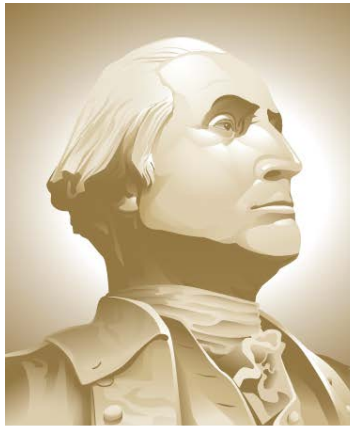


VTRA – INTRODUCING COUNTING LINES and VTOSS 2010 – AIS 2010 Comparison

Presentation by: J. Rene van Dorp



THE GEORGE
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UNIVERSITY

WASHINGTON, DC

VCU

GWU Personnel: Dr. J. Rene van Dorp

VCU Personnel: Dr. Jason R. W. Merrick

FEBRUARY 6, 2013

BY COURTESY OF MARINE EXCHANGE

2005 MXPS VESSEL VISIT COUNTS

Vessel Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2005
BULK	32	25	32	24	33	26	23	34	21	28	28	26	332
CONTAINER	111	97	100	99	101	110	112	124	121	127	113	118	1333
GENERAL	15	8	17	11	17	16	15	21	16	18	14	14	182
PASSENGER	0	0	0	0	27	32	37	31	37	4	0	0	168
RO/RO	11	10	12	12	12	13	10	10	12	11	10	10	133
ATB	INCLUDED IN PETROL TANKER COUNTS												
VEHICLES	15	15	19	16	13	17	16	17	12	17	18	15	190
PETROL TANKER	49	46	49	46	51	49	55	51	51	48	47	58	600
NON-PETROL TANKER	0	3	0	0	3	0	1	1	1	2	1	2	14
OTHER*	2	0	4	2	2	4	5	6	5	1	4	0	35

1.18

0.81

2010 MXPS VESSEL VISIT COUNTS

Vessel Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2010
BULK	35	32	35	36	31	30	40	34	21	31	37	31	393
CONTAINER	91	88	95	90	100	86	95	92	84	98	87	84	1090
GENERAL	8	6	5	7	7	10	3	5	5	7	7	4	74
PASSENGER	1	0	0	1	42	45	50	49	37	1	0	0	226
RO/RO	9	10	11	10	9	9	11	14	14	12	9	12	130
ATB	17	13	17	12	12	9	9	10	11	15	11	12	148
VEHICLES	12	19	17	18	14	18	17	15	22	19	19	15	205
PETROL TANKER	40	46	36	36	36	32	34	33	33	34	33	34	427
NON-PETROL TANKER	1	1	1	2	1	0	1	1	2	2	2	1	15
OTHER*	0	0	1	3	6	6	1	1	6	1	1	0	26

0.95

BY COURTESY OF USCG

2005 USCG VTS VESSEL TRANSIT COUNTS

Vessel Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2005
TANKER	166	181	163	178	170	184	180	192	188	155	183	177	2117
FREIGHTER	425	520	452	485	454	461	446	455	545	573	662	620	6098
TUGTOW	1874	2043	1838	1992	1901	1989	1947	2158	1986	1803	1921	2023	23475
FERRY	13441	13900	13232	13795	14089	14857	14869	14172	14205	13545	13739	12241	166085
PUBLIC	183	146	192	228	197	224	189	176	223	190	261	225	2434
OTHER	160	48	111	161	207	179	112	260	206	143	172	104	1863

2010 USCG VTS VESSEL TRANSIT COUNTS

Vessel Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2010
TANKER	191	232	165	221	195	178	149	220	173	200	195	199	2318
FREIGHTER	365	507	460	590	532	630	597	616	629	565	499	519	6509
TUGTOW	1684	2207	1809	2025	2075	2046	2058	2330	2281	2151	2059	1957	24682
FERRY	13543	12263	13640	13433	13879	13626	14406	14408	13874	13781	13301	13811	163965
OTHER FERRY	210	260	330	390	420	450	450	450	410	380	235	235	4220
EXCURSION	1087	1073	1124	1213	1135	1246	1369	1365	1036	938	880	906	13372
CRUISE	2	2	0	2	84	90	100	98	74	2	0	0	454
PUBLIC	95	238	199	324	311	323	246	364	270	244	241	219	3074
OTHER	135	149	146	214	278	413	392	660	507	383	286	151	3714

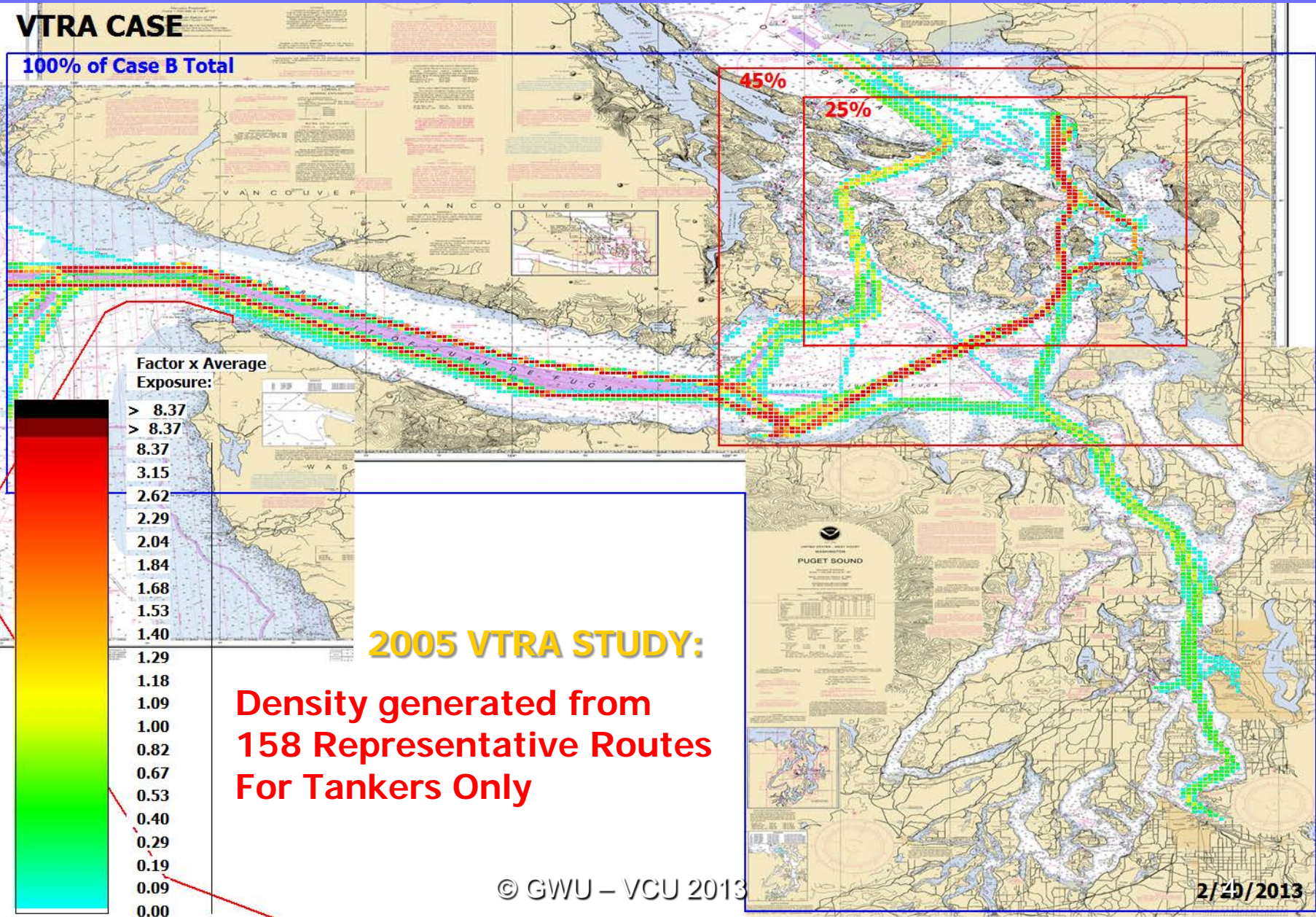
1.07

1.09

2005 VTRA STUDY – TANKER TRAFFIC DENSITY

VTRA CASE

100% of Case B Total



2005 VTRA STUDY:

Density generated from
158 Representative Routes
For Tankers Only

2010 VTRA STUDY – PRELIMINARY TANKER TRAFFIC DENSITY

VTRA CASE

82% of Case B Total

0.82

35%

19%

Factor x Average Exposure:

> 8.37

> 8.37

8.37

3.15

2.62

2.29

2.04

1.84

1.68

1.53

1.40

1.29

1.18

1.09

1.00

0.82

0.67

0.53

0.40

0.29

0.19

0.09

0.09

0.09

0.00

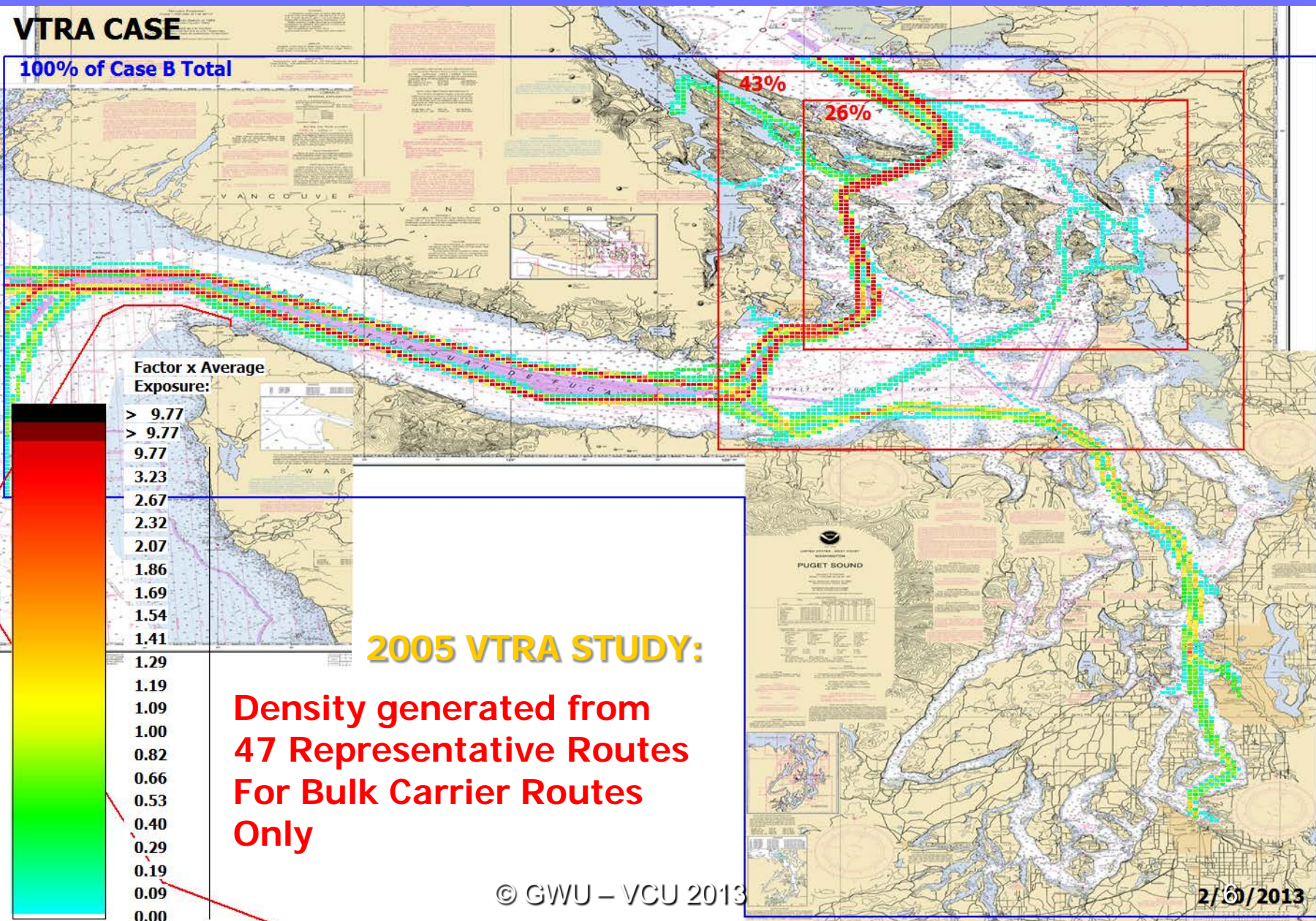
2010 VTRA STUDY:

Density generated from
2,328 Route Segments For
Tankers Only

2005 VTRA STUDY – BULK CARRIER TRAFFIC DENSITY

VTRA CASE

100% of Case B Total



2005 VTRA STUDY:

Density generated from
47 Representative Routes
For Bulk Carrier Routes
Only

2010 VTRA STUDY – FEB'13 BULK CARRIER TRAFFIC DENSITY

VTRA CASE

111% of Case B Total

1.11

46%

27%

Factor x Average Exposure:

