

The Marine Observer



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The Marine Observer

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The Marine Observer is a quarterly journal produced by the Met Office. All correspondence should be addressed to:

The Editor 'The Marine Observer'
Met Office Beaufort Park
Easthampstead Wokingham
Berkshire RG40 3DN

Fax: +44 (0)1344 855873
E-mail: obsmar@metoffice.com
www.metoffice.com

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Editorial

It might be expected that the atmosphere, comprising nitrogen, oxygen, methane and rare gases, would become unbalanced thanks to all the air-breathing organisms that exhale carbon dioxide 24 hours a day, and have done so for millions of years. So have you ever wondered why the Earth never gets ‘short of breath’?

There is a link that brings together life on land, in the sea or in the air —the element carbon. How carbon is stored in the natural world, and the ways in which it can be released — the carbon cycle — is the subject of much research. Recent work has found that part of the cycle involves the jungles of the Amazon which appear to act as a major ‘sink’ (or retention mechanism) for carbon. The trees fix carbon through the process of photosynthesis and release oxygen back into the air.

Unfortunately, man’s enthusiasm for cutting down large swathes of the jungle depletes that carbon sink, while the burning of felled trees returns carbon back into the atmosphere in the form of carbon dioxide. These activities are thought to contribute significantly to the amount of carbon dioxide entering the atmosphere from other sources such as through burning fossil fuels.

Whilst incoming short wave solar radiation is able to pass through the ‘soup’ of combined gases on its journey to Earth, the outgoing long-wave heat is trapped by that same combination. There are signs that the resulting atmospheric warming — the now familiar ‘greenhouse’ effect — is increasing, and the finger of suspicion is pointing more and more towards greater carbon dioxide levels as a major culprit (in addition to ever present water vapour).

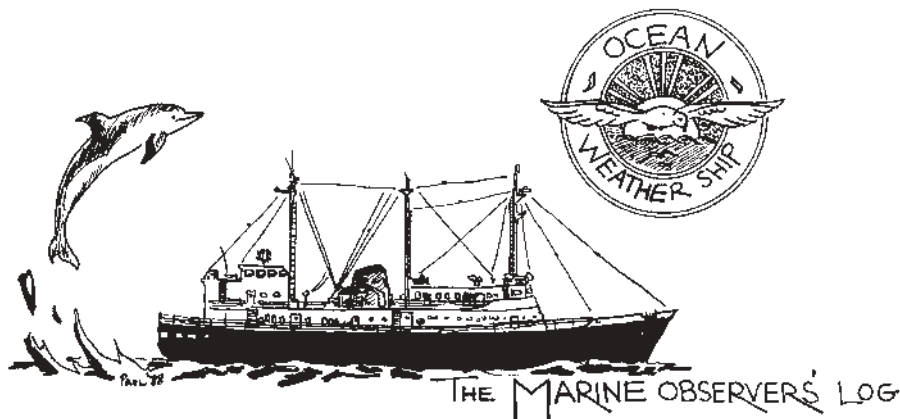
The knock-on effects of such warming are still being assessed, but ‘climate change’ — to give the subject a broad label — features prominently. In order to understand what may or may not be happening, especially over remote ocean areas, researchers rely on high-quality observational data being available. Historical sea surface datasets go back to the nineteenth century and so ought to provide a good record; however, such was the type of meteorological instrumentation, its calibration (or lack of it) and siting in the early days, that much of the data is unreliable.

Improvements to instrument design, siting and calibration, combined with new initiatives such as the VOS Climate Project will help to increase the accuracy of marine data. This essential data can then be used for climate change studies and climate research. In particular marine data is needed to fuel the computer model simulations which are used to predict conditions at the air-sea interface.

When this edition of *The Marine Observer* went to press, the weather in much of the UK was unusually warm, and also very wet in some regions. There were no real signs of what those who are somewhat longer in the tooth than others, would call ‘traditional’ autumn or winter weather. Indeed, the records for the Central England Temperature for October revealed the warmest October since records began, in 1659.

Perhaps such conditions are simply an exception to the norm, but they might equally be a demonstration of the effects of global warming. The continued value of observations from voluntary observing ships should not therefore be underestimated. Now, possibly more than ever, they are needed to help monitor our atmosphere and consequently ensure a secure future for our planet

Wherever marine observers may find themselves at the head of the new year, we thank everyone for their continued support of the voluntary weather observing scheme and wish you all fair winds for the coming year.



This section of *The Marine Observer* comprises reports of interest and scientific value contributed by individual observers or as part of a ship's meteorological logbook.

All reports are welcome in the Observations Supply section of the Met Office and, wherever possible, they are forwarded to relevant sources of expertise for comment and analysis. The following list includes many of the normal and some of the more unusual subjects reported from ships at sea — the list is by no means exhaustive, and we always hope for additions:

- tropical storms, hurricanes and typhoons, depressions and squalls
- waterspouts and funnel clouds
- electrical phenomena and thunderstorms
- dust and sand
- fog and fogbanks
- currents, tide rips, whirlpools and disturbed water
- extreme waves
- marked changes in sea temperature
- earthquakes, volcanoes and seaquakes
- birds, bats and insects (including locusts)
- whales, dolphins and other mammals such as seals and manatees
- sea snakes, turtles
- fish and other marine life;
- bioluminescence, milky seas, phosphorescent wheels
- optical phenomena such as haloes, rainbows, fogbows and coronae
- refraction
- crepuscular rays, 'flash' phenomena and noctilucent clouds
- comets, meteors, meteorite showers, eclipses
- sunspots, the aurora, satellites and 'UFOs'

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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 mile.

Heavy weather

North Atlantic

4–5 January 2001

m.v. *Buccleuch*

■ Port Talbot to Tubarão

■ Captain S.D. Bhatena

■ Observers: Captain Bhatena,
P.S. Devarpalli (3rd Officer) and ship's company

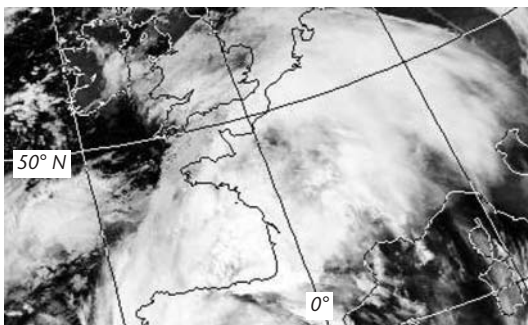
The table below summarises the weather conditions experienced by the vessel during her ballast passage towards Tubarao in position 47° 18' N, 08° 16' W. Making use of weather fax transmissions from Offenbach, the observers realised that they were passing through two depressions, one after the other. (See barograph trace.)

Date and time (UTC)	Temperature		Pressure (mb)	Wind		Seas (Average in m)
	Air	Wet		Dir'n	Force	
4th/2000	13.1	12.4	995.9	195°	9	8
2200	12.8	12.0	986.8	248°	8	7
5th/0000	10.5	9.5	988.5	262°	3	4
0300	10.0	9.2	988.1	240°	3	1
0600	10.5	10.0	986.7	250°	2	1
0800	14.5	12.0	982.0	200°	7	3
0900	13.1	12.0	984.8	212°	7	5
1200	9.8	8.5	991.1	332°	6	4

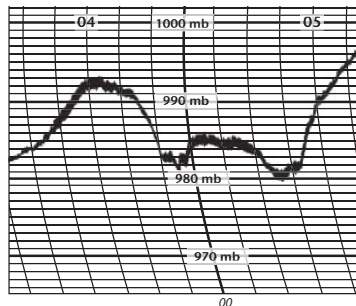
The lowest recorded pressure was 982 mb at which point the average height of the seas was 8–9 m. Between 2030 and 2220 UTC on the 4th the wind speed remained constant at SW'ly, force 9, but then eased down to force 2 by 0600 on the 5th.

After this, the second depression came along bringing with it an average wind speed of force 6 from the north-west.

Right: Barograph trace from *Buccleuch* for 4/5 January 2001.



Satellite image courtesy of Dundee Satellite Receiving Station,
Dundee University, Scotland: www.sat.dundee.ac.uk/



Left: Infra red satellite image of the
depressions at 0531 UTC on 5 January 2001.

The vessel had not sustained any damage in the heavy weather, the only discomfort felt resulted from the rolling motion (30° on either side). Full credit was given to the faxed charts and weather information which had alerted the observers well in advance.

Heavy weather

North Atlantic

6 March 2001

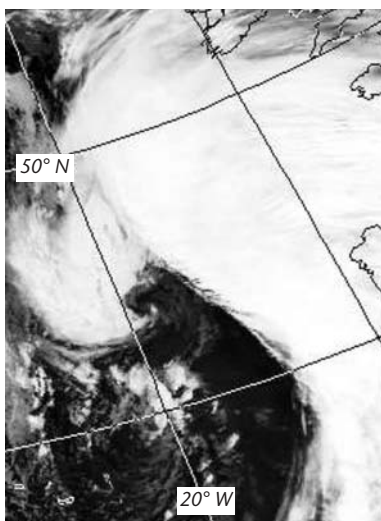
s.t.s. *Tenacious*

- Gran Canaria to United Kingdom
- Captain J.C. Etheridge
- Observers: P. Compton (Chief Officer) and members of ship's company

On 6 March *Tenacious* was homeward bound 500 miles south-west of the English Channel with a well trained voyage crew. The weather had been generally fair since departing from Gran Canaria on 20 February but occasional moderate gales had given all aboard some experience of heavy weather.

The weather forecast received from France Telecom at 0900 UTC advised SE'ly winds of force 8 or 9 veering SW'ly within six hours. This did not arouse more than normal concern as to securing the vessel since lifelines had been rigged on departure from the Azores. The wind direction was favourable for our passage and so the sails were reduced to lower topsails and fore topmast staysail.

At 0900 SE'ly winds of force 9 were being experienced along with a rapidly building sea, while the pressure had dropped to 970.5 mb and was still falling. The weather deck was placed out of bounds except to the watch on deck who remained clipped on whenever possible. Voyage crew with balance problems were advised to remain in their bunks. By this time the lee (port) deck was dipping from time to time.



Satellite image courtesy of Dundee Satellite Receiving Station, Dundee University, Scotland: www.sat.dundee.ac.uk/

By 1000 the wind had reached force 10 with rain squalls reducing visibility. The sea was becoming very steep and the lower topsails were handed, the ship was then run off before the wind in order to minimise motion and reduce apparent wind speed.

Despite this precaution some damage had already occurred to the main lower topsail before it was clewed up; the sails could not be stowed aloft due to the risk involved to personnel. The fore staysail was kept on in order to help prevent the ship running up into the wind (broaching).

By 1100 the wind was blowing spray from the wave tops thus reducing seriously visibility; one officer was stationed by the radar to watch for traffic and squalls and pass information to the open bridge by VHF radio. The whole bridge watch were clipped on.

Both main engines were started to assist the steering — by this time the course was directed from minute to minute to avoid squalls and meet the largest waves well aft. The whole lee rail was submerged and the pressure of water forced the port bridge lift to rise like a piston and then fall back. At the same time the lift screen tore from the deck and the lift door buckled. The ship was surfing frequently and logging 12 knots. The main deck was constantly awash to a depth of about 0.6 m owing to seas coming aboard from both sides. One deck locker lid was washed off and a number of buoyancy aids were lost overboard.

Below decks the crew kept to their bunks and there were no serious injuries. However the galley cold room and deep-freeze shelving both collapsed due to inadequate fixings, and water was found to have penetrated the galley power distribution board rendering the cooking range inoperable. By 1400 the wind was abating although still reaching force 9 in gusts and veering to S'ly. This had the effect of producing a cross sea which caused heavy rolling, with water now coming aboard from both sides.

Depression
North Pacific Ocean
6–7 February 2001

- m.v. Jervis Bay**
- **Oakland to Yokohama**
 - **Captain K.C. Riddick**
 - **Observers: R.G.C. Noble (Chief Officer), F.H. Munro (3rd Officer) and ship's company**

Whilst crossing the North Pacific Ocean the vessel was subjected to a number of passing depressions. The observations that follow were taken during the passage of the most violent one which crossed directly over the vessel's course.

Date and time (UTC)	Temperature			Pressure (mb)	Wind	
	Air	Wet	Sea		Dir'n	Force
6th/1200	12.6	9.5	15.3	1017.3	WSW	2
1800	13.9	12.1	15.1	1002.2	S	7
2100	16.2	15.0	16.8	991.9	WSW	12
2200	16.6	14.2	16.9	997.2	W	11
2300	14.1	12.5	16.7	1003.1	NW	10
7th/0000	12.2	10.9	16.5	1005.4	NW	9
0300	10.7	7.1	15.1	1010.3	NW	9
0600	9.9	6.2	15.1	1013.9	NW	7
1200	11.1	8.6	13.9	1018.0	NxW	3

The minimum pressure was recorded at 2100 on the 6th at which point the ship's position was 35° 24' N, 160° 42' E. During the period several alterations to the vessel's course were necessary in order to avoid damage from the violent seas and swell, while the ship's average speed of 22 knots was reduced to 12 knots. The highest relative wind speed noted was 88 knots.

Waterspout
Indian Ocean
7 January 2001

- m.v. Al Kuwait** (Australian 'Selected' ship)
- **Portland (Australia) to Khorfakkan**
 - **Captain M. Nazareth**
 - **Observers: Z.A. Khan (2nd Officer), and A. Chauhan (Radio Officer)**

The vessel was in position 04° 37' S, 84° 56' E and following a course of 137° at a speed of 17 knots when, at 0055 UTC, a waterspout was observed at a distance of approximately 5–6 miles on the port beam. It began as a large funnel shape extending from the following end of a large cumulonimbus cloud, and then narrowed in a downward direction to become an almost complete spout that stopped short of the sea surface by about 40–60 m.

The direction of movement was north-westerly in a curving path, and the sea below the spout was slightly agitated within an area of 10–15 m, being disrupted and surrounded by sea spray. Its height was approximately 1,000 m, and it rotated in a clockwise direction.

Resembling a hollow tube, the waterspout seemed to be double-walled and was a dark greyish-black colour at the ‘edges’. It lasted for 15 minutes before starting to break up from the lower section upwards to the middle portion, and shortly afterwards started to dissipate. Weather conditions at the time were: air temperature 27.5°, wet bulb 25°, sea 29°, pressure 1009.4 mb. The wind was NW’ly, force 3 and there were 3 oktas of cloud comprising cumulonimbus, cumulus of moderate extent, stratocumulus and a few patches of cirrostratus.

Waterspout

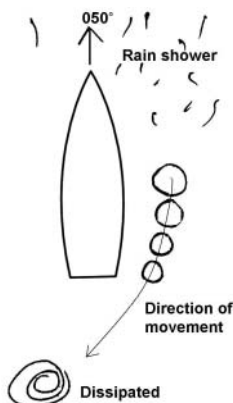
North Atlantic Ocean

7 April 2001

m.v. *Nariva*

- Pt Lisas to Hull
- Captain P.L. Stallaert
- Observers: D.C. Fermin (Chief Officer), and E. Peraldo (2nd Officer)

The vessel was on a heading of 050° en route for Hull when a small waterspout was observed at 1935 UTC about three cables off the starboard side. It had a diameter of 3–4 m and was going in the opposite direction to the vessel.



As indicated in the sketch, the waterspout followed a path that took it around the stern of the vessel, its closest point of approach being about 200 m before it went steadily astern.

The waterspout dissipated after about three minutes when it was aft the port quarter and about 4–5 cables away.

