GIS in a Marine Environment

In days long gone by, it used to be said that electronics and the marine environment did not mix. Well, it is still true that electricity and water don't mix but computers and the marine environment certainly go hand-in-hand. To be more specific, Geographical Information Systems are just as 'at home' in handling marine data as they are in handling onshore data.

Many people fail to think beyond the use of GIS as a tool used by market researchers to analyse the demo-graphics of a community based on a series of postcodes. This planning is often used to help major supermarket chains to plan new sites for you and I to go and obtain the input for our part in the onshore food chain. Well, marine scientists conduct similar 'what if' scenario planning but instead of using people going to a supermarket as the logic for their queries, they look at animal populations and compare food demands in the different stages of the food chain.

GIS Input and Output

The activities of the marine research scientist are ideally suited to the GIS environment for the combination of various (apparently) disparate datasets to produce tools for the analysis of environmental impact in a variety of different scenarios. Just try and work with the age-old problem of the impact of oil and gas pipelines on fishery activities in the North Sea. Input parameter: fish stock (based on demographics of size and type and location); Overlay: water depths, water temperatures, water currents, oil company infrastructure, food-stock sources per fish type and Output: a variety of scenarios about potential relationships between the input parameters and the overlays. This is one easy way to make use of a GIS.

One of the interesting outcomes of these sorts of study is the fact that oil and gas pipelines were originally located in areas where there was no impact on fish populations because there was no marine growth in the areas to provide the basis of the food chains. The seabeds were essentially the marine equivalent of windswept plains. However, the introduction of pipelines has provided the shelter necessary for marine organisms to start growing; the analogy with the open plains would be some form of windbreak being erected. Marine organism growth creates a food source for fish, hence the introduction of fish to a previously barren area. Fish bring fishermen, fishermen bring nets, nets can bring pipeline damage, pipeline damage may cause pollution and so begins conflict between different areas of interest! However, use of a GIS to analyse these interactions can also help provide solutions with which apparent conflicts may be resolved very easily.

In certain parts of the world de-commissioned offshore structures are being deliberately deployed on the seabed so as to provide additional habitat for marine growth, thereby encouraging the growth of fish stocks, providing a source of income for local communities and, sometimes, an infrastructure for a new tourist industry namely - diving! Prior to this sort of change in the ecological balance of an area, extensive independent environmental impact studies are carried out to try and maintain the best balance in the ecosystem. GIS is probably the foremost tool used in the analysis stage of these impact studies. What is in fact happening is that the artificial reefs are providing the marine equivalent of a supermarket for the marine life of the area.

Move to the other side of the world and take a cruise on one of the catamarans that transports tourists around the Great Barrier Reef. An ideal way to keep the punters quiet in adverse weather conditions is to give them a GIS to play with. The storm-bound diver will not know that he is looking at a GIS when he plays with the computer in order to try and plan his next days' diving. He will be looking at various combinations of information such as water depths, types of coral, fish he might see, migration patterns of turtles and historical climatic conditions - and even combining all of this with online weather forecasts and three dimensional terrain models. The combinations are only limited by the amount of time and effort that the data preparation people have put into preparing the system.

GIS Applications

One of the big growth areas in the last ten years has been in the so-called 'dot com' industry. Aided by large data pipes (in the form of fibre optic cables) very disparate communities have been linked on the Internet. Whilst this in itself is also being extensively used to provide a GIS 'Down The Wire' service (e.g. route planning with hotel, restaurant and petrol station information) very few people have actually stopped to think about the amount of GIS use that went into the planning for these cable routes. Most of the large fibre optic cables have been laid in a marine environment as this is quicker and easier than the on-shore equivalent.

Whilst it may be a lot easier to obtain planning permission for a marine route than a land-based route (mainly because there are no underwater towns - yet) the environmental impact of these operations is still of major concern for all of us. The marine environment is one of the least impacted areas of the world. It is still something that we can hope to leave to our grandchildren in a 'reasonably' intact state. Think of the use that is made of GIS in studying pipeline routes and the ecology of the Barrier Reef and you can start to think of how it is used by the people planning cable routes.

The ability of GIS to make use of multiple layers or themes makes it one of the most valuable tools to many people working in a marine environment. They are using navigation linked in to real-time positioning data from GPS; the flying map seen onboard aircraft is a similar application. GIS are being used for ecological studies by governments, research scientists and developers of all sorts of marine facilities. They are being used by companies trying to exploit all sorts of marine resources, whether it is manganese nodules on the seabed, specific types of fish in the water or resources that lie hidden in the sub-strata under the seabed. Because they handle data and data is not too bothered whether it comes from land or water, GIS systems become invaluable tools for everybody involved in the marine world. The next time that you look at a navigation chart it will probably be as part of a GIS system, with the incredible added value of being able to link the chart with so many different data types.

GIS and Water Do Mix

So whether you want to know the weather in mid Atlantic, track the latest results in the Round the World Yacht race, find the nearest fibre optic cable, look for pipelines, find all water deeper than 2,000 metres or see where you can find an underwater volcano, the chances are that you will do it with all sorts of marine data that has been gathered or is being used in a Marine Environment. Electricity and water may not mix but GIS and water certainly do!