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## NETWORKS OF "NO-TAKE" MARINE RESERVES ARE PRACTICAL AND NECESSARY.

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### SUMMARY

The first marine reserve in New Zealand was established in 1977 for scientific reasons. The rules were simple but strict - no fishing, no removals and no disturbance - but everyone welcome to come and study or just appreciate the more natural conditions.

The value of having "no-take" areas in the sea has, since then, become widely appreciated by recreational groups, schools, tourists, scientists, and fisheries interests. The list of potential benefits has steadily expanded, and evidence for their existence has accumulated. Specific benefits are commonly perceived, but the possibility of wider benefits, resulting from a network of ecologically-representative marine reserves, is beginning to receive serious consideration.

As a result, more marine reserves are being proposed at an increasing rate. By early 1994, eleven reserves had been established, five more await final decision and 20 further proposals are in various stages of public discussion. All political parties in N.Z. now endorse "no take" marine reserves in principle, and some are proposing "10% of all marine habitats by the year 2000".

The lessons are simple but surprising. Management of marine resource exploitation and its problems is necessary but not sufficient. An independent and additional system that ignores the "problems" (of controlling fisheries, waste disposal, habitat destruction, etc.) and concentrates on providing unexploited areas in the sea is scientifically essential (for observational and experimental controls); economically sensible (for insurance and sustainability); and socially-acceptable in a democracy (for a wide variety of positive reasons, including conservation principles, education and recreation).

## INTRODUCTION

New Zealand is a small, isolated country with a low population density. New ideas stand a better chance of getting a trial in small remote populations, not because the inhabitants are smarter, but simply because of the laws of probability. It may well have been just a series of accidents, but New Zealand was the first nation to give women the vote, to pioneer universal medical schemes and, more recently, to experiment with the development of "no-take" marine reserves. The history of this development extends back over 30 years. The steadily increasing success of the idea was closely tied to changes in basic attitudes to the sea and its life.

### (I) A SHORT HISTORY OF MARINE RESERVES IN NEW ZEALAND

In 1965, members of the University of Auckland requested some special protection for the sea directly in front of their marine laboratory at Leigh on the open NE coast. When told this was not possible under existing legislation, they campaigned publically, initially for some general empowering legislation (Marine Reserves Act, 1971) and then for the establishment of an actual reserve, which was formally established in 1977.

During this process two basic principles were established for marine reserves:

- (a) The conservation of the natural marine environment was the primary objective; all forms of fishing, any kind of extraction or disruption was prohibited within reserves.
- (b) People were encouraged to visit, appreciate and study the natural environment in the reserves, subject only to effects under the first principle.

To the surprise of most people, these principles proved to be both popular and practical. Although the public were not allowed to fish or disturb anything, increasing numbers came to enjoy viewing the marine life. Although scientists had no automatic right to experiment or sample, authority could be obtained if the effects would be well within natural variations and the study could not be carried out effectively elsewhere.

As the first marine reserves proved successful in both social and scientific terms, pressure for the creation of more developed. This process was aided by an increasing appreciation that marine reserves could act as general solutions for many problems (Ballantine, 1991).

By early 1994, some 11 marine reserves had been formally established, 5 more were awaiting final approval, and at least 20 others were in an advanced stage of investigation and public discussion. It is clear that New Zealand will very soon have a scatter of marine reserves, in most regions and covering many types of marine habitat. Discussion in New Zealand now centres on whether there should be a full system of such reserves, and, if so, what principles should be used to design and justify the system.

## (II) THE BASIC PRINCIPLES FOR MARINE CONSERVATION

If we wish to state the general principles for marine conservation, we do not get much help from existing practices. In fact, many of our present activities in the sea are unlikely to be sustainable, and the first global review of marine biodiversity (Norse, 1993) catalogues many widespread threats and problems. The following list attempts to ignore existing activities and assumptions, except to note where these are preventing sensible outcomes, and to look for the fundamental principles.

### **1. The sea is huge and its life is vitally important to the planet.**

This is the only solar planet with copious liquid water. Water covers more than two-thirds of the surface and is the basis of all life. Humans may call the planet "Earth", but this is just a symptom of our parochial attitudes. When we are not ignoring the sea altogether, we uncritically apply to it the principles and attitudes we have learnt on land. The first principle is to be more objective about the sea.

