auroral maximum (as judged by the frequency and brilliancy of displays) to lag some one or two years behind the solar maximum as judged by sunspot numbers.

A third pattern of aurora, commonly observed from Central Scotland and most frequently around solar minimum, is sometimes referred to as 'coronal-hole' aurora. In events of this type, the auroral particles emanate from the M-regions in the solar corona which have now been positively identified with coronal holes. These holes are cool, low-density areas with weak magnetic fields which extend away from the sun. Their diverging, open field lines give rise to high-speed solar wind streams that cause geomagnetic storms. The resulting aurorae are very quiet amounting to no more than a glow or homogeneous arc along the northern horizon as in stage 1 of substorm events. They tend to appear on consecutive nights and to recur at 27 day intervals over several solar rotations

because of the relative stability of the solar magnetic field around sunspot minimum. However, they give rise to prolonged and serious interruptions to radio-transmission out of all proportion to their visual effects. In all of the respects, the coronal-hole aurorae contrast markedly with flare type events which are brilliant, short-lived and non-recurrent.

The aurora: the present position

In the past twenty years, ground-based observations and direct experimental evidence from rocket and satellite studies have considerably enlarged our understanding of the aurora as outlined in the foregoing account. However, at least two major problems remain. The first concerns the precise mechanism which triggers the substorm, there being some doubt as to whether a simple north-to-south change in the direction of the interplanetary field can effect the reconnection that allows the solar wind to flood into the magnetosphere. The second problem concerns the processes and factors that determine the fine structure and morphology of the observed auroral forms. At the moment, the scientific knowledge and technology are available to investigate these problems experimentally so it is probably only just a matter of time until these difficulties are resolved. When that day comes, the incomparable splendour of the aurora and the sense of wonder it inspires will remain undiminished but our enjoyment and appreciation of it will be much enhanced by a fuller understanding of the processes involved.

Acknowledgement

I am most grateful to Mr Alan Robson for drawing Figure 5.

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GLORIA Surveys of the Exclusive Economic Zone around the United States of America*

By D. G. MASSON

(Institute of Oceanographic Sciences, Wormley, Godalming, Surrey)

In March 1983 the United States proclaimed the area of ocean out to 200 n. mile from its coasts to be its Exclusive Economic Zone (EEZ). As a result the United States Geological Survey (USGS) began to look for a survey method which could rapidly provide 'road maps' of the sea bed and allow targets for more detailed study to be identified. This led them to the GLORIA system.

Resources of the Exclusive Economic Zone.

The U.S. EEZ covers a vast area of ocean surrounding both the mainland United States and its island territories (Figure 1). In fact, it is over $1\frac{1}{2}$ times

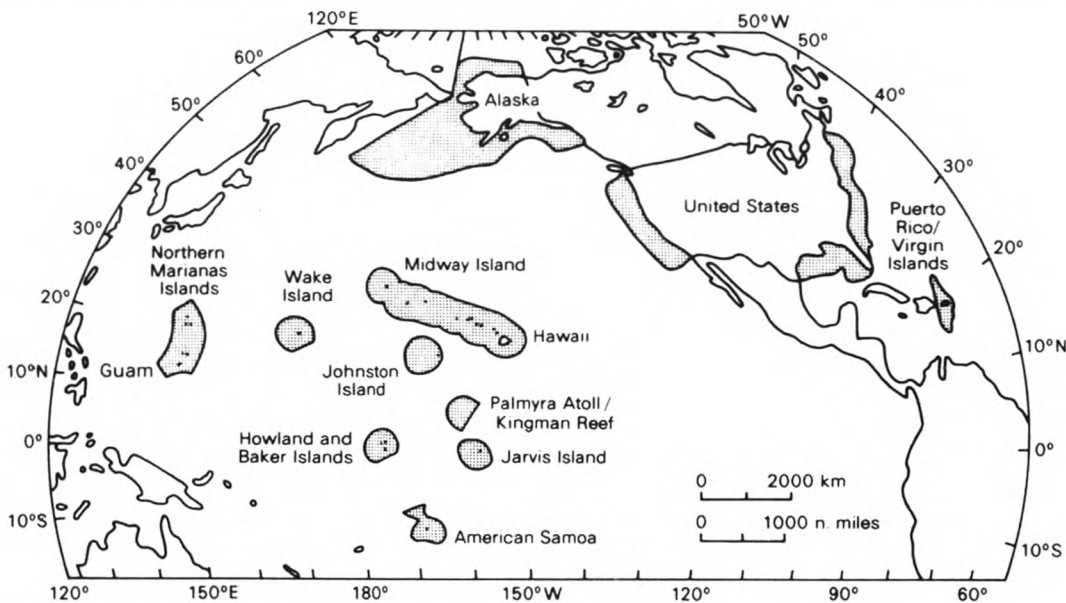


Figure 1. Exclusive Economic Zones around the United States and its territories (stippled areas).

larger than that of the land area of the United States. Although detailed studies have been made in small areas of the EEZ, allowing some important features and processes to be defined, very large areas remain almost completely unsurveyed and many features, for example seamounts, remain to be mapped.

The potential for mineral resources on and below the sea bed within the EEZ are considerable. Resources might include hydrocarbons, polymetallic sulphide deposits (from which a variety of metals could be obtained), manganese nodules and manganese crusts (rich in the strategically important metal, cobalt) and placer deposits of valuable metals such as gold and platinum. In addition, the study of geological processes occurring in and beneath the ocean at the present day increases our understanding of factors that have been responsible for shaping the land areas and, in some cases, controlling the distribution of their mineral resources.

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GLORIA (Geological Long Range Inclined Asdic)

GLORIA-II, designed primarily for work in the deep ocean, is a unique sidescan sonar developed at IOS. It uses a towed sonar 'fish' to isonify a swathe up to 30 km on each side of the ship's track, the returning signals being plotted to produce a map-like sonograph of the sea floor. The 'fish' is towed about 400 m behind the survey ship at a depth of 50 m. At a typical survey speed of 8 knots, up to 20 000 square kilometers can be surveyed per day, although shallow water or unfavourable acoustic propagation conditions may reduce this figure. This survey rate is some six to seven times greater than that of other long range sidescan sonars currently in operation.

The GLORIA system is the ideal tool for large-scale reconnaissance surveying, rapidly providing detailed physiographic maps of the sea floor as well as the sea bed roughness and substrate character. Considerable detail of the sea bed character is revealed and insight gained into the geological processes operating on the sea floor. In most areas bathymetric maps can be vastly improved by combining bathymetric trends derived from the GLORIA data with conventional echo-sounding data bases.

GLORIA produces images of the sea floor in photographic form. These are somewhat analogous to oblique aerial photographs in land surveying. In the USGS survey, a basic image processing package will be applied to the data. This will correct the sonographs for changes in the ship's speed along track and for slant-range distortion (the raw data gives the oblique range of any target from the ship to the sea floor rather than the true horizontal range). It will also enhance signals in the far field of the sonographs which tend to be much weaker than those from the near field. The overall result will be a true scale plan view of the sea floor with features given equal prominence regardless of their position relative to the ship's track.

The 1984 GLORIA survey off the west coast of the United States

Prior to 1984, IOS and the USGS had carried out two GLORIA surveys within United States waters. The first of these, in 1979, surveyed part of the Atlantic continental slope, the second, in 1981, part of the Texas-Louisiana slope region of the Gulf of Mexico. However, both of these surveys were of relatively small areas and were designed around specific targets of scientific interest. By contrast, the 1984 survey off the West coast of the United States was designed as a systematic survey of the entire EEZ from the Mexican to the Canadian border ($32^{\circ} 30' \text{N}$ to $48^{\circ} 30' \text{N}$) and from the 400 m depth contour out to 200 nautical miles. The major objective of the survey was to obtain complete sonograph coverage of the EEZ with no prejudgement as to which might be the more economically or scientifically interesting areas.

The 1984 survey was conducted from the m.v. *Farnella*, a converted stern trawler chartered from J. Marr and Sons of Hull. Two-channel seismic reflection profiles, 3.5 kHz high resolution profiles, 10 kHz bathymetric profiles and magnetic field data were also collected. High resolution and bathymetric profiles give data on sea bed topography and composition which can be extrapolated laterally using the GLORIA data. In effect, they 'calibrate' the GLORIA image. Seismic reflection profiles show the deeper structure of the sub sea bed rocks and sediments and permit surface topography to be related to deeper structure.

The survey began in San Diego, on 26 April and ended there on 15 August. Mid-survey port calls in Long Beach, San Francisco and Coos Bay divided the survey into four legs ranging in length from 21 to 35 days. In total, 225 500 square miles (575 000 square kilometers) of sea bed were surveyed with GLORIA and over 20 000 miles of profile data were collected during 105 days at

sea. Only 3½ days of surveying were lost due to bad weather and equipment failure during this period. The cost of the survey has been calculated at between 2 and 5 U.S. dollars per square kilometre or about 1 cent per acre.

Results of the 1984 survey

The EEZ to the west of the United States is a geologically complex area. South of Cape Mendocino (40½°N, Figure 2) the continental margin is a fossil active margin (a collision zone between two of the plates which make up the Earth's crust) which became inactive only some 25–30 million years ago.

