Craftsbury
SCULLING CENTER

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Rigging Basics

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Rigging

Getting Started:

Rigging is adjusting a boat and oars to meet your individual needs. The hardware of a boat can be set to optimize your position in the boat in conjunction with your chosen oar dimensions and blade type. The make of your boat will dictate the amount of adjustability available to you. Generally, performance singles have the widest range of possibilities to customize your rig.

Before you begin you will need to get organized:

- Keep a logbook of all your rigging activities. Record the date and current measurements so you can retrace your steps if you need to.

- Have the correct tools ready: Hex keys, wrenches, a pitch meter, a long carpenter's level, and a tape measure with centimeters.

- Secure your boat in slings in a quiet place away from the distractions and curiosity of other scullers willing to give you lots of advice.

- Take your time and write everything down.

- Complete one step at a time.

- Once you measure, measure again.

- If you get tired, take a break. Keep your sense of humor.

Setting Up Your Boat:

Before you start to take measurements or change the dimensions of your rigging you need to set your boat up in a way that will make it easy for you to work on it. Since a third hand is not always easy to come by here is another suggestion.

- Set your boat on slings of about the same size. To stabilize your boat, take a rod or stick (like a broomstick) and place it vertical next to one of the riggers. Using a large spring clamp- clamp the rigger to the stick to prevent the boat from tipping.

- Level the boat end-to-end. Place the carpenter's level along a level part of the boat such as the base of the gunwale; do not use the seat deck because there is a slight angle from bow to stern. If needed, fold and prop a towel between the boat and sling to level the boat.

- Level the boat side-to-side. Place the carpenter's level across the gunwales. When the bubble is centered, adjust the clamped rigger with the vertical stick to hold the boat level.

- Strap or tie your boat to the slings to further stabilize it.

- Bring your toolbox near by. Now you are ready to start.

When you rig your single you are setting the dimensions of the riggers and oars to maximize your biomechanical efficiency and comfort in the boat. Rigging is not an exact science as there is a fair amount of art and "touch" mixed in. There are some basic rules and references that need to be adhered to and serve as a platform to fine-tune your boat for you. Your rigging needs can also change over time. As certain elements of your technique improve, rigging details can be adapted to support those improvements.

Keep in mind that you are working multi-dimensionally when you rig your boat. You are balancing horizontal, vertical, angled, and diagonal measurements to create a leverage system that allows you to move the boat effectively. When you make one change to your rigging it affects the entire system and small alterations, at times, can produce large effects. Once you alter your rig you need to row with it several times to get accustomed to a new feel to decide whether the change was positive or not. Using a speed device such as a Speedcoach that can measure meters per second, distance, and 500-meter split times, is useful for objectively observing whether a rigging change makes you go faster or not. Having a stretch of flat water without current is valuable for testing rigging changes over 500-meter or 1000-meter repeats.

Before we start measuring, the following descriptions of the terms “through the pin” and “load” will give you an overview of important aspects of rigging.

Through the Pin:

The pin is the vertical axle the oarlock rotates around that extends upward from the end of the rigger. In rigging, the pin serves as a reference point for positioning yourself in the boat. The terms “through the pin” and “work through” refer to where the centerline of the hip joint and the seat is relative to the location of the pin. The hip joint axis may be behind, equal to, or astern of the pin at the catch position. Drawing an imaginary line from pin to pin provides a standard for the hip joint axis to reach in full compression when ready for the catch. In a performance single it is desirable to be at zero, or equal, with the pin. In a faster moving boat you may work 1-2 cm through the pin. Your flexibility, skill level, and boat type can all affect your ability to get up through the pin, but the point here is to identify the pin as a reference. Being centered in the boat and around the “work” helps to produce the optimum angle of the oar at the catch and the release. This prevents the boat from being “pinched” which is when the blade is in an ineffective, extreme position that actually pushes water laterally against the hull disrupting forward propulsion.

Load:

Load is the term that defines the resultant physical relationship of the distance between the pins, inboard/outboard settings of the oars, blade size, and a sculler’s physical dimensions. On a rowing ergometer, the concept of load is illustrated by setting the damper resistance high at “10” or low at “1” and is expressed as drag factor. Unfortunately, in the boat, there is no clear-cut way for the average person to define drag factor and measure the load of their rigging system. There does exist, however, reasonable parameters to follow as we continue our discussion of rigging.

