King Mackerel and Spanish Mackerel larval data on the northeast U.S. Shelf

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INTRODUCTION

Ichthyoplankton (egg and larval fish) surveys have a long history of use in examining fisheries-independent indices of abundance, particularly for species that are difficult to assess using other methodologies. Since 1971, five different Northeast Fisheries Science Center (NEFSC) programs have sampled ichthyoplankton along the northeast U.S. shelf (Richardson et al. 2010). The intent of this working document was to examine the distribution and abundance of King Mackerel (*Scombermorus cacalla*) and Spanish Mackerel (*S. maculates*) larvae on the northeast U.S. (NEUS) shelf.

ICHTHYOPLANKTON SAMPLING METHODS

The focus of this working paper is on larval King and Spanish Mackerel data from two multi-year sampling programs, Marine Resources Monitoring, Assessment, and Prediction (MARMAP; 1977 - 1987) and Ecosystem Monitoring (EcoMon; 1999 - present) programs. MARMAP was designed as a multi-species survey, and sampling effort covered the entire NEUS shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia, four to eight times per year. MARMAP used primarily a fixed

station design covering the sample area of each survey approximately evenly. EcoMon samples the same spatial extent of the shelf as MARMAP, but uses a random-stratified design based on the NEFSC bottom trawl survey design to collect samples from 47 strata. The area encompassed by each stratum determined the number of samples in each stratum. The number of stations sampled during an EcoMon survey is approximately 30 % less than that of MARMAP. The EcoMon survey is conducted six times per year. Two of these surveys are piggybacked on the NEFSC spring bottom trawl (March to May) and fall bottom trawl (September to November) surveys. The four dedicated surveys occur in January/February, May, August, and November. However, ship time cutbacks combined with delays due to weather or mechanical issues have resulted in reduced coverage during certain seasons in certain years.

All plankton tows used a 61-cm bongo net that was fished from the surface to within 5-m of the bottom or to a maximum depth of 200-m. The bongo net included both a 333-µm and 505-µm mesh nets, with samples from the wider mesh net processed for ichthyoplankton during MARMAP. After 1995, the center began using paired 333-µm mesh nets.

Initial processing of most samples occurred at the Morski Instytut Rybacki in Szczecin, Poland. All larval fish were removed from the samples, identified to the lowest possible taxonomic level, and measured to the nearest 0.1-mm interval. A subsample of 50 individuals was measured in those samples containing >50 individuals of one taxa. Taxa abundance for each station was standardized to

number under 10 • m-2 sea surface. Analysis of the EcoMon data was limited to 2012, the year with complete seasonal coverage for larval processing.

LARVAL KING MACKEREL DISTRIBUTION AND ABUNDANCE

King Mackerel and Spanish Mackerel larvae were collected in low numbers on the NEUS shelf. Percent frequency of occurrence was 0.37 % for Spanish Mackerel (*n* = 127 larvae) and 0.11 % for King Mackerel (*n* = 35 larvae). Larval King Mackerel from 2 to 9 mm in length were collected (Figure 1A). Spanish Mackerel larvae were collected from 1 to 8 mm in length, with a peak in frequency of 2 to 3 mm larvae (Figure 1B). Both species were collected from May to October (Figure 2). Peak seasonal abundance was in July – August and September – October for King Mackerel (Figure 2A) and July – August for Spanish Mackerel (Figure 2B).

Plots of larval King Mackerel and Spanish Mackerel distribution during MARMAP and EcoMon are presented in Figure 3. Mean areal abundance was calculated for the current EcoMon strata. King Mackerel larvae were only collected in strata off Chesapeake Bay and southward (Figure 3A and B). Spanish Mackerel larvae were collected from strata off Long Island, New York and southward (Figure 3C and D).

RELATIVE ANNUAL ABUNDNACE

An annual weighted abundance was calculated as an index of relative annual abundance for each species to examine trends in abundance. For both species the index was limited to samples collected from May to September, when larvae were

present on the NEUS shelf (Figure 2). Data for each species was also sub-sampled spatially to strata where each species were collected. There were five strata for King Mackerel (Figure 3A and B) and 13 strata for Spanish Mackerel (Figure 3C and D). The weighted abundance was the annual summed abundance of each species divided by the number of stations sampled.

