The Marine Observer

A quarterly journal

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Contributors are reminded that all photographs should carry clear identification of source, and that texts may be subject to alteration at the discretion of the Editor.

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IMPORTANT ANNOUNCEMENT

We would like to draw your attention to the following letter, announcing that we are no longer able to produce *The Marine Observer* in its present hard-copy format. The editorial staff would like to take this opportunity to thank all the observers at sea, and all the shore-side readers, who have contributed to the journal and provided support and encouragement over the years.

Dear Readers,

Please be advised that we are no longer able to produce The Marine Observer journal in its current format, therefore we regret that this will be the final issue.

In order to improve services to customers, the Met Office is streamlining its operations by reducing expenditure in some areas, including the production of The Marine Observer.

For many years, copies of the journal have been issued free of charge to all our observing ships and to associated marine interests around the world, with the primary aim of encouraging interest in observing at sea. Sadly, we are no longer able to support the editorial, printing, publishing and distribution costs involved in producing the journal.

To cease publication has not been an easy decision, and it is not one that has been taken lightly. We are, however, considering the possibility of moving to an interactive web-based format, although it is recognised that it will be some years before all ocean-going ships have access to the internet.

We would be grateful if you would continue submitting your additional marine observations. Although we can no longer include them in the journal, they will still be of value, and we shall endeavour to provide expert commentary whenever possible.

The journal has been published almost continuously since the first issue in 1924 and, throughout its long life, it has been held in high regard, both by seagoing observers and by shore-based marine institutions. Almost everyone who ventures to sea will have come across a copy at some time during their career. It has helped to encourage generations of observers on ships and rigs to submit the weather observations that are — and will continue to be — so essential to ensuring the accuracy of both our land and marine forecasts.

On behalf of the Met Office, I offer my sincere thanks for the support that you have given to the journal.

K S Groves

Keith Groves
Head of Observations Supply

The Marine Observer

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LONDON: THE STATIONERY OFFICE

The Marine Observers' Log

This section of *The Marine Observer* comprises reports of interest and scientific value which have originated from the following sources:

- completed ships' meteorological logbooks or individual correspondence;
- e-mails and CDs direct from ships, or from individual observers;
- additional observations files associated with TurboWin records;

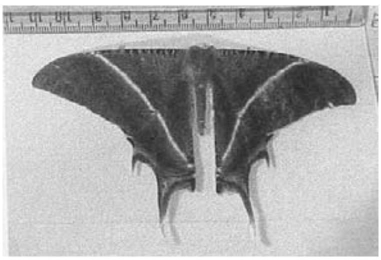
All reports are welcome in the Marine Networks section of the Met Office and, wherever possible, they are forwarded to the relevant sources of expertise for comment and analysis. Reports are also welcome from ships recruited to observing fleets other than that of the UK.

All temperatures in this publication are given in degrees Celsius unless otherwise stated, and the barometric pressure is given in millibars (mb) although the standard international unit is the hectopascal (hPa) which is the numerical equivalent. Where mentioned, 'mile' and 'miles' are to be taken as the nautical measurement.

m.v. *Jervis Bay*

- **March 2002 (Exact date not given)**
- **Captain K.C. Riddick**
- **North Atlantic Ocean**
- **Observer: M.F.J. Eade (Cadet)**

Moth: Whilst carrying out ballast tank inspections, a headless moth was discovered in No. 3 cargo hold. It measured approximately 12 cm between the tips of its wings and was basically a dark-brown colour with white or cream markings, the most dominant feature being a large 'V' shape formed from the combined markings on the fore and aft wings. The moth had obviously been dead for some time, and its origin was unknown.



M.F.J. Eade

Editor's note. Unfortunately, the image resolution would not allow good colour reproduction, but a greyscale version is shown, together with the comments of Dr Andrew Whittington (Geology and Zoology Department, National Museums of Scotland). He said:

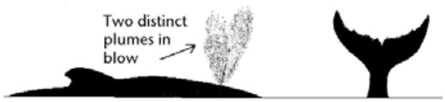
"This fine moth belongs to the family and subfamily Uraniidae; Uraniinae. These large, tailed moths resemble swallow-tail butterflies (Papilionidae), but they are actually Geometrid moths. This particular species is probably *Lyssa menoetius* (Hopffer, 1856). Although Uraniids are usually day flying, the genus *Lyssa* is nocturnal, feeding on the flowers of trees, and sometimes flying in large numbers at treetop level. Larvae (caterpillars) feed on the leaves of vines and trees (possibly often those associated with the flowers the adults feed from)."

m.v. *Colombo Bay*

- **1 July 2002**
- **Captain M.J. Power**
- **North Pacific Ocean**
- **Observers: T. Bebbington (3rd Officer)**
  M. Cadiao (AB)

Whale: A humpback whale was sighted from the bridge of the *Colombo Bay* at about 0800 UTC. Conditions at this time were calm but the vessel was in fog, a brief improvement in visibility, however, allowed the whale to be seen for four or five minutes.

It was swimming slowly away from the ship, blowing at intervals of 20 seconds, and it blew eight times before diving, offering a clear view of its flukes as it disappeared. They were black with a distinctive notch at the centre. Before diving, the whale's dorsal fin was also clearly seen; this was low and stubby with a distinct 'hook' on the rear edge (see sketch). The whale seemed to be travelling alone and was not seen again.



The whale was spotted in position 42° 24′ N, 170° 56′ E whilst the ship was on passage from Kaohsiung towards Seattle.

m.v. *British Purpose*

- **8 and 12 July 2002**
- **Captain K.E. Peacock**
- **Gulf of Oman**
- **Observer: J. McDougall (3rd Officer)**

Dolphins: At 0400 UTC, when the *British Purpose* was on a heading of 129° in the Gulf of Oman, on passage from Ras al Juaymah to Singapore, a large pod of bottlenose dolphins was observed heading east across the bow. There were about 80 individuals of varying sizes and were all very active, some were leaping clear of the water. At this time the ship's position was 23° 33′ N, 59° 36′ E.

No more dolphins were spotted until the 12th when the vessel was off the west coast of India. Then, a smaller pod of 50–60 dolphins was sighted between Cochin and Cape Comorin. Again their sizes varied and, like the previous sighting, they were jumping from the water in an apparently joyful manner. All were heading in a north-westerly direction.

m.v. *Palliser Bay*

- **21 July 2002**
- **Captain L.H. Johnson**
- **Coral Sea**
- **Observer: C. Longmuir (2nd Officer)**
  J. Madduma (AB)
  C. Masakayan (AB)

Bird: The *Palliser Bay* was on passage from Port Botany to Hong Kong, and was about 100 miles east of the Great Barrier Reef when, at around 1500 UTC, the watchkeeper became puzzled by a 'thrashing' sound coming from the starboard bridge wing. Further investigation revealed that the source of the noise was a large bird, obviously in a panic, attempting to take off from the deck.

The presence of the observers only seemed to add to its distress, so it was left alone to calm down — its wings did not seem to be damaged since it was able to flap them quite vigorously, although to little effect. The bird was thought to have flown into a radio mast and stunned itself.

After about five minutes it had calmed down enough to allow a closer inspection. It had a dull-white head and neck, yellow beak and greyish-brown wings. Most interesting were its brilliant red legs and feet! Several minutes of perusing the seabird guidebook led the observers to believe that it was a young red-footed booby.

The bird seemed relatively docile after the initial panic, making little attempt to move away when approached. Water and several strips of fish were then placed nearby, and it was left alone. At about 2100 it was seen taking off, and was spotted sitting on the foremast the following evening. It stayed with the ship until in the vicinity of the D'Entrecasteaux Islands, after which it was not seen again.

Editor's note. Captain P.W.G. Chilman, of the Royal Naval Birdwatching Society, said:

"I agree with the observers' identification — except that it was not a juvenile, which would have had yellow to brownish-red legs. This species always has bright-red legs as adults, but are otherwise most confusing as they vary [in colour] from all grey-brown to mainly white with black wing tips. They occur all round the tropics, and nest mainly in trees on offshore islands. They often follow ships, sometimes for several days, and come on board."

m.v. *Linares*

- **12 August 2002**
- **Captain J.E. Dingle**
- **Indian Ocean**
- **Observer: D.J. Korala (Cadet)**

Racing pigeon: The *Linares* was on a coastal passage of South Africa on the way from Bahrain to Paranagua (Brazil) when, at 1030 UTC, a pigeon was found lying on the deck unable to fly. The ship was 25 miles off Cape Baracouta in W'ly winds of force 10 and very rough seas, it was pitching heavily and shipping seas on deck.

The pigeon's colouring and size were similar to a that of a blue rock pigeon, but its cere was white. On its legs were three plastic rings — one orange and one blue on its right leg, and a blue one on the left leg which carried the following details: SA 2001–WBU–1934.

The pigeon was placed in a cardboard box and left to rest with some fresh water and raw rice. About two hours later it was able to walk although still unwilling to fly, but during the afternoon it left the box and went inside a mast house. Cape Agulhas was passed at 1730, this being the nearest land for another nine days. Fresh water and food were left for the pigeon overnight.

On the 13th, the pigeon had fed, watered, and appeared to be fit once more; it walked very healthily and also flew short distances. A crew member reported that it had flown from the mast house at 1500 and it was not seen again.

m.v. *Copiapo*

- **19/20 August 2002**
- **Captain W.A. Moursy**
- **South Atlantic Ocean**
- **Observer: W.S.P. Weerasinghe (3rd Officer)**

Aurora australis: During the ship's passage from Paranagua to Jeddah, a fairly quiet display of the aurora australis was observed at 2300 UTC from position 29° 59′ S, 23° 35′ W.

The aurora took the form of an arc that lay between 290° and 040°, and seemed to follow the curvature of the Earth. By using a sextant, the highest part of the arc's upper edge was found to lie at an elevation of 10° 02.6′, while the lower edge lay at 05° 32.4′.

The arc was uniformly bright but lacked internal structure. Changes in its brightness and colour took place slowly; during the display a green colour was seen, as was a mixture of red, green and blue emissions. At the time of the sighting, the *Copiapo* was on a heading of 099°, making good a speed of 16 knots.

m.v. *P&O Nedlloyd Kobe*

- **15 September 2002**
- **Captain J.L. Peterson**
- **Indian Ocean**
- **Observers: T. Oliver (Chief Officer)
I. Renders (2nd Officer)
A. Graham (3rd Officer)**

Moth: When the *P&O Nedlloyd Kobe* was approaching the coast of Sri Lanka on passage from Singapore to Suez, the Master discovered a moth on the bridge. Its dimensions when resting were approximately 2.5 cm long and 3.5 cm across (between wing-tips), but the most noticeable feature was the red and black colouration that appeared on both pairs of wings.

During the night the moth was left in a ventilated tin at the back of the bridge and was not disturbed. In the morning it seemed a little more lively and was therefore placed in the Second Officer's small herb garden for a few hours. However, it was then found to have died. When the moth was first found, the ship's position was 05° 58′ N, 86° 46′ E.

Editor's note. Dr Whittington was unable to identify the moth from the brief details supplied, but believed that it most likely belonged to the family Arctiidae, the members of which are frequently black and red in colour and distasteful to predators.

m.v. *Baltic Eider*

- **20 October 2002**
- **Captain D.R. Cripps**
- **Kattegat**
- **Observers: G. Armstrong (Chief Officer)**
  P. Brooks (2nd Officer)
  J.M. Simpson (3rd Officer)

Birds: Between 0600 UTC and 1800, a large number of small birds were viewed accompanying the *Baltic Eider* during its passage of the Kattegat en route from Helsinki to Felixstowe. It was thought they had been blown off shore during their migration south, and were using the vessel as a shelter from the wind. Several birds took advantage of the calm provided by the wheelhouse, while one preferred the warmth of the engine room! Throughout the day about 20 birds entered the wheelhouse, perching on different fixtures for a rest; they all appeared to be quite tame and not at all afraid of humans. Once inside they could be studied more closely, and were identified by the Second Officer as great tits (shown left).


Anon

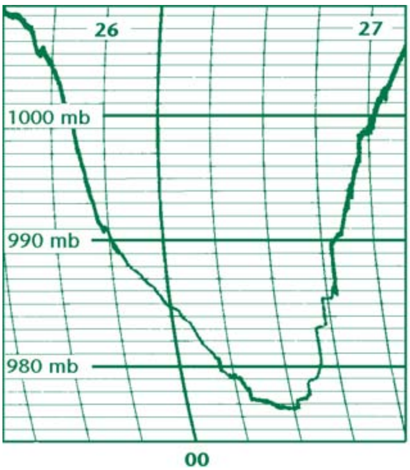
However, their friendly nature was wasted since some were later found dead on the after decks, having also been pecked at, presumably by their companions. The wind at the start of the period was NW'ly backing NNW'ly, force 5 decreasing to force 3, whilst the dry-bulb temperature was 5.2°. At this point the ship was in position 56° 47′ N, 11° 31′ E.

Editor's note. Rather than the dead birds having fallen foul of their companions, we feel it was more likely that an unseen bird of prey might well have been using the *Baltic Eider* as a 'mobile diner', and feeding on the smaller birds.

m.v. *European Envoy*

- **27 October 2002**
- **Captain P. Hudson**
- **Irish Sea**
- **Observers: Captain Hudson**
  D. Crerar (2nd Officer),
  A. Cook (2nd Officer)
  D. Garrett (2nd Officer)

Depression: The *European Envoy* was on a routine crossing from Dublin to Mostyn (North Wales) whilst experiencing the effects of a vigorous depression (which is illustrated by the ship's) resulting barograph trace. At 0530 UTC the wind was SW'ly, force 7/8 while the pressure read 979 mb. The ship was proceeding at full speed, on a heading of 072° in the rough seas and heavy swell.



At 0700 having passed Anglesey, the ship gained shelter along the coast of north Wales.

By 0800 the wind had veered to WNW'ly and increased to force 10. The *European Envoy's* course was now 112° in very rough seas and moderate swell. During the next hour, the wind increased further to NW'ly, force 11 although the pressure had now risen to 986 mb.

The port approach was aborted at 0930, and the vessel hove to off the coast as the wind speed rose to an estimated 60 knots with gusts to 80 knots. By then the rising pressure had reached 1002 mb. The wind was easing at 1300, estimated at 40 knots, but the vessel remained hove to until conditions improved further.

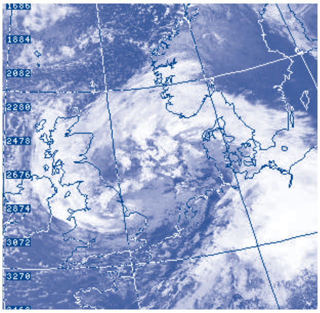


Image courtesy of the University of Dundee.(www.sat.dundee.ac.uk)

Editor's note. This depression caused severe weather conditions for parts of the UK. It moved very quickly from western Ireland at about midnight to be out over the North Sea by mid-afternoon on the 27th. The central pressure was 976 mb and the system produced very strong winds, as experienced by the *European Envoy*. The areas of the UK with strongest winds and the greatest damage were across Wales, the Midlands and into East Anglia (the strongest gust recorded by a Met Office observing station was 96 m.p.h. near Swansea, and many areas reported gusts of 80 m.p.h.).

Although wind was the dominant feature of this event it was also very wet in places with 68 mm falling in north-west Wales. After leaving the UK the low continued to move rapidly east across north-west Europe, causing substantial damage.

m.v. *Linderos*

- **10–11 November 2002**
- **Captain R.J. Kendall**
- **Moçambique Channel**
- **Observers: Captain Kendall**
  S.B.S. Lakmal (3rd Officer)
  Members of ship's company

Bird: At approximately 1900 UTC something of a commotion occurred in the darkness when a tropicbird crash-landed on the port bridge wing (ship's position 22° 19′ S, 39° 34′ E). Roughly the size of a bantam, it had a striking lobster-red bill and two long red tail feathers that extended 30–45 cm beyond the remainder of the tail. Its body was predominantly white with an orange/red tinge, it had two black 'eye patches', while its legs and feet were brown/grey in colour.

A small squid was noted beside the bird while it rested (see photograph) — this had either been regurgitated, or else dropped when the bird arrived. Fresh water was offered but ignored; the bird seemed unharmed or distressed but kept a wary eye on anyone approaching for a closer look. Having taken refuge behind a wooden locker, the bird remained there until 0730 the next day. At this point it simply walked out onto the bridge wing, ruffled its feathers and flew off!

Anon

Editor's note. Captain Chilman said:

"Undoubtedly a red-tailed tropicbird (*Phaethon rubricauda*), the two red central tail feathers are very clear in the photo. The observers noted that the white plumage had a pinkish tinge; this is a sign that the feathers were new as they fade to white as they get older. It breeds in the tropical Indian and Pacific Oceans, including Aldabra, Comoro, Mauritius and the Seychelles. I think they are probably attracted by ships' lights, and collide with rigging or masts in the dark. I have offered them food and water but they never seem to take any. It is probably best to launch them overboard if they are not obviously damaged, taking care to keep clear of the bill."

m.v. *British Enterprise*

- **12 November 2002**
- **Captain D. Mulhern**
- **Arabian Sea**
- **Observer: M. Newton (2nd Officer)**

Fish: Whilst the *British Enterprise* was anchored off Salalah, two rays which were about 120 cm to 150 cm across were seen swimming near the surface along the vessel's lee side. The larger of the two remained about 60 m away and was slightly submerged whilst the other came to within 20 m and often broke the surface.

