1979
FASTNET RACE INQUIRY

ROYAL YACHTING ASSOCIATION • ROYAL OCEAN RACING CLUB

REPORT

BY

SIR HUGH FORBES SIR MAURICE LAING

LIEUTENANT-COLONEL JAMES MYATT

TO

THE COUNCIL OF THE RYA AND THE COMMITTEE OF THE RORC

The research for this report was carried out under the direction of a working party consisting of:—

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Bill Anderson	RYA Cruising Secretary
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Most of the material on which the report is based was supplied by competitors in the 1979 Fastnet Race. The working party wish to thank the following individuals and organisations who provided information or specialist advice: The Commanding Officer HNLMS Overijssel; Rodney Hill, owner of the yacht Morningtown; HM Coastguard S.W. District, Lands End Coastguard and Falmouth Coastguard; the staff of the Flag Officer Plymouth and the Commander Southern Maritime Air Region on behalf of the Southern Rescue Co-ordination Centre; RN and RAF aircrew of RNAS Culdrose, RAF St Mawgan and RAF Kinloss; The Irish Naval Service; personnel of the RNLI; The Post Office, including the staff of Lands End Coast Radio Station; The Hydrographic Department; The Department of Trade, Marine Division; The Meteorological Office; Ministère des Transports, Direction de la Météorologier; The BBC; HM Naval Base, Chatham; Mr. Lawrence Draper, Institute of Oceanographic Sciences; The Royal Western Yacht Club of England; The Cruising Club of America; The Cruising Yacht Club of Australia; The Wolfson Unit for Marine Technology, University of Southampton; K. Adlard Coles; Mrs. Mary Pera; Andrew Besley; *Yachting World*; Specialist Research Unit; numerous yacht designers.

The compilation of the report of the inquiry was co-ordinated by Joan Kimber, Alan Green and Bill Anderson.

Printed by T. H. Brickell & Son Ltd, The Blackmore Press, Shaftesbury, Dorset.

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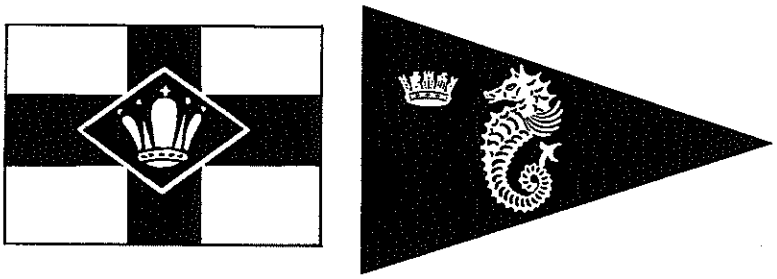

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Introduction

0.1 Great Britain has always been involved with the sea, and the Fastnet Race is but a part of this tradition. In 1979 the race took place in extreme conditions causing tragic loss of life and severe pressure on the race and rescue organisation. Following the loss of life in the 1979 Fastnet Race we were appointed jointly by the Council of the Royal Yachting Association (the National Authority in the United Kingdom) and the Committee of the Royal Ocean Racing Club (the organisers of the race) to consider what lessons might be learnt from what occurred during the race and, if we thought fit, to make recommendations. A Working Party was set up under the joint leadership of Lieutenant Commander W S B Anderson, RN, Cruising Secretary of the RYA, and Alan Green, Secretary of the RORC, with the assistance of Joan Kimber, the Inquiry Secretary. The composition of the Working Party appears on page one. A comprehensive questionnaire was devised by the Working Party and sent to the skipper and two crew members of each of the 303 yachts, which started the race. Replies were received from 235 yachts, and these answers were analysed by computer. Replies were received from a further 30 yachts, but these were not included in the computer analysis, for the reasons given in table 1.3. A total of 669 questionnaires has been returned and the Inquiry would like to record its gratitude for this very high degree of response.

0.2 The questions asked in the questionnaire will be found at the head of each of the tables in which the detailed computer analysis of the answers is set out in appropriate sections throughout the report. In addition the Working Party obtained information from a number of organisations whose activities either did have, or might be thought to have had, an influence on the behaviour of yachts in the race or the rescue operation which was mounted. The skippers and crews of a number of yachts were interviewed as soon as they came ashore after completing or retiring from the race. The main body of the report summarises the information obtained from all these sources, and attempts an evaluation of this information. The work involved, culminating in this evaluation has fallen entirely on the Working Party, and we would wish to express our gratitude, as well as our admiration, for the way they have carried out this task. The conclusions and recommendations are our own.

Contents

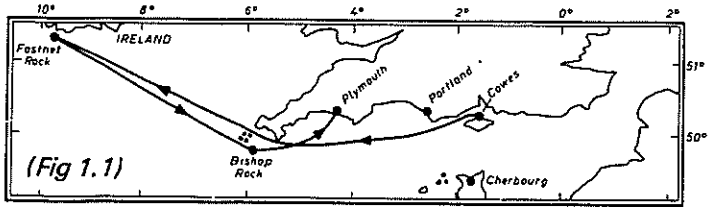
TABLE 1.1

Year	*Starters*	*Finishers*	*% Finishers*	*Elapsed Time of 5th Boat*
1955	47	44	93.6%	4 days 9 hr 51 mins.
6-12 August				
Light to moderate WNW winds veered northerly and became very light and variable in direction on 7th. Between 7th and 10th winds were mainly light northerly after which they veered ENE and increased to moderate by 11th. Winds fell light again on 12th.				
1957	41	12	29.3%	4 days 20 hr 16 mins.
10-15 August				
The race started in fresh SW winds which increased to gale force by the evening of the first day. A short moderation to force 6, with occasional stronger gusts was followed by an increase to gale force from the SW, and a slow veer to north with little decrease in strength. A very rough race.				
1959	59	43	72.9%	5 days 8 hr 8 mins.
8-16 August				
Light and variable or calm at the start and for the first two days, then freshening winds ahead of a depression produced fresh winds, locally gale or even severe gale, in the Fastnet area. 14th mainly moderate to fresh WSW winds decreased to become light or moderate by 15th and light variable or calm on 16th.				
1961	95	62	65.3%	4 days 18 hr 21 mins.
5-11 August				
Light to moderate WSW winds gradually decreased and became light variable or calm by 7th. On the 8th a small depression moved northeastwards into Western Approaches producing moderate to fresh winds reaching gale force on the southern side of the circulation between Scilly Isles and Fastnet. As the depression moved away northeastwards across UK mainly Force 3 to 4 westerly winds on the 9th decreased to become variable light or calm on 10th and 11th.				
1963	127	103	81.1%	4 days 17 hr 15 mins.
10-16 August				
Light to moderate westerly winds veered NW between Scilly Isles and Fastnet on 11th but the strength continued to be only light or moderate until 13th when it decreased further to become light variable or calm and these conditions continued until 14th. A light to moderate NW breeze set in from the western part of the course on 15th and winds continued to increase to moderate or fresh mainly SW until the end of the race.				
1965	151	146	96.7%	4 days 9 hr 2 mins.
7-13 August				
Light to variable or calm for most of race. It did however increase to light to moderate mainly SE on 13th.				
1967	209	194	92.8%	3 days 23 hr 49 mins.
5-11 August				
Light variable or calm becoming light SW on the 6th, increasing to mainly moderate and backing southerly on 7th. Winds remained very light and variable or calm between the 7th and 11th when winds started to increase a little from the SW but remained mainly light.				
1969	179	169	94.4%	4 days 7 hr 55 mins.
9-16 August				
Light and variable winds local thunderstorms which may have produced some gusts in their vicinity. Winds were light variable or calm throughout but increased a little from a northerly point to light to moderate on 16th.				
1971	219	199	90.8%	3 days 16 hr 41 mins.
7-14 August				
Mainly light SW until 10th when veering NW in Fastnet area. Between 10th and 12th winds were mainly W to NW light and remained this way until they increased a little to give moderate SW towards the end of the race.				
1973	258	247	95.7%	4 days 1 hr 27 mins.
Winds light variable or easterly with fog patches and a fair number of calm periods.				
1975	256	239	93.4%	4 days 10 hr 22 mins.
The start was in force 3 westerly winds which freshened to give a fast sail to the Fastnet Rock. Visibility was intermittently bad at the Fastnet. The leaders found patches of flat calm round the Isles of Scilly, while the winners and those who went to the west and south found light continuous westerly breezes.				
1977	286	229	80.1%	5 days 10 hr 24 mins.
6th-12th August				
Light and variable winds with long calm patches.				
1979	303	85	28.1%	3 days 3 hr 52 mins.
11-16 August				
WNW winds, light to moderate at first, backed and increased as a rapidly deepening depression moved across the Fastnet area on the night of the 13/14th August. There were associated storm force winds which decreased and veered northerly, before again freshening to gale force from SW on the 16th.				

Section 1
Background

1A HISTORY OF THE FASTNET RACE IN RECENT YEARS

1.1 The course for the Fastnet Race is from Cowes, direct as safe navigation permits to the Fastnet Rock, then to Plymouth, passing south of the Scillies, a distance of 605 miles (see map below).



(Fig 1.1)

1.2 The first race over this course was sailed in 1925, and races have been sailed every other year, with a break during the 1939-45 war. The number of competitors has increased considerably during recent years, as the summary of races sailed since 1955 in table 1.1 shows.

1.3 The weather summaries in table 1.1 up until 1975 were provided by the Meteorological Office, from records of weather over a large area. In one case (1959) the record is supplemented from a report which appeared in *Yachting World*.

1.4 There has been a number of races sailed in gale force winds but light to moderate weather predominated in races sailed between 1963 and 1977.

1.5 The time taken to complete the race depends upon weather conditions. Comparison with two of the roughest races, in 1957 and 1979 shows that speed has increased, the fifth boat to finish in 1957 averaged 5¼ knots and in 1979 8 knots. (The fifth boat is taken to represent an average for the large class).

1B THE 1979 RACE

1.6 There were 336 entries in the 1979 race of which 303 started. Table 1.2 shows the results in each of the six classes into which the fleet is divided by rating bands. The rating of a yacht is a measure of her effective sailing length, with certain allowances for factors such as engine weight and propeller drag and penalties for features such as very light displacement or excessive sail area. The minimum size of boat which might qualify for entry is about 28ft length and the maximum about 85ft.

1.7 There can be no direct comparison of the results of this race with previous Fastnets as there has been no previous race which has resulted in the loss of more than one life nor have yachts previously been abandoned on anything like the same scale.

1.8 The one previous instance of loss of life in bad weather in a Fastnet Race occurred in 1931.

1.9 Much of the information on which this report is based is derived from questionnaires completed by competitors. As the Inquiry is concerned primarily with the conduct of boats during the storm questionnaires from boats which retired or completed the course before the storm were not included in the main analysis. Table 1.3 shows a breakdown of the boats which did and did not supply answers to questionnaires.

1.10 Some of the computer analysis was carried out before the last reply was received from one of the abandoned boats. In the tables derived from this analysis the total number of boats is 234.

1.11 Throughout the report it has been assumed that the sample of 235 boats which were exposed to the storm and constituted the base for computer analysis was a representative sample. Where the report refers to "the fleet" or "competitors" it does so on the basis of what is believed to be a valid assumption.

TABLE 1.2

Class	*Rating Limits*	*Started*	*Finished*	*Retired*	*No. of Crew Lost*	*Yachts Abandoned*	
						Since Recovered	*Lost Believed Sunk*
0	42.1-70	14	13	1	—	—	—
I	33-42	56	36	19	—	1	—
II	29-32.9	53	23	30	—	—	—
III	25.5-28.9	64	6	52	6	4	2
IV	23-25.4	58	6	44	6	7	1
V	21-22.9	58	1	48	3	7	2
TOTAL		303	85	194	15	19	5

TABLE 1.3

	Finished	*Retired*	*Abandoned*	*Total*
Included in main computer analysis	64	148	23	235
Completed questionnaire but not at sea during storm	1	20	—	21
Questionnaire returned too late for inclusion in main computer analysis	6	3	—	9
Questionnaire not returned	14	23	1	38

1C THE INTERNATIONAL OFFSHORE RULE

1.12 The International Offshore Rule (IOR) is the measurement system for handicapping under which RORC races are sailed. The IOR was introduced some 9 years ago, replacing a number of national rating rules, principally the RORC rating rule in Europe and the Cruising Club of America rating rule in the United States.

1.13 The custodian of the IOR is the Offshore Racing Council (ORC). The ORC is an international body; the majority of councillors are nominated by the national authorities for offshore racing with two councillors nominated by the International Yacht Racing Union. The rating rule is therefore in the hands of an authority whose constitution ensures broad international representation and the council is respected as an authoritative impartial body, with adequate power to amend the rule whenever it appears necessary to do so.

1.14 The design of racing yachts has always been influenced strongly by the measurement rule under which races are sailed. The ORC acknowledges the influence of the rating rule on design in the introduction to the rule, which states:—

> **RULE MANAGEMENT POLICY**
> IOR exists to provide ratings for a diverse group of yachts. The Council will manage the Rule, changing it as necessary to permit the development of seaworthy offshore racing yachts.
> In changing the Rule, the Council will endeavour to protect the value of the majority of the existing IOR fleet from rapid obsolescence caused by design trends, loopholes in the Rule, and other developments which produce increased performance without corresponding increases in ratings. The Council will act to discourage developments which lead to excessive costs, or reduce safety or the suitability of yachts for cruising. It will attempt to manage Rule changes to minimize disruption to the existing fleet.
> The Council will act promptly to close loopholes as they are discovered.It will control and moderate design trends by penalizing design features which depart significantly from fleet norms while affecting as little as possible boats near the norms. The Council will provide retrospective rating credits to extend the competitive life of older boats and reduce the impact on the fleet of gradual improvements in design.
> The Council recognizes that there will be conflict among these objectives and will do its best to achieve a balance that will ensure the long term vitality of IOR.

1.15 Trends which have been noticeable in yachts designed to the IOR have included light displacement, broad beam, shallow hull form and large sail area. In 1978 the ORC decided that these trends were reaching undesirable proportions which were not in keeping with the spirit and intent of the Rule. In particular boats of extreme light displacement and dubious ultimate stability were appearing and the Rule was amended to penalise boats of very light displacement and exclude potentially unstable boats from racing. At the same time measures were taken to penalise boats with excessively large sail area. The Rule is under constant review by an International Technical Committee which is alert for developments which might reduce the seaworthiness of yachts.

1.16 In analysing the results of the Fastnet Race certain parameters of boats have been extracted from their rating certificates to determine whether or not those which, in terms of traditional yacht design, might be considered unusual or extreme encountered particular problems. Details of the method adopted will be found in Section 3.

1.17 In considering the effect of the IOR on design it is difficult to separate trends which have resulted from improved technology, the availability of new materials and general progress of yacht design, which are likely to occur whatever rating rule is in current use, from trends which are the result of designers' endeavours to produce boats with the lowest possible rating and which are therefore directly dependent upon the current rating rule.

1D THE RORC SPECIAL REGULATIONS

1.18 The RORC Special Regulations, the safety rules for the race, are published in the club's annual racing programme. The regulations for 1979, together with amendments which were distributed in early May, are set out in Annex 1A.

1.19 These regulations are basically those of the Offshore Racing Council (ORC) the international authority for offshore racing, with certain amendments considered necessary by the RORC to take account of the particular conditions under which races are sailed around the British Isles. Similar modifications to the ORC Special Regulations exist for two other offshore races of similar length to the Fastnet Race, the Sydney—Hobart Race, organised by the Cruising Yacht Club of Australia and the Bermuda Race, organised by the Cruising Club of America. The major differences between the Special Regulations for the Fastnet and those for Sydney—Hobart and Bermuda Races include the following:—

1. Both make it mandatory for yachts to carry two way MF radio.
2. Both have specific regulations on crew composition. The CYCA requires a minimum of four persons on board each yacht, and sets a minimum age limit of 18. The Bermuda race is an invitation event, open only to CCA and Royal Bermuda Yacht Club or Service Academy members or to owners of yachts invited by one of the sponsoring clubs.
3. Both require a safety inspection for every competing yacht before the start of the race.

1.20 British law controlling the design, construction and safety equipment carried by private pleasure vessels is set out in the Merchant Shipping Acts. Ocean racing yachts are not required to conform to any statutory standards for design or construction. Yachts of more than 45ft overall length are required to carry life saving equipment such as distress flares and fire fighting equipment on a scale similar to the RORC Special Regulations. Yachts of less than 45ft in overall length are subject to no statutory requirements but the Department of Trade publishes recommendations for equipment to be carried in sea going vessels less than 45ft in overall length which are less stringent than the RORC Special Regulations.

1.21 All yachts competing in RORC races are liable to spot checks for compliance with the Special Regulations. Checks are carried out on a percentage of the fleet, either before the start or after the finish of each race, often when the yacht is at sea in racing trim. Thus these checks are different in emphasis from the safety checks carried out by the CYCA and CCA, which are conducted at a pre-arranged time in harbour.

1.22 RORC checks for compliance with the Special Regulations are intended to make certain that there is no breach of the regulations on the part of an owner through inexperience or lack of understanding of the intention of the Regulations, and to see that no yacht is gaining an unfair advantage by stowing heavy items of equipment in any position other than an authorised stowage. Yachts have been disqualified from races for failure to comply with the regulations.

1E RELATIVE RESPONSIBILITIES OF OWNERS AND RACE ORGANISERS

1.23 It is a long accepted principle of seagoing that decisions affecting the safety of a ship and her crew can only be taken by her Master. He is the only person who has a complete picture of all the factors involved and is therefore the only person able to take decisions on matters of safety. Service authorities, shipping companies and the Department of Trade lay down regulations for equipment to be carried and issue general advice on matters of safety but do not attempt to dictate the action to be taken by the Captain or Master of a ship at sea.

1.24 All RORC races may last for 48 hours or more, twice the period covered by the shipping forecast, so whatever the actual and forecast weather at the start of a race there is always the possibility of totally different conditions before the finish.

1.25 It is the general policy of the RORC to offer race starts in all conditions of actual or forecast weather. The only exceptions to this general policy are in cases where a combination of weather and tidal conditions at or shortly after the start appear to give rise to an exceptionally high degree of risk. This policy is intended to encourage only boats of seaworthy type to take part.

1.26 RORC Special Regulation 2 makes it clear that the safety of a yacht and her crew and the decision to start or continue a race rests with the owner. Every owner entering an RORC race signifies his acceptance of these responsibilities when he signs the entry form.

1.27 It is thought that if races were postponed or cancelled in the face of adverse weather forecasts there might be an incentive for designers to pay less heed to the ultimate strength and weatherliness of racing boats as the need for these qualities would be greatly reduced.

1.28 There have been many cases of yachts temporarily taking shelter from adverse conditions and subsequently continuing a race to obtain good results. A policy of abandoning races after the start has not been adopted in the past for three reasons: it has been felt that those at sea rather than those ashore are best able to decide whether or not to continue a race; the means of communication with competitors has not been available; and the same considerations dictate policy on abandonment after the start as cancellation before the start. Even if a race was abandoned this would not ensure that all competing yachts returned to harbour to take shelter. The warning of bad weather might be so short that the most seamanlike action would be to remain at sea, or even to gain an offing from the land to find sea-room to ride out the storm.

1F RORC RACE ENTRY AND CONTROL PROCEDURE, COWES AND PLYMOUTH

1.29 An owner wishing to enter a yacht in any RORC race including the Fastnet Race does so by completing an entry form (see Annex 1B) taken from the Annual Programme (which contains rules and regulations). About 10 days before the start of the race a set of "Provisional Arrangements" is sent to each owner. Before the start of the race, each owner is required to hand in a crew list to race headquarters and in return receives a copy of Sailing Instructions which includes a list of entries. Race headquarters is established at Cowes before the start of the Fastnet. The exchange of crew lists for sailing instructions is designed to ensure that no yacht will start and sail the course without having lodged a crew list.

1.30 In a fleet of over 300 there are a few late withdrawals and a few late entries are accepted. At the start a number of experienced observers, both ashore and afloat, record sail numbers (displayed, under the rules, on all the larger sails and on a side-cloth shown towards the committee), to attempt to verify that all yachts entered have started. Because it is Cowes Week and the Fastnet start is of great interest, there are large numbers of spectator yachts in the start area, many similar to competing yachts, so it is difficult, with the very large fleet, for the race officers to obtain a 100% accurate list of starters.

1.31 Further complications are introduced when yachts have identical or almost identical names, or identical sail numbers (though issued by different national authorities and bearing different national prefix letters) e.g. K2468 is Morning Cloud; B2468 is Phantom III. Yachts owned by a group bore the "family" name "Festina". Individuals were identified as "Festina Secunda", "Festina Tertia", etc. The owners have already decided to re-name these yachts.

1.32 After the start race headquarters are transferred from Cowes to Plymouth. The race officers check their list of competitors against original entry forms, crew lists, the Cowes office records and observed sail numbers.

1.33 At any time after the start yachts may retire and those which do so are required to report to the RORC at the earliest possible opportunity. The list of competitors is thus continuously amended to take account of retirements.

1.34 The RORC procedure for verifying their list of starters includes several cross checks. In normal races during the season, when fleets between 50 and 250 may be expected, without the complication of a large start during Cowes Week, the procedure appears to be perfectly satisfactory. However, as indicated above there is some difficulty in the Fastnet Race.

1.35 Before the race, plans had been made with the Royal Western Yacht Club of England (who contributed many volunteers and much support) for a race headquarters to be sited at a normally empty office block at Millbay Docks, into which most of the competitors were expected. The Royal Western Yacht Club would supply two teams to the offices:—

1. Information. To obtain information from coastguards and lighthouses and from the prearranged Admiral's Cup radio position reporting, via HM Coastguard. The team would log their information on master sheets and inform enquirers of race progress. They would be aided by a computer.
2. Domestic. To supply information and assistance to competitors in respect of laundry, taxis, water, fuel, accommodation, etc.

1.36 In addition the club prepared its clubhouse at Plymouth Hoe, a few minutes' walk from the docks, to receive large numbers of visitors. Transport was organised and stores obtained for the RORC team which manned the Plymouth breakwater lighthouse finishing line.

1.37 The RORC had commissioned the services of Datawest Limited, a computer agency which brought in a large and flexible Data General computer installation to provide instant progress reports on handicap (based on Admiral's Cup radio reporting schedules and actual sighting reports) and also a continuous results service when the fleet began to arrive.

1.38 At the nearby Duke of Cornwall Hotel the RORC established a Press Office with the assistance of the Admiral's Cup sponsors, Champagne Mumm. The Press Office had its own team of press officers and was normally equipped, together with high-speed telephone facsimile machines to connect it with the Amstelco telex centre in London.

Figure 2.1

COURSE OF FASTNET RACE
SHOWING CODE SQUARES USED FOR ANALYSIS

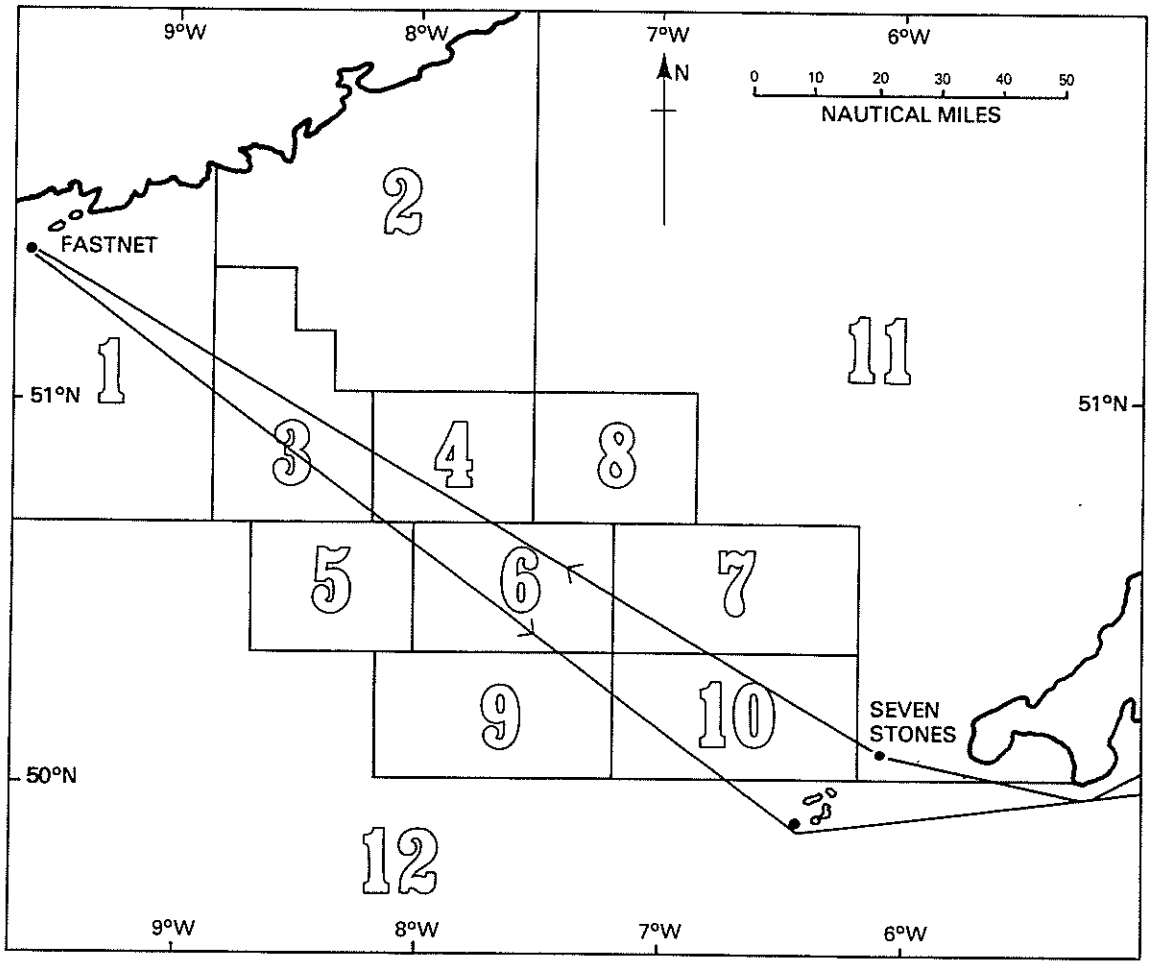


TABLE 2.1

Question: At what time do you now feel that the weather was at its worst?

	Total	Position Sector where weather was worst (Fig 2.1). 1	2	3	4	5	6	7	8	9	10	11	12
BASE	235	63	13	49	19	15	10	11	6	1	4	2	2
Before 2400 13/8	3 1%	1 2%	–	1 2%	–	–	–	–	–	–	–	–	–
2401-0200 14/8	22 9%	11 17%	–	4 8%	2 11%	2 13%	–	–	–	–	–	–	–
0201-0400	71 30%	20 32%	2 15%	17 35%	6 32%	5 33%	2 20%	5 45%	1 17%	1 100%	1 25%	–	–
0401-0600	69 29%	17 27%	5 38%	13 27%	7 37%	2 13%	3 30%	3 27%	2 33%	–	1 25%	1 50%	–
0601-0800	28 12%	6 10%	3 23%	4 8%	1 5%	2 13%	3 30%	–	1 17%	–	1 25%	1 50%	1 50%
0801-1000	9 4%	1 2%	–	3 6%	1 5%	2 13%	1 10%	–	–	–	–	–	–
Later than 1000	8 3%	–	–	1 2%	1 5%	–	2 20%	2 18%	–	–	–	–	–
All Night	22 9%	6 10%	1 8%	6 12%	1 5%	3 20%	1 10%	2 18%	1 17%	–	–	–	–
No Answer	18 8%	5 8%	2 15%	3 6%	–	–	–	–	1 17%	–	1 25%	1 50%	1 50%

TABLE 2.2

Question: What was your estimate of the wind speed?

	Total	Position Sector where weather was worst (Fig 2.1). 1	2	3	4	5	6	7	8	9	10	11	12
BASE	235	63	13	49	19	15	10	11	6	1	4	2	2
Less than Beaufort 8	4 2%	1 2%	–	2 4%	–	–	–	–	–	–	–	–	–
Beaufort 8	2 1%	–	–	–	–	1 7%	–	–	–	–	–	–	–
Beaufort 9	12 5%	2 3%	1 8%	5 10%	–	–	1 10%	1 9%	–	–	–	–	–
Beaufort 10	48 20%	12 19%	2 15%	8 16%	10 53%	2 13%	2 20%	3 27%	–	–	1 25%	–	–
Beaufort 11	92 39%	25 40%	2 15%	20 41%	5 26%	6 40%	4 40%	5 45%	3 50%	1 100%	1 25%	2 100%	1 50%
More than Beaufort 11	72 31%	22 35%	8 62%	13 27%	4 21%	5 33%	3 30%	2 18%	3 50%	–	2 50%	–	1 50%
No Answer	5 2%	1 2%	–	1 2%	–	1 7%	–	–	–	–	–	–	–

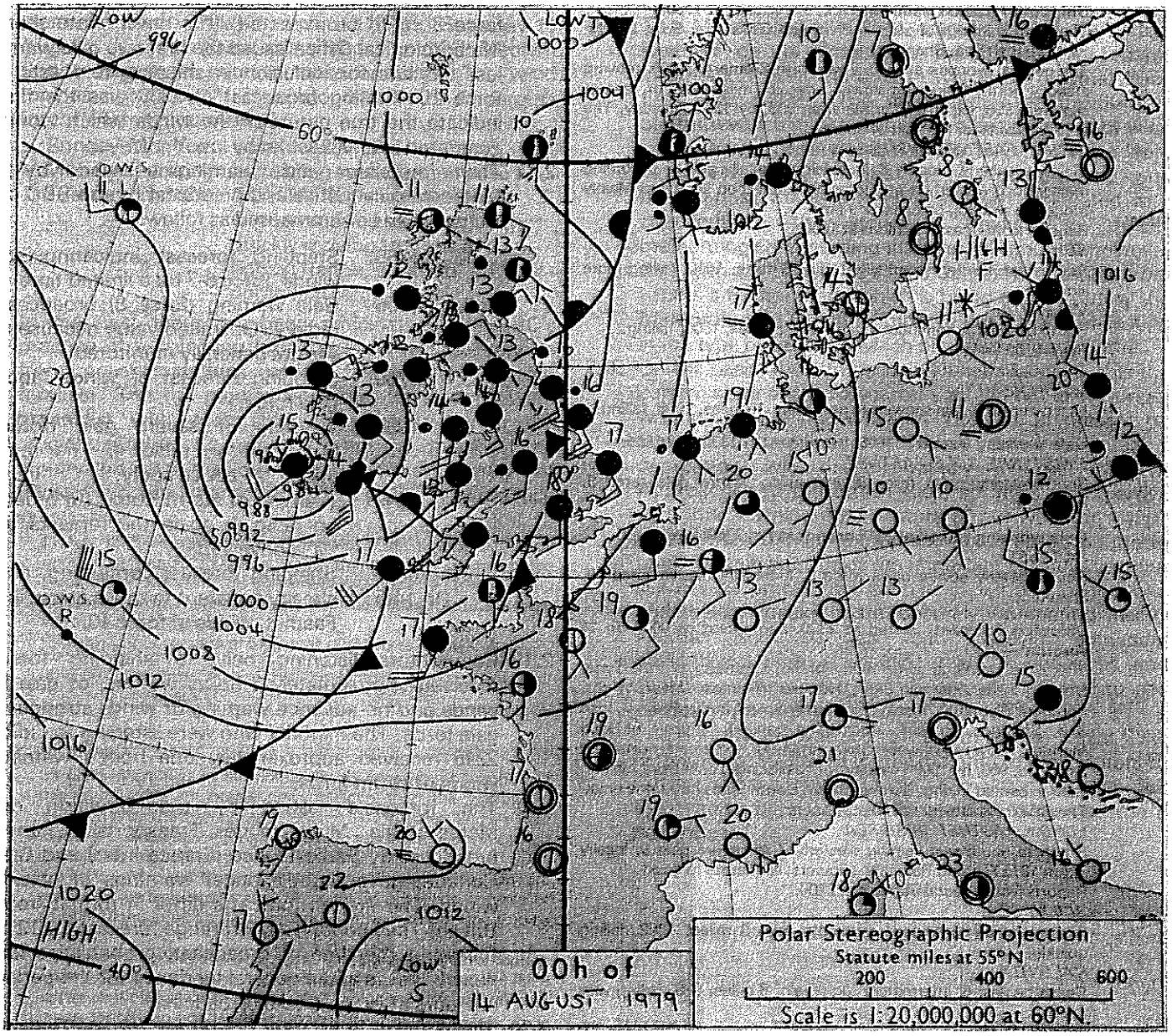
2.10 The storm was not without precedent. On the night of 15/16 August 1970 a depression of the same depth, 979 mb, moved on a very similar track across Southern Ireland into the Irish Sea. There were two previous deeper depressions over the United Kingdom in August. These gave pressures down to 967 mb at Cape Wrath in northwest Scotland in 1957 and to 968.3 mb at Southport in 1917. Winds were probably near to the previous records which gave a mean wind of 55 knots at Pendennis Castle in 1931. Wind gusts of 68-69 knots occurred in August in 1923, 1931 and 1975. Although this depression may not have created any new records it was undoubtedly severe for the time of year.

2.11 As low Y moved across the north of sea area Fastnet there was a marked and rapid wind veer. This resulted in the wind and waves coming from different directions. Those in the vicinity of the Fastnet Rock experienced the veer during the hours of darkness and for them the lack of conformity between wind and sea directions made conditions particularly difficult.

2.12 34% of the competitors in the race reported having experienced similar weather before, for 58% it was the worst weather they had ever experienced. The question from which these percentages are derived referred to "weather". It was for those who answered it to decide whether it referred to wind strength or sea state. Many very experienced competitors stated that the wind strength was not unusual but the sea conditions were the most dangerous they had ever experienced possibly because of the rapid wind veer. Most of the damage done to the fleet appears to have been caused by waves rather than wind. A special study of wave conditions was therefore commissioned from the Institute of Oceanographic Sciences and is included at Annex 2A. The study notes the Meteorological Office assessment of the weather, which put maximum winds at force 10, whereas most competitors believe that the wind was at least force 11.

2B FORECASTS AVAILABLE TO COMPETITORS

2.13 Tables 2.5 and 2.6 show the forecasts to which competitors were listening, the use they made of these forecasts, the usefulness of their own observations of barometer and visible phenomena and the times at which they believed they were first aware of the probable severity of the storm.



Synoptic Chart at Midnight, 13 August 1979.