### **2. Marine conservation is conspicuous by its general absence.**

We have many marine regulations, but most of these are problem-orientated. They aim to reduce the conflicts between various human users of the sea or to limit the damage of various human activities in the sea. These regulations are only put in place *after* problems become serious; are only applied *where* the problems have occurred; and, if they have any conservation content, are limited to *particular* species or habitats that are *already* under threat. There are virtually no marine conservation programmes that are general in scope, designed to prevent problems arising, and applied on principle. The second principle is, of course, that we need such programmes.

### **3. The concept of naturalness is denied in the sea.**

Despite the recent increase of disruptive activity by humans in the sea, the concept of "natural" is still clearly the most sensible basis for marine conservation. This is not usually apparent because of our long and intimate co-evolution with other life-forms in most terrestrial habitats. Indeed many scientists deny the concept of natural altogether, being unable to imagine anything free from human influence, even in marine habitats we cannot live in, cannot control and have only recently learnt to disrupt on a large scale. The third principle is to recognise the concept of natural in the sea; to realise that the intrinsic properties of the sea and its life are still governing; and that the real danger is not to our local convenience or profits but to the system itself. Our power to disrupt this system is now great but our power of control over the sea is still weak or non-existent.

### **4. "No take" marine reserves would conserve biodiversity, but are rare.**

Areas of the sea reserved from extractive and disruptive use, are, by definition, the best way of maximising global marine biodiversity. However, very few such reserves exist, and even the latest scientific reviews barely mention them (Norse, 1993). All kinds of complex regulations attempt to *control* disruptive activities in the sea, but the idea of having marine areas without *any* exploitation rarely occurs to us. This is surprising, since

such reserves, as well as promoting conservation, would also support:-  
the scientific investigation of natural processes  
general education and specialised training  
the monitoring of natural and human-induced events in the sea  
many cheap and healthy forms of recreation  
sustainable harvesting

#### **5. Scientific controls and planning baselines are lacking in the sea.**

"No-take" marine reserves are fundamentally important as controls in marine science, and as natural baselines for marine management. However, these points are rarely acknowledged, still less acted on, because of preoccupations with other concepts. Politicians are more concerned with preserving individual choice, planners with the urgent problems of conflicting interests, fishery managers with single-species programmes, fishermen with actual catches, and scientists with precise but limited questions.

#### **6. Dispersive propagules require a network design for marine reserves.**

Most marine species have small, highly-dispersive propagules (spores, eggs, larvae, etc. drifting in the water). These effectively decouple the reproduction of marine populations from their recruitment. Because of this process, a network design for marine reserves is a fundamental requirement. However, since we have only recently considered that, on land, single large reserves may be best, the need for networks in the sea is rarely stated and, so far, has never been acted on.

#### **7. Representative marine reserves are the basic requirement.**

Representation of all biogeographic and major ecological systems is, by definition, the key to selection of sites for a marine reserve network. However, it is difficult for us, especially those in positions of authority, to act on this. Most existing marine reserves are for unique or special areas, or exist to control special problems. Professionals are trained to recognise special circumstances, and employed to react to particular problems. They and their employers find it hard to act on general principles, except after prolonged experience.

#### **8. Widespread human agreement could create marine reserve networks.**

Widespread public support is the only real requirement for the establishment of a network of "no-take" marine reserves. Because the sea is deemed to be communally owned, it is not possible for marine reserves to be created by purchase or just local agreement. Equally, however, widespread agreement for a change in public management is all that is needed.

#### **9. Marine reserves require public access and appreciation.**

We can learn from theory, but it is much easier to learn from direct experience. If some representative marine reserves are created, and people encouraged to visit them, the idea would quickly become more popular and accepted. However, many existing marine protected areas actually prohibit public access. The reasons given include the protection

of scientific work, the needs of rare or endangered species, and safety or secrecy (many military areas are effective marine reserves). Only rarely do marine reserves prohibit extractive activities *and* welcome people to come and appreciate their full natural marine heritage, thus learning about its complex intrinsic properties and the need for caution in exploitation.

### **10. Changes in attitudes are needed.**

Disruptive changes to marine ecosystems due to human activities are increasing at a rapid rate. The actual disruptions are largely unintended, unforeseen and unnecessary. Unless there are some rapid alterations in human attitudes and assumptions, the maintenance of marine ecosystems is in doubt.

### (III) ASSUMPTIONS THAT PREVENT MARINE CONSERVATION

Since, as shown above,

- (a) "no-take" marine reserves are successful in actual trials
- (b) basic theory indicates such reserves are necessary
- (c) they cost nothing, except for general public agreement on their value

We have to ask the question - Why have so few been established (indeed none in most regions) and what can and should be done about this?