Keep in mind that more is not necessarily better when it comes to load. It can be too heavy producing undo stress on the lumbar spine, creating excessively large arcs in the water, and making it a strain to increase your stroke rate adequately during a race. On the contrary, too light is a bit like trying to pedal a bike down a hill while spinning your small chain ring; you need to take too many strokes to maintain the desired speed. Your individual body dimensions, strength, and race pace stroke rating, play a role in how much load you can optimally row with. Boat builder, Ted Van Dusen, of Concord, MA, advised to, “Rig for the end of your race,” meaning set a load that is adequate to maintain efficient race tempo yet light enough that you can increase the stroke rate for the final sprint when you are in a fatigued state.

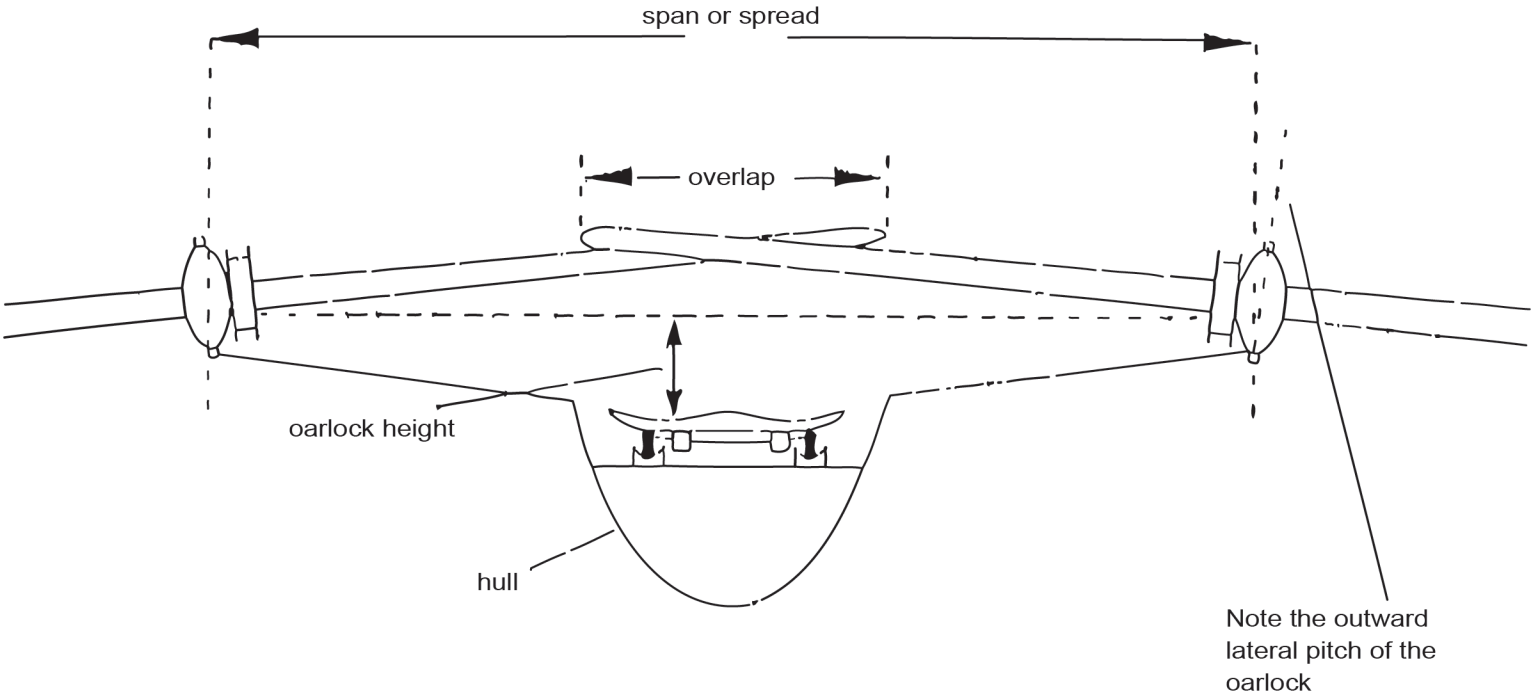
Step 1: Setting the Spread

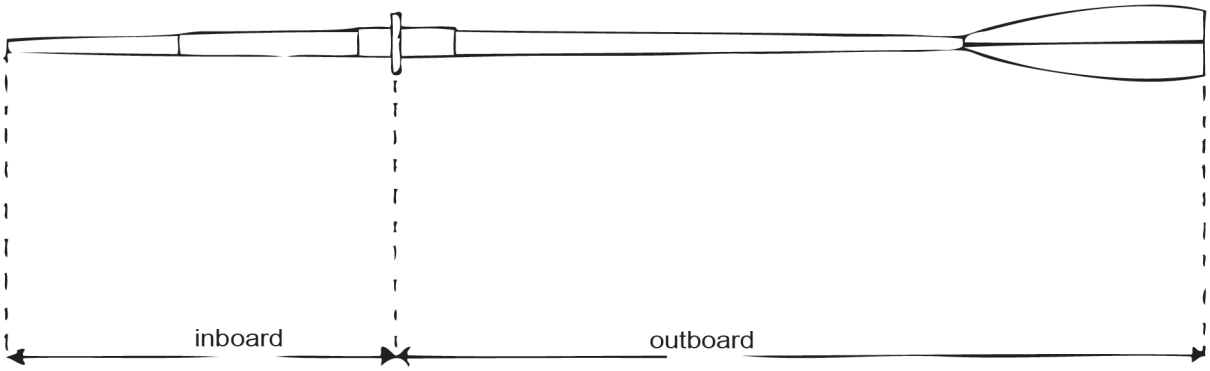
