Dear Senators,

I am writing to you in opposition of proposed House Bill 4138.

There are many causative factors of erosion. There have been studies and reports in other states, in other countries; but more importantly, studies and reports on waterways here in Oregon. Overwhelming, natural erosion is the largest contributor to erosion along a continuous flowing waterway. The Willamette River is an active, continuous waterway with a documented history of cyclical and historic flooding. The river runs continously, 365 days a year, with various debris and rising & lowering water levels and velocity. My observation of the boating community (outside of fishermen) is that boaters are using the waterway for 3-4 months out of the year, depending on weather conditions. During those 3-4 months, there are about 16 - 18 weekends (32 - 36 days) with the highest water activity use, generally when water levels are lower. My observation may be inaccurate (based on my observation at home in Wilsonville and at work along the Willamette River in Lake Oswego); however, I would hypothesize that very few boaters use the waterway outside of the summer months. I'd be interested to know how the 36 days of highest boating activity impacts the river and how the 365 days of continuous water variances (the velocity of water flow, debris, volume of water, dredging or lack thereof, changes to river channel gradients, etc.) impacts the river.
I would also like to point out that areas along the Willamette River with homes (and docks) are within the FEMA Regulatory Floodplain. The dynamics of a rivers volume and velocity will be impactful on erosion, as well as the the presence of (or removal of) natural vegetation and riparian areas. Another factor to the erosion component is to consider the impact of the lack of/decrease of dredging along parts of the Willamette River.

From my point of view, the main purpose of this bill is a backdoor way to restrict a certain style and type of boat along the Willamette River — without the data to support this restriction. There are many factors that show the impact of a wake - not just simply "the size". As to restrictions on a certain type of boat - all boats create a wake and each wake has its own energy and rate of energy dissipation. The Willamette River has been a river "highway" for boat vessels of all sizes. Before a law is restricting a certain type of boat, there should be some data to support that restriction.
There may be studies done in different countries and different states on boat wakes and erosion, but when reading those reports a few components of the study need to be considered for its application to the Willamette River. Is the study for a lake or a river, is the water sea/salt water or fresh water, what is the depth of the waterway, what is the width of the waterway, does the body of water have a marsh along its shoreline, what type of soil makes up the waterway shoreline (or bank line), what type of vegetation is along the waterway (and slope if applicable), does the waterway have a floodplain, what is the velocity of the waterway current, does the water have wind waves as a factor, what is the development around the waterway, what type of boat was used, etc.

I'm disappointed to see this legislation has made to this far as I feel, especially after a phone conversation with an Oregon Representative, that this piece of legislation is not for the "good of the people" but rather to benefit a few riverfront homeowners. As a Oregonian who enjoys using the Willamette River for boating and other recreational activities, I have been dismayed at how this legislation has come about and the appearance of a lack of data to support the legislation (I have asked for any data/study that has supported Rep. Kennemmer's position and reason for this legislation - his response to me was, "I have my own personal observation". While I can appreciate his personal observation - even pictures - that does not tell the accurate "story". Personal observation is subjective; and unfortunately, not always accurate. Studies and data rely upon science to draw conclusions, not just personal observation. Science, simply, is knowledge based on demonstrable and reproducible data. Science aims for measurable results through testing and analysis and is based on factual & accurate data, not opinion or preference. Personal opinion, perception, observation, and experience will inherently be prone to bias.)

I have attached below the many different reports or studies I have found - all in Oregon. I also have attached the FEMA information. I implore you to look into this further. And I am hopefully that you will find that boat wakes & the restriction of boats will NOT be the "Solution" to the erosion process along the Willamette River.

Please vote NO on HB 4138.

Sincerely,
Elizabeth McCord

links for studies:

- In the *Willamette River Basin Challenge of Change*, on page 16 it states: "Rivers are dynamic and complex living systems. When waters rise or flood, they move gravel around, carve new banks, topple trees, and push sediment downstream. These processes form and reform habitat for aquatic creatures by carving new side channels, building sheltering alcoves, damming pools with large logs, and forming new gravel bars."
  https://ir.library.oregonstate.edu/downloads/s1784r73f

- FEMA Flood Plain information https://msc.fema.gov/portal/search#searchresultsanchor

- More information regarding flooding can also be found in the FEMA Flood Insurance Study - Clackamas County, Oregon - Effective: June 17, 2008:
  http://www.oregonriskmap.com/index.php?option=com_docman&view=download&category_slug=pdf&alias=37-clackamas-co-fis-vol1&Itemid=32

