Independent Anchor Performance Testing

A compilation of the credible comparison tests of recent years

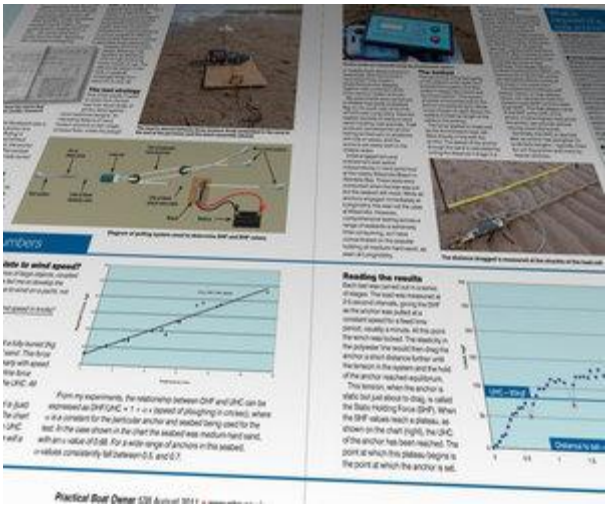
Magazine small boat anchor testing is of typically poor quality and has a commensurately bad reputation. Much of it unfortunately amounts to nothing better than noise: terrible test designs, total absence of controls, lack of repeat trials, and even commercial or nationalist biases generate only worthless data points that serve to confuse and distract. Anchor manufacturers and loyal adherents to a particular type pick up on one point or another and broadcast it to the world, horribly muddying the waters of the discourse until the innocent boater cannot trust anything he reads.

Writers tend not to possess science or engineering backgrounds and lack understanding of what would constitute valid testing, much less reasonable analysis of the resulting data. Even if the publication boasts qualified personnel, testing of an acceptable standard is expensive and unlikely to ever become an activity a magazine will engage in, as will attest those struggling writers familiar with the low monetary value assigned by publishers to their hard work. Such organizations will never fund adequate tests, as the three- or four-figure worth of a six page article can never bring a financial return on the five- or six-figure cost of conducting the required project.

While blemished, the picture is not universally bleak. The tests below manage to present credible data according to two very different agendas. At one end of the spectrum is the West Marine testing, stemming from the world's largest marine retailer's desire to test the products it distributes. Although obviously commercial, WM's testers at least uphold the appearance of brand-neutrality, and indeed their bestselling anchors (at the time) are those with the poorest results. And almost the very opposite, John Knox's work in the UK's *Practical Boat Owner* is a continuation of a longtime obsession with anchors, much more a labor of love than any mercenary earning of a paycheck by a journalist turned "tester" for a day.

These tests are therefore overviewed here according to their scientific credibility, a standard which leads to the rejection of a number of recently published articles. Tests are also restricted to those which include the Rocna, and to those which have no connections to any anchor manufacturer.

Practical Boat Owner (John Knox) August 2011



PBO August 2011

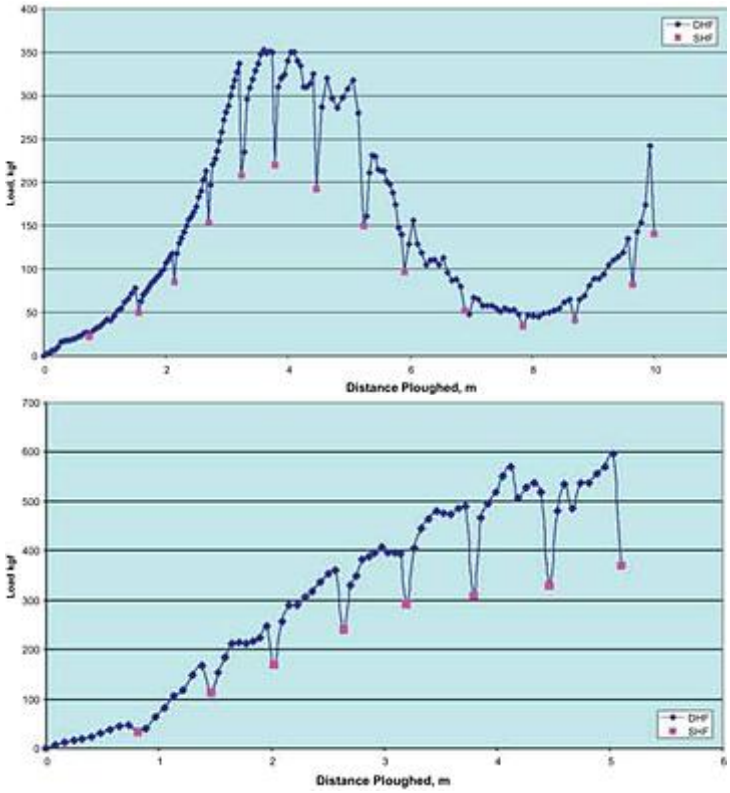
Scotsman Professor John Knox has a history of anchor testing, write-ups of which have appeared in *Practical Boat Owner* before. Introducing this article, he describes his experience tenuously anchored to a CQR in the Inner Hebrides during a storm in 1988, and how this led to the testing of anchor types in order to best appraise performance.