The spread is the distance between the two oarlock pins. This is a major measurement of your gearing system that will combine with your oar settings to determine the load of your rig. Measure from the center of the top of the pin to the center of the top of the other pin. To make it easier, you may have another person to hold one end of the tape measure for you. Record the number of centimeters.

The range for setting the spread is usually between 158-cm. to 164-cm. An average starting point is 160-cm. If you are a smaller sculler a spread of 158-cm may be appropriate and if you are a larger sculler, 162-cm. may be more comfortable.

Moving the spread in creates a heavier load and larger arc through the water. Moving the spread out lightens the load, creating a smaller arc in the water. You need to feel that you are comfortable to open your hands along a horizontal plane well over the gunwales as the blade is prepared for the catch. This happens in conjunction with other factors but setting the spread is the initial consideration.

Rigging Figure 1: The basic boat measurements





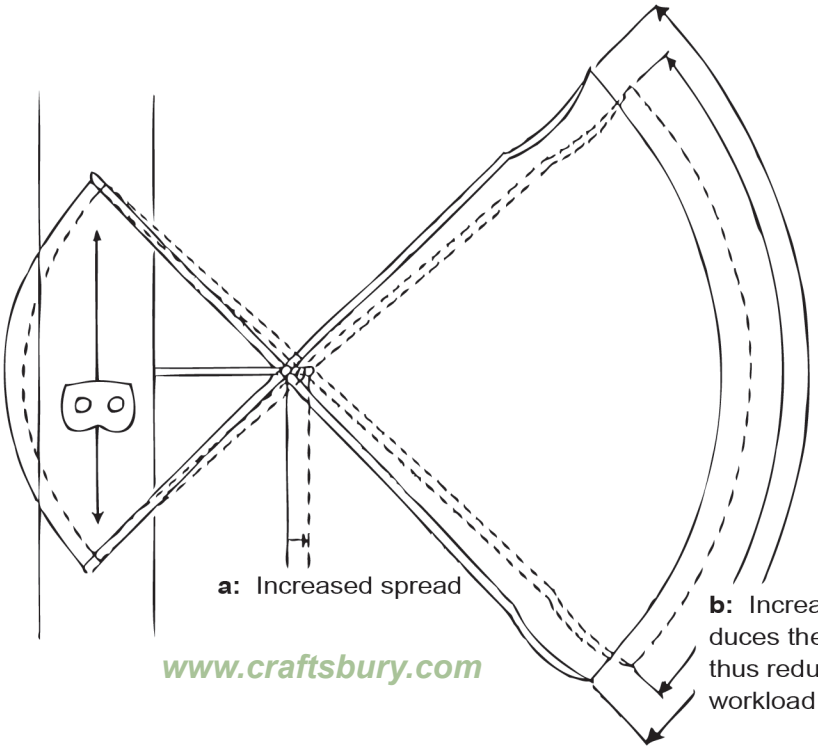


Figure 2: The effect of changing the spread of the rigger on the arc of the stroke.

