Context:
Gabriola, oceanography

Citations:
Doe, Nick, Summer tides, *SHALE* 5, pp.45–7, December 2002.

Errors and omissions:

References:

Doe, Nick, Winter tides, *SHALE* 10, pp.33–36, January 2005.

Doe, Nick, Two tides a day? *SHALE* 6, pp.25–31, April 2003.

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found the study interesting and informative and I imagine that many researchers of Northwest Coast prehistory will too.

Because the report is based on a dissertation, it treats the analysis of burials quite objectively and impersonally as is proper for an academic work. Curtin succeeds in avoiding any extravagant claims or interpretations and does not glorify the research in any way—an important consideration when dealing with skeletal remains, and particularly when many Aboriginal people have reservations about the propriety of conducting such analyses. The dead deserve to be treated with respect, and that Joanne Curtin has managed to do, while at the same time providing us with an interesting, and unexpected glimpse into the lives of Aboriginal people on Gabriola in prehistoric times.

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Summer tides—*by Nick Doe*

Have you ever wondered why the tide is *always* out during the day in the summer? Go to the beach on Gabriola any summer day, and chances are, the tide is low.

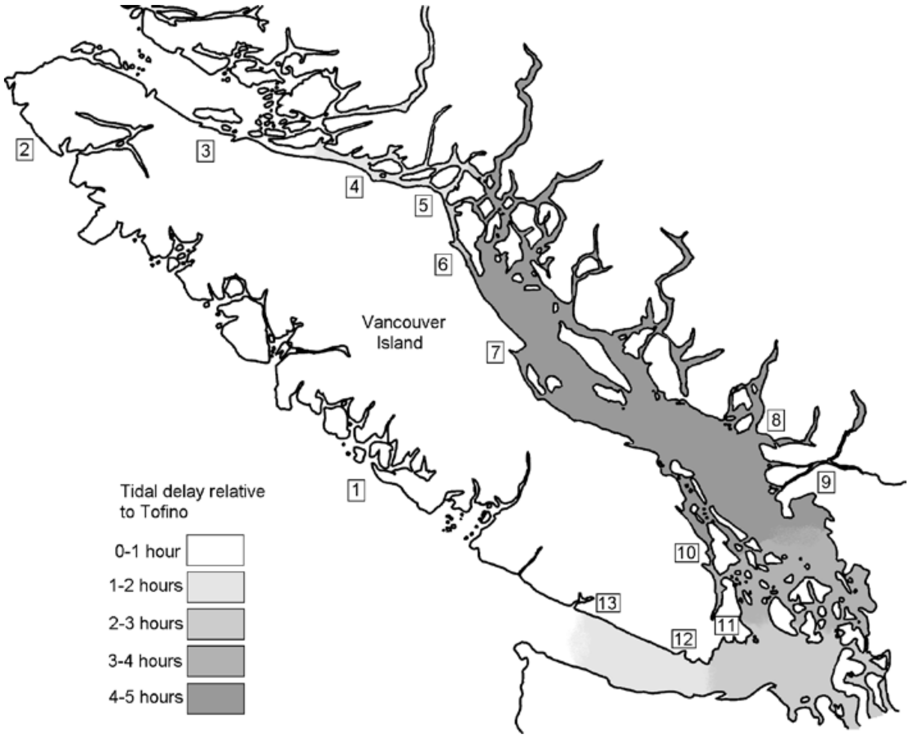
Just to prove this *scientifically*, let's take the year 2002 as an example and look at the tidetables. The number of days that the lowest tide of the day on Gabriola occurred between six in the morning and six in the evening in June and July was 57 times out of 60. For December and January, it was only twice. Clearly, although the moon has a lot to do with our tides, the sun must also play an important role. It can't be the moon that is causing the tide to be low during the day because the position of the moon in the sky has nothing to do with the time of day.

So what's the problem? Well it's this. If an important component of the tide is due to the gravitational pull of the sun, shouldn't the highest solar tide occur whenever the sun is highest in the sky—noon on a summer's day for example. Well, as we know—it's not. Not only is it not high, it's not even close. Let's include the moon just to make the point. There was a new moon on June 20, 1993. The summer solstice was just one day later. At noon, when both the moon and the sun were high above, the tide on Gabriola stood at only 0.7 feet. High tide that day was just before five in the morning and again at about eight o'clock at night. This happens all the time. It just doesn't add up if you believe that the moon and sun are "tugging" at the water—pulling it higher.

