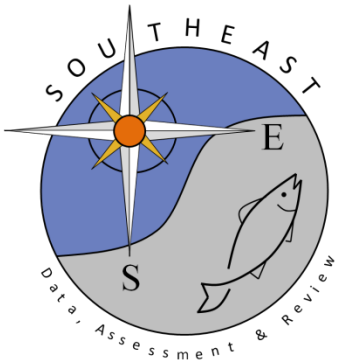
Analysis of annual, monthly and weekly king mackerel landings in the east FL "mixing zone": evidence of stock migrations and a "resident" population on the east coast of FL

Peter J. Barile

SEDAR38-DW-08

22 November 2013



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Analysis of annual monthly and weekly king mackerel landings in the southeast Florida winter "mixing zone:" evidence for stock migrations and a resident population along the east coast of Florida.

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November 22, 2013

Introduction

Much attention has been given to the dynamic of the east Florida "mixing zone" where Atlantic and Gulf of Mexico (GOM) king mackerel, *Scomberomorus cavalla*, stocks migrate to over-winter in warmer water adjacent to the Florida current, before spring migrations to return to their respective summer distributions. Previous analyses include over a dozen extensive life history studies to resolve the "source" of king mackerel stocks in the winter mixing zone using tags, and analyses of otolith shape and biochemistry. These studies have provided resolution on the composition of the stocks residing in the "mixing zone" and their fate before and after migrations. However, highly resolved landings data at explicit time and spatial scales can provide an understanding of latitudinal migrations of king mackerel.

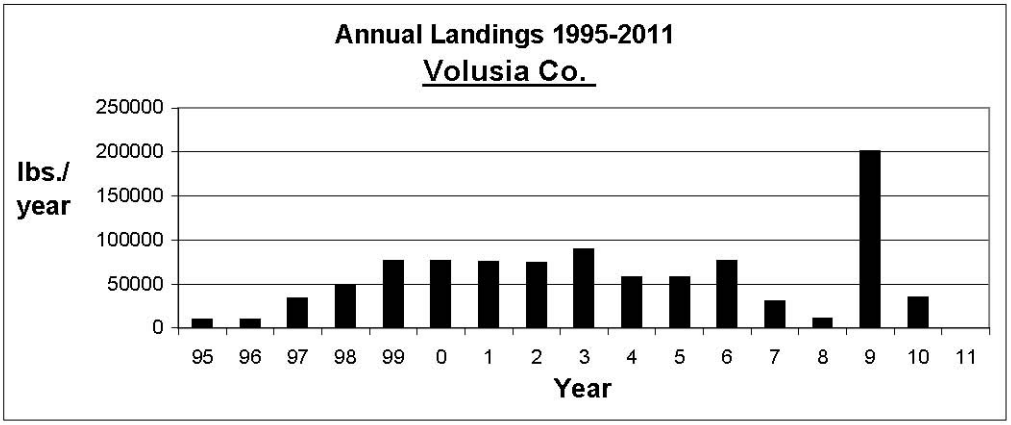
Methods

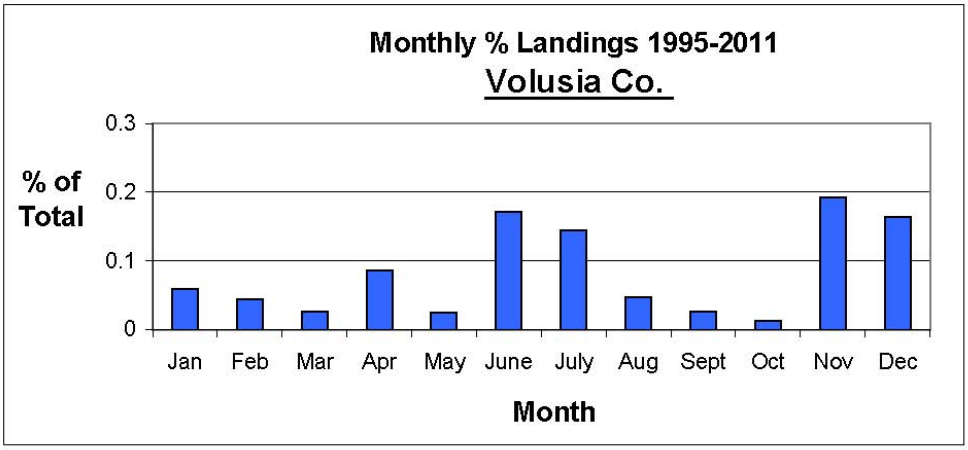
Landings and trip data from the state of Florida's trip ticket database are utilized to characterize Atlantic king mackerel stock migrations as they become highly abundant and landed at elevated levels during migrations into and out of the east Florida "mixing zone." These data are sorted by the county in which they were landed, month, and year as a function of landings and trips. Also, some very specific weekly landings data are presented here to resolve migrations patterns in the winter of 2010, when a historically cold winter allegedly resulted in a spatially constricted king mackerel mixing zone population. Further, annual landings and nominal CPUE (landings/ trip) can give insights into annual changes in landings and population abundance along the east coast of Florida, where a significant portion of both the Atlantic and GOM stocks are fished.

