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JUNE 2015

ASSESSMENT OF THE PACIFIC SARDINE RESOURCE IN 2015 FOR U.S.A. MANAGEMENT IN 2015-16

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

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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)
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 (fixed at 3 meters depth)
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 fleet based on ENS, SCA, and CCA fishery data
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 fleet based on OR, WA, and BC fishery data
PairoVET	Paired CalVET 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 2015-16 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).

The stock assessment update was conducted using Stock Synthesis (SS), and includes one additional year of data from fishery-dependent and fishery-independent sources. A preliminary draft assessment was reviewed by members of the Scientific and Statistical Committee's CPS Subcommittee on March 6, 2015 in Vancouver, WA. The following final draft incorporates changes recommended during that review and was provided to the Pacific Fishery Management Council for their April 2015 briefing book.

EXECUTIVE SUMMARY

The following Pacific sardine assessment update was conducted to inform U.S. fishery management for the fishing year that begins July 1, 2015 and ends June 30, 2016. 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). This update assessment appends Model T with one additional year of data from fishery-dependent and -independent sources and is based on similar parameterizations as included in the most recently reviewed Model T.

Stock

This assessment focuses on the Pacific sardine northern subpopulation (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 ENS and SCA 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 Southern California Bight, 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 ENS and southern California (SCA) ports in order 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
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	29,203.7	0.0
2014-1	2013-2	17,667.5	2,106.2	1,237.7	666.7	4,404.0	0.0	908.0	0.0
2014-2	2014-1	49,076.6	0.0	320.0	0.0	1,830.8	7,788.4	7,208.5	0.0

Data and Assessment

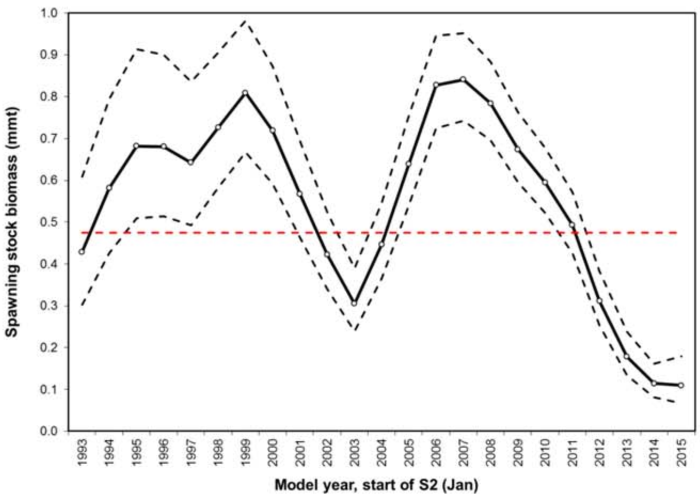
The assessment was conducted using Stock Synthesis (SS version 3.24s), and includes fishery and survey data collected from mid-1993 through 2014. The model is based on a July-June fishing year (aka 'model year'), with two semester-based seasons per year (S1=Jul-Dec and S2=Jan-Jun). Catches and biological 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 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 (1994-2013) and acoustic-trawl method (ATM) estimates of biomass along the west coast (2006-2014). Catchability (*q*) for the ATM surveys (spring and summer) was fixed (1.0) in the final base model T and *q*'s for the egg production surveys were freely estimated. The spring and summer ATM time series were modeled with independent, asymptotic selectivities.

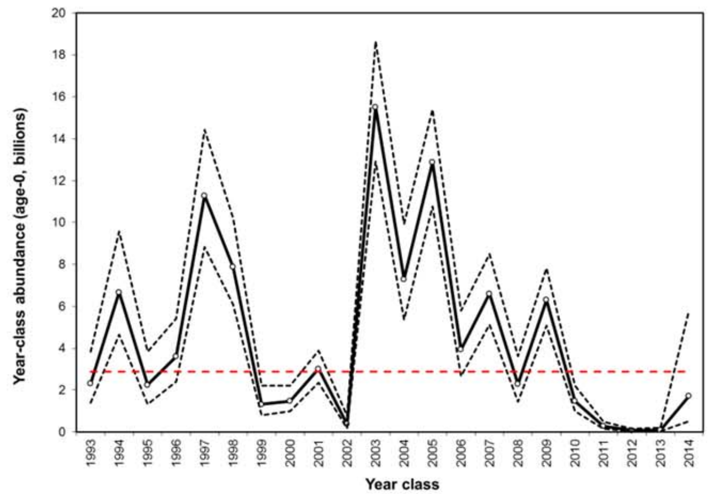
The following data were updated or appended to the update model:

- Landings for 2012 through 2014 were updated for all fishing regions (ENS to WA), including projected estimates for the first half of 2015 (model year 2014-2);
- Length compositions from SCA, CCA, OR, and WA fisheries were updated for model year 2013 and appended with the first semester of model year 2014 (Jul-Dec 2014 samples);
- Conditional age-at-length data from SCA, CCA, OR, and WA were updated through Dec 2013. Age data were not yet available for 2014;
- ATM estimates of biomass from the spring 2014 survey off California and the summer 2014 SaKe survey off the U.S. west coast (San Diego to Vancouver Island) were added to the model; and
- Due to very sparse data collected in the most recent CalCOFI survey conducted in the spring 2014 off California, it was not possible to produce an updated DEPM estimate of SSB for this index of abundance.

Spawning Stock Biomass and Recruitment

Recruitment was modeled using the Beverton-Holt (B-H) stock-recruitment relationship (σ_R=0.75). Steepness estimates typically bounded at 1.0 for most model scenarios evaluated in sensitivity analysis, with steepness being fixed at 0.8 in the final base model, based on a reasonable range for clupeid stocks indicated from stock-recruitment meta-analysis research. Virgin recruitment (R_0) for the final base model was estimated to be 2.884 billion age-0 fish. The virgin value of the spawning stock biomass (SSB) was estimated to be 0.475 million metric tons (mmt). The SSB increased throughout the 1990s, peaking at 0.809 mmt in 1999 and 0.841 mmt in 2007. Recruitment (age-0 abundance) peaked at 11.3 billion fish in 1997, 15.5 billion in 2003, and 12.9 billion in 2005. The 2010 to 2013 year classes were among the weakest in recent history. The 2014 year class, derived largely from the predicted stock-recruitment curve, was poorly estimated (CV=0.69) and unrealistically high, given the paucity of spawning activity during spring 2014.

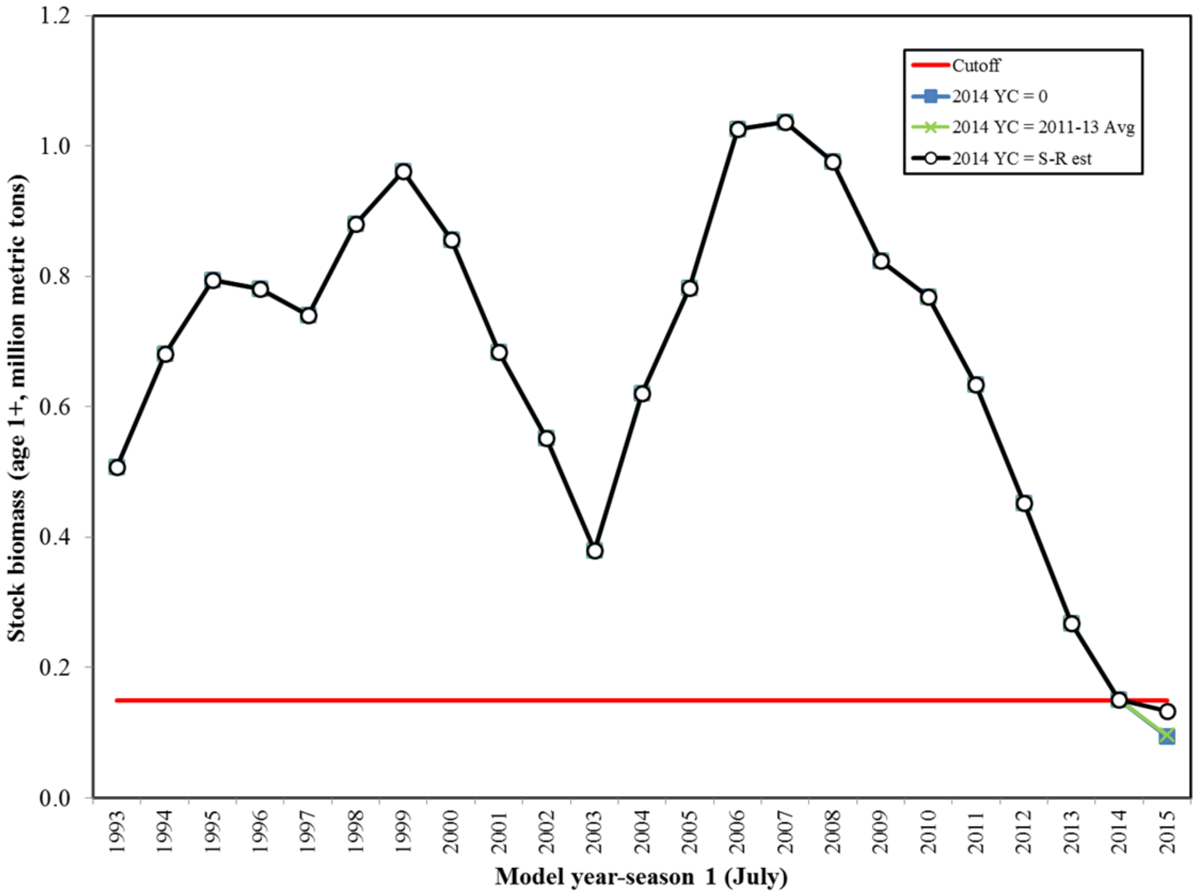




Calendar Yr-Sem	Model Yr-Seas	SSB (mt)	SSB Std Dev	Year class abundance (billions)	Recruits Std Dev
2004-1	2003-2	305,319	38,207	---	---
2004-2	2004-1	---	---	7.294	1.155
2005-1	2004-2	445,992	45,653	---	---
2005-2	2005-1	---	---	12.867	1.182
2006-1	2005-2	639,018	54,433	---	---
2006-2	2006-1	---	---	3.936	0.787
2007-1	2006-2	827,400	56,420	---	---
2007-2	2007-1	---	---	6.597	0.853
2008-1	2007-2	840,513	53,143	---	---
2008-2	2008-1	---	---	2.288	0.542
2009-1	2008-2	783,997	47,716	---	---
2009-2	2009-1	---	---	6.302	0.701
2010-1	2009-2	673,537	42,702	---	---
2010-2	2010-1	---	---	1.473	0.309
2011-1	2010-2	595,091	39,326	---	---
2011-2	2011-1	---	---	0.275	0.080
2012-1	2011-2	492,999	37,406	---	---
2012-2	2012-1	---	---	0.076	0.029
2013-1	2012-2	310,918	32,865	---	---
2013-2	2013-1	---	---	0.087	0.037
2014-1	2013-2	178,656	26,352	---	---
2014-2	2014-1	---	---	1.718	1.177
2015-1	2014-2	114,566	20,330	---	---
2015-2	2015-1	---	---	---	---
2016-1	2015-2	109,441	27,938	---	---

Stock Biomass

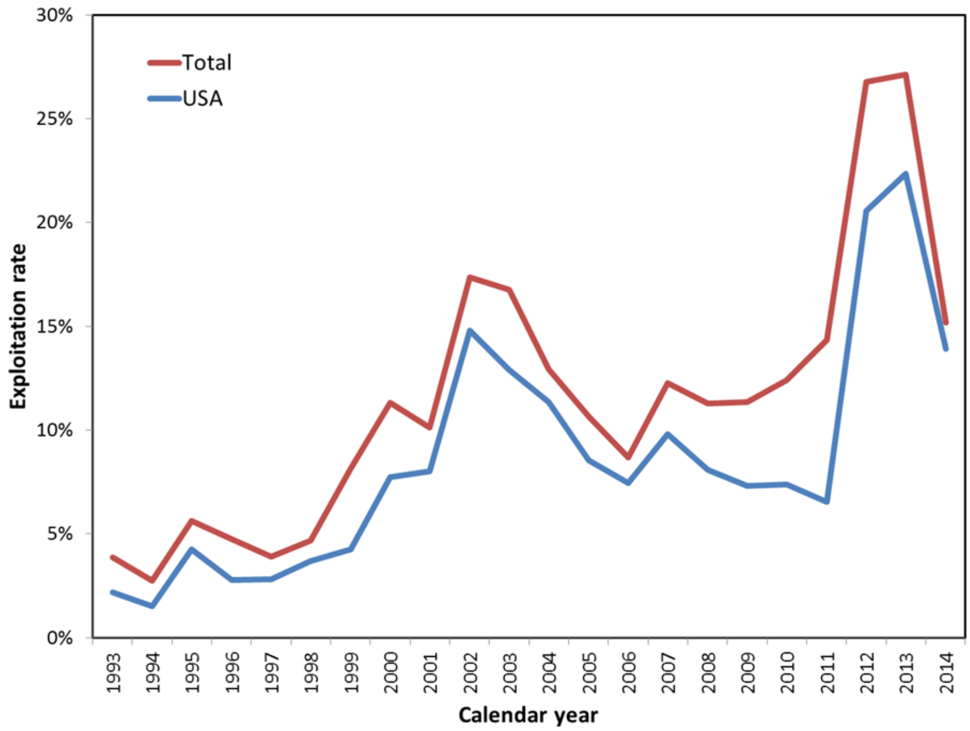
Stock biomass, used for calculating harvest specifications, is defined as the sum of the biomass for sardine ages one and older (age 1+). Stock biomass increased throughout the 1990s, peaking at 0.961 mmt in 1999 and 1.037 mmt in 2007. Stock biomass is projected to be less than 150,000 mt as of July 2015. When the 2014 year class is freely estimated, then stock biomass is projected to be 132,884 mt in July 2015. When the 2014 year class is based on an average of recruitments from 2011-2013, then stock biomass is projected to be 96,688 mt in July 2015. Given the lack of evidence for spawning in 2014, and the fact that recent recruitments have been over-estimated in the past several assessments, the latter is considered to represent the most likely scenario and is recommended for calculating harvest control rules (HCR) in 2015-2016.



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, exploitation rate for the U.S. fishery peaked at 22.4% in 2013. U.S. exploitation rate was 13.9% in 2014. U.S. exploitation rate has averaged about 11% since the onset of Council management in 2000. U.S. and total exploitation rates for the NSP, calculated from the update model, are:

Calendar year	USA	Total
2000	7.74%	11.31%
2001	8.02%	10.11%
2002	14.78%	17.36%
2003	12.90%	16.77%
2004	11.35%	12.93%
2005	8.52%	10.65%
2006	7.47%	8.68%
2007	9.80%	12.26%
2008	8.07%	11.29%
2009	7.30%	11.37%
2010	7.37%	12.41%
2011	6.54%	14.33%
2012	20.57%	26.79%
2013	22.36%	27.13%
2014	13.91%	15.20%



Harvest Control Rules

Harvest guideline

The annual HG is calculated as follows:

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

where HG is the total U.S. quota for the period July 2015 to June 2016, BIOMASS is the stock biomass (ages 1+) projected as of July 1, 2015, CUTOFF (150,000 mt) is the lowest level of biomass for which directed harvest is allowed, FRACTION (5-20%) 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 update model, and regardless of assumptions regarding strength of the 2014 year-class, stock biomass is projected to be below the 150,000 mt threshold. Therefore, HG for 2015-2016 is calculated to be 0 mt.

OFL and ABC

On March 11, 2014, the PFMC adopted the use of CalCOFI SST data for specifying environmentally-dependent E_{MSY} each year, beginning July 2014. Based on this recent decision, the following tables of OFL and ABCs are based on an E_{MSY} = 0.157239, which corresponds to the three-year running average of CalCOFI SST for 2012-2014 (15.562 °C). OFL and ABC values for 2015-2016 will depend on assumptions regarding strength of the 2014 year-class used to project stock biomass to July 1, 2015. As noted above, when the 2014 year class is freely estimated (albeit primarily derived from the spawner-recruit relationship) then stock biomass is projected to be 132,884 mt in July 2015. When the 2014 year class is based on an average of recruitments from 2011-2013, then stock biomass is projected to be 96,688 mt in July 2015.

Given the lack of spawning activity observed during spring 2014, the latter scenario is considered more realistic. The OFLs and ABCs for these two recruitment scenarios and for a range of P-star values follow:

a) HCRs when 2014 YC is derived from S-R Curve.

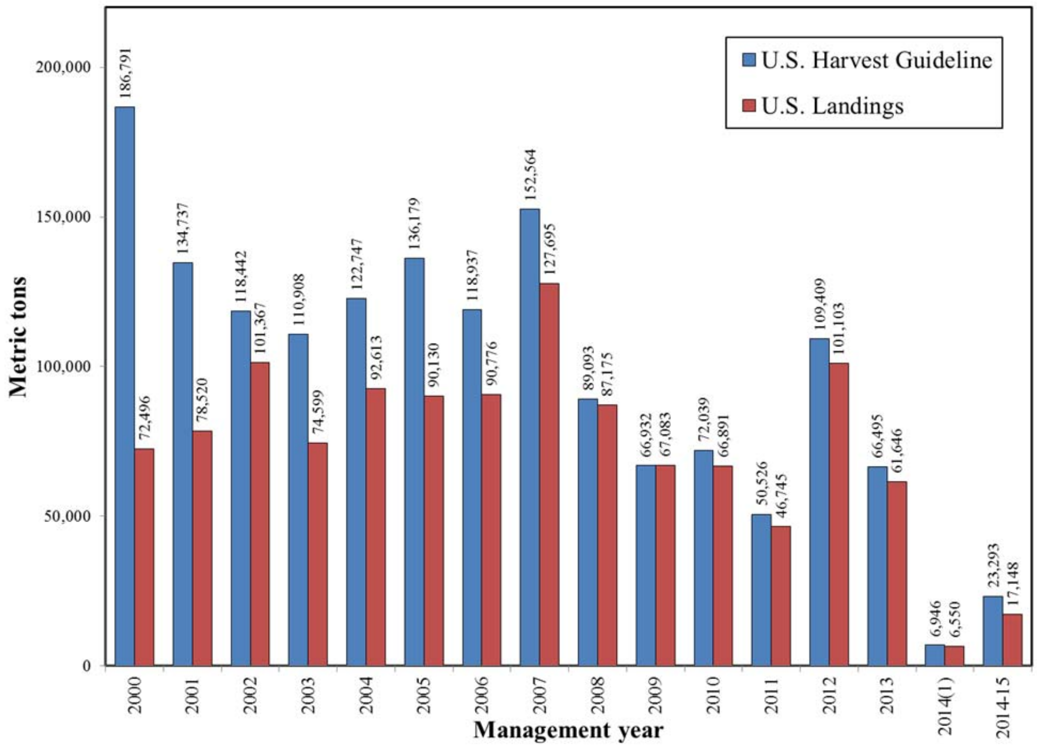
Harvest Control Rule Formulas									
OFL = BIOMASS * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
$ABC_{P\text{-}star}$ = BIOMASS * $BUFFER_{P\text{-}star}$ * E_{MSY} * DISTRIBUTION; where E_{MSY} is bounded 0.00 to 0.25									
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION; where FRACTION is E_{MSY} bounded 0.05 to 0.20									
Harvest Formula Parameters									
BIOMASS (ages 1+, mt)	132,884								
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 (2012-2014)	15.562								
E_{MSY}	0.157239								
FRACTION	0.157239								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**18,178**								
$ABC_{Tier\ 1}$ =	17,374	16,594	15,824	15,051	14,259	13,427	12,517	11,460	10,055
HG =	**0**								

b) HCRs when 2014 YC is based on the average of 2011-2013 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)	96,688								
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 (2012-2014)	15.562								
E_{MSY}	0.157239								
FRACTION	0.157239								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**13,227**								
$ABC_{Tier\ 1}$ =	12,642	12,074	11,514	10,951	10,375	9,769	9,108	8,338	7,316
HG =	**0**								

Management performance

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



Unresolved Problems and Major Uncertainties

Population estimates from this update model scaled an average 26% lower than stock biomass estimated in the 2014 assessment (Model T). This change was attributed to a shift in the spring ATM length selectivity to small sizes as well as the updated fit to the ATM surveys that included the very low estimated biomass observed in 2014. This selectivity sensitivity was observed previously in the 2014 full assessment (see sections *Retrospective analyses* and *Likelihood profile for virgin recruitment*) and was part of the STAR 2014 panel deliberations (see STAR 2014), but was unable to be effectively resolved in 2014. During the SSC CPS Subcommittee's review of this update, it became apparent that the final 2014 assessment did not correspond to the best overall fit to the data. This was due to an uneven likelihood surface and the 2014 model converging to a local minimum. This problem was discovered by re-running the 2014 model from a lower initial R_0 value and estimating this parameter in a later phase. The 2015 update model was subsequently run through a series of convergence tests to ensure the current model represents the optimal solution.

The 2014 year-class strength is highly uncertain and poorly informed by the available data. The model estimate of recruitment in 2014 is unrealistically high given the lack of spawning observed from the surveys during spring 2014. This is important, given the 2014 year-class is part of the calculation of the age 1+ stock biomass for July 2015. The STAT's proposed alternative approach would be to base the 2014 year-class estimate on average recruitment levels from 2011-13, account for natural and fishing mortality throughout 2014, and add the resulting age-1 biomass to the age 2+ biomass from the update model to determine the stock biomass for July 2015.

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 last year's assessment (Hill et al. 2014).

Pacific sardines spawn in loosely aggregated schools in the upper 50 meters of the water column. The northern subpopulation spawning 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).

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.

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.

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 decade. 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 the 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. HG values 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). For this assessment, we applied a more objective method to partition data from ENS and SCA ports in order 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 alternative 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 this assessment using a least-squares method to fit to sample data from the modeled period, 1993-2013. Coefficients for the NSP (subscript '2' models) data set were, a = 7.5242e-06, b = 3.2332 (n = 104,326; corrected R^2 = 0.936) (Figure 4).

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 CV values 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 using sardines sampled from survey trawls conducted from 1994 to 2013. Their 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 final base model T (2014) is presented in Figure 6b.

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) did examine 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 landings and 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. 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 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 2013 were taken from CONAPESCA's web archive of Mexican fishery yearbook statistics (CONAPESCA 2014). Ensenada landings for 2014 were based on an aggregate total for Jan-Oct (Concepción Enciso-Enciso, INAPESCA-Ensenada, pers. comm.) that was apportioned across months and projected through the end of 2014 using monthly data from 2013.

California (SCA and CCA) commercial landings were obtained from CDFW's 'Wetfish Tables' (1993 to 1999, and Aug-Dec 2014) and the PacFIN database (2000 to Jul 2014). Oregon (OR) and Washington (WA) landings (1999-2014) were obtained solely from PacFIN. 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 or 2014.

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. New catch-based weighting vectors were also calculated for creating aggregate NSP length compositions.

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. Compositions having fewer than two samples per semester were omitted from the 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. Length compositions for the two stock structure assumptions (All vs. NSP) are presented side-by-side in these displays. For the current assessment, length compositions from SCA, CCA, OR, and WA fisheries were updated for model year 2013 and appended with the first semester of model year 2014 (Jul-Dec 2014 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 2013. Age data were not yet available for 2014.

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 and aerial survey methods were reviewed in May 2009, and the ATM survey was reviewed in February 2011 and included in the 2011 assessment. Survey data are presented in Tables 5-8, Figures 15-18, and Appendices A and B (Zwolinski et al. 2015a,b) of this report.

Daily egg production method spawning biomass

From 1994 to 2013, the times series of TEP and DEPM and estimates of SSB were based on SWFSC ship-based surveys conducted each April between San Diego and San Francisco. 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 fecundity 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 18).

In this assessment, it was not possible to calculate an unbiased estimate of egg density (P0) from the 2014 survey, because no eggs or larvae were collected in the CalVET net tows (Table 6). That is, strict adherence to adopted methodology would result in a P0 estimate of zero mt, however there is no approved method for calculating a variance on this quantity and there is no way to include such an estimate in the SS model. Given that eggs and larvae were collected using other sampling tools (CUFES and Bongo; Table 6), it is highly unlikely that population SSB is zero mt. Although other survey data and methods could theoretically be applied to derive a new time series of egg production, such time series would not be appropriate, based on the Terms of Reference for assessing CPS, for use in the 2015 assessment update. The CUFES intake samples the upper 3 m of the water column and CUFES egg densities can poorly correlated with CalVET densities. Bongo nets are able to retain sardine eggs, however the larger mesh size (505 microns) results in some egg extrusion, so density estimates from bongo hauls are not directly comparable to those provided by the CalVET (333 micron mesh). Finally, it is worth noting that very low egg and larval counts encountered in 2014 were also observed during the historic period of low sardine abundance (mid-1960s to mid-1980s; Figure 16).

In 2014, the SWFSC conducted the sardine DEPM biomass survey aboard the chartered research vessel R/V *Ocean Starr* (April 23 – April 28) and the NOAA ship *Bell M. Shimada* (April 15 – May 8) within the standard DEPM area (CalCOFI line 60 to 95). The *Ocean Starr* covered the area from Del Mar, California up to the northern Channel Islands, California while the NOAA ship *Bell M. Shimada* covered the area north of Point Reyes, California (line 56.7) to Point Conception, California (Figure 15b). The *Ocean Starr* also conducted the standard spring CalCOFI survey from March 28 to April 22 (Figure 15a). Because no trawls were taken during the CalCOFI survey, only the data from the DEPM portion of *Ocean Starr* are reported in this assessment (i.e., data from April 23 to April 28). The DEPM survey from both research vessels employed all the usual methods for collecting data for estimating sardine SSB (Lo et al. 2010). The survey included a complete sampling of the 'standard' area for the assessment models' DEPM time series, i.e. San Francisco to San Diego (Figure 15).

The 2014 DEPM index area off California (CalCOFI lines 56.7 to 93.8, about 38.49˚ – 31.85˚N) was 160,305 km^2 (Figure 15). During the survey 69 CalVET tows were performed from the two vessels, but no eggs or larvae were observed in these tows. Similarly, no larvae were captured in 40 bongo tows cast over the period of the survey. Because no eggs and no larvae were collected in the CalVET or in the bongo tows, the mortality rate of eggs-at-age couldn't be derived. Therefore, both the egg production (P_0) and the female spawning biomass for 2014 could not be estimated based on established methods (see Dorval et al. 2014, Table 7).

Adult reproductive parameters for the survey are presented in Table 8. The estimated daily-specific fecundity was 23.70 (number of eggs/population weight (g)/day) using the following estimates of reproductive parameters from 7 mature females collected from 3 positive trawls: mean batch fecundity (F) was 46,124 eggs/batch (CV = 0.08), spawning fraction (S) was 0.143 females spawning per day (CV = 0.49), mean female fish weight (W_f) was 155.82 g (CV = 0.03), and sex ratio of females by weight (R) was 0.560 (CV = 0.26). Since 2005, trawling has been conducted randomly, at CalCOFI stations, or near daytime positive acoustic CPS locations, which resulted in sampling adult sardines in both high and low sardine egg-density areas. During the 2014 survey there was no post stratification of the DEPM area, which was only consisted of low egg-density areas (< 1 egg/min in CUFES). Sardines were captured in 7 of the 53 trawl tows conducted and a total of 18 male and female sardines were caught (Dorval et al. 2015).

In SS, the DEPM series was taken to represent female SSB 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. In 2014, it was not possible to compute the TEP or the DEPM estimate based on previous methods used from 1994 to 2013 (Tables 5-8, Figure 18).

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 18. 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 18).

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. 2015; see Appendices A and B 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).

Two new ATM-based biomass estimates were included in this assessment; one from the spring 2014 survey off CA and the other from the summer 2014 survey spanning San Diego to northern Vancouver Island, Canada. Biomass estimates and associated size distributions from the 2014 surveys are described in detail in Appendices A and B of this report (Zwolinski et al. 2015a,b). Biomass estimates from the spring and summer 2014 surveys, 35,339 (CV=0.396) mt and 26,280 (CV=0.704) mt respectively, were considerably lower than estimates from the previous year (Table 5, Figure 18). These low ATM estimates were qualitatively consistent with the lack of spawning observed during spring 2014.

The time series of ATM biomass estimates is presented in Table 5 and Figure 18, and associated biomass-weighted length compositions are displayed in Figure 17. ATM survey biomass estimates (2006-2014) were partitioned into two (spring and summer) surveys, with q=1 for each survey. Length compositions were fit using asymptotic length-selectivity, where spring and summer surveys were estimated independently.

ASSESSMENT MODEL

History of Modeling Approaches

The Pacific sardine population's dynamics and status 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), and this 2015 update assessment, were based on SS version 3.24s.

Update Model Configuration

Readers should consult both the final 2014 assessment report (Hill et al. 2014) and final review report (STAR 2014) 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 update model incorporated specifications. Changes from 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 **2014**;
- 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-**2014**);
  - 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-**2013**;
- virgin (R_0) and initial recruitment offset (R_1) were estimated;
- initial Fs set to 0 for all fleets (non-equilibrium model);
- DEPM (1993-2012)and TEP(1995-2005) indices of spawning biomass with q estimated for both surveys;
- ATM survey biomass 2006-**2014**, partitioned into two (spring and summer) surveys, with q=1 for each survey;
  - length compositions with effective sample sizes set by dividing the number of fish sampled by 25 and lambda weighting =1; and
  - asymptotic length-based selectivity for spring and summer surveys, estimated independently.

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 comprises 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. Finally, from an international context, the SS model is rapidly gaining popularity, with SS-based stock assessments being conducted on numerous marine species throughout the world.

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 base model T 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, 1999-2014) 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 (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 (6 years before the start of the model). A recruitment bias adjustment ramp (Methot and Taylor 2011) was applied to the early period (Figure 34d). Main period recruitment deviations were estimated from 1993-2013, which means that the 2014 year class was freely estimated (albeit poorly) from the data and not justified from the surveys conducted in the spring 2014.

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), 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 encountered by the ATM survey, 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 23b and 27b, respectively. In the ATM spring survey, fish are 55% selected by age 1. Fish caught in the MexCal_S2 fishery (1999-2013 block) are ~60% 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
The iterative process for determining numerical solutions in the model was continued until the difference between successive likelihood estimates was <0.0001. Final gradient for the base model was 6.51*e*-6.

Update Model Results

Parameter estimates and errors
Parameter estimates and standard errors (SE) for the update model, along with estimates from the 2014 assessment (model T; Hill et al. 2014), are presented in Table 10. The only parameter estimates to change noticeably in this update were the two length-selectivity parameters (peak, ascending slope) associated with the spring ATM survey (see following sections).

Growth and fits to conditional age-at-length data
Modeled length-at-age is displayed in Figure 19. Length-at-age 0.5 was estimated to be 11.4 cm SL, L_∞ was 23.4 cm, and the growth coefficient K was 0.424. Standard deviations for growth parameters are provided in Table 10. Fits to fishery conditional age-at-length data are shown in Figures 20-22. Most conditional age-at-length compositions fit reasonably well, with the exceptions of MexCal_S1 in 2001-2003 (Figure 20) and PacNW in 2008-2010 (Figure 22).

Selectivity estimates and fits to fishery length-composition data
Length selectivity estimates for each fleet and time block are displayed in Figure 23a. Implied age selectivities (product of length selectivity and the age-length key) for each fleet and period are shown in Figure 23b. The MexCal fleets (S1 and S2) captured progressively smaller fish between the early and latter time blocks (Figure 23a).

Model fits to fleet length frequencies, implied age-frequencies, Pearson residuals, and observed and effective samples sizes are displayed in Figures 24a-26a. 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 24a-25a). The PacNW fleet displayed notable residuals patterns for strong year classes (1997, 1998, and 2003) moving through the fishery (Figure 26).

Selectivity estimates and fits to survey length-composition data
Length selectivity estimates for surveys are displayed in Figure 27a and implied age selectivities for each survey are shown in Figure 27b. Selectivities for the ATM spring and summer surveys are notably different, with the spring survey selecting for smaller, younger sardine than in summer (Figure 27a,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 28-29. Poor fits to the ATM survey length data are indicated in most years (Figure 28). As noted above (*Parameter estimates and errors*), the selectivity pattern for the spring ATM survey underwent a marked shift toward smaller, younger sardine in this update assessment (Table 10, Figure 39). This inconsistency in knife-edged selectivity is not a new observation, as it was noted during various sensitivity runs conducted prior to and during the 2014 STAR. Given that the ATM series are fit with q fixed at 1.0, the shift to selecting smaller sardine had a noticeable effect on abundance scaling in the update model. This area of sensitivity is further discussed under **Uncertainty and Sensitivity Analysis** below.

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 30-33. Model fits to the ATM surveys were reasonable (near mean estimates and within error bounds, Figures 30-31), with the exceptions of the estimate for the initial survey year 2005 (spring 2006 survey), which was notably under-estimated and the recent 2014 survey (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) that was not evident in last year's assessment (Hill et al. 2014) (Figure 31). The trend in under-fitting was likely driven by the low estimate from the 2014 surveys coupled with the selectivity shift in the spring ATM series.

Fits to the DEPM and TEP surveys are displayed in Figures 32-33. 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 0.215 and the TEP series q=0.71.

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 base model T (2014) is displayed in Figure 34a. Recruitment deviations for the main era were estimated for years 1993 to 2012 (2013 year-class) (Figure 34b). Asymptotic standard errors for recruitment deviations are displayed in Figure 34c and the S-R bias adjustment ramp (Methot and Taylor 2011) is shown in Figure 34d.

Spawning stock biomass

Base model estimates (with 95% confidence intervals) of total SSB are provided in Table 13 and Figure 35a. The estimate of virgin SSB was 0.475 mmt. SSB increased throughout the 1990s, peaking at 0.809 million metric tons (mmt) in 1999 and 0.841 mmt in 2007 (Table 13, Figure 35a).

Recruitment

Estimated time series of recruit (age-0) abundance is provided in Table 13 and Figure 35b. Virgin recruitment (R_0) for base model T was estimated to be 2.884 billion age-0 fish. Recruitment (year-class abundance) peaked at 11.3 billion fish in 1997, 15.5 billion in 2003, and 12.9 billion in 2005. The 2010 to 2013 year classes were among the weakest in recent history. The 2014 year class, derived largely from the predicted stock-recruitment curve, was poorly estimated (CV=0.69) and unrealistically high, given the paucity of spawning activity observed in the surveys during spring 2014 (Table 13, Figures 15 and 35b).

Stock biomass for PFMC management

Stock biomass, used for setting management specifications, is defined as the sum of the biomass for ages one and older (age 1+). Model estimates of stock biomass are provided in Table 12b and displayed in Figure 43. Stock biomass increased throughout the 1990s, peaking at 0.961 mmt in 1999 and 1.037 mmt in 2007. Stock biomass is projected to be less than 150,000 mt as of July 2015. When the 2014 year class is drawn from the S-R relationship, stock biomass is projected to be 132,884 mt in July 2015. As noted previously, the S-R derived estimate 2014 year-class strength is biased high, given the lack of evidence for spawning during spring 2014 (Figure 15), as well as the recent trend in poor recruitment (Figure 35b). Alternatively, when the 2014 year class is based on an average recruitment from 2011-2013, and accounting for natural and fishing mortality during 2014, then stock biomass is projected to be 96,688 mt in July 2015 (Figure 43). Given that recent recruitment has been consistently over-estimated in the past several assessments (Figure 41), the low-recruitment scenario is considered more plausible and is recommended for calculating HCRs for 2015-16.

Harvest and exploitation rates

Harvest rates (catch per selected biomass, continuous-*F*) by fleet are displayed in Figure 36a. 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 36b. Based on update model estimates, exploitation rate for the U.S. fishery peaked at 22.4% in 2013. The U.S. exploitation rate was 13.9% in 2014. U.S. exploitation rate has averaged about 11% since the onset of Council management in 2000.

Uncertainty and Sensitivity Analysis

Sensitivity to addition of new data

Sensitivity of the update 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. The update model gradually scaled lower with the addition of each updated data component. The downward scaling of population estimates between the 2014 full and this update assessment has been attributed to a shift in spring ATM selectivity to smaller fish (Figure 39), as well as the updated fit to the ATM surveys that included the very low estimated biomass observed in 2014. The stock biomass time-series scaled 26% lower in the update model relative to the 2014 'final' model (Figure 39). It is important to note that a downward scaling of population estimates was also observed during the course of the 2014 STAR panel and thus, was not entirely unexpected (STAR 2014). This shift was typically associated with changes in selectivity for the spring ATM survey (larger to smaller sardine). This model instability was carried forward in the final 2014 model, evidenced by the retrospective analysis by Hill et al. (2014) (see Figure 38 lower panel). Figure 39 compares spring ATM selectivity and biomass estimates from the update model to estimates from the final 2014 model, as well as the 2014 model minus one year of data. The 2015 update model and 2014 retrospective (y-1) models displayed similar selectivity patterns and biomass estimates in the last eight years relative to the final 2014 model (Figure 39).

During the SSC CPS Subcommittee's review of this update (March 6, 2015), it became further apparent that the final 2014 assessment did not correspond to the best overall fit to the data. This was due to an uneven likelihood surface and the 2014 model converging to a local rather than a global minimum (see following subsection and Figure 37). This problem was uncovered by re-running the 2014 model from a lower initial R_0 value and estimating this parameter in a later phase. Likelihoods and derived quantities for the 'revised' 2014 model are included in Table 9. Biomass trajectories and spring 2014 selectivity estimates for all stepwise models are presented in Figure 40. The revised 2014 model stock biomass estimate is now much closer to that of the 2015 update model (Figure 40).

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 2015 update model was profiled for $\ln(R_0)$ values ranging from 14.4 to 16.0 for comparison to the final 2014 model, which ranged from 14.8 to 16.4 (Figure 37). Both the 2014 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 37). Profile surfaces for the total and component likelihoods were generally similar in form between the 2014 and 2015 assessments, however, the 2015 update model had a lower R0 and displayed a steeper gradient for some model components (e.g., spring ATM length, MexCal_S2 length, and PacNW conditional age-at-length compositions). 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 2009. Update model results were compared to the retrospective analysis conducted for the final 2014 model T (Hill et al. 2014). Stock biomass estimates for these analyses are displayed in Figure 38. The 2014 model displayed a systematic retrospective pattern for recent years, with the greatest change in scale occurring for the model fitting data through end year -1 (Figure 38 lower panel; also see discussion in STAR 2014). The retrospective pattern observed in the 2014 final model was not exhibited in the update model (Figure 38 upper panel).

Convergence tests
Convergence properties of the 2015 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 (R0, R1, growth, selectivity, and survey *Q*) was randomized from 1 to 5 (Table 14), and all parameters were jittered by 10%. All models solved to one of two very similar total negative log likelihoods (1164.64 or 1164.61) and had similar final estimates of R_0 (14.8748 or 14.8782) (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 41. Full and updated SS models since 2009 (Hill et al. 2009-2014), including the 'revised' 2014 model, were included in the comparison. Biomass and recruitment are similar in trend across models, with some differences in scale for peak and low periods. Note that terminal-year recruitment strength has consistently been over-estimated for the past several years (Figure 41).

Uncertainty regarding strength of the 2014 year class
In this assessment, there exists considerable uncertainty surrounding absolute levels of recruitment (age-0 abundance) in the terminal year of the estimated time series of numbers-at-age, which can in some years, comprise a substantial portion of the total biomass of short-lived, small pelagic species, such as Pacific sardine(Figure 42a,b). It is important to note that recent samples from both fisheries and surveys indicate recruitment remains at depressed levels, indicating an extended period of weak compensation exhibited by the population, which is likely to translate to continued, decreased stock biomass in the immediate future.

As noted above (*Recruitment* and *Stock biomass for PFMC management*), estimated abundance of the 2014 year-class is poorly informed by the existing data and not supported by the spring 2014 surveys. The STAT considers the S-R estimate to be unrealistically high, given: 1) the lack of spawning observed during spring 2014 (Figure 15); and 2) consistent over-estimation of terminal year recruitment in the past several assessments (Figure 41, lower panel). The STAT proposes addressing this uncertainty by basing the 2014 year-class estimate on recent average recruitment (see *Stock biomass for PFMC management*) for purposes of calculating an OFL and ABCs (Table 15b), e.g., as recommended in recent Pacific mackerel (projection) assessments reviewed by CPS-SSC panels.

HARVEST CONTROL RULES FOR THE 2015-16 MANAGEMENT CYCLE

Harvest guideline

The annual HG is calculated as follows:

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

where HG is the total U.S. quota for the period July 2015 to June 2016, BIOMASS is the stock biomass (ages 1+) projected as of July 1, 2015, CUTOFF (150,000 mt) is the lowest level of biomass for which directed harvest is allowed, FRACTION (5-20%) 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 update model, and regardless of assumptions regarding strength of the 2014 year-class (i.e. S-R derived versus recent average), stock biomass is projected to be below the 150,000 threshold. Therefore, HG for 2015-16 is calculated to be 0 mt (Table 15a,b). The U.S. harvest guidelines and landings since the onset of federal management are displayed in Figure 2. The 2015-16 fishing season will be the first where harvest guideline will be 0 mt.

OFL and ABC

On March 11, 2014, the PFMC adopted the use of CalCOFI SST data for specifying environmentally-dependent E_{MSY} each year, beginning July 2014. Based on this recent decision, the following table of OFL and ABCs is based on an E_{MSY} = 0.157239, which corresponds to the three-year running average of CalCOFI SST for 2012-14 (15.562 °C). OFL and ABC values for 2015-16 will depend on assumptions regarding strength of the 2014 year-class used to project stock biomass to July 1, 2015. As noted above, when the 2014 year class is freely estimated (albeit primarily derived from the spawner-recruit relationship), then stock biomass is projected to be 132,884 mt in July 2015. When the 2014 year class is based on an average of recruitments from 2011-2013, then stock biomass is projected to be 96,688 mt in July 2015. Given the lack of spawning activity observed during spring 2014, the latter scenario is considered more plausible. OFLs and ABCs for these two recruitment scenarios and for a range of Pstar values are provided in Table 15a,b.

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 guidelines (HG) and landings (metric tons) since the onset of federal management.

Mgmt Year	Harvest Guideline	Landings
2000	186,791	72,496
2001	134,737	78,520
2002	118,442	101,367
2003	110,908	74,599
2004	122,747	92,613
2005	136,179	90,130
2006	118,937	90,776
2007	152,564	127,695
2008	89,093	87,175
2009	66,932	67,083
2010	72,039	66,891
2011	50,526	46,745
2012	109,409	101,103
2013	66,495	61,646
2014(1)	6,946	6,550
2014-15	23,293	17,148

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	29,203.7	0.0
2014-1	2013-2	17,667.5	2,106.2	1,237.7	666.7	4,404.0	0.0	908.0	0.0
2014-2	2014-1	49,076.6	0.0	320.0	0.0	1,830.8	7,788.4	7,208.5	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	17	9	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	7	7	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	40	40	5	5	75	74	66	62	0	0
2014-1	2013-2	0	0	27	0	14	0	0	0	1	0	0	0
2014-2	2014-1	0	0	8	0	6	0	27	0	24	0	0	0

Table 4. Pacific sardine landings (mt) by model 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	56802.71	42272.96	0.00	56802.71
2014-1	2013-2	0.00	7176.11	908.01	0.00	23309.15	908.01
2014-2	2014-1	1824.56	0.00	14996.92	51227.40	0.00	14996.92
2015-1	2014-2	0.00	6346.70	759.46	0.00	6346.70	759.46
2015-2	2015-1	1000.00	0.00	1000.00	n/a	n/a	n/a
2016-1	2015-2	0.00	1000.00	1000.00	n/a	n/a	n/a

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 loge(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

Table 6. Pacific sardine ichthyoplankton and adult collections made during the spring 2014 CalCOFI and DEPM cruises off California.

CALCOFI			DEPM			
March 28 - April 15, 2014			April 15 - May 8, 2014			
OCEAN STARR				OCEAN STARR	SHIMADA	TOTAL
CALVET (Pairovet)	Total tows	53	Total tows	9	60	69
	Positive tows	0	Positive tows	0	0	0
	EGGS	0	EGGS	0	0	0
	Larvae	0	Larvae	0	0	0
BONGO	Total tows	64	Total tows	9	60	69
	Total positive tows	7	Total positive tows	0	0	0
	Positive egg tows	6	Positive egg tows	0	0	0
	EGGS	90	EGGS	0	0	0
	Positive larvae tows	4	Positive larvae tows	0	0	0
	Larvae	73	Larvae	0	0	0
CUFES	Total samples	316	Total samples	72	379	451
	Positive samples	11	Positive samples	2	1	3
	EGGS	98	EGGS	2	1	3
Trawl	n/a	n/a	Total tows	14	39	53
			Total positive tows	0	7	7
			Total sardine	0	18	18
			Female sardine	0	7	7

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 2007-2013.

