Exh. KAE-01T
Witness: Ken Eriksen

BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND PILOTS,** **Respondent.**	**Docket TP-**

TESTIMONY OF

KEN A. ERIKSEN

ON BEHALF OF PUGET SOUND PILOTS

JUNE 29, 2022

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I. IDENTIFICATION OF WITNESS

Q: Please state your name, occupation and business address.

A: My name is Ken A. Eriksen. I am a Senior Vice President with IHS Markit, a global information and consulting firm that provides a complete view of global energy, commodity and shipping market intelligence to enable strategic outcomes for long-term, sustainable value to our clients. We take vast amounts of data and transform it into a knowledge set to inform strategic analysis. Our clients regularly include commodity producers, manufacturers, transportation providers, financial institutions and government regulators. We work upstream from production fields and mines, downstream through production and manufacturing processes and through the transformation to consumers, all the while using tools to track and monitor the trade, movement and value of commodities and goods from our best-in-class detailed global ocean vessel database and monitoring system. My business address is 949 South Shady Grove, Suite 103, Memphis, TN 38120.

Q: Please describe your educational background.

A: I earned a bachelor of science degree in agribusiness in 1994 from Washington State University and a Masters degree in agricultural economics in 1996, both from Washington State University.

Q: Please describe your work history.

A: In my work for IHS Markit, I provide consulting services to a wide variety of clients related to maritime trade, transportation and logistics. Before joining IHS Market in 2001, I

worked for five years at Washington State University, first as a technical assistant in the Department of Crop and Soil Science and then as a teaching assistant and undergraduate instructor in the Department of Agricultural Economics. In my last year at WSU, I was a transportation economist in the same department. During the period of 1996-2001, I worked for the U.S. Department of Agriculture, serving first as an agricultural economist in the USDA Transportation and Marketing Program and then as an agricultural statistician with the National Agricultural Statistics Service. I also worked for the Pacific Maritime Association as a casual longshore laborer through the International Longshore and Warehouse Union Local 23, Tacoma, WA. A copy of my curriculum vitae is Exhibit KAE-02.

II. PURPOSE OF TESTIMONY.

Q: What is the purpose of your testimony?

A: My testimony presents shipping industry data and economics analysis addressing the following 10 topics:

1. Shipping volume data at major West Coast ports;
2. PSP pilotage assignments and revenue by vessel type;
3. Ship traffic volatility in Puget Sound;
4. Substantial increases in ocean freight rates;
5. Soaring shipping industry profits;
6. Five-fold increase in container vessel size since the 1990s;
7. Long-term trends in ship builds by vessel type;
8. Comparison of PSP's current and proposed pilotage rates to other West Coast ports;

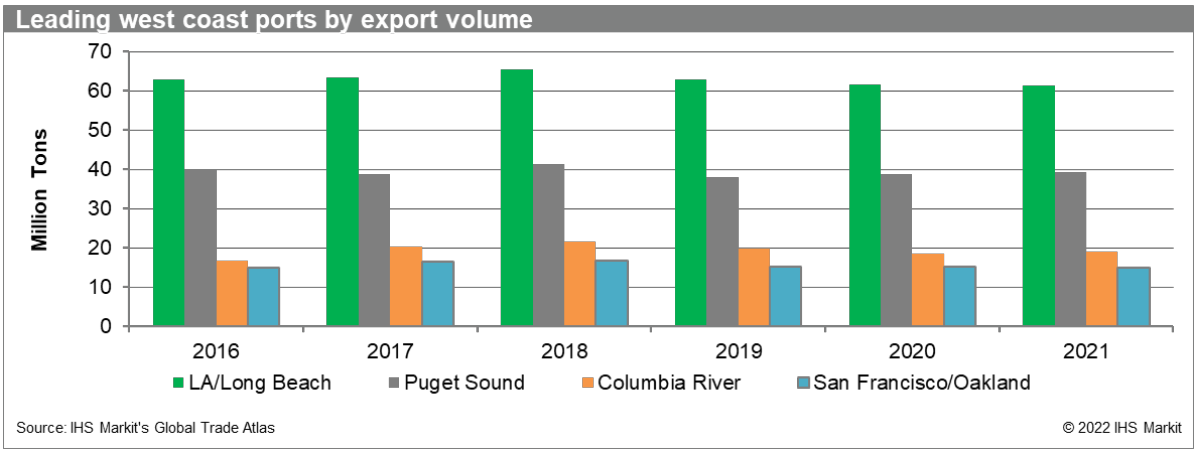
9. As a matter of maritime shipping economics, pilotage fees are an insignificant component of port costs that do not drive where ships call; and

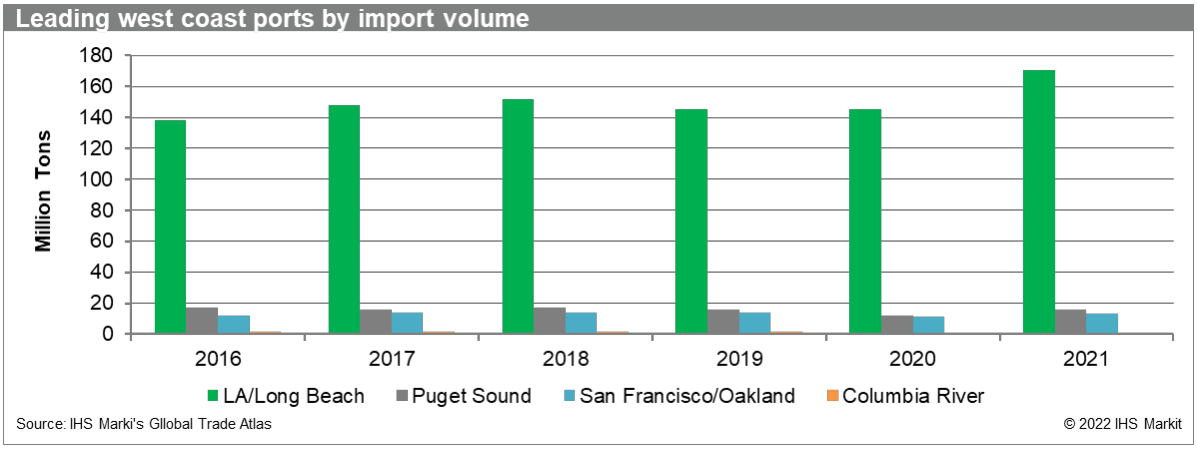
10. The conclusion in a 2017 cost-benefit analysis of marine pilotage in Canada that the safety and efficiency benefits of pilotage exceed the cost of the pilotage system by a ratio of more than 20 to 1 is equally applicable to the pilotage system serving Puget Sound.

A. Shipping Volume Data at Major West Coast Ports.

Q: Please describe the shipping data that you assembled for West Coast ports.

A: The charts below show the export and import volumes for major port clusters on the West Coast. Moving north to south, these include Puget Sound (ports of Seattle and Tacoma), Columbia River (multiple ports on the Columbia River from Astoria to Portland/Vancouver), San Francisco Bay (ports of San Francisco and Oakland), and LA/Long Beach (ports of LA and Long Beach). For the five-year period of 2016-21, the two charts below display export volume in tons by port cluster and import volume in tons.





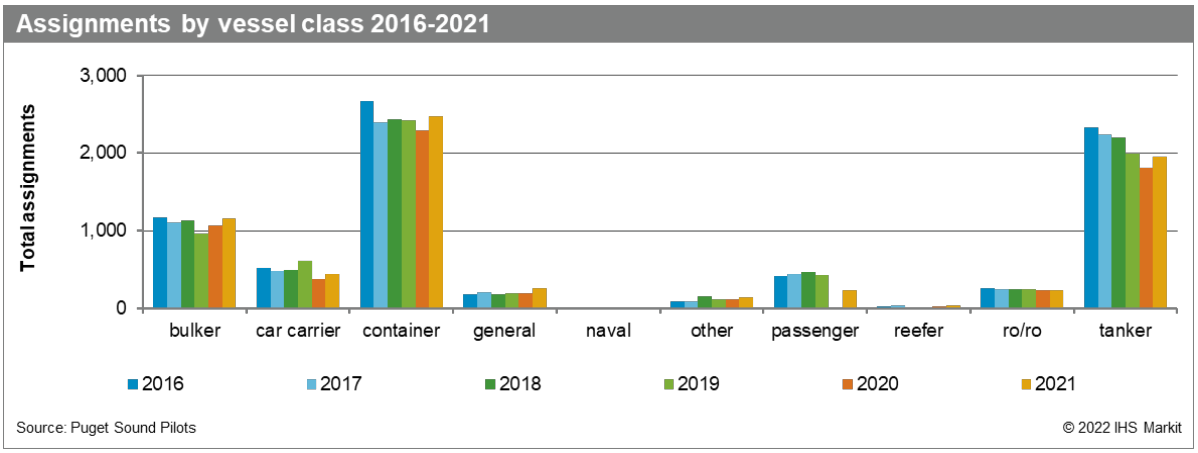
Q: What observations do you have regarding the above export and import volume data by port cluster?

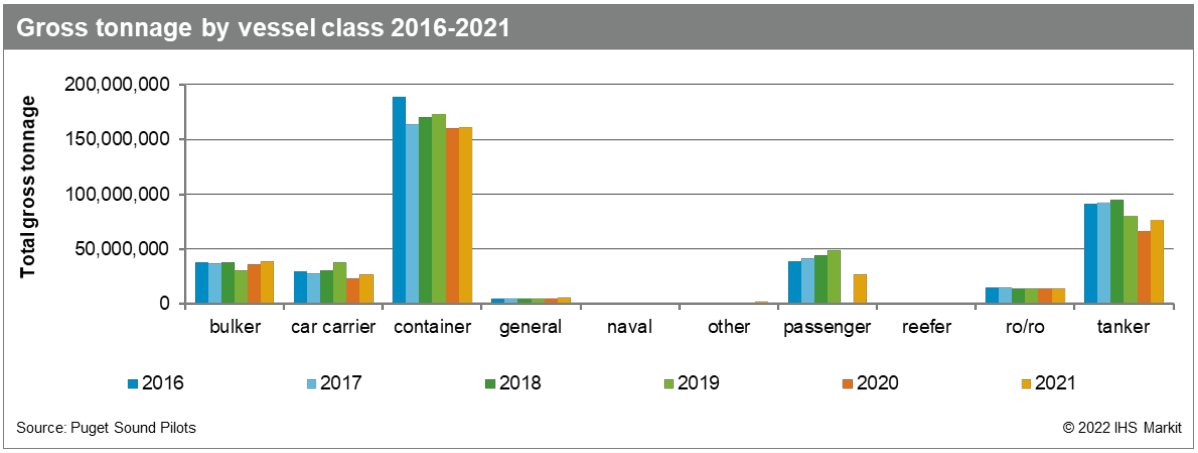
A: The ports of LA/Long Beach handle the bulk of imports into the US West Coast. Exports are roughly half the size of imports into LA/Long Beach. Puget Sound exports are roughly two-thirds of those out of LA/Long Beach. Columbia River and San Francisco/Oakland exports combined are slightly less than exports out of the Puget Sound. Import volumes have relatively constant over the past five years, with no noticeable disruption because of Covid-19 in 2020 or 2021. During 2021, there were increased import volumes. Washington ports tend to have more exports than imports while California ports tend to have more imports than exports. Total imports into Washington ports were 144.4 million tons while total exports totaled 453.6 million tons over the past five years.

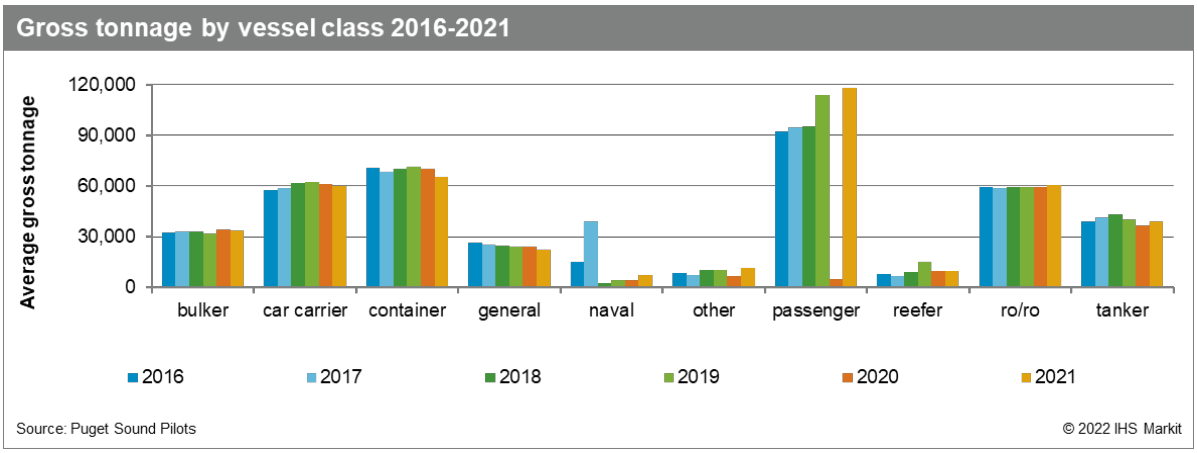
B. <u>PSP Pilotage Assignments and Revenue by Vessel Type.</u>

Q: In an overview manner, please describe the data you have assembled regarding PSP pilotage assignments.

A: For the five-year period of 2016-21, the data sets display in chart form PSP pilotage assignments by vessel type and pilotage revenues by vessel type. The first set of three charts immediately below show in descending order PSP total annual assignments by vessel class, total gross tonnage by vessel class and average gross tonnage by vessel class:







Q: What observations do you have regarding these three charts?

A: I have several. First, from 2016 through 2021, there were total of 42,298 pilotage assignments. Total gross tonnage during this period of six years was 2.24 billion tons. Container and tanker vessels represent the two largest categories of vessel type, accounting for 64% of all assignments. During this timeframe, PSP performed 2,453 container ship assignments and 2,090 tanker assignments.

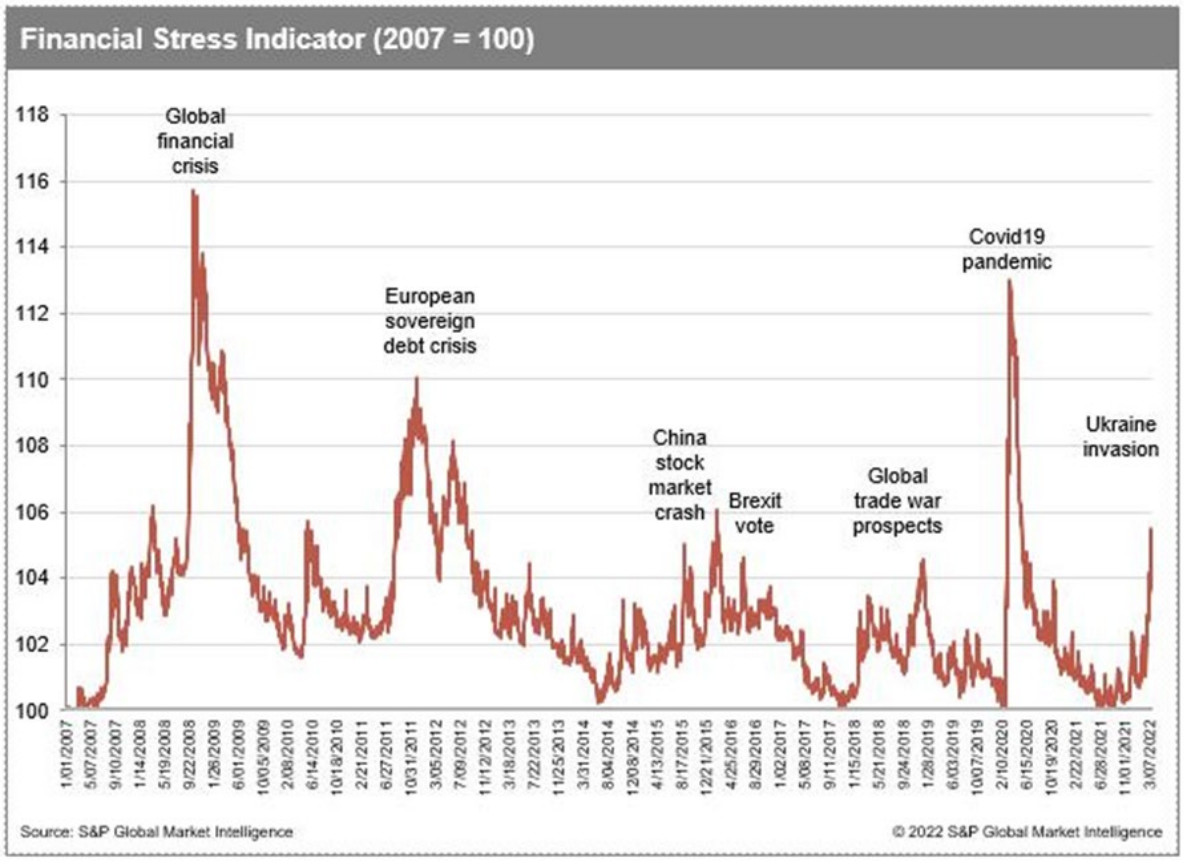
There was a steep decline in the number of passenger vessel calls in 2020 as result of Covid-19, but there was a modest rebound in cruise traffic in 2021. Overall, since 2016, there has been a slightly declining trend for assignments, total gross tonnage and average gross tonnage.

C. <u>Ship Traffic Volatility in Puget Sound.</u>

Q: Based upon the data that you have reviewed, how would you describe the volatility of ship traffic in Puget Sound?

