

HEAVY WEATHER SAILING

by

K. ADLARD COLES

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To my wife and to the crews who have shared these experiences

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Bibliography

Alone through the Roaring Forties, Vito Dumas. Adlard Coles Ltd.
Deep Sea Sailing, by Erroll Bruce. Stanley Paul Ltd.
Heavy Weather Guide, by Captains Ewin T. Harding and S. Kotsch, U.S. Navy United States Naval Institute.
Once is Enough, by Miles Smeeton. Rupert Hart-Davis Ltd.
Royal Cruising Club Journal 1961. Royal Cruising Club.
Royal Cruising Club Journal 1966. Royal Cruising Club.
To the Great Southern Sea, by W. A. Robinson. Peter Davies Ltd.
Vertue XXXV, by Humphrey Barton. Adlard Coles Ltd.
Yacht and Sea, by Gustav Plym. Adlard Coles Ltd.

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ALASDAIR GARRETT
Editor of the Journal of the Royal Cruising Club

FOREWORD

‘Any fool can carry sail on a ship—’ burst out the master, indignant at the officer of the watch failing to order sail to be shortened. But the words were spoken a century ago in the Golden Age of seafaring before mechanical propulsion drove sail from the face of the great oceans. Indeed, the shipmaster often found himself between the devil and the deep blue sea. On the one hand, his owners expected as fast a passage as the ship was capable of; on the other, a voyage account which included a long list of items of heavy weather damage—spars, sails and cordage carried away—was likely to incur the owners’ displeasure and they were often not slow to make the master aware of it. Yet one cannot fail to draw inspiration from their achievements in an age when radio, weather forecasts and all the other aids to the safe conduct of a vessel of today were unknown. Of course, the sea exacted its toll and there were casualties. Ships were posted overdue and later, after weeks of anxiety, as lost without trace. All too often the reason for their being overwhelmed remained a matter for conjecture.

The middle decades of the present century have seen the regeneration of sail and its reappearance on the oceans is now commonplace. The great square-rigger of yesterday with its towering masts and spread of canvas and a ship’s company of two score men or more has given way to tiny vessels, some with less canvas than would make a belltent and manned by only four or five souls and often fewer. Although for the most part they are amateur sailors, they are the living heirs to a noble tradition of sail, and it therefore behoves them to acquire the skills of a seaman in order to be worthy of their inheritance. It is true that science and the ingenuity of man have made great advances. Our knowledge of the behaviour patterns of wind and sea has increased immeasurably and with it the means of placing this knowledge at the disposal of the seafarer a thousand miles or more from the land. But still the might of wind and sea remains unsubdued, ready to exact a toll of those who treat them lightly.

Indeed, the sea demands definite qualities in the seafarer—certain attitudes of mind and character. Humility, prudence and a recognition that there is no end to learning and to the acquisition of experience. Humility I put first, for who would dare be other than humble in the presence of two great elements—of sea and sky and all the uncertainties which they hold for us? Prudence comes second—it is the ingrained characteristic of the professional seaman—and I

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would define it as the ability to distinguish between the risk which can reasonably be accepted having regard to prevailing conditions and the risk which must be rejected as unacceptable. Lastly, learn by your own experience and by the experience of others, for there is never an end to your learning. When some months ago my friend, Adlard Coles, disclosed to me that he was engaged upon a book about heavy weather sailing, my interest was immediately aroused, for few sailing men today have had as much experience as he of the handling of small sailing vessels in heavy weather. The book is proof of an excellent pudding and I would go further and say that it is a valuable contribution to sailing lore. It should be studied by everyone who puts to sea in a small sailing boat. Indeed, the book offers a splendid opportunity to increase your knowledge and experience and so to equip yourself to face the onset of your first gale at sea with some measure of confidence. And even if you count yourself a man of experience in these conditions, consider your own experiences in the light of those related in this book. In making the comparison, it is likely that you will be the gainer.