It is of the utmost importance to make sure that the pins are set an equal distance from the centerline of the boat. Measure across the gunwales of the boat, take half the number of centimeters, and then measure from that point to the pin. For example, if gunwale to gunwale is 46 centimeters, half of 46 is 23, locate the 23-cm. mark on your tape measure, place it on the gunwale nearest the pin you are measuring, and measure the remaining distance to the pin. It should read 57 centimeters if your overall spread is 160 centimeters. (1/2 of 160 cm.=80 cm.) Another method to check if the pins are equidistant is to measure from the outside of the opposite track to the base of the pin and check that both sides are the same. You can use this method because the seat tracks should be set centered in the boat. Once you have finished setting the spread. Measure it again. Do not change your spread casually once you have it set, you can use other adjustments to make smaller gearing changes.

Step 2: Determining Inboard

Setting the inboard on your oars is another rigging step that relates to overall load. The inboard is the measurement that is defined as the distance from the end of the handle to the blade-side face of the collar. The inboard setting is dependent on the overall spread and the amount of overlap of the oar handles or crossover. Take ½ your spread and add 8 centimeters for a good initial setting of your inboard. Thus, if your spread was 160-cm., you inboard setting would be 88 cm. The inboard measurement serves as a way to fine-tune your load as you may move the collar in small increments to affect the load. Moving the collar towards the handle creates a shorter inboard lever and makes the load heavier. Conversely, moving the collar towards the blade, makes the inboard lever longer and lighter. Measurements between 87 to 89 centimeters allow a great deal of adjustment. If you need a setting such as 86 centimeters, you also may need to select a shorter overall length of the oar to avoid an excessively heavy load.

Step 3: Oar Length

The third factor in determining load is the overall length of your oars. Your size, strength, and blade design will affect what length oar you choose to scull with. A shorter oar lightens the load; a longer oar increases the load due to the longer outboard. Outboard is the measurement from the blade-side face of the collar to the tip of the blade. A standard overall length for a Macon blade is 298 centimeters; hatchet-shaped blades- 288 centimeters. A larger heavyweight man may increase these measurements by 1-2 centimeters and a lightweight woman sculler may decrease these measurements by 1-2 centimeters.

Some experimentation is needed in your sculling to set the overall length. Your needs may change as your personal style of sculling develops and you race at higher rates or gain strength. You also may find that you prefer a lighter load if you tend to be quicker and more reactive versus someone who prefers a heavier, power stroke. Remember that spread, inboard, oar length, and personal attributes must all work together. There is no sense to row with excessively heavy loads to impress others. If anything lean towards lighter loads to protect overstressing the lumbar spine.

Step 4: Oarlock Height

When you sit in a boat, the first thing that you usually notice is where the handle height is. If you row club boats, you know that some boats feel “high” and others “low”. This can be due both to the size of the boat relative to your weight and to the height set at the oarlock. If you row a hull that is too big for you, you do not sink the boat to the proper water line and you will generally feel too “high” in the boat; as if the oar handles come up to your chest. Rowing with the correct height is a one reason to row the right hull size for your weight. Accurate oarlock height allows you to clear your blade from the water on the recovery and lets you to apply your body weight properly during the drive.

Due to the crossover, in sculling there is a slight height differential between the starboard and port oarlocks of 1- 2 centimeters allowing the sculler to row left over right. This difference in the height setting gives room for the hands to nest together at the crossover and keep the boat level. The differential setting can be a personal setting, as some scullers may like a little more and some a little less. The important point is that the boat stays on keel at the point of crossover.

Standard oarlock height runs between 13 to 18 centimeters and is largely a comfort or stylistic setting. At the finish, sitting with good posture, and blades buried, your thumbs on the handles should just brush your middle ribs at the level of your sternum. You do not want to feel that your handles are in your lap or up near your neck.

To measure height, use a long level placed across the gunwales. Set one end of the level under the center of the oarlock and place the other end over the seat. Use a tape measure to establish the distance from the bottom edge of the long level, to the bottom of the oarlock, and the top of the seat. Every time you measure height make sure to put your level in the same place and measure to the same point on the seat and oarlock to keep the references consistent.