It seems likely that there are some widely-held, but erroneous assumptions that block the adoption of the idea. Not just one assumption, but an interlocking and apparently supporting set. Since the responsible professionals are generally lukewarm on marine reserves, at least some of these assumptions are not just ignorant or stupid, but actually appeal to the sophisticated and highly trained.

The history of science shows that many ideas, which seem obvious with hindsight, were held up for a long time by inappropriate theoretical assumptions. We should be careful, similar things could be happening now. The following section goes over the principles already listed, in a deliberate search for blocking attitudes and unwarranted assumptions.

#### **1. We treat the sea as a marginal extra, not as a main feature.**

The tremendous practical difficulties we experience in trying to learn about, or manage the sea tend to blind us to its size and importance. In the foreseeable future, we are unlikely to be able to give the sea scientific effort proportional to its size or importance. But we should recognise this as a failure in our ability. It may be inevitable, but it is not a good idea, nor is it supported by any reasonable theory. If we can admit our inadequacies, we can at least start to deal with them.

#### **2. We work to correct problems in the sea, but do little to prevent them.**

Most of our current marine "management" is simply fire-fighting. We have plenty of "problems" which are urgent and exciting. Dealing with them can absorb all of our attention and effort. Those trying to propose ways of avoiding the problems can be made

to appear idealistic, unpractical or even anti-social, because they are not immediately helping. But broad experience strongly suggests that general solutions, based on principle, while less exciting, are the only efficient method of management.

### **3. We fail to recognise the natural properties of the sea and its life.**

We are very parochial and if something doesn't work on land, we assume it doesn't work in the sea. On land we have often obliterated anything remotely natural, even in physical terms and most of us live in areas where our control seems total. But in the sea, natural processes still govern most things and while we now have power to damage these processes, we have little positive control over them.

### **4. We rely on complex marine management, but reject simple insurance.**

Detailed planning and management arrangements are necessary, but we should not rely solely on these. In any business, insurance is a sign of intelligent management. Even large fisheries can collapse. Detailed management is not sufficient. Stock refuges, nursery grounds, the adequate supply of food for commercially important fish depend on the health and well-being of the whole ecosystem. Non-extractive areas are obviously a form of broad insurance.

### **5. We see marine reserves as special features, rather than as general standards.**

Because legal and social effort is needed to create a marine reserve, the scientists, managers and planners tend to regard them as experiments, which need special justification. Less sophisticated people can see that places which you don't fish or disturb are the general standards for comparison (i.e. the controls).

### **6. We ignore the need for network designs in marine conservation.**

On land most organisms reproduce directly into the same population as their parents, and, as a result, single large reserves seem best. But in the sea, widespread larval dispersal is the rule. It is a notorious fact in fisheries biology that stock/recruitment ratios are almost impossible to explain or predict, although, of course, there must be *some* relationship. The only effective reaction to this, for conservation, is to have a network of marine reserves. A network, by definition, does not require detailed or specific knowledge.

### **7. We concentrate on the rare and special, rather than the frequent and typical.**

Reserves representing most marine habitats in all biogeographic regions are clearly the best approach to conservation, but we tend to put our effort into the rare and exotic. Although endangered species, unique locations and special habitats have obvious interest, it is not sensible to base general policy on them, or to give their care priority over widespread declines and degradation.

On land, where management can include real control and actual production, we distinguish sensibly between interest and importance (the Crown Jewels are more interesting, but the potato crop is more important). In the sea, where management is mostly the prevention of disruption, this distinction is even more critical.

### **8. We give "rights" to users of public property, but not to the public.**

Fishermen and other "user groups" get most of the political attention and all the "resource allocation", while those not currently disrupting anything are often denied any say in the matter at all. At present we have no system for assigning *any* value to the intrinsic properties of the sea or its life, not even some small proportion for contingencies or insurance.

Virtually any identifiable "use" of the sea, from salt works and dredge dumping to big game fishing and water skiing, is treated as requiring an appropriate allocation. But those who just want to look at undisturbed life and habitat in a marine reserve have to make a special plea, and are generally unrecognised. This is extraordinary, because it denies even the most fundamental concepts of environmental science.

### **9. We need more public interest in the sea but hinder its development.**

The public are potentially very interested in the natural properties of the sea, but to develop and enjoy this interest they need provision of areas that are not actively disturbed. In most regions there is no provision for this, and all they are allowed to see is what the "users" didn't want. This makes it difficult to appreciate the range or richness of the sea and reinforces the prevalent view that the sea is only there to be "used".

