

Upper Basin Pallid Sturgeon Survival Estimation Project

2017 Update

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Background

Currently, pallid sturgeon (*Scaphirhynchus albus*) are listed as endangered under the Endangered Species Act. One component of the Recovery Plan for the species is the artificial propagation and release of pallid sturgeon. Each year, tens to hundreds of thousands of juveniles are propagated in captivity and then released in various locations throughout the Upper Basin according to a stocking and augmentation plan (USFWS 2008). These individuals are considered by the USFWS to be members of the listed species. Thus, there is interest in knowing the contribution of hatchery-origin fish to the population. One key step in measuring that contribution is to estimate the probability that a fish reared in captivity and released into the wild will survive to various ages of interest.

Hadley and Rotella (2009) estimated apparent survival for pallid sturgeon on 3 RPMA's using data collected via mark-release-recapture studies of hatchery-reared individuals. The data they used were collected during 1998-2007. Rotella (2010) analyzed updated data that included data from 4 new trapping occasions in each of the RPMA's during 2008-2009. Rotella (2012) analyzed updated data that included data collected through September of 2010. Rotella (2015) analyzed updated data that included data collected through September of 2013. In this addendum to the Hadley and Rotella (2009) and Rotella (2010, 2012, and 2015) reports, results are updated after incorporating data collected through September of 2016 and running the models employed in previous efforts on the updated datasets.

Analysis methods

As was true in previous reports, I estimated apparent annual survival (hereafter survival) and capture probabilities and also evaluated the relationships between covariates of interest and survival and capture probabilities for all mark-recapture data sets that were available for pallid sturgeon in Upper Basin RPMAs using Cormack-Jolly-Seber capture-recapture models (Pollock et al. 1990, Lebreton et al. 1992, Williams et al. 2002). All analyses were done using Program MARK (White and Burnham 1999) with the addition that for this report all analyses were done via computer scripts that execute Program MARK through the RMark package (Laake 2010) in the software program R (R Development Core Team 2010). References, more detailed methods, competing model lists, and methods and measures of overdispersion are provided in Hadley and Rotella (2009).

Assumptions of analysis approach

1. Every marked animal present in population at sampling period i has same capture probability (p_i) & apparent survival rate (ϕ_i).
 - a. Bias in estimates of ϕ_i from heterogeneity in capture probability is usually negative and small. The models used here incorporated a variety of covariates such as age, RPMA, release type, occasion, season of year and others to model possible sources of heterogeneity.
 - b. Bias in estimates of ϕ_i from heterogeneity in survival probability is usually positive except in the case of transients being in the release sample. Transients are fish that are released and then move to locations that are never subject to sampling or in which they cannot be caught. Transients have apparent survival rates of 0 and cause negative bias in estimates of ϕ_i . The models used here incorporated a variety of covariates such as age, RPMA, release type, occasion, season of year, disease status and others to model possible

sources of heterogeneity. However, it is not known to what extent heterogeneity in survival rates might exist due to variation within in age class (e.g., due to differences in size) or due to transient behavior.

2. Marks are not lost, overlooked, or misread. If marks are lost, estimates of ϕ_i are biased downwards. Such bias can be corrected if estimates of tag loss exist. Estimates of tag loss were obtained for the spring yearlings and summer yearlings released in RPMA 2 and used to adjust estimates of survival in the analyses presented here. Tag-loss rates were not available for other release groups, but can be incorporated quite easily in the future if they become available.
3. Sampling is instantaneous and animals are released immediately upon capture. If sampling is not instantaneous, then the intervals between sampling occasions are different lengths for different fish, which creates heterogeneity in survival probabilities (because different fish are exposed to mortality for different lengths of time), and, as noted above, the effect of such heterogeneity on bias in apparent survival rates is usually positive. In earlier work, Hadley and Rotella (2009) tried to establish sampling occasions that prevented using excessively long sampling windows while also avoiding eliminating too much recapture data when the start and ending dates of sampling occasions were moved closer together in time. It is not known how much mortality might be occurring during the sampling windows.
4. All emigration is permanent. Temporary emigration causes extreme heterogeneity in capture probability for those individuals that are away from the sampling areas during sampling, i.e., their $p = 0$ on those occasions. If the probability that a fish will be away from the sampling areas is the same for fish that are outside the study area as it is for a fish that is inside the sampling area (i.e., the probability of being temporary emigrant does not depend on the individual's current location), no bias in survival estimation is expected. Otherwise, temporary emigration can cause negative bias in estimates of ϕ_i .
5. Animal fates with respect to capture and survival are independent. If this is not true, then model-selection procedures tend to choose overly complex models and estimates of precision tend to be too small or overly optimistic. The analyses presented here incorporate the estimates of overdispersion calculated by Hadley and Rotella (2009), which means that model selection and precision estimation were adjusted for estimated lack of independence that might have occurred in the data. It is notable that levels of overdispersion were estimated to be quite modest in these data.

Report organization

This report is provided as an addendum to Hadley and Rotella (2009) and Rotella (2010, 2012, and 2015). It is not intended to stand-alone. Rather, it is assumed that the reader will be familiar with the earlier reports to be able to take full advantage of the material in this report. This report provides information for one RPMA at a time.

For each RPMA, I first summarize the data that were available on numbers released and recaptured over the course of the study. I then provide estimates for each release type (e.g., fingerlings, spring yearlings, etc) starting with the youngest release type and ending with the oldest. For each release type, I first present estimates based on the earliest cohort (longest time since release) and based on predictions of how that cohort would have done if the fish in that cohort had no disease issues. If the cohort itself had no disease issues, then the actual covariate conditions for that cohort were used. If the cohort had fin curl or iridovirus, estimates were

generated from the mark-recapture model for a hypothetical healthy cohort based on data from cohorts released in the river at a later date and that were healthy. I then provide the estimates of survival rates and surviving numbers of fish for each release cohort based on the actual covariate conditions for each cohort, i.e., their true disease status, river of origin and any other covariates found to be important in the modeling. Finally, I present summaries of the results for all released cohorts of a given release type. I then go on to the results for the next type of release. After results for all release types in a given RPMA are provided, I summarize results by age class across all release types. Finally, I end with summary tables shown together for each RPMA. Throughout the results, I try to emphasize providing the reader with estimated survival rates, surviving proportions, and surviving numbers through time and how those might vary among RPMAs, release types, and release cohorts. (*Note: SE's reported as 0.00 represent values <0.01*)

RPMA 1

Dates and numbers for releases and recapture work on RPMA 1

Occ	Begin	End	Midpoint	Release Numbers for Each Fish Type				
				Spring		Summer		
1	08/18/98	08/18/98	08/18/98			1	691	
2	09/23/98	10/30/98	10/11/98					
3	04/13/99	04/13/99	04/13/99					
4	08/31/99	09/21/99	09/10/99					
5	09/25/00	09/28/00	09/26/00					
6	09/25/01	10/31/01	10/13/01					
7	07/23/02	07/23/02	07/23/02			2	2,038	
8	08/20/02	09/25/02	09/07/02					
9	04/08/03	05/30/03	05/04/03					
10	08/19/03	10/17/03	09/17/03					
11	03/23/04	05/26/04	04/24/04					
12	08/20/04	10/15/04	09/17/04			3	3,128	
13	03/29/05	05/25/05	04/26/05	1	521			
14	08/19/05	11/01/05	09/25/05			4	186	
15	04/13/06	05/17/06	04/30/06	2	4,655			
16	08/23/06	10/25/06	09/23/06					
17	04/03/07	05/31/07	05/02/07	3	4,462			
18	09/24/07	10/24/07	10/09/07					
19	04/08/08	05/21/08	04/30/08	4	6,791			
20	07/23/08	10/24/08	09/07/08					
21	04/13/09	05/20/09	05/01/09	5	6,292			
22	09/10/09	10/23/09	10/01/09					
23	03/31/10	04/23/10	04/11/10	6	6,108			
24	08/03/10	10/14/10	09/08/10					
25	04/12/11	05/10/11	04/26/11	7	753			
26	08/01/11	11/02/11	09/16/11					
27	04/03/12	05/22/12	04/28/12					
28	08/01/12	10/30/12	09/15/12					
29	04/01/13	05/01/13	04/16/13	8	465			
30	07/23/13	10/29/13	09/10/13					
31	04/02/14	05/16/14	04/24/14	10	323			
32	08/05/14	10/30/14	09/17/14			5	55	
33	03/23/15	05/15/15	04/19/15	11	522			
34	08/04/15	09/28/15	09/01/15					
35	03/14/16	06/02/16	04/23/16	12	911			
36	08/10/16	09/28/16	09/04/16					
			Totals		31,803		6,098	37,901

For RPMA 1, the top model of the mark-recapture data included the following covariates of survival: release type (spring versus summer yearlings), age of fish, fin curl status, the interaction of release type with fish age and with fin curl status, and the proportion of the interval between sampling occasions that was in winter months. The model of capture probability included fish age (on the natural log scale) and capture occasion.

To depict survival patterns estimated from the data for each type of release, the earliest release of a given type (e.g., spring yearlings at release) is used. In this way, the greatest amount of time from release to present is used, and in this way the cumulative proportion of fish remaining alive in the river is presented for the greatest extent of time possible with the data. Results for other releases are similar but do not extend as far forward in time or in terms of fish age.

Results for releases of Spring Yearlings in RPMA 1

Data on the number of spring yearlings released on each occasion ($R(i)$) along with information on when they were 1st subsequently recaptured (on occasion j) is provided in the table below. At the time of the analyses presented here, 33,743 releases and re-releases of fish originally released as spring yearlings had been conducted, which resulted in 2,009 recaptures. The results presented below are based on the analyses conducted in 2017 of data consisting of 33,743 releases and re-releases of fish originally released as spring yearlings, which resulted in 2,009 recaptures in RPMA 1 up through September of 2016.

Occ	R(i)	j=2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Sum
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	0									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	0										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	0												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	521													0	0	1	1	1	2	1	1	2	1	0	0	0	0	1	1	1	0	0	0	0	0	13	
14	0														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	4655															26	51	31	27	19	53	15	36	16	23	24	23	7	26	11	8	1	5	10	0	6	
16	27																1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
17	4515																12	31	16	36	40	69	14	19	31	35	23	27	16	12	11	14	23	10	4	443	
18	44																	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	
19	6851																		5	30	13	30	12	20	14	15	12	14	15	7	1	2	9	7	4		
20	41																			3	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	7	
21	6416																				31	48	19	29	16	33	22	43	25	15	3	12	14	19	9		
22	102																					3	2	3	0	1	4	0	1	0	0	1	0	0	0	15	
23	6298																						22	38	14	36	17	43	55	43	7	28	20	28	13	364	
24	85																								2	1	3	0	1	0	0	0	0	0	2	2	13
25	889																									2	6	8	12	14	9	0	5	1	7	2	
26	102																										4	0	2	2	1	0	0	0	1	0	
27	156																											0	5	0	1	2	0	1	0	0	
28	96																												2	3	1	0	2	0	1	0	
29	641																													4	2	1	3	3	7	2	
30	147																														3	1	0	1	2	2	
31	425																															0	6	2	5	4	
32	27																																1	1	1	0	
33	601																																	6	5	6	
34	93																																		5	5	
35	1011																																			10	
Totals	33743	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	53	44	60	41	124	102	190	85	136	102	156	96	176	147	102	27	79	93	100	69	2009

Estimates of survival for the 1st release cohort of healthy spring yearlings (~9.5 months old at time of release, which was ~4/26/2005) in RPMA 1 (cohort= 521 fish, Fin Curl status = 0). Estimates are for a fish without fin curl.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
04/26/05	09/25/05	5.1	9.5	14.6	0.999	(0.001)	1.00	(0.00)	(0.99	to	1.00)
09/25/05	04/30/06	7.2	14.6	21.8	0.957	(0.003)	0.72	(0.02)	(0.69	to	0.76)
04/30/06	09/23/06	4.9	21.8	26.7	0.999	(0.001)	0.72	(0.02)	(0.69	to	0.76)
09/23/06	05/02/07	7.4	26.7	34.0	0.959	(0.002)	0.53	(0.02)	(0.48	to	0.57)
05/02/07	10/09/07	5.3	34.0	39.4	0.999	(0.001)	0.52	(0.02)	(0.48	to	0.57)
10/09/07	04/30/08	6.8	39.4	46.2	0.954	(0.002)	0.38	(0.02)	(0.34	to	0.42)
04/30/08	09/07/08	4.3	46.2	50.5	0.999	(0.001)	0.38	(0.02)	(0.34	to	0.42)
09/07/08	05/01/09	7.9	50.5	58.4	0.967	(0.003)	0.29	(0.02)	(0.25	to	0.33)
05/01/09	10/01/09	5.1	58.4	63.5	0.999	(0.001)	0.29	(0.02)	(0.25	to	0.33)
10/01/09	04/11/10	6.4	63.5	69.9	0.928	(0.010)	0.18	(0.01)	(0.15	to	0.21)
04/11/10	09/08/10	5.0	69.9	74.9	0.999	(0.001)	0.18	(0.01)	(0.15	to	0.21)
09/08/10	04/26/11	7.7	74.9	82.5	0.963	(0.003)	0.13	(0.01)	(0.11	to	0.16)
04/26/11	09/16/11	4.8	82.5	87.3	0.999	(0.001)	0.13	(0.01)	(0.11	to	0.16)
09/16/11	04/28/12	7.5	87.3	94.8	0.961	(0.004)	0.10	(0.01)	(0.08	to	0.12)
04/28/12	09/15/12	4.7	94.8	99.5	0.999	(0.001)	0.10	(0.01)	(0.08	to	0.12)
09/15/12	04/16/13	7.1	99.5	106.6	0.951	(0.005)	0.07	(0.01)	(0.05	to	0.09)
04/16/13	09/10/13	4.9	106.6	111.5	0.999	(0.001)	0.07	(0.01)	(0.05	to	0.09)
09/10/13	09/17/14	7.5	111.5	119.0	0.961	(0.005)	0.05	(0.01)	(0.04	to	0.07)
09/17/14	04/19/15	4.9	119.0	123.9	0.999	(0.001)	0.05	(0.01)	(0.04	to	0.07)
04/19/15	09/01/15	7.1	123.9	131.0	0.951	(0.007)	0.04	(0.01)	(0.02	to	0.05)
09/01/15	04/24/14	4.5	131.0	135.5	0.999	(0.001)	0.04	(0.01)	(0.02	to	0.05)
04/24/14	04/23/16	7.8	135.5	143.3	0.965	(0.007)	0.03	(0.01)	(0.01	to	0.04)
04/23/16	09/04/16	4.5	143.3	147.8	0.999	(0.001)	0.03	(0.01)	(0.01	to	0.04)

¹The monthly survival rate for each month in the interval represented on a given row of the table. The interval-specific survival rate can be calculated by raising the monthly survival rate to the number of months in the interval, e.g., $0.999^{5.1} = 0.996$ (or ~1.0 for the 1st interval) or $0.957^{7.2} = 0.73$ (for the 2nd interval). The interval-specific rates can be multiplied together to estimate the proportion still alive after >1 interval of time has passed.

²The proportion of a release cohort still alive, which is calculated based on monthly survival estimates for each interval, the resulting interval-specific estimates of survival, and the product of interval-specific estimates. For example, for the 1st interval, the interval-specific survival rate was $0.999^{5.1} = 0.996$, and for the 2nd interval, the interval-specific survival rate was $0.957^{7.2} = 0.73$. Thus, the proportion still alive at the end of the 1st interval is 0.996 and the proportion still alive at the end of 2nd interval is $0.996 \times 0.73 = 0.72$.

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. In the table below, the survival rate was ~0.72 for the period from initial release of Spring Yearlings to ~1 year later. For the next year, the rate was 0.74, and so on. Rates don't always follow a smooth progression with increasing age because (a) intervals are not all exactly 1 year apart and (b) features that affect survival such as season or (for this instance) proportion of the interval in winter, aren't always consistent in their values from one interval to the next.*

After the last interval reported, either there are no more estimates available for intervals approximately 1-year apart or all subsequent estimated annual survival rates were ~1.0 based on model's predictions and so are not reported after the first time a survival rate of 1.0 was reported. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.03	12.3	0.72	0.02	Spr. Yrlg.	1
2.04	24.5	0.74	0.06	Spr. Yrlg.	1
3.06	36.7	0.72	0.09	Spr. Yrlg.	1
4.08	48.9	0.76	0.11	Spr. Yrlg.	1
5.03	60.4	0.62	0.14	Spr. Yrlg.	1
6.08	73	0.72	0.13	Spr. Yrlg.	1
7.11	85.3	0.77	0.16	Spr. Yrlg.	1
8.09	97.1	0.70	0.25	Spr. Yrlg.	1
9.13	109.5	0.71	0.34	Spr. Yrlg.	1
10.13	121.5	0.80	0.40	Spr. Yrlg.	1
11.15	133.8	0.75	0.56	Spr. Yrlg.	1

When the number of fish released in a cohort is taken into account, it is possible to estimate the number of fish from each cohort that are estimated to have been alive through time. The tables below do this for each release type and cohort using **the average value for disease status in each release cohort.**

Estimates of survival for the 1st release cohort of spring yearlings in RPMA 1 (cohort= 521 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
1	SPR	04/26/05	09/25/05	9.5	14.6	1.00	0.00	519	514	to	521
1	SPR	09/25/05	04/30/06	14.6	21.8	0.72	0.02	377	360	to	395
1	SPR	04/30/06	09/23/06	21.8	26.7	0.72	0.02	376	357	to	394
1	SPR	09/23/06	05/02/07	26.7	34.0	0.53	0.02	275	253	to	298
1	SPR	05/02/07	10/09/07	34.0	39.4	0.52	0.02	274	250	to	297
1	SPR	10/09/07	04/30/08	39.4	46.2	0.38	0.02	199	178	to	221
1	SPR	04/30/08	09/07/08	46.2	50.5	0.38	0.02	198	177	to	220
1	SPR	09/07/08	05/01/09	50.5	58.4	0.29	0.02	152	131	to	173
1	SPR	05/01/09	10/01/09	58.4	63.5	0.29	0.02	151	129	to	173
1	SPR	10/01/09	04/11/10	63.5	69.9	0.18	0.01	94	80	to	108
1	SPR	04/11/10	09/08/10	69.9	74.9	0.18	0.01	94	80	to	107
1	SPR	09/08/10	04/26/11	74.9	82.5	0.13	0.01	70	59	to	81
1	SPR	04/26/11	09/16/11	82.5	87.3	0.13	0.01	70	59	to	81
1	SPR	09/16/11	04/28/12	87.3	94.8	0.10	0.01	52	42	to	62
1	SPR	04/28/12	09/15/12	94.8	99.5	0.10	0.01	52	42	to	62
1	SPR	09/15/12	04/16/13	99.5	106.6	0.07	0.01	36	28	to	45
1	SPR	04/16/13	09/10/13	106.6	111.5	0.07	0.01	36	27	to	45
1	SPR	09/10/13	09/17/14	111.5	119.0	0.05	0.01	27	18	to	35
1	SPR	09/17/14	04/19/15	119.0	123.9	0.05	0.01	27	18	to	35
1	SPR	04/19/15	09/01/15	123.9	131.0	0.04	0.01	18	11	to	26
1	SPR	09/01/15	04/24/14	131.0	135.5	0.04	0.01	18	11	to	26
1	SPR	04/24/14	04/23/16	135.5	143.3	0.03	0.01	14	7	to	21
1	SPR	04/23/16	09/04/16	143.3	147.8	0.03	0.01	14	7	to	21

Estimates of survival for the 2nd release cohort of spring yearlings in RPMA 1 (cohort= 4,655 fish, average fin curl value in cohort = 0.71).

Release	Type	Start Date	End Date	int. start (mos.)	int end (mos.)	Ppn. Still Alive	(SE)	Interval End	(95% CI for N at Inteval End)		
2	SPR	04/30/06	09/23/06	9.5	14.4	0.99	0.01	4,628	4,571	to	4,655
2	SPR	09/23/06	05/02/07	14.4	21.7	0.65	0.02	3,045	2,859	to	3,231
2	SPR	05/02/07	10/09/07	21.7	27.1	0.65	0.02	3,019	2,815	to	3,224
2	SPR	10/09/07	04/30/08	27.1	33.9	0.42	0.02	1,973	1,767	to	2,178
2	SPR	04/30/08	09/07/08	33.9	38.2	0.42	0.02	1,963	1,753	to	2,172
2	SPR	09/07/08	05/01/09	38.2	46.1	0.29	0.02	1,370	1,164	to	1,576
2	SPR	05/01/09	10/01/09	46.1	51.2	0.29	0.02	1,361	1,146	to	1,576
2	SPR	10/01/09	04/11/10	51.2	57.6	0.15	0.01	721	594	to	848
2	SPR	04/11/10	09/08/10	57.6	62.6	0.15	0.01	716	594	to	839
2	SPR	09/08/10	04/26/11	62.6	70.2	0.10	0.01	486	402	to	570
2	SPR	04/26/11	09/16/11	70.2	75	0.10	0.01	483	400	to	566
2	SPR	09/16/11	04/28/12	75	82.5	0.07	0.01	324	262	to	386
2	SPR	04/28/12	09/15/12	82.5	87.2	0.07	0.01	322	260	to	384
2	SPR	09/15/12	04/16/13	87.2	94.3	0.04	0	200	154	to	245
2	SPR	04/16/13	09/10/13	94.3	99.2	0.04	0	198	153	to	244
2	SPR	09/10/13	09/17/14	99.2	106.7	0.03	0	132	94	to	171
2	SPR	09/17/14	04/19/15	106.7	111.6	0.03	0	131	93	to	170
2	SPR	04/19/15	09/01/15	111.6	118.7	0.02	0	81	50	to	112
2	SPR	09/01/15	04/24/14	118.7	123.2	0.02	0	80	49	to	111
2	SPR	04/24/14	04/23/16	123.2	131	0.01	0	55	28	to	83
2	SPR	04/23/16	09/04/16	131	135.5	0.01	0	55	28	to	83

Estimates of survival for the 3rd release cohort of spring yearlings in RPMA 1 (cohort= 4,462 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
3	SPR	05/02/07	10/09/07	9.5	14.8	0.99	0.01	4,435	4,380	to	4,462
3	SPR	10/09/07	04/30/08	14.8	21.6	0.73	0.02	3,242	3,095	to	3,390
3	SPR	04/30/08	09/07/08	21.6	26	0.72	0.02	3,230	3,079	to	3,381
3	SPR	09/07/08	05/01/09	26	33.8	0.56	0.02	2,480	2,263	to	2,698
3	SPR	05/01/09	10/01/09	33.8	38.9	0.55	0.03	2,468	2,237	to	2,699
3	SPR	10/01/09	04/11/10	38.9	45.3	0.35	0.02	1,543	1,339	to	1,747
3	SPR	04/11/10	09/08/10	45.3	50.3	0.34	0.02	1,536	1,340	to	1,732
3	SPR	09/08/10	04/26/11	50.3	58	0.26	0.02	1,155	1,003	to	1,306
3	SPR	04/26/11	09/16/11	58	62.8	0.26	0.02	1,150	1,001	to	1,298
3	SPR	09/16/11	04/28/12	62.8	70.3	0.19	0.01	857	737	to	976
3	SPR	04/28/12	09/15/12	70.3	74.9	0.19	0.01	853	734	to	973
3	SPR	09/15/12	04/16/13	74.9	82	0.13	0.01	600	505	to	695
3	SPR	04/16/13	09/10/13	82	86.9	0.13	0.01	597	503	to	692
3	SPR	09/10/13	09/17/14	86.9	94.5	0.10	0.01	443	360	to	526
3	SPR	09/17/14	04/19/15	94.5	99.3	0.10	0.01	441	357	to	525
3	SPR	04/19/15	09/01/15	99.3	106.5	0.07	0.01	309	236	to	381
3	SPR	09/01/15	04/24/14	106.5	111	0.07	0.01	307	234	to	380
3	SPR	04/24/14	04/23/16	111	118.8	0.05	0.01	234	163	to	304
3	SPR	04/23/16	09/04/16	118.8	123.3	0.05	0.01	233	162	to	304

Estimates of survival for the 4th release cohort of spring yearlings in RPMA 1 (cohort= 6,791 fish, average fin curl value in cohort = 0.20).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SPR	04/30/08	09/07/08	9.5	13.8	1.00	0	6,763	6,703	to	6,791
4	SPR	09/07/08	05/01/09	13.8	21.7	0.75	0.02	5,080	4,762	to	5,399
4	SPR	05/01/09	10/01/09	21.7	26.8	0.74	0.03	5,054	4,693	to	5,416
4	SPR	10/01/09	04/11/10	26.8	33.2	0.45	0.03	3,041	2,659	to	3,422
4	SPR	04/11/10	09/08/10	33.2	38.2	0.45	0.03	3,026	2,665	to	3,386
4	SPR	09/08/10	04/26/11	38.2	45.9	0.33	0.02	2,221	1,947	to	2,495
4	SPR	04/26/11	09/16/11	45.9	50.6	0.33	0.02	2,211	1,944	to	2,477
4	SPR	09/16/11	04/28/12	50.6	58.1	0.24	0.02	1,608	1,399	to	1,817
4	SPR	04/28/12	09/15/12	58.1	62.8	0.24	0.02	1,601	1,393	to	1,809
4	SPR	09/15/12	04/16/13	62.8	69.9	0.16	0.01	1,094	938	to	1,249
4	SPR	04/16/13	09/10/13	69.9	74.8	0.16	0.01	1,088	934	to	1,243
4	SPR	09/10/13	09/17/14	74.8	82.3	0.12	0.01	788	664	to	911
4	SPR	09/17/14	04/19/15	82.3	87.2	0.12	0.01	784	659	to	909
4	SPR	04/19/15	09/01/15	87.2	94.3	0.08	0.01	532	434	to	631
4	SPR	09/01/15	04/24/14	94.3	98.8	0.08	0.01	530	431	to	629
4	SPR	04/24/14	04/23/16	98.8	106.7	0.06	0.01	394	300	to	488
4	SPR	04/23/16	09/04/16	106.7	111.1	0.06	0.01	392	297	to	488

Estimates of survival for the 5th release cohort of spring yearlings in RPMA 1 (cohort= 6,292 fish, average fin curl value in cohort = 0.27).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	SPR	05/01/09	10/01/09	9.5	14.6	0.99	0.01	6,259	6,190	to	6,292
5	SPR	10/01/09	04/11/10	14.6	21	0.59	0.05	3,721	3,142	to	4,299
5	SPR	04/11/10	09/08/10	21	26	0.59	0.04	3,702	3,160	to	4,245
5	SPR	09/08/10	04/26/11	26	33.7	0.43	0.03	2,698	2,308	to	3,087
5	SPR	04/26/11	09/16/11	33.7	38.4	0.43	0.03	2,685	2,315	to	3,055
5	SPR	09/16/11	04/28/12	38.4	45.9	0.31	0.02	1,938	1,661	to	2,215
5	SPR	04/28/12	09/15/12	45.9	50.6	0.31	0.02	1,929	1,661	to	2,197
5	SPR	09/15/12	04/16/13	50.6	57.7	0.21	0.02	1,306	1,096	to	1,516
5	SPR	04/16/13	09/10/13	57.7	62.6	0.21	0.02	1,299	1,096	to	1,503
5	SPR	09/10/13	09/17/14	62.6	70.1	0.15	0.01	933	789	to	1,078
5	SPR	09/17/14	04/19/15	70.1	75	0.15	0.01	929	786	to	1,071
5	SPR	04/19/15	09/01/15	75	82.1	0.10	0.01	625	520	to	729
5	SPR	09/01/15	04/24/14	82.1	86.6	0.10	0.01	622	519	to	725
5	SPR	04/24/14	04/23/16	86.6	94.5	0.07	0.01	459	375	to	543
5	SPR	04/23/16	09/04/16	94.5	98.9	0.07	0.01	457	373	to	542

Estimates of survival for the 6th release cohort of spring yearlings in RPMA 1 (cohort= 6,108 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
6	SPR	04/11/10	09/08/10	9.5	14.5	1.00	0	6,081	6,025	to	6,108
6	SPR	09/08/10	04/26/11	14.5	22.2	0.75	0.02	4,593	4,350	to	4,836
6	SPR	04/26/11	09/16/11	22.2	26.9	0.75	0.02	4,574	4,302	to	4,845
6	SPR	09/16/11	04/28/12	26.9	34.4	0.56	0.03	3,425	3,099	to	3,751
6	SPR	04/28/12	09/15/12	34.4	39.1	0.56	0.03	3,411	3,065	to	3,757
6	SPR	09/15/12	04/16/13	39.1	46.2	0.40	0.02	2,413	2,143	to	2,683
6	SPR	04/16/13	09/10/13	46.2	51.1	0.39	0.02	2,402	2,121	to	2,684
6	SPR	09/10/13	09/17/14	51.1	58.6	0.29	0.02	1,791	1,534	to	2,048
6	SPR	09/17/14	04/19/15	58.6	63.5	0.29	0.02	1,783	1,517	to	2,050
6	SPR	04/19/15	09/01/15	63.5	70.6	0.21	0.02	1,255	1,061	to	1,449
6	SPR	09/01/15	04/24/14	70.6	75.1	0.20	0.02	1,250	1,050	to	1,449
6	SPR	04/24/14	04/23/16	75.1	83	0.16	0.02	955	764	to	1,146
6	SPR	04/23/16	09/04/16	83	87.4	0.16	0.02	951	755	to	1,148

Estimates of survival for the 7th release cohort of spring yearlings in RPMA 1 (cohort= 753 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
7	SPR	04/26/11	09/16/11	9.5	14.3	1.00	0	750	743	to	753
7	SPR	09/16/11	04/28/12	14.3	21.8	0.75	0.02	563	535	to	590
7	SPR	04/28/12	09/15/12	21.8	26.4	0.74	0.02	560	529	to	591
7	SPR	09/15/12	04/16/13	26.4	33.5	0.53	0.02	397	365	to	429
7	SPR	04/16/13	09/10/13	33.5	38.4	0.53	0.02	395	362	to	428
7	SPR	09/10/13	09/17/14	38.4	46	0.39	0.02	295	262	to	328
7	SPR	09/17/14	04/19/15	46	50.8	0.39	0.02	294	260	to	328
7	SPR	04/19/15	09/01/15	50.8	58	0.28	0.02	207	181	to	234
7	SPR	09/01/15	04/24/14	58	62.5	0.27	0.02	206	179	to	233
7	SPR	04/24/14	04/23/16	62.5	70.3	0.21	0.02	158	133	to	184
7	SPR	04/23/16	09/04/16	70.3	74.8	0.21	0.02	157	131	to	184

Estimates of survival for the 8th release cohort of spring yearlings in RPMA 1 (cohort= 465 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
8	SPR	04/16/13	09/10/13	9.5	14.4	1.00	0	463	459	to	465
8	SPR	09/10/13	09/17/14	14.4	21.9	0.75	0.02	347	330	to	364
8	SPR	09/17/14	04/19/15	21.9	26.8	0.74	0.02	345	326	to	365
8	SPR	04/19/15	09/01/15	26.8	33.9	0.53	0.02	244	225	to	264
8	SPR	09/01/15	04/24/16	33.9	38.4	0.52	0.02	244	223	to	264
8	SPR	04/24/14	04/23/16	38.4	46.3	0.40	0.02	187	165	to	209
8	SPR	04/23/16	09/04/16	46.3	50.7	0.40	0.03	186	163	to	209

Estimates of survival for the 9th release cohort of spring yearlings in RPMA 1 (cohort= 323 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
9	SPR	09/17/14	04/19/15	9.5	14.4	1.00	0	322	319	to	323
9	SPR	04/19/15	09/01/15	14.4	21.5	0.71	0.02	228	216	to	240
9	SPR	09/01/15	04/24/16	21.5	26	0.70	0.02	227	216	to	239
9	SPR	04/24/14	04/23/16	26	33.8	0.54	0.02	175	160	to	190
9	SPR	04/23/16	09/04/16	33.8	38.3	0.54	0.02	174	158	to	190

Estimates of survival for the 10th release cohort of spring yearlings in RPMA 1 (cohort= 522 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
10	SPR	09/01/15	04/24/16	9.5	14	1.00	0	520	516	to	522
10	SPR	04/24/14	04/23/16	14	21.8	0.77	0.02	400	377	to	424
10	SPR	04/23/16	09/04/16	21.8	26.3	0.76	0.03	399	373	to	425

Estimates of survival for the 11th release cohort of spring yearlings in RPMA 1 (cohort= 911 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
11	SPR	04/23/16	09/04/16	9.5	14	1.00	0.00	907	900	to	911

Summary information for Spring Yearlings released in RPMA 1

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as spring yearlings are estimated to have been alive by the end of data collection. On the date when data were last collected for use in the analyses presented here (09/04/2016), ~3,925 fish released as spring yearlings were estimated to have been alive in the river. Of these ~42% (*n* 1,666) were 1- to 5-years old, ~50% (1,957) were ~5- to 10-years old, and ~8% (301) were 10- to 15-years old.

Estimates of surviving proportions and numbers for spring yearling releases in RPMA 1.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 521	SPR	09/04/16	147.8	12.3	0.03	0.01	14	7	<i>to</i>	21
2: 4,714	SPR	09/04/16	135.5	11.3	0.01	0.00	55	28	<i>to</i>	83
3: 4,461	SPR	09/04/16	123.3	10.3	0.05	0.01	233	162	<i>to</i>	304
4: 6,791	SPR	09/04/16	111.1	9.3	0.06	0.01	392	297	<i>to</i>	488
5: 6,292	SPR	09/04/16	98.9	8.2	0.07	0.01	457	373	<i>to</i>	542
6: 6,095	SPR	09/04/16	87.4	7.3	0.16	0.02	951	755	<i>to</i>	1,148
7: 752	SPR	09/04/16	74.8	6.2	0.21	0.02	157	131	<i>to</i>	184
8: 465	SPR	09/04/16	50.7	4.2	0.40	0.03	186	163	<i>to</i>	209
9: 323	SPR	09/04/16	38.3	3.2	0.54	0.02	174	158	<i>to</i>	190
10: 522	SPR	09/04/16	26.3	2.2	0.76	0.03	399	373	<i>to</i>	425
11: 911	SPR	09/04/16	14.0	1.2	1.00	0.00	907	900	<i>to</i>	911

Results for releases of Summer Yearlings in RPMA 1

Data on the number of summer yearlings released on each occasion ($R(i)$) along with information on when they were 1st subsequently recaptured (on occasion j) is provided in the table below.

The results presented below are based on the analyses conducted in 2017 of data consisting of 6,556 releases and re-releases of fish originally released as summer yearlings, which resulted in 463 recaptures in RPMA 1 up through September of 2016.