TABLE 3.2

Question: Did you experience a knockdown beyond horizontal (including a 360° roll) (B2 Knockdown)

Comparison with Rated Dimensions

			B2 Knockdown	
	Total	*Aban-doned*	*Yes*	*No*
BASE	235	23	77	136
Fastnet Class				
0	8 3%	—	—	6 4%
I	40 70%	—	6 8%	29 21%
II	40 17%	—	4 5%	33 24%
III	52 22%	6 26%	24 31%	24 18%
IV	46 20%	8 35%	20 26%	19 14%
V	47 20%	8 35%	22 29%	24 18%
No answer	2 1%	1 4%	1 1%	1 1%

			B2 Knockdown	
	Total	*Aban-doned*	*Yes*	*No*
BASE	235	23	77	136
BALLAST RATIO				
20 TO 24.9%	1 0%	—	—	1 1%
25 TO 29.9%	6 3%	1 4%	4 5%	1 1%
30 TO 34.9%	5 2%	1 4%	2 3%	3 2%
35 TO 39.9%	16 7%	2 9%	5 6%	11 8%
40 TO 44.9%	42 18%	5 22%	18 23%	20 15%
45 TO 49.9%	60 26%	6 26%	20 26%	34 25%
50 TO 55%	64 27%	4 17%	19 25%	37 27%
Less than 20%	1 0%	—	—	1 1%
No answer	40 17%	4 17%	9 12%	28 21%

			B2 Knockdown	
	Total	*Aban-doned*	*Yes*	*No*
BASE	235	23	77	136
L/DSP				
Less than 125	4 2%	—	—	3 2%
121 TO 149	15 6%	3 13%	11 14%	4 3%
150 TO 174	16 7%	2 9%	5 6%	10 7%
175 TO 199	78 33%	6 26%	26 34%	45 33%
200 TO 244	50 21%	4 17%	15 19%	31 23%
225 TO 249	16 7%	2 9%	6 8%	10 7%
250+	7 3%	—	—	5 4%
No Answer	49 21%	6 26%	14 18%	28 21%

			B2 Knockdown	
	Total	*Aban-doned*	*Yes*	*No*
BASE	235	23	77	136
L/B				
Less than 2.4	9 4%	2 9%	6 8%	3 2%
2.5	9 4%	2 9%	5 6%	4 3%
2.6	36 15%	6 26%	14 18%	19 14%
2.7	51 22%	3 13%	18 23%	27 20%
2.8	39 17%	2 9%	12 16%	25 18%
2.9	22 9%	2 9%	8 10%	13 10%
3.0	5 2%	— —	— —	5 4%
More than 3.0	14 6%	—	—	11 8%
No answer	50 21%	6 26%	14 18%	29 21%

			B2 Knockdown	
	Total	*Aban-doned*	*Yes*	*No*
BASE	235	23	77	136
B/CMD				
Under 4	6 3%	—	—	5 4%
4 TO 4.99	15 6%	1 4%	2 3%	11 8%
5 TO 5.99	71 30%	3 13%	17 22%	47 35%
6 TO 6.99	68 29%	7 30%	27 35%	36 26%
7 TO 7.99	21 9%	3 13%	15 19%	6 4%
8 or more	3 1%	3 13%	2 3%	1 1%
No answer	51 22%	6 26%	14 18%	30 22%

			B2 Knockdown	
	Total	*Aban-doned*	*Yes*	*No*
BASE	235	23	77	136
T.R.				
40+	2 1%	—	2 3%	—
39.9 TO 36	20 9%	4 17%	10 13%	8 6%
35.9 TO 32	62 26%	3 13%	20 26%	37 27%
31.9 TO 28	76 32%	9 39%	25 32%	46 34%
27.9 TO 24	20 9%	1 4%	5 6%	13 10%
Less than 24	4 2%	—	—	3 2%
No answer	51 22%	6 26%	15 19%	29 21%

			B2 Knockdown	
	Total	Aban-doned	Yes	No
BASE	235	23	77	136
S.V.				
More than 0	—	—	—	—
0 TO -0.49	33 14%	3 13%	16 21%	13 10%
-0.5 TO -0.99	89 38%	12 52%	32 42%	51 38%
-1.0 TO -1.49	50 21%	2 9%	15 19%	32 24%
-1.5 TO -1.99	10 4%	—	—	10 7%
Less than -2.0	3 1%	—	—	1 1%
No answer	50 21%	6 26%	14 18%	29 21%

Section 3
Ability of the Yachts and their Equipment to withstand the storm

3A BOAT STABILITY

3.1 It has been alleged that in their quest for faster boats designers have gone to extremes which surpass the bounds of common sense and ignore constraints which should be imposed by the requirement for offshore racing yachts to be able to cope with any weather conditions which they might be expected to encounter. In particular light displacement, broad beam, shallow hull form and lack of both initial and ultimate stability have been singled out as targets for criticism.

3.2 In analysing the results of the race the following features of each yacht have been determined from rating certificates:—

a) Displacement/length Ratio

$$\frac{DSPL}{(0.01L)^3 \times 2240} = D/L \text{ ratio}$$

DSPL is the rated displacement (The closest approximation which can be obtained from measurements taken) and L is the rated length.

b) Length/Beam Ratio

$\frac{L}{B}$ = L/B ratio

Where L is the rated length and B the rated beam.

c) Beam/Depth Ratio (to show trend toward wide shallow hulls)

$\frac{B}{CMDI}$ = B/D ratio

Where B is the rated beam and CMDI the centre mid depth immersed.

d) Tenderness Ratio

Tenderness ratio (TR) is derived from a measurement of the inclining moment required to heel the yacht through 1°. It therefore gives an indication of initial stability and hence ballast ratio. The lower the value the more stable is the yacht.

e) Screening Value

The screening value (SV) is calculated from the tenderness ratio and other hull measurements to ensure that the yacht is self righting at 90° angle of heel. A negative value indicates positive self righting at 90°. Boats with positive SV values are required to show that they have an adequate safety margin of positive stability by righting themselves from 90° with weights attached to the mast.

3.3 It has also been alleged that the underwater lateral profile encouraged by the rating rule results in boats which have unseaworthy characteristics. In fact the present rating rule, in common with all previous rating rules, neither measures nor controls underwater profile, so developments towards very short fin keels have occurred because this configuration is believed to be the fastest and not because it confers a rating advantage. As no measurements of underwater lateral profile are taken it was not considered feasible to analyse the performance of boats with different underwater profiles.

TABLE 3.1

Question: Did you experience a knockdown to horizontal or almost horizontal during the storm? (B1 Knockdown)

		Fastnet Class					
	Total	*0*	*I*	*II*	*III*	*IV*	*V*
BASE	235	8	40	40	52	46	47
Yes	113	3	11	14	28	25	30
	48%	38%	28%	35%	54%	54%	64%
No	108	5	26	24	21	16	16
	46%	63%	65%	60%	40%	35%	34%
No Answer	34	—	3	2	3	5	1
	6%		8%	5%	6%	11%	2%

3.4 Concern has also been expressed about the apparent lack of directional stability and tendency to broach exhibited by some modern racing yachts. Tendency for any yacht to broach increases in direct proportion to speed and power applied through sail area. Modern keel shapes are highly efficient in terms of lift/drag ratio but they do not add to directional stability in the way in which a longer keel increases the radius of a yacht's turning circle; nor do they act as a roll damping fin in the way that a longer keel is believed to act. Lack of readily available data has precluded any detailed investigation of this subject, but neither has any factual evidence emerged from the 1979 Fastnet Race to indicate the subject merits special study in connection with the ability of yachts to survive storm conditions in the open sea. There were very few boats of traditional long keel configuration sailing so comparisons cannot be made.

3.5 48% of the fleet (112 boats) reported that on one or more occasions the yacht was knocked down to horizontal during the storm. Table 3.1 shows that as might be expected the smaller boats were generally more vulnerable. Knockdowns to horizontal (referred to in the tables in this report as a B1 knockdown) have always been a potential danger in cruising and offshore racing yachts in heavy seas; therefore no attempt has been made to analyse the causes or effects.

3.6 33% of the fleet (77 boats) reported experiencing knockdowns to substantially beyond horizontal, including total inversions and full 360° rolls. This type of knockdown (referred to in the tables in this report as a B2 knockdown) is a rare occurrence and an analysis of those boats involved, the factors which might have been expected to have been important, the resulting damage and injury and the number of boats badly knocked down which were subsequently abandoned has therefore been carried out.

3.7 Table 3.2 shows the comparison of measurements taken from rating certificates with boats which were knocked down past 90°. It can be seen that, in the sea conditions experienced, characteristics which appeared to increase a yacht's likelihood of suffering a knockdown past 90° include: lack of initial stability as indicated by high tenderness ratio and low negative screening value; wide beam as indicated by low L/B ratio (there is only a slight indication that this factor was significant); wide shallow hull form as indicated by high B/CMDI ratio. There is little indication of any relationship between ballast ratio or length/displacement ratio and vulnerability to knockdowns. It must be stressed that while these tabulations appear to indicate trends towards, for instance, wide boats being prone to knockdowns past 90°, they do not constitute proof that all wide boats will inevitably suffer knockdowns. High B/CMDI and low L/B ratios are generally associated

with the smaller boats; and boat size to wave size ratio is an important factor which will always make smaller boats more vulnerable. In classes 0-2 the percentage of severe knockdowns was 11% compared with 46% in classes 3-5.

3.8 Table 3.3 shows the severe knockdowns related to whether or not the boat was subsequently abandoned and also indicates the extent to which boats of which there were six or more of a similar type sailing were involved. The OOD 34 appears from this tabulation to have been particularly vulnerable but it is impossible to say whether this was due to the design of the boats or the fact that boats of this size and speed encountered particularly severe sea conditions. With only 11 boats of this type included the sample is not large enough to be statistically reliable. The connection between severe knockdowns and subsequent abandonments is clearly shown in table 3.3.

3.9 Table 3.4 shows the amount of sail carried, speed through the water, aspect presented to the waves and whether or not warps or drogues were in use at the time of the knockdown. No positive conclusion can be drawn from table 3.4, as there are no control groups against which comparisons can be made. It was not possible to ask questions such as "What was speed through the water when the boat might have been, but was not, severely knocked down?". These tables do, however, indicate that the factors related to in the questions were not of outstanding significance.

TABLE 3.3

Question: Did you experience a knockdown beyond horizont (including a 360° roll) (B2 knockdown)?

			Type of Yacht (6 or more in Fleet)			
	Total	*Abandoned*	*OOD 34*	*Oyster 37*	*UFO 34*	*Contesse 32*
BASE	235	23	11	7	6	5
Yes	77 33%	22 96%	9 82%	2 29%	2 33%	2 33%
No	136 58%	1 4%	2 18%	3 43%	3 50%	3 56%
No Answer	22 9%	—	—	2 29%	1 17%	1 11%

3.10 The damage suffered in severe knockdowns is listed i table 3.5. 37% of the boats in this category did nc report any significant damage. The largest category c damage was dismasting but this should not be taken t indicate weakness of rig. In many cases boats wer rolled through 360° and to construct rigs which woul withstand the very large forces involved woul necessitate stronger hulls to support them, and the sta of a spiral towards more heavily constructed boats requiring more sail to drive them. The general pattern c damage is much as would be expected in yacht subjected to the violent accelerations and enormou forces involved in a bad knockdown, total inversion c 360° roll.

3.11 Injuries to crew members are categorised in table 3.6 Five of the six reported instances of loss of life were th indirect rather than direct results of knockdowns, th

TABLE 3.4

AT THE TIME OF THE KNOCKDOWN BEYOND HORIZONTAL

Question: What sail was set?

	Total
Base	77
None	45 58%
Head Sail Only (Larger than storm Jib)	1 1%
Storm Jib Only	20 26%
Mainsail or Trisail Only	4 5%
Jib & Mainsail or Trisail	3 4%
No Answer	4 5%

Question: What was the speed through the water?

	Total
Base	77
0-1.9 knots	12 16%
2-3.9 knots	13 17%
4-5.9 knots	20 26%
6-7.9 knots	11 14%
8-9.9 knots	4 5%
10+ knots	5 6%
No Answer	13 17%

Question: What was the aspect presented by the boat to the waves?

	Total
Base	77
Astern (±30°)	10 13%
Quarter (30°-60°)	20 26%
Abeam (±30°)	26 34%
Bow (±60°)	13 17%
No Answer	8 10%

Question: Were warps/drogue in use?

	Total
Base	77
No	53 69%
Warps	16 21%
Drogue/Sea Anchor	4 5%
No Answer	6 89%

casualties being washed overboard and not recovered. One man was lost when his harness was released to enable him to gain the surface from an upturned yacht. One casualty was reported to have been trapped in the cockpit of an upturned boat for some minutes, was revived by artificial respiration after the boat righted herself but died about 45 minutes later. (See also sections 3G and 4C).

3.12 Several crews reported that buoyancy aids gave useful protection against injuries which might otherwise have been sustained by crew members being thrown across the cabin. One crew rigged safety lines along the saloon which they found invaluable as a means of preventing injury. (See also Section 3D).

TABLE 3.5

Question: At the time of knockdown beyond horizontal was there any significant damage to the boat?

	Total
Base	77
Yes/Other	11 14%
Floor Damage	7 9%
Dismasted	12 16%
Minor Rig Damage	6 8%
Deck/Deckhouse/Coachroof	1 1%
Hatches/Washboards	6 8%
Instruments/Aerials	4 5%
Liferaft Lost	2 3%
Windows	5 6%
Accommodation	5 6%
Steering	4 5%
Loose Gear Lost	2 3%
None/No	20 26%
No Answer	8 10%

TABLE 3.6

Question: At the time of the knockdown to beyond horizontal was there any significant damage to the crew?

	Total
Base	77
Small Injuries	14 18%
Serious Injuries	12 16%
Loss of Life	6 8%
No Answer	8 10%

3.13 Table 3.7 shows the extent to which skippers believed that knockdowns were inevitable in the specific circumstances in which they occurred, whether any specific design defect was responsible and whether there was any doubt about the ultimate self-righting ability of the boat.

3.14 The answers received show a consensus of opinion that it was the severity of the conditions rather than any defect in the design of the boats which was the prime consideration. In narrative answers, however, there are five accounts of boats which spent between 30 seconds and 5 minutes totally inverted. As the period of the waves was no more than 13 seconds it can be inferred that these five boats attained positive inverted stability during the passage of three waves. All five boats did right themselves, but all were subsequently abandoned, although only one actually sank. These five reports give grounds for concern about the ultimate self righting ability of certain boats and a full stability analysis of two boats, one of a type which reported remaining inverted for five minutes and another which reported very rapid self-righting, was commissioned. The results of this analysis will be found in Annex 3A.

3.15 Much of the damage to yachts and many of the abandonments stemmed from yachts being knocked down substantially past 90°. While it is accepted that under the prevailing conditions some of these knockdowns were inevitable it is believed that the incidence of bad knockdowns was unacceptably high. It is also believed that boats in classes 3-5 with wide shallow hulls are at greater than average risk under these conditions.

TABLE 3.7

Question: Do you consider, with hindsight, that the knockdown indicated a basic defect in the designed stability of the boat?

Question: Do you consider, with hindsight, that any boat of similar size would inevitably have suffered a knock-down or roll in the circumstances?

Question: Did the length of time the boat took to recover from a knockdown cause you to doubt the ultimate self-righting ability of the boat?

		B2 Knockdown	
	Total	*Yes*	*No*
BASE	205	61	123
DID KNOCKDOWN INDICATE BASIC DEFECT OF DESIGN?			
Yes	2 1%	1 2%	1 1%
No	110 54%	59 97%	47 38%
No answer	94 46%	1 2%	76 62%
WOULD ANY BOAT OF SIMILAR SIZE INEVITABLY HAVE SUFFERED KNOCKDOWN?			
Yes	89 43%	53 87%	32 26%
No	27 13%	6 10%	18 15%
No answer	89 43%	2 3%	73 59%
DID LENGTH OF RECOVERY TIME CAUSE DOUBT ABOUT SELF-RIGHTING ABILITY OF BOAT?			
Yes	1 *	1 2%	—
No	106 52%	59 97%	43 35%
No answer	98 48%	1 2%	80 65%

TABLE 3.8

Question: Was there any significant damage to the rig?

		Fastnet Class						B2 Knockdown	
	Total	*0*	*I*	*II*	*III*	*IV*	*V*	*Yes*	*No*
BASE	235	8	40	40	52	46	47	77	136
Yes	42 18%	—	5 13%	4 10%	11 21%	9 20%	12 26%	29 38%	12 9%
No	182 77%	8 100%	32 80%	34 85%	40 77%	34 74%	33 70%	48 62%	119 88%
No Answer	11 5%	—	3 8%	2 5%	1 2%	3 7%	2 4%	—	5 4%

3B DAMAGE

3.16 Table 3.8 shows the extent of reports of significant damage to rigs. Much of this damage was sustained in knockdowns, and was therefore caused by weight of water rather than pressure of wind. Table 3.9 gives some indication of the causes of damage. This table is of limited value, largely because at the time skippers and crews were preoccupied with minimising further damage and there was little time or inclination to ascertain the cause.

3.17 A number of skippers have commented on the problems of severing the rigging after a dismasting, to avoid the possibility of the mast puncturing the hull. In one instance the wreckage of the mast was deliberately left alongside the boat and the crew stated that it was useful as a sea anchor. There must, however, have been considerable risk to the hull. The traditional bolt-croppers often carried in compliance with Special Regulation 10.4 found little favour. Bolt-croppers are believed to be ineffective in severing rod rigging and the problems of using this tool, which requires two hands, were thought to give rise to unacceptable risks of being washed overboard.

3.18 One crew used hacksaws to sever rod rigging. It should be possible for four people to work simultaneously and they felt that it was reasonable to carry four hacksaws. They commented that a minimum of six spare blades should be available for each saw as the breakage rate was high and even if blades did not break they were quickly blunted. One saw frame and at least twelve blades is a more common proposal. Another crew disconnected the shrouds from the chain plates by removing the pins. They commented that the operation would have been much easier if the retaining split pins had been splayed rather then bent back through 180°.

3.19 Table 3.10 describes the damage inflicted on accommodation. A number of narrative reports comment on the inadequacy of securing arrangements for batteries and cookers which were dependent on gravity acting in the general direction of mast to keel. In several boats cookers and batteries fell out of their mountings. Both items are potentially lethal missiles and the acid spillage from batteries made them doubly dangerous. Fully sealed batteries are now commercially available. Special Regulation 7.31 makes specific, although probably insufficiently detailed, reference to the installation arrangements for cookers.

3.20 Table 3.11 shows the incidence of steering failure. This is the only type of damage to which the larger boats appeared to be more susceptible than the smaller and this is certainly due to the number of larger boats equipped with a particular type of carbon fibre rudder. Tests are being carried out to ascertain the cause of these failures.

TABLE 3.9

Rig Damage

Question: Do you now feel that you know the cause? (comment)

	Total
Base	42
Sea State/Pressure of Water	5 12%
Knockdown/Capsize	7 17%
Shrouds Breaking	1 2%
Shift of Internal Ballast	1 2%
Overstress	3 7%
Other	8 19%
Reasons not known	8 19%
No Answer	10 24%

Question: With hindsight, would better pre-race checks have avoided this damage?

	Total
Base	42
Yes	7 17%
No	33 79%
No Answer	2 5%

TABLE 3.10

Question: Was there any significant damage to the accommodation and interior fittings?

		Fastnet Class					
	Total	*0*	*I*	*II*	*III*	*IV*	*V*
BASE	235	8	40	40	52	46	47
Yes	31 13%	—	1 3%	3 8%	9 17%	8 17%	9 19%
No	177 75%	7 88%	33 83%	31 78%	37 71%	34 74%	34 72%
No Answer	27 11%	1 13%	6 15%	6 15%	6 12%	4 9%	4 9%

Question: Do you now feel that you know the cause? (comment)

	Total
BASE	31
Flood	2 6%
Materials Not Able to Withstand	9 29%
Materials Not Properly Fixed	12 39%
Knockdown/Capsize	4 13%
No Answer	6 19%

TABLE 3.11

Steering Gear Damaged

Question: Was there any significant damage to the steering gear?

	Total	Fastnet Class 0	I	II	III	IV	V	Abandoned
BASE	235	8	40	40	52	46	47	23
Yes	25 11%	—	9 23%	2 5%	5 10%	3 7%	6 13%	4 17%
No	196 83%	7 88%	28 70%	34 85%	46 88%	40 87%	39 83%	18 78%
No Answer	14 6%	1 13%	3 8%	4 10%	1 2%	3 7%	2 4%	1 4%

Question: Do you now feel that you know the cause? (comment)

	Total
BASE	25
Carbon Fibre Rudder/ Rudder Broken/Weakness of Structure	14 56%
Wheel/Pedestal/ Tiller Broken	8 32%
No Answer	4 16%

Question: Were you able to make satisfactory emergency steering arrangements? (comment)

	Total
BASE	25
No	6 24%
Trailed Spinnaker Poles	3 12%
Rigged Steering Oar	3 12%
Emergency Tiller	7 28%
No Answer	6 24%

3.21 Table 3.11 also shows the success achieved in rigging emergency steering arrangements. Under half the boats which suffered steering gear failure reported being able to make satisfactory emergency arrangements. Special Regulation 10.3, as it stands, appears to be inadequate and although the proposed change which will come into force in 1980 is an improvement it is doubtful if it will be fully effective. Either an emergency rudder, to be fully effective, would have to be stronger than the normal steering arrangements or a lower degree of directional control would have to be accepted.

3.22 Several competitors expressed the view that emergency rudders were an unrealistic ideal. If the boat builder, working under factory conditions, had been unable to manufacture one that was strong enough, there was little hope of a yacht's crew doing so under conditions of extreme difficulty.

3.23 It is unlikely that emergency steering arrangements which give the same directional control as the main rudder will ever be developed, unless boats carry complete prefabricated alternative steering equipment. However a number of yachts were brought under directional control with jury steering gear.

3.24 In the long term there can be no advantage in terms of racing success to be gained by accepting periodic steering failures as the inevitable penalty for lightly built rudders. Designers who specified carbon fibre rudders for boats sailing in this race are accutely aware of their high failure rate and are already taking positive steps to establish the exact cause of the failures in order to prevent a recurrence.

3.25 Tables 3.12 and 3.13 itemize the hull damage sustained. Most of the 34 boats which reported under this category

TABLE 3.12

Question: Did you experience significant structural damage to the hull, including hatches and companionways?

	Total	Fastnet Class 0	I	II	III	IV	V
BASE	235	8	40	40	52	46	47
Yes	34 14%	1 13%	2 5%	2 5%	9 17%	7 15%	11 23%
No	185 79%	6 75%	35 88%	35 88%	42 81%	33 72%	34 72%
No Answer	17 7%	1 13%	3 8%	3 8%	2 4%	6 13%	2 4%

Type of Yacht: OOD 34	Oyster 37	UFO 34	Contessa 32
11	7	6	9
5 45%	—	—	3 33%
6 55%	6 86%	5 83%	6 67%
—	1 14%	1 17%	—

Length/Displacement: Less than 120	121-149	150-174	175-199	200-224	225-249	250+
4	15	16	78	50	16	7
—	5 33%	3 19%	11 14%	6 12%	1 6%	—
4 100%	10 67%	11 69%	61 78%	39 78%	15 94%	7 100%
—	—	2 13%	7 9%	5 10%	—	—

TABLE 3.13

HULL DAMAGE

Question: Do you now feel that you know the cause? (Comment)

	Total	Rig Damage: Yes	No	Accom. Damage: Yes	No	Steering Damage: Yes	No	Type of Yacht: OOD 34	Oyster 37	UFO 34	Contessa 32
BASE: STRUCTURAL DAMAGE TO THE HULL	34	14	20	12	21	4	29	5	—	—	3
Washboard Lost	5 15%	—	5 25%	2 17%	3 14%	1 25%	4 14%	1 20%	—	—	1 33%
Washboard Damaged	2 6%	1 7%	1 5%	1 8%	1 5%	—	2 7%	—	—	—	—
Loss of Equipment	4 12%	2 14%	2 10%	—	4 19%	—	4 14%	—	—	—	2 67%
Building Defect	5 15%	1 7%	4 20%	1 8%	3 14%	—	5 17%	1 20%	—	—	—
Knockdown/Capsize	6 18%	3 21%	3 15%	3 25%	3 14%	1 25%	4 14%	—	—	—	—
Impact of/on Wave	3 9%	2 14%	1 5%	1 8%	2 10%	—	3 10%	1 20%	—	—	—
Mast Compression	1 3%	1 7%	—	1 8%	—	—	1 3%	—	—	—	—
Should Have Carried Stormboard	1 3%	1 7%	—	—	1 5%	1 25%	—	—	—	—	—
Flexibility of Coach Roof	2 6%	1 7%	1 5%	—	2 10%	—	2 7%	—	—	—	1 33%
Damage to Structure of Hull	4 12%	1 7%	3 15%	—	3 14%	—	4 14%	1 20%	—	—	—
No Answer	6 18%	3 21%	3 15%	4 33%	2 10%	1 25%	5 17%	1 20%	—	—	—

The table shows the extent to which yachts with hull damage also experienced other types of damage.

did so with reference to items of ancillary hull equipment rather than damage to the main structure of the yacht and it is a considerable credit to builders and designers that under such severe conditions so little structural damage was done.

3.26 Table 3.12 compares hull damage with length/displacement ratio. The lighter boats appear to have been more susceptible to hull damage than the heavier. 23% of boats with an L/DSPL figure of less than 175 reported hull damage, compared with 12% of boats with an L/DSPL over 175.

3.27 Table 3.14 shows the extent to which boats reporting hull damage also reported other types of damage. The related subject of watertight integrity is dealt with in Section 3C.

3C WATERTIGHT INTEGRITY AND BILGE PUMPING ARRANGEMENTS

3.28 Table 3.14 shows the extent to which lack of watertight integrity was considered a problem. With one third of the fleet reporting that it was, this is clearly a question which requires investigation.

3.29 It might be thought that the displacement of a boat would be relevant to her watertightness but this was nc in fact the case; no particular pattern emerges from comparison of length/displacement ratio wit watertightness.

3.30 Competitors were asked to comment on significar water entry points, and Table 3.15 lists the responses More crews listed significant entry points than state that water entering the boat was a problem, indicatin that offshore racing crews accept a certain amount c water below as a fact of life.

3.31 The largest category of response refers t companionways. Some crews were reluctant to keep a the wash-boards in place because they felt tha communication between companionway and cockpi was essential. Others discovered that the only way c positively securing the wash-boards was to lock th hatch over them from the outside and some wer reluctant to do so because of effectively trapping thos off watch in the accommodation. Some of those witl angled sides to companionway entrances commente that this was bad design, as each wash-board had to lif only a few inches before it fell out completely. I general crews felt that the sides of the companionwa

TABLE 3.14

Question: A questionnaire following the 1956 Channel race gale revealed that the majority had serious problems caused by water enterin the boat through cockpit lockers, hatches, ventilators and similar openings not normally under water. Did you have similar problems?

Question: Did the amount of water in the boat affect the decisions taken?

		Length/Displacement							*Type of Yacht*			
	Total	*Less than 120*	*121-149*	*150-174*	*175-199*	*200-224*	*225-249*	*250+*	*OOD 34*	*Oyster 37*	*UFO 34*	*Contessa 32*
BASE	234	4	15	16	77	50	16	7	11	7	6	9
WAS WATER ENTERING THROUGH OPENINGS NOT NORMALLY SUBMERGED A PROBLEM?												
Yes	77 33%	1 25%	7 47%	4 25%	28 36%	14 28%	7 44%	2 29%	5 45%	2 29%	3 50%	2 22%
No	152 65%	3 75%	8 53%	12 75%	48 62%	35 70%	9 56%	5 71%	6 55%	4 57%	2 33%	7 78%
No Answer	6 3%	—	—	—	2 3%	1 2%	—	—	—	1 14%	1 17%	—
DID AMOUNT OF WATER IN BOAT AFFECT DECISIONS TAKEN?												
Yes	26 11%	—	3 20%	2 13%	11 14%	4 8%	1 6%	1 14%	2 18%	1 14%	—	1 11%
No	200 85%	4 100%	12 80%	14 88%	64 83%	43 86%	15 94%	6 86%	9 82%	5 71%	5 83%	7 78%
No Answer	8 3%	—	—	—	2 3%	3 6%	—	—	—	1 14%	1 17%	1 11%

TABLE 3.15

Question: Do you now feel that any of the following were significant water entry points?

	Total
Base	234
Companionways	
Yes	98 42%
No	113 48%
No Answer	23 10%
Hatches/Skylights	
Yes	35 15%
No	178 76%
No Answer	21 9%
Ventilators	
Yes	33 14%
No	181 77%
No Answer	20 9%

	Total
Base	234
Cockpit Lockers	
Yes	46 20%
No	167 71%
No Answer	21 9%
Engine Controls/Fuel Filling Points	
Yes	9 4%
No	204 87%
No Answer	21 9%
Hull to Deck Joints	
Yes	9 4%
No	204 87%
No Answer	21 9%

	Total
Base	234
Opening Port Lights	
Yes	6 3%
No	205 88%
No Answer	24 10%
Multiple Small Leaks Under Deck Fittings	
Yes	21 9%
No	191 82%
No Answer	22 9%
Mast Coat	
Yes	35 15%
No	175 75%
No Answer	24 10%

entrance should be vertical or nearly vertical and that it must be possible to secure and open the hatch from both inside and outside. A number commented on the lack of strength of both hatches and companionways and a minority felt that it was necessary to carry spare wash-boards. Some of those who lost or broke wash-boards plugged the aperture reasonably effectively with a bagged sail.

3.32 Many crews made strong comments about the dangers of inadequate closing arrangements for companionways, stressing that this was a major and important weakness. Several boats which were abandoned were left with main hatches open and wash-boards out and were subsequently recovered. However by the time these boats were abandoned the storm had started to moderate.

3.33 Table 3.15 lists a number of other significant water entry points. Greater attention to detailed design and construction could eliminate most of these. The report of the investigation into the 1956 RORC Channel Race which was sailed in storm force winds showed that many boats shipped large quantities of water through openings which are not normally immersed. That report stated that those findings were passed to designers and builders without comment. Some of those lessons were either not properly learnt or appear to have been forgotten. Since the Fastnet race a number of builders have taken action to modify stock boats which were shown to have weak features.

3.34 Table 3.16 shows the methods used to pump or bail and competitors' assessments of their efficiency. There is at present no Special Regulation which requires boats to carry buckets with strong lanyards and many competitors think that this is an omission which should be rectified. It seems unfortunate that regulations are considered desirable to teach owners the value of elementary equipment. Several crews commented adversely on the use of the heads pump as the second bilge pump. They felt that it was in the wrong part of the accommodation, too far forward in the hull with insufficient space to work and that the complicated plumbing involved was inappropriate to such an important item of equipment.

3.35 Pumps which discharged into the cockpit were also criticised, as when there was a large quantity of water in the hull the cockpit did not drain effectively and had itself to be bailed. The lack of any adequate bilge sump caused much annoyance, and although it was probably not relevant to the ultimate safety of the yacht, it was certainly a factor in lowering morale and increasing the risk of hypothermia due to wet clothes and bedding, because of the difficulty in removing the last few gallons of water from a hull with no depth of bilge or sump. Many competitors reported that a stirrup pump was extremely useful for removing water which could not be drained into the main bilge and for clearing the water from boats with very shallow bilges.

3.36 The most serious defect affecting watertight integrity is the design and construction of wash-boards. The blocking arrangements for the main companionway should be totally secure, yet openable from above and below decks.

TABLE 3.16
BILGE PUMPING

Question: Did the bilge pumping arrangements prove satisfactory?

	Total
Base	234
Yes	177
	76%
No	47
	20%
No Answer	10
	4%

Question: With hindsight, what alterations would you make to the pumping arrangements? (Comment)

	Total
Base	234
None	76
	32%
Bigger Capacity Pumps	14
	6%
Better Below	11
	5%
Better Cockpit	7
	3%
Sump	23
	10%
Better Drain-Holes	15
	6%
Handle Stowage	5
	2%
Additional Pumps	36
	15%
Re-site Pumps	23
	10%
No Answer	54
	23%

Question: Did you use buckets to bail?
Question: Did you find them effective?
Question: If you did not carry buckets, would you do so in future?

	Total
Base	234
Did You Use Buckets to Bail?	
Yes	69
	29%
No	153
	65%
No Answer	12
	5%
Did You Find Buckets Effective to Bail?	
Yes	69
	29%
No	8
	3%
No Answer	157
	67%
Would You Carry Buckets in Future?	
Yes	27
	12%
No	8
	3%
No Answer	199
	85%

TABLE 3.17

Question: Were you able to keep the cabin in reasonable order?

		Fastnet Class						B1 Knock-down		B2 Knock-down	
	Total	0	I	II	III	IV	V	Yes	No	Yes	N
BASE	235	8	40	40	52	46	47	113	108	77	13
Yes	185 79%	7 88%	35 88%	28 70%	42 81%	34 74%	38 81%	85 75%	93 86%	58 75%	11 849
No	38 16%	1 13%	3 8%	8 20%	8 15%	8 17%	9 19%	25 22%	10 9%	17 22%	1 139
No Answer	12 5%	—	2 5%	4 10%	2 4%	4 9%	—	3 3%	5 5%	2 3%	49

3D COMFORT AND SECURITY OF ACCOMMODATION

3.37 A number of questions on the adequacy of accommodation was asked and the answers given appear in tables 3.17—3.20. The only general shortcoming which appears from these tables to have been widespread throughout the fleet was a lack of adequate hand rails or "crash" bars but the full tables are considered worth including because they draw attention to a number of items of detail which could easily be improved.

3.38 It will be noted that only two boats reported loose batteries as a specific hazard. Many more boats commented that batteries came loose and were a hazard, but this point was made as a general comment rather than in answer to a specific question in the section of the questionnaire dealing with "Comfort below/routine". Although a relatively small number of boats actually reported problems with loose gear a number of others spent a great deal of time clearing up gear which had been thrown out of its stowage. They did not, however, consider this a problem, merely an occupational hazard.

3.39 Some stowage arrangements previously found secure at any angle of heel became totally ineffective when boats were inverted and a number of reports draw attention to the hazard from tins of food which became potentially lethal missiles as boats turned upside down. Cookers which dropped out of gimbals were even more dangerous and it is essential that such heavy items of equipment should be locked in position by positive fastenings and should not rely on gravity to keep them in place.

3.40 Special Regulation 6.7 states the requirement for all items of heavy equipment to be securely fastened and Special Regulation 7.31 requires cookers to be securely

TABLE 3.18

Question: Did you find loose gear was a problem or a hazard?