Three sharks, which were not identified but were each about one metre long were also seen, they swam at a depth of two or three metres below the nearer ray. There was also another, smaller fish that swam close to the ray's body and tail. After about five minutes spent cruising at the surface, both rays then dived deeper and were lost from sight.

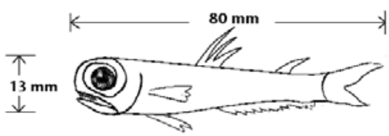
Editor's note. Dr Frank Evans, of the Dove Marine Laboratory, said:

"This type of report is always welcome. I imagine from the quoted size of the rays at 1.2 m to 1.5 m that we are dealing with one of the eagle, cow or even manta group of rays. All these large rays can be found swimming near the surface, quietly feeding on plankton. The sharks cannot be identified simply by their length, of course, but the small fish associated with the rays was most probably a pilot fish, a species with the habit of accompanying larger fish."

m.v. *Kakariki*

- **November 2002 (Exact date not given)**
- **Captain not stated**
- **South Pacific Ocean**
- **Observers: E.N. Greenwood (2nd Officer)**
  B. Bird (Chief Officer)

Fish: Whilst the *Kakariki* was on a coastal passage from Marsden Point (North Island, New Zealand) to Wellington, a period of heavy weather was experienced after which the fish shown in the sketch was discovered on deck. It was 80 mm in length over all, 13 mm high at its head, and eight millimetres wide. The huge eye was nine millimetres in diameter, and this, combined with a very large mouth that was 12 mm long, comprised the whole head. Within the mouth was a set of finely serrated teeth. The dorsal fin appeared to consist of three spines, but this might have been evidence of damage. There did not seem to be any scales on the fish, but it had a bright, metallic silver skin tinged with blue. The ship's freeboard is seven metres, thus only heavy spray would normally be taken on board, and it was not known how the fish arrived.



Editor's note 1. Dr Evans commented:

"The fish was a myctophid or lantern fish. Lantern fishes are among the commonest of the mid-water fishes and are found abundantly in all the oceans of the world including the polar regions. World wide there are perhaps 200 species. They are small fish, usually between 5 cm and 10 cm long with large eyes, a large weak mouth and a row of light-emitting organs along the underside of the body. The body itself is commonly silvery. There are two dorsal fins as in the drawing, the second one small and the first one, in this case as suggested, damaged. Feeding on small planktonic animals they undertake large vertical migrations, spending the day at depths of between 200 m and 600 m and the night nearer the surface, sometimes in shoals at the very surface, where their luminescence can be sparkling and striking.

"The most abundant species in New Zealand waters is *Lampanyctodes hectoris* and the drawing fits this species very well. It is found in more inshore waters than other myctophids. Further offshore and second commonest is the slightly larger *Symbolophorus barnardi*. The fish is most probably one or the other of these.

"We have encountered the problem of small fish found on high decks before, with hatchet fish in the Bay of Biscay, and the solution is that they get dropped there by seabirds."

Note 2. The *Kakariki* is recruited to the New Zealand Voluntary Observing Fleet.

m.v. *Linderos*

- **10 December 2002**
- **Captain R.J. Kendall**
- **Arabian Sea**
- **Observers: S.B.S. Lakmal (3rd Officer)**
  Ship's company

Jellyfish: The *Linderos* was heading into the Arabian Sea from the Gulf of Oman when, between 0635 UTC and 0705, it passed through an area of green 'scum' floating on the water. Initially this looked like tank washings, but on reflection it looked more like the algal growth found on ponds. The scum covered the surface as far as the eye could see, and varied in thickness from 'slime' to patches between which the sea was clearly visible.

Amongst the slime were thousands of small jellyfish moving under their own power in all directions. They were 10–15 cm across with a clear dome lying on top of a brown-red area under which were dark-brown or black tentacles.

The green scum rapidly thinned and, within minutes, the sea was clear; there were hardly any jellyfish left either, they obviously preferred the algal growth to clear water. At the time of the sighting, the ship was about 10 miles from shore in position 22° 34′ N, 59° 57′ E, and the water depth was in excess of 1,000 m.

Editor's note. Dr Evans commented:

"Unfortunately I am unable to throw much light on the nature of the green scum seen in such quantity at the entrance to the Gulf of Oman except to say that it was surely an algal bloom, species unknown. However, the numerous jellyfish lurking beneath the surface were of the genus *Stomolophus*. This creature was reported from the Gulf of Oman in November 1991 and an exact identification was also made by Dr S. Moore, of the Natural History Museum, London, of a specimen from the Gulf of California from a photograph supplied from the *G.A. Walker* (see *The Marine Observer*, 1988, 113). It is a large jellyfish of widespread tropical distribution. The present description of a clear dome surmounting a red-brown disk and a club of dark mouth arms beneath (there are no true tentacles) fits the more mature specimens while the example from the *G.A. Walker* was younger and totally blue in colour.

"The species is related to the moon jellies of British waters and, like them, can clearly form in huge numbers if the conditions are right. Like all jellies *Stomolophus* is carnivorous and so they were not feeding directly on the algae."

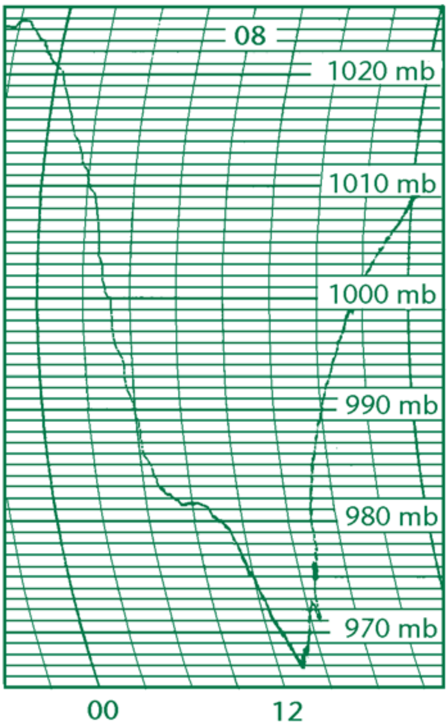
m.v. *Shenzhen Bay*

- **8 February 2003**
- **Captain M. Barraclough**
- **North Atlantic Ocean**
- **Observers: Captain Barraclough Ship's company**

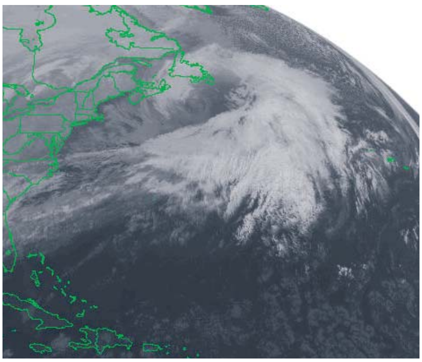
Depression: The *Shenzhen Bay* was south of the Grand Banks, heading towards Halifax NS. During the evening watch significant changes in both pressure and sea temperature were noted; the observers were also aware that a depression with hurricane-force winds was approaching from the south.

At 0200 the pressure fell by 9.0 mb while the sea temperature increased from 4.0° to 16.3° within a period of 30 minutes, and the wind increased to force 7, coming from the stern. The ship's position at this time was 41° 46′ N, 50° 57′ W and the course was 284°, while the speed was reduced to 18 knots. At 0300 the pressure was 1010.1 mb, falling rapidly (see barograph trace) and, during the next hour, the sea temperature fell to 4.0° while the ship's speed gradually increased to 24.5 knots.

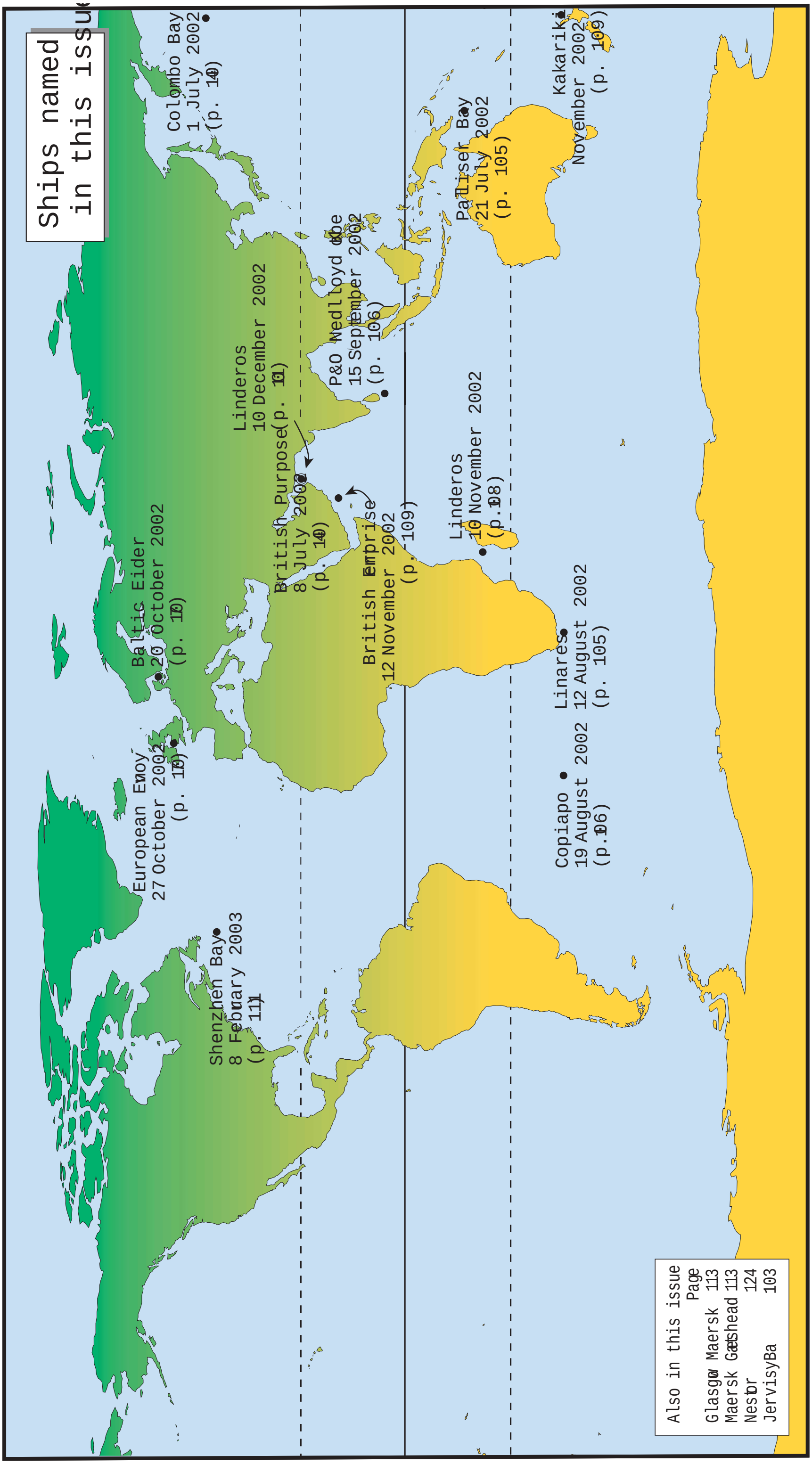
Over the next three hours the pressure plunged a further 22 mb before steadying for a similar period, it again fell rapidly at about 0800 and continued to do so until 1400. Between these times the wind speed averaged 80 knots but sometimes exceeded 100 knots as the storm progressed northwards.



Left: *The barograph trace from the* Shenzhen Bay*.*



Right: *An infrared image of the storm captured by the GOES-8 satellite at 1200 UTC on 8 February 2003. (Image courtesy of the National Climatic Data Centre, NOAA.)*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We would like to thank...

*...**Captain G. Wolstenholme** and the observing officers of the* Maersk Gateshead *for participating in the VOSClim project.*

Katy MacDonald

Right: *Captain Wostenholme is shown receiving a VOSClim certificate from Captain Harry H. Gale (Port Met. Officer for South-east England) in February 2003.*

*...**Captain D. Johnstone** and the observers on board the* Glasgow Maersk *for their participation in the VOSClim project.*

M. Samant

Right: *Captain Johnstone receives a VOSClim certificate, on behalf of the ship, from Captain Harry H. Gale in March 2003.*

A new marine screen

Martin Parker (Met Office)

The wooden marine screen, so familiar to ships' observers, was first developed from the 'Stevenson screen' — designed in the nineteenth century — and has remained virtually unchanged to the present day.

Although it functions satisfactorily, the survival of a wooden screen in the marine environment depends on its maintenance, i.e. repainting. On modern automated ships, in which manpower has been so reduced in recent years, the lack of opportunity for ships' personnel to carry out such maintenance has largely left the marine screen to fend for itself. Without proper maintenance, the lifetime of a wooden screen is only two years during which time the following problems occur:

- painting is often required within a year of exposure to the marine environment.
- door hinges need to be replaced at intervals of around two years.
- internally, the retaining clips for thermometry perish and need frequent renewal.
- the upper retaining clip has a tendency to snap the top off the thermometer.
- the single-louvred construction of the screen allows the exchange of radiant energy between the thermometers inside the screen and the surface below.

In addition, this design has become more expensive to produce. In order to address all these points, it was felt that an alternative construction material — such as plastic — should be considered, this would also offer a 10-year life to marine screens.

First prototype and trials

Initially, a screen was constructed using standard sections of plastic angle with which a double-louvred effect was created. Three sides of the screen were made first and then screwed together with stainless screws. The fourth side — a drop-down door — was made in a similar way and fitted to the front. The top and base of the screen was constructed from standard 'foamboard'.

M. Parker

During the summer of 2002, the screen underwent trials at the Experimental Site of the Met Office, near Bracknell. The trials compared the performance of two Stevenson screens, one wooden marine screen, and the new plastic version. The conclusions were:

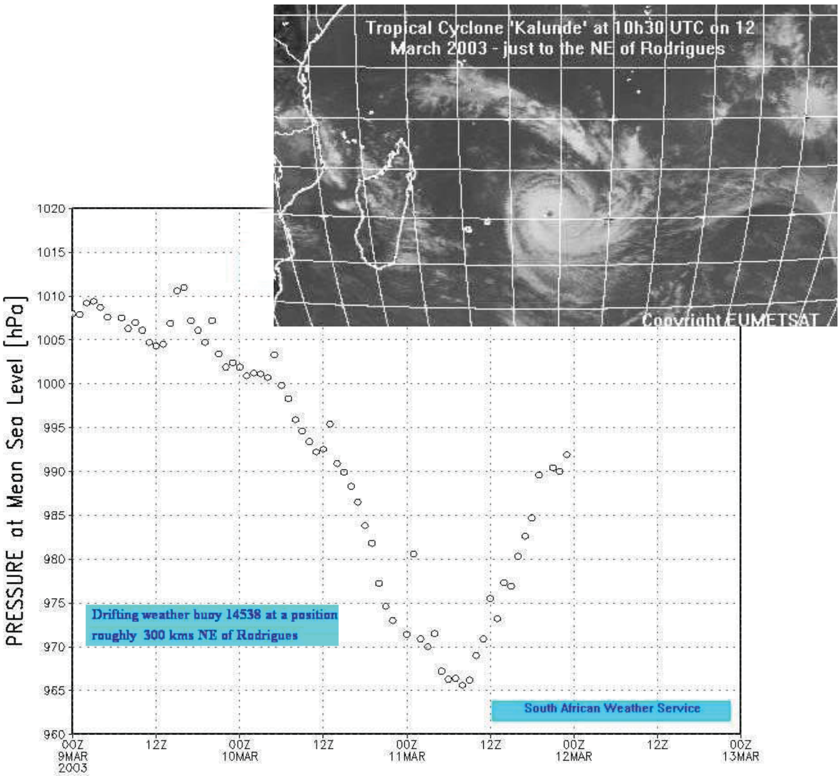
- the plastic prototype provided a radiation shield superior to the wooden screen. Its dry-bulb temperatures were in close agreement with the Stevenson screen.
- it has a faster thermal response than the Stevenson screen, noticeable at dawn and dusk, when the air temperature changes more quickly.
- its dew-point temperatures were in close agreement with the Stevenson screen.

A small number of the screens have now been assembled and are undergoing final land and sea trials. A modified version will also be tested on one of the Met Office's open ocean moored buoys.

Tropical Cyclone ‘Kalunde’ and a drifting buoy, 11 March 2003

Ian T. Hunter (South African Weather Service)

The accompanying pressure trace is from a drifting weather buoy in the path of Tropical Cyclone ‘Kalunde’. This buoy was in a position roughly 300 km north-east of the island of Rodrigues and — as can be seen from the time series — it experienced its lowest air pressure (965 mb) late on 11 March 2003, at around midday (local time).



