

SUMMARY REPORT

**STATUS OF WHITE STURGEON
IN THE LOWER FRASER RIVER**

***REPORT ON THE FINDINGS OF THE LOWER FRASER RIVER
WHITE STURGEON MONITORING AND ASSESSMENT PROGRAM
2009***

BY

TROY C. NELSON¹
WILLIAM J. GAZEY²
AND
KARL K. ENGLISH³



FRASER RIVER STURGEON
CONSERVATION SOCIETY

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¹ Fraser River Sturgeon Conservation Society, 300 – 3820 Cessna Drive, Richmond, BC V7B 0A2

² W. J. Gazey Research, 1214 Camas Court, Victoria, BC V8X 4R1

³ LGL Limited environmental research associates, 9768 Second Street, Sidney, BC V8L 3Y8

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EXECUTIVE SUMMARY

The Fraser River Sturgeon Conservation Society (FRSCS), a not-for-profit charitable organization founded in 1997, has a mandate to conserve and restore Fraser River white sturgeon stocks, raise public awareness regarding Fraser River sturgeon and their ecosystem, and gather reliable information on sturgeon and their habitat. This summary report presents updated population and stock status assessments (as of December 2009) for the FRSCS' Lower Fraser River White Sturgeon Monitoring and Assessment Program. For detailed information regarding program background, methodologies, and population modeling, please refer to the 2007 manuscript report (Nelson et al. 2008) available on the FRSCS web site: (<http://www.frasersturgeon.com/research.html>).

Since April 2000, this program has relied greatly on the in-kind efforts and contributions from true stewards of the resource: angling guides, recreational, commercial, and Aboriginal fishermen, test fishery and enforcement personnel, and various fishery monitors. Volunteers from each of these sectors were trained to sample and tag white sturgeon, and record and transfer data. By December 2009, volunteers had tagged and released 42,774 sturgeon, sampled 74,304 sturgeon for the presence of a tag, and documented 26,523 recapture events of tags applied under the FRSCS program.

A descriptive population model has been developed to provide reliable estimates of the population of white sturgeon in the lower Fraser River, by size/age group and location, based on tag release and recapture. The population component of the model considers tag distribution and seasonal mixing, and is sensitive to estimates of mortality, emigration, and observer error. The model also describes patterns of inter- and intra-annual movements by size/age group.

As of January 2009, the population estimate for white sturgeon (from 40-260 cm fork length) in the lower Fraser River was 43,628. This mean population estimate represents a population decrease of 4.9% from the previous (2008) estimate, and a 24.9% decrease from the 2003 mean estimate. Comparative population estimates of the numbers of sturgeon before and after January 2003 strongly suggest a decrease in the overall population of lower Fraser sturgeon, with the greatest decreases occurring for sturgeon less than 100 cm fork length). These estimates also suggest that, since 2001, the abundance of sturgeon over 160 cm fork length (sexually mature sturgeon) has increased and remained relatively stable since 2007. Note that the population estimates for 2001, 2002, and 2003 presented in this summary report were updated from previous years' reports; the changes are a result of the application of the current analytical process (used since 2004) to the previous years' data.

Comparisons of the proportion of juvenile sturgeon captured by angling only and by the Albion Test Fishery (an independent program that utilizes drift gill net gear) over time also suggests that the overall abundance of juvenile white sturgeon has been decreasing since approximately 2003. Recaptures of tagged sturgeon during this study confirm that movements and migrations occur throughout the entire lower Fraser River study area. Multiple capture events for individual tagged sturgeon can occur on an annual basis.

A comparison of average annual growth rates, determined from measurements obtained from individual tagged sturgeon that were subsequently recaptured and re-measured, suggests that annual growth rates for most size groups of white sturgeon were greater before 2005 than after 2005. For 2009, average annual growth rates dropped below respective 2008 growth rates for all size groups below 160 cm FL.



TABLES



Table 1. Sampling zones used for population estimation of white sturgeon, 2008-2009.

Zone	River Km	From	To
S*	1-26	Georgia Strait	Eastern Annacis Island
3, 5**	26-56.5 & P0-P4	Eastern Annacis Island	Albion Ferry Crossing
6	56.5-79	Albion Ferry Crossing	Mission Bridge
8	79-94	Mission Bridge	Mouth of Sumas River
10	H0-H19	Confluence Fraser River	Outlet of Harrison Lake
12	94-123	Mouth of Sumas River	Agassiz Bridge
13	123-159	Agassiz Bridge	Hwy 1 Bridge (Hope)
14	159-187	Hwy 1 Bridge (Hope)	Lady Franklin Rock (Yale)

* Zone S is the Main (South) Arm including Canoe Pass; from Figure 3 this is zone 2S and zone 2C

** Zone 5 includes the lower 4 kms of the Pitt River, from the Fraser mainstem to the Hwy 7 Bridge

Table 2. Sampling regions used for population estimates of white sturgeon, 2008-2009.

Region	Zones	Description
A	S	Georgia Strait to Eastern Annacis Island (South Arm of Fraser)
B	3-5, 6	Eastern Annacis Island to Mission Bridge
C	8, 10, 12, 13	Mission Bridge to Hope including the Harrison River
D	14	Hwy 1 Bridge (Hope) to Lady Franklin Rock (Yale)

Table 3. Parameter estimates for linear and non-linear sturgeon growth models (2008-2009).

Parameter	Estimate	Std Error	R ²
<u>Linear</u>			
Daily Increment	8.212E-03	4.100E-04	0.158
<u>Non-Linear von-Bertalanffy</u>			
L _∞	532.6	15.8	
g	2.076E-05	1.003E-06	

Table 4. Population estimates for white sturgeon in the Lower Fraser River, by sampling region, 2009.

Sampling Region			Zone Codes	Mean	95% HPD ¹		Std. Dev
From	To	Low			High		
A	Georgia Strait	East Annacis Is.	S	7,031	5,100	9,180	1,054
B	East Annacis Is.	Mission Br.	3 to 6	15,883	14,690	17,110	615
C	Mission Br.	Hwy 1 Br. (Hope)	8 to 13	18,962	18,240	19,690	367
D	Hwy 1 Br. (Hope)	Yale	14	1,752	1,475	2,047	147
Total				43,628	41,114	46,142	1,283

¹ HPD - Highest Probability Density . See Nelson et al. 2004 for explanation of this statistic.

Table 5. Population estimates for white sturgeon in the Lower Fraser River, by 20-cm size class, 2009. Estimates scaled to the mean total estimate (see Table 4).

Size Class (cm)	Scaled MLE ¹	Percent	HPD ² (percent)		CV ³ (%)
			Low	High	
40-59	2,211	5.1	4.3	6.0	8.4
60-79	6,395	14.7	12.8	16.9	7.0
80-99	9,266	21.2	19.5	23.2	4.5
100-119	7,369	16.9	15.6	18.4	4.2
120-139	5,735	13.1	12.0	14.5	4.7
140-159	3,960	9.1	8.3	10.0	4.7
160-179	2,954	6.8	6.1	7.6	5.8
180-199	2,063	4.7	4.1	5.5	7.6
200-219	1,328	3.0	2.5	3.8	11.4
220-239	1,583	3.6	2.3	6.3	26.3
240-259	482	1.1	0.7	2.0	27.8
260-279	282	0.6	0.2	4.7	94
Total	43,628	100.0			2.2

¹ MLE - Maximum Likelihood Estimate

² HPD - Highest Probability Density

³ CV - Coefficient of Variation

Table 6. Summary of changes in the annual population estimates, and respective proportional (percent) changes, of white sturgeon in the lower Fraser River, 2001-2009, and respective changes since 2003.

Population Assessment Year:	2001	2002	2003	2004	2005	2006	2007*	2008	2009
Mean (Annual) Population Estimate:	48,136	47,432	58,090	56,268	49,955	46,957	46,108	45,896	43,628
Change (No. Sturgeon) from previous (annual) estimate:	-	-704	10,658	-1,822	-6,313	-2,998	-849	-212	-2,268
Percent change from previous (annual) estimate:	-	-1.5%	22.5%	-3.1%	-11.2%	-6.0%	-1.8%	-0.5%	-4.9%
Change (No. Sturgeon) from 2003 estimate:	-	-	-	-1,822	-8,135	-11,133	-11,982	-12,194	-14,462
Percent change from 2003 estimate:	-	-	-	-3.1%	-14.0%	-19.2%	-20.6%	-21.0%	-24.9%