- The Willamette River has also had historic flooding. The flooding of 1861 & 1894 wiped out some small towns that were built along the Willamette River floodplains, including Champoeg. The flooding in 1964 and 1996 also caused extensive damage. During the winter of 2016-2017, we had extensive snow and ice throughout the Willamette Valley. Damage to trees and other structures along the river could be seen. I recommend a quick read on the the FEMA Floodplains/Flood Inundations report: "Floods raise many concerns for communities living along major rivers such as the Willamette River…….Development of urban and agricultural areas along the Willamette River has placed many homes, buildings, and other structures within the floodplain of the Willamette. Communities and landowners often protect these investments by hardening the banks and minimizing channel change, which leads to reduced channel dynamics and impaired ecological conditions." — "During the recent floods of 1964 and 1996, the Willamette River fully occupied its historical floodplain in the lower, narrow river and occupied most of the historical floodplain in the middle section of the river." http://www.fsl.orst.edu/pnwerc/wrb/Atlas_web_compressed/3.Water_Resources/3e.flood&fema_web.pdf

- On the *US Army Corps of Engineers* website: “The floods of winter 1964 (Dec. 19, 1964–Jan. 31, 1965) were some of the largest flood events ever recorded for many rivers in western Oregon. Heavy rain fell directly on high elevation snowpack, melting the snow and increasing the floodwaters to levels not seen since the historic floods of 1861. The excess water altered the landscape and substantially changed river channels throughout the region. Headwater streams in the mountains of the Cascades and Coast Range became choked with debris from landslides that were triggered across the steep terrain. Floodwaters scoured the previously stable sediment from the floodplain of valley-bottom streams, causing channels to widen and meander and new gravel bars to form.
  Today, nearly 50 years after the flood, the geomorphic impacts of this flood can still be seen throughout western Oregon. The sediment that was deposited along many rivers during the flooding became seeded with cottonwood, willow, and alder trees, creating distinctive, even-aged modern forests. Many of the channel changes triggered by the 1964 floods have survived recent smaller floods, so that the habitats, ecosystems, and infrastructure still show the effects of the 1964 floods.”
  http://www.nwp.usace.army.mil/Missions/Water-Management/Flood-Ready/Were-We/Impact/

- The "*Geomorphic and Vegetation Processes of the Willamette River Floodplain, Oregon—Current Understanding and Unanswered Questions*” 2013 study is a report that “summarizes the current understanding of floodplain processes and landforms for the Willamette River and its major tributaries.” Pages 14 - 25, and page 40 has information on riparian vegetation, flooding, bed-material sediment, and large wood affects on river channels.
  On page 19, the study states:
  "Flooding shapes landforms, habitat, and vegetation patterns along river corridors in the Willamette River Basin (fig. 10). The capacity of floods to form and modify channels and flood- plains is dictated largely by interactions between flood magnitude and channel geometry, and resulting local hydraulics and patterns of sediment erosion and deposition. Stream velocity and sheer stress can be highly variable, but generally increase with channel slope and water depth. Complicating the relations between floods and geomorphic consequences is the nonlinear behavior of erosion and sediment transport in relation to stream velocity and sheer stress."
  https://pubs.usgs.gov/of/2013/1246/pdf/ofr2013-1246.pdf

- The “Willamette Riverbank Design Notebook” is a notebook by the GreenWorks company published in May 2001. On the company website it states: "Hired by the City of Portland, GreenWorks led a team of biology, engineering, and erosion consultants to investigate existing bank conditions along the Willamette River in downtown Portland.” Although this notebook focus is on the Willamette River in Portland, the beginning of the notebook gives descriptions and characteristics of the Willamette River.
  http://greenworkspc.com/willamette-design-notebook/ https://www.nps.gov/WaterTrails/Toolbox/DownloadFile/127

- Studies have been done on other waterways in Oregon. Such as the *"Investigation of Motorboat-Induced Streambank Erosion on the Lower Deschutes River*" study in 1990, which states: "Furthermore, bank erosion occurs in many places where motorboats are not the cause for erosion. Hence, motorboats should not be generally blamed for erosion problems." https://ir.library.oregonstate.edu/concern/defaults/2b88qh38b

- I did find an out-dated report,"*Corps of Engineers Actions Affecting Riverbanks and Channels in Willamette River Basin, Oregon*", from May 1974 that does discuss this portion of the Willamette. It is interesting to consider statements made in this report as to erosion along the river. Such as:
  "Presumably, the proposed major reduction in Willamette River dredging will result in some increase in meandering and bank erosion by Willamette River."
  "Lands along the river which were formerly left in brush and trees because of of the threat of erosion are sometimes plowed and planted up to the riverbank following revetment construction. This change in land use has been frequently observed over many years by Corps project engineers, but no information is available as to the amount of land involved or whether this is a significant impact of bank protection."
  "Continue the past dredging practice…….from the Willamette River between Portland and Corvallis, as well as snagging. While the channel has been maintained at only 14 percent of the authorized project, it has provided considerable benefits to commercial and recreational boaters and has served to reduce bank erosion and channel changes."
  https://books.google.com/books?id=JhU0AQAAMAAJ

