

# INTERNATIONAL PACIFIC HALIBUT COMMISSION

COMMISSIONERS:  
ROBERT ALVERSON  
SEATTLE, WA  
TED ASSU  
CAMPBELL RIVER, B.C.  
JAMES BALSIGER  
JUNEAU, AK  
LINDA BEHNKEN  
SITKA, AK  
PAUL RYALL  
VANCOUVER, B.C.  
JAKE VANDERHEIDE  
DUNCAN, B.C.

ESTABLISHED BY A CONVENTION BETWEEN CANADA  
AND THE UNITED STATES OF AMERICA

EXECUTIVE DIRECTOR  
DAVID T. WILSON

2320 W. COMMODORE WY, STE 300  
SEATTLE, WA 98199-1287

TELEPHONE:  
(206) 634-1838

FAX:  
(206) 632-2983

EL2017064  
9 May 2017

Agenda Item G.1.a  
IPHC Letter  
June 2017

Mr. Charles A. Tracy  
Executive Director, Pacific Fishery Management Council  
7700 NE Ambassador Place, Suite 101  
Portland, OR 97220-1384

## Re: Council request for IPHC Regulatory Area 2A spatial data for Pacific halibut

Dear Mr. Tracy:

Thank you for your letter dated 29 July 2016, requesting data from the International Pacific Halibut Commission (IPHC) on the spatial distribution of the Pacific halibut exploitable biomass in IPHC Regulatory Area 2A (IPHC's regulatory area offshore of Washington, Oregon, and California) for the June 2017 Pacific Fishery Management Council (PFMC) meeting. The IPHC understands that the PFMC may use this information to inform its consideration of allocations in the Regulatory Area 2A Pacific Halibut Catch Sharing Plan (CSP). With this letter, IPHC is providing our fisheries-independent setline survey data and highlighting the uncertainty in and caveats to using the data for allocation.

As you are aware, the IPHC assesses the Pacific halibut resource as a single coastwide stock ranging from the Bering Sea and Aleutian Islands to California. The distribution extremities of the Pacific halibut resource, such as the southern end of Regulatory Area 2A, have much higher annual variability in stock abundance, reflected through our biomass estimates from year to year, as well as both lower density and more localized distribution of Pacific halibut. This was described in our letter to the PFMC during scoping for this CSP allocation issue ([Agenda Item E.1.a, Supplemental IPHC Report, June 2016](#)). That letter also noted that estimates on smaller scales than the IPHC Regulatory Areas, such as by State, contain further interannual variability and uncertainty.

Recently, the IPHC has developed a space-time modeling approach for our fishery-independent setline survey data that can provide estimates at smaller spatial scales than the IPHC Regulatory Areas, along with estimates of uncertainty, including in years when a region has had no survey coverage. New for 2017, the IPHC is using a space-time model of the fishery-independent setline survey data to improve our estimates of weight per unit effort (WPUE, an index of density) by Regulatory Area, and to provide insights into factors that affect changes in the spatial distribution of Pacific halibut density ([Webster 2017](#)). The modelling has undergone review through the IPHC's Scientific Review Board, and was used by the IPHC for the first time for the 2017 stock distribution modeling process. As with estimates obtained directly from the raw data, we note that any WPUE estimates from the model at small spatial scales (such as for northern California) will be relatively imprecise, with uncertainty increasing as time since the last survey increases.

This letter provides the IPHC's fishery-independent setline survey WPUE data for the period 1998-2016 organized by State boundaries and including the Columbia River subarea shared between Washington and Oregon, as defined in the CSP. This will differ slightly from the information we provided in our June 2016

letter which was organized by the IPHC's charter regions and did not directly correspond to State boundaries. The boundaries used to separate the survey data are:

3 Regions (by State):

- WA - US/Canada border south to Washington/Oregon border (46°16.00' N. lat.)
- OR – south of Washington/Oregon border (46°16.00' N. lat.) and north of Oregon/California Border (42° 00.00' N. lat.)
- CA – south of Oregon/California Border (42° 00.00' N. lat.) to 39° N. lat. only

