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Uncertainty in Landings Allocation Algorithm at Stock Level is Insignificant

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At the GARM 2008 Data Meeting a working paper was presented describing the new trip-based allocation algorithm for commercial landings (Wigley et al. 2007). This algorithm assigned area fished to dealer landings using a hierarchical matching procedure. Trips that could match Vessel Trip Reports (VTR) exactly were assigned the commercial statistical area reported in the VTR and assigned a matching level of 'A'. Levels B-D were matched less precisely and were assigned a statistical area on a probabilistic basis by sampling (with replacement) the distribution of unique statistical areas within the stratification cell for that level. This uncertainty was examined through the use of a bootstrap procedure and the working paper concluded "An evaluation of the random component of the allocation indicated that the random component did not contribute to wide spreads in stock landings, indicating that the random component is not a large source of stock landings variability." (Wigley et al. 2007). Subsequently, an approximation to estimate the uncertainty in the landings allocation based on the multinomial distribution was developed. This approximation was found to produce confidence intervals quite close to those from the bootstrap, although slightly tighter in most stocks (Wigley et al. in prep). In this working paper, the multinomial approach was used for the three yellowtail stocks and the two haddock stocks for years 1995-2006 to demonstrate that the random component of the landings allocation does not contribute a significant source of uncertainty to the stock assessments, even for small stock components.

Yellowtail flounder have three stocks defined in the Northeast US: Cape Cod-Gulf of Maine (CCGOM), Georges Bank (GB), and Southern New England-Mid Atlantic (SNEMA). Currently, the SNEMA stock is at low abundance and landings are dominated by the GB stock. Application of the multinomial approach to estimating the uncertainty of the landings by stock resulted in quite tight 80% confidence intervals, so tight that they are difficult to distinguish from the point estimate in most years (Figure 1).

Haddock have two stocks defined in the Northeast US: Gulf of Maine (GOM) and Georges Bank (GB). Landings in recent years are dominated by the GB stock. Application of the multinomial approach to estimating the uncertainty of both the GB and GOM haddock landings also resulted in quite tight 80% confidence intervals (Tables 1 and 2). These results are presented in tabular form to demonstrate the increasing uncertainty of landings allocation as the landings allocation algorithm is applied to level A (no uncertainty) to levels B-D (increasing uncertainty), as seen in the increasing CV. However, the amounts of landings in levels B-D are often low, resulting in an overall level of uncertainty that is low for the stock.

We conclude that while the uncertainty in commercial landings due to the random component of the allocation algorithm can be quantified, it is of such a low magnitude that it can be safely ignored in stock assessments.

Literature Cited

Wigley, S.E., P. Hersey and J.E. Palmer. 2007. A Description of the Allocation Procedure applied to the 1994 to present Commercial Landings Data. Working Paper A.1 for the GARM3 Data Meeting. 29 Oct – 2 Nov 2007 Woods Hole.

Wigley, S.E., P. Hersey and J.E. Palmer. In prep. A Description of the Allocation Procedure applied to the 1994 to 2007 Commercial Landings Data. Northeast Fisheries Science Center Reference Document.