	Total
Base	235
No	156 66%
Yes	40 17%
Batteries	2 1%
Food	6 3%
Broken Glass	1 *
Cookers	9 4%
Other	19 8%
No Answer	12 5%

TABLE 3.19

Question: Was anyone seriously injured while below?

Question: With hindsight, would you now fit extra hand rails?

		B2 Knockdown		Fit Extra Hand Rail	
	Total	Yes	No	Yes	
BASE	235	77	136	47	1
Yes	12 5%	11 14%	1 1%	3 6%	5
No	218 93%	66 86%	134 99%	43 91%	1 95
No Answer	5 2%	—	1 1%	1 2%	

Question: Was the injury inevitable or did it result from poor interi design? (Comment)

		B2 Knockdown		Fit Extra Hand Rail	
	Total	Yes	No	Yes	I
BASE	12	11	1	3	
Inevitable	5 42%	5 45%	—	1 33%	44
Might have been avoided	3 25%	3 27%	—	—	33
From Poor Design	1 8%	1 9%	—	1 33%	
No Answer	3 25%	2 18%	1 100%	1 33%	22

fastened. These regulations are specific and appear require no elaboration in that they already refer to th heaviest items. However it would appear that a numb of crews regard the requirement for secure stowage a being met by retaining devices which are satisfacto only up to normal angles of heel but are ineffective if th yacht is rolled past 90°.

3E DECK ARRANGEMENTS

3.41 Table 3.21 shows the replies to questions on dec layouts and arrangements. The 38 boats whic commented that there were insufficient hand holds ar harness attachment points give grounds for concer This matter is commented on in detail in the section c safety harnesses. The percentage reporting inadequa toe-rails was much smaller but might be considere indicative of a serious deficiency, albeit in a minority the fleet, which is not at present covered by a Speci Regulation.

3.42 A significant number of boats lost important items deck gear and safety equipment. A smaller numb commented that items of safety equipment were s securely stowed that they were not immediate available when required. Equipment such as lifejacke and marker buoys must be immediately available whe required, and competitors have commented th stowages for this equipment can only be real satisfactory if they are incorporated as integral feature of the deck layout at the design stage. Simil comments referring to liferaft stowage are dealt with the appropriate section.

3.43 61 crews felt that the cockpit draining arrangemen were unsatisfactory. A number commented th Special Regulation 6.31 should be changed to specify maximum time for the cockpit to drain rather than minimum area for the drains. This is a sensible an

TABLE 3.22

Question: What percentage length of luff of mainsail remains when fully reefed?

	Total
Base	234
0-20%	21 9%
21-40%	56 24%
41-60%	100 43%
61-80%	35 15%
81-100%	–
No Answer	22 9%

Question: What percentage length of luff do you consid necessary?

	Total
Base	234
0-20%	29 12%
21-40%	50 21%
41-60%	52 22%
61-80%	7 3%
81-100%	2 1%
No Answer	96 41%

TABLE 3.23

TRISAILS

Did you carry a Trisail?

Yes	52 22%
No	168 72%
No Answer	14 6%

Did you set a Trisail?

Yes	19 8%
No	162 69%
No Answer	53 23%

Did you Feel a Need to Carry a Trisail?

Yes	105 45%
No	104 44%
No Answer	25 11%

practical suggestion; three minutes is suggested as the maximum acceptable time for a cockpit to drain but there would be difficulties adapting existing boats to meet this standard.

3.44 Comment on the deplorable lack of towing points forward in modern racing yachts has been received from an RNLI Coxswain who was involved in towing in abandoned yachts after the storm. The traditional samson post is seldom fitted to racing yachts as it adds nothing to speed and is a heavy structure in the forward part of the boat. There is no requirement in the Special Regulations for any form of securing point for anchor cable, although 8.31 is specific on a requirement for two anchors.

3.45 An adequate strong point and fairlead for anchor and towing warp is a requirement which was not highlighted during the race, but a number of yachts suffered unnecessary damage afterwards because of the need to improvise fittings which should have been integral features of the deck layout.

3F RIGS

3.46 Questions which competitors were asked to answer about rigs were intended to discover whether the sails carried on board were adequate for storm conditions. Table 3.22 summarises the views expressed on mainsails. A number of crews experienced considerable difficulty rigging the third slab-line to pull down the last reef. Many found that it was necessary to lower the main fully, rig the line and then re-hoist the sail.

3.47 The answers to questions on trisails are shown in table 3.23. Only 36% of those who had a trisail on board actually set it. However half of those who expressed a view on the need to carry a trisail said they felt that there should be one available.

3.48 Table 3.24 shows the responses received to questions about storm jibs.

3.49 A meeting of offshore sailmakers was held on 20 September 1979 to discuss existing and anticipated legislation on storm sails in the light of experience in the Fastnet Race. Certain extracts from the minutes of that meeting are of interest and will be found at Annex 3B.

3.50 Specific regulations on storm sails are likely to have be very detailed if they are to be effective. Yachts wi different rig and hull configurations present differe requirements for storm sails. Some boats work windward satisfactorily under just a storm jib, othe require some sail set aft of the mast and a headsail and third category make good progress under a deep-reefe mainsail or trisail only. Each of these three typ requires a different combination of sizes of storm sails.

3.51 Sail limitation rules, designed to limit the number light and medium weather sails, need careful phrasir to ensure that they do not in any way curb owner freedom to carry adequate storm sails.

TABLE 3.24

STORM JIBS

	Total
BASE	234
Do You Feel that Area of Storm Jib is Correct?	
Yes	177 76%
No	40 17%
No Answer	17 7%
Do You Consider Sheeting Arrangements For Storm Jib Were Adequate?	
Yes	212 91%
No	10 4%
No Answer	12 5%
Were the Provisions for Attaching Storm Jib Adequate?	
Yes	167 71%
No	15 6%
No Answer	52 22%

floor broke away from the top ring and canopy. This raft had recently been serviced, but not by an authorised agent.

3.69 An 8 man raft inflated upside down, it was righted, then capsized after 45 minutes in use and the canopy broke away. The raft is described as being "sausaged by a wave". No drogue was in use.

TABLE 3.29

USE OF LIFERAFTS

	Total	Beaufort	Avon	RFD survive	Angeviniere
BASE	15	5	4	2	2
DID IT INFLATE AS EXPECTED?					
Yes	10	4	4	—	2
	67%	80%	100%		100%
No	3	—	—	1	—
	20%			50%	
No Answer	2	1	—	1	—
	13%	20%		50%	
WERE THE CREW ABLE TO BOARD WITHOUT ENTERING SEA FIRST?					
Yes	12	4	4	1	2
	80%	80%	100%	50%	100%
No	—	—	—	—	—
No Answer	3	1	—	1	—
	20%	20%		50%	
WAS THERE TIME TO COLLECT SPARE CLOTHING/GEAR BEFORE BOARDING?					
Yes	7	3	2	1	—
	47%	60%	50%	50%	
No	4	1	1	—	2
	27%	20%	25%		100%
No Answer	4	1	1	1	—
	27%	20%	25%	50%	
WERE YOU ABLE TO STREAM SEA ANCHOR STRAIGHT AWAY?					
Yes	5	2	2	—	1
	33%	40%	50%		50%
No	4	1	—	1	1
	27%	20%		50%	50%
No Answer	6	2	2	1	—
	40%	40%	50%	50%	
DO YOU FEEL THAT SEA ANCHOR AFFECTED BEHAVIOUR OF THE RAFT?					
Yes	3	2	1	—	—
	20%	40%	25%		
No	3	—	1	1	1
	20%		25%	50%	50%
No Answer	9	3	2	1	1
	60%	60%	50%	50%	50%
DID THE RAFT CAPSIZE IN USE?					
Yes	5	2	1	1	1
	33%	40%	25%	50%	50%
No	7	2	3	—	1
	47%	40%	75%		50%
No Answer	3	1	—	1	—
	20%	20%		50%	
WAS THE SEA ANCHOR IN USE AT TIME OF CAPSIZE?					
Yes	—	—	—	—	—
No	4	1	—	1	2
	27%	20%		50%	100%
No Answer	11	4	4	1	—
	73%	80%	100%	50%	
WERE ALL/NEARLY ALL OF CREW SEATED WHEN RAFT CAPSIZED?					
Yes	4	2	1	—	1
	27%	40%	25%		50%
No	2	—	—	1	1
	13%			50%	50%
No Answer	9	3	3	1	—
	60%	60%	75%	50%	
DID YOU FEEL THAT WATER IN THE RAFT WAS ADVERSELY AFFECTING STABILITY?					
Yes	1	—	—	—	1
	7%				50%
No	7	2	3	1	—
	47%	40%	75%	50%	
No Answer	7	3	1	1	1
	47%	60%	25%	50%	50%
DO YOU FEEL THAT REASONABLE DISCIPLINE WAS MAINTAINED DURING BOARDING?					
Yes	10	4	3	—	2
	67%	80%	75%		100%
No	1	—	—	1	—
	7%			50%	
No Answer	4	1	1	1	—
	27%	20%	25%	50%	
WERE YOU ABLE TO TAKE R/T INTO THE RAFT					
Yes	—	—	—	—	—
No	8	3	3	1	1
	53%	60%	75%	50%	50%
No Answer	7	2	1	1	1
	47%	40%	25%	50%	50%
WAS COLD WAS AN IMPORTANT FACTOR?					
Yes	8	2	3	1	1
	53%	40%	75%	50%	50%
No	3	2	—	—	1
	20%	40%			50%
No Answer	4	1	1	1	—
	27%	20%	25%	50%	
WERE YOU ABLE TO KEEP ACCESS DOOR CLOSED?					
Yes	3	1	1	—	1
	20%	20%	25%		50%
No	5	1	2	1	1
	33%	20%	50%	50%	50%
No Answer	7	3	1	1	—
	47%	60%	25%	50%	

3.70 The crew of a 6 man raft streamed their drogue without any problem but the skipper considered that the raft became sluggish, with waves breaking over the canopy and the crew feared a capsize. The drogue was pulled in and the raft became more buoyant and lively. The raft did not capsize and the crew were all rescued in under an hour. The skipper subsequently consulted the manufacturers who agreed that in the prevailing conditions the raft would ride better without a drogue.

3.71 However, the raft which was longest afloat before rescue (8 hours), a six man, did not capsize and the crew comment as follows on the use of the drogue:—

> "The drogue was deployed when the raft was cut adrift from the yacht. It lasted between half and one hour and then carried away apparently at two points—one at the drogue and the other at one of the yoke lines to the raft. A second drogue was made from materials on board but this too failed after some hours.
>
> The drogue performs three functions:
> 1) To reduce the rate of drift;
> 2) To stabilise the raft's attitude to the wind;
> 3) To stabilise the attitude of any bottom pockets on the raft to the sea.
>
> I do not know, what, if any, stability pockets were fitted to the bottom of the raft. In any event, it did not capsize although it was "banana'd" on several occasions and half filled with water by breaking waves. On each occasion the hoops over pressurised and vented off and consequently needed pumping up by hand. The attitude of the raft to the sea therefore seems to be unimportant.
> It is desirable that the fixed side of the raft cover be held to the wind not only to keep the wind out but breaking seas also. This relieves the strain on the fastenings. However, if these are secure, this aspect too becomes of less importance.
> Finally, one is left with the desirability or otherwise of reducing the rate of drift, and I am led to the conclusion that in storm conditions, if there is sufficient sea room, life is more comfortable and the raft less at risk if it is allowed to drift at the same rate as the waves".

3.72 Other adverse comments on the performance of rafts related to the protection from the sea and from cold which the rafts afforded. Many crews felt that the securing arrangements for canopy accesses were inadequate and several felt that this point was of greater significance than was keeping the access to leeward. Cold was a hazard faced by the crews who were in rafts for any length of time. Some suggested that foil "space blankets" would solve this, others that an inflatable floor would have been a considerable improvement.

3.73 Trials carried out on foil "space blankets" some years ago indicated that they were likely to be of little use in a life raft. The blankets are extremely efficient in preventing loss of heat by radiation but the major heat loss suffered by survivors in a life raft is by conduction through the raft floor, against which a foil blanket affords little protection.

3.74 Several comments received relate to the lack of hand holds on the outside of rafts. Morningtown's crew had a raft alongside for a short time but they were unable to hold onto it or turn it round to gain access to the canopy opening.

3.75 Life rafts clearly failed to provide the safe refuge which many crews expected. Seven lives were lost in incidents associated with rafts of which three were directly attributable to the failure of the raft and the yachts which these seven people abandoned were subsequently found afloat and towed to harbour. However 14 lives were saved in incidents in which survivors took to rafts from yachts which have not been recovered. Many crews used rafts successfully to transfer from yachts to helicopters or other vessels. It is asking a great deal of any very small craft to expect it to provide safe refuge in conditions which overwhelm a large yacht but this is what life rafts are expected to do.

3J LIFE JACKETS

3.76 91% of the fleet reported that their yachts were equipped with life jackets to BS3595, and 37% that they were equipped with buoyancy aids. 43% reported that lifejackets were worn as standard procedure during the storm, 53% that they were not. 39% reported that life jackets impaired working efficiency, and an identical percentage reported that they did not.

3.77 Crews appeared to attach considerably less importance to life jackets than to safety harnesses as items of safety equipment. Only 10 reports on life jackets in use were received, two commented that the buoyancy provided was very effective, seven that it was effective and one that it was ineffective.

3.78 Three reports were received of bodies being sighted or recovered floating face down in the water although a life jacket was being worn. In one instance the wearer's head appeared to have slipped out of the collar and the life jacket which was then attached only by a waist tie had slipped round to the wearer's back. It is not known whether this jacket, of a make which conforms to BS3595, was put on correctly in the first place. The post mortem carried out states that the wearer died of exposure, not drowning, so it is likely that up until the time of death the life jacket did provide adequate buoyancy. However, authoritative comment on the incident by the rescuers indicates that there is some doubt as to whether the British Standard Specification is totally effective as it contains no requirement for a positive retaining strap for the collar.

3.79 A further report of the same make of jacket concerns a crewman who jumped into the water to be rescued by a helicopter:—

> "The life jacket was a very effective device and kept the head well clear of the water. The auto-inflation device only semi-inflated the jacket."

3.80 One life jacket, to a design which is no longer manufactured but which conforms to BS3595, was criticised for its manual inflation mechanism. The mechanism was accidentally activated after the jacket had been inflated by mouth and the wearer thought he was going to be strangled before the jacket burst. The instructions clearly state that the manual inflation device must not be activated if the jacket has already been inflated by mouth. However, the wearer felt that a possible death penalty was a little harsh for anyone who ignored or accidentally contravened the manufacturer's instructions.

3.81 Four of the six men lost overboard through harness failure were not wearing life jackets. As none of the yachts involved was able to recover the lost men it is not possible to state that a life jacket would have been effective in saving life, but it must be assumed that it would have increased the chances of a successful rescue.

3.82 In some cases the views expressed by those who did not use life jackets may have been conditioned by the lack of compatibility of life jackets and safety harnesses. There is a strongly held belief that the first priority must be the safety harness and the life jacket is therefore of secondary importance. Throughout the competitors' comments on life jackets the argument for incorporating the harness and life jacket as a single garment is repeated. A number consider inflatable jackets too flimsy to wear as standard procedure and those with permanent buoyancy too cumbersome. There is a marked lack of agreement on the ideal life jacket, opinions differ on the relative merits of permanent buoyancy, oral inflation, manual inflation and automatic inflation.

TABLE 3.30

Question: How are the flares normally stored?
Do you now consider that stowage satisfactory?

	Total	*Stowage Satisfactory*
Base	235	198
Dry Container/Waterproof	143 61%	125 63%
Storage on Entrance to Hatchway	21 9%	18 9%
By/Over Chart-Table	37 16%	33 17%
Vicinity of Quarter Berth	14 6%	11 6%
Cabin Locker	15 6%	11 6%
Ready to Use	7 3%	7 4%
Cockpit Locker	12 5%	11 6%
No Answer	13 6%	7 4%

3.83 Apart from the inconvenience of wearing them, and the lack of compatibility with safety harnesses there seems to be no proof of major aspects of life jacket design or construction which gives cause for concern.

3K PYROTECHNICS

3.84 Table 3.30 shows the answers received to a question on flare stowage. In general competitors were satisfied with their stowage arrangements for flares. There was, however, some criticism of the large Polythene jar in which one manufacturer supplies the full flare outfit required by the Special Regulations; it was considered inconvenient as it was very difficult to find the required type of flare without emptying the entire contents of the jar.

3.85 Table 3.31 summarises the use of flares and table 3.32 lists the adverse comments which were made. The majority of those who used flares found that they did not have as many as they would have liked. It is not known, however, whether this was due to indiscriminate use or a genuine shortcoming in the number required by Special Regulations. Several crews commented that they had ample red handflares but not enough red parachute rockets.

3.86 One report indicates that flares worked effectively in spite of having been left floating in a pool of water in a life raft for over an hour.

3.87 In spite of strong recommendations on the standardisation of firing mechanisms a number of crews reported confusion caused by different firing methods for different flares. However desirable full standardisation of firing methods may be, it has been pointed out by manufacturers that to change production lines to a single standard would be extremely expensive and would prevent any further development of new improved mechanisms.

3L ELECTRICS/ENGINES

3.88 Several yachts reported losing the use of all electrics or of one or more items of electrical equipment during the race due to flooding. Damage to electrical equipment is probably an inevitable result of flooding and no attempt has been made to analyse the causes and effects.

3.89 Table 3.33 shows the extent to which competitors were able to maintain battery power during and after the storm. 77% of the fleet used normal navigation lights throughout and 69% reported that they were aware of the presence of other yachts in their vicinity at the

TABLE 3.31

PYROTECHNICS

	Total
Base	235
Did You Use White Hand Flares?	
Yes	23 10%
No	200 85%
No Answer	12 5%
Did You Use White Illuminating Rockets?	
Yes	8 3%
No	201 86%
No Answer	26 11%
Did You Use Red Distress Rockets?	
Yes	41 17%
No	173 74%
No Answer	21 9%
Did You Use Red Hand Flares?	
Yes	23 10%
No	189 80%
No Answer	23 10%

	Total
Base	235
Did You Use Verey Pistol Flares?	
Yes	7 3%
No	195 83%
No Answer	33 14%
Did Flares Perform as Expected?	
Yes	41 17%
No	23 10%
No Answer	171 73%
Did Any Flares Fail to Ignite?	
Yes	12 5%
No	48 20%
No Answer	175 74%
With Hindsight, Would You Carry Additional Flares?	
Yes	35 15%
No	112 48%
No Answer	88 37%

height of the storm. 16% of the fleet reported major difficulties with either compass or cabin lighting. The questionnaire contained no specific questions on the use of engines. However, it is known that several yachts used their engines during the storm to help maintain steerage way, to keep the yacht at what was considered a safe angle to the waves or to improve pointing to make an offing from the Cornish coast. At least two dismasted yachts retired under power unaided. Of the three yachts which picked up survivors from other yachts or life rafts, two used their engines to improve manoeuvrability. Some competitors who tried to use engines to manoeuvre during the storm reported being unable to do so because they had no electrical power available for starting.

3.90 Some competitors suggested that there should be a Special Regulation requiring the carriage of a specified minimum quantity of fuel. The basis for this suggestion was in most cases general opinion rather than specific fact.

TABLE 3.32

Question: Comment briefly on performance of flares

	Total
Base	52
Failure Due to Losing Striker Overboard	2 4%
Useless/Inefficient	14 28%
Satisfactory	28 56%
Excellent	4 8%

TABLE 3.33

Question: How regularly do you normally charge batteries during a race?

Question: What percentage of the normal battery capacity do you estimate you had available during the storm?

	Total	Frequency Charge Batteries				
		Not Spec.	Daily	Twice Daily	1-2 Days	Once in 2 Days
BASE	235	38	120	34	9	17
0-25%	21 9%	2 5%	9 8%	4 12%	2 22%	1 6%
26-50%	23 10%	5 13%	13 11%	2 6%	–	2 12%
51-75%	53 23%	8 21%	29 24%	10 29%	1 11%	3 18%
75% +	110 47%	18 47%	55 46%	14 41%	6 67%	10 59%
Don't know	3 1%	–	2 2%	–	–	1 6%
No answer	27 11%	5 13%	14 12%	4 12%		

Question: What percentage of normal battery capacity did you have by the end of the race or on entering harbour if you retired?

Total	Frequency Charge Batteries				
	Not Spec.	Daily	Twice Daily	1-2 Days	Once in 2 Days
235	38	120	34	9	17
29 12%	4 11%	14 12%	4 12%	2 22%	2 12%
22 9%	6 16%	11 9%	–	–	3 18%
25 11%	3 8%	11 9%	7 21%	1 11%	1 6%
121 51%	18 47%	66 55%	19 56%	6 67%	9 53%
1 •	–	1 1%	–	–	–
37 15%	7 18%	17 14%	4 12%	–	2 12%

Section 4
Ability of Skippers and Crews to withstand the storm

4A LEVEL OF EXPERIENCE OF SKIPPERS AND CREWS

4.1 There is no qualification in terms of competence or experience for skippers or crews to enter the Fastnet Race. The less experienced skippers and crews might have been expected to be more likely to get into difficulties than the more experienced. Each skipper was asked to assess the experience of his crew as either "Very experienced", "Of adequate experience" or "Somewhat short of experience". He was also asked to comment on whether, with hindsight, he felt that different action might have been taken if the crew had been more experienced. The answers to these totally subjective questions are tabulated in table 4.1. As would be expected, the skippers who felt that they or their crews were somewhat short of experience also tended to consider that with a more experienced crew their actions would have been different. However a relatively small percentage of the fleet felt that the crew were short of experience.

4.2 Seasickness was considered likely to have been a considerable problem in exceptionally rough conditions. Competitors were asked "How many of their crew might normally be expected to be incapacitated by seasickness?", "How many were somewhat incapacitated?" and "How many were seriously incapacitated?". Tables 4.2 and 4.3 show how expectations of seasickness compared with the numbers who actually suffered. Although the numbers somewhat incapacitated were slightly higher than the pre-race expectation the numbers seriously incapacitated were slightly below expectation.

4.3 The use of anti-seasickness pills was also examined. Table 4.4 shows that only a quarter of the fleet normally use anti-seasickness pills but that they were generally effective. It can not be inferred from these answers that everyone who suffers from seasickness will find pills an effective preventative. Many people do not take anti-seasickness pills because they have been unable to find a brand which is effective for them and is also free from side effects such as drowsiness

4.4 A more objective question on experience was asked by inviting skippers to complete the box in Fig 4.1 to show their experience of races and passages of various distances. Answers to this question were tabulated against abandonments, severe knockdowns and various categories of damage and the results are shown in table 4.5. In this tabulation there is a slight indication that boats with very experienced skippers, who had completed 7 or more races or passages of over 500 miles were less involved in abandonment, severe knockdown and damage than boats whose skippers had completed 2 or less races or passages or over 500 miles. The indication is, however, very slight and certainly can not be taken as evidence that boats skippered by yachtsmen with little long-race experience were at exceptionally high risk.

4.5 The experience of crews as teams with a background of experience sailing together in their present boat was also examined. The criteria for the question were the number of races over 200 miles in which at least two thirds of the crew had sailed together in the boat. Table

TABLE 4.1

Question: Would you describe the crew of the yacht that you were sailing as:
very experienced?
having adequate experience?
somewhat short of experience?

Question: Do you now feel that the actions taken might have been different if the crew had had more experience?

	Total	*Crew Experience*		
		Very	*Adequate*	*Short*
BASE	235	124	120	18
Yes	39 17%	10 8%	26 22%	10 56%
No	178 76%	106 85%	89 74%	8 44%
No Answer	18 8%	8 6%	5 4%	—

TABLE 4.2

Question: How many on board might normally be expected to be somewhat incapacitated by sea-sickness?

	Total
	Base 235
1 Person	51 22%
1 or 2 People	18 8%
2 People	35 15%
3 People	13 6%
4 People	3 1%
5 People	2 1%
6 People	1 0%
7 People	1 0%
No Answer	110 47%

TABLE 4.3

Question: How many were *somewhat* incapacitated by seasickness?
Question: How many were *seriously* incapacitated by seasickness?

	Somewhat Incapacitated	*Seriously Incapacitated*
Base	235	235
1Person	65 28%	36 15%
1 or 2 People	10 4%	10 4%
2 People	31 13%	5 2%
3 People	11 5%	3 1%
4 People	8 3%	1 0%

Fig. 4.1

Passages or races	None	1-2	3-6	7 or more
100 M—200 M				
200 M—500 M				
Over 500 M				

TABLE 4.4

Question: Do you normally take anti-seasick pills and if so what do you normally take?

	Total
Base	56
Stugeron	29 52%
Sea Legs	2 4%
Dramanine	4 7%
Quells	3 5%
Avomine	5 9%
Marzine	4 7%
Others	9 16%
No Answer	3 5%

Question: How effective did you find them?

	Total
Base	56
Moderately Effective Yes	23 41%
No	7 13%
Highly Effective Yes	32 57%
No	2 4%
Ineffective Yes No	– 7 13%

4.6 shows the answers received as a fleet total and for abandonments. There is again a slight indication that the highly experienced were less likely to abandon but there is no strong evidence to show that crew team experience and familiarity with the boat were factors of overriding significance.

4.6 There were 49 reported instances of individuals who had particular problems coping with the very severe conditions on account of physical fitness, handicap or disability, advancing years or extreme youth. Table 4.7 shows how competitors categorised these problems. These aspects of the ability of individuals to cope with storm conditions have not been examined in depth. A very small number of skippers has reported that in future they would be more rigorous in excluding people with potential for these problems from their crews and with only 49 reported problems in a total of some 2,500 competitors the problem does not appear to merit further investigation. There certainly do not seem to be any grounds for limiting the responsibility of owners for the selection of their own crews. Indeed a few skippers who were not satisfied with the experience or stamina of their crews retired before the storm.

TABLE 4.6

Question: On how many races over 200 M had at least two-thirds of your FASTNET crew previously sailed together in the boat?

	Total	*Aban-doned*
Base	235	23
None	64 27%	6 26%
1-2	43 18%	7 30%
3-6	77 33%	8 35%
7 or more	45 19%	2 9%
No Answer	6 3%	–

TABLE 4.5 SKIPPER EXPERIENCE

			B2 Knock-Down		*Damage Rig*		*Damage Accom.*		*Damage Steering*		*Damage Hull*	
	Total	*Aban-doned*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*
BASE	235	23	77	136	42	182	31	177	25	196	34	185
100-200 MILES												
None	2 1%	–	–	2 1%	–	2 1%	–	2 1%	–	2 1%	–	2 1%
1-2	7 3%	–	2 3%	5 4%	1 2%	6 3%	1 3%	4 2%	–	7 4%	–	6 3%
3-6	19 8%	3 13%	8 10%	10 7%	4 10%	15 8%	4 13%	12 7%	–	19 10%	3 9%	15 8%
7 or more	182 77%	19 83%	63 82%	100 74%	36 86%	137 75%	24 77%	143 81%	24 96%	148 76%	29 85%	145 78%
No Answer	25 11%	1 4%	4 5%	19 14%	1 2%	22 12%	2 6%	16 9%	1 4%	20 10%	2 6%	17 9%
200-500 MILES												
None	6 3%	1 4%	3 4%	3 2%	–	6 3%	–	6 3%	–	6 3%	1 3%	5 3%
1-2	28 12%	4 17%	13 17%	13 10%	4 10%	24 13%	7 23%	19 11%	4 16%	24 12%	3 9%	24 13%
3-6	41 17%	6 26%	14 18%	24 18%	11 26%	28 15%	7 23%	30 17%	1 4%	39 20%	7 21%	31 17%
7 or more	132 56%	10 43%	42 55%	75 55%	25 60%	100 55%	16 52%	103 58%	18 72%	105 54%	21 62%	103 56%
No Answer	28 12%	2 9%	5 6%	21 15%	2 5%	24 13%	1 3%	19 11%	2 8%	22 11%	2 6%	22 12%
OVER 500 MILES												
None	29 12%	3 13%	10 13%	17 13%	3 7%	25 14%	4 13%	23 13%	4 16%	24 12%	5 15%	23 12%
1-2	52 22%	5 22%	20 26%	29 21%	12 29%	39 21%	6 19%	43 24%	8 32%	42 21%	8 24%	42 23%
3-6	52 22%	6 26%	16 21%	30 22%	10 24%	38 21%	10 32%	36 20%	4 16%	44 22%	10 29%	37 20%
7 or more	77 33%	5 22%	23 30%	45 33%	11 26%	61 34%	8 26%	58 33%	7 28%	64 33%	9 26%	62 34%
No Answer	26 11%	4 17%	8 10%	16 12%	6 14%	20 11%	3 10%	17 10%	2 8%	23 12%	3 9%	21 11%

TABLE 4.7

Question: Did anyone on board have particular problems in coping with the conditions?

	Total
Base	235
Yes	50 21%
No	177 75%
No Answer	11 5%

Physical Fitness	
Yes	9 18%
No	18 36%

Handicap or Disability	
Yes	4 8%
No	20 40%

Too Old	
Yes	7 14%
No	26 52%

Too Young	
Yes	10 20%
No	22 44%

TABLE 4.8

SURVIVAL TACTICS

Question: At the height of the storm what do you now feel was the principal danger? (Comment)

		Survival Tactics Adopted				*R.1—R.4*			
	Total	*Heave to (R1)*	*Lie bare poles (R2)*	*Run off bare poles (R3)*	*Stream warps (R4)*	*Any two*	*Any three*	*All four*	*None*
BASE	235	26	86	57	46	40	13	—	86
Steep Breaking Sea	103 44%	10 39%	46 53%	26 46%	19 41%	17 43%	7 54%	—	33 38%
Gear Damage	6 3%	1 4%	—	1 2%	1 2%	1 3%	—	—	4 5%
Man Overboard	15 6%	1 4%	5 6%	4 7%	6 13%	3 8%	2 15%	—	6 7%
Hull Damage	7 3%	1 4%	1 1%	2 4%	3 7%	2 5%	—	—	2 2%
Rig Damage	13 6%	1 4%	6 7%	3 5%	4 9%	5 13%	—	—	4 5%
Excessive Speed	9 4%	5 19%	3 3%	4 7%	3 7%	5 13%	1 8%	—	1 1%
Knockdown/Capsize	37 16%	3 12%	18 21%	12 21%	10 22%	5 13%	3 23%	—	5 6%
Crew Injury	15 6%	3 12%	5 6%	3 5%	5 11%	3 8%	1 8%	—	4 5%
Collision	11 5%	3 12%	4 5%	1 2%	—	1 3%	—	—	4 5%
Steering Damage	7 3%	1 4%	4 5%	3 5%	2 4%	2 5%	1 8%	—	1 1%
Sailing Under	3 1%	1 4%	1 1%	—	—	—	—	—	1 1%
Pooped	10 4%	1 4%	5 6%	3 5%	2 4%	3 8%	1 8%	—	4 5%
No answer	30 13%	3 12%	5 6%	3 5%	1 2%	3 8%	—	—	21 24%

TABLE 4.9

Question: If ever faced with a similar situation would you do the same thing again?

		Survival Tactics Adopted				*R.1—R.4*			
	Total	*Heave to (R1)*	*Lie bare poles (R2)*	*Run off bare poles (R3)*	*Stream warps (R4)*	*Any two*	*Any three*	*All four*	*None*
BASE	235	26	86	57	46	40	13	—	86
Yes	179 76%	19 73%	77 90%	52 91%	39 85%	35 88%	11 85%	—	49 57%
No	3	—	2 2%	1 2%	2 4%	1 3%	1 8%	—	1 1%
No answer	53 23%	7 27%	7 8%	4 7%	5 11%	4 10%	1 8%	—	36 42%

4B TACTICS DURING THE STORM

4.7 There are four accepted categories of survival tactics which may be used in severe weather: heaving-to, lying a-hull, running off under bare poles, and running off with warps streamed to reduce speed. The tactics adopted by each boat depended upon her skipper's assessment of the principal danger, which his survival tactics were designed to avoid or to minimise. All competitors were asked to state, with hindsight, what they now feel was the principal danger. This was an open question to which any reply could be given, and the answers are shown in table 4.8. The largest category of responses was general rather than specific, identifying the danger in terms of sea conditions, rather than the damage which the sea might inflict on the boat or her crew.

4.8 There is little significant difference between the answers given by those who adopted different tactics during the storm. It is perhaps inevitable that those who lay a-hull under bare poles, thus giving up the ability to take any avoiding action for particularly large steep waves, showed the highest percentage of those who identified sea conditions as the principal danger. It is extremely difficult to ascertain the effectiveness of each type of survival tactic. Table 4.9 shows the numbers reporting having used each of them (a number of boats tried different tactics at different times). In each case about 80% of those adopting each method considered that the boat was safe as a result, although of course under those conditions safety must be assumed to be a relative term.

