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ASSESSMENT OF THE PACIFIC SARDINE RESOURCE IN 2016 FOR U.S.A. MANAGEMENT IN 2016-17

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

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National Marine Fisheries Service
Eileen Sobeck, Assistant Administrator for Fisheries

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ACRONYMS AND DEFINITIONS

ABC	acceptable biological catch
ATM	acoustic-trawl method of biomass estimation
BC	British Columbia (Canada)
Bongo	obliquely-towed ichthyoplankton net (505 micron mesh)
CA	California
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CalVET	California vertical egg tow (333 micron mesh ichthyoplankton net)
CCA	Central California fishery
CDFW	California Department of Fish and Wildlife
CDFO	Canada Department of Fisheries and Oceans
CICIMAR	Centro Interdisciplinario de Ciencias Marinas
CONAPESCA	National Commission of Aquaculture and Fishing (México)
CPS	coastal pelagic species
CPSAS	Coastal Pelagic Species Advisory Subpanel
CPSMT	Coastal Pelagic Species Management Team
CUFES	continuous underway fish egg sampler
DEPM	daily egg production method
ENS	Ensenada (México)
FMP	fishery management plan
HG	harvest guideline
INAPESCA	National Fisheries Institute (México)
Model Year	July 1 (year) to June 30 (year+1)
mt	metric tons
mmt	million metric tons
MexCal	southern sardine fleet (ENS, SCA, and CCA)
NMFS	National Marine Fisheries Service
NSP	Northern subpopulation of Pacific sardine, as defined by satellite oceanography data
NWSS	Northwest Sardine Survey (aka 'Aerial Survey')
NOAA	National Oceanic and Atmospheric Administration
ODFW	Oregon Department of Fish and Wildlife
OFL	overfishing limit
OR	Oregon
PacNW	northern sardine fleet (OR, WA, and BC)
PairoVET	Paired CalVET ichthyoplankton net (333 micron mesh)
PFMC	Pacific Fishery Management Council
SAFE	Stock Assessment and Fishery Evaluation
SCA	Southern California fishery
SCB	Southern California Bight (Pt. Conception, CA to northern Baja California)
SS	Stock Synthesis model
SSB	spawning stock biomass
SSC	Scientific and Statistical Committee
SST	sea surface temperature
STAR	Stock Assessment Review
STAT	Stock Assessment Team
SWFSC	Southwest Fisheries Science Center
TEP	Total egg production
VPA	virtual population analysis
WA	Washington
WDFW	Washington Department of Fish and Wildlife

PREFACE

The Pacific sardine resource is assessed each year in support of the Pacific Fishery Management Council (PFMC) process of recommending annual harvest specifications for the U.S. fishery. The following assessment update for 2016-17 management is based on data and methods reviewed by a Stock Assessment Review (STAR) Panel during March 2014 (STAR 2014) and more fully described in Hill et al. (2014). A stock assessment update conducted in March-April 2015 served as the basis for management measures during the 2015-16 management year (Hill et al. 2015).

The 2016 stock assessment update includes one additional year of data from fishery-dependent and fishery-independent sources. The draft assessment was reviewed by members of the Scientific and Statistical Committee's CPS Subcommittee on March 10, 2016 in Sacramento, CA. The following final draft reflects minor modifications recommended during that review and was provided to the Pacific Fishery Management Council for their April 2016 briefing book.

EXECUTIVE SUMMARY

The following Pacific sardine assessment update was conducted to inform U.S. fishery management for the cycle that begins July 1, 2016 and ends June 30, 2017. Model 'T' represented the final base model from the most recent stock assessment review (STAR) conducted in March 2014 (Hill et al. 2014, STAR 2014). In 2015, the model was updated and served as the basis for management in 2015-16 (Hill et al. 2015). This 2016 update assessment includes one additional year of data from fishery-dependent and -independent sources and is based on similar parameterizations as included in the most recently reviewed assessments (Hill et al. 2014, 2015).

Stock

This assessment focuses on the northern subpopulation of Pacific sardine (NSP) that ranges from northern Baja California, México to British Columbia, Canada and extends up to 300 nm offshore. In all past assessments, the default approach has been to assume that all catches landed in ports from Ensenada (ENS) to British Columbia (BC) were from the northern subpopulation. There is now general scientific consensus that catches landed in the Southern California Bight (SCB, i.e., Ensenada and southern California) likely represent a mixture of the southern subpopulation (warm months) and northern subpopulation (cool months) (Felix-Uraga et al. 2004, 2005; Garcia-Morales 2012; Zwolinski et al. 2011; Demer and Zwolinski 2014). Although the ranges of the northern and southern subpopulations can overlap within the SCB, the adult spawning stocks likely move north and south in synchrony each year and do not occupy the same space simultaneously to any significant extent (Garcia-Morales 2012). Satellite oceanography data (Demer and Zwolinski 2014) were used to partition catch data from Ensenada (ENS) and southern California (SCA) ports to exclude both landings and biological compositions attributed to the southern subpopulation.

Catches

The assessment includes sardine landings (metric tons) from six major fishing regions: Ensenada (ENS), southern California (SCA), central California (CCA), Oregon (OR), Washington (WA), and British Columbia (BC). Landings for each port and for the NSP over the past ten years follow:

Calendar Yr-Sem	Model Yr-Seas	ENS Total	ENS NSP	SCA Total	SCA NSP	CCA	OR	WA	BC
2006-1	2005-2	17,600.9	11,214.6	17,157.7	16,504.9	2,032.6	101.7	0.0	0.0
2006-2	2006-1	39,636.0	0.0	16,128.2	4,909.8	15,710.5	35,546.5	4,099.0	1,575.4
2007-1	2006-2	13,981.4	13,320.0	26,343.6	19,900.7	6,013.3	0.0	0.0	0.0
2007-2	2007-1	22,865.5	11,928.2	19,855.0	5,350.3	28,768.8	42,052.3	4,662.5	1,522.3
2008-1	2007-2	23,487.8	15,618.2	24,127.2	24,114.3	2,515.3	0.0	0.0	0.0
2008-2	2008-1	43,378.3	5,930.0	6,962.1	21.8	24,195.7	22,939.9	6,435.2	10,425.0
2009-1	2008-2	25,783.2	20,244.4	9,250.8	9,221.3	11,079.9	0.0	0.0	0.0
2009-2	2009-1	30,128.0	0.0	3,310.3	29.8	13,935.1	21,481.6	8,025.2	15,334.3
2010-1	2009-2	12,989.1	7,904.2	19,427.7	19,427.7	2,908.8	437.1	510.9	421.7
2010-2	2010-1	43,831.8	9,171.2	9,924.7	562.7	1,397.1	20,414.9	11,869.6	21,801.3
2011-1	2010-2	18,513.8	11,588.5	12,526.4	12,515.4	2,713.3	0.1	0.0	0.0
2011-2	2011-1	51,822.6	17,329.6	5,115.4	11.9	7,358.4	11,023.3	8,008.4	20,718.8
2012-1	2011-2	10,534.0	9,026.1	11,906.2	10,018.8	3,672.7	2,873.9	2,931.7	0.0
2012-2	2012-1	48,534.6	0.0	6,896.1	883.6	568.7	39,744.1	32,509.6	19,172.0
2013-1	2012-2	13,609.2	12,827.9	2,592.2	769.7	84.2	149.3	1,421.4	0.0
2013-2	2013-1	37,803.5	0.0	3,658.1	62.9	811.3	27,599.0	29,618.9	0.0
2014-1	2013-2	12,929.7	412.5	1,242.6	666.7	4,403.3	0.0	908.0	0.0

2014-2	2014-1	77,466.3	0.0	291.7	0.0	1,830.9	7,788.4	7,428.4	0.0
2015-1	2014-2	7,682.5	0.0	911.4	0.0	727.7	2,131.3	62.6	0.0
2015-2	2015-1	46,028.6	0.0	56.6	0.0	6.1	0.1	66.1	0.0

Data and Assessment

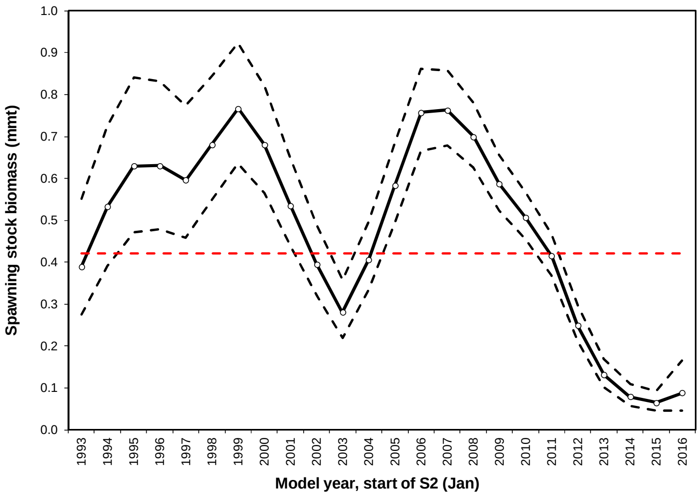
The assessment was conducted using Stock Synthesis (SS version 3.24s), and includes fishery and survey data collected from mid-1993 through 2015. The model is based on a July-June biological year (aka 'model year'), with two semester-based seasons per year (S1=Jul-Dec and S2=Jan-Jun). Catches and biological samples for the fisheries off ENS, SCA, and CCA were pooled into a single MexCal fleet (fishery), for which selectivity was modeled separately in each season (S1 and S2). Catches and biological samples from OR, WA, and BC were modeled by season as a single PacNW fleet (fishery). Three indices of abundance from ongoing surveys were included in the base model: daily and total egg production method (DEPM and TEPM) estimates of spawning stock biomass off CA (1994-2015) and acoustic-trawl method (ATM) estimates of biomass along the west coast (2006-2015). Catchability (q) for the ATM surveys (spring and summer) was fixed at 1.0 and q's for the egg production surveys were freely estimated. Length compositions from the spring and summer ATM time series were each modeled with their own asymptotic selectivities.

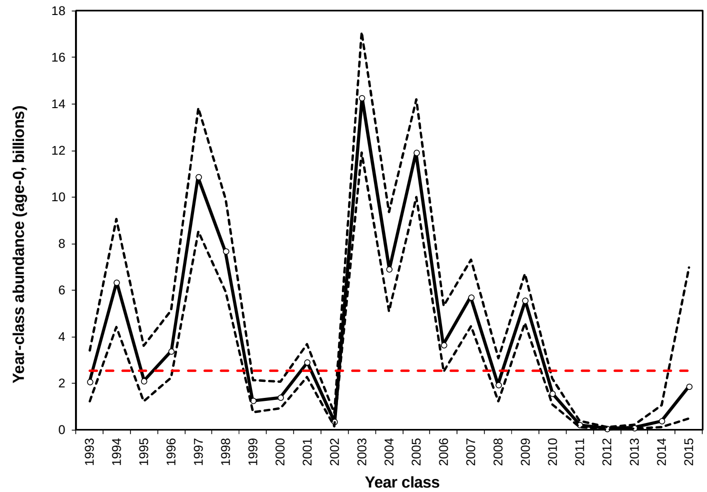
The following data were updated or appended to the update model:

- Landings for 2013 through 2015 were updated for all fishing regions (ENS to WA), including projected estimates for the first half of 2016 (model year 2015-2);
- Length compositions from SCA, CCA, OR, and WA fisheries were updated for model year 2014 and appended with new data for model year 2015-1 (Jul-Dec 2015);
- Conditional age-at-length (CAAL) data from SCA and CCA fisheries were updated through model step 2014-2 (first half of 2015). CAAL data for OR and WA fisheries were appended through 2014-1;
- A daily egg production method (DEPM) estimate of female spawning biomass (SSB) produced from the spring 2015 survey conducted between Morro Bay, CA and Newport, OR;
- ATM estimates of biomass and associated length compositions from the spring and summer 2015 surveys off the U.S. west coast were added to the model. For reasons described subsequently, the summer 2015 length composition proved problematic and was excluded from the proposed update model.

Spawning Stock Biomass and Recruitment

Recruitment was modeled using the Beverton-Holt (B-H) stock-recruitment relationship (σ_R=0.75). Steepness was fixed at 0.8 in model (Hill et al. 2014). Virgin recruitment (R_0) for the update model was estimated to be 2.548 billion age-0 fish. The virgin value of the spawning stock biomass (SSB) was estimated to be 0.422 million metric tons (mmt). The SSB increased throughout the 1990s, peaking at 0.767 mmt in 1999 and 0.763 mmt in 2007. Recruitment (age-0 abundance) peaked at 10.9 billion fish in 1997, 14.3 billion in 2003, and 11.9 billion in 2005. The 2010 to 2014 year classes were among the weakest in recent history. The 2015 year class (1.868 billion fish), predicted largely from the stock-recruitment curve, was poorly estimated (CV=0.76) given the paucity of data available for model year 2015.

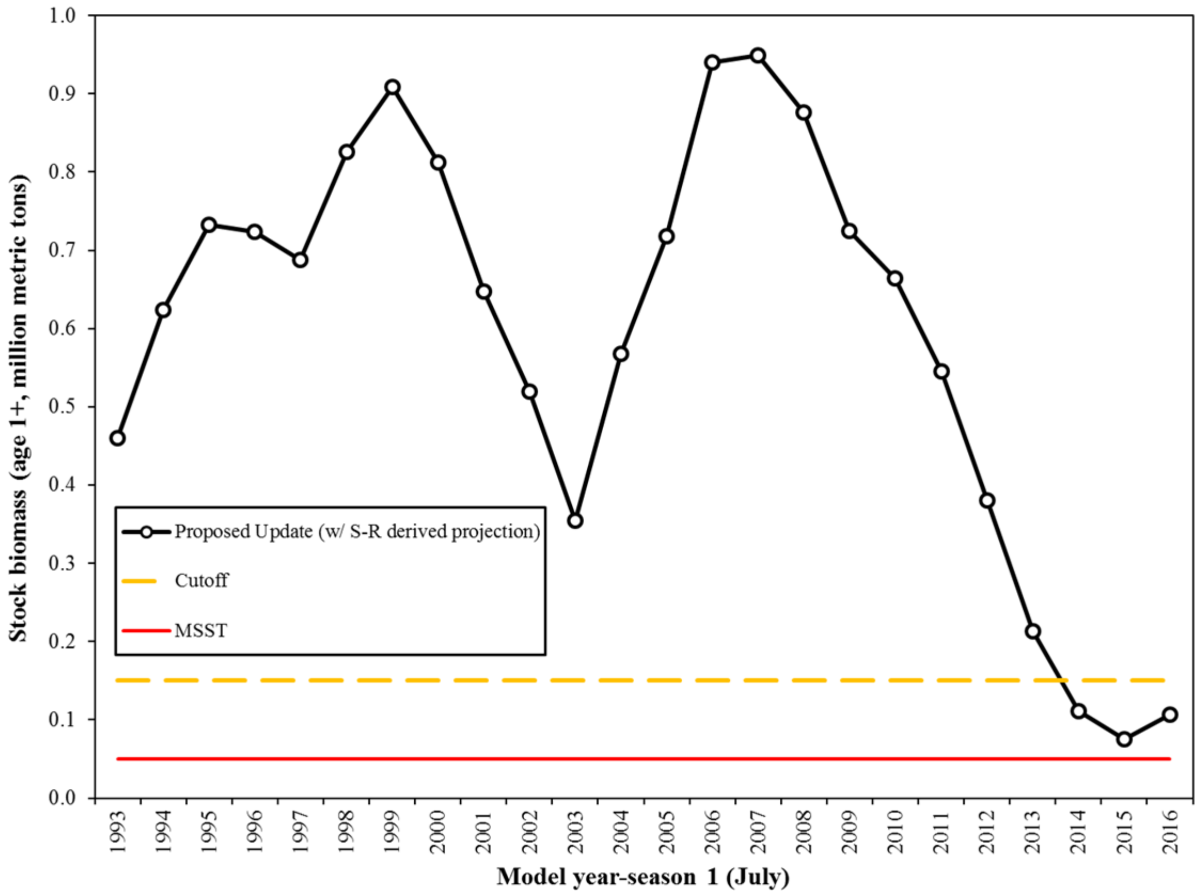




Calendar Yr-Sem	Model Yr-Seas	SSB (mt)	SSB Std Dev	Year class abundance (billions)	Recruits Std Dev
2007-1	2006-2	757,295	49,700	---	---
2007-2	2007-1	---	---	5.71836	0.71794
2008-1	2007-2	763,427	45,608	---	---
2008-2	2008-1	---	---	1.95675	0.45607
2009-1	2008-2	699,527	39,366	---	---
2009-2	2009-1	---	---	5.56375	0.53790
2010-1	2009-2	586,470	33,561	---	---
2010-2	2010-1	---	---	1.55935	0.27682
2011-1	2010-2	507,364	28,618	---	---
2011-2	2011-1	---	---	0.22770	0.06396
2012-1	2011-2	415,388	25,428	---	---
2012-2	2012-1	---	---	0.06895	0.02459
2013-1	2012-2	249,089	21,795	---	---
2013-2	2013-1	---	---	0.10403	0.03967
2014-1	2013-2	131,188	17,337	---	---
2014-2	2014-1	---	---	0.38226	0.21846
2015-1	2014-2	79,391	13,273	---	---
2015-2	2015-1	---	---	1.86812	1.41155
2016-1	2015-2	65,118	11,623	---	---
2016-2	2016-1	---	---	---	---
2017-1	2016-2	87,961	29,089	---	---

Stock Biomass

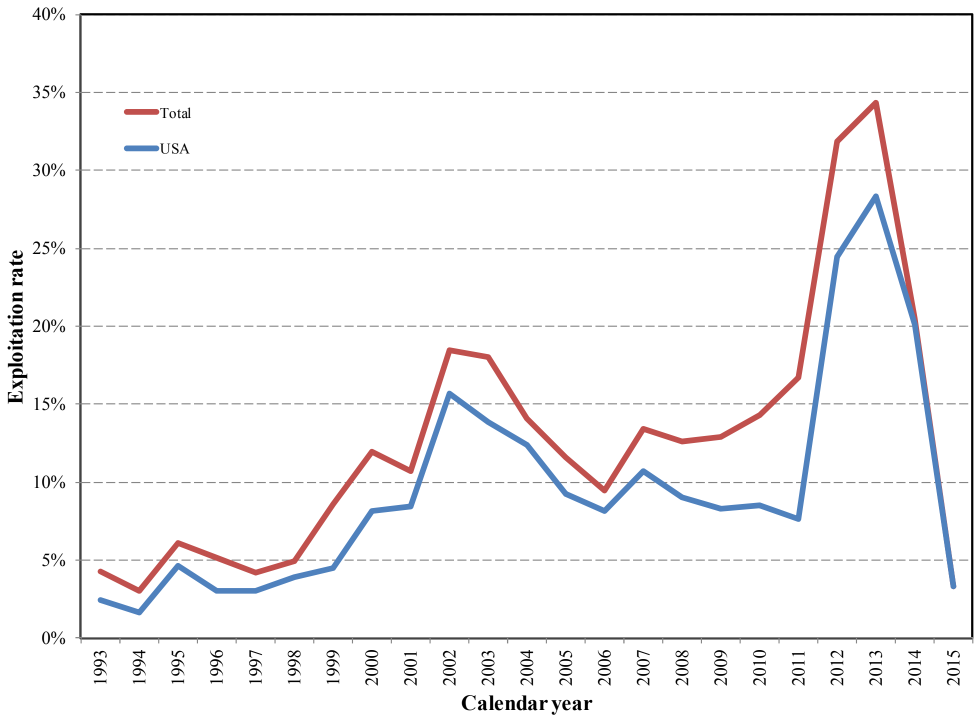
Stock biomass, used for calculating harvest specifications, is defined as the sum of the biomass for sardine ages one and older (age 1+). Stock biomass increased throughout the 1990s, peaking at 0.908 mmt in 1999 and 0.950 mmt in 2007. Stock biomass projected for July 2016 depends on assumptions regarding strength of recruitment in 2015. If the 2015 year class is estimated in SS (i.e., derived primarily from the S-R relationship), then stock biomass is projected to be **106,137 mt** in July 2016. If the 2015 year class is based on an average of recruitments from 2012-2014, then stock biomass is projected to be 64,422 mt in July 2016. Given ancillary survey evidence presented at the March 2016 update review, the SSC CPS Subcommittee recommended that the 2015 recruitment be estimated from the stock-recruitment relationship. The STAT concurred with this recommendation.



Exploitation Status

Exploitation rate is defined as the calendar year NSP catch divided by the total mid-year biomass (July-1, ages 0+). Based on update model estimates, the U.S. exploitation rate has averaged about 12% since the onset of federal management, but peaked at 28% in 2013. U.S. and total exploitation rate was 3% in 2015. U.S. and total exploitation rates for the NSP, calculated from the update model, are:

Calendar year	USA	Total
2000	8.15%	11.91%
2001	8.47%	10.68%
2002	15.70%	18.44%
2003	13.87%	18.03%
2004	12.37%	14.09%
2005	9.27%	11.59%
2006	8.14%	9.46%
2007	10.73%	13.42%
2008	9.00%	12.58%
2009	8.29%	12.91%
2010	8.50%	14.31%
2011	7.61%	16.68%
2012	24.46%	31.86%
2013	28.32%	34.32%
2014	20.14%	20.50%
2015	3.31%	3.31%



Ecosystem Considerations
Readers should consult PFMC (2014) and NMFS (2016a,b) for comprehensive information regarding environmental processes generally hypothesized to influence small pelagic finfish species, such as Pacific sardine, that inhabit the California Current Ecosystem and broader northeastern Pacific Ocean.

Harvest Control Rules
Harvest guideline
The annual HG is calculated as follows:

HG = (BIOMASS – CUTOFF) • FRACTION • DISTRIBUTION;

where HG is the total U.S. directed harvest for the period July 2016 to June 2017, BIOMASS is the stock biomass (ages 1+) projected as of July 1, 2016, CUTOFF (150,000 mt) is the lowest level of biomass for which directed harvest is allowed, FRACTION (= E_{MSY} bounded 0.05-0.20) is the percentage of biomass above the CUTOFF that can be harvested, and DISTRIBUTION (87%) is the average portion of BIOMASS assumed in U.S. waters. Based on results from the proposed update model, and for either of two 2015 year-class scenarios, stock biomass is projected to be below the 150,000 mt threshold. Therefore, the HG for 2016-2017 is calculated to be 0 mt.

OFL and ABC
On March 11, 2014, the PFMC adopted the use of CalCOFI sea-surface temperature (SST) data for specifying environmentally-dependent E_{MSY} each year. E_{MSY} is calculated:

$$E_{MSY} = -18.46452+3.25209(T)-0.19723(T^2)+0.0041863(T^3),$$

where T is the three-year running average of CalCOFI SST, and E_{MSY} for OFL and ABC is bounded 0.00 to 0.25. Based on recent warm conditions in the California Current, the average temperature for 2013-2015 has increased to 16.3891 °C and the calculated E_{MSY} is 0.2865. Therefore, E_{MSY} for the 2016-17 season is bounded at 0.25.

OFL and ABC values for 2016-17 depend on assumptions regarding strength of the 2015 year-class used to project stock biomass to July 1, 2016. As noted above, when the 2015 year class is freely estimated (but primarily derived from the spawner-recruit relationship), stock biomass is projected to be **106,137 mt** in July 2016. When the 2015 year class is based on an average of recruitments from 2012-2014, stock biomass is projected to be 64,422 mt in July 2016. OFLs and ABCs for these two recruitment scenarios and for a range of P-star values follow:

a) HCRs when 2015 YC is derived from S-R Curve (proposed approach).

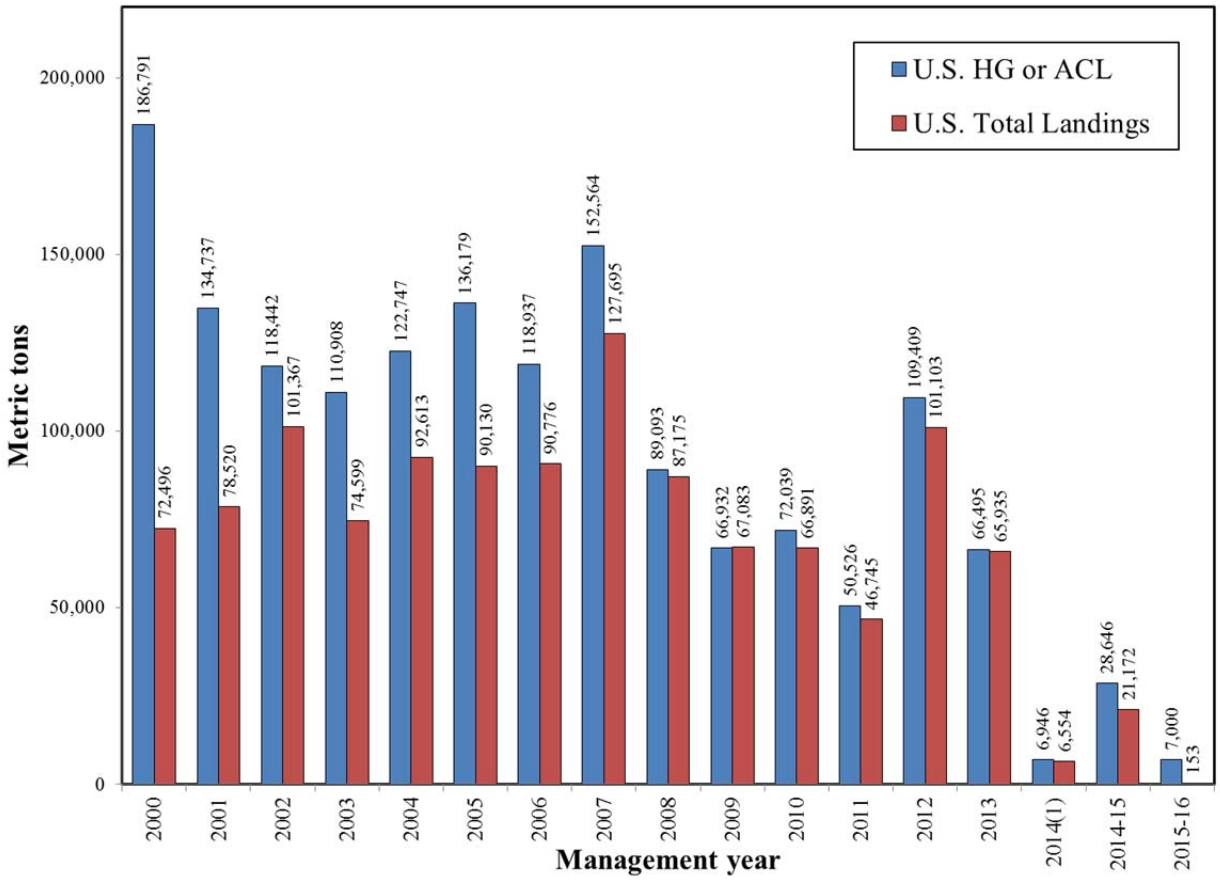
Harvest Control Rule Formulas									
OFL = BIOMASS * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
$ABC_{P\text{-}star}$ = BIOMASS * $BUFFER_{P\text{-}star}$ * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION; where FRACTION is E_{MSY} bounded 0.05 to 0.20									
Harvest Formula Parameters									
BIOMASS (ages 1+, mt)	106,137								
P-star	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05
ABC $Buffer_{Tier\ 1}$	0.9558	0.9128	0.8705	0.8280	0.7844	0.7386	0.6886	0.6304	0.5531
CalCOFI SST (2013-2015)	16.3891								
E_{MSY}	0.25								
FRACTION	0.20								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**23,085**								
$ABC_{Tier\ 1}$ =	22,064	21,072	20,095	19,113	18,108	17,051	15,896	14,553	12,769
HG =	**0**								

b) HCRs when 2015 YC is based on the average of 2012-2014 YC sizes.

Harvest Control Rule Formulas									
OFL = BIOMASS * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
$ABC_{P\text{-}star}$ = BIOMASS * $BUFFER_{P\text{-}star}$ * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION; where FRACTION is E_{MSY} bounded 0.05 to 0.20									
Harvest Formula Parameters									
BIOMASS (ages 1+, mt)	64,422								
P-star	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05
ABC $Buffer_{Tier\ 1}$	0.95577	0.91283	0.87048	0.82797	0.78442	0.73861	0.68859	0.63043	0.55314
CalCOFI SST (2013-2015)	16.3891								
E_{MSY}	0.25								
FRACTION	0.20								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**14,012**								
$ABC_{Tier\ 1}$ =	13,392	12,790	12,197	11,601	10,991	10,349	9,648	8,833	7,750
HG =	**0**								

Management performance

U.S. HG/ACL values and catches since the onset of federal management follow:



Unresolved Problems and Major Uncertainties

The biomass-weighted length composition estimated for the ATM summer 2015 survey contained an anomalously large portion of small sardine (>80% were smaller than the lowest length data bin of 9 cm). All of the small sardines sampled in summer 2015 were collected off central California. The summer ATM survey typically encounters larger fish associated with sardine movement annually to the Pacific Northwest (asymptotic selectivity inflection point is ~20 cm). Given the low probability of capturing small fish during this survey and the large portion of small fish encountered in the summer 2015 trawls, the strict update model resulted in an implausible terminal-year recruitment estimate (56.2 billion fish, reflecting a 2015 year class nearly four times greater than the largest year class in the modeled time series). Ultimately, updated selectivity for the ATM survey indicated a substantial shift to much smaller fish, and consequently, unrealistic estimated recruitment in 2015. Thus, a decision was made to exclude the summer 2015 ATM length composition from the proposed update model. The SSC's CPS Subcommittee endorsed this change during the March 2016 update review. This specific issue, along with the general problem of improving fits to length compositions from the ATM surveys, will be addressed during the next full sardine assessment in 2017.

Finally, as indicated in past CPS assessments/reviews, strength of the terminal-year recruitment is highly uncertain and poorly informed by the available data and thus, the estimate derived directly from the spawner-recruit relationship is driven by limited information and has the potential for being overly optimistic. This is important, given the terminal year recruitment (age-0) is part of the calculation of the age-1+ stock biomass projected for start of the new management year (July 1). During the 2015 sardine update assessment (Hill et al. 2015), the STAT noted a tendency of the model to over-estimate terminal year-class abundance over the recent period of poor recruitments, i.e. 2011-2013. The STAT had also noted lack of evidence to indicate any spawning success in 2014. Thus, a recommendation was made that the 2014 recruitment be based on an average of 2011-2013 year-class abundances for projecting stock biomass to July 2015. That approach was endorsed by the SSC for purposes of setting 2015-16 harvest specifications. A similar projection approach (i.e. recent average recruitment for 2012-2014) was initially proposed by the STAT for estimating 2015 recruitment in this assessment. However, ancillary survey information presented at the March 2016 update review indicated that the 2015 year-class may be higher than the recent average. Evidence included the following: 1) a marked increase in larval sardine biomass collected along the Newport hydrographic line during the NWFSC's survey conducted during Jan-Mar 2015 (Leising et al. 2015); and 2) a spike in young (4-8 cm) sardine abundance observed in all regions (North, Core, and South) during May-Jun 2015 of the SWFSC Santa Cruz Lab's 'Rockfish Recruitment and Ecosystem Assessment' survey (Sakuma 2015). Given this ancillary evidence, the SSC's CPS Subcommittee recommended basing 2015 recruitment on the model estimate derived from the stock-recruit relationship. The STAT concurred with this recommendation, but reiterates it's request to the SSC for guidance regarding more standardized approaches to addressing terminal year-class uncertainty in ongoing CPS assessments.

INTRODUCTION

Distribution, Migration, Stock Structure, Management Units

Information regarding Pacific sardine (*Sardinops sagax caerulea*) biology and population dynamics is available in Clark and Marr (1955), Ahlstrom (1960), Murphy (1966), MacCall (1979), Leet et al. (2001), as well as references cited below.

The Pacific sardine has at times been the most abundant fish species in the California Current Ecosystem (CCE). When the population is large, it is abundant from the tip of Baja California (23^{o} N latitude) to southeastern Alaska (57^{o} N latitude) and throughout the Gulf of California. Occurrence tends to be seasonal in the northern extent of its range. When sardine abundance is low, as during the 1960-70s and presently, sardines do not generally occur in high quantities commercially north of Baja California.

There is a longstanding, general consensus in the scientific community that sardines off the west coast of North America represent three subpopulations (see review by Smith 2005). A northern subpopulation (northern Baja California to Alaska; Figure 1), a southern subpopulation (outer coastal Baja California to southern California), and a Gulf of California subpopulation were distinguished on the basis of serological techniques (Vrooman 1964) and in studies of oceanography as pertaining to temperature-at-capture (Felix-Uraga et al., 2004, 2005; Garcia-Morales et al. 2012; Demer and Zwolinski 2014). An electrophoretic study (Hedgecock et al. 1989) showed, however, no genetic variation among sardines from central and southern California, the Pacific coast of Baja California, or the Gulf of California. Although the ranges of the northern and southern subpopulations can overlap within the Southern California Bight, the adult spawning stocks likely move north and south in synchrony and do not occupy the same space simultaneously to a significant extent (Garcia-Morales 2012). The northern subpopulation (NSP) is exploited by fisheries off Canada, the U.S., and northern Baja California (Figure 1), and represents the stock included in the CPS Fishery Management Plan (CPS-FMP; PFMC 1998). The 2014 assessment (Hill et al. 2014) addressed the above stock structure hypotheses in a more explicit manner, by partitioning southern (Ensenada and Southern California ports) fishery catches and composition data using an environment-based approach described by Demer and Zwolinski (2014) and in the following sections.

Pacific sardines probably migrated extensively during historical periods when abundance was high, moving as far north as British Columbia in the summer and returning to southern California and northern Baja California in the fall. Tagging studies have indicated that the older and larger fish moved farther north (Janssen 1938; Clark & Janssen 1945). Migratory patterns were probably complex, and the timing and extent of movement were affected by oceanographic conditions (Hart 1973) and stock biomass levels. During the 1950s to 1970s, a period of reduced stock size and unfavorably cold sea surface temperatures together likely caused the stock to abandon the northern portion of its range. In recent decades, the combination of increased stock size and warmer sea surface temperatures resulted in the stock re-occupying areas off Central California, Oregon, Washington, and British Columbia, as well as distant offshore waters off California. During a cooperative U.S.-U.S.S.R. research cruise for jack mackerel in 1991, several tons of sardine were collected 300 nm west of the Southern California Bight (SCB) (Macewicz and Abramenkoff 1993). Resumption of seasonal movement between the southern spawning habitat and the northern feeding habitat has been inferred by presence/absence of size classes in focused regional surveys (Lo et al. 2011a) and measured directly using the acoustic-trawl method (Demer et al. 2012).

Life History Features Affecting Management

Pacific sardines may reach 41 cm in length, but are seldom longer than 30 cm in fishery catches and survey samples. They may live up to 15 years, but fish in California commercial catches are usually younger than five years. Sardine are typically larger and two to three years older in regions off the Pacific Northwest than observed further south in waters off California. There is evidence for regional variation in size-at-age, with size increasing from south to north and from inshore to offshore (Phillips 1948, Hill 1999). Size- and age-at-maturity may decline with a decrease in biomass, latitude, and temperature (Butler 1987). At relatively low biomass levels, sardines appear to be fully mature at age one, whereas at very high biomass levels, only some of the two-year-olds are mature (MacCall 1979).

Until 1953, sardines fully recruited to the fishery when they were ages three and older (MacCall 1979). Recent fishery data indicate that sardines begin to recruit at age zero and are fully recruited to the southern California fishery (SCA) by age two. Age-dependent availability to the fishery likely depends upon the location of the fishery, with young fish unlikely to be fully available to fisheries located in the north and older fish less likely to be fully available to fisheries south of Point Conception.

Age-specific mortality estimates are available for the entire suite of life history stages (Butler et al. 1993). Mortality is high at the egg and yolk sac larvae stages (instantaneous rates in excess of 0.66 d^{-1}). The adult natural mortality rate has been estimated to be M=0.4 yr^{-1} (Murphy 1966; MacCall 1979) and 0.51 yr^{-1} (Clark and Marr 1955). Zwolinski and Demer (2013b) studied natural mortality using trends in abundance from the acoustic-trawl method (ATM) surveys (2006-2011), accounting for fishery removals, and estimated M=0.52 yr^{-1}. A natural mortality rate of M=0.4 yr^{-1} means that 33% of the adult sardine stock would die each year of natural causes. Sensitivities to assumptions regarding *M* were addressed in the 2014 assessment (Hill et al. 2014).

Pacific sardines spawn in loosely aggregated schools in the upper 50 meters of the water column. Spawning of the northern subpopulation begins in January off northern Baja California and ends by August off the Pacific Northwest (Oregon, Washington, and Vancouver Island), typically peaking off California in April. Sardine eggs are most abundant at sea-surface temperatures of 13 to 15 ^{o}C, and larvae are most abundant at 13 to 16 ^{o}C. The spatial and seasonal distribution of spawning is influenced by temperature. During periods of warm water, the center of sardine spawning shifts northward and spawning extends over a longer period of time (Butler 1987; Ahlstrom 1960). Recent spawning has been concentrated in the region offshore and north of Point Conception (Lo et al. 1996, 2005). Sardines are oviparous, multiple-batch spawners, with annual fecundity that is indeterminate and age- or size-dependent (Macewicz et al. 1996).

Ecosystem Considerations

Readers should consult PFMC (2014) and NMFS (2016a,b) for comprehensive information regarding environmental processes generally hypothesized to influence small pelagic finfish species, such as Pacific sardine, that inhabit the California Current Ecosystem and broader northeastern Pacific Ocean.

Abundance, Recruitment, and Population Dynamics

Extreme natural variability is characteristic of clupeid stocks, such as Pacific sardine (Cushing 1971). Estimates of sardine abundance from 300 AD through 1970 have been reconstructed from the deposition of fish scales in sediment cores from the Santa Barbara basin off SCA (Soutar and Issacs 1969, 1974; Baumgartner et al. 1992). Sardine populations existed throughout the period, with biomass levels varying widely on decadal time scales. Both sardine and anchovy populations tend to vary over periods of roughly 60 years, although sardines have varied more than anchovies. Estimates of sardine biomass inferred from scale-depositions in the 19th and 20th centuries suggest that abundance peaked at approximately 6 mmt in 1925 (Soutar and Isaacs 1969; Smith 1978). Declines in sardine populations have generally lasted an average of 36 years and recoveries an average of 30 years.

Pacific sardine spawning biomass (ages 2+), estimated from virtual population analysis methods, averaged 3.5 mmt from 1932 through 1934, fluctuated from 1.2 to 2.8 mmt over the next ten years, then declined steeply from 1945 to 1965, with some short-term reversals following periods of strong recruitment success (Murphy 1966; MacCall 1979). During the 1960s and 1970s, spawning biomass levels were less than about five to ten thousand mt (Barnes et al. 1992). The sardine stock began to increase by an average rate of 27% per annum in the early 1980s (Barnes et al. 1992).

Pacific sardine recruitment is highly variable. Analyses of the sardine stock recruitment relationship have resulted in inconsistent findings, with some studies showing a strong density-dependent relationship (production of young sardines declines at high levels of spawning biomass) and others, concluding no relationship (Clark and Marr 1955; Murphy 1966; MacCall 1979). Jacobson and MacCall (1995) found both density-dependent and environmental factors to be important, as was also agreed during a sardine harvest control rule workshop held in 2013 (PFMC 2013).

Relevant History of the Fishery

The sardine fishery was first developed in response to demand for food during World War I. Landings increased from 1916 to 1936, peaking at over 700,000 mt. Pacific sardines supported the largest fishery in the western hemisphere during the 1930s and 1940s, with landings in Canada, WA, OR, CA, and Mexico. The population and fishery declined, beginning in the late 1940s and with some short-term reversals, to extremely low levels in the 1970s. There was a southward shift in catch as the fishery collapsed, with landings ceasing in the Pacific Northwest in 1947 through 1948 and in San Francisco, from 1951 through 1952. Sardines were primarily reduced to fish meal, oil, and canned food, with small quantities used for bait.

In the early 1980s, sardines were taken incidentally with Pacific and jack mackerel in the SCA mackerel fishery. As sardine continued to increase in abundance, a directed purse-seine fishery was re-established. The incidental fishery for sardines ended in 1991. Besides SCA and CCA, substantial quantities of Pacific sardine have been landed at OR, WA, BC, and ENS over the past two decades, although volumes have reduced dramatically in the past two years. Total annual harvest by the Mexican fishery is not yet regulated by quotas, but there is a minimum legal size limit of 150 mm SL.

Recent Management Performance

Management authority for the U.S. Pacific sardine fishery was transferred to the PFMC in January 2000. The Pacific sardine was one of five species included in the federal CPS-FMP (PFMC 1998). The CPS-FMP includes harvest control rules intended to prevent Pacific sardines from being overfished and to maintain relatively high and consistent, long-term catch levels. Harvest control rules for Pacific sardine are provided at the end of this report. A thorough description of PFMC management actions for sardines, including HG values, may be found in the most recent CPS SAFE document (PFMC 2014). U.S. harvest specifications and landings since 2000 are displayed in Table 1 and Figure 2. Harvests in major fishing regions from ENS to BC are provided in Table 2 and Figure 3a-b.

ASSESSMENT DATA

Biological Parameters

Stock structure

For this assessment, we modeled the northern subpopulation (NSP) that ranges from northern Baja California, México to British Columbia, Canada and extends up to 300 nm offshore (Macewicz and Abramenkoff 1993). In past assessments, the approach has been to assume that all catches landed at ports from ENS to BC were from the northern subpopulation. As mentioned above, there is general consensus that catches landed in ENS and SCA likely represent a mixture of southern subpopulation (during warm months) and northern subpopulation (cool months) (Felix-Uraga et al. 2004, 2005; Garcia-Morales 2012; Zwolinski et al. 2011; Demer and Zwolinski 2014) (Figure 1). This assessment again applied a more objective method to partition data from ENS and SCA ports to exclude catch and composition data attributed to the southern subpopulation.

Efforts to survey, assess, and manage Pacific sardine in the California Current may depend on accurate differentiation of the purported two migrating stocks (Smith, 2005). A decade ago, a practical method was proposed for differentiating landings from the two stocks using concomitant measurements of sea surface temperature (SST) (Felix-Uraga *et al.*, 2004, 2005). Demer and Zwolinski (2013) independently corroborated and refined the method using regional indices of optimal and good potential habitat for the northern stock (Zwolinski *et al.*, 2011), and SST-based indices associated with the probability of including 99.9 % of all the sardine egg sampled over a 12-year period. The indices equal the proportions of each fishing region containing optimal or good potential habitat for the northern sardine stock habitat (Zwolinski et al. 2011) and SST <16.4°C, respectively. For months when either index is <0.5, (i.e., when the minority of a fishing region probably includes potential northern stock habitat), the commercial landings are attributed to the southern stock, and vice versa. Because sardine landings at Ensenada or San Pedro were often low when the local habitat was transitioning (Felix-Uraga *et al.* 2004, 2005), the efficacy of the method is largely insensitive to the choice of index. To potentially improve the assessment estimates of northern stock biomass, Demer and Zwolinski's SST-index was calculated for the Ensenada and San Pedro regions, monthly since 1980, enabling the exclusion of southern stock sardine landings and their respective length compositions from the SS model.

Growth

The weight-at-length relationship for Pacific sardine (combined sexes) was modeled by the standard power function,

$$W = a\,(L^b);$$

where W is weight (kg) at length L (cm), and a and b are regression coefficients. The weight-at-length relationship was re-examined for the 2014 assessment (Hill et al. 2014) using a least-squares method to fit to sample data from 1993 to 2013. Coefficients for NSP sample data were, a = 7.5242e-06, b = 3.2332 (n = 104,326; corrected R^2 = 0.936) (Figure 4). Weight-at-length parameters were not changed for this update assessment, but will be re-evaluated for the next full assessment in 2017.

The largest recorded Pacific sardine reached a standard length (*SL*) of 41 cm (Eschmeyer et al. 1983), but the largest Pacific sardine commercially captured since 1981 was *SL* = 29.7 cm. The heaviest sardine weighed 0.323 kg. The oldest recorded Pacific sardine was 15 years old, but commercially-caught Pacific sardine are typically less than 7 years old.

Sardine ageing using otolith methods was first described by Walford and Mosher (1943) and extended by Yaremko (1996). Pacific sardines are routinely aged by fishery biologists in México, CA, and the PNW using annuli enumerated in whole sagittae. A birth date of July 1 is assumed when assigning year classes. Lab-specific ageing errors were calculated and applied as described in Hill et al. (2011).

Sardine growth was first estimated outside the SS model to provide initial parameter values and CVs for length-at-age$_{min}$ (0.5 yrs), length-at-age$_{max}$ (15 yrs), and growth coefficient K (Figure 5b). A re-analysis of size-at-age from fishery samples (1993-2013) did not indicate sexual dimorphism (Figure 5a) and thus, combined sexes are included in the present assessment model.

Maturity

Maturity-at-length parameters were updated in 2014 using sardines sampled from survey trawls conducted from 1994 to 2013 (Hill et al. 2014). Reproductive state was primarily established through histological examination, although some immature individuals were simply identified through gross visual inspection. Parameters for the logistic maturity function were estimated using,

$$\text{Maturity} = 1/(1+\exp(slope*L-L_{\text{inflexion}})));$$

where slope = -0.89252 and inflexion = 15.44 cm-SL. Maturity-at-length parameters were fixed in the assessment model. Fecundity was fixed at 1 egg/gram body weight. Maturity- and fecundity-at-length vectors are presented in Figure 6a. Maturity-at-age during the spawning season (beginning of S2), as derived from growth estimation in this update model is presented in Figure 6b. Maturity parameters will be re-evaluated prior to the next full assessment in 2017.

Natural mortality

The instantaneous rate of adult natural mortality has been estimated to be $M = 0.4\ yr^{-1}$ (Murphy 1966; MacCall 1979), 0.51 yr^{-1} (Clark and Marr 1955), and 0.52 yr^{-1} (Zwolinski and Demer 2013b). Consistent with all previous sardine assessments, our base models were parameterized with $M = 0.4\ yr^{-1}$ for all ages and years (Murphy 1966, MacCall 1979, Deriso et al. 1996, Hill et al. 1999, Hill et al. 2014). A natural mortality rate of $M = 0.4\ yr^{-1}$ means that roughly 33% of the stock die of natural causes each year.

The 2014 assessment (Hill et al. 2014) examined sensitivity to alternative natural mortality assumptions based on: 1) new analyses by Zwolinski and Demer (2013b), where M = 0.52 yr^{-1} for all ages; and 2) using the Lorenzen function based on the hypothesis that M is higher at younger ages (Butler et al. 1993). A general Lorenzen formulation was applied,

$$M_{\text{age}} = M_c\ (L_{mat}/L_{age}) \text{ for } a<a_{mat};$$

where M_c = 0.4, L_{mat}=15.44 cm-SL, and L_{age} =8 cm for age 0, 13.46 cm for age 1, and a_{mat}=2 years. This resulted in an M_{age} vector of 0.77 yr^{-1} for age-0 fish, 0.46 yr^{-1} for age-1 fish, and 0.4 yr^{-1} for fish ages 2 and older. Neither the higher M nor Lorenzen function were included in the final 2014 model (STAR 2014).

Fishery Data

Overview

Available fishery data include commercial landings and biological samples from six regional fisheries: Ensenada (ENS), Southern California (SCA), Central California (CCA), Oregon (OR), Washington (WA), and British Columbia (BC). Standard biological samples include individual weight (kg), standard length (cm), sex, maturity, and otoliths for age determination (in most, but not all cases). A complete list of available port sample data by fishing region, model year, and season is provided in Table 3.

The INAPESCA has collected sardine samples from the port of Ensenada since 1989. Sampling has been comparable to that of the U.S. with respect to randomness, frequency, and types of biological data. The INAPESCA has collected roughly 10 random samples of 25 fish per month for size, sex, and reproductive condition, with a random subset being aged using otoliths (Table 3). We include length compositions (catch-weighted semester aggregates provided by INAPESCA) representing the full set of INAPESCA samples collected from mid-1988 through mid-2009. The INAPESCA also provided a full complement of conditional age-at-length compositions, however, those data have not been included in formal assessments to date, given unresolved methodological issues. No new composition data have been obtained from Mexico since the 2011 full assessment (Hill et al. 2011).

The CDFW has collected sardine samples from SCA and CCA ports on a regular basis since 1981. The CDFW currently collects 12 random port samples (25 fish per sample) per month from each region. ODFW has collected port samples since 1999, and WDFW since 2000 (Table 3). Oregon and Washington fishery samples are collected at higher frequency due to the compressed fishing season, but each sample contains 25 fish.

The CDFO has sampled the BC sardine fishery since 1998. The CDFO collects 100 fish per sample and requires 50%-100% observer coverage, so many of the BC loads are sampled relative to other fisheries. The CDFO's protocol does include collection of otoliths. However, their ageing efforts have primarily focused on survey samples, with no fishery ages being available for this or past assessments.

All fishery catches and compositions were compiled based on the sardine's biological year ('model year') to match the July 1st birth date assumption used in age assignments. Each model year is labeled with the first of two calendar years spanned (e.g., model year '1993' includes data from July 1, 1993 through June 30, 1994). Further, each model year has two six-month seasons, where 'S1'=Jul-Dec and 'S2'=Jan-Jun. Major fishery regions were pooled to represent a southern 'MexCal' fleet (ENS+SCA+CCA) and a northern 'PacNW' fleet (OR+WA+BC), where the MexCal fleet was treated with semester-based selectivities ('MexCal_S1' and 'MexCal_S2'). Rationale for this design is provided in Hill et al. (2011).

Landings

Ensenada monthly landings, 1993 to 2002, were compiled using the 'Boletín Anual' series previously produced by INAPESCA's Ensenada office (e.g., Garcia and Sánchez 2003). Monthly landings from 2003 to 2014 were taken from CONAPESCA's web archive of Mexican fishery yearbook statistics (CONAPESCA 2015). Ensenada landings for 2015 were based on a preliminary aggregate total for Jan-Oct (Concepción Enciso-Enciso, INAPESCA-Ensenada, pers. comm.) that was apportioned across months and projected through June 2016 using monthly data from 2014.

California (SCA and CCA) commercial landings were obtained from CDFW's 'Wetfish Tables' (1993 to 1999, and 2015) and the PacFIN database (2000 to 2014). Oregon (OR) and Washington (WA) landings (1999-2015) were obtained entirely from PacFIN. Given the current moratorium on directed fishing in the U.S., we assumed only a small volume of catch will be taken through June 2016. British Columbia monthly landing statistics, 1999 to 2012, were provided by CDFO (Linnea Flostrand and Jordan Mah, pers. comm.). Sardine were not landed in Canada during 2013 to 2015.

As stated above, satellite oceanography data were used to characterize ocean climate (SST) within typical fishing zones off Ensenada and Southern California and attribute monthly catch for each fishery to either the southern or northern subpopulation (NSP). Landings by model year-season for each fishing region and stock scenario (port-based versus environment-based NSP) are presented in Table 2 and Figure 3. The current SS model aggregates regional fisheries into a southern 'MexCal' fleet and a northern 'PacNW' fleet (Figure 1). Landings aggregated by model year-season and fleet are presented in Table 4 and Figure 7.

Length compositions

Length compositions for each fleet and season were the sums of catch-weighted length observations, with monthly landings within each port and season serving as the weighting unit. As indicated above, environmental criteria used to assign landings to subpopulations were also applied to monthly port samples to categorize NSP fish. Catch-based weighting vectors were updated for creating aggregate NSP length compositions in this assessment.

Length compositions were comprised of 0.5-cm bins ranging from 9 to 28 cm standard length (39 bins total). The 9-cm bin reflects all fish ≤9.49 cm, the 28-cm bin reflects all fish ≥28 cm, and all other bins (9.5 to 27.5 cm) reflect the lower bound of the respective 0.5-cm interval (e.g., the 9.5-cm bin includes fish ranging 9.5 to 9.99 cm).

Total numbers of lengths observed in each fleet-semester stratum were divided by the typical number of fish collected per sampled load (25 fish per sample for most regions, 100 fish per sample in Canada) to calculate the sample sizes for compositions included in the assessment model. Length compositions were input as proportions. While raw sample data were not available from the ENS and BC regional fisheries, catch-weighted length distributions, assembled per above, were made available by INAPESCA and CDFO. To combine ENS with SCA-CCA data ('MexCal') and to combine BC with OR-WA data ('PacNW'), the respective length distributions and sample sizes were weighted by catch from each region and summed at the season level. Length compositions and input sample sizes by fleet are displayed in Figures 8-10. For the current assessment, length compositions from SCA, CCA, OR, and WA fisheries were updated for model year 2014 and appended with the first semester of model year 2015 (Jul-Dec 2015 samples).

Age compositions

Age compositions were compiled based on the same fishery samples and weighting methods described above. Implied ('ghost') age-compositions were included as model inputs, but omitted from likelihood calculations, to facilitate comparison of model predictions of age composition with the inferred values through examination of model residual patterns. Aggregate age-composition data are presented in Figures 8-10.

Conditional age-at-length compositions, used to estimate growth in length-based models, were constructed from the same fishery samples and weighting methods described above. Age bins included 0, 1, 2, 3, 4, 5, 6, 7, 8-10, 11-15 (10 bins total). The age 11-15 bin served as an accumulator allowing growth to approach maximum length (L_∞). Age compositions were input as proportions of fish in 1-cm length bins. As was done for the length compositions, the number of individuals comprising each bin was divided by the number of fish per sample to set the initial, input sample size. In most cases, age data were available for every length observation. Conditional age-at-length compositions for each fishery are presented in Figures 11-13. For the current assessment, conditional age-at-length data from SCA, CCA, OR, and WA were updated through model year 2014, including Jan-June 2015.

Oregon and Washington fishery ages from model season 2 (S2, Jan-Jun), which would have been included in the PacNW fleet, were omitted from all models due to inter-laboratory inconsistencies in the application of birth-date criteria during this semester. Total OR and WA landings and samples during S2 are typically small, so this omission did not represent a major loss of information to the model.

It is important to note that length data, but not age data, were available for the BC fishery. As a result, length-based models more accurately represent sizes-at-removal for the aggregate PacNW fleet, but age-based models would only represent removals-at-age by the OR and WA fleets. The same problem applies to the southern MexCal fleet, where lengths, but not ages, were available from the ENS fishery.

Ageing error

Ageing-error vectors for fishery data were unchanged from Hill et al. (2011). Ageing error vectors (SD at true age) were linked to fishery-specific conditional age-at-length or aggregate age-composition data (Figure 14). For complete details regarding age-reading data sets, model development and assumptions, see Hill et al. (2011, Appendix 2), as well as Dorval et al. (2013).

Fishery-independent Data

Overview

This assessment uses three time series obtained from fishery-independent surveys: 1) daily egg production method (DEPM) estimates of female spawning biomass; 2) total egg production (TEP) estimates of total spawning biomass; and 3) acoustic-trawl method (ATM) surveys of biomass, which are separated into spring and summer components. Each of these surveys and estimation methods have been vetted through PFMC-SSC Methodology Reviews (panels included representatives from the PFMC-SSC and the Center for Independent Experts). The DEPM/TEP methods were reviewed in May 2009, and the ATM survey was reviewed in February 2011. Survey data are presented in Tables 5-8, Figures 15-17, and Appendix A (Zwolinski et al. 2016) of this report.

Daily egg production method spawning biomass

From 1994 to 2013 DEPM and TEP estimates of SSB were based on SWFSC ship-based surveys conducted each April between San Diego and San Francisco, California, although in some years the surveys were extended as far as Washington. Warm oceanic conditions prevailed in the California Current during spring of 2015. An examination of satellite environmental data immediately prior to the April 2015 survey indicated the majority of the sardine potential spawning habitat was distributed north of San Francisco. Therefore, in 2015, the survey was conducted mostly north of the standard DEPM area and the SSB estimate was based on the whole DEPM survey area. The DEPM index of female SSB is used when adult daily-specific fecundity data are available from the survey. The total egg production (TEP) index of SSB is used when survey-specific adult reproductive data are unavailable. The DEPM and TEP series have been used for sardine stock assessment since the 1990s, and the surveys and estimation method were reviewed by a STAR panel in May 2009. Both time series are treated as indices of relative SSB, with catchability coefficients (q) being estimated (Figure 17).

In 2015 the SWFSC conducted the sardine DEPM biomass survey aboard the NOAA ship *Bell M. Shimada* (March 28 – May 1) from about Winchester Bay, Oregon (43.75°N) to Moro Bay, California (CalCOFI line 75.0) (Figure 15). The spring CalCOFI survey was conducted on the Scripps Institution of Oceanography research vessel *New Horizon* (April 4 – April 29) from San Diego to San Francisco Bay, California. However, data from the CalCOFI survey were not used because no trawling was conducted since *New Horizon* is not equipped to tow mid-water trawls. Further, sardine eggs and larvae collected during the spring CalCOFI were low from all nets, with only 1 egg and 1 larva collected from CalVET tows (Table 6). Consequently, only data from the DEPM survey on the *Shimada* were included in the estimation of spawning biomass of Pacific sardine. The DEPM survey from the *Shimada* employed all the usual methods for estimating sardine SSB (Lo et al. 2010), but sampling was performed over a much broader area than the standard DEPM area (i.e. San Francisco to San Diego) (Figure 15).

Initially, the 2015 CPS-Sardine DEPM survey was designed with thirty distinct transects at 20 mile spacing to cover the area from Cape Mendocino, California to the California USA-Mexico border. Based on Zwolinski et al. (2011)' habitat model forecast for April 2015, consecutive years of a warming trend in the north eastern Pacific, and information received from sardine fishermen off Oregon, an additional fourteen transect lines were added to the north of the existing pattern, extending the most northern transect to a position south of Waldport, Oregon. Since the northern extent of the population was not known, the ship traveled northward and sampled a predetermined transect, located at 44.2°N. However, the CUFES broke in route and was not used for sampling eggs on the first two transects. Likewise, the whole DEPM area defined in Figure 15 did not include these transects. After repairing the CUFES, transect spacing was reduced, as much as 10 nautical mile, whenever sardine eggs, larvae or fish were encountered. In areas with no observed eggs, fish or larvae, transect spacing was increased as much as 40 nautical miles to save time and cover a broader area of the coast.

The 2015 DEPM index area for the entire survey (43.75°N latitude to CalCOFI line 75.0) was 181,249.60 km^2 (Figure 15). The egg production (P_0) estimate was 1.71/0.05m^2 (CV = 0.71) in the high egg-density region and 0.17/0.05 m^2 (CV = 0.71) for the whole survey area. These areas were computed after a 2.5 nautical mile expansion (i.e. half of the distance between CUFES samples) from survey line or station (see Dorval et al. 2016). Female spawning biomass for the whole survey area was taken as the sum of female spawning biomasses in Regions 1 and 2 (Table 7). The female spawning biomass (sum) and total spawning biomass for the DEPM whole survey area were estimated to be 19,376 mt (CV = 58) and 33,412 mt (CV = 0.74), respectively (Table 7).

Adult reproductive parameters for the 2015 whole survey area are presented in Table 8. The estimated daily-specific fecundity was 18.09 (number of eggs/population weight (g)/day) using the following estimates of reproductive parameters from 25 mature females collected from 4 positive trawls: mean batch fecundity (F) was 60,916 eggs/batch (CV = 0.02), fraction spawning (S) was 0.118 females spawning per day (CV = 0.16), mean female fish weight (W_f) was 192.21 g (CV = 0.05), and sex ratio of females by weight (R) was 0.485 (CV = 0.08). Since 2005, trawling has been conducted randomly or at CalCOFI stations, which resulted in sampling adult sardines in both high (Region 1) and low (Region 2) sardine egg-density areas. During the 2015 survey, the number of tows positive for mature female sardines was similar in Regions 1 and 2 (2 tows in each), while two additional tows caught solely males and one tow caught a single immature female (Dorval et al. 2016). Further, due to the low number of females sampled during the survey, batch fecundity was predicted from a regression model using data collected from 2013, 2014 and 2015 surveys.

In SS, the DEPM series was taken to represent female SSB (length selectivity option '30') in the middle of S2 (April). Since 2009, the time series of spawning biomass was replaced by female spawning biomass for years when sufficient trawl samples were available and the total egg production for other years as inputs to the stock assessment of Pacific sardines. The 2015 DEPM estimate is considerably lower than in the previous few years (Tables 5 & 7; Figure 17).

Total egg production spawning biomass

Adult sardine samples are needed to calculate the daily-specific fecundity for true DEPM estimates. Trawls were not always conducted during the egg production surveys. In the 2007 assessment, we chose to include these data as a Total Egg Production (TEP) series, which is simply the product of egg density (P_0) and spawning area (km^2). Calculated TEP values are provided in Tables 5 and 7 and displayed in Figure 17. TEP was also taken to represent relative SSB in the model (*q* estimated), but in this case the female fraction was unknown (Tables 5 and 7, Figure 17).

Acoustic-trawl method survey

The ATM time series is based on SWFSC surveys conducted along the Pacific coast since 2006 (Cutter and Demer 2008; Zwolinski et al. 2011, 2012, 2014, Demer et al. 2012, and Zwolinski et al. 2016 in Appendix A of this report). The ATM survey and estimation methods were reviewed by a panel in February 2011 and the results from these surveys have been included in the assessment since 2011 (Hill et al. 2011, 2012, 2014, 2015).

Two new ATM-based biomass estimates were included in this assessment; one from the spring 2015 survey off central California to Oregon, and the other from the summer 2015 survey spanning San Diego to northern Vancouver Island, Canada. Biomass estimates and associated size distributions from the 2015 surveys are described in detail in Appendix A of this report (Zwolinski et al. 2016). Biomass estimates from the spring and summer 2015 surveys, 29,048 (CV=0.299) mt and 15,870 (CV=0.802) mt respectively, were as low as or lower than estimates from the previous year (Table 5, Figure 17). The low ATM biomass estimates were consistent with the low DEPM spawning stock biomass estimated for spring 2015 (Table 5).

The time series of ATM biomass estimates is presented in Table 5 and Figure 17, and associated biomass-weighted length compositions are displayed in Figure 16. ATM survey biomass estimates (2006-2015) were partitioned into two (spring and summer) surveys, with q=1 for each survey. Length compositions were fit using asymptotic length-selectivity, where selectivity for the spring and summer surveys were estimated independently. For reasons explained in **Uncertainty and Sensitivity Analysis**, the summer 2015 ATM length composition was excluded from the proposed update model.

ASSESSMENT MODEL

History of Modeling Approaches

The population's dynamics and status of Pacific sardine prior to the collapse in the mid-1900s was first modeled by Murphy (1966). MacCall (1979) refined Murphy's virtual population analysis (VPA) model using additional data and prorated portions of Mexican landings to exclude the southern subpopulation. Deriso et al. (1996) modeled the recovering population (1982 forward) using CANSAR, a modification of Deriso's (1985) CAGEAN model. The CANSAR was subsequently modified by Jacobson (Hill et al. 1999) into a *quasi*, two-area model CANSAR-TAM to account for net losses from the core model area. The CANSAR and CANSAR-TAM models were used for annual stock assessments and management advice from 1996 through 2004 (e.g., Hill et al. 1999; Conser et al. 2003). In 2004, a STAR panel endorsed the use of an Age Structured Assessment Program (ASAP) model for routine assessments. The ASAP model was used for sardine assessment and management advice from 2005 to 2007 (Conser et al. 2003, 2004; Hill et al. 2006a,b). In 2007, a STAR panel reviewed and endorsed an assessment using Stock Synthesis 2 (Methot 2005, 2007), and the results were adopted for management in 2008 (Hill et al. 2007), as well as an update for 2009 management (Hill et al. 2008). The sardine model was transitioned to Stock Synthesis version 3.03a in 2009 (Methot 2009) and was again used for an updated assessment in 2010 (Hill et al. 2009 & 2010). Stock Synthesis version 3.21d was used for the 2011 full assessment (Hill et al. 2011), the 2012 update assessment (Hill et al. 2012), and the 2013 catch-only projection (Hill 2013). The 2014 sardine assessment (Hill et al. 2014), the 2015 update (Hill et al. 2015), and this 2016 update assessment, were based on SS version 3.24s.

Responses to Previous STAR Panel Recommendations

The data and model parameterizations for this update assessment are based upon a model reviewed by a STAR panel in 2014. Responses to STAR 2014 recommendations are documented in STAR (2014) and Hill et al. (2014). The 2014 assessment also contained thorough documentation of responses to previous STAR panel reviews (Hill et al. 2014, STAR 2011).

Proposed Update Model Configuration

Readers should consult both the final 2014 assessment report (Hill et al. 2014), final review report (STAR 2014), and 2015 update report (Hill et al. 2015) for background information regarding various model scenarios investigated in the initial sensitivity analysis and bases for final choices, assumptions, and parameterizations associated with base model T, generally described below.

The proposed update model incorporated specifications. Changes from the 2014 model are highlighted in bold:

- catches for the MexCal fleet computed using the environmentally-based method;
- two seasons (Jul-Dec and Jan-Jun) for each assessment year from 1993 to **2015**;
- sexes are combined;

- two fishery fleets (MexCal, PacNW), with an annual selectivity pattern for the PacNW fleet, and seasonal selectivity patterns (S1 and S2) for the MexCal fleet;
  - MexCal fleet:
    - dome-shaped length-based selectivity with two time blocks (1993-1998, 1999-**2015**);
  - PacNW fleet:
    - asymptotic length-based selectivity for a single time block;
  - length compositions with effective sample size set to 1 per haul and lambda weighting =1;
  - conditional age-at-length with effective sample size set to 1 per haul and lambda weighting = 0.2;
- Beverton-Holt stock-recruitment relationship steepness set to 0.8 (fixed value);
- M = 0.4 yr^{-1}; σ_R = 0.75 (fixed value);
- recruitment deviations estimated for SSB years 1987-**2014 (2015 year class is estimated)**;
- virgin (R_0) and initial recruitment offset (R_1) were estimated;
- initial *F*s set to 0 for all fleets (non-equilibrium model);
- DEPM (1993-**2015**)and TEP (1995-2005) indices of spawning biomass with *q* estimated for both surveys;
- ATM survey biomass 2006-**2015**, partitioned into two (spring and summer) surveys, with *q*=1 for each survey;
  - length compositions with effective sample sizes set based on the number of trawl clusters;
  - asymptotic length-based selectivity for spring and summer surveys, estimated independently.
  - **The summer 2015 ATM length composition was excluded from the proposed update model**.

Model Description

Assessment program with last revision date

In 2014, the STAT transitioned from Stock Synthesis (SS) version 3.21d to version 3.24s (compiled 12/16/2013; Methot 2013, Methot and Wetzel 2013) for conducting the stock assessment. The SS model is founded on the AD Model Builder software environment, which serves as a suite of C++ libraries of automatic differentiation code for nonlinear statistical optimization (Otter Research 2001). The modeling framework allows for the full integration of both population size and age structure, with explicit parameterization both spatially and temporally. The model incorporates all relevant sources of variability and estimates goodness of fit in terms of the original data, allowing for final estimates of precision that accurately reflect uncertainty associated with the sources of data used as input in the overall modeling effort.

The SS model is comprised of three sub-models: (1) a population dynamics sub-model, where abundance, mortality, and growth patterns are incorporated to create a synthetic representation of the true population; (2) an observation sub-model that defines various processes and filters to derive expected values for different types of data; and (3) a statistical sub-model that quantifies the difference between observed data and their expected values and implements algorithms to search for the set of parameters that maximizes goodness of fit (Methot 2013; Methot and Wetzel 2013). This modeling platform is also very flexible in terms of estimation of management quantities typically involved in forecast analysis.

Definitions of fleets and areas
Data from major fishing regions are aggregated to represent southern and northern fleets (fisheries). The southern 'MexCal' fleet includes data from three major fishing areas at the southern end of the stock's distribution: northern Baja California (Ensenada, Mexico), southern California (Los Angeles to Santa Barbara), and central California (Monterey Bay). Fishing can occur throughout the year in the southern region. However, availability-at-size/age changes due to migration. Selectivity for the southern 'MexCal' fleet was therefore modeled separately for seasons 1 and 2 (semesters, S1 and S2).

The 'PacNW' fleet (fishery) includes data from the northern range of the stock's distribution, where sardine are typically abundant between late spring and early fall. The PacNW fleet includes aggregate data from Oregon, Washington, and Vancouver Island (British Columbia, Canada). The majority of fishing in the northern region typically occurs between July and October (S1).

Likelihood components and model parameters
A complete list of model parameters for the update model is provided in Tables 10 and 11. The total objective function for the update model included likelihood component contributions from: 1) fits to catch time series; 2) fits to the DEPM, TEP, and ATM survey abundance indices; 3) fits to length compositions from the three fleets and ATM surveys; 4) fits to conditional age-at-length data from the three fleets; 5) deviations about the spawner-recruit relationship; and 6) minor contributions from soft-bound penalties associated with particular estimated parameters (Tables 9 and 11).

Selectivity assumptions
Length data from the MexCal and PacNW fisheries were fit using length-based selectivity. The MexCal compositions were based on domed-shaped selectivity , given the assumption that not all larger sardines were available to the Baja California and California fisheries from 1993 onward. At that stage in the population's recovery, large spawning events were observed off central California (Lo et al. 1996), and sardines were captured in trawls 300 nm off the California coast (Macewicz and Abramenkoff 1993). Selectivity for the MexCal fleet was estimated by season and in two time blocks (1993-1998, 1999-2015) to better account for both seasonal- and decadal-scale shifts in sardine availability to the southern region. The PacNW fishery length compositions were fit using asymptotic selectivity. Large sardines are typically found in the northern region, and it is assumed the largest sardines typically migrate to northern feeding habitats in the summer.

Stock-recruitment constraints and components
Pacific sardines are believed to have a broad spawning season, beginning in January off northern Baja California and ending by July off the Pacific Northwest. The SWFSC's annual egg production surveys are timed to capture (as efficiently as possible) the peak of spawning activity off the central and southern California coast during April. In our semester-based model, we calculated SSB at the beginning of S2. Recruitment was specified to occur in S1 of the following model year (consistent with the July-1 birth date assumption). In past assessments, a Ricker stock-recruitment (S-R) relationship had been assumed following Jacobson and MacCall (1995).

However, following recommendations from past reviews, a Beverton-Holt S-R was investigated and ultimately adopted in the 2014 assessment (Hill et al. 2014).

Virgin recruitment (R_0) and initial recruitment offset (R_1) were estimated and steepness was fixed (at 0.8). Recruitment variability (σ_R) to apply in S-R estimation was set to 0.75. Recruitment deviations were estimated as separate vectors for the early and main data periods in the overall model. Early recruitment deviations for the initial population were estimated from 1987 onward (6 years before the start of the model). A recruitment bias adjustment ramp (Methot and Taylor 2011) was applied to the early period (Figure 33d). Main period recruitment deviations were advanced one year for this update, i.e. estimated from 1993-2014 (S2 of each model year), which means that the 2015 year class was freely estimated (albeit poorly) from the 2015 data.

It is important to note that there exists little to no data in the assessment to directly evaluate recent recruitment strength (e.g., absolute numbers of age-0, 6-9 cm fish in the most recent year), with the exception of length data from the southern fisheries (MexCal), which in past years, have caught these juveniles in low volume during their first semester of life (S1), but in greater volume during their second semester (S2). Age-0 fish are not typically encountered by the ATM survey (with the exception of summer 2015), with reliable identification of age-1 fish typically only during strong recruitment years. Implied age-selectivities (product of length selectivity and the age-length key) from the fisheries and surveys are displayed in Figures 22b and 26b, respectively. In the ATM spring survey, fish are 56% selected by age 1. Fish caught in the MexCal_S2 fishery (1999-2015 block) are 59% selected by age 0 (approaching their first birthday) and fully selected by age 1 (approaching their second birthday). In the MexCal_S1 fishery (same time block), fish are fully selected by age 2.

Selection of first modeled year and treatment of initial population

The initial population was calculated by estimating early recruitment deviations from 1987-1992, six years prior to the model start year. Initial F values were fixed to zero, following recommendations from past assessments/reviews (see STAR 2011). The 'early years' recruitment deviations are applied to the initial equilibrium age frequency to adjust this composition before the time series start, whereby the model applies the initial F level to an equilibrium age composition to get a preliminary numbers-at-age time series, then applies the recruitment deviations for the specified number of younger ages in this initial vector. If the number of estimated ages in the initial age composition is less than the total number of age groups assumed in the model (as is the case with Pacific sardine assessment), then the older ages will retain their equilibrium levels. Because the older ages in the initial age composition will have progressively less information from which to estimate their true deviation, the start of the bias adjustment was set accordingly (see Methot 2013; Methot and Wetzel 2013).

Convergence criteria and status

The iterative process for determining numerical solutions in the model was continued until the difference between successive likelihood estimates was <0.00001. Final gradient for the base model was 3.61*e*-6.

Results for the Proposed Update Model

Parameter estimates and errors

Parameter estimates and standard errors (SE) for the proposed and strict update models, along with estimates from the 2015 update assessment (Hill et al. 2015), are presented in Table 10. The only parameter estimates to change noticeably from the 2015 update were the two length-selectivity parameters (peak, ascending slope) associated with the summer ATM lengths (see *Sensitivity to addition of new data*) when the summer 2015 lengths were included in the model (i.e. '2016 strict update'). Parameters in the proposed update model (which excluded the summer 2015 ATM lengths; '2016 noAT15 len'), were consistent with estimates from the 2015 update (Table 10).

Growth and fits to conditional age-at-length data

Modeled length-at-age is displayed in Figure 18. Length-at-age 0.5 was estimated to be 11.3 cm SL, L_{∞} was 23.4 cm, and the growth coefficient K was 0.4323 yr^{-1}. Standard deviations for growth parameters are provided in Table 10. Fits to fishery conditional age-at-length data are shown in Figures 19-21. Most conditional age-at-length compositions fit reasonably well, with the exceptions of MexCal_S1 in 2001-2003 (Figure 19) and PacNW in 2008-2010 (Figure 21).

Selectivity estimates and fits to fishery length-composition data

Length selectivity estimates for each fleet and time block are displayed in Figure 22a. Implied age selectivities (product of length selectivity and the age-length key) for each fleet and period are shown in Figure 22b. The MexCal fleets (S1 and S2) captured progressively smaller fish between the early and latter time blocks (Figure 22a).

Model fits to fleet length frequencies, implied age-frequencies, Pearson residuals, and observed and effective samples sizes are displayed in Figures 23a-25a. Results are grouped by fleet to aid examination of fits to length compositions, bubble plots of Pearson residuals, and corresponding fits to implied age compositions on opposing pages. Results indicate random residual patterns for most data and fleets. The MexCal_S1 and S2 fleet length data were poorly fit during the last couple of years, when larger sardine were taken by the fishery (Figures 23a-24a). The PacNW fleet displayed notable residuals patterns for strong year classes (1997, 1998, and 2003) moving through the fishery (Figure 25a).

Selectivity estimates and fits to survey length-composition data

Length selectivity estimates for surveys are displayed in Figure 26a and implied age selectivities for each survey are shown in Figure 26b. Selectivities for the ATM spring and summer surveys are notably different, with the spring survey selecting for smaller, younger sardine than in summer (Figure 26a,b). Presumably, this difference is due to spatial differentiation of the migrating stock during the spring (off California) vs. summer (primarily PacNW) seasons.

Model fits to ATM survey length compositions, Pearson residuals, and observed and effective samples sizes are displayed in Figures 27-28. Poor fits to the ATM survey length data are indicated in most years. As noted above (*Parameter estimates and errors*), the selectivity pattern for the summer ATM survey underwent a marked shift when the summer 2015 ATM length was included in the model ('Strict Update')(Table 10, Figure 26). The proposed model (excluding the summer 2015 ATM length) had a selectivity pattern similar to that in the 2015 update (Table 10). This area of sensitivity is further discussed in **Uncertainty and Sensitivity Analysis**.

Fits to survey indices of abundance
Model fits to the DEPM, TEP, and ATM spring and summer survey time series are displayed in both arithmetic and log scale in Figures 29-32. Model fits to the ATM surveys were reasonable (near mean estimates and within error bounds, Figures 29-30), with the exceptions of the estimate for the initial survey year 2005 (spring 2006 survey), which was notably under-estimated and the recent 2014 and 2015 surveys (spring and summer), which was over-estimated by the model. Fits to the summer ATM survey also indicated a trend in the residuals (under-fitting in 2009-2013)(Figure 30). The trend in under-fitting was likely driven by the low biomass estimates in 2014 and 2015.

Fits to the DEPM and TEP surveys are displayed in Figures 31-32. Both time series are poorly fit compared to the ATM time series. However, the fit to the DEPM survey is slightly better than the fitted TEP time series. Catchability coefficient (q) for the DEPM series of female SSB was estimated to be 0.244 and the TEP series q=0.760.

Population numbers- and biomass-at-age
Update model estimates of numbers-at-age are provided in Table 12a. Corresponding estimates of population biomass-at-age, total biomass (age 0+), and stock biomass (age 1+) are shown in Table 12b.

Stock-recruitment relationship
Recruitment was modeled using the Beverton-Holt stock-recruitment relationship (σ_R=0.75, fixed value). Steepness (h) estimates for 2014 preliminary model runs typically bounded at h=1, so steepness was fixed at 0.8 – a value considered reasonable for clupeid stocks (Myers et al. 1999). The Beverton-Holt stock-recruitment relationship for the update model is displayed in Figure 33a. Recruitment deviations for the main era were estimated for SSB years 1993 to 2014 (2015 year-class) (Figure 33b). Asymptotic standard errors for recruitment deviations are displayed in Figure 33c and the S-R bias adjustment ramp (Methot and Taylor 2011) is shown in Figure 33d.

Spawning stock biomass
Base model estimates (with 95% confidence intervals) of total SSB are provided in Table 13 and Figure 34a.The virgin value of the spawning stock biomass (SSB) was estimated to be 0.422 million metric tons (mmt). The SSB increased throughout the 1990s, peaking at 0.767 mmt in 1999 and 0.763 mmt in 2007 (Table 13, Figure 34a).

Recruitment
Estimated time series of recruit (age-0) abundance is provided in Table 13 and Figure 34b. Virgin recruitment (R_0) for the update model was estimated to be 2.548 billion age-0 fish. Recruitment (age-0 abundance) peaked at 10.9 billion fish in 1997, 14.3 billion in 2003, and 11.9 billion in 2005. The 2010 to 2014 year classes were among the weakest in recent history. The 2015 year class (1.86 billion), predicted largely from the stock-recruitment curve, was poorly estimated (CV=0.76) given the paucity of data available for model year 2015.