- Some in favor of these bills will reference the "*Review of Boat Wake Wave Impacts on Shoreline Erosion and Potential Solutions for the Chesapeake Bay*" report. (http://ccrm.vims.edu/2017_BoatWakeReviewReport.pdf) Interesting to note in the Chesapeake Bay report that *"The amount of boat wake energy impacting a given shoreline is a function of not only the size and speed of vessels passing that shoreline, but also the frequency of vessels (Zabawa and Ostrom 1980, Glamore 2008)"* something to consider with an ordinance that restricts boats with WED's to certain areas of the river and will increase the frequency of boats having certain style of wakes in a condensed area.

  These are other points from the report to consider:

  "Boat wake energy is event-dependent and is influenced by the vessel length, water depth, channel shape, and boat speed (Sorensen 1973, Glamore 2008). Wakes are most destructive in shallow and narrow waterways because wake energy does not have the opportunity to dissipate over distance (FitzGerald et al. 2011). Although boat wakes are periodic disturbances, in comparison to wind waves, they can be a significant source of erosive wave force due to their longer wave period and greater wave height, even when they represent only a small portion of the total wave energy (Houser 2010). Our review of the literature demonstrated that even small recreational vessels within 150 m (~500 ft.) of the shoreline are capable of producing wakes that can cause shoreline erosion and increased turbidity (e.g., Zabawa and Ostrom 1980). Vegetated shorelines can effectively attenuate

waves in certain settings; however, there is a limit to this capacity particularly if there is frequent exposure to boat wakes."

"Policy makers who are concerned about boat wakes may want to use existing models of boat wake erosive potential (e.g., BoMo, Decision Support Tool) to inform decisions on where to put no-wake zones or other boat policies. However, at this time, we do not have sufficient data to run either model for the Chesapeake Bay."

"Shoreline erosion is a natural process that can be exacerbated by human activities. Natural drivers of shoreline erosion include wind waves, currents, and sea level rise (SLR). Human activities that exacerbate erosion include shoreline hardening (armoring) and boat wake impacts. It is not possible to visually distinguish between the natural and human-induced components of erosion; these must be deduced from measure of human use of an area combined with wind wave erosion models.

This report focused on boat wake-induced erosion, but this should not be interpreted to mean that the other drivers of erosion are unimportant in the Chesapeake Bay"

"Waves that travel in water that is deeper than 1/2 of their wavelength (the distance between two successive wave crests) are referred to as deep water waves. The motion of deep water waves do not penetrate the full depth of the water column, thus these waves have little impact on the bottom sediments (Sorenson 1997, Hill et al. 2002). As a deep water wave travels away from the sailing line, wave height will decrease with distance traveled as wave energy spreads out along the wave crest. Given a long enough transit in deep water, much of the wave energy will distribute over a wide area before reaching a shoreline. In deep water, the speed at which a wave moves away from its point of generation is largely a function of wavelength; waves with longer wavelengths travel faster than those with shorter wavelengths"

"In the Kenai River, Alaska, Maynord et al. (2008) demonstrated higher shoreline erosion rates when peak boating conditions corresponded to times of high river flow and decreased erosion, despite high boat activity, during lower flow conditions. They noted that during low flow conditions, much of the wave energy was lost due to contact with gravel sediments near the river margins."

"As a result, the presence of living root material in shoreline soils results in a stronger soil that is less easily eroded (van Eerdt 1985, Francalanci et al. 2013). Additionally, shoreline vegetation like marsh plants combats erosion by attenuating wave energy (Yang et al. 2012, Möller et al. 2014; Figure 5) and this response is proportional to both the height and density of the vegetation (Möller 2006). The presence of even a narrow band (on the order of 1 m wide) of marsh vegetation in front of the shoreline has been shown to result in decreased rates of shoreline erosion (Currin et al. 2015)."

*** interesting to note for the Willamette River, most boating is done when the water level is low and some of the vegetation is on the higher slope of the riverbank.

"Shoreline change may include shoreline erosion and resuspension in the foreshore environment, although sediment can be transported landward as well. The balance of transport (whether the shoreline erodes or accretes) depends on the size of the wake (Osborne and Boak 1999, Houser 2011). Most studies found the effects of boat wakes on the shoreline are dependent on many factors. Site-specific conditions such as water depth, bank profile, type, size and supply of sediment and bank resistance can control suspended-sediment concentrations (McConchie and Toleman 2003, Hughes et al. 2007)."