Length Frequency of Striped Marlin from the Hawaii-based Longline Fishery, 1994-2010

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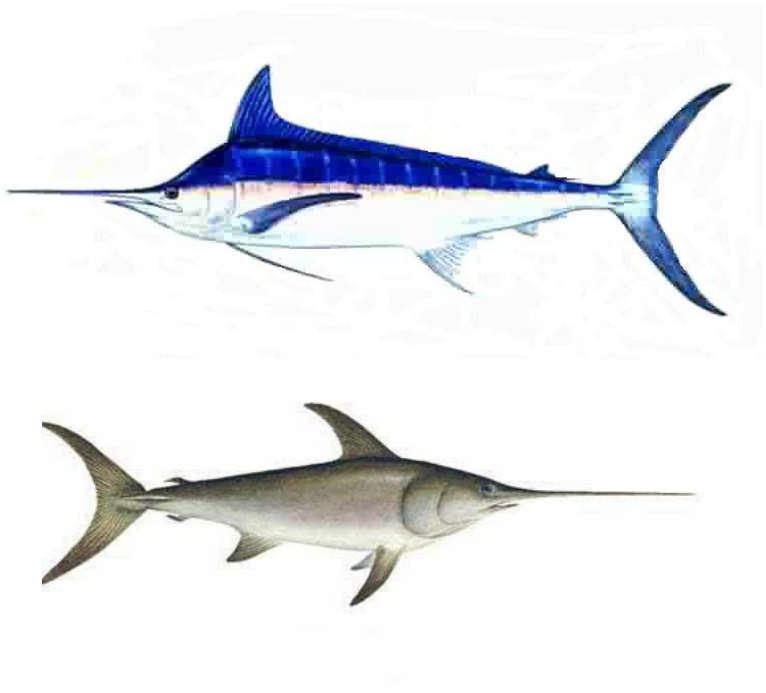

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Length Frequency of Striped Marlin (*Tetrapturus audax*) from the Hawaii-based Longline Fishery, 1994 – 2010[1]

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Abstract

This working paper summarizes quarterly length frequency data for striped marlin from the observed Hawaii-based pelagic longline fishery during the years 1994 – 2010. Length frequency data were combined for shallow-sets (i.e., < 15 hooks per float) and deep-sets (i.e., ≥ 15 hooks per float), because data from shallow sets were limited. Length frequency data were combined for males, females, and unknown sex, because sexually specific length frequency data were limited. Modal progression was evident in striped marlin quarterly length frequency in recent years. This might indicate the presence of strong recruitment events.

Introduction

This working paper summarizes quarterly length frequency data for striped marlin (*Tetrapturus audax*) from the observed Hawaii-based pelagic longline fishery during the years 1994 – 2010. In the Hawaii-based pelagic longline fishery, shallow-sets generally target swordfish (*Xiphias gladius*), while deep-sets target bigeye tuna (*Thunnus obesus*). Swordfish targeted shallow-sets typically begin in the late afternoon/evening, use relatively low numbers of hooks and hooks per float (i.e., < 15 hooks per float) and result in relatively shallow sets. In contrast, bigeye tuna targeted deep-sets typically begin around dawn, use relatively high numbers of hooks and hooks per float (i.e., ≥ 15 hooks per float) and result in relatively deeper sets.

Methods

Length frequency data were queried from the NOAA Hawaii Longline Observer Database System (LODS[2] September, 2010). Length data presented here were limited to "approved" sets. Data within approved sets were verified according to standards established by LODS. Length measurements were reported here as eye to fork length (EF) to the nearest centimeter (cm). Length frequency data were combined for shallow-sets (i.e., < 15 hooks per float) and deep-sets (i.e., ≥ 15 hooks per float), because data from shallow sets were limited. Length frequency data were combined for males, females, and unknown sex, because sexually specific length frequency data were limited.

[1] PIFSC Working Paper WP-11-002. Issued 5 January 2011.
[2] http://ias.pifsc.noaa.gov/lds/lods.html

Fish lengths were sampled from commercial catch on board fishing vessels by the Hawaii Longline Observer Program of NOAA Fisheries[3]. Observer coverage began in 1994 at about 5% (Appendix A). The percentage of commercial vessel fishing trips in the deep-set sector covered by NOAA observers increased to 20% after 2001. The percentage of commercial vessel fishing trips in the shallow-set sector covered by NOAA observers increased to 100% after 2004. An assumption is that the observed length frequency represents the length frequency of fish removed by the commercial fishery.

The Observer Program sampling design changed in 2004. All fish captured on observed sets were recorded to species, but only a subsample of captured fish were measured for length. Prior to April 2004, only target species were measured for length. After April 2004, every third **fish** encountered on an observed set was sampled for length regardless of species and regardless of whether or not the fish was intended to be kept by the fisher. Changes to the billfish length sampling design after April 2004 also resulted in the collection of additional information for each subsampled fish which allowed length measurements to be tied back to the individual hook location in LODS. Prior to April 2004, this information was not available. As a result, in LODS, swordfish length data collected after April 2004 are included in the "production" quality data released by LODS, while length data collected prior to April 2004 are stored in a separate "legacy" table. For this report, length data from LODS were necessarily queried separately for legacy (1994-2003) and recent production data (2004 – 2010) and then combined at the set level.

