Longfin Smelt Spatiotemporal Domain

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## Load and process Longfin Smelt data

Grab Longfin Smelt data from the integrated fish dataset (LTMRdata package by Sam Bashevkin et al.) and produce one fish data per row. I will exclude fish with no length measurement. Note that unmeasured fish that were collected alongside measured fish were converted to have fish length per LTMRdata documentation. I converted count to integer however, since the process that Sam implemented created decimal points for counts.

Surveys included in this calculation:

1. San Francisco Bay Study
2. Suisun Marsh Study
3. Fall Midwater Trawl
4. Spring Kodiak Trawl
5. Delta Juvenile Fish Monitoring Program
6. Enhanced Delta Smelt Monitoring
7. 20-mm Survey
8. Smelt Larval Survey
9. Summer Townet Survey

#Load data  
data\_longfinsmelt <-LTMRdata::fish(sources=c("Baystudy", "Suisun", "FMWT", "SKT", "DJFMP", "EDSM", "TMM", "SLS","STN"),species="Spirinchus thaleichthys", size\_cutoff=NULL,remove\_unknown\_lengths=TRUE) %>%  
 filter(year(Date)>=1994)  
  
#Create time series summary  
data\_longfinsmelt\_time\_summary<-data\_longfinsmelt %>% group\_by(Source) %>% summarise(StartDate=min(Date),EndDate=max(Date))  
data\_longfinsmelt\_time\_summary

## # A tibble: 9 x 3  
## Source StartDate EndDate   
## <chr> <dttm> <dttm>   
## 1 20mm 1995-04-24 00:00:00 2021-07-16 00:00:00  
## 2 Bay Study 1994-02-02 00:00:00 2020-12-01 00:00:00  
## 3 DJFMP 1994-01-03 00:00:00 2020-12-31 00:00:00  
## 4 EDSM 2016-12-15 00:00:00 2021-03-25 00:00:00  
## 5 FMWT 1994-01-10 00:00:00 2020-12-15 00:00:00  
## 6 SKT 2002-01-07 00:00:00 2021-04-29 00:00:00  
## 7 SLS 2009-01-05 00:00:00 2021-03-17 00:00:00  
## 8 STN 1994-06-15 00:00:00 2021-08-19 00:00:00  
## 9 Suisun 1994-01-06 00:00:00 2021-09-23 00:00:00

#Change count to integer  
data\_longfinsmelt$Count<-as.integer(data\_longfinsmelt$Count)  
#Remove zero catch data  
data\_longfinsmelt<- data\_longfinsmelt%>% filter(Count>0)  
  
#Create long form, remove data prior to 1994  
data\_longfinsmelt\_long <-data\_longfinsmelt[rep(1:nrow(data\_longfinsmelt), data\_longfinsmelt$Count),] %>% mutate(Count=1)

## Size cutoffs used for Longfin Smelt

Larvae: (<20mm FL)

Juvenile: (20-84mm FL)

Adult: (>84mm FL)

### Brood year cutoff for the life stages

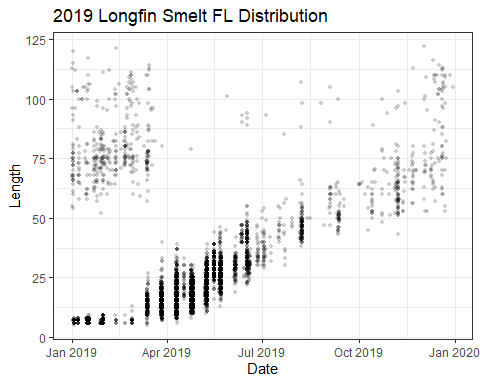
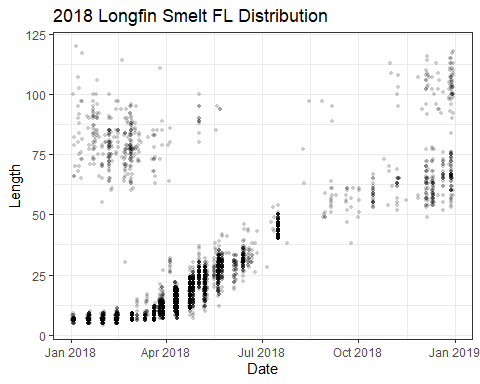
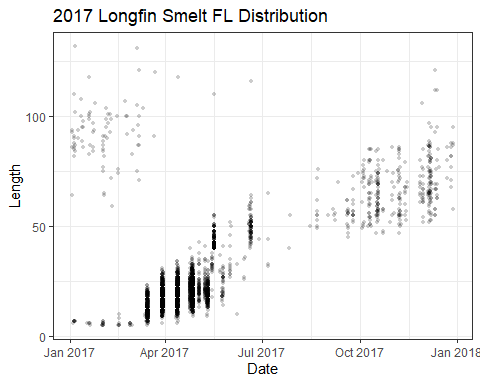
Larvae: brood year = calendar year

Juvenile: brood year = calendar year

Adult: brood year starts in July 1st of current year to June 30th of the following year

# Overview of size distribution

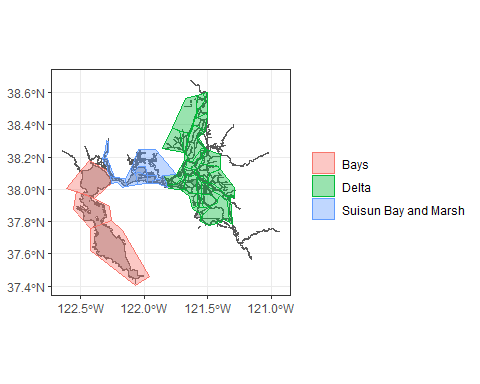
Subadult and adult Longfin Smelt typically are present and caught from January to July, and then again starting October to November.



## San Francisco Bay-Delta (all regions)

### Regions

Shown below are the regional cutoffs used to better understand when fish are found in a particular area within the estuary



### Adult Longfin Smelt

(mature and immature adults of >84 mm FL, cohort year set to July 1st - June 30th)

