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A maximum likelihood approach for calculating fish hold volume for tuna purse seine vessels

By Victor Restrepo and Ana Justel-Rubio (ISSF)
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1. Introduction

One of the preferred ways to measure fishing capacity of a vessel is the fish hold volume (FHV). Unfortunately, FHV values for individual vessels are not always available from publicly-available records, such as the RFMO authorized lists of vessels. For this reason, it is often necessary to estimate FHV on the basis of other more readily-available information, such as the overall length of the vessel.

The purpose of this study is to use a likelihood-based approach to infer a vessel's FHV, given that other size measurements are known (but FHV is not). The approach allows one to make probability statements about the likely FHV of a vessel, conditional on other dimensions.

2. Data and Methods

ISSF regularly updates a global list of purse seine vessels based on lists from the tuna RFMOs and other sources (Restrepo and Forrestal, 2012; Justel-Rubio and Restrepo, 2014; Justel-Rubio and Restrepo, 2015). From 1,955 vessels available globally from the 2015 update, the following fields related to vessel size or vessel capacity have different rates of reporting (**Table 1**):

Table 1. Reporting rates of different vessel size and vessel capacity measures extracted from Justel-Rubio and Restrepo, 2015.

Data Field*	Reporting rate
LOA	85%
LBP	35%
RGL	21%
GRT	47%
GT	57%
FCC	23%
FHV	30%

*The Glossary (**Appendix 1**) defines acronyms used in this document.

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Justel-Rubio and Restrepo (2015) fitted various relationships between these size/capacity-related measurements in order to be able to calculate FCC and FHV for all 1,955 vessels, based on the predicted relationships.

In this paper, however, we do not make use of all of the available data. The reason for this is that FHV, the variable of primary interest in this study, is only verified by one RFMO: the Inter-American Tropical Tuna Commission (IATTC). Therefore, FHV values listed on the IATTC Record are deemed to be more reliable than those in other RFMO records. The dataset that served as raw data for this study contains only those vessels listed at the IATTC Record as of April 2016 (**Appendix 2**).

The likelihood-based approach followed here assumes that the Variance of FHV is proportional to the value of the explanatory length/tonnage variable. The explanatory variables considered are fish carrying capacity (FCC), length overall (LOA), length between the perpendiculars (LBP) registered length (RGL), gross registered tonnage (GRT) and gross tonnage (GT). A Normal distribution is assumed in the fits (no other possibilities were investigated, but a normality assumption seems reasonable upon visual examination.)

The predicted values of FHV for each vessel *i* ($\hat{h}_i$) were obtained by either linear (with intercept = 0) or power relationships with the explanatory variable, as follows:

2.1 FHV (m^3) as a function of FCC (C, in tonnes):

$$\hat{h}_i = \hat{a}C_i \qquad \text{with} \quad \sigma_i^2 = \hat{\sigma}_*^2 C_i$$

A total of n=277 observations were available.

2.2 FHV (m^3) as a function of LOA (L, in meters):

$$\hat{h}_i = \hat{a}L_i^{\hat{b}} \qquad \text{with} \quad \sigma_i^2 = \hat{\sigma}_*^2 L_i$$

A total of n=259 observations were available.

2.3 FHV (m^3) as a function of LBP (B, in meters):

$$\hat{h}_i = \hat{a}B_i^{\hat{b}} \qquad \text{with} \quad \sigma_i^2 = \hat{\sigma}_*^2 B_i$$

A total of n=175 observations were available.

2.4 FHV (m^3) as a function of RGL (R, in meters):

$$\hat{h}_i = \hat{a}R_i^{\hat{b}} \qquad \text{with} \quad \sigma_i^2 = \hat{\sigma}_*^2 R_i$$

A total of n=81 observations were available.

2.5 FHV (m³) as a function of GRT (G, in tonnes):

$$\hat{h}_i = \hat{a} G_i^{\hat{b}} \qquad \text{with} \qquad \sigma_i^2 = \hat{\sigma}_*^2 G_i$$

A total of n=141 observations were available.

2.6 FHV (m³) as a function of GT (T, in meters):

$$\hat{h}_i = \hat{a} T_i^{\hat{b}} \qquad \text{with} \qquad \sigma_i^2 = \hat{\sigma}_*^2 T_i$$

A total of n=148 observations were available.

The fits are obtained by maximizing the value of the log-likelihood:

$$\varphi = \sum_i [-log(\sqrt{2\pi}) - log(\sigma_i) - \frac{1}{2\sigma_i^2}(h_i - \hat{h}_i)]$$

given the parameters for the selected relationship ($\hat{a}, \hat{b}, \hat{\sigma}_*^2$).

3. Results

The values of the estimated parameters are provided in **Table 2**. Plots of the fitted regressions and 95% confidence intervals are given in **Figure 1**.

Table 2. Summary table of fitted FHV regressions.