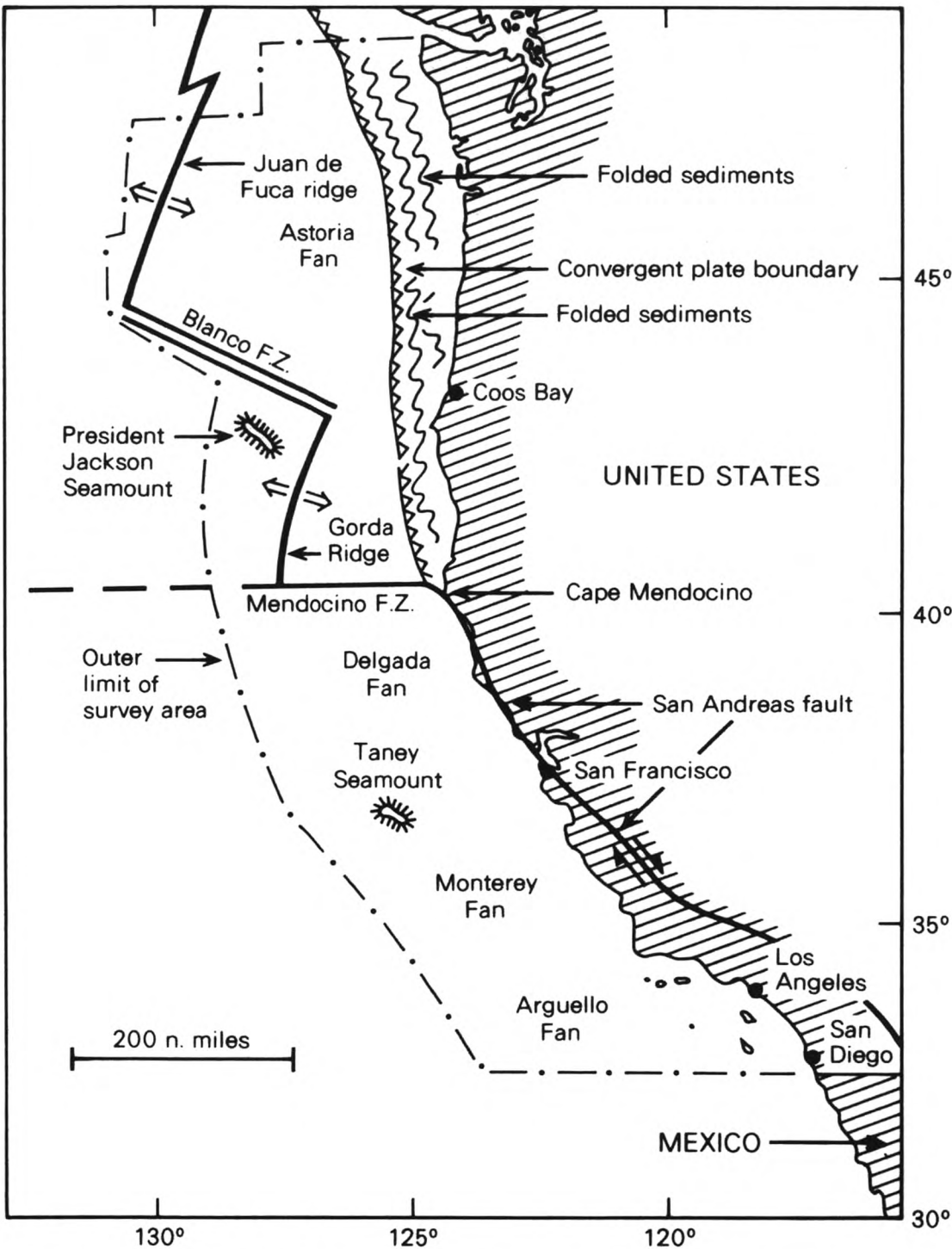


Figure 2. Area of the Exclusive Economic Zone off the west coast of the United States showing its major structural and geological features.

Features related to sediment transport (submarine canyons, sediment slides and sediment fans) dominate the continental slope. A series of large sediment fans, the most important of which are Delgada, Monterey and Arguello Fans (Figure 2) extend out from the base of the continental slope. These are slowly burying the oceanic basement fabric of volcanic ridges and submarine volcanoes (seamounts). Taney Seamount, a linear chain of three very large volcanoes showing central caldera up to 4 km in diameter, is an excellent example of a large seamount (Figure 3). Well over a hundred previously unknown seamounts were discovered in the southern part of the EEZ during the GLORIA survey.

North of Cape Mendocino the area of the EEZ is geologically much more complex than further south. In this northern part of the survey area convergence between the plate to the west and the continental plate to the east is still occurring, leading to the subduction of the oceanic plate beneath the continent. This convergence zone is clearly seen on the sonographs as a northwards broadening area of folded sediments beneath the continental slope (Figure 2).

Further offshore, new oceanic crust is being generated at the Gorda and Juan de Fuca sea floor spreading ridges. These ridges, and the associated Blanco and Mendocino Fracture Zones, are particularly well imaged by GLORIA. The pattern of ridge parallel fault scarps and volcanic ridges characteristics of mid-ocean ridges is clearly seen (Figure 4). Numerous seamounts also occur (Figure 4, top left, opposite page 96).

In terms of the economic future of the EEZ, the GLORIA survey is important in a number of ways. As already mentioned, it will provide detailed physiographic maps and allow considerable improvement to existing bathymetric maps; these are the basic 'road maps' on which future surveys will be planned. It will increase our understanding of submarine fans, fossil examples of which are important to the hydrocarbon industry, which could lead to better hydrocarbon exploration strategies. Many of the seamounts that have been found may be covered by manganese crusts rich in cobalt, a particularly important component of high grade steel alloys. In the Juan de Fuca ridge area, where polymetallic sulphide deposits have already been discovered, the GLORIA data will give a better idea of the tectonic setting of the ridge and may assist in deciding where future, more detailed, surveys should be sited.

Future GLORIA surveys

Future joint IOS-USGS GLORIA surveys are planned to give complete coverage of the United States EEZ. These surveys will be undertaken over the next six years. In 1985, approximately one hundred days of survey time were planned for the Gulf of Mexico area and for the EEZ around Puerto Rico. The construction of a new Mark-III GLORIA should be completed for the start of the 1986 survey.

The following biography of Edmond Halley completes the feature on the man and his comet, the first part of which appeared on page 24 of the previous issue of *The Marine Observer*.

Dr Edmond Halley, CAPTAIN RN., MA., LL.D., DCL., FSA., FRS. (1656–1742)

By R. J. LIVESEY

(British Astronomical Association)

Edmond Halley was one of the great scientists of his age, overshadowed only by his close friend Sir Isaac Newton. It was Halley who personally financed and arranged for the printing of Newton's *Principia*, thus giving publicity to Newton's genius.

Halley's biography makes astonishing reading when one realizes the width and depth of his researches, the posts and honours bestowed upon him. In the present context, it is germane to honour that part of his life's work which is of interest to mariners.

Having assisted John Flamsteed, the first Astronomer Royal at Greenwich, to catalogue stars in the Northern Hemisphere, young Halley at the age of twenty, travelled to St Helena, the most southerly British territory of the day, in order to measure the positions of the stars in the Southern Hemisphere. He published his catalogue in 1678, giving the positions of some 341 objects.

On completion of the post as Deputy Controller of the Chester Mint, Edmond Halley was commissioned Captain, RN, by King William III, and given command of the ship *Paramore* of 89 tonnes and with a crew of twenty. Halley set sail in 1698, and for two years made voyages of scientific importance, reaching as far as 52° 30's. From the results of these voyages in conjunction with material obtained from other sources, Halley produced two isogonic charts showing contours of places having the same compass variation. Halley again set out with the *Paramore* in the summer of 1701 to produce a detailed chart of the English Channel together with information on the tides.

In 1720, King George I commissioned Halley as the Astronomer Royal to fill the post made vacant by the death of Flamsteed. This he speedily became and succeeded in obtaining funds from the Board of Ordnance for the re-equipment of the Royal Observatory at Greenwich. The observatory was founded in 1675 by King Charles II for the benefit of navigation. The building was to the design of Sir Christopher Wren, who was an astronomer before he became noted for his architecture.

Halley was elected a member of the Board of Longitude in 1714 by reason of his appointment as Savilian Professor of Geometry. In 1728, Halley was visited by the self-trained clockmaker John Harrison who received great encouragement to perfect a self-compensating marine chronometer suitable for calculating longitude at sea. Harrison succeeded, and the chronometer was demonstrated before Halley and the Board of Longitude in 1737.

Among other activities of interest to mariners, Halley published a paper relating to the physical mechanisms of trade winds and monsoons, incorporating the earliest meteorological chart covering thirty degrees north to thirty degrees south. He was a pioneer of deep-sea diving, and took out a patent relating to an improved diving bell; he also promoted a company to salvage wrecks. He was the first scientist to attempt a theory of the aurora borealis and relate it to the Earth's magnetic field. From observations made, Halley developed the method of finding longitude at sea by determination of the moon's position; and so the catalogue goes on.

It is fitting that Dr Edmond Halley, scientist, astronomer, antiquary and Captain RN, is honoured by having his name associated with the great comet that has kept station with historical mankind. His fellow countrymen know less about him than the Newtons and the Wrens of his time, yet he has the stature of a Captain Cook in his own fields of maritime work. If you are fortunate enough to see Halley's Comet from the deck of a ship, please remember what he did for the development of safe navigation.

LONG ASSOCIATION WITH SHIPOWNERS—BOLTON MARITIME MANAGEMENT LIMITED

It seems appropriate that a short history of this esteemed company should be chosen as the subject of our annual narrative in the series, as the first ever Master of that company to receive a Met. Office barograph is shortly to be presented with his long-service award. Captain John Parsloe has served with the Bolton Group for almost all of his sea years and has provided weather observations from all the company's ships over a 34-year period. The year 1985 also happened to be the centenary of the first voyage of a Bolton ship, s.s. *Raphael* of 2600 tons dead-weight.