Stock biomass for PFMC management

Stock biomass, used for calculating annual harvest specifications, is defined as the sum of the biomass for sardine ages one and older (age 1+) at the start of the management year. Proposed update model estimates of stock biomass are provided in Table 12b and displayed in Figure 41.

Stock biomass increased throughout the 1990s, peaking at 0.908 mmt in 1999 and 0.950 mmt in 2007. Stock biomass projected for July 2016 depends on assumptions regarding strength of recruitment (age-0) in 2015, as these fish will become age-1 in July 2016. If the 2015 year class is estimated in SS (i.e., derived primarily from the S-R relationship), then stock biomass is projected to be **106,137 mt in July 2016**. If the 2015 year class is based on an average of recruitments from 2012-2014, then stock biomass is projected to be 64,422 mt in July 2016. Given ancillary survey evidence presented at the March 2016 update review, the SSC CPS Subcommittee recommended that the 2015 recruitment be estimated from the stock-recruitment relationship. The STAT concurred with this recommendation. Under either 2015 year class scenario, stock biomass is projected to remain below the 150,000 mt 'Cutoff' threshold and above the minimum stock size threshold (50,000 mt) as of July 2016.

Harvest and exploitation rates

Harvest rates (catch per selected biomass, continuous-*F*) by fleet are displayed in Figure 35a. Instantaneous *F* estimates were all within a plausible range of values and less than 0.5 in most years/seasons.

Exploitation rate is defined as the calendar year NSP catch divided by the total mid-year biomass (July-1, ages 0+). The U.S. and total exploitation rates for the NSP are shown in Figure 35b. Based on update model estimates, the U.S. exploitation rate has averaged about 12% since the onset of federal management, but peaked at 28% in 2013. U.S. and total exploitation rates dropped to 3% in 2015.

Uncertainty and Sensitivity Analyses

Sensitivity to addition of new data

Sensitivity of the model to new data was examined through stepwise addition of updated sources of information. Likelihoods and derived quantities of interest are presented in Table 9. Biomass and recruitment trajectories associated with Table 9 are displayed in Figure 38. The update model scaled slightly lower upon addition of the 2015 survey abundance estimates, which were lower than the 2014 estimates. When 2015 ATM survey length compositions were added to the model (constituting the strict update), the stock biomass forecast for 2016 increased dramatically from 70,372 mt in July 2015 to 1,385,290 mt in July 2016 due to a record high recruitment estimate for 2015 (Table 9, Figures 38 and 39).

The biomass-weighted length composition estimated for the ATM summer 2015 survey contained an anomalously large portion of small sardine (>80% were smaller than the lowest length data bin of 9 cm) (Figure 16). All of the small sardine sampled in summer 2015 were collected off central California. The summer ATM survey typically encounters larger fish associated with sardine movement annually to the Pacific Northwest (asymptotic selectivity inflection point is ~20 cm). The low probability of capturing small fish during this survey and the large portion of small fish encountered in the summer 2015 trawls, translated to a 2015 year-class estimate (56.2 billion fish) that was nearly four times greater than the largest year class in the modeled time series (2003 year class of 14.3 billion fish). Given this discrepancy, the shift in selectivity when attempting to fit this observation (Figure 39), and general lack of fit to the data when doing so (70 additional likelihood points; Table 9), the decision was made to exclude the summer 2015 ATM length composition from the proposed update model. This specific issue, along with the general problem of improving fits to length compositions from the ATM surveys, will be addressed during the next full sardine assessment in 2017.

Likelihood profile for virgin recruitment

Likelihood profiles for virgin recruitment (R_0) can provide insight as to which data components influence scale in a stock assessment model. The 2016 update model was profiled for ln(R_0) values ranging from 14.4 to 15.9 (multiple runs at each R_0 level with jitter=20% to ensure convergence) for comparison to the 2015 update model (Figure 36). Both the 2016 and 2015 models displayed non-smooth total likelihood surfaces. Likelihood profiles for the individual model components are likewise inconsistent and in some cases, conflicting with regard to scale (Figure 36). Profile surfaces for the total and component likelihoods were generally similar in form between the 2016 and 2015 assessments. However, the 2016 update model had a slightly lower R_0 and displayed a steeper gradient for some model components, most notably, the ATM-spring survey and the PacNW length composition. As noted in Hill et al. (2014), while assuming a fixed q=1 for the ATM series theoretically provides more stability in scaling, the model may yet change unpredictably when additional data are included due to this inherent tension in the model. This possibility was also highlighted in the STAR report (STAR 2104).

Retrospective analysis

Retrospective analysis can provide another means of examining model properties and characterizing uncertainty. A retrospective analysis was performed on the update model, where data were incrementally removed from the end year back to 2010. Update model results were compared to the retrospective analysis conducted in the previous update (Hill et al. 2015). Stock biomass estimates for these analyses are displayed in Figure 37. The severe retrospective pattern observed in the 2014 final model (Hill et al. 2014) was not exhibited either the current or 2015 update models.

Convergence tests

Convergence properties of the 2016 update model were tested to ensure the model represents an optimal solution. The update model was run with a wide range of initial R_0 values (14.1 to 16.0). For each run, phase order for estimating parameter components (R_0, R_1, growth, selectivity, and survey Q) was randomized from 1 to 5 (Table 14), and all parameters were jittered by 20%. All models solved to the same total negative log likelihood (1230.88) and had identical final estimates of R_0 (14.7509) (Table 14). The update model appears to have converged to a global minimum.

Historical analysis

Update model estimates of stock biomass and recruitment are compared to recent assessments in Figure 40. Full and updated SS models since 2009 (Hill et al. 2009-2015) were included in the comparison. Biomass and recruitment are similar in trend across models, with some differences in scale for peak and low periods.

Uncertainty regarding strength of the 2015 year class
As indicated in past CPS assessments/reviews, strength of the terminal-year recruitment is highly uncertain and poorly informed by the available data and thus, the estimate derived directly from the spawner-recruit relationship is driven by limited information and has the potential for being overly optimistic. This is important, given the terminal year recruitment (age-0) is part of the calculation of the age-1+ stock biomass projected for start of the new management year (July 1). During the 2015 sardine update assessment (Hill et al. 2015), the STAT noted a tendency of the model to over-estimate terminal year-class abundance over the recent period of poor recruitments, i.e. 2011-2013. The STAT had also noted lack of evidence to indicate any spawning success in 2014. Thus, a recommendation was made that the 2014 recruitment be based on an average of 2011-2013 year-class abundances for projecting stock biomass to July 2015. That approach was endorsed by the SSC for purposes of setting 2015-16 harvest specifications. A similar projection approach (i.e. recent average recruitment for 2012-2014) was initially proposed by the STAT for estimating 2015 recruitment in this assessment. However, ancillary survey information presented at the March 2016 update review indicated that the 2015 year-class may be higher than the recent average. Evidence included: 1) a spike in YOY (4-8 cm) sardine abundance observed in all regions (North, Core, and South) of the SWFSC Santa Cruz Lab's 'Rockfish Recruitment and Ecosystem Assessment' survey conducted May-Jun 2015 (Sakuma 2015); and 2) a marked increase in larval sardine biomass collected along the Newport hydrographic line during the NWFSC's survey conducted during Jan-Mar 2015 (Leising et al. 2015). Given this ancillary evidence, the SSC's CPS Subcommittee recommended basing 2015 recruitment on the model estimate derived from the stock-recruit relationship. The STAT concurred with this recommendation, but reiterates it's request to the SSC for guidance regarding more standardized approaches to addressing terminal year-class uncertainty in ongoing CPS assessments.

HARVEST CONTROL RULES FOR THE 2016-17 MANAGEMENT CYCLE

Harvest Guideline
The annual HG is calculated as follows:

HG = (BIOMASS – CUTOFF) • FRACTION • DISTRIBUTION;

where HG is the total U.S. directed harvest for the period July 2016 to June 2017, BIOMASS is the stock biomass (ages 1+) projected as of July 1, 2016, CUTOFF (150,000 mt) is the lowest level of biomass for which directed harvest is allowed, FRACTION (= E_{MSY} bounded 0.05-0.20) is the percentage of biomass above the CUTOFF that can be harvested, and DISTRIBUTION (87%) is the average portion of BIOMASS assumed in U.S. waters. Based on results from the proposed update model, and for either of two 2015 year-class scenarios, stock biomass is projected to be below the 150,000 mt threshold. Therefore, the HG for 2016-2017 is calculated to be 0 mt (Table 16).

OFL and ABC

On March 11, 2014, the PFMC adopted the use of CalCOFI sea-surface temperature (SST) data for specifying environmentally-dependent E_{MSY} each year. E_{MSY} is calculated:

$$E_{MSY} = -18.46452+3.25209(T)-0.19723(T^2)+0.0041863(T^3),$$

where T is the three-year running average of CalCOFI SST (Table 15, Figure 42), and E_{MSY} for OFL and ABC is bounded 0.00 to 0.25 (Figure 42). Based on recent warm conditions in the California Current, the average temperature for 2013-2015 has increased to 16.3891 °C and the calculated E_{MSY} is 0.2865. Therefore, E_{MSY} for the 2016-17 season is bounded at 0.25 (Figure 42).

OFL and ABC values for 2016-17 depend on assumptions regarding strength of the 2015 year-class used to project stock biomass to July 1, 2016. As noted above, when the 2015 year class is freely estimated (but primarily derived from the spawner-recruit relationship), stock biomass is projected to be **106,137 mt** in July 2016. When the 2015 year class is based on an average of recruitments from 2012-2014, stock biomass is projected to be 64,422 mt in July 2016. OFLs and ABCs for these two recruitment scenarios and for a range of P-star values are provided in Table 16.

REGIONAL MANAGEMENT CONSIDERATIONS

Pacific sardine, as well as other species considered in the CPS FMP, are not managed formally on a regional basis within the USA, due primarily to the extensive distribution and annual migration exhibited by these stocks. A form of regional (spatial/temporal) management has been adopted for Pacific sardine, whereby seasonal allocations are stipulated in attempts to ensure regional fishing sectors have at least some access to the directed harvest each year (PFMC 2014).

RESEARCH AND DATA NEEDS

See the 2014 assessment (Hill et al. 2014) and STAR (STAR 2014) reports for extensive lists of Research and Data Needs for Pacific sardine.

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TABLES

Table 1. U.S. Pacific sardine harvest specifications and landings (metric tons) since the onset of federal management. U.S. harvest limits and closures are based on total catch, regardless of subpopulation source. Landings for the 2015-16 management year are preliminary and incomplete.

Mgmt Year	U.S. OFL	U.S. ABC	U.S. HG or ACL	U.S. Total Landings	U.S. NSP Landings
2000	---	---	186,791	72,496	67,086
2001	---	---	134,737	78,520	56,800
2002	---	---	118,442	101,367	82,052
2003	---	---	110,908	74,599	64,846
2004	---	---	122,747	92,613	76,964
2005	---	---	136,179	90,130	75,334
2006	---	---	118,937	90,776	78,905
2007	---	---	152,564	127,695	106,748
2008	---	---	89,093	87,175	80,222
2009	---	---	66,932	67,083	63,773
2010	---	---	72,039	66,891	57,529
2011	92,767	84,681	50,526	46,745	41,631
2012	154,781	141,289	109,409	101,103	93,203
2013	103,284	94,281	66,495	65,935	60,517
2014(1)	59,214	54,052	6,946	6,554	5,978
2014-15	39,210	35,792	28,646	21,172	19,969
2015-16	13,227	12,074	7,000	*153*	*84*

Table 2. Pacific sardine landings (mt) for major fishing regions off northern Baja California (Ensenada, Mexico), the United States, and British Columbia (Canada). ENS and SCA landings are presented as totals and northern subpopulation (NSP) portions.

Calendar Yr-Sem	Model Yr-Seas	ENS Total	ENS NSP	SCA Total	SCA NSP	CCA	OR	WA	BC
1993-2	1993-1	13,396.8	0.0	3,728.8	487.6	335.2	0.0	0.0	0.0
1994-1	1993-2	5,711.6	2,994.5	7,738.5	7,722.5	628.8	0.0	0.0	0.0
1994-2	1994-1	15,165.4	6,079.3	2,607.4	1,029.2	1,730.2	0.0	0.0	0.0
1995-1	1994-2	18,227.3	11,183.6	28,122.2	28,122.2	442.7	0.0	0.0	0.0
1995-2	1995-1	17,168.9	0.0	8,439.2	1,508.1	4,485.2	0.0	0.0	22.7
1996-1	1995-2	15,665.9	11,643.9	14,409.4	12,435.9	2,485.9	0.0	0.0	0.0
1996-2	1996-1	23,398.8	4,394.2	10,761.5	1,123.9	6,399.2	0.0	0.0	0.0
1997-1	1996-2	13,498.4	8,911.1	11,523.5	9,905.0	342.6	0.0	0.0	43.5
1997-2	1997-1	54,940.6	0.0	21,313.3	0.0	13,018.2	0.0	0.0	27.2
1998-1	1997-2	20,238.8	4,980.8	19,094.1	16,800.1	2,746.7	0.8	0.0	0.0
1998-2	1998-1	27,573.4	3,792.0	12,880.5	8,799.1	6,334.0	0.2	0.0	488.1
1999-1	1998-2	34,759.8	31,656.8	24,049.9	23,880.8	7,740.8	50.1	0.0	24.3
1999-2	1999-1	23,809.6	6,203.7	18,813.1	2,649.3	6,143.2	725.0	0.0	0.2
2000-1	1999-2	33,933.4	23,716.6	34,119.2	33,339.8	1,285.0	205.0	62.2	162.4
2000-2	2000-1	33,911.9	5,526.6	12,715.5	8,084.4	10,082.4	9,324.0	4,703.2	1,559.0
2001-1	2000-2	16,544.9	9,937.5	29,343.4	24,467.3	774.4	2,288.0	48.5	0.4
2001-2	2001-1	29,526.4	3,609.5	18,318.3	1,474.0	6,467.0	10,492.0	10,788.5	1,265.5
2002-1	2001-2	17,421.7	13,552.0	26,620.6	25,991.6	1,574.8	2,724.0	412.3	0.5
2002-2	2002-1	29,423.6	0.0	22,745.3	4,059.7	12,503.0	19,987.0	14,799.8	738.9
2003-1	2002-2	15,514.3	12,405.4	20,379.6	18,639.6	5,085.7	503.0	93.9	0.4
2003-2	2003-1	25,827.5	6,081.9	9,909.5	1,896.1	2,362.6	24,755.0	11,510.0	977.3
2004-1	2003-2	11,212.9	3,922.9	15,232.0	15,232.0	2,145.7	2,203.5	235.3	179.6
2004-2	2004-1	30,684.0	2,373.9	17,161.5	1,512.5	13,162.6	33,908.3	8,564.1	4,258.4
2005-1	2004-2	17,323.0	11,186.6	15,419.0	13,948.1	115.3	691.9	324.0	0.4
2005-2	2005-1	37,999.5	4,396.7	14,833.6	1,508.6	7,824.9	44,316.2	6,605.0	3,231.4
2006-1	2005-2	17,600.9	11,214.6	17,157.7	16,504.9	2,032.6	101.7	0.0	0.0
2006-2	2006-1	39,636.0	0.0	16,128.2	4,909.8	15,710.5	35,546.5	4,099.0	1,575.4
2007-1	2006-2	13,981.4	13,320.0	26,343.6	19,900.7	6,013.3	0.0	0.0	0.0
2007-2	2007-1	22,865.5	11,928.2	19,855.0	5,350.3	28,768.8	42,052.3	4,662.5	1,522.3
2008-1	2007-2	23,487.8	15,618.2	24,127.2	24,114.3	2,515.3	0.0	0.0	0.0
2008-2	2008-1	43,378.3	5,930.0	6,962.1	21.8	24,195.7	22,939.9	6,435.2	10,425.0
2009-1	2008-2	25,783.2	20,244.4	9,250.8	9,221.3	11,079.9	0.0	0.0	0.0
2009-2	2009-1	30,128.0	0.0	3,310.3	29.8	13,935.1	21,481.6	8,025.2	15,334.3
2010-1	2009-2	12,989.1	7,904.2	19,427.7	19,427.7	2,908.8	437.1	510.9	421.7
2010-2	2010-1	43,831.8	9,171.2	9,924.7	562.7	1,397.1	20,414.9	11,869.6	21,801.3
2011-1	2010-2	18,513.8	11,588.5	12,526.4	12,515.4	2,713.3	0.1	0.0	0.0
2011-2	2011-1	51,822.6	17,329.6	5,115.4	11.9	7,358.4	11,023.3	8,008.4	20,718.8
2012-1	2011-2	10,534.0	9,026.1	11,906.2	10,018.8	3,672.7	2,873.9	2,931.7	0.0
2012-2	2012-1	48,534.6	0.0	6,896.1	883.6	568.7	39,744.1	32,509.6	19,172.0
2013-1	2012-2	13,609.2	12,827.9	2,592.2	769.7	84.2	149.3	1,421.4	0.0
2013-2	2013-1	37,803.5	0.0	3,658.1	62.9	811.3	27,599.0	29,618.9	0.0
2014-1	2013-2	12,929.7	412.5	1,242.6	666.7	4,403.3	0.0	908.0	0.0
2014-2	2014-1	77,466.3	0.0	291.7	0.0	1,830.9	7,788.4	7,428.4	0.0
2015-1	2014-2	7,682.5	0.0	911.4	0.0	727.7	2,131.3	62.6	0.0
2015-2	2015-1	46,028.6	0.0	56.6	0.0	6.1	0.1	66.1	0.0

Table 3. Pacific sardine length and age samples available for major fishing regions off northern Baja California (Mexico), the United States, and Canada.

Calendar Yr-Sem	Model Yr-Seas	ENS Length	ENS Age	SCA Length	SCA Age	CCA Length	CCA Age	OR Length	OR Age	WA Length	WA Age	BC Length	BC Age
1993-2	1993-1	83	0	22	15	0	0	0	0	0	0	0	0
1994-1	1993-2	33	0	105	31	0	0	0	0	0	0	0	0
1994-2	1994-1	37	0	26	26	0	0	0	0	0	0	0	0
1995-1	1994-2	38	0	278	121	0	0	0	0	0	0	0	0
1995-2	1995-1	51	0	59	35	0	0	0	0	0	0	0	0
1996-1	1995-2	27	0	61	60	11	11	0	0	0	0	0	0
1996-2	1996-1	43	0	34	33	88	87	0	0	0	0	0	0
1997-1	1996-2	21	0	59	58	2	2	0	0	0	0	0	0
1997-2	1997-1	50	0	54	53	55	55	0	0	0	0	0	0
1998-1	1997-2	18	0	60	59	5	5	0	0	0	0	0	0
1998-2	1998-1	41	0	54	53	52	51	0	0	0	0	0	0
1999-1	1998-2	58	0	61	61	14	14	1	1	0	0	0	0
1999-2	1999-1	41	0	49	49	0	0	3	3	0	0	3	0
2000-1	1999-2	46	0	58	58	0	0	4	4	0	0	0	0
2000-2	2000-1	51	0	56	56	0	0	32	31	36	35	29	0
2001-1	2000-2	46	0	68	68	4	4	7	7	4	4	6	0
2001-2	2001-1	29	0	67	67	28	28	28	28	54	54	12	0
2002-1	2001-2	37	0	65	65	13	12	10	10	19	10	3	0
2002-2	2002-1	36	0	70	10	35	30	50	47	125	64	93	0
2003-1	2002-2	18	0	70	70	19	19	1	1	7	4	3	0
2003-2	2003-1	41	0	61	60	8	8	38	37	109	56	92	0
2004-1	2003-2	201	0	67	67	8	8	5	5	12	6	0	0
2004-2	2004-1	205	0	69	69	24	23	35	35	61	32	67	0
2005-1	2004-2	168	0	71	70	1	1	2	2	6	3	0	0
2005-2	2005-1	115	0	73	72	24	23	14	14	54	27	65	0
2006-1	2005-2	53	0	67	66	32	31	0	0	0	0	0	0
2006-2	2006-1	46	0	61	61	58	58	12	12	15	15	0	0
2007-1	2006-2	22	0	74	72	47	46	3	3	0	0	0	0
2007-2	2007-1	46	0	72	72	68	68	80	80	10	10	23	0
2008-1	2007-2	43	0	53	53	15	15	0	0	0	0	0	0
2008-2	2008-1	83	0	25	25	30	30	80	80	14	14	229	0
2009-1	2008-2	50	0	20	20	20	20	0	0	0	0	0	0
2009-2	2009-1	0	0	13	12	23	23	82	81	12	12	285	0
2010-1	2009-2	0	0	62	62	37	36	3	1	2	2	2	0
2010-2	2010-1	0	0	25	25	13	13	64	26	8	8	287	0
2011-1	2010-2	0	0	22	21	11	11	0	0	0	0	0	0
2011-2	2011-1	0	0	22	22	22	22	34	33	10	10	362	0
2012-1	2011-2	0	0	48	47	16	16	8	8	8	8	0	0
2012-2	2012-1	0	0	44	41	18	17	83	82	37	37	106	0
2013-1	2012-2	0	0	16	16	2	2	0	0	3	3	0	0
2013-2	2013-1	0	0	39	39	5	5	75	74	66	65	0	0
2014-1	2013-2	0	0	27	26	14	13	0	0	1	1	0	0
2014-2	2014-1	0	0	8	8	6	6	27	27	24	23	0	0
2015-1	2014-2	0	0	18	18	14	14	15	15	1	0	0	0
2015-2	2015-1	0	0	0	0	1	0	0	0	1	0	0	0

Table 4. Pacific sardine landings (mt) by year-season and SS fleet for NSP (update model) and total catch (not used).

		NSP Catch (update model)			Total Catch (not used)		
Calendar Yr-Sem	Model Yr-Seas	MexCal_S1	MexCal_S2	PacNW	MexCal_S1	MexCal_S2	PacNW
1993-2	1993-1	822.80	0.00	0.00	17460.78	0.00	0.00
1994-1	1993-2	0.00	11345.83	0.00	0.00	14078.85	0.00
1994-2	1994-1	8838.65	0.00	0.00	19503.00	0.00	0.00
1995-1	1994-2	0.00	39748.42	0.00	0.00	46792.12	0.00
1995-2	1995-1	5993.28	0.00	22.68	30093.29	0.00	22.68
1996-1	1995-2	0.00	26565.72	0.00	0.00	32561.24	0.00
1996-2	1996-1	11917.29	0.00	0.00	40559.48	0.00	0.00
1997-1	1996-2	0.00	19158.65	43.54	0.00	25364.55	43.54
1997-2	1997-1	13018.20	0.00	27.22	89272.03	0.00	27.22
1998-1	1997-2	0.00	24527.60	0.82	0.00	42079.67	0.82
1998-2	1998-1	18925.15	0.00	488.25	46787.92	0.00	488.25
1999-1	1998-2	0.00	63278.38	74.39	0.00	66550.51	74.39
1999-2	1999-1	14996.21	0.00	725.20	48765.83	0.00	725.20
2000-1	1999-2	0.00	58341.39	429.59	0.00	69337.59	429.59
2000-2	2000-1	23693.38	0.00	15586.16	56709.77	0.00	15586.16
2001-1	2000-2	0.00	35179.21	2336.90	0.00	46662.67	2336.90
2001-2	2001-1	11550.53	0.00	22545.99	54311.70	0.00	22545.99
2002-1	2001-2	0.00	41118.36	3136.84	0.00	45617.11	3136.84
2002-2	2002-1	16562.71	0.00	35525.69	64671.88	0.00	35525.69
2003-1	2002-2	0.00	36130.69	597.29	0.00	40979.60	597.29
2003-2	2003-1	10340.64	0.00	37242.26	38099.55	0.00	37242.26
2004-1	2003-2	0.00	21300.55	2618.43	0.00	28590.55	2618.43
2004-2	2004-1	17048.96	0.00	46730.80	61008.15	0.00	46730.80
2005-1	2004-2	0.00	25249.92	1016.32	0.00	32857.28	1016.32
2005-2	2005-1	13730.19	0.00	54152.62	60658.00	0.00	54152.62
2006-1	2005-2	0.00	29752.00	101.70	0.00	36791.15	101.70
2006-2	2006-1	20620.28	0.00	41220.90	71474.68	0.00	41220.90
2007-1	2006-2	0.00	39234.00	0.00	0.00	46338.25	0.00
2007-2	2007-1	46047.30	0.00	48237.10	71489.22	0.00	48237.10
2008-1	2007-2	0.00	42247.81	0.00	0.00	50130.29	0.00
2008-2	2008-1	30147.46	0.00	39800.10	74536.03	0.00	39800.10
2009-1	2008-2	0.00	40545.56	0.00	0.00	46113.91	0.00
2009-2	2009-1	13964.90	0.00	44841.15	47373.39	0.00	44841.15
2010-1	2009-2	0.00	30240.66	1369.73	0.00	35325.50	1369.73
2010-2	2010-1	11130.97	0.00	54085.91	55153.61	0.00	54085.91
2011-1	2010-2	0.00	26817.27	0.09	0.00	33753.60	0.09
2011-2	2011-1	24700.00	0.00	39750.49	64296.47	0.00	39750.49
2012-1	2011-2	0.00	22717.65	5805.63	0.00	26113.00	5805.63
2012-2	2012-1	1452.24	0.00	91425.63	55999.36	0.00	91425.63
2013-1	2012-2	0.00	13681.80	1570.78	0.00	16285.63	1570.78
2013-2	2013-1	874.21	0.00	57217.96	42272.96	0.00	57217.96
2014-1	2013-2	0.00	5482.44	908.01	0.00	18575.53	908.01
2014-2	2014-1	1830.92	0.00	15216.82	79588.92	0.00	15216.82
2015-1	2014-2	0.00	727.71	2193.87	0.00	9321.57	2193.87
2015-2	2015-1	6.13	0.00	66.28	46091.33	0.00	66.28
2016-1	2015-2	0.00	12.00	0.00	0.00	7706.51	0.00

Table 5. Fishery-independent indices of Pacific sardine relative abundance. Complete details regarding calculation of DEPM and TEP estimates are provided in Tables 7 and 8. In the SS model, indices had a lognormal error structure with units of standard error of log*e*(index). Variances of the observations were available as a CVs, so the S.E.s were approximated as sqrt(log*e*(1+CV^2)).

Model Yr-Seas	DEPM	S.E. ln(index)	TEP	S.E. ln(index)	Acoustic	S.E. ln(index)
1993-2	69,065	0.29	---	---	---	---
1995-2	---	---	97,923	0.40	---	---
1996-2	---	---	482,246	0.21	---	---
1997-2	---	---	369,775	0.33	---	---
1998-2	---	---	332,177	0.34	---	---
1999-2	---	---	1,252,539	0.39	---	---
2000-2	---	---	931,377	0.38	---	---
2001-2	---	---	236,660	0.17	---	---
2002-2	---	---	556,177	0.18	---	---
2003-2	145,274	0.23	---	---	---	---
2004-2	459,943	0.55	---	---	---	---
2005-2	---	---	651,994	0.25	1,947,063	0.30
2006-2	198,404	0.30	---	---	---	---
2007-2	66,395	0.27	---	---	751,075	0.09
2008-1	---	---	---	---	801,000	0.30
2008-2	99,162	0.24	---	---	---	---
2009-1	---	---	---	---	---	---
2009-2	58,447	0.40	---	---	357,006	0.41
2010-1	---		---	---	---	---
2010-2	219,386	0.27	---	---	493,672	0.30
2011-1	---	---	---	---	---	---
2011-2	113,178	0.27	---	---	469,480	0.28
2012-1	---	---	---	---	340,831	0.33
2012-2	82,182	0.29	---	---	305,146	0.24
2013-1	---	---	---	---	313,746	0.27
2013-2	---	---	---	---	35,339	0.38
2014-1	---	---	---	---	26,280	0.63
2014-2	19,376	0.54	---	---	29,048	0.29
2015-1	---	---	---	---	15,870	0.70

Table 6. Pacific sardine ichthyoplankton and adult collections made during the spring 2015 CalCOFI and DEPM cruises off California and the summer 2015 SaKe survey (1507SH) off the U.S. west coast.

Gear	Sample type & tows	CALCOFI	DEPM	Summer SaKe Survey
		April 4-19, 2015	Mar 30 -Apr 30, 2015	Jun 19 -Sep 7, 2015
		New Horizon	*Bell M. Shimada*	*Bell M. Shimada*
CalVET	Total tows	59	66	
	Positive tows	2	22	
	Total eggs	1	86	
	Total larvae	1	36	
Bongo	Total tows	70	56	59
	Total positive tows	2	*	
	Positive egg tows	2	*	
	EGGS	31	*	
	Positive larvae tows	1	>= 11*	
	Total larvae	1	>= 63*	
CUFES	Total samples	444	370	
	Positive samples	8	56	
	Total eggs	35	325	
Trawl	Total tows	N/A	51	160
	Total positive tows		9 (7 w/ adults; 2 w/ juv.)	21
	Total sardine adults		62	2547
	Total female sardine		28	

* Bongo sample processing is in progress. A total of 12 tows were not sorted, so the data are incomplete. Note also that egg data from bongo nets are not used in the DEPM biomass estimation.

Table 7. The spawning biomass related parameters: daily egg production/0.05m^2 (P_0),daily mortality rate (z), survey area (km^2), two daily specific fecundities: (RSF/W), and (SF/W); s. biomass, female spawning biomass, total egg production (TEP) and sea surface temperature for 1986, 1987, 1994, 2004, 2005 and 2007-2015.

Calendar Year	Month	Region	[1]P_0/0.05m^2 (cv)	Z (CV)	[2]RSF/W based on S_1	[3]RSF/W based on S_{12}	[3]FS/W based on S_{12}	[4]Area (km^2)	[5]S. biomass (cv)	S. biomass females (cv)	S. biomass females (Sum of R1andR2) (cv)	Total egg production (TEP)	Mean temper-ature (°C) for positive eggs	Mean temper-ature (°C) from Calvet
1986	Aug.	[6]S	1.48(1)	1.59(0.5)	38.31	43.96	72.84	6478	4362 (1.00)	2632 (1)		9587.44		
		N	0.32(0.25)		8.9	13.34	23.89	5333	2558 (0.33)	1429 (0.28)		1706.56		
		whole	0.95(0.84)		23.61	29.89	49.97	11811	7767 (0.87)	4491 (0.86)	4061 (0.66)	11220.45	18.7	18.5
1987	July	1	1.11(0.51)	0.66(0.4)	38.79	37.86	57.05	22259	13050 (0.58)	8661 (0.56)		24707.49		
		2	0					15443	0	0		0		
		whole	0.66(0.51)		38.79	37.86	57.05	37702	13143 (0.58)	8723 (0.56)	8661 (0.56)	25637.36	18.9	18.1
1994	April	1	0.42(0.21)	0.12(0.91)	11.57	11.42	21.27	174880	128664 (0.30)	69065 (0.30)		73449.6		
		2	0(0)	-				205295	0	0		0		
		whole	0.193(0.21)		11.57	11.42	21.27	380175	128531 (0.31)	68994 (0.30)	69065 (0.30)	73373.775	14.3	14.7
2004	April	1	3.92(0.23)	0.25(0.04)	27.03	26.2	42.37	68204	204118 (0.27)	126209 (0.26)		267359.68		
		2	0.16(0.43)		-	-	-	252416	30833 (0.45)	19065 (0.44)		40386.56		
		whole	0.96(0.24)		27.03	26.2	42.37	320620	234958 (0.28)	145297 (0.27)	145274 (0.23)	307795.2	13.4	13.7
2005	April	1	8.14(0.4)	0.58(0.2)	31.49	25.6	46.52	46203	293863 (0.45)	161685 (0.42)		376092.42		
		2	0.53(0.69)		3.76	3.2	7.37	207417	686168 (0.86)	298258 (0.89)		109931.01		
		whole	1.92(0.42)		15.67	12.89	27.11	253620	755657 (0.52)	359209 (0.50)	459943 (0.60)	486950.4	14.21	14.1
2007	April	1	1.32(0.2)	0.13(0.36)	12.06	13.37	27.54	142403	281128 (0.42)	136485 (0.36)		187971.96		
		2	0.56(0.46)		24.48	23.41	38.94	213756	102998 (0.67)	61919 (0.62)		119703.36		
		whole	0.86(0.26)		15.68	16.17	31.52	356159	380601 (0.39)	195279 (0.36)	198404 (0.31)	306296.74	13.7	13.6
2008	April	1	1.45(0.18)	0.13(0.29)	57.4	53.89	68.54	53514	29798 (0.20)	22642 (0.19)		77595.3		
		2	0.202(0.32)		13.84	12.6	22.57	244435	78359 (0.45)	43753 (0.42)		49375.87		
		whole	0.43(0.21)		21.82	20.31	32.2	297949	126148 (0.40)	79576 (0.35)	66395 (0.28)	128118.07	13.1	13.1
2009	April	1	1.76(0.22)	0.25(0.19)	19.50	20.37	36.12	74966	129520 (0.31)	73048 (0.29)		131940.16		
		2	0.15(0.27)		14.25	14.34	22.97	199929	41816 (0.38)	26114 (0.38)		29989.35		
		whole	0.59(0.22)		17.01	17.53	29.11	274895	185084 (0.28)	111444 (0.27)	99162 (0.24)	162188.05	13.6	13.5

Table 7 Continued

Calendar Year	Month	Region	[1]P0/0.05m2 (cv)	Z (CV)	[2]RSF/Wb ased on S_1	[3]RSF/W based on S_{12}	[3]FS/W based on S_{12}	[4]Area (km^2)	[5]S. biomass (cv)	S. biomass females (cv)	S. biomass females (Sum of R1andR2) (cv)	Total egg production (TEP)	Mean temper-ature (°C) for positive eggs	Mean temper-ature (°C) from Calvet
2010	April	1	1.70(0.22)	0.33(0.23)	21.08	24.02	51.56	27462	38875 (0.44)	18111 (0.39)		46685.4		
		2	0.22(0.42)		14.55	16.20	26.65	244311	66345 (0.58)	40336 (0.58)		53748.42		
		whole	0.36(0.29)		16.08	18.07	31.49	271773	108280 (0.46)	62131 (0.46)	58447 (0.42)	97838.28	13.7	13.9
2011	April	1	5.57(0.24)	0.51(0.14)	19.03	24.26	41.16	41878	192332 (0.31)	113340 (0.30)		233260.5		
		2	0.487(0.33)		11.40	14.67	25.04	272603	181016 (0.48)	106046 (0.49)		132757.7		
		whole	1.16(0.26)		14.85	19.04	32.40	314481	383286 (0.32)	225155 (0.32)	219386 (0.28)	364798.0	13.5	13.6
2012	April	1	5.28 (0.27)	0.66(0.11)	17.76	19.25	42.17	32322	177289 (0.37)	80930 (0.33)		170660.16		
		2	0.24 (0.27)		15.34	14.67	35.52	238669	78102 (0.60)	32248 (0.46)		57280.56		
		whole	0.84 (0.27)		16.14	16.14	37.65	270991	282110 (0.43)	120902 (0.36)	113178 (0.27)	227632.44	13.57	13.3
2013	April	1	5.47 (0.29)	0.64(0.16)	32.35	27.41	47.91	29176	116455 (0.40)	66633 (0.36)		159592.72		
		2	0.27 (0.44)		13.20	24.71	39.00	112221	24547 (0.48)	15549 (0.49)		30299.67		
		whole	1.34 (0.299)		26.22	26.22	44.70	141397	144880 (0.36)	84972 (0.33)	82182 (0.30)	198471.98	13.51	13.47
2014	April	1	--	--	--	--	--	--	--	--	--	--		
		2	--	--	0	23.70	42.28		--	--	--	--		
		whole	--	--	0	23.70	42.28	160305	--	--	--	--	--	14.51
2015	April	1	1.71 (0.71)	1.095(0.15)	37.42	21.38	47.75	8814	14087 (0.79)	6308 (0.74)		15071.9		
		2	0.09 (0.73)		0	12.07	23.46	172436	25408 (0.76)	13068 (0.78)		15329.6		
		whole	0.17 (0.72)		25.62	18.09	37.28	181250	33412 (0.74)	16207 (0.74)	19376 (0.58)	30395.6	12.02	12.64

1: P_0 for the whole is the weighted average with area as the weight.

2. The estimates of adult parameters for the whole area were unstratified and RSF/W was based on original S_1 data of day-1 spawning females. For 2004, 27.03 was based on sex ratio= 0.618 while past biomass used RSF/W of 21.86 based on sex ratio = 0.5.(Lo et al. 2008).

3. The estimates of adult parameters for the whole area were unstratified. Batch fecundity was estimated with error term. For 1987 and 1994, estimates were based on S_1 using data of day-1 spawning females. For 2004, all trawls were in Region 1 and value was applied to Region 2.

4. Region 1 area is based: in 2015, on CUFES ≥ 0.3 eggs/min; in 2004-2013, on CUFES ≥1 eggs/min; and prior to 1997, from CalVET tows with eggs/0.05m^2 >0.

5: For the spawning biomass, the estimate for the whole area uses unstratified adult parameters.

6. Within southern and northern area, the survey area was stratified as Region 1 (eggs/0.05m2>0 with embedded zero) and Region 2 (zero eggs).

Table 8. Pacific sardine female adult parameters for surveys conducted in the standard daily egg production method (DEPM) sampling area off California in during 1994-2014 (1994 includes females from off Mexico) and off Oregon and northern California in 2015.

		1994	1997	2001	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Midpoint date of trawl survey		22-Apr	25-Mar	1-May	21-Apr	25-Apr	13-Apr	2-May	24-Apr	16-Apr	27-Apr	20-Apr	8-Apr	19-Apr	25-Apr	26-Apr	14-Apr
Beginning and ending dates of positive collections		04/15-05/07	03/12-04/06	05/01-05/02	04/18-04/23	04/22-04/27	03/31-04/24	05/01-05/07	04/19-04/30	04/13-04/27	04/17-05/06	04/12-04/27	03/23-04/25	04/08-04/28	04/18-05/03	04/25-05/03	04/01-04/17
N collections with mature females		37	4	2	6	16	14	7	14	12	29	17	30	16	15	3	4
N collection within Region 1		19	4	2	6	16	6	2	8	4	15	3	14	8	8	3	2
Average surface temperature (°C) at collection locations		14.36	14.28	12.95	12.75	13.59	14.18	14.43	13.6	12.4	12.93	13.62	13.12	13.18	13.65	12.96	12.54
Female fraction by weight	**R**	0.538	0.592	0.677	0.385	0.618	0.469	0.451	0.515	0.631	0.602	0.574	0.587	0.429	0.586	0.560	0.485
Average mature female weight (grams): with ovary	**W_f**	82.53	127.76	79.08	159.25	166.99	65.34	67.41	81.62	102.21	112.40	129.51	127.59	141.36	138.17	155.82	192.21
without ovary	**W_{of}**	79.33	119.64	75.17	147.86	156.29	63.11	64.32	77.93	97.67	106.93	121.34	119.38	131.58	129.76	146.35	178.26
Average batch fecundity[a] (mature females, oocytes)	**F**	24283	42002	22456	54403	55711	17662	18474	21760	29802	29790	39304	38369	38681	41339	46124	60916
Relative batch fecundity (oocytes/g)		294	329	284	342	334	270	274	267	292	265	303	301	274	299	296	317
N mature females analyzed		583	77	9	23	290	175	86	203	187	467	313	244	126	121	7	25
N active mature females		327	77	9	23	290	148	72	187	177	463	310	244	125	119	7	25
Spawning fraction of mature females[b]	**S**	0.074	0.133	0.111	0.174	0.131	0.124	0.0698	0.114	0.1186	0.1098	0.1038	0.1078	0.1376	0.149	0.143	0.118
Spawning fraction of active females[c]	**S_a**	0.131	0.133	0.111	0.174	0.131	0.155	0.083	0.134	0.1187	0.1108	0.1048	0.1078	0.1388	0.153	0.143	0.118
Daily specific fecundity	**$\frac{RSF}{W}$**	11.7	25.94	21.3	22.91	27.04	15.67	8.62	15.68	21.82	17.53	18.07	19.04	16.14	26.22	23.70	18.09

[a] 1994-2001 estimates were calculated using F_b = -10858 + 439.53 W_{of} (Macewicz et al. 1996), 2004 used F_b = 356.46W_{of}. (Lo and Macewicz 2004), 2005 used F_b = -6085 + 376.28 W_{of} (Lo and Macewicz 2006), 2006 used F_b = -396 + 293.39 W_{of} (Lo et al. 2007a), 2007 used F_b = 279.23W_{of} (Lo et al. 2007b), 2008 used F_b = 305.14W_{of} (Lo et al. 2008), 2009 used F_b = -4598 + 326.78W_{of} + e (Lo et al. 2009), 2010 used F_b = 5136 + 287.37W_{of} + e (Lo et al. 2010), 2011 used F_b = -2252 + 347.6W_{of} + e (Lo et al. 2011), 2012 used F_b = -12724 + 402.3W_{of} + e (Lo et al. 2013), 2013 used F_b = -9759 + 404.24W_{of} + e (Dorval et al. 2014), 2014 used equation from 2013, and 2015 used F_b = -5112 + 365.85W_{of} + e .

[b] Mature females include females that are active and those that are postbreeding (incapable of further spawning this season). S_1 was used for years prior to 2009 and S_{12} was used staring 2009.

[c] Active mature females are capable of spawning and have ovaries containing oocytes with yolk or postovulatory follicles less than 60 hours old.

Table 9. Likelihood components and derived quantities of interest for stepwise addition of new data to the update model.

NEW DATA / PROCESS:	2015 Update	+Catch	+MexCal_S1 Lengths	+MexCal_S2 Lengths	+PacNW Lengths	+All Fshy Lengths	+All Fshy CondAL	+Survey Estimates	+ATM Lengths (Strict Update)	Update (no summer AT15 length)
New Catch & Adj Rec Devs										
New MexCal_S1 Length Comp										
New MexCal_S2 Length Comp										
New PacNW Length Comp										
New Fishery CondAL Comps										
2015 Survey Estimates										
2015 ATM Length Comps										
LIKELIHOOD COMPONENT:	**2015 Update**	**+Catch**	**+MexCal_S1 Lengths**	**+MexCal_S2 Lengths**	**+PacNW Lengths**	**+All Fshy lengths**	**+All Fshy CondAL**	**+Survey Estimates**	**+ATM Lengths (Strict Update)**	**Update (no summer AT15 length)**
DEPM Survey	12.7408	12.5111	12.5130	12.4821	12.5257	12.5355	12.6533	12.5030	12.9957	12.4894
TEP Survey	12.6253	12.6729	12.6617	12.6596	12.7440	12.7216	12.5467	12.7835	12.6839	12.6756
ATM Spring	6.7948	7.3467	7.4350	7.4050	7.3474	7.4715	8.2489	8.4925	7.6612	8.5345
ATM Summer	1.5017	1.6740	1.6901	1.7401	1.6815	1.7586	1.9579	4.0414	5.8039	4.0361
Survey Subtotal	**33.6625**	**34.2048**	**34.2997**	**34.2867**	**34.2986**	**34.4872**	**35.4068**	**37.8204**	**39.1446**	**37.7355**
MexCal_S1 Lengths	180.3010	180.3290	183.4860	180.5360	179.9700	183.0750	185.7610	185.4020	186.8040	185.4260
MexCal_S2 Lengths	197.9900	198.4410	198.5100	210.6680	198.1340	210.4630	211.4620	211.9060	214.0140	211.8920
PacNW Lengths	394.3950	402.3270	402.4830	402.6200	409.6360	410.0180	410.8850	412.5430	414.5770	413.0730
ATM Spring Lengths	44.8175	45.0167	45.0937	45.3570	45.0599	45.4413	46.0423	44.9917	52.6261	53.8821
ATM Summer Lengths	40.5409	40.8439	40.8615	40.9102	40.9863	41.0645	41.6355	41.8112	96.6621	41.5785
Lengths Subtotal	**858.0444**	**866.9576**	**870.4342**	**880.0912**	**873.7862**	**890.0618**	**895.7858**	**896.6539**	**964.6832**	**905.8516**
MexCal_S1 CondAL	252.6580	252.9590	252.8250	252.1790	252.9430	252.1860	260.8580	261.5230	263.9600	261.7270
MexCal_S2 CondAL	309.1470	310.1970	310.0080	310.5710	310.1300	309.8140	348.9850	350.3860	341.2530	351.0770
PacNW CondAL	613.0840	612.1680	611.5230	613.1360	614.2840	614.5790	634.0450	630.1880	629.6370	628.0180
CondAL Subtotal (λ=0.2)	**234.9778**	**235.0648**	**234.8712**	**235.1772**	**235.4714**	**235.3158**	**248.7776**	**248.4194**	**246.9700**	**248.1644**
Catch	8.31E-14	8.09E-14	8.27E-14	9.16E-14	8.29E-14	9.67E-14	8.94E-14	2.15E-13	2.54E-13	2.14E-13
Recruitment	37.9503	37.3795	37.1954	35.5464	37.7548	35.7896	33.7981	38.8825	49.9890	39.1220
Parm_softbounds	0.0068	0.0052	0.0051	0.0067	0.0052	0.0067	0.0052	0.0070	0.0078	0.0070
TOTAL	**1164.64**	**1173.61**	**1176.81**	**1185.11**	**1181.32**	**1195.66**	**1213.77**	**1221.78**	**1300.79**	**1230.88**
DERIVED QUANTITIES:	**2015 Update**	**+Catch**	**+MexCal_S1 Lengths**	**+MexCal_S2 Lengths**	**+PacNW Lengths**	**+All Fshy lengths**	**+All Fshy CondAL**	**+Survey Estimates**	**+ATM Lengths (Strict Update)**	**Update (no summer AT15 length)**
Ln(R0)	14.8748	14.8822	14.8767	14.8662	14.8787	14.8606	14.8731	14.7545	14.914	14.7509
SSB-Virgin	475,035	478,001	475,325	470,917	476,411	468,074	475,513	423,002	495,750	421,572
Stock Biomass -2007 peak	1,037,180	1,035,690	1,035,890	1,030,000	1,035,270	1,029,450	1,009,730	948,949	961,115	949,526
Stock Biomass - 2015	132,884	142,917	136,255	122,858	142,309	120,358	124,886	75,584	70,372	75,476
Stock Biomass - 2016	---	183,107	174,745	154,849	182,231	152,108	154,568	106,356	1,385,290	106,137

Table 10. Parameters and asymptotic standard deviations for the 2015 and 2016 update models.

					2015 update		2016 strict update		2016 noAT15 len	
Parameter	**Phase**	**Min**	**Max**	**Initial**	**Final**	**Std Dev**	**Final**	**Std Dev**	**Final**	**Std Dev**
NatM_p_1_Fem_GP_1	-3	0.3	0.7	0.4000	0.4000	_	0.4000	_	0.4000	_
L_at_Amin_Fem_GP_1	3	3	15	10.0000	11.3881	0.2819	10.9018	0.2893	11.2948	0.2927
L_at_Amax_Fem_GP_1	3	20	30	25.0000	23.3801	0.1506	23.2370	0.1355	23.3583	0.1465
VonBert_K_Fem_GP_1	3	0.05	0.99	0.4000	0.4238	0.0234	0.4603	0.0237	0.4323	0.0236
CV_young_Fem_GP_1	3	0.05	0.3	0.1400	0.1347	0.0076	0.1409	0.0080	0.1375	0.0079
CV_old_Fem_GP_1	3	0.01	0.1	0.0500	0.0474	0.0025	0.0492	0.0023	0.0478	0.0024
Wtlen_1_Fem	-3	-3	3	7.5242E-06	0.0000	_	0.0000	_	0.0000	_
Wtlen_2_Fem	-3	-3	5	3.2332	3.2332	_	3.2332	_	3.2332	_
Mat50%_Fem	-3	9	19	15.4400	15.4400	_	15.4400	_	15.4400	_
Mat_slope_Fem	-3	-20	3	-0.8925	-0.8925	_	-0.8925	_	-0.8925	_
Eggs/kg_inter_Fem	-3	0	10	1.0000	1.0000	_	1.0000	_	1.0000	_
Eggs/kg_slope_wt_Fem	-3	-1	5	0.0000	0.0000	_	0.0000	_	0.0000	_
SR_LN(R0)	1	3	25	16.0000	14.8748	0.0734	14.9140	0.0736	14.7509	0.0733
SR_R1_offset	2	-15	15	0.0000	-0.2225	0.2595	-0.2835	0.2581	-0.2097	0.2599
SR_BH_steep	-6	0.2	1	0.8000	0.8000	_	0.8000	_	0.8000	_
SR_sigmaR	-3	0	2	0.7500	0.7500	_	0.7500	_	0.7500	_
Early_InitAge_6	_	_	_	_	-0.3454	0.6468	-0.3581	0.6440	-0.3438	0.6472
Early_InitAge_5	_	_	_	_	-0.3811	0.6348	-0.3985	0.6310	-0.3792	0.6351
Early_InitAge_4	_	_	_	_	-0.3730	0.6281	-0.4022	0.6227	-0.3725	0.6285
Early_InitAge_3	_	_	_	_	-0.0702	0.6145	-0.1242	0.6070	-0.0740	0.6150
Early_InitAge_2	_	_	_	_	0.3810	0.4879	0.3171	0.4829	0.3760	0.4913
Early_InitAge_1	_	_	_	_	1.3938	0.2813	1.3499	0.2800	1.4321	0.2814
Main_RecrDev_1993	_	_	_	_	1.1060	0.1858	1.0184	0.1862	1.1802	0.1840
Main_RecrDev_1994	_	_	_	_	0.0001	0.2686	-0.0767	0.2653	0.0656	0.2690
Main_RecrDev_1995	_	_	_	_	0.4631	0.2083	0.3585	0.2089	0.5297	0.2086
Main_RecrDev_1996	_	_	_	_	1.6068	0.1344	1.5615	0.1334	1.6913	0.1339
Main_RecrDev_1997	_	_	_	_	1.2496	0.1469	1.2101	0.1453	1.3452	0.1460
Main_RecrDev_1998	_	_	_	_	-0.5398	0.2638	-0.6099	0.2614	-0.4585	0.2652
Main_RecrDev_1999	_	_	_	_	-0.4386	0.2073	-0.5050	0.2056	-0.3694	0.2097
Main_RecrDev_2000	_	_	_	_	0.2844	0.1361	0.2002	0.1360	0.3672	0.1359
Main_RecrDev_2001	_	_	_	_	-1.7772	0.3554	-1.7660	0.3512	-1.7087	0.3569
Main_RecrDev_2002	_	_	_	_	1.9517	0.1069	1.8366	0.1073	1.9892	0.1077
Main_RecrDev_2003	_	_	_	_	1.2235	0.1666	1.1877	0.1601	1.2900	0.1658
Main_RecrDev_2004	_	_	_	_	1.7610	0.1109	1.6433	0.1113	1.8065	0.1118
Main_RecrDev_2005	_	_	_	_	0.5562	0.2005	0.4876	0.1913	0.6057	0.1998
Main_RecrDev_2006	_	_	_	_	1.0619	0.1413	0.8396	0.1411	1.0417	0.1422
Main_RecrDev_2007	_	_	_	_	0.0026	0.2313	-0.0525	0.2088	-0.0310	0.2315
Main_RecrDev_2008	_	_	_	_	1.0182	0.1187	0.8198	0.1121	1.0173	0.1143
Main_RecrDev_2009	_	_	_	_	-0.4290	0.2034	-0.4521	0.1759	-0.2473	0.1795
Main_RecrDev_2010	_	_	_	_	-2.1023	0.2733	-2.3935	0.2678	-2.1642	0.2690
Main_RecrDev_2011	_	_	_	_	-3.3736	0.3562	-3.5791	0.3301	-3.3474	0.3368
Main_RecrDev_2012	_	_	_	_	-3.2928	0.3912	-3.0718	0.3339	-2.9599	0.3604
Main_RecrDev_2013	_	_	_	_	-0.3321	0.6504	-1.9514	0.4846	-1.6367	0.5437
Main_RecrDev_2014	_	_	_	_	_	_	3.2945	0.6067	-0.0066	0.7248
LnQ_base_4_DEPM	5	-3	3	-1.3900	-1.5362	0.1122	-1.4135	0.1100	-1.4099	0.1089
LnQ_base_5_TEP	5	-3	3	-0.6900	-0.3423	0.1318	-0.2906	0.1298	-0.2742	0.1292
LnQ_base_8_ATM_Spr&Sum	-5	-3	3	0.0000	0.0000	_	0.0000	_	0.0000	_

Table 10 (cont.). Parameters and asymptotic standard deviations for the 2015 and 2016 update models.

					2015 update		2016 strict update		2016 noAT15 len	
Parameter	**Phase**	**Min**	**Max**	**Initial**	**Final**	**Std Dev**	**Final**	**Std Dev**	**Final**	**Std Dev**
SizeSel_1P_1_MexCal_S1_93-98	4	10	28	18.0000	18.5165	0.3536	18.4999	0.3477	18.5252	0.3511
SizeSel_1P_2_MexCal_S1_93-98	-4	-5	3	-4.9850	-4.9850	_	-4.9850	_	-4.9850	_
SizeSel_1P_3_MexCal_S1_93-98	4	-1	9	2.5000	2.8690	0.1888	2.8449	0.1881	2.8622	0.1871
SizeSel_1P_4_MexCal_S1_93-98	4	-1	9	4.0000	0.5432	0.5500	0.5349	0.5345	0.5362	0.5491
SizeSel_1P_5_MexCal_S1_93-98	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S1_93-98	4	-10	10	-10.0000	-3.5107	1.0472	-3.5979	1.0399	-3.5117	1.0462
SizeSel_1P_1_MexCal_S1_99-15	4	10	28	18.0000	17.0810	0.1980	17.0907	0.1929	17.0972	0.1986
SizeSel_1P_2_MexCal_S1_99-15	-4	-5	3	-4.9980	-4.9980	_	-4.9980	_	-4.9980	_
SizeSel_1P_3_MexCal_S1_99-15	4	-1	9	2.5000	2.1050	0.1369	2.0729	0.1376	2.1162	0.1370
SizeSel_1P_4_MexCal_S1_99-15	4	-1	9	4.0000	-0.2977	0.4810	-0.2863	0.4712	-0.3052	0.4902
SizeSel_1P_5_MexCal_S1_99-15	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S1_99-15	4	-10	10	-10.0000	-2.2423	0.1996	-2.3060	0.1940	-2.2175	0.1957
SizeSel_1P_1_MexCal_S2_93-98	4	10	28	18.0000	16.3601	0.2808	16.2198	0.2744	16.3516	0.2796
SizeSel_1P_2_MexCal_S2_93-98	-4	-5	3	-4.9930	-4.9930	_	-4.9930	_	-4.9930	_
SizeSel_1P_3_MexCal_S2_93-98	4	-1	9	2.5000	1.7947	0.1918	1.7088	0.1891	1.7823	0.1902
SizeSel_1P_4_MexCal_S2_93-98	4	-1	9	4.0000	1.8461	0.3597	1.9142	0.3265	1.8485	0.3586
SizeSel_1P_5_MexCal_S2_93-98	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S2_93-98	4	-10	10	-10.0000	-2.3386	0.5800	-2.5048	0.5839	-2.3366	0.5783
SizeSel_1P_1_MexCal_S2_99-15	4	10	28	18.0000	14.6774	0.2001	14.6759	0.1831	14.7441	0.1931
SizeSel_1P_2_MexCal_S2_99-15	-4	-5	3	-4.9970	-4.9970	_	-4.9970	_	-4.9970	_
SizeSel_1P_3_MexCal_S2_99-15	4	-1	9	2.5000	1.5394	0.1968	1.3976	0.1743	1.5343	0.1881
SizeSel_1P_4_MexCal_S2_99-15	4	-1	9	4.0000	1.9650	0.1721	1.9268	0.1593	1.9168	0.1711
SizeSel_1P_5_MexCal_S2_99-15	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S2_99-15	4	-10	10	-10.0000	-2.5563	0.2201	-2.6838	0.2055	-2.5423	0.2079
SizeSel_3P_1_PacNW	4	10	28	19.0000	20.9337	0.2285	20.7509	0.2055	20.8528	0.2221
SizeSel_3P_2_PacNW	-4	-5	10	2.5000	2.5000	_	2.5000	_	2.5000	_
SizeSel_3P_3_PacNW	4	-5	10	5.0000	1.8489	0.1241	1.7985	0.1221	1.8124	0.1254
SizeSel_3P_4_PacNW	-4	-5	10	5.0000	5.0000	_	5.0000	_	5.0000	_
SizeSel_3P_5_PacNW	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_3P_6_PacNW	-4	-10	10	10.0000	10.0000	_	10.0000	_	10.0000	_
SizeSel_8P_1_ATM_Spring	4	10	28	18.0000	16.7009	0.5535	16.6464	0.5064	16.6602	0.4998
SizeSel_8P_2_ATM_Spring	-4	-5	3	3.0000	3.0000	_	3.0000	_	3.0000	_
SizeSel_8P_3_ATM_Spring	4	-1	9	2.5000	-0.8025	1.5009	-0.8450	1.4337	-0.8461	1.4012
SizeSel_8P_4_ATM_Spring	-4	-1	9	4.0000	4.0000	_	4.0000	_	4.0000	_
SizeSel_8P_5_ATM_Spring	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_8P_6_ATM_Spring	-4	-10	10	10.0000	10.0000	_	10.0000	_	10.0000	_
SizeSel_9P_1_ATM_Summer	4	10	28	18.0000	22.6552	1.0042	26.1382	1.2356	22.2953	0.8792
SizeSel_9P_2_ATM_Summer	-4	-5	3	3.0000	3.0000	_	3.0000	_	3.0000	_
SizeSel_9P_3_ATM_Summer	4	-1	9	2.5000	2.2610	0.5414	3.9852	0.3015	2.1219	0.5255
SizeSel_9P_4_ATM_Summer	-4	-1	9	4.0000	4.0000	_	4.0000	_	4.0000	_
SizeSel_9P_5_ATM_Summer	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_	-10.0000	_
SizeSel_9P_6_ATM_Summer	-4	-10	10	10.0000	10.0000	_	10.0000	_	10.0000	_

Table 11. Likelihood components and data weightings for the 2016 update models.

STRICT UPDATE

COMPONENT	**-log(L)**	**MexCal_S1**	**MexCal_S2**	**PacNW**	**DEPM**	**TEP**	**ATM_Spring**	**ATM_Summer**
Catch	2.53821E-13	1.0277E-13	1.42304E-13	8.74598E-15	---	---	---	---
Survey	39.14462	---	---	---	12.9957	12.6839	7.66116	5.80386
Length comp	964.6832	186.804	214.014	414.577	---	---	52.6261	96.6621
Age comp	246.97	263.96	341.253	629.637	---	---	66.522	42.680
Recruitment	49.989							
Parm softbounds	0.00777864							
TOTAL	1300.794599							

PROPOSED UPDATE w/o AT15 Summer Length Composition

COMPONENT	**-log(L)**	**MexCal_S1**	**MexCal_S2**	**PacNW**	**DEPM**	**TEP**	**ATM_Spring**	**ATM_Summer**
Catch	2.13919E-13	1.00158E-13	1.05382E-13	8.3796E-15	---	---	---	---
Survey	37.73553	---	---	---	12.4894	12.6756	8.53447	4.03606
Length comp	905.8516	185.426	211.892	413.073	---	---	53.8821	41.5785
Age comp	248.1644	261.727	351.077	628.018	---	---	68.1277	42.8506
Recruitment	39.122							
Parm softbounds	0.00702228							
TOTAL	1230.880552							

VARIANCE ADJUSTMENTS	**MexCal_S1**	**MexCal_S2**	**PacNW**	**DEPM**	**TEP**	**ATM_Spring**	**ATM_Summer**
Index_extra_CV	---	---	---	0.0	0.0	0.0	0.0
effN_mult_Lencomp	1.0	1.0	1.0	---	---	1.0	1.0
effN_mult_Agecomp	1.0	1.0	1.0			1.0	1.0

LAMBDA WEIGHTINGS	**MexCal_S1**	**MexCal_S2**	**PacNW**	**DEPM**	**TEP**	**ATM_Spring**	**ATM_Summer**
Survey	---	---	---	1.0	1.0	1.0	1.0
Length comp	1.0	1.0	1.0	---	---	1.0	1.0
Age comp	0.2	0.2	0.2	---	---	0.0	0.0

Table 12a. Pacific sardine population numbers-at-age (1,000s) by model year and semester for the proposed update model.

		POPULATION NUMBERS-AT-AGE (1,000s of fish)										
Calendar Yr-Sem	Model Yr-Seas	0 (R)	1	2	3	4	5	6	7	8	9	10+
---	VIRG	2,548,280	1,708,160	1,145,020	767,527	514,489	344,872	231,175	154,961	103,873	69,629	141,572
---	VIRG	2,086,350	1,398,530	937,459	628,398	421,228	282,357	189,270	126,871	85,044	57,007	115,909
---	INIT	2,066,240	1,385,040	928,423	622,341	417,168	279,636	187,445	125,648	84,225	56,458	114,792
---	INIT	1,691,700	1,133,980	760,129	509,530	341,548	228,946	153,467	102,872	68,957	46,224	93,984
1993-2	1993-1	6,857,610	4,596,800	1,103,290	485,455	248,553	170,374	121,809	125,648	84,225	56,458	114,792
1994-1	1993-2	5,614,200	3,757,220	900,534	396,509	203,242	139,404	99,694	102,847	68,944	46,216	93,969
1994-2	1994-1	6,352,900	4,560,930	2,981,850	720,080	320,639	165,205	113,536	81,257	83,856	56,222	114,334
1995-1	1994-2	5,199,210	3,691,930	2,391,300	580,104	260,293	134,693	92,735	66,419	68,566	45,978	93,514
1995-2	1995-1	2,122,680	4,162,900	2,764,480	1,829,560	458,375	208,746	108,627	74,955	53,737	55,500	112,957
1996-1	1995-2	1,737,480	3,385,280	2,235,600	1,483,520	373,370	170,472	88,806	61,304	43,959	45,405	92,420
1996-2	1996-1	3,402,270	1,400,710	2,605,200	1,746,330	1,185,050	301,335	138,119	72,062	49,780	35,707	111,984
1997-1	1996-2	2,784,010	1,129,210	2,073,780	1,398,730	959,087	245,312	112,718	58,869	40,684	29,188	91,558
1997-2	1997-1	10,871,200	2,244,740	869,549	1,620,640	1,117,520	774,098	198,760	91,467	47,802	33,046	98,108
1998-1	1997-2	8,893,460	1,796,970	683,364	1,285,110	899,645	628,517	161,960	74,641	39,033	26,993	80,159
1998-2	1998-1	7,671,780	7,147,020	1,365,510	528,708	1,021,410	723,949	508,146	131,185	60,507	31,655	86,928
1999-1	1998-2	6,275,440	5,704,330	1,067,040	417,195	819,702	586,581	413,395	106,899	49,341	25,822	70,934
1999-2	1999-1	1,270,570	4,981,970	4,127,920	795,444	325,162	652,097	470,273	332,441	86,081	39,758	78,012
2000-1	1999-2	1,039,930	3,993,600	3,286,220	642,743	264,355	530,762	382,838	270,641	70,079	32,368	63,510
2000-2	2000-1	1,395,120	775,379	2,787,540	2,503,150	509,605	211,853	426,561	307,951	217,773	56,398	77,170
2001-1	2000-2	1,141,340	602,155	2,113,440	1,949,640	400,935	166,878	335,997	242,555	171,522	44,419	60,779
2001-2	2001-1	2,901,170	834,523	406,363	1,582,960	1,531,170	318,854	133,155	268,376	193,816	137,080	84,085
2002-1	2001-2	2,373,540	649,806	307,758	1,220,710	1,187,550	247,277	103,226	208,020	150,218	106,242	65,168
2002-2	2002-1	360,038	1,639,570	397,899	220,365	938,456	930,273	194,670	81,392	164,117	118,545	135,291
2003-1	2002-2	294,409	1,232,350	283,947	161,033	690,019	683,127	142,817	59,690	120,339	86,918	99,193
2003-2	2003-1	14,281,900	196,951	714,927	198,908	122,999	539,366	537,262	112,537	47,068	94,924	146,837
2004-1	2003-2	11,679,100	148,369	505,257	140,969	86,791	378,861	376,685	78,851	32,971	66,487	102,842
2004-2	2004-1	6,909,280	9,131,370	112,139	396,874	112,541	69,560	303,949	302,300	63,288	26,465	135,923
2005-1	2004-2	5,653,960	7,184,220	81,624	269,196	73,431	44,761	194,770	193,462	40,484	16,926	86,918
2005-2	2005-1	11,917,900	4,495,180	5,591,760	65,179	217,377	59,464	36,274	157,874	156,828	32,819	84,187
2006-1	2005-2	9,754,710	3,593,350	4,207,370	46,029	148,372	40,112	24,384	106,014	105,272	22,027	56,495
2006-2	2006-1	3,658,480	7,726,390	2,780,490	3,357,810	37,259	120,560	32,626	19,840	86,266	85,666	63,901
2007-1	2006-2	2,994,140	6,148,510	2,136,380	2,530,790	27,753	89,366	24,147	14,676	63,802	63,354	47,255
2007-2	2007-1	5,718,360	2,341,770	4,656,410	1,688,800	2,040,420	22,494	72,534	19,607	11,919	51,820	89,841
2008-1	2007-2	4,676,890	1,783,020	3,384,450	1,247,920	1,512,840	16,650	53,637	14,494	8,809	38,298	66,395
2008-2	2008-1	1,956,750	3,563,570	1,291,530	2,622,310	997,331	1,219,130	13,447	43,349	11,717	7,122	84,650
2009-1	2008-2	1,600,540	2,734,170	952,723	1,969,850	752,749	919,282	10,133	32,655	8,825	5,364	63,754
2009-2	2009-1	5,563,750	1,198,760	1,923,340	728,513	1,565,230	604,311	740,023	8,164	26,318	7,114	55,721
2010-1	2009-2	4,552,500	940,906	1,454,700	547,867	1,170,230	450,244	550,660	6,072	19,572	5,290	41,433
2010-2	2010-1	1,559,350	3,450,870	675,319	1,120,960	436,035	939,358	362,234	443,334	4,890	15,764	37,636
2011-1	2010-2	1,276,070	2,726,990	509,785	823,554	315,170	674,544	259,575	317,479	3,501	11,285	26,940
2011-2	2011-1	227,698	973,503	1,979,440	395,360	658,450	254,050	544,911	209,831	256,705	2,831	30,914
2012-1	2011-2	186,185	729,452	1,400,300	285,020	476,336	183,371	392,824	151,196	184,938	2,039	22,268
2012-2	2012-1	68,946	135,566	487,971	1,038,130	221,030	373,627	144,259	309,327	119,102	145,705	19,154
2013-1	2012-2	56,438	108,771	354,021	661,994	131,779	217,861	83,580	178,869	68,824	84,173	11,063
2013-2	2013-1	104,033	38,396	64,891	250,471	506,100	102,831	170,925	65,685	140,662	54,138	74,927
2014-1	2013-2	85,151	30,585	46,398	157,020	296,110	58,792	97,073	37,228	79,666	30,653	42,417
2014-2	2014-1	382,256	58,496	18,551	33,067	120,400	231,481	46,195	76,396	29,316	62,752	57,567
2015-1	2014-2	312,613	44,232	13,071	23,020	82,846	158,209	31,496	52,044	19,965	42,731	39,197
2015-2	2015-1	1,868,120	249,388	34,516	10,320	18,202	65,457	124,961	24,875	41,104	15,768	64,706
2016-1	2015-2	1,529,480	204,132	28,241	8,442	14,887	53,531	102,192	20,343	33,614	12,895	52,915
2016-2	2016-1	---	1,252,050	167,087	23,119	6,911	12,188	43,826	83,665	16,655	27,520	53,879

Table 12b. Biomass-at-age and summary biomass (metric tons) by model year and semester for the proposed update model.

		POPULATION BIOMASS-AT-AGE (mt)											SUMMARY BIOMASS	
Calendar Yr-Sem	Model Yr-Seas	0	1	2	3	4	5	6	7	8	9	10+	Ages 0+	Ages 1+
1993-2	1993-1	54,514	169,893	82,329	53,218	34,192	26,940	21,019	22,918	15,918	10,916	22,781	514,637	460,123
1994-1	1993-2	114,698	208,887	83,628	49,388	30,223	23,142	17,741	19,132	13,196	9,009	18,706	587,750	473,052
1994-2	1994-1	50,502	168,567	222,510	78,938	44,108	26,123	19,591	14,821	15,848	10,871	22,690	674,570	624,068
1995-1	1994-2	106,220	205,257	222,067	72,255	38,707	22,360	16,503	12,356	13,123	8,963	18,615	736,427	630,207
1995-2	1995-1	16,874	153,856	206,290	200,564	63,056	33,008	18,744	13,671	10,156	10,731	22,416	749,366	732,492
1996-1	1995-2	35,497	188,208	207,608	184,781	55,522	28,300	15,804	11,404	8,414	8,852	18,397	762,787	727,290
1996-2	1996-1	27,046	51,769	194,404	191,440	163,020	47,648	23,833	13,144	9,408	6,904	22,224	750,840	723,794
1997-1	1996-2	56,877	62,780	192,581	174,220	142,621	40,724	20,059	10,951	7,787	5,690	18,226	732,516	675,639
1997-2	1997-1	86,420	82,963	64,887	177,661	153,731	122,403	34,297	16,683	9,034	6,390	19,498	773,967	687,548
1998-1	1997-2	181,693	99,905	63,460	160,068	133,782	104,339	28,822	13,885	7,471	5,262	15,976	814,663	632,970
1998-2	1998-1	60,986	264,146	101,897	57,959	140,509	114,474	87,683	23,928	11,435	6,121	17,286	886,423	825,437
1999-1	1998-2	128,207	317,139	99,090	51,964	121,894	97,377	73,567	19,886	9,444	5,034	14,143	937,745	809,538
1999-2	1999-1	10,100	184,128	308,032	87,200	44,731	103,112	81,148	60,636	16,268	7,688	15,513	918,555	908,455
2000-1	1999-2	21,246	222,029	305,174	80,057	39,311	88,111	68,129	50,347	13,413	6,310	12,663	906,789	885,543
2000-2	2000-1	11,090	28,657	208,011	274,405	70,103	33,499	73,605	56,169	41,157	10,905	15,325	822,928	811,837
2001-1	2000-2	23,318	33,477	196,264	242,839	59,621	27,703	59,793	45,122	32,829	8,659	12,106	741,732	718,414
2001-2	2001-1	23,063	30,843	30,323	173,530	210,634	50,418	22,977	48,951	36,629	26,505	16,665	670,539	647,477
2002-1	2001-2	48,491	36,127	28,580	152,047	176,595	41,050	18,370	38,698	28,752	20,711	12,959	602,379	553,887
2002-2	2002-1	2,862	60,597	29,692	24,157	129,098	147,098	33,591	14,846	31,016	22,922	26,710	522,589	519,727
2003-1	2002-2	6,015	68,514	26,369	20,058	102,609	113,405	25,415	11,104	23,033	16,944	19,663	433,128	427,114
2003-2	2003-1	113,533	7,279	53,349	21,805	16,920	85,287	92,707	20,526	8,895	18,354	29,021	467,677	354,144
2004-1	2003-2	238,604	8,249	46,920	17,559	12,906	62,894	67,034	14,669	6,311	12,961	20,405	508,511	269,907
2004-2	2004-1	54,925	337,485	8,368	43,507	15,482	10,999	52,448	55,138	11,961	5,117	26,903	622,333	567,408
2005-1	2004-2	115,510	399,415	7,580	33,530	10,920	7,431	34,661	35,989	7,749	3,300	17,265	673,349	557,839
2005-2	2005-1	94,741	166,137	417,266	7,145	29,903	9,403	6,259	28,796	29,639	6,346	16,730	812,364	717,624
2006-1	2005-2	199,289	199,776	390,716	5,733	22,064	6,659	4,339	19,722	20,149	4,294	11,259	883,999	684,710
2006-2	2006-1	29,083	285,559	207,485	368,097	5,126	19,063	5,630	3,619	16,303	16,564	12,700	969,228	940,145
2007-1	2006-2	61,170	341,833	198,394	315,225	4,127	14,836	4,297	2,730	12,212	12,351	9,418	976,593	915,422
2007-2	2007-1	45,458	86,549	347,469	185,133	280,688	3,557	12,516	3,576	2,253	10,020	17,765	994,984	949,526
2008-1	2007-2	95,549	99,129	314,296	155,436	224,967	2,764	9,545	2,696	1,686	7,466	13,178	926,712	831,163
2008-2	2008-1	15,555	131,706	96,376	287,468	137,197	192,774	2,320	7,907	2,214	1,377	16,764	891,658	876,103
2009-1	2008-2	32,699	152,009	88,474	245,357	111,938	152,608	1,803	6,075	1,689	1,046	12,670	806,368	773,669
2009-2	2009-1	44,229	44,305	143,523	79,863	215,319	95,556	127,695	1,489	4,974	1,375	11,091	769,418	725,189
2010-1	2009-2	93,008	52,311	135,090	68,240	174,019	74,744	97,994	1,130	3,746	1,031	8,268	709,581	616,573
2010-2	2010-1	12,396	127,540	50,393	122,884	59,983	148,535	62,505	80,862	924	3,048	7,509	676,580	664,184
2011-1	2010-2	26,070	151,610	47,341	102,579	46,867	111,980	46,193	59,060	670	2,200	5,386	599,956	573,886
2011-2	2011-1	1,810	35,980	147,709	43,341	90,579	40,171	94,027	38,272	48,515	547	6,153	547,105	545,295
2012-1	2011-2	3,804	40,555	130,038	35,501	70,834	30,441	69,906	28,127	35,397	398	4,444	449,443	445,640
2012-2	2012-1	548	5,010	36,413	113,804	30,406	59,079	24,893	56,420	22,509	28,173	3,824	381,079	380,531
2013-1	2012-2	1,153	6,047	32,876	82,455	19,596	36,167	14,874	33,275	13,173	16,409	2,213	258,238	257,085
2013-2	2013-1	827	1,419	4,842	27,458	69,621	16,260	29,494	11,981	26,584	10,468	14,738	213,692	212,865
2014-1	2013-2	1,740	1,700	4,309	19,558	44,033	9,760	17,275	6,926	15,248	5,976	8,384	134,908	133,168
2014-2	2014-1	3,039	2,162	1,384	3,625	16,563	36,603	7,971	13,934	5,540	12,133	11,369	114,324	111,285
2015-1	2014-2	6,387	2,459	1,214	2,867	12,320	26,264	5,605	9,682	3,821	8,330	7,772	86,721	80,334
2015-2	2015-1	14,851	9,217	2,576	1,131	2,504	10,350	21,563	4,537	7,768	3,049	12,781	90,326	75,476
2016-1	2015-2	31,247	11,349	2,623	1,051	2,214	8,887	18,186	3,784	6,434	2,514	10,494	98,782	67,535
2016-2	2016-1	15,094	46,274	12,468	2,534	951	1,927	7,562	15,260	3,148	5,321	10,691	121,230	106,137

Table 13. Derived SSB (mt) and recruits (year-class abundance, billions of age-0 fish) for the proposed update model. SSB estimates are calculated at the beginning of Season 2 of each model year (January). Recruits are age-0 fish calculated at the beginning of each model year (July).

Calendar Yr-Sem	Model Yr-Seas	SSB (mt)	SSB Std Dev	Year class abundance (billions)	Recruits Std Dev
---	VIRG-1	---	---	2.54828	0.18679
---	VIRG-2	421,572	30,729	---	---
---	INIT-1	---	---	2.06624	0.54098
---	INIT-2	341,827	89,472	---	---
1993-2	1993-1	---	---	---	---
1994-1	1993-2	389,395	69,526	---	---
1994-2	1994-1	---	---	6.35290	1.16699
1995-1	1994-2	533,450	84,494	---	---
1995-2	1995-1	---	---	2.12268	0.58631
1996-1	1995-2	630,040	93,497	---	---
1996-2	1996-1	---	---	3.40227	0.71638
1997-1	1996-2	630,932	89,564	---	---
1997-2	1997-1	---	---	10.87120	1.34549
1998-1	1997-2	596,042	79,638	---	---
1998-2	1998-1	---	---	7.67178	1.00506
1999-1	1998-2	681,023	74,829	---	---
1999-2	1999-1	---	---	1.27057	0.34184
2000-1	1999-2	766,577	72,792	---	---
2000-2	2000-1	---	---	1.39512	0.29087
2001-1	2000-2	681,193	65,016	---	---
2001-2	2001-1	---	---	2.90117	0.36305
2002-1	2001-2	534,937	53,161	---	---
2002-2	2002-1	---	---	0.36004	0.13440
2003-1	2002-2	395,682	42,504	---	---
2003-2	2003-1	---	---	14.28190	1.31589
2004-1	2003-2	280,332	34,670	---	---
2004-2	2004-1	---	---	6.90928	1.07516
2005-1	2004-2	406,208	41,347	---	---
2005-2	2005-1	---	---	11.91790	1.06604
2006-1	2005-2	583,424	48,769	---	---
2006-2	2006-1	---	---	3.65848	0.71652
2007-1	2006-2	757,295	49,700	---	---
2007-2	2007-1	---	---	5.71836	0.71794
2008-1	2007-2	763,427	45,608	---	---
2008-2	2008-1	---	---	1.95675	0.45607
2009-1	2008-2	699,527	39,366	---	---
2009-2	2009-1	---	---	5.56375	0.53790
2010-1	2009-2	586,470	33,561	---	---
2010-2	2010-1	---	---	1.55935	0.27682
2011-1	2010-2	507,364	28,618	---	---
2011-2	2011-1	---	---	0.22770	0.06396
2012-1	2011-2	415,388	25,428	---	---
2012-2	2012-1	---	---	0.06895	0.02459
2013-1	2012-2	249,089	21,795	---	---
2013-2	2013-1	---	---	0.10403	0.03967
2014-1	2013-2	131,188	17,337	---	---
2014-2	2014-1	---	---	0.38226	0.21846
2015-1	2014-2	79,391	13,273	---	---
2015-2	2015-1	---	---	1.86812	1.41155
2016-1	2015-2	65,118	11,623	---	---
2016-2	2016-1	---	---	---	---
2017-1	2016-2	87,961	29,089	---	---

Table 14. Convergence tests of the proposed update model, where randomized parameter phase orders and 20% jittering were applied over a wide range of initial R_0 values.