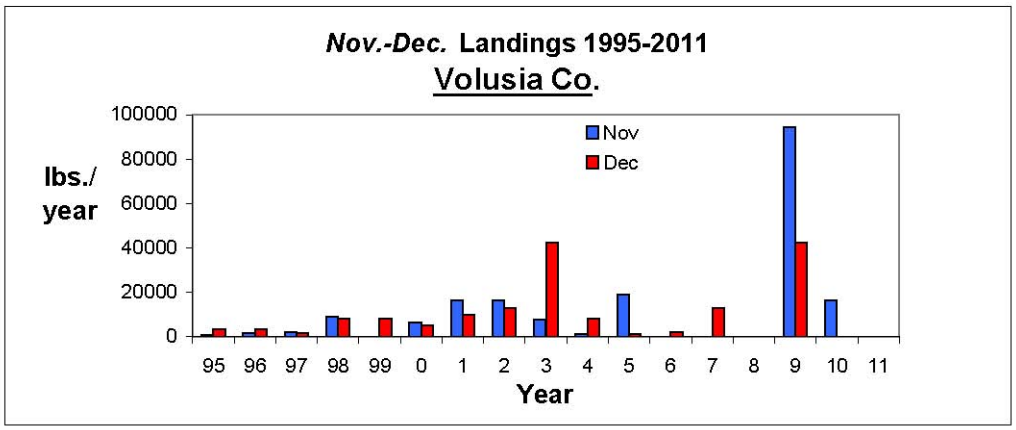
Historical landings data

Below are total annual landings plots, long-term monthly landings proportions, nominal CPUE annual means and CPUEs for significant landings months in a latitudinal gradient (north to south) in counties along the east coast of Florida, from Volusia Co., Brevard Co., Indian River Co., St, Lucie Co., Martin Co. and Palm Beach Co. Additionally, weekly composite landings following the severe winter of 2010 indicate migration patterns northerly, by county, from the mixing zone.

