

Anchor Measurement & Performance

by
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Our cruising experience suggests that an anchor's most important trait is the ability to set easily (and reset after a wind shift) in the widest possible variety of bottoms. We do not consider ultimate holding power measurements, the normal parameter measured by anchor tests, to be as important because we carry extra large anchors (and recommend all cruisers do), so once set, they easily have sufficient holding power.

We have had tremendous success with Bruce anchors during two circumnavigations. However, our 50kg Bruce was broken during regalanizing and genuine Bruce anchors are no longer made, so we have been looking at and testing other anchors. We recently had an opportunity to use and directly compare three different 50kg anchor designs (Genuine Manson Supreme, ROCNA and Manson Ray) and make some measurements on a fourth (Bügel). In our testing, our focus was not on ultimate holding power but the ability of the anchors to set quickly even in difficult bottoms and with short scope and to stay set when conditions changed.

Anchor Measurements

Physical measurements of anchors cannot produce definitive conclusions about anchor performance but they can provide tentative clues as to likely performance in different conditions. Measurements of the anchors we have available suggest that the ROCNA & Manson Supreme are pretty much tied for best holding power when fully buried in a good bottom. The Ray could have an edge in setting performance and in holding power in a common type of poor bottom (thin sand over rock/coral). One note of caution is that these measurements apply only to these particular size anchors and scale effects may change the rank order in smaller anchors.

	Total Anchor Weight	Tip weight (% total weight)	Total Blade Area (in ² per lb)	Tip Blade Area (in ² per lb)	Cost
Manson Ray (50 kg)	118 lbs	46 lbs (39%)	305 in ² (2.6)	68 in ² (.57)*	\$2039
ROCNA (55 kg)	118 lbs	30 lbs (25%)	357 in ² (3.0)	36 in ² (.31)	\$1300
Manson Supreme (55 kg)	130 lbs	30 lbs (23%)	355 in ² (2.7)	32 in ² (.24)	\$920
Bügel (60 kg)	138 lbs	28 lbs (20%)	298 in ² (2.2)	23 in ² (.16)	na

* Using only two of the three flukes

Highest score in category

Tip weight is the percent of the anchor's total weight that the tip of the anchor is puts on the sea bottom when the anchor is lying on its side (the position the anchor normally assumes when it lands on the bottom). This is viewed as one important factor in determining anchor setting ability. The designs differed in tip weight from 39% (Ray) to 20% (Bügel) of total anchor weight.

Blade area is the surface area of the anchor blade when the anchor is completely dug in. This is viewed as one important factor in determining anchor holding power. The designs differed in total blade area from 3.0 in² per lb (ROCNA) to 2.2 in² per lb (Bügel). Tip blade area is the surface area of the first 9" of the blade tip. A common poor holding bottom type has a couple inches of sand or mud over a harder rock or coral surface. Our experience indicates that only the first 9" or so of the tip will bury in these bottoms (and often only 2 of the 3 flukes in a Bruce design), so this measurement is an indication of holding power in these sorts of bad bottoms. The designs differed in tip blade area from .57 in² per lb (Ray) to .16 in² per lb (Bügel).

Beach Testing

All these anchors are large and of well regarded design. So, they will all set easily and hold well in good sand/mud bottoms. The interesting question is how they each perform in more difficult bottom conditions. In our cruising experience we find 70-80% of our anchorages have 'good bottoms' with deep sand or mud, and 20-30% of the anchorages pose a setting or holding challenge (rock, coral, kelp, etc. to small/crowded/deep for proper scope).

1. Rocky bottom. We performed a pull test on a beach with rocks over hard sand. We lined the anchors up on the top of the beach and pulled them toward the water with our windlass. The effective scope (taking into account that we were pulling the anchors 'downhill') was 10:1.

	Distance until start digging in	Distance until set*	Cross section of furrow when dug in (depth)
Manson Ray 50kg	30cm	348cm	175 cm ² (26cm)
ROCNA 55kg	90cm	385cm	300 cm ² (20cm)
Manson Supreme 55kg	80cm	363cm	200 cm ² (15cm)

* Anchors considered 'set' when holding 1000lb rode load

Highest score in category

Given how bad the holding conditions were I expected the anchors to have difficulty setting and holding. However, all three anchors set within 4m and held 1000lbs of rode load. Thus all three performed quite satisfactorily.

The Ray penetrated the rock and started digging into the sand in a 50% shorter distance than the ROCNA and Supreme. This is consistent with the tip weight measurements. The

Ray also took slightly less distance than the others to dig in enough to hold the 1000lb load, but the differences were not very large. The ROCNA dug the biggest furrow. The RAY did not 'roll upright' and thus only dug in one side fluke and half the main fluke, but it dug in the deepest and did hold the 1000lb loading.

Anchors after 1000lb set



All three of the anchors would have dug in even deeper with a greater pulling force and the holding power of all would easily have exceeded the pulling power of our windlass (3,500lb). A greater load would have rolled the Ray upright. Our short scope testing described below also shows that a more upward rode angle will roll the Ray upright.

