



## Understanding anchors and their bad habits

For unreliable holding grounds, Ken Endean suggests a new approach to anchor testing

**H**ere's a philosophical question: imagine that two types of anchor – we'll call them A and B – are being tested for use on a particular size of yacht. For this evaluation, it is assumed that the maximum force imposed on the anchor would be 200kg in a Force 8 wind and 400kg in a Force 10.

Here are two tests. In the first, each anchor is taken to a typical 'good' anchorage, a bed of moderately compact sand, and the horizontal force on the cable

is increased until it just starts to drag. Anchor A resists a force of 600kg and anchor B achieves 800kg.

The second test is in an area with a sea bed of mixed materials: sand, mud, rock, weed, cobbles, etc. Each anchor is lowered in ten different places and subjected to a horizontal force of up to 200kg. Anchor A holds the 200kg force in nine places and drags freely in one. Anchor B holds 200kg in eight places and drags freely twice. Now for the question: which is the best anchor?

For my boat, I would choose anchor A,

reasoning that both are adequate on good holding grounds but in normal cruising use, when we are often unsure about the composition of the sea bed, anchor B is twice as likely to drag. However, the majority of anchor evaluation exercises only undertake the first test and are therefore likely to come to the opposite conclusion. This may explain why some yachts drag their anchors in less-than-extreme conditions: because their anchors are only reliable on perfect sea beds.

It is tempting to regard the forces in the first test as representing safety factors of  $600/400 = 1.5$  (for anchor A) and  $800/400 = 2.0$  (for anchor B). However, those apparent safety factors only relate to uncertainty in the wind force. The probability of experiencing a wind stronger than Force 10 is fairly low, so the corresponding risk of dragging on sand is low for both anchors – and such winds are usually forecast in advance, so there will be a chance to adopt extra precautions.

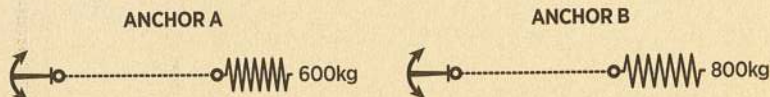
### Doubts about holding

On the other hand, variations in the sea bed material are much more probable and the consequences are demonstrated by the second test. An anchor that might suddenly release its hold and drag freely would be a significant risk in all weathers, whenever there is uncertainty about the properties of the holding ground.

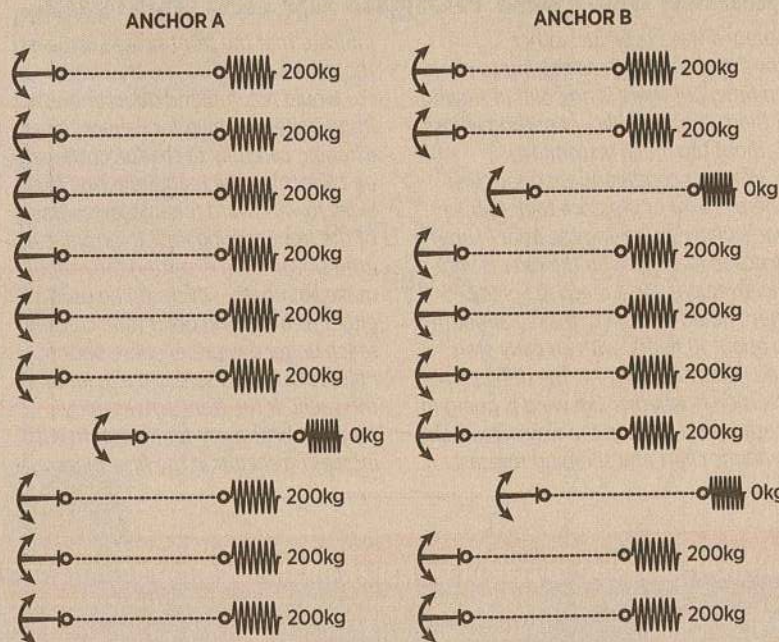
A yacht skipper could aim to use only well-trieved anchorages that are known

