The Marine Observer

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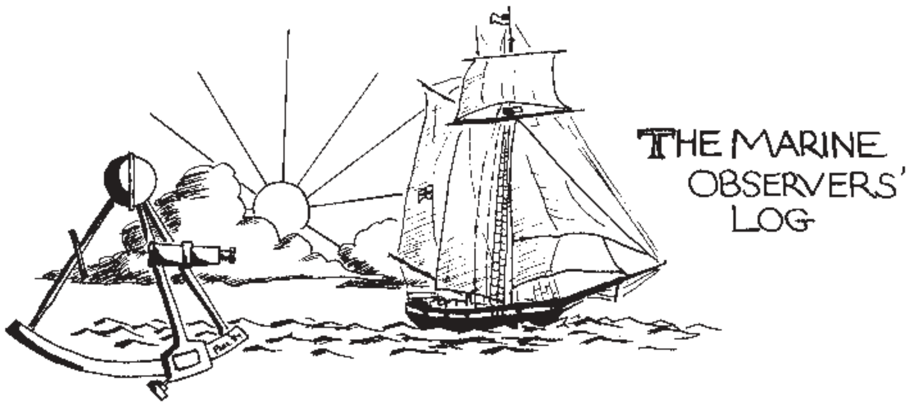


This section of *The Marine Observer* comprises reports of interest and scientific value contributed by individual observers or as part of a ship's meteorological logbook. All reports are welcome in the Observations Supply section and, wherever possible, they are forwarded to relevant sources of expertise for comment and analysis.

Responsibility for the content of any item offered for publication rests with the contributor, although texts may be subject to amendment at the discretion of the Editor.

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.

Thunderstorm

North Atlantic Ocean

25 August 2001

- **R.M.S. *Queen Elizabeth 2***
- **Captain R.W. Warwick**
- **La Coruña to Santander**
- **Observers: R. Hone (1st Officer), G. Hunter (3rd Officer) and R. Atchinkson (Cadet)**

The ship was steering 095° along the northern coast of Spain and was near Cape Ortegal when, at 1948 UTC, forked lightning moving between cumulonimbus and stratus clouds was observed although no thunder was heard. Detected on radar at this time was a band of cloud in excess of 18 miles long, lying north-north-west to south-south-east, but heading north-west.

Rain commenced at 2000 while lightning flashes numbered five per minute and, three minutes later, a large pink-coloured fork crossed 30° of the horizon, being visible for three seconds. By 2011 the lightning rate had increased to 11 flashes per minute and, by 2030, lightning was visible all around the horizon. Driving rain then began, and thunder was heard for the first time.

By 2042 the wind and rain had stopped but the occasional flash of lightning (one per minute) was still evident and this rate had decreased to about one flash every two or three minutes by 2056. At the commencement of the storm, the weather conditions were: dry bulb 19.5°, sea temperature 17.2°, pressure 1012.7 mb, wind E×S'ly , force 3. However, at 2130 it was noted that the dry-bulb reading had risen to 21° whereas the pressure had reached 1013.2 mb, the sea temperature was 20° and the wind had backed to NE'ly, force 3.

Editor's note. During 25 August 2001 a large area of thundery activity occupied much of Spain and Portugal. At around 1730 UTC thunderstorms broke out over the high ground at the western end of the Cordillera Cantabrica and moved towards the Spanish northern coast. The peak of the storm activity occurred around 1930–2000 in the area of Cape Ortegal, and the *Queen Elizabeth 2* was passing through it more or less at that time.

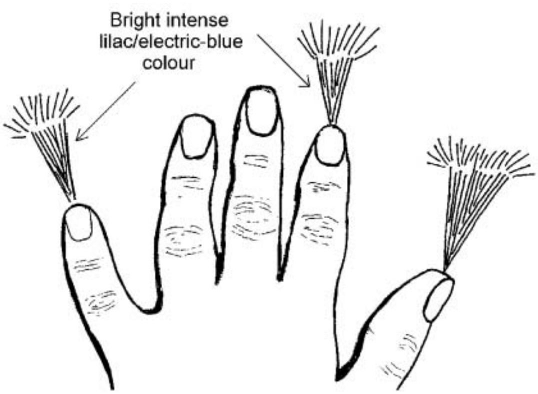
The observers' estimates of the lightning flash rate corresponds well with the records of the land-based automatic lightning detector network. This particular centre of thundery activity had largely died away by midnight, having moved further north into the western part of the Bay of Biscay in the interim.

Corposants
North Pacific Ocean
24 September 2001

- **m.v. *Providence Bay***
- **m.v. Capatain M. Barraclough**
- **m.v. Oakland (CA) to Los Angeles**
- **m.v. Observers: Captain Baraclough, S.N. Foster (2nd Officer), L.J. Bell (3rd Officer) and M.S.I. Huddlestone (Cadet)**

The ship had departed from Oakland and, not long after the pilot had left, the Master went on to the port bridge wing where he heard a buzzing sound and then observed corposants ('St Elmo's fire')at the extremities of the Monkey Island at 0324 UTC.

He called the Third Officer and the deck cadet who were on watch at the time to witness this phenomenon. All three of them placed their hands forward over the front of the bridge wing and were amazed to see St Elmo's fire radiating from their fingers, as indicated in the sketch made by the Third Officer.



The Master, who happened to have a broken fingernail, observed a luminous globe 'dancing' from one part of his nail to the other. The colour was a very intense pinkish-lilac which was clearly visible in the dark night. The cadet then stood on the wooden step that was on the bridge wing and saw St Elmo's fire shining not only from his fingers but also from the buckles on his shoes. The metal buckles appeared to be glowing bright white. Whilst doing this he felt a tingly sensation all over his body, especially in his legs. Throughout this part of the experience, 'crackling' noises could be heard from the Monkey Island above.

Approximately 10 minutes later on the starboard bridge wing, the phenomenon was seen again, this time radiating a brush discharge of distinctive pink/lilac streamers from the azimuth ring.

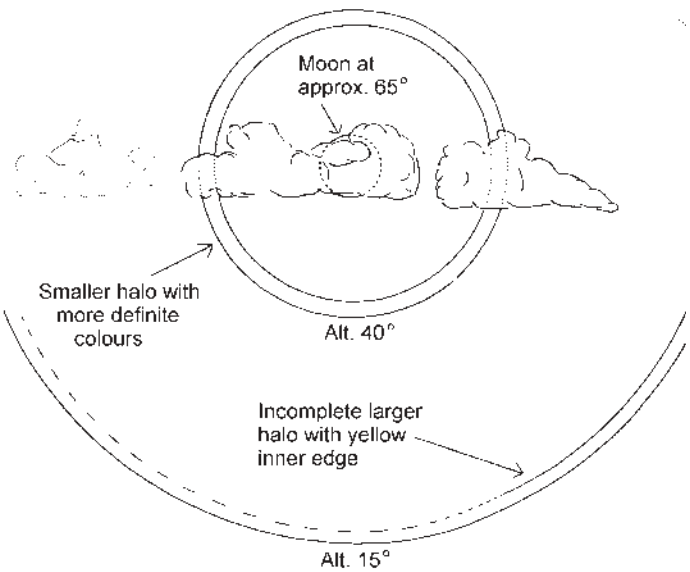
There was thunder with forked lightning very close to the vessel prior to the observation. During this period the Second Mate, who was the foc'sle, reported that he had felt his hair standing 'on end' and that his arms and legs tingled. The whole St Elmo's fire phenomenon subsided after about 20 minutes, just prior to a heavy downpour of rain. The ship's position was 37° 43′ N, 122° 42′ W and the weather conditions at the time were: air temperature 14.2°, wet bulb 13.7°, sea temperature 14.7°; the pressure was 1014. mb while the wind was virtually calm, merely light airs.

A few days later when the ship was on passage from Los Angeles to Panama, the Second Mate witnessed the same phenomenon on two consecutive nights, on both occasions when lightning was observed reasonably close to the ship.

Haloes
Indian Ocean
08 September 2001

- **m.v. *Jervis Bay***
- **Captain K.C. Riddick**
- **Singapore to Colombo**
- **Observers: Captain Riddick and J. Phillips (Cadet)**

On a clear, calm night in the Indian Ocean there were few clouds about with the exception of small cumulus and a thin veil of cirrostratus which between them amounted to three oktas of cover. At 2300 UTC part of a halo was seen around the moon; it showed a yellow inner edge but all the other colours faded into each other and were not easy to make out. The altitude of the moon was 65° while the lower rim of the halo was about 15° above the horizon. As the observers watched, a second smaller halo appeared (both are indicated in the sketch).



The altitude of this one was about 40° at its lower edge, and it was much brighter than the larger one, its colours also being much better defined. The ship's position at the time was 05° 55.7′ N, 85° 21.5′ E.

Editor's note. An article about meteorological optical phenomena appears on page 117 of this edition.

Waterspouts
South China Sea
26 September 2001

- **m.v. *British Argosy***
- **Captain D. Lewis**
- **Singapore to Daesan**
- **Observers: Captain Lewis, B. Blythe (2nd Officer) and A. Taylor (Cadet)**

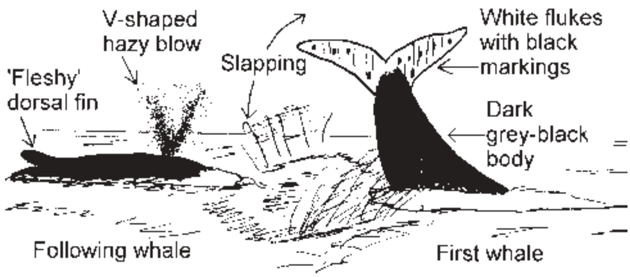
Whilst the vessel was passing through an area of rain showers, a thick dark cumulonimbus cloud based at about 200 feet was observed on the port beam. It moved rapidly towards the vessel and then two downward-pointing ‘tails’ of narrow cloud were seen forming from its base. At 0720 UTC one of them formed into a fully-fledged waterspout which rapidly approached the vessel to about three-quarters of a mile before dissipating. There was turbulent water at the foot of it.

Then another spout appeared at one point on the starboard bow about four miles ahead; this was wider than the first, also reaching the surface and throwing up spray. Meanwhile spray from disturbed water was seen on the port beam about 100 m away, and two more waterspouts formed on the starboard beam within a mile of the vessel. The five waterspouts were seen within a 25-minute period before the rain and clouds moved away in an easterly direction. At the time of the first sighting the ship’s position was 06° 12′ N, 107° 43′ E.

Whales
Tasman Sea
14 July 2001

- **m.v. *Kestrel Arrow***
- **Captain P.J. Pratley**
- **Newcastle NSW to Yokohama**
- **Observer: A.J. Bradbury (Cadet)**

At about 2110 UTC when the vessel was off the eastern Australian coast in position 31° 40′ S, 153° 00′ E, a large disturbance of the sea surface was noticed four points on the starboard bow, about half a mile away. The visibility at the time was good, and there was NW’ly wind of force 3/4 with a slight swell. With the use of binoculars it was realised that the disturbance was in fact two whales, as indicated in the sketch.



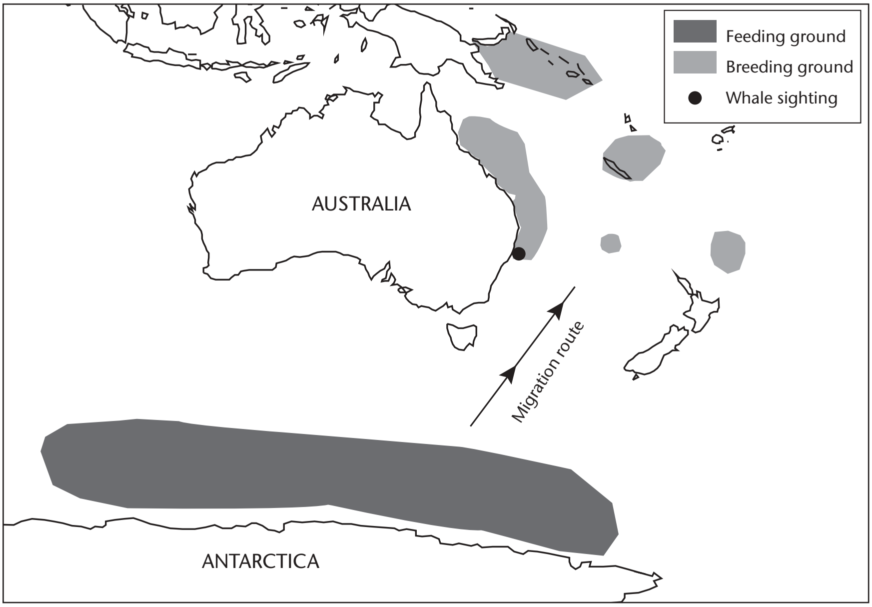
One of them kept diving forward whilst swimming at a fair speed; it would also lift its flukes high in the air and then slap the sea surface four or five times, causing an impressive splash with each slap. The whale would then submerge briefly, surface once more and then repeat the performance. The second whale followed close behind but kept a constant distance and speed while swimming in the familiar whale fashion, and blowing every time the top of its head surfaced.

Both whales seemed to be about 6 m long, possibly larger. They were very dark grey or black in colour except for the undersides of the tail flukes which were white with black spots and lines. The heads of the whales were at no time visible but their backs were noted as being rounded, with a ‘fleshy-looking’ dorsal fin, while their low, hazy blows made a V-shaped angle of about 30° .

Editor's note 1. Dr Kelly MacLeod, the Gatty Marine Laboratory, University of St Andrews, Fife, said:

"The species sighted is most likely to be a humpback whale *(Megaptera novaeangliae)*. The observers describe the characteristically small knobbly dorsal fin of this species and, most importantly, the white and "black" undersides of the flukes, which make them easily identifiable from the other baleen whale species. At 6 m, the two whales are small suggesting that they would be less than one year old. New-borns average a length of 4–4.6 m. Humpback whale calves are weaned at average lengths of 8 m and so would be with their mothers at least until this time. Since no mention is made of one animal being larger than the other I suggest that the size of the animals, in this case, has been underestimated. The estimation of the length of whales at sea is extremely difficult given that only a portion of the overall body is usually visible at the surface at any one time.

"The area and timing of the sighting indicates that they were on the winter breeding ground. Humpback whales, like other baleen whale species, undertake seasonal migrations from the high latitude summer feeding grounds, where prey abounds, to the warmer water low latitudes to breed and calf (see map below). Very little feeding, if any, takes place on the breeding grounds and the animals rely on the energy stored in their blubber reserves for the entire season. In the southern hemisphere, births peak in early August. Males outnumber females on the breeding grounds and compete, vocally and physically, for access to females. Small groups, including pairs as recorded in this observation, are most common on the breeding grounds and associations are brief.



"The surface behaviour of one of the whales is not uncommon for humpback whales; this species being the most acrobatic of the large whales. Tail-slapping may be an aggressive or threat behaviour, which may suggest that the observers potentially witnessed a form of competitive behaviour between two males. However, it is likely that surface behaviours do not have a single function and their meaning changes with social context. Female-female pairs are uncommon on the breeding ground, but the two whales observed may have been a male-female association."

"In general, southern hemisphere humpbacks are larger than their northern conspecifics. This, coupled with variations in colour, has led to a number of proposals for a sub-species to be declared. However, there is no genetic evidence to support this and so this species is best considered monotypic. A high proportion of humpbacks which winter in the Coral Sea and to the west of Australia generally, do have a greater extent of white colouration on the throat grooves and belly than other populations, in which dark-grey/black undersides predominate. If the animals had breached during the observation, the whiteness of the undersides might have been apparent to the observers."

Editor's note 2. The *Kestrel Arrow* is not currently involved with voluntary weather observing.

Birds and dolphins
Andaman Sea
31 August 2001

- **m.v. *Teignbank***
- **Captain C.C. Baines**
- **Port Klang to Suez**
- **Observers: A. Stammers (Chief Officer) and J. Simpson (Cadet)**

Whilst on the 1600–2000 watch (at 1050 UTC) the observers noted a small flock of seabirds approximately 50 m on the starboard side; they seemed to be diving for food. After watching this activity for a minute or so it was noticed that something bigger was in the water and, after a closer inspection, dolphins could be identified too.

There was a school of 15–20 small dark-grey dolphins about 1 m in length, and they joined the vessel, travelling with it for about one-quarter of a mile. During this time the dolphins — which could not be identified by those on board — played in the bow wave and wake, but then turned to the north-west and were gradually lost from sight. They were assumed to be returning to the fish on which they had previously been feeding, since the seabirds could still be seen diving as before. The ship's heading was 284° in position 05° 39.9′ N, 96° 33.9′ E and the wind was SSE'ly, force 2. The sea temperature was 28.2° and there was a south-westerly swell of moderate length.

Whales
Great Australian Bight
22 August 2001

- **m.v. *Mairangi Bay***
- **Captain A. Ellis**
- **Fremantle to Adelaide**
- **Observer: A. Graham (3rd Officer)**

At 0030 UTC when the vessel was stopped in position 35° 27′ S, 134° 33′ E and drifting whilst awaiting berthing instructions, several disturbances were observed on the starboard side. On closer inspection about 12–15 whales were seen.

As shown in the sketch, they were black in colour with a rounded head and a fairly long curved dorsal fin. It was estimated that they were approximately 5 m long. After consulting the vessel's wildlife books, it was thought that these were pilot whales. At the time of the sighting, the whales were heading east.

In brief: On 9 July 2001 at 1148 UTC, Second Officer O. Ridyard, on the *P&O Nedlloyd Hudson*, sighted two whales' blows at a distance of just over one mile. Estimated to be 2 m tall and quite bushy, they were seen at three points off the port bow, and roughly 8–10 blows were counted at intervals of 10–15 seconds. A very small but distinctly sickle-shaped dorsal fin was observed continuously above the surface while each whale breathed. Their size was difficult to estimate, but the distance between blow and dorsal area was about 5 m. When abeam the whales dived too quickly to be observed properly. They were thought to have been minke whales. The wind at the time was SW'ly, force 4 and a slight westerly swell was noted; the ship's position was 45° 08′ N, 08° 23′ W.

Sharks and dolphins
Red Sea
16 August 2001

- **m.v. *Arunbank***
- **Captain P. Stapleton**
- **Singapore to Hamburg**
- **Observers: R. Bickerton (Cadet) and I. Razbitnov (3rd Officer)**

At approximately 0750 UTC whilst passing through the Red Sea a number of sharks were spotted passing down the port side of the vessel in position 17° 20.6′ N, 40° 38.7′ E. There were six to eight in all although one of them seemed to be on its own, passing only 30 m from the ship, while the remainder were about 100 m away. They did not appear to be at all phased by the presence of the vessel.

It was thought that they were nurse sharks. Grey in colour, and about 3–4 m long, they had a small dorsal fin, flat head and a long tail that curved away from the body. The single shark was heading slowly towards the south-south-west whereas the main group appeared to be swimming in no clear direction.

One hour on either side of sighting the sharks, dolphins were seen approaching from a northerly direction. The first school was made up of about 15 dolphins that played in the bow wave and wake of the ship for one or two minutes before continuing in a south-south-westerly direction. When the second school of around eight dolphins arrived, they too played around the vessel for a couple of minutes before heading off in the same direction as the others. The dolphins were grey with long beaks, a white under-belly and medium-size dorsal fins, and were on average one to two metres long.

During the period of the observations the sea was calm with a slight swell from the north-north-west, the dry-bulb reading was 35° and the sea was 33°.