	PHASE ORDER BY PARAMETER COMPONENT					RESULTS	
Initial R_0	Growth	R_0	R_1	ln(Q)	Selex	Final R_0	Total -(L)
14.1	3	1	5	4	2	14.7509	1230.88
14.2	4	2	1	5	3	14.7509	1230.88
14.3	1	4	5	3	2	14.7509	1230.88
14.4	2	3	5	1	4	14.7509	1230.88
14.5	2	5	3	4	1	14.7509	1230.88
14.6	2	3	5	4	1	14.7509	1230.88
14.7	5	4	1	2	3	14.7509	1230.88
14.8	3	1	2	5	4	14.7509	1230.88
14.9	3	5	4	2	1	14.7509	1230.88
15.0	4	2	3	1	5	14.7509	1230.88
15.1	3	1	4	5	2	14.7509	1230.88
15.2	4	2	5	3	1	14.7509	1230.88
15.3	1	4	2	3	5	14.7509	1230.88
15.4	4	3	1	2	5	14.7509	1230.88
15.5	3	5	1	4	2	14.7509	1230.88
15.6	4	3	5	1	2	14.7509	1230.88
15.7	1	5	2	4	3	14.7509	1230.88
15.8	1	2	4	5	3	14.7509	1230.88
15.9	5	4	1	2	3	14.7509	1230.88
16.0	4	1	5	3	2	14.7509	1230.88

Table 15. CalCOFI annual and three-year average sea surface temperature (SST) since 1984. Three-year average SST is used to calculate E_{MSY} in the harvest control rules.

Calendar year	Annual SST (°C)	3-yr average SST (°C)
1984	16.3533	---
1985	15.7605	---
1986	15.9823	16.0320
1987	16.2973	16.0134
1988	15.7851	16.0216
1989	15.4632	15.8485
1990	15.9946	15.7476
1991	15.7998	15.7525
1992	16.7028	16.1657
1993	16.4182	16.3069
1994	16.4762	16.5324
1995	15.9241	16.2729
1996	16.3252	16.2419
1997	16.6950	16.3148
1998	16.7719	16.5973
1999	15.2843	16.2504
2000	15.7907	15.9490
2001	15.5535	15.5429
2002	14.9414	15.4285
2003	16.0328	15.5092
2004	15.8849	15.6197
2005	15.4585	15.7920
2006	15.9157	15.7530
2007	15.1543	15.5095
2008	15.2724	15.4475
2009	15.3583	15.2617
2010	15.5520	15.3942
2011	15.5618	15.4907
2012	15.2939	15.4692
2013	14.9097	15.2551
2014	16.7756	15.6597
2015	17.4819	16.3891

Table 16. Pacific sardine harvest control rules for the 2016-17 management year based on stock biomass estimated in the proposed base model and under two scenarios regarding 2015 year class strength.

a) HCRs when 2015 YC is derived from S-R Curve (proposed approach).

Harvest Control Rule Formulas									
OFL = BIOMASS * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
$ABC_{P\text{-}star}$ = BIOMASS * $BUFFER_{P\text{-}star}$ * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION; where FRACTION is E_{MSY} bounded 0.05 to 0.20									
Harvest Formula Parameters									
BIOMASS (ages 1+, mt)	106,137								
P-star	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05
ABC $Buffer_{Tier\ 1}$	0.9558	0.9128	0.8705	0.8280	0.7844	0.7386	0.6886	0.6304	0.5531
CalCOFI SST (2013-2015)	16.3891								
E_{MSY}	0.25								
FRACTION	0.20								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**23,085**								
$ABC_{Tier\ 1}$ =	22,064	21,072	20,095	19,113	18,108	17,051	15,896	14,553	12,769
HG =	**0**								

b) HCRs when 2015 YC is based on the average of 2012-2014 YC sizes.

Harvest Control Rule Formulas									
OFL = BIOMASS * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
$ABC_{P\text{-}star}$ = BIOMASS * $BUFFER_{P\text{-}star}$ * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION; where FRACTION is E_{MSY} bounded 0.05 to 0.20									
Harvest Formula Parameters									
BIOMASS (ages 1+, mt)	64,422								
P-star	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05
ABC $Buffer_{Tier\ 1}$	0.95577	0.91283	0.87048	0.82797	0.78442	0.73861	0.68859	0.63043	0.55314
CalCOFI SST (2013-2015)	16.3891								
E_{MSY}	0.25								
FRACTION	0.20								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**14,012**								
$ABC_{Tier\ 1}$ =	13,392	12,790	12,197	11,601	10,991	10,349	9,648	8,833	7,750
HG =	**0**								

FIGURES

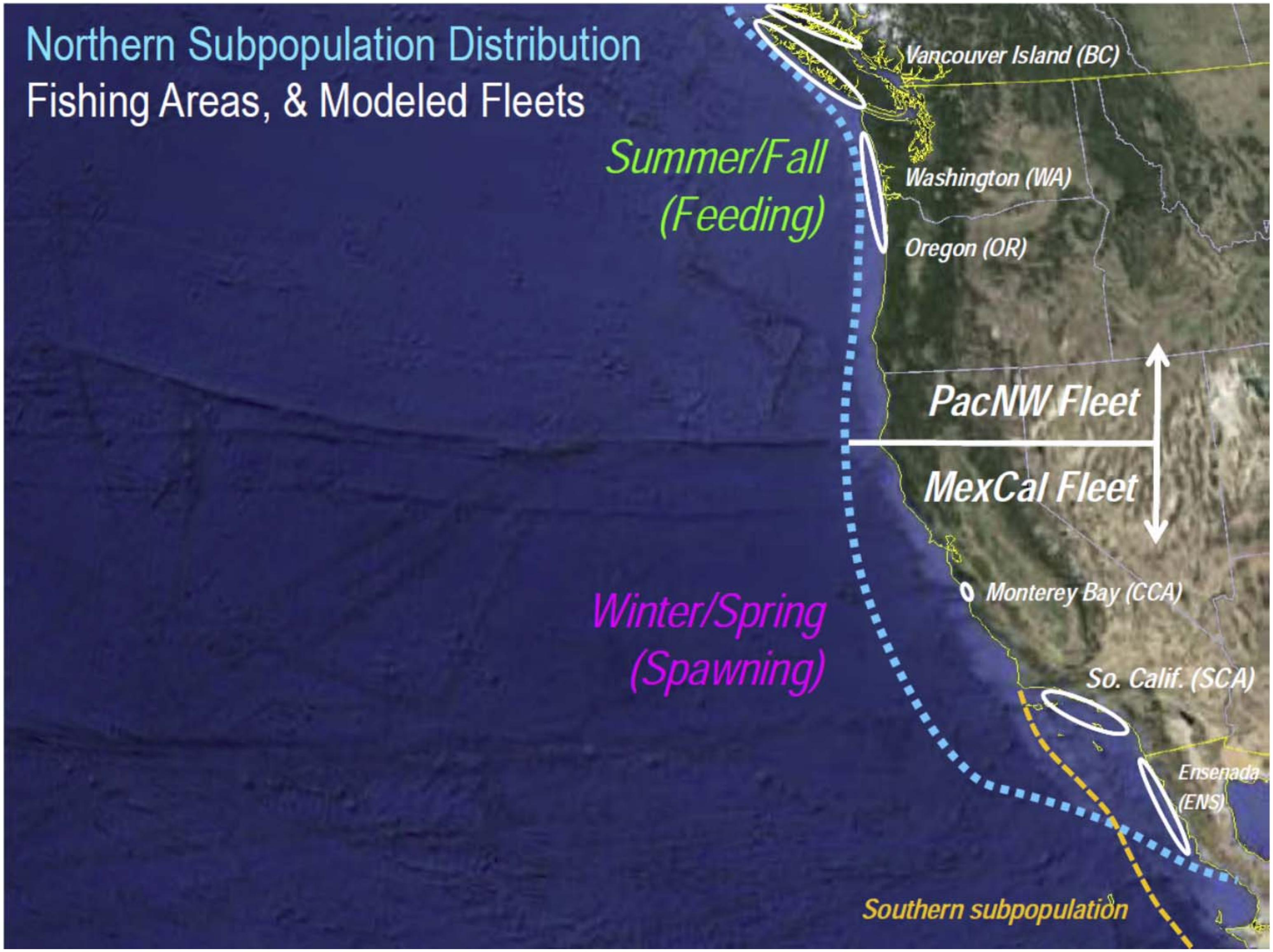


Figure 1. Distribution of the northern subpopulation of Pacific sardine, primary commercial fishing areas, and modeled fleets.

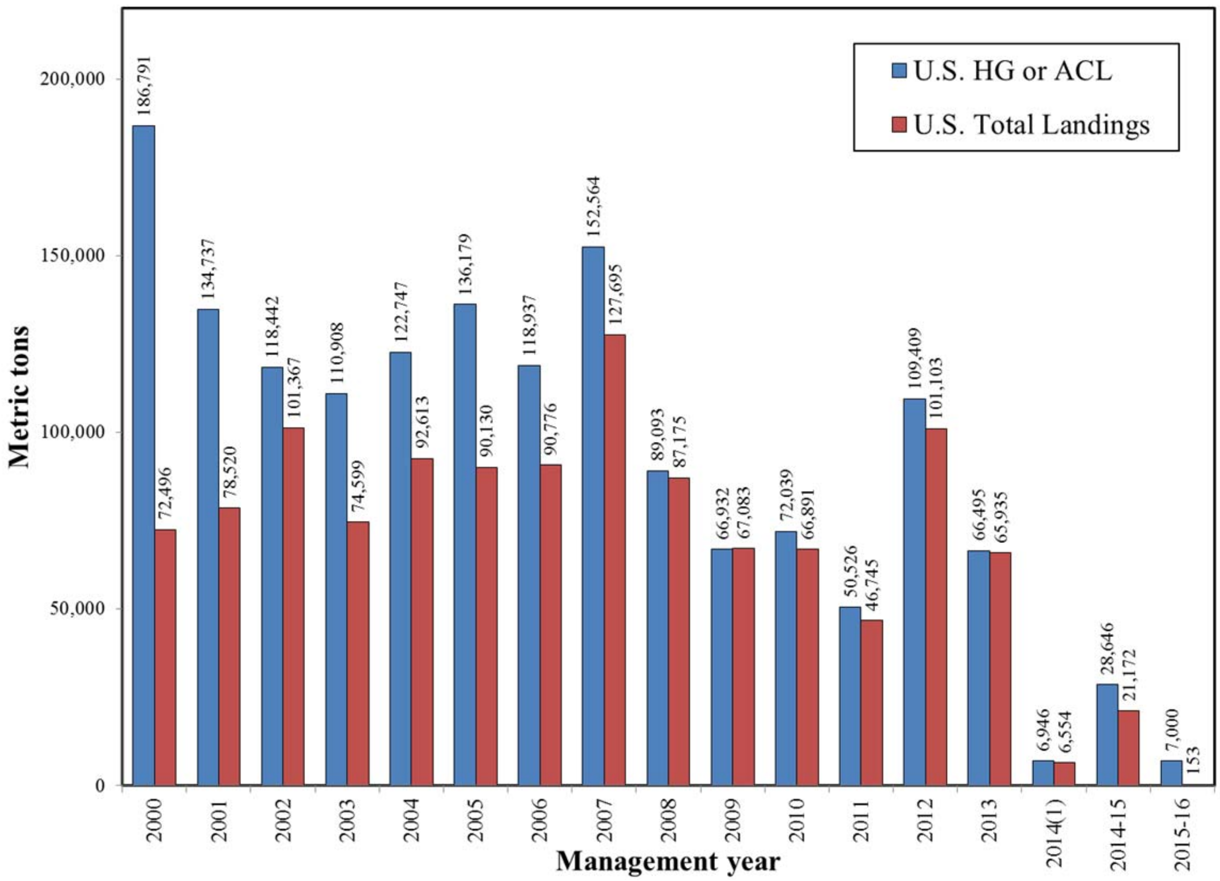


Figure 2. U.S. Pacific sardine harvest guidelines and landings since the onset of federal management.

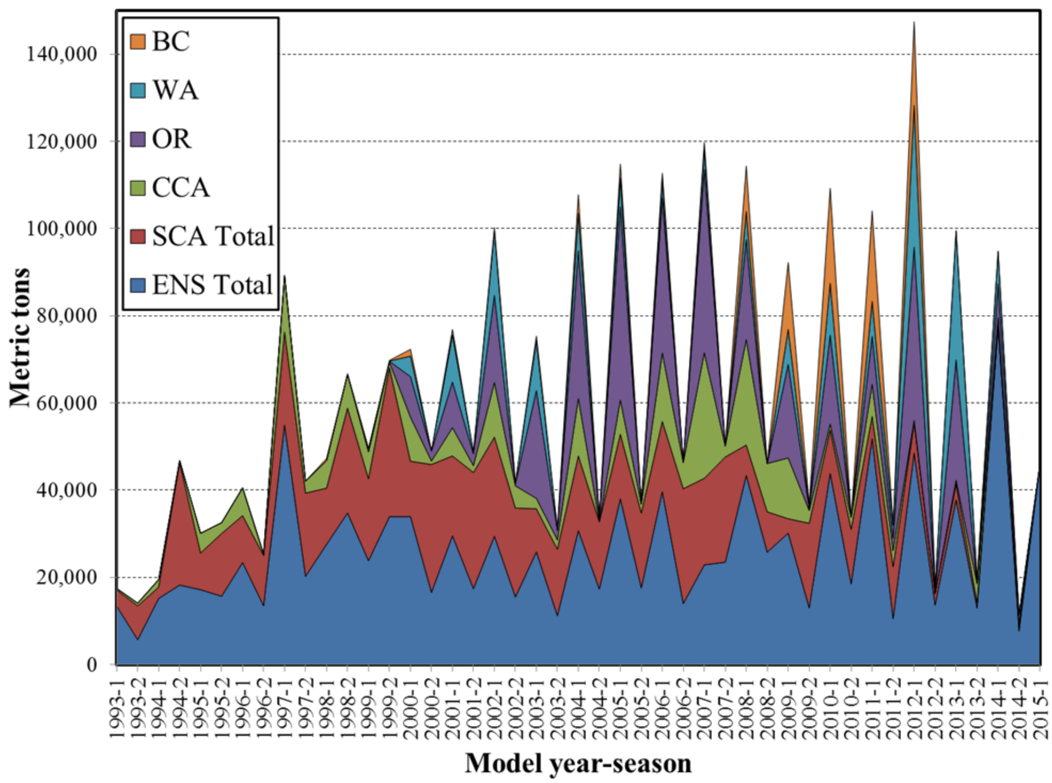


Figure 3a. Total Pacific sardine landings (mt) by major fishing region.

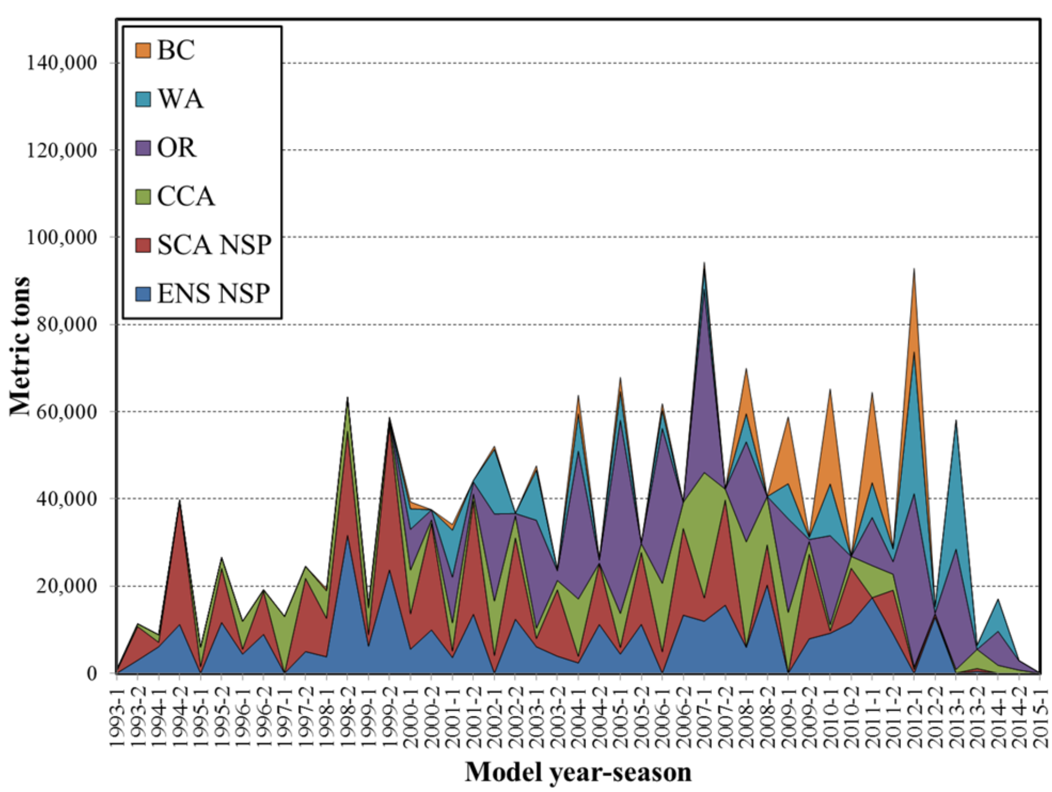


Figure 3b. Pacific sardine NSP landings (mt) by major fishing region.

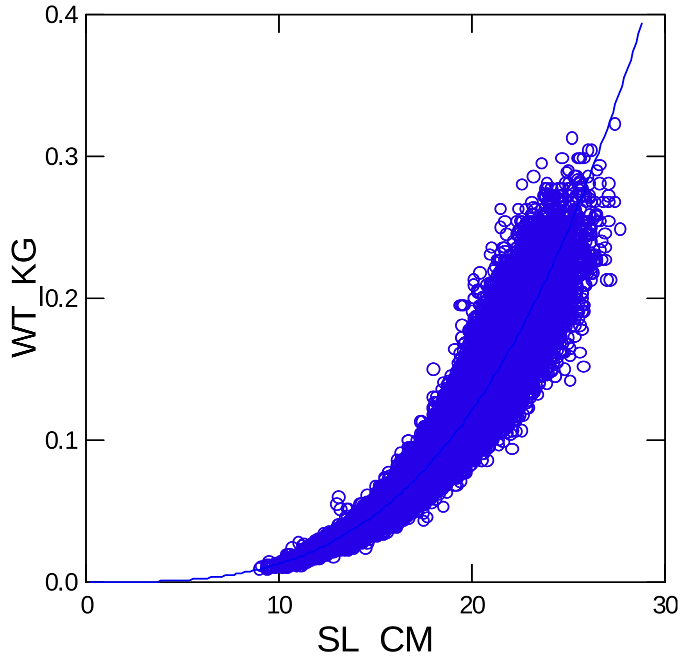


Figure 4. Weight-at-length regression from NSP fishery samples as applied in model T, where: *a* = 7.5242e-06 and *b* = 3.2332 (n=104,326, R^2 = 0.936).

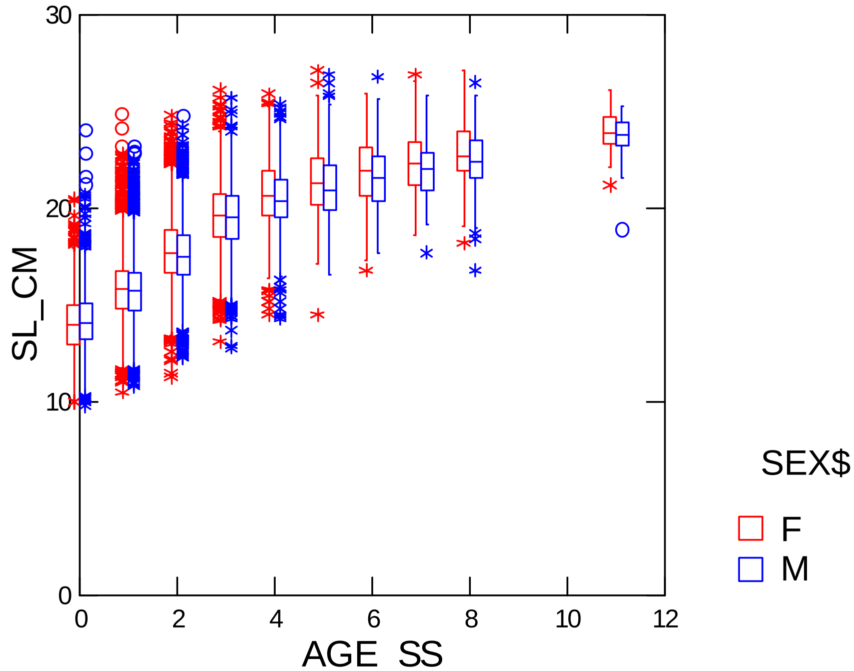


Figure 5a. Length-at-age by sex from fishery samples. Box symbols indicate median and quartile ranges for the raw data. The SS model is based on pooled sexes.

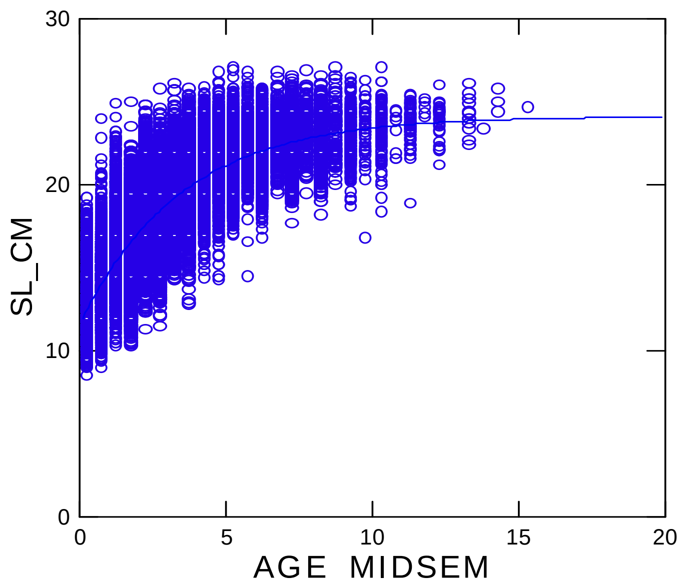


Figure 5b. von Bertalanffy growth from NSP fishery samples, sexes combined, estimated independently from the SS model (t_0 = -2.01, K = 0.318, L_∞ = 23.788).

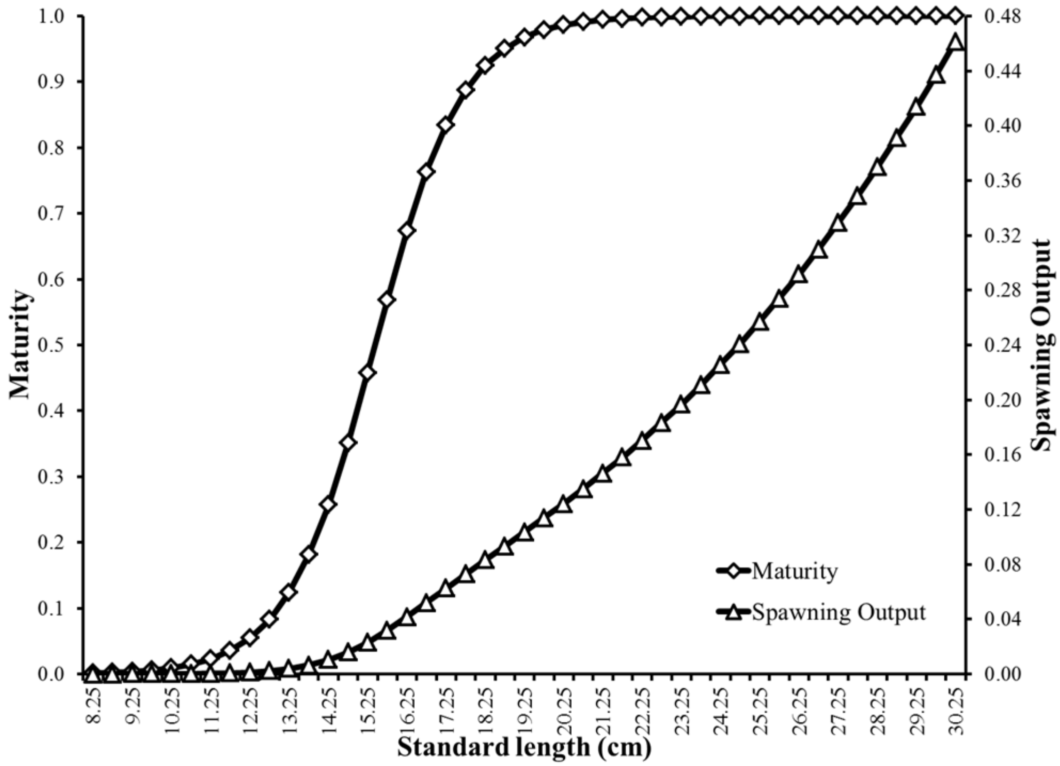


Figure 6a. Maturity (L_{50} = 15.44 cm) and spawning output as a function of length.

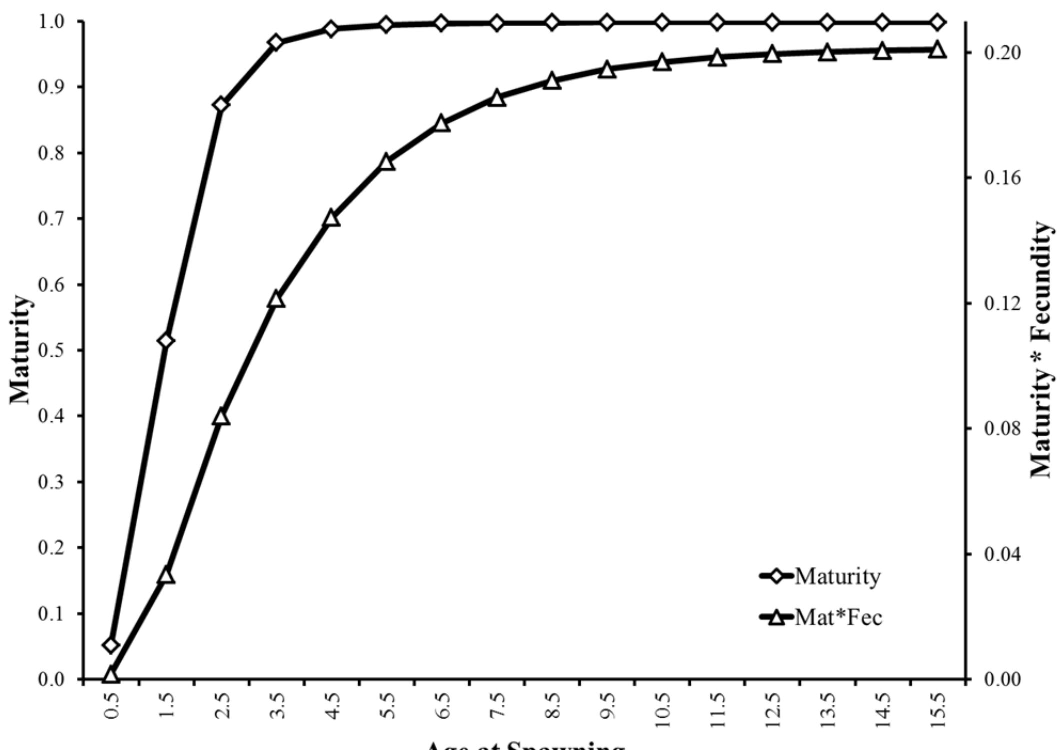


Figure 6b. Maturity and fecundity as a function of age derived from growth in the update model.

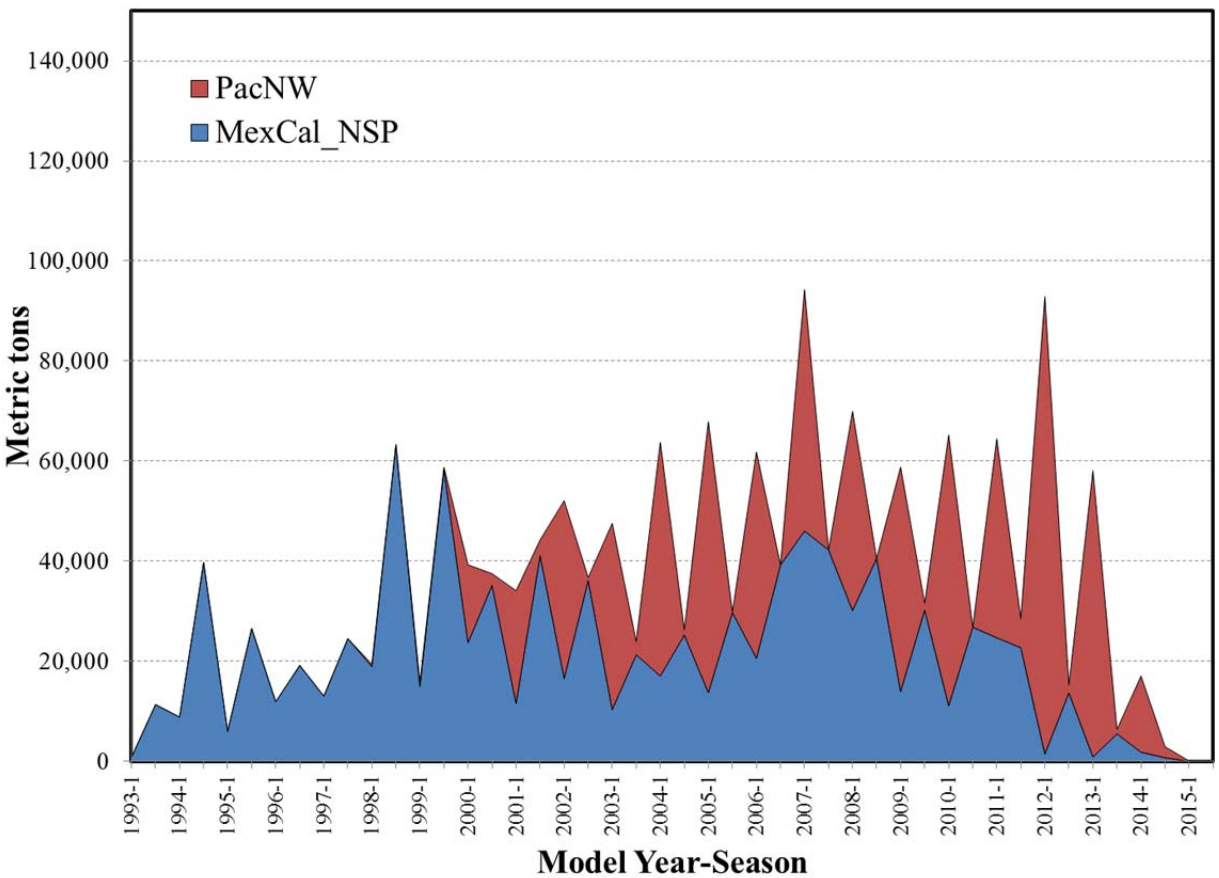


Figure 7. Pacific sardine NSP landings (mt) by fleet, model year and semester as used in all model scenarios.

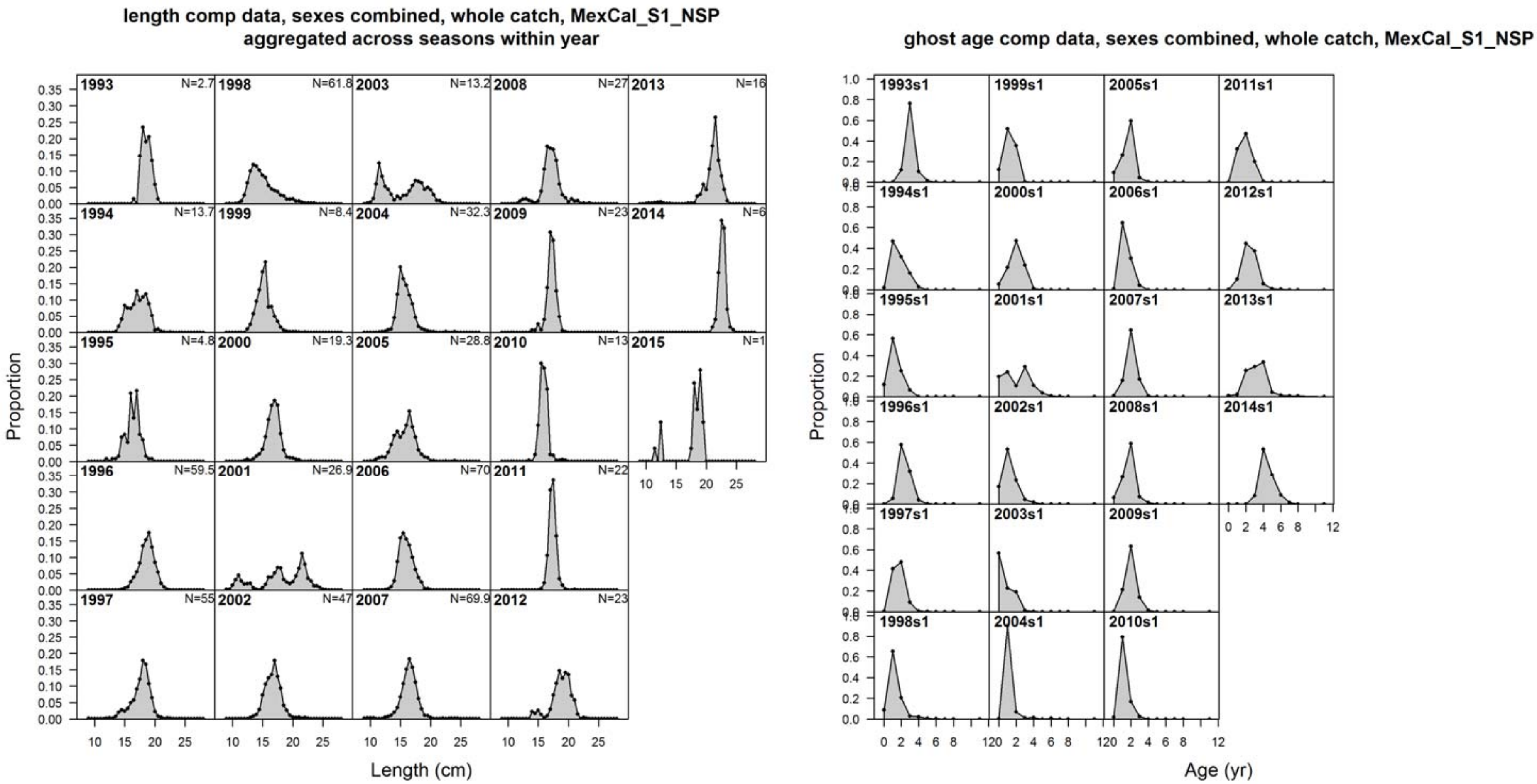


Figure 8. Length-composition (left panel) and implied age composition (right panel) data for the MexCal_S1 fleet.

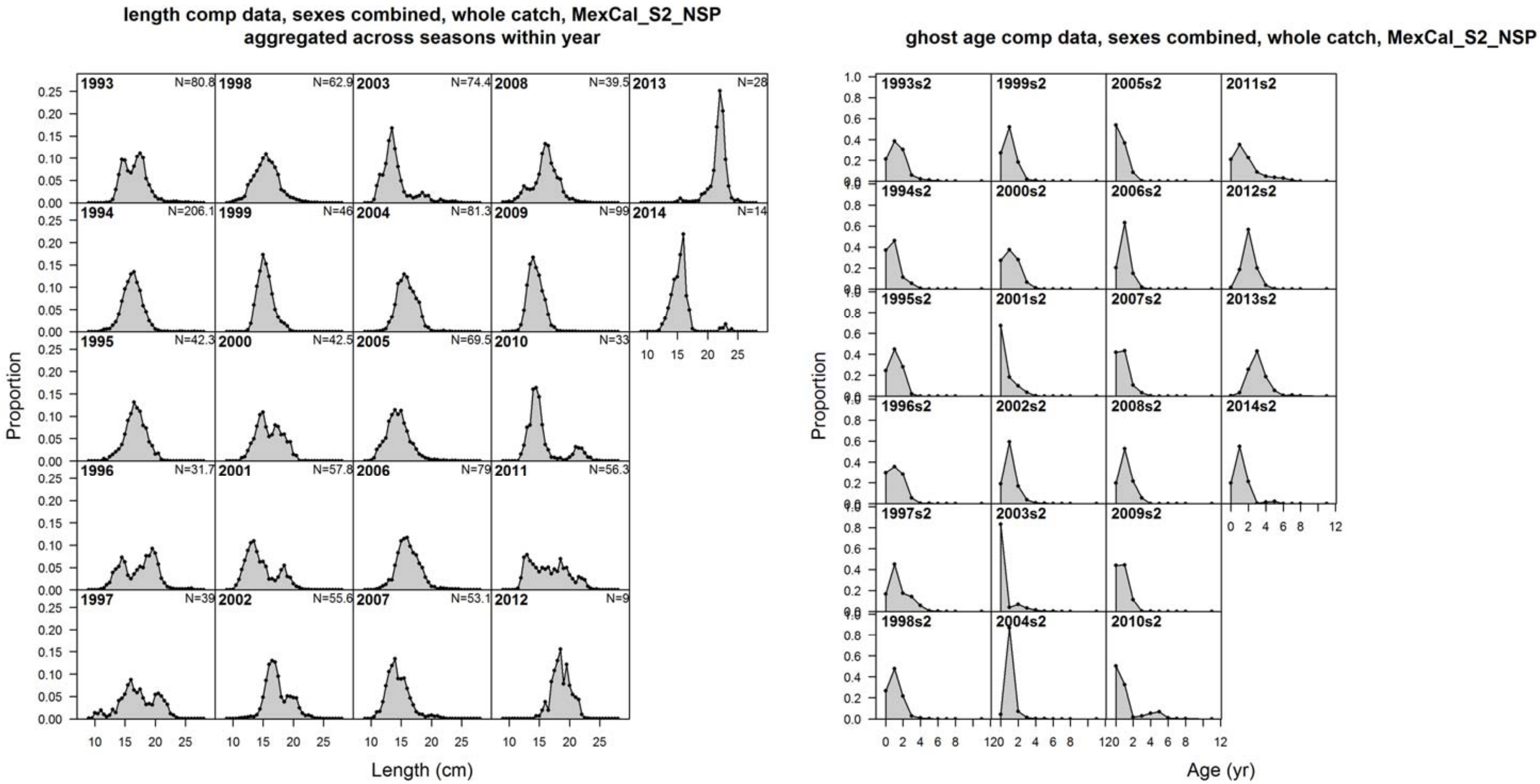


Figure 9. Length-composition (left panel) and implied age composition (right panel) data for the MexCal_S2 fleet.

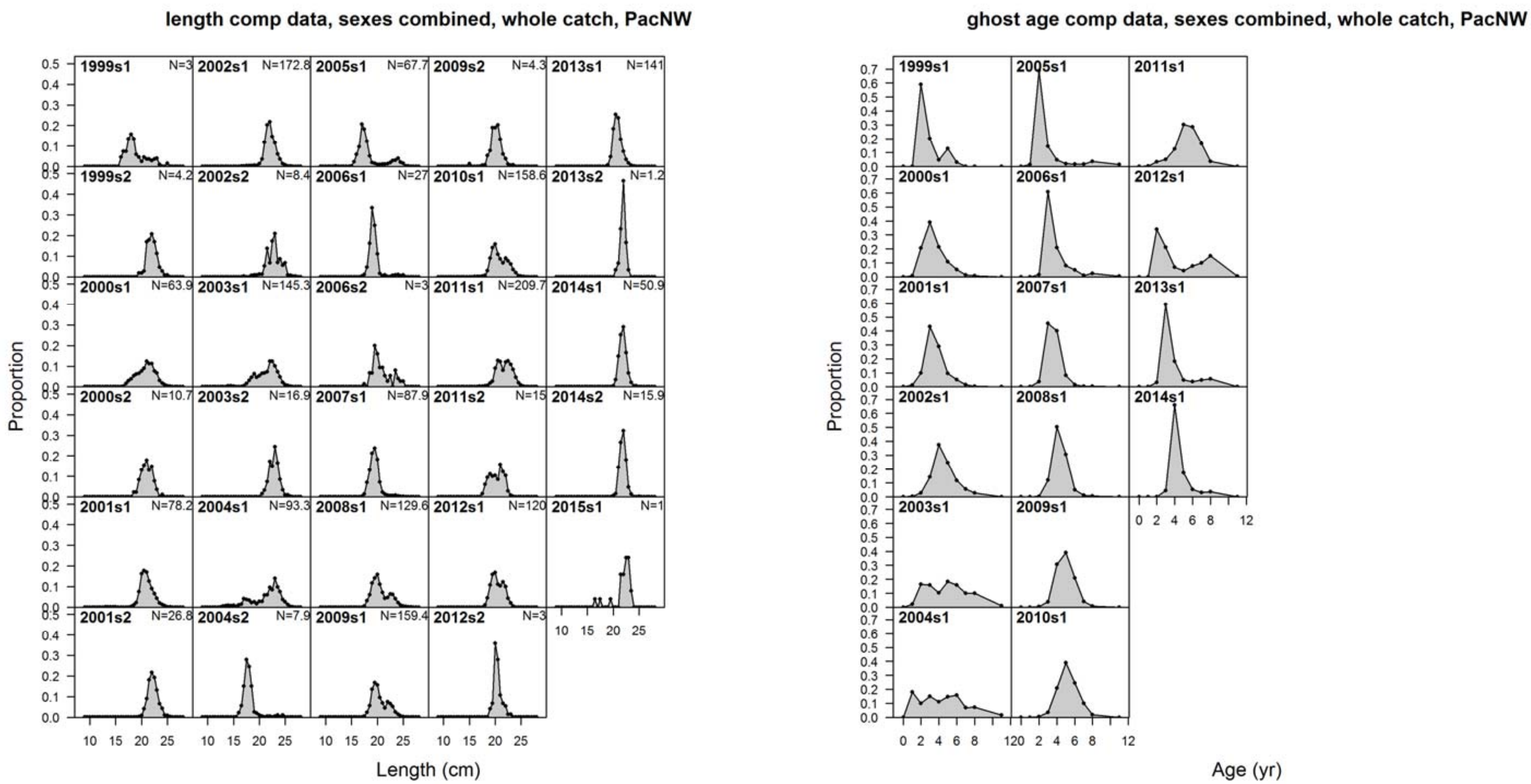


Figure 10. Length-composition (left panel) and implied age-composition (right panel) data for the PacNW fleet.

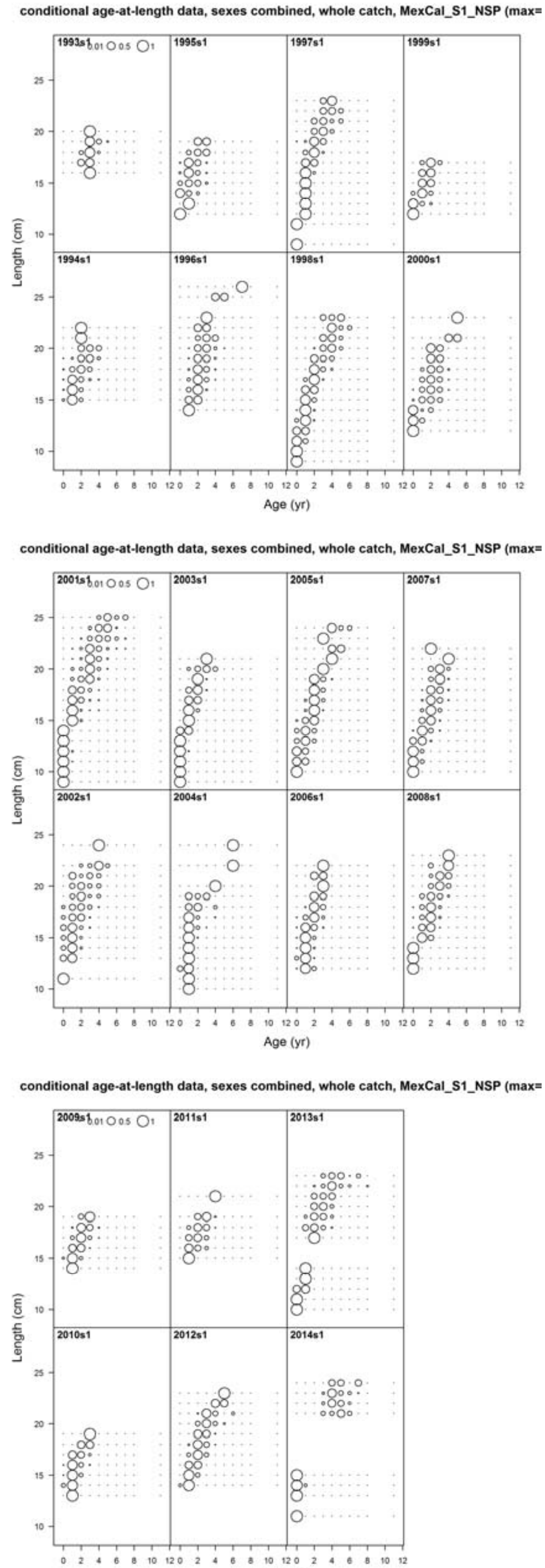


Figure 11. Conditional age-at-length data for the MexCal_S1 fleet.

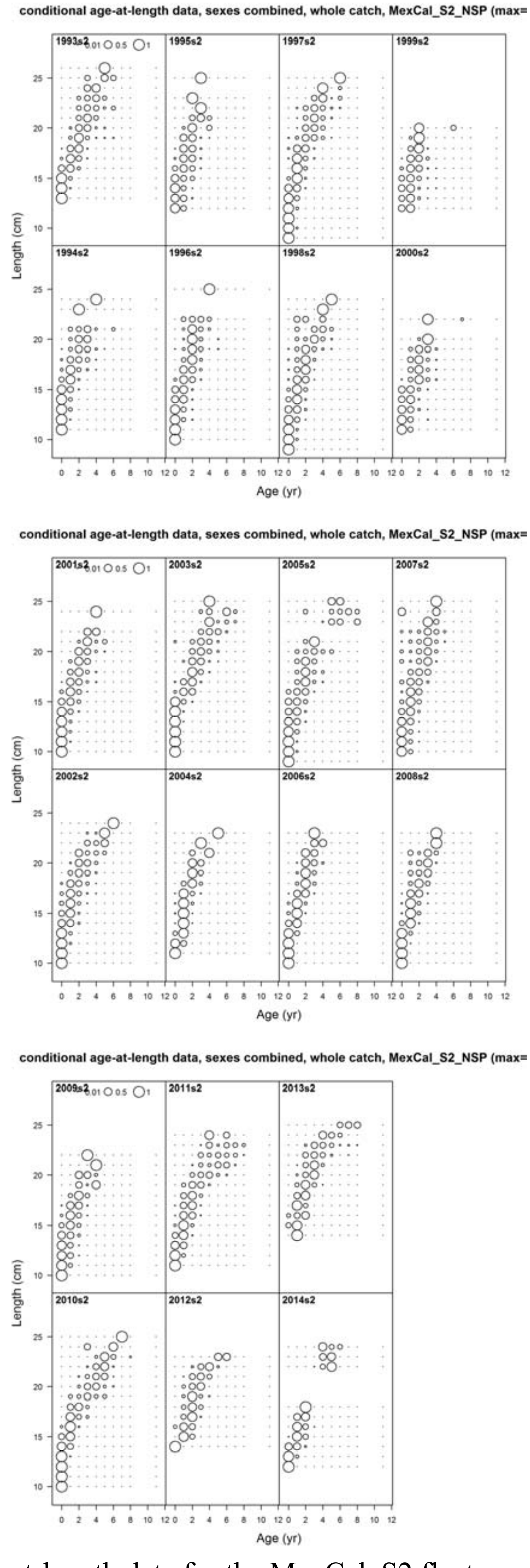


Figure 12. Conditional age-at-length data for the MexCal_S2 fleet.

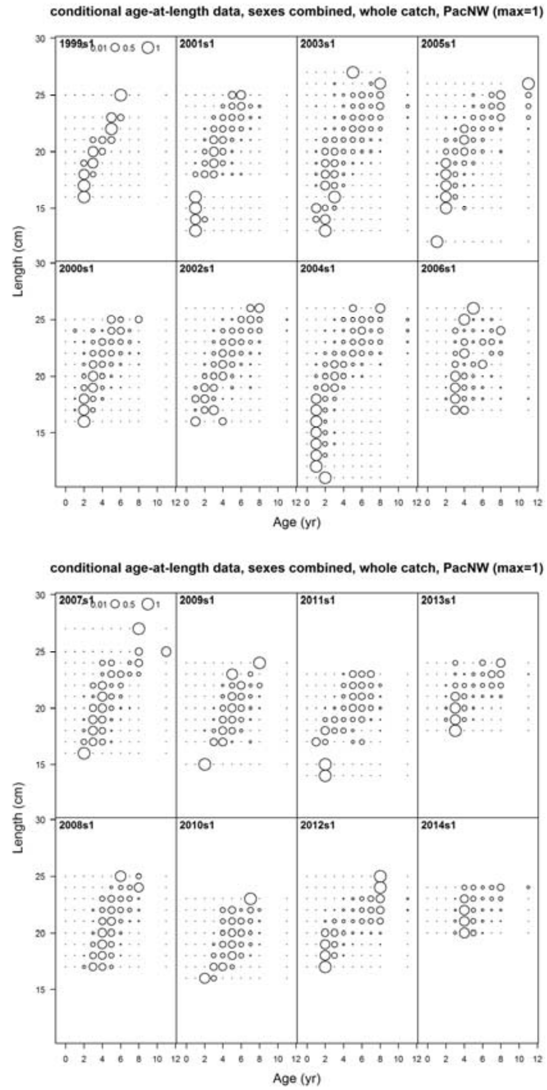


Figure 13. Conditional age-at-length data for the PacNW fleet.

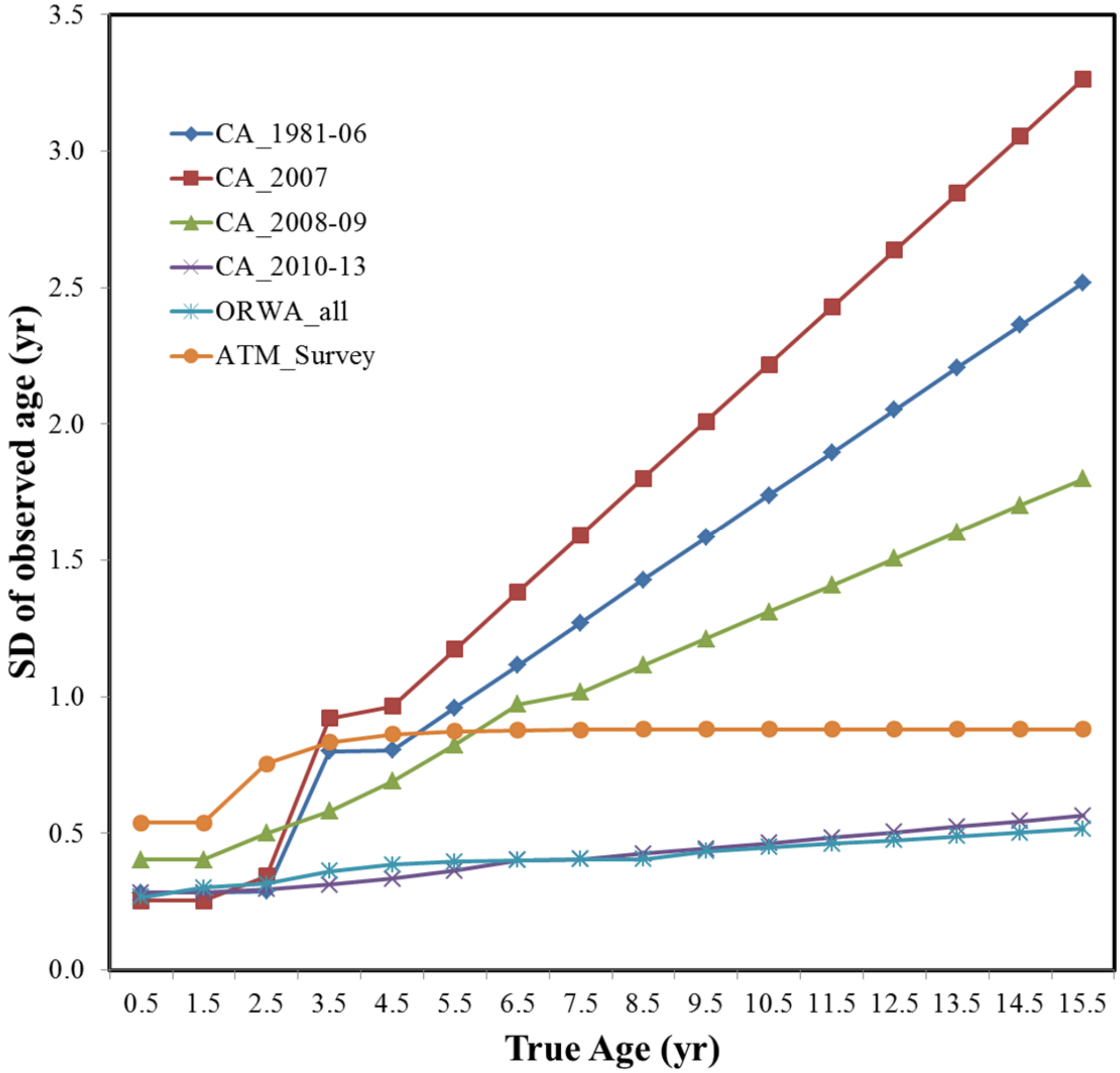


Figure 14. Laboratory- and year-specific ageing errors applied in all models.

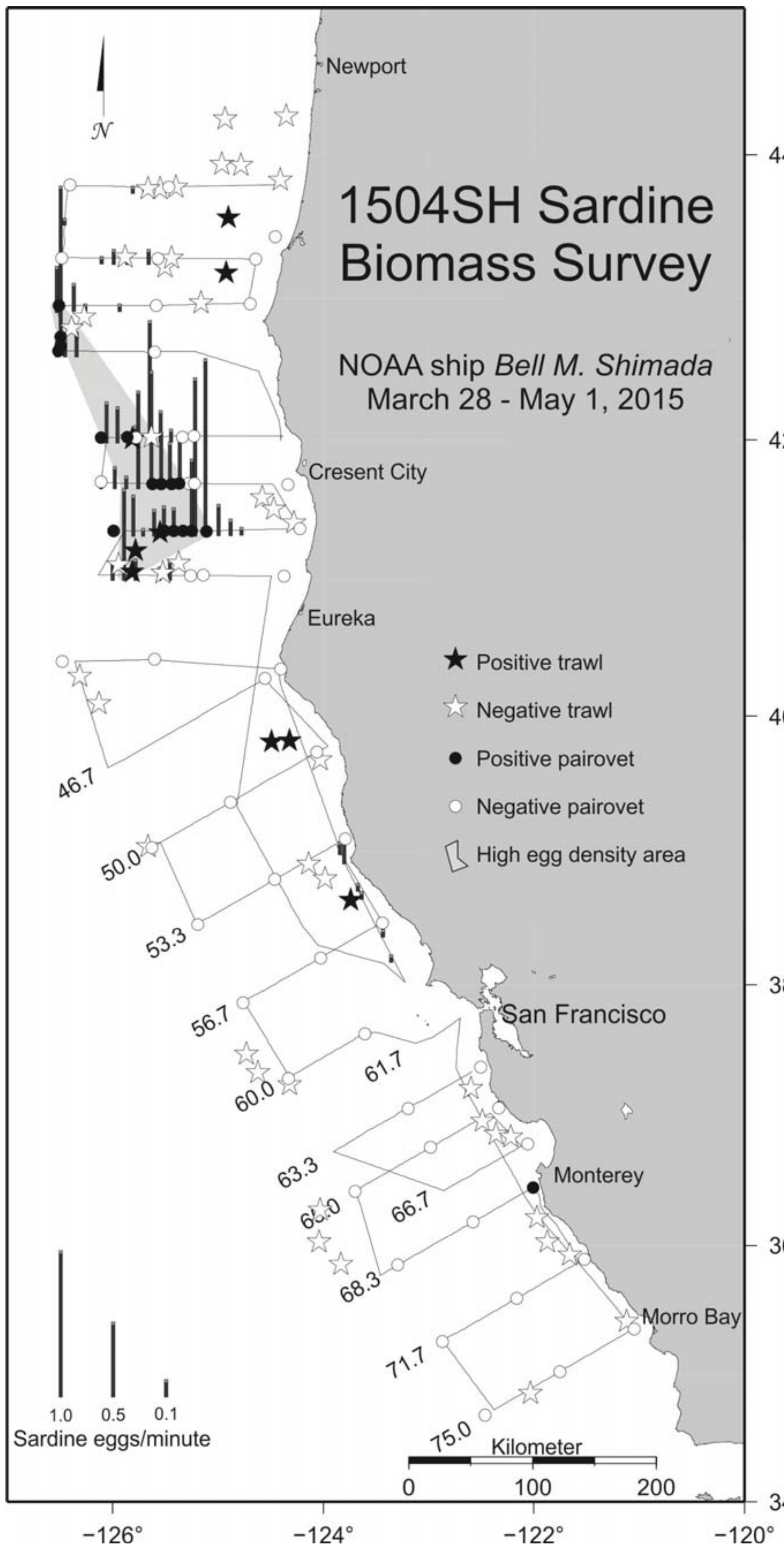


Figure 15. Distribution of CUFES, bongo, pairovet, and adult trawl samples from the 1504 DEPM survey conducted aboard the FSV *Bell M. Shimada* during spring 2015.

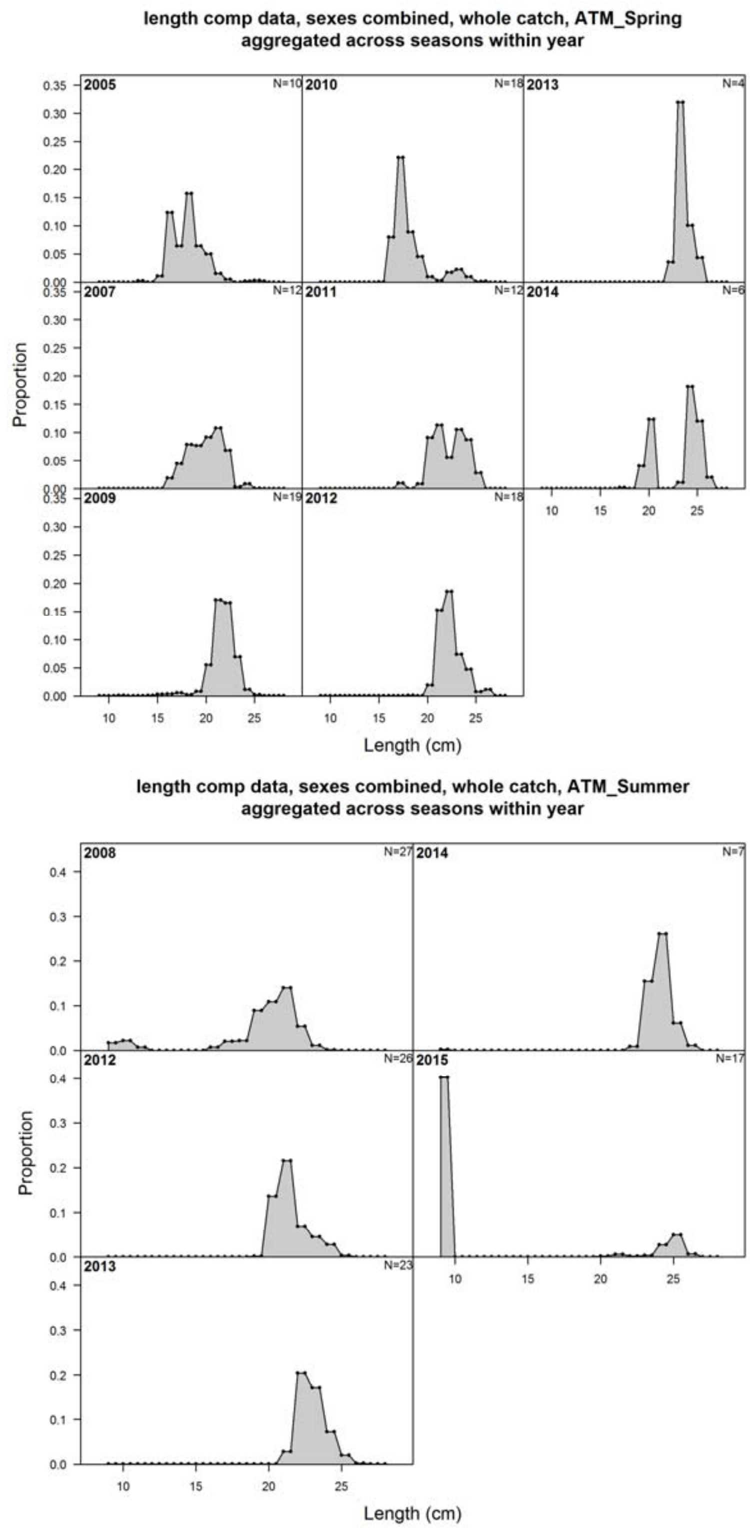


Figure 16. Length-composition data (1-cm resolution) for the ATM Spring (upper panel) and Summer (lower panel) surveys. The summer 2015 length composition was excluded from the proposed update model.

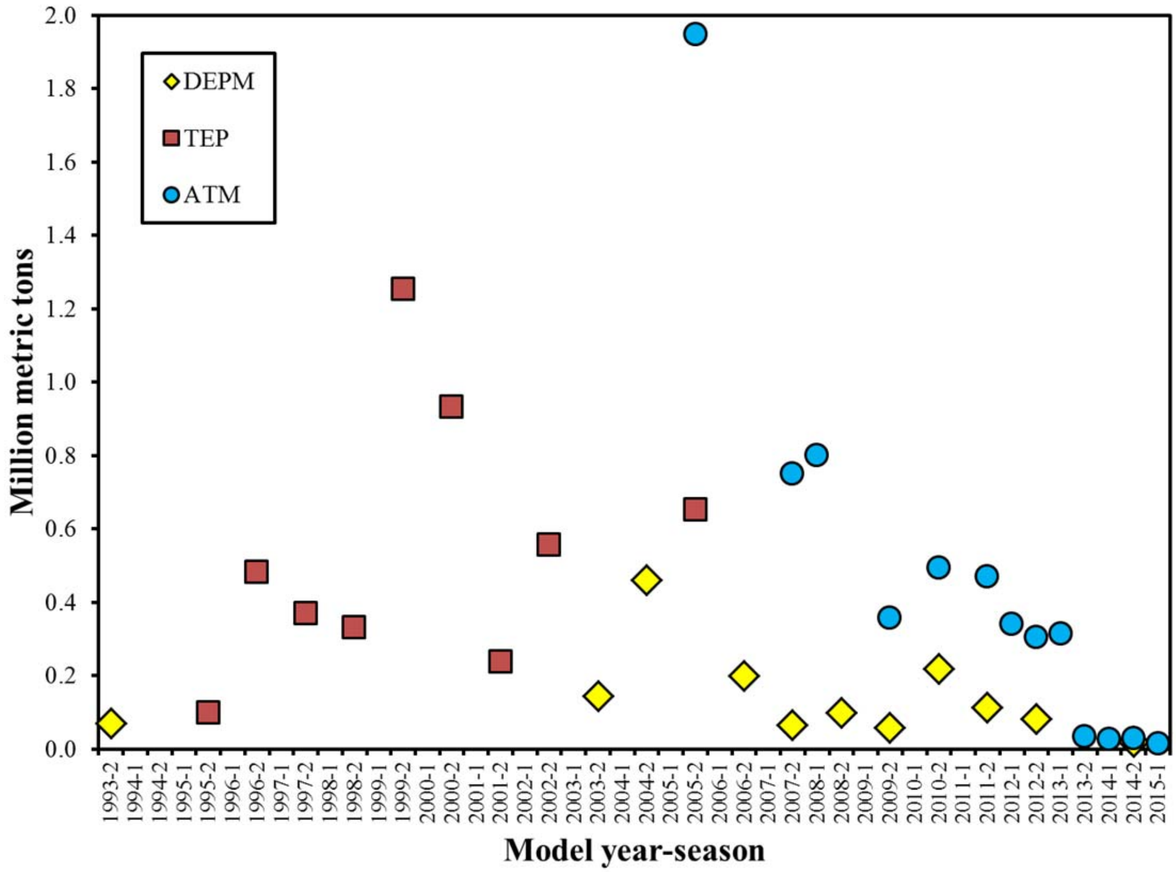


Figure 17. Survey indices of abundance (biomass units) included in the update model. TEP is modeled as total SSB, and DEPM as female SSB. Error bars for survey estimates are shown in subsequent displays for model fits to respective surveys. Values are not rescaled according to their estimated *q*'s.

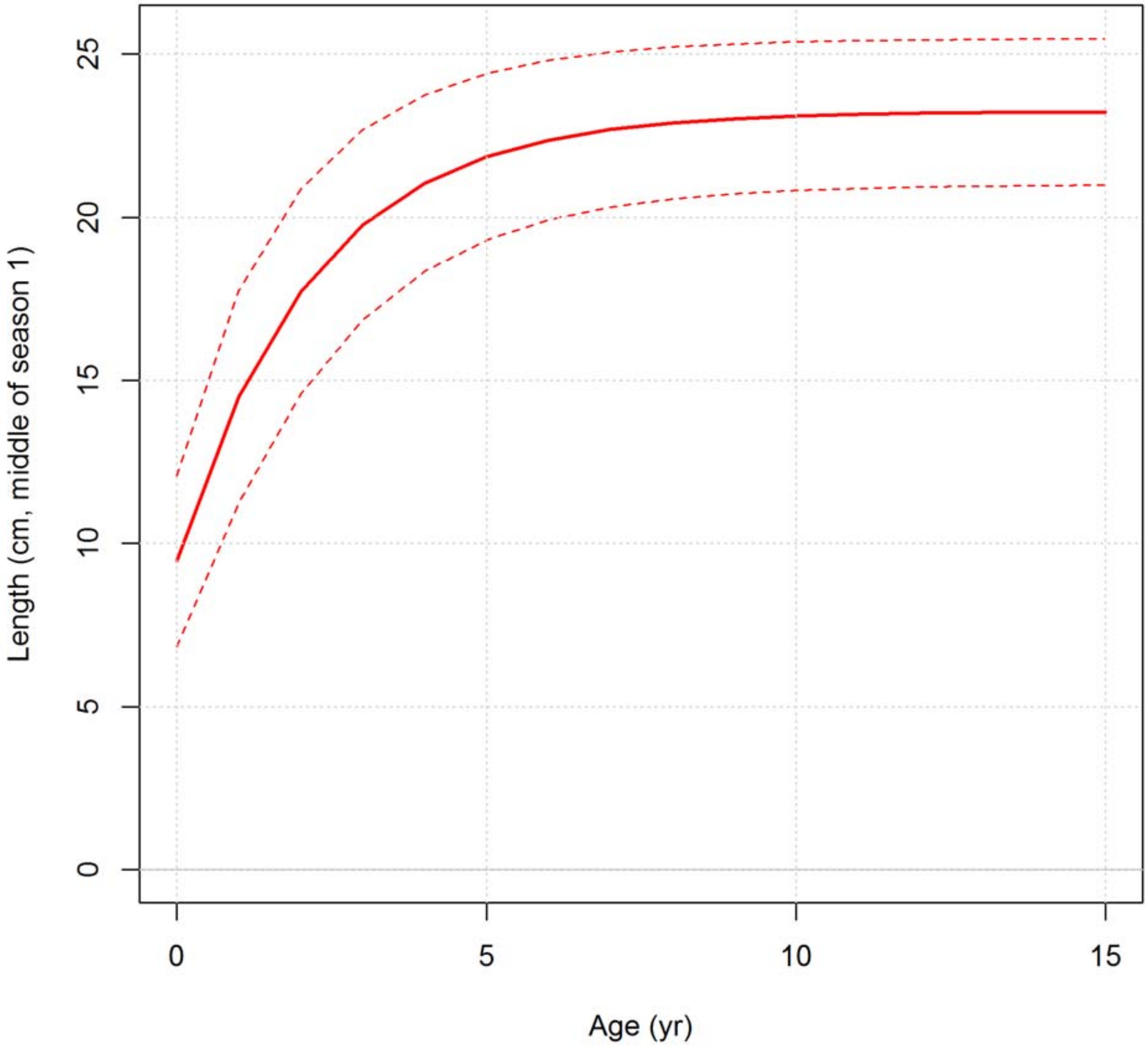
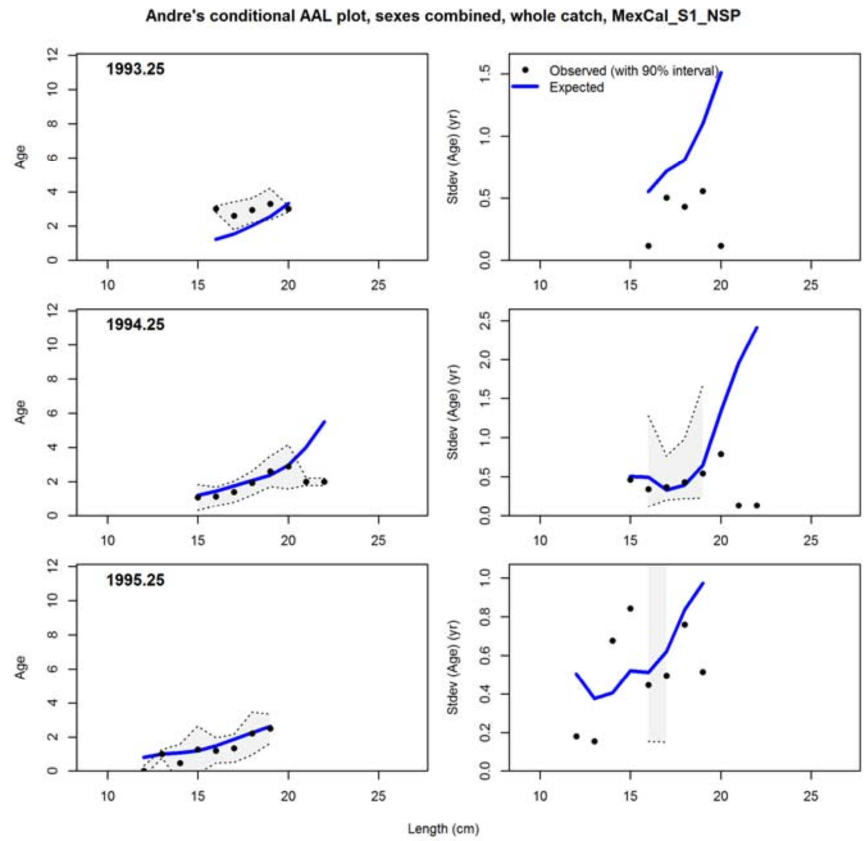


Figure 18. Length-at-age relationship estimated in the proposed update model ($L_{0.5yr}$ = 11.2948 (0.1375), L_{∞} = 23.3583 (0.0478), K = 0.4323).



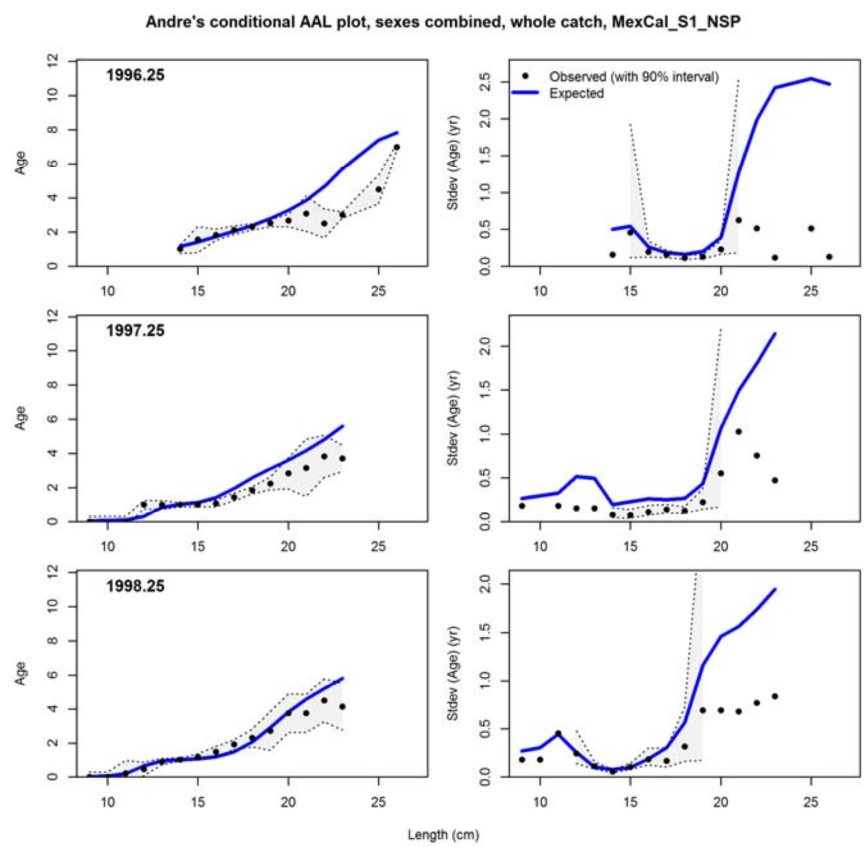
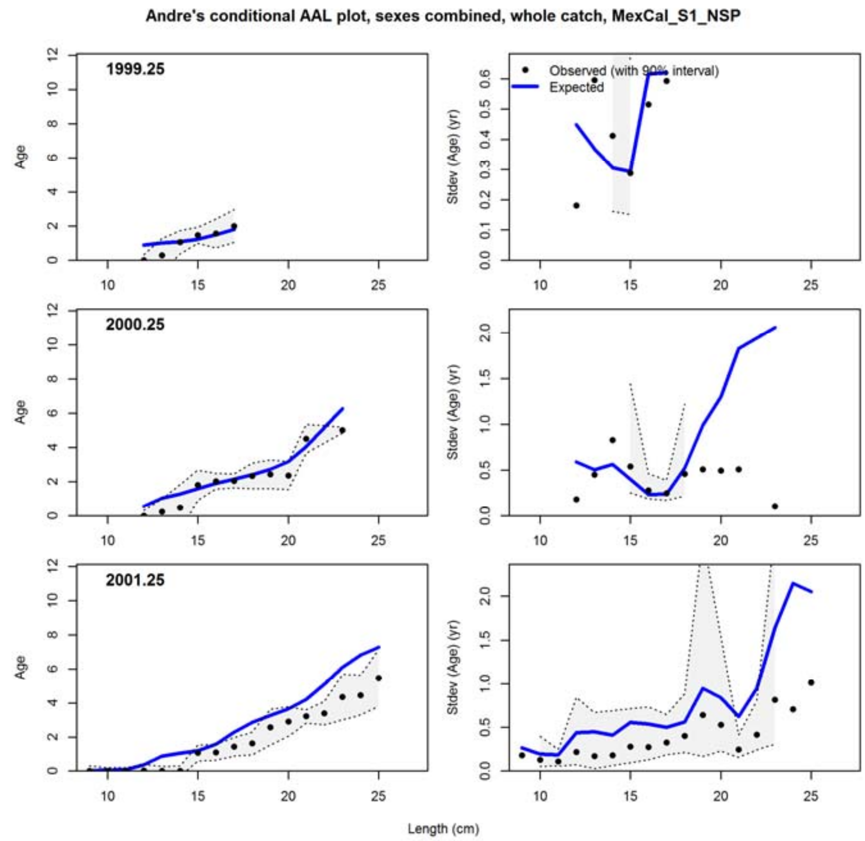


Figure 19. Proposed update model fit to conditional age-at-length compositions for the MexCal_S1 fleet.



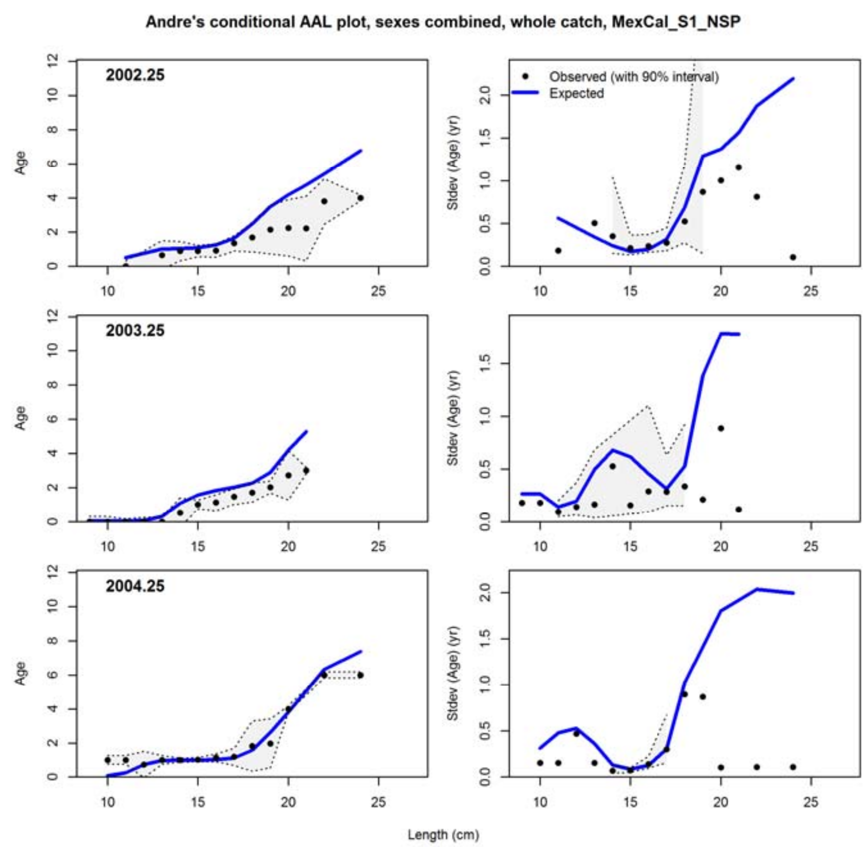
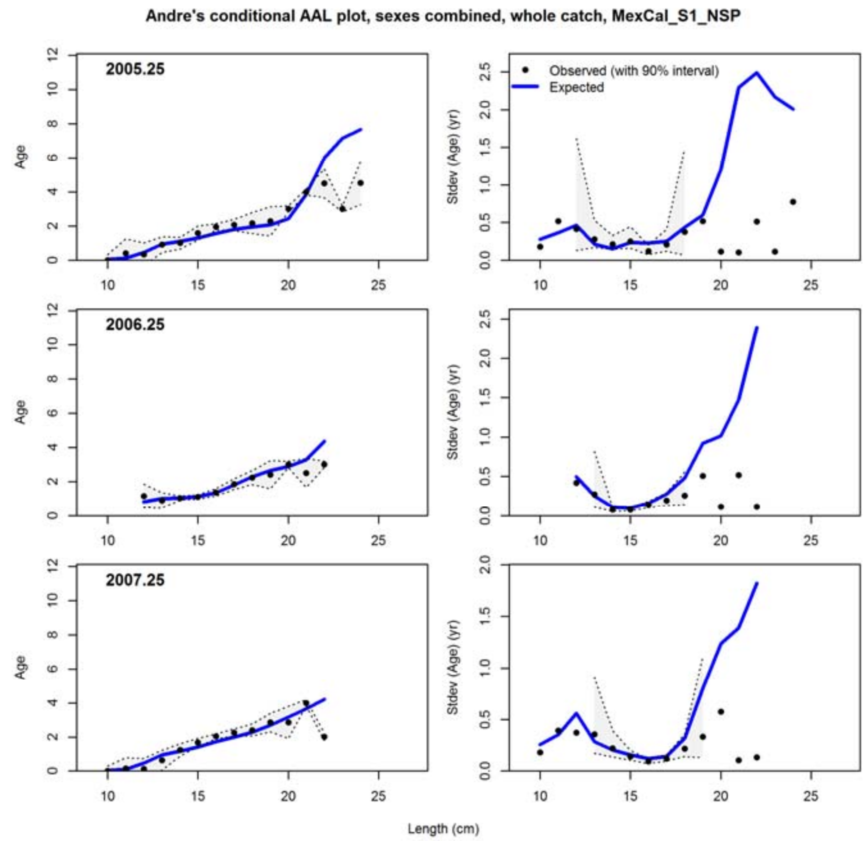


Figure 19 (cont.). Proposed update model fit to conditional age-at-length compositions for the MexCal_S1 fleet.