Management actions designed to reduce sea turtle interactions have resulted in effort restrictions in the shallow-set sector of the Hawaii-based pelagic longline fishery, but the management actions have not restricted the deep-set sector. Prior to December 23, 1999, the pelagic longline fishery was unrestricted. From December 23, 1999 to March 14, 2001, the pelagic longline fishery was subject to effort limitations, area restrictions, and increased observer coverage on the swordfish target sector (shallow-sets). From March 14, 2001 to April 2, 2004 there was a complete prohibition of Hawaii-based pelagic longline swordfish target sector. After April 2, 2004 until the present, the swordfish target sector has been allowed to resume under new guidelines that establish a turtle catch cap, and mandate 100% observer coverage. The turtle cap was reached in 2006 and the swordfish targeted sets were prohibited after March of 2006 for the remainder of the year. The turtle cap was not reached in 2005 or 2007 – 2010. However, striped marlin length frequency data from shallow sets were limited, and as a result, these management actions probably had a limited effect on the observed length frequency of striped marlin.

Results

Modal progression was evident in striped marlin quarterly length frequency in recent years (Figures 1 and 2).This might indicate the presence of strong recruitment events. Striped marlin length frequency differed somewhat between shallow and deep sets. Striped marlin length frequency was bimodal in deep sets and unimodal in shallow sets (Figure 3). Striped marlin length frequency did not appear to differ substantially between

[3] http://www.fpir.noaa.gov

males and females. The mode in female length frequency was only slightly larger than that of males (Figure 4). Most striped marlin length frequency data were from deep sets (Figures 5 – 8). Sexually specific length frequency data were extremely limited prior to 2005 (Figures 5 – 8).

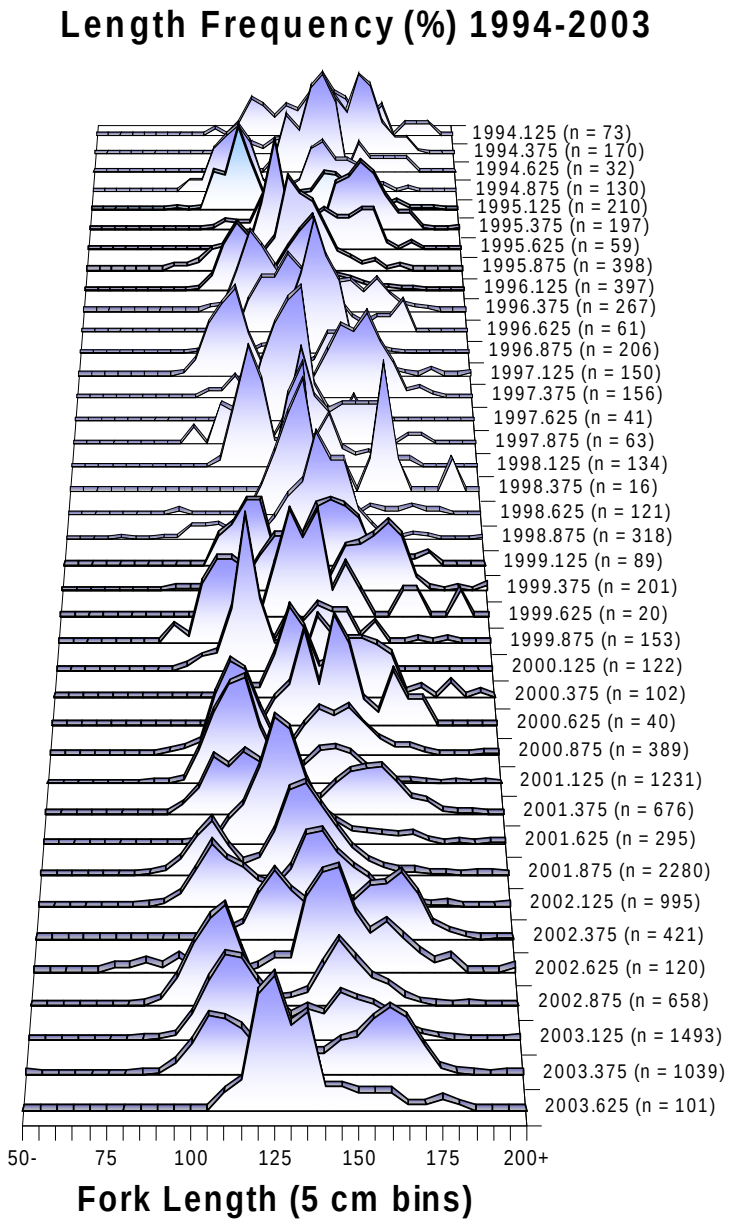

Figure 1. Observed striped marlin quarterly length frequency (%), 1994 – 2003, from Hawaii-based pelagic longline fishery for shallow-sets and deep-sets combined (mid-eye to fork, EF; females, males, and unknown sex combined).