| ‘Cohort’ Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | July 03 1994 | November 28 1994 | December 06 1994 | February 10 1995 | March 06 1995 | June 12 1995 | 2061 |
| 1995 | July 10 1995 | December 28 1995 | January 04 1996 | May 13 1996 | May 14 1996 | June 27 1996 | 2229 |
| 1996 | July 03 1996 | December 06 1996 | December 16 1996 | January 24 1997 | March 03 1997 | June 30 1997 | 12193 |
| 1997 | July 09 1997 | December 01 1997 | December 07 1997 | January 26 1998 | March 02 1998 | June 08 1998 | 2085 |
| 1998 | September 16 1998 | December 07 1998 | December 09 1998 | May 19 1999 | June 08 1999 | June 16 1999 | 1604 |
| 1999 | July 07 1999 | December 01 1999 | December 16 1999 | March 07 2000 | May 09 2000 | June 14 2000 | 2982 |
| 2000 | July 07 2000 | December 06 2000 | December 13 2000 | March 19 2001 | April 16 2001 | June 13 2001 | 2103 |
| 2001 | July 03 2001 | December 11 2001 | December 19 2001 | January 24 2002 | March 12 2002 | June 18 2002 | 6922 |
| 2002 | July 10 2002 | December 16 2002 | December 23 2002 | January 29 2003 | March 05 2003 | June 25 2003 | 2036 |
| 2003 | July 14 2003 | December 12 2003 | December 17 2003 | January 13 2004 | March 03 2004 | June 30 2004 | 5039 |
| 2004 | July 07 2004 | December 07 2004 | December 16 2004 | February 03 2005 | February 25 2005 | June 23 2005 | 1511 |
| 2005 | July 11 2005 | December 07 2005 | December 09 2005 | February 22 2006 | April 26 2006 | June 14 2006 | 829 |
| 2006 | July 17 2006 | November 07 2006 | December 05 2006 | April 30 2007 | May 14 2007 | June 13 2007 | 283 |
| 2007 | July 11 2007 | December 01 2007 | December 11 2007 | February 13 2008 | March 05 2008 | June 05 2008 | 759 |
| 2008 | August 07 2008 | November 13 2008 | December 08 2008 | March 18 2009 | April 16 2009 | June 25 2009 | 459 |
| 2009 | July 07 2009 | December 07 2009 | December 11 2009 | March 10 2010 | March 15 2010 | May 27 2010 | 663 |
| 2010 | July 08 2010 | December 17 2010 | December 17 2010 | March 14 2011 | April 11 2011 | June 08 2011 | 290 |
| 2011 | July 07 2011 | November 01 2011 | December 05 2011 | March 07 2012 | April 04 2012 | June 07 2012 | 331 |
| 2012 | July 05 2012 | December 07 2012 | December 14 2012 | January 15 2013 | February 22 2013 | June 11 2013 | 1139 |
| 2013 | July 03 2013 | October 09 2013 | November 13 2013 | February 24 2014 | March 13 2014 | May 19 2014 | 147 |
| 2014 | September 03 2014 | December 10 2014 | December 19 2014 | March 09 2015 | April 10 2015 | June 08 2015 | 128 |
| 2015 | July 10 2015 | July 10 2015 | September 17 2015 | February 12 2016 | February 22 2016 | February 24 2016 | 20 |
| 2016 | November 08 2016 | December 07 2016 | December 19 2016 | March 07 2017 | March 21 2017 | June 21 2017 | 94 |
| 2017 | October 10 2017 | November 07 2017 | December 05 2017 | April 05 2018 | May 03 2018 | May 23 2018 | 134 |
| 2018 | August 15 2018 | November 08 2018 | December 05 2018 | March 14 2019 | March 15 2019 | June 17 2019 | 192 |
| 2019 | July 05 2019 | September 04 2019 | November 06 2019 | February 26 2020 | March 11 2020 | June 11 2020 | 121 |
| 2020 | July 07 2020 | September 23 2020 | October 15 2020 | February 12 2021 | February 12 2021 | April 29 2021 | 44 |

### Juvenile Longfin Smelt

(20-84 mm FL, cohort year set to January 1st - December 31st; same as calendar year)

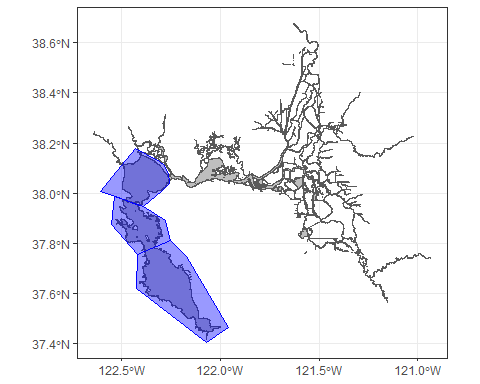
| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | January 03 1994 | January 11 1994 | March 07 1994 | June 14 1994 | June 17 1994 | December 31 1994 | 10555 |
| 1995 | January 03 1995 | May 04 1995 | May 12 1995 | November 13 1995 | December 05 1995 | December 28 1995 | 23238 |
| 1996 | January 03 1996 | January 04 1996 | January 11 1996 | July 25 1996 | November 18 1996 | December 30 1996 | 17300 |
| 1997 | January 07 1997 | April 04 1997 | April 05 1997 | December 03 1997 | December 19 1997 | December 31 1997 | 12185 |
| 1998 | January 03 1998 | April 10 1998 | April 10 1998 | November 17 1998 | December 15 1998 | December 31 1998 | 28354 |
| 1999 | January 01 1999 | April 15 1999 | April 16 1999 | September 01 1999 | October 05 1999 | December 31 1999 | 47903 |
| 2000 | January 02 2000 | April 06 2000 | April 07 2000 | June 29 2000 | October 04 2000 | December 20 2000 | 66352 |
| 2001 | January 03 2001 | February 04 2001 | March 23 2001 | May 30 2001 | June 03 2001 | December 31 2001 | 25507 |
| 2002 | January 02 2002 | March 22 2002 | March 22 2002 | June 18 2002 | October 30 2002 | December 31 2002 | 21876 |
| 2003 | January 02 2003 | February 21 2003 | March 27 2003 | May 24 2003 | November 04 2003 | December 31 2003 | 8883 |
| 2004 | January 02 2004 | January 27 2004 | February 04 2004 | September 17 2004 | December 08 2004 | December 31 2004 | 4875 |
| 2005 | January 02 2005 | January 05 2005 | January 21 2005 | July 11 2005 | November 02 2005 | December 28 2005 | 2823 |
| 2006 | January 09 2006 | April 22 2006 | April 22 2006 | September 07 2006 | October 04 2006 | December 31 2006 | 9298 |
| 2007 | January 03 2007 | January 08 2007 | January 10 2007 | June 07 2007 | August 07 2007 | December 30 2007 | 1470 |
| 2008 | January 02 2008 | March 19 2008 | March 19 2008 | June 04 2008 | July 02 2008 | December 24 2008 | 11719 |
| 2009 | January 02 2009 | February 05 2009 | March 12 2009 | June 11 2009 | June 17 2009 | December 23 2009 | 2912 |
| 2010 | January 05 2010 | March 16 2010 | March 17 2010 | May 25 2010 | May 27 2010 | December 09 2010 | 5126 |
| 2011 | January 05 2011 | March 16 2011 | April 13 2011 | October 05 2011 | December 06 2011 | December 30 2011 | 5916 |
| 2012 | January 03 2012 | February 07 2012 | March 06 2012 | September 06 2012 | November 06 2012 | December 21 2012 | 1921 |
| 2013 | January 04 2013 | April 09 2013 | April 09 2013 | June 05 2013 | June 12 2013 | December 11 2013 | 20489 |
| 2014 | January 06 2014 | March 12 2014 | March 20 2014 | May 29 2014 | September 10 2014 | December 31 2014 | 1404 |
| 2015 | January 02 2015 | January 06 2015 | January 07 2015 | May 12 2015 | May 29 2015 | October 12 2015 | 474 |
| 2016 | February 03 2016 | March 14 2016 | March 31 2016 | May 13 2016 | June 08 2016 | December 27 2016 | 792 |
| 2017 | January 03 2017 | March 29 2017 | March 30 2017 | October 10 2017 | November 13 2017 | December 28 2017 | 2366 |
| 2018 | January 04 2018 | February 20 2018 | March 28 2018 | October 15 2018 | December 11 2018 | December 30 2018 | 2084 |
| 2019 | January 01 2019 | March 14 2019 | April 11 2019 | June 17 2019 | August 08 2019 | December 23 2019 | 5278 |
| 2020 | January 03 2020 | April 06 2020 | April 28 2020 | August 24 2020 | September 23 2020 | December 28 2020 | 1991 |
| 2021 | January 04 2021 | April 07 2021 | April 07 2021 | May 19 2021 | May 19 2021 | August 11 2021 | 6011 |