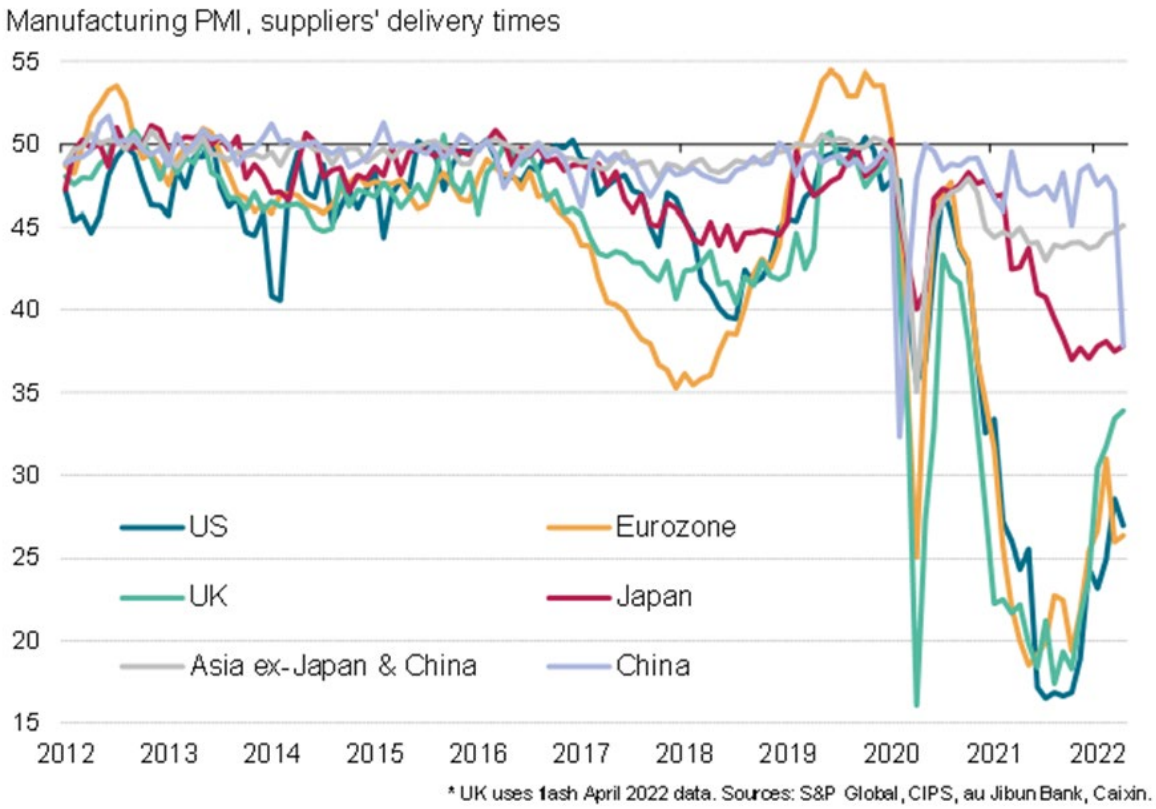
A: I would describe it as quite volatile for multiple reasons, one or more of which are very likely to continue. Looking back over the last 15 years, multiple factors have contributed to traffic volatility in Puget Sound. The chart below, which tracks global financial stress factors,

typically matches up with significant changes in international trade, most of which is carried by oceangoing vessel. Major factors in this 15-year timeframe include the global financial crisis in 2008 through 2010, the European sovereign debt crisis in 2012-13, the China stock market crash in 2015, the Brexit vote in 2016, the global trade war between the U.S. and China in 2018 through 2019, China's outbreak of African Swine Fever among its hog herd in 2018 through 2020, the Covid-19 pandemic in 2020 through 2022 and most recently Russia's war with Ukraine.



Q: Do manufacturing supplier delivery times contribute to the volatility of international ship traffic?

A: Yes, the two charts immediately below tell that story. The Manufacturing Purchasing Manager's Index (PMI) of S&P Global is an index of the prevailing direction of economic trends in the manufacturing and service sectors. The supplier delivery times index of the PMI fell drastically from the 45-50 range in 2020 as the full impact of Covid-19 was felt with global shutdowns. Production was constrained in many Asian factories hitting shipments to the rest of the world. Delivery delays were mostly felt in the U.S. and Europe. Toward the end of 2020, delivery times improved until the spread of the Delta variant increased Covid-19 cases, resulting in another slowdown in deliveries due to global lockdowns. Delivery times have been improving in 2022. Looking at the second chart, one can see an improvement in global delivery times until another wave of Covid-19 resulted in a lockdown in Shanghai. Global delivery times excluding China show a slight decline in 2022 but not as sharp as when China is included.


Manufacturing PMI, suppliers' delivery times
55
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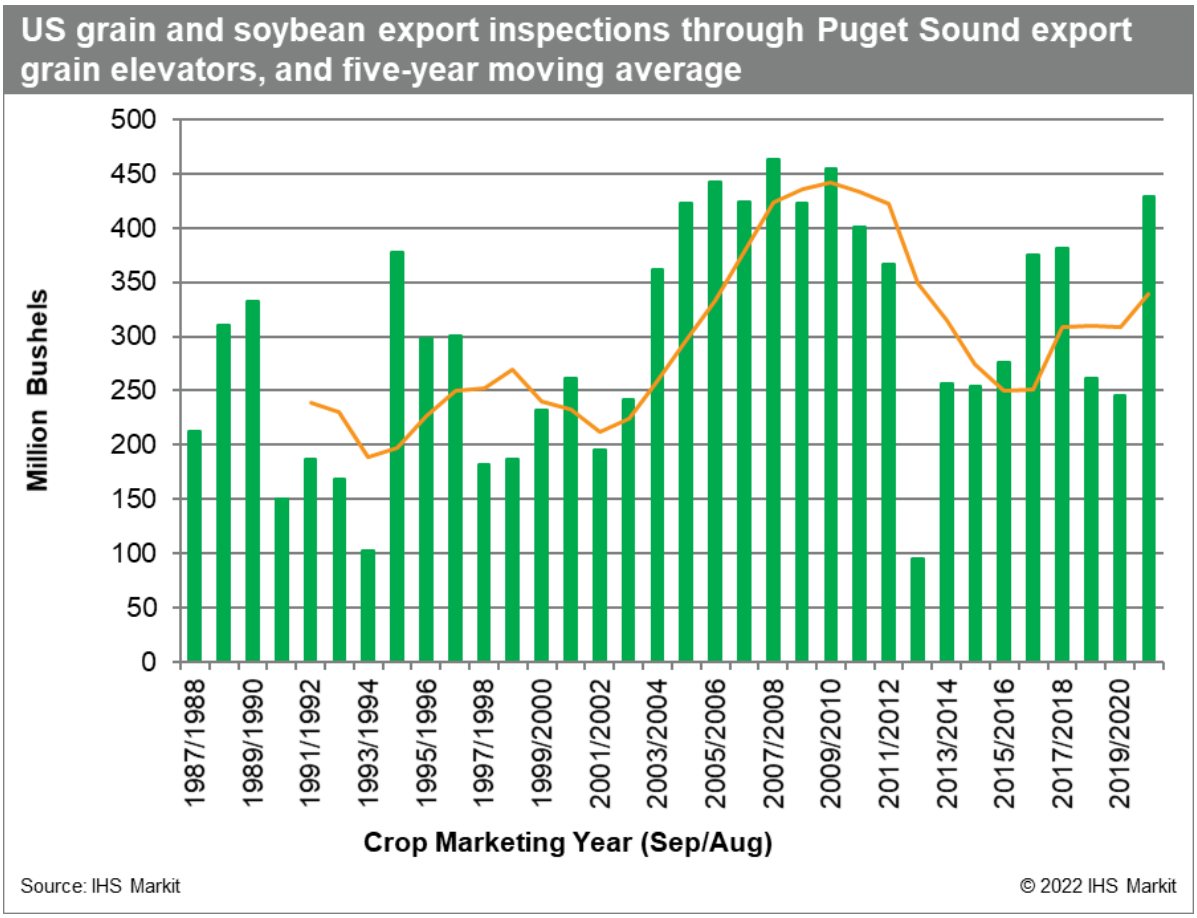
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
US
Eurozone
UK
Japan
Asia ex-Japan & China
China
* UK uses flash April 2022 data. Sources: S&P Global, CIPS, au Jibun Bank, Caixin.

Q: Are there particular data sets unique to shipments through Puget Sound that display the volatility of particular product categories?

A: There certainly are. The first chart below displays that volatility for U.S. grain and soybean exports through Puget Sound export grain elevators:

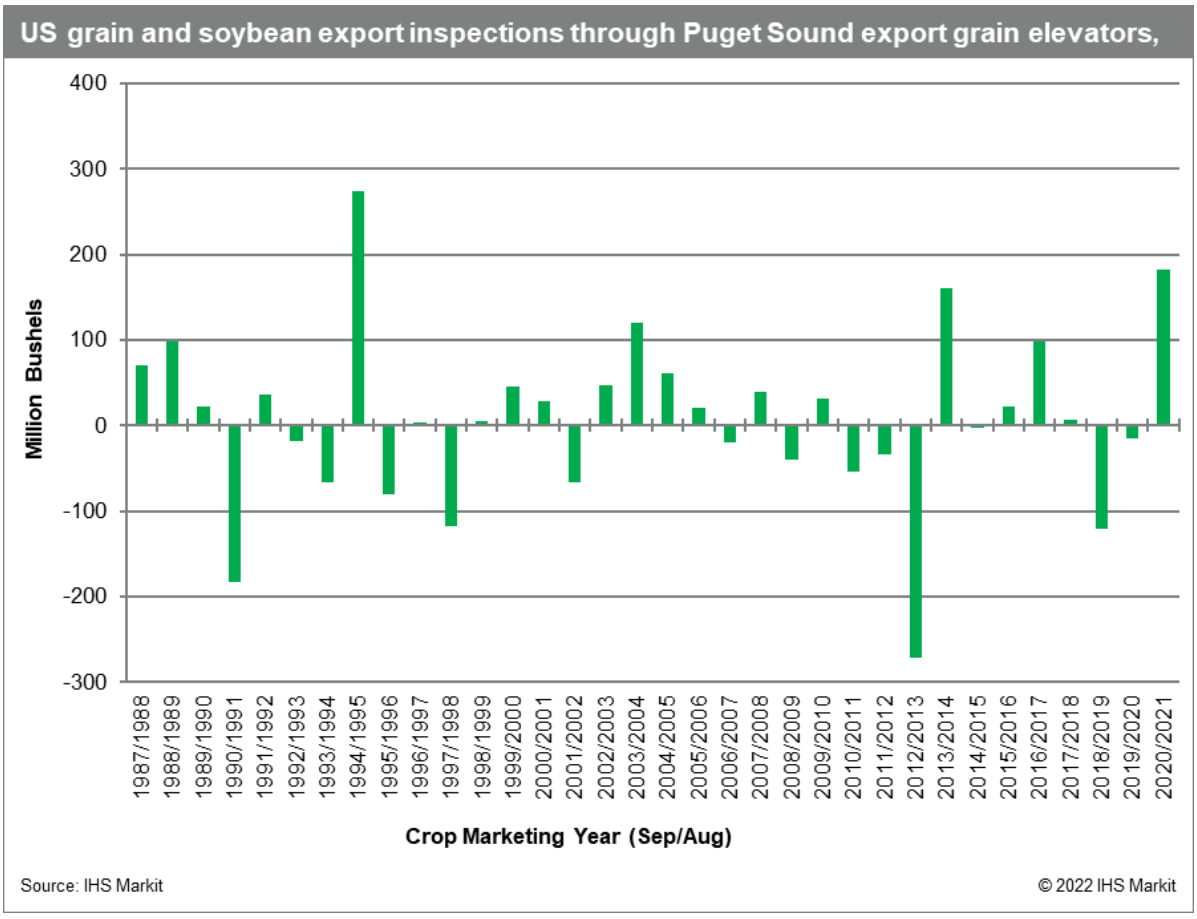


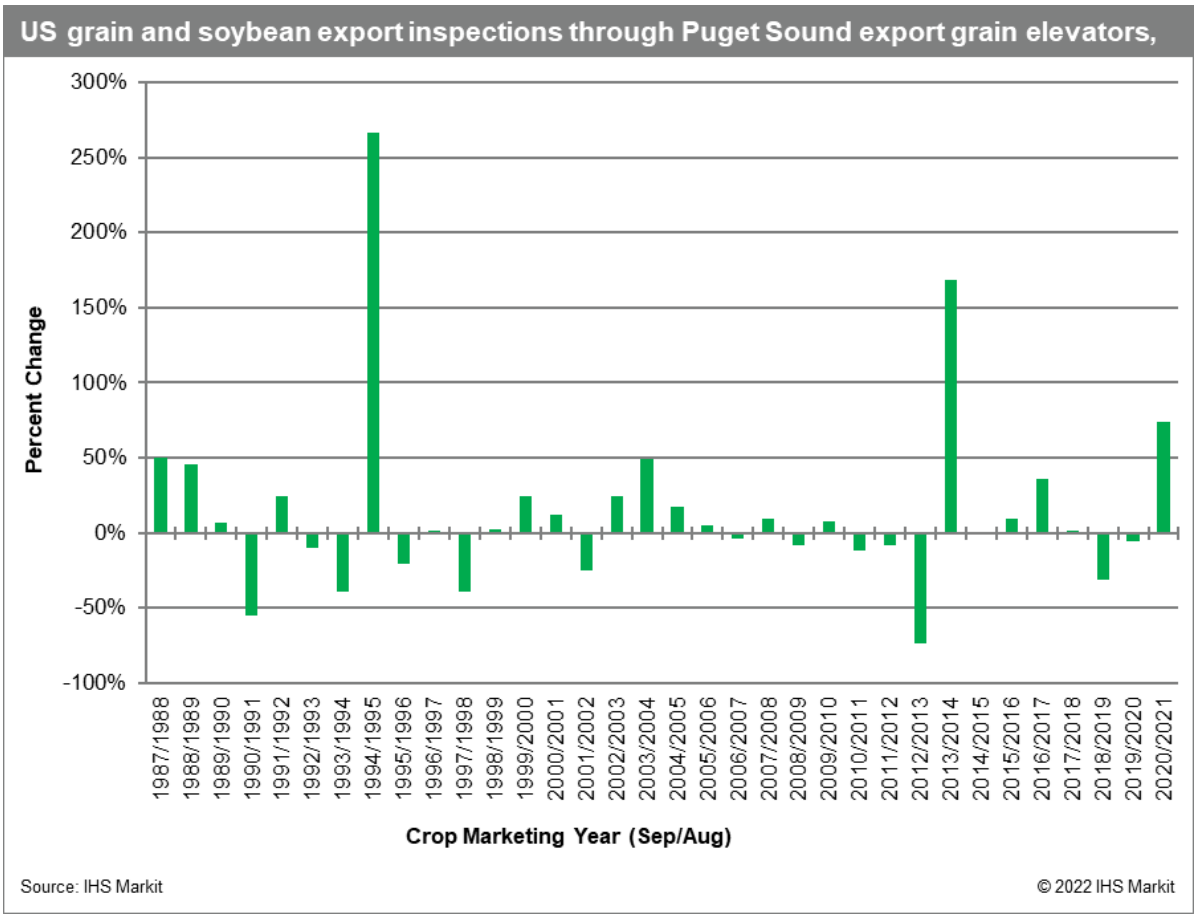
The key events or impacts driving the volatility in grain and soybean exports through Puget Sound are summarized below:

- 1993/1994 – Flooding across upper Mississippi River
- 1994/1995 – Rebound from flood induced crop in 1993, and strong demand for corn in Asia
- About 1994/1995 TEMCO elevator explosion in Tacoma, Washington
- 1997 – Recession across various global regions including former Soviet Union, South America and Asia
- 2003/2004 – China appetite for soybean increasing
- 2006/2007 – TEMCO installs “rain shed” awning in Tacoma, Washington
- 2012/2013 – U.S. drought negatively impacted crop production and exports

- 2015/2016 – South America crop problems
- 2016/2017 – Strong crop production and solid residual supplies available to export market
- 2018/2019 – China hog production slashed due to African swine fever; U.S.-China trade war hit soybean exports
- 2020/2021 – US-China trade agreement and expanding hog herd in China leads to strong rebound in exports

The volatility in the grain and soybean exports through Puget Sound is displayed in two different formats in the charts below, first one in millions of bushels and the second in percent change from one crop marketing year to the next.





Q: Did you find additional data related to container shipments in the 10-year period of 2012-2021 through Puget Sound showing traffic volatility in other markets?

A: Yes. The first chart displayed below shows container vessel exports in metric tons for agricultural, fishery and wood products during a 10-year period. Notably, container shipments of these products in 2020 were down one million metric tons from 2019 due to Covid-19 causing labor shortages and supply chain issues. These shipments also dropped in 2021 due to continued supply chain issues and a shortage of containers.

All Container Vessel Export of Agricultural Fishery and Wood Products via Puget Sound

Product/Port	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cereals (HS 10)	**274,586**	**248,497**	**244,287**	**185,981**	**298,640**	**355,438**	**574,003**	**437,602**	**301,275**	**205,292**
Seattle, WA	126,111	151,535	105,229	50,460	59,403	83,692	154,569	110,877	108,831	154,534
Tacoma, WA	148,475	96,962	139,058	135,521	239,237	271,746	419,434	326,725	192,444	50,758
Oilseeds (HS 12)	**1,830,613**	**1,719,814**	**1,593,708**	**1,795,468**	**2,277,182**	**2,503,029**	**2,667,202**	**2,557,959**	**2,265,758**	**2,201,634**
Seattle, WA	822,950	761,509	614,971	703,807	745,924	961,661	993,676	991,610	873,313	912,054
Tacoma, WA	1,007,663	958,305	978,737	1,091,661	1,531,258	1,541,368	1,673,526	1,566,349	1,392,445	1,289,580
Wood & Paper Products (HS 44, 47, 48 & 49)	**2,434,530**	**2,725,672**	**2,590,657**	**2,310,120**	**2,704,547**	**2,810,177**	**2,694,975**	**2,380,988**	**1,955,068**	**1,658,478**
Seattle, WA	1,290,349	1,205,295	1,086,029	954,122	1,055,587	1,229,297	1,164,047	975,872	852,763	719,489
Tacoma, WA	1,144,181	1,520,377	1,504,628	1,355,998	1,648,960	1,580,606	1,530,928	1,405,116	1,102,305	938,989
Anacortes, WA						274				
Fruit & Vegetables (HS 7 & 8)	**890,853**	**885,600**	**1,104,606**	**1,078,926**	**1,095,014**	**1,179,357**	**1,015,618**	**1,109,057**	**1,121,736**	**789,061**
Seattle, WA	628,241	516,615	708,754	672,191	634,093	680,035	503,206	639,209	788,216	513,847
Tacoma, WA	262,612	368,985	395,852	406,735	460,921	499,322	512,412	469,823	333,518	275,214
Anacortes, WA								25	2	
Preparations of Fruit & Vegetables (HS 20)	**841,683**	**770,240**	**820,613**	**780,345**	**911,954**	**908,476**	**913,065**	**970,185**	**760,271**	**728,921**
Seattle, WA	445,828	323,962	303,049	251,985	300,739	347,962	390,641	423,228	324,788	317,942
Tacoma, WA	395,855	446,278	517,564	528,360	611,215	560,514	522,424	546,957	435,483	410,979
Animal Feed & Other (HS 23)	**535,320**	**746,607**	**596,165**	**555,559**	**909,888**	**522,484**	**1,132,831**	**995,038**	**973,264**	**630,643**
Seattle, WA	200,880	397,380	198,847	193,895	223,045	158,920	369,283	264,696	318,490	261,981
Tacoma, WA	334,440	349,227	397,318	361,631	686,843	363,564	763,548	730,342	654,774	368,662
Anacortes, WA	0	0	0	33	0	0	0	0	0	0
Other	**966,325**	**966,990**	**1,024,195**	**844,622**	**941,736**	**1,013,788**	**1,030,505**	**917,474**	**942,371**	**877,734**
Seattle, WA	536,908	442,601	446,698	360,410	414,927	525,157	549,156	490,131	486,485	470,651
Tacoma, WA	429,417	524,389	577,497	484,245	526,785	488,631	481,349	427,343	455,886	407,056
Anacortes, WA	0	0	0	-33	24	0	0	0	0	27
Total Agriculture Shipments	**7,773,910**	**8,063,420**	**7,974,231**	**7,551,021**	**9,138,961**	**9,292,749**	**10,028,199**	**9,368,303**	**8,319,743**	**7,091,763**
Seattle, WA	4,051,267	3,798,897	3,463,577	3,186,870	3,433,718	3,986,724	4,124,578	3,895,623	3,752,886	3,350,498
Tacoma, WA	3,722,643	4,264,523	4,510,654	4,364,151	5,705,219	5,305,751	5,903,621	5,472,655	4,566,855	3,741,238
Anacortes, WA					24	274		25	2	27

Notes: Agricultural, fishery and wood products includes HS codes 1,2,3,4,7,8,9,10,11,12,13,15,16,17 18,19,20,21,22,23,24,33,44,47,48,49

Source: Global Trade Atlas

The second chart immediately below illustrates the volatility of liquid bulk fuel shipments through Puget Sound during the five-year period of 2017 through 2021. After hitting a record of 5.4 million metric tons in 2019, shipments of liquid bulk fuels dropped by 18% in 2020 and by 15.5% in 2021, both compared to 2019.