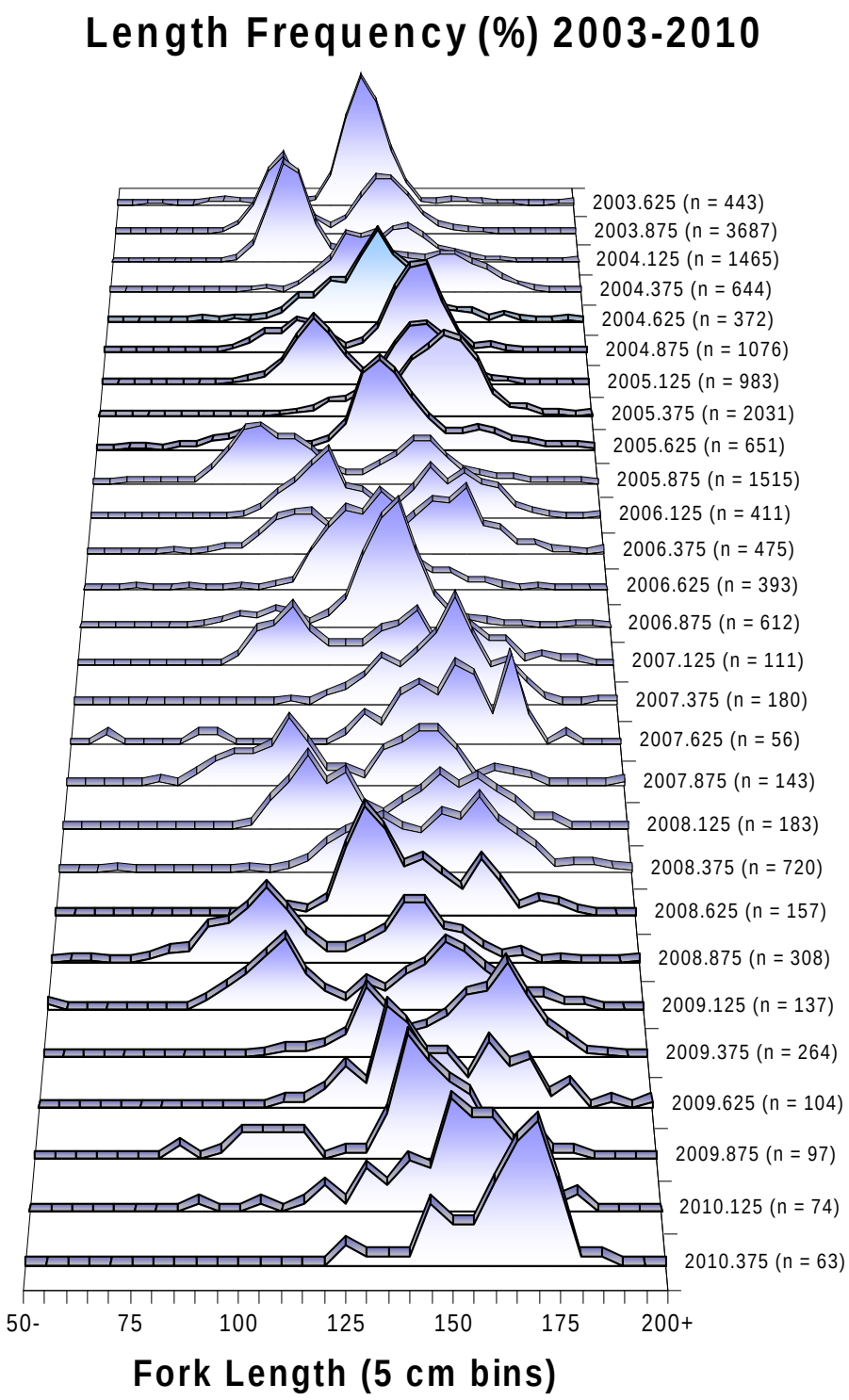

Figure 2. Observed striped marlin quarterly length frequency (%), 2003 – 2010, from Hawaii-based pelagic longline fishery for shallow-sets and deep-sets combined (mid-eye to fork, EF; females, males, and unknown sex combined).

