Appendix E

Integrating NOAA's ELMR Database

and

ESI Biology Data Layers and Data Tables

On occasion, ESI atlases have incorporated NOAA's Estuarine Living Marine Resources (ELMR) databases to model fish and invertebrates into salinity zones throughout estuaries. This incorporation of ELMR into ESI integrates all of the attribute data into the current ESI data structure. However, many users may find the original salinity geospatial data interesting and applicable in their GIS and desktop mapping applications. Therefore, the data layer SALINITY is added to those atlases that have used ELMR data. The SALINITY polygon data includes WATER_CODE (specifies a polygon as either water or land as in the HYDRO data layer), ESTUARY (the name of the estuary and bathymetry zone for ocean areas, SAL_HIGH (salinity level during the high-salinity time period), SAL_LOW (salinity level during the low-salinity time period), SAL_TRAN (salinity level during the transitional salinity time period), UNIQUE_HIGH (identification number that links to the original ELMR database and links to those records associated with the high-salinity time period), UNIQUE_LOW (same as UNIQUE_HIGH except the linked records are for the low-salinity time period), and UNIQUE_TRAN (same as UNIQUE_HIGH except the linked records are for the transitional salinity time period). The SALINITY arc data includes BOUND (identifies the arc as a boundary for the salinity time period) and SYMBOL (the number of the map symbol used to color-shade the arc for either high [red] or low [blue] salinity and increasing or decreasing on either side of the line). The SALINITY data layer is generated by NOAA's ELMR program (within the National Centers for Coastal Ocean Science Division) using the HYDRO as a base and then adding the above attributes.

The three fundamental steps associated with the integration process (Figure E-1) are: 1) develop seasonal salinity isohalines by 5 parts per thousand (ppt) for each estuary; 2) update fish and invertebrate species distribution and abundance data; and 3) via GIS technology, organize species distribution data by biologically relevant estuarine salinity zones.

The ELMR fish and invertebrate polygons organize the species spatial and temporal distribution data via salinity zones. Salinity analysis for the National Estuarine Inventory (NEI) estuarine systems focuses on two three-month periods (high- and low-salinity time periods) and one transitional salinity time period. These periods represent the typical high-, transitional-, and low-salinity conditions experienced under average seasonal freshwater inflow conditions. This organizational structure results in estuarine salinity zone polygons that are synonymous with the fish distribution polygons. Salinity is chosen to provide the underlying structure for portraying the fisheries information