Knox examined eight different anchor types, with the addition of multiple sizes of a few. He used tidal pools on sand flats on the west coast of Scotland, using a custom rig to exactly control pull forces and speeds.

Test design

Anchors ranged from small 5 kg (11 lb) to medium 15 kg (33 lb) examples. Unlike the dump-and-pull technique frequently used in other tests, Knox used a carefully designed rig powered by a winch and purchase system with a slightly elastic line. The anchors were pulled with intermittent pauses, allowing the candidate to rest and settle according to the pull maintained by the elasticity of the "rode". This provided a figure for what Knox labels SHF ("Static Holding Force"). This process was repeated until the figures for SHF had leveled off and were judged unlikely to increase with further pulling – this final plateau dictated the anchor's recorded holding power.

This methodology provides graphs of the anchor's intermittently recorded SHF figures over time during each set, the shapes of which are also of direct interest. A poor design will give fluctuating and unstable SHF numbers – or an anchor that sets poorly and with shallow depth will quickly hit its plateau, while a good performer will show a steady rise stabilizing only at a relatively high force level.

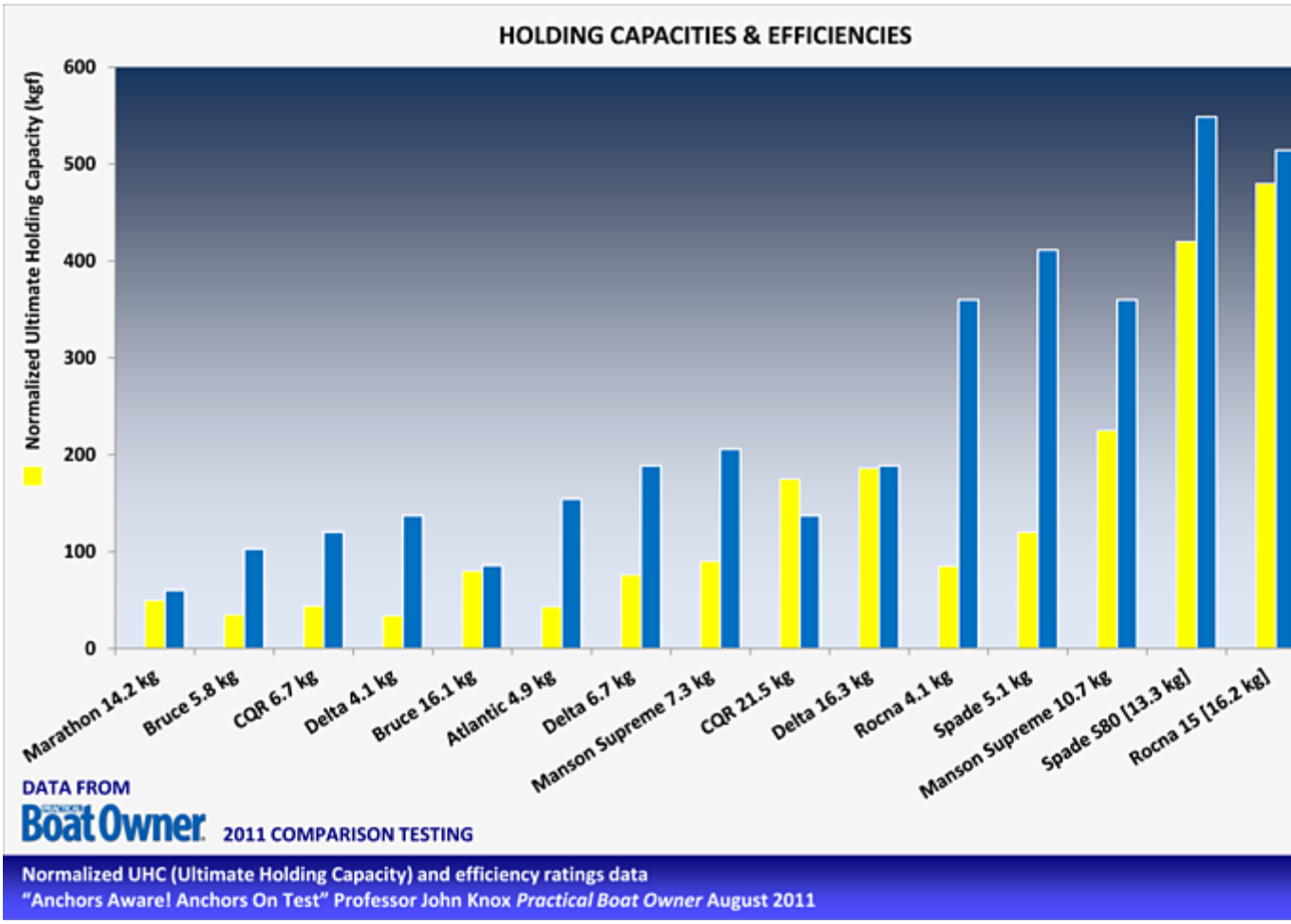


Load graphs for CQR (left) and Rocna (right) anchors. Nb.: vertical scales are unequal. The dipped points in pink track the SHF for each anchor: the 45 lb (~20 kg) CQR snakes and rolls unstably, never exceeding a normalized SHF of 175 kgf, while the smaller Rocna 15 (33 lb) sets and buries quickly as its SHF climbs inexorably toward a normalized SHF of about 480 kgf. Graphs © Practical Boat Owner 2011

Results

Knox seems well aware of the various pitfalls of anchor testing, and has avoided many of them in this test. His pull figures were firstly normalized against the results for a particular anchor for each session, to account for variations specific to that day or seabed area. Consolidated results were then further analyzed on a weight-for-weight basis and presented as “efficiency” values. The smaller anchors of each type, where multiple weights were tested, were found to be less efficient that the larger versions; nonetheless the results are presented without further analysis.