Occ	R(i)	j=2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Sum	
1	691	3	1	2	3	5	0	8	10	6	31	9	19	6	8	9	13	11	11	6	8	5	9	2	2	12	9	2	7	4	1	2	6	5	8	4	247	
2	3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	2				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	3					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	5						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
7	2038							5	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
8	13								0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
9	10									0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
10	9										0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4
11	34											1	0	1	1	1	3	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	12	
12	3138												10	1	0	0	2	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	17	
13	29													0	2	2	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8	
14	194														1	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	
15	12															0	0	1	2	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	6	
16	16																0	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	8	
17	20																	2	4	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	10	
18	19																		1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	7	
19	24																			0	0	0	4	1	0	0	1	2	0	1	0	1	2	1	0	0	13	
20	11																				1	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	5	
21	11																					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
22	11																						0	1	1	0	0	0	1	1	0	0	0	0	0	0	5	
23	22																						3	0	0	0	1	0	0	0	0	0	0	1	1	0	0	7
24	6																							1	1	0	2	0	1	0	0	0	0	2	0	1	0	4
25	3																								0	0	0	0	1	0	0	0	0	0	0	0	0	3
26	13																									0	1	0	1	1	0	0	0	0	0	0	0	6
27	15																										0	0	0	2	1	0	0	0	0	0	0	3
28	7																											2	1	0	1	0	0	0	3	0	7	
29	17																													0	4	1	3	0	3	0	11	
30	9																														0	1	1	0	2	0	4	
31	7																															0	2	0	3	0	5	
32	63																																0	5	2	1	0	8
33	26																																	2	20	0	22	
34	18																																		14	0	14	
35	56																																				1	1
Totals	6556	3	1	2	3	5	0	13	10	9	34	10	29	8	12	16	20	19	24	11	11	11	22	6	3	13	15	7	17	9	7	8	26	18	56	5	463	

Estimates of survival for the 1st release cohort of summer yearlings (~14.2 months old at time of release, which was ~8/18/1998) in RPMA 1. Estimates are for fish without fin curl.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
08/18/98	10/11/98	1.8	14.2	16.0	0.999	(0.001)	1.00	(0.00)	(0.99	to	1.00)
10/11/98	04/13/99	6.1	16.0	22.2	0.967	(0.008)	0.81	(0.04)	(0.73	to	0.90)
04/13/99	09/10/99	5.0	22.2	27.2	1.000	(0.000)	0.81	(0.04)	(0.73	to	0.89)
09/10/99	09/26/00	12.7	27.2	39.9	0.996	(0.002)	0.77	(0.03)	(0.70	to	0.84)
09/26/00	10/13/01	12.7	39.9	52.6	0.996	(0.002)	0.73	(0.03)	(0.67	to	0.79)
10/13/01	07/23/02	9.4	52.6	62.1	0.994	(0.002)	0.69	(0.04)	(0.62	to	0.76)
07/23/02	09/07/02	1.5	62.0	63.6	1.000	(0.000)	0.69	(0.04)	(0.62	to	0.76)
09/07/02	05/04/03	8.0	63.6	71.5	0.987	(0.001)	0.62	(0.04)	(0.55	to	0.70)
05/04/03	09/17/03	4.5	71.5	76.1	1.000	(0.000)	0.62	(0.04)	(0.55	to	0.69)
09/17/03	04/24/04	7.3	76.1	83.4	0.984	(0.001)	0.56	(0.04)	(0.49	to	0.62)
04/24/04	09/17/04	4.9	83.4	88.3	1.000	(0.000)	0.55	(0.04)	(0.49	to	0.62)
09/17/04	04/26/05	7.4	88.3	95.7	0.985	(0.001)	0.50	(0.03)	(0.43	to	0.56)
04/26/05	09/25/05	5.1	95.7	100.7	1.000	(0.000)	0.50	(0.03)	(0.43	to	0.56)
09/25/05	04/30/06	7.2	100.7	108.0	0.986	(0.001)	0.45	(0.03)	(0.39	to	0.51)
04/30/06	09/23/06	4.9	108.0	112.8	1.000	(0.000)	0.45	(0.03)	(0.39	to	0.51)
09/23/06	05/02/07	7.4	112.8	120.2	0.987	(0.001)	0.41	(0.03)	(0.35	to	0.46)
05/02/07	10/09/07	5.3	120.2	125.5	1.000	(0.000)	0.41	(0.03)	(0.35	to	0.46)
10/09/07	04/30/08	6.8	125.5	132.3	0.987	(0.002)	0.37	(0.03)	(0.32	to	0.42)
04/30/08	09/07/08	4.3	132.3	136.7	1.000	(0.000)	0.37	(0.03)	(0.32	to	0.42)
09/07/08	05/01/09	7.9	136.7	144.5	0.991	(0.001)	0.34	(0.03)	(0.29	to	0.40)
05/01/09	10/01/09	5.1	144.5	149.6	1.000	(0.000)	0.34	(0.03)	(0.29	to	0.39)
10/01/09	04/11/10	6.4	149.6	156.0	0.981	(0.004)	0.30	(0.03)	(0.26	to	0.35)
04/11/10	09/08/10	5.0	156.0	161.0	1.000	(0.000)	0.30	(0.02)	(0.26	to	0.35)
09/08/10	04/26/11	7.7	161.0	168.7	0.991	(0.002)	0.28	(0.02)	(0.24	to	0.33)
04/26/11	09/16/11	4.8	168.7	173.5	1.000	(0.000)	0.28	(0.02)	(0.24	to	0.33)
09/16/11	04/28/12	7.5	173.5	181.0	0.991	(0.002)	0.27	(0.02)	(0.22	to	0.31)
04/28/12	09/15/12	4.7	181.0	185.6	1.000	(0.000)	0.27	(0.02)	(0.22	to	0.31)
09/15/12	04/16/13	7.1	185.6	192.7	0.990	(0.002)	0.25	(0.03)	(0.20	to	0.30)
04/16/13	09/10/13	4.9	192.7	197.6	1.000	(0.000)	0.25	(0.03)	(0.20	to	0.30)
09/10/13	09/17/14	7.5	197.6	205.2	0.992	(0.002)	0.23	(0.03)	(0.18	to	0.28)
09/17/14	04/19/15	4.9	205.2	210.0	1.000	(0.000)	0.23	(0.03)	(0.18	to	0.28)
04/19/15	09/01/15	7.1	210.0	217.2	0.991	(0.002)	0.22	(0.03)	(0.16	to	0.27)
09/01/15	04/24/14	4.5	217.2	221.7	1.000	(0.000)	0.22	(0.03)	(0.16	to	0.27)
04/24/14	04/23/16	7.8	221.7	229.5	0.994	(0.002)	0.21	(0.03)	(0.15	to	0.26)
04/23/16	09/04/16	4.5	229.5	234.0	1.000	(0.000)	0.21	(0.03)	(0.15	to	0.26)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.08	13	0.81	0.04	Sum. Yrlg.	1
2.14	25.7	0.95	0.07	Sum. Yrlg.	1
3.20	38.4	0.95	0.06	Sum. Yrlg.	1
3.99	47.9	0.95	0.08	Sum. Yrlg.	1
5.16	61.9	0.90	0.10	Sum. Yrlg.	1
6.18	74.1	0.89	0.11	Sum. Yrlg.	1
7.21	86.5	0.91	0.10	Sum. Yrlg.	1
8.22	98.6	0.90	0.10	Sum. Yrlg.	1
8.83	106	0.91	0.11	Sum. Yrlg.	1
9.84	118.1	0.90	0.12	Sum. Yrlg.	1
10.86	130.3	0.92	0.13	Sum. Yrlg.	1
11.82	141.8	0.88	0.15	Sum. Yrlg.	1
12.88	154.5	0.93	0.13	Sum. Yrlg.	1
13.90	166.8	0.96	0.11	Sum. Yrlg.	1
14.88	178.5	0.93	0.15	Sum. Yrlg.	1
15.92	191	0.92	0.19	Sum. Yrlg.	1
16.92	203	0.96	0.20	Sum. Yrlg.	1
17.94	215.3	0.95	0.21	Sum. Yrlg.	1

When the number of fish released in a cohort is taken into account, it is possible to estimate the number of fish from each cohort that are estimated to have been alive through time. The tables below do this for each release type and cohort using **the average value for disease status in each release cohort.**

Estimates of survival for the 1st release cohort of summer yearlings in RPMA 1 (cohort=691¹ fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	SUM	08/18/98	10/11/98	14.2	16.0	1.00	0.00	690	688	to	691
1	SUM	10/11/98	04/13/99	16.0	22.2	0.81	0.04	561	503	to	619
1	SUM	04/13/99	09/10/99	22.2	27.2	0.81	0.04	560	504	to	616
1	SUM	09/10/99	09/26/00	27.2	39.9	0.77	0.03	533	487	to	579
1	SUM	09/26/00	10/13/01	39.9	52.6	0.73	0.03	505	461	to	549
1	SUM	10/13/01	07/23/02	52.6	62.1	0.69	0.04	477	429	to	524
1	SUM	07/23/02	09/07/02	62.0	63.6	0.69	0.04	477	429	to	524
1	SUM	09/07/02	05/04/03	63.6	71.5	0.62	0.04	431	382	to	480
1	SUM	05/04/03	09/17/03	71.5	76.1	0.62	0.04	430	381	to	480
1	SUM	09/17/03	04/24/04	76.1	83.4	0.56	0.04	384	336	to	431
1	SUM	04/24/04	09/17/04	83.4	88.3	0.55	0.04	383	335	to	431
1	SUM	09/17/04	04/26/05	88.3	95.7	0.50	0.03	344	299	to	389
1	SUM	04/26/05	09/25/05	95.7	100.7	0.50	0.03	343	298	to	389
1	SUM	09/25/05	04/30/06	100.7	108.0	0.45	0.03	309	267	to	351
1	SUM	04/30/06	09/23/06	108.0	112.8	0.45	0.03	309	266	to	351
1	SUM	09/23/06	05/02/07	112.8	120.2	0.41	0.03	280	241	to	320
1	SUM	05/02/07	10/09/07	120.2	125.5	0.41	0.03	280	241	to	319
1	SUM	10/09/07	04/30/08	125.5	132.3	0.37	0.03	256	219	to	292
1	SUM	04/30/08	09/07/08	132.3	136.7	0.37	0.03	255	218	to	292
1	SUM	09/07/08	05/01/09	136.7	144.5	0.34	0.03	238	202	to	273
1	SUM	05/01/09	10/01/09	144.5	149.6	0.34	0.03	237	202	to	273
1	SUM	10/01/09	04/11/10	149.6	156.0	0.30	0.03	210	176	to	244
1	SUM	04/11/10	09/08/10	156.0	161.0	0.30	0.02	210	176	to	244
1	SUM	09/08/10	04/26/11	161.0	168.7	0.28	0.02	196	163	to	230
1	SUM	04/26/11	09/16/11	168.7	173.5	0.28	0.02	196	163	to	229
1	SUM	09/16/11	04/28/12	173.5	181.0	0.27	0.02	184	150	to	217
1	SUM	04/28/12	09/15/12	181.0	185.6	0.27	0.02	183	150	to	217
1	SUM	09/15/12	04/16/13	185.6	192.7	0.25	0.03	170	136	to	205
1	SUM	04/16/13	09/10/13	192.7	197.6	0.25	0.03	170	136	to	205
1	SUM	09/10/13	09/17/14	197.6	205.2	0.23	0.03	161	125	to	196
1	SUM	09/17/14	04/19/15	205.2	210.0	0.23	0.03	161	125	to	196
1	SUM	04/19/15	09/01/15	210.0	217.2	0.22	0.03	150	113	to	187
1	SUM	09/01/15	04/24/14	217.2	221.7	0.22	0.03	150	113	to	187
1	SUM	04/24/14	04/23/16	221.7	229.5	0.21	0.03	143	105	to	182
1	SUM	04/23/16	09/04/16	229.5	234.0	0.21	0.03	143	105	to	182

¹Note: data provided for the analyses presented here, included data for 691 summer yearlings that were originally released in 1998 whereas 731 were known to have been released, which indicates that it is possible for an additional 10 fish approximately 20 years old might be alive in RPMA 1.

Estimates of survival for the 2nd release cohort of summer yearlings in RPMA 1 (cohort= 2,038 fish, average fin curl value in cohort = 1). As in previous reports, the survival of fish with high levels of fin curl are not estimated to survive long.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	SUM	07/23/02	09/07/02	14.2	15.8	0.99	0.01	2,022	1,988	to	2,038
2	SUM	09/07/02	05/04/03	15.8	23.7	0.24	0.04	496	347	to	646
2	SUM	05/04/03	09/17/03	23.7	28.3	0.24	0.04	485	325	to	646
2	SUM	09/17/03	04/24/04	28.3	35.6	0.05	0.01	101	45	to	156
2	SUM	04/24/04	09/17/04	35.6	40.5	0.05	0.01	98	42	to	155
2	SUM	09/17/04	04/26/05	40.5	47.8	0.01	0.00	22	4	to	40
2	SUM	04/26/05	09/25/05	47.8	52.9	0.01	0.00	22	4	to	39
2	SUM	09/25/05	04/30/06	52.9	60.1	0.00	0.00	5	0	to	10
2	SUM	04/30/06	09/23/06	60.1	65.0	0.00	0.00	5	0	to	10
2	SUM	09/23/06	05/02/07	65.0	72.4	0.00	0.00	1	0	to	3
2	SUM	05/02/07	10/09/07	72.4	77.7	0.00	0.00	1	0	to	3
2	SUM	10/09/07	04/30/08	77.7	84.5	0.00	0.00	0	0	to	1
2	SUM	04/30/08	09/07/08	84.5	88.8	0.00	0.00	0	0	to	1
2	SUM	09/07/08	05/01/09	88.8	96.7	0.00	0.00	0	0	to	0
2	SUM	05/01/09	10/01/09	96.7	101.8	0.00	0.00	0	0	to	0
2	SUM	10/01/09	04/11/10	101.8	108.2	0.00	0.00	0	0	to	0
2	SUM	04/11/10	09/08/10	108.2	113.2	0.00	0.00	0	0	to	0
2	SUM	09/08/10	04/26/11	113.2	120.9	0.00	0.00	0	0	to	0
2	SUM	04/26/11	09/16/11	120.9	125.6	0.00	0.00	0	0	to	0
2	SUM	09/16/11	04/28/12	125.6	133.1	0.00	0.00	0	0	to	0
2	SUM	04/28/12	09/15/12	133.1	137.8	0.00	0.00	0	0	to	0
2	SUM	09/15/12	04/16/13	137.8	144.9	0.00	0.00	0	0	to	0
2	SUM	04/16/13	09/10/13	144.9	149.8	0.00	0.00	0	0	to	0
2	SUM	09/10/13	09/17/14	149.8	157.3	0.00	0.00	0	0	to	0
2	SUM	09/17/14	04/19/15	157.3	162.2	0.00	0.00	0	0	to	0
2	SUM	04/19/15	09/01/15	162.2	169.3	0.00	0.00	0	0	to	0
2	SUM	09/01/15	04/24/14	169.3	173.8	0.00	0.00	0	0	to	0
2	SUM	04/24/14	04/23/16	173.8	181.7	0.00	0.00	0	0	to	0
2	SUM	04/23/16	09/04/16	181.7	186.1	0.00	0.00	0	0	to	0

Estimates of survival for the 3rd release cohort of summer yearlings in RPMA 1 (cohort=3,128 fish, average fin curl value in cohort = 1).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)			
3	SUM	09/17/04	04/26/05	14.2	21.6	0.19	0.03	579	394	to	763	
3	SUM	04/26/05	09/25/05	21.6	26.7	0.18	0.03	564	387	to	742	
3	SUM	09/25/05	04/30/06	26.7	33.9	0.04	0.01	110	44	to	177	
3	SUM	04/30/06	09/23/06	33.9	38.8	0.03	0.01	108	43	to	173	
3	SUM	09/23/06	05/02/07	38.8	46.1	0.01	0.00	24	3	to	44	
3	SUM	05/02/07	10/09/07	46.1	51.5	0.01	0.00	23	3	to	43	
3	SUM	10/09/07	04/30/08	51.5	58.3	0.00	0.00	6	0	to	12	
3	SUM	04/30/08	09/07/08	58.3	62.6	0.00	0.00	5	0	to	11	
3	SUM	09/07/08	05/01/09	62.6	70.5	0.00	0.00	2	0	to	4	
3	SUM	05/01/09	10/01/09	70.5	75.6	0.00	0.00	2	0	to	4	
3	SUM	10/01/09	04/11/10	75.6	82.0	0.00	0.00	0	0	to	1	
3	SUM	04/11/10	09/08/10	82.0	87.0	0.00	0.00	0	0	to	1	
3	SUM	09/08/10	04/26/11	87.0	94.6	0.00	0.00	0	0	to	0	
3	SUM	04/26/11	09/16/11	94.6	99.4	0.00	0.00	0	0	to	0	
3	SUM	09/16/11	04/28/12	99.4	106.9	0.00	0.00	0	0	to	0	
3	SUM	04/28/12	09/15/12	106.9	111.6	0.00	0.00	0	0	to	0	
3	SUM	09/15/12	04/16/13	111.6	118.7	0.00	0.00	0	0	to	0	
3	SUM	04/16/13	09/10/13	118.7	123.6	0.00	0.00	0	0	to	0	
3	SUM	09/10/13	09/17/14	123.6	131.1	0.00	0.00	0	0	to	0	
3	SUM	09/17/14	04/19/15	131.1	136.0	0.00	0.00	0	0	to	0	
3	SUM	04/19/15	09/01/15	136.0	143.1	0.00	0.00	0	0	to	0	
3	SUM	09/01/15	04/24/14	143.1	147.6	0.00	0.00	0	0	to	0	
3	SUM	04/24/14	04/23/16	147.6	155.4	0.00	0.00	0	0	to	0	
3	SUM	04/23/16	09/04/16	155.4	159.9	0.00	0.00	0	0	to	0	

Estimates of survival for the 4th release cohort of summer yearlings in RPMA 1 (cohort=186 fish, average fin curl value in cohort = 1).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
4	SUM	09/25/05	04/30/06	14.2	21.5	0.18	0.03	33	22	to	44
4	SUM	04/30/06	09/23/06	21.5	26.3	0.17	0.03	32	22	to	43
4	SUM	09/23/06	05/02/07	26.3	33.7	0.04	0.01	7	3	to	11
4	SUM	05/02/07	10/09/07	33.7	39.0	0.03	0.01	6	3	to	10
4	SUM	10/09/07	04/30/08	39.0	45.8	0.01	0.00	1	0	to	3
4	SUM	04/30/08	09/07/08	45.8	50.2	0.01	0.00	1	0	to	3
4	SUM	09/07/08	05/01/09	50.2	58.0	0.00	0.00	0	0	to	1
4	SUM	05/01/09	10/01/09	58.0	63.1	0.00	0.00	0	0	to	1
4	SUM	10/01/09	04/11/10	63.1	69.5	0.00	0.00	0	0	to	0
4	SUM	04/11/10	09/08/10	69.5	74.5	0.00	0.00	0	0	to	0
4	SUM	09/08/10	04/26/11	74.5	82.2	0.00	0.00	0	0	to	0
4	SUM	04/26/11	09/16/11	82.2	87.0	0.00	0.00	0	0	to	0
4	SUM	09/16/11	04/28/12	87.0	94.5	0.00	0.00	0	0	to	0
4	SUM	04/28/12	09/15/12	94.5	99.1	0.00	0.00	0	0	to	0
4	SUM	09/15/12	04/16/13	99.1	106.2	0.00	0.00	0	0	to	0
4	SUM	04/16/13	09/10/13	106.2	111.1	0.00	0.00	0	0	to	0
4	SUM	09/10/13	09/17/14	111.1	118.7	0.00	0.00	0	0	to	0
4	SUM	09/17/14	04/19/15	118.7	123.5	0.00	0.00	0	0	to	0
4	SUM	04/19/15	09/01/15	123.5	130.7	0.00	0.00	0	0	to	0
4	SUM	09/01/15	04/24/14	130.7	135.2	0.00	0.00	0	0	to	0
4	SUM	04/24/14	04/23/16	135.2	143.0	0.00	0.00	0	0	to	0
4	SUM	04/23/16	09/04/16	143.0	147.5	0.00	0.00	0	0	to	0

Estimates of survival for the 5th release cohort of summer yearlings in RPMA 1 (cohort= 55 fish, average fin curl value in cohort = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
5	SUM	04/19/15	09/01/15	14.2	21.4	0.84	0.03	46	43	to	49
5	SUM	09/01/15	04/24/14	21.4	25.9	0.84	0.03	46	43	to	49
5	SUM	04/24/14	04/23/16	25.9	33.7	0.74	0.04	41	37	to	45
5	SUM	04/23/16	09/04/16	33.7	38.2	0.74	0.04	41	37	to	44

Summary information for Summer Yearlings released in RPMA 1

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as summer yearlings are estimated to have been alive at the time data collection ended. An estimated ~184 fish released as summer yearlings are estimated to have been alive in the river at the time the final data were collected (09/04/2016) for the analyses presented here. Of these ~184 fish, 22% ($n = 41$) were <5-years old, and ~78% ($n = 143$) were 15- to 20-years old.

Estimates of surviving proportions and numbers for summer yearling releases in RPMA 1.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 691	SUM	09/04/16	234.0	19.5	0.21	0.03	143	105	to	182
2: 2,038	SUM	09/04/16	186.1	15.5	0.00	0.00	0	0	to	0
3: 3,128	SUM	09/04/16	159.9	13.3	0.00	0.00	0	0	to	0
4: 186	SUM	09/04/16	147.5	12.3	0.00	0.00	0	0	to	0
5: 55	SUM	09/04/16	38.2	3.2	0.74	0.04	41	37	to	44

Summary of number estimated to have been alive in RPMA 1 as of 04 Sept. 2016

1: 691	SUM	09/04/16	234.0	19.5	0.21	0.03	143	105	to	182
2: 2,038	SUM	09/04/16	186.1	15.5	0.00	0.00	0	0	to	0
3: 3,128	SUM	09/04/16	159.9	13.3	0.00	0.00	0	0	to	0
1: 521	SPR	09/04/16	147.8	12.3	0.03	0.01	14	7	to	21
4: 186	SUM	09/04/16	147.5	12.3	0.00	0.00	0	0	to	0
2: 4,714	SPR	09/04/16	135.5	11.3	0.01	0.00	55	28	to	83
3: 4,461	SPR	09/04/16	123.3	10.3	0.05	0.01	233	162	to	304
4: 6,791	SPR	09/04/16	111.1	9.3	0.06	0.01	392	297	to	488
5: 6,292	SPR	09/04/16	98.9	8.2	0.07	0.01	457	373	to	542
6: 6,095	SPR	09/04/16	87.4	7.3	0.16	0.02	951	755	to	1,148
7: 752	SPR	09/04/16	74.8	6.2	0.21	0.02	157	131	to	184
8: 465	SPR	09/04/16	50.7	4.2	0.40	0.03	186	163	to	209
9: 323	SPR	09/04/16	38.3	3.2	0.54	0.02	174	158	to	190
5: 55	SUM	09/04/16	38.2	3.2	0.74	0.04	41	37	to	44
10: 522	SPR	09/04/16	26.3	2.2	0.76	0.03	399	373	to	425
11: 911	SPR	09/04/16	14.0	1.2	1.00	0.00	907	900	to	911

**The Release column represents (a) the release cohort for the specific type of release and (b) the number of individuals in that release cohort.*

When summarized by age class, the estimates indicate that ~4,109 of the fish that were released from hatcheries beginning in 1998 in RPMA 1 were still alive there in September of 2016. Of these fish, ~42% (1,707 fish) were estimated to be ~1- to 5-years old, ~48% (1,957 fish) were ~5- to 10-years old, ~7% (302 fish) were ~10- to 15-years old, and ~3% (143 fish) were 15- to 20-years old. Note: Actual numbers of stocked pallid sturgeon that were still alive as of September of 2016 were likely higher than the numbers presented above because over (1) 90,000 additional pallid sturgeon were released as fingerlings in RPMA 1 but were not included in the analysis due to low recapture rates for that release type in RPMA1 and (2) data provided for the analyses presented here, included data for 691 summer yearlings that were originally released in 1998 whereas 731 were known to have been released, which indicates that it is possible for an additional 10 fish approximately 20 years old might be alive in RPMA 1.

Summary information for RPMA 1 organized with age classes in ascending order

RPMA	Date	Age in years	N Alive	(Sum of 95% CI elements for N Alive)			ppn of total
1	09/04/16	1 to 5	1,707	1,631	to	1,779	0.42
1	09/04/16	5 to 10	1,957	1,556	to	2,362	0.48
1	09/04/16	10 to 15	302	197	to	408	0.07
1	09/04/16	15 to 20	143	105	to	182	0.03

RPMA 2

Dates and numbers for releases and recapture work on RPMA 2

Numbers in the table below are based on the most recent input files provided by biologists during summer 2017. Numbers of fish in the first table (summarized by release type but not by river of release) contains data from an additional 252 fish (15 fish released as fingerlings, 104 fish released as spring yearlings, and 133 fish released as summer yearlings). Information on river of release was not available for those 252 fish when they were recaptured due to PIT tag loss. Accordingly, those fish were assigned covariate values for river of release equal to the average proportion of fish in that release type that were released in each river. This allowed the fish to contribute information to survival estimation survival and prevent biases that would have occurred by excluding fish known to have survived long enough to be recaptured. Those fish were not included in estimation of numbers of fish remaining alive; any errors due to this should be small given the modest numbers of fish in this situation relative to the large numbers with river of release information (~0.1% of all fish ever released).

				Release Numbers for Each Fish Type								
Occ	Begin	End	Midpoint	Fingerlings			Spring		Summer			
1	08/11/98	08/11/98	08/11/98					1	821	1	791	
2	10/11/00	10/17/00	10/14/00							2	478	
3	07/18/02	09/18/02	08/18/02							3	3,078	
4	08/07/03	08/28/03	08/17/03							4	4,046	
5	04/13/04	04/13/04	04/13/04				1	2	869	5	1,584	
6	08/16/04	10/21/04	09/21/04	1	16,811					6	174	
7	04/12/05	05/18/05	04/30/05							7	1,375	
8	08/15/05	11/02/05	09/23/05	2	12,484							
9	03/28/06	05/31/06	04/29/06				3	6,630				
10	07/13/06	07/13/06	07/13/06									
11	08/14/06	11/08/06	09/27/06	3	6,919							
12	04/03/07	05/31/07	05/02/07									
13	08/14/07	10/31/07	09/22/07	4	41,467		4	3,943				
14	03/26/08	06/04/08	04/30/08									
15	07/17/08	07/30/08	07/22/08									
16	08/04/08	10/29/08	09/16/08	5	58,831							
17	04/13/09	06/03/09	05/08/09				6	5,001				
18	07/22/09	07/22/09	07/22/09									
19	08/03/09	10/28/09	09/15/09	6	40,992							
20	04/05/10	06/02/10	05/04/10									
21	07/28/10	10/21/10	09/08/10	7	3,998		7	10,356		10	1,886	
22	04/19/11	06/06/11	05/09/11									
23	08/01/11	10/25/11	09/12/11									
24	04/09/12	06/07/12	05/08/12									
25	07/20/12	10/24/12	09/06/12				9	748				
26	04/18/13	06/11/13	05/05/13									
27	08/12/13	10/29/13	09/20/13									
28	04/21/14	06/11/14	05/16/14									
29	08/04/14	10/27/14	09/15/14				10	847				
30	04/07/15	06/11/15	05/10/15									
31	08/10/15	10/22/15	09/16/15									
32	04/11/16	06/18/16	05/15/16									
33	08/01/16	10/11/16	09/05/16				12	1,465				
Totals					181,502			42,586		21,413	245,501	

Occ	Midpoint	Release Numbers for Each Fish Type & River of Release						
		Fingerlings		Spring		Summer		
		Miss. R.	Yell. R.	Miss. R.	Yell. R.	Miss. R.	Yell. R.	
1	08/11/98					1	295	486
2	10/14/00					2	179	299
3	08/18/02					3	1,272	1,752
4	08/17/03					4	2,061	1,929
5	04/13/04			1	821			
6	09/21/04	1	11,342	5,469		5	896	676
7	04/30/05			2	558	309		
8	09/23/05	2	8,483	4,001		6		174
9	04/29/06			3	4,329	2,260		
10	07/13/06					7	918	457
11	09/27/06	3	4,656	2,262				
12	05/02/07			4	1,922	1,966		
13	09/22/07	4	20,264	21,202				
14	04/30/08			5	5,055	3,042		
15	07/22/08					8	688	2,569
16	09/16/08	5	27,344	31,478				
17	05/08/09			6	1,892	3,105		
18	07/22/09					9	2,000	1,781
19	09/15/09	6	20,207	20,781				
20	05/04/10			7	5,179	5,177		
21	09/08/10	7	1,998	2,000		10	809	1,077
22	05/09/11			8	1,592	1,585		
23	09/12/11					11	525	437
24	05/08/12							
25	09/06/12							
26	05/05/13			9	375	373		
27	09/20/13							
28	05/16/14			10	423	424		
29	09/15/14							
30	05/10/15			11	314	316		
31	09/16/15							
32	05/15/16			12	710	755		
33	09/05/16							
Totals		94,294	87,193	23,170	19,312	9,643	11,637	245,249
Proportions		0.52	0.48	0.55	0.45	0.45	0.55	
Grp. Total			181,487		42,482		21,280	

For RPMA 2, the top model remained the same as the best-supported model in the previous analysis (Rotella 2015). The top model of the mark-recapture data included the following covariates of survival: release type, age of fish, an interaction between release type and age of fish, release site (Missouri vs Yellowstone River), iridovirus status for fish released as fingerlings, and fin curl status at release. The model of capture probability included release type, fish age, season of year (spring versus fall), river of release (Missouri vs Yellowstone River), and an interaction between season of year and river of release.

In this report, the survival of each cohort in each river of release is presented. For fin curl and iridovirus values, the average values across individuals in a given cohort were used to obtain estimates for that cohort. All tables of survival and abundance estimates for those cohorts of Spring & Summer yearlings that were released after 2003 in RPMA 2 are presented using values that are adjusted for PIT Tag Retention rates being less than 1.0. Details of methods used for making adjustments for PIT Tag Retention are provided in Rotella (2015).

Data on the number of fingerlings released on each occasion ($R(i)$) along with information on when they were 1st subsequently recaptured (on occasion j) is provided in the table below. At the time of the analyses presented here, (1) 95,226 releases and re-releases of fish originally released as fingerlings in the Missouri River had been conducted, which resulted in 962 recaptures, and (2) 88,351 releases and re-releases of fish originally released as fingerlings in the Yellowstone River had been conducted, which resulted in 1,185 recaptures. The results presented below are based on the analyses of the data for those fish.

[illegible][illegible]

Fingerlings released in RPMA2 in the Missouri River

Estimates of survival for the 1st fully healthy release cohort of fingerlings (~2.7 months old at time of release, which was the 3rd cohort of fingerlings) in RPMA 2 in the Missouri River (cohort= 4,733 fish, IV status = 0, Fin Curl status = 0). Estimates are for fish without disease problems (no fin curl or iridovirus) and released in Missouri River. The estimates are for the 1st healthy release (cohort 3 for fingerlings) so as to provide estimates for as many ages as possible for a healthy release cohort.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
09/27/06	05/02/07	7.2	2.7	9.9	0.959	(0.004)	0.74	(0.02)	(0.69	to	0.78)
05/02/07	09/22/07	4.8	9.9	14.7	0.962	(0.003)	0.61	(0.03)	(0.56	to	0.67)
09/22/07	04/30/08	7.4	14.7	22.1	0.965	(0.003)	0.47	(0.03)	(0.41	to	0.53)
04/30/08	07/22/08	2.8	22.1	24.8	0.968	(0.002)	0.43	(0.03)	(0.37	to	0.49)
07/22/08	09/16/08	1.9	24.8	26.7	0.969	(0.002)	0.40	(0.03)	(0.35	to	0.46)
09/16/08	05/08/09	7.8	26.7	34.5	0.970	(0.002)	0.32	(0.03)	(0.26	to	0.37)
05/08/09	07/22/09	2.5	34.5	37.0	0.972	(0.002)	0.30	(0.03)	(0.25	to	0.35)
07/22/09	09/15/09	1.8	37.0	38.8	0.973	(0.002)	0.28	(0.03)	(0.23	to	0.33)
09/15/09	05/04/10	7.7	38.8	46.5	0.974	(0.002)	0.23	(0.02)	(0.19	to	0.27)
05/04/10	09/08/10	4.2	46.5	50.8	0.976	(0.002)	0.21	(0.02)	(0.17	to	0.25)
09/08/10	05/09/11	8.1	50.8	58.9	0.978	(0.002)	0.17	(0.02)	(0.14	to	0.21)
05/09/11	09/12/11	4.2	58.9	63.1	0.980	(0.002)	0.16	(0.02)	(0.12	to	0.19)
09/12/11	05/08/12	8.0	63.0	71.0	0.981	(0.002)	0.14	(0.02)	(0.11	to	0.17)
05/08/12	09/06/12	4.0	71.0	75.1	0.983	(0.002)	0.13	(0.02)	(0.10	to	0.16)
09/06/12	05/05/13	8.0	75.1	83.1	0.984	(0.002)	0.11	(0.01)	(0.08	to	0.14)
05/05/13	09/20/13	4.6	83.1	87.7	0.985	(0.002)	0.10	(0.01)	(0.08	to	0.13)
09/20/13	05/16/14	7.9	87.7	95.6	0.986	(0.002)	0.09	(0.01)	(0.07	to	0.12)
05/16/14	09/15/14	4.1	95.6	99.7	0.987	(0.002)	0.09	(0.01)	(0.06	to	0.11)
09/15/14	05/10/15	7.9	99.7	107.6	0.988	(0.002)	0.08	(0.01)	(0.06	to	0.11)
05/10/15	09/16/15	4.3	107.6	111.9	0.989	(0.002)	0.08	(0.01)	(0.05	to	0.10)
09/16/15	05/15/16	8.1	111.9	120.0	0.990	(0.002)	0.07	(0.01)	(0.05	to	0.10)
05/15/16	09/05/16	3.8	120.0	123.7	0.991	(0.002)	0.07	(0.01)	(0.04	to	0.09)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.00	12.0	0.61	0.03	Fing.-MO.	2
2.00	24.0	0.66	0.14	Fing.-MO.	2
3.01	36.1	0.70	0.19	Fing.-MO.	2
4.01	48.1	0.75	0.19	Fing.-MO.	2
5.03	60.4	0.76	0.21	Fing.-MO.	2
6.03	72.4	0.81	0.24	Fing.-MO.	2
7.08	85.0	0.77	0.24	Fing.-MO.	2
8.08	97.0	0.90	0.17	Fing.-MO.	2
9.10	109.2	0.89	0.19	Fing.-MO.	2
10.08	121.0	0.88	0.22	Fing.-MO.	2

When the number of fish released in a cohort is taken into account, it is possible to estimate the number of fish from each cohort that are estimated to have been alive through time. The tables below do this for each release type, cohort, and river of release using **the average value for the cohort's disease status**.

