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Cat's Paws To Grey Beards: Wave Theory And Practice

Waves can be the most beautiful and the most fearsome aspect of the sea. Whether you float above them or dive beneath them, you had better understand them and most certainly respect them. This column is about that.

Winds Are Known From Whence They Blow, Currents By Where They Go

A northerly wind means a wind FROM the north, thus blowing you south. A northerly current means a current heading TO the north, setting you in the same direction – north. What does that have to do with waves? Largely, waves are the offspring of the wind.

Ignoring for the moment that wave action can be created by tidal forces sluicing through a narrow channel, waves are created by the wind. When the water is fairly still, as you'll often see early in the morning, and the wind starts to pick up, those little over-lapping wavelets, called the Cat's Paws, will eventually build into something significant.

The greater the distance that the wind has blown over the water unhindered by land (called its "fetch"), the greater the size of the waves.

If you ever wondered why mariners for centuries have feared Cape Horn at the bottom of South America, it is because the "fetch" there is essentially infinite. Wind can blow continuously, unimpeded by land, around the entire planet in the space between Cape Horn and Antarctica. Again. Again. And again. One hundred-foot waves are not impossible.

Packing A Punch

The "sea state," which can be characterized as the sum of the height, frequency and direction of waves, is the key to understanding comfort – and safety – of any passage over the water, even more so than the strength and direction of the wind.

Anyone who has ever been caught in six foot seas that are but six seconds apart in frequency would gladly trade them for 10 foot waves that are 30 seconds apart.

The first is a kidney-busting beating; the latter is a sleigh ride. Of boats that sink at sea, slightly more than one in 20 of them sink because they break apart from the pounding of the waves upon the hull.

BTW, for very different reasons, four times as many boats sink at their dock than sink at sea.

So, I'm Heading Out To Sea – How Are the Waves?

One of the unsung heroes of our maritime services is NOAA and their National Ocean Service. They, along with the Army Corps of Engineers, understand how important wave action is and maintain 70 wave-gauging stations placed around the coastline of the United States (including the Great Lakes) collecting data on wave height and direction in near-shore areas.

Now you can get an hourly update from these stations, direct to your cell phone. I get Buoy #44017, which is 23 nautical miles southeast of Montauk. Go to www.buoyalarm.com to find the buoy or buoys you want to monitor. Oh, and it is your favorite price. Free.

Surf Happens, But How Do I Gauge It?

For the more scientifically inclined, the energy within a wave is proportional to the square of the wave's height. Like many things in nature, a four-foot wave isn't four times as powerful as a one-foot' wave. Four-foot seas are 16 times as energetic as one-foot seas, all else being equal. How much energy is in one of those 100-foot "grey beards" passing by Cape Horn, compared to a four-foot wave in Moriches Inlet? Do the math. Not 25 times more powerful (100' x 4') but 625 times more powerful!

But things are rarely equal. A long, slow, four-foot sea is one of life's great pleasures at sea. What matters is how close together and how steep those waves are. A good way to compare waves for steepness is the wave height divided by the square of the frequency period. This is essentially how fast your sleigh ride – or the beating you are going to take – is going to be.

Halving the frequency period (from, say, 10 seconds to five seconds) of a wave quadruples the acceleration of your sleigh ride, and more than likely multiplies the sea sickness aboard the boat.

Another way to gauge what awaits you at sea is a Severity measurement. This indicates the amount of energy carried by each bit of wave and is proportional to the energy of a wave (the square of its height) divided by its wavelength (how much distance the waves are apart, measured from peak to peak.)

As you can probably do in your head, six-feet waves that are six feet (distance, not time) apart are more severe than six feet waves that are 12 feet apart. We don't need the Cray computer for that one.

In a subsequent column, we'll get into different kinds of waves – tsunamis, deep, shallow, non-wind, etc – and the effect they have on mariners. But this column will hopefully get you thinking about safety before you leave the dock.

Here's one more – what is the longest wave on Earth?

The wave that is created by the moon, pulling the water up and around the Earth. What is its Frequency? Email me with the answer!

BTW, if you are interested in being part of USCG Forces, email me at JoinUSCGAux@aol.com or go direct to the D1SR Human Resources department, who are in charge of new members matters, at DSO-HR and we will help you “get in this thing…”