4 Regions (by State with addition of Columbia River):

- WA - US/Canada border south to Leadbetter Point, WA (46°38.17' N. lat.)
- Columbia River – south of Leadbetter Point, WA (46°38.17' N. lat.) and north of Cape Falcon, OR (45°46.00' N. lat.)
- OR – south of Cape Falcon, OR (45°46.00' N. lat.) and north of Oregon/California Border (42° 00.00' N. lat.)
- CA – south of Oregon/California Border (42° 00.00' N. lat.) to 39° N. lat. only

For estimation purposes, the IPHC currently uses 37° 45' N as the southern limit of the distribution of Pacific halibut: south of that latitude, the density of Pacific halibut is assumed to be zero. However, the IPHC fishery-independent setline survey has only fished as far south at 39°N, and therefore, the space-time model estimates of WPUE only apply for the region north of this latitude. The 37° 45' N limit is based on data from the NMFS annual West Coast trawl survey, which has caught some Pacific halibut between this latitude and 39° N, and we account for this biomass by making an adjustment to the overall Regulatory Area 2A WPUE and bottom area. The data presented here, therefore, exclude a small fraction of Pacific halibut biomass in Regulatory Area 2A between the latitudes of 37° 45' and 39° N. Our survey for 2017 will include new stations in this part of Regulatory Area 2A.

Table 1 and Figure 1 provide the average fishery-independent setline survey WPUE density index from the space-time model by State for the period 1998-2016. Table 2 and Figure 2 provide the average fishery-independent setline survey WPUE from the space-time model by State and Columbia River subarea for the period 1998-2016. Table 3 provides the average fishery-independent setline survey WPUE from the raw survey data by State and Columbia River subarea for the period 1998-2016. Note in particular that the quality of the estimates for California are very poor in years other than those in which the survey took place, as indicated by the wide 95% intervals. In the absence of data, the estimates for California approach the Regulatory Area 2A mean, and are likely not reflective of the underlying density of Pacific halibut in that region.

The survey WPUE (Tables 1 through 3) provides an index of Pacific halibut density that when combined with the ocean bottom area, provides an estimate of the Pacific halibut biomass index.

$$\text{Biomass index} = \text{survey WPUE (lb/skate)} * \text{bottom area (nmi}^2\text{)}$$

Tables 4 and 5 provide the estimated Pacific halibut biomass index (amount and percent) by State and by region, respectively. The bottom area used in the biomass calculations are as follows:

3 Regions (by State) used in Table 4:

- WA – 6,407 nmi<sup>2</sup>
- OR – 7,954 nmi<sup>2</sup>
- CA – 3,153 nmi<sup>2</sup> (OR border to 39° 00.00' N. lat. only)

4 Regions (by State with addition of Columbia River) used in Table 5:

- *WA* – 5,769 nmi<sup>2</sup>
- *Columbia River* – 1,767 nmi<sup>2</sup>
- *OR* – 6,826 nmi<sup>2</sup>
- *CA* – 3,153 nmi<sup>2</sup> (OR border to 39° 00.00' N. lat. only)

As described above for Tables 1 through 3, the quality of the estimates for California are very poor in years where no survey occurred, as indicated by the wide 95%. In the absence of data, the WPUE estimates for California approach the Regulatory Area 2A mean, and are likely not reflective of the underlying biomass of Pacific halibut in that region. The uncertainty in the California WPUE estimates carries over into the biomass share estimates (Tables 4 and 5), not just for California itself, but for other areas since the shares must sum to 100%. Estimates of biomass shares by State (Table 4) and region (Table 5) are all imprecise, although we note the 95% intervals are narrowest in the year with the most complete survey, 2014.

The IPHC looks forward to working with the PFMC to provide the best scientific information available to help inform the PFMC's decision making process. Please do not hesitate to contact us if you require further clarification.