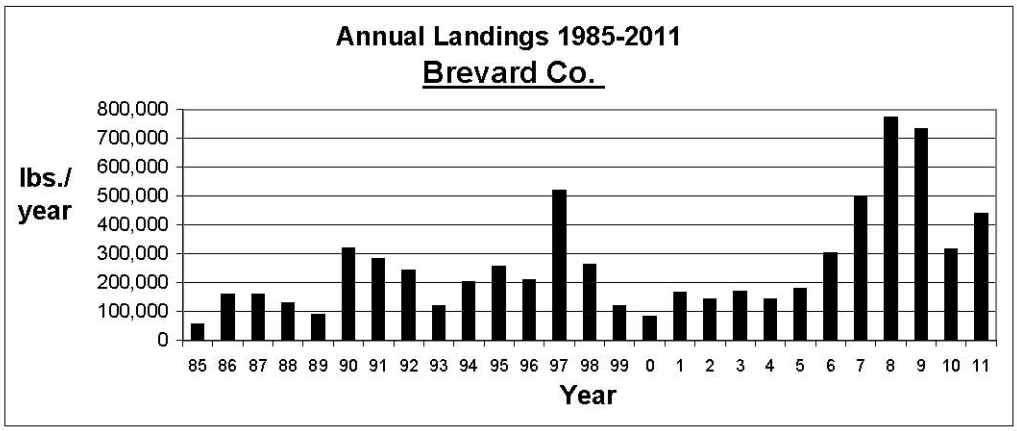
Volusia County

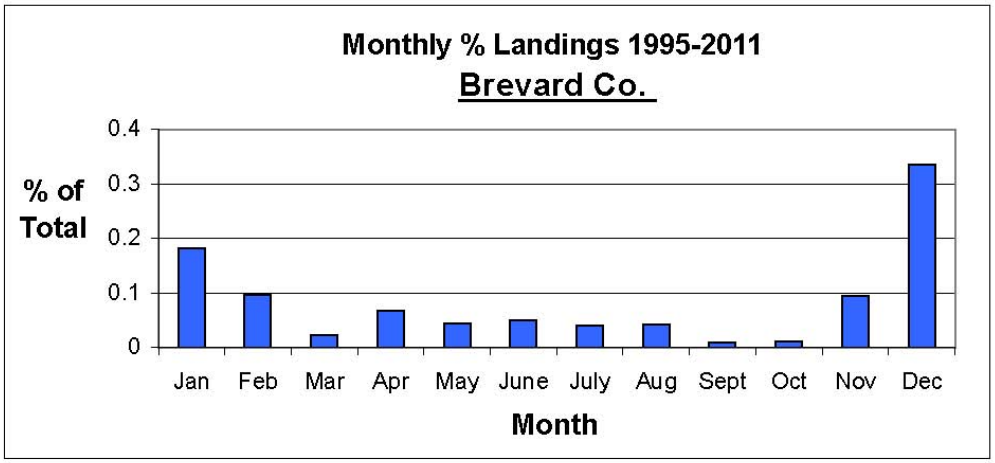


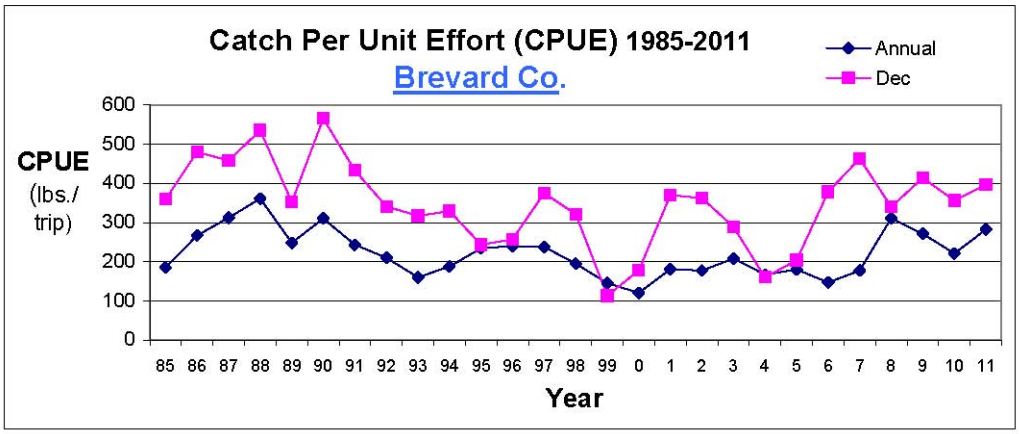


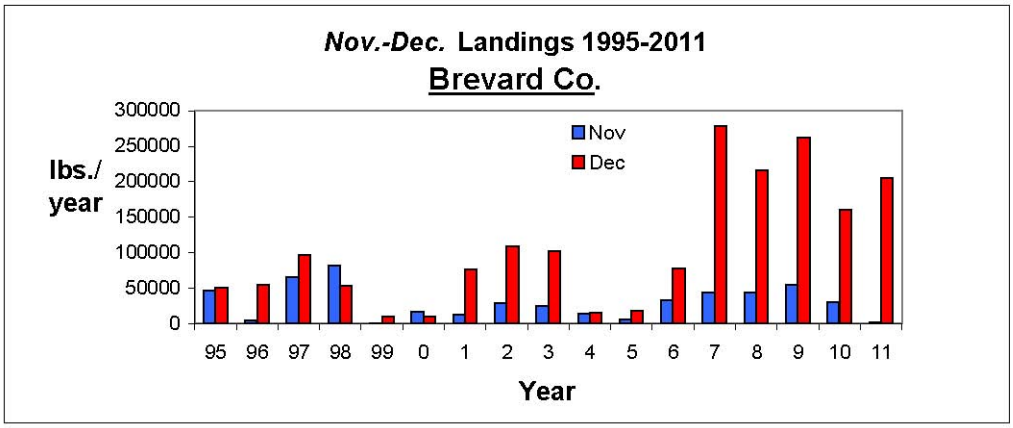


Brevard County

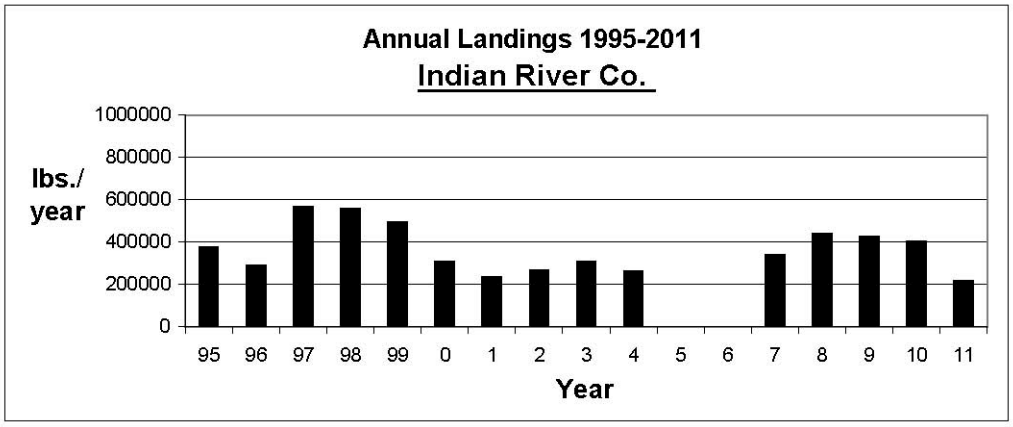


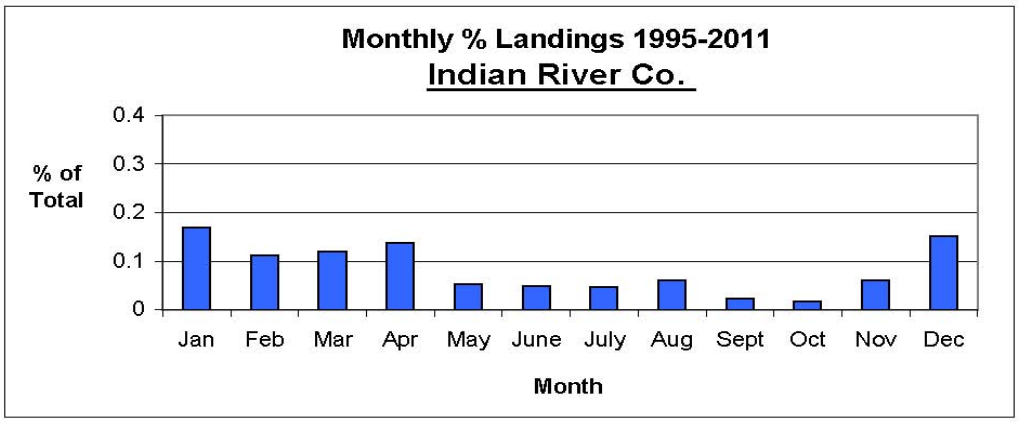

Monthly % Landings 1995-2011
Brevard Co.
% of Total
0.4
0.3
0.2
0.1
0
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
Month

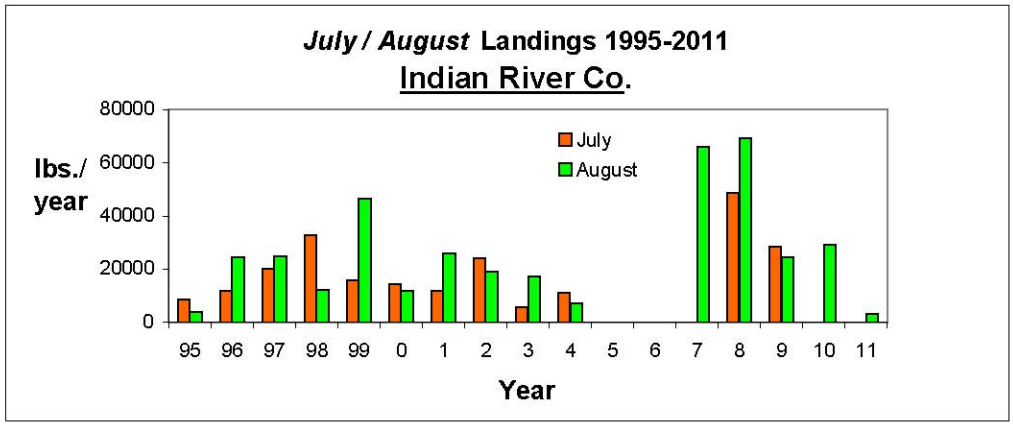

Catch Per Unit Effort (CPUE) 1985-2011
Brevard Co.
Annual
Dec
CPUE (lbs./ trip)
600
500
400
300
200
100
0
85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Year