I learned the answer to this puzzle many years ago when living in North Vancouver. Being new to BC, I determined to make a trip to the west coast of Vancouver Island one weekend to see the famous tidepools at Botanical Beach near Port Renfrew. Tidetables in the newspaper were consulted; ferry schedules enquired about; library books on marine life withdrawn; and bright and early one Sunday morning, off I set.

I arrived shortly after twelve, only to see—not tidepools, not even beach really—just the surf sweeping up to the salal at the forest's edge. My timing just couldn't have been worse.

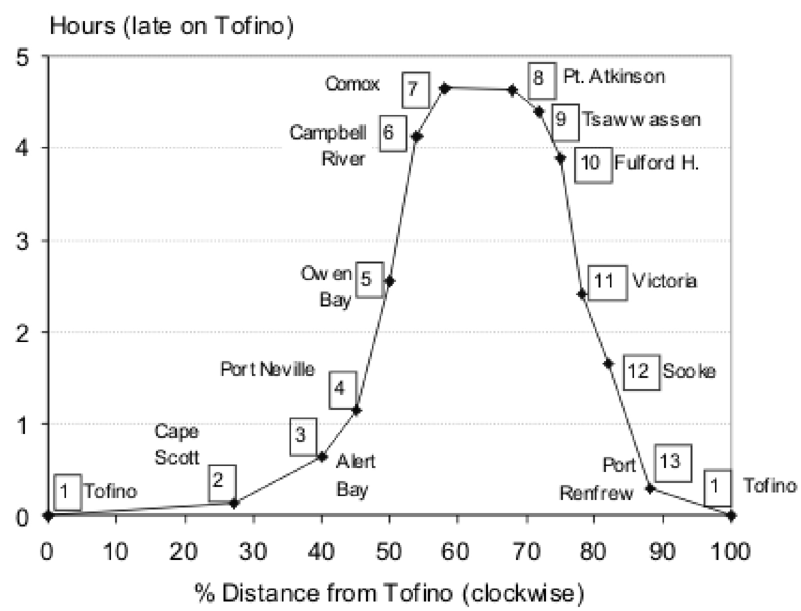
Thinking about why this had happened on my long drive home, it occurred to me that, assuming there was no mistake, the timing of the tide in the Strait of Georgia must lag behind that in the open Pacific. However, to prove that, I needed to calculate the delay between the tides at different places, and this is not quite as straightforward as it may seem.