Estimates of survival for the 1st release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 11,342 fish, IV status = 1, Fin Curl status = 0). *Lower survival rates of fish with iridovirus status of 1 are readily apparent when these results are compared with those for release cohorts with iridovirus status of 0 (see subsequent tables for survival rates for cohorts with lower disease values).*

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	FNG	9/21/04	4/30/05	2.7	10.1	0.4	0.1	4,597	3,562	to	5,632
1	FNG	4/30/05	9/23/05	10.1	14.9	0.2	0.0	2,666	1,733	to	3,599
1	FNG	9/23/05	4/29/06	14.9	22.2	0.1	0.0	1,240	599	to	1,881
1	FNG	4/29/06	7/13/06	22.2	24.7	0.1	0.0	975	424	to	1,527
1	FNG	7/13/06	9/27/06	24.7	27.2	0.1	0.0	770	299	to	1,242
1	FNG	9/27/06	5/2/07	27.2	34.5	0.0	0.0	401	104	to	698
1	FNG	5/2/07	9/22/07	34.5	39.2	0.0	0.0	271	51	to	491
1	FNG	9/22/07	4/30/08	39.2	46.6	0.0	0.0	153	12	to	293
1	FNG	4/30/08	7/22/08	46.6	49.4	0.0	0.0	126	6	to	246
1	FNG	7/22/08	9/16/08	49.4	51.2	0.0	0.0	111	3	to	219
1	FNG	9/16/08	5/8/09	51.2	59.0	0.0	0.0	66	0	to	136
1	FNG	5/8/09	7/22/09	59.0	61.5	0.0	0.0	57	0	to	119
1	FNG	7/22/09	9/15/09	61.5	63.4	0.0	0.0	51	0	to	108
1	FNG	9/15/09	5/4/10	63.4	71.1	0.0	0.0	33	0	to	72
1	FNG	5/4/10	9/8/10	71.1	75.3	0.0	0.0	26	0	to	59
1	FNG	9/8/10	5/9/11	75.3	83.4	0.0	0.0	18	0	to	41
1	FNG	5/9/11	9/12/11	83.4	87.6	0.0	0.0	15	0	to	35
1	FNG	9/12/11	5/8/12	87.6	95.6	0.0	0.0	11	0	to	26
1	FNG	5/8/12	9/6/12	95.6	99.6	0.0	0.0	9	0	to	23
1	FNG	9/6/12	5/5/13	99.6	107.6	0.0	0.0	7	0	to	18
1	FNG	5/5/13	9/20/13	107.6	112.2	0.0	0.0	6	0	to	15
1	FNG	9/20/13	5/16/14	112.2	120.2	0.0	0.0	5	0	to	13
1	FNG	5/16/14	9/15/14	120.2	124.2	0.0	0.0	4	0	to	11
1	FNG	9/15/14	5/10/15	124.2	132.1	0.0	0.0	3	0	to	10
1	FNG	5/10/15	9/16/15	132.1	136.4	0.0	0.0	3	0	to	9
1	FNG	9/16/15	5/15/16	136.4	144.5	0.0	0.0	3	0	to	7
1	FNG	5/15/16	9/5/16	144.5	148.3	0.0	0.0	2	0	to	7

Estimates of survival for the 2nd release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 8,483 fish, IV status = 0, Fin Curl status = 0.13).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	FNG	9/23/05	4/29/06	2.7	9.9	0.7	0.02	5,975	5,575	to	6,374
2	FNG	4/29/06	7/13/06	9.9	12.4	0.6	0.03	5,353	4,902	to	5,805
2	FNG	7/13/06	9/27/06	12.4	15.0	0.6	0.03	4,807	4,324	to	5,291
2	FNG	9/27/06	5/2/07	15.0	22.2	0.4	0.03	3,570	3,061	to	4,078
2	FNG	5/2/07	9/22/07	22.2	27.0	0.4	0.03	2,985	2,499	to	3,471
2	FNG	9/22/07	4/30/08	27.0	34.4	0.3	0.03	2,301	1,867	to	2,736
2	FNG	4/30/08	7/22/08	34.4	37.1	0.3	0.02	2,106	1,693	to	2,518
2	FNG	7/22/08	9/16/08	37.1	39.0	0.2	0.02	1,987	1,590	to	2,385
2	FNG	9/16/08	5/8/09	39.0	46.8	0.2	0.02	1,570	1,229	to	1,911
2	FNG	5/8/09	7/22/09	46.8	49.3	0.2	0.02	1,467	1,142	to	1,791
2	FNG	7/22/09	9/15/09	49.3	51.1	0.2	0.02	1,397	1,084	to	1,710
2	FNG	9/15/09	5/4/10	51.1	58.8	0.1	0.02	1,145	874	to	1,417
2	FNG	5/4/10	9/8/10	58.8	63.0	0.1	0.02	1,038	785	to	1,290
2	FNG	9/8/10	5/9/11	63.0	71.1	0.1	0.01	867	644	to	1,091
2	FNG	5/9/11	9/12/11	71.2	75.4	0.1	0.01	798	586	to	1,010
2	FNG	9/12/11	5/8/12	75.4	83.3	0.1	0.01	687	492	to	881
2	FNG	5/8/12	9/6/12	83.3	87.4	0.1	0.01	641	453	to	830
2	FNG	9/6/12	5/5/13	87.4	95.4	0.1	0.01	563	385	to	742
2	FNG	5/5/13	9/20/13	95.4	100.0	0.1	0.01	527	353	to	701
2	FNG	9/20/13	5/16/14	100.0	107.9	0.1	0.01	473	304	to	642
2	FNG	5/16/14	9/15/14	107.9	112.0	0.1	0.01	450	283	to	617
2	FNG	9/15/14	5/10/15	112.0	119.9	0.1	0.01	410	246	to	574
2	FNG	5/10/15	9/16/15	119.9	124.2	0.1	0.01	392	228	to	555
2	FNG	9/16/15	5/15/16	124.2	132.2	0.0	0.01	361	199	to	523
2	FNG	5/15/16	9/5/16	132.2	136.0	0.0	0.01	349	188	to	511

Estimates of survival for the 3rd release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 4,656 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	FNG	9/27/06	5/2/07	2.7	9.9	0.7	0.02	3,433	3,233	to	3,634
3	FNG	5/2/07	9/22/07	9.9	14.7	0.6	0.03	2,859	2,607	to	3,111
3	FNG	9/22/07	4/30/08	14.7	22.1	0.5	0.03	2,191	1,915	to	2,467
3	FNG	4/30/08	7/22/08	22.1	24.8	0.4	0.03	2,001	1,727	to	2,274
3	FNG	7/22/08	9/16/08	24.8	26.7	0.4	0.03	1,886	1,616	to	2,155
3	FNG	9/16/08	5/8/09	26.7	34.5	0.3	0.03	1,482	1,233	to	1,730
3	FNG	5/8/09	7/22/09	34.5	37.0	0.3	0.03	1,382	1,143	to	1,621
3	FNG	7/22/09	9/15/09	37.0	38.8	0.3	0.03	1,315	1,083	to	1,547
3	FNG	9/15/09	5/4/10	38.8	46.5	0.2	0.02	1,073	867	to	1,279
3	FNG	5/4/10	9/8/10	46.5	50.8	0.2	0.02	970	777	to	1,162
3	FNG	9/8/10	5/9/11	50.8	58.9	0.2	0.02	807	637	to	977
3	FNG	5/9/11	9/12/11	58.9	63.1	0.2	0.02	741	581	to	901
3	FNG	9/12/11	5/8/12	63.0	71.0	0.1	0.02	635	490	to	781
3	FNG	5/8/12	9/6/12	71.0	75.1	0.1	0.02	592	453	to	732
3	FNG	9/6/12	5/5/13	75.1	83.1	0.1	0.01	519	389	to	649
3	FNG	5/5/13	9/20/13	83.1	87.7	0.1	0.01	485	358	to	611
3	FNG	9/20/13	5/16/14	87.7	95.6	0.1	0.01	434	312	to	555
3	FNG	5/16/14	9/15/14	95.6	99.7	0.1	0.01	412	292	to	532
3	FNG	9/15/14	5/10/15	99.7	107.6	0.1	0.01	375	257	to	492
3	FNG	5/10/15	9/16/15	107.6	111.9	0.1	0.01	358	241	to	475
3	FNG	9/16/15	5/15/16	111.9	120.0	0.1	0.01	329	213	to	446
3	FNG	5/15/16	9/5/16	120.0	123.7	0.1	0.01	318	202	to	434

Estimates of survival for the 4th release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 20,264 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	FNG	9/22/07	4/30/08	2.7	10.1	0.7	0.02	14,855	13,969	to	15,742
4	FNG	4/30/08	7/22/08	10.1	12.8	0.7	0.03	13,359	12,335	to	14,384
4	FNG	7/22/08	9/16/08	12.8	14.7	0.6	0.03	12,467	11,382	to	13,552
4	FNG	9/16/08	5/8/09	14.7	22.5	0.5	0.03	9,408	8,210	to	10,606
4	FNG	5/8/09	7/22/09	22.5	25.0	0.4	0.03	8,671	7,486	to	9,855
4	FNG	7/22/09	9/15/09	25.0	26.8	0.4	0.03	8,184	7,016	to	9,352
4	FNG	9/15/09	5/4/10	26.8	34.5	0.3	0.03	6,453	5,375	to	7,530
4	FNG	5/4/10	9/8/10	34.5	38.8	0.3	0.03	5,734	4,722	to	6,746
4	FNG	9/8/10	5/9/11	38.8	46.9	0.2	0.02	4,628	3,737	to	5,519
4	FNG	5/9/11	9/12/11	46.9	51.1	0.2	0.02	4,188	3,355	to	5,020
4	FNG	9/12/11	5/8/12	51.0	59.0	0.2	0.02	3,499	2,762	to	4,236
4	FNG	5/8/12	9/6/12	59.0	63.1	0.2	0.02	3,224	2,527	to	3,920
4	FNG	9/6/12	5/5/13	63.0	71.1	0.1	0.02	2,761	2,130	to	3,392
4	FNG	5/5/13	9/20/13	71.1	75.7	0.1	0.02	2,549	1,947	to	3,151
4	FNG	9/20/13	5/16/14	75.7	83.6	0.1	0.01	2,239	1,675	to	2,802
4	FNG	5/16/14	9/15/14	83.6	87.7	0.1	0.01	2,108	1,559	to	2,658
4	FNG	9/15/14	5/10/15	87.7	95.6	0.1	0.01	1,887	1,359	to	2,416
4	FNG	5/10/15	9/16/15	95.6	99.9	0.1	0.01	1,788	1,267	to	2,309
4	FNG	9/16/15	5/15/16	99.9	108.0	0.1	0.01	1,623	1,112	to	2,134
4	FNG	5/15/16	9/5/16	108.0	111.7	0.1	0.01	1,559	1,050	to	2,068

Estimates of survival for the 5th release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 27,344 fish, IV status = 0, Fin Curl status = 0.10).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	FNG	9/16/08	5/8/09	2.7	10.5	0.7	0.02	18,945	17,618	to	20,272
5	FNG	5/8/09	7/22/09	10.5	13.0	0.6	0.03	17,032	15,554	to	18,511
5	FNG	7/22/09	9/15/09	13.0	14.8	0.6	0.03	15,795	14,248	to	17,342
5	FNG	9/15/09	5/4/10	14.8	22.5	0.4	0.03	11,585	9,943	to	13,226
5	FNG	5/4/10	9/8/10	22.5	26.7	0.4	0.03	9,929	8,349	to	11,509
5	FNG	9/8/10	5/9/11	26.7	34.8	0.3	0.03	7,507	6,101	to	8,913
5	FNG	5/9/11	9/12/11	34.8	39.0	0.2	0.02	6,588	5,287	to	7,888
5	FNG	9/12/11	5/8/12	39.0	47.0	0.2	0.02	5,210	4,093	to	6,326
5	FNG	5/8/12	9/6/12	47.0	51.0	0.2	0.02	4,681	3,648	to	5,714
5	FNG	9/6/12	5/5/13	51.0	59.1	0.1	0.02	3,823	2,930	to	4,716
5	FNG	5/5/13	9/20/13	59.1	63.7	0.1	0.02	3,444	2,616	to	4,271
5	FNG	9/20/13	5/16/14	63.7	71.6	0.1	0.01	2,906	2,169	to	3,643
5	FNG	5/16/14	9/15/14	71.6	75.7	0.1	0.01	2,686	1,985	to	3,388
5	FNG	9/15/14	5/10/15	75.7	83.6	0.1	0.01	2,325	1,678	to	2,971
5	FNG	5/10/15	9/16/15	83.6	87.9	0.1	0.01	2,165	1,541	to	2,790
5	FNG	9/16/15	5/15/16	87.9	95.9	0.1	0.01	1,909	1,316	to	2,501
5	FNG	5/15/16	9/5/16	95.9	99.7	0.1	0.01	1,810	1,228	to	2,392

Estimates of survival for the 6th release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 20,207 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	FNG	9/15/09	5/4/10	2.7	10.4	0.7	0.02	14,609	13,698	to	15,520
6	FNG	5/4/10	9/8/10	10.4	14.6	0.6	0.03	12,432	11,337	to	13,526
6	FNG	9/8/10	5/9/11	14.6	22.7	0.5	0.03	9,277	8,072	to	10,483
6	FNG	5/9/11	9/12/11	22.7	26.9	0.4	0.03	8,092	6,915	to	9,269
6	FNG	9/12/11	5/8/12	26.9	34.9	0.3	0.03	6,330	5,251	to	7,408
6	FNG	5/8/12	9/6/12	34.9	38.9	0.3	0.03	5,659	4,645	to	6,672
6	FNG	9/6/12	5/5/13	38.9	46.9	0.2	0.02	4,578	3,687	to	5,469
6	FNG	5/5/13	9/20/13	46.9	51.5	0.2	0.02	4,104	3,277	to	4,930
6	FNG	9/20/13	5/16/14	51.5	59.5	0.2	0.02	3,436	2,704	to	4,167
6	FNG	5/16/14	9/15/14	59.5	63.5	0.2	0.02	3,164	2,474	to	3,855
6	FNG	9/15/14	5/10/15	63.5	71.4	0.1	0.02	2,720	2,094	to	3,346
6	FNG	5/10/15	9/16/15	71.4	75.7	0.1	0.02	2,525	1,926	to	3,124
6	FNG	9/16/15	5/15/16	75.7	83.8	0.1	0.01	2,213	1,653	to	2,772
6	FNG	5/15/16	9/5/16	83.8	87.6	0.1	0.01	2,093	1,547	to	2,639

Estimates of survival for the 7th release cohort of fingerlings in RPMA 2 in the Missouri River (cohort= 1,998 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
7	FNG	9/8/10	5/9/11	2.7	10.8	0.7	0.02	1,420	1,327	to	1,513
7	FNG	5/9/11	9/12/11	10.8	15.0	0.6	0.03	1,211	1,101	to	1,321
7	FNG	9/12/11	5/8/12	15.0	22.9	0.5	0.03	909	790	to	1,029
7	FNG	5/8/12	9/6/12	22.9	27.0	0.4	0.03	798	681	to	914
7	FNG	9/6/12	5/5/13	27.0	35.0	0.3	0.03	623	517	to	730
7	FNG	5/5/13	9/20/13	35.0	39.6	0.3	0.03	548	449	to	648
7	FNG	9/20/13	5/16/14	39.6	47.5	0.2	0.02	446	358	to	533
7	FNG	5/16/14	9/15/14	47.5	51.6	0.2	0.02	405	323	to	487
7	FNG	9/15/14	5/10/15	51.6	59.5	0.2	0.02	339	267	to	412
7	FNG	5/10/15	9/16/15	59.5	63.8	0.2	0.02	311	243	to	379
7	FNG	9/16/15	5/15/16	63.8	71.9	0.1	0.02	267	205	to	328
7	FNG	5/15/16	9/5/16	71.9	75.7	0.1	0.02	250	191	to	309

Summary information for fingerlings released in RPMA 2 in the Missouri River

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as fingerlings in the Missouri River are estimated to have been alive at the time data collection ended. The estimates indicate that substantial proportions of cohorts and numbers of fish were still alive in RPMA 2 from Missouri River releases. An estimated ~6,381 fish released as fingerlings are estimated to have been alive in the river at the time the last data were collected (09/208/2013) for the analyses presented here. Of these, none were less than 6-years old, ~90% (5,712) were ~6- to ~10-years old, and 10% (669) were >10 years old.

Estimates of surviving proportions and numbers for fingerling releases in RPMA 2 in the Missouri River.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 11,342	FNG	09/05/16	148.3	12.4	0.00	0.00	2	0	to	7
2: 8,483	FNG	09/05/16	136.0	11.3	0.04	0.01	349	188	to	511
3: 4,656	FNG	09/05/16	123.7	10.3	0.07	0.01	318	202	to	434
4: 20,264	FNG	09/05/16	111.7	9.3	0.08	0.01	1,559	1,050	to	2,068
5: 27,344	FNG	09/05/16	99.7	8.3	0.07	0.01	1,810	1,228	to	2,392
6: 20,207	FNG	09/05/16	87.6	7.3	0.10	0.01	2,093	1,547	to	2,639
7: 1,998	FNG	09/05/16	75.7	6.3	0.13	0.02	250	191	to	309

Fingerlings released in RPMA2 in the Yellowstone River

Estimates of survival for the 1st healthy release cohort of fingerlings (~2.7 months old at time of release, which was the 3rd cohort of fingerlings) in RPMA 2 in the Yellowstone River (cohort= 2,262 fish, IV status = 0, Fin Curl status = 0). Estimates are for fish without disease problems (no fin curl or iridovirus) and released in Yellowstone River. The estimates are for the 1st healthy release (cohort 3 for fingerlings) so as to provide estimates for as many ages as possible for a healthy release cohort.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
09/27/06	05/02/07	7.2	2.7	9.9	0.943	(0.005)	0.65	(0.03)	(0.60	to	0.71)
05/02/07	09/22/07	4.8	9.9	14.7	0.948	(0.004)	0.50	(0.03)	(0.44	to	0.57)
09/22/07	04/30/08	7.4	14.7	22.1	0.951	(0.003)	0.35	(0.03)	(0.29	to	0.41)
04/30/08	07/22/08	2.8	22.1	24.8	0.955	(0.002)	0.31	(0.03)	(0.25	to	0.36)
07/22/08	09/16/08	1.9	24.8	26.7	0.957	(0.002)	0.28	(0.03)	(0.23	to	0.34)
09/16/08	05/08/09	7.8	26.7	34.5	0.958	(0.002)	0.20	(0.02)	(0.16	to	0.24)
05/08/09	07/22/09	2.5	34.5	37.0	0.962	(0.002)	0.18	(0.02)	(0.14	to	0.22)
07/22/09	09/15/09	1.8	37.0	38.8	0.963	(0.002)	0.17	(0.02)	(0.13	to	0.21)
09/15/09	05/04/10	7.7	38.8	46.5	0.964	(0.002)	0.13	(0.02)	(0.10	to	0.16)
05/04/10	09/08/10	4.2	46.5	50.8	0.967	(0.002)	0.11	(0.01)	(0.08	to	0.14)
09/08/10	05/09/11	8.1	50.8	58.9	0.969	(0.002)	0.09	(0.01)	(0.06	to	0.11)
05/09/11	09/12/11	4.2	58.9	63.1	0.972	(0.002)	0.08	(0.01)	(0.06	to	0.09)
09/12/11	05/08/12	8.0	63.0	71.0	0.973	(0.002)	0.06	(0.01)	(0.05	to	0.08)
05/08/12	09/06/12	4.0	71.0	75.1	0.976	(0.003)	0.06	(0.01)	(0.04	to	0.07)
09/06/12	05/05/13	8.0	75.1	83.1	0.977	(0.003)	0.05	(0.01)	(0.03	to	0.06)
05/05/13	09/20/13	4.6	83.1	87.7	0.979	(0.003)	0.04	(0.01)	(0.03	to	0.05)
09/20/13	05/16/14	7.9	87.7	95.6	0.980	(0.003)	0.04	(0.01)	(0.03	to	0.05)
05/16/14	09/15/14	4.1	95.6	99.7	0.982	(0.003)	0.03	(0.00)	(0.02	to	0.04)
09/15/14	05/10/15	7.9	99.7	107.6	0.983	(0.003)	0.03	(0.00)	(0.02	to	0.04)
05/10/15	09/16/15	4.3	107.6	111.9	0.985	(0.003)	0.03	(0.00)	(0.02	to	0.04)
09/16/15	05/15/16	8.1	111.9	120.0	0.986	(0.003)	0.02	(0.00)	(0.02	to	0.03)
05/15/16	09/05/16	3.8	120.0	123.7	0.987	(0.003)	0.02	(0.00)	(0.01	to	0.03)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.00	12.0	0.50	0.03	Fing.-YE.	2
2.00	24.0	0.56	0.22	Fing.-YE.	2
3.01	36.1	0.61	0.26	Fing.-YE.	2
4.01	48.1	0.65	0.23	Fing.-YE.	2
5.03	60.4	0.73	0.21	Fing.-YE.	2
6.03	72.4	0.75	0.28	Fing.-YE.	2
7.08	85.0	0.67	0.45	Fing.-YE.	2
8.08	97.0	0.75	0.33	Fing.-YE.	2
9.10	109.2	1.00	0.00	Fing.-YE.	2
10.08	121.0	0.67	0.00	Fing.-YE.	2

Estimates of survival for the 1st release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 5,469 fish, IV status = 1, Fin Curl status = 0). *Poor survival rates of fish with iridovirus status of 1 are readily apparent when these results are compared with those for release cohorts with iridovirus status of 0 (see subsequent tables for survival rates for cohorts with lower disease values).*

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	FNG	9/21/04	4/30/05	2.7	10.1	0.3	0.05	3,263	2,240	to	4,287
1	FNG	4/30/05	9/23/05	10.1	14.9	0.1	0.03	1,537	788	to	2,286
1	FNG	9/23/05	4/29/06	14.9	22.2	0.1	0.02	533	150	to	916
1	FNG	4/29/06	7/13/06	22.2	24.7	0.0	0.01	382	82	to	682
1	FNG	7/13/06	9/27/06	24.7	27.2	0.0	0.01	276	41	to	510
1	FNG	9/27/06	5/2/07	27.2	34.5	0.0	0.01	111	0	to	226
1	FNG	5/2/07	9/22/07	34.5	39.2	0.0	0.00	65	0	to	137
1	FNG	9/22/07	4/30/08	39.2	46.6	0.0	0.00	29	0	to	66
1	FNG	4/30/08	7/22/08	46.6	49.4	0.0	0.00	22	0	to	51
1	FNG	7/22/08	9/16/08	49.4	51.2	0.0	0.00	19	0	to	43
1	FNG	9/16/08	5/8/09	51.2	59.0	0.0	0.00	9	0	to	22
1	FNG	5/8/09	7/22/09	59.0	61.5	0.0	0.00	7	0	to	18
1	FNG	7/22/09	9/15/09	61.5	63.4	0.0	0.00	6	0	to	16
1	FNG	9/15/09	5/4/10	63.4	71.1	0.0	0.00	3	0	to	9
1	FNG	5/4/10	9/8/10	71.1	75.3	0.0	0.00	2	0	to	7
1	FNG	9/8/10	5/9/11	75.3	83.4	0.0	0.00	1	0	to	4
1	FNG	5/9/11	9/12/11	83.4	87.6	0.0	0.00	1	0	to	3
1	FNG	9/12/11	5/8/12	87.6	95.6	0.0	0.00	1	0	to	2
1	FNG	5/8/12	9/6/12	95.6	99.6	0.0	0.00	1	0	to	2
1	FNG	9/6/12	5/5/13	99.6	107.6	0.0	0.00	0	0	to	1
1	FNG	5/5/13	9/20/13	107.6	112.2	0.0	0.00	0	0	to	1
1	FNG	9/20/13	5/16/14	112.2	120.2	0.0	0.00	0	0	to	1
1	FNG	5/16/14	9/15/14	120.2	124.2	0.0	0.00	0	0	to	1
1	FNG	9/15/14	5/10/15	124.2	132.1	0.0	0.00	0	0	to	0
1	FNG	5/10/15	9/16/15	132.1	136.4	0.0	0.00	0	0	to	0
1	FNG	9/16/15	5/15/16	136.4	144.5	0.0	0.00	0	0	to	0
1	FNG	5/15/16	9/5/16	144.5	148.3	0.0	0.00	0	0	to	0

Estimates of survival for the 2nd release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 4,001 fish, IV status = 0, Fin Curl status = 0.14).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	FNG	9/23/05	4/29/06	2.7	9.9	0.6	0.030	5,145	4,659	to	5,631
2	FNG	4/29/06	7/13/06	9.9	12.4	0.5	0.030	4,398	3,876	to	4,920
2	FNG	7/13/06	9/27/06	12.4	15.0	0.4	0.030	3,772	3,241	to	4,302
2	FNG	9/27/06	5/2/07	15.0	22.2	0.3	0.030	2,465	1,979	to	2,951
2	FNG	5/2/07	9/22/07	22.2	27.0	0.2	0.030	1,909	1,483	to	2,334
2	FNG	9/22/07	4/30/08	27.0	34.4	0.2	0.020	1,316	982	to	1,649
2	FNG	4/30/08	7/22/08	34.4	37.1	0.1	0.020	1,159	857	to	1,460
2	FNG	7/22/08	9/16/08	37.1	39.0	0.1	0.020	1,067	785	to	1,348
2	FNG	9/16/08	5/8/09	39.0	46.8	0.1	0.010	761	549	to	973
2	FNG	5/8/09	7/22/09	46.8	49.3	0.1	0.010	690	497	to	883
2	FNG	7/22/09	9/15/09	49.3	51.1	0.1	0.010	644	463	to	825
2	FNG	9/15/09	5/4/10	51.1	58.8	0.1	0.010	484	346	to	623
2	FNG	5/4/10	9/8/10	58.8	63.0	0.1	0.010	420	300	to	541
2	FNG	9/8/10	5/9/11	63.0	71.1	0.0	0.010	325	230	to	420
2	FNG	5/9/11	9/12/11	71.2	75.4	0.0	0.010	288	203	to	373
2	FNG	9/12/11	5/8/12	75.4	83.3	0.0	0.000	232	161	to	303
2	FNG	5/8/12	9/6/12	83.3	87.4	0.0	0.000	211	145	to	277
2	FNG	9/6/12	5/5/13	87.4	95.4	0.0	0.000	175	116	to	233
2	FNG	5/5/13	9/20/13	95.4	100.0	0.0	0.000	159	103	to	214
2	FNG	9/20/13	5/16/14	100.0	107.9	0.0	0.000	136	84	to	188
2	FNG	5/16/14	9/15/14	107.9	112.0	0.0	0.000	126	76	to	177
2	FNG	9/15/14	5/10/15	112.0	119.9	0.0	0.000	111	63	to	159
2	FNG	5/10/15	9/16/15	119.9	124.2	0.0	0.000	104	56	to	151
2	FNG	9/16/15	5/15/16	124.2	132.2	0.0	0.000	92	46	to	139
2	FNG	5/15/16	9/5/16	132.2	136.0	0.0	0.000	88	42	to	134

Estimates of survival for the 3rd release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 2,262 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	FNG	9/27/06	5/2/07	2.7	9.9	0.7	0.03	3,039	2,794	to	3,285
3	FNG	5/2/07	9/22/07	9.9	14.7	0.5	0.03	2,351	2,068	to	2,635
3	FNG	9/22/07	4/30/08	14.7	22.1	0.4	0.03	1,619	1,343	to	1,895
3	FNG	4/30/08	7/22/08	22.1	24.8	0.3	0.03	1,425	1,164	to	1,687
3	FNG	7/22/08	9/16/08	24.8	26.7	0.3	0.03	1,312	1,061	to	1,562
3	FNG	9/16/08	5/8/09	26.7	34.5	0.2	0.02	935	730	to	1,140
3	FNG	5/8/09	7/22/09	34.5	37.0	0.2	0.02	848	658	to	1,038
3	FNG	7/22/09	9/15/09	37.0	38.8	0.2	0.02	791	611	to	970
3	FNG	9/15/09	5/4/10	38.8	46.5	0.1	0.02	594	452	to	736
3	FNG	5/4/10	9/8/10	46.5	50.8	0.1	0.01	515	391	to	640
3	FNG	9/8/10	5/9/11	50.8	58.9	0.1	0.01	398	301	to	496
3	FNG	5/9/11	9/12/11	58.9	63.1	0.1	0.01	353	266	to	440
3	FNG	9/12/11	5/8/12	63.0	71.0	0.1	0.01	284	214	to	355
3	FNG	5/8/12	9/6/12	71.0	75.1	0.1	0.01	258	193	to	322
3	FNG	9/6/12	5/5/13	75.1	83.1	0.1	0.01	214	158	to	269
3	FNG	5/5/13	9/20/13	83.1	87.7	0.0	0.01	194	142	to	246
3	FNG	9/20/13	5/16/14	87.7	95.6	0.0	0.01	166	119	to	213
3	FNG	5/16/14	9/15/14	95.6	99.7	0.0	0.00	154	109	to	200
3	FNG	9/15/14	5/10/15	99.7	107.6	0.0	0.00	135	92	to	179
3	FNG	5/10/15	9/16/15	107.6	111.9	0.0	0.00	127	84	to	169
3	FNG	9/16/15	5/15/16	111.9	120.0	0.0	0.00	113	71	to	154
3	FNG	5/15/16	9/5/16	120.0	123.7	0.0	0.00	107	66	to	149

Estimates of survival for the 4th release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 21,202 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	FNG	9/22/07	4/30/08	2.7	10.1	0.7	0.03	13,118	12,038	to	14,198
4	FNG	4/30/08	7/22/08	10.1	12.8	0.6	0.03	11,305	10,114	to	12,496
4	FNG	7/22/08	9/16/08	12.8	14.7	0.5	0.03	10,261	9,039	to	11,482
4	FNG	9/16/08	5/8/09	14.7	22.5	0.3	0.03	6,914	5,725	to	8,103
4	FNG	5/8/09	7/22/09	22.5	25.0	0.3	0.03	6,166	5,036	to	7,296
4	FNG	7/22/09	9/15/09	25.0	26.8	0.3	0.03	5,685	4,603	to	6,768
4	FNG	9/15/09	5/4/10	26.8	34.5	0.2	0.02	4,073	3,185	to	4,961
4	FNG	5/4/10	9/8/10	34.5	38.8	0.2	0.02	3,450	2,668	to	4,233
4	FNG	9/8/10	5/9/11	38.8	46.9	0.1	0.02	2,553	1,943	to	3,164
4	FNG	5/9/11	9/12/11	46.9	51.1	0.1	0.01	2,219	1,682	to	2,755
4	FNG	9/12/11	5/8/12	51.0	59.0	0.1	0.01	1,723	1,300	to	2,146
4	FNG	5/8/12	9/6/12	59.0	63.1	0.1	0.01	1,536	1,158	to	1,913
4	FNG	9/6/12	5/5/13	63.0	71.1	0.1	0.01	1,235	927	to	1,543
4	FNG	5/5/13	9/20/13	71.1	75.7	0.1	0.01	1,104	826	to	1,381
4	FNG	9/20/13	5/16/14	75.7	83.6	0.1	0.01	919	680	to	1,159
4	FNG	5/16/14	9/15/14	83.6	87.7	0.0	0.01	845	619	to	1,070
4	FNG	9/15/14	5/10/15	87.7	95.6	0.0	0.01	723	517	to	928
4	FNG	5/10/15	9/16/15	95.6	99.9	0.0	0.00	670	471	to	868
4	FNG	9/16/15	5/15/16	99.9	108.0	0.0	0.00	585	396	to	773
4	FNG	5/15/16	9/5/16	108.0	111.7	0.03	0.00	552	367	to	738

Estimates of survival for the 5th release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 31,478 fish, IV status = 0, Fin Curl status = 0.18).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	FNG	9/16/08	5/8/09	2.7	10.5	0.6	0.03	15,702	14,055	to	17,349
5	FNG	5/8/09	7/22/09	10.5	13.0	0.5	0.03	13,366	11,636	to	15,097
5	FNG	7/22/09	9/15/09	13.0	14.8	0.4	0.03	11,924	10,188	to	13,660
5	FNG	9/15/09	5/4/10	14.8	22.5	0.3	0.03	7,457	5,903	to	9,011
5	FNG	5/4/10	9/8/10	22.5	26.7	0.2	0.03	5,903	4,535	to	7,271
5	FNG	9/8/10	5/9/11	26.7	34.8	0.1	0.02	3,863	2,830	to	4,896
5	FNG	5/9/11	9/12/11	34.8	39.0	0.1	0.02	3,168	2,287	to	4,049
5	FNG	9/12/11	5/8/12	39.0	47.0	0.1	0.01	2,218	1,568	to	2,869
5	FNG	5/8/12	9/6/12	47.0	51.0	0.1	0.01	1,885	1,327	to	2,444
5	FNG	9/6/12	5/5/13	51.0	59.1	0.1	0.01	1,386	968	to	1,804
5	FNG	5/5/13	9/20/13	59.1	63.7	0.0	0.01	1,182	824	to	1,540
5	FNG	9/20/13	5/16/14	63.7	71.6	0.0	0.01	913	633	to	1,194
5	FNG	5/16/14	9/15/14	71.6	75.7	0.0	0.00	810	559	to	1,062
5	FNG	9/15/14	5/10/15	75.7	83.6	0.0	0.00	650	441	to	859
5	FNG	5/10/15	9/16/15	83.6	87.9	0.0	0.00	583	391	to	776
5	FNG	9/16/15	5/15/16	87.9	95.9	0.0	0.00	481	312	to	651
5	FNG	5/15/16	9/5/16	95.9	99.7	0.0	0.00	444	282	to	606

Estimates of survival for the 6th release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 20,781 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	FNG	9/15/09	5/4/10	2.7	10.4	0.6	0.03	12,829	11,725	to	13,933
6	FNG	5/4/10	9/8/10	10.4	14.6	0.5	0.03	10,232	8,997	to	11,466
6	FNG	9/8/10	5/9/11	14.6	22.7	0.3	0.03	6,788	5,595	to	7,980
6	FNG	5/9/11	9/12/11	22.7	26.9	0.3	0.03	5,603	4,513	to	6,693
6	FNG	9/12/11	5/8/12	26.9	34.9	0.2	0.02	3,969	3,085	to	4,853
6	FNG	5/8/12	9/6/12	34.9	38.9	0.2	0.02	3,391	2,608	to	4,174
6	FNG	9/6/12	5/5/13	38.9	46.9	0.1	0.02	2,518	1,907	to	3,129
6	FNG	5/5/13	9/20/13	46.9	51.5	0.1	0.01	2,159	1,629	to	2,689
6	FNG	9/20/13	5/16/14	51.5	59.5	0.1	0.01	1,682	1,264	to	2,099
6	FNG	5/16/14	9/15/14	59.5	63.5	0.1	0.01	1,498	1,125	to	1,871
6	FNG	9/15/14	5/10/15	63.5	71.4	0.1	0.01	1,210	906	to	1,515
6	FNG	5/10/15	9/16/15	71.4	75.7	0.1	0.01	1,090	814	to	1,366
6	FNG	9/16/15	5/15/16	75.7	83.8	0.0	0.01	905	668	to	1,142
6	FNG	5/15/16	9/5/16	83.8	87.6	0.0	0.01	837	613	to	1,061

Estimates of survival for the 7th release cohort of fingerlings in RPMA 2 in the Yellowstone River (cohort= 2,000 fish, IV status = 0, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
7	FNG	9/8/10	5/9/11	2.7	10.8	0.6	0.03	1,239	1,127	to	1,351
7	FNG	5/9/11	9/12/11	10.8	15.0	0.5	0.03	991	868	to	1,114
7	FNG	9/12/11	5/8/12	15.0	22.9	0.3	0.03	663	545	to	781
7	FNG	5/8/12	9/6/12	22.9	27.0	0.3	0.03	552	444	to	660
7	FNG	9/6/12	5/5/13	27.0	35.0	0.2	0.02	390	303	to	477
7	FNG	5/5/13	9/20/13	35.0	39.6	0.2	0.02	326	250	to	402
7	FNG	9/20/13	5/16/14	39.6	47.5	0.1	0.02	244	184	to	303
7	FNG	5/16/14	9/15/14	47.5	51.6	0.1	0.01	213	160	to	265
7	FNG	9/15/14	5/10/15	51.6	59.5	0.1	0.01	166	125	to	207
7	FNG	5/10/15	9/16/15	59.5	63.8	0.1	0.01	147	110	to	183
7	FNG	9/16/15	5/15/16	63.8	71.9	0.1	0.01	118	88	to	148
7	FNG	5/15/16	9/5/16	71.9	75.7	0.1	0.01	108	81	to	135

Summary information for fingerlings released in RPMA 2 in the Yellowstone River

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as fingerlings in the Yellowstone River are estimated to have been alive at the end of data collection. The estimates indicate that ~2,136 fish released as fingerlings in the Yellowstone River were alive at the time when the last data were collected (9/5/2016) for the analyses presented here. Of these none were less than 6 years old, ~91% (2,153) were ~6- to ~10-years old, and ~9% (195) were 10-13 years old.

Estimates of surviving proportions and numbers for fingerling releases in RPMA 2 in the Yellowstone River.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 5,469	FNG	09/05/16	148.3	12.4	0.00	0.00	0	0	to	0
2: 4,001	FNG	09/05/16	136.0	11.3	0.01	0.00	88	42	to	134
3: 2,262	FNG	09/05/16	123.7	10.3	0.02	0.00	107	66	to	149
4: 21,202	FNG	09/05/16	111.7	9.3	0.03	0.00	552	367	to	738
5: 31,478	FNG	09/05/16	99.7	8.3	0.02	0.00	444	282	to	606
6: 20,781	FNG	09/05/16	87.6	7.3	0.04	0.01	837	613	to	1,061
7: 2,000	FNG	09/05/16	75.7	6.3	0.05	0.01	108	81	to	135

Summary information for fingerlings released in RPMA 2 in the Missouri & Yellowstone Rivers

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as fingerlings in the Missouri and Yellowstone River are estimated to have been alive at the time data collection ended. The estimates indicate that substantial proportions of cohorts and numbers of fish remained alive in RPMA 2 from those releases. Approximately ~8,517 fish released as fingerlings are estimated to have been alive in the river at the time the last data were collected (09/05/2016) for the analyses presented here. Of these, none were less than 6 years old, ~90% (7,653) were ~6- to ~10-years old, ~10% (864) were ~10- to ~13-years old.

Release	Type	Date	Age in months	Age in years	N Alive	(95% CI for N Alive)		
1: 16,811	FNG	09/05/16	148.3	12.4	2	0	<i>to</i>	7
2: 12,484	FNG	09/05/16	136.0	11.3	437	230	<i>to</i>	645
3: 6,918	FNG	09/05/16	123.7	10.3	425	268	<i>to</i>	583
4: 41,466	FNG	09/05/16	111.7	9.3	2,111	1,417	<i>to</i>	2,806
5: 58,822	FNG	09/05/16	99.7	8.3	2,254	1,510	<i>to</i>	2,998
6: 40,988	FNG	09/05/16	87.6	7.3	2,930	2,160	<i>to</i>	3,700
7: 3,998	FNG	09/05/16	75.7	6.3	358	272	<i>to</i>	444

Data on the number of spring yearlings released on each occasion ($R(i)$) along with information on when they were 1st subsequently recaptured (on occasion j) is provided in the table below. The results presented below are based on analyses of data from (1) 23,912 releases and re-releases of fish originally released as spring yearlings in the Missouri River and the resulting 777 recaptures of those fish and (2) 20,530 releases and re-releases of fish originally released as spring yearlings in the Yellowstone River and the resulting 1,275 recaptures of those fish.