Sincerely,



Dr. David T. Wilson  
Executive Director

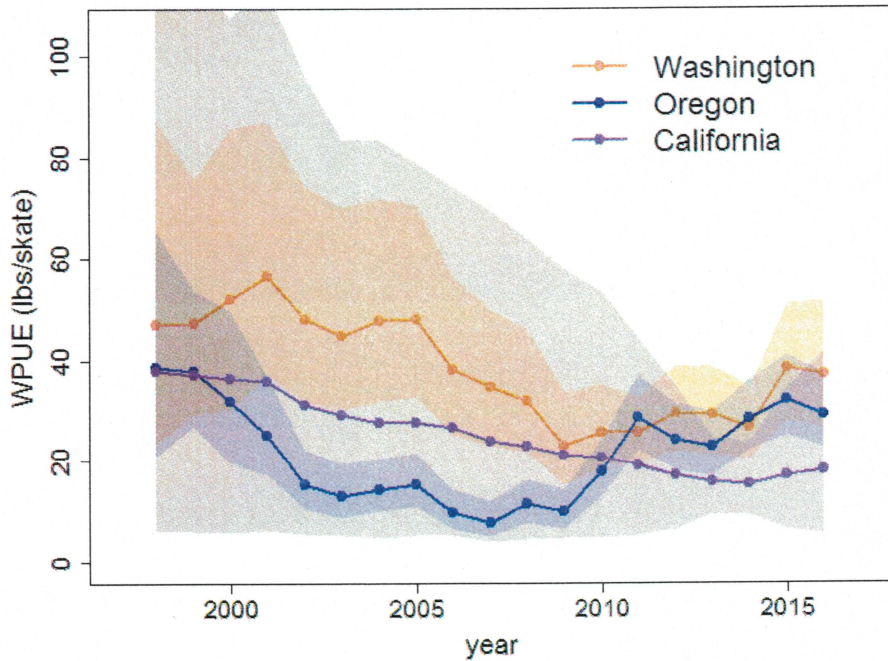
cc: IPHC Commissioners  
Mike Burner, PFMC  
Kelly Ames, PFMC

#### References

Webster, R.A. 2017. Results of space-time modelling of IPHC fishery-independent setline survey WPUE and NPUE data. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2016: 241-257.

**Table 1.** Mean WPUE (lb/skate) by State, along with 95% credible intervals, as estimated by the space-time modelling of IPHC fishery-independent setline survey data in 2016. Values in bold indicate years in which the IPHC survey took place in a State.