Nov.-Dec. Landings 1995-2011
Brevard Co.
lbs./ year
300000
250000
200000
150000
100000
50000
0
Nov
Dec
95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Year

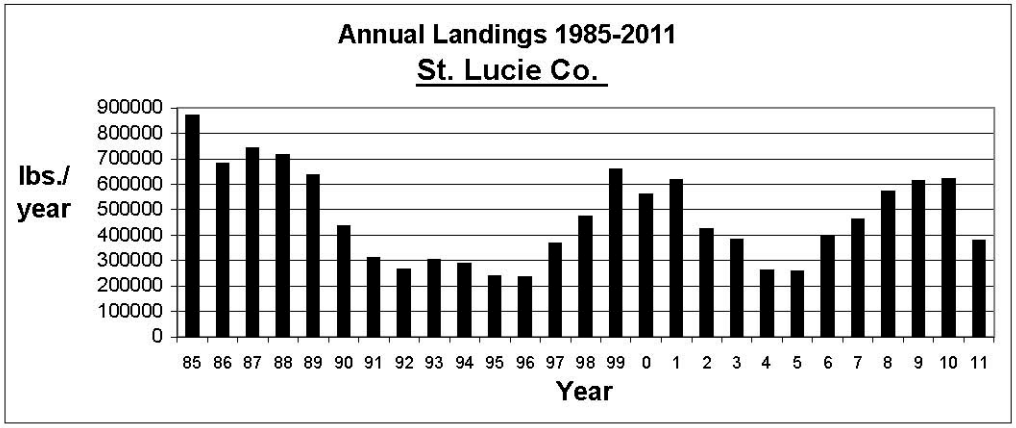
Indian River Co.