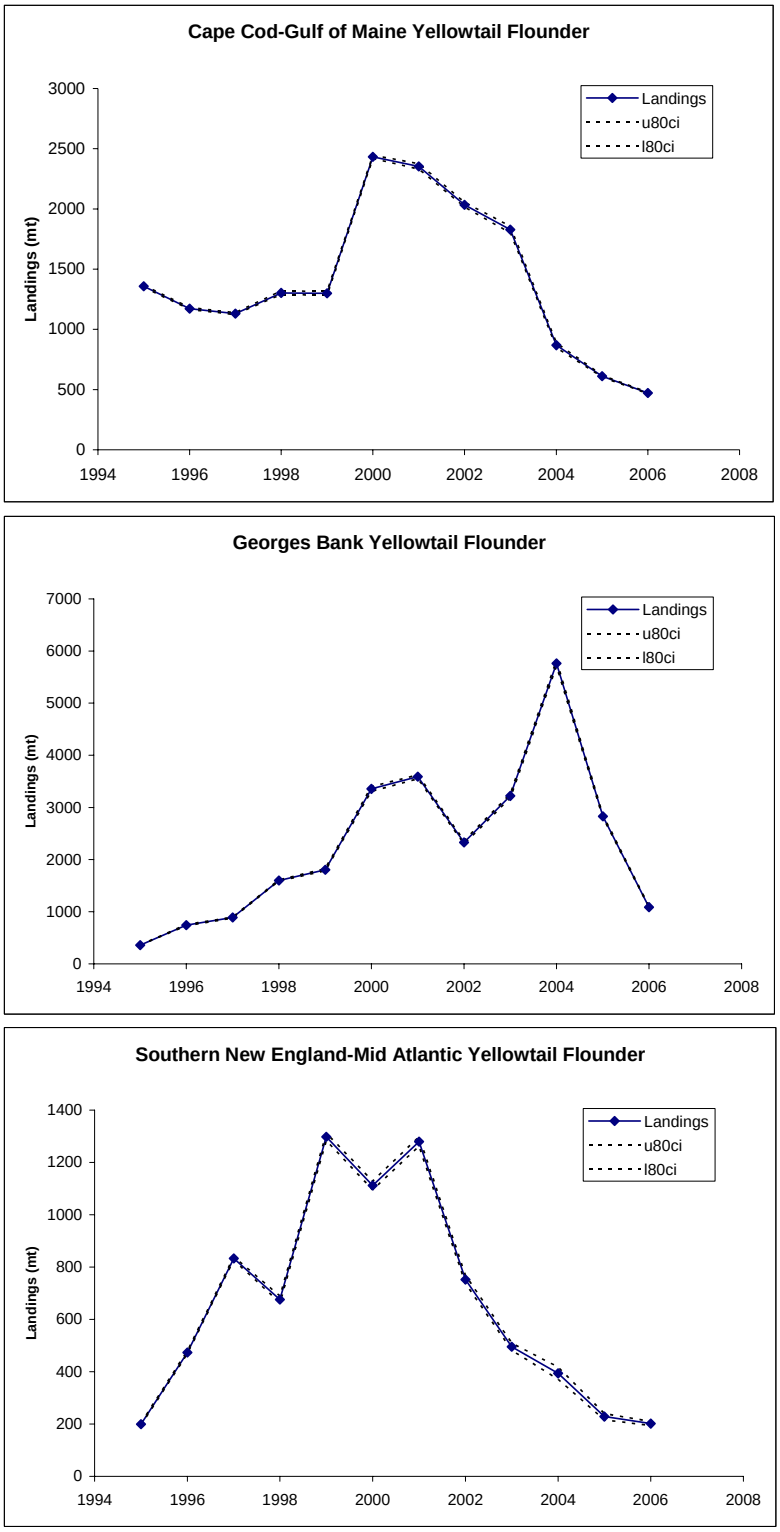

Figure 1. Point estimate and 80% confidence interval for commercial landings of yellowtail flounder for the three stocks based on uncertainty in the landings allocation algorithm.

Table 1. Uncertainty in Georges Bank haddock commercial landings from random component of landings allocation as annual totals and broken down by area level (Alevel) matching criteria.

