https://doi.org/10.26749/rstpp.108.1.1

KEYNOTE ADDRESS

by A. Dunbavin Butcher

Ministry for Conservation, Melbourne, Victoria

ABSTRACT

The complexity of the management of the marine environment increases as our understanding of that environment grows and as we accept social responsibility.

The living marine resource as a whole remains under-exploited and increased harvesting is largely dependent on overseas demand.

Concern for the mercury level in school shark has led to an expansion of exploratory fishing activities.

Management is the end-point of a long sequence of actions and it involves the interpretation of data and the giving of advice. The subsequent management action requires continual monitoring and re-assessment, with the community's best interest as the matter for primary concern. Management may be concerned with the conflict between competing users of a resource and between the users of different resources when one of the latter adversely affects the marine environment; also with the introduction of exotic living species and with the withholding of a fresh water input by the damming of streams.

Estuaries have a role in the marine environment which is disproportionate to their area. It is important that the growing problem of heavy metals in estuaries be placed in perspective relative to the total marine environment and that flexibility be introduced into the regulations governing the mercury level in marine organisms used as food.

INTRODUCTION

This symposium concerns itself with the resources of the sea, and descriptions will be given of the physical setting, of the physical resource and of the aesthetics of the scenic margin which is provided by the coastline of this island of Tasmania. There will be descriptions also of the living resource, its harvesting, its manipulation in the art of "farming" of marine organisms and of the inter-dependence of and the inter-reactions between its component parts.

Each of these matters is of great importance in its own right. But the purpose of this paper is to take the overall view and to look broadly at the growing complexity of management of the marine environment and of the resource which contributes to that environment. The complexity increases as our understanding of the environment and of the resource grows; it increases with the growing recognition of our social responsibilities.

HISTORICAL

At the time of settlement of this country there was little knowledge of the physical resource of the sea; there was a very great interest in the seas themselves and of the influences acting on the seas. The settlers' early concern was with food and with commerce when it became apparent that the aquatic mammalian resource of the region was in demand overseas. Reference will be made to the continuing influence of the overseas demand on the harvesting of fish and aquatic invertebrates.

Keynote Address

During the early colonisation of south-eastern Australia and the initial pursuit of pastoral and agricultural activities, and later of mining, fresh fish was a costly commodity available mainly to coast dwellers. Fishing operations were conducted in shallow coastal waters, lakes and estuaries and supplies were irregular.

Winstanley (1973) reports that from the first colonisation of Tasmania at Hobart in 1804, settlers took advantage of the abundant marine life in nearby waters, relishing in particular the rock lobster. Early concern was expressed as to the future welfare of the fisheries around Tasmania and in 1882, there was a Royal Commission on Fisheries to ascertain the status of the various fisheries, the knowledge of the resources and to recommend courses of action to promote the development of these fisheries.

Prior to this, the entrepreneurs of the infant colony of Sydney sought actively to acquire wealth in many fields of commerce - importing, exporting, manufacturing, ship building, public contracting and maritime adventuring (Hainsworth 1972, p.21). It was therefore natural and to be expected that reports of extensive seal colonies to the south, in Bass Strait (Matthew Flinders 1798 publ. 1814, p.clxx), resulted in an immediate surge of activity in the hitherto unexplored region. Seal products - fur skins and oil - were valuable commodities and obtained a ready market in China and Europe. At the beginning of the industry four species of seals occurred abundantly in Bass Strait - two fur seals, a sea lion and the elephant seal. Within ten years most of the more accessible "grounds" were virtually exhausted and the elephant seal had been totally eliminated. This situation was primarily due to the greed of the principals concerned and partly to the inability of the colonial administration to conserve the herds, even though the need was clearly recognised (Australia Parliament 1914, p.145, and Anon 1803). Within that first decade at least 100,000 skins and many hundreds of tons of seal-oil were exported from Sydney. This was the colony's first export industry.

As the profitability of sealing in Bass Strait declined, the colonial sealers shifted operations to new colonies that were discovered along the south coast of New Zealand and on islands to the south and east. Commercial interest in south-eastern Australia did not wane however, for with the settlement of the Derwent in Tasmania came the discovery of a second valuable marine resource - the right whale.

