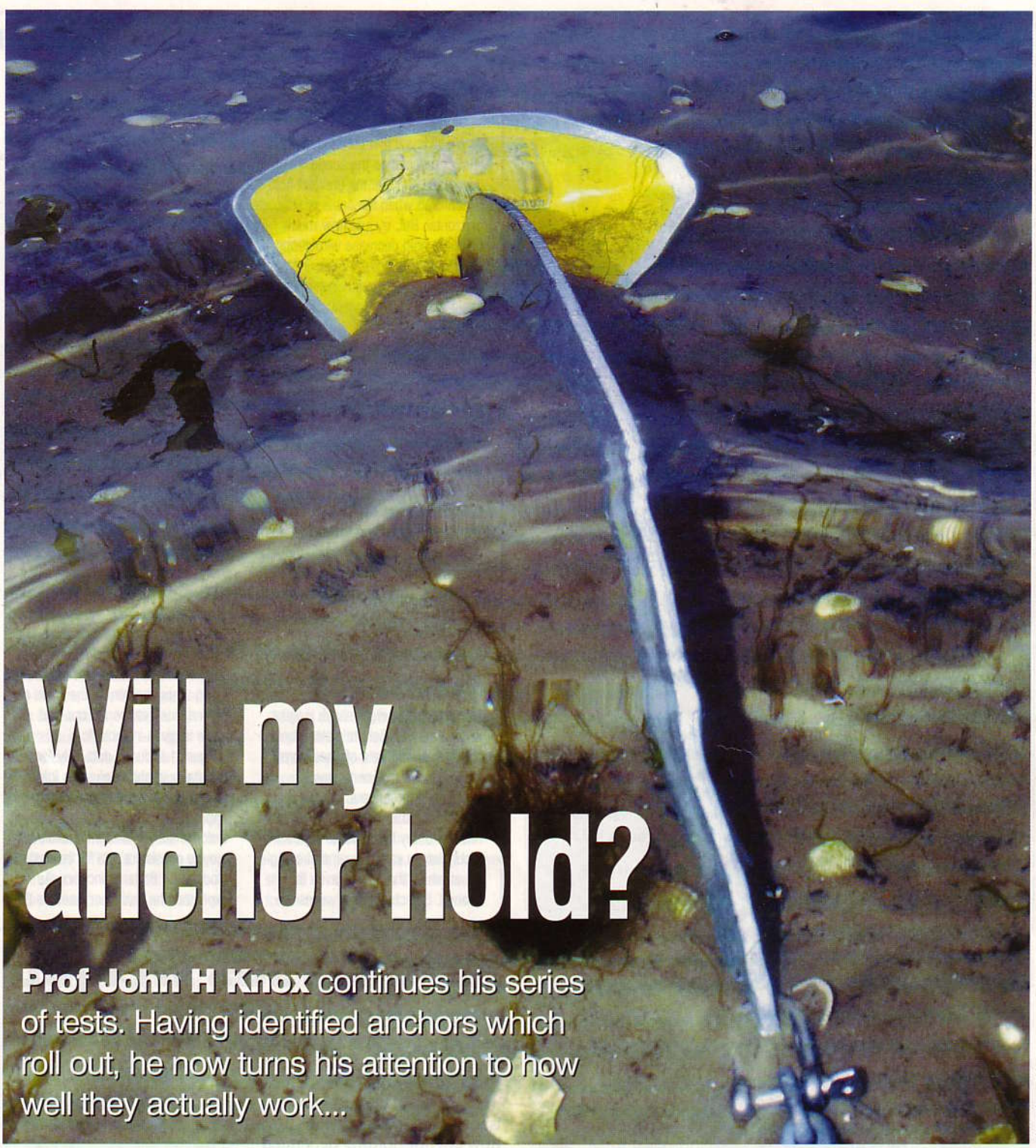


Will my anchor hold?