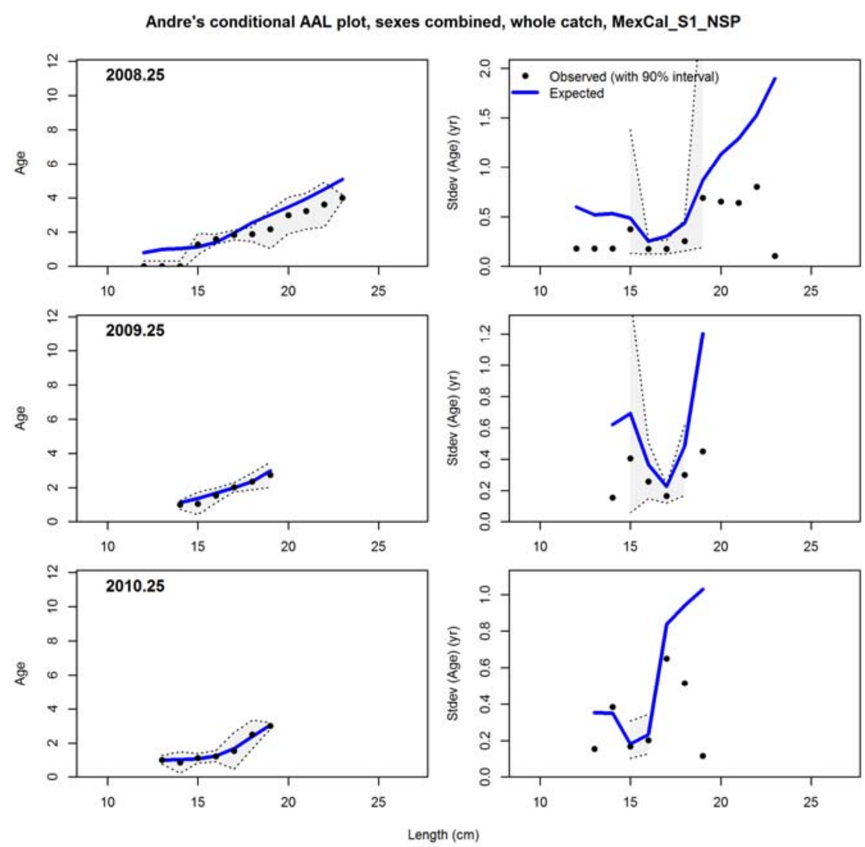
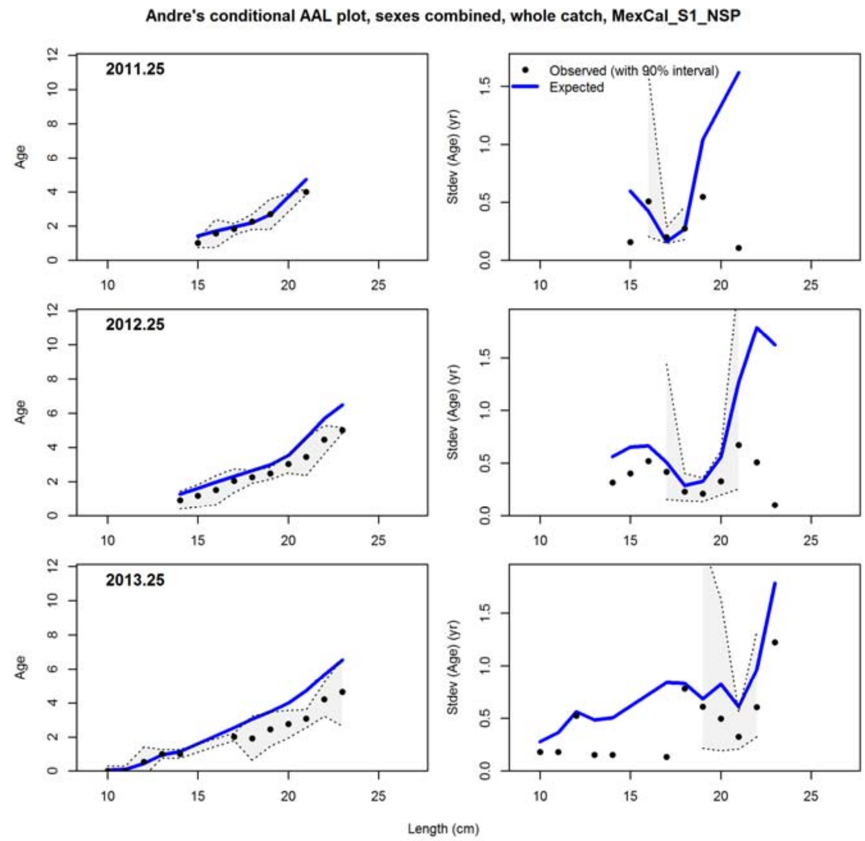
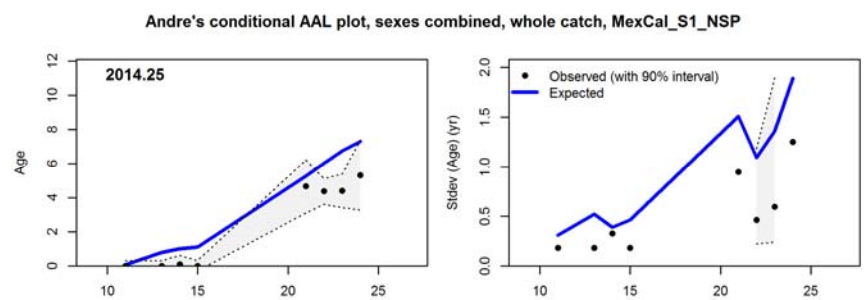


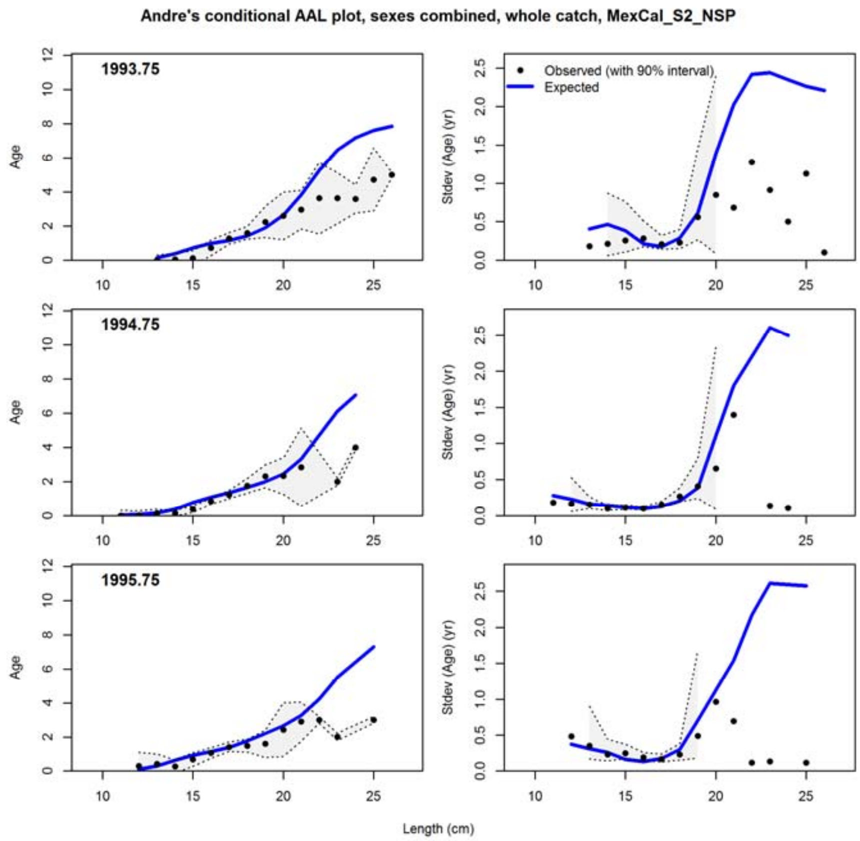
Figure 19 (cont.). Proposed update model fit to conditional age-at-length compositions for the MexCal_S1 fleet.





Length (cm)

Figure 19 (cont.). Proposed update model fit to conditional age-at-length compositions for the MexCal_S1 fleet.



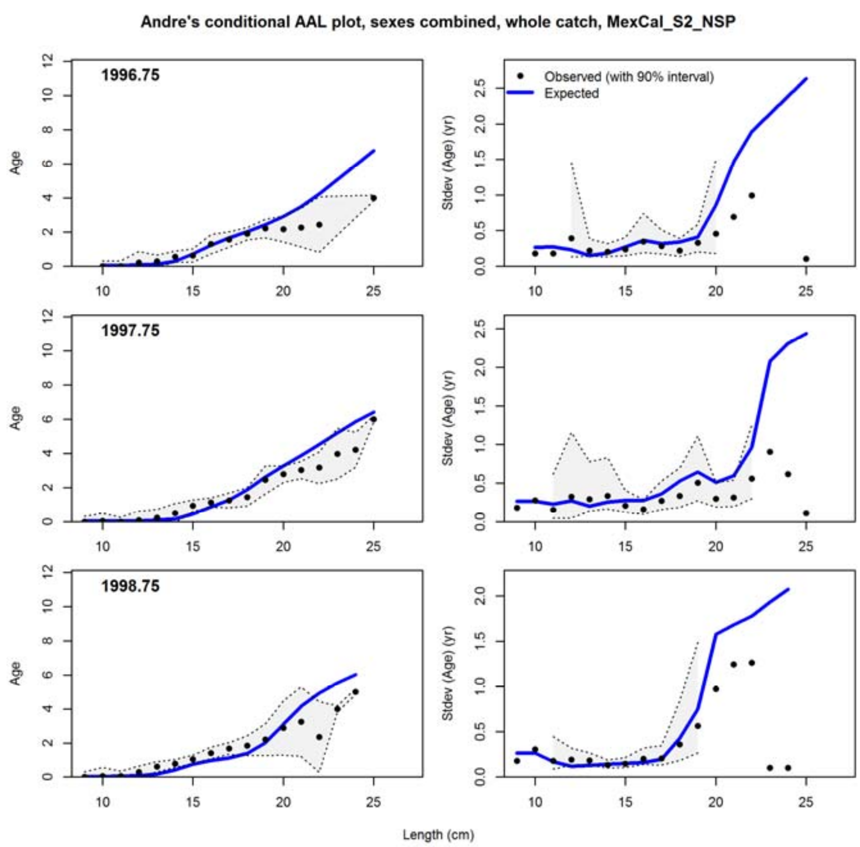
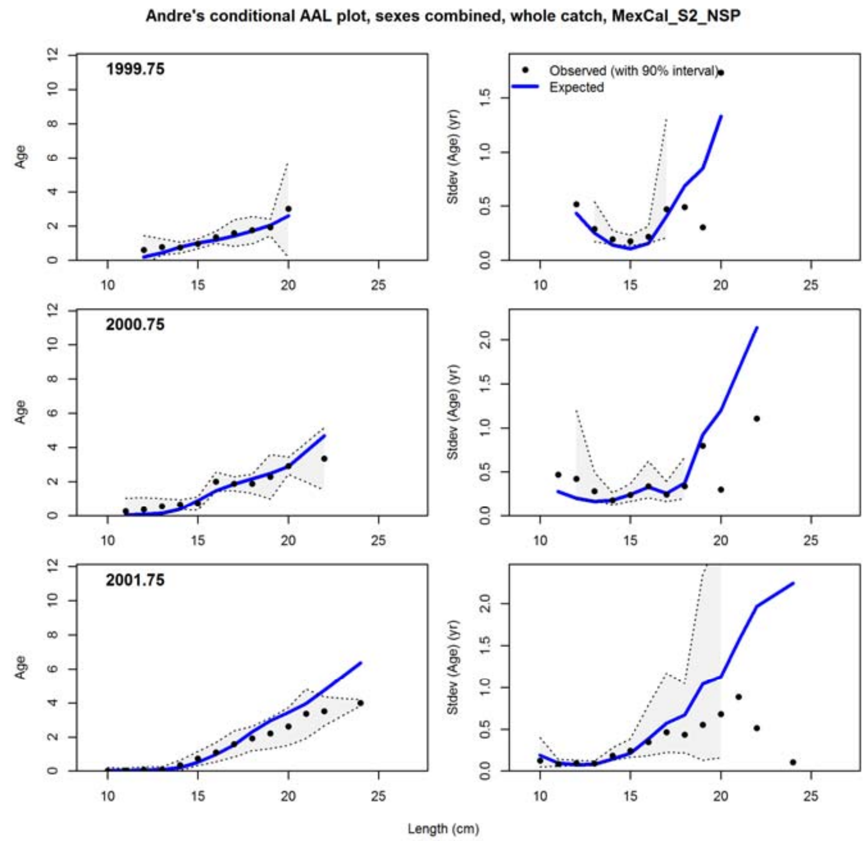


Figure 20. Proposed update model fit to conditional age-at-length compositions for the MexCal_S2 fleet.



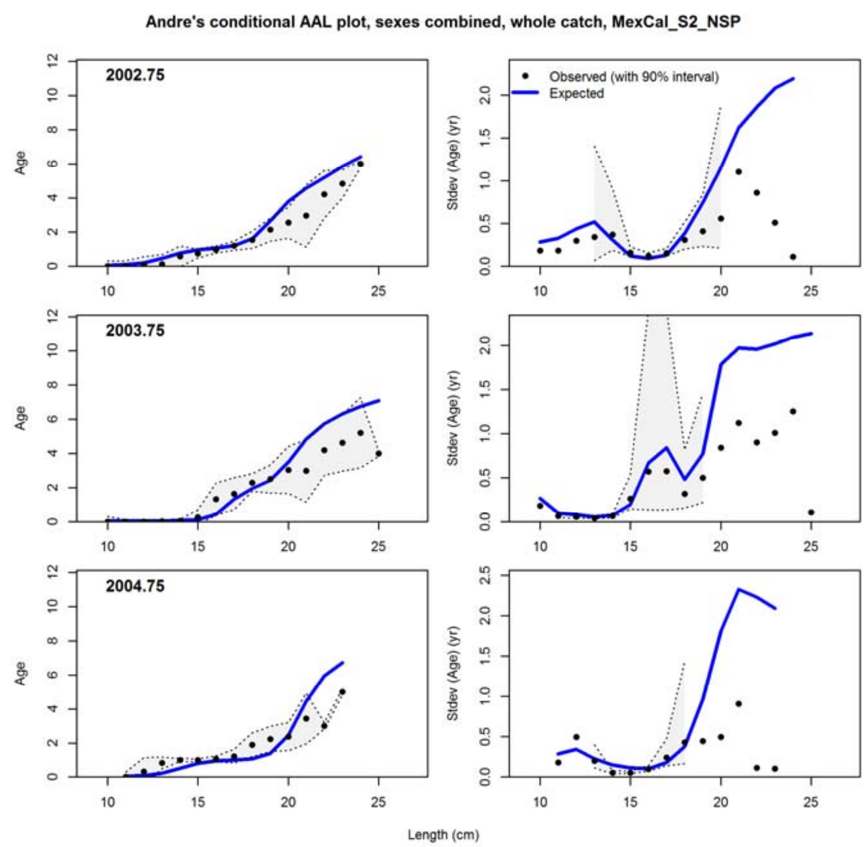


Figure 20 (cont.). Proposed update model fit to conditional age-at-length compositions for the MexCal_S2 fleet.

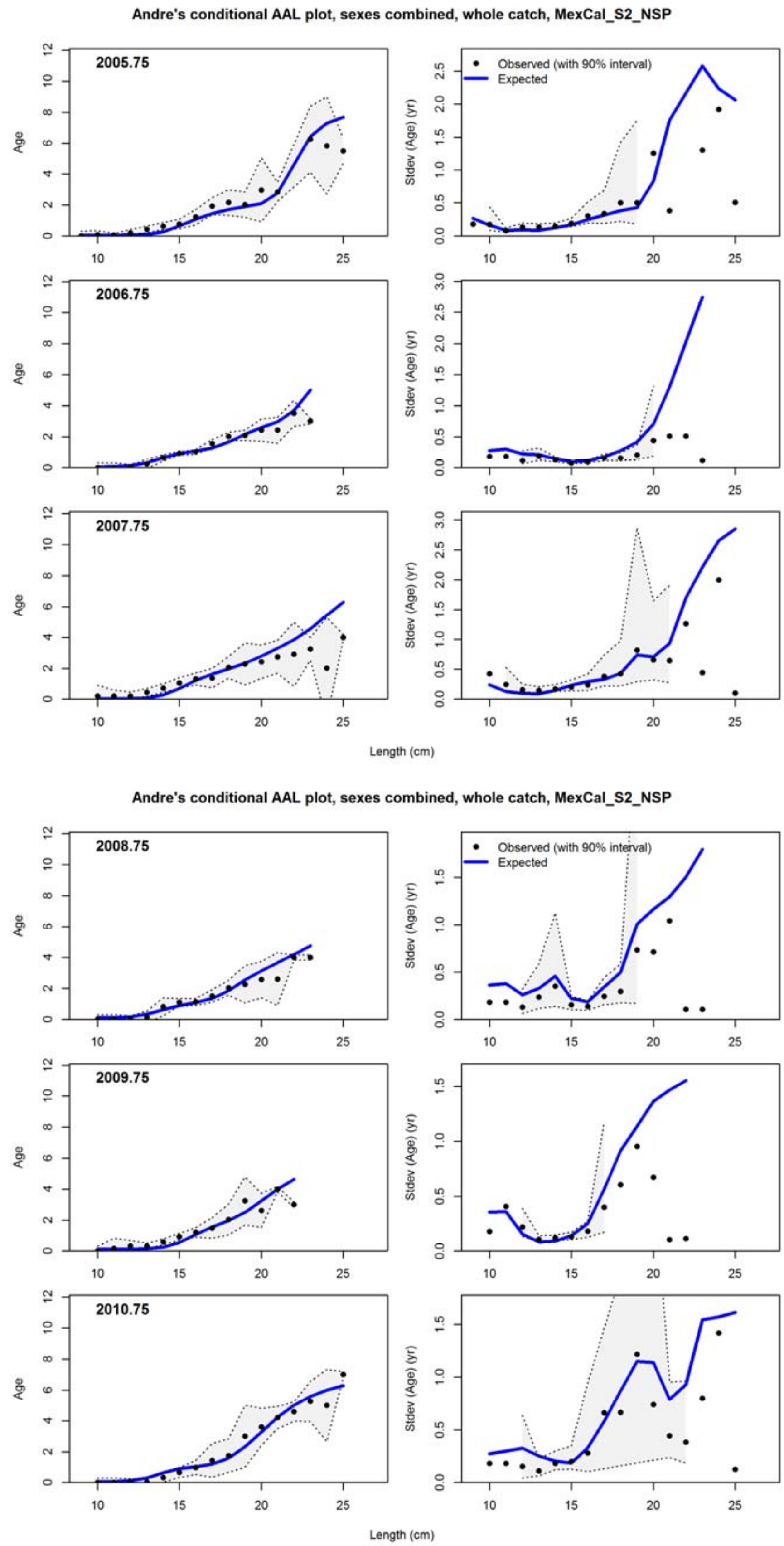
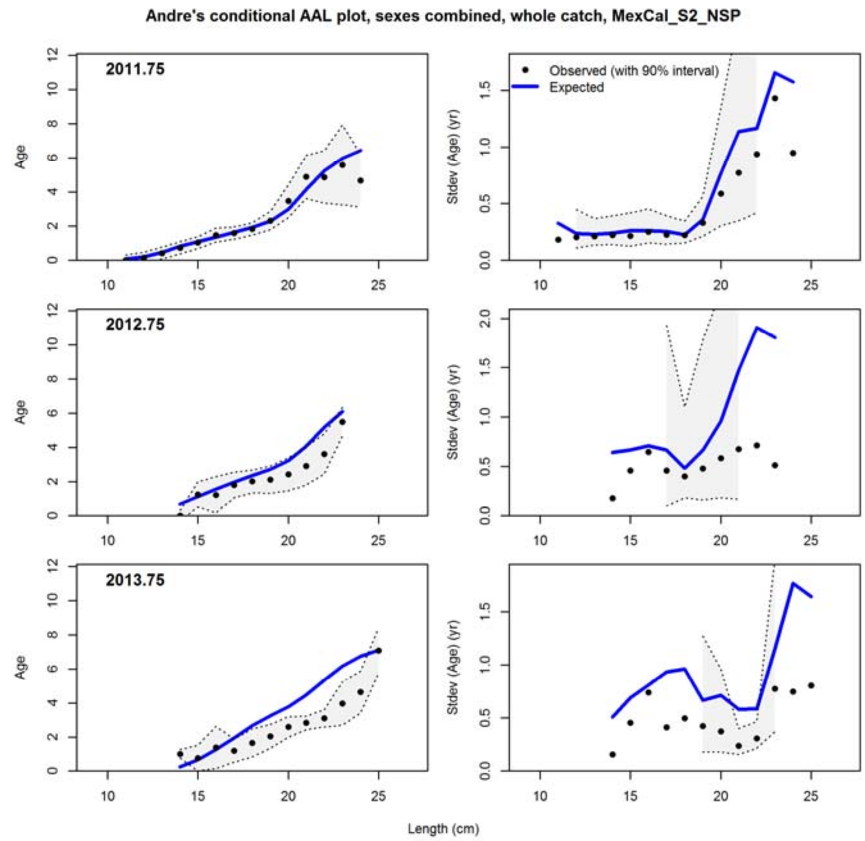
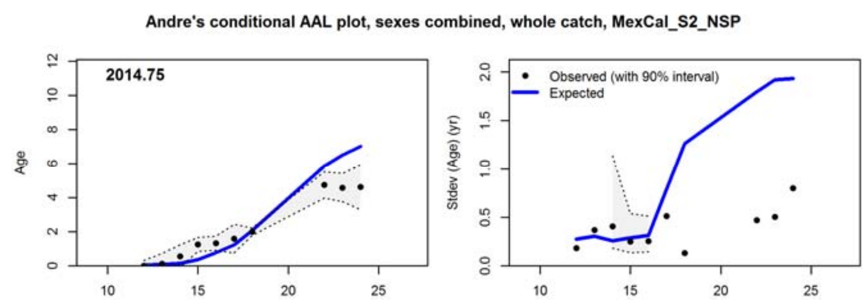


Figure 20 (cont.). Proposed update model fit to conditional age-at-length compositions for the MexCal_S2 fleet.





Length (cm)

Figure 20 (cont.). Proposed update model fit to conditional age-at-length compositions for the MexCal_S2 fleet.

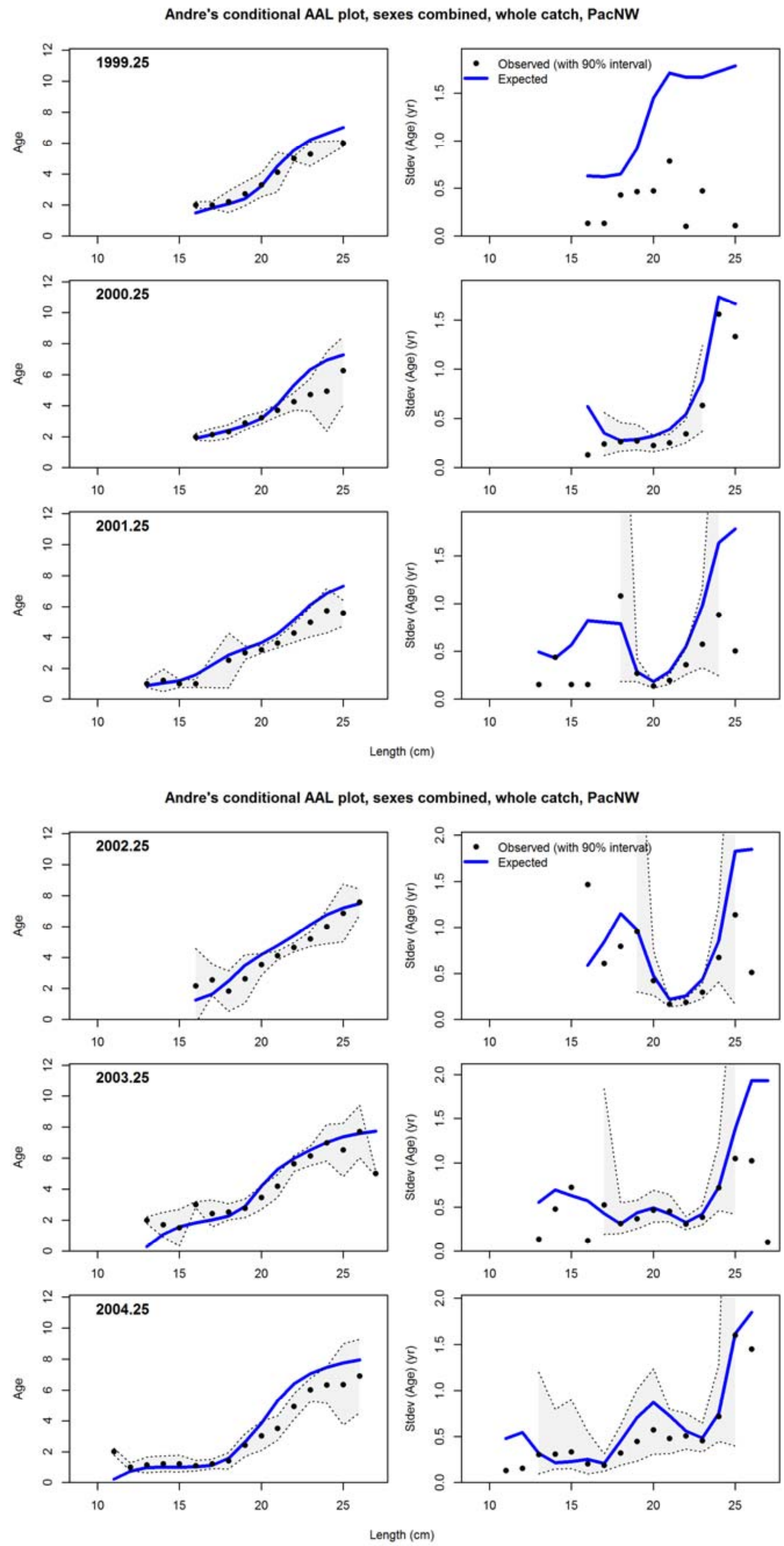
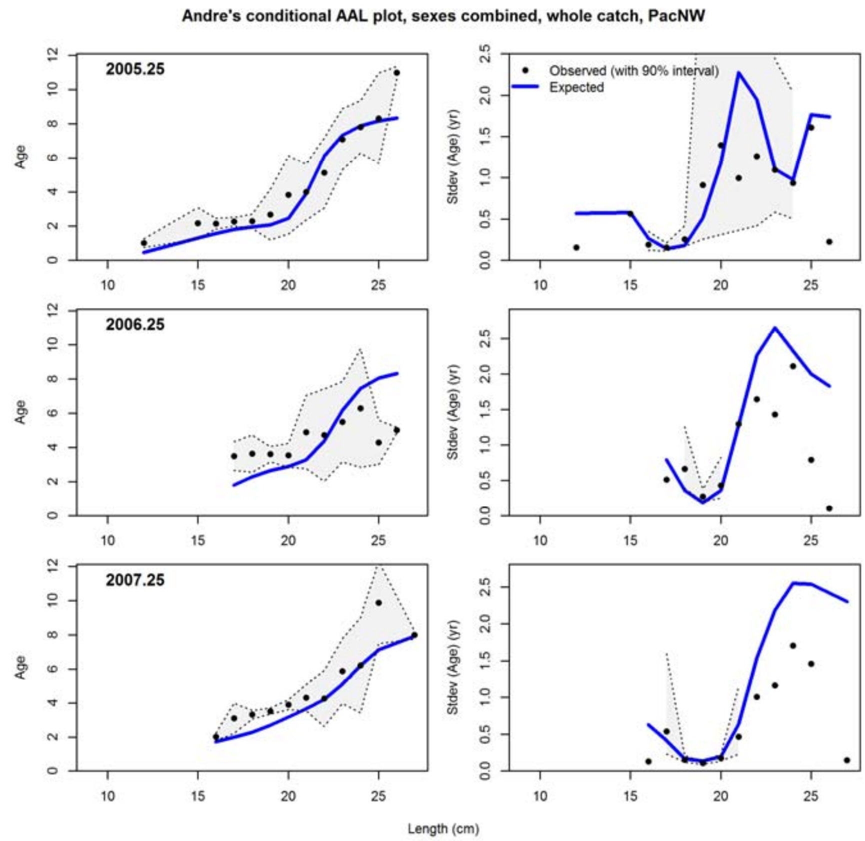


Figure 21. Proposed update model fit to conditional age-at-length compositions for the PacNW fleet.



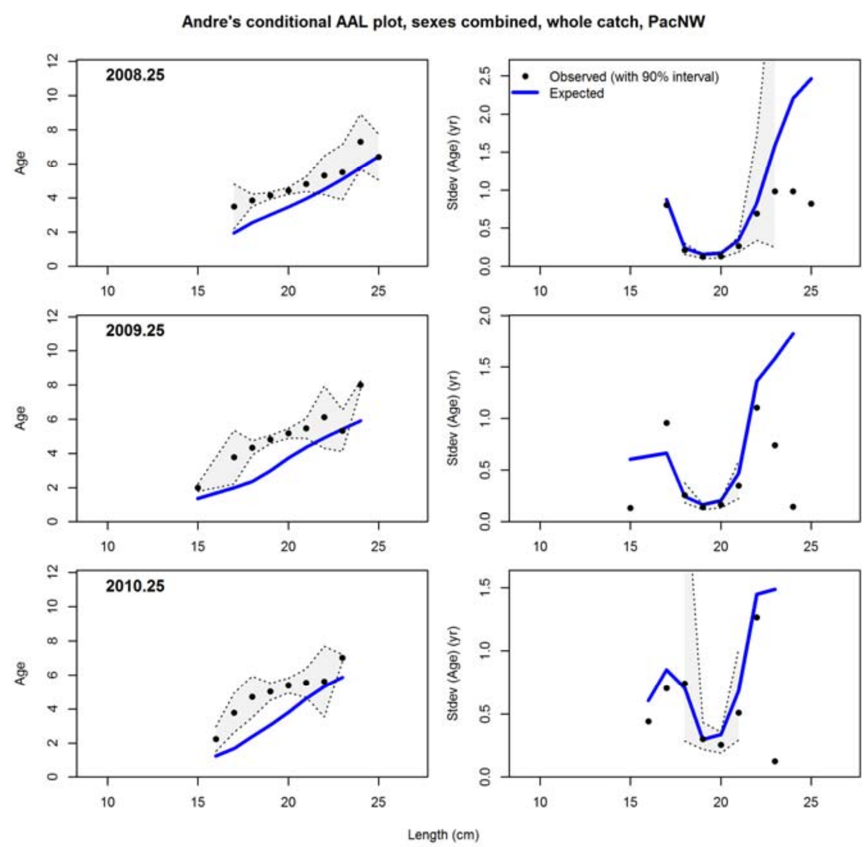
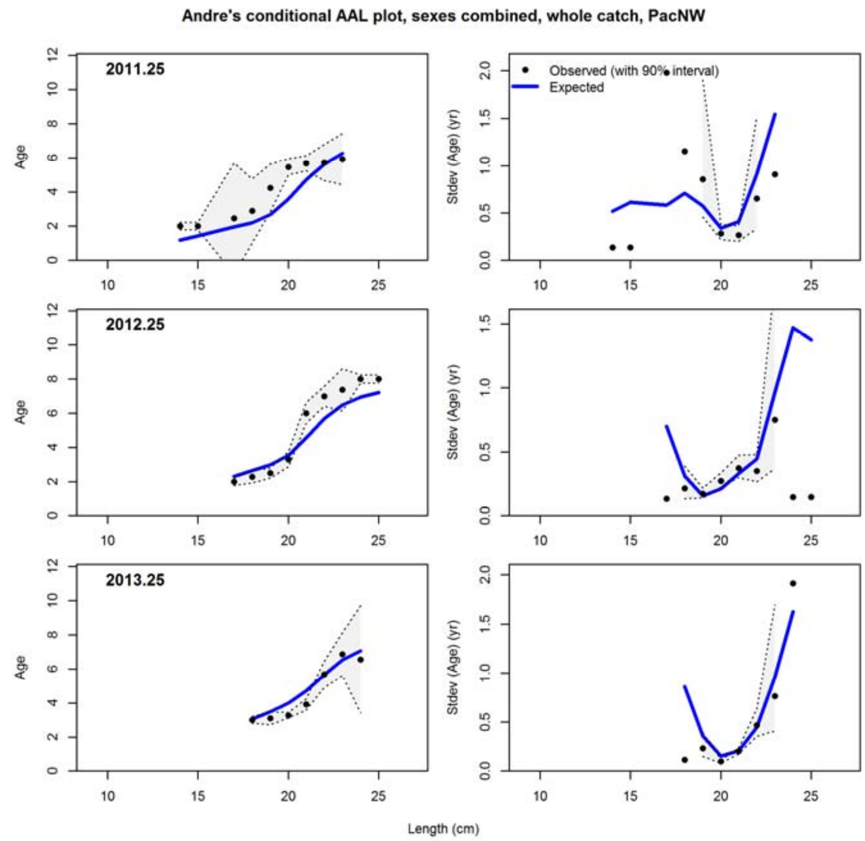


Figure 21 (cont.). Proposed update model fit to conditional age-at-length compositions for the PacNW fleet.



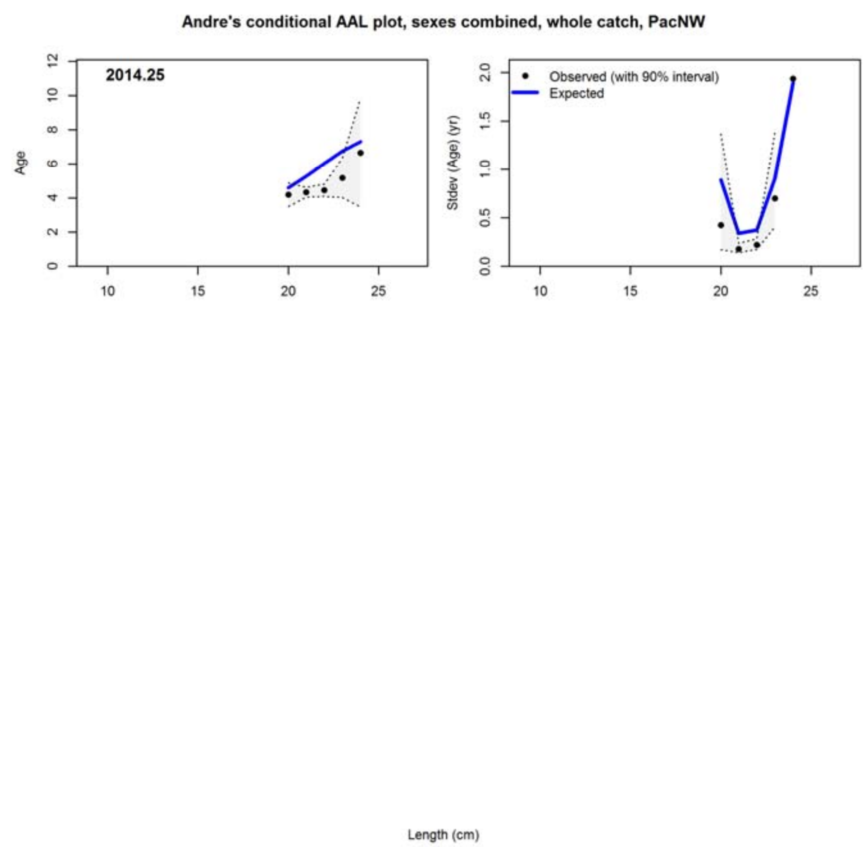


Figure 21 (cont.). Proposed update model fit to conditional age-at-length compositions for the PacNW fleet.

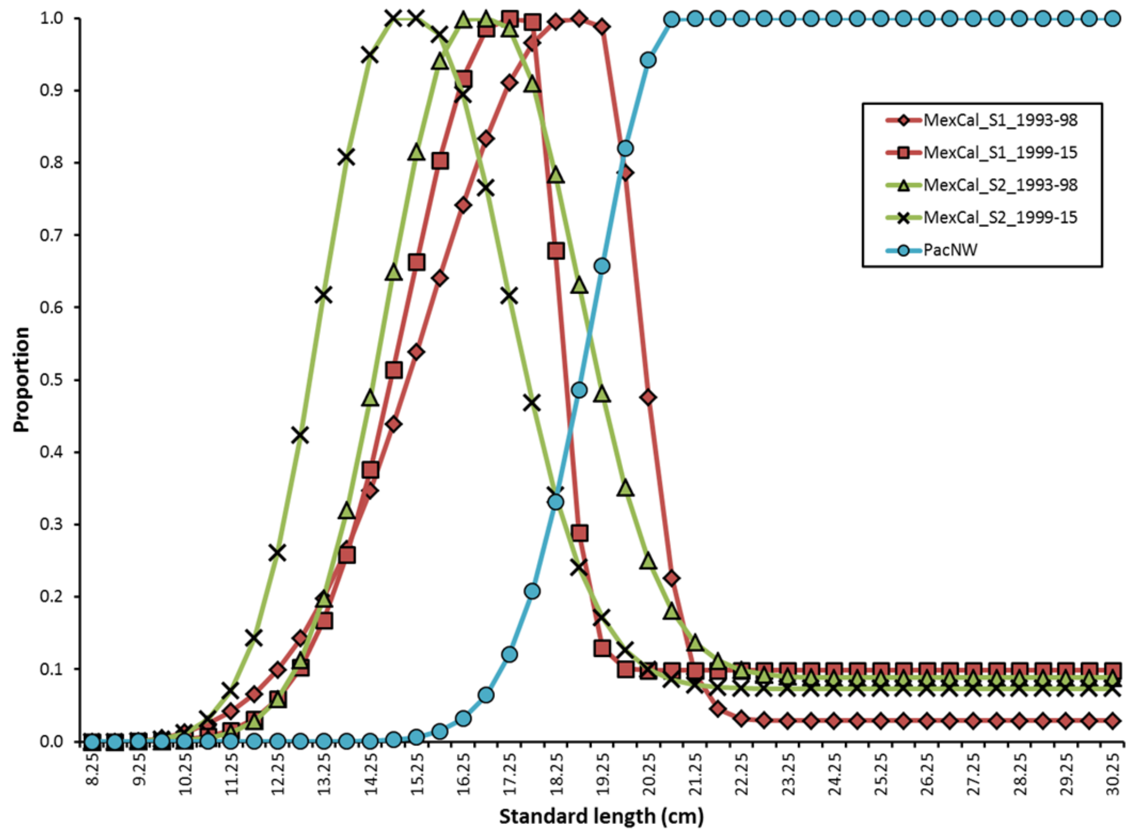


Figure 22a. Length-based selectivity patterns for fleets in the proposed update model.

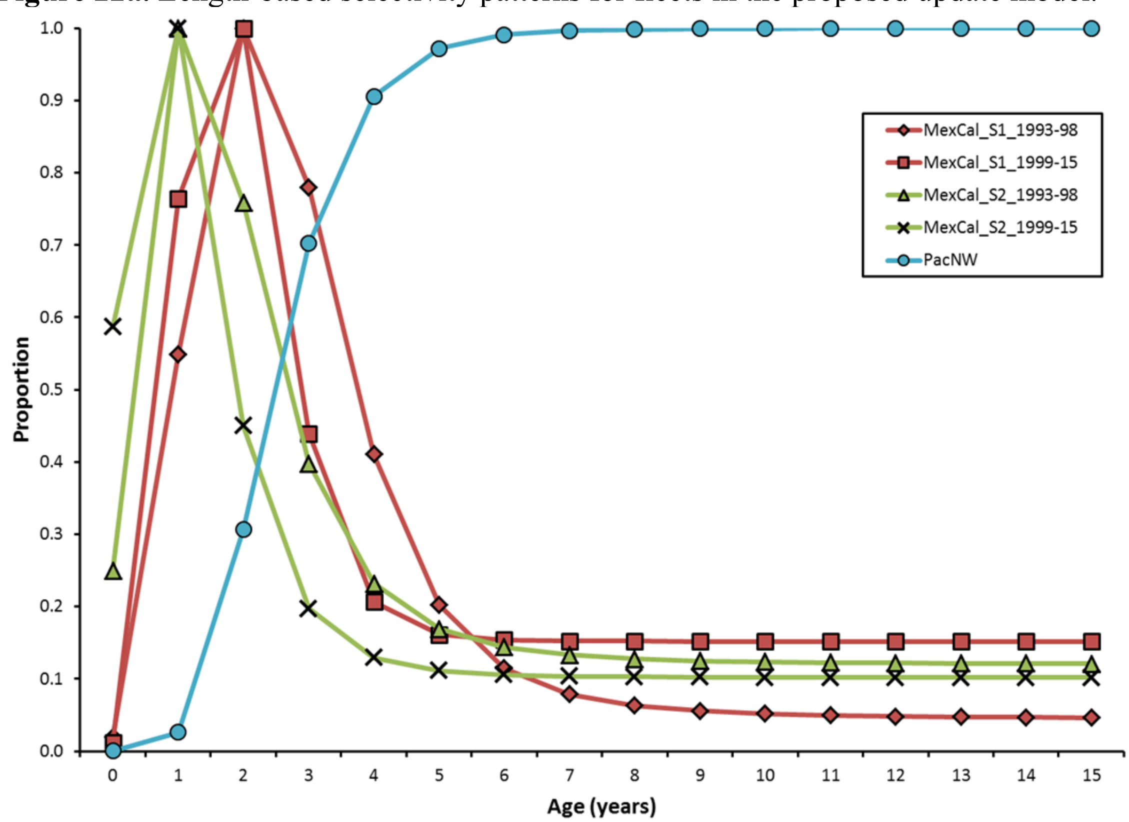
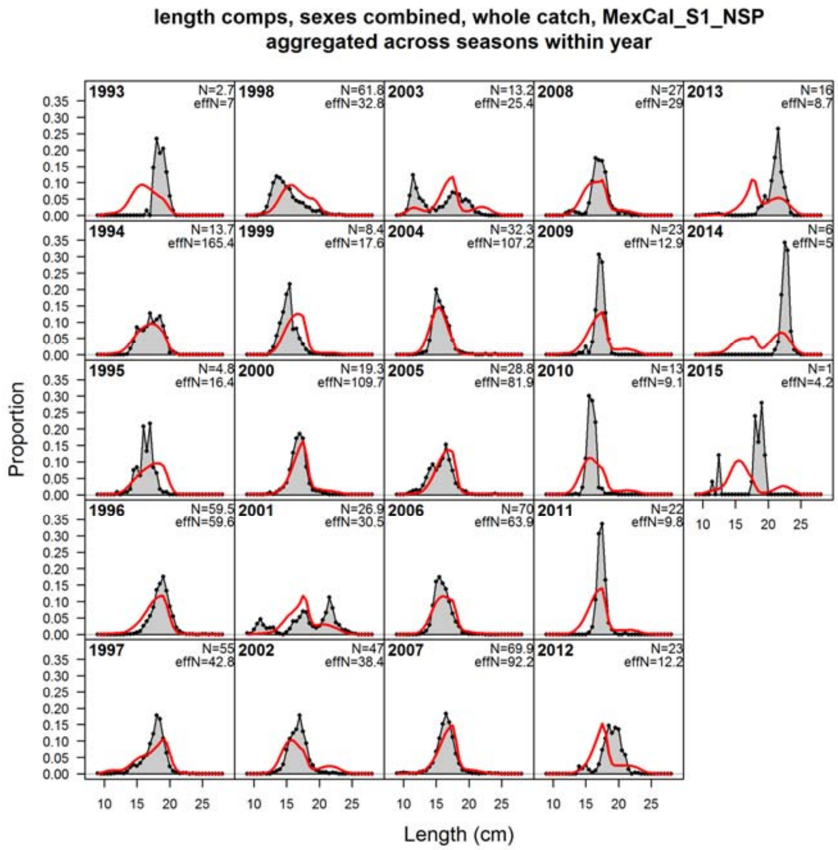


Figure 22b. Implied age-selectivity patterns for fleets in the proposed update model.



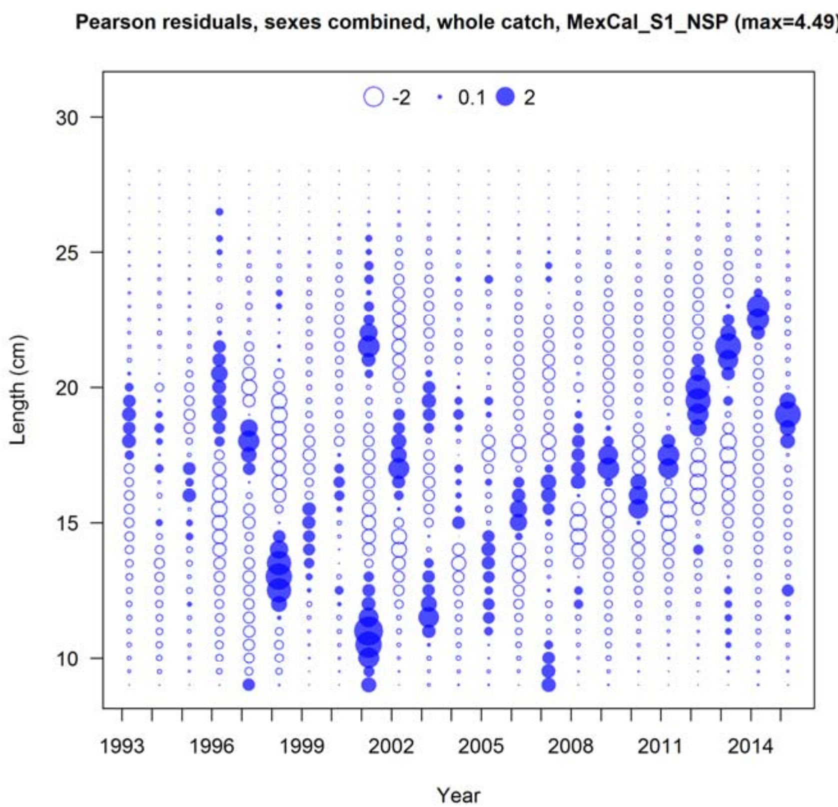


Figure 23a. Proposed update model fit to length compositions and residual plot for the MexCal_S1 fleet.

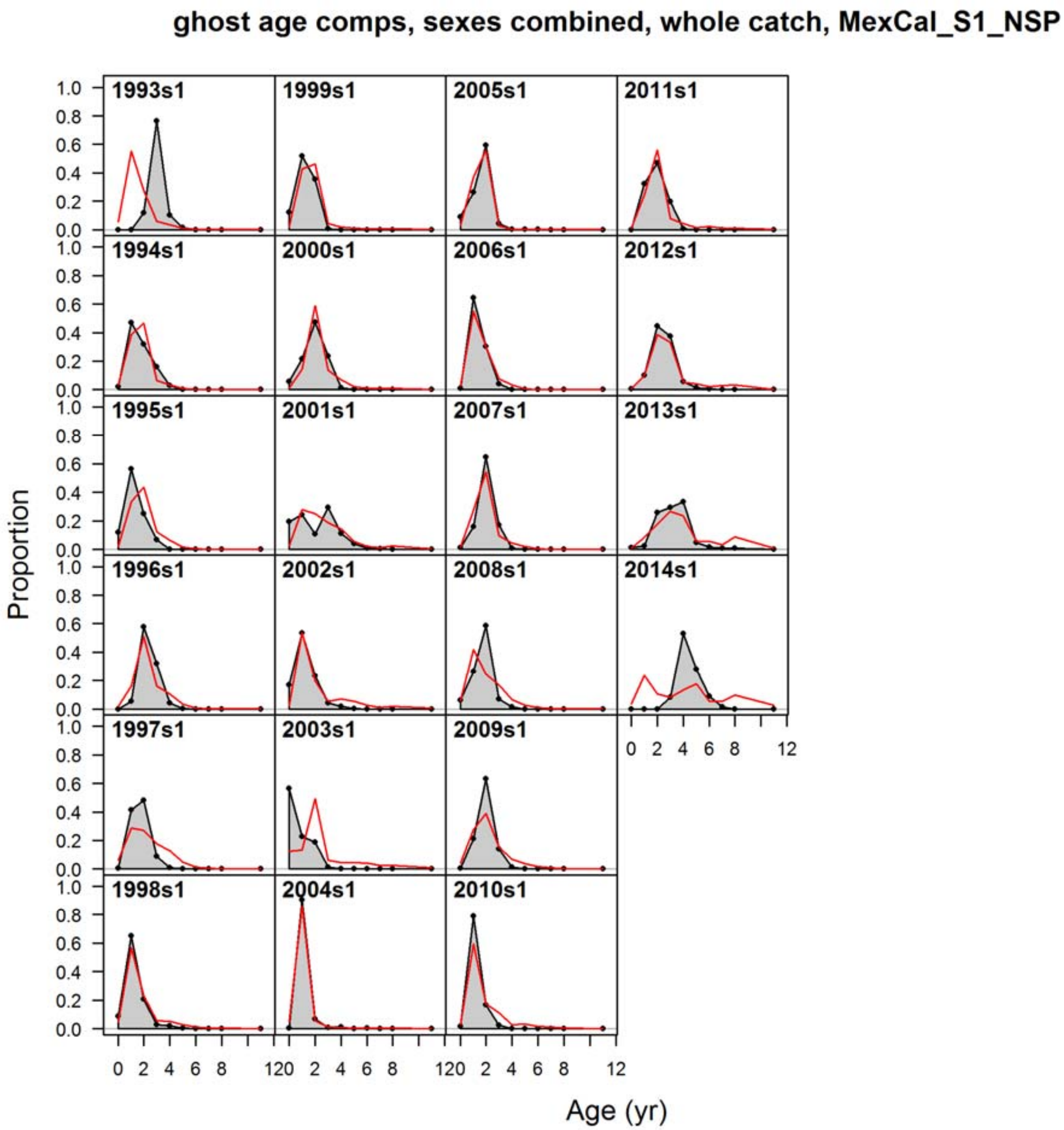
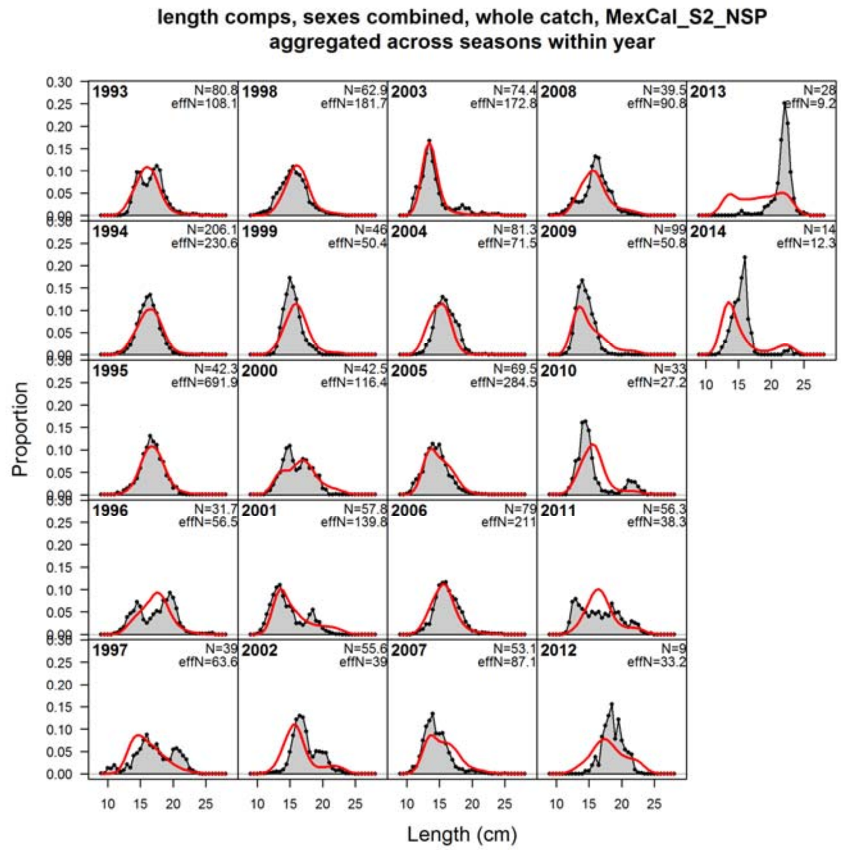


Figure 23b. Proposed update model fit to implied age compositions for the MexCal_S1 fleet.



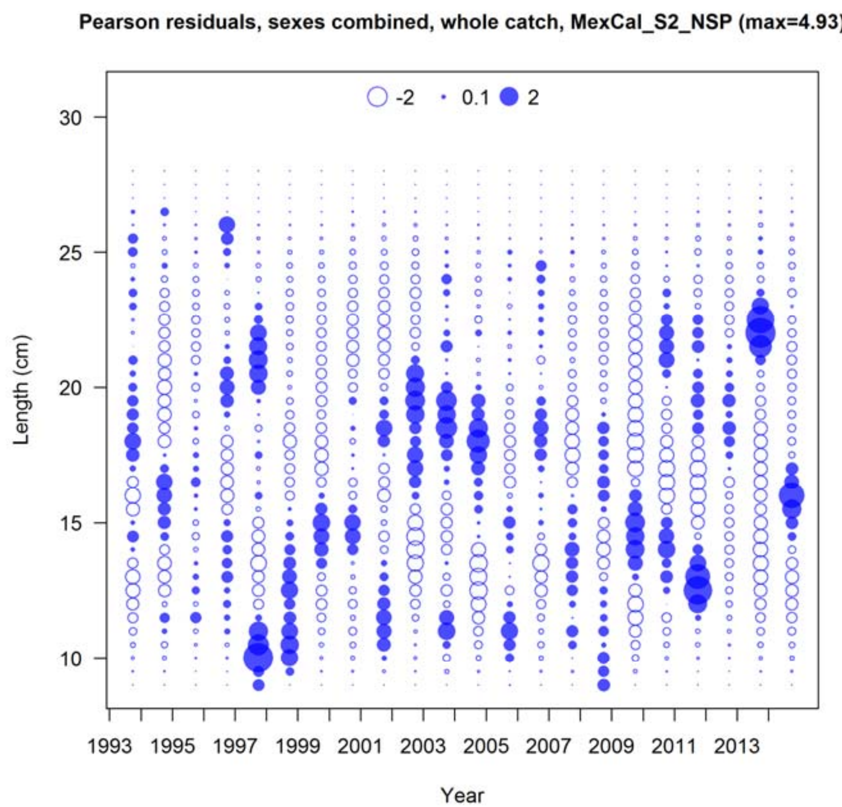


Figure 24a. Proposed update model fit to length compositions and residual plot for the MexCal_S2 fleet.

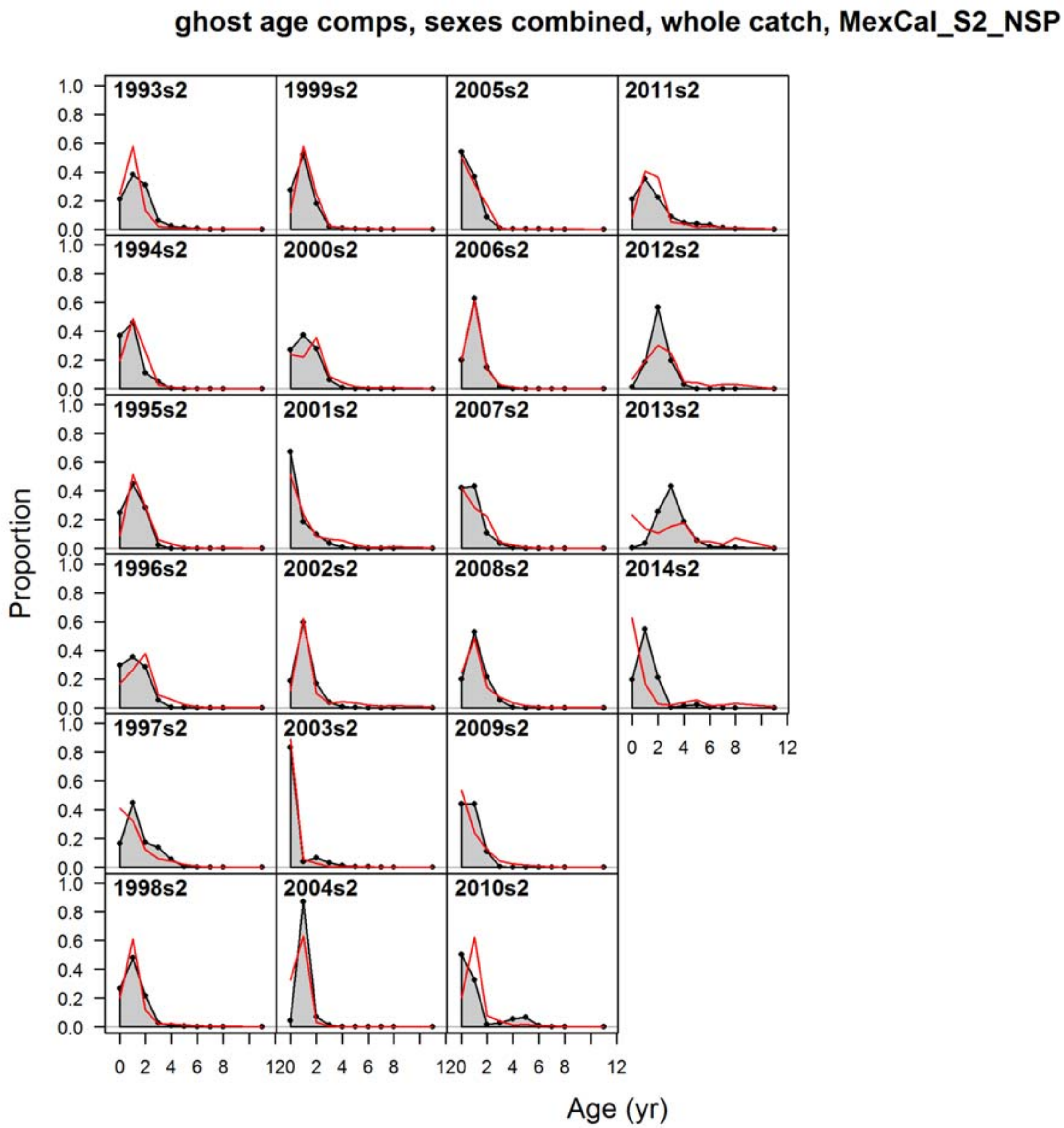


Figure 24b. Proposed update model fit to implied age-compositions for the MexCal_S2 fleet.

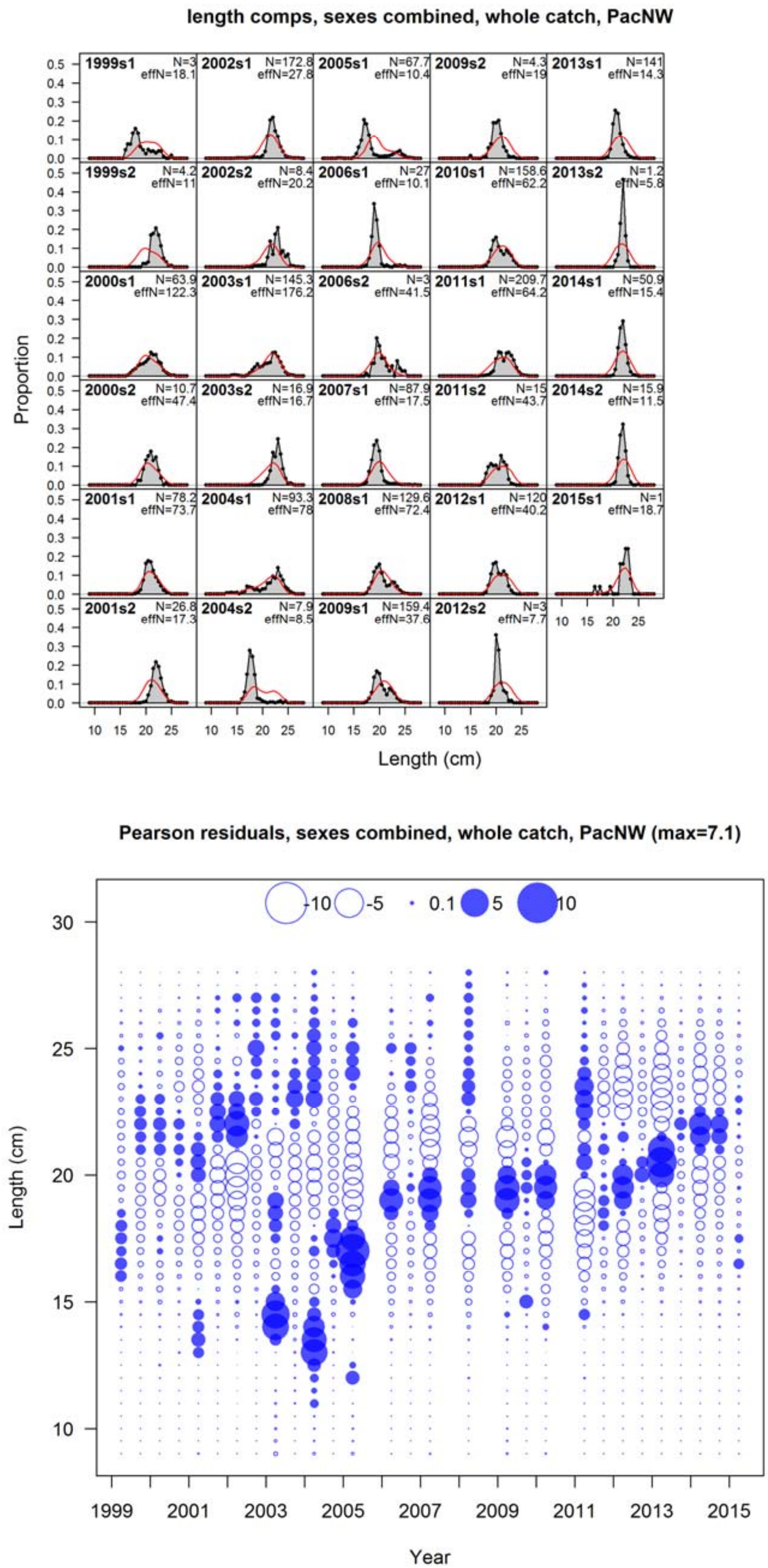


Figure 25a. Proposed update model fit to length compositions and residual plot for the PacNW fleet.

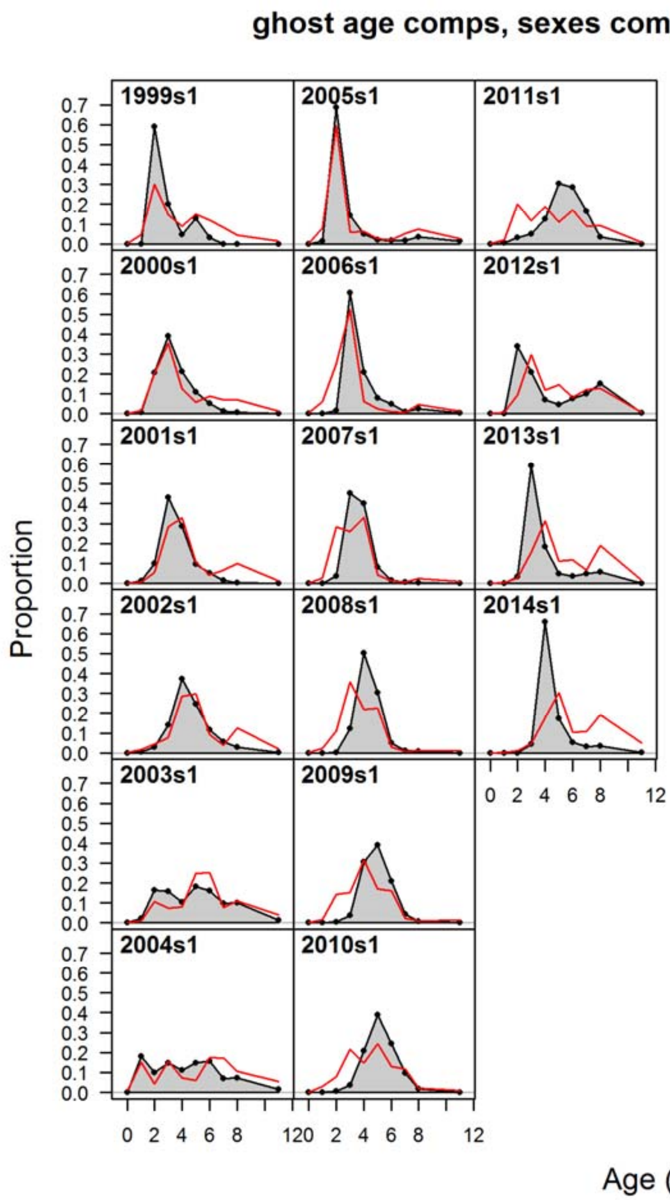


Figure 25b. Proposed update model fit to implied age compositions for the PacNW fleet.

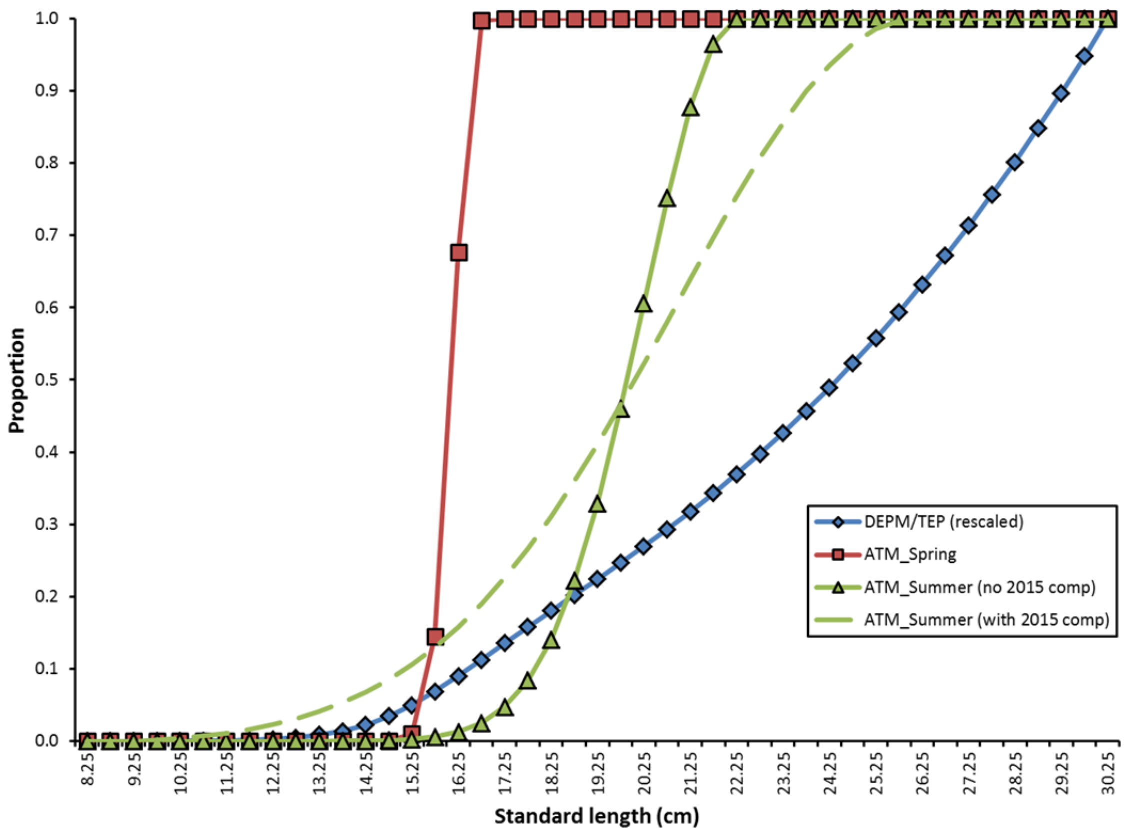


Figure 26a. Length-based selectivity patterns for surveys in the update models.

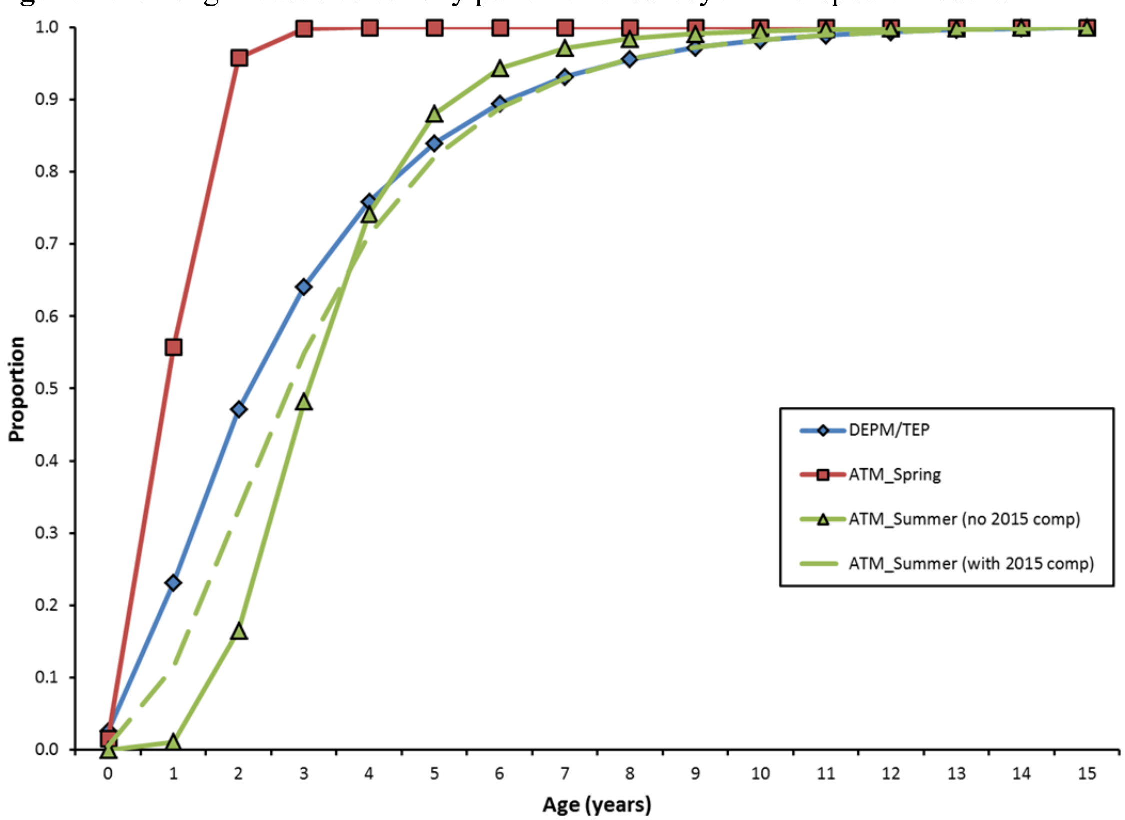
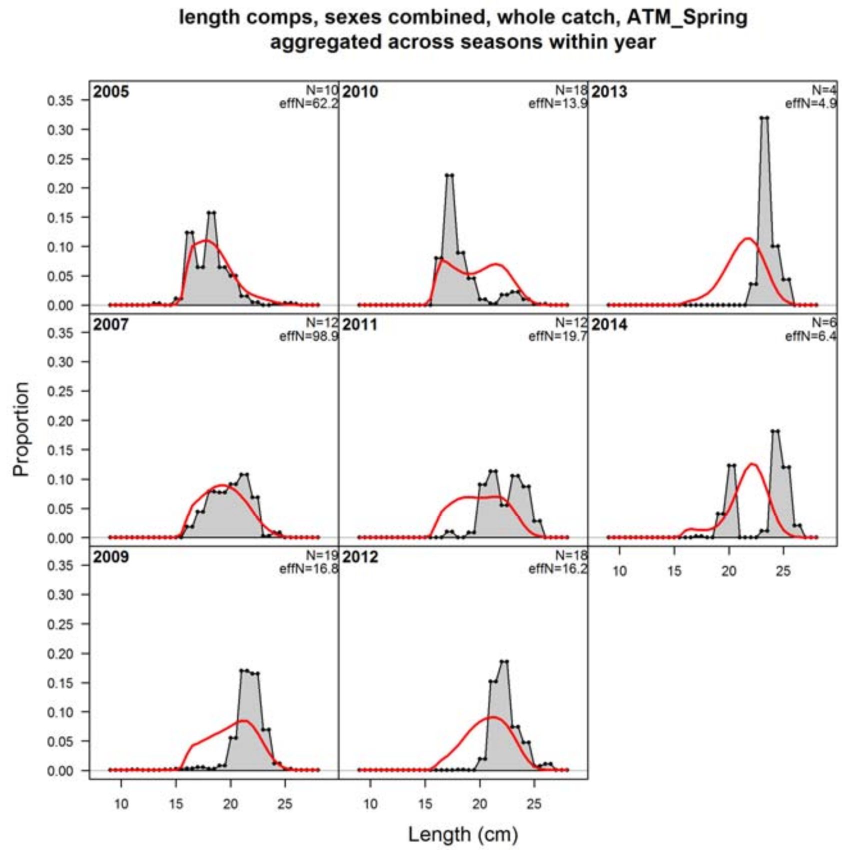


Figure 26b. Implied age-selectivity patterns for surveys in the update models.



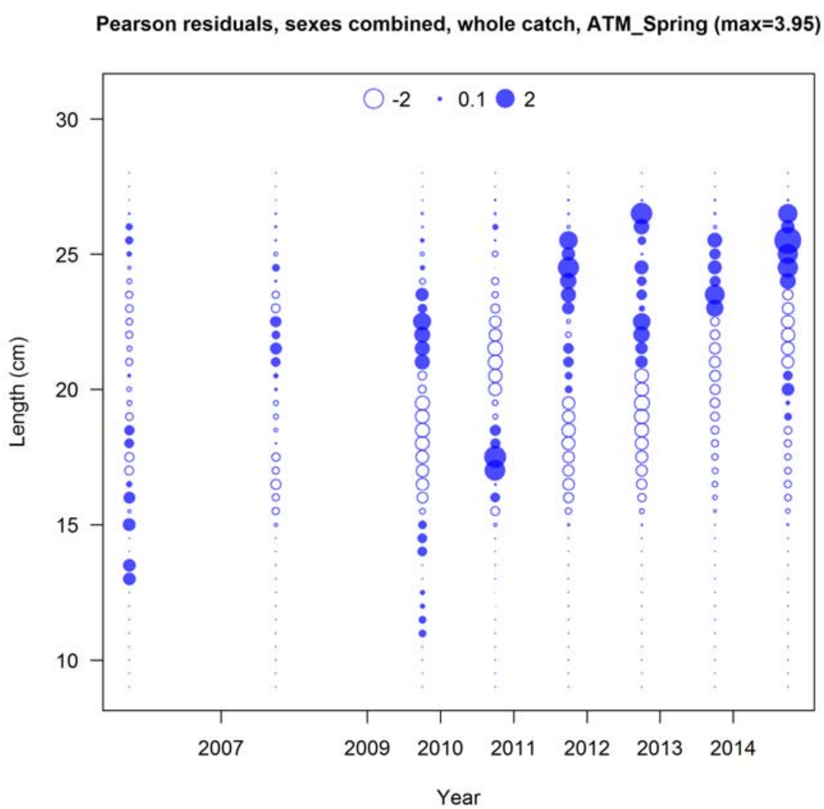
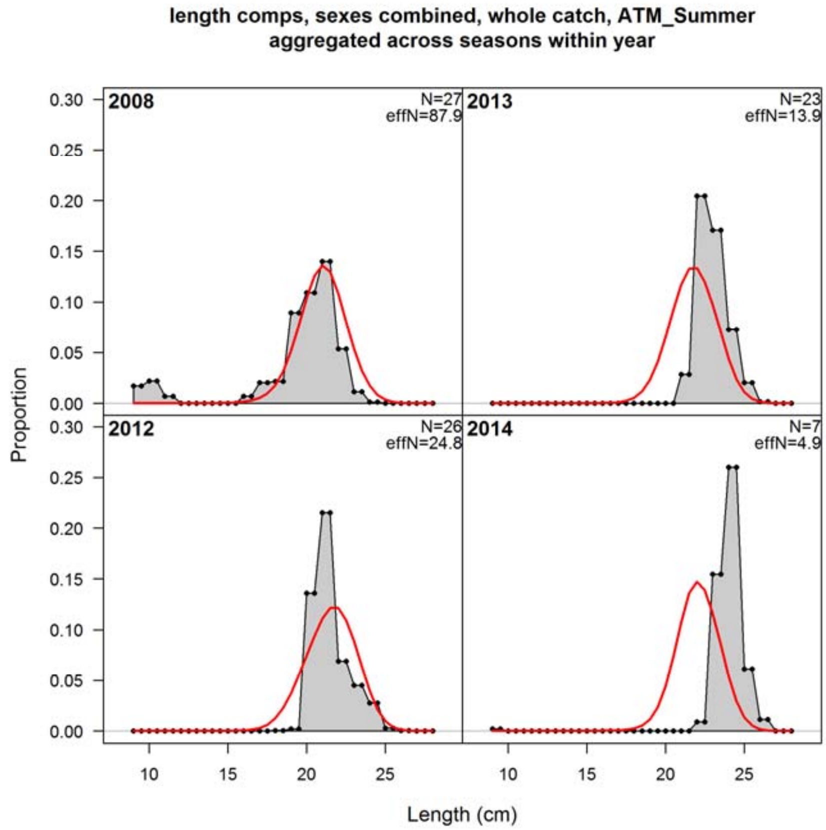


Figure 27. Proposed update model fit to length compositions and residual plot for the Spring ATM survey.