Explanatory Variable	**n**	$\hat{a}$	$\hat{b}$	$\hat{\sigma}_*^2$	φ	**R²**
FCC (t)	277	1.2839	N/A	19.8326	-1679.53	0.95
LOA (m)	259	0.3043	1.9806	688.1274	-1727.3031	0.89
LBP (m)	175	0.4572	1.9375	833.7361	-1184.5187	0.86
RGL (m)	81	0.3835	1.9587	690.6453	-537.7738	0.90
GRT (t)	141	1.4984	0.9489	52.0870	-912.9060	0.85
GT (t)	148	2.4145	0.8668	50.5179	-1016.3578	0.85

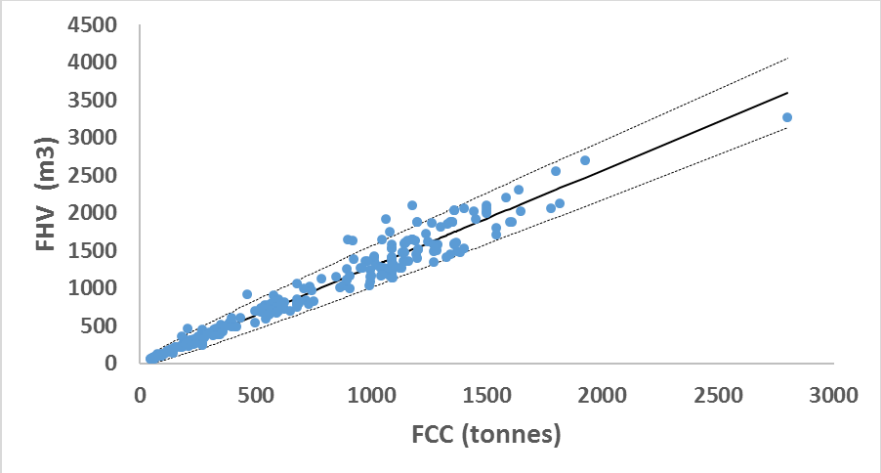

Figure 1a. Fitted relationship between FCC (tonnes) and FHV (m^3). R^2 = 0.9513, n = 277.

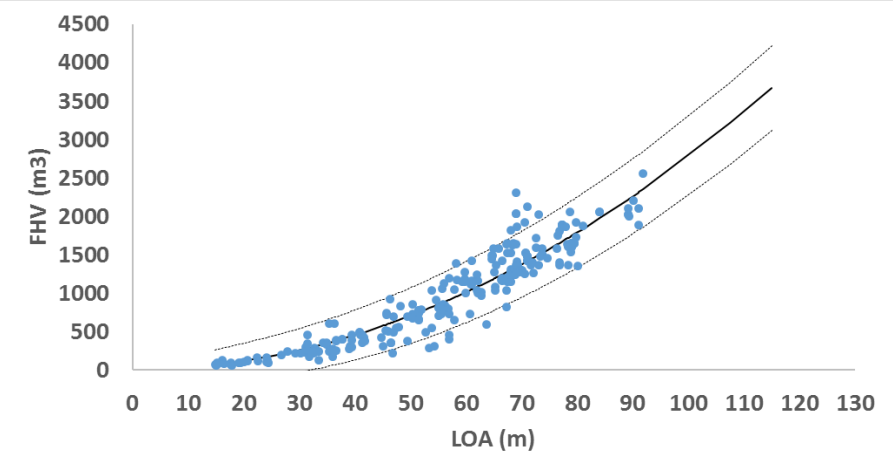

Figure 1b. Fitted relationship between LOA (meters) and FHV (m^3). R^2 = 0.8891, n = 259.

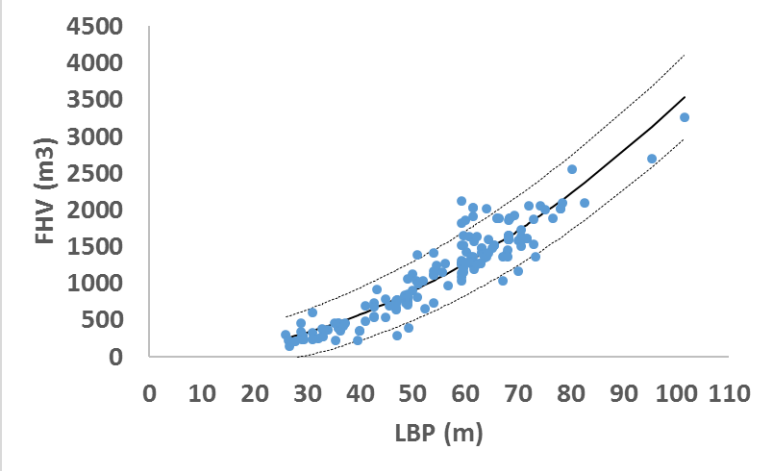

Figure 1c. Fitted relationship between LBP (meters) and FHV (m^3). R^2 = 0.8592, n = 175.

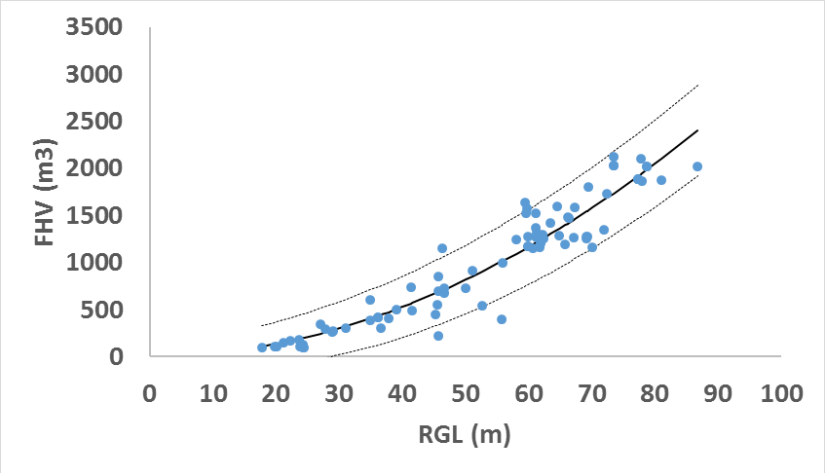

Figure 1d. Fitted relationship between RGL (meters) and FHV (m^3). R^2 = 0.8973, n = 81.