Calendar year	Season	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)	1986	[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 (Jul)	1987	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	1993	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	2003	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	2004	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	2006	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	2007	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	2008	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 (cont'd).

Calendar year	Season	Region	P0/0.05m2 (cv)	Z (CV)	RSF/Wb ased on S_1	RSF/W based on S_{12}	FS/W based on S_{12}	Area (km^2)	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	2009	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	2010	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)	0	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	2011	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	2012	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	2014	1	--											
		2	--	--	0	23.70	42.28		--	--		--		
2014	2014	whole	--	--	0	23.70	42.28	160305	--	--	--	--	--	14.51

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, since 1997, is the area where the eggs/min from CUFES ≥1 and prior to 1997, is the area where the eggs/0.05m^2 >0 from CalVET tows

5: For the spawning biomasses, the estimates 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 (1994 includes females from off Mexico).

		1994	1997	2001	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
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
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
N collections with mature females		37	4	2	6	16	14	7	14	12	29	17	30	16	15	3
N collection within Region 1		19	4	2	6	16	6	2	8	4	15	3	14	8	8	3
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
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
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
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
Average batch fecundity[a] (mature females, oocytes)	**F**	24283	42002	22456	54403	55711	17662	18474	21760	29802	29790	39304	38369	38681	41339	46124
Relative batch fecundity (oocytes/g)		294	329	284	342	334	270	274	267	292	265	303	301	274	299	296
N mature females analyzed		583	77	9	23	290	175	86	203	187	467	313	244	126	121	7
N active mature females		327	77	9	23	290	148	72	187	177	463	310	244	125	119	7
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
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
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

[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), and 2014 used equation from 2013.

[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. Biomass trajectories and spring ATM selectivities for each model are provided in Figure 40.

NEW DATA / PROCESS:	T-2014 Final	T-2014 Revised	+Catch	+MexCal_S1_len	+MexCal_S2_len	+PacNW_len	+All Fshy Lengths	+All Fshy CondAL	+ATM (2015 Update)
Revised & New Catch									
MexCal_S1 Length Comp									
MexCal_S2 Length Comp									
PacNW Length Comp									
New Fishery CondAL Comps									
ATM 2014 Estimates & Comps									

LIKELIHOOD COMPONENT:	T-2014 Final	T-2014 Revised	+Catch	+MexCal_S1_len	+MexCal_S2_len	+PacNW_len	+All Fshy Lengths	+All Fshy CondAL	+ATM (2015 Update)
DEPM Survey	11.9121	12.1741	12.1747	12.2843	12.3693	12.2739	12.5203	12.6746	12.7408
TEP Survey	12.8943	12.9910	13.0133	12.8476	12.4988	13.1204	12.6171	12.5074	12.6253
ATM Spring	2.4185	0.4765	0.5338	0.8277	1.1836	0.6406	1.3040	1.2758	6.7948
ATM Summer	-3.1019	-2.3961	-2.3297	-2.3982	-2.4801	-2.3628	-2.5075	-2.5346	1.5017
Survey Subtotal	**24.1231**	**23.2455**	**23.3922**	**23.5614**	**23.5716**	**23.6721**	**23.9339**	**23.9232**	**33.6625**
MexCal_S1 Lengths	167.0000	167.1250	176.8860	186.9600	171.7850	174.4460	177.1140	180.8430	180.3010
MexCal_S2 Lengths	170.5580	171.3570	170.7970	170.8710	199.2760	171.1080	197.4150	197.3290	197.9900
PacNW Lengths	367.6850	365.8020	373.7440	373.1340	373.4570	393.6150	391.1980	393.0610	394.3950
ATM Spring Lengths	41.0370	41.0895	41.0407	41.1474	40.9247	40.9435	40.6351	41.1632	44.8175
ATM Summer Lengths	31.5671	31.8504	31.7132	31.6322	31.5272	31.6547	31.4176	32.0022	40.5409
Lengths Subtotal	**777.8471**	**777.2239**	**794.1809**	**803.7446**	**816.9699**	**811.7672**	**837.7797**	**844.3984**	**858.0444**
MexCal_S1 CondAL	247.8570	244.5480	244.9150	244.5590	243.5550	244.6820	242.8730	252.0110	252.6580
MexCal_S2 CondAL	316.3550	311.6180	314.8770	314.7130	316.6730	315.4480	316.1400	309.4960	309.1470
PacNW CondAL	508.5030	520.8010	524.8190	529.1810	537.8290	534.0360	551.2280	615.6430	613.0840
CondAL Subtotal (λ=0.2)	**214.5430**	**215.3934**	**216.9222**	**217.6906**	**219.6114**	**218.8332**	**222.0482**	**235.4300**	**234.9778**
Catch	1.08E-14	1.66E-14	2.09E-14	3.07E-14	3.87E-14	2.60E-14	4.45E-14	4.14E-14	8.31E-14
Recruitment	17.2696	17.5958	19.4677	22.4845	32.5387	21.2052	35.5523	33.8802	37.9503
Parm_softbounds	0.0041	0.0047	0.0049	0.0050	0.0048	0.0049	0.0050	0.0050	0.0068
TOTAL	**1033.79**	**1033.46**	**1053.97**	**1067.49**	**1092.70**	**1075.48**	**1119.32**	**1137.64**	**1164.64**

DERIVED QUANTITIES:	T-2014 Final	T-2014 Revised	+Catch	+MexCal_S1_len	+MexCal_S2_len	+PacNW_len	+All Fshy Lengths	+All Fshy CondAL	+ATM (2015 Update)
Ln(R0)	15.3899	15.2604	15.2175	15.1288	15.0054	15.1742	14.9595	14.9784	14.8748
SSB-Virgin	776,158	684,268	656,023	600,446	533,030	628,891	510,287	525,270	475,035
Stock Biomass -2007 peak	1,360,980	1,123,750	1,118,340	1,118,560	1,116,890	1,114,680	1,110,610	1,093,550	1,037,180
Stock Biomass - 2014	369,506	275,705	255,916	217,106	210,069	232,681	208,995	215,770	150,335
Stock Biomass - 2015	---	---	277,520	209,182	202,218	244,905	183,410	190,028	132,884

Table 10. Parameters and asymptotic standard deviations for base model T.

					2014 final		2015 update	
Parameter	**Phase**	**Min**	**Max**	**Initial Value**	**Final Value**	**Std Dev**	**Final Value**	**Std Dev**
NatM_p_1_Fem_GP_1	-3	0.3	0.7	0.4000	0.4000	_	0.4000	_
L_at_Amin_Fem_GP_1	3	3	15	10.0000	11.7754	0.2718	11.3881	0.2819
L_at_Amax_Fem_GP_1	3	20	30	25.0000	23.4636	0.1806	23.3801	0.1506
VonBert_K_Fem_GP_1	3	0.05	0.99	0.4000	0.3855	0.0232	0.4238	0.0234
CV_young_Fem_GP_1	3	0.05	0.3	0.1400	0.1274	0.0071	0.1347	0.0076
CV_old_Fem_GP_1	3	0.01	0.1	0.0500	0.0491	0.0030	0.0474	0.0025
Wtlen_1_Fem	-3	-3	3	0.0000	0.0000	_	0.0000	_
Wtlen_2_Fem	-3	-3	5	3.2332	3.2332	_	3.2332	_
Mat50%_Fem	-3	9	19	15.4400	15.4400	_	15.4400	_
Mat_slope_Fem	-3	-20	3	-0.8925	-0.8925	_	-0.8925	_
Eggs/kg_inter_Fem	-3	0	10	1.0000	1.0000	_	1.0000	_
Eggs/kg_slope_wt_Fem	-3	-1	5	0.0000	0.0000	_	0.0000	_
SR_LN(R0)	1	3	25	16.0000	15.3899	0.1018	14.8748	0.0734
SR_BH_steep	-6	0.2	1	0.8000	0.8000	_	0.8000	_
SR_sigmaR	-3	0	2	0.7500	0.7500	_	0.7500	_
SR_R1_offset	2	-15	15	0.0000	-0.3356	0.2587	-0.2225	0.2595
Early_InitAge_6	_	_	_	_	-0.3790	0.6395	-0.3454	0.6468
Early_InitAge_5	_	_	_	_	-0.4169	0.6278	-0.3811	0.6348
Early_InitAge_4	_	_	_	_	-0.3988	0.6224	-0.3730	0.6281
Early_InitAge_3	_	_	_	_	-0.0771	0.6092	-0.0702	0.6145
Early_InitAge_2	_	_	_	_	0.3516	0.4843	0.3810	0.4879
Early_InitAge_1	_	_	_	_	1.2824	0.2787	1.3938	0.2813
Main_RecrDev_1993	_	_	_	_	0.8290	0.1904	1.1060	0.1858
Main_RecrDev_1994	_	_	_	_	-0.2509	0.2708	0.0001	0.2686
Main_RecrDev_1995	_	_	_	_	0.2351	0.2073	0.4631	0.2083
Main_RecrDev_1996	_	_	_	_	1.2799	0.1377	1.6068	0.1344
Main_RecrDev_1997	_	_	_	_	0.8195	0.1550	1.2496	0.1469
Main_RecrDev_1998	_	_	_	_	-0.8884	0.2622	-0.5398	0.2638
Main_RecrDev_1999	_	_	_	_	-0.7929	0.2092	-0.4386	0.2073
Main_RecrDev_2000	_	_	_	_	-0.0824	0.1419	0.2844	0.1361
Main_RecrDev_2001	_	_	_	_	-2.0683	0.3507	-1.7772	0.3554
Main_RecrDev_2002	_	_	_	_	1.7539	0.1109	1.9517	0.1069
Main_RecrDev_2003	_	_	_	_	0.9213	0.1747	1.2235	0.1666
Main_RecrDev_2004	_	_	_	_	1.4853	0.1163	1.7610	0.1109
Main_RecrDev_2005	_	_	_	_	0.2177	0.2075	0.5562	0.2005
Main_RecrDev_2006	_	_	_	_	0.6903	0.1530	1.0619	0.1413
Main_RecrDev_2007	_	_	_	_	-0.2729	0.2417	0.0026	0.2313
Main_RecrDev_2008	_	_	_	_	0.7689	0.1334	1.0182	0.1187
Main_RecrDev_2009	_	_	_	_	-0.8222	0.2546	-0.4290	0.2034
Main_RecrDev_2010	_	_	_	_	-1.5699	0.2761	-2.1023	0.2733
Main_RecrDev_2011	_	_	_	_	-2.0573	0.4508	-3.3736	0.3562
Main_RecrDev_2012	_	_	_	_	-0.1959	0.6890	-3.2928	0.3912
Main_RecrDev_2013	_	_	_	_	_	_	-0.3321	0.6504
LnQ_base_4_DEPM	5	-3	3	-1.3900	-1.8502	0.1561	-1.5362	0.1122
LnQ_base_5_TEP	5	-3	3	-0.6900	-0.5997	0.1631	-0.3423	0.1318
LnQ_base_8_ATM_Spring (& Summer)	-5	-3	3	0.0000	0.0000	___	0.0000	_

Table 10 (cont.). Parameters and asymptotic standard deviations for base model T.

					2014 final		2015 update	
Parameter	Phase	Min	Max	Initial Value	Final Value	Std Dev	Final Value	Std Dev
SizeSel_1P_1_MexCal_S1_NSP_1993-98	4	10	28	18.0000	18.5134	0.3667	18.5165	0.3536
SizeSel_1P_2_MexCal_S1_NSP_1993-98	-4	-5	3	-4.9850	-4.9850	_	-4.9850	_
SizeSel_1P_3_MexCal_S1_NSP_1993-98	4	-1	9	2.5000	2.9077	0.1959	2.8690	0.1888
SizeSel_1P_4_MexCal_S1_NSP_1993-98	4	-1	9	4.0000	0.5753	0.5684	0.5432	0.5500
SizeSel_1P_5_MexCal_S1_NSP_1993-98	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S1_NSP_1993-98	4	-10	10	-10.0000	-3.4271	1.0621	-3.5107	1.0472
SizeSel_1P_1_MexCal_S1_NSP_1999-14	4	10	28	18.0000	17.0451	0.1980	17.0810	0.1980
SizeSel_1P_2_MexCal_S1_NSP_1999-14	-4	-5	3	-4.9980	-4.9980	_	-4.9980	_
SizeSel_1P_3_MexCal_S1_NSP_1999-14	4	-1	9	2.5000	2.1075	0.1372	2.1050	0.1369
SizeSel_1P_4_MexCal_S1_NSP_1999-14	4	-1	9	4.0000	-0.0949	0.4573	-0.2977	0.4810
SizeSel_1P_5_MexCal_S1_NSP_1999-14	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S1_NSP_1999-14	4	-10	10	-10.0000	-2.4192	0.2287	-2.2423	0.1996
SizeSel_1P_1_MexCal_S2_NSP_1993-98	4	10	28	18.0000	16.4577	0.2923	16.3601	0.2808
SizeSel_1P_2_MexCal_S2_NSP_1993-98	-4	-5	3	-4.9930	-4.9930	_	-4.9930	_
SizeSel_1P_3_MexCal_S2_NSP_1993-98	4	-1	9	2.5000	1.8849	0.1993	1.7947	0.1918
SizeSel_1P_4_MexCal_S2_NSP_1993-98	4	-1	9	4.0000	1.8145	0.3861	1.8461	0.3597
SizeSel_1P_5_MexCal_S2_NSP_1993-98	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S2_NSP_1993-98	4	-10	10	-10.0000	-2.2433	0.5862	-2.3386	0.5800
SizeSel_1P_1_MexCal_S2_NSP_1999-14	4	10	28	18.0000	14.6115	0.2116	14.6774	0.2001
SizeSel_1P_2_MexCal_S2_NSP_1999-14	-4	-5	3	-4.9970	-4.9970	_	-4.9970	_
SizeSel_1P_3_MexCal_S2_NSP_1999-14	4	-1	9	2.5000	1.6284	0.2177	1.5394	0.1968
SizeSel_1P_4_MexCal_S2_NSP_1999-14	4	-1	9	4.0000	2.2416	0.1742	1.9650	0.1721
SizeSel_1P_5_MexCal_S2_NSP_1999-14	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_1P_6_MexCal_S2_NSP_1999-14	4	-10	10	-10.0000	-3.0857	0.3432	-2.5563	0.2201
SizeSel_3P_1_PacNW	4	10	28	19.0000	20.9834	0.2330	20.9337	0.2285
SizeSel_3P_2_PacNW	-4	-5	10	2.5000	2.5000	_	2.5000	_
SizeSel_3P_3_PacNW	4	-5	10	5.0000	1.8487	0.1242	1.8489	0.1241
SizeSel_3P_4_PacNW	-4	-5	10	5.0000	5.0000	_	5.0000	_
SizeSel_3P_5_PacNW	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_3P_6_PacNW	-4	-10	10	10.0000	10.0000	_	10.0000	_
SizeSel_8P_1_ATM_Spring	4	10	28	18.0000	23.2458	1.7109	16.7009	0.5535
SizeSel_8P_2_ATM_Spring	-4	-5	3	3.0000	3.0000	_	3.0000	_
SizeSel_8P_3_ATM_Spring	4	-1	9	2.5000	3.4423	0.5041	-0.8025	1.5009
SizeSel_8P_4_ATM_Spring	-4	-1	9	4.0000	4.0000	_	4.0000	_
SizeSel_8P_5_ATM_Spring	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_8P_6_ATM_Spring	-4	-10	10	10.0000	10.0000	_	10.0000	_
SizeSel_9P_1_ATM_Summer	4	10	28	18.0000	22.8332	0.9872	22.6552	1.0042
SizeSel_9P_2_ATM_Summer	-4	-5	3	3.0000	3.0000	_	3.0000	_
SizeSel_9P_3_ATM_Summer	4	-1	9	2.5000	2.2279	0.5083	2.2610	0.5414
SizeSel_9P_4_ATM_Summer	-4	-1	9	4.0000	4.0000	_	4.0000	_
SizeSel_9P_5_ATM_Summer	-4	-10	10	-10.0000	-10.0000	_	-10.0000	_
SizeSel_9P_6_ATM_Summer	-4	-10	10	10.0000	10.0000	_	10.0000	_

Table 11. Likelihood components and data weightings for base model T.

COMPONENT	-log(L)	MexCal_S1	MexCal_S2	PacNW	DEPM	TEP	ATM_Spring	ATM_Summer
Catch	8.31217E-14	4.01568E-14	3.96337E-14	3.33114E-15	---	---	---	---
Survey	33.663	---	---	---	12.741	12.625	6.795	1.502
Length comp	858.044	180.301	197.990	394.395	---	---	44.818	40.541
Age comp	234.978	252.658	309.147	613.084	---	---	69.438	44.681
Recruitment	37.9503							
Parm softbounds	0.00677722							
TOTAL	1164.64							

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 update model T.

		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	2,884,210	1,933,340	1,295,960	868,708	582,312	390,335	261,650	175,389	117,567	78,807	160,235
---	VIRG	2,361,390	1,582,890	1,061,040	711,238	476,757	319,580	214,221	143,596	96,256	64,522	131,189
---	INIT	2,308,880	1,547,690	1,037,450	695,422	466,155	312,473	209,457	140,403	94,115	63,087	128,272
---	INIT	1,890,350	1,267,140	849,390	569,363	381,656	255,831	171,489	114,952	77,055	51,652	105,020
1993-2	1993-1	7,374,590	4,943,330	1,239,030	544,525	277,614	190,026	135,900	140,403	94,115	63,087	128,272
1994-1	1993-2	6,037,460	4,041,050	1,011,620	444,846	227,027	155,492	111,230	114,927	77,042	51,644	105,006
1994-2	1994-1	6,665,910	4,906,830	3,215,620	810,377	360,045	184,639	126,693	90,695	93,740	62,849	127,809
1995-1	1994-2	5,455,460	3,975,230	2,583,060	653,596	292,442	150,579	103,500	74,144	76,657	51,402	104,544
1995-2	1995-1	2,246,370	4,372,810	2,998,020	1,985,930	517,667	234,872	121,582	83,745	60,048	62,111	126,405
1996-1	1995-2	1,838,740	3,557,640	2,426,730	1,611,350	421,795	191,837	99,407	68,500	49,125	50,817	103,429
1996-2	1996-1	3,596,460	1,483,220	2,749,850	1,901,180	1,288,960	340,716	155,540	80,717	55,657	39,928	125,402
1997-1	1996-2	2,942,960	1,196,900	2,193,250	1,524,790	1,043,830	277,459	126,962	65,950	45,494	32,643	102,541
1997-2	1997-1	11,285,600	2,374,370	925,757	1,719,090	1,219,970	843,250	224,969	103,094	53,586	36,976	109,906
1998-1	1997-2	9,232,720	1,903,430	729,636	1,365,840	983,019	684,984	183,374	84,150	43,766	30,209	89,814
1998-2	1998-1	7,874,930	7,424,680	1,453,790	566,422	1,087,320	791,841	554,258	148,642	68,265	35,518	97,438
1999-1	1998-2	6,441,700	5,933,420	1,139,060	447,747	873,331	641,891	451,062	121,160	55,682	28,981	79,529
1999-2	1999-1	1,322,740	5,116,820	4,320,670	852,493	349,604	695,578	515,137	363,079	97,656	44,909	87,569
2000-1	1999-2	1,082,640	4,104,900	3,443,490	689,222	284,338	566,359	419,511	295,689	79,531	36,574	71,316
2000-2	2000-1	1,470,010	806,239	2,885,100	2,629,760	546,996	228,065	455,585	337,770	238,158	64,067	86,923
2001-1	2000-2	1,202,640	627,320	2,194,600	2,053,310	431,268	180,007	359,558	266,554	187,937	50,556	68,591
2001-2	2001-1	3,014,670	879,483	428,039	1,651,110	1,615,640	343,509	143,854	287,647	213,330	150,438	95,387
2002-1	2001-2	2,466,480	686,217	325,435	1,277,630	1,256,970	267,185	111,842	223,594	165,813	116,926	74,137
2002-2	2002-1	379,342	1,707,430	428,538	234,931	985,677	987,418	210,921	88,429	176,893	131,216	151,224
2003-1	2002-2	310,213	1,288,380	308,208	172,973	729,918	730,073	155,783	65,284	130,573	96,849	111,612
2003-2	2003-1	15,513,500	207,709	763,012	217,685	132,555	572,064	575,701	123,083	51,619	103,276	164,920
2004-1	2003-2	12,687,200	157,249	545,086	156,087	94,619	406,374	408,137	87,196	36,559	73,137	116,783
2004-2	2004-1	7,293,630	9,950,400	119,990	430,139	124,926	75,992	326,667	328,182	70,123	29,402	152,748
2005-1	2004-2	5,968,730	7,855,240	88,426	297,351	83,210	49,915	213,639	214,334	45,774	19,189	99,676
2005-2	2005-1	12,866,700	4,750,380	6,141,790	70,760	240,380	67,445	40,486	173,323	173,902	37,141	96,449
2006-1	2005-2	10,531,500	3,804,790	4,660,310	50,649	166,481	46,156	27,606	118,048	118,394	25,282	65,644
2006-2	2006-1	3,935,670	8,352,900	2,959,760	3,727,560	41,037	135,367	37,566	22,476	96,119	96,406	74,042
2007-1	2006-2	3,221,100	6,661,470	2,287,370	2,830,550	30,804	101,107	28,012	16,750	71,621	71,829	55,163
2007-2	2007-1	6,596,600	2,522,970	5,078,770	1,813,150	2,284,670	24,988	82,128	22,764	13,614	58,217	103,231
2008-1	2007-2	5,395,640	1,932,180	3,730,480	1,352,350	1,708,550	18,650	61,232	16,965	10,145	43,377	76,912
2008-2	2008-1	2,288,420	4,130,600	1,419,850	2,908,070	1,083,530	1,379,340	15,088	49,568	13,737	8,215	97,420
2009-1	2008-2	1,872,030	3,191,470	1,059,760	2,205,250	824,692	1,048,530	11,460	37,638	10,430	6,237	73,957
2009-2	2009-1	6,301,980	1,413,320	2,293,290	817,776	1,759,010	663,854	846,147	9,255	30,407	8,427	64,803
2010-1	2009-2	5,156,970	1,115,710	1,753,890	621,902	1,329,640	500,024	636,490	6,959	22,859	6,335	48,710
2010-2	2010-1	1,473,040	3,941,910	817,634	1,363,970	497,000	1,070,510	403,386	513,809	5,619	18,459	44,456
2011-1	2010-2	1,205,520	3,130,460	624,942	1,018,620	365,670	782,708	294,330	374,649	4,096	13,455	32,401
2011-2	2011-1	274,733	924,807	2,308,130	487,912	816,690	295,340	633,437	238,350	303,467	3,318	37,152
2012-1	2011-2	224,681	700,560	1,666,000	358,651	602,310	217,334	465,555	175,097	222,893	2,437	27,284
2012-2	2012-1	76,257	164,892	480,151	1,249,820	280,026	475,194	171,943	368,655	138,701	176,590	23,550
2013-1	2012-2	62,424	132,737	357,054	837,539	177,262	294,931	106,092	227,050	85,369	108,661	14,488
2013-2	2013-1	87,128	43,477	83,715	258,987	647,756	139,511	233,223	84,022	179,922	67,667	97,627
2014-1	2013-2	71,318	34,843	61,995	173,861	411,915	87,048	144,693	52,035	111,356	41,869	60,399
2014-2	2014-1	*1,718,330*	48,316	21,018	44,073	133,296	322,384	68,510	114,084	41,055	87,887	80,731
2015-1	2014-2	*1,405,630*	37,221	15,404	32,154	96,524	232,264	49,263	81,978	29,494	63,131	57,987
2015-2	2015-1	---	*1,045,560*	26,091	11,714	25,368	76,906	185,550	39,388	65,567	23,593	96,897

Table 12b. Pacific sardine biomass-at-age and summary biomass (metric tons) by model year and semester for update model T.

		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	58,391	184,071	92,031	59,267	37,935	29,890	23,365	25,553	17,770	12,199	25,496	565,967	507,576
1994-1	1993-2	126,301	224,530	93,334	55,015	33,558	25,698	19,737	21,347	14,740	10,072	20,940	645,272	518,971
1994-2	1994-1	52,780	182,712	238,845	88,202	49,199	29,043	21,782	16,506	17,699	12,153	25,404	734,325	681,545
1995-1	1994-2	114,126	220,873	238,319	80,832	43,227	24,886	18,366	13,772	14,666	10,025	20,848	799,938	685,812
1995-2	1995-1	17,786	162,827	222,682	216,151	70,738	36,944	20,903	15,242	11,338	12,010	25,125	811,745	793,959
1996-1	1995-2	38,466	197,671	223,895	199,279	62,347	31,705	17,639	12,723	9,399	9,911	20,625	823,660	785,194
1996-2	1996-1	28,476	55,229	204,249	206,926	176,134	53,593	26,741	14,690	10,509	7,721	24,925	809,195	780,718
1997-1	1996-2	61,566	66,503	202,354	188,574	154,292	45,856	22,529	12,250	8,704	6,366	20,448	789,440	727,875
1997-2	1997-1	89,358	88,413	68,762	187,107	166,706	132,640	38,678	18,763	10,118	7,150	21,880	829,574	740,216
1998-1	1997-2	193,145	105,759	67,318	168,916	145,303	113,208	32,539	15,630	8,373	5,892	17,933	874,016	680,871
1998-2	1998-1	62,353	276,467	107,982	61,650	148,580	124,553	95,291	27,053	12,889	6,868	19,409	943,095	880,743
1999-1	1998-2	134,758	329,674	105,092	55,374	129,090	106,086	80,039	22,505	10,653	5,652	15,887	994,809	860,052
1999-2	1999-1	10,473	190,531	320,924	92,786	47,773	109,412	88,565	66,080	18,438	8,684	17,443	971,109	960,636
2000-1	1999-2	22,648	228,078	317,704	85,237	42,029	93,603	74,440	54,922	15,216	7,133	14,246	955,256	932,608
2000-2	2000-1	11,639	30,021	214,295	286,226	74,746	35,874	78,327	61,474	44,967	12,388	17,290	867,247	855,607
2001-1	2000-2	25,159	34,855	202,478	253,937	63,747	29,750	63,802	49,511	35,956	9,860	13,686	782,741	757,582
2001-2	2001-1	23,870	32,749	31,793	179,708	220,774	54,033	24,732	52,351	40,279	29,089	18,932	708,311	684,442
2002-1	2001-2	51,598	38,128	30,025	158,007	185,797	44,158	19,846	41,531	31,723	22,804	14,767	638,384	586,786
2002-2	2002-1	3,004	63,578	31,830	25,570	134,691	155,317	36,263	16,094	33,399	25,373	29,895	555,014	552,010
2003-1	2002-2	6,490	71,585	28,436	21,392	107,891	120,660	27,643	12,126	24,981	18,889	22,160	462,253	455,763
2003-2	2003-1	122,834	7,734	56,674	23,693	18,113	89,983	98,978	22,401	9,746	19,970	32,639	502,766	379,932
2004-1	2003-2	265,411	8,737	50,291	19,304	13,986	67,162	72,422	16,196	6,994	14,264	23,207	557,974	292,563
2004-2	2004-1	57,750	370,515	8,912	46,817	17,071	11,953	56,163	59,729	13,240	5,685	30,278	678,113	620,363
2005-1	2004-2	124,863	436,455	8,158	36,774	12,300	8,250	37,909	39,811	8,757	3,742	19,833	736,854	611,990
2005-2	2005-1	101,877	176,886	456,190	7,702	32,847	10,609	6,961	31,545	32,835	7,182	19,200	883,833	781,956
2006-1	2005-2	220,315	211,403	429,970	6,264	24,608	7,628	4,899	21,927	22,651	4,931	13,107	967,702	747,387
2006-2	2006-1	31,162	311,030	219,840	405,711	5,608	21,293	6,459	4,091	18,148	18,642	14,742	1,056,725	1,025,563
2007-1	2006-2	67,384	370,127	211,038	350,060	4,553	16,710	4,971	3,111	13,703	14,009	11,015	1,066,680	999,296
2007-2	2007-1	52,231	93,946	377,233	197,345	312,196	3,930	14,120	4,143	2,571	11,257	20,443	1,089,414	1,037,183
2008-1	2007-2	112,875	107,356	344,182	167,248	252,546	3,082	10,865	3,151	1,941	8,460	15,292	1,026,998	914,123
2008-2	2008-1	18,119	153,808	105,461	316,517	148,062	216,965	2,594	9,021	2,594	1,589	19,323	994,054	975,934
2009-1	2008-2	39,162	177,325	97,776	272,728	121,900	173,292	2,034	6,991	1,995	1,216	14,724	909,142	869,980
2009-2	2009-1	49,898	52,627	170,337	89,008	240,365	104,422	145,475	1,684	5,741	1,629	12,922	874,109	824,211
2010-1	2009-2	107,882	61,991	161,818	76,912	196,538	82,639	112,942	1,293	4,373	1,235	9,739	817,363	709,481
2010-2	2010-1	11,663	146,782	60,731	148,456	67,914	168,387	69,353	93,513	1,061	3,569	8,886	780,315	768,651
2011-1	2010-2	25,219	173,936	57,658	125,975	54,051	129,359	52,227	69,588	784	2,624	6,491	697,912	672,693
2011-2	2011-1	2,175	34,436	171,440	53,105	111,599	46,456	108,904	43,379	57,298	642	7,408	636,843	634,667
2012-1	2011-2	4,700	38,925	153,709	44,355	89,029	35,919	82,610	32,523	42,644	475	5,455	530,344	525,644
2012-2	2012-1	604	6,140	35,664	136,032	38,265	74,746	29,561	67,095	26,188	34,146	4,711	453,153	452,549
2013-1	2012-2	1,306	7,375	32,943	103,580	26,202	48,744	18,825	42,173	16,333	21,192	2,904	321,577	320,271
2013-2	2013-1	690	1,619	6,218	28,188	88,515	21,945	40,097	15,292	33,971	13,084	19,223	268,842	268,152
2014-1	2013-2	1,492	1,936	5,720	21,502	60,886	14,386	25,675	9,665	21,305	8,166	11,953	182,686	181,194
2014-2	2014-1	*13,606*	1,799	1,561	4,797	18,215	50,710	11,779	20,763	7,752	16,994	15,965	163,940	150,335
2015-1	2014-2	*29,405*	2,068	1,421	3,977	14,268	38,387	8,741	15,227	5,643	12,312	11,516	142,965	113,560
2015-2	**2015-1**	---	*38,933*	1,938	1,275	3,466	12,097	31,901	7,169	12,380	4,562	19,163	---	***132,884***

Table 13. Derived SSB (mt) and recruits (year-class abundance, billions of age-0 fish) for base model T. SSB estimates are calculated at the beginning of Season 2 of each model year, e.g. the 2013 value is SSB January 2014. 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	---	---	2.884	0.212
---	VIRG-2	475,035	34,512	---	---
---	INIT-1	---	---	2.309	0.605
---	INIT-2	380,277	99,533	---	---
1993-2	1993-1	---	---	7.375	---
1994-1	1993-2	428,804	76,971	---	---
1994-2	1994-1	---	---	6.666	1.239
1995-1	1994-2	581,221	92,778	---	---
1995-2	1995-1	---	---	2.246	0.621
1996-1	1995-2	681,695	102,288	---	---
1996-2	1996-1	---	---	3.596	0.759
1997-1	1996-2	680,194	97,832	---	---
1997-2	1997-1	---	---	11.286	1.420
1998-1	1997-2	642,013	86,908	---	---
1998-2	1998-1	---	---	7.875	1.049
1999-1	1998-2	726,025	81,830	---	---
1999-2	1999-1	---	---	1.323	0.355
2000-1	1999-2	809,031	79,963	---	---
2000-2	2000-1	---	---	1.470	0.306
2001-1	2000-2	718,471	71,582	---	---
2001-2	2001-1	---	---	3.015	0.385
2002-1	2001-2	566,791	58,560	---	---
2002-2	2002-1	---	---	0.379	0.142
2003-1	2002-2	422,637	46,878	---	---
2003-2	2003-1	---	---	15.514	1.454
2004-1	2003-2	305,319	38,207	---	---
2004-2	2004-1	---	---	7.294	1.155
2005-1	2004-2	445,992	45,653	---	---
2005-2	2005-1	---	---	12.867	1.182
2006-1	2005-2	639,018	54,433	---	---
2006-2	2006-1	---	---	3.936	0.787
2007-1	2006-2	827,400	56,420	---	---
2007-2	2007-1	---	---	6.597	0.853
2008-1	2007-2	840,513	53,143	---	---
2008-2	2008-1	---	---	2.288	0.542
2009-1	2008-2	783,997	47,716	---	---
2009-2	2009-1	---	---	6.302	0.701
2010-1	2009-2	673,537	42,702	---	---
2010-2	2010-1	---	---	1.473	0.309
2011-1	2010-2	595,091	39,326	---	---
2011-2	2011-1	---	---	0.275	0.080
2012-1	2011-2	492,999	37,406	---	---
2012-2	2012-1	---	---	0.076	0.029
2013-1	2012-2	310,918	32,865	---	---
2013-2	2013-1	---	---	0.087	0.037
2014-1	2013-2	178,656	26,352	---	---
2014-2	2014-1	---	---	1.718	1.177
2015-1	2014-2	114,566	20,330	---	---
2015-2	2015-1	---	---	---	---
2016-1	2015-2	109,441	27,938	---	---

Table 14. Convergence tests of the update model, where randomized parameter phase orders and 10% jittering were applied over a wide range of initial R0 values.

	PHASE ORDER BY PARAMETER COMPONENT					RESULTS	
Initial R0	Growth	R0	R1	*ln*(Q)	Selex	Final R0	Total -(L)
14.1	1	4	5	3	2	14.8748	1164.64
14.2	2	3	5	1	4	14.8782	1164.61
14.3	2	5	3	4	1	14.8748	1164.64
14.4	4	2	1	5	3	14.8782	1164.61
14.5	3	1	5	4	2	14.8748	1164.64
14.6	3	1	2	5	4	14.8782	1164.61
14.7	3	5	4	2	1	14.8748	1164.64
14.8	4	2	3	1	5	14.8748	1164.64
14.9	5	4	1	2	3	14.8748	1164.64
15.0	2	3	5	4	1	14.8748	1164.64
15.1	4	3	1	2	5	14.8782	1164.61
15.2	1	4	2	3	5	14.8782	1164.61
15.3	3	5	1	4	2	14.8782	1164.61
15.4	3	1	4	5	2	14.8782	1164.61
15.5	4	2	5	3	1	14.8782	1164.61
15.6	1	5	2	4	3	14.8782	1164.61
15.7	5	4	1	2	3	14.8782	1164.61
15.8	1	2	4	5	3	14.8748	1164.64
15.9	4	1	5	3	2	14.8748	1164.64
16.0	4	3	5	1	2	14.8782	1164.61

Table 15. Pacific sardine harvest control rules for the 2015-16 management year based on stock biomass estimated in base model T and under two different scenarios regarding 2014 YC strength.

a) HCRs when 2014 YC is derived from S-R Curve.

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)	132,884								
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 (2012-2014)	15.562								
E_{MSY}	0.157239								
FRACTION	0.157239								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**18,178**								
$ABC_{Tier\ 1}$ =	17,374	16,594	15,824	15,051	14,259	13,427	12,517	11,460	10,055
HG =	**0**								

b) HCRs when 2014 YC is based on the average of 2011-2013 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)	96,688								
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 (2012-2014)	15.562								
E_{MSY}	0.157239								
FRACTION	0.157239								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (MT)									
OFL =	**13,227**								
$ABC_{Tier\ 1}$ =	12,642	12,074	11,514	10,951	10,375	9,769	9,108	8,338	7,316
HG =	**0**								

FIGURES

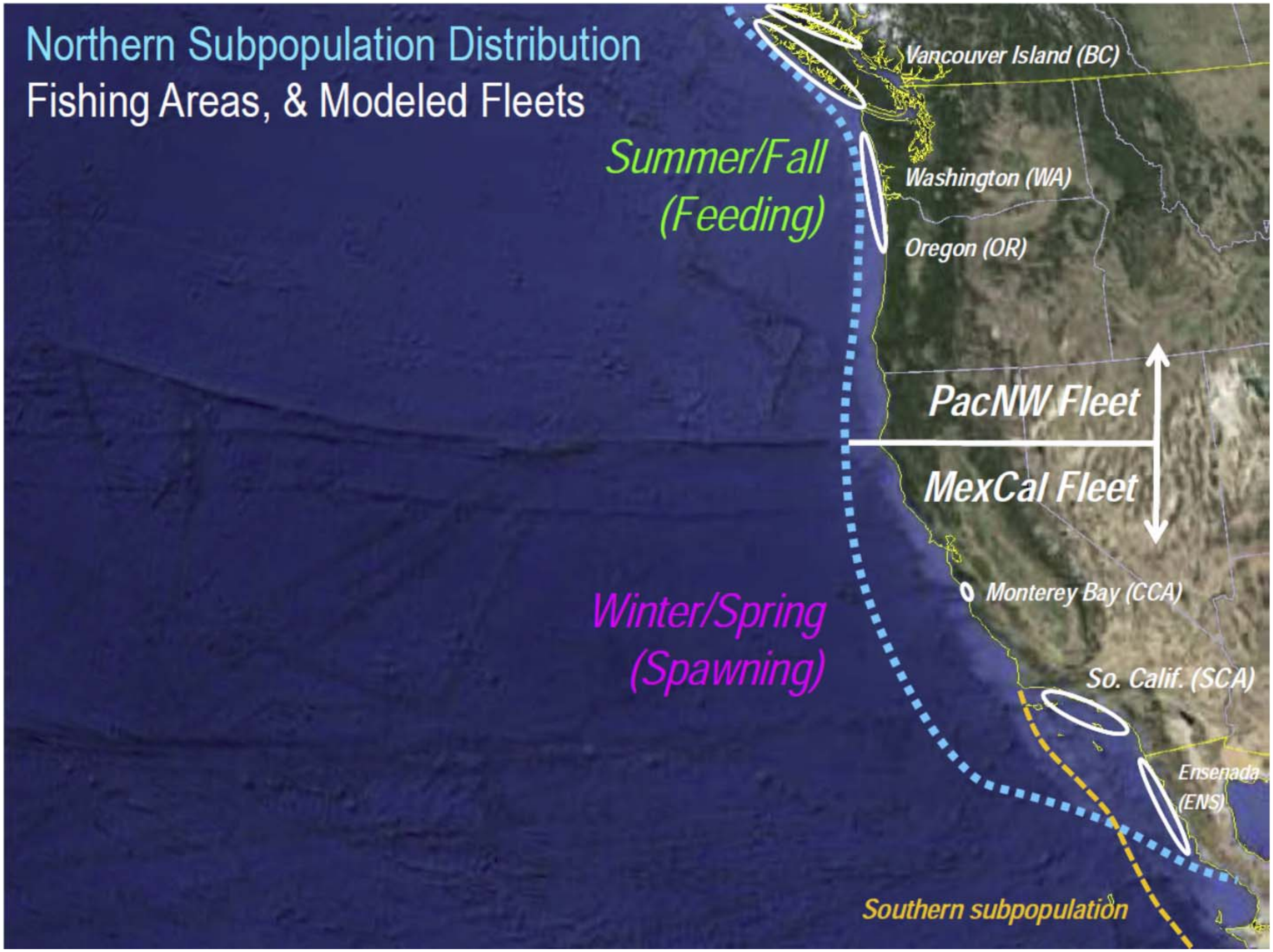


Figure 1. Pacific sardine northern subpopulation distribution, primary commercial fishing areas, and modeled fleets.

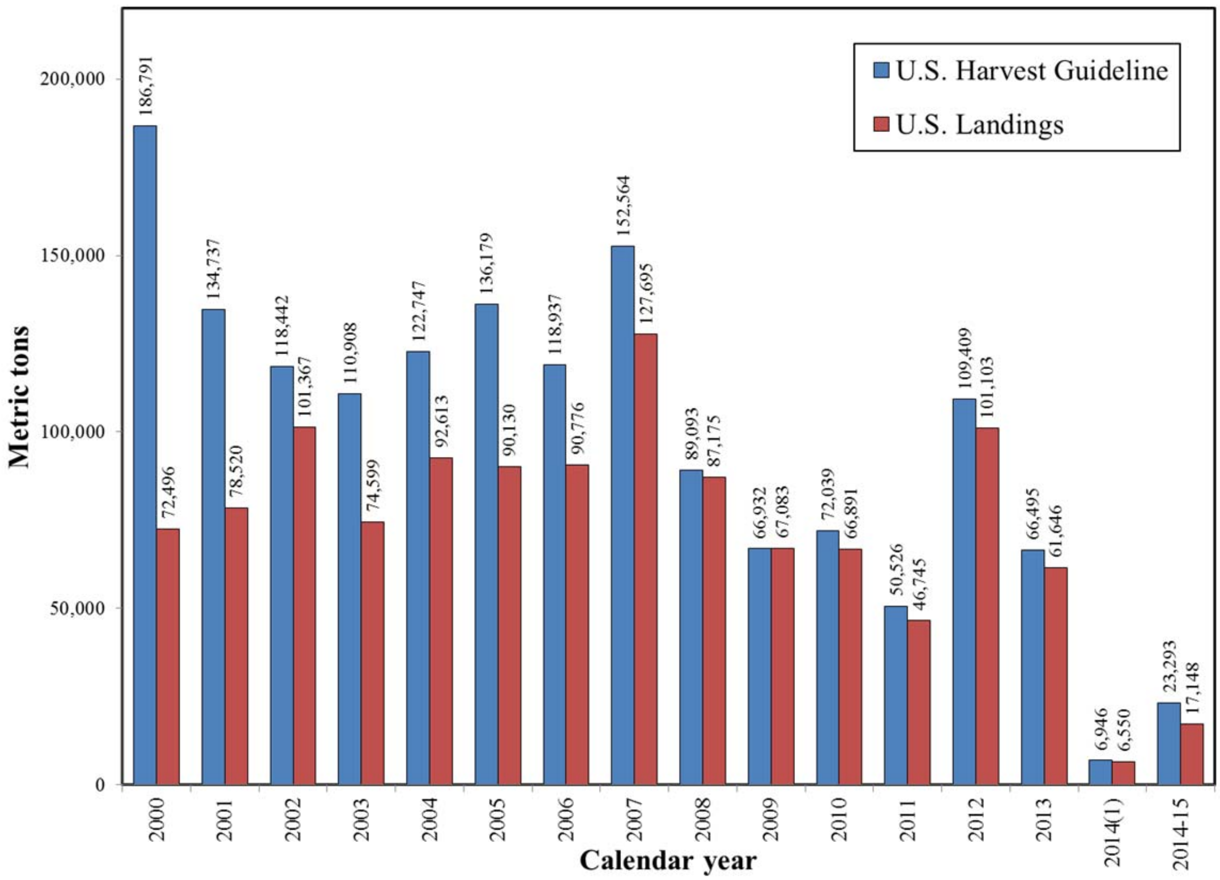


Figure 2. U.S. Pacific sardine harvest guidelines and landings since the onset of federal management.

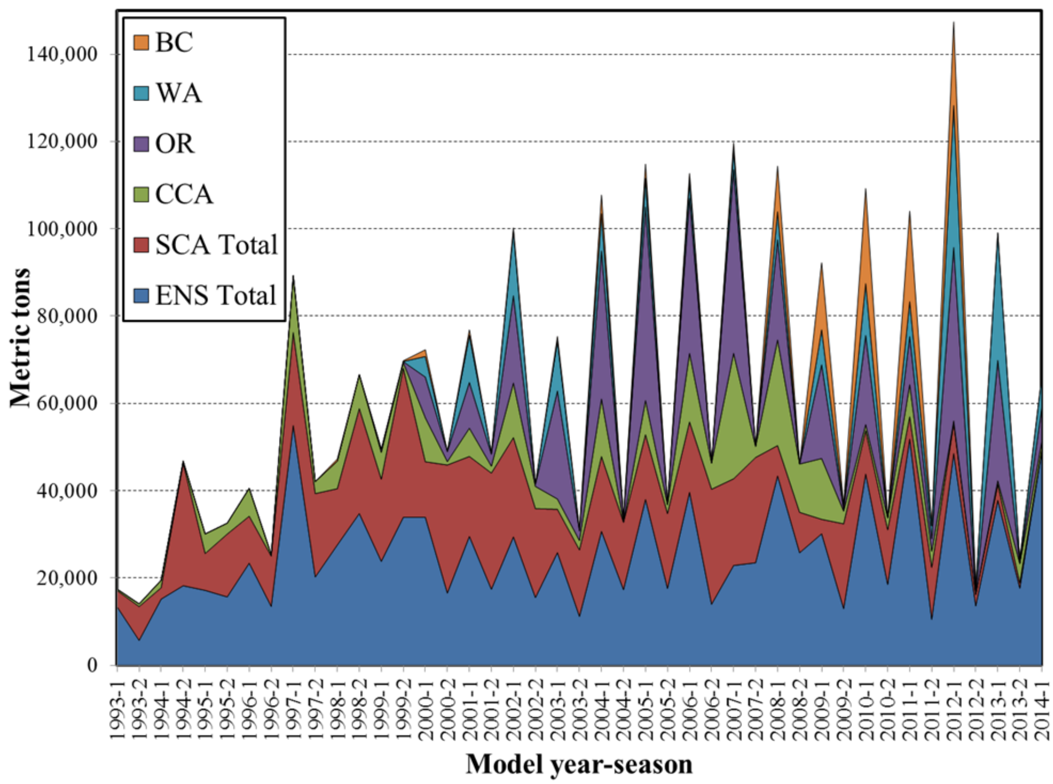


Figure 3a. Total Pacific sardine landings (mt) by major fishing region.

