

# Hull design for water jet propulsion

Roger Mutimer

April 2022



The hull needs to be selected knowing the fundamentals of the workings of the water jet unit. Jets have no rudders or skegs to assist in tracking, so the boats tracking at low and high speed relies totally on the hull.

Most water jets do not have the ability to trim the boat, by this I mean, trim the bow up or down, so the hull design is essential for water jet propulsion.

There are many hull designs on the market, but the challenge is to know which ones will work with water jets propulsion. To try and help, let's look at the two most common hull forms:

**1. Monohedron** - Constant deadrise, and

**2. Warped** or Variable.

Monohedron is the preferred hull form because it satisfies the basic requirements needed for the operation of a water jet unit.

## Warped hull

Warped or variable deadrise hulls have a few things going against their inclusion.

Warped is really what it means, *WARPED*, meaning the deadrise or the V in these boats hull changes from the transom or just forward of the transom to the bow.

Having the V change over that distance, in most cases, it ends up giving the bow a fairly fine entry.

Having a fine entry (bow) and a fairly flattish aft on the hull for a water jet, means that travelling at low speed and no real tracking assistance from the hull you will find the bow and the wrong strakes taking over (the boat weaving, not traveling straight) and then having to correct with the jets steering. Traveling at speed with on real directional assistance from the hull again you will find that when the boat is in a following sea and it just happens to bury the bow into the back of another wave there's a very good possibility of the boat to broaching.

Broaching can be caused by not having enough buoyancy in the bow and also wrong strakes.

Having less buoyancy in the bow can also mean that the centre of balance in the boat is more to the back of the boat, less carrying capacity.

## Monohedron hull

Monohedron constant deadrise meaning, the V from the transom to more than half the hull is the same. Having the flat V surface for more than half is where most of the tracking comes from, and then with the help of the correct strakes.

Having the V for more than half is then giving the bow a more bluffer entry to the water and with the correct strakes will stop the bow from bearing it's self into the back of a wave and then broaching.

With the monohedron hull and a bluffer bow, they can give you the capacity to carry more without changing the hulls performance.

*The hull design is essential for water jet propulsion*

Applying lifting strakes and chines to a hull

# For & Against

When, and it must be stressed they must be applied correctly, because only then will you see and feel the benefits.

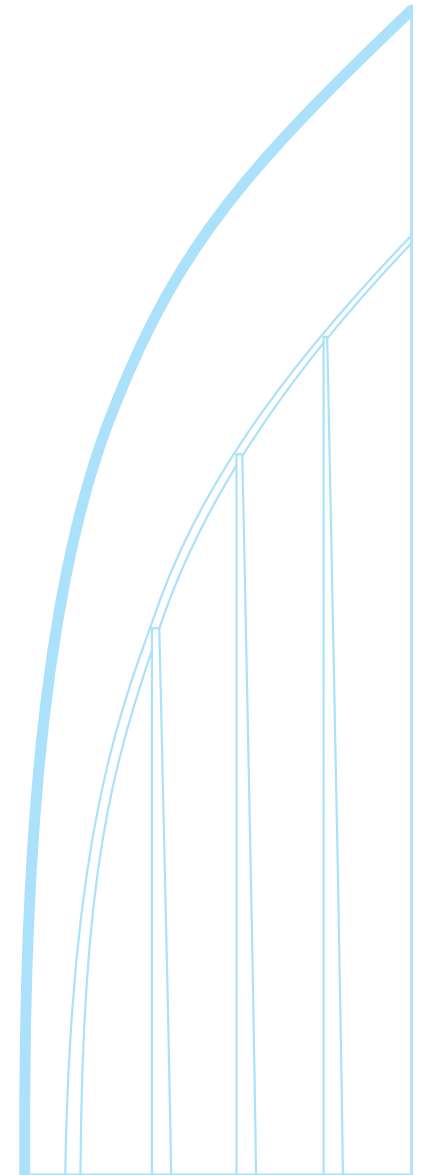
The ride is smoother, no trimming required depending on how many strakes are applied and how far they go back to the back of the hull.