Last autumn I had some correspondence with Bernard Moitessier, who earlier in the year had completed a voyage from Moorea to Alicante by way of Cape Horn—a voyage of 14,216 miles in 126 days without any intermediate port of call. This was a most remarkable achievement. Moitessier explained to me the reasons which led him to select this route, but what really impressed me was the very thorough researches which he made into all the literature available about high latitudes in the South Pacific and the handling of boats in the conditions to be anticipated in those waters. Here, then, was a seaman of considerable experience demonstrating the attitude to which reference has been made—a willingness to learn from the experience of others even though these were only available through the medium of the written word. Later he described running before a severe gale which lasted six days with hurricane force gusts. Warps had been streamed astern and Moitessier found the vessel somewhat sluggish on the helm. He felt great anxiety that he might be pitch-poled by one of the enormous greybeards which carried the boat forward at great speed, the rush of water completely engulfing the hull so that only the masts were visible. Of a sudden, he wrote, he appreciated the wisdom of Dumas's technique of running free and taking the following seas at a slight angle. Immediately he cut his warps adrift and the vessel, becoming responsive to her helm, could be handled with safety. Moitessier makes it clear that he owed the survival of his wife, himself and the yacht to this decision—to *knowledge gained by reading*.

The narrative chapters in this book are fascinating and the author's conclusions are put forward boldly and clearly. Few will venture to disagree with them, but in shades of emphasis I like to think that they will be the subject of discussion and comparison among sailing men. Let me quote the words of an uncommonly articulate and experienced seaman of yesterday:

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“Like all true art, the general conduct of a ship and her handling in particular cases had a technique which could be discussed with delight and pleasure by men who found in their work, not bread alone, but an outlet for the peculiarities of their temperament. To get the best and truest effect from the infinitely varying moods of sky and sea, not pictorially, but in the spirit of their calling, was their vocation, one and all; and they recognized this with as much sincerity, and drew as much inspiration from this reality, as any man who ever put brush to canvas. The diversity of temperaments was immense amongst those masters of the fine art.”

These words were written of the shipmasters of the Golden Age—they are still true today and apply as well to the professional masters of the enormous mechanical monsters of our day and age as they do to the yachtmasters of sea-going small craft. And here let me, as a sailing man, pay brief tribute to our professional brethren—they have a fund of knowledge and experience which only a fool would disdain. For years I was engaged in the management of merchant shipping and became closely associated with many shipmasters. It always gave me the liveliest pleasure to listen to their discussions of the problems of ship-handling—there was so much to be learned from them and from the professional seaman’s attitude of mind—the coveted quality of prudence, as I have defined it, which is the hall-mark of the true mariner.

For myself, although I have been at sea on several occasions in a hard blow, I am no collector of gales. I have experienced moments of anxiety—of being laid over on my beam ends, of seeing a topmast go by the board and a headsail burst with a crack like a cannon-shot and reduced in a second to a few wisps of tattered canvas—but all this is nothing to the rich harvest of experience contained between the covers of this book, and I believe that if one can absorb this fund of knowledge and learn to apply it, one may at length be able to say, like Conrad: ‘Well, I have loved, lived with, and left the sea without ever seeing a ship’s tall fabric of sticks, cobwebs, and gossamer go by the board.’ And for many of us that, too, may be sheer luck.

The Royal Cruising Club

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PREFACE

By heavy weather I refer in this book to fresh winds of 17–21 knots (Force 5), strong winds of 22–33 knots (Force 6 and 7) and gales of 34–40 knots (Force 8) and sometimes over.

It is the gales that provide the big-game shooting of cruising and ocean racing in yachts. They provide a bit of line-shooting, too, for they add to sailing the element of risk that marks the difference between a pastime and a sport.

Gales are rarely pleasant experiences, except for the sense of exhilaration in their early stages, and of elation when they have passed. The intermediate part is often one of anxiety and tiredness, but, whether one likes it or not, heavy weather at some time or another is the lot of most of us, whether cruising or ocean racing.

