

## Beaufort Wind Scale

Developed in 1805 by Sir Francis Beaufort of England as a standardized description for weather observations including wind speed.

Beaufort Force Scale	Wind Speed <sup>1</sup>		WMO <sup>2</sup> Description	Wave Height <sup>3</sup> (feet)	Appearance of Wind Effects <sup>1</sup>		Paddler Notes <sup>4</sup>
	Knots	MPH			On the Water	On Land	
0	< 1	< 1	Calm	0	Sea surface smooth and mirror-like	Calm, smoke rises vertically	Best for beginners
1	1-3	1-3	Light Air	0.25	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes	Still easy
2	4-6	4 - 7	Light Breeze	0.5 - 1	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move	Novices will experience weathercocking
3	7 - 10	8 - 12	Gentle Breeze	2 - 3	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended	Good practice for intermediate paddlers
4	11-16	13 - 18	Moderate Breeze	3½ - 5	Small waves becoming longer, numerous whitecaps	Dust, leaves, loose paper lifted, small tree branches move	Difficult for novices, may be challenging for intermediates
5	17 - 21	19 - 24	Fresh Breeze	6 - 8	Moderate waves taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway	Small craft warnings. Hard paddling into the wind. Following seas will result in surf rides. Rescues difficult.
6	22 - 27	25 - 31	Strong Breeze	9½-13	Larger waves with whitecaps common, more spray	Larger tree branches moving, whistling in wires	Experienced paddlers only. Very hard paddling into wind. Rescues very difficult.
7	28 - 33	32 - 38	Near Gale	13½-19	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.	Whole trees moving, resistance felt walking against wind	Headway very hard. Very difficult to turn/maneuver. Communication hard. Wind may rip paddle out of hand.
8	34-40	39-46	Gale	18-25	Moderately high waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind	It's every person for themselves. Rescues are virtually impossible.
9	41-47	47-54	Strong Gale	23-32	High waves, sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs	Survival paddling. Rescues are impossible.
10	48-55	55-63	Storm	29-41	Very high waves with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"	<b>Pray!!!</b>
11	56-63	64-72	Violent Storm	37-52	Exceptionally high waves, foam patches cover sea, visibility more reduced		
12	64 +	73 +	Hurricane	45 +	Air filled with foam, sea completely white with driving spray, very reduced visibility		

<sup>1</sup> NOAA; <sup>2</sup> World Meteorological Organization; <sup>3</sup> <http://whale.wheelock.edu/whalenet-stuff/beaufort.html>; <sup>4</sup> *Sea Kayaking Rough Waters* by Alex Matthews

## Effect of Wind on Forward Progress

This table shows the effects of wind on cruising speed or “speed made good.” It is meant solely as a rough guide (from *Sea Kayaking Rough Waters* by Alex Matthews) .

Wind Speed	Headwind Resistance	Tailwind Assistance
0 knots	0 knots	0 knots
5 knots	-0.5 knots	0 knots
10 knots	-1 knots	+1 knots
15 knots	-1.5 knots	+1.5 knots
20 knots	-2 knots	+2 knots
25 knots	-3 knots	+2.5 knots

For example, if a paddler who would normally travel at 3 knots has a headwind of 10 knots, the headwind resistance of -1 knot would reduce forward speed to 2 knots (speed made good).

## Effect of Headwind on Paddling Speed and Time

The following table shows the effects of headwind on speed made good and travel time. It uses the general guidance from the table above and is meant solely as a rough guide (from *Sea Kayaking Rough Waters* by Alex Matthews).

Wind Speed	Speed Made Good	Time Paddling to Cover 6 Nautical Miles
<i>Based on 2.5 knot paddling speed</i>		
0 knots	$2.5 - 0 = 2.5$ knots	2.4 hrs.
5 knots	$2.5 - 0.5 = 2$ knots	3 hrs.
10 knots	$2.5 - 1.0 = 1.5$ knots	4 hrs.
15 knots	$2.5 - 1.5 = 1$ knots	6 hrs.
20 knots	$2.5 - 2 = 0.5$ knots	12 hrs.
<i>Based on 3 knot paddling speed</i>		
0 knots	$3 - 0 = 3$ knots	2 hrs.
5 knots	$3 - 0.5 = 2.5$ knots	2.4 hrs.
10 knots	$3 - 1.0 = 2$ knots	3 hrs.
15 knots	$3 - 1.5 = 1.5$ knots	4 hrs.
20 knots	$3 - 2 = 1$ knots	6 hrs.
<i>Based on 3.5 knot paddling speed</i>		
0 knots	$3.5 - 0 = 3.5$ knots	1.7 hrs.
5 knots	$3.5 - 0.5 = 3$ knots	2 hrs.
10 knots	$3.5 - 1 = 2.5$ knots	2 hrs.
15 knots	$3.5 - 1.5 = 2$ knots	3 hrs.
20 knots	$3.5 - 2 = 1.5$ knots	4 hrs.

**Question:** Now that we can predict wind speed for any day we paddle by crossing an elephant with a rhinoceros, should you paddle slowly to conserve energy or paddle harder and pick up speed, if you have 6 miles to paddle back to camp and suddenly get hit by a 15 knot headwind?

**Hint:** using the table above, figure the paddling time assuming a 2.5 knot paddle speed and then compare it to a paddling time using a 3.5 knot speed.

### Did You Know?

1 nautical mile = 1.2 miles; NOAA issues small craft advisories when wind waves are predicted to reach and sustain 4 feet or greater usually caused by winds of 18-33 knots.

<http://www.cs.rice.edu/~jnavarro/windsurfing/beaufort.html> for good pics on Beaufort Scale.