Editor's note. Dr Frank Evans, of the Dove Marine Laboratory, was pleased to receive the report of the sharks, and said:

"The suggestion that the sharks were nurse sharks is plausible although some details are puzzling. The long tail and flat head are characteristic but the dorsal fin is not exactly small, as described. Tawny nurse sharks are found throughout the Indo-Pacific region. They are lazy, largely bottom-dwelling creatures with barbels around the mouth and a good sense of smell for finding their bottom prey of small fish and invertebrates. However, they are wider ranging than other smaller bottom-living sharks, and this might have been a migrating school, although without further detail it is not possible to be certain."

Sharks
Red Sea
11 September 2001

- **m.v. *P&O Nedlloyd Drake***
- **Captain K. Worthington**
- **Suez to Singapore**
- **Observers: C. Grundy (3rd Officer) and C. Hallam (1st Officer)**

Several shoals of large sharks were seen at around 0700 UTC in position 16° 30′ N, 41° 06′ E. There were five in all, each containing about 20 grey-coloured sharks basking at the surface, and they passed very close to the ship's sides. After consulting *The Seafarer's Guide to Marine Life* by Paul V. Horsman, it was concluded that these were probably basking sharks based on the fact that they appeared to be 8–10 m long. They had two dorsal fins and a large distinctive tail fin.

The sharks did not seem concerned by the ship's presence and, as a result, were passed by it at approximately 10 m. The sea state at this time was relatively calm with small wavelets and a very confused, low, almost non-existent swell; the ship's course and speed were 143° at 24 knots and the sea temperature was 32.8°.

Editor's note 1. Dr Evans said:

"The location in the Red Sea and the very high sea temperature suggests that these were unlikely to have been basking sharks, as proposed, for this species prefers the cooler waters of the three major oceans, being recorded principally from cold temperate coastal seas. I have seen no earlier reports of basking sharks in the Red Sea. The estimated size of 8–10 m narrows the possibility of their identity; few sharks grow to this size, perhaps only the whale shark. Like the basking shark this species is a plankton feeder and spends much time moving slowly at the surface. It is known from the Red Sea and, as the observers note, it has the complement of fins found in most sharks. My difficulty is that whale sharks have an obvious broad, flattened head and this was not mentioned in the report. However, it remains my best guess.

"Much of the interest in the observation lies in the very large numbers of sharks reported — five shoals each with an estimated 20 sharks. This is an important record. A report from the *British Renown* in almost exactly this locality appeared in *The Marine Observer* (July 1990, 116).

Editor's note 2. For interest, an extract of the above-mentioned report from the *British Renown* (16 September 1989. Observers: T.T. Latto, 3rd Officer, and J. Smith, Radio Officer) follows:

"...several objects were sighted in the sea...the objects revealed themselves to be a big school of approximately 15 whale sharks. Three individuals passed very near to the vessel...at a distance of about 30 m. The distinctive flattened snout, speckled upper body and rounded dorsal fin were clearly visible on all of them. These closest specimens were...about 6 m long. Despite being near to the vessel, the sharks appeared to take no notice of the engine noise and continued to swim lazily around."

In brief: On 2 August 2001 at 1640 UTC when the *Chiquita Frances* was in the area of the Gulf of Tehuantepec, a floating object was sighted dead ahead by Second Officer M. Ranis and Third Officer W.D. Cortazar. The ship's heading of 289° was immediately altered in order to avoid the object which was successfully passed at about 8 m on the starboard side. The observers were then able to see that the object was in fact two turtles, one on top of the other, apparently in the act of mating and paying no attention to either the noise of the ship or its wake. The ship's position was 15° 09.8′N, 95° 44.8′ W and there was a slight sea with a low swell.

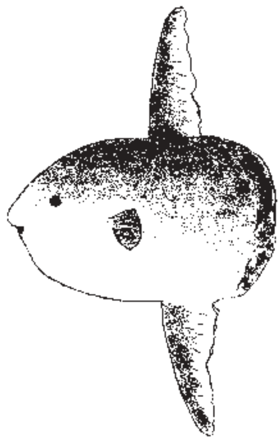
In brief: On 10 July 2001, the setting sun was observed to be distorted as it sank through a thick layer of discolouration in the atmosphere at the horizon. From the *British Valour* near Cabo de São Vicente, Third Officer C.M. Napper measured the elevation of this layer to be about 43° and it eventually caused the sun's shape to become stepped and rather triangular in appearance, while the portion of it that remained above the band showed a green tinge.

In brief: At 1405 UTC on 12 August 2001 very bright bioluminescence was seen in the bow wave of the *Shenzhen Bay*, down its sides and in the 'white horses' on the crests of the wind waves. Third Officer J. Southam and members of the ship's company observed the effect for 20 minutes during which time it was visible for as far as the eye could see. The wind was SW×S'ly, force 6 at the time, and the sea temperature read 26.9°. The ship's course was 269° at 20.5 knots on passage from Singapore to Colombo, in position 05° 51′ N, 82° 23.7′ E.

Sunfish
North Atlantic Ocean
6 September 2001

- **R.M.S. *St Helena***
- **Captain D.N.R. Roberts**
- **Tenerife to Ascension Island**
- **Observers: Captain Roberts, A. Greentree (2nd Officer), A. Williams (3rd Officer), M. Henry and G. Alderman (Cadets)**

At 1350 UTC three sunfish, one of which is shown in the Third Officer's sketch, were sighted in line at the surface, about 100 m apart and at an equal distance from the ship's sides. The ship's position was 18° 24′ N, 17° 52′ W on a heading of 180° at 15 knots, and the fish were passed on its starboard side. All three fish were about the same size, and the measurement from the tip of one fin to the tip of the other was estimated at 1.5 m. They were olive-green on their upper surfaces, and this colour faded away to pale-green or white over the remaining areas.



The sea temperature was 27° while the wind was N'ly, force 2, and there was a northerly swell of 1.0 m.

Editor's note. Dr Evans said:

"Reports of these fascinating fish are most welcome and I am glad to have this account of three sunfish of 1.5 m. from fin-tip to fin-tip. Sunfish are among the largest of the bony fish. They swim using the large dorsal and anal fins which they flap in a bird-like fashion, very like the distantly related blackfish of Ascension, the island to which the ship was bound. The tail fin is also unusual in being closely drawn round the body and is immovably rigid in the adult form. Nevertheless these fish can swim very fast when required, but their diet appears to consist largely of jelly, of which there is a huge amount in the sea — jellyfish, salps, comb jellies, Portuguese men o'war and the like — a surprising selection for such large animals.

"They are found world-wide in tropical seas but stray into temperate latitudes and my last received report from a Selected Ship was of a sunfish of 75 cm from St Bride's Bay in west Wales. There are numerous reports of the animals lying on their sides near the surface. I do not accept the suggestion that these are sick animals but believe they are lying on their sides to observe the people who are observing them, a necessary manoeuvre for such a deep bodied fish in order to look upwards. Sunfish sometimes swim with the dorsal fin breaking the surface, when they can easily be mistaken for sharks."

Bioluminescence
Arabian Sea
22 August 2001

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

At 1652 UTC the sky was dark, the moon had set and only the stars were visible — the sea was in total darkness. Ahead of the vessel a large area of the sea was lit up by a bright luminous-green glow. It was in the form of what could only be described as a slick (since the area had a defined boundary) beyond which the sea was in darkness. The whole area in general was alight although the 'white horses' were glowing even more distinctly. As the ship entered the area, the sea around it 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 general area around the ship. This continued until 1726.

The area of luminescence was two or three miles wide by nine miles long and, after passing through it the ship was once again in dark sea, although behind it the luminescence could still be seen glowing brightly in the distance. At the time of the event the sea temperature was 28° while the wind was W'ly, force 5, and the ship's position at 1652 was 12° 07.9′ N, 70° 01.4′ E.

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

"The ship passed through a patch of luminous plankton, and the organisms most likely to have been involved were dinoflagellates. They are single-celled (but may measure up to a millimetre in diameter) and sometimes occur in dense patches (visible in daylight as 'red tides'). Not all are luminous, but those that are produce just the appearance described here, as they respond to the mechanical stimulus of surface turbulence. The accentuated effect in the wave crests is a feature of the increased turbulent shear. Some luminous dinoflagellates are buoyant and, in calm conditions, they accumulate in large numbers near the surface."

Meteor Shower

North Pacific Ocean

12 August 2001

- **m.v. *P&O Nedlloyd Kobe***
- **Captain J.L. Petersen**
- **Shimizu to Singapore**
- **Observers: D.J. Harkness (2nd Officer) and G. Anderson (SM1)**

Whilst on a heading of 232° in position 24° 13′ N, 125° 59′ E, the Perseids meteor shower was observed between 1500 and 1900 UTC (midnight to 0400 SMT), having also been clearly seen on the previous 08–12 watch. The sky offered good observing conditions throughout, being cloudless with good visibility.

Numerous meteors were sighted, sometimes several within 'split seconds' of each other, sometimes at intervals of around 20 minutes. They appeared as bright white objects travelling very quickly in a straight line orientated along 300°–260° approximately, at an altitude of 25°–30°. Occasional meteors appeared either at higher or lower altitudes than this range, but they were not as frequent. The duration of flight averaged less than one second, and trails were rarely produced.

Editor's note. An article about the prospects for viewing the 2002 Perseids appears on page 137 of this edition.

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 Hawk.* Observers: Captain C. Gaukroger, D. Lavery (2nd Officer), and E. Lavery (Supernumerary)

On 31 July 2001 on a clear, fine afternoon a wake was observed fine on the port bow at1800 UTC, and the distinctive blow of a whale was soon apparent. As the vessel approached at closer range, this single whale was revealed to be quite large and, on breaching, the 'throat grooves' of a rorqual species were evident. There was no 'fluking' when breaching, but as the whale twisted prior to re-entry to the sea, the underside of the flippers could be seen to be white. From an onboard publication describing whales it was deduced that it may have been a fin whale. It appeared to be travelling alone (at least no other whales were seen) and in a north-easterly direction.

The ship's position at the time was 21° 19′ S, 95° 54′ W whilst on passage from Long Beach to Caleta Cordova (Argentina).

m.v. *British Spirit.* Observers: Captain A.M. Lakey, R.K. Harding (Chief Officer), J. Whitehead (2nd Officer), P. Hilditch (3rd Engineer) and N. Nodado (AB)

On 10 September 2001 at 0010 UTC as the vessel approached its anchorage position of 31° 54.8′ S, 115° 33.1′ E (off Rottnest Island) a number of whales, perhaps eight or 10, were spotted — but at a distance and in very high swell conditions which made any form of detail too difficult to make out.

At one point a very large whale was observed to emerge vertically from the water astern of the vessel to the extent where only its tail remained immersed. It rolled onto its left side as it fell back into the water. Very spectacular!

At 0645 while the vessel was lying at anchor, two more whales were observed within a couple of hundred feet of the vessel. They were swimming very close to each other, one had extensive white patches across its back and a very small white triangular dorsal fin. The trailing edge of its tail was white. The other was all dark grey including its (again) very small triangular dorsal fin. The underside of both whales' tails was completely white. Their fins seemed to be totally out of scale to the overall size of the animals.

Casting light on meteorological optics

It was once believed by physicists that white light — that emitted by the sun — was the pure form of light, and that any colours detected in it were the result of added properties somehow gained through reflection from other matter. Following on from research into the properties of light by Descartes in the first half of the seventeenth century (in which he established the principle of refraction), further extensive investigations into the subject were made by Sir Isaac Newton in the latter half of that century. Working with light and glass prisms he concluded that, rather than white light being the 'norm', it was coloured light that was fundamental and, in 1666, demonstrated how it could be recombined into white. Newton's ground-breaking work was finally published in his book *Opticks* in 1704.

Research into light has since revealed that it interacts with particles in the atmosphere in several ways such as, by refraction, reflection, diffraction and scattering. Seafarers often report sightings of haloes, mock suns, rainbows and coronae (resulting from the first three of these mechanisms), and witness spectacular sunsets and other effects caused by scattering.

1— Optical effects associated with light and ice

The way in which energy waves — whether they are rays of light, or sound or radio waves — bend on passing through a medium of varying density, or through a boundary separating one medium from another, is termed 'refraction'. When light passes directly from one medium to another which is more dense optically, it is immediately bent away from the straight path it would otherwise have followed. When passing to a less dense medium, light is again bent away from its former path (Figure 1). This simple principle lies behind the formation of many optical phenomena in which colours appear. In the formation of haloes and coloured arcs, sunlight passes from air into individual ice crystals of cirrus clouds and back into air again. However, the shape of the feature(s) observed in the sky depends in turn upon the shape of the crystals, their orientation, density, movement, and the route taken by the light through individual crystals. Additionally, the altitude of the sun or moon dictates the features that might be visible at all.

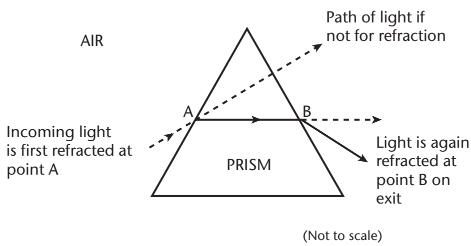


Figure 1: *A prism demonstrates the principle of refraction, showing how light passing from less dense medium into a more dense one, and out again is made to bend twice*

Haloes

Cirriform clouds comprise multitudes of groups and individual ice crystals, and it often occurs that a proportion of them will be placed relative to the observer such that parallel light from the sun passing through them will be refracted into the observer's eye. Ice crystals usually responsible for optical features take the forms shown in Figure 2.

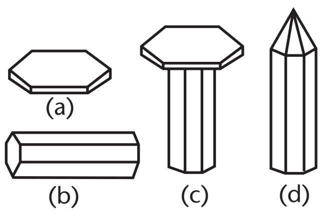


Figure 2: *Ice crystal shapes responsible for the formation of halo phenomena: (a) plate; (b) column; (c) capped column; (d) bullet or needle.*

Of these, random arrangements of the hexagonal column allow the formation of the 22-degree halo, and the 46-degree halo. Figures 3(a) and 3(b). The angles generated in halo phenomena depend on the optical density and refractive characteristics of ice — the latter known as its refractive index. (The value of this index is individual to each type of refracting surface, i.e. it differs from that for water, for example.)

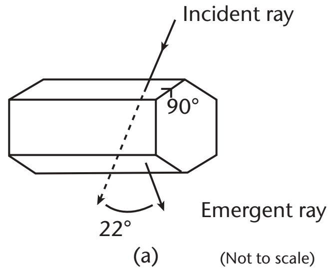


Figure 3(a): *The 22-degree halo forms when light enters one face of an ice crystal and exits through another, refracted by a total of 22 degrees in the process.*

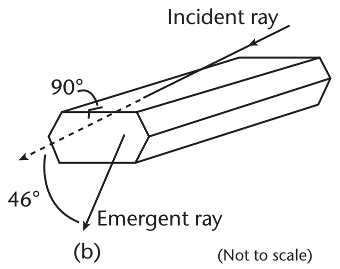


Figure 3(b): *The 46-degree halo forms when light enters one face of an ice crystal and exits through one end of it, refracted by a total of 46 degrees.*

The 22-degree halo is the most commonly observed ring around the sun or moon, whereas the 46-degree version is more likely to be seen only partially since the area of cirrus cloud needed for the formation of a complete ring is very large.

Observers should not assume that these are the only two haloes to be seen, for other 'odd radius' haloes are also possible. Should light be refracted by rare pyramidal crystals having a pyramid top angle of 56.142°, observers might be able to take measurements of haloes with radii of 18, 20, 23, 24 or 35 degrees.

Colour in haloes

When light is refracted, the amount of bending depends on the wavelength of the incident rays and the optical properties of ice. Sunlight comprises a spectrum of colours each with its particular wavelength; those towards the 'red' end of the spectrum are refracted to a lesser extent than those at the 'violet' end. The result is a smaller red ring nearest the sun, followed by concentric larger rings of other colours all of which constitute the single feature known as the halo. Yellow and green rings are sometimes seen outside the red one, but the outer edge of the halo is usually a whitish colour since the refractive properties of violet and other colours 'cancel' each other out. In the 46-degree halo, the colouration is similar although not as bright, but the colour separation is more clear.

Observing halo phenomena

Cirriform clouds that have the greatest potential for the formation of halo phenomena are those that contain well formed crystals — normally clouds that are actively developing. Cirrostratus is the best provider, especially if large areas of the sky are covered (or being covered), but virga ('fall streaks'), contrails, the anvil tops of cumulonimbus, and patchy cirrus resulting from decayed cumulonimbus tops are also possible sources.

When observing haloes always protect the eyes, and stand so that an object (a hand, post, or corner of the ship's superstructure, for example) obscures the sun itself. If no measurements of a halo radius can be made, try to estimate the size by hand — for example, if the thumb of an outstretched hand is placed over the sun, and the tip of the little finger reaches the halo ring, then a radius of approximately 22 degrees is indicated.

Look for additional features such as: upper or lower tangent arcs to the halo; a circumzenithal arc nearly overhead; arcs that might be part of larger or smaller haloes than the 22-degree form; parhelia (these could indicate the presence of features elsewhere in the sky, even behind the observer); the colourless anthelion in the opposite direction to the sun, and the two paranthelia (bright 'beads 'on the parhelic circle); individual arcs in any part of the sky. Figure 4 shows features that might be seen in a well-developed halo complex.

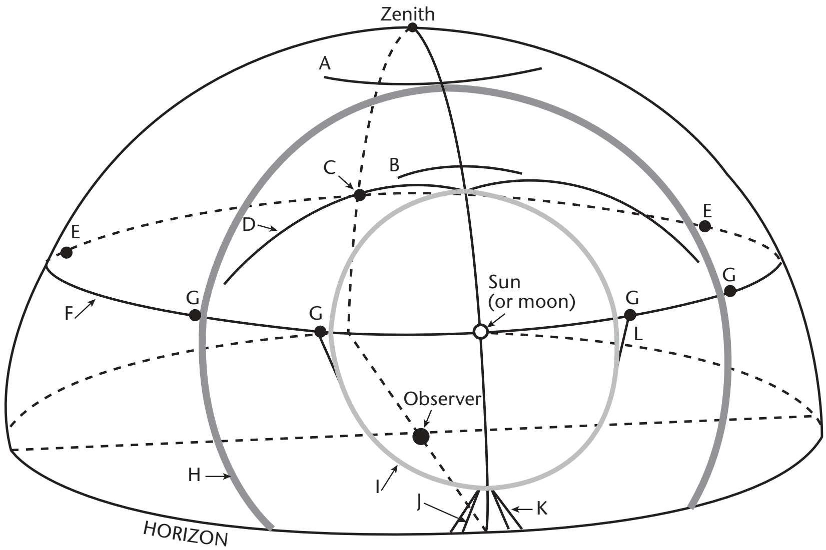


Figure 4: *Haloes, arcs and other features of a complex halo display.*

KEY: A–circumzenithal arc; B–upper Parry arc; C–anthelion; D–circumscribed halo; E–paranthelion; F–parhelic circle; G–parhelion; H–46-degree halo; I–22-degree halo; J–lower Parry arc; K–lower tangent arc (part of the circumscribed halo, see Figure 5 for the complete feature); L–Lowitz arc.

If a display seems at all unusual or complex, note the features that are presented, and any colours seen. Make a sketch if possible and include the date, time (UTC), position and solar/lunar elevation.