- > 9.77
- > 9.77
- 9.77
- 3.23
- 2.67
- 2.32
- 2.07
- 1.86
- 1.69
- 1.54
- 1.41
- 1.29
- 1.19
- 1.09
- 1.00
- 0.82
- 0.66
- 0.53
- 0.40
- 0.29
- 0.19
- 0.09
- 0.00

1% of total has location misclassified

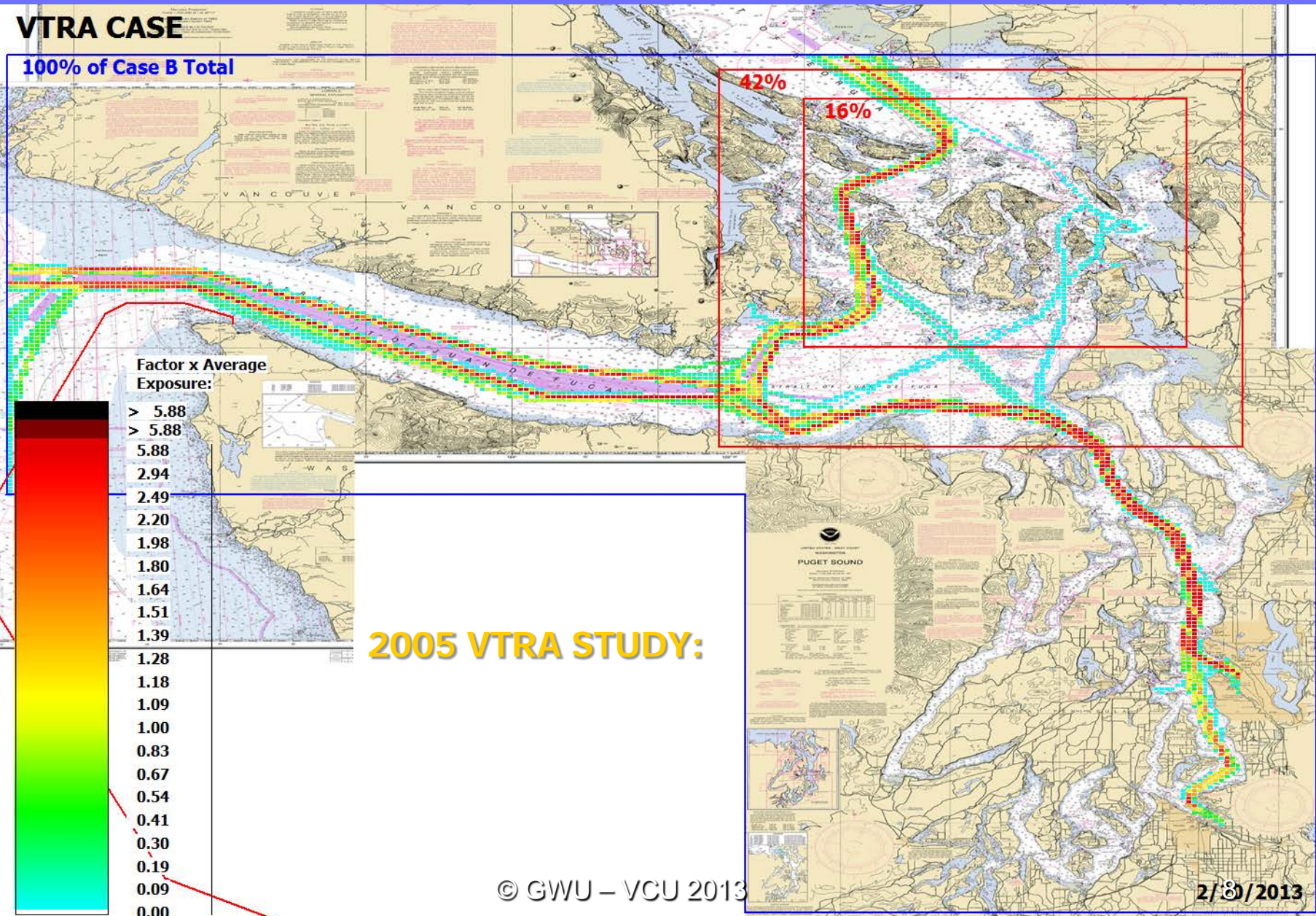
2010 VTRA STUDY:

Density generated from 6,343 Route Segments For Bulk Carrier

2005 VTRA STUDY – CONTAINER TRAFFIC DENSITY

VTRA CASE

100% of Case B Total



2005 VTRA STUDY:

2010 VTRA STUDY – PRELIM. CONTAINER TRAFFIC DENSITY

VTRA CASE

279% of Case B Total

2.79

110%

38%

Factor x Average Exposure:

- > 5.88
- 5.88
- 2.94
- 2.49
- 2.20
- 1.98
- 1.80
- 1.64
- 1.51
- 1.39
- 1.28
- 1.18
- 1.09
- 1.00
- 0.83
- 0.67
- 0.54
- 0.41
- 0.30
- 0.19
- 0.09
- 0.00

2010 VTRA STUDY:

CONTAINER UP BY FACTOR 3?

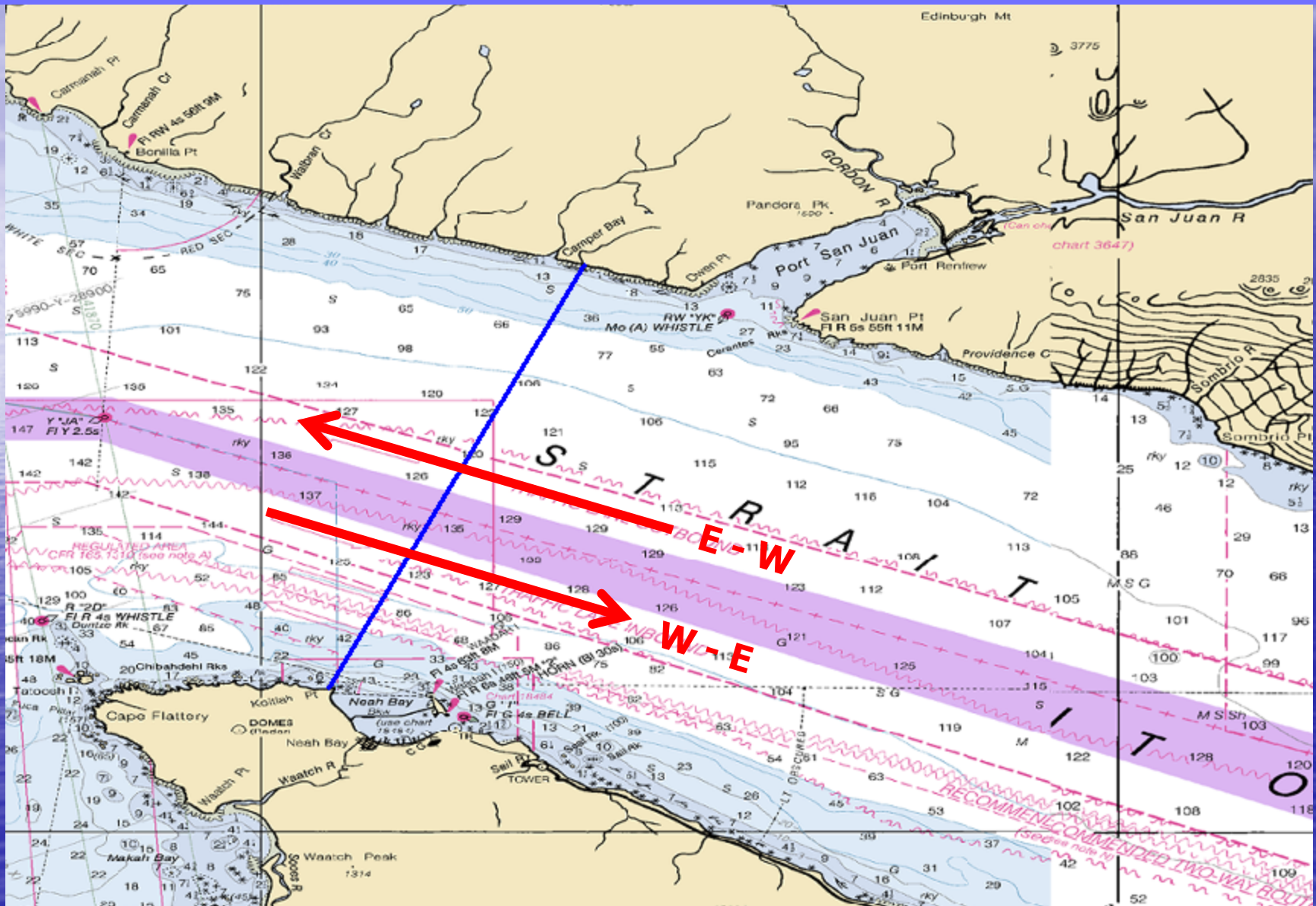
WHAT IS GOING ON?????

**IMPOSSIBLE TO RECONCILE
EXISTING DATA SOURCES**

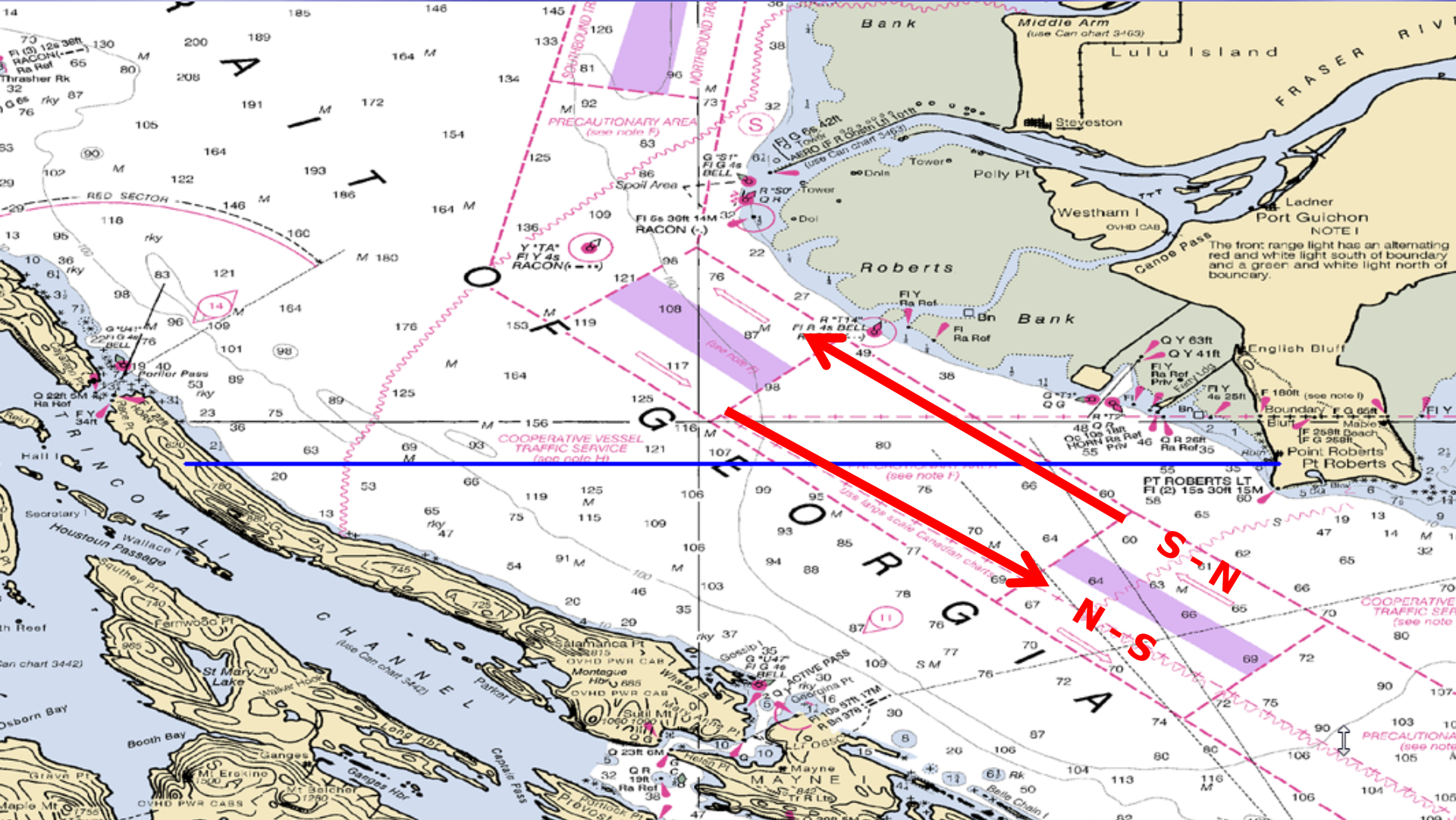
WE NEED A NEW ONE!