### Larval Longfin Smelt

(<20 mm FL, cohort year set to just calendar year)

| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | March 18 1994 | March 18 1994 | March 18 1994 | April 24 1994 | April 24 1994 | April 24 1994 | 4 |
| 1995 | April 27 1995 | April 27 1995 | April 27 1995 | May 26 1995 | May 26 1995 | June 27 1995 | 532 |
| 1996 | April 12 1996 | April 14 1996 | April 14 1996 | May 11 1996 | May 14 1996 | June 29 1996 | 12644 |
| 1997 | March 31 1997 | April 04 1997 | April 04 1997 | April 30 1997 | April 30 1997 | June 01 1997 | 8454 |
| 1998 | April 10 1998 | April 10 1998 | April 10 1998 | April 10 1998 | April 10 1998 | June 19 1998 | 11104 |
| 1999 | April 12 1999 | April 15 1999 | April 15 1999 | April 30 1999 | May 14 1999 | July 23 1999 | 28367 |
| 2000 | March 22 2000 | March 24 2000 | April 05 2000 | April 21 2000 | April 22 2000 | September 11 2000 | 101536 |
| 2001 | March 19 2001 | March 22 2001 | March 23 2001 | April 20 2001 | April 20 2001 | July 12 2001 | 50403 |
| 2002 | March 18 2002 | March 20 2002 | March 21 2002 | April 17 2002 | April 18 2002 | July 31 2002 | 28116 |
| 2003 | March 24 2003 | March 26 2003 | March 26 2003 | April 12 2003 | April 25 2003 | June 07 2003 | 13552 |
| 2004 | March 29 2004 | April 01 2004 | April 01 2004 | April 16 2004 | April 28 2004 | June 10 2004 | 7493 |
| 2005 | March 14 2005 | March 17 2005 | March 18 2005 | April 27 2005 | April 29 2005 | June 21 2005 | 5714 |
| 2006 | March 23 2006 | March 24 2006 | April 22 2006 | May 19 2006 | May 19 2006 | August 16 2006 | 7726 |
| 2007 | March 14 2007 | March 17 2007 | March 17 2007 | April 25 2007 | April 25 2007 | May 12 2007 | 2174 |
| 2008 | March 05 2008 | March 18 2008 | March 19 2008 | April 30 2008 | April 30 2008 | June 12 2008 | 12408 |
| 2009 | January 05 2009 | January 22 2009 | February 03 2009 | April 08 2009 | April 21 2009 | June 11 2009 | 19514 |
| 2010 | January 04 2010 | January 19 2010 | January 21 2010 | April 14 2010 | April 14 2010 | May 26 2010 | 27584 |
| 2011 | January 18 2011 | January 31 2011 | February 01 2011 | May 09 2011 | May 11 2011 | June 30 2011 | 21201 |
| 2012 | January 09 2012 | January 10 2012 | January 23 2012 | March 27 2012 | May 08 2012 | June 06 2012 | 17427 |
| 2013 | January 02 2013 | January 29 2013 | February 11 2013 | April 23 2013 | April 24 2013 | July 03 2013 | 49016 |
| 2014 | January 06 2014 | January 21 2014 | January 22 2014 | March 21 2014 | April 03 2014 | May 13 2014 | 6498 |
| 2015 | January 05 2015 | January 08 2015 | January 22 2015 | April 01 2015 | April 08 2015 | May 11 2015 | 1208 |
| 2016 | January 04 2016 | January 19 2016 | January 21 2016 | April 26 2016 | April 26 2016 | May 23 2016 | 1315 |
| 2017 | January 04 2017 | March 15 2017 | March 16 2017 | April 27 2017 | May 10 2017 | June 07 2017 | 2840 |
| 2018 | January 02 2018 | January 18 2018 | January 31 2018 | April 24 2018 | April 24 2018 | June 05 2018 | 4449 |
| 2019 | January 02 2019 | January 29 2019 | March 13 2019 | May 08 2019 | May 10 2019 | June 05 2019 | 6048 |
| 2020 | January 06 2020 | January 21 2020 | January 21 2020 | April 22 2020 | April 23 2020 | December 28 2020 | 3652 |
| 2021 | January 11 2021 | January 26 2021 | February 10 2021 | April 21 2021 | May 05 2021 | June 03 2021 | 5297 |

## Bays (South Bay, San Francisco Bay, San Pablo Bay)



### Adult Longfin Smelt

(mature and immature adults of >84 mm FL, cohort year set to July 1st - June 30th)

| ‘Cohort’ Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | July 06 1994 | September 12 1994 | November 07 1994 | May 03 1995 | May 04 1995 | May 09 1995 | 80 |
| 1995 | July 10 1995 | July 10 1995 | January 08 1996 | June 06 1996 | June 10 1996 | June 10 1996 | 203 |
| 1996 | July 03 1996 | August 12 1996 | November 06 1996 | April 14 1997 | May 12 1997 | June 10 1997 | 439 |
| 1997 | July 09 1997 | September 08 1997 | November 05 1997 | May 11 1998 | May 11 1998 | June 08 1998 | 181 |
| 1998 | November 02 1998 | December 03 1998 | December 07 1998 | May 27 1999 | June 09 1999 | June 15 1999 | 173 |
| 1999 | July 08 1999 | July 12 1999 | July 12 1999 | April 05 2000 | May 10 2000 | June 13 2000 | 119 |
| 2000 | July 07 2000 | August 24 2000 | December 12 2000 | April 16 2001 | May 10 2001 | June 07 2001 | 196 |
| 2001 | July 17 2001 | October 25 2001 | November 14 2001 | April 04 2002 | April 04 2002 | May 14 2002 | 154 |
| 2002 | September 09 2002 | December 04 2002 | January 08 2003 | June 02 2003 | June 25 2003 | June 25 2003 | 114 |
| 2003 | July 17 2003 | August 07 2003 | October 14 2003 | April 15 2004 | May 05 2004 | May 11 2004 | 67 |
| 2004 | September 09 2004 | September 09 2004 | December 06 2004 | June 09 2005 | June 09 2005 | June 13 2005 | 62 |
| 2005 | July 11 2005 | October 05 2005 | November 08 2005 | May 06 2006 | May 18 2006 | June 14 2006 | 95 |
| 2006 | July 19 2006 | September 07 2006 | November 08 2006 | May 14 2007 | May 14 2007 | June 05 2007 | 65 |
| 2007 | July 11 2007 | July 11 2007 | August 08 2007 | March 05 2008 | June 05 2008 | June 05 2008 | 15 |
| 2008 | August 07 2008 | November 05 2008 | December 02 2008 | April 13 2009 | May 06 2009 | June 03 2009 | 62 |
| 2009 | July 13 2009 | July 13 2009 | July 13 2009 | March 08 2010 | March 10 2010 | May 12 2010 | 41 |
| 2010 | July 08 2010 | December 06 2010 | January 13 2011 | May 04 2011 | May 04 2011 | June 08 2011 | 39 |
| 2011 | July 07 2011 | October 10 2011 | December 07 2011 | April 09 2012 | May 10 2012 | June 07 2012 | 77 |
| 2012 | July 05 2012 | July 10 2012 | September 06 2012 | March 11 2013 | June 11 2013 | June 11 2013 | 46 |
| 2013 | July 03 2013 | July 03 2013 | July 09 2013 | February 11 2014 | May 19 2014 | May 19 2014 | 19 |
| 2014 | December 03 2014 | December 03 2014 | December 03 2014 | May 12 2015 | May 12 2015 | May 12 2015 | 7 |
| 2016 | December 12 2016 | December 12 2016 | December 12 2016 | June 21 2017 | June 21 2017 | June 21 2017 | 8 |
| 2017 | October 31 2017 | October 31 2017 | November 29 2017 | February 27 2018 | February 28 2018 | February 28 2018 | 16 |
| 2018 | December 06 2018 | December 06 2018 | December 06 2018 | June 12 2019 | June 17 2019 | June 17 2019 | 10 |
| 2019 | July 22 2019 | July 22 2019 | August 07 2019 | February 03 2020 | February 03 2020 | February 03 2020 | 17 |
| 2020 | September 23 2020 | September 23 2020 | September 23 2020 | November 12 2020 | November 12 2020 | November 12 2020 | 5 |

