Science, Service, Stewardship

SEDAR 22 Review Workshop: Tilefish Data Inputs

Tampa, FL

Feb. 14-17, 2011

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LANDINGS & DISCARDS

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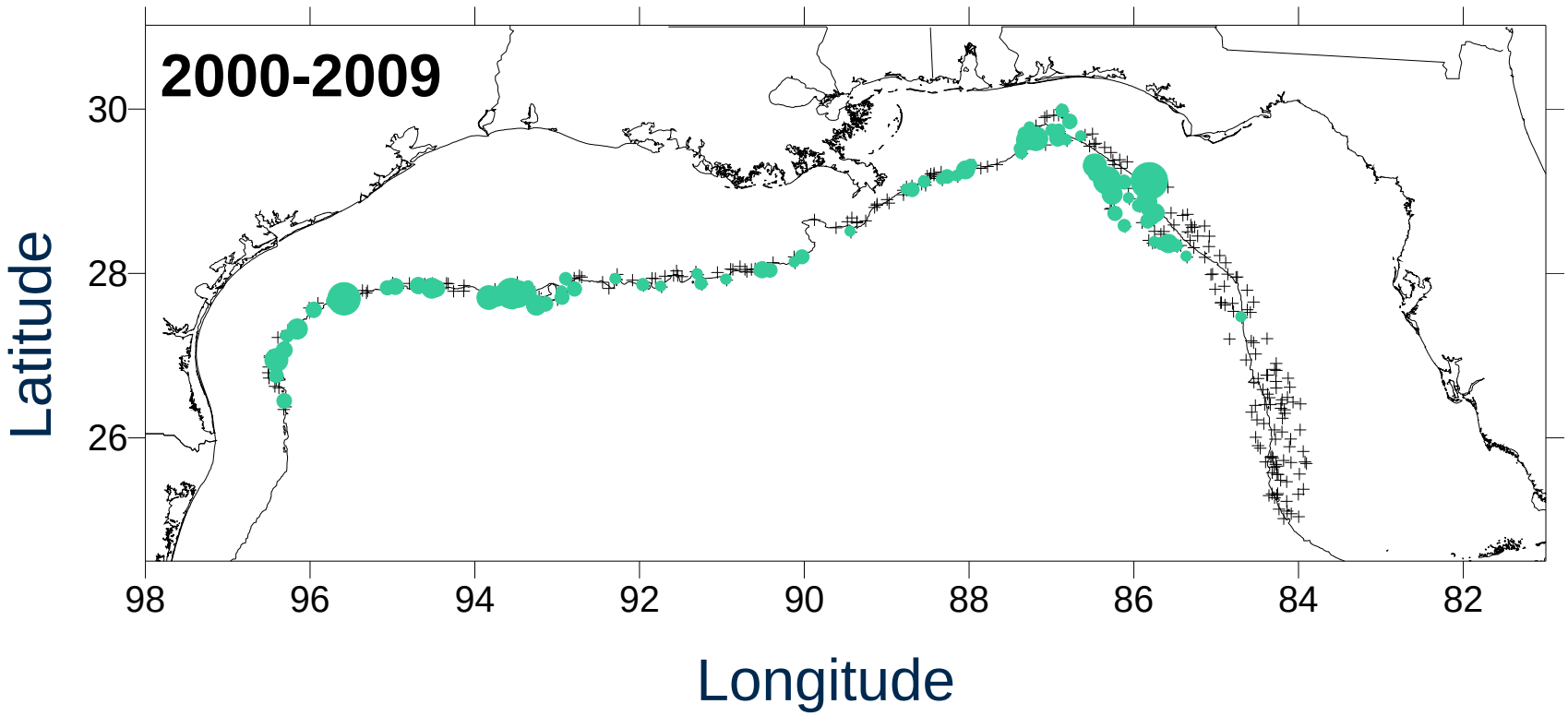
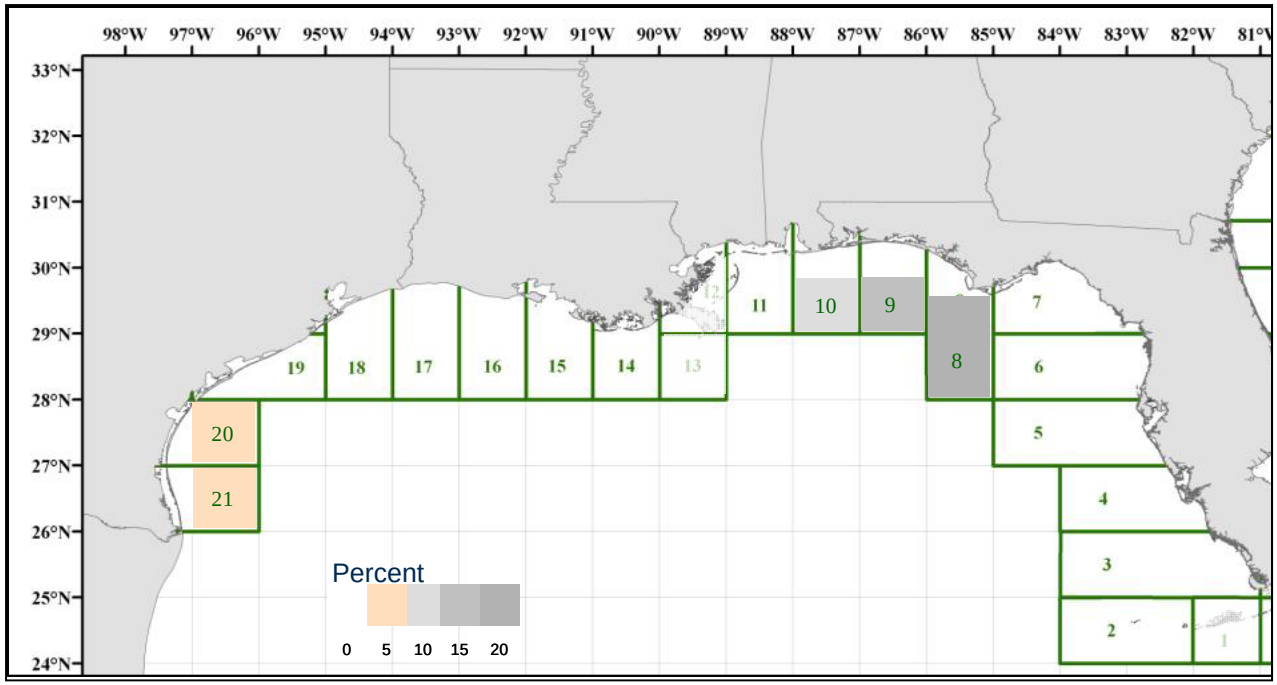
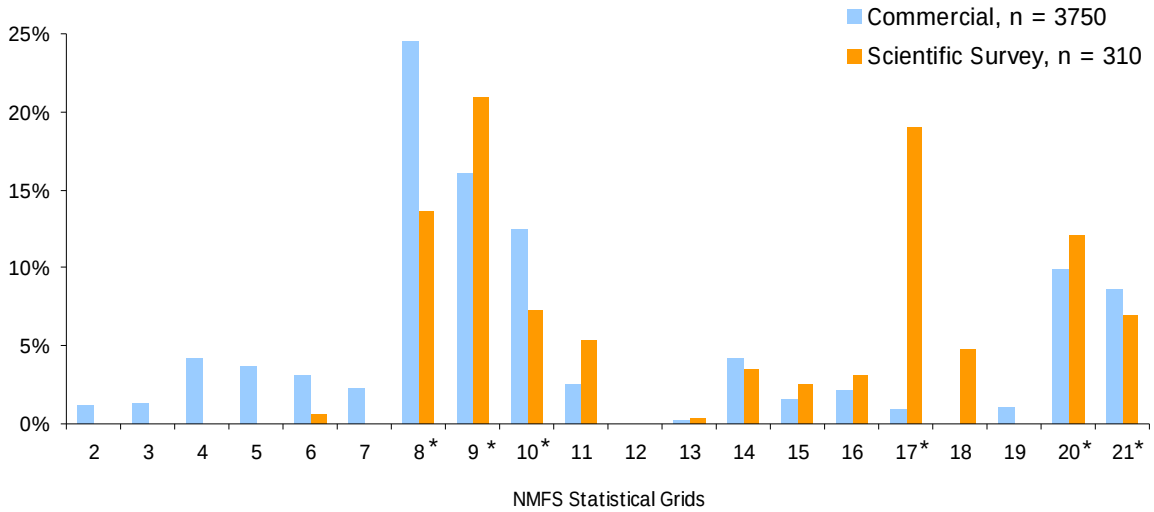
NMFS BLL Survey Index - Map



capture locations of golden tilefish from the Gulf of Mexico (comm, NMFS LL)



(a) shaded areas represent the % of commercial longline landings



(b) (b) frequency of occurrence by source and NMFS stat area

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Commercial Landings

- Majority of tilefish landings from stat areas 1-5 were thought to be blueline tilefish
- Calculated proportion of landings from stat areas 1-5 for 1992-1996 that were golden tilefish
- Applied proportion to tilefish landings from 1965-1991 to get adjusted golden tilefish landings

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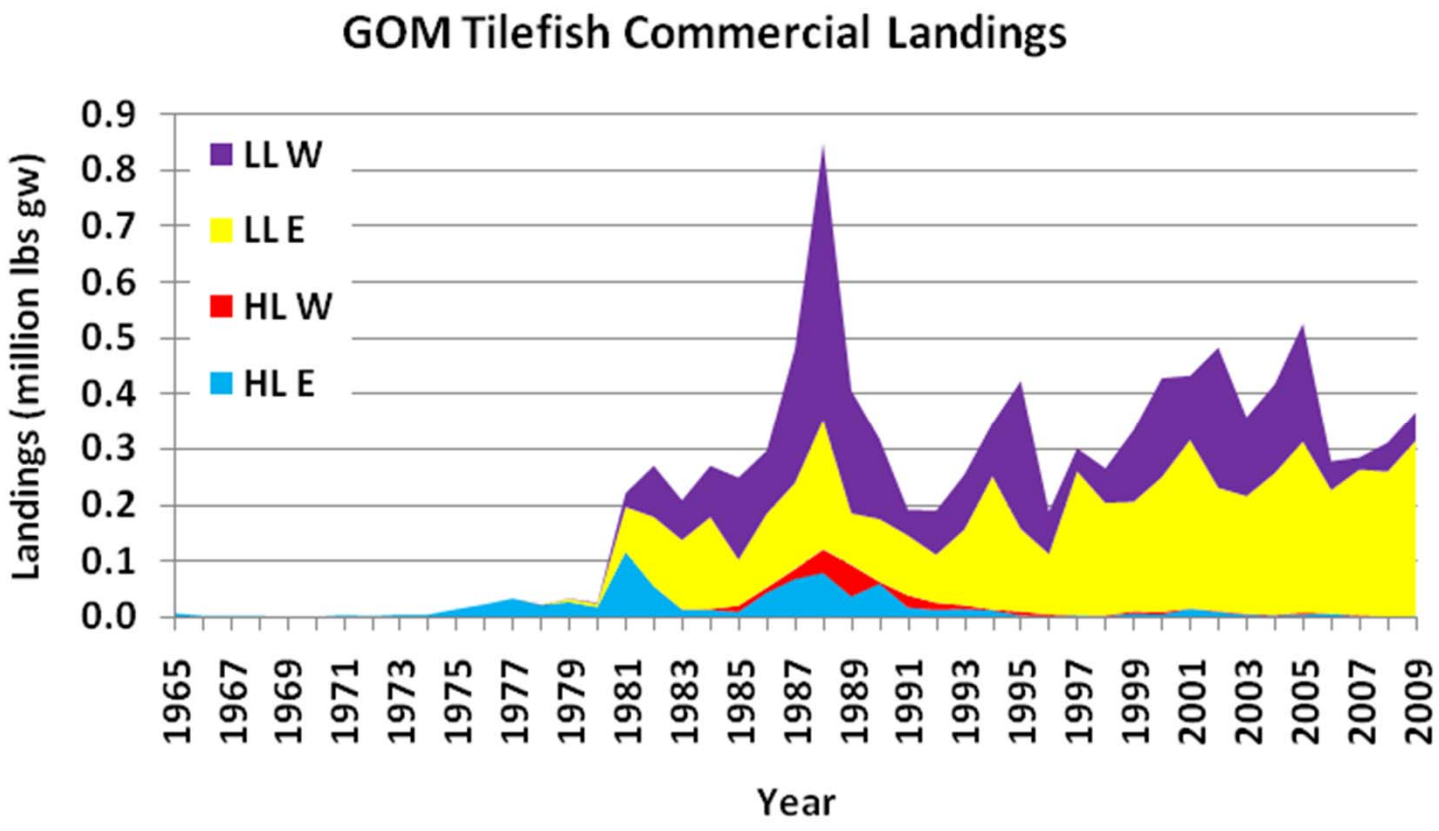
Commercial Landings