AIS CROSSING LINE DATA

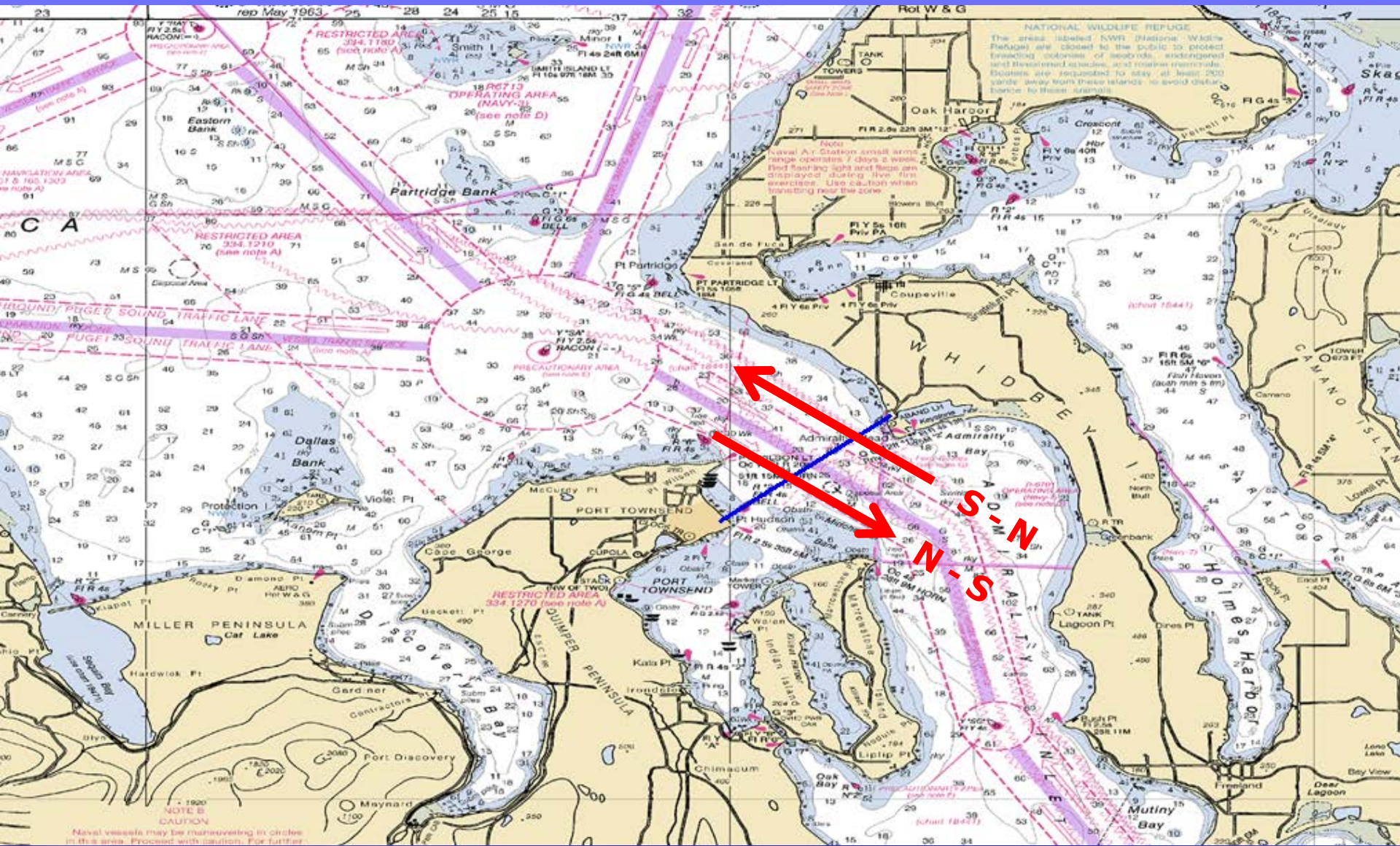
ADDED COUNT LINE AT WSJF ENTRANCE



ADDED COUNT LINE AT GEORGIA STRAIT ENTRANCE



ADDED COUNT LINE AT PUGET SOUND ENTRANCE



AIS COLLECTED DATA FOR 2010

WSJF CROSSING LINE 2010

Ship Type	East Bound	West Bound	Grand Total
Cargo	3216	3157	6373
Tanker	694	685	1379
Passenger	244	221	465
Grand Total	4154	4063	8217

G_STR CROSSING LINE 2010

Ship Type	North Bound	South Bound	Grand Total
Cargo	2278	2133	4411
Tanker	267	266	533
Passenger	414	113	527
Grand Total	2959	2512	5471

PUGET SOUND CROSSING LINE 2010

Ship Type	North Bound	South Bound	Grand Total
Cargo	1754	1766	3520
Tanker	95	95	190
Passenger	958	971	1929
Grand Total	2807	2832	5639

ENTERING/LEAVING VTRA 2010

Ship Type	ENTERING VTRA	LEAVING VTRA	DIFFERENCE %
Cargo	5349	5435	1.6%
Tanker	960	952	-0.8%
Passenger	357	635	77.9%
Grand Total	6666	7022	5.3%

FLOW BOTH DIRECTIONS 2010

Ship Type	WSJF TO G_STR	G_STR TO WSJF	DIFFERENCE %
Cargo	2747	2645	-3.7%
Tanker	480.5	475.5	-1.0%
Passenger	329	167	-49.2%
Grand Total	3556.5	3287.5	-7.6%

AIS COLLECTED DATA FOR 2010

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Passenger	329	167	-49.2%
Grand Total	3556.5	3287.5	-7.6%

RECLASSIFICATION OF GWU/VCU SIM VESSEL TYPES TO ALLOW FOR COMPARISON OF VTOSS – AIS 2010

#	VESSEL TYPE	MASTER TYPE	#	VESSEL TYPE	Master Type
1	BULKCARRIER	Cargo	19	SUPPLYOFFSHORE	Service
2	CHEMICALCARRIER	Tanker	20	TUGTOWBARGE	Tugtow
3	CONTAINERSHIP	Cargo	21	UNKNOWN	Service
4	DECKSHIPCARGO	Cargo	22	USCOASTGUARD	Service
5	FERRY	Ferry	23	VEHICLECARRIER	Cargo
6	FERRYNONLOCAL	Passenger	24	YACHT	Yacht
7	FISHINGFACTORY	Fishing	25	ATB	Tanker
8	FISHINGVESSEL	Fishing	26	ITB	Tanker
9	LIQGASCARRIER	Tanker	27	OILBARGE	Tugtow
10	NAVYVESSEL	Cargo	28	TUGNOTOW	TugTow
11	OILTANKER	Tanker	29	BULKCARGOBARGE	TugTow
12	OTHERSPECIALCARGO	Cargo	30	CHEMICALBARGE	TugTow
13	OTHERSPECIFICSERV	Service	31	CONTAINERBARGE	TugTow
14	PASSENGERSHIP	Passenger	32	DERRICKBARGE	TugTow
15	REFRIGERATEDCARGO	Cargo	33	UNLADENBARGE	TugTow
16	RESEARCHSHIP	Service	34	LOG_BARGE	TugTow
17	ROROCARGOSHIP	Cargo	35	WOODCHIPBARGE	TugTow
18	ROROCARGOCONTSHIP	Cargo			

GWU/VCU SIM COLLECTED DATA – VTOSS 2010

WSJF CROSSING LINE 2010

Ship Type	East Bound	West Bound	Grand Total
Cargo	3168	3141	6309
Tanker	617	629	1246
Passenger	242	65	307
Grand Total	4027	3835	7862

G_STR CROSSING LINE 2010

Ship Type	North Bound	South Bound	Grand Total
Cargo	2163	1943	4106
Tanker	274	231	505
Passenger	49	64	113
Grand Total	2486	2238	4724

PUGET SOUND CROSSING LINE 2010

Ship Type	North Bound	South Bound	Grand Total
Cargo	1780	1806	3586
Tanker	113	116	229
Passenger	489	602	1091
Grand Total	2382	2524	4906

ENTERING/LEAVING VTRA 2010

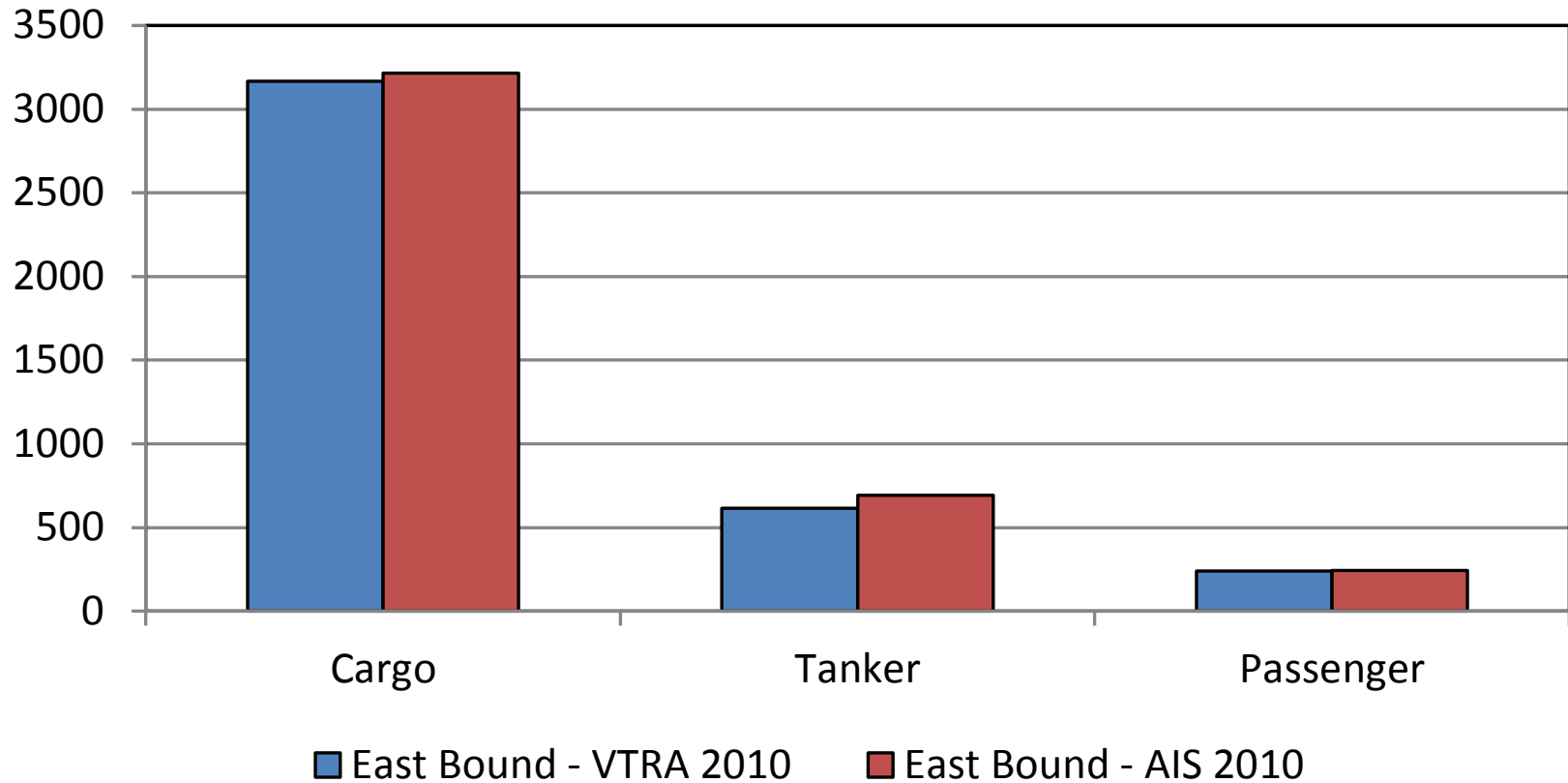
Ship Type	ENTERING VTRA	LEAVING VTRA	DIFFERENCE %
Cargo	5111	5304	3.8%
Tanker	848	903	6.5%
Passenger	306	114	-62.7%
Grand Total	6265	6321	0.9%

FLOW BOTH DIRECTIONS 2010

Ship Type	WSJF TO G_STR	G_STR TO WSJF	DIFFERENCE %
Cargo	2665.5	2542	-4.6%
Tanker	445.5	430	-3.5%
Passenger	145.5	64.5	-55.7%
Grand Total	3256.5	3036.5	-6.8%