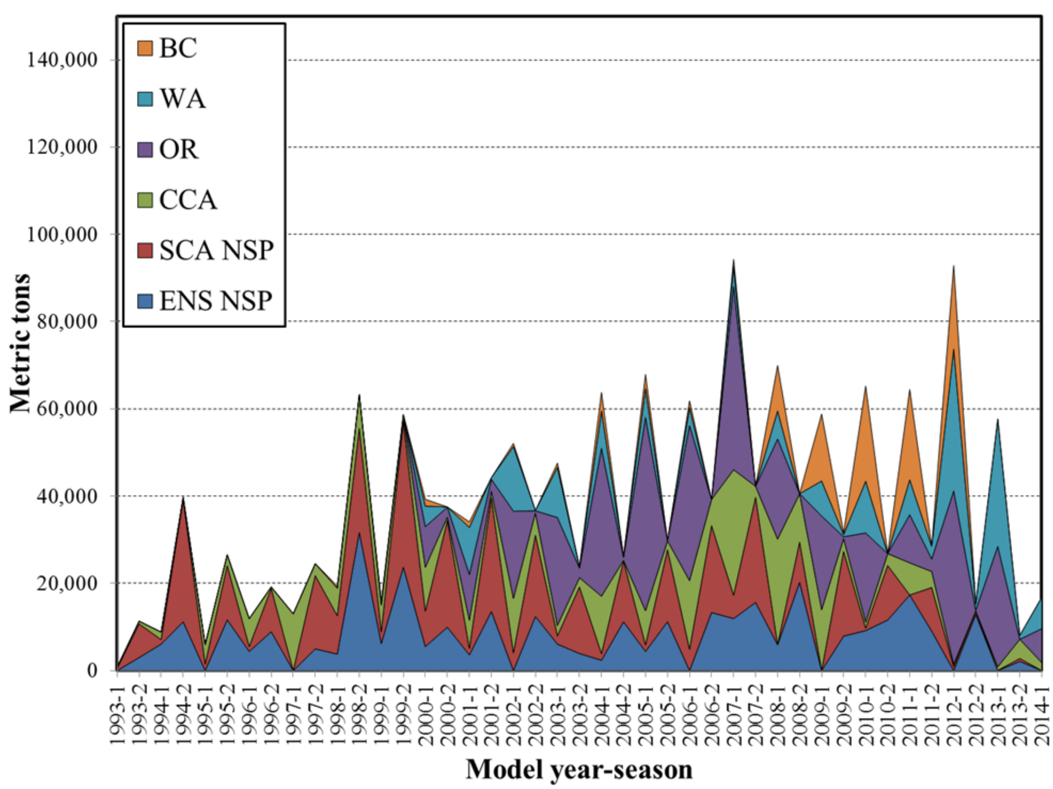


Figure 3b. Pacific sardine NSP landings (mt) by major fishing region.

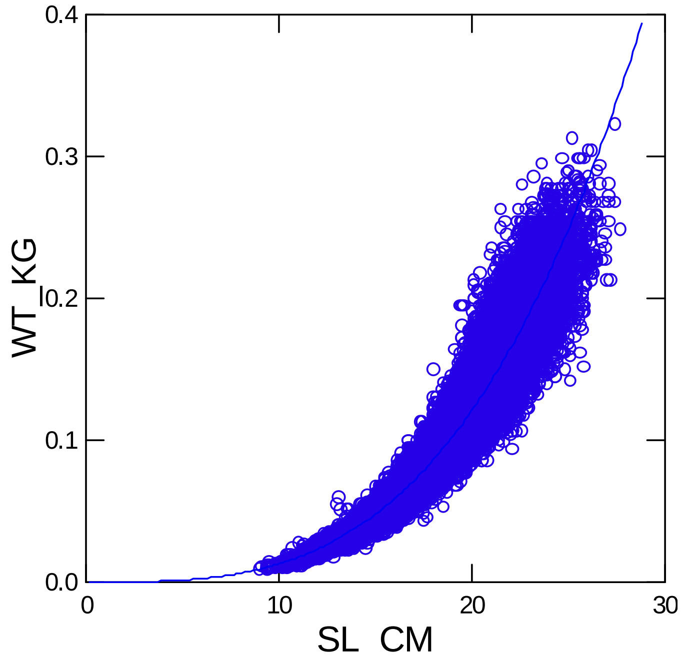


Figure 4. Weight-at-length regression from NSP fishery samples as applied in model T, where: *a* = 7.5242e-06 and *b* = 3.2332 (n=104,326, R^2 = 0.936).

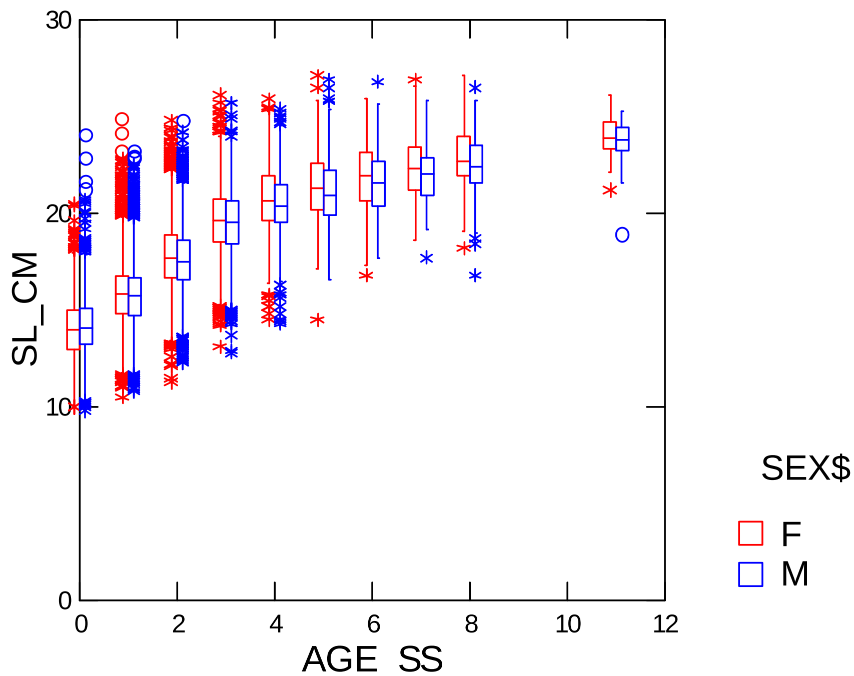


Figure 5a. Length-at-age by sex from fishery samples. Box symbols indicate median and quartile ranges for the raw data. The SS model is based on pooled sexes.

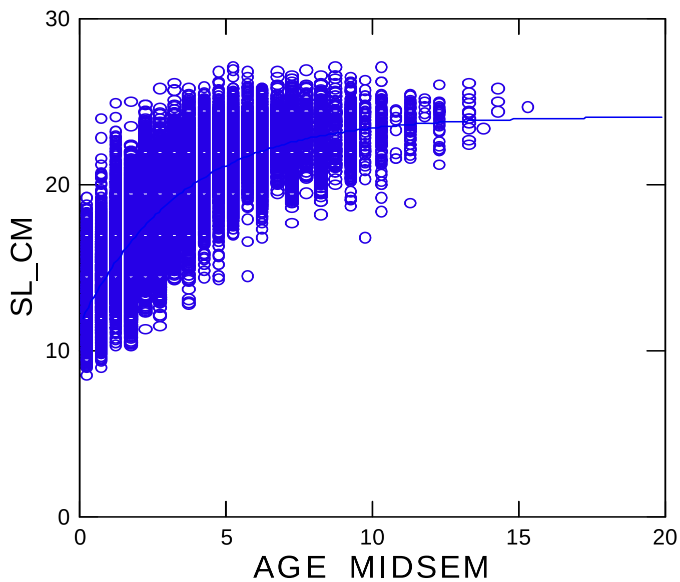


Figure 5b. von Bertalanffy growth from NSP fishery samples, sexes combined, as estimated outside of the SS model (t_0 = -2.01, K = 0.318, L_∞ = 23.788).

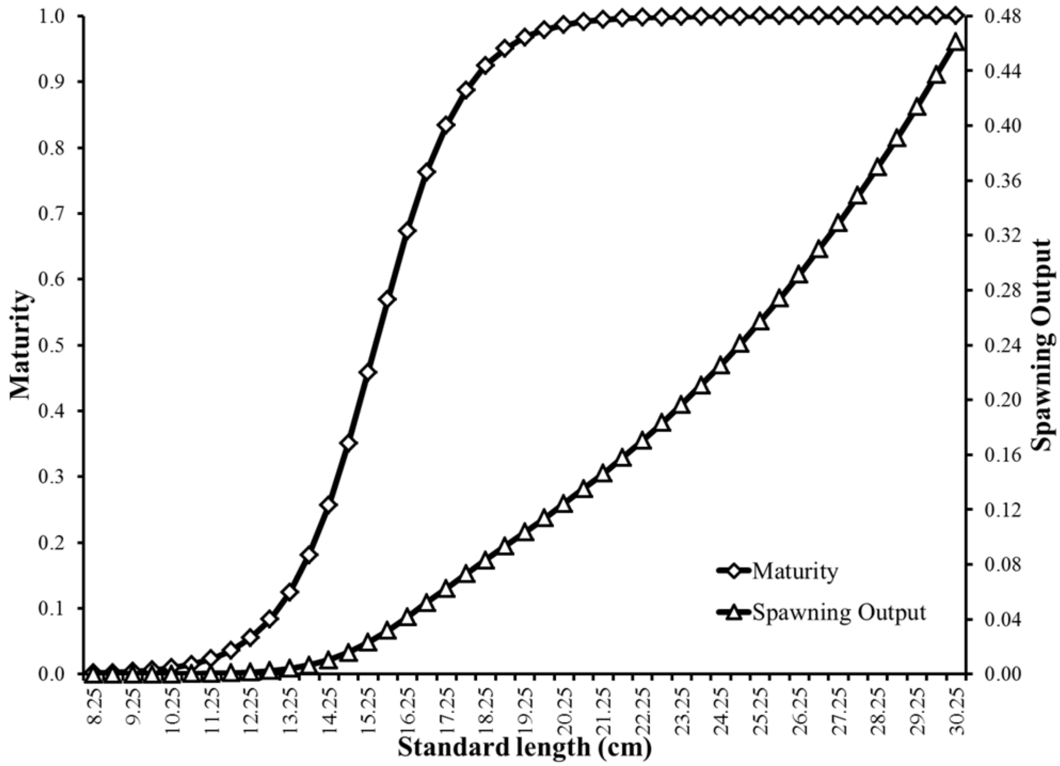


Figure 6a. Maturity (L_{50} = 15.44 cm) and spawning output as a function of length.

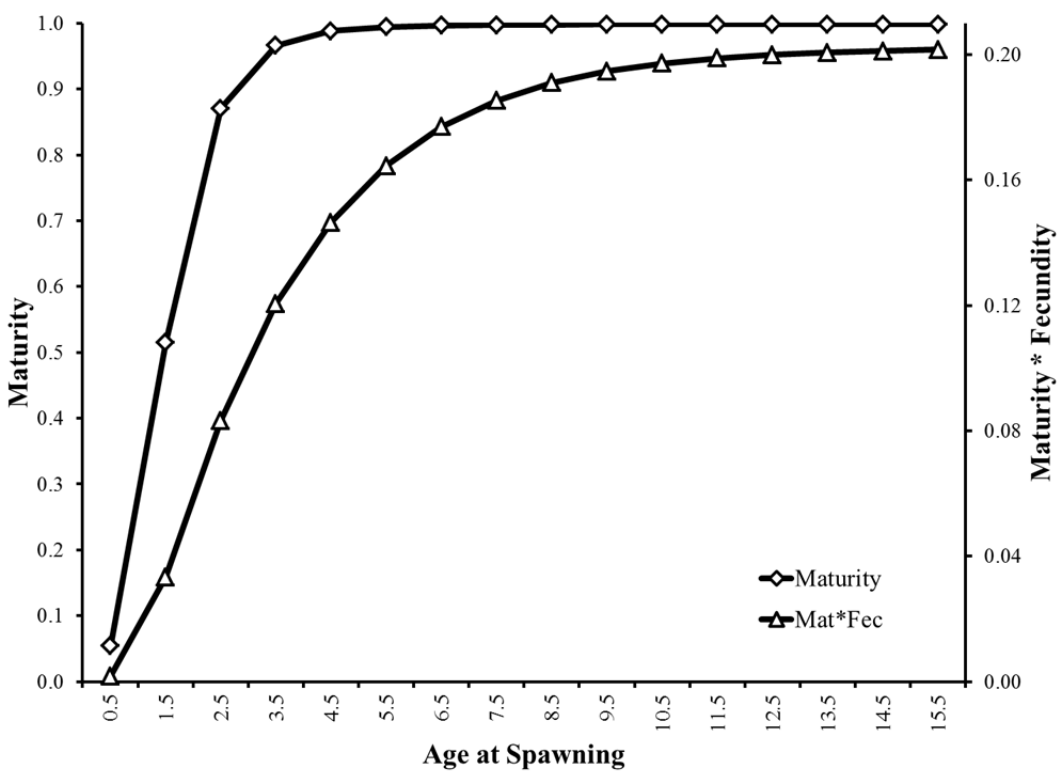


Figure 6b. Maturity and fecundity as a function of age derived from growth in model T.

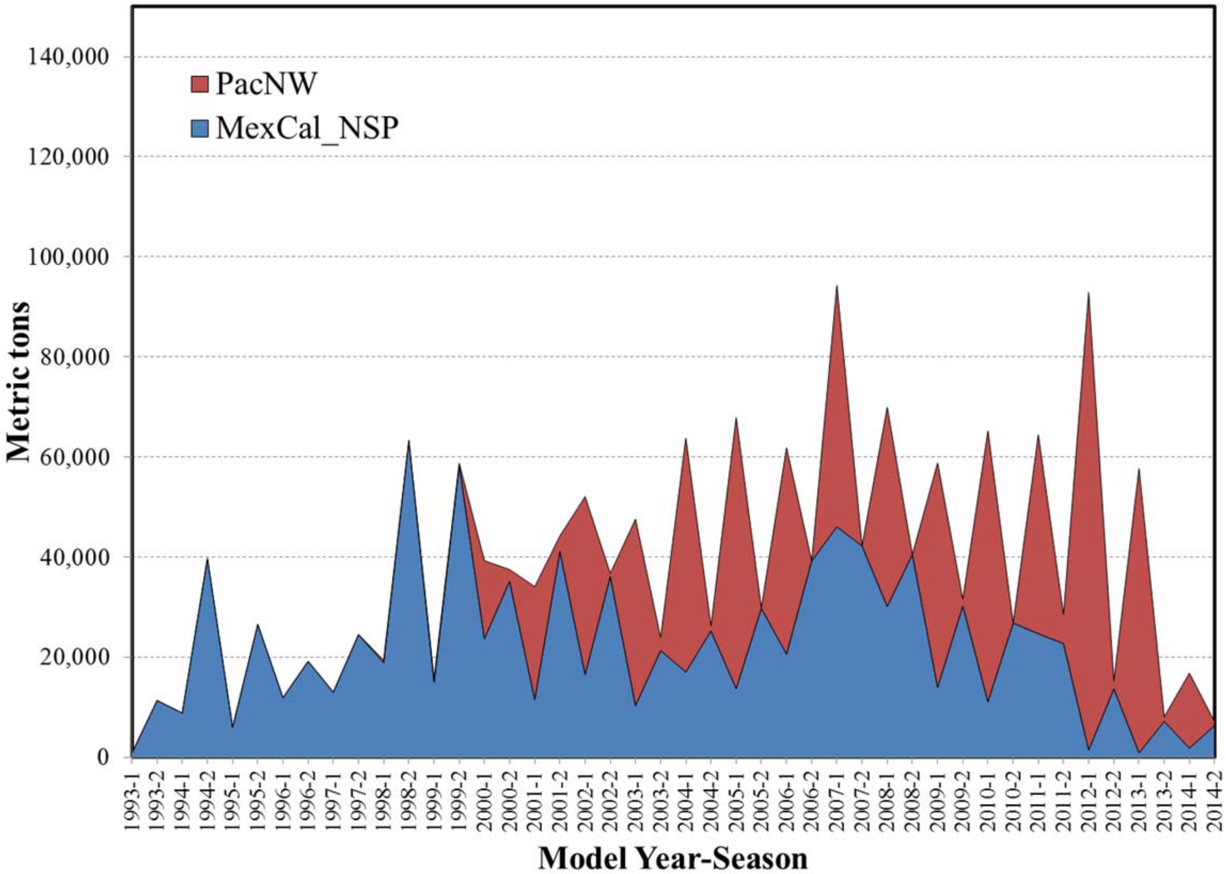


Figure 7. Pacific sardine landings (mt) by fleet, model year and semester as used in NSP model scenarios, including final base model T.

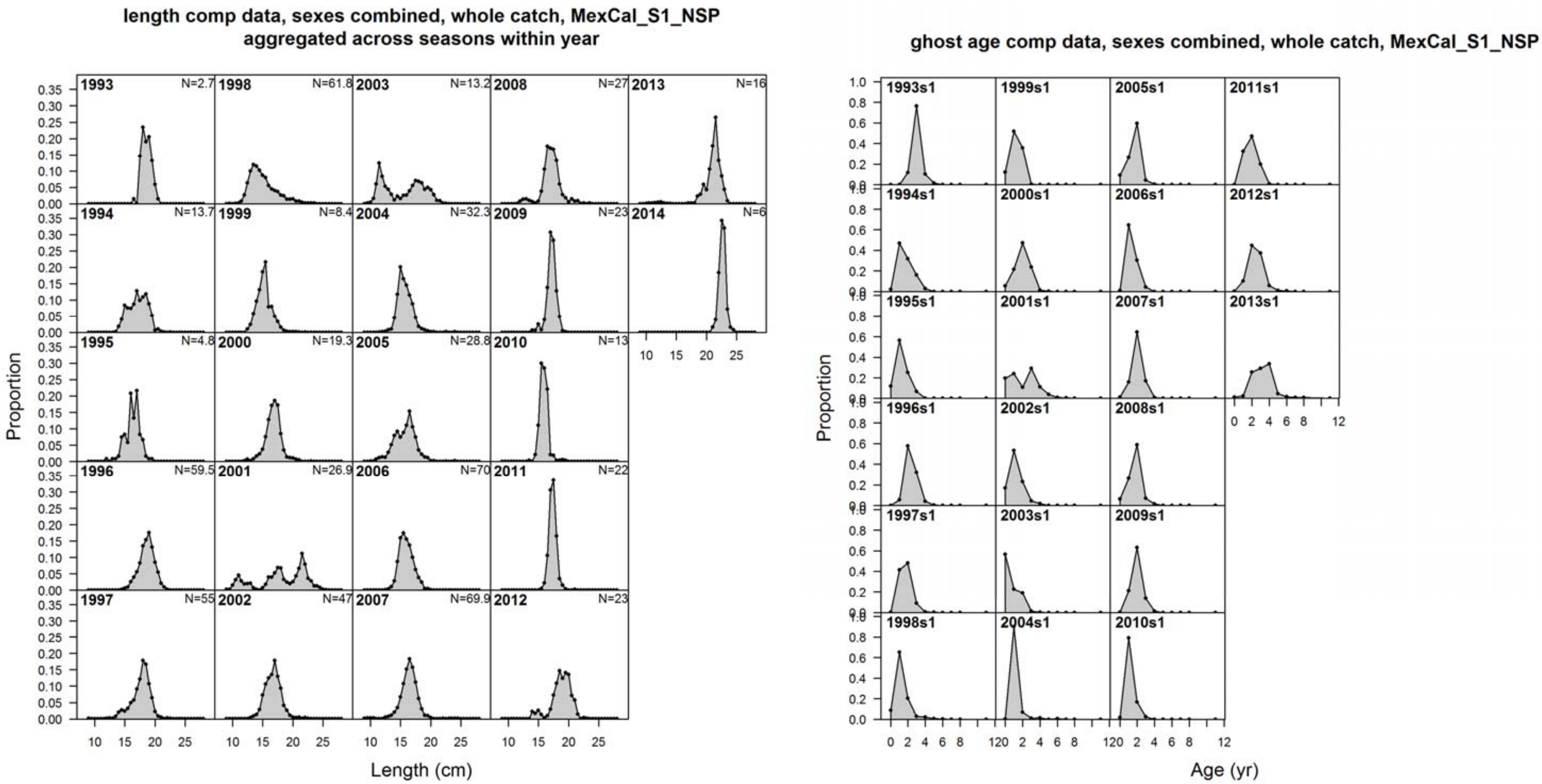


Figure 8. Length-composition (left panel) and implied age composition (right panel) data for the MexCal_S1 fleet.

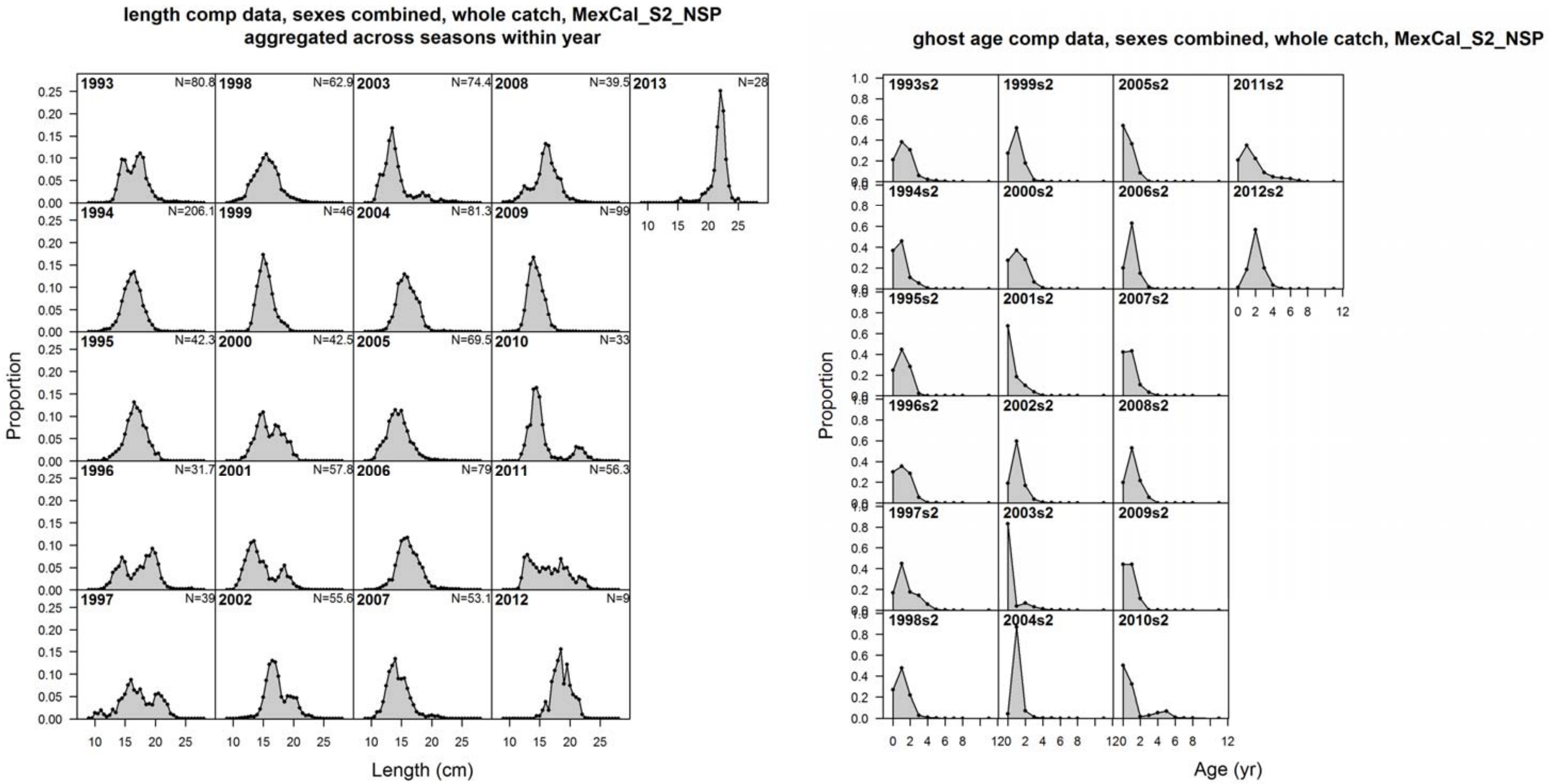


Figure 9. Length-composition (left panel) and implied age composition (right panel) data for the MexCal_S2 fleet.

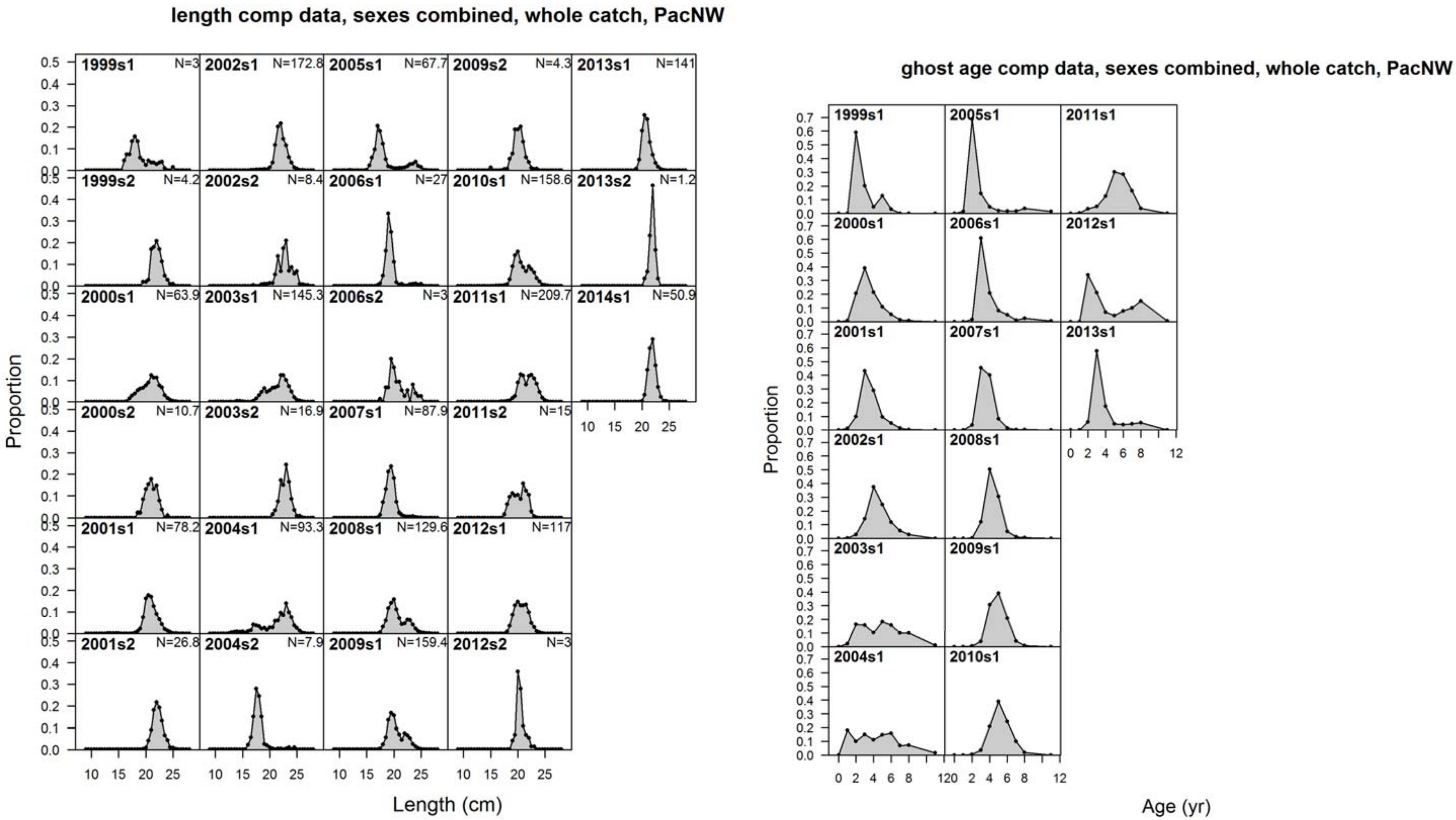


Figure 10. Length-composition (left panel) and implied age-composition (right panel) data for the PacNW fleet.

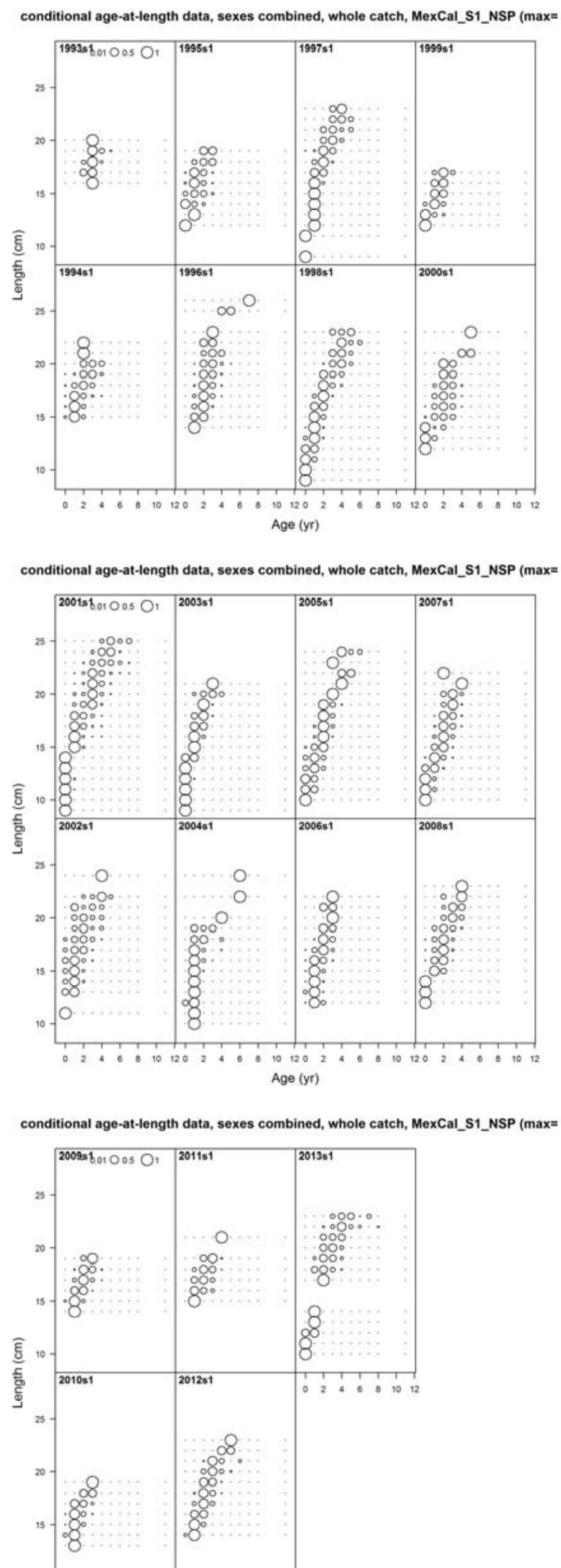
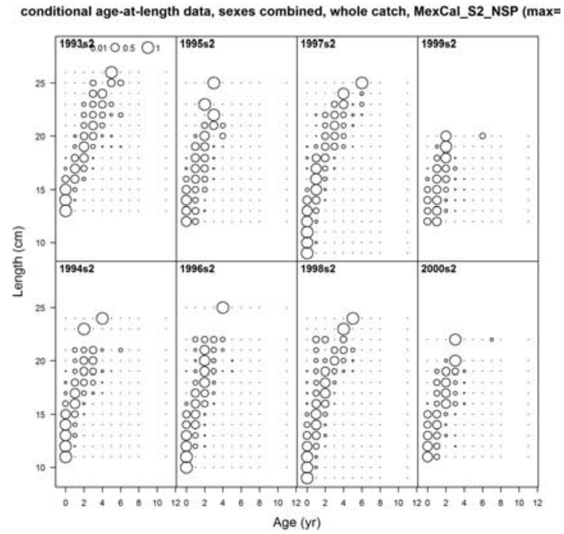
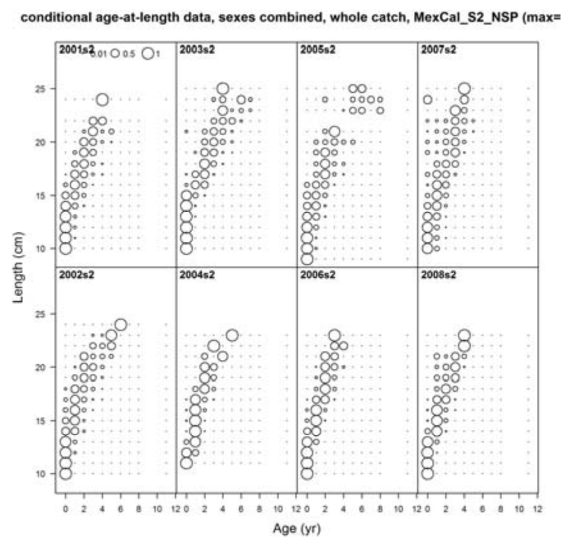


Figure 11. Conditional age-at-length data for the MexCal_S1 fleet.





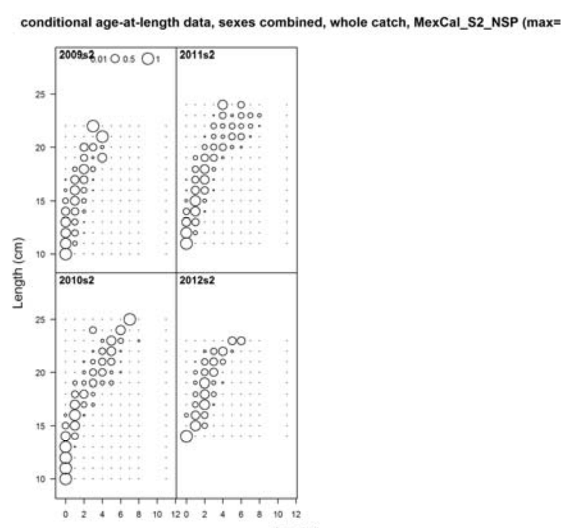


Figure 12. Conditional age-at-length data for the MexCal_S2 fleet.

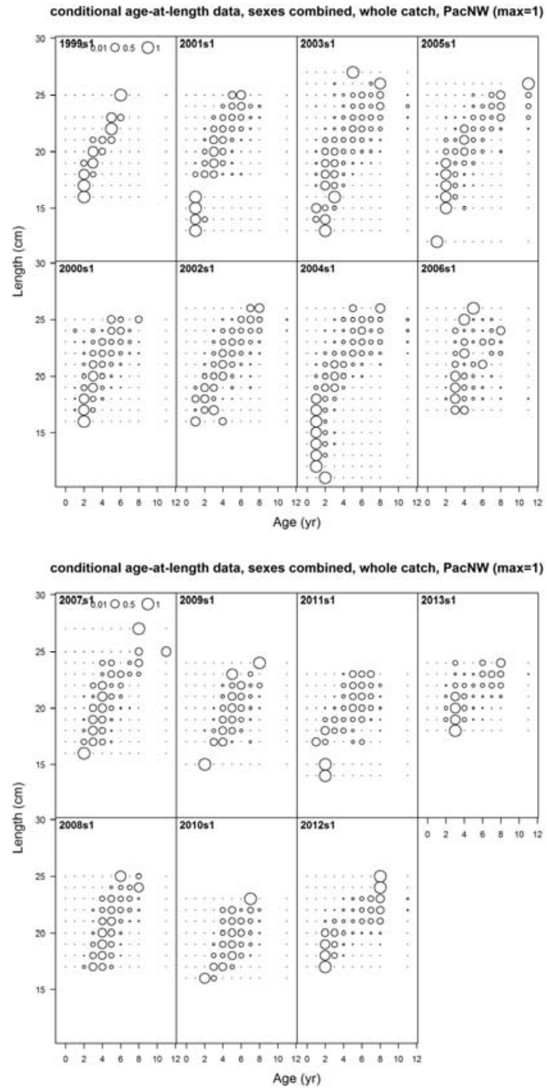


Figure 13. Conditional age-at-length data for the PacNW fleet.

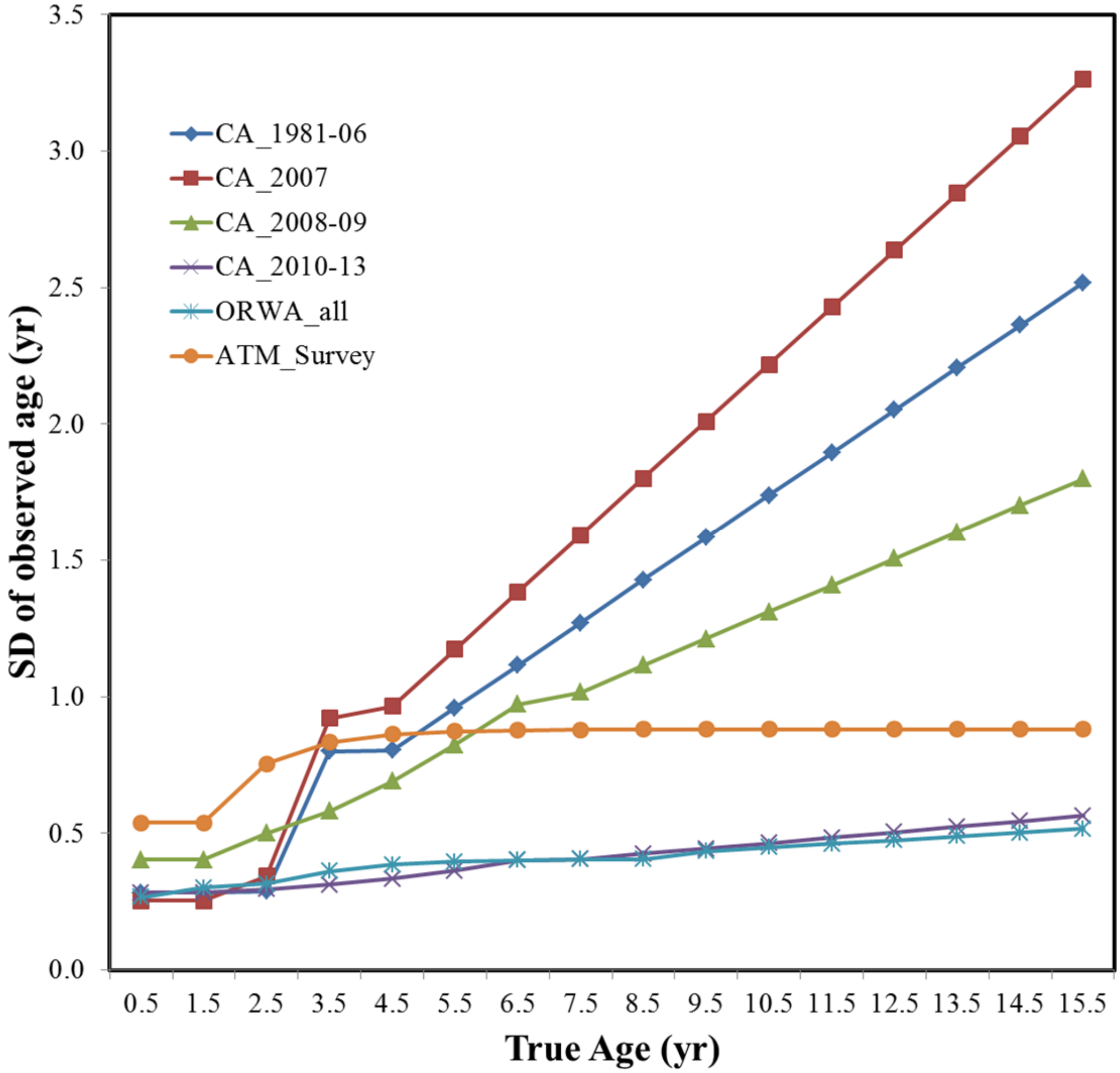


Figure 14. Laboratory- and year-specific ageing errors applied in all models.

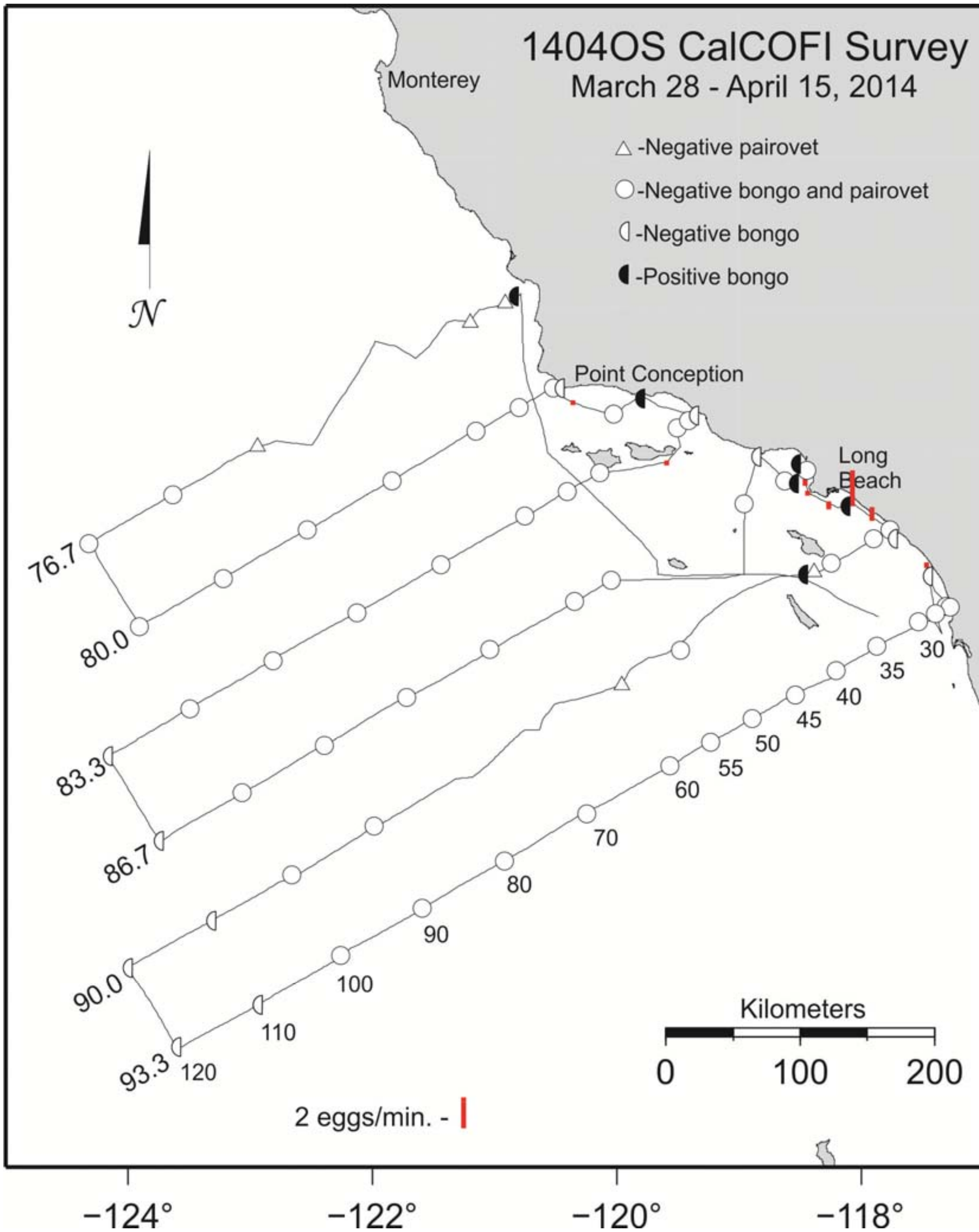


Figure 15a. Distribution of CUFES, bongo, and pairovet samples from the 1404 CalCOFI survey conducted aboard the R/V *Ocean Starr* during spring 2014.