At the time of the observation there was a rain shower ahead of the vessel, and the skies were generally covered by clouds of the stratus family. The pressure was 1021.5 mb, the wind was S’ly, force 4 and the seas were moderate with a low easterly swell.

The ship’s position at the time was 26° 17’ N, 42° 30’ W.

Waterspouts

Indian Ocean

10 March 2001

m.v. *Pisces Explorer*

- Townsville to Bing Bong
- Captain E.M. Pereira
- Observers: W. Ahmad (2nd Officer), S. Mandrekar (3rd Officer) and members of ship’s company

The vessel was on a heading of 228° and passing through the Gulf of Carpentaria at 0030 UTC when a waterspout was observed forming in position 12° 48.1’ S, 139° 26.7’ E.



E.M. Pereira

It started with an area of agitated sea and then a small funnel extended from the end of large cumulonimbus cloud (see photograph). The funnel grew longer and became a waterspout which stopped about 20 m above the sea surface. During the next 30 minutes six more waterspouts developed around the

ship, all within a distance of approximately four miles of it. The nearest one passed the vessel at distance of about 70 m at which time it was dissipating. The area of agitation at the sea surface appeared to be about 5–10 m in diameter, and the direction of rotation of the waterspouts was anticlockwise. Each spout lasted for about half an hour before dissipating. At the time of the event, the air temperature was 30°, the wet bulb was 26.8° and the sea temperature was 28.0°. The pressure was noted to be 1008.5 mb while the wind was ENE'ly, force 2 and the cloud cover was 6 oktas (mainly cumulonimbus).

Whales and seabirds

South Atlantic Ocean

11 February 2001

m.v. *Maersk Rapier*

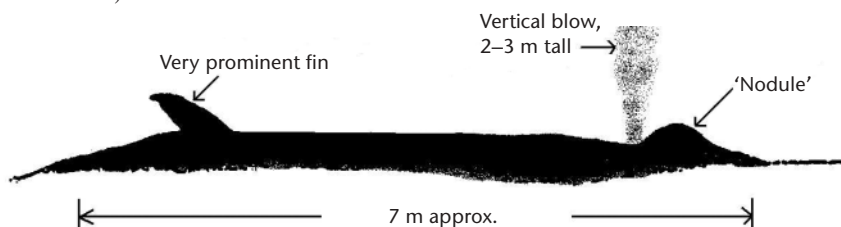
■ Falkland Islands to Algeciras

■ Captain I. Macaulay

■ Observers: T.P. Hutton (2nd Officer) and
C. Gannon (3rd Officer)

The ship was in position 41° 30' S, 50° 14' W on a heading of 026° under clear skies but with a moderate north-westerly sea showing numerous 'white horses'. At around 1830 UTC a large flock of small seabirds was sighted off the port bow. On closer inspection of the area several whale blows then appeared half a mile off the port bow.

The whales appeared to be on a parallel course with the vessel and were in a group of three or four, of estimated length 7–9 m. They were very dark grey in colour, the prominent dorsal fin was about three-quarters of the way down the back, and the blow was very near the front of the whales' bodies (just behind a distinct 'nodule' on the top of their heads). The sketch indicates what was seen.



Further whale sightings occurred continuously all afternoon — the observers lost count after 60 or 70 — but all the whales seemed to be travelling in groups of three to five individuals, with the occasional straggler, all heading in the same direction.

The seabirds were small, blue-grey in colour with a black leading edge to the wings, white undersides and what appeared to be a white eye stripe. There were 100–150 birds, some of which seemed to fly quite erratically. An albatross was also seen among them. After referring to a bird guide, the smaller ones were thought to have been prions.

In brief: On 11 January 2001 a family of three or more whales was seen crossing ahead of the *Pacific Swan* at 2040 UTC. Captain T.R. Greig along with Chief Officer J. Gaskin, Third Officer D. Binyon and A. Gunningham, AB watched as the whales passed at a distance of less than 5 cables.

Clearly identifiable as Killer Whales from their distinctive black-and-white pattern and prominent dorsal fin, there were at least two adults and one 'pup' in the group although there could have been more. The 'pup' was keeping close to a much larger adult. Prevailing conditions were: wind NE'ly, force 4, sea temperature 8.8° while the sea was slight with a swell of 3 m from the south-east. The ship's position was 53° 49.3' S, 62° 30.6' W.

Whales and dolphins

North Pacific Ocean

9–10 March 2001

m.v. *British Hunter*

- Drifting off Cap Lopez
- Captain J.O. Bailey
- Observers: M.S. Tiffany (3rd Officer) and members of ship's company

The vessel had stopped the main engine in order to continue drifting off Cap Lopez whilst waiting for orders when, at 0900 UTC, a school of between 50 and 70 dolphins were sighted. They stayed around the vessel until she came to a standstill (around 30 minutes) during which time they were jumping clear of the water, a few of them also turning in the air and flipping over, much to the delight of the onlookers.

Also spotted were a couple of juveniles that tended to stay close to the main pack throughout. After apparently becoming bored with the vessel, the dolphins swam off to the north, away from the ship's position (00° 33' S, 08° 22' E). At the time of this event the sea temperature was 29°, the wind was SW'ly, force 3 and the dry-bulb temperature was 31°.

On the 10th at 0800, the vessel was proceeding back to her original position after having drifted, when what were believed to be two pilot whales swam directly toward the vessel from dead ahead. The pair of them stayed for about five minutes before swimming under the vessel and heading off towards land (eastwards). They were both very dark in colour and each had a prominent dorsal fin. The larger of the two whales was 3.5–4 m long, and its dorsal fin flopped slightly to the left; the other one was 3–3.5 m long and had a straighter fin. No flukes were seen at any time. The weather conditions at the time of the sighting were very similar to those of the previous day.

In brief: On 20 February 2001 a large Sperm Whale was sighted from the *Lord Nelson* by Clare Cupples (Mate) and ship's company. It swam slowly at the surface, heading south-east while blowing at one-minute intervals. The ship's position was 28° 22' N, 15° 30' W.

Dolphins

North Pacific Ocean

6 January 2001

m.v. *Peninsular Bay*

- Los Angeles to Panama
- Captain S.G. Millar
- Observers: P.E. Garner-Richards (2nd Officer) and members of ship's company

The vessel was proceeding off the coast of Mexico on a bright day with rippled seas and no swell. At 1600 UTC, a school of about 50 dolphins was observed swimming towards the vessel on the port side, leaping out of the water as they approached. On reaching the vessel's side they turned away and swam back in the direction of the coast. Several of the dolphins crossed ahead of the vessel passing down the starboard side.

The dolphins were fairly small in size being about 1–1.5 m in length and had a robust body. The beaks were quite short in length and the dorsal fins were recurved and located in the middle of the back. The dolphins had a grey back with a white belly. Unfortunately there were no books on board that could be used to identify the dolphins.

At the time of observation the vessel's position, course and speed were: 19° 08.8' N, 105° 15.5' W, steering 117° at 23.5 knots.

Bat

South Pacific Ocean

3 February 2001

m.v. Maersk Scotland

- Bahia Blanca to Guayaquil
- Captain R. Orange
- Observers: Captain Orange, P. Wood (Chief Officer) and D. Keaney (3rd Officer)

While assisting the Chief Officer with repairs to an antenna on the monkey island, the Third Officer noticed a small bat about 9–10 cm long lying motionless on the deck with wings outstretched (see photograph).



D. Keaney

After a brief inspection the bat was pronounced dead. However, after a more detailed examination by the Chief Officer its condition was upgraded to 'alive but quite unwell'. There were signs of breathing although weak and infrequent, and the bat made very slight movements when attempts were made to move it. Milk was offered to the unfortunate creature, but attempts to make it drink proved unsuccessful so it was placed on soft rags along with a saucer of milk in a cardboard box in a quiet corner of the bridge.

By the following morning there was no obvious change in the condition of the bat, and it was decided that recovery was very unlikely. Sadly, therefore, it was granted a quick and humane death before being buried at sea. The ship's position was 37° 09' S, 79° 24' W.

Editor's note. We feel it is most likely that the bat joined the vessel at Bahia Blanca but found little in the way of insect life around the vessel to sustain it once the ship had departed. From the photograph it would appear that the bat's tail is not enclosed by the skin membranes that form the wings, so it may be one of the species of free-tailed bat. Beyond that we would not care to speculate!

Luminescence

Indian Ocean

18 January 2001

m.v. Shenzhen Bay

- Colombo to Suez
- Captain J. Dodworth
- Observers: O. Ridyard (3rd Officer) and D. Mora (Seaman)

At 1635 UTC the Third Officer was on the starboard bridge wing when he noticed random luminescence resembling camera 'flashes' in the water, and watched them for 5–10 minutes. However, this display was merely the prelude to a more spectacular event the beginning of which was not seen, but was first noted at 1705.

On the port side of the vessel were numerous bright blue-green lights just beyond the waves created by the ship. These 'blobs' of light appeared to well up to the surface in line with the port bridge wing, and their numbers could be estimated in hundreds at any one time — together they produced a very intense glow. The lights appeared to be following the ship, the creatures perhaps being attracted by its lights since they could only really be seen on the port side where the accommodation lighting was brighter.

Then, at around 1715, the Third Officer tried a few experiments with the Aldis lamp. The results were dramatic! Wherever the light was shone the creatures welled up to the surface in still greater numbers; zigzag patterns, squares and circles could be conjured up at will using their reaction to the lamp. Even as far forward as the bow there was a response to the lamp's light.

At 1720 the ships' position was 11° 12' N, 55° 57' E and the heading was 281° at 20.5 knots. The sky was overcast, the wind was NE'ly, force 4 and the sea temperature read 26.2°.

Their numbers peaked at around 1730 after which they declined steadily until 1745. At the peak of the activity the whole sea out to roughly 70 m from the ship's port side was bathed in the blue-green glow. It was astonishing how intensely these animals could light up the night — comparable perhaps to city lights. From a height of 32 m it was difficult to judge their size but a typical length of around 20 cm was estimated, and there was much speculation as to the species responsible for the phenomenon.

Editor's note. Dr Peter J. Herring, of the Southampton Oceanography Centre said of this report:

"This is a remarkable account of light-stimulated bioluminescence. The usual sources are tiny crustaceans called ostracods or copepods, or much larger cylindrical animals called pyrosomes. The latter do not move quickly and could not 'well up' as described, and the former are too small.

"There are also some (small) shrimp which will respond to light by squirting out a puff or cloud of light — which appears as a blob that usually lasts several seconds. Such animals do occur in the Indian Ocean so they are a possible explanation. Alternatively, the observers may have seen lanternfishes or luminous squid reacting to the light, but this has not been reported before so I think it unlikely. Sorry, but I am baffled too!"

Luminescence

Indian Ocean

28/29 January 2001

m.v. *British Pioneer*

■ Durban to Fujairah

■ Captain P. Seaman

■ Observers: M. Graaskov (3rd Officer) and E. Angala (OS)

Marine luminescence in the form of 'milky sea' was noted between positions 10° 50' N, 55° 08' E and 11° 02' N, 55° 13' E from 2320 UTC on the 28th to 0005 on the 29th.

At the height of the phenomenon (in position 10° 56' N, 55° 11' E) the sea around the vessel on all sides and out to the horizon had a white glow which lit up the sky, reflecting off the low clouds. The wind was force 7 at the time of the observation but the 'white horses' could not be seen owing to the intensity of the luminescence.

The ship's course and speed were 025° at 17 knots, and the visibility at the time was excellent as the lights of another vessel 19 miles away could be seen.

Editor's note. Dr Herring, said:

"This is a typical account of a 'Milky Sea'. The cause is still not understood, but a scum of luminous bacteria is one possible explanation. The phenomenon occurs primarily during the south-west monsoon (July to September) in the northern Indian Ocean, although a smaller number of reports, like this one, come from the period of the north-east monsoon."

Luminescence

Caribbean Sea
31 March 2001

m.v. Tobias Maersk

- Manzanillo to Cartagena
- Captain C. Robinson
- Observers: Captain Robinson and S. Eves (3rd Officer)

At 0200 UTC the observers noted brilliantly flashing individual spots of luminescence surrounding the ship. The distance between the flashes was 4–5 m whilst the duration of each flash was about one second. Unlike the ‘usual’ surface luminescence caused by the ship’s wake, these lights appeared to be below the surface and extended to a distance of more than 50 m from the ship’s sides.

The phenomenon was first observed in position 10° 02.4’ N, 77° 26.5’ W, and ended at 10° 03.3’ N, 77° 20.1’ W. During the period of observation the sea temperature was 28°, the wind was NE’ly, force 3 and there was a swell of 3.5 m.

Editor’s note. Dr Herring said:

“This is another good description of underwater flashes. There are many animals that could have been responsible, but jellyfish are the most likely ones here.”

Extreme wave

North Atlantic Ocean
23 January 2001

m.v. Canterbury Star

- Hamburg to Cotonou
- Captain S.M. Ross
- Observers: Captain Ross and E. Gerona (3rd Officer)

At 0915 UTC the vessel was in heavy seas and proceeding at a slow speed in SW’ly winds of force 9. There were two swells, firstly from 240°, height 7 m, period 14 seconds, and also from 220°, height 5 m, period 12 seconds. In position 45° 51’ N, 08° 01’ W a very steep-faced wave was sighted 30 seconds before it struck the vessel. The wave top was level with the height of eye — 20 m — and the bow started to climb its near vertical face. When it broke over the bow, it caused considerable damage to deck cargo. It was thought that the two swells had combined to form this extreme wave.

Editor’s note. Only occasionally are reports of such high waves received, and we are more accustomed to the occurrence of these in areas where strong currents and high seas oppose each other. The waters off the southern tip of South Africa are a favoured site for the formation of extreme waves owing to the opposition of the strong Agulhas Current to seas generated by storms in the South Atlantic Ocean. As stated in the report, it is likely, in the absence of currents or seismic activity as triggers for this event, that the swells briefly fell into phase to cause the single very large wave.

In brief: On 29 January 2001 at about 2250 UTC Chief Officer A. Davidson spotted around 10 dorado leaping from the water as they chased flying-fish within 50 m of the *Maersk Somerset*. The usual ‘blunt faces’ of the fish could be seen along with their beautifully-coloured backs. Approximately 100 m off to starboard, a small shark was noticed just ‘floating’ on the surface but then dived away after about one minute. The dorado and shark were seen at 02° 26.2’ S, 81° 30’ W while the ship was en route between Callao and Balboa.

Currents

North Pacific Ocean

31 January 2001

m.v. *Havkong*

- Singapore to Portland (US)
- Captain C.M.J. Payton
- Observers: N.J. Blacker (2nd Officer)

Whilst following a course of 050° at 15.1 knots in the seas south of Japan, it was noticed shortly after taking the 0300 UTC position that the ship was being displaced to starboard from its course line. Initially 5° was allowed for correction but it had no effect. After making regular checks on the magnetic compass to ensure there had not been a gyro failure it was then found that between 15° and 18° of course adjustment to port was needed in order to halt the rapid displacement to starboard. This displacement was finally stopped after the ship had pushed eight cables off course.

The ship had to be steered 032° in order to achieve 050°, and this remained necessary until 0500 after which time the ship slowly returned to the GPS track. Over a 40-minute period the amount of set was steadily reduced until, by 0545, the ship was steering 050° and holding her track.

During the period it was noted that the sea temperature dropped from 20° to 16° before climbing to 19.5° (as measured by the hull temperature sensor), whilst on the bridge the air felt cooler. The ship's position was 32° 06.1' N, 137° 18.2' E at 0300, and 32° 25.2' N, 137° 44.7' E at 0500.