Recreational Landings (lbs gw)

Separated by region according to state landed

Added to Com. HL landings

Year	Rec E	Rec W
1987	291	0
1988	0	0
1989	0	0
1990	3,523	0
1991	0	0
1992	0	2
1993	0	0
1994	0	0
1995	2	0
1996	0	0
1997	0	0
1998	0	5
1999	0	0
2000	0	0
2001	0	1
2002	0	0
2003	0	0
2004	0	0
2005	4,197	0
2006	0	0
2007	0	0
2008	0	68
2009	0	0

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Commercial Discards (numbers)

Pooled due to confidentiality restrictions

Added to Com. landings

Year	CM HL	CM LL
2002		
2003		
2004		
2005	981	3,509
2006		
2007		
2008		
2009		

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AGE & LENGTH COMPOSITIONS

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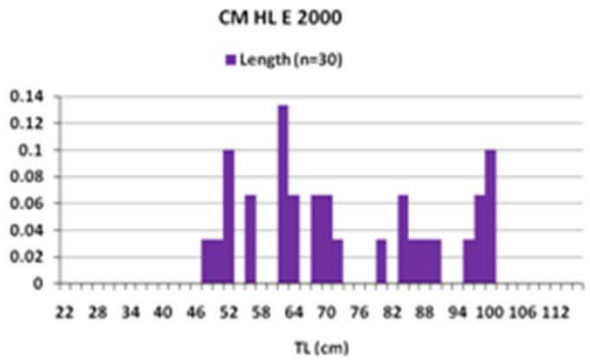
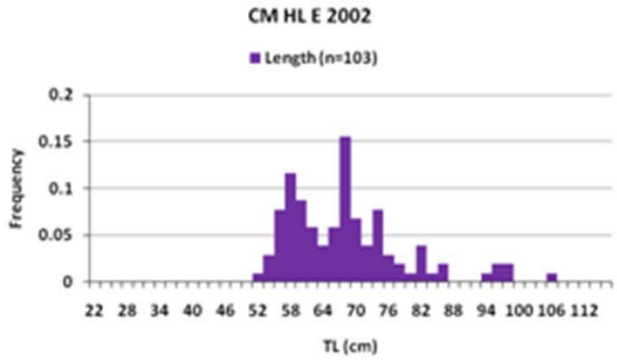
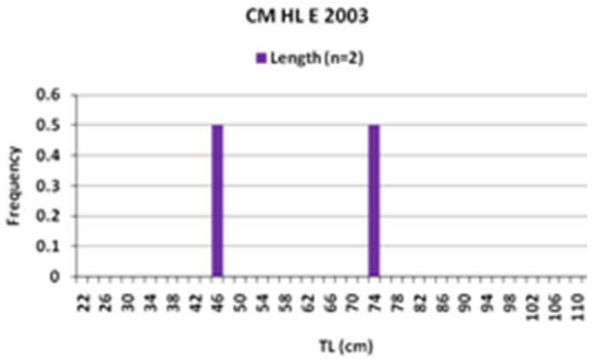
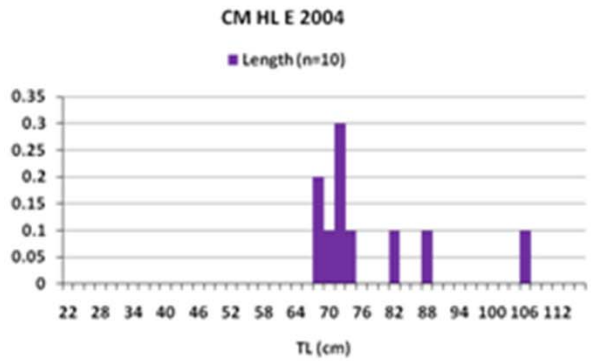
Length Composition

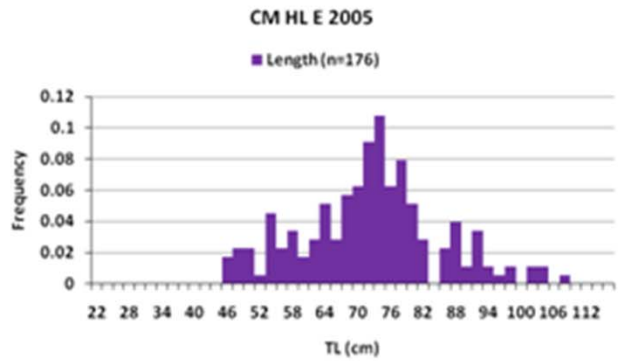
- Used TIP length data
- Aggregated in 2 cm size bins ranging from 20-114 cm
- Stratified by
  - fishery/survey
  - region
  - gender
- Maximum effective sample size set at 200

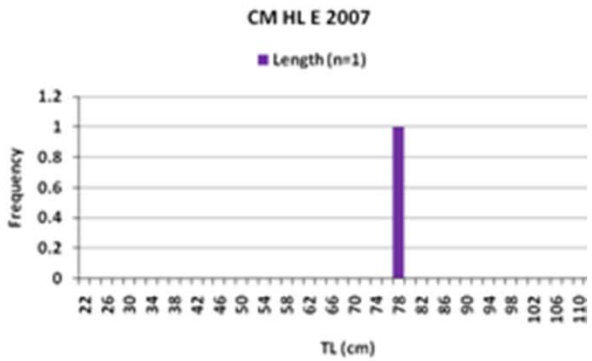

CM HL E 2000
Length (n=30)
TL (cm)

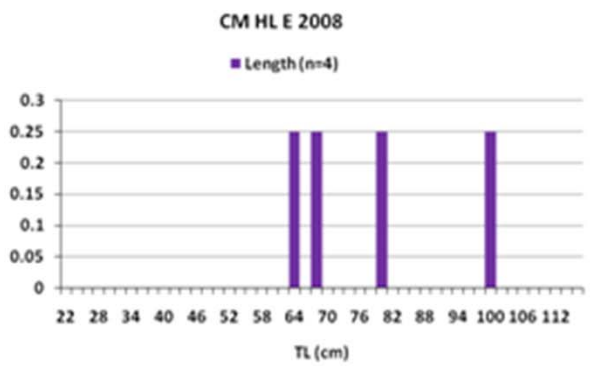

CM HL E 2002
Length (n=103)
Frequency
TL (cm)

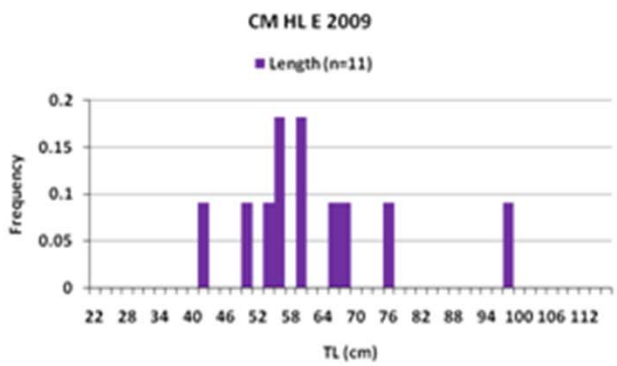

CM HL E 2003
Length (n=2)
Frequency
TL (cm)

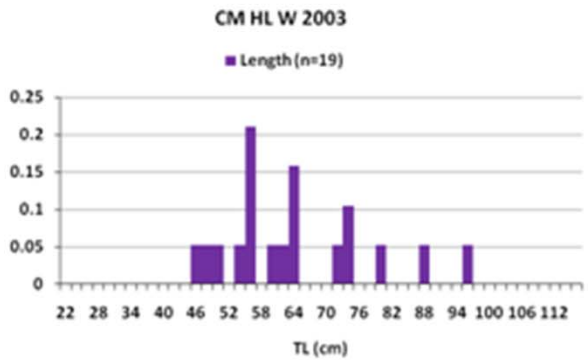

CM HL E 2004
Length (n=10)
TL (cm)

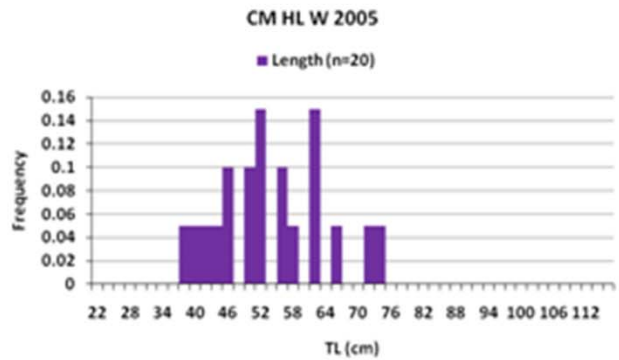

CM HL E 2005
Length (n=176)
Frequency
TL (cm)

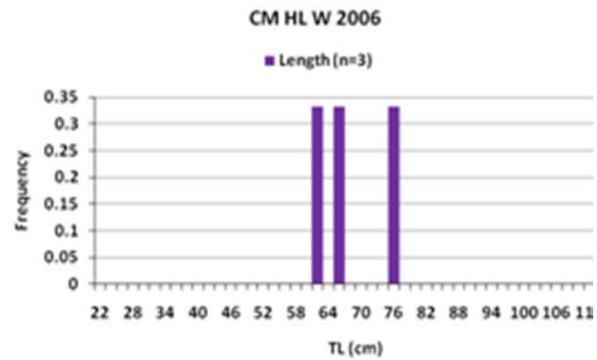

CM HL E 2007
Length (n=1)
Frequency
TL (cm)


CM HL E 2008
Length (n=4)
TL (cm)


CM HL E 2009
Length (n=11)
Frequency
TL (cm)