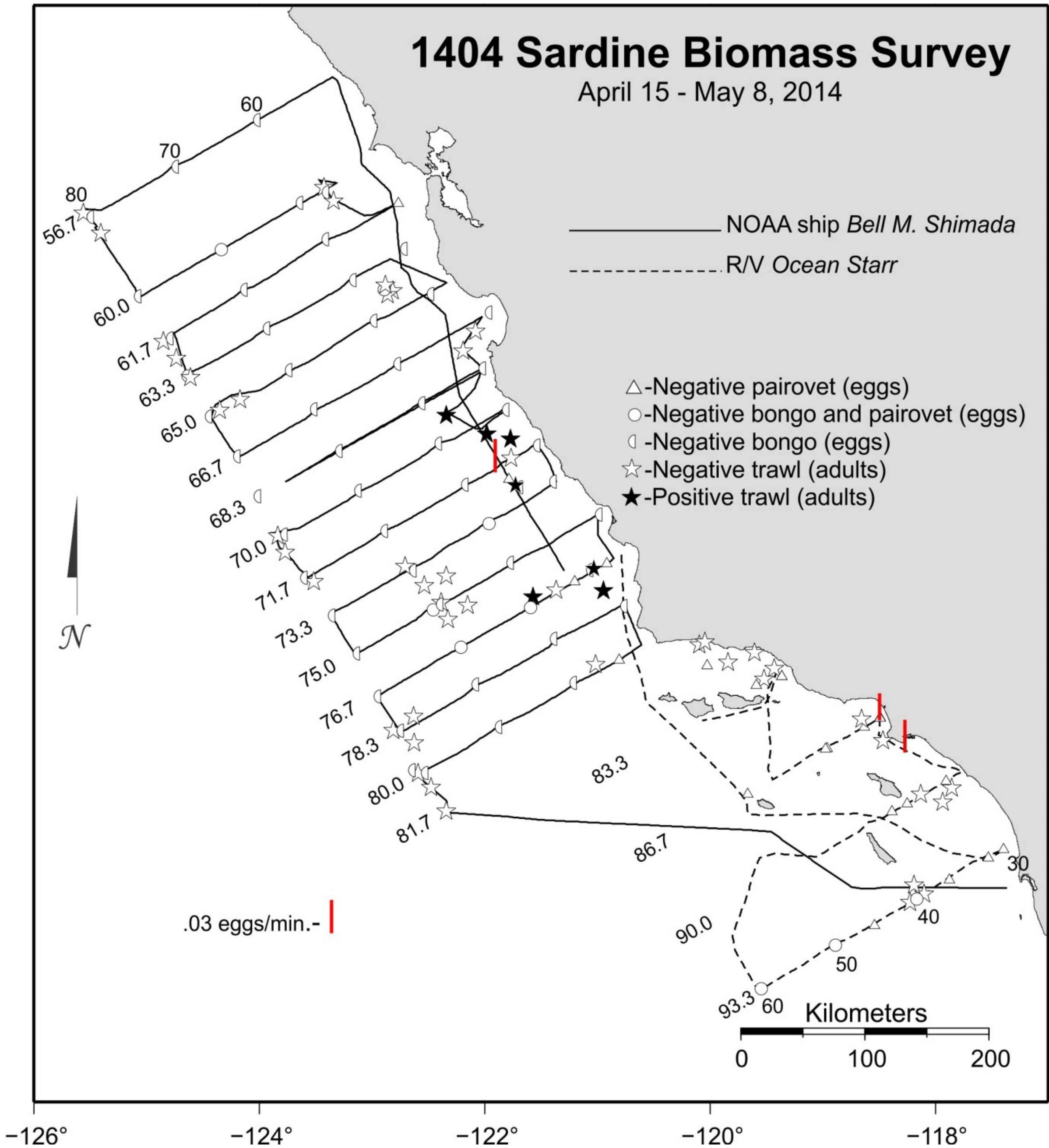


Figure 15b. Distribution of CUFES, bongo, pairovet, and adult trawl samples from the 1404 SWFSC sardine survey in the standard DEPM sampling DEPM index, conducted aboard the R/V *Ocean Starr* and the NOAA ship *Bell M. Shimada* during spring 2014.

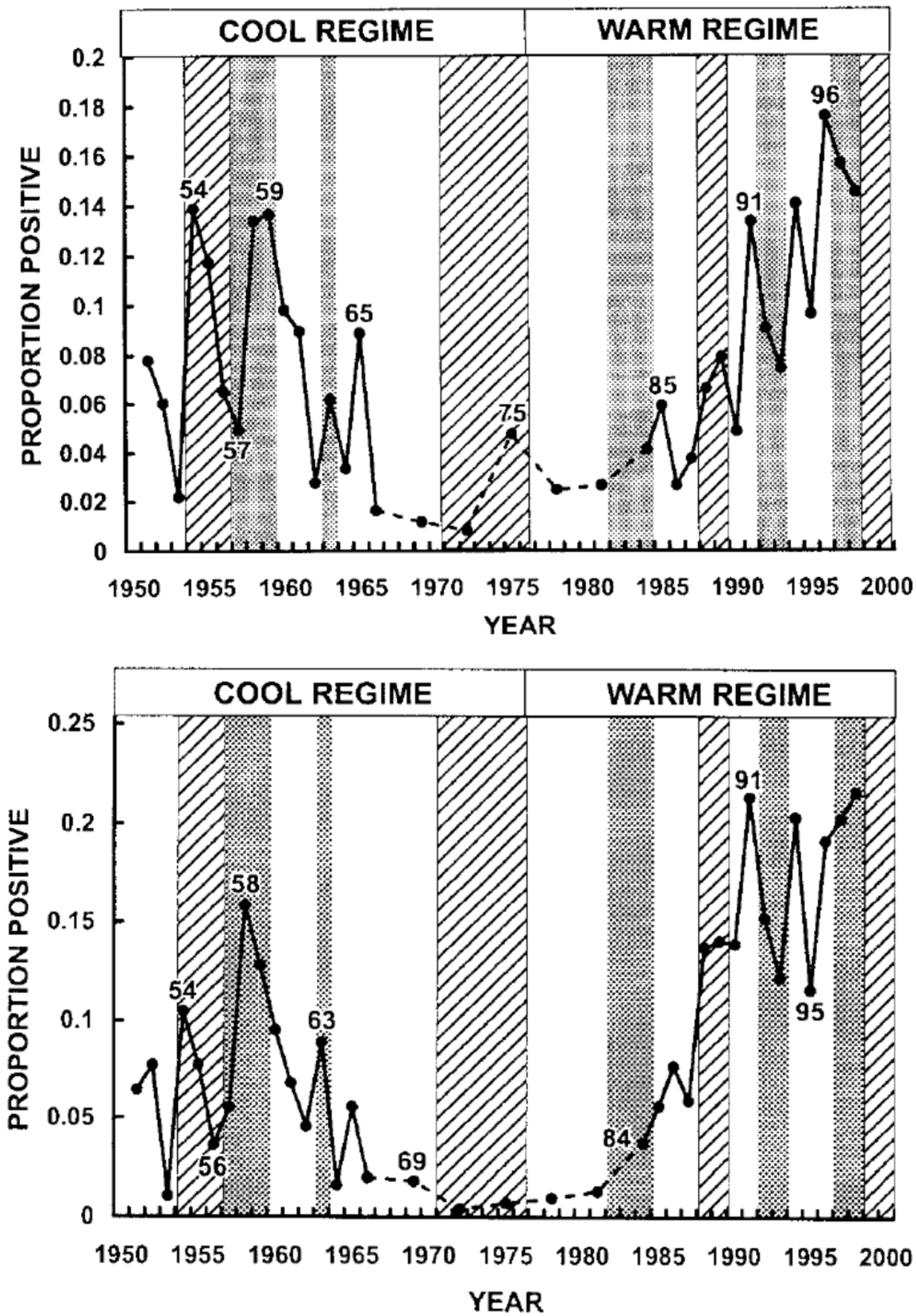


Figure 16. Historical time series of Pacific sardine eggs (upper) and larvae (lower) sampled in the current CalCOFI sampling grid (San Diego to Avila Beach, CA). Data are proportion of bongo tows positive for eggs or larvae. Displays are from CalCOFI Atlas No. 34 (Moser et al. 2001).

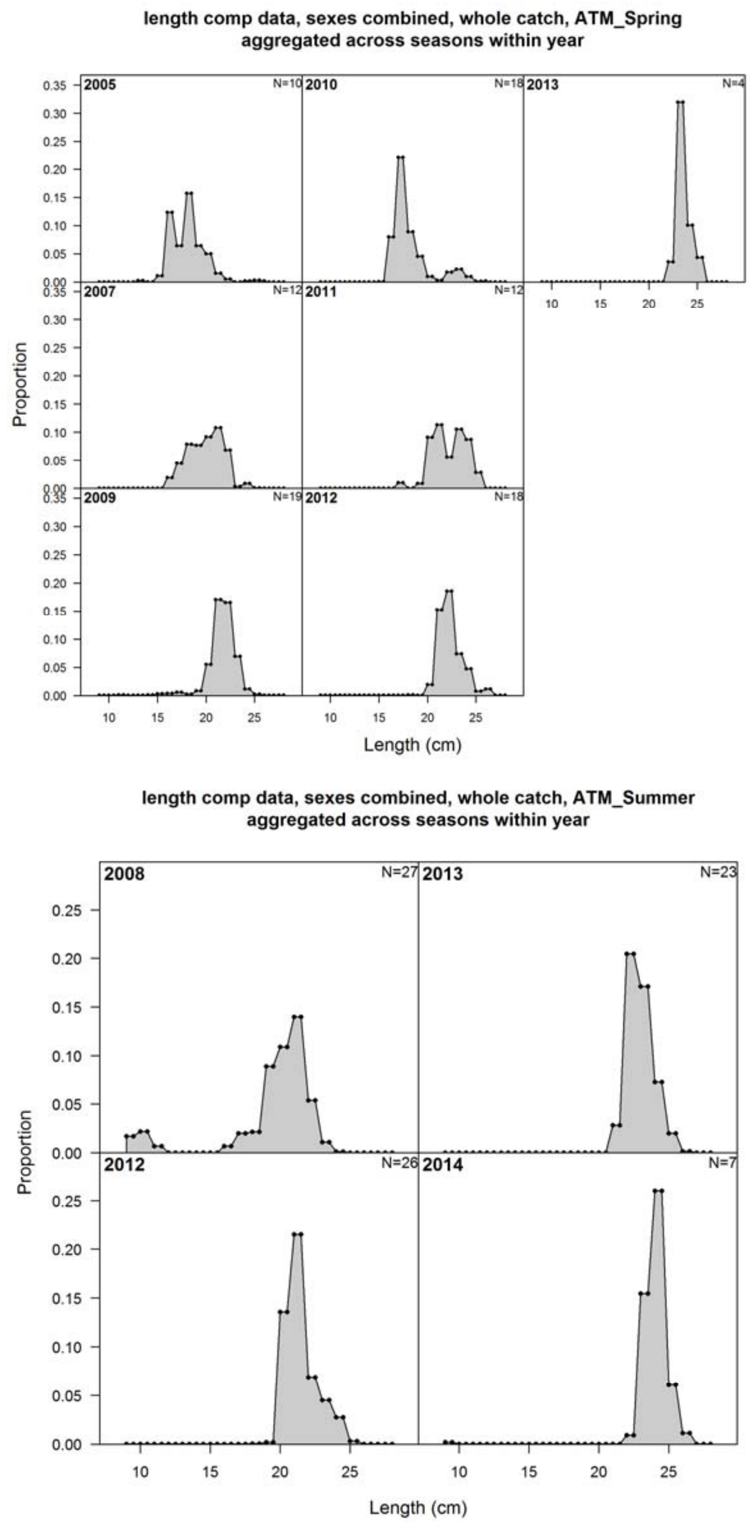


Figure 17. Length-composition data (1-cm resolution) for the ATM Spring (upper panel) and Summer (lower panel) surveys.

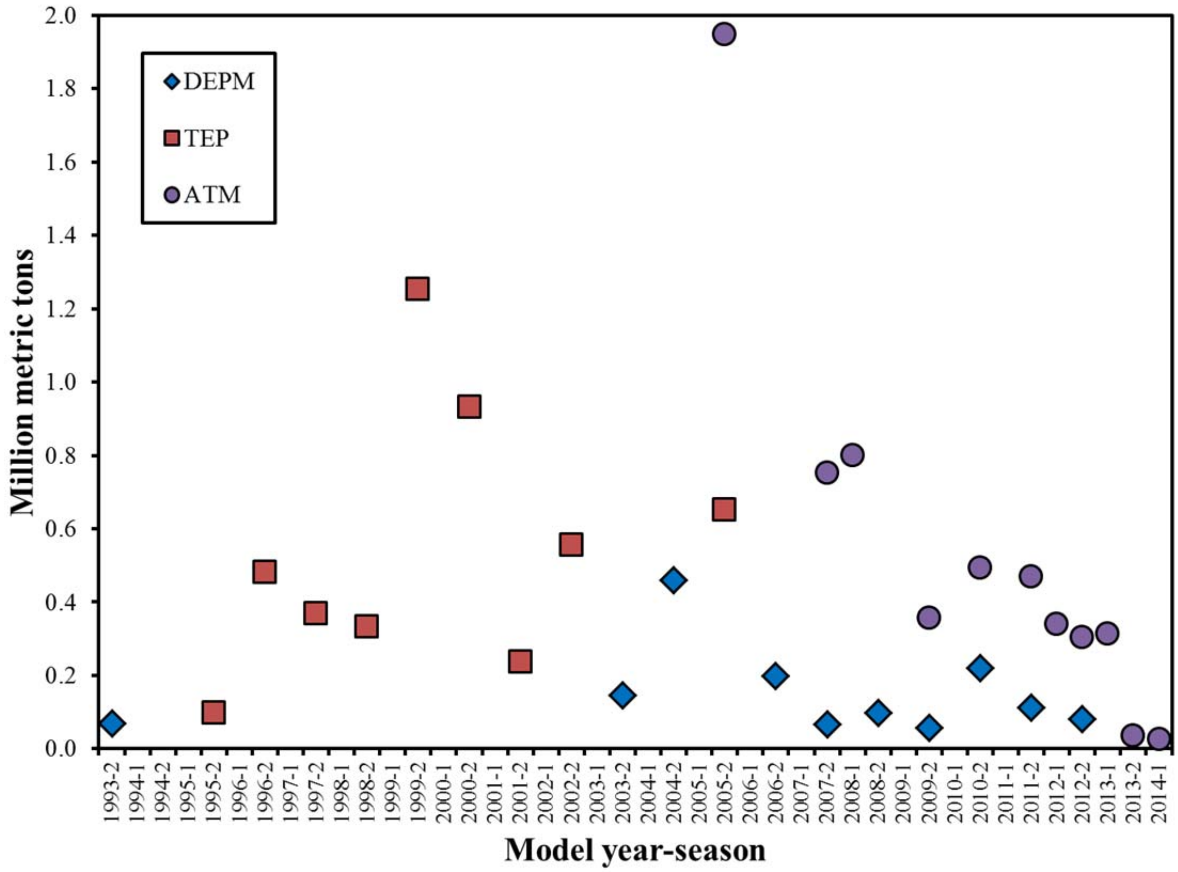


Figure 18. Survey indices of abundance (biomass units) included in final base model T. TEP is modeled as total SSB, and DEPM as female SSB. Error bars for survey estimates are shown in subsequent displays for model fits to respective surveys.

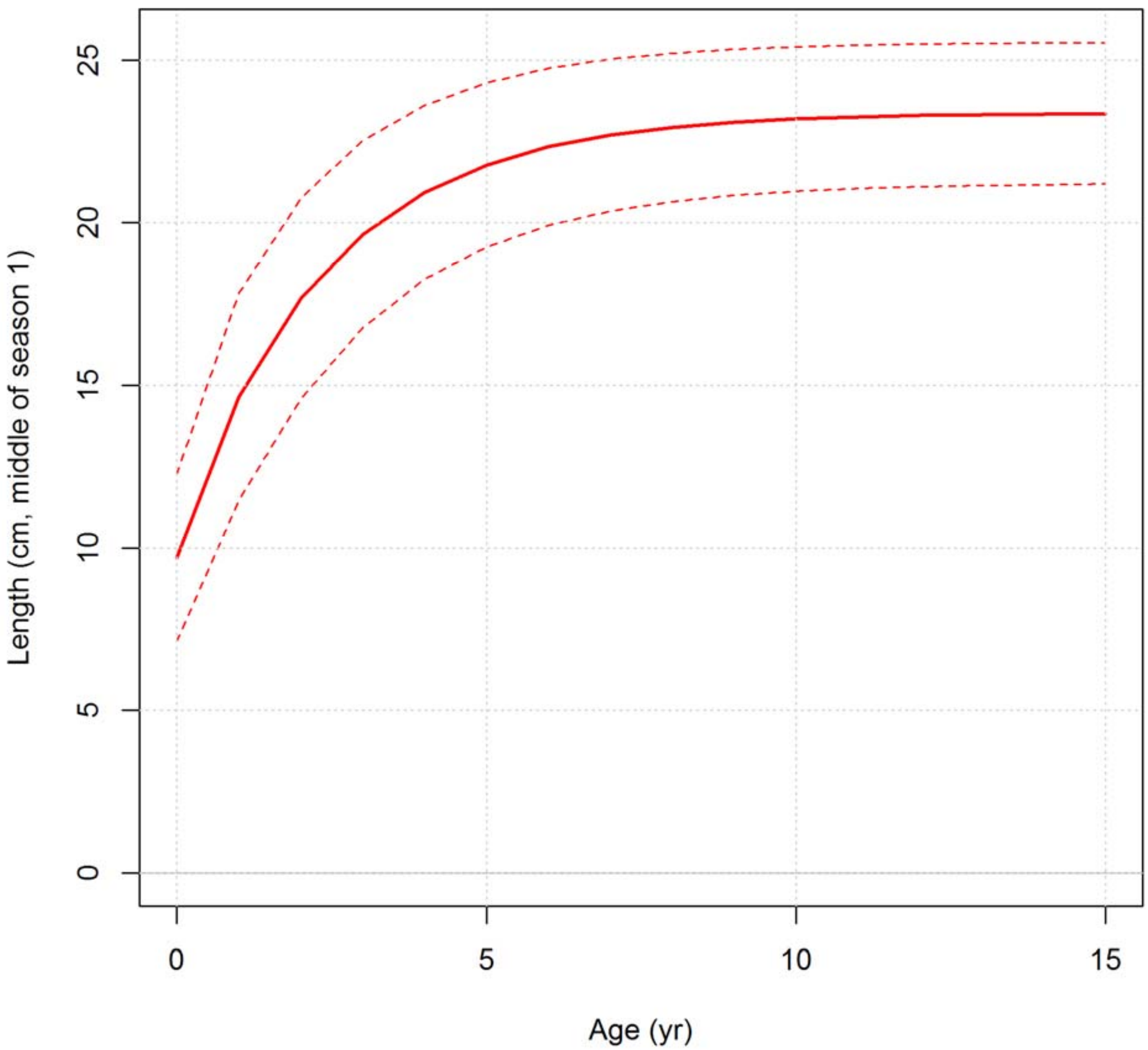
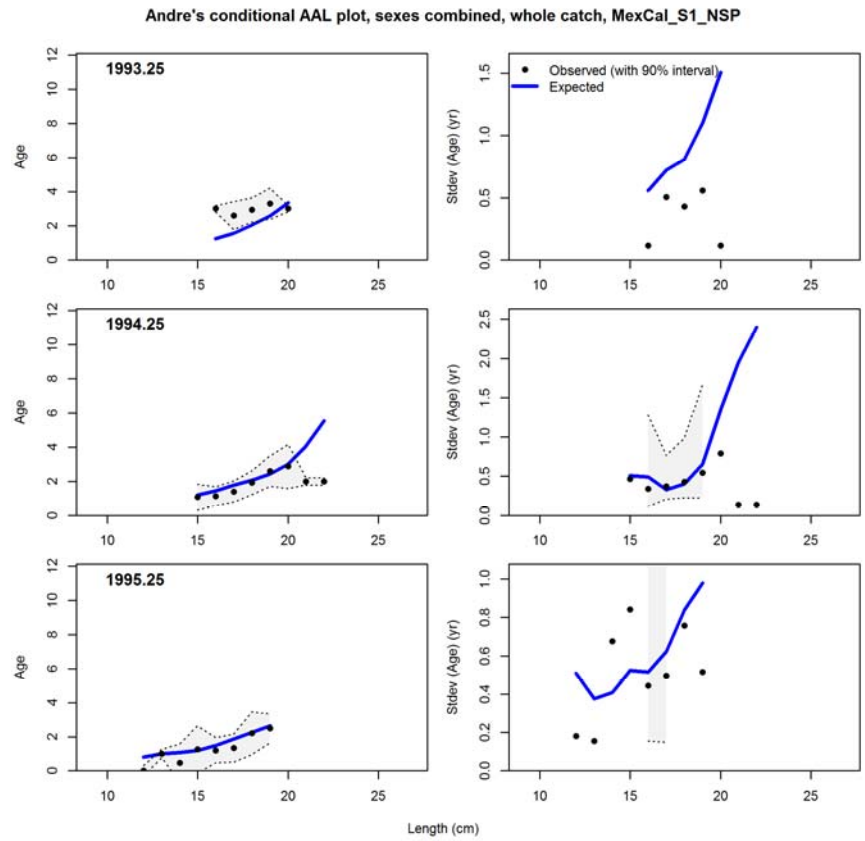


Figure 19. Length-at-age relationship estimated in base model T ($L_{0.5yr}$ = 11.3881 (0.2819), L_∞ = 23.3801 (0.1506), K = 0.4238 (0.0234)).



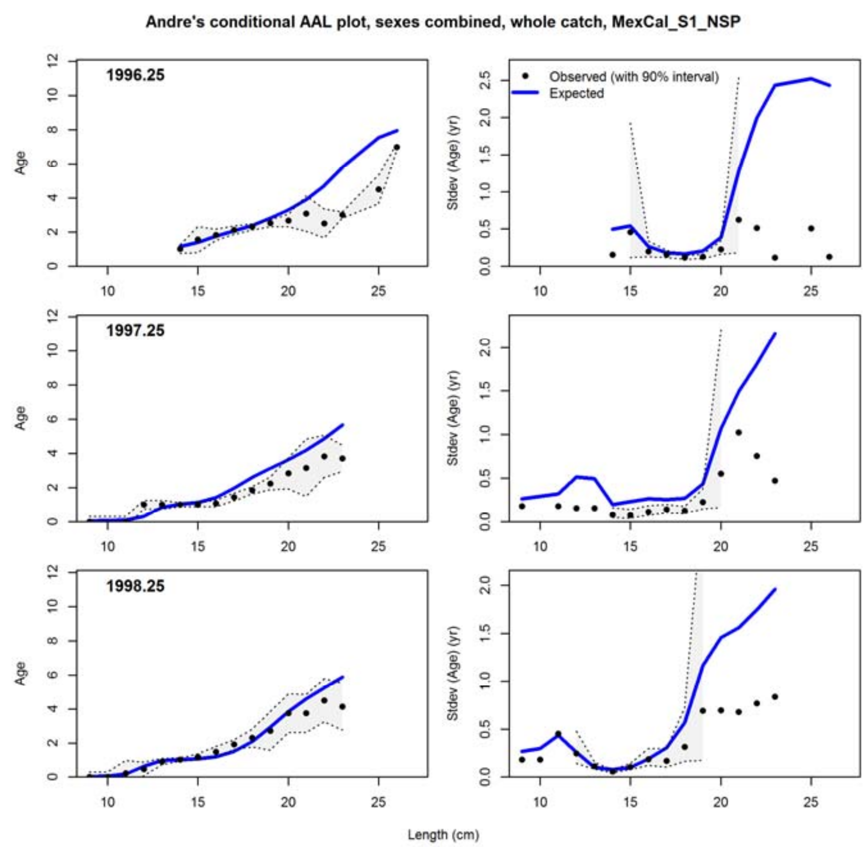
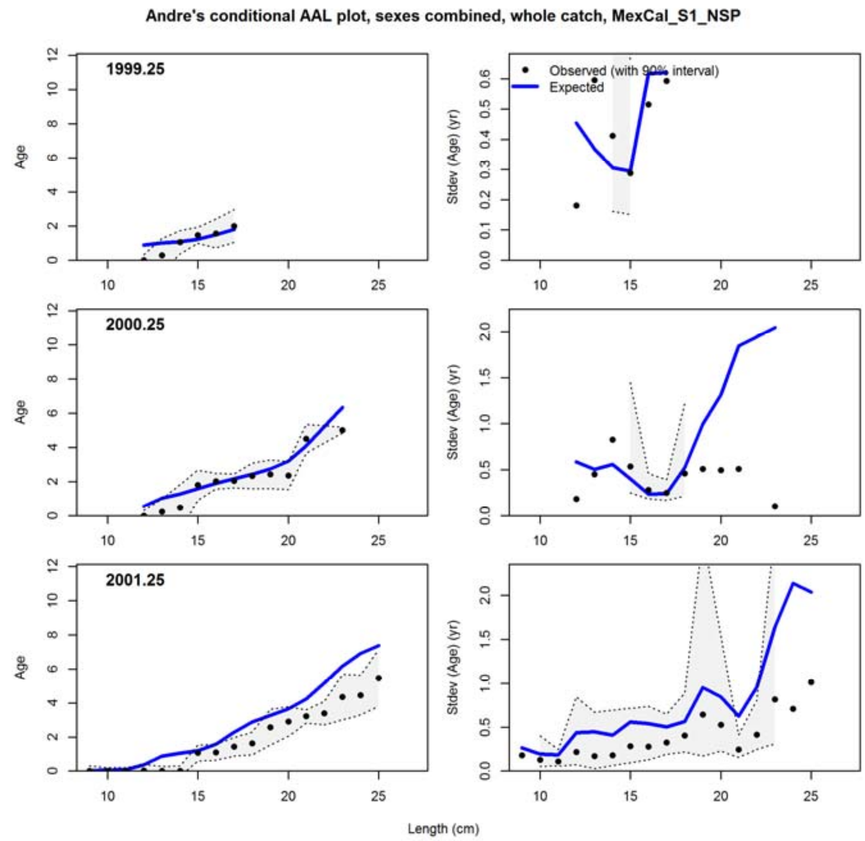


Figure 20. Model T fit to conditional age-at-length compositions for the MexCal_S1 fleet.



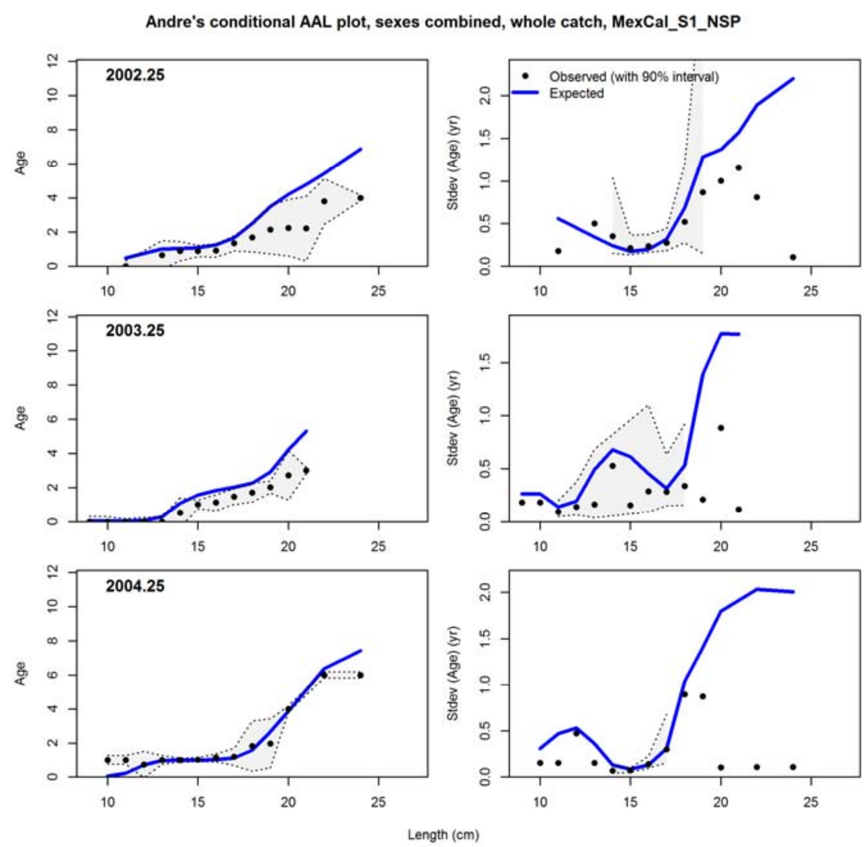
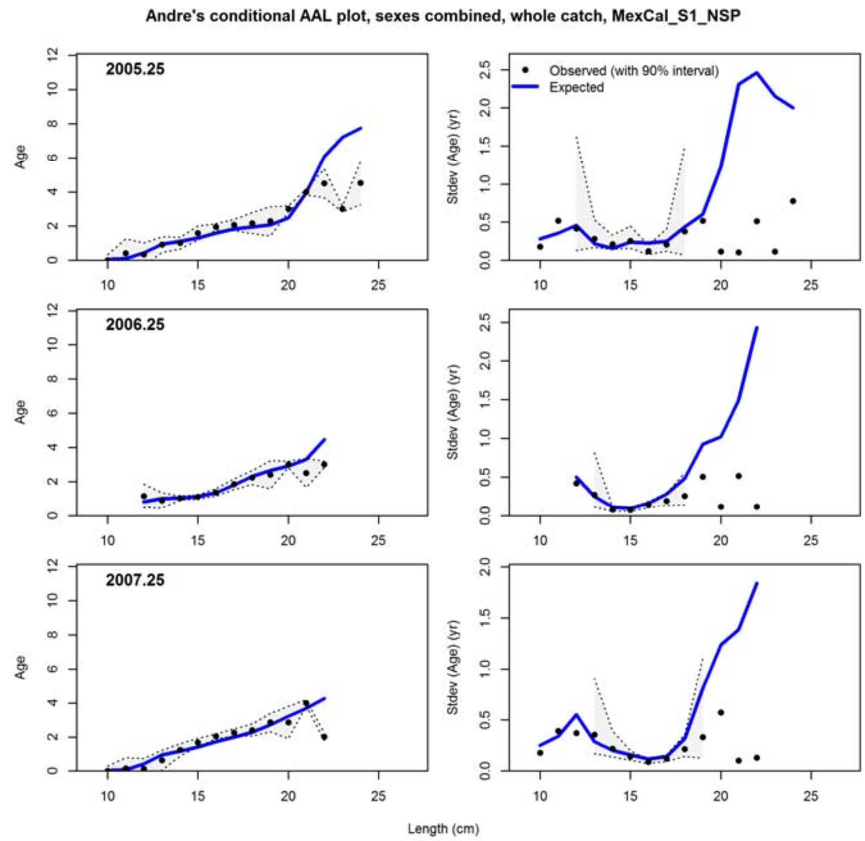


Figure 20 (cont.). Model T fit to conditional age-at-length compositions for the MexCal_S1 fleet.



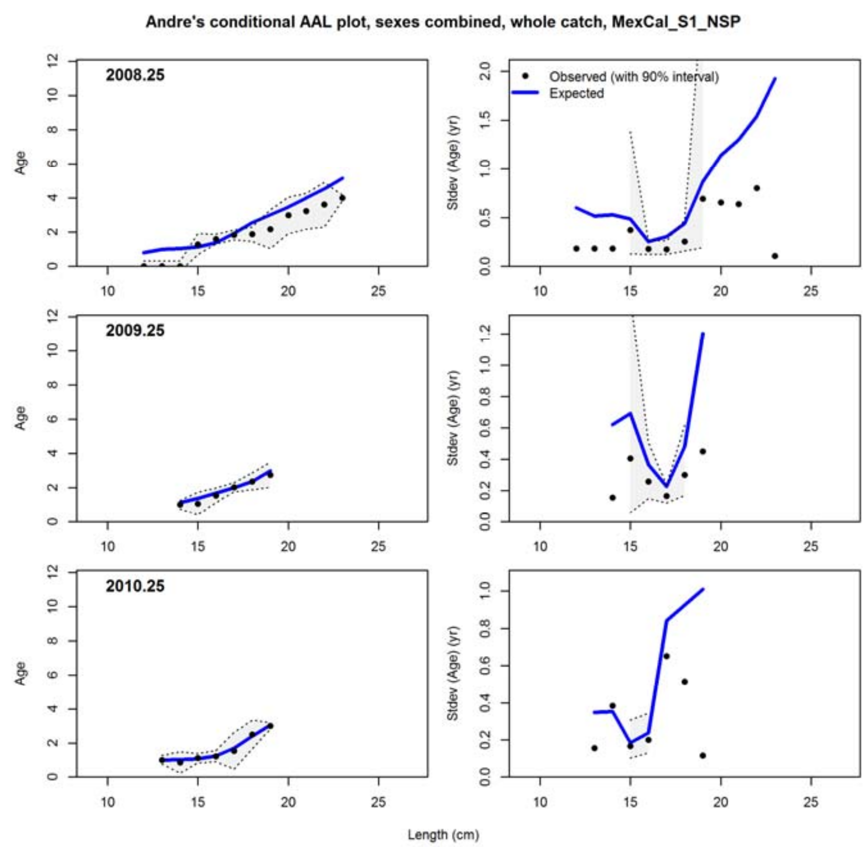


Figure 20 (cont.). Model T fit to conditional age-at-length compositions for the MexCal_S1 fleet.

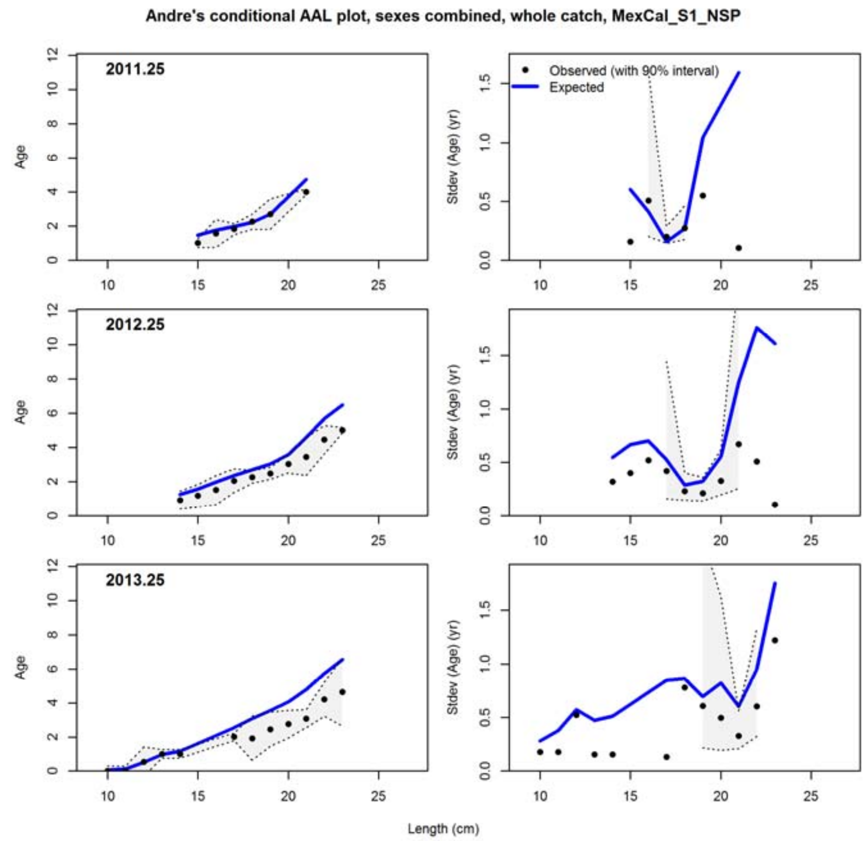


Figure 20 (cont.). Model T fit to conditional age-at-length compositions for the MexCal_S1 fleet.

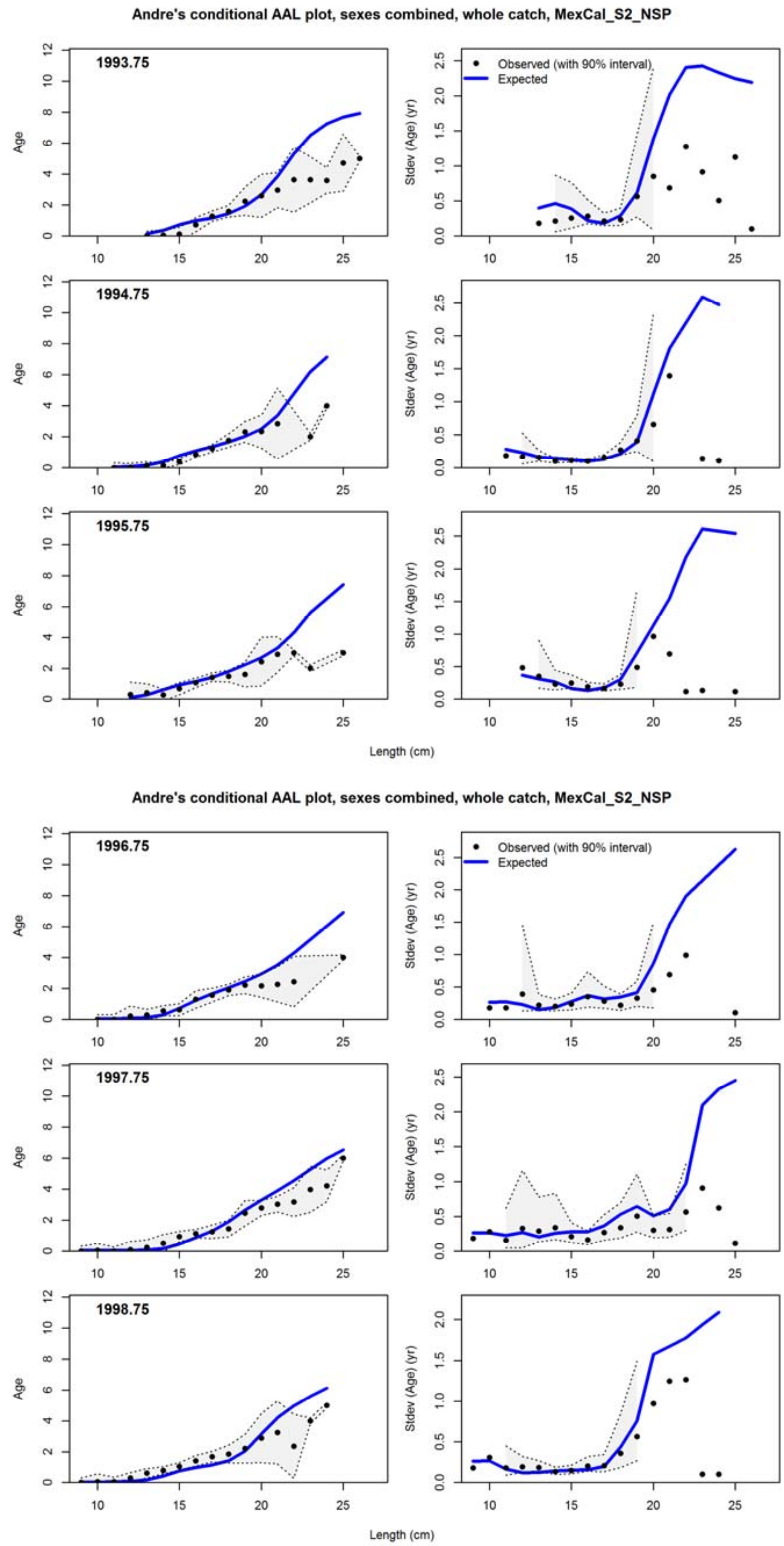


Figure 21. Model T fit to conditional age-at-length compositions for the MexCal_S2 fleet.

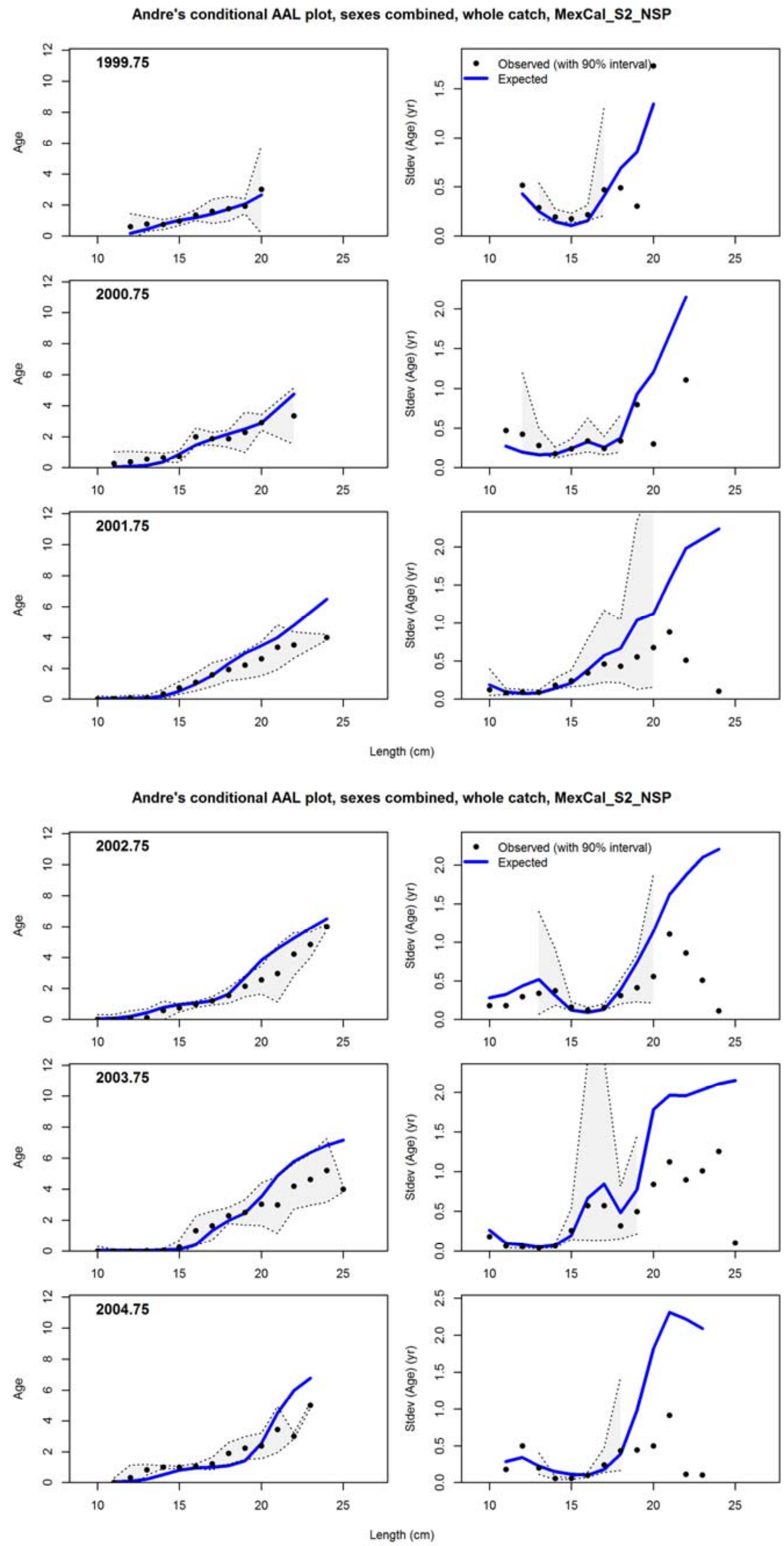
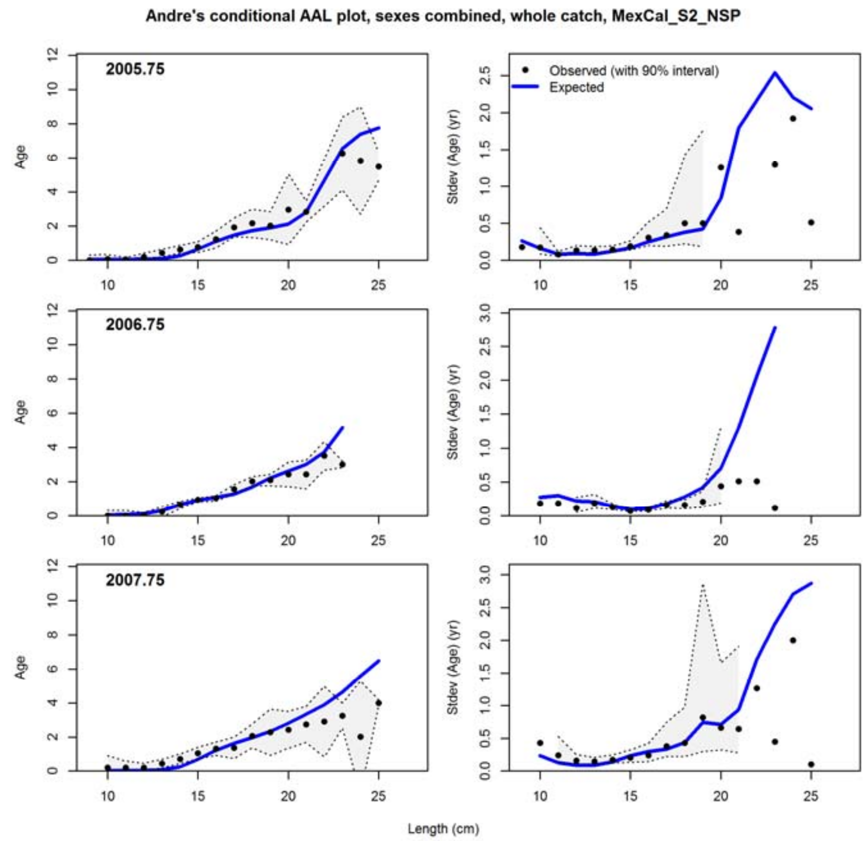


Figure 21 (cont.). Model T fit to conditional age-at-length compositions for the MexCal_S2 fleet.