The cyclone had been tracking in a generally south-westerly direction over the previous few days so that by the evening of 12 March it had passed very close to Rodrigues, on its eastern side. By 0600 UTC on the 13th the island had recorded 329 mm of rainfall. Wind gusts of up to 200 km/hr [188 m.p.h.] were measured on the island overnight.

Bearing in mind that these drifting weather buoys are a mere 40 cm in diameter, weighted with a long drogue and packed with sensitive electronic equipment, it is a significant achievement of modern technology to have designed something so robust as to continue operating in the middle of a tropical cyclone. At the time of its passage ‘over’ the buoy, Kalunde was estimated to be generating individual waves of over 20 m and gusts of wind well over 200 km/hr!

The buoy (14538) was deployed by Météo-France on 16 December 2002 at position 10° S, 71° E. Together with drifting weather buoys deployed in all oceans — from the tropics to the polar regions — it forms a very important part of the global observing network.

Take a deep breath…*

L. Halsey

How do creatures such as whales, marine turtles, seals and penguins spend almost their entire lives submerged without being able to breath underwater?

Well, of course the simple answer is that they come up for air. But this means they have to break off from whatever they are doing and risk attacks from predators. So how do air-breathing creatures keep surfacing to a minimum? Who stays down longest, and how do they cope with the rigours of diving?

Going deep

Emperor penguins are famously deep divers, reaching 500 m — deeper than any other bird. But mammals beat birds when it comes to depth. Some seals dive to several hundred metres while northern elephant seals can get down to 1,500 m. Certain whale species routinely dive to around 1,000 m, but not many air-breathers go deeper. No light penetrates below around 1,000 m, so for sight hunters there's not much point in going further.

The sperm whale, a huge animal up to 18.5 m long and weighing up to 50 tonnes, is the exception. Sperm whales have been recorded 2.25 km (1.4 miles) down in the ocean. A dogfish that only lives on the deep seafloor was found in the stomach of one sperm whale, suggesting that they may dive to over 3 km. Sperm whales largely use sound (or echolocation) to hunt, so light is largely irrelevant — perfectly healthy but blind sperm whales have been captured with food in their stomachs. A sperm whale's head is one-quarter of its length and one-third of its weight. It contains massive organs filled with concentric layers of waxes, known as spermaceti oils, which refract and focus sound, allowing sperm whales to find their prey of giant squid (weighing up to 300 kg), bottom-dwelling sharks, cuttlefish and octopuses. Sperm whales spend 90 per cent of their time in deep water, only occasionally resting at the surface. By altering the density of their spermaceti oils and adjusting their buoyancy to match the surrounding water, they can hang motionless 'listening' for prey while using very little oxygen.

Above: *Sperm whales (courtesy International Fund for Animal Welfare. www.ifaw.org)*

Under pressure

Conserving oxygen isn't the only challenge for deep divers. Water pressure increases by one atmosphere (the pressure we experience at the surface) every 10 m, building up to a crushing weight on the lungs and leading to several other problems.

* Reprinted from *Planet Earth* (Published by the Natural Environment Research Council) Winter 2002, with permission of the Editor and author. NERC home site: www.nerc.ac.uk

Lung collapse

Without pressurised air, we humans can't dive far before our lungs collapse. The deepest human dive aided by a rope is 73 m. Whales don't appear to suffer this restriction. It seems whale lungs and chests are designed to collapse without injury. Increasing pressure on the intestines forces the diaphragm against the lungs, which crumple, pushing the air into the windpipe and extensive nasal passages.

The tremors

Increased pressure also causes 'high pressure neurological syndrome' in a number of land vertebrates, including humans. The increased pressure probably cause the nerves to fire more often and intensely, causing tremors and eventually a complete seizure. It is only very recently that we have reached some understanding of how deep diving species combat the tremors. Studies on toothed whales suggest that their central nervous systems probably have a way of stopping the nerves getting over-excited.

Nitrogen tensions

Human divers go into a stupor and then lose consciousness if they dive too deeply for too long. During a dive, the increased pressure pushes nitrogen through the lung walls and it is absorbed into the bloodstream. Nitrogen is an anaesthetic gas, especially at higher pressures, so it reduces one's ability to think and move, then causes euphoria, coma and death.

On the way back up, the gases in the body expand. If decompression is too rapid, nitrogen bubbles form in the bloodstream and can cause paralysis and death (known as 'the bends' in human divers). But cetaceans' lungs probably collapse totally before nitrogen reaches a critical level in the blood, preventing further nitrogen being absorbed. Also nitrogen cannot get into their bloodstream from the air forced into the windpipes and large nasal cavities as their lungs collapse.

Latent hypoxia

Human divers can also suffer brain anoxia, a lack of oxygen in the brain, which causes unconsciousness. Under high pressure, oxygen rushes from the lungs into the bloodstream causing oxygen pressure to rise in the arteries and lower in the lungs. As the diver comes back up through the top 10 m of water, the lungs double in volume. Then oxygen rushes back into the lungs and starves the brain of oxygen.

Once again, the cetaceans' collapsible lungs avoid this problem by reducing the rate at which oxygen leaves the lungs when they are diving deeply. Other diving mammals can cope with low oxygen pressure as they come up from the deep because they have much lower oxygen pressure in their brain arteries than land mammals.

Long dives

Certain species stay underwater for a long time without diving particularly deeply. The longest a human has held his breath underwater is seven minutes and 38 seconds, although this was only a face immersion and not an active dive. Certain reptiles and amphibians, such as the snapping turtle and the green turtle, can stay submerged for weeks during cooler seasons by reducing their metabolic rates to well below their normal resting levels and remaining inactive. In the laboratory, reptiles other than turtles do not tend to dive for longer than an hour. For example, the Nile monitor lizard submerges for around 15 minutes at 25°, and the elephant-trunk snake dives for up to 30 minutes. However, in the wild, startled iguana have remained submerged and inactive for over four hours at 25°. Most impressive of all is the Lake Titicaca frog, which lives in the bottom of the lake and has never been observed surfacing in the wild. It does so in the lab if the oxygen pressure is sufficiently reduced.

Above: *Green turtle (NOAA Central Library)*

Size matters

How long an animal can dive for depends on how much oxygen it can store and its efficiency at consuming oxygen. Larger divers store more oxygen, and use it up more slowly, in relation to their body mass. Sperm whales, the deepest divers, take advantage of their great mass and therefore their ability to store large quantities of oxygen, spending long periods travelling to and from their deep feeding sites and locating prey. They are further adapted to dive for longer than the similar sized baleen whale by having significantly more myoglobin (a red iron-containing protein pigment similar to haemoglobin) in their muscles in which to store oxygen.

However, most large species, including cetaceans, do not stay underwater for long. The pantropical spotted dolphin, weighing about the same as man, averages only 30 seconds underwater, perhaps because of the low myglobin concentration in its skeletal muscles.

Endurance divers

Some smaller species with low oxygen storage capacities and high metabolic rate for their size regularly submerge for incredibly long periods of time. This suggests that they possess particularly specialised behavioural and/or physiological adaptations. Penguins can really hold their breath. The emperor penguin, at only 30 kg, can dive for well over 10 minutes.

But when comparing body size against dive duration, the diving kings are the Alcidae, a family of small Atlantic seabirds including guillemots and razorbills. The champion endurance diver is the black guillemot. Weighing less than 500g, it can travel underwater for over two minutes. The black guillemot is found throughout the North Atlantic, including the British Isles, and feeds in both shallow and deep waters.

Jonathan Wills

Left: *A guillemot demonstrates under water 'flying' skills.(Courtesy www.bressaboats.com)*

We are not sure what makes alcids such effective divers. Because they fly as well as swim, they have not increased their body density to reduce their buoyancy to the extent of flightless diving birds. They therefore use more energy in shallow waters. For their size, they seem to have similar oxygen storing capacities and metabolic rates to other marine birds. Therefore, alcids regularly dive for longer than one would think possible.

Behavioural adaptations in alcids

Alcids may use oxygen efficiently by getting into deep water quickly. They propel themselves with their wings (and some also use their feet) at the start of a dive, enabling them to overcome their buoyancy. Once they reach a depth where their internal cavities are compressed air and their buoyancy reduced, they can use less energy and oxygen to maintain their depth. These birds might also use anaerobic respiration as the oxygen store depletes (see below). For such species, their oxygen stores and metabolic rate will never fully account for their diving endurance.

Anaerobic respiration

Many species always surface before they run out of oxygen. However, some underwater foragers can respire anaerobically under certain circumstances, such as when hunting shoals of quick-moving camouflaged fish. These dives cannot continue indefinitely because anaerobic respiration causes lactate fermentation in the muscles, which produces fatigue if it accumulates. When they do surface, the divers tolerate lactic acid build up in their muscles rather than metabolising it. This allows them to concentrate simply on re-saturating their lungs and blood with oxygen. Anaerobic diving usually ends with a long rest on the surface to get rid of the lactate.

To finish off

A vast array of aquatic, diving creatures have evolved to exploit the oceans. Even today, our understanding of these creatures is limited. Further research will develop our appreciation of how they interact with their environments, both aquatic and terrestrial, so that we can ensure their continued and enchanting presence in the world's oceans.

Acknowledgement

Thank you to Pat Butler for his advice on this article.

About the author

Lewis Halsey is a PhD student in the School of Biosciences at the University of Birmingham. His doctoral research centres on optimal foraging behaviour in diving animals, in particular tufted ducks.

The growth of marine meteorology — a major support programme for the World Weather Watch *

R.J. Shearman †

Introduction

At the time of the First International Meteorological Conference in Brussels in August 1853, a number of major maritime nations had been recording and exchanging weather information for several years. Lieutenant Matthew Maury of the US Navy was the driving force behind the conference, and he was also respected for his studies of ocean currents and winds. He can be said to be the founder of marine meteorology, operational oceanography and the international co-operation, that ultimately led to WMO and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

The Conference agreed on a standardised ship's meteorological logbook and accompanying instructions, as well as specifying the parameters to be measured. Twenty-four columns covered pressure, wet and dry bulb temperature, wind, cloud, sea-surface temperature and, notably, sea temperature at depth. This may be seen as laying a first very small foundation stone for the World Weather Watch.

Development of a European Meteorological Observing Network was spurred on by the loss of 38 French, English and Turkish ships engaged in the Crimea. Urbain Le Verrier, Head of the Paris Observatory, investigated the Crimean storm, collecting observations from across Europe. He also proposed to the French Government, shocked by the wreck of the *Semillante* and the loss of 700 sailors and soldiers in1855, that the newly invented electric telegraph be used to transmit observations. This was a first tiny step on the road to the Global Telecommunication System (GTS). Although the ability to hindcast storms was demonstrated, little had been done to predict weather, although empirical relationships were available, such as that published by Buys-Ballot in 1857.

In the United Kingdom, Admiral FitzRoy, of the *Beagle* and Charles Darwin fame, became the first Director of the Meteorological Service and developed an observation collection and forecast warning system for ships at anchor. He proceeded to publish his forecasts in the press and developed and published forecasting rules. His attempts to meet the needs of customers were in the best tradition of marine meteorology.

International co-operation continued, leading in 1905 to the formal creation of the International Meteorological Organization (IMO). However, there was little development in marine meteorology because ships at sea could not communicate over long distances in real-time, and interest in climatology had waned as sail gave way to steam ships. The advent of wireless telegraphy heralded further development of the marine observing system.

Two notable events were the decision in 1907 to oblige all ships to be fitted with wireless telegraphy equipment and to transmit observations to shore, and the creation of a Technical Commission on Maritime Meteorology.

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* Reproduced from the *WMO Bulletin*, 52 (1).

† Head of Production Resources, UK Met Office, and president of the former Commission for Marine Meteorology, 1989–1997.

As wireless telegraphy improved, the collection of data over longer distances became possible, and the oceans were better covered by observations. By the late 1930s, the growth of transatlantic aviation, using aircraft that still flew at a low level and were vulnerable to adverse weather, had led to the concept of the dedicated weather ship to fill gaps in the observing networks at sea. The needs of air and sea transport between the USA and Europe during the Second World War led to the expansion of these stations and a network that endured into the 1980s, and is still represented by one surviving Norwegian ship. At the same time, weather forecasting capability steadily improved.

Crown Copyright

Above: *An early weather ship*

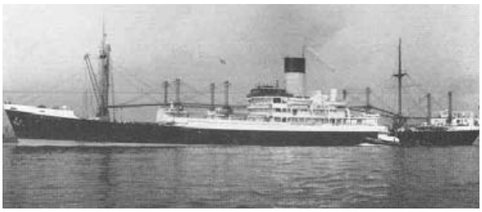
The Commission for Marine Meteorology

In 1952, the Commission for Maritime (later Marine) Meteorology (CMM) met under the auspices of the newly created WMO. It was to meet approximately every four years for the next 45 years. The major concerns were those that have been addressed by CMM ever since, notably:

- securing and transmitting observations at sea;
- standards of marine observations;
- climatological data;
- services to those using the high seas.

Maritime countries were encouraged to recruit voluntary ships, but exhorted to rationalise the activity to obtain as complete and balanced a network as possible. Co-operation with the International Telecommunications Union was initiated. Making radiosonde soundings from merchant ships was rejected as impractical, as was the use of visibility or cloud sensors at sea.

Much time was devoted to the discussion of measurement problems and the measurement of rainfall at sea was addressed in some detail. The requirement came from operational needs related to cargo ventilation, and was discussed at several subsequent CMM sessions. By CMM–IV (1964), trials of rain-gauges were underway, as well as discussions of the use of visual estimates and the effect on 3 cm radar. No successful technique was identified and the requirement had decreased due to changing cargo practices. However, the subject returned in 1981 at CMM–VIII, in the context of climate research, and a rapporteur was appointed. Little progress was made, and the problem remains, although remote-sensing now offers a solution.



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Above: *s.s* Nestor *(Albert Holt & Co.) a 1952 Voluntary Observing Ship.*

The 1952 meeting took the first steps towards assembling a climatological database by arranging for Members to co-operate in exchanging data. The data were required in connection with avoiding damage to goods during carriage at sea. There was concern regarding the sparsity of data in the Southern Ocean, and a cipher system was devised to allow whaling ships to transmit observations without revealing their all-important position.

The second session of CMM in 1956 was notable for its discussion of co-operation and support for other bodies and programmes, for example: support to the International Geophysical Year (IGY), the Commission for Aeronautical Meteorology, conditions for ditching aircraft, and the Commission for Instruments and Methods of Observation regarding automatic weather stations at sea.

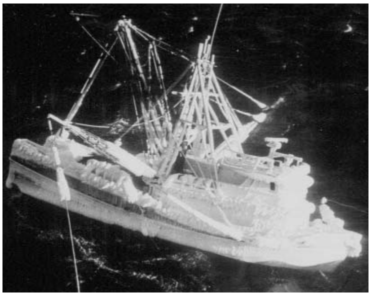
By the early 1960s there was clear evidence of the foresight of the founder members of CMM in that all the themes that would dominate the work programmes for the next 30 years had been identified and discussed to some extent. Broadly these were:

- Marine meteorological services
- Marine observations and data collection
- Marine climatology
- Sea ice

There was clear evidence from the earliest days of the crosscutting issue of physical oceanography and oceanographic services.

Marine meteorological services

Until 1968, marine meteorological services were mainly determined by the needs of the professional mariner and particularly the fishing industry. Most of the work was motivated by improving safety at sea. For example, there was a major effort regarding ice accretion on ships as a consequence of fishing losses. There was also recognition of the economic benefits to be gained by forecasting sea-surface temperature more accurately for commercial fishing. At CMM–III (1960), the need to forecast 'state of sea' from meteorological data and the urgent requirement for research aimed at extending weather and wave forecasts were both recognised. The shipping industry had begun to accept the benefit of embryonic ship-routeing services and it was clear that these should be developed on a more secure scientific footing. As part of the planning for the WWW, CMM was urged to consider the requirements of a wider range of customers and there was a determined move to integrate all the activities of CMM much more closely with the WWW.



Above: *An iced trawler.US Coastguard*

The importance of storm surges to some Members was first mentioned at CMM–V with proposals to institute a warning service: the vulnerability of some coastal communities and activities had been recognised.

Throughout the 1970s a vigorous and demanding offshore oil industry moved into deeper and less hospitable waters. The investment was large and the industry expected specialised meteorological services in both the design and implementation phases of these projects. By 1980, the range of service users had expanded to the extent that CMM's work was divided into two somewhat disproportionate areas:

- High seas—mostly concerned with mariners
- Coastal—comprising harbour operations; coastal protection; search and rescue; coastal transport; inshore fishing; offshore oil platform' pollution and recreational boating.

Throughout the next decade, much was done to provide guidance on products intended for these areas, and to address problems. There was also increasing awareness of the need to seek users' views, with a survey of ships' masters conducted in 1981, and becoming a regular task of each intersessional period thereafter.