### Juvenile Longfin Smelt

(20-84 mm FL, cohort year set to January 1st - December 31st; same as calendar year)

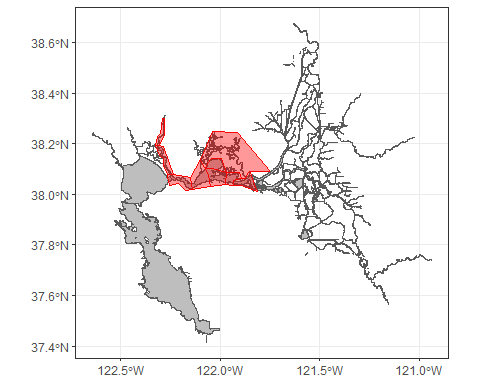
| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | February 04 1994 | February 04 1994 | February 04 1994 | December 05 1994 | December 05 1994 | December 05 1994 | 288 |
| 1995 | January 05 1995 | May 04 1995 | May 09 1995 | September 11 1995 | November 14 1995 | December 13 1995 | 14009 |
| 1996 | January 08 1996 | January 08 1996 | February 14 1996 | December 09 1996 | December 11 1996 | December 12 1996 | 1390 |
| 1997 | January 07 1997 | February 04 1997 | March 04 1997 | December 01 1997 | December 01 1997 | December 09 1997 | 969 |
| 1998 | January 06 1998 | February 11 1998 | May 08 1998 | November 02 1998 | December 02 1998 | December 08 1998 | 3927 |
| 1999 | January 13 1999 | February 08 1999 | April 21 1999 | September 07 1999 | September 30 1999 | November 29 1999 | 6184 |
| 2000 | January 24 2000 | February 09 2000 | March 24 2000 | November 17 2000 | December 12 2000 | December 15 2000 | 2352 |
| 2001 | January 10 2001 | January 10 2001 | January 10 2001 | September 10 2001 | October 31 2001 | December 11 2001 | 425 |
| 2002 | February 14 2002 | March 14 2002 | April 06 2002 | November 06 2002 | December 04 2002 | December 09 2002 | 638 |
| 2003 | January 08 2003 | January 09 2003 | January 09 2003 | December 01 2003 | December 03 2003 | December 18 2003 | 428 |
| 2004 | January 07 2004 | January 07 2004 | January 13 2004 | December 06 2004 | December 07 2004 | December 14 2004 | 432 |
| 2005 | January 05 2005 | January 05 2005 | January 11 2005 | October 11 2005 | December 13 2005 | December 20 2005 | 402 |
| 2006 | January 09 2006 | April 22 2006 | April 22 2006 | September 05 2006 | October 04 2006 | December 11 2006 | 7929 |
| 2007 | January 08 2007 | January 08 2007 | January 08 2007 | September 13 2007 | October 10 2007 | December 05 2007 | 308 |
| 2008 | January 28 2008 | June 05 2008 | June 10 2008 | December 02 2008 | December 04 2008 | December 04 2008 | 237 |
| 2009 | January 07 2009 | January 12 2009 | January 13 2009 | July 13 2009 | October 12 2009 | December 09 2009 | 243 |
| 2010 | January 06 2010 | January 19 2010 | February 09 2010 | December 06 2010 | December 06 2010 | December 09 2010 | 151 |
| 2011 | January 12 2011 | February 10 2011 | March 14 2011 | December 05 2011 | December 07 2011 | December 12 2011 | 1386 |
| 2012 | January 05 2012 | January 05 2012 | January 05 2012 | November 06 2012 | November 06 2012 | December 10 2012 | 328 |
| 2013 | January 09 2013 | January 09 2013 | February 06 2013 | December 04 2013 | December 09 2013 | December 10 2013 | 334 |
| 2014 | January 13 2014 | January 13 2014 | January 13 2014 | November 12 2014 | December 04 2014 | December 09 2014 | 66 |
| 2015 | January 07 2015 | January 07 2015 | January 07 2015 | June 09 2015 | October 12 2015 | October 12 2015 | 31 |
| 2016 | May 04 2016 | May 04 2016 | May 04 2016 | September 07 2016 | November 29 2016 | December 13 2016 | 32 |
| 2017 | February 09 2017 | March 29 2017 | March 29 2017 | July 07 2017 | October 17 2017 | December 13 2017 | 1083 |
| 2018 | February 26 2018 | February 27 2018 | May 29 2018 | December 10 2018 | December 11 2018 | December 11 2018 | 406 |
| 2019 | January 14 2019 | March 13 2019 | March 27 2019 | September 12 2019 | November 07 2019 | December 11 2019 | 945 |
| 2020 | January 28 2020 | June 23 2020 | July 27 2020 | November 05 2020 | November 05 2020 | December 01 2020 | 321 |
| 2021 | February 22 2021 | February 22 2021 | February 22 2021 | February 22 2021 | February 22 2021 | February 22 2021 | 1 |

### Larval Longfin Smelt

(<20 mm FL, cohort year set to just calendar year)

| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1995 | April 28 1995 | April 28 1995 | April 28 1995 | May 26 1995 | May 26 1995 | June 09 1995 | 146 |
| 1996 | April 14 1996 | April 14 1996 | April 14 1996 | April 17 1996 | April 17 1996 | May 29 1996 | 2759 |
| 1997 | April 18 1997 | April 18 1997 | April 18 1997 | April 18 1997 | April 18 1997 | April 18 1997 | 14 |
| 1998 | April 10 1998 | April 10 1998 | April 10 1998 | May 08 1998 | May 08 1998 | June 05 1998 | 398 |
| 1999 | April 15 1999 | April 15 1999 | April 15 1999 | May 13 1999 | May 13 1999 | June 25 1999 | 43 |
| 2000 | March 24 2000 | March 24 2000 | March 24 2000 | May 04 2000 | May 04 2000 | September 11 2000 | 298 |
| 2001 | March 23 2001 | March 23 2001 | March 23 2001 | April 06 2001 | April 06 2001 | April 20 2001 | 26 |
| 2002 | March 22 2002 | March 22 2002 | March 22 2002 | March 22 2002 | June 01 2002 | June 01 2002 | 13 |
| 2004 | April 15 2004 | April 15 2004 | April 15 2004 | April 15 2004 | April 15 2004 | April 15 2004 | 1 |
| 2005 | April 02 2005 | April 02 2005 | April 02 2005 | April 29 2005 | April 29 2005 | April 29 2005 | 8 |
| 2006 | March 24 2006 | April 22 2006 | April 22 2006 | May 06 2006 | May 19 2006 | May 19 2006 | 7006 |
| 2007 | March 30 2007 | March 30 2007 | March 30 2007 | April 13 2007 | April 13 2007 | April 13 2007 | 6 |
| 2008 | March 20 2008 | March 20 2008 | March 20 2008 | March 20 2008 | March 20 2008 | March 20 2008 | 3 |
| 2009 | March 13 2009 | March 13 2009 | March 13 2009 | March 26 2009 | April 24 2009 | May 08 2009 | 31 |
| 2010 | March 17 2010 | March 17 2010 | March 17 2010 | April 14 2010 | April 14 2010 | May 26 2010 | 37 |
| 2011 | March 17 2011 | April 25 2011 | April 25 2011 | April 25 2011 | April 25 2011 | May 10 2011 | 2972 |
| 2012 | March 14 2012 | March 14 2012 | March 14 2012 | May 23 2012 | May 23 2012 | May 23 2012 | 7 |
| 2013 | April 10 2013 | April 10 2013 | April 10 2013 | April 24 2013 | April 24 2013 | April 24 2013 | 8 |
| 2017 | March 15 2017 | March 15 2017 | March 15 2017 | April 26 2017 | April 26 2017 | May 10 2017 | 1530 |
| 2018 | March 28 2018 | March 28 2018 | March 28 2018 | March 28 2018 | March 28 2018 | March 28 2018 | 1 |
| 2019 | March 13 2019 | March 13 2019 | March 27 2019 | April 24 2019 | April 24 2019 | May 22 2019 | 1784 |