In brief: Whilst the *Waterford* was in the Bismarck Sea on 15 March 2001, exceptional visibility was noted at 0830 UTC when the ship's position was 04° 25.09' S, 146° 54.72' E en route to Dalrymple Bay. At this time Chief Officer R.T. Mattos saw that Crown Island, Long Island and Tolokiwa Island were all clearly visible from the above position, indicating that the visibility was in excess of 52 miles.

Halo

North Atlantic Ocean

7 January 2001

m.v. *Trein Maersk*

- Fort de France to Dunkirk
- Captain O.H. Cook
- Observers: L. Kavanagh (3rd Officer),
M. Haynes (2nd Officer) and members of ship's
company

Whilst approaching the English Channel, a large halo was noticed around the moon at 2300 UTC. It was at least 30 times the diameter of the moon, and showed a well-defined inner edge whilst the outer edge was less discernible. The moon was two days from the full phase and, apart from cirrus and some cumulus clouds, the night was clear and some of the brightest stars were also visible.

The halo was observed for 20 minutes after which the cloud patterns altered and it was gone. The ship's position was 46° 52.3' N, 10° 20.7' W.

Editor's note. Depending upon the orientation of individual ice crystals, light refracted through them can produce haloes in a variety of sizes, the most common being that with a radius of 22°. However, the observers describe this one as “large” which seems to indicate that it was not the 22-degree halo, but without measurements it is not possible to identify the phenomenon with any certainty.

If possible, observers should take accurate measurements of the radius of the inner edge of a halo (or whatever portion of a halo is seen) from the moon or sun's centre. The altitude of the moon or sun, to the nearest degree, is also useful since this can help determine which optical effects might be expected.

Noctilucent cloud

South Atlantic Ocean

16/17 January 2001

R.R.S. Ernest Shackleton

- Scientific passage
- Captain S.J. Lawrence
- Observers: Captain Lawrence, A. Liddell (Cadet), J. Shanklin (Meteorologist) and members of ship's company

Between 0139 UTC and 0310 moderately bright, silvery clouds arranged in bands extending to about 10° in altitude were sighted towards the southern horizon. They had not been present at 0110. By 0207 the clouds had become bright, but by 0223 they had lowered and only extended to an altitude of 6°.

By 0247 they had descended further to 4.5°, changing their appearance to become more like whirls within a general bright veil. The display was still present at 0130 but had been partly covered by dark tropospheric cloud. Unfortunately, the ship was pitching too much to allow photographs to be taken.

At the time of the first sighting, the ship's position was 52° 01' S, 57° 03' W.

Volcanic activity

South Pacific Ocean

17 March 2001

m.v. Pacific Islander

- Pago Pago to Papeete
- Captain B.S. Tanwar
- Observers: A. Pereira (3rd Officer), —. Sunny (2nd Officer) and N. Hyder (Chief Officer)

At 1950 UTC in position 14° 34.5' S, 168° 55.5' W, dense white smoke was seen coming out of the sea, remaining clearly visible until lost in the distance behind the ship. The vessel was following a course of 099° at a speed of 15 knots.

It was assumed that this phenomenon was connected with some underwater volcanic activity although no signs of lava or bubbles were noticed. The charted depth of water at the above position was marked on BA4630 as 4,630 m, and there was no indication of volcanic activity either on the chart or in the *Admiralty Sailing Directions for the Pacific Islands (Volume 2)*.

E-mailed reports from UK observing ships

Readers are reminded that additional observations can be e-mailed direct to the Editor at: obsmar@metoffice.com

m.v. *British Spirit*. Observers: Captain A.M. Lakey and J. Whitehead (2nd Officer).

Approximately 40 dolphins were observed close on the port side of the vessel at 0630 UTC on 15 August 2001. They were repeatedly jumping out of the water and spinning in the air prior to re-entering the water. They were approximately 1.5 m–2.0 m in length, grey in colour with an elongated nose, and were identified as Spinner dolphins (*Stennella longirostris*).

The vessel was steaming on a course of 128° at a speed of 12.5 knots heading from Al Jubail in Saudi Arabia to Singapore. At the time of the observation the vessel was in the following position 06° 01.5' N, 79° 19.9' E west of Pt. De Galle in Sri Lanka.

m.v. *British Purpose*. Captain N. Hannam. Observers: P.R. Anderson (3rd Officer) and R. Pacaldo (OS).

At 1652 UTC on 22 August 2001 the vessel was on passage from Singapore to Fujayrah on a heading of 319° at 16.5 knots. The sky was clear as the moon had already set, and the sea was in darkness with only the stars visible. Ahead of the vessel a large area of the sea was lit up by a bright, luminous-green glow in what could only be described as a slick; the area had a defined boundary where the sea was glowing and outwith this the sea was in darkness. The ship's position at this time was 12° 07.9' N, 70° 01.4' E.

The whole area in general was alight, however the 'white horses' were glowing even more distinctly. As we entered the area, the sea around the vessel glowed a very bright luminous green, as if someone had turned a light on. The bow waves and the wake lit up even more than the area around the vessel which stayed at a steady glow, this continuing until 1726 UTC. This area of bioluminescence was two or three miles wide and stretched for about nine miles. After the vessel had passed through the patch, the sea was once again in darkness, yet behind the vessel the patch could still be seen glowing in the distance. At the end of the period the ship's position was 12° 15.2' N, 69° 54.9' E. The air temperature was 27.5°, wet bulb 25.4°, sea 28°, and the wind was W'ly, force 5.

Editor's note. Dr Herring said:

"The vessel probably encountered a patch of luminous dinoflagellates. After calm weather these buoyant microscopic organisms collect as a scum at the surface (often reddish in colour) and produce just the effect described when stimulated by a vessel or at a wave crest."

... and finally

Where circumstances conspire to prevent the inclusion of expert comment and analysis alongside observers' reports, we will print those comments at the earliest opportunity, referring to readers to the original item.

■ Luminescence reported from **m.v. Grafton**. October 2001. Page 167.

Dr Peter J. Herring, of the Southampton Oceanography Centre, said:

"I do not know what these patches were, except that they were clearly some form of plankton. Anything slightly more opaque than water looks white when a light is shone on it, and the patches must have been accumulations of small organisms. Dinoflagellates could have been among these."

■ Luminescence reported from **m.v. Shenzhen Bay**. October 2001. Page 168.

Dr Herring said:

"Dinoflagellates produce the most spectacular bow waves, but their individual flashes cannot be distinguished because they are so small. Large flecks of light or flashes would be caused by something else (perhaps jellies). All bow wave luminescence is a mixture of the lights of many different organisms (mostly very small) but when dinoflagellates are very abundant they swamp most of the other light sources."

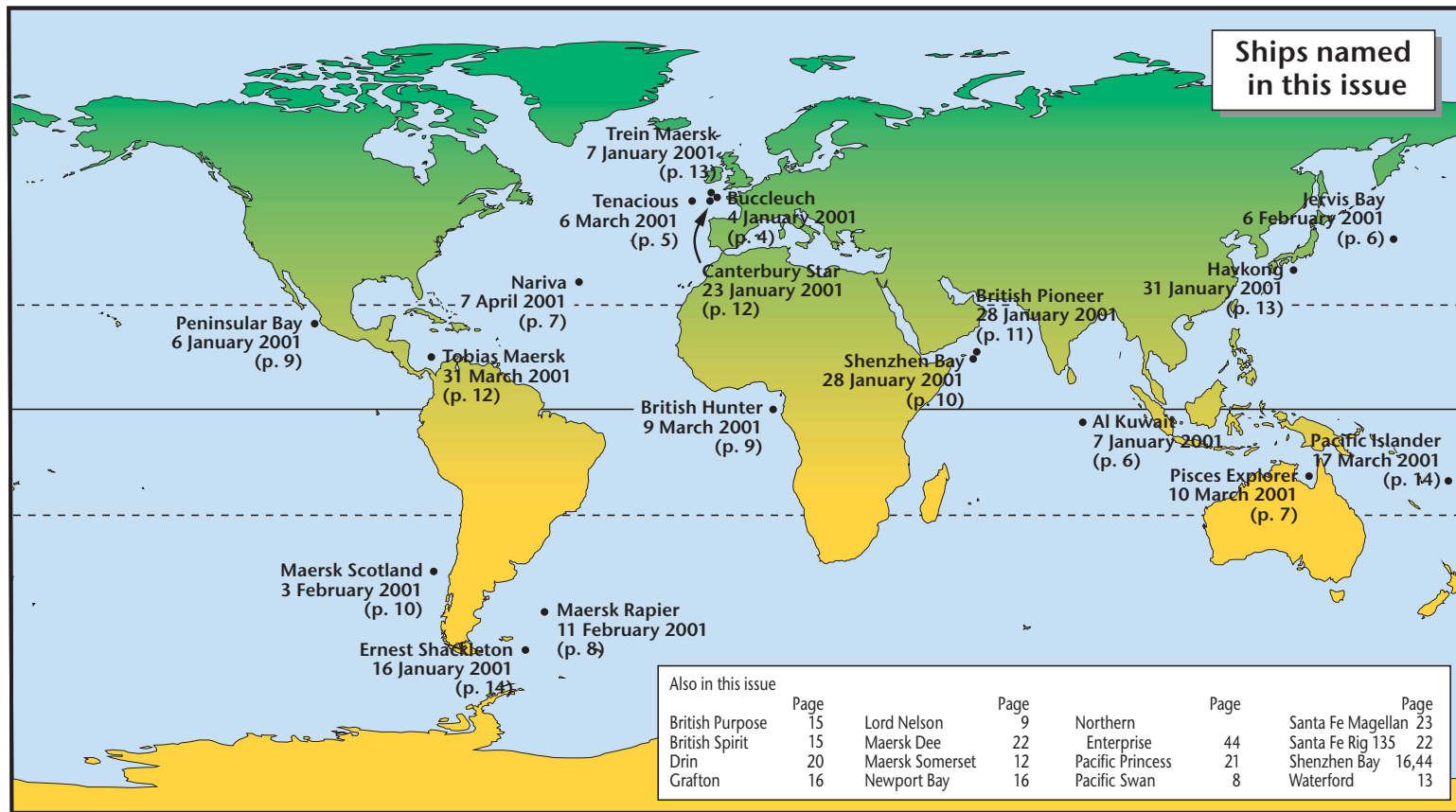
■ Dall's porpoise reported from **m.v. Newport Bay**. October 2001. Page 165.

Kelly MacLeod, of the Natural Resources Institute, University of Greenwich, said:

"Dall's porpoise (*Phocoenoides dalli*) is a distinctive species to identify at sea. There are two types — *Dalli* and *Truei* — of this species, distinguishable by the extent of the white-patch on the belly and flanks. This is larger and extends forward to the flippers in the *Truei* type. The *Truei* type is also restricted in range to the western North Pacific, specifically off the Kuril Islands and northern Japan. The position of this sighting confirms that this report was of the *Dalli* type which ranges across the northern Pacific, including the southern Bering Sea and Sea of Okhotsk.

"This species is generally encountered in groups of up to 20 individuals and is a vivacious swimmer. The Dall's porpoise commonly bow-rides, and can swim at speeds of up to 35 m.p.h. By bow riding they essentially get a free ride in the bow wave of the vessel thus reducing their energy expenditure needed for swimming. It is unlikely that they were unable to keep up with the vessel and may have simply used it to aid part of their journey. In fact, off California it has been noted that Dall's porpoises only bow ride fast moving vessels and exhibit what has been described as impatience with slow vessels (moving at less than 9 knots)!

"Whilst the Dall's porpoise is one of the most common small cetaceans in the North Pacific there is some concern over the status of the western Pacific populations. Several thousand are hunted off Japan and incidentally killed in salmon drift-nets annually. Little information exists to assess the sustainability of the populations under the pressure of such mortalities."



UK observers' sightings of cetaceans — 2000 to 2001

Identifying whales and dolphins at sea can be tricky at the best of times, and is made no easier when they offer only brief glimpses of themselves. Field guides should help a great deal, but for inexperienced observers a whale not looking or behaving exactly as described could be the source of confusion or be misidentified.

The map opposite shows whale and dolphin species that have been reported by UK observers between October 2000 and October 2001, and the plotted symbols represent species identified by Kelly MacLeod (Natural Resources Institute, University of Greenwich).

There are several plots where symbols for 'Unidentified whale' and 'Unidentified dolphin' have been used; these indicate reports where essential details were not given, perhaps because they were simply not observable or else were seen but thought to be of no significance.

When watching whales and dolphins, observers should try to provide a sketch, and also aim to answer as many of the following questions as possible:

- Does the colouring on the body show stripes?
- Are there spots, patches or mottling?
- Is the body a uniform colour?
- Is there a dorsal fin?
- What shape is the dorsal fin?
- Where is it positioned in relation to the head or tail?



- Is the general body shape slender or robust?
- Are there any scars or scratches on the body?
- Is the beak long, short, pointed or blunt?
- How long is the beak?
- How long (in whales) is the visible area of the back?
- Is there a definite 'break' where the beak meets the forehead?
- Is the forehead clearly bulbous, or gently sloping?
- Is the blow 'V-shaped'?
- Is the blow directed forward rather than being vertical?
- Is the blow bushy or narrow?

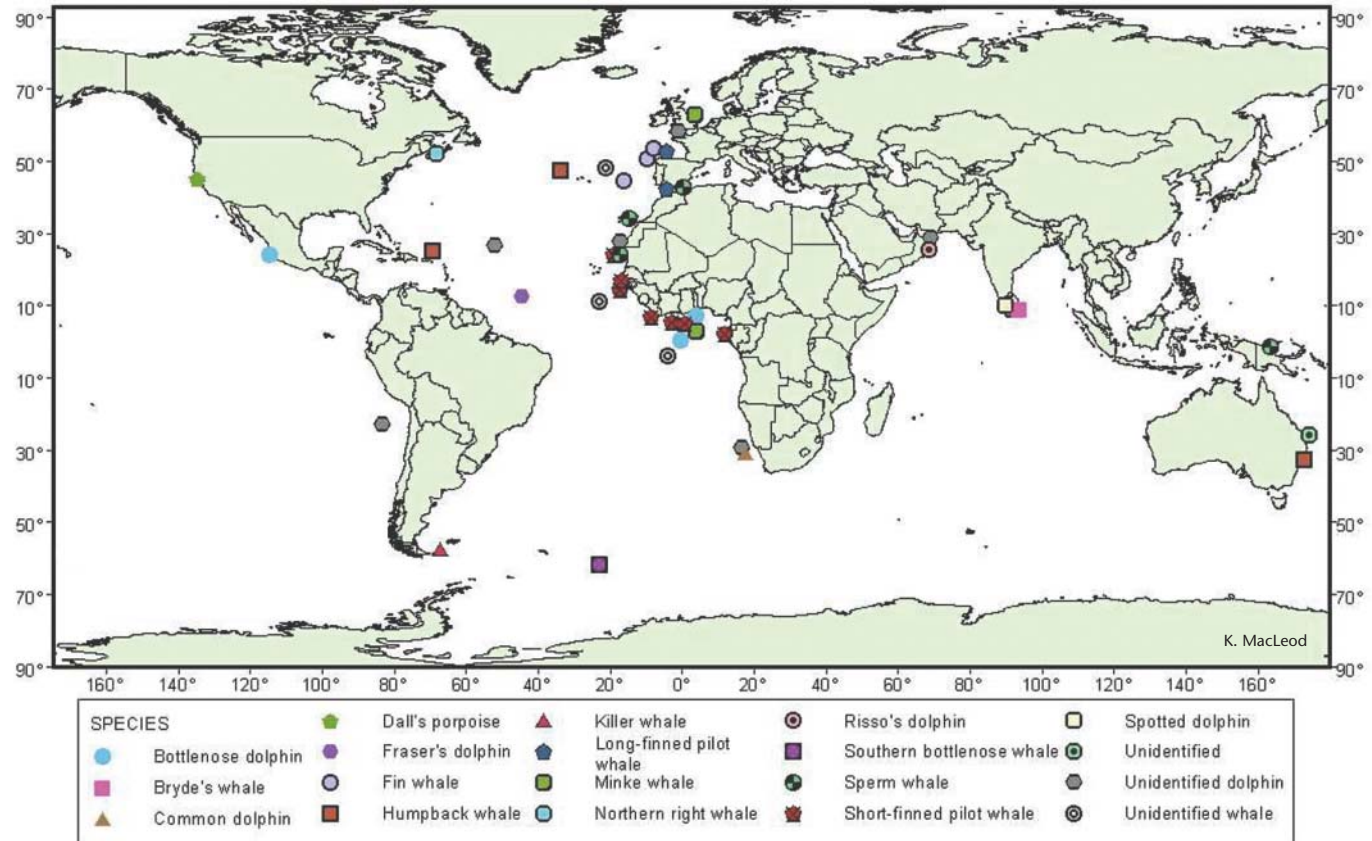
- How often does the whale or dolphin surface?
- Is the subject very active or simply resting at the surface?
- Are flukes shown when diving?
- How long does the dive last?