A closer relationship was developed with professional bodies representing user industries, notably the International Chamber of Shipping, International Federation of Ship Masters, the Oil Industry Exploration and Production Forum, and of course the International Maritime Organization.

By the end of the twentieth century, marine meteorological services had been refined to meet emerging user needs, but there had also been a steady development amongst Members to provide associated oceanographic services. Guidance on storm-surge analysis and numerical forecasting was produced. Many users were demanding integrated marine meteorological and oceanographic services, and the science was moving in that direction.

Communications

The provision of services to maritime customers had always been critically dependent on communications. The development of radio and radio-facsimile provided a more flexible medium for the dissemination of meteorological products. The first weather maps had been transmitted by radio-facsimile in 1930, but it was only in 1960 that CMM originated a formal recommendation to encourage Members to increase such services and to attempt to convince ship operators to universally fit such equipment.

CMM has always had a remit to agree the content, areal coverage and production/dissemination of marine meteorological warnings and forecasts. Individual Members agreed to accept responsibility for particular elements of the service, with revisions achieved by negotiation. Standard symbols and nomenclature were similarly agreed. It was recognised in the early 1970s that satellite-based communications would bring a revolution in the provision of services. In particular, the inauguration of the INMARSAT network in 1982 was a major step forward. WMO engaged in early discussions with INMARSAT to develop the potential of the system for marine meteorological services.

The International Maritime Organization adopted the Global Maritime Distress and Safety System in 1988, as an amendment to the SOLAS Convention. It was to come into force in 1992 with a seven-year transition to full implementation in 1999. The new system was predominantly dependent on INMARSAT, although NAVTEX was used to cover coastal waters. A fundamental review of areas of responsibility was conducted, replacing the existing system, which had been in force since the 1940s. In particular, areas were co-ordinated wherever possible with the World Wide Navigational Warning Service's NAVAREAs to simplify the system for the user. Some initial difficulties were overcome by co-operation between Members and the meteorological system became available on time in 1992, successfully transitioning fully in 1999. The same areas were used as the basis of the Marine Pollution Emergency Response Support System proposed in 1993 at CMM–XI. Many Meteorological Services are now exploiting the World-Wide Web to deliver services to customers, both for general and specific use. Many ships now have PCs with Internet access on the bridge, presenting the possibility of innovative product development aimed at a closer involvement with the customer's activity and value chain.

Marine observations and data collection

The main component of the high-seas observing system is still the Voluntary Observing Ship (VOS) equipped with fairly basic sensors to measure air and sea temperature, pressure and sometimes wind. The other meteorological parameters, i.e. cloud, visibility, weather and wave or state of sea are provided by visual estimate from a ship officer. There has been little change in this situation throughout the lifetime of CMM.

The requirement for in situ observations from mobile ships was re-affirmed in the WWW plan, circa 1970, together with a call for a 25 per cent increase in numbers. However, as ships have increased in size, numbers have decreased although this is offset to some extent by the fact that modern vessels spend rather more time at sea than their predecessors. Despite the significant advances in space-based and other remote-sensing, ship observations remain an important source of in situ 'ground truth' data.

The importance of Port Meteorological Officers (PMO) in encouraging and training voluntary observers, and recruiting their services, was recognized by CMM–II in 1956. Their role has been steadily enhanced and they became a formalised part of the data-quality feedback loop in 1990.

Above: *Oil rig in the North Sea*

Marathon

As shipboard communications were automated, and radio operators became fewer, timely transmission of observations became an issue and some effort was devoted to automation of the coding and transmission process. It was recognised, as early as 1960, that coding the observation was error-prone, and a 'slide rule coder' was developed for use by fishermen and whalers. Efforts were also made to simplify the codes. Further successful attempts were made in the late 1980s to automate the process and software is now available for use on a shipboard PC linked to satellite communications. The system removes much of the potential for error, and also stores the data on magnetic media so that the meteorological logbook can be discontinued.

Until recently, the developments in automatic weather stations on land have not been carried through to mobile ships, although similar systems have been installed and operated on research vessels, light vessels, offshore platforms and moored meteorological buoys. The main obstacle has been the risk of losing the significant capital investment involved because merchant ships have changed ownership much more frequently in recent years. Thus there is a need for a system with a relatively small footprint, independent of the ship's systems, so that it can be installed and removed in the few hours that modern ships are in port. In the last two years, a system adapted from data buoy technology, with its own integral GPS and satellite communications has been developed and used on Canadian VOSs in the Arctic. The increase in data coverage in these areas has been spectacular.

The problems of instrument exposure, and even estimation of sea state, remain, particularly on large tankers, container ships or bulk carriers. In 1987, approximately 50 VOSs, all noted for good-quality data and reliable reporting, were recruited to a special observing project (VSOP–NA) lasting for three years. These ships were asked to complete much more detailed meteorological logbooks while transiting the North Atlantic, to record information regarding lading, cargo configuration and observing practices, all of which could be used to place the observations in the context of exposure at the time. In addition, plans of the ships and location of instrumentation were collated and archived. The data were analysed and a comprehensive report produced in 1991. It is now proposed to extend some of the findings to a larger subset of some 200 VOSs. The benefit is greatest for climatological studies, but greater concentration on observing practices will also assist synoptic meteorology.

Upper-air observations

The first session of CMM concluded that radiosonde observations from merchant ships were not practicable. Given the need for ground truth in support of satellite profile data, and the subsequent demise of the Ocean Weather Ships (OWS), it was fortunate that a number of countries persevered in attempting to solve the problems. By 1968, the United Kingdom, for example, was making regular balloon ascents from the *Sugar Exporter*, employing a trained meteorologist on board. The major difficulty encountered was transmitting the whole message via coastal radio stations.

These initiatives led, via containerised radiosonde ground stations and satellite communications, to the Automated Shipboard Aerological Programme (ASAP) systems in use today. Twenty-three ASAP vessels were in operation in 2001, sponsored by eight Members, and a further vessel had been equipped that would ply from Europe to Australia as the first step in a Worldwide Recurring ASAP project (WRAP). Average burst heights of 21 km and a data-retrieval rate of 90 per cent are a significant achievement, given the problems of launching from the turbulent environment of a moving ship.

Data-sparse areas

An observing network based on voluntary merchant ships has the inherent limitation that they tend to follow trade routes. The tendency has increased in recent years as deep ocean vessels have become larger and ports of call relatively fewer. There are large areas of the oceans, particularly the Southern Ocean, that are devoid of data. However, even a relatively busy region such as the North Atlantic has areas that are between ship routes.

There was considerable discussion of the use of data buoys. Development of both moored and drifting buoys continued within a number of mainly research-orientated programmes. In particular, a great deal of experience was gained during FGGE*.

In 1985, a preliminary meeting was proposed with the objective of setting up a consortium under the joint sponsorship of WMO and IOC to proceed with the implementation of drifting buoy programmes. This initiative became the Drifting (later Data) Buoy Co-operation Panel (DBCP), that continues to organise drifting and moored buoy programmes via a number of action groups. The Panel also facilitates exchange of expertise and communal development of equipment and techniques. It appoints and funds a Technical Co-ordinator post tasked with ensuring the enhanced quality and quantity of drifting buoy data. In 1989, approximately 200 drifting buoys were providing data to the GTS, although there were known to be many more deployed. By 2000, over 750 buoys out of 1,300 known to be deployed were appearing via the GTS providing measurement of some or all of pressure, air temperature and sea temperature.

In parallel, a number of Members now regularly operate moored open-ocean data buoys at depths of up to 6,000 m.

* FGGE: First GARP Global Experiment. (GARP: Global Atmospheric Research Programme)

Marine climatology

The exchange and collation of marine climatological data were created with the objective of producing climatological atlases and summaries which could be consulted by those engaged in weather-sensitive marine activities. Given the limitations in the forecast period, climatology was also a powerful and necessary tool for ship routeing. By 1960, the main features of the WMO Marine Climatological Summary Scheme had been established and survives to the present day. Eight Members had each taken responsibility for an ocean area, and all other Members operating voluntary ships sent data from the areas to the appropriate Responsible Member.

In 1976, a project was proposed to transfer 20 million observations for the period 1860–1960 onto magnetic tape to create the Historical Sea Surface Temperature Dataset, which was then analysed to produce monthly means and standard deviations of sea and air temperatures and wind. The work was carried out by the Federal Republic of Germany, The Netherlands, USA and United Kingdom. With hindsight, the most valuable product was the carefully ordered dataset, rather than the statistical data.

Above: *Container ship (2001)*

During the next decade, it became apparent that customers, and particularly design engineers working for the offshore industry, required specialised analyses of the climatological data. Thus, it was more appropriate to concentrate resources on the creation of a good-quality climatological dataset than produce the summaries. It was decided to change the summaries scheme such that Responsible Members were only required to produce the summaries on demand. There was little or no demand.

Plans to produce a Marine Climatological Atlas were also dropped, but a *Guide to the Applications of Marine Climatology* was produced, assembling all the acquired experience and analysis techniques of those Members which had been working closely with various users from a range of marine industries.

Considerable effort was devoted to improving quality-control techniques, to eliminate the significant variations in performance exhibited by the systems used by the individual Responsible Members. Eventually, two Responsible Global Centres were set up in the United Kingdom and Germany, applying the same basic quality control to duplicate global datasets. Responsible Members continue to apply differing higher-level quality control schemes.

Ultimately, the large datasets created were used to support the World Climate Research Programme (WRCP) and climate change studies, a somewhat more significant role than the humble origins of meeting the need for estimating the likelihood of cargo damage.

Sea ice

Early work on sea ice was inevitably focused on safety of navigation and concentrated on standardisation of the nomenclature used by different Members for their warning services, as well as revised codes for reporting ice. During the early 1960s, CMM rationalised codes so that the same one was used by ship, shore station and, more importantly, by aircraft. The ice nomenclature was further enhanced by adding pictures, although progress was slow due to difficulty in obtaining suitable examples. There was also an attempt to standardise symbols on ice charts — surely a welcome initiative for the user!

By 1968, it was recognised that efforts had been almost completely targeted on the needs of the shipping industry, and a survey was initiated to identify other users. During the next decade, attention turned to the storage and retrieval of sea-ice data, and the need for a catalogue of such data, particularly in view of the climate change issue.

Over the next 10 years, a chart digitisation code was developed, the emphasis being on use of the best, 'end-of-season' version of each chart and arrangements for a centralised archive put in place. By the mid-1990s two global centres were operational in Boulder, Colorado, USA, and St. Petersburg, Russian Federation. The archived data are invaluable in support of the World Climate Programme and WCRP.

Guidance material was also produced both for mariners operating in sea-ice areas and those providing forecast and analysis services. Latterly, there has been close collaboration with the International Ice Charting Working Group to identify a practical mechanism to include sea-ice information in electronic navigation charts.

The most significant impact on this area of work was the availability of satellite data. Operational services tasked with providing ice-navigation services were once dependent on visual sightings from land and sea, then specialised airborne reconnaissance missions. They now have much more robust and reliable information on sea-ice cover thickness and ice edge provided by satellite-borne sensors.

Marine meteorology and oceanography

It is inevitable that the areas of endeavour of the marine meteorological and oceanographic communities will overlap.

Until the mid-1960s, the marine meteorological community was concerned with services to mariners, and co-operation was, therefore, largely concerned with waves and currents. Problems of measurement and deriving waves from wind data were addressed in a collaborative manner. Similarly, the OWS were used as platforms for wave-recorders, and latterly for sub-surface profiling.

At CMM–IV (1964), there was a discussion of the need to give meteorological personnel some oceanographic training, and an agenda item on the application of meteorology to oceanography. This was largely driven by work on ocean-atmosphere interaction. The discussion led to a formal request for closer co-operation with IOC. The latter adopted the concept of an Integrated Global Ocean Station System (IGOSS) and invited WMO to collaborate in 1968.

IGOSS was conceived as the ocean version of WWW with components for observing, data processing and telecommunications, although the first manifestation of the new order was the use of marine meteorological platforms for ocean observing, and discussion regarding the need for spectral wave data.

WMO via CMM set up an active wave and storm surge programme in 1981, whose elements were concerned with:

- observations including those from radar and satellites;
- the archiving and exchange of data in real-time as well as delayed mode;
- standardisation of products;
- analysis, forecasting, and hindcasting techniques.

In many cases, users of marine meteorological services also required oceanographic services and exerted pressure to achieve a single source of supply. Typically, oceanographers had moved the science forward and then collaborated with meteorologists to provide operational models and products.

Added impetus to collaboration was provided by the proposal from the Second World Climate Conference in 1990 to create a Global Ocean Observing System (GOOS) to provide analogous observations and systems for the oceans to those provided by WWW for the atmosphere. However, the proposal is even more ambitious in that it seeks to create the full range of activities and services for the ocean that modern meteorology provides for the atmosphere but with the added complication of ocean chemistry and biology.

The value of space-based remote-sensing technology to marine meteorologists and oceanographers was demonstrated by SEASAT in 1978 and subsequently by ERS–1 and ERS–2. Similarly, Topex-Poseidon, Quickscat and ADEOS–1 all made contributions. Initially, there was a reluctance to base operational products on these satellites because continuity was not assured. However, missions such as Metop, NPOESS, the JASON series, ICESat and ADEOS–2, point to a more assured future and meteorologists and oceanographers are collaborating to exploit the information, and also to convince the satellite operators of their requirement and the need for sustained provisions to meet them. In the context of all the above factors, the President of CMM proposed to the forty-eigth session of the WMO Executive Council in 1996 that the Commission for Marine Meteorology be replaced by a similar body jointly sponsored by WMO and IOC, with expanded terms of reference.

The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)

WMO and IOC recognised the complementary nature of programmes and expertise, as well as synergies and duplication in the activities of some of the management bodies. It was felt that benefits in terms of costs and co-ordination could be derived from a more coherent and consolidated approach to ocean monitoring. An additional benefit would be the ability of IOC to stimulate participation in ocean monitoring programmes by oceanographic institutions and agencies world wide. In 1999, the WMO Congress and the IOC Assembly approved the creation of a Joint Technical Commission.

The first session of JCOMM was held in Akureyri, Iceland, in June 2001, and both the marine meteorological and oceanographic communities were well represented. A working group structure was created which took advantage of the strengths of the skilled people available from both disciplines, and a work plan was agreed. At the same time, the commitments of existing programmes were respected and preserved while exposing them to a cross fertilisation of ideas.

Southampton Oceanographic Centre

Above: *An ARGO float*

The observation section of the agenda illustrates this:

- Voluntary Observing Ships Programme;
- Ship of Opportunity Programme (BATHY, TESAC);
- ASAP;
- drifting and moored buoys;
- Argo subsurface floats;
- discussions regarding the Argos system;
- oceanographic satellites;
- ocean sensing by in-situ radar;
- sea-level.

In addition the proposal to create an in situ Observing Platform Support Centre based on existing DBCP, SOOP and Argo coordination mechanisms was adopted.

Future developments

This article has attempted to provide an outline of the development of marine meteorology and set the scene for progression to the fully integrated atmosphere, ocean observation, numerical modelling and services system which will eventually develop. Some 70 per cent of our planet consists of oceans, and we will always be affected by them, directly or indirectly. Those involved in marine activities, whether large-scale marine development or limited local aquaculture will require improved environmental services. The climate issue ensures that marine meteorology and oceanography is relevant to the entire human population.

Lieutenant Maury and his colleagues would undoubtedly be impressed if they could see how far their initial initiative has developed, but it is equally certain that they would point out how much more has yet to be done.

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The weather during the voyages of the Royal Spanish Mail Ship *Grimaldi*, February — March 1795 *

Dennis Wheeler

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Shortly after 6.00 p.m. on 6 February 1795 the Spanish vessel *Grimaldi* set out on her regular run from the northern Spanish port of La Coruña to Falmouth. This vessel was employed in the service of the Spanish Crown and carried official and private correspondence between Spain and her European neighbours and, on other occasions, her colonial centres in Latin America. As a vessel engaged on state business her logbook has survived in the national archives and, in common with the contemporary documents of English vessels (Wheeler 1999), its contents give a clear and detailed impression of the weather conditions encountered on the voyage.

Setting aside the intrinsic interest that might be generated by records that yield such a comprehensive view of weather and life at sea in those distant times, this example serves the wider purpose of illustrating how documentary sources can be used by historical climatologists for scientific purposes. In this latter respect it is important to note that this logbook is but one of a large number of similar items that have survived in Spain from the final three decades of the eighteenth century. The principal repository for these documents is the Archivo General de Indias in Seville (www.mcu.es/lab/archivos.agi/AGI.html).

Historical background to the voyage

The logbook's opening page informs us that the *Grimaldi* was commanded by Don José de la Quadra y Fonserrada. She is described by him as a brigantine; this was a vessel popular for such work at this time (Figure 1). Although neither large nor heavily armed and bearing little resemblance to the popularly imagined contemporary ships of the line, such vessels were fast and manoeuvrable. Of her two masts, the foremast was square-rigged and the main mast schooner-rigged. It was this combination that distinguished this type of vessel; it also provided greater manoeuvrability, allowing them to sail closer to the wind than square-rigged vessels. There were, nonetheless, limits and they could not sail within 5 points (55°) of the wind.