Sliding the oarlock off the pin and changing the number of washers above and below the pin can usually suffice to change height in most boats. Note: When you purchase a boat ask the builder if the height differential is set in the rigger construction or needs to be set at the oarlock; if you row in a boat with a wing rigger check whether the starboard side of the wing is shimmed higher than the port. Some European clubs row right over left, in which case you need to reverse the standard height differential to raise the port side.

Step 5: Sternward Pitch

Sternward pitch is the angle of the blade away from perpendicular during the pull through of the stroke. A small amount of pitch, 4 to 6 degrees, is enough to help the blade stay buried at the proper depth through the water. If a blade has too much pitch, more than 7 degrees, the blade will wash out at the finish; too little pitch, less than 4 degrees, causes the blade too dive deep. Sternward pitch is a fore-and-aft measurement usually taken at the oarlock but it must be kept in mind that it is the angle of the blade that we are concerned with, so knowing the pitch of the pins and the oars has to be taken into final consideration. The pitch of the blade = the pitch of the pin + the pitch of the oarlock + the pitch built into the blade.

Measuring the pitch will begin with checking the pin. Ideally, if the pin is set at 0 degrees it makes it easy to calculate your oarlock pitch. Unless you check it you don't know what the reference is. A commercially available pitch meter or a simple level can be used. With your boat set up level in slings, slide the oarlock off taking care to count the washers setting the height. Place a vertical level against the sternward face of the pin and see if it zeros out. If it does the pin is at 0 degrees, if not, you may be able to shim your pin to get it to 0 degrees, otherwise use your pitch meter to determine how many degrees you are +/- 0.

Adjust your pitch meter on a level portion of the gunwale. Put the pointer on 0 and then center the bubble on the level. Tighten the level so it is firmly in place. Place the squared surface of the pitch meter against the face of the pin and move the pointer until the level's bubble is centered. Record the number of degrees the pointer reads in that pin.

Next, put the round pitch inserts into your oarlock with the number of degrees you want. Check that the top and bottom shims are in the right orientation (read your oarlock owner's manual). Slide the oarlock back on the pin. For example: If your pin is at 0 degrees and you want +5 degrees put in the +5-degree shim. However, if your pin is +1 degree you need a +4-degree shim to give your oarlock +5.

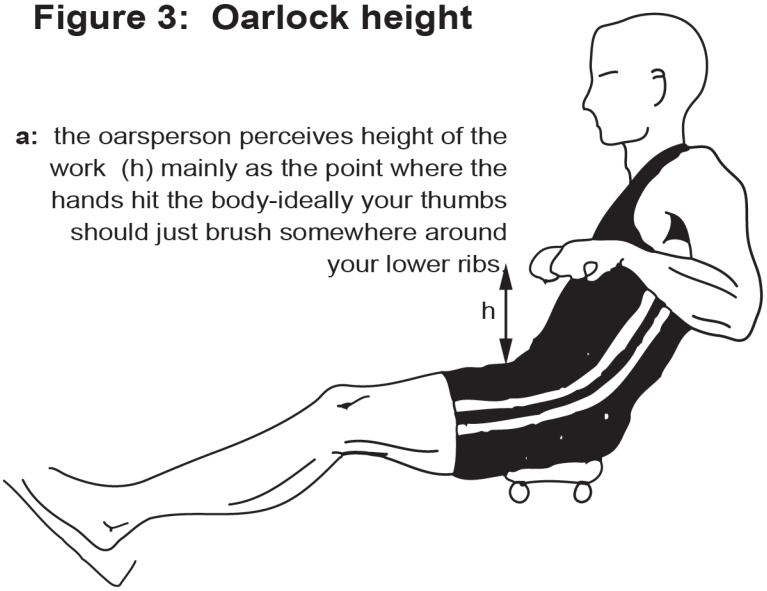
Once you have put the oarlock back on the pin and secured the top bolt, measure the pitch in the oarlock. Hold the oarlock at the mid-drive position (with the gate closed and nut pointing towards the stern) parallel to the midline of the boat. Zero your pitch meter and then place the squared surface of the pitch meter against the back plate of the oarlock. A spring clamp can be handy for this. Make sure the surfaces are flush to get an accurate reading. Your measurement should agree with the sum of the degrees in the pin + the inserts. If not, try again until you get the desired degrees. 5 degrees is the most common setting, 6 may give you a little more bite at the catch and 4 a little less lift to the boat at the catch. Whatever amount of pitch you choose, make sure that both sides are the same.