Associated phenomena

Associates of the halo family can form when crystals lie in preferred orientations, and occur mainly in colder climates. Some features that might be seen are:

Tangent arc to the top of the 22-degree halo — This bright arc, as its name implies, only touches the upper rim of the halo, forming if there are ice crystals that lie with their long axes orientated horizontally.

Sun pillar — Plate crystals and the basal plates of capped columns are also responsible for the sun pillar, which can occur above or below the sun. Pillars produce no colour of their own, but since reflection is the mechanism behind their formation, they take on the colour of the sun and therefore often appear to be yellow or red.

Parhelic circle — This colourless horizontal ring of light runs through the sun and encircles the sky parallel to the horizon, the light appearing to come to the observer from every point of the compass. Vertical side faces of capped columns, plate crystals, and the ends of horizontal columns reflect light to form the circle. Because the sky is not often covered by sufficient uniform cloud, this ring is rarely complete.

Arcs — Numerous arcs can occur all around the sky. They can all be brightly-coloured since they are refractive features, many being found in association with the haloes of 22 and 46 degrees, parhelia, paranthelia, the anthelion (counter-sun) and the zenith. Figure 5 shows the arrangement of many of these arcs.

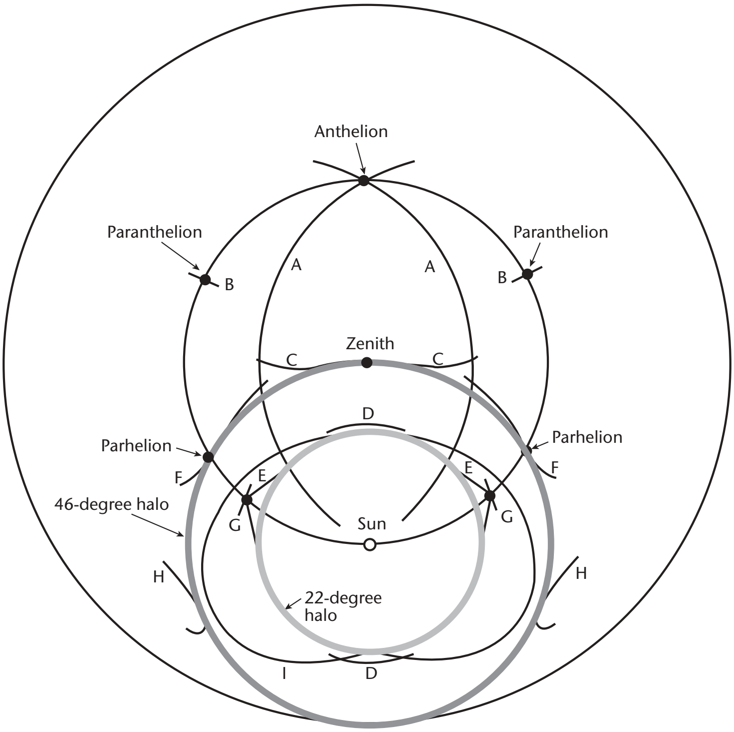


Figure 5: *Arcs that may occur individually or in association with more common optical effects.*

KEY: A–anthelic arc; B–paranthelic arc; C–upper tangent arc to the 46-degree halo; D–upper and lower Parry arcs; E–supralateral arc of the 22-degree halo; F–supralateral arc of the 46-degree halo; G–mesolateral arc of the 22-degree halo; H–infralateral arcs of the 46-degree halo; I–circumscribed halo (shown whole, but this 'halo' is often incomplete, appearing as separated upper and lower arcs, as shown in Figure 4).

Circumzenithal arc (Figure 6) — This often spectacular arc lies at the top of the 46-degree halo (often mistaken for a tangent arc) convex to the sun, and forms when prisms lie 'on end'. It can lie almost overhead, but does not form where the solar elevation exceeds 32 degrees.

Parhelia ('mock suns' or 'sundogs') (Figure 7(a) and (b) — Quite often observed alone, or else seen lying just outside the 22- and 46-degree haloes, these brightly-coloured spots of light lie one on each side of the sun. They form when plate crystals (which tend to 'flatten' as they fall) lie with their flat faces horizontal, allowing refraction of 22 degrees.

Halo phenomena can also occur by night although the lesser intensity of moonlight weakens their appearance. Additionally, the human eye does not easily detect colours in low light conditions, therefore lunar halo phenomena usually seem to be white or grey in colour. Nevertheless, very bright moonlight may permit the detection of faint colours occasionally.

Examples of common meteorological optical features

***Figure 6**: Circumzenithal arc lying almost overhead.*

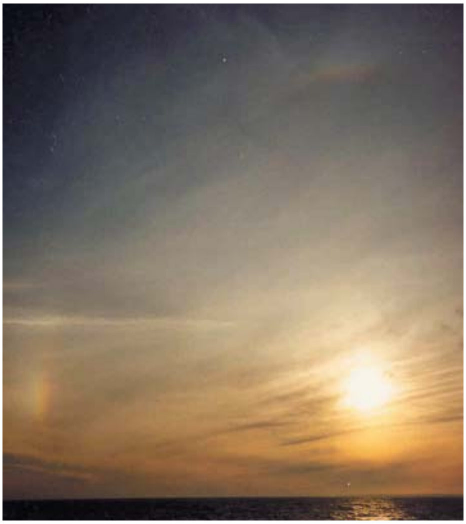


***Figure 7(a):** A simple halo display that shows a faint upper arc of contact at (i), a parhelion at (ii), with a section of an indistinct 22-degree halo on which these two features lie.*

***Figure 7(b):** A bright parhelion to the right of the sun. Parhelia are among several bright spots that lie on the parhelic circle and can appear at various positions around the sky. The parhelic circle itself, if present, is a colourless white ring lying in the horizontal plane, passing through the sun.*

Editor's note. Links to additional information about halo phenomena:
http://www.astrophys-assist.com/wilobs/weatherwin/haloes.htm
http://www.weather-photography.com/Atmospherics_Optics

Halo photography

The sun and the nearby very bright sky should always be obscured by an object or hand. A 'compact' 35-mm camera, digital imager or even disposable camera can be used, but any auto-focus facility should be locked on 'Infinity' since haloes are difficult targets for automatic settings.

Single lens reflex cameras with a standard 50-mm lens are another alternative. A standard 100 ISO film should be sufficient for all cameras and, if possible, the exposure should be stepped down by two settings from that provided by a light-meter or automatic camera exposures. Generally, exposures of f500/22 for the solar direction, and f125/18 elsewhere should give reasonable results. If necessary, a range of overlapping pictures could be taken with any camera with the exception of 'polaroid' types (which are not well suited to halo photography anyway).

Commercially processed negatives may give disappointing results owing to the 'blanket' settings generally applied during mass processing (an image of halo phenomena might well register as 'over exposed' and be completely omitted). However, if adequately informed beforehand of the content of the undeveloped film, some photographic shops undertaking to process films themselves may be willing to try and adjust settings in order to compensate to some extent for what may appear to be over exposed film. Digital imagers avoid this type of problem, but users of this format should remember to archive their shots — perhaps even make duplicates — before considering any other form of processing.

2 — Optical effects associated with light and water

Whereas the halo phenomena are associated with the presence of ice crystals in cirriform clouds, many other features familiar to the sky-watcher result from the interaction of light with water droplets. These effects include rainbows, coronae, iridescence and 'silver linings', which between them involve the mechanisms of refraction, reflection, and diffraction.

Rainbow

A rainbow will be visible if the sun is behind the observer, while a mass of falling raindrops illuminated by the sun lies ahead, whether close to the observer or at a distance. The coloured bows, which form around the antisolar point (the point above or below the horizon, towards which an extension of the line from the sun to an observer's eye is directed) are produced by the refraction and internal reflection of light by the raindrops.

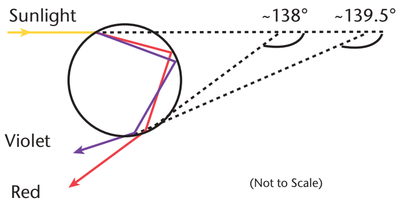


Figure 8: *Simplified diagram showing the passage of light at minimum deviation* through a water droplet. (*That point where the minimum change of direction is suffered by the incoming ray.)*

Figure 8 shows the passage of light at the point of minimum deviation through a random water droplet.

On entry, the component wavelengths of sunlight are refracted by different amounts, resulting in rays of separate colours. These are in turn reflected internally by the rear 'mirror' wall of the drop.

On exit the coloured rays are refracted once more. Descartes found that the deviation for red light was about 138 degrees in all, and that it was a concentration of incoming rays concentration of incoming rays near this path of minimum deviation that was that was responsible for the formation of rainbows.

Colour in the primary bow

Of the rainbow 'family', the primary bow is seen most often and is frequently reported by ships' observers. This bow shows the following colour sequence (starting at the outside): red, orange, yellow, green, blue, indigo and violet. In a well-developed display, a secondary bow lies outside the primary one, and shows the colours in reverse sequence, while inside the primary bow there may be one or more supernumerary bows (see 'other effects of diffraction' page 125).

The mechanisms of refraction and reflection are responsible for the colours of the rainbow. As may be deduced from Figure 8, violet light, being deviated the most, makes an angle of about 40 degrees relative to the observer's eye (on the line of the antisolar point), whereas red light makes an angle of 42 degrees, with other colours emerging at intermediate angles. Figure 9 helps to show how the traditional sequence of colours reaches the observer's eye. Since only one colour of light is observed from each raindrop, incalculable numbers of raindrops must surely be involved in the formation of a primary rainbow.

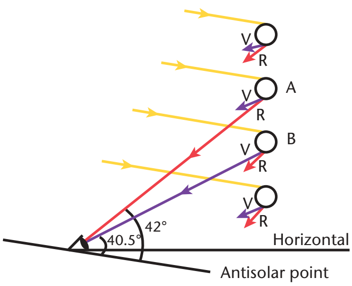


Figure 9: *The primary rainbow. Some of the light that refracts at minimum deviation reaches the eye. From drop A, the red component (R) is received, while from drop B the violet component (V) is received. Intermediate drops provide the other colours in the well-known sequence.*

The highest arches, with their tops at 42 degrees, will be seen only when the sun is low relative to the horizon, and they become more and more shallow with increased solar elevations.

The secondary bow

The secondary bow lies outside the primary and forms in a similar manner to its partner (weak secondaries can be seen in Figure 10(a) and (b)), but it is not so bright and displays the colour sequence in reverse order. The reason for this is that some of the light passing through raindrops undergoes two internal reflections such that, for red light the total deviation is about 230 degrees, while for violet light it is about 233 degrees. After its journey around the inside of the raindrop, light is refracted once more on exit. With the observer's eye lying on the line of the antisolar point he sees the resultant violet light at an angle of about 53 degrees, and red light at about 50 degrees, with the intermediate colours formed by raindrops refracting within this range. The area of sky between the two bows (and also beyond the primary) appears to be darker since no refracted light is received that would add to the general illumination.

Lunar rainbows

Rainbows can also occur at night although they will be much paler owing to the relative weakness of moonlight, and are harder to detect. Lunar rainbows are generally perceived by the human eye to be white or grey because colours are difficult to detect in low light conditions. However, bright moonlight may produce easily visible rainbows, and these may also show a trace of colour. Secondary lunar rainbows and supernumeraries are very rarely seen.

Size and shape

The angular radius of approximately 42 degrees is constant for all primary rainbows, but the extent of the arc that is visible to the observer depends on the elevation of the sun (or moon) and the height of eye. It should be remembered that as the sun's elevation increases, the length of the rainbow arc decreases. When the sun's elevation is such that refracted light subtends an angle of greater than 42 degrees at the observer's position, a rainbow will not be visible. It follows, therefore, that rainbows will be seen most frequently during the early morning or late afternoon, and in the winter months rather than the summer.

A rainbow seldom extends far below the level of the horizon because there are too few drops in that direction to refract light of detectable intensity (Figure 10(a)). Seafarers however, owing to their raised platform of observation might see that rainbows close to the ship may form arcs that are greater than a semicircle (as suggested by Figure 10(b)).

I.C. Oke

***Figure 10(a)**: Rainbows at the horizon.*

Anon

***Figure 10(b)**: High arched bows at a ship.*

M. Allison

***Figure 10(c)**: Squat section of rainbow below a cloud.*

At the other extreme, are short vertical sections of rainbows. These squat forms develop in showers at the horizon (Figure 10(c)), extending from the surface to the cloud base (or else to the point in the precipitation where liquid becomes solid).

Other rainbow phenomena

Depending on the size of water droplets present and the location of the observer, arches other than the most common form may be seen:

Cloudbow and fogbow — If the droplets are very small, as found in cloud and fog, the colours of the primary and secondary bows overlap to produce an almost white arch in either fog or cloud (Figure 11). These are slightly smaller than their full-colour cousins, and any supernumeraries present are also white. Both forms are best seen from an elevated position. When at sea, observers may be able to see fogbows in shallow sea fog — navigational demands permitting.

Anon

***Figure 11**: Fogbow*

Reflected rainbow — When a rainbow occurs over calm water, its reflection may be seen; if complete it will be an inverted image of the original, so appearing as circle.

Reflection rainbow — If the calm water surface lies behind the observer, sunlight may be reflected from it before refraction by the raindrops, thus giving a reflection rainbow. To the observer, the source of light for this bow would seem to be a point below the horizon equal to that of the sun above.

Spray bow — These form in the spray from waterfalls and hoses, also in spray raised at sea. In the latter, a complete rainbow would be a little smaller than a normal bow since the salt content alters the refractive properties of water. Both normal and sea spray bows can occur together at sea.

3 — Coronae, iridescence and supernumerary rainbows

When the sun shines through cloud comprising minute water droplets of approximately uniform size, the mechanism of diffraction causes light to 'bend' slightly around the edge of the droplets. The degree of bending varies with the wavelengths within the light; longer wavelengths are bent more than short ones, thus red light is bent more than blue or violet light. Instead of the brilliant colours that can occur with haloes and rainbows, diffraction allows the formation of much paler phenomena such as the corona and iridescence.

A corona is centred on the sun in similar fashion to a halo. The sky immediately around the sun shows a bluish tinge surrounded by a reddish ring, and a well-developed corona may also show intermediate colours of green and yellow. Colours may be repeated in further sets of rings although only greenish or pinkish tints may seen in these. Depending on the size of the droplets involved, the angular radius of the red edge can vary between 2 degrees and 20 degrees (the radius increasing as the droplet size decreases). Because coronae can be close to the sun, observers should exercise care when looking at or for them.

Only small portions of larger coronae are normally seen, appearing as irregular patches of pastel shades of pink and green. In this form they are known as iridescence or irisation (Figure 12). Thin water-based clouds are best for viewing iridescence; it is often seen in altocumulus, particularly in the lenticular form, or along the thinned edges of larger cloud masses.

J. Freeman

Figure 12: *Irisation along the edge of thin altocumulus.*

Halo or corona?

Although similar at first glance, haloes and coronae are very different, and the following comparisons may help less experienced observers to decide which of the two is on display. (It should be remembered that a favourable arrangement of suitable clouds may allow a halo and corona to occur simultaneously, and that both can occur in moonlight.)

	Halo	**Corona**
Cloud type	Cirrus family (ice-based)	Thin water-based clouds
Size	Generally larger than corona	Smaller than a halo, and closer to the sun *
Colour	Red colour nearest the sun	Red colour away furthest from sun

Other effects of diffraction

Other effects caused by diffraction include supernumerary bows that may appear inside primary rainbows, and the 'silver lining' along the edge of some cloud masses. Supernumerary bows will be seen more easily if the raindrops happen to be the same size, in which case the colour separation will be good. Usually, however, a range of sizes produces only one bow of violet or blue. The silver lining effect occurs when light is diffracted by cloud droplets along the cloud's outer edge, and is observed around thicker clouds containing larger droplets — large cumuliform clouds providing the best source.

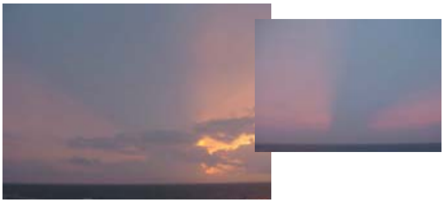
* A corona normally occurs at 10 degrees from the sun for an average drop size of 6μm, and at 22 degrees for a very small drop of 500 nanometres, but the spectrum of colour in this case would extend from 18–30 degrees, thus looking very different to a halo.

4 — Optical effects associated with light and the atmosphere

Not only does light interact with directly with ice crystals and water droplets, it is also scattered by atmospheric particles to produce a range of effects including crepuscular rays. These form where rays of light are made visible by dust or moisture in the air. They occur where sunbeams penetrate through gaps in the cloud (Figure 13(a)); as red or rose-coloured beams at dawn or sunset that diverge upwards from below the horizon (Figure 13(b)); and as pale-blue or whitish rays diverging upwards from the sun hidden behind cumuliform clouds.

W. Yeo

Figure 13(a): *Crepuscular rays form as sunlight penetrates cloud.*



S. Gallaway

Figure 13(b): *Main picture: Crepuscular rays formed after sunset. Inset. Anticrepuscular rays at the opposite horizon.*

Another phenomenon caused by scattering is a ‘blue’ moon or sun, which occurs where intense scattering of the red component of light by airborne particles makes the luminary appear blue or green. Thick smoke can cause this effect, and a bluish sun shone over Sydney during the serious bush-fires of December 2001.

Colourful skies at sunset and sunrise are also due to scattering. As sunlight passes through the atmosphere, its blue and violet wavelengths are scattered before those of red and orange. Thus, as sunset approaches, light reaching the observer loses increasing amounts of the blue component, and the sky turns through yellow to orange then red (a yellow sunset indicates that sunlight has been scattered by the atmosphere alone, and not by additional particles). At dawn, the effects of scattering are reduced and the colour sequence is reversed.

Summary

On average, optical phenomena can be seen if carefully looked for, on half of all observing days. Apart from their aesthetic value, they can also be of use to science — haloes, for example, reveal the temperature of the cloud, the size, shape and orientation of the ice crystals. Such information may contribute to research into the effects of global warming on cloudiness. Having the advantage of clear skies and wide horizons, shipborne observers are therefore well-placed to observe and record haloes, rainbows and their allies.

Acknowledgement

We would like to thank Dr John Hodkinson (Met Office) for his help and advice in the preparation of this article.