Prof John H Knox continues his series of tests. Having identified anchors which roll out, he now turns his attention to how well they actually work...

Photo: Laura Kerr

THERE are many reasons why some anchors tend to roll but this month I show how the holding of a roll-stable anchor depends upon scope, anchor weight and the rate it's dragged through the seabed.

For those who missed last month's article, I'd simply say that my experiments were conducted in a shallow tidal pool at Longniddry beach on the shores of the Firth of Forth, where the bottom was medium-hard sand. Anchors were dragged through the sand by a 5 or 10-part pulley system that enabled forces of up to 700 kg to be applied at the anchor. The cable was either nylon multiplait or, for the heavier anchors, wire plus ¼-inch chain. It passed over a pulley held one metre above the sand by means of a pyramidal frame. The scope, S/D (S=cable length from pulley to anchor, D=the height of the pulley above the sand), was therefore equal to the length of the pulling cable from the anchor to the pulley, measured in metres.

How we measured them

The tension on the anchor cable was measured using ANCHORWATCH, a device invented by Kevin Scott and myself which uses a load cell to measure forces up to a ton. The CQR type, HiBlade, Delta, Brittany, Danforth, Danforth copy, Bruce, claw and SPADE anchors tested ranged in weight from 1 kg to 15 kg.

ABOUT THE AUTHOR

■ John Knox has had a lifelong interest in boats and in the 1960s became interested in kayaking while on sabatical leave in Utah. He took to dinghy sailing in the 1970s, first in a Graduate and later an Albacore dinghy. In 1983 he bought *Myfanwy*, a Hustler 35, and has sailed extensively on the west coast of Scotland.

IN CASE YOU MISSED PART 1

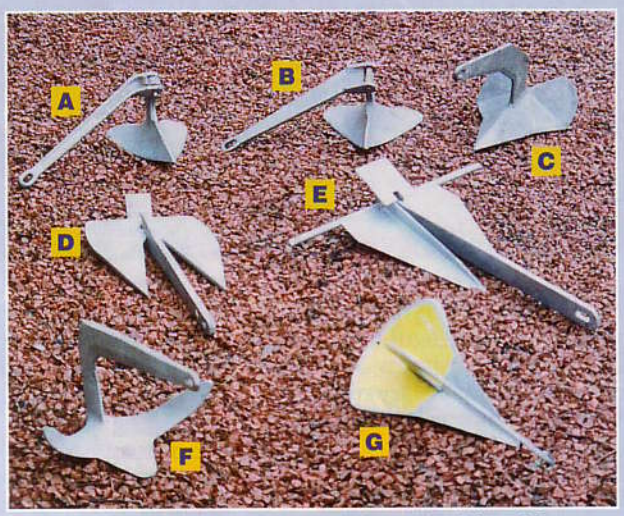
The story so far...

Photo: Laura Kerr

The SPADE gave the best results in last month's test

IN my previous article, I looked at the roll stability of some commonly used yacht anchors. The results were surprising and disturbing. The Brittany (6 kg) rolled out when dragged some five shank lengths and when veered. The plough (10 lb) also behaved in the same way, while the plough (35 lb) rolled out consistently when veered but not when dragged straight. I concluded that, under stress, these anchors could drag – with serious consequences for a yacht and her crew. The HiBlade, Delta, claw and SPADE anchors, on the other hand, were stable to rolling, both when dragged straight and when veered, with the SPADE giving the best hold. The Danforth and copy anchors were somewhere in-between. It was difficult to set symmetrically, but when it did, it gave a remarkable hold. However, when veered, it tended to roll out – though that wasn't inevitable. It was hard to lift, however. This month, I consider how the holding of roll-stable anchors depends upon the scope of the cable, the anchor weight and the rate at which they are dragged through the seabed.

The anchors...