## Suisun Bay and Suisun Marsh



### Adult Longfin Smelt

(mature and immature adults of >84 mm FL, cohort year set to July 1st - June 30th)

| ‘Cohort’ Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | July 03 1994 | November 30 1994 | December 07 1994 | February 10 1995 | March 06 1995 | June 12 1995 | 1929 |
| 1995 | August 09 1995 | January 03 1996 | January 04 1996 | May 13 1996 | May 13 1996 | June 27 1996 | 2003 |
| 1996 | July 10 1996 | December 08 1996 | December 17 1996 | January 23 1997 | March 03 1997 | June 30 1997 | 11703 |
| 1997 | July 15 1997 | December 06 1997 | December 09 1997 | January 12 1998 | January 26 1998 | June 03 1998 | 1879 |
| 1998 | September 16 1998 | December 07 1998 | December 09 1998 | May 19 1999 | June 08 1999 | June 16 1999 | 1421 |
| 1999 | July 07 1999 | December 04 1999 | December 16 1999 | March 06 2000 | May 09 2000 | June 14 2000 | 2826 |
| 2000 | July 11 2000 | December 08 2000 | December 20 2000 | March 19 2001 | April 12 2001 | June 13 2001 | 1761 |
| 2001 | July 03 2001 | December 12 2001 | December 19 2001 | January 22 2002 | February 27 2002 | June 18 2002 | 6671 |
| 2002 | July 10 2002 | December 17 2002 | December 24 2002 | January 22 2003 | January 31 2003 | June 24 2003 | 1913 |
| 2003 | July 14 2003 | December 14 2003 | December 17 2003 | January 12 2004 | March 02 2004 | June 30 2004 | 4916 |
| 2004 | July 07 2004 | December 07 2004 | December 16 2004 | January 24 2005 | February 14 2005 | June 23 2005 | 1438 |
| 2005 | July 25 2005 | December 07 2005 | December 10 2005 | February 09 2006 | February 22 2006 | April 21 2006 | 725 |
| 2006 | July 17 2006 | November 11 2006 | December 17 2006 | April 20 2007 | May 06 2007 | June 13 2007 | 211 |
| 2007 | August 13 2007 | December 01 2007 | December 11 2007 | February 12 2008 | February 26 2008 | April 02 2008 | 722 |
| 2008 | October 22 2008 | November 24 2008 | December 09 2008 | March 18 2009 | April 15 2009 | June 25 2009 | 376 |
| 2009 | July 07 2009 | December 09 2009 | December 16 2009 | March 10 2010 | March 15 2010 | May 27 2010 | 586 |
| 2010 | October 07 2010 | December 17 2010 | December 17 2010 | January 11 2011 | February 25 2011 | June 07 2011 | 238 |
| 2011 | August 02 2011 | October 26 2011 | November 14 2011 | March 06 2012 | March 20 2012 | June 05 2012 | 200 |
| 2012 | September 10 2012 | December 10 2012 | December 17 2012 | January 11 2013 | February 15 2013 | May 13 2013 | 1038 |
| 2013 | September 09 2013 | November 12 2013 | November 25 2013 | February 26 2014 | March 19 2014 | May 15 2014 | 116 |
| 2014 | September 03 2014 | December 10 2014 | December 19 2014 | March 02 2015 | April 07 2015 | June 08 2015 | 113 |
| 2015 | July 10 2015 | July 10 2015 | September 17 2015 | February 12 2016 | February 22 2016 | February 24 2016 | 20 |
| 2016 | November 08 2016 | December 09 2016 | December 19 2016 | March 01 2017 | March 06 2017 | March 22 2017 | 77 |
| 2017 | October 10 2017 | November 07 2017 | December 05 2017 | May 03 2018 | May 03 2018 | May 23 2018 | 112 |
| 2018 | August 15 2018 | November 08 2018 | December 04 2018 | March 06 2019 | March 15 2019 | June 17 2019 | 173 |
| 2019 | July 05 2019 | October 23 2019 | December 03 2019 | February 28 2020 | March 12 2020 | June 11 2020 | 98 |
| 2020 | July 07 2020 | September 15 2020 | October 15 2020 | February 12 2021 | February 12 2021 | April 29 2021 | 32 |

### Juvenile Longfin Smelt

(20-84 mm FL, cohort year set to January 1st - December 31st; same as calendar year)

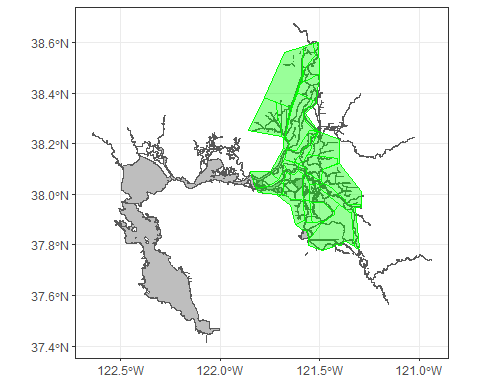
| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | January 03 1994 | January 11 1994 | March 08 1994 | June 14 1994 | June 17 1994 | December 31 1994 | 10221 |
| 1995 | January 03 1995 | April 28 1995 | May 12 1995 | December 06 1995 | December 20 1995 | December 28 1995 | 8856 |
| 1996 | January 03 1996 | January 04 1996 | January 11 1996 | June 29 1996 | July 29 1996 | December 30 1996 | 15855 |
| 1997 | January 17 1997 | April 04 1997 | April 05 1997 | December 15 1997 | December 23 1997 | December 31 1997 | 7724 |
| 1998 | January 03 1998 | April 10 1998 | April 10 1998 | November 27 1998 | December 15 1998 | December 31 1998 | 24064 |
| 1999 | January 01 1999 | April 15 1999 | April 16 1999 | August 16 1999 | October 05 1999 | December 31 1999 | 41573 |
| 2000 | January 02 2000 | April 06 2000 | April 07 2000 | June 09 2000 | September 01 2000 | December 20 2000 | 63160 |
| 2001 | January 03 2001 | February 06 2001 | March 24 2001 | May 30 2001 | June 03 2001 | December 31 2001 | 24142 |
| 2002 | January 02 2002 | March 21 2002 | March 22 2002 | June 14 2002 | October 18 2002 | December 31 2002 | 18238 |
| 2003 | January 02 2003 | March 26 2003 | March 28 2003 | May 22 2003 | October 08 2003 | December 31 2003 | 8288 |
| 2004 | January 02 2004 | January 27 2004 | February 02 2004 | September 08 2004 | December 09 2004 | December 31 2004 | 4078 |
| 2005 | January 02 2005 | January 05 2005 | January 24 2005 | June 09 2005 | September 07 2005 | December 28 2005 | 2387 |
| 2006 | January 10 2006 | March 24 2006 | March 24 2006 | October 03 2006 | November 07 2006 | December 31 2006 | 1324 |
| 2007 | January 04 2007 | January 10 2007 | January 22 2007 | May 26 2007 | June 07 2007 | December 30 2007 | 1081 |
| 2008 | January 02 2008 | March 19 2008 | March 19 2008 | June 04 2008 | June 18 2008 | December 24 2008 | 10528 |
| 2009 | January 02 2009 | March 12 2009 | March 25 2009 | June 11 2009 | June 17 2009 | December 23 2009 | 2295 |
| 2010 | January 05 2010 | March 16 2010 | March 17 2010 | May 13 2010 | May 25 2010 | December 06 2010 | 4829 |
| 2011 | January 05 2011 | March 16 2011 | April 13 2011 | June 17 2011 | November 14 2011 | December 30 2011 | 4451 |
| 2012 | January 04 2012 | February 24 2012 | March 28 2012 | June 13 2012 | June 27 2012 | December 21 2012 | 1470 |
| 2013 | January 04 2013 | April 09 2013 | April 09 2013 | June 06 2013 | June 12 2013 | December 11 2013 | 11590 |
| 2014 | January 07 2014 | March 19 2014 | March 20 2014 | May 15 2014 | June 18 2014 | December 31 2014 | 1081 |
| 2015 | January 02 2015 | January 06 2015 | January 06 2015 | May 12 2015 | May 27 2015 | June 09 2015 | 315 |
| 2016 | February 03 2016 | March 10 2016 | March 29 2016 | May 11 2016 | May 24 2016 | December 27 2016 | 739 |
| 2017 | January 03 2017 | March 30 2017 | March 30 2017 | October 18 2017 | November 30 2017 | December 28 2017 | 1272 |
| 2018 | January 04 2018 | February 08 2018 | March 28 2018 | August 29 2018 | December 20 2018 | December 30 2018 | 1672 |
| 2019 | January 01 2019 | March 28 2019 | April 11 2019 | June 06 2019 | June 26 2019 | December 23 2019 | 4317 |
| 2020 | January 03 2020 | April 06 2020 | April 22 2020 | June 18 2020 | June 22 2020 | December 28 2020 | 1538 |
| 2021 | January 04 2021 | April 07 2021 | April 07 2021 | May 19 2021 | June 04 2021 | August 11 2021 | 2206 |