4.9 Competitors were also asked if they adopted other survival tactics at the height of the storm. Table 4.10 shows the responses, in terms of sail carried or a particular method of heaving-to. More detailed reports which can not be subjected to quantitative comparison have been received. Those reports, together with detailed reports of capsizes, confirm that "The greatest danger was of being caught by a particularly steep breaking wave". Many skippers felt that in daylight, provided the boat had reasonable speed and control, there was a chance of seeing these waves in time either to avoid them or meet them at the least dangerous angle of incidence. Extracts from reports give an indication of the tactics adopted by a number of boats and their skippers' assessments of their success:-

Class	*Comment*
Class I	Heavy knockdown while lying a-hull. This tactic would never have been used if the steering gear had not failed.
Class I	Kept sailing. It worked well.
Class I	No problems while the boat was kept sailing on a close reach.
Class I	Rolled and dismasted by exceptionally steep wave. The sea was very confused and the actual angle of approach of the wave was impossible to judge.
Class III	Lay a-hull safely for three hours before being badly knocked down. Then ran off purposely fast, 5-10 knots, which seemed to work well.
Class III	Could not slow the boat down enough in spite of warps streamed. Experienced heavy falls off waves, one resulting in a capsize.
Class III	Rolled while running with warps streamed. The boat would have been safer if she had been sailing two knots faster.
OOD 34	Lay a-hull for half an hour, then experienced bad knockdown. Then tried lying with sail over the bow to hold head up to sea, seemed satisfactory at first but after 1½ hours boat was rolled 360°. Ran off with warps and drogues streamed for 12 hours, a tactic which seemed to work well but by this time the sea was easing.
OOD 34	Lay a-hull for half an hour, then rolled over by a wave which would have capsized us whatever angle it had approached from.
OOD 34	Kept sailing under storm jib, which was too big. Would have been much happier with a trisail.
Class IV	Kept reaching under storm jib but suffered several knockdowns.
Class IV	Seemed to be safe as long as we could keep the boat absolutely stern-on to each wave.
Class IV	Ran directly before waves successfully for several hours, but then rolled over when caught by a cross sea which appeared from nowhere.
Class IV	Broached while running under bare poles and then rolled upside down by the next wave which caught her beam on.
Class IV	Three bad knockdowns while running with warps streamed. The boat was probably sailing too slowly.
Class IV	No tactics seemed safe. Knockdowns occurred both reaching under storm jib and running under bare poles with warps streamed.
Class IV	Running under bare poles with warps streamed was safe. Without the warps the boat went too fast, on any point of sailing.
Class IV	Very bad knockdown, almost a pitch-pole, while running down sea to go to the assistance of another boat.
Class V	Two bad knockdowns while hove to. Further two knockdowns at speed, up to 15 knots, down wind. Best tactics

TABLE 4.10

Question: If you employed survival tactics which you have been unable to describe above please state what they were

	Total	*Adopt same tactics*	
		Yes	*No*
BASE	235	133	4
Jib only	13 6%	9 7%	1 25%
Main/Trisail only	6 3%	4 3%	—
Main/Trisail & Jib	7 3%	7 5%	—
Hove to/Tiller lashed	5 2%	3 2%	1 25%
Hove to/Tiller manned	8 3%	7 5%	—
No Answer	196 83%	103 77%	2 50%

Class	Comment
	appeared to be to keep sailing to windward.
Class V	Kept going to windward under storm jib, luffing to the worst seas. It worked well and would probably have been even better using a trisail instead of the storm jib.
Class V	Lay a-hull during darkness and kept sailing during daylight. No real problems.
Class V	Capsized while trying to sail to windward. Could not maintain sufficient speed to meet the sea on the bow.
Class V	Knocked down once to about 120° during a period of 19 hours that the boat was lying a-hull.
Contessa 32	Kept sailing to windward, with no particular problems.
Contessa 32	Kept the boat sailing, with no particular problems.
Contessa 32	Heavily knocked down while lying a-hull.

4.12 From analysis of the experience gained during the Fastnet storm it is clear that all the established types of survival tactics provide a measure of safety in very severe wind and sea conditions. Many competitors have suggested that given adequate storm sails a skilful and determined helmsman could avoid the worst waves, or meet them at an angle of encounter which would minimise their effect. Others have reported that at the height of the storm there were some waves which were of a size and shape such that there was no defensive tactic which would prevent them from rolling or severely damaging a yacht caught in their path. The views expressed depend upon the actual skill of the helmsmen on board and probably on chance which may have determined whether or not a yacht was caught by a particularly severe "rogue wave". Because of their speed of formation and transient nature, even during daylight hours these waves can be almost impossible to avoid.

4.13 Table 4.11 shows the extent to which competitors tried to steer their boats during the storm and the extent to which they felt, with hindsight, that it was important to try to do so. The majority felt at the time that it was important to keep the helm manned and many of those who did not do so now feel that they should have done.

4.14 No magic formula for guaranteeing survival emerges from the experiences of those who were caught in the storm. There is, however, an inference that active rather than passive tactics were successful and those who were able to maintain some speed and directional control fared better.

4C WATCHKEEPING ROUTINES AND GENERAL ORGANISATION

4.15 The ability of any vessel to remain efficient in severe weather depends upon the ability of her skipper and crew to conserve their strength. That ability is traditionally derived from a watchkeeping routine which ensures that everyone has as much opportunity for rest as conditions allow, that there is an adequate supply of food and that routine safety precautions are so well practiced that they remain an integral part of the general pattern of sailing.

4.16 Table 4.12 shows the extent to which watchkeeping routines were maintained; crews considered that they were adequately fed and lack of sleep or exhaustion were considered important considerations. In general the yachts with more experienced skippers fared slightly better, their crews certainly seemed to be better fed, and lack of sleep or exhaustion were less widespread.

4.17 Several competitors reported that extreme cold was an important problem. Very few who remained on deck were able to keep dry and in boats which suffered severe knockdowns those on deck were of course soaked. A few boats reported keeping the whole crew on deck during the height of the storm because of the danger of being trapped in the cabin during a knockdown. This is now seen to have been a mistake. Two lives were lost as a result of people being trapped in cockpits; in one case the safety harness of a trapped and injured man was cut to free him from the cockpit and he was unable to retain his grasp on the yacht when it righted; in the same incident a crewman drowned as a result of being trapped in the cockpit of an upturned boat. There were no instances of yachts sinking upside down and all those temporarily trapped in cabins had time to abandon the yacht after she righted.

4.18 Many skippers actually restricted the number on deck at the height of the storm to two and in a few cases to just the helmsman with a man on standby waiting under the hatch. In a minority of boats the helm was lashed and the whole crew retired below, keeping as good a lookout as possible through the cabin windows. In these boats the skipper felt that the risk of collision was small compared with the risk of a man being lost overboard. As 51 yachts reported one or more crew being washed overboard, several on more than one

TABLE 4.11

Question: Was it possible to keep someone at the helm at all times?

	Total	Heave to (R1)	Lie Bare Poles (R2)	Run Off Bare (R3)	Strm. Warps (R4)	R.1-R.4 None	R.1-R.4 Any
BASE	235	26	86	57	46	149	86
Yes	190 81%	21 81%	67 78%	54 95%	41 89%	125 84%	65 76%
No	21 9%	2 8%	17 20%	2 4%	4 9%	19 13%	2 2%
No Answer	24 10%	3 12%	2 2%	1 2%	1 2%	5 3%	19 22%

Question: Do you think it was significant to keep the helm manned?

Total	Yes	No
235	190	21
172 73%	165 87%	7 33%
37 16%	22 12%	14 67%
26 11%	3 2%	–

occasion, it was obviously sensible to reduce the number on deck, and therefore at risk, to the minimum.

4.19 It is probably not possible to manufacture foul weather clothing which will give complete protection against the conditions experienced by the Fastnet Race fleet. In one case a yacht had to be abandoned when a crewman was changing out of wet clothes and he took to the life raft in his underclothing. In general, however, there were few reports of crews having to remain in wet clothes for long periods and the risk of changing into dry clothes was minimal compared with that of becoming hypothermic due to spending long periods in wet clothes.

4.20 It is not possible to determine the extent to which hypothermia was a problem. A few reports of hypothermia have been received, but in general this seems to be a danger which offshore racing crews recognise and guard against. A few crews reported that they had taken no precautions to protect clothes in lockers against water and as a result they were completely without dry clothes to change into. The majority, however, kept spare clothing in Polythene bags or waterproof hold-alls and were not reduced to the state of having no dry clothes.

4.21 Safety procedures for the use of harnesses, and in some cases the recovery of men overboard, were severely tested by the storm. Those with two lines on safety harnesses found them invaluable for use in the cockpit, particularly for the helmsman who had considerable difficulty if he was not held firmly in place. Many crews used the tails of sheets in addition to harnesses to lash themselves firmly into the cockpit. Several skippers reported reluctance to send anyone onto the foredeck at the height of the storm because of the obvious danger of losing them overboard. Inadequacy of harness attachment points and lack of adequate toe-rails may have influenced decisions on sail changes and once a yacht was down to bare poles the dangers of foredeck work were a disincentive to setting a storm jib, even if the yacht was not lying safely without sail.

4.22 There have been insufficient reports of the use of man overboard recovery equipment such as horseshoe lifebelts, dan buoys, marker lights and buoyant heaving lines to draw any conclusions on the effectiveness of these items of equipment.

TABLE 4.12

COMFORT BELOW/ROUTINE

		Experience of Skipper-Passages or Races over 500 miles				*Fastnet Class*					
	Total	*None*	*1-2*	*3-6*	*7+*	*0*	*I*	*II*	*III*	*IV*	*V*
BASE	235	29	52	52	77	8	40	40	52	46	47
WAS IT POSSIBLE TO MAINTAIN A WATCHKEEPING SCHEDULE?											
Yes	199	20	47	44	68	8	35	33	44	35	42
	85%	69%	90%	85%	88%	100%	88%	83%	85%	76%	89%
No	26	7	4	6	6	–	4	6	7	6	3
	11%	24%	8%	12%	8%		10%	15%	13%	13%	6%
No Answer	10	2	1	2	3	–	1	1	1	5	2
	4%	7%	2%	4%	4%		3%	3%	2%	11%	4%
WAS IT POSSIBLE TO SERVE HOT/ACCEPTABLE FOOD DURING STORM?											
Yes	169	16	37	37	63	8	31	30	37	31	32
	72%	55%	71%	71%	82%	100%	78%	75%	71%	67%	68%
No	58	12	14	11	12	–	8	10	13	11	14
	25%	41%	27%	21%	16%		20%	25%	25%	24%	30%
No Answer	8	1	1	4	2	–	1	–	2	4	1
	3%	3%	2%	8%	3%		3%		4%	9%	2%
DID YOU CARRY FOOD SPECIALLY PREPARED FOR SEVERE CONDITIONS?											
Yes	104	13	25	21	35	1	18	15	25	20	24
	44%	45%	48%	40%	45%	13%	45%	38%	48%	43%	51%
No	123	15	27	28	39	7	21	24	26	22	22
	52%	52%	52%	54%	51%	88%	53%	60%	50%	48%	47%
No Answer	8	1	–	3	3	–	1	1	1	4	1
	3%	3%		6%	4%		3%	3%	2%	9%	2%
DO YOU CONSIDER LACK OF SLEEP/EXHAUSTION WAS A FACTOR IN ACTIONS?											
Yes	43	9	14	7	6	1	3	10	10	10	9
	18%	31%	27%	13%	8%	13%	8%	25%	19%	22%	19%
No	178	19	35	41	66	7	35	27	41	29	37
	76%	66%	67%	79%	86%	88%	88%	68%	79%	63%	79%
No Answer	14	1	3	4	5	–	2	3	1	7	1
	6%	3%	6%	8%	6%		5%	8%	2%	15%	2%

4D NAVIGATION

4.23 The circumstances of the Fastnet storm were such that accurate navigation was unlikely to be a crucial factor. After the race there were suggestions that the RORC rule on the use of sophisticated navigational aids added unnecessarily to the dangers of the race. Attitudes to navigation, the importance attached to the subject and the accuracy achieved have therefore been examined.

4.24 In 90% of the fleet one member of the crew had specific responsibility for navigation. Table 4.13 shows the accuracy which competitors believed that they achieved, the extent to which uncertainty of navigational position was an important factor which influenced the decisions taken and the attitudes to a change of rule to allow the use of sophisticated navigational aids.

4.25 The navigational aids which are prohibited from use are specified in general condition 12(n):

> "For the guidance of owners the following are specifically prohibited: Radar; Omni; Loran; Satnav; Decca; Omega; automatic or self-seeking direction finders; pre-arranged radio transmissions for the use of individual competitors including yacht-to-yacht, and yacht-to-ship transmissions . . .".

4.26 There is some support from competitors for a relaxation of this rule, but twice the number who would support a relaxation would oppose it. As only 11% of the fleet reported that uncertainty of navigational position was a factor which influenced the decisions taken there would seem to be little firm evidence that a relaxation would make racing significantly safer.

4.27 Competitors' views on the extent to which depth of water affected sea conditions are shown in table 4.14. The topography of the seabed between Lands End and the Fastnet is shown on British Admiralty Chart 2649, published in 1978. Over most of the area there are depths of 100-120 metres, shoaling to 62 metres over the Labadie Bank, 71 metres over North West Bank and rather under 50 metres around the Fastnet Rock itself. At the western end of North West Bank there is a rock outcrop, Haig Fras, with a least depth of 38 metres but this is about 10 miles southwest of the rhumb line from the Fastnet to the Bishop. The charted soundings and depth contour lines are derived from random sources as there has never been a full systematic survey of the area.

4.28 The majority of competitors felt that the depth of water did affect the sea state but this may have been a subjective answer which is not supported by expert opinion (see Annex 2A). It is possible that there are shoals or deeps in the area which have not been reported to a charting authority and less than half the fleet were able to navigate to an accuracy of better than ± 5 miles. It is therefore impossible to derive any reliable indication of the extent to which the shoals such as Labadie Bank affected sea conditions.

4.29 Table 4.15 shows the extent to which yachts had sufficient charts on board and the degradation of charts due to flooding. At the time of the race there was a printers' strike at the Hydrographic Department which gave rise to some shortage of chart supplies. It is, however, disturbing that 18% of the fleet should report that there were not sufficient large scale charts on board to give them an unrestricted choice of harbours of refuge.

TABLE 4.13

Question: During the storm, were you able to keep an accurate position plot
(a) To better than ± 5 miles?
(b) To better than ± 15 miles?
(c) Worse than ± 15 miles?

Question: Was uncertainty of position a significant factor in action taken during the storm?

Question: With hindsight, would you support a change of RORC policy to allow the use of hyperbolic fixing equipment and other sophisticated navigational aids, (remember that all sophisticated equipment is a drain on yacht's batteries)?

		Fastnet Class					
	Total	*0*	*I*	*II*	*III*	*IV*	*V*
BASE	235	8	40	40	52	46	47
WERE YOU ABLE TO KEEP POSITION PLOT TO WITHIN 5 MILES?							
Yes	103	5	22	24	25	11	16
	44%	63%	55%	60%	48%	24%	34%
No	53	1	5	6	9	18	12
	23%	13%	13%	15%	17%	39%	26%
No answer	79	2	13	10	18	17	19
	34%	25%	33%	25%	35%	37%	40%
WERE YOU ABLE TO KEEP POSITION PLOT TO WITHIN 15 MILES?							
Yes	109	3	15	14	24	24	28
	46%	38%	38%	35%	46%	52%	60%
No	13	–	1	2	2	4	3
	6%		3%	5%	4%	9%	6%
No answer	113	5	24	24	26	18	16
	48%	63%	60%	60%	50%	39%	34%
WERE YOU ABLE TO KEEP POSITION PLOT WORSE THAN 15 MILES?							
Yes	18	–	1	–	3	7	6
	8%		3%		6%	15%	3%
No	46	2	5	5	8	13	12
	20%	25%	13%	13%	15%	28%	26%
No answer	171	6	34	35	41	26	29
	73%	75%	85%	88%	79%	57%	62%
WAS UNCERTAINTY OF POSITION A FACTOR IN ACTION TAKEN?							
Yes	27	1	7	3	8	4	4
	11%	13%	18%	6%	15%	9%	9%
No	190	4	29	33	43	38	41
	81%	50%	73%	83%	83%	83%	87%
No answer	18	3	4	4	1	4	2
	8%	38%	10%	10%	2%	9%	4%
WOULD YOU SUPPORT CHANGE IN RORC POLICY TOWARDS NAVIGATION AIDS?							
Yes	67	5	19	16	12	9	6
	29%	63%	48%	40%	23%	20%	13%
No	151	1	17	22	39	30	40
	64%	13%	43%	55%	75%	65%	85%
No answer	18	2	5	2	1	7	1
	8%	25%	13%	5%	2%	15%	2%

TABLE 4.14

Question: Did you make any attempt to avoid areas of "shoals"?
Question: Do you consider, with hindsight, that the depth of water significantly affected the sea condition?

		Fastnet Class						*B2 Knockdown*	
	Total	*0*	*I*	*II*	*III*	*IV*	*V*	*Yes*	*No*
BASE	235	8	40	40	52	46	47	77	136
DID YOU ATTEMPT TO AVOID AREAS OF SHOALS?									
Yes	62	3	11	14	14	9	11	24	32
	26%	38%	28%	35%	27%	20%	23%	31%	24%
No	147	4	25	23	33	30	30	45	92
	63%	50%	63%	58%	63%	65%	64%	58%	68%
No answer	27	1	5	3	5	7	6	8	12
	11%	13%	13%	8%	10%	15%	13%	10%	9%
DO YOU CONSIDER THAT DEPTH OF WATER AFFECTED SEA CONDITIONS?									
Yes	135	7	21	27	26	23	29	48	76
	57%	88%	53%	68%	50%	50%	62%	62%	56%
No	75	—	14	9	20	17	15	21	49
	32%		35%	23%	38%	37%	32%	27%	36%
No answer	26	1	5	4	6	6	4	8	12
	11%	13%	13%	10%	12%	13%	9%	10%	9%

TABLE 4.15

Question: Did you have sufficient up to date charts and navigational publications on board to consider making use of harbours of refuge?
Question: Did navigation become much more difficult or impossible, because of deterioration of the chart due to repeated soaking?

		Fastnet Class					
	Total	*0*	*I*	*II*	*III*	*IV*	*V*
BASE	235	8	40	40	52	46	47
DID YOU HAVE SUFFICIENT CHARTS TO CONSIDER USING HARBOURS OF REFUGE?							
Yes	182	8	32	29	41	32	38
	77%	100%	80%	73%	79%	70%	81%
No	42	—	5	9	10	10	8
	18%		13%	23%	19%	22%	17%
No answer	11	—	3	2	1	4	1
	5%		8%	5%	2%	9%	2%
DID NAVIGATION BECOME MORE DIFFICULT DUE TO CHART SOAKING?							
Yes	65	1	5	6	19	18	15
	28%	13%	13%	15%	37%	39%	32%
No	160	6	32	32	32	25	32
	68%	75%	80%	80%	62%	54%	68%
No answer	10	1	3	2	1	3	—
	4%	13%	8%	5%	2%	7%	

TABLE 4.16
Primary and Contributory Reasons for Retirement (Primary—then Contributory)

	Total	Fastnet Class						Length/Displacement							B2 Knock-down	
		0	I	II	III	IV	V	Less than 120	121–149	150–174	175–199	200–224	225–249	250+	Yes	No
BASE	235	8	40	40	52	46	47	4	15	16	78	50	16	7	77	136
GENERAL CREW FATIQUE																
Yes	13	–	–	2	2	2	7	–	–	1	4	5	1	1	6	7
	6%			5%	4%	4%	15%			6%	5%	10%	6%	14%	8%	5%
No	63	1	6	8	15	12	20	1	4	7	22	17	4	–	27	33
	27%	13%	15%	20%	29%	26%	43%	25%	27%	44%	28%	34%	25%		35%	24%
No Answer	159	7	34	30	35	32	20	3	11	8	52	28	11	6	44	96
	68%	88%	85%	75%	67%	70%	43%	75%	73%	50%	67%	56%	69%	86%	57%	71%
Yes	46	–	3	8	12	10	12	1	4	2	16	12	1	1	17	27
	20%		8%	20%	23%	22%	26%	25%	27%	13%	21%	24%	6%	14%	22%	20%
No	44	1	4	5	9	11	13	–	2	5	15	13	3	2	18	23
	19%	13%	10%	13%	17%	24%	28%		13%	31%	19%	26%	19%	29%	23%	17%
No Answer	145	7	33	27	31	25	22	3	9	9	47	25	12	4	42	86
	62%	88%	83%	68%	60%	54%	47%	75%	60%	56%	60%	50%	75%	57%	55%	63%
SEA-SICKNESS																
Yes	3	–	–	2	1	–	–	–	–	–	1	–	2	–	–	3
	1%			5%	2%						1%		13%			2%
No	76	1	6	8	20	12	27	1	6	8	26	20	3	1	35	39
	32%	13%	15%	20%	38%	26%	57%	25%	40%	50%	33%	40%	19%	14%	45%	29%
No Answer	156	7	34	30	31	34	20	3	9	8	51	30	11	6	42	94
	66%	88%	85%	75%	60%	74%	43%	75%	60%	50%	65%	60%	69%	86%	55%	69%
Yes	22	–	1	3	6	7	5	–	1	1	8	7	1	1	8	13
	9%		3%	8%	12%	15%	11%		7%	6%	10%	14%	6%	14%	10%	10%
No	61	1	5	6	11	14	22	1	4	6	21	17	2	2	25	32
	26%	13%	13%	15%	21%	30%	47%	25%	27%	38%	27%	34%	13%	29%	32%	24%
No Answer	152	7	34	31	35	25	20	3	10	9	49	26	13	4	44	91
	65%	88%	85%	78%	67%	54%	43%	75%	67%	56%	63%	52%	81%	57%	57%	67%
LOW CREW MORALE																
Yes	5	–	–	1	4	–	–	–	–	–	4	–	1	–	2	3
	2%			3%	8%						5%		6%		3%	2%
No	80	1	6	11	19	14	27	1	7	9	25	20	4	1	35	42
	34%	13%	15%	28%	37%	30%	57%	25%	47%	56%	32%	40%	25%	14%	45%	31%
No Answer	150	7	34	28	29	32	20	3	8	7	49	30	11	6	40	91
	64%	88%	85%	70%	56%	70%	43%	75%	53%	44%	63%	60%	69%	86%	52%	67%
Yes	23	–	3	1	6	8	5	–	2	2	9	6	1	2	8	15
	10%		8%	3%	12%	17%	11%		13%	13%	12%	12%	6%	29%	10%	11%
No	58	1	4	7	9	14	21	1	3	6	18	18	3	1	24	30
	25%	13%	10%	18%	17%	30%	45%	25%	20%	38%	23%	36%	19%	14%	31%	22%
No Answer	154	7	33	32	37	24	21	3	10	8	51	26	12	4	45	91
	66%	88%	83%	80%	71%	62%	45%	75%	67%	50%	65%	52%	75%	57%	58%	67%
PERSONAL FATIGUE OF SKIPPER																
Yes	3	–	–	–	1	1	1	–	–	1	2	–	–	–	3	–
	1%				2%	2%	2%			6%	3%				4%	
No	76	1	6	9	19	13	26	1	6	8	25	20	3	1	32	41
	32%	13%	15%	23%	37%	28%	55%	25%	40%	50%	32%	40%	19%	14%	42%	30%
No Answer	156	7	34	31	32	32	20	3	9	7	51	30	13	6	42	95
	66%	88%	85%	78%	62%	70%	43%	75%	60%	44%	65%	60%	81%	86%	55%	70%
Yes	26	–	1	3	7	6	9	–	3	1	10	7	3	–	9	15
	11%		3%	8%	13%	13%	19%		20%	6%	13%	14%	19%		12%	11%
No	60	1	5	8	12	15	17	1	4	5	20	18	2	3	24	33
	26%	13%	13%	20%	23%	33%	36%	25%	27%	31%	26%	36%	13%	43%	31%	24%
No Answer	149	7	34	29	33	25	21	3	8	10	48	25	11	4	44	88
	63%	88%	85%	73%	63%	54%	45%	75%	53%	63%	62%	50%	69%	57%	57%	65%
ACTUAL DAMAGE TO BOAT																
Yes	45	–	9	4	9	6	16	–	6	7	13	10	1	1	27	18
	19%		23%	10%	17%	13%	34%		40%	44%	17%	20%	6%	14%	35%	13%
No	57	1	3	9	16	11	16	1	4	4	21	14	4	1	21	33
	24%	13%	8%	23%	31%	24%	34%	25%	27%	25%	27%	28%	25%	14%	27%	24%
No Answer	133	7	28	27	27	29	15	3	5	5	44	26	11	5	29	85
	57%	88%	70%	68%	52%	63%	32%	75%	33%	31%	56%	52%	69%	71%	38%	63%
Yes	23	–	1	2	9	3	6	–	5	1	6	2	1	1	15	7
	10%		3%	5%	17%	7%	13%		33%	6%	8%	4%	6%	14%	19%	5%
No	54	1	4	7	9	16	17	1	–	3	22	20	2	2	16	34
	23%	13%	10%	18%	17%	35%	36%	25%		19%	28%	40%	13%	29%	21%	25%
No Answer	158	7	35	31	34	27	24	3	10	12	50	28	13	4	46	95
	67%	88%	88%	78%	65%	59%	51%	75%	67%	75%	64%	56%	81%	57%	60%	70%
INJURY/FATALITY																
Yes	10	–	–	1	2	4	3	–	–	1	4	4	–	–	7	2
	4%			3%	4%	9%	6%			6%	5%	8%			9%	1%
No	73	1	6	11	20	10	23	1	6	7	23	18	5	1	27	43
	31%	13%	15%	28%	38%	22%	49%	25%	40%	44%	29%	36%	31%	14%	35%	32%
No Answer	152	7	34	28	30	32	21	3	9	8	51	28	11	6	43	91
	65%	88%	85%	70%	58%	70%	45%	75%	60%	50%	65%	56%	69%	86%	56%	67%
Yes	13	–	–	–	6	4	3	–	3	–	6	3	–	–	9	3
	6%				12%	9%	6%		20%		8%	6%			12%	2%
No	65	1	6	8	13	16	19	1	2	5	24	18	4	3	20	41
	28%	13%	15%	20%	25%	35%	40%	25%	13%	31%	31%	36%	25%	43%	26%	30%
No Answer	157	7	34	32	33	26	25	3	10	11	48	29	12	4	48	92
	67%	88%	85%	80%	63%	57%	53%	75%	67%	69%	62%	58%	75%	57%	62%	68%
RISK OF WORSENING EXISTING SLIGHT DAMAGE																
Yes	22	1	1	2	7	4	7	–	5	2	7	3	1	–	13	8
	9%	13%	3%	5%	13%	9%	15%		33%	13%	9%	6%	6%		17%	6%
No	63	–	5	10	16	12	18	1	2	6	21	18	5	1	23	38
	27%		13%	25%	31%	26%	38%	25%	13%	38%	27%	36%	31%	14%	30%	28%
No Answer	150	7	34	28	29	30	22	3	8	8	50	29	10	6	41	90
	64%	88%	85%	70%	56%	65%	47%	75%	53%	50%	64%	58%	63%	86%	53%	66%
Yes	25	–	–	5	6	5	9	–	1	2	12	4	1	–	15	9
	11%			13%	12%	11%	19%		7%	13%	15%	8%	6%		19%	7%
No	47	–	6	5	7	14	13	1	–	4	15	16	2	3	11	33
	20%		15%	13%	13%	30%	28%	25%		25%	19%	32%	13%	43%	14%	24%
No Answer	163	8	34	30	39	27	25	3	14	10	51	60	13	4	51	94
	69%	100%	85%	75%	75%	59%	53%	75%	93%	63%	65%	60%	81%	57%	66%	69%

	Total	Fastnet Class 0	I	II	III	IV	V	Length/Displacement Less than 120	121–149	150–174	175–199	200–224	225–249	250+	B2 Knock-down Yes	No
LACK OF CONFIDENCE IN ABILITY OF YACHT TO CONTINUE																
Yes	12 5%	—	—	2 5%	4 8%	2 4%	3 6%	—	1 7%	—	6 8%	2 4%	—	—	9 12%	3 2%
No	68 29%	1 13%	6 15%	10 25%	18 35%	10 22%	22 47%	1 25%	6 40%	9 56%	20 26%	19 38%	5 31%	1 14%	26 34%	40 29%
No Answer	155 66%	7 88%	34 85%	28 70%	30 58%	34 74%	22 47%	3 75%	8 53%	7 44%	52 67%	29 58%	11 69%	6 86%	42 55%	93 68%
Yes	22 9%	—	1 3%	3 8%	5 10%	9 20%	4 9%	1 25%	1 7%	—	8 10%	8 16%	—	—	10 13%	11 8%
No	57 24%	1 13%	5 13%	5 13%	11 21%	13 28%	21 45%	—	3 20%	7 44%	20 26%	16 32%	4 25%	3 43%	20 26%	33 24%
No Answer	156 66%	7 88%	34 85%	32 80%	36 69%	24 52%	22 47%	3 75%	11 73%	9 56%	50 64%	26 52%	12 75%	4 57%	47 61%	92 68%
SEVERE LOSS OF BATTERY CAPACITY																
Yes	2 1%	—	—	1 3%	—	—	1 2%	1 25%	—	—	—	1 2%	—	—	—	2 1%
No	81 34%	1 13%	6 15%	11 28%	20 38%	13 28%	28 60%	—	7 47%	9 56%	27 35%	20 40%	5 31%	1 14%	36 47%	43 32%
No Answer	152 65%	7 88%	34 85%	28 70%	32 62%	33 72%	18 38%	3 75%	8 53%	7 44%	51 65%	29 58%	11 69%	6 86%	41 53%	91 67%
Yes	16 7%	—	1 3%	—	7 13%	5 11%	3 6%	—	2 13%	—	3 4%	7 14%	1 6%	—	9 12%	6 4%
No	72 31%	1 13%	6 15%	8 20%	13 25%	18 39%	24 51%	—	3 20%	7 44%	28 36%	20 40%	3 19%	3 43%	27 35%	41 30%
No Answer	148 63%	7 88%	33 83%	32 80%	33 63%	23 50%	20 43%	4 100%	10 67%	9 56%	48 62%	23 46%	12 75%	4 57%	41 53%	90 66%
UNCERTAINTY OF NAVIGATIONAL POSITION																
Yes	5 2%	—	2 5%	1 3%	1 2%	—	1 2%	—	1 7%	—	3 4%	1 2%	—	—	3 4%	2 1%
No	79 34%	1 13%	5 13%	11 28%	20 38%	13 28%	27 57%	1 25%	6 40%	9 56%	25 32%	22 44%	5 31%	1 14%	35 45%	42 31%
No Answer	151 64%	7 88%	33 83%	28 70%	31 60%	33 72%	19 40%	3 75%	8 53%	7 44%	50 64%	27 54%	11 69%	6 86%	39 51%	92 68%
Yes	6 3%	—	—	2 5%	1 2%	2 4%	1 2%	—	1 7%	—	2 3%	—	1 6%	—	3 4%	2 1%
No	76 32%	1 13%	6 15%	8 20%	14 27%	20 43%	25 53%	1 25%	3 20%	7 44%	27 35%	23 46%	3 19%	3 43%	29 38%	43 32%
No Answer	153 65%	7 88%	34 85%	30 75%	37 71%	24 52%	21 45%	3 75%	11 73%	9 56%	49 63%	27 54%	12 75%	4 57%	45 58%	91 67%
SHORTAGE OF FOOD/WATER/FUEL																
Yes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No	84 36%	1 13%	6 15%	12 30%	22 42%	13 28%	28 60%	1 25%	7 47%	9 56%	27 35%	22 44%	4 25%	1 14%	36 47%	45 33%
No Answer	151 64%	7 88%	34 85%	28 70%	30 58%	33 72%	19 40%	3 75%	8 53%	7 44%	51 65%	28 56%	12 75%	6 86%	41 53%	91 67%
Yes	1 0%	—	—	—	—	1 2%	—	—	—	—	—	—	1 6%	—	1 1%	—
No	77 33%	1 13%	6 15%	9 23%	14 27%	20 43%	25 53%	1 25%	4 27%	7 44%	28 36%	23 46%	3 19%	3 43%	30 39%	43 32%
No Answer	157 67%	7 88%	34 85%	31 78%	38 73%	25 54%	22 47%	3 75%	11 73%	9 56%	50 64%	27 54%	12 75%	4 57%	46 60%	93 68%

4E RETIREMENTS

4.30 Competitors were asked to state their primary and secondary reasons for retirement. The answers are shown in table 4.16.

4.31 A total of 171 crews who returned questionnaires retired from the race. Table 4.16 lists a total of 120 primary reasons connected with boat or crew failure which were given, but many crews listed more than one primary reason. When no primary reason is given a retirement may be assumed to be for reasons not associated with damage to yacht or crew. It would be misleading to suggest that a large number of boats retired in disarray. Table 4.17 shows the pattern of retirements of boats which provided detailed reports. The majority of yachts which were not significantly damaged retired because, having regard to the forecast of further gales, they considered it the prudent thing to do; crews who heard of the disasters which had overtaken other yachts lost all interest in the race and felt that the responsible course was to get out of the area in order not to impede the rescue authorities. Yachts without R/T were anxious to make port as soon as possible to report their safety (as requested in an announcement broadcast by the BBC) and allay the anxiety of their families and friends.

4.32 Many yachts decided that discretion was the better part of valour. Although close to or approaching the Fastnet Rock, they considered the conditions were too dangerous to carry on and round the Rock. Many yachts which had safely ridden out the storm found that they had been blown many miles to leeward and a long beat to the Rock held little appeal.

4.33 Some competitors who sought shelter in Irish ports might, under rather different circumstances, have been expected to continue the race when the weather moderated. However the reports of loss of life, which at one time suggested that the final toll was likely to be much higher, made it inappropriate for anyone who had made harbour to set out again towards the Fastnet.

4.34 24 yachts report that they asked for or accepted some degree of assistance in situations which technically did not amount to distress. 17 yachts were towed or escorted into harbour by RNLI lifeboats. Five of these had lost their rudders, one had been dismasted and

TABLE 4.17

STATUS OF BOATS RETIRING
EXCLUDING BOATS ABANDONED

	Undamaged	Undamaged but had been Knocked down B1	B2	Damaged but Unaided	Towed in or escorted by Lifeboat	Received assistance to enter Harbour
Class 0	0	0	0	1	0	
Class 1	2	2	1	7	4	
Class 2	9	5	0	3	3	
Class 3	9	7	5	6	4	
Class 4	13	3	8	7	2	
Class 5	8	8	10	10	4	
Total	41	25	24	34	17	6*

*Not analysed by class.

abandoned and another had been dismasted but was under jury rig. Many of these yachts made their own way to within a few miles of harbour and only sought or accepted assistance to ensure safe entry with a damaged yacht. Several crews reported seeking tows into berths as they were unable to start their engines and to sail into the berth would have involved an unnecessary risk of minor damage. One dismantled yacht reported that she obtained 35 litres of fuel from a French fishing boat before proceeding to Plymouth under her own power. A number of yachts called up fishing vessels, helicopters and coasters in their vicinity to seek confirmation of navigational position.

4.35 Table 4.18 shows that 44 yachts originated a distress call and lists the reasons for doing so. There appears to have been some misunderstanding of this question, which was intended to apply to yachts originating distress calls on their own behalf but at least two competitors who relayed distress calls are known to have given positive answers. 33 skippers consider that they acted correctly in originating distress calls. No criticism of the other 11 skippers is implied as the consequences of delaying a distress call are likely to be much worse than the consequence of making a premature or possibly unnecessary call. Too many unnecessary calls could, of course, overload the available rescue services but neither competitors nor rescuers have reported anything to give reason for concern on this point.

4.36 Questionnaires were returned by a further 20 yachts which were not included in the computer analysis as they had retired before the storm. 10 skippers decided to retire on or shortly after the 1750 shipping forecast on Monday 13 August which forecast winds southerly 4, increasing 6 locally gale 8. Gale 8 however is not a deterrent to the majority of offshore racing yachts. Eight yachts retired early owing to damage or gear failure incurred before the storm. One yacht retired because a diabetic crew member was not well, and one skipper was concerned about a badly seasick crew member who had joined the crew at the last minute.

4.37 The high percentage of retirements should not give any cause for concern. Most of the yachts which retired did so for sound reasons, based on a seamanlike assessment of the situation and prevailing conditions.