The availability of information provided by these questions could make identification of whales and dolphins a little easier for shipborne observers once the sighting has ended, and could also offer that vital clue to enable experts such as Kelly MacLeod to add more confirmed sightings to their records.



Photographs: I.C. Oke

Distribution of cetacean sightings reported from ships of the UK Voluntary Observing Fleet (October 2000 to October 2001).



Scene at sea



P.A. Gordon

This dramatic image of ice accretion was taken on board the Drin whilst on passage between Seattle and Qingdao in February 2001. Captain S.K. Sharma said that the vessel had departed Seattle on 7 February and experienced stormy weather throughout the voyage, with the wind averaging force 7, while the dry-bulb temperature averaged 5°.

The above was the scene in position 49° 34' N, 158° 47' E on 19 February at 0400 UTC. At this time the dry-bulb temperature was minus 11.5°, the sea temperature was 1.5° while the wind was WNW'ly, force 9. The seas of 9 m accompanied by a swell of 6 m contributed the freezing spray amid frequent snowstorms.

Scene at sea



(a)



(b)



(c)



(d)



(e)

(f)

All pictures: K Taylor

On 15 September 2001 the *Pacific Princess* was between Bermuda and Boston in position $38^{\circ} 31' N$, $67^{\circ} 42' W$ on a heading of 337° at 18 knots. The sky was overcast with no sign of rain, but at 1430 UTC conditions started to deteriorate quickly. About 4 miles away waterspouts started to form below cumulus clouds — not just one but three at once. Then two spouts twisted around each other in an embrace (see (a) to (d) taken over a period of about one minute). When the spouts neared the ship, the observers were able to see ‘inside’ one of them, the whole picture (e) resembling a mushroom. The ‘dancing twisters’ passed 30 m down the starboard side (f) whilst onlookers stared open-mouthed. The spouts moved like tornadoes — their inner cores could be seen moving in an anticlockwise direction at an alarming rate.

Observers on the starboard bridge wing (22 m above sea level) felt the suction and wind movement, whilst poor visibility, heavy rain and a drop in pressure were also experienced. The elliptical pattern on the sea surface was about 75 m wide, the disturbance being equivalent to a ‘force 8’ even though the wind was only NNW’ly, force 3. The waterspouts moved off in a south-easterly direction, the whole experience lasting for about 30 minutes. The air temperature was 25.2° , wet bulb 21.6° , sea 26° .

Woodpeckers start new drilling operations

C. Cumming



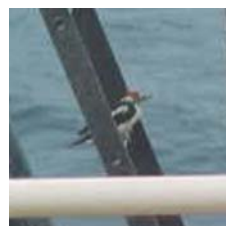
On 25 September 2001 at roughly 1415 UTC the Safety Training Co-ordinator (Jason Henderson) was on the pipe deck of the *Global Santa Fe Rig 135*, when his attention was drawn to a strange tapping noise coming from the direction of the starboard crane. His curiosity somewhat aroused, he went towards the crane to investigate and there to his utter amazement, he found a woodpecker chipping away on the crane boom.

Having been disturbed, the woodpecker flew off but was then followed all over the rig until finally cornered and caught by Mr Henderson. After making his escape from the cardboard box into which he was first placed, the woodpecker was again apprehended and given more secure accommodation in a perforated ice-cream carton. There was a debate as to whether the bird was a 'greater', or 'lesser' Spotted Woodpecker and, indeed, whether or not the species migrates. (The picture shows 'Woody' in the capable hands of Jason Henderson.)

The rig was drilling for British Gas on the Blake Field, in position 58° 11' N, 01° 20' W which is approximately 64 miles off the coast of Fraserburgh in Scotland. At the time of the event the wind was NE'ly, force 4 and the weather was partly cloudy with a dry-bulb temperature of 11.8°.

With permission from British Gas and the helicopter pilots serving the rig, the woodpecker was later flown to the mainland and then released none the worse for his experience. It was subsequently learned that two other woodpeckers had been taken ashore a few days earlier from other North Sea sites.

The *Maersk Dee*, also working in the North Sea, had been visited by another Great Spotted Woodpecker on 19 September (shown on the right). Chief Officer Gary Colby and his colleagues were greatly surprised when the bird started pecking at the wipers on the bridge windows. The ship at the time was in position 56° 43' N, 01° 18' E.



G. Colby

Postscript

With such a number of woodpeckers being reported at sea within a short time, we asked the Royal Naval Birdwatching Society if this was at all unusual. Through Commander M.B. Casement OBE, RN (past Chairman of that society), we heard from Mr S. Howe who maintains the RNBWS database (and also founded the North Sea Bird Club), who said that Great Spotted Woodpeckers are still classed as 'rare' by the North Sea Bird Club although they did turn up on North Sea installations in three consecutive years from 1981 to 1983, tapping on the deck pipework! Another was found on the Forties field in September 1986, an immature male was photographed on the Magnus field in October 1988 while another landed on the Brent field in that month.

The conclusion is that the UK 'resident' species is ssp. *anglicus*. The nominate form is a winter visitor from the north in small numbers. They cross the North Sea, on a 'broad front', mostly in the autumn months (September and October), but with occasional records also in April.

Why voluntary weather observations are so important

The value of meteorological observations from voluntary observing ships and offshore units cannot be overstated. UK voluntary observers provide weather data in two forms — ‘real-time’ and ‘delayed mode’. Real-time synoptic observation data transmitted from the observing ship (nowadays usually by Sat-C) form part of that essential information input to powerful computer systems to analyse the current situation and enable the forecasters to fine-tune the computer predictions and optimise the accuracy of their forecasts. Once the real-time potential of observations has passed, these data, which have either been recorded in ships’ meteorological logbooks or stored in TurboWin files, then assume their ‘delayed-mode’ form and are ultimately archived to a marine data bank holding innumerable observations.

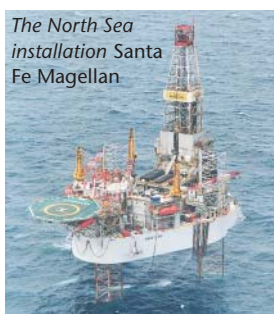


S. Key

These marine data banks contribute greatly to our understanding of the atmosphere and its interaction with the oceans. They are therefore indispensable in the development of long-range weather forecasting techniques and for addressing complex issues such as the spectre of global warming.

Depending upon the use for which marine data are required, scientists and researchers create separate datasets of selected elements from ships’ reports. Further applications featuring differing combinations of these elements, many of which might not be immediately obvious to observing officers, are outlined below.

Offshore and marine forecasts



Bob Fleumer

The offshore and shipping sectors are frequent recipients of Met Office products, either through public broadcast services or via consultancy services. For example, offshore operators can arrange to receive forecasts tailored to such activities as the movement of installations, while high-speed ferry owners can ask to receive information about the sea state which is an element essential for safe operation. In addition, forecast services are provided for helicopter operations, for which observations of cloud base, visibility and weather are particularly needed.

Much of this work takes place at the Met Office in Aberdeen. Data for these products can be obtained from automatic weather stations attached to moored buoys at various locations in UK coastal waters* but ship observations remain invaluable, and are particularly sought in the more remote areas to the north and west of the British Isles. Ships’ wave data particularly, are also priceless in the Irish Sea and English Channel, although observations in such areas should never be undertaken to the detriment of navigational safety. The parameters considered essential for commercial marine forecasting include:

- wind speed and direction;
- significant wave height and period;
- pressure and pressure tendency;
- swell direction, height and period;
- temperature and dew point;
- visibility.

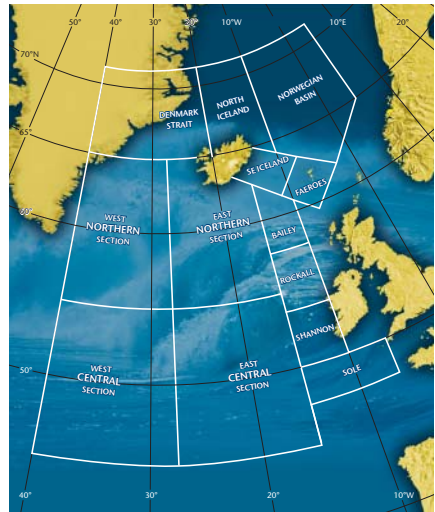
The contents of forecast products are verified on a routine basis in order to ensure the quality of weather services provided to the marine and offshore communities.

* See ‘European Group on Ocean Stations’ on page 28 of this edition.

The forecast, which is probably most familiar to seafarers, is the Shipping Forecast. This is produced by an experienced team of forecasters in the National Meteorological Centre at the Met Office, Bracknell relying heavily on the observations from the Voluntary Observing Fleet. This team of forecasters also produce the High Seas bulletin

(essentially for the high seas areas of Metarea I) which is broadcast via the Inmarsat SafetyNET™ service twice a day at 0930 and 2130 UTC.

Left: UK shipping Forecast sea areas. (Note new area FitzRoy, and changes to the southern boundaries of Sole and Plymouth, all of which become effective as of 4 February 2002.)



Right: Sea areas covered by the High Seas bulletin.

The accuracy of these products, which include forecasts and storm or gale warnings, rely heavily on marine data provided by voluntary ship observers as well as calling on data from moored buoys, automated light-vessels, offshore installations and increasingly from satellites.

Other weather forecasts and warnings which the Met Office prepares, and which will be familiar to mariners include those broadcast by HM Coastguard via the NAVTEX service. This service provides Maritime Safety Information (MSI) for the waters around the UK and out to 20°W. These bulletins are disseminated from transmitters located at Cullercoats, Niton and Portpatrick, and also via the NAVTEX stations at Malin Head and Valentia in the Republic of Ireland, courtesy of the Irish Coastguard. HM Coastguard also broadcasts forecasts and warnings via its VHF and MF service disseminated from its network of co-ordination centres located strategically around the UK coast* The service on VHF also includes an inshore waters forecast — the inshore waters of the UK being divided into 16 discrete coastal areas.

The marine observations from sea areas Lundy, Thames, Malin and Fair Isle are also used for the verification of gale warnings, an important exercise which provides the forecasters with a measure of the accuracy of their predictions. Therefore data, especially concerning wind, provided by ships in these sea areas have particular importance.

* See *The Marine Observer*, 71, 48

One area that lacks adequate observational coverage at present is the area to the north-west of the UK, between Iceland and north-west Scotland. (Formerly, when the UK fishing fleet was in a much more buoyant state, ocean-going trawlers would provide information from this area and much of the Nordic seas.)

For the shipping forecaster, the primary elements of a weather report are

- Wind speed and direction
- Mean-sea level pressure and pressure tendency
- Weather (past and present)
- Visibility

Weather and/or visibility observations are especially useful because they are frequently the only information available on the extent of sea fog, or for predicting its development, in coastal waters around the UK.



P.W. Jackson

Marine data also contribute, either directly or indirectly, to the accuracy of forecasts for aviation and can also be used by EMARC* for flood forecasting, validation of wave models for coastal defence work, and for the analysis of marine pollution incidents. Because of their close proximity to the coastline, vessels reporting in the MARID code are ideally placed to provide sea-temperature and wind data for use by EMARC.

Numerical Weather Prediction

The Met Office is one of the world's leading centres in Numerical Weather Prediction (NWP), the output of which forms the basis of nearly all the forecast services of the Office. These range from forecasts of weather over the UK for a few hours ahead to experimental global seasonal forecasts.

NWP rely heavily on marine observations, whether from the voluntary fleet or from other marine sources. A spacing of 75 km for observations would be the ideal for the scientists, but they would be reasonably happy to achieve a spacing of 200 km between surface-level marine observations around the UK. However, even this density of observations is difficult to achieve, hence the importance of every single observation that is made.

Numerical modelling requires the following elements from ships' reports:

- wind speed and direction;
- air temperature;
- dew point;
- sea surface temperature;
- surface pressure;
- visibility;
- wave height, period and direction;
- wave energy spectrum;
- cloud amount and base.

* EMARC. Environment Monitoring and Response Centre (Met Office)

The importance of the timely transmission of observations can be realised when it is noted that the first run of the computer models — the mesoscale model — which provides forecasters with information for the Shipping Forecast, is just 1hr 55m after observation time, while the second run — the global model — which provides the numerical forecasts that are used in the preparation of the High Seas bulletin, is just 3 hours after observation time. Observations received after these times are still very useful and are scrutinised by the forecaster and may result in the issue of gale or storm warnings.

Ocean applications

Sea-surface temperature (SST) observations are assimilated into the global Forecasting Ocean-Atmosphere Model (FOAM) which produces real-time analyses and forecasts of the temperature, salinity and currents of the deep ocean. The data requirement here is practically identical to that of NWP above. Both the Global, and the Atlantic and Arctic model use SST data.

Observations of surface wind speed and surface wave height/period, etc, are also needed for the operational wave models.

Climate research

The elements of SST, air temperature, wet-bulb temperature, pressure and wind speed are the primary ones used in climate research within the Met Office. All real-time surface marine data, whether from ships or buoys is ultimately stored in meteorological databases within the Met Office and, as 'delayed' mode data, can be retrieved and further stored in specific datasets for research purposes.

With research into the effects of global warming being a continual process, voluntary observing ships have an important role to play by transmitting accurate and timely weather observations.

Other applications

In addition to the main uses outlined above, marine data is also valued by a variety of other marine applications, activities and users. These include:

- the Royal Navy which uses data from all sea areas although some areas take on more importance at certain times of year e.g. during naval exercises;
- investigations into specific marine casualties or incidents such as damage to, or loss of cargo at sea, where the weather may have had a crucial influence. Such events call for the retrieval of stored synoptic observations at a range of times and in the area around the incident and may assist in subsequent marine arbitration;
- consultancy services where archived marine data can provide extensive support for a wide range of marine-related organisations. Underwriters, P&I clubs, ship-owners, marine surveyors, salvage companies, coastal engineers and naval architects regularly seek advice from the Met Office;
- investigations into climate change wherein ship data is assembled into large datasets so that they can be used to quantify global changes in sea and marine air temperature and to detect climate trends;
- an important role in the detection and correction of biases in remotely sensed satellite data.