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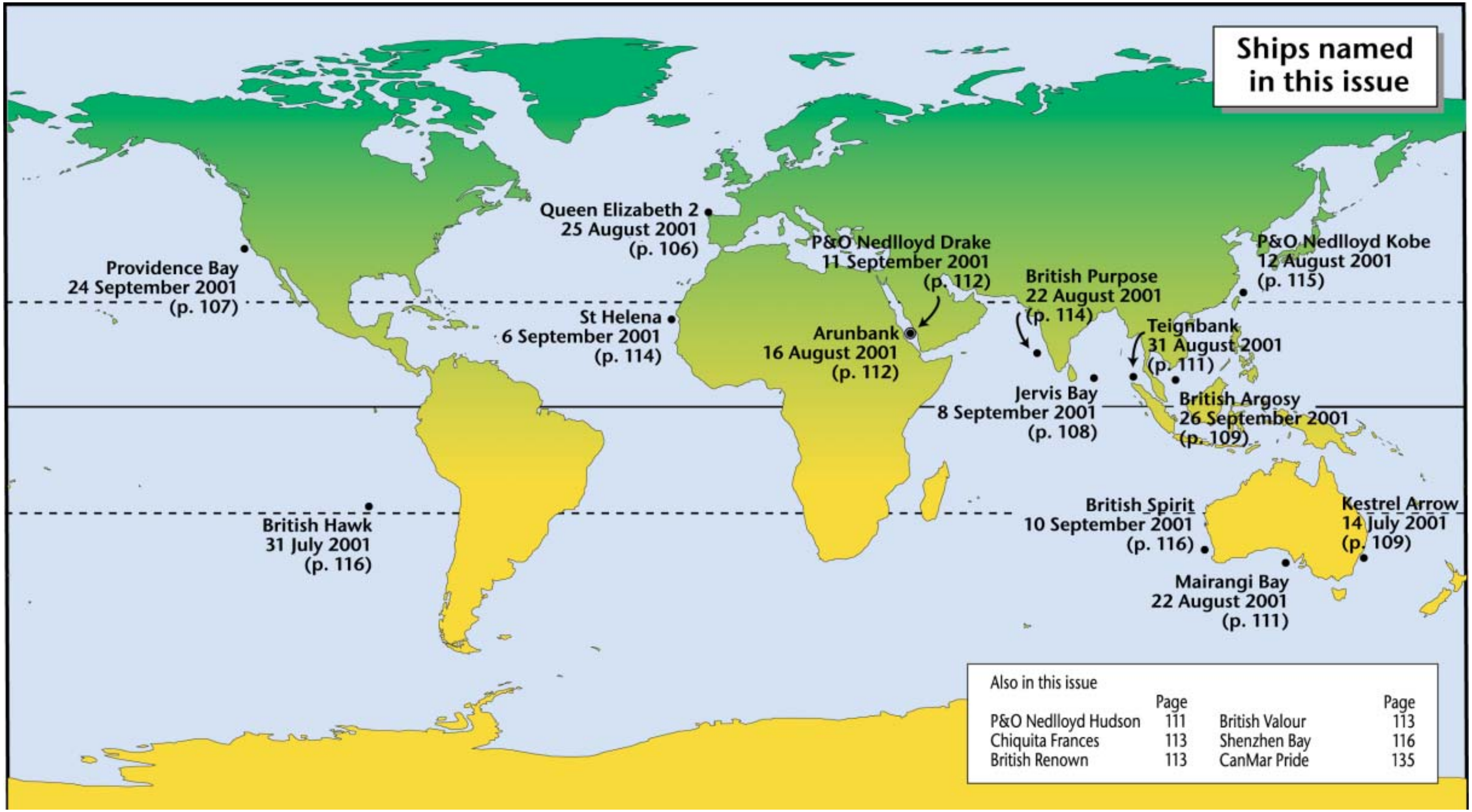
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Real-time ocean forecasting at the Met Office

Jon Turton, Martin Holt and Mike Bell (Met Office)

For those working at sea or living near the coast, forecasts of wave height, ocean currents or storm surges are just as vital as forecasts of the weather. The Met Office routinely runs a number of ocean models to provide forecasts that help marine-related organisations such as ferry operators and oil companies to plan their operations at sea.

These include sea-state forecasting with ocean wave models; development of the Forecasting Ocean Assimilation Model (FOAM), a global and regional real-time deep ocean analysis and forecast system; and regional modelling of the shallower shelf seas around the UK, for which a long-standing operational application is storm surge prediction. In addition to operational oceanography, the Met Office also develops ocean models in support of climate research and seasonal forecasting, specifically providing the ocean component of the coupled ocean–atmosphere models run by the Hadley Centre for Climate Prediction and Research.

Wave modelling

For many years the Met Office has run second-generation global and regional spectral wave models to provide forecasts of sea state, supporting a range of user applications. There are three operational wave model configurations: UK waters, European and global, with different areas and resolutions. All use the same wave model formulation, and include the effects of shallow water on the wave energy spectrum [see 'Sea State'].

UK waters wave model — This covers the north-west European continental shelf from 12° W, between 48° N and 63° N at a resolution of 1/9° longitude by 1/6° latitude (approximately 12 km). It also includes the effect of time-varying currents on the waves, using forecast currents from the operational storm-surge model. (For waves of up to 2-3 m height, the wave height can be affected by up to 10%.) It is run four times daily from 00, 06, 12 and 18 UTC, taking hourly surface winds from the Met Office's regional UK numerical weather prediction (NWP) model to give a 48-hour forecast. A second run of the UK waters wave model is also made to give a five-day forecast, but does not include the effects of currents.

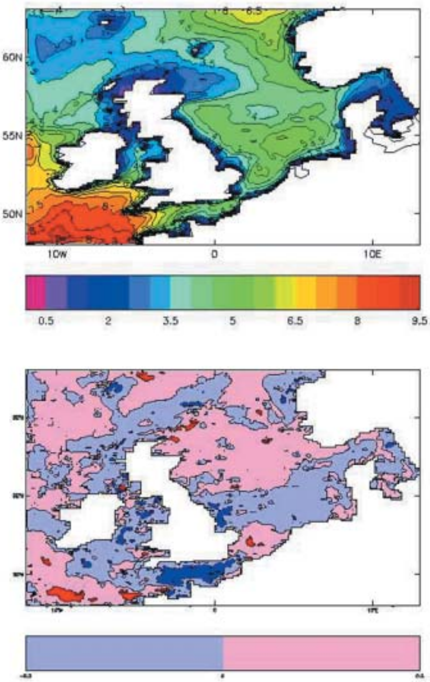

***Figure 1** (top): Significant wave height (m) from the UK waters wave model including the effect of currents; (bottom) Difference in predicted significant wave height after inclusion of wave-current interactions; in this case, predicted wave heights in the English Channel are reduced by over 30 cm because of a wind-driven surge current following in the same direction as the waves. Examples are for 0000 UTC on 25 December 1999.*

Editor's note. The public web site of the Met Office holds further details on the models and on how to access data and products: http://www.metoffice.com/research/ocean/operational

European wave model — This covers the area from 30.75° N to 67° N and 14.46° W to 41.14° E (covering the north-west European shelf seas, the Baltic Sea, Mediterranean Sea and Black Sea) with a resolution of approximately 35 km. It is run twice daily from 0000 UTC and 1200 UTC data times out to two days ahead, using hourly forecast winds from the Met Office's global NWP model and takes boundary data from the global wave model, allowing swell from the Atlantic to propagate in.

Global wave model — This covers the area from 80.28° N to 79.17° S on a regular latitude–longitude grid, with a resolution of 5/6° longitude by 5/9° latitude; it includes all sea areas, and takes ice edge information from the global NWP model. It is run twice daily from 0000 UTC and 1200 UTC data times to five days ahead, using hourly NWP forecast winds. The winds from global NWP are at the same spatial resolution as the global wave model. It also assimilates observations of wave height from the radar altimeter on the ERS-2 satellite *.

Sea state

The sea state at any point may be thought of as the sum of many individual waves, each of a particular direction and frequency. This can be represented as the wave energy spectrum, where the wave energy in each frequency and each direction is known.

The Met Office wave models divide the wave energy spectrum at each grid point into 13 frequency components and 16 direction components. The lowest model frequency is at 0.04 Hz (25 seconds period or 975 m wavelength), and the highest frequency resolved by the model is 0.324 Hz (three seconds period or 15 m wavelength), though waves at higher frequencies (shorter periods) are included in the calculation of wave growth.

The wave models account for growth of waves due to wind input, dissipation of energy by breaking waves, and transfer of energy due to wave–wave interactions. Wave energy is advected from one grid point to the next at the group velocity. All the models include some shallow-water physics, namely bottom friction, refraction and shoaling.

Swell

Knowledge of the expected wave period is as important as wave height in calculating the response of a vessel or oil rig to sea state. If wave energy is present at periods close to the resonant period of the vessel, then the vessel motion will be enhanced.

Long-period swells can arrive around the UK in one of two ways — either generated locally by strong winds, in which case the weather and sea state on site will already be extreme, or — generated remotely several days earlier, and then crossing the Atlantic. In the latter case the weather on site may be calm, and the amplitude of the long-period swell may be small.

Because longer-period wave energy travels faster, such remotely generated swell may arrive without warning, as the longest-period waves arrive first. Such swells are very difficult to predict manually, and so the forecast relies on the output from the global wave model. In order to accurately predict near-shore wave conditions it is important to account for the effect of incoming swell.

Figure 2 shows modelled long-period swell from hurricane 'Gert' some 48 hours after generation.

**Editor's note.* ERS-2 — the later of two remote sensing satellites launched by the European Space Agency in the 1990s, and which was succeeded by the Envisat satellite in March 2002. Envisat is the most powerful Earth-observing satellite yet, and is designed to monitor the atmosphere, ocean, land and ice over a five-year period.

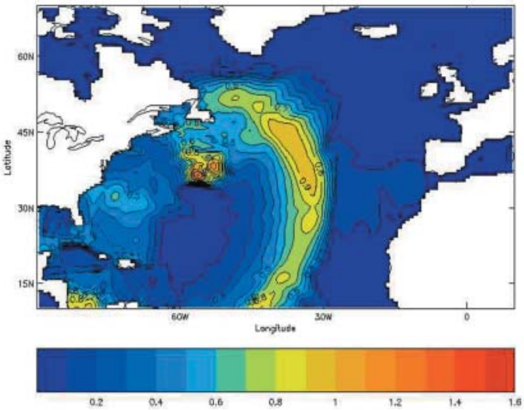

***Figure 2**: Met Office global wave model prediction of waves of 21 seconds period from hurricane Gert (1800 UTC on 22 September 1999)*

Wave energy spectra from the global wave model are being compared with satellite observations from the ERS-2 Synthetic Aperture Radar (SAR) and, later, from Envisat (launched in March 2002). This validates swell in the model and will also guide future development of the SAR observation retrieval.

Wave model output

For output the wave model spectra are processed to give values of significant wave height, wave period and direction for each of total sea, wind-sea and swell. Products from the Met Office's European and global wave models are available through both the WMO Global Telecommunication System (GTS) and over the internet (e-mail or ftp) from the Met Office's Data and Products Distribution System (DPDS). Products available on GTS are at a reduced resolution (2.5° by 2.5° for the global wave model and 1.25° by 1.25° for the European wave model). Full resolution products for a greater number of times are available via DPDS. The UK Waters wave model data will be available from the DPDS later in 2002.

Future developments

Work is ongoing towards implementing the third-generation WAve Model (WAM) as the next operational wave model. Also, as part of the European Community 5th Framework project MAXWAVE, new diagnostics are being developed to better predict the occurrence of extreme wave conditions.

Forecasting Ocean Assimilation Model (FOAM)

FOAM is an ocean model and assimilation system producing real-time daily analyses and forecasts of temperature, salinity and currents of the deep ocean, for up to five days ahead. It is also used by the Hadley Centre for coupled climate simulations (and also for coupled seasonal forecasting). The FOAM system is built around a physically based ocean model and a sea ice model to predict sea ice thickness, concentration and velocities. It is driven by six-hourly mean surface fluxes from the Met Office's operational NWP system and assimilates near real-time ocean observations (in situ and remotely sensed). This includes thermal profiles from expendable bathythermographs, conductivity/temperature/depth sensors and profiling floats, together with data from the TAO/TRITON and PIRATA moored buoy arrays.*

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* *Editor's note.* Buoy systems located in tropical regions of the Atlantic and Pacific Oceans, for research into El Niño and El Niña conditions and predicting their occurrence.

It also assimilates ship, buoy and satellite AVHRR (Advanced Very High Resolution Radiometer) sea-surface temperature reports, and sea-ice concentration fields received from the Canadian Meteorological Centre. Since September 2001 regional configurations of FOAM have also assimilated sea surface height data from satellite altimeter. Observations from the previous 10 days are assimilated with variable weighting.

Operational FOAM and output — Several configurations of FOAM are currently run operationally. A global version of FOAM with 1° horizontal resolution and 20 levels in the vertical has been run every day by the Met Office since October 1997. A regional version of FOAM (nested within the global model) for the North Atlantic and Arctic oceans, with 1/3° horizontal resolution and 20 levels in the vertical has been run daily since April 2001.

FOAM produces gridded fields of temperature, salinity and current profiles, mixed layer depth, sea-ice concentration and sea-ice thickness and cover. These are available in real-time over the internet (e-mail or ftp) from the Met Office's DPDS. Selected FOAM outputs are also available to research users over the internet via the Natural Environment Research Council (NERC) Environmental Systems Science Centre (ESSC) Live Access Server. Real-time products from 1/3° FOAM can also be accessed on the Met Office's public website.

High resolution FOAM — The current operational global FOAM, at 1° resolution, allows features in the upper ocean structure due to meteorological forcing and large-scale ocean processes to be analysed and forecast, but cannot represent fronts and eddies. The 1/3° Atlantic and Arctic FOAM is 'eddy permitting'. Typically a resolution of 1/9° (~11 km) is required to resolve mesoscale ocean eddies, as shown in Figure 3, and nested higher resolution FOAM configurations are being set up.

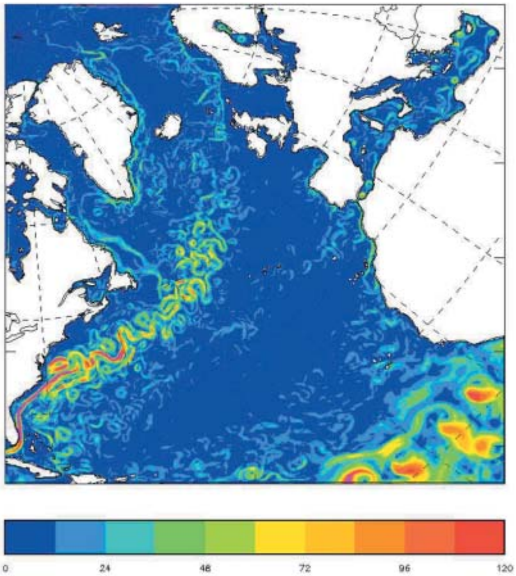


***Figure 3:** Five-day mean current speeds (cm/s) from 1/9° North Atlantic FOAM.*

Initial tests of a nested high resolution (1/9°) FOAM for the Caribbean and Gulf of Mexico demonstrated the ability of the model to represent eddies and the need to assimilate satellite altimeter data to determine and predict where the eddies are, as shown by the sea-surface temperature fields in Figure 4. Without these data, high resolution models would generate a plausible eddy field, but one poorly correlated with the actual eddy field occurring in the ocean.

The combination of satellite altimeter and Argo float data, which are complementary, will allow much more reliable analyses of ocean conditions. Float data has high vertical detail but limited spatial resolution, whilst altimeter data has higher spatial resolution but no information on vertical structure. Using altimeter surface height data it is possible to adjust the temperature profiles to better represent the vertical structure on the mesoscale.

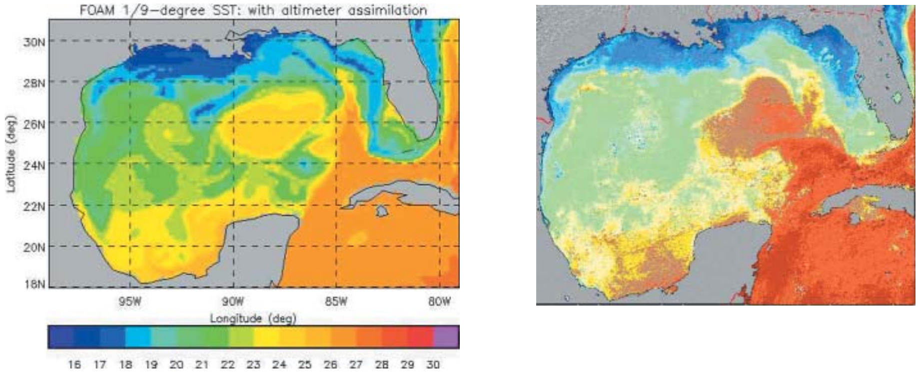


Figure 4 *(left):. Sea surface temperature in the Gulf of Mexico, from FOAM for 14 to 19 March 1998, (right) corresponding seven-day AVHRR composite.*

A relocatable, nested, high resolution FOAM capability has been developed and 1/9° (or better) 'eddy-resolving' versions are being set up for a number of ocean basins. In addition to real-time analyses and forecasts, these can be used for hindcasting or to generate re-analysis datasets for regional ocean climate assessment.

Global Ocean Data Assimilation Experiment (GODAE)

GODAE will bring together float data (Argo), satellite data (Jason-1) and high-resolution modelling to produce global ocean (current, temperature, salinity) analyses and forecasts in near real-time for intercomparison. GODAE is scheduled for 2003–2005, with an Atlantic pilot project planned in 2002, to which the Met Office will contribute products from a new 1/9° North Atlantic FOAM (as shown in Figure 3). For the duration of the experiment these products will be available to GODAE partners and potential users over the internet via the NERC ESSC Live Access Server.

Forecasting the shelf-seas around the British Isles

The shelf-seas forecast model — This model was developed by the Proudman Oceanographic Laboratory (POL) and was brought to operational status by the Met Office, where it has been run operationally daily since June 2000. It is run to produce real-time predictions of the temperature, salinity and current structure over the north-west European shelf and shelf break, out to two days ahead.

The model is fully baroclinic and represents dynamical processes on the shelf and in deeper water, and includes a state-of-the-art advection (horizontal transport) scheme to preserve strong gradients. It is driven by hourly winds and pressures, and three-hourly heat fluxes from the Met Office's regional UK NWP model.

It has a grid of 1/9° latitude by 1/6° longitude (approximately 12 km resolution) covering the north-west European continental shelf and much of the shelf break to the west of the British Isles, and uses a terrain-following vertical co-ordinate system with 14 model levels. The model includes tidal forcing (for sea level and currents) at its Atlantic boundaries and includes freshwater inputs from 47 sources (river estuaries and the Baltic).

Output and applications — The shelf-seas model produces gridded fields of temperature, salinity and current profiles. These are available in real-time over the internet (e-mail or ftp) from the Met Office's DPDS. Selected shelf-seas model outputs are also available to research users over the internet via the NERC/ESSC Live Access Server. Real-time products from the shelf-seas model can also be accessed on the Met Office's public website.

Output from the shelf-seas model has a number of potential applications, such as improved predictions for marine pollution (e.g. oil spill modelling); search and rescue; real-time modelling of water quality and sediment transport; aquaculture (forecasts of temperature, salinity and nutrient levels); offshore oil and gas (current profiles for diving and the use of unmanned submersibles).

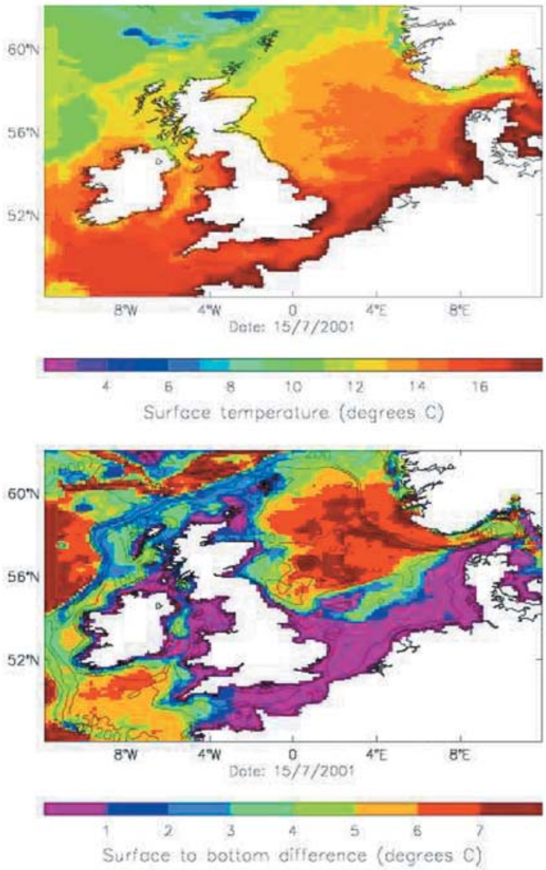


__Figure 5__ (top): Shelf-seas model sea-surface temperature. (Bottom) Surface to sea bed temperature difference, showing the position and strength of the North Sea tidal mixing front.