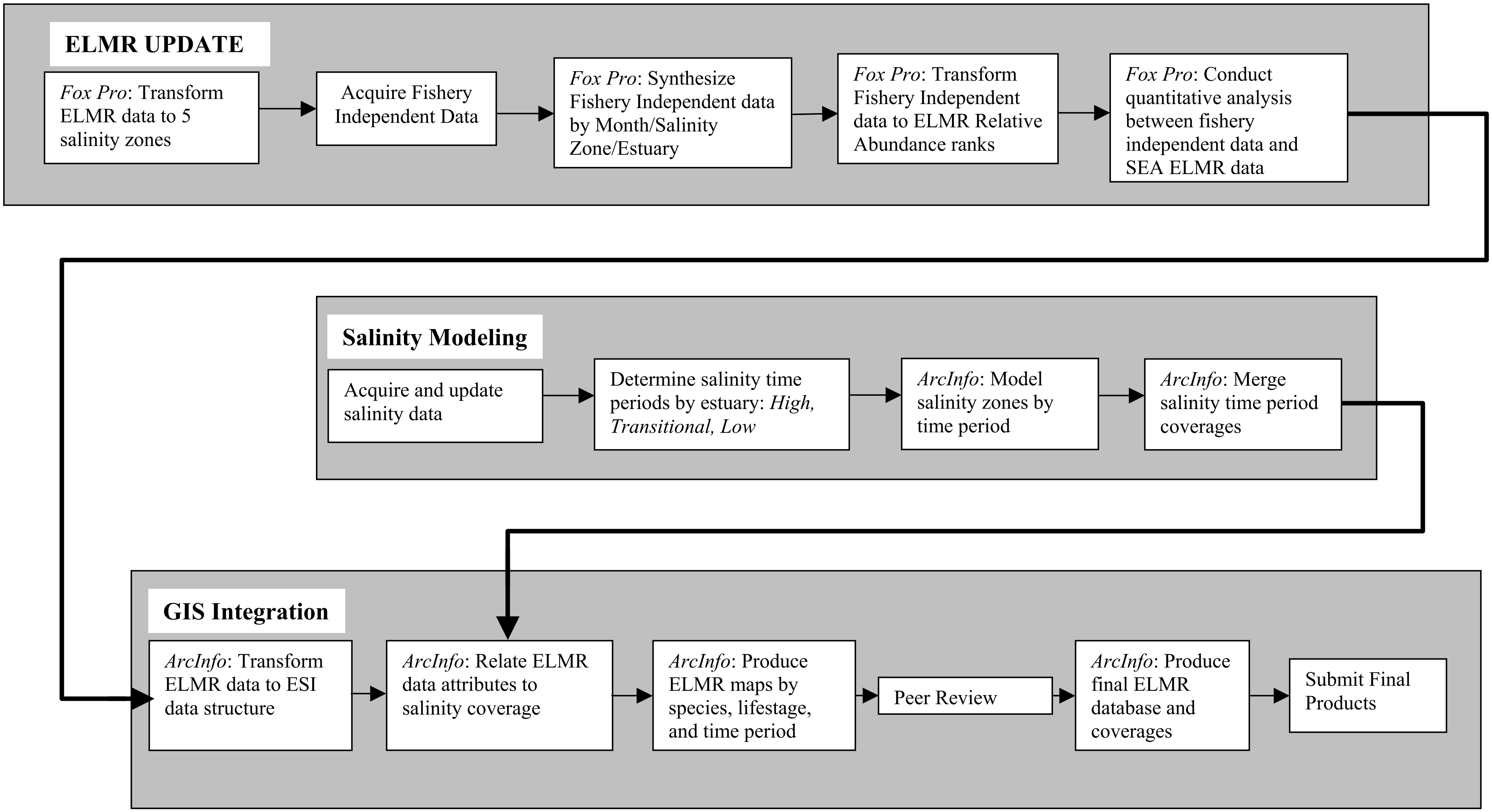

Figure E-1. Fundamental steps associated with the ELMR/NEI/ESI integration process.

since it is a primary factor affecting the distribution of estuarine species (Bulger et al. 1993; Monaco et al. in review). In addition, ELMR data are organized by month to account for the influence of water temperature.

The spatial and temporal distribution of ELMR's categorical relative abundance data are assigned to estuaries based on regional and local fisheries science experts, survey reports, peer-reviewed literature, and existing quantitative data. Species relative abundance rankings (highly abundant, abundant, common, rare, and not present) are determined by month for each of the selected species (Nelson 1991; Monaco 1995).

The relative abundance of a species are classified using the following species categories (Nelson 1991):

- Highly Abundant (5) - species is numerically dominant relative to other species within an assemblage.
- Abundant (4) - species is often encountered in substantial numbers relative to other species within an assemblage.
- Common (3) - species is generally encountered but not in large numbers; does not imply an even distribution over a specific salinity zone.
- Rare (2) - species is present, but not frequently encountered.
- No information available (1) - no data available, and after expert review it was determined that even an educated guess would not be appropriate.

There is approximately an order of magnitude difference in species abundance between each of these categories (Monaco 1995).

Fish and invertebrate relative abundance and seasonal life-stage data are aggregated for the seasonality data shown on the ESI maps. A hierarchical method uses the relative abundance information for the juvenile life-stage in the appropriate time period as the default. Using this method, the relative abundance information shown in the atlas represents the juvenile life-stage for the vast majority of the months. When juveniles are not present in a given month, information from the adult and larval life-stage is used, in that order. An ELMR supplement to the ESI atlas is available for those seeking a more detailed explanation of fish and invertebrate distribution and relative abundance data (Battista and Monaco 1996). However, in the ESI-GIS, all abundance values for all life-stages are stored in the BREED table.

As stated in Chapter 3, special concentration area polygons are included on the ESI maps for selected fish and invertebrate species to provide additional detail beyond ELMR-based distributions. For fish, these areas would emphasize important spawning, nursery, and migratory areas; and for invertebrates they would include harvested shellfish beds. Furthermore, these polygons may be attributed with concentration data for fish and invertebrates when this information is requested and when the data is available. Threatened or endangered species are an example of biological resources that warrant the development of these additional special concentration polygons.

NOAA conducts an array of GIS procedures to spatially integrate the ELMR data with the salinity information. The isohalines that define the salinity zones are modeled in time and space using GIS contouring techniques that use data from long-term point sampling stations. ELMR fishery data are then integrated with the salinity polygon features using unique attributes and digital relates between various tables. A unique attribute is created to enable the integration process that is a combination of salinity zone, estuary, and life-stage. Thus, separate time period, estuary, and life-history tables are linked in time and space. The ELMR data are completely merged into the BIORES, SEASONAL, and BREED data tables and the polygons are merged into the FISH and INVERT data layers. The RARNUMs and IDs are calculated and lookup tables are created.