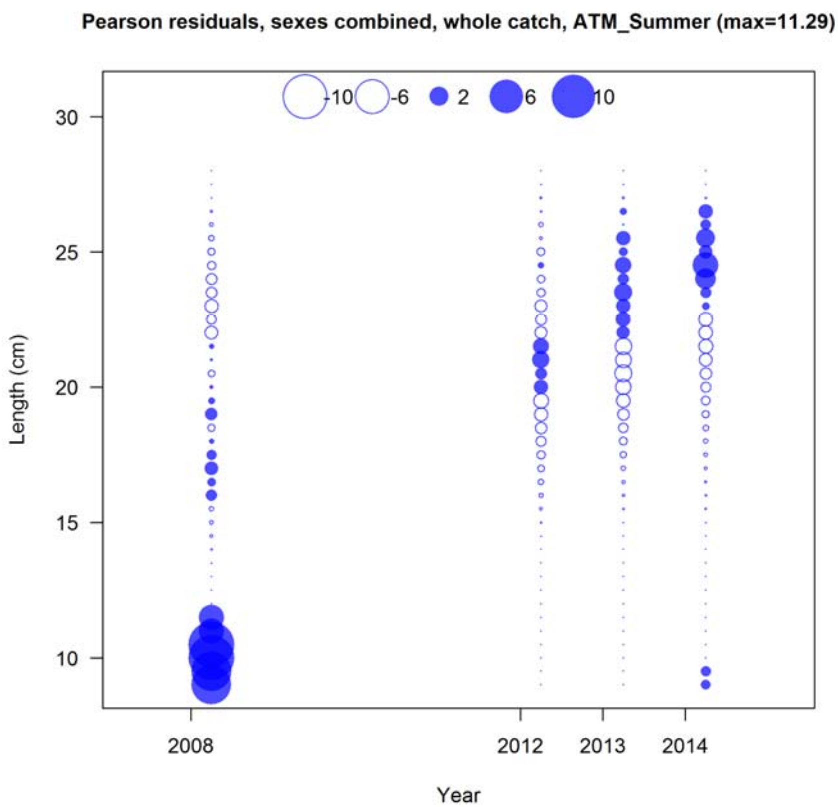


Figure 28. Proposed update model fit to length compositions and residual plot for the Summer ATM survey.

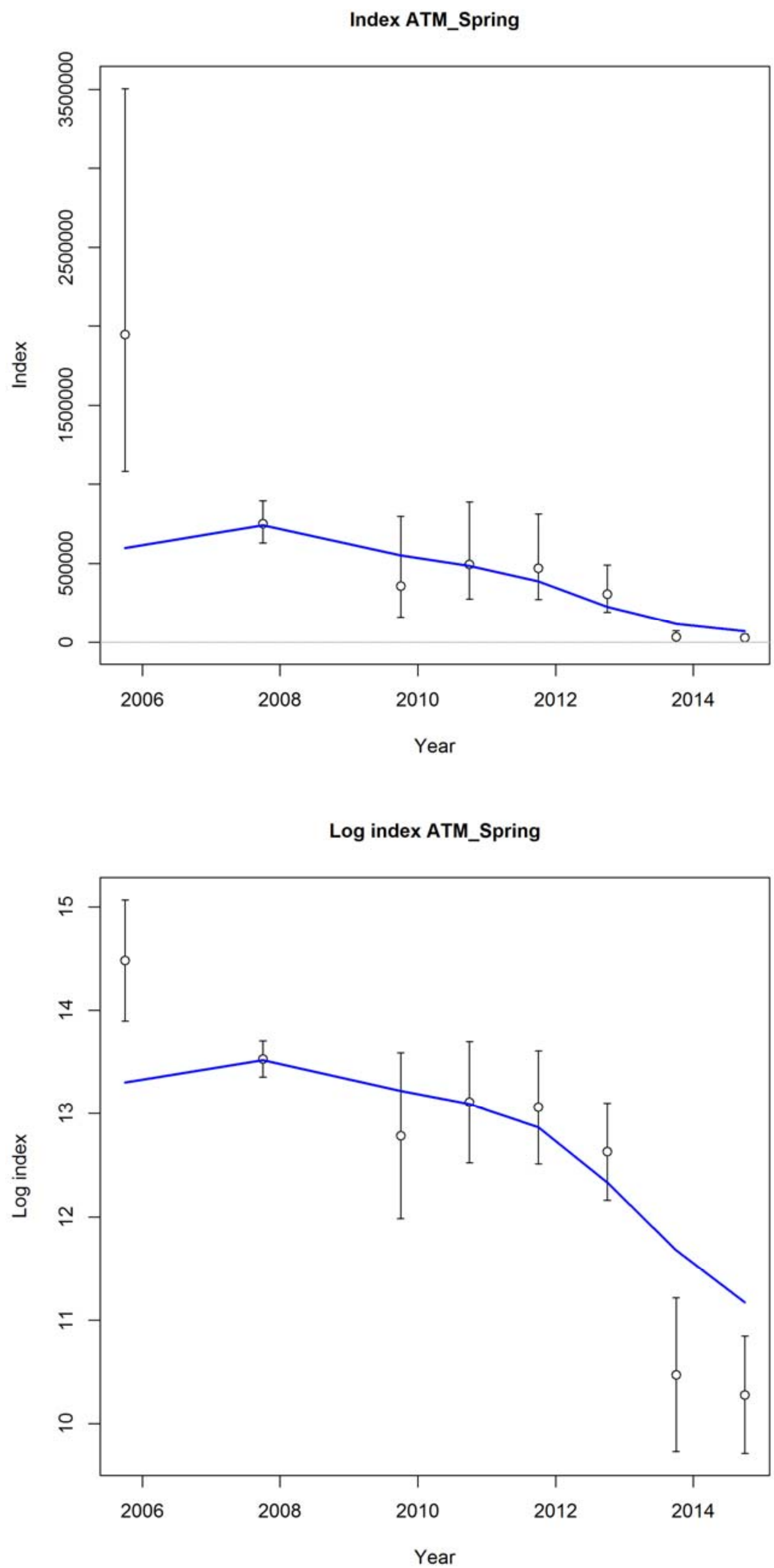
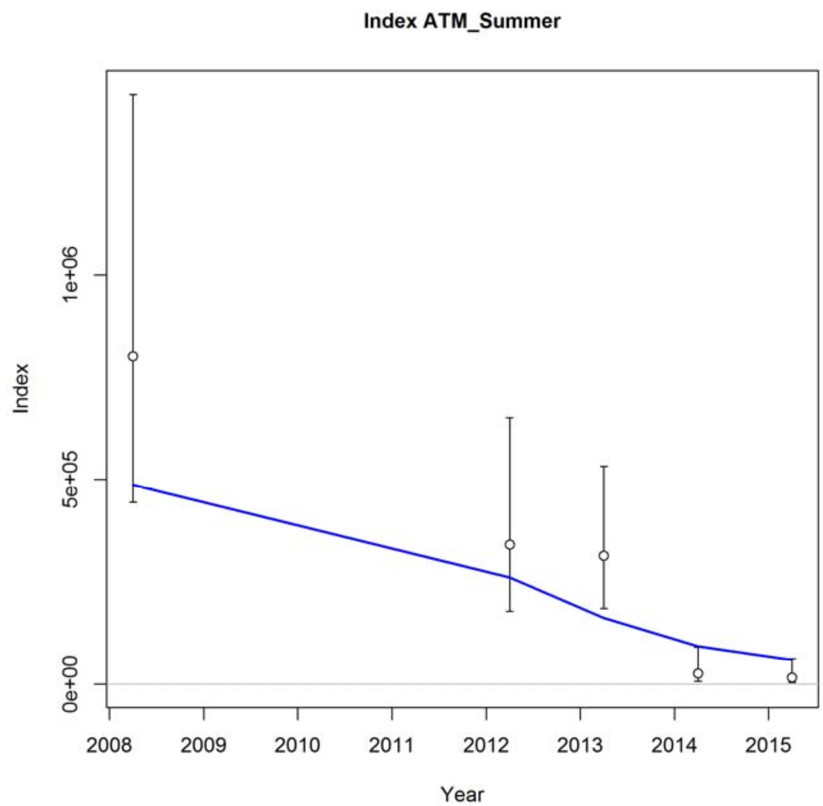


Figure 29. Proposed update model fit to the Spring ATM survey abundance index in arithmetic (upper) and log (lower) scales. q=1.0 (fixed).



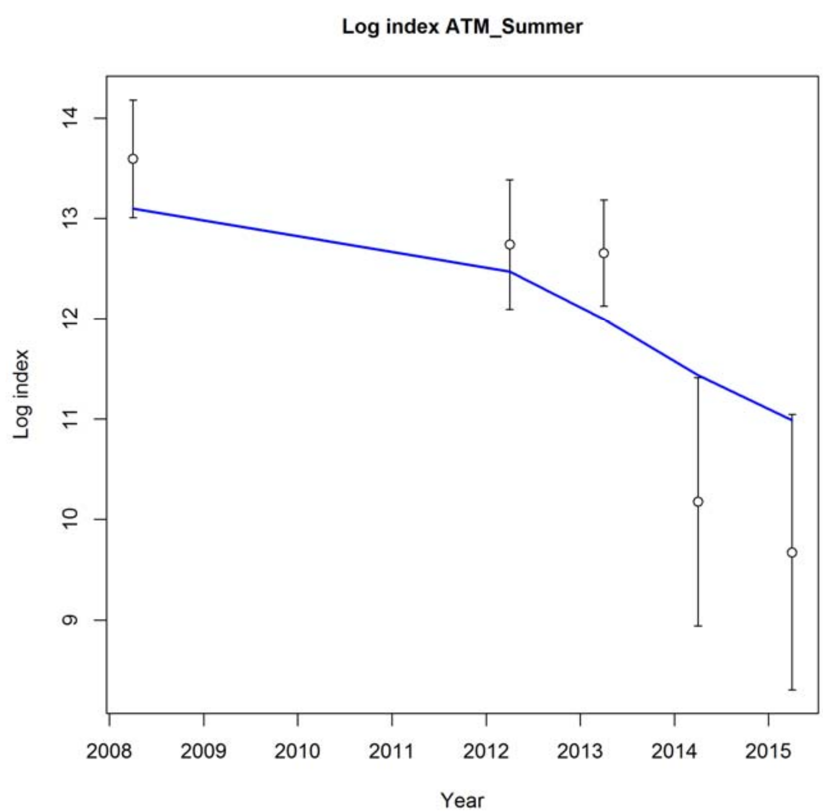


Figure 30. Proposed update model fit to the Summer ATM survey abundance index in arithmetic (upper) and log (lower) scales. q=1.0 (fixed).

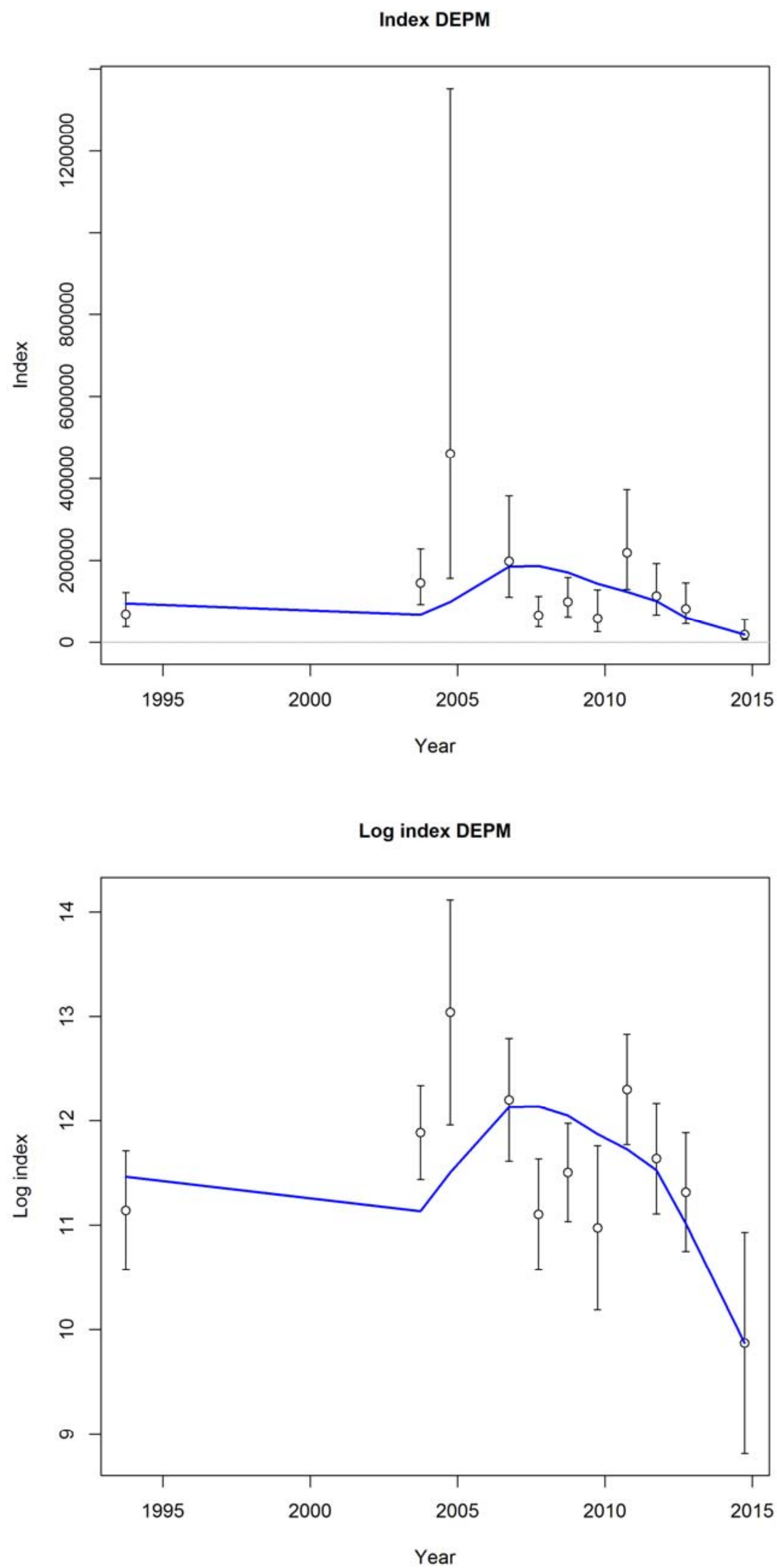


Figure 31. Proposed update model fit to the DEPM survey abundance index of female spawning biomass in arithmetic (upper) and log (lower) scales. q=0.244.

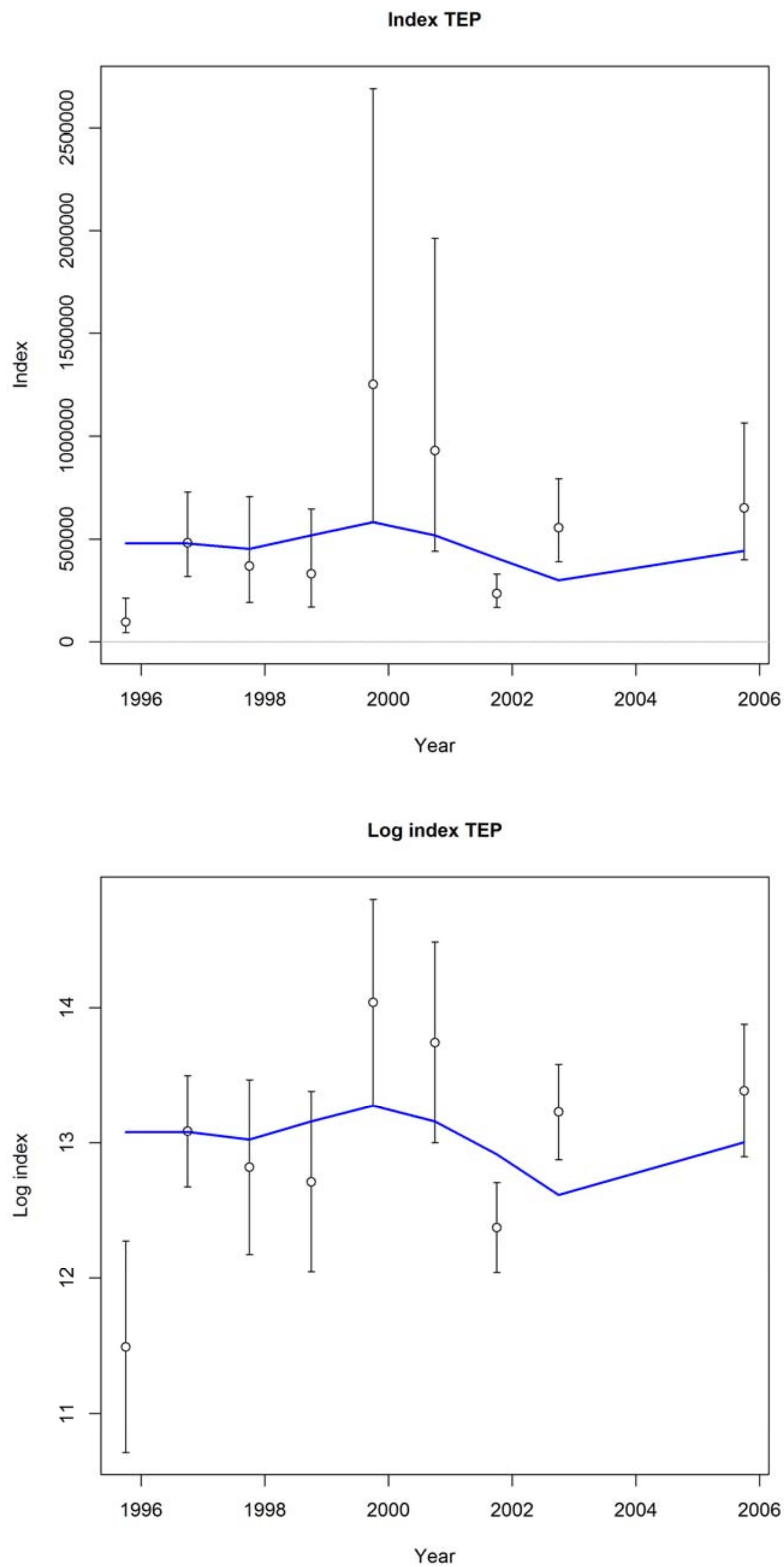


Figure 32. Proposed update model fit to the TEP survey abundance index of total spawning biomass in arithmetic (upper) and log (lower) scales. q=0.760.

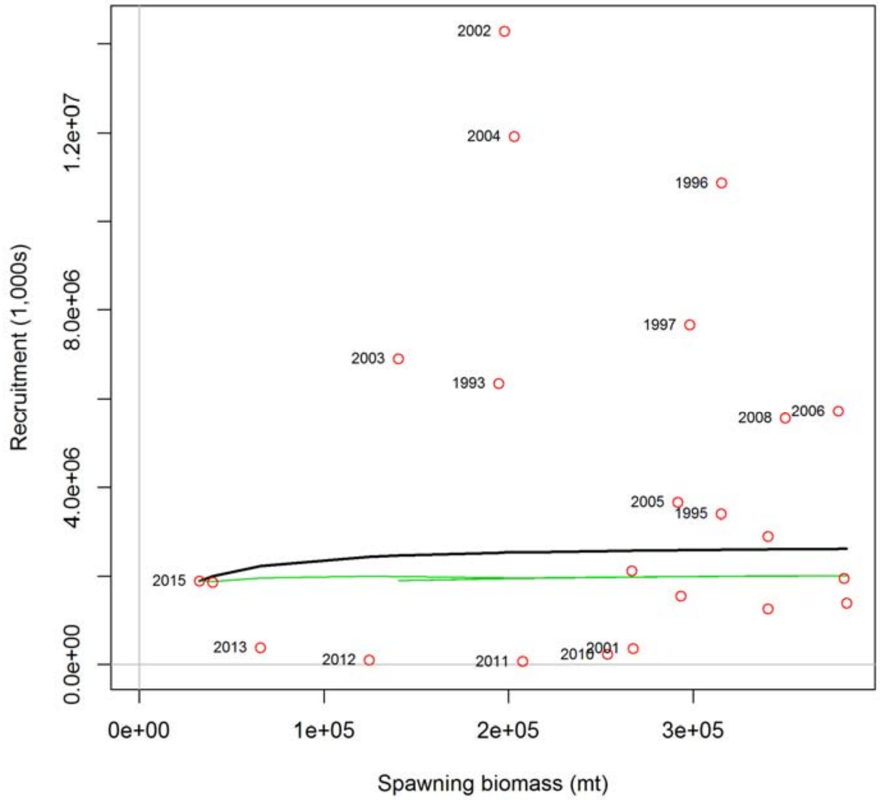


Figure 33a. Estimated stock-recruitment (Beverton-Holt) relationship for the proposed update model. Year labels represent year of SSB producing the subsequent year class.

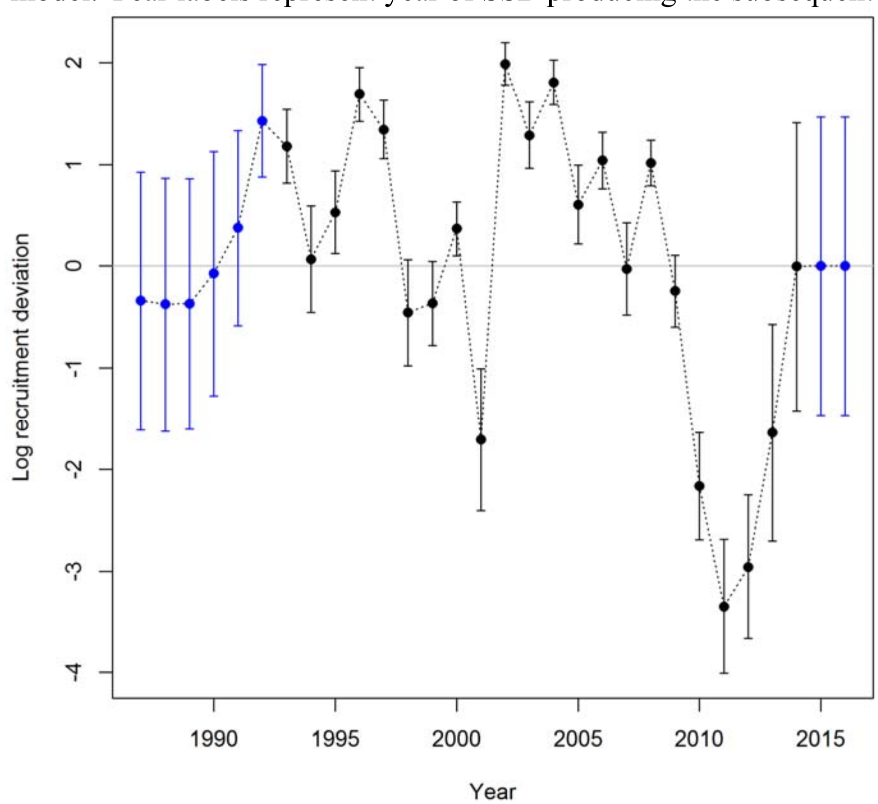


Figure 33b. Recruitment deviations and standard errors ($\sigma_R = 0.75$) for the proposed update model. Year labels represent year of SSB producing the subsequent year class.

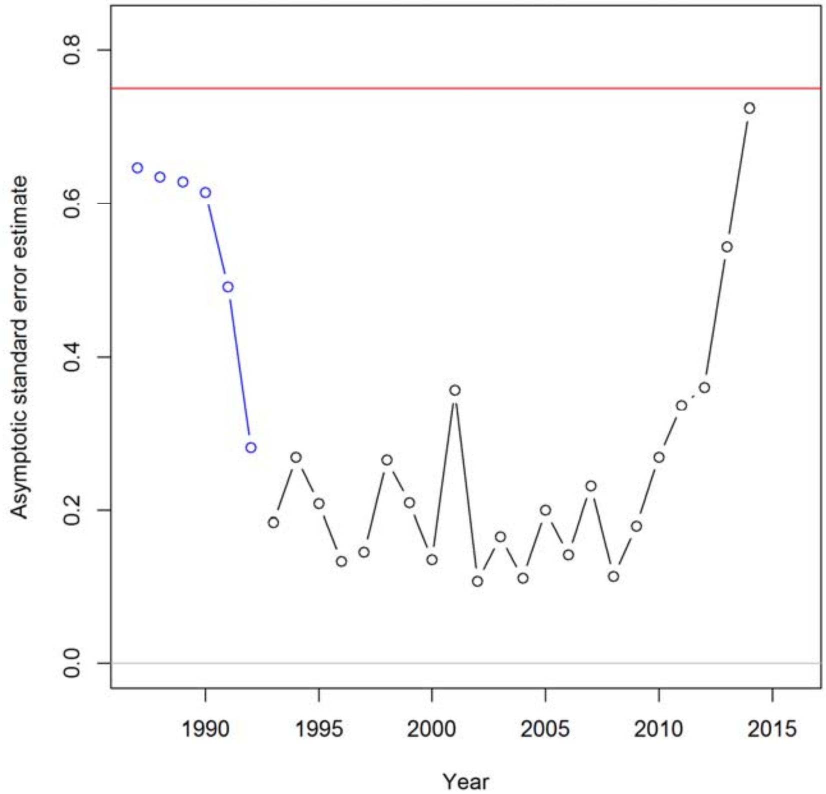


Figure 33c. Asymptotic standard errors for estimated recruitment deviations for the proposed update model.

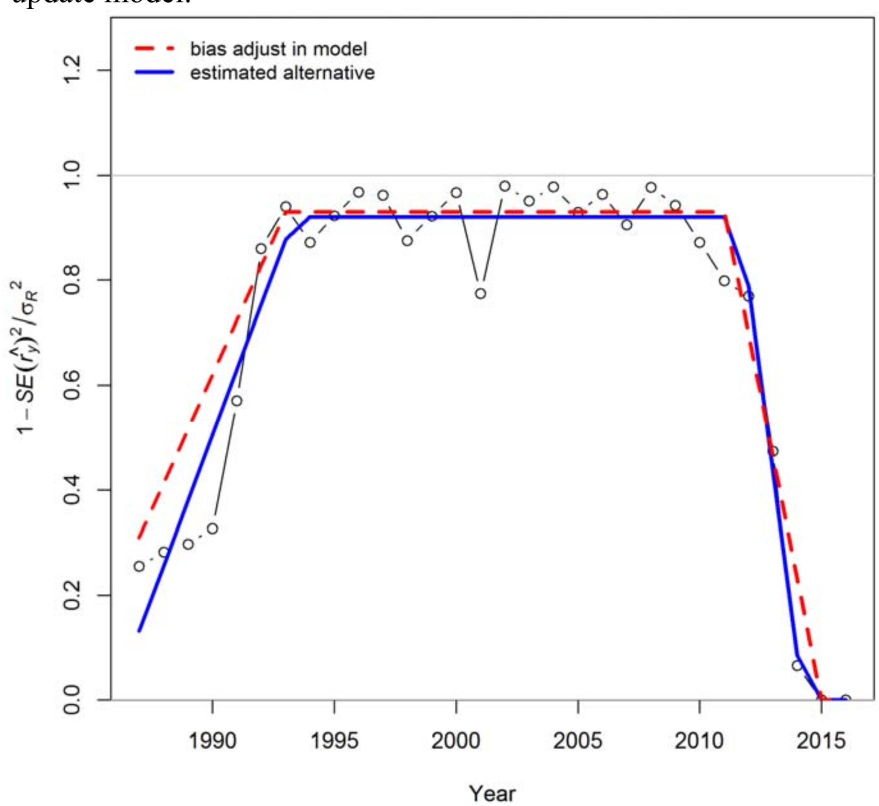


Figure 33d. S-R bias adjustment ramp for the proposed update model.

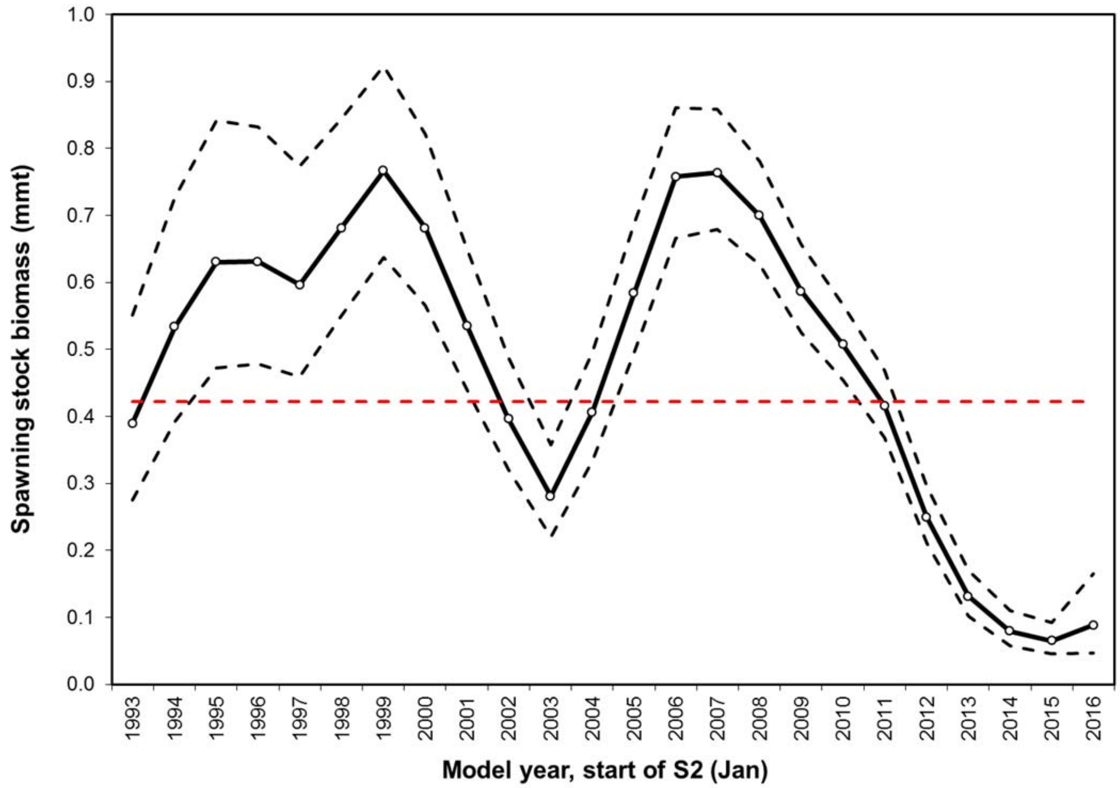


Figure 34a. Spawning stock biomass time series with ~95% confidence intervals for the proposed update model. Red line is SSB-zero.

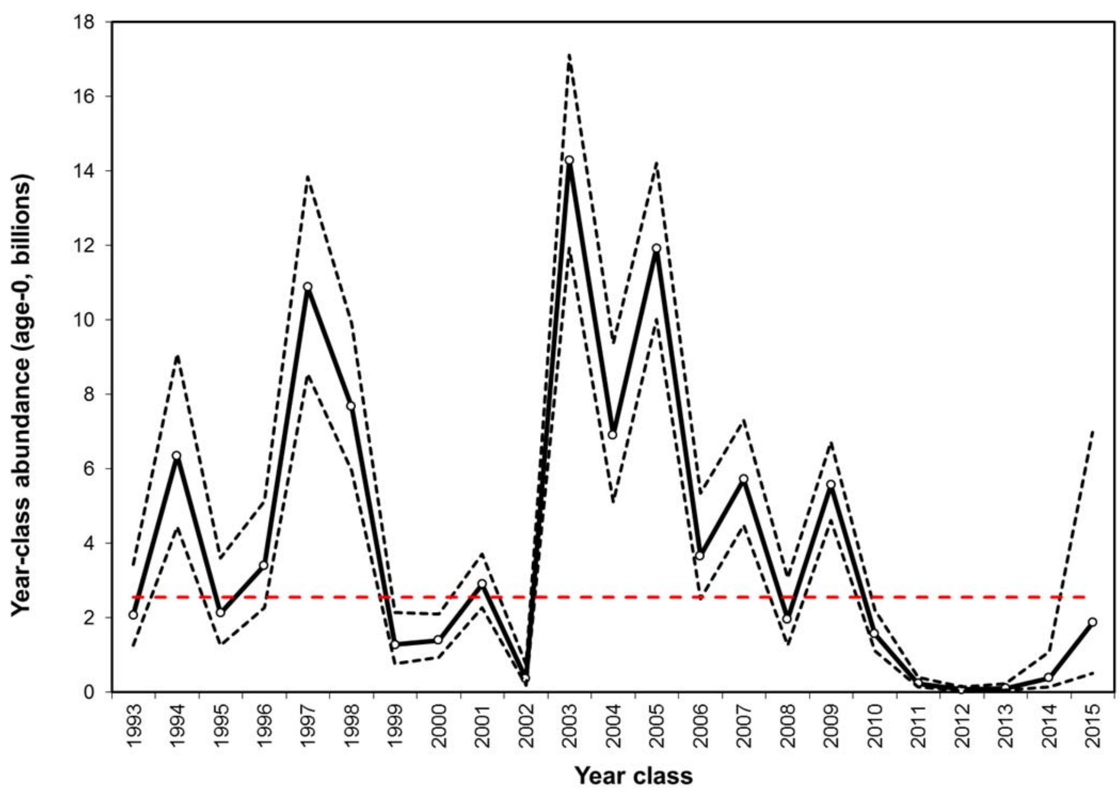


Figure 34b. Year-class abundance time series with ~95% confidence intervals for the proposed update model. The 2015 year class is estimated in this display. Red line is R_0.

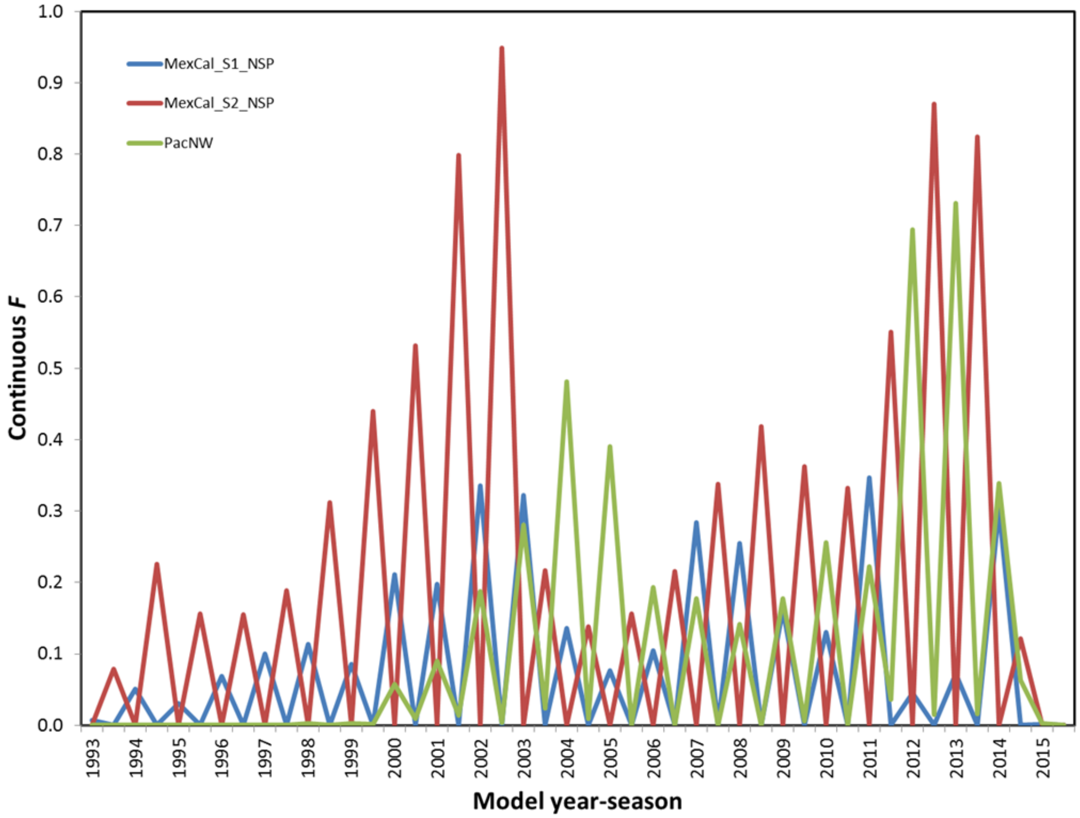


Figure 35a. Estimated fishing mortality (*F*) time series for the proposed update model.

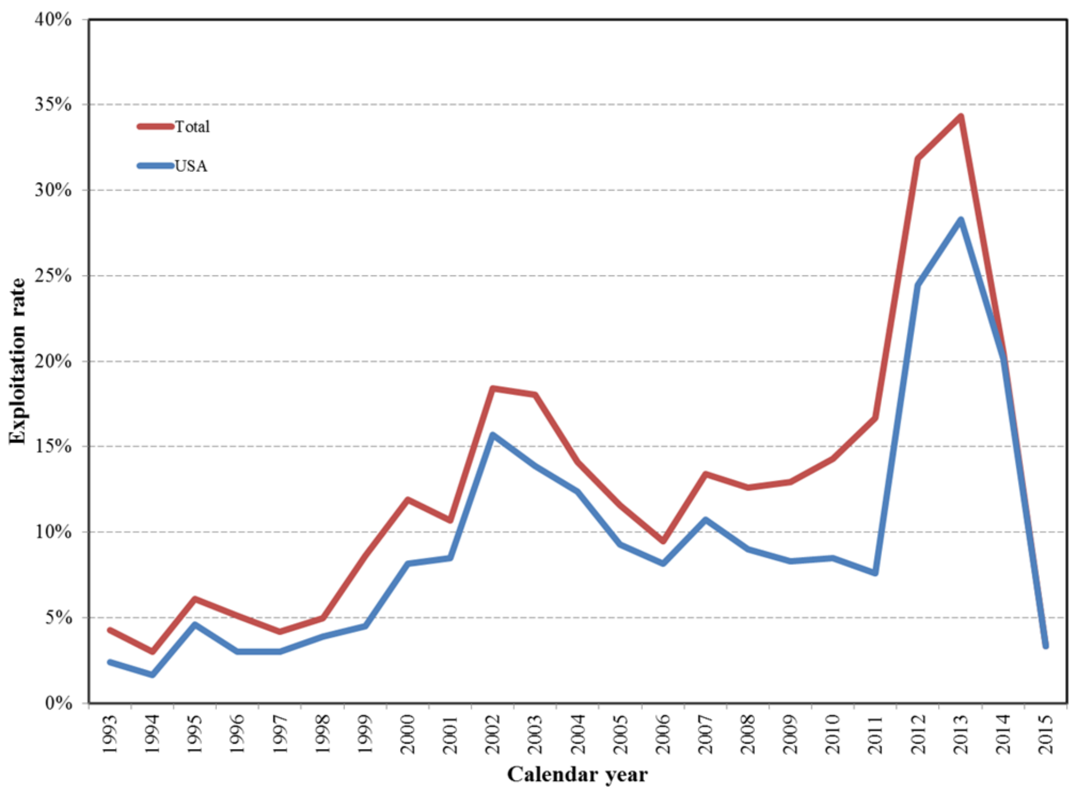


Figure 35b. Annual exploitation rate (CY landings / July total biomass) for the proposed update model.

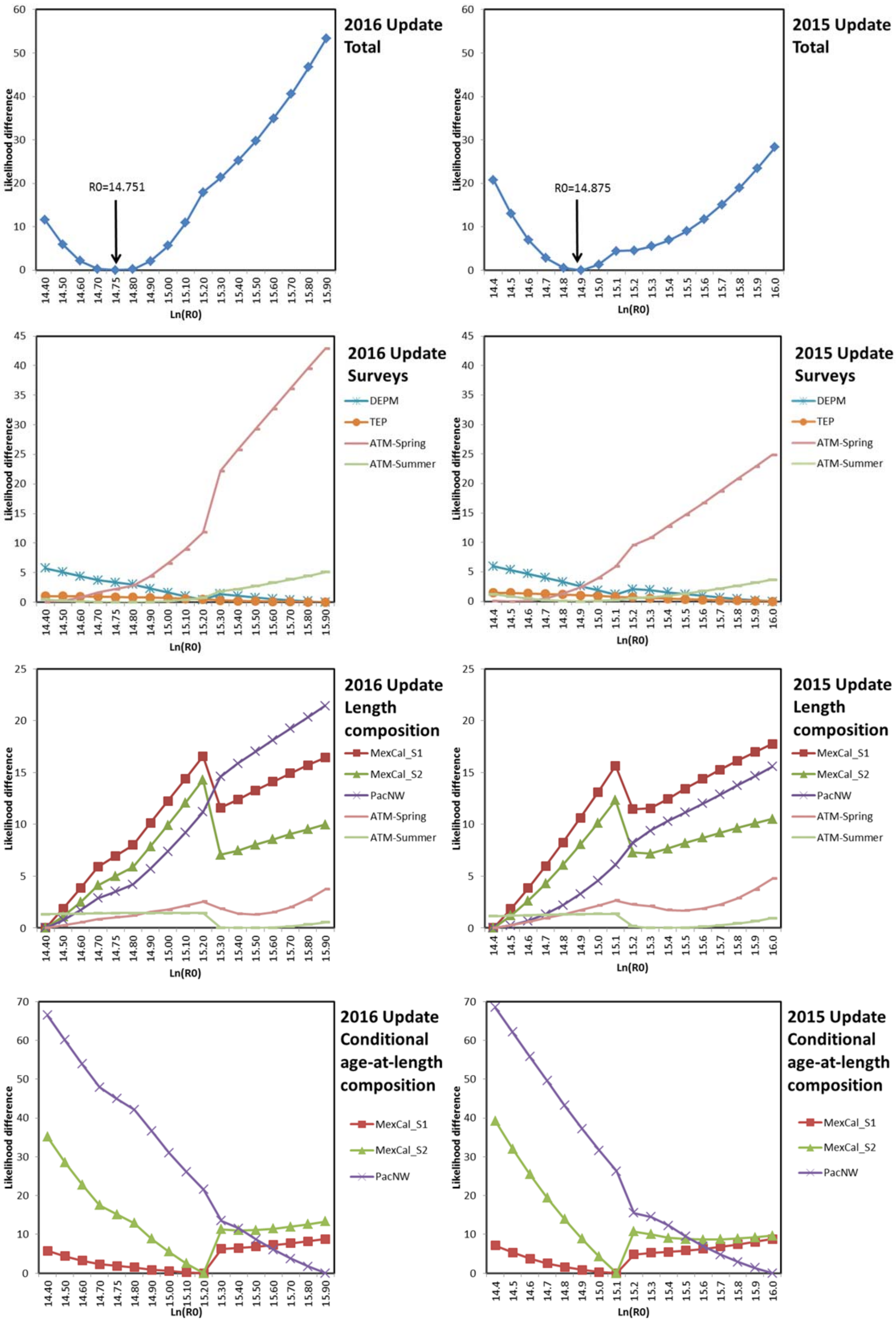
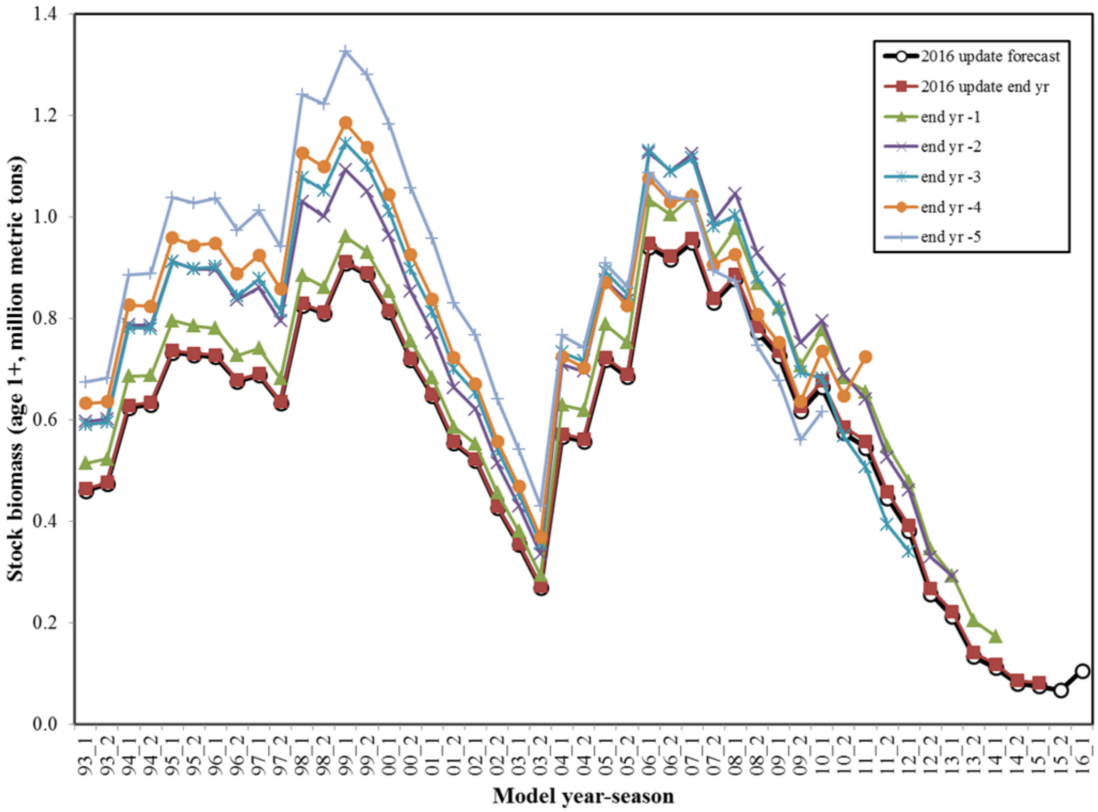


Figure 36. R_0 profiles for 2016 proposed update (left) and 2015 update (right) model components.



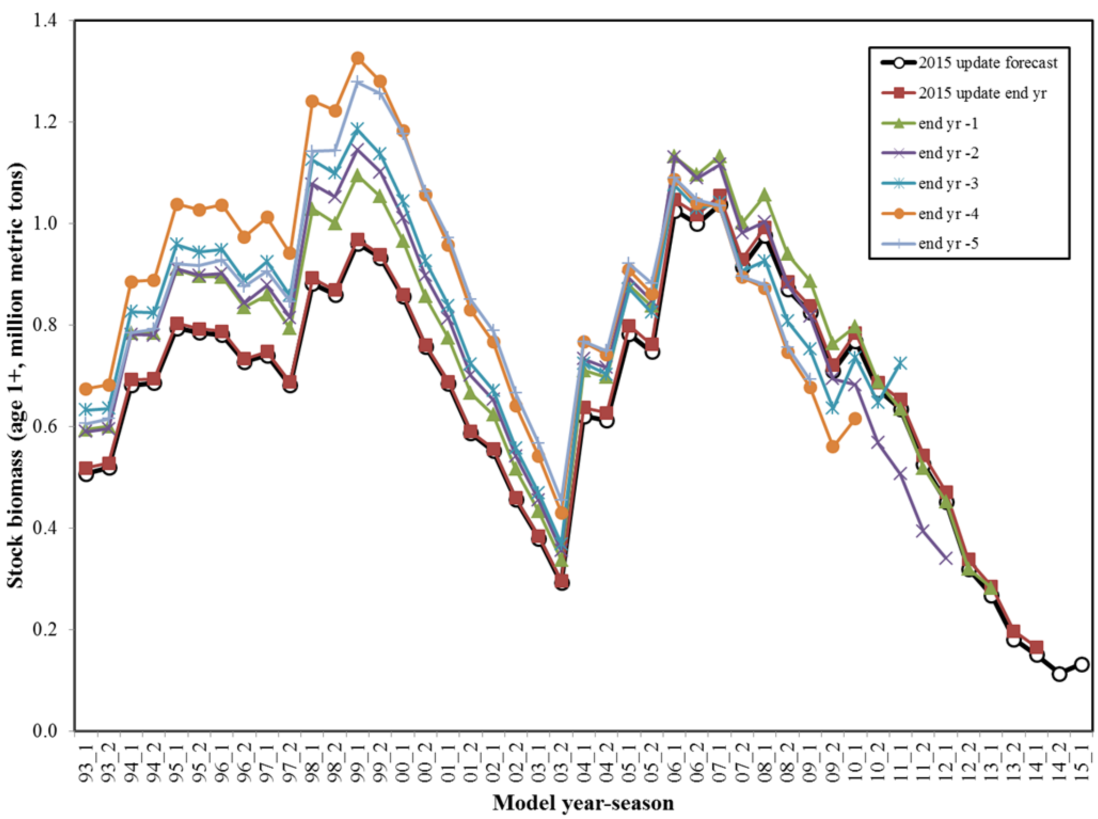


Figure 37. Retrospective analyses of stock biomass (age 1+) for the 2016 proposed update (upper) and 2015 update (lower) models.

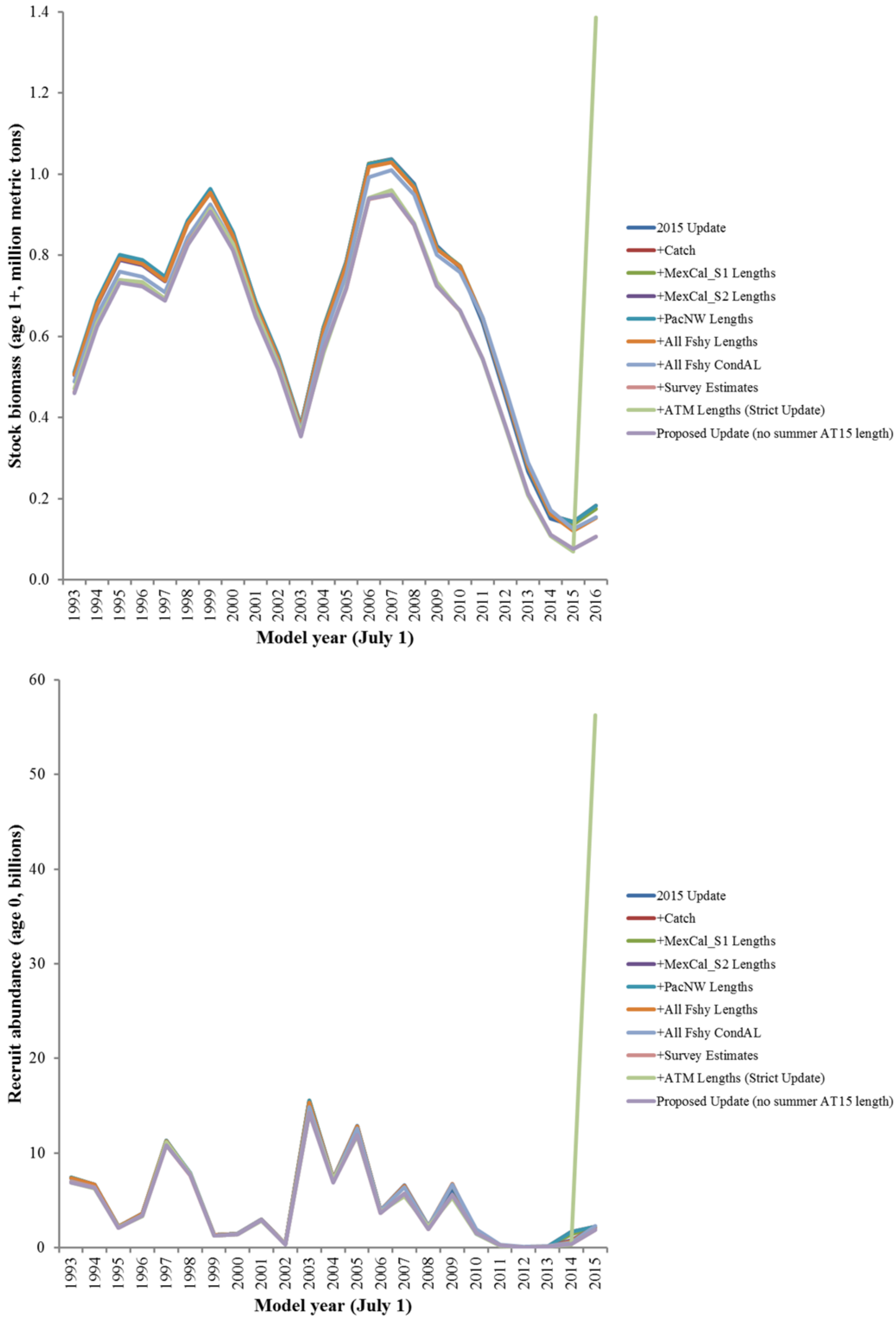


Figure 38. Biomass and recruitment trajectories for the 2015 update model with the sequential addition of new data for 2016 (see Table 9).

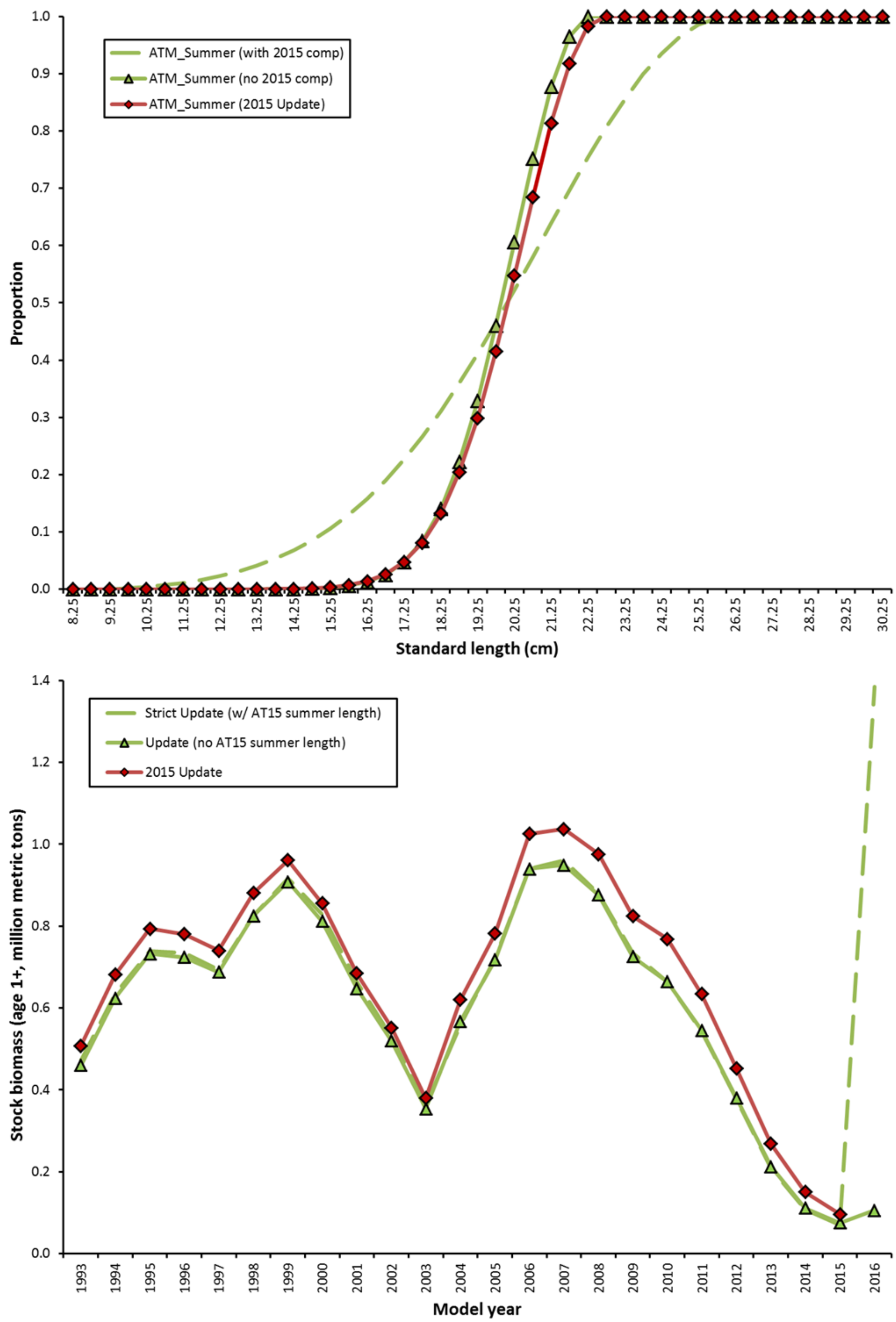
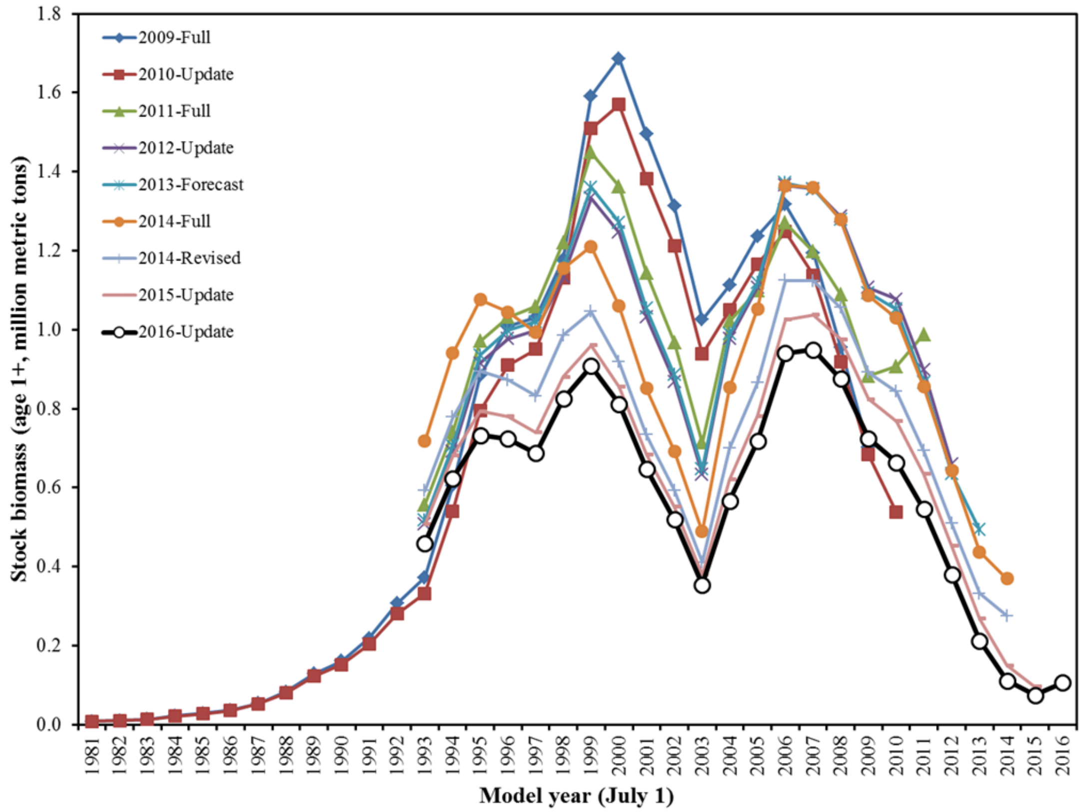


Figure 39. ATM summer survey selectivities (upper panel) for the final 2015 model, strict update (w/ AT summer 2015 length), and proposed update model. Stock biomass series for these models are displayed in the lower panel.



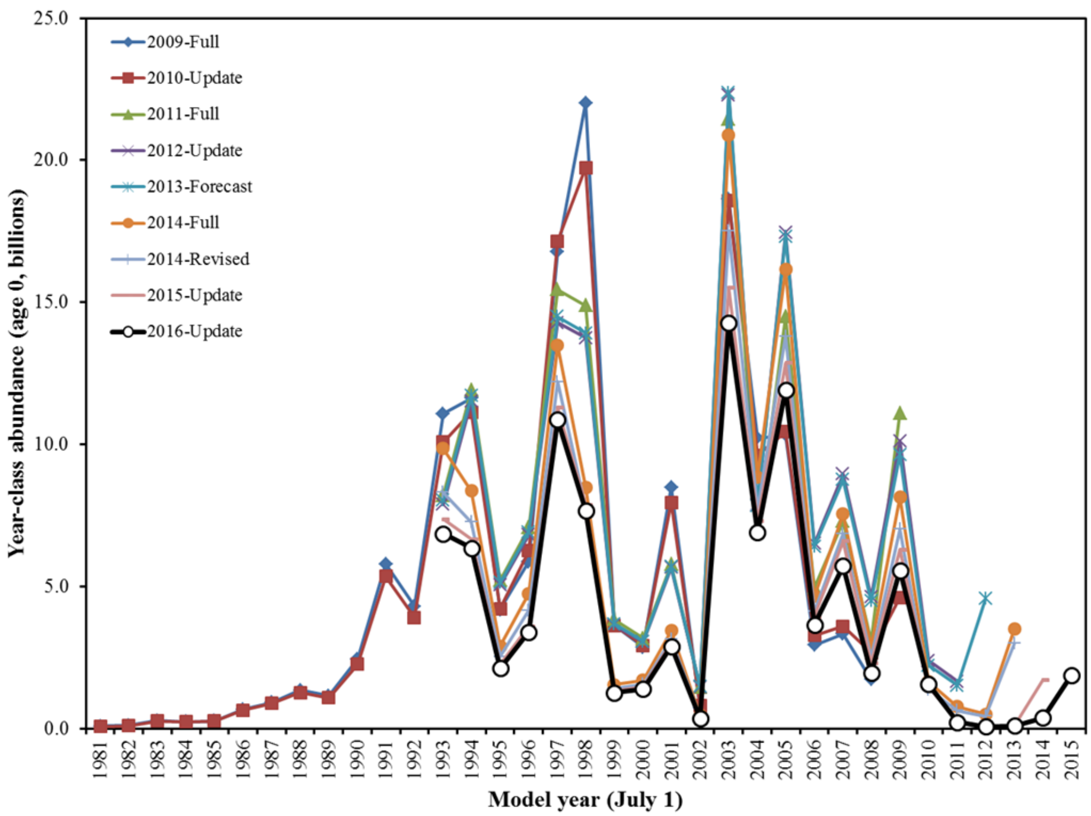


Figure 40. Estimated stock biomass (upper) and recruitment (lower) time series for the proposed update model and past management models.

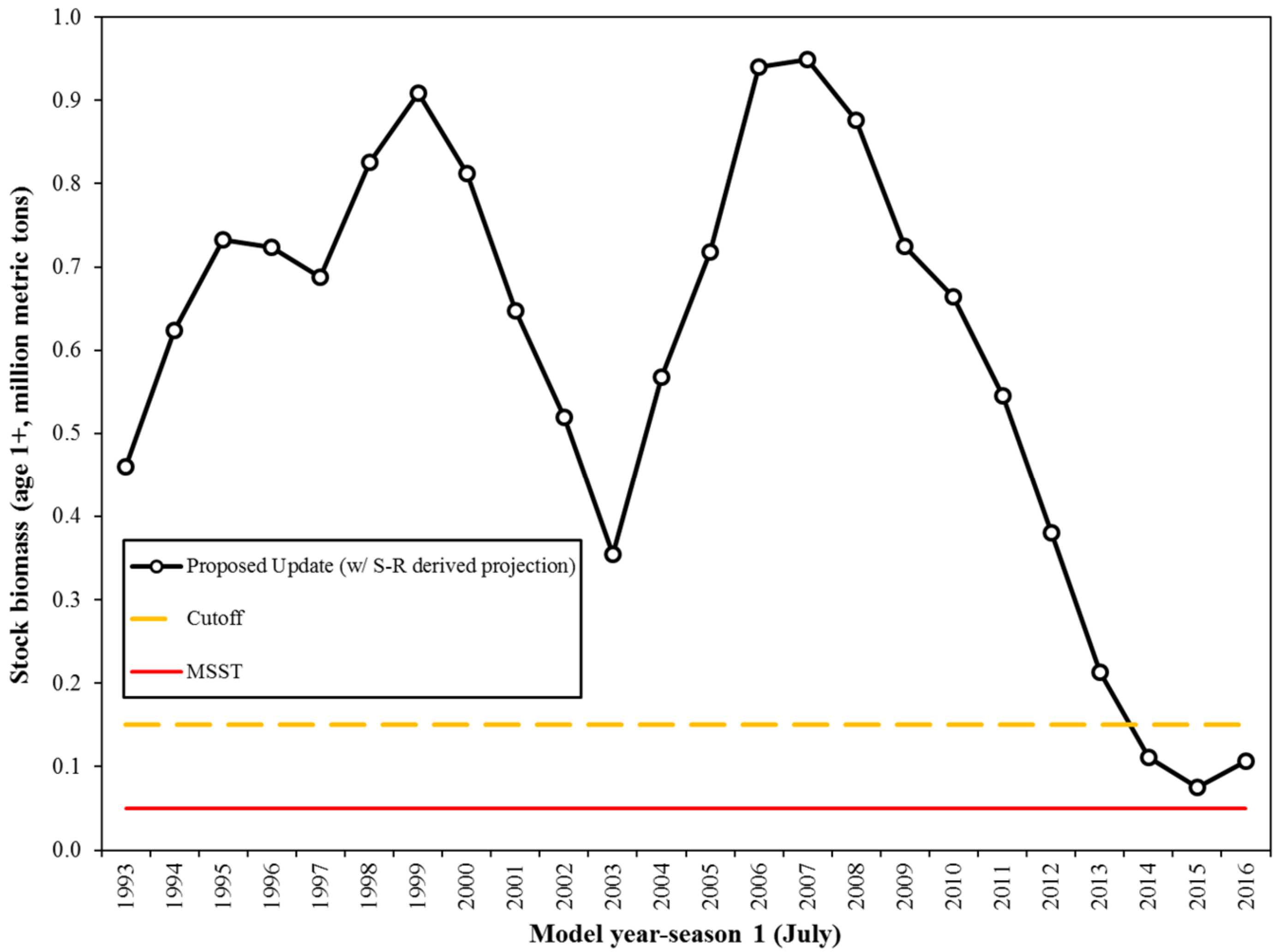


Figure 41. Proposed update model stock biomass (age 1+) for July 2016 when the 2015 year class is estimated from the S-R curve (proposed projection approach).

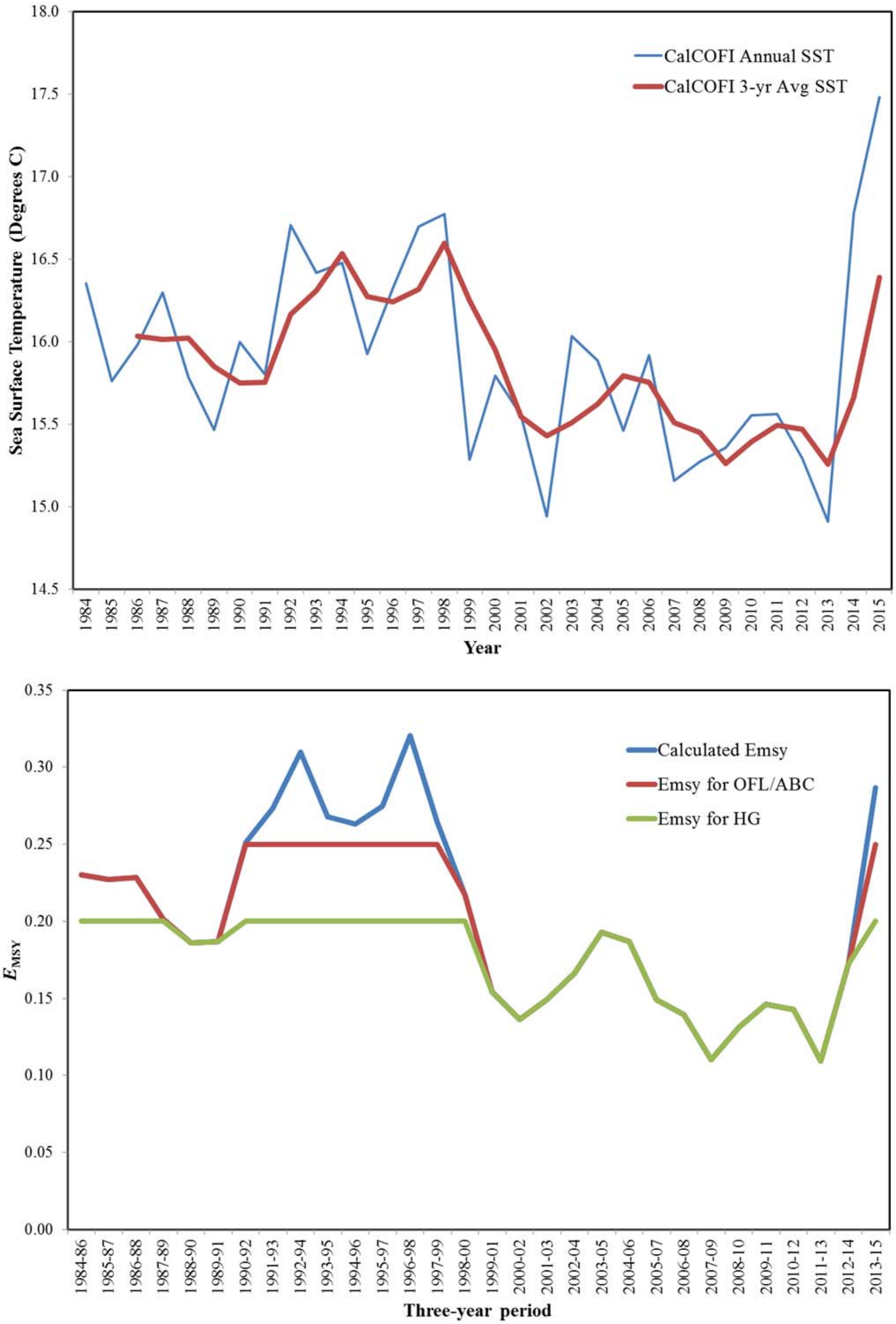


Figure 42. CalCOFI annual and three-year average SST (upper) and calculated E_{MSY} values based on three-year average SST (lower).

APPENDICES

APPENDIX A

Acoustic-trawl estimates of northern-stock Pacific sardine biomass during 2015

Juan Zwolinski, David A. Demer, Beverly J. Macewicz, George R. Cutter Jr., Brian Elliot, Scott Mau, David Murfin, Josiah S. Renfree, Thomas S. Sessions, and Kevin Stierhoff

Summary

The biomass of the northern stock of sardine during spring 2015 was estimated using acoustic-trawl method to be 29,048 metric tons (t), CV = 29.9%. The stock was comprised of remnants from two stronger than average year-classes, 2009 and 2010, and recruits from a small 2014 year-class. The biomass estimated during the following summer survey was 15,870 t, CV = 80.2%. The demographic was comparable to that of the spring, but there were also recruits from a small 2015 year-class. Despite the 2014 and 2015 recruits, the biomass of the northern stock of sardine was the lowest since the acoustic-trawl surveys began in 2006.

Introduction

Presented here are estimates of northern-stock Pacific sardine (*Sardinops sagax*) abundance, distribution, demographics, and habitat from spring and summer 2015 acoustic-trawl surveys off the West Coast of North America.

Material and methods

The spring and summer surveys were conducted onboard NOAA FSV *Bell M. Shimada*. The spring survey was during 30 days circa April, and spanned the majority of the coastal sardine potential habitat (Zwolinski et al., 2011; Demer and Zwolinski, 2014). Due to the warm conditions in the northeast Pacific, the potential habitat and survey extended farther north than usual for this time of the year (Fig. 1). The survey started off Newport, Oregon and progressed south to Avila Beach, California, totaling 1843 n.mi. of daytime east-west tracklines. Catches from 55 night-time surface trawls were used for species identification and length measurements. The summer survey was during 80 days and spanned the west coast of the U.S. and Canada from San Diego to the northern end of Vancouver Island (Fig. 2), totaling 2614 n.mi. of daytime east-west tracklines. Catches from 160 night-time surface trawls were used for species identification and length measurements. Echosounder calibrations, survey design, and sampling protocols are detailed in Stierhoff et al. (*in preparation*) and Zwolinski et al. (*in preparation-b*). Data analyses are detailed in (Demer et al., 2012; Zwolinski et al., 2012; Demer et al., 2013; Demer and Zwolinski, 2014; Zwolinski et al., 2014; Zwolinski et al., *in preparation-a*).

Results

Post-survey strata were defined for each survey, considering transect spacing, echoes or catches of coastal pelagic fish species, sardine eggs in the continuous underway fish egg sampler, and the presence of sardine potential habitat (Figs. 1 and 2; Tables 1 and 2).

The area surveyed in the spring contained an estimated 29,048 t of sardine, $CI_{95\%}$ = [14510, 50650] t, CV = 29.9% (Table 1). The distribution of abundance-density weighted standard length had modes at SL = [19, 20] and [24, 25] cm (Table 3; Fig 4). The larger fish are from the 2009 and 2010 year-classes. The smaller fish are recruits from 2014.

The area surveyed in the summer survey contained an estimated 15,870 t of sardine, $CI_{95\%}$ = [1450, 44620] t, CV = 80.2% (Table 2). The distribution of abundance-density weighted SL had a mode at [24, 25] cm (Table 3; Fig 6). This mode was exceeded in numbers, but not in biomass, by a putative 2015 cohort with SL = [6, 7] cm. Fish from these two modes were geographically separated, with the larger and older fish off Oregon and the recruits off central California (Figs. 5 and 6).

Table 1. Sardine biomass by stratum during the spring 2015 survey (see Figs. 3 and 4).

Stratum		**Transect**		**Trawls**		**Sardine**		
Name	**Area (n.mi.^{2})**	**Number**	**Distance (n.mi.)**	**CPS clusters**	**Number of sardine**	**Biomass (1000 tons)**	**95% confidence interval (1000 tons)**	**CV**
North	9217	7	501	5	31	22.118	8.011 – 42.471	37.9
Central-North	1134	2*	122*	3*	3	0.024	0.001 – 0.054	84.7
Central-South	5606	4	242	3	30	5.060	2.052 – 7.948	28.4
South	4466	2	131	3	3	1.845	0.499 – 3.098	48.9
Total	**20423**	**13**	**875**	**9**	**64**	**29.048**	**14.506 – 50.653**	**29.9**

*The Central-North stratum had its average density obtained from the nearest transect in each of the adjacent strata.

Table 2. Sardine biomass by stratum during the summer 2015 survey (see Figs. 5 and 6).

Stratum		Transect		Trawls		Sardine		
Name	**Area ($n.mi.^2$)**	**Number**	**Distance (n.mi.)**	**CPS clusters**	**Number of sardine**	**Biomass (1000 tons)**	**95% confidence interval (1000 tons)**	***CV***
North	1346	2	86	2	1	0.000	0.000 – 0.000	52.4
Central-North	7555	8	376	9	1969	14.387	0.195 – 42.594	92.2
Central-South	9359	13	508	10	574	1.480	0.542 – 2.734	37.1
South	6506	9	321	6	3	0.004	0.000 – 0.008	53.7
Total	**24767**	**32**	**1290**	**27**	**2547**	**15.87**	**1.45 – 44.62**	**80.2**

Table 3. Sardine abundance versus standard length for spring and summer 2015 surveys.

	Spring	Summer
Standard length (cm)	**Abundance (millions)**	**Abundance (millions)**
4	0	0
5	0	0.58
6	0	139.34
7	0	108.29
8	0	62.56
9	0	0.13
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0.70	0
18	0	0
19	14.56	0
20	44.24	1.44
21	0	4.32
22	0	1.48
23	3.98	2.88
24	65.09	20.79
25	43.09	37.76
26	7.28	5.13
27	0	0.04
28	0	0
29	0	0
30	0	0

Figure 1. Spring 2015 acoustic backscatter from coastal pelagic fish species (CPS) superimposed on the distribution of potential sardine habitat defined at the mid-point of the survey (left), acoustic proportions of CPS in trawl clusters (middle), and sardine-egg densities from the continuous underway fish egg sampler (right).