There was nothing unusual, in the second half of the nineteenth century, about a young and enterprising man starting his own business in the City of London. It is less common to find the same firm still in existence a hundred years later, with the fourth consecutive generation of the founder's family now represented in it, and still operating in substantially the same spheres of shipping, underwriting and insurance broking which were so attractive to the young Fred Bolton in the 1870s.

Frederick Bolton was born in Islington in 1851, educated at a nearby day school only until he was fourteen and a half and started work as an office boy with a firm of shipowners called Smith. This firm was almost certainly the forerunner of Smith's Dock, the North Shields ship repairers with whom the Bolton Shipping Company was to be so closely connected in the building of the company's ships in the future. Fred Bolton started his working life with what his son described as 'no outside interests, very little education and in very narrow non-conformist surroundings': a background which throws into further prominence his future achievements, which were substantial by any standards. He left Smith's and joined a firm of insurance brokers at Lloyd's in 1869, where he must have handled a fair proportion of the firm's business and done so satisfactorily, as there is in existence a gold pocket watch of his, dated 1870, which family tradition says was presented to him by his employer.

During a period of unemployment a few years later, Fred Bolton renewed a friendship with a school acquaintance that was to result in a long association in shipbroking. John Glover had set up his business in London with his brother in 1853, and it was in 1873 that Fred Bolton suggested that he might start underwriting. Glover agreed, after initial hesitation, and this venture, which began in March 1874, was the start of the Bolton underwriting business, which has continued without a break until this day.

Four years later Fred Bolton became an underwriting member himself and married a Devon girl in the same year, setting up home in north London. They had one daughter and two sons in the next 8 years, and their schooling eventually resulted in another family connection through the founder, Charles Ingham, whose son Percy later started his own underwriting agency at Lloyd's which became part of the Bolton Group in due course.

Both Eric and Louis Hamilton Bolton, the two sons, went to preparatory school, were good sportsmen and LHB (as he was always called) was additionally a skilled fives player.

By the early 1880s, Fred Bolton's business was flourishing and he placed the insurance of the ships owned by Glovers. He began, tentatively at first, to hold shares in ships on the traditional 64th basis which was still widely prevalent at this date and is still used theoretically today. In 1884, ten years after he had started as an underwriter, he decided to collect together his own 64th shareholders, and to manage his own ships. As he wrote to a prospective shareholder in 1887: 'For some years I have been interested in steamers, but carefully kept back during the inflated year 1883 and for some little time after. In 1885 I built the first steamer for my own account and paid for her nearly £10,000 less than the prices that had been lately current . . .' The *Raphael* was an iron ship built by J. L. Thompson of Sunderland with a compound engine, and she had auxiliary sail power. At this time, steam had been given a boost by the completion of the Suez Canal, and the shortened route from England to the East meant that they used less coal and could bunker more frequently than on the old route round the Cape.

Success with the first ships led to the purchase of the *Rembrandt* and the *Rubens* in the years following. The tradition of Bolton vessels being named after famous painters whose initial was 'R' was probably established as a result of the brother-in-law of John Glover having pretensions as a water-colourist, and he also joined the underwriting venture from the start.

In 1893, Thompson built two more ships for the original partners in the firm, *Rossetti* of 3000 deadweight tons and *Romney*, which at 4400 tons was the biggest so far. The *Romney* is the first Bolton ship for which meteorological logbooks are held in the archives at Bracknell, although the first logbook itself is missing. The only reference to this log exists in the register of the time, in the entry for 2 May 1894 which records receiving a log from the *Romney*, Captain F. C. Mullan, on a voyage from Batavia (Java) to Europe via Shanghai. The next meteorological log received from Captain Mullan covered the period October 1894 to April 1895 on the *Romney*, and was marked 'Excellent.' The voyage commenced from Cardiff and proceeded to Shanghai via Suez and Singapore; the weather conditions in Shanghai were 'raw and cold' wrote the Master on Christmas Day, but a barometer error had to be corrected at the same time, regardless of the holiday. On the homeward voyage, the *Romney* called at Moji, Singapore, Rangoon, Fiume (Trieste) after Suez, Constantinople (Istanbul), Nicolaeff and Odessa, ending at Rotterdam. The 24th November 1894, passing by Ceylon (Sri Lanka), was an eventful day: '2 p.m. Much rubbish floating on sea. 4 p.m. Dry bulb 89°, damp bulb 84°. Caused by heat from stokehole. Wind blowing in direction of thermometers. Only lasted short time, then temp 83°, wet 80°. 4.30 p.m. Passing 7 miles off Pt. de Galle.'

The first *Reynolds*, 5100 deadweight tons, built in 1898, was also an observing ship, as have been her four successors with the same name, including *Reynolds V*, built in 1973, which continues this mutually beneficial co-operation which has lasted over 100 years. (See photographs opposite page 81).

Eric Bolton and LHB joined their father in the city in 1901 and five years later the broking became a separate department under Eric's management. The two sons — LHB being particularly interested — were taken into partnership on the shipping side in 1906 and in the same year the first four Bolton vessels, now

aged between 16 and 29 years, were sold off. With the proceeds of these sales, *Rubens II* was built, in size and design much like the *Ribera* built two years before. In 1908 Frederick Bolton, who had been Chairman of Lloyd's in 1906 and became Deputy Chairman of Lloyd's Register from 1912–1917, received a knighthood from King Edward VII. During the First World War he was kept busy in the Ministry of Shipping and the Admiralty, but his health was failing. He owned seven vessels at the outbreak of war, lost 3 and built 2 during that period. Sir Frederick Bolton died in February 1920 at the age of 69, leaving the leadership of the firm which bore his name to his only surviving son, Louis Hamilton (LHB), whose brother Eric had died of cancer in 1916.

Due to the reluctance of Frederick Bolton's partner, Louis Bartholomew, to continue as manager of the ships, the Bolton Steam Shipping Company had been voluntarily wound up by liquidators in 1917. However, once LHB had taken the reins and established a new syndicate in marine underwriting at Lloyds, he was able to turn his attention to the activity which, as with his father, was really nearest to his heart. He had intended all along to re-start the Bolton Steam Shipping Company if possible, and he did so in 1921. The new company purchased two second-hand steamers, *Rubens II* and *Ribera III*, built in 1906 and 1907. They also bought a new ship, *Ramsay II*, 8200 deadweight tons, costing £77 799. *Ribera III* was a distinctive vessel in many ways, having finer lines than most cargo ships, and also being the only one ever disposed of by the company direct to the breaker's yard, in 1931.

There are some unique recollections of life at sea in Bolton ships from the early 'twenties. Bill Copping, who became senior master, was apprenticed in 1927 at the age of 15 on the *Reynolds I*. It was a 'rough and hard life' and Copping's first voyage was long by today's standards, setting off with coal to Aden, via the Mediterranean, then out to Australia where grain was loaded for Sunderland and Hull; a six month voyage without leave which took him 21 000 miles at an average speed of 8·7 knots. An ice-box was the only refrigeration and they ate salt beef and pork pickled in brine, as well as huge cheeses which would be stored for months. Rations included one tin of milk every three weeks, $\frac{3}{4}$ lb meat and 1 lb of bread per day, plus 2 eggs per week. The crew slept on horsehair beds, not hammocks, and the captains insisted on the boys studying during the dog-watches.

The Depression hit cargo shipping particularly hard, and the Bolton Steam Shipping Company, like many of its British competitors, was hampered by the high cost of maintaining out-of-date vessels. In 1926, LHB decided it was imperative to buy a new one, and the *Reynolds II* was delivered from the yard of Robert Duncan in Port Glasgow the following year. The company survived and kept abreast of changing conditions, and then came through the Second World War years with the same number of ships as at the beginning: three at the outbreak of war, two launched during and two lost to enemy action. Just before the beginning of the war the company had seen the advent of the third Bolton generation when LHB's second child, Frederic Bolton, universally known as 'Tim', arrived in the City for a brief six months before joining the Army.

LHB himself became increasingly busy during the war with work for the Dover Harbour Board and the Port of London Authority, whose board he had served on for several years before the war. By 1951 his health was markedly failing, worn out as he was with his war-time responsibilities, and he had a heart attack at Christmas 1952, never fully recovering. He was hardly in the new London Office at Plantation House in Mincing Lane the following year, and died on a cruise on the P & O liner *Chusan* in September 1953. He was buried at sea. LHB's influence on the family firm had been immeasurable, with almost fifty years in the office and he was a repository of knowledge on all aspects of shipping business. Tim Bolton pays him a handsome tribute: 'I was lucky in every sense — not many people have a father with whom they can work so

happily and congenially.

Then began some new shipping ventures, such as a new company being formed to run ore-carriers for the British Iron and Steel Corporation, for which four specially designed vessels were built and operated between 1956 and 1973. Two of these ore-carriers were built by Smith's Dock, with whose chairman a great rapport now existed.

The fourth generation of the Bolton family is now represented in the firm in the form of Tim Bolton's second son James, who is determined to make his career in the City. One of the many changes brought about in the era of Tim Bolton's energetic chairmanship has been the formation of Bolton Maritime Management for the purpose of operating the new British company called Nosira Shipping, set up by Ted Arison of Carnival Cruise Lines of Miami, with three bulk carriers. Together with the *Reynolds V*, *Rubens IV* and *Rembrandt IV*, the 3 Nosira ships are all ardent voluntary observers and the Met. Office will look forward to many more years co-operation in this field.