CM HL W 2003
Length (n=19)
0.25
0.2
0.15
0.1
0.05
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM HL W 2005
Length (n=20)
Frequency
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM HL W 2006
Length (n=3)
Frequency
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0.3
0.25
0.2
0.15
0.1
0.05
0
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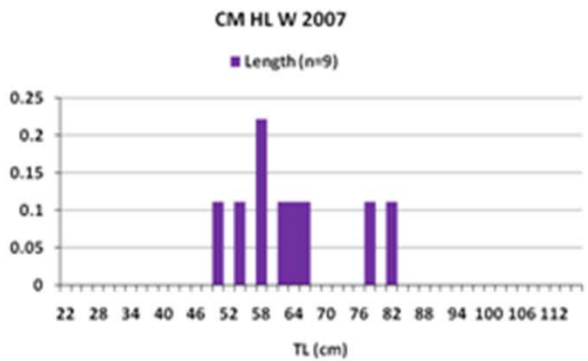
TL (cm)


CM HL W 2007
Length (n=9)
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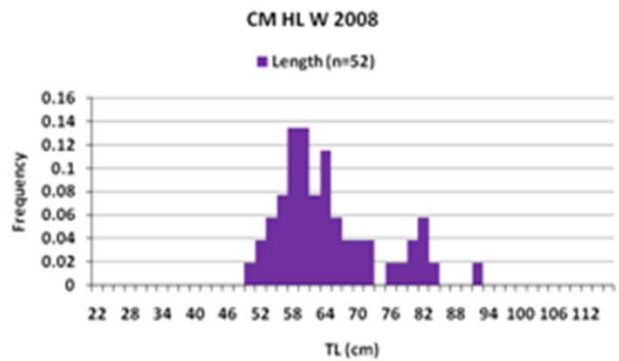
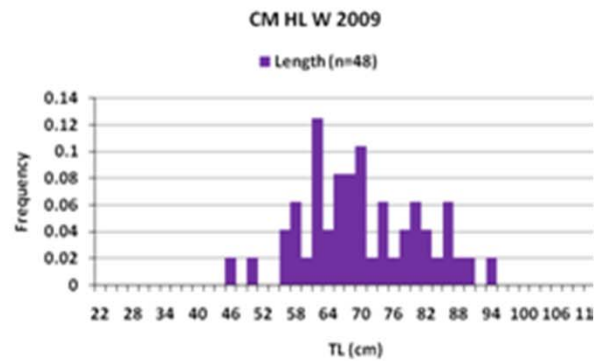
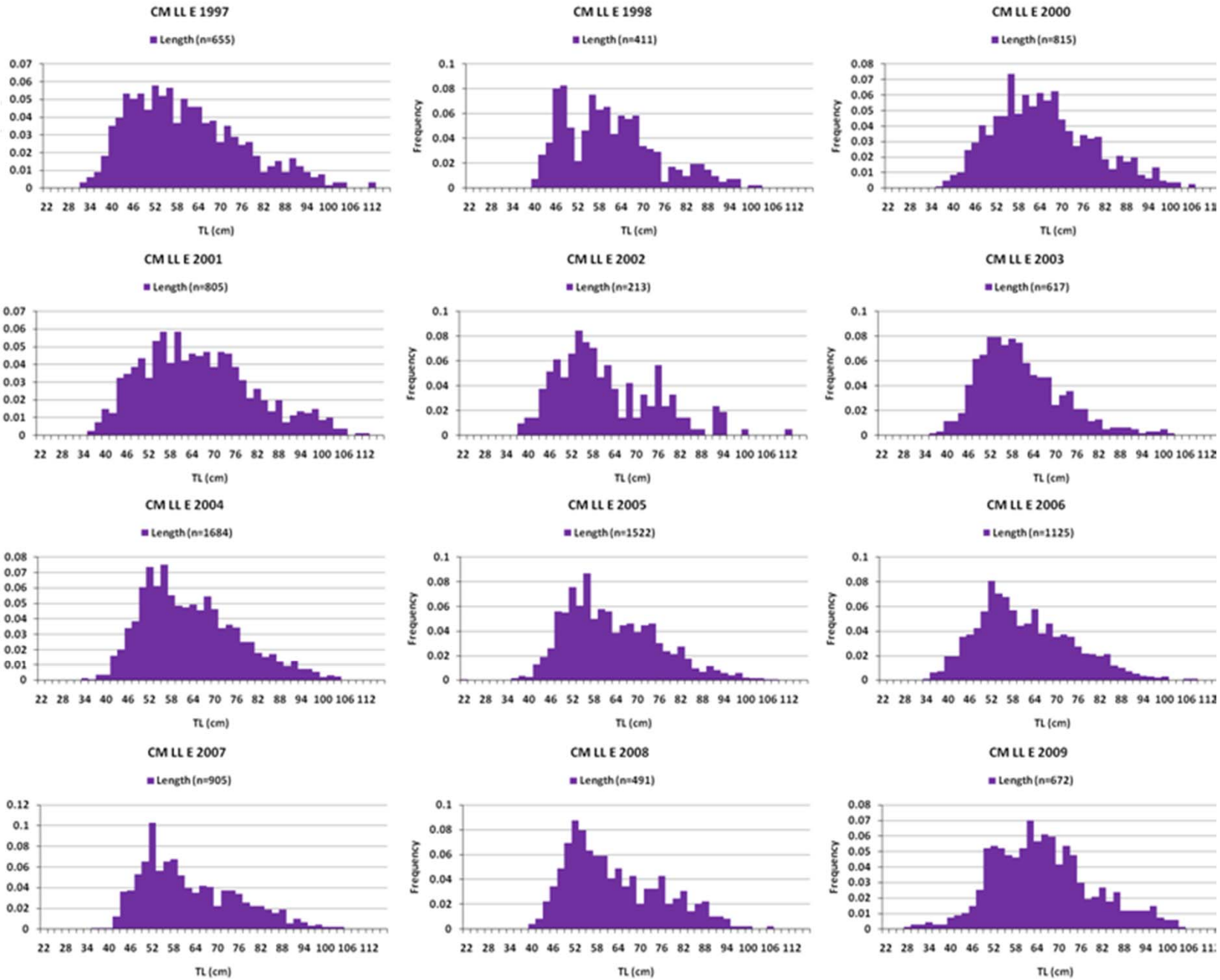
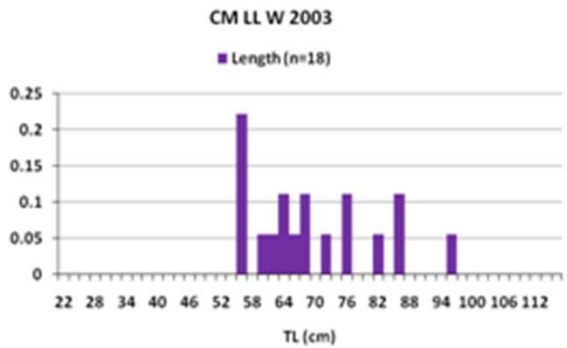
0.2
0.15
0.1
0.05
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM HL W 2008
Length (n=52)
Frequency
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM HL W 2009
Length (n=48)
Frequency
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 11
TL (cm)


CM LL E 1997
Length (n=655)
CM LL E 1998
Length (n=411)
CM LL E 2000
Length (n=815)
CM LL E 2001
Length (n=805)
CM LL E 2002
Length (n=213)
CM LL E 2003
Length (n=617)
CM LL E 2004
Length (n=1684)
CM LL E 2005
Length (n=1522)
CM LL E 2006
Length (n=1125)
CM LL E 2007
Length (n=905)
CM LL E 2008
Length (n=491)
CM LL E 2009
Length (n=672)
Frequency
TL (cm)


CM LL W 2003
Length (n=18)
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0.2
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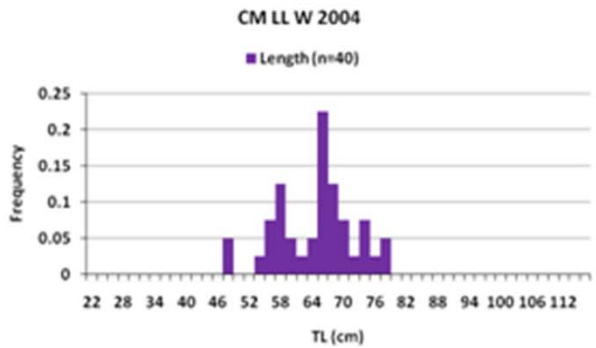
0.1
0.05
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM LL W 2004
Length (n=40)
Frequency
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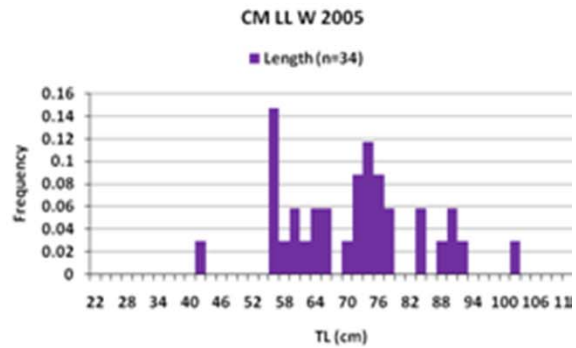
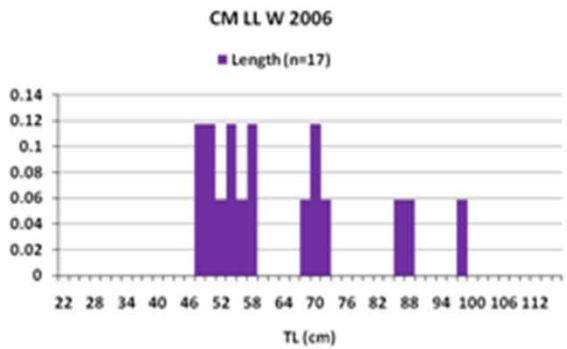
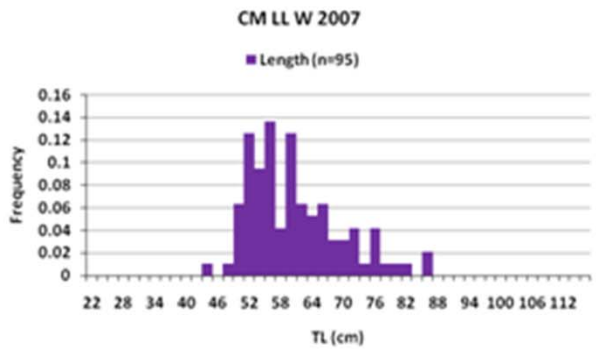
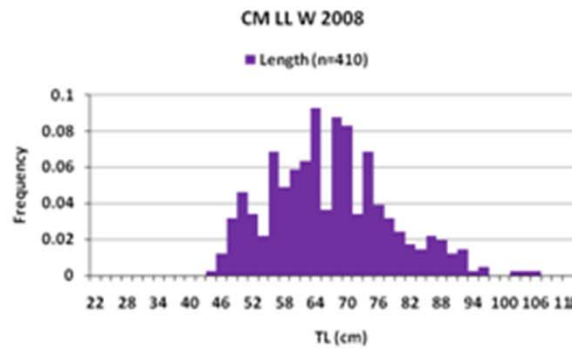
0.2
0.15
0.1
0.05
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM LL W 2005
Length (n=34)
Frequency
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106
TL (cm)


CM LL W 2006
Length (n=17)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM LL W 2007
Length (n=95)
Frequency
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)