Releases and recaptures for spring yearlings released in the Missouri River[illegible]

Releases and recaptures for spring yearlings released in the Yellowstone River

[illegible]

Estimates of survival for the 1st healthy release cohort of spring yearlings (~9.6 months old at time of release, which was 4/30/2005) in RPMA 2 in the Missouri River. Estimates are for fish without disease problems (no fin curl or iridovirus) and released in the Missouri River.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
04/13/04	09/21/04	5.4	9.6	14.9	0.979	(0.003)	0.89	(0.01)	<i>(0.86</i>	<i>to</i>	<i>0.92)</i>
09/21/04	04/30/05	7.4	14.9	22.3	0.980	(0.003)	0.77	(0.03)	<i>(0.71</i>	<i>to</i>	<i>0.82)</i>
04/30/05	09/23/05	4.9	22.3	27.2	0.981	(0.002)	0.70	(0.03)	<i>(0.63</i>	<i>to</i>	<i>0.76)</i>
09/23/05	04/29/06	7.3	27.2	34.4	0.981	(0.002)	0.61	(0.04)	<i>(0.54</i>	<i>to</i>	<i>0.68)</i>
04/29/06	07/13/06	2.5	34.4	36.9	0.982	(0.002)	0.58	(0.04)	<i>(0.51</i>	<i>to</i>	<i>0.66)</i>
07/13/06	09/27/06	2.5	36.9	39.5	0.983	(0.002)	0.56	(0.04)	<i>(0.48</i>	<i>to</i>	<i>0.63)</i>
09/27/06	05/02/07	7.2	39.5	46.7	0.983	(0.002)	0.49	(0.04)	<i>(0.41</i>	<i>to</i>	<i>0.57)</i>
05/02/07	09/22/07	4.8	46.7	51.5	0.972	(0.002)	0.43	(0.04)	<i>(0.36</i>	<i>to</i>	<i>0.50)</i>
09/22/07	04/30/08	7.4	51.5	58.8	0.972	(0.002)	0.35	(0.03)	<i>(0.28</i>	<i>to</i>	<i>0.41)</i>
04/30/08	07/22/08	2.8	58.8	61.6	0.973	(0.002)	0.32	(0.03)	<i>(0.26</i>	<i>to</i>	<i>0.39)</i>
07/22/08	09/16/08	1.9	61.6	63.5	0.974	(0.002)	0.31	(0.03)	<i>(0.25</i>	<i>to</i>	<i>0.37)</i>
09/16/08	05/08/09	7.8	63.5	71.3	0.974	(0.002)	0.25	(0.03)	<i>(0.20</i>	<i>to</i>	<i>0.30)</i>
05/08/09	07/22/09	2.5	71.3	73.8	0.975	(0.002)	0.23	(0.03)	<i>(0.18</i>	<i>to</i>	<i>0.29)</i>
07/22/09	09/15/09	1.8	73.8	75.6	0.975	(0.002)	0.22	(0.03)	<i>(0.17</i>	<i>to</i>	<i>0.28)</i>
09/15/09	05/04/10	7.7	75.6	83.3	0.975	(0.002)	0.18	(0.02)	<i>(0.14</i>	<i>to</i>	<i>0.23)</i>
05/04/10	09/08/10	4.2	83.3	87.5	0.976	(0.002)	0.17	(0.02)	<i>(0.12</i>	<i>to</i>	<i>0.21)</i>
09/08/10	05/09/11	8.1	87.5	95.6	0.977	(0.002)	0.14	(0.02)	<i>(0.10</i>	<i>to</i>	<i>0.18)</i>
05/09/11	09/12/11	4.2	95.6	99.8	0.977	(0.003)	0.13	(0.02)	<i>(0.09</i>	<i>to</i>	<i>0.16)</i>
09/12/11	05/08/12	8.0	99.8	107.8	0.978	(0.003)	0.10	(0.02)	<i>(0.07</i>	<i>to</i>	<i>0.14)</i>
05/08/12	09/06/12	4.0	107.8	111.8	0.979	(0.003)	0.10	(0.02)	<i>(0.06</i>	<i>to</i>	<i>0.13)</i>
09/06/12	05/05/13	8.0	111.8	119.9	0.979	(0.003)	0.08	(0.02)	<i>(0.05</i>	<i>to</i>	<i>0.11)</i>
05/05/13	09/20/13	4.6	119.9	124.5	0.980	(0.003)	0.07	(0.01)	<i>(0.04</i>	<i>to</i>	<i>0.10)</i>
09/20/13	05/16/14	7.9	124.5	132.4	0.980	(0.003)	0.06	(0.01)	<i>(0.04</i>	<i>to</i>	<i>0.09)</i>
05/16/14	09/15/14	4.1	132.4	136.5	0.981	(0.003)	0.06	(0.01)	<i>(0.03</i>	<i>to</i>	<i>0.08)</i>
09/15/14	05/10/15	7.9	136.5	144.4	0.981	(0.004)	0.05	(0.01)	<i>(0.02</i>	<i>to</i>	<i>0.07)</i>
05/10/15	09/16/15	4.3	144.4	148.7	0.982	(0.004)	0.05	(0.01)	<i>(0.02</i>	<i>to</i>	<i>0.07)</i>
09/16/15	05/15/16	8.1	148.7	156.7	0.982	(0.004)	0.04	(0.01)	<i>(0.02</i>	<i>to</i>	<i>0.06)</i>
05/15/16	09/05/16	3.8	156.7	160.5	0.983	(0.004)	0.04	(0.01)	<i>(0.01</i>	<i>to</i>	<i>0.06)</i>

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.01	12.1	0.78	0.03	Spring-MO	2
2.03	24.4	0.78	0.10	Spring-MO	2
3.04	36.5	0.82	0.13	Spring-MO	2
4.08	48.9	0.70	0.17	Spring-MO	2
5.08	61.0	0.71	0.21	Spring-MO	2
6.11	73.3	0.76	0.21	Spring-MO	2
7.13	85.5	0.74	0.24	Spring-MO	2
8.13	97.5	0.79	0.29	Spring-MO	2
9.18	110.1	0.73	0.43	Spring-MO	2
10.17	122.0	0.75	0.40	Spring-MO	2
11.20	134.4	0.83	0.31	Spring-MO	2

When the number of fish released in a cohort is taken into account, it is possible to estimate the number of fish from each cohort that are estimated to have been alive through time. The tables below do this for each release type, cohort, and river of release using **the average value for the cohort's disease status**.

Estimates of survival for the 1st release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 821 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	SPR	04/13/04	09/21/04	9.6	14.9	0.89	0.01	732	709	to	755
1	SPR	09/21/04	04/30/05	14.9	22.3	0.77	0.03	629	586	to	672
1	SPR	04/30/05	09/23/05	22.3	27.2	0.70	0.03	572	521	to	624
1	SPR	09/23/05	04/29/06	27.2	34.4	0.61	0.04	499	440	to	559
1	SPR	04/29/06	07/13/06	34.4	36.9	0.58	0.04	477	417	to	538
1	SPR	07/13/06	09/27/06	36.9	39.5	0.56	0.04	457	395	to	519
1	SPR	09/27/06	05/02/07	39.5	46.7	0.49	0.04	404	340	to	467
1	SPR	05/02/07	09/22/07	46.7	51.5	0.43	0.04	352	292	to	412
1	SPR	09/22/07	04/30/08	51.5	58.8	0.35	0.03	287	233	to	341
1	SPR	04/30/08	07/22/08	58.8	61.6	0.32	0.03	266	214	to	318
1	SPR	07/22/08	09/16/08	61.6	63.5	0.31	0.03	253	203	to	303
1	SPR	09/16/08	05/08/09	63.5	71.3	0.25	0.03	206	161	to	250
1	SPR	05/08/09	07/22/09	71.3	73.8	0.23	0.03	193	150	to	236
1	SPR	07/22/09	09/15/09	73.8	75.6	0.22	0.03	184	142	to	226
1	SPR	09/15/09	05/04/10	75.6	83.3	0.18	0.02	152	115	to	189
1	SPR	05/04/10	09/08/10	83.3	87.5	0.17	0.02	137	102	to	172
1	SPR	09/08/10	05/09/11	87.5	95.6	0.14	0.02	113	81	to	145
1	SPR	05/09/11	09/12/11	95.6	99.8	0.13	0.02	103	73	to	133
1	SPR	09/12/11	05/08/12	99.8	107.8	0.10	0.02	86	58	to	113
1	SPR	05/08/12	09/06/12	107.8	111.8	0.10	0.02	79	52	to	105
1	SPR	09/06/12	05/05/13	111.8	119.9	0.08	0.02	66	42	to	91
1	SPR	05/05/13	09/20/13	119.9	124.5	0.07	0.01	60	37	to	84
1	SPR	09/20/13	05/16/14	124.5	132.4	0.06	0.01	52	29	to	74
1	SPR	05/16/14	09/15/14	132.4	136.5	0.06	0.01	48	26	to	69
1	SPR	09/15/14	05/10/15	136.5	144.4	0.05	0.01	41	21	to	62
1	SPR	05/10/15	09/16/15	144.4	148.7	0.05	0.01	38	18	to	58
1	SPR	09/16/15	05/15/16	148.7	156.7	0.04	0.01	33	14	to	52
1	SPR	05/15/16	09/05/16	156.7	160.5	0.04	0.01	31	12	to	49

Estimates of survival for the 2nd release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 558 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	SPR	04/30/05	09/23/05	9.6	14.4	0.90	0.01	503	489	to	517
2	SPR	09/23/05	04/29/06	14.4	21.7	0.78	0.03	433	404	to	461
2	SPR	04/29/06	07/13/06	21.7	24.2	0.74	0.03	412	380	to	444
2	SPR	07/13/06	09/27/06	24.2	26.7	0.70	0.03	393	358	to	427
2	SPR	09/27/06	05/02/07	26.7	34	0.61	0.04	343	303	to	383
2	SPR	05/02/07	09/22/07	34	38.7	0.56	0.04	315	273	to	356
2	SPR	09/22/07	04/30/08	38.7	46.1	0.50	0.04	277	234	to	320
2	SPR	04/30/08	07/22/08	46.1	48.9	0.46	0.04	256	214	to	298
2	SPR	07/22/08	09/16/08	48.9	50.7	0.44	0.04	243	202	to	284
2	SPR	09/16/08	05/08/09	50.7	58.5	0.35	0.03	195	158	to	232
2	SPR	05/08/09	07/22/09	58.5	61	0.33	0.03	182	147	to	217
2	SPR	07/22/09	09/15/09	61	62.9	0.31	0.03	174	139	to	208
2	SPR	09/15/09	05/04/10	62.9	70.6	0.25	0.03	141	111	to	172
2	SPR	05/04/10	09/08/10	70.6	74.8	0.23	0.03	127	98	to	155
2	SPR	09/08/10	05/09/11	74.8	82.9	0.19	0.02	103	78	to	129
2	SPR	05/09/11	09/12/11	82.9	87.1	0.17	0.02	93	70	to	117
2	SPR	09/12/11	05/08/12	87.1	95.1	0.14	0.02	77	56	to	99
2	SPR	05/08/12	09/06/12	95.1	99.1	0.13	0.02	70	50	to	91
2	SPR	09/06/12	05/05/13	99.1	107.1	0.11	0.02	59	40	to	78
2	SPR	05/05/13	09/20/13	107.1	111.7	0.10	0.02	53	35	to	71
2	SPR	09/20/13	05/16/14	111.7	119.7	0.08	0.02	45	28	to	62
2	SPR	05/16/14	09/15/14	119.6	123.7	0.07	0.01	41	25	to	57
2	SPR	09/15/14	05/10/15	123.7	131.6	0.06	0.01	35	20	to	50
2	SPR	05/10/15	09/16/15	131.6	135.9	0.06	0.01	32	18	to	47
2	SPR	09/16/15	05/15/16	135.9	144	0.05	0.01	28	14	to	42
2	SPR	05/15/16	09/05/16	144	147.8	0.05	0.01	26	12	to	40

Estimates of survival for the 3rd release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 4,329 fish, IV status not considered, Fin Curl status = 0.24).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	SPR	04/29/06	07/13/06	9.6	12.1	0.92	0.01	3,998	3,927	to	4,070
3	SPR	07/13/06	09/27/06	12.1	14.6	0.85	0.02	3,694	3,565	to	3,823
3	SPR	09/27/06	05/02/07	14.6	21.8	0.68	0.03	2,957	2,716	to	3,197
3	SPR	05/02/07	09/22/07	21.8	26.6	0.59	0.03	2,569	2,294	to	2,845
3	SPR	09/22/07	04/30/08	26.6	34	0.48	0.04	2,082	1,783	to	2,381
3	SPR	04/30/08	07/22/08	34	36.7	0.45	0.04	1,931	1,631	to	2,231
3	SPR	07/22/08	09/16/08	36.7	38.6	0.42	0.04	1,837	1,538	to	2,136
3	SPR	09/16/08	05/08/09	38.6	46.4	0.35	0.03	1,495	1,207	to	1,783
3	SPR	05/08/09	07/22/09	46.4	48.9	0.31	0.03	1,361	1,087	to	1,635
3	SPR	07/22/09	09/15/09	48.9	50.7	0.29	0.03	1,272	1,008	to	1,535
3	SPR	09/15/09	05/04/10	50.7	58.4	0.22	0.03	957	735	to	1,180
3	SPR	05/04/10	09/08/10	58.4	62.7	0.19	0.02	824	622	to	1,026
3	SPR	09/08/10	05/09/11	62.7	70.8	0.14	0.02	621	453	to	789
3	SPR	05/09/11	09/12/11	70.8	75	0.12	0.02	539	386	to	692
3	SPR	09/12/11	05/08/12	75	82.9	0.10	0.02	414	286	to	543
3	SPR	05/08/12	09/06/12	82.9	87	0.08	0.01	364	246	to	483
3	SPR	09/06/12	05/05/13	87	95	0.07	0.01	283	182	to	385
3	SPR	05/05/13	09/20/13	95	99.6	0.06	0.01	247	153	to	340
3	SPR	09/20/13	05/16/14	99.6	107.5	0.05	0.01	195	114	to	277
3	SPR	05/16/14	09/15/14	107.5	111.6	0.04	0.01	174	97	to	250
3	SPR	09/15/14	05/10/15	111.6	119.5	0.03	0.01	139	71	to	207
3	SPR	05/10/15	09/16/15	119.5	123.8	0.03	0.01	124	60	to	188
3	SPR	09/16/15	05/15/16	123.8	131.8	0.02	0.01	100	43	to	157
3	SPR	05/15/16	09/05/16	131.8	135.6	0.02	0.01	91	37	to	145

Estimates of survival for the 4th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 1,922 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SPR	05/02/07	09/22/07	9.6	14.3	0.90	0.01	1,736	1,688	to	1,783
4	SPR	09/22/07	04/30/08	14.3	21.7	0.78	0.03	1,491	1,392	to	1,589
4	SPR	04/30/08	07/22/08	21.7	24.5	0.73	0.03	1,412	1,302	to	1,523
4	SPR	07/22/08	09/16/08	24.5	26.3	0.71	0.03	1,362	1,245	to	1,480
4	SPR	09/16/08	05/08/09	26.3	34.1	0.61	0.04	1,176	1,038	to	1,314
4	SPR	05/08/09	07/22/09	34.1	36.6	0.59	0.04	1,125	983	to	1,266
4	SPR	07/22/09	09/15/09	36.6	38.5	0.57	0.04	1,089	946	to	1,233
4	SPR	09/15/09	05/04/10	38.5	46.2	0.50	0.04	954	806	to	1,102
4	SPR	05/04/10	09/08/10	46.2	50.4	0.44	0.04	845	704	to	986
4	SPR	09/08/10	05/09/11	50.4	58.5	0.35	0.03	673	546	to	799
4	SPR	05/09/11	09/12/11	58.5	62.7	0.31	0.03	600	482	to	719
4	SPR	09/12/11	05/08/12	62.7	70.7	0.25	0.03	485	381	to	590
4	SPR	05/08/12	09/06/12	70.7	74.7	0.23	0.03	438	339	to	536
4	SPR	09/06/12	05/05/13	74.7	82.7	0.19	0.02	358	270	to	445
4	SPR	05/05/13	09/20/13	82.7	87.3	0.17	0.02	320	238	to	402
4	SPR	09/20/13	05/16/14	87.3	95.2	0.14	0.02	265	191	to	339
4	SPR	05/16/14	09/15/14	95.2	99.3	0.13	0.02	241	171	to	312
4	SPR	09/15/14	05/10/15	99.3	107.2	0.11	0.02	202	138	to	266
4	SPR	05/10/15	09/16/15	107.2	111.5	0.10	0.02	184	122	to	246
4	SPR	09/16/15	05/15/16	111.5	119.6	0.08	0.02	155	98	to	212
4	SPR	05/15/16	09/05/16	119.6	123.4	0.07	0.01	143	88	to	199

Estimates of survival for the 5th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 5,055 fish, IV status not considered, Fin Curl status = 0.25).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	SPR	04/30/08	07/22/08	9.6	12.3	0.91	0.01	4,621	4,529	to	4,713
5	SPR	07/22/08	09/16/08	12.3	14.2	0.86	0.01	4,354	4,211	to	4,496
5	SPR	09/16/08	05/08/09	14.2	22	0.67	0.03	3,406	3,120	to	3,691
5	SPR	05/08/09	07/22/09	22	24.5	0.63	0.03	3,160	2,851	to	3,468
5	SPR	07/22/09	09/15/09	24.5	26.3	0.59	0.03	2,994	2,673	to	3,314
5	SPR	09/15/09	05/04/10	26.3	34	0.47	0.04	2,391	2,042	to	2,740
5	SPR	05/04/10	09/08/10	34	38.2	0.42	0.04	2,126	1,778	to	2,475
5	SPR	09/08/10	05/09/11	38.2	46.4	0.34	0.03	1,709	1,374	to	2,043
5	SPR	05/09/11	09/12/11	46.3	50.5	0.29	0.03	1,456	1,150	to	1,762
5	SPR	09/12/11	05/08/12	50.5	58.5	0.21	0.03	1,081	825	to	1,337
5	SPR	05/08/12	09/06/12	58.5	62.5	0.18	0.02	934	702	to	1,167
5	SPR	09/06/12	05/05/13	62.5	70.6	0.14	0.02	703	510	to	896
5	SPR	05/05/13	09/20/13	70.6	75.2	0.12	0.02	601	427	to	774
5	SPR	09/20/13	05/16/14	75.2	83.1	0.09	0.01	461	315	to	606
5	SPR	05/16/14	09/15/14	83.1	87.2	0.08	0.01	404	270	to	538
5	SPR	09/15/14	05/10/15	87.2	95.1	0.06	0.01	314	200	to	429
5	SPR	05/10/15	09/16/15	95.1	99.4	0.05	0.01	276	170	to	381
5	SPR	09/16/15	05/15/16	99.4	107.4	0.04	0.01	216	125	to	308
5	SPR	05/15/16	09/05/16	107.5	111.2	0.04	0.01	194	108	to	280

Estimates of survival for the 6th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 1,892 fish, IV status not considered, Fin Curl status = 0.23).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	SPR	05/08/09	07/22/09	9.6	12.1	0.93	0.01	1,750	1,720	to	1,781
6	SPR	07/22/09	09/15/09	12.1	13.9	0.87	0.01	1,655	1,606	to	1,704
6	SPR	09/15/09	05/04/10	13.9	21.6	0.69	0.03	1,311	1,207	to	1,414
6	SPR	05/04/10	09/08/10	21.6	25.8	0.61	0.03	1,160	1,042	to	1,279
6	SPR	09/08/10	05/09/11	25.8	33.9	0.49	0.04	924	793	to	1,056
6	SPR	05/09/11	09/12/11	33.9	38.1	0.44	0.04	826	694	to	958
6	SPR	09/12/11	05/08/12	38.1	46.1	0.36	0.03	672	544	to	800
6	SPR	05/08/12	09/06/12	46.1	50.1	0.31	0.03	579	461	to	697
6	SPR	09/06/12	05/05/13	50.1	58.1	0.23	0.03	432	333	to	531
6	SPR	05/05/13	09/20/13	58.1	62.7	0.19	0.02	368	278	to	457
6	SPR	09/20/13	05/16/14	62.7	70.7	0.15	0.02	280	205	to	355
6	SPR	05/16/14	09/15/14	70.7	74.7	0.13	0.02	245	176	to	313
6	SPR	09/15/14	05/10/15	74.7	82.6	0.10	0.02	189	132	to	247
6	SPR	05/10/15	09/16/15	82.6	86.9	0.09	0.01	165	112	to	218
6	SPR	09/16/15	05/15/16	86.9	95.0	0.07	0.01	129	84	to	174
6	SPR	05/15/16	09/05/16	95	98.8	0.06	0.01	115	73	to	158

Estimates of survival for the 7th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 5,179 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
7	SPR	05/04/10	09/08/10	9.6	13.8	0.91	0.01	4,731	4,616	to	4,847
7	SPR	09/08/10	05/09/11	13.8	21.9	0.77	0.03	4,000	3,731	to	4,269
7	SPR	05/09/11	09/12/11	21.9	26.1	0.71	0.03	3,685	3,369	to	4,001
7	SPR	09/12/11	05/08/12	26.1	34.1	0.61	0.04	3,169	2,795	to	3,543
7	SPR	05/08/12	09/06/12	34.0	38.1	0.57	0.04	2,950	2,562	to	3,337
7	SPR	09/06/12	05/05/13	38.1	46.1	0.50	0.04	2,568	2,166	to	2,970
7	SPR	05/05/13	09/20/13	46.1	50.7	0.43	0.04	2,250	1,870	to	2,630
7	SPR	09/20/13	05/16/14	50.7	58.6	0.35	0.03	1,800	1,460	to	2,140
7	SPR	05/16/14	09/15/14	58.6	62.7	0.31	0.03	1,612	1,293	to	1,932
7	SPR	09/15/14	05/10/15	62.7	70.6	0.25	0.03	1,307	1,024	to	1,589
7	SPR	05/10/15	09/16/15	70.6	74.9	0.23	0.03	1,170	906	to	1,434
7	SPR	09/16/15	05/15/16	74.9	83.0	0.18	0.02	955	721	to	1,189
7	SPR	05/15/16	09/05/16	83.0	86.8	0.17	0.02	871	650	to	1,093

Estimates of survival for the 8th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 1,592 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
8	SPR	05/09/11	09/12/11	9.6	13.8	0.91	0.01	1,455	1,420	to	1,491
8	SPR	09/12/11	05/08/12	13.8	21.7	0.77	0.03	1,234	1,152	to	1,315
8	SPR	05/08/12	09/06/12	21.7	25.8	0.72	0.03	1,140	1,044	to	1,236
8	SPR	09/06/12	05/05/13	25.8	33.8	0.61	0.04	979	865	to	1,093
8	SPR	05/05/13	09/20/13	33.8	38.4	0.57	0.04	902	782	to	1,021
8	SPR	09/20/13	05/16/14	38.4	46.3	0.49	0.04	787	663	to	910
8	SPR	05/16/14	09/15/14	46.3	50.4	0.44	0.04	700	583	to	818
8	SPR	09/15/14	05/10/15	50.4	58.3	0.35	0.03	560	455	to	666
8	SPR	05/10/15	09/16/15	58.3	62.6	0.31	0.03	499	400	to	597
8	SPR	09/16/15	05/15/16	62.6	70.7	0.25	0.03	402	315	to	489
8	SPR	05/15/16	09/05/16	70.7	74.4	0.23	0.03	365	283	to	447

Estimates of survival for the 9th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 375 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
9	SPR	05/05/13	09/20/13	9.6	14.2	0.91	0.01	340	331	to	349
9	SPR	09/20/13	05/16/14	14.2	22.1	0.77	0.03	288	269	to	308
9	SPR	05/16/14	09/15/14	22.1	26.1	0.71	0.03	266	244	to	289
9	SPR	09/15/14	05/10/15	26.2	34.1	0.61	0.04	229	202	to	257
9	SPR	05/10/15	09/16/15	34.0	38.3	0.57	0.04	213	184	to	241
9	SPR	09/16/15	05/15/16	38.4	46.4	0.49	0.04	185	156	to	214
9	SPR	05/15/16	09/05/16	46.4	50.2	0.44	0.04	166	138	to	194

Estimates of survival for the 10th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 423 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
10	SPR	05/16/14	09/15/14	9.6	13.6	0.92	0.01	388	379	to	397
10	SPR	09/15/14	05/10/15	13.6	21.5	0.78	0.03	329	308	to	351
10	SPR	05/10/15	09/16/15	21.5	25.8	0.72	0.03	303	277	to	328
10	SPR	09/16/15	05/15/16	25.8	33.9	0.61	0.04	260	229	to	290
10	SPR	05/15/16	09/05/16	33.9	37.7	0.57	0.04	243	211	to	274

Estimates of survival for the 11th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 314 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
11	SPR	05/10/15	09/16/15	9.6	13.9	0.91	0.01	286	279	to	294
11	SPR	09/16/15	05/15/16	13.9	21.9	0.77	0.03	242	226	to	259
11	SPR	05/15/16	09/05/16	21.9	25.7	0.72	0.03	225	206	to	244

Estimates of survival for the 12th release cohort of spring yearlings in RPMA 2 in the Missouri River (cohort= 710 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
12	SPR	05/15/16	09/05/16	9.6	13.3	0.92	0.01	655	636	to	675

Summary information for spring yearlings released in RPMA 2 in the Missouri River

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as spring yearlings are estimated to have been alive when data collection ended. The point estimates indicate that ~3,125 fish released as spring yearlings in the Missouri River were alive in RPMA 2 at the time data collection ended for the analyses presented here. Of those, ~41% (1,289) were <5-years old, ~49% (1,545) are 6- to 10-years old, and ~9% (291) are between 10- and 14-years old.

Estimates of surviving proportions and numbers for spring yearlings released in RPMA 2 in the Missouri River.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 821	SPR	09/05/16	160.5	13.4	0.04	0.01	31	12	to	49
2: 558	SPR	09/05/16	147.8	12.3	0.05	0.01	26	12	to	40
3: 4,329	SPR	09/05/16	135.6	11.3	0.02	0.01	91	37	to	145
4: 1,922	SPR	09/05/16	123.4	10.3	0.07	0.01	143	88	to	199
5: 5,055	SPR	09/05/16	111.2	9.3	0.04	0.01	194	108	to	280
6: 1,892	SPR	09/05/16	98.8	8.2	0.06	0.01	115	73	to	158
7: 5,179	SPR	09/05/16	86.8	7.2	0.17	0.02	871	650	to	1,093
8: 1,592	SPR	09/05/16	74.4	6.2	0.23	0.03	365	283	to	447
9: 375	SPR	09/05/16	50.2	4.2	0.44	0.04	166	138	to	194
10: 423	SPR	09/05/16	37.7	3.1	0.57	0.04	243	211	to	274
11: 314	SPR	09/05/16	25.7	2.1	0.72	0.03	225	206	to	244
12: 710	SPR	09/05/16	13.3	1.1	0.92	0.01	655	636	to	675

Estimates of survival for the 1st healthy release cohort of spring yearlings (~9.6 months old at time of release, which was 4/30/2005) in RPMA 2 in the Yellowstone River. Estimates are for fish released in the Yellowstone River without disease problems (no fin curl or iridovirus).

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)	
04/30/05	09/23/05	4.9	9.6	14.4	0.965	(0.003)	0.84	(0.01)	(0.81	to 0.87)
09/23/05	04/29/06	7.3	14.4	21.7	0.966	(0.003)	0.65	(0.03)	(0.61	to 0.70)
04/29/06	07/13/06	2.5	21.7	24.2	0.968	(0.002)	0.60	(0.03)	(0.55	to 0.66)
07/13/06	09/27/06	2.5	24.2	26.7	0.968	(0.002)	0.56	(0.03)	(0.50	to 0.61)
09/27/06	05/02/07	7.2	26.7	34.0	0.969	(0.002)	0.44	(0.03)	(0.38	to 0.50)
05/02/07	09/22/07	4.8	34.0	38.7	0.970	(0.002)	0.38	(0.03)	(0.33	to 0.44)
09/22/07	04/30/08	7.4	38.7	46.1	0.971	(0.002)	0.31	(0.03)	(0.26	to 0.36)
04/30/08	07/22/08	2.8	46.1	48.9	0.960	(0.002)	0.27	(0.02)	(0.23	to 0.32)
07/22/08	09/16/08	1.9	48.9	50.7	0.960	(0.002)	0.25	(0.02)	(0.21	to 0.30)
09/16/08	05/08/09	7.8	50.7	58.5	0.961	(0.002)	0.19	(0.02)	(0.15	to 0.22)
05/08/09	07/22/09	2.5	58.5	61.0	0.962	(0.002)	0.17	(0.02)	(0.14	to 0.20)
07/22/09	09/15/09	1.8	61.0	62.9	0.963	(0.002)	0.16	(0.02)	(0.13	to 0.19)
09/15/09	05/04/10	7.7	62.9	70.6	0.963	(0.002)	0.12	(0.01)	(0.09	to 0.14)
05/04/10	09/08/10	4.2	70.6	74.8	0.964	(0.002)	0.10	(0.01)	(0.08	to 0.12)
09/08/10	05/09/11	8.1	74.8	82.9	0.965	(0.003)	0.08	(0.01)	(0.06	to 0.09)
05/09/11	09/12/11	4.2	82.9	87.1	0.966	(0.003)	0.07	(0.01)	(0.05	to 0.08)
09/12/11	05/08/12	8.0	87.1	95.1	0.967	(0.003)	0.05	(0.01)	(0.04	to 0.06)
05/08/12	09/06/12	4.0	95.1	99.1	0.968	(0.003)	0.04	(0.01)	(0.03	to 0.06)
09/06/12	05/05/13	8.0	99.1	107.1	0.968	(0.004)	0.03	(0.01)	(0.02	to 0.04)
05/05/13	09/20/13	4.6	107.1	111.7	0.969	(0.004)	0.03	(0.01)	(0.02	to 0.04)
09/20/13	05/16/14	7.9	111.7	119.7	0.970	(0.004)	0.02	(0.00)	(0.01	to 0.03)
05/16/14	09/15/14	4.1	119.6	123.7	0.971	(0.004)	0.02	(0.00)	(0.01	to 0.03)
09/15/14	05/10/15	7.9	123.7	131.6	0.972	(0.005)	0.02	(0.00)	(0.01	to 0.02)
05/10/15	09/16/15	4.3	131.6	135.9	0.973	(0.005)	0.01	(0.00)	(0.01	to 0.02)
09/16/15	05/15/16	8.1	135.9	144.0	0.973	(0.005)	0.01	(0.00)	(0.00	to 0.02)
05/15/16	09/05/16	3.8	144.0	147.8	0.974	(0.005)	0.01	(0.00)	(0.00	to 0.02)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.01	12.1	0.65	0.03	Spring-YE	2
2.03	24.4	0.68	0.12	Spring-YE	2
3.04	36.5	0.70	0.17	Spring-YE	2
4.08	48.9	0.61	0.23	Spring-YE	2
5.08	61.0	0.63	0.21	Spring-YE	2
6.11	73.3	0.67	0.23	Spring-YE	2
7.13	85.5	0.63	0.38	Spring-YE	2
8.13	97.5	0.60	0.65	Spring-YE	2
9.18	110.1	0.67	0.50	Spring-YE	2
10.17	122.0	1.00	0.00	Spring-YE	2
11.20	134.4	0.50	0.00	Spring-YE	2

When the number of fish released in a cohort is taken into account, it is possible to estimate the number of fish from each cohort that are estimated to have been alive through time. The tables below do this for each release type, cohort, and river of release using **the average value for the cohort's disease status**.

Estimates of survival for the 1st release cohort of spring yearlings in RPMA 2 in the Yellowstone River. No Spring Yearlings were reported as being released in the Yellowstone River in the 1st cohort in RPMA 2 in the latest dataset provided. (cohort 1 = 0 fish for Yellowstone River).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)
1	SPR	04/13/04	09/21/04	NO FISH RELEASED					

Estimates of survival for the 2nd release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 309 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
2	SPR	04/30/05	09/23/05	9.6	14.4	0.84	0.01	260	251	to	268
2	SPR	09/23/05	04/29/06	14.4	21.7	0.65	0.03	202	187	to	218
2	SPR	04/29/06	07/13/06	21.7	24.2	0.60	0.03	186	170	to	203
2	SPR	07/13/06	09/27/06	24.2	26.7	0.56	0.03	172	155	to	189
2	SPR	09/27/06	05/02/07	26.7	34.0	0.44	0.03	136	119	to	154
2	SPR	05/02/07	09/22/07	34.0	38.7	0.38	0.03	118	101	to	135
2	SPR	09/22/07	04/30/08	38.7	46.1	0.31	0.03	95	79	to	110
2	SPR	04/30/08	07/22/08	46.1	48.9	0.27	0.02	84	70	to	99
2	SPR	07/22/08	09/16/08	48.9	50.7	0.25	0.02	78	65	to	92
2	SPR	09/16/08	05/08/09	50.7	58.5	0.19	0.02	57	47	to	68
2	SPR	05/08/09	07/22/09	58.5	61.0	0.17	0.02	52	42	to	62
2	SPR	07/22/09	09/15/09	61.0	62.9	0.16	0.02	49	39	to	58
2	SPR	09/15/09	05/04/10	62.9	70.6	0.12	0.01	36	29	to	44
2	SPR	05/04/10	09/08/10	70.6	74.8	0.10	0.01	31	25	to	38
2	SPR	09/08/10	05/09/11	74.8	82.9	0.08	0.01	23	18	to	29
2	SPR	05/09/11	09/12/11	82.9	87.1	0.07	0.01	20	15	to	25
2	SPR	09/12/11	05/08/12	87.1	95.1	0.05	0.01	15	11	to	19
2	SPR	05/08/12	09/06/12	95.1	99.1	0.04	0.01	13	10	to	17
2	SPR	09/06/12	05/05/13	99.1	107.1	0.03	0.01	10	7	to	14
2	SPR	05/05/13	09/20/13	107.1	111.7	0.03	0.01	9	6	to	12
2	SPR	09/20/13	05/16/14	111.7	119.7	0.02	0.00	7	4	to	10
2	SPR	05/16/14	09/15/14	119.6	123.7	0.02	0.00	6	4	to	9
2	SPR	09/15/14	05/10/15	123.7	131.6	0.02	0.00	5	3	to	7
2	SPR	05/10/15	09/16/15	131.6	135.9	0.01	0.00	4	2	to	7
2	SPR	09/16/15	05/15/16	135.9	144.0	0.01	0.00	4	1	to	6
2	SPR	05/15/16	09/05/16	144.0	147.8	0.01	0.00	3	1	to	5

Estimates of survival for the 3rd release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 2,260 fish, IV status not considered, Fin Curl status = 0.24).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	SPR	04/29/06	07/13/06	9.6	12.1	0.88	0.01	1,995	1,953	to	2,036
3	SPR	07/13/06	09/27/06	12.1	14.6	0.78	0.02	1,761	1,690	to	1,832
3	SPR	09/27/06	05/02/07	14.6	21.8	0.55	0.03	1,239	1,124	to	1,354
3	SPR	05/02/07	09/22/07	21.8	26.6	0.44	0.03	991	872	to	1,111
3	SPR	09/22/07	04/30/08	26.6	34.0	0.31	0.03	709	597	to	821
3	SPR	04/30/08	07/22/08	34.0	36.7	0.28	0.02	628	523	to	734
3	SPR	07/22/08	09/16/08	36.7	38.6	0.26	0.02	580	479	to	681
3	SPR	09/16/08	05/08/09	38.6	46.4	0.18	0.02	416	333	to	500
3	SPR	05/08/09	07/22/09	46.4	48.9	0.16	0.02	365	289	to	440
3	SPR	07/22/09	09/15/09	48.9	50.7	0.15	0.02	331	261	to	401
3	SPR	09/15/09	05/04/10	50.7	58.4	0.10	0.01	222	170	to	273
3	SPR	05/04/10	09/08/10	58.4	62.7	0.08	0.01	179	136	to	222
3	SPR	09/08/10	05/09/11	62.7	70.8	0.05	0.01	120	89	to	151
3	SPR	05/09/11	09/12/11	70.8	75.0	0.04	0.01	98	71	to	125
3	SPR	09/12/11	05/08/12	75.0	82.9	0.03	0.00	68	47	to	88
3	SPR	05/08/12	09/06/12	82.9	87.0	0.02	0.00	56	39	to	74
3	SPR	09/06/12	05/05/13	87.0	95.0	0.02	0.00	39	25	to	54
3	SPR	05/05/13	09/20/13	95.0	99.6	0.01	0.00	32	20	to	45
3	SPR	09/20/13	05/16/14	99.6	107.5	0.01	0.00	23	13	to	33
3	SPR	05/16/14	09/15/14	107.5	111.6	0.01	0.00	20	10	to	29
3	SPR	09/15/14	05/10/15	111.6	119.5	0.01	0.00	14	7	to	22
3	SPR	05/10/15	09/16/15	119.5	123.8	0.01	0.00	12	5	to	19
3	SPR	09/16/15	05/15/16	123.8	131.8	0.00	0.00	9	3	to	15
3	SPR	05/15/16	09/05/16	131.8	135.6	0.00	0.00	8	2	to	13

Estimates of survival for the 4th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 1,966 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SPR	05/02/07	09/22/07	9.6	14.3	0.84	0.01	1,660	<i>1,606</i>	<i>to</i>	<i>1,713</i>
4	SPR	09/22/07	04/30/08	14.3	21.7	0.65	0.03	1,287	<i>1,190</i>	<i>to</i>	<i>1,385</i>
4	SPR	04/30/08	07/22/08	21.7	24.5	0.60	0.03	1,175	<i>1,070</i>	<i>to</i>	<i>1,279</i>
4	SPR	07/22/08	09/16/08	24.5	26.3	0.56	0.03	1,106	<i>998</i>	<i>to</i>	<i>1,213</i>
4	SPR	09/16/08	05/08/09	26.3	34.1	0.44	0.03	861	<i>750</i>	<i>to</i>	<i>972</i>
4	SPR	05/08/09	07/22/09	34.1	36.6	0.41	0.03	798	<i>689</i>	<i>to</i>	<i>907</i>
4	SPR	07/22/09	09/15/09	36.6	38.5	0.38	0.03	755	<i>648</i>	<i>to</i>	<i>862</i>
4	SPR	09/15/09	05/04/10	38.5	46.2	0.31	0.03	601	<i>503</i>	<i>to</i>	<i>698</i>
4	SPR	05/04/10	09/08/10	46.2	50.4	0.26	0.02	505	<i>419</i>	<i>to</i>	<i>592</i>
4	SPR	09/08/10	05/09/11	50.4	58.5	0.19	0.02	365	<i>298</i>	<i>to</i>	<i>433</i>
4	SPR	05/09/11	09/12/11	58.5	62.7	0.16	0.02	311	<i>251</i>	<i>to</i>	<i>370</i>
4	SPR	09/12/11	05/08/12	62.7	70.7	0.12	0.01	230	<i>183</i>	<i>to</i>	<i>276</i>
4	SPR	05/08/12	09/06/12	70.7	74.7	0.10	0.01	198	<i>157</i>	<i>to</i>	<i>240</i>
4	SPR	09/06/12	05/05/13	74.7	82.7	0.08	0.01	149	<i>115</i>	<i>to</i>	<i>182</i>
4	SPR	05/05/13	09/20/13	82.7	87.3	0.06	0.01	127	<i>97</i>	<i>to</i>	<i>157</i>
4	SPR	09/20/13	05/16/14	87.3	95.2	0.05	0.01	97	<i>71</i>	<i>to</i>	<i>122</i>
4	SPR	05/16/14	09/15/14	95.2	99.3	0.04	0.01	85	<i>61</i>	<i>to</i>	<i>109</i>
4	SPR	09/15/14	05/10/15	99.3	107.2	0.03	0.01	66	<i>45</i>	<i>to</i>	<i>87</i>
4	SPR	05/10/15	09/16/15	107.2	111.5	0.03	0.01	58	<i>38</i>	<i>to</i>	<i>77</i>
4	SPR	09/16/15	05/15/16	111.5	119.6	0.02	0.00	45	<i>27</i>	<i>to</i>	<i>63</i>
4	SPR	05/15/16	09/05/16	119.6	123.4	0.02	0.00	40	<i>23</i>	<i>to</i>	<i>57</i>