### TESTS ON ANCHOR TYPES A & B

#### First anchor test: Maximum resistance in sand



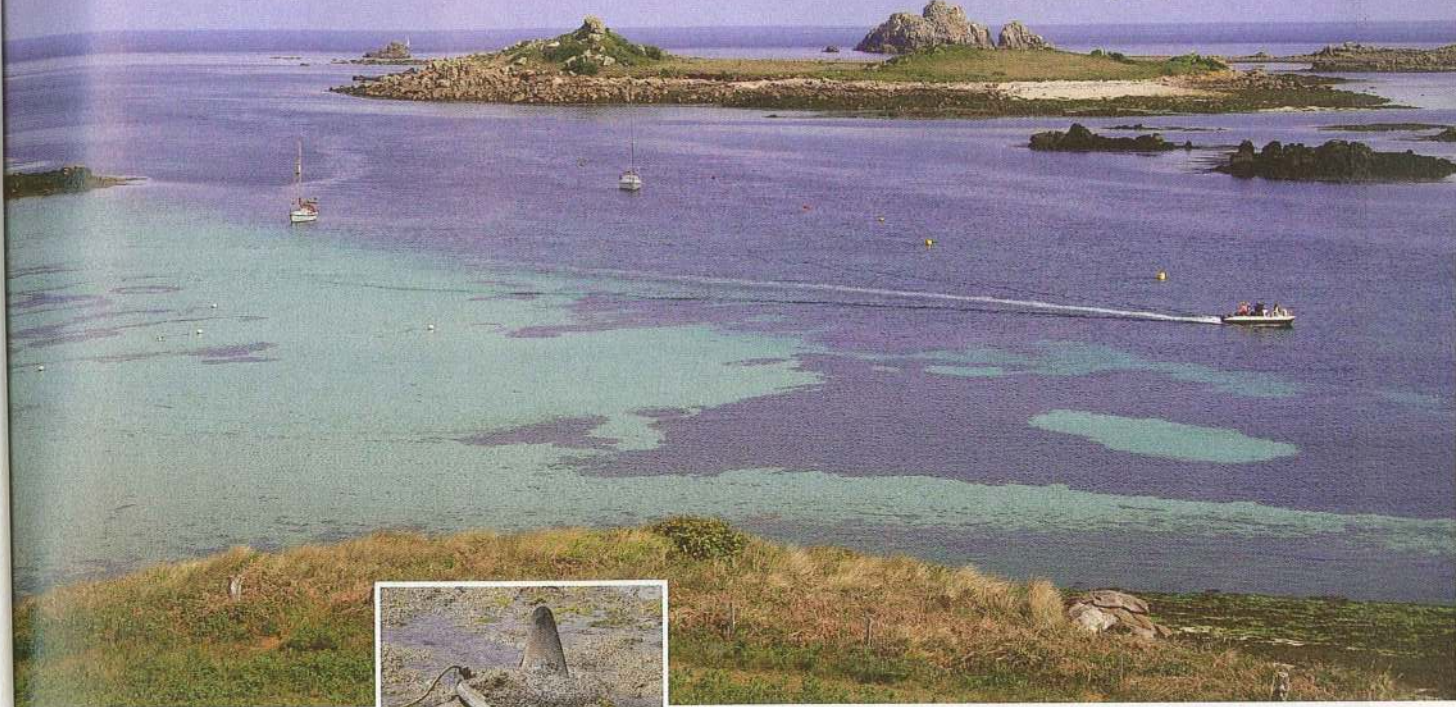
#### Second anchor test: Pull of up to 200kg on mixed seabeds



If an anchor collects weed, its holding power is likely to be reduced

ALL PHOTOS: KEN ENDEAN

*Sand makes for a good holding ground and looks green under shallow water, but in darker areas the holding may be unreliable*



**A hinged-plough blade digs itself into the sea bed with its edge before rotating its point downwards**

to have good holding qualities. It is also possible, when sailing on clear water, to identify clean sand by looking for a patch of light green between darker areas of rock and weed. Even so, for many sailors there will be times when they have to anchor in silty water, or deep water, or after dark, and in places ignored by the pilot books. Will the hook go down on to a nice bed of sand or on a nasty mixture such as underwater scree and leathery kelp? To deal with a variety of sea beds, some yachts carry a modern anchor, for good holding conditions, and a Fisherman anchor for everything else. The holy grail of anchor design is a single anchor that will do both jobs.

Back in the 1980s, the RNLI carried out tests to compare a selection of anchors on widely varying sea beds, including sand, shingle, mud, clay, weed and broken rock. The anchor types included the Fisherman, CQR and Meon (similar to a Danforth), which were well established designs, and also the relatively new Bruce and Delta. The result was a clear win for the Delta, which soon appeared on the foredecks of many lifeboats. It not only achieved greater holding power in most tests but also – possibly more important – displayed an ability to grapple effectively with the more treacherous materials.

In 2001, after decades of sailing with

CQR anchors, I changed to a Delta and was immediately struck by its willingness literally to get stuck in. In recent years, several newer anchor designs have demonstrated higher holding capacities than the Delta on uniform beds of sand or mud, but I am reluctant to change again unless I can be sure that I will not lose out when anchoring on unidentified materials.