CM LL W 2008
Length (n=410)
Frequency
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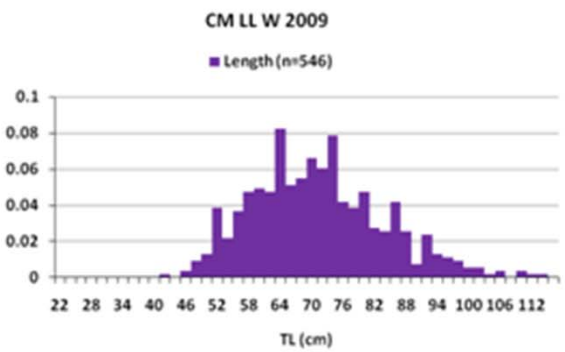
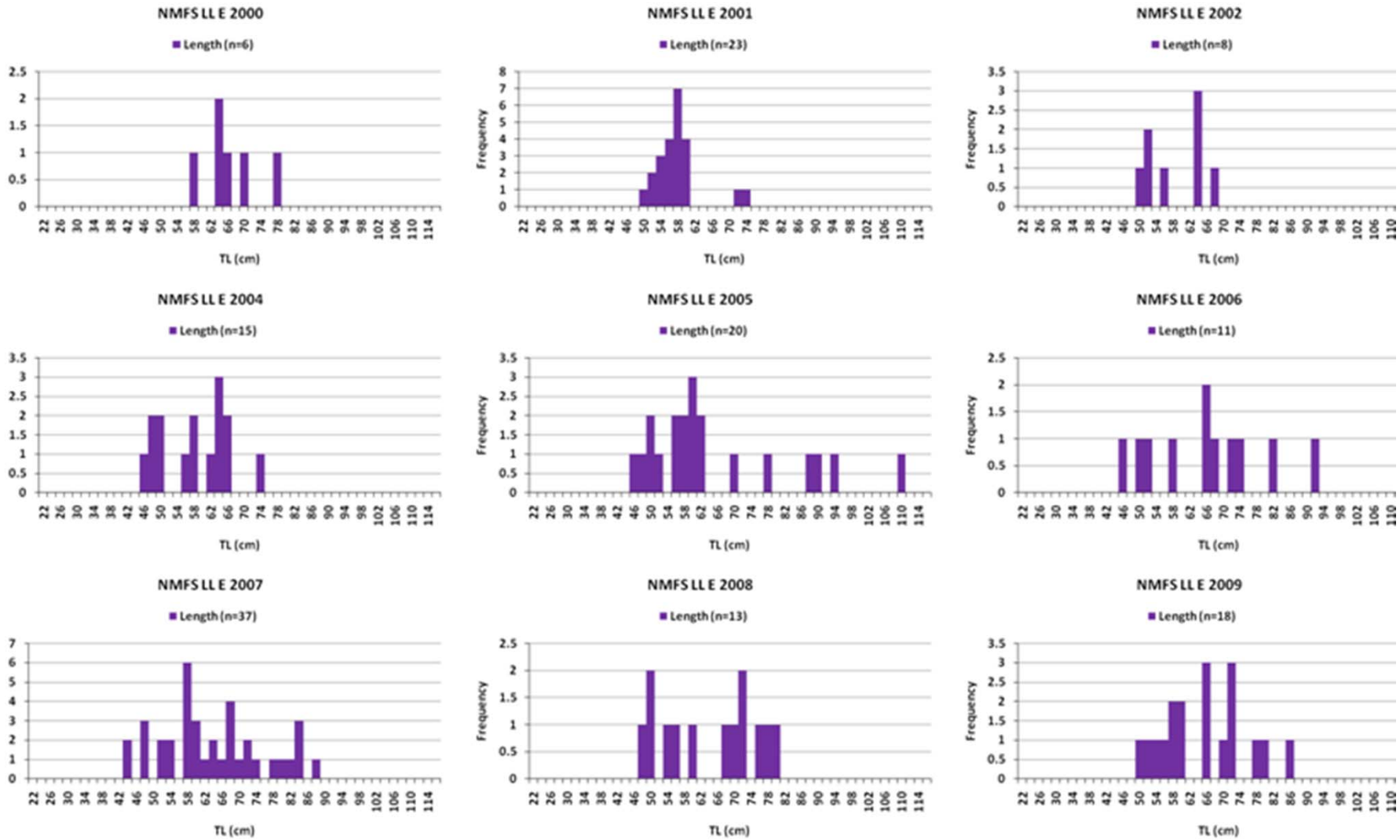
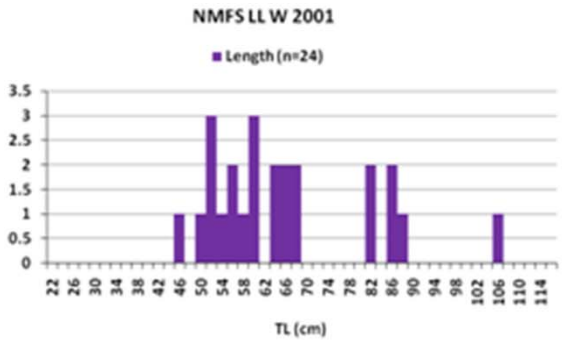
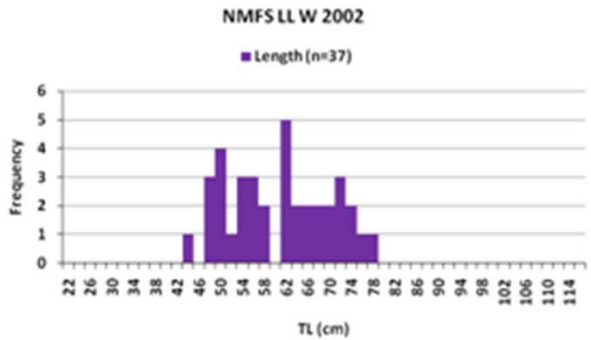
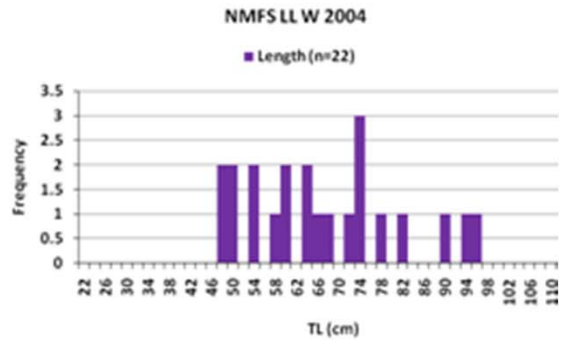
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106
TL (cm)

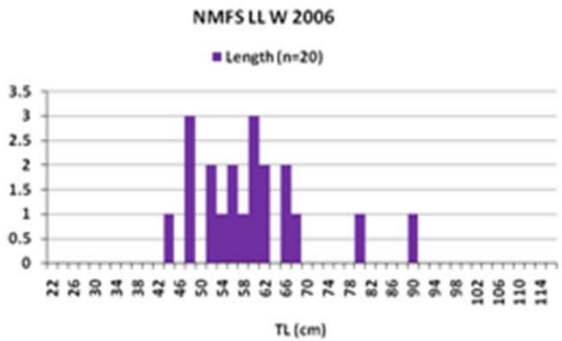

CM LL W 2009
Length (n=546)
0.1
0.08
0.06
0.04
0.02
0
22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112
TL (cm)

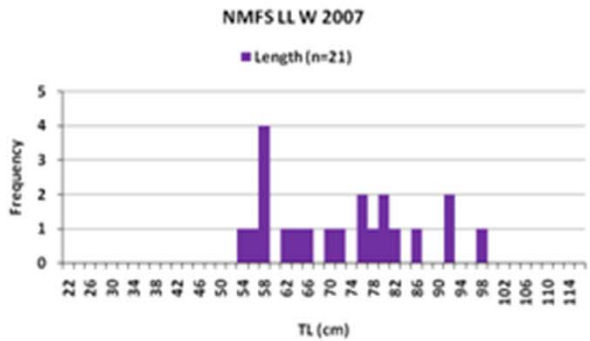

NMFS LL E 2000
Length (n=6)
NMFS LL E 2001
Length (n=23)
NMFS LL E 2002
Length (n=8)
NMFS LL E 2004
Length (n=15)
NMFS LL E 2005
Length (n=20)
NMFS LL E 2006
Length (n=11)
NMFS LL E 2007
Length (n=37)
NMFS LL E 2008
Length (n=13)
NMFS LL E 2009
Length (n=18)
Frequency
TL (cm)

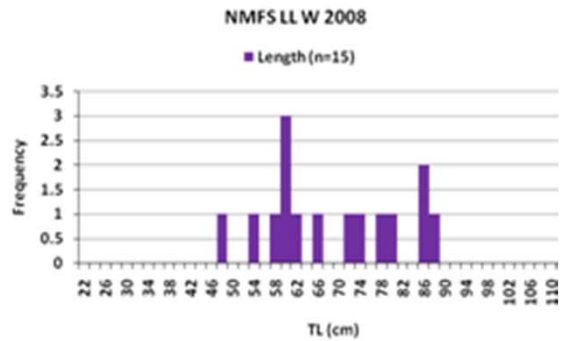

NMFS LL W 2001
Length (n=24)
TL (cm)

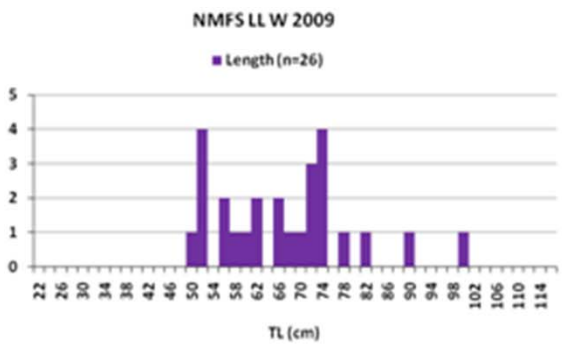

NMFS LL W 2002
Length (n=37)
Frequency
TL (cm)


NMFS LL W 2004
Length (n=22)
Frequency
TL (cm)


NMFS LL W 2006
Length (n=20)
TL (cm)


NMFS LL W 2007
Length (n=21)
Frequency
TL (cm)


NMFS LL W 2008
Length (n=15)
Frequency
TL (cm)


NMFS LL W 2009
Length (n=26)
TL (cm)

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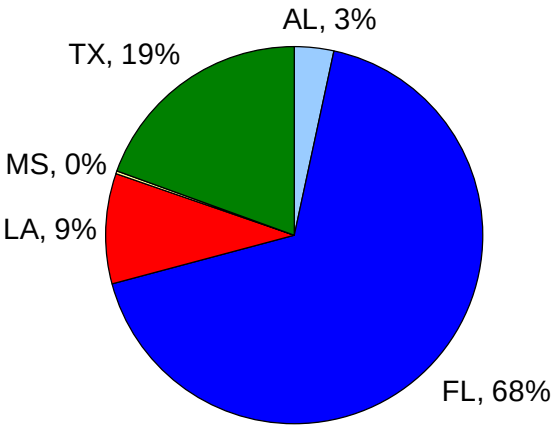
Age Composition

- 4841 otoliths (1985, 1997-2009)
- 93% years 2003-2009
- 68% Florida federal waters
- 92% commercial longline



- Indices of Precision

  APE 11%

  Percent Agreement 77% ± 3 years

- Validation: lead-radium (^{210}Pb:^{226}Ra) radiometric analysis
  - Good agreement majority age groups, except age 10-14 yr males