Estimates of survival for the 5th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 3,042 fish, IV status not considered, Fin Curl status = 0.25).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
5	SPR	04/30/08	07/22/08	9.6	12.3	0.87	0.01	2,642	2,581	to	2,704
5	SPR	07/22/08	09/16/08	12.3	14.2	0.79	0.02	2,406	2,315	to	2,497
5	SPR	09/16/08	05/08/09	14.2	22.0	0.54	0.03	1,635	1,478	to	1,791
5	SPR	05/08/09	07/22/09	22.0	24.5	0.48	0.03	1,452	1,291	to	1,612
5	SPR	07/22/09	09/15/09	24.5	26.3	0.44	0.03	1,332	1,172	to	1,493
5	SPR	09/15/09	05/04/10	26.3	34.0	0.31	0.03	932	783	to	1,082
5	SPR	05/04/10	09/08/10	34.0	38.2	0.25	0.02	773	636	to	909
5	SPR	09/08/10	05/09/11	38.2	46.4	0.18	0.02	544	433	to	655
5	SPR	05/09/11	09/12/11	46.3	50.5	0.14	0.02	434	340	to	528
5	SPR	09/12/11	05/08/12	50.5	58.5	0.09	0.01	285	217	to	352
5	SPR	05/08/12	09/06/12	58.5	62.5	0.08	0.01	232	175	to	288
5	SPR	09/06/12	05/05/13	62.5	70.6	0.05	0.01	155	114	to	196
5	SPR	05/05/13	09/20/13	70.6	75.2	0.04	0.01	124	89	to	158
5	SPR	09/20/13	05/16/14	75.2	83.1	0.03	0.00	85	59	to	111
5	SPR	05/16/14	09/15/14	83.1	87.2	0.02	0.00	71	48	to	93
5	SPR	09/15/14	05/10/15	87.2	95.1	0.02	0.00	49	31	to	68
5	SPR	05/10/15	09/16/15	95.1	99.4	0.01	0.00	41	25	to	57
5	SPR	09/16/15	05/15/16	99.4	107.4	0.01	0.00	29	16	to	42
5	SPR	05/15/16	09/05/16	107.5	111.2	0.01	0.00	25	13	to	37

Estimates of survival for the 6th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 3,105 fish, IV status not considered, Fin Curl status = 0.23).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
6	SPR	05/08/09	07/22/09	9.6	12.1	0.88	0.01	2,747	2,690	to	2,803
6	SPR	07/22/09	09/15/09	12.1	13.9	0.81	0.01	2,514	2,427	to	2,600
6	SPR	09/15/09	05/04/10	13.9	21.6	0.56	0.03	1,738	1,581	to	1,895
6	SPR	05/04/10	09/08/10	21.6	25.8	0.46	0.03	1,431	1,267	to	1,596
6	SPR	09/08/10	05/09/11	25.8	33.9	0.32	0.03	996	840	to	1,151
6	SPR	05/09/11	09/12/11	33.9	38.1	0.27	0.02	832	689	to	975
6	SPR	09/12/11	05/08/12	38.1	46.1	0.19	0.02	596	478	to	714
6	SPR	05/08/12	09/06/12	46.1	50.1	0.16	0.02	483	382	to	583
6	SPR	09/06/12	05/05/13	50.1	58.1	0.10	0.01	319	246	to	392
6	SPR	05/05/13	09/20/13	58.1	62.7	0.08	0.01	254	194	to	314
6	SPR	09/20/13	05/16/14	62.7	70.7	0.06	0.01	172	128	to	217
6	SPR	05/16/14	09/15/14	70.7	74.7	0.05	0.01	142	104	to	180
6	SPR	09/15/14	05/10/15	74.7	82.6	0.03	0.00	99	70	to	128
6	SPR	05/10/15	09/16/15	82.6	86.9	0.03	0.00	82	56	to	107
6	SPR	09/16/15	05/15/16	86.9	95.0	0.02	0.00	57	37	to	77
6	SPR	05/15/16	09/05/16	95.0	98.8	0.02	0.00	49	31	to	67

Estimates of survival for the 7th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 5,177 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
7	SPR	05/04/10	09/08/10	9.6	13.8	0.86	0.01	4,455	4,328	to	4,582
7	SPR	09/08/10	05/09/11	13.8	21.9	0.65	0.03	3,366	3,106	to	3,626
7	SPR	05/09/11	09/12/11	21.9	26.1	0.57	0.03	2,931	2,647	to	3,215
7	SPR	09/12/11	05/08/12	26.1	34.1	0.44	0.03	2,269	1,974	to	2,564
7	SPR	05/08/12	09/06/12	34.0	38.1	0.39	0.03	2,006	1,721	to	2,292
7	SPR	09/06/12	05/05/13	38.1	46.1	0.31	0.03	1,580	1,321	to	1,839
7	SPR	05/05/13	09/20/13	46.1	50.7	0.25	0.02	1,309	1,083	to	1,536
7	SPR	09/20/13	05/16/14	50.7	58.6	0.18	0.02	954	775	to	1,132
7	SPR	05/16/14	09/15/14	58.6	62.7	0.16	0.02	815	658	to	972
7	SPR	09/15/14	05/10/15	62.7	70.6	0.12	0.01	604	481	to	728
7	SPR	05/10/15	09/16/15	70.6	74.9	0.10	0.01	516	407	to	625
7	SPR	09/16/15	05/15/16	74.9	83.0	0.07	0.01	387	299	to	474
7	SPR	05/15/16	09/05/16	83.0	86.8	0.07	0.01	339	259	to	420

Estimates of survival for the 8th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 1,585 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
8	SPR	05/09/11	09/12/11	9.6	13.8	0.86	0.01	1,365	1,327	to	1,404
8	SPR	09/12/11	05/08/12	13.8	21.7	0.65	0.03	1,036	957	to	1,115
8	SPR	05/08/12	09/06/12	21.7	25.8	0.57	0.03	907	821	to	994
8	SPR	09/06/12	05/05/13	25.8	33.8	0.44	0.03	701	610	to	791
8	SPR	05/05/13	09/20/13	33.8	38.4	0.38	0.03	609	522	to	696
8	SPR	09/20/13	05/16/14	38.4	46.3	0.30	0.03	481	402	to	560
8	SPR	05/16/14	09/15/14	46.3	50.4	0.26	0.02	407	337	to	478
8	SPR	09/15/14	05/10/15	50.4	58.3	0.19	0.02	297	242	to	352
8	SPR	05/10/15	09/16/15	58.3	62.6	0.16	0.02	251	203	to	300
8	SPR	09/16/15	05/15/16	62.6	70.7	0.12	0.01	185	147	to	223
8	SPR	05/15/16	09/05/16	70.7	74.4	0.10	0.01	161	127	to	195

Estimates of survival for the 9th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 373 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
9	SPR	05/05/13	09/20/13	9.6	14.2	0.85	0.01	317	307	to	327
9	SPR	09/20/13	05/16/14	14.2	22.1	0.65	0.03	241	222	to	260
9	SPR	05/16/14	09/15/14	22.1	26.1	0.56	0.03	211	190	to	231
9	SPR	09/15/14	05/10/15	26.2	34.1	0.44	0.03	164	142	to	185
9	SPR	05/10/15	09/16/15	34.0	38.3	0.38	0.03	143	123	to	164
9	SPR	09/16/15	05/15/16	38.4	46.4	0.30	0.03	113	94	to	131
9	SPR	05/15/16	09/05/16	46.4	50.2	0.26	0.02	97	80	to	113

Estimates of survival for the 10th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 424 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
10	SPR	05/16/14	09/15/14	9.6	13.6	0.87	0.01	367	357	to	377
10	SPR	09/15/14	05/10/15	13.6	21.5	0.66	0.03	279	258	to	300
10	SPR	05/10/15	09/16/15	21.5	25.8	0.57	0.03	242	219	to	265
10	SPR	09/16/15	05/15/16	25.8	33.9	0.44	0.03	187	163	to	211
10	SPR	05/15/16	09/05/16	33.9	37.7	0.39	0.03	166	143	to	190

Estimates of survival for the 11th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 316 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
11	SPR	05/10/15	09/16/15	9.6	13.9	0.86	0.01	271	263	to	279
11	SPR	09/16/15	05/15/16	13.9	21.9	0.65	0.03	205	189	to	221
11	SPR	05/15/16	09/05/16	21.9	25.7	0.57	0.03	181	164	to	198

Estimates of survival for the 12th release cohort of spring yearlings in RPMA 2 in the Yellowstone River (cohort= 755 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
12	SPR	05/15/16	09/05/16	9.6	13.3	0.87	0.02	660	637	to	683

Summary information for spring yearlings released in RPMA 2 in the Yellowstone River

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as spring yearlings are estimated to have been alive at the time data collection ended for the analyses presented here. The point estimates indicate that ~1,729 fish that were released in RPMA 2 in the Yellowstone River as spring yearlings were alive as of 9/5/2016 and that ~64% (1,104) were <5-years old, ~33% (574) were 6- to 10-years old, and ~3% (51) were 10- to 13-years old.

Estimates of surviving proportions and numbers for spring yearlings released in RPMA 2 in the Yellowstone River

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 0	SPR	09/05/16								
2: 309	SPR	09/05/16	147.8	12.3	0.01	0.00	3	1	to	5
3: 2,260	SPR	09/05/16	135.6	11.3	0.00	0.00	8	2	to	13
4: 1,966	SPR	09/05/16	123.4	10.3	0.02	0.00	40	23	to	57
5: 3,042	SPR	09/05/16	111.2	9.3	0.01	0.00	25	13	to	37
6: 3,105	SPR	09/05/16	98.8	8.2	0.02	0.00	49	31	to	67
7: 5,177	SPR	09/05/16	86.8	7.2	0.07	0.01	339	259	to	420
8: 1,585	SPR	09/05/16	74.4	6.2	0.10	0.01	161	127	to	195
9: 373	SPR	09/05/16	50.2	4.2	0.26	0.02	97	80	to	113
10: 424	SPR	09/05/16	37.7	3.1	0.39	0.03	166	143	to	190
11: 316	SPR	09/05/16	25.7	2.1	0.57	0.03	181	164	to	198
12: 755	SPR	09/05/16	13.3	1.1	0.83	0.02	660	637	to	683

Summary information for spring yearlings released in RPMA 2 in the Missouri & Yellowstone Rivers

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as spring yearlings in the Missouri and Yellowstone River are estimated to have been alive when data collection ended. Approximately 4,854 fish released as spring yearlings were estimated to have been alive in the river at the time the last data were collected (09/05/2016) for the analyses presented here. Of these ~49% (2,393) were <5-years old, ~44% (2,119) were ~5- to ~10-years old, and ~7% (342) were 10- to 14-years old.

Release	Type	Date	Age in months	Age in years	N Alive	(95% CI for N Alive)		
1: 821	SPR	09/05/16	160.5	13.4	31	12	to	49
2: 867	SPR	09/05/16	147.8	12.3	29	13	to	45
3: 6,589	SPR	09/05/16	135.6	11.3	99	39	to	158
4: 3,888	SPR	09/05/16	123.4	10.3	183	111	to	256
5: 8,097	SPR	09/05/16	111.2	9.3	219	121	to	317
6: 4,997	SPR	09/05/16	98.8	8.2	164	104	to	225
7: 10,356	SPR	09/05/16	86.8	7.2	1,210	909	to	1,513
8: 3,177	SPR	09/05/16	74.4	6.2	526	410	to	642
9: 748	SPR	09/05/16	50.2	4.2	263	218	to	307
10: 847	SPR	09/05/16	37.7	3.1	409	354	to	464
11: 630	SPR	09/05/16	25.7	2.1	406	370	to	442
12: 1,465	SPR	09/05/16	13.3	1.1	1,315	1,273	to	1,358

Estimates of survival for the 1st release cohort of summer yearlings (~13.9 months old at time of release, which was 8/11/1998) in RPMA 2 in the Missouri River. Estimates are for a fish without disease problems (no fin curl or iridovirus) released in the Missouri River.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
08/11/98	10/14/00	26.5	13.9	40.4	0.964	(0.004)	0.38	(0.04)	<i>(0.30</i>	<i>to</i>	<i>0.46)</i>
10/14/00	08/18/02	22.4	40.4	62.8	0.976	(0.001)	0.22	(0.03)	<i>(0.17</i>	<i>to</i>	<i>0.28)</i>
08/18/02	08/17/03	12.1	62.8	74.9	0.983	(0.001)	0.18	(0.02)	<i>(0.13</i>	<i>to</i>	<i>0.23)</i>
08/17/03	04/13/04	8.0	74.9	82.9	0.986	(0.002)	0.16	(0.02)	<i>(0.12</i>	<i>to</i>	<i>0.20)</i>
04/13/04	09/21/04	5.4	82.9	88.3	0.988	(0.002)	0.15	(0.02)	<i>(0.11</i>	<i>to</i>	<i>0.19)</i>
09/21/04	04/30/05	7.4	88.3	95.7	0.989	(0.002)	0.14	(0.02)	<i>(0.10</i>	<i>to</i>	<i>0.17)</i>
04/30/05	09/23/05	4.9	95.7	100.5	0.990	(0.002)	0.13	(0.02)	<i>(0.10</i>	<i>to</i>	<i>0.16)</i>
09/23/05	04/29/06	7.3	100.5	107.8	0.991	(0.002)	0.12	(0.01)	<i>(0.09</i>	<i>to</i>	<i>0.15)</i>
04/29/06	07/13/06	2.5	107.8	110.3	0.992	(0.002)	0.12	(0.01)	<i>(0.09</i>	<i>to</i>	<i>0.15)</i>
07/13/06	09/27/06	2.5	110.3	112.8	0.992	(0.002)	0.12	(0.01)	<i>(0.09</i>	<i>to</i>	<i>0.15)</i>
09/27/06	05/02/07	7.2	112.8	120.1	0.992	(0.002)	0.11	(0.01)	<i>(0.08</i>	<i>to</i>	<i>0.14)</i>
05/02/07	09/22/07	4.8	120.1	124.8	0.993	(0.002)	0.11	(0.01)	<i>(0.08</i>	<i>to</i>	<i>0.13)</i>
09/22/07	04/30/08	7.4	124.8	132.2	0.994	(0.002)	0.10	(0.01)	<i>(0.08</i>	<i>to</i>	<i>0.13)</i>
04/30/08	07/22/08	2.8	132.2	135.0	0.994	(0.002)	0.10	(0.01)	<i>(0.08</i>	<i>to</i>	<i>0.13)</i>
07/22/08	09/16/08	1.9	135.0	136.8	0.995	(0.002)	0.10	(0.01)	<i>(0.08</i>	<i>to</i>	<i>0.13)</i>
09/16/08	05/08/09	7.8	136.8	144.7	0.995	(0.002)	0.10	(0.01)	<i>(0.07</i>	<i>to</i>	<i>0.12)</i>
05/08/09	07/22/09	2.5	144.7	147.2	0.995	(0.002)	0.09	(0.01)	<i>(0.07</i>	<i>to</i>	<i>0.12)</i>
07/22/09	09/15/09	1.8	147.2	149.0	0.995	(0.001)	0.09	(0.01)	<i>(0.07</i>	<i>to</i>	<i>0.12)</i>
09/15/09	05/04/10	7.7	149.0	156.7	0.996	(0.001)	0.09	(0.01)	<i>(0.07</i>	<i>to</i>	<i>0.12)</i>
05/04/10	09/08/10	4.2	156.7	160.9	0.996	(0.001)	0.09	(0.01)	<i>(0.06</i>	<i>to</i>	<i>0.11)</i>
09/08/10	05/09/11	8.1	160.9	169.0	0.996	(0.001)	0.09	(0.01)	<i>(0.06</i>	<i>to</i>	<i>0.11)</i>
05/09/11	09/12/11	4.2	169.0	173.2	0.997	(0.001)	0.09	(0.01)	<i>(0.06</i>	<i>to</i>	<i>0.11)</i>
09/12/11	05/08/12	8.0	173.2	181.2	0.997	(0.001)	0.08	(0.01)	<i>(0.06</i>	<i>to</i>	<i>0.11)</i>
05/08/12	09/06/12	4.0	181.2	185.2	0.997	(0.001)	0.08	(0.01)	<i>(0.06</i>	<i>to</i>	<i>0.11)</i>
09/06/12	05/05/13	8.0	185.2	193.2	0.998	(0.001)	0.08	(0.01)	<i>(0.06</i>	<i>to</i>	<i>0.11)</i>
05/05/13	09/20/13	4.6	193.2	197.8	0.998	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.11)</i>
09/20/13	05/16/14	7.9	197.8	205.8	0.998	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.11)</i>
05/16/14	09/15/14	4.1	205.8	209.8	0.998	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.11)</i>
09/15/14	05/10/15	7.9	209.8	217.7	0.998	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.10)</i>
05/10/15	09/16/15	4.3	217.7	222.0	0.999	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.10)</i>
09/16/15	05/15/16	8.1	222.0	230.1	0.999	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.10)</i>
05/15/16	09/05/16	3.8	230.1	233.9	0.999	(0.001)	0.08	(0.01)	<i>(0.05</i>	<i>to</i>	<i>0.10)</i>

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.01	12.1	0.64	0.03	Sum-MO	2
2.13	25.5	0.69	0.12	Sum-MO	2
2.73	32.8	0.82	0.13	Sum-MO	2
3.75	45.0	0.78	0.17	Sum-MO	2
4.77	57.2	0.82	0.17	Sum-MO	2
5.78	69.4	0.83	0.17	Sum-MO	2
6.82	81.8	0.89	0.18	Sum-MO	2
7.83	93.9	0.88	0.20	Sum-MO	2
8.85	106.2	0.87	0.23	Sum-MO	2
9.86	118.3	0.92	0.25	Sum-MO	2
10.87	130.4	1.00	0.24	Sum-MO	2
11.91	142.9	0.92	0.27	Sum-MO	2
12.91	154.9	0.91	0.30	Sum-MO	2
13.94	167.3	1.00	0.28	Sum-MO	2

The tables below provide estimates for each release type and cohort **based on the actual river of releases and for disease status in each release cohort**. Thus, these represent estimates based on the average covariate conditions experienced by an actual release cohort.

Estimates of survival for the 1st release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 295 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	SUM	08/11/98	10/14/00	13.9	40.4	0.38	0.04	112	89	to	136
1	SUM	10/14/00	08/18/02	40.4	62.8	0.22	0.03	65	49	to	82
1	SUM	08/18/02	08/17/03	62.8	74.9	0.18	0.02	53	40	to	66
1	SUM	08/17/03	04/13/04	74.9	82.9	0.16	0.02	47	36	to	59
1	SUM	04/13/04	09/21/04	82.9	88.3	0.15	0.02	44	34	to	55
1	SUM	09/21/04	04/30/05	88.3	95.7	0.14	0.02	41	31	to	51
1	SUM	04/30/05	09/23/05	95.7	100.5	0.13	0.02	39	30	to	48
1	SUM	09/23/05	04/29/06	100.5	107.8	0.12	0.01	36	28	to	45
1	SUM	04/29/06	07/13/06	107.8	110.3	0.12	0.01	35	27	to	44
1	SUM	07/13/06	09/27/06	110.3	112.8	0.12	0.01	35	27	to	43
1	SUM	09/27/06	05/02/07	112.8	120.1	0.11	0.01	33	25	to	41
1	SUM	05/02/07	09/22/07	120.1	124.8	0.11	0.01	32	24	to	39
1	SUM	09/22/07	04/30/08	124.8	132.2	0.10	0.01	30	23	to	38
1	SUM	04/30/08	07/22/08	132.2	135.0	0.10	0.01	30	22	to	37
1	SUM	07/22/08	09/16/08	135.0	136.8	0.10	0.01	30	22	to	37
1	SUM	09/16/08	05/08/09	136.8	144.7	0.10	0.01	28	21	to	36
1	SUM	05/08/09	07/22/09	144.7	147.2	0.09	0.01	28	21	to	35
1	SUM	07/22/09	09/15/09	147.2	149.0	0.09	0.01	28	21	to	35
1	SUM	09/15/09	05/04/10	149.0	156.7	0.09	0.01	27	20	to	34
1	SUM	05/04/10	09/08/10	156.7	160.9	0.09	0.01	26	19	to	34
1	SUM	09/08/10	05/09/11	160.9	169.0	0.09	0.01	26	18	to	33
1	SUM	05/09/11	09/12/11	169.0	173.2	0.09	0.01	25	18	to	33
1	SUM	09/12/11	05/08/12	173.2	181.2	0.08	0.01	25	17	to	32
1	SUM	05/08/12	09/06/12	181.2	185.2	0.08	0.01	24	17	to	32
1	SUM	09/06/12	05/05/13	185.2	193.2	0.08	0.01	24	16	to	32
1	SUM	05/05/13	09/20/13	193.2	197.8	0.08	0.01	24	16	to	31
1	SUM	09/20/13	05/16/14	197.8	205.8	0.08	0.01	23	16	to	31
1	SUM	05/16/14	09/15/14	205.8	209.8	0.08	0.01	23	15	to	31
1	SUM	09/15/14	05/10/15	209.8	217.7	0.08	0.01	23	15	to	31
1	SUM	05/10/15	09/16/15	217.7	222.0	0.08	0.01	23	15	to	31
1	SUM	09/16/15	05/15/16	222.0	230.1	0.08	0.01	22	14	to	31
1	SUM	05/15/16	09/05/16	230.1	233.9	0.08	0.01	22	14	to	31

Estimates of survival for the 2nd release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 179 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	SUM	10/14/00	08/18/02	13.9	36.3	0.44	0.04	79	65	to	93
2	SUM	08/18/02	08/17/03	36.3	48.4	0.32	0.03	58	46	to	70
2	SUM	08/17/03	04/13/04	48.4	56.4	0.27	0.03	49	38	to	59
2	SUM	04/13/04	09/21/04	56.4	61.8	0.25	0.03	44	34	to	54
2	SUM	09/21/04	04/30/05	61.8	69.2	0.22	0.02	39	30	to	47
2	SUM	04/30/05	09/23/05	69.2	74.0	0.20	0.02	36	28	to	44
2	SUM	09/23/05	04/29/06	74.0	81.3	0.18	0.02	32	25	to	39
2	SUM	04/29/06	07/13/06	81.3	83.8	0.18	0.02	31	25	to	38
2	SUM	07/13/06	09/27/06	83.8	86.3	0.17	0.02	30	24	to	37
2	SUM	09/27/06	05/02/07	86.3	93.6	0.16	0.02	28	22	to	34
2	SUM	05/02/07	09/22/07	93.6	98.3	0.15	0.02	27	21	to	32
2	SUM	09/22/07	04/30/08	98.3	105.7	0.14	0.02	25	19	to	30
2	SUM	04/30/08	07/22/08	105.7	108.5	0.14	0.02	24	19	to	29
2	SUM	07/22/08	09/16/08	108.5	110.4	0.13	0.01	24	19	to	29
2	SUM	09/16/08	05/08/09	110.4	118.2	0.12	0.01	22	17	to	27
2	SUM	05/08/09	07/22/09	118.2	120.7	0.12	0.01	22	17	to	27
2	SUM	07/22/09	09/15/09	120.7	122.5	0.12	0.01	22	17	to	27
2	SUM	09/15/09	05/04/10	122.5	130.2	0.11	0.01	21	16	to	25
2	SUM	05/04/10	09/08/10	130.2	134.4	0.11	0.01	20	15	to	25
2	SUM	09/08/10	05/09/11	134.4	142.5	0.11	0.01	19	14	to	24
2	SUM	05/09/11	09/12/11	142.5	146.7	0.11	0.01	19	14	to	24
2	SUM	09/12/11	05/08/12	146.7	154.7	0.10	0.01	18	13	to	23
2	SUM	05/08/12	09/06/12	154.7	158.7	0.10	0.01	18	13	to	23
2	SUM	09/06/12	05/05/13	158.7	166.7	0.10	0.01	17	12	to	22
2	SUM	05/05/13	09/20/13	166.7	171.3	0.10	0.01	17	12	to	22
2	SUM	09/20/13	05/16/14	171.3	179.3	0.09	0.01	17	11	to	22
2	SUM	05/16/14	09/15/14	179.3	183.3	0.09	0.01	16	11	to	22
2	SUM	09/15/14	05/10/15	183.3	191.2	0.09	0.02	16	11	to	21
2	SUM	05/10/15	09/16/15	191.2	195.5	0.09	0.02	16	11	to	21
2	SUM	09/16/15	05/15/16	195.5	203.6	0.09	0.02	16	10	to	21
2	SUM	05/15/16	09/05/16	203.6	207.4	0.09	0.02	16	10	to	21

Estimates of survival for the 3rd release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 1,272 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	SUM	08/18/02	08/17/03	13.9	26.0	0.64	0.03	817	739	to	895
3	SUM	08/17/03	04/13/04	26.0	34.0	0.50	0.03	642	557	to	727
3	SUM	04/13/04	09/21/04	34.0	39.4	0.44	0.03	556	473	to	639
3	SUM	09/21/04	04/30/05	39.4	46.7	0.36	0.03	464	387	to	541
3	SUM	04/30/05	09/23/05	46.7	51.6	0.33	0.03	417	345	to	489
3	SUM	09/23/05	04/29/06	51.6	58.9	0.28	0.03	360	295	to	425
3	SUM	04/29/06	07/13/06	58.9	61.4	0.27	0.02	344	282	to	406
3	SUM	07/13/06	09/27/06	61.4	63.9	0.26	0.02	329	269	to	389
3	SUM	09/27/06	05/02/07	63.9	71.1	0.23	0.02	292	238	to	346
3	SUM	05/02/07	09/22/07	71.1	75.9	0.21	0.02	272	221	to	322
3	SUM	09/22/07	04/30/08	75.9	83.3	0.19	0.02	245	199	to	291
3	SUM	04/30/08	07/22/08	83.3	86.0	0.19	0.02	237	192	to	282
3	SUM	07/22/08	09/16/08	86.1	87.9	0.18	0.02	232	188	to	276
3	SUM	09/16/08	05/08/09	87.9	95.7	0.17	0.02	212	171	to	253
3	SUM	05/08/09	07/22/09	95.7	98.2	0.16	0.02	207	166	to	247
3	SUM	07/22/09	09/15/09	98.2	100.0	0.16	0.02	203	163	to	243
3	SUM	09/15/09	05/04/10	100.1	107.8	0.15	0.02	189	150	to	228
3	SUM	05/04/10	09/08/10	107.8	112.0	0.14	0.02	182	143	to	221
3	SUM	09/08/10	05/09/11	112.0	120.1	0.13	0.02	171	133	to	209
3	SUM	05/09/11	09/12/11	120.1	124.3	0.13	0.02	166	128	to	204
3	SUM	09/12/11	05/08/12	124.3	132.2	0.12	0.02	157	119	to	196
3	SUM	05/08/12	09/06/12	132.2	136.3	0.12	0.02	154	115	to	193
3	SUM	09/06/12	05/05/13	136.3	144.3	0.12	0.02	147	108	to	187
3	SUM	05/05/13	09/20/13	144.3	148.9	0.11	0.02	144	104	to	184
3	SUM	09/20/13	05/16/14	148.9	156.8	0.11	0.02	139	99	to	180
3	SUM	05/16/14	09/15/14	156.8	160.9	0.11	0.02	137	96	to	178
3	SUM	09/15/14	05/10/15	160.9	168.8	0.10	0.02	133	91	to	175
3	SUM	05/10/15	09/16/15	168.8	173.1	0.10	0.02	131	89	to	174
3	SUM	09/16/15	05/15/16	173.1	181.2	0.10	0.02	128	85	to	171
3	SUM	05/15/16	09/05/16	181.2	185.0	0.10	0.02	127	83	to	170

Estimates of survival for the 4th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 2,061 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SUM	08/17/03	04/13/04	13.9	21.9	0.75	0.02	1,539	1,443	to	1,636
4	SUM	04/13/04	09/21/04	21.9	27.2	0.63	0.03	1,295	1,175	to	1,415
4	SUM	09/21/04	04/30/05	27.2	34.6	0.51	0.03	1,041	910	to	1,171
4	SUM	04/30/05	09/23/05	34.6	39.5	0.44	0.03	915	787	to	1,043
4	SUM	09/23/05	04/29/06	39.5	46.8	0.37	0.03	766	646	to	886
4	SUM	04/29/06	07/13/06	46.8	49.2	0.35	0.03	725	609	to	841
4	SUM	07/13/06	09/27/06	49.2	51.8	0.33	0.03	687	575	to	800
4	SUM	09/27/06	05/02/07	51.8	59.0	0.29	0.03	594	492	to	696
4	SUM	05/02/07	09/22/07	59.0	63.8	0.26	0.02	545	450	to	640
4	SUM	09/22/07	04/30/08	63.8	71.1	0.23	0.02	482	396	to	567
4	SUM	04/30/08	07/22/08	71.2	73.9	0.22	0.02	462	379	to	545
4	SUM	07/22/08	09/16/08	73.9	75.8	0.22	0.02	450	369	to	531
4	SUM	09/16/08	05/08/09	75.8	83.6	0.20	0.02	404	330	to	478
4	SUM	05/08/09	07/22/09	83.6	86.1	0.19	0.02	391	319	to	464
4	SUM	07/22/09	09/15/09	86.1	87.9	0.19	0.02	383	312	to	454
4	SUM	09/15/09	05/04/10	87.9	95.6	0.17	0.02	351	283	to	418
4	SUM	05/04/10	09/08/10	95.6	99.9	0.16	0.02	336	270	to	402
4	SUM	09/08/10	05/09/11	99.9	108.0	0.15	0.02	311	247	to	375
4	SUM	05/09/11	09/12/11	108.0	112.2	0.15	0.02	300	237	to	364
4	SUM	09/12/11	05/08/12	112.2	120.1	0.14	0.02	282	219	to	345
4	SUM	05/08/12	09/06/12	120.1	124.2	0.13	0.02	274	211	to	337
4	SUM	09/06/12	05/05/13	124.2	132.2	0.13	0.02	260	196	to	324
4	SUM	05/05/13	09/20/13	132.2	136.8	0.12	0.02	253	189	to	318
4	SUM	09/20/13	05/16/14	136.8	144.7	0.12	0.02	243	177	to	309
4	SUM	05/16/14	09/15/14	144.7	148.8	0.12	0.02	238	172	to	305
4	SUM	09/15/14	05/10/15	148.8	156.7	0.11	0.02	230	162	to	298
4	SUM	05/10/15	09/16/15	156.7	161.0	0.11	0.02	226	158	to	295
4	SUM	09/16/15	05/15/16	161.0	169.1	0.11	0.02	220	149	to	290
4	SUM	05/15/16	09/05/16	169.1	172.8	0.11	0.02	217	146	to	288

Estimates of survival for the 5th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 896 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	SUM	09/21/04	04/30/05	13.9	21.2	0.85	0.02	758	715	to	801
5	SUM	04/30/05	09/23/05	21.2	26.1	0.77	0.03	692	633	to	750
5	SUM	09/23/05	04/29/06	26.1	33.4	0.69	0.04	614	541	to	686
5	SUM	04/29/06	07/13/06	33.4	35.9	0.66	0.04	594	519	to	669
5	SUM	07/13/06	09/27/06	35.9	38.4	0.64	0.04	576	499	to	653
5	SUM	09/27/06	05/02/07	38.4	45.6	0.59	0.05	531	451	to	611
5	SUM	05/02/07	09/22/07	45.6	50.4	0.57	0.05	510	430	to	591
5	SUM	09/22/07	04/30/08	50.4	57.8	0.49	0.04	442	368	to	516
5	SUM	04/30/08	07/22/08	57.8	60.5	0.47	0.04	422	351	to	493
5	SUM	07/22/08	09/16/08	60.5	62.4	0.46	0.04	409	340	to	478
5	SUM	09/16/08	05/08/09	62.4	70.2	0.40	0.04	361	298	to	424
5	SUM	05/08/09	07/22/09	70.2	72.7	0.39	0.03	349	288	to	410
5	SUM	07/22/09	09/15/09	72.7	74.5	0.38	0.03	340	281	to	400
5	SUM	09/15/09	05/04/10	74.5	82.2	0.34	0.03	308	253	to	363
5	SUM	05/04/10	09/08/10	82.2	86.5	0.33	0.03	294	240	to	347
5	SUM	09/08/10	05/09/11	86.5	94.6	0.30	0.03	270	219	to	321
5	SUM	05/09/11	09/12/11	94.6	98.8	0.29	0.03	260	209	to	310
5	SUM	09/12/11	05/08/12	98.8	106.8	0.27	0.03	243	193	to	292
5	SUM	05/08/12	09/06/12	106.8	110.8	0.26	0.03	236	186	to	285
5	SUM	09/06/12	05/05/13	110.8	118.8	0.25	0.03	223	174	to	272
5	SUM	05/05/13	09/20/13	118.8	123.4	0.24	0.03	217	167	to	267
5	SUM	09/20/13	05/16/14	123.4	131.3	0.23	0.03	208	157	to	259
5	SUM	05/16/14	09/15/14	131.3	135.4	0.23	0.03	204	153	to	256
5	SUM	09/15/14	05/10/15	135.4	143.3	0.22	0.03	198	145	to	251
5	SUM	05/10/15	09/16/15	143.3	147.6	0.22	0.03	195	141	to	248
5	SUM	09/16/15	05/15/16	147.6	155.7	0.21	0.03	189	134	to	245
5	SUM	05/15/16	09/05/16	155.7	159.5	0.21	0.03	188	131	to	244

Estimates of survival for the 6th release cohort of summer yearlings in RPMA 2 in the Missouri River (no summer yearlings were released in the Missouri River in this release).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	SUM	NONE RELEASED									

Estimates of survival for the 7th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 918 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Inteval End)		
7	SUM	07/13/06	09/27/06	13.9	16.4	0.94	0.01	867	850	to	884
7	SUM	09/27/06	05/02/07	16.4	23.6	0.81	0.03	743	691	to	795
7	SUM	05/02/07	09/22/07	23.6	28.4	0.74	0.04	683	619	to	748
7	SUM	09/22/07	04/30/08	28.4	35.8	0.66	0.04	610	534	to	686
7	SUM	04/30/08	07/22/08	35.8	38.5	0.64	0.04	590	512	to	668
7	SUM	07/22/08	09/16/08	38.5	40.4	0.63	0.04	578	499	to	657
7	SUM	09/16/08	05/08/09	40.4	48.2	0.58	0.05	533	451	to	615
7	SUM	05/08/09	07/22/09	48.2	50.7	0.57	0.05	523	440	to	605
7	SUM	07/22/09	09/15/09	50.7	52.5	0.55	0.04	504	424	to	585
7	SUM	09/15/09	05/04/10	52.5	60.2	0.48	0.04	437	364	to	510
7	SUM	05/04/10	09/08/10	60.2	64.5	0.44	0.04	407	338	to	476
7	SUM	09/08/10	05/09/11	64.5	72.6	0.39	0.03	360	297	to	422
7	SUM	05/09/11	09/12/11	72.6	76.8	0.37	0.03	340	280	to	400
7	SUM	09/12/11	05/08/12	76.8	84.7	0.34	0.03	308	252	to	363
7	SUM	05/08/12	09/06/12	84.7	88.8	0.32	0.03	295	240	to	349
7	SUM	09/06/12	05/05/13	88.8	96.8	0.30	0.03	272	220	to	323
7	SUM	05/05/13	09/20/13	96.8	101.4	0.28	0.03	261	210	to	312
7	SUM	09/20/13	05/16/14	101.4	109.3	0.27	0.03	245	194	to	295
7	SUM	05/16/14	09/15/14	109.3	113.4	0.26	0.03	238	187	to	288
7	SUM	09/15/14	05/10/15	113.4	121.3	0.25	0.03	226	175	to	277
7	SUM	05/10/15	09/16/15	121.3	125.6	0.24	0.03	221	169	to	272
7	SUM	09/16/15	05/15/16	125.6	133.7	0.23	0.03	212	159	to	264
7	SUM	05/15/16	09/05/16	133.7	137.4	0.23	0.03	208	155	to	262

Estimates of survival for the 8th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 688 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
8	SUM	07/22/08	09/16/08	13.9	15.7	0.96	0.01	659	650	to	669
8	SUM	09/16/08	05/08/09	15.7	23.5	0.81	0.03	557	518	to	596
8	SUM	05/08/09	07/22/09	23.5	26.0	0.77	0.03	533	488	to	577
8	SUM	07/22/09	09/15/09	26.0	27.9	0.75	0.04	517	470	to	564
8	SUM	09/15/09	05/04/10	27.9	35.6	0.67	0.04	459	402	to	515
8	SUM	05/04/10	09/08/10	35.6	39.8	0.63	0.04	435	376	to	495
8	SUM	09/08/10	05/09/11	39.8	47.9	0.58	0.05	399	338	to	461
8	SUM	05/09/11	09/12/11	47.9	52.1	0.56	0.05	387	325	to	448
8	SUM	09/12/11	05/08/12	52.1	60.1	0.48	0.04	333	277	to	389
8	SUM	05/08/12	09/06/12	60.1	64.1	0.45	0.04	311	258	to	364
8	SUM	09/06/12	05/05/13	64.1	72.1	0.40	0.04	275	227	to	323
8	SUM	05/05/13	09/20/13	72.1	76.7	0.38	0.03	258	212	to	304
8	SUM	09/20/13	05/16/14	76.7	84.7	0.34	0.03	234	191	to	277
8	SUM	05/16/14	09/15/14	84.7	88.7	0.33	0.03	224	183	to	265
8	SUM	09/15/14	05/10/15	88.7	96.6	0.30	0.03	207	167	to	246
8	SUM	05/10/15	09/16/15	96.6	100.9	0.29	0.03	199	160	to	238
8	SUM	09/16/15	05/15/16	100.9	109.0	0.27	0.03	186	148	to	225
8	SUM	05/15/16	09/05/16	109.0	112.8	0.26	0.03	181	143	to	220

Estimates of survival for the 9th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 2,000 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
9	SUM	07/22/09	09/15/09	13.9	15.7	0.96	0.01	1,919	1,891	to	1,946
9	SUM	09/15/09	05/04/10	15.7	23.4	0.81	0.03	1,623	1,510	to	1,736
9	SUM	05/04/10	09/08/10	23.4	27.6	0.75	0.04	1,506	1,369	to	1,644
9	SUM	09/08/10	05/09/11	27.6	35.7	0.66	0.04	1,326	1,159	to	1,493
9	SUM	05/09/11	09/12/11	35.7	39.9	0.63	0.04	1,260	1,086	to	1,433
9	SUM	09/12/11	05/08/12	39.9	47.9	0.58	0.05	1,158	978	to	1,338
9	SUM	05/08/12	09/06/12	47.9	51.9	0.56	0.05	1,123	942	to	1,303
9	SUM	09/06/12	05/05/13	51.9	60.0	0.48	0.04	964	801	to	1,127
9	SUM	05/05/13	09/20/13	60.0	64.6	0.45	0.04	893	740	to	1,047
9	SUM	09/20/13	05/16/14	64.6	72.5	0.40	0.04	791	651	to	931
9	SUM	05/16/14	09/15/14	72.5	76.6	0.37	0.03	749	616	to	882
9	SUM	09/15/14	05/10/15	76.6	84.5	0.34	0.03	679	555	to	802
9	SUM	05/10/15	09/16/15	84.5	88.8	0.32	0.03	648	528	to	767
9	SUM	09/16/15	05/15/16	88.8	96.8	0.30	0.03	597	482	to	711
9	SUM	05/15/16	09/05/16	96.8	100.6	0.29	0.03	577	465	to	690

Estimates of survival for the 10th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 809 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
10	SUM	09/08/10	05/09/11	13.9	22.0	0.83	0.03	673	631	to	715
10	SUM	05/09/11	09/12/11	22.0	26.2	0.77	0.03	623	569	to	676
10	SUM	09/12/11	05/08/12	26.2	34.1	0.68	0.04	547	480	to	613
10	SUM	05/08/12	09/06/12	34.1	38.2	0.64	0.04	519	449	to	589
10	SUM	09/06/12	05/05/13	38.2	46.2	0.59	0.05	474	401	to	547
10	SUM	05/05/13	09/20/13	46.2	50.8	0.56	0.05	456	383	to	530
10	SUM	09/20/13	05/16/14	50.8	58.7	0.48	0.04	392	325	to	458
10	SUM	05/16/14	09/15/14	58.7	62.8	0.45	0.04	366	303	to	429
10	SUM	09/15/14	05/10/15	62.8	70.7	0.40	0.04	323	266	to	380
10	SUM	05/10/15	09/16/15	70.7	75.0	0.38	0.03	304	250	to	358
10	SUM	09/16/15	05/15/16	75.0	83.1	0.34	0.03	274	224	to	324
10	SUM	05/15/16	09/05/16	83.1	86.8	0.32	0.03	263	214	to	311

Estimates of survival for the 11th release cohort of summer yearlings in RPMA 2 in the Missouri River (cohort= 525 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
11	SUM	09/12/11	05/08/12	13.9	21.8	0.83	0.03	438	411	to	465
11	SUM	05/08/12	09/06/12	21.8	25.9	0.77	0.03	407	372	to	441
11	SUM	09/06/12	05/05/13	25.9	33.9	0.68	0.04	356	313	to	399
11	SUM	05/05/13	09/20/13	33.9	38.5	0.64	0.04	335	290	to	381
11	SUM	09/20/13	05/16/14	38.5	46.4	0.59	0.05	307	260	to	355
11	SUM	05/16/14	09/15/14	46.4	50.5	0.57	0.05	297	249	to	345
11	SUM	09/15/14	05/10/15	50.5	58.4	0.49	0.04	255	212	to	298
11	SUM	05/10/15	09/16/15	58.4	62.7	0.45	0.04	237	196	to	278
11	SUM	09/16/15	05/15/16	62.7	70.8	0.40	0.04	208	172	to	245
11	SUM	05/15/16	09/05/16	70.8	74.5	0.38	0.03	198	163	to	233

Summary information for summer yearlings released in RPMA 2 in the Missouri River

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as summer yearlings in the Missouri River were estimated to have been alive at the time the last data were collected (9/5/2016) for the analyses presented here. The point estimates indicate that ~1,997 fish of different ages were still alive and that no fish were <6-years old, ~61% (1,219) were ~6- to ~10-years old, ~31% (613) were 10- to 15-years old, and ~8% (165) were 15- to 20-years old.