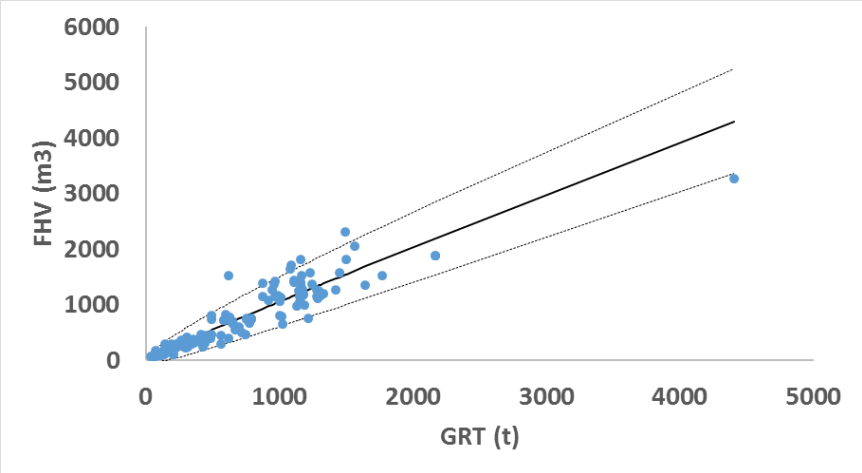

Figure 1e. Fitted relationship between GRT (meters) and FHV (m^3). R^2 = 0.8529, n = 141.

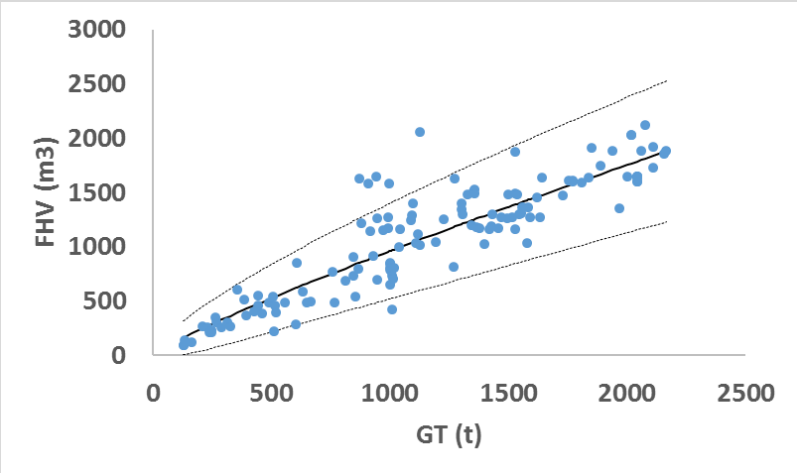

Figure 1f. Fitted relationship between GT (meters) and FHV (m^3). R^2 = 0.8505, n = 148.

The results obtained (**Table 2**) indicate that all regressions fit well on the basis of R^2 (values range between 0.85 and 0.95). Nevertheless, this cannot be the only criterion used to determine which explanatory variables would be more reliable when inferring an unknown FHV value. For that purpose, the number of observations available in each case should be also taken into consideration, given that some sample sizes are very limited such as that for the RGL regression (n= 81).

For each of the regressions estimated in this study, one can predict the expected value of FHV for a given value of the explanatory variable (say, FCC). In addition, one can calculate the variance of that prediction using the formulae in Sections 2.1 to 2.6. These two values, the mean predicted FHV and its variance can in turn be used to estimate probability levels using the normal distribution. **Table 3** shows the estimated values of FHV for levels of FCC ranging from 250 to 2450 tonnes. Each column corresponds to a probability level from the normal distribution.

As an example for using **Table 3**, consider a vessel with FCC = 1,000 tonnes:

- Its expected FHV is 1,284 m3 (i.e. the value corresponding to p=0.5);
- 80% of the vessels with that FCC will have an FHV between 1,103 and 1,464 m^3 (i.e. the values corresponding to p=0.1 and p=.9, which comprise 80% of the distribution);
- The probability that such a vessel will have an FHV greater than 1,516 m^3 is less than 5%.

Similar tables can also be constructed for the other explanatory variables such as length overall, etc.

4. Summary and conclusions

When extrapolating likely values of FHV given a number of possible explanatory variables, we recommend using the one explanatory variable that is deemed to be most accurate. In the absence of that knowledge, we recommend a hierarchical approach based on the goodness of fit (as measured by R^2, see **Table 2**) and number of observations of the various relationships estimated in this paper (**Table 4**).

Table 4. Suggested hierarchical approach for FHV estimation.

#	Variable	R^2	n
1	FCC	0.95	277
2	LOA	0.89	259
3	LBP	0.86	175
4	GT	0.85	148
5	GRT	0.85	141
6	RGL	0.90	81

5. REFERENCES

Justel-Rubio, A. and V.R. Restrepo 2015. A Snapshot of the Large-Scale Tropical Tuna Purse Seine Fishing Fleets at the Beginning of 2015. ISSF Technical Report 2015-05. International Seafood Sustainability Foundation, McLean, Virginia, USA.

Justel-Rubio, A. and V.R. Restrepo 2014. A Snapshot of the Large-Scale Tropical Tuna Purse Seine Fishing Fleets at the Beginning of 2014. ISSF Technical Report 2014-07. International Seafood Sustainability Foundation, McLean, Virginia, USA.

Restrepo, V.R. and F. Forrestal. 2012. A Snapshot of the Tropical Tuna Purse Seine Large-Scale Fishing Fleets at the End of 2011. ISSF Technical Report 2012-01. International Seafood Sustainability Foundation, McLean, Virginia, USA.

Table 3. Predicted values of FHV for different levels of FCC, at different probability levels (.05 to .95).