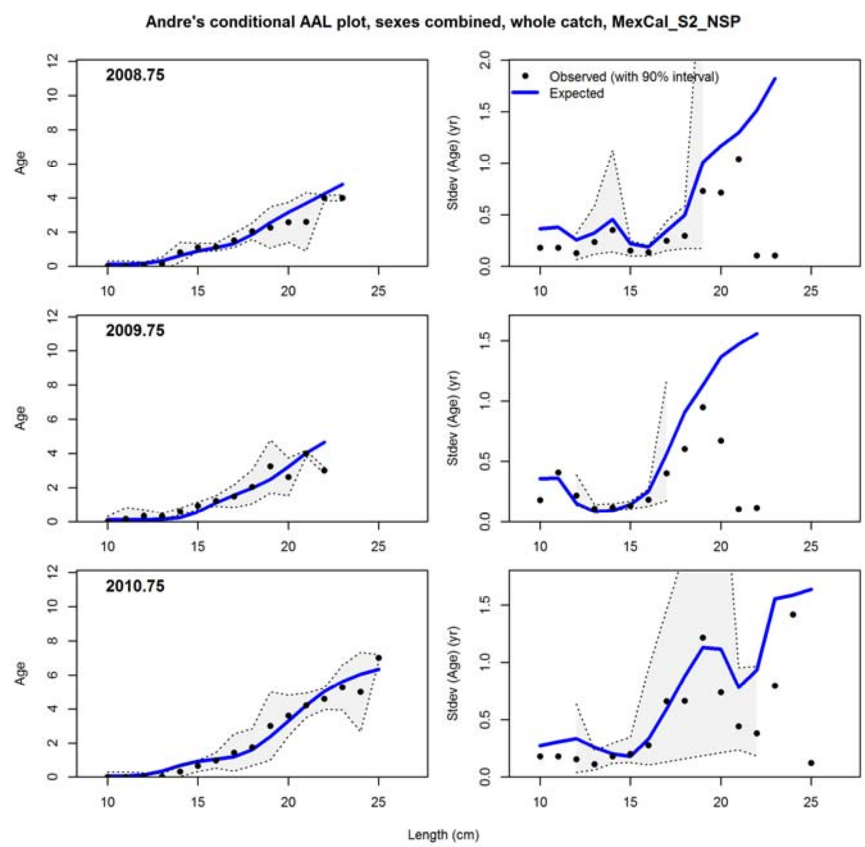


Figure 21 (cont.). Model T fit to conditional age-at-length compositions for the MexCal_S2 fleet.

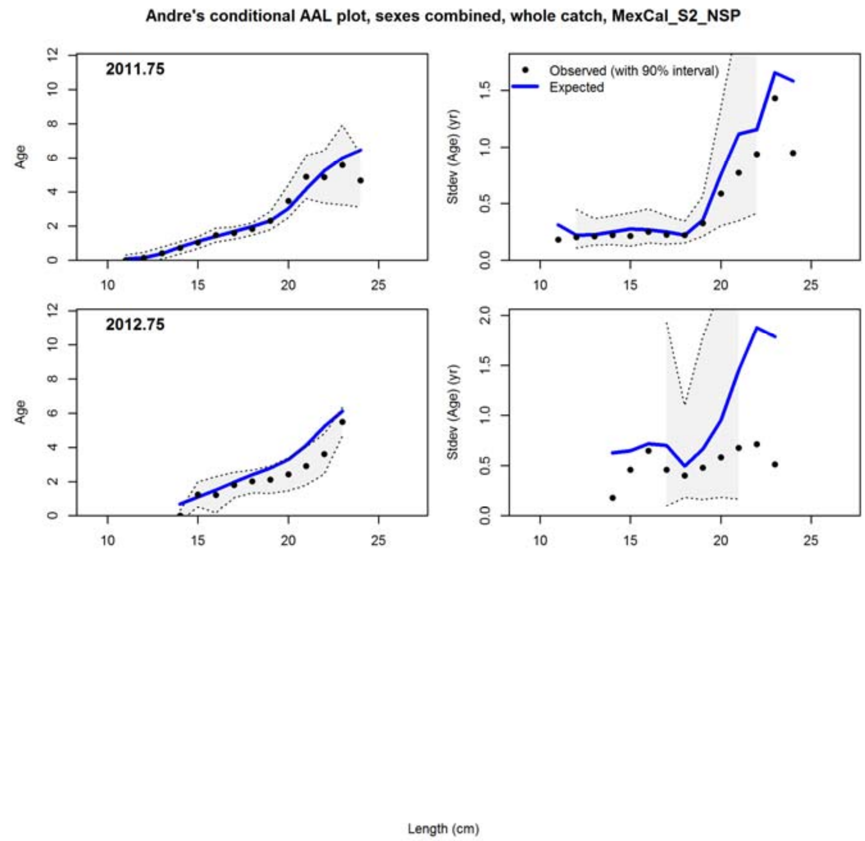


Figure 21 (cont.). Model T fit to conditional age-at-length compositions for the MexCal_S2 fleet.

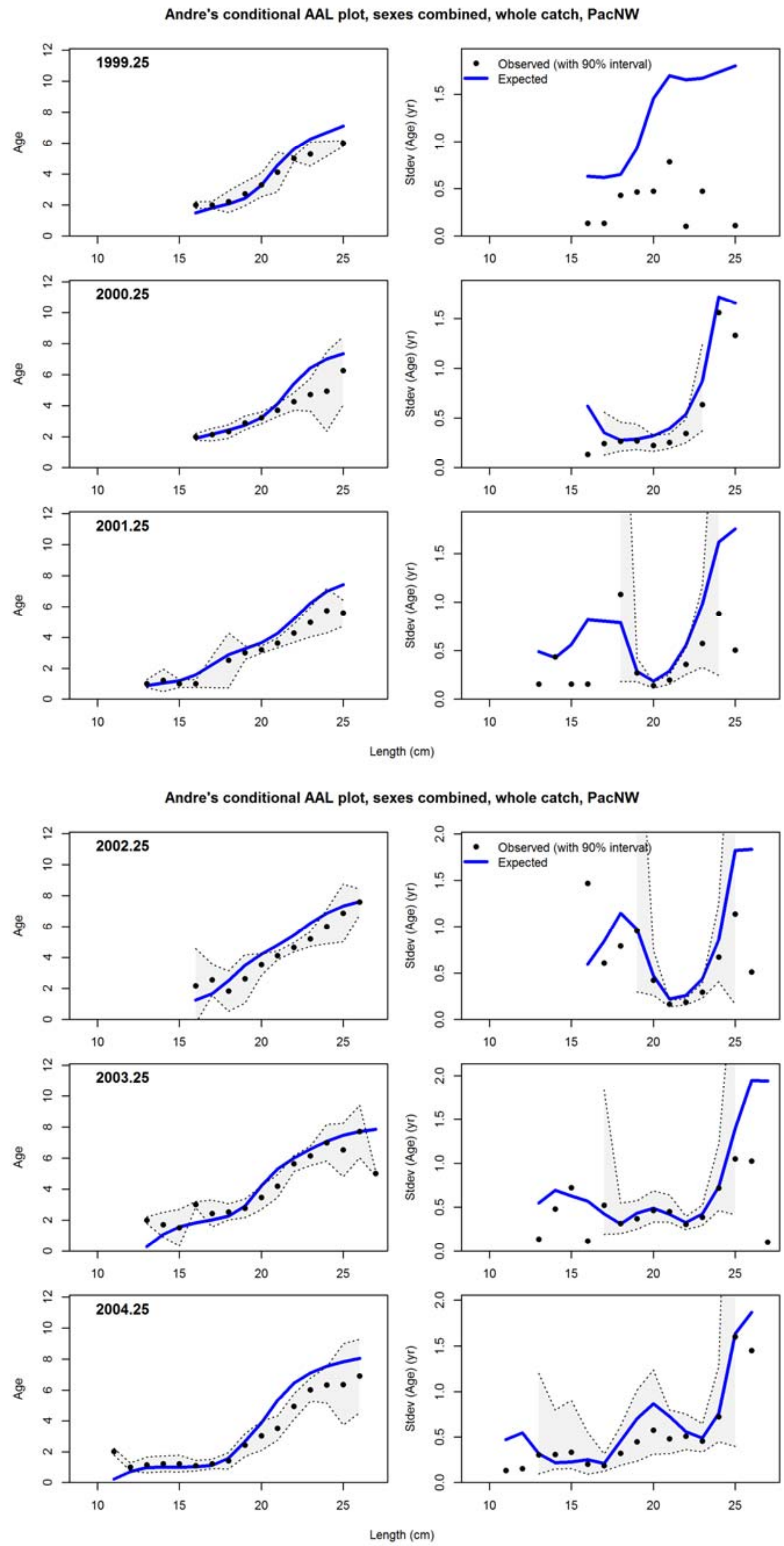
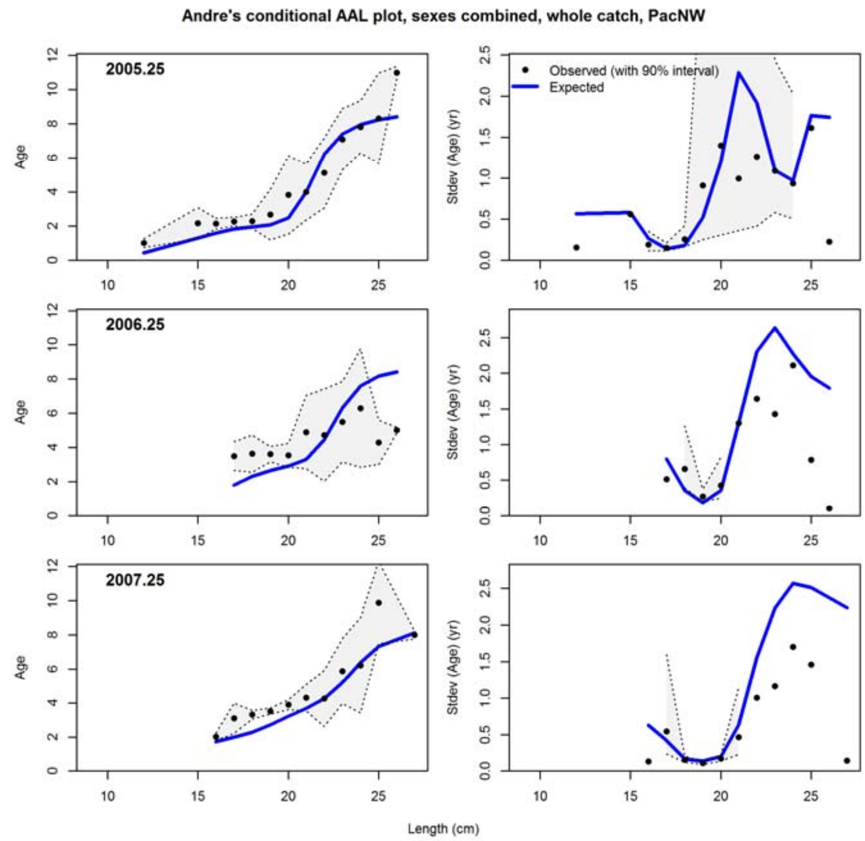


Figure 22. Model T fit to conditional age-at-length compositions for the PacNW fleet.



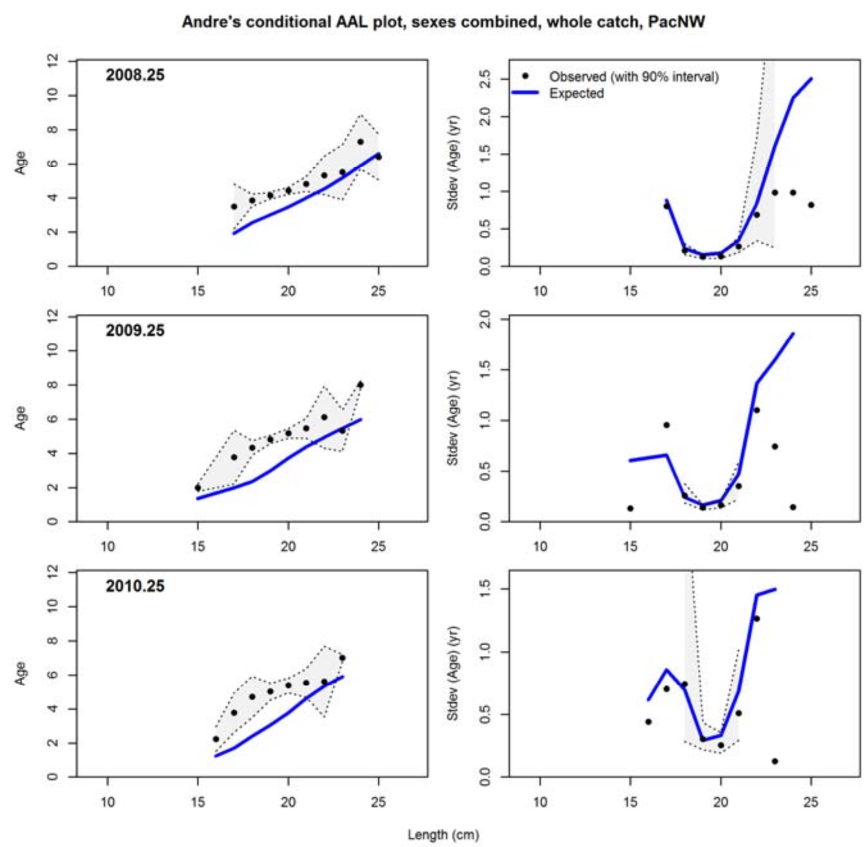


Figure 22 (cont.). Model T fit to conditional age-at-length compositions for the PacNW fleet.

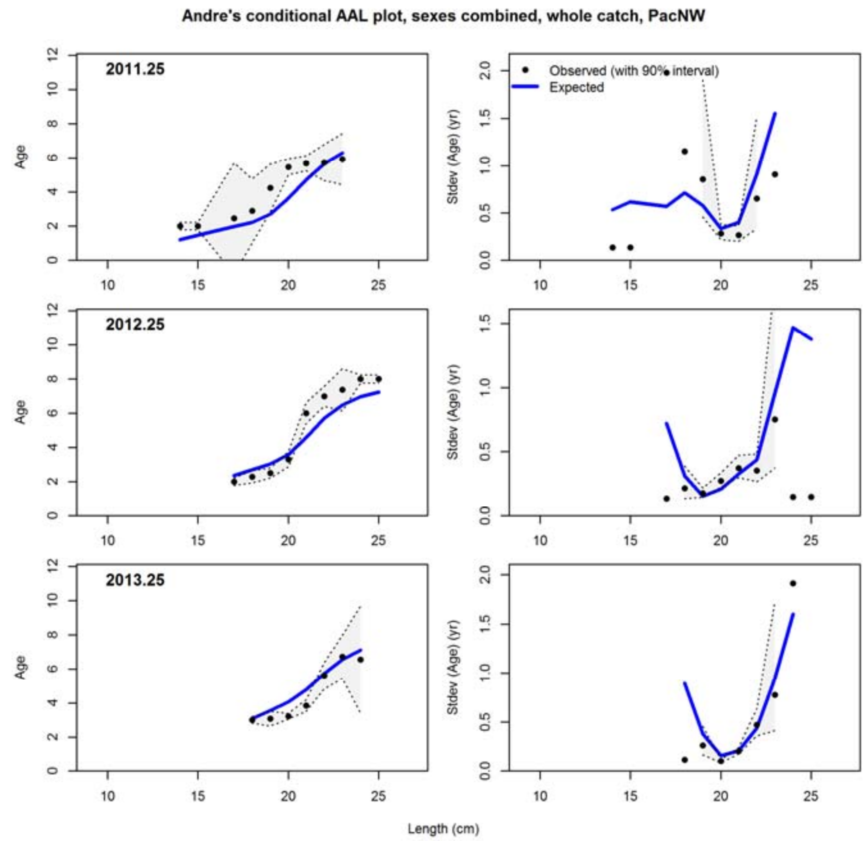


Figure 22 (cont.). Model T fit to conditional age-at-length compositions for the PacNW fleet.

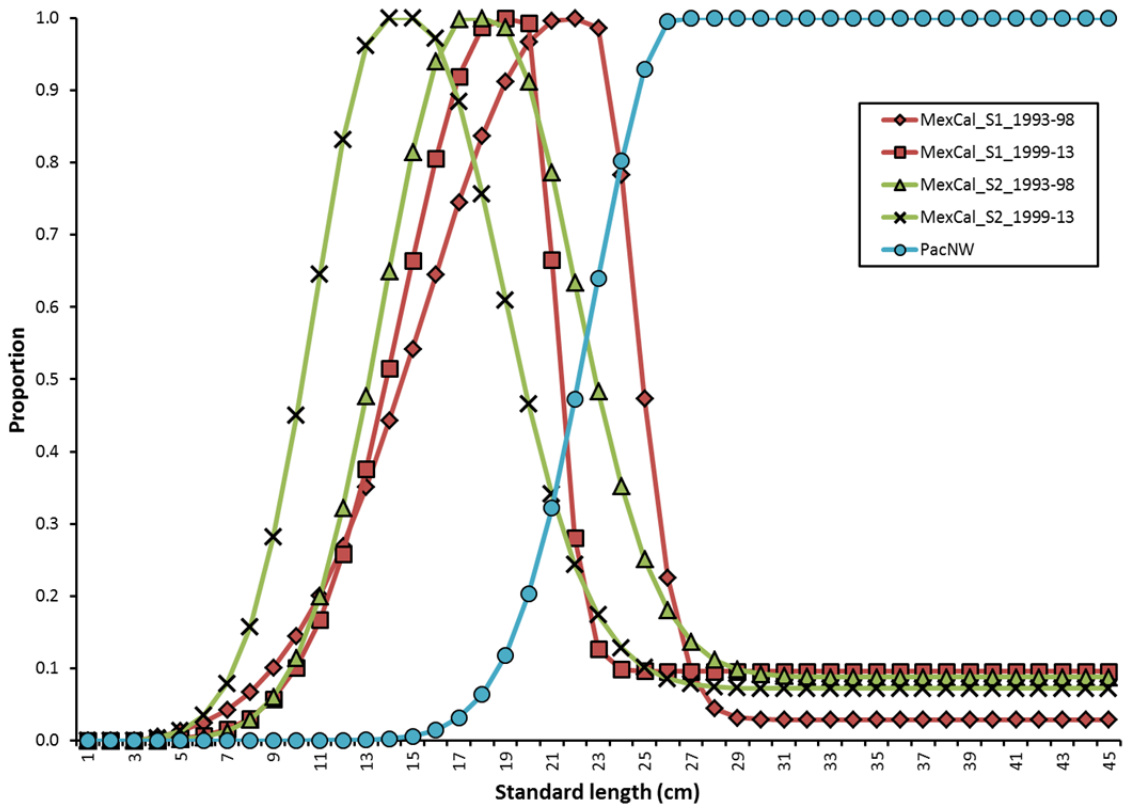


Figure 23a. Length-based selectivity patterns for fleets in base model T.

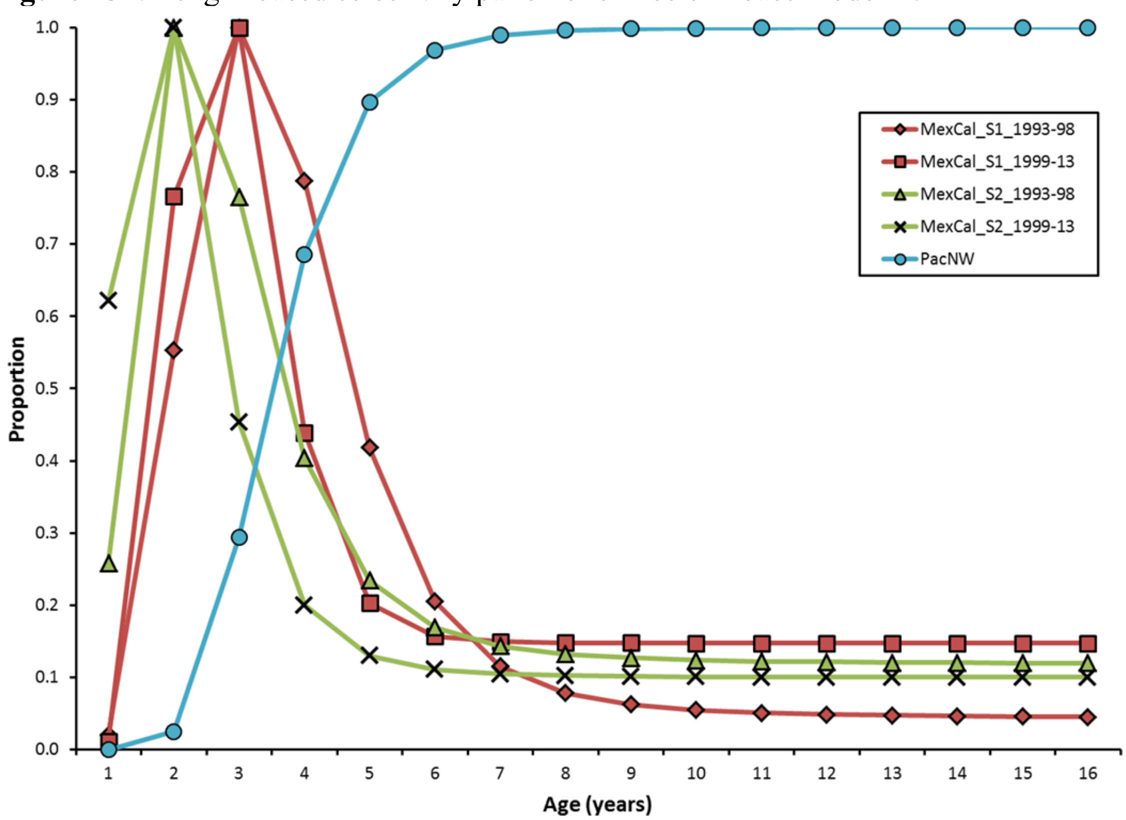


Figure 23b. Implied age-selectivity patterns for fleets in base model T.

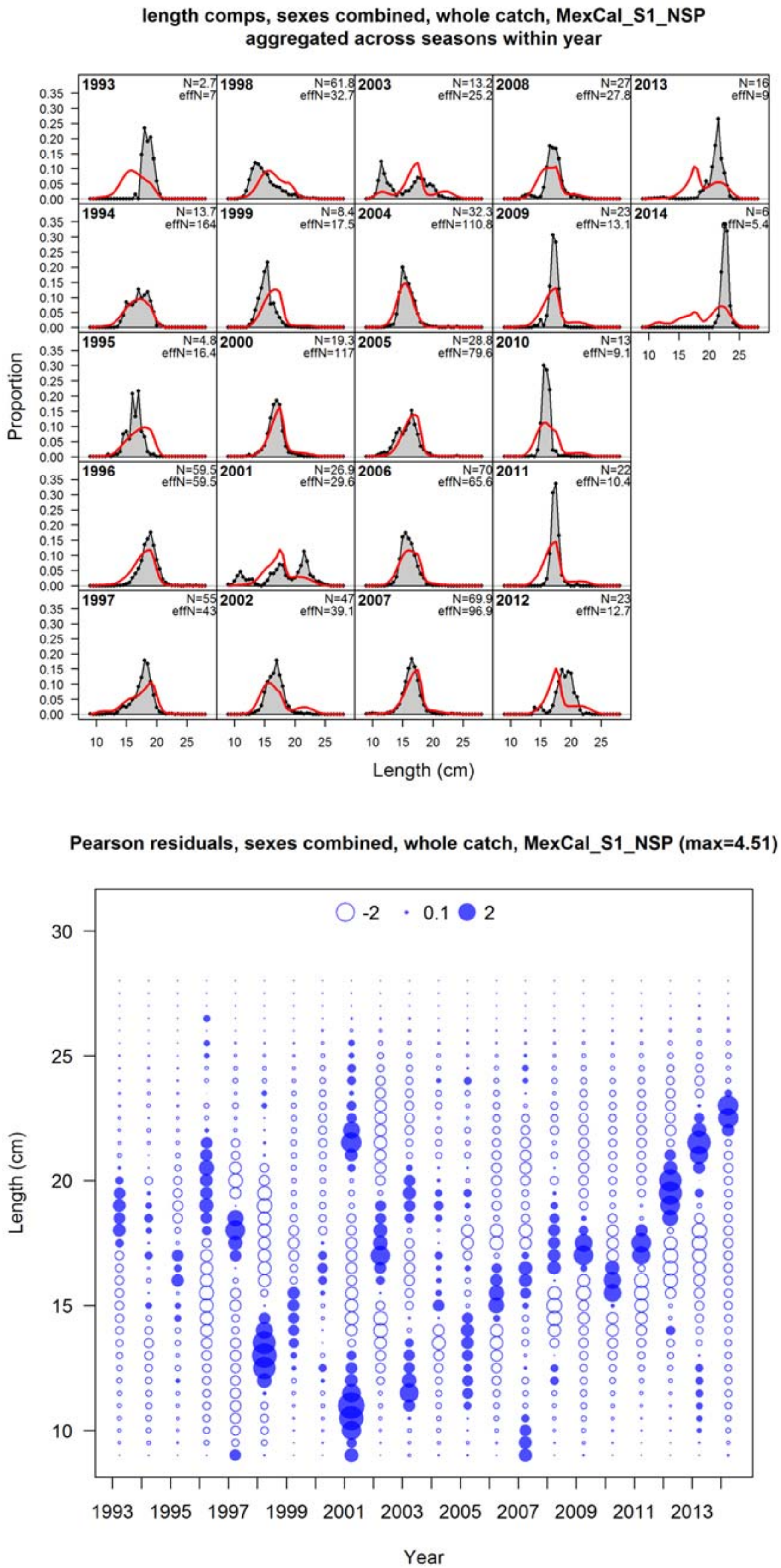


Figure 24a. Fits to length compositions and associated residual plot for MexCal_S1 fishery for base model T.

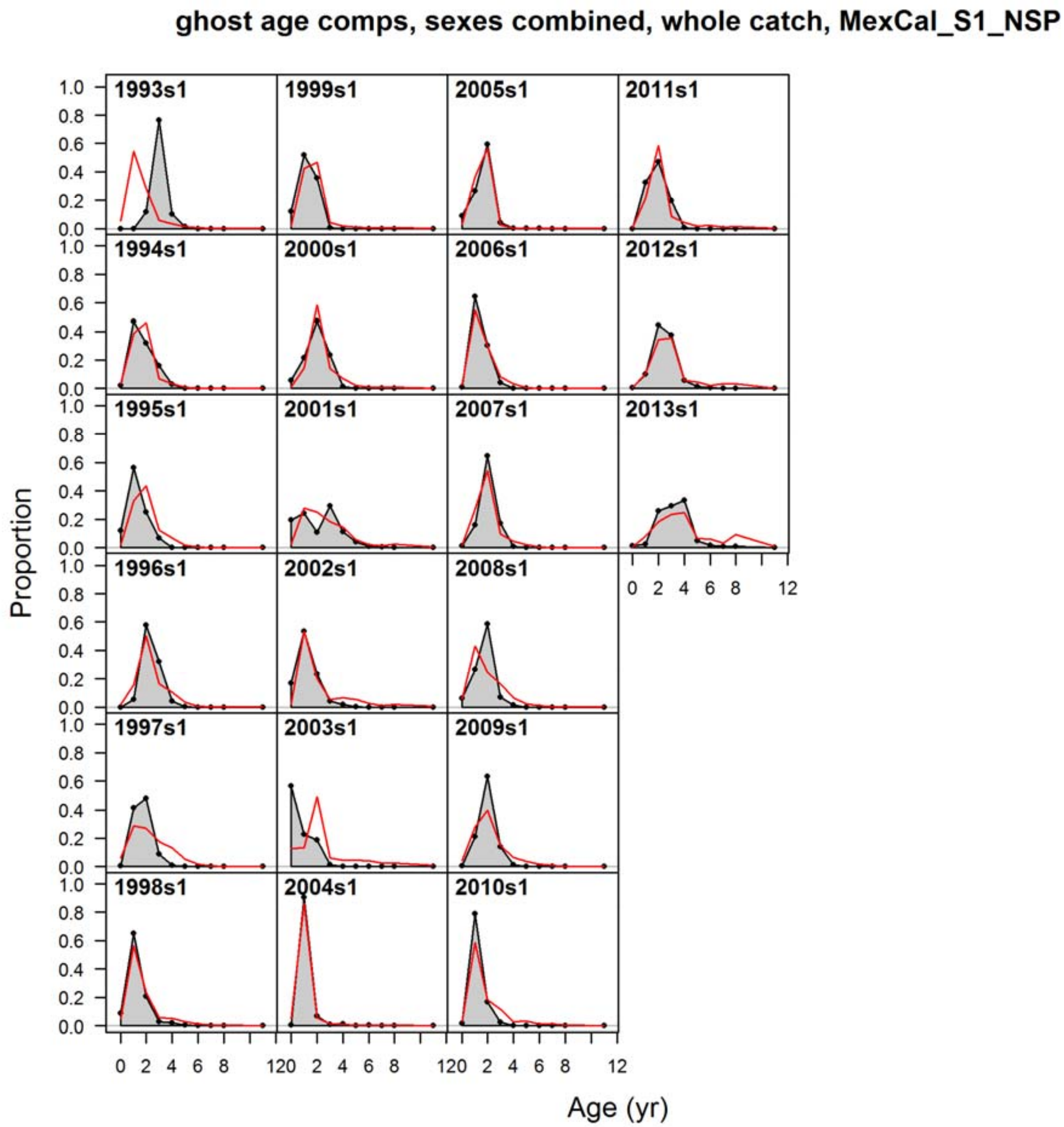


Figure 24b. Fits to implied age compositions for MexCal_S1 fleet in base model T.

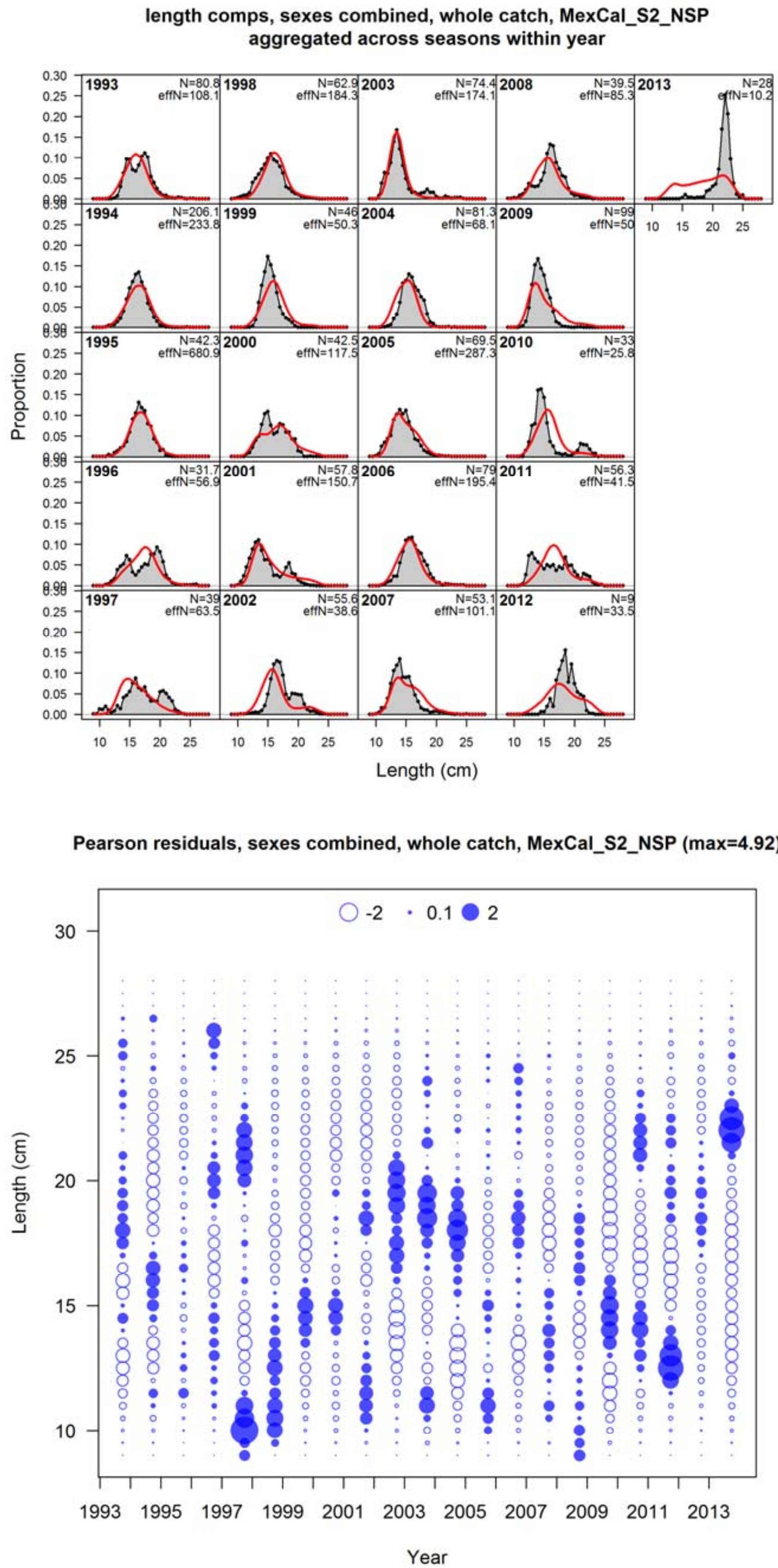


Figure 25a. Fits to length compositions and associated residual plot for MexCal_S2 fleet for base model T.

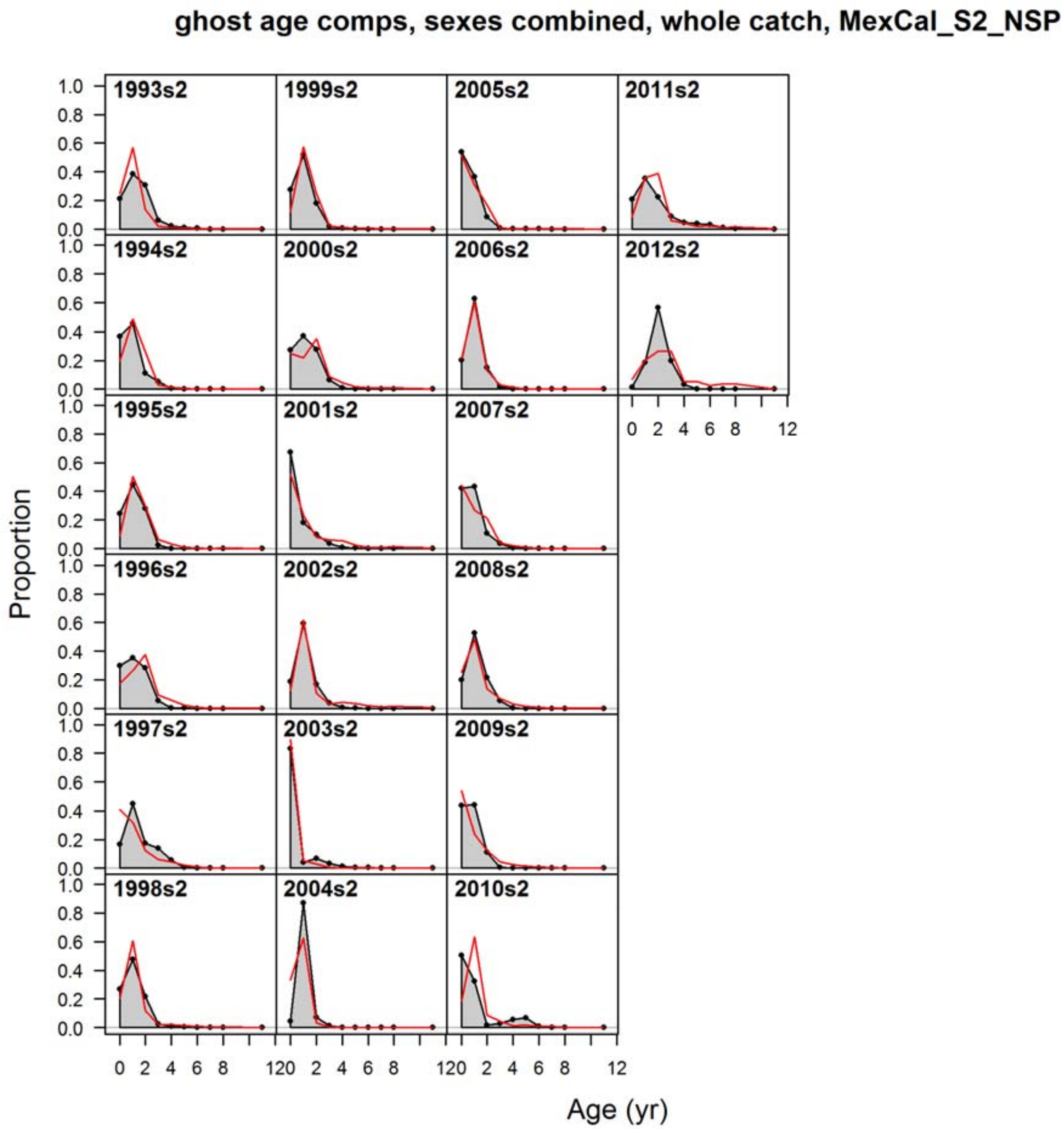


Figure 25b. Fits to implied age-compositions for MexCal_S2 fleet for base model T.

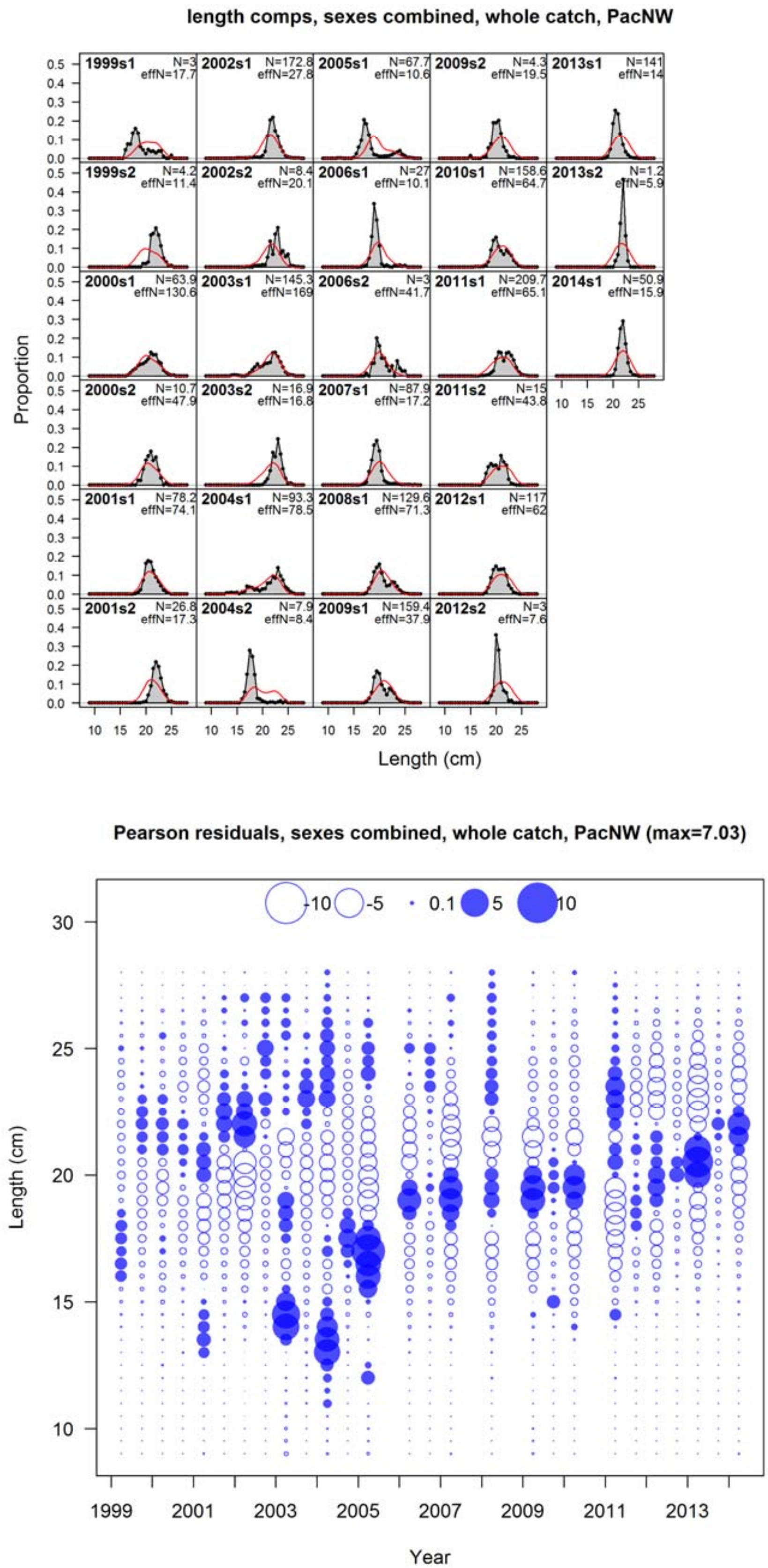


Figure 26a. Fits to length compositions and associated residual plot for PacNW fishery for base model T.

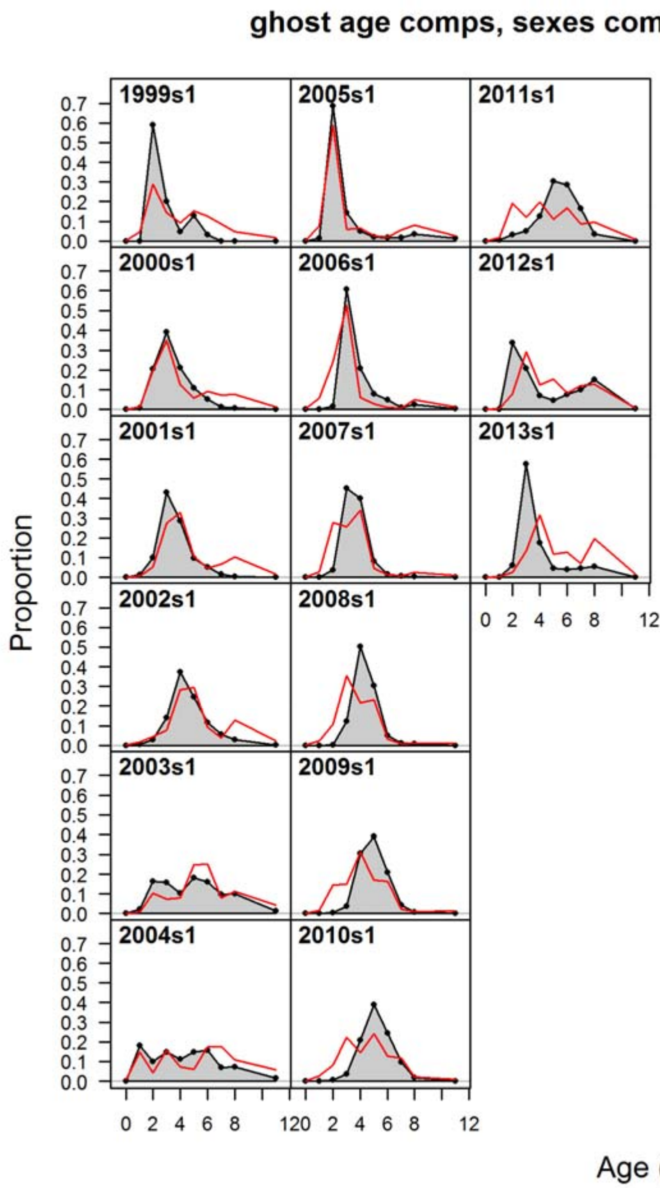


Figure 26b. Fits to implied age compositions for PacNW fishery for base model T.