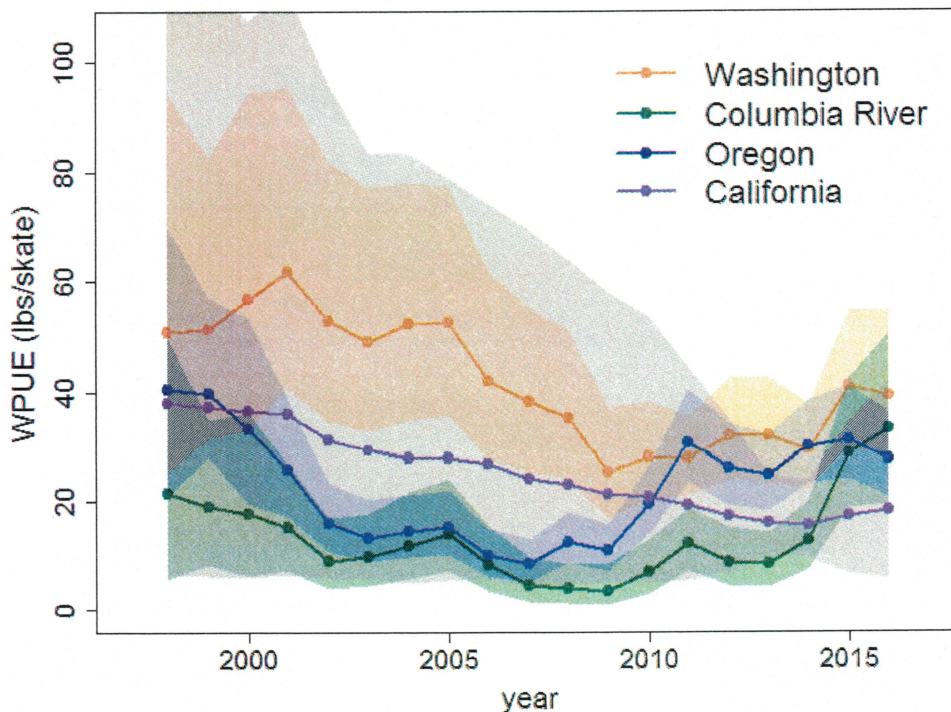
Year	Washington	Oregon	California
1998	47.2 (23.6, 87.2)	38.7 (21.0, 65.5)	38.0 (6.7, 117.5)
1999	<b>47.4 (29.1, 75.7)</b>	<b>37.9 (26.9, 53.9)</b>	37.1 (6.4, 116.1)
2000	52.2 (30.2, 85.7)	32.0 (19.7, 49.8)	36.3 (6.0, 107.6)
2001	<b>56.5 (37.1, 87.0)</b>	<b>25.1 (17.6, 36.9)</b>	36.0 (6.5, 113.4)
2002	<b>48.0 (31.6, 74.3)</b>	<b>15.5 (10.8, 22.3)</b>	31.1 (5.9, 96.0)
2003	<b>44.9 (30.0, 70.1)</b>	<b>13.3 (9.2, 19.4)</b>	29.1 (5.7, 83.4)
2004	<b>47.9 (32.0, 71.7)</b>	<b>14.6 (10.4, 20.5)</b>	27.8 (5.1, 83.3)
2005	<b>48.1 (32.6, 70.6)</b>	<b>15.6 (11.2, 21.7)</b>	27.8 (5.5, 79.0)
2006	<b>38.2 (25.2, 56.2)</b>	<b>10.0 (6.8, 14.6)</b>	26.6 (5.5, 74.2)
2007	<b>34.7 (23.1, 49.8)</b>	<b>8.1 (5.3, 12.3)</b>	23.9 (4.4, 69.4)
2008	<b>32.0 (21.8, 46.2)</b>	<b>11.7 (8.1, 16.6)</b>	22.9 (4.9, 64.0)
2009	<b>22.9 (15.4, 33.6)</b>	<b>10.3 (6.9, 14.5)</b>	21.2 (5.0, 58.1)
2010	<b>25.8 (18.9, 35.2)</b>	<b>18.1 (13.2, 24.1)</b>	20.6 (5.0, 53.6)
2011	<b>25.7 (19.6, 32.7)</b>	<b>28.8 (22.3, 37.2)</b>	19.1 (5.7, 44.3)
2012	<b>29.4 (22.0, 39.0)</b>	<b>24.2 (18.2, 31.5)</b>	17.3 (6.9, 34.9)
2013	<b>29.2 (21.3, 38.7)</b>	<b>23.0 (17.3, 29.8)</b>	<b>16.1 (9.9, 24.8)</b>
2014	<b>26.7 (20.2, 34.6)</b>	<b>28.5 (22.3, 36.2)</b>	<b>15.6 (9.5, 23.6)</b>
2015	<b>38.3 (28.0, 51.1)</b>	<b>32.1 (25.2, 41.1)</b>	17.4 (6.9, 35.6)
2016	<b>37.1 (26.5, 51.5)</b>	<b>29.2 (22.9, 37.4)</b>	18.2 (5.8, 41.6)



**Figure 1.** Mean WPUE (lb/skate) by state (points and lines), along with 95% credible intervals (shaded regions), as estimated by the space-time modelling of IPHC fishery-independent setline survey data in 2016.

**Table 2.** Mean WPUE (lb/skate) by region, along with 95% credible intervals, as estimated by the space-time modelling of IPHC fishery-independent setline survey data in 2016. Values in bold indicate years in which the IPHC survey took place in a region.