### Larval Longfin Smelt

(<20 mm FL, cohort year set to just calendar year)

| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | March 18 1994 | March 18 1994 | March 18 1994 | April 24 1994 | April 24 1994 | April 24 1994 | 4 |
| 1995 | April 27 1995 | April 27 1995 | April 27 1995 | May 12 1995 | May 25 1995 | June 27 1995 | 386 |
| 1996 | April 12 1996 | April 13 1996 | April 16 1996 | May 13 1996 | May 14 1996 | June 29 1996 | 9816 |
| 1997 | April 04 1997 | April 04 1997 | April 04 1997 | April 19 1997 | April 30 1997 | June 01 1997 | 6650 |
| 1998 | April 10 1998 | April 10 1998 | April 10 1998 | April 10 1998 | April 10 1998 | June 19 1998 | 10706 |
| 1999 | April 14 1999 | April 15 1999 | April 15 1999 | April 30 1999 | May 14 1999 | July 23 1999 | 28194 |
| 2000 | March 23 2000 | March 24 2000 | April 06 2000 | April 21 2000 | April 22 2000 | June 17 2000 | 100249 |
| 2001 | March 21 2001 | March 22 2001 | March 23 2001 | April 20 2001 | April 20 2001 | July 12 2001 | 49415 |
| 2002 | March 20 2002 | March 20 2002 | March 21 2002 | April 17 2002 | April 18 2002 | July 31 2002 | 24859 |
| 2003 | March 26 2003 | March 26 2003 | March 26 2003 | April 11 2003 | April 25 2003 | June 07 2003 | 13196 |
| 2004 | April 01 2004 | April 01 2004 | April 01 2004 | April 16 2004 | April 28 2004 | May 28 2004 | 7392 |
| 2005 | March 17 2005 | March 17 2005 | March 18 2005 | April 27 2005 | April 29 2005 | June 15 2005 | 5572 |
| 2006 | March 23 2006 | March 24 2006 | March 24 2006 | June 02 2006 | June 03 2006 | July 13 2006 | 709 |
| 2007 | March 16 2007 | March 17 2007 | March 17 2007 | April 13 2007 | April 25 2007 | May 12 2007 | 2085 |
| 2008 | March 06 2008 | March 18 2008 | March 19 2008 | April 30 2008 | April 30 2008 | June 12 2008 | 10952 |
| 2009 | January 07 2009 | February 04 2009 | February 18 2009 | April 08 2009 | April 21 2009 | June 11 2009 | 15885 |
| 2010 | January 04 2010 | January 19 2010 | February 01 2010 | April 14 2010 | April 28 2010 | May 26 2010 | 24279 |
| 2011 | January 18 2011 | January 31 2011 | January 31 2011 | May 11 2011 | May 11 2011 | June 30 2011 | 15228 |
| 2012 | January 09 2012 | January 09 2012 | January 23 2012 | April 11 2012 | May 08 2012 | June 06 2012 | 13242 |
| 2013 | January 02 2013 | February 11 2013 | February 11 2013 | April 10 2013 | April 23 2013 | July 03 2013 | 37186 |
| 2014 | January 06 2014 | January 06 2014 | January 21 2014 | April 02 2014 | April 15 2014 | April 30 2014 | 2996 |
| 2015 | January 08 2015 | January 08 2015 | January 22 2015 | March 20 2015 | April 03 2015 | April 28 2015 | 774 |
| 2016 | January 04 2016 | January 20 2016 | February 03 2016 | April 26 2016 | April 26 2016 | May 23 2016 | 1149 |
| 2017 | January 05 2017 | March 16 2017 | March 16 2017 | May 10 2017 | May 11 2017 | May 25 2017 | 1297 |
| 2018 | January 03 2018 | January 18 2018 | January 31 2018 | April 24 2018 | April 25 2018 | June 05 2018 | 4270 |
| 2019 | January 03 2019 | January 17 2019 | January 30 2019 | May 10 2019 | May 10 2019 | June 05 2019 | 4182 |
| 2020 | January 08 2020 | January 21 2020 | January 21 2020 | April 22 2020 | April 28 2020 | May 20 2020 | 2753 |
| 2021 | January 12 2021 | January 13 2021 | February 10 2021 | April 07 2021 | April 21 2021 | May 19 2021 | 1570 |

## Sacramento and San-Joaquin Delta



### Timing of Adult Longfin Smelt Migration into the Delta

Per conversation with Trinh Nguyen, who is working on a Longfin Smelt migration window model using Chipps Island Trawl data with Jim Hobbs and Michael Eakin, 2+ year old Longfin Smelt catch are defined as “spawning adults” moving into the Delta.