FCC	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
250	205	231	248	262	273	284	294	303	312	321	330	339	348	358	368	380	394	411	437
300	258	286	305	320	333	345	355	366	375	385	395	405	415	426	437	450	465	484	512
350	312	343	363	379	393	406	417	428	439	449	460	470	481	493	506	519	536	556	586
400	367	399	421	439	453	467	479	491	502	514	525	536	548	560	574	589	606	628	660
450	422	457	480	498	514	528	541	554	566	578	590	602	614	627	641	657	676	699	733
500	478	514	539	558	575	590	604	617	629	642	654	667	680	694	709	726	745	770	806
550	534	572	598	618	636	651	666	680	693	706	719	733	746	761	777	794	814	840	878
600	591	631	657	679	697	713	728	743	757	770	784	798	812	828	844	862	883	910	950
650	648	689	717	739	758	775	791	806	820	835	849	863	878	894	911	930	952	980	1021
700	705	748	777	800	819	837	853	869	884	899	914	929	944	961	978	998	1021	1050	1093
750	762	807	837	860	881	899	916	932	948	963	978	994	1010	1027	1045	1066	1089	1119	1164
800	820	866	897	921	942	961	979	995	1011	1027	1043	1059	1076	1093	1112	1133	1158	1189	1234
850	878	925	957	982	1004	1023	1041	1058	1075	1091	1108	1124	1141	1159	1179	1201	1226	1258	1305
900	936	984	1017	1043	1065	1085	1104	1122	1139	1156	1172	1189	1207	1226	1246	1268	1294	1327	1375
950	994	1044	1077	1104	1127	1148	1167	1185	1202	1220	1237	1254	1273	1292	1312	1335	1362	1396	1445
1000	1052	1103	1138	1165	1189	1210	1230	1248	1266	1284	1302	1320	1338	1358	1379	1402	1430	1464	1516
1050	1111	1163	1199	1227	1251	1272	1292	1312	1330	1348	1366	1385	1404	1424	1445	1470	1498	1533	1585
1100	1169	1223	1259	1288	1313	1335	1355	1375	1394	1412	1431	1450	1469	1490	1512	1537	1565	1602	1655
1150	1228	1283	1320	1349	1375	1397	1418	1438	1458	1476	1495	1515	1535	1556	1578	1604	1633	1670	1725
1200	1287	1343	1381	1411	1437	1460	1481	1502	1521	1541	1560	1580	1600	1622	1645	1671	1701	1738	1794
1250	1346	1403	1442	1472	1499	1522	1544	1565	1585	1605	1625	1645	1666	1687	1711	1737	1768	1807	1864
1300	1405	1463	1503	1534	1561	1585	1607	1628	1649	1669	1689	1710	1731	1753	1777	1804	1835	1875	1933
1350	1464	1524	1564	1596	1623	1647	1670	1692	1713	1733	1754	1775	1796	1819	1844	1871	1903	1943	2002
1400	1523	1584	1625	1657	1685	1710	1733	1755	1777	1797	1818	1840	1862	1885	1910	1938	1970	2011	2072
1450	1583	1644	1686	1719	1747	1773	1796	1819	1840	1862	1883	1905	1927	1951	1976	2004	2037	2079	2141
1500	1642	1705	1747	1781	1810	1835	1859	1882	1904	1926	1948	1970	1992	2016	2042	2071	2105	2147	2210
1550	1702	1765	1808	1842	1872	1898	1922	1946	1968	1990	2012	2034	2058	2082	2108	2138	2172	2215	2278
1600	1761	1826	1870	1904	1934	1961	1986	2009	2032	2054	2077	2099	2123	2148	2174	2204	2239	2283	2347
1650	1821	1887	1931	1966	1996	2024	2049	2073	2096	2118	2141	2164	2188	2213	2240	2271	2306	2350	2416
1700	1881	1947	1992	2028	2059	2086	2112	2136	2160	2183	2206	2229	2253	2279	2306	2337	2373	2418	2485
1750	1940	2008	2054	2090	2121	2149	2175	2200	2223	2247	2270	2294	2319	2345	2372	2404	2440	2486	2553
1800	2000	2069	2115	2152	2184	2212	2238	2263	2287	2311	2335	2359	2384	2410	2438	2470	2507	2553	2622
1850	2060	2130	2177	2214	2246	2275	2301	2327	2351	2375	2399	2424	2449	2476	2504	2536	2574	2621	2690
1900	2120	2191	2238	2276	2308	2338	2365	2390	2415	2439	2464	2489	2514	2541	2570	2603	2641	2688	2759
1950	2180	2252	2300	2338	2371	2400	2428	2454	2479	2504	2528	2553	2579	2607	2636	2669	2707	2756	2827
2000	2240	2313	2361	2400	2433	2463	2491	2517	2543	2568	2593	2618	2645	2672	2702	2735	2774	2823	2895
2050	2300	2374	2423	2462	2496	2526	2554	2581	2607	2632	2657	2683	2710	2738	2768	2802	2841	2890	2964
2100	2361	2435	2485	2524	2559	2589	2618	2644	2671	2696	2722	2748	2775	2803	2834	2868	2908	2958	3032
2150	2421	2496	2546	2587	2621	2652	2681	2708	2734	2760	2786	2813	2840	2869	2900	2934	2974	3025	3100
2200	2481	2557	2608	2649	2684	2715	2744	2772	2798	2825	2851	2877	2905	2934	2965	3000	3041	3092	3168
2250	2541	2618	2670	2711	2746	2778	2807	2835	2862	2889	2915	2942	2970	3000	3031	3067	3108	3159	3236
2300	2602	2679	2732	2773	2809	2841	2871	2899	2926	2953	2980	3007	3035	3065	3097	3133	3174	3227	3304
2350	2662	2740	2793	2835	2872	2904	2934	2962	2990	3017	3044	3072	3100	3130	3163	3199	3241	3294	3372
2400	2723	2802	2855	2898	2934	2967	2997	3026	3054	3081	3109	3137	3165	3196	3229	3265	3307	3361	3440
2450	2783	2863	2917	2960	2997	3030	3061	3090	3118	3146	3173	3201	3230	3261	3294	3331	3374	3428	3508

Appendix 1. Glossary

FCC. Fish Carrying Capacity. The amount of fish, in tonnes, that a vessel can carry. This is related to the size of the fish wells. However, the actual tonnage carried may vary depending on the size of the fish and how they are stored. FCC is often measured as the maximum landings observed for a given vessel.