Inter-annual trends in occurrence and abundance varied for each species. King Mackerel were collected in 36 % of the years sampled, with no apparent increase in frequency or abundance during the most recent sampling period (Figure 4A). Spanish Mackerel have increased in both frequency of annual occurrence and abundance on the northeast U.S. shelf over the past 30 years (Figure 4B).

LITERTURE CITED

Richardson DE, Hare JA, Overholtz WJ, Johnson DL (2010) Development of long-term larval indices for Atlantic herring (*Clupea harengus*) on the northeast US continental shelf. Ices Journal of Marine Science 67: 617-627.

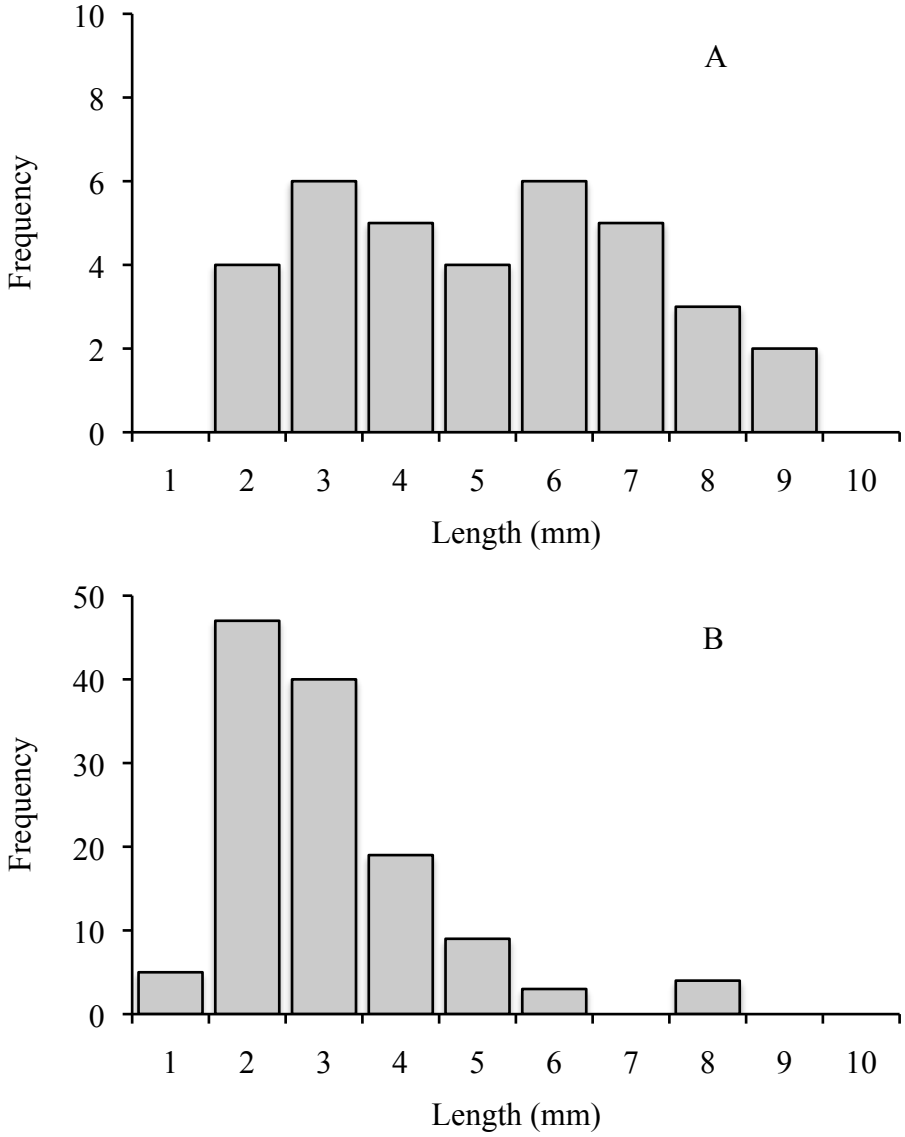

Figure 1. Frequency distributions of larval length (mm) of King Mackerel (A; *n* = 35) and Spanish Mackerel (B; *n* = 127) collected on the northeast U.S. shelf.