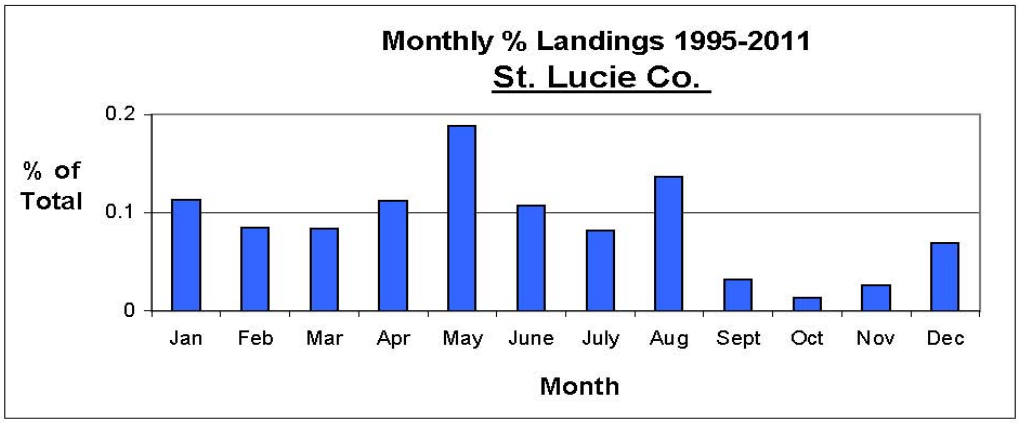


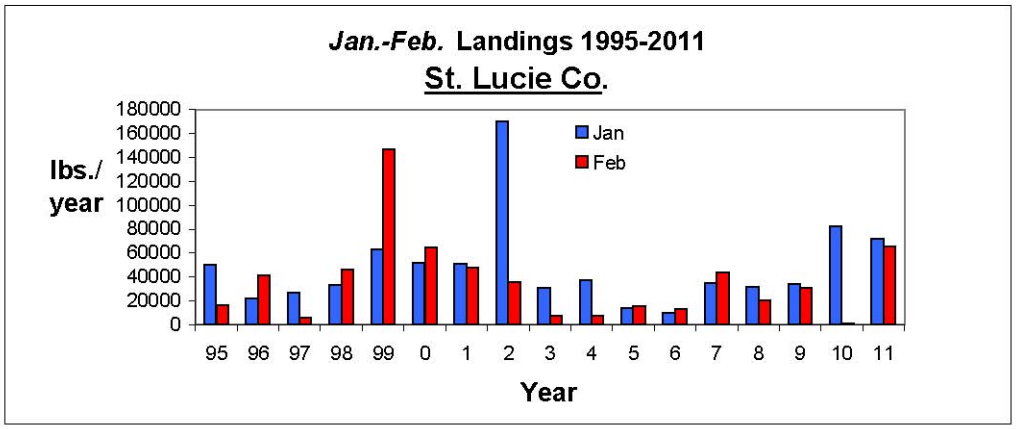


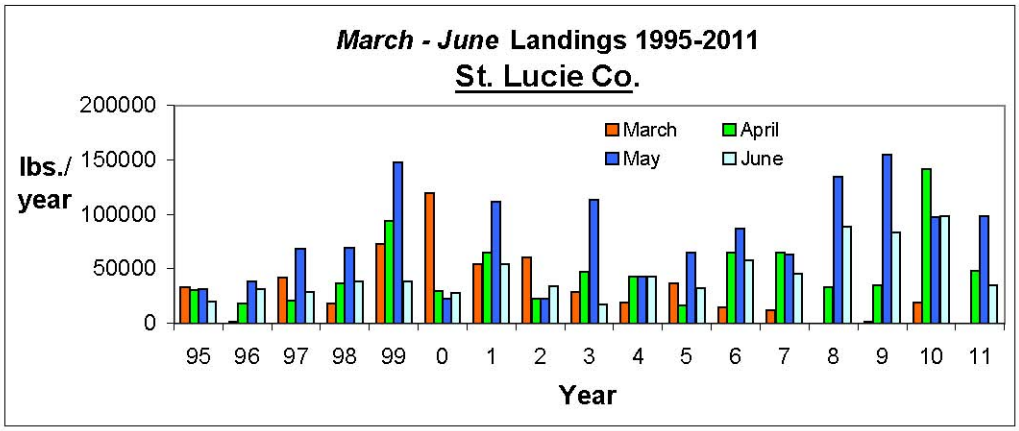


St. Lucie County

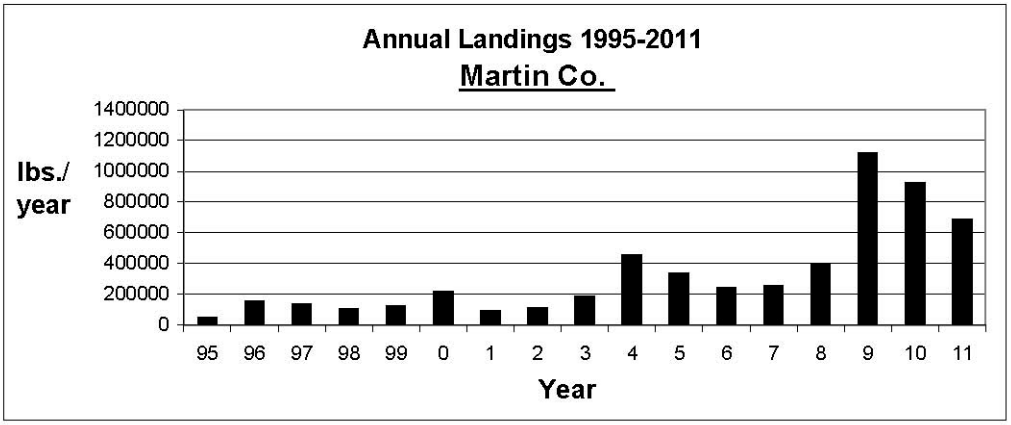


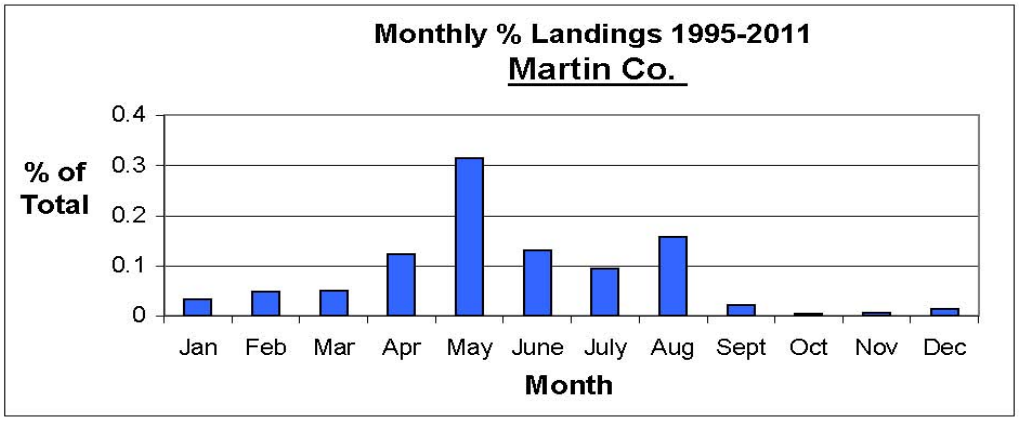


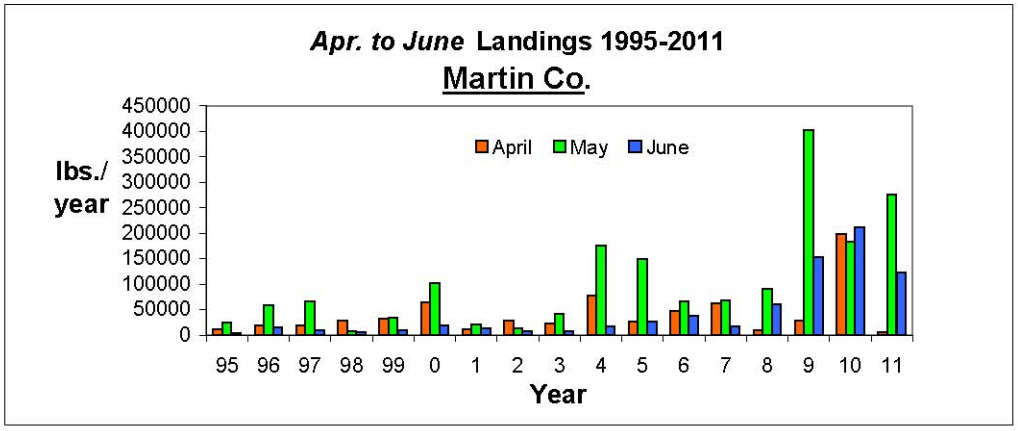



March - June Landings 1995-2011
St. Lucie Co.
lbs./ year
200000
150000
100000
50000
0
March
April
May
June
95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Year

