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1999 TUGBOAT FUEL CONSUMPTION IN SEATTLE AREA



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Tugboats in Seattle Area



- **In the Puget Sound area, tugboats emit about 7% of NO_x and 10% of SO_x. Tugboat emissions have been difficult to inventory because operators consider their data proprietary and there is no published data on tugboat fuel consumption.**

Estimating Tugboat Fuel



- **We used inputs from harbormasters, tug operators, tugboat pilots, and the unique geography of Puget Sound shipping lanes to convert tug towing trips published in Waterborne Commerce into miles, then tow hours, then into fuel consumption.**

Tab 1: 1999 Towing Trips



	<i>Self-Propelled Ships</i>	<i>Towed Ships</i>	<i>Tugs & Barges</i>
<u>to & from:</u>			
Olympia	30	182	415
Tacoma	17,434	5,177	17,815
Seattle	71,836	8,130	20,048
L. Wash.	4,871	1,489	2,084
Everett	2,379	988	2,745
P. Gamble		31	120

Tab 2: Lane Miles in County



	King	Kitsap	Pierce	Sno
<u>going to:</u>				
Olympia	27	37	25	3
Tacoma	28	27	6	3
Seattle	12	19		3
L. Wash.	15	19		3
Everett		6		8
P. Gamble		7		

Ref: Puget Sound Pilots Association

Tab 3: Hours/Tow in County



	King	Kitsap	Pierce	Sno
<u>going to:</u>				
Olympia	5.9	8.0	5.4	0.7
Tacoma	6.1	5.9	1.2	0.7
Seattle	2.6	4.1		0.7
L. Wash.	3.3	4.1		0.7
Everett		1.3		1.6
P. Gamble		1.5		

Assumed tugs tow at 4 knots (PS Pilots)

Tab 4: Tow Hours in County



	King	Kitsap	Pierce	Sno
<u>to & from:</u>				
Olympia	3,500	4,796	3,240	389
Tacoma	139,767	134,775	27,454	14,975
Seattle	73,411	116,234		18,353
L. Wash.	11,636	14,739		2,327
Everett		4,863		6,078
P. Gamble		229		

(from Tables 1 & 3) Towed ships & barges

Tab 5: Self-Propelled Tow Hrs



	King	Kitsap	Pierce	Sno
<u>berthing at:</u>				
Olympia				
Tacoma			7,570	
Seattle	31,192			
L. Wash.	2,115			
Everett				1,033
P. Gamble				

Tugs tow self-propelled ships for 2 miles

Tab 6: Total Tow Hours



	King	Kitsap	Pierce	Sno
<i><u>going to:</u></i>				
Olympia	3,500	4,796	3,240	389
Tacoma	139,767	134,775	35,024	14,975
Seattle	104,603	116,234		18,353
L. Wash.	13,751	14,739		2,327
Everett		4,863		7,111
P. Gamble		229		

(from Tables 4 & 5)

Tab 7: 1000 Gal Fuel



	King	Kitsap	Pierce	Sno
<u>to & from:</u>				
Olympia	297	408	275	33
Tacoma	11,880	11,456	2,977	1,273
Seattle	8,891	9,880		1,560
L. Wash.	1,169	1,253		198
Everett		413		604
P. Gamble		20		
<u>Totals</u>	22,237	23,430	3,252	3,668

Tugs burn ~ 85 gal/hour (Tug Operators)

Tab 8: Compare Fuel Usage



	King	Kitsap	Pierce	Sno
<u>1,000 gal:</u>				
Tugs	22,238	23,429	3,252	3,668
Ships	16,383	22,235	1,159	3,433
Ferries	4,796	6,638	88	2,476
Military	618	837	72	153
Fishing	63	90	16	19
<i>Totals</i>	<i>44,098</i>	<i>53,228</i>	<i>4,587</i>	<i>9,749</i>

Ref: 1999 PS Clean Air Agency Inventory

Tab 9: Compare Fuel Usage



4-County Region

1,000 gal:

Tugs	52,588
Ships	43,210
Ferries	13,997
Military	1,680
<u>Fishing</u>	<u>188</u>

Total ***111,663***

Ref: 1999 PS Clean Air Agency Inventory Slide 12

Conclusion: Tug Fuel



Puget Sound Clean Air Agency 1999 inventory suggests that, in the Puget Sound region, tugboats burn more fuel than any other vessel category. The Agency has requested more data from the American Waterways Association to fine-tune the estimates we obtain using the vessel movement method.