Year	Washington	Columbia River	Oregon	California
1998	50.9 (25.2, 94.3)	21.6 (5.9, 49.8)	40.3 (21.1, 63.2)	38.0 (6.7, 117.5)
1999	<b>51.3 (31.3, 82.5)</b>	<b>18.9 (8.3, 34.8)</b>	<b>39.7 (27.9, 57.1)</b>	37.1 (6.4, 116.1)
2000	56.9 (32.8, 94.4)	17.7 (6.3, 36.2)	33.2 (19.6, 53.3)	36.3 (6.0, 107.6)
2001	<b>61.9 (40.5, 95.2)</b>	<b>15.3 (7.4, 26.7)</b>	<b>25.7 (17.2, 38.6)</b>	36.0 (6.5, 113.4)
2002	<b>52.8 (34.4, 82.0)</b>	<b>9.1 (4.0, 16.9)</b>	<b>16.0 (10.9, 23.3)</b>	31.1 (5.9, 96.0)
2003	49.2 (32.7, 77.3)	9.8 (4.5, 17.8)	13.3 (9.0, 20.2)	29.1 (5.7, 83.4)
2004	52.4 (34.7, 78.0)	11.8 (5.8, 21.8)	14.6 (9.9, 21.1)	27.8 (5.1, 83.3)
2005	52.6 (35.6, 77.3)	13.9 (7.2, 23.9)	<b>15.3 (10.3, 22.0)</b>	27.8 (5.5, 79.0)
2006	41.8 (27.5, 61.8)	8.2 (3.5, 15.4)	<b>10.0 (6.4, 15.0)</b>	26.6 (5.5, 74.2)
2007	38.1 (25.3, 55.0)	4.6 (1.6, 9.9)	8.4 (5.3, 13.0)	23.9 (4.4, 69.4)
2008	35.2 (23.9, 51.0)	4.0 (1.3, 8.7)	12.6 (8.7, 17.9)	22.9 (4.9, 64.0)
2009	25.1 (16.8, 37.0)	3.6 (1.1, 8.4)	11.1 (7.3, 15.8)	21.2 (5.0, 58.1)
2010	28.0 (20.4, 38.0)	7.0 (3.0, 13.0)	19.5 (14.1, 26.4)	20.6 (5.0, 53.6)
2011	27.6 (20.9, 35.3)	12.2 (7.3, 18.7)	<b>30.7 (23.4, 40.3)</b>	19.1 (5.7, 44.3)
2012	31.9 (23.7, 42.3)	8.9 (4.5, 15.2)	26.1 (19.3, 34.1)	17.3 (6.9, 34.9)
2013	31.8 (23.2, 42.4)	8.6 (4.4, 14.4)	24.6 (18.3, 32.2)	<b>16.1 (9.9, 24.8)</b>
2014	29.1 (22.0, 37.6)	12.8 (7.6, 20.1)	29.9 (23.2, 38.4)	<b>15.6 (9.5, 23.6)</b>
2015	40.9 (29.8, 54.8)	28.8 (18.7, 42.3)	31.2 (23.9, 40.8)	17.4 (6.9, 35.6)
2016	39.0 (27.7, 54.6)	33.1 (19.6, 50.7)	27.4 (20.7, 36.2)	18.2 (5.8, 41.6)



**Figure 2.** Mean WPUE (lb/skate) by region (points and lines), along with 95% credible intervals (shaded regions), as estimated by the space-time modelling of IPHC fishery-independent setline survey data in 2016.

**Table 3.** Mean IPHC fishery-independent setline survey WPUE (lb/skate), calculated directly from the survey data. Note that trends cannot be reliably inferred from these data due to differences in the numbers of stations fished in each year.