Anchors are listed by name, claimed weight, actual weight and the surface area of the fluke

A Plough 10lb – 4.8kg, 480 sq cm; **B** HiBlade 10lb – 4.7kg, 510 sq cm; **C** Delta 6kg – 6.7kg, 620 sq cm; **D** Brittany 6kg – 6.2kg, 560 sq cm; **E** Danforth copy 6kg – 6.2kg, 610 sq cm; **F** Claw 5kg – 4.9kg, 300 sq cm; **G** SPADE 6kg – 5.1kg, 460 sq cm

THE FIRST TEST

Hold versus scope

■ We all know that the hold of an anchor reduces as the scope decreases and that the greatest hold is achieved when the cable is horizontal. But, by just how much does the hold decrease with scope, and do all anchors perform similarly? Although one of the functions of chain is to keep the cable close to horizontal, as soon as there's real tension, it runs more or less straight from the anchor to the stemhead. Consequently, it leaves the anchor at a finite angle to the seabed. This is the normal situation when you're worrying whether your anchor will hold. In all my experiments, the cable was straight between the anchor and pulley, whether it was nylon or wire. So, the scope (S/D) was simply related to the angle (q) that the cable makes with the seabed, by the equation: *S/D = 1/Sin q*. I also made sure the anchors were launched and initially pulled at the scope required for any particular test. So, when working at a scope of three, I'd launch the anchor at this scope, and pull it at the same scope for six to eight shank lengths in order to establish its plateau hold. A standard drag rate of about three centimetres per second was maintained throughout. This is about 1/20 knot, so is extremely slow relative to any boat speed. Figure 1 plots plateau values against the angle (q) at which the cable leaves the seabed. Selected scope values are also shown by the vertical lines in the figure. For clarity, the data points for each anchor are displaced vertically by an amount given by the value of Z. The relation between scope and angle is given in Table 1.

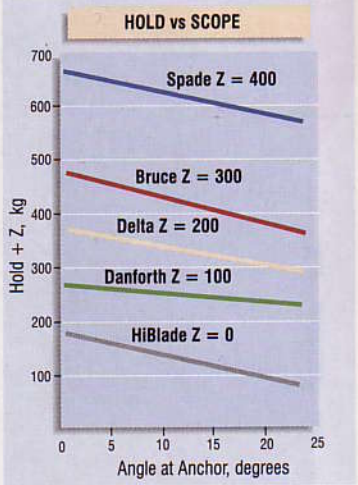


FIGURE 1 Dependence of hold upon Scope for 5-7 kg Anchors and 2 kg Danforth, ploughing at 3 cm/sec

Figure 1 includes data only for the roll-stable anchors, plus the 2 kg Danforth which was stable when engaged symmetrically. Unfortunately, it was impossible to provide consistent data for the unstable plough and Brittany anchors. As expected, the hold decreased as the

Hold versus weight

■ The weight of an anchor required for a given yacht obviously depends upon its size. But the question of just how the two should be related is unclear. I was able to test how anchor holding depended upon the weight using the roll-stable claw and Delta which I had available in a range of weights from 1 to 16 kg. The results are shown in Figure 2. The anchors were pulled at a scope of five. The weights used for plotting the data are their true ones rather than those quoted by the manufacturers. Within the limits of error, the holding power at a scope of five is proportional to the weight for these types of anchor.

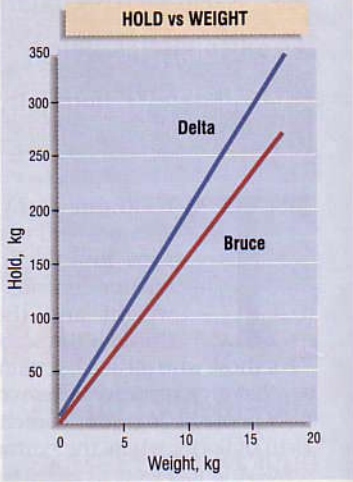


FIGURE 2 Holding power was proportional to weight at a scope of five for these anchors