Conclusion

From this assessment, it can be seen that, despite the increased use of satellite data and automatic weather systems in recent years, UK voluntary observing ships and rigs continue to play an extremely important role — not just in marine forecasting, but also in a wide range of other marine-related activities and applications.

It is anticipated that the accuracy of observations, and consequently their range of uses, will be further enhanced by the increased use of onboard software such as TurboWin, and by the implementation of observing programs like the VOS Climate project.*

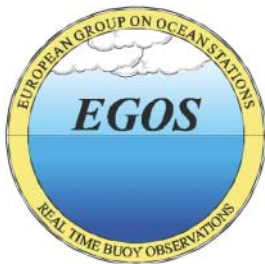
However, without the continued co-operation of our observing officers it would not be possible to ensure the quality of our marine forecasts and services.

* See page 48 of this edition for an update on the recruitment of UK ships to the VOS Climate project.

See *The Marine Observer*, 71, 76 for more general information about the VOS Climate project.

European Group on Ocean Stations

Torleif Lothe (Technical Secretary, EGOS)



In 1977 eight European countries agreed to initiate a project with the aim of setting up and maintaining an experimental European buoy network. The project* was set up as an EEC programme and, in 1979, a Management Committee consisting of one representative from each Party to the agreement was formally established to co-ordinate the project.

A Technical Secretariat was appointed to support the work of the Management Committee and, in 1988, the European Group on Ocean Stations — EGOS — was formed to help co-ordinate the acquisition of meteorological and oceanographic buoy data in the North Atlantic. Eleven years later in 1999 it was decided to also appoint a Technical Co-ordinator to help deal with the increasing number of drifting buoys.

EGOS currently functions as an action group of the joint WMO-IOC[†] Data Buoy Co-operation Panel (DBCP) and has grown to include nine member countries — Denmark, France, Germany, Iceland, Ireland, The Netherlands, Norway, Sweden and the UK. Since its formation, EGOS has proven to be an efficient forum for technical decision-makers with hands-on experience of the difficult observing regime that the oceans constitute. The buoy network has made marked advances since its early experimental phase, and the focus of EGOS has now moved on to advanced topics such as data quality, buoy metadata[‡], deployment strategy and spatial/temporal data coverage.

The objectives of the EGOS programme are:

- to maintain an operational network of drifting and moored buoys in the data sparse areas of the North Atlantic;
- to co-ordinate the development of drifting buoys provided by EGOS members;
- to co-ordinate data dissemination and monitor data quality;
- to provide information on the operational status of buoys to members and co-operating parties on a regular basis.

Deployments

The EGOS drifting and moored buoys are deployed and operated in an area of interest bounded by the latitudes of 30° N and 65° N and between the longitudes of 50° W and the European continent, including the adjacent waters of the Baltic Sea and the Mediterranean Sea.

In order to maintain a continuous operational drifting-buoy network, new buoys have to be deployed on a frequent basis. Drifting buoys are usually deployed by ships sailing from Iceland to the eastern coast of North America or by observing ships normally operating on routes from Denmark to Greenland, or from the UK to North America.

* COST 43 or Co-operation in Science and Technology action 43

† WMO-IOC. World Meteorological Organization — Intergovernmental Oceanographic Commission

‡ 'Metadata'. A large database containing observations-related data, practices and storage details.

In recent years an increasing number of air deployments sponsored by the Commander, Naval Meteorology and Oceanography Command has helped to improve the spatial resolution.

In the past decade the annual average number of operational drifting buoys in the EGOS area increased from approximately 11 buoys in 1992 to 49 in 2000 (see Figure 1 below).

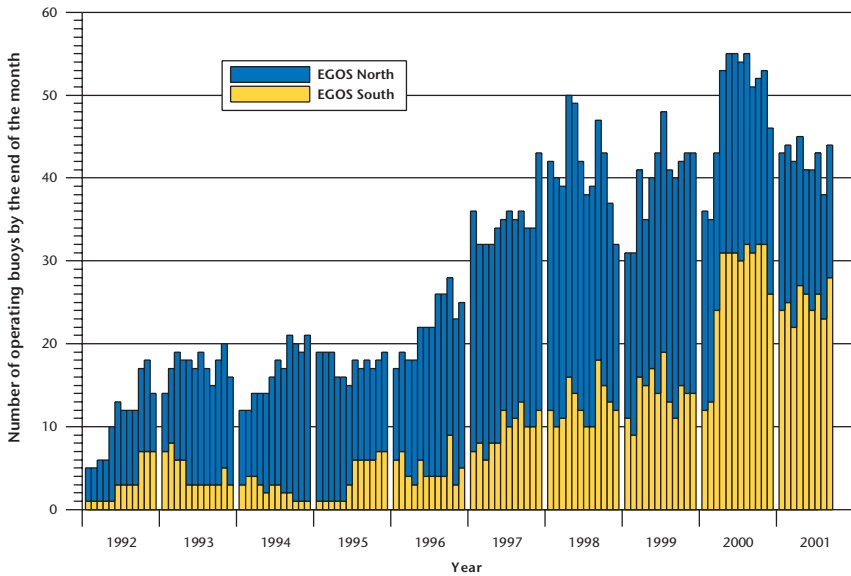


Figure 1: The number of EGOS drifting buoys reporting air pressure data on the Global Telecommunication System from 1992 to October 2001.

Note. For the purposes of the above graph EGOS is subdivided into two sub-areas — EGOS North for buoys deployed north of 50° N, and EGOS South for buoys deployed south of 50° N. Because of its importance as a development area for cyclonic weather systems most of the EGOS programme activity is in the EGOS North area.

The regular seeding of the North Atlantic with drifter buoys and the routine deployment and maintenance of the moored buoys ensures a comprehensive network of in situ observation data essential for forecasting and climatological purposes. When possible, servicing visits are made to each moored buoy at six-monthly intervals. The upper moorings are examined every 12 months and the mooring changed at three-yearly intervals.

The Met Office currently contributes nine open ocean moored buoys to the EGOS programme and, in addition, jointly operates with Météo-France the 'Brittany' and 'Gacogne' buoys located within the Bay of Biscay*. Météo-France also operates the 'Côte d'Azur' and 'Pomme' buoys. In collaboration with the Met Office the Irish Marine Institute has also recently initiated a moored buoy programme and deployed their moored data buoy, M1, at a site west of the Aran Islands. A further moored buoy, M2, was deployed earlier in 2001 to the east of Dublin and a further three new deployments are planned.

Figure 2 overleaf shows the locations of EGOS drifting and moored buoy arrays as at 2 October 2001, while Figure 3 shows the drift trajectories of EGOS drifting buoys during the first half of 2001. Interestingly, and contrary to normal expectations, very few of these buoys appear to be drifting out of the square indicated on Figure 3 to the south-west of Iceland.

* See *The Marine Observer*, 69, 116

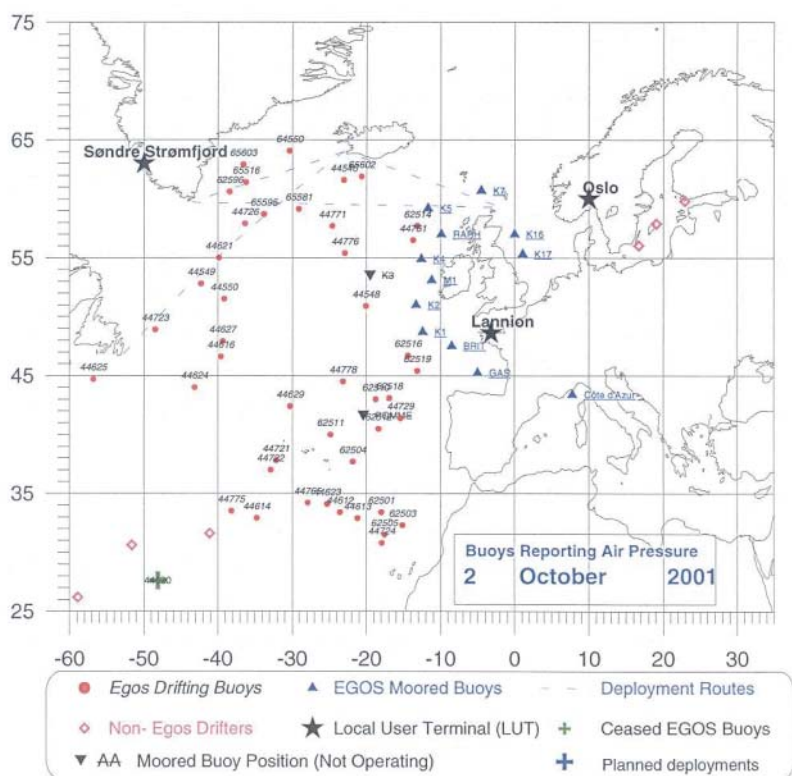


Figure 2: Location of EGOS drifting and moored buoys

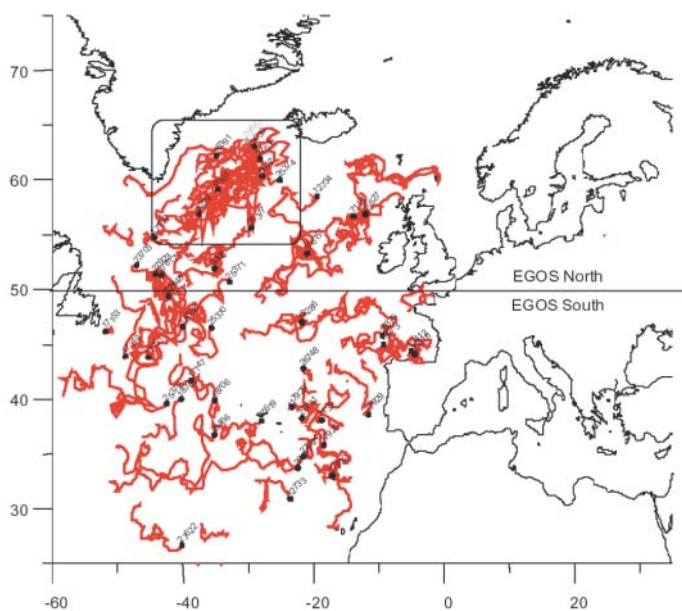


Figure 3: Drift trajectories of EGOS drifting buoys during the first half of 2001. (Note that very few of these buoys appear to be drifting out of the area to the south-west of Iceland.)

Buoy types

The drifting buoys currently deployed within the EGOS area of operation are primarily SVP-B type drifters which are cylindrical in design and report air pressure, pressure tendency and sea-surface temperature on an hourly basis. (See Figures 4(a) and 4(b)).

These buoys are made by a number of different manufacturers and some are also designed to report wind speed and direction. A smaller number of buoys commonly called FGGE* type buoys are also capable of reporting parameters such as air temperature.

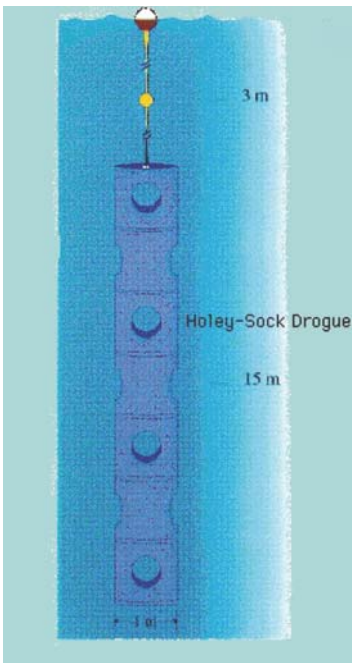


Figure 4(a) (right): SVP-B type buoys afloat and (inset) prior to deployment
Note: The buoy shown in the inset is also fitted with a wind vane



J. Turnbull

Figure 4(b) (left): Schematic diagram through a SVP-B type drifting buoy and drogue system.

The average lifetime for drifting buoys within EGOS has increased in recent years as indicated in Figure 5. Although the buoys are expendable and not intended for recovery, they are recovered and re-deployed in suitable cases.

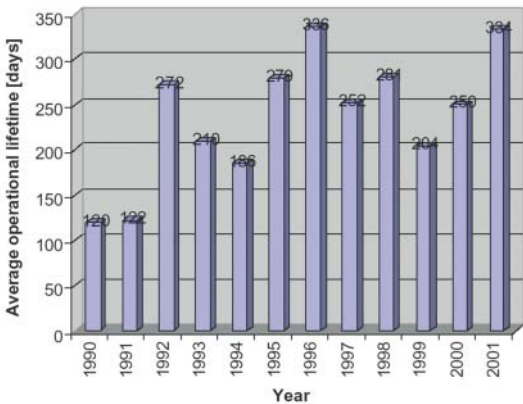


Figure 5: Average operational lifetime of EGOS drifting buoys 1990–August 2001

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

The moored buoys form part of a more comprehensive observing programme off the European continental shelf, anchored in water depths of 2,000 to 4,500 metres (see Figure 2 for locations). Parameters measured by the moored buoys include, but are not limited to, the following:

- Wind speed
- Wind gust
- Wind direction
- Air pressure
- Air temperature
- Sea-surface temperature
- Humidity
- Significant wave height
- Wave period

Figure 6 opposite shows a typical moored meteorological open ocean buoy in the process of being serviced.

The hull of the moored buoy is normally made from a combination of mild steel and closed cell buoyancy. The buoyancy, a yellow-coloured elastomer material, is protected against abrasion and damage.

The superstructure of the buoy normally comprises a truncated pyramid supporting an instrument sensor ring. The buoy moorings are usually an inverse catenary type with a one-tonne reserve buoyancy sub-surface float and an acoustic release.

The data sensors for moored buoys are duplicated (with the exception of the heave sensor) and are normally required to be capable of unattended operation in the marine environment for at least six months.

The buoys' systems are powered by sealed lead-acid gel batteries and charged by solar panels attached to the superstructure.

Each moored buoy is fitted with two multi-element radar reflectors and a navigation lamp giving an amber light. The lamp has a visibility of 5 miles and has an illumination cycle of 5 flashes in a period of 10 seconds followed by a pause of 10 seconds with no illumination.



Figure 6. Servicing a moored buoy.

Data transmission

The drifting buoys transmit data to the ARGOS system which is a satellite-based system collecting platform data before delivering it to users world-wide. Telemetry from the platforms is used to calculate the geographic position. The Argos operation begins with transmissions from Platform Transmitter Terminals (PTTs) attached to the buoy sensors.

The PTTs up-link (transmit) their messages at pre-set intervals to the Argos receivers that are on board the National Oceanic and Atmospheric Administration (NOAA) polar orbiting satellites. The transmitted messages are then relayed to one of the three main system ground stations at Wallops Island (Virginia, USA), Fairbanks (USA) and Lannion (France).

Received buoy data are also processed through local Land User Terminals (LUTs) located in Norway, Greenland and France (Oslo, Søndre Strømfjord and Lannion, respectively). This reduces the delay of disseminating data to the Global Telecommunication System (GTS).

On the moored buoys all the data from the data acquisition and processing systems are transferred to a Data Collection Platform (DCP) and then transmitted via the Meteosat geostationary satellite operated by EUMETSAT. There are usually two DCPs on each moored buoy. The data received by EUMETSAT (at Darmstadt in Germany) are then forwarded to the Met Office where they are converted into WMO FM13-XI SHIP code for retransmission onto the Global Telecommunication System.