In the present era of change and reorganisation, the names and characters of companies in all branches of commerce in which the Bolton Group is engaged are continually altering. It is a source of no little satisfaction and comfort to the group that Boltons has retained much the same nature after more than a hundred years of business. Though it has grown so much since the days when Fred Bolton first started underwriting in a small way in 1874, the firm can still pride itself on possessing many of the same characteristics — integrity, loyalty, optimism and enthusiasm and, most importantly, its private company status, as those its founder imprinted on it from the very first. A modestly sized concern has produced: four Presidents of the General Council of British Shipping; two Chairmen of Lloyd's; two Chairmen of Lloyd's Register and two of the Baltic Exchange. This indicates that a smallish firm has attracted men of quality to its ranks and retained them, as well as given them the facility to be available for service in their industry and in the City. As Tim Bolton says: 'I consider I have an obligation to pass on to the next generation the opportunity to enjoy their life in the City as much as I have enjoyed mine.'

We wish Sir Frederic Bolton well as the new president of the British Maritime League in succession to Admiral of the Fleet, Lord Hill-Norton, and on his election to Honorary Fellowship of the Nautical Institute in December 1985.

AURORA NOTES APRIL TO JUNE 1985

By R. J. LIVESEY

(Director of the Aurora Section of the British Astronomical Association)

In Table No. 1 are summarized the auroral observations received from mariners for the above period. In Table No. 2 is reviewed the activity seen by such land and marine observers as have sent reports.

A very interesting auroral form was reported by Todd Lohvinenko at 0349 GMT on the night of 10/11 June from Winnipeg. The green band which stretched from east to west was broken just south of the zenith by a writhing whirlpool,

Table 1—Marine Aurora Observations April to June 1985

DATE	SHIP	GEOGRAPHICAL POSITION		TIME (GMT)	FORMS IN SEQUENCE
14 April ..	<i>Canadian Explorer</i> ..	45° 00'N,	75° 00'W	0100–0500	qHa, aRA, aRA, aRB
19 ..	<i>C.P. Ambassador</i> ..	49° 20'N,	65° 16'W	0050–0336	RA, RP, pRB, aRB, HB, aRB, HA, RA Radar contact with aurora.
19 ..	<i>Moreton Bay</i> ..	04° 00'S,	123° 36'E	1830–1910	qHG, qHG
19 ..	<i>ACT 2</i> ..	48° 24'S,	84° 54'E	2100	qN
20 ..	<i>Cumulus</i> ..	57° 00'N,	20° 00'W	0000–0300	qfHG, qfHG, qfHA, amHR, RA, amHG, P, qmHG, P, qfHG
20 ..	<i>ACT 2</i> ..	48° 36'S,	94° 06'E	1605–1713	qHG, qHA, p ₂ RA, qHA,
24 ..	<i>Cumulus</i> ..	57° 00'N,	20° 00'W	0000–0130	qN, HG
27 ..	<i>Remuera Bay</i> ..	55° 55'S,	167° 00'W	2230–2310	G, pRA
8 May ..	<i>Starella</i> ..	57° 00'N,	20° 00'W	0150	qN
9 ..	<i>Starella</i> ..	57° 00'N,	20° 00'W	2245	qN
10/11 ..	<i>Starella</i> ..	57° 00'N,	20° 00'W	2350–0240	qN
13/14 ..	<i>Starella</i> ..	57° 00'N,	20° 00'W	2345–0045	qN
6 June ..	<i>New Forest</i> ..	49° 15'N,	62° 20'W	2000–2010	HA
9/10 ..	<i>Dart Britain</i> ..	43° 12'N,	64° 11'W	2349–0500	G, HA, RB, G

KEY: a = active, f = fragmentary, m = multiple, p = pulsating, p₂ = flickering, q = quiet, A = arc, B = band, G = glow, H = homogeneous, N = aurora of specified form, P = patch, R = rayed.

the two halves of the band being tangential on either side of the vortex. The central spirals of the structure were red in colour and the outer spirals green. Todd described the apparition as being similar to the eye of a tornado although to an astronomer it closely resembled a spiral galaxy. The cause of such an apparition is the complex twisting interaction of electric currents and magnetic fields in the high atmosphere during a period when the transient type of auroral storm is expanding and a western travelling surge of activity develops.

Todd further reported that at 0417 a more conventional corona developed with a red and purple centre surrounded on all sides by converging green rays. At the same time active atmospheric electrical fields were measured using a pair of electrodes connected to a sensitive meter.

The corona forms at the observer's magnetic zenith which is equatorwards of the geographic zenith because the magnetic lines of force bend towards the magnetic equator as they leave the Earth's surface except at the magnetic dip

Table 2—Auroral Activity reported April to June 1985.

DATE (NIGHT)	LOCATION AND NUMBER OF OBSERVERS	GEOMAGNETIC LATITUDE			MAXIMUM STORM ACTIVITY CODE*	TIME (GMT)
		LOWEST	HIGHEST	AT STORM PEAK		
10/11 April	Alberta (1)	64	—	—	5	0450–0500
13/14	Western Atlantic (1)	56	—	—	5	0100–0500
19/20	Manitoba, 'Lima' Scotland, New Zealand (7)	59	63	59	5	1830–0930
20/21	Canada, Atlantic, U.K., Australasia (13)	56	65	59	7	1605–0703
21/22	Canada, Norway, U.K., Australasia (11)	56	61	56	5	2130–0950
23/24	'Lima' (1)	63	—	—	1	0001–0130
27/28	Canada, Australasia (3)	59	64	59	5	2330–0550
28/29	Manitoba (1)	59	—	—	6	0357–0424
7/8 May	'Lima'	63	—	—	1	0150
9/10	Atlantic (2)	54	63	63	2	2130–2245
10/11	'Lima' (1)	63	—	—	1	2350–0240
13/14	'Lima' (1)	63	—	—	1	2345–0045
31 May/ 1 June	Alberta (1)	64	—	—	4	0630–0830
6/7	St Lawrence (1)	60	—	—	2	2000–2010
8/9	New Zealand (1)	—	—	—	1	0800–0945
9/10	Canada, U.S.A. (5)	54	60	55	6	2349–0500
10/11	Manitoba (1)	59	—	—	7	0342–0444

*Storm Activity Code: 1 = Glow or unspecified form, 2 = Homogeneous arc or band, 3 = Rayed arc or band, 4 = Ray bundles, 5 = Active storm, 6 = Coronal structures, 7 = All sky storm.

poles where they are vertical. Auroral particles are guided down the lines of force into the atmosphere to form the visible aurora, which if it happens at the magnetic zenith above the observer, he or she sees the rays in a spoke-like effect due to the perspective of looking along them. The 'tornado' corona referred to above is really the effect of seeing the swirling of draperies from immediately below them.

The article on phosphorescent wheels by Dr Herring and Mr Horsman (*The Marine Observer*, October 1985) is of interest in the context of the auroral corona in that the suggestion was made that parallel lines of light when seen in

perspective could give the impression of the spokes of a wheel. A complete auroral corona gives just this impression if one is standing looking up at the magnetic zenith when a large number of rays are forming immediately above the observer.

Figure 1 shows the effects of the observer's position upon the appearance of the spiral aurora referred to above. During transient type auroral storms ships sometimes report having seen a western movement of auroral light and forms

