Super 8 Vessels for CFEC In-house Use

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Abstract

In recent popular commercial fishing periodicals, some newly built fishing vessels are referred to as '*Super 8s'*. This indicates the vessel is at or below 58 feet in length overall, and fits as an Alaska salmon limit seiner, but also has dimensions and attributes which are 'super-sized' relative to the length. The Alaska Commercial Fisheries Entry Commission (CFEC) needs to identify such vessels in order to better understand their use and their capabilities in Alaska. Linear discriminant function analysis was used to help make determinations of which commercial fishing vessels registered with CFEC are *Super 8s*.

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Introduction

In recent popular commercial fishing periodicals, some newly built vessels are referred to as '*Super 8s'*. This indicates the vessel is at or below 58 feet in length overall, and fits as a salmon limit seiner[1], but also has dimensions and attributes which are 'super-sized' relative to the length. The chief super-sized dimensions may be the beam, hull depth, and net and gross tonnages. Simply put, a *Super 8* appears enormous when compared side by side at the dock with a traditionally dimensioned salmon limit seiner.

The North Pacific Fisheries Management Council (NPFMC) has explored vessel capacity as a means to limit entry into certain Federally managed fisheries in the Gulf of Alaska. As part of that effort, the NPFMC looked at various alternatives, including using a length-to-width ratio of less than 3:1 as a determinant for high capacity vessels[2]. They were unable to come to any consensus on what is 'high capacity'[3]. The NPFMC has since backed away from the vessel capacity issue, and has no formal definition for *Super 8*.

For the State of Alaska's limitation program, CFEC has advocated that fishing capacity constraints should go hand in hand with limiting a fishery. The concern is that without capacity constraints in place to go along with limitation, subsequent improvements could still result in increases to catching power leading to problems down the road – the reemergence of the race for fish, overcapitalization, and need for conservation of the fishery resource. This is especially true of vessel size: a larger vessel is generally more effective and can catch more fish than a smaller vessel.

Vessel length has been constrained to the 58 foot limit by law for Alaskan salmon fisheries, and by regulation in many limited and non-limited fisheries - the Chignik Area Pacific cod pot and jig fisheries are examples[4]. However, many other vessel attributes are not constrained at all. In the *Super 8*s, the attributes typical to a 58 foot salmon limit seiner have seemingly been stretched to the maximum extent possible by marine architecture. The super-sized dimensions are cited above, but there are others as well – the expansive aft deck space found on a *Super 8* for example. Unfortunately, the size of the aft deck is not data collected by CFEC; neither are other provisional vessel attributes which tend to be bigger and better in a *Super 8*: the size of the wheel house, engine room size, galley size, and perhaps even the existence of an onboard laundry facility. Such bigger and better attributes likely benefit the fishing effectiveness of a *Super 8*: the expansive aft deck space can allow for storage of more fishing pots and other gear; a larger sized wheel house can accommodate more electronics for better navigation and telemetry for finding fish; a larger sized engine room can accommodate redundant propulsion systems and electricity generation systems for safety, and other sophisticated engineering such as centrifugal fuel filters which help keep the vessel longer on the fishing grounds; and, last but not least, greater amenities and creature comforts can help the crew be more responsive and effective during long fishing

[1] AS 16.05.835(a)
[2] Discussion paper 'Vessel Capacity Limits' from the NPFMC meeting in Anchorage, Alaska, June 3 – 9, 2009.
[3] Anecdotally, it was whether to include Delta Series-59, the so-called 'Fat-Boy Deltas'.
[4] 5 AAC 28.537(h)(D)

trips. Taken together, these super-size dimensions along with bigger and better attributes enhance the capability for a *Super 8* to go to sea farther, stay out longer, and catch, hold, and deliver more fish.