During the winter vast numbers of this Antarctic species migrated to the bays and estuaries of Tasmania's east coast. Whaling from shore stations began as early as 1806 and flourished enormously, but like the sealing industry before it, it too finally collapsed about 1840. Local ships then fitted out for the more sophisticated enterprise of sperm whaling on the open seas, in competition with large numbers of foreign vessels already working the southern grounds. Such records as exist indicate that the bay whaling phase of Australia's early whaling industry was very lucrative. For the decade 1828 - 1838 at least the value of this "fishery" was in excess of half a million pounds (Norman 1938, p.28).

Another resource of the sea, the mutton bird, played an important role in those early days and it has been utilised by Europeans from the very beginning of discovery and settlement in south-eastern Australia. The navigator Matthew Flinders was astonished at the size of an enormous flock which he encountered when surveying in western Bass Strait in 1798 (Flinders 1814). Widely distributed, abundant and remarkably regular in the timing of its annual return to its nesting islands, it was a guaranteed source of food to resident sealers and others in Bass Strait; both eggs and young were taken. Later, with the growth of population in Tasmania and Victoria, it became an article of commerce and a small seasonal industry developed. Commercial mutton-birding persists to the present day and represents the only successful wild-fowling industry in Australia.

As the development of the colonies continued, improved transport, the introduction of cold storage, industrial growth and the expansion of the coastal cities favoured the development of the fishing industry. Urban life and a growing export of frozen meat to Europe, which was assisted greatly by a local contribution to the technique of cold storage on ships, led to an increased cost of living and this in turn made the further development of fisheries a necessity.

In 1902 the Agent-General for New South Wales was requested "to consult the best authorities and obtain, as far as possible, the most competent fisheries expert available" (Lockyer 1915, p.iii). Harald Dannevig, a Norwegian was recommended and appointed.

Dannevig succeeded in bringing to Sydney from England on his voyage to Australia several hundred live adult plaice, turbot and other fish. The fish all died in inadequate ponds which had been constructed in Sydney. (The matter of the introduction of fish is to be the subject of later comment).

In 1908, the Commonwealth Government commenced a systematic survey of trawl fish resources off south-eastern Australia. Dannevig, in his capacity as Commonwealth Director of Fisheries, was responsible for the programme and the F.I.S. "Endeavour" located extensive trawl grounds in eastern Bass Strait between 1909 and 1913.

In subsequent years steam trawlers based at Eden and other mainland ports commenced fishing these grounds. Today the Danish seine fishery based at Lakes Entrance continues the harvest of demersal fish species in eastern Bass Strait and supplies a substantial part of the fresh fish eaten in Victoria. Major fisheries based on the scallop stocks, which were discovered off eastern Victoria and the Furneaux Islands during the Endeavour's survey, have been developed during the last 15 years.

An Australian Fisheries Development Conference was held in 1967 and the Commonwealth Scientific and Industrial Research Organisation Division of Fisheries and Oceanography submitted a paper "Major Australian Marine Fisheries and the Prospects for their Exploitation." The status of the "developmental estimates" was qualified by the statement "For only about a quarter of the listed species has there been anything in the nature of a stock assessment from which prospective catches can be forecast with evidence... Forecasts therefore are extremely tentative, made from a review of a variety of evidence" (CSIRO Division of Fisheries and Oceanography 1967).

For the purpose of this paper, comment can be confined to the fact that the qualification expressed is not significant when the prospective increased production for certain species of fish, ranging through 10 fold, 50 fold, 100 fold and 300 fold, has not eventuated and those particular fisheries remain static or insignificantly increased.

DEVELOPMENT

In a country such as Australia there is need to examine the factors which influence utilisation of the living marine resource. A statement made in the United States of America (Anon 1960) has equal application here: "In our beef eating country, many species of fishes have their greatest value to the people as objects furnishing vital outdoor recreation." Australia is not a fish eating country traditionally and there has been little incentive to develop the harvesting of marine organisms for domestic consumption.

