

# where should reserves be located?

## Science Can Provide Options

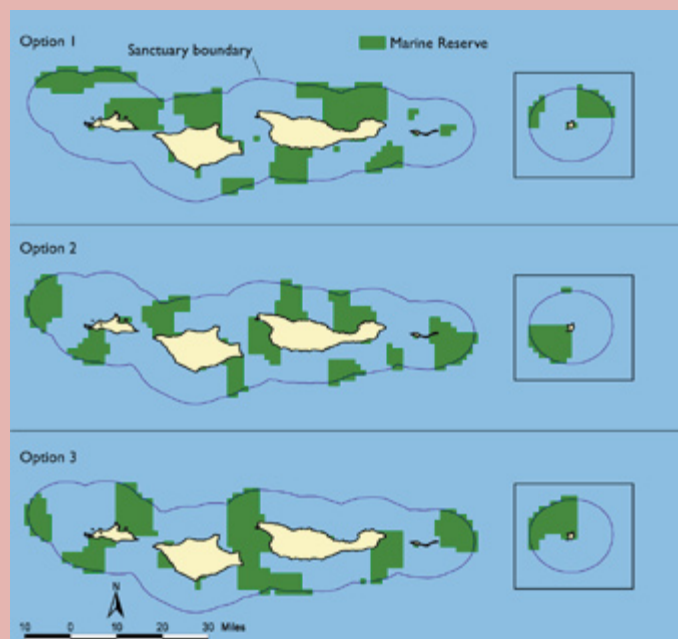
The reserve planning process often involves collaboration among many groups, including resource managers, government agencies, natural and social scientists, commercial and recreational fishermen, environmentalists, and other community members. Various scientific tools can provide options for the design of reserves or reserve networks, but decision-makers ultimately must weigh tradeoffs among short- and long-term goals, costs, and benefits.

Science can provide options through the use of models that analyze data and assist in the design of marine reserves. One such computer model, known as SITES or MARXAN, has been used to design reserve options in California's Channel Islands, the Florida Keys, and the Great Barrier Reef. This tool can identify many possible arrangements of reserve sites that satisfy particular management objectives. Maps of possible reserve sites produced by the program can help resource managers and stakeholders review many different options. This approach uses scientific criteria, but provides flexibility for reserve design.

### General Principles

- Reserve design can be based upon ecological, economic, and personal knowledge.
- Useful ecological criteria have been identified (see checklist on previous page) to guide reserve design.
- Models are available to help resource managers identify various options.
- There are often many options for reserve design that meet a particular set of goals.

In the Channel Islands of southern California, for example, a group of federal and state agencies, fishermen, conservationists, and other members of the community initiated a process to design a network of marine reserves in 1999. The group selected a panel of marine scientists to gather and evaluate biological information from this region. These scientists used the SITES model to generate hundreds of options for marine reserves. The three maps on this page are among the many options produced using SITES for a potential marine reserve network covering 30 percent of the Channel Islands National Marine Sanctuary. These options are based on the goals established by the community, and the options satisfy the ecological criteria for reserve design, including different biogeographic regions, habitats, and vulnerable species.



Three of the hundreds of options for marine reserves in the Channel Islands National Marine Sanctuary, developed using the SITES computer model.

## Human Values and Community Involvement Are Important

The social and natural science of marine reserves indicates that a great deal of flexibility often exists in reserve design. In many cases, this flexibility makes it possible to accommodate the behaviors, livelihoods, and lives of many ocean users.

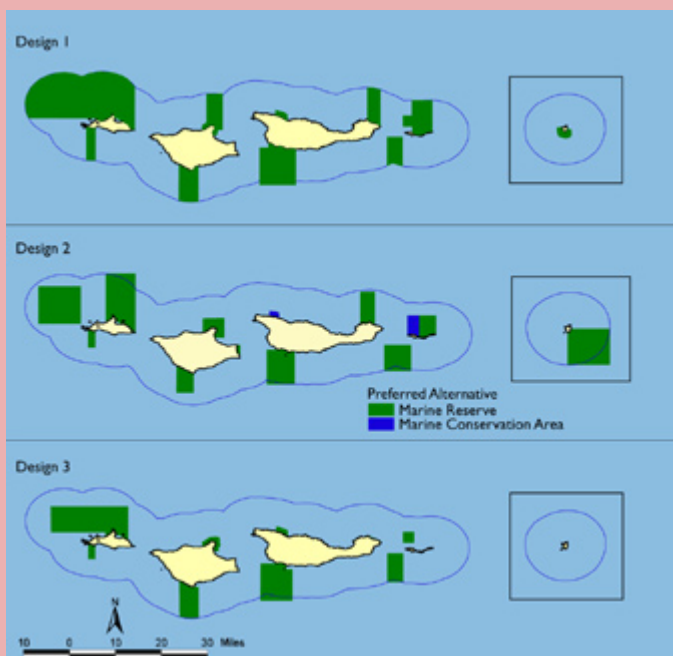
Full community involvement is one of the most important aspects of successful reserve design. Science can help us learn what reserves do, but communities must work together to decide how to apply this knowledge. A variety of questions must be considered before reserve design can satisfy the goals of diverse communities.

- **How will marine reserves affect commercial and recreational activities?**
- **How will current management regulations affect reserve design?**
- **What other management strategies will be needed to complement marine reserves?**
- **Who has the authority to establish and enforce marine reserves?**
- **How will the reserves be enforced?**
- **How will an agency or community secure adequate funding for establishment, maintenance, monitoring, and evaluation of reserves?**
- **What kinds of monitoring will take place in the reserve?**

The breadth of knowledge and values in each community can help to answer some of these questions. Personal knowledge can fill some of the gaps in scientific data. Economic modeling, based on data from landing records and logbooks, can be used to evaluate the potential short- and long-term economic impacts of reserves. Societal values can influence the design of reserves so that our traditional relationships with the ocean are protected and sustained.

Consider an example of how these questions were integrated into the design of marine reserves. In the Channel Islands of southern California, a group of regional community representatives developed various designs to protect marine ecosystems and address fisheries concerns. The representatives used the options developed by the SITES computer model (previous page) and additional scientific recommendations, as well as economic data and personal knowledge, to develop reserve designs.

Some of the designs (e.g., Designs 1 and 2) meet most of the ecological criteria, while accommodating different interests in the community. However, some designs (e.g., Design 3) do not satisfy all of the ecological criteria because of the way that economic and social factors were incorporated. Design 3 does not include habitat protection in some areas that are popular for recreational fishing, and this limits the effectiveness of the reserve network. Eventually, decision-makers must evaluate potential short- and long-term ecological and economic costs and benefits of reserves, and make the necessary choices given the trade-offs among these factors.



Three of nearly 40 designs for marine reserves in the Channel Islands National Marine Sanctuary. The community worked together to develop these designs using the ecological and economic data, as well as personal knowledge.