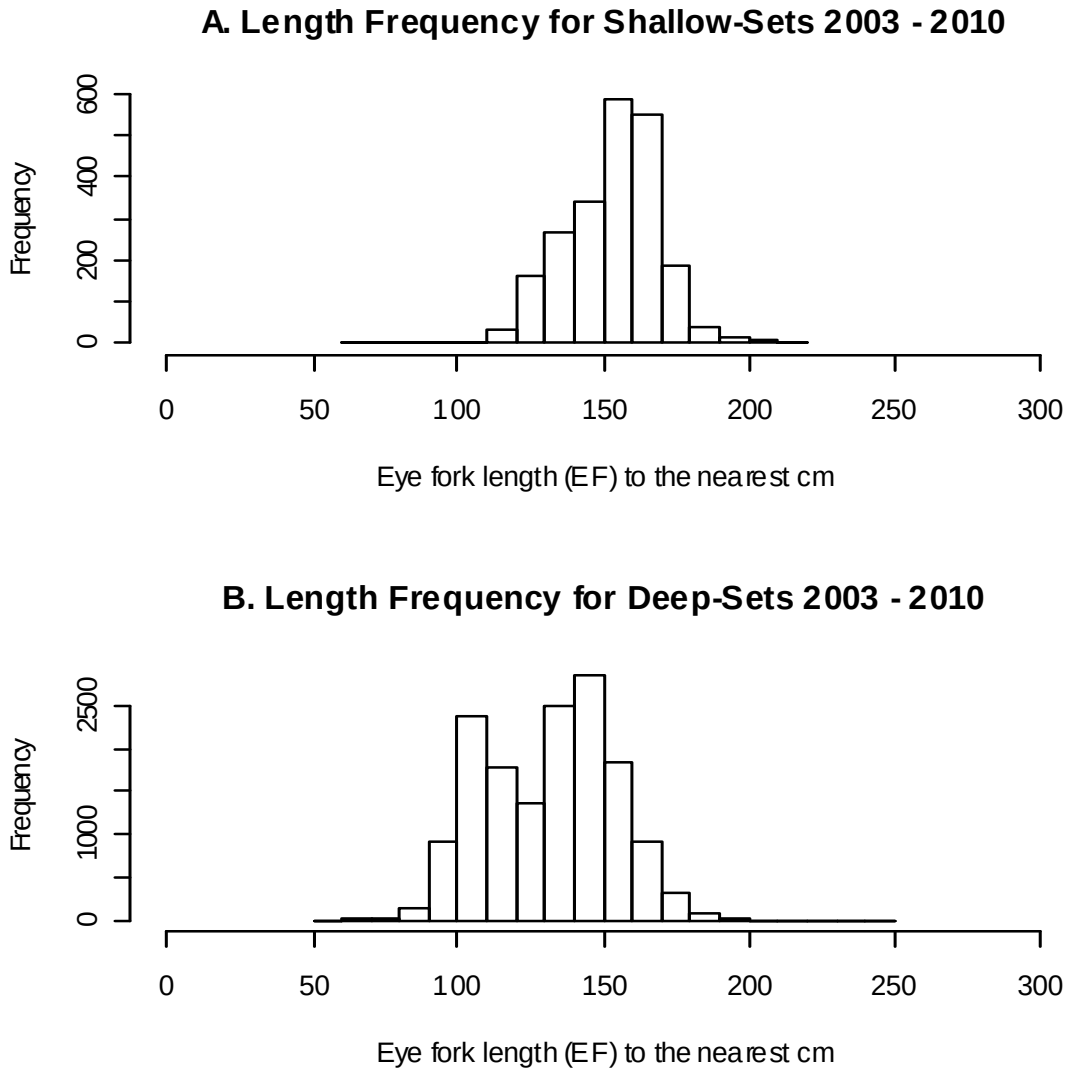

Figure 3. Observed striped marlin length frequency, 2003 – 2010, from shallow-sets and deep-sets.