FIGURES



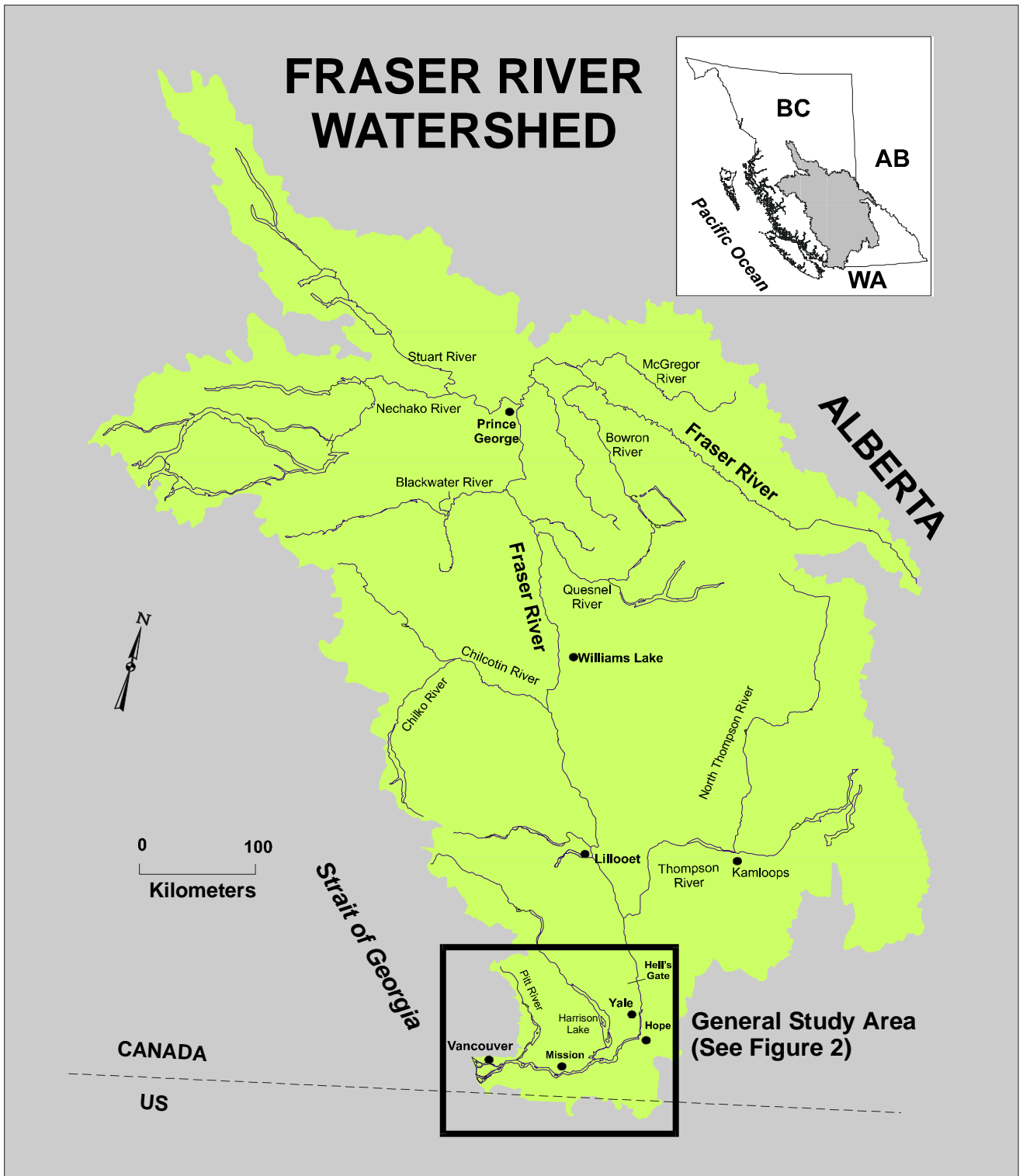


Figure 1. Map of the Fraser River watershed and its location in BC, and the general study area for the Lower Fraser River White Sturgeon Monitoring and Assessment Program 1999-2009.

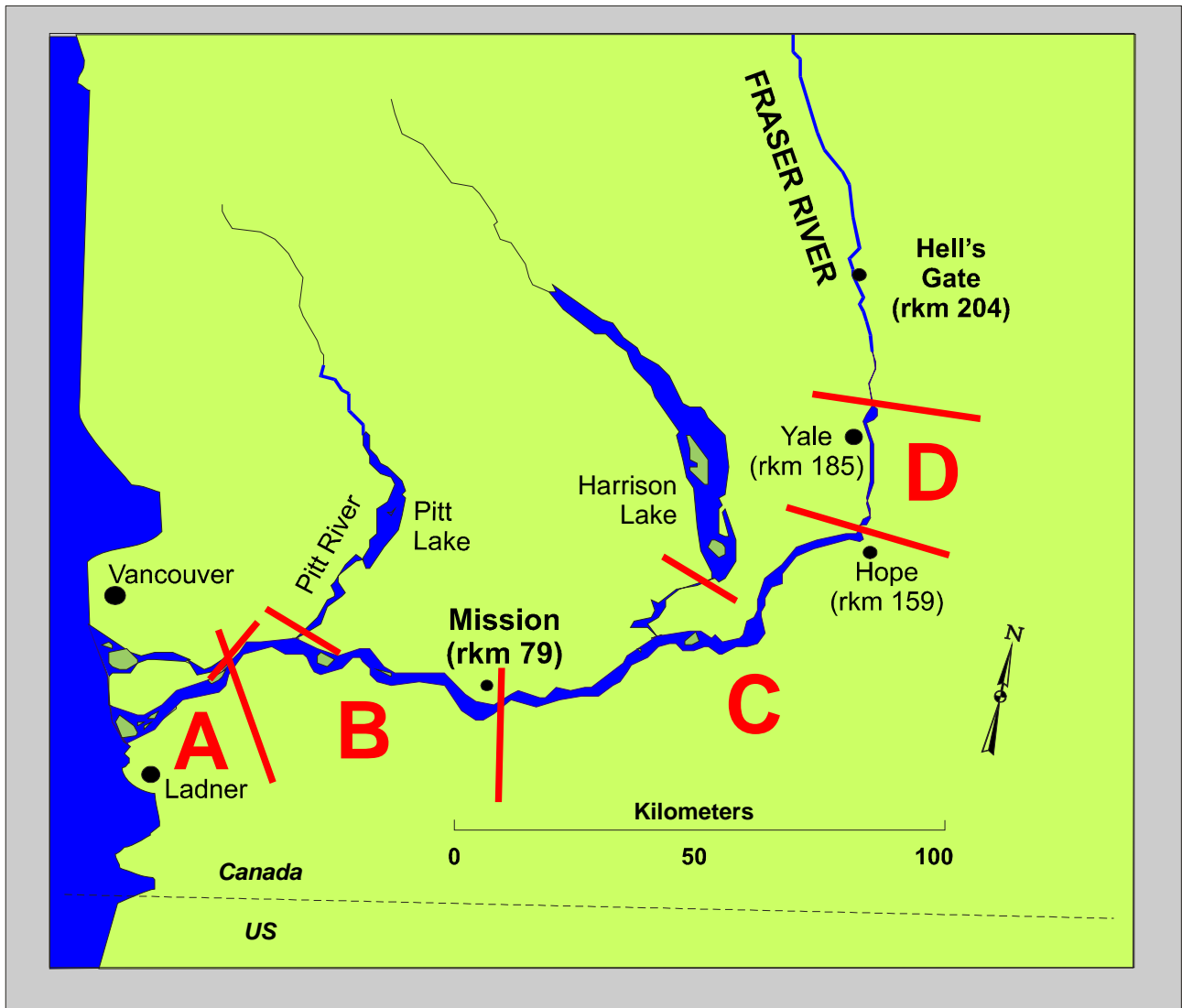


Figure 2. Illustration of the general study area and the location of the four main sampling regions (A, B, C, and D) used for data summaries presented in this report. See Table 2 for a description of the boundaries for each sampling region.

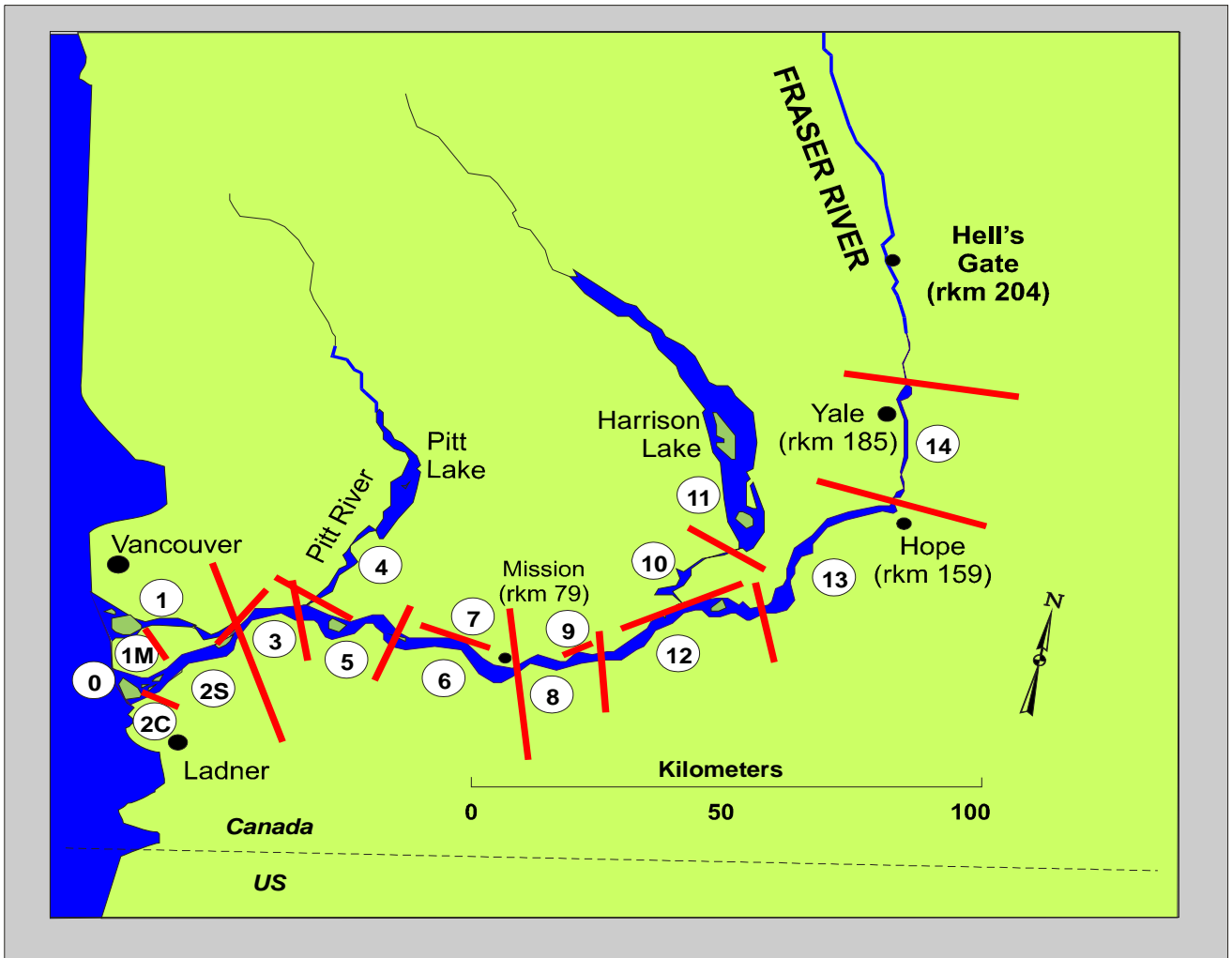


Figure 3. Locations of sampling zones used for data summaries during the Lower Fraser River White Sturgeon Monitoring and Assessment Program 1999-2009.