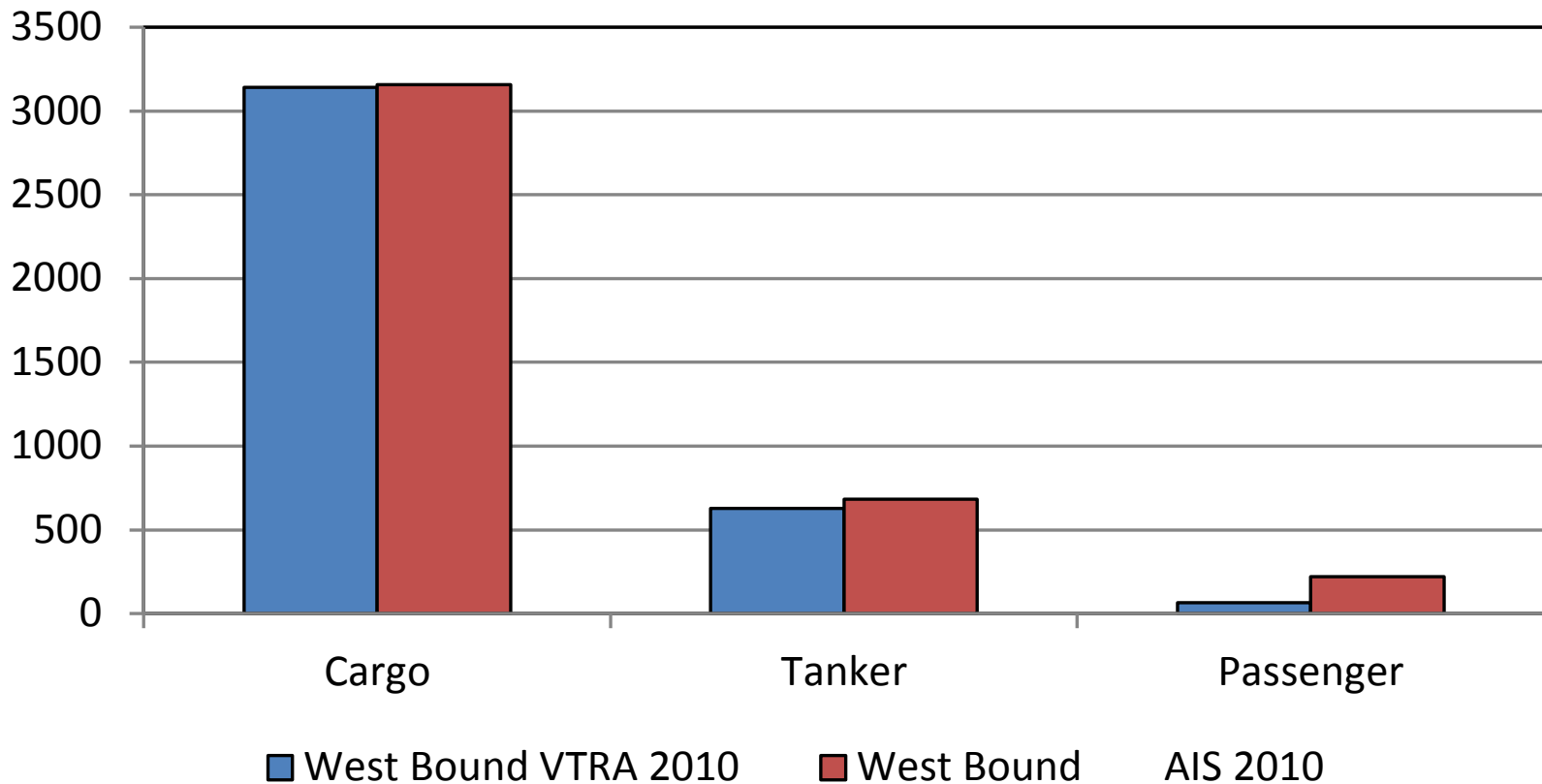
VTOSS 2010 – AIS 2010 COMP: WSJF EAST BOUND

2010 WSJF CROSSING LINE: EAST BOUND



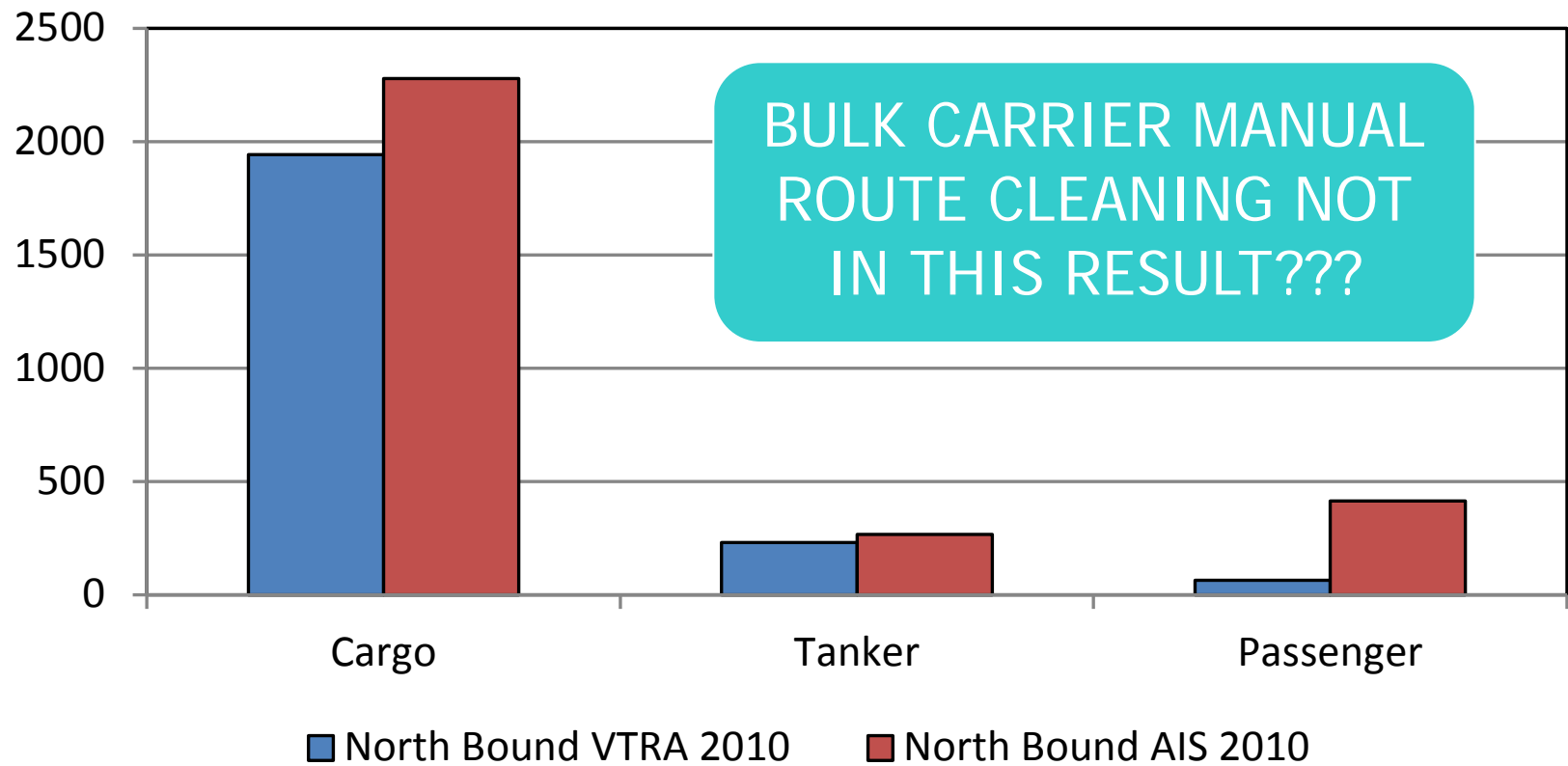
VTOSS 2010 – AIS 2010 COMP: WSJF WEST BOUND

2010 WSJF CROSSING LINE: WEST BOUND



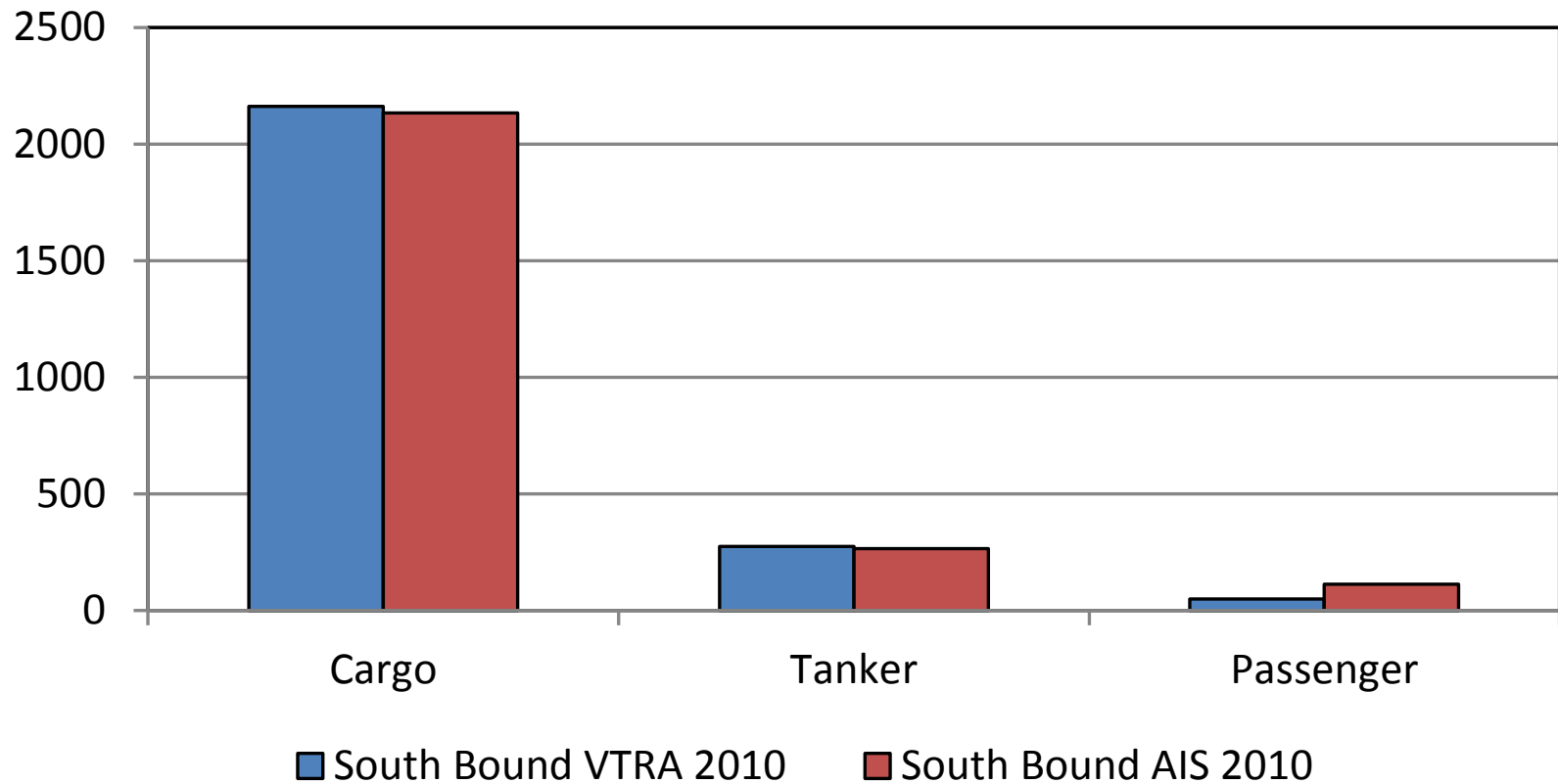
VTOSS 2010 – AIS 2010 COMP: G_STR NORTH BOUND