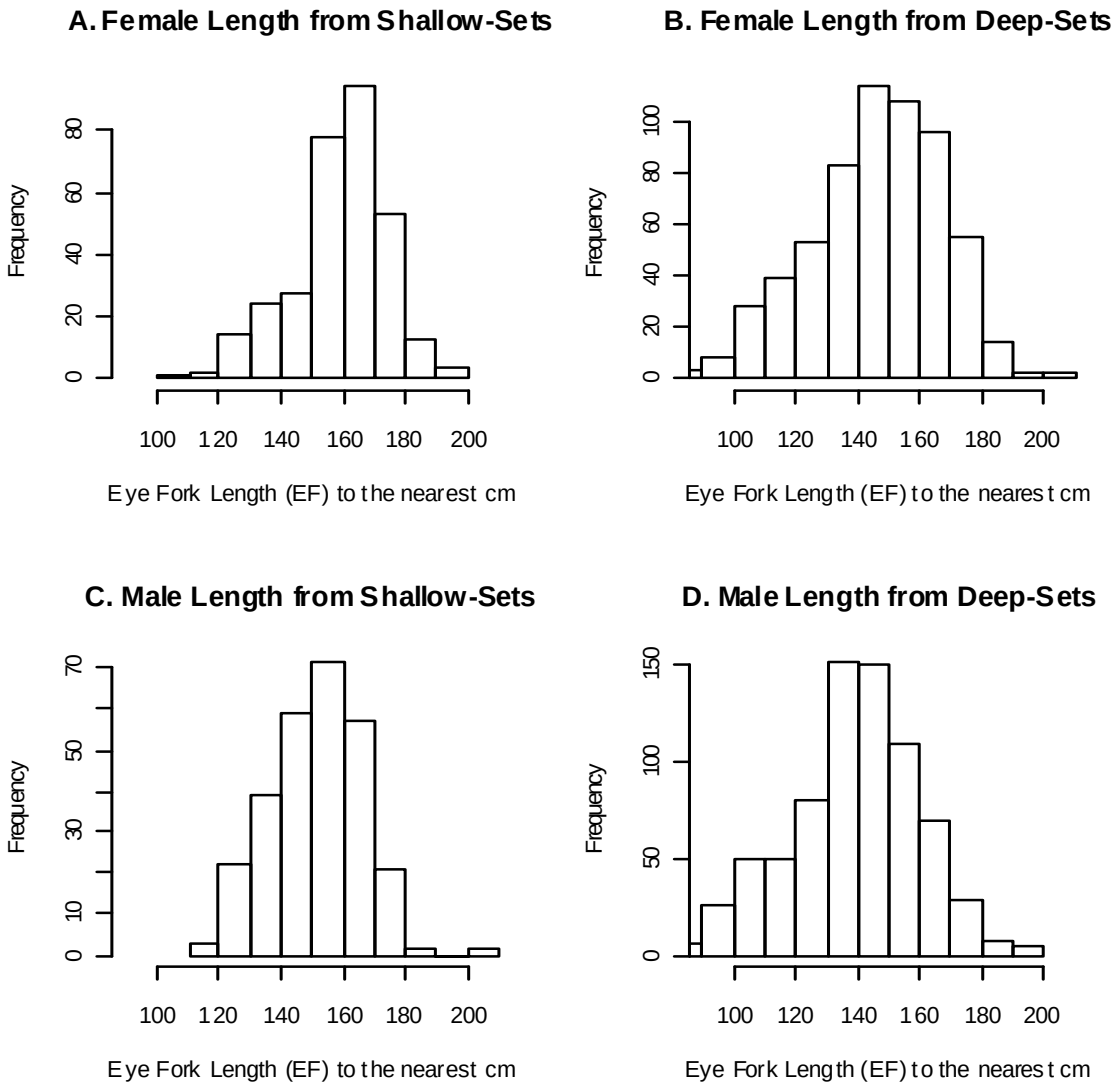

Figure 4. Observed striped marlin length frequency, 2003 – 2010, by sex from shallow-sets and deep-sets.