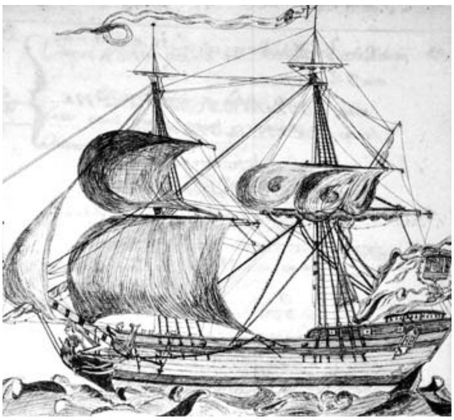


Figure 1. *No representation of the* Grimaldi *is known to survive. The illustration shows a contemporary and near-identical vessel in the service of the spanish postal system.© Ministerio de Educación, Cultura y Deporte. Archivo General de Indias (Spain). CORREOS, 279B, R.2*

* Reproduced from *Weather*, a monthly magazine published by the Royal Meteorological Society, with permission of the Editor and author. The web site address of the Royal Meteorological Society is: www.royal-met-soc.org.uk

The first entry in the logbook describes the ship's departure on the voyage that forms the basis of this paper:

"At midday I received on board the Royal Mail, fired a cannon and unfurled the postal pennant.

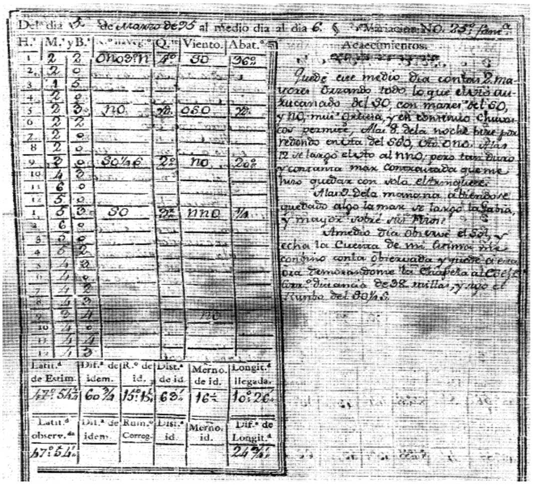
At half past four I made sail with the wind from the south.

At 5 I was beyond the Point.

At half past five I was delayed at the entrance of Ferrol to the east at 3 miles [4.8 km].

At half past six I observed Cape Prior to the SSE."

As a naval officer, the *Grimaldi's* captain would have been expected to keep a daily record of events. More important, however, would have been the value of keeping a logbook for the purposes of navigation. Latitude could, at this time, be determined with relative ease by use of a sextant or octant and making reference to the altitude of the midday sun (Taylor 1956). For this reason the nautical day began at midday and was 12 hours in advance of the civil day, i.e. midday on the 12th by the civil day would be the start of the 13th on the nautical calendar. To confuse matters, however, whilst in port the record often reverted to the civil day. Longitude was far more difficult to determine whilst at sea. Indeed, the discovery of methods for its accurate determination was one of the great intellectual challenges of the eighteenth century (Hewson 1983). The need for an estimate of longitude accounts for the careful daily checks of the ship's progress that were entered in the logbooks. Entries for those days when the vessel was at sea were made on standard printed forms, the principal elements of which consisted of a series of columns set out as in Figure. 2. Of great importance was the hourly estimate of the ship's speed in knots (M) and fathoms (B). Also noted were the course (R° naveg°), leeway* (Qto), wind direction (Viento) and course correction (Abat°). A record was also made of magnetic variation from true north. The body of the page was taken up with an account of the weather, navigational landmarks observed, the general running of the ship and the various calculations made to determine the ship's latitude and longitude. The latter was measured from some arbitrarily determined point, often the port of departure — the universal adoption of the zero meridian at Greenwich lay many years in the future. Although both the lunar distance and chronological methods of determining longitude had been invented by this time, these procedures required training (in the case of determining longitude by lunar distances) or the possession of a Harrison-style chronometer (at this time rare and expensive).


Del dia 5 de Marzo de 95 al medio dia al dia 6. Variacion NO. 23°

H.s	M.s	B.s	R.o naveg.o	Q.to	Viento.	Abat.o
1	2	2	ONO3°N	4°	SO	36°
2	2	0				
3	1	5				
4	2	0				
5	2	3	NO	2°	OSO	2°
6	2	2				
7	2	0				
8	2	0				
9	2	0	SO¼S	2°	NO	20°
10	4	3				
11	6	0				
12	5	0				
1	5	3	SO	3°	NNO	¼
2	6	0				
3	5	0				
4	5	2				
5	4	2				
6	4	0				
7	4	2				
8	4	3				
9	3	4			NO	
10	4	0				
11	4	4				
12	4	3				

Acaecimientos.

Latit.d de Estim.	Dif.a de idem.	R.o de id.	Dist.a de id.	Merno. de id.	Longit.d llegada.
47° 54½	60⅔	15° 15	63	16½	10° 26

Latit.d observ.da	Dif.a de idem.	Rum.o Correg.	Dist.a id.	Merno. id.	Dif.a de Longit.d
47° 54					24⅔

Figure 2. A typical page from a Spanish logbook of the late-eighteenth century. © Ministerio de Educación, Cultura y Deporte. Archivo General de Indias (Spain). CORREOS, 279B, R.II

* Leeway is the degree to which the vessel was blown off the compass by wind and sea currents.

It is clear that Don José continued, as many did at that time, to estimate position by one of the methods of so-called 'dead (deduced) reckoning'. It is interesting to note how similar to the contemporary English documents (see, for example, Wheeler 1995) is the presentation of these Spanish documents — reflecting no doubt the common challenge of contemporary navigation.

The *Grimaldi* was one of a number of vessels specially commissioned for the Spanish Imperial Postal Service. This important communication system was instituted by the reforming King Carlos (Charles) III who reigned between 1759 and 1788. In 1764 he had declared the Reglamento Provisional de Correos (Postal Act), followed by the Real Ordenanza del Correo Maritimo (Royal Decree for Naval Post) in 1777. These were attempts to improve communications within the Empire. For his model he took the British system used for the North American Colonies. Prior to this the links between Spain and her vast American Empire had been maintained by various bodies, the most important of which were the Consejo de Indias (the Council of the Indies), the Casa de Contración (the House of Contracts; this was the body charged with the administration of trade with the Spanish American Empire between 1503 and 1790) and the Consulado de Sevilla (the Consulate of Seville). The two principal postal routes were those to Havana and Buenos Aires, but several voyages were made to Falmouth and to New York. The Spanish port of La Coruña was the main point of departure for these undertakings.

The weather of the two voyages

Maps summarising the route of the *Grimaldi's* voyages to and from Falmouth are shown in Figures 3 and 4. The weather information for individual days is discussed below, but Table 1 summarises the conditions of the outward and return voyages.

6/7 February. The entries start at 6.00 p.m. with the Grimaldi taking a north-north-east course with winds at south-west. Conditions were favourable and the vessel made good progress at an average speed of 6 kn. There is no record of rain although the skies were overcast and the sun was not visible with sufficient clarity for a determination of latitude. This description suggests altostratus cloud, perhaps ahead of a warm front.

7/8 February. The vessel maintained her northerly course, making good progress in freshening west-south-west winds. After midnight the winds fell and backed to the south-west and her speed decreased from 8 to 5 kn. Between 6.00 and 9.00 a.m. she was becalmed after which wind speeds increased and rain showers were noted. Visibility improved and the midday sun was visible. This suggestion of showery and clear weather implies a polar maritime airmass marking the passage of a weak depression whose warm front was suggested above.

Figure 3. *Reconstructed voyage of the* Grimaldi's *return voyage from La Coruña to Falmouth.*

8/9 February. The winds remained fresh in the west-south-west all day but cloud and poor visibility returned making it impossible to observe the altitude of the midday sun. At 8.00 a.m. The Lizard (Cornwall) was sighted, 25 miles (40 km) to the north-east. By the standards of the day, and with the advantage of a steady following wind and the absence of gales, the *Grimaldi* had made the voyage across the Bay of Biscay in a noteworthy 60 hours.

9/10 February. Conditions now conspired against the ship. Winds remained in the west-south-west but declined in vigour, the ship now making only 1 or 2 kn on a course south-south-east. With a following wind and the threat of a notoriously dangerous lee shore on the Cornish coast, Don José took the wise precaution of standing off. Cloud cover denied any possibility of a sun sighting at midday on the 10th. Instead, the logbook records a series of soundings with the lead line. This exercise served not only to give advance notice of shoaling and possible hazards ahead, but also the changing composition of the seabed was well known in these waters and its careful observations would help navigators to determine, even if only approximately, the ship's location.*

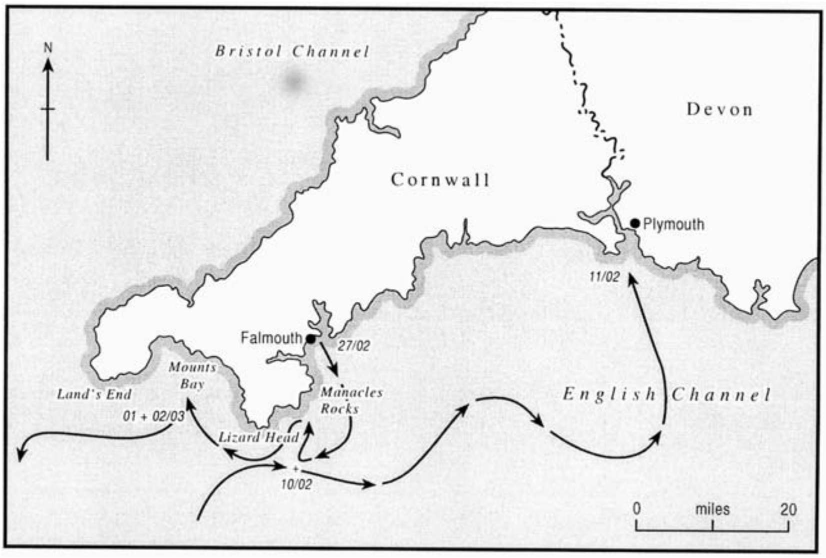


Figure 4. *Probable route of the* Grimaldi *whilst in English waters showing also the principal locations cited in the logbook.*

10/11 February. West-south-west winds persisted but the ship's course varied between north-west and south. The winds were not strong and the *Grimaldi*,s speed was only 2–3 kn. It is not clear why Don José adopted such a circuitous route. The most likely explanation was that he was still uncertain of his exact whereabouts off a hazardous coast. By mid-afternoon on the 11th, however, he had put in to Plymouth where he found himself in the company of five Portuguese men-of-war, some smaller Royal Navy vessels and merchant ships awaiting convoy to 'America'.

Until 27 February the logbook reverts to short daily entries on plain paper. As noted above, this was normal for vessels in port. There are still, however, some helpful weather notes.

* Samples of sea floor material could be retrieved by coating the lead with tallow or thick grease to which it would adhere.

12 February. Dawn was cloudy with light north-westerlies but towards dusk the winds veered to the north-east with rain. Overnight they veered further to east-north-east and started to blow more strongly.

13 February. Don José made the short crossing to Falmouth, taking advantage of the easterly winds. He weighed anchor at 8.30 a.m. and arrived off Falmouth at 3.00 p.m.

The entries for the period 14–16 February provide little of climatological interest, other than to indicate light winds from the south-west on the 22nd backing to south-east on the 26th. The journey home began the next day, but it was to prove a more protracted voyage than the outward leg.

Table 1 — Summary of weather conditions experienced by the *Grimaldi* whilst at sea, February and March 1795

Dates by civil days	Distance sailed (nautical miles)*	Winds	Latitude (N) at close of nautical day	Weather
Outward leg				
6/7 Feb.	140	SSW/SW	45°48′	overcast
7/8 Feb.	133	WSW/SW/calm	47°31′	showers and clear
8/9 Feb.	174	WSW	49°56′	cloudy and hazy
9/10 Feb.	37	WSW	50°24′	clear then overcast
10/11 Feb.	75	WSW	50°31′	
Homeward leg				
27/28 Feb.	84	N/NW/calm/ SW/WNW	—	hazy
1/2 Mar.	32	WSW/SW	—	cool and overcast
2/3 Mar.	55	N/NNE/calm/SW	49°16′	clear or partly cloudy
3/4 Mar.	41	SW/WSW/W/ WNW	48°51′	clear or partly cloudy
4/5 Mar.	59	WNW/WSW/SW	48°55′	hazy and cloudy
5/6 Mar.	85	SW/WSW/NW/ NNW	47°54′	
6/7 Mar.	138	NW	45°38′	clear
7/8 Mar.	107	NNW	—	fresh and clear

* 1 nautical mile = 1.852 km.

At dawn on the 27th the winds were light from east-south-east; they freshened for a while and then, doubtless to the consternation of a crew anxious to get back to Spain, they fell calm. They recovered sufficiently from the north-east to offer the opportunity to set sail and at 1.00 p.m. the logbook reports the dangerous Manacles rocks † to be 3 miles (4.8 km) distant. From midday on the 27th (civil calendar) the logbook reverts to the nautical day with entries again being made on the printed 'sea pages'.

† The Manacles rocks lie a short distance to the east of the Lizard peninsula.

27/28 February. The *Grimaldi* followed a course to the west-south-west, but at 3.00 a.m. changed to the east-north-east then north-east. During the afternoon the winds were light from the north allowing the ship to make between 4 and 6 kn. The Lizard was sighted to the north-west at between 4 and 5 nautical miles (7.4 and 9.2 km), but the conditions are described as hazy and this may have been the limit of visibility. In a sequence that suggests the passage of a weak high pressure ridge, the winds backed to north-west before becoming calm at midnight and then returning to south-west at 3.00 a.m. However, the latter was an unfavourable headwind and it was then that the course to the north-east was taken. At this point Don José considered a return to Falmouth as these were dangerous waters frequented by the French, with whom Spain was then at war.* Fortunately, the winds returned to a more advantageous west-north-west at 8.00 a.m. and Don José pressed on for Spain. At 8.00 a.m. he sighted land but only at 9.00 a.m. did he confirm it to be the Lizard. No log entry was made for the 28th/1st and it appears that the *Grimaldi* lay at anchor that day.

1/2 March. At 3.00 p.m. on the 1st the Lizard was estimated to be at 5 or 6 leagues. As a league is 3 miles (4.8 km) the visibility must have improved from the 27th/28th. At dusk the skies were overcast with light breezes from the west-south-west. At this time the ship made 3–4 kn on a southerly course, this being as close to the wind as she could manage, but the winds died away after midnight and the speed fell to 1 kn. Unable to make headway, the *Grimaldi* lay to in the shelter of Mount's Bay, Cornwall. Conditions were difficult and Don José makes reference to the cold and to the inadequacy of the crew's clothing for such weather.

2/3 March. At 4.00 p.m. a course was set to the west-south-west and northerly winds were of sufficient vigour to allow the *Grimaldi* to make 5 kn, but by 2.00 a.m. they had decreased to calm. Later the midday sun could be seen.

3/4 March. The winds had now backed to south-west. The *Grimaldi* took a west-north-west route, turning more southerly, and homewards, only after midnight when the winds veered to the west giving the brigantine just enough seaway for the manoeuvre. The ship's progress was, however, slow. Don José notes that all possible sail was hoisted but speeds were logged at only between 1 and 2 kn. Nonetheless, the skies were clearer and the midday sun's altitude gave the latitude as 48° 51′ N — a correction, according to the logbook, of only 40 seconds being required for the dead-reckoning estimate.

4/5 March. The winds were between west-north-west and south-west and are described as light, but the sky was overcast. The wind must have strengthened later in the day as topsails were taken in. This was usually done to limit the strain on the rigging and masts. Using Beaufort's, slightly later, sea criteria, such an action suggests wind of about force 6 (Fry 1967).

5/6 March. The slow progress against headwinds from the south-west continued, but at 8.00 p.m. the winds veered to the north-west with the result that the ship's logged speed increased from 2 to 5 kn. More sails were hoisted and the following morning land was sighted at 38 nautical miles (70 km). As the latitude was then 47° 54′ N this must have been part of the Brittany coastline so slow and faltering had been the southward progress.

* Spain was then under the rule of Carlos IV. As a royal monarch he was implacably opposed to Republican France and forged a temporary alliance with Britain.

6/7 March. The winds remained in the north-west until 1.00 a.m. when they veered to the north. The *Grimaldi* could now make better progress and covered nearly 140 nautical miles (259 km) in 24 hours. The skies were clear throughout. At dawn on the 7th, with winds still fresh from the north, Cape Prior (north-west Spain) was sighted to the south-south-east at 40 leagues (193 km).

7/8 March. Visibility was now good with winds holding from the north-north-west and a steady 5–6 kn was logged. At dawn on the 9th Cape Ortegal was sighted to the east-south-east and the *Grimaldi* docked at 3.00 p.m. The return journey had taken over 10 days to complete — a consequence of light and unfavourable winds that in this age of sail could condemn a vessel to weeks at sea even on short journeys.