We tried pulling several other lighter anchors on this beach and none dug in. They just skated over the rocks and frozen sand. This is consistent with our experience discussed below comparing the 40kg 'roll bar' copy with the 50kg Bruce. Weight is critical for performance on these sorts of bad bottoms.

2. Short Scope. In small, crowded or deep anchorages we occasionally have to anchor with shorter scope than we would like. In these situations we have used as little as 2:1 scope. We performed a second pull test on a beach using 2:1 scope (we put a block up top of the Puerto Williams yacht club to get the proper angle) with much easier setting (soft black sand/mud). We conducted this test twice, once with only a rope rode and a second time with 6 feet of chain. None of the anchors would hold the 1000lb load in this test so we reduced our definition of set to 500lbs.

With only rope rode	Distance until set	Cross section of furrow when dug in
Manson Ray 50kg	100cm	646 cm ²
ROCNA 55kg	N.A.	80 cm ²
Manson Supreme 55kg	N.A.	38 cm ²

* Anchors considered 'set' when holding 500lb rode load, N.A. means they did not set
Highest score in category

With 6 feet of chain	Distance until set	Cross section of furrow when dug in
Manson Ray 50kg	57cm	950 cm ²
ROCNA 55kg	N.A.	120 cm ²
Manson Supreme 55kg	194cm	684 cm ²

* Anchors considered 'set' when holding 500lb rode load, N.A. means they did not set
Highest score in category

We were surprised by the results of this test. Given the loose bottom conditions we expected all the anchors to dig in easily and quickly. However, in the first pull, with only a rope rode and no chain, only the Bruce dug in. The ROCNA and Supreme just skated along the surface. The ROCNA did dig a deeper trench than the Supreme (4 cm vs 2 cm) but neither showed any inclination to set. In the second pull we added 6' of chain to the rode. The Ray then dug in almost immediately (57cm) as we had expected, but the Supreme took 2m to dig in, and the ROCNA continued to skate along the surface. We repeated the ROCNA pull three times to be sure this was not an artifact of a small hard spot on the beach, and it skated each time.

2:1 Scope with all rope rode



2:1 Scope with 6' of chain on rode



We can conclude two things from this 2:1 scope testing. First, sufficient scope and heavy chain is critical to getting the anchors to set and hold. This confirms our experience watching other boats drag: the most common cause of dragging is too short scope or too light chain. If you have to set with short scope, it's best to do so very slowly and gently to give the anchor tip an opportunity to angle down into the bottom. Second, the Ray performs much better in short scope conditions than either of the two roll bar anchors, and produced a set that would have been adequate for anything less than gale conditions. This is also consistent with our actual experiences with the Bruce in short scope situations.

3. Veer test. Often an anchor will be properly set in one direction and then the wind will shift 90 degrees, causing some anchor designs to pull out of the bottom and not reset. We simulated this by setting each of the anchors (to 1000lbs) and then pulling on them at 90 degrees at the set. All three designs passed this test with flying colors. The Ray simply pivoted 90 degrees and remained set. The two roll bar anchors rolled over on their side, pivoted 90 degrees while dragging about an anchor length and then rolled back upright, but remained buried throughout.

Anchors in Use

All these anchors are large and of well regarded design. So, they will all set easily and hold well in good sand/mud bottoms. The interesting question is how they each perform in more difficult bottom conditions.

During 2002/2003 we anchored in 58 anchorages along the Chilean channels with a 50kg Bruce. During 2007 we anchored in 26 anchorages with a 40kg Chilean anchor that was a quite close copy of a Manson Supreme. Both anchors performed perfectly in sand and mud bottoms, but as shown in the table below the Bruce performance was much superior to the ‘roll-bar’ anchor in rocky bottoms. This is consistent with the anchor measurement conclusions above. However, it is not a completely ‘apple to apples’ comparison for two reasons: (1) the Bruce was 10kgs (25%) heavier and (2) the ‘roll-bar’ anchor was a copy (although with no significant measurable differences to the genuine anchor).

Anchor Failure Rates*	40kg ‘roll-bar’ copy	50kg Bruce
Failed to set 1 st time	27%	2%
Dragged	8%	0%

* All failures with both anchors occurred in rocky bottoms

Also during (winter) 2007 we compared ‘the real world performance’ of the three different anchors (Manson Ray, Manson Supreme and ROCNA) during a cruise in the Beagle Canal.

These are all good anchors and all will set and hold well under normal anchoring circumstances. We thus went out specifically looking for difficult or unusual anchorages. The holding ground in this part of Chile is typically quite good mud, but we did find several coves rated only ‘fair’ or ‘poor’ holding in the local cruising guide. We ended up anchoring in 15 different coves; we had absolutely no problem with setting or holding in 8 of these coves.