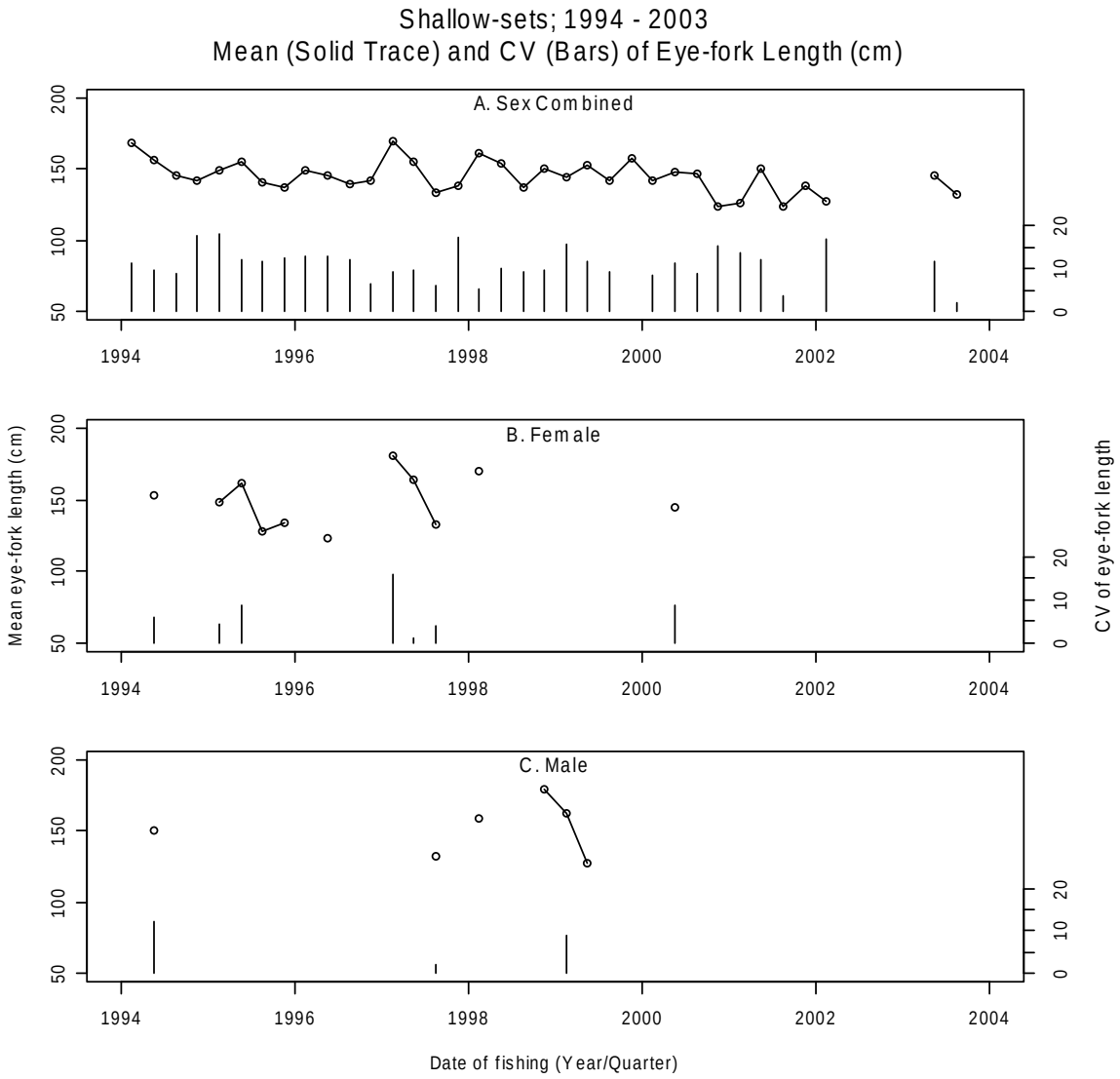

Figure 5. Observed striped marlin mean length and coefficient of variation (CV), 1994 – 2003, shallow-sets (< 15 hooks per float).

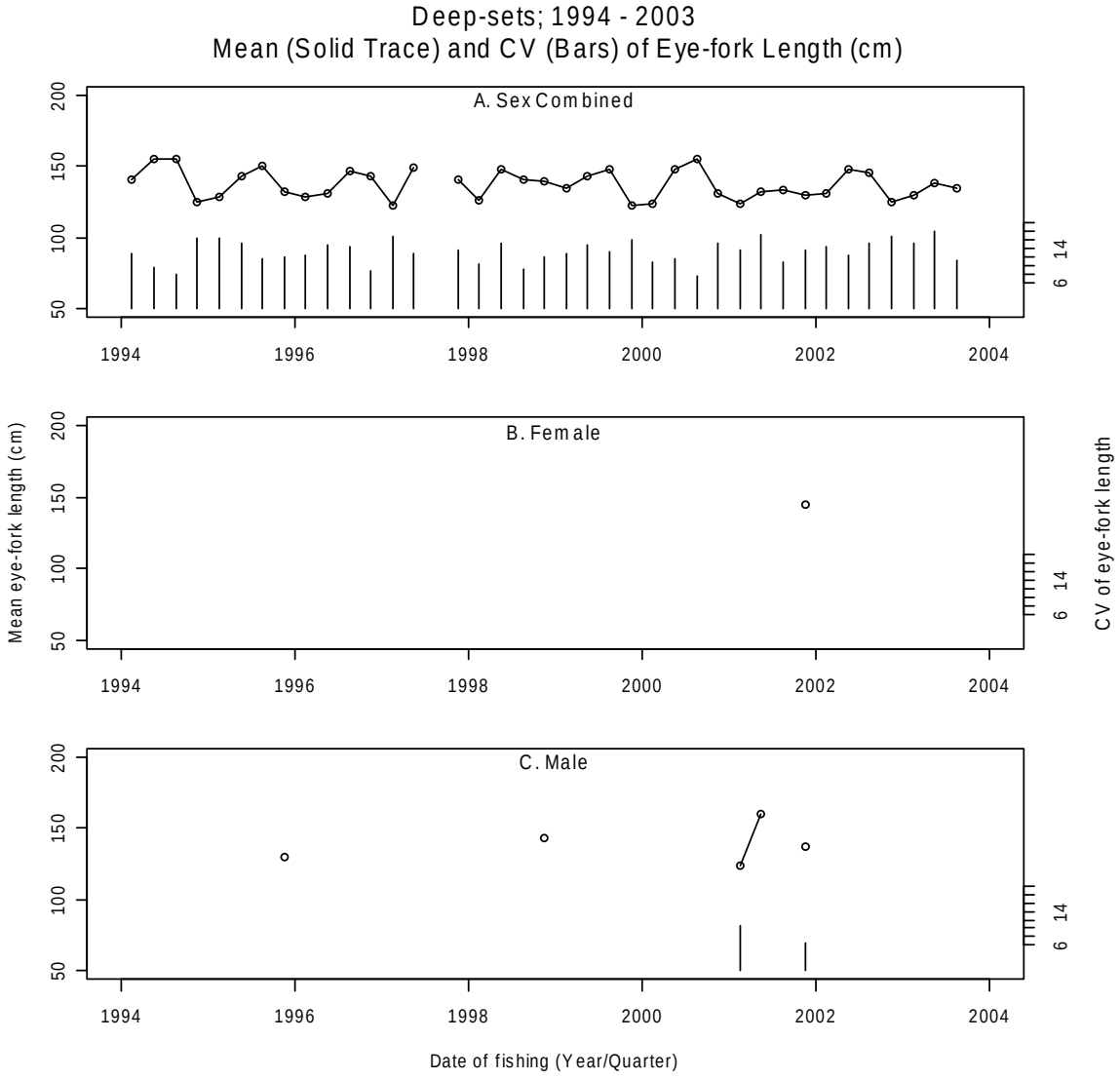

Figure 6. Observed striped marlin mean length and coefficient of variation (CV), 1994 – 2003, deep-sets (≥ 15 hooks per float).