2010 G_STR CROSSING LINE: NORTH BOUND

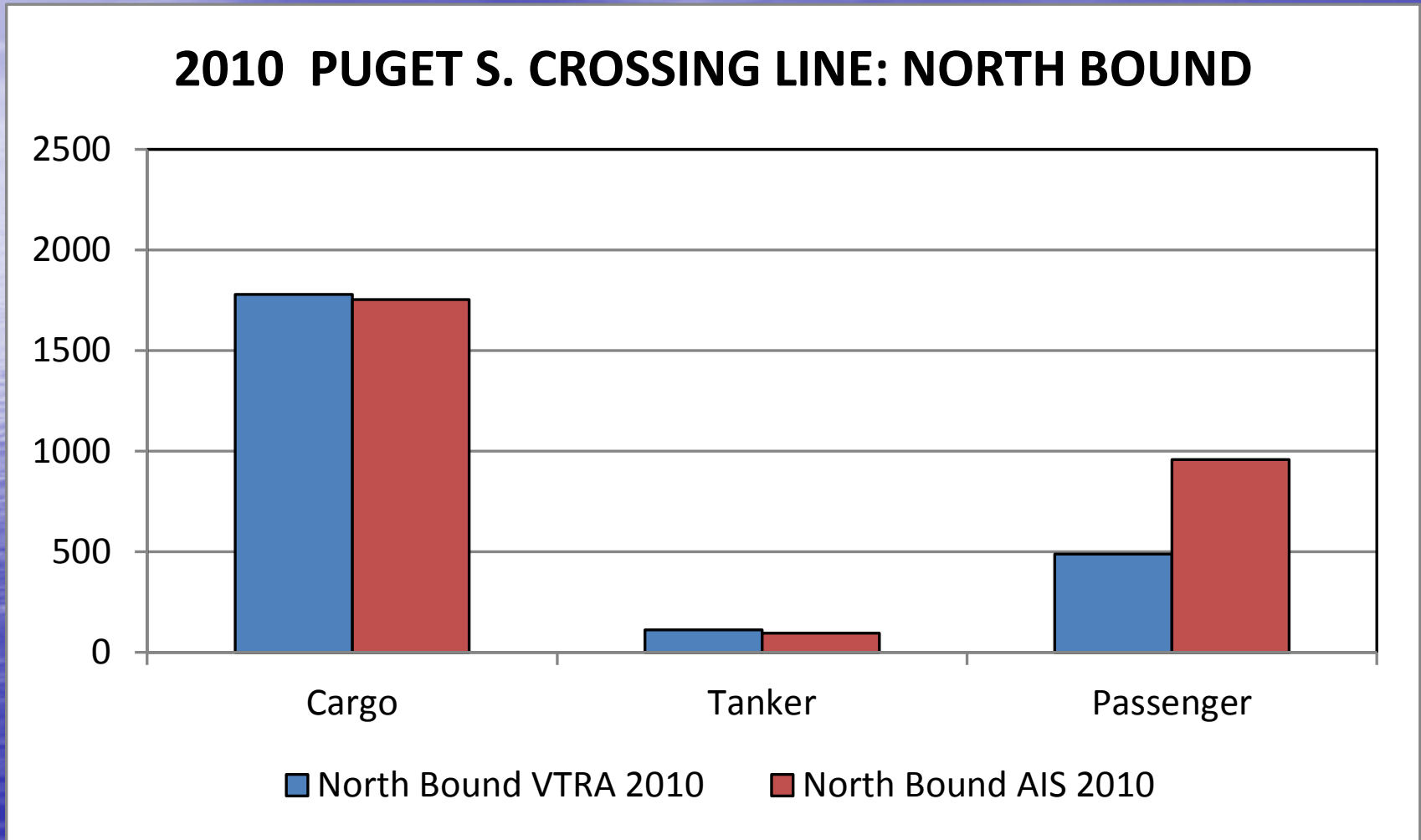


VTOSS 2010 – AIS 2010 COMP: G_STR SOUTH BOUND

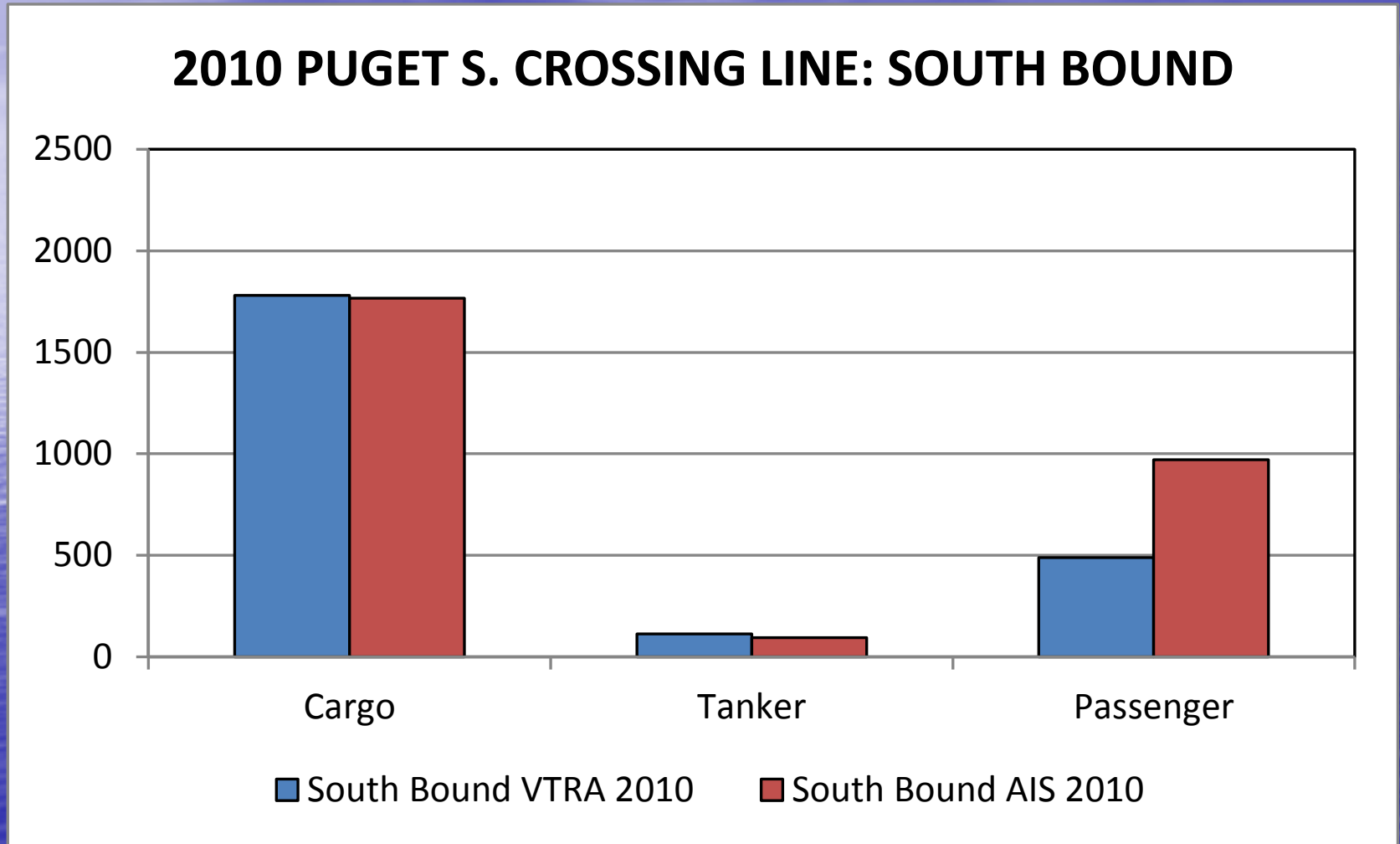
2010 G_STR CROSSING LINE: SOUTH BOUND



VTOSS 2010 – AIS 2010 COMP: PUGET S. NORTH BOUND

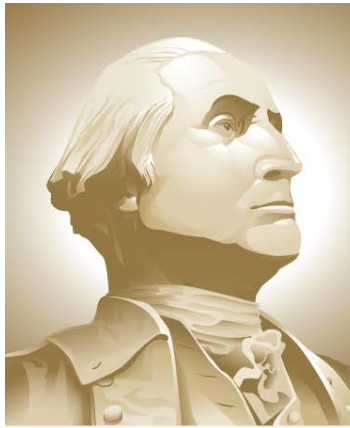


VTOSS 2010 – AIS 2010 COMP: PUGET S. SOUTH BOUND



AIS 2010 – VTRA 2010 MONTH:Y BULK CARRIER COMPARISON

Presentation by: J. Rene van Dorp



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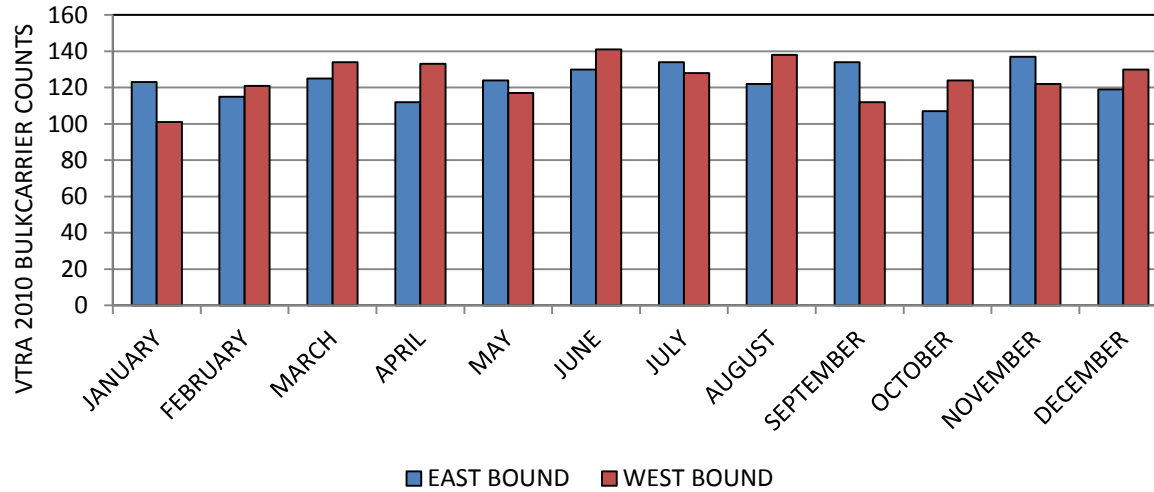
VCU

GWU Personnel: Dr. J. Rene van Dorp

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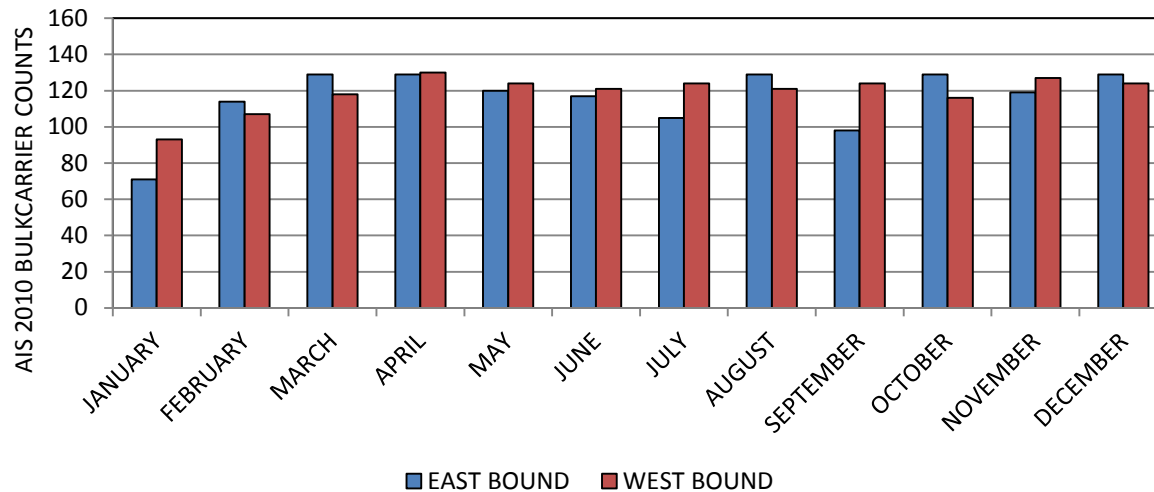
FEBRUARY 6, 2012

2010 VTOSS DATA - BULKCARRIER WSFJ CROSSINGS

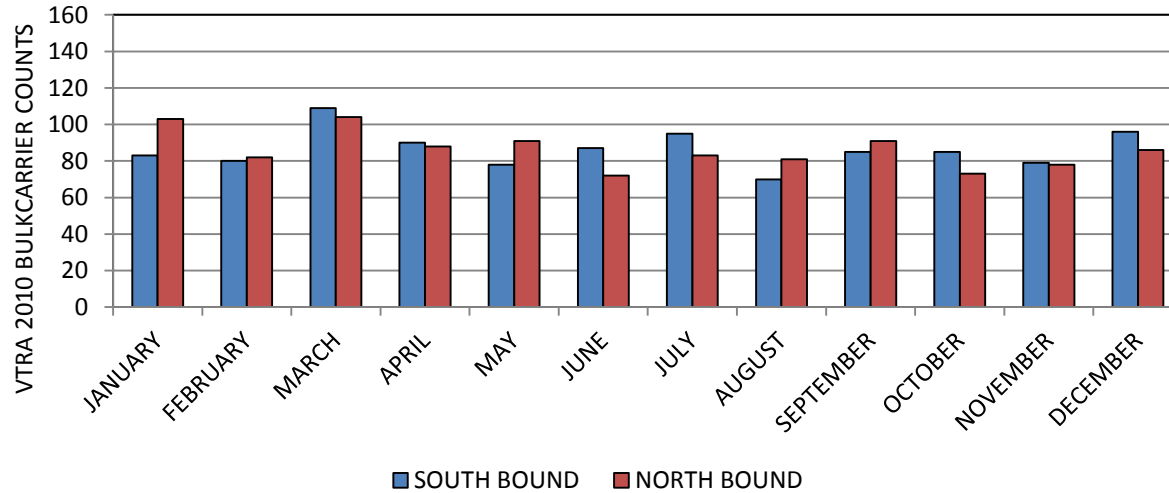


BULK CARRIER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - BULKCARRIER WSFJ CROSSINGS