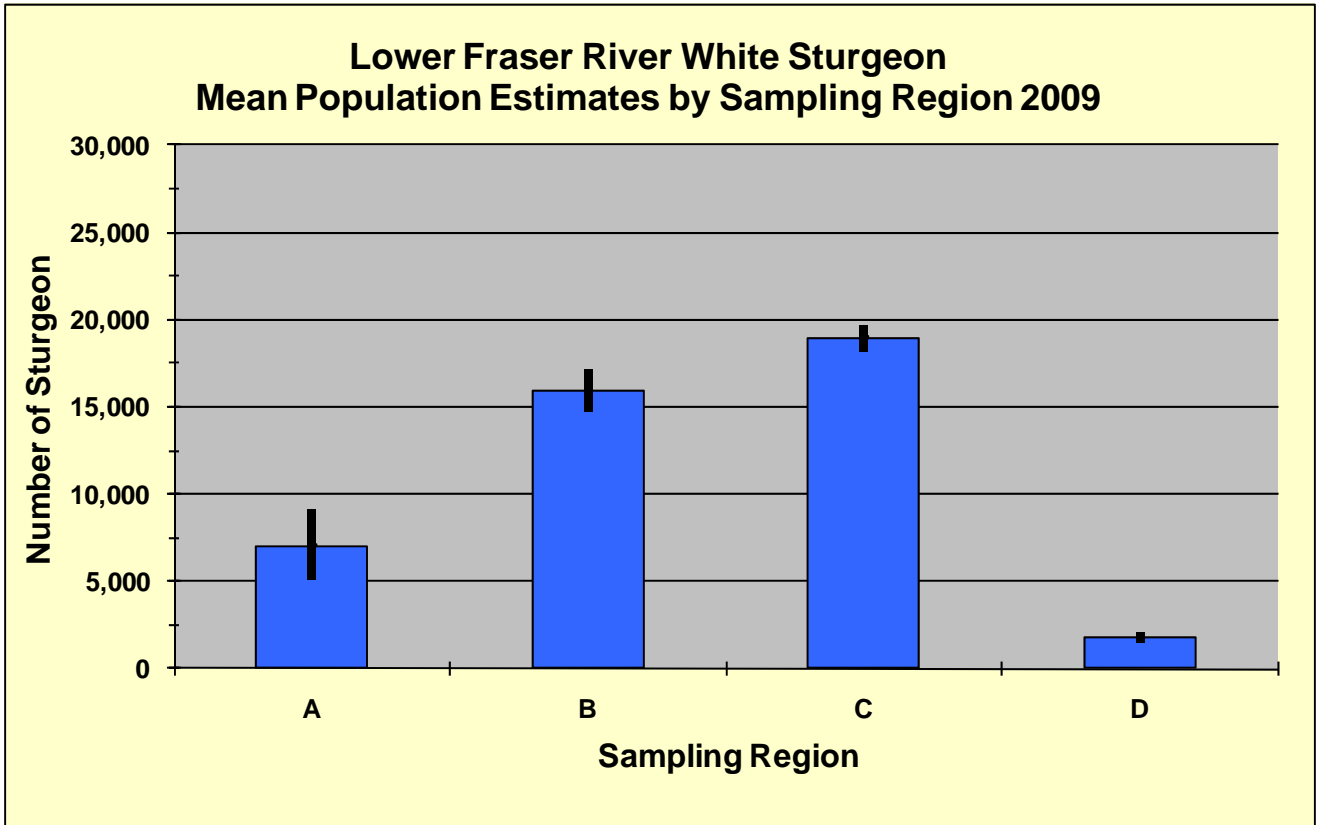


Figure 4. Mean population estimates of white sturgeon in the lower Fraser River, by sampling region, 2009 (see Table 4). Ranges show the 95% Highest Probability Density.

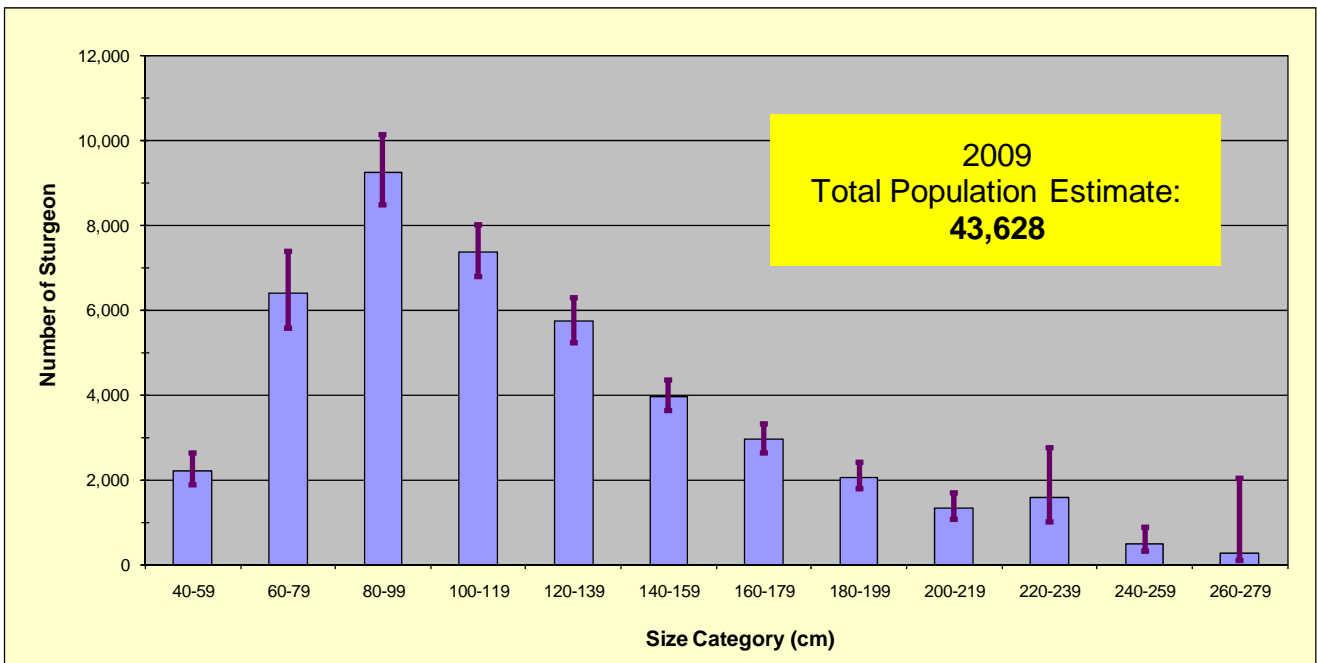
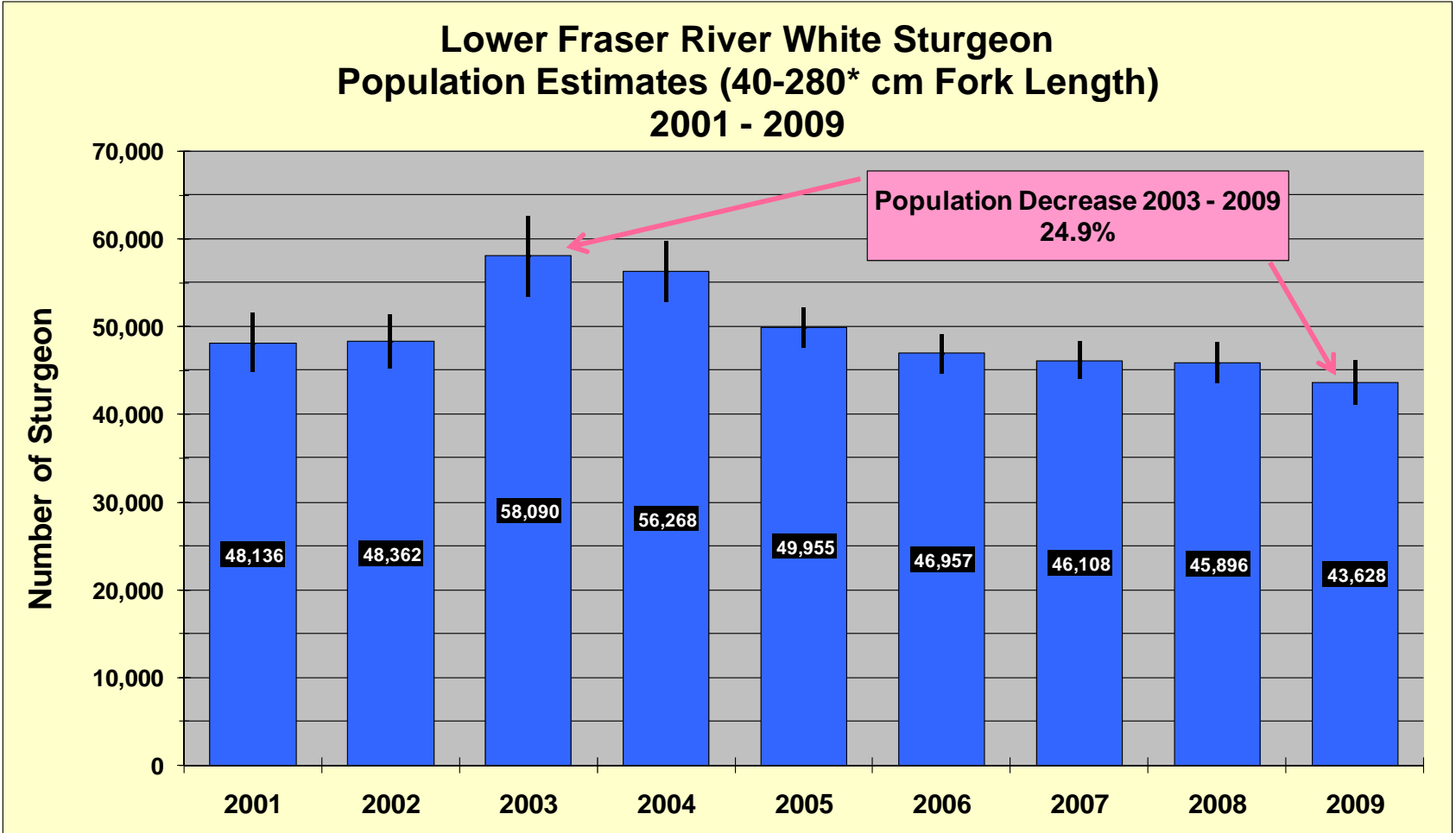


Figure 5. Mean population estimates of white sturgeon in the lower Fraser River, by 20-cm size, 2009. Ranges show the 95% Highest Probability Density. All sampling regions are combined for this analysis.