FHV. Fish Hold Volume: The total measured cubic content of the fish wells, in cubic meters.

GRT. Gross Register Tonnage: The total measured cubic content of the permanently-enclosed spaces of a vessel, with some allowances or deductions for exempt spaces such as living quarters (1 gross register ton = 100 ft^3 = 2.83 m^3).

GT. Gross Tonnage: The volume of all ship's enclosed spaces (from keel to funnel) measured to the outside of the hull framing.

LBP. Length between perpendiculars: The length of a vessel (loaded) along the waterline from the forward surface of the stem, or main bow perpendicular member, to the after surface of the sternpost, or main stern perpendicular member.

LOA. Length overall: The maximum length of a vessel from the two points on the hull measured perpendicular to the waterline.

RGL. Registered length: The length of the vessel as registered with the national authorities. Different countries have different requirements, so RGL could be LOA, LBP, or other measurements.

Appendix 2. Vessels dataset

IATTC#	LOA	LBP	RGL	GRT	GT	FCC	FHV
6525	32.56	NA	NA	304.00	NA	176.00	222.00
3556	71.02	63.02	66.20	NA	1535.00	1145.00	1480.00
3274	59.74	NA	59.87	NA	990.00	1055.00	1272.00
3844	55.60	46.80	50.00	NA	1009.00	581.00	729.00
13554	44.81	36.88	NA	NA	1010.00	360.00	421.00
2557	36.57	NA	34.92	417.00	NA	329.00	390.00
3151	59.74	NA	46.34	NA	971.00	998.00	1152.00
3616	68.10	59.29	61.21	1159.00	NA	1131.00	1274.00
3250	59.74	NA	59.87	1183.00	NA	1089.00	1176.00
3964	66.50	61.65	65.84	NA	1428.00	1060.00	1193.00
9435	78.33	68.28	NA	NA	1771.00	1367.00	1603.00
3571	74.67	67.97	NA	NA	1619.00	1196.00	1451.00
2698	32.91	NA	29.00	NA	210.00	227.00	270.00
3259	59.74	NA	59.87	NA	990.00	1045.00	1175.00
3496	68.08	59.26	NA	NA	1468.00	1121.00	1274.00
3619	64.70	NA	NA	1110.00	NA	1344.00	1446.00
3214	47.85	NA	NA	673.00	NA	396.00	555.00
11977	41.00	37.13	NA	NA	516.00	331.00	464.00
6343	56.93	NA	NA	412.00	NA	270.00	458.00
9571	56.90	49.18	55.81	619.00	NA	280.00	399.00
5229	53.85	44.81	52.61	NA	504.00	387.00	542.00
3838	49.51	45.50	NA	NA	810.00	523.00	688.00
991	NA	35.41	NA	NA	246.00	181.00	217.00
3553	36.58	32.85	NA	357.00	NA	280.00	374.00
3184	33.53	28.96	NA	314.00	NA	210.00	235.00
3682	40.80	NA	NA	718.00	NA	350.00	493.00
2365	30.17	26.45	NA	145.00	NA	150.00	217.00
3286	32.75	29.19	NA	229.00	NA	230.00	290.00
4105	68.83	NA	NA	1295.00	NA	1089.00	1242.00
4030	65.11	56.11	NA	NA	1514.00	953.00	1269.00
15252	34.98	NA	NA	322.00	NA	253.00	356.00
2974	31.75	NA	NA	198.00	NA	136.00	168.00
13623	34.98	30.92	NA	369.00	NA	234.00	328.00
3805	47.00	41.00	NA	NA	488.00	397.00	490.00
3517	73.11	64.01	86.79	NA	2384.00	1645.00	2023.00
2392	37.75	35.97	NA	485.00	NA	298.00	399.00
5811	56.52	NA	NA	NA	1016.00	686.00	803.00
3523	63.71	NA	NA	NA	633.00	544.00	591.00
3277	40.86	NA	NA	NA	765.00	350.00	490.00
110	46.75	39.53	45.80	NA	509.00	156.00	218.00
3028	NA	26.62	NA	NA	135.00	142.00	142.00
3727	60.00	51.00	55.88	NA	1038.00	711.00	995.00
14405	36.66	32.06	NA	NA	230.00	191.00	255.00
3385	35.97	32.82	NA	321.00	NA	272.00	274.00
1471	34.30	NA	27.00	NA	265.00	249.00	349.00
3070	38.91	33.00	NA	NA	325.00	193.00	270.00
3835	50.42	42.68	46.60	585.00	NA	624.00	728.00
3757	50.42	42.68	46.60	650.00	NA	590.00	676.00
4123	77.30	66.02	NA	NA	1938.00	1350.00	1881.00
13564	45.50	NA	NA	NA	385.00	350.00	515.00
2929	35.94	NA	NA	207.00	NA	145.00	176.00
3139	46.26	43.29	NA	NA	927.00	463.00	917.00
3859	35.35	30.92	NA	696.00	NA	398.00	603.00
3961	70.52	61.52	NA	NA	1848.75	1062.00	1915.00
208	NA	42.59	45.55	NA	443.00	499.00	547.00
3166	36.30	NA	34.86	NA	355.00	434.00	607.00
13561	30.79	NA	NA	NA	245.00	190.00	231.00
3853	51.51	46.94	NA	754.00	NA	544.00	755.00
3661	76.76	67.98	NA	NA	1967.00	982.00	1358.00
205	58.40	54.41	NA	NA	1457.00	1000.00	1170.00
2416	27.81	NA	NA	153.00	NA	180.00	241.00
3610	39.45	35.92	NA	NA	459.00	347.00	390.00
7181	107.50	95.47	NA	NA	3722.00	1924.00	2693.00
14619	29.27	27.64	NA	NA	237.00	154.00	216.00
2647	41.60	NA	36.20	310.00	NA	272.00	420.00
3811	51.51	46.94	NA	1022.00	NA	544.00	644.00
14691	56.00	50.00	NA	1014.00	NA	785.00	1126.00
3742	50.60	NA	45.79	640.00	NA	601.00	699.00
3202	31.48	28.76	NA	291.00	NA	196.00	248.00
4129	77.30	68.43	77.30	2165.00	NA	1200.00	1881.00
4126	77.30	68.43	77.30	2165.00	NA	1200.00	1881.00
2797	NA	NA	37.80	NA	427.00	300.00	407.00