I suppose that I can claim to have experienced a fair ration of hard weather, as I made my first long-distance cruise as far back as 1923. Since then, mostly with my wife or family, we have cruised along a large part of the coast of Europe from Spain in the south, Ireland in the west and north-eastward to Finland and Russia in the far Baltic. After the Second World War I started ocean racing, which took me on Bay of Biscay and Fastnet Races and farther afield in the Bermuda and Transatlantic events, and I have been involved in most of the heavy weather R.O.R.C. races since 1947.

From these experiences I have made a selection of gales, or near gales, from which something useful was learnt. The early ones make more colourful reading because they occurred in my apprenticeship to heavy weather sailing. It would be wrong to leave them out, because they illustrate the fact that gales appear more serious when one is not so accustomed to them, especially if the boat is sailed short-handed, as is normally the case when family cruising.

My later experiences were gained in ocean racing. This provides a good school in which to acquire knowledge of heavy weather sailing, as the races are started and continued regardless of weather conditions. Hence one gets “caught out” more often than would otherwise be the case, and one also learns how much punishment a yacht and her crew can stand up to. Where a number of yachts are involved in gales it is possible to compare experiences with one’s fellow-competitors which, together with anemometer readings and meteorological reports, enable fair assessments of the weather to be arrived at.

With some exceptions, the heavy weather experiences which I record are

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limited to the "common or garden" varieties of gales, associated with the normal depressions or troughs passing through, which are the occasional lot of the ordinary amateur sailor. In order to broaden the picture I have added major gales met with by other yachtsmen. In Chapter 11, for example, I record the experiences gained when the ocean-racing fleet was caught out in a Force 10 storm in the English Channel. Many valuable lessons were learnt from the report prepared on this by a special committee appointed by the Royal Ocean Racing Club. For a similar gale in ocean racing on the other side of the Atlantic, I refer in Chapter 14 to the experiences of the American yachts in a Bermuda Race gale. From gales I lead up to survival storms and hurricanes of a severity exceeding my own experiences, but which have to be reckoned with as possibilities on the western side of the Atlantic and elsewhere.

The method which I have adopted is to give a description of each gale, followed by observations and conclusions drawn from it. These express my own views, but Mr. Alan Watts (who is both a meteorologist and a yachtman and is the author of *Wind and Sailing Boats*) has contributed a chapter on the Meteorology of Depressions. In this he reviews some of the principal gales and the meteorological conditions causing them. In particular his analysis of the Channel Storm of 1956 will be found most informative. The interesting appendices on *Wave Theory and Fact* by Captain C. Stewart, Extra Master, and *Freak Waves* by Mr. L. Draper, M.Sc., throw a more scientific light on many occurrences described earlier in the book.

Most of the photographs are my own. They were taken in following winds of about 30 to 35 knots, Force 7 to 8 on the Beaufort Scale, gusting perhaps 40 to 50 knots. I have found it impossible to obtain pictures of the sea when going to windward in rough weather because of the spray, and, as it chanced, most of the major gales I have experienced occurred at night or in appalling visibility, so no photography was possible. Nevertheless, although unimpressive, the pictures are at least practical in illustrating the kind of seas to be expected in ordinary gales or near gales. To these I have added photographs from other sources of seas which are not ordinary, and of which you and I would prefer to have no experience.

An unexpected sidelight thrown by this book reveals the remarkable developments in the efficiency of the modern small yacht in her equipment and in her sea-going ability. More and more circumnavigations and long voyages are being accomplished by smaller and smaller yachts. Passages across the Atlantic have become almost a commonplace. Even the extremes of heavy weather of the Roaring Forties and Cape Horn are being sought by adventurous single-handlers such as Sir Francis Chichester, aided by the development of self-steering.

Parallel with the development in small yacht voyaging, historic changes have occurred during the period covered by this book and in the attitude towards

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small yachts in ocean racing. It was in 1949 that for the first time a small Class III yacht carried on beating to windward throughout a severe gale without heaving-to. In 1950 small yachts were admitted for the first time in a transatlantic race organized by the Royal Ocean Racing Club, but it was not until 1954 that they were accepted, albeit rather reluctantly, in the Fastnet Race.