Clean and Dirty Fuel Shipments via Puget Sound					
Month/Port	**2017**	**2018**	**2019**	**2020**	**2021**
Jan	**414,824**	**622,853**	**283,219**	**539,169**	**447,147**
Anacortes	188,359	251,440		174,215	124,346
Cherry Point	226,465	371,413	283,219	364,954	322,801
Feb	**217,730**	**357,453**	**490,036**	**466,895**	**295,276**
Anacortes	146,259	177,438	117,202	181,580	100,554
Cherry Point	71,471	136,019	320,610	285,315	194,722
Seattle			52,224		
Tacoma		43,996			
Mar	**258,702**	**334,125**	**462,896**	**385,255**	**286,120**
Anacortes	101,157	108,870	38,732	39,464	37,110
Cherry Point	157,545	225,255	424,164	345,791	249,010
Seattle					
Apr	**433,603**	**196,897**	**365,934**	**436,087**	**395,160**
Anacortes	213,973	43,268	37,242	189,328	144,287
Cherry Point	219,630	69,567	304,486	246,759	250,873
Seattle		84,062	24,206		
May	**430,600**	**553,231**	**178,607**	**384,865**	**402,378**
Anacortes	165,617	277,180		147,740	172,634
Cherry Point	264,983	276,051	178,607	237,125	229,744
Jun	**335,989**	**410,950**	**496,787**	**293,765**	**404,491**
Anacortes	75,513	79,367	83,108	44,679	73,317
Cherry Point	260,476	331,583	413,679	249,086	331,174
Jul	**83,704**	**459,954**	**511,985**	**252,281**	**388,472**
Anacortes		76,021	186,091		83,612
Cherry Point	83,704	383,933	325,894	252,281	304,860
Aug	**120,354**	**408,252**	**524,433**	**324,856**	**339,607**
Anacortes		135,221	117,783	34,382	112,566
Cherry Point	120,354	273,031	406,650	290,474	227,041
Sep	**373,431**	**417,845**	**653,071**	**305,296**	**299,392**
Anacortes	101,078	108,529	209,194	75,629	36,647
Cherry Point	272,353	309,316	405,450	229,667	237,024
Seattle			38,427		
Tacoma					25,721
Oct	**353,947**	**476,099**	**511,110**	**349,352**	**610,052**
Anacortes	46,343	134,556	105,181	37,629	298,365
Cherry Point	209,107	290,084	405,929	311,723	311,687
Seattle	98,497	51,459			
Nov	**305,689**	**465,502**	**450,874**	**297,379**	**416,184**
Anacortes		107,078	125,825	54,930	115,392
Cherry Point	305,689	358,424	273,815	242,449	300,792
Seattle			51,234		
Dec	**368,893**	**626,330**	**504,176**	**409,615**	**306,130**
Anacortes	146,464	211,942	159,159	71,150	38,714
Cherry Point	222,429	372,584	345,017	338,465	209,726
Seattle		41,804			57,690
Grand Total	**3,697,466**	**5,329,491**	**5,433,128**	**4,444,815**	**4,590,409**

Source: Commodities at Sea

Q: What is your opinion regarding the likelihood that oceangoing vessel traffic levels in Puget Sound will continue to be volatile in the future?

A: Given the highly diverse character of the vessel traffic calling Puget Sound ports and terminals, I believe continued volatility is likely and that it is not realistic to predict with any degree of certainty the volume of vessel traffic annually in Puget Sound.

Q: In its November 2019 rate order, the UTC used a five-year average of Puget Sound vessel traffic to project the traffic levels for the two years following issuance of the order. Is the use of a five-year rolling average an appropriate way to predict vessel traffic in Puget Sound?

A: No. As explained above, the different classes of ship types calling Puget Sound and the multiple unpredictable factors affecting the traffic level for each ship type make it, in my opinion, impossible to predict vessel traffic on the basis of the past.

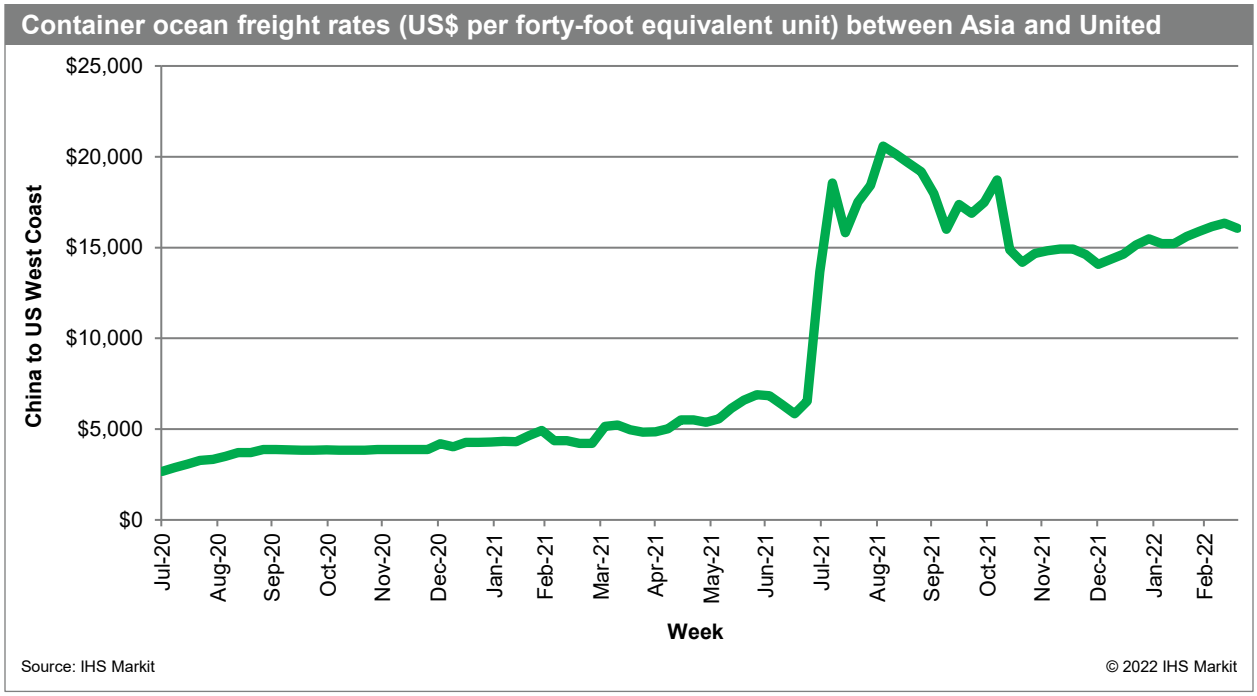
Q: What are your thoughts on the proposal by the Puget Sound Pilots that traffic fluctuations in Puget Sound be smoothed out through the use of a quarterly tariff adjuster that trues up the vessel traffic in the preceding quarter for the following quarter utilizing a trailing 12-month traffic average?

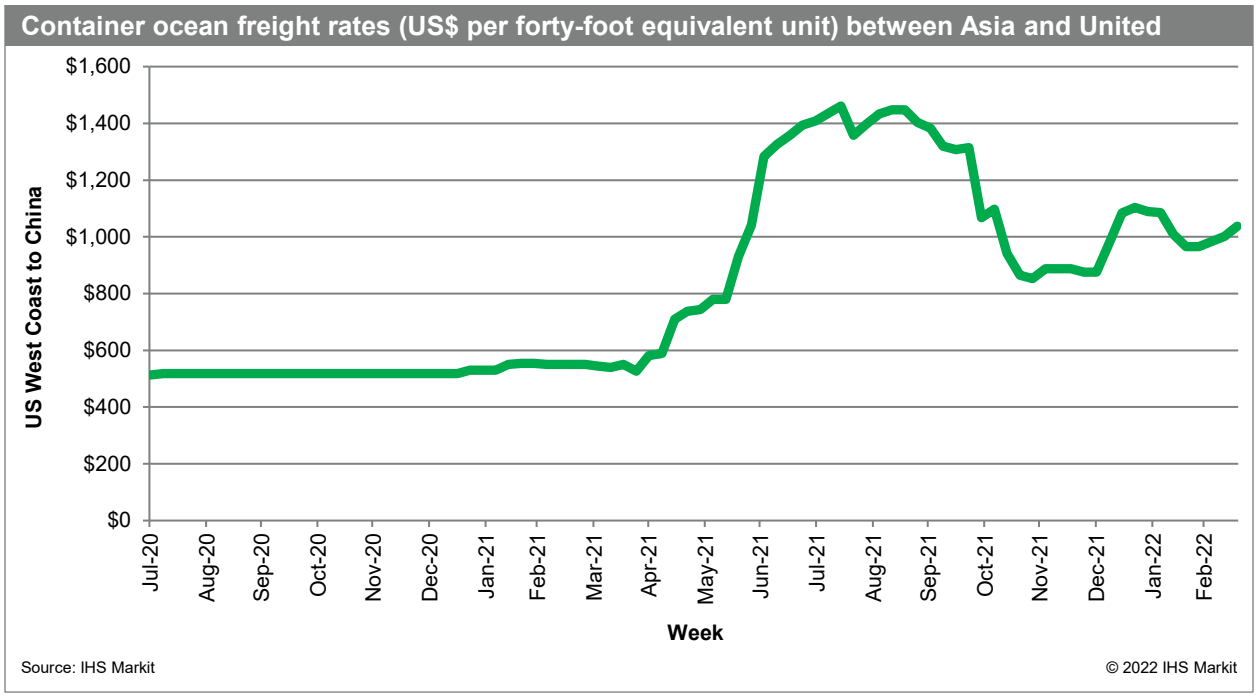
A: I know that this particular type of quarterly traffic adjuster has already been in use for over a decade with respect to the tariff funding the pilotage system on the Columbia River Bar pilotage ground. I consider this approach to be an excellent means of dealing with the known probability of traffic volatility, which makes use of a moving average inappropriate.

D. Substantial Increases in Ocean Freight Rates.

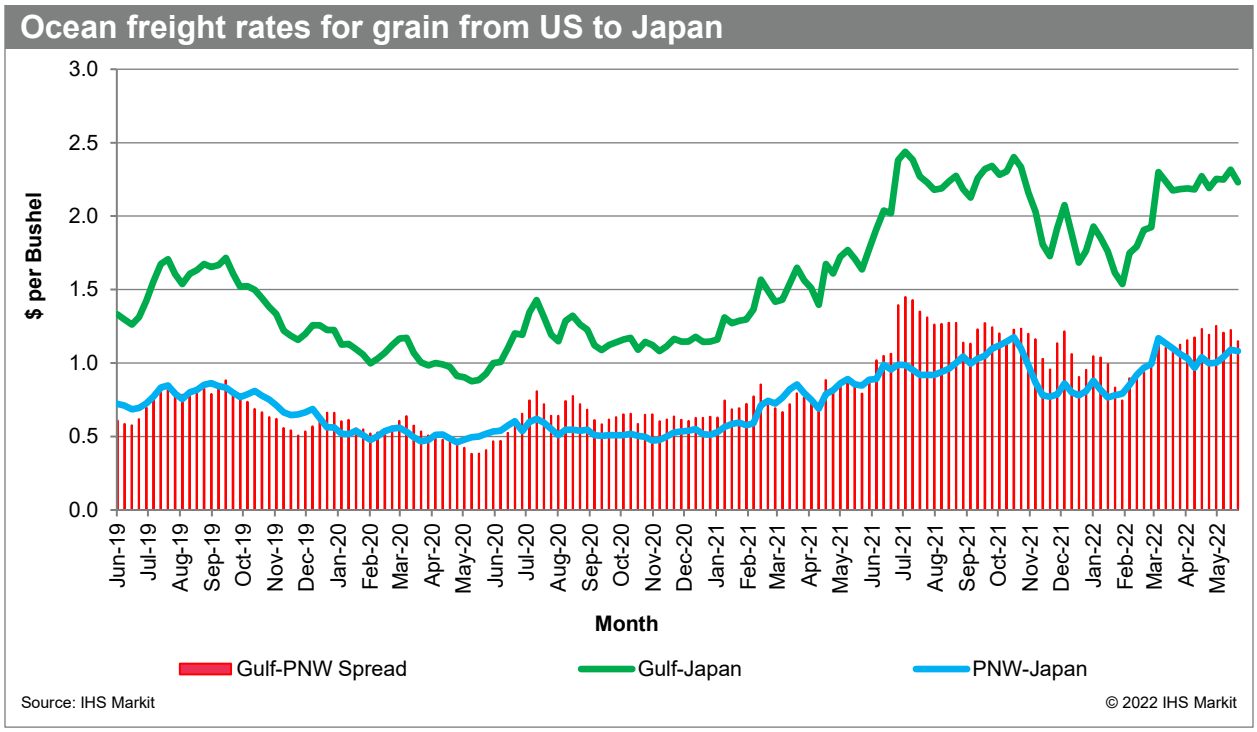
Q: What has happened to ocean freight rates in the last two years?

A: Both container ocean freight rates and dry bulk freight rates have risen dramatically. The freight rates for containers shipped from Asia to the United States have gone up more than tenfold from below $2,000 in early 2022 more than $15,000 today with a spike to above $20,000 per container in the summer of 2021. Container rates from the U.S. West Coast to Asia have also gone up dramatically, nearly doubling from around $500 per container in 2022 over $1,000 today. Two charts displaying these large increases in ocean freight rates are below:





Dry bulk rates from Asia to the Pacific Northwest and the Gulf Coast have increased substantially since the fall of 2020, more than doubling throughout most of 2021 and 2022 from approximately $20 per metric ton of $0.50 per bushel to over $40 per metric ton or about $1.10 per bushel from the Pacific Northwest.



E. <u>Soaring Shipping Industry Profits.</u>

Q: What has been the trend in container shipping industry revenues and net income in the last several years?

A: Major container cargo carriers have seen record growth in revenues and net income in 2020 and 2021. This is occurring despite logistics challenges from Covid-19. For major container carriers, year-over-year revenue growth in 2021 ranged from 57% to 133%, and year-over-year net income growth increased dramatically between a range of 466% to 1357%. These carriers were able to capture record profits in 2021 from higher freight rates and a rebound in shipping volume from 2020. The two charts below display the revenues and net income for five major container cargo carriers during the five-year period of 2017 through 2021.

Revenues of Major Container Carriers (Million USD)						
	2017	2018	2019	2020	2021	*2020-2021 growth*
Maersk	31,189	39,257	38,890	39,470	61,787	*57%*
CMA CGM	21,116	23,476	30,254	31,445	55,980	*78%*
Hapag-Lloyd	11,286	13,726	14,115	14,577	26,356	*81%*
Evergreen	4,946	5,611	6,165	6,999	17,468	*150%*
Yang Ming	4,306	4,702	4,824	5,113	11,912	*133%*

Net Income of Major Container Cargo Carriers (Million USD)						
	2017	2018	2019	2020	2021	*2020-2021 growth*
Maersk	(214)	(357)	967	3,307	18,730	*466%*
CMA CGM	731	68	(219)	1,776	17,894	*908%*
Hapag-Lloyd	35	54	418	1,068	10,750	*907%*
Evergreen	230	10	4	824	8,532	*936%*
Yang Ming	11	(219)	(139)	405	5,900	*1357%*

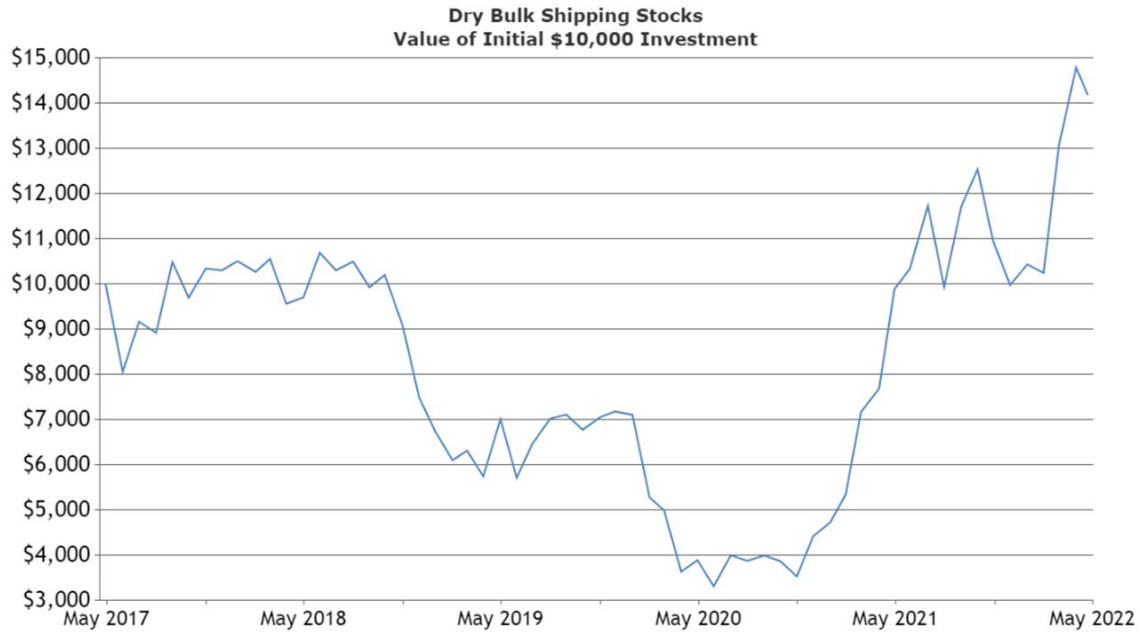
HSBC estimates that the container shipping industry will make more than $163 billion in operating profit in 2022. For comparison, this industry generated a $5 billion profit just two years ago in 2019.

Like container carriers, bulk carriers recorded significant growth in revenues and net income from 2020 to 2021. In fact, 2021 was a year in which both carriers reported their highest levels of revenue and net income over the past five years. Despite the impacts of Covid-19, the eight publicly held bulk carrier companies in the charts below show year-over-year revenue growth for 2021 ranging from 9% to 116%, and year-over-year net income growth increasing from 143% to 6710%.