14592	56.94	48.67	NA	NA	843.00	522.00	731.00
3820	60.97	54.01	NA	1148.00	NA	1014.00	1419.00
2671	37.75	35.97	NA	NA	519.00	297.00	399.00
3955	67.29	67.06	NA	1153.00	NA	877.00	1038.00
3850	51.51	46.94	NA	754.00	NA	549.00	738.00
3193	31.48	28.76	NA	288.00	NA	209.00	245.00
3868	55.81	49.08	NA	NA	1000.00	680.00	849.00
3766	69.02	NA	NA	1496.00	NA	1637.00	2304.00
3535	31.48	28.76	NA	398.00	NA	190.00	338.00
3451	57.92	NA	NA	NA	1193.00	889.00	1040.00
3913	NA	NA	69.20	NA	1226.00	1080.00	1257.00
4009	72.12	63.00	67.10	NA	1492.00	961.00	1265.00
115	33.00	NA	NA	239.00	NA	190.00	250.00
3883	56.22	48.52	NA	NA	998.00	717.00	843.00
4093	73.76	70.57	NA	1449.00	NA	1286.00	1581.00
3262	62.17	NA	NA	1185.00	NA	907.00	996.00
14689	46.00	NA	39.15	NA	665.00	375.00	500.00
3733	45.78	NA	NA	585.00	NA	550.00	715.00
4000	39.48	35.82	NA	745.00	NA	329.00	456.00
4006	54.62	49.92	51.08	NA	845.00	580.00	908.00
3160	35.96	NA	28.87	NA	289.00	230.00	257.00
13720	35.36	30.99	NA	426.00	NA	270.00	239.00
3871	55.22	49.08	NA	1017.00	NA	730.00	796.00
4138	115.00	101.56	NA	4401.00	NA	2799.00	3264.00
3892	55.78	49.07	NA	NA	1000.00	680.00	786.00
3898	62.78	56.75	NA	1132.00	NA	742.00	971.00
14690	56.80	48.40	NA	NA	865.00	571.00	800.00
3031	41.30	36.20	NA	267.00	NA	181.00	357.00
3907	53.83	50.78	NA	NA	1110.00	888.00	1033.00
3856	67.30	50.88	NA	NA	1267.00	625.00	818.00
2479	NA	NA	36.20	310.00	NA	272.00	420.00
4042	71.61	67.06	NA	NA	1583.00	1139.00	1366.00
3724	51.51	46.92	NA	779.00	NA	563.00	662.00
28	16.15	NA	NA	132.00	NA	76.00	125.00
3826	51.51	46.94	NA	788.00	NA	567.00	756.00
3979	55.16	49.08	NA	NA	1001.00	680.00	809.00
3832	47.00	41.00	NA	NA	945.00	496.00	694.00
4051	78.00	68.16	78.00	NA	2193.00	1262.00	1862.00
3952	65.33	59.26	NA	NA	1576.00	992.00	1033.00
2806	NA	NA	27.86	148.00	NA	209.00	292.00
3706	31.48	28.76	NA	NA	444.00	206.00	459.00
4114	81.00	73.02	81.00	NA	1529.00	1600.00	1875.00
6347	77.32	66.02	77.40	NA	2165.00	1608.00	1881.00
4039	69.00	61.50	NA	NA	1560.00	974.00	1363.00
6297	62.70	NA	NA	NA	1127.00	865.00	1012.00
3874	50.40	NA	45.79	NA	606.00	600.00	855.00
3937	66.43	NA	NA	NA	1375.00	1041.00	1168.00
3403	64.72	NA	NA	NA	1356.00	1373.00	1488.00
4135	78.63	NA	NA	NA	1125.00	1400.00	2056.00
3919	76.76	67.92	NA	NA	1098.00	1089.00	1402.00
15576	39.53	NA	NA	563.00	NA	215.00	301.00
15662	91.10	76.60	NA	NA	2835.00	1344.00	1881.00
12491	49.50	33.81	NA	NA	395.00	316.00	372.00
14422	45.10	NA	NA	356.00	NA	220.00	310.00
14708	54.25	NA	NA	441.00	NA	220.00	308.00
12262	69.22	59.95	NA	NA	2157.00	1329.00	1860.00
4132	91.90	80.22	NA	NA	3005.00	1800.00	2554.00
4075	79.80	69.25	NA	NA	2109.00	1450.00	1919.00
3775	73.46	65.11	66.42	NA	1730.00	1385.00	1475.00
3946	55.78	49.08	NA	1215.00	NA	680.00	751.00
4027	80.14	63.71	71.92	1157.00	1302.00	1270.00	1348.00
4069	70.01	61.52	NA	NA	1546.00	1089.00	1297.00
3982	55.78	49.07	NA	1001.00	NA	680.00	1062.00
3958	67.52	59.44	NA	1279.00	NA	1090.00	1147.00
4108	68.43	68.27	NA	NA	1274.00	1246.00	1627.00
4012	68.10	59.29	NA	1165.00	NA	1097.00	1304.00
4090	70.72	65.56	NA	1773.00	NA	1202.00	1520.00
4054	69.35	NA	NA	1280.00	NA	1080.00	1273.00
4036	69.49	NA	69.24	NA	1633.00	1043.00	1273.00
4057	69.18	NA	69.34	NA	1589.00	1089.00	1273.00
3904	70.72	65.54	NA	620.00	NA	1202.00	1520.00
3988	73.10	64.01	NA	1645.00	NA	1089.00	1358.00
3916	55.78	49.07	NA	1001.00	NA	680.00	806.00
4003	68.81	61.19	61.33	NA	1552.00	1022.00	1312.00
3934	55.16	49.08	NA	650.00	1013.00	650.00	702.00