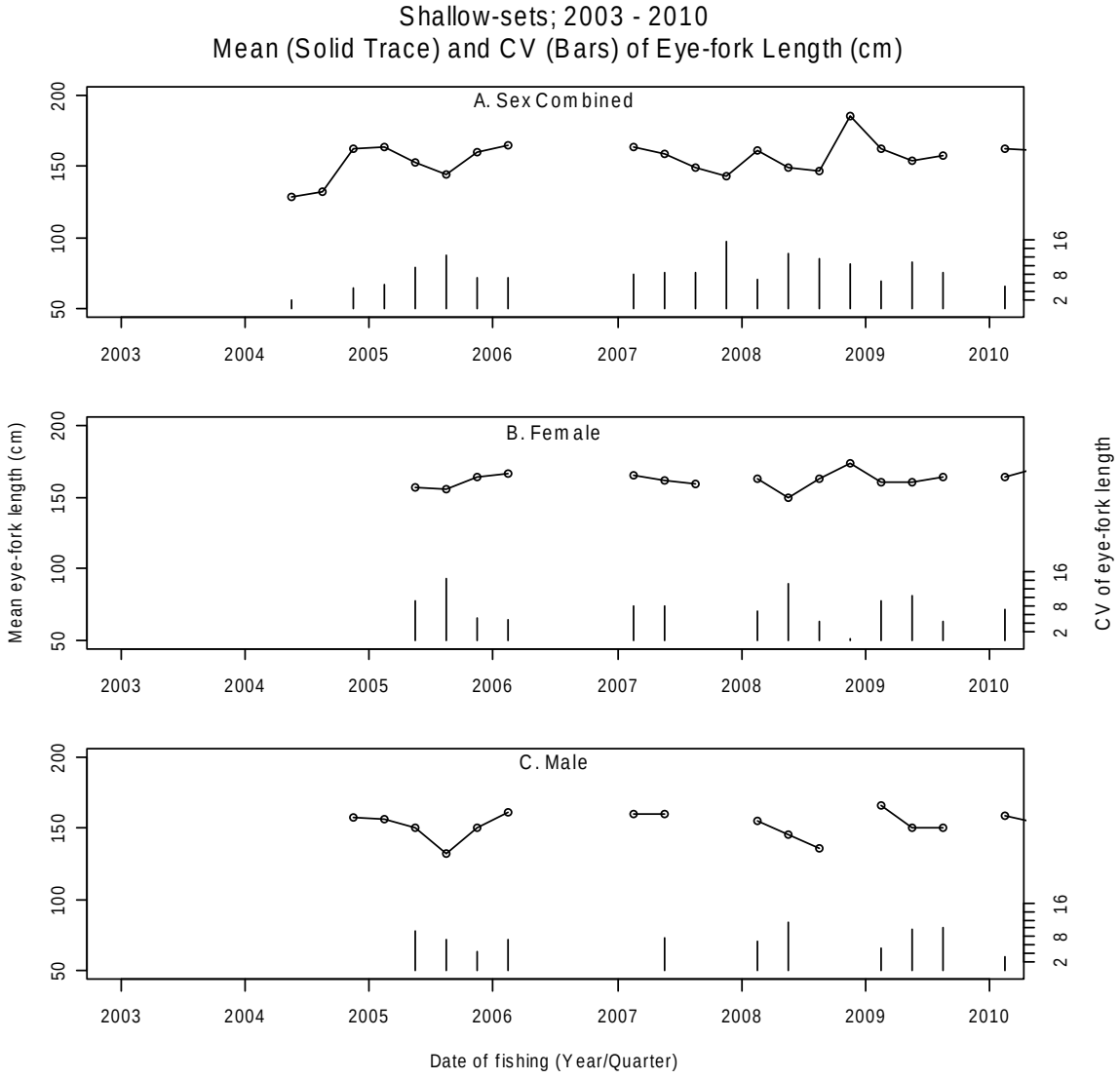

Figure 7. Observed striped marlin mean length and coefficient of variation (CV), 2003 – 2010, shallow-sets (< 15 hooks per float).