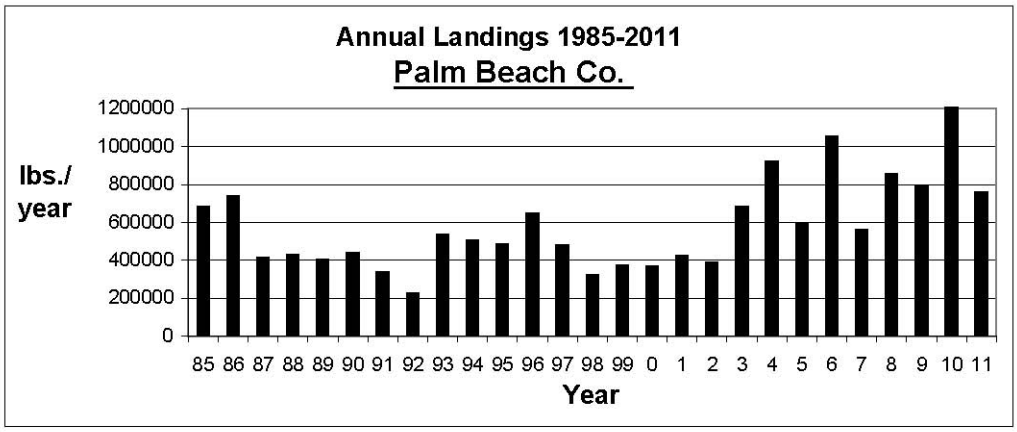
Martin Co.

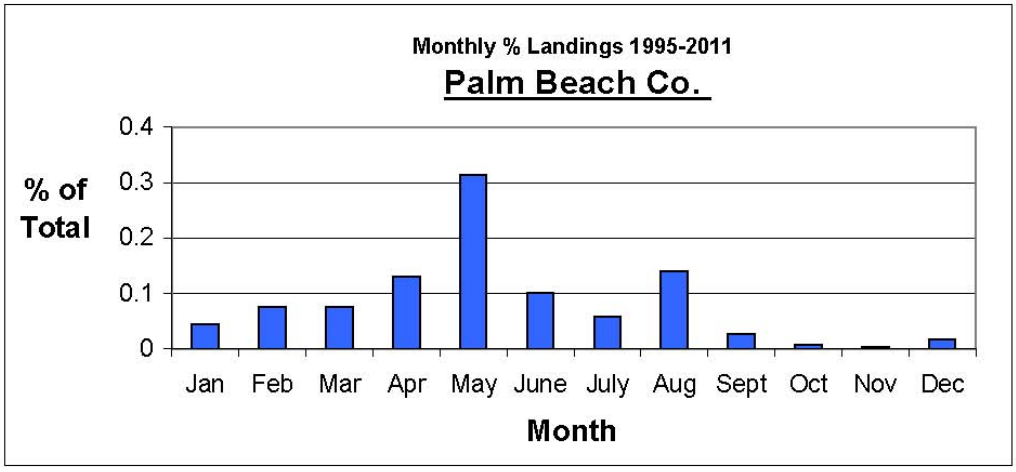

Annual Landings 1995-2011
Martin Co.
lbs./ year
1400000
1200000
1000000
800000
600000
400000
200000
0
95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Year

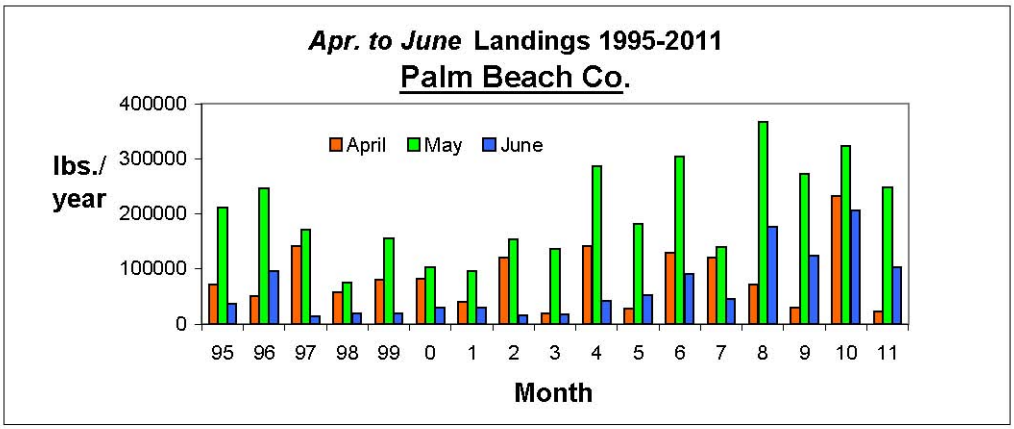

Monthly % Landings 1995-2011
Martin Co.
% of Total
0.4
0.3
0.2
0.1
0
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
Month