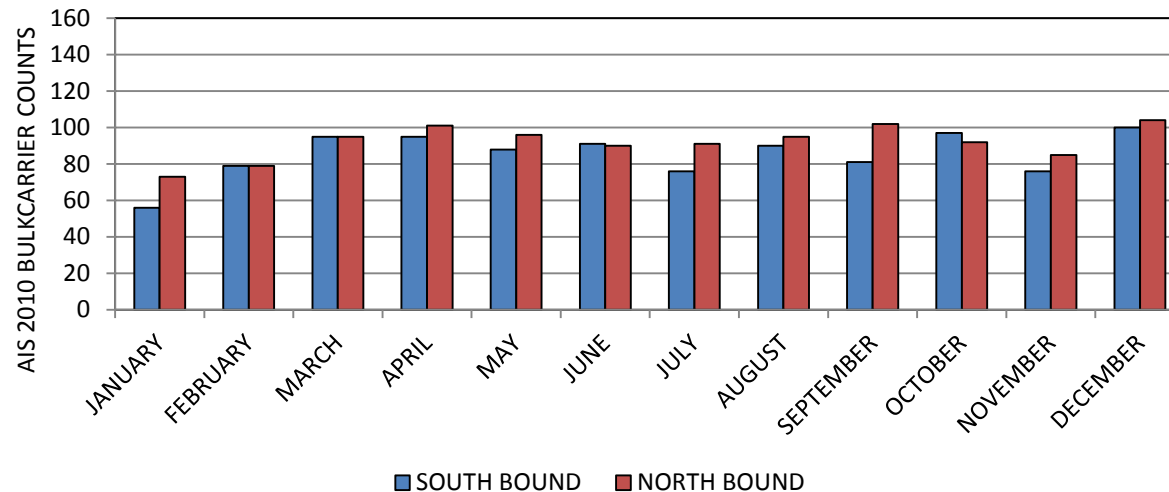


2010 VTOSS DATA - BULKCARRIER G_STR CROSSINGS

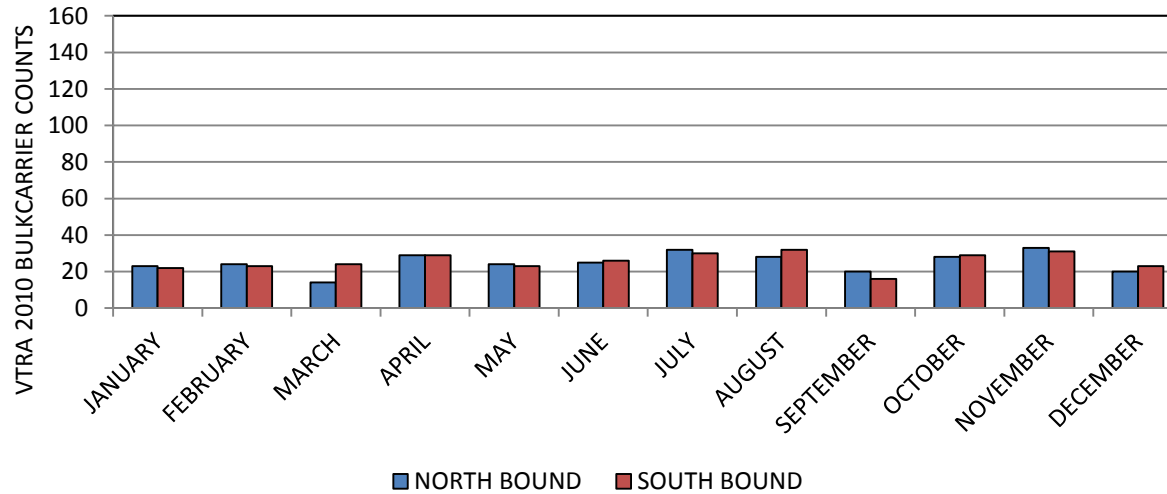


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2010 AIS DATA - BULKCARRIER G_STR CROSSINGS

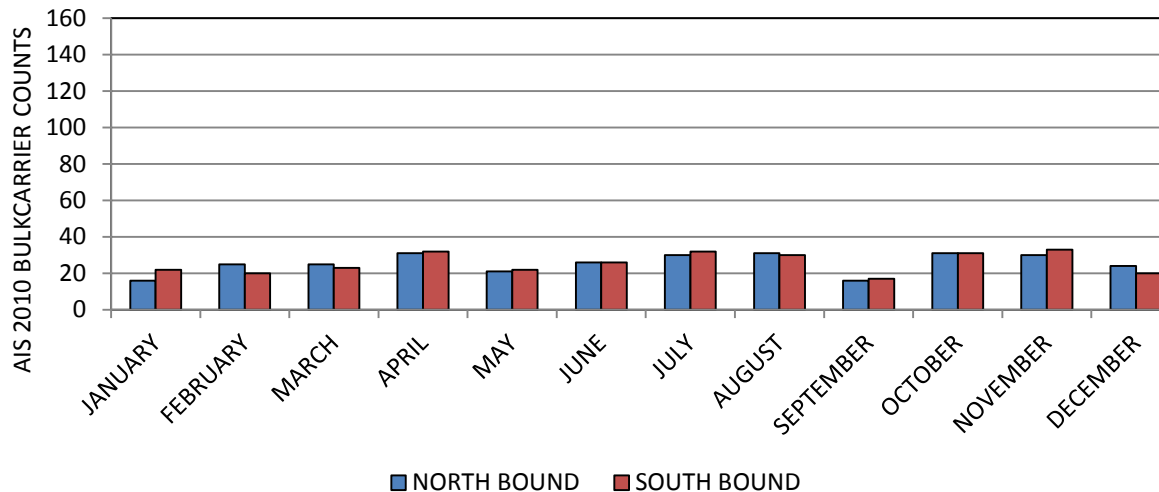


2010 VTOSS DATA - BULKCARRIER PS CROSSINGS



BULK CARRIER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - BULKCARRIER PS CROSSINGS



RANKING OF CROSSINGS FOR 2010

BULK CARRIER COMPARISON

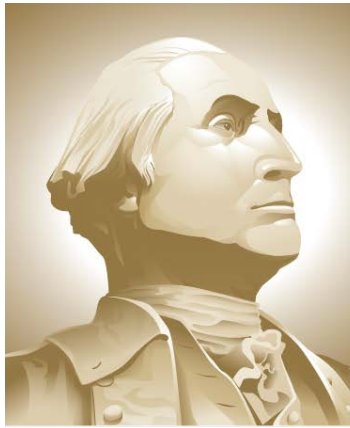
RANK	CROSSING LINE	VTOSS 2010	AIS 2010
1	WEST STRAIT OF JUAN DE FUCA	East B.: 1455 West B.: 1496	East B.: 1389 West B.: 1429
2	GEORGIA STRAIT	North B.: 1009 South B.: 1039	North B.: 1024 South B.: 1103
3	PUGET SOUND	North B.: 300 South B.: 308	North B.: 306 South B.: 308

**BULK CARRIER COMPARISON BY MATCHING
VTOSS TO AIS VESSEL NAMES**

NOT EXACT DUE TO NAME VARIATIONS

AIS 2010 – VTRA 2010 MONTH:Y CONTAINER COMPARISON

Presentation by: J. Rene van Dorp



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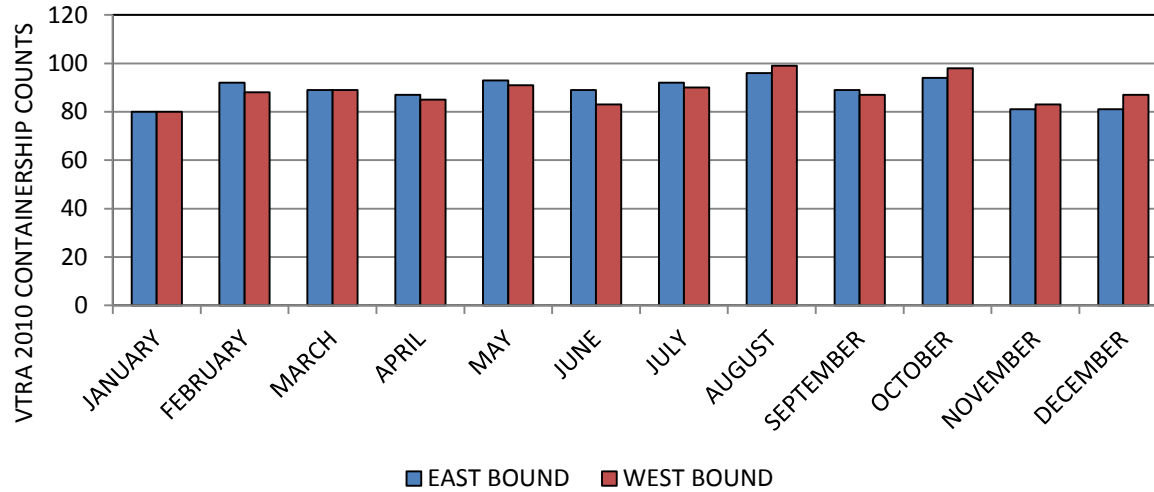
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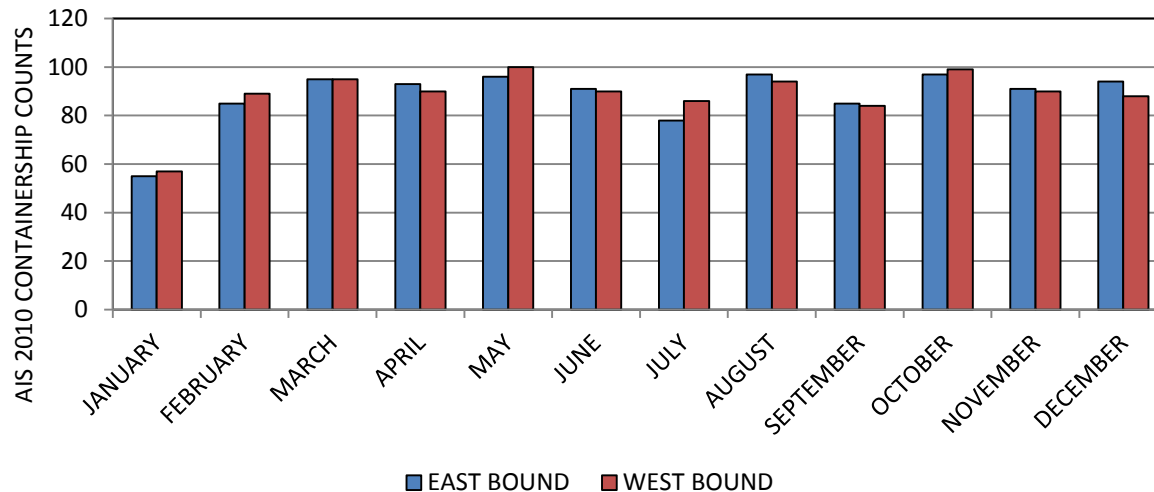
FEBRUARY 6, 2012

2010 VTOSS DATA - CONTAINERSHIP WSFJ CROSSINGS

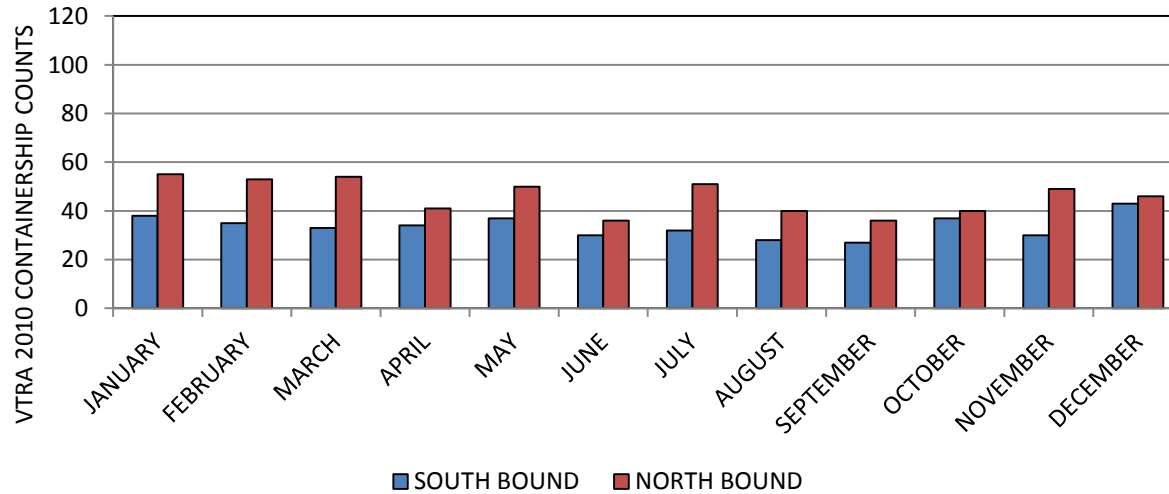


CONTAINER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - CONTAINERSHIP WSFJ CROSSINGS

