

Catamaran v. monohull: myths, perceptions and reality

By Kim Klaka

Are the following statements true or false?

1. Catamarans capsize, monohulls don't.
2. Monohulls sink, catamarans float.
3. Catamarans are more expensive than monohulls.
4. Catamarans are faster than monohulls.
5. Catamarans make you seasick.

Catamarans capsize, monohulls don't

Sort of true, but not really.

The view that cats capsize but monos don't has its roots in the history of multihull development. Years ago cats were focussed on high speed, especially for racing. It is only in the last 20-30 years that many catamarans have been designed specifically with cruising in mind. Racing catamarans are light, highly powered (lots of sail), with narrow hulls for low drag and wide beam for power to carry that sail. Cruising catamarans are much heavier, about the same sail area (so less power per ton), and have wider hulls for better load-carrying capacity. Consequently the modern cruising catamaran is very resistant to capsize compared with its stereotypical equivalent of 20-30 years ago.

Monohulls, on the other hand, have become increasingly beamier over the last 20-30 years. This means that, whilst highly resistive to capsize, once they do turn over they are not as likely to re-right as older monohulls.

The statistics for capsizing of cruising cats v monohulls is not revealing, because there are so very few cruising cats that have capsized.

Don't be mistaken into thinking that monohulls don't capsize. They all do, it's just a question of

- a) How steep is the breaking wave required to cause a capsize? and
- b) How likely is it that the boat will come back upright again before sinking?

Which leads us to the next debate....

Monohulls sink, Catamarans float

This is generally true.

As with the capsize debate, the notion that catamarans float if holed needs a bit of review. Most cruising monohulls will sink if severely holed, partly because they have a lead keel attached which drags them down. Catamarans do not have lead keels, but they do have an awful lot of heavy machinery (twin engines, generators, banks of batteries etc.). The question of whether a fully flooded cruising cat would float or sink is a complicated naval architecture question to answer (it needs detailed analysis of not only the mass of every component of the yacht, but also the volume it occupies). Fortunately it can be sidestepped as largely irrelevant by considering the circumstances of when a boat is holed and might sink. Leaving aside the calamity of going aground (when you can step off the boat onto the rock), the most likely causes of flooding are damaged rudder post (distressingly common), collision with whale (increasingly common) and collision with container (not as common as folklore suggests). On a monohull, any of these events will breach the watertight integrity of the entire

vessel, but on a catamaran the strong likelihood is that only one hull will be breached, leaving the other hull intact and providing sufficient buoyancy to float.

So whilst the question of whether a fully flooded cat floats or sinks is unanswered, the reality is that such a situation is unlikely to occur.

What about watertight bulkheads? I hear you ask. Watertight bulkheads, be they in a cat or a mono, will certainly help improve the chances of staying afloat if holed. But, and it is a big but, only if they are truly watertight. The majority of so-called watertight bulkheads end up full of holes for piping, electrics etc. so their watertight integrity is compromised. Plugging big holes with sealant won't make them watertight for the sort of pressures generated by a sloshing compartment of water (about 5psi); it has to be done very carefully with the correct materials.

Catamarans are more expensive than monohulls

Yes, but then again no.

The question needs rephrasing. Are we comparing a cat and a mono of the same length? Or weight? Or number of berths, or speed, or deck space, or what? I believe this is the crux of the debate; what do you get for your dollar? So I rephrase the question as: for a given amount of money handed over, do you get more or less boat with a cat or a mono?

A search through new boat prices does not really help us – the list of optional extras can often add 50% to the base price of the boat! Better to compare the prices of recent second-hand boats. Whilst they will still have different specifications, and asking prices don't match selling prices very well, at least the boats are all equipped for coastal cruising as a minimum.

A comparison of the prices of production cats and monos less than 5 years old revealed that an 11m cat costs about the same as a 12.5m mono and a 12.5m cat costs about the same as a 14.5m mono. Having established a valid comparison point, how does each one fare?

	Cat: mono (%)
Length	87
Weight	68
draft	50
Sail area	84
Saloon area	112
Cockpit area	148

Table 1: cat compared with mono of same cost

So, for a given price, the cat is:

- Shorter - helps offset the marina fees.
- Lighter - potentially faster, but not as much load carrying capacity.
- Shallower - better for shallow water but potentially slower to windward.
- Less sail area - lower loads so easier to handle.
- More saloon area - take this with a pinch of salt, it depends on what's included.
- More cockpit area - an advantage when under way and in port.

Catamarans are faster than monohulls

No, but read on.