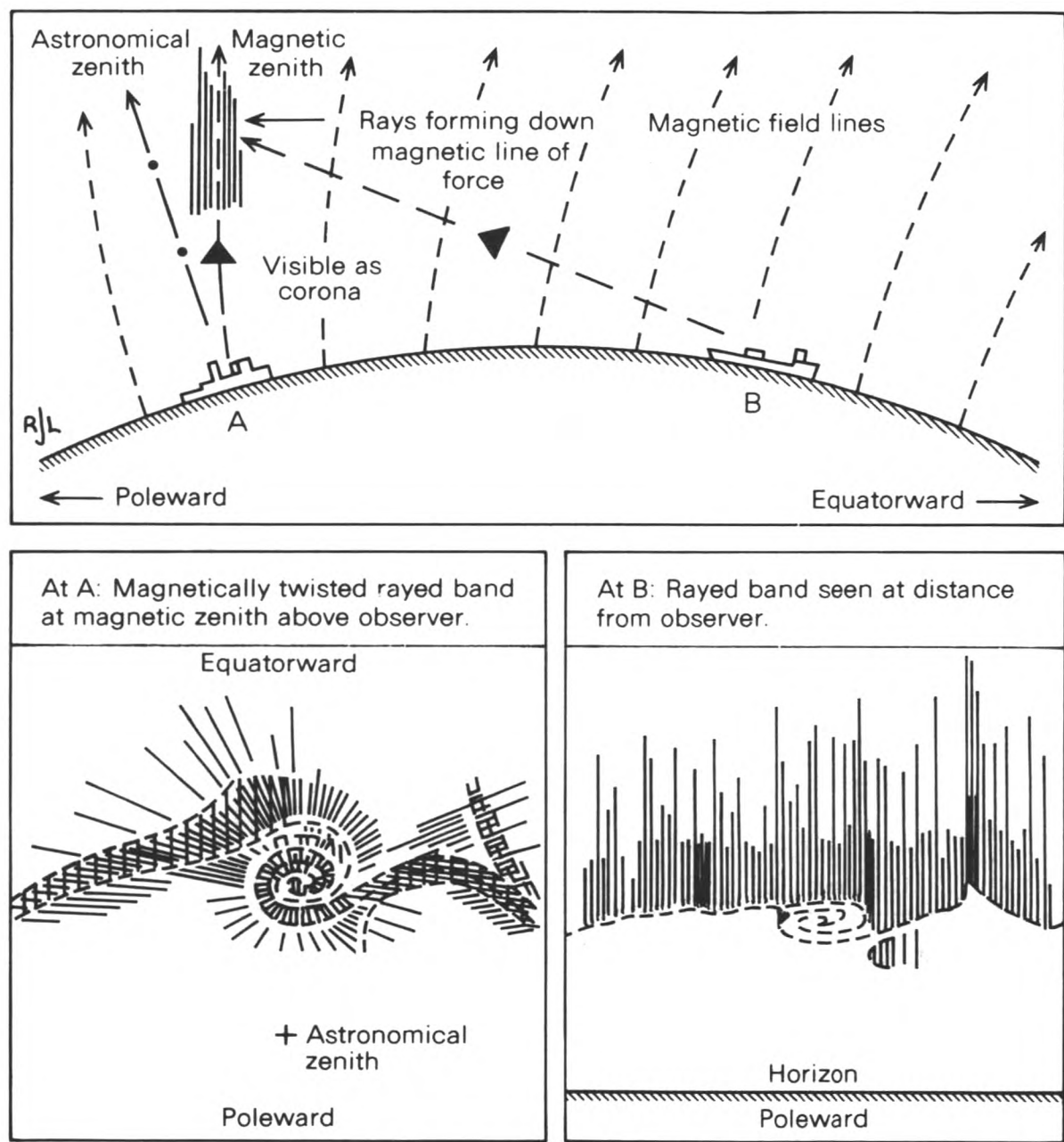


Figure 1. The effect of the observer's position on the appearance of the aurora.

during the period of a surge prior to local magnetic midnight while eastward surges may be seen after magnetic midnight which approximates to the time when the sun, the magnetic pole and the observer are in the same straight line. Sometimes both the surges are seen simultaneously.

One may ask if the aurora has any practical significance to mankind. It has certainly inspired painters, writers and poets as well as scientific researchers. The answer must be in the affirmative, although the effects are not generally noticed by the man in the street except on special occasions. The ionised clouds forming the aurora provide pathways for electrical currents in the high atmosphere which themselves induce changes in the Earth's magnetic field readily detected at ground level. Now such variations generate an electric field in any conductor lying in that field. Long welded steel gas, oil and water pipelines form such conductors and the resulting currents passing up and down the pipeline can effect both corrosion protection systems and their instrumentation. For example, in the 1.28 m diameter by 1000 km long Alaska oil pipeline, Wallace Campbell of the U.S. Geological Survey, measured currents of 50 amperes during only moderate magnetic activity. He predicted that currents many times higher might flow during the course of a severe auroral-magnetic storm.

Auroral currents can also induce electrical surges in power transmission lines. In south Canada and the northern U.S.A. auroral activity reaches down into lower latitudes in which are situated industrialised and populated regions having a complicated transmission system. Auroral currents amounting to 100 amperes have been known and their effect is to overload the electrical supply system. The result is that transformers temporarily overheat and are switched out by the safety instrumentation. The whole power network then becomes unstable and starts to shut itself down. The power blackouts in New York in 1969 and 1972 were attributed to this phenomenon. It is curious to note that because of the loss of power, New Yorkers lost their normal amusements such as watching television and it is reported that a minor increase in the birth rate took place some nine months after the event. If this is so, then it must be one of the only examples of a solar event having a direct effect on the birth rate of the human race.

Similar auroral activity affects telegraph and telephone lines, resulting in the interruption of communications. Generated electric fields of between 0.5 and 60 volts per kilometre have been reported in the auroral zones. Marine radio operators are well aware of the effects of the aurora upon signal transmission, causing fadeouts on HF and extension of ranges of VHF frequencies. Spurious radar echoes have also been reported. During certain events when protons of high energy come well down into the polar atmospheres, it is not advisable to fly at very high altitudes on the polar routes because of the possibility of radiation effects.

It will be seen therefore that the aurora touches the lives of many people without many of them realising what is happening.

Our observers will be encouraged to know that their observational records do not lie around gathering dust in filing cabinets. Dr J. P. Legrand of the French National Institute for Astronomy has regularly received copies of auroral observations for use in solar-terrestrial studies. Dr J. Liritzis of the Academy of Athens has received similar assistance. A comparison of observations made on both sides of the North Atlantic has been of interest to Dr M. Hapgood of the Rutherford Appleton Laboratory with regard to the southerly penetration of auroral storms. Details of auroral activity have also been issued to other specialist enquirers. Perhaps the most unusual request for information came from a women's magazine in respect of formulating a reply to a reader's letter to the editor. You never know when an observation may be useful to somebody else so please keep them coming.

Weather Watchers Still Needed*

What with computerised weather forecasts on television which purport to show depressions tracking their way across the North Atlantic, advancing in 500 mile leaps at the touch of the presenter's button, one sometimes forgets just what is involved in the gathering of weather data. Satellite pictures on call, facsimile machines, even the crisp directions of the weather routers, all seem to be such a long way away from the prosaic business of reading temperatures and pressure, estimating wind and sea states and winding up wet old sea-water temperature buckets in the middle of the night. With all this high technology ironmongery flying through the firmament, is it really so necessary to be reading our humble instruments as we roll and pitch around at zero altitude?

Well, for all those people who still believe that weather is a really worthwhile study for the mariner, I am delighted to tell you that in fact, more observations from satellites require the services of these on the surface even more. Satellite observations, according to the British Meteorological Office's Captain G. V. Mackie, require coincident observations from the surface for comparison and validation purposes. Further, even the all-seeing satellite which can scrutinise the small ads on a yesterday's copy of *Izvestia* lying in Gorki Park, cannot yet measure such quantities as surface pressure. Captain Mackie also makes the point that as weather models develop and improve, they become more 'hungry' for more observations, which are required to be increasingly accurate and available at finer horizontal resolution.

A further requirement for ships' observations arises from the need to continuously update the unique Marine Data Bank which is held at the Met. Office headquarters at Bracknell and which contains 58 million observations taken over the past 130 years. New data are added at the rate of 1.3 million observations per year, and all this information is becoming more important, with, for instance, marine engineers and the offshore industries being important 'customers' for weather data as they design and operate new plant. And if the 'environment' is your concern (and it jolly well ought to be), you should be aware that these humble surface observations are vital in investigations being pursued in international experiments such as the World Climate Research Programme, looking into the causes of climate change and whether man's activities are influencing the climate. So the meteorological community needs these observations more and not less today. And weather forecasting has always been something of an investment, with the more you put into it being reflected in improved and better forecasts to ships and to ship operators.

A particular need of the Met. Office at present is in the North Atlantic, where there is a World Meteorological Organisation programme under way. This badly needs an increase of about 100 in the number of good quality midnight reports received in real time from this ocean by 1987 at the latest. This needs many more additions to the Voluntary Observing Fleet which remains at the forefront of this work. So if your ships can help in this way, at no cost to your good selves, I hasten to add, I urge you to contact your national Met. Office for details. And if you operate under one of the open registries which does not have a VOF, your help is needed too. It is a worthwhile and interesting activity, which undoubtedly does its bit in improving the professionalism of mariners.

Footnote. Further details can be obtained from Captain G. V. Mackie, Marine Superintendent, Meteorological Office Marine Division, Headquarters Annexe, Eastern Road, Bracknell, Berkshire RG12 2UR.

*Reproduced from *Fairplay*, August 29th, 1985, by kind permission of the Editor.