It behooves CFEC to better understand the use and capabilities of such vessels in Alaska. The first task for CFEC, the object of this paper, is just to identify *Super 8s*. It was apparently problematic for the NPFMC to define 'high capacity'. Rather than invent a definition for *Super 8* which could then be open to interpretation and argument, I instead started with the premise that there are already *Super 8s* recognized as such and not subject to interpretation. Fred Wahl Marine Construction, located in Reedsport, Oregon, is widely recognized for building *Super 8*s. The corollary premise is that there are modern salmon limit seiners which are not *Super 8s* but which are more traditionally dimensioned and with traditional attributes. Delta Marine Industries, located in Seattle, Washington, is widely recognized for producing a veritable standard among 58-foot salmon limit seiners – the Delta Series-58 (does *not* include Delta Series-59, the so-called 'Fat-Boy Deltas'). With these two known and distinct vessel groupings, I developed a linear discriminant function model for separating all CFEC registered commercial fishing boats into two classes – the vessels most similar to Wahl *Super 8s*, versus the vessels most similar to Delta Series -58. With the results from the model, I determined the full representation of *Super 8s* operating in Alaska waters.

Data

All commercial fishing vessels must be licensed annually with CFEC. The licensing procedure captures data on vessels and owners, including vessel attributes reported voluntarily by the owner, and is known as the CFEC Vessel File[5]. In the CFEC Vessel File, some data were missing or were out-of-range and not valid. Of the missing data, some could be filled in using other sources - the U.S. Coast Guard (USCG) vessel documentation website[6] or other websites[7] and various periodicals[8]. Out-of range vessel data were not used in the analyses. The CFEC Vessel File was also augmented with data for USCG registered hull depth of the vessel and USCG registered hull breadth.

Methods

Corrected and augmented data from the CFEC Vessel File were used to determine which vessels are *Super 8s*. The determination was a two-step process: linear discriminant function analysis, followed by a cutpoint analysis.

The linear discriminant function analysis was done with a SAS Institute Inc. (SAS) procedure - proc discrim - which builds a discriminant model that best predicts a categorical dependent variable. The dependent variable was 'super-ness', i.e., whether a vessel's attributes are sufficiently super-sized to be a potential *Super 8*. The independent variables for the model were from the following list of vessel

[5] CFEC Vessel Extract File includes the vessel name, ADFG number, USCG number, overall length, make, year built, net and gross tonnage, fuel tank(s) capacity, fish hold(s) capacity, engine type and horsepower, hull construction, hull ID, and vessel value, among the total of 119 variables.
[6] http://www.st.nmfs.noaa.gov/st1/CoastGuard/VesselByName.html
[7] As examples: http://www.fredwahlmarine.com and http://www.shipbuildinghistory.com
[8] For example: Pacific Fishing magazine October 2012.

attributes: gross tonnage, fish hold(s) capacity, year built, fuel tank(s) capacity, engine horsepower, USCG registered hull depth, and USCG registered hull breadth.

In order to make the discrimination, two sets of knowns were constructed. Fred Wahl Marine Construction, located in Reedsport, Oregon, is widely recognized for building *Super 8*s. Wahl design/build vessels beginning with F/V Arctic Fox[9] were used for a dataset of *Known Super 8s*. Delta Marine Industries, located in Seattle, Washington, is widely recognized for producing a modern 58-foot salmon limit seiner – the Delta Series-58 (does *not* include Delta Series-59, the so-called 'Fat-Boy Deltas'). Produced from the late 1970s to the late 1980s, Delta Series-58s were well suited for use in a wide variety of Alaskan fisheries, not just salmon, and became known as 'combination boats'. The Delta Series-58s were used for a dataset of the *Known Traditionals*.

The discrimination was performed on a third dataset, the *Unknowns*, consisting of all CFEC registered commercial fishing vessels from the years 2000 to 2014 (but with the two sets of knowns removed). Only vessels between 49 feet and 58 feet in overall length were included. Further restrictions also applied to the *Unknowns*: no vessels used exclusively as tenders or used exclusively as charter boats; only vessels with engine horsepower ranging between 100HP and 1000HP; only vessels with gross tonnages in excess of 7 (to avoid any confusion with USCG documentation requirements starting at 5 net tons); only vessels with fish hold(s) sized greater than 32 cubic feet (greater than the size of a fish tote); and vessels with fuel tank(s) less than 31,000 gal. (less than a Boeing 777-200 jet). The above restrictions yielded 958 unique vessels in the *Unknowns* to be classified by the discriminant function analysis.