During the period 1957 - 1961, an ecological survey of Port Phillip Bay conducted by the Fisheries and Wildlife Division and the National Museum of Victoria located

commercial concentrations of scallop (*Pecten alba*). This was publicised but no fishing activity followed. The Tasmanian scallop fishery had long been accepted as the Australian fishery and there had been little or no production elsewhere. This fishery met the requirements of mainland Australia and also the overseas market. In 1963, production in Tasmania fell dramatically and export orders could not be met. In September of that year, Tasmanian fishermen brought their boats into Port Phillip Bay and commenced a new fishery which was so successful that Australia rapidly became the world's third highest producer of scallops.

In June 1970, the Port Phillip Bay scallop fishery was temporarily depressed. The occurrence of scallops off Lakes Entrance had long been known and now they were located in commercial concentrations. The Victorian Department has since conducted further surveys.

Tasmania has experienced repeated recruitment failures on the old scallop grounds and currently the fishery on these grounds is in a depressed state. The Tasmanian Fisheries Division has also carried out surveys and these have been in Bass Strait below latitude 39° 12' south and at a depth less than 40 fathoms (Grant and Alexander 1973). These surveys brought about a revitalisation of the scallop industry.

The presence of abalones (black-lip abalone *Haliotis ruber* and green-lip abalone *Schismotis laevigata*) had long been established, but it was not until the summer of 1963-64 that commercial exploitation commenced. An export demand by South East Asian countries provided the incentive for this development and today Australia is the greatest producer of abalones. Tasmania is the most productive state, followed by Victoria and South Australia.

The Fisheries and Wildlife Division successfully demonstrated the feasibility of catching striped tuna (*Katsuwonus pelamis*) with monofilament mesh nets off Lakes Entrance in 1963. This was intended to provide an additional source of fish for the canneries, but for a number of reasons the fishery was not developed. Subsequently, the fishermen themselves established that this particular gear developed for taking striped tuna was efficient in the capture of shark and it partly displaced the traditional long line.

Fish meal is a widely used commodity as an additive to stock and poultry food and for other purposes and it has been a significant import item. In 1969, a fish meal plant was established at Lakes Entrance and this provided an impetus to the infant purse seine fishery for pilchards (*Sardinops neopilchardus*) and anchovy (*Engraulis australis*). Four large vessels now operate and the catch is either processed as fish meal or prepared as frozen blocks to be incorporated in the rapidly growing pet food industry. High quality defatted fish flour was first produced in Tasmania in 1973 using catches of jack mackerel (*Trachurus declerisi*) from two new purse seiners.

Squid are numerous in south-eastern Australian waters and two species (Gould's squid *Notodarus gouldi* and Southern calmary *Sepiotheuthis australis*) are of commercial significance. Squid have long been prized as food in the Mediterranean and the Orient, but demand in Australia has developed only since the intensive post-war immigration programme. Significant development of the fishery will be dependent on the export market which is offered by Japan (Wolfe 1972). Both Tasmania and Victoria have been actively engaged in exploratory fishing.

The marine food requirements of Japan are potentially the most significant factor to influence the harvesting of the aquatic resource in Australian waters. Japan must increasingly seek its needs further afield and Japanese fishing vessels and merchants now reach into the oceans of the world. Japan seeks to take fish using its

own resources; it actively seeks participation in joint ventures and it is prepared to buy direct from the national producers.

The most important influences on the development of new fisheries and on the expansion of old fisheries are not derived from the domestic market. This applies to Australia as a whole, not only to south-eastern Australia. Some marine products are a valuable export commodity and the return to be obtained from export far outweighs the return available on the domestic market and therefore the local citizen is frequently deprived. In some instances, it is only the export market which sustains the optimum rate of exploitation of a particular resource; the local demand is minimal.

There are departures from these influences on both production and consumption and the oyster is a good example. The oyster is regarded as a desirable luxury in many countries and there is a very lucrative industry on the east coast of Australia. As the oyster is mostly consumed alive it must remain intact in the shell until shortly before it is eaten so that the problem of weight severely limits the export of oysters from any country. Oyster production is normally for the home market. This situation, together with the concern that the east coast industry may be confronted with some of the problems affecting the oyster industry in Europe, has led Tasmania to enter into production of oysters.