Revenues of Bulk Carriers (Million USD)						
	2017	2018	2019	2020	2021	*2020-2021 growth*
Diana Shipping	162	226	221	170	214	*26%*
Eagle Bulk Shipping	237	310	292	275	595	*116%*
Genco Shipping	210	368	389	356	547	*54%*
Golden Ocean Group Ltd	460	656	706	608	1,203	*98%*
Navios Maritime Holdings	463	506	482	417	586	*41%*
Star Bulk Carriers Ltd	332	650	819	692	1,427	*106%*
Capital Product Partners	264	132	123	141	185	*31%*
SFL Holdings	381	419	459	471	513	*9%*

Net Income of Bulk Carriers (Million USD)						
	2017	2018	2019	2020	2021	*2020-2021 growth*
Diana Shipping	(512)	17	(11)	(134)	57	*143%*
Eagle Bulk Shipping	(44)	13	(22)	(35)	185	*627%*
Genco Shipping	(59)	(33)	(56)	(226)	182	*181%*
Golden Ocean Group Ltd	(2)	85	37	(138)	527	*482%*
Navios Maritime Holdings	(165)	(266)	(180)	(189)	92	*149%*
Star Bulk Carriers Ltd	(10)	58	(16)	10	681	*6710%*
Capital Product Partners	38	(7)	24	30	96	*223%*
SFL Holdings	101	74	89	(224)	164	*173%*

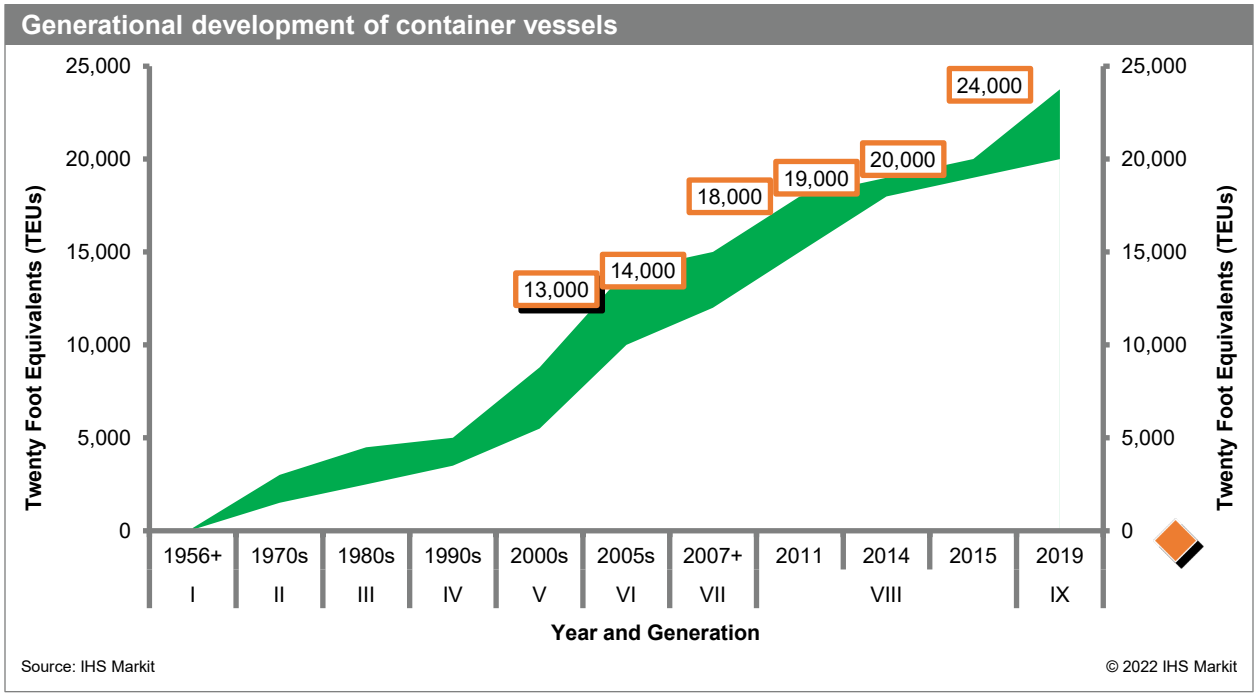
The increased profitability of bulk shipping companies is also reflected in particularly strong share price performance over the past year, as displayed in the graph below:



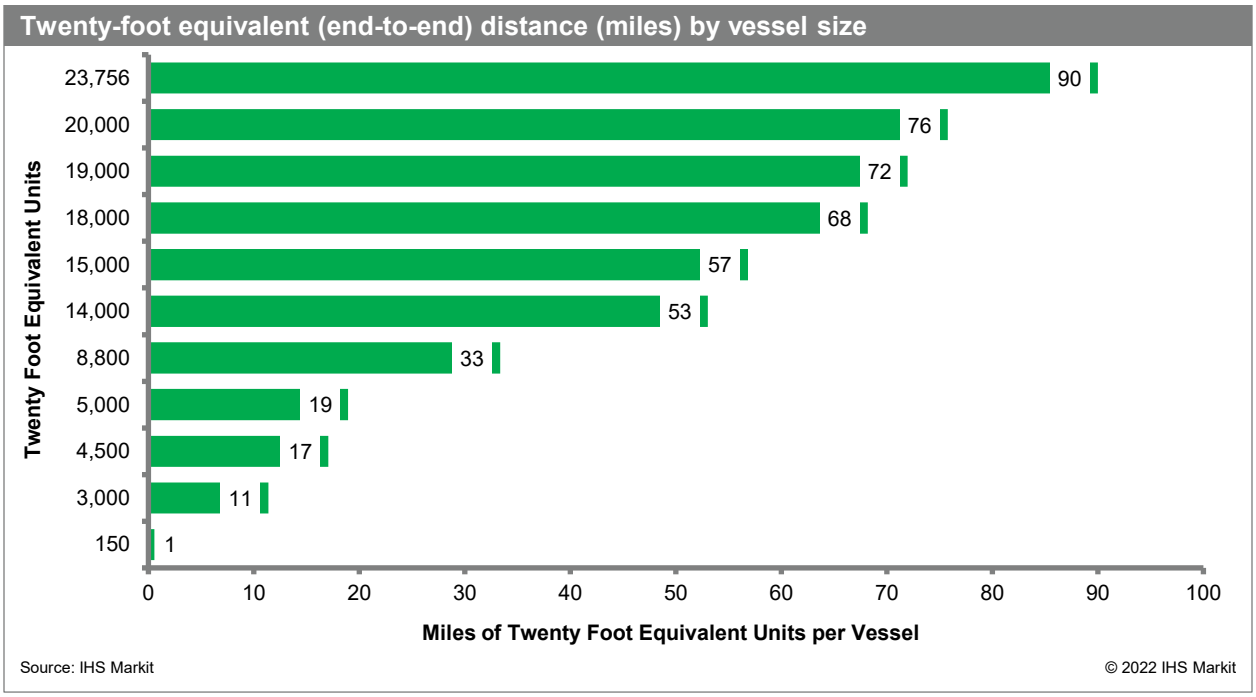
F. Five-Fold Increase in Container Vessel Size Since the 1990s.

Q: What observations do you have regarding the size of container vessels since this new type of cargo ship was first introduced in the 1950s?

A: For more than 500 years, cargo-carrying ships have grown ever larger. Although container vessels are a modern phenomenon with the first container ship launched in 1956, the size of container vessels has continued on a steep upward climb for nearly seven decades. In fact, container vessel size has seen a fivefold increase from the 1990s to 2019, increasing from 5,000 TEUs in 1990 to nearly 25,000 TEUs in 2019. The increasing size of container vessels reflects larger deadweight tonnage, longer lengths overall, wider beams, deeper drafts and taller bridge clearances, which requires larger engines and more fuel. As this class of ships becomes ever larger, so has the demand for the services rendered by these vessels while at sea, entering pilotage areas and while at a terminal in a port. The chart below depicts the generational development of container vessels from Generation I in 1956 to Generation IX in 2019:



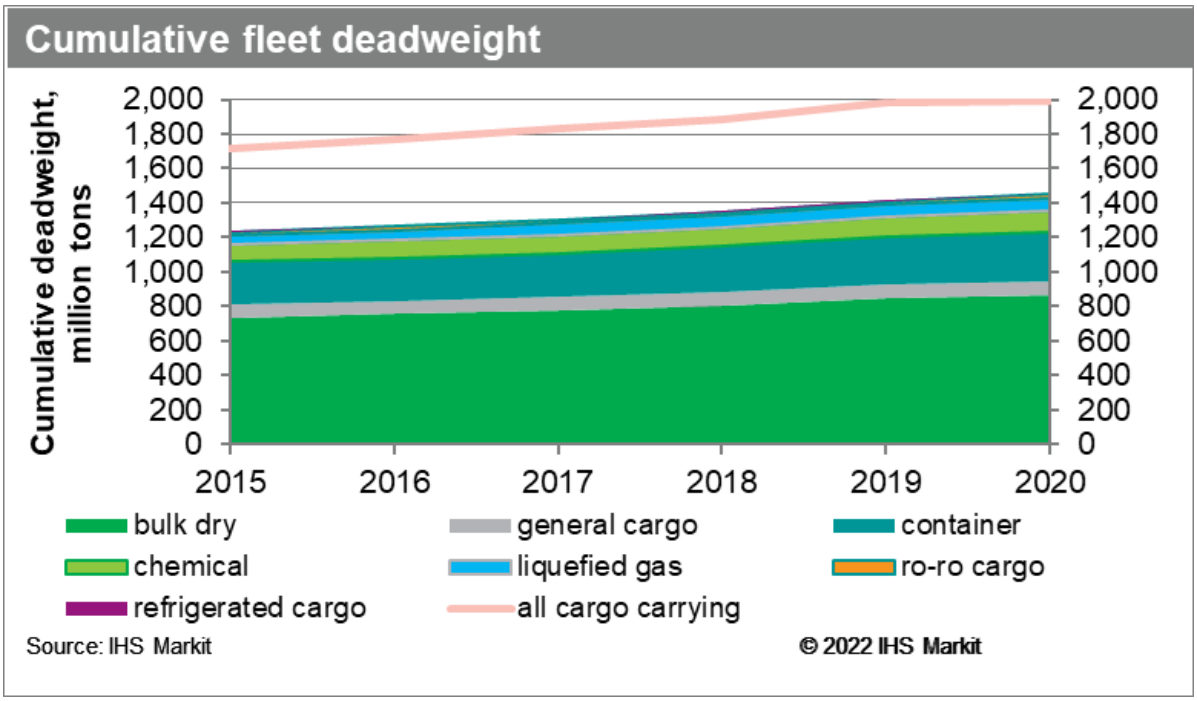
Another way to show the gargantuan cargo-carrying capacity of an ultra-large container vessel ("ULCV") is to chart the length of the TEUs carried by these huge vessels end to end. The chart below depicts how the miles of 20-foot equivalent units per vessel have grown from less than one mile for a vessel with 150 TEUs to 90 miles for a vessel with nearly 24,000 TEUs. For a large container ship calling on the Puget Sound to the Port of Seattle or Port of Tacoma, those containers would stretch from Seattle to Olympia. The chart below illustrates this dramatic growth and the increasing burden of servicing these vessels in terms of crew needs, shoreside crane and yard capacity, drayage and intermodal requirements.

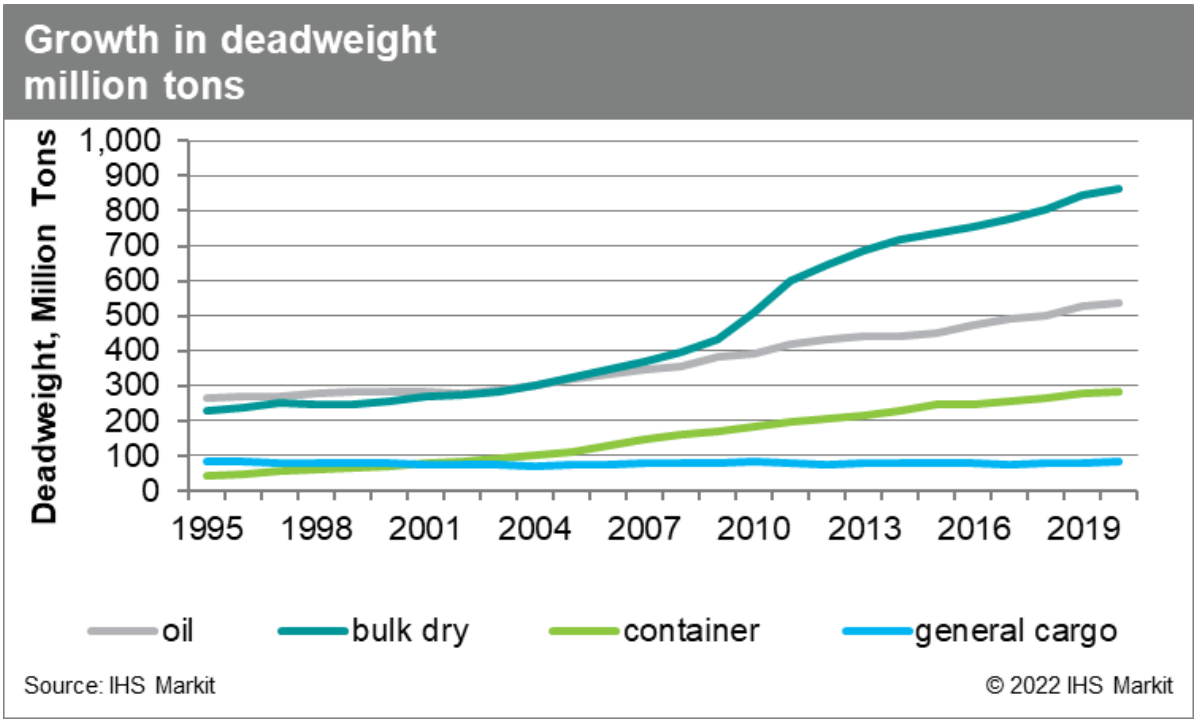


G. Long-Term Trends in Ship Builds by Vessel Type.

Q: Looking to the future, what data is available regarding ship size by vessel type?

A: There is both deadweight tonnage size data and booked ship builds data available to answer that question. That data shows that both oil tankers and bulk dry cargo vessels have been two of the major components of the world's cargo carrying fleet for many years. The charts below display cumulative fleet deadweight by vessel type and growth in deadweight million tons by vessel type:


Cumulative fleet deadweight
Cumulative deadweight, million tons
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2016
2017
2018
2019
2020
bulk dry
general cargo
container
chemical
liquefied gas
ro-ro cargo
refrigerated cargo
all cargo carrying
Source: IHS Markit
© 2022 IHS Markit


Growth in deadweight
million tons
Deadweight, Million Tons
1,000
900
800
700
600
500
400
300
200
100
0
1995
1998
2001
2004
2007
2010
2013
2016
2019
oil
bulk dry
container
general cargo
Source: IHS Markit
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Deadweight tonnage is defined as the maximum weight of cargo, fuel, crew, passengers food and water that a vessel can carry. It does not include the weight of the vessel. In general, the greater the deadweight tonnage the greater weight of cargo a vessel can carry.

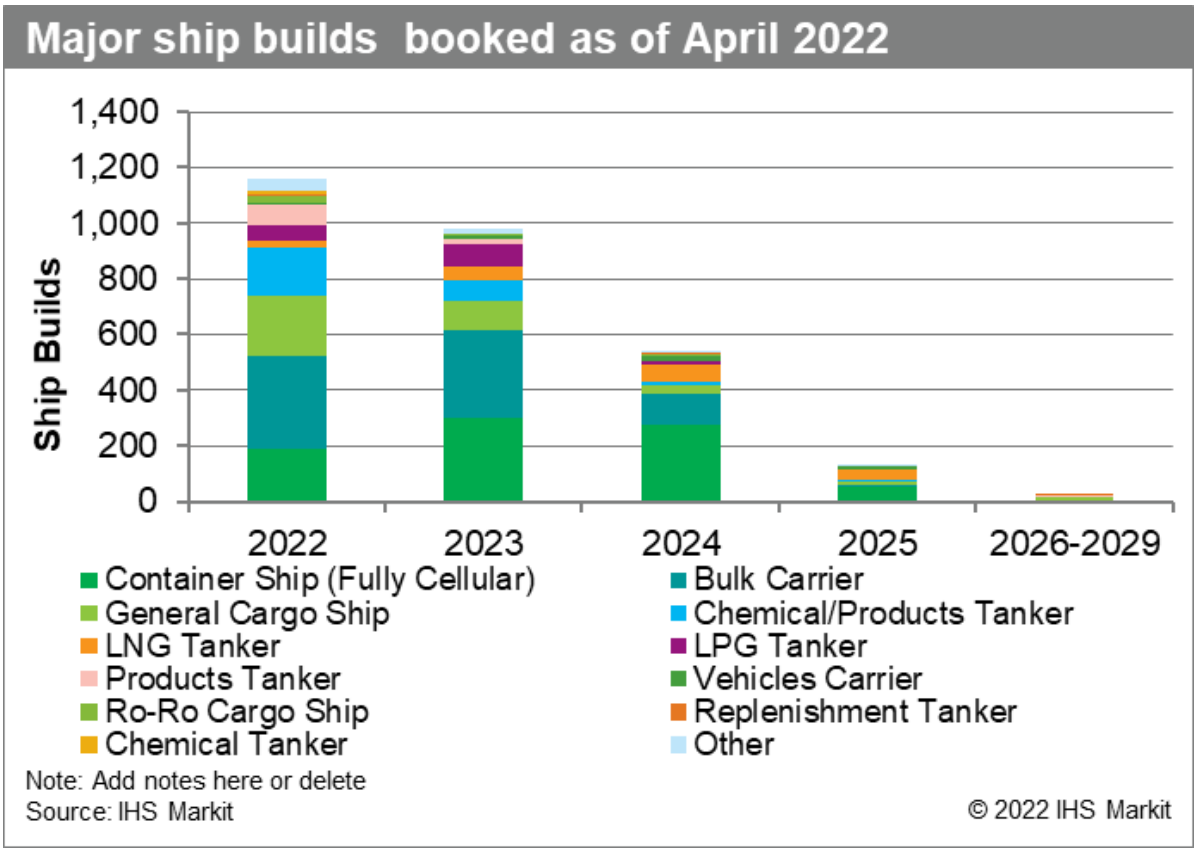
Gross tonnage is a measure of a ship's overall internal volume and is determined by dividing by 100 the contents, in cubic feet, of the vessel's enclosed spaces. Gross tonnage applies to the vessel, not the cargo.

Net tonnage is the ship's gross tonnage minus the space occupied by accommodations for crew, by machinery, for navigation, by the engine room and fuel. It represents the space available for cargo or passengers.