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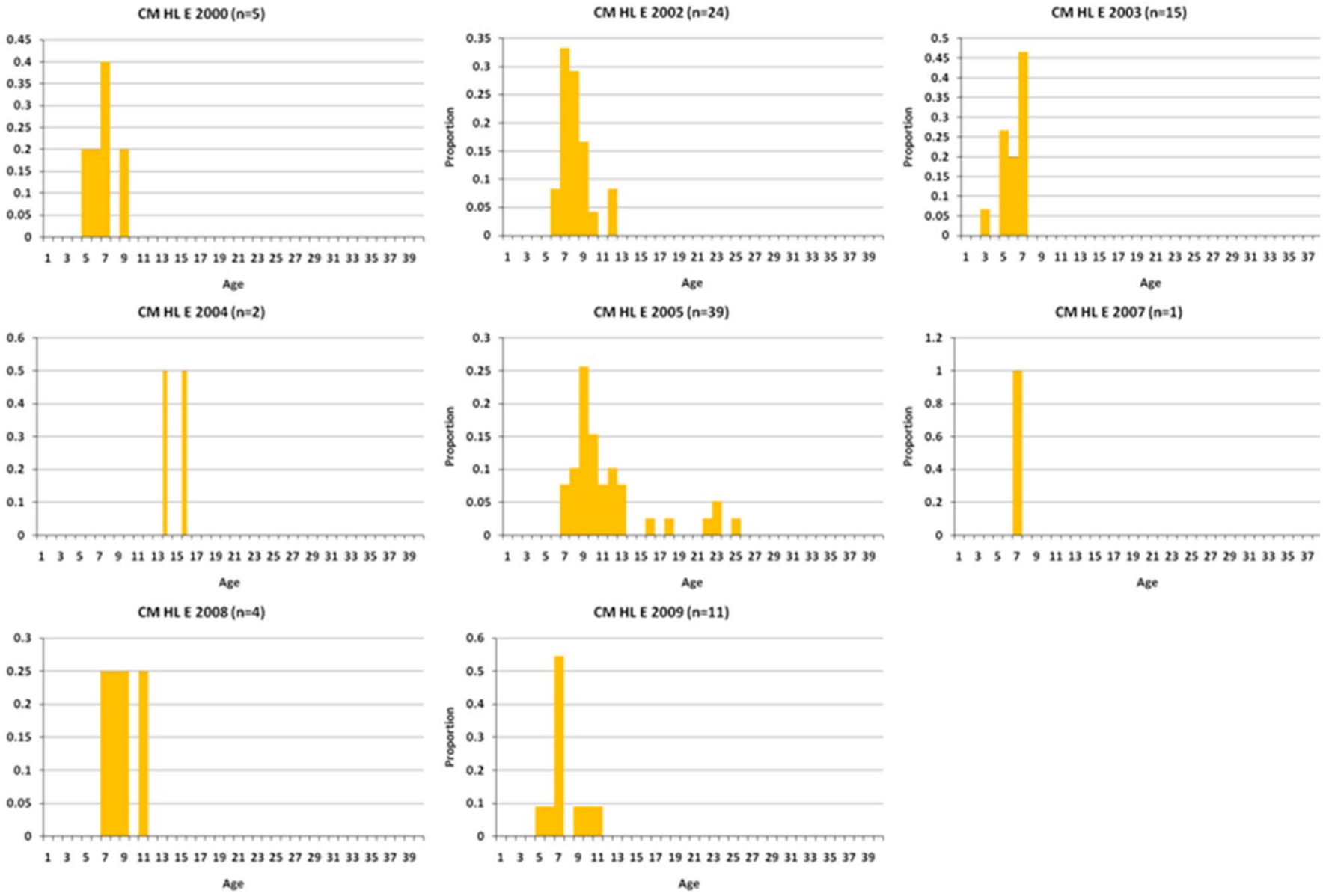
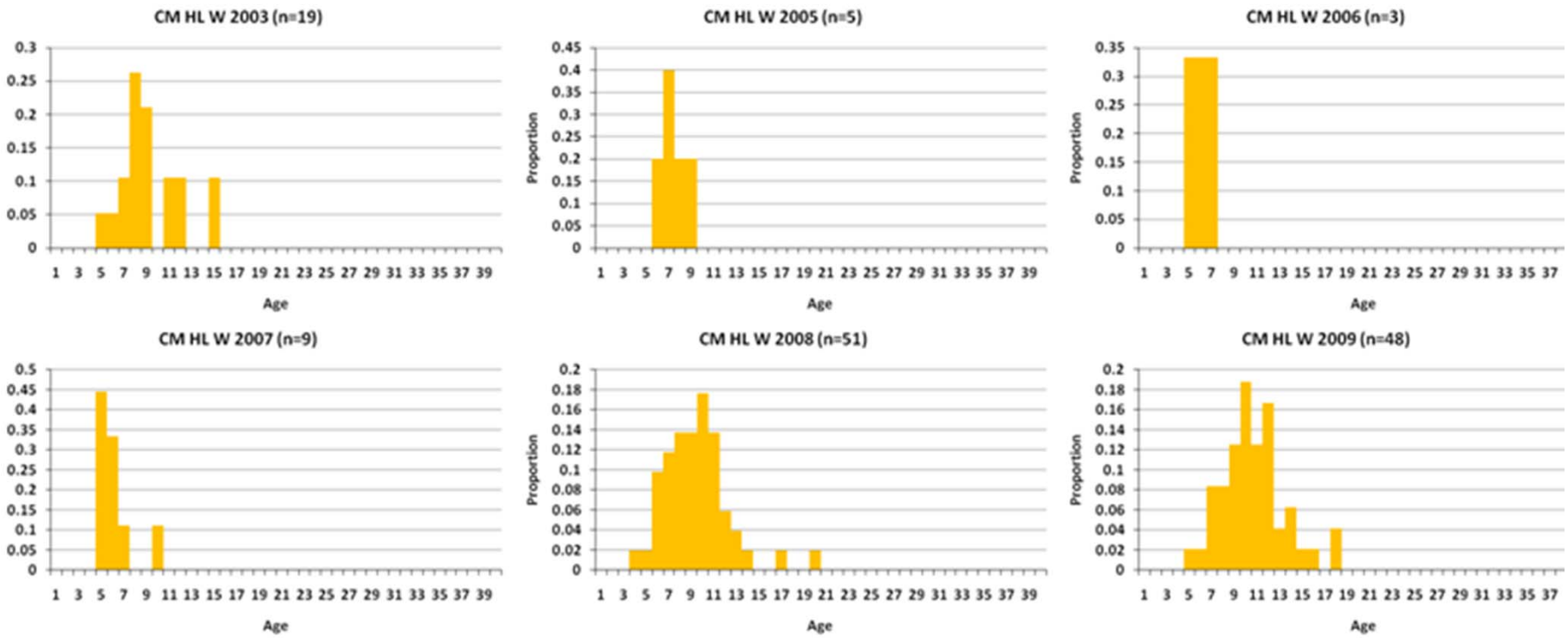
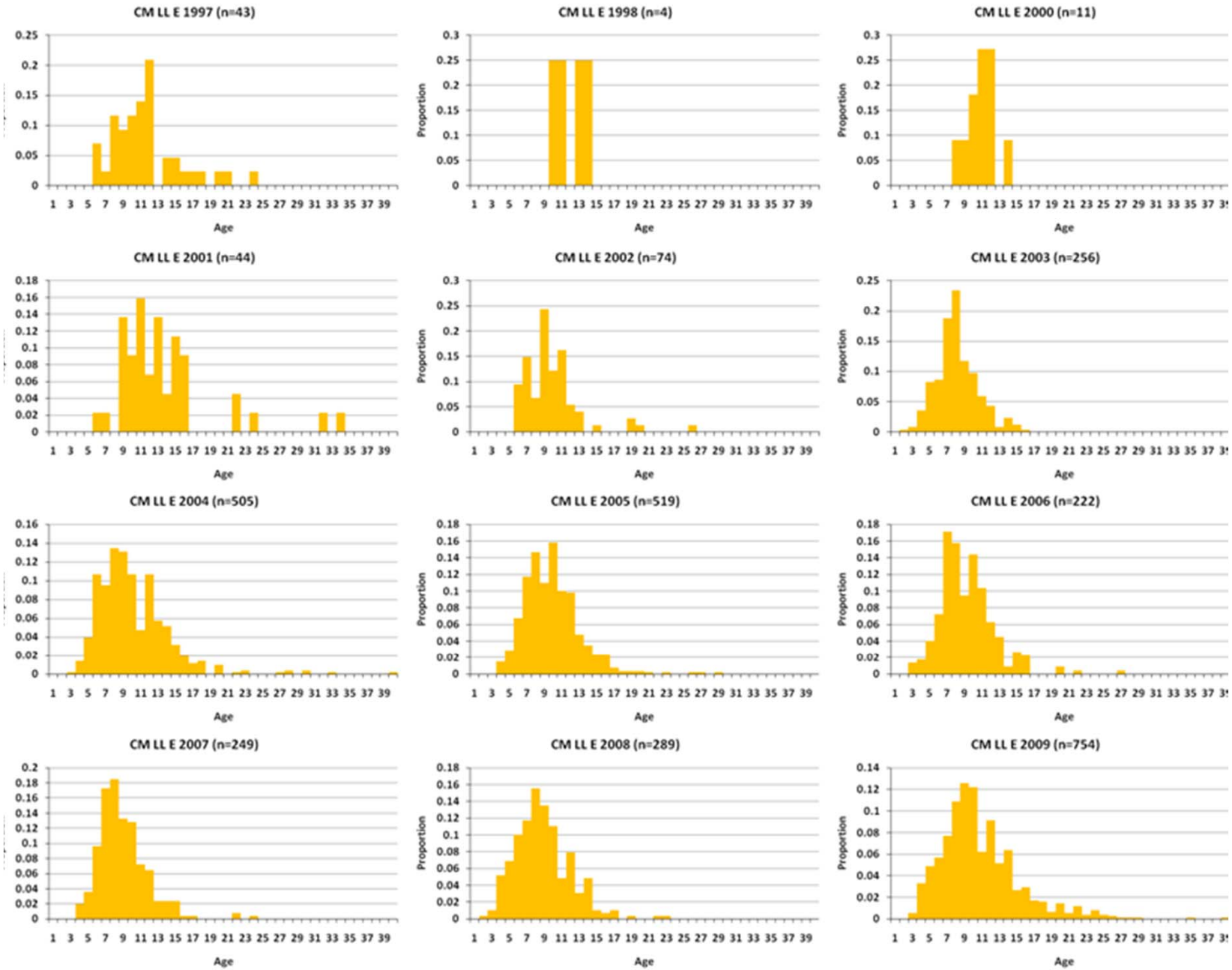
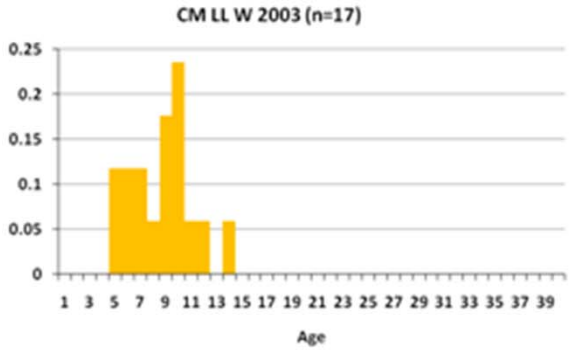
Age Composition