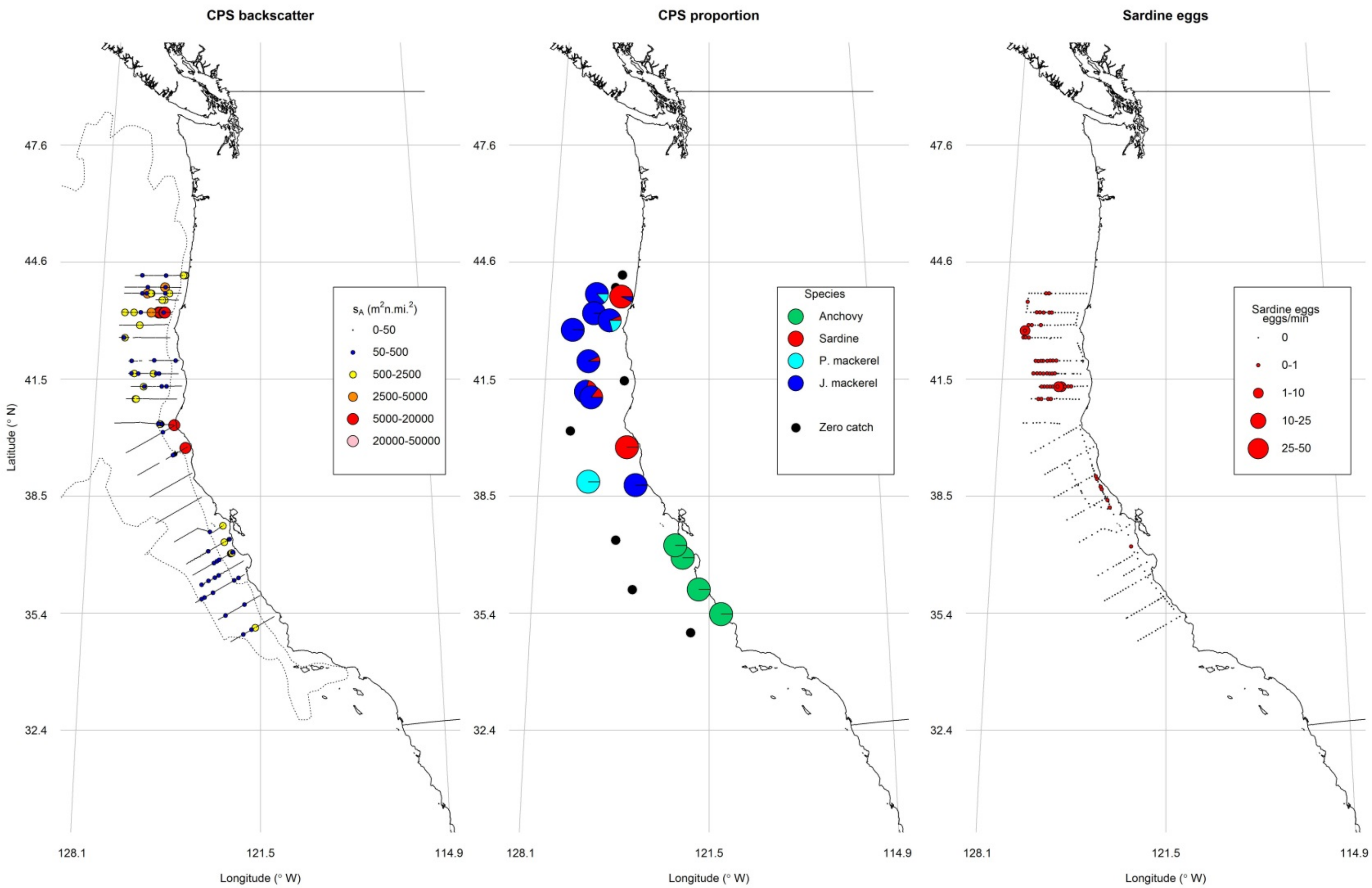


Figure 2. Summer 2015 acoustic backscatter from coastal pelagic fish species (CPS; left), and the acoustic proportions of CPS in trawl clusters (right). Egg samples are not shown because sardine have residual spawning during the summer.

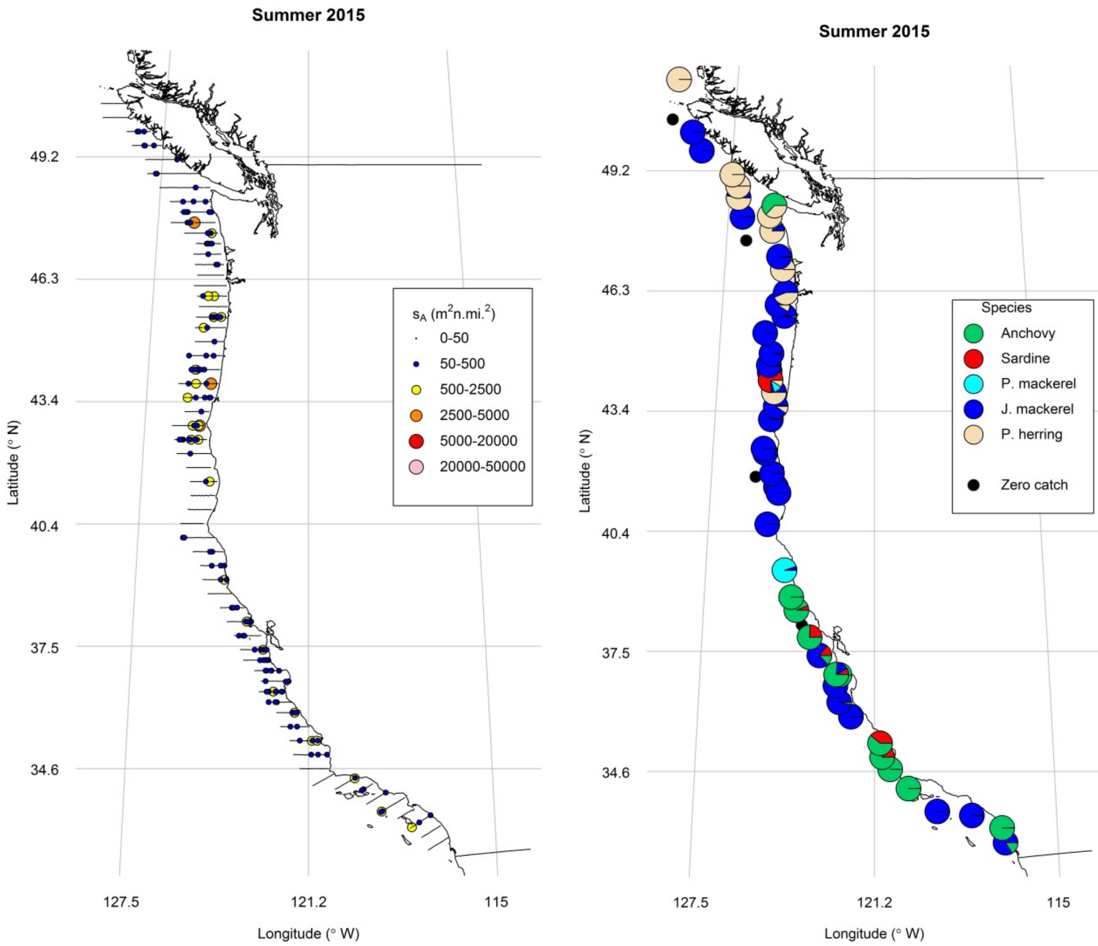


Figure 3. Spring 2015 sardine-biomass densities versus stratum (Table 1) estimated using the acoustic-trawl method. The numbers in blue represent the locations of trawl clusters with at least 1 sardine.

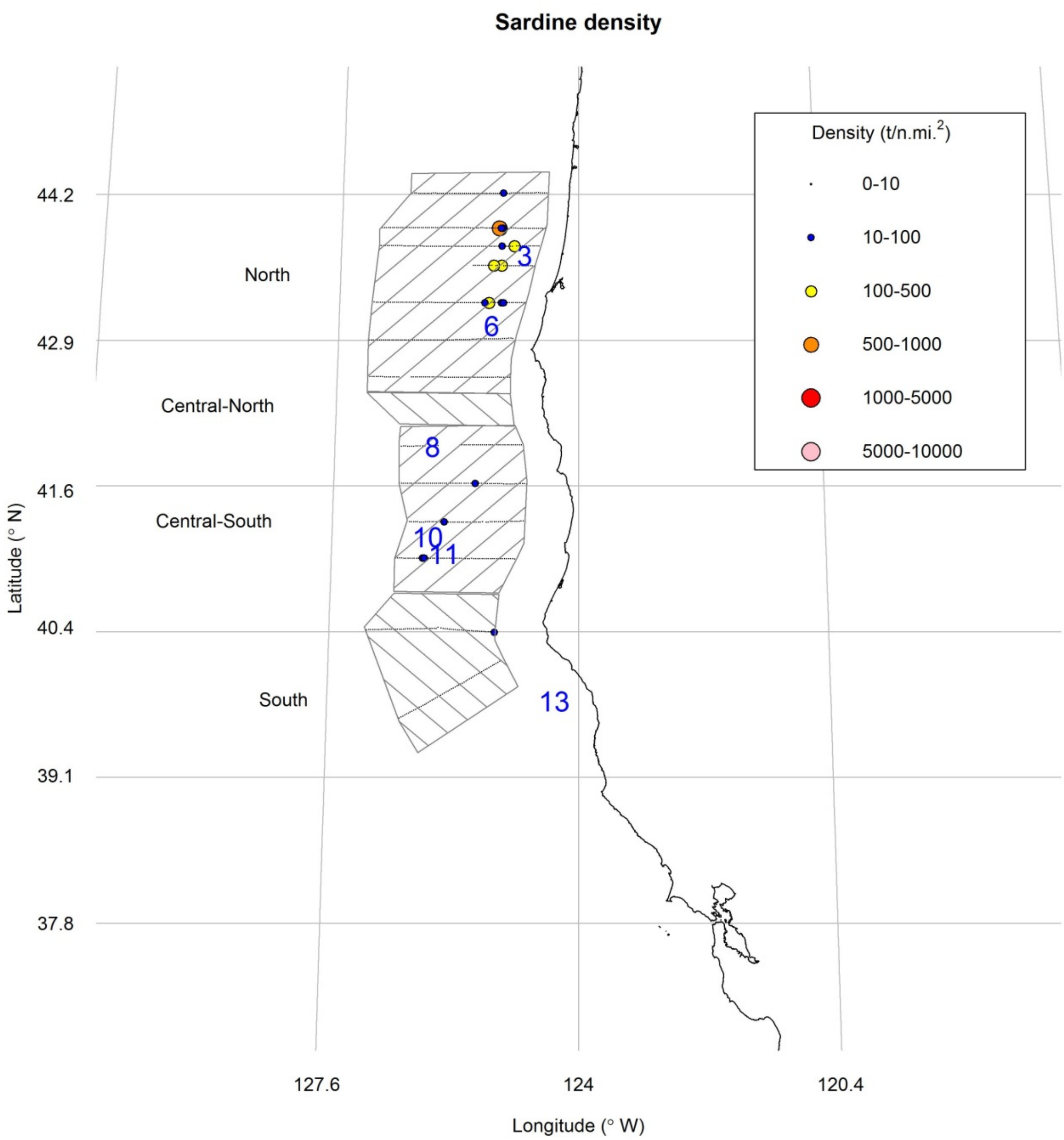


Figure 4. Sardine abundance versus standard length and stratum for the spring 2015 survey. Abundance per length class for the survey is provided in Table 3. The contribution from the Central-North stratum (Fig. 3) to the total abundance was negligible and therefore its demographic is not included.

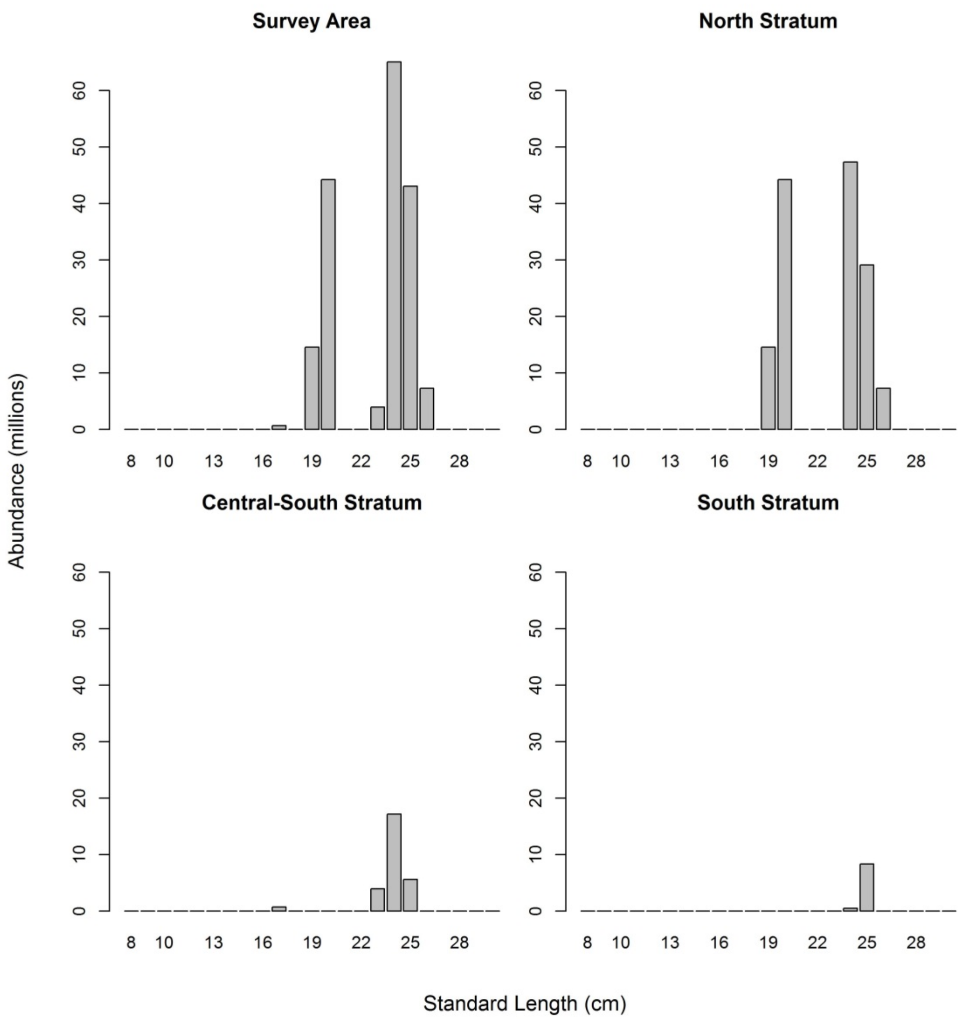


Figure 5. Summer sardine biomass densities versus stratum (Table 2) estimated using the acoustic-trawl method. The numbers in blue represent the locations of trawl clusters with at least 1 sardine.

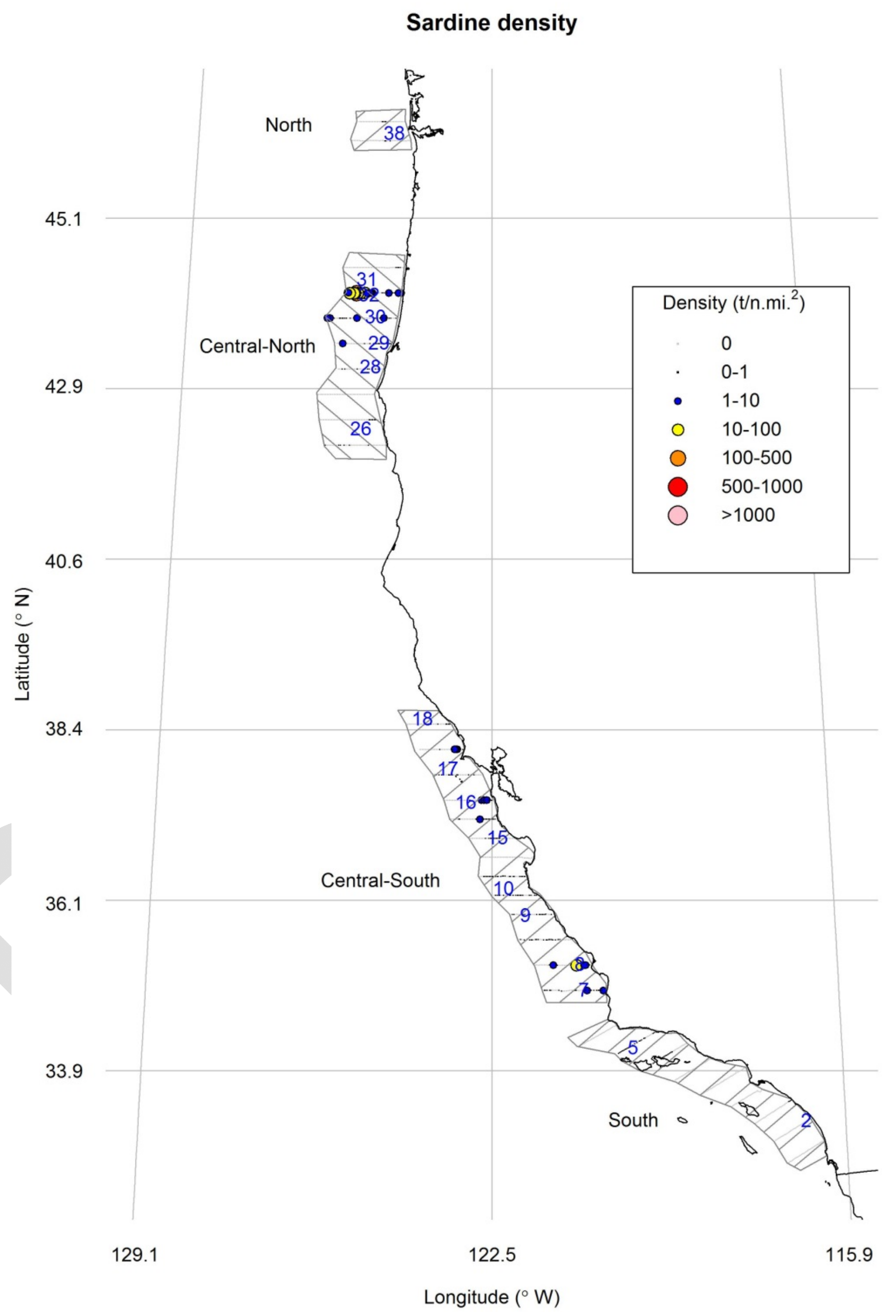
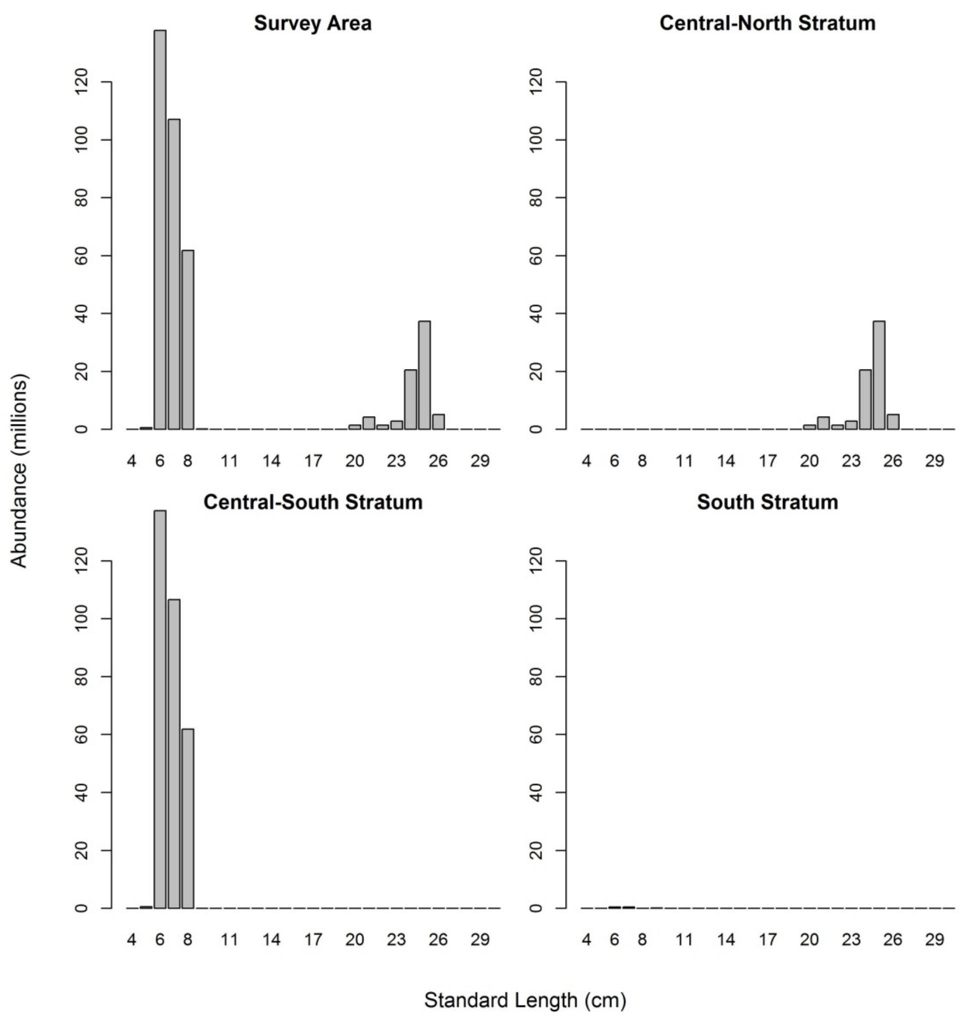


Figure 6. Sardine abundance versus standard length and stratum for the summer 2015 survey. Abundance per length class for the survey is provided in Table 3. The contribution from the North stratum (Fig. 5) to the total abundance was negligible and therefore its demography is not included.



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Appendix B
SS Input Files for the 2016 Update Model

STARTER.SS

```
# Pacific sardine stock assessment update for 2016-17
# K. T. Hill and P. R. Crone (Feb 2016)
# 2014 Final model 'T' updated with new landings, comps, and survey estimates
# SS model ver. 3.24s
T_2016.dat
T_2016.ctl
0 # 0=use init values in control file; 1=use ss3.par
1 # Run display detail (0,1,2)
2 # Detailed age-structured reports in REPORT.SSO: (0,1,2)
1 # Write detailed checkup.sso file (0,1)
3 # Write parm values to ParmTrace.sso (0=no,1=good,active; 2=good,all; 3=every_iter,all_parms; 4=every,active)
2 # Write to cumreport.sso (0=no, 1=like&timeseries, 2=add survey fits)
0 # Include prior_like for non-estimated parameters (0,1)
1 # Use soft boundaries to aid convergence: (0,1)
1 # Number of datafiles to produce: 1st is input, 2nd is estimates, 3rd and higher are bootstrap
10 # Turn off estimation for parameters entering after this phase
10 # MCeval burn interval
2 # MCeval thin interval
0.05 # Jitter initial parm value by this fraction
-1 # Min yr for sdreport outputs (-1 for styr)
-2 # Max yr for sdreport outputs (-1 for endyr; -2 for endyr+Nforecastyrs
0 # N individual STD years
# Vector of year values
0.00001 # Final convergence criteria (e.g., 1.0e-05)
0 # Retrospective year relative to end year (e.g. -4)
1 # Min age for calc of summary biomass
1 # Depletion basis:  denom is: 0=skip; 1=rel X*B0; 2=rel X*Bmsy; 3=rel X*B_styr
1 # Fraction (X) for depletion denominator (e.g. 0.4)
4 # SPR_report_basis: 0=skip; 1=(1-SPR)/(1-SPR_tgt); 2=(1-SPR)/(1-SPR_MSY); 3=(1-SPR)/(1-SPR_Btarget); 4=rawSPR
4 # F_report_units: 0=skip; 1=exploitation(Bio); 2=exploitation(Num); 3=sum(Frates); 4=true F for range of ages
0 13 # Min and max age over which average F will be calculated with F_reporting=4
2 # F_report_basis: 0=raw; 1=F/Fspr; 2=F/Fmsy ; 3=F/Fbtgt
999 # End of file
```

FORECAST.SS

```
# Pacific sardine stock assessment update for 2016-17
# K. T. Hill and P. R. Crone (Feb 2016)
# 2014 Final model 'T' with new landings, comps, and survey estimates for 2016 update
# SS model ver. 3.24s
# Note: for all year entries except rebuilder, enter either: actual year, -999 for styr, 0 for endyr, neg number
for relative endyr
1 #_Benchmarks: 0=skip, 1=calc F_spr,F_btgt,F_msy
2 #_MSY: 1= set to F(SPR), 2=calc F(MSY), 3=set to F(Btgt), 4=set to F(endyr)
0.4 #_SPR target (e.g., 0.40)
0.4 #_Biomass target (e.g., 0.40)
# Bmark_years: beg_bio, end_bio, beg_selex, end_selex, beg_relF, end_relF (enter actual year, or values of 0 or
-integer to be rel. endyr)
0 0 0 0 0 0
1 # Bmark_relF_basis: 1 = use year range; 2 = set relF same as forecast below
1 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=Ave F (uses first-last relF yrs); 5=input annual F scalar
1 # N forecast years
0 # F scalar (only used for Do_Forecast==5)
# Fcast_years: beg_selex, end_selex, beg_relF, end_relF  (enter actual year, or values of 0 or -integer to be
rel. endyr)
0 0 0 0
1 # Control rule method (1=catch=f(SSB) west coast, 2=F=f(SSB) )
0.5 # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.40); (Must be > the no F level below)
0.1 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
0.75 # Control rule target as fraction of Flimit (e.g. 0.75)
3 # N forecast loops
3 # First forecast loop with stochastic recruitment
0 # Forecast loop control #3 (reserved for future bells&whistles)
0 # Forecast loop control #4 (reserved for future bells&whistles)
0 # Forecast loop control #5 (reserved for future bells&whistles)
2020 # FirstYear for caps and allocations (should be after years with fixed inputs)
0 # Stddev of log(realized catch/target catch) in forecast (set value>0.0 to cause active impl_error)
0 # Do West Coast gfish rebuilder output (0/1)
```

```
0 # Rebuilder: first year catch could have been set to zero (Ydecl)(-1 to set to 1999)
0 # Rebuilder: year for current age structure (Yinit) (-1 to set to endyear+1)
1 # Fleet relative F: 1=use first-last alloc year, 2=read seas(row) x fleet(col) below
# Note: fleet allocation is used directly as average F if Do_Forecast=4
2 # Basis for forecast catch tuning and for forecast catch caps and allocation: 2=deadbio, 3=retainbio,
5=deadnum, 6=retainnum
# Conditional input if relative F option=2
# Fleet relative F: rows are seasons, columns are fleets
# Fleet: MexCal_S1 MexCal_S2 PNW
# 0 0 0 # S1
# 0 0 0 # S2
# Max total catch by fleet (-1 to have no max): must enter value for each fleet
-1 -1 -1
# Max total catch by area (-1 to have no max): must enter value for each fleet
-1
# Fleet assignment to allocation group (enter group ID# for each fleet, 0 for not included in an alloc group)
0 0 0
# Conditional on >1 allocation group
# Allocation fraction for each of: 0 allocation groups
# No allocation groups
6 # Number of forecast catch levels to input (or else calculate catch from forecast F)
2 # Basis for input forecast catch: 2=dead catch, 3=retained catch, 99 = input Hrate(F) with units that are from
fishery units
# Input fixed catch values
# Year Season Fleet Catch/F
2016   1      1      10
2016   2      1      0
2016   1      2      0
2016   2      2      10
2016   1      3      10
2016   2      3      0
999 # End of file
```

CONTROL FILE 'T_2016.CTL'

```
# Pacific sardine stock assessment update for 2016-17
# K. T. Hill and P. R. Crone (Feb 2016)
# 2014 Final model 'T' with new landings, comps, and survey estimates for 2016 update
# SS model ver. 3.24s
1 #_N_growth patterns
1 # N_Morphs within growth pattern
# Cond 1 # Morph between/within SD ratio (no read if N_morphs=1)
# Cond 1 # Vector Morphdist (-1_in first value gives normal approximation)
1 # N_recruitment assignments (overrides GP*area*season parameter values)
0 # Recruitment interaction requested
# GP season area for each recruitment assignment
1 1 1
# Cond 0 # N_movement_definitions goes here if N_areas >1
# Cond 1 # First age that moves (real age at begin of season, not integer) also conditioned on Do_migration >0
# Cond 1 1 1 2 4 10 # example move definition for seas=1, morph=1, source=1 dest=2, age1=4, age2=10
1 # N_block patterns - selectivity
1 # N_blocks per pattern 1
# Begin and end years of block patterns
1999 2015 # (ADVANCED ONE YEAR) Block pattern 1 - MexCal_S1 and MexCal_S2
0.5 # Fraction female
0 # Natural mortality type: 0=1 Parm, 1=N_breakpoints, 2=Lorenzen, 3=agespecific, 4=age-specific with season
interpolation
# No additional input for M_type=0 (read 1 parametr per morph)
1 # Growth model: 1=vonBert with L1&L2, 2=Richards with L1&L2, 3=age_speciific_K, 4=not implemented
0.5 # Growth_age for_L1
999 #_Growth_age for_L2 (999=use Linf)
0 # SD add to LAA (set to 0.1 for SS2 V1.x compatibility)
0 # CV_growth pattern: (0) CV=f(LAA), (1) CV=F(A), (2) SD=F(LAA), (3) SD=F(A), (4) log(SD)=F(A)
1 # Maturity_option: 1=length logistic, 2=age logistic, 3=read age-maturity matrix by growth pattern, 4=read
age-fecundity, 5=read fecundity/wt from wtatage.ss
# Placeholder for empirical age-maturity by growth pattern
0 # First mature age
1 # Fecundity option:(1) eggs=Wt*(a+b*Wt),(2) eggs=a*L^b,(3) eggs=a*Wt^b, (4) eggs=a+b*L, (5)eggs=a+b*W
0 # Hermaphroditism option: 0=none, 1=age-specific
1 # Parameter offset approach: 1=none, 2=Mortality, growth, CV_growth as offset from female-GP1, 3=like SS2 V1.x
1 # Env/block/dev adjust method: 1=standard, 2=logistic transform keeps in base parm bounds, 3=standard w/ no
bound check
# Growth parameters
# LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev block block_Fxn
```

```
0.3 0.7 0.4 0 -1 99 -3 0 0 0 0 0 0 0 # NatM_p_1_Fem_GP_1
3 15 10 0 -1 99 3 0 0 0 0 0 0 0 # LAA_min_Fem_GP_1
20 30 25 0 -1 99 3 0 0 0 0 0 0 0 # LAA_max_Fem_GP_1
0.05 0.99 0.4 0 -1 99 3 0 0 0 0 0 0 0 # VonBert_K_Fem_GP_1
0.05 0.3 0.14 0 -1 99 3 0 0 0 0 0 0 0 # CV_young_Fem_GP_1
0.01 0.1 0.05 0 -1 99 3 0 0 0 0 0 0 0 # CV_old_Fem_GP_1
-3 3 7.5242e-006 0 -1 99 -3 0 0 0 0 0 0 0 # WtLt_1_Fem
-3 5 3.233205 0 -1 99 -3 0 0 0 0 0 0 0 # WtLt_2_Fem
9 19 15.44 0 -1 99 -3 0 0 0 0 0 0 0 # Mat50%_Fem
-20 3 -0.89252 0 -1 99 -3 0 0 0 0 0 0 0 # Mat_slope_Fem
0 10 1 0 -1 99 -3 0 0 0 0 0 0 0 # Eggs/kg_inter_Fem
-1 5 0 0 -1 99 -3 0 0 0 0 0 0 0 # Eggs/kg_slope_wt_Fem
-4 4 0 0 -1 99 -3 0 0 0 0 0 0 0 # RecrDist_GP_1
-4 4 1 0 -1 99 -3 0 0 0 0 0 0 0 # RecrDist_Area_1
-4 4 1 0 -1 99 -3 0 0 0 0 0 0 0 # RecrDist_Seas_1
-4 4 0 0 -1 99 -3 0 0 0 0 0 0 0 # RecrDist_Seas_2
1 1 1 0 -1 99 -3 0 0 0 0 0 0 0 # Cohort Growth_Dev
#
# Cond 0  # Custom MG-env_setup (0/1)
# Cond -2 2 0 0 -1 99 -2 # Placeholder when no MG-env parameters
# Custom MG-block_setup (0/1)
# Cond No MG parm trends
# Seasonal effects on biology parameter
0 0 0 0 0 0 0 0 0 0 # femwtlt1, femwtlt2, mat1, mat2, fec1, fec2, malewtlt1, malewtlt2, L1, K
# Cond -2 2 0 0 -1 99 -2 # Placeholder when no seasonal MG parameters
# Cond -4 # MGparm_dev Phase
#
# Spawner-recruit (SR) parameters
3 # SR function: 1=Null, 2=Ricker (2 parm), 3=std_B-H (2 parm), 4=S-CAA, 5=Hockey stick, 6=flat-top_B-H,
7=Survival_3Parm
# LO HI INIT PRIOR PR_type SD PHASE
3 25 15 0 -1 99 1 # SR_R0
0.2 1 0.8 0 -1 99 -6 # SR_steepness (Ricker= 0.2 4 2.5 0 -1 99 6)(B-H= 0.2 1 0.8 0 -1 99 6)
0 2 0.75 0 -1 99 -3 # SR_sigmaR
-5 5 0 0 -1 99 -3 # SR_env link
-15 15 0 0 -1 99 2 # SR_R1_offset
0 0 0 0 -1 99 -3 # SR_autocorr
0 # SR_env link
0 # SR_env target: 0=none, 1=devs, 2=R0, 3=steepness
1 # Do recdev:  0=none, 1=devvector, 2=simple deviations
1993 # First year of main rec_devs (early devs can preceed this era)
2014 # (ADVANCED ANOTHER YEAR) Last year of main rec_devs (forecast devs start in following year) (was 2012 for
2014 full)
1 # Rec_dev phase
#
1 # Read 13 advanced options (0/1)
-6 # Rec_dev early start: 0=none (neg value makes relative to rec_dev)
2 # Rec_dev early phase
0 # Forecast rec phase (includes late rec): 0 value sets to maxphase+1
1 # Lambda for Forecast rec likelihood occurring before endyr+1
# FOLLOWING ARE BIAS RAMP VALUES USED FOR A1:
1984 # Last early_yr nobias adjustment in MPD
1993 # First yr fullbias adjustment in_MPD
2011 # Last yr fullbias adjustment in MPD (was 2010 in last full)
2015 # (ADVANCED ANOTHER YEAR) First recent_yr nobias adjustment in MPD (was 2013 in last full)
0.93 # Max bias adjustment in_MPD (-1 to override ramp and set bias adjustment=1.0 for all estimated rec_devs)
0 # Period of cycles in recruitment (N_parms read below)
-5 # Min rec_dev
5 # Max rec_dev
0 # Read rec_devs
# End of advanced SR options
#
# Placeholder for full parameter lines for recruitment cycles
# Read specified rec_devs
# Yr Input_value
#
# Fishing mortality (F) parameters
0.1 # F ballpark for tuning early phases
-2006 # F ballpark year (neg value to disable)
3 # F method: 1=Pope, 2=instant F, 3=hybrid
4 # Max F or harvest rate (depends on F method)
# No additional F input needed for F method 1
# If F method=2 then read overall start F value, overall phase, N_detailed inputs to read
# If F method=3 then read N_iterations for tuning for F method=3
10 # N_iterations for tuning F (F method=3 only, e.g., 3-7)
```

```
#
# Initial F parameters
# LO HI INIT PRIOR PR_type SD PHASE
0 4 0 0 -1 99 -1 # Init F_MexCal_S1
0 4 0 0 -1 99 -1 # Init F_MexCal_S2
0 4 0 0 -1 99 -1 # Init F_PacNW
#
# Catchability (Q) parameters
# Den_dep: 0=off and survey is proportional to abundance, 1=add parameter for non-linearity
# Env_var: 0=off, 1 = add parameter for env effect on Q
# Extra_SE: 0=off, 1 = add parameter for additive constant to input SE in ln space
# Q_type: <0=mirror, 0=median_float, 1=mean_float, 2=estimate parameter for ln(Q), 3=parameter with random_dev,
4=parameter with random walk, 5=mean unbiased float assigned to parameter
#         <0=mirror
#         0=Q floats as a scaling factor (no variance bias adjustment is taken into account)
#         1=Q floats as scaling factor (variance bias adjustment is used) ** recommended option **
#         2=Q is a parameter (variance bias adjustment is NOT used, so produces same result as option=0)
#         3=parameter with random_dev
#         4=parameter with random walk
#         5=mean unbiased float assigned to parameter
# Note: a new option will be created to include bias adjustment in the parameter approach
# Den-dep  Env-var  Extra_SE  Q_type
0 0 0 0 # 1 MexCal_S1
0 0 0 0 # 2 MexCal_S2
0 0 0 0 # 3 PacNW
0 0 0 2 # 4 DEPM
0 0 0 2 # 5 TEP
0 0 0 2 # 6 TEP_all
0 0 0 2 # 7 Aerial
0 0 0 2 # 8 Acoustic_Spring
0 0 0 -8 # 9 Acoustic_Summer
#
# Cond # If Q has random component then 0=read one parameter for each fleet with random Q, 1=read a parameter
for each year of index
# Q parameters (if any)
# LO HI INIT PRIOR PR_type SD PHASE
-3 3 -1.39 0 -1 99 5 # Q_DEPM
-3 3 -0.69 0 -1 99 5 # Q_TEP
-3 3 -0.69 0 -1 99 5 # Q_TEP_full
-3 3 0 0 -1 99 5 # Q_Aerial
-3 3 0 0 -1 99 -5 # Q_Acoustic_Spring
# -3 3 0 0 -1 99 5 # Q_Acoustic_Summer
#
# Size selectivity types
# Pattern Discard Male Special
24 0 0 0 # 1 MexCal_S1
24 0 0 0 # 2 MexCal_S2
24 0 0 0 # 3 PacNW
30 0 0 0 # 4 DEPM
30 0 0 0 # 5 TEP
30 0 0 0 # 6 TEP_full
24 0 0 0 # 7 Aerial
24 0 0 0 # 8 Acoustic_Spring
24 0 0 0 # 9 Acoustic_Summer
#
# Age selectivity types
# Pattern Discard Male Special
0 0 0 0 # 1 MexCal_S1
0 0 0 0 # 2 MexCal_S2
0 0 0 0 # 3 PacNW
0 0 0 0 # 4 DEPM
0 0 0 0 # 5 TEP
0 0 0 0 # 6 TEP_full
0 0 0 0 # 7 Aerial
0 0 0 0 # 8 Acoustic_Spring
0 0 0 0 # 9 Acoustic_Summer
#
# Size selectivity
# LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
# MexCal_S1 (dome)
10 28 18 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P1_MexCal_S1
-5 3 -4.985 0 -1 99 -4 0 0 0 0 0 1 2 # SizeSel_P2_MexCal_S1
-1 9 2.5 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P3_MexCal_S1
-1 9 4 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P4_MexCal_S1
-10 10 -10 0 -1 99 -4 0 0 0 0 0 1 2 # SizeSel_P5_MexCal_S1
```

```
-10 10 -10 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P6_MexCal_S1
#_MexCal_S2 (dome)
10 28 18 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P1_MexCal_S2
-5 3 -4.993 0 -1 99 -4 0 0 0 0 0 1 2 # SizeSel_P2_MexCal_S2
-1 9 2.5 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P3_MexCal_S2
-1 9 4 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P4_MexCal_S2
-10 10 -10 0 -1 99 -4 0 0 0 0 0 1 2 # SizeSel_P5_MexCal_S2
-10 10 -10 0 -1 99 4 0 0 0 0 0 1 2 # SizeSel_P6_MexCal_S2
# PacNW (Asymptotic)
10 28 19 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P1_PNW
-5 10 2.5 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P2_PNW
-5 10 5 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P3_PNW
-5 10 5 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P4_PNW
-10 10 -10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P5_PNW
-10 10 10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P6_PNW
# Aerial (Asymptotic)
10 28 18 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P1__Aerial
-5 3 3 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P2__Aerial
-1 9 2.5 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P3__Aerial
-1 9 4 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P4__Aerial
-10 10 -10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P5__Aerial
-10 10 10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P6__Aerial
# Acoustic_Spring (Asymptotic)
10 28 18 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P1_Acoustic
-5 3 3 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P2_Acoustic
-1 9 2.5 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P3_Acoustic
-1 9 4 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P4_Acoustic
-10 10 -10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P5_Acoustic
-10 10 10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P6_Acoustic
# Acoustic_Summer (Asymptotic)
10 28 18 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P1_Acoustic
-5 3 3 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P2_Acoustic
-1 9 2.5 0 -1 99 4 0 0 0 0 0 0 0 # SizeSel_P3_Acoustic
-1 9 4 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P4_Acoustic
-10 10 -10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P5_Acoustic
-10 10 10 0 -1 99 -4 0 0 0 0 0 0 0 # SizeSel_P6_Acoustic
#
# Cond 0 # Custom sel-env setup (0/1)
# Cond -2 2 0 0 -1 99 -2 # Placeholder when no env_fxns
1 # Custom sel-blk setup (0/1)
#_MexCal_S1 (Block 2)
10 28 18 0 -1 99 4 # SizeSel_P1_MexCal_S1_Blk2
-5 3 -4.998 0 -1 99 -4 # SizeSel_P2_MexCal_S1_Blk2
-1 9 2.5 0 -1 99 4 # SizeSel_P3_MexCal_S1_BLK2
-1 9 4 0 -1 99 4 # SizeSel_P4_MexCal_S1_Blk2
-10 10 -10 0 -1 99 -4 # SizeSel_P5_MexCal_S1_Blk2
-10 10 -10 0 -1 99 4 # SizeSel_P6_MexCal_S1_Blk2
#_MexCal_S2 (Block 2)
10 28 18 0 -1 99 4 # SizeSel_P1_MexCal_S2_Blk2
-5 3 -4.997 0 -1 99 -4 # SizeSel_P2_MexCal_S2_Blk2
-1 9 2.5 0 -1 99 4 # SizeSel_P3_MexCal_S2_Blk2
-1 9 4 0 -1 99 4 # SizeSel_P4_MexCal_S2_Blk2
-10 10 -10 0 -1 99 -4 # SizeSel_P5_MexCal_S2_Blk2
-10 10 -10 0 -1 99 4 # SizeSel_P6_MexCal_S2_Blk2
#
# Cond 1 # No selectivity parameter trends
# Cond 1 # Placeholder for selectivity parm_dev phase
1 # Cond # Env/Block/Dev_adjustment method: 1=standard, 2=logistic trans to keep in base parameter bounds, 3=standard with no bound check
#
# Tag loss and Tag reporting parameters
0 # Tag custom:  0=no read, 1=read if tags exist
# Cond -6 6 1 1 2 0.01 -4 0 0 0 0 0 0 0  # Placeholder if no parameters
#
1 # Variance adjustments
# Fleet/Survey: 1 2 3 4 5 6 7 8
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	#_add_to_survey_CV
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	#_add_to_discard_stddev
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	#_add_to_bodywt_CV
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	#_mult_by_lencomp_N
```

```
1.000000    1.000000    1.000000    1.000000    1.000000    1.000000    1.000000    1.000000    1.000000
       #_mult_by_agecomp_N
1.000000    1.000000    1.000000    1.000000    1.000000    1.000000    1.000000    1.000000    1.000000
       #_mult_by_size-at-age_N
#
1 # Max lambda phase
1 # SD_offset
#
25 # Number of changes to make to default Lambdas (default value=1)
# Like_comp codes: 1=survey, 2=discard, 3=mean_wt, 4=length, 5=age, 6=size-freq, 7=size_age, 8=catch,
#                  9=initial equilibrium catch, 10=rec_dev, 11=parameter_prior, 12=parameter_dev,
#                  13=crash penalty, 14=morph composition; 15=tag composition, 16=tag neg_bin
# Like_comp fleet/survey  phase  value  size-freq_method
1 4 1 1 1      # DEPM
1 5 1 1 1      # TEP
1 6 1 0 1      # TEP_full
1 7 1 0 1      # Aerial
1 8 1 1 1      # Acoustic_Spring
1 9 1 1 1      # Acoustic_Summer
4 1 1 1 1      # MexCal_S1 (length)
4 2 1 1 1      # MexCal_S2 (length)
4 3 1 1 1      # PacNW (length)
4 7 1 0 1      # Aerial (length)
4 8 1 1 1      # Acoustic_Spring (length)
4 9 1 1 1      # Acoustic_Summer (length)
5 1 1 0.2 1    # MexCal_S1 (Cond AAL)
5 2 1 0.2 1    # MexCal_S2 (Cond AAL)
5 3 1 0.2 1    # PacNW (Cond AAL)
5 8 1 0 1  # Acoustic_Spring (Cond AAL)
5 9 1 0 1  # Acoustic_Summer (Cond AAL)
7 1 1 0 1      # MexCal_S1 (Mean LAA)
7 2 1 0 1      # MexCal_S2 (Mean LAA)
7 3 1 0 1      # PacNW (Mean LAA)
7 8 1 0 1  # Acoustic_Spring (Mean LAA)
7 9 1 0 1  # Acoustic_Summer (Mean LAA)
9 1 1 0 1  # Initial equilibrium catch (MexCal_S1)
9 2 1 0 1  # Initial equilibrium catch (MexCal_S2)
9 3 1 0 1  # Initial equilibrium catch (PacNW)
#
0 # Read specs for more SD reporting (0/1)
# 0 1 -1 5 1 5 1 -1 5 # Placeholder for selectivity type, lt/age, year, N_selectivity bins, growth pattern,
N_growth ages, natage_area (-1 for all), natage_yr, N_natages
# Placeholder for vector of selectivity bins to be reported
# Placeholder for vector of growth ages to be reported
# Placeholder for vector of natage ages to be reported
999 # End of file
```

DATA FILE 'T_2016.DAT'

```
# Pacific sardine stock assessment update for 2016-17
# K. T. Hill and P. R. Crone (Feb 2016)
# 2014 Final model 'T' with new landings, comps, and survey estimates for 2016 update.
# SS model ver. 3.24s
# .DAT FILE FOR 'NORTHERN SUBPOPULATION' DATA FROM ENS to BC
1993 # Start year (July 1993)
2015 # End year (ADVANCED ONE YEAR; FORECAST= 2016-17 season)
2 # N_seasons
6 6 # Months per season (2 semesters per fishing year)
2 # Spawning season (Spring semester)
3 # N_fleets
6 # N_surveys
1 # N_areas
MexCal_S1_NSP%MexCal_S2_NSP%PacNW%DEPM%TEP%TEP_full%Aerial%ATM_Spring%ATM_Summer
0.5 0.5 0.5 0.58 0.58 0.58 0.2 0.58 0.2 # Survey timing in season
1 1 1 1 1 1 1 1 1 # Area assignments for each fishery/survey
1 1 1 # Units of catch: 1=biomass, 2=number
0.05 0.05 0.05 # SE of log(catch), only used for initial equilibrium catch and for Fmethod=2-3
1 # N_genders
15 # N_ages
0 0 0 # Initial equilibrium catch for each fishery
46 # N_lines of catch to read
# Catch biomass(mt): columns are fisheries, year, season
#_2016: UPDATED LANDINGSS FOR 2013-2015
822.80 0.00    0.00    1993    1
0.00    11345.83       0.00    1993    2
```

```
8838.65 0.00    0.00    1994    1
0.00    39748.42        0.00    1994    2
5993.28 0.00    22.68   1995    1
0.00    26565.72        0.00    1995    2
11917.29        0.00    0.00    1996    1
0.00    19158.65        43.54   1996    2
13018.20        0.00    27.22   1997    1
0.00    24527.60        0.82    1997    2
18925.15        0.00    488.25  1998    1
0.00    63278.38        74.39   1998    2
14996.21        0.00    725.20  1999    1
0.00    58341.39        429.59  1999    2
23693.38        0.00    15586.16        2000    1
0.00    35179.21        2336.90 2000    2
11550.53        0.00    22545.99        2001    1
0.00    41118.36        3136.84 2001    2
16562.71        0.00    35525.69        2002    1
0.00    36130.69        597.29  2002    2
10340.64        0.00    37242.26        2003    1
0.00    21300.55        2618.43 2003    2
17048.96        0.00    46730.80        2004    1
0.00    25249.92        1016.32 2004    2
13730.19        0.00    54152.62        2005    1
0.00    29752.00        101.70  2005    2
20620.28        0.00    41220.90        2006    1
0.00    39234.00        0.00    2006    2
46047.30        0.00    48237.10        2007    1
0.00    42247.81        0.00    2007    2
30147.46        0.00    39800.10        2008    1
0.00    40545.56        0.00    2008    2
13964.90        0.00    44841.15        2009    1
0.00    30240.66        1369.73 2009    2
11130.97        0.00    54085.91        2010    1
0.00    26817.27        0.09    2010    2
24700.00        0.00    39750.49        2011    1
0.00    22717.65        5805.63 2011    2
1452.24 0.00    91425.63        2012    1
0.00    13681.80        1570.78 2012    2
874.21  0.00    57217.96        2013    1
0.00    5482.44 908.01  2013    2
1830.92 0.00    15216.82        2014    1
0.00    727.71  2193.87 2014    2
6.13    0.00    66.28   2015    1
0.00    12.00   0.00    2015    2
#_10    0.00    10.00   2016    1       # Placed in FORECAST
#_0     10.00   0.00    2016    2       # Placed in FORECAST
#
57 #_N_cpue_and_surveyabundance_observations
#_Units:  0=numbers; 1=biomass; 2=F
#_Errtype:  -1=normal; 0=lognormal; >0=T
#_Fleet Units Errtype
1 1 0 # MexCal_S1
2 1 0 # MexCal_S2
3 1 0 # PacNW
4 1 0 # DEPM
5 1 0 # TEP
6 1 0 # TEP_full
7 1 0 # Aerial
8 1 0 # Acoustic_Spring
9 1 0 # Acoustic_Summer
# Year season index obs error
1993    2       4       69065   0.29    #_DEPM_9404
2003    2       4       145274  0.23    #_DEPM_0404
2004    2       4       459943  0.55    #_DEPM_0504
2006    2       4       198404  0.30    #_DEPM_0704
2007    2       4       66395   0.27    #_DEPM_0804
2008    2       4       99162   0.24    #_DEPM_0905
2009    2       4       58447   0.40    #_DEPM_1004
2010    2       4       219386  0.27    #_DEPM_1104
2011    2       4       113178  0.27    #_DEPM_1204
2012    2       4       82182   0.29    #_DEPM_1304
2014    2       4       19376   0.54    #_DEPM_1504
1995    2       5       97923   0.40    #_TEP_9604
1996    2       5       482246  0.21    #_TEP_9704
1997    2       5       369775  0.33    #_TEP_9804
```

```
1998    2       5       332177  0.34    #_TEP_9904
1999    2       5       1252539 0.39    #_TEP_0004
2000    2       5       931377  0.38    #_TEP_0104
2001    2       5       236660  0.17    #_TEP_0204
2002    2       5       556177  0.18    #_TEP_0304
2005    2       5       651994  0.25    #_TEP_0604
1993    2       6       73374   0.21    #_TEPall_9404
1995    2       6       97923   0.40    #_TEPall_9604
1996    2       6       482246  0.21    #_TEPall_9704
1997    2       6       369775  0.33    #_TEPall_9804
1998    2       6       332177  0.34    #_TEPall_9904
1999    2       6       1252539 0.39    #_TEPall_0004
2000    2       6       931377  0.38    #_TEPall_0104
2001    2       6       236660  0.17    #_TEPall_0204
2002    2       6       556177  0.18    #_TEPall_0304
2003    2       6       307795  0.24    #_TEPall_0404
2004    2       6       486950  0.40    #_TEPall_0504
2005    2       6       651994  0.25    #_TEPall_0604
2006    2       6       306297  0.26    #_TEPall_0704
2007    2       6       128118  0.21    #_TEPall_0804
2008    2       6       162188  0.22    #_TEPall_0904
2009    2       6       97838   0.39    #_TEPall_1004
2010    2       6       364798  0.26    #_TEPall_1104
2011    2       6       227632  0.27    #_TEPall_1204
2012    2       6       198472  0.29    #_TEPall_1304
2014    2       6       30396   0.66    #_TEPall_1504
2009    1       7       1236911 0.90    #_Aerial_09N
2010    1       7       173390  0.40    #_Aerial_10N
2011    1       7       201888  0.29    #_Aerial_11N
2012    1       7       696251  0.37    #_Aerial_12N
2005    2       8       1947063 0.30    #_Acoustic_0604
2007    2       8       751075  0.09    #_Acoustic_0804
2009    2       8       357006  0.41    #_Acoustic_1004
2010    2       8       493672  0.30    #_Acoustic_1104
2011    2       8       469480  0.28    #_Acoustic_1204
2012    2       8       305146  0.24    #_Acoustic_1304
2013    2       8       35339   0.38    #_Acoustic_1404
2014    2       8       29048   0.29    #_Acoustic_1504
2008    1       9       801000  0.30    #_Acoustic_0807
2012    1       9       340831  0.33    #_Acoustic_1207
2013    1       9       313746  0.27    #_Acoustic_1307
2014    1       9       26280   0.63    #_Acoustic_1407
2015    1       9       15870   0.70    #_Acoustic_1507
#
0 # N_fleets with discard
# Discard units: 1=same_as_catch units (bio/num), 2=fraction, 3=numbers
# Discard error type: >0 for DF of T-dist(read CV below), 0 for normal with CV, -1 for normal with se, -2 for
lognormal
# Fleet discard units and error type
0 # N_discard obs
# Year season index obs error
#
0 # N_meanbodywt obs
100 # DF for_meanbodywt t-distribution likelihood
#
2 # Length bin method: 1=use databins; 2=generate from binwidth,min,max below; 3=read vector
0.5 # Bin width for population size composition
8 # Minimum size in the population (lower edge of first bin and size at age 0)
30 # Maximum size in the population (lower edge of last bin)
-0.0001 # Composition tail compression
0.0001 # Add to composition
0 # Combine males into females at or below this bin number
39 # N_length bins
9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5 18 18.5 19 19.5 20 20.5 21 21.5 22 22.5 23
23.5 24 24.5 25 25.5 26 26.5 27 27.5 28
91 # 91 N_length obs
# Year Season Fleet/Survey Gender Part Nsamp Datavector(female-male)
1993    1       1       0       0       2.72    0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.01470588      0.00000000      0.14705882
        0.23529412      0.19117647      0.20588235      0.13235294      0.05882353      0.01470588      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       13.74   0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00192997      0.01865635
```

	0.04117263	0.08430434	0.07591361	0.07404029	0.08683868	0.12757807	0.09884957		
	0.10926901	0.11878046	0.08880898	0.05178937	0.00695027	0.01026562	0.00365034		
	0.00060123	0.00000000	0.00060123	0.00000000	0.00000000	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
1995	1	1	0	0	4.80	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00833333	0.00000000	0.00833333	0.00833333	0.01666667		
	0.07500000	0.08333333	0.05833333	0.20833333	0.13333333	0.21666667	0.08333333		
	0.06666667	0.01666667	0.00833333	0.00833333	0.00000000	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
1996	1	1	0	0	59.54	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00034806	0.00058009		
	0.00219937	0.00576503	0.00957964	0.02611018	0.04050980	0.05620072	0.08282782		
	0.13533238	0.15435462	0.17604004	0.13254345	0.08564194	0.05547979	0.02087313		
	0.00993156	0.00286865	0.00069611	0.00023204	0.00062219	0.00000000	0.00000000		
	0.00042114	0.00042114	0.00000000	0.00042114	0.00000000	0.00000000	0.00000000		
1997	1	1	0	0	54.96	0.00161047	0.00000000	0.00000000	0.00000000
	0.00000000	0.00070613	0.00190931	0.00249531	0.00157254	0.00740264	0.02034422		
	0.02746041	0.02356657	0.03226502	0.04920364	0.05812807	0.09131547	0.12217437		
	0.17851369	0.16690609	0.10823880	0.06410378	0.02256286	0.00874199	0.00479242		
	0.00070613	0.00249531	0.00176969	0.00030895	0.00070613	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
1998	1	1	0	0	61.82	0.00000000	0.00013950	0.00000000	0.00054913
	0.00217145	0.00754043	0.02660605	0.06328062	0.09928446	0.12017588	0.11452861		
	0.10222652	0.08662035	0.08022393	0.05559320	0.04519876	0.03979356	0.03720684		
	0.02689637	0.02425384	0.01374267	0.01309129	0.01455336	0.00735521	0.00736115		
	0.00379924	0.00202174	0.00182034	0.00226600	0.00169950	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
1999	1	1	0	0	8.45	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00970931	0.02427327	0.05825584	0.09709307		
	0.13107564	0.18600867	0.21698374	0.07874420	0.08045604	0.05037072	0.03313752		
	0.01627580	0.00727624	0.00325516	0.00229776	0.00229776	0.00153184	0.00038296		
	0.00019148	0.00038296	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2000	1	1	0	0	19.31	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00214444	0.00687013	0.00236284	0.00816075	0.01610311		
	0.02362844	0.03736871	0.07557145	0.12782502	0.17187176	0.18629126	0.17216776		
	0.08516998	0.03492402	0.01434741	0.01172984	0.01007111	0.00731811	0.00463296		
	0.00036867	0.00000000	0.00000000	0.00107222	0.00000000	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2001	1	1	0	0	26.92	0.00299140	0.00273498	0.01506817	0.03187710
	0.04628212	0.02810027	0.01845921	0.01980049	0.02094225	0.00689629	0.00233494		
	0.00009139	0.00702992	0.01724077	0.03944303	0.04010245	0.05293178	0.06963658		
	0.06813359	0.03349161	0.02422864	0.01998817	0.02567865	0.04374940	0.06629584		
	0.11235528	0.07962582	0.03629326	0.02802019	0.01335362	0.01339213	0.00843442		
	0.00307756	0.00191866	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2002	1	1	0	0	46.96	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00058534	0.00000000	0.00000000	0.00427117	0.00856097	0.01383827		
	0.02882084	0.07292346	0.10667321	0.12477102	0.13591949	0.17905045	0.12960308		
	0.09350153	0.04093142	0.02615243	0.01065275	0.00566682	0.00430140	0.00526596		
	0.00146460	0.00420899	0.00225146	0.00000000	0.00000000	0.00000000	0.00058534		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2003	1	1	0	0	13.15	0.00000000	0.00169262	0.00451718	0.01608292
	0.06021648	0.12408570	0.08347189	0.05346355	0.04403720	0.02879712	0.01144579		
	0.02279141	0.01563165	0.02462320	0.02606885	0.03942352	0.05607711	0.07024577		
	0.06869371	0.06366968	0.04343752	0.04937621	0.04233675	0.02762563	0.01033400		
	0.00851117	0.00243153	0.00091182	0.00000000	0.00000000	0.00000000	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2004	1	1	0	0	32.30	0.00000000	0.00000000	0.00000000	0.00024514
	0.00024514	0.00073543	0.00205767	0.00283243	0.00824157	0.00988930	0.04485433		
	0.11745533	0.20110987	0.16552816	0.14517069	0.11552133	0.08888914	0.04629335		
	0.01857389	0.01104107	0.00756468	0.00443794	0.00243413	0.00239788	0.00000806		
	0.00000201	0.00000000	0.00223572	0.00000000	0.00000000	0.00223572	0.00000000		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2005	1	1	0	0	28.75	0.00000000	0.00000000	0.00071949	0.00143897
	0.00653511	0.01157153	0.01384485	0.01309843	0.02798175	0.05168794	0.07930643		
	0.09237886	0.07490876	0.08847601	0.11085534	0.15343903	0.10619562	0.07417982		
	0.03501566	0.02276698	0.01374071	0.01125064	0.00258153	0.00246207	0.00002240		
	0.00056560	0.00000000	0.00113119	0.00056560	0.00000000	0.00271410	0.00056560		
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000		
2006	1	1	0	0	70.00	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000817	0.00139593	0.00370309	0.01051305	0.02830085		
	0.08812453	0.16038481	0.17472994	0.15633215	0.13757842	0.10032027	0.06327177		
	0.03845569	0.02449167	0.00528078	0.00445611	0.00132639	0.00033160	0.00033160		

```
     0.00033160   0.00033160   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2007 1      1     0      0     69.87  0.00164969   0.00247453   0.00329937   0.00264684
     0.00076071   0.00094036   0.00106112   0.00505987   0.00726599   0.01044510   0.02075499
     0.03448703   0.06756079   0.10788447   0.15231813   0.18353671   0.15746569   0.11193402
     0.06189772   0.03095113   0.01131497   0.00936246   0.00448928   0.00070277   0.00070277
     0.00049491   0.00111500   0.00082484   0.00181466   0.00164969   0.00164969   0.00115478
     0.00032994   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2008 1      1     0      0     27.00  0.00000000   0.00001951   0.00001951   0.00007805
     0.00007805   0.00025365   0.00812568   0.01322437   0.01507600   0.01012736   0.00703638
     0.00222432   0.00815459   0.03743973   0.10519409   0.17673635   0.17069402   0.16753307
     0.13252684   0.05969125   0.02792098   0.01779568   0.00494964   0.01433373   0.00739166
     0.00899568   0.00066448   0.00187718   0.00005853   0.00177962   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2009 1      1     0      0     23.00  0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00718480
     0.00659772   0.02510462   0.00834218   0.03988813   0.13822895   0.30734108   0.28332180
     0.12859970   0.04820622   0.00544034   0.00174446   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2010 1      1     0      0     13.00  0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00307692   0.00000000
     0.02153846   0.11076923   0.30153846   0.28615385   0.22153846   0.02153846   0.01846154
     0.00307692   0.00307692   0.00615385   0.00307692   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2011 1      1     0      0     22.00  0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00550160   0.02270543   0.10592845   0.30705434   0.33715847
     0.16548304   0.03472523   0.01524281   0.00344984   0.00000000   0.00000000   0.00275080
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2012 1      1     0      0     22.96  0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.02288534
     0.01634667   0.02615468   0.01307734   0.00326933   0.00980800   0.02916482   0.07258330
     0.10858359   0.14709358   0.12463433   0.14112953   0.13635974   0.07152817   0.05732066
     0.01399447   0.00048164   0.00372320   0.00186160   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2013 1      1     0      0     16.00  0.00000000   0.00000000   0.00074231   0.00148463
     0.00222694   0.00296925   0.00371157   0.00519619   0.00222694   0.00074231   0.00074231
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00148463   0.00148463
     0.00234205   0.02328286   0.02859415   0.05945618   0.04296925   0.10566584   0.17808666
     0.26589605   0.13284417   0.08507572   0.04410319   0.00867218   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2014 1      1     0      0     6.00   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000895   0.00000000   0.00000000   0.00000000   0.00000895   0.00003133   0.00003581
     0.00001790   0.00000448   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.01599821
     0.03999552   0.18397941   0.34396598   0.31996419   0.07199194   0.01599821   0.00799910
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
2015 1      1     0      0     1.00   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.04000000   0.00000000   0.12000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.04000000
     0.24000000   0.16000000   0.28000000   0.12000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
1993 2      2     0      0     80.83  0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00000000   0.00024233   0.00140226   0.00726413   0.02974873   0.06247855
     0.09739572   0.09557449   0.07134655   0.06703480   0.08193713   0.10366195   0.11143525
     0.10144129   0.05447251   0.03973350   0.02527592   0.01453475   0.00850628   0.00787906
     0.00345701   0.00250677   0.00214831   0.00346978   0.00312588   0.00135054   0.00021661
     0.00128376   0.00093526   0.00000000   0.00014086   0.00000000   0.00000000   0.00000000
1994 2      2     0      0     206.08 0.00000000   0.00000000   0.00000000   0.00000000
     0.00145457   0.00504078   0.00606898   0.00700771   0.01410691   0.02242621   0.04034287
     0.06906816   0.09654861   0.11238178   0.12955228   0.13501642   0.11091489   0.09320556
     0.05899874   0.04552064   0.02495894   0.01511850   0.00540478   0.00359894   0.00066879
     0.00092576   0.00026691   0.00000000   0.00012087   0.00000000   0.00029208   0.00069722
     0.00000000   0.00000000   0.00000000   0.00029208   0.00000000   0.00000000   0.00000000
1995 2      2     0      0     42.30  0.00000000   0.00000000   0.00000000   0.00000000
     0.00000000   0.00483005   0.00181639   0.00978760   0.01443863   0.02041858   0.02632739
     0.03677194   0.05949842   0.09049866   0.10561619   0.13138787   0.11886270   0.11101527
     0.07941884   0.07368271   0.04314995   0.03412017   0.01538229   0.01735834   0.00323563
     0.00100235   0.00056203   0.00000000   0.00040900   0.00000000   0.00000000   0.00000000
     0.00040900   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
```

1996	2	2	0	0	31.69	0.00000000	0.00000000	0.00000001	0.00000006	
	0.00208698	0.00474184	0.01105977	0.01641602	0.03848093	0.04640019	0.05225376			
	0.07284165	0.06293899	0.03267289	0.02526977	0.03481597	0.04474040	0.05224002			
	0.05002577	0.07588550	0.07647282	0.09283255	0.08189359	0.05770817	0.02553826			
	0.01572120	0.00742768	0.00448802	0.00253262	0.00168842	0.00168842	0.00168842			
	0.00168842	0.00238407	0.00337683	0.00000000	0.00000000	0.00000000	0.00000000			
1997	2	2	0	0	39.04	0.00116688	0.00116688	0.01283567	0.01168079	
	0.01911496	0.00995550	0.00463359	0.00836094	0.02093227	0.01412310	0.04077870			
	0.04592240	0.05486011	0.07529587	0.08758462	0.06419613	0.05883337	0.06624342			
	0.04634799	0.03228601	0.03351542	0.03099222	0.05453763	0.05713365	0.05113369			
	0.04096875	0.03221245	0.01144112	0.00765009	0.00308468	0.00057263	0.00023650			
	0.00020197	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
1998	2	2	0	0	62.89	0.00000000	0.00052375	0.00292399	0.00531268	
	0.00807976	0.00892394	0.01445008	0.04007347	0.04947419	0.06018640	0.07160912			
	0.08430841	0.09930662	0.11026781	0.09545976	0.09022715	0.07892527	0.06308014			
	0.02943892	0.02494755	0.01733738	0.01275855	0.01065188	0.00689855	0.00555941			
	0.00337949	0.00283313	0.00163188	0.00071536	0.00040797	0.00030739	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
1999	2	2	0	0	45.97	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00373364	0.01858885	0.06092482	0.10283009			
	0.13630227	0.17321851	0.15257482	0.12476550	0.08514671	0.05049129	0.03310700			
	0.02304860	0.01857073	0.01262764	0.00349994	0.00042741	0.00014219	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2000	2	2	0	0	42.47	0.00000000	0.00000000	0.00000000	0.00007818	
	0.00031273	0.00695721	0.00948363	0.02298990	0.03958827	0.04929372	0.07791587			
	0.10364298	0.10939476	0.07624154	0.05471634	0.05940971	0.08000407	0.07736515			
	0.05906656	0.05988523	0.04314596	0.04274591	0.01443181	0.01154905	0.00083513			
	0.00000000	0.00086812	0.00007818	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2001	2	2	0	0	57.78	0.00000000	0.00000000	0.00114442	0.01008725	
	0.02360642	0.04515338	0.06577894	0.08827063	0.10528246	0.11005028	0.08543740			
	0.06257413	0.06371308	0.05222215	0.02452615	0.02527951	0.02070571	0.02867169			
	0.04446623	0.05499618	0.03036332	0.02717653	0.01354428	0.00784013	0.00561628			
	0.00208727	0.00069576	0.00069576	0.00000000	0.00000000	0.00001467	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2002	2	2	0	0	55.61	0.00000000	0.00000000	0.00000000	0.00037996	
	0.00113988	0.00189980	0.00264471	0.00378459	0.00573358	0.00469099	0.00904018			
	0.02153204	0.04856377	0.08579611	0.12189739	0.13011447	0.12668342	0.09525103			
	0.04868384	0.03776127	0.05061458	0.05005716	0.04759173	0.04675377	0.02437622			
	0.01196384	0.00688184	0.00781155	0.00573013	0.00095678	0.00080336	0.00086203			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2003	2	2	0	0	74.37	0.00000000	0.00000000	0.00002333	0.00737407	
	0.03796815	0.06330862	0.06164288	0.08781023	0.13955871	0.16815734	0.12204441			
	0.08096378	0.04889651	0.02406924	0.01538764	0.01563158	0.01102487	0.01358790			
	0.01561320	0.02270900	0.01540512	0.01581931	0.00585443	0.00228531	0.00198207			
	0.00690423	0.00409315	0.00215683	0.00243203	0.00283737	0.00324271	0.00081068			
	0.00040534	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2004	2	2	0	0	81.35	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00093783	0.00153447	0.00348067	0.00686443	0.02125242	0.03295020	0.06153444			
	0.10844211	0.11494040	0.12997977	0.12299243	0.09934347	0.09079576	0.07490959			
	0.06642619	0.03379681	0.01274994	0.00944827	0.00238726	0.00082184	0.00068687			
	0.00101954	0.00203739	0.00000000	0.00066788	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2005	2	2	0	0	69.54	0.00003323	0.00016617	0.00198183	0.00724287	
	0.02546488	0.03423464	0.04343134	0.05161252	0.08921533	0.10317372	0.11440362			
	0.10395214	0.11260776	0.08466520	0.06700801	0.04312203	0.03875394	0.02639734			
	0.01505989	0.01090155	0.00709011	0.00530332	0.00273073	0.00352497	0.00253710			
	0.00095835	0.00156157	0.00078078	0.00027632	0.00048453	0.00064604	0.00035514			
	0.00032302	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2006	2	2	0	0	79.01	0.00000000	0.00000000	0.00000000	0.00007155	
	0.00193274	0.00448013	0.00870836	0.01190914	0.02276871	0.02245554	0.05508678			
	0.08312489	0.10950482	0.11508847	0.11718795	0.09778619	0.08344183	0.07797438			
	0.05950222	0.04982304	0.02853562	0.01769640	0.00778031	0.00668425	0.00192038			
	0.00407420	0.00371857	0.00243818	0.00184306	0.00148743	0.00148743	0.00148743			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2007	2	2	0	0	53.13	0.00000000	0.00000000	0.00056916	0.00458294	
	0.01523107	0.01624194	0.03828270	0.07429633	0.10589583	0.11936676	0.13445629			
	0.09028317	0.08948056	0.09093413	0.06813034	0.04676708	0.03148477	0.01534756			
	0.01102726	0.00991497	0.00445812	0.00594738	0.00799020	0.00561403	0.00666222			
	0.00305137	0.00193240	0.00055948	0.00018649	0.00055948	0.00018649	0.00018649			
	0.00037299	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2008	2	2	0	0	39.53	0.00130827	0.00130827	0.00261985	0.00174435	
	0.00820997	0.01240801	0.02192600	0.03724275	0.03155898	0.02949098	0.03131780			
	0.04421268	0.06406849	0.11119877	0.13321561	0.12895909	0.08889473	0.07252151			

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        0.05604855     0.05270723     0.02472053     0.01390128     0.00841632     0.00910891     0.00492096
        0.00313298     0.00174435     0.00198249     0.00043609     0.00067422     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2009    2      2       0      0       99.00  0.00000000     0.00000000     0.00000000     0.00033110
        0.00098937     0.00364222     0.01526663     0.04815485     0.10491762     0.15225861     0.16727933
        0.14395945     0.12763433     0.09200956     0.07251219     0.03921100     0.01392598     0.00964499
        0.00259569     0.00164641     0.00095708     0.00053046     0.00065827     0.00089258     0.00090368
        0.00000000     0.00000000     0.00007860     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2010    2      2       0      0       32.96  0.00000000     0.00000000     0.00000000     0.00000329
        0.00000986     0.00000000     0.01533814     0.03545198     0.07505310     0.08012643     0.16082054
        0.16409807     0.14395429     0.08121932     0.03649645     0.02499783     0.00880498     0.00803841
        0.00505031     0.00646200     0.00190905     0.00326271     0.00879883     0.01489032     0.03181114
        0.02910381     0.02842698     0.01759765     0.00812199     0.00744516     0.00067683     0.00135367
        0.00067683     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2011    2      2       0      0       56.28  0.00000000     0.00000000     0.00000000     0.00000000
        0.00042055     0.00393862     0.02649871     0.07254863     0.07899923     0.06480918     0.05727363
        0.04957664     0.04043675     0.05008019     0.04620495     0.05065969     0.03636937     0.04610942
        0.04153957     0.06936597     0.04808470     0.04969147     0.03341529     0.02532542     0.01673552
        0.02905829     0.02593557     0.02224027     0.00818459     0.00324890     0.00108297     0.00216593
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2012    2      2       0      0       9.00   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00634863     0.00634863     0.01904590     0.03809180     0.01904590     0.08292541     0.10792675
        0.13008930     0.15627021     0.07814954     0.12219678     0.07438000     0.05428802     0.04833258
        0.04339435     0.00937866     0.00227252     0.00151501     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2013    2      2       0      0       28.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00026894     0.00287596     0.00971450     0.00404500     0.00323817     0.00206913     0.00296922
        0.00360037     0.00476941     0.01809207     0.02177791     0.03006646     0.03606958     0.07238448
        0.17035400     0.25213401     0.20643699     0.09677617     0.03764854     0.01076876     0.00506478
        0.00634317     0.00253239     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2014    2      2       0      0       14.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00334979     0.01674895     0.03014811     0.05359663     0.08400949
        0.11768389     0.12398933     0.17300721     0.21933638     0.08066685     0.04959071     0.00700984
        0.00119060     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00718278     0.00850714     0.01678294     0.00122678     0.00597259     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
1999    1      3       0      0       3.04   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000095
        0.00000095     0.00000285     0.00001236     0.04484245     0.07472347     0.07472918     0.13447410
        0.15869488     0.13446554     0.05976204     0.04482153     0.02422648     0.04642701     0.03714674
        0.03716576     0.02788359     0.03717908     0.03919457     0.00929548     0.00000666     0.00000285
        0.01494051     0.00000000     0.00000095     0.00000000     0.00000000     0.00000000     0.00000000
1999    2      3       0      0       4.24   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.01886792     0.01886792     0.02830189     0.16981132
        0.17924528     0.20754717     0.16981132     0.11320755     0.04716981     0.02830189     0.00943396
        0.00943396     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2000    1      3       0      0       63.93  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00003375     0.00006482     0.00000000     0.00003375     0.00000000
        0.00003375     0.00000000     0.00000000     0.00063677     0.00308924     0.01570860     0.02898601
        0.03823612     0.05495875     0.06093348     0.06560425     0.07664897     0.09104633     0.12502336
        0.11358864     0.11316074     0.07608888     0.06753608     0.03163643     0.01814741     0.01018023
        0.00428843     0.00365138     0.00060061     0.00003107     0.00003970     0.00000000     0.00001246
2000    2      3       0      0       10.72  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000026     0.00012460     0.00000000     0.00000000
        0.00000026     0.00000000     0.00000026     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.02350879     0.02375825     0.08315347     0.13179081     0.15417981     0.17881393
        0.13080486     0.14894118     0.07718786     0.03579353     0.00003091     0.01189510     0.00000951
        0.00000449     0.00000106     0.00000079     0.00000000     0.00000000     0.00000000     0.00000026
2001    1      3       0      0       78.15  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00087005     0.00156608     0.00121806
        0.00115894     0.00060192     0.00046425     0.00000000     0.00046425     0.00000000     0.00000002
        0.00261835     0.01024098     0.02323570     0.07467192     0.16300429     0.17738632     0.16996193
        0.12669923     0.09158078     0.06693893     0.04293152     0.02073142     0.01275755     0.00758599
        0.00156533     0.00158897     0.00011092     0.00004628     0.00000000     0.00000000     0.00000002
2001    2      3       0      0       26.76  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00048288     0.00048288     0.00000053
        0.00000000     0.00000000     0.00000000     0.00367294     0.00879451     0.04010952     0.09046219
        0.18199439     0.21660795     0.19187645     0.13186477     0.06604471     0.04323092     0.01074198
        0.00880089     0.00289994     0.00048341     0.00096629     0.00048288     0.00000000     0.00000000
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2002	1	3	0	0	172.79	0.00000000	0.00000000	0.00000000	0.00000313	
	0.00000626	0.00000626	0.00000626	0.00000313	0.00000938	0.00000626	0.00001363			
	0.00000313	0.00062473	0.00031198	0.00094645	0.00136169	0.00143519	0.00317196			
	0.00361648	0.00444832	0.00536365	0.00421846	0.01381946	0.03565991	0.11857744			
	0.20342331	0.21914500	0.14683906	0.11571644	0.06020604	0.03543252	0.01287390			
	0.00777273	0.00240956	0.00164771	0.00033310	0.00054432	0.00001901	0.00002414			
2002	2	3	0	0	8.44	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00312357	0.00000000			
	0.00000000	0.00624714	0.00937071	0.00937295	0.01249428	0.01249652	0.05221134			
	0.13789484	0.06785376	0.17431751	0.21008191	0.06999081	0.08758723	0.05631804			
	0.06875428	0.00938411	0.00624714	0.00312580	0.00312357	0.00000000	0.00000446			
2003	1	3	0	0	145.33	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000397	0.00000000	0.00000397	0.00000397	0.00081444	0.00403192			
	0.00514471	0.00338591	0.00141363	0.00001985	0.00029674	0.00455528	0.01661655			
	0.03216569	0.04716668	0.06356196	0.04611645	0.05368928	0.06537740	0.06742541			
	0.07208935	0.12367128	0.12474048	0.10239500	0.07361669	0.04797912	0.02147233			
	0.01095014	0.00687007	0.00305615	0.00071418	0.00062688	0.00001260	0.00001191			
2003	2	3	0	0	16.88	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00068529	0.01626167	0.03183805			
	0.07470549	0.17346083	0.15096679	0.24561041	0.16554308	0.08604058	0.03407916			
	0.01027932	0.00915877	0.00137058	0.00000000	0.00000000	0.00000000	0.00000000			
2004	1	3	0	0	93.35	0.00001567	0.00001567	0.00000000	0.00000000	
	0.00056254	0.00028127	0.00056254	0.00142204	0.00609585	0.00738530	0.00901487			
	0.00780880	0.00880757	0.00314547	0.01122084	0.01449783	0.04081487	0.03735165			
	0.03390459	0.02231370	0.02555715	0.01629821	0.02816169	0.02899177	0.05840626			
	0.06057283	0.09562618	0.08453840	0.14026268	0.09805984	0.07524450	0.03709070			
	0.02707205	0.01236191	0.00425655	0.00131717	0.00055007	0.00017067	0.00024033			
2004	2	3	0	0	7.88	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.02131378	0.05692221	0.15080485	0.27920147			
	0.24587915	0.15038613	0.02495166	0.02063744	0.00998066	0.00499033	0.00000000			
	0.00499033	0.00499033	0.00000000	0.00499033	0.00998066	0.00000000	0.00998066			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2005	1	3	0	0	67.68	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000553	0.00001355	0.00159531	0.00039392	0.00002710	0.00004066	0.00020755			
	0.00020258	0.00270103	0.02291847	0.05924987	0.09616749	0.20727817	0.18328761			
	0.12443673	0.05097571	0.01877167	0.01515760	0.00998755	0.00942919	0.01080600			
	0.01225695	0.01347518	0.01909393	0.02824136	0.03110144	0.04082612	0.02108261			
	0.01447999	0.00282130	0.00249264	0.00027437	0.00014659	0.00002710	0.00002710			
2006	1	3	0	0	27.00	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00385525	0.01151585			
	0.04782390	0.16295078	0.33602885	0.24986185	0.11243519	0.01737664	0.00466226			
	0.00994350	0.00193035	0.00122605	0.00686819	0.00826354	0.01135211	0.00487000			
	0.00864962	0.00000000	0.00000000	0.00038607	0.00000000	0.00000000	0.00000000			
2006	2	3	0	0	3.00	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.01333333			
	0.00000000	0.06666667	0.06666667	0.20000000	0.16000000	0.09333333	0.09333333			
	0.05333333	0.02666667	0.05333333	0.00000000	0.08000000	0.04000000	0.02666667			
	0.02666667	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
2007	1	3	0	0	87.86	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000737	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00000000	0.00001639	0.00061942	0.00255561	0.01442330			
	0.07011329	0.13161223	0.21359514	0.23707687	0.18219854	0.07245245	0.02287642			
	0.01307278	0.00799927	0.00556329	0.00684479	0.00802636	0.00410422	0.00215245			
	0.00214591	0.00115543	0.00071927	0.00011042	0.00050099	0.00001250	0.00004528			
2008	1	3	0	0	129.64	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00004054	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.00000000	0.00041928	0.00000000	0.00000000	0.00058332	0.00460794			
	0.03193930	0.06132653	0.11715864	0.14270701	0.15921219	0.11117985	0.07109068			
	0.04339494	0.04764464	0.06409722	0.06209469	0.04086420	0.02147774	0.01039633			
	0.00450936	0.00253737	0.00106315	0.00059479	0.00056213	0.00027694	0.00022122			
2009	1	3	0	0	159.41	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000722	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00036834	0.00036834	0.00000722	0.00002165	0.00000722	0.00001443	0.00385185			
	0.02385351	0.05630274	0.13546005	0.16896254	0.15574778	0.09681599	0.06985591			
	0.04410210	0.07537644	0.06582272	0.05197468	0.02553117	0.01450460	0.00584005			
	0.00330284	0.00143161	0.00023704	0.00012583	0.00002508	0.00004879	0.00003229			
2009	2	3	0	0	4.33	0.00000000	0.00000000	0.00000000	0.00000000	
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000			
	0.00000000	0.01398663	0.00000000	0.00000000	0.00000000	0.00000000	0.00640983			