For 2022, there are 1161 ship builds booked, ranging from on order to launched status. The breakdown by ship type for the years 2022 through 2024 is as follows:

- 335 bulk carriers ordered for 2022; 316 ordered for 2023; and 107 for 2024.
- 217 general cargo ships ordered for 2022; 105 for 2023; and 31 for 2024.
- 187 container ships ordered for 2022; 301 for 2023; and 277 for 2024.
- 172 chemical/products tankers ordered for 2022; 75 for 2023; and 18 for 2024.

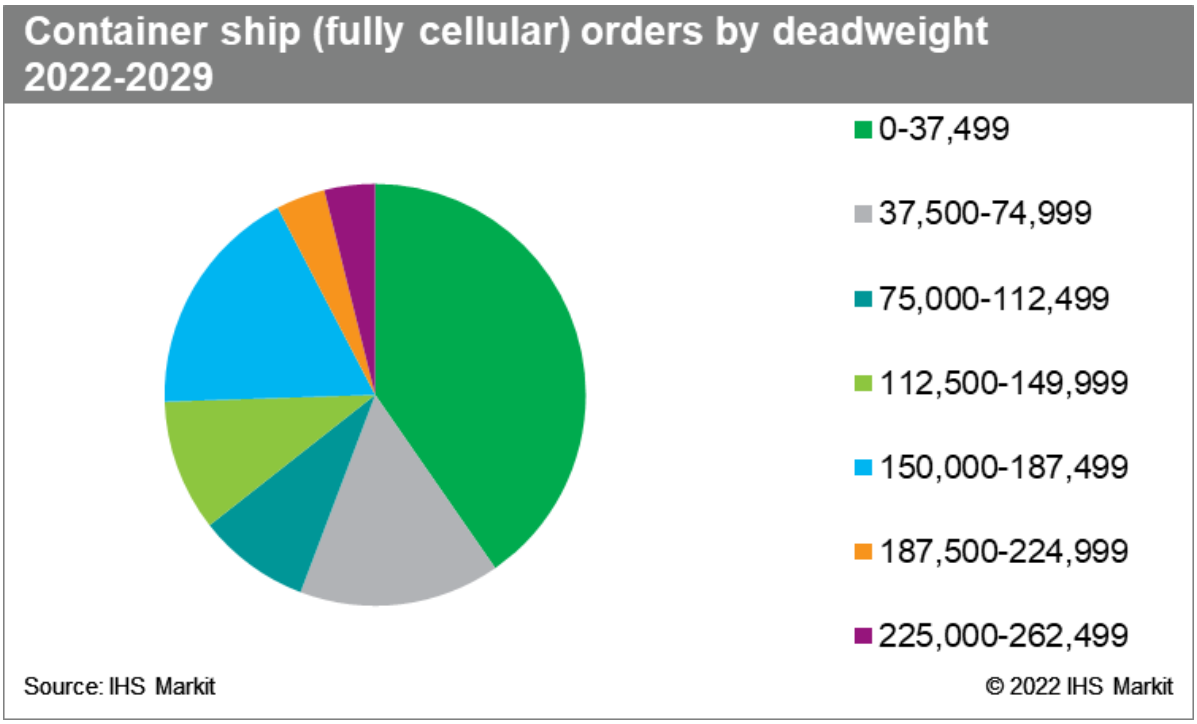
The charts below display new ship build orders for the 2022-29 timeframe by ship type:

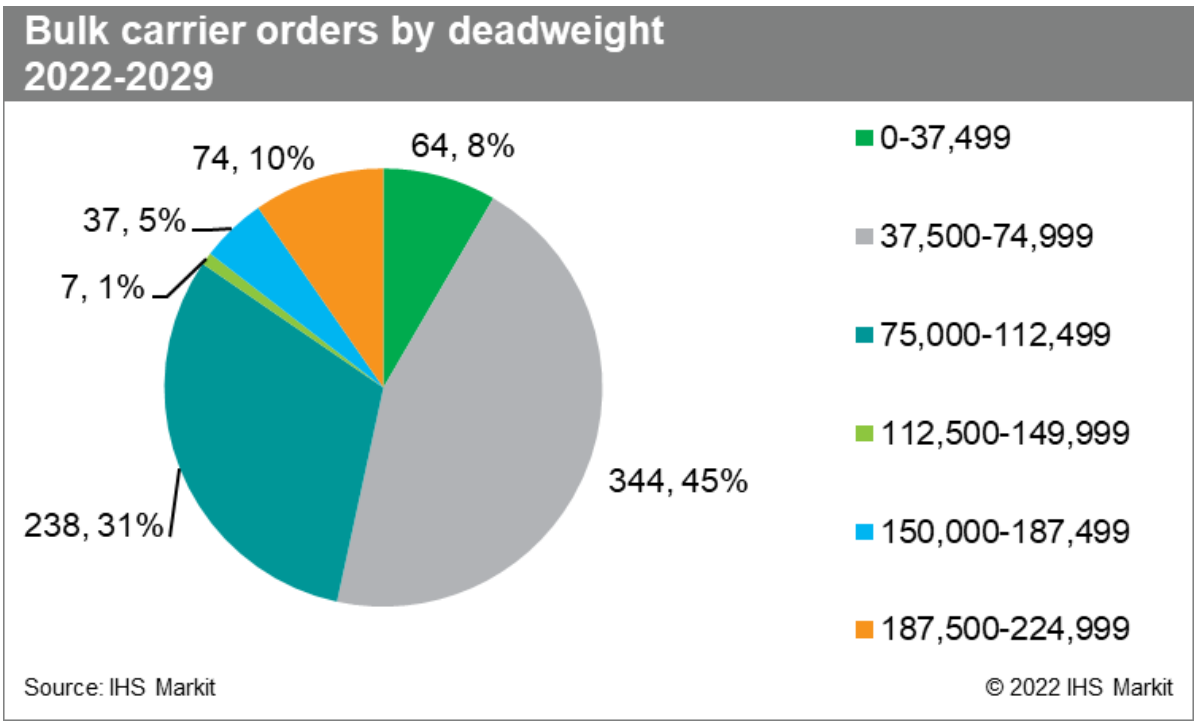


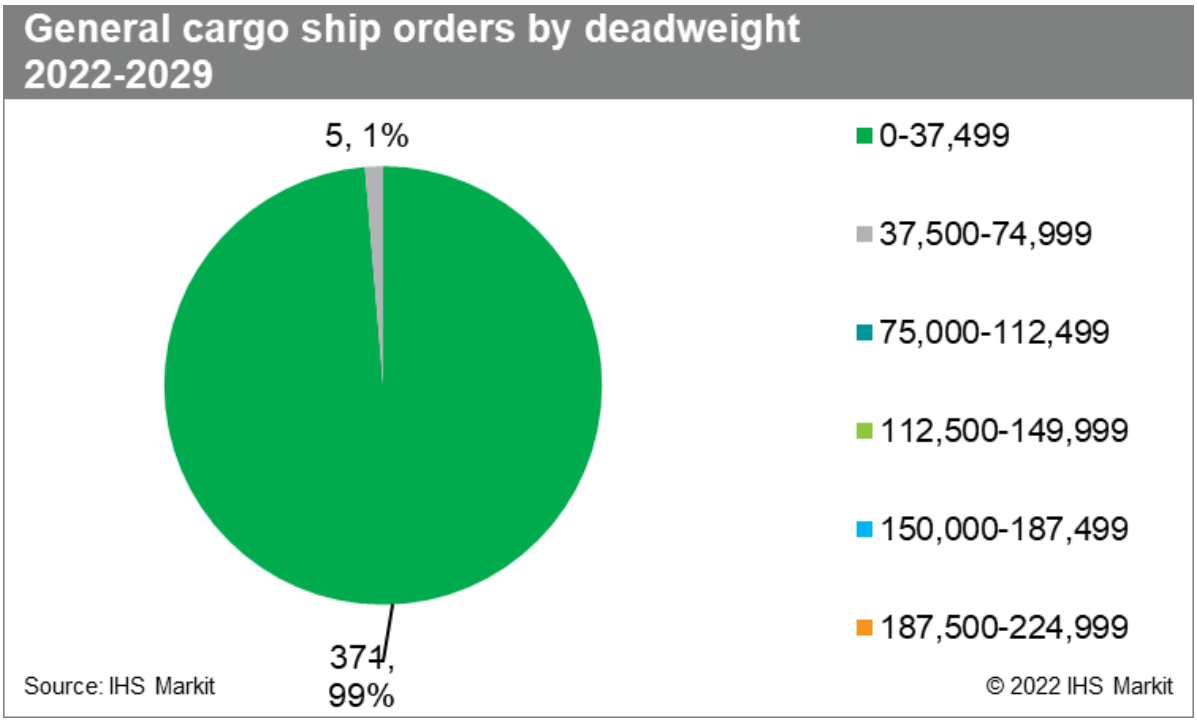
Major ship builds booked as of April 2022

	2022	2023	2024	2025	2026-2029	Total
Container Ship (Fully Cellular)	187	301	277	53	5	823
Bulk Carrier	335	316	107	6	-	764
General Cargo Ship	217	105	31	15	8	376
Chemical/Products Tanker	172	75	18	4	-	269
LNG Tanker	24	48	58	38	3	171
LPG Tanker	57	81	16	1	1	156
Products Tanker	77	14			2	93
Vehicles Carrier	3	13	18	7	-	41
Ro-Ro Cargo Ship	26	6	3	2	-	37
Replenishment Tanker	5	5	4	4	5	23
Chemical Tanker	15				-	15
Other	43	17	8	2	-	70
Total	1,161	981	540	132	24	2,838

The pie charts below display ship build by deadweight in seven ship type categories (container, bulk carrier, general cargo, chemical, LNG tanker, LPG tanker and products tanker):






General cargo ship orders by deadweight
2022-2029
5, 1%
374, 99%
0-37,499
37,500-74,999
75,000-112,499
112,500-149,999
150,000-187,499
187,500-224,999
Source: IHS Markit
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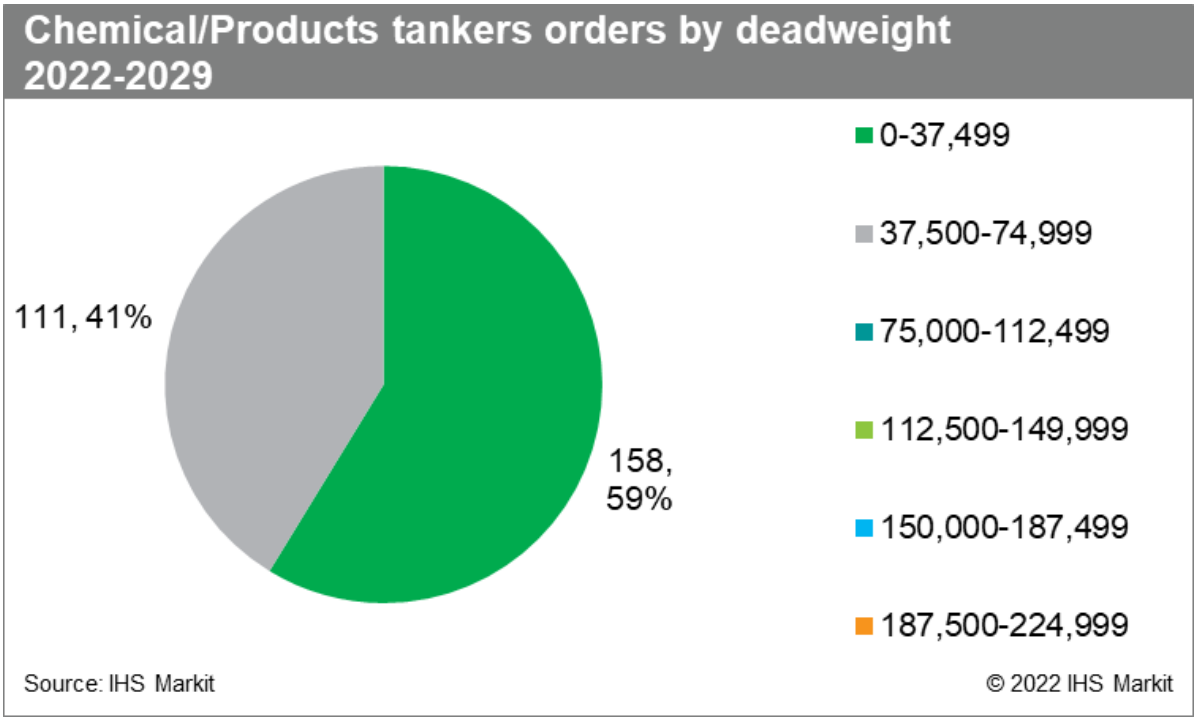
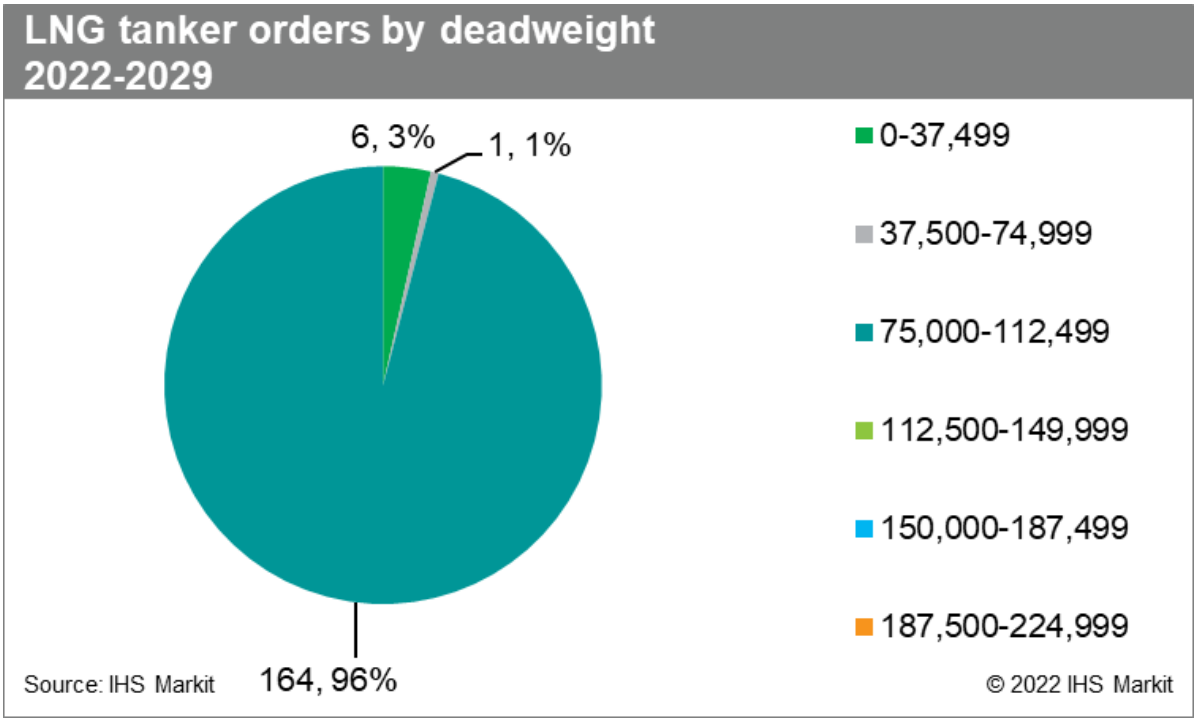
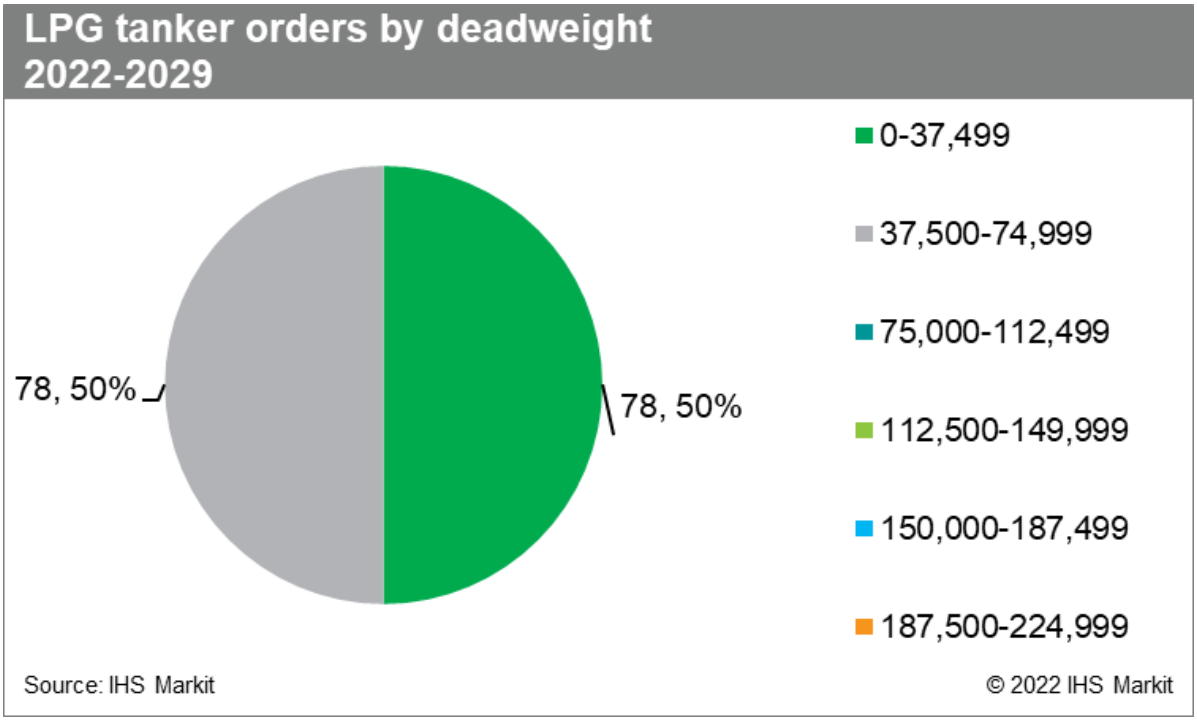

Chemical/Products tankers orders by deadweight
2022-2029
111, 41%
158, 59%
0-37,499
37,500-74,999
75,000-112,499
112,500-149,999
150,000-187,499
187,500-224,999
Source: IHS Markit
© 2022 IHS Markit


LNG tanker orders by deadweight
2022-2029
6, 3%
1, 1%
164, 96%
0-37,499
37,500-74,999
75,000-112,499
112,500-149,999
150,000-187,499
187,500-224,999
Source: IHS Markit
© 2022 IHS Markit