Six years later the Royal Western Yacht Club sponsored the start of the first east to west single-handed transatlantic race. In 1963 the windward performance of three small yachts during a short spell of heavy weather in the Fastnet Race confirmed the R.O.R.C. in its conclusion that in the last quarter of a century the small yacht had improved her efficiency more than the big one. The time allowances in the handicapping system were altered to help the larger yachts, marking the first change in the time scale since its introduction in 1926. The alteration may be said to have been rather a back-handed compliment, but it marked an epoch in the evolution of the small yacht, hitherto regarded as inferior to larger in heavy weather.

INTRODUCTION

WIND AND WAVE

Opinions on wind strengths vary greatly according to the experience of the observer. Judgement is also influenced by psychological reasons. For example, bad weather and heavy seas appear much worse when viewed from the deck of a 4-tonner than they do from a larger yacht. A man and his wife cruising alone will find a gale more impressive than it is for a tough crew of five or six men in an ocean racer—for apart from anything else, a light crew will tire more easily. Finally, everybody is influenced by the particular weather conditions. If the wind is Force 6, 7 or 8, but the weather is clear and sunny, its strength is often underestimated, especially when running downwind. On the other hand, if the gale is in its early stages with driving rain, bad visibility and ragged clouds chasing across the sombre sky, there will be a tendency to exaggerate the wind force, particularly if the crew is exhausted or seasick or if the yacht has been allowed to get out of order, with ropes adrift on deck and the disorder of misplaced articles and unwashed dishes below.

Even experienced owners make errors of judgement, because it is impossible to estimate with any exactitude how high is the force of the wind. A skipper may be able to assess Force 5, Force 6, and even Force 7 from experience, and in relation to the amount of sail his boat can carry, but sustained winds of a genuine Force 8 and over are so rare that he may have to think back several years to find anything as a yardstick for comparison. To put it bluntly, dogmatic statements of high wind forces are pure guesswork, unless confirmed by a masthead anemometer, with the appropriate adjustments between apparent and true wind or by the Meteorological Office.

A number of gales recorded in this book were major gales which made headlines in the newspapers at the time, but I am afraid the reader looking for big game in the way of wind forces will be disappointed at the low figures which I give. The reason why yachtsmen and yachting authors often overstate wind forces is that they are impressed by the gusts more than the lulls which result in a lower average velocity. Alan Watts tells me there is a scientific reason for this, because a lull (a transitory and sudden lack of wind speed) where the wind drops, say, to 10 knots for 1 second will travel some 32 ft. (the same length as many small yachts) when the mean wind is 36 knots. Thus a lull will be felt only for a brief instant and not last long enough appreciably to reduce the yacht's angle of heel before the wind rises

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again. A lull may thus not be noticed at all, because it passes too quickly.

On the other hand, as the air pressure varies as the square of the velocity a 40-knot gust of the same duration as the lull cannot fail to be observed as it delivers sixteen times more heeling punch. Thus it is natural for the yachtsman to be most influenced by the gusts and squalls. It is these that make the impacts on the boat and which masts and sails have to stand up to. A gust of 64 knots or over can dismast a yacht or knock her down flat on her beam ends as effectively in a few seconds as in a prolonged blow. In fact, a wind of mean Force 6 accompanied by violent gusts and squalls is more dangerous to yachts and dinghies than a relatively steady Force 7. Gusty winds create far worse seas than steady gale-force winds do, and often are the cause of abnormal seas, particularly when accompanied by a shift of wind as a cold front goes through. It is thus sensible to describe a bout of heavy weather as say, "a gale gusting up to 50 knots", but it may be entirely misleading to call it a "Force 10 gale", because the force on the Beaufort notation is lower, as it is the *mean* and not the *maximum* force. In a genuine storm of Force 10 on the Beaufort notation the gusts might well be up to the 64 knots which, if sustained, would be hurricane force.