The conservatism of the average Australian in respect to what sea foods he is prepared to eat is also an important influence on the development of potential resources. This, in turn, reflects the availability of alternative sources of protein and this particular influence is not confined to Australia. In many countries fish (marine organisms) production is in an inverse ratio to the availability of other proteins.

In March 1972, the Customs Laboratory in Melbourne found high mercury levels in school shark (*Galeorhinus australis*) from New Zealand. Subsequently the Victorian Health Department and the Fisheries and Wildlife Division conducted a study of the mercury levels in sharks from south-eastern Australia. Tests indicated that the levels of mercury in nearly all gummy sharks (*Mustelus antarcticus*) were within the permissible standard of 0.5 parts per million. Nearly all school sharks over 104 cm long had a higher mercury content than 0.5 parts per million.

As a consequence during September 1972, legislation was introduced to ban the landing or consignments of school sharks over 104 cm in length in Victoria. This action affected many shark fishermen and Governments assisted by providing funds for a programme of exploratory fishing. Shark boats were chartered to conduct trials using beam trawls and otter board trawls, for mid-water trawling and for drop lining for deep-sea trevalla (*Hyperoglyphe porosa*) off the continental shelf. Other craft were chartered for trials for crab trapping, for fish trapping and Danish seining on new grounds.

MANAGEMENT

Considerations

Carpenter (1971) in speaking on "Expectations of the Decision Maker" during a Summer Study organised to discuss "Man's Impact on Terrestial and Oceanic Ecosystems" raised issues which are highly relevant both to Man's direct and deliberate impact on the oceanic ecosystem through his utilisation of the marine resource and to his indirect impact on the ocean arising from his utilisation of other resources. This latter aspect is to be developed later in this paper. He said "Human beings make decisions constantly regardless of the adequacy of information and, to an extent, regardless of the penalty for being wrong. The basis for this Summer Study, however, is that leaders in society want to make better decisions (that is, optimum for human

progress) and that science can provide approximate truths as a basis."

> "Decisions of individuals (freedom) can become a tyranny on the collective welfare as in the impacts of population on the world commons. Democratic political processes seek the proper trade-off between the common good and individual liberty. As technology and population increase, good collective decisions become more important, but that does not mean that they can or should all be made by political bodies. Through education and leadership the locus of decision can still often remain with the individual. Thus the results of the Summer Study are directed at both the citizen and public officials. Both individuals and institutions have a limit as to the number of issues they can consider at any one time."

Having discussed the need to demonstrate that a problem is worthy of special consideration, he then listed several criteria to be met if a particular problem is to be ranked in high priority and one of these was that "man-made sources are important relative to natural sources or background values."
Carpenter continued:

> "Extrapolations and 'if-then' scenarios are perhaps useful in arousing public interest, but they confound the decision-making process. The decision maker is used to incomplete knowledge, in fact this is always the case. The scientist is used to hypothesis and experimentation. As long as the presentation of scientific advice is careful to separate out the 'do know', 'don't know', and 'could know', the communication will be beneficial to the politician. A pro-and-con format may be useful. Another device is the admitted weighting of evidence (on the basis of peer judgement) in order to make a definitive statement - with dissent and its reasons placed in a footnote."

Carpenter's comments are of particular significance if it is accepted that the respective roles of the scientist and of the decision-maker, as defined by him, are appropriate and are to be developed further.

Carpenter states further, "Scientific advice to the political process stops short of advocacy even though one course of action may be obvious to the scientist" and "Even in these complex technical matters the ability of the politician to integrate economic, social, raw political and human intuitional inputs is valuable and should be guarded."

He concludes his paper by saying "The decision maker can be greatly helped by the purposeful seeking out of those facts and interpretations that strengthen implementation of desired courses of action by enlisting human nature. In fact, it would appear that people will do the right thing even at some personal inconvenience if some reinforcing of their ethical armament is provided by pointing out practicality and prudence. This does not suggest any distortion of the scientific information but only that effort be directed at revealing the relevance of good environmental management to personal health and welfare. And since the ecologists seem to be on to something, that ought to be easy enough to do."

Carpenter's views emphasise that the management of the living marine resource is a vastly more complex matter than it was even a few years ago. This has arisen through a recognition of, and an acceptance of new elements in management.