Size cut-off for their study was >=98 mm FL.

| Water Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1995 | October 14 1994 | December 06 1994 | December 10 1994 | February 08 1995 | February 13 1995 | August 31 1995 | 1422 |
| 1996 | November 07 1995 | December 20 1995 | December 28 1995 | February 29 1996 | April 19 1996 | August 05 1996 | 235 |
| 1997 | October 28 1996 | December 17 1996 | December 18 1996 | January 21 1997 | February 04 1997 | July 28 1997 | 9072 |
| 1998 | October 03 1997 | December 07 1997 | December 13 1997 | January 14 1998 | January 26 1998 | June 03 1998 | 1278 |
| 1999 | November 10 1998 | December 05 1998 | December 08 1998 | February 26 1999 | May 19 1999 | September 30 1999 | 417 |
| 2000 | November 24 1999 | December 15 1999 | December 17 1999 | February 01 2000 | February 29 2000 | September 01 2000 | 1766 |
| 2001 | October 20 2000 | December 08 2000 | December 18 2000 | March 19 2001 | March 23 2001 | September 21 2001 | 579 |
| 2002 | October 17 2001 | December 17 2001 | December 19 2001 | January 21 2002 | January 26 2002 | June 15 2002 | 6145 |
| 2003 | November 14 2002 | December 19 2002 | December 23 2002 | January 15 2003 | January 17 2003 | June 18 2003 | 1110 |
| 2004 | November 21 2003 | December 16 2003 | December 18 2003 | January 09 2004 | January 14 2004 | August 31 2004 | 4357 |
| 2005 | October 27 2004 | December 17 2004 | December 18 2004 | January 18 2005 | February 02 2005 | September 19 2005 | 999 |
| 2006 | November 23 2005 | December 08 2005 | December 11 2005 | February 09 2006 | February 15 2006 | April 21 2006 | 565 |
| 2007 | November 11 2006 | December 23 2006 | December 29 2006 | January 27 2007 | February 27 2007 | May 23 2007 | 83 |
| 2008 | November 17 2007 | December 01 2007 | December 12 2007 | February 12 2008 | February 26 2008 | March 27 2008 | 568 |
| 2009 | November 10 2008 | December 08 2008 | December 17 2008 | March 09 2009 | March 18 2009 | April 15 2009 | 171 |
| 2010 | December 07 2009 | December 11 2009 | December 18 2009 | March 10 2010 | March 12 2010 | March 24 2010 | 492 |
| 2011 | December 13 2010 | December 17 2010 | December 17 2010 | January 05 2011 | January 07 2011 | March 02 2011 | 203 |
| 2012 | November 02 2011 | December 05 2011 | December 05 2011 | March 02 2012 | March 09 2012 | March 27 2012 | 49 |
| 2013 | October 22 2012 | December 14 2012 | December 17 2012 | January 09 2013 | January 18 2013 | April 26 2013 | 962 |
| 2014 | November 25 2013 | November 29 2013 | November 29 2013 | March 12 2014 | March 21 2014 | April 11 2014 | 59 |
| 2015 | November 26 2014 | December 10 2014 | December 17 2014 | March 02 2015 | March 02 2015 | July 10 2015 | 60 |
| 2016 | December 18 2015 | December 18 2015 | December 18 2015 | February 24 2016 | February 24 2016 | February 24 2016 | 8 |
| 2017 | December 19 2016 | December 19 2016 | December 21 2016 | March 05 2017 | March 05 2017 | March 11 2017 | 20 |
| 2018 | December 11 2017 | December 11 2017 | December 11 2017 | January 26 2018 | February 18 2018 | February 18 2018 | 10 |
| 2019 | December 04 2018 | December 20 2018 | December 27 2018 | March 03 2019 | March 15 2019 | March 15 2019 | 84 |
| 2020 | October 23 2019 | December 15 2019 | December 16 2019 | February 16 2020 | February 19 2020 | June 10 2020 | 27 |
| 2021 | November 25 2020 | November 25 2020 | November 25 2020 | December 27 2020 | December 27 2020 | December 27 2020 | 5 |

### Adult Longfin Smelt

(mature and immature adults of >84 mm FL, cohort year set to July 1st - June 30th)

| ‘Cohort’ Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | October 11 1994 | October 11 1994 | December 12 1994 | February 09 1995 | February 09 1995 | February 09 1995 | 52 |
| 1995 | October 17 1995 | October 17 1995 | October 17 1995 | January 09 1996 | January 09 1996 | January 09 1996 | 23 |
| 1996 | November 04 1996 | December 02 1996 | December 12 1996 | March 06 1997 | March 06 1997 | March 06 1997 | 51 |
| 1997 | November 03 1997 | November 12 1997 | November 12 1997 | March 09 1998 | March 09 1998 | March 09 1998 | 25 |
| 1998 | November 02 1998 | November 02 1998 | November 02 1998 | February 01 1999 | March 15 1999 | March 15 1999 | 10 |
| 1999 | September 28 1999 | November 02 1999 | December 02 1999 | January 20 2000 | March 06 2000 | April 03 2000 | 37 |
| 2000 | October 05 2000 | November 14 2000 | December 05 2000 | February 08 2001 | February 20 2001 | February 20 2001 | 146 |
| 2001 | October 10 2001 | October 24 2001 | November 08 2001 | March 06 2002 | March 12 2002 | April 15 2002 | 97 |
| 2002 | October 10 2002 | October 10 2002 | October 10 2002 | February 03 2003 | February 03 2003 | February 03 2003 | 8 |
| 2003 | September 15 2003 | November 06 2003 | December 01 2003 | January 05 2004 | January 13 2004 | February 02 2004 | 56 |
| 2004 | January 03 2005 | January 03 2005 | January 03 2005 | March 07 2005 | March 07 2005 | March 07 2005 | 11 |
| 2005 | September 12 2005 | September 12 2005 | September 12 2005 | March 08 2006 | March 08 2006 | March 08 2006 | 9 |
| 2006 | November 15 2006 | November 15 2006 | November 15 2006 | March 05 2007 | March 05 2007 | March 05 2007 | 7 |
| 2007 | November 15 2007 | December 03 2007 | December 03 2007 | March 03 2008 | March 03 2008 | March 10 2008 | 22 |
| 2008 | October 16 2008 | October 16 2008 | December 09 2008 | February 03 2009 | February 03 2009 | March 02 2009 | 20 |
| 2009 | November 30 2009 | November 30 2009 | November 30 2009 | March 10 2010 | March 10 2010 | March 10 2010 | 16 |
| 2010 | December 21 2010 | December 21 2010 | January 10 2011 | January 12 2011 | January 12 2011 | January 12 2011 | 13 |
| 2011 | November 15 2011 | December 05 2011 | December 05 2011 | February 06 2012 | March 05 2012 | April 02 2012 | 54 |
| 2012 | December 03 2012 | December 12 2012 | December 12 2012 | March 04 2013 | March 04 2013 | March 04 2013 | 55 |
| 2013 | October 09 2013 | October 09 2013 | November 13 2013 | December 10 2013 | January 06 2014 | January 06 2014 | 12 |
| 2014 | January 05 2015 | January 05 2015 | January 05 2015 | May 04 2015 | May 04 2015 | May 04 2015 | 8 |
| 2016 | December 06 2016 | December 06 2016 | December 06 2016 | March 21 2017 | March 21 2017 | March 21 2017 | 6 |
| 2017 | December 05 2017 | December 05 2017 | December 05 2017 | March 27 2018 | March 27 2018 | March 27 2018 | 6 |
| 2018 | December 10 2018 | December 10 2018 | December 10 2018 | February 05 2019 | February 05 2019 | February 05 2019 | 9 |
| 2019 | December 02 2019 | December 02 2019 | December 02 2019 | March 12 2020 | March 12 2020 | March 12 2020 | 6 |
| 2020 | December 08 2020 | December 08 2020 | December 08 2020 | March 03 2021 | March 03 2021 | March 03 2021 | 7 |