Then there is the size and length of the strakes and shape.

Size is the width, and that depends on the size of the boat. Too big and you will have a harder ride, too small and it probably won't give you the ride for the cost.

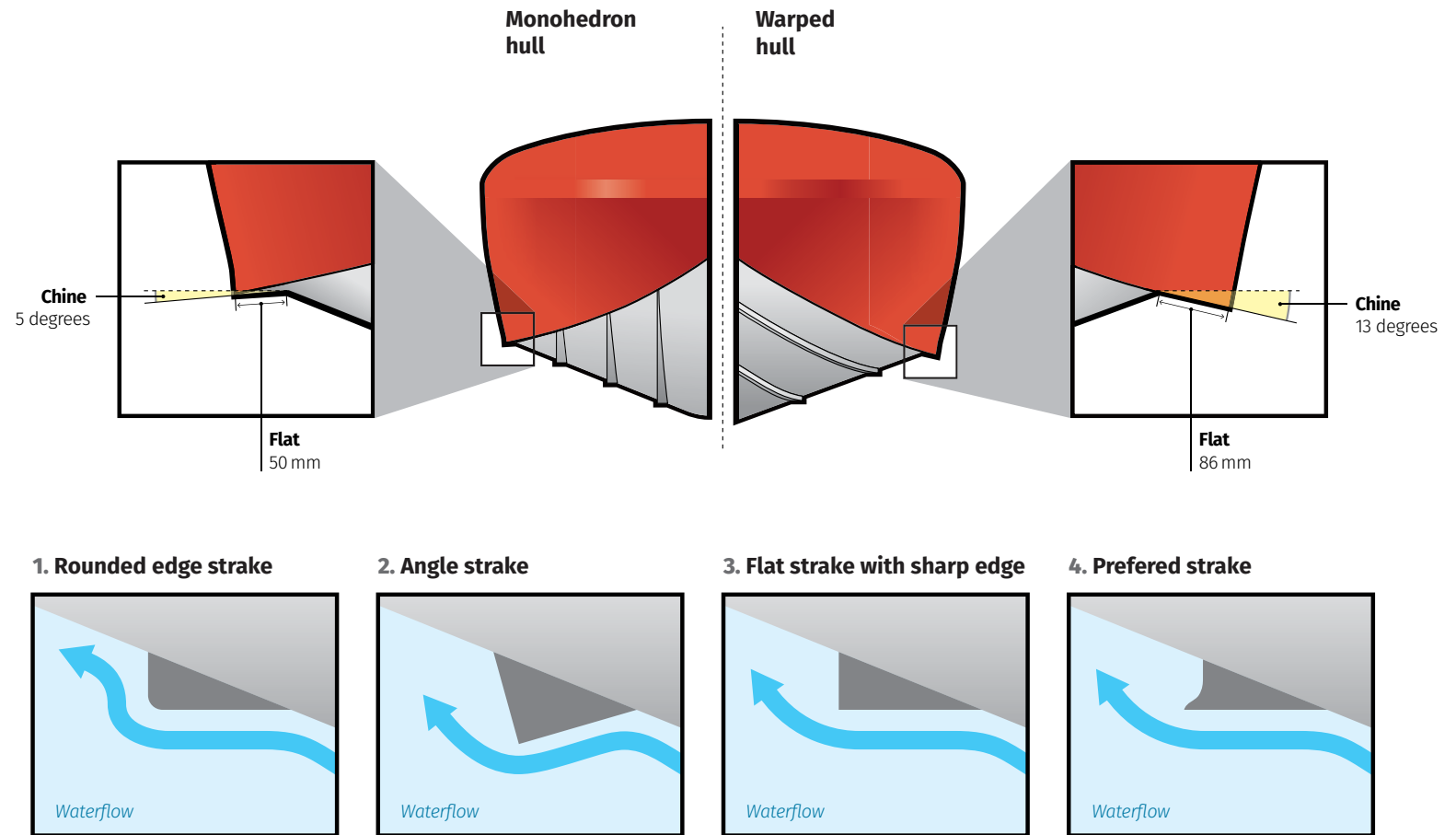
Against is mainly cost, boat builder, I can save you money by not applying them.