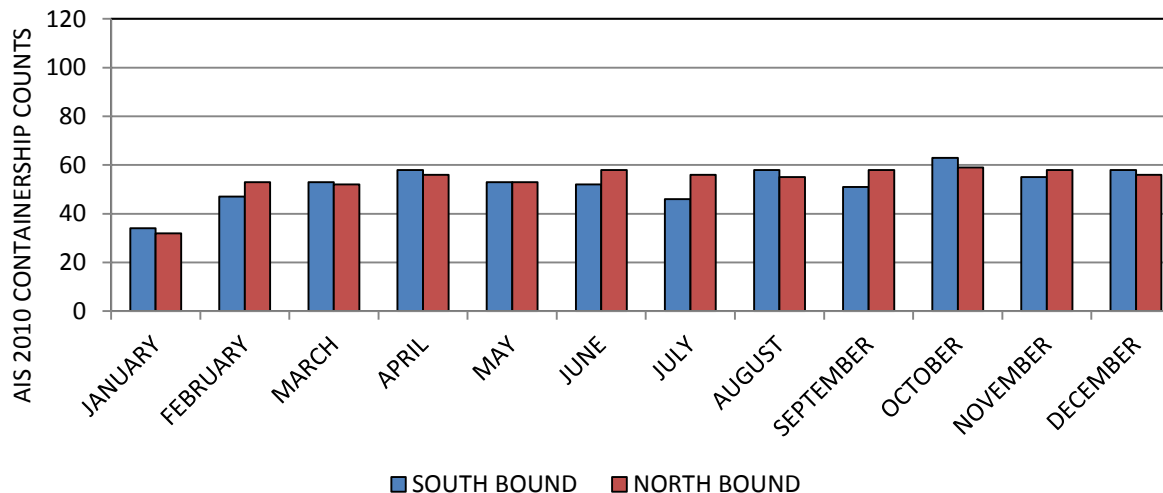


2010 VTOSS DATA - CONTAINERSHIP G_STR CROSSINGS

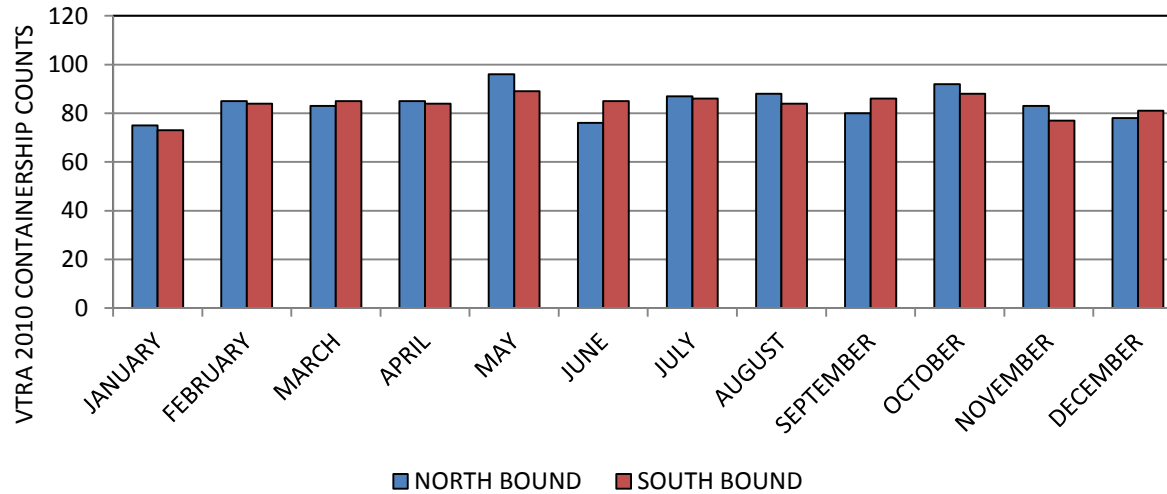


CONTAINER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - CONTAINERSHIP G_STR CROSSINGS

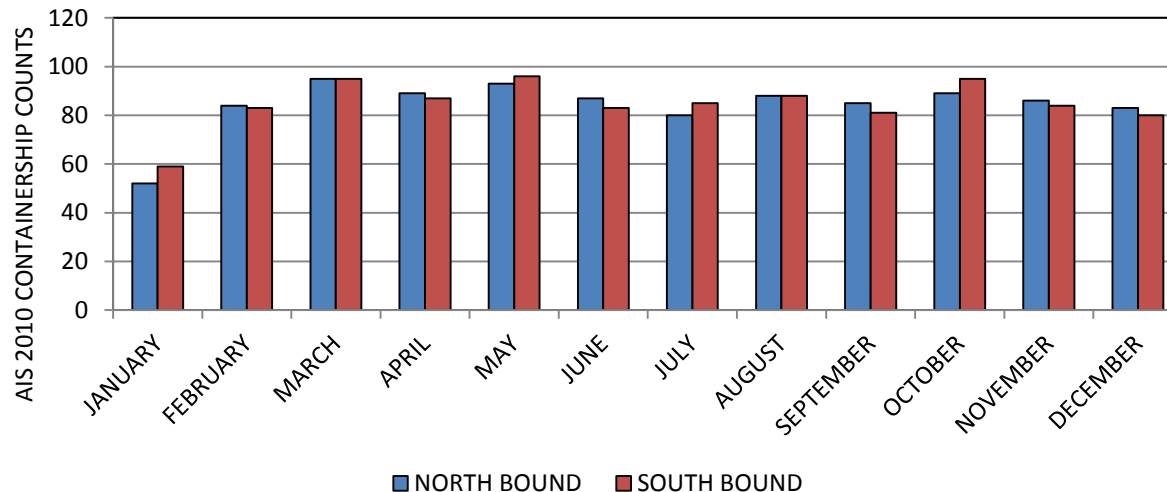


2010 VTOSS DATA - CONTAINERSHIP PS CROSSINGS



CONTAINER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - CONTAINERSHIP PS CROSSINGS



RANKING OF CROSSINGS FOR 2010

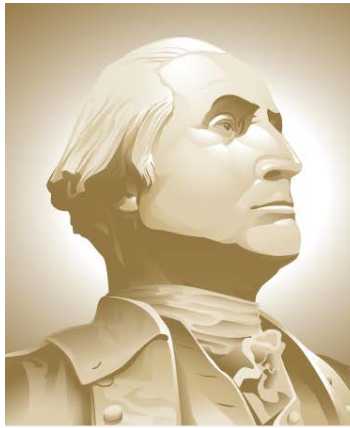
CONTAINER SHIP COMPARISON

RANK	CROSSING LINE	VTOSS 2010	AIS 2010
1	WEST STRAIT OF JUAN DE FUCA	East B.: 1055 West B.: 1052	East B.: 1057 West B.: 1062
2	PUGET SOUND	North B.: 1009 South B.: 998	North B.: 1011 South B.: 1016
3	GEORGIA STRAIT	North B.: 404 South B.: 451	North B.: 628 South B.: 646

CONTAINER SHIP COMPARISON BY MATCHING
VTOSS TO AIS VESSEL NAMES
NOT EXACT DUE TO NAME VARIATIONS

AIS 2010 – VTRA 2010 MONTH:Y OIL TANKER COMPARISON

Presentation by: J. Rene van Dorp



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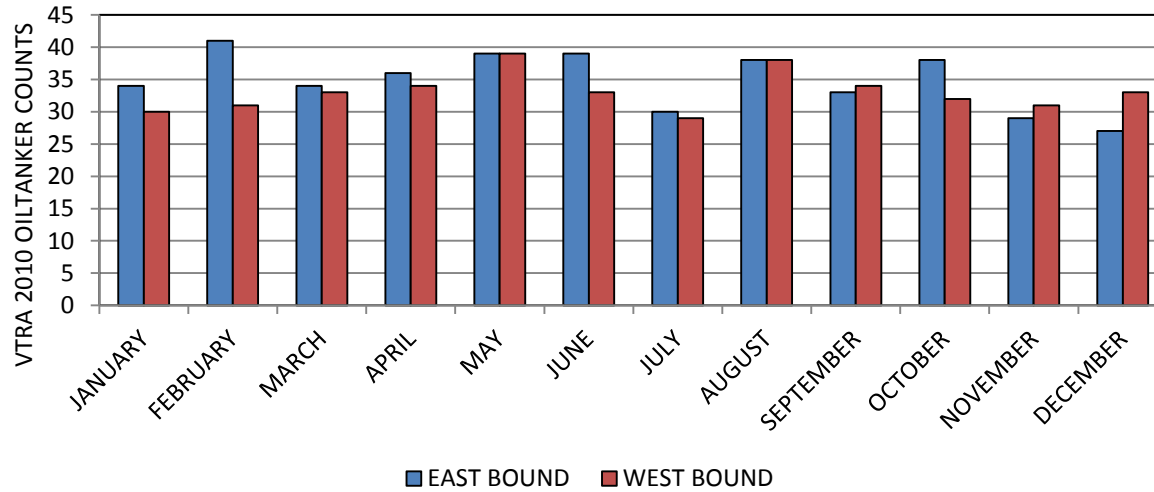
VCU

GWU Personnel: Dr. J. Rene van Dorp

VCU Personnel: Dr. Jason R. W. Merrick

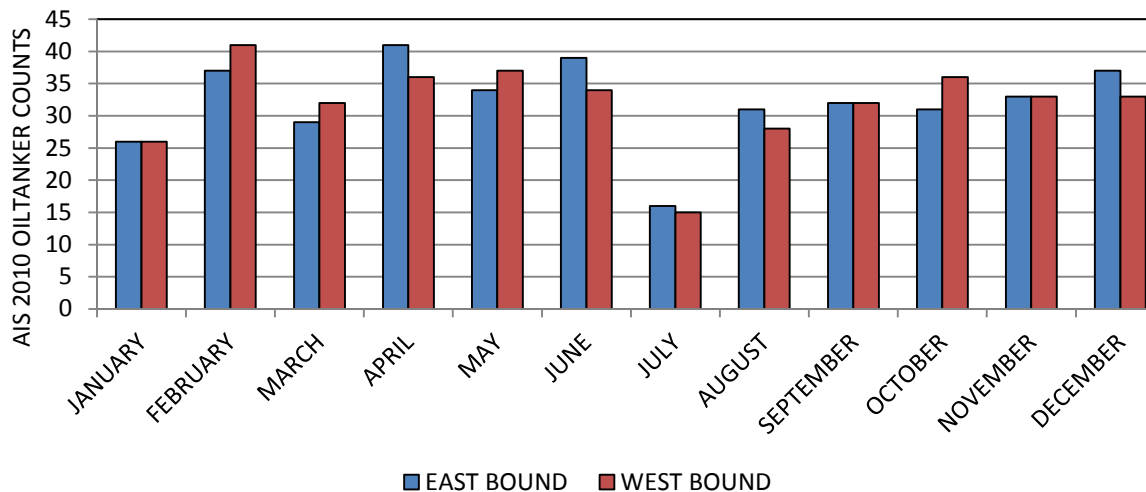
FEBRUARY 6, 2012

2010 VTOSS DATA - OILTANKER WSFJ CROSSINGS

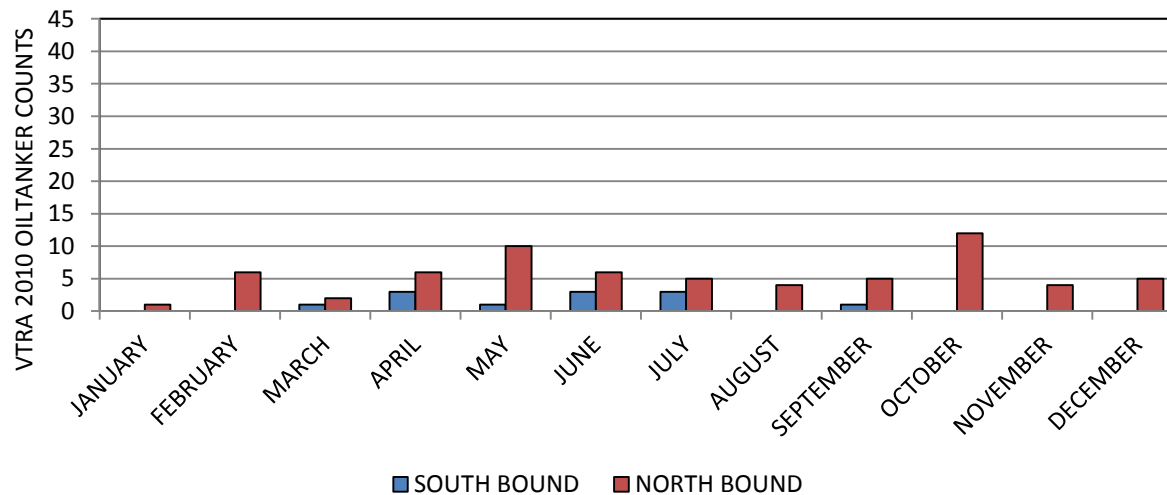


OIL TANKER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - OILTANKER WSFJ CROSSINGS