I performed the discriminant function analysis using a stepwise procedure available in SAS proc discrim. Out of the seven vessel attributes cited above, SAS selected four as the independent variables for the discriminant model: USCG registered hull breadth, CFEC vessel fish hold(s) capacity, USCG registered hull depth, and CFEC gross tonnage. The primary predictor for 'super-ness' was USCG registered hull breadth with a partial r-squared value of 0.9879. The model was weighted to account for the difference in the group sizes of the knowns – *Known Super 8s* (n = 13) and *Known Traditionals* (n = 56). The classification matrix showed no classification errors. *Unknowns* with missing data for one or more of the independent variables were unable to be classified by the model, and out of 533 *Unknowns* having complete data, 38 were classified with 'super-ness' (Appendix A).

[9] Of Wahl design/build vessels: built in 2006, the F/V Arctic Fox is conceded as their first *Super 8* (dimensions of 58' length by 26' beam). Some Wahl design/build vessels have other dimensions similar to Delta Series-59 vessels, so are not included in the *Known Super 8s*, but instead are included in the pool of unknowns to be classified. F/V April Lane and F/V Loui M are two such examples.

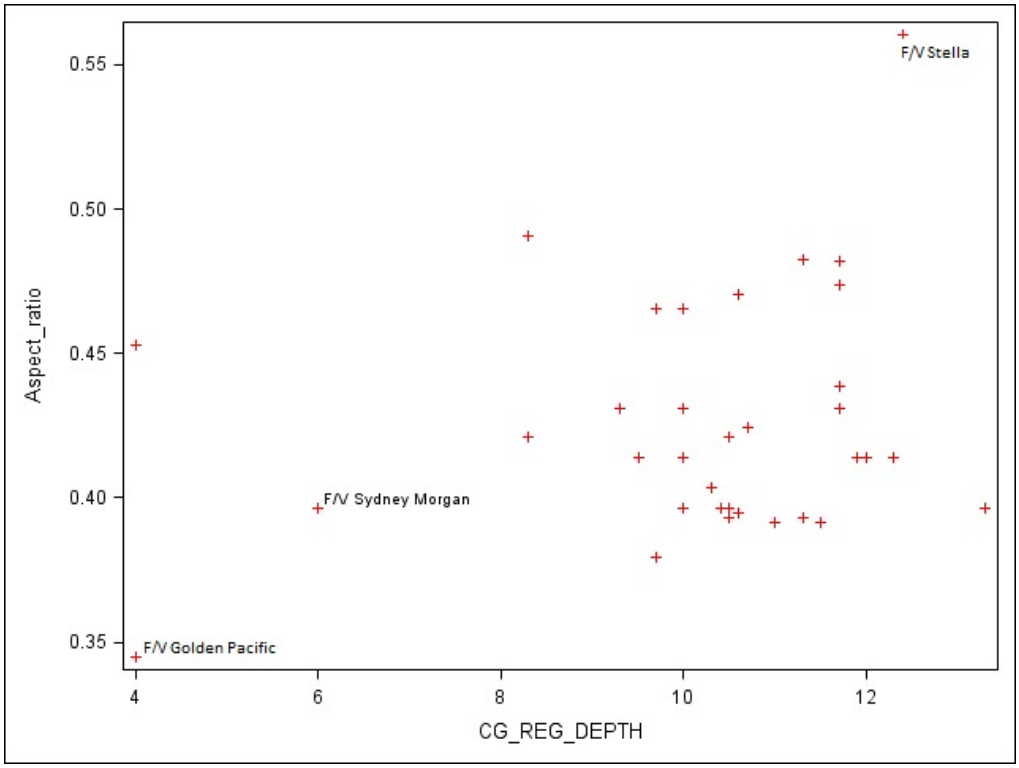

Figure 1. Unknowns classified with 'super-ness' by discriminant function analysis.