LPG tanker orders by deadweight
2022-2029
78, 50%
78, 50%
0-37,499
37,500-74,999
75,000-112,499
112,500-149,999
150,000-187,499
187,500-224,999
Source: IHS Markit
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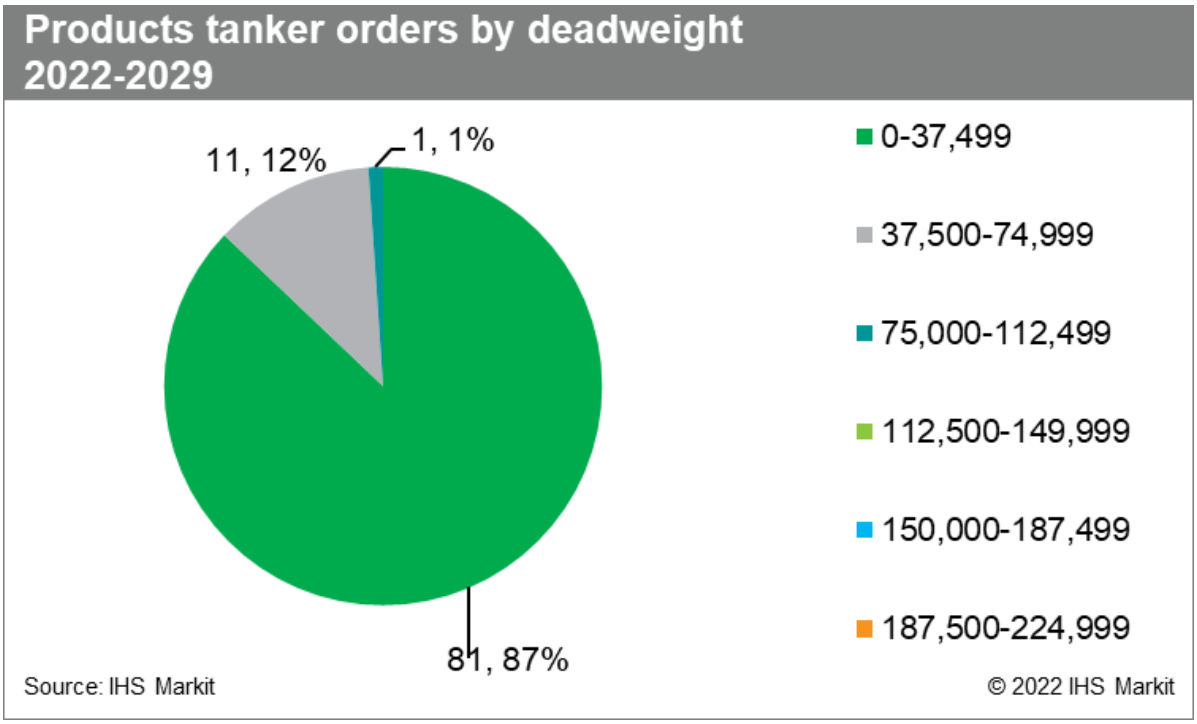
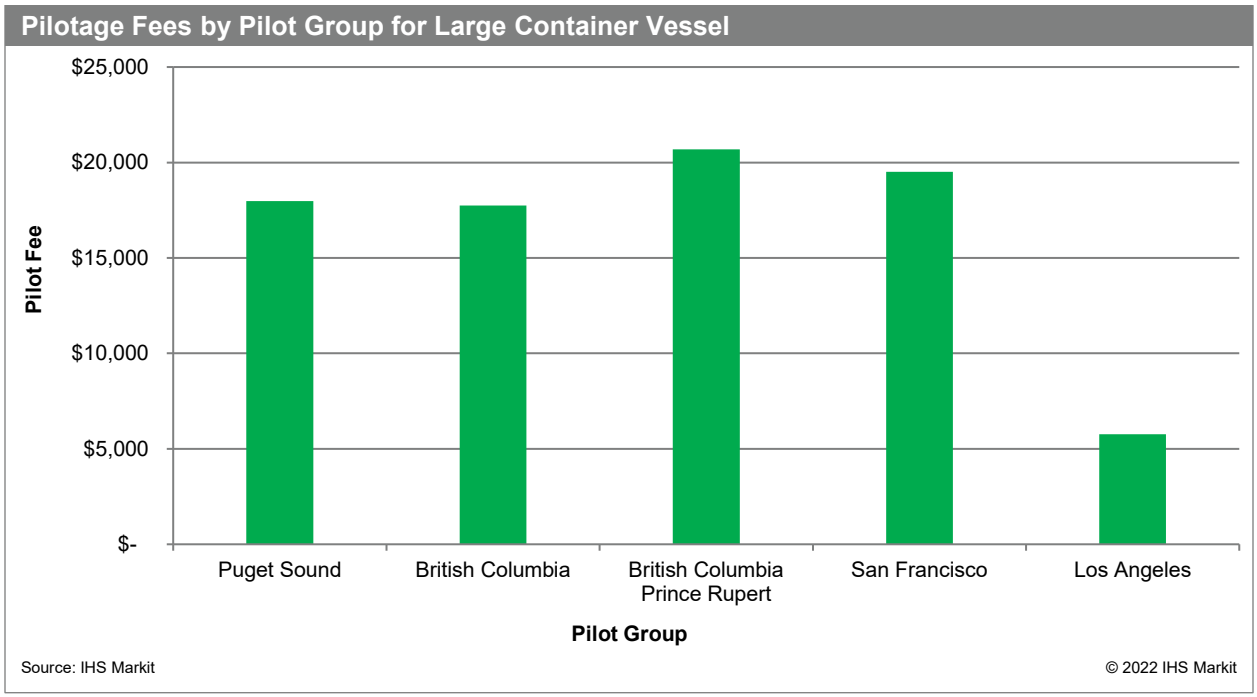


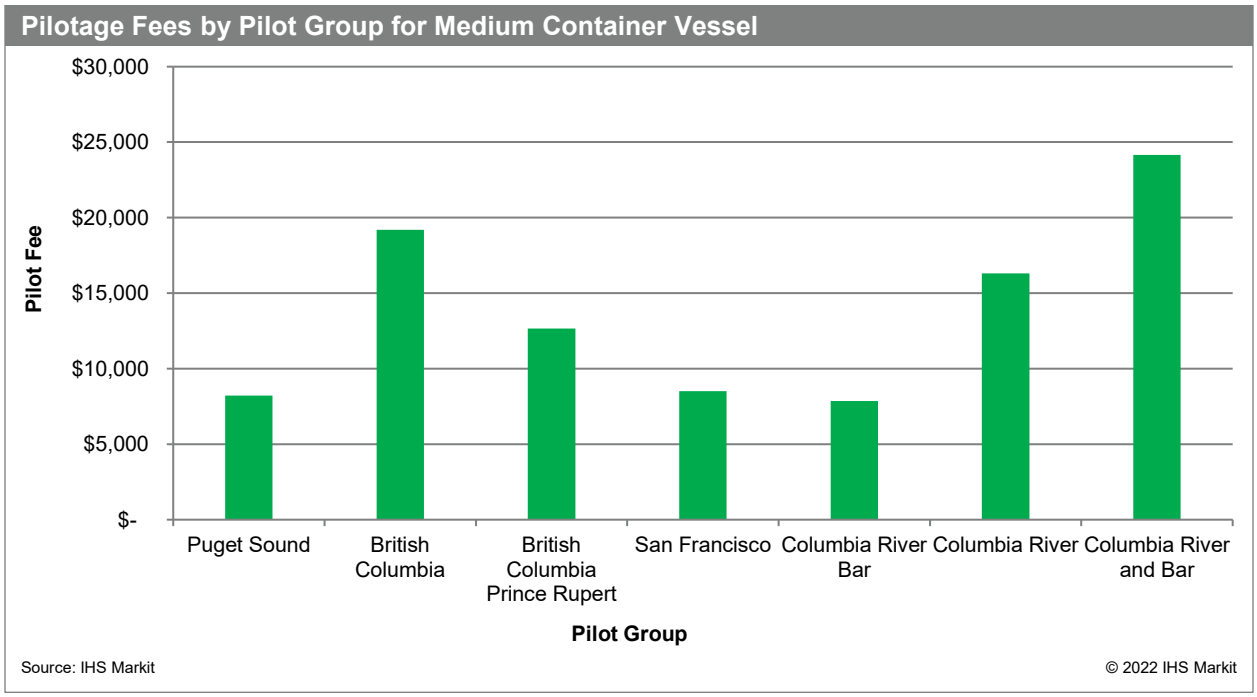
H. Comparison of PSP's Current and Proposed Pilotage Rates to Other West Coast Ports.

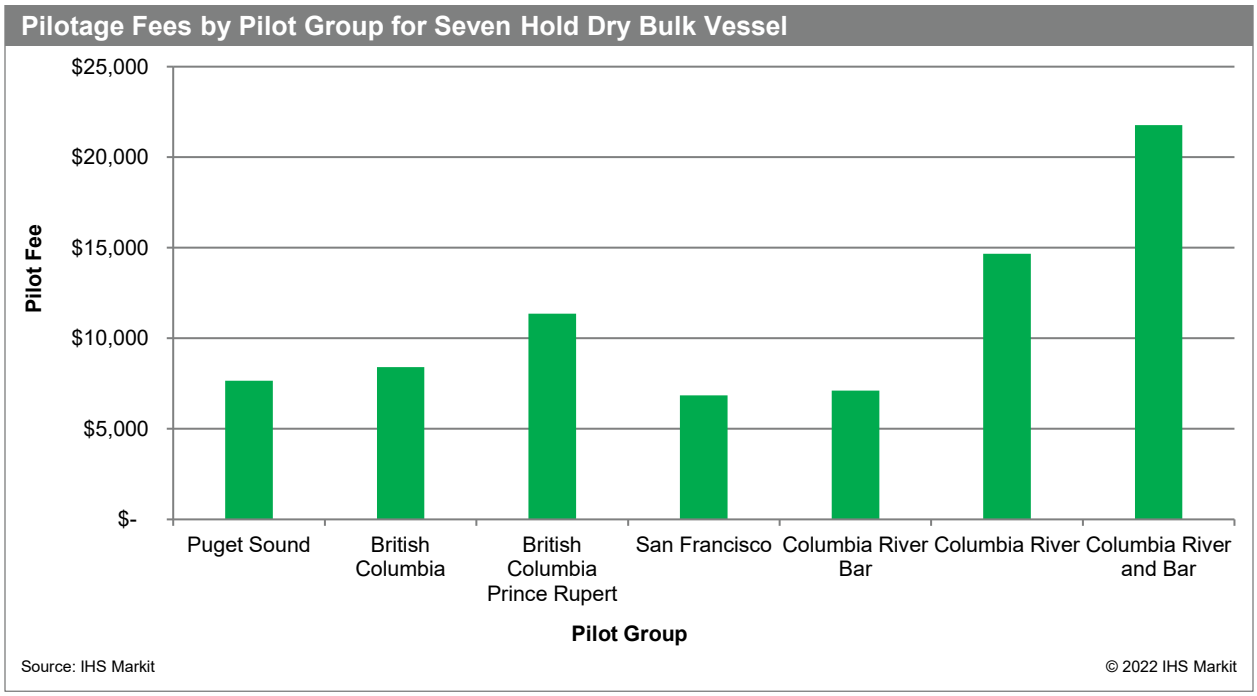
Q: Did you prepare a comparison of PSP's proposed pilotage rates in this rate case to the existing rates charged to specific vessels in five ship type classes in the major port clusters on the West Coast?

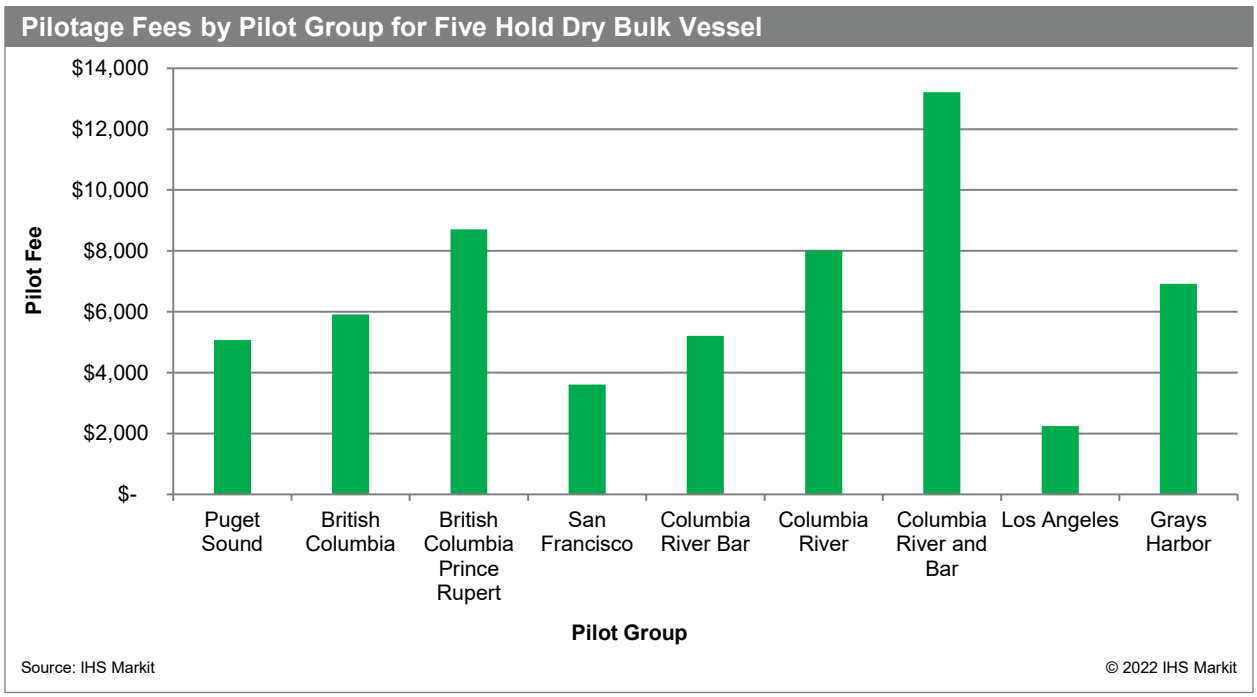
A: Yes. We were provided the data for the actual charges to the specific ships in different ship type classes by pilot groups in the major port clusters on the West Coast as well as the proposed rates that PSP proposes go into effect as of January 1, 2023 with an important proviso. This proposed rate data also included the first year cost of the transition of PSP's unfunded pension plan to a fully funded defined-benefit plan using the first of the two options submitted to the UTC. This added $4.86 million to the total revenue requirement for 2023 that we modeled below, although I understand that this cost will not be added to the rates, if approved by the

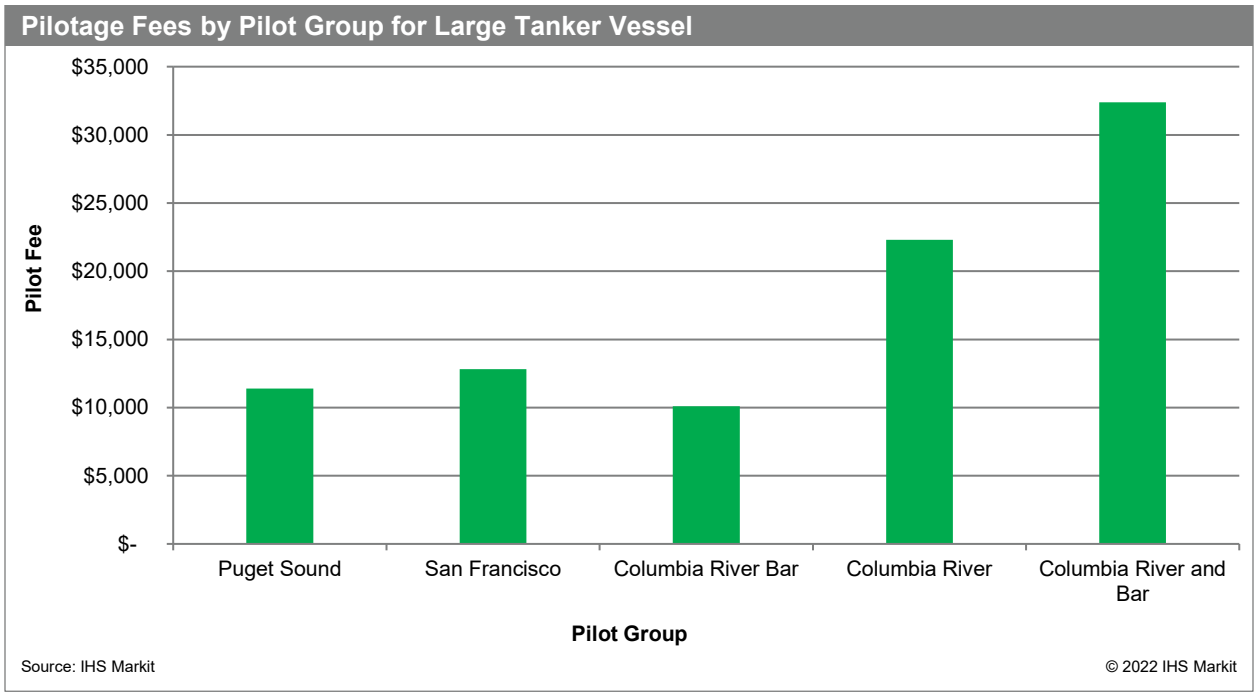
UTC, until 2024. We then utilized that data to compare PSP's proposed rates to the pilotage charges for the same ships in different ship type classes on a per mile, per hour and overall charge basis. The charts generated by this data are set out below:

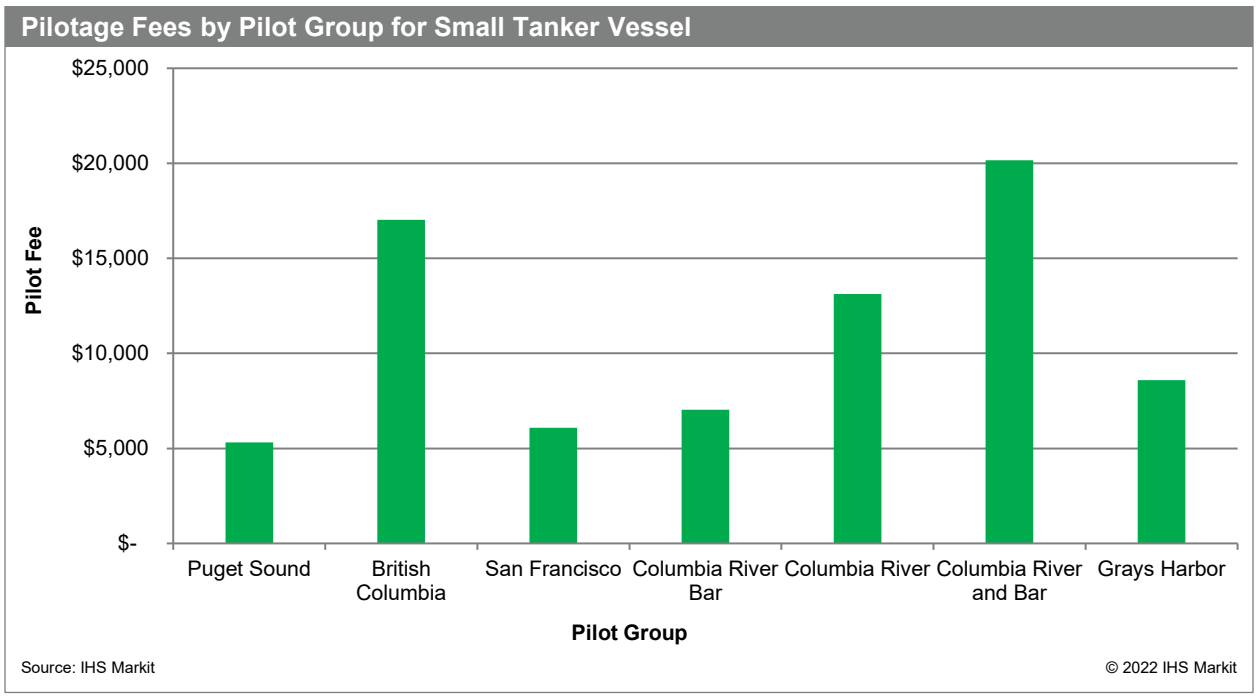





Pilotage Fees by Pilot Group for Seven Hold Dry Bulk Vessel
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Pilot Fee
Puget Sound
British Columbia
British Columbia Prince Rupert
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Pilot Group
Source: IHS Markit
© 2022 IHS Markit


