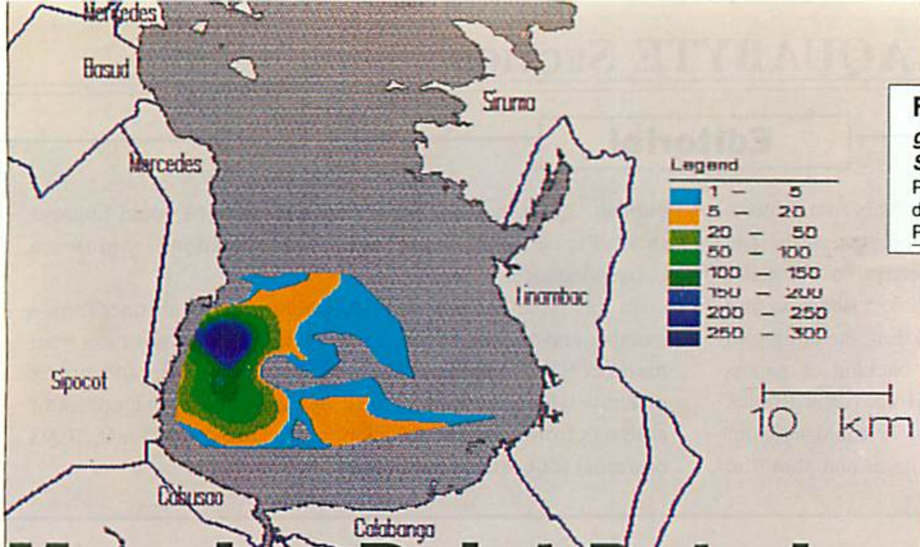

Fig. 1. ***Fishing grounds visited by gillnetters based in Sipocot, Camarines Sur, Philippines, January-June 1993.*** From Padilla, J.E., M.L. Dalusung and G. Calica. The dynamics of fishing operations in San Miguel Bay, Philippines. (In prep.)

Mapping Point Data in Geographic Information Systems

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Data collected from field survey whether biological, chemical or socioeconomic have always had a spatial component. Depending on the observer and the purpose of the survey, the spatial component is either ignored, given minor consideration or a certain degree of importance. Typically when reports are submitted, we see the results in graphs and tables, particularly those data that obviously have locational characteristics such as physicochemical parameters (water quality and sediment), fishing areas/catch and fishing populations. With the accessibility to global positioning systems (GPS), it is now relatively easy to record locational data during transects or surveys. Thus, mapping of fisheries data can be done with ease.

Presentation of spatial data is best done through maps. Here, we can see the spatial interrelationships between two or more entities whether complementary or conflicting such as between small-scale and commercial fisheries. Current modelling efforts, especially in fisheries, often ignore spatial feedback or are virtually landscape independent. The reality, however, is that fisheries management is spatial in nature. For a full discussion on fishery thematic mapping, see Caddy and Garcia[1].

With the growing popularity of softwares for cartographic modeling, geological modeling and geographic information systems (GIS), thematic mapping of spatial data such as by interpolation has become relatively easy. Spatial interpolation of point data like water quality paramaters into maps can be done in 1-, 2- or 3-dimensional configurations depending on the software used. Generally, geological softwares (e.g., SURFER, GRIDZO, Z/CON, KSTAT) have most of these features. Cartographic softwares and GIS generally have 1- and 2-dimensional display. In the latter, however, analysis such as overlay is done on a 1-dimensional surface. Except in GIS, most softwares exaggerate the locational setting from where the data have been collected (e.g., shape of the coastline). In GIS, the shape of the coastline matches that of the map of the area where data have been collected. This short paper deals with spatial interpolation in GIS.

Several spatial interpolation methods for point data are used. These are B-splines, kriging, trend surface analysis, contouring and distance weighted average. Most of these methods are found in geostatistical packages such as those mentioned above. Typical methods used in fisheries research are kriging and contouring. Kriging is a geostatistic technique that is based on the rate at which the variance between two sample points changes over space, expressed in a variogram. The variogram is a function of the distance between the points. It has been used to estimate fish density and abundance but it is not easy to use.[2] For spatial interpolation in GIS, the widely used techniques are Thiessen polygons (also known as Voronoi, Dirichlet tessellation and S-mosaic), contouring (triangulated irregular networks or TIN) and distance weighted average. Only two of these will be covered—Thiessen polygons and TIN.

Both spatial interpolation techniques require numerical data but Thiessen polygons can be used for categorical (non-numerical) data. TIN essentially partitions the entire study into triangular regions (Delaunay triangulation) with the value of the sample (e.g., depth) specified at the triangle nodes. TIN has been used to produce bathymetric and surface maps on water quality parameters. In Fig. 1, TIN is used to plot the fishing areas of two municipalities (Cabusao and Sipocot) in Camarines Sur, Philippines, and shows the number of fishing trips per area over a six-month period.

Thiessen polygon is a mosaic of tiles in which a line bisects perpendicularly all the lines drawn from a point to all its neighboring points. Thus, any point within that polygon is nearer to that point than any other point. Generally, the polygon becomes smaller where there is a high density of points. Thiessen polygon has been used to assess distributional pattern of species (e.g., trees) and rainfall. Thiessen polygons were used to construct a bottom sediment map of Lingayen Gulf, Philippines.[3] Since the digitized data are nominal classes like muddy and sandy, TIN cannot be used. Hence, Thiessen polygon would be appropriate. However, it is necessary to collapse the number of polygons into the number of classes as digitized through reclassification.

Further Reading

[1]Caddy, J.F. and S. Garcia. 1986. Fisheries thematic mapping - a prerequisite for intelligent management and development of fisheries. Oceanogr. Trop. 21(1):31-52.

[2]Sullivan, P.J. 1991. Stock abundance estimation using depth-dependent trends and spatially correlated varition. Can. J. Fish. Aquat. Sci. 48(9):1691-1703.

[3]GISCAMP. 1994. Siting of ARS using GIS. GISCAMP project technical report, ICLARM, Manila.

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