3967	67.52	59.70	61.79	990.00	NA	1089.00	1159.00
4096	71.01	63.02	NA	NA	1328.00	1134.00	1480.00
3370	59.30	NA	NA	971.00	918.00	1090.00	1145.00
3577	72.66	NA	NA	1092.00	NA	1542.00	1711.00
12297	78.33	71.63	NA	NA	1771.00	1150.00	1610.00
3643	41.38	36.00	NA	490.00	NA	346.00	460.00
12355	78.33	71.63	NA	NA	1755.00	1150.00	1610.00
4066	70.10	61.52	62.21	NA	1307.00	1089.00	1298.00
3940	52.00	44.91	NA	NA	1004.00	540.00	780.00
3814	60.96	54.01	NA	NA	1116.00	896.00	1118.00
3865	48.15	NA	NA	596.00	NA	750.00	829.00
4084	60.94	54.01	NA	1291.00	NA	896.00	1118.00
4045	71.01	63.02	63.48	1127.00	NA	1089.00	1416.00
3847	55.16	NA	NA	489.00	NA	680.00	808.00
3730	41.75	NA	NA	454.00	NA	339.00	381.00
3994	NA	62.18	NA	1174.00	NA	1089.00	1260.00
3922	60.96	54.01	NA	1306.00	1417.00	906.00	1160.00
4021	71.01	63.02	NA	1127.00	NA	1089.00	1416.00
3928	71.01	NA	NA	NA	1499.00	1134.00	1480.00
3196	32.91	NA	NA	206.00	NA	240.00	276.00
3328	59.86	NA	NA	NA	1365.00	1089.00	1181.00
4018	71.93	63.71	NA	1157.00	1302.00	1199.00	1398.00
4015	NA	70.11	70.10	1174.00	1527.00	1089.00	1161.00
3109	32.91	29.27	NA	227.00	NA	180.00	234.00
15578	79.05	68.15	NA	NA	2042.00	1143.00	1600.00
15600	79.50	NA	NA	NA	2042.00	1177.00	1648.00
15641	79.05	68.15	NA	NA	2042.00	1177.00	1648.00
15661	79.05	68.15	NA	NA	2042.00	1143.00	1600.00
15666	79.50	NA	NA	NA	2042.00	1177.00	1648
15833	79.05	68.15	NA	NA	2042.00	1177.00	1648.00
3586	64.70	NA	NA	NA	1526.00	1270.00	1487.00
3595	61.91	54.56	58.00	NA	1086.00	998.00	1244.00
3970	56.90	NA	NA	NA	1342.00	1073.00	1198.00
3505	64.89	NA	NA	NA	906.00	1089.00	1582.00
3529	68.09	NA	NA	NA	880.00	1089.00	1217.00
6607	76.50	NA	NA	NA	1888.00	1081.00	1750.00
3685	68.58	60.20	64.80	NA	1091.00	1039.00	1287.00
3781	45.73	NA	41.48	496.00	NA	556.00	742.00
3697	68.94	60.71	NA	NA	1835.00	1191.00	1633.00
3010	NA	NA	41.58	NA	650.00	415.00	486.00
3652	78.29	70.57	NA	NA	1640.00	1157.00	1633.00
4063	70.11	61.17	NA	1167.00	NA	1089.00	1275.00
12466	91.00	82.61	NA	NA	2284.00	1500.00	2100.00
4033	69.26	61.15	61.20	1245.00	NA	1148.00	1363.00
3997	67.52	59.70	61.96	1329.00	NA	1089.00	1202.00
3943	66.45	NA	NA	NA	1040.00	1080.00	1161.00
15911	47.50	42.70	NA	NA	855.00	389.00	544.00
9545	89.21	78.08	78.76	NA	2310.00	1500.00	2019.00
13555	89.21	78.08	78.76	NA	2310.00	1442.00	2019.00
14392	77.30	66.45	NA	NA	2058.00	1344.00	1881.00
15623	77.32	68.43	NA	NA	2167.00	1350.00	1881.00
4099	65.40	NA	NA	NA	1557.00	1162.00	1360.00
15622	89.28	75.20	NA	NA	2749.00	1500.00	2000.00
15624	41.00	35.20	NA	563.00	NA	330.00	454.00
15557	60.71	54.00	NA	789.00	NA	523.00	732.00
14964	31.09	25.90	NA	194.00	NA	214.00	299.00
15327	NA	NA	31.09	NA	266.00	215.00	300.00
15556	NA	NA	45.22	452.00	NA	321.00	450.00
15625	57.90	52.40	NA	656.00	1000.00	555.00	650.00
15626	52.68	NA	NA	NA	556.00	416.00	487.00
15675	46.57	40.00	NA	392.00	NA	280.00	350
15674	46.57	40.00	NA	392.00	NA	280.00	350
14604	89.21	78.36	77.82	NA	2450.00	1179.00	2100.00
3772	84.10	74.30	NA	1562.23	2479.00	1777.00	2060.00
3754	84.10	72.10	NA	NA	2505.00	1500.00	2060.00
15665	78.82	73.00	NA	NA	2232.00	1400.00	1529.00
6489	NA	NA	19.78	137.00	NA	91.00	107.00
3112	NA	NA	22.31	194.00	NA	145.00	170.00
670	69.02	61.52	73.46	NA	2019.00	1360.00	2032
3406	67.49	59.70	59.59	NA	1355.00	1089.00	1525.00
3739	69.02	61.50	73.46	NA	2019.00	1360.00	2032.00
1078	72.65	64.47	64.50	NA	1809.00	1361.00	1593.00
3604	68.10	59.29	61.17	1167.00	NA	1089.00	1525.00
4120	76.43	70.10	67.30	NA	996.00	1361.00	1581.00
3745	65.84	61.57	59.77	1231.00	NA	1270.00	1578.00