Year	Washington		Columbia River		Oregon		California	
	Mean	N	Mean	N	Mean	N	Mean	N
1998								
1999	50.7	25	12.3	9	34.5	50		
2000								
2001	99.9	25	26.0	9	15.0	50		
2002	80.8	25	5.1	9	14.5	50		
2003	54.5	25	6.7	9	8.5	50		
2004	61.9	25	6.4	9	13.2	50		
2005	71.9	25	10.3	9	9.3	50		
2006	36.8	25	4.6	9	8.0	50		
2007	52.4	25	1.8	9	4.9	50		
2008	40.3	25	2.0	9	10.5	50		
2009	17.0	25	0.6	9	4.9	50		
2010	27.5	25	2.6	9	14.0	50		
2011	26.0	52	8.7	15	22.7	67		
2012	46.2	30	5.0	11	25.7	54		
2013	31.7	30	6.5	11	23.3	55	22.1	15
2014	21.2	53	6.4	15	21.1	67	9.2	27
2015	47.0	30	27.5	11	23.2	55		
2016	37.5	30	23.7	11	26.2	54		

**Table 4.** Estimated share (%) of Regulatory Area 2A biomass north of 39° N by State, along with 95% credible intervals, as estimated by the space-time modelling of IPHC fishery-independent setline survey data in 2016. Values in bold indicate years in which the IPHC survey took place in a State.

Year	Washington	Oregon	California
1998	41.6 (24.3, 60.9)	42.8 (24.8, 62.3)	15.6 (3.4, 39.3)
1999	<b>42.2 (28.1, 56.8)</b>	<b>42.6 (27.8, 56.8)</b>	15.2 (3.3, 37.6)
2000	47.7 (31.1, 64.9)	36.8 (22.3, 52.5)	15.4 (3.1, 37.0)
2001	<b>54.0 (37.7, 68.2)</b>	<b>30.3 (19.1, 42.8)</b>	15.8 (3.5, 38.5)
2002	<b>58.6 (40.6, 74.0)</b>	<b>24.0 (13.9, 35.1)</b>	17.4 (4.4, 41.0)
2003	<b>59.7 (41.2, 75.0)</b>	<b>22.4 (13.1, 32.9)</b>	17.9 (4.3, 40.4)
2004	<b>60.4 (42.5, 75.4)</b>	<b>23.3 (14.5, 34.1)</b>	16.2 (3.6, 39.0)
2005	<b>59.6 (43.4, 72.9)</b>	<b>24.5 (15.3, 35.0)</b>	15.9 (3.9, 37.1)
2006	<b>60.5 (40.8, 75.8)</b>	<b>20.1 (11.9, 30.1)</b>	19.4 (5.0, 43.3)
2007	<b>62.0 (42.1, 77.3)</b>	<b>18.4 (10.4, 27.6)</b>	19.6 (4.8, 44.0)
2008	<b>55.9 (38.8, 70.1)</b>	<b>25.7 (16.3, 36.2)</b>	18.5 (4.9, 40.6)
2009	<b>50.3 (33.2, 65.1)</b>	<b>28.3 (17.2, 39.7)</b>	21.4 (6.7, 45.2)
2010	<b>44.5 (32.4, 55.4)</b>	<b>38.8 (28.0, 49.6)</b>	16.6 (4.8, 35.1)
2011	<b>36.5 (28.1, 44.9)</b>	<b>50.5 (39.6, 60.2)</b>	13.0 (4.2, 26.6)
2012	<b>43.3 (34.6, 52.6)</b>	<b>44.3 (35.7, 53.7)</b>	12.4 (5.4, 22.9)
2013	<b>44.4 (36.0, 53.0)</b>	<b>43.5 (35.4, 52.2)</b>	<b>12.1 (7.7, 17.8)</b>
2014	<b>38.3 (30.6, 46.4)</b>	<b>50.7 (42.7, 58.9)</b>	<b>11.0 (6.9, 16.1)</b>
2015	<b>44.2 (35.6, 53.2)</b>	<b>46.0 (37.6, 54.7)</b>	9.8 (4.2, 17.9)
2016	<b>45.0 (35.2, 55.7)</b>	<b>44.3 (34.7, 53.4)</b>	10.7 (3.7, 22.1)

**Table 5.** Estimated share (%) of Regulatory Area 2A biomass north of 39° by region, along with 95% credible intervals, as estimated by the space-time modelling of IPHC fishery-independent setline survey data in 2016. Values in bold indicate years in which the IPHC survey took place in a region.