Currents in the shelf-seas are predominantly due to tidal forcing, but seasonal coastal currents are associated with the onset of tidal mixing fronts. Such residual currents (as shown in Figure 6) are persistent features and can be a significant fraction of the total current speed.

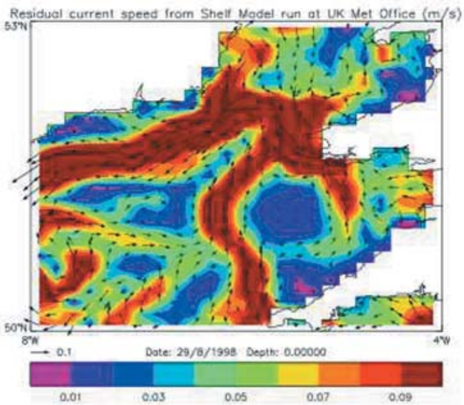


__Figure 6:__ Residual surface currents (0–10 cm/s) at the Celtic Sea tidal mixing front.

Model assessment — The model is validated against observations of sea-surface temperature from both satellite (AVHRR) and moored buoys. The example in Figure 7 illustrates the annual cycle of warming and cooling, and shows that the waters were well-mixed from November 2000 to April 2001 and became stratified from May to October 2001, during which the sea surface temperature varied on the synoptic scale.

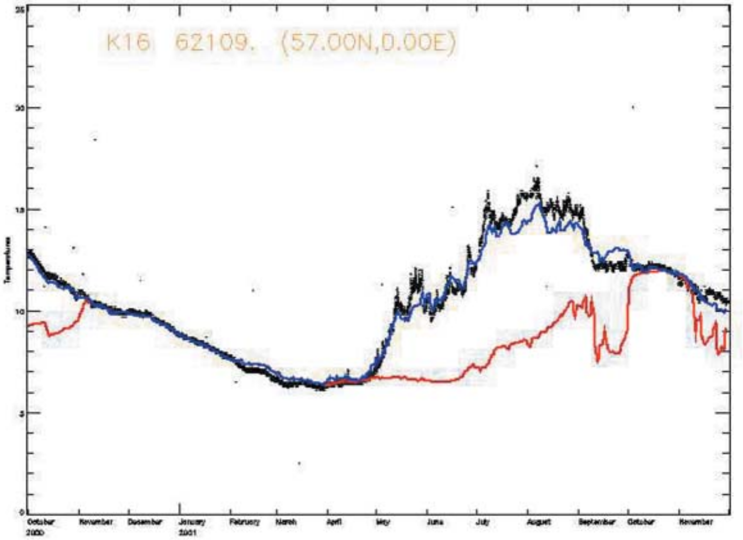
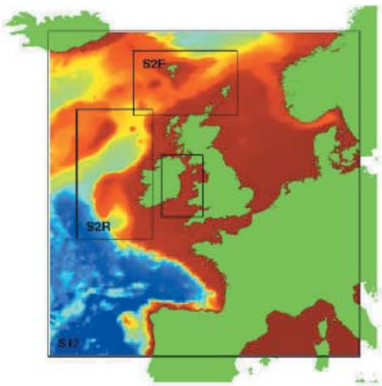


Figure 7*: Time-series of observed (black) and modelled sea surface temperature (blue) and modelled sea bed temperature (red) for the northern North Sea from October 2000 to December 2001.*

Future developments

In conjunction with POL a new improved 'Atlantic Margin' model, see Figure 8, covering a larger area (extending south into Biscay and west into the Atlantic margin) is being developed; together with nested higher resolution (2 km or better) models for the Irish Sea and Rockall Trough.



The model will be nested into FOAM to give improved currents at its boundaries, and will use a hybrid vertical co-ordinate system to give better resolution of the surface layer in both deep and shallow water.

Figure 8: *Domain and bathymetry of the Atlantic Margin model and nested higher resolution sub-models. Red tones denote shallow water, blue tones denote deep water.*

A special “Thank you” for contributions to the Automated Shipboard Aerological Programme (ASAP)

When the *CanMar Pride* called at Thamesport in March this year while on its regular Thamesport-Antwerp–Le Havre–Montreal route, the Met Office took the opportunity to acknowledge the help provided to the ASAP by the Master — Captain John Simcox — and members of his crew.

G.Allen

Ever since the early days of the UK’s ASAP operation, in the late 1980s, Captain Simcox has been an enthusiastic and helpful supporter of the programme and Captain Edward J. O’Sullivan (Manager Marine Networks, Met Office) was therefore pleased to acknowledge his contributions.

Left: *Captain Simcox receives a bulkhead barometer from Captain Edward J. O’Sullivan.*

With the encouragement of the Master, the cadets responsible for performing radiosonde launches during the ship’s crossings of the North Atlantic have been both diligent and enthusiastic, often carrying out the radiosonde launches under difficult conditions. The efforts of all cadets involved with ASAP are acknowledged, and Captain O’Sullivan was pleased to make a special award to Cadet Neeraj Wadhwa who was on board in Thamesport. Similar awards have also been made to cadets previously involved with the programme on this ship.

G.Allen

Left: *Cadet Neeraj Wadhwa is presented with a special book award by Captain O’Sullivan.*

Noticeboard

JCOMM launches the Ship Observations Team

The first session of a new Ship Observations Team (SOT) was held at the National Institute of Oceanography, Goa from 25 February to 2 March 2002. This new team has been established by the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and aims to integrate the activities of a number of existing ship-based panels — notably those relating to voluntary observing ships, ships of opportunity and ships hosting ASAP (Automated Shipboard Aerological Programme) systems.

It is envisaged that in the coming years SOT will act as an important focus for all matters related to shipborne observing programmes. To this end, it has set itself a number of ambitious objectives which will be considered intersessionally by small expert task teams. Topics to be considered include proposals to encourage voluntary ship recruitment and proposals for common design standards for the fitting of observing equipment on ships. The meeting reaffirmed the importance of the international Port Met. Officer network, particularly in view of the planned increased involvement in ASAP operations; Argo float and expendable bathythermograph deployments; and the VOSClim project. In addition, the meeting highlighted the potential for new observations from voluntary observing ships, in particular the increasing requirement to establish a global CO2 observing system for global carbon cycle models. The growing trend towards the use of automatic onboard weather systems on carefully selected observing ships also featured prominently during the meeting's discussions.

Thanks to a US PMO for a good job well done

As published in the April 2002 edition of *The Marine Observer*, James (Jim) E. Nelson (US Port Met. Officer for Houston/Galveston) retired at the end of March this year after a long career in meteorology during which he had been a particularly enthusiastic and helpful supporter of the UK Port Met. Officer network.

NWS (D. Helvy)

Whilst on a private holdiay to the US in April, Captain Edward J. O'Sullivan (Manager Marine Networks, Met Office) was pleased to take up an invitation to visit Jim at his home in Houston. The pre-arranged visit was an opportunity to present Jim with a miniature brass sundial and compass as a small token of appreciation for the work he has undertaken on behalf of the Met Office over many years.

In 1993, at the International Port Met. Officers' Conference, held at the International Maritime Organisation in London, the US delegates showed much good will in their eagerness to assist with any visiting UK VOF ships that did not return home regularly.

Since then, the Met Office has regularly called on their services when assistance with UK ships has been required, with Jim Nelson at Houston being the main reference point. His enthusiasm for his work has been acknowledged by many of his colleagues and friends in the US and world wide. Telexes and e-mails received by the Met Office over the years also bear witness to his efforts, with UK Masters stating that, for example, they had "...received the supplies from the PMO, Houston..." during their stay at Lake Charles, or else requesting "...for 'your' PMO to visit during our forthcoming stay at Houston".

The photograph shows the informal presentation that took place at the National Weather Service, Dickinson, Texas at (Jim's former work place), Captain O'Sullivan on the left.

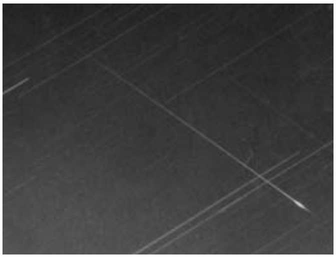
The Perseid meteor shower in 2002

Neil Bone (Director, BAA Meteor Section)

Being active from late July to 20 August, the Perseid meteor shower is one of the four most prolific of the annual meteor showers, and therefore a favourite target for amateur astronomers. The shower is produced by debris shed from Comet 109P/Swift-Tuttle, which has a roughly 130-year orbital period and was last seen in 1992. Enhanced Perseid rates attended this latest return of the parent comet, with additional strong peaks being seen in the activity profile up to about 1997.

Prospects for the 2002 Perseid shower

The most recent Perseid showers appear to have brought a return to the more normal activity pattern which shows a slow, steady rise through the first week of August, ahead of a sharp maximum on 12/13 August, following which rates fall away rapidly. At a typical maximum, the Perseid shower may produce one or two meteors per minute (i.e., 60–120 per hour) under clear, dark sky conditions. Observed rates are usually pegged back somewhat by haze, cloud or moonlight.


N Bone

The circumstances for the shower in 2002 are rather more favourable than they have been for a couple of years. The moon will be an early-setting four-day old crescent on 12/13 August, and its glare will not interfere with the Perseid spectacle. The sharp maximum is expected to occur around 2200 UTC on the 12th, favouring western European longitudes. Rates should stay close to maximum level for several hours after this time, and it is expected that Perseids will be numerous during the early morning hours (UTC) of the 13th. Activity will be particularly noticeable for two or three nights on either side of the 12/13 August maximum too.

Source of the Perseid shower

The Perseids appear to emanate from a radiant in the northern part of the constellation of Perseus, near the 'Double Cluster' (a pair of open star clusters which can be resolved into myriad stars with a pair of binoculars, but appear to the naked eye as an elongated hazy patch). As their orbit around the sun is in the opposite direction to that of the Earth, the particles (meteoroids) in Swift-Tuttle's debris stream collide almost head-on with the upper atmosphere, where they are destroyed by ablation at altitudes of about 100 km (60 miles). Consequently, Perseid meteors are notably fast-moving. A lot of energy is expended in the ablation process, meaning that Perseids are often bright, and many leave behind them short-lived ionisation trains which may glow and fade for several seconds after the meteor itself has gone.

Fireballs

The very brightest meteors, exceeding the brilliance of the planet Venus (an 'Evening Star' during August) are called fireballs, and are produced by particularly large meteoroids in the Perseid stream; perhaps one in 500 may prove this bright. Sometimes known as 'the Tears of St Lawrence', the Perseids are a dependable regular spectacle, and even casual sky-watchers are sure to see at least a few on clear nights this coming August.

Image details. Bright Perseid above Sagitta. Date — 1993 Aug 12d 21 h 37 m UTC.
Lens — 29 mm, f2.8 wide angle. Film — Ilford HP5plus, ISO 400. Exposure — 15 minutes.

UK Fleet (Information dated 31 March 2002)

Key to 'Status': T = TurboWin software in use; L = ship uses logbook; * = TurboWin or logbook data awaited; N = newly recruited ship.

All participating observers are listed where ships use both TurboWIn and logbooks. Ships participating in the VOSClimate project are indicated in bold face.

VESSEL	STATUS	MASTER(s)	OBSERVIERS	OWNER/MANAGER
Aberdeen	L	PJ Day, V Golding, M Ahrens	T Crowley, D Gentry, GB O'Kelly	Northern Marine Management Ltd
Abidjan Star II	L	—	—	Barber Ship Management Inc
African Ruby	L *	—	—	MOL Tankship Management Ltd
Al Awdah	L *	—	—	Kuwait Oil Tanker Co. S.A.K.
Al Funtas	L	S Loutfi, ZA Rizwani	AM Salim, MK Ghattass, JR Canete	Kuwait Oil Tanker Co. S.A.K
Al Samidoon	L *	—	—	Kuwait Oil Tanker Co. S.A.K.
Al Shuhadaa	L *	—	—	Kuwait Oil Tanker Co. S.A.K.
Al Tahreer	L *	—	—	Kuwait Oil Tanker Co. S.A.K.
Al Wajba	L *	—	—	United Arab Shipping Company (S.A.G.)
Alam Selaras	L *	—	—	Pacific Ship-Managers Sendirian Berhad
Al Zohal 1	L	AN Musalige, WAA Moursy, R Eukewatta	HMVN Barammane, NTG Wewewatta, WS Fernando, B Thangavelu, PPU Gurguge, SA Tinsay, M Senadipathy	London Ship Managers Ltd
Al-Farahidi	T L	V Karkarey, Z Hussain, IB Hagar	S Hafez, M Ahmad, M Mansour, A Shahin	United Arab Shipping Company
Alkman	L *	—	—	Wallem Shipmanagement Ltd
Alliance	L	JA Holst, L Holtschmidt, M Perth	D Wood, J Davidson, N Samson, DT Carus, M Perth, R Wegner, P Darlington, N Dunbar, J Stone, G Jones	Denholm Ship Management (UK) Ltd
Alnoof	L * N	—	—	United Arab Shipping Company (S.A.G.)
Anastasis	T L *	—	—	Mercy Ships
APL Agate	L	TA Cardoz	L Lee	Neptune Shipmanagement Services (Pte) Ltd
APL Cyprine	L *	—	—	Neptune Shipmanagement Services (Pte) Ltd
APL Iolite	L *	—	—	Neptune Shipmanagement Services (Pte) Ltd
APL Jade	L	J Narayanan	SP Ayyar, A Banerjee, H Supramaniam, CHC Chong, W Tan, CY Chin, KL Tewg	Neptune Shipmanagement Services (Pte) Ltd
APL Orchid	L *	—	—	Neptune Shipmanagement Services (Pte) Ltd
APL Pearl	L *	—	—	Neptune Shipmanagement Services (Pte) Ltd
Arcadia	L	MP Carr, I Walters, H Reid	BM Lloyd, BK Scott, M Sharples, RB Robson, SJ Howarth, GDG Turner, N Brown, PHR Godderidge, JH Ratcliffe	P&O Cruises (UK) Ltd
Arctic Goose	L *	—	—	Holy House Shipping AB

Arctic Swan	L *	—	—	Holy House Shipping AB
Argentina Star	T L	PC French, PJ Newton	GF Bongat, DV Bernabe, R Espanola, D Pablo, J Ramos	P&O Nedlloyd Ltd
Arunbank	T L	P Stapleton	I Razbitnov, D McDonald, R Stone, JT Glasson, RTW Bickerton	Andrew Weir Shipping Ltd
Astrid Schulte	L *			Eurasia Shipping & Management Co. Ltd
Auckland Star	T L *	—	—	Norbulk Shipping UK Ltd.
Audacity	T L *	—	—	FT Everard & Sons Ltd
Auk Arrow	L *	—	—	Gearbulk (UK) Ltd
Baltic Breeze	L *	—	—	Wallenius Shipmanagement Pte. Ltd
Baltic Eider	T L	DR Cripps, RH Barker	DM Histon, JE Collett, GR Armstrong, SL Galbraith, SJ Wallace	Andrew Weir Shipping Ltd
Baltic Tern	T	KF Steven, LC Pink	IC Taylor, SL Galbraith, J Bush, M Causon, SM Eggleton	Andrew Weir Shipping Ltd
Barbet Arrow	L	MM Grass, PS Moseley	DJ Imerie, A Da-anoy, R Husmillo, AJ Bradbury, AJ Norwood, EV Mayuyo	Gearbulk (UK) Ltd
Belo Oriente	L *	—	—	New Asian Shipping Co. Ltd
Berge Atlantic	L	SK Jain, S Nordfjord	ND Levillard, S Pravinkumar, N Manhas	Bergesen d.y. ASA
Berlin Express	T L	IM Hill, AE Spencer	FH Munro, GS Rice, C Henderson, A Cox, M Langford, A Fraser, G Young	P&O Nedlloyd Ltd
British Admiral	L	T Johnson, J Tarling	MJ Young, AJ Lane, RJ Holt, L Williams, C Green, D Witts, R Speksnijder	BP Shipping Ltd
British Adventure	L	C Johns, PR Anderson	G McCracken, S Angove, GJ Davies, DLS West, M Rickaby, MM Pratt, S Woodward	BP Shipping Ltd
British Argosy	L	H Elliott, D Lewis	CJ Green, C Kelly, AO Roaf, B Blythe, M Clack	BP Shipping Ltd
British Energy	L * N	—	—	BP Shipping Ltd
British Enterprise	L	D Mulhern, RD Mead	M Graaskov, GJ Davies, M Vallins, AD Wheatley, HS Herok, C Winterbottom, GSL Williams, T Maclean, G Ballantyne	BP Shipping Ltd
British Harrier	L	NJ Greig, MR Etherington	AJ Short, A Chylak, KJ Mason, SP Moss, M Tofinga, G Pragnell, AM Zawirski	BP Shipping Ltd
British Hawk	L	C Gaukroger, J Harris	DJ lavery, PS Westgate, M Hagan, T Ruth, MM Pratt, DM Sharp	BP Shipping Ltd
British Hunter	L	TL Cullen, JO Bailey	PS Westgate, MS Tiffany, D Stacey, T Forrest	BP Shipping Ltd
British Pioneer	L	P Seaman, A Macleod	M Graaskov, S Boss Walker, M Ramsay, C Henrickson, R Rykala	BP Shipping Ltd
British Pride	T L *	—	—	BP Shipping Ltd
British Progress	L *	—	—	BP Shipping Ltd
British Purpose	L	N Hannah, KE Peacocok	T Szulczeciski, H Ballard, JC Welford, RC Moss, PR Anderson, JP Rumsby	BP Shipping Ltd
British Skill	T L	M Mansbridge, RJ Hancock	MJ Walker, IK Maesepp, PM Thompson, JT Illingworth, MA Trembling	BP Shipping Ltd
British Spirit	L	AM Lakey, J Buchanan	J Whitehead, M Young, RK Harding, S Ankowski, D Dados	BP Shipping Ltd
British Strength	L	D Mulhern, E Davis	AN Shearer, IK Maesepp, MF Orchard, CW Kelly, D Austin	BP Shipping Ltd
British Success	L	NK Price, CP Shoolbraid	SR Angove, S Magalotti, SJ Stewart, S Nozdrin, A Hayward	BP Shipping Ltd
British Valour	L	JN Gregson, M Phillips	DM Way, NA Hall, J Lewandowski, C Napper, G Haynes, M Corey	BP Shipping Ltd
British Vigilance	L	B Wardman, S Keitch	N Haysom, S Clark, T Forrest, R Williams, A Wheatley	BP Shipping Ltd
Buccleuch	L	KG Murthy	RU Shahidi, IJ Antony	Zodiac Maritime Management Services
Bulk Ispat Leher	L	AM David, SS Srivastava	JM D'Abreo, SR Sahoo, K Anvil, M Silveira, FL Dias	Anglo-Eastern Ship Management Ltd
Burgos	L *	—	—	AP Moller

UK Fleet (contd)