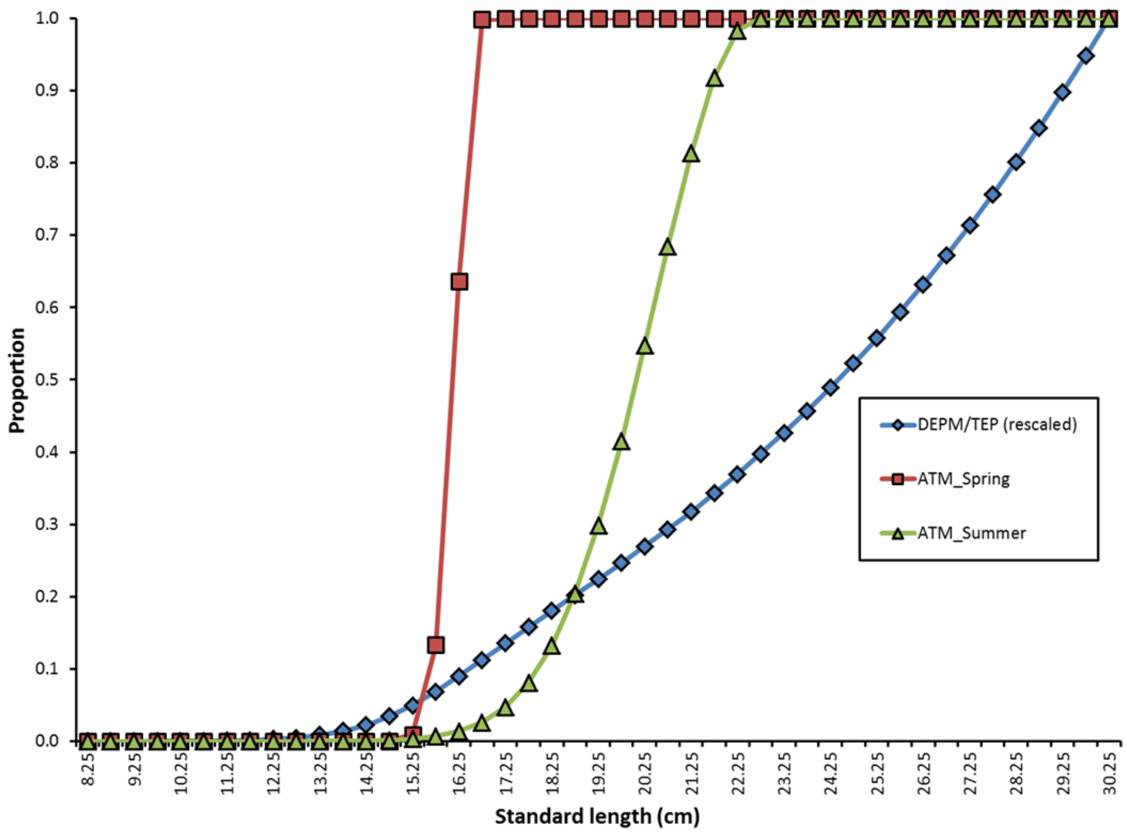


Figure 27a. Length-based selectivity patterns for surveys in base model T.

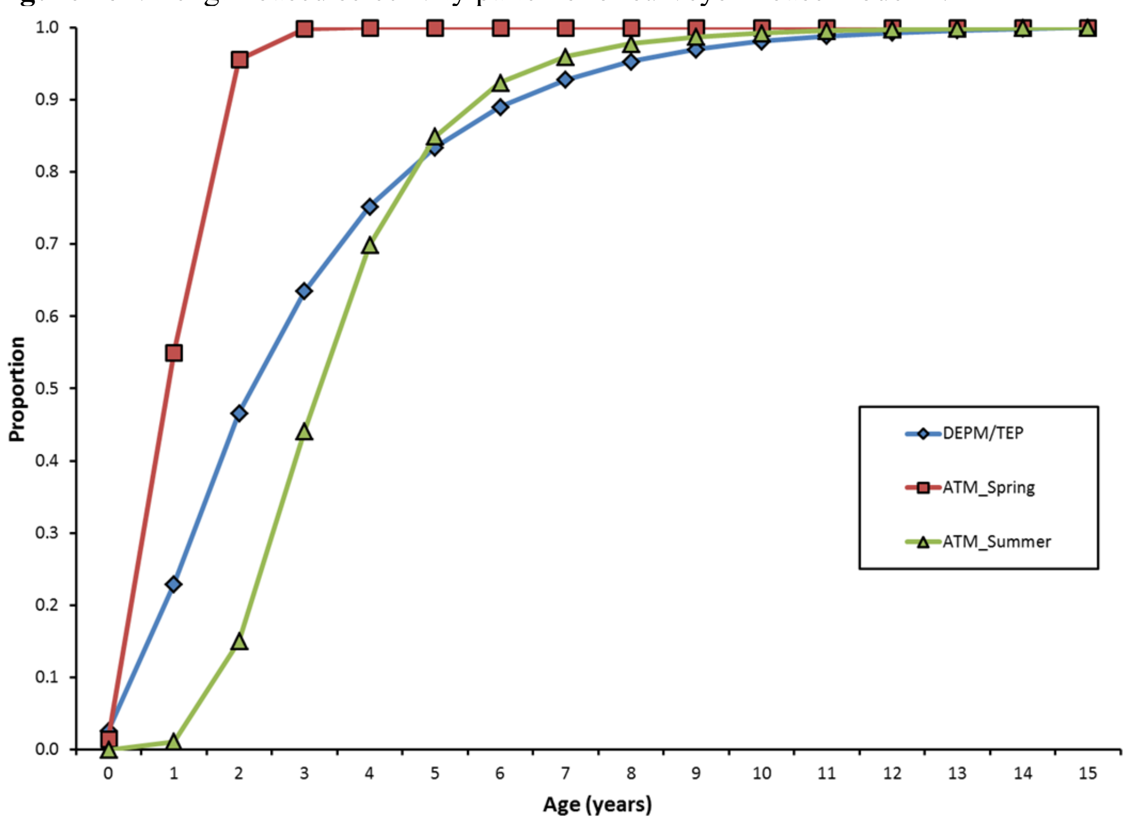


Figure 27b. Implied age-selectivity patterns for surveys in base model T.

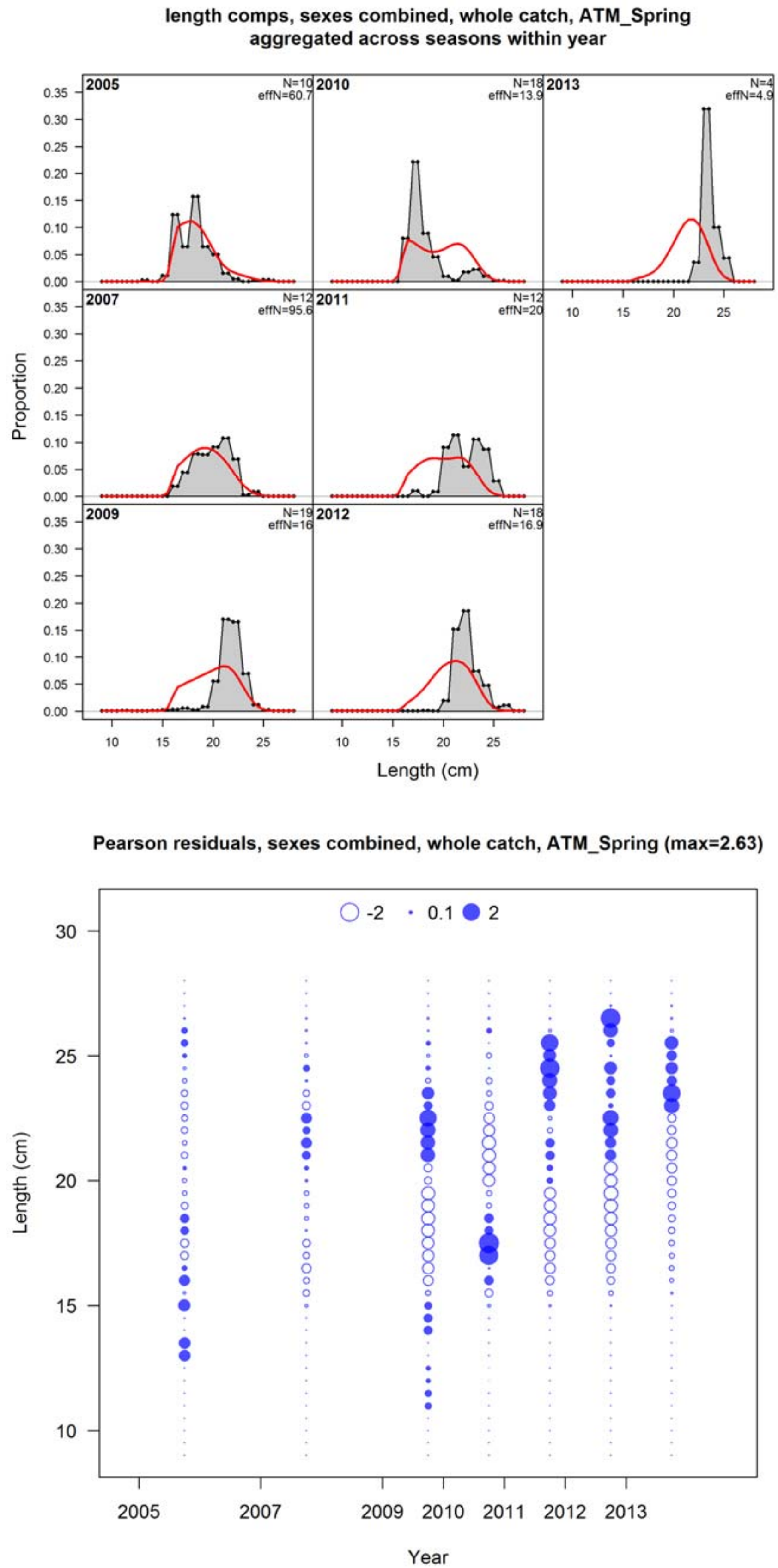
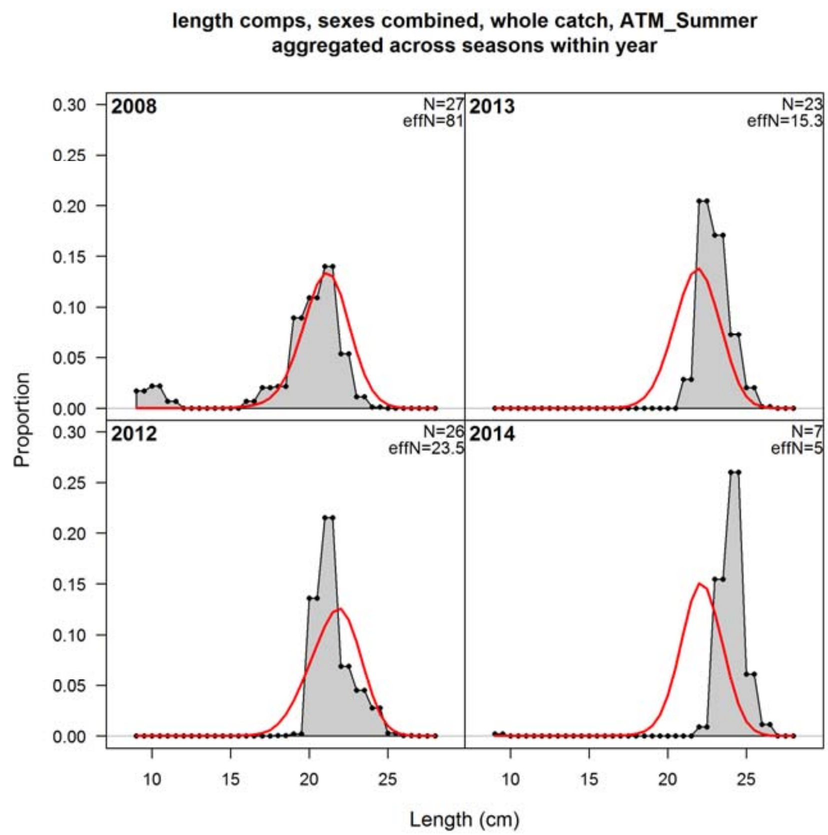


Figure 28. Fits to length compositions and associated residual plot for the Spring ATM survey for base model T.



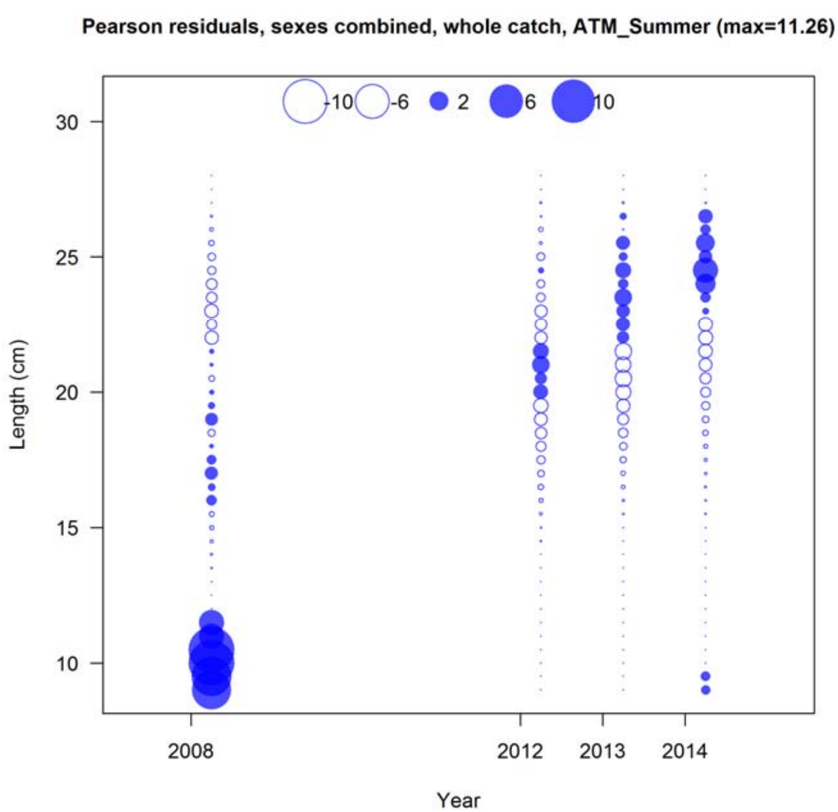


Figure 29. Fits to length compositions and associated residual plot for the Summer ATM survey for base model T.

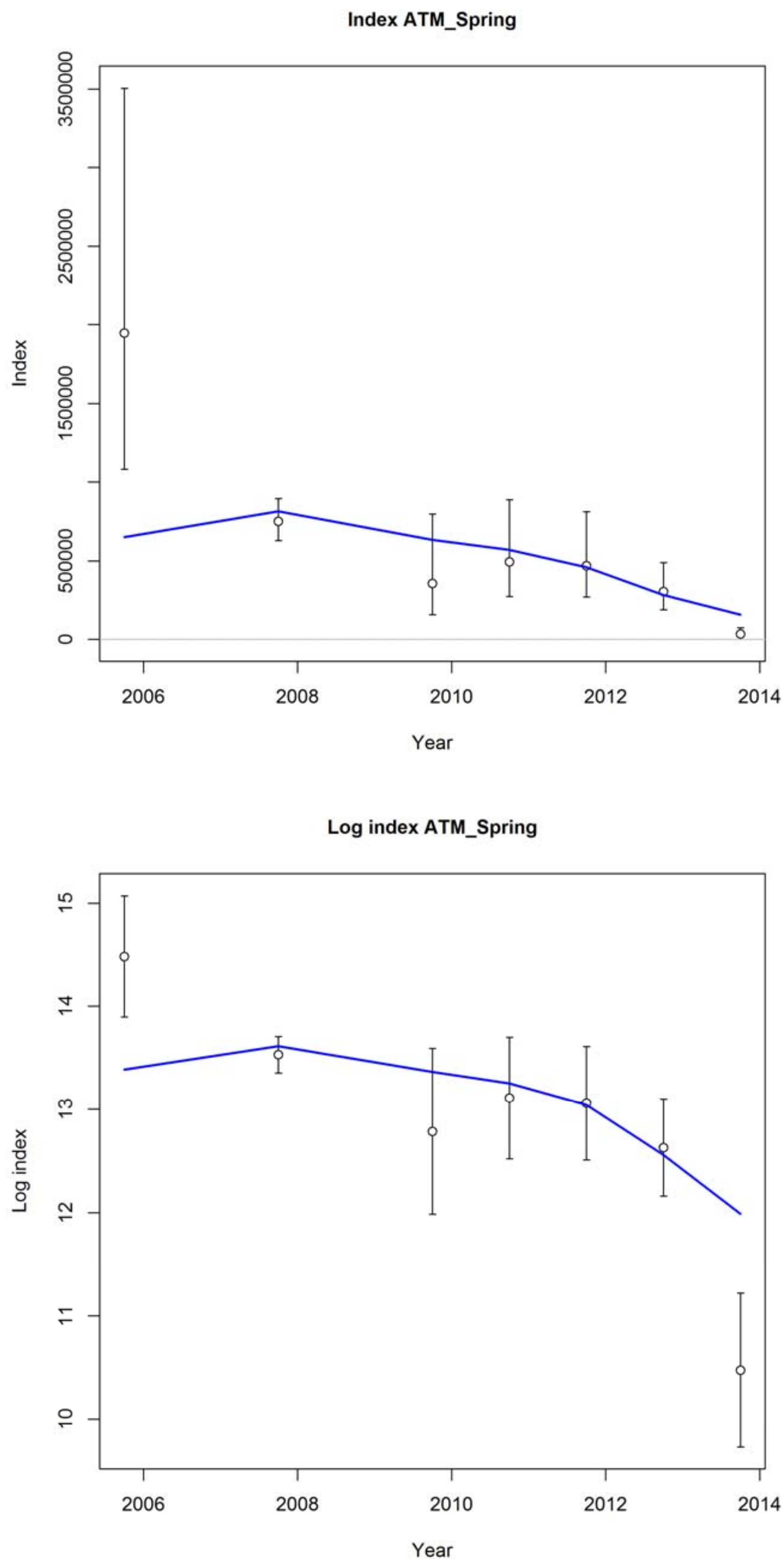
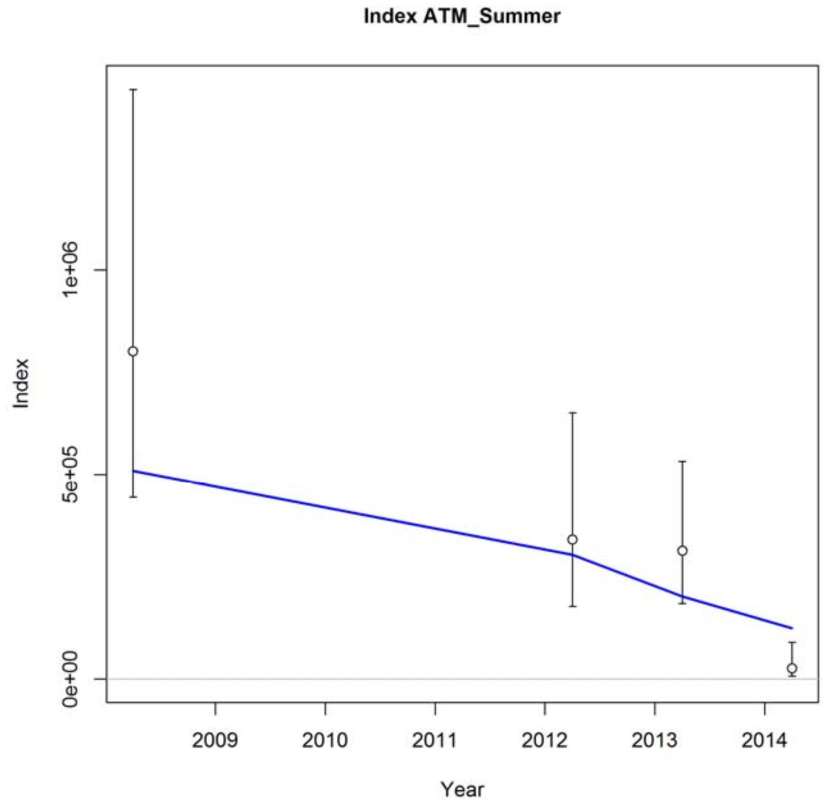


Figure 30. Fits to Spring ATM survey abundance index for base model T: arithmetic (upper) and log (lower) scales. q=1.0 (fixed).



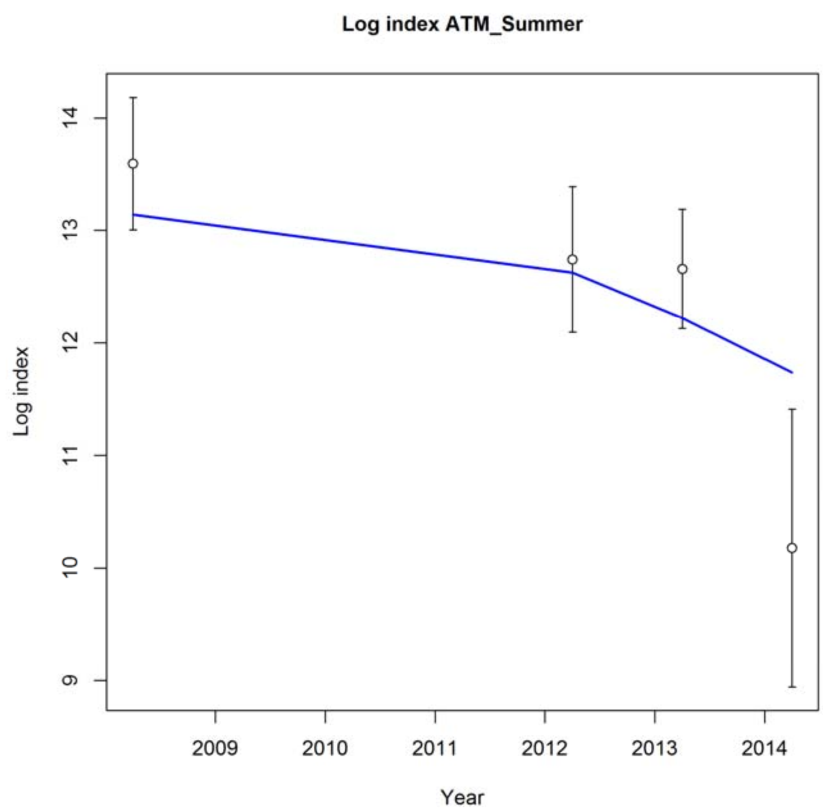


Figure 31. Fits to Summer ATM survey abundance index for base model T: arithmetic (upper) and log (lower) scales. *q*=1.0 (fixed).

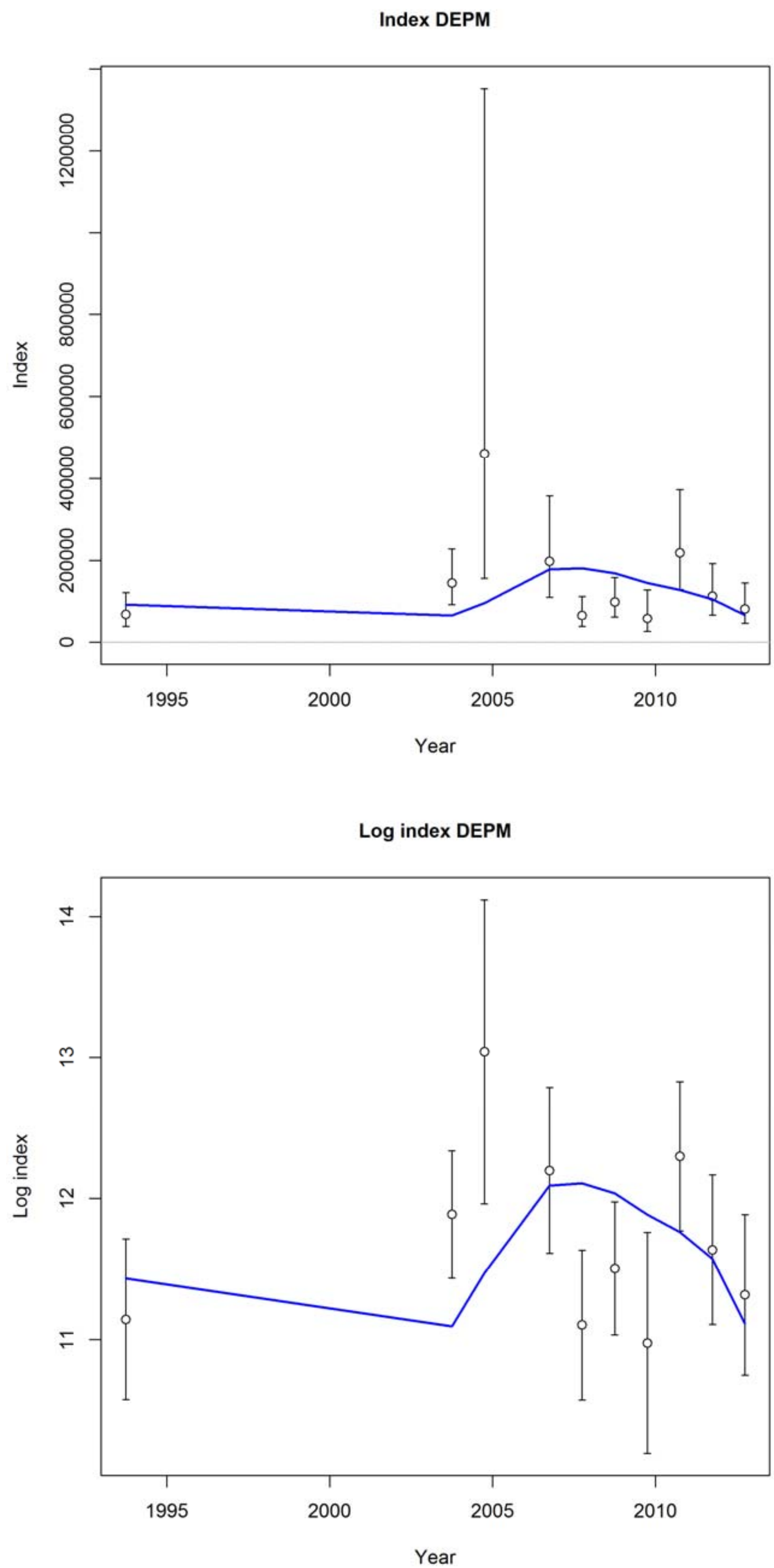
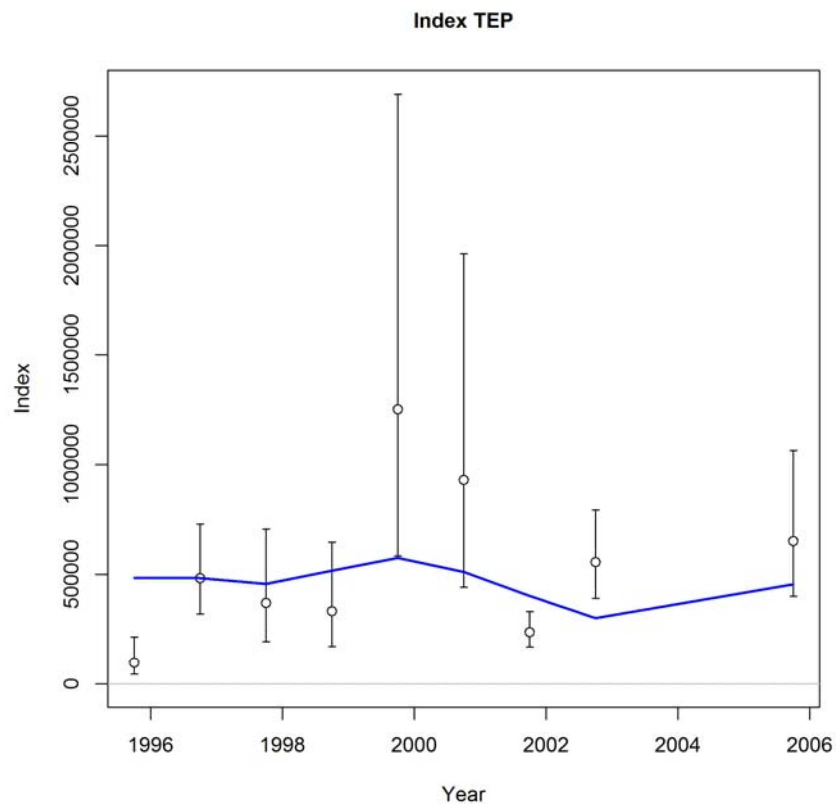


Figure 32. Fits to DEPM survey abundance index for base model T: arithmetic (upper) and log (lower) scales. q=0.215.



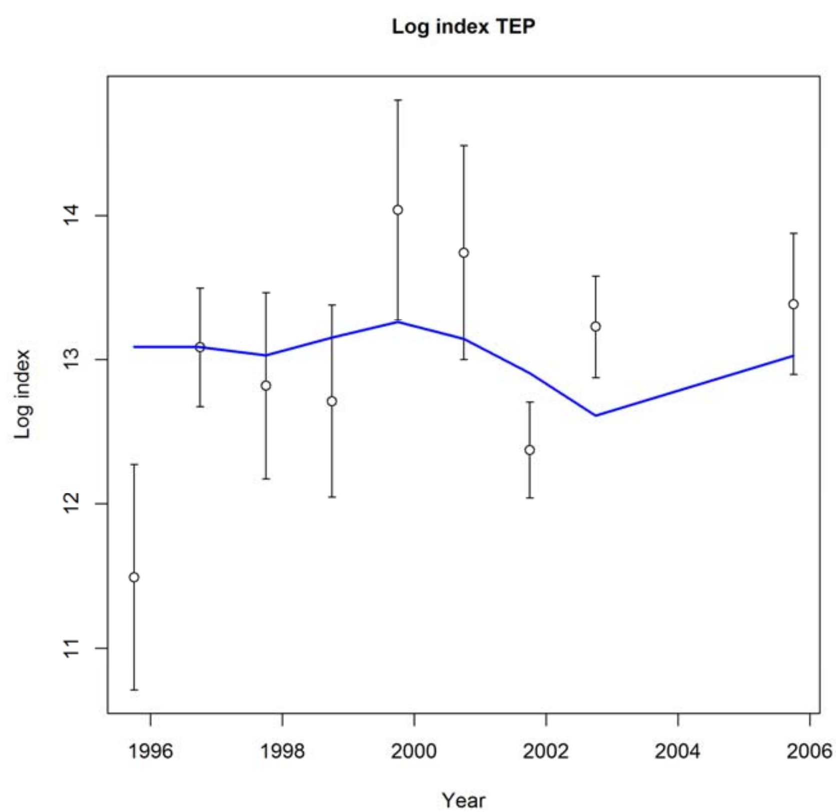


Figure 33. Fits to TEP survey abundance index for base model T: arithmetic (upper) and log (lower) scales. q=0.710.

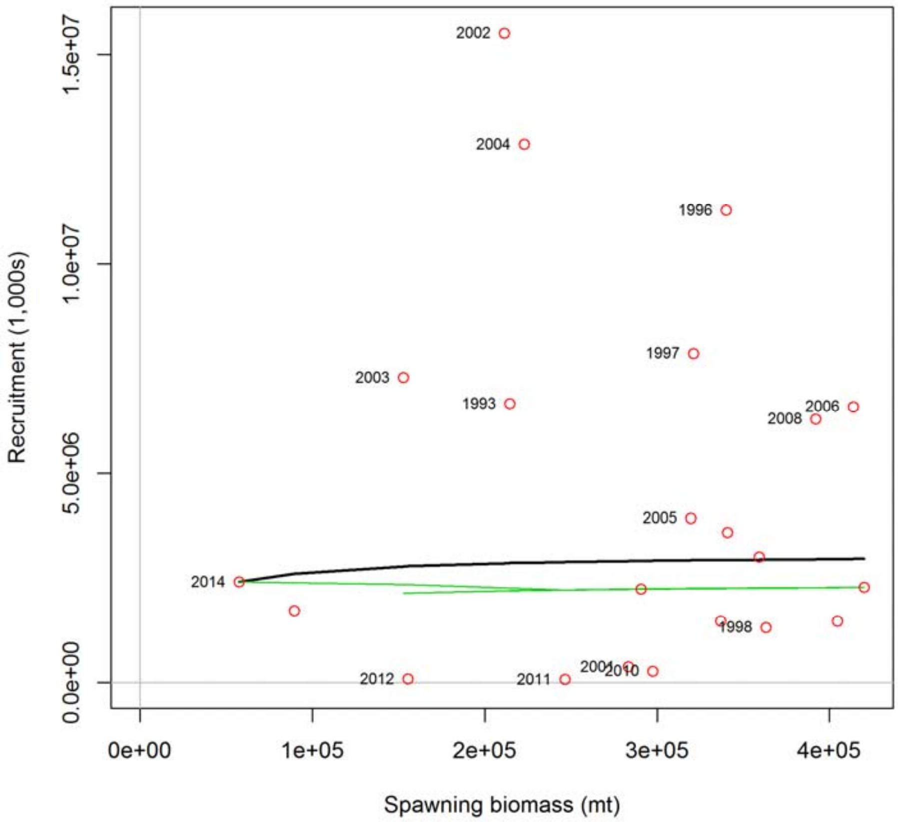


Figure 34a. Estimated stock-recruitment (Beverton-Holt) relationship for base model T. Year labels represent year of SSB producing the subsequent year class.

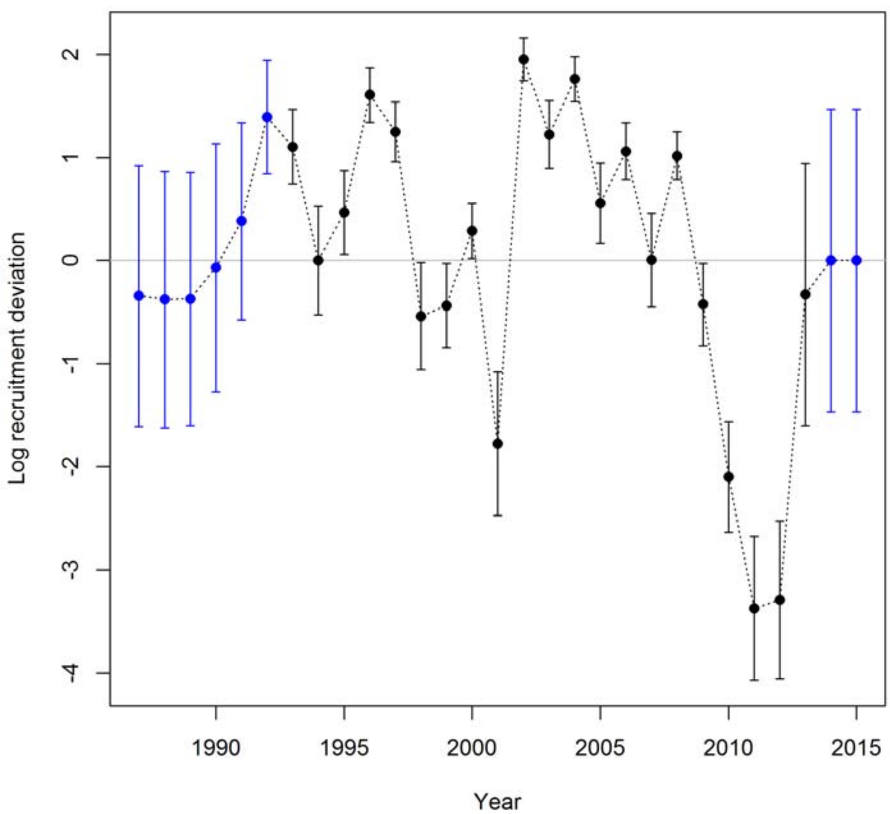


Figure 34b. Recruitment deviations and standard errors estimated in base model T ($\sigma_R = 0.75$). Year labels represent year of SSB producing the subsequent year class.

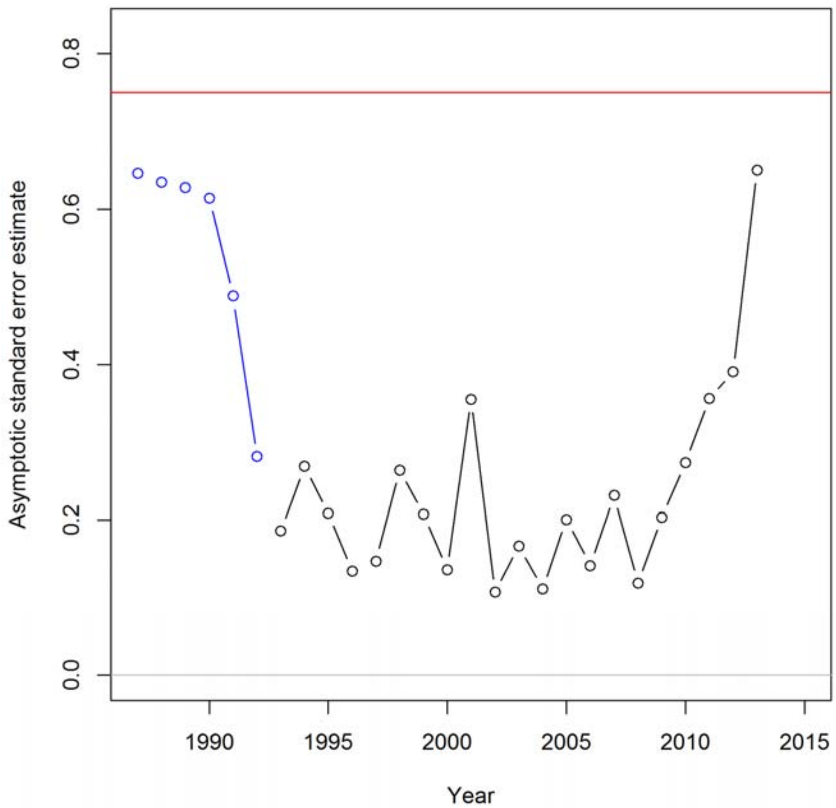


Figure 34c. Asymptotic standard errors for estimated recruitment deviations in base modelT.

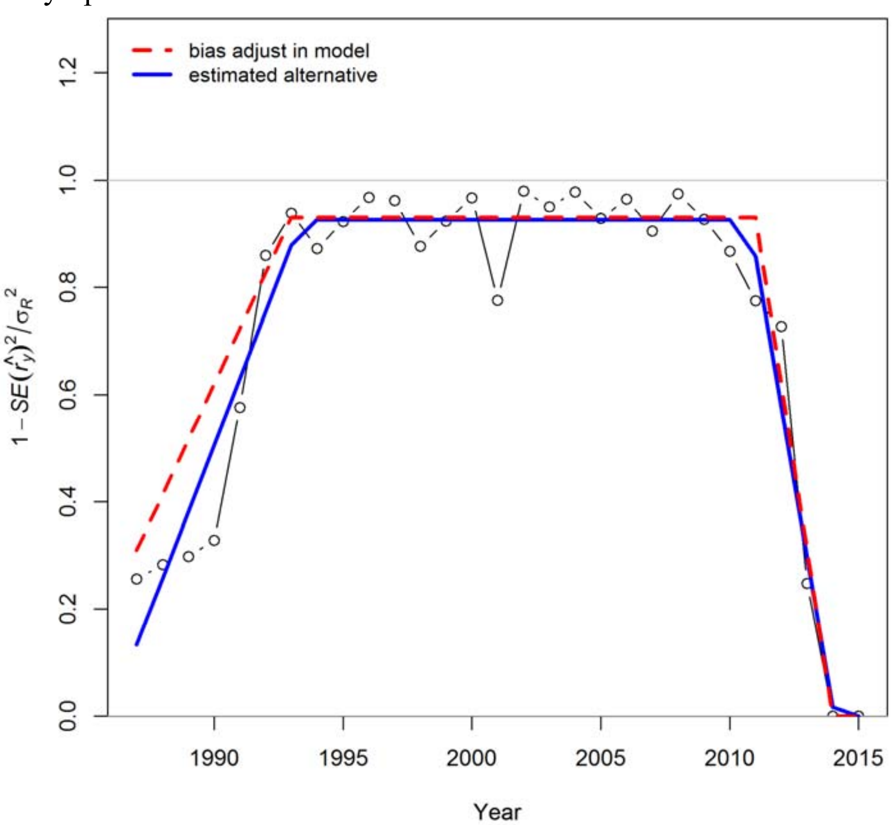


Figure 34d. S-R bias adjustment ramp applied in base model T.

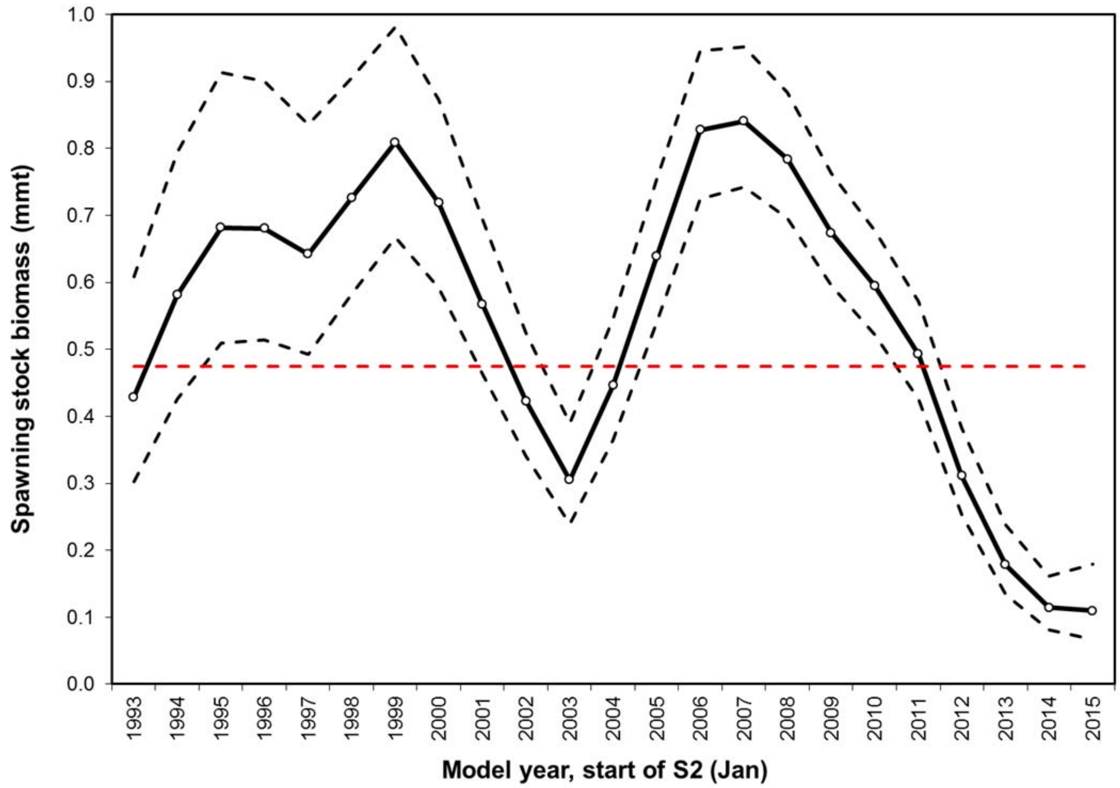


Figure 35a. Spawning stock biomass with ~95% confidence intervals for base model T. Red line is SSB-zero.