### **10. These attitudes are the barrier to marine conservation.**

The set of assumptions about the sea we have just listed is the main barrier to effective marine conservation. Taken separately, each of these assumptions can be shown to be inappropriate or inaccurate. But when held as a set they form a formidable block.

If you try to challenge these assumptions at a local level, say as a conservationist trying to get a local marine reserve, you are forced to give special reasons to counteract the cry "*Why should it be here?*" The more successful you are in this, the more difficult it is to move up scale, and the less support you get from the professionals. Even if your reserve is established and is a success, since you have proved it is special, it is not replicable or representative. Furthermore, because it is special, its effects are local and it does not prove anything anyway. You have not developed any general argument for more reserves elsewhere.

If you try to challenge the blocking assumptions from the top down, for example as a ecologist stating the principles actually appropriate to the sea, there is little opposition from the professionals, but you are far from anything practical. The politicians and general public can ignore you completely. You have no argument for any particular action, or any actual marine reserves.

## **(IV) A PRACTICAL PLAN FOR ACTION**

Although at first sight the above analysis seems to leave us with no route for action, I believe the solution is really quite simple -

1. We must attack the barrier of assumptions from both sides at once. We need two simultaneous approaches, one drawing on local pride, personal enthusiasm and particular concerns and the other based on general wisdom, global scale and scientific principles. A pincer action is need to produce:

- (a) the rapid provision of some actual marine reserves as examples (the local action)
- (b) the forcible statement of appropriate principles as the banner (the global thought)

Both these approaches are low cost, but both require changes in attitude.

2. To get appropriate principles, we, the professional scientists, have to question our assumptions and change our attitudes. We must sort out the principles that actually work in the sea, and stop believing that either traditional assumptions or land-based attitudes must be valid. The first clear principle is that we need unconfounded situations for research and education. Such areas, with zero extraction and minimal disturbance, will also provide for monitoring effects, for recreation and for ecosystem support.

3. When we have re-educated ourselves, we can recommend *additional* policies that will provide positive action for marine conservation. Top of this list would be networks of "no-take" marine reserves.

4. But the politicians and the public will be not be able to appreciate these new principles unless they have working examples. So we must, *while* we are working on our principles, get some actual "no-take" marine reserves to act as learning grounds and show cases. To do this we can use any special local points, but we must talk more about the typical and representative features. Each reserve can use local or sectional interests to gain support (including educational, scenic, historic or scientific) but must also proclaim the general need for insurance.

5. Given these examples we could encourage the public to enjoy the full natural diversity in the sea on show there, to appreciate the complexity of this and learn more about its importance.

6. When informed by the public that marine reserves are popular, by the scientists that they are necessary, and by treasury officials that they don't cost money, politicians will be able organise a system.

## CONCLUSION

Archimedes, when trying to emphasise the principles of levers, said:-

*Give me a firm enough place to stand and I will move the world.*

At present, trying to establish some marine conservation, there is no firm place to stand. Not just because the sea itself is fluid and mobile, but also because our mental grounding is full of data gaps and inappropriate principles. Some of this is inevitable, - the sea is very large, full of strange life-forms and unfamiliar processes. We are not able to live in it or see through it - but some of our mental confusion is self-inflicted.

Due to a series of accidents in New Zealand, we now have working examples of marine reserves. From these we can recognise some firm principles for the sea. Principles that are capable of general application and which could "move the world" in a sensible way.

A network of 'no-take' marine reserves will not solve all our problems, but it would certainly help us think more clearly and act more intelligently. If we decided to have places in the sea as undisturbed and natural as possible, we could learn what was natural, instead of just trying to imagine it. If we had some natural baselines, we could measure the effects of our activities, instead of just arguing about them. If we had better ideas about how the sea itself operates on its own, we could plan sustainable harvests and sensible manipulations, instead of booms, busts and creeping degradation. We could even show our children the real marine world, for education, and appreciate it ourselves, for recreation and as heritage.

*Note:* The first humans only reached New Zealand about 1000 years ago and the population is still relatively low. Despite plenty of introductions and habitat alterations, and the loss of some species, it is still possible for anyone in New Zealand to picture their land without people and base practical policies on this (e.g. National Park management policies). Because they can do this on land, they have no problem transferring the idea to the sea, where it fits even better. Indeed, natural, meaning without human interference, is a sensible and useful idea in the *sea* nearly everywhere. But, because in most regions "natural" has no clear meaning on land, the idea is not invoked or used in the sea.

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