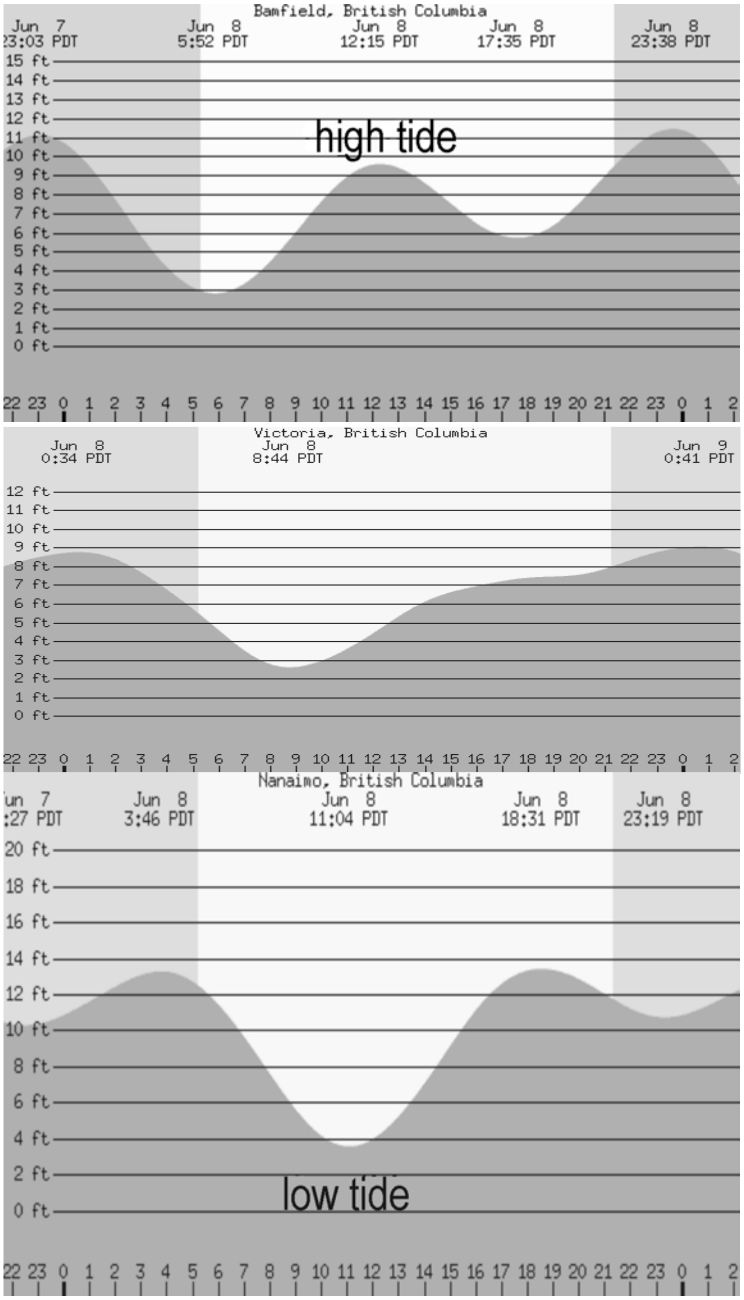


The delay of the tides around Vancouver Island. The darker the shading, the later the tide compared with the tide in the open Pacific.

Because the pattern of the tide varies from day to day and from location to location, any comparison based on the timings of one particular point in the tidal cycle—the higher of the two daily high tides (HHW) for example—is likely to give a different answer from a comparison based on the timings of a different point in the cycle. Sometimes it is not even clear which tide corresponds to which at the two locations. What is needed is a comparison method that computes the average delay of all the points of many cycles, not just one particular point.

Engineers have long since had the solution to problems of this sort. What they do is to look for the peak in the *cross-correlation function* of the two patterns. This may sound terribly technical, but in fact it's quite simple. Imagine you have two rolls of film, each of which has been exposed to a light whose intensity varies with the height of the tide at the two separate locations. The clear patches on the films would correspond to high tide; and the darker, unexposed areas would correspond to low tide. The pattern of light and dark might be very different on the two films, but to find the best match, you could lay one film on top of the other, hold them up to a light, and slide one strip over the other until you could see the most amount of light through the two strips. The offset of the two films is than a measure of the time delay between the two patterns.





Noon in summer: high tide on the outer coast (top); low tide at Nanaimo (bottom). Twice daily, the water in one place goes up, while in the other it goes down. Victoria (middle) is near the "pivot" of this seesaw where the twice-daily component vanishes, leaving only a smaller once-daily tide.

David Flater & Jeff Dairiki http://www.dairiki.org/tides

Using a computationally equivalent technique, I calculated the delay of the tide between various points around Vancouver Island compared to Tofino. The result was the pictures you see here, and they paint, I think, an interesting picture. Envisage the Strait of Georgia as an inland sea (the Salish Sea would be a good name) whose level rises and falls with little variation in the timing of the tide around its shores. The rise and fall of this inland sea is almost exactly out of phase with the rise and fall of the open ocean. When there is a low tide on the inner coast, it is close to being high tide on the outer coast. The reason being that, although the strait tries to follow the ups and downs of the open ocean, it takes time for it to fill and drain because of the congestion at both ends.

To the south are the narrow confines of the Gulf and San Juan Islands, and to the north the islands of Discovery Passage and Desolation Sound. The back and forth flow along the Strait of Juan de Fuca is fairly evenly distributed, but through the narrow channels of the north—Yuculta Rapids, Arran Rapids, Surge Narrows, Seymour Narrows—the flow becomes, almost literally, precipitous, with no let up in the turbulent currents. These rapids are the tangible result of a difference in timing, and therefore also in height, in the tides at the ends of the rapids.

So here's the answer, the tide is low at noon in summer, because on Gabriola, the tide is running almost one half of a 12-hour tidal cycle late. Simple really. That's actually not the whole story——but it will do for now. ◊