4F ABANDONMENTS

4.38 24 yachts were abandoned, of which 23 returned questionnaires. The 24th abandoned yacht is believed to have sought assistance from a helicopter after she had lost her rudder and broken both spinnaker poles which were being used as an emergency rudder. She was in no immediate danger at the time but her skipper decided that it would be wrong to remain on board with gales still forecast, a lee shore some 40 miles away and no means of exercising directional control in the prevailing conditions.

4.39 Of the 24 abandoned yachts only five have not been recovered and one of these five sank under tow. There has been considerable criticism that yachts were abandoned too hastily, the criticism being based on the premise that a damaged yacht is a safer place than a life raft. Considerable weight is given to this argument by the fact that seven lives were lost from three life rafts and in each case the yacht was subsequently recovered. But it was not easy to make this assessment at the time,

TABLE 4.18

Question: Which of the following did you consider applied at the time of originating a distress call?

Question: Do you feel now, with hindsight, that you acted correctly in originating a distress signal in the prevailing conditions?

(Primary reasons are given first, followed by contributory factors.)

	Total	Abandoned	Distress Signal Correct: Yes	Distress Signal Correct: No
BASE	44	22	33	6
CONCERN THAT YACHT IN SINKING CONDITION				
Yes	8 18%	6 27%	8 24%	—
No	17 39%	7 32%	12 36%	4 67%
No answer	19 43%	9 41%	13 39%	2 33%
Yes	4 9%	3 14%	4 12%	—
No	15 34%	7 32%	10 30%	4 67%
No answer	25 57%	12 55%	19 58%	2 33%
DAMAGE TO HULL OR RIG				
Yes	25 57%	17 77%	20 61%	3 50%
No	8 18%	1 5%	7 21%	1 17%
No answer	11 25%	4 18%	6 18%	2 33%
Yes	5 11%	3 14%	3 9%	1 17%
No	8 18%	3 14%	7 21%	1 17%
No answer	31 70%	16 73%	23 70%	4 67%

	Total	Abandoned	Distress Signal Correct: Yes	Distress Signal Correct: No
BASE	44	22	33	6
MAN OVERBOARD/INJURY/FATALITY				
Yes	8 18%	5 23%	8 24%	—
No	14 32%	7 32%	9 27%	4 67%
No answer	22 50%	10 45%	16 48%	2 33%
Yes	6 14%	4 18%	5 15%	1 17%
No	13 30%	8 36%	9 27%	3 50%
No answer	25 57%	10 45%	19 58%	2 33%
LOSS OF CONFIDENCE IN ABILITY OF BOAT TO CONTINUE				
Yes	6 14%	5 23%	3 9%	2 33%
No	12 27%	4 18%	10 30%	2 33%
No answer	26 59%	13 59%	20 61%	2 33%
Yes	12 27%	10 45%	11 33%	
No	8 18%	2 9%	6 18%	2 33%
No answer	24 55%	10 45%	16 48%	4 67%

	Total	Abandoned	Distress Signal Correct: Yes	Distress Signal Correct: No
BASE	44	22	33	6
CONCERN FOR GENERAL SAFETY OF CREW				
Yes	24 55%	13 59%	16 48%	5 83%
No	5 11%	3 14%	5 15%	—
No answer	15 34%	6 27%	12 36%	1 17%
Yes	11 25%	8 36%	9 27%	1 17%
No	3 7%	1 5%	2 6%	1 17%
No answer	30 68%	13 59%	22 67%	4 67%
IN URGENT NEED OF TOW				
Yes	3 7%	—	2 6%	1 17%
No	13 30%	6 27%	10 30%	2 33%
No answer	28 64%	16 73%	21 64%	3 50%
Yes	5 11%	4 18%	4 12%	1 17%
No	15 34%	8 36%	12 36%	2 33%
No answer	24 55%	10 45%	17 52%	3 50%

when the yacht appeared to be in danger of sinking and full confidence was placed in the life raft as a means of survival.

4.40 Table 4.19 shows that with one exception, the abandoned yachts had been knocked down to past horizontal, and all of them had suffered severe damage to their hull, steering or rig. 17 were "calculated" abandonments, in that the crew remained on board the yacht until help in the form of a helicopter, ship or another yacht arrived. In several of these cases the life raft was used to effect transfer to the rescue vehicle but the raft was launched only as a means of transfer. Only six yachts were abandoned before help was at hand. Of these six yachts two have not been recovered and may be considered to have been in sinking condition at the time they were abandoned. Two had suffered knockdowns and major damage to superstructure so that although they were recovered, at the time of abandonment there was excellent reason to believe that they were unlikely to survive a further knockdown. Thus only two yachts were abandoned simply on the grounds that the life raft was likely to provide more security than the virtually undamaged hull of the yacht.

4.41 The 17 skippers who took the conscious decision to abandon to a helicopter, ship or another yacht believed that at the time there was an unacceptably high risk to the crew if they remained on board the yacht. It would be improper to question these decisions without lengthy and detailed investigations of the circumstances which led to them. Such investigations would, it is believed, be pointless; there is certainly no evidence that those who originated distress calls did so for any reason other than that they believed their yachts were in grave and imminent danger, nor that conditions of grave and imminent danger did not in fact exist.

4.42 The methods of rescue by which survivors were taken to safety are described in Section 5. The presence of efficient rescue services clearly added to the total number of yachts abandoned, as many of those who were taken off by ships and helicopters would not have abandoned unless rescue had been at hand. There have been allegations that the rescue services positively encouraged crews to abandon their yachts but no evidence has come to light to support these allegations.

TABLE 4.19

METHODS OF ABANDONMENT AND STATUS OF YACHTS ABANDONED

	Total	Abandoned to Life Raft	Abandoned to other Yacht	Abandoned to Ship/ Helicopter
BASE	23	6	1	16
B2 Knockdown	22	6	1	15
Structural Damage to Hull	6	2	1	3
Lost Steering	6	1	—	5
Dismasted	16	4	—	12

4G FATALITIES

43 The Council of the RYA, the Committee of the RORC and all those concerned with the 1979 Fastnet Race regret most deeply the tragic loss of life that occurred.

44 15 men from yachts participating in the race died. The clinical cause of death, for those whose bodies have been recovered, has been established as drowning, exposure or exposure and drowning. The circumstances in which these deaths occurred were as follows:—

a) **Three were lost after the capsize and disintegration of their life raft.**

The yacht first got into difficulties at about 0100 on 14 August while motoring to stand by another yacht which was already in trouble. She experienced two severe knockdowns, in the course of which she was dismasted and lost her rudder.

After righting from the second knockdown the skipper was found to be over the side but still attached by his safety harness. Two of the crew pulled the skipper back on board, while the remainder set about launching the liferaft. The decision to abandon the yacht appears to have been taken instinctively. During the second knockdown the yacht shipped a considerable amount of water and her crew described her as half full. They felt that, withouhmast or rudder, she was at the mercy of the waves and it was only a matter of time until she was rolled over and sank. In fact the yacht was later recovered and her salvors say that when they found her she had about two feet of water in the cabin.

The abandonment to the liferaft was accomplished successfully. The yacht Morningtown sighted the liferaft and after several unsuccessful attempts succeeded in laying alongside it. Morningtown's crew had great difficulty in holding onto the raft and they were unable to gain access to the canopy opening. While the raft was alongside, Morningtown's steering wires jumped the quadrant and by the time this defect had been repaired she had lost contact with the raft.

Shortly after the brief contact with Morningtown the raft was capsized and the two buoyancy chambers were torn apart. The crew remained in the lower half of the raft but there was only one attachment point, (the remains of the painter or the drogue line) to which one man was able to clip his safety harness. An hour later two of the survivors were washed out of the raft and it was impossible for the others to rescue them.

Three hours later, at about 0630, the lower half of the raft was again capsized and all but one of the survivors found themselves clinging to the lanyards of the upper buoyancy chamber, which had become completely separated from the lower. One man died while still clinging to the lanyards before a helicopter arrived at about 0945. The helicopter lifted off two survivors but the remaining three were heavily entangled and unable to extricate themselves. By this time HNLMS Overijssel had arrived at the scene and she rescued the remaining survivors.

b) **Three were lost while attempting to climb the pilot ladder of a coaster from their capsized liferaft.**

Four men were lost from the crew of this yacht. She was lying a-hull, battened down, when she rolled slowly through 360°. One crewman was trapped under water and badly injured. The yacht was dismasted and below everything was in total chaos. Half an hour later while two men were bailing with buckets down below and three men were in the cockpit, one at the helm and two pumping, the yacht was caught by a massive breaking wave and rolled quickly through 360°. The three men in the cockpit were all washed overboard. Two remained attached by their life lines but the third man was washed away, either his harness or the point of attachment having parted.

The survivors then took to the life raft. The yacht has subsequently been recovered and at the time of recovery there was extensive damage to the bulkhead at the forward end of the cockpit. It would therefore

appear reasonable for the crew to have assumed that if she capsized again she might sink very quickly. Flares were lit and a coaster approached. At that point the raft capsized. As help was at hand no attempt was made to right the raft and the men clung to it while the coaster, rolling heavily, put a pilot ladder over the side. The coaster had to make several passes at the raft before laying alongside it. Two young crew members managed to grasp the ladder and climb up it, but two other men who managed to get hold of the ladder were unable to climb it and fell back into the sea, one of them being pulled back by his harness which was still attached to the life raft. The fifth man lost his hold on the life raft and fell under the stern of the coaster.

c) **One was lost when the liferaft in which he was stowing emergency gear capsized and broke adrift.**

The sequence of events leading to this fatality started when the yacht tried to go to the assistance of another. While trying to manoeuvre through the heavy seas she was capsized and her rudder broke.

During the capsize the yacht shipped a considerable quantity of water and the crew's efforts to remove it were initially unsuccessful. They suspected a leak in the vicinity of the rudder post but it was subsequently discovered that the hull was still tight.

The crew decided that they should prepare to abandon the yacht and launched the liferaft. They secured it alongside on a short painter and one man boarded it to stow emergency gear which was passed to him by the others. While he was doing so the raft was capsized, its painter snapped and both raft and crewman were washed away. Nothing could be done to recover the lost man as the yacht was already disabled.

d) **Two were lost after being trapped in the cockpit of an inverted yacht.**

The exact sequence of events is difficult to ascertain. During the early hours of 14 August the yacht was heavily knocked down several times and then ran off under bare poles with warps streamed. The entire crew remained in the cockpit for most of the night but the skipper went below to send a distress call. While he was doing so he was hit on the head by an item of loose gear, believed to have been a tin of food. He was concussed and thereafter lapsed into unconsciousness from time to time.

The yacht was rolled through 180° and remained upside down for a period of time estimated by various members of the crew to have been between two and five minutes. Two of the crew were thrown clear but remained attached by their harnesses. A third crewman extricated the skipper by cutting his safety harness, but after bringing him to the surface he lost his grasp on him and the skipper was washed out of reach. One of the three crewmen in the water climbed onto the upturned hull and the yacht then righted herself, dismasted.

The three conscious survivors were able to climb back on board. They found that two crew members who had been trapped in the cockpit throughout the capsize were lying motionless in the bottom of the cockpit and assumed they were dead. They launched the life raft and abandoned the yacht. They were unable to do anything about recovering the skipper and they were subsequently rescued by helicopter.

One of the unconscious casualties came to some time later, in the water alongside the hull. (It seems that the yacht may have capsized again while he was unconscious). He was able to climb back on board and with the aid of a winch he pulled his semi-conscious companion into the boat. His companion was still alive and responded to resuscitation but died about three-quarters of an hour later. The one remaining survivor spent some 12 hours bailing the disabled yacht and keeping a lookout for rescue before being lifted off by helicopter.

e) **Six were lost after being washed overboard from yachts.** (see also b above)

(i) A crew member was washed overboard and lost from a yacht which capsized (180°) while close reaching under storm jib. The boat had been behaving well until hit by a large breaking wave. Two men in the cockpit were thrown overboard. One man was attached by two hooks, one to the toe-rail and the other to the jackstay. He considers that he broke the first impact by hanging on by hand as his arm and hand both suffered injury, but the line still took considerable force as was shown by the bruises caused by the belt. The line of the other crew member broke. It is thought that there was a knot in the line.

A buoy with light attached was immediately thrown overboard; the yacht gybed and returned to the light, scanning the sea with searchlights for some twenty minutes before deciding that further search was hopeless and a danger to the rest of the crew.

(ii) The skipper was lost from a yacht which capsized while running under bare poles, streaming warps, and travelling at about 5-6 knots. The skipper was at the helm. The other man who was in the cockpit describes how he himself was thrown into the water as the yacht capsized; he was surrounded by a mass of broken water pulling very strongly away from the yacht and all that held him was his harness. As the yacht righted he found the mainsheet and was effectively scooped up by the yacht and landed in the cockpit. He then found that the skipper had been washed away leaving the clip, safety line and webbing belt of his harness still attached to the yacht.

(iii) Three men were washed overboard from a yacht when she was severely knocked down while reaching under storm jib, travelling at about 7 knots. One man remained attached by his harness and was recovered, but the two others were lost. So far as it has been established the safety line of one harness parted, and in the other case the harness was clipped onto the guardrail, which failed.

(iv) A crew member was washed overboard when the yacht was picked up by a rogue wave and rolled about 140°. At the time the yacht was broad reaching under storm jib, with four warps in use, doing 8-10 knots. The whole harness was left on board and had come undone. As the engine was saturated it took some time to return to the man in the water. At the first attempt they missed him by 10 yards. At the second attempt another crew man tied himself to a long line and jumped into the water to try and pick up the man overboard, but missed him by only a few yards. Several more attempts were made to pick up the man in the water without success, until it became clear that there was no sign of life, and that further manoeuvring was placing the yacht and her crew in danger.

4.45 In every case there were a number of contributory factors which are described elsewhere in this report. The common link between all 15 deaths was the violence of the sea, an unremitting danger faced by all who sail.

Section 5
The Search and Rescue Phase

5A EXTENT OF THE SEARCH AND RESCUE OPERATION

5.1 The first indications of difficulties with the Fastnet Race fleet became apparent during the late evening of Monday 13 August, when a number of yachts reported problems with rudders and steering gear. At this time the fleet was spread over about 140 miles between Lands End and the Fastnet Rock. Rescue operations began when the Baltimore life-boat left her station at 2215 on Monday 13 August in answer to a distress signal from a rudderless yacht. Between midnight and 0200 on the morning of Tuesday 14 August, numerous red flares were reported and Mayday calls intercepted, and four further life-boats were launched to join in the rescue operation.

5.2 After daybreak, the SAR operation consisted of two phases. The first, which took place on Tuesday 14 August, involved the rescue of survivors from 24 abandoned yachts and was largely completed by dusk on that day. The second, which involved accounting for the safety of all competing yachts, ran concurrent with phase one but continued until 1412 on Thursday 16 August when all yachts were accounted for.

5.3 The extent of the Search and Rescue operation is summarised in reports from the Southern Rescue Co-ordination Centre (which is set out overleaf) and The Royal National Lifeboat Institution (Table 5.1)

TABLE 5.1

RNLI SERVICES TO FASTNET RACE YACHTS

Time	*Station*	*Hours at Sea*	*Services Rendered*
13 August			
22.15	Baltimore	10 hours	Towed in rudderless yacht.
14 August			
02.40	Courtmacsherry Harbour	0.7 hours	Search for rudderless yacht.
02.55	Ballycotton	5.1 hours	Escorted rudderless yacht.
03.00	St. Mary's	5.5 hours	Search for rudderless yacht.
03.20	Courtmacsherry	7.7 hours	Search for rudderless yacht.
07.01	St. Ives	3.4 hours	Search for yacht originating Mayday call.
07.06	Sennen Cove	9.4 hours	General search.
08.00	Ballycotton	11.3 hours	Towed in yacht.
08.30	St. Mary's	11 hours	Escorted yacht into harbour.
09.05	Baltimore	11.9 hours	Towed in rudderless yacht.
09.08	Dunmore East	15.9 hours	Towed in yacht with rig damage.
11.00	Courtmacsherry Harbour	13.1 hours	Towed in rudderless yacht.
19.04	Padstow	3.5 hours	Took doctor to yacht and escorted yacht into harbour.
19.30	St. Mary's	1.5 hours	Escorted yacht for night entry into harbour.
21.00	St. Mary's	2.5 hours	Towed in yacht.
22.12	Falmouth	12.7 hours	Towed in rudderless yacht.
22.33	Padstow	14.4 hours	Took over tow of damaged yacht and landed one crew member.
15 August			
00.50	Lizard-Cadgwith	1.1 hours	Transferred and landed two survivors from coaster.
01.00	Dunmore East	0.5 hours	Escorted yacht into harbour.
01.05	Angle	0.9 hours	Escorted yacht into harbour.
01.30	Dunmore East	0.3 hours	Escorted two yachts into harbour.
01.59	Angle	5.3 hours	Escorted yacht into harbour.
01.53	Falmouth	5.3 hours	Took over tow of abandoned yacht.
13.00	Padstow	0.2 hours	Assisted yacht into berth.
19.05	Clovelly	12.9 hours	General search.
16 August			
04.14	Penlee	3.5 hours	Took over tow of abandoned yacht.
	TOTAL	169.6 hours	

In accordance with the traditions of RNLI crewmen, no salvage claims have been made with regard to these yachts.

Extract from report of Southern Rescue Co-ordination Centre (Times GMT preceeded by day of month)

1. At 140216 MRCC Lands End requested Southern Rescue Co-ordination Centre assistance for several yachts in difficulty in area 505ON—081OW. Because of the severe weather and poor visibility in the area it was agreed that the air search would be delayed until first light. Moreover 4 lifeboats and HMS ANGLESEY were already proceeding to the DATUM, and the Dutch Warship OVERIJSSEL, the Race Guardship, was in the general area.

2. The SAR Nimrod at KINLOSS (Rescue 01) was brought to advanced readiness at 140334, briefed at 140353 and was airborne at 140418. CULDROSE were informed of the situation at 140345 and a Wessex was airborne at 140435. At 140445 a Sea King was launched followed shortly afterwards by 2 Wessex. Rescue 01 arrived at the scene at 140530, established communication with Southern Rescue Co-ordination Centre, assumed Scene of Search Commander, and co-operated with surface shipping, yachts and helicopters in locating yachts in distress and bodies in the water. Weather in the area at this time was reported as Wind Velocity 250/60, sea state 8, Visibility 3 Nautical Miles, Cloud Base 1200 ft, wave height 50-60 feet.

3. As events unfolded it was realised that a potential major disaster was probable, and at 140715 CULDROSE was asked to provide as many helicopters as possible. YEOVILTON was contacted and asked to support CULDROSE, SAR Wing Finningley had no assets available and it was decided not to denude Coltishall of its Sea Kings at this stage, in case similar problems occurred elsewhere around the coast. St. MAWGAN and KINLOSS were asked to prepare aircraft with SAR fit and to be prepared for a protracted operation. ODIHAM was asked to keep a Wessex on stand by as a back up for SAR Helo Forces.

4. At 140851 RMAS ROLLICKER was diverted to the scene and at 140915 HMS BROADSWORD was ordered to sail from the Sound. At 141616 RMAS ROBUST was sailed. BROADSWORD assumed Scene of Search Commander at 141730. At 151735 CINCFLEET detached SCYLLA to the scene to replace OVERIJSSEL and ordered RFA OLNA to sail at 151730 from Portsmouth.

5. Consecutive Nimrod sorties, with occasionally 2 aircraft on task simultaneously were flown until 161500. Helicopter operations were flown continuously on 14/15 Aug from first to last light and sometimes into the dark hours, and for most of the 16 Aug. At night 2 Sea Kings were held at 15 minutes. Search areas were continually adjusted to take account of winds and tides. It is estimated that 20,000 square miles of ocean were searched. Communications amongst all search agencies were generally good throughout the operation. The major problems hampering the search forces were poor weather, the large number of yachts involved and the inability of yachts to communicate with the search units.

6. Of the 303 yachts that started the '79 Fastnet race, 24 were abandoned, and the majority of these subsequently recovered. 139 survivors were rescued by SAR services and 15 yachtsmen lost their lives. Full details of the SAR proceedings are at Annexes C, D and E. (Reproduced as Annex 5A to this report)

5.4 The majority of emergency rescues were carried out at distances of 60-80 miles from land, where the speed of helicopters working in daylight in co-operation with Nimrod aircraft made them the most effective rescue vehicles. The life-boats worked closer inshore, towing and escorting damaged boats which had retired from the race into harbour, by day and night.

5.5 Comments after the race suggest that the role of the guardship for an offshore race is generally misunderstood. In the past the Royal Navy has provided a guardship for the Fastnet and other RORC races, as operational commitments have allowed. No British warship was available for the 1979 Fastnet and in view of the international nature of the race the RORC requested a guardship from the Netherlands Navy who provided the destroyer Overijssel. The role of the guardship for an offshore race has never been clearly defined. It is certainly not intended to provide safety cover in the way that a rescue boat provides cover for a racing dinghy fleet. The availability of HNLMS Overijssel in the Fastnet area was, therefore, to some extent fortuitous. She played a very full part in the SAR operation both as a communications relay and in the actual rescue of survivors. However the presence of a warship acting as guardship, although very valuable, can not be guaranteed as ships are likely to be made available for this duty only when other operational commitments allow.

5.6 The yacht Morningtown was also at sea in the race area acting as a communications relay, her owner having generously volunteered to undertake this task. Again she was not primarily a rescue vessel, although she also played a full and valuable part in the SAR operation.

5B CO-ORDINATION OF SEARCH AND RESCUE

5.7 HM Coastguard have statutory responsibility for the co-ordination of search and rescue in the United Kingdom. The ability of HM Coastguard to co-ordinate SAR depends to a large extent upon the co-operation of the race organisers and individual participants.

5.8 The procedure adopted by the RORC to confirm that yachts had started in the race has been described in section 1. When the storm hit the fleet on the night of 13-14 August the organisers did not have a 100% up-to-date accurate list of competitors, as opposed to entrants, and neither HM Coastguard SW District, nor Maritime Rescue Sub Centre (MRSC) Land's End, who were rapidly becoming involved, had a list of entrants. The initial phase of the SAR operation involved a search for yachts and crews actually in distress so a list would have been of little value. The rescue authorities were alerted by Mayday calls, radio reports of flare sightings and reports from HNLMS Overijssel and Morningtown of yachts in difficulties.

5.9 Rescue operations on 14 August were certainly complicated by the number of yachts in the search area and the difficulty experienced by aircrew in differentiating between yachts in distress and yachts hove to, running off before the storm and lying a-hull in relative safety. There were a number of survivors in liferafts and also empty liferafts which had broken adrift from their stowages and inflated.

5.10 During 14 August about half the fleet was accounted for: some 150 yachts had been positively identified as having retired to harbours of refuge; been abandoned and all crew rescued or confirmed dead; or still at sea and known to be in no difficulty. Having spent the day rescuing over 100 survivors the rescue authorities believed that the search should continue until all yachts had been confirmed safe or their crews rescued.

5.11 A number of yachts which communicated by radio with searching aircraft, or which were overflown by low flying search aircraft, assumed that they would be reported as safe. On return to harbour, however, they found that this had not always been done (no doubt because of pressure on the SAR organisations) and that they were listed as unaccounted for.

5.12 The search operation carried out on 15 and the morning of 16 August involved a larger number of ships and aircraft than the search and rescue operation on 14 August. It did not result in the saving of further lives but this can not be taken as a reason why it should not have been carried out. After a fleet of yachts has been subjected to storm conditions, with the abandonment of over 20 yachts and the known loss of 15 lives, any responsible SAR authority must feel a duty to continue to search for possible casualties until all yachts known to have been in the area of the storm have been accounted for.

5.23 The multihull "Bucks Fizz" capsized with the loss of her crew of four whilst following the race. She was the lone starter from Yarmouth, Isle of Wight, in an event organised by the Multihull Offshore Cruising and Racing Association (MOCRA). The RORC had agreed, in advance, to take the time of any multihull arriving at Plymouth, and MOCRA held responsibility for entries, rules and regulations and race results. Contacts were established between MOCRA and the RORC in Plymouth and as information came in relatives of the trimaran's crew were informed by MOCRA who held the crew list. MOCRA is holding its own inquiry into this accident.

5C USE OF RADIO

5.24 32 boats were equipped with HF or MF R/T and a further 10 with "Emergency Only" MF R/T. MF and HF radio is not widely fitted in cruising or offshore racing yachts in Northern Europe. The rigorous standards set for type approval of sets result in the cheapest MF R/T costing over £2,000 to install. In the USA and Australia M/F equipment can be installed at a cost of about £500 because the standards for type approval are much less rigorous.

5.25 The authority responsible for type approval standards in the UK is the Home Office and unofficial consultations after the Fastnet Race indicate that there is some hope of standards being relaxed for MF R/T fitted in yachts in which there is no statutory requirement for two-way radio to be carried.

5.26 A much larger number of competitors carried VHF R/T and table 5.2 shows that it was fitted in the majority of the large boats but in only a quarter of the smaller. This table shows the proportion of boats in which the radio remained serviceable. Table 5.3 shows the cause of radio failure and includes both MF and VHF. Table 5.4 shows the ranges at which communication was achieved with both MF and VHF.

5.27 During the race HNLMS Overijssel and the yacht Morningtown were acting as radio relay ships for position reports from the Admiral's Cup Fleet. As the storm developed both these vessels ceased operating with the Admiral's Cup yachts as they were fully occupied relaying distress traffic.

5.28 In spite of the fact that 65% of the competing yachts were fitted with VHF radio, communications during the SAR phase of the event were less effective than they might have been. With the exception of the Admiral's Cup yachts there was no overall radio organisation, with no special frequencies allocated for position reporting and no set listening or reporting schedules. Thus VHF Channel 16, the international distress and calling channel, became heavily overloaded. This is not to imply that the radio procedure or discipline were universally bad, in most yachts they were quite good, but the sheer number of boats trying to communicate with SAR ships and aircraft, with each other and with Coast Radio Stations, imposed a very heavy load on the system.

5.29 There were instances of lack of radio discipline and bad procedure which added unnecessarily to the overloading of the available communication channels.

TABLE 5.2

Question: Do you carry VHF R/T? *Question:* Did it remain operational?

		Fastnet Class						*Battery 0-25% remaining*	
	Total	*0*	*I*	*II*	*III*	*IV*	*V*	*Storm*	*Harbour*
BASE	235	8	40	40	52	46	47	21	29
DO YOU CARRY VHF R/T?									
Yes	153 65%	7 88%	36 90%	34 85%	38 73%	24 52%	13 28%	13 62%	18 62%
No	55 23%	—	1 3%	3 8%	8 15%	16 35%	26 55%	5 24%	8 28%
No answer	27 11%	1 13%	3 8%	3 8%	6 12%	6 13%	8 17%	3 14%	3 10%
DID THE VHF R/T REMAIN OPERATIONAL									
Yes	115 49%	7 88%	30 75%	29 73%	25 48%	17 37%	6 13%	6 29%	11 38%
No	36 15%	—	8 20%	4 10%	11 21%	7 15%	6 13%	6 29%	7 24%
No answer	84 36%	1 13%	2 5%	7 18%	16 31%	22 48%	35 74%	9 43%	11 38%

TABLE 5.3

Question: If you had a radio failure, do you know why? (comment)

		Fastnet Class						*Battery 0-25%*	
	Total	*0*	*I*	*II*	*III*	*IV*	*V*	*Storm*	*Harbour*
BASE	45	—	9	6	12	10	8	8	9
No Battery Power	10 22%	—	1 11%	2 33%	3 25%	2 20%	2 25%	5 63%	4 44%
Radio Receiver Swamped	4 9%	—	1 11%	1 17%	1 8%	—	1 13%	—	1 11%
Aerial Failure/Destroyed	9 20%	—	—	—	4 33%	3 30%	2 25%	1 13%	1 11%
Reason not Known	9 20%	—	2 22%	2 33%	2 17%	3 30%	—	1 13%	—
No answer	14 31%	—	5 56%	1 17%	2 17%	3 30%	3 38%	1 13%	3 33%

TABLE 5.4

Question: At what range were you able to communicate:
(a) by MF? (b) by VHF?

	Total	*MF/HF Oper.*	*VHF Oper.*
BASE	235	36	115
MF			
Less than 30 miles	3 1%	1 3%	2 2%
30-50 miles	7 3%	3 8%	4 3%
More than 50 miles	9 4%	5 14%	5 4%
Not Used	5 2%	3 8%	1 1%
No Answer	211 90%	24 67%	103 90%
VHF			
Less than 15 miles	23 10%	4 11%	17 15%
15-19 miles	6 3%	1 3%	3 3%
20-24 miles	16 7%	2 6%	12 10%
25-30 miles	25 11%	6 17%	22 19%
More than 30 miles	27 11%	5 14%	18 16%
Not Known	9 4%	2 6%	8 7%
No Answer	129 55%	16 44%	35 30%

One yacht which called continually on channel 16 VHF to an Irish Coast Radio Station for a long period was a particularly blatant example of overloading caused by ignorance. That particular Coast Radio Station is MF only and does not have VHF facilities and the regulations clearly state that if a station does not reply, the call should not be repeated, initially for 10 minutes and thereafter for 30 minutes.

5.30 The SAR authorities and the Coast Radio Station at Lands End did not know until some time after the start of the SAR operation the names of the competing yachts and whether or not each was fitted with radio. Thus it was some time before any effective action was taken to co-ordinate the record of boats which were safe and this is believed to have contributed significantly to the length of the second phase of the SAR operation.

5.31 Table 5.5 shows how the 44 distress calls made during the race were originated and gives an indication of whether or not they were answered promptly. A number of boats made radio Mayday calls at the same time as using flares but there is no strong indication of radio having been more effective than flares to call for help.

5D USE OF RADIO IN FUTURE RACES

5.32 As the SAR authorities have laid great emphasis on the importance they attach to the use of radio the Inquiry has considered how radio might be used more effectively in future races. It is believed that an organisation could be devised which would minimise the requirement for a prolonged search in the aftermath of a storm, although it is doubtful if compulsory radio in all yachts and a comprehensive radio organisation would actually have resulted in saving more lives in the 1979 Fastnet Race.

5.33 On the basis that 65% of the Fastnet Race fleet carried VHF radio, it might be assumed that 2 way radio is becoming an accepted item of offshore racing equipment.

5.34 There is one serious drawback to mandatory position reporting schedules. The radio failure rate during the Fastnet Race was 15% for VHF fitted yachts, as opposed to an abandonment percentage of 8%. In any weather the radio failure rate is likely to exceed the number of yachts in distress by a similar amount. A radio failure, or even an alarm clock or memory failure, causes a yacht to miss a reporting schedule and there is a danger of over-reaction. The present system of assuming that all is well unless there is an indication of trouble has much to recommend it over a system in which a yacht is assumed to be in trouble if she is not positively known to be safe.

5.35 If radio is to be made compulsory it must also be made as reliable as possible and the equipment required should include an emergency aerial which can be rigged if a yacht is dismasted or loses her masthead aerial and a reserve power supply for use if the main batteries become unserviceable.

5.36 The three factors which prolonged the search after the Fastnet storm were the number of competitors, the distance of many yachts from land and the initial absence of a contingency plan for keeping tally of yachts reported safe. The case for compulsory radio is therefore strongest for races in which there is a particularly large number of entries, and in which the course takes competitors a long distance offshore (but the limited range of VHF has to be considered).

5.37 The current regulations which discourage the use of MF radio in yachts in Northern Europe make it necessary to consider VHF as more realistic than MF. For the Fastnet type of incident the range advantage of MF would be highly desirable and it is therefore essential that the possibility of a relaxation of MF type approval standards for voluntarily fitted yachts should be explored with vigour before introducing a regulation for compulsory VHF.

5.38 A communications plan for a race in which radio was compulsory would have to be drawn up by the organising club and made known to HM Coastguard, the rescue authorities and the Post Office. It is

TABLE 5.5

Question: Did you originate a distress signal, by any means?
Question: What was the time interval before your distress signal was acknowledged?
Question: What means of making distress signal was used:
MF radio?
VHF radio?
Pyrotechnics?

	Total	*Time Interval*		*Never*
		Less than 5 min	*More than 5 min*	
BASE	44	9	8	6
MF RADIO				
Yes	5 11%	—	1 13%	—
No	21 48%	4 44%	5 63%	4 67%
No Answer	18 41%	5 56%	2 25%	2 33%
VHF RADIO				
Yes	16 36%	4 44%	2 25%	3 50%
No	17 39%	4 44%	4 50%	2 33%
No Answer	11 25%	1 11%	2 25%	1 17%
PYROTECHNICS				
Yes	31 70%	7 78%	8 100%	5 83%
No	3 7%	1 11%	—	—
No Answer	10 23%	1 11%	—	1 17%

suggested that the communications plan should take account of the following factors:—

1. The availability of competing yachts or escort vessels fitted with VHF and MF or HF to act as radio relays.
2. The availability of frequencies and the compatability of foreign and service equipment with the frequencies.
3. The need to guarantee compliance with radio schedules.
4. The use of radio in the early stages of any race to check on starters and early retirements.
5. Communication between the organising club, HM Coastguard and Coast Radio Stations.
6. Possible future relaxations of type approval for MF radio voluntarily fitted in yachts.
7. Alternative communication plans for normal and emergency use.

5E EMERGENCY POSITION INDICATING RADIO BEACONS

5.39 It has been suggested that the SAR operation would have been simplified, with a possible saving of more lives, if all yachts had carried Emergency Position Indicating Radio Beacons (EPIRB).

5.40 All EPIRB currently available operate on one or more of three distress frequencies, 243MHz, military aircraft distress, 121.5MHz, civil aircraft distress, and 2182kHz, international maritime MF distress. Each of these frequencies has limitations.

5.41 243MHz is monitored by some military aircraft and by military airfields when flying is in progress. It is a VHF frequency (although it is sometimes referred to as UHF) and the range is therefore limited to line of sight. 121.5MHz is monitored by civil aircraft when they have radio capacity available. In controlled airspace, in which all aircraft fly around Northern Europe, the frequency is seldom monitored because aircraft do not have sufficient radio capacity. Because of the relatively short flight times of aircraft the rescue services are alerted very quickly by the non-arrival of a plane and a search can always be instituted within at the very most a few hours and more usually a few minutes after an aircraft has crashed. Under these circumstances an EPIRB is an invaluable aid to the location of survivors. It is, however, much less effective as a means of raising the alarm, because of its short range and the lack of frequency monitoring stations in coastal waters.