Figure 1 presents a scatterplot of the 38 vessels classified with 'super-ness' by the discriminant function analysis. The scatterplot shows the aspect ratio versus USCG registered hull depth for a vessel. The aspect ratio is a vessel's width-to-length ratio used in marine architecture (aside: it is a mathematical reciprocal of the length:width ratio used by the NPFMC to potentially determine 'high capacity'). When aspect ratio and USCG registered hull depth are taken together, it is a standard measurement of the volume of a vessel's hull, and a good proxy for the physical size of a vessel. Note the variability in size of the vessel in the scatterplot: from the smallest vessel (F/V Golden Pacific) in the lower left to the largest vessel (F/V Stella) in the upper right.

Some vessels in Figure 1 arguably should not be *Super 8s*. Take the F/V Sydney Morgan as an example: built in 2010 primarily as a salmon/herring vessel, it has a wide beam (23 feet) but a relatively shallow hull depth (6 feet), and would likely not perform well as a combination boat in open ocean conditions found in the Gulf of Alaska or the Bering Sea. Although somewhat intangible, this is a key trait for a *Super 8* – the capability to operate in all waters in any fishery in Alaska.

Further analysis was necessary on the 38 *Unknowns* classed with 'super-ness' to restrict them to the capability to operate in all waters in any fishery in Alaska. Figure 2 is a scatterplot for a pool of 51 vessels, the 13 *Known Super 8s* together with the 38 *Unknowns* classed with 'super-ness'. Density plots are also shown for the scatterplot's dependent and independent variables. The *Known Super 8s* have cookie cutter attributes and are tightly grouped in the scatterplot. The *Unknowns* classified with 'super-ness' are more widely dispersed. Vessels of greatest physical size would be in the upper right of the