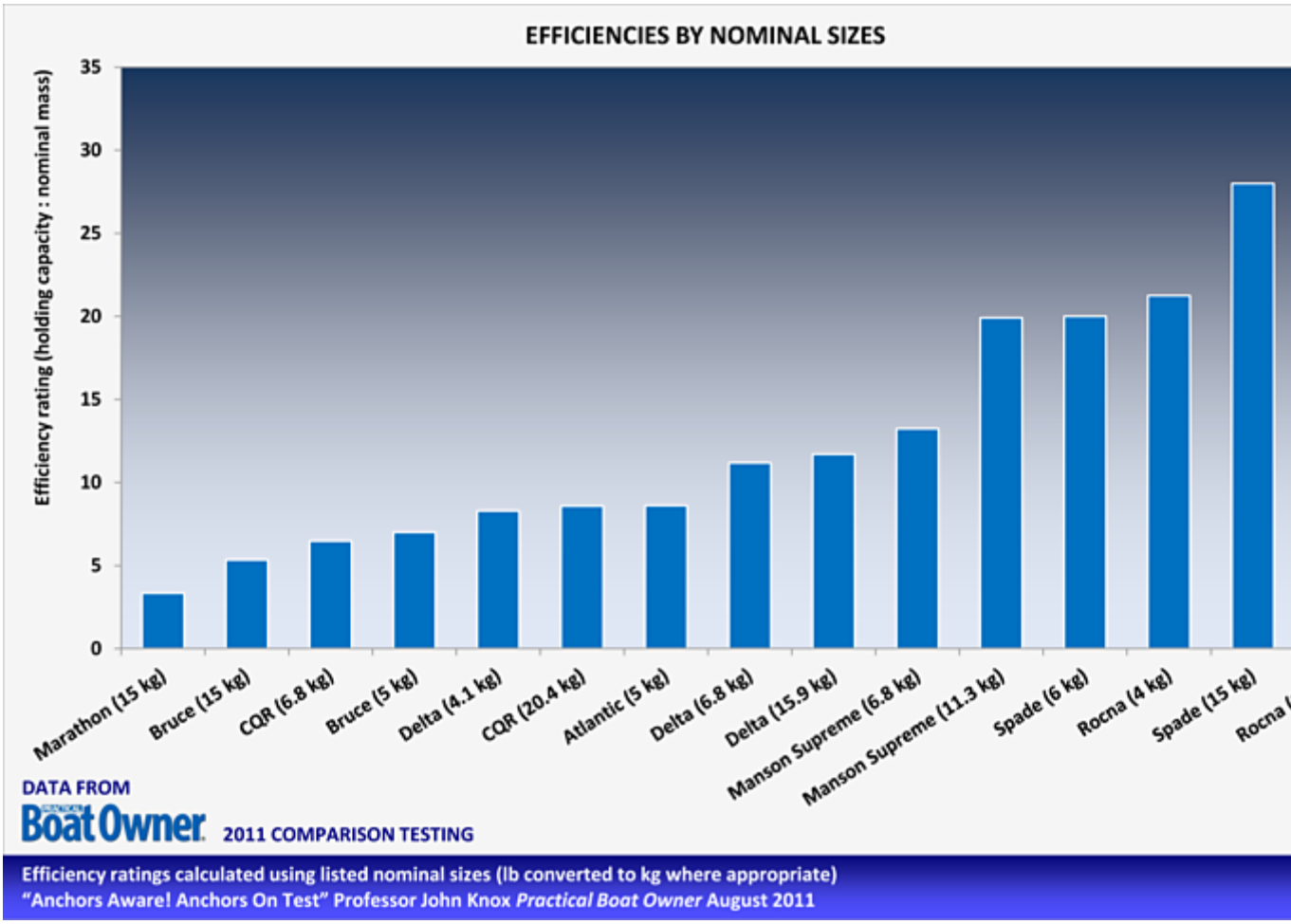
The below chart shows both normalized holding power and the rated efficiency values.



Practical Boat Owner original data

This weight-for-weight efficiency measure is a fair approach in principle but does favor anchors with reduced strength (thinner section profiles and the like resulting in lower weights for a larger fluke surface area). It also fails to account for manufacturing tolerances outputting a lighter or heavier sample for what is really the same nominal 'size'. For example, the Rocna 15 tested is nominally 15 kg but measured by Knox at a conservative 16.2 kg, while its Spade S80 competitor with an equal listed mass was found to shortchange its owner at only 13.3 kg. These variances combine to favor the undersized anchor in results – unduly so, because while tolerances or wear of material on a used anchor may cause significant variation, the surface area of the fluke, which dictates performance, is not affected by these factors.

The below chart depicts the same data as above, but with the efficiency values re-calculated based on nominal sizes.



Efficiency ratings calculated using nominal sizes

Larger anchors may expect to gain higher efficiency ratings, and this is borne out in this test when two sizes of the same type are compared. This is most obvious in the small sizes selected; by simple virtue of size, 15 kg anchors may expect their fluke tips to find better quality substrates than their 4 or 6 kg little brothers which have to make do with only the very top layer of the seabed. More telling is when a smaller anchor is proven to be substantially more efficient than its larger competitor.

West Marine, *SAIL*, & *Yachting Monthly* 2006

West Marine used a powerful motorboat to test 14 anchors on hard sand in real world locations

The big American retail chain has conducted a number of anchor tests over the years, and 2006 saw it put together a series of trials on three different sand seabeds with no less than fourteen different anchor types. They used real world locations and a realistic rode make-up.

Brief summaries of the results were included in the 2007 and 2008 West Marine catalogs. Additionally, staff from magazines *SAIL* and *Yachting Monthly* were present and proceeded to publish their own write-ups of the testing. These write-ups were problematic with confused analyses of the data and outright contradiction of one another on a number of details, but *SAIL* provided a good overview of the results in a chart averaging holding power and peak resistance.