Step 6: Outward Pitch

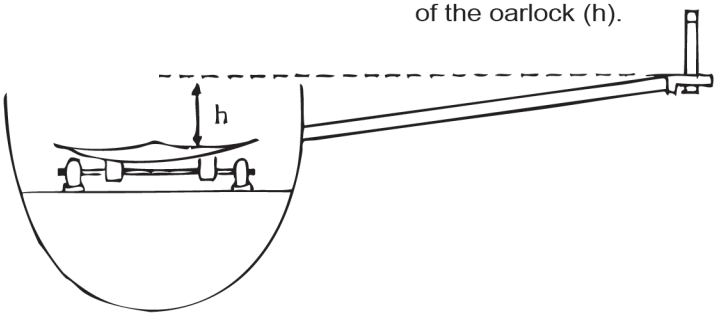
Outward or lateral pitch is the tilt of the pin away from the centerline of the hull. The standard 0 to +2 degrees assists the tracking of the blade in the water. You can measure it by placing your pitch meter on the lateral aspect of the pin and measuring. You can also see the effect of lateral pitch in the oarlock. With the pitch meter in place against the back plate of the oarlock, check your reading of degrees at mid-drive, swing the oarlock to the catch position and you should see the sternward pitch increase. Then swing the oarlock to the finish and you should see the degrees diminish to assist the release of the blade. Your readings should look like: catch +6 degrees, mid-drive +5, and finish +4. If you have the inverse relationship, your pins could have negative lateral pitch and require creative shimming to rectify.

Figure 3: Oarlock height

a: the oarsperson perceives height of the work (h) mainly as the point where the hands hit the body-ideally your thumbs should just brush somewhere around your lower ribs.



b: to quantify oarlock height, the distance from the front top edge of the seat to the bottom of the oarlock (h).



c: height is generally adjusted by exchanging washers above and below the body of the oarlock.

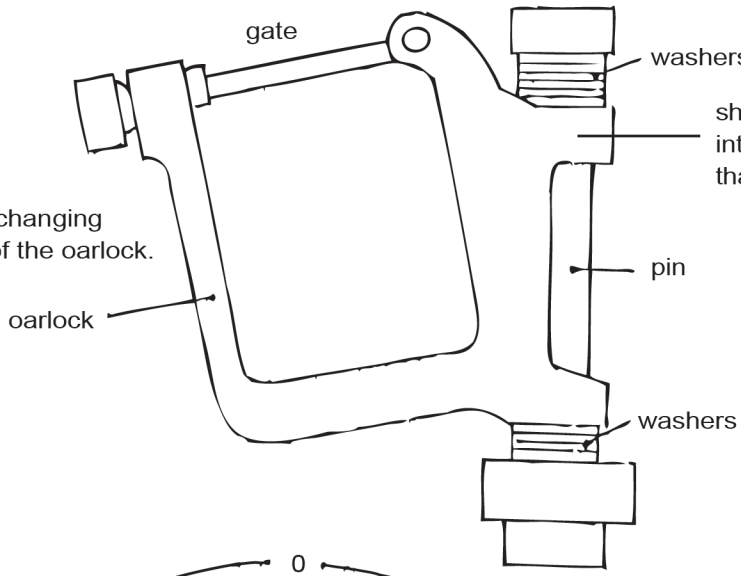
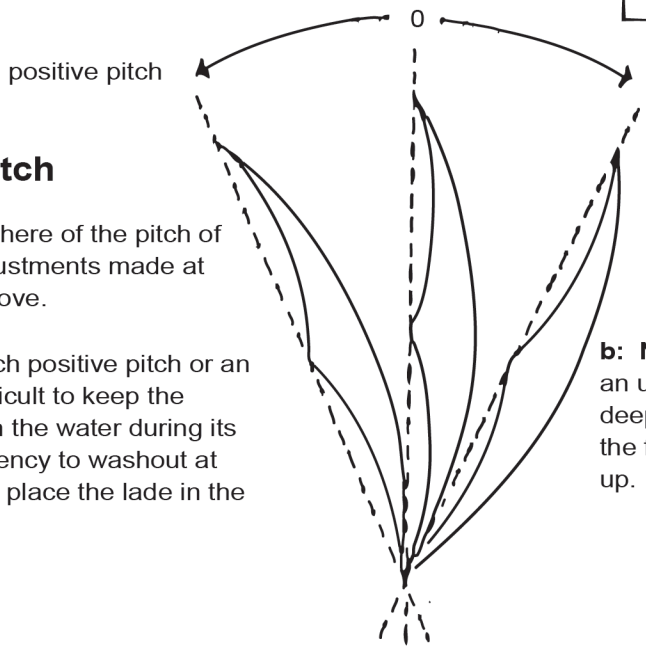