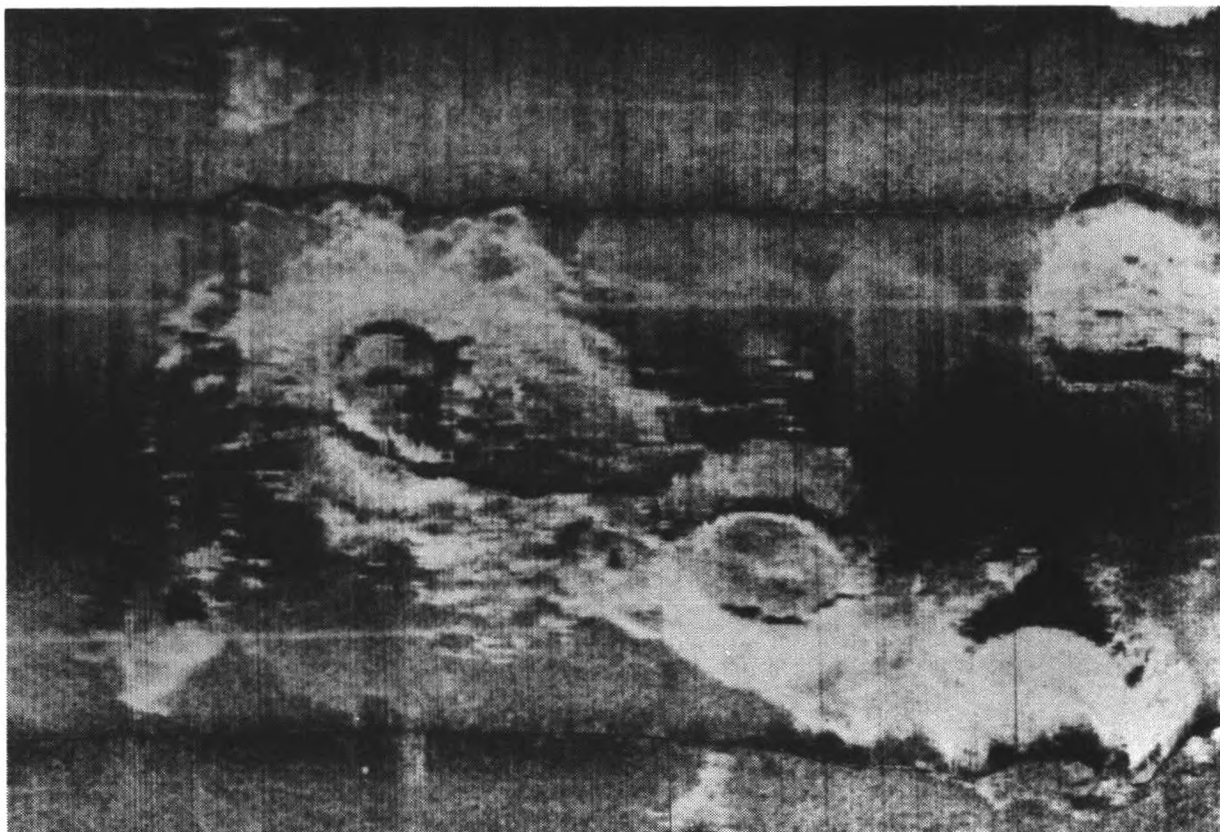
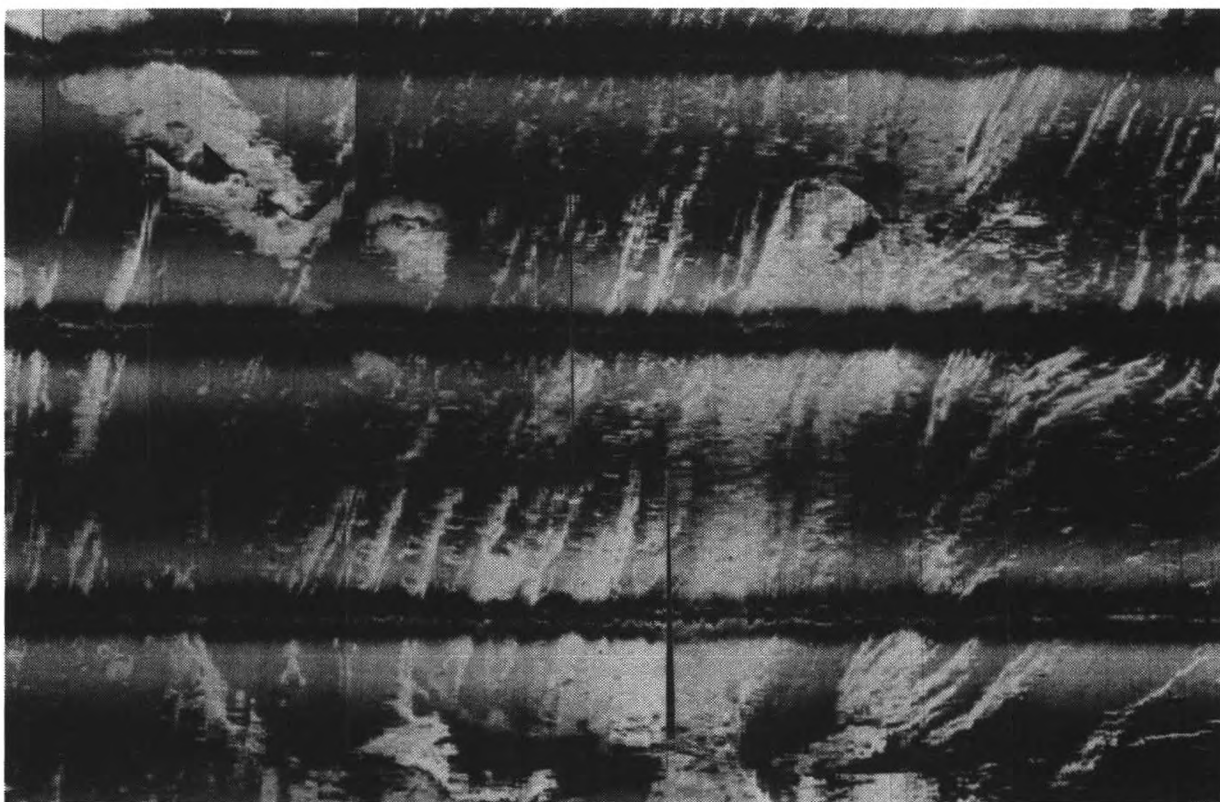


Figure 3. Sonographic mosaic of Taney Seamount showing a chain of three very large volcanoes. The two westernmost volcanoes have large central caldera 4 to 6 km in diameter.

↓ Mid-ocean ridge



↑ Mid-ocean ridge

Figure 4. Sonographic mosaic of Gorda Ridge showing a typical mid-ocean ridge tectonic fabric of parallel volcanic ridges (lighter areas). A large seamount (President Jackson Seamount) occurs in the top-left corner of the figure. (See page 83).



Photo by G. J. Simpson

Horseshoe Crab on board m.v. *Lincolnshire* (See page 68)



Photo by R. Tremlett

Barn Swallow pictured on board m.v. *Fort Victoria* (See page 72)

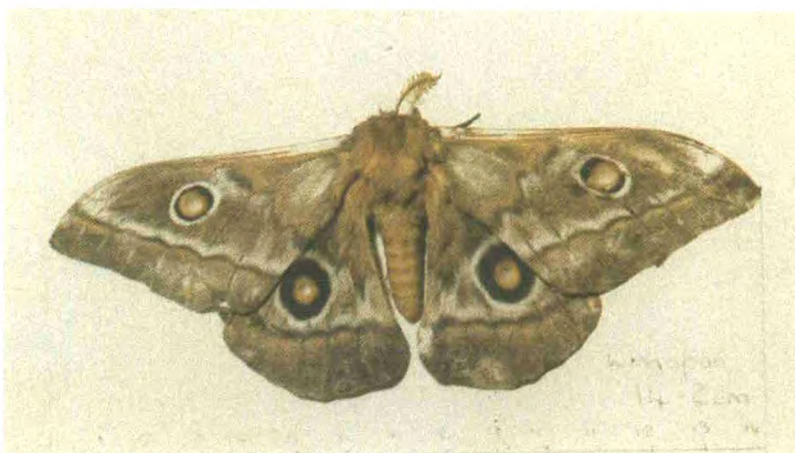


Photo by A. Willard

Pine Emperor moth on board m.v. *Servia* (See page 74)

Port Meteorological Officers' Conference

A 2-day conference was hosted by the Marine Superintendent, Captain G. V. Mackie, at Bracknell headquarters in October 1985, and attended by all U.K. Port Meteorological Officers, the Ocean Weather Ship Officer and H.Q. staff, numbering 20 in all. (See photograph of participants opposite page 80.)

Although it was little more than a year since the last conference was held, there were significant numbers of developments and important issues to be discussed to justify this gathering, which had as its main aim the improvement of services to the Voluntary Observing Fleet.

The first day was devoted to talks by senior Met. Office staff, detailing the latest innovations in forecasting and instrumentation and on the Marine Advisory and Consultancy Service recently transferred to the control of the Marine Division. There was also a presentation about the latest advances in satellite communications given by Mr Chris Bell, Service Development Officer for the Business Development Department of INMARSAT.

Following the formal welcome by Dr P. Ryder, Deputy Director of Observational Services, the Chairman briefed those attending on the results of his recent attendance at the WMO Working Group on Marine Meteorological Services held in Geneva. Subjects under review included a standard format for offshore platform forecasts, planning for the introduction of the Future Global Maritime Distress and Safety System in the early 1990s and training of overseas meteorologists with no marine experience, aboard the newly acquired Ocean Weather ship *Cumulus*.

In stressing the continued essential need for observations from surface craft for validation and verification of satellite data in real time, it was demonstrated that ships' observations are used not only for synoptic purposes but are also the basis for oceanic climatology. The Operational World weather watch System Evaluation – North Atlantic (OWSE-NA) has an obligation to increase the number of midnight weather reports by the involvement of 100 more ships in the North Atlantic region in 1986. Another aim of the OWSE-NA is to make use of a merchant ship for taking upper-air soundings, and Finland also wishes to install similar equipment on board a British ship. Fixed and drifting buoys with automatic weather instruments, some of which are now monitored by the Marine Division, were part of the scheme.

Other marine service items of interest include affirmation that facsimile transmissions via Bracknell GFA would, after all, be maintained for the foreseeable future, following objections made by Masters of observing ships informed of the imminent withdrawal of GFA services. Facsimile transmission by digital means would replace present methods in the future and would be less expensive and produce a reduction in transmission times.

Port Met. Officers reported that feedback from ships visited indicated that NAVTEX and 'Marineline' services were generally well received. Recruitment of non-U.K. flag ships into the Voluntary Observing Fleet (VOF) was a matter for the individual to decide, dependent on expected benefits and future security of the valuable equipment employed. The notion of abbreviations on NAVTEX was unwelcome.

As a result of the WMO sponsored programme for reports of waves, more emphasis is now placed on the need for accurate sea and swell observations. Estimated quantities from observer reports were sometimes found open to doubt by users. There was general agreement that visual observation of sea state and wind force remained the best methods for estimating sea and swell data from the ship's bridge. Comparison with heights of fo'c'sle head and flagstaffs was a useful method of estimating wave height. It was hoped that the single-manned bridge with instrument consoles to be monitored would not deter navigating officers from taking practical observations.

Continued success in the receipt of midnight and 0600 reports from the 8 ships fitted with the Meteorological Observing System for Ships (MOSS), including arbitrary inclusion of the Weather Group, and with MOSS operations in general, is an encouragement to increase the number of ships fitted with this equipment. Up to ten more ships may receive MOSS within the year and further installations are anticipated in following years.