As with the value-for-money debate above, I suggest we need to compare boats of similar cost rather than similar length. If you do this, there is no significant difference in speed between a cat and monohull. Any difference between them is overshadowed by how well they are sailed, and the different boat types within each category (cat or mono). How did I reach this conclusion? Rather than look at computer-generated speed predictions, or even sailing trials data, I took a far more pragmatic view and assessed the actual speeds on a voyage. I am fortunate in having access to a good data set of catamarans and monohulls completing a 1,300 mile cruise in the same waters and at the same time – the 2013 Fremantle (Australia) to Bali rally. There were 9 monohulls and 5 cats for which I could obtain useful comparative data. I have used the Yellowbrick tracker data to compare the average speeds. Neither the monohulls nor the multihulls come out as faster – they are spread fairly evenly down the elapsed times. A couple of arguments against using these data might have come to your attention.

Firstly, the boats are of different sizes, so we get back to the question of comparing boats of equivalent cost. However, they really were very different costs so I have invented a new (to me) way of levelling that playing field. Consider how this is done for comparing monohulls of different length; we use the speed:length ratio (speed divided by square root of waterline length, or Froude number in naval architecture-speak). What I have done is develop a speed:cost ratio along the same lines. Commercial yards often cost ships in dollars per metre, so instead of using square root of length I use square root of cost. So now we can compare speed per dollar, and monos come out slightly better.

	total voyage time	
	speed/length	speed/\$
cat	0.48	2.40
mono	0.50	2.74

Table 2: relative speeds of cat and mono based on total elapsed time Fremantle to Bali

Secondly, the boats weren't sailing all of the time. Most of the boats motored at some time or other, and several of them stopped to shelter from a gale that passed through the fleet. I counter the first objection by pointing out that it is the speed of the voyage that we are interested in, rather than the power source used. Besides, from talking to some of the skippers, the average time spent motoring seemed to be about the same regardless of whether it was a cat or a mono. The issue of time spent sheltering can also be countered by the argument that it is the overall time spent completing the voyage that counts. However, to see if it made any difference, I tediously tracked each boat on Yellowbrick and extracted the time spent sheltering, then subtracted this from the voyage elapsed time. It made only a slight difference to the results and the conclusions are the same.

	corrected for stopping	
	speed/length	speed/\$
cat	0.56	2.83
mono	0.56	3.07

Table 3: relative speeds of cat and mono based on total time at sea Fremantle to Bali

Catamarans make you seasick

Yes and no. You are probably getting sick of that answer 😊

As a rule of thumb, if you are susceptible to motion sickness due to the relatively rapid motions of sailing to windward (or being a passenger in a car), you are better off in a monohull; whereas if you

get sick due to the languid downwind rolling motion of a monohull, then a cat will probably suit you better.

The causes of seasickness are complicated and not yet fully understood. There is broad but not full agreement amongst medics and psychologists that the fundamental cause is sensory conflict – your eyes tell you one thing about the motion but your ear balance tells you something different, and the body's reaction is to empty its stomach. The movement that causes this sensory conflict is of itself complicated. We can simplify it down to two things – the amount of acceleration or movement you experience, and the rate of that movement to and fro (the frequency, or period, of the motion). The greater the accelerations are, the more likely you are to get sick – that is fairly intuitive. However, the relationship between seasickness and rate of movement is not as straightforward. The overall situation is best described by the graph below.