Figure 4: Blade pitch

To be clear, we're speaking here of the pitch of the blade resulting from adjustments made at the oarlock as described above.



a: Positive Pitch - too much positive pitch or an overpitched rig makes it difficult to keep the blade at the correct depth in the water during its stroke. Often there's a tendency to washout at the finish and it is difficult to place the lade in the water at the catch.

b: Negative Pitch - too much negative pitch or an underpitched rig causes the blade to dive deep at the catch and be difficult to extract at the finish. The tendency to catch a crab goes up.

Step 7: Pitch in Oars

In North America, the majority of oars are built with 0 degrees of pitch, meaning that the position of the blade is level with the wear plate surface on the sleeve. If you row with unknown or wooden oars you may have to measure your oars at the blade to determine if there is pitch built into the blades and take those degrees into consideration when setting the pitch at the oarlock. You can do this by setting your oar on a bench with a level block as wide as the blade supporting the blade and another support block under the handle. Place the blade face down on the block with 1" of the tip off the edge of the block if you are measuring a Macon blade or with the short side corner radius of the blade just off the edge of the block for hatchet-shaped blades. Then put your level across the wear plate surface to see whether it is at 0 degrees. Shimming to get the level zeroed, Concept 2 recommends that .025" equals approximately 1 degree of pitch. If it is necessary to measure your oars check with your manufacturer for specific instructions because there are variations depending on blade type.

Step 8: Foot Stretcher Adjustment

The foot stretcher adjustment should be placed so that you are both able to get up through the pin at the catch and have about the width of a fist between the handles at the release comfortably in front of your body. You need to avoid feeling crowded by your oar handles at the release forcing unnecessary lay back and yet not have excessive room to allow the handles to swing past the plane of the body, thus losing the weight off the handles.

Step 9: Heel Height

Heel height is another measurement that can facilitate easier compression into the catch. The standard range is 16 to 18 centimeters from the top of the seat to the bottom of the heels. Many boats have adjustable footboards making this easy to change. If you boat has clogs, you may be able to re-drill and lower the heel cups to get a better setting.

Step 10: Rake of the Footboard

The angle of the footboard can be measured with a protractor or a goniometer (like those used in physical therapy clinics). Standard measurements should fall between 39 to 42 degrees. Poor ankle flexibility, may necessitate flattening the footboard to get into a more comfortable position at the catch. If you have good flexibility, 40 to 42 degrees is a desired setting to assist the leg drive in using the entire surface of the foot. Many performance boats have this adjustable feature, otherwise you will have to reposition the footboard and its attachments.

Step 11: Setting the Tracks

Once you have set your rigging dimensions and foot stretchers, you need to set the seat track so you do not touch either end and have freedom of seat movement. Most tracks are quite long giving lots of room for adjustability. Reaching inside the hull and loosening the small wing nuts that hold the track usually allow you to move the tracks. Do not take the wing nuts off; just loosen enough to slide the tracks fore-and-aft. Set the front stops to the stern of the pin far enough to allow you to get up through the pin in full compression but not so far as to hit the back of your calves in an uncomfortable way.

If your boat does not have adjustable tracks you must do your best to get the best possible position within the dimensions available to you.

Step 12: Wing Rigger Adjustments

Boats with wing riggers offer some additional adjustability with regards to getting through the pin, setting height differential, and overall oarlock height if the amount available on the pin is not enough. Some care needs to be taken to position the wing in a way that maintains the trim of the boat and does not shift weight too far to either to the stern or bow. Your boat builder is the best person to discuss the rigging of the wing of a particular type of hull.

Ref: Craftsbury Website: Tech Tips, Spring 2002