Year	Washington	Columbia River	Oregon	California
1998	40.5 (23.3, 59.5)	5.4 (1.6, 12.2)	38.4 (21.4, 57.2)	15.7 (3.4, 39.3)
1999	<b>41.4 (27.3, 56.2)</b>	<b>4.8 (2.0, 9.1)</b>	<b>38.5 (25.0, 52.1)</b>	15.3 (3.4, 37.7)
2000	47.0 (30.5, 64.2)	4.6 (1.5, 9.5)	32.9 (19.4, 48.1)	15.5 (3.1, 37.2)
2001	<b>53.4 (37.1, 67.8)</b>	<b>4.1 (1.9, 7.3)</b>	<b>26.6 (16.4, 38.7)</b>	15.8 (3.6, 38.6)
2002	<b>58.2 (39.8, 73.6)</b>	<b>3.1 (1.3, 6.1)</b>	<b>21.2 (12.2, 31.6)</b>	17.5 (4.4, 41.1)
2003	<b>59.1 (40.5, 74.3)</b>	<b>3.7 (1.6, 7.0)</b>	<b>19.3 (11.2, 29.0)</b>	17.9 (4.3, 40.5)
2004	<b>59.5 (41.7, 74.6)</b>	<b>4.2 (1.9, 7.8)</b>	<b>20.0 (12.3, 30.1)</b>	16.3 (3.6, 39.1)
2005	<b>58.7 (42.4, 71.9)</b>	<b>4.8 (2.3, 8.7)</b>	<b>20.5 (12.5, 29.6)</b>	15.9 (3.9, 37.2)
2006	<b>59.7 (40.3, 75.0)</b>	<b>3.7 (1.4, 7.2)</b>	<b>17.2 (9.8, 26.8)</b>	19.4 (5.0, 43.4)
2007	<b>61.6 (41.6, 77.1)</b>	<b>2.3 (0.7, 5.1)</b>	<b>16.4 (9.1, 25.2)</b>	19.7 (4.8, 44.2)
2008	<b>55.6 (38.7, 70.0)</b>	<b>2.0 (0.6, 4.3)</b>	<b>23.9 (15.0, 33.9)</b>	18.5 (5.0, 40.7)
2009	<b>49.9 (32.8, 64.6)</b>	<b>2.2 (0.6, 5.2)</b>	<b>26.4 (15.8, 37.6)</b>	21.5 (6.7, 45.4)
2010	<b>43.8 (31.7, 54.7)</b>	<b>3.4 (1.4, 6.3)</b>	<b>36.1 (25.5, 46.7)</b>	16.7 (6.7, 45.4)
2011	<b>35.5 (27.3, 43.7)</b>	<b>4.8 (2.8, 7.3)</b>	<b>46.6 (36.3, 56.0)</b>	13.0 (4.3, 26.7)
2012	<b>42.6 (33.9, 52.0)</b>	<b>3.7 (1.9, 6.3)</b>	<b>41.3 (32.6, 50.6)</b>	12.5 (5.4, 23.0)
2013	<b>43.9 (35.6, 52.7)</b>	<b>3.6 (1.8, 6.1)</b>	<b>40.3 (32.3, 49.0)</b>	<b>12.2 (7.8, 17.9)</b>
2014	<b>37.8 (30.2, 45.8)</b>	<b>5.1 (3.0, 8.1)</b>	<b>46.0 (38.0, 54.4)</b>	<b>11.1 (7.0, 16.3)</b>
2015	<b>42.5 (34.1, 51.4)</b>	<b>9.2 (5.8, 13.3)</b>	<b>38.5 (30.6, 46.7)</b>	9.8 (4.2, 17.8)
2016	<b>42.6 (32.9, 53.3)</b>	<b>11.1 (6.6, 16.8)</b>	<b>35.6 (27.1, 44.6)</b>	10.7 (3.7, 22.1)