CEC Cardigan	L * N		—	Graig Ship Management Ltd
C.S.Nexus	L	DJ King, AK Ullah	B Petch, F Blackstock, S De Jonge, K Fraser, JR Beck, A Lowicki, MD Macleod	James Fisher (Shipping Services) Ltd
C.S. Sovereign	L *	—	—	Global Marine Ltd
CSCL Chiwan	L * N	—	—	Seaspan Ship Management Ltd
CSCL Hamburg	L * N	—	—	Seaspan Ship Management Ltd
Cable Innovator	L	DS Hibbert, IC Smallshaw	MD Bongartz, T Meechan	Global Marine Ltd
Cable Installer	L	K Hughes-Jones, S Beal	J Fruggatt	Global Marine Ltd
Cable Retriever	L *	—	—	Global Marine Ltd
Cabo Negro	L *	—	—	MOL Tankship Management Ltd
Caledonian Isles	L	A McCrindle	P Welsh, J Stewart, R Littlefield, P Harkness	Caledonian MacBrayne Ltd
CanMar Conquest	L *	—	—	Canada Maritime Services Ltd
CanMar Courage	T L	AD Van Hees, MB Iranpur	G Choudhary, R Gaur, KB D'Silva, SS Sharma, DM Das, PB Nansi	Canada Maritime Services Ltd
CanMar Fortune	L	JM Mistry, K Nayyar	G Singh, S Mondal, KS Singh, KS Krishnan	Canada Maritime Services Ltd
CanMar Glory	L *	—	—	Canada Maritime Services Ltd
CanMar Honour	T L —	P Bland, RB Lakhani	MA Wadkar, M Dua, S Kuma, R Matta, VS Gaur, MK Titto, MX Pir	Canada Maritime Services Ltd
CanMar Pride	T	—	—	Canada Maritime Services Ltd
CanMar Triumph	L *	—	—	Canada Maritime Services Ltd
CanMar Victory	L *	—	—	Canada Maritime Services Ltd
Canterbury Star	T L	SM Ross, JW Bird	L Villacencio, R Rontoro, PF Senador, EC Gerona, DH Hermogino, AE Avellana	Norbulk Shipping UK Ltd
Cape Horn	L *	—	—	MOL Tankship Management Ltd
Caronia	L *	—	—	Cunard Seabourn Ltd
Cartagena	L *	—	—	Enterprises Shipping & Trading S.A.
Cast Performance	L	S Chahan, MB Iranpur	HP Lobo, C Rai, BS Singh, G Nautiyal, R Mamlatdar, S Bhattacharrya	Canada Maritime Services Ltd
Cast Power	T L	LFK Pereira	S Chauhan, B Mathias, AB Issac, I Akiva, F Amevel, BI Singh	Canada Maritime Services Ltd
Cast Progress	T L * N	—	—	Canada Maritime Services Ltd
Charles Darwin	L	KO Avery, GM Long	PCT Reynolds, KL McAlea, PP Gauld, J Mitchell, PW Newton	NERC Research Ship Unit
Cheshire	L *	—	—	Bibby-Harrison Management Services Ltd
Chiquita Belgie	T L	A Ruszcynski, R Murch	C Rarael, A Rabanzo, E Gelbolingo, D Oracles, J Mabatau	Great White Fleet Ltd
Chiquita Bremen	L	G Bent, B Vanmeensel	Ayazo, W Ortiz, GV Pastrona	Great White Fleet Ltd
Chiquita Brenda	T L	F Hill, J Bradham, J Gladstone, BGA Erikson	F Santillan, RR Jimena, J Cholewinski, JAD Tampus, AS Sina-on, G Pasraha	Great White Fleet Ltd
Chiquita Deutschland	L	M Morshed, R Murch, C Campbell	P Tandog, L Delfin, A McMaster, H Janda, K Botica, P Dziak	Great White Fleet Ltd
Chiquita Elke	T L	W Tebbutt, P Ruszcynski, F Hill	A Ayazo, DRJ Deldo, V Battad, D Fernandez	Great White Fleet Ltd
Chiquita Frances	L	RG Murch, P Ruszczynski, G Walker	WD Cortazar, D Ahern, M Ranis, B Dumanic, W Ortiz, A Rocha	Great White Fleet Ltd
Chiquita Italia	L *	—	—	Great White Fleet Ltd

Chiquita Jean	T L	I Rowan, P Scarrott	E Ramonal, R Pacis, R Guillang, R Legaspi	Great White Fleet Ltd
Chiquita Joy	T L	T Coornaert, P Scarrott	N Villaverde, R Cigarruista, N Dejino, O Piechatzek, D Ahern	Great White Fleet Ltd
Chiquita Nederland	T L	W Artymionek, J Cholewinski	R Pacis, JO Tillermo, A Laupeano, D Ednacot, JJ Villamora	Great White Fleet Ltd
Chiquita Rostock	L	M Cherry, RI Hay	R Cigarruista, T Furcic, R Reynolds, M Bezil	Great White Fleet Ltd
Chiquita Scandinavia	L *	—	—	Great White Fleet Ltd
Chiquita Schweiz	L	A O'Neil, RI Hay	JD Carcedo	Great White Fleet Ltd
Chrismir	L	L Andrews	DP Wakelam, CE Partridge, D Richardson, G Pearce	Souter Shipping Ltd
Cielo di Biscaglia	L *	—	—	Dorchester Maritime Ltd
Cirolana	L *	—	—	Smit International (Scotland) Ltd
City of Amsterdam	L	R Lyall, J Murray, E Dzamech, W. Bartlett	MW Bingham, J Hunter, S Ding, N Davies, J Fallon	Denholm Ship Management (UK) Ltd
City of Barcelona	L *	—	—	Denholm Ship Management (UK) Ltd
City of Cape Town	T L	GH Preston	S Iqbal, CJ Hughes, TJGY Mills, MA Samin, KN McCartney, NA Edjah	P&O Nedlloyd Ltd
City of London	T L	RM Raybould, EF Stewart A McDowell	S Shalygin, D Miller, A Plisenko, A Danilyuk, I Yefimenko, Y Bulash,	Andrew Weir Shipping Ltd
City of Sunderland	L	GM Railson	S Benstead, PA Rock, B Tasker, RI Walker, S Ding	Denholm Ship Management (UK) Ltd
Clansman	L *	—	—	Caledonian MacBrayne Ltd
Colombo Bay	L	CK Urwin, PD Davies DJ Harkness, ML Mullins	SD Westall, AG Wilson, S Azim, C Windsor-Price, AW Lewington,	P&O Nedlloyd Ltd
Condor Arrow	L *	—	—	Gearbulk (UK) Ltd
Constantia	L *	—	—	The South African Marine Corporation Ltd
Copiapo	L	SJ Davies, T Elahi	BC De S Sapukotana, HAHK Weerakkady, S Baskkaran, MPIR Perera	London Ship Managers Ltd
Cormorant Arrow	L	G Planinsek, M Cibilic, A Piatkowski		Gearbulk (UK) Ltd
Corystes	L *	—	—	Smit International (Scotland) Ltd
Cotswold	L	C Panayot	C Zbigniew, C Gabriel, S Evgeny	Zodiac Maritime Management Services
Criscilla	L *	—	—	Marr Vessel Management Ltd
Crown Princess	L	G Romano, A Poggi	J Brown, J Tomlinson, L Borghesi, G Arma, D Watts, L Imperato, G Benincasa	P&O Cruises (UK) Ltd
CSO Marianos	L	A Morris, W Donnan, P Appleford	P McParlin, K Devine, B Dooley, J Thompson	Coflexip Stena Offshore Ltd
Curico	L	PM Frost, J Dingle	BR Pabon, RT Banas, JB Hangsitang	London Ship Managers Ltd
Dallington	L *	—	—	Stephenson Clarke Shipping Ltd
Discovery	L *	—	—	Stolt Offshore Ltd
Discovery	T L	RC Plumley, RJ Chamberlain	MP Hood, PC Sergeant, PT Oldfield	NERC Research Ship Unit
Dolvi	L *	—	—	Pioneer Tankers Shipping Corp., Athens
Dominica	T L	RJ Hawkins, AB Ward, J Antonsen	K Jaskiewicz, J Gardon, D Makowski, T Zaworoner	IUM Shipmanagement AS
Donnington	L *	—	—	Stephenson Clarke Shipping Ltd
Drin	L *	—	—	V.Ships Inc.
Duhallow	L	D Kapoor	VJ Quadros, M Cordeiro, M Bansal, AJ Raberts	Zodiac MaritimeManagement Services
Durrington	L	P Johnson, M McKinnon, D Fardo	MB Wdowikowski, T Evans, C Lewis, Z Kiczka	Stephenson Clarke Shipping Ltd

UK Fleet (contd)

Eagle	L	S P Williams, M Sellars	CA Sanz, R Saludez, R Santos I	nternational Marine Transportation Ltd
Earl of Romney	L *	—	—	The Marine Society
Eastern Express	T L *	—	—	Univan Ship Management Ltd
Eclipse	L *	—	—	nternational Marine Transportation Ltd
Emily C	L	B Parsloe, M Osborne	SD Merritt, MTJ Awan, S Chutter, A Gajdacs	Carisbrooke Shipping PLC
Enchanter	L *	—	—	Biglift Shipping B.V.
English Star	T L *	—	—	Norbulk Shipping UK Ltd
Eridge	L	R Lakhotia	LA Corda	Zodiac Maritime Management Services
Erna Oldendorff	L *	—	—	Egon Oldendorff
Ernest Shackleton	T	S Lawrence	A Liddell, R KIlroy, N Lynam, N Bailey, E Hudd, C Moore, J Shanklin, T Gatti, J Harper, I Marriott, A Graffikin	British Antarctic Survey
Ernst Oldendorff	L *	—	—	Egon Oldendorff
Erradale	L	D MacCorquodale, KD Campbell	S McDonald, LS Cosgrove, ML Mullins, J Townsend, SC Lugg, DRN Cropley	The China Navigation Co. Ltd
European Envoy	T	R Pinchen, J Jamieson	D WInder, D McCauley, D Crerar, S Harwood	P&O Ship Management (Irish Sea) Ltd
European Leader	L *	—	—	P&O Ship Management (Irish Sea) Ltd
European Navigator	L *	—	—	P&O Ship Management (Irish Sea) Ltd
European Pioneer	L *	—	—	P&O Ship Management (Irish Sea) Ltd
European Seafarer	T L	M Austin, M Ingham, A Alonso, F Humberto, M Atkinson	WM Terry, RT Jamieson, N Osoro, SE Harrison, JA Balcazar, T O'Dwyer, Gracia-Nieto, A Facey, KG Fiske, P Reynolds, I Tranter, T Caley, C Ennis	P&O Ship Management (Irish Sea) Ltd
European Shearwater	L	B Miller, JB Appleby	L Johnson, MD Brown, B Worthington, J Gasking, R Mitcheson, R Bickleton, P McNeil	James Fisher (Shipping Services) Ltd
Explorer	L * N	—	—	V.Ships Inc.
Falcon Arrow	L	GM Kerur, SK Mathur	P Kumar, NJ Mohan Srinivasan, RPS Gill, AJ Nelson, HS Vora, KV Dhass	Gearbulk (UK) Ltd
Fantasy	L *	—	—	Dynacom Tankers Management Ltd
Federal Bergen	L	SG Kamath	R Mistry, S Majumdar	Malaysia International Shipping Corp. BHD
Federal Rhine	L *	—	—	Anglo-Eastern Ship Management Ltd
Federal St Laurent	L	PJ Reddipalayam, V Chawla, SU Nail, D Mehra	RS Hundra, B Gaurav, W D'silva, A Wadhera, CP Pereira	Anglo-Eastern Ship Management Ltd
Federal Yukon	L * N	—	—	Anglo-Eastern Ship Management Ltd
Fernie	L	PN Karkarey, V Philip, A Chitnis	S Kumar, G Georgiev	Zodiac Maritime Management Services
Finch Arrow	L *	—	—	Gearbulk (UK) Ltd
Flinders	T L *	—	—	ASP Ship Management
Foylebank	T L	EM Pallister, AD McPherson	ED Guy, A Plisenko, JP Keans, P Igor, N Il'ya, P Medvedkov C Cooper, N Inman	Andrew Weir Shipping Ltd
French Bay	L *	—	—	Unique Shipping (H.K.) Ltd
Front Rider	L *	—	—	Acomarit Oriental Shipmanagement Pte. Ltd

Front Sunda	L *	—	—	Wallem Shipmanagement Ltd
General Delgado	L *	—	—	Aboitiz Jebsens Shipmanagement
General Tirona	L *	—	—	Aboitiz Jebsens Shipmanagement
Gisela Oldendorff	L *	—	—	Egon Oldendorff
Glasgow Maersk	T L	M Nash, M Samwell	D Lambert, S Carmichael, D O'Donovan, RJ Wilson, SP Saunders, KW Treacy, JRR Saltonstall	The Maersk Company Ltd
Glen Maye	L	LG Helander, K Curry, G Hooiveld	RE Aguro, N Palmenco, H Alipio	MOL Tankship Management Ltd
Glen Roy	L *	—	—	MOL Tankship Management Ltd
Golden Duke	L *	—	—	IndoChina Ship Management (H.K.) Ltd
Gosport Maersk	L	AH Peermohamed, A Murray	D Wardle, D Johnstone, P Handley, P Veldhoen, N Barratt, EJ Dick, D Griffiths, G Brown, DC Duffy, S Gudgeon	Maersk Company (I.O.M.) Ltd
Graceous	L	H Ambat, S Mohan	BP Samant, LA Concessio	Anglo-Eastern Ship Management Ltd
Grafton	L	R Monga, VV Pimpalkhare	GFM Tole, C Remedios, G Singh, OJ Fernandes, S Shukla, MS Uddin	Zodiac Maritime Management Services
Grand Princess	L	MJ Moulin	R D'Arcy, A Randle, TA Howse, G Genovese, M Tuyo	Princess Cruises Inc.
Grasmere Maersk	L	A Groom, G Wostenholme	M North, M Lloyd-Smith, S Bizinos, R Beattie, J Mielniczuk, G Guthrie, N Gilbert, C Jackson, L Higson	The Maersk Company Ltd
Grebe Arrow	L	M Sobol	—	Gearbulk (UK) Ltd
Greenwich Maersk	T L	MHF Kenny, S Cresswell	RA Marshall, BA Rowland, PW Schutz, J Steen, GA McCarthy, M Lloyd-Smith	The Maersk Company Ltd
Gull Arrow	L *	—	—	Gearbulk (UK) Ltd
Hadiyah	L *	—	—	Kuwait Oil Tanker Co. S.A.K.
Hamane Spirit	L	D Matesic, N Koch	P Sule, P Predovan, RV Delos Reyes, ER Santos, M Villanueua, V Pestereus	Teekay Shipping (Canada) Ltd
Hato	L *	—	—	SMT Shipmanagement & Transport Ltd
Havdrott	L	TA Andrews, R Tanguy	MA Pagente, CA Ong, EA Rivera, ML De Los Santos, JB Timmango, JE Patriara, M Steel	Bergesen d.y. ASA
Havjarl	L	C Hatcher, K Bennett	I Pavlinovic, T Senador, C Tayag, M Cauilan, V Macale	Bergesen d.y. ASA
Havkong	L *	—	—	V. Ships (UK) Ltd
Hebridean Isles	L *	—	—	Caledonian MacBrayne Ltd
Hebridean Spirit	L * N	—	—	Hebridean Princess Cruises
Hebrides	L *	—	—	Caledonian MacBrayne Ltd
Hekabe	L *	—	—	Bergesen d.y. ASA
Helios	L	DT Simpson, G Pearson	R Asuncion, RN Cubilo, AC Domingo, MB Davalos	Bergesen d.y. ASA
Hemina	T L *	—	—	Bergesen d.y. ASA
Hesiod	L *	—	—	Bergesen d.y. ASA
Heythrop	L	AK Prabhakar, PN Karkarey	J George, A Garde, B Dias, E Fernandes, SP Thottam	Zodiac Maritime Management Services
Hoegh Duke	L *	—	—	Egon Oldendorff
Hoi Siong No.1	L *	—	—	IKS Fishing Co. Ltd

UK Fleet (contd)

HSH Kusu	L *	—	—	OW Ship Management Pte. Ltd
HSH Ubin	I *	—	—	OW Ship Management Pte. Ltd
Ibis Arrow	L	D Cedro, I Pavesic	AN Hermoso, RB Canova, JR Marquez, PNG Jardio, DL Campbell, JF Serrano	Gearbulk (UK) Ltd
Ibn Abdoun	L *	—	—	United Arab Shipping Company (S.A.G.)
Iron King	T L	LA Crole	V Lobzin, S Duzhenko, V Nagorny	Enterprises Shipping & Trading S.A.
Iron Queen	T L *	W Lorenz, DHM Young	JD Acot, J Camangian, RI Imperial, EA Isla, RL De La Cruz, RA Delen	The South African Marine Corporation Ltd
Isle of Arran	L	NW Martin, D Fyfe	D Allan, F Miller	Caledonian MacBrayne Ltd
Isle of Lewis	L *	—	—	Caledonian MacBrayne Ltd
Isle of Mull	L	R Sneeden, D Fyfe, I Scar	S Ross, A Ross, D Dove, C Mullarky	Caledonian MacBrayne Ltd
Isomeria	L *	—	—	Shell Marine Personnel (IOM) Ltd
Ivory Dawn	L *	—	—	Hoegh Fleet Services AS
Jaeger Arrow	T L * N	—	—	Gearbulk (UK) Ltd
James Clark Ross	T	CR Elliott	P Bradbury, J McCarthy, D Gooberman, N MacLeod, GP Chapman, S Baker, R Brooks, P Moxom, MJS Burgan	British Antarctic Survey
Jeannie	L *	—	—	Tomazos Shipping Co. Ltd
Jervis Bay	L	W Stocker, KC Riddick	MJ Moody, EJ Cahill, D Vickery, T Davidson, JA Milner	P&O Nedlloyd Ltd
Kagoro	T L *	—	—	V. Ships (UK) Ltd
Kazimah	L *	—	—	Kuwait Oil Tanker Co. S.A.K.
Kedah	L *	—	—	Vietnam National Shipping Lines
Kent Voyageur	L *	—	—	Kent Line Ltd
Kintampo	T	MA Cully, FB Botta	J Jurjevic, ZI Zgur, BT Biondic, GB Grubisic	V. Ships (UK) Ltd
Kiwi Arrow	L	A Piatkowski, K Szerszen	V Devera, D Barro, G Adriano, A Wdowiak, M Kiepek, H Cabe	Gearbulk (UK) Ltd
Knock Allan	L	AJ Horabik, G Bielinski	CSL Petronilo, FI Ilagon, J Palliparambil	Red Band AS
Knock Stocks	L	J Del Rio, I Ikonomopoulos	A Woltanski, AJ Bacatan, JAG Cervantes	V.Ships Norway AS
Lady Barbara	L *	—	—	Tecto Belgium N.V.
Lapponian Reefer	L	V Ancic, UM Krogstad	T Yu, E De Guzman, G Son	Holy House Shipping AB
Leopardi	L *	—	—	Barber Ship Management Inc
Licorne Pacifique	L	M Janes	W Kalagayan, AC Beniga, A Prus, V Ranes, ELC Suay, O Krzystof	Sosema S.A.
Linares	L	SP Harris	PB Vibar, JL Panghulan, KWK Gunasekara	London Ship Managers Ltd
Lincolnshire	L *	—	—	Bibby-Harrison Management Services Ltd
Linderos	L	DS Winser, DP Colley	WMP Aponso, AK Weerasekera, HB Dissanayake, DA Mendis, YMSC Karunasundera	London Ship Managers Ltd
Lord Nelson	L *	—	—	Jubilee Sailing Trust Ltd
Lord of the Isles	L *	—	—	Caledonian MacBrayne Ltd
Lough Foyle	L *	—	—	G. Heyn & Sons Ltd