* The 2001-2004 estimates do not include fish over 239 cm FL; see Figure 7.

Figure 6. Comparison of mean annual population estimates of lower Fraser River white sturgeon, 1999-2009. Confidence ranges show the 95% Highest Probability Density. All sampling regions are combined for this analysis.

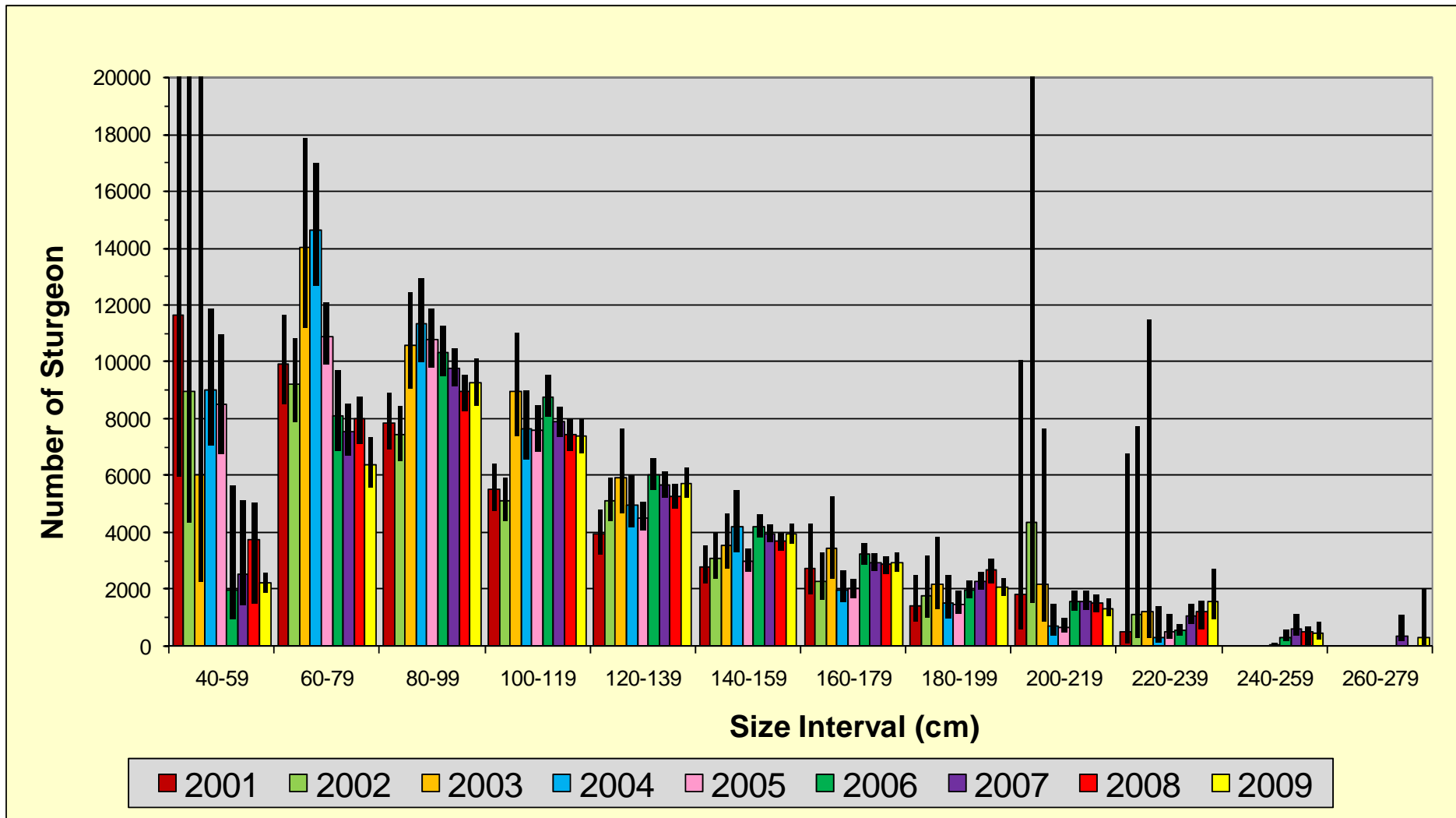


Figure 7. Comparison of mean population estimates of white sturgeon in the lower Fraser River, by 20-cm size category, for assessment years 2001 through 2009. Ranges show the 95% Highest Probability Density.

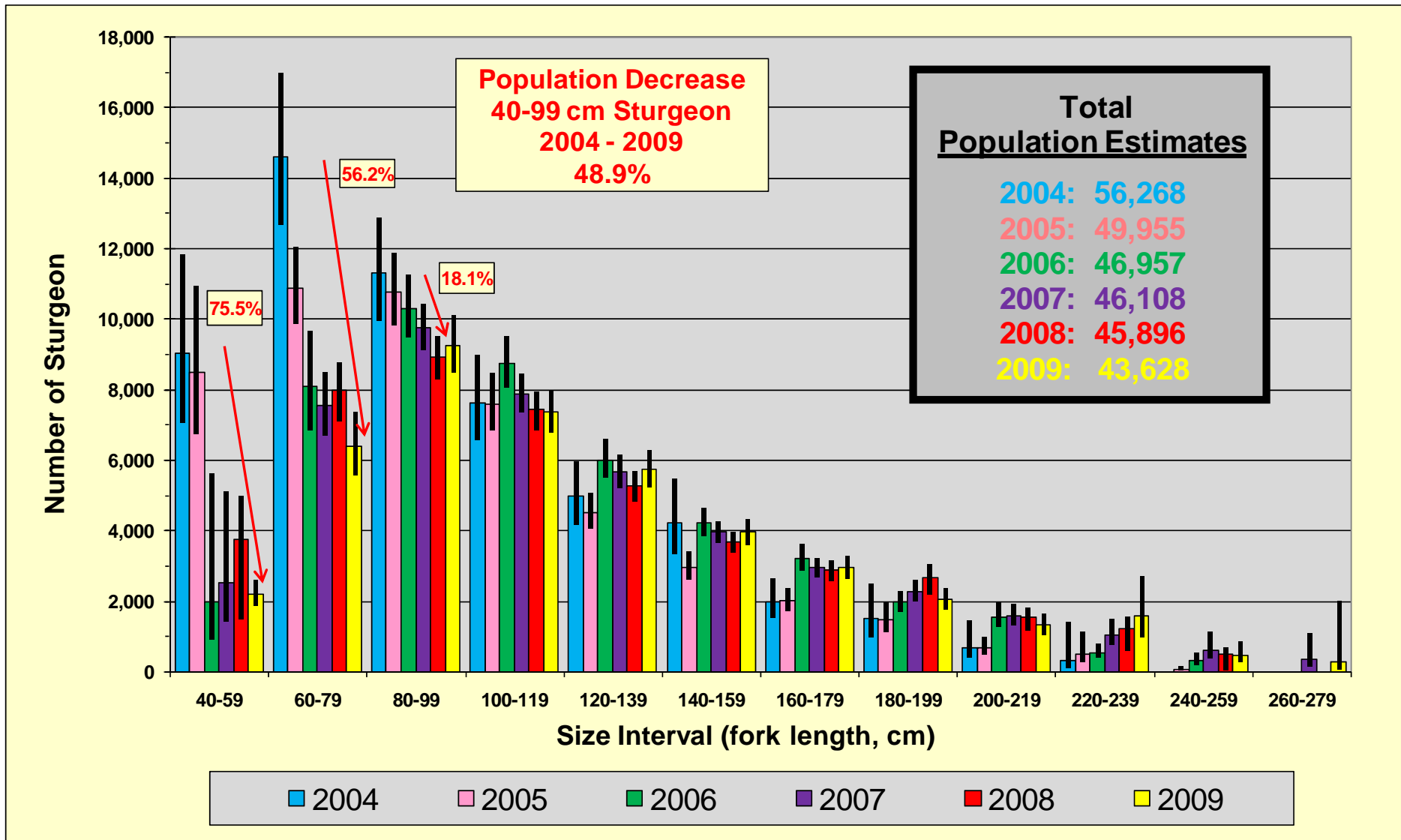


Figure 8. Comparison of mean population estimates of white sturgeon in the lower Fraser River, by 20-cm size category, for assessment years 2004 through 2009. Ranges show the 95% Highest Probability Density.