5.42 2182kHz is monitored by HM Coastguard and certain fishing vessels at sea are also required to monitor the frequency. Direction finding facilities are limited and the general use of the frequency by shipping internationally makes direction finding difficult. It is the present policy of the Home Office to discourage the voluntary carriage of EPIRB in yachts in coastal waters because of the doubtful efficiency of the beacons and the degrading of the system by inadvertent operation which would, it is believed, inevitably result from increased numbers of beacons.

5.43 It would no doubt be possible to set up a special EPIRB frequency monitoring service for races such as the Fastnet. On the other hand offshore racing yachts should not expect a higher degree of safety cover than other yachts or vessels. The basis of the sport is that the risks are exactly the same as in all other forms of sea-going and to provide special rescue services which would not be available unless racing would be totally contrary to the spirit and intent of the RORC and other clubs and associations which organise races offshore.

5F METHODS OF RESCUE

5.44 Most of the crews who abandoned their yachts were lifted off by helicopter. Crews in dismasted yachts and life rafts were lifted direct and those in yachts whose masts were still intact either launched life rafts or jumped into the sea before being lifted.

5.45 Helicopter aircrew were working under extremely hazardous conditions and it is a great credit to them that they provided such effective rescue service. Aircrew report that in general survivors co-operated well. The rescue task would have been simplified if all yachts had been fitted with radio telephones. There were a few cases in which crews did not understand the limitations to helicopters imposed by standing rigging and some crews were understandably reluctant to jump into the sea. In one case a crew took the decision to abandon, but as it took 30 minutes for the first crewman to be lifted out of the sea the decision was reversed, the remainder of the crew deciding that it would be safer to remain in the yacht. This was the only instance of a pick-up taking any length of time, and in other cases the whole crew was lifted in 20-30 minutes.

5.46 Survivors from three yachts were rescued by HNLMS Overijssel. In two cases this involved survivors in life rafts, in the other the rescue was carried out direct from the yacht. HNLMS Overijssel was handled with skill and determination under hazardous conditions and members of her ship's company accepted considerable personal risk in recovering these survivors. The use of men working in scrambling nets was crucial in recovering the exhausted survivors from the remains of one of the rafts.

5.47 HMS Anglesey rescued one crew, who transferred by life raft from their severely damaged yacht. Two crews were taken off by fishing vessels, and one by an oil rig supply vessel. In each case the rescuing vessel handled the operation skilfully and effected the transfer successfully.

5.48 Two survivors from one crew were successfully rescued from their upturned life raft by the coaster. Nanna. Three other members of this crew were lost during the rescue as they did not have the strength to climb the pilot ladder which was lowered to them.

5.49 Two crews who had taken to their life rafts were rescued by the yachts Lorelei, (SHE36) and Moonston (OOD34). In each case the rescuing yacht used her engine to manoeuvre alongside the raft and effected the recovery without loss of life. One damaged yacht was taken in tow by the yacht Dasher (Nicholson 55) but the damaged yacht capsized and her crew took to their life raft to transfer successfully to Dasher. Dasher carried out the tow and rescue under bare poles.

5.50 Several yachts which were riding out the storm attempted to go to the assistance of other yachts in difficulties. In a number of cases this resulted in the rescuing yacht herself getting into difficulties as soon as she attempted to manoeuvre in the heavy seas.

5.51 It has been suggested that those who finished the race acted thoughtlessly in continuing rather than going to the assistance of yachts in distress. The large yacht which completed the course were already rounding the Scillies on the morning of 14 August and if they had returned to the Fastnet area, or if the smaller yachts had lingered to search for survivors, it would have increased the number of yachts at risk and further complicated the SAR operation. It would have been foolhardy for yachts to attempt to join the search and there is no evidence that any competitor failed to answer a distress call.

Recommendations

RACE ORGANISATION

00.1 Unless ocean racing is to cease entirely (and we do not regard this as a serious proposition) the first question that should logically arise is whether the organisers of any ocean race should, either by postponing the start or by ordering abandonment before the finish, seek to eliminate the effects of extreme weather conditions. The weather experienced by the Fastnet fleet was unusually severe, but it was not entirely unprecedented. Winds reached over force 10 with very heavy seas, but conditions of this severity are not unknown in long-distance sailing and even in the British Isles yachts sailing offshore must expect, if only very occasionally, to encounter such conditions. At present shipping forecasts are not issued by the Meteorological Office for broadcast by the BBC for periods in excess of 24 hours. Even this period has been shown to be beyond the range of accurate prognosis. In the present case the warning given of the approach of a force 8 gale was 9 hours, about the length of warning that might normally be expected. The increase to force 9 was forecast about 6 hours before the worst of the wind and to force 10 only about 1 hour beforehand, though the warning given to the competitors was in fact much less than these periods. Even if the organisers had been throughout in direct touch with the Meteorological Office they could have taken no action either by postponing the start or by ordering abandonment of the race which could have affected the position in the 1979 Fastnet. We do not think that organisers of offshore races should be expected to take decisions of this kind except, perhaps, as the RORC does at present, where predictable conditions of weather and tide at, or shortly after, the start indicate an exceptional degree of risk. The arrival of force 8 gales with little warning is a feature of our weather which all who sail must expect to encounter from time to time, and no ocean racing skipper would regard such a wind as involving conditions which would ordinarily dictate the abandonment of the race. A timely forecast of winds in excess of this might well influence a skipper to consider taking shelter if conditions were appropriate, or, if proper seamanship dictated, remaining at sea with suitable precautions against heavy weather; but he would be in a much better position than would be the race organisers to make a proper assessment of the position. We do not think therefore that organisers should be expected to order abandonment of the race after the start: we find the reasoning behind current RORC practice, of offering race starts in all conditions of actual or forecast weather, while making it clear that the decision to start or continue a race rests with the owner, convincing; and even if means of communication with all competitors were available, we would not recommend any policy which would place on the race organisers a duty which is traditionally and properly assigned to the master of every sea-going ship.

00.2 If we assume that future ocean races may take place in which extreme weather conditions may be experienced, we should then logically consider how the effect of these conditions could be minimised. We think that such possibilities could be examined under four broad headings:-

(a) the design and construction of competing yachts and of their equipment;
(b) the level of experience of competitors, including the procedures adopted at the approach of and during bad weather;
(c) weather information available and the means of communicating it to skippers to enable them to take appropriate decisions;
(d) co-operation, including means of communication between skippers, race organisers, and search and rescue authorities.

YACHT DESIGN

00.3 Before examining this question, and this applies in varying degrees to other questions as well, it would be well to recall that the conditions experienced at the height of the storm, whilst no doubt precedented, must be regarded as an exceptional experience for most yachtsmen other than those engaged in very long distance sailing and in other waters than those in the South of the British Isles. There is abundant evidence, for instance, that it was the severity of those conditions rather than failure in yacht design which was regarded by participants in the race as the prime factor in knockdowns—themselves one of the major causes of abandonments. Nevertheless there appears to be a disturbing correlation between certain design characteristics and lack of stability, as exhibited by severe knockdowns. The special analysis referred to in paragraph 3.14 has produced further illumination of this problem. We do not believe that we should make any specific recommendation in this area, as the subject is highly technical. We do recommend, however, that the findings

of this section of the report, together with the results of the special analysis, should be placed before the ORC with a view to their considering whether further changes in the measurement rules might not be required. The RORC should also consider whether the Special Regulations should not be amended to permit the elimination of yachts whose design parameters may indicate a lack of stability. We can find insufficient evidence to lead us to recommend any alteration in the size limits for entrants.

YACHT CONSTRUCTION

00.4 With the exception of damage to steering gear, the damage sustained by the 1979 Fastnet Race fleet was consistent with what might be expected in the prevailing weather conditions. The following conclusions and recommendations refer to specific weaknesses detected:-

a) **Steering Gear.** The damage sustained to steering gear gives grounds for concern. Much of it was attributed to the weakness of carbon fibre rudders and the designers who specified the use of this material for rudder construction are aware of the seriousness of the problem and are taking steps to analyse the cause. In general it must be fully understood that no system of emergency steering as required in Special Regulation 10.3 can be relied on to give more than the minimum directional control necessary to enable a yacht to return to harbour, but it is nevertheless important to have such a system and to make sure that it works.

b) **Watertight Integrity.** The most serious defect affecting watertight integrity was the design and construction of main companionways. It is recommended that the Special Regulation relating to the blocking arrangements for main companionways should be extended to introduce specific requirements for the blocking arrangements to be totally secure but openable from above and below decks. It is understood that the ORC has already made some changes in this area. It is also recommended that the Special Regulation relating to bilge pumping should require bilge pumps to discharge overboard and not into a cockpit, unless the cockpit is open ended.

c) **Comfort and Security of Accommodation.** It is evident that the stowage arrangements in some boats are designed to be effective only up to 90° angle of heel. It is recommended that the Memorandum on Safety should draw attention to the need for the securing arrangements for heavy items of equipment and all stowages to be effective in the event of a total inversion.

d) **Deck Arrangements.** The present cockpit drainage arrangements in some boats are inadequate. It is desirable that the present Special Regulation on this subject which refers to minimum diameter of drains should be replaced by a requirement for cockpits to drain within a minimum time. It is realised that the implementation of this regulation could prove difficult in some existing yachts. It is also recommended that the Special Regulation relating to anchors should be extended to include a requirement for a strong securing point on the foredeck and a bow fairlead for anchor cable and towing warp. It is recommended that the RORC should introduce a Special Regulation requiring adequate toe-rails to be fitted, especially forward of the mast.

SAILS AND EQUIPMENT

00.5 a) **Storm Sails.** The Special Regulation relating to storm sails does not fully cover the requirement but it is doubtful if any regulation could be effective for all types of yacht. It is understood that the ORC's new regulation which includes the provision of a trisail has emphasized the owner's responsibility for ensuring that storm sails, adequate for the size and type of yacht, are on board, and in consequence it is unnecessary to make any further recommendations. Attention is drawn to the advisability of carrying a hacksaw with several spare blades, for severing standing rigging from the hull in the event of a dismasting.

b) **Safety Harnesses.** In spite of an adequate Special Regulation and a paragraph in the Memorandum on Safety, six lives are believed to have been lost through the failure of safety harnesses or their attachment points. It is recommended that the RYA and the RORC should draw attention to the importance of the following points;-

1. The need for harnesses which comply with BS4224, which are regularly surveyed and maintained and for which strong attachment points are available.
2. The need for double harness life lines in severe weather conditions.

3. The danger of clipping onto guardrails, as in heavy weather these do not necessarily constitute strong attachment points.
4. The need for an adequate deck line or lines led from the cockpit to a point forward of the mast for use as a harness attachment point, and the advantages of having permanent life lines in suitable places which can be clipped to harnesses.

In addition we would like to emphasise the practical advantages of a harness which is manufactured as a combination harness and life jacket (See our recommendation 00.5d below).

c) **Life Rafts.** There is evidence of shortcoming in the design, structural standards of, and weather protection afforded by the life rafts which were used. It is recommended that the RYA should approach the Department of Trade and request the Department, to draw up in consultation with the RYA, RORC and life raft manufacturers, a specification for yacht life rafts, and to accept responsibility for over-seeing the construction of rafts built to this standard.

d) **Life Jackets.** No reports have been received which give major cause for concern about life jackets. There was however evidence to suggest the desirability of requiring life jackets to be fitted with collar retaining straps and of requiring jackets with both oral and manual or automatic inflation to be fitted with pressure relief valves. It is recommended that the British Standards Institution be invited to consider these two points. Although there is no conclusive evidence that failure to wear life jackets caused loss of life in the race, the large number of competitors potentially at risk through failing to do so is disturbing. A combined harness and life jacket is in fact available on the market but it is clearly not widely used. We think that the advantages of such an article are considerable. We therefore recommend that the RYA should initiate discussions with manufacturers of harnesses and life jackets with a view to the wider production of combined harnesses/life jackets. At an appropriate stage it might be necessary to involve the Department of Trade and the British Standards Institution in these discussions.

e) **Electrics/Engines.** Several damaged yachts retired safely under power. There is also some evidence that the use of engines improved the maneouvreability of yachts in picking up survivors and in some cases assisted in maintaining steerage way in storm conditions. In addition the use of engines for maintaining battery power was shown to be of importance. The RORC should consider whether engines should not be mandatory for safety reasons and whether alternative methods of starting engines should be required when the starting battery is flat.

EXPERIENCE AND PROCEDURES ADOPTED

00.6 a) **Skipper and crew experience.** There is no evidence that the level of experience of the skippers and crews taking part in the 1979 Race had any significant bearing on the total of knockdowns, instances of severe damage, abandonment or loss of life. Under Special Regulation 2.1 it is rightly the responsibility of the owner to ensure that the yacht is manned by an experienced crew who are physically fit to face bad weather. There appears to be, purely on this evidence, no warrant for the imposition of any experience requirement for skippers, or crew, for entry in the Fastnet Race. Nevertheless we think that the RORC would be wise to consider whether some qualification for entry in the longer ocean races is not now required.

b) **Tactics during the storm.** Insufficient evidence has emerged to indicate the best tactics to guarantee survival in very severe conditions where there is a lack of conformity between wind and sea directions. There is however a general inference that active rather than passive tactics were successful and those who were able to maintain some speed and directional control fared better.

c) **Navigation.** There is insufficient evidence to support any recommendation relating to the RORC general condition prohibiting the use of sophisticated navigational aids. A small percentage of the yachts racing did not carry sufficient large scale charts of harbours of refuge and it is recommended that the Special Regulation on charts should be expanded to ensure that all competitors carry an adequate chart outfit.

d) **Retirements.** The high percentage of retirements should not give cause for concern. Most of the yachts which retired did so for sound reasons, based on a seamanlike assessment of the situation and prevailing conditions.

e) **Abandonments.** At least two yachts were abandoned prematurely. This conclusion has been drawn after three months research and it must be

remembered that the crews involved believed that their lives were at risk if they did not take the decision to abandon within a very few minutes. The old adage "Stay with your boat" appears to be relevant.

INFORMATION AVAILABLE TO COMPETITORS

00.7 The most important information which becomes available to ocean racing competitors during the race is the forecast of the weather. A forecast of heavy weather may influence a racing skipper not only as to his tactics; it may dictate future action from a decision about probable sail changes to whether to seek shelter, to abandon the race, or to be prepared to adopt survival procedures. In the 1979 Fastnet a warning of a force 9 severe gale in the Fastnet area was released by the Meteorological Office at 1805 on 13 August, only 10 minutes after the previous shipping forecast had finished. This did not appear in the shipping forecast until 00.15 on 14 August. The broadcasting of gale warnings by the BBC at times other than the shipping forecasts has been shown to be of limited value to yachtsmen: a permanent radio watch on appropriate channels in case a gale warning might be broadcast is out of the question on even the best manned ocean racing yacht. Shipping forecasts occur at roughly six hourly intervals and it is clear that, in the unpredictable state of much of our weather, an accurate prognosis even for 6 hours ahead can not reasonably be expected on every occasion from the expert forecasters. At the critical time those yachts in the area worst affected could have received earlier warnings if they had sought alternative sources of radio weather information. Perhaps the only recommendation we can make is that the RYA should take appropriate steps to emphasize to the Meteorological Office the importance of the shipping forecasts and of producing in time for those forecasts the most up-to-date information; gale warnings disseminated during the period of broadcast entertainment are unlikely to be received by yachtsmen. We should also emphasize the importance of seeking every available source of radio weather information in worsening conditions.

SEARCH AND RESCUE

00.8 The organisation set up by the RORC with the assistance of the Royal Western Yacht Club of England became over-stretched due to the unprecedented and unforeseeable scale of the Search and Rescue operation required. In the circumstances it reacted with extraordinary and commendable promptitude to the strains put upon it. It is recommended that in future for races of this length and with a very large number of entrants a contingency organisation, using modern data processing and transmitting equipment, should, when possible, be set up and exercised in collaboration with search and rescue co-ordinators. The Search and Rescue organisations worked in a fashion which can only excite the admiration of all who can understand the difficulties of the task which they were called upon to fulfil. It is clear from the evidence that if there were shortcomings in the race organisation, these did not add to any difficulties the Search and Rescue organisations may have faced during the rescue operations. The main lessons to be learnt are concerned with two facets of these operations, firstly the identification of yachts whose crews required assistance, and secondly the extent of the search undertaken to ensure that all yachts were accounted for.

IDENTIFICATION OF YACHTS REQUIRING ASSISTANCE

00.9 A yacht in distress, whether racing or not, should be in no different position from any other vessel. The use of flares and of Mayday radio calls by vessels in distress are part of the universal practice of seamen. The large number of yachts which potentially might have been considered as in danger added to the difficulty of identifying those which were in fact in need of assistance. Difficulties with igniting flares were reported; the rescue authorities suggest that yachtsmen in some cases appeared to be unaware of the official search procedures; the display of identifying numbers seems to have been haphazard: and there is in any event disagreement between sea and air rescue authorities as to the best method of displaying means of identification. We feel that we are unable to make any specific recommendations here, other than that the subject requires further intensive study. We recommend therefore that the RYA should take the initiative in providing a forum for discussion of this subject between that Association, the RORC, HM Coastguard, RNLI, and the other Search and Rescue authorities with a view to producing comprehensive guide-lines for procedures and equipment for yachts in distress.

ACCOUNTING FOR AN OCEAN RACING FLEET

00.10 The evidence discloses that the inability of the race organisers to provide the Search and Rescue authorities with precise lists of the fleets engaged in the race, coupled with the lack of information about the identity of yachts which were already safely in harbours of refuge, prolonged the search which was designed to ensure that the authorities could account for every yacht in the race. Again we feel there is difficulty in making specific recommendations. We do recommend, however, that the RORC should take steps, possibly by introducing a gate at the start, to ensure that an accurate record of the starters in an ocean race can be made. We also recognise that the proximity of a large spectator fleet poses problems over which the Race Organisers have no control. It is probable that only a harbour authority can deal with this problem, and we recommend therefore that, whenever the popularity of any offshore race as a spectacle is likely to make the task of recording starters difficult, the race organisers, in conjunction if necessary with the RYA, should approach the appropriate harbour authority with a view to securing an acceptable measure of spectator control. We also feel that there is much to be said for a requirement that all yachts in the longer ocean races should be equipped with two-way radio and that an appropriate radio organisation should be set up by the RORC in consultation with the statutory authorities; however, due to the many technical problems involved, we feel unable to make any recommendation other than that this should be given more detailed study by the RORC.

CONCLUSIONS

00.11 We have only attempted recommendations where we think the evidence justifies this; but a great many other lessons were learnt by competitors and race organisers in the 1979 Fastnet Race. These are detailed in the body of the report and are commended to all those who sail offshore or who organise races. For most of the competitors the sea conditions they encountered were outside their previous experience, so that errors were inevitable. We have not attempted to enumerate these errors because the general standards of seamanship, navigation and certainly of courage, were commendably high. It does not appear to us that the size of the fleet in itself contributed to the scale of the disaster, though it is clear that the sheer numbers made the search and rescue operation more extended. There must, however, come a point at which the size of an ocean racing fleet will present unacceptable problems to the organisers and perhaps to other authorities which may be affected or involved. We invite the RORC to give this question further study in the light of the difficulties experienced in the 1979 Fastnet Race.

The problems encountered during the race resulted from a storm in the open waters of the North Atlantic during which exceptionally severe sea conditions were experienced. Many of the lessons learnt are applicable to heavy weather in general, but there are other hazards which may confront yachts in heavy weather which did not arise in the 1979 Fastnet Race.

The Fastnet is a supreme challenge to ocean racing yachtsmen in British waters. In the 1979 race the sea showed that it can be a deadly enemy and that those who go to sea for pleasure must do so in the full knowledge that they may encounter dangers of the highest order. However, provided that the lessons so harshly taught in this race are well learnt we feel that yachts should continue to race over the Fastnet course.

Annex 1A

RORC SPECIAL REGULATIONS 1979

In the left-hand margin: a vertical line indicates a change in 1979
a star indicates a modification by RORC Prescription

MEMORANDUM ON SAFETY

Manoeuverability of Ships: There is now greatly increased commercial traffic in waters around the United Kingdom. Some large single-screw ships cannot manoeuvre easily and owners are urged to bear this in mind at all times.

Lookout: Particular attention is drawn to the importance of keeping a full and proper lookout, especially when low-cut sails are set.

Use of Engine to Prevent Collision: If a yacht has to take urgent avoiding action to prevent a collision, the engine should be used and the circumstances reported on the declaration. *(See RORC General Condition 14)* Auxiliary engines should be kept in a condition in which they will start readily.

White Flares: White flares may be used at any time to draw attention to the presence of the yacht. Flares carried for this purpose should be kept in readiness for instant use.

Lamps: Aldis lamps should not be aimed at ships' bridges for long periods as this can obscure the pilots' vision.

Clip Points and Deck Lines: The usefulness of safety harnesses depends on strong practical clipping points being available; owners should ensure that crew can clip on before coming on deck or unclip after going below, and should where possible arrange guide-lines so that crew can work along the deck safely and efficiently.

Lifebuoys liferafts and lifejackets are recommended to be fitted with retro-reflective materials as an additional aid to search and rescue operations (Merchant Shipping Notice No. M696).

Radar reflectors: care should be taken to display these correctly as otherwise their efficiency is much impaired (see Regulation 8.7).

MINIMUM EQUIPMENT AND ACCOMMODATION STANDARDS

check points (see 1.3)

1.0 INTRODUCTION

1.1 *This section is based on Categories 2 & 3 of O.R.C. Special Regulations 1978, and is modified by RORC Prescriptions in italics.*

★ 1.2 *Specific alternatives for Category 3 in these regulations will be accepted in yachts sailing the short course in races 4, 6 and 10 and in Classes V-VIII in races 7 and 12 (Categories 2 & 3 differ in only a few points).*

1.3 *Checkpoints have been included as indices in the text and are repeated in the right hand column. These are intended as an aid to checking by owners and inspectors.*

2.0 OWNER'S RESPONSIBILITY

2.1 The safety of a yacht and her crew is the sole and inescapable responsibility of the owner, who must do his best to ensure that the yacht is fully found, thoroughly seaworthy and manned by an experienced crew who are physically fit to face bad weather [1]. He must be satisfied as to the soundness of hull, spars, rigging, sails and all gear [2]. He must ensure that all safety equipment is properly maintained [3] and stowed [4] and that the crew know where it is kept and how it is to be used [5]. 1 2 3 4 5

2.2 Nothing in these regulations in any way detracts from or reduces the complete and unlimited responsibility of the owner.

2.3 It is the sole and exclusive responsibility of each yacht to decide whether or not to start or continue to race.

3.0 BASIC STANDARDS

3.1 Yachts shall be self-righting (see IOR Part XII). They shall be strongly built, watertight and, particularly with regard to hulls, decks and cabin trunks, capable of withstanding solid water and knock-downs [1]. They must be properly rigged and ballasted, be fully seaworthy and must meet the standards set forth herein [2]. 1 2

"Properly rigged" means (inter alia) that shrouds shall never be disconnected.

3.2 All equipment shall function properly, be readily accessible and be of a type, size and capacity suitable and adequate for the intended use and the size of the yacht, and shall meet standards accepted in the country of registry [1]. 1

3.3 Inboard engine installation shall meet standards accepted in the country of registry and shall be such that the engine, when running, can be securely covered [1], and that the exhaust and fuel supply systems are securely installed [2] and adequately protected from the effects of heavy weather [3]. 1 2 3

4.0 INSPECTION

4.1 A yacht may be inspected at any time. If she does not comply with these special regulations her entry may be rejected, or she will be liable to disqualification or penalty *under General Condition 17.*

6.0 STRUCTURAL FEATURES

6.1 The hull, including deck, coach roof and all other parts, shall form an integral, essentially watertight, unit and any openings in it shall be capable of being immediately secured to maintain this integrity (see 3.1). For example, running rigging or control lines shall not compromise this watertight unit. Centerboard and daggerboard trunks shall not open into the interior of the hull. No hatch forward of the BMAX station shall open inwards excepting ports having an area of less than 110 sq. in. (670cm^2). Hatches shal l be so arranged as to be above the water when the hull is heeled 90°. All hatches shall be permanently fitted so that they can be closed immediately. Cockpit companionways, if extended below main deck level, must be capable of being blocked off to the level of the main deck at the sheer line abreast the opening [2]. When such blocking arrangements are in place this companionway (or hatch) shall continue to give access to the interior of the hull [3]. 2 3

Cockpits opening aft to the sea: The lower edge of the companionway shall not be below main deck level as measured above [1]. The opening shall not be less than 50 per cent of max. cockpit depth × max. cockpit width. The requirement in 6.31 and 6.32 that cockpits must drain at all angles of heel, applies [2]. 1 2

6.2 Cockpits must be structurally strong, self draining and permanently incorporated as an integral part of the hull [1]. They must be essentially watertight, that is, all openings to the hull below the main deck level must be capable of being strongly and rigidly secured [2]. Any bow, lateral, central or stern well will be considered as a cockpit for the purpose of 6.22, 6.31 & 6.32 [3]. 1 2 3

★ 6.22 The maximum volume of all cockpits below lowest coamings shall not exceed 9% L times B × FA [1]. The cockpit sole must be at least 2% L above LWL. *height of the cockpit sole shall apply only to yachts built after 1.1.73* [3]. 1

6.31 For yachts 21 feet rating and over: Cockpit drains adequate to drain cockpits quickly but with a combined area (after allowance for screens, if attached) of not less than the equivalent of four ¾ ins. (2.0 cm) diameter drains [1]. Yachts built before 1.1.72 must have drains with a combined area (after allowance for screens, if attached) of not less than the equivalent of two 1 in. (2.5 cm) drains [2]. Cockpits shall drain at all angles of heel [3]. 1 2 3

Yachts built before 1.1.77 may conform to 6.32, if Category 3 applies [4]. 4

6.32 For yachts under 21 feet rating: Cockpit drains adequate to drain cockpits quickly [1] but not less in combined area (after allowance for screens, if attached) than the equivalent of two 1 ins. (2.5 cm) diameter drains [2]. Cockpits shall drain at all angles of heel [3]. 1 2 3

6.4 Storm coverings for all windows more than two square feet in area [1]. 1

6.51 Sea cocks or valves on all through-hull openings below LWL, except integral deck scuppers, shaft log, speed indicators, depth finders and the like [1], however a means of closing such openings, when necessary to do so, shall be provided [2]. 1 2

6.6 Soft wood plugs, tapered and of various sizes [1]. 1

6.6 LIFE LINES AND PULPITS

6.61.1 For yachts 21 feet rating and over: Taut double life-lines [1], with upper life-line of wire [2] at a height of not less than 2 feet (60 cm) above the working deck [3], to be permanently supported at intervals of not more than 7 feet (2.15m)l [4]. When the cockpit opens aft to the sea, additional life lines shall be fitted so that no opening is greater in height than 22 ins. (56 cms.). 1 2 3 4

6.61.2 Life-line terminals: A taut lanyard of synthetic rope may be used to secure life-lines, provided that when in position its length does not exceed 4 ins. (10 cm) [1]. 1

★ *Apart from synthetic rope lanyards, insulators may not be used as life-line connections unless their construction is such that a metal interlock is provided which will fully maintain the strength of the life-line in the event of physical collapse of the insulating material* [2]. 2

6.61.3 Stanchions shall not be angled from the point of their attachment to the hull at more than ten degrees from vertical throughout their length [1]. 1

6.61.4 For yachts 21 feet rating and over: Fixed bow pulpit (Forward of headstay) [1] and stern pulpit (unless life-lines are arranged as to adequately substitute for a stern pulpit) [2]. Lower life-lines need not extend through the bow pulpit [3]. Upper rails of pulpits shall be at no less height above the working deck than upper life-lines [4]. Upper rails in bow pulpits shall be securely closed while racing [5]. Any lifeline attachment point will be considered as a stanchion in so far as its base shall not be situated outboard of the working deck. 1 2 3 4 5

6.61.5 Overlapping pulpits: Life-lines need not be affixed to the bow pulpit if they terminate at, or pass through, adequately braced stanchions 2 feet (60 cm) (18 inches (45 cm) in yachts under 21 feet rating) above the working deck [1], and set inside of and overlapping the bow pulpit [2], provided that the gap between the upper life-line and the bow pulpit shall not exceed 6 ins. (15 cm) [3]. 1 2 3

6.61.6 Pulpit and stanchion fixing: Pulpits and stanchions shall be through-bolted or welded [1], and the bases thereof shall not be further in-board from the edge of the working deck than 5% of B max. or 6 ins. (15 cm), whichever is greater [2]. Stanchion bases shall not be situated outboard of the working deck [3]. 1 2 3

6.62.1 For yachts under 21 feet rating: Taut single wire life-line [1], at a height of not less than 18 ins. (45 cm) above the working deck [2], to be permanently supported at intervals of not more than 7 feet (2.15m) [3]. If the life-line is at any point more than 22" (56 cm) above the rail cap, a second intermediate life-line must be fitted [4]. If the cockpit opens aft to the sea additional life-lines must be fitted so that no opening is greater in height than 22 ins. (56 cm) [5]. 1 2 3 4 5

6.62.4 For yachts under 21 feet rating: Fixed bow pulpit and stern pulpit (unless life-lines are arranged as to adequately substitute for a stern pulpit) [1]. Lower life-lines need not extend through the bow pulpit [2]. Upper rails of pulpits must be at no less height above the working deck than upper life-lines [3]. Upper rails in bow pulpits shall be securely closed while racing [4]. The bow pulpit may be fitted abaft the the forestay with its bases secured at any point on deck, but a point on its upper rail must be within 16 ins. (40 cm) of the forestay on which the foremost headsail is hanked [5]. Any life-line attachment point will be considered as a stanchion in so far as its base shall not be situated outboard of the working deck. 1 2 3 4 5

6.7 Ballast and Heavy Equipment: inside ballast in a yacht shall be securely fastened in position. All other heavy internal fittings (such as batteries, stoves, gas bottles, tanks, outboard motors, etc.), and anchors and chains shall be securely fastened (see 8.31).

6.8 Sheet winches shall be mounted in such a way that no operator is required to be substantially below deck.

7.0 ACCOMMODATIONS

7.11 Toilet, securely installed (or fitted bucket—Category 3 only).

7.2 Bunks, securely installed.

7.31 Cooking stove, securely installed [1], capable of being safely operated in a seaway [2], with safe accessible fuel shutoff control. 1 2

7.41 Galley facilities [1], including sink [2] (sink not essential— Category 3 only). 1 2

★ 7.52 At least one securely installed water tank, plus at least one additional container holding 2 gallons (nine litres) *and kept full of water for emergency use.* (Category 3 only, alternative to 7.52: Water in suitable containers).

8.0 GENERAL EQUIPMENT

8.1 Fire extinguishers, readily accessible and of the type and number required by the country of registry, provided there be at least one [1] *in yachts rating less than* ★ *23 ft.* [2] *and at least two in suitable and separate parts of yachts rating 23 ft. and over* [3]. 1 2

★ 8.21 Bilge pumps, at least two, manually operated [1], one of which must be operable with all cockpit seats and all hatches and companionways closed [2]. *At least one of the bilge pumps shall be securely fixed to the yacht's structure* [3]. (Category 3 only, alternative to 8.21: One manual bilge pump operable with all cockpit seats, hatches and companionways closed.) *See also General Condition 14.* 1 2 3

‖ 8.31 Anchors. Two with cables except yachts rating under 21 feet, which shall carry at least one anchor and cable [1]. Anchor(s) and any chain shall be securely fastened in the position recorded on the Rating Certificate when not in use. 1

8.41 Flashlights, water resistant [1], one of which is suitable for signalling [2], with spare batteries and bulbs [3]. 1 2 3

8.5 First aid kit [1] and manual [2]. 1 2

8.6 Foghorn [1]. 1

8.7 Radar reflector [1]. *If the radar reflector is octahedral it must have a* ★ *minimum diagonal measurement of 18 ins (46 cm), or if not octahedral must have an "equivalent echoing area" of not less than 10m². The minimum effective height above water is 12 ft. (4m). Octahedral reflectors should be displayed in the "catch rain" position.* 1 2

8.9 Shutoff valves on all fuel tanks [1]. *The yacht's electrical system must be* ★ *equipped with fuses or circuit breakers and be capable of being isolated* [2]. 1 2

9.0 NAVIGATION EQUIPMENT

9.1 Compass, marine type [1], properly installed [2] and adjusted [3]. 1 2 3

9.2 Spare compass [1]. 1

9.3 Charts [1], light list [2] and piloting equipment [3]. 1 2 3

9.5 Radio direction finder. *See General Condition 12 (e).*

9.6 Lead line or echo sounder [1]. 1

9.7 Speedometer or distance measuring instrument [1]. 1

9.8 Navigation lights, to be shown as required by the International Regulations for Preventing Collision at Sea, mounted so that they will not be masked by sails or the heeling of the yacht [1]. Yachts under 7m LOA shall comply with the regulations for those between 12m and 7m LOA (i.e. they shall exhibit sidelights and a stern 1

light). *Each sidelight bulb must have a manufacturer's rating of at least ten watts. In yachts over 12 m. L.O.A., each sidelight bulb must have a manufacturer's rating of least 25 watts [2]. Sternlight bulbs must have a manufacturer's rating of at least five watts [3].*

★ 2 3

10.0 EMERGENCY EQUIPMENT

10.1 Emergency navigation lights with self contained *power source sufficient for the duration of the race.*

★ 10.21 Special storm sail(s) capable of taking the yacht to windward in heavy weather (Category 3 only, alternative to 10.1: Heavy weather jib or heavy weather sail in boat with no forestay and reefing equipment for mainsail.)

In addition to the scale set out in IOR 895, the following may be carried: one heavy jib of cloth heavier than the weight of the mainsail cloth with an area not greater than 0.135 IG², which can be hoisted in the same way as the largest genoa (e.g. with luff tape of hanks) and which does not contain reef points.

★

The following rule is expected to apply from 1.1.1980 but yachts are urged to comply as soon as possible:—

10.22 *Mainsails shall be capable of being so reefed that the effective luff is reduced to 60% P or a trysail shall be carried on board.*

10.23 *At least one* storm or heavy-weather jib if designed for a seastay or luff-groove device shall have an alternative method of attachment to the stay, or a wire luff.

10.24 No yacht shall have less than two halyards each capable of hoisting a sail.

10.3 Emergency steering equipment. *The following rule is expected to apply from 1.1.1980 but yachts are urged to comply as soon as possible:— All yachts shall carry an emergency tiller capable of being fitted to the rudder stock. Crews shall be aware of alternative methods of steering the yacht in the event of total rudder failure in any sea condition. An inspector may require that this method be demonstrated.*

★

10.4 Tools [1] and spare parts [2], including adequate means to disconnect or sever the standing rigging from the hull in emergency [3]. 1 2 3

10.5 Yacht's name on miscellaneous buoyant equipment, such as life jackets, oars, cushions [1], etc. Portable sail number [2]. *See General Condition 10.* 1 2

10.61 Yachts fitted with VHF transceivers are recommended to install VHF Channel 72 (156.625 MHz Simplex). This is an international ship-ship channel which, by "common use", could become an accepted yacht-yacht channel for ocean racing yachts anywhere in the world.