Estimates of surviving proportions and numbers for summer yearlings released in RPMA 2 in the Missouri River

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 295	SUM	09/05/16	233.9	19.5	0.08	0.01	22	14	to	31
2: 179	SUM	09/05/16	207.4	17.3	0.09	0.02	16	10	to	21
3: 1,272	SUM	09/05/16	185.0	15.4	0.10	0.02	127	83	to	170
4: 2,061	SUM	09/05/16	172.8	14.4	0.11	0.02	217	146	to	288
5: 896	SUM	09/05/16	159.5	13.3	0.21	0.03	188	131	to	244
6: 0	SUM	09/05/16								
7: 918	SUM	09/05/16	137.4	11.5	0.23	0.03	208	155	to	262
8: 688	SUM	09/05/16	112.8	9.4	0.26	0.03	181	143	to	220
9: 2,000	SUM	09/05/16	100.6	8.4	0.29	0.03	577	465	to	690
10: 809	SUM	09/05/16	86.8	7.2	0.32	0.03	263	214	to	311
11: 525	SUM	09/05/16	74.5	6.2	0.38	0.03	198	163	to	233

Estimates of survival for the 1st release cohort of summer yearlings (~13.9 months old at time of release, which was 8/11/1998) in RPMA 2 in the Yellowstone River. Estimates are for a fish without disease problems (no fin curl or iridovirus) released in the Yellowstone River.

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
08/11/98	10/14/00	26.5	13.9	40.4	0.950	(0.005)	0.26	(0.04)	(0.18	to	0.33)
10/14/00	08/18/02	22.4	40.4	62.8	0.967	(0.002)	0.12	(0.02)	(0.08	to	0.16)
08/18/02	08/17/03	12.1	62.8	74.9	0.976	(0.001)	0.09	(0.02)	(0.06	to	0.12)
08/17/03	04/13/04	8.0	74.9	82.9	0.980	(0.002)	0.08	(0.01)	(0.05	to	0.10)
04/13/04	09/21/04	5.4	82.9	88.3	0.983	(0.002)	0.07	(0.01)	(0.05	to	0.09)
09/21/04	04/30/05	7.4	88.3	95.7	0.984	(0.002)	0.06	(0.01)	(0.04	to	0.08)
04/30/05	09/23/05	4.9	95.7	100.5	0.986	(0.002)	0.06	(0.01)	(0.04	to	0.07)
09/23/05	04/29/06	7.3	100.5	107.8	0.987	(0.002)	0.05	(0.01)	(0.04	to	0.07)
04/29/06	07/13/06	2.5	107.8	110.3	0.988	(0.002)	0.05	(0.01)	(0.04	to	0.06)
07/13/06	09/27/06	2.5	110.3	112.8	0.989	(0.002)	0.05	(0.01)	(0.04	to	0.06)
09/27/06	05/02/07	7.2	112.8	120.1	0.989	(0.002)	0.05	(0.01)	(0.03	to	0.06)
05/02/07	09/22/07	4.8	120.1	124.8	0.990	(0.002)	0.04	(0.01)	(0.03	to	0.05)
09/22/07	04/30/08	7.4	124.8	132.2	0.991	(0.002)	0.04	(0.01)	(0.03	to	0.05)
04/30/08	07/22/08	2.8	132.2	135.0	0.992	(0.002)	0.04	(0.01)	(0.03	to	0.05)
07/22/08	09/16/08	1.9	135.0	136.8	0.992	(0.002)	0.04	(0.01)	(0.03	to	0.05)
09/16/08	05/08/09	7.8	136.8	144.7	0.993	(0.002)	0.04	(0.00)	(0.03	to	0.05)
05/08/09	07/22/09	2.5	144.7	147.2	0.993	(0.002)	0.04	(0.00)	(0.03	to	0.05)
07/22/09	09/15/09	1.8	147.2	149.0	0.994	(0.002)	0.04	(0.00)	(0.03	to	0.05)
09/15/09	05/04/10	7.7	149.0	156.7	0.994	(0.002)	0.03	(0.00)	(0.03	to	0.04)
05/04/10	09/08/10	4.2	156.7	160.9	0.995	(0.002)	0.03	(0.00)	(0.02	to	0.04)
09/08/10	05/09/11	8.1	160.9	169.0	0.995	(0.002)	0.03	(0.00)	(0.02	to	0.04)
05/09/11	09/12/11	4.2	169.0	173.2	0.995	(0.002)	0.03	(0.00)	(0.02	to	0.04)
09/12/11	05/08/12	8.0	173.2	181.2	0.996	(0.002)	0.03	(0.00)	(0.02	to	0.04)
05/08/12	09/06/12	4.0	181.2	185.2	0.996	(0.002)	0.03	(0.00)	(0.02	to	0.04)
09/06/12	05/05/13	8.0	185.2	193.2	0.996	(0.002)	0.03	(0.00)	(0.02	to	0.04)
05/05/13	09/20/13	4.6	193.2	197.8	0.997	(0.001)	0.03	(0.00)	(0.02	to	0.04)
09/20/13	05/16/14	7.9	197.8	205.8	0.997	(0.001)	0.03	(0.00)	(0.02	to	0.04)
05/16/14	09/15/14	4.1	205.8	209.8	0.997	(0.001)	0.03	(0.00)	(0.02	to	0.04)
09/15/14	05/10/15	7.9	209.8	217.7	0.998	(0.001)	0.03	(0.00)	(0.02	to	0.04)
05/10/15	09/16/15	4.3	217.7	222.0	0.998	(0.001)	0.03	(0.01)	(0.02	to	0.04)
09/16/15	05/15/16	8.1	222.0	230.1	0.998	(0.001)	0.03	(0.01)	(0.02	to	0.04)
05/15/16	09/05/16	3.8	230.1	233.9	0.998	(0.001)	0.03	(0.01)	(0.02	to	0.04)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.01	12.1	0.51	0.04	Sum-YE	2
2.13	25.5	0.55	0.24	Sum-YE	2
2.73	32.8	0.75	0.24	Sum-YE	2
3.75	45.0	0.67	0.30	Sum-YE	2
4.77	57.2	0.71	0.24	Sum-YE	2
5.78	69.4	0.80	0.20	Sum-YE	2
6.82	81.8	0.75	0.28	Sum-YE	2
7.83	93.9	0.83	0.31	Sum-YE	2
8.85	106.2	0.80	0.40	Sum-YE	2
9.86	118.3	1.00	0.35	Sum-YE	2
10.87	130.4	1.00	0.35	Sum-YE	2
11.91	142.9	0.75	0.56	Sum-YE	2
12.91	154.9	1.00	0.47	Sum-YE	2
13.94	167.3	1.00	0.47	Sum-YE	2

The tables below provide estimates based on the results of the model that is best-supported by the data for the numbers and proportions of fish in each release cohort of summer yearlings in the Yellowstone River **based on the actual river of releases and for disease status in each release cohort**. Thus, these represent estimates based on the average covariate conditions experienced by an actual release cohort.

Estimates of survival for the 1st release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 486 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	SUM	08/11/98	10/14/00	13.9	40.4	0.26	0.04	125	88	<i>to</i>	163
1	SUM	10/14/00	08/18/02	40.4	62.8	0.12	0.02	59	38	<i>to</i>	79
1	SUM	08/18/02	08/17/03	62.8	74.9	0.09	0.02	44	29	<i>to</i>	59
1	SUM	08/17/03	04/13/04	74.9	82.9	0.08	0.01	37	25	<i>to</i>	50
1	SUM	04/13/04	09/21/04	82.9	88.3	0.07	0.01	34	23	<i>to</i>	45
1	SUM	09/21/04	04/30/05	88.3	95.7	0.06	0.01	30	21	<i>to</i>	39
1	SUM	04/30/05	09/23/05	95.7	100.5	0.06	0.01	28	20	<i>to</i>	36
1	SUM	09/23/05	04/29/06	100.5	107.8	0.05	0.01	26	18	<i>to</i>	33
1	SUM	04/29/06	07/13/06	107.8	110.3	0.05	0.01	25	18	<i>to</i>	32
1	SUM	07/13/06	09/27/06	110.3	112.8	0.05	0.01	24	18	<i>to</i>	31
1	SUM	09/27/06	05/02/07	112.8	120.1	0.05	0.01	22	16	<i>to</i>	28
1	SUM	05/02/07	09/22/07	120.1	124.8	0.04	0.01	21	16	<i>to</i>	27
1	SUM	09/22/07	04/30/08	124.8	132.2	0.04	0.01	20	15	<i>to</i>	25
1	SUM	04/30/08	07/22/08	132.2	135.0	0.04	0.01	19	15	<i>to</i>	24
1	SUM	07/22/08	09/16/08	135.0	136.8	0.04	0.01	19	14	<i>to</i>	24
1	SUM	09/16/08	05/08/09	136.8	144.7	0.04	0.00	18	14	<i>to</i>	23
1	SUM	05/08/09	07/22/09	144.7	147.2	0.04	0.00	18	13	<i>to</i>	22
1	SUM	07/22/09	09/15/09	147.2	149.0	0.04	0.00	18	13	<i>to</i>	22
1	SUM	09/15/09	05/04/10	149.0	156.7	0.03	0.00	17	12	<i>to</i>	21
1	SUM	05/04/10	09/08/10	156.7	160.9	0.03	0.00	16	12	<i>to</i>	21
1	SUM	09/08/10	05/09/11	160.9	169.0	0.03	0.00	16	11	<i>to</i>	20
1	SUM	05/09/11	09/12/11	169.0	173.2	0.03	0.00	15	11	<i>to</i>	20
1	SUM	09/12/11	05/08/12	173.2	181.2	0.03	0.00	15	10	<i>to</i>	19
1	SUM	05/08/12	09/06/12	181.2	185.2	0.03	0.00	15	10	<i>to</i>	19
1	SUM	09/06/12	05/05/13	185.2	193.2	0.03	0.00	14	10	<i>to</i>	19
1	SUM	05/05/13	09/20/13	193.2	197.8	0.03	0.00	14	10	<i>to</i>	19
1	SUM	09/20/13	05/16/14	197.8	205.8	0.03	0.00	14	9	<i>to</i>	18
1	SUM	05/16/14	09/15/14	205.8	209.8	0.03	0.00	14	9	<i>to</i>	18
1	SUM	09/15/14	05/10/15	209.8	217.7	0.03	0.00	13	9	<i>to</i>	18
1	SUM	05/10/15	09/16/15	217.7	222.0	0.03	0.01	13	8	<i>to</i>	18
1	SUM	09/16/15	05/15/16	222.0	230.1	0.03	0.01	13	8	<i>to</i>	18
1	SUM	05/15/16	09/05/16	230.1	233.9	0.03	0.01	13	8	<i>to</i>	18

Estimates of survival for the 2nd release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 299 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	SUM	10/14/00	08/18/02	13.9	36.3	0.32	0.04	95	71	to	119
2	SUM	08/18/02	08/17/03	36.3	48.4	0.20	0.03	61	43	to	79
2	SUM	08/17/03	04/13/04	48.4	56.4	0.16	0.02	48	34	to	63
2	SUM	04/13/04	09/21/04	56.4	61.8	0.14	0.02	42	29	to	54
2	SUM	09/21/04	04/30/05	61.8	69.2	0.12	0.02	35	25	to	45
2	SUM	04/30/05	09/23/05	69.2	74.0	0.11	0.02	31	22	to	40
2	SUM	09/23/05	04/29/06	74.0	81.3	0.09	0.01	27	20	to	35
2	SUM	04/29/06	07/13/06	81.3	83.8	0.09	0.01	26	19	to	33
2	SUM	07/13/06	09/27/06	83.8	86.3	0.08	0.01	25	18	to	32
2	SUM	09/27/06	05/02/07	86.3	93.6	0.07	0.01	22	16	to	28
2	SUM	05/02/07	09/22/07	93.6	98.3	0.07	0.01	21	15	to	26
2	SUM	09/22/07	04/30/08	98.3	105.7	0.06	0.01	19	14	to	23
2	SUM	04/30/08	07/22/08	105.7	108.5	0.06	0.01	18	14	to	22
2	SUM	07/22/08	09/16/08	108.5	110.4	0.06	0.01	18	13	to	22
2	SUM	09/16/08	05/08/09	110.4	118.2	0.05	0.01	16	12	to	20
2	SUM	05/08/09	07/22/09	118.2	120.7	0.05	0.01	16	12	to	19
2	SUM	07/22/09	09/15/09	120.7	122.5	0.05	0.01	15	12	to	19
2	SUM	09/15/09	05/04/10	122.5	130.2	0.05	0.01	14	11	to	18
2	SUM	05/04/10	09/08/10	130.2	134.4	0.05	0.01	14	11	to	17
2	SUM	09/08/10	05/09/11	134.4	142.5	0.04	0.01	13	10	to	16
2	SUM	05/09/11	09/12/11	142.5	146.7	0.04	0.01	13	9	to	16
2	SUM	09/12/11	05/08/12	146.7	154.7	0.04	0.01	12	9	to	15
2	SUM	05/08/12	09/06/12	154.7	158.7	0.04	0.01	12	9	to	15
2	SUM	09/06/12	05/05/13	158.7	166.7	0.04	0.01	11	8	to	14
2	SUM	05/05/13	09/20/13	166.7	171.3	0.04	0.01	11	8	to	14
2	SUM	09/20/13	05/16/14	171.3	179.3	0.04	0.01	11	7	to	14
2	SUM	05/16/14	09/15/14	179.3	183.3	0.03	0.01	10	7	to	14
2	SUM	09/15/14	05/10/15	183.3	191.2	0.03	0.01	10	7	to	14
2	SUM	05/10/15	09/16/15	191.2	195.5	0.03	0.01	10	7	to	13
2	SUM	09/16/15	05/15/16	195.5	203.6	0.03	0.01	10	6	to	13
2	SUM	05/15/16	09/05/16	203.6	207.4	0.03	0.01	10	6	to	13

Estimates of survival for the 3rd release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 1,752 fish, IV status not considered, Fin Curl status = 0.09).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	SUM	08/18/02	08/17/03	13.9	26.0	0.51	0.04	886	753	to	1,020
3	SUM	08/17/03	04/13/04	26.0	34.0	0.35	0.04	610	483	to	737
3	SUM	04/13/04	09/21/04	34.0	39.4	0.28	0.03	489	375	to	603
3	SUM	09/21/04	04/30/05	39.4	46.7	0.21	0.03	370	275	to	464
3	SUM	04/30/05	09/23/05	46.7	51.6	0.18	0.02	314	231	to	396
3	SUM	09/23/05	04/29/06	51.6	58.9	0.14	0.02	250	183	to	317
3	SUM	04/29/06	07/13/06	58.9	61.4	0.13	0.02	233	170	to	295
3	SUM	07/13/06	09/27/06	61.4	63.9	0.12	0.02	217	159	to	275
3	SUM	09/27/06	05/02/07	63.9	71.1	0.10	0.01	180	133	to	228
3	SUM	05/02/07	09/22/07	71.1	75.9	0.09	0.01	161	120	to	203
3	SUM	09/22/07	04/30/08	75.9	83.3	0.08	0.01	138	103	to	172
3	SUM	04/30/08	07/22/08	83.3	86.0	0.07	0.01	131	99	to	163
3	SUM	07/22/08	09/16/08	86.1	87.9	0.07	0.01	126	96	to	157
3	SUM	09/16/08	05/08/09	87.9	95.7	0.06	0.01	110	84	to	136
3	SUM	05/08/09	07/22/09	95.7	98.2	0.06	0.01	106	81	to	130
3	SUM	07/22/09	09/15/09	98.2	100.0	0.06	0.01	103	79	to	127
3	SUM	09/15/09	05/04/10	100.1	107.8	0.05	0.01	92	70	to	113
3	SUM	05/04/10	09/08/10	107.8	112.0	0.05	0.01	87	67	to	107
3	SUM	09/08/10	05/09/11	112.0	120.1	0.04	0.01	79	60	to	97
3	SUM	05/09/11	09/12/11	120.1	124.3	0.04	0.01	75	57	to	94
3	SUM	09/12/11	05/08/12	124.3	132.2	0.04	0.01	69	51	to	87
3	SUM	05/08/12	09/06/12	132.2	136.3	0.04	0.01	67	49	to	85
3	SUM	09/06/12	05/05/13	136.3	144.3	0.04	0.01	62	45	to	80
3	SUM	05/05/13	09/20/13	144.3	148.9	0.03	0.01	60	42	to	78
3	SUM	09/20/13	05/16/14	148.9	156.8	0.03	0.01	57	39	to	76
3	SUM	05/16/14	09/15/14	156.8	160.9	0.03	0.01	56	37	to	74
3	SUM	09/15/14	05/10/15	160.9	168.8	0.03	0.01	53	34	to	72
3	SUM	05/10/15	09/16/15	168.8	173.1	0.03	0.01	52	33	to	71
3	SUM	09/16/15	05/15/16	173.1	181.2	0.03	0.01	50	31	to	70
3	SUM	05/15/16	09/05/16	181.2	185.0	0.03	0.01	50	30	to	69

Estimates of survival for the 4th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 1,929 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SUM	08/17/03	04/13/04	13.9	21.9	0.66	0.03	1,281	<i>1,166</i>	<i>to</i>	<i>1,397</i>
4	SUM	04/13/04	09/21/04	21.9	27.2	0.52	0.04	1,005	<i>872</i>	<i>to</i>	<i>1,138</i>
4	SUM	09/21/04	04/30/05	27.2	34.6	0.38	0.03	740	<i>609</i>	<i>to</i>	<i>871</i>
4	SUM	04/30/05	09/23/05	34.6	39.5	0.32	0.03	617	<i>496</i>	<i>to</i>	<i>739</i>
4	SUM	09/23/05	04/29/06	39.5	46.8	0.25	0.03	481	<i>376</i>	<i>to</i>	<i>585</i>
4	SUM	04/29/06	07/13/06	46.8	49.2	0.23	0.03	445	<i>347</i>	<i>to</i>	<i>543</i>
4	SUM	07/13/06	09/27/06	49.2	51.8	0.21	0.02	413	<i>321</i>	<i>to</i>	<i>505</i>
4	SUM	09/27/06	05/02/07	51.8	59.0	0.17	0.02	336	<i>260</i>	<i>to</i>	<i>413</i>
4	SUM	05/02/07	09/22/07	59.0	63.8	0.15	0.02	298	<i>230</i>	<i>to</i>	<i>365</i>
4	SUM	09/22/07	04/30/08	63.8	71.1	0.13	0.01	250	<i>194</i>	<i>to</i>	<i>306</i>
4	SUM	04/30/08	07/22/08	71.2	73.9	0.12	0.01	236	<i>184</i>	<i>to</i>	<i>288</i>
4	SUM	07/22/08	09/16/08	73.9	75.8	0.12	0.01	227	<i>178</i>	<i>to</i>	<i>277</i>
4	SUM	09/16/08	05/08/09	75.8	83.6	0.10	0.01	195	<i>154</i>	<i>to</i>	<i>237</i>
4	SUM	05/08/09	07/22/09	83.6	86.1	0.10	0.01	187	<i>148</i>	<i>to</i>	<i>226</i>
4	SUM	07/22/09	09/15/09	86.1	87.9	0.09	0.01	181	<i>144</i>	<i>to</i>	<i>219</i>
4	SUM	09/15/09	05/04/10	87.9	95.6	0.08	0.01	160	<i>127</i>	<i>to</i>	<i>193</i>
4	SUM	05/04/10	09/08/10	95.6	99.9	0.08	0.01	151	<i>120</i>	<i>to</i>	<i>181</i>
4	SUM	09/08/10	05/09/11	99.9	108.0	0.07	0.01	135	<i>108</i>	<i>to</i>	<i>163</i>
4	SUM	05/09/11	09/12/11	108.0	112.2	0.07	0.01	128	<i>102</i>	<i>to</i>	<i>155</i>
4	SUM	09/12/11	05/08/12	112.2	120.1	0.06	0.01	118	<i>92</i>	<i>to</i>	<i>143</i>
4	SUM	05/08/12	09/06/12	120.1	124.2	0.06	0.01	113	<i>88</i>	<i>to</i>	<i>138</i>
4	SUM	09/06/12	05/05/13	124.2	132.2	0.05	0.01	105	<i>80</i>	<i>to</i>	<i>130</i>
4	SUM	05/05/13	09/20/13	132.2	136.8	0.05	0.01	101	<i>76</i>	<i>to</i>	<i>126</i>
4	SUM	09/20/13	05/16/14	136.8	144.7	0.05	0.01	95	<i>70</i>	<i>to</i>	<i>121</i>
4	SUM	05/16/14	09/15/14	144.7	148.8	0.05	0.01	93	<i>67</i>	<i>to</i>	<i>118</i>
4	SUM	09/15/14	05/10/15	148.8	156.7	0.05	0.01	88	<i>62</i>	<i>to</i>	<i>115</i>
4	SUM	05/10/15	09/16/15	156.7	161.0	0.04	0.01	86	<i>60</i>	<i>to</i>	<i>113</i>
4	SUM	09/16/15	05/15/16	161.0	169.1	0.04	0.01	83	<i>55</i>	<i>to</i>	<i>110</i>
4	SUM	05/15/16	09/05/16	169.1	172.8	0.04	0.01	81	<i>54</i>	<i>to</i>	<i>109</i>

Estimates of survival for the 5th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 676 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	SUM	09/21/04	04/30/05	13.9	21.2	0.76	0.03	513	471	to	555
5	SUM	04/30/05	09/23/05	21.2	26.1	0.65	0.04	439	386	to	493
5	SUM	09/23/05	04/29/06	26.1	33.4	0.53	0.05	357	297	to	417
5	SUM	04/29/06	07/13/06	33.4	35.9	0.50	0.05	336	276	to	396
5	SUM	07/13/06	09/27/06	35.9	38.4	0.47	0.04	317	258	to	377
5	SUM	09/27/06	05/02/07	38.4	45.6	0.40	0.04	272	215	to	329
5	SUM	05/02/07	09/22/07	45.6	50.4	0.37	0.04	250	196	to	304
5	SUM	09/22/07	04/30/08	50.4	57.8	0.30	0.03	204	158	to	249
5	SUM	04/30/08	07/22/08	57.8	60.5	0.28	0.03	190	148	to	233
5	SUM	07/22/08	09/16/08	60.5	62.4	0.27	0.03	182	142	to	223
5	SUM	09/16/08	05/08/09	62.4	70.2	0.23	0.03	152	119	to	186
5	SUM	05/08/09	07/22/09	70.2	72.7	0.21	0.02	145	114	to	176
5	SUM	07/22/09	09/15/09	72.7	74.5	0.21	0.02	140	110	to	170
5	SUM	09/15/09	05/04/10	74.5	82.2	0.18	0.02	121	96	to	146
5	SUM	05/04/10	09/08/10	82.2	86.5	0.17	0.02	113	90	to	136
5	SUM	09/08/10	05/09/11	86.5	94.6	0.15	0.02	100	80	to	120
5	SUM	05/09/11	09/12/11	94.6	98.8	0.14	0.01	94	76	to	113
5	SUM	09/12/11	05/08/12	98.8	106.8	0.13	0.01	85	68	to	103
5	SUM	05/08/12	09/06/12	106.8	110.8	0.12	0.01	82	65	to	98
5	SUM	09/06/12	05/05/13	110.8	118.8	0.11	0.01	75	59	to	91
5	SUM	05/05/13	09/20/13	118.8	123.4	0.11	0.01	72	57	to	88
5	SUM	09/20/13	05/16/14	123.4	131.3	0.10	0.01	68	52	to	84
5	SUM	05/16/14	09/15/14	131.3	135.4	0.10	0.01	66	50	to	82
5	SUM	09/15/14	05/10/15	135.4	143.3	0.09	0.01	63	46	to	79
5	SUM	05/10/15	09/16/15	143.3	147.6	0.09	0.01	61	44	to	78
5	SUM	09/16/15	05/15/16	147.6	155.7	0.09	0.01	59	41	to	76
5	SUM	05/15/16	09/05/16	155.7	159.5	0.09	0.01	58	40	to	76

Estimates of survival for the 6th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 174 fish, IV status not considered, Fin Curl status = 1).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	SUM	09/23/05	04/29/06	13.9	21.1	0.38	0.06	67	48	to	86
6	SUM	04/29/06	07/13/06	21.1	23.6	0.29	0.05	50	32	to	68
6	SUM	07/13/06	09/27/06	23.6	26.2	0.22	0.05	37	21	to	54
6	SUM	09/27/06	05/02/07	26.2	33.4	0.10	0.03	17	7	to	28
6	SUM	05/02/07	09/22/07	33.4	38.2	0.06	0.02	11	3	to	19
6	SUM	09/22/07	04/30/08	38.2	45.5	0.03	0.01	6	1	to	11
6	SUM	04/30/08	07/22/08	45.5	48.3	0.03	0.01	5	1	to	9
6	SUM	07/22/08	09/16/08	48.3	50.2	0.02	0.01	4	0	to	8
6	SUM	09/16/08	05/08/09	50.2	58.0	0.01	0.01	2	0	to	4
6	SUM	05/08/09	07/22/09	58.0	60.5	0.01	0.01	2	0	to	4
6	SUM	07/22/09	09/15/09	60.5	62.3	0.01	0.00	2	0	to	3
6	SUM	09/15/09	05/04/10	62.3	70.0	0.01	0.00	1	0	to	2
6	SUM	05/04/10	09/08/10	70.0	74.2	0.00	0.00	1	0	to	1
6	SUM	09/08/10	05/09/11	74.2	82.3	0.00	0.00	0	0	to	1
6	SUM	05/09/11	09/12/11	82.3	86.5	0.00	0.00	0	0	to	1
6	SUM	09/12/11	05/08/12	86.5	94.5	0.00	0.00	0	0	to	1
6	SUM	05/08/12	09/06/12	94.5	98.5	0.00	0.00	0	0	to	0
6	SUM	09/06/12	05/05/13	98.5	106.6	0.00	0.00	0	0	to	0
6	SUM	05/05/13	09/20/13	106.6	111.2	0.00	0.00	0	0	to	0
6	SUM	09/20/13	05/16/14	111.2	119.1	0.00	0.00	0	0	to	0
6	SUM	05/16/14	09/15/14	119.1	123.2	0.00	0.00	0	0	to	0
6	SUM	09/15/14	05/10/15	123.2	131.1	0.00	0.00	0	0	to	0
6	SUM	05/10/15	09/16/15	131.1	135.4	0.00	0.00	0	0	to	0
6	SUM	09/16/15	05/15/16	135.4	143.4	0.00	0.00	0	0	to	0
6	SUM	05/15/16	09/05/16	143.4	147.2	0.00	0.00	0	0	to	0

Estimates of survival for the 7th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 457 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
7	SUM	07/13/06	09/27/06	13.9	16.4	0.91	0.01	416	404	to	427
7	SUM	09/27/06	05/02/07	16.4	23.6	0.70	0.04	322	290	to	354
7	SUM	05/02/07	09/22/07	23.6	28.4	0.61	0.04	279	241	to	316
7	SUM	09/22/07	04/30/08	28.4	35.8	0.50	0.04	228	188	to	268
7	SUM	04/30/08	07/22/08	35.8	38.5	0.47	0.04	214	174	to	254
7	SUM	07/22/08	09/16/08	38.5	40.4	0.45	0.04	206	166	to	245
7	SUM	09/16/08	05/08/09	40.4	48.2	0.38	0.04	176	139	to	213
7	SUM	05/08/09	07/22/09	48.2	50.7	0.37	0.04	169	133	to	205
7	SUM	07/22/09	09/15/09	50.7	52.5	0.35	0.04	161	126	to	195
7	SUM	09/15/09	05/04/10	52.5	60.2	0.29	0.03	130	102	to	159
7	SUM	05/04/10	09/08/10	60.2	64.5	0.26	0.03	118	92	to	144
7	SUM	09/08/10	05/09/11	64.5	72.6	0.22	0.02	99	77	to	120
7	SUM	05/09/11	09/12/11	72.6	76.8	0.20	0.02	91	72	to	110
7	SUM	09/12/11	05/08/12	76.8	84.7	0.17	0.02	79	63	to	95
7	SUM	05/08/12	09/06/12	84.7	88.8	0.16	0.02	74	59	to	89
7	SUM	09/06/12	05/05/13	88.8	96.8	0.14	0.01	66	53	to	79
7	SUM	05/05/13	09/20/13	96.8	101.4	0.14	0.01	62	50	to	74
7	SUM	09/20/13	05/16/14	101.4	109.3	0.12	0.01	56	45	to	68
7	SUM	05/16/14	09/15/14	109.3	113.4	0.12	0.01	54	43	to	65
7	SUM	09/15/14	05/10/15	113.4	121.3	0.11	0.01	50	39	to	61
7	SUM	05/10/15	09/16/15	121.3	125.6	0.11	0.01	48	37	to	59
7	SUM	09/16/15	05/15/16	125.6	133.7	0.10	0.01	45	34	to	56
7	SUM	05/15/16	09/05/16	133.7	137.4	0.10	0.01	44	33	to	55

Estimates of survival for the 8th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 2,569 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
8	SUM	07/22/08	09/16/08	13.9	15.7	0.93	0.01	2,396	2,346	to	2,445
8	SUM	09/16/08	05/08/09	15.7	23.5	0.70	0.04	1,810	1,628	to	1,993
8	SUM	05/08/09	07/22/09	23.5	26.0	0.65	0.04	1,678	1,479	to	1,878
8	SUM	07/22/09	09/15/09	26.0	27.9	0.62	0.04	1,592	1,384	to	1,800
8	SUM	09/15/09	05/04/10	27.9	35.6	0.50	0.04	1,289	1,063	to	1,515
8	SUM	05/04/10	09/08/10	35.6	39.8	0.46	0.04	1,170	947	to	1,394
8	SUM	09/08/10	05/09/11	39.8	47.9	0.39	0.04	991	780	to	1,202
8	SUM	05/09/11	09/12/11	47.9	52.1	0.36	0.04	925	723	to	1,126
8	SUM	09/12/11	05/08/12	52.1	60.1	0.29	0.03	745	579	to	912
8	SUM	05/08/12	09/06/12	60.1	64.1	0.26	0.03	677	527	to	828
8	SUM	09/06/12	05/05/13	64.1	72.1	0.22	0.02	566	443	to	690
8	SUM	05/05/13	09/20/13	72.1	76.7	0.20	0.02	518	407	to	629
8	SUM	09/20/13	05/16/14	76.7	84.7	0.17	0.02	449	356	to	542
8	SUM	05/16/14	09/15/14	84.7	88.7	0.16	0.02	421	335	to	507
8	SUM	09/15/14	05/10/15	88.7	96.6	0.15	0.01	374	299	to	449
8	SUM	05/10/15	09/16/15	96.6	100.9	0.14	0.01	354	283	to	425
8	SUM	09/16/15	05/15/16	100.9	109.0	0.13	0.01	322	256	to	387
8	SUM	05/15/16	09/05/16	109.0	112.8	0.12	0.01	309	246	to	373

Estimates of survival for the 9th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 1,781 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
9	SUM	07/22/09	09/15/09	13.9	15.7	0.93	0.01	1,663	1,629	to	1,697
9	SUM	09/15/09	05/04/10	15.7	23.4	0.71	0.04	1,261	1,136	to	1,386
9	SUM	05/04/10	09/08/10	23.4	27.6	0.62	0.04	1,109	964	to	1,253
9	SUM	09/08/10	05/09/11	27.6	35.7	0.50	0.05	887	729	to	1,044
9	SUM	05/09/11	09/12/11	35.7	39.9	0.45	0.04	806	650	to	962
9	SUM	09/12/11	05/08/12	39.9	47.9	0.38	0.04	685	538	to	832
9	SUM	05/08/12	09/06/12	47.9	51.9	0.36	0.04	641	500	to	781
9	SUM	09/06/12	05/05/13	51.9	60.0	0.29	0.03	515	399	to	631
9	SUM	05/05/13	09/20/13	60.0	64.6	0.26	0.03	462	358	to	565
9	SUM	09/20/13	05/16/14	64.6	72.5	0.22	0.02	388	302	to	473
9	SUM	05/16/14	09/15/14	72.5	76.6	0.20	0.02	358	281	to	435
9	SUM	09/15/14	05/10/15	76.6	84.5	0.17	0.02	310	246	to	375
9	SUM	05/10/15	09/16/15	84.5	88.8	0.16	0.02	290	230	to	349
9	SUM	09/16/15	05/15/16	88.8	96.8	0.14	0.01	257	206	to	309
9	SUM	05/15/16	09/05/16	96.8	100.6	0.14	0.01	245	196	to	294

Estimates of survival for the 10th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 1,077 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
10	SUM	09/08/10	05/09/11	13.9	22.0	0.74	0.03	796	724	to	867
10	SUM	05/09/11	09/12/11	22.0	26.2	0.65	0.04	697	612	to	783
10	SUM	09/12/11	05/08/12	26.2	34.1	0.52	0.05	555	459	to	652
10	SUM	05/08/12	09/06/12	34.1	38.2	0.47	0.05	505	409	to	601
10	SUM	09/06/12	05/05/13	38.2	46.2	0.39	0.04	425	334	to	516
10	SUM	05/05/13	09/20/13	46.2	50.8	0.36	0.04	393	306	to	479
10	SUM	09/20/13	05/16/14	50.8	58.7	0.29	0.03	315	244	to	387
10	SUM	05/16/14	09/15/14	58.7	62.8	0.27	0.03	286	221	to	350
10	SUM	09/15/14	05/10/15	62.8	70.7	0.22	0.03	239	185	to	292
10	SUM	05/10/15	09/16/15	70.7	75.0	0.20	0.02	219	171	to	267
10	SUM	09/16/15	05/15/16	75.0	83.1	0.18	0.02	189	149	to	229
10	SUM	05/15/16	09/05/16	83.1	86.8	0.16	0.02	177	140	to	214

Estimates of survival for the 11th release cohort of summer yearlings in RPMA 2 in the Yellowstone River (cohort= 437 fish, IV status not considered, Fin Curl status = 0).