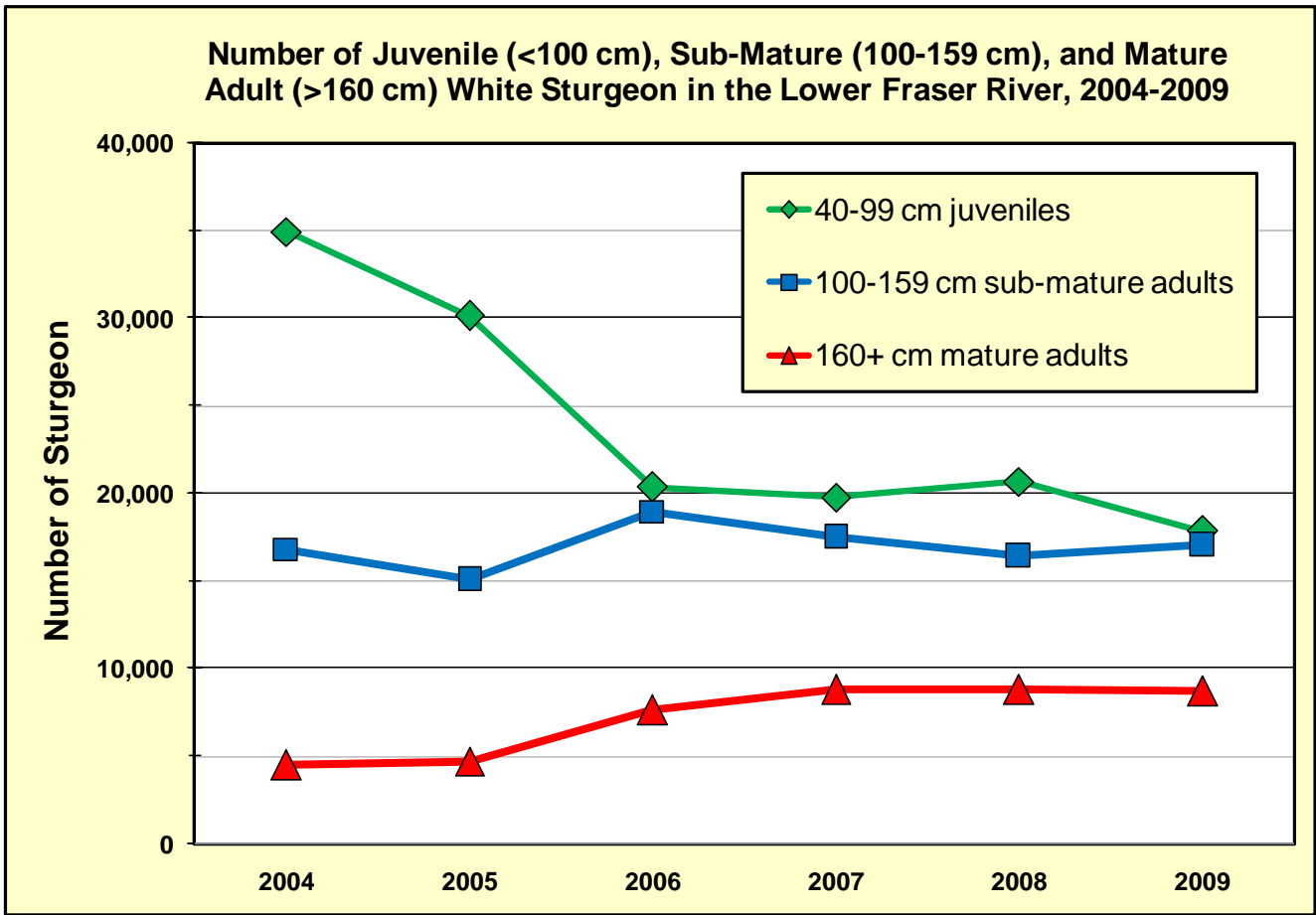


Figure 9. Comparison of the number of juvenile sturgeon (40-99 cm), sub-mature sturgeon (100-159 cm), and mature adult sturgeon (>160 cm fork length) in the lower Fraser River, 2004-2009.

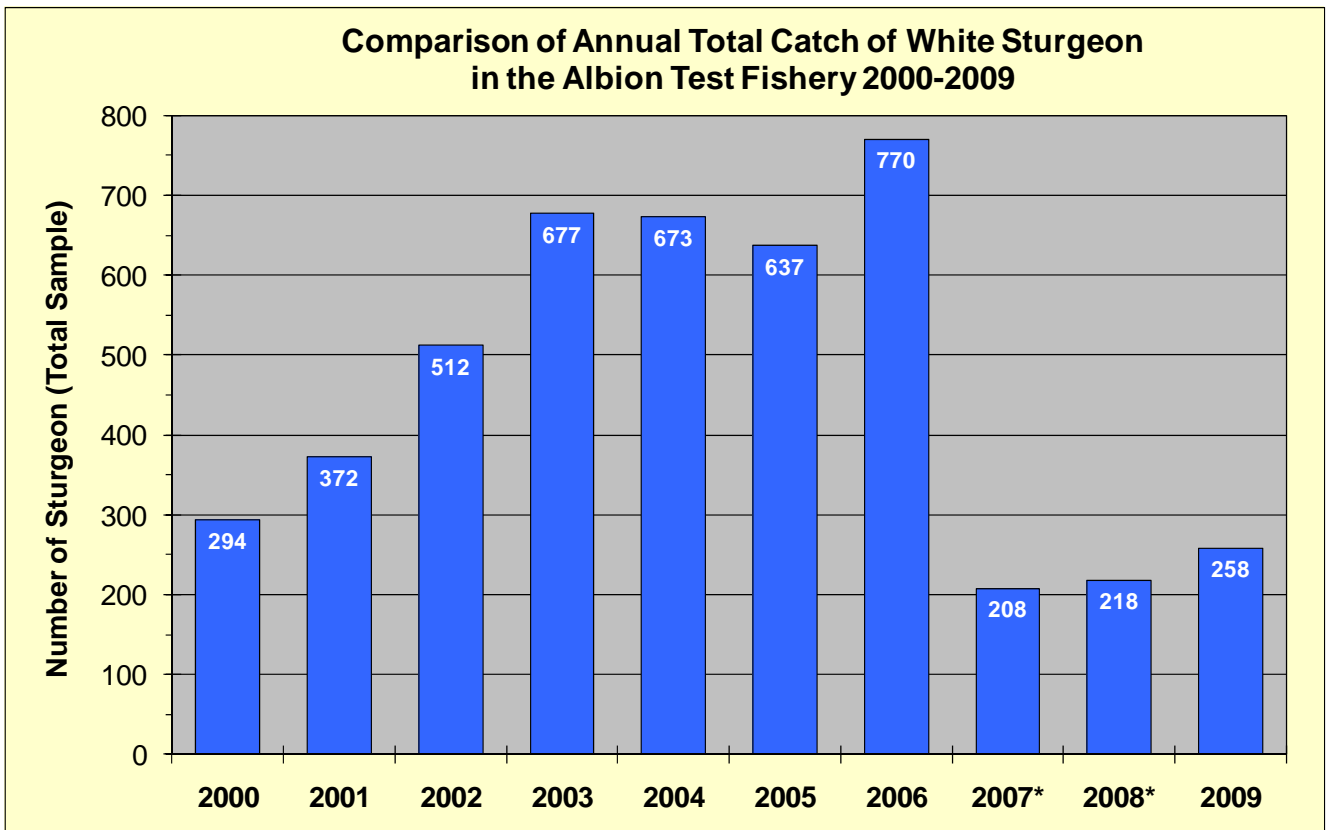


Figure 10. Comparison of the number of white sturgeon (all sizes) captured in the Albion Test Fishery, in 2000-2009. The Albion Test Fishery (a test gill net) applies relatively similar levels of effort (two 20-min sets during high slack tide) on a daily basis from April-November at the same location (sampling region B, rkm 58) in the mainstem Fraser River.

* In 2007 the test fishery operated from 18 June through 30 November; in 2008 the test fishery operated from 5 May through 30 November.

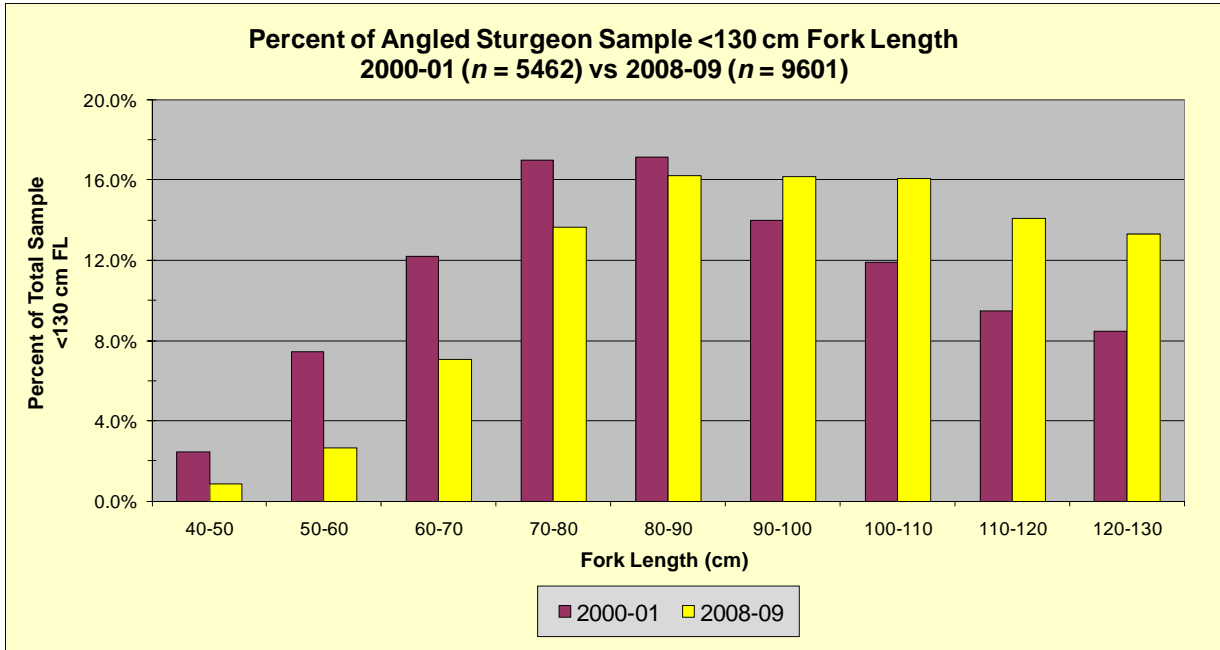


Figure 11. Illustration of the comparative percentages of sampled sturgeon less than 130 cm FL, by 10-cm size groups, captured by angling in 2000-01 and 2008-09.