Lowlands Rose	T L	VV Espino	ND Legaspi, R Nufable, C Galia	Euroship Services Ltd
Lowlands Yarra	L * N	—	—	EuroShip Services Ltd
Macoma	L *	—	—	Shell Marine Personnel (IOM) Ltd
Maersk Biscay	L	J Szymansk, R Miller	T Kazalaski, P Macha, A Olbrumski	Dorchester Maritime Ltd
Maersk Dee	T L	J Heald	G Colby, J Currie	Maersk Company (I.O.M.) Ltd
Maersk Gannet	L	T Sinclair, DJ Podger	BD Nisbet, CR Cobb, G Moir, RJA Brearley, CA Murphy, IH Roberts R Wiseman, S Lynas, P Stanton	The Maersk Company Ltd
Maersk Mariner	L *	—	—	The Maersk Company Ltd
Maersk Perth	T L * N	—	—	The Maersk Company Ltd
Maersk Ramsay	L * N	—	—	The Maersk Company Ltd
Maersk Rapier	L *	—	—	The Maersk Company Ltd
Maersk Rhine	L * N	—	—	Univan Ship Management Ltd
Maersk Rochester	L *	—	—	The Maersk Company Ltd
Maersk Rye	L *	—	—	The Maersk Company Ltd
Maersk Stafford	L *	—	—	The Maersk Company Ltd
Maersk Sussex	L	AB Waller, F Mulrooney, S Gallaway	E Waterman, RS Nair, P Bonehill, I Blair, B Murphy, A Hobley, SJ Fant, G McFarlane, J Carter, C J Deasy	The Maersk Company Ltd
Magnolia	L *	—	—	International Marine Transportation Ltd
Mairangi Bay	T L	R Ellis	A Graham, MP Green, G Collier	P&O Nedlloyd Ltd
Maracas Bay	L	D Bonetta, MW Shoolbraid, PJ Jameson,	JS Pedro, GQ Flores, AR Tingzon, DC Fermin, NR Haya	MOL Tankship Management Ltd
Marienborg	T L *	—	—	The Maersk Company Ltd
Matco Clyde	L	KJ Dye, PD Kelly	B McKenna, D Garcia, P Lazell, K Hickery, R Hood, C Scothern, M Fennell, R Pressler	International Marine Transport Co. Ltd
Matco Thames	L *	—	—	International Marine Transportation Ltd
Matilde	T L *	—	—	Souter Shipping Ltd
Mauranger	L *	—	—	MOL Tankship Management Ltd
Meynell	L *	—	—	Zodiac Maritime Management Services
Mineral Century	L	R Gupta, CPS Waraich	MD Ashraf Ali,	Anglo-Eastern Ship Management Ltd
Mineral Colombia	L *	—	—	Anglo-Eastern Ship Management Ltd
Mineral Dragon	L *	—	—	Anglo-Eastern Ship Management Ltd
Mineral Sakura	L * N	—	—	Tecto Belgium N.V.
MSC Bruxelles	L *	—	—	Worlder Shipping Ltd
Murex	L	AD Guillaume	CA Johnson, GA Robertson, J N Lucas, M Caric	Shell Marine Personnel (IOM) Ltd
Myrina	L *	—	—	Shell Marine Personnel (IOM) Ltd
Nandu Arrow	L *	—	—	Gearbulk (UK) Ltd
Naparima	L	J Richard, JS Cruikshank, IR Salter	AM Advincula, MV Caalim, RP Dela, PE Yamson, JVH Paniagua	MOL Tankship Management Ltd
Nariva	L	P Stallaert	DC Fermin, R Ortaliz, E Paraldo	MOL Tankship Management Ltd

UK Fleet (contd)

Newport Bay	L	LJ Fletcher, R Burney	TF Bebbington, J Cross, C Macleod, A Ward, C Tulloch, J Harboard, G Collier	P&O Nedlloyd Ltd
Newton	L	R Mills, S Pugsley	R Cutting, A Jezard, S Foster, M Duncan	Royal Maritime Auxiliary Service
Nivaga II	L *	—	—	Gov't of Tuvalu (Ministry of Home Affairs)
Nord Sea	L *	—	—	Wallem Shipmanagement Ltd
Norna	T L	MCJ Jewell	MP Donnelly, T Collins, C Turner, DG Boynton, M Worsnop	Scottish Fisheries Protection Agency
Norrisia	L *	—	—	Shell Marine Personnel (IOM) Ltd
Norsea	L *	—	—	P&O North Sea Ferries Ltd
North Pacific	L *	—	—	Wallem Shipmanagement Ltd
Northern Horizon	L *	—	—	Marr Vessel Management Ltd
Northern Prince	L *	—	—	Marr Vessel Management Ltd
OOCL Belgium	L	Y Ping, DJ Pritchard	I Moriarty, G Bell, G Hand, B Keegan, W Coxon, C Allen, N P Goh, P O'Reilly	OOCL (UK) Ltd
OOCL Britain	L *	—	—	OOCL (UK) Ltd
OOCL Canada	T L	DJ Prichard,S Lloyd	AJ Scarrott, GM Hand, JN Balkwill, NP Goh, P Woodcock, T Chia	OOCL (UK) Ltd
Ocean Goose	L *	—	—	Yacht Ocean Goose
Ocean Princess	L *	—	—	P&O Cruises (UK) Ltd
Ocean Spirit of Moray	L *	—	—	Gordonstoun School
Ogooue	L *	—	—	Jolane S.A.
Orange Sky	L *	—	—	Egon Oldendorff
Oriana	T L	P Fennelow	P Simpson	P&O Cruises (UK) Ltd
Oriental Bay	L	R Moxon, PR Kaye RH Ellison,	A Mackenzie, ZSS Al Maskry, M Barraclough, S Capes, MB Doyle, MS Armistead,	P&O Nedlloyd Ltd CE Partridge, AN Murray
Oriental Venture	L *	—	—	MOL Tankship Management Ltd
Orion Reefer	L *	—	—	Wallem Shipmanagement Ltd
Ormond	L *	—	—	Zodiac Maritime Management Services
P&O Nedlloyd Cook	L	DL Batchelor, KW Smith	LS Cosgrove, JA Milner, JH Beale, NCP Sutcliffe, N Beavis, H Ajam, JP Slattford	P&O Nedlloyd Ltd
P&O Nedlloyd Drake	L	K Worthington, DC Thompson	C Hallam, CM Grundy, J Cross, L Mahdi, M Huddlestone	P&O Nedlloyd Ltd
P&O Nedlloyd Genoa	T L * N	—	—	P&O Nedlloyd Ltd
P&O Nedlloyd Hudson	L	GR Jackson, PA Furneaux	M Wilkie, G Mathias, M Shahadah, D Hartigan, CI Macleod, RK Mills, JP Spencer, M Messenger, T Oliver	P&O Nedlloyd Ltd
P&O Nedlloyd Kobe	L	JL Petersen, DJ Bailey	EJ Cahill, SJ Maple, JA Hale, S Iqbal, CJ Ryden, CW Longmuir, REC Noble, I Renders, M Green	P&O Nedlloyd Ltd
P&O Nedlloyd Lyttelton	L	PJ Newton, LM Colam	AD Hemedez, FMC Fabila, I Damolo, L Cabardo, JC Kagaoan	P&O Nedlloyd Ltd

P&O Nedlloyd Marseille	L	DK MacCorquodale, KD Campbell	JL Cuttriss, JE Nuttall, DRN Cropley, MS Reynolds	P&O Nedlloyd Ltd
P&O Nedlloyd Shackleton	T L	C Woodward, K Byrne	M Wilkie, SD Twichin, R Hawthorne, A Farthing, N Khan, S Bryans, J Richardson, M Huddlestone	P&O Nedlloyd Ltd
P&O Nedlloyd Southampton	T L	BV Chipperfield, RA Kenchington	MJ Moody, JP Farr, M Samin, JL Annand, L-J Cheesbrough, RE Smith	P&O Nedlloyd Ltd
P&O Nedlloyd Tasman	L	PJR Manson, RJ McLarty	AG Wilson, N Neelemaat, AH Abid, CW Longmuir, J Poulter, N Mayers, SM Coe	P&ONedlloyd Ltd
Pacheco	L *	—	—	Andrew Weir Shipping Ltd
Pacific Crane	L	K Young	MA Perkins, MJ Booth, BH Birch, DP Hatfield, M McCallum	James Fisher (Shipping Services) Ltd
Pacific Emerald	L *	—	—	Botany Bay Management Services Pty. Ltd
Pacific Guardian	L *	—	—	Global Marine Ltd
Pacific Pintail	L	AG Lacey	MA Perkins, JG Worthington, TT Lunt, AP Austen	James Fisher (Shipping Services) Ltd
Pacific Princess	L	T Yeomans, N Carlton	C Corder, M Forbes, AP Caminong	Princess Cruises Inc.
Pacific Sandpiper	L	J Appleby	L Saxton, D Hadfield, P McNeil, D Panton, JA Rawlison, PR Spading, M Macallum	James Fisher (Shipping Services) Ltd
Pacific Swan	L	TR Greig	DEC Binyon, JP Gaskin, RD Spooner, CP Brockbank	James Fisher (Shipping Services) Ltd
Pacific Teal	L	D Marr	P Brown, MJ Booth, B Elston, T McMahon	James Fisher (Shipping Services) Ltd
Pacific Venture	L *	—	—	MOL Tankship Management Ltd
Pacific Wave	L *	—	—	MOL Tankship Management Ltd
Palliser Bay	T	DR Lewis	AJ Cox, D Harkness, G Taylor, J Weber, JG Swindlehurst, J Parnaby, MP Green, RC Burn, RD Thomas, SC Lugg, SW Francis, SP Sturdy	P&O Nedlloyd Ltd
Pegasus Bay	T L	RH Jowett	AN Lovick, R Oliver, K Bradshaw	P&O Nedlloyd Ltd
Pelican Arrow	L	S Bashin, RM D'Souza, S Narang	RJ Pereira, SJ Lakdawala, S Ghosh	Gearbulk (UK) Ltd
Peninsular Bay	T L	SG Miller, BL Brierley	DJ Cooper, J Pemberton, J Poulter, AWR Piggott, R Harding, CJ Hughes, DJ Old, LUC Turner	P&O Nedlloyd Ltd
Petersfield	L	MM Grass, A Kardum	JR Yongque, AO Evangelista	Gearbulk (UK) Ltd
Petro Fife	L	DW Ling, A Hodgson	A Khan, DJ Buckley, DF Campbell	International Marine Transportation. Ltd
Pharos	L *	—	—	Northern Lighthouse Board
Pine Arrow	L * N	—	—	Gearbulk (UK) Ltd
Pioneer Leader	L *	—	—	Wallem Shipmanagement Ltd
Pisces Trader	L	A Nayyar, NPS Bharaj	JS Fernandes, CS Dias, P Singh, K Shetty, A Kumar, FK Nettacadan, H Shahinshah, R Thakur	Bibby-Harrison Management Services Ltd
Plover Arrow	L	MD Cummins, K Finckenhagen	K Bjorgan, N Knego, G Demayo, V Cruz, - Ausland, N Oksnes, S Kallestad	Gearbulk (UK) Ltd
Pride of Bilbao	L	RJ Ross, A McFadyen, N Dunn	M Hampton, J Mercer, SJ Ivey, T Vincent, J Cartlidge, C Hek	P&O European Ferries (Portsmouth) Ltd
Pride of Bristol	L *	—	—	The Pride of Bristol Trust
Pride of Cherbourg	L	PI Hillman, C Bell	DL Ellis, CPJ Robins, RM Hayward, CM Ward, TJ Vincent	P&O European Ferries (Portsmouth) Ltd
Pride of Hampshire	L *	—	—	P&O European Ferries (Portsmouth) Ltd
Pride of Le Havre	L	W Field, C Walford, R Shopland	NE Rice, S Gross, C Bull, GI Hamer, K Bedhoost	P&O European Ferries (Portsmouth) Ltd

UK Fleet (contd)

Pride of Portsmouth	L *	—	—	P&O European Ferries (Portsmouth) Ltd
Primo	L	HR Dhanu, TT Makashi	S Sood,	Barber Ship Management AS
Prince 1	L *	—	—	Charles M. Willie & Co. (Shipping) Ltd
Prince of Waves	L	AP Agabao, FA Manuel	RM Sapida, AT Digal, RB Canete, O Panday	Seatrade Groningen B.V.
Princess Katherine	L *	—	—	Ravenscroft Shipping Inc
Princess Nadia	L *	—	—	Ravenscroft Shipping Inc
Providence Bay	T L	KW Smith, DL Batchelor	A Graham, LS Cosgrove, GP Williams, LS Mahdi, I Renders, AL Smith, J Poulter, L-J Cheesbrough, G Chatwin, M Messenger	P&O Nedlloyd Ltd
Puerto Cortes	L *	—	—	Sea Containers Services Ltd
Putford Achates	L *	—	—	Boston-Putford Offshore Safety Ltd
Pytchley	L	MJ Walker	L De Jun, D Yi-Wen, F Suizhen, L Dong-bo	Zodiac Maritime Management Services
Queen Elizabeth 2	T L	RW Warwick	R Hone, OS Ghoshroy, GE Hunter, RR Clunas, A Stratford, C Douglas, DS McIntosh	Cunard Seabourn Ltd
Queensland Star	L *	—	—	P&O Nedlloyd Ltd
Quorn	L	PAW Sequeira	SK Pandit, JA Vaz Leonand, G Jethva	Zodiac Maritime Management Services
Raven Arrow	L	JK Boben, SD Shetye, H Singh	N Kanetkar, RB Deshpande, KC Dhas, HS Pawar, AA Indurkar	Gearbulk (UK) Ltd
Regent Rose	L *	—	—	United Sea Service S.A. de C.V.
Regina Oldendorff	L *	—	—	Egon Oldendorff
Repulse Bay	T	KS Hardy, M Rossiter	PJ Fowler, J Beviere, FH Munro, S Fish, S Twitchin, A Hughes, H Ajam, J Geddes	P&O Nedlloyd Ltd
Resolution Bay	T L	AM Tweedie, MD Moore	JA Hale, SJ Maple, SJ Illingworth, P Seaney, D WInter, C Moss, K Hart, WD Hope, I Renders, R Hughes, W Doolon, C Hall	P&O Nedlloyd Ltd
Rhone	L *	—	—	United Ship Management Ltd
Rixta Oldendorff	L *	—	—	Egon Oldendorff
Rocknes	L *	—	—	Wilson Ship Management (Bergen) AS
Royal Princess	L	RM Oliver	S Bradshaw, T Kotkavoori,	P&O Cruises (UK) Ltd
Rutland	L *	—	—	Zodiac Maritime Management Services
S.A.Fortius	L	DHM Young	J Opatowicz, F Bernath, P Przybylski	The South African Marine Corporation Ltd
Sabina	L *	—	—	Carisbrooke Shipping plc
Safmarine Asia	L *	—	—	Safmarine Ship Management
Safmarine Europe	L *	—	—	Safmarine Ship Management
Safmarine Infanta	L *	—	—	Target Marine S.A.
Safmarine Nolizwe	L *	—	—	Safmarine Ship Management
Saga Horizon	L	T Hexell, A Coulter	E Tenazas, E Mariano, D Ramirez, J Perfas	Patt Manfield & Co. Ltd
Saga Rose	T L	D Warden-Owen, M Reed, A McLundie	IH Roberts, J Struthers, B Ross, G Jones	Saga Shipping Co. Ltd
Saga Wave	L *	—	—	Denholm Ship Management Ltd

Saga Wind	L	KB Ferries, EM McDonnell	—	Patt Manfield & Co. Ltd
Sagacity	L	T Hatalski	M Piwecki, P Wroblewski, W Tkaczyk	F.T. Everard & Sons Ltd
St Clair	L *	—	—	P&O Scottish Ferries Ltd
St Helena	L	DNR Roberts, MLM Smith	AR Williams, A Greentree, MA Henry, GJ Alderman, PA Alvarez-Munoz	Andrew Weir Shipping Ltd
St Lucia	T L	AB Ward, J Antonsen, R Hawkins	M Wojciechowski, K Jaskiewicz, J Pliszko, K Salmon, JG Matthews	IUM Shipmanagement AS
St Sunniva	L *	—	—	P&O Scottish Ferries Ltd
Saldanha	L *	—	—	The South African Marine Corporation Ltd
Saloma	L *	—	—	Univan Ship Management Ltd
Samarinda	T L * N	—	—	EuroShip Services Ltd
Scillonian III	L *	—	—	Isles of Scilly Steamship Co. Ltd
Scotia	T L *	—	—	Marr Vessel Management Ltd
Scott Guardian	T L	J Cargill, RM Coull	M Bradley, I Sanderson, R Sorensen, I Duthie	BUE North Sea Limited
Scottish Star	T	P Buckley	DY Caparaz, JD Amo, FT Octa, RD Hussain, E Catequista	IUM Shipmanagement AS
Sea Ahmed	L *	—	—	Oesterreichischer Lloyd Ship Mgmnt GmbH
Sea Amethyst	L	W Venning, A Wormald, K Doyle	MB Wdowikowski, HD Nutt, DM Shaw, B Standerline, D Jellonnek	Stephenson Clarke Shipping Ltd
Sea Princess	L *	—	—	P&O Cruises (UK) Ltd
Seabourn Sun	L	HT Gundersen, T Lura	IK Olsen	Cunard Seabourn Ltd
Semac 1	L *	—	—	European Marine Contractors Ltd
Seniority	L	T Sienkiewicz, T Hatalski	J Sobczyk, M Staniewski, M Smigielski, W Grzegodzek	F.T. Everard & Sons Ltd
Severn Fisher	L	G Mount	A Carvalhal	James Fisher (Shipping Services) Ltd
Shenzhen Bay	L	JM Dodworth, DW Lax	NG Flintoff, A Graham, EFS Harrison, A Firman, RK Harding, JA Webber, PM Crawford, CI Macleod	P&O Nedlloyd Ltd
Shetland Service	T L	IGC Ferguson	JD Thompson, J Coull, DM Fullerton	BUE North Sea Limited
Singapore Bay	L	JR Kennedy, M Watts	TJGY Mills, JB Harbord, BK Quayson	P&O Nedlloyd Ltd
Sir Eric Sharp	L *	—	—	Global Marine Ltd
Siskin Arrow	L *	—	—	Gearbulk (UK) Ltd
Snowdon	L * N	—	—	Zodiac Maritime Management Services
Snow Crystal	L	G Callebro, M Iver	M Sorra, P Loyola, N Rizada, Z Krawczyk, H Nonesco, D Ladasic	Holy House Shipping AB
Snow Drift	L	B Yelland	V Vicic, M Delacruz, N Tonog, B Semic, H Nonesco	Holy House Shipping AB
Snow Flower	L	M Baker, G Callebro	D Kovacevic, N Jabay, R Cabusa	Holy House Shipping AB
Snow Land	L	WG Lockie, PA Andoh-Wilson	P Kostic, R Dajay, S Faelnar, J Cabrena, D Kovacevic	Holy House Shipping AB
Solitaire	L *	—	—	Allseas Engineering
Southampton Star	L *	—	—	World Marine Co. Ltd
Spar Topaz	L *	—	—	Spar Shipping AS
Speybank	T L	W Campbell	D Hall	Andrew Weir Shipping Ltd
Sponsalis	L	GJ Smith, D Peraic, KAG Biscoe	E Jaffery, SMJ Abbas, A Beverwijk, JD Currie	Shell Marine Personnel (IOM) Ltd
Star Isoldana	T	NA Legaspi	RA Calamayan, R Paca, JR Jaromahum, JM Merano	Masterbulk Pte Ltd
Star Princess	L * N	—	—	P&O Cruises (UK) Ltd