Some boat builders will argue that they don't work and the boat rides harder.



**Figure 1** shows four different shapes of strakes.

1. Is what you would find on a fiberglass boat. The radius can vary. But its the radius that stops this strake from working effectively. Having a radius allows the water to travel quite freely around it. Water under pressure will always take the easy way. And when the boats at rest, again the water is really not restricted.
2. Not a good idea to really restrict the flow of water. When you start compressing water, the only reaction you will get is a very hard and uncomfortable ride.
3. This is what you should see on boats. With the sharp edge the water finds it virtually impossible to round that edge, so when it leaves the edge there is a time before it then touches the hull therefore reducing the resistance on the hull. Again at rest the hull can be restricted in its movements.
4. Now this is a strake that gives you the best in everything. When traveling and at rest.



**Figure 1-**  
Comparison of strake shapes and waterflow.

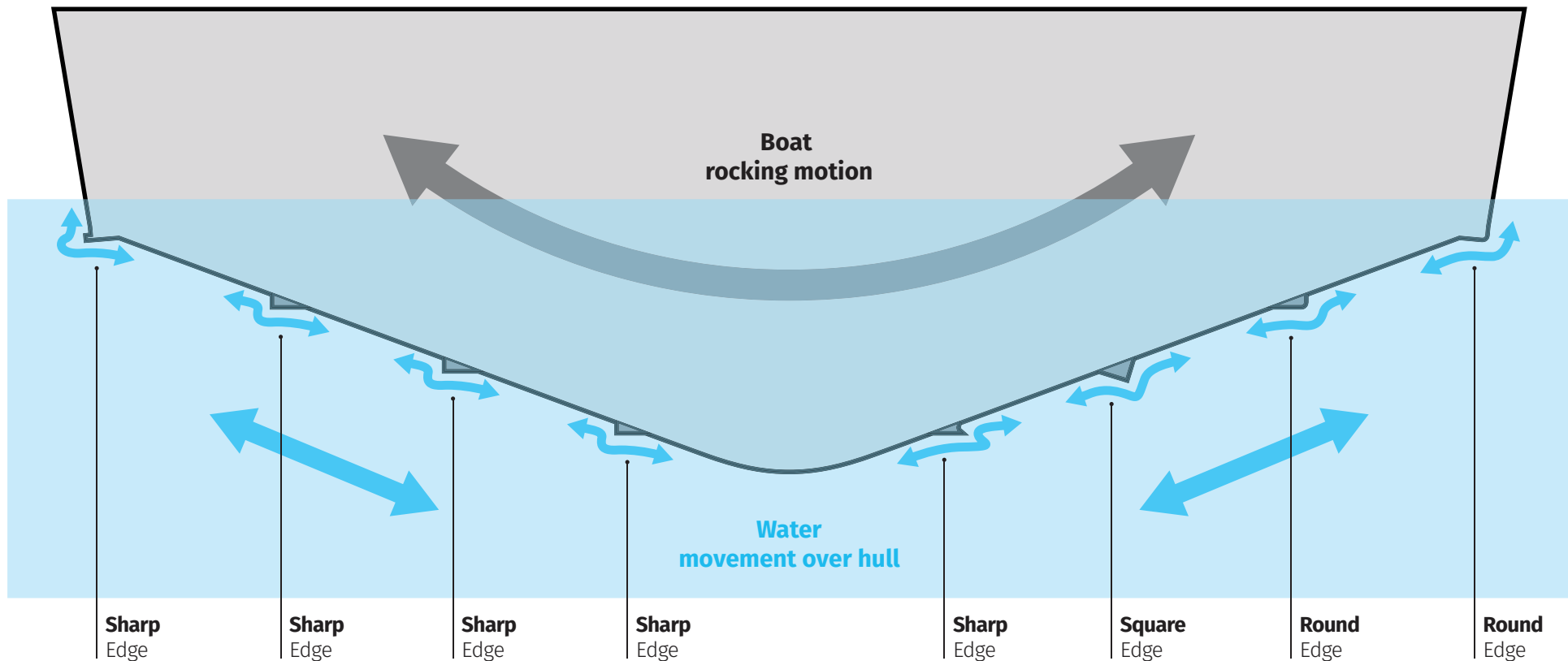
The strakes not only work when the boat is running, but they can also assist when the boat is at rest. By this I mean the boat hull can rock side to side. But by having the right strakes they can restrict the movement of the water across the hull bottom.