Climatological interpretation

This account reveals the notable degree of detail available to those searching for information of past weather and climate. Whilst not being instrumental in character, the information is nonetheless valuable. Not only is there a general indication of the degree of cloud cover and visibility but also the important question of prevailing winds is treated in detail. The hourly account of the latter makes it possible to determine, for those times when the vessel was at sea, the duration of winds from different directions. This information is presented in Table 2. Such a table illustrates the value of this source. It shows a marked concentration of winds in a westerly quarter and less than 10 per cent from the easterly directions, although it should be noted that easterly winds were observed when the *Grimaldi* was at Falmouth and the individual hours not logged.

Table 2 — Absolute and relative frequency with which the wind prevailed from the principal points of the compass*

	N	NE	E	SE	S	SW	W	NW	calm
Hours	25	22	0	0	0	67	99	47	23
% of total	8.8	7.8	0	0	0	23.7	35.0	16.6	8.1

* Figures are based on the hourly counts from the logbooks whilst the *Grimaldi* was at sea from late February to mid-March 1795. The table does not, therefore, include any estimate of the easterly conditions noted in informal entries towards late February.

There seems, however, to have been a remarkable absence of strong winds and the return journey in particular saw the vessel often becalmed or making only slow progress. The logbook suggests nothing in excess of force 6. Lamb's (1991) index suggests the decades of the late eighteenth and early nineteenth century to have been amongst the least 'westerly' of the millennium. Whilst these few weeks might be interpreted as being anomalous from this point of view, it would be wrong to challenge Lamb's reconstruction on the basis of such limited evidence. Indeed, Lamb himself (1991, p.110) refers to a "period of quiet weather" in early 1795 before the great storm that did so much damage in Scandinavia between 6 and 12 May that year. It is in the clarification of such detail that the true value of logbook sources is found. Not only can weather be resolved to a daily scale, but also in many cases even hourly information is available. These benefits are realised to even greater effect when set against other contemporary sources to recreate a more comprehensive picture of weather events of the time. Such additional sources are not lacking.

The weather records of Thomas Barker (Kington 1988) cover this period. His account of February and March 1795 creates a picture of intermittently cool but settled conditions. After drawing attention to the frosty and cold conditions of January, he goes on to state:

"...yet not without a thawing day or two now and then in January, and a greater thaw for four or five days, February 8 to 12, which took away a great part of the snow, and made a greater flood than any remembered, which did more damage to the bridges all over the kingdom than was ever known, yet without taking away all the ice and snow; the frost returned again as hard as before, and with a less break near the end of February, it continued into March. It was in general a calm frost..."

Syon House, situated in the Thames Valley west of London, has a daily instrumental record that also covers this period. In common with Thomas Barker's record, it suggests a cold month. Snow was recorded on seven occasions (13, 18–21 and 28 February, and 2 March). The wind direction was also noted for each day. The winds were easterly on all 'snow days' except 2 March when they were southerly. It was easterly winds that dominated the regime for the period from 6 February to 7 March (Table 3). This contrasts with the predominantly westerly character of winds over the Bay of Biscay and the western approaches to the English Channel, and corresponds more closely to the picture presented by Lamb's westerly index series.

Table 3 — Absolute and relative frequency of wind directions recorded at Syon House, Middlesex, 6 February to 7 March 1795

	N	NE	E	SE	S	SW	W	NW	calm
days	0	1	9	6	8	2	4	0	0
% of total	0	3.3	30.0	20.0	26.7	6.7	13.3	0	0

One possible interpretation of this situation is that low pressure systems were passing between the two areas. This would have left the Thames Valley on their cooler northern flanks dominated by easterly winds, whilst on the southern side of the systems westerly, milder conditions (there is no record of snow in the *Grimaldi*'s logbook) prevailed. Furthermore, the absence of any record of gales suggests that those systems may not have been very deep or active. The easterly regime seems to have extended to include the south-west of England only around the 12th when Don José took advantage of it to make the short crossing from Plymouth to Falmouth.

Don José's rueful observations on the cold conditions of 1 March are also reflected in the Syon House record. On this day the morning thermometer reading was 24 °F (–5 °C) (the lowest over the two months in question) and only rose later in the day to 32 °F (0 °C). Snow fell on the 2nd in the Thames Valley. Both months were indeed generally cold and the Central England Temperatures were 0.8°C and 3.9 °C (respectively 3.0 and 0.8 °C below the 1780–1809 average). Figure 5 shows the (uncorrected) morning temperature and air pressure plots for Syon House. Notable features are the pressure, that fails to fall below 985 mb, and the pattern of temperature, in which the spells of high pressure produce, not unexpectedly for winter, the lowest temperatures. The warmest conditions were associated with mild, cyclonic weather especially in early February. The south-westerlies associated with this system hurried the *Grimaldi* towards Britain. The spells of snow were the result of the easterly, anticyclonic weather in mid-February. More variable, generally high pressure conditions characterised the close of the period. The conclusion that only light winds would have prevailed at this time is born out by the *Grimaldi*'s struggle to find sufficient winds to take her back to Spain.

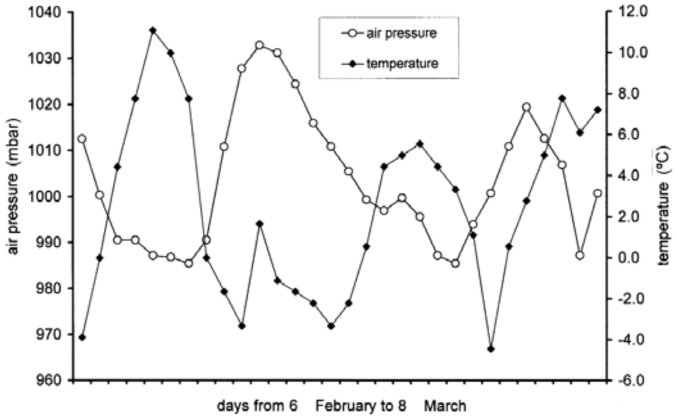


Figure 5. *Air pressure and temperature readings (adjusted to current units but not to sea-level equivalents) from Syon House, Middlesex, for early 1795. Data are based on 9.00 a.m. (local time) observations.*

Conclusions

It is interesting to note how recourse to such a range of contemporary documents as these, with their fine temporal scale of resolution, allows climatologists to identify the detailed changes and variations often hidden in the long-term trends about which we already know so much. The smaller-scale geographical picture is also enlivened by using geographically disparate sources. Whilst this study examines only one such logbook, many others can be found in the Archivo General de Indias in Seville. Similar collections exist in other European archives amounting to tens of thousands of logbooks. Such accumulations of information enable the reconstruction of detailed, daily weather over much longer time periods. This work is now in hand with co-ordinated research groups working in Spain, France and The Netherlands as well as in Britain to produce a daily database for the period 1750–1850 covering each of the world's major oceanic areas.*

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* This is an EU-funded project number EVK2-2000-00090. For details on this project contact the author or visit the project website at http://www.ucm.es/info/cliwoc/.

A long-life buoy hits the record books

On 17 March this year, the Australian Bureau of Meteorology's most enduring drifting buoy celebrated its sixth birthday.

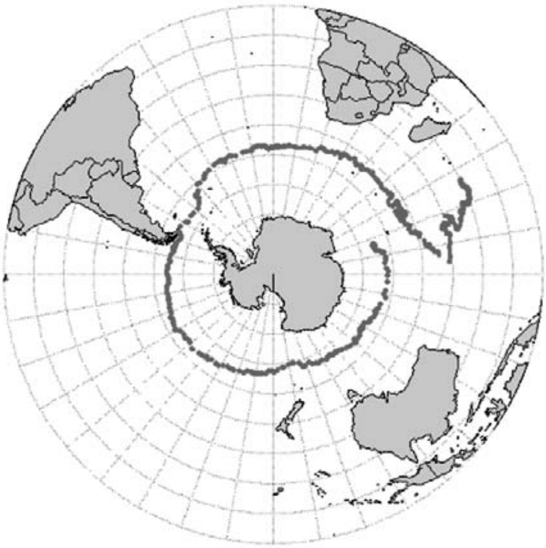
Deployment

The buoy was deployed near Heard Island from the RSV *Aurora Australis* on 17 March 1997, and is believed to be the longest serving, fully functioning meteorological drifting buoy on record. It easily surpasses the two previous long-lived Bureau buoys that both lasted almost four years.

Track

The buoy followed the currents and completed one full circumnavigation of the southern hemisphere before beaching on Rodrigues Island, near Mauritius, in September 2002. The track of the buoy's route is shown (right).

The buoy is still reporting reliable air pressure and air temperature from Rodrigues Island, however the Bureau is endeavouring to recover it with the help of Indian Ocean drifting buoy partners.



Bureau of Meteorology

Acknowledgement

Our thanks to Graeme Ball (Manager, Marine Operations Group) Australian Bureau of Meteorology, for his assistance.

Update

This buoy was finally taken out of service at 1047 UT on 27 May 2003, exactly six years and two months after deployment.

Noticeboard

FTP Mail Service — UK products update

The FTP Mail Service allows access to national weather service products via e-mail, such international products being supplied as public service. The FTP Mail 'help' file contains a more detailed description of the system and available products. To obtain a copy of this file, an e-mail should be sent as follows:

E-mail address: ftpmail@weather.noaa.gov
Subject: Specific text is not required, anything can be entered.
Body: help

UK marine text forecasts

The following is an example message. (Note that the entered text is case sensitive, and ensure that there are no spaces left at the end of any lines.)

Address: ftpmail@weather.noaa.gov
Subject: Specific text is not required, anything can be entered.
Body:

```
open iwin.nws.noaa.gov
cd data
cd text
cd FQNT21
get EGRR.TXT
cd . .
cd FPUK71
get EGRR.TXT
cd . .
cd WONT54
get EGRR.TXT
quit
```

Product description	File name
High seas forecast for METAREA 1	FQNT21/EGRR,TXT
UK Shipping Forecast	FPUK71/EGRR.TXT
Storm warning for METAREA 1	WONT54/EGRR.TXT

UK graphical forecasts

The following is an example message. (Note that the entered text is case sensitive, and ensure that there are no spaces left at the end of any lines.)

Address: ftpmail@weather.noaa.gov
Subject: Specific text is not required, anything can be entered.
Body:

```
open iwin.nws.noaa.gov
cd fax
get PPVA89.TIF
quit
```

Product description	File name
Surface analysis	PPVA89.TIF
24-hr Surface chart	PPVE89.TIF
36-hr Surface chart	PPVG89.TIF
48-hr Surface chart	PPVI89.TIF
60-hr Surface chart	PPVJ89.TIF
72-hr Surface chart	PPVK89.TIF
96-hr Surface chart	PPVM89.TIF
120-hr Surface chart	PPVO89.TIF

For further information see: http://www.nws.noaa.gov/om/marine/home.htm

Closure of Land Earth Station Burum to 'Code 41' messages

With effect from 1 May 2003 LES Burum (station 212), serving the Pacific Ocean Region, ceased to process messages sent under Code 41.

The closure affects only the transmission of weather messages, and does not affect other traffic. The Pacific Ocean Region continues to be served by LES Perth (station 222), Santa Paula (station 201), Sentosa (station 210) and, and Yamaguchi (station 203).

A full listing of LES which process Code 41 messages is shown inside the rear cover of this issue.

Advance notice of new address for the Met Office

The Met Office is in the process of relocating its Headquarters to Exeter, and expects to be fully operational there by the autumn. With effect from 1 September, therefore, the existing Bracknell address will be superseded by that which follows:

Met Office   FitzRoy Road   Exeter   EX1 3PB

This should be used for all non-electronic correspondence, with existing e-mail addresses remaining unchanged.

With effect from 11 November 2003, the telephone number for callers in the UK wishing to contact the Customer Centre will be 0870 900 0100, while the fax number for the Customer Centre will be 0870 900 5050.

The Marine Observer back issues

Back issues of *The Marine Observer* are now available on request. They are free, but a nominal charge may be made to cover postage.

Ships' observers can send an e-mail stating requirements (plus a delivery address) to:

obsmar@metoffice.com

Those without access to e-mail should write, giving similar details, to:

Met Office   Observations Supply (Marine Networks)   Beaufort Park   Easthampstead
Wokingham   Berkshire   RG40 3DN

Note: The Marine Networks section of the Met Office will relocate to Exeter on 17 November 2003. After this date, written requests and telephone enquiries concerning back issues should be directed to the Met Office Customer Centre in Exeter (see contact details in the previous 'Noticeboard' item).

UK Voluntary Observing Fleet (Selected ships — Information dated 31 March 2003)

Key to symbols shown under ‘Status’:
1. ‘V’ — Ships which are contributing to the VOSClim Project.
2. ‘T’ — Ships equipped with a version of either ‘Turbo’ or ‘TurboWin’ software.
3. ‘L’ — Ships using meteorological logbooks.
4. ‘*’ — Ships from which weather observations were awaited at the time of going to press. (It is recognised that many of these will have contributed data by the time these lists are published.)

Full listings of the UK VOF including the names of Masters and Observing Officers are available on request from UK Port Met Officers.

SHIP	STATUS (see Notes)	OWNER/MANAGER
Aberdeen	*	Northern Marine Management Ltd
Adonia	*	P&O Cruises (UK) Ltd
African Ruby	*	MOL Tankship Management Ltd
Al Awdah	*	Kuwait Oil Tanker Co. S.A.K.
Al Funtas	*	Kuwait Oil Tanker Co. S.A.K.
Al Tahreer	*	Kuwait Oil Tanker Co. S.A.K.
Al Wajba	*	United Arab Shipping Company (S.A.G.)
Al Zohal 1	L	London Ship Managers Ltd
Al-Farahidi	T *	United Arab Shipping Company (S.A.G.)
Alliance	*	Anglo-Eastern Ship Management Ltd.
Amer Whitney	*	Amer Shipping Ltd
Anastasis	T *	Mercy Ships
APL Agate	*	Neptune Shipmanagement Services (Pte) Ltd
APL Cyprine	*	Neptune Shipmanagement Services (Pte) Ltd
APL Jade	L	Neptune Shipmanagement Services (Pte) Ltd
APL Orchid	*	Neptune Shipmanagement Services (Pte) Ltd
APL Pearl	*	Neptune Shipmanagement Services (Pte) Ltd
Arcadia	L	P&O Cruises (UK) Ltd
Arctic Night	*	Lagoa Shipping Corporation
Arunbank	T	Andrew Weir Shipping Ltd
Astrid Schulte	*	Eurasia International (China) Ltd. Partnership
Auckland Star	T *	IUM Shipmanagement AS
Auk Arrow	*	Gearbulk (UK) Ltd
Baltic Eider	L	Andrew Weir Shipping Ltd
Baltic Tern	T *	Andrew Weir Shipping Ltd
Barbet Arrow	L	Gearbulk (UK) Ltd
Belo Oriente	*	New Asian Shipping Co. Ltd
Berge Arctic	*	Bergesen d.y. ASA
Berge Atlantic	L	Bergesen d.y. ASA
Bosporus	*	Marmaras Navigaion Ltd
British Admiral	L	BP Shipping Ltd
British Adventure	L	BP Shipping Ltd
British Argosy	L	BP Shipping Ltd
British Endeavour	T *	BP Shipping Ltd
British Endurance	*	BP Shipping Ltd
British Energy	L	BP Shipping Ltd
British Enterprise	L	BP Shipping Ltd
British Harrier	L	BP Shipping Ltd
British Hawk	L	BP Shipping Ltd
British Hunter	L	BP Shipping Ltd
British Pioneer	L	BP Shipping Ltd
British Pride	T L	BP Shipping Ltd
British Progress	T	BP Shipping Ltd
British Purpose	L	BP Shipping Ltd
Buccleuch	*	Zodiac Maritime Agencies Ltd
Bulk Ispat Leher	L	Anglo-Eastern Ship Management Ltd
Burgos	*	A.P. Moller
C.S.Sovereign	L	Global Marine Ltd
Cable Innovator	*	Global Marine Ltd
Cable Retriever	*	Global Marine Ltd
Cabo Negro	*	MOL Tankship Management Ltd
Caledonian Isles	L	Caledonian MacBrayne Ltd
Canelo Arrow	L	Gearbulk (UK) Ltd
CanMar Honour	V T L	Canada Maritime Services Ltd
CanMar Pride	T L	Canada Maritime Services Ltd
Cape Horn	L	MOL Tankship Management Ltd