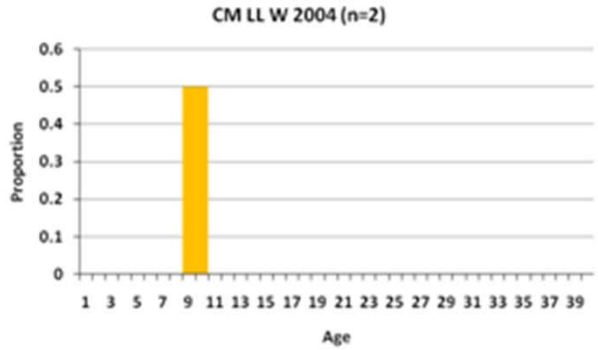
- Used TIP age data
- Age 30+ plus group
- Age composition conditional on length
- Stratified by
  - fishery/survey
  - region
  - gender
- Maximum effective sample size of 100

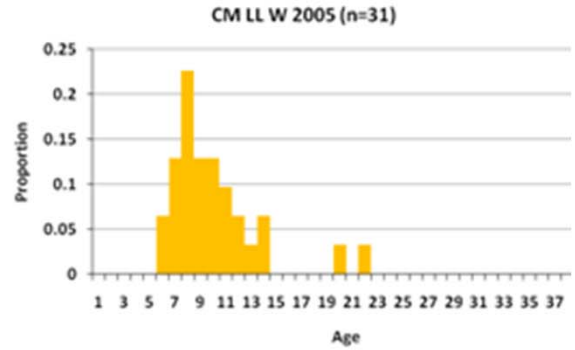

CM HL E 2000 (n=5)
CM HL E 2002 (n=24)
CM HL E 2003 (n=15)
CM HL E 2004 (n=2)
CM HL E 2005 (n=39)
CM HL E 2007 (n=1)
CM HL E 2008 (n=4)
CM HL E 2009 (n=11)
Proportion
Age

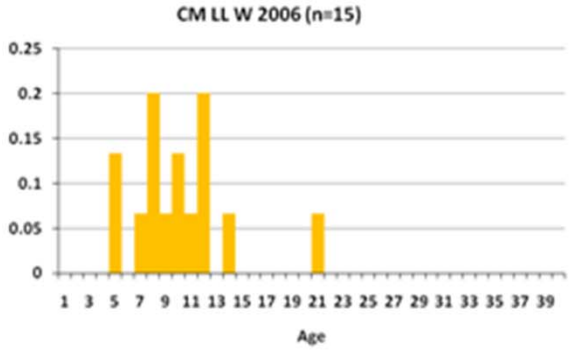

CM HL W 2003 (n=19)
CM HL W 2005 (n=5)
CM HL W 2006 (n=3)
CM HL W 2007 (n=9)
CM HL W 2008 (n=51)
CM HL W 2009 (n=48)
Proportion
Age

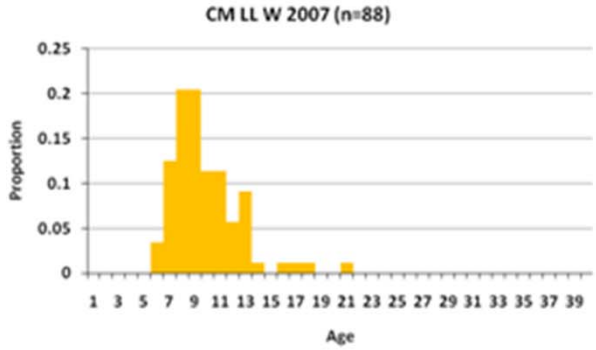

CM LL E 1997 (n=43)
CM LL E 1998 (n=4)
CM LL E 2000 (n=11)
CM LL E 2001 (n=44)
CM LL E 2002 (n=74)
CM LL E 2003 (n=256)
CM LL E 2004 (n=505)
CM LL E 2005 (n=519)
CM LL E 2006 (n=222)
CM LL E 2007 (n=249)
CM LL E 2008 (n=289)
CM LL E 2009 (n=754)
Proportion
Age