**Figure 2** illustrates the movement and interaction between the hull and the water with various strake shapes.

Water does not like sharp edges. A rounded edge, no problem.

You have to remember, water is more than 800 times denser than air, so the hull and everything that is applied to it has to be perfect.

**Figure 2-**  
Comparison of strake shapes and waterflow when the hull is at rest.



If your hull has any defects like a slight twist or one chine is slightly lower than the other or one strake not in the same position as it's opposite. Then on the water this will show up with the boat wanting to track differently.

Now applying the strakes. These have to be applied dead accurate in every way. I have inserted a drawing explaining the check points.

From the transom to the shoulder (end of constant deadrise forward) they must be at the same measurements apart and the same height, and from the shoulder to the chine at the bow they will start to taper in width and height. The taper will depend on the size of strake and hull. Example 50mm strake, taper down to 15mm wide and 10mm height.

The chines are mainly there to deflect the water away from the sides of the boat while the boat is travelling. But again having them too big and on too much of an angle can have the same effect as having the wrong strakes and contributing to the ride. Having the chines the same size as the strakes and at an angle of no more than 5 degrees and a sharp edge helps in cornering and again at rest.

Chines should start tapering from the shoulders to the bow stem.

All this tapering on the strakes and chines is to stop water from being trapped at the bow and not allowing the hull to travel through the water smoothly.