Ship	V	T	L	*	Manager
Caronia			L		Cunard Seabourn Ltd
Cast Performance			L		Canada Maritime Services Ltd
Cast Power		T			Canada Maritime Services Ltd
Cast Progress		T	L		Canada Maritime Services Ltd
CEC Cardigan				*	Graig Ship Management Ltd
Charles Darwin			L		NERC Research Ship Unit
Cheshire				*	Bibby-Harrison Management Services Ltd
Chiquita Belgie	V	T	L		Great White Fleet Ltd
Chiquita Bremen				*	Great White Fleet Ltd
Chiquita Brenda		T	L		Great White Fleet Ltd
Chiquita Deutschland			L		Great White Fleet Ltd
Chiquita Italia				*	Great White Fleet Ltd
Chiquita Jean			L		Great White Fleet Ltd
Chiquita Joy				*	Great White Fleet Ltd
Chiquita Nederland		T	L		Great White Fleet Ltd
Chiquita Rostock			L		Great White Fleet Ltd
Chiquita Scandinavia			L		Great White Fleet Ltd
Chiquita Schweiz			L		Great White Fleet Ltd
Chrismir				*	OSG Ship Management (UK) Ltd
Cirolana				*	Smit International (Scotland) Ltd
City of Amsterdam				*	Denholm Ship Management (UK) Ltd
City of Barcelona				*	Denholm Ship Management (UK) Ltd
City of Cape Town	V	T	L		P&O Nedlloyd BV
City of London	V	T			Andrew Weir Shipping Ltd
City of Sunderland				*	Denholm Ship Management (UK) Ltd
Clansman		T	L		Caledonian MacBrayne Ltd
Colombo Bay			L		P&O Nedlloyd BV
Condor Arrow				*	Gearbulk (UK) Ltd
Constantia				*	The South African Marine Corporation Ltd
Contship Aurora		T		*	Anglo-Eastern Ship Management Ltd.
Contship Australis		T		*	Anglo-Eastern Ship Management Ltd.
Contship Borealis		T		*	Anglo-Eastern Ship Management Ltd.
Copiapo			L		London Ship Managers Ltd
Coral Princess				*	P&O Cruises (UK) Ltd
Cormorant Arrow				*	Gearbulk (UK) Ltd
Cotswold			L		Zodiac Maritime Agencies Ltd
CSCL Chiwan			L		Seaspan Ship Management Ltd
CSCL Dalian				*	Seaspan Ship Management Ltd
CSCL Felixstowe				*	Seaspan Ship Management Ltd
CSCL Hamburg			L		Seaspan Ship Management Ltd
CSCL Ningbo				*	Seaspan Ship Management Ltd
CSO Marianos			L		Coflexip Stena Offshore Ltd

Ship	V	T	L	*	Manager
Curico			L		London Ship Managers Ltd
Dallington			L		Stephenson Clarke Shipping Ltd
Discovery	V	T			NERC Research Ship Unit
Discovery				*	Stolt Offshore Ltd
Dominica	V	T	L		IUM Shipmanagement AS
Donnington				*	Stephenson Clarke Shipping Ltd
Duhallow			L		Zodiac Maritime Agencies Ltd
Durrington			L		Stephenson Clarke Shipping Ltd
Eagle			L		International Marine Transport Co. Ltd
Earl of Romney				*	The Marine Society
Eastern Express		T			Univan Ship Management Ltd
Eastern Fortune				*	Star Tanker Pte. Ltd
Edward Oldendorff				*	Egon Oldendorff
Ehm Maersk				*	A.P. Moller
Elisabeth Schulte				*	Eurasia International (China) Ltd Partnership
Enchanter				*	Biglift Shipping B.V.
English Star		T			IUM Shipmanagement AS
Eridge			L		Zodiac Maritime Management Services
Erna Oldendorff			L		Egon Oldendorff
Ernest Shackleton	V	T			British Antarctic Survey
Erradale			L		The China Navigation Co. Ltd
Etrusca				*	Jolane S.A.
Eugen Maersk				*	A.P. Moller
European Ambassador		T			P&O European Ferries (Irish Sea) Ltd
European Envoy		T		*	P&O European Ferries (Irish Sea) Ltd
European Leader				*	P&O European Ferries (Irish Sea) Ltd
European Pioneer				*	P&O European Ferries (Irish Sea) Ltd
European Seafarer				*	P&O European Ferries (Irish Sea) Ltd
European Shearwater		T	L		James Fisher (Shipping Services) Ltd
Explorer		T			V.Ships Inc.
Falcon				*	SMT Shipmanagement & Transport Ltd
Federal Bergen				*	Malaysia International Shipping Corporation
Federal Rhine				*	Anglo-Eastern Ship Management Ltd
Federal St. Laurent			L		Anglo-Eastern Ship Management Ltd
Federal Yukon				*	Anglo-Eastern Ship Management Ltd
Fernie			L		Zodiac Maritime Agencies Ltd
Finch Arrow				*	Gearbulk (UK) Ltd
Foylebank		T			Andrew Weir Shipping Ltd
French Bay			L		Unique Shipping (H.K.) Ltd
Front Rider				*	Acomarit Oriental Shipmanagement Pte. Ltd
Front Sunda				*	Wallem Shipmanagememnt Ltd
General Delgado				*	Aboitiz Oriental Shipmanagement Pte. Ltd

UK Voluntary Observing Fleet *(contd)*

SHIP	STATUS (see Notes)	OWNER/MANAGER
Genmar Pacific	*	General Maritime Management
Gisela Oldendorff	*	Egon Oldendorff
Glasgow Maersk	V T	The Maersk Company Ltd
Glen Maye	*	MOL Tankship Management Ltd
Glen Roy	*	MOL Tankship Management Ltd
Golden Princess	T L	P&O Cruises (UK) Ltd
Golden Ray II	*	Stamco Ship Management Co. Ltd
Gosport Maersk	L	The Maersk Company Ltd
Graceous	L	Anglo-Eastern Ship Management Ltd
Grafton	L	Zodiac Maritime Management Services
Grand Princess	*	P&O Cruises (UK) Ltd
Grasmere Maersk	V T L	The Maersk Company Ltd
Grebe Arrow	L	Gearbulk (UK) Ltd
Greenwich Maersk	T L	The Maersk Company Ltd
Gull Arrow	*	Gearbulk (UK) Ltd
Hadiyah	*	Kuwait Oil Tanker Co. S.A.K.
Hai Nun	*	Shanghai Time Shipping
Hato	*	Smit Shipmanagement & Transport Ltd
Havdrott	*	Bergesen d.y. ASA
Havkong	*	V.Ships (UK) Ltd
Hebridean Isles	*	Caledonian MacBrayne Ltd
Hebridean Spirit	*	Hebridean Princess Cruises
Hebrides	*	Caledonian MacBrayne Ltd
Hekabe	*	Bergesen d.y. ASA
Helios	*	Bergesen d.y. ASA
Hemina	T	Bergesen d.y. ASA
Heythrop	L	Zodiac Maritime Management Services
HSH Kusu	*	OW Ship Management Pte. Ltd
HSH Ubin	*	OW Ship Management Pte. Ltd
Hurst Point	*	Andrew Weir Shipping Ltd
Ibis Arrow	*	Gearbulk (UK) Ltd
Iron King	T *	The South African Marine Corporation Ltd
Isle of Arran	*	Caledonian MacBrayne Ltd
Isle of Lewis	*	Caledonian MacBrayne Ltd
Isle of Mull	L	Caledonian MacBrayne Ltd
Isomeria	*	Shell Marine Personnel (IOM) ltd
Ivory Dawn	*	Hoegh Fleet Services AS
Jaeger Arrow	T	Gearbulk (UK) Ltd

SHIP	STATUS (see Notes)	OWNER/MANAGER
James Clark Ross	V T	British Antarctic Survey
Jervis Bay	L	P&O Nedlloyd Ltd
Kagoro	L	V. Ships (UK) Ltd
Kate	*	Neda Maritime Agency Co. Ltd
Kazimah	*	Kuwait Oil Tanker Co. S.A.K.
Kent Voyageur	L	Kent Line Ltd.
Kiwi Arrow	*	Gearbulk (UK) Ltd
Knock Allan	L	Red Band AS
Knock Stocks	L	V.Ships Norway AS
Kymi	*	Starmarine Management Inc.
Lady Barbara	*	Tecto Belgium NV
Lapponian Reefer	L	Holy House Shipping AB
Laura Delmas	T *	V.Ships (UK) Ltd
Leopardi	*	Barber Ship Management Inc.
Linares	L	London Ship Managers Ltd
Lincolnshire	*	Bibby-Harrison Management Services Ltd
Linderos	L	London Ship Managers Ltd
LNG Rivers	*	Exel Freight Management (UK) Ltd
LNG Sokoto	L	Exel Freight Management (UK) Ltd
Lord Nelson	L	Jubilee Sailing Trust Ltd
Lowlands Rose	T *	EuroShip Services Limited
Lowlands Yarra	L	EuroShip Services Limited
Lucie Delmas	T *	V.Ships (UK) Ltd
Macoma	*	Shell Marine Personnel (IOM) ltd
Maersk Dee	L	The Maersk Company Ltd
Maersk Gannet	*	Maersk Company (IOM) Ltd
Maersk Gateshead	V T *	The Maersk Company Ltd
Maersk Mariner	*	The Maersk Company Ltd
Maersk Perth	T	Maersk Sealand
Maersk Ramsey	L	The Maersk Company Ltd
Maersk Rapier	L	Maersk Company (IOM) Ltd
Maersk Rhine	*	Univan Ship Management Ltd
Maersk Rochester	*	The Maersk Company Ltd
Maersk Rye	*	The Maersk Company Ltd
Magnolia	*	International Marine Transportation Ltd
Maracas Bay	*	MOL Tankship Management Ltd
Marienborg	L	The Maersk Company Ltd
Marvellous	*	Anglo-Eastern Ship Management Ltd

Matco Clyde			L		International Marine Transport Co. Ltd
Matilde		T		*	OSG Ship Management (UK) Ltd
Meynell				*	Zodiac Maritime Agencies Ltd
Mineral Dragon			L		Tecto Belgium N.V.
Mona Lisa				*	Kyma Ship Management
MSC Amsterdam				*	Sinotrans Shipping Ltd
MSC Bruxelles				*	Worlder Shipping Ltd
MSC Corsica				*	Target Marine S.A.
MSC Greece				*	Sinotrans Shipping Ltd
MSC Hudson			L		Neptune Shipmanagement Services (Pte) Ltd
Murex				*	Shell Marine Personnel (IOM)
Myrina		T		*	Shell Marine Personnel (IOM)
Nandu Arrow				*	Gearbulk (UK) Ltd
Naparima			L		MOL Tankship Management Ltd
Napier Star		T		*	Dobson Fleet Management Ltd
Nariva			L		MOL Tankship Management Ltd
Navarino				*	Avin International S.A.
New Independence				*	Barber Ship Management Inc.
Newport Bay	V	T	L		P&O Nedlloyd
Newton			L		Royal Maritime Auxiliary Service
Nord Sea				*	Wallem Shipmanagement Ltd
Norna		T	L		Scottish Fisheries Protection Agency
Norrisia				*	Shell Marine Personnel (IOM) ltd
Ocean Goose				*	Mr DA Church
Ocean Princess			L		P&O Cruises (UK) Ltd
Ocean Spirit of Moray				*	Gordonstoun School
Oceana				*	P&O Cruises (UK) Ltd
Olympia Spirit			L		Sosema S.A.
OOCL Belgium			L		OOCL Shipping
OOCL Britain			L		OOCL Shipping
OOCL Canada		T	L		OOCL Shipping
Orange Sky				*	Egon Oldendorff
Oriana	V	T			P&O Cruises (UK) Ltd
Oriental Bay			L		P&O Nedlloyd BV
Oriental Venture				*	MOL Tankship Management Ltd
Orion Reefer				*	Wallem Shipmanagement Ltd
Ormond				*	Zodiac Maritime Agencies Ltd
P&O Nedlloyd Cook			L		P&O Nedlloyd BV
P&O Nedlloyd Drake			L		P&O Nedlloyd BV
P&O Nedlloyd Genoa	V	T			P&O Nedlloyd BV
P&O Nedlloyd Hudson			L		P&O Nedlloyd BV
P&O Nedlloyd Kobe			L		P&O Nedlloyd BV
P&O Nedlloyd Marseille			L		P&O Nedlloyd BV
P&O Nedlloyd Shackleton	V	T			P&O Nedlloyd BV
P&O Nedlloyd Southampton	V	T			P&O Nedlloyd BV
P&O Nedlloyd Tasman			L		P&O Nedlloyd BV
Pacheco				*	Andrew Weir Shipping Ltd
Pacific Guardian				*	Global Marine Ltd
Pacific Pintail			L		James Fisher (Shipping Services) Ltd
Pacific Sandpiper				*	James Fisher (Shipping Services) Ltd
Pacific Swan			L		James Fisher (Shipping Services) Ltd
Pacific Teal			L		James Fisher (Shipping Services) Ltd
Pacific Venture				*	MOL Tankship Management Ltd
Pacific Wave				*	MOL Tankship Management Ltd
Pelican Arrow				*	Gearbulk (UK) Ltd
Peninsular Bay	V	T			P&O Nedlloyd BV
Petersfield			L		Gearbulk (UK) Ltd
Petro Fife			L		International Marine Transport Co. Ltd
Pharos		T	L		Northern Lighthouse Board
Phu May				*	Vietnam National Shipping Lines
Pine Arrow				*	Gearbulk (UK) Ltd
Pioneer Leader				*	Wallem Shipmanagement Ltd
Plover Arrow			L		Gearbulk (UK) Ltd
Pride of Bilbao		T		*	P&O European Ferries (Portsmouth) Ltd
Pride of Bristol					P&O European Ferries (Portsmouth) Ltd
Pride of Le Havre					P&O European Ferries (Portsmouth) Ltd
Pride of Portsmouth			L		P&O European Ferries (Portsmouth) Ltd
Pride of York				*	P&O North Sea Ferries Ltd
Primo			L		Barber Ship Management AS
Prince of Waves				*	Seatrade Groningen BV
Princess Katherine				*	Ravesnscroft Shipping Inc.
Princess Nadia				*	Ravesnscroft Shipping Inc.
Providence Bay	V	T			P&O Nedlloyd BV
Pytchley			L		Zodiac Maritime Management Services
Queen Elizabeth 2	V	T			Cunard Seabourn Ltd
Quorn				*	Zodiac Maritime Management Services
Raven Arrow			L		Gearbulk (UK) Ltd
Regent Rose				*	United Sea Service S.A. de C.V.
Regina Oldendorff				*	Egon Oldendorff
Repulse Bay		T			P&O Nedlloyd BV

UK Voluntary Observing Fleet *(contd)*

SHIP	STATUS (see Notes)	OWNER/MANAGER
Rhone	*	United Ship Management Ltd
Royal Princess	T	P&O Cruises (UK) Ltd
Rutland	L	Zodiac Maritime Agencies Ltd
S.A. Altius	*	The South African Marine Corporation Ltd
S.A. Fortius	*	The South African Marine Corporation Ltd
Safmarine Asia	L	The Maersk Company Ltd
Safmarine Europe	*	Safmarine Ship Management
Safmarine Nolizwe	*	Safmarine Ship Management
Saga Crest	*	Anglo-Eastern Ship Management Ltd
Saga Horizon	L	Patt Manfield & Co. Ltd
Saga Rose	T *	Saga Shipping Co. Ltd
Saga Wave	*	Anglo-Eastern Ship Management Ltd
Saga Wind	*	Patt Manfield & Co. Ltd
Saldanha	L	The South African Marine Corporation Ltd
Saloma	L	Univan Ship Management Ltd
Samarinda	T L	EuroShip Services Limited
Sarah	*	Minister for Meteorology, Abu Dhabi
Scotia	*	Marr Vessel Management Ltd
Scott Guardian	T L	BUE North Sea Limited
Scottish Star	V T	IUM Shipmanagement AS
Sea Ahmed	*	Oesterreichischer Lloyd Ship Management
Sea Amethyst	L	Stephenson Clarke Shipping Ltd
Semac 1	*	European Marine Contractors Ltd
Severn Fisher	*	James Fisher (Shipping Services) Ltd
Shenzhen Bay	T L	P&O Nedlloyd BV
Shetland Service	T L	BUE North Sea Limited
Singapore Bay	L	P&O Nedlloyd BV
Sir Eric Sharp	L	Global Marine Ltd
Siskin Arrow	*	Gearbulk (UK) Ltd
Snow Crystal	L	Holy House Shipping AB
Snow Drift	L	Holy House Shipping AB
Snow Flower	L	Holy House Shipping AB
Snow Land	L	Holy House Shipping AB
Snowdon	*	Zodiac Maritime Agencies Ltd
Solitaire	*	Allseas Engineering
Southampton Star	L	World Marine Co. Ltd
Spar Topaz	*	Spar Shipping AS
Speybank	T L	Andrew Weir Shipping Ltd
Sponsalis	L	Shell Marine Personnel (IOM) Ltd
St Helena	*	Andrew Weir Shipping Ltd
St Lucia	V T *	IUM Shipmanagement AS
Star Inventana	T *	Masterbulk Pte Ltd
Star Isoldana	T *	Masterbulk Pte Ltd
Star Princess	*	P&O Cruises (UK) Ltd
Stavros S Niarchos	*	STA Tall Ships
Stellar Navigator	*	Hachiuma Steamship Co. Ltd
Stewart Island	*	IndoChina Ship Management (HK) Ltd
Stolt Durham	*	Bibby-Harrison Management Services Ltd
Stolt Kittiwake	L	Stolt-Nielsen Transportation Group BV
Storrington	L	Stephenson Clarke Shipping Ltd
STS Prince William	*	Northern Marine Management Ltd
Sulisker	T L	Scottish Fisheries Protection Agency
Summer Flower	L	IUM Shipmanagement AS
Summer Meadow	*	Hoegh Fleet Services AS
Summer Wind	*	Hoegh Fleet Services AS
Sun Princess	*	P&O Cruises (UK) Ltd
Sun Suma	*	United Ship Management Ltd
Swan	*	SMT Shipmanagement & Transport Ltd
Swan Bay	*	Wallem Shipmanagement Ltd
Swan River	L	Wallem Shipmanagement Ltd
Swan Stream	*	Wallem Shipmanagement Ltd
Talca	L	London Ship Managers Ltd
Tamar F1	*	Byron Marine Ltd
Taunton	*	Zodiac Maritime Agencies Ltd
Tauranga Star	*	Dobson Fleet Management Lts
Teignbank	T L	Andrew Weir Shipping Ltd
Tenacious	L	Jubilee Sailing Trust Ltd
Teno	L	London Ship Managers Ltd
Tobias Maersk	L	The Maersk Company Ltd
Toisa Coral	T L	Sealion Shipping Ltd
Toisa Cougar	*	Sealion Shipping Ltd
Toisa Perseus	T *	Sealion Shipping Ltd
Toisa Petrel	*	Boston-Putford Offshore Safety Ltd
Toisa Sentinel	*	Sealion Shipping Ltd
Tor Baltica		DFDS Tor Line Ltd
Torben Maersk	L	The Maersk Company Ltd