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
11	SUM	09/12/11	05/08/12	13.9	21.8	0.74	0.03	324	296	to	353
11	SUM	05/08/12	09/06/12	21.8	25.9	0.65	0.04	286	251	to	320
11	SUM	09/06/12	05/05/13	25.9	33.9	0.52	0.05	227	188	to	266
11	SUM	05/05/13	09/20/13	33.9	38.5	0.47	0.05	203	165	to	242
11	SUM	09/20/13	05/16/14	38.5	46.4	0.39	0.04	172	135	to	209
11	SUM	05/16/14	09/15/14	46.4	50.5	0.37	0.04	160	125	to	196
11	SUM	09/15/14	05/10/15	50.5	58.4	0.29	0.03	129	99	to	158
11	SUM	05/10/15	09/16/15	58.4	62.7	0.27	0.03	116	90	to	142
11	SUM	09/16/15	05/15/16	62.7	70.8	0.22	0.03	96	75	to	118
11	SUM	05/15/16	09/05/16	70.8	74.5	0.20	0.02	89	70	to	109

Summary information for summer yearlings released in RPMA 2 in the Yellowstone River

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, an estimated 1,076 fish released as summer yearlings in the Yellowstone River are estimated to have been alive as of 9/05/2016. Of those estimated survivors, none were <5-years old, ~76% (820) were 6- to 10-years old, 17% (183) were 10- to 15-years old, and ~7% (73) were 15- to 20-years old.

Estimates of surviving proportions and numbers for summer yearlings released in RPMA 2 in the Yellowstone River

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 486	SUM	09/05/16	233.9	19.5	0.03	0.01	13	8	to	18
2: 299	SUM	09/05/16	207.4	17.3	0.03	0.01	10	6	to	13
3: 1,752	SUM	09/05/16	185.0	15.4	0.03	0.01	50	30	to	69
4: 1,929	SUM	09/05/16	172.8	14.4	0.04	0.01	81	54	to	109
5: 676	SUM	09/05/16	159.5	13.3	0.09	0.01	58	40	to	76
6: 174	SUM	09/05/16	147.2	12.3	0.00	0.00	0	0	to	0
7: 457	SUM	09/05/16	137.4	11.5	0.10	0.01	44	33	to	55
8: 2,569	SUM	09/05/16	112.8	9.4	0.12	0.01	309	246	to	373
9: 1,781	SUM	09/05/16	100.6	8.4	0.14	0.01	245	196	to	294
10: 1,077	SUM	09/05/16	86.8	7.2	0.16	0.02	177	140	to	214
11: 437	SUM	09/05/16	74.5	6.2	0.20	0.02	89	70	to	109

Summary information for summer yearlings released in RPMA 2 in the Missouri & Yellowstone Rivers.

Based on the most recent estimates of the proportion surviving and the number surviving from all cohorts released as summer yearlings in RPMA 2 in either the Missouri or the Yellowstone River, ~3,073 fish of different ages were estimated to have been alive at the time of the most recent survey used here (09/05/16). Of those fish, none were <6 years old, ~66% (2,039) were ~6- to ~10-years old, ~26% (796) were 10- to 15-years old, and ~8% (238) were 15- to 20-years old.

Release cohort	Number Released	Type	Date	Age in months	Age in years	N Alive	(95% CI for N Alive)		
1	781	SUM	09/05/16	233.9	19.5	35	22	<i>to</i>	49
2	478	SUM	09/05/16	207.4	17.3	26	16	<i>to</i>	34
3	3,024	SUM	09/05/16	185.0	15.4	177	113	<i>to</i>	239
4	3,990	SUM	09/05/16	172.8	14.4	298	200	<i>to</i>	397
5	1,572	SUM	09/05/16	159.5	13.3	246	171	<i>to</i>	320
6	174	SUM	09/05/16	147.2	12.3	0	0	<i>to</i>	0
7	1,375	SUM	09/05/16	137.4	11.5	252	188	<i>to</i>	317
8	3,257	SUM	09/05/16	112.8	9.4	490	389	<i>to</i>	593
9	3,781	SUM	09/05/16	100.6	8.4	822	661	<i>to</i>	984
10	1,886	SUM	09/05/16	86.8	7.2	440	354	<i>to</i>	525
11	962	SUM	09/05/16	74.5	6.2	287	233	<i>to</i>	342

Summary of number estimated to have been alive in RPMA 2 as of 05 Sept. 2016

Release cohort	Number Released	Type	Date	Age in months	Age in years	N Alive	(95% CI for N Alive)		
1	781	SUM	09/05/16	233.9	19.5	35	22	to	49
2	478	SUM	09/05/16	207.4	17.3	26	16	to	34
3	3,024	SUM	09/05/16	185.0	15.4	177	113	to	239
4	3,990	SUM	09/05/16	172.8	14.4	298	200	to	397
1	821	SPR	09/05/16	160.5	13.4	31	12	to	49
5	1,572	SUM	09/05/16	159.5	13.3	246	171	to	320
1	16,811	FNG	09/05/16	148.3	12.4	2	0	to	7
2	867	SPR	09/05/16	147.8	12.3	29	13	to	45
6	174	SUM	09/05/16	147.2	12.3	0	0	to	0
7	1,375	SUM	09/05/16	137.4	11.5	252	188	to	317
2	12,484	FNG	09/05/16	136.0	11.3	437	230	to	645
3	6,589	SPR	09/05/16	135.6	11.3	99	39	to	158
3	6,918	FNG	09/05/16	123.7	10.3	425	268	to	583
4	3,888	SPR	09/05/16	123.4	10.3	183	111	to	256
8	3,257	SUM	09/05/16	112.8	9.4	490	389	to	593
4	41,466	FNG	09/05/16	111.7	9.3	2,111	1,417	to	2,806
5	8,097	SPR	09/05/16	111.2	9.3	219	121	to	317
9	3,781	SUM	09/05/16	100.6	8.4	822	661	to	984
5	58,822	FNG	09/05/16	99.7	8.3	2,254	1,510	to	2,998
6	4,997	SPR	09/05/16	98.8	8.2	164	104	to	225
6	40,988	FNG	09/05/16	87.6	7.3	2,930	2,160	to	3,700
7	10,356	SPR	09/05/16	86.8	7.2	1,210	909	to	1,513
10	1,886	SUM	09/05/16	86.8	7.2	440	354	to	525
7	3,998	FNG	09/05/16	75.7	6.3	358	272	to	444
11	962	SUM	09/05/16	74.5	6.2	287	233	to	342
8	3,177	SPR	09/05/16	74.4	6.2	526	410	to	642
9	748	SPR	09/05/16	50.2	4.2	263	218	to	307
10	847	SPR	09/05/16	37.7	3.1	409	354	to	464
11	630	SPR	09/05/16	25.7	2.1	406	370	to	442
12	1,465	SPR	09/05/16	13.3	1.1	1,315	1,273	to	1,358

**The Release cohort is the release cohort for the specific type of release, i.e., for fingerlings, spring yearlings, or summer yearlings.*

When summarized by age class, the estimates indicate that 16,444 of the 245,249 fish that were released from hatcheries from 1998 through May of 2016 in RPMA 2 were still alive there in September of 2016. Of those fish, ~15% (2,393) were 1- to 5-years old, ~72% (11,811) were 5- to 10-years old, ~12% (2,002) were 10- to 15-years old, and ~1% (238) were 15- to 20-years old.

Summary information for RPMA 2 organized with age classes in ascending order

RPMA	Date	Age in years	N Alive	(Sum of 95% CI elements for N Alive)			<i>ppn of total</i>
2	09/05/16	1 to 5	2,393	2,215	<i>to</i>	2,571	0.15
2	09/05/16	5 to 10	11,811	8,540	<i>to</i>	15,089	0.72
2	09/05/16	10 to 15	2,002	1,232	<i>to</i>	2,777	0.12
2	09/05/16	15 to 20	238	151	<i>to</i>	322	0.01

RPMA 3

For RPMA 3, the top model of the mark-recapture data included the following covariates of survival: release type (categorized as spring yearlings, summer yearlings, or fish aged 2 or 3 years of age at time of release), age of fish, the proportion of the survival period that was in winter versus summer, and interactions between release type and age of fish. The top model's structure remained the same as the best-supported structure in Rotella (2015) for survival and capture probability.

For RPMA 3, neither diseases status nor river of release covariates were included in the model used to estimate survival rates. Thus, results are simply provided for each release cohort from time of release to the most recent date used in these analyses. The results below are for the release of 4,717 spring yearlings, 3,241 summer yearlings, 103 2-year-olds, and 651 3-year-olds (total = 8,712 fish).

Dates and numbers for releases and recapture work on RPMA 3.

				Release Numbers for Each Fish Type									
Occ	Begin	End	Midpoint	Spring		Summer		TwoYr		ThreeYr			
1	06/06/00	09/20/00	07/29/00					1	103	1	461		
2	04/21/02	04/27/02	04/24/02	1	563					2	190		
3	04/10/03	05/07/03	04/23/03										
4	07/26/03	07/26/03	07/26/03			1	606						
5	08/14/03	11/18/03	10/01/03										
6	04/15/04	05/19/04	05/02/04										
7	10/06/04	11/01/04	10/19/04			2	511						
8	03/13/05	05/26/05	04/19/05										
9	08/30/05	11/08/05	10/04/05			3	865						
10	03/30/06	05/17/06	04/23/06										
11	08/25/06	11/14/06	10/04/06			4	1,004						
12	04/01/07	05/09/07	04/20/07	2	601								
13	08/15/07	11/01/07	09/23/07										
14	04/08/08	05/15/08	04/26/08	3	1,171								
15	08/26/08	11/04/08	09/30/08										
16	04/08/09	05/29/09	05/03/09	4	626								
17	08/03/09	08/19/09	08/11/09										
18	04/11/10	06/15/10	05/13/10	5	840								
19	08/02/10	08/22/10	08/12/10										
20	04/14/11	05/19/11	05/11/11	6	595								
21	03/26/12	05/31/12	04/28/12										
22	07/10/12	08/09/12	07/25/12	7	81								
23	04/01/13	06/20/13	05/11/13			5	82						
24	08/26/13	09/11/13	09/03/13										
25	05/14/14	06/11/14	05/28/14			6	173						
26	08/12/14	10/15/14	09/13/14										
27	04/20/15	06/17/15	05/19/15	8	120								
28	04/12/16	05/26/16	05/04/16	9	120								
29	07/11/16	08/01/16	07/21/16										
Totals					4,717		3,241		103		651		8,712

Results for releases of Spring Yearlings in RPMA 3

Data on the number of spring yearlings released on each occasion ($R(i)$, represented by row) along with information on when they were 1st subsequently recaptured (occasion j , represented as columns, where $j = 2:29$) is provided in the table below. At the time of the analyses presented here, 4,960 releases and re-releases and 249 recaptures of fish originally released as spring yearlings had occurred. The results presented below are based on the analyses of those data.

Occ	R(i)	j=2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Sum
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	563	0	0	2	1	0	0	1	2	1	2	2	4	2	7	0	10	0	2	7	0	5	0	1	0	1	1	1	1	52
3	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	2				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	1					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	1								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	2									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	1										0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	
12	603											8	1	0	2	3	6	2	4	5	3	4	3	4	0	4	4	1	54	
13	10												0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
14	1176													4	4	3	8	0	8	2	5	0	4	4	0	2	3	0	47	
15	7														4	0	0	0	1	0	0	0	0	0	0	0	0	0	1	
16	640															0	0	0	0	1	0	0	0	0	0	0	0	0	28	
17	9																3	5	0	3	1	0	1	1	2	0	4	8	0	
18	870																	0	0	0	0	0	1	0	0	0	0	0	1	
19	2																		0	0	0	0	1	6	3	2	4	1	39	
20	617																		0	4	1	0	0	0	0	0	0	0	0	
21	16																			0	0	0	0	0	0	0	0	0	0	
22	98																				0	3	2	0	7	0	0	2	0	
23	17																					0	1	0	0	0	0	0	1	
24	10																						0	0	0	0	0	0	2	
25	24																							0	2	0	0	0	0	
26	1																								0	0	0	0	0	
27	135																									0	1	0	1	
28	155																										0	0	1	
TOTALS	4960	0	0	0	2	1	0	0	1	2	1	2	10	5	7	14	9	30	2	22	16	17	17	10	24	1	15	35	6	249

Estimates of survival for the 1st release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3. *The estimates presented here indicate that survival is modest in the 1st year in the river and then that survival is 1.0 thereafter.*

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
04/24/02	04/23/03	12.1	9.5	21.6	0.891	(0.011)	0.25	(0.04)	(0.17	to	0.32)
04/23/03	07/26/03	3.1	21.6	24.8	0.999	(0.001)	0.25	(0.04)	(0.17	to	0.32)
07/26/03	10/01/03	2.2	24.8	27.0	1.000	(0.000)	0.25	(0.04)	(0.17	to	0.32)
10/01/03	05/02/04	7.1	27.0	34.1	0.992	(0.009)	0.23	(0.03)	(0.17	to	0.30)
05/02/04	10/19/04	5.7	34.1	39.8	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
10/19/04	04/19/05	6.1	39.8	45.9	1.000	(0.001)	0.23	(0.03)	(0.17	to	0.30)
04/19/05	10/04/05	5.6	45.9	51.5	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
10/04/05	04/23/06	6.7	51.5	58.2	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
04/23/06	10/04/06	5.5	58.2	63.6	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
10/04/06	04/20/07	6.6	63.6	70.2	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
04/20/07	09/23/07	5.2	70.2	75.4	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
09/23/07	04/26/08	7.2	75.4	82.6	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
04/26/08	09/30/08	5.2	82.6	87.9	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
09/30/08	05/03/09	7.2	87.9	95.0	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/03/09	08/11/09	3.3	95.0	98.4	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
08/11/09	05/13/10	9.2	98.4	107.5	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/13/10	08/12/10	3.0	107.5	110.6	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
08/12/10	05/11/11	9.1	110.6	119.6	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/11/11	04/28/12	11.8	119.6	131.4	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
04/28/12	07/25/12	2.9	131.4	134.3	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
07/25/12	05/11/13	9.7	134.3	144.0	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/11/13	09/03/13	3.8	144.0	147.8	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
09/03/13	05/28/14	8.9	147.8	156.7	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/28/14	09/13/14	3.6	156.7	160.3	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
09/13/14	05/19/15	8.3	160.3	168.6	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/19/15	05/04/16	11.7	168.6	180.3	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)
05/04/16	07/21/16	2.6	180.3	182.9	1.000	(0.000)	0.23	(0.03)	(0.17	to	0.30)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate. Note: for spring yearlings in RPMA 3, survival rates were estimated to be ~1.0 for all intervals after the initial year post-release. Thus, estimates are only reported for approximate 1-year intervals for the first year post-release in the table below.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.01	12.1	0.25	0.04	Spring	3

Estimates of survival for the 1st release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	95% CI for N at Interval End		
1	SPR	04/24/02	04/23/03	9.5	21.6	0.25	0.04	140	97	to	182
1	SPR	04/23/03	07/26/03	21.6	24.8	0.25	0.04	139	97	to	181
1	SPR	07/26/03	10/01/03	24.8	27.0	0.25	0.04	139	97	to	181
1	SPR	10/01/03	05/02/04	27.0	34.1	0.23	0.03	131	96	to	167
1	SPR	05/02/04	10/19/04	34.1	39.8	0.23	0.03	131	96	to	167
1	SPR	10/19/04	04/19/05	39.8	45.9	0.23	0.03	131	96	to	166
1	SPR	04/19/05	10/04/05	45.9	51.5	0.23	0.03	131	96	to	166
1	SPR	10/04/05	04/23/06	51.5	58.2	0.23	0.03	131	96	to	166
1	SPR	04/23/06	10/04/06	58.2	63.6	0.23	0.03	131	96	to	166
1	SPR	10/04/06	04/20/07	63.6	70.2	0.23	0.03	131	96	to	166
1	SPR	04/20/07	09/23/07	70.2	75.4	0.23	0.03	131	96	to	166
1	SPR	09/23/07	04/26/08	75.4	82.6	0.23	0.03	131	96	to	166
1	SPR	04/26/08	09/30/08	82.6	87.9	0.23	0.03	131	96	to	166
1	SPR	09/30/08	05/03/09	87.9	95.0	0.23	0.03	131	96	to	166
1	SPR	05/03/09	08/11/09	95.0	98.4	0.23	0.03	131	96	to	166
1	SPR	08/11/09	05/13/10	98.4	107.5	0.23	0.03	131	96	to	166
1	SPR	05/13/10	08/12/10	107.5	110.6	0.23	0.03	131	96	to	166
1	SPR	08/12/10	05/11/11	110.6	119.6	0.23	0.03	131	96	to	166
1	SPR	05/11/11	04/28/12	119.6	131.4	0.23	0.03	131	96	to	166
1	SPR	04/28/12	07/25/12	131.4	134.3	0.23	0.03	131	96	to	166
1	SPR	07/25/12	05/11/13	134.3	144	0.23	0.03	131	96	to	166
1	SPR	05/11/13	09/03/13	144.0	147.8	0.23	0.03	131	96	to	166
1	SPR	09/03/13	05/28/14	147.8	156.7	0.23	0.03	131	96	to	166
1	SPR	05/28/14	09/13/14	156.7	160.3	0.23	0.03	131	96	to	166
1	SPR	09/13/14	05/19/15	160.3	168.6	0.23	0.03	131	96	to	166
1	SPR	05/19/15	05/04/16	168.6	180.3	0.23	0.03	131	96	to	166
1	SPR	05/04/16	07/21/16	180.3	182.9	0.23	0.03	131	96	to	166

Estimates of survival for the 2nd release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	SPR	04/20/07	09/23/07	9.5	14.7	0.94	0.04	567	523	to	601
2	SPR	09/23/07	04/26/08	14.7	21.9	0.30	0.04	179	128	to	229
2	SPR	04/26/08	09/30/08	21.9	27.1	0.30	0.04	178	128	to	228
2	SPR	09/30/08	05/03/09	27.1	34.3	0.28	0.04	168	117	to	220
2	SPR	05/03/09	08/11/09	34.3	37.6	0.28	0.04	168	117	to	220
2	SPR	08/11/09	05/13/10	37.6	46.8	0.28	0.04	168	116	to	220
2	SPR	05/13/10	08/12/10	46.8	49.8	0.28	0.04	168	116	to	220
2	SPR	08/12/10	05/11/11	49.8	58.9	0.28	0.04	168	116	to	220
2	SPR	05/11/11	04/28/12	58.9	70.7	0.28	0.04	168	116	to	220
2	SPR	04/28/12	07/25/12	70.7	73.6	0.28	0.04	168	116	to	220
2	SPR	07/25/12	05/11/13	73.6	83.3	0.28	0.04	168	116	to	220
2	SPR	05/11/13	09/03/13	83.3	87.1	0.28	0.04	168	116	to	220
2	SPR	09/03/13	05/28/14	87.1	96	0.28	0.04	168	116	to	220
2	SPR	05/28/14	09/13/14	96	99.6	0.28	0.04	168	116	to	220
2	SPR	09/13/14	05/19/15	99.6	107.9	0.28	0.04	168	116	to	220
2	SPR	05/19/15	05/04/16	107.9	119.6	0.28	0.04	168	116	to	220
2	SPR	05/04/16	07/21/16	119.6	122.2	0.28	0.04	168	116	to	220

Estimates of survival for the 3rd release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	SPR	04/26/08	09/30/08	9.5	14.7	0.94	0.04	1,104	1,018	to	1,171
3	SPR	09/30/08	05/03/09	14.7	21.9	0.30	0.04	352	254	to	450
3	SPR	05/03/09	08/11/09	21.9	25.2	0.30	0.04	352	254	to	449
3	SPR	08/11/09	05/13/10	25.2	34.4	0.29	0.04	335	236	to	434
3	SPR	05/13/10	08/12/10	34.4	37.4	0.29	0.04	335	236	to	434
3	SPR	08/12/10	05/11/11	37.4	46.5	0.29	0.04	334	234	to	434
3	SPR	05/11/11	04/28/12	46.5	58.3	0.29	0.04	334	234	to	434
3	SPR	04/28/12	07/25/12	58.3	61.2	0.29	0.04	334	234	to	434
3	SPR	07/25/12	05/11/13	61.2	70.9	0.29	0.04	334	234	to	434
3	SPR	05/11/13	09/03/13	70.9	74.7	0.29	0.04	334	234	to	434
3	SPR	09/03/13	05/28/14	74.7	83.6	0.29	0.04	334	234	to	434
3	SPR	05/28/14	09/13/14	83.6	87.2	0.29	0.04	334	234	to	434
3	SPR	09/13/14	05/19/15	87.2	95.5	0.29	0.04	334	234	to	434
3	SPR	05/19/15	05/04/16	95.5	107.2	0.29	0.04	334	234	to	434
3	SPR	05/04/16	07/21/16	107.2	109.8	0.29	0.04	334	234	to	434

Estimates of survival for the 4th release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SPR	05/03/09	08/11/09	9.5	12.8	0.96	0.02	603	573	to	626
4	SPR	08/11/09	05/13/10	12.8	22	0.35	0.03	216	175	to	257
4	SPR	05/13/10	08/12/10	22	25	0.34	0.03	216	174	to	257
4	SPR	08/12/10	05/11/11	25	34.1	0.33	0.04	205	150	to	260
4	SPR	05/11/11	04/28/12	34.1	45.9	0.33	0.05	204	148	to	261
4	SPR	04/28/12	07/25/12	45.9	48.8	0.33	0.05	204	148	to	261
4	SPR	07/25/12	05/11/13	48.8	58.5	0.33	0.05	204	148	to	261
4	SPR	05/11/13	09/03/13	58.5	62.3	0.33	0.05	204	148	to	261
4	SPR	09/03/13	05/28/14	62.3	71.2	0.33	0.05	204	148	to	261
4	SPR	05/28/14	09/13/14	71.2	74.8	0.33	0.05	204	148	to	261
4	SPR	09/13/14	05/19/15	74.8	83.1	0.33	0.05	204	148	to	261
4	SPR	05/19/15	05/04/16	83.1	94.8	0.33	0.05	204	148	to	261
4	SPR	05/04/16	07/21/16	94.8	97.4	0.33	0.05	204	148	to	261

Estimates of survival for the 5th release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	SPR	05/13/10	08/12/10	9.5	12.5	0.97	0.02	812	775	to	840
5	SPR	08/12/10	05/11/11	12.5	21.6	0.32	0.03	273	223	to	323
5	SPR	05/11/11	04/28/12	21.6	33.4	0.30	0.04	253	187	to	319
5	SPR	04/28/12	07/25/12	33.4	36.3	0.30	0.04	253	187	to	319
5	SPR	07/25/12	05/11/13	36.3	46	0.30	0.04	252	185	to	320
5	SPR	05/11/13	09/03/13	46	49.8	0.30	0.04	252	185	to	320
5	SPR	09/03/13	05/28/14	49.8	58.7	0.30	0.04	252	185	to	320
5	SPR	05/28/14	09/13/14	58.7	62.3	0.30	0.04	252	185	to	320
5	SPR	09/13/14	05/19/15	62.3	70.6	0.30	0.04	252	185	to	320
5	SPR	05/19/15	05/04/16	70.6	82.3	0.30	0.04	252	185	to	320
5	SPR	05/04/16	07/21/16	82.3	84.9	0.30	0.04	252	185	to	320

Estimates of survival for the 6th release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	SPR	05/11/11	04/28/12	9.5	21.3	0.23	0.04	136	88	to	183
6	SPR	04/28/12	07/25/12	21.3	24.2	0.23	0.04	135	89	to	182
6	SPR	07/25/12	05/11/13	24.2	33.9	0.22	0.03	128	90	to	166
6	SPR	05/11/13	09/03/13	33.9	37.7	0.22	0.03	128	90	to	166
6	SPR	09/03/13	05/28/14	37.7	46.6	0.21	0.03	128	90	to	165
6	SPR	05/28/14	09/13/14	46.6	50.2	0.21	0.03	128	90	to	165
6	SPR	09/13/14	05/19/15	50.2	58.5	0.21	0.03	128	91	to	165
6	SPR	05/19/15	05/04/16	58.5	70.2	0.21	0.03	128	91	to	165
6	SPR	05/04/16	07/21/16	70.2	72.8	0.21	0.03	128	91	to	165

Estimates of survival for the 7th release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
7	SPR	07/25/12	05/11/13	9.5	19.2	0.14	0.06	11	2	to	21
7	SPR	05/11/13	09/03/13	19.2	23	0.14	0.06	11	2	to	21
7	SPR	09/03/13	05/28/14	23	31.9	0.13	0.04	10	3	to	17
7	SPR	05/28/14	09/13/14	31.9	35.5	0.13	0.04	10	3	to	17
7	SPR	09/13/14	05/19/15	35.5	43.8	0.13	0.04	10	3	to	17
7	SPR	05/19/15	05/04/16	43.8	55.5	0.13	0.04	10	3	to	17
7	SPR	05/04/16	07/21/16	55.5	58.1	0.13	0.04	10	3	to	17

Estimates of survival for the 8th release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
8	SPR	05/19/15	05/04/16	9.5	21.2	0.23	0.04	28	18	to	37
8	SPR	05/04/16	07/21/16	21.2	23.8	0.23	0.04	28	18	to	37

Estimates of survival for the 8th release cohort of spring yearlings (~9.6 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
9	SPR	05/04/20	07/21/16	9.5	12.1	0.97	0.02	117	112	to	120

Summary information for Spring Yearlings released in RPMA 3

When the most recent estimates of the proportion surviving and the number surviving from each release cohort released prior to the end of the data collection period used in these analyses are assembled, one can review how many fish released as spring yearlings were estimated to have been alive at the time the last data were collected for the analyses presented here. The point estimates indicate that 1,372 of these fish were still alive in RPMA 3 as of July 21, 2016. Of those, ~11% (~155) were \leq 5 years old, ~67% (~918) were between 5 and 10 years old, and the remaining ~22% (~299) were more than 10 years old.

Estimates of surviving proportions and numbers for spring yearling releases in RPMA 3

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 563	SPR	07/21/16	182.9	15.2	0.23	0.03	131	96	to	166
2: 601	SPR	07/21/16	122.2	10.2	0.28	0.04	168	116	to	220
3: 1,171	SPR	07/21/16	109.8	9.2	0.29	0.04	334	234	to	434
4: 626	SPR	07/21/16	97.4	8.1	0.33	0.05	204	148	to	261
5: 840	SPR	07/21/16	84.9	7.1	0.30	0.04	252	185	to	320
6: 595	SPR	07/21/16	72.8	6.1	0.21	0.03	128	91	to	165
7: 81	SPR	07/21/16	58.1	4.8	0.13	0.04	10	3	to	17
8: 120	SPR	07/21/16	23.8	2.0	0.23	0.04	28	18	to	37
9: 120	SPR	07/21/16	12.1	1.0	0.97	0.02	117	112	to	120

Results for releases of Summer Yearlings in RPMA 3

Data on the number of summer yearlings released on each occasion ($R(i)$, represented by row) along with information on when they were 1st subsequently recaptured (occasion j , represented as columns, where $j = 2:29$) is provided in the table below. At the time of the analyses presented here, 3,633 releases and re-releases of fish originally released as summer yearlings had been conducted, which resulted in 396 recaptures. The results presented below are based on the analyses of the data collected on those released and recaptured fish.

Occ	R(i)	j=2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Sum
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	606				1	1	3	1	4	3	3	7	3	4	11	9	0	8	0	9	4	1	13	2	5	0	2	1	1	96
5	1				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	514						0	5	0	1	8	3	7	5	9	0	6	0	5	0	0	3	1	3	0	2	1	0	59	
8	1							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	874								3	1	1	8	4	4	19	2	15	1	5	4	1	9	3	7	1	4	3	2	97	
10	6									0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
11	1,009										0	5	6	5	9	3	18	5	9	6	2	11	4	2	1	1	0	0	87	
12	16											0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3	
13	19												1	2	0	0	2	0	0	1	0	0	0	0	0	0	0	1	0	7
14	22														1	2	0	1	0	1	0	0	1	0	1	0	1	0	0	8
15	28															1	0	4	0	0	1	1	1	0	1	0	0	0	0	9
16	50																1	7	0	2	1	1	1	0	0	0	0	0	0	13
17	6																	0	0	0	0	0	0	0	0	0	0	0	0	0
18	63																		0	2	0	0	2	2	0	0	0	0	0	6
19	6																				1	0	0	0	0	0	0	0	0	1
20	34																					1	0	0	1	0	0	0	0	2
21	18																						0	0	0	0	0	0	0	0
22	6																							0	0	0	0	0	0	1
23	125																							1	0	0	0	0	0	0
24	13																								0	3	1	0	1	6
25	195																									0	0	0	0	0
26	3																										0	0	0	0
27	10																											0	0	0
28	7																												0	0
TOTALS	3633	0	0	0	1	1	3	1	9	6	5	16	19	22	28	50	6	63	6	34	18	6	43	13	22	3	10	7	4	396

Estimates of survival for the 1st release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Start Date	End Date	Months	Age at int. start (mos.)	Age at in: end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
07/26/03	10/01/03	2.2	14.2	16.5	0.999	(0.001)	1.00	(0.00)	(0.99	to	1.00)
10/01/03	05/02/04	7.1	16.5	23.6	0.948	(0.012)	0.68	(0.06)	(0.56	to	0.81)
05/02/04	10/19/04	5.7	23.6	29.3	0.999	(0.001)	0.68	(0.06)	(0.56	to	0.80)
10/19/04	04/19/05	6.1	29.3	35.3	0.955	(0.005)	0.51	(0.06)	(0.40	to	0.63)
04/19/05	10/04/05	5.6	35.3	40.9	0.999	(0.001)	0.51	(0.06)	(0.40	to	0.62)
10/04/05	04/23/06	6.7	40.9	47.6	0.968	(0.005)	0.41	(0.04)	(0.33	to	0.50)
04/23/06	10/04/06	5.5	47.6	53.1	1.000	(0.001)	0.41	(0.04)	(0.33	to	0.49)
10/04/06	04/20/07	6.6	53.1	59.7	0.976	(0.008)	0.35	(0.03)	(0.29	to	0.41)
04/20/07	09/23/07	5.2	59.7	64.9	1.000	(0.000)	0.35	(0.03)	(0.29	to	0.41)
09/23/07	04/26/08	7.2	64.9	72.1	0.986	(0.007)	0.32	(0.03)	(0.25	to	0.38)
04/26/08	09/30/08	5.2	72.1	77.3	1.000	(0.000)	0.32	(0.03)	(0.25	to	0.38)
09/30/08	05/03/09	7.2	77.3	84.5	0.990	(0.007)	0.29	(0.04)	(0.21	to	0.37)
05/03/09	08/11/09	3.3	84.5	87.8	1.000	(0.000)	0.29	(0.04)	(0.21	to	0.37)
08/11/09	05/13/10	9.2	87.8	97.0	0.997	(0.003)	0.29	(0.05)	(0.19	to	0.38)
05/13/10	08/12/10	3.0	97.0	100.0	1.000	(0.000)	0.29	(0.05)	(0.19	to	0.38)
08/12/10	05/11/11	9.1	100.0	109.1	0.998	(0.003)	0.28	(0.05)	(0.18	to	0.38)
05/11/11	04/28/12	11.8	109.1	120.9	0.999	(0.001)	0.28	(0.05)	(0.17	to	0.38)
04/28/12	07/25/12	2.9	120.9	123.8	1.000	(0.000)	0.28	(0.06)	(0.17	to	0.38)
07/25/12	05/11/13	9.7	123.8	133.5	0.999	(0.002)	0.27	(0.06)	(0.16	to	0.39)
05/11/13	09/03/13	3.8	133.5	137.3	1.000	(0.000)	0.27	(0.06)	(0.16	to	0.39)
09/03/13	05/28/14	8.9	137.3	146.2	0.999	(0.002)	0.27	(0.06)	(0.15	to	0.39)
05/28/14	09/13/14	3.6	146.2	149.8	1.000	(0.000)	0.27	(0.06)	(0.15	to	0.39)
09/13/14	05/19/15	8.3	149.8	158.1	0.999	(0.002)	0.27	(0.06)	(0.14	to	0.40)
05/19/15	05/04/16	11.7	158.1	169.8	1.000	(0.001)	0.27	(0.07)	(0.14	to	0.40)
05/04/16	07/21/16	2.6	169.8	172.4	1.000	(0.000)	0.27	(0.07)	(0.14	to	0.40)

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
0.78	9.4	0.68	0.06	Summer	3
1.76	21.1	0.75	0.20	Summer	3
2.78	33.4	0.80	0.19	Summer	3
3.79	45.5	0.85	0.15	Summer	3
4.83	57.9	0.91	0.14	Summer	3
6.13	73.6	0.91	0.18	Summer	3
6.90	82.8	1.00	0.22	Summer	3
7.91	94.9	0.97	0.26	Summer	3
9.13	109.6	1.00	0.28	Summer	3
10.26	123.1	0.96	0.32	Summer	3
11.30	135.6	1.00	0.31	Summer	3
11.99	143.9	1.00	0.31	Summer	3

Estimates of survival for the 1st release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	SUM	07/26/03	10/01/03	14.2	16.5	1.00	0.00	605	602	to	606
1	SUM	10/01/03	05/02/04	16.5	23.6	0.68	0.06	414	341	to	488
1	SUM	05/02/04	10/19/04	23.6	29.3	0.68	0.06	411	339	to	484
1	SUM	10/19/04	04/19/05	29.3	35.3	0.51	0.06	312	243	to	381
1	SUM	04/19/05	10/04/05	35.3	40.9	0.51	0.06	311	243	to	379
1	SUM	10/04/05	04/23/06	40.9	47.6	0.41	0.04	251	201	to	300
1	SUM	04/23/06	10/04/06	47.6	53.1	0.41	0.04	250	201	to	299
1	SUM	10/04/06	04/20/07	53.1	59.7	0.35	0.03	213	175	to	250
1	SUM	04/20/07	09/23/07	59.7	64.9	0.35	0.03	212	175	to	250
1	SUM	09/23/07	04/26/08	64.9	72.1	0.32	0.03	192	153	to	231
1	SUM	04/26/08	09/30/08	72.1	77.3	0.32	0.03	192	152	to	231
1	SUM	09/30/08	05/03/09	77.3	84.5	0.29	0.04	178	130	to	227
1	SUM	05/03/09	08/11/09	84.5	87.8	0.29	0.04	178	129	to	227
1	SUM	08/11/09	05/13/10	87.8	97.0	0.29	0.05	173	118	to	228
1	SUM	05/13/10	08/12/10	97.0	100.0	0.29	0.05	173	117	to	228
1	SUM	08/12/10	05/11/11	100.0	109.1	0.28	0.05	169	108	to	231
1	SUM	05/11/11	04/28/12	109.1	120.9	0.28	0.05	167	102	to	233
1	SUM	04/28/12	07/25/12	120.9	123.8	0.28	0.06	167	102	to	233
1	SUM	07/25/12	05/11/13	123.8	133.5	0.27	0.06	166	96	to	235
1	SUM	05/11/13	09/03/13	133.5	137.3	0.27	0.06	166	96	to	235
1	SUM	09/03/13	05/28/14	137.3	146.2	0.27	0.06	164	91	to	237
1	SUM	05/28/14	09/13/14	146.2	149.8	0.27	0.06	164	91	to	237
1	SUM	09/13/14	05/19/15	149.8	158.1	0.27	0.06	163	86	to	240
1	SUM	05/19/15	05/04/16	158.1	169.8	0.27	0.07	163	84	to	241
1	SUM	05/04/16	07/21/16	169.8	172.4	0.27	0.07	163	84	to	241