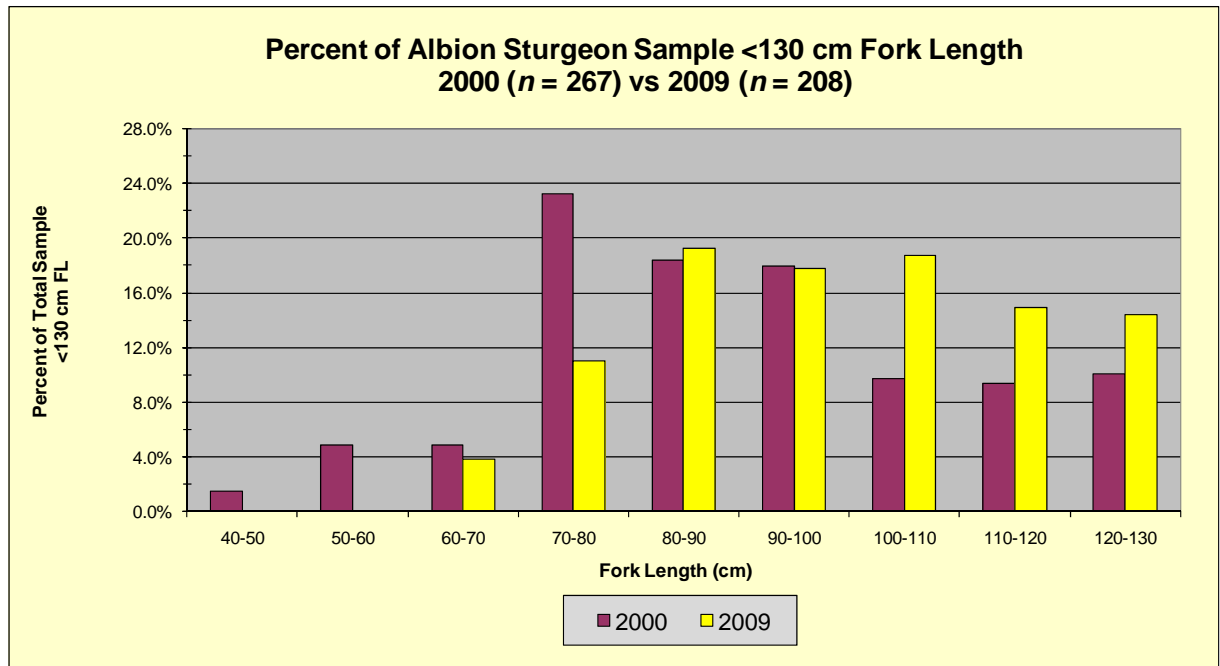


Figure 12. Illustration of the comparative percentages of sampled sturgeon less than 130 cm FL, by 10-cm size groups, captured in the Albion Test Fishery in 2000 and 2009.

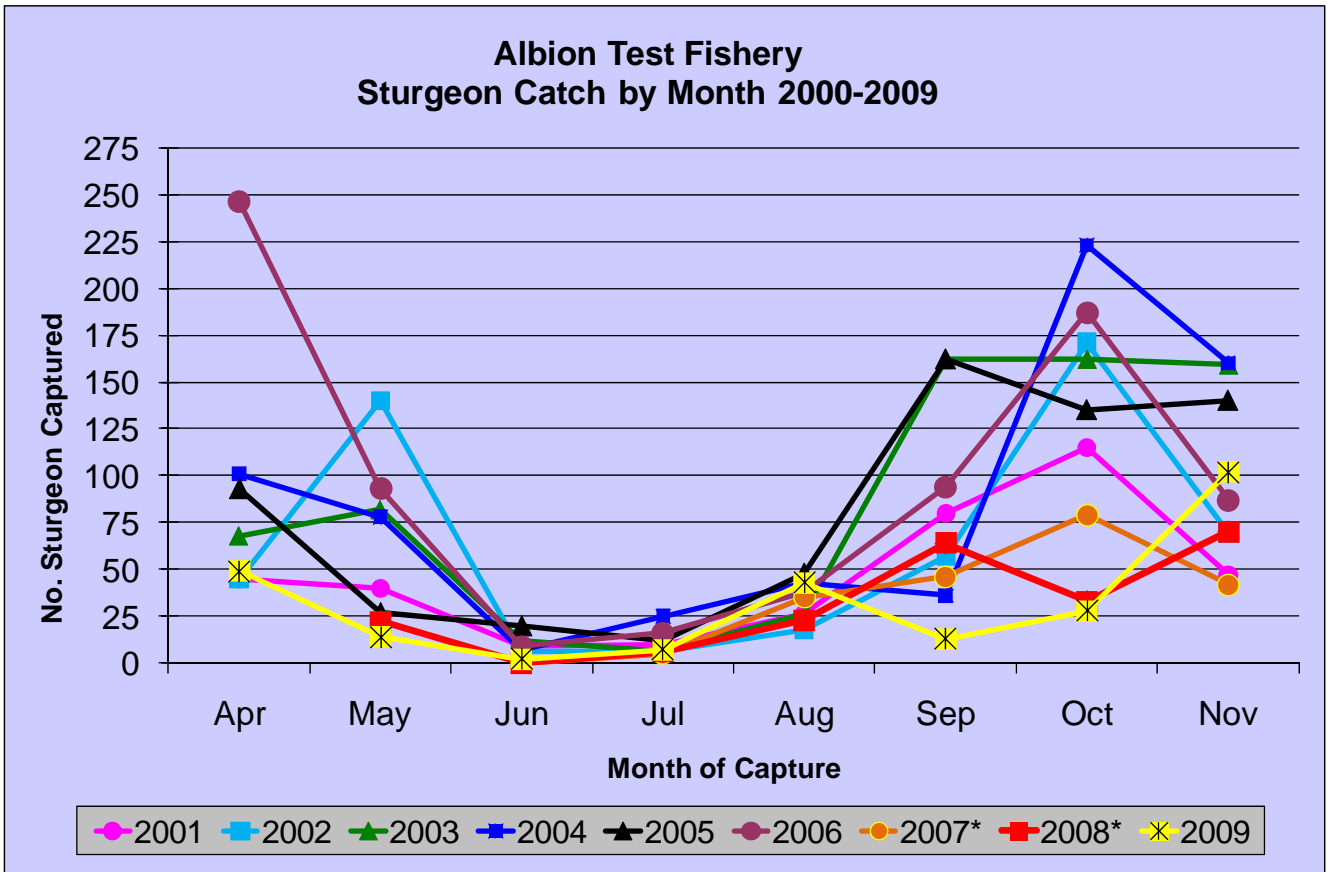


Figure 13. Comparison of the number of white sturgeon (all sizes) captured in the Albion Test Fishery, by like month, in 2000-2009. The Albion Test Fishery (a test gill net) applies relatively similar levels of effort (two 20-min sets during high slack tide) on a daily basis from April-November at the same location (sampling region B, rkm 58) in the mainstem Fraser River.

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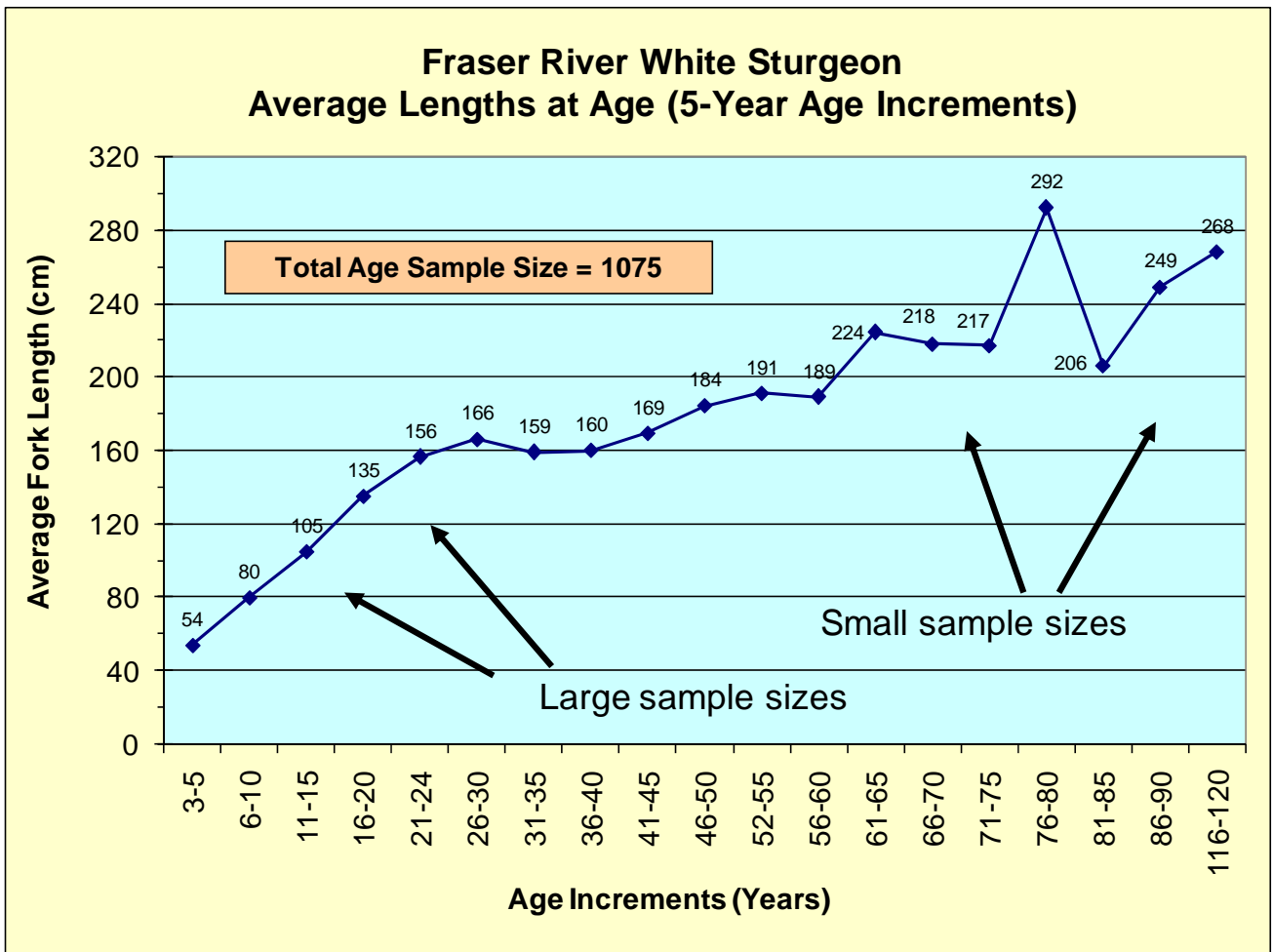


Figure 14. Average lengths at estimated age for Fraser River white sturgeon sampled from 1995-99 (data provided by Ted Down, BC Fisheries). Age data were derived from pectoral fin ray analysis and include samples from throughout the Fraser River watershed.