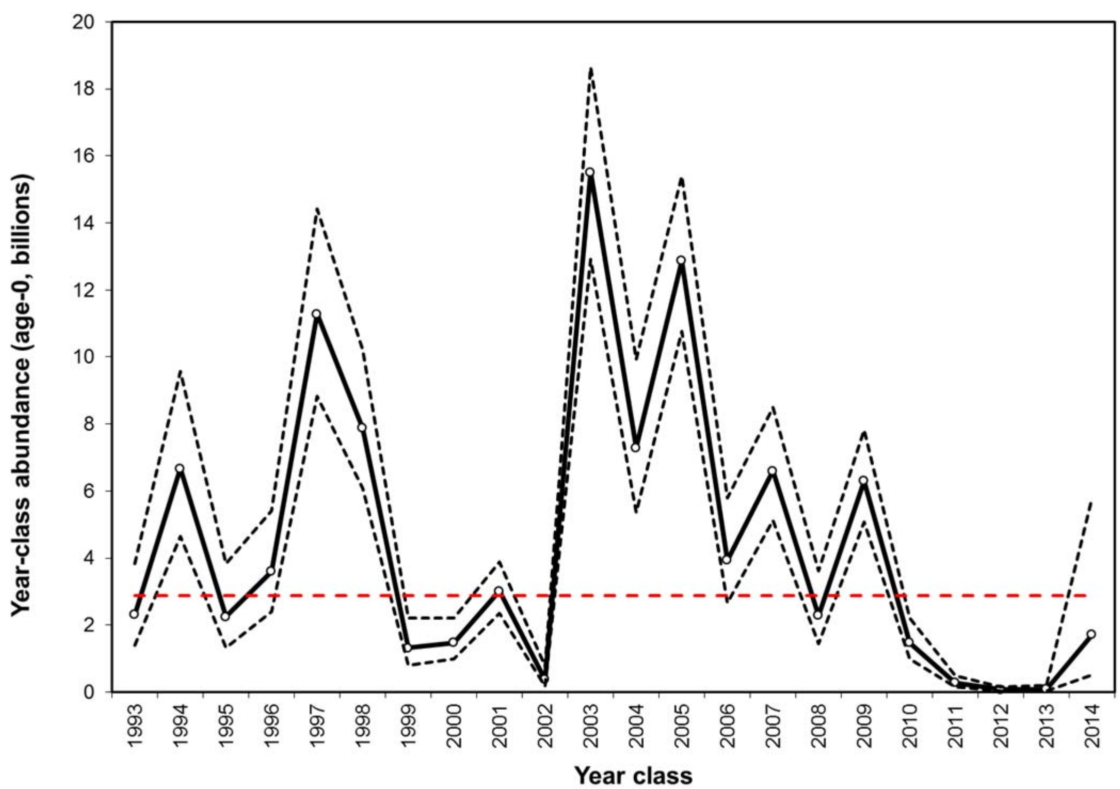


Figure 35b. Year-class abundance with ~95% confidence intervals for base model T. Red line is R-zero.

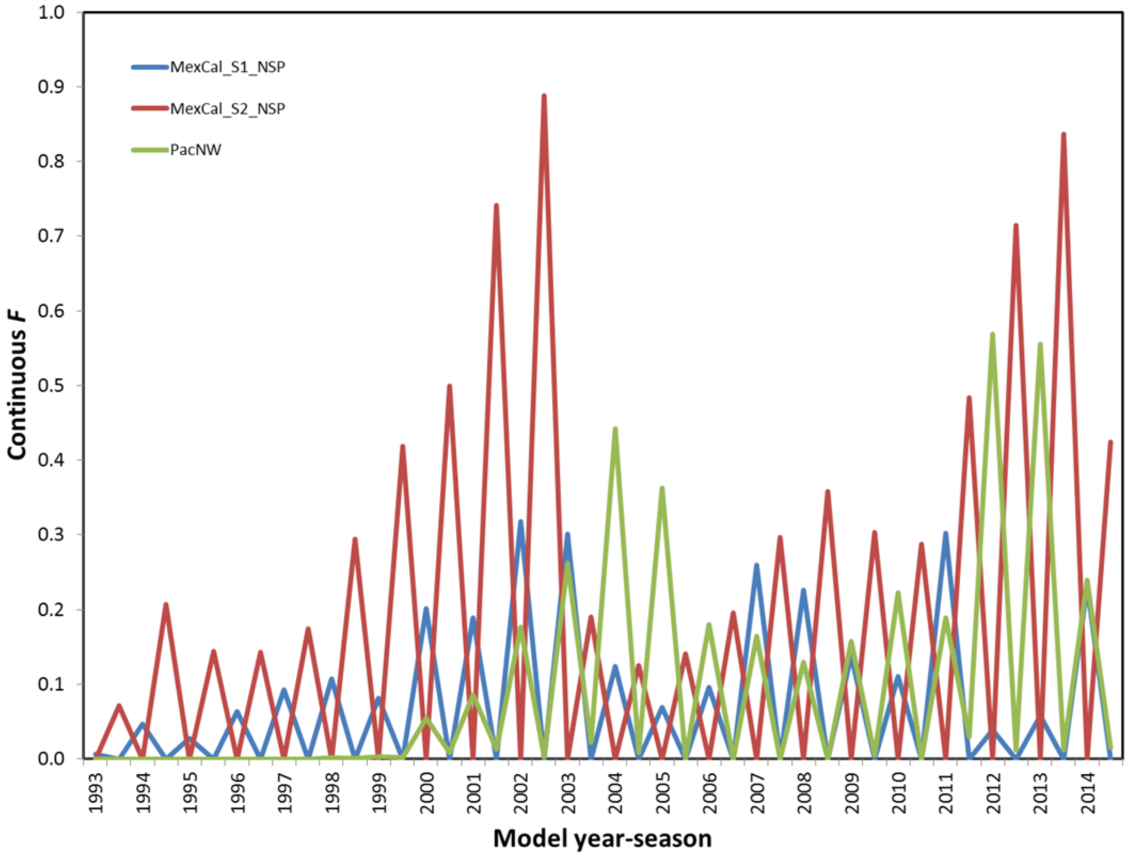


Figure 36a. Estimated fishing mortality (*F*) time series for fisheries for base model T.

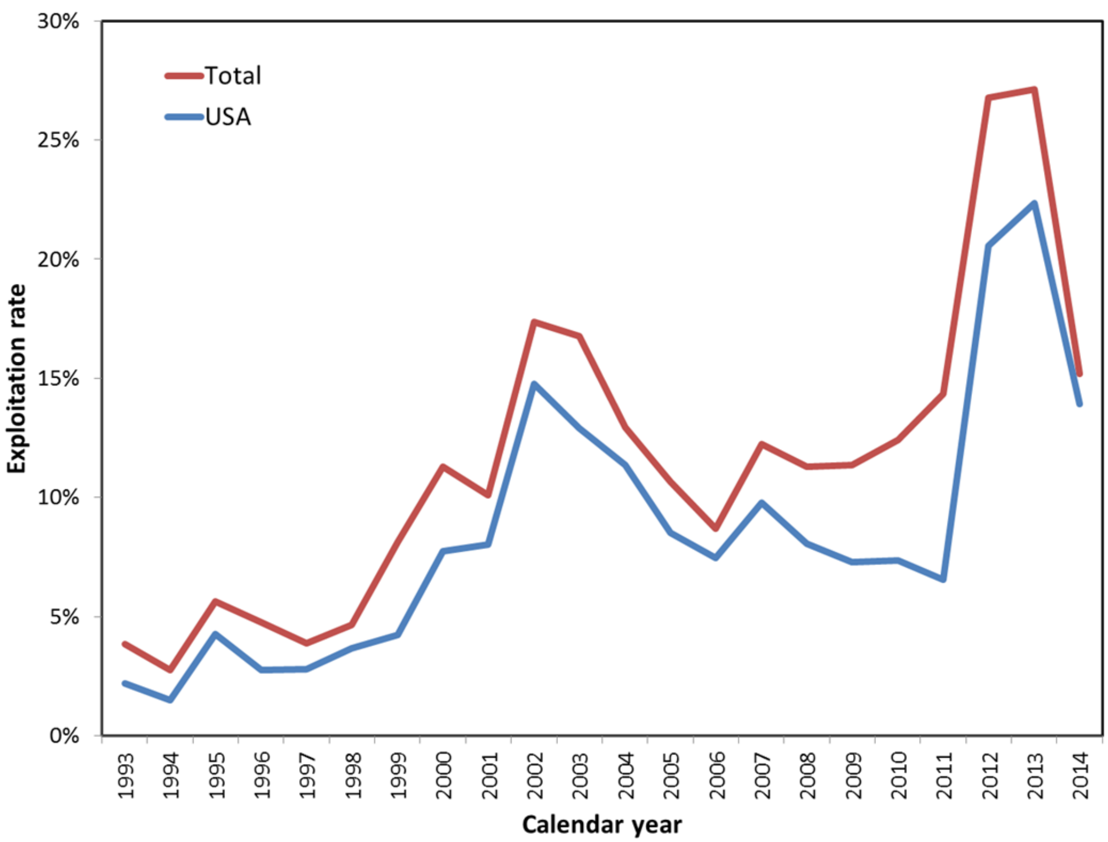


Figure 36b. Annual exploitation rate (CY landings / July total biomass) for base model T.

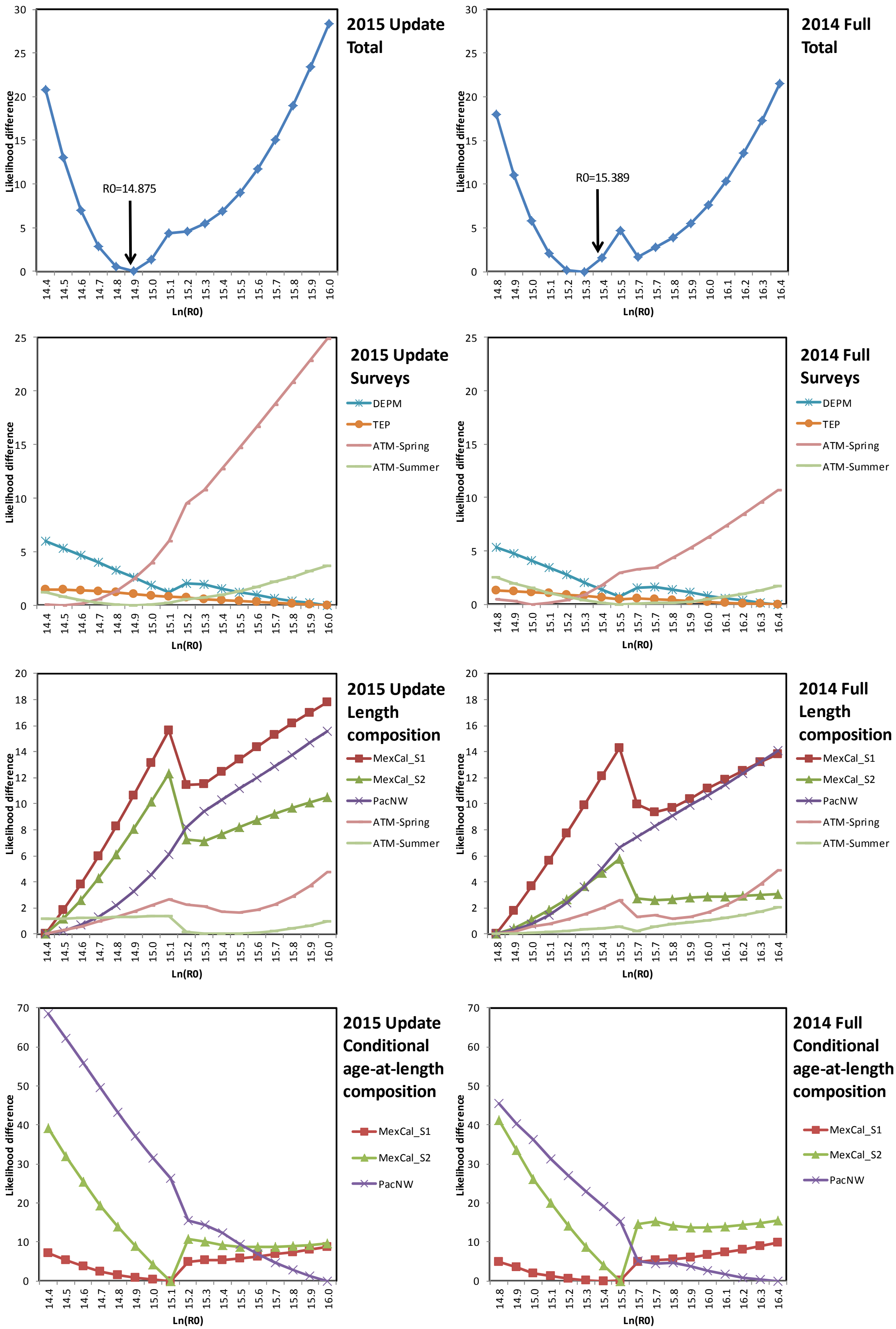


Figure 37. R_0 profiles for 2015 update (left) and 2014 final (right) model components.

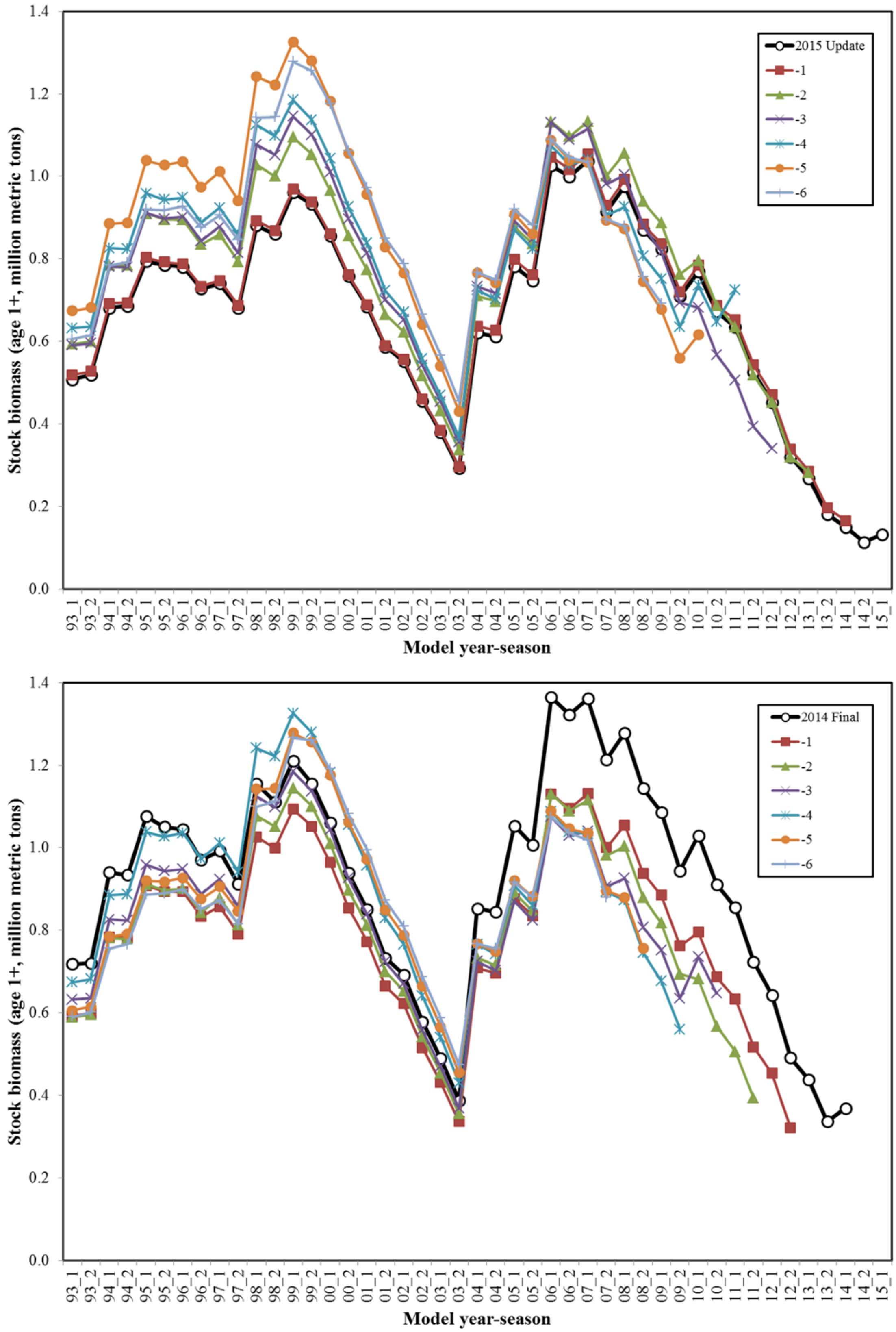


Figure 38. Retrospective analyses of stock biomass (age 1+) for the 2015 update (upper) and 2014 final (lower) models.

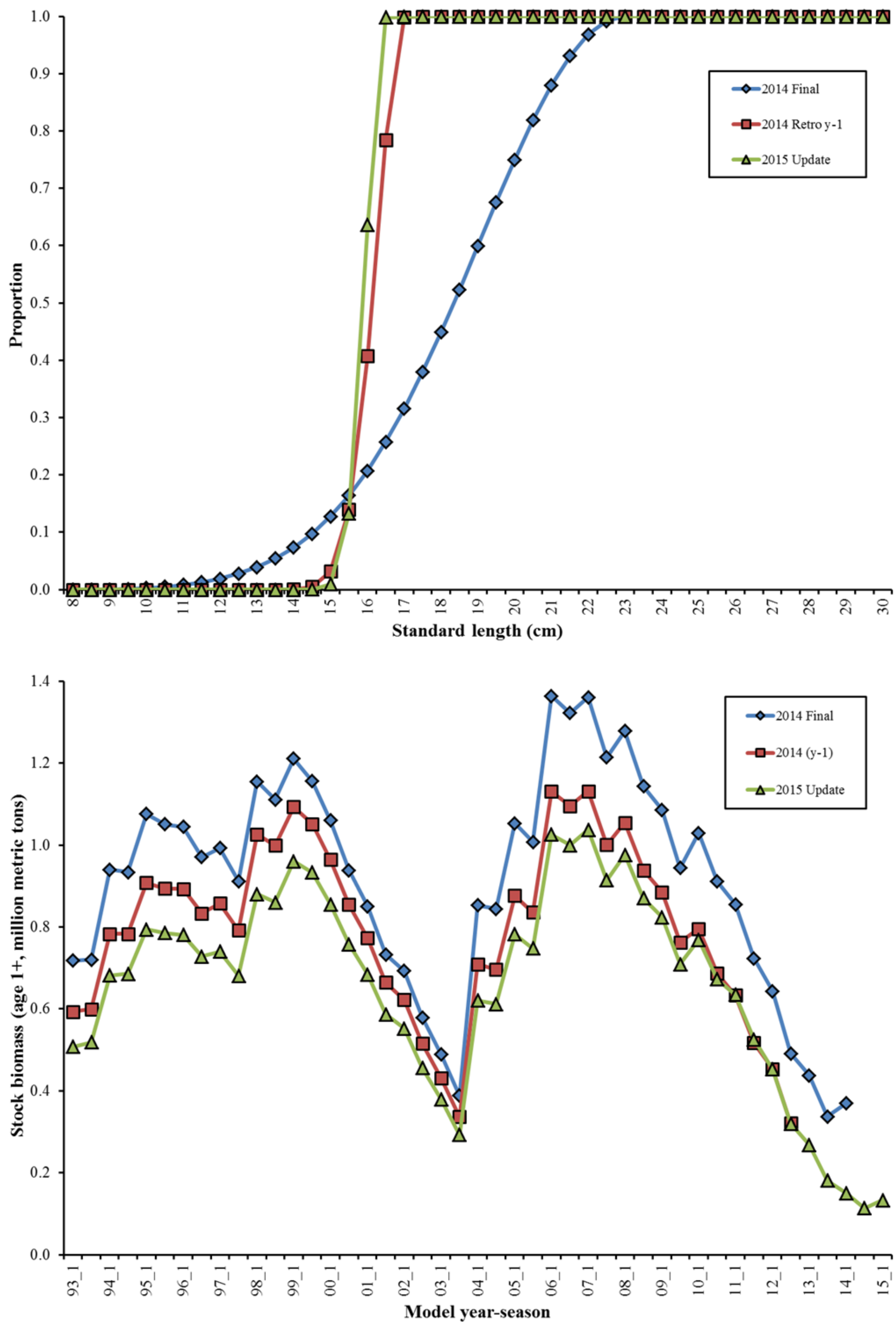
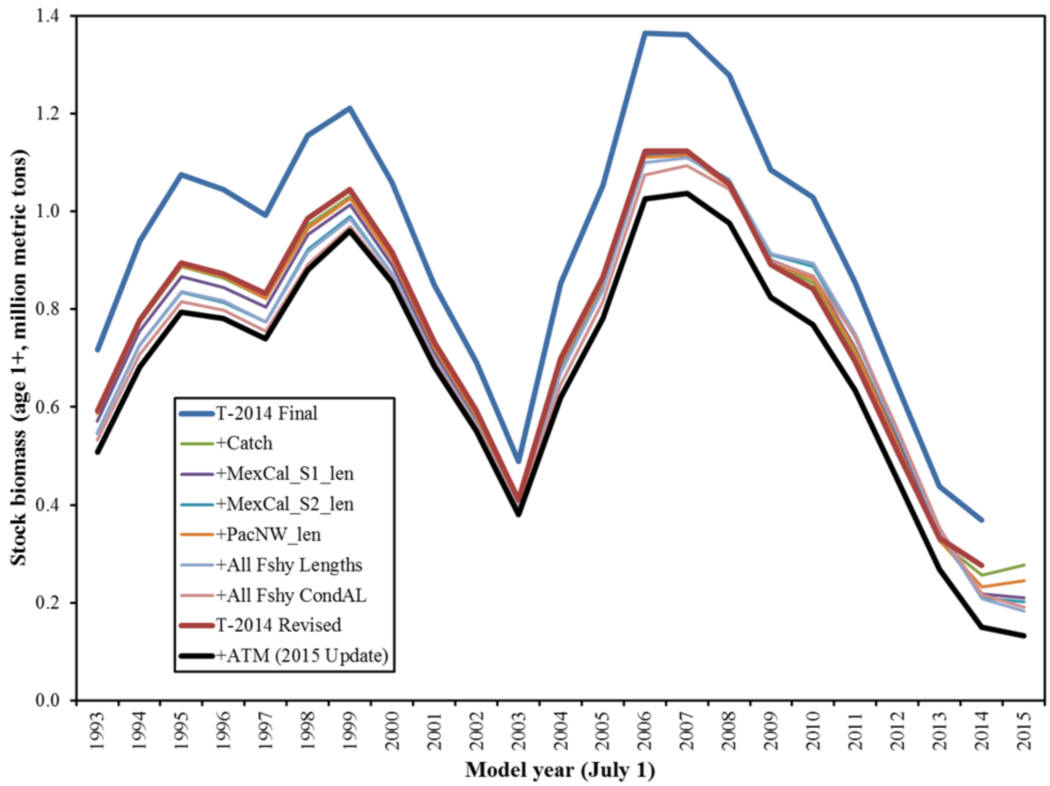


Figure 39. ATM Spring survey selectivities (upper panel) for the final 2014 model, the 2014 retrospective model (year -1), and the 2015 update model. Stock biomass series for these models are displayed in the lower panel.



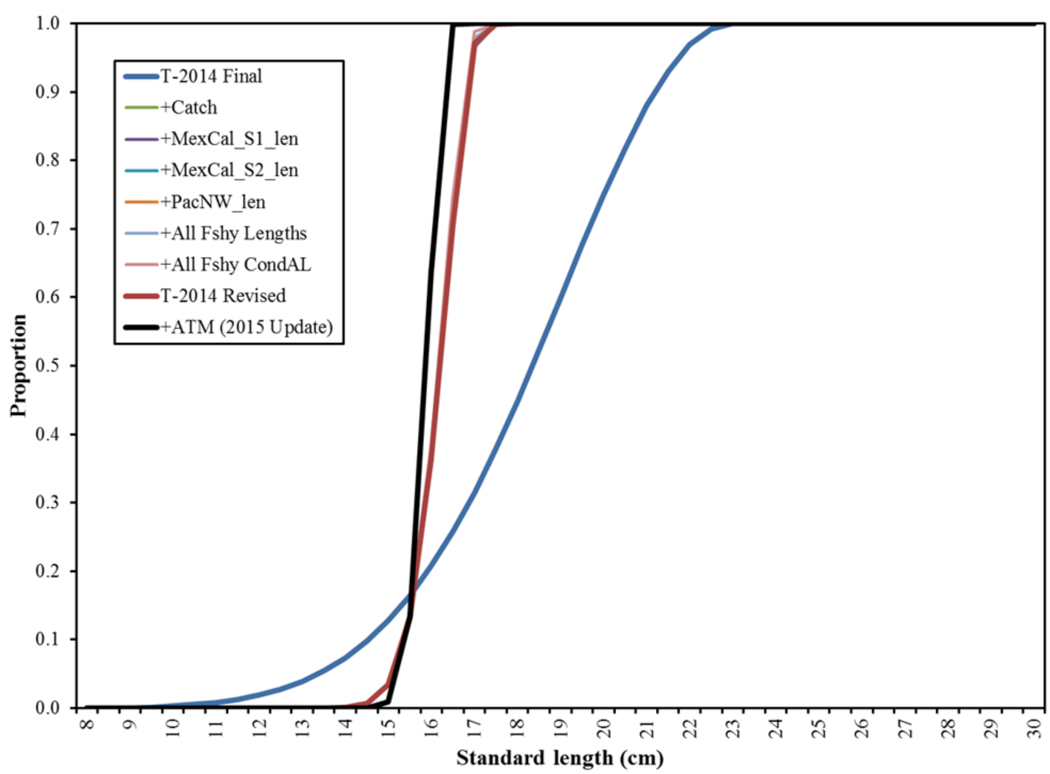


Figure 40. Stock biomass (upper) and ATM Spring survey selectivities (lower) for the final 2014 model, the revised 2014 model, and the 2015 update where new data were sequentially added to the model (see Table 9).

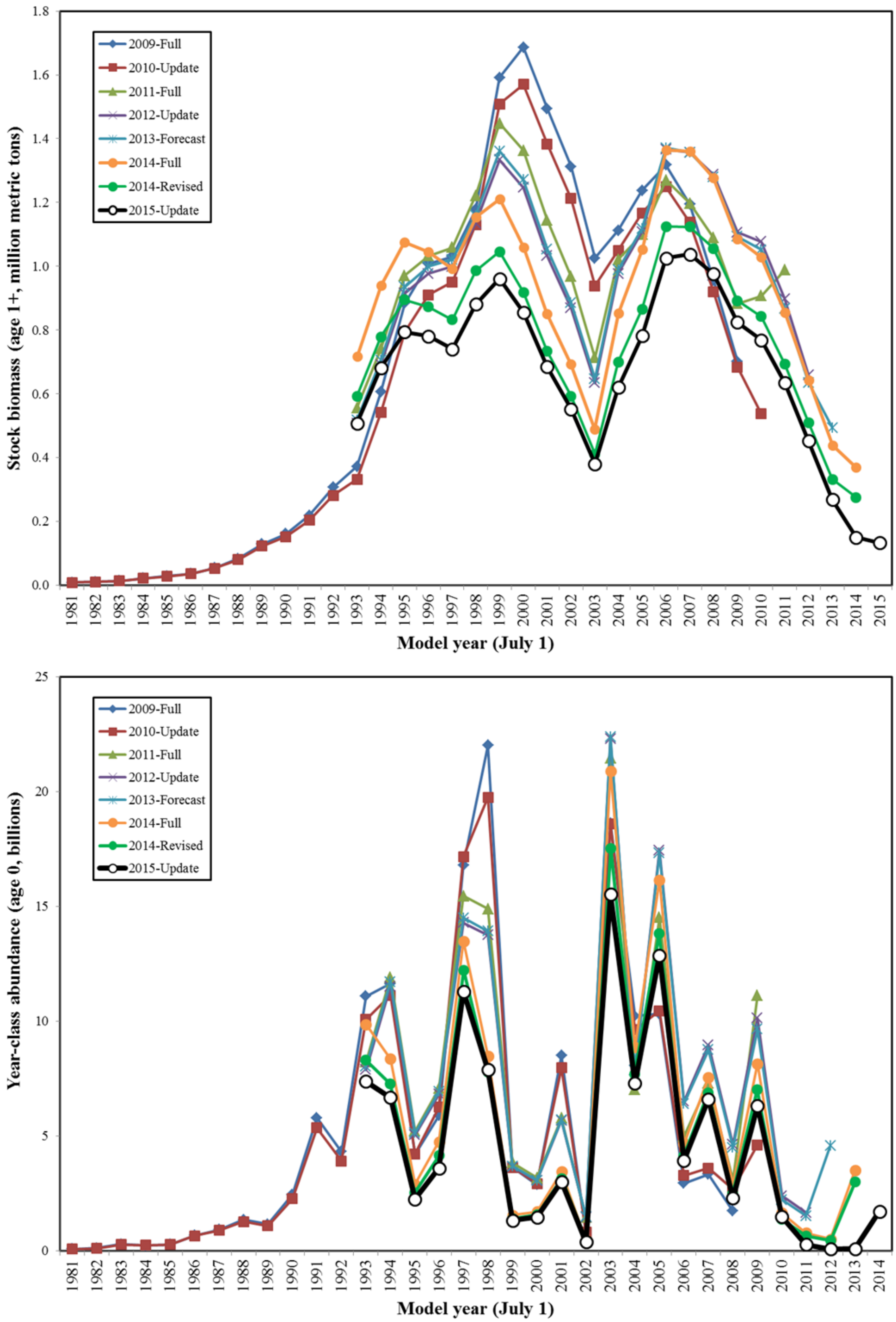


Figure 41. Estimated stock biomass (upper) and recruitment (lower) time series for the base model and past management models.

Figure 42a. Age 0-1 biomass as percentage of total population biomass (update model).

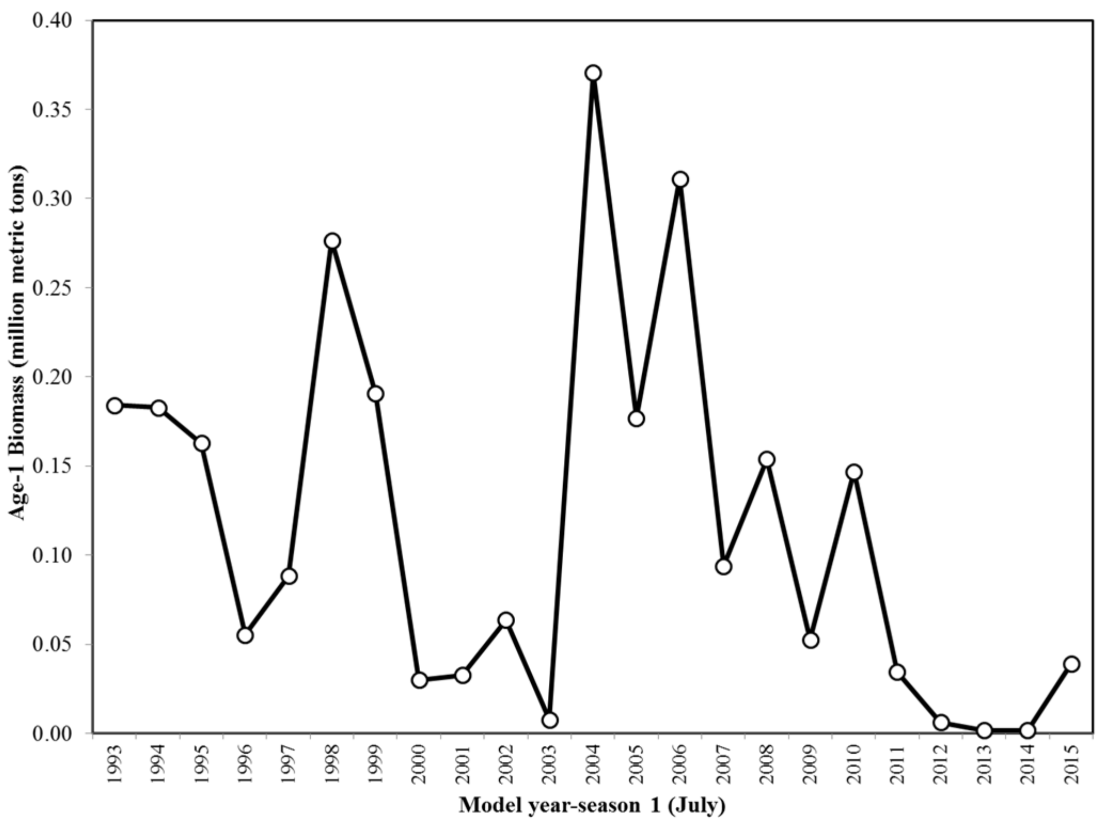


Figure 42b. Biomass of age-1 sardine (update model).

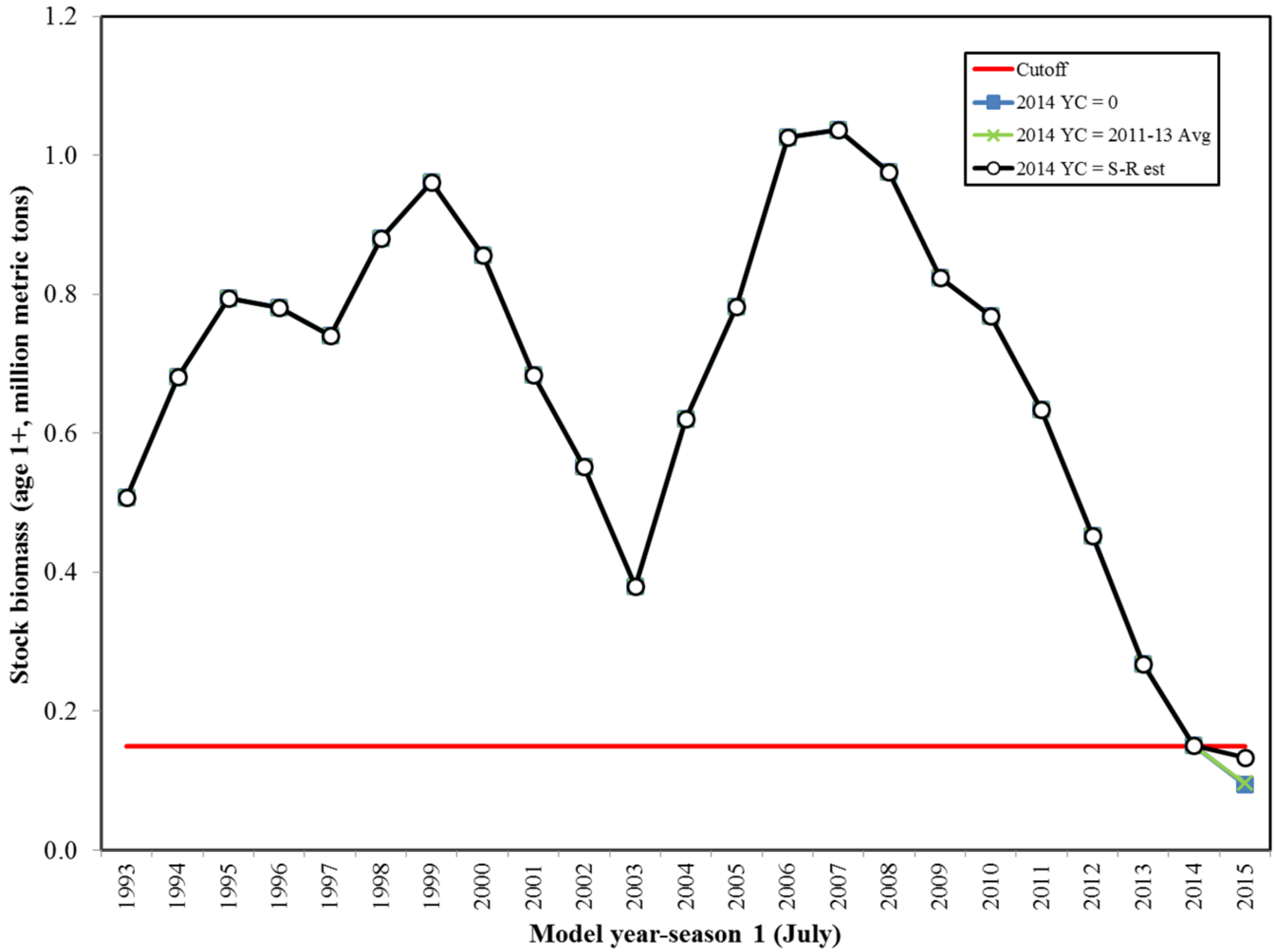


Figure 43. Update model stock biomass (age 1+) for a range of possible projection scenarios for July 2015: 1) the 2014year-class is estimated from the S-R curve; 2) 2014 year-class strength is based on an average of the 2011-13 year-classes; and 3) the 2014 year-class has failed (zero).

APPENDICES

APPENDIX A

Acoustic-trawl estimates of sardine biomass off California during spring 2014

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

We report results from the spring 2014 acoustic-trawl method (ATM) survey of the northern sub-population of Pacific sardine off central and southern California (Fig. 1). The survey was conducted from NOAA FSV *Bell M. Shimada* and chartered FV *Ocean Starr*.

The ATM survey spanned the expected distribution of the stock (Fig. 1), from the US-Mexico border to north of San Francisco. From sunrise to sunset, multi-frequency echosounders were used to sample acoustic backscatter from epipelagic coastal pelagic species (CPS). Day and night, a continuous underway fish egg sampler (CUFES) was used to sample CPS eggs within 5 m of the sea-surface. During nighttime, catches from as many as four surface trawls each night were combined into clusters to identify the proportions of CPS and their lengths.

With considerations to the sampling intensity, the presence of CPS in the echosounder and net samples, and the existence of sardine in the trawl catches (Fig. 1), a single, central stratum was defined (Fig. 2). Eight of the 16 trawl-catch clusters included CPS, but only four of these clusters included sardine (18 total). All of the sampled sardine were adults in spawning condition (Table 2 and Fig. 3); and all were located in the central stratum where no sardine eggs were sampled. A few sardine eggs were sampled south of Point Conception where no adult sardine were sampled (Fig. 1).

The estimated total sardine biomass was 0.035 Mt ($CI_{95\%}$ = [0.012; 0.077]; CV = 39.6%) (Table 1). The sampled population had no recruits, and a modal standard length (*SL*) of ~ 23 cm (Table 2, Fig. 4).

Table 1. Sardine biomass by stratum for the spring 2014 survey.

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***
Central	21218	10	1279	8	18	35.3	12.3 – 77.0	39.6
Total	21218	10	1279	8	18	35.3	12.3 – 77.0	39.6

Table 2. Sardine abundance versus standard length for the spring 2014 survey.

Standard length (cm)	**Abundance (number);**
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	14773781
23	133233577
24	41809882
25	18033397
26	0
27	0
28	0
29	0
30	0

Figure 1. Acoustic backscatter from coastal pelagic fish species (CPS, left), acoustic proportions of CPS in trawl clusters (middle), and sardine egg densities from the continuous underway fish egg sampler (CUFE; right).

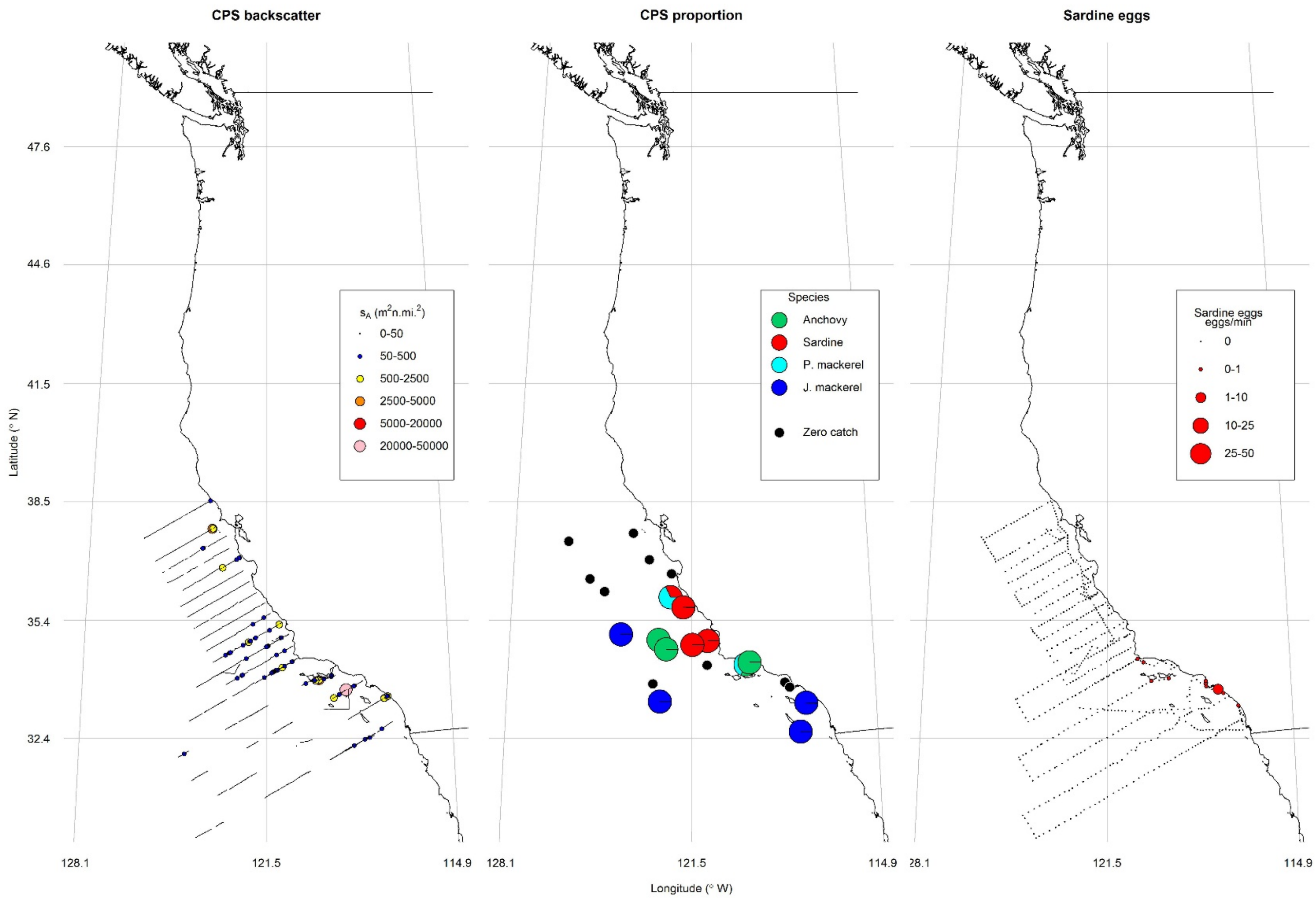


Figure 2. Sardine biomass densities for the single, central stratum (Table 1) estimated using the acoustic-trawl method (ATM). The numbers in blue represent the locations of trawl-cluster catches including at least 1 CPS.

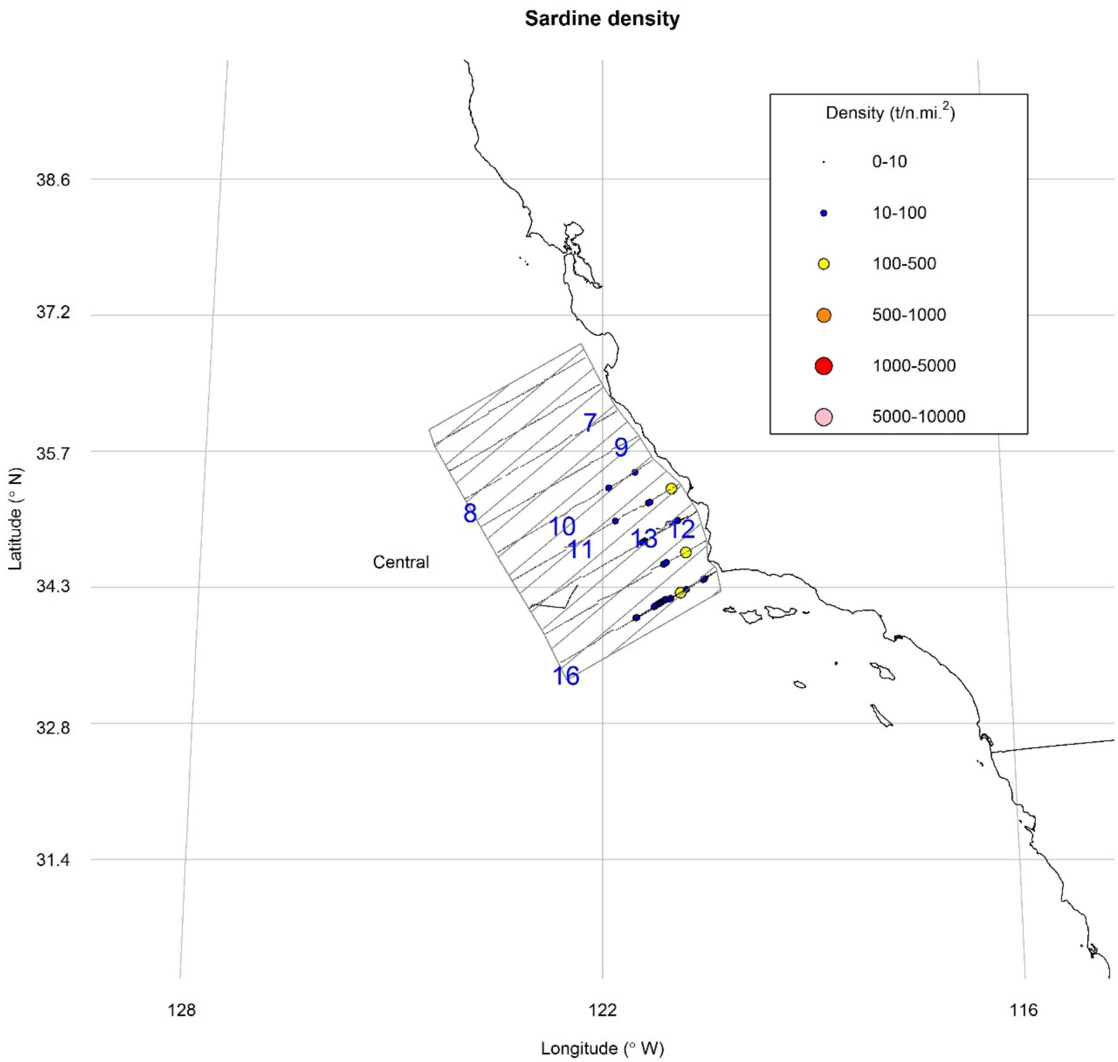


Figure 3. The sardine length distribution, the total number of sardine caught, and the percentage of sardine abundance in the central stratum, for each cluster with sardine (see Fig. 2 for locations).