For an intelligent assessment of an anchor's performance, we should certainly check that it can resist a large force in good holding conditions, but it is also vital to identify anything that could induce it to suddenly lose its grip. Most anchor types exhibit bad habits in particular circumstances, but those circumstances vary from anchor to anchor.

**Known bad habits**

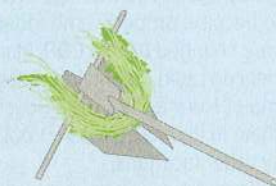
In the absence of comprehensive tests, the bad habits of different anchors can only be identified by observing them in service. It is quite educational to walk around a drying anchorage, at low tide, to examine how anchors have set – or failed to set.

The main drawback of the CQR and similar hinged-plough anchors is that the blade initially lies on its side and tries to scoop its way into the surface before gradually rotating its point downwards. If the sea bed has a hard

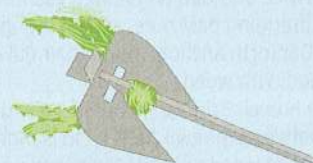
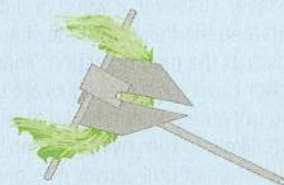
**Some anchors are easily disabled by weed**



CQR with weed around the blade



Danforth with debris between twin blade and shank – if it turns over, the blade may be jammed with points upward, as shown below



The Brittany, with widely-spaced points, is more tolerant of weed

GRAPHICS: MAXINE HEATH

ALL PHOTOS: KEN EIDEAN



A Danforth-type anchor may turn over if the cable swings to one side and makes it rotate about its stabilising bar



Britany anchors, and derivatives such as this FOB, are fairly tolerant of thin weed, but may corkscrew under very high loads



The Fisherman anchor sticks one fluke in like a spear, but it is only a small spear



In thin sand over hard clay, this Delta was unable to dig in but dragged slowly until its point lodged in a clay crevice

crust, or bears a layer of loose material, the blade will be reluctant to dig in and may skid for some distance, probably collecting weed (see page 35) so that it is even less likely to become properly embedded. Before we changed from a CQR, Mary and I experienced rapid downwind drifts on firm sand at Normandy's Utah Beach, on loose shale in Plymouth's Barn Pool, and at many other locations.

In Danforth types, many of which have other proprietary names, the hinged flukes are sharply pointed and quite capable of penetrating a hard or loose surface layer. However, if weed or debris gets between the flukes and the shank it may obstruct the hinging action. Then, if the anchor turns over, the flukes are left pointing upwards, unable to dig in, and it is quite likely to turn over if a change in the direction of pull causes it to pivot around one end of its stabilising bar. We have twice boarded unmanned yachts that were dragging past ours, and on lifting their Danforth anchors found their flukes jammed with weed.

The French Brittany anchor has a wider gap between the two flukes and is more tolerant of weed. It tends to misbehave by 'corkscrewing', but this generally occurs under high test loads – possibly higher than it would experience in service. It is a

fairly good all-rounder, carried by some French lifeboats and even favoured by Breton *goémoniers* (seaweed dredgers).

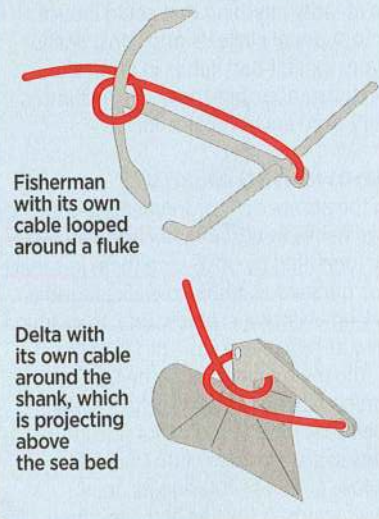
The Bruce possesses some of the rock-hooking qualities of a grapnel and many years ago Rod Heikell commended it as a reasonably foolproof anchor for Mediterranean charter boats. However, its three-fingered 'hand' struggles to penetrate stringy weed, such as eel grass,

which can bunch between the fingers. It has also been known to clutch large lumps of rock and I know a mooring contractor who found that Bruce anchors retained big chunks of stiff mud, which then prevented them setting properly.

The Fisherman and the Delta share a bad habit (see page 36). The former can be fouled by its own cable wrapping around the upper fluke and the same thing may happen to the Delta if it is only lightly set, with its shank projecting above the sea bed. I made that mistake once and the cable lassoed the shank, but now I know better and always make a point of digging the anchor in firmly, which brings the end of the shank down against the bed.