10.62 Radio receiver capable of receiving weather bulletins. *See General Condition 12 (d).*

11.0 SAFETY EQUIPMENT

★ 11.1 Life jackets, one for each crew member [1]. *Inflating-type life jackets must be checked regularly for proper air retention. Owners are recommended to consult British Standard 3595.* 1

11.2 Whistles attached to life jackets [1]. 1

★ 11.3 Safety belt (harness type) one for each crew member [1]. *Owners are recommended to consult British Standard 4224.* 1

11.41 Life raft(s) capable of carrying the entire crew and meeting the following requirements:

(i) Must be carried on deck (not under a dinghy) or in a special stowage opening immediately to the deck containing life raft(s) only. *Each life raft shall be stowed so that one person can get it to the life-lines within 10 seconds. (Category 3 only, life raft(s) need not be carried on deck or in special stowage but attention is called to Special Regulation 3.2. and the 10-second rule).*

(ii) Must be designed and used solely for saving life at sea.

(iii) Must have at least two separate buoyancy compartments, each of which must be automatically inflatable; each life raft must be capable of carrying its rated capacity with one compartment deflated.

(iv) Must have a *self-erecting* canopy to cover occupants.

★ (v) Must have been inspected, tested and approved within one year by the manufacturer or other competent authority and *each life raft shall have a valid annual certificate; this or a copy must be kept on board the yacht.*

(vi) Must have the following equipment appropriately secured to each raft:—

1 Sea anchor or drogue
1 Bellows, pump or other means for maintaining inflation of air chambers
1 Signalling light
3 Hand flares
1 Baler
1 Repair Kit
2 Paddles
1 Knife

(vii) *The number of crew shall not exceed the official capacity of the life raft(s) as specified by the manufacturer.*

★	11.52 At least one horseshoe-type life ring [1] equipped with a drogue [2], a *whistle* [3], a self-igniting high-intensity water light or a *self-igniting light having a duration of at least 45 minutes,*[4] and a pole and flag [5]. The pole is to be attached to the ring with 25 feet (8m) of floating line [6] and is to be of a length and so ballasted that the flag will fly at least 8 feet (2.45m) off the water [7]	1 2 3 4 5 6 7
	11.61 Distress signals stowed in waterproof container(s):—	
	11.63 Four red parachute flares [1].	1
	11.64 Four red hand flares [2].	2
	11.65 Four white hand flares [3].	3
	11.66 Two orange smoke day signals [4].	4
	11.67 *It is recommended that white flares are kept separately from red flares* [6]. *Mini-flares or pistol-fired flares are acceptable instead of hand flares. (See Memorandum on Safety).*	6
	11.7 Heaving line (50 foot (16m) minimum length [1], floating type line [2]) readily accessible to cockpit [3]. *Patent lines such as Balcan are acceptable.*	1 2 3

ROYAL OCEAN RACING CLUB

20 ST. JAMES'S PLACE, LONDON, SW1A 1NN. Tel. 493 5252, 499 4264

RORC SPECIAL REGULATIONS 1979

1. Horseshoe liferings and dan buoy. There is no change in the regulations on these items and the rule is as in 1978. Due to a printing error part of the rule was omitted in 1979 and the correction is as follows:—

Delete Special Regulation 11.52

Insert 11.52 At least one horseshoe-type life-ring equipped with a drogue, a *whistle* and a self-igniting light having a duration
* of at least 45 minutes within reach of the helmsman and ready for instant use.
11.53 At least one more horseshoe-type life-ring equipped with a drogue, a whistle, dye marker, a self-igniting high-
* intensity water light, and a pole and flag. The pole is to be attached to the ring with 25 feet (8m) of floating line and is to be of a length and so ballasted that the flag will fly at least 8 feet (2.45m) off the water. *A self-igniting light having a duration of at least 45 minutes may be used instead of a high-intensity water light.* (Category 3 only: 11.53 optional.)

2. Inspections at the beginning of the season have shown that special attention should be drawn to certain regulations, including some which are new in 1979 (please see RORC Special Regulations and also the IOR MkIII for full details. The IOR may be purchased from the ORC, 19 St. James's Place, London SW1A 1NN—tel. 01-629 8701.):—

(a) Anchors, chain and ballast. See Special Regulation 8.31 and IOR 202.H. "Anchors and chain shall be secured in *clearly marked stowage".* "Batteries shall be secured in . . . proper stowage." "The measurer shall affix a notice in the yacht . . . of the items and weights . . . this notice shall always be displayed . . . during the validity of the Rating".

(b) Compass adjustment. See Special Regulation 9.1: "compass, marine type, properly installed and adjusted". Production of a recent deviation card will provide an inspector with good evidence that this regulation has been complied with.

(c) Emergency steering. See Special Regulation 10.3.
Whether or not this is purpose-built, or whether it is the intention to use parts of the yacht's gear normally used for other purposes, it is recommended that the emergency steering method be thoroughly tried out in advance (note Special Regulation 2.1 ". . . the owner . . . must ensure . . . that the crew know where it is kept and how it is to be used")

(d) Forestay adjustment. See IOR 802.6.
". . . the forestay shall be fitted *and not adjusted whilst racing.* An exception is a yacht rigged with all spreaders clearly swept aft. In this case the forestay may be adjusted but no stays abaft the mast may be adjusted whilst racing."

(e) Man overboard drill. An inspector may ask when this was last carried out.

(f) Liferaft servicing. Attention is invited to Department of Trade Merchant Shipping Notice M874, which makes clear the importance of having liferafts serviced at service stations approved by either the Department of Trade or the liferaft manufacturers. Rafts have been found to be unusable after service at some other service stations.

10.5.79

E. Alan Green
Secretary

Royal Ocean Racing Club

Annex 1B

RACE ENTRY FORM 1979

20 St. James's Place, London, SW1A 1NN.

Race No.	Race	Date
	MAY	
1	Cervantes Trophy (Closing date 23rd April)	4th
2	Seine Bay (Closing date 7th May)	18th
3	*Middle Sea	19th
4	North Sea (Closing date 14th May)	25th
	JUNE	
5	De Guingand Bowl (Closing date 28th May)	8th
6	Morecambe Bay (Closing date 4th June)	16th
7	Morgan Cup (Closing date 11th June)	22nd
8	Harwich-Harwich (Closing date 11th June)	22nd
9	*Services Offshore	28th
10	West Mersea-Zebrugge (Closing date 18th June)	29th
11	*Isle of Man	30th
	JULY	
12	Cowes-Bay of St. Malo (Closing date 25th June)	6th
13	*Clyde-Cork	14th
14	*Skaw	18th
15	Hartlepool-Ijmuiden (Closing date 9th July)	21st
	AUGUST	
16	Channel (Closing date 23rd July)	3rd
17	Fastnet (Closing date 23rd July)	11th
18	Plymouth-La Rochelle (Closing date 23rd July)	18th/ 19th

*For entry to these races see Programme

Entry fee per race

Class

Mk III/IIIA

	RORC Members & Club Yachts	All others
O & I 70-33ft.	£21	£28
II 32.9-29ft.	£17	£22
III 28.9-25.5ft.	£15	£19
IV 25.4-23ft.	£15	£19
V 22.9-21ft.	£12	£16
VI 20.9-19.5ft.	£10	£13
VII & VIII Under 19.5 ft.	£ 8	£11

Admiral's Cup yachts pay £250 for the series, this includes races 16 and 17.

Overseas entries may pay fees on arrival but must enter before closing date.

Name of yacht .....

Sail No. .....

I.O.R. Mk III ..... IIIA. .....

Rating issue by. .....

Age date (on rating certificate) .....

Rating issued by: .....

Date of issue .....

Full name of Yacht Club (not RORC) for Club points Championship (G.C. 23).

.....

Owner. .....

Sailed by .....

Sailing for (country) .....

Hull colour ..... Rig .....

Designer .....

Type ..... L.O.A. .....

Builder ..... L.W.L. .....

Material .....

During the RORC season this yacht will normally be kept at .....

Radio transmitters—Distress set, type:

.....

Main set: VHF/MF/HF, type:

.....

Channels: 16/72/M/67/2182/2301

ae power .....

This Declaration must be Signed

I agree to be bound by I.Y.R.U. Racing Rules R.Y.A. Prescriptions, RORC General Conditions and Special Regulations. The yacht will be available for inspection.

If any alteration likely to affect the rating is made* I will notify the Rating Secretary immediately. (*Such as those to sail plan, mast, ballast, trim, engine or propellor.)

I understand that the RORC and organising clubs accept no responsibility for loss of life or injury to members or others, or for the loss of, or damage to any vessel.

I have read paragraphs 108 and 109 of the I.O.R. and accept the owner's responsibilities therein.

Signed..... Date.....

Please enter my yacht

for races numbers .....

Entry fee for ..... races at .....£ .....

Late fee if applicable (half entry fee) £ .....

Bank charges (if paying by overseas draft) (£1.50) £ .....

TOTAL £ .....

Name (please print). .....

Address .....

.....

Tel: Day ..... Evening .....

Annex 2A

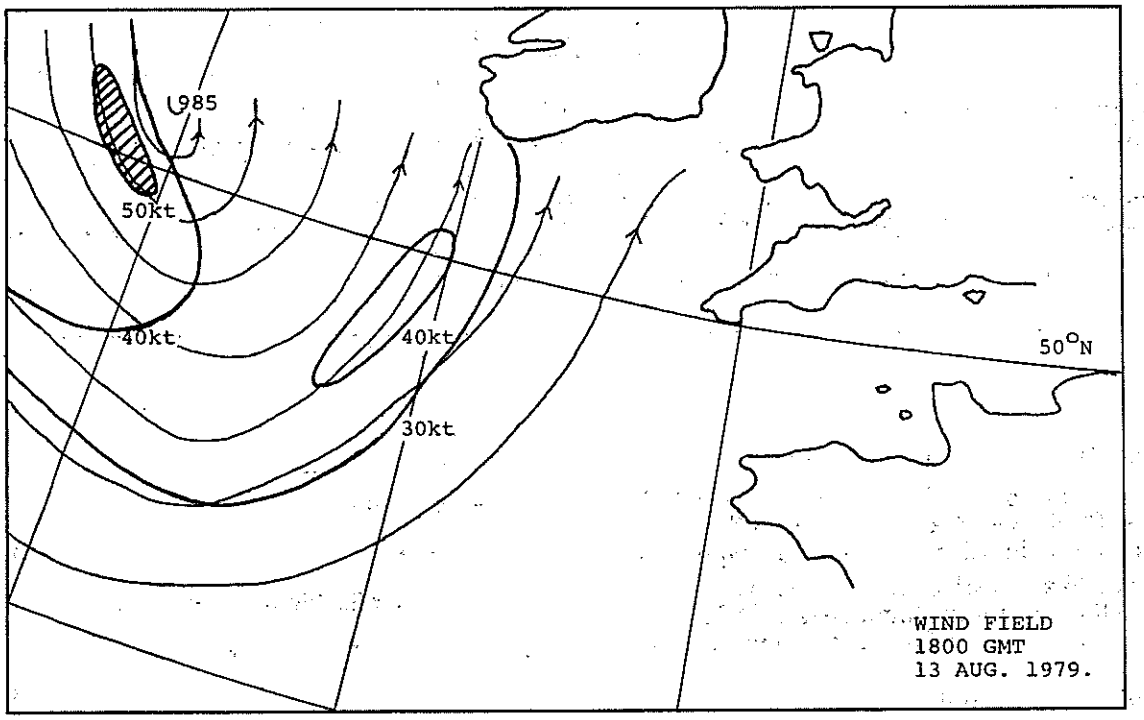
Report by the Institute of Oceanographic Sciences on Severe Wave Conditions During the Fastnet Race—August 1979

General Situation
The primary cause of the high waves seems to have been a lenticular area of strong winds of about 50 knots which approached from the west along the line of the 50° latitude. The east-west extent of the wind field was much larger than its north-south extent. At about 1800 on 13 August at 10°W the winds were southerly of 30-40 knots, and by midnight they were westerly of 50 knots. At 0600 on 14 August this speed was maintained at 10°W and the narrow wind field, of 50 knots, had extended eastwards to just north of the Scillies. The waves produced by the earlier southerly wind would have been travelling as swell from the south in the Fastnet area during the early morning of 14 August, and the higher newly generated waves from the 50 kt winds would have been travelling from the west, or even from slightly north of west, before dawn on 14 August.

Wave Conditions—heights
The worst wave conditions would have occurred between about 49° and 51° N; they would have arrived at 10°W at about midnight on 13-14 August. To the north of this band, conditions would not have been quite as severe, but the residual swell from the southerly wind of late on 13 August would have made a confused sea. In the area of most severe weather, within about 50 miles north of 50°N, waves probably achieved a significant height of almost 10 metres (33ft). If one accepts the validity of yacht reports of force 11 and over it might have approached 14 metres (46ft). The most likely highest individual wave every three hours would be close to about twice the significant wave height. Considering the periods of the two principal systems (see below) such waves could have possessed steep or near-vertical-sided profiles. Individual wave crests of the larger waves would have been travelling at speeds of about 30-40 knots.
Waves at DBI (48½°N 9°W) increased from a significant height of 4 metres at 0200 to 6 metres at 0400 which fits in well with the wind-field data. They remained at around 6 metres until about noon on 14 August and then decreased.

Effect of tide
This is likely to have been negligible in the Fastnet storm area.

Effect of shallows
There would have been no obvious effect caused by shallows 100 ft. or more below the surface. The Labadie Bank is about twice this depth.



e Conditions—periods

wave periods from the southerly winds would have been around 10 seconds and those from the westerly and more severe nds would have been of about 12 to 13 seconds.

Wave conditions have been hindcast using the IOS method (Darbyshire and Draper 1963).

The wind-field analysis was provided by the Meteorological Office, Bracknell.

L. Draper
IOS, Wormley.

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Hogben, N. and Lumb, F.E. 1965 Ocean Wave Statistics.

Darbyshire, Mollie and Draper, L. 1963
Forecasting wind-generated sea waves.
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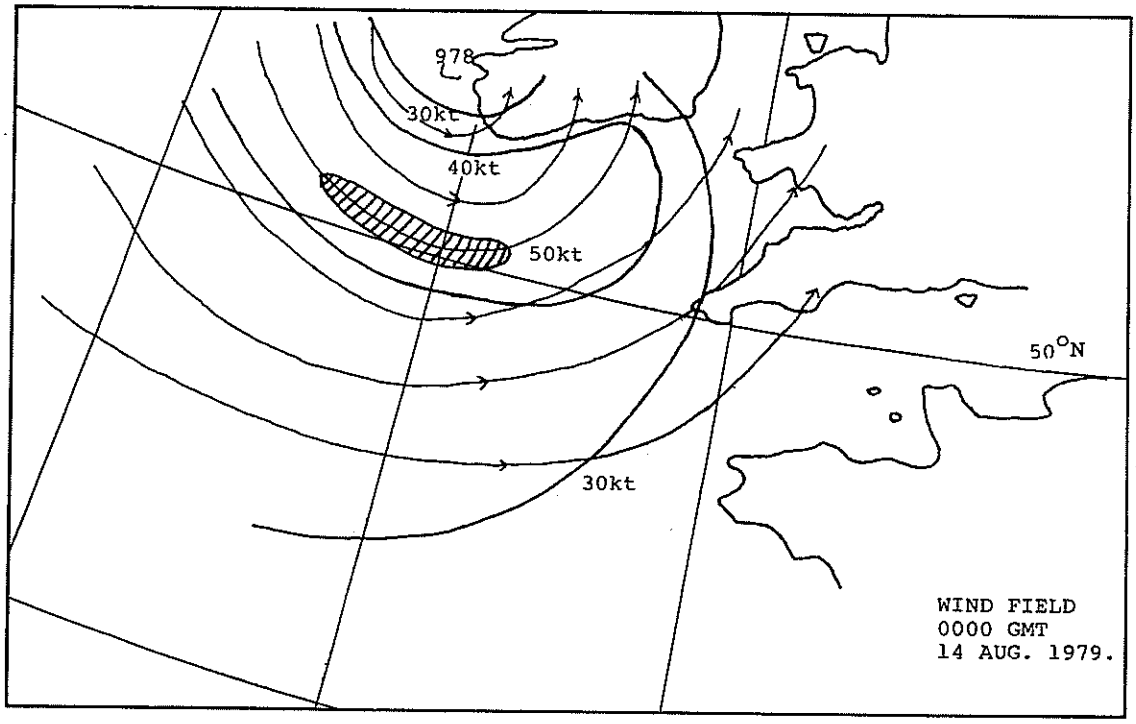


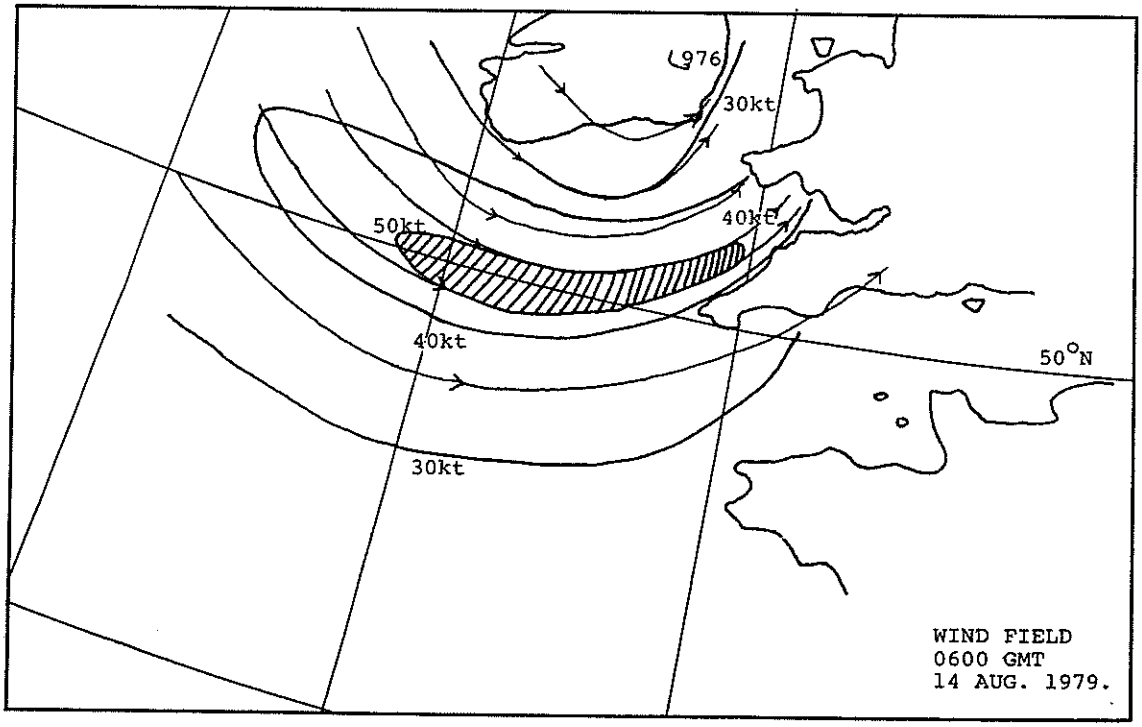
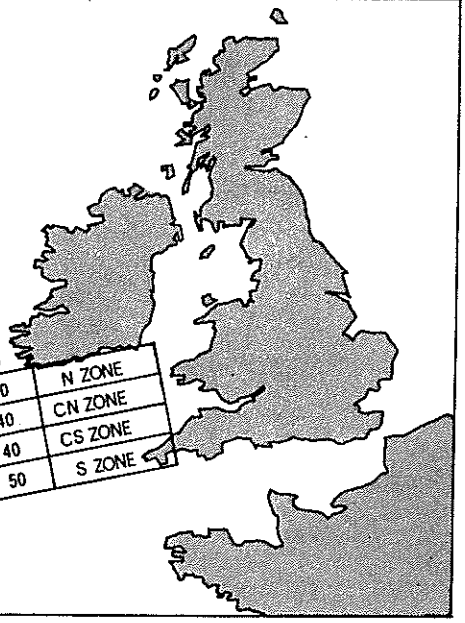


Fig. 2. By dividing the race area into northern, central northern, central southern and southern zones and measuring the distance apart of the isobars, the gradient wind speed (the speed at a level clear of surface friction) can be given between 1300 Monday and 1300 Tuesday. Take two thirds of these speeds as representative of mean speeds at yacht level, but individual gusts can be up to gradient speed



MONDAY 13th		TUESDAY 14th					
13	19	06	04	07	10	13	
18	25	75	75	40	40	40	N ZONE
20	30	75	75	75	60	40	CN ZONE
25	30	40	75	65	65	50	CS ZONE
30	40	40	50				S ZONE

and Plymouth. All the above warnings were, of course, repeated in the preamble to the shipping forecast at 1750.

The next forecast of importance to Fastnet was originated at 1805 and was broadcast at 1830, repeated at 1905. It said "Finisterre, Sole, Fastnet. South westerly gales Force 8, increasing severe gale Force 9 imminent". So the warning of Force 9 was broadcast well in advance of the wind gathering to strength 9. As time went on, however, the gap between warnings and the actual arrival of wind of that strength telescoped.

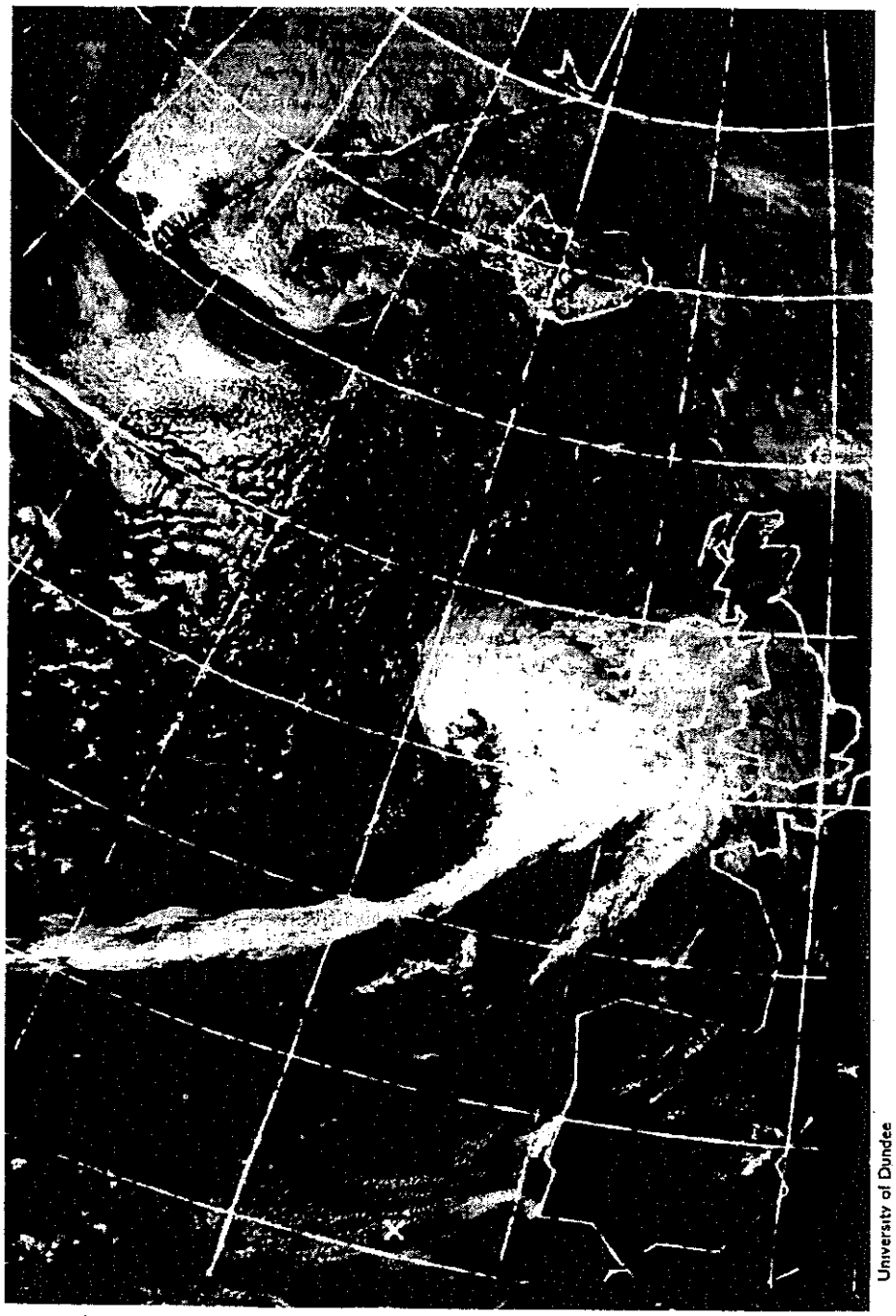
It was while they were drawing up the 2200 chart that the forecasters realised that the isobars were tightening to such a degree as to make it inevitable that Force 10 would occur in Fastnet. So at 2245 they sent the BBC the following "Sole: Severe gale Force 9 veering north westerly and increasing storm Force 10 imminent. Fastnet: South westerly gales severe Force 9 increasing storm Force 10 imminent. Shannon: North westerly gales severe Force 9 increasing storm Force 10 imminent." The BBC, now well-alerted to the implications, broadcast this within a quarter of an hour of its origination, i.e. the warning went out at 2300.

Richard Matthews, owner of *Oystercatcher 79* tells me that at 2300 they were 50 miles south of the Rock and somewhat to windward of the dead-beat course. He estimated the wind at 45-50 knots (Force 9/10) with a rising 6m seaway. No warning of Force 11 was actually issued, but it can be argued that the difference between Force 10 and Force 11 for yachts at sea is a rather academic one. For *Oystercatcher* the wind did not reach Force 11 until about 0300.

It is evident from this that the warning of storm Force 10 coincided with the arrival of the storm force winds themselves for much of the fleet. Until a more detailed analysis is done, we shall not know how many, or where they were. It is interesting to note that *Oystercatcher* had winds of 40 knots (top of Force 8) by 2000 that evening, so the forecast of winds of that strength came out some five hours ahead of the wind.

From the foregoing it is obvious that there was no possible warning that could have been given to the fleet in advance of it becoming evident that a Force 9/10 storm was about to occur in Fastnet. The warning of Force 8 gales was not something that would make the ocean-racing crews consider making for shelter particularly as, in the case of the Admiral's Cup boats, national pride was at stake. By the time Force 10 was forecast, Force 10 was already there.

Before castigating the forecasters



University of Dundee

Fig. 3. How the TIROS N satellite saw the Fastnet low at 1637 on Monday. Reference to Fig. 1 will show where the low centre was at this time. The long tail of cloud lies along the cold front while thick cloud covers the centre off Ireland

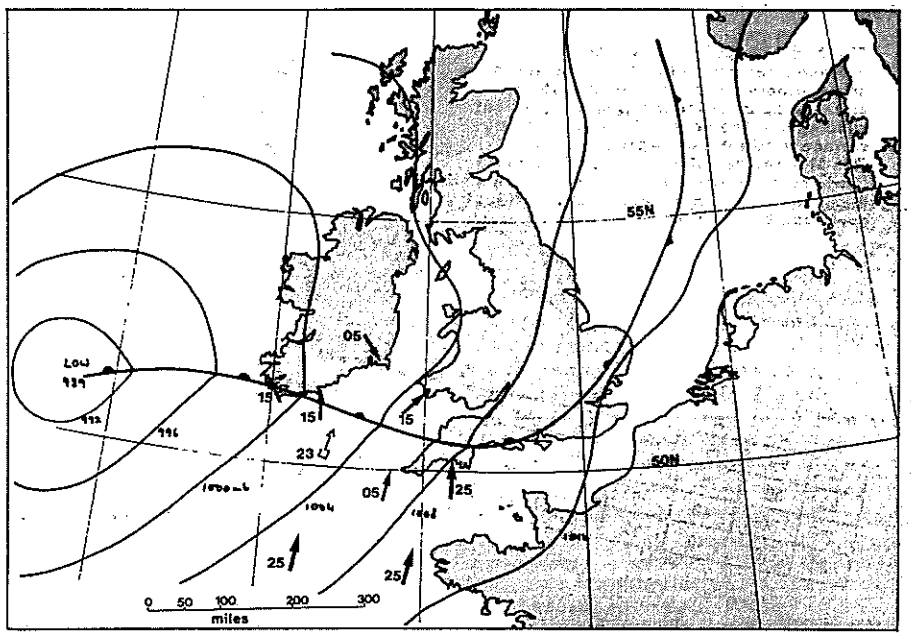


Fig. 4. The weather map for 1900 Monday. The calm before the storm—Scilly had 5 knots—and strangely in Wexford the light wind was blowing contrary to the trend in the isobars

for not recognising earlier that a storm-force situation existed, it must be realised that the nearest station to the Fastnet Rock, Valentia Observatory, at 2200 only showed a tendency of some 6 mb/3hr. This tendency of the barometer is recognised as an immediate forecast of Force 6 (if it is not indeed already blowing Force 6), but need not lead to Force 8.

At no time, except briefly between 0100 and 0200, did Valentia show anything like the 10 mb/3hr that makes Force 8 a near certainty. On the southern side of Fastnet the synoptic station is Scilly (St. Mary's) and equally they showed no tendency that would lead to anything like the winds experienced in the sea area to the north of them. Ships in the vicinity might have sent reports that would have led to a quicker appraisal of the situation, but unfortunately two that did report sent their pressures wrongly.

In fact the practised eyes of the forecasters saw that these ship reports were wrong and, divining that the originators had misplaced the decimal points (which I know from experience is quite easy to do) corrected them.

It is an unfortunate fact that ships which ply the Atlantic and faithfully send in their weather reports to Portishead for onward routing to Bracknell give up when they reach "small waters" like Fastnet, and another hazard is that many who might report in calmer conditions do not do so when the wind and sea rise with the onset of a gale. They say they have other more important things to do!

No Storm-force tendency

Yachts noting their own barometric readings in their logs some 50 miles south of Valentia would have seen a Force 8+ tendency developing after about 2200, but at the time of writing there is as yet no evidence that tendencies of storm-force proportions were recorded anywhere.

That is another of the oddities of this very odd storm. It would help the final analysis if skippers or navigators were able to supply, via this magazine, details of barometer readings, times, positions and state of wind and sea so that we could find out if, perhaps, there was a storm within a storm.

Credence is given to the last contention by Rodney Hill of *Morningtown*—the Admiral's Cup radio relay vessel—who reports that, at the height of the storm with distress flares going up and while in the vicinity of the Labadie Banks, they appeared to be in a situation akin to the eye of a hurricane with bright stars above and all around the impression of swirling clouds of mist and murk, and the "impossible" seaway that was tossing craft over and rolling them under in some cases several times. That kind of seaway speaks of sudden wave-making impetus generated over a relatively small area and the shoaling ground of the Labadie Banks may have had something to do with it. But not much. There is a hint of a meteorological mystery here.

The weather charts shown in Figs. 4-7 do not reveal anything very odd other than the fact that, by a strange twist of fate, the strongest winds were in a corridor which lay south of Ireland and across the Fastnet fleet. They appear to have first risen to their storm force 60+ knots just south of the Fastnet and then to have extended their zone of influence southwards across much of the fleet (Fig. 6). There may actually be amendments to be made to this simple picture when the stories of the participants can be pieced together.

The growth of the seaway constitutes another puzzle. The wind which generated the sea, as opposed to the swell, was of short duration yet referring to *Oystercatcher's* observation at 2300 of a 6m sea with a 45-50 knot wind, which had only increased by 5 to 10 knots in the previous three hours, we can estimate what theory says the waves ought to have been.

Some time ago Peter Deeks, who is the Senior Forecaster, Offshore at the London Weather Centre (and deeply involved with forecasting sea conditions for the oil rigs) sent me copies of the graphs they use for predicting wave height. These are a mixture of Darbishire and Draper's curves for coastal waters and World Met. Organisation graphs for deeper waters.

In many ways Fastnet is oceanic and not coastal and to get 6m waves with a 40-50 knot wind, the WMO graphs estimate requires the wind to have blown at this strength and in one direction for some six hours, i.e. in *Oystercatcher's* case since at least 1700 that afternoon. Yet the 1900 chart (Fig. 4) indicates a surface wind speed of no more than about 25 knots Atlantic-wards of the Fastnet fleet. The period of the waves would then be about seven seconds.

A well-known fundamental relation tells us that the wavelength $L = 5 \times (\text{period})^2$ so that the wavelength should have been around 75m. I am sure that the majority of crews will tell us that the wavelength was nothing like that. It was disastrously short with massively breaking tops so that yachts were being crested, sliding down the steep leading edges to meet the inevitable rolling-over condition where centre of gravity goes on and keel does not. The momentum of rotation precipitates the masthead into the water, while the impetus of the following wave throws its weight under the temporarily upturned keel and completes the roll. The time involved is of the same order as the one intimated by the theory.

The waves in the area of the Labadie Banks and elsewhere were not in line with the theory, however. They were more of the shape we experience on a small scale in a wind-against-tide chop. In this case, that signifies the sudden arrival of a very strong wind before a corresponding seaway has had time to develop.

It speaks of more than normal frictional force between wind and water of the kind that occurs when the wind is trying to force wave-making against the inertial reluctance of the water to move. I may be wrong here, but the shoaling over the Banks should not have contributed much as the lower levels of the wave motion would not have reached so far down in so short a time.

Certainly the tidal streaming through the area was against the wind from about 2000 in the southern and central southern zones (as defined in Fig. 2) and from about 2200 in the central northern and northern zones, but the speeds are not more

than half a knot so this is not a truly significant factor although it adds its contribution to the forces that formed the short, steep seaway.

The Wind Shift

The intense seaway of the early hours of the Fastnet storm were, it seems, due to the sudden arrival of storm-force south westerlies, but there is another factor which needs to be taken into account. The higher a wave, the slower it travels. Conversely the lower it is, the faster it travels. Thus the low waves travel out of storm areas leaving the higher ones behind. A presage of hurricanes is the sudden arrival of low swell in an otherwise calm situation.