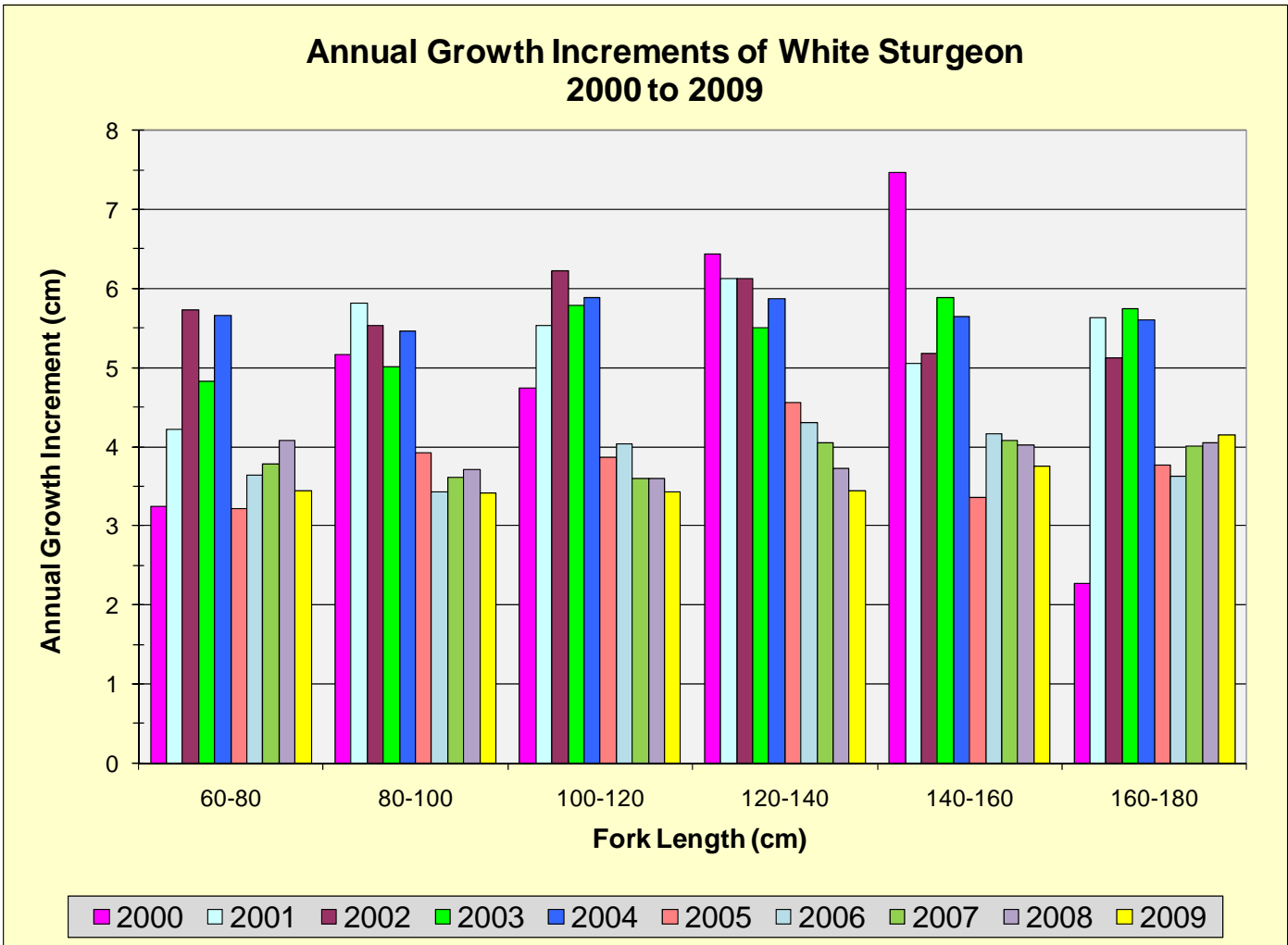


Figure 15. Comparison of average annual growth increments of white sturgeon (cm), by 20-cm size groups, from 2000 through 2009. Annual growth was determined from measurements obtained from individual, tagged sturgeon that were subsequently recaptured.

APPENDIX A

Sturgeon biosampling, tagging, and recapture data entry form



Name/Phone Number of Person that Recorded Data: _____

Phone No: _____

Date (dd/mmm/yy) _____ Sampling Area: _____ Weather: _____ No. Passengers: _____

Vessel Information: Vessel Name _____ Launch Location _____ Launch Time: _____ Return Time: _____

Angling/Sampling Effort	Start Time	End Time	Total Minutes	Start Time	End Time	Total Minutes	Start Time	End Time	Total Minutes	Grand Total (Minutes)
Rod/Gear 1 (Name) _____										
Rod/Gear 2 (Name) _____										
Rod/Gear 3 (Name) _____										
Rod/Gear 4 (Name) _____										

COMPLETE FOR ALL STURGEON CAPTURED

TAGS APPLIED

RECAPTURES

tn2OTHER

Fish No.	River Km (Captured)	Was the Sturgeon Scanned? (Yes/No)	Fork Length (cm)	Girth (cm)	Deformity / Wound Code ¹	Verified (Scanned at release) Tag Number	Tag Number	Condition code for sturgeon at release ²	Comments

Comments:

¹Deformity/wound/scar codes: DEF = physical deformity; BLED = bleeding; BITE = seal bite; CUT = slice or tear; NET = net scar; OTHER = other (note in comments)

²Condition codes: 1 = vigorous, no bleeding; 2 = vigorous, bleeding; 3 = lethargic, no bleeding; 4 = lethargic, bleeding; 5 = dead

APPENDIX B

**Lower Fraser River sturgeon sampling, tagging, and recapture summary,
by month and year, 1999-2008**



Appendix B. Lower Fraser River sturgeon sampling, tagging, and recapture summary, by month and year, 1999-2009.

Month	No. Scanned (All)	No. Released With Tag	No. Scanned, Not Tagged, Not Recaptured	No. Recaptured (Head Tag)	Mark Rate (%)	Year	No. Scanned (All)	No. Released With Tag	No. Scanned, Not Tagged, Not Recaptured	No. Recaptured (Head Tag)	Mark Rate (%)
Oct-99	96	89	7	0	0.0%						
Nov-99	206	182	24	0	0.0%						
Dec-99	157	143	14	0	0.0%	1999	459	414	45	0	0.0%
Jan-00	38	37	1	0	0.0%						
Feb-00	148	135	6	7	4.7%						
Mar-00	232	191	33	8	3.4%						
Apr-00	286	265	12	9	3.1%						
May-00	380	351	17	12	3.2%						
Jun-00	279	257	15	7	2.5%						
Jul-00	753	695	27	31	4.1%						
Aug-00	471	424	23	24	5.1%						
Sep-00	469	437	5	27	5.8%						
Oct-00	711	629	38	44	6.2%						
Nov-00	561	506	12	43	7.7%						
Dec-00	57	45	6	6	10.5%	2000	4385	3972	195	218	5.0%
Jan-01	178	165	0	13	7.3%						
Feb-01	152	134	0	18	11.8%						
Mar-01	299	250	0	49	16.4%						
Apr-01	423	340	30	53	12.5%						
May-01	410	361	5	44	10.7%						
Jun-01	509	427	8	74	14.5%						
Jul-01	434	357	14	63	14.5%						
Aug-01	844	717	20	107	12.7%						
Sep-01	582	484	4	94	16.2%						
Oct-01	851	711	26	114	13.4%						
Nov-01	512	417	6	89	17.4%						
Dec-01	316	197	78	41	13.0%	2001	5510	4560	191	759	13.8%
Jan-02	117	60	46	11	9.4%						
Feb-02	147	45	83	19	12.9%						
Mar-02	138	65	53	20	14.5%						
Apr-02	251	107	102	42	16.7%						
May-02	343	173	114	56	16.3%						
Jun-02	225	131	36	58	25.8%						
Jul-02	730	529	87	114	15.6%						
Aug-02	866	622	78	166	19.2%						
Sep-02	396	149	151	96	24.2%						
Oct-02	1149	582	368	199	17.3%						
Nov-02	531	187	232	112	21.1%						
Dec-02	157	97	31	29	18.5%	2002	5050	2747	1381	922	18.3%
Jan-03	72	55	11	6	8.3%						
Feb-03	39	20	12	7	17.9%						
Mar-03	131	89	28	14	10.7%						
Apr-03	451	290	77	84	18.6%						
May-03	553	383	84	86	15.6%						
Jun-03	310	180	73	57	18.4%						
Jul-03	474	311	92	71	15.0%						
Aug-03	674	473	89	112	16.6%						
Sep-03	1132	759	134	239	21.1%						
Oct-03	835	586	68	181	21.7%						
Nov-03	659	395	132	132	20.0%						
Dec-03	114	97	1	16	14.0%	2003	5444	3638	801	1005	18.5%
Jan-04	144	122	0	22	15.3%						
Feb-04	316	272	3	41	13.0%						
Mar-04	145	114	3	28	19.3%						
Apr-04	743	575	7	161	21.7%						
May-04	589	447	4	138	23.4%						
Jun-04	430	314	7	109	25.3%						
Jul-04	493	362	5	126	25.6%						
Aug-04	656	434	44	178	27.1%						
Sep-04	840	583	14	243	28.9%						
Oct-04	1695	917	310	468	27.6%						
Nov-04	1092	603	205	284	26.0%						
Dec-04	97	64	6	27	27.8%	2004	7240	4807	608	1825	25.2%

(continued)

(continued from 2004)

