

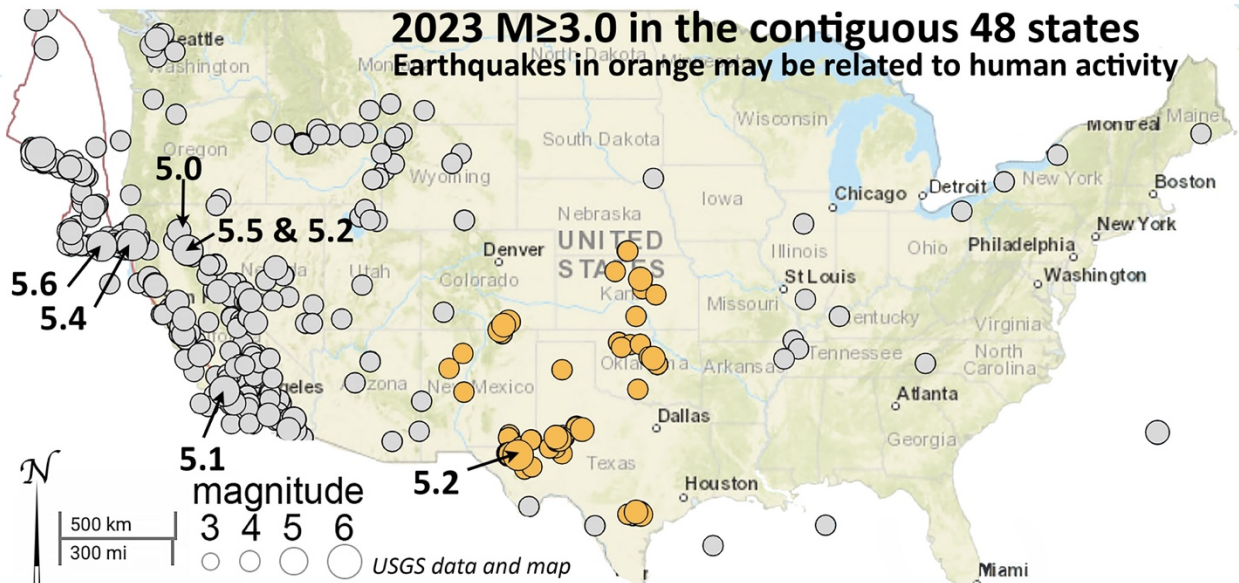
# Times Standard

## Not My Fault: The 2023 U.S. earthquake story

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The 2023 leader in U.S. quakes was a no-brainer. Alaska always tops the list and 2023 was no exception with over 2500 magnitude 3 and larger earthquakes more than three times as many as the rest of the Nation. Most were centered south of the Alaska Peninsula or in remote areas of the Aleutians and not reported felt but there were some exceptions.

The largest U.S. quake of the year was magnitude 7.2. Located south of the Alaska Peninsula, it was large enough to be felt throughout the peninsula region, on the Kenai Peninsula, and in the greater Anchorage area over 600 miles away. It was not large enough to damage populated areas and the small tsunami (six inches at the Sand Point tide gauge) was not large enough to cause damage. Unfortunately, a pedestrian in Kodiak died in a hit and run collision during a panicky vehicle evacuation.

The July 15th 7.2 was the seventh earthquake of magnitude 6 or larger in a zone called the Shumagin gap, a roughly 250-mile-long zone between the rupture areas of magnitude 8+ earthquakes in 1946 and 1938. Seismic gaps are sections of active plate boundaries that have been seismically quiet relative to adjacent areas. A seismic gap theory proposed in 1979 suggested gaps were more likely than other areas to produce the next major quake.

Between July 2020 and July 2021, three major quakes occurred in the gap – a 7.8, 7.6, and 8.2. This series has not behaved like a typical mainshock-aftershock sequence with a single large earthquake followed by smaller ones. The 2023 7.2 falls within the gap and

suggests that the earthquake story in this area is more complicated. I am looking forward to learning more at this spring's annual meeting of the Seismological Society of America in Anchorage where the Shumagin gap events will be featured.

There is a good reason for Californians to be concerned about this section of the Alaska – Aleutian subduction zone. If a magnitude 9+ quake occurred within it, the tsunami it produced could be as large or even larger than what happened in 1964. The tsunami modeling group at the California Geological Survey considers this “eastern Aleutians” tsunami to be the greatest threat to much of the California coast and for counties south of Cape Mendocino, it is the worst-case map used for tsunami evacuation maps.