The plot of the forecasts issued by the BBC on Monday evening shows that by 2100 it was blowing Force 9 from the north west in Sole; not long after 2200 it had increased

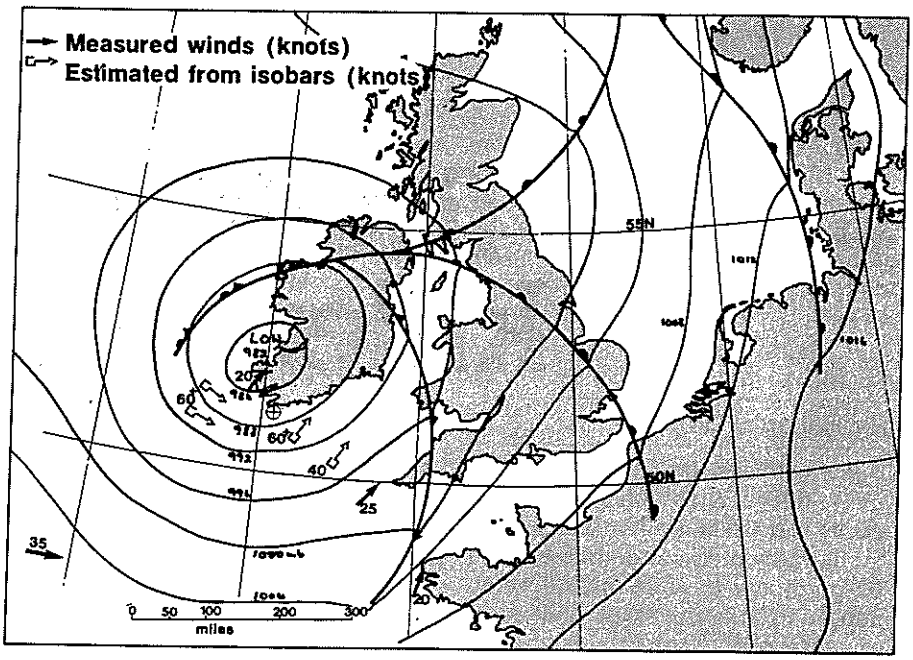


Fig. 5. The storm corridor develops with surface winds above 60 knots off the Fastnet (0100 Tuesday)

to Force 10. In coastal waters with a wind speed of 55 knots (top of Force 10), the maximum wave height after the wind has blown for two hours (i.e. at midnight in this case) is some 7·5m with an average height of about 5m and a period of about eight seconds. These waves would have travelled at some 25 knots, but the lower waves of the spectrum of heights would have travelled at perhaps twice this speed.

In two hours, waves generated from the north west in Shannon would have run into Fastnet under the weather and have met the perpendicular seaway due to the Force 10 in Fastnet. This cross-sea wave interaction is the most likely candidate for the extreme wave conditions met 50 miles or so south of the Rock.

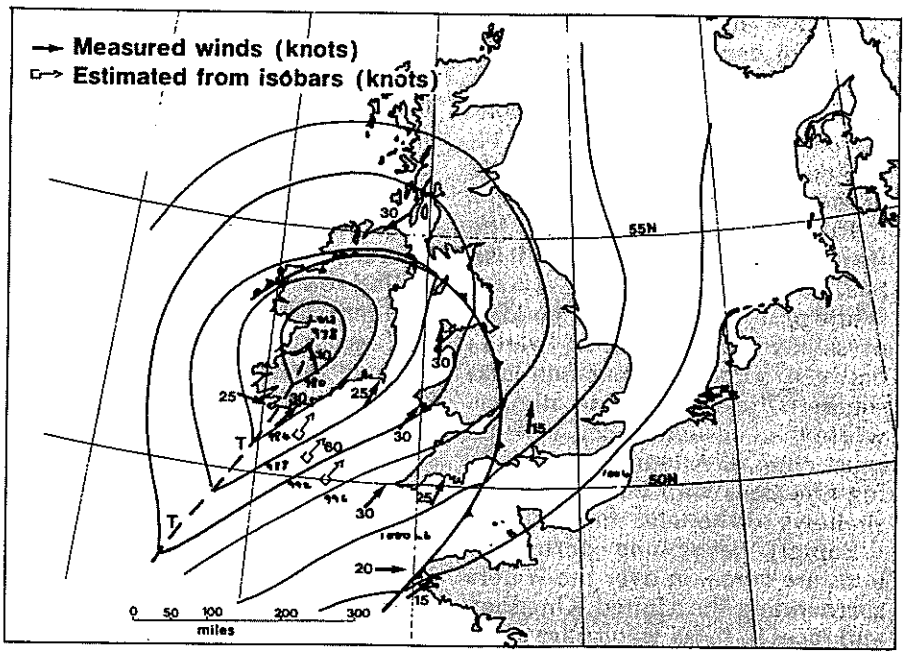


Fig. 6. The height of the storm (0400) when the violent storm-force winds (Force 11) had spread across much of the fleet. All land stations fail to record anything above 30 knots mean speed. A trough-line (T) with a 90° shift on it begins to move across the area

Long before the trough shown in Figs. 6 and 7 had worked round into Fastnet, the effects of winds many miles away would have been making their impact on the fleet.

Thus we begin to understand the Fastnet storm; a storm where the seaway was the governing factor in an extreme situation. In the Channel Storm of 1956 where the winds grew along the Channel to the same ferocity as this year, there was not the same cross-sea problem as here. Yachts at sea were able to run under bare poles towing warps before the simple seaway, high as it was. This time the boats did not have a chance. No amount of seamanship would have prevented many of those which rolled, or were knocked down repeatedly, from succumbing to their fate. The cruel sea saw to that. ■

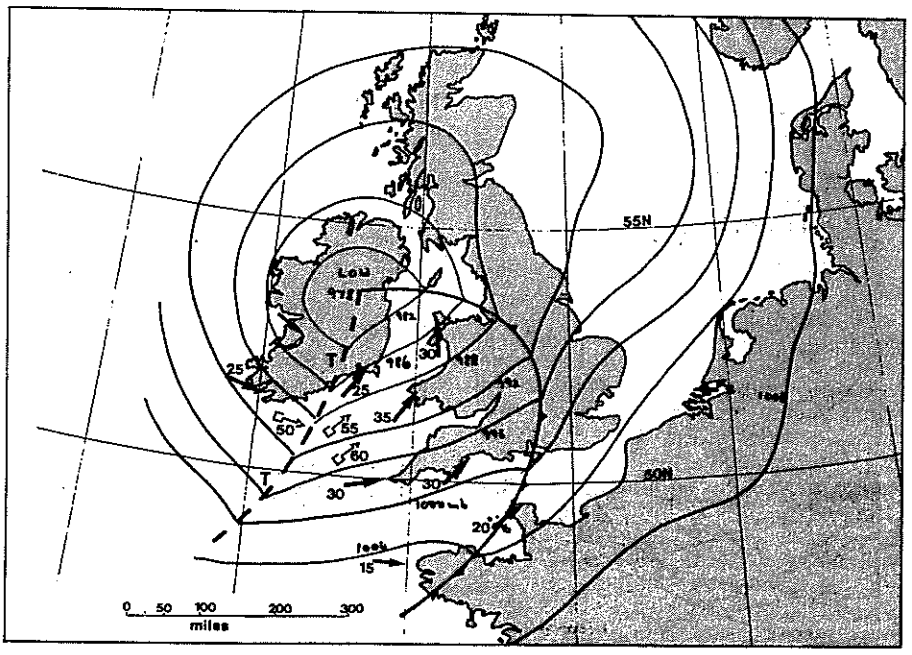


Fig. 7. Off the Rock the wind shifts and relents, but it still blows storm to violent storm force over the rescue operation. The wind drops to Force 10 behind the trough

Reproduced from
Sail,
October 1979.

Tracking a killer storm

By Robert B. Rice

Severe storms can be found raging over the earth's surface nearly every day. Usually their development, movement, and strength can be predicted in advance, allowing people to take the steps necessary to protect life and property. From time to time, though, a severe storm develops quickly and attains a place in history.

Such a storm developed late Monday, August 13, 1979, and continued into Tuesday, August 14, exploding almost without warning in the midst of the Fastnet fleet.

The strongest winds caught the fleet strung out across the Irish Sea. As British meteorologist Alan Watts observed, "There is no kind of shelter in that box of waters between southwest England and southern Ireland. The weather is worse than oceanic because of the interaction of Atlantic wave-making processes with the developing shallows of the land masses."

Rapidly developing storm systems are common over the waters surrounding the United Kingdom, and races in these waters are often plagued by gales and steep seas. The 1979 Fastnet storm developed a central pressure of about 980 millibars, which, although notable, is not uncommon. Many races held within the past 30 years have seen storms of this intensity rip through the fleet. (*Heavy Weather Sailing*, by K. Adlard Coles, is filled with tales of these storms.)

The story began across the Atlantic on Thursday, August 9, as a weak disturbance moved eastward across the United States into the Gulf of Maine on August 10. Although the storm system was small and relatively weak at this point, it had already begun its history of death and destruction by spawning tornadoes and severe thunderstorms across the Ohio Valley on Thursday, and over southern New England on Friday (killing two people in Massachusetts and socking the J/24 worlds off Newport, Rhode Island, with winds up to 35 knots).

As a preceding storm system became stationary southwest of Iceland, the weak storm raced eastward across the Atlantic over the weekend, reaching a position near 48°N, 19°W by 1200 Greenwich Mean Time (GMT), Monday, August 13, with a central pressure of about 1007 millibars (Fig. 1).

At this time, the system gave only subtle hints of what was to happen in the next 12 hours. The only tangible clues were the vast amount of cold air in the associated upper-level low-pressure trough and the storm's climatologically dangerous surface position. Aloft, the air temperature was on the order of −25° to −30°C, which is comparable to winter normals. It is this presence of cold air over warm, moist surface air that often feeds storm development.

Climatologically, all waves or minor storm systems approaching these waters around the edge of a depression in the Icelandic region must be viewed with suspicion. Even so, there is nothing in the 1200 GMT reports to warrant a forecast for conditions as severe as those that were experienced.

During the six hours from 1200 to 1800 GMT, the storm began to intensify and move rapidly east-northeast. By 1800, the central pressure had dropped to about 995 millibars, and the storm center was near 51°N, 13°W (Fig. 2). It was between 1500 and 1800 GMT Monday that questions about the storm's potential development were

Figure 1: 1200 GMT Monday—storm center 1007 millibars

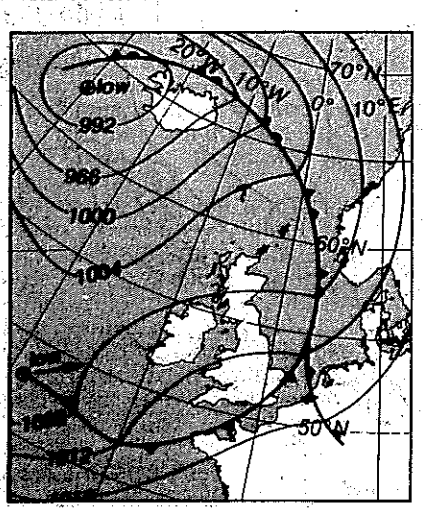


Figure 2: 1800 GMT Monday—storm center 996 millibars

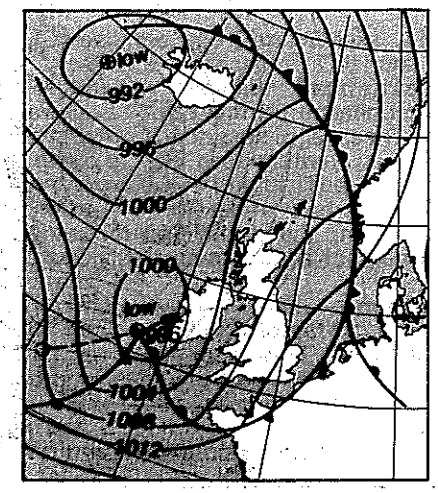
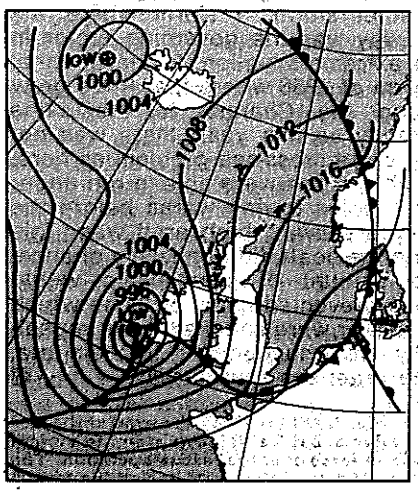


Figure 3: 2100 GMT Monday—storm center 983 millibars



answered. The development rate of two millibars per hour, although not extreme, indicated that the rapid development just beginning would be likely to continue. The combination of development rate and forward speed were giving barometric falls of up to three millibars per hour at locations just ahead of the storm.

At 1625 GMT the Meteorological Office issued a Force 8 gale warning for Plymouth, Fastnet, and the Irish Sea, which was broadcast on the 1650 BBC shipping forecast. Soon thereafter, at 1705 GMT, the warning was upgraded to "Southwest gale Force 8 increasing severe gale Force 9 imminent." (The term "imminent" in British forecasts means "within six hours.")

The weather map for 2100 GMT (Fig. 3) shows the truly explosive development that was under way within the decelerating storm system. Valentia, on the southwest Irish coast, reported a pressure of 989 millibars and winds gusting to 48 knots. The rapidly developing pressure gradient suggests that gusts of 50 or 60 knots were already being felt over the water south of Ireland, eastward to around 7°W. These higher winds generally occur ahead of a developing storm in the region of maximum pressure falls, and again behind the storm and its associated cold front in the rapidly rising pressures. The latter region is apt to provide the strongest pressure gradient along with a wind shift, and this feature later became important in the storm's life cycle.

At 2145 GMT, as the wind really began to freshen on the course, the Meteorological Office issued a new warning: "Southwest gale Force 9 increasing to Force 10 imminent." Although the leaders (including the overall winner, *Tenacious*), had already rounded Fastnet Rock and had the wind abeam, most of the fleet was still spread out behind, struggling to beat into a rising wind and sea.

By midnight GMT (Fig. 4) the storm center was off Galway Bay with a central pressure near 980 millibars, which then held fairly steady for the next six hours. The associated cold front had moved to a position just east of Fastnet Rock, where the rapidly rising pressure gradient created Force 10 and higher winds from the west-southwest.

At 0250 GMT Tuesday, the Meteorological Office issued a further warning that the strongest winds were yet to come—Force 9, locally gusting to Force 10—veering westerly over the next six hours.

Just over three hours later, at 0600 GMT, the storm center had moved to a position near Londonderry, while its attendant cold front had whipped eastward into the coastal sections of Scotland and England. As often happens, the front had accelerated out of the principal low-pressure trough, which extended across eastern Ireland and out to sea east of Fastnet. The rapidly rising pressures behind this trough created what Alan Watts calls "the most potent feature of the tragedy." As the principal trough sped east, Watts says it created "a wickedly confused seaway as the Force 9-10 winds ahead of it were suddenly replaced by an almost right-angled shift to the northwest. It is this feature, perhaps more than the wind strength, that had so many craft in terrible trouble." Reports of rogue seas of 50 feet and wind gusts to 80 knots can therefore be accepted as realistic, despite the relatively short duration and fetch of the wind.

By 1200 GMT Tuesday, the storm had moved on to the Moray Firth off northern Scotland, heading for the Shetland Islands (Fig. 6). The squares to the north of the storm center in Figure 6 represent the continued six-hour plots as the storm moved on toward the Norwegian Sea. This retreat from the scene allowed sea conditions to subside over the area, which permitted the widespread deployment of air/sea rescue units to aid the stricken yachts. Had the storm lingered on for several days, the toll would very likely have been even more staggering.

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Figure 4: 0000 GMT Tuesday—storm center 979 millibars

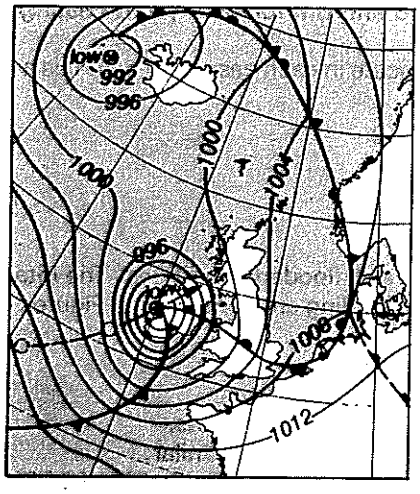


Figure 5: 0600 GMT Tuesday—storm center 983 millibars

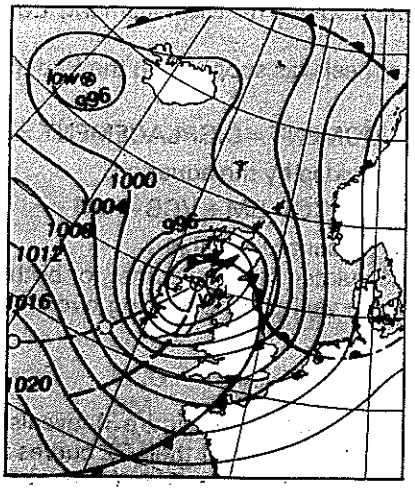
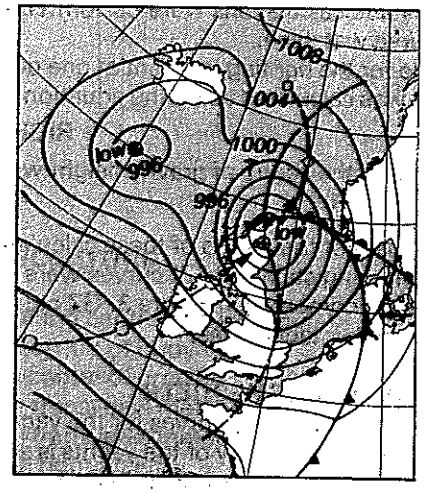


Figure 6: 1200 GMT Tuesday—storm center 983 millibars



Annex 3A

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FOR MARINE TECHNOLOGY
AND INDUSTRIAL AERODYNAMICS

Report No. 431 November 1979

ROYAL YACHTING ASSOCIATION

Stability Conditions on
Contessa 32 and 1976 Half Tonner

* * * * * * * *

INTRODUCTION

The following report describes an investigation into the statical stability of a Contessa 32 and a Half Tonner designed in 1976. *(The designer feels that the Half Tonner is representative of yachts of her size and type designed at that time).*
A programme of work was set out in a proposal issued by the Wolfson Unit on 18.10.79 and was agreed by Cdr. W. Anderson, coordinator of the Fastnet Race Inquiry, in his letter of 26.10.79.
Hydrostatic and statical stability data were computed for the two yachts and were used in conjunction with data on the respective I.O.R. Rating certificates to assess and compare the stability of the two yachts.

THE YACHTS CONCERNED

The yachts selected for the investigation were a Half Tonner, and a Contessa 32.
Both yachts took part in the 1979 Fastnet Race.

PREPARATION OF HYDROSTATIC AND STATICAL STABILITY DATA

Lines plans of the two yachts, together with drawings of their deck, coachroof and cockpit arrangements were supplied by their respective designers and builders. Suitable data were lifted from these drawings adequately to define the vessels for the Department of Trade approved computer programs used to carry out the calculations. Figures 1 and 2 illustrate the data used in each case.
Hydrostatic calculations were performed to obtain values for Displacement, LCB, VCB and BM for each yacht floating at its measured waterline.
A value for the righting moment at one degree of heel was supplied on the Rating certificate in each case, and with this a value of GM was calculated using the equation:

$$\text{RIGHTING MOMENT} = \text{DISPLACEMENT} \times \text{GM} \sin\theta$$

A value for the centre of gravity height was then yielded by the equation.

$$\text{VCG} = \text{BM} + \text{VCB} - \text{GM}$$

A summary of the results of these calculations is presented in Table 1.
Free trimming stability (GZ) curves were then calculated for the yachts, for both intact and flooded conditions. The intact GZ curves are compared in Figure 3. GZ curves for the yachts experiencing two stages of flooding are compared in Figures 4 and 5, with their intact curves.

DISCUSSION OF RESULTS

Examination of the GZ curves for the yachts in their intact state (Figure 3) reveals the following main points.

1. The initial stability of the yachts is similar, i.e. the slopes of their GZ curves at zero heel angle are similar.
   In fact the Contessa 32 is initially slightly more stable with a GM of 3.1ft compared to the Half Tonner's GM of 2.78ft.
2. The Contessa 32 has a greater maximum GZ value. This is largely due to the Contessa's low centre of gravity location and large coachroof. The latter is the cause of the hump in the GZ curve which appears after 70° heel.
3. The Contessa 32 has a greater range of positive stability. The point of vanishing stability occurs at 156° compared with 117° for the Half Tonner. When a vessel heels past its point of vanishing stability it will become stable in the inverted position. Its stability whilst upside down will depend upon the slope of the GZ curve at 180°. The Contessa 32 would be less likely to remain upside down after a capsize since the slope of its GZ curve at 180° is low, and it need only be rolled through 24° in order to regain its upright stability.

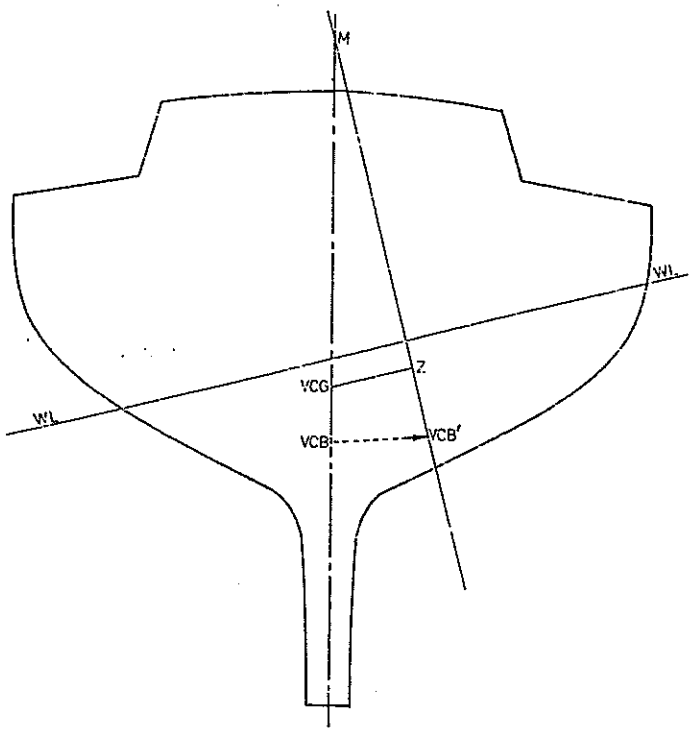
4. The energy absorbed by a yacht from a sudden gust of wind is represented by the area under its GZ curve multiplied by its displacement. The Contessa 32, with a greater displacement, and a greater area under its GZ curve at any given angle, can absorb more energy than the Half Tonner. It cannot be assumed however that the Contessa would survive a gust capable of capsizing the Half Tonner, since the work done by the wind on the yacht is dependant on the sail plan and hull windage. As we have confined ourselves to an examination of the hulls, we can draw no conclusions on this point.
The effect of flooding on the two yachts is very similar (see Figures 4 and 5) in that the angle of vanishing stability of the flooded boat is increased in both cases examined, which implies it will be less likely to remain inverted should a capsize occur.
It is likely that a capsized yacht will experience flooding, and as sinkage continues it will become increasingly easy for a wave or gust of wind to roll the boat back into a stable, upright position, since the area under the negative part of the GZ curve is decreasing.
In interpreting these data it must be remembered that the results are dependant on the following assumptions:
A. The VCG derived from the Rating certificate represents an accurate assessment of the vesel's centre of gravity.
B. When flooding, the flood water uniformly permeates the underwater space by 95%.
C. The aluminium mast is free flooding.
D. The displacement calculated using data contained in the Rating certificate correctly represents the sailing trim of the vessel, eg. no crew were aboard.

CONCLUSIONS

The Half Tonner has an initial GM of 2.78ft, a maximum GZ value of 1.61ft at a heel angle of 53 degrees, and a heel angle of vanishing stability of 117 degrees.
The Contessa 32 has an initial GM of 3.1ft, a maximum GZ value of 2.3ft at a heel angle of 78 degrees, and a heel angle of vanishing stability of 157 degrees.
For both yachts the addition of flood water increases the range of positive stability.

TABLE 1

	Contessa 32	Half Tonner
Displacement (lbs)	10112	8320
LCB (ft aft of STN 5)	-0.86	-0.84
BM (ft)	3.34	4.09
GM (ft)	3.10	2.78
VCG (ft above measured WL)	-0.75	0.65



NOMENCLATURE

LCB — Longitudinal position of the centre of buoyancy
VCB — Vertical position of the centre of buoyancy
VCG — Vertical position of the centre of gravity
BM — Vertical distance of the transverse metacentre (M) above VCB
GM — Vertical distance of the transverse metacentre (M) above VCG
GZ — Horizontal length of the righting lever

Annex 3B

Extract from the Minutes of a meeting of Offshore Sailmakers held on 20 September 1979 to discuss existing and anticipated legislation on storm sails in the light of experience in the Fastnet Race

1. *Reefs and Reefing Systems*

A suggestion that regulations may be desirable to ensure that entrants in certain categories of offshore races could reef their mainsails down to, say, 40% of the full P measurement met with universal opposition. With the reef cringle half way along the boom, the power of an end mainsheet would be doubled, creating immeasurable loads on the sail, calling for extra heavy reinforcing. It was felt that, if a rule was considered desirable, it should define residual area rather than a percentage of P. It was agreed unanimously that no rule should enforce reefs to reduce area by more than 50%.

The manner in which many boats set out on offshore races with only the lowest reef pennants rove was the subject of some discussion. The use of the third reef in such cases required the reef pennant for the first reef to be re-rove often under hazardous conditions. It was felt that the Special Regulations Committee might consider this point in connection with regulations for Category 1 and 2 races.

Attention was drawn to American regulations demanding the use of main boom topping lifts permanently rove in Category 1 and 2 races. This was unanimously opposed due to the risk of unnecessary chafing to stitching on the leech area of the mainsail.

2. *Storm Trisails*

Little experience was available at the meeting from which recommendations on trisails could be framed and discussed. It was agreed, however, that if many modern yachts carried trisails it would be a difficult and arduous task to set them. The meeting agreed unanimously that any rule concerning trisails should include the ability to set a trisail from deck level as never having to reach higher than 5' from the deck or coachroof. This implied the need for gates and junctions in tracks and extrusions on the mast of a type which were no longer fitted to modern spars. It was felt, too, that the difference in shape between a normal trisail and reefed mainsail would impose additional loads at the head of the sail which would tend to pull the head out of the bolt rope extrusion. Any additional support for the head of the trisail with a toggle or parral ball arrangement would be impractical due to its inability to pass the spinnaker pole cups and in some cases the very low lower spreaders. In the light of these difficulties, the meeting agreed that no recommendation be made for any regulations concerning trisails. If, however, legislation on trisails was considered necessary, the meeting recommended that their size should be approximately $0.18 \times P \times E$.

3. *Storm Jibs*

In the light of inconsistent reports as to whether yachtsmen had found their storm jibs too large or too small, the meeting considered the possibility of limiting storm jib size to $2 \times B \times D$ so that the area became related to the boat's inherent ability to carry sail. Whilst this formula would overcome the current tendency for I to get larger at the same time as displacement tended to become lighter, it was considered unsatisfactory to relate sail measurements to hull measurements which could only be computed after flotation tests and were therefore not fixed.

The only section of the I.O.R. restricting storm jibs was Rule 892.1, the sole intention of which was to define a storm jib for the purpose of limiting the number of sails on board. It was felt that the tendency to use a Rule as a yardstick had again occurred in this instance and should be discouraged. It was also felt that the size of a storm jib was the responsibility of the yacht's designer rather than the rule makers. For example, the storm jib on the OOD 34 had proved to be significantly too large and was also well outside the limit defined in 892.1.

In the light of the purpose of Rule 892.1, the meeting agreed that the existing definition of a storm jib remained satisfactory although some reservations were expressed as to whether a jib not exceeding $0.05\ I^2$ would be totally effective in some ¾ rig boats. It was felt, however, that the experience of the Fastnet Race did not necessarily shed any light on this matter since the purpose of a storm jib should be to enable the yacht to make progress to windward so long as it could carry any sail at all. In the Fastnet storm this windward situation had not existed.

ANNEXES C, D, AND E
TO THE REPORT OF SOUTHERN RESCUE CO-ORDINATION CENTRE
(TIMES GMT)

Details of SAR Units Involved
Fixed Wing Aircraft

	Aircraft	*Squadron*	*Time Airborne*
1.	NIMROD MK 1	201 SQN KINLOSS	9.00 HRS 14 AUG
	NIMROD MK 1	201 SQN KINLOSS	8.00 HRS 14 AUG
	NIMROD MK 1	201 SQN KINLOSS	9.20 HRS 15 AUG
	NIMROD MK 1	201 SQN KINLOSS	8.58 HRS 15 AUG
	NIMROD MK 1	120 SQN KINLOSS	9.45 HRS 15/16 AUG
	NIMROD MK 1	120 SQN KINLOSS	8.22 HRS 16 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	5.40 HRS 14 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	8.46 HRS 14 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	9.15 HRS 14/15 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	6.25 HRS 15 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	7.15 HRS 15/16 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	9.10 HRS 15 AUG
	NIMROD MK 1	42 SQN ST MAWGAN	9.02 HRS 16 AUG
			TOTAL 109.25 HRS
	FRENCH ATLANTIQUE		8.00 HRS 16 AUG
	IRISH BEECH KING AIR 6 SORTIES		18.30 HRS
			TOTAL FIXED WING 135.55 HRS

Helicopters RN

2. Total Helicopters HRS and Sorties as follows:
   WESSEX NAS CULDROSE 771 SQN
   27 SORTIES — 62.35 HRS 14/16 AUG
   SEA KING NAS CULDROSE 706 SQN
   25 SORTIES — 112.10 HRS 14/16 AUG
   LYNX NAS CULDROSE
   10 SORTIES — 20.20 HRS 14/16 AUG
   TOTAL 195.05 HRS

Helicopter RAF and Irish Air Corps

3. WHIRLWIND 'A' FLIGHT RAF CHIVENOR
   2 SORTIES — 4.20 HRS
   WHIRLWIND 'B' FLIGHT RAF BRAWDY
   7 SORTIES — 12.50 HRS
   THIS INCLUDED 1 SORTIE BY SEA KING FROM RAF COLTISHALL ATTACHED TO:
   RAF BRAWDY — TOTAL 17.10 HRS
   IRISH HELICOPTER 2 SORTIES — 4.20 HRS
   TOTAL ALL HELICOPTER HRS — 216.35 HRS

Military Surface Vessels

		Time On/Off Task
4.	HNLMS OVERIJSSEL	— /160630
	HMS ANGLESEY	— /161315
	HMS BROADSWORD	141730/161315
	HMS SCYLLA	160200/170925
	RMAS ROLLICKER	141730/161315
	RMAS ROBUST	141630/161315
	RFA OLNA	160600/161315
	IRISH PATROL VESSEL DIEDRE	

Other Known Non Service Vessels Participation

5. NUMEROUS LIFE BOATS FROM BOTH UK PORTS AND IRISH PORTS
   MV NANNA—WEST GERMAN
   DUTCH TRAWLER SIDE NUMBER SCH 6
   MV CHESTREE
   TRAWLER SANYANN
   TRAWLER PETIT POISSON
   TRAWLER MASSINGY

Naval Movements (Times Zulu)

14 Aug

0238 ANGLESEY proceeding to assist yacht CONDOR, OVERIJSSEL already assisting other yachts in area.
0851 ROLLICKER diverted to 51N 0700W ETA 1730.
0915 BROADSWORD ordered to proceed from Sound—carrying out heeling trials and requires fuel—ETD 1330.
1000 ROBUST ordered to prepare to sail.
1430 BROADSWORD sailed—making good 21 knots—assuming duty of SOSF when at Lands End 1730.
1433 ROBUST sailed—to patrol Lizard to Scillies.
1730 BROADSWORD assumed duties SOSF. ANGLESEY, OVERIJSSEL, ROBUST, ROLLICKER in search force. Ships allocated individual square areas to search.

15 Aug

0735 BROADSWORD ordered to continue search throughout day.
1531 OVERIJSSEL dead bodies recovered now in poor condition returning to Plymouth ETA 160630.
1735 CINCFLEET (151645) detached SCYLLA to join search force vice OVERIJSSEL, OLNA to join sail 1730 from Portsmouth.

16 Aug

0200 SCYLLA joined search force.
0600 OLNA arrived off Scillies.
0630 OVERIJSSEL arrived Plymouth sailing later to return Den Helder.
1315 All race yachts accounted for. Search called off—SCYLLA to remain as guardship. BROADSWORD, ANGLESEY, OLNA, ROBUST, ROLLICKER, PIAWPO.

List of Rescues by Individual Units—Helicopters

	Time	*Helo C/S*	*Survivors/Yachts*	*Remarks*
1.	*14 Aug 79*			
	0815	R77	1 TARANTULA	REMAINDER OF CREW STAYED ON BOARD
	0946	R97	2 TROPHY	5 MISSING AT THAT TIME
			3 GRIMALKIN	3 MISSING AT THAT TIME
	0948	R20	5 MAGIC	COMPLETE CREW
	1025	R21	8 CAMARGUE	COMPLETE CREW
	1130	R98	1 ARIADNE	TAKEN TO TRELISKE HOSPITAL TRURO
	1139	R20	5 SKIDBLADNER	ALL LIFTED FROM LIFERAFT
			6 GAN	
	1212	R77	6 HESTRUL	
	1400	R97	7 GRINGO	COMPLETE CREW
	1512	R30	1 FESTINA TERTIA	HYPOTHERMIA CASE
	1630	R98	1 GUNSLINGER	YACHT OK 1 LOST OVERBOARD NIGHT 13/14
	1655	R21	10 GOLDEN APPLE	COMPLETE CREW
	1722	R25	4 FLASHLIGHT	COMPLETE CREW
	1830	R96	5 ALLAMANDA	COMPLETE CREW
			6 BILLY BONES	COMPLETE CREW
	1920	R21	1 INJURED GRIMALKIN	
			1 DEAD GRIMALKIN	
	15 Aug 79			
	0130	R90	COMPLETED LAST SORTIE OF THE DAY, BUT REMAINED ON 15 MINS NOTICE.	
	16 Aug 79			
	1555	R97	RECOVERED 1 BODY, FLOWN TO TRELISKE HOSPITAL TRURO. TOTAL OF 74 SURVIVORS RECOVERED ADMITTED TO CULDROSE SICK BAY—3 DEAD.	
	17 Aug 79			
			BRAWDY WHIRLWIND RECOVERED 1 BODY.	