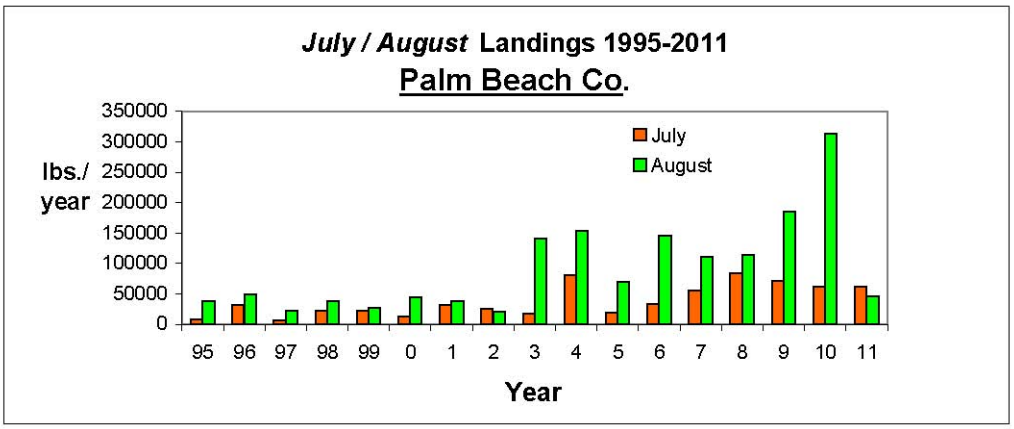


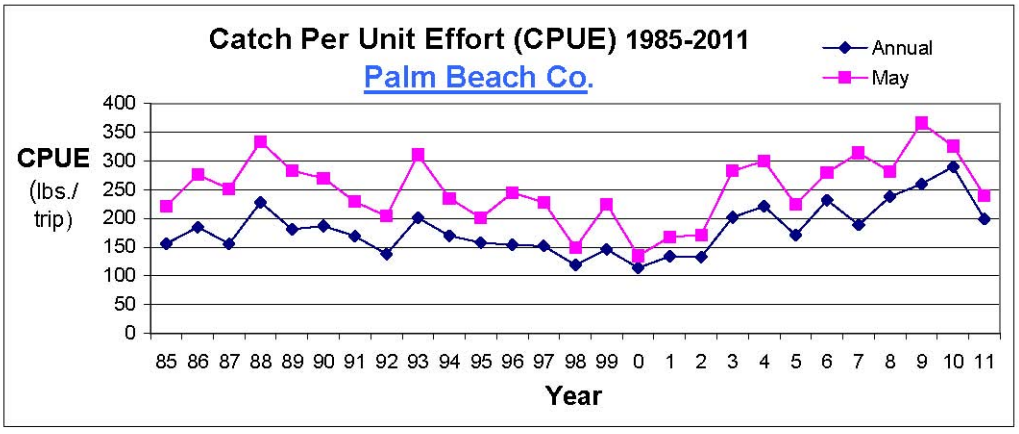
Palm Beach County



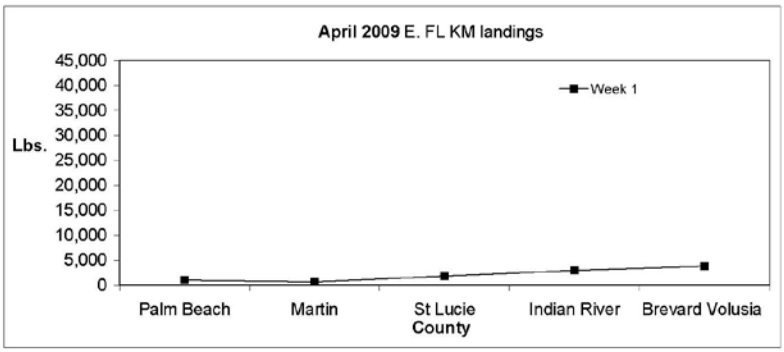


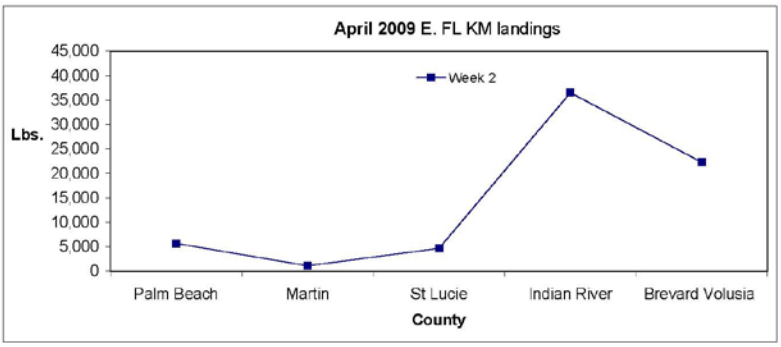

Apr. to June Landings 1995-2011
Palm Beach Co.
lbs./ year
400000
300000
200000
100000
0
April
May
June
95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Month

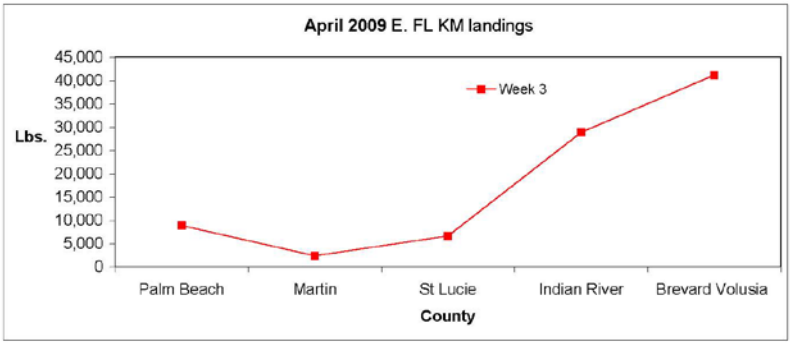

July / August Landings 1995-2011
Palm Beach Co.
lbs./ year
350000
300000
250000
200000
150000
100000
50000
0
July
August
95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Year

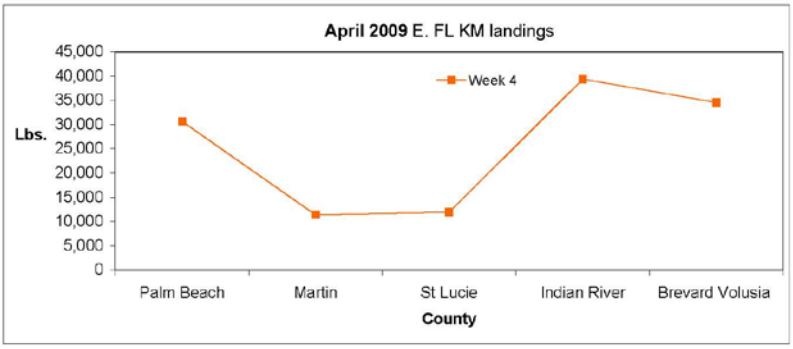

Catch Per Unit Effort (CPUE) 1985-2011
Palm Beach Co.
Annual
May
CPUE (lbs./ trip)
400
350
300
250
200
150
100
50
0
85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 0 1 2 3 4 5 6 7 8 9 10 11
Year