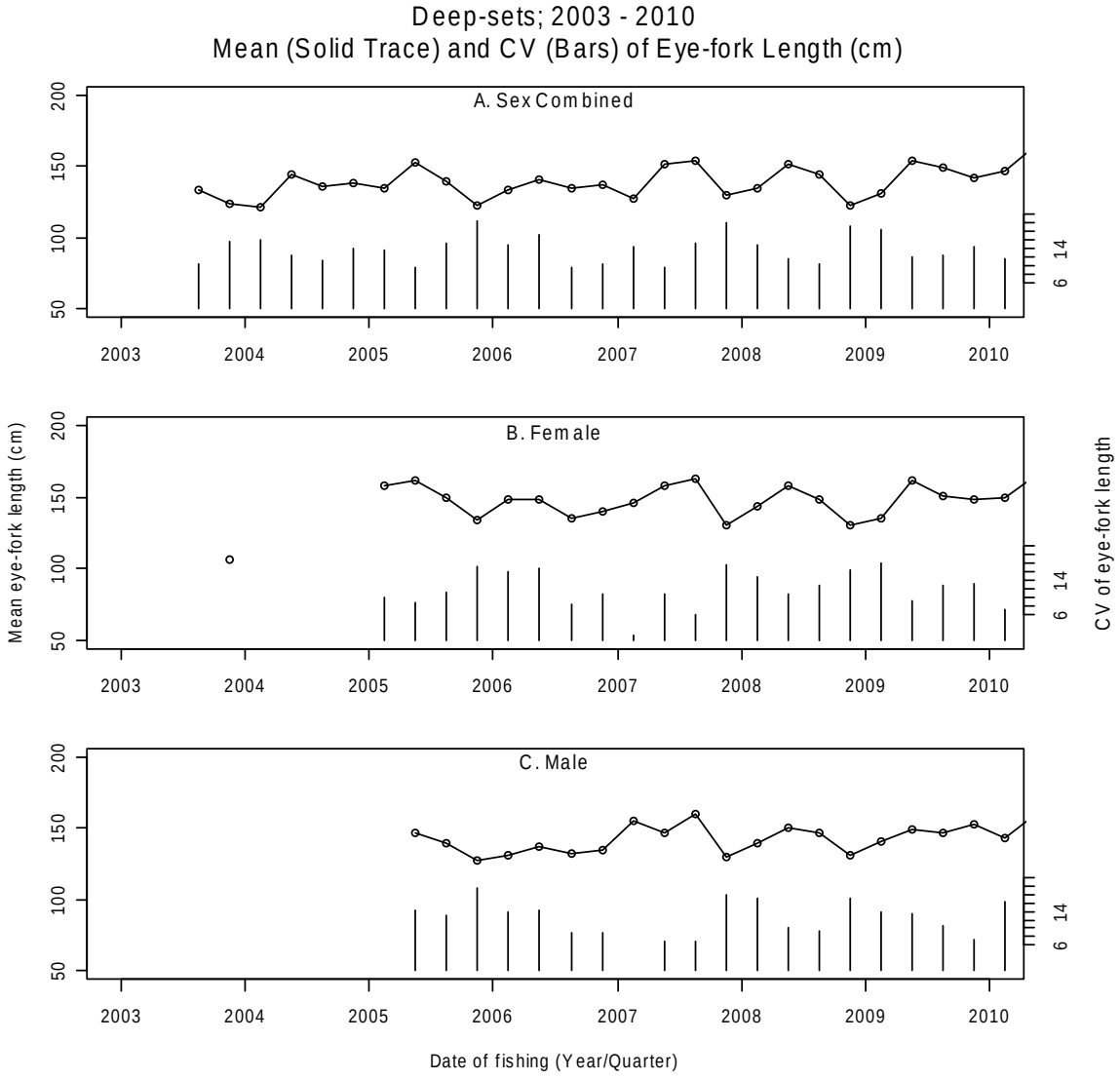

Figure 8. Observed striped marlin mean length and coefficient of variation (CV), 2003 – 2010, deep-sets (≥ 15 hooks per float).

Appendix A

The percentage of observed fishing trips in the Hawaii-based pelagic longline fishery.

Percentage of Observed Fishing Trips			
Year	Fishing trips	Observed trips	Fishing trips observed (%)
1994	861	50	5.8%
1995	1108	47	4.2%
1996	1062	53	5.0%
1997	1123	40	3.6%
1998	1180	48	4.1%
1999	1136	38	3.3%
2000	1134	118	10.4%
2001	1035	233	22.5%
Deep-Set			
Year	Fishing trips	Observed trips	Fishing trips observed (%)
2001	1,129	278	24.6%
2002	1,200	266	22.2%
2003	1,344	330	24.6%
2004	1,377	360	26.1%
2005	1,300	275	21.2%
2006	1,382	278	20.1%
2007	1,314	285	21.7%
2008	1,221	251	20.6%
Shallow-Set			
Year	Fishing trips	Observed trips	Fishing trips observed (%)
2004	11	11	100.0%
2005	106	106	100.0%
2006	57	57	100.0%
2007	69	69	100.0%
2008	95	95	100.0%
2009	104	104	100.0%
Reproduced from the Hawaii Longline Observer Program of NOAA Fisheries[4] (September, 2010).			

[4] http://www.fpir.noaa.gov