Estimates of survival for the 2nd release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	SUM	10/19/04	04/19/05	14.2	20.3	0.66	0.08	339	258	<i>to</i>	421
2	SUM	04/19/05	10/04/05	20.3	25.9	0.66	0.08	338	258	<i>to</i>	417
2	SUM	10/04/05	04/23/06	25.9	32.6	0.48	0.08	245	168	<i>to</i>	323
2	SUM	04/23/06	10/04/06	32.6	38.1	0.48	0.08	245	169	<i>to</i>	320
2	SUM	10/04/06	04/20/07	38.1	44.7	0.38	0.06	192	135	<i>to</i>	250
2	SUM	04/20/07	09/23/07	44.7	49.9	0.38	0.06	192	135	<i>to</i>	249
2	SUM	09/23/07	04/26/08	49.9	57.1	0.32	0.04	165	124	<i>to</i>	206
2	SUM	04/26/08	09/30/08	57.1	62.3	0.32	0.04	165	124	<i>to</i>	205
2	SUM	09/30/08	05/03/09	62.3	69.5	0.29	0.03	148	116	<i>to</i>	179
2	SUM	05/03/09	08/11/09	69.5	72.8	0.29	0.03	148	116	<i>to</i>	179
2	SUM	08/11/09	05/13/10	72.8	82.0	0.28	0.03	141	111	<i>to</i>	171
2	SUM	05/13/10	08/12/10	82.0	85.0	0.28	0.03	141	111	<i>to</i>	171
2	SUM	08/12/10	05/11/11	85.0	94.1	0.27	0.03	137	105	<i>to</i>	169
2	SUM	05/11/11	04/28/12	94.1	105.8	0.26	0.03	135	101	<i>to</i>	168
2	SUM	04/28/12	07/25/12	105.8	108.8	0.26	0.03	134	101	<i>to</i>	168
2	SUM	07/25/12	05/11/13	108.8	118.4	0.26	0.04	132	96	<i>to</i>	169
2	SUM	05/11/13	09/03/13	118.4	122.3	0.26	0.04	132	96	<i>to</i>	169
2	SUM	09/03/13	05/28/14	122.3	131.2	0.26	0.04	131	91	<i>to</i>	170
2	SUM	05/28/14	09/13/14	131.2	134.8	0.26	0.04	131	91	<i>to</i>	170
2	SUM	09/13/14	05/19/15	134.8	143.0	0.25	0.04	129	87	<i>to</i>	172
2	SUM	05/19/15	05/04/16	143.0	154.7	0.25	0.04	129	85	<i>to</i>	173
2	SUM	05/04/16	07/21/16	154.7	157.3	0.25	0.04	129	85	<i>to</i>	173

Estimates of survival for the 3rd release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
3	SUM	10/04/05	04/23/06	14.2	20.9	0.65	0.08	562	423	to	700
3	SUM	04/23/06	10/04/06	20.9	26.4	0.65	0.08	559	423	to	695
3	SUM	10/04/06	04/20/07	26.4	33.0	0.47	0.08	404	273	to	535
3	SUM	04/20/07	09/23/07	33.0	38.2	0.47	0.08	403	274	to	532
3	SUM	09/23/07	04/26/08	38.2	45.4	0.38	0.06	328	231	to	425
3	SUM	04/26/08	09/30/08	45.4	50.6	0.38	0.06	327	231	to	423
3	SUM	09/30/08	05/03/09	50.6	57.8	0.33	0.04	282	214	to	350
3	SUM	05/03/09	08/11/09	57.8	61.1	0.33	0.04	282	214	to	350
3	SUM	08/11/09	05/13/10	61.1	70.3	0.31	0.03	265	208	to	322
3	SUM	05/13/10	08/12/10	70.3	73.3	0.31	0.03	265	208	to	321
3	SUM	08/12/10	05/11/11	73.3	82.4	0.29	0.03	253	201	to	306
3	SUM	05/11/11	04/28/12	82.4	94.2	0.29	0.03	248	194	to	302
3	SUM	04/28/12	07/25/12	94.2	97.1	0.29	0.03	248	194	to	302
3	SUM	07/25/12	05/11/13	97.1	106.8	0.28	0.03	243	186	to	300
3	SUM	05/11/13	09/03/13	106.8	110.6	0.28	0.03	243	185	to	300
3	SUM	09/03/13	05/28/14	110.6	119.5	0.28	0.04	239	176	to	301
3	SUM	05/28/14	09/13/14	119.5	123.1	0.28	0.04	239	176	to	301
3	SUM	09/13/14	05/19/15	123.1	131.4	0.27	0.04	235	167	to	303
3	SUM	05/19/15	05/04/16	131.4	143.1	0.27	0.04	234	163	to	304
3	SUM	05/04/16	07/21/16	143.1	145.7	0.27	0.04	234	163	to	304

Estimates of survival for the 4th release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
4	SUM	10/04/06	04/20/07	14.2	20.8	0.64	0.09	643	475	to	811
4	SUM	04/20/07	09/23/07	20.8	26	0.64	0.08	640	476	to	805
4	SUM	09/23/07	04/26/08	26	33.2	0.48	0.08	482	332	to	632
4	SUM	04/26/08	09/30/08	33.2	38.5	0.48	0.08	481	333	to	629
4	SUM	09/30/08	05/03/09	38.5	45.6	0.39	0.06	392	281	to	503
4	SUM	05/03/09	08/11/09	45.6	49	0.39	0.06	392	281	to	502
4	SUM	08/11/09	05/13/10	49	58.1	0.36	0.04	360	272	to	447
4	SUM	05/13/10	08/12/10	58.1	61.2	0.36	0.04	359	272	to	447
4	SUM	08/12/10	05/11/11	61.2	70.2	0.34	0.04	338	265	to	412
4	SUM	05/11/11	04/28/12	70.2	82	0.33	0.04	328	257	to	399
4	SUM	04/28/12	07/25/12	82	84.9	0.33	0.04	328	257	to	399
4	SUM	07/25/12	05/11/13	84.9	94.6	0.32	0.04	319	248	to	390
4	SUM	05/11/13	09/03/13	94.6	98.4	0.32	0.04	319	247	to	390
4	SUM	09/03/13	05/28/14	98.4	107.3	0.31	0.04	311	236	to	386
4	SUM	05/28/14	09/13/14	107.3	110.9	0.31	0.04	311	236	to	386
4	SUM	09/13/14	05/19/15	110.9	119.2	0.3	0.04	305	223	to	386
4	SUM	05/19/15	05/04/16	119.2	130.9	0.3	0.04	302	216	to	388
4	SUM	05/04/16	07/21/16	130.9	133.5	0.3	0.04	302	216	to	388

Estimates of survival for the 5th release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
5	SUM	05/11/13	09/03/13	14.2	18.1	1	0	82	81	to	82
5	SUM	09/03/13	05/28/14	18.1	27	0.81	0.04	67	59	to	74
5	SUM	05/28/14	09/13/14	27	30.6	0.81	0.05	66	59	to	74
5	SUM	09/13/14	05/19/15	30.6	38.8	0.68	0.06	56	47	to	65
5	SUM	05/19/15	05/04/16	38.8	50.5	0.64	0.07	52	40	to	64
5	SUM	05/04/16	07/21/16	50.5	53.1	0.63	0.07	52	40	to	64

Estimates of survival for the 6th release cohort of summer yearlings (~14.2 months old at time of release) in RPMA 3.

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
6	SUM	05/28/14	09/13/14	14.2	17.8	1	0	172	171	to	173
6	SUM	09/13/14	05/19/15	17.8	26.1	0.78	0.04	135	121	to	150
6	SUM	05/19/15	05/04/16	26.1	37.8	0.71	0.06	123	101	to	144
6	SUM	05/04/16	07/21/16	37.8	40.4	0.71	0.06	123	101	to	144

Summary information for Summer Yearlings released in RPMA 3

When the most recent estimates of the proportion surviving and the number surviving from each release cohort are assembled, one can review how many fish released as summer yearlings are estimated to have been alive at the time the last data were collected for the analyses presented here. The point estimates indicate that 1,003 of these fish were still alive in RPMA 3 at that time. Of those, ~17% (~175) were \leq 5 years old, none were between 5 and 10 years old, and the remaining ~83% (~828) were more than 10 years old.

Estimates of surviving proportions and numbers for summer yearling releases in RPMA 3

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 606	SUM	07/21/16	172.4	14.4	0.27	0.07	163	84	to	241
2: 511	SUM	07/21/16	157.3	13.1	0.25	0.04	129	85	to	173
3: 865	SUM	07/21/16	145.7	12.1	0.27	0.04	234	163	to	304
4: 1,004	SUM	07/21/16	133.5	11.1	0.30	0.04	302	216	to	388
5: 82	SUM	07/21/16	53.1	4.4	0.63	0.07	52	40	to	64
6: 173	SUM	07/21/16	40.4	3.4	0.71	0.06	123	101	to	144

Results for releases of Two-Year Olds in RPMA 3

Data on the number of two-year-olds released on each occasion ($R(i)$, represented by row) along with information on when they were 1st subsequently recaptured (occasion j , represented as columns, where $j = 2:29$) is provided in the table below. At the time of the analyses presented here, 119 releases and re-releases of fish of this release type had been achieved, which resulted in 16 recaptures. The results presented below are based on the analyses of the data collected on those released and recaptured fish.

Occ	R(i)	j=2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Sum
1	103	0	0	0	1	1	1	0	1	0	0	1	0	0	1	1	0	1	0	1	2	0	0	0	0	0	0	0	0	11
2	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1												0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
13	0													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0														0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1															0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1																1	0	0	0	0	0	0	0	0	0	0	0	0	1
17	1																	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1																		0	1	0	0	0	0	0	0	0	0	0	1
19	0																			0	0	0	0	0	0	0	0	0	0	0
20	1																				0	0	0	0	0	0	0	0	0	1
21	3																					0	1	0	0	0	0	0	0	1
22	0																						0	0	0	0	0	0	0	0
23	3																							0	0	0	0	0	0	0
24	0																								0	0	0	0	0	0
25	0																									0	0	0	0	0
26	0																										0	0	0	0
27	0																											0	0	0
28	0																												0	0
TOTAL	119	0	0	0	1	1	1	0	1	0	0	1	0	0	1	1	1	1	0	1	3	0	3	0	0	0	0	0	0	16

Estimates of survival for the 1st (& only) release cohort of two-year olds (~27.7 months old at time of release) in RPMA 3

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
07/29/00	04/24/02	21.1	27.7	48.9	0.962	(0.010)	0.44	(0.10)	0.25	to	0.64
04/24/02	04/23/03	12.1	48.9	61.0	0.984	(0.005)	0.36	(0.10)	0.17	to	0.56
04/23/03	07/26/03	3.1	61.0	64.1	0.999	(0.001)	0.36	(0.10)	0.17	to	0.55
07/26/03	10/01/03	2.2	64.1	66.4	0.999	(0.001)	0.36	(0.10)	0.17	to	0.55
10/01/03	05/02/04	7.1	66.3	73.5	0.943	(0.010)	0.24	(0.07)	0.11	to	0.36
05/02/04	10/19/04	5.7	73.5	79.2	0.999	(0.001)	0.24	(0.06)	0.11	to	0.36
10/19/04	04/19/05	6.1	79.2	85.2	0.949	(0.010)	0.17	(0.05)	0.08	to	0.26
04/19/05	10/04/05	5.6	85.2	90.8	0.999	(0.001)	0.17	(0.05)	0.08	to	0.26
10/04/05	04/23/06	6.7	90.8	97.5	0.962	(0.007)	0.13	(0.03)	0.07	to	0.20
04/23/06	10/04/06	5.5	97.5	103.0	0.999	(0.001)	0.13	(0.03)	0.07	to	0.20
10/04/06	04/20/07	6.6	103.0	109.6	0.970	(0.007)	0.11	(0.03)	0.06	to	0.16
04/20/07	09/23/07	5.2	109.6	114.8	1.000	(0.000)	0.11	(0.02)	0.06	to	0.16
09/23/07	04/26/08	7.2	114.8	122.0	0.982	(0.005)	0.09	(0.02)	0.05	to	0.13
04/26/08	09/30/08	5.2	122.0	127.2	1.000	(0.000)	0.09	(0.02)	0.05	to	0.13
09/30/08	05/03/09	7.2	127.2	134.4	0.986	(0.005)	0.08	(0.02)	0.05	to	0.12
05/03/09	08/11/09	3.3	134.4	137.7	1.000	(0.000)	0.08	(0.02)	0.05	to	0.12
08/11/09	05/13/10	9.2	137.7	146.9	0.995	(0.003)	0.08	(0.02)	0.05	to	0.11
05/13/10	08/12/10	3.0	146.9	149.9	1.000	(0.000)	0.08	(0.02)	0.05	to	0.11
08/12/10	05/11/11	9.1	149.9	159.0	0.997	(0.002)	0.08	(0.02)	0.05	to	0.11
05/11/11	04/28/12	11.8	159.0	170.8	0.999	(0.001)	0.08	(0.02)	0.05	to	0.11
04/28/12	07/25/12	2.9	170.8	173.7	1.000	(0.000)	0.08	(0.02)	0.05	to	0.11
07/25/12	05/11/13	9.7	173.7	183.4	0.998	(0.001)	0.08	(0.02)	0.05	to	0.11
05/11/13	09/03/13	3.8	183.4	187.2	1.000	(0.000)	0.08	(0.02)	0.05	to	0.11
09/03/13	05/28/14	8.9	187.2	196.1	0.998	(0.001)	0.07	(0.02)	0.04	to	0.10
05/28/14	09/13/14	3.6	196.1	199.7	1.000	(0.000)	0.07	(0.02)	0.04	to	0.10
09/13/14	05/19/15	8.3	199.7	208.0	0.998	(0.001)	0.07	(0.02)	0.04	to	0.10
05/19/15	05/04/16	11.7	208.0	219.7	1.000	(0.001)	0.07	(0.02)	0.04	to	0.10
05/04/16	07/21/16	2.6	219.7	222.3	1.000	(0.000)	0.07	(0.02)	0.04	to	0.10

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. Interval survival rates represent the probability of surviving from one point in time to the next. NOTE 1: The first interval here was 21.2 months and so much longer than a year. This was used as it was the first actual interval; an annual rate is reported in the footnotes of the table. Interval survival rates represent the probability of surviving from one point in time to the next. After last interval reported, estimated annual survival was ~1.0 based on model's predictions and so are not reported. NOTE 2: Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.77	21.2	0.44	0.10	Two-yr	3
3.03	36.4	0.82	0.44	Two-yr	3
3.82	45.8	0.67	0.60	Two-yr	3
4.79	57.5	0.71	0.58	Two-yr	3
5.82	69.8	0.76	0.49	Two-yr	3
6.83	81.9	0.85	0.42	Two-yr	3
7.86	94.3	0.82	0.43	Two-yr	3
8.89	106.7	0.89	0.38	Two-yr	3
9.93	119.2	1.00	0.35	Two-yr	3
10.94	131.3	1.00	0.35	Two-yr	3
12.17	146	1.00	0.35	Two-yr	3
13.29	159.5	1.00	0.35	Two-yr	3

*0.44 raised to 1/1.77 yields an estimated annual rate of 0.63 during the 1st interval, which was 1.77 years long.

Estimates of survival for the 1st release cohort of two-year olds (~27.7 months old at time of release) in RPMA 3

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int. end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	Two	07/29/00	04/24/02	27.7	48.9	0.44	0.10	46	25	to	66
1	Two	04/24/02	04/23/03	48.9	61.0	0.36	0.10	37	17	to	57
1	Two	04/23/03	07/26/03	61.0	64.1	0.36	0.10	37	17	to	57
1	Two	07/26/03	10/01/03	64.1	66.4	0.36	0.10	37	17	to	57
1	Two	10/01/03	05/02/04	66.3	73.5	0.24	0.07	24	11	to	38
1	Two	05/02/04	10/19/04	73.5	79.2	0.24	0.06	24	11	to	37
1	Two	10/19/04	04/19/05	79.2	85.2	0.17	0.05	18	8	to	27
1	Two	04/19/05	10/04/05	85.2	90.8	0.17	0.05	18	8	to	27
1	Two	10/04/05	04/23/06	90.8	97.5	0.13	0.03	14	7	to	20
1	Two	04/23/06	10/04/06	97.5	103.0	0.13	0.03	14	7	to	20
1	Two	10/04/06	04/20/07	103.0	109.6	0.11	0.03	11	6	to	16
1	Two	04/20/07	09/23/07	109.6	114.8	0.11	0.02	11	6	to	16
1	Two	09/23/07	04/26/08	114.8	122.0	0.09	0.02	10	6	to	14
1	Two	04/26/08	09/30/08	122.0	127.2	0.09	0.02	10	6	to	14
1	Two	09/30/08	05/03/09	127.2	134.4	0.08	0.02	9	5	to	12
1	Two	05/03/09	08/11/09	134.4	137.7	0.08	0.02	9	5	to	12
1	Two	08/11/09	05/13/10	137.7	146.9	0.08	0.02	8	5	to	12
1	Two	05/13/10	08/12/10	146.9	149.9	0.08	0.02	8	5	to	12
1	Two	08/12/10	05/11/11	149.9	159.0	0.08	0.02	8	5	to	11
1	Two	05/11/11	04/28/12	159.0	170.8	0.08	0.02	8	5	to	11
1	Two	04/28/12	07/25/12	170.8	173.7	0.08	0.02	8	5	to	11
1	Two	07/25/12	05/11/13	173.7	183.4	0.08	0.02	8	5	to	11
1	Two	05/11/13	09/03/13	183.4	187.2	0.08	0.02	8	5	to	11
1	Two	09/03/13	05/28/14	187.2	196.1	0.07	0.02	8	5	to	11
1	Two	05/28/14	09/13/14	196.1	199.7	0.07	0.02	8	5	to	11
1	Two	09/13/14	05/19/15	199.7	208.0	0.07	0.02	8	5	to	11
1	Two	05/19/15	05/04/16	208.0	219.7	0.07	0.02	8	4	to	11
1	Two	05/04/16	07/21/16	219.7	222.3	0.07	0.02	8	4	to	11

Summary information for fish released as Two-Year-Olds in RPMA 3

Based on the most recent estimates of the proportion surviving and the number surviving from the single release cohort, 8 fish are estimated to have been alive in RPMA 3 as of 07/21/2016. These fish were ~18.5 years old at that time.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 103	Two	07/21/16	222.3	18.5	0.07	0.02	8	4	to	11

Results for releases of Three-Year Olds in RPMA 3

Data on the number of three-year-olds released on each occasion ($R(i)$, represented by row) along with information on when they were 1st subsequently recaptured (occasion j , represented as columns, where $j = 2:29$) is provided in the table below. At the time of the analyses presented here, 753 releases and re-releases of fish in this release type had been achieved, which resulted in 102 recaptures. The results presented below are based on the analyses of the data collected on those released and recaptured fish.

Occ	R(i)	j=2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Sum
1	461	0	3	0	8	5	0	1	2	0	2	1	4	2	5	6	2	3	0	1	1	0	2	0	2	0	1	0	0	51
2	190		2	0	5	2	1	1	0	0	1	0	0	0	1	2	0	0	0	0	1	0	0	0	3	1	0	0	0	19
3	5			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	13					0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3
6	7						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	3								0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
9	2									0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
10	0										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	4											0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	
12	1												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	4													0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14	2														0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
15	7															3	0	1	0	0	0	0	1	1	0	0	0	0	0	6
16	13																1	0	1	0	0	0	2	0	1	0	0	1	0	6
17	3																	2	0	0	0	0	0	0	0	0	0	0	0	2
18	7																		0	3	0	0	0	0	0	0	0	0	0	3
19	1																			0	1	0	0	0	0	0	0	0	0	1
20	4																				0	0	0	0	0	0	0	0	0	0
21	4																					0	0	0	0	0	1	0	0	1
22	0																						0	0	0	0	0	0	0	0
23	7																							0	0	0	0	0	0	0
24	1																								0	0	0	0	0	0
25	6																									0	0	1	0	1
26	1																										0	0	0	0
27	3																											1	0	1
28	3																												0	0
TOTALS	753	0	5	0	13	7	1	3	2	0	4	1	4	2	7	13	3	7	1	4	4	0	7	1	6	1	3	3	0	102

Estimates of survival for the 1st release cohort of three-year olds (~36.3 months old at time of release) in RPMA 3

Start Date	End Date	Months	Age at int. start (mos.)	Age at int end (mos.)	Monthly Survival	(SE)	Ppn. Still Alive	(SE)	(95% CI for Cum. Ppn. Surviving)		
07/29/00	04/24/02	21.1	36.3	57.4	0.969	(0.007)	0.51	(0.08)	0.35	to	0.67
04/24/02	04/23/03	12.1	57.4	69.5	0.987	(0.004)	0.43	(0.09)	0.26	to	0.61
04/23/03	07/26/03	3.1	69.5	72.7	0.999	(0.001)	0.43	(0.09)	0.26	to	0.60
07/26/03	10/01/03	2.2	72.7	74.9	0.999	(0.001)	0.43	(0.09)	0.26	to	0.60
10/01/03	05/02/04	7.1	74.9	82.0	0.953	(0.007)	0.31	(0.06)	0.20	to	0.42
05/02/04	10/19/04	5.7	82.0	87.7	0.999	(0.001)	0.30	(0.06)	0.19	to	0.42
10/19/04	04/19/05	6.1	87.7	93.8	0.958	(0.008)	0.23	(0.04)	0.16	to	0.31
04/19/05	10/04/05	5.6	93.8	99.4	0.999	(0.001)	0.23	(0.04)	0.16	to	0.31
10/04/05	04/23/06	6.7	99.4	106.1	0.969	(0.006)	0.19	(0.03)	0.13	to	0.24
04/23/06	10/04/06	5.5	106.1	111.5	1.000	(0.001)	0.19	(0.03)	0.13	to	0.24
10/04/06	04/20/07	6.6	111.5	118.1	0.975	(0.007)	0.16	(0.02)	0.11	to	0.21
04/20/07	09/23/07	5.2	118.1	123.3	1.000	(0.000)	0.16	(0.02)	0.11	to	0.21
09/23/07	04/26/08	7.2	123.3	130.5	0.985	(0.005)	0.14	(0.02)	0.10	to	0.19
04/26/08	09/30/08	5.2	130.5	135.8	1.000	(0.000)	0.14	(0.02)	0.10	to	0.19
09/30/08	05/03/09	7.2	135.8	142.9	0.989	(0.005)	0.13	(0.02)	0.09	to	0.18
05/03/09	08/11/09	3.3	142.9	146.3	1.000	(0.000)	0.13	(0.02)	0.09	to	0.18
08/11/09	05/13/10	9.2	146.3	155.4	0.996	(0.002)	0.13	(0.02)	0.08	to	0.17
05/13/10	08/12/10	3.0	155.4	158.5	1.000	(0.000)	0.13	(0.02)	0.08	to	0.17
08/12/10	05/11/11	9.1	158.5	167.5	0.997	(0.002)	0.12	(0.02)	0.08	to	0.17
05/11/11	04/28/12	11.8	167.5	179.3	0.999	(0.001)	0.12	(0.02)	0.07	to	0.17
04/28/12	07/25/12	2.9	179.3	182.2	1.000	(0.000)	0.12	(0.02)	0.07	to	0.17
07/25/12	05/11/13	9.7	182.2	191.9	0.999	(0.001)	0.12	(0.03)	0.07	to	0.17
05/11/13	09/03/13	3.8	191.9	195.7	1.000	(0.000)	0.12	(0.03)	0.07	to	0.17
09/03/13	05/28/14	8.9	195.7	204.6	0.999	(0.001)	0.12	(0.03)	0.07	to	0.17
05/28/14	09/13/14	3.6	204.6	208.2	1.000	(0.000)	0.12	(0.03)	0.07	to	0.17
09/13/14	05/19/15	8.3	208.2	216.5	0.999	(0.001)	0.12	(0.03)	0.07	to	0.17
05/19/15	05/04/16	11.7	216.5	228.2	1.000	(0.000)	0.12	(0.03)	0.06	to	0.17
05/04/16	07/21/16	2.6	228.2	230.8	1.000	(0.000)	0.12	(0.03)	0.06	to	0.17

Survival rates for approximately 1-year intervals post-release. *Intervals were based on observed intervals above and chosen based on which were closest to 1-year intervals post-release. **NOTE 1:** The first interval here was 21.1 months and so much longer than a year. This was used as it was the first actual interval; an annual rate is reported in the footnotes of the table. Interval survival rates represent the probability of surviving from one point in time to the next. After last interval reported, estimated annual survival was ~1.0 based on model's predictions and so are not reported. **NOTE 2:** Standard errors reported in the table treat survival rates in table above as being independent and are approximate.*

Years Since Release	Months Since Release	Interval Survival Rate	SE	Release Type	RPMA
1.76	21.1	0.51	0.08	Three-yr	3
3.03	36.4	0.84	0.31	Three-yr	3
3.81	45.7	0.72	0.40	Three-yr	3
5.26	63.1	0.74	0.35	Three-yr	3
5.82	69.8	0.83	0.28	Three-yr	3
6.82	81.8	0.84	0.24	Three-yr	3
8.29	99.5	0.88	0.22	Three-yr	3
9.93	119.1	0.93	0.23	Three-yr	3
10.93	131.2	0.92	0.25	Three-yr	3
12.16	145.9	1.00	0.24	Three-yr	3
13.28	159.4	1.00	0.30	Three-yr	3

*0.51 raised to 1/1.76 yields an estimated annual rate of 0.68 during the 1st interval, which was 1.76 years long.

Estimates of survival for the 1st release cohort of three-year olds (~36.3 months old at time of release) in RPMA 3

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
1	Three	07/29/00	04/24/02	36.3	57.4	0.51	0.08	236	160	to	311
1	Three	04/24/02	04/23/03	57.4	69.5	0.43	0.09	200	121	to	279
1	Three	04/23/03	07/26/03	69.5	72.7	0.43	0.09	200	120	to	279
1	Three	07/26/03	10/01/03	72.7	74.9	0.43	0.09	199	120	to	279
1	Three	10/01/03	05/02/04	74.9	82.0	0.31	0.06	141	90	to	192
1	Three	05/02/04	10/19/04	82.0	87.7	0.30	0.06	140	89	to	192
1	Three	10/19/04	04/19/05	87.7	93.8	0.23	0.04	108	73	to	143
1	Three	04/19/05	10/04/05	93.8	99.4	0.23	0.04	107	72	to	142
1	Three	10/04/05	04/23/06	99.4	106.1	0.19	0.03	87	61	to	113
1	Three	04/23/06	10/04/06	106.1	111.5	0.19	0.03	87	61	to	113
1	Three	10/04/06	04/20/07	111.5	118.1	0.16	0.02	73	52	to	95
1	Three	04/20/07	09/23/07	118.1	123.3	0.16	0.02	73	52	to	95
1	Three	09/23/07	04/26/08	123.3	130.5	0.14	0.02	66	46	to	86
1	Three	04/26/08	09/30/08	130.5	135.8	0.14	0.02	66	46	to	86
1	Three	09/30/08	05/03/09	135.8	142.9	0.13	0.02	61	40	to	81
1	Three	05/03/09	08/11/09	142.9	146.3	0.13	0.02	61	40	to	81
1	Three	08/11/09	05/13/10	146.3	155.4	0.13	0.02	58	38	to	79
1	Three	05/13/10	08/12/10	155.4	158.5	0.13	0.02	58	37	to	79
1	Three	08/12/10	05/11/11	158.5	167.5	0.12	0.02	57	35	to	79
1	Three	05/11/11	04/28/12	167.5	179.3	0.12	0.02	56	34	to	78
1	Three	04/28/12	07/25/12	179.3	182.2	0.12	0.02	56	34	to	78
1	Three	07/25/12	05/11/13	182.2	191.9	0.12	0.03	55	33	to	78
1	Three	05/11/13	09/03/13	191.9	195.7	0.12	0.03	55	32	to	78
1	Three	09/03/13	05/28/14	195.7	204.6	0.12	0.03	55	31	to	78
1	Three	05/28/14	09/13/14	204.6	208.2	0.12	0.03	55	31	to	78
1	Three	09/13/14	05/19/15	208.2	216.5	0.12	0.03	54	30	to	78
1	Three	05/19/15	05/04/16	216.5	228.2	0.12	0.03	54	30	to	78
1	Three	05/04/16	07/21/16	228.2	230.8	0.12	0.03	54	30	to	78

Estimates of survival for the 2nd release cohort of three-year olds (~36.3 months old at time of release) in RPMA 3

Release	Type	Start Date	End Date	Age at int. start (mos.)	Age at int. end (mos.)	Ppn. Still Alive	(SE)	N at Interval End	(95% CI for N at Interval End)		
2	Three	04/24/02	04/23/03	36.3	48.4	0.77	0.06	146	123	to	169
2	Three	04/23/03	07/26/03	48.4	51.5	0.76	0.06	145	121	to	169
2	Three	07/26/03	10/01/03	51.5	53.8	0.76	0.07	145	120	to	169
2	Three	10/01/03	05/02/04	53.8	60.9	0.44	0.06	83	61	to	105
2	Three	05/02/04	10/19/04	60.9	66.6	0.43	0.06	82	60	to	104
2	Three	10/19/04	04/19/05	66.6	72.6	0.28	0.06	54	32	to	75
2	Three	04/19/05	10/04/05	72.6	78.2	0.28	0.06	53	32	to	74
2	Three	10/04/05	04/23/06	78.2	84.9	0.20	0.05	38	20	to	56
2	Three	04/23/06	10/04/06	84.9	90.4	0.20	0.05	38	20	to	55
2	Three	10/04/06	04/20/07	90.4	97.0	0.15	0.04	29	14	to	44
2	Three	04/20/07	09/23/07	97.0	102.2	0.15	0.04	29	14	to	43
2	Three	09/23/07	04/26/08	102.2	109.4	0.13	0.03	24	12	to	37
2	Three	04/26/08	09/30/08	109.4	114.6	0.13	0.03	24	12	to	36
2	Three	09/30/08	05/03/09	114.6	121.8	0.11	0.03	21	10	to	32
2	Three	05/03/09	08/11/09	121.8	125.1	0.11	0.03	21	10	to	32
2	Three	08/11/09	05/13/10	125.1	134.3	0.10	0.03	20	10	to	30
2	Three	05/13/10	08/12/10	134.3	137.3	0.10	0.03	20	10	to	30
2	Three	08/12/10	05/11/11	137.3	146.4	0.10	0.02	19	10	to	28
2	Three	05/11/11	04/28/12	146.4	158.2	0.10	0.02	19	10	to	27
2	Three	04/28/12	07/25/12	158.2	161.1	0.10	0.02	19	10	to	27
2	Three	07/25/12	05/11/13	161.1	170.8	0.10	0.02	18	10	to	27
2	Three	05/11/13	09/03/13	170.8	174.6	0.10	0.02	18	10	to	27
2	Three	09/03/13	05/28/14	174.6	183.5	0.09	0.02	18	10	to	26
2	Three	05/28/14	09/13/14	183.5	187.1	0.09	0.02	18	10	to	26
2	Three	09/13/14	05/19/15	187.1	195.4	0.09	0.02	18	9	to	26
2	Three	05/19/15	05/04/16	195.4	207.1	0.09	0.02	17	9	to	26
2	Three	05/04/16	07/21/16	207.1	209.7	0.09	0.02	17	9	to	26

Summary information for fish released as Three-Year-Olds in RPMA 3

Based on the most recent estimates of the proportion surviving and the number surviving from the 2 release cohorts for this group, 71 fish are estimated to have been alive in RPMA 3 as of 07/21/2016. Of these, all were between 17 and 20 years old at that time.

Release	Type	Date	Age in months	Age in years	Ppn. Still Alive	(SE)	N Alive	(95% CI for N Alive)		
1: 461	Three	07/21/16	230.8	19.2	0.12	0.03	54	30	to	78
2: 190	Three	07/21/16	209.7	17.5	0.09	0.02	17	9	to	26

Summary of number estimated to be alive in RPMA 3 as of 21 July 2016

Release	Type	Date	Age in years	N Alive	(95% CI for N Alive)		
1: 461	Three	07/21/16	19.2	54	30	to	78
1: 103	Two	07/21/16	18.5	8	4	to	11
2: 190	Three	07/21/16	17.5	17	9	to	26
1: 563	SPR	07/21/16	15.2	131	96	to	166
1: 606	SUM	07/21/16	14.4	163	84	to	241
2: 511	SUM	07/21/16	13.1	129	85	to	173
3: 865	SUM	07/21/16	12.1	234	163	to	304
4: 1,004	SUM	07/21/16	11.1	302	216	to	388
2: 601	SPR	07/21/16	10.2	168	116	to	220
3: 1,171	SPR	07/21/16	9.2	334	234	to	434
4: 626	SPR	07/21/16	8.1	204	148	to	261
5: 840	SPR	07/21/16	7.1	252	185	to	320
6: 595	SPR	07/21/16	6.1	128	91	to	165
7: 81	SPR	07/21/16	4.8	10	3	to	17
5: 82	SUM	07/21/16	4.4	52	40	to	64
6: 173	SUM	07/21/16	3.4	123	101	to	144
8: 120	SPR	07/21/16	2.0	28	18	to	37
9: 120	SPR	07/21/16	1.0	117	112	to	120

**The Release column represents (a) the release cohort for the specific type of release and (b) the number of individuals in that release cohort.*

When summarized by age class, the estimates indicate that ~2,454 of the fish that were released from hatcheries in recent years in RPMA 3 were still alive there as of 07/21/2016. Of these fish, an estimated 330 (~13%) were in the 1- to 5-year-old age class, 918 (~37%) were in the 5- to 10-year-old age class, 996 (~41%) were in the 10- to 15-year-old age class, and 210 (~9%) were in the 15- to 20-year-old age class.

Summary information for RPMA 3 organized with age classes in ascending order

RPMA	Date	Age in years	N Alive	(Sum of 95% CI elements for N Alive)			ppn of total
3	07/21/16	1 to 5	330	274	to	382	0.13
3	07/21/16	5 to 10	918	658	to	1,180	0.37
3	07/21/16	10 to 15	996	664	to	1,326	0.41
3	07/21/16	15 to 20	210	139	to	281	0.09

Summary of estimated numbers across RPMAs with estimates updated in summer 2017

RPMA	Date	Age in years	N Alive	(Sum of 95% CI elements for N Alive)			<i>ppn of total</i>
1	09/04/16	1 to 5	1,707	1,631	to	1,779	0.42
1	09/04/16	5 to 10	1,957	1,556	to	2,362	0.48
1	09/04/16	10 to 15	302	197	to	408	0.07
1	09/04/16	15 to 20	143	105	to	182	0.03

RPMA	Date	Age in years	N Alive	(Sum of 95% CI elements for N Alive)			<i>ppn of total</i>
2	09/05/16	1 to 5	2,360	2,240	to	2,482	0.14
2	09/05/16	5 to 10	11,811	9,426	to	14,204	0.72
2	09/05/16	10 to 15	2,002	1,440	to	2,570	0.12
2	09/05/16	15 to 20	238	174	to	299	0.01

RPMA	Date	Age in years	N Alive	(Sum of 95% CI elements for N Alive)			<i>ppn of total</i>
3	07/21/16	1 to 5	330	274	to	382	0.13
3	07/21/16	5 to 10	918	658	to	1,180	0.37
3	07/21/16	10 to 15	996	664	to	1,326	0.41
3	07/21/16	15 to 20	210	139	to	281	0.09

Note: Actual numbers of stocked pallid sturgeon that were still alive in RPMA 1 as of September of 2016 were likely higher than the numbers presented above because over (1) 90,000 additional pallid sturgeon were released as fingerlings in RPMA 1 but were not included in the analysis due to low recapture rates for that release type in RPMA1 and (2) data provided for the analyses presented here, included data for 691 summer yearlings that were originally released in 1998 whereas 731 were known to have been released, which indicates that it is possible for an additional 10 fish approximately 20 years old might be alive in RPMA 1.

Concluding comments

Addition of data from recent trapping occasions and years has added data for each RPMA and all stocking categories. The results provided update previous estimates of actual proportions and total numbers projected to be still alive for actual release cohorts. Based on these estimates, it appears that substantial numbers of fish were still alive in the RPMAs at the time the last data reported for 2016 were collected.

The reliability of the estimates depends on how well the assumptions are met. Of particular interest is how well the models fit the data. Unfortunately, testing goodness-of-fit for mark-recapture data and count data in general is difficult. Thus, although available procedures were employed here, it is not possible to know just how well the models fit the various datasets or where in the data lack of fit might exist. Given this, it is important to try to continue to (1) improve capture probabilities for more age classes of fish, (2) consider other covariates that might help explain any sources of heterogeneity in survival and capture probabilities, and (3) to consider other approaches for assessing the results.

Other approaches might include strategic use of radio telemetry to investigate survival rates of fish in various age classes that might be of great interest and difficult to estimate with high confidence given the sample sizes available in the work presented in this document for older fish. Alternatively, one might consider other methods of estimating population size. Here, we combined survival information with knowledge of the number of released fish to estimate population sizes of release cohorts through time. Other independent and complementary approaches to estimating abundance, e.g., closed population estimators, could be employed to try to validate these results but have proven difficult to implement in the field for pallid sturgeon.