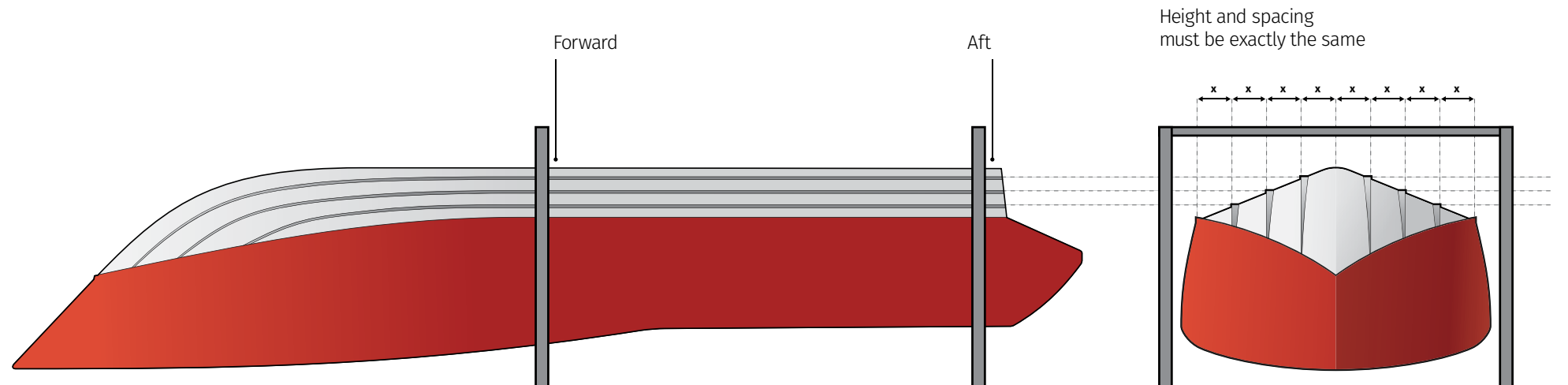


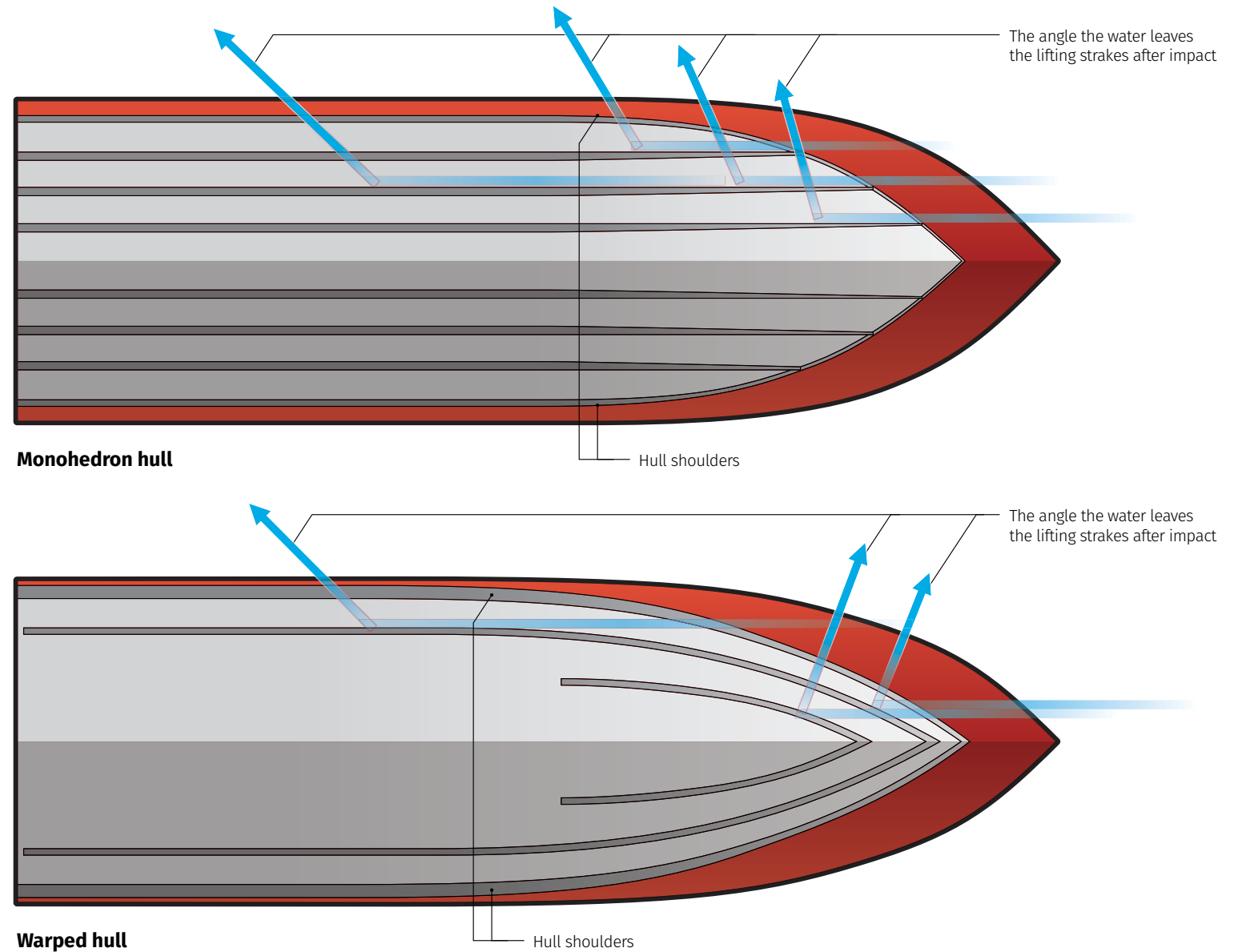
Figure 3-  
Basic illustration of the monohedron hull construction configuration.

