

Theme 1 - Defining what is at stake

Presentation: The Living Resources

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The plants, animals and microbes of the oceans are rich beyond imagining. Life below the surface is wondrously diverse, exotic and marvelous. It used to be thought that the seas were so vast that little could affect them. The phrase 'dilution is the solution to pollution' captures the old general attitudes toward most activities affecting the oceans. The oceans are vast, bountiful and infinitely resilient - or so we thought.

A series of recent events has revealed how misplaced these attitudes are. We are learning that the oceans, especially coastal areas, are under increasing and serious threat from multiple sources. We do not yet know the full extent of the problems, but marine scientists are in strong agreement that we are faced with a crisis of unprecedented complexity, proportions and consequences.

We have witnessed multiple *symptoms* which reflect numerous problems. We know there are a number of activities which pose *threats* to life in the seas. We are beginning to discover the *consequences* of some of these activities and the *challenges* in dealing with them. Let me take each of these in turn: symptoms, threats, consequences and challenges.

Symptoms

There are clear signals that we are faced with multiple problems, the most serious of which are as follows.

1. The seventeen major oceanic fisheries are all now being fished at or beyond capacity and nine of them are in a state of decline. The world-wide seafood production per person from 1950 to 1988 increased by 128% but from 1988 to 1993 decreased by 9%.
2. Non-commercial gleaning of seaweeds, shellfish and fish from local shores, which provides a significant amount of the nutrition of many peoples around the world, is also declining precipitously.
3. Unexpected, dramatic mass mortalities of many marine species are reported: marine mammal die-offs, fish kills, mass mortality of sea urchins, abalone, seagrasses and others.
4. The incidence of coral reef bleaching appears to be increasing.
5. Water quality in coastal regions is seriously impaired and in many places represents a critical human health hazard.
6. Increases in litter and trash, especially plastics, are obvious to almost everyone.
7. There appears to be an increase in blooms of toxic algae, such as those producing red tides, specifically increases in the magnitude, frequency and extent of these blooms. The consequences range from human health hazards such as paralytic shellfish poisoning, to aquacultural die-offs, to increased mortality of fishes and marine mammals.

These symptoms vary considerably in space and time; some are well documented; others less so. The symptoms are of obvious concern. Most of the world's population lives within 80 km of the coast. Coral reefs, estuaries, kelp forests and rocky shores are among the most productive ecosystems on Earth. Coastal fisheries are the richest in the world, with 75% of the world's fish catch coming from coastal waters.

Both land-based and ocean-based activities are concentrated at the coastal margins: tourism, recreation, fishing, mariculture, domestic and industrial waste disposal, military activities, transportation, mining and energy industries. This plethora of *activities*, the increasing *migration* of people around the world to coastal regions, the explosive *growth* of the human population and the *overconsumption* of resources are causing the changes we see reflected in the symptoms.

Threats

A number of recent scientific assessments list the following most important agents of present and potential change. (The order does not imply relative importance.)

1. Fisheries operations.
2. Chemical pollution.
3. Eutrophication.
4. Alteration of physical habitats (e.g. from trampling, trawling, dredging, drilling, dynamiting, building and dumping).
5. Invasion of exotic species.
6. Global climatic change.
7. Increases in UV-B radiation as a result of stratospheric ozone depletion.

Of these threats, pollution and climatic change have received much attention. There is no doubt that both of these are of critical importance. At the same time, over-fishing, habitat destruction and introduced species are in some places more serious or more immediate problems.

The magnitude of the problem of introduced species has only recently become known. Some species are transported around the globe in the ballast water of ships. It has been estimated that more than 3000 species a day are in motion inside the giant aquaria that serve as ballast tanks in ocean-going vessels. These introduced species have the potential to completely alter the trophic structure and ecosystem dynamics of bays and estuaries into which ballast water is discharged.

The loss of biological diversity resulting from habitat destruction and introduced species is of particular concern because it is irreversible and because people are so dependent upon the living resources of the ocean.

Consequences

I have described seven major symptoms and seven major threats. What are the likely consequences of these problems?

Marine life has already been altered to a large extent, sometimes with dramatic consequences.

In considering consequences, we tend to focus primarily on alterations to the *goods* which we reap from the oceans. Changes in the *ecological services* provided by ecosystems are also of great importance. Let me explain.

Ecological systems provide *goods* such as food, fibre, fuel, medicines, chemicals and genes which people use or trade. Ecological systems also provide *services*, for example:

- kelp forests and estuaries provide habitats and nursery areas for many economically important fishes;
- oysters filter and cleanse the water of bays and estuaries;
- kelp forests, mangroves and coral reefs protect coastal shores from erosion during storms;
- some phytoplankton may play a key role in regulating climate.

These ecological services, also called ecosystem services, are provided free of charge. They are largely outside our systems of economic valuation. They are of critical importance to us, but are largely unappreciated.

A recently completed international scientific assessment called the Global Biodiversity Assessment sponsored by the United Nations Environment Programme and published by Cambridge University Press (1995) draws attention to the links between biodiversity and the continued provision of these ecosystem services. This is an exciting new area of research with much promise for providing useful information for policy and management.

The suite of activities mentioned earlier is threatening both the ecological goods and the ecological services

of the seas. Even fisheries that were once thought to be inexhaustible, for example on the Georges Banks or the Grand Banks, are collapsing. Oyster populations in Chesapeake Bay that once filtered the entire Chesapeake estuary once a week now filter it only once a year. Stock depletion from over-fishing and disease have taken their toll not only on the food provided by oysters but also on the services of water filtration and cleansing which they provide.

Challenges

In the light of these consequences, what are the challenges?

The changes we are precipitating are unprecedented in their magnitude, kind and rate. Making predictions about likely outcomes of different possible management or policy options is extremely difficult. This uncertainty, coupled with incomplete baseline information about many systems presents enormous challenges. I echo and emphasise Professor Norman Myers' points made in his paper about the future holding surprises and uncertainty. This uncertainty and the likely irreversible consequences of many paths should make us much more careful and cautious.

The best possible scientific information should be readily available and easily understood by a wide variety of possible users. In some cases, we have insufficient scientific information to make informed decisions. Research to obtain urgently needed information is appropriate. In many other cases, sufficient information exists but is not communicated adequately or is not used. New mechanisms are needed to disseminate scientific information more efficiently and effectively and to utilise it more appropriately.

It would be useful to have a comprehensive, international scientific assessment of the state of the world's oceans. Such an assessment could be quite useful in providing a consensus statement on which to ground discussions about the wide variety of topics considered above. We might even be so bold as to suggest it be named OIKOS for Our International Knowledge of the Ocean State ('*oikos*' of course being the Greek root for our words 'ecology' and 'economics').

Conclusions

I have tried to summarise some of the symptoms, threats, consequences and challenges concerning the living resources of the seas. I was asked to address the question: 'What is at stake?' My answer is, very simply, 'Our future, and that of our children and grandchildren.' Why? Because a sustainable biosphere requires a living ocean. Moreover, it is clear to me that the seas are loved by many, needed by all but cared for by none.

Thus far we have failed to be good stewards of the oceans. Based on the knowledge summarised above, we have an urgent responsibility to work together to be better stewards, in short, to act.