Test design

Anchors of approximately 15 kg (35 lb) were selected, mostly steel but unfortunately including a few with part or whole aluminium construction. The aluminium Fortress FX-37 Danforth-type chosen is relatively compared to the other anchors tested, a size that would weigh in at over 25 kg (55 lb) if its aluminium was swapped to steel. Aluminium is weaker than steel, especially when compared to high strength grades: no less than two Fortresses were damaged and put out of action during this testing.

The testers used a short 20′ (6 m) length of 5/16″ (8 mm) chain, coupled to 1″ (25 mm) nylon to make up the rest of the rode. Tests were conducted at scopes of 7:1, 5:1, and 3:1, by a suitably large motorboat permitted to run up a maximum force of 5,000 lb-force (2,270 kgf). Consistency and reliability of the contending anchors was measured by further varying the testing to cover three different locations with different variations on a theme of hard sand.

The ability of the anchors to deal with a variety of tough (hard to penetrate) bottoms was well examined in this test, and the results serve to show up magazine “tests” which do not conduct repeat trials. Some anchors gave high peak results during some trials, but let themselves down during others. Consistency is a critical element of any anchor’s performance.

This table contains the summary comments published by West Marine themselves. Charted data results are below.

Company	Anchor	Material	Weight (lb)	West Marine comments, complete and verbatim
Noteco	**Bulwagga 27**	Steel	28.6	Held up to 3,000lb., engaged each attempt. Released and failed to reset at higher loads.
Lewmar	**Claw 33**	Steel	36.3	Failed to set during this test. Maximum tension under 700lb., briefly.
Lewmar	**CQR 35**	Steel	38.5	One promising set to 2,000lb., but little else. Would not engage bottom.
Lewmar	**Delta 35**	Steel	36	Variable results ranging from around 1,500lb. to 4,500lb. Drags at limit.
NavX Corp	**Fortress FX-37**	Aluminium	21.9	Generally held as much tension as we could throw at it. Was slightly damaged when pulled over 5,000lb. Excellent performance.
Anchor Concepts	**Hydrobubble 45 SA**	Aluminium + stainless steel	16	Surprise performer based on small size and weight. Held over 5,000lb. twice, also held to 1,600lb twice and released.
Manson Marine	**Manson Supreme 35**	Stainless steel	35.9	In six pulls never held less than 2,300lb, and held over 5,000lb three times. Seemed to engage the bottom immediately.
SPADE	**Océane 35**	Steel	38.2	Highly variable results. After four disappointing results, the Océane held over 5,000lb on the last two pulls. Puzzling.
Rocna Anchors	**Rocna 15**	Steel	32	Superb, consistent performance. Held a minimum of 4,500lb and engaged immediately.
Anchor Right	**SARCA #5**	Steel	33	Medium performer that held in the 2,000lb range and either released or dragged. One pull to 5,000lb.
SPADE	**Spade S80**	Steel + lead	34.4	Somewhat mixed results with three OK pulls, and three maximum pulls. Set immediately each time.
WASI	**WASI 35 SS**	Stainless steel	32	Varied results from 1,300lb to maximum tension. Failure mode

Company	Anchor	Material	Weight (lb)	West Marine comments, complete and verbatim
				was generally dragging.
West Marine	**West Marine Performance 20**	Steel	26.3	Disappointing results considering previous tests. Held 200 to 1,500lb, but could not get a secure grip.
XYZ Marine	**XYZ**	Stainless steel	10.6	Could not get anchor to work. One pull at 900lb, but mostly dragged on the bottom.

Averaged results

SAIL published the below chart, which graphs three different metrics if applicable for each anchor. "Max before releasing" is the only figure presented for all (except two anchors which failed to set): this is the most important, averaged "holding power" or static resistance. "Max pull" is the peak resistance measured by the testers, either static (holding) or dynamic (dragging) – this figure should be higher than "Max before releasing", as a good anchor will give increasing resistance as it is dragged beyond yield. The absence of this figure, where it was lower than the static holding power, does not tell a pleasant tale for that type.