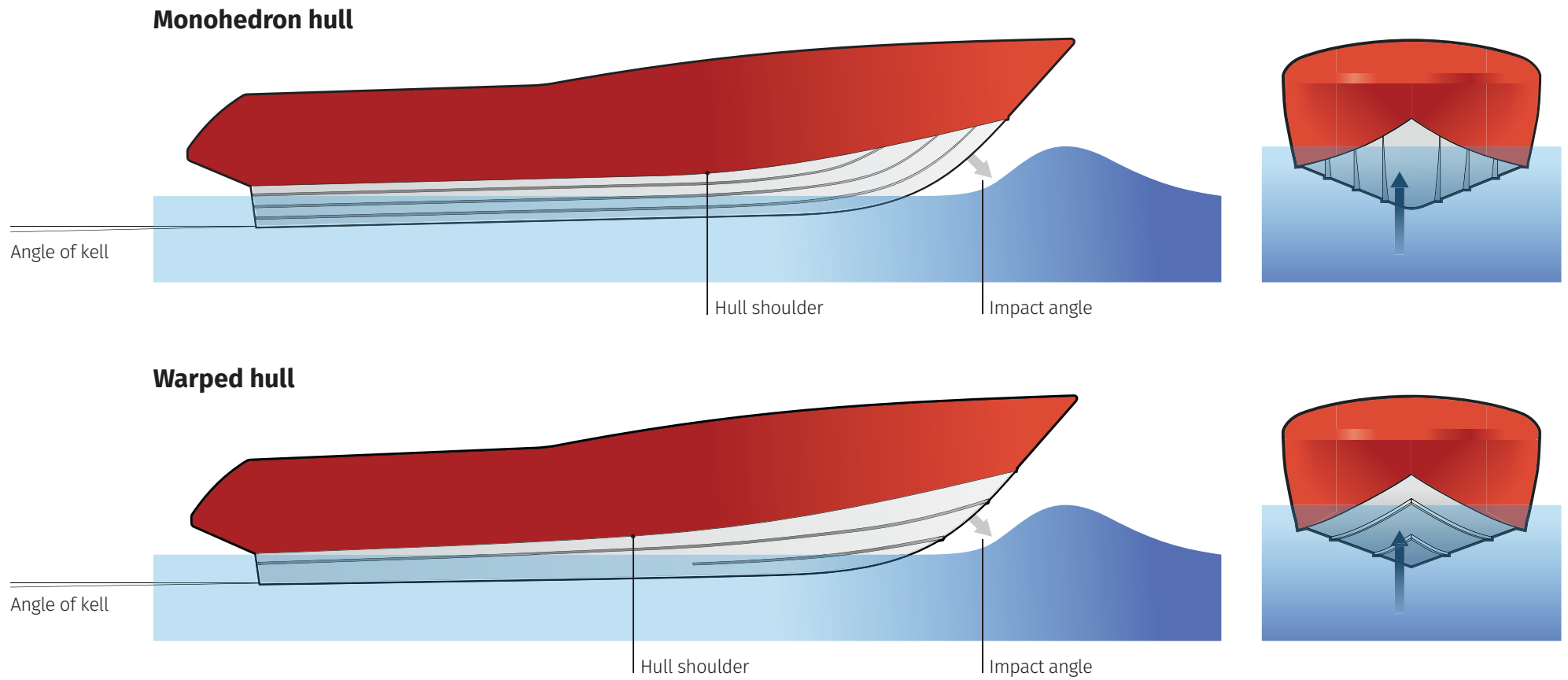
When looking at the front of the boat out of the water, see if you can have the bow lifted about 10 degrees, then sit down and look slightly up at the bow checking the strakes. If they wrap around you will see that part of the strake would be pushing the water slightly forward restricting the movement of the boat forward. If the strakes are traveling straight and tapering up to the chine you will see there is really no restrictions for the water and the boat traveling forwards.

As shown in **Figure 4** the strakes that are running parallel are in the same direction the boat is. The lower hull, is showing what one finds on most boats. Well what direction is the boat traveling and that can depend on what the water is doing as well.

These strakes are like shock absorbers on your car. If they are not working correctly your ride would not be comfortable.

**Figure 4-**  
Bottom view of a monohedron and warped hull showing the direction water takes after impacting with the strakes.





**Figure 5-**  
Side view of a monohedron and warped hull impacting  
with a swell.