In the 7 anchorages we did encounter some difficulty. It is impossible to be as ‘scientific’ (ensuring consistency and repeatability) in real anchorages as you can with beach drags, and in murky water you can’t see clearly what is going wrong. But we have assessed the source of each difficulty and the relative performance of the anchors as well each situation allowed.

Anchor Ratings in specific difficult bottoms

	First Place	Second Place	Third Place
Very Soft Mud	Supreme	ROCNA	Ray
Heavy Kelp	Ray	ROCNA	Supreme
Smooth Rock	Ray		ROCNA & Supreme
Short Scope & Sloped Bottom	Ray	Supreme	ROCNA
Total holding power	ROCNA &		Ray

in hurricane conditions*	Supreme		
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*based on other anchor tests focused on holding power, not independently confirmed by our testing

We found one anchorage which had very very soft mud. None of the local's would anchor or even set moorings in this area because the holding so poor. When we dropped the anchors in the ooze and started pulling on the rode immediately, we found the Manson supreme set the quickest (I suspect because it's the heaviest and thus settled down into the harder mud fastest), and the ROCNA a close second and the Ray just pulled thru. However, if we did not pull immediately on the Ray, letting it settle on the bottom for a while, and only then pulled on it gently, it would also set and hold.

We had one anchorage with very dense kelp. A kelp knife is essential cruising equipment in the Chilean channels, exactly for anchorages like this, as each time you pulled an anchor up from this bottom you also pulled up several hundred lbs of kelp which has to be cut away. This is probably the most difficult bottom in which to do a repeatable & well controlled test because it impossible to drop each anchor into exactly the same level of kelp. However, the Ray was most consistent (probably because of its high tip weight), the ROCNA a distant second (probably because of its sharp tip) and the Supreme a close third. All the anchors preferred a slow settle and set, rather than a fast yank, in this bottom.

We found two anchorages with glacier carved rock bottoms. The Ray did quite well, snagging quite quickly onto something each time we dropped it. I would not want to have swung to this anchor set because it would probably come unstuck if we pulled from a different direction but it was just fine for the stern tying approach used in these coves. The ROCNA & Supreme both performed identically and were tied as a distant third place – as we pulled them, they would snag and then let go and snag and let go, apparently having their tips pull around or over the rocky bottom. They never set.

We had two coves which were very small. Normally in Chile we would stern tie into these sorts of coves but for this test we tried anchoring in them with short scope. We were using 2:1 scope. The Ray set each time. The Manson came second, requiring a few try's and the ROCNA was third, only setting after we let out more scope for the initial set and then shortened up. We also had one cove where the bottom sloped quite steeply away from the anchor pull, which mechanically is similar to short scoping. The roll bar anchors pulled away just under 15-20kts of wind force while we were trying to sort of the dinghy and lines for a stern shore tie. The Ray would hold at least long enough to get a stern line ashore.

Conclusions

For full time cruising we strongly recommend the biggest anchor your boat can carry. An extra 10kg may make the difference between setting in a difficult bottom and having to move to another anchorage.

The Ray, ROCNA & Supreme are all good anchors. The design and performance of the ROCNA and Supreme are very close, with the edge going to the Supreme on lower cost.

The Ray/Bruce is a quite different design – potentially offering faster & deeper setting in bad bottoms but with lower total holding power. The Ray/Bruce does make an excellent general purpose anchor you must go a size or two larger than the equivalent roll-bar anchor. (Note: we do not recommend Bruce copies in sizes less than 20kg as the design does not scale down below that size very well and the holding power drops off dramatically). The Ray is quite expensive compared to other Bruce copies, but it is noteworthy that its forged shank construction would prevent the casting cracks than destroyed our Bruce.

We would consider any of these anchors acceptable as a main cruising anchor. They are all good, but with distinctive strengths and weaknesses. The Ray offers the best all around setting ability in poor bottoms but according to other anchor tests has the lowest holding power per lb. To use the Ray as a main anchor you need to get a big one. The ROCNA and Supreme have much higher holding power per lb but are less reliable setting in very difficult bottom conditions and may take a bit of additional skill and scope to get set in these unusual sort of conditions.

Which anchor is best for you will depend on which sort of difficult bottoms you are most likely to encounter and the trade-off you make between setting reliability in difficult bottoms vs. weight/holding power in more normal bottoms.

For our own personal cruising we came away with three feelings. First, we were somewhat disappointed in the ROCNA & Supreme's performance as our expectations were very high based on their marketing and the results of other people's anchor tests. These test demonstrated to us why we have had such good success with big Bruce designs in the past, and we will definitely keep the Ray. Second, the Supreme has the biggest/highest profile roll bar and it will just simply not fit down any of our hatches so we can't stow it. Therefore we are giving it away to a 53' Antarctic charter boat (which took it out for a testing session and really liked it) – not for any concerns about its performance but simply because can't fit it. The ROCNA has a bit lower profile roll bar and will just barely fit down our hatches. Third, a big anchor, proper scope, and a slow but firm setting technique are for us the real keys to excellent anchoring performance.