The conference concluded with discussions on various topics relating to improvements in the supply and fitting of meteorological equipment to observing ships, and ways of helping all co-operating officers to enrich their gratuitous observing proficiency.

Farewell *Starella*, Welcome *Cumulus*

As foreshadowed in the January editorial, Ocean Weather Ship *Cumulus* was formally handed over to the United Kingdom by the Royal Netherlands Meteorological Institute at Hull on 18 December 1985. At a special ceremony attended by the respective Directors General, World Meteorological Organisation officers and Hull City officials including the local M.P. and Lord Mayor, Mr J. Scherpenhuizen, the Netherlands Secretary for Transport and Public Works, presented the formal Bill of Sale for ows *Cumulus*. In exchange a symbolic sum of £1.00 sterling, mounted on an inscribed plaque, was handed over by the U.K. Under Secretary of State for Defence Procurement, Mr. John Lee, M.P. This method of purchase was agreed by the consortium of European nations, represented by the North Atlantic Ocean Stations (NAOS) Board, on the understanding that the *Cumulus* would be sold back to the Netherlands after a certain period of use, probably 4 years.

There is a long history of co-operation in the field of ocean weather ships between the U.K. and the Netherlands, starting in 1949 when the North Atlantic network was first set up, with 13 stations spread across the ocean. For the past 4 years, the Netherlands has operated *Cumulus* in conjunction with the U.K. ows *Starella*, maintaining alternate monthly vigils at station 'Lima' in position 57° 00' N, 20° 00' W. Like the *Starella*, whose charter has now ended, the *Cumulus* will be managed for the Met. Office by J. Marr & Son of Hull, continuing the mutually beneficial bond between the two bodies.

The single manning of station 'Lima' by *Cumulus* will enable the station to be continuously manned for about 25 days in every 33, allowing for a replenishment turn-round at the ship's new home port of Greenock of 36 hours, plus 3 days transit time to and from station. The ships will be crewed by a U.K. complement of 12 men drawn from a pool of 18 recruited mainly from Hull and Fleetwood trawlermen, thus increasing the numbers of mariners in employment from the private sector and adding to the British personnel involvement in the weathership operation. There will also be a team of 7 specialist staff on board to carry out the meteorological and oceanographical work, radio operations and contributions to research into sea pollution, marine life migration and environmental data collection.

During the penultimate handover from *Starella* to *Cumulus* at station 'Lima' on 18 November 1985, an opportunity occurred to take unique photographs of the two ocean weather ships together, and one such appears opposite page 69. It is unlikely that a similar occasion for photography will ever again present itself, since *Cumulus* relieved *Starella* for the last time in mid-January and the latter was handed back to her owners, J. Marr & Son.

Cumulus was built in 1963 at Deest, Netherlands, to passenger ship standards and thus has a large amount of extra accommodation for guest scientists and trainees embarked on special research projects. Besides all the customary features of a small ocean-going ship, *Cumulus* has a spacious instrument room, balloon hangar with rising door, stores for helium balloon inflation and a fully fitted hobbies room. There is also a laboratory for oceanographic survey work and a winch for the deployment and recovery of thermometers or water scoops from any desired depth. She has, needless to say, been meticulously maintained by her Netherlands personnel and remains in first class condition throughout. She has a gross tonnage of 1974, length overall is 233 ft 7 in, beam 41 ft, draft 15 ft 4 in and a service speed of 10 knots. The main engine is a 6-cylinder Werkspoor diesel of 1400 BHP driving a single screw. Total accommodation is for 52 persons.

Following the withdrawal of France and the Netherlands from the NAOS Board on 31 December 1985, there remain only two other manned ocean stations. The U.S.S.R. man station 'Charlie' in mid-Atlantic (52° 45'N, 35° 30'W) using some five specialised vessels in rotation out of their Black Sea home port of Odessa. Norway operates a single vessel on station 'Mike' about 500 miles NNW of her haven of Bergen.

To some extent satellites are able to provide information once solely obtained from ocean weather ships, whilst other methods of making measurements from fixed and drifting buoys, commercial ships and aircraft are being introduced. Nevertheless these methods are not yet ready to take over the important role of ocean weather ships entirely. Against this background and the continuing need to rationalise costs, NAOS members have devised a cost-effective method of providing essential observations from the three remaining stations whilst encouraging investment in other weather data acquisition systems.

LETTERS TO THE EDITOR

From Mr R. K. Q. Butler, 3rd Officer Navigating, m.v. *Remuera Bay*, Overseas Containers Ltd.

Observing at sea has many enjoyable facets, the most important of which is, of course, the coded weather reports. In this connection I wish to raise the following questions:-

1. Group 4, code i_x . If the weather message cannot be sent for some reason, e.g. faulty equipment, yet the weather group is significant, is i_x coded 1 or 2?
2. If prior to an observation there has been rain within the vicinity of the vessel but not at the vessel, is W_1W_2 to indicate rain? If so, is there a range at which W_1W_2 might not indicate rain?
3. In the example pages 8 & 9 the W_1W_2 code on 16 and 17 May at 1200 and 0600 respectively have been entered as 2/1. This surely is a contradiction in terms, and has been a point of heated discussion on more than one occasion?
4. There is sometimes the case when, without developing or dissolving, a cloud layer may move such that the observer's cloud cover increases or decreases. How is this coded under ww?

5. Code D_s. If the vessel has been anchored, is this coded as 9 or 0?
6. Groups 19, 20 and 21. If any of these are coded as solidi, are they to be transmitted in the message?
7. In differentiating drizzle from rain the *Marine Observer's Handbook* advises 0.5 mm as the deciding size of water droplets. The only method I could come up with is to measure droplets when they first land on windows. However, they may have spread on impact. Do you have further suggestions please?

Finally, may I suggest that letters of thanks and acknowledgement to ships be duplicated to the Principal Observing Officers? There is often useful comment in these letters that we as P.O.Os. may not see, as seldom do we return to the same ship after leave. This could help to reduce the occurrence of errors to which we may be oblivious.

Mr Butler's queries are most welcome and show a very keen interest in the finer points of observing aboard ship, which is highly commendable from our viewpoint.

To answer the final question first, and then the others in number order, we would like to be able to keep willing observing officers fully informed but constraints on our operating budget and the time available regrettably preclude us from taking such action.

1. If the weather group is significant it will be sufficient to assume the message may be transmitted and code i_x as 1.
2. There is no code for 'precipitation in sight but not at station' in the Past Weather table.
3. Spotting this 'deliberate mistake' in the logbook examples shows a high degree of enthusiasm amongst observers and is very commendable. The error is being corrected in reprints of the log, and an explanation of admissible groups for present and past weather appears in the editorial of *The Marine Observer* for January 1984.
4. If the observer's cloud cover increases overall, figure 03 should be reported. If the amounts of different types of cloud vary but total coverage remain the same, 02 is the better figure to report.
5. If the vessel has been anchored throughout the previous 3 hours, D_s would be recorded as 0. If, however, the question refers to the situation where the vessel has spent part of the time at anchor and part under way, then the best code figure for D_s will be 9.
6. These groups need only be transmitted when one or other of the columns contains practical information.
7. One of the most satisfactory ways of identifying drizzle from rain is to decide the type of cloud from which the precipitation has fallen, bearing in mind the following. Drizzle is most likely to fall from a uniform layer of stratiform cloud with no visible cumuliform development. Any shred cloud beneath a main layer is more indicative of rain than drizzle. Another method is by deciding the 'feel' of the precipitation impact on face or hand. Drizzle but imperceptibly wets the surface, whereas raindrops make noticeable but independent impacts. Any doubt can be covered by the use of the combined precipitation codes of rain and drizzle mixed. Amount and type should be identified subjectively. Serious attempts at raindrop size measurement should be confined to the silly season. – Editor.

Book Reviews

Navies of the West by Bernard Ireland. 235 mm × 170 mm, 192 pp., *illus.* Ian Allan Ltd, Coombelands, Addlestone, Weybridge, Surrey KT15 1HY. Price: £9.95.

This book follows a previous work on escorts published a few years ago and the author has also had articles recently published in defence magazines. He is therefore becoming an acknowledged commentator on warships.

The first reaction to this book is a comparison with *Jane's Fighting Ships*. At nearly £60 per copy, 'Jane's' is a book that most of us will only see in a library. Working through the book one appreciates that the author has expanded the factual text style of 'Jane's' with his own comment. The merits of this book lie in these comments and the quality of the illustrations.

The author has restricted himself to the major fighting and support vessels of the chosen western nations. Survey vessels, minor training craft and such-like are not covered.

The various nations are dealt with in alphabetical order and the ships class by class. Most, but not all, of the entries are illustrated by photograph or drawing. The illustrations are of good quality and generally cover the full width of the page. None of the six Portuguese entries are illustrated and this seems a pity as the Joao Coutinos class are quite attractive at sea and the Almirantes markedly different from the Norwegian Oslos.

The selection of photographs for a work of this type poses a problem. Beam shots give the best indication of weaponry and equipment fit but a book full of these would soon become boring. Most ships look good from the bow and the picture of the *Huron* is a good example of this. However the equipment fitted aft is lost in these shots. A balance between aerial and surface shots from various angles has therefore to be struck. This balance is not quite achieved; Mike Lennon, who appears to have travelled extensively to obtain most of the photographs, seems to have a predilection for the quarter view.

The author provides about half a column of comment on most entries, more on the more interesting ones. To examine critically the results of the deliberations of the Naval Staffs of 16 nations could be seen as pretentious. These comments are however thought-provoking if not all realistic, for example, the re-vamping of the Tribal class; on the other hand many of his points appear valid.