### Juvenile Longfin Smelt

(20-84 mm FL, cohort year set to January 1st - December 31st; same as calendar year)

| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1994 | January 07 1994 | January 14 1994 | January 14 1994 | June 16 1994 | July 14 1994 | November 15 1994 | 43 |
| 1995 | January 05 1995 | October 17 1995 | November 06 1995 | December 11 1995 | December 11 1995 | December 11 1995 | 373 |
| 1996 | January 03 1996 | January 04 1996 | January 04 1996 | December 02 1996 | December 02 1996 | December 02 1996 | 55 |
| 1997 | April 14 1997 | April 15 1997 | April 16 1997 | May 14 1997 | May 14 1997 | December 04 1997 | 3492 |
| 1998 | January 13 1998 | October 20 1998 | October 20 1998 | November 04 1998 | November 04 1998 | November 04 1998 | 358 |
| 1999 | January 04 1999 | April 14 1999 | April 27 1999 | September 28 1999 | November 04 1999 | November 04 1999 | 146 |
| 2000 | January 10 2000 | May 02 2000 | May 08 2000 | December 07 2000 | December 07 2000 | December 11 2000 | 840 |
| 2001 | January 03 2001 | January 05 2001 | January 08 2001 | May 30 2001 | May 31 2001 | December 03 2001 | 940 |
| 2002 | March 18 2002 | April 15 2002 | April 15 2002 | June 14 2002 | June 17 2002 | December 10 2002 | 3000 |
| 2003 | March 24 2003 | April 07 2003 | April 07 2003 | December 01 2003 | December 04 2003 | December 04 2003 | 167 |
| 2004 | January 05 2004 | May 10 2004 | May 11 2004 | June 23 2004 | July 08 2004 | December 13 2004 | 365 |
| 2005 | March 14 2005 | March 14 2005 | March 14 2005 | November 07 2005 | December 08 2005 | December 08 2005 | 32 |
| 2006 | January 20 2006 | May 01 2006 | September 14 2006 | November 15 2006 | December 04 2006 | December 04 2006 | 40 |
| 2007 | January 03 2007 | January 03 2007 | January 03 2007 | May 23 2007 | June 06 2007 | November 15 2007 | 81 |
| 2008 | March 17 2008 | April 15 2008 | April 30 2008 | June 03 2008 | June 24 2008 | December 16 2008 | 951 |
| 2009 | January 06 2009 | April 06 2009 | April 20 2009 | June 03 2009 | June 10 2009 | December 10 2009 | 373 |
| 2010 | March 29 2010 | April 01 2010 | April 14 2010 | May 26 2010 | May 26 2010 | December 06 2010 | 146 |
| 2011 | April 06 2011 | June 14 2011 | June 28 2011 | December 12 2011 | December 12 2011 | December 12 2011 | 79 |
| 2012 | January 03 2012 | January 03 2012 | March 05 2012 | June 04 2012 | June 11 2012 | June 26 2012 | 123 |
| 2013 | March 12 2013 | April 10 2013 | April 23 2013 | May 08 2013 | May 08 2013 | December 10 2013 | 8565 |
| 2014 | January 06 2014 | March 18 2014 | March 21 2014 | May 14 2014 | June 03 2014 | December 09 2014 | 257 |
| 2015 | January 05 2015 | March 30 2015 | April 02 2015 | May 11 2015 | May 12 2015 | June 08 2015 | 128 |
| 2016 | May 04 2016 | May 04 2016 | May 04 2016 | May 23 2016 | May 25 2016 | June 08 2016 | 21 |
| 2017 | February 10 2017 | February 10 2017 | February 15 2017 | December 05 2017 | December 05 2017 | December 05 2017 | 11 |
| 2018 | January 18 2018 | January 18 2018 | January 18 2018 | December 10 2018 | December 10 2018 | December 10 2018 | 6 |
| 2019 | January 16 2019 | January 16 2019 | January 24 2019 | December 03 2019 | December 04 2019 | December 04 2019 | 16 |
| 2020 | March 16 2020 | April 27 2020 | May 12 2020 | May 12 2020 | May 12 2020 | June 12 2020 | 132 |
| 2021 | January 20 2021 | April 06 2021 | April 07 2021 | May 05 2021 | May 19 2021 | June 19 2021 | 3794 |

### Larval Longfin Smelt

(<20 mm FL, cohort year set to just calendar year)

| Calendar Year | 0.0% | 5.0% | 10.0% | 90.0% | 95.0% | 100.0% | Sample size |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1996 | April 24 1996 | April 30 1996 | April 30 1996 | April 30 1996 | April 30 1996 | April 30 1996 | 69 |
| 1997 | March 31 1997 | April 15 1997 | April 15 1997 | April 30 1997 | May 14 1997 | May 15 1997 | 1790 |
| 1999 | April 12 1999 | April 14 1999 | April 14 1999 | May 13 1999 | May 15 1999 | May 23 1999 | 130 |
| 2000 | March 22 2000 | April 05 2000 | April 05 2000 | May 08 2000 | May 08 2000 | June 14 2000 | 989 |
| 2001 | March 19 2001 | March 21 2001 | March 21 2001 | May 01 2001 | May 15 2001 | May 29 2001 | 962 |
| 2002 | March 18 2002 | March 19 2002 | March 20 2002 | May 01 2002 | May 13 2002 | June 14 2002 | 3244 |
| 2003 | March 24 2003 | March 24 2003 | March 25 2003 | April 23 2003 | April 23 2003 | May 06 2003 | 356 |
| 2004 | March 29 2004 | March 30 2004 | April 01 2004 | May 11 2004 | May 12 2004 | June 10 2004 | 100 |
| 2005 | March 14 2005 | March 14 2005 | March 14 2005 | April 26 2005 | April 27 2005 | June 21 2005 | 134 |
| 2006 | April 18 2006 | April 18 2006 | May 01 2006 | August 16 2006 | August 16 2006 | August 16 2006 | 11 |
| 2007 | March 14 2007 | March 27 2007 | March 28 2007 | May 09 2007 | May 09 2007 | May 11 2007 | 83 |
| 2008 | March 05 2008 | March 18 2008 | April 01 2008 | May 15 2008 | May 16 2008 | June 12 2008 | 1453 |
| 2009 | January 05 2009 | January 20 2009 | January 21 2009 | April 07 2009 | April 21 2009 | June 03 2009 | 3598 |
| 2010 | January 04 2010 | January 05 2010 | January 05 2010 | March 24 2010 | April 14 2010 | May 26 2010 | 3268 |
| 2011 | January 18 2011 | January 18 2011 | January 31 2011 | February 15 2011 | March 14 2011 | April 26 2011 | 3001 |
| 2012 | January 09 2012 | January 10 2012 | January 10 2012 | March 06 2012 | March 14 2012 | May 23 2012 | 4178 |
| 2013 | January 02 2013 | January 29 2013 | February 11 2013 | April 24 2013 | May 07 2013 | June 03 2013 | 11822 |
| 2014 | January 06 2014 | January 21 2014 | January 22 2014 | March 04 2014 | March 19 2014 | May 13 2014 | 3502 |
| 2015 | January 05 2015 | January 22 2015 | February 02 2015 | April 13 2015 | April 27 2015 | May 11 2015 | 434 |
| 2016 | January 04 2016 | January 04 2016 | January 05 2016 | March 16 2016 | April 12 2016 | May 23 2016 | 166 |
| 2017 | January 04 2017 | January 04 2017 | January 17 2017 | April 12 2017 | June 07 2017 | June 07 2017 | 13 |
| 2018 | January 02 2018 | January 03 2018 | January 03 2018 | February 28 2018 | February 28 2018 | May 21 2018 | 178 |
| 2019 | January 02 2019 | January 03 2019 | January 03 2019 | January 29 2019 | January 29 2019 | February 26 2019 | 82 |
| 2020 | January 06 2020 | January 08 2020 | January 22 2020 | March 17 2020 | March 31 2020 | December 28 2020 | 899 |
| 2021 | January 11 2021 | January 26 2021 | February 25 2021 | April 21 2021 | May 05 2021 | June 03 2021 | 3727 |