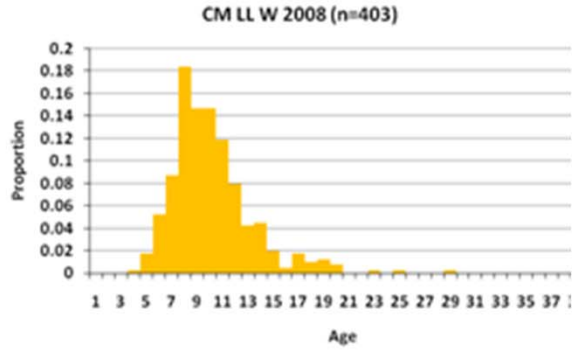

CM LL W 2003 (n=17)
Age

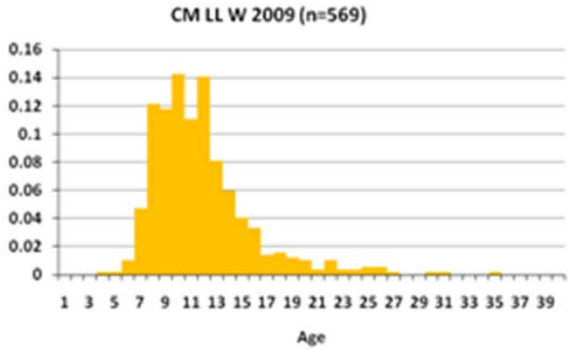

CM LL W 2004 (n=2)
Proportion
Age

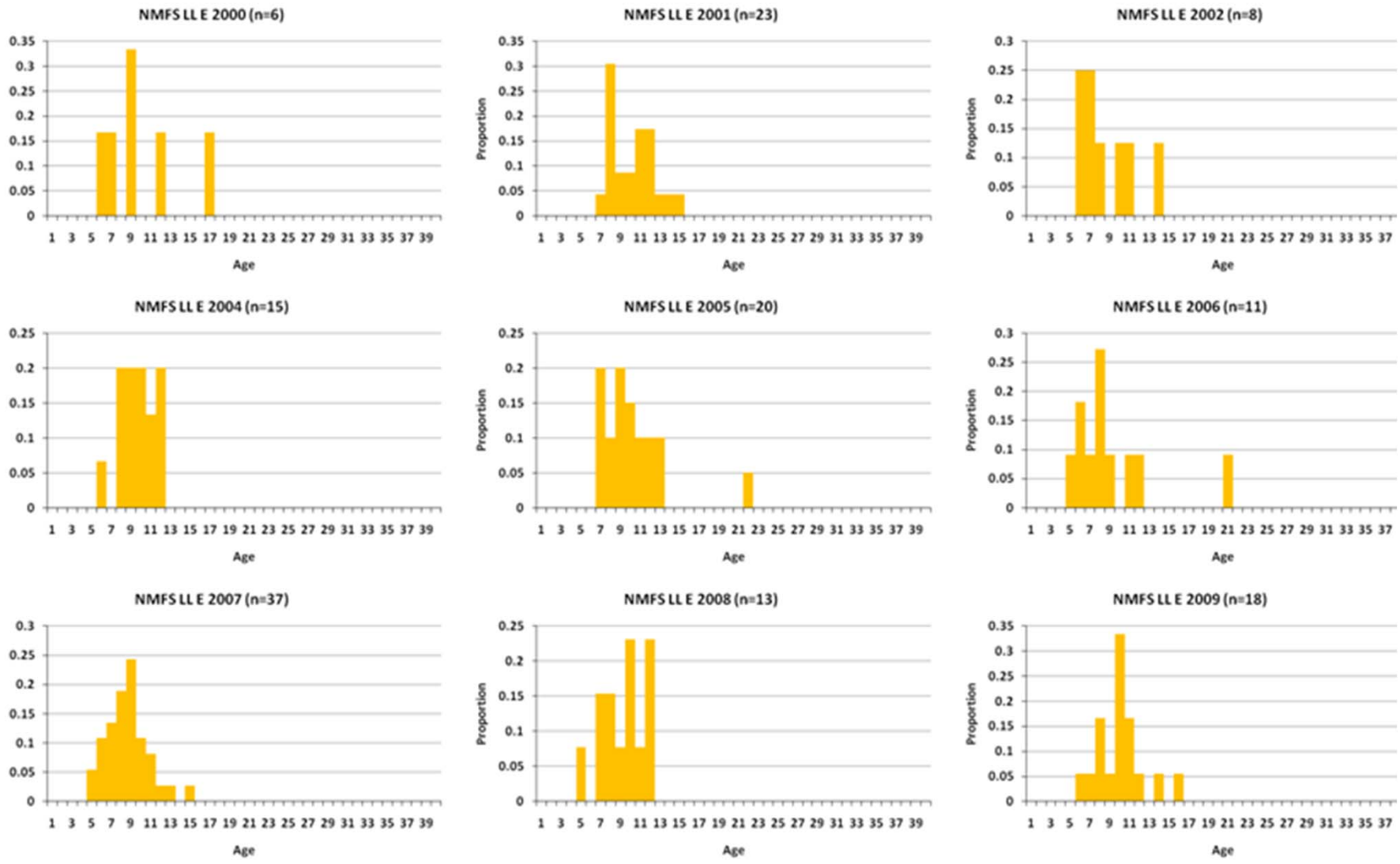

CM LL W 2005 (n=31)
Proportion
Age

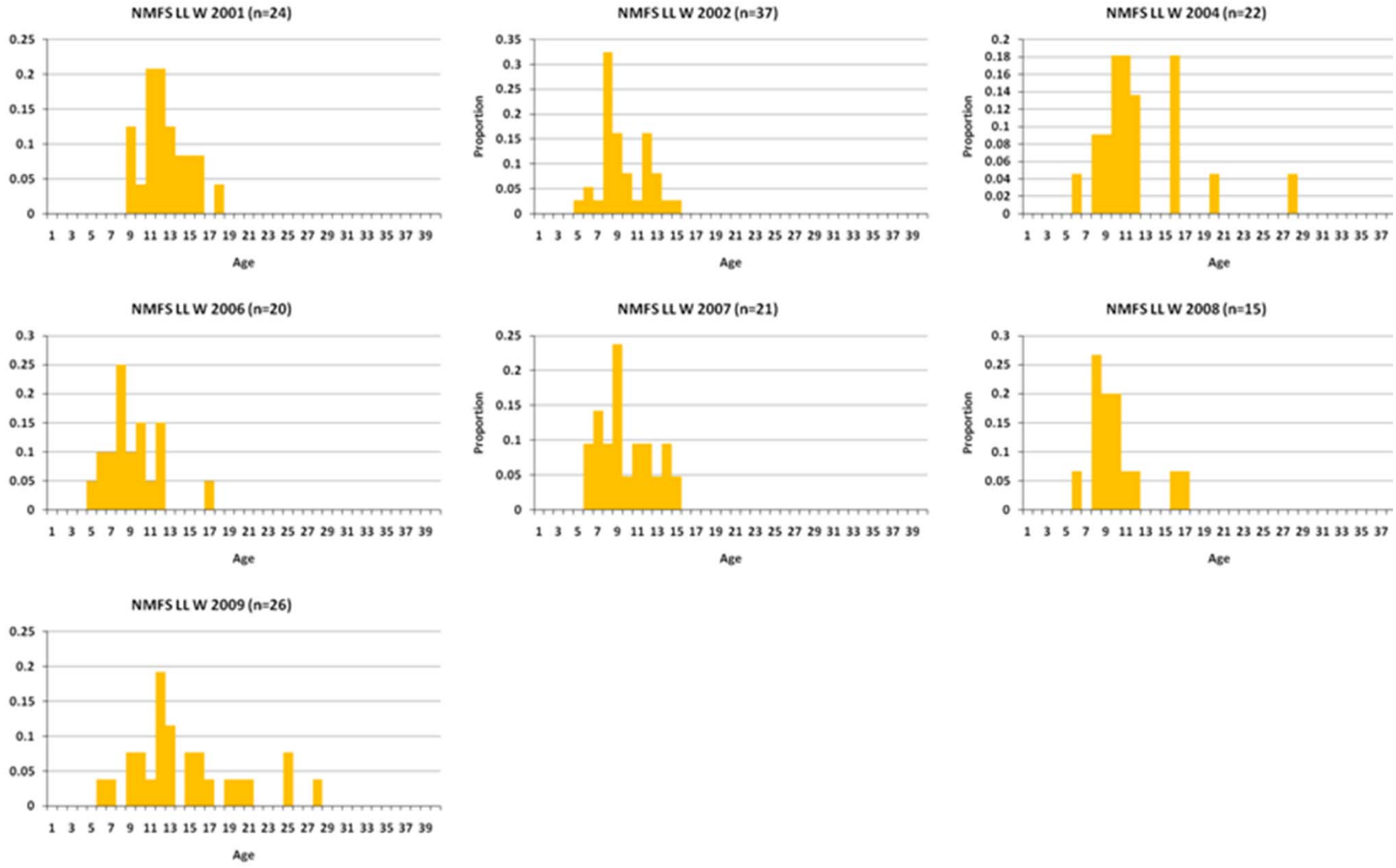

CM LL W 2006 (n=15)
Age


CM LL W 2007 (n=88)
Proportion
Age


CM LL W 2008 (n=403)
Proportion
Age


CM LL W 2009 (n=569)
Age


NMFS LL E 2000 (n=6)
NMFS LL E 2001 (n=23)
NMFS LL E 2002 (n=8)
NMFS LL E 2004 (n=15)
NMFS LL E 2005 (n=20)
NMFS LL E 2006 (n=11)
NMFS LL E 2007 (n=37)
NMFS LL E 2008 (n=13)
NMFS LL E 2009 (n=18)
Proportion
Age


NMFS LL W 2001 (n=24)
NMFS LL W 2002 (n=37)
NMFS LL W 2004 (n=22)
NMFS LL W 2006 (n=20)
NMFS LL W 2007 (n=21)
NMFS LL W 2008 (n=15)
NMFS LL W 2009 (n=26)
Proportion
Age

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Age Estimation Error Matrix

Mean Age`	**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**
SD of Age`	**0.01**	**0.27**	**0.96**	**1.37**	**1.65**	**1.88**	**2.06**	**2.21**	**2.35**	**2.46**	**2.57**	**2.66**	**2.75**	**2.83**	**2.9**	**2.97**
Mean Age`	**16.5**	**17.5**	**18.5**	**19.5**	**20.5**	**21.5**	**22.5**	**23.5**	**24.5**	**25.5**	**26.5**	**27.5**	**28.5**	**29.5**	**30.5**	
SD of Age`	**3.04**	**3.1**	**3.16**	**3.21**	**3.26**	**3.31**	**3.36**	**3.4**	**3.44**	**3.48**	**3.52**	**3.56**	**3.6**	**3.63**	**3.67**	

SDs come from age estimation precision analysis

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INDICES OF ABUNDANCE

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Indices of Abundance

- Fishery-dependent indices
  - Commercial longline – east and west Gulf
- Fishery-independent indices
  - NMFS bottom longline survey – east and west Gulf

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Com LL Index - East

- Stephens & MacCall trip selection
- Delta-lognormal model

Type 3 Tests of Fixed Effects for Binomial Submodel

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
year	17	137	25.96	1.53	0.0752	0.0938
subregion	2	137	19.49	9.75	<.0001	0.0001
hk_dist1	2	137	11.18	5.59	0.0037	0.0046

Type 3 Tests of Fixed Effects for Lognormal Submodel

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
year	17	34	27.40	1.61	0.0525	0.1157
seadays	2	34	36.52	18.26	<.0001	<.0001
subregion	2	34	18.32	9.16	0.0001	0.0007

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Com LL Index - West

- Stephens & MacCall trip selection
- Delta-lognormal model

Type 3 Tests of Fixed Effects for Binomial Submodel

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
year	16	116	13.17	0.82	0.6601	0.6570
seadays	2	116	27.14	13.57	<.0001	<.0001
subregion	2	116	18.63	9.31	<.0001	0.0002

Type 3 Tests of Fixed Effects for Lognormal Submodel

Effect	Num DF	Den DF	Chi-Square	F Value	Pr > ChiSq	Pr > F
year	16	641	42.34	2.65	0.0004	0.0005
hk_dist1	2	641	47.18	23.59	<.0001	<.0001
subregion	2	641	25.76	12.88	<.0001	<.0001
crew1	1	641	21.39	21.39	<.0001	<.0001

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NMFS BLL Survey Index - Model

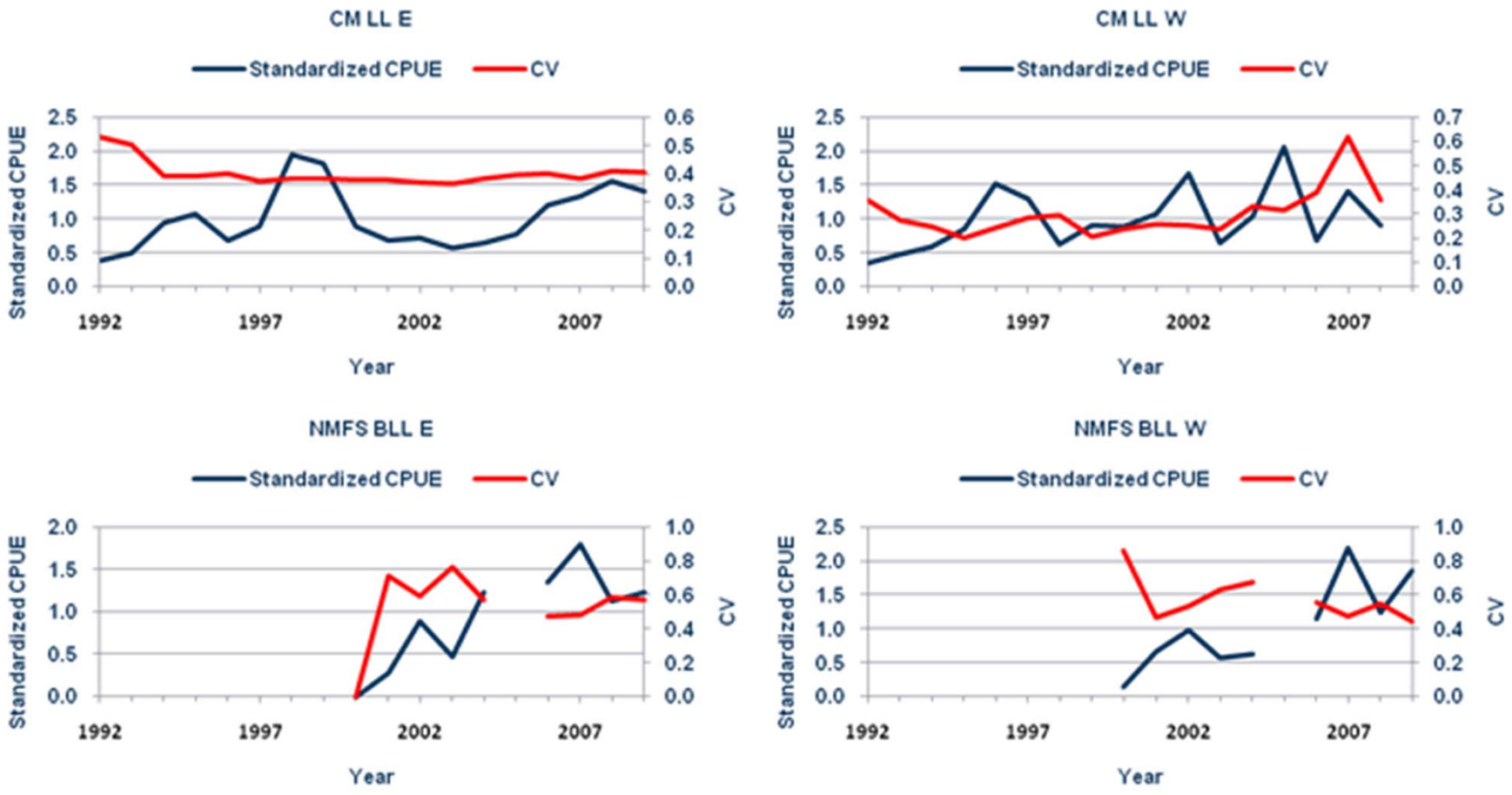
- Delta-lognormal model

Type 3 Tests of Fixed Effects for the Binomial Submodel for Golden Tilefish

Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
YEAR	8	221	12.07	1.51	0.1480	0.1552
Area	2	221	0.80	0.40	0.6707	0.6712
sta_dpth	1	221	32.99	32.99	<.0001	<.0001
Clay	1	221	1.80	1.80	0.1793	0.1807
Sorting	1	221	1.10	1.10	0.2944	0.2955
*YEAR*Area*	7	221	6.97	1.00	0.4318	0.4350

Type 3 Tests of Fixed Effects for the Lognormal Submodel for Golden Tilefish

Effect	*Num DF*	*Den DF*	*F Value*	*Pr > F*
YEAR	8	78	1.40	0.2087
Area	2	78	1.02	0.3658
sta_dpth	1	78	5.48	0.0218
*YEAR*Area*	7	78	0.90	0.5110


CM LL E
Standardized CPUE
CV
Standardized CPUE
CV
Year
CM LL W
Standardized CPUE
CV
Standardized CPUE
CV
Year
NMFS BLL E
Standardized CPUE
CV
Standardized CPUE
CV
Year
NMFS BLL W
Standardized CPUE
CV
Standardized CPUE
CV
Year

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LIFE HISTORY

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Life History

Stock Definition and Description

- Distribution: US from Maine to FL and throughout Gulf of Mexico
- One stock, possible some gene flow south Atlantic

Habitat & Behavior

- Soft, malleable sediment to make burrows
- Water temperature 9 – 14°C
- Depths 125 – 400 m

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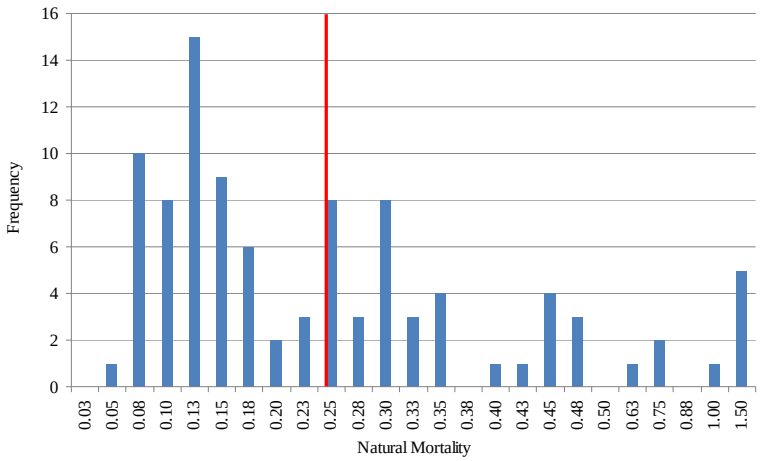
Life History