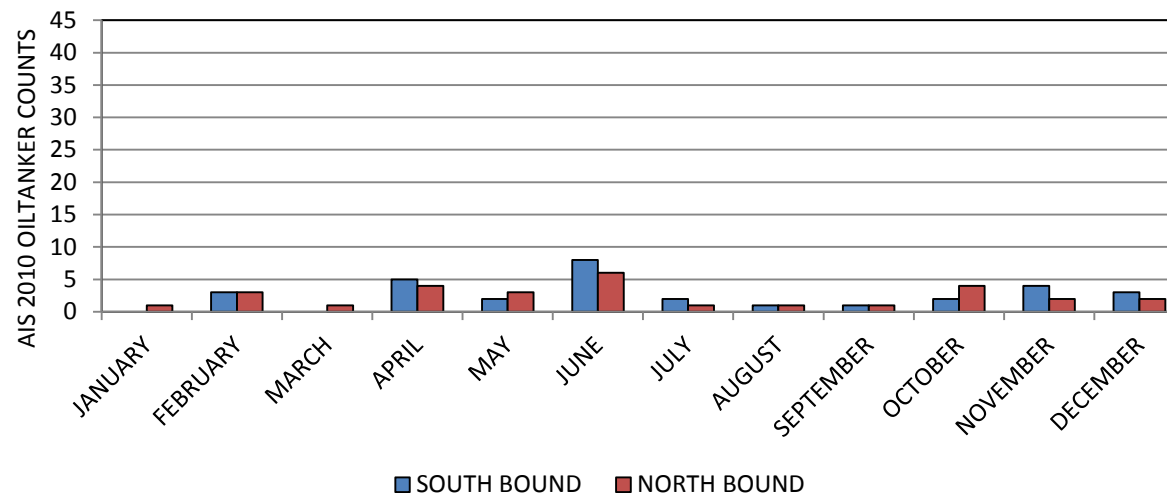


2010 VTOSS DATA - OILTANKER G_STR CROSSINGS

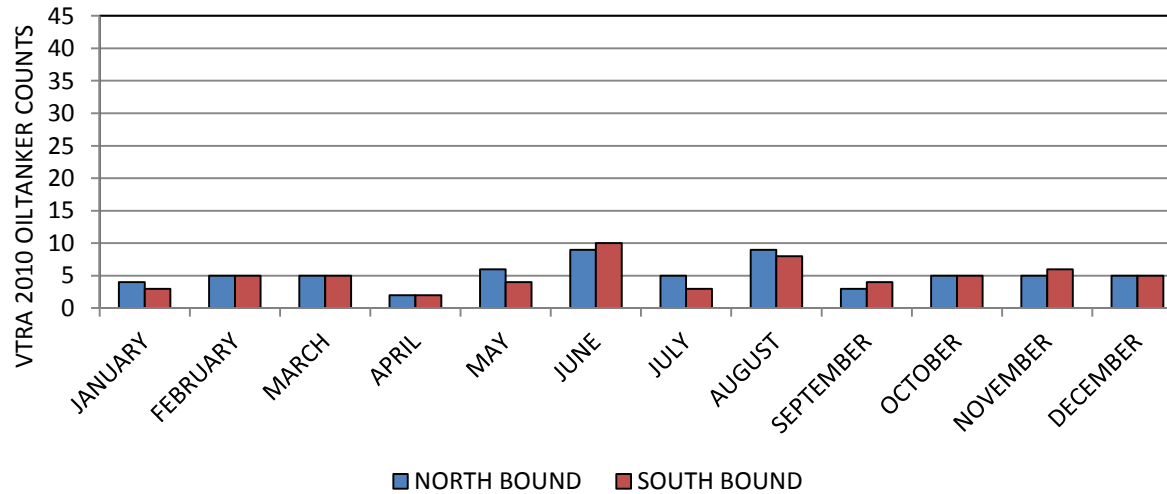


OIL TANKER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - OILTANKER G_STR CROSSINGS

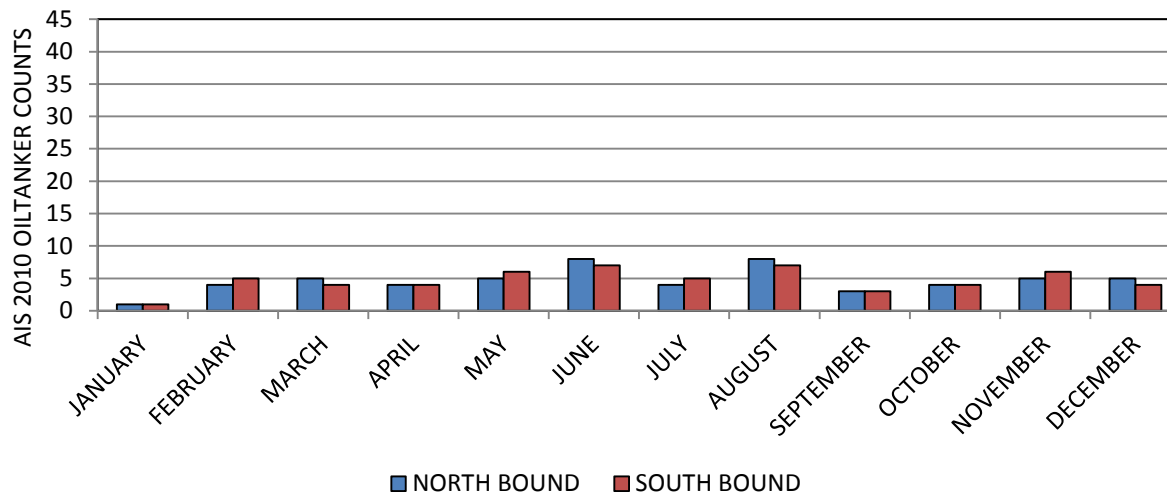


2010 VTOSS DATA - OILTANKER PS CROSSINGS



OIL TANKER COMPARISON BY MATCHING VTOSS TO AIS VESSEL NAMES

2010 AIS DATA - OILTANKER PS CROSSINGS



RANKING OF CROSSINGS FOR 2010

OIL TANKER COMPARISON

RANK	CROSSING LINE	VTOSS 2010	AIS 2010
1	WEST STRAIT OF JUAN DE FUCA	East B.: 400 West B.: 389	East B.: 386 West B.: 383
2	PUGET SOUND	North B.: 64 South B.: 60	North B.: 56 South B.: 56
3	GEORGIA STRAIT	North B.: 11 South B.: 66	North B.: 31 South B.: 29

OIL TANKER COMPARISON BY MATCHING
VTOSS TO AIS VESSEL NAMES
NOT EXACT DUE TO NAME VARIATIONS

CONCLUSIONS/FINDINGS 1 of 2

1. GWU/VCU sim data using VTOSS 2010 and AIS 2010 data reconcile well.
2. We have, however, not explained the factor 3 increase in container density going from GWU/VCU sim data using VTOSS 2005 to GWU/VCU sim data using VTOSS 2010 data.
3. We could further investigate the factor 3 increase in container density if AIS 2005 Crossing Line data was available for reconciliation.

UNFORTUNATELY, AIS CROSSING LINE DATA FOR 2005 WAS AND IS NOT AVAILABLE !

4. Moving forward the VTOSS 2010 data shall be used to develop a base case scenario for comparison to future and risk mitigation scenarios. Hence, such comparisons are not affected by this observed difference between the VTOSS 2005 and VTOSS 2010 data.

CONCLUSIONS/FINDINGS 2 of 2

5. We do not believe container ship traffic went up by a factor 3 in light of Marine Exchange and USCG data consulted for 2005 and 2010.
6. When a vessel makes multiple visits to the same Vessel Traffic Service VTS, its name can be entered differently across different trips. This is compounded by the same vessel visiting different VTS centers in the VTOSS data set we use.
7. Moreover, the same vessel can be classified as different types across different trips and different VTS centers within the VTOSS data. For instance, the types oil tanker and chemical carrier are used for the same vessels and the types bulk carrier, container ship, and other cargo vessel type are used for the same vessel.

We hypothesize that findings 6 and 7 provide the root argument for explaining the observed factor 3.

RECALL: RECLASSIFICATION OF GWU/VCU SIM VESSEL TYPES TO ALLOW FOR COMPARISON OF VTOSS – AIS 2010

#	VESSEL TYPE	MASTER TYPE	#	VESSEL TYPE	Master Type
1	BULKCARRIER	Cargo	19	SUPPLYOFFSHORE	Service
2	CHEMICALCARRIER	Tanker	20	TUGTOWBARGE	Tugtow
3	CONTAINERSHIP	Cargo	21	UNKNOWN	Service
4	DECKSHIPCARGO	Cargo	22	USCOASTGUARD	Service
5	FERRY	Ferry	23	VEHICLECARRIER	Cargo
6	FERRYNONLOCAL	Passenger	24	YACHT	Yacht
7	FISHINGFACTORY	Fishing	25	ATB	Tanker
8	FISHINGVESSEL	Fishing	26	ITB	Tanker
9	LIQGASCARRIER	Tanker	27	OILBARGE	Tugtow
10	NAVYVESSEL	Cargo	28	TUGNOTOW	TugTow
11	OILTANKER	Tanker	29	BULKCARGOBARGE	TugTow
12	OTHERSPECIALCARGO	Cargo	30	CHEMICALBARGE	TugTow
13	OTHERSPECIFICSERV	Service	31	CONTAINERBARGE	TugTow
14	PASSENGERSHIP	Passenger	32	DERRICKBARGE	TugTow
15	REFRIGERATEDCARGO	Cargo	33	UNLADENBARGE	TugTow
16	RESEARCHSHIP	Service	34	LOG_BARGE	TugTow
17	ROROCARGOSHIP	Cargo	35	WOODCHIPBARGE	TugTow
18	ROROCARGOCONTSHIP	Cargo			

VTOSS 2005-2010 GWU/VCU SIM COLLECTED CROSSING LINE COUNTS BY MASTER TYPE

Table: 2005 VTOSS GWU/VCU SIM VESSEL COUNTS OF CROSSING WSJF, G_STR, PS COUNT LINES

Master Type	TOT WSJF W-E	TOT WSJF E-W	TOT G_STR N-S	TOT G_STR S-N	TOT PS N-S	TOT PS S-N
Cargo	2190	1971	1532	1774	932	910
Tanker	706	640	135	185	98	97
TugTow	77	116	775	888	1842	1322
Subtotal	2973 - 100%	2727 - 92%	2442 - 100%	2847 - 117%	2872 - 100%	2329 - 81%

Table: 2010 GWU/VCU VESSEL COUNTS OF CROSSING WSJF, G_STR, PS COUNT LINES

Master Type	TOT WSJF W-E	TOT WSJF E-W	TOT G_STR N-S	TOT G_STR S-N	TOT PS N-S	TOT PS S-N
Cargo	3168	3141	1943	2163	1806	1780
Tanker	617	629	231	274	116	113
TugTow	353	341	1347	1437	1595	1704
Subtotal	4138 - 100%	4111 - 99%	3521 - 100%	3874 - 110%	3517 - 100%	3597 - 102%

VTOSS 2005-2010 GWU/VCU SIM COLLECTED CROSSING LINE % FROM 2005 BY MASTER TYPE

Table: 2005 VTOSS GWU/VCU SIM VESSEL % FROM 2005 OF CROSSING WSJF, G_STR, PS COUNT LINES

Master Type	TOT WSJF W-E	TOT WSJF E-W	TOT G_STR N-S	TOT G_STR S-N	TOT PS N-S	TOT PS S-N
Cargo	100%	100%	100%	100%	100%	100%
Tanker	100%	100%	100%	100%	100%	100%
TugTow	100%	100%	100%	100%	100%	100%
Subtotal	100%	100%	100%	100%	100%	100%

Table: 2010 GWU/VCU VESSEL % FROM 2005 OF CROSSING WSJF, G_STR, PS COUNT LINES

Master Type	TOT WSJF W-E	TOT WSJF E-W	TOT G_STR N-S	TOT G_STR S-N	TOT PS N-S	TOT PS S-N
Cargo	145%	159%	127%	122%	194%	196%
Tanker	87%	98%	171%	148%	118%	116%
TugTow	458%	294%	174%	162%	87%	129%
Subtotal	139%	151%	144%	136%	122%	154%