The 7.2 happened early morning my time on July 16th. My time was in Iceland, and I spent a couple of hours texting Ryan Aylward at the Eureka National Weather Service Office about whether it posed any threat. Ryan is the Warning Coordination Meteorologist at Eureka and is responsible for communicating weather and tsunami threats to the public. We were pretty sure that it wasn't large enough to be of concern but waited until the official “tsunami NOT expected” statement from the National Tsunami Warning Center (NTWC) before stating anything in public.

Small tsunamis were recorded on the North Coast following the larger Alaska Peninsula quakes of 2020 and 2021. They weren't large enough to cause any flooding but the July 2021 M8.2 made us aware of a potential new threat. I became aware of it because of an email from my friend Donald Forrest.

Donald was heading offshore on a fishing trip. He had worked with me long enough to be aware of tsunami hazards and had dutifully checked to see if any warnings or advisories were in place. The NTWC had issued the ‘no tsunami’ statement several hours earlier, so he felt good to go. The ocean was calm. Suddenly the cross currents in the channel crossing the bar were crazy, pushing their boat every which way. Any experienced mariner knows that ebb tide crossing the bar is always a little daunting but his was extreme.

After Donald's email, we queried other people who were in the channel that morning and got similar responses – a surprise, worst we've ever seen, decided to turn back. My colleague Amanda Admire looked at instrument recordings in the bay and quantified that the currents were much stronger than on previous days in similar weather conditions. Our conclusion: the relatively modest tsunami currents caused wave interference with the ebb flow and the unique configuration of the Humboldt bar and channel created dangerous conditions.

We would not be aware of this new twist on tsunami hazards if it weren't for Donald and his email. It is a reminder that everyone's eyes and experiences are important in understanding the threats of earthquakes and tsunamis. We lost Donald to COVID last October. He left an amazing legacy in the theater world and with friends and family. But maybe his longest lasting one will be the “Donald Effect.” We now alert the maritime community to always be aware of current amplification during the many hours even a very small tsunami could be occurring.

The largest 2023 quake in the lower 48 was a magnitude 5.6 on May 2. It was on the Mendocino fault 60 miles west of Cape Mendocino. It was felt from the Santa Cruz area to the Oregon border and inland to Oroville and the Sierra foothills but was too far offshore to cause damage and not large enough to pose a tsunami threat. It is the 12th time in the 21st century that the North Coast has topped the U.S. mainland leader board for magnitude.

Four other mainland quakes made it into the M5 range in 2023. A 5.5 and 5.2 were centered near Lake Almanor in northern California. Both were widely felt but caused no damage other than toppling items off shelves in markets and homes. The January 1 M5.4 near Rio Dell was more damaging. This was the largest aftershock of the December 2022 M6.4 Ferndale earthquake and for some in Rio Dell, caused more damage than the mainshock.

The final member of the top 5 was more unusual in terms of location and cause. On November 11th, a 5.2 occurred in west Texas. Centered about 57 miles south of Carlsbad New Mexico, it was felt in much of Texas and New Mexico. Earthquakes in Texas have been on the rise in the past decade and in 2023, Texas and California were just about tied for the number of magnitude 3 and larger quakes.

The consensus of seismologists is that human activities are to blame. Almost all of the earthquake activity in Texas can be attributed to the disposal of drilling waste fluids in deep wells or hydrofracturing techniques. Texas isn't the only place where human-caused quakes are happening. Oklahoma, Nebraska, Kansas, New Mexico, and Colorado have all seen a rise in induced earthquake activity. By my estimate, about 45% of the magnitude 3 and larger quakes last year fall in this category.

The number of induced quakes fell drastically after Oklahoma imposed regulations on the rate and volume of waste fluid disposal. In 2015 over 800 M3 and larger quakes occurred' last year the number was down to 16. Texas may soon follow suit. After November's 5.2, regulations on Texas' disposal methods are being established.

We can't blame the oil industry for California earthquakes. We have no shortage of natural tectonic forces that we can thank for our spectacular topography and an occasional tremor. Good news is that we can reduce damage and injuries by building better and taking actions to prepare.

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Lori Dengler is an emeritus professor of geology at Humboldt State University, an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times-Standard's. All Not My Fault columns are archived online at <https://kamome.humboldt.edu/taxonomy/term/5> and may be reused for educational purposes. Leave a message at (707) 826-6019 or email [Kamome@humboldt.edu](mailto:Kamome@humboldt.edu) for questions and comments about this column. The new 2023 edition of the preparedness magazine "Living on Shaky Ground" is posted at <https://rctwg.humboldt.edu/prepare/shaky-ground>.