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        0.00764838     0.05363834     0.07792424     0.18996976     0.18962297     0.20269211     0.13261832
        0.06086833     0.03818737     0.01244710     0.00622355     0.00776308     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2010    1       3      0       0      158.60 0.00000000     0.00000000     0.00000000     0.00000000
        0.00001429     0.00001429     0.00001429     0.00001429     0.00001429     0.00001429     0.00044699
        0.00000000     0.00000121     0.00000000     0.00182244     0.00202608     0.00164970     0.00257329
        0.00747769     0.02929572     0.09131722     0.14271426     0.15874857     0.10985279     0.08726802
        0.06754262     0.09067348     0.07714994     0.06213060     0.03582122     0.02020100     0.00620373
        0.00350799     0.00107204     0.00019082     0.00002417     0.00005373     0.00002859     0.00012036
2011    1       3      0       0      209.70 0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00003151     0.00000000     0.00000000     0.00001309     0.00000000
        0.00098545     0.00003928     0.00059179     0.00017022     0.00011007     0.00198926     0.00187005
        0.00458734     0.00621298     0.01733638     0.02663686     0.09056926     0.12766615     0.12250119
        0.08001007     0.12016808     0.12573893     0.10839274     0.08486996     0.04554796     0.01977992
        0.00882012     0.00339068     0.00107283     0.00055389     0.00018109     0.00013134     0.00003151
2011    2       3      0       0      15.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.01595748
        0.06102858     0.09574485     0.11202126     0.10134751     0.10393621     0.08544319     0.15735814
        0.12312026     0.10388306     0.02943256     0.00803189     0.00269502     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2012    1       3      0       0      119.96 0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00039374
        0.01042668     0.04536653     0.10833995     0.15991690     0.16908725     0.11185223     0.10350004
        0.12242207     0.10086189     0.04285995     0.01986392     0.00450227     0.00011357     0.00000000
        0.00000000     0.00049302     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2012    2       3      0       0      3.00   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.04000000     0.06666667     0.36000000     0.28000000     0.10666667
        0.06666667     0.05333333     0.01333333     0.01333333     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2013    1       3      0       0      141.00 0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00031076     0.00826635     0.04840622     0.18377225     0.25546424     0.23831458
        0.13242000     0.07340381     0.03383920     0.01716330     0.00642818     0.00176975     0.00044137
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2013    2       3      0       0      1.20   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.03333333     0.06666667
        0.23333333     0.46666667     0.16666667     0.03333333     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2014    1       3      0       0      50.88  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00486853     0.03420662     0.14943202
        0.25345626     0.29136535     0.16668853     0.06801615     0.02262697     0.00535488     0.00398470
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2014    2       3      0       0      15.92  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00518691     0.01580589     0.14519508
        0.26636975     0.32264050     0.18093404     0.04798212     0.01321244     0.00007982     0.00000000
        0.00259345     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2015    1       3      0       0      1.00   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.04000000     0.00000000     0.04000000
        0.00000000     0.00000000     0.00000000     0.04000000     0.00000000     0.00000000     0.00000000
        0.16000000     0.16000000     0.24000000     0.24000000     0.08000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2009    1       7      0       0      33.20  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00052810     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00057622     0.00495836
        0.03103000     0.09960013     0.16374495     0.20219759     0.22838807     0.15886180     0.07916015
        0.02095343     0.00615335     0.00086496     0.00258641     0.00000000     0.00039648     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2010    1       7      0       0      24.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00080160     0.00000000     0.00000000     0.00000000     0.00051869     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00101947     0.00144396     0.00068636
        0.00132264     0.00518994     0.02150013     0.09853051     0.21071417     0.29173440     0.18574131
        0.11417842     0.04092949     0.01770211     0.00669268     0.00000000     0.00129411     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
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2011    1       7       0       0       50.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00032391     0.00048844     0.00090264     0.00004834     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00067671     0.00000000
        0.00017503     0.00058270     0.00081600     0.00639086     0.02291477     0.10158366     0.24939403
        0.26460441     0.20025064     0.09328675     0.03327509     0.01190588     0.00477899     0.00363973
        0.00294363     0.00000000     0.00101779     0.00000000     0.00000000     0.00000000     0.00000000
2012    1       7       0       0       23.00  0.00000000     0.00000000     0.00000000     0.00096182
        0.00000000     0.00000000     0.00325589     0.00292761     0.00000000     0.00000000     0.00080840
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00198040     0.04085942     0.12161069     0.32194293     0.25935231     0.10149073
        0.05042019     0.03717053     0.03715582     0.01294936     0.00496227     0.00104007     0.00111157
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2005    2       8       0       0       10.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00270862     0.00270862     0.00000000
        0.00000000     0.01100873     0.01100873     0.12353364     0.12353364     0.06453880     0.06453880
        0.15773170     0.15773170     0.06426980     0.06426980     0.05009669     0.05009669     0.01516183
        0.01516183     0.00505394     0.00505394     0.00000000     0.00000000     0.00168465     0.00168465
        0.00336930     0.00336930     0.00168465     0.00000000     0.00000000     0.00000000     0.00000000
2007    2       8       0       0       12.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.01871052     0.01871052     0.04456086     0.04456086
        0.07885461     0.07885461     0.07720993     0.07720993     0.09196321     0.09196321     0.10803940
        0.10803940     0.06881783     0.06881783     0.00321240     0.00321240     0.00825866     0.00825866
        0.00037258     0.00037258     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2009    2       8       0       0       19.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00071913     0.00071913     0.00036184     0.00036184     0.00000000     0.00000000     0.00121512
        0.00121512     0.00265337     0.00265337     0.00332081     0.00332081     0.00555546     0.00555546
        0.00224440     0.00224440     0.00833426     0.00833426     0.05506318     0.05506318     0.17107802
        0.17107802     0.16580872     0.16580872     0.06954074     0.06954074     0.01153821     0.01153821
        0.00243023     0.00243023     0.00027301     0.00000000     0.00000000     0.00000000     0.00000000
2010    2       8       0       0       18.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000449     0.00000449     0.00000000     0.00000000     0.00000000
        0.00000000     0.00015121     0.00015121     0.08020558     0.08020558     0.22135962     0.22135962
        0.08918809     0.08918809     0.04535153     0.04535153     0.00957193     0.00957193     0.00287216
        0.00287216     0.01710648     0.01710648     0.02239309     0.02239309     0.00960401     0.00960401
        0.00139900     0.00139900     0.00158562     0.00000000     0.00000000     0.00000000     0.00000000
2011    2       8       0       0       12.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00966230     0.00966230
        0.00000000     0.00000000     0.00874343     0.00874343     0.09109599     0.09109599     0.11348639
        0.11348639     0.05587484     0.05587484     0.10595060     0.10595060     0.08715280     0.08715280
        0.02797210     0.02797210     0.00006153     0.00006153     0.00000000     0.00000000     0.00000000
2012    2       8       0       0       18.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00087027     0.00087027     0.00043514     0.00043514     0.01933857     0.01933857     0.15265050
        0.15265050     0.18642185     0.18642185     0.07407997     0.07407997     0.04749947     0.04749947
        0.00758276     0.00758276     0.01112147     0.01112147     0.00000000     0.00000000     0.00000000
2013    2       8       0       0       4.00   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.03553942     0.03553942     0.32050317     0.32050317     0.10057675     0.10057675
        0.04338066     0.04338066     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2014    2       8       0       0       6.00   0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00195881     0.00195881
        0.00000000     0.00000000     0.04068968     0.04068968     0.12361069     0.12361069     0.00000000
        0.00000000     0.00000000     0.00000000     0.01110877     0.01110877     0.18187444     0.18187444
        0.12041276     0.12041276     0.02034484     0.02034484     0.00000000     0.00000000     0.00000000
2008    1       9       0       0       27.00  0.01700544     0.01700544     0.02210707     0.02210707
        0.00680218     0.00680218     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00680218     0.00680218     0.02009720     0.02009720
        0.02164783     0.02164783     0.08951514     0.08951514     0.10939327     0.10939327     0.14029251
        0.14029251     0.05385909     0.05385909     0.01118376     0.01118376     0.00129435     0.00129435
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
2012    1       9       0       0       26.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00035481     0.00035481     0.00193496     0.00193496     0.13636929     0.13636929     0.21595031
        0.21595031     0.06930702     0.06930702     0.04528789     0.04528789     0.02760803     0.02760803
        0.00294741     0.00294741     0.00024028     0.00024028     0.00000000     0.00000000     0.00000000
2013    1       9       0       0       23.00  0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
        0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000     0.00000000
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```
        0.00000000      0.00000000      0.00000000      0.00000000      0.00002651      0.00002651      0.02839681
        0.02839681      0.20512511      0.20512511      0.17157365      0.17157365      0.07299605      0.07299605
        0.02026224      0.02026224      0.00161961      0.00161961      0.00000000      0.00000000      0.00000000
2014    1       9       0       0       7.00    0.00204979      0.00204979      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000369
        0.00000369      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00903077      0.00903077      0.15522242      0.15522242      0.26099332      0.26099332
        0.06138772      0.06138772      0.01131228      0.01131228      0.00000000      0.00000000      0.00000000
2015    1       -9      0       0       17.00   0.40403690      0.40403690      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000380      0.00000380      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00187125      0.00187125      0.00561487
        0.00561487      0.00192622      0.00192622      0.00374361      0.00374361      0.02701399      0.02701399
        0.04906669      0.04906669      0.00666849      0.00666849      0.00005418      0.00005418      0.00000000
#
10 # N_age bins

0 1 2 3 4 5 6 7 8 11

6  # N_ageerror definitions

#

0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5     10.5    11.5    12.5    13.5    14.5
        15.5    #_1_CA_1981-06
0.2832  0.2832  0.289   0.8009  0.8038  0.9597  1.1156  1.2715  1.4274  1.5833  1.7392  1.8951  2.051   2.2069  2.3627
        2.5186  #_1_CA_1981-06
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5     10.5    11.5    12.5    13.5    14.5
        15.5    #_2_CA_2007
0.2539  0.2539  0.3434  0.9205  0.9653  1.1743  1.3832  1.5922  1.8011  2.0101  2.219   2.428   2.6369  2.8459  3.0548
        3.2638  #_2_CA_2007
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5     10.5    11.5    12.5    13.5    14.5
        15.5    #_3_CA_2008-09
0.4032  0.4032  0.4995  0.58    0.6902  0.8246  0.9727  1.0165  1.1144  1.2123  1.3102  1.4082  1.5061  1.604   1.702
        1.7999  #_3_CA_2008-09
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5     10.5    11.5    12.5    13.5    14.5
        15.5    #_4_CA_2010-13
0.2825  0.2825  0.2955  0.3125  0.3347  0.3637  0.4017  0.4046  0.4245  0.4445  0.4645  0.4844  0.5044  0.5243  0.5443
        0.5643  #_4_CA_2010-13
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5     10.5    11.5    12.5    13.5    14.5
        15.5    #_5_ORWA_all
0.26655 0.30145 0.3149  0.3615  0.3847  0.3961  0.4018  0.4047  0.4061  0.4352  0.4487  0.4622  0.4756  0.4891  0.5026
        0.516   #_5_ORWA_all
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5     10.5    11.5    12.5    13.5    14.5
        15.5    #_6_CalCOFI_C
0.5386  0.5386  0.7547  0.8341  0.8634  0.8741  0.8781  0.8796  0.8801  0.8801  0.8801  0.8801  0.8801  0.8801  0.8801
        0.8801  #_6_CalCOFI_C
#
860 # N_age composition obs
3 # Length bin method: 1=poplenbins, 2=datalenbins, 3=lengths
-1 # Combine males into females at or below this bin number
# Year Season Fleet/Survey Gender Part Ageerr Lbin_lo Lbin_hi Nsamp datavector(female-male)
1993    1       1       0       0       1       16.0    16.5    0.04    0.00000000      0.00000000      0.00000000
        1.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1993    1       1       0       0       1       17.0    17.5    0.40    0.00000000      0.00000000      0.40000000
        0.60000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1993    1       1       0       0       1       18.0    18.5    1.16    0.00000000      0.00000000      0.13793103
        0.79310345      0.06896552      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1993    1       1       0       0       1       19.0    19.5    0.92    0.00000000      0.00000000      0.00000000
        0.73913043      0.21739130      0.04347826      0.00000000      0.00000000      0.00000000      0.00000000
1993    1       1       0       0       1       20.0    20.5    0.20    0.00000000      0.00000000      0.00000000
        1.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       1       15.0    15.5    0.64    0.06555503      0.80333490      0.13111007
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       1       16.0    16.5    1.56    0.02720121      0.82987390      0.14292490
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       1       17.0    17.5    3.92    0.01800542      0.66544962      0.23382015
        0.06471939      0.01800542      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       1       18.0    18.5    3.20    0.02584465      0.24477748      0.51450358
        0.21051706      0.00435722      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       1       19.0    19.5    2.04    0.00651038      0.05119051      0.39133174
        0.44858636      0.10238102      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
1994    1       1       0       0       1       20.0    20.5    0.28    0.00000000      0.00000000      0.37554250
        0.37554250      0.24891501      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
```

1994	1	1	0	0	1	21.0	21.5	0.08	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1994	1	1	0	0	1	22.0	22.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	12.0	12.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	13.0	13.5	0.08	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	14.0	14.5	0.44	0.63636364	0.27272727	0.09090909
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	15.0	15.5	0.64	0.18750000	0.43750000	0.31250000
	0.06250000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	16.0	16.5	1.64	0.04878049	0.73170732	0.19512195
	0.02439024		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	17.0	17.5	1.44	0.02777778	0.63888889	0.30555556
	0.02777778		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	18.0	18.5	0.40	0.00000000	0.20000000	0.40000000
	0.40000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1995	1	1	0	0	1	19.0	19.5	0.08	0.00000000	0.00000000	0.50000000
	0.50000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	14.0	14.5	0.12	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	15.0	15.5	1.28	0.00000000	0.44897248	0.55102752
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	16.0	16.5	6.24	0.00000000	0.20902801	0.75030358
	0.04066841		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	17.0	17.5	14.96	0.00000000	0.10419308	0.69554700
	0.18400205		0.01500520		0.00125267		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	18.0	18.5	28.44	0.00000000	0.04005148	0.64987230
	0.28378437		0.02424253		0.00204932		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	19.0	19.5	26.68	0.00000000	0.01621994	0.50808503
	0.42049373		0.05031671		0.00488459		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	20.0	20.5	9.92	0.00000000	0.01435739	0.40880868
	0.48247061		0.07970037		0.01466295		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	21.0	21.5	1.40	0.00000000	0.00000000	0.23003121
	0.45723664		0.31273215		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	22.0	22.5	0.08	0.00000000	0.00000000	0.50000000
	0.50000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.50000000		0.50000000		0.00000000		0.00000000	0.00000000	0.00000000
1996	1	1	0	0	1	26.0	26.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		1.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	9.0	9.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	11.0	11.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	12.0	12.5	0.16	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	13.0	13.5	0.72	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	14.0	14.5	4.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	15.0	15.5	4.56	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	16.0	16.5	7.36	0.00000000	0.92361566	0.07638434
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	17.0	17.5	13.84	0.00000000	0.56076615	0.43632757
	0.00290628		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	18.0	18.5	15.36	0.00000000	0.20645551	0.74805856
	0.04548592		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	19.0	19.5	6.88	0.00934460	0.04764680	0.63951375
	0.30349485		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	20.0	20.5	1.44	0.00000000	0.00000000	0.31385049
	0.54512566		0.14102386		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	21.0	21.5	0.24	0.00000000	0.00000000	0.29289001
	0.41776573		0.12842148		0.16092278		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	22.0	22.5	0.16	0.00000000	0.00000000	0.00000000
	0.37760183		0.41493211		0.20746606		0.00000000		0.00000000	0.00000000	0.00000000
1997	1	1	0	0	1	23.0	23.5	0.08	0.00000000	0.00000000	0.00000000
	0.30435611		0.69564389		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	9.0	9.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

1998	1	1	0	0	1	10.0	10.5	0.08	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	11.0	11.5	0.72	0.77179412	0.22820588	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	12.0	12.5	4.56	0.52354126	0.47645874	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	13.0	13.5	14.04	0.12472173	0.83932736	0.03595091	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	14.0	14.5	19.88	0.00755918	0.95562857	0.03681224	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	15.0	15.5	15.92	0.00189458	0.81696133	0.18114409	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	16.0	16.5	7.84	0.00000000	0.51773405	0.48226595	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	17.0	17.5	5.72	0.00000000	0.12190583	0.84714166	0.03095251	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	18.0	18.5	3.20	0.00000000	0.00000000	0.75348715	0.19827166	0.04824119	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	19.0	19.5	1.28	0.00000000	0.00000000	0.48477799	0.31566788	0.19955413	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	20.0	20.5	0.88	0.00000000	0.00000000	0.02174408	0.33200944	0.52769706	0.11854942	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	21.0	21.5	0.64	0.00000000	0.00000000	0.00000000	0.39164730	0.47995442	0.12839828	0.00000000	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	22.0	22.5	0.24	0.00000000	0.00000000	0.00000000	0.00000000	0.66666667	0.16666667	0.16666667	0.00000000	0.00000000	0.00000000
1998	1	1	0	0	1	23.0	23.5	0.28	0.00000000	0.00000000	0.00000000	0.28571429	0.28571429	0.42857143	0.00000000	0.00000000	0.00000000	0.00000000
1999	1	1	0	0	1	12.0	12.5	0.08	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	1	1	0	0	1	13.0	13.5	0.68	0.76470588	0.17647059	0.05882353	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	1	1	0	0	1	14.0	14.5	1.88	0.12765957	0.70212766	0.17021277	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	1	1	0	0	1	15.0	15.5	3.24	0.00000000	0.54320988	0.45679012	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	1	1	0	0	1	16.0	16.5	0.84	0.00000000	0.42857143	0.57142857	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	1	1	0	0	1	17.0	17.5	0.24	0.00000000	0.16666667	0.66666667	0.16666667	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	12.0	12.5	0.24	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	13.0	13.5	0.20	0.77547183	0.22452817	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	14.0	14.5	0.76	0.73513244	0.05947023	0.20539733	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	15.0	15.5	2.48	0.04184241	0.34985918	0.38220788	0.22609053	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	16.0	16.5	7.32	0.00789018	0.23451758	0.50324882	0.24287279	0.01147062	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	17.0	17.5	8.52	0.00000000	0.22372714	0.52623066	0.23738678	0.01265541	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	18.0	18.5	2.52	0.00000000	0.10780866	0.49898474	0.35130144	0.04190515	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	19.0	19.5	0.28	0.00000000	0.00000000	0.57142857	0.42857143	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	20.0	20.5	0.20	0.00000000	0.00000000	0.64477748	0.35522252	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	21.0	21.5	0.08	0.00000000	0.00000000	0.00000000	0.00000000	0.50000000	0.50000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1	1	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	9.0	9.5	0.28	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	10.0	10.5	2.00	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	11.0	11.5	3.44	0.98962726	0.01037274	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	12.0	12.5	1.52	0.95694052	0.04305948	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	13.0	13.5	1.12	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	14.0	14.5	0.12	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000

2001	1	1	0	0	1	15.0	15.5	0.72	0.00000000	0.94144234	0.05855766
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	16.0	16.5	2.52	0.00000000	0.93072865	0.04908709
	0.01009213		0.01009213		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	17.0	17.5	4.32	0.00000000	0.65761214	0.28043072
	0.04490983		0.01704730		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	18.0	18.5	3.48	0.00000000	0.52059262	0.35201836
	0.11348088		0.01390813		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	19.0	19.5	1.32	0.00000000	0.09566902	0.28511142
	0.57373618		0.04548338		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	20.0	20.5	2.20	0.00000000	0.08098452	0.09414834
	0.69451401		0.11021743		0.02013571		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	21.0	21.5	6.68	0.00000000	0.01097761	0.04893767
	0.69266867		0.21654653		0.03086952		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	22.0	22.5	4.56	0.00000000	0.01013073	0.06708930
	0.56915583		0.26557073		0.06115037		0.01677232		0.01013073	0.00000000	0.00000000
2001	1	1	0	0	1	23.0	23.5	1.80	0.00000000	0.00000000	0.02801048
	0.19328092		0.36134382		0.26859609		0.12075821		0.02801048	0.00000000	0.00000000
2001	1	1	0	0	1	24.0	24.5	0.96	0.00000000	0.00000000	0.00000000
	0.08790503		0.40295158		0.47433427		0.03480912		0.00000000	0.00000000	0.00000000
2001	1	1	0	0	1	25.0	25.5	0.20	0.00000000	0.00000000	0.00000000
	0.00000000		0.15206736		0.46391019		0.15206736		0.23195510	0.00000000	0.00000000
2002	1	1	0	0	1	11.0	11.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	13.0	13.5	0.64	0.34819315	0.65180685	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	14.0	14.5	2.16	0.19080057	0.74295168	0.06624776
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	15.0	15.5	6.08	0.18228648	0.74492089	0.07279263
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	16.0	16.5	8.64	0.26111752	0.60128336	0.11432186
	0.02327725		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	17.0	17.5	7.48	0.12851185	0.43163453	0.41302223
	0.02683138		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	18.0	18.5	3.24	0.10308813	0.30784160	0.40739980
	0.16097894		0.02069153		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	19.0	19.5	1.12	0.00000000	0.22094657	0.54446895
	0.10340392		0.13118056		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	20.0	20.5	0.44	0.00000000	0.24521992	0.42641430
	0.16884672		0.15951906		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	21.0	21.5	0.20	0.00000000	0.41949119	0.11978151
	0.29970968		0.16101762		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	22.0	22.5	0.24	0.00000000	0.00000000	0.10316942
	0.13868663		0.61945732		0.13868663		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	1	0	0	1	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	9.0	9.5	0.08	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	10.0	10.5	0.84	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	11.0	11.5	3.72	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	12.0	12.5	2.52	0.98245740	0.01754260	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	13.0	13.5	1.24	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	14.0	14.5	0.44	0.48294759	0.51705241	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	15.0	15.5	0.52	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	16.0	16.5	1.52	0.00000000	0.88536046	0.11463954
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	17.0	17.5	3.36	0.00000000	0.54652359	0.45347641
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	18.0	18.5	2.40	0.00000000	0.31560192	0.66200264
	0.02239544		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	19.0	19.5	0.72	0.00000000	0.00000000	0.97348824
	0.02651176		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	20.0	20.5	0.36	0.00000000	0.09488687	0.28466061
	0.43351017		0.18694235		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	1	0	0	1	21.0	21.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	10.0	10.5	0.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

2004	1	1	0	0	1	11.0	11.5	0.12	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	12.0	12.5	0.32	0.26982236	0.73017764	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	13.0	13.5	0.60	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	14.0	14.5	6.08	0.00188560	0.99391267	0.00420173	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	15.0	15.5	13.64	0.00000000	0.97925637	0.01732336	0.00000000	0.00342027	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	16.0	16.5	8.20	0.00505216	0.86811527	0.11755742	0.00927515	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	17.0	17.5	3.32	0.00000000	0.85656519	0.11887042	0.00558631	0.01897807	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	18.0	18.5	0.76	0.00000000	0.39684213	0.49701007	0.00000000	0.10614780	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	19.0	19.5	0.28	0.00000000	0.38960446	0.25214348	0.35825205	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	20.0	20.5	0.08	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	22.0	22.5	0.04	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000
2004	1	1	0	0	1	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	10.0	10.5	0.08	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	11.0	11.5	1.00	0.60000000	0.40000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	12.0	12.5	1.48	0.66372335	0.33627665	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	13.0	13.5	4.92	0.23073098	0.62970257	0.13956644	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	14.0	14.5	8.84	0.18573131	0.63240199	0.18186670	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	15.0	15.5	5.60	0.04064125	0.33093795	0.62373605	0.00468476	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	16.0	16.5	6.80	0.00000000	0.06282689	0.91934231	0.01783080	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	17.0	17.5	4.32	0.00000000	0.05576095	0.83201279	0.11222627	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	18.0	18.5	1.12	0.00000000	0.00000000	0.82757016	0.17242984	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	19.0	19.5	0.72	0.00000000	0.00000000	0.74964298	0.22394597	0.02641105	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	20.0	20.5	0.08	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	21.0	21.5	0.04	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	22.0	22.5	0.08	0.00000000	0.00000000	0.00000000	0.00000000	0.50000000	0.50000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2005	1	1	0	0	1	24.0	24.5	0.12	0.00000000	0.00000000	0.00000000	0.00000000	0.65509203	0.17245399	0.17245399	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	12.0	12.5	0.64	0.00969274	0.82381022	0.16649704	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	13.0	13.5	2.12	0.12950784	0.85495467	0.01553749	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	14.0	14.5	11.92	0.01372349	0.94883032	0.03744619	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	15.0	15.5	24.12	0.00827923	0.88315188	0.10720699	0.00136190	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	16.0	16.5	17.08	0.00617434	0.64052788	0.33200330	0.02129448	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	17.0	17.5	9.12	0.00634360	0.22254651	0.68627996	0.08482992	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	18.0	18.5	3.56	0.00000000	0.01820135	0.73249892	0.24929974	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	19.0	19.5	0.88	0.00000000	0.00000000	0.59828848	0.40171152	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	20.0	20.5	0.20	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2006	1	1	0	0	1	21.0	21.5	0.08	0.00000000	0.00000000	0.50000000	0.50000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000

2006	1	1	0	0	1	22.0	22.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	10.0	10.5	0.08	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	11.0	11.5	0.56	0.85714286	0.14285714	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	12.0	12.5	0.80	0.87626801	0.12373199	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	13.0	13.5	2.68	0.40483739	0.55358268	0.04157993
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	14.0	14.5	5.68	0.01803592	0.75380995	0.20726697
	0.02088716		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	15.0	15.5	14.56	0.00387012	0.34648381	0.62501079
	0.02463528		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	16.0	16.5	28.80	0.00028385	0.09330496	0.77807930
	0.12710868		0.00122320		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	17.0	17.5	23.16	0.00281026	0.04058452	0.66877144
	0.26920715		0.01862662		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	18.0	18.5	7.36	0.00000000	0.01236885	0.59949472
	0.35606275		0.03207368		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	19.0	19.5	1.84	0.00000000	0.00000000	0.18710923
	0.78336207		0.02952870		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	20.0	20.5	0.40	0.00000000	0.00000000	0.24239178
	0.66239470		0.09521352		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	21.0	21.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	1	0	0	2	22.0	22.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	12.0	12.5	0.56	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	13.0	13.5	0.52	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	14.0	14.5	0.12	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	15.0	15.5	1.60	0.00000000	0.72257965	0.27742035
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	16.0	16.5	10.08	0.01437160	0.40213365	0.57334683
	0.01014792		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	17.0	17.5	10.40	0.01495756	0.20893843	0.71709879
	0.05900522		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	18.0	18.5	5.12	0.01158259	0.19549447	0.70461698
	0.08830597		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	19.0	19.5	1.36	0.00000000	0.19981464	0.49211465
	0.25835350		0.04971721		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	20.0	20.5	0.60	0.00000000	0.00000000	0.21969054
	0.58469349		0.19561597		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	21.0	21.5	0.36	0.00000000	0.00000000	0.11111111
	0.55555556		0.33333333		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	22.0	22.5	0.08	0.00000000	0.00000000	0.19646010
	0.00000000		0.80353990		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	1	0	0	3	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	1	0	0	3	14.0	14.5	0.56	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	1	0	0	3	15.0	15.5	1.08	0.05215629	0.84353112	0.10431259
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	1	0	0	3	16.0	16.5	4.44	0.00000000	0.47928776	0.50836509
	0.01234715		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	1	0	0	3	17.0	17.5	12.64	0.00296329	0.13276991	0.72454418
	0.12490618		0.01481644		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	1	0	0	3	18.0	18.5	4.00	0.00000000	0.02948402	0.60770512
	0.33461294		0.02819793		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	1	0	0	3	19.0	19.5	0.16	0.00000000	0.00000000	0.25073428
	0.74926572		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	1	0	0	4	13.0	13.5	0.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	1	0	0	4	14.0	14.5	0.28	0.14285714	0.85714286	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	1	0	0	4	15.0	15.5	5.28	0.01515152	0.86363636	0.12121212
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	1	0	0	4	16.0	16.5	6.36	0.01257862	0.77358491	0.19496855
	0.01886792		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	1	0	0	4	17.0	17.5	0.52	0.00000000	0.53846154	0.38461538
	0.07692308		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

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2010    1       1       0       0       4       18.0    18.5    0.08    0.00000000      0.00000000      0.50000000
        0.50000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2010    1       1       0       0       4       19.0    19.5    0.12    0.00000000      0.00000000      0.00000000
        1.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2011    1       1       0       0       4       15.0    15.5    0.08    0.00000000      1.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2011    1       1       0       0       4       16.0    16.5    1.96    0.00000000      0.55600263      0.32620509
        0.11779228      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2011    1       1       0       0       4       17.0    17.5    12.36   0.00000000      0.33958915      0.50120495
        0.15920590      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2011    1       1       0       0       4       18.0    18.5    6.60    0.00000000      0.12877487      0.50542429
        0.35157075      0.01423009      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2011    1       1       0       0       4       19.0    19.5    0.60    0.00000000      0.00000000      0.33656921
        0.62603421      0.03739658      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2011    1       1       0       0       4       21.0    21.5    0.04    0.00000000      0.00000000      0.00000000
        0.00000000      1.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       14.0    14.5    0.48    0.08333333      0.91666667      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       15.0    15.5    0.48    0.00000000      0.83333333      0.16666667
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       16.0    16.5    0.16    0.00000000      0.50000000      0.50000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       17.0    17.5    1.76    0.00000000      0.12388536      0.70653509
        0.16957955      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       18.0    18.5    5.92    0.00000000      0.03878870      0.67166629
        0.27666426      0.01288075      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       19.0    19.5    6.60    0.00000000      0.00093824      0.53772555
        0.44589212      0.01544409      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       20.0    20.5    4.92    0.00000000      0.00000000      0.20675044
        0.59305156      0.16229851      0.03789949      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       21.0    21.5    1.80    0.00000000      0.00000000      0.02764022
        0.66790505      0.22153409      0.00000000      0.08292065      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       22.0    22.5    0.16    0.00000000      0.00000000      0.00000000
        0.00000000      0.55727171      0.44272829      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       1       0       0       4       23.0    23.5    0.04    0.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      1.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       10.0    10.5    0.12    1.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       11.0    11.5    0.28    1.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       12.0    12.5    0.44    0.45454545      0.54545455      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       13.0    13.5    0.16    0.00000000      1.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       14.0    14.5    0.04    0.00000000      1.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       17.0    17.5    0.16    0.00000000      0.00000000      1.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       18.0    18.5    0.64    0.00000000      0.30945925      0.48776178
        0.17381055      0.02896842      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       19.0    19.5    1.68    0.00000000      0.09006056      0.46271615
        0.35716273      0.09006056      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       20.0    20.5    1.88    0.00000000      0.00000000      0.38344689
        0.48487969      0.13167342      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       21.0    21.5    6.40    0.00000000      0.00000000      0.29955967
        0.33181888      0.36495182      0.00366964      0.00000000      0.00000000      0.00000000      0.00000000
2013    1       1       0       0       4       22.0    22.5    3.52    0.00000000      0.00000000      0.04129804
        0.13019542      0.58965328      0.12556413      0.07552609      0.00000000      0.03776305      0.00000000
2013    1       1       0       0       4       23.0    23.5    0.52    0.00000000      0.00000000      0.00000000
        0.16432241      0.34271035      0.32864483      0.01406552      0.15025689      0.00000000      0.00000000
2014    1       1       0       0       4       11.0    11.5    0.08    1.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2014    1       1       0       0       4       13.0    13.5    0.32    1.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2014    1       1       0       0       4       14.0    14.5    0.48    0.91666667      0.08333333      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2014    1       1       0       0       4       15.0    15.5    0.04    1.00000000      0.00000000      0.00000000
        0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2014    1       1       0       0       4       21.0    21.5    0.24    0.00000000      0.00000000      0.00000000
        0.16666667      0.16666667      0.50000000      0.16666667      0.00000000      0.00000000      0.00000000
2014    1       1       0       0       4       22.0    22.5    2.68    0.00000000      0.00000000      0.00000848
        0.09090832      0.51514715      0.31817912      0.07575693      0.00000000      0.00000000      0.00000000
2014    1       1       0       0       4       23.0    23.5    1.96    0.00000000      0.00000000      0.00000000
        0.06122449      0.61224490      0.20408163      0.10204082      0.02040816      0.00000000      0.00000000
```

2014	1	1	0	0	4	24.0	24.5	0.12	0.00000000	0.00000000	0.00000000
	0.00000000	0.33333333	0.33333333	0.00000000	0.33333333	0.00000000	0.00000000				
1993	2	2	0	0	1	13.0	13.5	0.20	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	14.0	14.5	1.36	0.97070472	0.02929528	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	15.0	15.5	2.12	0.87662406	0.12337594	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	16.0	16.5	5.36	0.38724536	0.51316166	0.09959298
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	17.0	17.5	9.44	0.07213542	0.61158283	0.29388355
	0.01953423	0.00286397	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	18.0	18.5	6.28	0.01233362	0.40889523	0.55275049
	0.02602066	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	19.0	19.5	2.64	0.00000000	0.10547058	0.68579430
	0.14425622	0.02149297	0.02149297	0.02149297	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	20.0	20.5	1.04	0.00000000	0.06147662	0.42885278
	0.41036671	0.05459334	0.04471056	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	21.0	21.5	0.56	0.00000000	0.00000000	0.24819545
	0.54255200	0.20925255	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	22.0	22.5	0.52	0.00000000	0.00000000	0.19223104
	0.33136029	0.26109730	0.07177046	0.14354091	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	23.0	23.5	0.52	0.00000000	0.00000000	0.12733396
	0.27876739	0.42428329	0.16961536	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	24.0	24.5	0.16	0.00000000	0.00000000	0.00000000
	0.40563177	0.59436823	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	25.0	25.5	0.20	0.00000000	0.00000000	0.00000000
	0.26700525	0.00000000	0.46598950	0.26700525	0.00000000	0.00000000	0.00000000				
1993	2	2	0	0	1	26.0	26.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	11.0	11.5	0.72	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	12.0	12.5	1.88	0.98302973	0.01697027	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	13.0	13.5	6.64	0.86880561	0.12761125	0.00358315
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	14.0	14.5	15.00	0.87264589	0.12512599	0.00222812
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	15.0	15.5	23.80	0.64265504	0.33692582	0.01875050
	0.00166863	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	16.0	16.5	31.56	0.23602009	0.70894433	0.04969618
	0.00367082	0.00000000	0.00166858	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	17.0	17.5	23.40	0.08662464	0.67844162	0.16526082
	0.06184184	0.00783109	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	18.0	18.5	11.84	0.04546867	0.40515272	0.33567341
	0.19105666	0.02083700	0.00181155	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	19.0	19.5	4.60	0.01420067	0.14104731	0.44919582
	0.32473849	0.06329571	0.00752201	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	20.0	20.5	1.08	0.00000000	0.11300204	0.44817926
	0.43881870	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	21.0	21.5	0.36	0.00000000	0.16665558	0.23680924
	0.41616224	0.07015366	0.00000000	0.11021929	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1994	2	2	0	0	1	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	12.0	12.5	0.44	0.71231509	0.28768491	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	13.0	13.5	2.68	0.59996788	0.37064073	0.02939139
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	14.0	14.5	4.80	0.73717939	0.24782276	0.01499785
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	15.0	15.5	10.08	0.50967566	0.31351836	0.17303392
	0.00377205	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	16.0	16.5	16.44	0.23707804	0.48564470	0.25976314
	0.01751411	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	17.0	17.5	14.76	0.04581167	0.53108806	0.39150329
	0.03044360	0.00000000	0.00115339	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	18.0	18.5	7.20	0.01242179	0.52624193	0.41951324
	0.04182304	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	19.0	19.5	1.76	0.00000000	0.46335195	0.48609034
	0.03570396	0.01485375	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	20.0	20.5	0.32	0.00000000	0.08174470	0.66468272
	0.00000000	0.25357259	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				

1995	2	2	0	0	1	21.0	21.5	0.24	0.00000000	0.00000000	0.29285599
	0.51848817	0.18865585	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	22.0	22.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1995	2	2	0	0	1	25.0	25.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	10.0	10.5	0.40	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	11.0	11.5	0.60	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	12.0	12.5	1.60	0.80975028	0.16683245	0.02341728
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	13.0	13.5	5.96	0.73478866	0.24312398	0.02208736
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	14.0	14.5	8.12	0.46518847	0.51089433	0.02391719
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	15.0	15.5	6.24	0.41849666	0.54255775	0.03894559
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	16.0	16.5	3.76	0.08756362	0.56516625	0.31965063
	0.02761951	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	17.0	17.5	5.36	0.00000000	0.50925012	0.41255772
	0.07819215	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	18.0	18.5	5.60	0.00000000	0.18027972	0.73786000
	0.08186028	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	19.0	19.5	5.56	0.00797248	0.09130891	0.65341448
	0.21119852	0.00797248	0.02813313	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	20.0	20.5	1.88	0.00000000	0.04190018	0.78996467
	0.14355012	0.00000000	0.02458503	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	21.0	21.5	0.56	0.00000000	0.06665516	0.66672422
	0.19996547	0.06665516	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	22.0	22.5	0.24	0.00000000	0.20026673	0.31989331
	0.31989331	0.15994665	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1996	2	2	0	0	1	25.0	25.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	9.0	9.5	0.08	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	10.0	10.5	0.88	0.95240426	0.04759574	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	11.0	11.5	1.40	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	12.0	12.5	1.08	0.91020233	0.08979767	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	13.0	13.5	2.48	0.76619269	0.23380731	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	14.0	14.5	2.80	0.51770442	0.46377638	0.01851919
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	15.0	15.5	4.40	0.11696030	0.83583819	0.04620143
	0.00100008	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	16.0	16.5	5.40	0.00086050	0.87069252	0.12844699
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	17.0	17.5	4.48	0.02019942	0.75406485	0.19363098
	0.02872855	0.00337619	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	18.0	18.5	3.88	0.05477172	0.47661077	0.43935640
	0.02926111	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	19.0	19.5	3.48	0.02384269	0.09743413	0.41598185
	0.33822133	0.11611399	0.00840601	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	20.0	20.5	6.56	0.00000000	0.01314396	0.37161014
	0.43608829	0.17341751	0.00574010	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	21.0	21.5	6.20	0.00000000	0.01452790	0.19985641
	0.56258895	0.18587032	0.03715641	0.00000000	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	22.0	22.5	3.36	0.00000000	0.02844437	0.22226700
	0.42427703	0.23657884	0.05998839	0.02844437	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	23.0	23.5	0.80	0.00000000	0.00000000	0.00000000
	0.29555010	0.55667486	0.02630317	0.12147188	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	24.0	24.5	0.12	0.00000000	0.00000000	0.00000000
	0.00000000	0.89581040	0.00000000	0.10418960	0.00000000	0.00000000	0.00000000				
1997	2	2	0	0	1	25.0	25.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000				
1998	2	2	0	0	1	9.0	9.5	0.08	1.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				
1998	2	2	0	0	1	10.0	10.5	1.00	0.93302808	0.06697192	0.00000000
	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000				

1998	2	2	0	0	1	11.0	11.5	2.76	0.93937164	0.06062836	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	12.0	12.5	7.20	0.70798306	0.27701796	0.01499898	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	13.0	13.5	11.32	0.45328775	0.48748534	0.05922691	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	14.0	14.5	14.92	0.25039999	0.70896504	0.04063497	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	15.0	15.5	12.56	0.10807270	0.74316709	0.14876021	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	16.0	16.5	8.56	0.03179538	0.53952165	0.41540227	0.01328071	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	17.0	17.5	6.92	0.02123072	0.29925113	0.67254621	0.00697193	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	18.0	18.5	3.08	0.03216085	0.18604913	0.69226176	0.08952826	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	19.0	19.5	2.56	0.01770014	0.15680268	0.53573909	0.21011342	0.06194454	0.01770014	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	20.0	20.5	0.76	0.00000000	0.12209916	0.12209916	0.55328948	0.15824033	0.04427187	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	21.0	21.5	0.56	0.00000000	0.18419311	0.00000000	0.32230705	0.36957328	0.12392657	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	22.0	22.5	0.12	0.00000000	0.34126400	0.31747200	0.00000000	0.34126400	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1998	2	2	0	0	1	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	12.0	12.5	0.20	0.40000000	0.60000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	13.0	13.5	4.96	0.32014309	0.59185826	0.07961241	0.00838624	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	14.0	14.5	14.76	0.38169092	0.53787963	0.05824497	0.01109225	0.00792438	0.00316786	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	15.0	15.5	20.56	0.29216020	0.50155986	0.18149188	0.01622977	0.00855830	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	16.0	16.5	11.52	0.09831156	0.50838282	0.36209246	0.02387339	0.00733978	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	17.0	17.5	2.32	0.01043611	0.49352601	0.39132747	0.09949235	0.00521806	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	18.0	18.5	0.76	0.00000000	0.26746419	0.71685887	0.01567694	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	19.0	19.5	0.16	0.00000000	0.07997843	0.92002157	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1999	2	2	0	0	1	20.0	20.5	0.08	0.00000000	0.00000000	0.75037064	0.00000000	0.00000000	0.00000000	0.24962936	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	11.0	11.5	0.72	0.74752075	0.25247925	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	12.0	12.5	2.28	0.69582437	0.27982735	0.00000000	0.02434828	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	13.0	13.5	5.76	0.54811614	0.38124029	0.06174778	0.00889578	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	14.0	14.5	11.24	0.40848094	0.55352931	0.03355320	0.00443655	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	15.0	15.5	9.52	0.42979540	0.45185267	0.10229483	0.01605710	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	16.0	16.5	5.08	0.01642085	0.19905252	0.60775348	0.13866829	0.03810485	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	17.0	17.5	7.80	0.00000000	0.27828201	0.59017585	0.11411492	0.01742722	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	18.0	18.5	4.36	0.00000000	0.28601716	0.57222152	0.11953874	0.02222258	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	19.0	19.5	0.92	0.00000000	0.14449116	0.48172259	0.31375949	0.06002676	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	20.0	20.5	0.24	0.00000000	0.00000000	0.08261869	0.91738131	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	2	2	0	0	1	22.0	22.5	0.12	0.00000000	0.00000000	0.00000000	0.91738131	0.00000000	0.00000000	0.00000000	0.08261869	0.00000000	0.00000000
2001	2	2	0	0	1	10.0	10.5	2.00	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	11.0	11.5	7.60	0.97427376	0.02572624	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	12.0	12.5	14.40	0.92240780	0.07443303	0.00000000	0.00315917	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000

2001	2	2	0	0	1	13.0	13.5	16.48	0.90627331	0.08890553	0.00482116
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	14.0	14.5	10.28	0.70552085	0.25611000	0.03357300
	0.00479614		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	15.0	15.5	8.20	0.39784787	0.47685263	0.12242888
	0.00287063		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	16.0	16.5	3.28	0.13467477	0.63572470	0.22298713
	0.00661341		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	17.0	17.5	2.72	0.01132070	0.51465616	0.37410852
	0.07508872		0.02482590		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	18.0	18.5	2.96	0.00000000	0.29324400	0.54354648
	0.13118093		0.03202859		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	19.0	19.5	1.24	0.00000000	0.09918852	0.59034994
	0.31046154		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	20.0	20.5	1.24	0.00000000	0.00000000	0.51528889
	0.37935414		0.07775853		0.02759844		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	21.0	21.5	0.52	0.00000000	0.00000000	0.09031628
	0.63873488		0.09031628		0.18063256		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	22.0	22.5	0.08	0.00000000	0.00000000	0.00000000
	0.50000000		0.50000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	2	2	0	0	1	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	10.0	10.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	11.0	11.5	0.32	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	12.0	12.5	0.60	0.94090193	0.05909807	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	13.0	13.5	1.16	0.88345627	0.11654373	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	14.0	14.5	2.88	0.48918927	0.44747715	0.06333357
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	15.0	15.5	13.12	0.31065759	0.63716391	0.04841090
	0.00376759		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	16.0	16.5	23.64	0.16463876	0.70856009	0.12022830
	0.00632938		0.00000000		0.00000000		0.00000000		0.00000000	0.00024347	0.00000000
2002	2	2	0	0	1	17.0	17.5	21.24	0.11234893	0.62532418	0.22200514
	0.03331450		0.00700723		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	18.0	18.5	6.84	0.05496442	0.48012677	0.34689512
	0.10915720		0.00885649		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	19.0	19.5	3.96	0.00000000	0.21147060	0.47842753
	0.26219346		0.04790841		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	20.0	20.5	1.80	0.00000000	0.03922441	0.48545390
	0.36552610		0.10979558		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	21.0	21.5	0.40	0.00000000	0.00000000	0.49698361
	0.18994586		0.17934508		0.13372545		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	22.0	22.5	0.24	0.00000000	0.00000000	0.00000000
	0.27921688		0.22613844		0.49464468		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	23.0	23.5	0.20	0.00000000	0.00000000	0.00000000
	0.05517708		0.05517708		0.88964584		0.00000000		0.00000000	0.00000000	0.00000000
2002	2	2	0	0	1	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		1.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	10.0	10.5	0.52	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	11.0	11.5	7.40	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	12.0	12.5	11.16	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	13.0	13.5	26.04	0.99216013	0.00783987	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	14.0	14.5	15.40	0.97074099	0.02925901	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	15.0	15.5	3.96	0.76533365	0.21262370	0.02204265
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	16.0	16.5	1.24	0.08207484	0.51377819	0.40414697
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	17.0	17.5	1.24	0.03396623	0.34689388	0.57761967
	0.04152022		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	18.0	18.5	2.64	0.00000000	0.00000000	0.74075755
	0.23570895		0.02353350		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	19.0	19.5	2.20	0.00000000	0.05383938	0.46209001
	0.42658630		0.04311323		0.01437108		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	20.0	20.5	0.64	0.00000000	0.00000000	0.28011714
	0.46931240		0.19601734		0.05455312		0.00000000		0.00000000	0.00000000	0.00000000

2003	2	2	0	0	1	21.0	21.5	0.64	0.06615850	0.00000000	0.18886008
	0.42216843		0.27713679		0.04567620		0.00000000		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	22.0	22.5	0.60	0.00000000	0.00000000	0.00000000
	0.25966959		0.36244571		0.31296731		0.06491740		0.00000000	0.00000000	0.00000000
2003	2	2	0	0	1	23.0	23.5	0.52	0.00000000	0.00000000	0.00000000
	0.00000000		0.69230769		0.07692308		0.15384615		0.07692308	0.00000000	0.00000000
2003	2	2	0	0	1	24.0	24.5	0.40	0.00000000	0.00000000	0.00000000
	0.10000000		0.30000000		0.00000000		0.50000000		0.10000000	0.00000000	0.00000000
2003	2	2	0	0	1	25.0	25.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	11.0	11.5	0.20	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	12.0	12.5	0.84	0.67276468	0.32723532	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	13.0	13.5	4.20	0.17333774	0.82666226	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	14.0	14.5	14.12	0.01354159	0.98015485	0.00630357
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	15.0	15.5	18.92	0.02407765	0.96462996	0.01129239
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	16.0	16.5	13.52	0.02694741	0.88209742	0.09095517
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	17.0	17.5	4.36	0.00662725	0.78340253	0.18912430
	0.02084592		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	18.0	18.5	1.84	0.00000000	0.22342592	0.66408266
	0.11249141		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	19.0	19.5	0.72	0.00000000	0.00000000	0.76369562
	0.23630438		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	20.0	20.5	0.16	0.00000000	0.00000000	0.62830617
	0.37169383		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	21.0	21.5	0.12	0.00000000	0.00000000	0.28697889
	0.00000000		0.71302111		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	22.0	22.5	0.12	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	2	2	0	0	1	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		1.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	9.0	9.5	0.24	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	10.0	10.5	2.72	0.94665661	0.05334339	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	11.0	11.5	10.68	0.96530636	0.03469364	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	12.0	12.5	10.36	0.81270629	0.18729371	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	13.0	13.5	17.28	0.59682376	0.38056749	0.02260874
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	14.0	14.5	17.12	0.41831331	0.53139427	0.05029242
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	15.0	15.5	14.80	0.39763833	0.44064831	0.16171335
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	16.0	16.5	6.76	0.20647100	0.39320685	0.38209007
	0.01823208		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	17.0	17.5	4.00	0.00145799	0.22876657	0.64096402
	0.10121078		0.02760064		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	18.0	18.5	2.28	0.00000000	0.13419048	0.65656358
	0.12972242		0.07952352		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	19.0	19.5	1.72	0.00000000	0.19742790	0.58505873
	0.21751337		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	20.0	20.5	0.40	0.00000000	0.15374970	0.18538703
	0.35336388		0.15374970		0.15374970		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	21.0	21.5	0.12	0.00000000	0.00000000	0.15765441
	0.84234559		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	2	2	0	0	1	23.0	23.5	0.16	0.00000000	0.00000000	0.00000000
	0.00000000		0.03208177		0.32263941		0.32263941		0.00000000	0.32263941	0.00000000
2005	2	2	0	0	1	24.0	24.5	0.32	0.00000000	0.00000000	0.16131970
	0.00000000		0.00000000		0.16131970		0.19340148		0.32263941	0.16131970	0.00000000
2005	2	2	0	0	1	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.50000000		0.50000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	10.0	10.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	11.0	11.5	0.96	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	12.0	12.5	2.88	0.99618629	0.00381371	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

2006	2	2	0	0	1	13.0	13.5	6.12	0.77428590	0.22571410	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	14.0	14.5	16.36	0.36825533	0.63118455	0.00056011
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	15.0	15.5	25.96	0.10019307	0.88164250	0.01816443
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	16.0	16.5	20.96	0.06804923	0.84951026	0.08244051
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	17.0	17.5	13.92	0.01400216	0.43528504	0.53121210
	0.01950069		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	18.0	18.5	9.92	0.00000000	0.10728396	0.77280768
	0.11990836		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	19.0	19.5	5.56	0.00000000	0.06548736	0.77827275
	0.15623989		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	20.0	20.5	2.12	0.00000000	0.01675003	0.59447114
	0.33123547		0.05754335		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	21.0	21.5	0.20	0.00000000	0.00000000	0.58224916
	0.41775084		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	22.0	22.5	0.08	0.00000000	0.00000000	0.00000000
	0.50000000		0.50000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	2	2	0	0	1	23.0	23.5	0.08	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	10.0	10.5	0.52	0.81161422	0.18838578	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	11.0	11.5	3.56	0.81748933	0.16948738	0.01302330
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	12.0	12.5	7.96	0.80789846	0.18543433	0.00666722
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	13.0	13.5	13.60	0.58443765	0.40077974	0.01478262
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	14.0	14.5	12.40	0.35239361	0.57909543	0.06851095
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	15.0	15.5	8.40	0.13962133	0.67446158	0.18591708
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	16.0	16.5	5.72	0.04265578	0.60969432	0.34455928
	0.00309062		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	17.0	17.5	4.52	0.13907978	0.44035193	0.35454781
	0.06602048		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	18.0	18.5	3.24	0.00000000	0.25882826	0.41917676
	0.32199498		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	19.0	19.5	1.72	0.13230410	0.04936132	0.24787050
	0.54753177		0.02293231		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	20.0	20.5	2.76	0.10336144	0.05906368	0.25102064
	0.48319280		0.10336144		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	21.0	21.5	2.16	0.01919929	0.09599643	0.17973905
	0.56372476		0.11519571		0.02614477		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	22.0	22.5	0.56	0.07484045	0.07484045	0.10191455
	0.44904273		0.22452136		0.07484045		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	23.0	23.5	0.16	0.00000000	0.00000000	0.00000000
	0.75000000		0.25000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	24.0	24.5	0.08	0.50000000	0.00000000	0.00000000
	0.00000000		0.50000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	2	0	0	2	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	10.0	10.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	11.0	11.5	0.84	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	12.0	12.5	2.80	0.98557929	0.01442071	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	13.0	13.5	2.80	0.85459472	0.14540528	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	14.0	14.5	1.92	0.21852994	0.75404580	0.02742427
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	15.0	15.5	7.56	0.02649326	0.84675852	0.12433842
	0.00240980		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	16.0	16.5	11.56	0.03125844	0.83304051	0.12357623
	0.01212482		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	17.0	17.5	5.56	0.01343018	0.47528389	0.49238317
	0.01890276		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	18.0	18.5	4.44	0.00380832	0.15793925	0.63661667
	0.20163576		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	19.0	19.5	1.24	0.00000000	0.22595676	0.28517288
	0.48887036		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

2008	2	2	0	0	3	20.0	20.5	0.60	0.00000000	0.09286446	0.27321611
	0.60214765		0.03177178		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	21.0	21.5	0.32	0.00000000	0.24674396	0.08441868
	0.50000000		0.16883736		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	22.0	22.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	2	2	0	0	3	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	10.0	10.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	11.0	11.5	0.40	0.83691728	0.16308272	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	12.0	12.5	5.72	0.68145305	0.30663268	0.01191427
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	13.0	13.5	22.80	0.68617830	0.30180153	0.01202017
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	14.0	14.5	31.00	0.50072394	0.41119099	0.08808506
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	15.0	15.5	24.56	0.24486876	0.58373796	0.17103486
	0.00035843		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	16.0	16.5	10.52	0.06872480	0.66651811	0.25241790
	0.01233919		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	17.0	17.5	2.20	0.01588792	0.50372935	0.45454300
	0.02583974		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	18.0	18.5	0.48	0.00000000	0.15610386	0.64984043
	0.19405571		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	19.0	19.5	0.16	0.00000000	0.00000000	0.35660263
	0.05284122		0.59055614		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	20.0	20.5	0.12	0.00000000	0.00000000	0.47296513
	0.42445713		0.10257774		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	21.0	21.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		1.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	2	0	0	3	22.0	22.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	10.0	10.5	0.04	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	11.0	11.5	0.08	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	12.0	12.5	1.36	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	13.0	13.5	4.12	0.97937873	0.02062127	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	14.0	14.5	7.52	0.67153245	0.32846755	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	15.0	15.5	6.28	0.34882731	0.65117269	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	16.0	16.5	1.80	0.07426376	0.88304453	0.04269171
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	17.0	17.5	0.64	0.00000000	0.66556773	0.24839031
	0.08604197		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	18.0	18.5	0.48	0.00000000	0.36659141	0.51582438
	0.11758421		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	19.0	19.5	0.28	0.00000000	0.14661550	0.14661550
	0.41353799		0.14661550		0.14661550		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	20.0	20.5	1.40	0.00000000	0.00000000	0.08571429
	0.37142857		0.42857143		0.08571429		0.02857143		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	21.0	21.5	3.60	0.00000000	0.00000000	0.03333333
	0.15555556		0.40000000		0.40000000		0.01111111		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	22.0	22.5	2.72	0.00000000	0.00000000	0.00000000
	0.04411765		0.33823529		0.58823529		0.02941176		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	23.0	23.5	0.92	0.00000000	0.00000000	0.00000000
	0.00000000		0.08695652		0.65217391		0.21739130		0.00000000	0.04347826	0.00000000
2010	2	2	0	0	4	24.0	24.5	0.12	0.00000000	0.00000000	0.00000000
	0.33333333		0.00000000		0.00000000		0.66666667		0.00000000	0.00000000	0.00000000
2010	2	2	0	0	4	25.0	25.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		1.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	11.0	11.5	0.16	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	12.0	12.5	3.48	0.87151784	0.12848216	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	13.0	13.5	6.12	0.58895794	0.41104206	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	14.0	14.5	5.72	0.31002959	0.66498769	0.02498273
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

2011	2	2	0	0	4	15.0	15.5	4.40	0.07834036	0.82494300	0.09671665	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	16.0	16.5	5.36	0.01103939	0.53018555	0.43864331	0.02013174	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	17.0	17.5	6.16	0.01002697	0.40719167	0.56696774	0.01581362	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	18.0	18.5	8.72	0.00000000	0.30312009	0.57538979	0.11721027	0.00427985	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	19.0	19.5	6.24	0.00000000	0.15416024	0.43440474	0.35481783	0.05159881	0.00501838	0.00000000	0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	20.0	20.5	3.20	0.00000000	0.00225041	0.19916413	0.29504166	0.36341325	0.10256523	0.03756533	0.00000000	0.00000000	0.00000000
2011	2	2	0	0	4	21.0	21.5	2.36	0.00000000	0.00000000	0.02370815	0.15957820	0.11678121	0.34331561	0.32697276	0.02964408	0.00000000	0.00000000
2011	2	2	0	0	4	22.0	22.5	2.28	0.00000000	0.00000000	0.00000000	0.23982904	0.15442350	0.27219333	0.17317178	0.14299539	0.01738697	0.00000000
2011	2	2	0	0	4	23.0	23.5	0.56	0.00000000	0.00000000	0.00000000	0.02066462	0.34328736	0.06199386	0.26923320	0.21010218	0.09471878	0.00000000
2011	2	2	0	0	4	24.0	24.5	0.12	0.00000000	0.00000000	0.00000000	0.00000000	0.66666667	0.00000000	0.33333333	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	14.0	14.5	0.04	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	15.0	15.5	0.16	0.00000000	0.75000000	0.25000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	16.0	16.5	0.36	0.11111111	0.55555556	0.33333333	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	17.0	17.5	1.20	0.00000000	0.24086491	0.72472581	0.03440927	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	18.0	18.5	2.40	0.00000000	0.18265179	0.63037559	0.18697263	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	19.0	19.5	1.60	0.00000000	0.09506487	0.73668091	0.13460337	0.03365084	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	20.0	20.5	1.48	0.00000000	0.11634427	0.34903280	0.52873563	0.00588730	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	21.0	21.5	1.28	0.00000000	0.00887236	0.31640548	0.44277321	0.23194894	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	22.0	22.5	0.32	0.00000000	0.00000000	0.06501548	0.32507740	0.54489164	0.06501548	0.00000000	0.00000000	0.00000000	0.00000000
2012	2	2	0	0	4	23.0	23.5	0.08	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.50000000	0.50000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	14.0	14.5	0.04	0.00000000	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	15.0	15.5	0.76	0.23642233	0.76357767	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	16.0	16.5	0.52	0.14770697	0.32102442	0.53126861	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	17.0	17.5	0.28	0.00000000	0.82135170	0.17864830	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	18.0	18.5	0.40	0.00000000	0.35475512	0.64524488	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	19.0	19.5	2.12	0.00000000	0.16243627	0.65255175	0.17826647	0.00674551	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	20.0	20.5	2.64	0.00000000	0.05540472	0.30071145	0.64388383	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	21.0	21.5	6.88	0.00000000	0.01176805	0.25797490	0.62805155	0.10121872	0.00098678	0.00000000	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	22.0	22.5	9.76	0.00000000	0.00582286	0.28332171	0.40548302	0.23932329	0.05681670	0.00000000	0.00923242	0.00000000	0.00000000
2013	2	2	0	0	4	23.0	23.5	2.64	0.00000000	0.00000000	0.05651621	0.36611836	0.30649824	0.17555437	0.03404158	0.04243249	0.01883874	0.00000000
2013	2	2	0	0	4	24.0	24.5	0.24	0.00000000	0.00000000	0.00000000	0.00000000	0.52018474	0.31987684	0.15993842	0.00000000	0.00000000	0.00000000
2013	2	2	0	0	4	25.0	25.5	0.12	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.28532195	0.35733902	0.35733902	0.00000000
2014	2	2	0	0	4	12.0	12.5	0.24	1.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	13.0	13.5	1.00	0.88000000	0.12000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	14.0	14.5	2.32	0.49864223	0.44846314	0.05289463	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	15.0	15.5	3.64	0.01162263	0.73267960	0.25569778	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	16.0	16.5	4.12	0.00000000	0.68661093	0.30192905	0.01146002	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000

2014	2	2	0	0	4	17.0	17.5	0.92	0.00000000	0.41124996	0.58875004
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	18.0	18.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	22.0	22.5	0.44	0.00000000	0.00000000	0.00000000
	0.00977362		0.23867150		0.75155489		0.00000000		0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	23.0	23.5	1.00	0.00000000	0.00000000	0.00000000
	0.00000000		0.41585741		0.58414259		0.00000000		0.00000000	0.00000000	0.00000000
2014	2	2	0	0	4	24.0	24.5	0.16	0.00000000	0.00000000	0.00000000
	0.00000000		0.57563657		0.22501929		0.19934413		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	16.0	16.5	0.32	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	17.0	17.5	0.56	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	18.0	18.5	0.76	0.00000000	0.00000000	0.78519341
	0.21480659		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	19.0	19.5	0.28	0.00000000	0.00000000	0.28571429
	0.71428571		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	20.0	20.5	0.24	0.00000000	0.00000000	0.00000000
	0.69739439		0.30260561		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	21.0	21.5	0.32	0.00000000	0.00000000	0.00000000
	0.25000000		0.37500000		0.37500000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	22.0	22.5	0.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		1.00000000		0.00000000		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	23.0	23.5	0.16	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.69162500		0.30837500		0.00000000	0.00000000	0.00000000
1999	1	3	0	0	5	25.0	25.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		1.00000000		0.00000000	0.00000000	0.00000000
2000	1	3	0	0	5	16.0	16.5	0.24	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2000	1	3	0	0	5	17.0	17.5	3.16	0.00000000	0.02971019	0.81568211
	0.15460770		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2000	1	3	0	0	5	18.0	18.5	6.20	0.00000000	0.01663748	0.69778813
	0.22384006		0.05787131		0.00000000		0.00386302		0.00000000	0.00000000	0.00000000
2000	1	3	0	0	5	19.0	19.5	7.80	0.00000000	0.01005256	0.26678825
	0.58022529		0.11436740		0.02079638		0.00777013		0.00000000	0.00000000	0.00000000
2000	1	3	0	0	5	20.0	20.5	12.20	0.00000000	0.00000000	0.12132936
	0.62061646		0.19578829		0.04921868		0.01167967		0.00000000	0.00136755	0.00000000
2000	1	3	0	0	5	21.0	21.5	18.48	0.00000000	0.00000000	0.07284473
	0.43584726		0.29043133		0.13631424		0.05024663		0.00393816	0.01037764	0.00000000
2000	1	3	0	0	5	22.0	22.5	13.32	0.00000000	0.00376028	0.04421478
	0.24078300		0.31639225		0.25016788		0.09655734		0.03249653	0.01562794	0.00000000
2000	1	3	0	0	5	23.0	23.5	4.48	0.00000000	0.00996131	0.02853334
	0.11903465		0.33924029		0.19843023		0.21097310		0.08115465	0.01267242	0.00000000
2000	1	3	0	0	5	24.0	24.5	0.60	0.00000000	0.08604282	0.00000000
	0.09553265		0.03549035		0.35597674		0.35597674		0.07098070	0.00000000	0.00000000
2000	1	3	0	0	5	25.0	25.5	0.16	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.44069022		0.21415281		0.00000000	0.34515697	0.00000000
2001	1	3	0	0	5	13.0	13.5	0.56	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	14.0	14.5	0.36	0.00000000	0.78526625	0.21473375
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	15.0	15.5	0.16	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	16.0	16.5	0.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	18.0	18.5	1.12	0.00000000	0.18051209	0.33614455
	0.37483373		0.03610242		0.04280481		0.02960240		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	19.0	19.5	8.44	0.00000000	0.01925963	0.21266479
	0.54224992		0.19662330		0.02920235		0.00000000		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	20.0	20.5	29.64	0.00000000	0.00422791	0.14436947
	0.54004602		0.27399952		0.03365278		0.00370430		0.00000000	0.00000000	0.00000000
2001	1	3	0	0	5	21.0	21.5	23.96	0.00000000	0.00526833	0.05438869
	0.44296758		0.35803980		0.09663834		0.02718394		0.01385955	0.00165377	0.00000000
2001	1	3	0	0	5	22.0	22.5	11.28	0.00000000	0.00000000	0.02739324
	0.27709108		0.31245259		0.20449538		0.14091520		0.03370418	0.00394833	0.00000000
2001	1	3	0	0	5	23.0	23.5	4.16	0.00000000	0.00000000	0.00000000
	0.09938270		0.26174016		0.29696200		0.25522179		0.06547067	0.02122267	0.00000000
2001	1	3	0	0	5	24.0	24.5	1.36	0.00000000	0.00000000	0.00000000
	0.00000000		0.11400278		0.29653276		0.41151161		0.11324999	0.06470286	0.00000000
2001	1	3	0	0	5	25.0	25.5	0.20	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.42632700		0.57367300		0.00000000	0.00000000	0.00000000
2002	1	3	0	0	5	16.0	16.5	0.08	0.00000000	0.61079433	0.00000000
	0.00000000		0.38920567		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

2002	1	3	0	0	5	17.0	17.5	0.20	0.00000000	0.05397122	0.33719811
	0.60883067		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	3	0	0	5	18.0	18.5	0.96	0.00000000	0.36692199	0.47794134
	0.13307801		0.01102933		0.01102933		0.00000000		0.00000000	0.00000000	0.00000000
2002	1	3	0	0	5	19.0	19.5	1.48	0.00000000	0.08124207	0.44744620
	0.37831800		0.00351850		0.06096807		0.00000000		0.02850716	0.00000000	0.00000000
2002	1	3	0	0	5	20.0	20.5	5.72	0.00000000	0.00096806	0.16028495
	0.29077515		0.43336995		0.08898633		0.00974430		0.01587127	0.00000000	0.00000000
2002	1	3	0	0	5	21.0	21.5	36.20	0.00000000	0.00138445	0.03422952
	0.20205619		0.45716363		0.23106171		0.05486628		0.01522131	0.00401691	0.00000000
2002	1	3	0	0	5	22.0	22.5	40.68	0.00000000	0.00120007	0.00769523
	0.10957576		0.40541534		0.26660646		0.13228271		0.05251317	0.02390997	0.00080130
2002	1	3	0	0	5	23.0	23.5	18.56	0.00000000	0.00027504	0.00304354
	0.07014138		0.23002191		0.30895891		0.22516891		0.11658483	0.04580547	0.00000000
2002	1	3	0	0	5	24.0	24.5	5.08	0.00000000	0.00000000	0.00000000
	0.03031816		0.15396709		0.22605776		0.19593474		0.18364555	0.20308000	0.00699671
2002	1	3	0	0	5	25.0	25.5	1.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.03411823		0.03411823		0.29486547		0.38081541	0.22892806	0.02715461
2002	1	3	0	0	5	26.0	26.5	0.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.40176012	0.59823988	0.00000000
2003	1	3	0	0	5	13.0	13.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	3	0	0	5	14.0	14.5	0.64	0.00000000	0.29858794	0.70141206
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	3	0	0	5	15.0	15.5	0.32	0.00000000	0.62500000	0.25000000
	0.12500000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	3	0	0	5	16.0	16.5	0.04	0.00000000	0.00000000	0.00000000
	1.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	3	0	0	5	17.0	17.5	1.72	0.00000000	0.02889942	0.59388085
	0.29995467		0.07726506		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	3	0	0	5	18.0	18.5	6.04	0.00000000	0.04616067	0.48016399
	0.39541506		0.05770611		0.02055418		0.00000000		0.00000000	0.00000000	0.00000000
2003	1	3	0	0	5	19.0	19.5	8.72	0.00000000	0.04256105	0.42806829
	0.36049142		0.09471140		0.04309680		0.02116158		0.00990946	0.00000000	0.00000000
2003	1	3	0	0	5	20.0	20.5	10.76	0.00000000	0.01717435	0.29797333
	0.31388290		0.13396080		0.11909415		0.05801165		0.05330316	0.00659966	0.00000000
2003	1	3	0	0	5	21.0	21.5	13.28	0.00000000	0.00954035	0.17388138
	0.21066376		0.16657500		0.20443594		0.15382384		0.05487022	0.02620950	0.00000000
2003	1	3	0	0	5	22.0	22.5	24.52	0.00000000	0.00433987	0.02139465
	0.05261511		0.10155919		0.29939187		0.26100100		0.14053818	0.11045425	0.00870587
2003	1	3	0	0	5	23.0	23.5	17.40	0.00000000	0.00000000	0.00580201
	0.03805724		0.09739760		0.22253494		0.22808285		0.19974443	0.18466718	0.02371374
2003	1	3	0	0	5	24.0	24.5	6.56	0.00000000	0.00900865	0.00193705
	0.00576173		0.04555107		0.15018181		0.20368581		0.12017707	0.38184532	0.08185148
2003	1	3	0	0	5	25.0	25.5	1.92	0.00000000	0.00000000	0.00000000
	0.03311641		0.05115135		0.14950034		0.27774722		0.13268709	0.34825686	0.00754073
2003	1	3	0	0	5	26.0	26.5	0.32	0.00000000	0.00000000	0.00000000
	0.04130292		0.00000000		0.00000000		0.00000000		0.08260584	0.87609124	0.00000000
2003	1	3	0	0	5	27.0	27.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		1.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	11.0	11.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	12.0	12.5	0.24	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	13.0	13.5	1.48	0.00000000	0.86640401	0.13359599
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	14.0	14.5	2.64	0.00000000	0.81022906	0.16028563
	0.02948531		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	15.0	15.5	2.44	0.00000000	0.81693870	0.15224300
	0.02701525		0.00380304		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	16.0	16.5	2.44	0.00000000	0.91506888	0.08493112
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	17.0	17.5	7.08	0.00000000	0.82911979	0.13811037
	0.03276984		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	18.0	18.5	4.64	0.00000000	0.70590326	0.18379993
	0.11029681		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	19.0	19.5	3.28	0.00000000	0.12849706	0.38179877
	0.42007401		0.06963017		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	20.0	20.5	3.60	0.00000000	0.06764562	0.22718819
	0.43632745		0.20513650		0.02123408		0.04246816		0.00000000	0.00000000	0.00000000
2004	1	3	0	0	5	21.0	21.5	7.12	0.00000000	0.02507256	0.14317139
	0.40119569		0.27665293		0.08143410		0.04737353		0.00000000	0.02509980	0.00000000
2004	1	3	0	0	5	22.0	22.5	10.88	0.00000000	0.01339372	0.07334027
	0.13251533		0.12700182		0.29782043		0.20631143		0.09216441	0.05026100	0.00719159

2004	1	3	0	0	5	23.0	23.5	13.56	0.00000000	0.00000000	0.01271574
	0.04461322		0.10214081		0.22098845		0.27593474		0.15398881	0.15826834	0.03134988
2004	1	3	0	0	5	24.0	24.5	5.76	0.00000000	0.00000000	0.01698676
	0.01580170		0.05125012		0.18765518		0.40400194		0.08129150	0.18450322	0.05850957
2004	1	3	0	0	5	25.0	25.5	1.28	0.00000000	0.00000000	0.00000000
	0.02532908		0.13645475		0.14911929		0.25845116		0.20716081	0.15798550	0.06549941
2004	1	3	0	0	5	26.0	26.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.36623068		0.00000000		0.00000000	0.63376932	0.00000000
2005	1	3	0	0	5	12.0	12.5	0.08	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	1	3	0	0	5	15.0	15.5	0.84	0.00000000	0.00000000	0.91882170
	0.00000000		0.08117830		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	1	3	0	0	5	16.0	16.5	5.32	0.00000000	0.02117241	0.81569472
	0.15807194		0.00506093		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2005	1	3	0	0	5	17.0	17.5	14.84	0.00000000	0.00643022	0.78357060
	0.16751096		0.03437875		0.00732624		0.00078323		0.00000000	0.00000000	0.00000000
2005	1	3	0	0	5	18.0	18.5	7.20	0.00000000	0.02142792	0.74255130
	0.18572045		0.03920476		0.00770222		0.00134353		0.00000000	0.00204982	0.00000000
2005	1	3	0	0	5	19.0	19.5	1.36	0.00000000	0.01819245	0.64158675
	0.08655097		0.16711887		0.08655097		0.00000000		0.00000000	0.00000000	0.00000000
2005	1	3	0	0	5	20.0	20.5	0.72	0.00000000	0.00000000	0.18644387
	0.21159555		0.37478461		0.11262507		0.07764151		0.00000000	0.03690940	0.00000000
2005	1	3	0	0	5	21.0	21.5	1.00	0.00000000	0.00000000	0.11058216
	0.08033075		0.58483462		0.14392172		0.08033075		0.00000000	0.00000000	0.00000000
2005	1	3	0	0	5	22.0	22.5	1.56	0.00000000	0.00000000	0.00000000
	0.04232762		0.46888188		0.14965618		0.13515448		0.12377543	0.06188772	0.01831669
2005	1	3	0	0	5	23.0	23.5	3.40	0.00000000	0.00000000	0.02270702
	0.01580238		0.01941793		0.16224316		0.18771401		0.09741119	0.37852811	0.11617621
2005	1	3	0	0	5	24.0	24.5	3.56	0.00000000	0.00000000	0.00000000
	0.00000000		0.01297664		0.06131838		0.11939381		0.25404643	0.37055304	0.18171170
2005	1	3	0	0	5	25.0	25.5	0.88	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.05049915		0.00000000		0.20199661	0.52275381	0.22475042
2005	1	3	0	0	5	26.0	26.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	1.00000000
2006	1	3	0	0	5	17.0	17.5	0.24	0.00000000	0.00000000	0.00000000
	0.51704397		0.48295603		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2006	1	3	0	0	5	18.0	18.5	4.76	0.00000000	0.00000000	0.04347242
	0.63966086		0.16481578		0.07602547		0.04062132		0.00000000	0.01770207	0.01770207
2006	1	3	0	0	5	19.0	19.5	14.92	0.00000000	0.00000000	0.00727865
	0.64061532		0.20355835		0.08308284		0.04645900		0.00000000	0.01900585	0.00000000
2006	1	3	0	0	5	20.0	20.5	4.56	0.00000000	0.00000000	0.01204775
	0.62924849		0.24556590		0.07757939		0.00612325		0.02943522	0.00000000	0.00000000
2006	1	3	0	0	5	21.0	21.5	0.72	0.00000000	0.00000000	0.00000000
	0.28199047		0.05286559		0.15688084		0.50826311		0.00000000	0.00000000	0.00000000
2006	1	3	0	0	5	22.0	22.5	0.32	0.00000000	0.00000000	0.00000000
	0.14380492		0.61156791		0.00000000		0.00000000		0.12231358	0.12231358	0.00000000
2006	1	3	0	0	5	23.0	23.5	0.52	0.00000000	0.00000000	0.00000000
	0.05102799		0.32632300		0.05102799		0.27081202		0.24529802	0.05551098	0.00000000
2006	1	3	0	0	5	24.0	24.5	0.64	0.00000000	0.00000000	0.00000000
	0.22881018		0.04759812		0.07557884		0.02379906		0.09519624	0.52901755	0.00000000
2006	1	3	0	0	5	25.0	25.5	0.20	0.00000000	0.00000000	0.00000000
	0.00000000		0.85825403		0.04463446		0.04463446		0.05247705	0.00000000	0.00000000
2006	1	3	0	0	5	26.0	26.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		1.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	3	0	0	5	16.0	16.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	3	0	0	5	17.0	17.5	2.16	0.00000000	0.00000000	0.23740467
	0.45780179		0.27618093		0.02861261		0.00000000		0.00000000	0.00000000	0.00000000
2007	1	3	0	0	5	18.0	18.5	18.56	0.00000000	0.00000000	0.07683540
	0.57588439		0.31802187		0.02626425		0.00299409		0.00000000	0.00000000	0.00000000
2007	1	3	0	0	5	19.0	19.5	41.00	0.00000000	0.00000000	0.03081318
	0.50919315		0.39309440		0.05765305		0.00637106		0.00287516	0.00000000	0.00000000
2007	1	3	0	0	5	20.0	20.5	23.36	0.00000000	0.00000000	0.00437021
	0.32889907		0.48632183		0.14330941		0.02698247		0.00772495	0.00239205	0.00000000
2007	1	3	0	0	5	21.0	21.5	2.84	0.00000000	0.00000000	0.01790312
	0.06248941		0.60674578		0.22974585		0.08311583		0.00000000	0.00000000	0.00000000
2007	1	3	0	0	5	22.0	22.5	0.36	0.00000000	0.00000000	0.00000000
	0.21943393		0.48478081		0.10971697		0.18606829		0.00000000	0.00000000	0.00000000
2007	1	3	0	0	5	23.0	23.5	0.64	0.00000000	0.00000000	0.00000000
	0.00000000		0.09044068		0.34236015		0.31113120		0.12166964	0.13439832	0.00000000
2007	1	3	0	0	5	24.0	24.5	0.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.23026346		0.26146231		0.00000000		0.09267026	0.41560397	0.00000000
2007	1	3	0	0	5	25.0	25.5	0.12	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.37093453	0.62906547