220	24.20	NA	24.21	125.00	NA	84.00	99.00
2845	NA	NA	21.19	135.00	NA	127.00	149.00
14413	70.52	61.52	62.39	1146.00	NA	894.00	1251.00
3718	76.81	NA	69.49	1498.00	NA	1542.00	1805.00
14968	17.67	NA	NA	68.00	NA	60.00	70.00
3631	71.02	59.34	73.46	NA	2077.00	1814.00	2123.00
3067	24.26	NA	24.27	148.00	163.00	104.00	122.00
15659	22.55	NA	NA	84.00	NA	82.00	115.00
15671	15.11	NA	NA	65.00	NA	45.00	63.00
13491	NA	NA	17.76	NA	128.00	91.00	99
15676	20.72	NA	NA	105.00	NA	91.00	127.00
2662	20.11	NA	20.09	99.00	NA	73.00	102
12905	17.67	NA	NA	64.00	NA	63.00	88
15672	26.82	NA	NA	138.00	NA	136.00	190
14528	15.20	NA	NA	67.00	NA	63.00	88.00
3061	NA	NA	23.72	163.00	NA	129.00	181
15669	14.84	NA	NA	58.00	NA	63.00	65
15673	22.40	NA	NA	77.00	NA	118.00	165.00
14960	62.00	52.02	NA	NA	1396.00	736.00	1030.00
3694	70.01	61.52	NA	NA	1433.00	1089.00	1298.00
3409	65.31	59.26	NA	916.00	NA	998.00	1084.00
3751	58.22	50.91	NA	875.00	NA	925.00	1386.00
3658	68.10	59.29	NA	1163.00	NA	1300.00	1820.00
3283	68.58	62.82	NA	NA	945.00	1089.00	1265.00
3607	69.19	64.32	NA	1110.00	NA	1326.00	1410.00
3649	68.10	59.29	NA	1156.00	NA	1095.00	1145.00
3418	78.42	73.34	NA	958.00	NA	1011.00	1361.00
3232	68.28	62.82	61.30	945.00	NA	1089.00	1265.00
3394	67.26	62.18	59.40	NA	869.00	918.00	1632.00
14961	51.51	46.99	NA	630.46	NA	554.00	775.00
3244	62.17	55.58	60.70	874.00	NA	850.00	1154.00
3691	68.10	59.29	NA	1424.00	NA	1089.00	1260.00
3373	66.45	60.20	NA	971.00	NA	1015.00	1422.00
15630	51.52	47.00	NA	630.00	756.00	597.00	770.00
3508	67.52	59.70	NA	NA	943.00	898.00	1648.00
3538	68.60	NA	NA	1082.00	NA	1047.00	1644.00
9563	51.51	46.99	NA	630.00	NA	600.00	769.00
3415	73.76	70.57	NA	NA	1350.00	1285.00	1506.00
15609	90.10	NA	NA	NA	2700.00	1585.00	2202.00
6483	17.67	NA	NA	77.00	NA	54.00	73.00
13257	20.72	NA	NA	137.00	NA	82.00	115
15941	15.33	NA	NA	41.00	NA	55.00	77.00
15944	79.80	70.65	72.42	NA	2110.00	1235.00	1729
13935	24.44	NA	24.45	117.00	129.00	68.00	95.00
79	19.44	NA	NA	84.00	NA	68.00	95.00
14532	16.45	NA	NA	55.00	NA	54.00	76.00
15991	53.42	47.00	NA	344.00	602.00	204.00	285.00
16113	79.05	68.15	NA	NA	2042.00	1177.00	1648.00
15945	33.55	NA	NA	203.00	NA	91.00	127.00
1513	39.13	NA	36.64	NA	314.00	220.00	305.00
15962	79.05	68.15	NA	NA	2000.00	1177.00	1648.00
16001	17.89	NA	NA	43.00	NA	45.00	63.00
6491	24.07	NA	NA	147.00	NA	118.00	165.00
3058	19.17	NA	NA	70.00	NA	63.00	88.00
14558	NA	NA	23.77	206.00	NA	73.00	102.00