However, Alan Watts in his book *Wind and Sailing Boats*, considers that a fairer estimate of the strength of the wind as experienced by a yacht is what he terms "the yachts' mean wind", which is the average of the mean speed on the Beaufort notation and the mean velocity of the gusts. He tells me that in his opinion, because of the relatively small size of yachts compared with ships, a "yachtsman's gale" could be defined as wind of mean speed of 25-30 knots gusting regularly (i.e. every few minutes) up to 40 knots.

Nevertheless, in this book I prefer to express the wind forces at their *mean* velocities on the Beaufort notation. This scale is the official one which is used by the Meteorological Office, both for its weather forecasts and by shipping generally. And it must be remembered that ocean-racing and ocean-voyaging yachts experience precisely the same winds as larger ships. My estimates are based on long experience coupled with considerable research, aided by the Meteorological Office in digging out records as far back as 1925.

One difficulty which I found in the assessment of wind force is that gales are rarely uniform in character and are often very localized. For this reason, a yacht can meet exceptional local weather conditions and severe storms that are missed by other yachts in her vicinity, perhaps only 30 or fewer miles distant. This was particularly evident in the Channel Storm of 1956 in which the boats involved experienced widely different conditions of wind and sea. The reasons for this are explained in Alan Watts's analysis of the storm in Chapter 21.

The height of waves is another thing which is often overstated by yachtsmen and indeed sometimes by professionals. Yachtsmen usually measure the height of big seas in relation to the known height of the mast, maybe half, two-thirds,

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or masthead. This can be checked independently by the crew, and the average will give an honest expression of opinion. However, when the estimate is compared with the sea disturbance scale, taking into account wind force, duration, and fetch, it will be found that the height of the waves cannot possibly be what they appear. I take the real height of a wave to be three-fifths the measured height, but I have reluctantly come to the conclusion that this estimate is on the high side and that the real height is probably only about half the apparent height. I cannot explain why this is so, but oceanographers state that it is impossible to judge the height of waves just by eye. It is a matter of optics.

While I can to a great extent prove or disprove wind forces with the aid of Meteorological Office statistics, or of recent years by masthead anemometer, I cannot provide any evidence on the height of waves. I have therefore, with few exceptions, omitted estimates of height, as it is as upsetting to the yachtsman to question his big wave as it is to question a fisherman's big fish. I have sometimes seen waves in a Force 7 or 8 gale reported at 40 ft. Waves of 35 to 40 ft. may be encountered in a West Indian hurricane, but not as a rule, I am thankful to say, in an ordinary gale.

On the other hand, there are occasional abnormal waves which attain a height far in excess of the normal run of the seas. Such waves can attain heights as much as 100 ft. in violent ocean storms, and, as I shall show, the same phenomena can occur on a lesser scale even in near gales as low as Force 6 and Force 7. In this book I call such seas "freak" waves. The pedantic will say that they are not "freak" waves, because there is a scientific explanation for them—see Appendices 1 and 2. However, in the absence of a better term I use the word "freak" and I would point out that Mr. Draper does the same in the appendix he has contributed. What is good enough for an oceanographer is good enough for an amateur like me. I describe waves as freaks when they are abnormal in height, size or shape, whether caused by synchronization or crossing of different wave trains, or by wind shifts, frontal squalls, tidal streams, currents, shoals or several of these factors combined.

While on the subject of waves, I should add that to the oceanographer a wave is a wave, but to the seaman, a wave is a sea. As I am neither fish nor fowl, I use the word which seems most appropriate in the context of what I am writing.

Finally, the following definitions may be useful:

Observations at Shore Stations. The mean wind force as recorded by a station ashore is taken at the average *over the past hour*, during which a higher force may have been attained for part of the time. The wind as recorded by a station ashore is not necessarily representative of conditions over the open sea. The wind over the sea is generally stronger than on the coast, where the speed is likely to be diminished by friction and turbulence. This is explained by Alan Watts in Chapter 21 on the Meteorology of Depressions.