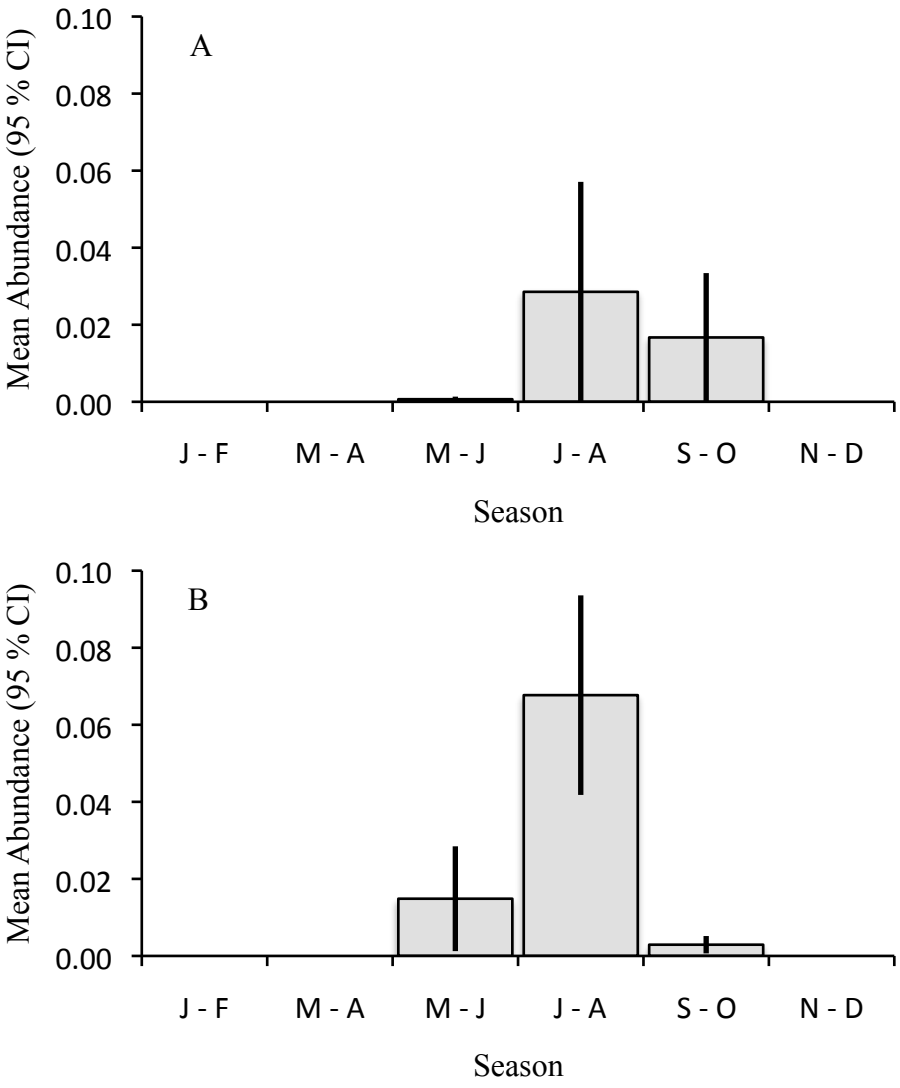

Figure 2. Mean seasonal abundance of King Mackerel (A) and Spanish Mackerel (B) collected on the northeast U.S. shelf. J – F = January-February, M – A = March-April, M – J = May-June, J – A = July-August, S – O = September-October, and N – D = November-December.