Pilotage Fees by Pilot Group for Five Hold Dry Bulk Vessel
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Pilot Fee
Puget Sound
British Columbia
British Columbia Prince Rupert
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Los Angeles
Grays Harbor
Pilot Group
Source: IHS Markit
© 2022 IHS Markit


Pilotage Fees by Pilot Group for Large Tanker Vessel
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Pilot Fee
Puget Sound
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Pilot Group
Source: IHS Markit
© 2022 IHS Markit


Pilotage Fees by Pilot Group for Small Tanker Vessel
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Pilot Fee
Puget Sound
British Columbia
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Grays Harbor
Pilot Group
Source: IHS Markit
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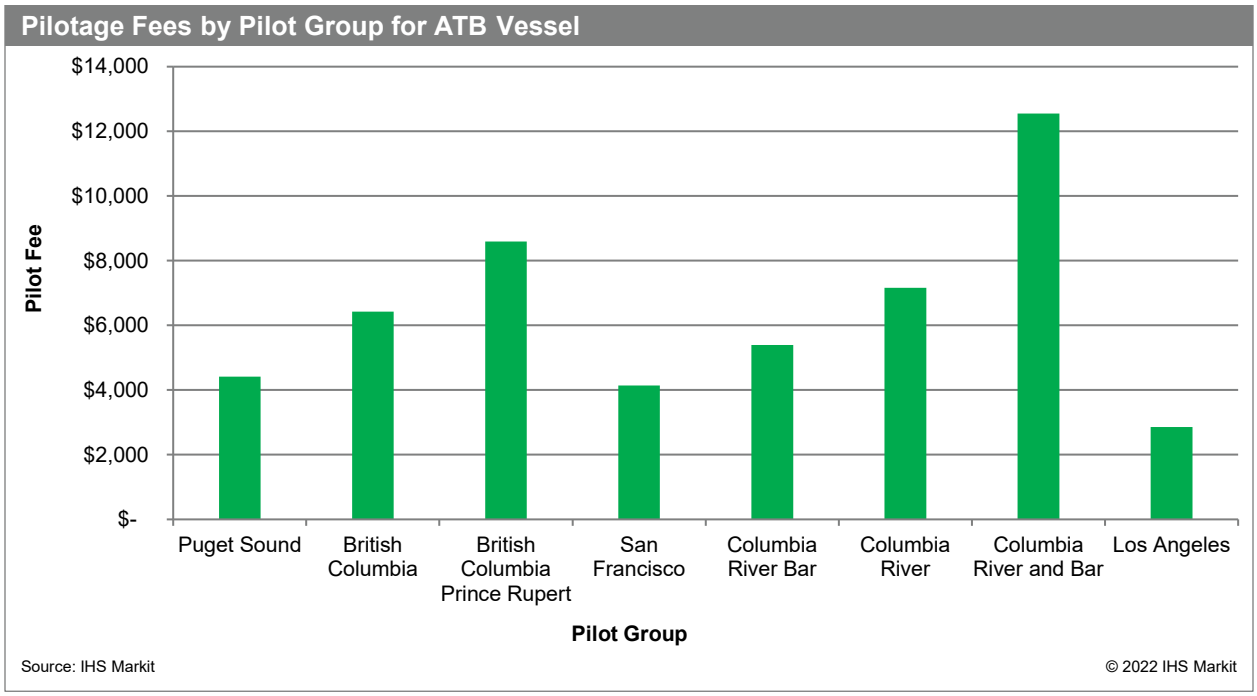
Pilotage Fees by Pilot Group for ATB Vessel
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Pilot Fee
Puget Sound
British Columbia
British Columbia Prince Rupert
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Los Angeles
Pilot Group
Source: IHS Markit
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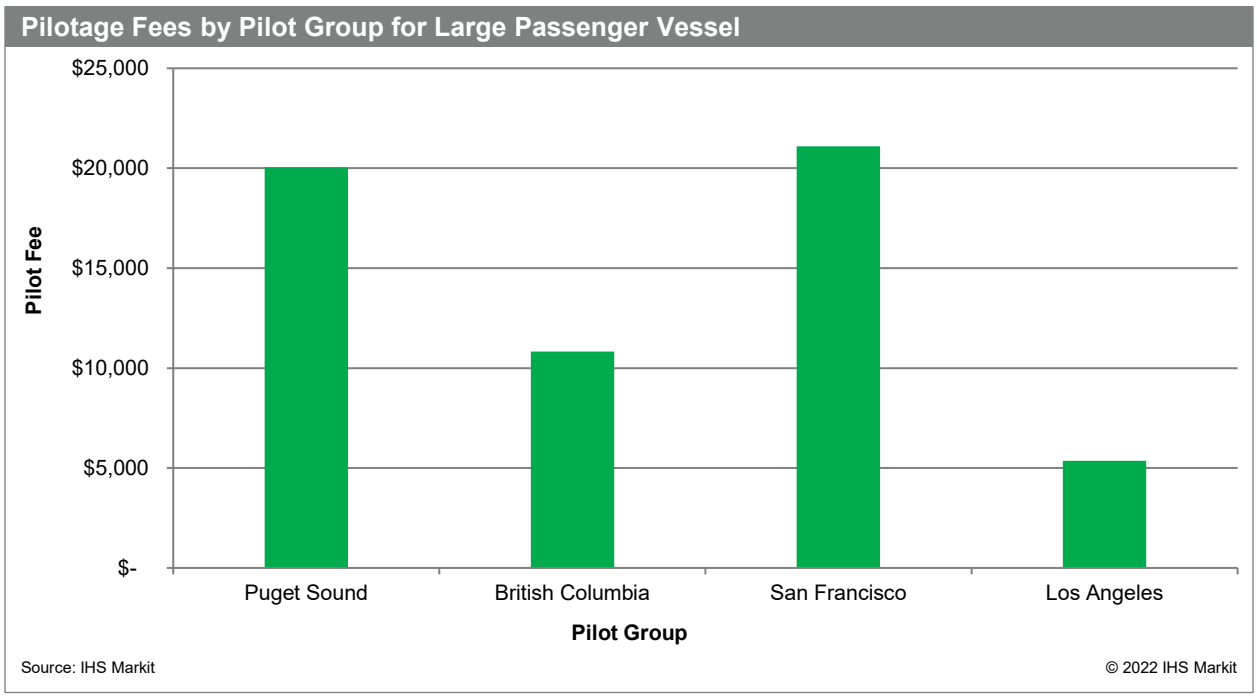
Pilotage Fees by Pilot Group for Large Passenger Vessel
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Pilot Fee
Puget Sound
British Columbia
San Francisco
Los Angeles
Pilot Group
Source: IHS Markit
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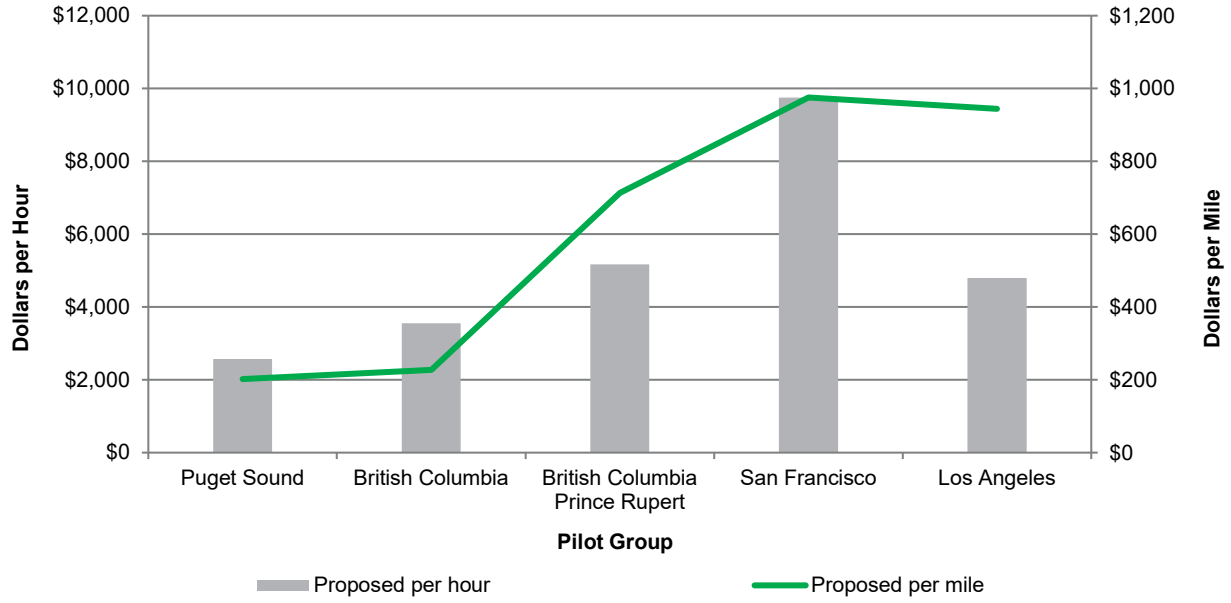
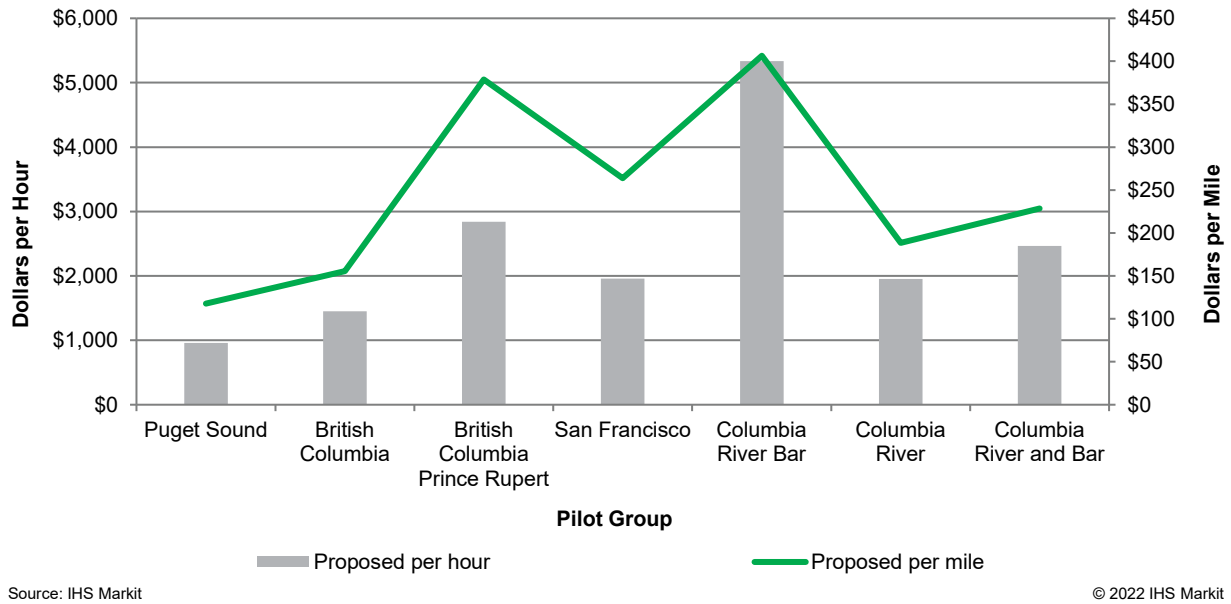
Puget Sound Pilots Proposed Fee for a Large Container Vessel Compared to Other West Coast

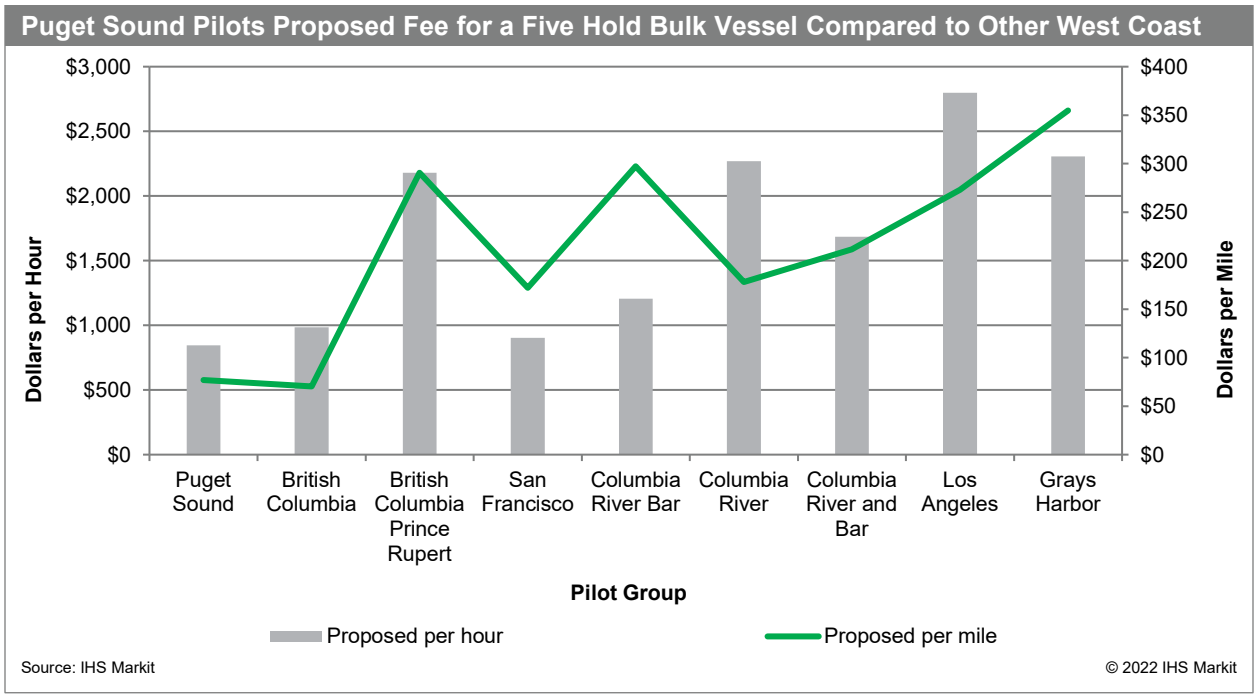


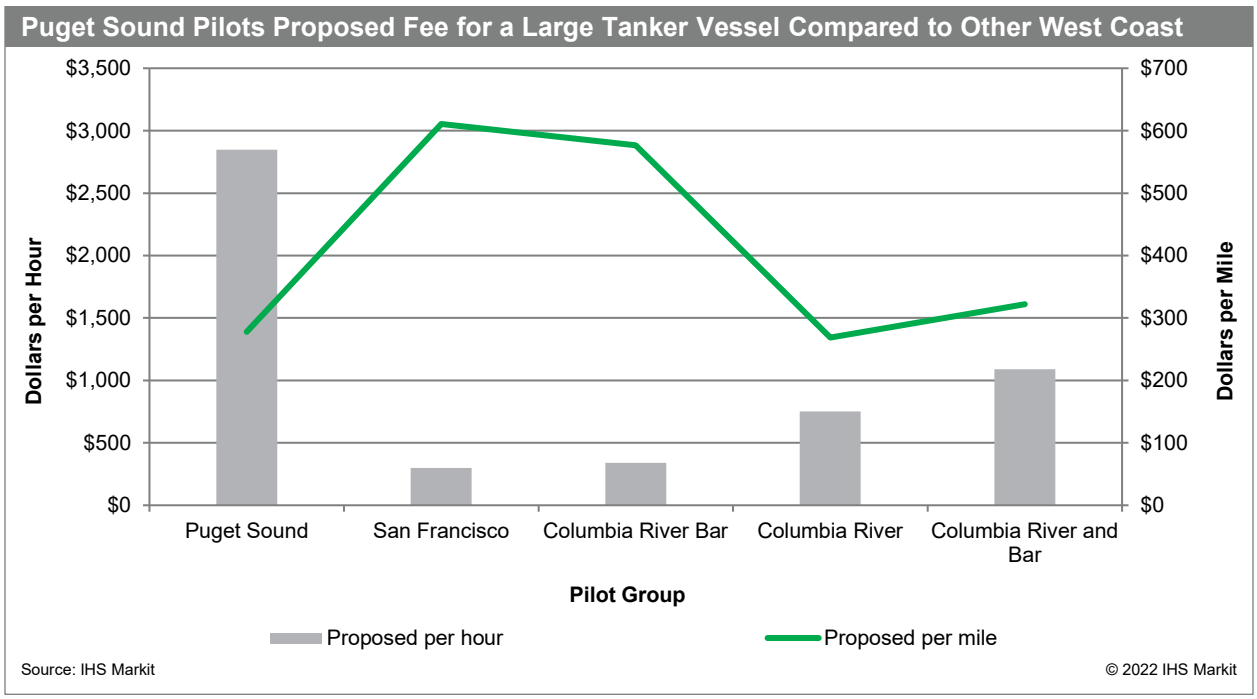
Source: IHS Markit

Puget Sound Pilots Proposed Fee for a Seven Hold Bulk Vessel Compared to Other West Coast Pilot Groups



Source: IHS Markit


Puget Sound Pilots Proposed Fee for a Five Hold Bulk Vessel Compared to Other West Coast
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
$400
$350
$300
$250
$200
$150
$100
$50
$0
Dollars per Hour
Dollars per Mile
Puget Sound
British Columbia
British Columbia Prince Rupert
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Los Angeles
Grays Harbor
Pilot Group
Proposed per hour
Proposed per mile
Source: IHS Markit
© 2022 IHS Markit