In my experience, the Delta's principal weakness stems from its principal virtue, which is that it almost always digs in with its point. This enables it to poke through thin weed, hook into crevices and wriggle into beds of rubble, displaying some of the spear-like qualities of the traditional Fisherman anchor (see page 37). However, to resist a high lateral force in sand or mud, a sharp point needs to be part of a large blade or fluke, and the Fisherman's small flukes limit its resistance in soft material. Similarly, when the Delta is in a thin layer of soft material over a hard stratum its dragging resistance is reduced, because

**Anchors fouled by their own cables**



*Most anchor tests replicate a high wind and a sandy sea bed, as here in Scilly's Green Bay, but many yachts drag in light winds because their holding is less reliable*



the point-down blade cannot bury itself fully to generate resistance with its whole area. Even so, I am inclined to forgive that bad habit because our Delta never lets go suddenly, but usually drags slowly while fighting for a grip, giving us plenty of time to decide on an alternative anchoring position. The Kobra anchor has an almost identical shape and behaves similarly.

**Suspected bad habits**

Some new anchor designs, such as the Spade, Rocna and Manson Supreme, have shown very high holding power in soft materials and have plenty of enthusiastic owners, with many endorsements on web forums. Also, some tests have been carried out in several locations. However, judging from the published photos, all those test sites looked pretty tame, while none of the forum reports seem to feature really treacherous conditions.

Intriguingly, the Australian Sarca Excel anchor resembles a tweaked Delta and has demonstrated greater holding power in tests, but it is not marketed in Europe. Most of the other new anchors have concave blades or rollbars, or both. A concave shape, scooping itself into the sea bed, will naturally 'grab' more material than a spear shape, which is inclined to cut through it, but anyone who has tried digging sticky soil with a curved-blade shovel will be aware that soil can adhere to its surface, when a flat blade is more suitable. I have seen concave-blade anchors bring up pillows of thick mud and one well-known anchor failed a test in stiff mud, when a large clod stuck to its surface and prevented it from re-burying after breaking out. That was reminiscent of the mooring contractor's difficulties with the

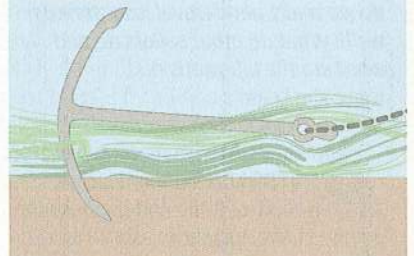
concave flukes of the Bruce. Rollbars do not appear to have any negative effects in sand or mud, but they could gather weed, and I am suspicious of their interaction with loose stones, because a large stone trapped against the rollbar could hinder the anchor's penetration, and the bar might also cause an anchor to be trapped under boulders. Also, an anchor's ability to penetrate through weed is likely to depend upon how far the point of the blade projects beyond its junction with the shank, and in some of the new anchors this dimension is quite short.

Of course, those suspicions may be completely unfounded, but I have seen nothing to disprove them, and I am reluctant to indulge in trial and error when all I really want is freedom from worry and an untroubled night's sleep! Our present anchor has held us safely in many different conditions: on deep mud with the consistency of gritty custard, on a bed of shattered Dorset limestone, on loose weed over sand, on muddy shingle in a Force 10, and even on a smooth, wave-cut chalk ledge off Sheringham, where we weighed before dawn and bright marks on our anchor and chain looked like luminous paint in the half light. We were seriously impressed because the white smudges of chalk were almost as slippery as grease.

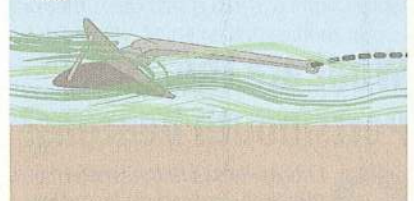
This is not a eulogy for the Delta. Rather, I am suggesting a change in anchor testing methods. I would consider a different anchor that combined higher holding power in sand and mud with reliable tenacity on other materials, but I want proof of its performance on every kind of sea bed. I want to know, with a fair degree of certainty, whether it has any bad habits. Anchor testers take note! ▲

**Typical behaviour of some anchors on loose weed**

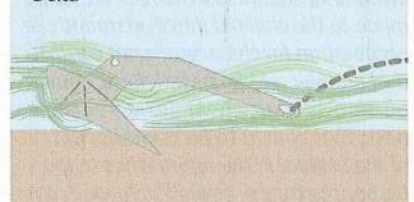
Fisherman



CQR



Delta



Bruce