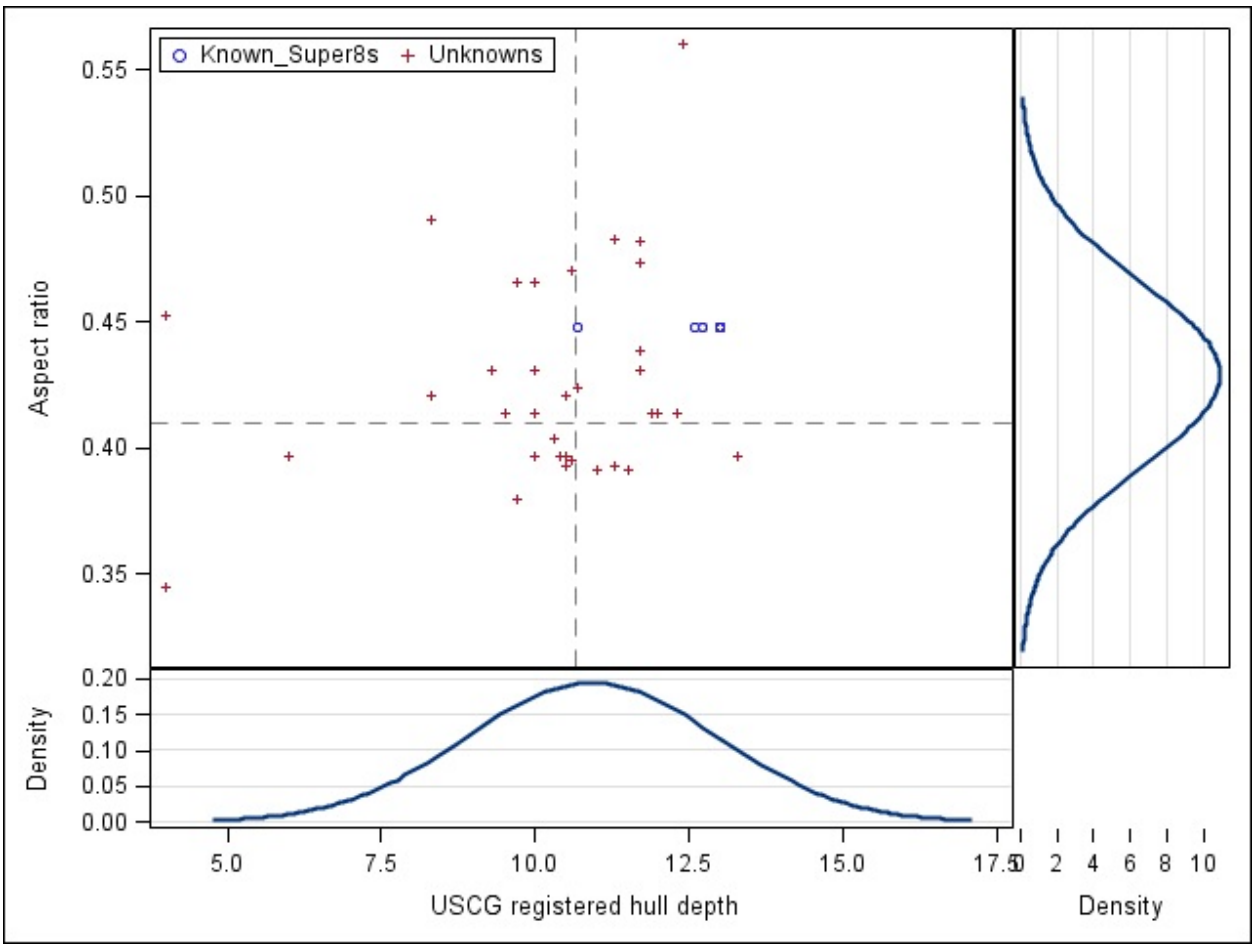

Figure 2. Density curves of scatterplot data on the pool of 51 vessels with 'super-ness'.

scatterplot. I established cutpoints (the dashed lines) near the highest densities – an aspect ratio of greater than 0.41 and a USCG registered hull depth of at least 10.7 feet. The cutpoints and dashed lines are liberal to the extent that they isolate an upper right domain of the scatterplot which is somewhat greater in size than a true quadrant. The upper right domain is the final determinant for *Super 8s*.

Results

Table 1 is a list of the 23 *Super 8s* determined from the above analyses. Thirteen are Wahl design/build vessels (the *Known Super 8s*). Of the remaining ten vessels, four are Jensen design, four are Hockema design, one is Northern Marine design/build, and one was built by the Hansen Boat Company in Marysville, WA, but the designer is unknown.

There is variability in attributes among the *Super 8s*. Most were built after 2006; however, the F/V Infinity was built in 1995, and the F/V Stella was built in 1998. The F/V Stella was later widened via a boatyard sponson, and is well known as the 'beamiest' of the *Super 8*s with a USCG registered hull breadth of 32.5 feet. The F/V Infinity and F/V Redemption both have beams of 24 feet, the smallest in

the group. USCG registered hull depths range from 10.7 feet (which is the cutpoint) to 13.0 feet. The F/V Optimus has the smallest gross tonnage (71), but this may be inaccurate as the USCG vessel documentation also records a net tonnage of only 17. To no surprise, the F/V Stella has the largest gross tonnage (156), and it has the largest fish hold capacity (5455 cubic feet[10]). The F/V Intrepid has the smallest fish hold capacity in the group at 3,000 cubic feet, which translates to 150,000 pounds of fish using a standard 50 pounds of fish per cubic foot.

Although Table 1 shows some *Super 8s* are home-ported outside of Alaska, all were active in Alaska fisheries in 2014 with the exception of the F/V Capt'n Andrew. F/V Capt'n Andrew went aground in 2011, but was salvaged and is awaiting major repairs yet to be done.

The *Super 8s* in Table 1 are from an exhaustive search of CFEC vessel data. It is a conservative rendering of *Super 8s* in Alaska in 2014 (using a cutpoint analysis over and above the linear discriminant function analysis). Likely, more *Super 8s* will yet be built and/or newly participate in fisheries in Alaska. CFEC Research will need to maintain and add to the list in Table 1 for any new vessels which meet the criteria established in this report. Other agencies or people may have different ideas on which vessels get labelled as *Super 8s*.

[10] No specific data was provided to CFEC; the estimation is derived from a delivery of over 300,000 pounds of fish at a conservative 55 pounds of fish per cubic foot.