Puget Sound Pilots Proposed Fee for a Large Tanker Vessel Compared to Other West Coast
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
$700
$600
$500
$400
$300
$200
$100
$0
Dollars per Hour
Dollars per Mile
Puget Sound
San Francisco
Columbia River Bar
Columbia River
Columbia River and Bar
Pilot Group
Proposed per hour
Proposed per mile
Source: IHS Markit
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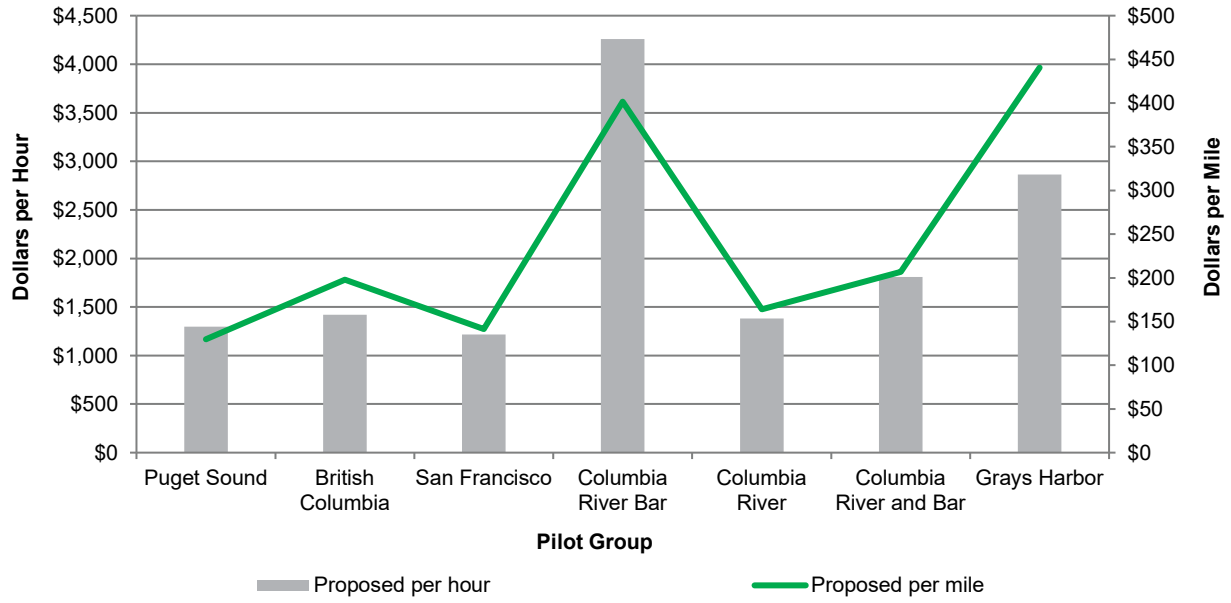
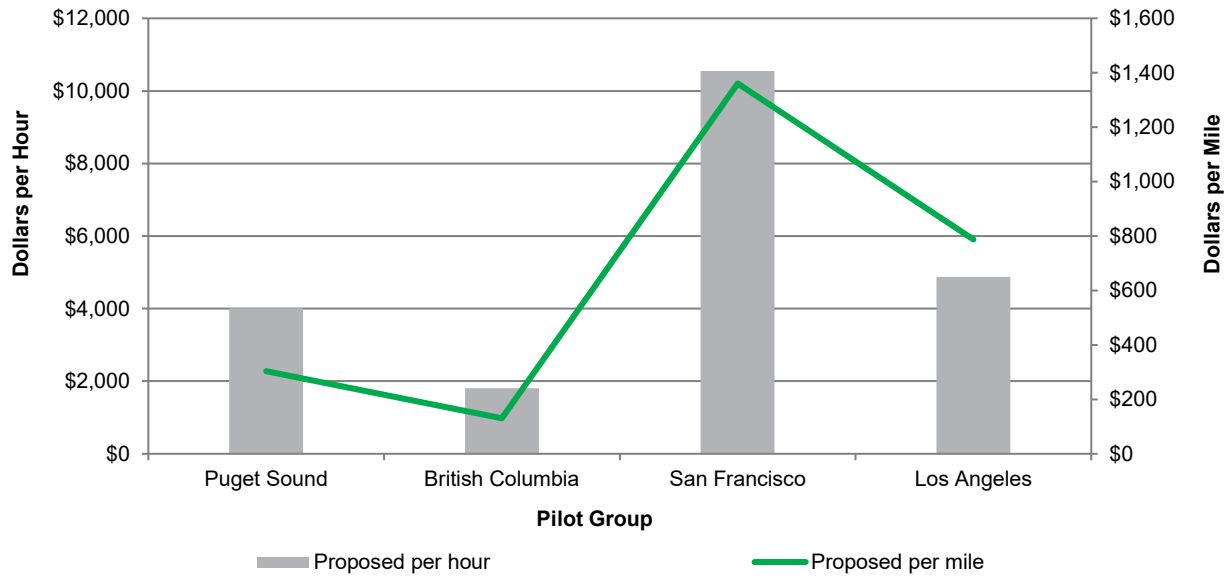
Puget Sound Pilots Proposed Fee for a Small Tanker Vessel Compared to Other West Coast



Source: IHS Markit

Puget Sound Pilots Proposed Fee for a Large Passenger Vessel Compared to Other West Coast Pilot Groups



Source: IHS Markit

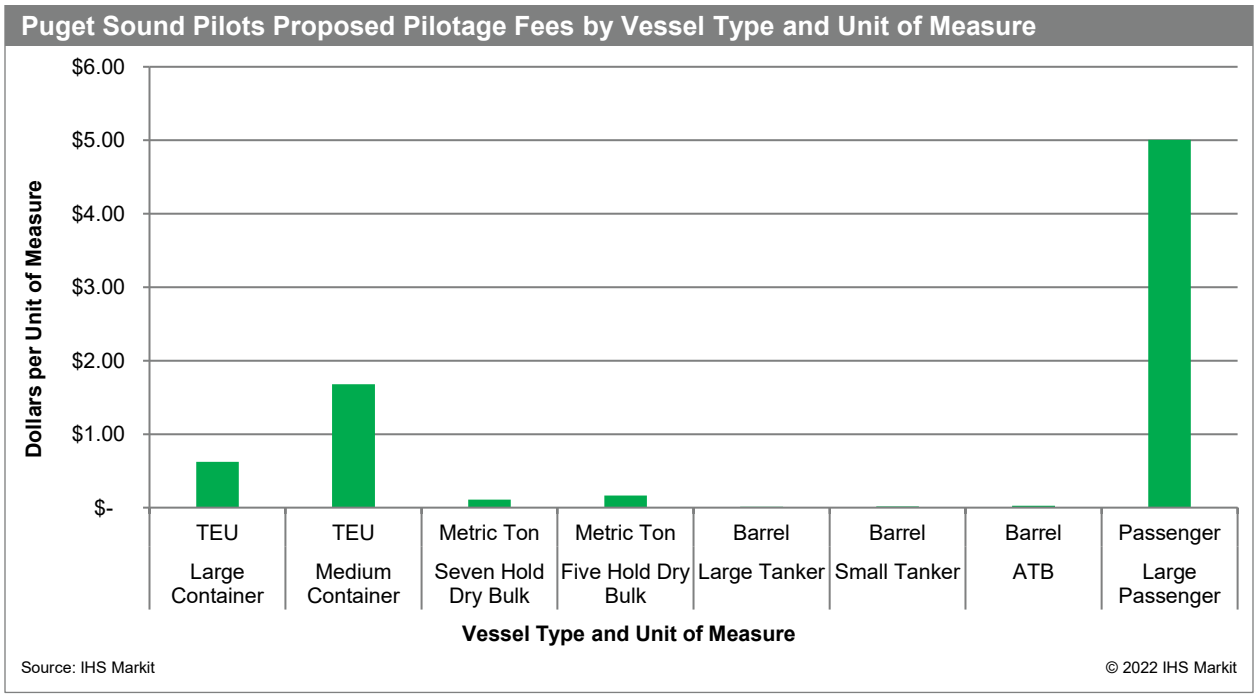
Q: What is your opinion regarding the comparability of PSP's proposed pilotage rates for 2023 and the existing pilotage fees being charged by pilot groups in the major West Coast port clusters to the same ships?

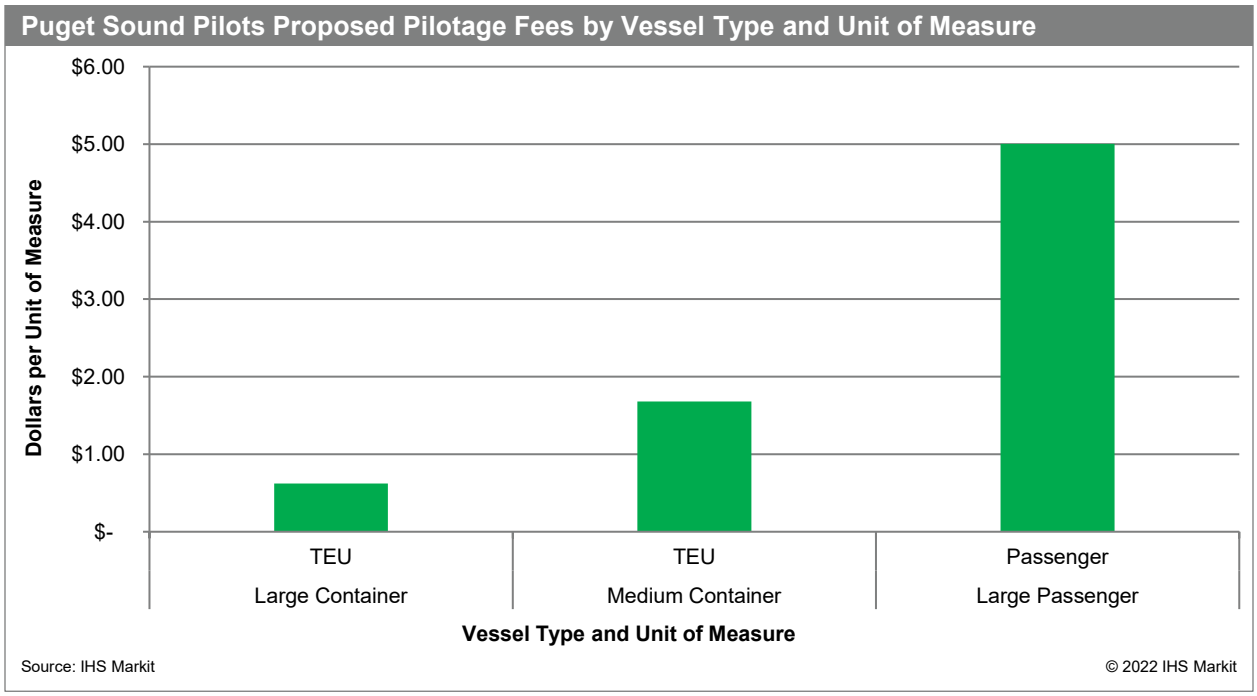
A: In my opinion, the proposed rates charged by the Puget Sound Pilots are a good value. The data demonstrates that these rates are clearly reasonable in comparison to those charged to vessels calling in the two major ports in British Columbia, the Columbia River, San Francisco Bay, and Los Angeles.

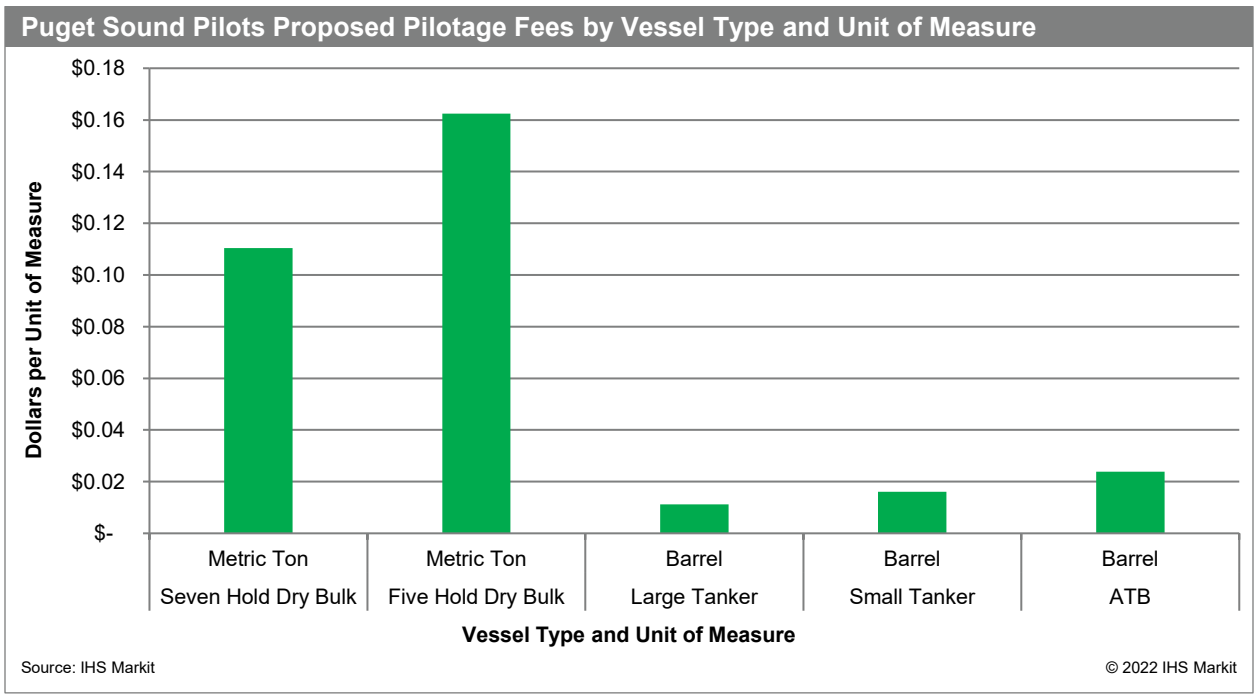
I. As a Matter of Maritime Shipping Economics, Pilotage Fees Are an Insignificant Component of Port Costs.

Q: Did you prepare series of charts showing the cost per cargo unit of PSP's proposed rates by cargo class?

A: Yes. The charts below show the actual cost of the PSP pilotage rates to container vessels on the basis of cost per TEU, to passenger vessels on the basis of cost per passenger, to oil tankers on the basis of cost per gallon and to bulk carriers of grain on the basis of cost per bushel.







Q: Based upon your background as a shipping and transportation economist, how would you characterize the costs to each of the ocean carrier categories covered in your charts that are proposed to be charged by the Puget Sound Pilots?

A: In my opinion, the pilotage fees proposed by PSP are completely insignificant to these ocean carriers. In fact, well-regarded maritime industry academics focused on shipping economics have concluded that pilotage fees are only an incidental component of a minor category of the cost of an oceangoing voyage for a cargo carrier. This clear from one of the major treatises on the topic, Martin Stopford's book entitled *Maritime Economics* (2nd edition, 2009).

Q: Have you had an opportunity to examine the relationship between the current revenue being earned by large container vessels and the value of the crude oil on a large oil tanker and the pilotage fees proposed by PSP in this rate case?

A: The clear insignificance of these fees to the owners or operators of ultra-large container vessels is demonstrated by a comparison of the revenues earned using current freight rates and the ultimate cost per container (TEU or 20-foot equivalent). For the ultra-large container vessel with 13,200 TEUs, the gross revenue at current freight rates from Asia to the West Coast totals $79 million. This compares with a cost per TEU of less than one dollar per TEU to pay the rates proposed by PSP, specifically 62 cents per TEU. In a different example using value of the cargo, for the large tanker carrying one million barrels of crude oil, the gross value of the cargo at current market rates is $114 million. This compares to a PSP pilotage cost per gallon (42 gallons per barrel) of a tiny fraction of a cent per gallon on the oil tanker, specifically 4/100s of a cent.

Q: With respect to pilotage fees and their economic insignificance to the cost of voyages for modern oceangoing vessels, is it possible in your opinion for there to be what is referred

to as "rate shock" associated with the difference between PSP's current pilotage rates and those for which it seeks approval by the UTC in this rate case?

A: Absolutely not. In my opinion, even a doubling or tripling of PSP's pilotage fees would have no effect on the number of oceangoing vessels calling Puget Sound.

J. A 2017 Canadian Cost-Benefit Analysis of Its Pilotage System Concluding That the Benefits of Pilotage Exceed Its Cost by a Ratio of More Than 20 to 1 is Strongly Indicative of the Economic Benefits of Pilotage.

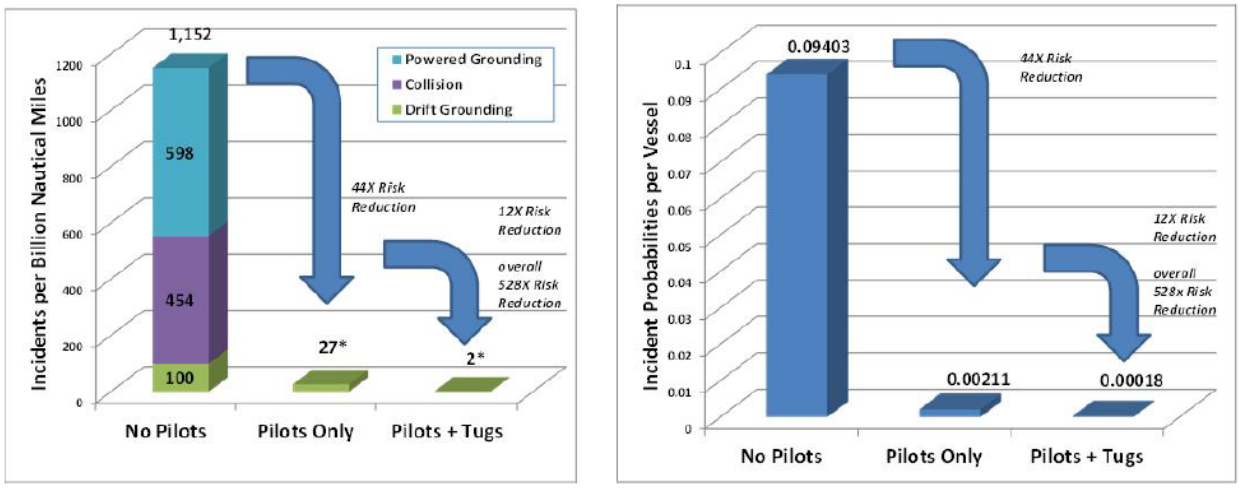
Q: Did you have an opportunity to review the 2017 study entitled "Marine Pilotage in Canada: A Cost Benefit Analysis" that reaches the conclusion that the combined safety and efficiency benefits of the Canadian pilotage system result in an overall cost-benefit ratio for the system of 21.9 to 1?

A: Yes.

Q: From a high-level perspective, what are your thoughts on the study's conclusion that pilotage systems deliver enormous value to the citizens of the jurisdiction in which the pilotage system operates?

A: In my opinion, there is no question that the data and analysis in the Canadian study, which is Exhibit KAE-02, is equally applicable in terms of overall result to the pilotage system serving Puget Sound. While a sophisticated cost-benefit analysis of the pilotage system serving the Puget Sound Pilotage District could well generate a different overall multiple than the 21.9 to 1 ratio found in the Canadian study, I am confident that the differential would be very significant. I was particularly struck by the graph below documenting the significance of the accident prevention capability of a waterway with compulsory pilotage.

Exhibit 2-6: Risk Reduction Effect of Pilots and Tugs



III. CONCLUSION.

Q: Does this conclude your testimony?

A: Yes.

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