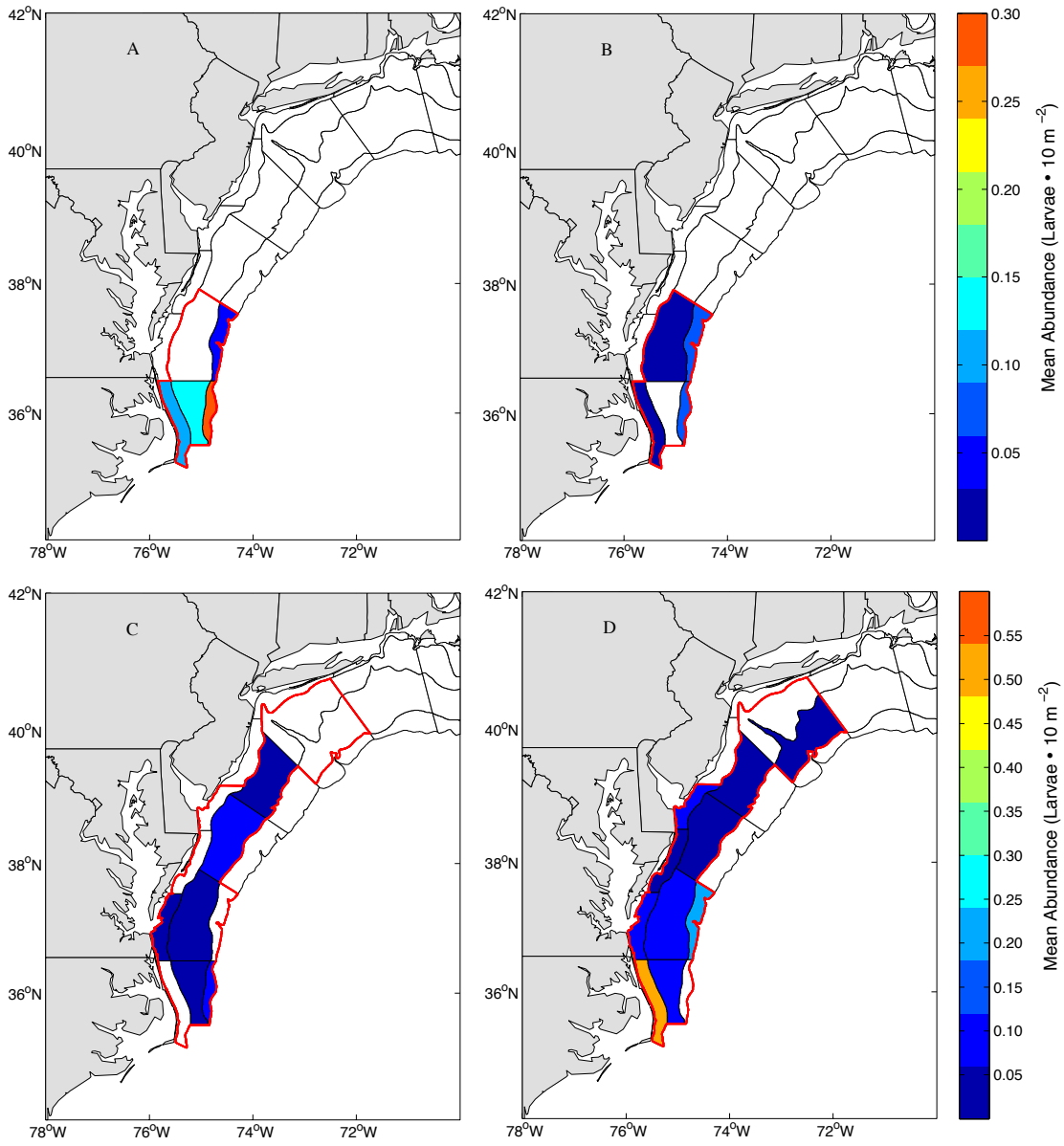

Figure 3. Mean areal abundance of King Mackerel (A and B) and Spanish Mackerel (C and D) collected during MARMAP (1977 to 1987; A and C) and EcoMon (1999 to 2012; B and D) on the northeast U.S. shelf. Larval abundance was averaged for all stations sampled within each of the current 47 EcoMon strata. The red polygon denotes strata used to calculate yearly relative abundance.