The book in fact belies its title as there is little about the men, the aircraft or the organisation. There is more to a navy than its ships. A few pages devoted to these would have been worthwhile.

In summary this is a book that I would be pleased to have on my bookshelf.

Lt. Cdr I. T. Pratt RN (Ret'd)
Storm Tide Warning Service

Ocean Birds, Their breeding, biology and behaviour by Lars Löfgren. 295 mm × 215 mm, 240 pp., *illus.* Croom Helm Ltd, Provident House, Burrell Row, Beckenham, Kent BR3 1AT. Price: £16.95.

Lars Löfgren was already an amateur ornithologist when he went to sea in 1960, his interest in seabirds having been kindled before this following the sighting off the coast of his native Sweden, of a bird which breeds in the Southern Hemisphere and undertakes great migrations to the north. His own extensive field observations and studies made during his ten years at sea, are here combined with his concern for ecology and the environment to produce *Ocean Birds*, a complete survey of seabirds. All aspects of them are covered in the eight chapters comprising the book, starting with their evolution and properties developed for survival and breeding in the marine environment, and then examining their species, migration, ecology, behaviour and reproduction. The final chapter deals with seabirds' relationships with we humans, and the ways by which we abuse and conserve them, both directly and indirectly.

Each section is complemented by the author's clear colour photographs as examples to illustrate the text, and there are numerous line drawings and charts

showing birds' structures, distribution and migration routes. As the title perhaps suggests, this book is not intended to be a field guide, but there are sufficient numbers of illustrations for it to serve as an additional source of identification.

Ocean Birds is the book for the general reader or the newcomer to seabirds, who wishes to know not only what a particular bird looks like, but also why it does so and how it fits into its niche in the world of the ocean. For the shipborne observer wondering why birds apparently in the middle of nowhere appear as they do, and behave as they do, this book should have the answers.

J.M.

Principles of Remote Sensing by Paul J. Curran. 245 mm × 188 mm, xi plus 282 pp., illus. Longman Group Limited, Longman House, Burnt Mill, Harlow, Essex CM20 2JE. Price: £11.95 (paperback only).

Remote sensing of the Earth, using both aircraft and satellite-borne sensors, has, over the last few years, assumed increasing importance to the environmental scientist in his quest for observational data. As workers in such diverse disciplines as oceanography, geology, and agriculture make use of remotely sensed data, so a number of post and undergraduate courses have become available at universities and colleges to cater for the training needs in these fields. Dr Curran, in this single volume, has sought to provide an introductory text book for students involved in these courses, covering many areas from the interpretation of aerial photographs to techniques for processing digital imagery.

The early chapters deal with the characteristics of electromagnetic radiation at the wavelengths of interest in remote sensing and all the radiometric units encountered in subsequent chapters are defined. The interaction of visible, infrared and microwave radiation with vegetation, soil, water and the urban environment are dealt with in some detail and form an important introduction to the applications of remote sensing techniques described subsequently.

Aerial photography, which formed the main source of remote sensing data in pre-satellite days, is dealt with at length, and the types of cameras, and monochrome and colour films applicable to remote sensing are described. Interpretation of these photographs is extensively covered and enough illustrations are provided so that the concepts described in the text are always clear. The bridge from aerial photography to satellite remote sensing is spanned by a section on the multi-spectral scanners now carried by some research aircraft involved in remote sensing, and the concepts involved in radar imaging from aircraft are clearly explained.

The chapter on satellite remote sensing begins by introducing impressive examples of photographs taken by astronauts on the early manned spacecraft, but more recent images such as those from the Shuttle Imaging Radar carried on the U.S. Space Shuttle are also included. The series of Landsat satellites has provided one of the main sources of high resolution, multi-spectral remote sensing data, and is rightly covered in some detail, with the characteristics of the Multi-spectral Scanning System (MSS) and the Thematic Mapper (TM), which are the principal instruments carried, being fully described. Sufficient examples of imagery from these sensors are also included for those not familiar with the data, to appreciate its usefulness in environmental studies. Brief outlines are given of some of the remote sensing satellites planned for launch in the next few years, such as SPOT and ERS-1, and the instruments on the current meteorological satellites, are also described. The section concludes with a tantalising glimpse into the world of military reconnaissance satellites and their capabilities.

The final section of the book is concerned with the processing of remote sensing images and brief outlines of photographic and optical processing techniques are given. The bulk of the text, however, is concerned with image processing on computers and specifically with the problems of radiometric and geometric correction, the stretching and filtering of images and the classification of data.

This attractive book provides a lively and up-to-date account of the exciting and fast developing field of remote sensing, with the only significant omission being a discussion of some of the more specialised techniques evolving, such as radar altimetry. Nevertheless, the book can be thoroughly recommended as an excellent introduction to remote sensing for the student or general reader.

J. Turner

Met. Office (Satellite Meteorology)

Personalities

RETIREMENT—CAPTAIN E. H. GREGSON retired on 1 January 1985 after forty years of the sea life.

Edwin Harold Gregson was born in Scotland in July 1928 and served his apprenticeship with J. & J. Denholm of Glasgow between 1945 and 1948. He then served continuously with Furness Withy Shipping Ltd until his retirement, sailing in passenger ships, cargo liners, mini container ships and mini-bulkers. He obtained his Master's Certificate in May 1954 and was promoted to Master in August 1969.

Edwin Gregson has served in Voluntary Observing ships throughout his sea career, supplying 43 meteorological logbooks of good value, 12 of these being assessed as Excellent. He received Excellent Awards in 1951, 1972, 1976, 1983 and 1984, the last for enhancing considerably our knowledge of weather conditions in the Falkland Islands by continuing observations aboard the *Oroya* whilst in East Cove for two weeks in early 1984.

In February 1979, Captain Gregson rescued the crew of a sinking Greek bulk carrier in mid-Atlantic in gale force winds, while in command of the *Jamaica Producer*. For his feat of great seamanship he was awarded the Royal Society of Arts Thomas Gray Silver Medal, the Ship-Wrecked Mariners *Emile Robin* Award and the Department of Trade Plate.

Amongst his many and varied interests, Captain Gregson continues as a Presenter for the *Mary Rose* Information Group, Friend of the Cape Horners Association, Member of the World Ship Society and Chairman of its mid-Essex branch and is a keen photographer, having an extensive ships collection. He is a Younger Brother of Trinity House, a Liveryman of the Honourable Company of Master Mariners and their Honorary Assistant Marine Superintendent, also a Fellow of the Royal Society of Arts.

Despite these wide commitments, Captain Gregson also manages to fulfill his obligations as Chairman of the London Branch of the Nautical Institute, for which he was recently elected to Fellowship of that body, having been a member and Vice-Chairman for a number of years. We can hardly convey our usual wishes for a happy retirement but rather to extend our congratulations to Captain Gregson on achieving such a full and satisfying position at this time.

RETIREMENT—CAPTAIN R. HAYWARD-WILLS retired from the sea at the early age of 52½ years on 1 May 1985.

Robert Hayward-Wills was born in 1932 and after attending Wimborne Grammar School, received pre-sea training at T.S. *Mercury* on the River

Hamble. He joined his first Anglo Saxon Petroleum Company ship, *Tribulus*, in May 1949, and served with the same company and its successors, Shell Tankers (U.K.) Ltd, up to the time of his retirement.

Captain Hayward-Wills obtained his Master's Certificate in 1959 and was promoted to command on s.s. *Hadra* in June 1970. His final command before he retired was the new *Tribulus*, which he left on 16 March 1985. He saw some war experience in the Vietnam field as Chief Officer.

Due to the existence of another observing officer also with the name R. H. Wills, and the lack of discharge book numbers at the time, Captain Hayward-Wills's record card contained entries relating to ships he had not sailed in, but he says that as his hobbies of golf, bowls and gardening do not make very interesting reading perhaps we could find out if this other officer is a long lost relative, which would be much more interesting.

He conveyed his thanks for services over the years, including several occasions when he was routed across the North Pacific by the Met. Office Metroute service. He has contributed 21 meteorological logbooks, including seven assessed as Excellent, and we reciprocate his good wishes and hope that his retirement is a long and happy one.

Notices to Marine Observers

APPOINTMENT OF NEW PORT METEOROLOGICAL OFFICER FOR THE BRISTOL CHANNEL AREA

Captain A. F. Ashton has been appointed Port Meteorological Officer for the Bristol Channel area based at Cardiff.

Archie Ashton joined the Met. Office in February 1985 as Sea Ice Officer, having transferred from the Department of Transport with whom he had been a Nautical Officer since 1978, latterly in their Cardiff section.

On completion of his pre-sea training at H.M.S. Conway in 1952, he became a Cadet in the Canadian Pacific Steamship Company. He left that company in 1955 to join the Bristol City Line as a Navigating Officer and was promoted to command in 1967. Five years later he transferred to Bibby Line and later still to the Island Navigation Company of Hong Kong.

It was during his service with Bibby Bros and Company that he was awarded the long-service barograph for voluntary service to the Met. Office in the 20 years up to 1974.

CONTINUANCE OF THE GFA FACSIMILE SERVICE FROM BRACKNELL

Following the discontentment expressed by ships' Masters at the proposed withdrawal of the GFA Bracknell facsimile transmissions, it has been confirmed that this service will continue for the time being. Its usefulness will be reviewed in the future, in the light of advances in satellite communications.

SHIPPING FORECAST STATION REPORTS ON BBC RADIO 4

As from 3 January 1986 and until further notice, station reports from the Varne Light Vessel have been replaced by reports from Dover, pending the installation of an Automatic Weather Station on the new unmanned Varne Light Vessel.



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