2007	1	3	0	0	5	27.0	27.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	1.00000000	0.00000000
2008	1	3	0	0	5	17.0	17.5	0.88	0.00000000	0.00000000	0.08076731
	0.45003422		0.35683235		0.11236612		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	3	0	0	5	18.0	18.5	13.12	0.00000000	0.00000000	0.01184838
	0.32043582		0.46529163		0.19547765		0.00694651		0.00000000	0.00000000	0.00000000
2008	1	3	0	0	5	19.0	19.5	32.08	0.00000000	0.00000000	0.00088424
	0.15493135		0.57736237		0.24563050		0.01859373		0.00259781	0.00000000	0.00000000
2008	1	3	0	0	5	20.0	20.5	32.48	0.00000000	0.00000000	0.00000000
	0.05859962		0.53023043		0.34778716		0.05769815		0.00246186	0.00322279	0.00000000
2008	1	3	0	0	5	21.0	21.5	10.88	0.00000000	0.00000000	0.00000000
	0.01475106		0.36452259		0.47038098		0.10796971		0.02632704	0.01604862	0.00000000
2008	1	3	0	0	5	22.0	22.5	2.80	0.00000000	0.00000000	0.00000000
	0.03766021		0.19998154		0.35594165		0.24583760		0.12291880	0.03766021	0.00000000
2008	1	3	0	0	5	23.0	23.5	1.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.19731636		0.34757381		0.22868898		0.19401355	0.03240729	0.00000000
2008	1	3	0	0	5	24.0	24.5	0.40	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.07480361		0.14173213		0.17913393	0.60433033	0.00000000
2008	1	3	0	0	5	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.79120760		0.00000000	0.20879240	0.00000000
2009	1	3	0	0	5	15.0	15.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	1	3	0	0	5	17.0	17.5	0.68	0.00000000	0.00000000	0.00000000
	0.42804400		0.48314281		0.03371438		0.00000000		0.05509881	0.00000000	0.00000000
2009	1	3	0	0	5	18.0	18.5	11.68	0.00000000	0.00000000	0.02050733
	0.12037526		0.46365604		0.31060975		0.08018280		0.00466882	0.00000000	0.00000000
2009	1	3	0	0	5	19.0	19.5	41.76	0.00000000	0.00000000	0.00226916
	0.03590519		0.36741479		0.37324927		0.18827612		0.02953106	0.00335441	0.00000000
2009	1	3	0	0	5	20.0	20.5	31.56	0.00000000	0.00000000	0.00219593
	0.01342498		0.21422056		0.43913111		0.25999418		0.06078386	0.01024938	0.00000000
2009	1	3	0	0	5	21.0	21.5	6.80	0.00000000	0.00000000	0.00212453
	0.00568681		0.10318651		0.44777766		0.31985777		0.10280451	0.01856221	0.00000000
2009	1	3	0	0	5	22.0	22.5	0.56	0.00000000	0.00000000	0.00000000
	0.00000000		0.04893710		0.22695408		0.46075579		0.08550180	0.17785124	0.00000000
2009	1	3	0	0	5	23.0	23.5	0.12	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.83888941		0.00000000		0.16111059	0.00000000	0.00000000
2009	1	3	0	0	5	24.0	24.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	1.00000000	0.00000000
2010	1	3	0	0	5	16.0	16.5	0.20	0.00000000	0.00000000	0.76934528
	0.23065472		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	3	0	0	5	17.0	17.5	0.20	0.00000000	0.00000000	0.00000000
	0.38467264		0.46130945		0.15401791		0.00000000		0.00000000	0.00000000	0.00000000
2010	1	3	0	0	5	18.0	18.5	1.84	0.00000000	0.00000000	0.00000000
	0.16788478		0.16797029		0.46967550		0.17677483		0.01769459	0.00000000	0.00000000
2010	1	3	0	0	5	19.0	19.5	12.44	0.00000000	0.00000000	0.00000000
	0.04896287		0.27875690		0.38697070		0.18333172		0.08992043	0.01205738	0.00000000
2010	1	3	0	0	5	20.0	20.5	14.44	0.00000000	0.00000000	0.00000000
	0.01016532		0.16180590		0.40427576		0.30760341		0.09572334	0.02042628	0.00000000
2010	1	3	0	0	5	21.0	21.5	4.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.17346526		0.35308184		0.28013074		0.16224575	0.03107640	0.00000000
2010	1	3	0	0	5	22.0	22.5	0.32	0.00000000	0.00000000	0.00000000
	0.00000000		0.20110753		0.39240600		0.07009449		0.26629749	0.07009449	0.00000000
2010	1	3	0	0	5	23.0	23.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		1.00000000	0.00000000	0.00000000
2011	1	3	0	0	5	14.0	14.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	1	3	0	0	5	15.0	15.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	1	3	0	0	5	17.0	17.5	0.36	0.00000000	0.51810763	0.21835447
	0.00000000		0.00000000		0.08820160		0.17533631		0.00000000	0.00000000	0.00000000
2011	1	3	0	0	5	18.0	18.5	0.88	0.00000000	0.00000000	0.50596905
	0.21929168		0.19223208		0.06856094		0.00000000		0.00000000	0.01394624	0.00000000
2011	1	3	0	0	5	19.0	19.5	3.40	0.00000000	0.00000000	0.15072866
	0.26068154		0.13777478		0.16189115		0.23719457		0.03802670	0.01370261	0.00000000
2011	1	3	0	0	5	20.0	20.5	18.40	0.00000000	0.00000000	0.00859330
	0.03904601		0.13922408		0.33680258		0.27486556		0.15650820	0.04496027	0.00000000
2011	1	3	0	0	5	21.0	21.5	16.08	0.00000000	0.00000000	0.00422339
	0.01197875		0.10077749		0.31338103		0.33280820		0.20914405	0.02768709	0.00000000
2011	1	3	0	0	5	22.0	22.5	3.12	0.00000000	0.00000000	0.00000000
	0.00000000		0.14846829		0.30437049		0.28564527		0.18671576	0.07480019	0.00000000
2011	1	3	0	0	5	23.0	23.5	0.56	0.00000000	0.00000000	0.00000000
	0.00000000		0.03268375		0.34533842		0.27886041		0.34311741	0.00000000	0.00000000
2012	1	3	0	0	5	17.0	17.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000

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2012   1      3      0      0      5      18.0   18.5   5.48   0.00000000   0.00000000   0.74304840
       0.23730442    0.01964719    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2012   1      3      0      0      5      19.0   19.5   30.96  0.00000000   0.00094202   0.66082840
       0.26778733    0.03782638    0.00983471    0.00554848    0.00428623   0.01294645   0.00000000
2012   1      3      0      0      5      20.0   20.5   35.76  0.00000000   0.00116550   0.38557432
       0.33735691    0.11024423    0.04944098    0.03141783    0.04173074   0.04306948   0.00000000
2012   1      3      0      0      5      21.0   21.5   26.64  0.00000000   0.00000000   0.03900776
       0.12680052    0.08678037    0.08175227    0.18143254    0.19322295   0.28507335   0.00593025
2012   1      3      0      0      5      22.0   22.5   16.44  0.00000000   0.00000000   0.01068538
       0.00799751    0.04921246    0.06488152    0.15952159    0.27504714   0.41065066   0.02200375
2012   1      3      0      0      5      23.0   23.5   2.84   0.00000000   0.00000000   0.00000000
       0.00000000    0.02087101    0.05696684    0.12747367    0.23738363   0.51556283   0.04174203
2012   1      3      0      0      5      24.0   24.5   0.04   0.00000000   0.00000000   0.00000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   1.00000000   0.00000000
2012   1      3      0      0      5      25.0   25.5   0.04   0.00000000   0.00000000   0.00000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   1.00000000   0.00000000
2013   1      3      0      0      5      18.0   18.5   0.04   0.00000000   0.00000000   0.00000000
       1.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2013   1      3      0      0      5      19.0   19.5   6.56   0.00000000   0.00000000   0.08970988
       0.75270156    0.13362565    0.01837156    0.00559135    0.00000000   0.00000000   0.00000000
2013   1      3      0      0      5      20.0   20.5   55.84  0.00000000   0.00000000   0.04175726
       0.72041131    0.18505544    0.03921209    0.00585859    0.00472263   0.00298269   0.00000000
2013   1      3      0      0      5      21.0   21.5   55.96  0.00000000   0.00000000   0.02112634
       0.56554855    0.21094756    0.05247252    0.04671603    0.03941410   0.06377488   0.00000000
2013   1      3      0      0      5      22.0   22.5   16.76  0.00000000   0.00000000   0.01792287
       0.18507945    0.14320747    0.08220304    0.12555940    0.21514684   0.23088093   0.00000000
2013   1      3      0      0      5      23.0   23.5   3.44   0.00000000   0.00000000   0.00000000
       0.04971385    0.02625867    0.07967820    0.11087805    0.37535933   0.34399629   0.01411561
2013   1      3      0      0      5      24.0   24.5   0.32   0.00000000   0.00000000   0.00000000
       0.18978846    0.00000000    0.00000000    0.24803446    0.00000000   0.56217708   0.00000000
2014   1      3      0      0      5      20.0   20.5   1.92   0.00000000   0.00000000   0.00000000
       0.07166032    0.69302169    0.21434924    0.02096874    0.00000000   0.00000000   0.00000000
2014   1      3      0      0      5      21.0   21.5   19.96  0.00000000   0.00000000   0.00000000
       0.05303215    0.67611596    0.19284149    0.05486157    0.01508869   0.00806014   0.00000000
2014   1      3      0      0      5      22.0   22.5   22.92  0.00000000   0.00000000   0.00000000
       0.04521396    0.68633038    0.14844784    0.04925969    0.03177549   0.03897265   0.00000000
2014   1      3      0      0      5      23.0   23.5   4.40   0.00000000   0.00000000   0.00000000
       0.00943229    0.47814116    0.20354826    0.06858224    0.11154479   0.12875126   0.00000000
2014   1      3      0      0      5      24.0   24.5   0.48   0.00000000   0.00000000   0.00000000
       0.00000000    0.17545906    0.18020953    0.08772953    0.14195618   0.34366762   0.07097809
2005   2      8      0      0      6      11.0   11.5   0.04   1.00000000   0.00000000   0.00000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      13.0   13.5   0.04   1.00000000   0.00000000   0.00000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      15.0   15.5   0.12   0.00000000   1.00000000   0.00000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      16.0   16.5   1.60   0.35000000   0.65000000   0.00000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      17.0   17.5   1.80   0.08888889   0.62222222   0.24444444
       0.04444444    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      18.0   18.5   2.40   0.00000000   0.68333333   0.31666667
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      19.0   19.5   3.24   0.00000000   0.56790123   0.40740741
       0.02469136    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      20.0   20.5   1.92   0.02083333   0.45833333   0.47916667
       0.02083333    0.02083333    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      21.0   21.5   0.56   0.00000000   0.50000000   0.42857143
       0.00000000    0.07142857    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      22.0   22.5   0.12   0.00000000   0.66666667   0.33333333
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      24.0   24.5   0.08   0.00000000   0.00000000   0.50000000
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.50000000   0.00000000
2005   2      8      0      0      6      25.0   25.5   0.16   0.00000000   0.25000000   0.00000000
       0.25000000    0.50000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2005   2      8      0      0      6      26.0   26.5   0.04   0.00000000   0.00000000   0.00000000
       0.00000000    0.00000000    1.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2007   2      8      0      0      6      16.0   16.5   0.12   0.00000000   0.33333333   0.66666667
       0.00000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2007   2      8      0      0      6      17.0   17.5   0.40   0.00000000   0.00000000   0.80000000
       0.20000000    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2007   2      8      0      0      6      18.0   18.5   0.96   0.00000000   0.08333333   0.70833333
       0.20833333    0.00000000    0.00000000    0.00000000    0.00000000   0.00000000   0.00000000
2007   2      8      0      0      6      19.0   19.5   1.00   0.00000000   0.00000000   0.36000000
       0.52000000    0.08000000    0.04000000    0.00000000    0.00000000   0.00000000   0.00000000
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2007	2	8	0	0	6	20.0	20.5	2.84	0.00000000	0.00000000	0.16901408
	0.66197183		0.14084507		0.02816901		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	8	0	0	6	21.0	21.5	4.96	0.00000000	0.00000000	0.08870968
	0.73387097		0.16935484		0.00806452		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	8	0	0	6	22.0	22.5	3.40	0.00000000	0.00000000	0.00000000
	0.77647059		0.21176471		0.01176471		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	8	0	0	6	23.0	23.5	0.80	0.00000000	0.00000000	0.00000000
	0.75000000		0.20000000		0.05000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	8	0	0	6	24.0	24.5	0.24	0.00000000	0.00000000	0.00000000
	0.50000000		0.50000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2007	2	8	0	0	6	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.00000000		0.50000000		0.50000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	12.0	12.5	0.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	14.0	14.5	0.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	15.0	15.5	0.12	0.00000000	0.66666667	0.33333333
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	16.0	16.5	0.24	0.16666667	0.50000000	0.33333333
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	17.0	17.5	0.32	0.00000000	0.62500000	0.37500000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	18.0	18.5	0.16	0.00000000	0.00000000	0.50000000
	0.50000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	19.0	19.5	0.36	0.00000000	0.11111111	0.11111111
	0.44444444		0.11111111		0.22222222		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	20.0	20.5	2.72	0.00000000	0.00000000	0.01470588
	0.39705882		0.42647059		0.16176471		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	21.0	21.5	8.12	0.00000000	0.00000000	0.01970443
	0.25123153		0.44827586		0.25123153		0.02955665		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	22.0	22.5	9.72	0.00000000	0.00411523	0.01646091
	0.18518519		0.45679012		0.25514403		0.07818930		0.00411523	0.00000000	0.00000000
2009	2	8	0	0	6	23.0	23.5	4.16	0.00000000	0.00000000	0.00000000
	0.17307692		0.46153846		0.30769231		0.05769231		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	24.0	24.5	0.96	0.00000000	0.00000000	0.00000000
	0.12500000		0.37500000		0.41666667		0.04166667		0.04166667	0.00000000	0.00000000
2009	2	8	0	0	6	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.50000000		0.00000000		0.50000000		0.00000000		0.00000000	0.00000000	0.00000000
2009	2	8	0	0	6	26.0	26.5	0.16	0.00000000	0.00000000	0.00000000
	0.00000000		0.50000000		0.00000000		0.25000000		0.25000000	0.00000000	0.00000000
2010	2	8	0	0	6	14.0	14.5	0.08	0.00000000	0.50000000	0.50000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	15.0	15.5	0.12	0.33333333	0.33333333	0.33333333
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	16.0	16.5	1.28	0.00000000	0.65625000	0.31250000
	0.03125000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	17.0	17.5	3.76	0.01063830	0.51063830	0.42553191
	0.04255319		0.01063830		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	18.0	18.5	5.60	0.02142857	0.37142857	0.50000000
	0.10000000		0.00714286		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	19.0	19.5	2.24	0.00000000	0.23214286	0.50000000
	0.25000000		0.01785714		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	20.0	20.5	0.48	0.00000000	0.00000000	0.75000000
	0.25000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	21.0	21.5	1.56	0.00000000	0.00000000	0.05128205
	0.25641026		0.33333333		0.28205128		0.07692308		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	22.0	22.5	4.92	0.00000000	0.00000000	0.04878049
	0.15447154		0.36585366		0.27642276		0.12195122		0.03252033	0.00000000	0.00000000
2010	2	8	0	0	6	23.0	23.5	4.16	0.00000000	0.00961538	0.03846154
	0.17307692		0.33653846		0.32692308		0.09615385		0.01923077	0.00000000	0.00000000
2010	2	8	0	0	6	24.0	24.5	0.84	0.00000000	0.00000000	0.00000000
	0.04761905		0.52380952		0.23809524		0.19047619		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	25.0	25.5	0.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.28571429		0.42857143		0.28571429		0.00000000	0.00000000	0.00000000
2010	2	8	0	0	6	26.0	26.5	0.16	0.00000000	0.00000000	0.00000000
	0.00000000		0.75000000		0.00000000		0.25000000		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	17.0	17.5	0.04	0.00000000	1.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	18.0	18.5	0.08	0.00000000	0.50000000	0.50000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	19.0	19.5	1.84	0.00000000	0.17391304	0.58695652
	0.19565217		0.04347826		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	20.0	20.5	3.20	0.00000000	0.13750000	0.62500000
	0.15000000		0.07500000		0.00000000		0.01250000		0.00000000	0.00000000	0.00000000

2011	2	8	0	0	6	21.0	21.5	2.00	0.00000000	0.16000000	0.40000000
	0.26000000		0.14000000		0.00000000		0.04000000		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	22.0	22.5	1.60	0.00000000	0.00000000	0.27500000
	0.17500000		0.12500000		0.20000000		0.20000000		0.02500000	0.00000000	0.00000000
2011	2	8	0	0	6	23.0	23.5	3.72	0.00000000	0.00000000	0.03225806
	0.15053763		0.32258065		0.29032258		0.15053763		0.05376344	0.00000000	0.00000000
2011	2	8	0	0	6	24.0	24.5	1.56	0.00000000	0.00000000	0.02564103
	0.10256410		0.35897436		0.33333333		0.17948718		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	25.0	25.5	0.24	0.00000000	0.00000000	0.16666667
	0.16666667		0.33333333		0.00000000		0.33333333		0.00000000	0.00000000	0.00000000
2011	2	8	0	0	6	26.0	26.5	0.04	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		1.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2012	2	8	0	0	6	18.0	18.5	0.12	0.00000000	0.33333333	0.33333333
	0.33333333		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2012	2	8	0	0	6	20.0	20.5	0.84	0.00000000	0.00000000	0.47619048
	0.42857143		0.04761905		0.04761905		0.00000000		0.00000000	0.00000000	0.00000000
2012	2	8	0	0	6	21.0	21.5	3.12	0.00000000	0.00000000	0.20512821
	0.53846154		0.19230769		0.01282051		0.05128205		0.00000000	0.00000000	0.00000000
2012	2	8	0	0	6	22.0	22.5	2.64	0.00000000	0.00000000	0.25757576
	0.54545455		0.10606061		0.03030303		0.03030303		0.01515152	0.01515152	0.00000000
2012	2	8	0	0	6	23.0	23.5	1.04	0.00000000	0.00000000	0.03846154
	0.19230769		0.11538462		0.15384615		0.30769231		0.03846154	0.15384615	0.00000000
2012	2	8	0	0	6	24.0	24.5	0.76	0.00000000	0.00000000	0.00000000
	0.05263158		0.15789474		0.26315789		0.10526316		0.26315789	0.15789474	0.00000000
2012	2	8	0	0	6	25.0	25.5	0.12	0.00000000	0.00000000	0.00000000
	0.00000000		0.33333333		0.00000000		0.00000000		0.66666667	0.00000000	0.00000000
2008	1	9	0	0	6	9.0	9.5	0.40	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	10.0	10.5	0.52	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	11.0	11.5	0.16	1.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	16.0	16.5	0.16	0.00000000	0.00000000	0.75000000
	0.25000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	17.0	17.5	0.48	0.00000000	0.00000000	0.41666667
	0.58333333		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	18.0	18.5	0.88	0.00000000	0.00000000	0.27272727
	0.59090909		0.13636364		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	19.0	19.5	4.76	0.00000000	0.00840336	0.25210084
	0.51260504		0.21848739		0.00840336		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	20.0	20.5	7.60	0.00000000	0.00526316	0.11578947
	0.45263158		0.40526316		0.02105263		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	21.0	21.5	9.32	0.00000000	0.00000000	0.05150215
	0.43347639		0.49356223		0.02145923		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	22.0	22.5	3.52	0.00000000	0.00000000	0.03409091
	0.40909091		0.51136364		0.04545455		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	23.0	23.5	0.68	0.00000000	0.00000000	0.00000000
	0.35294118		0.58823529		0.05882353		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	24.0	24.5	0.32	0.00000000	0.00000000	0.12500000
	0.37500000		0.50000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2008	1	9	0	0	6	25.0	25.5	0.08	0.00000000	0.00000000	0.00000000
	0.50000000		0.50000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2012	1	9	0	0	6	17.0	17.5	0.04	0.00000000	0.00000000	1.00000000
	0.00000000		0.00000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2012	1	9	0	0	6	19.0	19.5	0.80	0.00000000	0.10000000	0.45000000
	0.40000000		0.05000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2012	1	9	0	0	6	20.0	20.5	6.80	0.00000000	0.03529412	0.44705882
	0.35882353		0.12941176		0.02941176		0.00000000		0.00000000	0.00000000	0.00000000
2012	1	9	0	0	6	21.0	21.5	8.12	0.00000000	0.00492611	0.28571429
	0.39901478		0.18719212		0.06896552		0.02463054		0.02955665	0.00000000	0.00000000
2012	1	9	0	0	6	22.0	22.5	3.04	0.00000000	0.00000000	0.07894737
	0.28947368		0.18421053		0.22368421		0.09210526		0.10526316	0.02631579	0.00000000
2012	1	9	0	0	6	23.0	23.5	2.40	0.00000000	0.00000000	0.00000000
	0.03333333		0.10000000		0.26666667		0.26666667		0.23333333	0.10000000	0.00000000
2012	1	9	0	0	6	24.0	24.5	1.28	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.21875000		0.31250000		0.21875000	0.25000000	0.00000000
2012	1	9	0	0	6	25.0	25.5	0.40	0.00000000	0.00000000	0.00000000
	0.00000000		0.00000000		0.10000000		0.10000000		0.50000000	0.30000000	0.00000000
2013	1	9	0	0	6	20.0	20.5	0.16	0.00000000	0.00000000	0.00000000
	0.75000000		0.25000000		0.00000000		0.00000000		0.00000000	0.00000000	0.00000000
2013	1	9	0	0	6	21.0	21.5	3.40	0.00000000	0.00000000	0.35294118
	0.51764706		0.11764706		0.00000000		0.01176471		0.00000000	0.00000000	0.00000000
2013	1	9	0	0	6	22.0	22.5	6.00	0.00000000	0.00000000	0.32666667
	0.52000000		0.12666667		0.01333333		0.00666667		0.00666667	0.00000000	0.00000000

2013	1 9	0 0	6 23.0	23.5 3.24	0.00000000	0.00000000	0.22222222
	0.43209877	0.11111111	0.14814815	0.04938272	0.01234568	0.02469136	0.00000000
2013	1 9	0 0	6 24.0	24.5 1.08	0.00000000	0.00000000	0.00000000
	0.07407407	0.03703704	0.37037037	0.37037037	0.03703704	0.11111111	0.00000000
2013	1 9	0 0	6 25.0	25.5 0.28	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.14285714	0.57142857	0.14285714	0.14285714	0.00000000
1993	1 -1	0 0	1 9.0	28.0 2.72	0.00000000	0.00000000	0.11764706
	0.76470588	0.10294118	0.01470588	0.00000000	0.00000000	0.00000000	0.00000000
1994	1 -1	0 0	1 9.0	28.0 11.76	0.02233392	0.46921325	0.31997955
	0.15950127	0.02897201	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1995	1 -1	0 0	1 9.0	28.0 4.76	0.11764706	0.56302521	0.25210084
	0.06722689	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
1996	1 -1	0 0	1 9.0	28.0 89.28	0.00000000	0.05567822	0.57869148
	0.31936116	0.04119642	0.00460375	0.00000000	0.00046897	0.00000000	0.00000000
1997	1 -1	0 0	1 9.0	28.0 54.92	0.00393055	0.41526377	0.48143507
	0.08999595	0.00760341	0.00177125	0.00000000	0.00000000	0.00000000	0.00000000
1998	1 -1	0 0	1 9.0	28.0 75.32	0.08752419	0.65178011	0.20556040
	0.02738368	0.02185746	0.00530475	0.00058942	0.00000000	0.00000000	0.00000000
1999	1 -1	0 0	1 9.0	28.0 6.96	0.12068966	0.51724138	0.35632184
	0.00574713	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2000	1 -1	0 0	1 9.0	28.0 22.64	0.05612282	0.21594669	0.47409550
	0.23739199	0.01419224	0.00225076	0.00000000	0.00000000	0.00000000	0.00000000
2001	1 -1	0 0	1 9.0	28.0 37.24	0.19498424	0.24032396	0.10821490
	0.29193947	0.11194383	0.03989310	0.00899338	0.00370711	0.00000000	0.00000000
2002	1 -1	0 0	1 9.0	28.0 30.32	0.17079894	0.53308456	0.23318285
	0.04302452	0.01864624	0.00126289	0.00000000	0.00000000	0.00000000	0.00000000
2003	1 -1	0 0	1 9.0	28.0 17.76	0.56513500	0.22899483	0.18990839
	0.01273176	0.00323001	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2004	1 -1	0 0	1 9.0	28.0 33.52	0.00300111	0.90375628	0.06959324
	0.00743078	0.01147566	0.00000000	0.00474293	0.00000000	0.00000000	0.00000000
2005	1 -1	0 0	1 9.0	28.0 35.24	0.09102697	0.26552164	0.59466314
	0.04284618	0.00412282	0.00121284	0.00060642	0.00000000	0.00000000	0.00000000
2006	1 -1	0 0	1 9.0	28.0 69.76	0.00908783	0.64539166	0.30295669
	0.04256381	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2007	1 -1	0 0	2 9.0	28.0 86.00	0.01357889	0.16055166	0.64593872
	0.17061145	0.00931929	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2008	1 -1	0 0	3 9.0	28.0 30.84	0.06153622	0.26350954	0.58776778
	0.07218948	0.01499698	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2009	1 -1	0 0	3 9.0	28.0 22.88	0.00349661	0.21120316	0.63114846
	0.14041369	0.01373808	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2010	1 -1	0 0	4 9.0	28.0 12.68	0.01577287	0.79179811	0.16719243
	0.02523659	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2011	1 -1	0 0	4 9.0	28.0 21.64	0.00000000	0.32278273	0.47187076
	0.19905465	0.00629186	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
2012	1 -1	0 0	4 9.0	28.0 22.32	0.00335775	0.10053293	0.44773547
	0.37325638	0.05790999	0.01147166	0.00573583	0.00000000	0.00000000	0.00000000
2013	1 -1	0 0	4 9.0	28.0 15.84	0.01132400	0.02443363	0.25675788
	0.29354382	0.33484537	0.04608165	0.01688430	0.00806468	0.00806468	0.00000000
2014	1 -1	0 0	4 9.0	28.0 5.92	0.00009926	0.00000451	0.00000451
	0.08063643	0.53220043	0.28222750	0.08870007	0.01612729	0.00000000	0.00000000
1993	2 -2	0 0	1 9.0	28.0 30.44	0.21106902	0.38434172	0.30704382
	0.06010656	0.02088125	0.01089044	0.00566720	0.00000000	0.00000000	0.00000000
1994	2 -2	0 0	1 9.0	28.0 120.96	0.36945499	0.45924059	0.11019804
	0.05280057	0.00706495	0.00093579	0.00030505	0.00000000	0.00000000	0.00000000
1995	2 -2	0 0	1 9.0	28.0 58.84	0.24589769	0.44769841	0.28115147
	0.02299743	0.00194198	0.00031302	0.00000000	0.00000000	0.00000000	0.00000000
1996	2 -2	0 0	1 9.0	28.0 45.92	0.29892120	0.35526509	0.28407353
	0.05385728	0.00380762	0.00407529	0.00000000	0.00000000	0.00000000	0.00000000
1997	2 -2	0 0	1 9.0	28.0 47.44	0.16769604	0.44927048	0.17462436
	0.14077280	0.05754727	0.00731508	0.00277398	0.00000000	0.00000000	0.00000000
1998	2 -2	0 0	1 9.0	28.0 72.48	0.26761762	0.47815789	0.21604073
	0.02580353	0.00936489	0.00301533	0.00000000	0.00000000	0.00000000	0.00000000
1999	2 -2	0 0	1 9.0	28.0 55.32	0.27314763	0.51943459	0.18108008
	0.01831521	0.00686090	0.00095133	0.00021026	0.00000000	0.00000000	0.00000000
2000	2 -2	0 0	1 9.0	28.0 48.04	0.27341328	0.37293108	0.27881477
	0.06382949	0.01091465	0.00000000	0.00000000	0.00009674	0.00000000	0.00000000
2001	2 -2	0 0	1 9.0	28.0 71.04	0.67276346	0.18270578	0.09872123
	0.03669650	0.00653717	0.00257586	0.00000000	0.00000000	0.00000000	0.00000000
2002	2 -2	0 0	1 9.0	28.0 76.48	0.18899176	0.59397851	0.16841782
	0.03741263	0.00773647	0.00329546	0.00008367	0.00000000	0.00008367	0.00000000
2003	2 -2	0 0	1 9.0	28.0 74.64	0.83351604	0.04116990	0.06930792
	0.03300254	0.01468797	0.00389736	0.00353461	0.00088365	0.00000000	0.00000000
2004	2 -2	0 0	1 9.0	28.0 59.16	0.04238489	0.87005119	0.07242785
	0.01265237	0.00145970	0.00102400	0.00000000	0.00000000	0.00000000	0.00000000

```
2005    2       -2      0       0       1       9.0     28.0    89.04   0.53994582      0.36702223      0.08416083
        0.00500806      0.00132284      0.00090732      0.00072560      0.00045366      0.00045366      0.00000000
2006    2       -2      0       0       1       9.0     28.0    105.16  0.20172661      0.63015996      0.15000726
        0.01740041      0.00070577      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2007    2       -2      0       0       2       9.0     28.0    67.44   0.42021952      0.43386305      0.10589809
        0.03396340      0.00544372      0.00061223      0.00000000      0.00000000      0.00000000      0.00000000
2008    2       -2      0       0       3       9.0     28.0    39.76   0.19862191      0.52834154      0.21532639
        0.05558720      0.00212296      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2009    2       -2      0       0       3       9.0     28.0    98.08   0.44090117      0.44149224      0.11209083
        0.00372405      0.00179171      0.00000000      0.00000000      0.00000000      0.00000000      0.00000000
2010    2       -2      0       0       4       9.0     28.0    31.40   0.50304830      0.32470002      0.01757707
        0.02625377      0.05345083      0.06594583      0.00763583      0.00069417      0.00069417      0.00000000
2011    2       -2      0       0       4       9.0     28.0    54.88   0.20910019      0.35249163      0.22419952
        0.08833225      0.04648802      0.03648118      0.03009719      0.01083858      0.00197145      0.00000000
2012    2       -2      0       0       4       9.0     28.0    8.92    0.01286056      0.18465132      0.56709595
        0.19900628      0.03408414      0.00153450      0.00076725      0.00000000      0.00000000      0.00000000
2013    2       -2      0       0       4       9.0     28.0    26.40   0.00400245      0.03541231      0.25560467
        0.43215639      0.18609710      0.05679863      0.01021883      0.01366366      0.00604596      0.00000000
2014    2       -2      0       0       4       9.0     28.0    13.88   0.19601085      0.54781269      0.21272334
        0.00361995      0.01478894      0.02384416      0.00120007      0.00000000      0.00000000      0.00000000
1999    1       -3      0       0       5       9.0     28.0    2.96    0.00000000      0.00000000      0.59151581
        0.20074375      0.04758623      0.12952271      0.03063150      0.00000000      0.00000000      0.00000000
2000    1       -3      0       0       5       9.0     28.0    66.64   0.00000000      0.00661920      0.20664268
        0.39154056      0.21333728      0.10964756      0.05159158      0.01292370      0.00769745      0.00000000
2001    1       -3      0       0       5       9.0     28.0    81.28   0.00000000      0.01319829      0.09882524
        0.43321579      0.28807345      0.09650734      0.05247704      0.01444472      0.00325813      0.00000000
2002    1       -3      0       0       5       9.0     28.0    110.32  0.00000000      0.00376606      0.02888569
        0.14173143      0.37497785      0.24597782      0.11747427      0.05690067      0.02950284      0.00078337
2003    1       -3      0       0       5       9.0     28.0    92.32   0.00000000      0.02102307      0.16425121
        0.15811910      0.10310171      0.18273199      0.16023280      0.09892235      0.09975931      0.01185845
2004    1       -3      0       0       5       9.0     28.0    66.56   0.00000000      0.18029041      0.09935404
        0.14911095      0.11148963      0.14727065      0.15776410      0.06809703      0.07147469      0.01514850
2005    1       -3      0       0       5       9.0     28.0    40.84   0.00000000      0.01355483      0.68729690
        0.14494663      0.04909713      0.02077143      0.01635392      0.01781254      0.03540648      0.01476013
2006    1       -3      0       0       5       9.0     28.0    26.92   0.00000000      0.00000000      0.01497099
        0.60873284      0.20905176      0.07984672      0.04903877      0.00985519      0.02477402      0.00372971
2007    1       -3      0       0       5       9.0     28.0    89.40   0.00000000      0.00000000      0.03684181
        0.45391632      0.40243125      0.08105161      0.01657055      0.00464352      0.00366742      0.00087752
2008    1       -3      0       0       5       9.0     28.0    94.00   0.00000000      0.00000000      0.00238411
        0.12188750      0.50241139      0.30400027      0.05113905      0.01114247      0.00703520      0.00000000
2009    1       -3      0       0       5       9.0     28.0    93.24   0.00000000      0.00000000      0.00497725
        0.03834955      0.30673956      0.39095629      0.20858215      0.04278986      0.00760533      0.00000000
2010    1       -3      0       0       5       9.0     28.0    33.76   0.00000000      0.00000000      0.00486375
        0.03556323      0.20782114      0.39064640      0.24531203      0.09814472      0.01764872      0.00000000
2011    1       -3      0       0       5       9.0     28.0    42.88   0.00000000      0.00357123      0.03311394
        0.04935194      0.12486830      0.30299646      0.28571874      0.16388915      0.03649023      0.00000000
2012    1       -3      0       0       5       9.0     28.0    118.24  0.00000000      0.00058319      0.34026869
        0.21053451      0.06934004      0.04548403      0.07671303      0.10090398      0.15072623      0.00544631
2013    1       -3      0       0       5       9.0     28.0    138.92  0.00000000      0.00000000      0.03331987
        0.59242727      0.18326590      0.04825943      0.03647473      0.04773246      0.05820534      0.00031500
2014    1       -3      0       0       5       9.0     28.0    49.68   0.00000000      0.00000000      0.00000000
        0.04583663      0.65905889      0.17432845      0.05249064      0.03186569      0.03574139      0.00067831
2005    2       -8      0       0       6       9.0     28.0    12.12   0.06930693      0.58085809      0.31023102
        0.01980198      0.01320132      0.00330033      0.00000000      0.00000000      0.00330033      0.00000000
2007    2       -8      0       0       6       9.0     28.0    14.80   0.00000000      0.00810811      0.15945946
        0.65405405      0.15945946      0.01891892      0.00000000      0.00000000      0.00000000      0.00000000
2009    2       -8      0       0       6       9.0     28.0    27.20   0.00147059      0.02058824      0.02647059
        0.22205882      0.42794118      0.24852941      0.04852941      0.00441176      0.00000000      0.00000000
2010    2       -8      0       0       6       9.0     28.0    25.48   0.00784929      0.21507064      0.26844584
        0.13186813      0.17582418      0.13657771      0.05494505      0.00941915      0.00000000      0.00000000
2011    2       -8      0       0       6       9.0     28.0    14.32   0.00000000      0.08100559      0.31843575
        0.16759777      0.18435754      0.13687151      0.09497207      0.01675978      0.00000000      0.00000000
2012    2       -8      0       0       6       9.0     28.0    8.64    0.00000000      0.00462963      0.20833333
        0.43518519      0.13888889      0.06018519      0.07407407      0.04166667      0.03703704      0.00000000
2008    1       -9      0       0       6       9.0     28.0    28.88   0.03739612      0.00277008      0.11357341
        0.43628809      0.38919668      0.02077562      0.00000000      0.00000000      0.00000000      0.00000000
2012    1       -9      0       0       6       9.0     28.0    22.88   0.00000000      0.01573427      0.26223776
        0.30419580      0.14160839      0.10489510      0.06818182      0.06993007      0.03321678      0.00000000
2013    1       -9      0       0       6       9.0     28.0    14.16   0.00000000      0.00000000      0.27401130
        0.45762712      0.11299435      0.07062147      0.05649718      0.01129944      0.01694915      0.00000000
#
69 # N_mean_length-at-age_obs_(not_used_in_current_model)
# Year Season Fleet/Survey Gender Part Ageerr Nsamp datavector(female-male) Nfish (female-male)
1993    1       1       0       0       1       2.72    -1.0    -1.0    18.0    18.8    19.3    -1.0    -1.0    -1.0
        -1.0    -1.0    0.00    0.00    0.32    2.08    0.28    0.00    0.00    0.00    0.00    0.00
```

1994	1	1	0	0	1	11.76	17.8	-1.0	18.4	18.9	19.0	-1.0	-1.0	-1.0
	-1.0	-1.0	0.32	0.00	3.80	2.00	0.32	0.00	0.00	0.00	0.00	0.00		
1995	1	1	0	0	1	4.76	15.0	16.5	16.9	17.7	-1.0	-1.0	-1.0	-1.0
	-1.0	-1.0	0.56	2.68	1.20	0.32	0.00	0.00	0.00	0.00	0.00	0.00		
1996	1	1	0	0	1	89.28	-1.0	17.5	18.5	19.2	19.6	20.2	-1.0	26.6
	-1.0	-1.0	0.00	5.12	52.28	27.72	3.68	0.44	0.00	0.04	0.00	0.00		
1997	1	1	0	0	1	54.92	13.5	16.4	18.3	19.6	21.6	22.0	-1.0	-1.0
	-1.0	-1.0	0.12	25.80	24.68	3.92	0.32	0.08	0.00	0.00	0.00	0.00		
1998	1	1	0	0	1	75.32	12.7	14.5	17.0	19.6	20.8	21.9	22.4	-1.0
	-1.0	-1.0	3.56	53.52	14.84	1.76	1.24	0.36	0.04	0.00	0.00	0.00		
1999	1	1	0	0	1	6.96	13.7	15.1	15.7	17.9	-1.0	-1.0	-1.0	-1.0
	-1.0	-1.0	0.84	3.60	2.48	0.04	0.00	0.00	0.00	0.00	0.00	0.00		
2000	1	1	0	0	1	22.64	14.1	16.7	17.1	17.1	18.1	22.2	-1.0	-1.0
	-1.0	-1.0	1.08	3.92	10.64	6.56	0.36	0.08	0.00	0.00	0.00	0.00		
2001	1	1	0	0	1	37.24	11.6	17.3	18.8	21.3	22.1	23.3	23.5	23.8
	-1.0	-1.0	8.36	7.68	4.28	10.68	4.24	1.52	0.36	0.12	0.00	0.00		
2002	1	1	0	0	1	30.32	16.1	16.3	17.6	18.4	20.8	22.8	-1.0	-1.0
	-1.0	-1.0	5.36	16.48	6.84	1.16	0.44	0.04	0.00	0.00	0.00	0.00		
2003	1	1	0	0	1	17.76	12.0	16.9	18.2	20.0	20.7	-1.0	-1.0	-1.0
	-1.0	-1.0	8.56	4.48	4.36	0.32	0.04	0.00	0.00	0.00	0.00	0.00		
2004	1	1	0	0	1	33.52	13.9	15.6	16.9	18.5	18.5	-1.0	23.7	-1.0
	-1.0	-1.0	0.16	30.12	2.72	0.20	0.24	0.00	0.08	0.00	0.00	0.00		
2005	1	1	0	0	1	35.24	13.4	14.3	16.4	18.3	21.8	23.3	24.5	-1.0
	-1.0	-1.0	4.72	12.56	16.48	1.20	0.16	0.00	0.00	0.00	0.00	0.00		
2006	1	1	0	0	1	69.76	14.5	15.4	16.9	18.2	-1.0	-1.0	-1.0	-1.0
	-1.0	-1.0	0.92	47.36	18.60	2.88	0.00	0.00	0.00	0.00	0.00	0.00		
2007	1	1	0	0	2	86.00	12.9	15.2	16.7	17.6	18.1	-1.0	-1.0	-1.0
	-1.0	-1.0	2.24	16.16	52.00	14.80	0.80	0.00	0.00	0.00	0.00	0.00		
2008	1	1	0	0	3	30.84	14.1	16.9	17.4	18.9	21.2	-1.0	-1.0	-1.0
	-1.0	-1.0	1.60	8.56	18.08	2.24	0.36	0.00	0.00	0.00	0.00	0.00		
2009	1	1	0	0	3	22.88	16.1	16.4	17.4	17.9	-1.0	-1.0	-1.0	-1.0
	-1.0	-1.0	0.08	5.40	13.20	3.92	0.00	0.00	0.00	0.00	0.00	0.00		
2010	1	1	0	0	4	12.68	15.8	16.0	16.3	17.8	-1.0	-1.0	-1.0	-1.0
	-1.0	-1.0	0.20	10.04	2.12	0.32	0.00	0.00	0.00	0.00	0.00	0.00		
2011	1	1	0	0	4	21.64	-1.0	17.4	17.7	17.9	19.4	-1.0	-1.0	-1.0
	-1.0	-1.0	0.00	5.64	10.76	5.12	0.12	0.00	0.00	0.00	0.00	0.00		
2012	1	1	0	0	4	22.32	14.3	16.4	18.9	19.9	20.7	21.3	21.3	-1.0
	-1.0	-1.0	0.04	1.60	10.44	8.52	1.36	0.24	0.12	0.00	0.00	0.00		
2013	1	1	0	0	4	15.84	11.5	14.0	20.1	20.9	21.8	22.4	22.9	23.7
	22.7	-1.0	0.60	0.52	2.44	5.72	5.40	0.96	0.12	0.04	0.04	0.00		
2014	1	1	0	0	4	5.92	13.9	14.5	22.6	22.6	22.8	22.8	22.8	23.8
	-1.0	-1.0	0.88	0.04	0.04	0.40	2.64	1.40	0.44	0.08	0.00	0.00		
1993	2	2	0	0	1	30.44	15.8	17.5	18.4	20.6	22.1	23.6	-1.0	-1.0
	-1.0	-1.0	6.44	11.52	9.24	1.96	0.72	0.40	0.00	0.00	0.00	0.00		
1994	2	2	0	0	1	120.96	15.0	16.7	18.0	18.6	19.1	-1.0	21.0	-1.0
	-1.0	-1.0	47.44	54.28	12.08	6.24	0.76	0.00	0.04	0.00	0.00	0.00		
1995	2	2	0	0	1	58.84	15.5	16.6	17.3	18.1	20.5	-1.0	-1.0	-1.0
	-1.0	-1.0	13.20	29.12	14.96	1.36	0.16	0.00	0.00	0.00	0.00	0.00		
1996	2	2	0	0	1	45.92	13.9	15.9	18.5	19.2	22.2	-1.0	-1.0	-1.0
	-1.0	-1.0	14.00	15.16	13.80	2.60	0.16	0.00	0.00	0.00	0.00	0.00		
1997	2	2	0	0	1	47.44	13.2	16.6	19.5	21.0	21.5	21.8	23.8	-1.0
	-1.0	-1.0	8.36	15.04	9.64	9.84	3.76	0.64	0.16	0.00	0.00	0.00		
1998	2	2	0	0	1	72.48	13.4	15.1	17.1	19.6	20.8	21.2	-1.0	-1.0
	-1.0	-1.0	23.24	33.12	13.80	1.52	0.60	0.20	0.00	0.00	0.00	0.00		
1999	2	2	0	0	1	55.32	15.0	15.3	16.0	16.1	-1.0	-1.0	20.5	-1.0
	-1.0	-1.0	16.72	26.68	10.44	1.04	0.00	0.00	0.04	0.00	0.00	0.00		
2000	2	2	0	0	1	48.04	14.1	15.2	17.2	17.6	17.7	-1.0	-1.0	22.6
	-1.0	-1.0	13.04	19.12	12.76	2.60	0.48	0.00	0.00	0.04	0.00	0.00		
2001	2	2	0	0	1	71.04	13.1	15.4	17.7	19.3	20.3	21.1	-1.0	-1.0
	-1.0	-1.0	49.60	13.44	5.28	2.20	0.40	0.12	0.00	0.00	0.00	0.00		
2002	2	2	0	0	1	76.48	15.5	16.7	17.8	18.9	20.0	22.8	24.8	-1.0
	-1.0	-1.0	12.88	43.52	14.92	3.92	0.92	0.24	0.04	0.00	0.04	0.00		
2003	2	2	0	0	1	74.64	13.4	15.7	18.5	19.8	22.1	-1.0	23.9	-1.0
	-1.0	-1.0	63.08	2.76	4.60	2.16	1.24	0.00	0.32	0.00	0.00	0.00		
2004	2	2	0	0	1	59.16	14.2	15.4	17.6	19.7	21.7	23.4	-1.0	-1.0
	-1.0	-1.0	3.32	50.76	4.36	0.60	0.08	0.04	0.00	0.00	0.00	0.00		
2005	2	2	0	0	1	89.04	13.0	14.8	16.9	19.2	20.0	23.4	24.6	-1.0
	-1.0	-1.0	44.68	31.32	11.56	0.80	0.16	0.16	0.20	0.00	0.00	0.00		
2006	2	2	0	0	1	105.16	14.0	15.8	18.2	19.3	21.2	-1.0	-1.0	-1.0
	-1.0	-1.0	17.08	61.52	23.04	3.40	0.12	0.00	0.00	0.00	0.00	0.00		
2007	2	2	0	0	2	67.44	13.4	14.8	17.3	20.1	21.7	-1.0	-1.0	-1.0
	-1.0	-1.0	22.96	27.76	10.64	5.12	0.84	0.00	0.00	0.00	0.00	0.00		
2008	2	2	0	0	3	39.76	13.1	16.2	17.6	19.0	21.8	-1.0	-1.0	-1.0
	-1.0	-1.0	7.16	21.88	8.44	2.08	0.20	0.00	0.00	0.00	0.00	0.00		

```
2009    2       2       0       0       3       98.08   14.2    15.0    15.6    18.0    20.1    -1.0    -1.0    -1.0
        -1.0    -1.0    49.52   37.36   10.56   0.48    0.16    0.00    0.00    0.00    0.00    0.00
2010    2       2       0       0       4       31.40   14.2    15.5    19.1    20.8    21.5    22.1    23.0    25.1
        -1.0    -1.0    13.84   7.96    0.68    1.52    3.08    3.80    0.44    0.04    0.00    0.00
2011    2       2       0       0       4       54.88   13.4    15.9    18.2    19.8    21.0    21.7    22.0    22.5
        23.0    -1.0    9.40    18.92   14.96   5.24    2.44    2.08    1.28    0.48    0.08    0.00
2012    2       2       0       0       4       8.92    15.5    18.2    19.1    20.1    20.9    22.8    23.1    -1.0
        -1.0    -1.0    0.08    1.36    4.72    2.32    0.32    0.08    0.04    0.00    0.00    0.00
2013    2       2       0       0       4       26.40   16.0    17.5    20.9    21.8    22.4    22.8    24.5    23.6
        24.4    -1.0    0.28    1.80    6.24    11.28   4.84    1.52    0.16    0.20    0.08    0.00
2014    2       2       0       0       4       13.88   14.0    15.8    16.2    19.3    23.2    23.3    24.0    -1.0
        -1.0    -1.0    2.32    7.36    2.56    0.08    0.40    1.12    0.04    0.00    0.00    0.00
1999    1       3       0       0       5       2.96    -1.0    -1.0    17.8    19.7    21.0    22.5    24.2    -1.0
        -1.0    -1.0    0.00    0.00    1.56    0.60    0.20    0.52    0.08    0.00    0.00    0.00
2000    1       3       0       0       5       66.64   -1.0    19.9    19.1    20.7    21.5    22.1    22.3    22.7
        -1.0    -1.0    0.00    0.44    12.40   25.16   14.76   8.16    4.00    1.12    0.00    0.00
2001    1       3       0       0       5       81.28   -1.0    16.3    20.4    20.8    21.2    22.1    22.8    -1.0
        23.4    -1.0    0.00    1.76    8.68    34.96   22.88   7.56    4.08    0.00    0.00    0.00
2002    1       3       0       0       5       110.32  -1.0    19.5    20.7    21.7    22.0    22.3    22.8    23.2
        23.5    24.1    0.00    0.96    4.28    15.36   39.76   26.68   12.80   6.64    3.72    0.12
2003    1       3       0       0       5       92.32   -1.0    18.9    19.6    20.4    21.8    22.5    22.7    22.9
        23.5    23.8    0.00    1.80    15.12   14.40   10.40   17.80   14.88   8.08    8.72    1.12
2004    1       3       0       0       5       66.56   -1.0    16.9    19.7    21.2    22.5    23.1    23.4    23.5
        23.6    23.8    0.00    18.80   8.80    9.76    6.44    7.64    8.04    3.12    3.32    0.64
2005    1       3       0       0       5       40.84   -1.0    17.0    17.5    17.9    19.6    21.9    22.9    24.0
        24.0    24.3    0.00    0.96    22.12   5.48    2.72    1.76    1.52    1.64    3.20    1.44
2006    1       3       0       0       5       26.92   -1.0    -1.0    19.1    19.5    19.8    20.4    20.7    23.5
        -1.0    -1.0    0.00    0.00    0.48    17.64   5.40    1.80    0.76    0.32    0.48    0.04
2007    1       3       0       0       5       89.40   -1.0    -1.0    18.6    19.3    19.7    20.1    20.8    21.1
        24.1    25.5    0.00    0.00    3.00    38.36   37.80   7.76    1.68    0.40    0.32    0.08
2008    1       3       0       0       5       94.00   -1.0    -1.0    18.5    19.2    19.9    20.3    21.0    21.8
        22.8    -1.0    0.00    0.00    0.24    11.76   45.96   29.12   5.24    1.08    0.60    0.00
2009    1       3       0       0       5       93.24   -1.0    -1.0    19.1    19.1    19.5    19.9    20.1    20.4
        20.9    -1.0    0.00    0.00    0.64    4.16    28.68   35.48   19.56   4.00    0.72    0.00
2010    1       3       0       0       5       33.76   -1.0    -1.0    16.4    19.0    19.9    20.0    20.2    20.3
        20.4    -1.0    0.00    0.00    0.16    1.12    6.88    13.04   8.40    3.48    0.68    0.00
2011    1       3       0       0       5       42.88   -1.0    17.4    19.0    20.0    20.7    20.9    21.0    21.1
        21.0    -1.0    0.00    0.12    1.24    2.12    5.16    13.08   12.60   7.04    1.52    0.00
2012    1       3       0       0       5       118.24  -1.0    19.9    19.8    20.1    20.8    21.4    21.7    21.8
        21.9    22.4    0.00    0.12    41.72   25.04   8.12    5.44    8.92    11.76   16.52   0.60
2013    1       3       0       0       5       138.92  -1.0    -1.0    20.7    20.9    21.1    21.3    22.0    22.2
        22.2    23.1    0.00    0.00    4.24    80.44   26.12   6.80    5.52    6.96    8.80    0.04
2014    1       3       0       0       5       49.68   -1.0    -1.0    -1.0    21.9    22.0    22.0    22.1    22.7
        22.8    24.1    0.00    0.00    0.00    2.40    32.68   8.64    2.60    1.60    1.72    0.04
2005    2       8       0       0       6       12.12   16.4    18.6    19.4    20.1    23.3    26.8    -1.0    -1.0
        -1.0    -1.0    0.84    7.04    3.76    0.24    0.16    0.04    0.00    0.00    0.04    0.00
2007    2       8       0       0       6       14.80   -1.0    17.7    19.4    21.4    21.8    22.0    -1.0    -1.0
        -1.0    -1.0    0.00    0.12    2.36    9.68    2.36    0.28    0.00    0.00    0.00    0.00
2009    2       8       0       0       6       27.20   16.6    16.9    19.7    21.8    22.1    22.3    22.7    24.3
        -1.0    -1.0    0.04    0.56    0.72    6.04    11.64   6.76    1.32    0.12    0.00    0.00
2010    2       8       0       0       6       25.48   17.7    17.9    18.6    21.0    22.9    23.0    23.1    -1.0
        -1.0    -1.0    0.20    5.48    6.84    3.36    4.48    3.48    1.40    0.24    0.00    0.00
2011    2       8       0       0       6       14.32   -1.0    20.3    20.7    21.9    23.0    -1.0    23.3    23.3
        -1.0    -1.0    0.00    1.16    4.56    2.40    2.64    0.00    1.36    0.00    0.00    0.00
2012    2       8       0       0       6       8.64    -1.0    18.1    21.5    21.8    22.2    23.3    -1.0    24.3
        -1.0    -1.0    0.00    0.04    1.80    3.76    1.20    0.52    0.00    0.36    0.32    0.00
2008    1       9       0       0       6       28.88   10.2    19.7    19.9    20.7    21.2    21.5    -1.0    -1.0
        -1.0    -1.0    1.08    0.08    3.28    12.60   11.24   0.60    0.00    0.00    0.00    0.00
2012    1       9       0       0       6       22.88   -1.0    20.4    20.8    21.1    21.5    22.6    23.3    23.3
        24.0    -1.0    0.00    0.36    6.00    6.96    3.24    2.40    1.56    1.60    0.76    0.00
2013    1       9       0       0       6       14.16   -1.0    -1.0    22.3    22.4    22.4    23.7    -1.0    -1.0
        24.1    -1.0    0.00    0.00    3.88    6.48    1.60    1.00    0.00    0.00    0.24    0.00
#
0 # N_environment variables
0 # N_environment obs
0 # N_sizefreq methods to read in
0 # No tag data
0 # No morph composition data
999 # End of file
```

Appendix C

PFMC Scientific Peer Reviews and Advisory Body Reports.

Agenda Item H.1.b
Supplemental SSC Report
April, 2016

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON FINAL ACTION ON SARDINE ASSESSMENT, SPECIFICATIONS, AND MANAGEMENT MEASURES

Mr. Dale Sweetnam presented the 2016 sardine update assessment to the Scientific and Statistical Committee (SSC). The update had previously been reviewed by the SSC Coastal Pelagic Species (CPS) Subcommittee on March 10th, 2016. The update assessment was complete and well documented and followed the Terms of Reference for update assessments. The SSC endorses the update assessment as the best available science, an OFL of 23,085 mt and the Category-2 default sigma (σ) of 0.72 to be used in determining the ABC. The update assessment was assigned a Category-2 designation due to increased uncertainty relative to previous full and update assessments as evidenced by poor fits to recent survey biomass indices and length composition data, and the uncertainty associated with the size of the 2015 recruitment, which represents a large portion of the current biomass given the low overall stock size.

The spring and summer 2015 Acoustic-Trawl Method (ATM) surveys produced biomass indices of 29,048 mt (CV = 0.30) and 15,870 mt (CV = 0.80), respectively. These surveys were conducted in a similar manner to previous ATM surveys, with the exception that the spring survey was shifted substantially to the north compared to the area usually surveyed during this time of year. The habitat model indicated that sardine habitat in spring 2015 was shifted northward from the usual area due to warm ocean temperatures, and information from the fishery supported this prediction. The estimates of abundance are both below the respective indices produced in 2014 (~ 35,000 mt in spring and 26,000 mt in summer).

The SSC agrees with the STAT that the summer 2015 ATM length compositional data should be excluded from the update assessment. The 2015 recruitment is estimated to be implausibly large when the summer 2015 ATM survey lengths are included in the assessment. This is due to the estimated low survey selectivity on very small fish, which results in any small fish encountered being expanded up to an extremely large number. Selectivity is a model feature that cannot be addressed in an update according to the Terms of Reference for update assessments, and therefore removing these length data is an appropriate approach.

However, there are other indicators of the 2015 sardine recruitment being larger than those in recent years. These include: 1) a large number of sardine late larvae and juveniles (young-of-the-year) caught during the 2015 SWFSC Rockfish Recruitment survey in all three latitudinal areas (in contrast to virtually none over the previous three years); and 2) a large number of larval sardine caught along the Newport Hydrographic Line. The magnitude of encounters with larval and juvenile sardine in these surveys depends on oceanographic and spatial distribution factors as well as the overall size of the age class at the time of the survey. Therefore, it is difficult to include these types of data directly, even when conducting a full assessment. The SSC was also informed by Mr. Sweetnam that the Spring 2016 ATM survey, although not yet complete, has encountered small sardine of a size-class consistent with there being a significant 2015 recruitment.

In 2015, the SSC endorsed the approach of setting the 2014 recruitment to be the average of the previous three estimated recruitments to be more consistent with recent observed patterns in recruitment, and given retrospective patterns in recruitment estimation. In contrast to the approach used in 2015, this year the SSC concluded that allowing the model to estimate the terminal year recruitment value, after removing the summer 2015 ATM survey length data, and therefore (lacking informative data) taking the value off of the estimated spawner-recruit curve, is appropriate for estimating the 2015 recruitment.

The fits to the abundance indices and composition data in the assessment update remain poor, and the fits are worse in recent years than earlier in the time series. Sample sizes for compositional data have been consistently small for the survey, and have been small in recent years for the fisheries due limited fishing. The lack of fit is concerning. It is not clear how this can be addressed without better data. The catchability and selectivity of the acoustic and trawl portions of the ATM surveys in particular remain large sources of uncertainty in the assessment. These issues should be considered in more detail during the 2017 full assessment. In addition, the SSC continues to recommend a methodology review of the ATM survey in 2017.

SSC Notes:

Model fit is above the past 4 ATM survey indices – at edge of CIs. Fit to length data MexCal fleet over the past few years is poor.

The spring survey has caught a large number of sardines (over 13,000) in leg 1 off of Oregon, also apparently showing a strong 2015 recruitment event in the length comps.

- *The retrospective plot is unclear and the first retrospective run really begins at "-2", so maybe redo this plot in the 2016 update with a different color for last two points as forecast, and call -2 -1, etc.*
- *It would be good to include a plot of the time series of E_{MSY} for OFL/ABC and HG calculation in the document.*
- *The ATM survey backscatter graphs across all years for spring and for summer should be included in the next assessment report.*
- *It is possible that some sardines were missed to the north of the spring 2015 ATM survey.*
- *The small sample sizes from trawling during the ATM surveys remains a concern; during 2016 many trawls had just one or two fish, but most in 2 hauls; the third largest haul was 17 fish.*
- *Selectivity patterns may have changed due to changes in migration due to small stock size. The next full assessment should explore selectivity blocks for recent years.*
- *A formal consideration of recruitment autocorrelation could be explored in the next full assessment.*
- *The next full assessment should consider alternative values for M or estimate M. Note that estimating M may lead to the need to revise the HCRs, which were derived for $M=0.4yr^{-1}$.*
- *The catchability and selectivity of the acoustic and trawl portions of the ATM surveys in particular remain large sources of uncertainty in the assessment. The SSC CPS subcommittee recommends prioritizing a methodology review of the ATM survey*

New and updated data included in the 2016 update include: 1) landings data for 2015, with updated landings data from 2014 and projected catch data for the first half of 2016; 2) new *fishery length data from July-December 2015, with updated length data for July 2014 through June 2015; 3) new and updated conditional age-at-length data through June 2015 for the PacNW fisheries, and through the end of 2014 for the MexCal fisheries; 4) a 2015 Daily Egg Production Method index and both spring and summer 2015 Acoustic-Trawl method (ATM) survey indices; and 5) length data from the spring 2015 ATM survey (the summer 2015 ATM survey length data were not used for reasons described below).*

Last year, during the 2015 sardine assessment update, the STAT recognized that there had been a persistent retrospective issue with recruitment in preceding years, with terminal year recruitments determined to have been overestimated in the assessment models based on subsequent information.

SSC CPS subcommittee meeting report: Sardine assessment update review March 10, 2016, Sacramento, California.

General

Dr. Kevin Hill (SWFSC) presented the 2016 sardine update assessment to the SSC CPS subcommittee on March 10th, 2016, following presentations by Dr. Emmanis Dorval on the 2015 DEPM estimate, and by Dr. Juan Zwolinski on the 2015 ATM surveys. The SSC CPS subcommittee wishes to thank the STAT for a complete and well documented update assessment.

New data included in the 2016 update proposed by the STAT include: 1) landings data for 2015, with updated landings data from 2014 and projected catch data for the first half of 2016; 2) new fishery length data from July-December 2015, with updated length data for July 2014 through June 2015; 3) new and updated conditional age-at-length data through June 2014 for the PacNW fisheries, and through the end of 2014 for the MexCal fisheries; 4) a 2015 DEPM index and both the spring and the summer 2015 ATM survey indices; and 5) length data from the spring 2015 ATM survey (the summer 2015 ATM survey length data were not used for reasons described below).

The spring and summer 2015 ATM surveys produced biomass indices of 29,048 mt (CV = 0.30, ln(SE) = 0.29) and 15,870 mt (CV = 0.80, ln(SE) = 0.70), respectively. These surveys were conducted in a similar manner to previous ATM surveys, with the exception that the spring survey was shifted substantially to the north compared to the area usually surveyed during this time of year. In the spring of 2015, the habitat model indicated that sardine habitat was shifted northward from the usual area due to warm ocean temperatures, and information from the fishery supported this prediction. The estimates of abundance are both below the respective indices produced in 2014 (~ 35,000 mt in spring and 26,000 mt in summer). Very little catch has been taken in the current management year (less than 300 mt in the second half of 2015).

The major issues with the update assessment that were discussed at the SSC CPS subcommittee meeting related to: 1) the 2016 DEPM index, and 2) how to estimate the size of the 2015 cohort.

DEPM Index

The DEPM survey captured only six females that were at the right spawning stage for fecundity estimation. Fecundity data were consequently borrowed from the previous two years and combined with the current year's samples to estimate fecundity for applying the DEPM. The CPS subcommittee was concerned with this approach, as it deviates from usual practice as well as the observation that fecundity appears to vary among years. However, when the 2015 DEPM *index was removed from the assessment, the results were essentially unchanged. The CPS subcommittee therefore concluded there was no harm in including the 2015 DEPM estimate in the 2016 update assessment, but that the analysis and question of inclusion should be revisited during the full assessment in 2017.*

Recruitment estimate

During the 2015 sardine assessment update, the 2015 STAT recognized that there had been a persistent retrospective issue with recruitment in preceding years, with terminal year recruitments estimated in the assessment models proving to have been overestimated based on subsequent information. The SSC endorsed the approach of setting the 2014 recruitment to be the average of the previous three estimated recruitments (as had been done previously in the Pacific mackerel assessment) to be more consistent with recent observed patterns in recruitment.

Coming into the subcommittee meeting, the 2016 sardine STAT suggested using the same approach for the 2015 recruitment estimate (i.e., setting the 2015 recruitment to the average of the estimates of recruitment for 2012, 2013 and 2014). However, in contrast to the situation during the 2015 update assessment, there were data to suggest that the 2015 recruitment may have been relatively large. In fact, when the 2015 recruitment was estimated with all of the data in the model, including the summer 2015 ATM survey lengths, the estimated recruitment was the largest in the time series. This was because the selectivity of the very small fish (< 10 cm) that were observed in large numbers in the summer 2015 ATM is estimated to be near zero in the model, and therefore any fish encountered are expanded up to a very large, if implausible, value. Selectivity is a model feature that cannot be addressed in an update model according to the Terms of Reference for update assessments, and therefore removing this year of length data is an appropriate approach. However, the evidence of a relatively large recruitment event should not be ignored. There are other indicators of a relatively strong 2015 sardine recruitment event. These include: 1) a large number of sardine late larvae and juveniles (young-of-the-year) caught in the 2015 SWFSC Rockfish Recruitment survey in all three latitudinal areas (in contrast to virtually none over the previous three years); and 2) a large number of larval sardine caught along the Newport Hydrographic Line (Leising et al. 2015). In addition, the CalCOFI sea surface temperature data which are used to determine E_{MSY} *is the highest on record, providing for the maximum allowable* E_{MSY} *values in the harvest control rules.*

The CPS subcommittee concluded that while there was no evidence of a strong 2014 recruitment during the 2015 update assessment review, currently there is no direct evidence of a poor 2015 recruitment, and in contrast, several indicators of a strong recruitment, with the only indicator of poor recruitment in 2015 being recent poor recruitments (and the appearance of some degree of autocorrelation in recruitment). Therefore, allowing the model to estimate the terminal year recruitment value (with no summer 2015 ATM survey length data, and therefore (lacking informative data) taking the value off of the estimated spawner-recruit curve) is appropriate. The CPS subcommittee therefore recommended that the 2015 recruitment be estimated from the stock-recruitment relationship rather than either being set to the average of the estimates for 2012, 2013 and 2014 or estimated within the assessment when the assessment includes the summer 2015 ATM survey length-frequency data.

Conclusion

The SSC CPS subcommittee finds the 2016 update with the recommended recruitment estimation approach to represent an appropriate update of the 2014 sardine assessment model (i.e. it satisfies the Terms of Reference for Update Assessments). The results are consistent with the *previous assessment given the new data, and hence represent the best available science for management of the northern subpopulation of Pacific sardine. The biomass estimate and management quantities for this model are shown in part (a) of the table on page 12 of the 2016 Sardine Assessment Executive Summary. The SSC CPS subcommittee recommends endorsing the 2016/17 Pacific sardine OFL of 23,085 mt in that table.*

May 2016 data limited workshop

The CPS subcommittee briefly discussed the upcoming (2-5 May 2016) workshop that will respond to Council requests for planning for stock assessment of Pacific anchovy, including an assessment to be conducted during 2016. The planning for the workshop is underway. Jim Ianelli and André Punt have been designated as co-chairs. Seven or eight experts will be invited, along with representatives of the CPSAS and CPSMT. The CPS subcommittee agreed that the workshop should be conducted following the Terms of Reference for Methodology Reviews given that the methodology identified during the workshop could form the basis for an assessment of northern anchovy this year. The subcommittee recommends that the report of the workshop be reviewed by the SSC at the June Council meeting so that feedback can be provided to the analysts in a timely manner.

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON FINAL ACTION ON SARDINE ASSESSMENT, SPECIFICATIONS, AND MANAGEMENT MEASURES

The Coastal Pelagic Species Management Team (CPSMT), Coastal Pelagic Species Advisory Subpanel (CPSAS) and Scientific and Statistical Committee (SSC) jointly received a presentation from Mr. Dale Sweetnam concerning the Pacific sardine stock update assessment conducted in 2016. The CPSMT recommends that the Pacific Fishery Management Council (Council) adopt the update assessment for management of the 2016-2017 sardine fishery (Agenda Item H.1.a, Stock Assessment Report). The age 1+ biomass estimated from this assessment is 106,137 metric tons (mt).

Similar to the 2015-2016 biomass estimate of 96,688 mt, the 2016-2017 biomass estimate of 106,137 mt is below the CUTOFF value of 150,000 mt. Accordingly, the Fishery Management Plan dictates a closure of the primary directed fishery for Pacific sardine for the upcoming fishing year (July 1, 2016 - June 15, 2017). This closure, however, does not preclude the allowance for incidental catch in other CPS and non-CPS fisheries as well as directed live bait, recreational and tribal harvest fisheries.

Harvest Specifications for 2016-2017

Table 1 (below) contains the overfishing limit (OFL) and a range of acceptable biological catch (ABC) values based on various P* (probability of overfishing) values. Considering the results of the most recent full stock assessment conducted in 2014 and the update in 2015, the Council chose a P* of 0.40 for the 2014-2015 and 2015-2016 fisheries. The SSC designated this year's assessment as a tier 2. The P* value of 0.40 applied to the 2016-2017 OFL of 23,085 mt, using a Tier 2 sigma of 0.72 produces an acceptable biological catch (ABC) of 19,236 mt. The CPSMT recommends the use of this P* recognizing that the uncertainty in the assessment has been addressed by selecting a more precautionary sigma value.

For the 2015-2016 fishing season, the CPSMT evaluated the potential needs for incidental allowances for other CPS fisheries (Agenda item G.1.b, Supplemental CPSMT Report, April 2015). Given the similarity between the 2015-2016 and 2016-2017 biomass estimates, the CPSMT recommends the same annual catch limit (ACL) of 8,000 mt (Table 2) that we recommended in 2015 to enable the conservation of sardines while allowing other fisheries to proceed. The CPSMT believes these allowances could accommodate the fishery for the coming year, but recognizes that the dynamics of the other CPS may change as there is uncertainty around species mixing rates and the distribution along the coast. The CPSMT also recommends an annual catch target (ACT) of 5,000 mt for CPS fishery incidental catch, and the accountability measures presented below.

Consistent with 2015-2016 management and the CPS fishery management plan (FMP), tribal, live bait, and other minimal sources of mortality, such as recreational take, will be accounted for against the ACL.

Table 1. Pacific sardine harvest formula parameters for 2016-2017.

Harvest Control Rule Formulas

OFL = BIOMASS * *E* MSY * DISTRIBUTION; where *E* MSY is bounded 0.00 to 0.25
ABCP-star = BIOMASS * BUFFERP-star * *E* MSY * DISTRIBUTION; where *E* MSY is bounded 0.00 to 0.25
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION; where FRACTION is *E* MSY bounded 0.05 to 0.20

IHarvest Formula Parameters									
BIOMASS (ages 1+, mt)	106,137								
P-star	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05
ABC Buffer$_{Tier\ 2}$	0.9135	0.8333	0.7577	0.6855	0.6153	0.5455	0.4741	0.3974	0.3059
CalCOFI SST (2013-2015)	16.3891								
E_{MSY}	0.25								
FRACTION	0.20								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								

Harvest Control Rule Values (MT)									
OFL =	**23,085**								
ABC$_{Tier\ 2}$ =	21,088	19,236	17,492	15,825	14,204	12,594	10,946	9,175	7,063
ACL =	**8,000**								
HG =	0								

Table 2. 2016-17 Calculated OFL and ABC and CPSMT Recommended ACL and ACT Values.

Biomass	106,137mt
OFL	23,085mt
P* buffer	0.4
ABC$_{0.4}$	19,236mt
ACL	8,000mt
ACT	5,000mt

List of CPSMT-Recommended Accountability Measures

The following would be automatic inseason actions for CPS fisheries:

- An incidental per landing allowance of 40 percent Pacific sardine in non-treaty CPS fisheries until a total of 2,500 mt of Pacific sardine are landed.
- When the 2,500 mt is achieved the incidental per landing allowance would be reduced to 30 percent until a total of 5,000 mt of Pacific sardine have been landed.
- When 5,000 mt have been landed, the incidental per landing allowance would be reduced to 10 percent for the remainder of the 2016-2017 fishing year.

A 2 mt incidental per landing allowance in non-CPS fisheries.

Beyond the 2016-2017 fishing season

During the 2015-2016 fishing season the CPSMT became aware that the closure of directed fishing for sardine was impacting the fishing operations of a small number of mixed-used commercial fishermen who land limited amounts (10s-100s of pounds) of sardine that do not meet the existing incidental landing exemption in the FMP even though their total landings are very small. Because the amount of take by these individuals would not pose a conservation concern during situations like those both in 2015-2016 and 2016-2017 fishing years (i.e., biomass below CUTOFF and above the overfished threshold), the CPSMT recommends exploring options for allowing this small artisanal take to occur in future years. To ensure such an exemption could be in place for the 2017-2018 fishing year, this may require the Council taking action during 2016. However, the CPSMT is still reviewing what implementaiton of this action would entail.

Methodology Review

Finally, the CPSMT reiterates its support of a methodology review for the Southwest Fisheries Science Center (SWFSC) Acoustic-Trawl (A-T) survey. This survey has provided an index of abundance in the sardine stock assessment model since 2011, and has not been reviewed since February 2011. In addition, with a new vessel conducting the A-T and Daily Egg Production Method surveys, the CPSMT sees a need for a comprehensive review of both surveys, especially to address vessel selectivity differences.

PFMC
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Agenda Item H.1.b.
Supplemental CPSAS Report
April 2016

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON THE FINAL ACTION ON SARDINE STOCK ASSESSMENT, SPECIFICATIONS, AND MANAGEMENT MEASURES

The Coastal Pelagic Species Advisory Subpanel (CPSAS) and Coastal Pelagic Species Management Team (CPSMT) jointly heard a presentation of the update sardine stock assessment to the SSC presented by Dale Sweetnam of the Southwest Fishery Science Center (SWFSC). The CPSAS and CPSMT also listened to Scientific and Statistical Committee (SSC) comments and deliberations on the model and related uncertainty in light of the recruitment event observed in 2015. In addition, the CPSAS reviewed Agenda Item H.1.a, Pacific Sardine Stock Assessment Report for USA Management in 2016-17.

The CPSAS thanks the stock assessment team for their efforts and also appreciates the SSC Subcommittee acknowledgement that the multiple lines of evidence supporting a large recruitment event should be accounted for in the model in some way. The SSC stopped short of endorsing a strict update, which would have included the length comps from the small fish captured in the summer ATM survey, resulting in a biomass estimate exceeding 1 million tons. But the SSC did endorse using the stock-recruitment curve in the model, which produces a biomass estimate of 106,137 mt and an OFL of 23,085 mt, and the STAT concurred.

Due to the uncertainties inherent in this update assessment and apparent increasing lack of fit of data to the model, the SSC classified this assessment as Category 2, which results in a lower range of ABC values and more precaution in management. The uncertainty in this instance is driven by a large recruitment event documented by multiple lines of evidence that could not be incorporated into the model due to the strict Terms of Reference in an update year.

Adaptive management should work both ways. The Council's current policies make it easy to reduce fishing opportunity, but not to increase it. There is no parallel policy allowing for new data to be incorporated into assessments in update years – or for a fishery to be reopened -- until the next full assessment. The current policy has the real socio-economic effect of curtailing fisheries, and by extension harms the industry and dependent coastal communities. Requiring fishermen and industry to tie up the boats and close the doors for two or three years, or longer, does not achieve Optimum Yield.

The CPSAS appreciates the Council's consideration of the following points in deliberating management measures for the 2016-17 sardine fishery. Most of these points are carried over from our statement in 2015:

1. Industry remains concerned about the ability of current acoustic trawl surveys to measure the full extent of the biomass. Even in times of known high biomass, the SS model platform has had difficulty mirroring the reality in the ocean. The CPSAS strongly supports the SSC and CPSMT recommendations made in 2015 to conduct a methodology review of the ATM survey as soon as possible.

2. Again, this update assessment does not factor in small sardines that have been observed since last summer, both in California and the Pacific Northwest. In fact, the STAT excluded

3. Evidence of small sardines captured in the ATM survey in 2015. The spring 2016 sardine survey has observed spawning activity off southern Oregon. This evidence was presented in the SWFSC presentation to the SSC, but this information cannot be used in this update year's assessment.

4. The size of sardine stocks is largely driven by environmental conditions. There was a very poor year-class in 2010, followed by three years of poor recruitment. **With low recruitment, biomass drops very quickly absent any fishing.** This directly contradicts arguments that sardines declined due to overfishing.

   In fact, the 2015 El Niño has produced conditions that led to substantial documented recruitment. This recruitment parallels the large recruitment event following the 2003 El Niño, which resulted in peak sardine abundance in 2006-07.

5. **The sardine control rule is designed to shut down the directed fishery when biomass falls below CUTOFF. Industry supports the current cutoff of 150,000 mt.** The current sardine harvest control rule is a highly precautionary management policy.

The CPSAS further offers these recommendations to improve adaptive sardine management:

6. The May assessment workshop should re-evaluate assumptions in the sardine model, specifically
   - catchability quotient (q) in ATM surveys and
   - natural Mortality, in light of the exponential increase in marine mammal populations since Amendment 8 model assumptions were developed in the 1990s.

7. The Terms of Reference for stock assessments should be revised to provide flexibility, particularly in update years, to incorporate new findings and data into assessments that more accurately reflect conditions in the ocean.

   The Council should use the point of concern provisions in the FMP to reopen a fishery based on new lines of evidence as soon as possible, rather than the current requirement to wait for the next full assessment. Without flexibility to adaptively manage dynamic CPS stocks, industry is forced to sit idle for the better part of one or two years, or even longer, which may be beyond its economic tipping point.

8. Please consider that achieving Optimum Yield requires balancing fishery opportunity, economic stability and ecosystem needs. This means allowing incidental catch of sardine to support other fisheries. Sardines frequently school with other CPS species, and are now showing up in other CPS catches. An allowance of sardine caught incidentally in other CPS fisheries will be necessary to keep boats fishing and processors' doors open.

9. Management not only needs to maintain a sustainable resource, but also a sustainable.

Management Measures

The CPSAS recommends the following sardine management measures for July 1, 2016 – June 30, 2017, based on a Tier 2 Acceptable Biological Catch at P* 0.4 of 19,236 metric tons (mt), as outlined in the CPSMT Report (Agenda Item H.1.a. Table a).

The CPSAS notes the following rationale for our recommendation:

[1] Although industry did not capture the full set aside in 2015 that was due to the fact that in many instances sardines appeared to be above the 40 percent limit and fishermen released their catch, exercising extreme caution. If squid rebounds in 2016, industry will require additional incidental catch of sardine.

[2] The CPSAS is asking for an increase in the set aside in 2016 due to the possibility that the Pacific Northwest will target Pacific mackerel in 2016, thus increasing the need for additional incidental set aside to avoid curtailing fishing for both mackerel and anchovy, and possibly also squid, in California.

The CPSAS acknowledges that the management team is recommending basically status quo, but in light of the potential for increased catches in mackerel, anchovy and hopefully squid, and the sheer abundance of sardine now observed by fishermen in both the Northwest and California, we feel an increase is not only justified but essential to allow for fishing opportunity. Added precaution is encompassed in the lower Category 2 ABC values, the basis for our recommendation.

We feel it is better to have the incidental set aside and not use it, than to not have it and curtail the fisheries. Without a reasonable incidental catch of sardines, the CPS fleet could be preempted from fishing in 2016, particularly in California.

We recommend the following framework, which is based on the 2015 rationale:

Table 1

ACL	57.9 % of ABC at P* 0.4	11,138 mt
ACT	Set aside for incidental catch in other fisheries after accounting for tribal allocation and live bait	7,838 mt
ACT ≈	Allocated as follows:	
	40 % of Annual Catch Target	1,500 mt
	30% of Annual Catch Target	3,000 mt
	20% of Annual Catch Target	3,338 mt

If the ACT is reached, the CPSAS recommends a set aside of 10% incidental sardine by weight to allow for the squid fishery to continue if squid reappear in the fall.

The CPSAS also stresses the importance of the CPS FMP provision allowing the live bait fishery to continue. While this is considered take, an estimated 90 percent of the live bait catch is returned to the ocean alive.

Conservation Representative Statement:

The conservation member of the CPSAS recommends setting incidental catch at a more precautionary level that both protects the spawning stock while not unduly constraining other fisheries, including other CPS fisheries. Of a 7,000 mt ACL for the current season, less than 175 mt in sardine landings have been recorded so far (not including live bait), and there are few signals at this time that mackerel and/or squid fishing effort in California will be substantially greater in the coming year. Even taking into consideration the new directed mackerel fishery in Washington State and the slightly higher biomass projection for Pacific sardine, it appears likely that the current incidental catch allowance/Annual Catch Target does not need to be increased for the 2016-2017 season. While there are several lines of evidence showing high numbers of juvenile sardine, the conservation member suggests that the Council should exercise precaution in setting incidental catch until the juvenile sardine currently being observed recruit to the spawning stock.

PFMC
04/10/16