Year	Stock	Total landings (mt)	Landings assigned from unknown apportionment process (mt)	Stock landings with known areas						Breakdown of stock landings with known areas by Alevel						
				Landings (mt)	Variance	CV	Std. Dev.	Upper 80% CI	Lower 80% CI	Alevel	Landings (mt)	Variance	CV	Std. Dev.	Upper 80% CI	Lower 80% CI
											64.7	0.0	0.00	0.0	64.7	64.7
										A	95.2	0.0	0.00	0.0	95.2	95.2
1994	GB	206.4	1.4	205.0	0.7	0.00	0.8	206.1	203.9	B	31.1	0.4	0.02	0.6	31.9	30.3
										C	13.9	0.3	0.04	0.6	14.6	13.2
										D	0.1	0.0	0.12	0.0	0.1	0.1
											0.1	0.0	0.00	0.0	0.1	0.1
										A	170.6	0.0	0.00	0.0	170.6	170.6
1995	GB	231.4	1.9	229.5	1.0	0.00	1.0	230.8	228.2	B	41.9	0.5	0.02	0.7	42.7	41.0
										C	16.9	0.5	0.04	0.7	17.8	15.9
										D	0.1	0.0	0.40	0.0	0.1	0.0
											0.1	0.0	0.00	0.0	0.1	0.1
										A	238.4	0.0	0.00	0.0	238.4	238.4
1996	GB	320.3	2.9	317.4	1.9	0.00	1.4	319.2	315.6	B	61.3	1.4	0.02	1.2	62.8	59.8
										C	17.6	0.6	0.04	0.8	18.6	16.7
										D	0.1	0.0	0.28	0.0	0.1	0.0
											0.9	0.0	0.00	0.0	0.9	0.9
										A	640.0	0.0	0.00	0.0	640.0	640.0
1997	GB	880.2	1.1	879.0	35.6	0.01	6.0	886.7	871.4	B	169.5	20.2	0.03	4.5	175.3	163.7
										C	68.3	15.4	0.06	3.9	73.4	63.3
										D	0.2	0.0	0.22	0.0	0.3	0.2
											9.8	0.0	0.00	0.0	9.8	9.8
										A	1390.2	0.0	0.00	0.0	1390.2	1390.2
1998	GB	1913.9	4.7	1909.2	135.7	0.01	11.7	1924.1	1894.3	B	394.8	86.5	0.02	9.3	406.7	382.9
										C	113.6	49.2	0.06	7.0	122.6	104.6
										D	0.8	0.1	0.40	0.3	1.2	0.4
											14.0	0.0	0.00	0.0	14.0	14.0
										A	1928.1	0.0	0.00	0.0	1928.1	1928.1
1999	GB	2572.1	28.1	2544.0	396.5	0.01	19.9	2569.5	2518.5	B	519.6	352.9	0.04	18.8	543.7	495.6
										C	81.6	43.5	0.08	6.6	90.1	73.2
										D	0.7	0.1	0.39	0.3	1.1	0.4
											4.2	0.0	0.00	0.0	4.2	4.2
										A	2315.0	0.0	0.00	0.0	2315.0	2315.0
2000	GB	3202.8	3.2	3199.6	740.0	0.01	27.2	3234.5	3164.8	B	776.4	685.3	0.03	26.2	809.9	742.9
										C	103.9	54.7	0.07	7.4	113.4	94.5
										D	0.1	0.0	0.12	0.0	0.1	0.1
											35.0	0.0	0.00	0.0	35.0	35.0
										A	3554.0	0.0	0.00	0.0	3554.0	3554.0
2001	GB	4819.7	17.0	4802.7	1158.9	0.01	34.0	4846.3	4759.2	B	1098.8	1105.2	0.03	33.2	1141.4	1056.3
										C	114.6	53.7	0.06	7.3	124.0	105.2
										D	0.4	0.0	0.21	0.1	0.5	0.3
											15.8	0.0	0.00	0.0	15.8	15.8
										A	4420.8	0.0	0.00	0.0	4420.8	4420.8
2002	GB	6531.8	47.7	6484.0	2057.2	0.01	45.4	6542.1	6426.0	B	1722.8	1681.6	0.02	41.0	1775.3	1670.3
										C	323.4	375.3	0.06	19.4	348.2	298.6
										D	1.2	0.3	0.45	0.5	1.9	0.5
											19.3	0.0	0.00	0.0	19.3	19.3
										A	4191.0	0.0	0.00	0.0	4191.0	4191.0
2003	GB	5759.5	9.6	5749.9	2072.8	0.01	45.5	5808.2	5691.7	B	1196.2	1613.2	0.03	40.2	1247.7	1144.8
										C	341.6	459.3	0.06	21.4	369.0	314.1
										D	1.8	0.3	0.29	0.5	2.5	1.2
											15.3	0.0	0.00	0.0	15.3	15.3
										A	5264.2	0.0	0.00	0.0	5264.2	5264.2
2004	GB	7375.3	135.6	7239.7	2057.0	0.01	45.4	7297.7	7181.6	B	1437.3	1425.4	0.03	37.8	1485.7	1389.0
										C	467.0	592.4	0.05	24.3	498.1	435.8
										D	55.8	39.2	0.11	6.3	63.8	47.8
											0.0					
										A	4755.0	0.0	0.00	0.0	4755.0	4755.0
2005	GB	6603.7	561.0	6042.7	1777.4	0.01	42.2	6096.7	5988.8	B	1039.2	1486.8	0.04	38.6	1088.5	989.8
										C	181.3	199.6	0.08	14.1	199.4	163.2
										D	67.2	91.0	0.14	9.5	79.4	55.0
											1.2	0.0	0.00	0.0	1.2	1.2
										A	1944.1	0.0	0.00	0.0	1944.1	1944.1
2006	GB	2642.8	88.2	2554.6	225.6	0.01	15.0	2573.8	2535.4	B	439.3	152.7	0.03	12.4	455.1	423.5
										C	121.6	36.4	0.05	6.0	129.4	113.9
										D	48.4	36.6	0.12	6.0	56.1	40.6

Table 2. Uncertainty in Gulf of Maine haddock commercial landings from random component of landings allocation as annual totals and broken down by area level (Alevel) matching criteria.