UK Fleet (contd)

Stavros S Niarchos	L *	—	—	STA Tall Ships
Stellar Navigator	L * N	—	—	Hachiuma Steamship Co. Ltd
Stolt Kittiwake	L *	—	—	Stolt-Nielsen Transportation Group B.V.
Storrington	L	CDG Grahame, B Standerline	J Lipka, R Duff	Stephenson Clarke Shipping Ltd
Sulisker	L	JP Laycock	MW Fergusson, J Ebdy, DG Boynton, AC Cooper	Scottish Fisheries Protection Agency
Summer Flower	L	VP Masnayon,	GP Qequito ER Batoon, RB Micolub, HE Venegas, DL Del Castillo, J Monzales	Hoegh Fleet Services AS
Summer Meadow	L	JC Hare, RD Misa	—	Hoegh Fleet Services AS
Summer Wind	L *	—	—	Hoegh Fleet Services AS
Sun Suma	L *	—	—	United Ship Management Ltd
Superiority	L *	—	—	F.T. Everard & Sons Ltd
Swan Arrow	L *	—	—	Gearbulk (UK) Ltd
Swan Bay	L *	—	—	Wallem Shipmanagement Ltd
Swan River	L *	—	—	Fleet Management Ltd
Swan Stream	L	R Rasquinha	S Dutt, AB Garcia, M Encino, S Sharma	Wallem Shipmanagement Ltd
Talca	L	AM Akbar, P Gunaratna	KMVN Barammane, WDSK Mahanama, T Alskoutz, P Shahada	London Ship Managers Ltd
Tamar FI	L *	—	—	Byron Marine Limited
Taunton	L	SM Fernandes	—	Zodiac Maritime Services
Teignbank	T L	JJ Millar	E Korshikov, GR Phillips, SW Moffat, T Still, P Dmitry	Andrew Weir Shipping Ltd
Tenacious	L	JPH Fisher, JC Etheridge	P Compton, S Catterson, S Wesener, R Love, M Drew J	ubilee Sailing Trust Ltd
Tepozteco II	L *	—	—	Transportaçion Maritima Mexicana SA de CV
Tobias Maersk	L	GA Walter, M Cox	I Farrell, S Walsh, S J Eves, J Parkin, DT Stinton, TJ Workman, R Pienaar	The Maersk Company Ltd
Toisa Conqueror	T L	RO Chaplin, J Martinez	M Jennings, T Maciejuk, S Duffield	Sealion Shipping Ltd
Toisa Coral	L * N	—	—	Sealion Shipping Ltd
Toisa Cougar	L *	—	—	Sealion Shipping Ltd
Toisa Perseus	T L	RT Blackman	C Pritchard, C Bush, AF McKee, M Duckworth, J Gwinnell, M Pakula	Sealion Shipping Ltd
Toisa Petrel	L *	—	—	Boston-Putford Offshore Safety Ltd
Toisa Sentinel	L	RO Chaplin	SC Duffield, C Coquiem	Sealion Shipping Ltd
Tor Baltica	T L *	—	—	DFDS Tor Line Ltd
Torben Maersk	L	KE Hammerman, M Westphal, A Gambina, G Walter	C Loudon, W Leydon, S Walsh, SJ Eves, KA Walker, A Macintosh	Maersk Company (I.O.M.) Ltd
Toucan Arrow	L	P Akesson, L Benzon	R Persona, T Despi, F Manahan, HV Tupas, M Caleja, R Flores, L Ormilla	Gearbulk (UK) Ltd
Trade Eternity	L *	—	—	Worlder Shipping Ltd
Trade Maple	L *	—	—	Worlder Shipping Ltd
Trade Selene	L *	TS Fay	JMD Ali, XY Lai, SD Yuan, G Biao, LK Wing	Worlder Shipping Ltd
Transporter	L	RW Wade, GP Eyles	JC Barton, RL Pacrem	Graig Ship Management Ltd
Trein Maersk	L	MI Khan, S Davison, M Cox	AT Serero, J Penton, KF MacDonald, MA Haynes, P Masden, K Walker, S Fant, R Keown	Maersk Company (I.O.M.) Ltd

Trojan Star	L *	—	—	Norbulk Shipping UK Ltd
Tsuru Arrow	L *	—	—	Gearbulk (UK) Ltd
Tudor Star	L	A Tibbott, P Richards	PF Senador, C Almari, F Vidallon	Norbulk Shipping UK Ltd
Tundra Princess	L	P Baranowski	G Requillo, D Paca, W De Leon	IUM Shipmanagement AS
Ullswater	L	AS DeSouza, R Dasgupta	TT Raveski, PS Dhanoa, R Bhatia, S Nayyar, DS Baweja, GC Heramath, K Hassan	Zodiac Maritime Management Services
Victoria	L *			P&O Cruises (UK) Ltd
Vigilant	T L	DW Temple	E Sheldon, P Weychai, TA Wilson, CE Holmes, MB Syles	Scottish Fisheries Protection Agency
Vine	L	VP Singh, A Chaterjee	KG Varghese, AK Tripathi, BS Lasheer	Zodiac Maritime Management Services
Voc Frontier	L *	—	—	Dockendale Shipping Company Ltd
Waterford	L	K Deepak, P Mookerjee	CN Dubey, M Khan, R Srinivasan, M Gopal, RTS Mattos, S Farnandez	Zodiac Maritime Management Services
Western Bridge	T L	BJ Wilson	C L Ranasinghe, JR Hollamby, DG Lyon	Furness Withy (Shipping) Ltd
Westfield	L	M Raauz, Z Novak	BR Manalo, GC Santos, JV Palmaras, EA Ege, T Manuel, FCR Gotangco	Gearbulk (UK) Ltd
Westra	T L *	—	—	Scottish Fisheries Protection Agency
World Nord	L	KRA Krishnan	GB Zhong, YT Xue, SMM Famal	International United Shipping Agency Ltd
World Place	L *	—	—	The Eastern Shipping Co. Ltd
World Spark	T L	J Brouwer	EJ Botin, M Lubi, L Azul	Eurasia Shipping & Management Co. Ltd
Wren Arrow	L	V Buskovic, D Perusina	VD Legaspina, WV Vidallon, R Abrasia	Gearbulk (UK) Ltd
Yeoman Bank	L * N	—	—	CH Sorenson Management AS
Yeoman Bridge	L *	—	—	V. Ships (UK) Ltd
York	L	FX Pereira	BN Augustine, M Sony	Zodiac Maritime Management Services
Zetland	L *	—	—	Zodiac Maritime Management Services
Zuljalal	L *	—	—	United Ship Management Ltd

Note 1. Although they have now been withdrawn from the UK VOF, the following ships also contributed weather observations during the 12 months prior to 31 March 2002: *Argentina Star, Atlixco, Baltic Eagle, British Steel, Caribbean Reef, City of Paris, Coral Reef, Dove Arrow, Eye of the Wind, Harmac Dawn, Ironbridge, Jolly Ebano, Maersk Baffin, Maersk Holyhead, Maersk Scotland, Maersk Shetland, Maersk Somerset, Maersk Suffolk, Maersk Surrey, Mark C, Nordstrand, Safmarine Nomzi, Shun Kim, Sierra Nafria, Sierra Nava, Teno, Trade Cosmos*

Note 2. The following ship submitted logbooks during the last 12 months but are is fully recruited to the UK VOF: *Regalia, Trade Apollo*

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

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

UK fixed or mobile offshore stations. (North Sea and other exploration areas.) 'T' indicates TurboWin software In use.

UNIT		OPERATOR
AHOO1	T	Amerada Hess Ltd
Beryl A		Mobil North Sea Ltd
Beryl B		Mobil North Sea Ltd
Buchan A	T	Talisman Energy (UK) Ltd
Captain WPP A	T	Chevron Texaco
Global SantaFe Adriatic XI	T	Global SantaFe
Global SantaFe Arctic III	T	Global SantaFe
Global SantaFe Arctic IV	T	Global SantaFe
Global SantaFe Britannia	T	Global SantaFe
Global SantaFe Galaxy I	T	Global SantaFe
Global SantaFe Galaxy III	T	Global SantaFe
Global SantaFe Grand Banks	T	Global SantaFe
GlobalSantaFe Magellan	T	Global SantaFe
GlobalSantaFe Monarch	T	Global SantaFe
GlobalSantaFe Monitor	T	Global SantaFe
GlobalSantaFe Rig 135	T	Global SantaFe
GlobalSantaFe Rig 140	T	Global SantaFe
Gryphon A	T	Kerr-Magee Oil (UK) plc
Haewene Brim	T	Pierce Production Co. Ltd
Iolair		Transocean Offshore (North Sea) Ltd
Jack Bates	T	Transocean Offshore (North Sea) Ltd
Janice A	T	Kerr-Magee Oil (UK) plc
Maersk Endurer	T	Maersk Contractors Ltd
Morecambe Bay AP1	T	British Gas Hydrocarbon Resources Ltd
Noble Ton Van Langeveld	T	Noble Drilling (UK) Ltd
North Alwyn A	T	TotalFinalElf
Northern Producer	T	PGS Atlantic Power Ltd
Ocean Guardian	T	Diamond Offshore (UK) Ltd
Paul B Loyd Jr	T	Transocean Offshore (North Sea) Ltd
Sedco 706	T	Transocean Offshore (North Sea) Ltd
Sedco 711	T	Transocean Offshore (North Sea) Ltd
Sedco712	T	Transocean Offshore (North Sea) Ltd
Sedco 714	T	Transocean Offshore (North Sea) Ltd
Tartan A	T	Talisman Energy (UK) Ltd Ltd
Tiffany Platform	T	Agip (UK) Ltd
Transcocean John Shaw	T	Transocean Offshore (North Sea) Ltd
Viking B	T	Conoco (UK) Ltd

UK Auxiliary ships

VESSEL
Al Fujairah
Alam Baru
Amer Choapa
Carouge
Cielo di Spagna
Crude Transporter
Endeavour
Green Ice
Hightide
Jupiter Diamond
Lady Sushil II
Marine Explorer
Meridian Ace
Mineral Ordaz
Nordbeach
Ratna Deep
Safflower
Sargodha
Sinfonia
State of Manipur
Stena Shipper
Takamine
Uraga
Venus Diamond

Listings for overseas observing fleets

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

INDIA *(Information dated 1 March 2002)*

Selected Ships:

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

Supplementary Ships:

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

Supplementary Ships:

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

Supplementary Ships:

Jag Pragati Jag Praja
Jag Prakash
Jag Prayog
Jag Preeti
Jag Rashmi
Jag Ratna
Jag Vikram
Jala Doot
Jawaharlal Nehru
Jhulelal
Lal Bahadur Shastri
Lance Naik Albert Ekka PVC
Lt Arun Khetrapal PVC
Lok Kirti
Lok Kranti
Lok Maheshwari
Lok Pragati
Lok Prakash
Lok Pratap
Lok Pratima
Lok Prem
Lok Rajeshwari
Maharaja Agrasen
Maharashtra
Maharshi Karve
Major Hoshiar Singh PVC
Major Shaitan Singh PVC

Supplementary Ships:

Major Somnath Sharma PVC
Mandakini
Mizoram
Motilal Nehru
Murshidabad
Naik Jadunath Singh PVC
Nancowry
Nand Hari
Nand Kishore
Nand Rati
Nand Smiti
Nand Srishti
Nanga Parbat
Netaji Subash Bose
Nicobar
Nirmal Bhushan
Prabhu Das
Prabhu Daya
Prabhu Jivesh
Prabhu Puni
Prabhu Satram
Pratibha Cauvery
Rabindranath Tagore
Raja Mahendra
Rajiv Gandhi
Rama Raghoba Rane PVC
Ravidas

Supplementary Ships:

Sagar Samrat
Sampurna Swarajya
Sanmar Pioneer
Satya Murti
Skandy Surveyor
State of Tripura
State of Tripura
Subhedar Jogindar Singh PVC
Suvarna Swarajya
Swaraj Deep
Tamil Kamaraj
Tamilnadu
Tulsidas
Uttar Kashi
Varanasi
Viswa Doot
Vishva Karma
Vishva Nandini
Vishva Pankaj
Vivekananda
Yerawa

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

AUSTRALIA (Information dated 8 April 2002)

Selected ships:

Aburri
Al Khaleej
Al Kuwait
Al Messilah
Al Shuwaikh
Alltrans
Alnilam
ANL Progress
Aotearoa Chief
Arafura
Australian Pride
Bader IIi
Botany Tradewind
Cape Howe
Capitaine Cook
Capitaine Fearn
Challis Venture
Changsha
Chekiang
Chenan
Coral Chief
Danny F Ii
Endeavour River
Farid F
Fitzroy River
Forum Samoa
Francesco
Fua Kavenga
Goonyella Trader
Iron Carpentaria
Iron Chieftain
Iron Kembla
Iron Monarch
Iron Sturt
Iron Yandi
Kimberley
Kiribati Chief
Kokopo Chief
Kowulka
Lindesay Clark
Maersk Pelepas
Maersk Tacoma
Maersk Tampa
Maersk Trieste
Mawashi Al Gasseem
Maysora
MOL Waratah
Mosdeep
MSC Indonesia
MSC Kiwi
Nivosa
Northwest Sanderling
Northwest Sandpiper
Northwest Seaeagle
Northwest Shearwater
Northwest Snipe
Northwest Stormpetrel
Northwest Swift
OOCL Australia
Ormiston
P&O Nedlloyd Adelaide
P&O Nedlloyd Malacca
P&O Nedlloyd Taranaki
Pacific Sky
Pacific Triangle
Papuan Chief
Pathfinder Ii
Pioneer
Portland
River Boyne
River Embley
Roebuck Bay
Saraji Trader
Seakap
Southern Supporter
Spirit Of Tasmania
Tavake Oma
Wauri

Supplementary ships:

Duyfken

Auxiliary ships:

Bark Endeavour
Geo Arctic

NEW ZEALAND (Information dated 1 February 2002)

Selected ships:

America Star
Boral Gas
Capitaine Wallis II
Columbus Queensland
Golden Bay
Helen
Kakariki
Kiwi Breeze
Melbourne Star
Nele Maersk
New Zealand Pacific
Nexoe Maersk
Nicolai Maersk
Nicoline Maersk
Nora Maersk
Nysted Maersk
Pacific Chieftain
Pacific Gas
Pacific Onyx
P&O Nedlloyd Tauranga
Rotoiti
Rotoma
Sea Tow 22
Sea Tow 25
Sofrana Kermadec
Soren Larsen
Spirit of Competition
Sydney Express
Sydney Star
Taiko
Tangaroa
Tasman Adventure
Tasman Discoverer
Tasman Explorer
Wellington Express

Supplementary ships:

Arahura
Aratere
Kent
Straitsman
Suilven

Auxilliary ships:

Canterbury HMNZS
Endeavour HMNZS
Manawanui HMNZS
Resolution HMNZS
Spirit of New Zealand
Takapu HMNZS
Tarapunga HMNZS
Te Kaha HMNZS
Tui HMNZS
Waikato HMNZS
Wellington HMNZS

THE MARINE OBSERVER — Survey 2002

To help us gauge reader satisfaction with the journal it would be appreciated if you could find time to complete this survey form. Through this survey we will be able to ensure that the journal continues to meet your needs, whether you are a voluntary marine observer or a reader ashore with an interest in marine observing.

All readers are invited to participate in the survey, and this form can be photocopied as required for multiple submissions. Please return completed forms to the address overleaf (ships' officers can also pass them to a visiting UK Port Met. Officer).

1. Who are you?:

(Tick the box that most applies to you)

☐ Master
☐ Observing Officer
☐ Other ship staff (including Cadets)
☐ Land-based reader/organisation (including Subscriber)

2. When is the journal read? (Please tick one box only)

☐ As soon as you receive it
☐ I rarely read it.
☐ Duties/time permitting
☐ Held for library purposes only.

3. Is the journal received regularly each quarter?

☐ Yes ☐ No ☐ Not known

4. How pleased are you with the presentation and style of the journal?

☐ Very pleased ☐ Pleased ☐ No opinion ☐ Dissatisfied ☐ Very dissatisfied

5. How do you rate your interest in the following sections of *The Marine Observer?*

(Tick one box in each line. Guide: '1'='Very Interested', and '5'='Uninterested')

	1	2	3	4	5
Editorial	☐	☐	☐	☐	☐
Marine Observers' Log	☐	☐	☐	☐	☐
Articles	☐	☐	☐	☐	☐
Long-service Awards	☐	☐	☐	☐	☐
Excellent Awards	☐	☐	☐	☐	☐
Postbag	☐	☐	☐	☐	☐
Reviews	☐	☐	☐	☐	☐
Noticeboard	☐	☐	☐	☐	☐
Fleetlists	☐	☐	☐	☐	☐
Scene at sea	☐	☐	☐	☐	☐
Annual Report of Work	☐	☐	☐	☐	☐
The 'ship map'	☐	☐	☐	☐	☐

6. Which of the above sections do you think could be :

(a) Expanded . . . .
(b) Shortened . . . .
(c) Discontinued . . . .

7. What other topics you would like to see addressed in the journal?

. . . .

Questions 8 to 15 are for readers on voluntary observing ships only:

8. Where is the journal held on board? ....

9. Are back issues retained on board?

☐ Yes ☐ No ☐ Not sure

10. Do you ever read/refer to back issues?

☐ Often ☐ Sometimes ☐ Never

11. How often do you report marine phenomena in the 'Additional Observations' pages of the Ships' Meteorological Logbook?

☐ At every opportunity ☐ Often ☐ Not very often
☐ Rarely ☐ Never

12. If 'Never', please tick one or more of the following the statements.

☐ Other duties preclude my observation of additional phenomena.
☐ Maritime phenomena of significance are rarely observed on this ship.
☐ I have no real interest in observing maritime phenomena, wildlife etc.
☐ I am not aware of the usefulness of additional observations
☐ I would prefer to use e-mail (mailing to obsmar@metoffice.com)

13. Have you ever e-mailed obsmar@metoffice.com to send your additional observations while at sea?

☐ Yes, I prefer to use e-mail
☐ Yes, I occasionally use e-mail
☐ No, I have not used e-mail
☐ No, but I will use e-mail in future
☐ No, I have no access to e-mail

14. Has an additional observation you have written/co-written appeared in the journal?

☐ Yes ☐ No ☐ Not sure

15. If 'No', how do you feel about this?

☐ Very discouraged ☐ Discouraged
☐ Better luck next time ☐ No opinion

Readers' additional comments:

Please let us know if you have any further comments or suggestions that you think would help us to improve The Marine Observer.

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....

NAME OF SHIP, INSTALLATION or ORGANISATION	DATE

Thank you for helping with our survey. Please return your survey form to:

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