Table 1. The Super 8s and selected vessel attributes.

			CFEC Vessel Data						USCG Vessel Data		
ADFG	Name	Design	Year built	Length	Gross tons	Hold (ft^3)	HP	Home port	ID	Hull Breadth	Hull Depth
67579	INFINITY	JENSEN	1995	58	111	3527[11]	515	ANACORTES, WA	1031059	24	12
71208	STELLA	JENSEN	1998	58	156[1]	5455[12]	700	KODIAK	1070580	32.5	12.4
74991	ARCTIC FOX	WAHL	2006	58	129	3100	700	PETERSBURG	1187928	26	12.6
75343	ALASKAN DREAM	WAHL	2007	58	128	3324	640[13]	KODIAK	1196955	26	13
75473	SAINT PAUL	WAHL	2008	58	128	3300	640	ST PAUL ISLAND	1211672	26	13
75676	CAPT'N ANDREW	WAHL	2008	58	128	3400[11]	640[14]	KING COVE	1215338	26	12.7
75701	INTREPID	WAHL	2009	58	108	3000	640[15]	HOMER	1216688	26	10.7
75998	ICY MIST	WAHL	2009	58	128	3300	650	KODIAK	1221114	26	12.7
76034	CYNOSURE	HOCKEMA	2009	58	122	3700	660	DUTCH HARBOR	1218080	27	11.7
76319	REDEMPTION	JENSEN	2009	58	114	3527	600	PETERSBURG	1220458	24	12.3
76355	ROBERT MAGNUS	WAHL	2011	58	129	3309	500	PETERSBURG	1230071	26	13
76584	ALASKAN STAR	WAHL	2011	58	131	4000	625	KODIAK	1230782	26	13
76769	SAINT PETER	WAHL	2011	58	131	3330	660	SAINT PAUL ISLAND	1235623	26	13
76787	KAIA	WAHL	2011	58	128	3330[16]	750	MOUNT VERNON, WA	1236357	26	13
76842	ANTHEM	HANSEN	2012	58	117	3400	750	KODIAK	1238032	28	11.3
76858	AFOGNAK STRAIT	WAHL	2012	58	131	3330	600	KODIAK	1236804	26	13
77144	MAGNUS MARTENS	WAHL	2013	58	131[17]	3330[16]	660	JUNEAU	1245684	26	13
77211	CERULEAN	HOCKEMA	2013	56	119	3600	660	DUTCH HARBOR	1249334	27	11.7
77327	ISLE DOMINATOR	WAHL	2013	58	131	3330	500	KODIAK	1246391	26	13
77403	BROOKE MICHELLE	JENSEN	2011	58	109	3242	750[18]	BELLINGHAM, WA	1233421	24.6	10.7
77559	OPTIMUS	NORTHERN MARINE	2013	58	71	3800	750	SITKA	1244552	24.3[19]	12.0[19]
89173	INTANGIBLE	HOCKEMA	2009	58	113	3200	600	PETERSBURG	1219625	25	11.7
89178	ADAMANT	HOCKEMA	2013	58	113	3600	750	PETERSBURG	1245437	25	11.7

[11] CFEC data from other than 2014
[12] Estimated from 300,000 pounds of fish
[13] Estimated from report on Cummins K19
[14] Proxy F/V Saint Paul
[15] Estimated from report on Cummins QSK19
[16] From www.FredWahlMarine.com accessed 2/13/2015
[17] USCG vessel documentation
[18] From Facebook mendicinosportsplus accessed 2/13/2015
[19] From www.NorthernMarine.com accessed 2/13/2015

APPENDIX

Discriminant function analysis results: 38 vessels classified with 'super-ness'.

Table A1. Discriminant function analysis results: 38 vessels classified with 'super-ness'.