Toucan Arrow		L		Gearbulk (UK) Ltd
Trade Eternity			*	Worlder Shipping Ltd
Tramper			*	Graig Ship Management Ltd
Transporter		L		Graig Ship Management Ltd
Trein Maersk		L		The Maersk Company Ltd
Trojan Star		L		IUM Shipmanagement AS
Tsuru			*	SMT Shipmanagement & Transport Ltd
Tudor Star		L		IUM Shipmanagement AS
Tundra Princess			*	Fleet Management Ltd
Tyco Dependable			*	Tyco International
Tyco Resolute			*	Tyco International
Ullswater		L		Zodiac Maritime Agencies Ltd
Union Diamond			*	Union Transport Group plc
Victoria		L		P&O Cruises (UK) Ltd
Vigilant	T	L		Scottish Fisheries Protection Agency
Vine		L		Zodiac Maritime Management Services
Voc Frontier			*	Dockendale Shipping Co. Ltd
Waterford		L		Zodiac Maritime Management Services
Westfield		L		Gearbulk (UK) Ltd
Westra	T			Scottish Fisheries Protection Agency
World Spark	T		*	Eurasia Shipping & Management Co. Ltd
World Trader 1			*	Stavros Roussos
Wren Arrow		L		Gearbulk (UK) Ltd
Yeoman Bank		L		C.H. Sorensen Management AS
Yeoman Bridge			*	V.Ships (UK) Ltd
York			*	Zodiac Maritime Agencies Ltd
Zetland			*	Zodiac Maritime Agencies Ltd
Zuljalal			*	United Ship Management Ltd

Note:
Although they have now been withdrawn from the UK VOF, the following ships also contributed weather observations during the 12 months to 31 March 2003.

Al Samidoon, Al Shuhadaa, Alam Selaras, Alnoof, Arctic Goose, Audacity, Baltic Breeze, British Esk, British Skill, British Spirit, British Success, CS Nexus, Cable Installer, Cartagena, Cielo di Biscaglia, Corsystes, Criscilla, Drin, Eclipse, Emily C, European Navigator, Hamane Spirit, Havjarl, Hesiod, Iron Queen, Keta Lagoon, Licorne Pacifique, Mairangi Bay, Matco Thames, Mineral Century, Mineral Colombia, Mineral Sakura, Northern Horizon, Northern Prince, P&O Nedlloyd Lyttelton, Pacific Crane, Pacific Emerald, Palliser Bay, Pegasus Bay, Press, Pride of Cherbourg, Pride of Hampshire, Putford Achates, Resolution Bay, Rixta Oldendorff, Sabina, Saudi Splendour, Seabourn Sun, St Clair, St Sunniva, Tema, Toisa Conqueror, Union Emerald, Western Bridge, Wilson Mo.

UK ships recruited to report in the MARID code
(Sea temperature is the sole instrumental element)

Activity	FT Everard & Sons Ltd
Allurity	FT Everard & Sons Ltd
Annuity	FT Everard & Sons Ltd
Arco Avon	Hanson Aggregates Marine Ltd
Arco Dart	Hanson Aggregates Marine Ltd
Arduity	FT Everard & Sons Ltd
Blackfriars	Crescent Marine Services Ltd
Celtic Terrier	Campbell Maritime Ltd
Chartsman	James Fisher (Shipping Services) Ltd
City of Cardiff	United Marine Dredging Ltd
City of Chichester	United Marine Dredging Ltd
Clonlee	Dundalk Shipowners Ltd
Hera	Skibsaksjeselskapet Solvang AS
Hernes	Oesterreichischer Lloyd Ship Management (Cyprus) Ltd
Lord Rank	Ocean Youth Trust Northern Ireland
Lough Fisher	James Fisher (Shipping Services) Ltd
Merchant Brilliant	Merchant Ferries Ltd
Mersey Fisher	James Fisher (Shipping Services) Ltd
River Lune	Merchant Ferries Ltd
Royalist	Sea Cadet Offshore Office
Saga Moon	Merchant Ferries Ltd
Steersman	James Fisher (Shipping Services) Ltd
Stena Caledonia	Stena Line (Stranraer) Ltd
Stolt Avocet	Stolt-Nielsen Transportation Group BV
Tees Fisher	James Fisher (Shipping Services) Ltd
Waverley	Waverley Excursions Ltd
Wear Fisher	James Fisher (Shipping Services) Ltd
Welsh Piper	RMC Aggregates (South Wales) Ltd

UK fixed or mobile offshore stations.
(North Sea and other exploration areas.). Stations not using Turbo or TurboWin software are shown with '*'.

AH001	Amerada Hess Ltd
Beryl 'A' *	Mobil North Sea Ltd
Beryl 'B' *	Mobil North Sea Ltd
Buchan 'A'	Talisman Energy (UK) Ltd
Captain WPP 'A'	ChevronTexaco
GlobalSantaFe Adriatic XI	GlobalSantaFe
GlobalSantaFe Arctic III	GlobalSantaFe
GlobalSantaFe Arctic IV	GlobalSantaFe
GlobalSantaFe Britannia	GlobalSantaFe
GlobalSantaFe Galaxy I	GlobalSantaFe
GlobalSantaFe Galaxy III	GlobalSantaFe
GlobalSantaFe Magellan	GlobalSantaFe
GlobalSantaFe Monarch	GlobalSantaFe
GlobalSantaFe Monitor	GlobalSantaFe
GlobalSantaFe Rig 140	GlobalSantaFe
Gryphon 'A' FPSO	Kerr-McGee Oil (UK) plc
Haewene Brim FPSO	Bluewater Services (UK) Ltd
Iolair *	Transocean Offshore (North Sea) Ltd
Jack Bates	Transocean Offshore (North Sea) Ltd
Janice 'A'	Kerr-McGee Oil (UK) plc
Maersk Endurer	Maersk Contractors Ltd
Morecambe AP1	British Gas Hydrocarbon Resources Ltd
Noble Ton van Langeveld	Noble Drilling (UK) Ltd
North Alwyn 'A'	TotalFinaElf
Northern Producer	Petrofac Facilities Management Ltd
Ocean Guardian	Diamond Offshore (UK) Ltd
Paul B. Loyd Jr	Transocean Offshore (North Sea) Ltd
Petrojarl Foinaven FPSO	PGS Production
Sedco 711	Transocean Offshore (North Sea) Ltd
Sedco 712	Transocean Offshore (North Sea) Ltd
Sedco 714	Transocean Offshore (North Sea) Ltd
Tartan 'A'	Talisman Energy (UK) Ltd
Tiffany Platform	Agip (UK) Ltd
Transocean John Shaw	Transocean Offshore (North Sea) Ltd
Viking 'B'	Conoco (UK) Ltd

UK Auxiliary shiips

Al Fujairah
Amer Choapa
Carouge
Crude Transporter
DS Fantasy
Green Ice
Hightide
Jupiter Diamond
Maersk Wave
Marine Explorer
Meridian Ace
Mineral Ordaz
New Resolution
Nordbeach
Optima
Safflower
Saga Voyager
Sargodha
Sinfonia
Solomon Empress
Spruce Arrow
Stena Shipper
Takamine
Vaky Junior
Veroika

Listings for overseas observing fleets

(The Met Office holds no responsibility for any of the following information.)

INDIA (Information dated 1 April 2003)

Selected Ships:

Akbar
BR Ambedkar
Harshavardhan
Kanpur
Lokmanya Tilak
Major Dhansingh Thapa PVC
Patliputra
Sabarimala
Sagar Kanya
Sagar Sampada
Samudra Manthan
State of Nagaland
Tirumalai

Supplementary Ships:

Abul Kalam Azad
A B Tarapore PVC
APJ Anjali
APJ Shalin
APJ Sushma
Aditya Vijay
Alaknanda
Amini Divi
Ankaleshwar
Anomuran
Arcadia Progress

Supplementary Ships:

Bankim Chandra Chatterjee
Bharat Seema
Bharati Darsan
CHM Piru Singh PVC
C.V. Raman
Chennai Polivu
Chennai Velarchi
Chettinad Princess
Chhatrapati Shivaji
Dakshineshwar
Dev Prayag
Dweep Setu
Fonj Shekhon PVC
Gandhar
Ganga Sagar
Gati-(1)
Gem of Ennore
Gem of Madras
Goa
Guru Bachan Singh Salaria PVC
Guru Gobind Singh
Hardwar
Havildar Abdul Hamid PVC
Homi Bhabha
Indira Gandhi
Jag Palak

Supplementary Ships:

Jag Pari
Jag Pradip
Jag Pragati
Jag Praja
Jag Prakash
Jag Prayog
Jag Preeti
Jag Rani
Jag Ratna
Jag Vikram
Jala Doot
Jawaharlal Nehru
Jhulelal
Lal Bahadur Shastri
Lance Naik Albert Ekka PVC
Lt Arun Khetrapal PVC
Lok Kirti
Lok Maheshwari
Lok Pragati
Lok Prakash
Lok Pratap
Lok Pratima
Lok Prem
Lok Rajeshwari
Maharaja Agrasen
Maharashtra

Supplementary Ships:

Maharshi Karve
Maharsh Parshuram
Major Hoshiar Singh PVC
Major Shaitan Singh PVC
Major Somnath Sharma PVC
Mandakini
Motilal Nehru
Murshidabad
Naik Jadunath Singh PVC
Nancowry
Nand Hari
Nand Kishore
Nand Smiti
Nand Srishti
Nanga Parbat
Netaji Subash Bose
Nicobar
Nirmal Bhushan
Orient Strength
Palanimaleai
Prabhu Das
Prabhu Daya
Prabhu Jivesh
Prabhu Puni
Prabhu Satram
Pratibha Cauvery

Supplementary Ships:

Rabindranath Tagore
Radiant Rigel
Rajiv Gandhi
Rama Raghoba Rane PVC
Sagar Samrat
Sampurna
Swarajya
Satya Murti
Subhedar Jogindar Sing PVC
Suvarna Swarajya
Swaraj Deep
Tamil Kamaraj
Tamilnadu
Uttar Kashi
Varanasi
Viswa Doot
Vishva Karma
Vishva Nandini
Vivekananda
Yerawa

Auxiliary Ships: *Alexander, Asean Glory, Bell Blue, Bharat, Charisma-N, Concordia Gulf, Concordiafjord, Giorges, Hafez, Hoegh Pilot, Hoegh Pride. Indian Courier, Jag Darshan, Jag Rekha, Jagat Mohini, Jagat Padmini, Janusha, Kalyani-V, Laccadive, Leelavati, Maldive Importer, Matsya Harini, Matsya Jeevan, Meena Bharati, Meena Udyog, Nitya Nayak, Pratibha Krishna, Produce, Rani Padmini, Ratnamanorama, Red Snapper, Rukamavati, Sagar Geeta, Sagar Rani, Samudra Rekha, Skipper II, Skipper III, Starlight Splendour, Tungsha, Varuna Yamini, Vishva Anand.*

Australia (information dated 28 February 2003)

Selected ships:

Aburri
Al Khaleej
Al Kuwait
Al Messilah
Al Shuwaikh
Alltrans
Alnilam
Anl Progress
Aotearoa Chief
Arafura
Aurora Australis
Bader III
Botany Tradewind
Bunga Teratai
Bunga Teratai Dua
Cape Conway
Cape Darby
Cape Denison
Cape Don
Cape Preston
Cape York
Capitaine Cook
Capitaine Fearn II
Capitaine La Perouse
Capitaine Tasman
Challis Venture
Changsha
Chekiang
Chenan
Coral Chief
Danny F II
Direct Kestrel
Endeavour River
Farid F
Fitzroy River
Forum Samoa II
Francesco

Selected ships:

Goonyella Trader
Irenes Myth
Iron Carpentaria
Iron Chieftain
Iron Kembla
Iron Monarch
Iron Sturt
Iron Yandi
Japonica
Kimberley
Kiribati Chief
Kokopo Chief
Kowulka
L'Astrolabe
Lindesay Clark
Maersk Pelepas
Maersk Tacoma
Maersk Tampa
Maersk Trieste
Magnavia
Mawashi Al Gasseem
Maysora
MSC Vietnam
Nivosa
Northwest Sanderling
Northwest Sandpiper
Northwest Seaeagle
Northwest Shearwater
Northwest Snipe
Northwest Stormpetrel
Northwest Swift
Ormiston
P&O Nedlloyd Adelaide
P&O Nedlloyd Barossa Valley
P&O Nedlloyd Nelson
P&O Nedlloyd Nina
P&O Nedlloyd Taranaki

Selected ships:

Pacific Princess
Pacific Sky
Pacific Triangle
Papuan Chief
Pioneer
Portland
River Boyne
River Embley
Rodolfo Mata
Roebuck Bay
Sam Ratulangi
Saraji Trader
Seakap
Southern Supporter
Spirit Of Tasmania Ii
Wauri

Supplementary ships:

Frances Bay
Goliath
Hakula
Ikuna
Leeuwin II
Sir Hubert Wilkins

Auxiliary ships:

Bark Endeavour

NEW ZEALAND (Information dated 8 July 2003)

Selected ships:

ANL Pioneer
Arago
Boral Gas
Capitaine Wallis
Direct Condor
Forum Fij II
Golden Bay
Helen
Josephine Maersk
Kakariki
Kiwi Breeze
Miss Mataroa
MSC New Plymouth
Nele Maersk
New Zealand Pacific
Nexoe Maersk
Nicolai Maersk
Nicoline Maersk
Nora Maersk
Norfolk Guardian
Nysted Maersk
Pacific Chieftain
Pacific Gas
Pacific Onyx
Rangatira
Rotoiti
Rotoma
SeaTow 25
Soren Larsen
Southern Cross II
Southern Moana
Spirit of Competition
Taiko
Tangaroa
Tasman Adventure
Tasman Discoverer
Tasman Explorer

Supplementary ships:

Arahura
Aratere
Kent
Santa Regina
Straitsman
Suilven

Auxiliary ships:

Canterbury HMNZS
Endeavour HMNZS
Kahu HMNZS
Manawanui HMNZS
Resolution HMNZS
Spirit of New Zealand
Te Kaha HMNZS
Te Mana HMNZS

Index to Volume 73, 2003

Note: An index of observing ships named in this volume follows the main index listing.

Ships and installations contributing to *The Marine Observer* in 2002.

Inmarsat-C Land Earth Stations accepting 'Code 41' messages (ships' weather observations)

Atlantic Ocean Region — East

Station name	*Country*	*ID No.*
Aussaguel	France	121
Goonhilly	United Kingdom	102
Southbury	United States	101
Station 12	The Netherlands	112
Thermopylae	Greece	120

Atlantic Ocean Region — West

Station name	*Country*	*ID No.*
Goonhilly	United Kingdom	002
Southbury	United States	001
Station 12	The Netherlands	012

Indian Ocean Region

Station name	*Country*	*ID No.*
Arvi	India	N/A (Within Metearea VIII (N) only)
Aussaguel	France	321
Jeddah	Jeddah	315
Perth	Australia	322
Thermopylae	Greece	305
Sentosa	Singapore	328
Station 12	The Netherlands	312
Yamaguchi	Japan	303

Pacific Ocean Region

Station name	*Country*	*ID No.*
Perth	Australia	222
Santa Paula	United States	201
Sentosa	Singapore	210
Yamaguchi	Japan	203