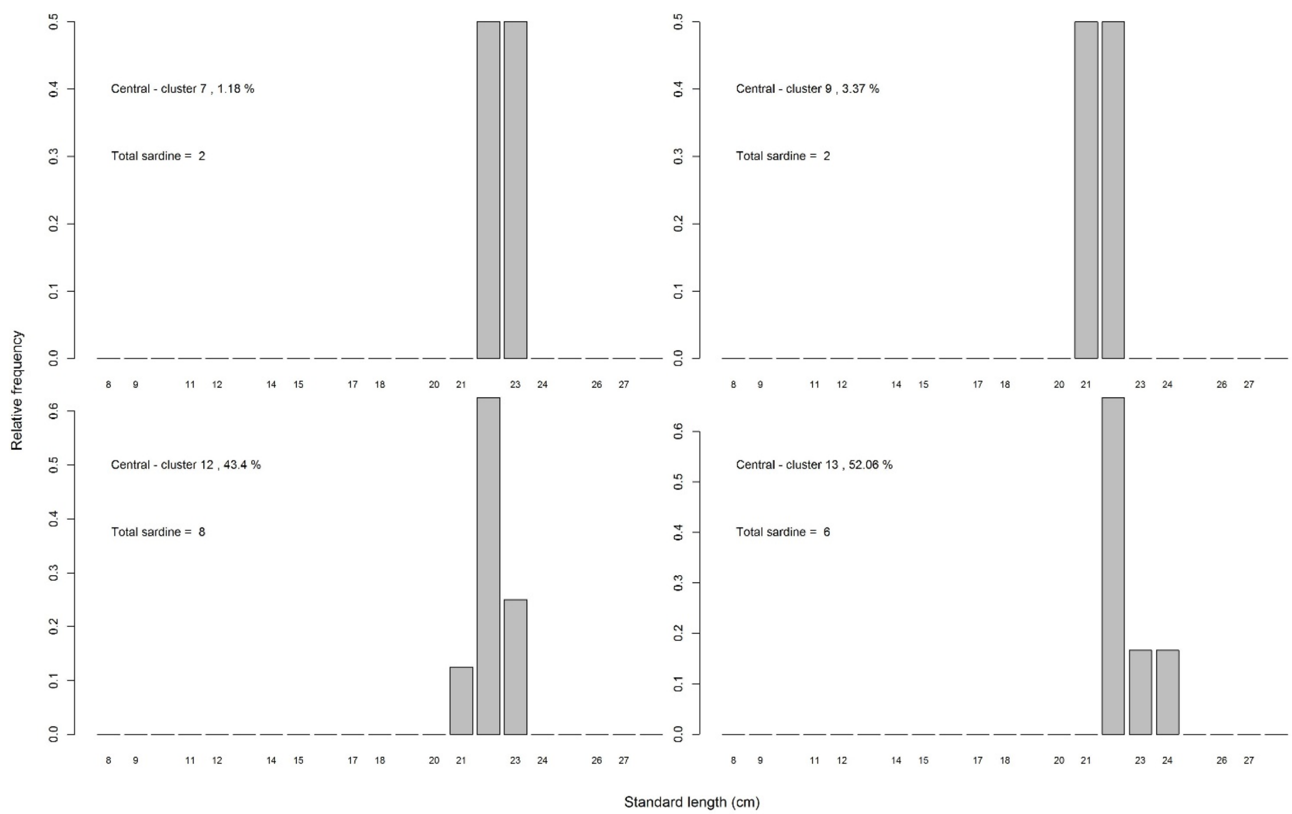
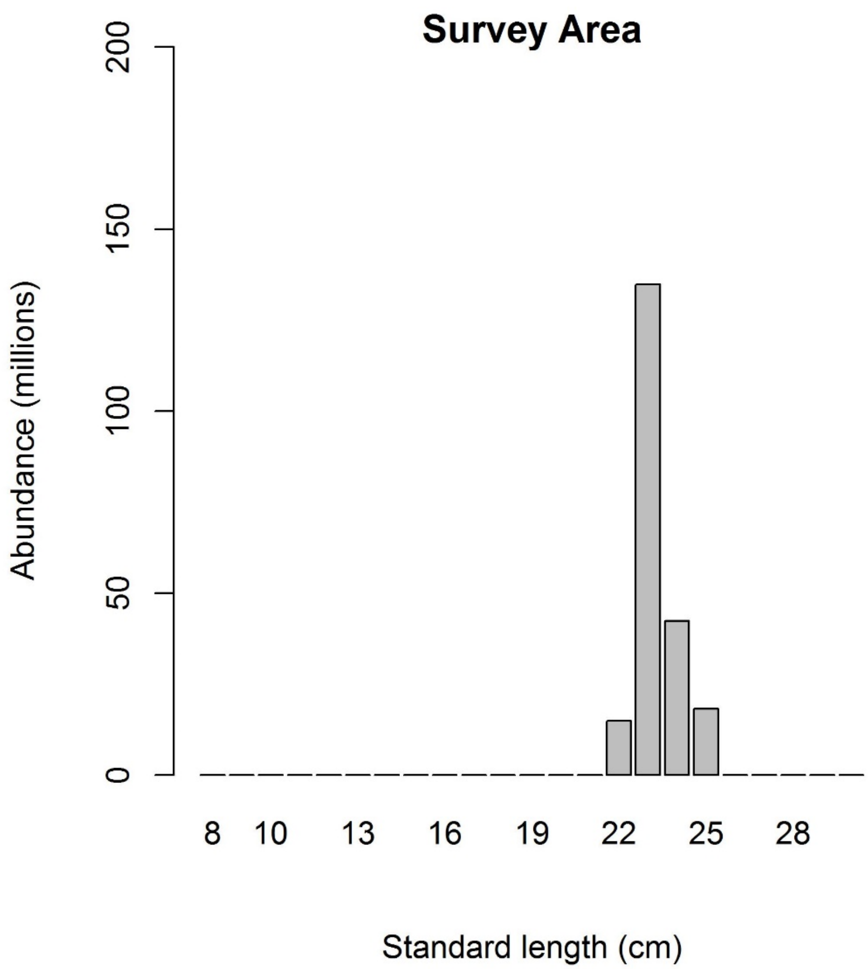


Figure 4. Sardine abundance versus standard length for spring 2014 survey. Abundance per length class for the survey is provided in **Table 2**.



APPENDIX B

Acoustic-trawl estimates of sardine biomass off USA and Canada during summer 2014

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and Kevin L. Stierhoff

We report results from the summer 2014 acoustic-trawl method (ATM) survey of the northern sub-population of Pacific sardine off the west coasts of the USA and Vancouver Island, Canada (Fig. 1). The survey was conducted from NOAA FSV *Bell M. Shimada*.

The ATM survey spanned the expected distribution of the stock (Fig. 1), from northern Vancouver Island to the Strait of Juan de Fuca (leg I) and from Cape Flattery, Washington to Morro Bay, California (leg II), to at least 35 n.mi. offshore or 1500 m depth (both legs). The spacing of the east-west tracklines was 20 nm. The aim was to reduce this spacing to 10 nm in areas where schools of coastal pelagic species (CPS) were observed acoustically or in trawl catches, or both.

From sunrise to sunset, multi-frequency echosounders were used to sample acoustic backscatter from epipelagic CPS. During nighttime, catches from as many as four surface trawls each night were combined into clusters to identify the proportions of CPS and their lengths. With considerations to the sampling intensity, the presence of CPS in the echosounder and net samples, and the existence of sardine in the trawl catches (Fig. 1), the survey data were apportioned to four independent and non-overlapping strata (Table 1; Fig 2). Eight of the 21 trawl-catch clusters with CPS included a total of 2085 total sardine.

Sardine were predominantly found in the Washington-Oregon stratum, south of the Columbia River mouth (Figs. 1, and 3). Relatively few sardine were also sampled off southern Vancouver Island, near the Oregon-California border, and south of Monterey, California (Fig. 2). The four strata (Table 1) contained a total sardine biomass of 0.026

Mt ($CI_{95\%}$ = [0.002; 0.063]; CV = 70.3%). The sampled population had few recruits, and a modal standard length (*SL*) of ~ 24 cm (Table 2; Fig. 4).

Table 1. Estimated sardine biomass by stratum during summer 2014.

Stratum		**Transect**		**Trawls**		**Sardine**		
Name	**Area (n.mi.)**	**Number**	**Distance (n.mi.)**	**CPS clusters**	**Number of sardine**	**Biomass (1000 tons)**	**95% confidence interval (1000 tons)**	***CV***
Vancouver Island (Leg I)	2520	4	245	4	28	0.15	0.02 – 0.29	63.5
Washington-Oregon (Leg II)	8020	9	396	4	2055	23.4	0.89 – 56.7	72.7
Oregon-California (Leg II)	4257	6	208	1	1	0.55	0.05 – 1.21	59.5
California (Leg II)	2459	3	121	3	1	0.00	0.00 – 0.01	91.4
Total	**17256**	**22**	**970**	**12**	**2085**	**26.3**	**1.57 – 62.7**	**70.3**

Table 2. Estimated sardine abundance versus standard length during summer 2014.

Standard length (cm)	**Abundance (number);**
≤8	578323
9	0
10	0
11	0
12	0
13	0
14	1042
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	2547916
23	43793993
24	73635878
25	17319748
26	3191613
27	0
28	0
29	0
30	0

Figure 1. Acoustic backscatter from coastal pelagic fish species (CPS; left) and the proportions of CPS in trawl clusters (right).

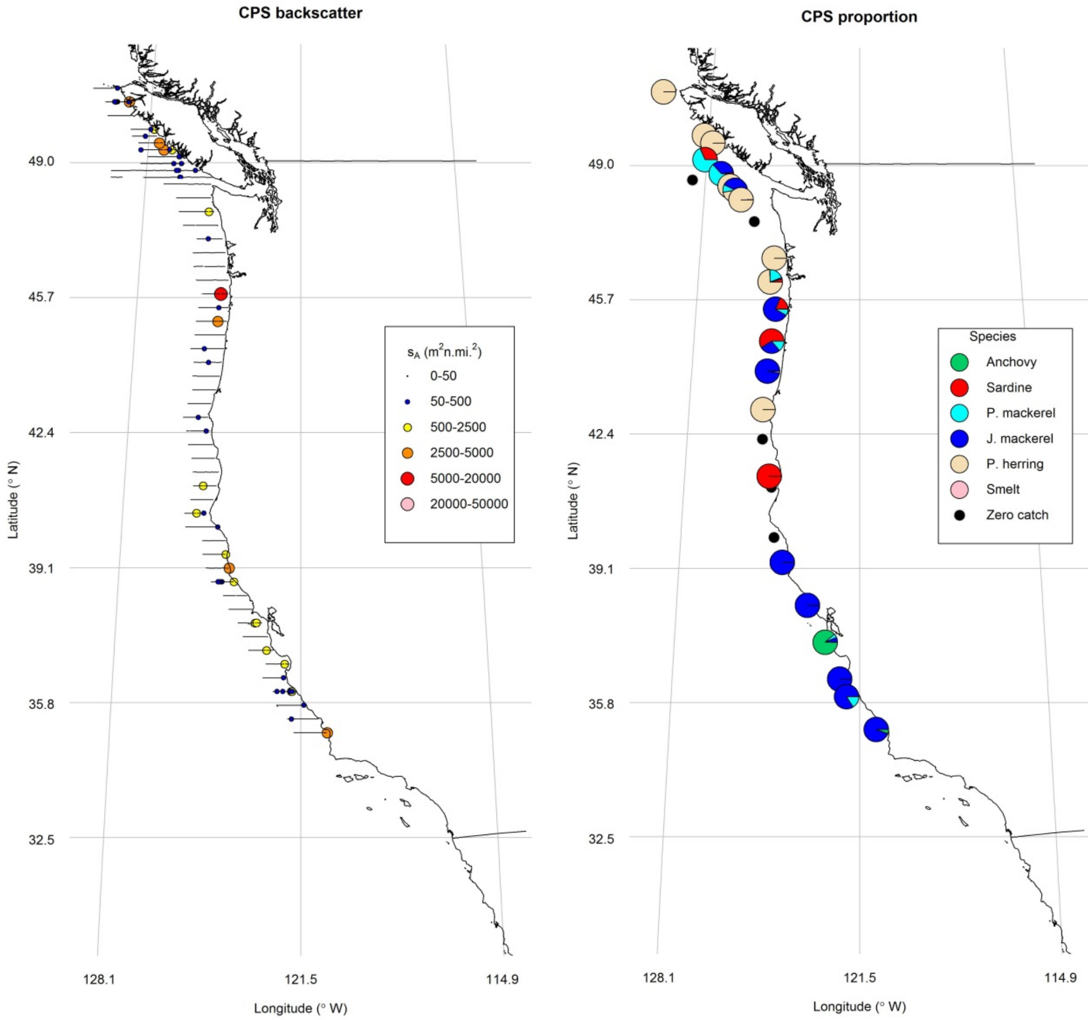


Figure 2. Estimated sardine biomass densities by stratum (see **Table 1**). The numbers in blue represent the locations of trawl cluster catches with at least one CPS specimen.

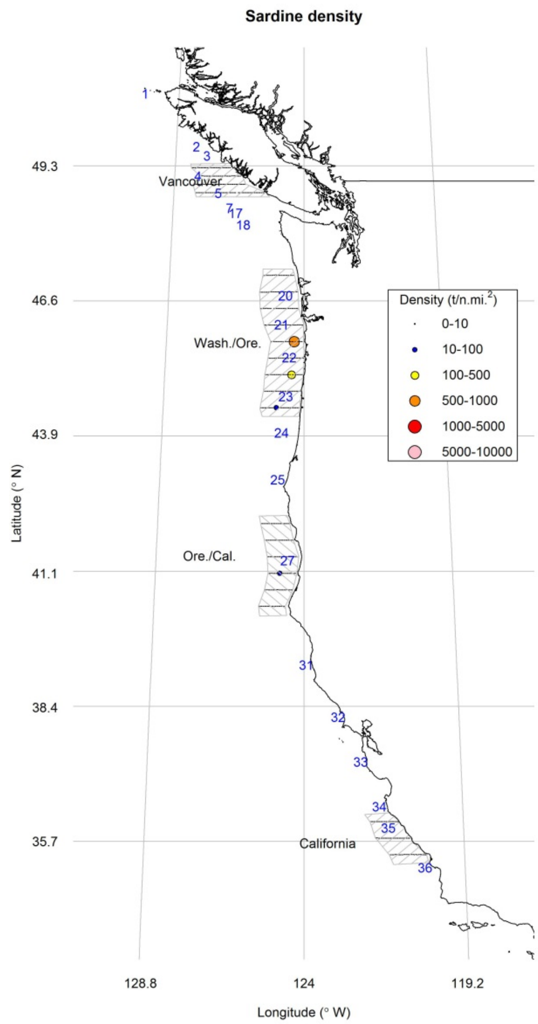


Figure 3. The sardine length distribution, the total number of sardine caught, and the percentage of sardine abundance in the associated stratum, for each cluster with sardine (see Fig. 2 for locations).

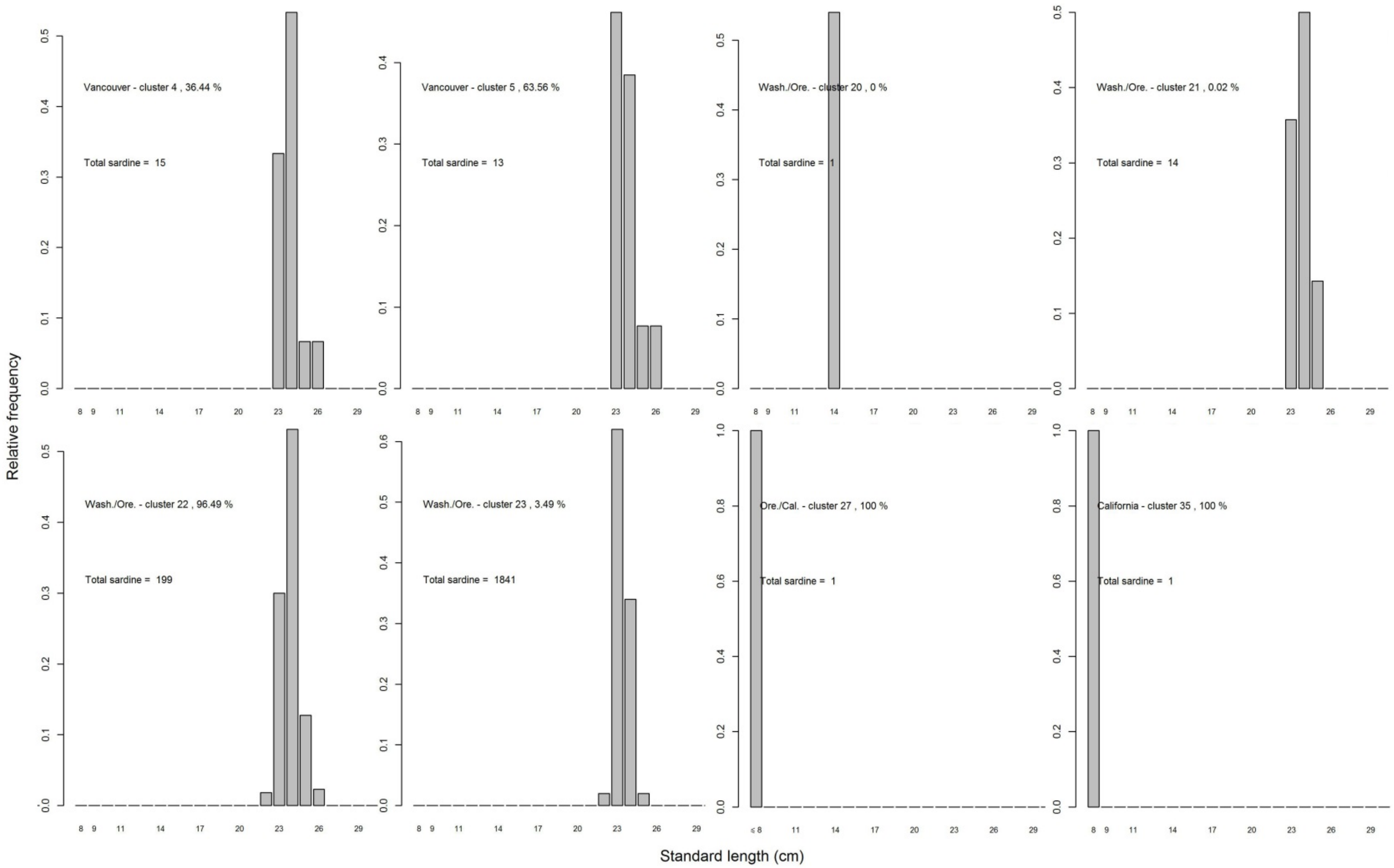
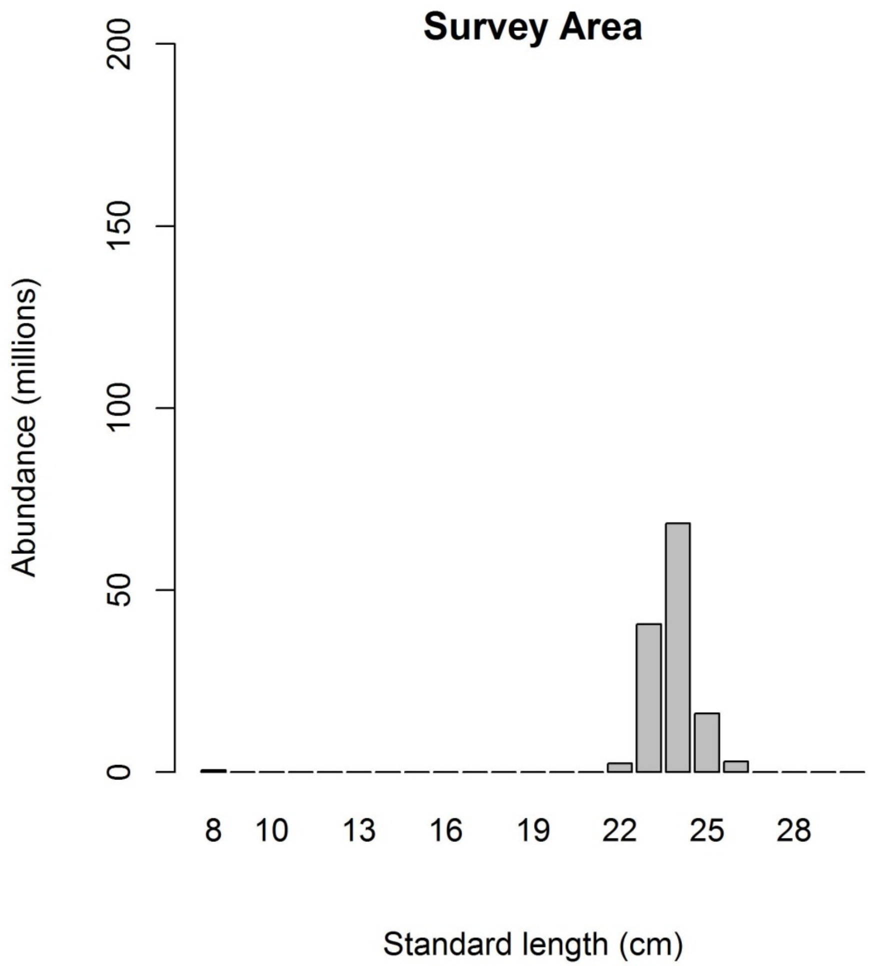


Figure 4. Estimated sardine abundance versus standard length during summer 2014 (see Table 2).



Appendix C
SS Input Files for the 2015 Update Model

STARTER.SS

```
# Pacific sardine stock assessment update for 2015-16
# K. T. Hill and P. R. Crone (Jan 2015)
# 2014 final model 'T' updated with new landings, comps, and survey estimates
# SS model ver. 3.24s
T_2015.dat
T_2015.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 # 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 2015-16
# K. T. Hill and P. R. Crone (Jan 2015)
# 2014 final model 'T' updated with new landings, comps, and survey estimates
# SS model ver. 3.24s
# FORECAST FILE
# 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
2015    1      1      1000
2015    2      1      0
2015    1      2      0
2015    2      2      1000
2015    1      3      1000
2015    2      3      1000
999 # End of file
```

CONTROL FILE 'T_2015.CTL'

```
# Pacific sardine stock assessment update for 2015-16
# K. T. Hill and P. R. Crone (Jan 2015)
# 2014 final model 'T' updated with new landings, comps, and survey estimates
# SS model ver. 3.24s
# CONTROL FILE 'A2.CTL' (NORTHERN SUBPOPULATION)
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 2014 # 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 16 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)
2013 # 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)
2014 # 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_2015.DAT'

```
# Pacific sardine stock assessment update for 2015-16
# K. T. Hill and P. R. Crone (Jan 2015)
# 2014 final model 'T' updated with new landings, comps, and survey estimates
# SS model ver. 3.24s
# .DAT FILE FOR 'NORTHERN SUBPOPULATION' DATA FROM ENS to BC
1993 # Start year (July 1993)
2014 # End year (forecast=2015)
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
44 # N_lines of catch to read
# Catch biomass(mt): columns are fisheries, year, season
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	56802.71	2013	1
0.00	7176.11	908.01	2013	2
1824.56	0.00	14996.92	2014	1
0.00	6346.70	759.46	2014	2
# 1000.00	0.00	1000.00	2015	1	# Placed in FORECAST
# 0.00	1000.00	1000.00	2015	2	# Placed in FORECAST
53 #_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
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
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
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
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
85 # 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
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        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
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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
        0.00000896     0.00000000     0.00000000     0.00000000     0.00000896     0.00003138     0.00003586
        0.00001793     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     0.18397938     0.34396593     0.31996414     0.07199193     0.01599821     0.00799910
        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
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	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		
	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		
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	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	0.00180019	0.00323817		
	0.00360037	0.00476941	0.01809207	0.02177791	0.03006646	0.03606958	0.07238447		
	0.17035400	0.25213401	0.20643699	0.09677617	0.03764854	0.01076876	0.00506478		
	0.00887556	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		

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        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
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        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
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        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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        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
        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       117.03 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      0.00031117
        0.00824020      0.03585317      0.08625069      0.13020785      0.14781588      0.13078359      0.13096350
        0.13450060      0.09826163      0.04865465      0.03019293      0.01048763      0.00505848      0.00152875
        0.00035161      0.00046650      0.00003843      0.00000000      0.00001799      0.00000000      0.00001476
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      0.00030034      0.00848199      0.04863772      0.18497779      0.25625100      0.23794398
        0.13149360      0.07286810      0.03354368      0.01705224      0.00630570      0.00171729      0.00042657
        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	0.00479389	0.03381210	0.14845967		
	0.25026556	0.29135358	0.16948725	0.06898725	0.02331949	0.00540271	0.00411850		
	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		
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		

```
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
        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
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
821 # 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

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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
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
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
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
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	6.08	0.00000000	0.00000000	0.12580305
	0.70740520		0.14079934		0.01929854		0.00669386		0.00000000	0.00000000	0.00000000
2013	1	3	0	0	5	20.0	20.5	54.16	0.00000000	0.00000000	0.07877190
	0.69238663		0.17782469		0.03788546		0.00625276		0.00378112	0.00309744	0.00000000
2013	1	3	0	0	5	21.0	21.5	55.68	0.00000000	0.00000000	0.04586018
	0.56265888		0.19516410		0.04987227		0.04529655		0.03792234	0.06322569	0.00000000
2013	1	3	0	0	5	22.0	22.5	16.64	0.00000000	0.00000000	0.02385550
	0.19097627		0.13967064		0.08448812		0.13023383		0.21638642	0.21438922	0.00000000
2013	1	3	0	0	5	23.0	23.5	3.4	0.00000000	0.00000000	0.00000000
	0.05034323		0.04198009		0.04425185		0.23421065		0.31509757	0.29986697	0.01424965
2013	1	3	0	0	5	24.0	24.5	0.32	0.00000000	0.00000000	0.00000000
	0.18999225		0.00000000		0.00000000		0.24963505		0.00000000	0.56037269	0.00000000
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
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
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

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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
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   136.32  0.00000000   0.00000000   0.06121362
       0.57620490   0.17484725   0.04635577   0.03963695   0.04575317   0.05567494   0.00031340
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
65 # N_mean size-at-age_obs
# 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		
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
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       136.32  -1.0    -1.0    20.8    20.9    21.1    21.3    22.1    22.2
        22.2    23.1    0.00    0.00    7.48    77.12   24.32   6.52    5.88    6.72    8.24    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
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Appendix D

PFMC Scientific Peer Reviews and Advisory Body Reports.

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

Dr. Kevin Hill presented the 2015 sardine update assessment to the Scientific and Statistical Committee (SSC). This update was reviewed by the SSC Coastal Pelagic Species (CPS) Subcommittee on March 6, 2015. The update assessment was complete and well documented and followed the Terms of Reference for update assessments. The SSC endorses an overfishing limit (OFL) of 13,227 mt and the tier-1 default sigma (σ) of 0.36 to be used in determining the ABC.

New data in the 2015 update include catch data for 2014 (and updated catch data from 2013), indices from both the spring and summer 2014 Acoustic Trawl Method (ATM) surveys, and 2013 fishery and survey conditional age-at-length data and 2014 length composition data. Age data were not available for the 2014 fisheries or surveys in time for inclusion in the update. The 2014 Daily Egg Production Method (DEPM) estimate was not included in the 2015 update because the CalVET gear used for that index caught no eggs during the 2014 California Cooperative Oceanic Fisheries Investigations (CalCOFI) survey, and therefore a usable index for the model could not be produced. Dr. Hill noted that very low and zero egg counts had occurred previously when the biomass of Pacific sardine was at very low levels. The issue of how to include zero and near zero biomass indices should be addressed prior to the next full assessment.

The spring and summer 2014 ATM surveys produced biomass indices of 35,339 mt (CV = 0.4) and 26,280 mt (CV = 0.7), respectively. These surveys were conducted in a similar manner to previous ATM surveys, and the biomass indices are both far below those produced in 2014 (each was over 300,000 mt). Both fishery fleets saw, on average, larger fish in 2014 and 2013 than were seen in previous years. This appears to reflect a lack of smaller fish due to poor recent recruitment.

In the course of reviewing the update assessment it became evident that the base model used in the 2014 assessment did not correspond to the best fit to the data. Upon further exploration, a better fit was achieved (Table 9, column “T-2014 Revised”, Agenda Item G.1.a). This revised 2014 model resulted in selectivity patterns similar to those in the 2015 update, while differences in selectivity patterns between the two assessments had been a point of concern in reviewing the 2015 update. The 2014 stock biomass in the revised 2014 model is lower than that reported in the 2014 assessment (275,705 vs. 369,506 mt). Application of the OFL control rule to the 2014 biomass estimate in the revised 2014 model results in a value of 29,256 mt (vs. 39,210 mt), while application of the HG control rule in place in 2014 to the revised 2014 biomass estimate results in a value of 16,405 mt (vs. 28,646 mt). It is not appropriate, in this context, to contemplate what the 2014/2015 OFL would have been based upon the 2014 biomass estimate from the 2015 assessment.

Recent assessments, including the 2014 assessment, have estimated the most recent recruitment from the stock-recruitment curve. However, this approach has been found to consistently overestimate the recruitment in recent years (based upon subsequent information). Because of this, the stock assessment team (STAT) recommended averaging the estimates of the previous three years' recruitments (as has been done previously in the Pacific mackerel assessment). The SSC considers this approach to be consistent with recent observed patterns and supports this method for estimating the 2014 recruitment. The SSC finds the 2015 update with this recruitment estimation approach to represent both an appropriate update of the 2014 sardine assessment model and the best available science. The biomass estimate (96,688 mt) and management quantities for this model are shown in part (b) of the table on page 12 of Agenda Item G.1.a, Assessment Report Executive Summary. The SSC endorsed 2015/16 Pacific sardine OFL of 13,227 mt is in that table.

The SSC notes that the 2014 ATM surveys were fairly influential in the final update assessment results. However, given the above SSC endorsed approach for estimating 2014 recruitment, the biomass estimate for 2015 remains below 150,000 mt (145,785 mt; Kevin Hill, pers. comm.) even when the 2014 ATM surveys are not included in the model.

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. This lack of fit is concerning, and it is not clear how this can be fixed 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. The SSC recommends prioritizing a methodology review of the ATM survey over a full assessment next year. If the Council also considers this a priority, the SSC CPS subcommittee will work with the Southwest Fisheries Science Center (SWFSC) to evaluate progress on recommendations from the last ATM survey review and prepare for the recommended methodology review.

PFMC
04/12/15

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

The Coastal Pelagic Species Management Team (CPSMT) and the Coastal Pelagic Species Advisory Panel (CPSAS) jointly received a presentation from Dr. Kevin Hill concerning the Pacific sardine stock update assessment conducted in 2015. The CPSMT recommends that the Pacific Fishery Management Council (Council) adopt the update assessment for management of the 2015-2016 sardine fishery (Agenda Item Supplemental Assessment Report) using the recent three year average to estimate recruitment. The age 1+ biomass estimated from this assessment, using the three year average to estimate recruitment, is 96,688 metric tons (mt).

A set of control rules describe harvest policy for the management of Pacific sardine, including the overfishing limit (OFL), the acceptable biological catch (ABC), and the harvest guideline (HG). The Pacific sardine HG control rule, the primary mechanism for setting the annual directed quota for Pacific sardine, includes a CUTOFF value of 150,000 mt. This amount is subtracted from the annual biomass estimate before calculating the applicable HG for the fishing season. The 2015-2016 biomass estimate of 96,688 mt is notable for being below CUTOFF. Accordingly, the CPSMT recommends closure of the primary directed fishery for Pacific sardine for the upcoming fishing year (July 1, 2015 - June 15, 2016). This closure however does not preclude the allowance for incidental catch in other CPS and non-CPS fisheries as well as directed live bait and tribal harvest.

Chapter 5 of the CPS FMP describes the established allowances for incidental and live bait harvest for CPS. Sections 5.1.2 and 5.1.5 of that chapter respectively provide guidance on the established allowances for incidental catch and live bait harvest for when stocks are not overfished. The overfished threshold for Pacific sardine is a biomass level of 50,000 mt. Because Pacific sardine is not overfished, the CPSMT used these as guidance for our recommendations on allowable harvest for the 2015-2016 fishing season.

> 5.1.2 Incidental Catch Allowances When Stocks are Not Overfished
>
> When a stock is not overfished according to the definition of overfishing in the FMP, incidental catch allowances for commercial fishing shall be set at zero percent to 45% of landed weight, as recommended by the Council.
>
> 5.1.5 Incidental Catch Allowances for Live Bait When Stocks are Not Overfished
>
> When a stock is not overfished according to the definition of overfishing in the FMP and an ACL is not anticipated to be exceeded, no restrictions are placed on live bait harvest.

Incidental Landings History

The CPSMT looked at the incidental catch history of Pacific sardine in all other fisheries from 2008 through 2014. Years of lower Pacific sardine biomass paired with higher incidental rates, are presented in Table 1. The CPSMT used this recent data to determine the most likely scenarios for the coming year. The Team recognizes that the dynamics of the other CPS (Pacific mackerel, jack mackerel, anchovy and squid) fisheries may change as a shift in effort occurs with the absence of a directed sardine fishery. Most incidental sardine landings occur in other CPS fisheries while minimal incidental landings have occurred in other fisheries using ten other gear types (<1 metric ton of landings since 2008).

Table 1. Incidental landings totals for Washington, Oregon, and California from 2012-2014/15 for all gear types (metric tons).

	2012	2013	2014 Interim	2014/15	Highest Year
WA	0.00	**0.62**	0.00	0.00	0.62
OR	47.83	17.14	0.00	**366.90**	366.90
CA	412.95	**1,327.39**	832.70	808.30	1,327.39
Total	460.78	1,345.15	832.70	1,175.20	1,694.91

The CPSMT reviewed California CPS landing receipts. A count of incidental landings of sardine in targeted CPS fisheries shows that the Pacific mackerel fishery has the highest rate of encounters with sardine (Figure 1). Of the 1,181 directed Pacific mackerel landing receipts, 263 or 22% of those landings contain incidental sardine, defined as loads with less than 50% sardine. Of the 263 Pacific mackerel loads with incidental sardine, proportions of sardine within these by percentage bin are indicated above each bar in Figure 1. If the Council sets an incidental allowance of 40%, it would have affected a total of 12% (7% + 5%) of the Pacific mackerel landings that contained incidental sardine between 2012 and 2014. An incidental allowance at 30% would affect another 13% (6% + 7%).

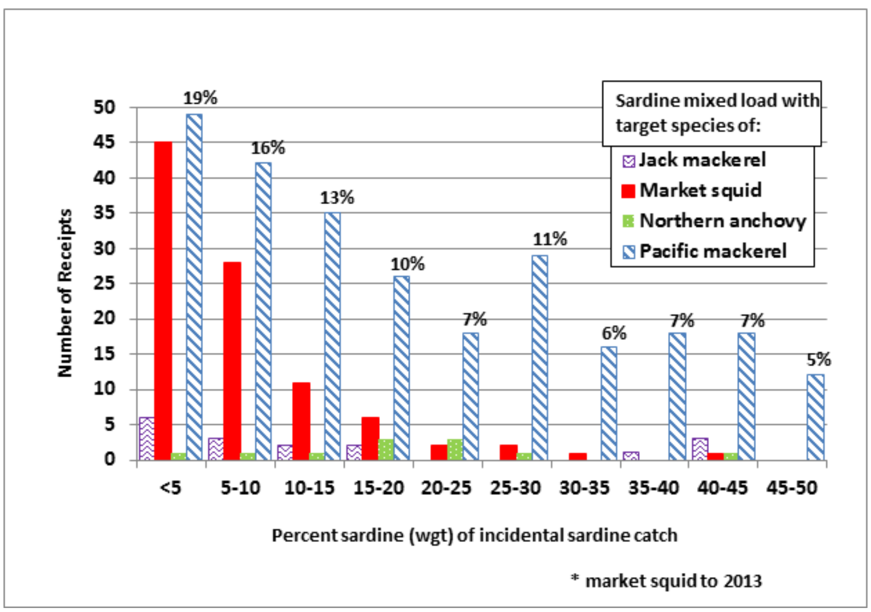

Figure 1. All mixed CPS load receipts where sardine was < 50% of load. Target species are predominant species in the load. Percentages of Pacific mackerel loads with incidental sardine by percentage bin are indicated above each bar. Market squid receipts for 2014 are undergoing a review, therefore the data for market squid are from years 2012-2013.

Harvest Specifications for 2015-2016

Table 2 (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 full stock assessment conducted in 2014, the Council chose a P* of 0.40 for the 2014-2015 fishery. This P* value applied to the OFL of 13, 227 mt produces an allowable biological catch (ABC) of 12,074 mt. To help conserve sardine while allowing fisheries to proceed, the CPSMT recommends an ACL of 8,000 mt (Table 3). The CPSMT also recommends the following accountability measures (AMs) as management controls: an ACT of 4,000 mt for CPS fishery incidental catch, an incidental per landing allowance of 40% Pacific sardine in non-treaty CPS fisheries until a total of 1,500 mt of Pacific sardine are landed; At this point, the recommended incidental per landing allowance would be reduced to 30%; when the ACT (4000 mt) is reached the incidental per landing allowance would be reduced to 5% for the remainder of the 2015-2016 fishing year. Additionally, the CPSMT recommends a 2 mt incidental per landing allowance in non-CPS fisheries. The CPSMT proposes these incidental allowances (as listed below) to allow the fisheries to proceed while also minimizing discard of fish at sea and in recognition that higher mixing of sardine and mackerel occurs at low biomass levels.

The proposed AMs are not intended to apply to the Quinault Indian Nation fishery and the live-bait fishery. However, the CPSMT acknowledges that this catch and other minimal sources of mortality, such as recreational take, are to be accounted for against the ACL and is consistent with the previous management and the CPS FMP.

The CPSMT further recommends the Council adopt an in-season review provision, tentatively scheduled for the September Council meeting, to consider revisions for incidental trip allowances.

Table 2. Pacific sardine harvest formula parameters for 2015-2016.

Harvest Control Rule Formulas									
$OFL = BIOMASS * E_{MSY} * DISTRIBUTION$									
$ABC_{P\text{-star}} = BIOMASS * BUFFER_{P\text{-star}} * E_{MSY} * DISTRIBUTION$									
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION									
Harvest Formula Parameters									
BIOMASS (age 1+, mt)	96,688								
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
E_{MSY}	0.15724								
FRACTION	0.15								
CUTOFF (mt)	150,000								
DISTRIBUTION (U.S.)	0.87								
Harvest Control Rule Values (mt)									
OFL =	**13,227**								
$ABC_{Tier\ 1}$ =	12,642	**12,074**	11,514	10,951	10,375	9,769	9,108	8,338	7,316
ACL =	**8,000**								
HG =	**0**								

Table 3. 2015-16 Calculated OFL and ABC and CPSMT Recommended ACL and ACT Values.

Biomass	96,688
OFL	13,227
P* buffer	0.4
$ABC_{0.4}$	12,074
ACL	8,000
ACT	4,000

List of CPS Recommend Accountability Measures

- An incidental per landing allowance of 40% Pacific sardine in non-treaty CPS fisheries until a total of 1,500 mt of Pacific sardine are landed.
- When the 1,500 mt is achieved the recommended incidental per landing allowance would be reduced to 30%.
- When the ACT (4000 mt) is reached the incidental per landing allowance would be reduced to 5% for the remainder of the 2015-2016 fishing year.
- A 2 mt incidental per landing allowance in non-CPS fisheries.

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. The Team also supports the Scientific and Statistical Committee’s (SSC) request to the survey principals for a formal, point-by-point response to the list of potential items that were requested of the lead scientists in the April 2011 Methodology Review Panel report . The MT notes that the A-T survey is the only point estimate for the 2014 surveys in the 2015 update assessment indicating to its importance in informing sardine management. Moreover, the A-T survey could be used to assess abundance of other CPS.

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

The Coastal Pelagic Species Advisory Subpanel (CPSAS) and Coastal Pelagic Species Management Team (CPSMT) received a joint briefing from Dr. Kevin Hill on the Pacific Sardine Stock Assessment for USA management in 2015-16 (Agenda Item G.1.a, Assessment Report).

The CPSAS thanks the Stock Assessment Team for their efforts. The CPSAS appreciates the Council's consideration of the following points in deliberating management measures for the 2015-2016 sardine fishery:

1. Although the current stock assessment reflects a declining trend and biomass has fallen below the CUTOFF, industry remains concerned about the ability of current acoustic trawl surveys to measure the full extent of the biomass. The CPSAS strongly supports the Scientific and Statistical Committee and CPSMT recommendation to conduct a methodology review of the Acoustic Trawl Method (ATM) survey.

2. The update assessment was based on 2014 spring and summer surveys, and does not factor in small sardines that have been observed in recent months both in California and the Pacific Northwest. The spring 2015 sardine survey is currently observing spawning activity off southern Oregon.

3. The size of sardine stocks are largely driven by environmental conditions. There was a very poor year-class in 2010, followed by three years of poor recruitment. Both the sardine stock assessment and the acoustic-trawl series clearly show this. **With low recruitment, biomass drops very quickly absent any fishing.** This directly contradicts arguments that sardines are declining due to overfishing.

4. **The sardine control rule is designed to shut down the directed fishery after a series of poor recruitment years.** The sardine harvest control rule is a highly precautionary management policy.

5. Please consider that achieving Optimum Yield requires balancing fishery opportunity, economic stability and ecosystem needs.

6. 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.

7. The industry wants to maintain a sustainable resource, as well as a sustainable fishing industry.

Management Measures

The CPSAS recommends the following sardine management measures for July 1, 2015 – June 30, 2016, based on an Overfishing Limit (OFL) of 13,227 metric tons (mt), and an Acceptable Biological Catch of 12,074 mt, as outlined in Table b of the Stock Assessment Report (Agenda Item G.1.a. Assessment Report).

The CPSAS supports the CPSMT recommendations (G.1.b, Supplemental CPSMT Report) including setting the Annual Catch Limit at 8,000 mt and an incidental landing allowance in other CPS fisheries of 40 percent Pacific sardine by weight until a total of 1,500 mt are landed in non-tribal fisheries; and then 30% by weight. We can also support the addition of an annual catch target (ACT) if recommended by the CPSMT, understanding these management measures will be reviewed in September, with the incidental landing allowance adjusted up or down as needed.

These incidental catch percentages are based on analysis by the California Department of Fish and Wildlife (CDFW), which finds sardine caught incidentally in all other CPS fisheries, but with the highest incidental rate in the Pacific mackerel fishery. Without an incidental catch of sardines the CPS fleet could be preempted from fishing in 2015, particularly in California.

The CPSAS also stresses the importance of the CPS Fishery Management Plan (FMP) provision allowing the live bait fishery to continue. While this is considered to be harvest, an estimated 90 percent of the live bait catch is returned to the ocean alive.

PFMC
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