EGOS maintains detailed buoy records and information

Data quality statistics produced by Météo-France comparing the buoy data with the model fields are reviewed and published in EGOS reports on a monthly basis. The monthly reports are prepared by the Technical Secretary and also include full details of buoys currently deployed, or planned for deployment, their locations, their sensor status etc. The reports are also made available on the dedicated EGOS web-site.*

EGOS is improving the quality of data on the GTS

The EGOS Technical Co-ordinator continuously collects information on the quality of EGOS buoy data and can interact directly with the GTS distribution system when required. If a buoy produces suspect or erroneous data the Technical Co-ordinator can arrange for the sensor data to be corrected or removed from the GTS.

EGOS is increasing the amount of data on the GTS

EGOS aims to increase the number and coverage of data on the GTS by minimising the time between deployment and GTS distribution, by optimising deployment strategies, and by performing cost benefit analyses of different buoy systems.

EGOS secures data for generations to come

The Technical Secretary maintains a meta database for all EGOS drifting buoys. This information is vital for the use of real-time data in climatological studies. EGOS intends to make this database compatible with international standards currently being established.

* <http://www.cmr.no/conmar/egos>

EGOS home pages are located at <http://meteo.shom.fr/egos/>

Summary

By combining their national buoy programmes within the EGOS framework it has enabled participating National Meteorological Services such as the Met Office to focus on their core activities while still being routinely updated on relevant technical and policy issues. Moreover, EGOS provides participating members with the necessary information to ensure that they can manage their buoy deployment strategies efficiently and also act as forum for the exchange of technical knowledge and ideas.

Addendum

A drifter was deployed from the UK Voluntary Observing ship *CanMar Pride* on 28 October, and two drifting buoys were deployed on behalf of the Met Office from the *Lagarfoss* by the Icelandic Meteorological Service at the end of October 2001.

A replacement K7 buoy was successfully deployed in mid-September 2001 and is operating normally. The K3 buoy which is shown as not operating in Figure 2 was successfully redeployed in November 2001.

* <http://www.cmr.no/conmar/egos>

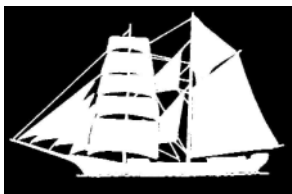
EGOS home pages are located at <http://meteo.shom.fr/egos/>

The *Mary Celeste*: a classic seaquake encounter?*

Captain D. Williams

(Deafwhale Society, Inc.)

J. Freeman



The brigantine *Mary Celeste*, commanded by Captain Benjamin S. Briggs, sailed from New York in early November 1872 bound for Genoa carrying some 1,700 barrels of alcohol. On 4 December, the British brigantine *Dei Gratia* found the little ship between the Azores and Portugal, her sails slightly damaged, several feet of water in her hold, and completely abandoned. The cargo was

basically intact, the ship was in good order, and there was plenty of food and water aboard. Only the lifeboat was gone.

The mystery of the disappearance of Captain Briggs, his wife and daughter, and the eight crewmen aboard has never been solved, and the story of this voyage of the *Mary Celeste* has become a classic.

The most accurate book ever written about the *Mary Celeste* was by Charles Edey Fay, originally published in 1917, he had travelled to Gibraltar and copied the actual records of the Vice Admiralty Court of Inquiry, which took place for several years after the ship was brought into the Bay of Gibraltar to be claimed as salvage by the crew of the *Dei Gratia*. The inquiry became the world-wide media show of the year, further securing the place of the *Mary Celeste* as the 'Greatest Sea Mystery of All Times'.

Mary Celeste heads towards the Azores

All the evidence as to what actually took place on board the *Mary Celeste*, presented here, is as described by the witnesses in the records of the Official Court of Inquiry as reported by Fay.

We catch up with the little brigantine near the Azores, where she is sailing due east with all her sails trimmed to a strong SW'y breeze. We can piece together much about the trip and the condition of the seas because we have the First Mate's log slate and the sworn testimony of the crew of the *Dei Gratia*, who were in the Atlantic not more than approximately 300 miles from the location of the *Mary Celeste*.

On board we notice the First Mate, Albert Richardson, gauging speed by hurling woodchips over the bow and counting the seconds until they drift past the stern. He computes her speed at 8 knots, then turns his attention to calculating their position, reckoning they are at 36° 56' N, 29° 20' W, about 227 miles directly west of Santa Maria Island.

The wind increases all morning. At noon, First Mate Richardson orders her sails shortened, putting a reef in her mainsail, main-gaff topsail, main-topmast staysail and middle staysail. As the afternoon progresses and the wind continues to strengthen he has the crew furl the main staysail, fore-royal, fore topgallant, and flying-jib. By 7 p.m. that evening, the wind reaches a moderate gale, increasing her speed to 9 knots.

*Reproduced with permission of the author. More information about historical seaquake observations, and also the effects of seaquakes on the ears and hearing of cetaceans can be found at:

www.deafwhale.com/stranding/observations.html

The night ahead promises to be a stormy one, the mate consults with the Captain and together they see to it that all hatches are secured and that all six windows around the cabin are battened tight with canvas and boards.

At 8 p.m. when the first watch comes on duty, the storm is raging, making it necessary to put a reef in the foresail, double-reef the upper topsail and furl the lower topsail.

Midnight passes and an eventful new day begins. The vessel makes steady progress. One o'clock, two o'clock, three o'clock — the entry against each hour reads the same — 8 knots. Soon the first streaks of dawn will be visible.

Arrival off Santa Maria

At 5 a.m. the Mate's log reads, "Made the Island of Saint Mary's, bearing ESE." (Note. Santa Maria Island was known as Saint Mary's in the 1800s.) The point of land observed by the vessel's watch, using this bearing, was probably near Ponta Cabrasente, on the north-western extremity of the island. The *Mary Celeste* was located somewhere near the small black dot on the left side of the chart shown in Figure 1.

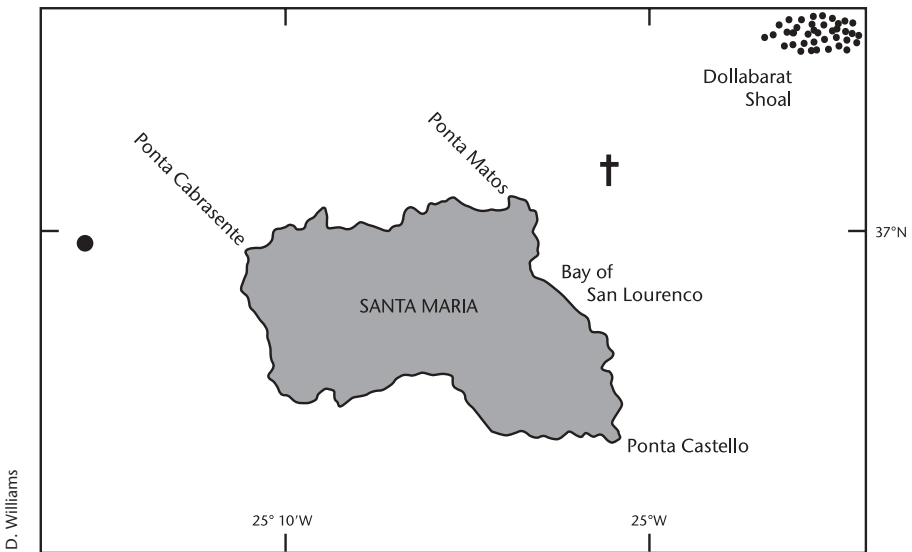


Figure 1: The approximate position of the *Mary Celeste* on 25 November at 5 a.m. (indicated by the black spot on the left), and the approximate position three hours later (indicated by the dagger symbol).

That the *Mary Celeste* had been pushed forcefully along by a gale blowing hard out of the south-west is supported by the course taken by Captain Briggs around Santa Maria Island. His first scheduled port, Gibraltar, lay on a latitude 60 miles south of his present position; therefore, the most direct route would be far south of Santa Maria Island, yet Captain Briggs steered to the north of the island. Why? The obvious reason would be to get in the lee of the island, and take a break from the rough seas. Maybe his daughter, little Sophia, was sick or had been crying the entire night? Maybe he promised his wife, Sarah, a break from the pounding sea? Maybe the crew were demanding a hot meal? The sea had been so rough during the last few days that the cook was most likely unable to fire the galley stove. Sailing on a vessel of this size during a very rough sea, seafarers would know better than to ask the cook for hot food. Cooks on sailing vessels are no different today than they were 100 years ago — no cooking whatsoever goes on during a gale! [A raging fire in the big cast-iron galley stove, which was set amidships in the forecabin, will turn out to be a key in solving this mystery.]

Regardless of all the bravado about ‘wooden ships and iron men’, the leeward conditions must have been a welcome sight after sailing for three weeks in the North Atlantic in November. As mentioned earlier, at 5 a.m. they would have been somewhere near the small black dot in Figure 1, but by 8 a.m. they would have been near the black cross. The *Mary Celeste* had taken three hours to sail the 10-mile length of Santa Maria Island which indicates that she had likely dropped anchor somewhere near shore for an hour or so, or else had slowly sailed the length of the island with only a jib set to hold course. [The cook likely lit the galley stove around 5 a.m. knowing that they would soon be on the lee side of the island in calm water.]

Disaster strikes

Sometime after 8 a.m. on 25 November, something dreadful happened on board the *Mary Celeste* that caused an experienced Master Mariner to place his wife, 2-year old daughter and seven other adults besides himself into a 20-foot yawl with 18 inches of freeboard, and hastily abandon a perfectly seaworthy, 101-foot, 282-ton vessel. The Captain had to believe, as must have everyone else, that staying aboard the *Mary Celeste* was extremely dangerous.



Left: Captain Benjamin S. Briggs



Right: Sarah Briggs with their daughter Sophia

The Azores — a seismically active area

The ocean around the Azores is one of the most seismically threatened places in the world. The Azores Fracture Zone is located about 30 miles south-west of Santa Maria. About 15 miles east-north-east lies another ‘hot-spot’ for undersea earthquakes known as the Gloria Fracture Zone. According to a chart compiled by the Acoustics Division of the US Naval Research Laboratory (1981), a major seaquake has occurred within 60 miles of Santa Maria Island every year since the beginning of man’s ability to record such happenings.

When asked whether he could be certain that a seaquake had occurred early on 25 November in the area of the sea near Santa Maria Island, Dr Lowell Whiteside, a senior geophysicist with the World Data Center in Boulder, Colorado said:

“Personnel at the National Geophysical Data Center (NGDC) have searched our database for earthquakes occurring on or near 25 November, 1872. While an earthquake is recorded by Zurich (SED) Switzerland as being felt (Intensity IV) at 46.2° N, 7.8° E (Switzerland-France border) at 1045 UT, it is not known whether this is the exact location or merely the felt location of a larger event occurring hundreds or thousands of kilometres distant. [Note. 1045 UT is 8.45 a.m. local time in the Azores.]

“The problem with identifying the occurrence of historical earthquakes from 1872 is that there were no seismological instruments at the time. The only earthquakes which could be identified, therefore were those which were felt. This means that earthquakes outside populated areas and under the ocean were seldom reported. The only evidence of large sub-oceanic events comes from tsunamis and seaquakes noted by people aboard ocean-going vessels. The Azores area is a highly seismic region and earthquakes occur often; often they are of moderate to large size. Unfortunately, because of the non-recording of oceanic events in 1872, it cannot be confirmed or denied that an earthquake occurred in that region on 25 November, 1872.”

Charles Fay wrote to the meteorological service in the Azores in 1940 to ask about the weather and any earthquakes there. He received the following answer:

"As the records from the stations in the Azores previous to the establishment of the Meteorological Service in the Islands, 1901, are kept in the Lisbon Observatory, I was forced to request the data from the Director of that Observatory, hence the delay in answering your questions. From the records from Angra do Heroísmo and Ponta Delgada, the two only stations existing in 1872, it is concluded that stormy conditions prevailed in the Azores on 24 and 25 November 1872. A cold front passed Angra do Heroísmo between 3 and 9 p.m. on the 25th, the wind shifting then from SW'ly to NW'ly. The minimum of pressure was 752 mm* and the wind velocity attained to 62 km at Ponta Delgada at 9 p.m. on the 24th. Calm or light wind prevailed on the forenoon of the 25th, but later, the wind became of a gale force. As usual the wind direction before the cold front was WSW'ly to SW'ly; after the cold front NW'ly. Fourteen millimetres of rain were collected at Angra from noon 24 to noon 25, and 29 mm at Ponta Delgada. No record of any earthquake is kept in the registers, neither in the local newspapers which we have searched."

As Dr Whiteside confirmed, no instruments or earthquake stations existed at the time to record earthquakes. The historical records of events in 1872 were created in the early 1900s by searching old newspapers and other printed accounts. Since the Azores are located in a seismically active area, an event would have had to be special in order to be newsworthy, such as would cause objects to fall from shelves or in some way disrupt the lives of inhabitants of the island. A slight tremor on land would have been too insignificant to note. However, a seaquake under the *Mary Celeste*, although not being especially notable by those on land, might have easily frightened her weary crew because of the explosive nature of her cargo.

The official court records stated that the stove was lifted up from the galley deck, by some unknown means and for no known reason, and set down in a spot away from four big chocks that secured it in order to prevent any movement in heavy seas. This 'bouncing up and down' of the stove would have loosened whatever flue system kept the burning embers away from the rigging and allowed fiery exhaust to escape into free air. Evidence also indicated that nine barrels of alcohol had leaked into the bilge. Had the same force that ruptured the barrels also bounced the heavy galley stove up and down?

A historical study of vessel/seaquake encounters strongly suggests that a medium-sized event under the *Mary Celeste* could have shaken it so violently as to cause the barrels of alcohol to leak, releasing fumes to spread throughout, while at the same time bouncing the stove up and down causing sparks and burning embers to fly about in the breeze. The Captain and crew, all knowing they were carrying an explosive cargo, would have experienced the shaking on deck followed seconds later by an overbearing smell of alcohol fumes coupled with the horrifying sight of burning embers in the same air that was filled with explosive fumes — a combination of sensual experiences that would scare the wits out of anyone and cause them to abandon ship.

What do the sails on the abandoned brigantine reveal?

The *Dei Gratia* sailed from New York on 15 November 1872, one week after the departure of the *Mary Celeste*, but did not encounter the abandoned vessel until 4 December.

The meeting of the two vessels was happenstance. It was the strange set of her sails and her irregular motion that had initially attracted the attention of Captain Moorehouse. For this reason, the condition of her sails, spars, and running rigging would be a helpful indication of what was going on at the time of the event.

*Editor's note. The pressure reading of 752 mm of mercury equates to 1002.5 mb.

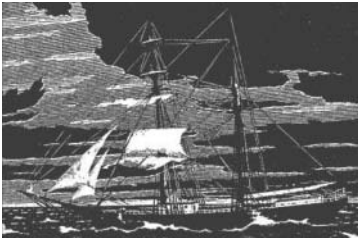


Figure 2: An engraving showing the sails set on the *Mary Celeste* when discovered. (The exact arrangement described by the crewmen on the *Dei Gratia* is not depicted here.)

The crew that found the lost ship noted that on the mainmast, the main staysail was run down loose on the forward deck-house; all the other sails were furled. On the foremast, the royal and the topgallant below it were furled. Below them, the upper-topsail, was blown away; below it, the lower-topsail was partly set, and the fore-sail (the first sail up the foremast from the deck) was reported blown away. On the bowsprit, the flying-jib was furled, the outer-jib, the jib, and the fore-topmast-staysail were set (Figure 2).