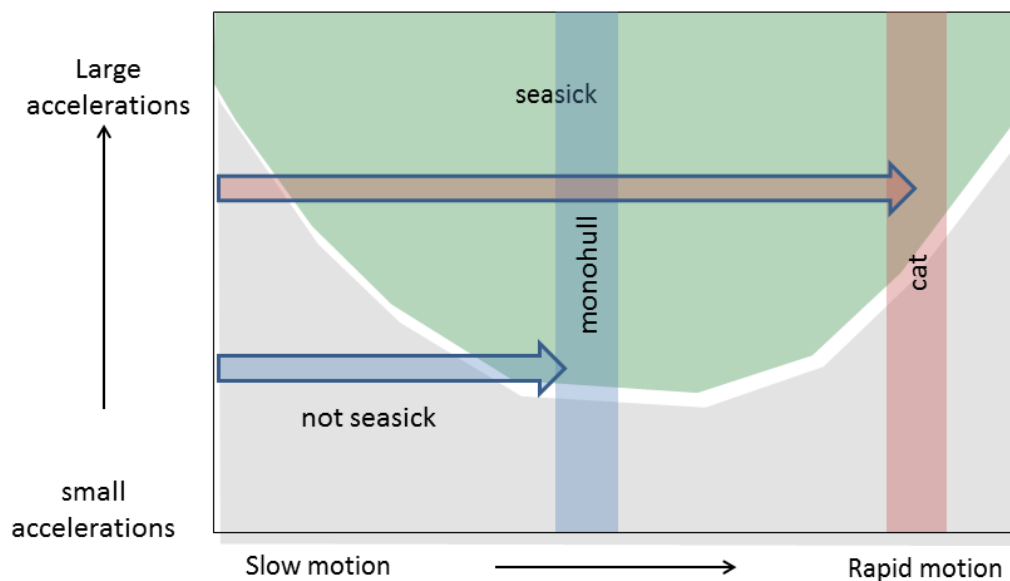


Figure 1: how motion affects sea sickness

This graph plots the magnitude of the motion accelerations on the vertical axis and the rate (frequency) of the motion on the horizontal axis. If the motion lies in the upper (green) region you are likely to get seasick; if it is in the lower (grey) region you are less likely to get seasick. If the motion rate of the boat is very slow, you are on the left of the graph and in the grey region so you are unlikely to get seasick easily. If it is rapid you are on the right side of the graph and again in the grey region so you are also unlikely to get seasick easily (think of a RIB planing in head seas – uncomfortable but rarely sick-making). If the motion is between these extremes then you are more likely to be in the green region so more likely to get sick. The motion of monohulls sit roughly in the middle of the graph, in the region of most green (seasick). Catamarans, on the other hand, have a much more rapid motion than monohulls (due their much greater beam), so they operate more towards the right hand side of the graph than a monohull, where there is less green (seasick) area. That would suggest

you are less likely to get sick on a cat than a monohull. However (here we go again), there are a few qualifiers to that conclusion:

- a) The curves in the diagram are statistical averages; everyone reacts differently to motion, as we all know.
- b) The magnitudes of the motion accelerations on a cat are often greater, which increases the incidence of sickness for any particular rate of motion.
- c) The curves relate to vertical accelerations; horizontal accelerations are also important, and they are higher on a cat than a monohull (the “train-ride” effect).
- d) The motion experienced depends on the waves you are in as much as it depends on the type of boat you are on. The boat that makes you seasick in open ocean swells might be fine for semi-sheltered coastal passages.

If it wasn't so complicated there wouldn't be so much debate!

Other issues:

Draft

Many cruising cats have stubby keels like a surfcat, whilst others have daggerboards. Both end up with a minimum draft of a metre or less, so they are capable of anchoring in very shallow water. The equivalent monohull usually has a draft of at least 2 metres, excluding it from some of the remoter and more sheltered anchorages.

Rolly anchorages

Whilst we are on the subject of sheltered anchorages, a big advantage of cats is that they hardly heel or roll at all. So a roly anchorage that might be almost untenable in a monohull can be calm and delightful in a catamaran.

Marina berths

Not only are marina berths for cats more expensive per metre (or per anything really), they are also more scarce. So if you like sailing from marina to marina then a monohull might suit you better. On the other hand, if anchoring is your preference, a cat opens up more places (see “draft” and “rolly anchorages” above).

Ease of sailing

This is something of a catch-all term, but let's consider two aspects – the physical effort required to sail the boat and the ease of moving around on board.

Assuming you have the same sized winches on a cat and a mono, and a vaguely similar rig, then the ease of sailing depends mainly on the sail area. So we are back to comparing boats of different cost; which has the most sail area? As illustrated in table 1, the cat has 13% less sail area, so should be easier to handle.

A catamaran hardly leans over at all, which not only makes it easier to walk around but also means you can put a mug of coffee down without it tipping over (usually). Contrast this with a monohull: trying to adjust the jib car position on the lee deck, or the number of times you have had to scrape dinner off the floor and back into the pot.

On the other hand (yet again), cats have a more jerky lateral motion that can cause you to lose your balance when moving around. Swings and roundabouts, cats and monos – that just about sums up the whole debate!

So how do you make the decision on whether to buy a cat or a mono? Here is a useful way of taking some of the emotion out of the debate. I have made up a table below and listed the qualities of each

boat type as already discussed (column 1), then rated each on a scale of 1 to 5 (columns 2 and 3). I have then given each quality a personal importance rating (column 4). I multiply each quality by its importance, then add up the weighted column (5) for a mono and also for a cat (column 6). The bigger total of either column 5 or 6 tells me which type of boat best suits my needs. Try it for yourself by using your own importance ratings (and if you disagree with my quality ratings, use your own). Before I went through this exercise I was really torn between favouring a cat or a mono, but on completing the table it seems like I prefer a cat!

1	2	3	4	5	6
quality	mono	cat	importance	Mono rating	Cat rating
Capsize	4	3	4	16	12
Flooding	2	4	4	8	16
Interior volume	3	3	3	9	9
Cockpit and deck space	3	5	3	9	15
Speed	3	3	4	12	12
Motion at sea	4	3	2	8	6
Motion at anchor	2	4	4	8	16
Berthing	4	2	3	12	6
anchoring	3	5	4	12	20
Weighted total				94	112

Table 4: weighted assessment of performance

Quality scores out of 5: 1 = poor, 5 = great

Importance scores 1= unimportant, 5 = critically important