Natural Mortality (M)

- 12 regressions, 140 estimates
- Range M = 0.031 – 1.178

- 58 estimates below Z = 0.25
- Z estimated from catch curves



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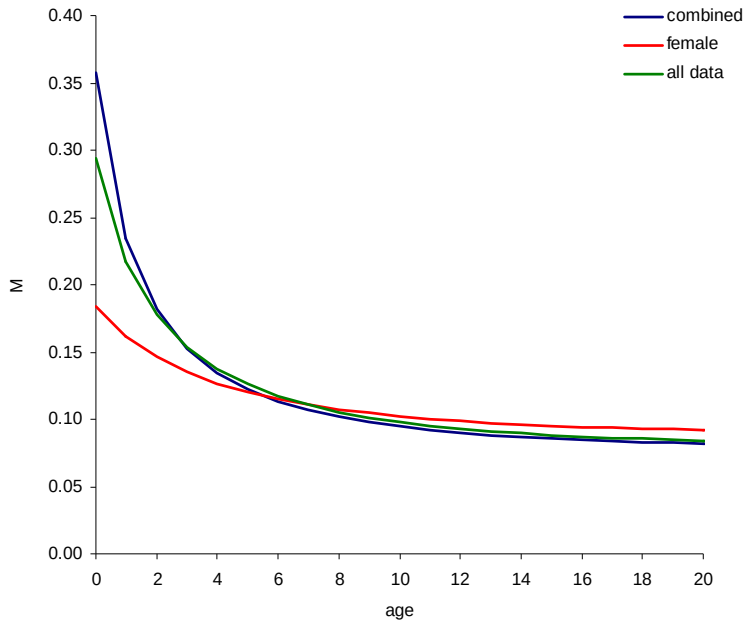
Life History

Mortality: Lorenzen Age and Sex Specific



point estimate

$Hoenig_{fish}$ M = 0.1038

(maximum age 40)

Discard Mortality

- 100%, given depths fished & condition at capture

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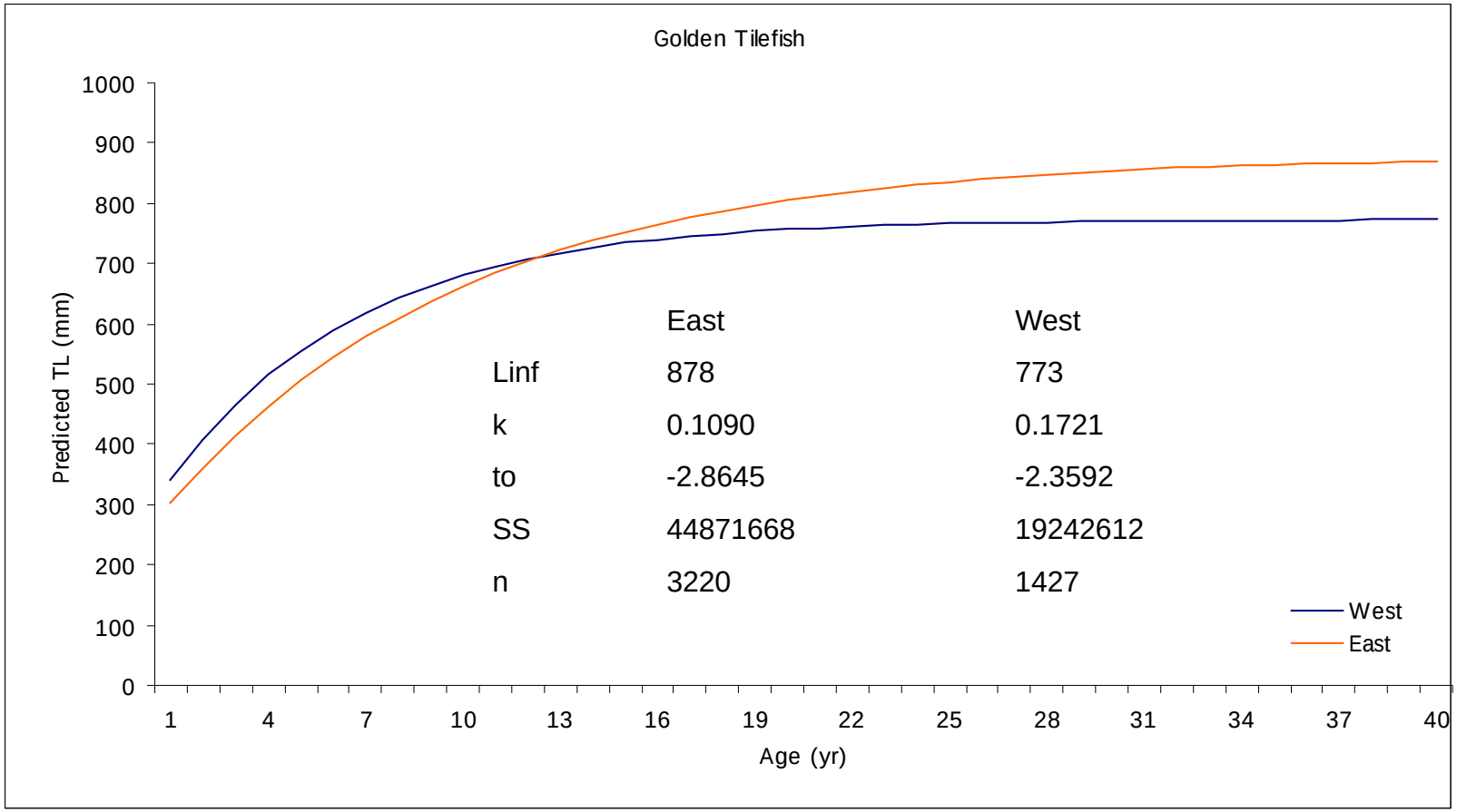
Life History

Growth



	East	West
Linf	878	773
k	0.1090	0.1721
to	-2.8645	-2.3592
SS	44871668	19242612
n	3220	1427

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Life History

Reproduction

Spawning season: January – June, peak April

50% Mature

- Age 2, 344 mm TL

Strategy: protogynous hermaphroditism?

- 62% of males with female tissue (all stages)
- 11% of females with male tissue

Size and Age at Transition

- 564 mm TL
- Age: inconclusive, males and females present each age class

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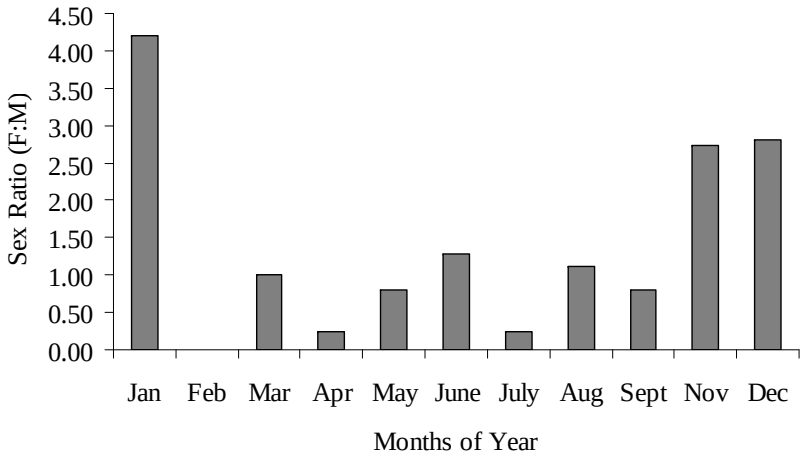
Life History

Reproduction

Sex Ratio

- Variation by Season



- Overall: 1: 1.57 (male:female)

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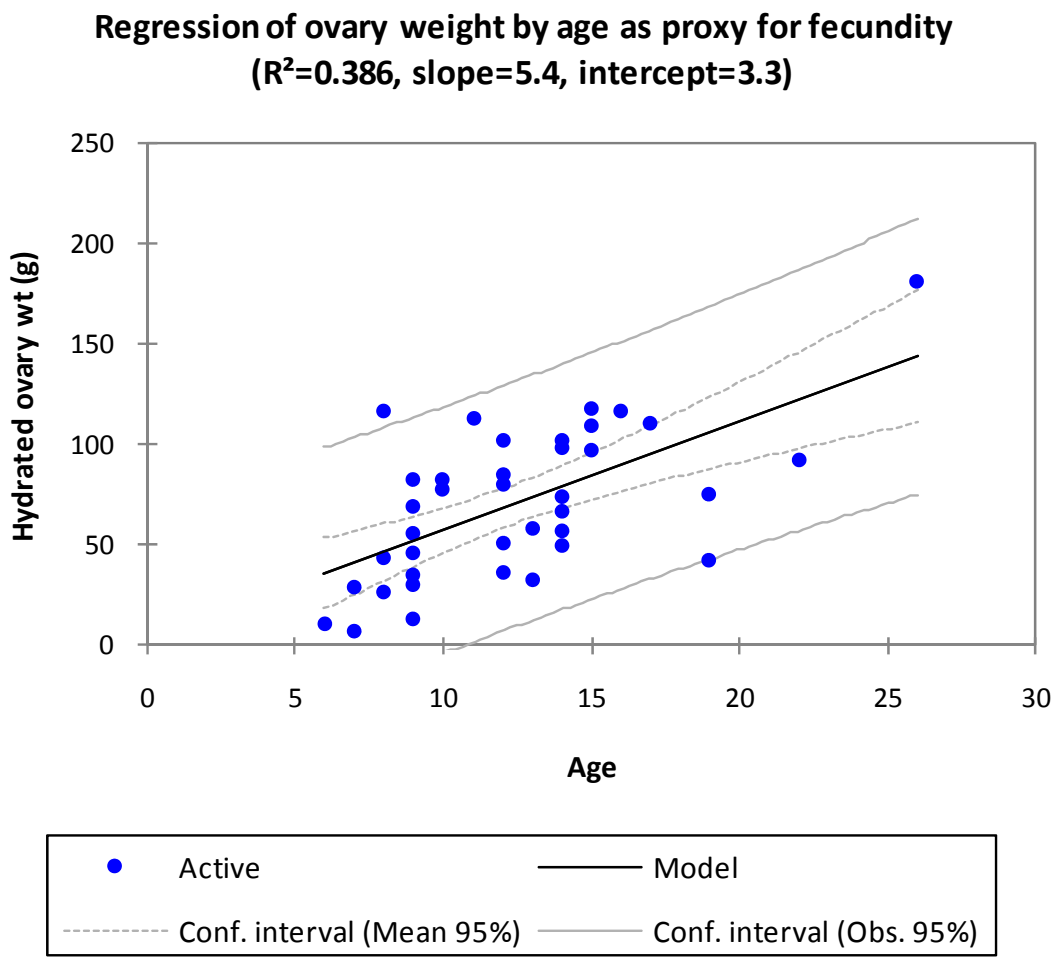
Life History

Reproduction

Used female gonad weight as proxy for SSB



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Life History

Movements and Migration

- Limited, experimental tagging NE Atlantic
- 384 tags deployed, 7 tag returns, at liberty 115-557 days, furthest distance traveled 1.9km