Obviously, most of the sails were furled when the *Mary Celeste* was quickly abandoned. Their loose condition indicates that whatever had occurred happened as the men were in the rigging, tending the sheets and getting ready to depart the lee side of Santa Maria Island for Gibraltar.

A seaquake hits the *Mary Celeste* — a suggested reconstruction of events

It is likely that while hove to near shore or anchored, Sarah tended to Sophia as the cook prepared their first hot meal in days. After the crew ate they took a well-deserved smoke break while the cook cleaned the pots and stowed things away.

Then, sometime after 8 a.m. (8.45 a.m. if we assume the earthquake noted by Zurich is the actual event) and after making a few calculations on the chart and setting a new course to clear south of Dollabararat Shoal (near the group of black dots in Figure 1), the Captain gave the orders to pump the bilge and run up the sails, putting order back into the *Mary Celeste*. Knowing their new course to be a safe one, he took his wife and retired for a nap, leaving the First Mate in charge with instructions to call him only if he was needed. We know this because the Captain's bed was reported unmade, something that never happened on board a well run ship in the 1800s unless the Captain was called or intended to go back to it later.

Just as the crew were setting about their duties, the seaquake erupted below the *Mary Celeste*, shaking her violently; it knocked her wooden compass stand over, breaking the compass housing, and shook one of the hands off the clock hanging on the wall in the main cabin. It vibrated the large drinking water casks loose from their chocks on the main deck, and danced the huge cast-iron stove out of place in the galley, probably flinging open its access door or lifting off one of the top lids, allowing smoke and embers to whirl about the deck. The vibrations also loosened the stays on a few barrels of her cargo, spilling alcohol into the bilge. [We know the damage is factual because it was reported by the crew of the *Dei Gratia* at the Court of Inquiry.] The men on the deck must have been knocked off their feet. Those working on the bilge pump probably were not injured, but the ones working up in the rigging were perhaps jolted, and either fell into the sea or landed hard on the deck.

Like an echo chamber, her hull thunderously reverberated the hammering on her bottom planks, inciting the God-fearing crew to think the judgement day had arrived. [Since liquids are virtually non-compressible, any vertical movement of the sea floor would have transferred to the deck through the hull, the effect felt on deck being as if there was no water whatsoever between the sea floor and the hull.] Shortly after the first shock was over, the entire ship began to permeate with alcohol fumes. Fearful of an explosion, the crew dropped whatever they were doing and ran to open the fore hatch to inspect the cargo. They opened the lazarette hatch, and the fore and aft skylights in an attempt to air out the lower decks.

Just then, the aftershocks began and more smoke, embers, and sparking bits of burning wood bellowed from the hot stove. No mention was made of the condition of the stove's flue or what type of flue system it possessed, but one would expect some means of exhausting the burning ash and smoke. [Note. The galley, located in the forecabin, with its floor some 2 m below the level of the main deck, would have been virtually enclosed on all sides save for the scuttle, or hatchway.] Whatever manner of exhaust was fitted, it was most likely lost when the stove was shaken from its chocks. Other safety standards and fire prevention measures would also have been breached when the stove was jarred loose. Under such a situation, the alcohol fumes could explode at any second and everyone knew it. Captain Briggs did the only rational thing he could do — he gave orders for the *Mary Celeste* to be abandoned.

The evidence given in the inquiry indicates that, in a mad dash, someone grabbed an axe and quickly cut the yawl loose from the main hatch and everyone helped drag it over to the starboard rail. At this point, the man with the axe grabbed the main peak halyard from the belaying pin in the pin-rack, played out a good section of line, placed it on the rail and whacked it through, making a deep cut into the rail in the process. He let the loose end go, took one end of the line he had just cut and tied it to the yawl. They heaved the yawl over the starboard side and secured it to the rail with the other end. The Captain directed his wife and daughter into the small boat, snatched his chronometer, sextant, and the ship's papers and jumped. The crew joined him.

At this point, with Sarah no doubt praying, Sophia screaming and everyone else near panic, the yawl drew away from the *Mary Celeste*. Another aftershock then occurred, sinking the yawl, turning its mass into a sea anchor and ripping the halyard loose from the rail.

Alternatively, the drama could have ended this way: To the horror of all, the halyard became unfastened and the yawl drifted away. Ten adults and a child in a 20-foot yawl with shallow freeboard stood little chance of surviving for very long in the cold North Atlantic.

The *Dei Gratia's* account of the *Mary Celeste's* condition on discovery

The evidence seems appropriate and straightforward. The crew were in the process of taking out the reefs in the foresail and upper topsail and unfurling the fore lower topsail when the quake hit. The jib and the fore-topmast staysail were never furled, remaining set throughout the ordeal. For some reason, perhaps because it was left dangling, they found that the gear of the foresail was broken with the clew-lines and bunting [sic] gone. The fore-braces on the port side were placed out of order, no doubt due to the hysteria of the men. Some of the other running rigging was left dangling for the same reason, which explains why two sails apparently tore loose from the yards and blew over board during the time the *Mary Celeste* sailed as a ghost ship.



It was reported that the main peak halyard, normally about 100 yards of stout line, was parted and most of it was missing. [Agreeable with the use of the halyard to secure the yawl.] The main hatch cover over the cargo hold was secured, but the fore cover and the lazarette cover were found removed, lying near their hatchways. [Consistent with inspecting the cargo and airing the alcohol fumes from the bilge.]

They found the wheel not lashed but spinning free and the ship's wooden compass stand, normally mounted in front of the wheel, knocked over and broken (Figure 3). [All agreeable with the panic of the moment and the severe vibrations in a seaquake.]

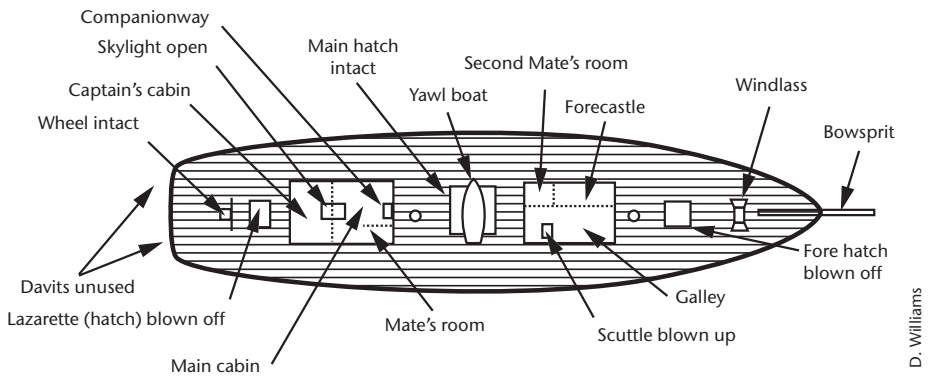


Figure 3: Deck conditions on the *Mary Celeste* upon discovery by the *Dei Gratia* (the position of the missing yawl is indicated).

Descending below, they found the cabin windows battened-down storm ready. The hour-hand had been flung from the clock hanging on the wall and lay on the cabin floor beneath it. The captain's bed was "unmade with bedding and clothes lying about as though he would soon step from the next cabin". Everything seemed to suggest that the occupants had left in a great hurry. [Consistent with the suddenness of a seaquake.]

In the Mate's cabin, they found the slate with "8:00 a.m., November 25th", printed at the top, and indicating the position off Santa Maria. Closed seaman's chests were found near the berths in the forecabin. The men's clothing had all been left behind — their oilskins, boots, razors, even their smoking pipes — as if they had left in a rush.

Seventeen-hundred barrels of commercial alcohol, poisonous if consumed, were found in the cargo hold along with 30 tons of stone ballast. [It was later found that nine barrels were empty, consistent with severe seaquake vibrations having loosened the barrel staves.]

The fact that both the galley stove and the drinking water barrels, the latter secured to the main deck by stout chocks, were jarred loose is strong evidence of a seaquake. Severe vertical vibrations transferred from the seafloor to the ship via the water column is about the only force that could cause the stove to dance up and out of her chocks!

[That a fire was burning in the stove is likely. That sparks from the fire and the smell of raw alcohol were the two factors that struck terror in Captain Briggs is also probable — these two factors might well cause most wise shipmasters to order their vessel to be abandoned.]

Her hull appeared to be "nearly new", and there was no evidence of damage by fire or smoke, and nothing to suggest there had been an explosion. It had rained for many days before the *Dei Gratia* came across the little ship so any evidence of ash on the deck would have been washed away.

The ship was provisioned for six months and her food storage casks were all in their proper places, this would not have been so if the ship had nearly capsized or had been hijacked. Indeed, the view that the *Dei Gratia's* crew presented to the Court of Inquiry was that a well-officered, well-provisioned and well-founded ship had been abandoned in mid-ocean for no reason they could ascertain.

Mysterious damage to planking on the *Mary Celeste*

However, one observation did stand out as the strangest of all. While tending the launch, one of the seamen from the *Dei Gratia* found two fresh grooves in the bow planking of the *Mary Celeste*, three feet above the waterline, mid-way between the waterline and her gunnel. This damage was the most paradoxical aspect of her condition. John Austin, Gibraltar's Surveyor of Shipping, became highly suspicious of the marks. In his official report to the Court of Inquiry, he stated:

"On approaching the vessel I found on the bow, between two and three feet above the waterline on the port side, a long narrow strip at the edge of a plank under the cathead cut away to the depth of about three -eighths of an inch and about one and a quarter inches wide for a length of about six to seven feet. This injury had been sustained recently and could not have been effected by weather or collision and was apparently done by a sharp cutting instrument continuously applied through the whole length of the injury. I found on the starboard bow but a little further from the stern of the vessel a precisely similar injury at the edge of a plank but perhaps an eighth or tenth of an inch wider, which in my opinion had been effected simultaneously and by the same means and not otherwise. However; as the Official Survey or for this Court of Inquiry, I must profess intense bewilderment as to the tool used to cut such marks and why they would have been cut in any vessel at these locations."

A possible explanation

Captain Winchester, one of the owners of the *Mary Celeste*, objected. His opinion agreed with the American naval officer, Captain Shufelt, who had determined that the injury was actually splinters or splints that had "spauled" off the wood, which had been steamed and bent to curve the bow when the *Mary Celeste* was built.

It is felt that, by his choice of the word 'spauled', Captain Shufelt must have hailed from Scotland. The words 'spall', 'spale', and 'spaling', as in 'fixing the frames with cross-spalls' are the only words that come close to "spauled" in most nautical dictionaries. Surely Captain Shufelt was not referring to the position of the frames? The word 'spald' occurs in a Scottish dialect that spells it 'spauled'. This word means to splinter, split, go apart or splay out, exactly what Captain Shufelt and Captain Winchester intended to imply by selecting the word.

The *Mary Celeste* had been 'on the rocks' several times in her long history. She had also been involved in two collisions, one of them recent. According to testimony, just prior to this trip, she had been purchased at a salvage auction in New York for US\$2,600 and rebuilt for US\$14,000. Her rebuilt condition was confirmed by the crew of the *Dei Gratia* when they said, "Her hull appeared to be nearly new".

We can assume that many of her bow planks were newly replaced. They were probably cut from black spruce, a long-fibred wood used most often in the construction of ships along the north-eastern coast of the US and in Newfoundland. Slight ring failure along the grain might have occurred in the planks while they were still curing in the repair yard. Even if they were perfect boards, the steaming and bending of the planks to fit the contour of the hull would weaken the grain.

The caulking done during her recent rebuild could also have been responsible for the edges of the planks to spaul out (Figure 4). Caulking was an extremely important process, not only because it rendered the vessel watertight, but also because driving the oakum between the planks put great pressure on them and squeezed them together tightly, so they were held in tension which added to the rigidity and strength of the vessel.

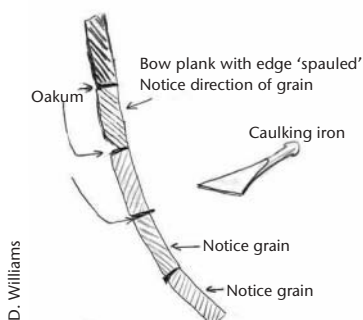


Figure 4: How the Mary Celeste's rebuild and caulking could contribute to spauling, and the damage observed by the crew of the Dei Gratia.

During caulking it was very important to allow for expansion of the planks when wet, especially if the grain ran in a direction that made splintering likely. If too much oakum was used, then a condition of excessive stress would have been established at the edges of the replaced planks. As these soaked up water, the stress would increase. Accordingly, it's not surprising that during the severe vibrations of the seaquake, long splints could be spauled from the edges of a few bow planks along the grain, making such splintering appear as if it were cut with an unknown instrument. Splintering at the edges of any new boards is direct evidence of a seaquake.

I think the 'Seaquake Theory' answers all aspects of the mystery although readers must be the final judges. Do you think the greatest sea mystery of all time has been explained by a seaquake?

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Editor's note. Captain Williams will be very pleased to hear from anybody who has ever experienced unusual sounds or vibrations at sea, and he can be e-mailed at: dwms02@yahoo.com

We also welcome readers' views on the 'Seaquake Theory' and look forward to receiving them by standard mail, or through our e-mail address: obsmar@metoffice.com

Sightings of rare whales and river dolphins

Editor's note. Occasionally we receive observers' reports featuring rare or infrequently seen cetacean species. Two examples of these follow.

North Atlantic Right Whales

The *Shenzhen Bay* was in the Halifax traffic approach scheme at 1410 UTC on 4 February 2001 when a whale was sighted at 1 point on the starboard bow, about a mile away. Even at this distance the observers — Captain J. Dodworth, O. Ridyard (Third Officer) and I. Norris (First Officer) — could see that it was very large.

As it moved across the bow, the whale displayed only its back and, from this, its length was estimated to be anything between 10 m and 15 m. Although no blow could be properly observed, and no flippers were seen, the observers were able to get a good look at its back which was smooth and showed no dorsal fin.

This feature, in the absence of anything else to go on, led the observers to believe that the whale was a rare North Atlantic Right Whale. A second whale was glimpsed briefly, but as the two crossed the bow they quickly vanished before their dive sequence could be noted. When the whales were sighted, the ship's position was 44° 25' N, 63° 25' W and it was on a heading of 330° at 19 knots.

Dolphins in the Amazon River

In late March 2001, the *Northern Enterprise* (a non-observing vessel) was moored for a few days to the Trombetas buoy on the Amazon River. On the 27th Chief Officer I.C. Oke spotted three Tucuxi dolphins near the north bank of the river; they were small, about 1.5 m long and were light-grey or off-white in colour. They also showed a small, slightly falcate, mid-length dorsal fin followed by a quite thick tail-stock. The dolphins moved slowly, and there was a period of around 30 seconds to one minute between dives.

The forehead was visible just ahead of a weak, low blow (seen through binoculars), and the dive sequence continued when the back, dorsal fin and head were all visible prior to a very slight arching movement and a shallow dive, all taking place in a slow manner.

Shortly after this, two more Tucuxi were seen on the south bank, and a further two near the north bank (these executing a few leaps from the water). A few hours later a solitary dolphin bearing the same characteristics as those seen earlier was observed close to the south bank.

On the following day, two Boto (Amazon River dolphins) were observed close to the vessel. One was possibly just over 2 m long whereas the other was nearly half that length and not so wide.



I.C. Oke

They appeared to be a mother with a calf, and both were easy to watch thanks to their leisurely movement. The dorsal ridge or hump was clearly seen (as in the dolphin shown on the left of the two in the photograph), while the body colouring was a very light blue-grey with a definite pink hue on the undersides. Their movements were almost synchronised as the much smaller calf stayed close to the adult's right side throughout.