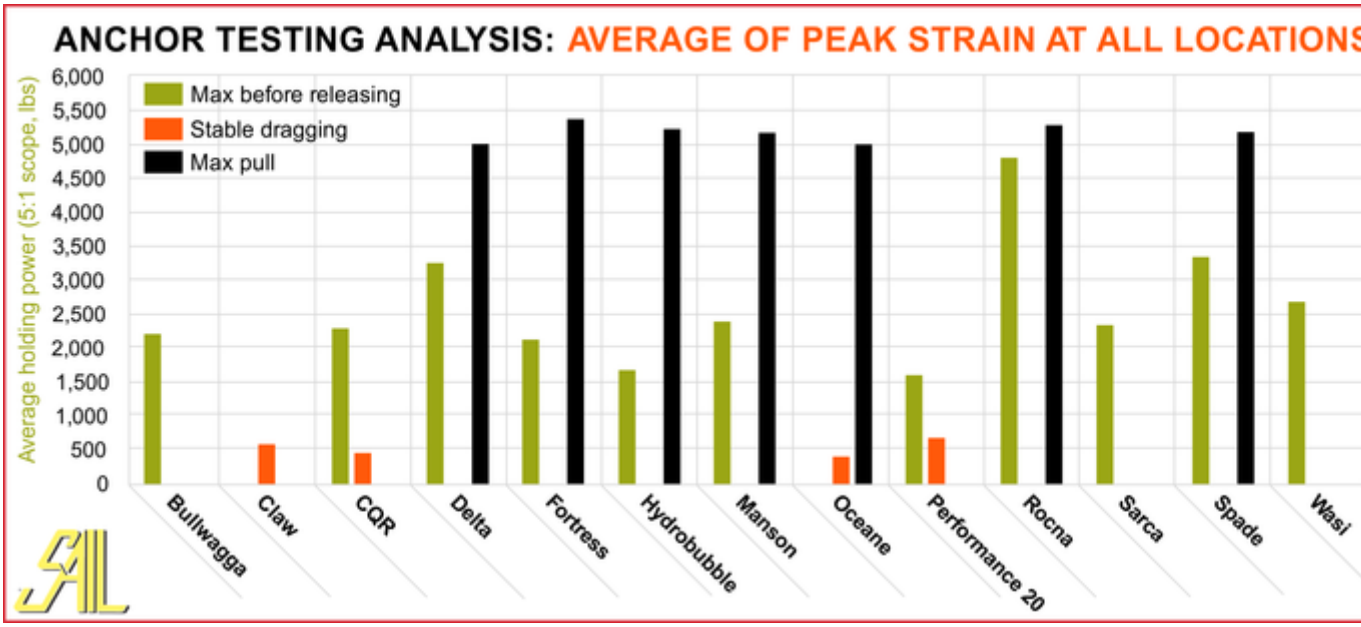


Chart from SAIL October 2006 (page 63). © SAIL 2006

References

- "Holding Power" Bill Springer, *SAIL* October 2006
- "Ultimate Holding Power" Toby Hodges and Bill Springer, *Yachting Monthly* December 2006
- "Anchor and Docking / The West Advisor", *West Marine Annual Catalog* 2007–2008

- “Anchors Aware! Anchors On Test” Professor John Knox *Practical Boat Owner* August 2011

More reading

- A Process of Evolution: New Generation Anchors (an essay on boat anchors by New Zealand boatbuilder, offshore cruiser, & consultant Peter Smith)
- The Bottom Line: Anchoring Beyond 2007 (Coastguard Member’s Handbook)
- Catenary & Scope In Anchor Rode: Anchor Systems For Small Boats
- Kellets or Anchor Angels/Sentinels – Uses and Applications
- Two to Tandem: Maximizing Holding Power With Tandem Anchoring / Dual Anchors – An outline of the theoretical & practical aspects of tandem anchoring
- Anchor Certification, HHP & SHHP Classification, and Type Approval – Lloyd’s, RINA, etc
- New Generation Anchors Explained
- Old Generation Anchors – What’s really the problem?
- Tuning an Anchor Rode – understanding and optimizing your anchor rode (external link)
- Rocna Anchors website, with exciting things like video
- The Rocna Knowledge Base – a comprehensive collection of more articles on anchors, anchoring, and accessories.