Appendix B. Lower Fraser River sturgeon sampling, tagging, and recapture summary, by month and year, 1999-2009.											
Month	No. Released		No. Scanned,		Mark Rate (%)	Year	No. Released		No. Scanned,		Mark Rate (%)
	Scanned (All)	With Tag (Head)	Not Tagged, Not Recaptured	Recaptured (Head Tag)			Scanned (All)	With Tag (Head)	Not Tagged, Not Recaptured	Recaptured (Head Tag)	
Jan-05	28	23	0	6	21.4%						
Feb-05	221	178	0	43	19.5%						
Mar-05	288	222	1	65	22.6%						
Apr-05	831	572	20	239	28.8%						
May-05	475	282	28	165	34.7%						
Jun-05	738	439	16	283	38.3%						
Jul-05	738	480	20	238	32.2%						
Aug-05	1425	788	155	482	33.8%						
Sep-05	1835	768	415	652	35.5%						
Oct-05	2092	966	319	807	38.6%						
Nov-05	1076	420	321	335	31.1%						
Dec-05	286	137	91	58	20.3%						
2005	10033	5275	1386	3373	33.6%						
Jan-06	83	68	0	15	18.1%						
Feb-06	2	2	0	0	0.0%						
Mar-06	116	76	3	37	31.9%						
Apr-06	885	582	8	295	33.3%						
May-06	439	254	10	175	39.9%						
Jun-06	274	161	6	107	39.1%						
Jul-06	523	289	26	208	39.8%						
Aug-06	810	451	32	327	40.4%						
Sep-06	1297	674	9	614	47.3%						
Oct-06	2566	1338	14	1214	47.3%						
Nov-06	1863	1054	38	770	41.3%						
Dec-06	171	116	0	55	32.2%						
2006	9029	5065	146	3817	42.3%						
Jan-07	59	45	0	14	23.7%						
Feb-07	122	83	0	39	32.0%						
Mar-07	558	359	1	198	35.5%						
Apr-07	602	363	5	234	38.9%						
May-07	326	154	5	167	51.2%						
Jun-07	466	222	2	242	51.9%						
Jul-07	832	378	3	451	54.2%						
Aug-07	1456	614	6	836	57.4%						
Sep-07	2666	1243	36	1387	52.0%						
Oct-07	2288	1091	17	1180	51.6%						
Nov-07	1219	614	17	588	48.2%						
Dec-07	43	27	0	16	37.2%						
2007	10637	5193	92	5352	50.3%						
Jan-08	60	42	0	18	30.0%						
Feb-08	26	18	1	7	26.9%						
Mar-08	118	66	5	47	39.8%						
Apr-08	464	233	3	228	49.1%						
May-08	495	199	5	291	58.8%						
Jun-08	442	189	4	249	56.3%						
Jul-08	576	240	10	326	56.6%						
Aug-08	877	354	12	511	58.3%						
Sep-08	1455	616	16	823	56.6%						
Oct-08	2014	896	12	1106	54.9%						
Nov-08	1789	894	14	881	49.2%						
Dec-08	83	51	0	32	38.6%						
2008	8399	3798	82	4519	53.8%						
Jan-09	23	13	1	9	39.1%						
Feb-09	94	64	2	28	29.8%						
Mar-09	146	82	0	64	43.8%						
Apr-09	540	254	13	273	50.6%						
May-09	319	100	0	219	68.7%						
Jun-09	349	118	2	229	65.6%						
Jul-09	429	180	1	248	57.8%						
Aug-09	1057	377	6	674	63.8%						
Sep-09	1735	642	7	1086	62.6%						
Oct-09	2032	828	21	1183	58.2%						
Nov-09	1251	586	13	652	52.1%						
Dec-09	143	61	14	68	47.6%						
2009	8118	3305	80	4733	58.3%						
Totals	74,304	42,774	5,007	26,523	35.7%	1999-2009	74,304	42,774	5,007	26,523	35.7%

* Lower Fraser River samples only for sturgeon captured downstream of rkm 188 (Yale).

APPENDICES C, D, E, and F

- Appendix C. Numbers of sturgeon examined for marks, and numbers of recaptures, by month and sampling zone, 2008-2009.
- Appendix D. Number of sturgeon recaptured and examined for a mark, by sampling zone of release and recapture, 2008-2009.
- Appendix E. Proportion (corrected) of sturgeon recaptured, by sampling zone of release, 2008-2009.
- Appendix F. Numbers of marked sturgeon releases available for recapture by sampling zone and month, 2008-2009.



Appendix C. Numbers of sturgeon examined for marks (Catch), and number of recaptures (Rec)¹, by month and sampling zone, 2008-2009.

Month	Zone S		Zone 3-5		Zone 6		Zone 8		Zone 10		Zone 12		Zone 13		Zone 14		Total	
	Catch	Rec	Catch	Rec	Catch	Rec	Catch	Rec	Catch	Rec	Catch	Rec	Catch	Rec	Catch	Rec	Catch	Rec
Jan-08	1	0	0	0	46	1	0	0	0	0	10	0	0	0	0	0	57	1
Feb-08	0	0	0	0	23	0	0	0	0	0	3	0	0	0	0	0	26	0
Mar-08	0	0	3	0	46	1	44	0	0	0	20	0	0	0	0	0	113	1
Apr-08	1	0	110	0	178	3	82	1	0	0	60	3	9	0	6	0	446	7
May-08	5	0	43	3	79	2	162	0	1	0	182	9	8	0	5	0	485	14
Jun-08	18	0	16	1	19	0	65	6	9	0	216	15	17	0	59	2	419	24
Jul-08	31	2	6	0	22	0	122	3	13	1	262	33	46	3	78	3	580	45
Aug-08	11	2	95	2	85	2	225	12	30	2	289	39	35	1	79	11	849	71
Sep-08	29	4	141	7	225	15	475	43	153	26	285	39	28	1	40	3	1,376	138
Oct-08	1	0	108	8	559	48	647	53	358	72	267	57	17	2	4	0	1,961	240
Nov-08	18	1	130	6	428	45	743	98	173	58	240	47	2	0	0	0	1,734	255
Dec-08	0	0	2	0	33	1	32	7	1	0	12	4	0	0	0	0	80	12
Jan-09	0	0	0	0	6	0	10	2	0	0	0	0	6	0	0	0	22	2
Feb-09	0	0	0	0	76	7	7	1	1	1	4	0	0	0	0	0	88	9
Mar-09	0	0	8	2	113	16	4	1	5	3	10	3	1	0	0	0	141	25
Apr-09	3	0	123	14	249	28	53	16	17	5	33	8	27	4	6	3	511	78
May-09	0	0	27	3	93	14	47	13	3	0	122	45	11	1	2	1	305	77
Jun-09	10	3	23	2	15	1	62	16	0	0	141	46	33	7	20	8	304	83
Jul-09	32	3	28	7	19	4	118	20	7	4	105	33	13	3	87	20	409	94
Aug-09	90	12	160	36	189	45	103	39	36	13	273	94	11	3	140	40	1,002	282
Sep-09	130	10	162	22	207	49	263	59	139	45	691	219	10	1	70	14	1,672	419
Oct-09	52	3	82	9	288	53	771	170	304	111	408	116	13	2	27	6	1,945	470
Nov-09	3	0	168	26	394	76	205	52	94	45	301	93	44	10	1	0	1,210	302
Dec-09	0	0	9	0	13	3	15	3	1	1	44	15	13	1	0	0	95	23
Totals	435	40	1,444	148	3,405	414	4,255	615	1,345	387	3,978	918	344	39	624	111	15,830	2,672

¹ Recaptures listed in this table are recaptured marks that were sampled or applied during the sampling period of Jan 2008-Dec 2009.

Appendix D. Number of sturgeon recaptured and examined for a mark by sampling zone of release and recapture, 2008-2009.

Release Zone	Recapture Zone								Total
	Zone S	Zone 3-5	Zone 6	Zone 8	Zone 10	Zone 12	Zone 13	Zone 14	
Zone S	15	3	5	3	1	3	0	0	30
Zone 3-5	10	71	39	22	0	14	2	1	159
Zone 6	4	39	250	73	7	43	1	0	417
Zone 8	7	23	82	377	15	163	3	0	670
Zone 10	1	1	5	10	244	101	1	1	364
Zone 12	3	8	30	123	114	575	15	6	874
Zone 13	0	3	1	1	2	16	13	10	46
Zone 14	0	0	2	6	4	3	4	93	112
Number Recaptured	40	148	414	615	387	918	39	111	2,672
Number Examined	435	1,444	3,405	4,255	1,345	3,978	344	624	15,830

Appendix E. Proportion (corrected) of sturgeon recaptured by sampling zone of release, 2008-2009 (recapture corrected for sampling intensity; see equation 3).

Release Zone	Recapture Zone								Total
	Zone S	Zone 3-5	Zone 6	Zone 8	Zone 10	Zone 12	Zone 13	Zone 14	
Zone S	0.857	0.052	0.036	0.018	0.018	0.019	0.000	0.000	1.000
Zone 3-5	0.231	0.493	0.115	0.052	0.000	0.035	0.058	0.016	1.000
Zone 6	0.063	0.185	0.504	0.118	0.036	0.074	0.020	0.000	1.000
Zone 8	0.078	0.077	0.117	0.431	0.054	0.199	0.042	0.000	1.000
Zone 10	0.011	0.003	0.007	0.011	0.832	0.116	0.013	0.007	1.000
Zone 12	0.021	0.017	0.026	0.087	0.255	0.434	0.131	0.029	1.000
Zone 13	0.000	0.034	0.005	0.004	0.024	0.065	0.610	0.259	1.000
Zone 14	0.000	0.000	0.004	0.008	0.018	0.005	0.070	0.896	1.000

Appendix F. Number of marked sturgeon released each month from January 2008 to December 2009 by sampling zone, including releases of fish that were previously tagged (i.e., recaptures) and marked fish removed (i.e., recapture not returned) from the population (see equation 4).

Month	Zone S	Zone 3-5	Zone 6	Zone 8	Zone 10	Zone 12	Zone 13	Zone 14	Total
Jan-08	4	9	23	6	4	8	2	0	56
Feb-08	1	4	11	3	2	3	1	0	25
Mar-08	7	13	28	25	8	19	5	1	107
Apr-08	44	94	111	65	25	58	27	11	435
May-08	34	50	67	95	57	115	39	12	469
Jun-08	29	20	24	47	64	102	44	61	392
Jul-08	42	23	33	75	78	129	67	82	529
Aug-08	54	82	84	127	103	165	74	77	765
Sep-08	105	144	180	240	199	229	83	45	1,225
Oct-08	110	194	345	341	338	284	82	17	1,711
Nov-08	122	185	286	345	192	257	70	9	1,467
Dec-08	5	9	20	15	5	11	3	0	68
Jan-09	1	2	4	4	1	2	4	2	20
Feb-09	5	13	36	11	4	8	2	0	79
Mar-09	8	21	50	14	7	11	4	1	116
Apr-09	45	98	127	50	27	41	29	11	427
May-09	15	31	49	32	27	48	21	6	228
Jun-09	17	19	18	31	27	53	32	20	218
Jul-09	40	24	25	52	28	53	26	65	312
Aug-09	106	99	102	69	77	110	48	99	710
Sep-09	169	127	134	157	218	275	92	68	1,240
Oct-09	128	133	205	313	274	287	83	33	1,455
Nov-09	71	144	197	128	112	156	69	18	895
Dec-09	4	8	8	9	7	13	7	2	58
Totals	1,165	1,547	2,165	2,254	1,884	2,440	912	640	13,007