Weekly migration pattern north from the "mixing zone" in April 2009

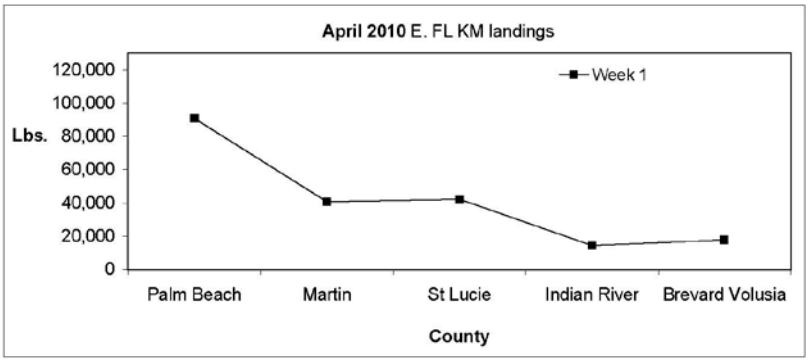


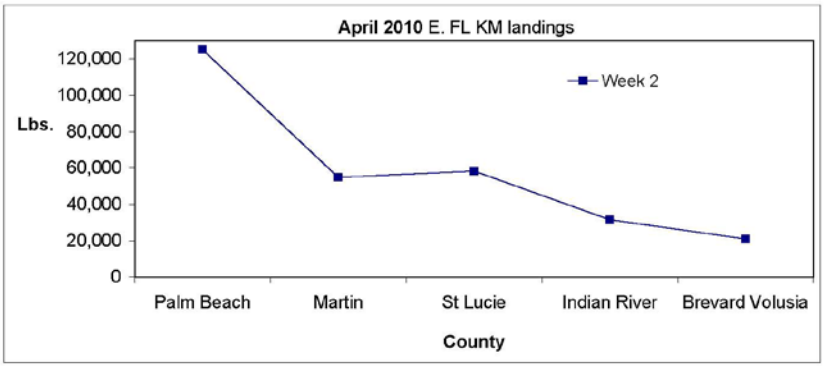


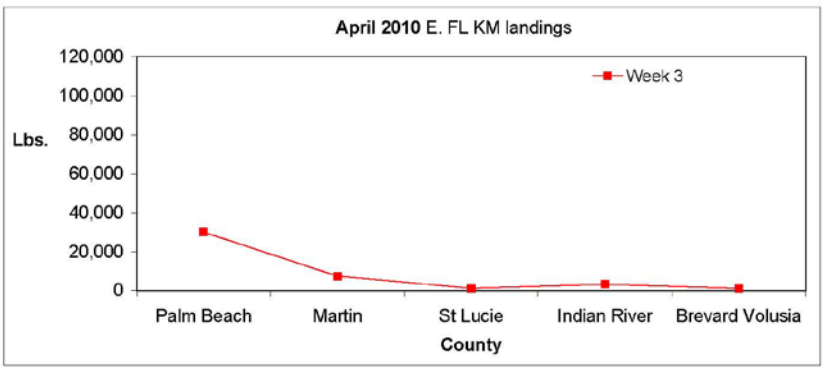


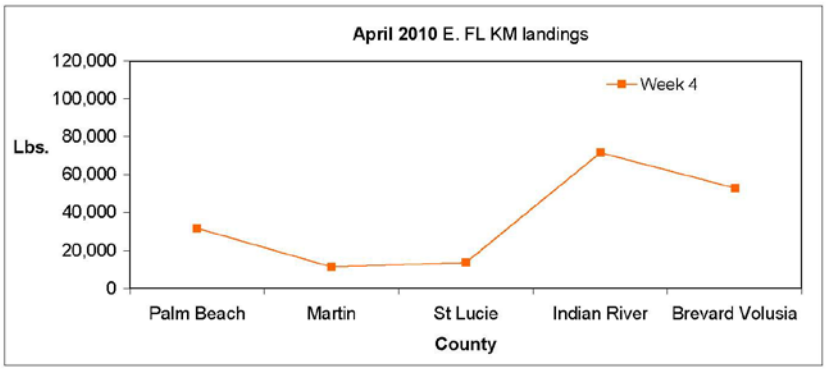


Weekly migration pattern north from the "mixing zone" in April 2010









Summary of findings

1) Peak landings months (from north to south along east FL)

Volusia Co.- **November**
Brevard Co.- **December**
Indian River. Co.- **January**
St. Lucie Co.- **May**
Martin Co.- **May**
Palm Bch. Co.- **May**

These data suggest that the fall migration of Atlantic stock represents the most significant landings of king mackerel in NE FL (Volusia Co.) in Nov., and the most significant monthly landings moving into Brevard Co. in December, and residing largely off of Indian River Co. in January, where peak monthly landings occur. Alternatively, counties to the south, from St. Lucie Co. to Palm Beach Co. see their most significant landings in May, which represents the "spawning run" of large gravid fish. Elevated nominal CPUE rates, above annual means, are typical for the most significant landings months.

2) Annual landings in counties with historically well reported landings, e.g. Brevard, St. Lucie, Palm Beach indicated a sinusoidal wave of landings peaks at ~ 10 year intervals, with the most recent peak in 2008-2010.

3) There is evidence, in all counties along the Florida's east coast, for a "resident" summer population (July-August) during the Atlantic stock fishing season.

4). Landings data from both a "normal" winter (2009) and a historically "cold" winter (2010, see NOAA/NWS- Melbourne, FL), indicate a "northerly" migration out of the mixing zone during a series of weekly April landings time series, by county- from south (Palm Beach Co.) to north (Volusia Co.)