Postscript

Kelly MacLeod, of the Natural Resources Institute, University of Greenwich, was very pleased to hear of these sightings. Of the *Shenzhen Bay* report she said:

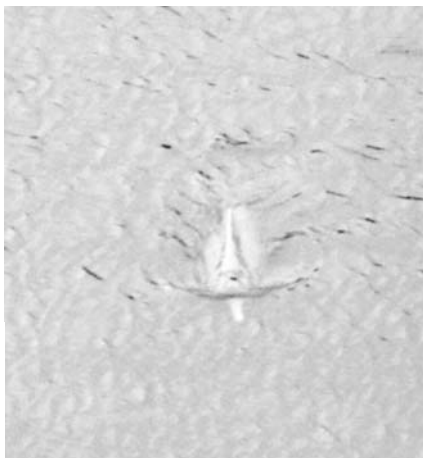
“The area of this sighting is a known feeding ground for the Northern Right Whale during summer and early autumn (June–October). The sighting of two whales of this species in the area is remarkable in itself, but especially as the sighting occurred in February. This species calves during the winter (December–March) on breeding grounds off the coasts of Florida and Georgia before making the summer migration to the more northerly feeding areas. Not all whales undertake the migration and there are year-round concentrations of Right whales in the Gulf of Maine and Bay of Fundy. However, on the Scotian Shelf, the position of this sighting, the frequency of sightings is greatest between July and October and there are very few reports in the winter months.

“Historically, the Northern Right Whale was distributed almost continuously northwards to Greenland and large winter concentrations occurred as far north as Cape Cod. The presence of these whales during winter off the coast of Nova Scotia suggests that they may be non-breeding animals and therefore, do not undertake the southward migration to the breeding grounds. The Northern Right Whale is now extremely rare having been heavily exploited in the nineteenth and early twentieth century. Although this species has received protection since the mid-1930s, the population shows no sign of recovery. The western population may be less than 300 individuals whilst in the eastern North Atlantic the population may be in the low tens with extremely few sightings recorded during the twentieth century. Direct exploitation of this species is no longer a threat to their survival but incidental mortalities as a result of ship-strikes and entrapment in fishing gear are a significant concern.

“The Right whale has only one calf every three to five years hence their reproductive capacity is low and any removal of animals from the population could have significant consequences. For this reason, authorities in Canada and the United States of America have devised a Mandatory Ship Reporting scheme to reduce ship strikes of right whales in critical habitat off the north-east US coast. There are two main zones; the first includes important feeding areas such as Cape Cod Bay, Massachusetts Bay and the Great South Channel and ships entering this area must report to the US Coast Guard. This is a year-round requirement. The other area includes the Georgia/Florida coastline and includes the breeding grounds. Mandatory reporting to the Coast Guard is required between November and April (see *The Marine Observer*, 2000, 114 for further details).”

About the sighting of the boto, Kelly MacLeod said:

“The river dolphins are easily recognisable by their perhaps peculiar features including a long, slender beak [as shown in the picture below]; blunt paddle-shaped flippers; a low, ridged dorsal fin, and their small eyes. Of the five species of river dolphin, two face extinction but the boto (*Inia geoffrensi*) is the most numerous of them. The boto inhabits the Orinoco and Amazon Rivers but the population consists of three morphologically distinguishable subspecies, which are geographically isolated from one another.



I.C. Oke

“Perhaps the most startling feature of the boto is its pigmentation which can assume a pink colouration. However, this varies greatly according to the age and sex of individuals, their geographical location, water temperature and clarity. The pink colour and crescent-shaped blowhole, displayed slightly to the left, are clearly identifiable in the photograph. They generally occur in pairs or are solitary but like many other cetaceans can be encountered in larger groups on good feeding grounds. Incidental captures of the boto in fishing gear are relatively common. However, they are not actively hunted as this species holds a

‘supernatural’ role in the folklore and legends of many Colombian people. In Brazil, however, parts of the boto, such as its eyes, oil and genitalia are considered to have aphrodisiac properties thus sustaining a commercial interest in killing this species in this area.”

Noctilucent clouds

R.J. Livesey

(British Astronomical Association)

The classical description of noctilucent clouds (NLC) is that they are pale-blue clouds seen in summer, in either hemisphere, between the latitude of 50° to 65° north or south, when the sun is at a depression angle below the horizon between 6° and 15°.

These clouds form at an altitude of about 82.5 kilometres above the Earth's surface where the temperature may be as low as 130° Kelvin. In Scotland, for example, they may be visible at times between late May and early August with the probability of a big display within a fortnight on either side of the summer solstice. They are seldom reported from the southern hemisphere because there are no suitable land masses to support observers within the classical NLC zone.

Some years ago I recall having seen a ship report in which an observation of NLC was reported. At the time it was rejected as being a false identification because the latitude and time of year relating to the ship's position fell outside the classical parameters.

In the last few years NLC have, on occasion, been reported from both hemispheres by experienced professional and amateur NLC observers at lower latitudes than the standard classical range. Further, there have been reports of NLC occurring outwith the classical months. Also, notwithstanding modulations attributed to the sunspot cycle and to major volcanic eruptions, the long-term secular frequency with which NLC appear annually seems to be rising. In addition, in the northern hemisphere at least, NLC are being seen at progressively more southerly latitudes as the years go by.

Observations of the changes in the behaviour of NLC are of vital importance to the scientists studying the Earth's upper atmosphere. Consequently, observers are being advised to keep a look out for NLC when the sun's depression angle is between 6° and 15° at *all* latitudes and at *all* times of the year. Photographs to accompany positive sightings would be a great advantage for identification purposes.

As an example of a fortuitous sighting, a video cameraman for a television programme panned across the horizon when making a film in a desert of the Middle East. A world expert on NLC happened to see the programme when it was broadcast, and identified NCL showing up in the background. The motto of the Royal Astronomical Society, freely translated from the Latin, says, 'If it shines, observe it!'

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Postbag

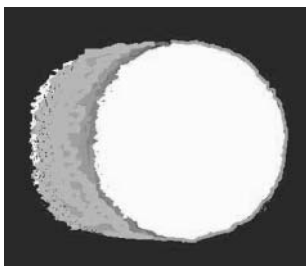
Unidentified light

Editor's note. *After 29 years the event described below by Captain Kozar is evidently still fresh in his mind. Unfortunately we are unable to throw any light on its cause — perhaps readers may have their own ideas, or be able to recall similar occasions.*

Captain Kozar writes:

"It happened in autumn 1973 in Atlantic Ocean. I was 3rd Mate on reefer vessel *Akademik Artobolevsky*. It was a night time and the end of my watch, approximately at 2320. Vessel was en route from English Channel to Cuba, about two days after passing English Channel. It was no vessels at vicinity and on the radar, visibility was excellent. We kept lookout and talked. We saw together a white light several degrees to starboard of the vessel's course. I decided that the white light was masthead light of on-coming vessel at least 15 miles away at such good visibility and she was still beyond horizon. So we just watch it without the use of binoculars and radar.

"To our great surprise the light was quickly growing and approaching. In about 15 seconds we saw a big ball nearly white with colour close to our vessel. The ball was about 20 m above the water surface and flew parallel to vessel's course. It flew parallel to sea surface all the time. The closest distance when we saw the object was about 30 m away, it came abreast of the vessel. The size of ball at that distance was like one metre in diameter.



"The speed of it was wondrous. When we saw that light at the beginning the distance should be at least 15–20 miles away because the object flew 20–25 [metres] above sea surface, and vessel's bridge was about 25 m above sea surface. It took 15 seconds to reach the vessel's beam, so object speed was approximately 1–1.3 miles per second. The object afterglow was weak, not more than one-third of diameter of object. It was a little bit glow and air disturbance around it. No noise was heard at all.

"We run to starboard bridge wing too watch it closer. But we saw leaving us light only. It disappeared in a few seconds. I have called the Master V. Taranin. He was very angry, "Why did you not call me in time?" I explained that it took half of minute only. He told me to write everything into logbook, which was done by me after watch."

Captain V. Kozar, Master of the *Hekabe*.

Correction

In the October 2001 edition of *The Marine Observer*, an error occurred on page 196 where it was stated that the year of Captain S.D. Smith's birth was 1949 rather than 1940.

We apologise for this unfortunate oversight, and for the subsequent inaccuracy implied in the details of his early sea-going career.

Noticeboard

VOS Climate Project update



Whilst observations made by ship-borne observers continue to be an essential ingredient for operational marine forecasting, a growing need for higher quality meteorological observations has been identified for climate studies, and in order to provide better ground truth for calibrating satellite data.

To satisfy this need for increased accuracy the VOS Climate Project* was established and the recruitment of UK Voluntary observing ships to participate in it commenced in late September 2001. Other nations contributing ships to participate in the project include Australia, Canada, France, Germany, India, Japan, Poland, and the US. Although a relatively small target of approximately 200 ships has been set, it is anticipated that this number, if carefully selected in respect of route and commitment to the project, will provide more or less global coverage in both space and time. The UK aims to contribute about 30 ships, and those so far recruited are listed in Table 1.

Table 1: VOS Climate Project recruited by the UK (to October 2001)

Berlin Express	Glasgow Maersk	Providence Bay
CanMar Honour	James Clark Ross	Queen Elizabeth 2
City of Cape Town	Mairangi Bay	Resolution Bay
City of London	Pegasus Bay	St Lucia
Dominica	Peninsular Bay	Scottish Star
Ernest Shackleton		

The exposure of instruments is vital to maintain continuity of observation quality, therefore Port Met. Officers will aim to visit these ships routinely to check that the exposure has not changed from the original configuration, and that the instruments are fully serviceable and are properly calibrated. During these visits, PMOs will also discuss relevant problems, if any, with the observers.

A meeting of the project team overseeing the project is planned to be held in the UK at the end of January 2002 to consider the next phase of the project. A report on developments of interest will be included in *The Marine Observer* in due course. In the interim we thank all those observers who have agreed to participate in the project.

* See *The Marine Observer*, 71, 76

Retirement

G. Allen



Captain Peter J. Barratt has recently retired from his position as the UK Port Met. Officer for Scotland and Northern Ireland, having occupied that post since 1995.

Peter's sea-going career began in 1961 when he sailed as an apprentice with Alfred Holt & Company, on the *Denbighshire*. He sailed in ships of all the Alfred Holt Group companies until 1983 during which time he sent the Met Office his first meteorological observations in a logbook from the *Glenorchy* in 1971.

Between 1984 and 1995 Peter served with the Denholm, Tamahine, Jebesen and Wah Tung companies in a variety of ships, having been promoted to command the ro-ro ferry *Exxtori* in 1987.

We thank Captain Barratt for all his efforts on behalf of UK VOF observers, and wish him a very happy retirement.

Changes to the UK Port Met. Office network

As restructuring of the work of the Observations Supply branch continues, further alterations to the UK Port Met. Office network have been made following the retirement of Captain Peter J. Barratt — Port Met. Officer for Scotland and Northern Ireland — based at Greenock.

Services hitherto available from Greenock have been transferred to the Met Office at Edinburgh. The new address details are as follows:

Port Met. Office Met Office Saughton House Broomhouse Drive Edinburgh E11 3XG

Tel: +44 (0)131 528 7305 Fax: +44 (0)131 528 7345

e-mail: pmoedinburgh@metoffice.com

Excellent awards for 2000

Thank you to all those observers who have so far claimed their awards for the year 2000. We would like to remind those from whom we have not yet heard that we need to be in receipt of claims by 30 April in order to guarantee the despatch of a book award. After this date, some claims may need to be honoured by a certificate as an alternative.

Would all observers who have not already received and acted upon letters of official notification please check for their names in the listings published in our October 2001 edition, subsequently contacting us as soon as possible if their names are discovered.

Fleet lists

Australia (Information dated 20 September 2001)

Name of vessel

Selected ships:

Aburri
Al Khaleej
Al Kuwait
Al Messilah
Al Shuwaikh
Alltrans
Alnilam
Aotearoa Chief
Arafura
Ariake
Aurora Australis
Australian Pride
Bader III
Botany Tradewind
Cape Howe
Cape Jervis
Cape York
Capitaine Cook
Capitaine Fearn
Challis Venture
Coral Chief
Danny F II
Endeavour River
Farid F
Fitzroy River
Fua Kavenga
Goonyella Trader
Highland Chief
Iron Carpentaria
Iron Chieftain
Iron Kembla
Iron Monarch
Iron Sturt
Iron Yandi
Kimberley
Kokopo Chief
Kowulka
Lindesay Clark
Maersk Tacoma

Selected ships:

Maersk Tampa
Maersk Trieste
Mawashi Al Gasseem
MOL Waratah
Mosdeep
MSC Indonesia
MSC Kiwi
Nivoso
Northwest Sanderling
Northwest Sandpiper
Northwest Seaeagle
Northwest Shearwater
Northwest Snipe
Northwest Stormpetrel
Northwest Swift
OOCL Australia
Ormiston
P&O Nedlloyd Malacca
P&O Nedlloyd Taranaki
Pacific Sky
Pacific Triangle
Papuan Chief
Pathfinder II
Perth Bridge
Pioneer
Polar Bird
Portland
Progress
River Boyne
River Embley
Roebuck Bay
Saraji Trader
Seakap
Sir Hubert Wilkins
Sitka
Southern Moana II
Southern Supporter
Spirit of Tasmania
Wauri

Selected ships:

Young Endeavour
Francesco
P&O Nedlloyd Adelaide

Supplementary ships

Botany Treasure
Duyfken
One and All
Pacific Sentinel

Auxiliary ships:

Bark Endeavour
Geo Arctic
Polar Duke

Updates to the fleet lists published in *The Marine Observer*, July 2001

India

Selected

Withdrawn: Bharatendu, Bhavabhuti

Supplementary

Withdrawn: Aditya Vikram, Chandidas, Gem of Tuticorin, Kanchan Junga, Ramdas, Sagar Deep, State of Haryana, State of Orissa, Swaraj Dweep, Vishva Kaumudi, Vishva Parag

Auxiliary

Withdrawn: Meena Bharati

New Zealand

Selected

Recruited: Capitaine La Perouse, Helen, Hermann Oldendorff, Johann Oldendorff, Rotoma

Withdrawn: Capitaine Wallis, Forum Samoa, Maasmond, Ngamaru III, Rotorua

Supplementary

Withdrawn: Arahanga

Auxiliary

Withdrawn: Charles Upham, Wellington HMNZS

United Kingdom

Selected

Recruited: Alnoof, APL Jade, British Enterprise, British Pride, Cast Progress, CEC Cardigan, Explorer, Hebridean Spirit, Jaeger Arrow, Lowlands Yarra, Maersk Ramsay, Maersk Rhine, Mineral Sakura, P&O Nedlloyd Cook, P&O Nedlloyd Shackleton, Petersfield, S.A. Fortius, Toisa Coral

Withdrawn: British Steel, C.S. Monarch, Cast Privilege, Euplecta, Eye of the Wind, Harmac Dawn, Ironbridge, Maersk Baffin, Maersk Holyhead, Maersk Shetland, Maersk Suffolk, Maersk Surrey, Maersk Sussex, Mark C, Nordstrand, P&O Nedlloyd Texas, Pride of Suffolk, Safmarine Nomzi, Sierra Nafria, Sierra Nava, Trade Cosmos, York

Marid

Recruited: Annuity

Withdrawn: Aptity, Azalea, UKD Bluefin, Union Arbo

Auxiliary

Recruited: Sinfonia, State of Manipur, Yeoman Bank

Withdrawn: Arklow Vale, Vectis Isle