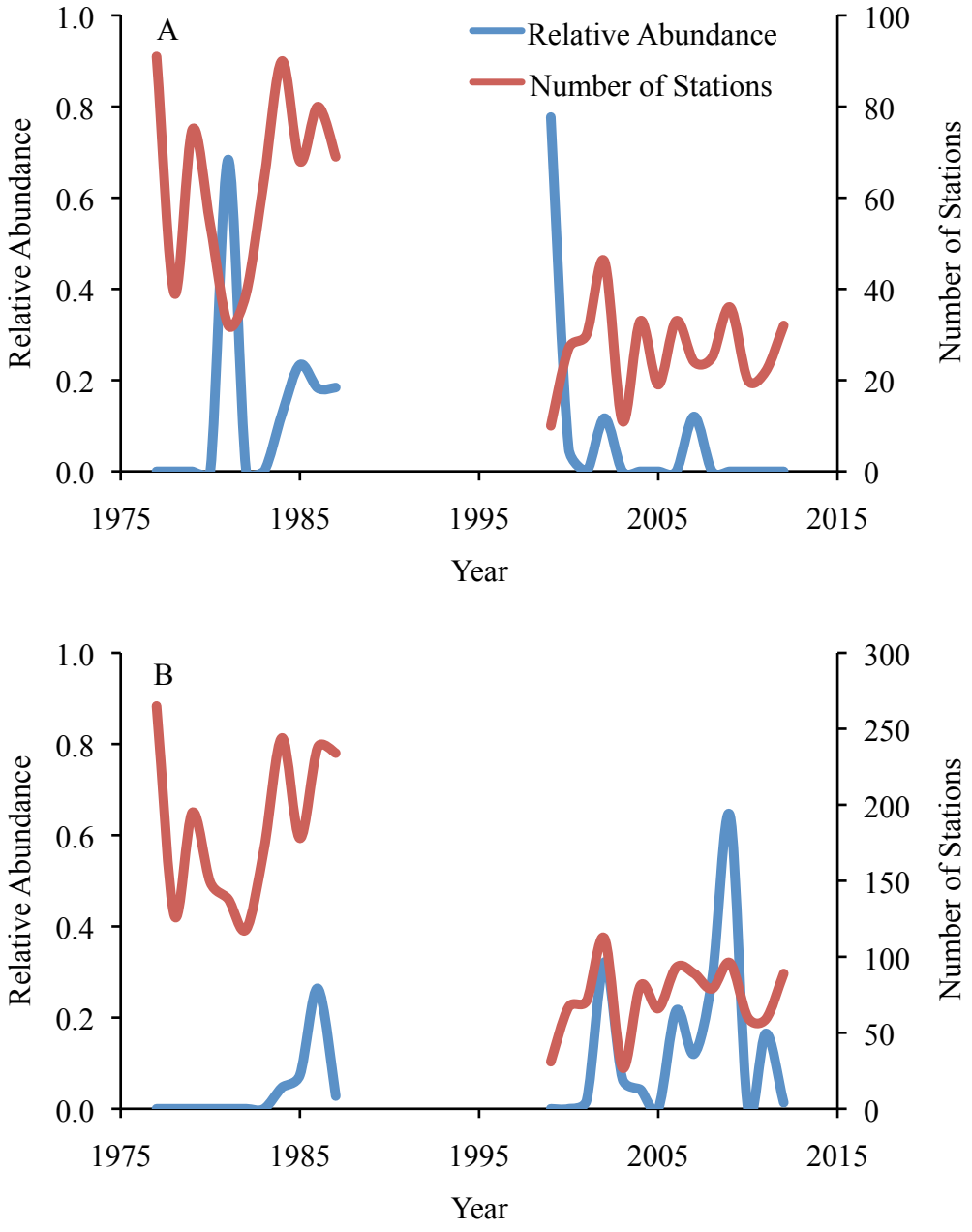

Figure 4. Relative abundance of larvae King Mackerel (A) and Spanish Mackerel (B) and number of stations sampled on the northeast U.S. shelf during MARMAP (1977 to 1987) and EcoMon (1999 to 2012). Relative abundance was calculated based on samples collected from May to October within strata that each species regularly was collected.