		CFEC Vessel Data						USCG Vessel Data		
ADFG	Name	Make	Year built	Length	Gross tons	Hold (ft^3)	HP	Home port	ID	Hull Breadth	Hull Depth
17076	TERN		1966	51	70	1735	340	SAND POINT	504131	24	10.6
20970	STARLIGHT	RAFFAEL	1986	58	88	1800	401	BLAINE	900453	24	9.5
21040	SPECTRE	JENSEN	1996	58	96	1700	500	SEWARD	1048304	23	10.5
25171	NICHOLAS MICHAEL		1974	58	89	2700	365	JUNEAU	558684	25	10
31083	OLIVIA M	CUSTOM	1980	53	36	1200	375	SITKA	617673	24	4
37508	HEIDI SUE		1974	53	63	1800	325	COOS BAY	545998	26	8.3
38727	ARCTIC ICE	UNION BAY	1979	58	63	1400	400	KODIAK	608177	27	10
41056	JOHNNY A	CUSTOM	1980	58	105	2000	500	HOONAH	625595	22	9.7
46701	KAREN EVICH		1983	58	81	2400	750	BELLINGHAM	656716	25	9.3
47952	EXCELLER		1983	58	92	2396	640	KODIAK	659770	24	10
53403	PACIFIC NOMAD		1979	57	77	1500	325	SEATTLE	614803	24	8.3
61324	ALASKAN FRONTIER		1991	58	93	2400	465	CHIGNIK LAGOON	971241	23	10
61395	TEMPTATION	DELTA	1990	58	99	2300	520	SAND POINT	971543	22.8	11.3
61660	PACIFIC RAIDER	DELTA	1991	58	96	2500	540	VENTURA	972638	22.7	11
62288	MARAUDER		1991	58	93	2676	540	SEATTLE	975597	22.8	10.5
62844	DECISION	DELTA	1991	58	99	2700	540	SAND POINT	980422	22.8	11.3
62922	LADY JOANNE		1991	58	94	2600	504	JUNEAU	979063	22.9	10.6
65119	CAPE RELIANT	SEINER	1994	58	118	2400	630	PETERSBURG	1000086	23	13.3
67579	INFINITY	VAN PEER	1995	58	111	2500	515	ANACORTES	1031059	24	12
69625	KONRAD I	MIDCOAST	1994	58	101	2500	600	JUNEAU	1000203	27	9.7
70135	SHUYAK	FRED WAHL	1997	58	92	2400	450	KODIAK	1055256	23	10.4
71208	STELLA	JENSEN	1998	58	156	5993	700	KODIAK	1070580	32.5	12.4
73568	KODIAK ISLE	FREDWAHL	2003	58	93	2620	500	KODIAK	1143510	23	10.5
76034	CYNOSURE	SEINER	2009	57	122	3700	660	DUTCH HARBOR	1218080	27	11.7
76319	REDEMPTION	SEINER	2009	58	114	3527	600	PETERSBURG	1220458	24	12.3
76436	SYDNEY MORGAN	HOWARD MOE	2010	58	50	2500	1000	KODIAK	1225596	23	6
76477	CLAIRE OCEANA	LIMITSEINE	2011	58	93	2600	500	SEWARD	1231859	23.4	10.3
76673	GOLDEN PACIFIC	MODUTECH	2011	58	90	2600	660	LATOOCHE	1233049	20	4
76842	ANTHEM	HANSEN	2012	58	117	3400	750	KODIAK	1238032	28	11.3
76992	SEQUEL		2012	58	101	2700	500	VALDEZ	1240846	22.7	11.5
77211	CERULEAN	LONGLINER	2013	56	119	3600	660	DUTCH HARBOR	1249334	27	11.7
77227	INVINCIBLE	DELTAMARIN	2013	58	101	2700	500	KODIAK	1244073	22.7	11.5
77241	ARIANNA SAGE	HOQUIAM	2013	57	96	2200		CHIGNIK LAGOON	1244398	24	10.5
77246	RISING SUN	DELTA	2013	58	102	3200	600	WESTPORT	1244677	22.7	11.5
77403	BROOKE MICHELLE	VANPEER	2011	58	109	3242		BELLINGHAM	1233421	24.6	10.7
77559	OPTIMUS	NORTHERN M	2013	58	71	3800	750	SITKA	1244552	24	11.9
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