Year	Stock	Total landings (mt)	Landings assigned from unknown apportionment process (mt)	Stock landings with known areas						Breakdown of stock landings with known areas by Alevel						
				Landings (mt)	Variance	CV	Std. Dev.	Upper 80% CI	Lower 80% CI	Alevel	Landings (mt)	Variance	CV	Std. Dev.	Upper 80% CI	Lower 80% CI
1994	GOM	120.1	0.6	119.6	0.7	0.007	0.8	120.6	118.5		47.8					
										A	41.1					
										B	13.8	0.2	0.033	0.4	14.4	13.2
										C	16.8	0.5	0.042	0.7	17.7	15.9
										D	0.0	0.0	0.269	0.0	0.0	0.0
1995	GOM	173.0	1.0	172.0	1.0	0.006	1.0	173.3	170.7		0.6					
										A	109.0					
										B	34.8	0.3	0.016	0.6	35.5	34.1
										C	26.7	0.7	0.032	0.8	27.7	25.6
										D	1.0	0.0	0.152	0.2	1.2	0.8
1996	GOM	246.6	0.5	246.2	2.7	0.007	1.6	248.3	244.1		0.2					
										A	166.1					
										B	44.0	1.3	0.026	1.2	45.5	42.5
										C	34.2	1.3	0.033	1.1	35.7	32.7
										D	1.7	0.1	0.138	0.2	2.0	1.4
1997	GOM	588.6	0.1	588.4	31.9	0.010	5.6	595.7	581.2	A	403.7					
										B	129.5	18.1	0.033	4.3	134.9	124.0
										C	54.0	13.7	0.068	3.7	58.7	49.3
										D	1.3	0.1	0.190	0.2	1.6	1.0
1998	GOM	885.2	2.3	882.9	159.2	0.014	12.6	899.0	866.7	A	607.4					
										B	147.6	32.4	0.039	5.7	154.9	140.3
										C	125.2	126.7	0.090	11.3	139.6	110.7
										D	2.8	0.1	0.126	0.3	3.2	2.3
1999	GOM	542.5	3.8	538.8	38.8	0.012	6.2	546.7	530.8	A	367.4					
										B	127.7	32.5	0.045	5.7	135.0	120.4
										C	43.3	6.3	0.058	2.5	46.5	40.1
										D	0.3	0.0	0.250	0.1	0.4	0.2
2000	GOM	737.9	1.6	736.3	112.3	0.014	10.6	749.9	722.7		0.0					
										A	463.6					
										B	165.2	34.3	0.035	5.9	172.7	157.7
										C	106.8	78.0	0.083	8.8	118.1	95.5
										D	0.7	0.0	0.263	0.2	0.9	0.4
2001	GOM	929.2	2.0	927.2	46.5	0.007	6.8	935.9	918.5		0.8					
										A	681.4					
										B	168.5	23.8	0.029	4.9	174.7	162.3
										C	76.4	22.7	0.062	4.8	82.5	70.3
										D	0.1	0.0	0.183	0.0	0.1	0.1
2002	GOM	976.9	1.5	975.4	46.6	0.007	6.8	984.2	966.7		0.3					
										A	769.7					
										B	116.6	8.1	0.024	2.9	120.3	113.0
										C	88.6	38.4	0.070	6.2	96.6	80.7
										D	0.2	0.0	0.257	0.0	0.2	0.1
2003	GOM	1023.0	5.3	1017.7	93.7	0.010	9.7	1030.1	1005.3		0.4					
										A	705.5					
										B	155.2	37.1	0.039	6.1	163.0	147.4
										C	151.1	54.7	0.049	7.4	160.5	141.6
										D	5.6	1.9	0.249	1.4	7.3	3.8
2004	GOM	946.5	43.7	902.8	151.0	0.014	12.3	918.5	887.1		0.2					
										A	627.9					
										B	152.9	15.5	0.026	3.9	157.9	147.9
										C	113.2	135.3	0.103	11.6	128.1	98.3
										D	8.6	0.2	0.056	0.5	9.2	8.0
2005	GOM	961.5	81.6	879.9	132.5	0.013	11.5	894.6	865.2		0.0					
										A	590.7					
										B	100.5	20.5	0.045	4.5	106.3	94.7
										C	87.8	38.5	0.071	6.2	95.7	79.8
										D	100.9	73.6	0.085	8.6	111.8	89.9
2006	GOM	618.2	32.6	585.6	7.1	0.005	2.7	589.0	582.2		0.4					
										A	456.4					
										B	83.3	3.0	0.021	1.7	85.5	81.1
										C	37.3	3.8	0.052	1.9	39.7	34.8
										D	8.3	0.3	0.071	0.6	9.0	7.5