> "Management is the end-point of a long sequence of actions. It requires an understanding of the resource and of the environment of which the harvested resource is part - ecological data; it requires a knowledge of the fishery itself including man-power, the vessels, the gear, the time it takes to catch fish, transport, marketing, the cash return to the fisherman - economic socio-economic data.

> Management requires an interpretation of these data and the giving of advice and, having given advice, it requires continual monitoring and continual re-assessment... It is paramount that whatever decisions are made, they must be in the best interest of the community." (Butcher 1969). (The greater part of comment in this address is directed to the living marine resource. The physical resource is not renewable, certainly not in situ, but much of the principle of management of the living resource applies equally to the non-renewable resource).

Butcher (1969) has stated further "One might well question how long the tradional concept of Man in relation to the marine environment and the resources it fosters is to prevail. The one significant change of recent years is the relatively large increase in the marine harvest. Rarely identified are the more subtle changes in the environment itself which is a product of this era of international irresponsibility. The change in the environment will be acknowledged, if not recognised, when the available marine resource is significantly reduced.

"Excluding for the moment Man's newly found skills, the marine environment is not a static thing. It is ever changing naturally, according to cyclical conditions, hourly, daily and at other intervals and it is also influenced by other, less regular, natural phenomena. It is vastly complex, but at the same time self-regulating. This applies also to the marine resource which man harvests, in part. This resource is part of the environment. Man himself is involved as a hunter still and it is Man's belief, wrongly held, that this environment has an endless capability to absorb the refuse of civilisation" and also,

> "A living resource may be used, in perpetuity, if that utilisation is so organised that it is at an optimum level, removing the surplus fish or other marine populations in conformity with the requirements of maintaining the stocks. This, in fact, is conservation."

The maintenance of optimum production by regulation is the subject of other papers in this symposium. In its simplest form management pays due regard to the biology of the organisms, the economics of marketing (a biologically adequate or desirable minimum legal length may be unacceptable from the marketing viewpoint), and a growing concern for social issues and objectives.

The Victorian Fisheries Act 1968 states "... the Minister shall have regard to the welfare of the fishery concerned and all the persons engaged in the industry," and this is interpreted to include the fishery itself, including those who harvest it, and all those persons involved up to the time the fish are placed before the consumer.

Conflict

The resources of the sea are the property of man only when reduced to his possession. Conflict is a characteristic of man and it is inherent in the use of the marine resource and may be manifest at the domestic or the international level. (Some aspects of the international level have been demonstrated again in the United Nations Law of the Sea Conference of this year which, after 10 weeks of discussion, has contributed little to the solution of this conflict).

The issue of conflict is complex and McHugh (1959) in considering the management of the Atlantic coastal fishery resources states "A fresh approach to coastal fisheries problems is needed; one including more biological and educational work and investigation of economic, social and political factors which are potent influences in the interaction of fisheries resources and man" (underlining is mine).

At the domestic level conflict may lie between whom is to make use of a resource; is it to be used by people harvesting for pleasure or people who harvest the seas as the source of their living? This is not a simple issue; the value of the two uses to the community must be considered. It is conceivable that harvesting for recreation as

an attraction to tourism in a particular district might far outweigh the value of harvesting as a commercial operation. The management solution might well, and properly, be a compromise.

The conflict may lie between the users of different types of fishing gear and again this is rarely capable of ready solution.

As further support of the complexity of management is the view advanced by Gordon (1953). He was a strong advocate of managing a fishery to maximise the net economic return on the grounds that "... with every productive enterprise - the measure of its own contribution to human economic welfare is determined by the net output, after the costs of the factors necessary to their output's production have been deducted." He does, however, qualify this by noting "... the economic optimum is not necessarily the human optimum. Under certain circumstances, we may well prefer to have an economically 'inefficient' fishery if the other effects of organising the fishery along economically optimum lines are politically difficult or socially undesirable."

Government agencies responsible for fisheries management traditionally employ biologists, more recently they have employed economists but have they ever employed sociologists?

Resource management can be justified only in the context of 'man' and the requirements of Man should be paramount in assessing the validity of proposed resource management measures. This is not the function of the biologist who, although he may be well aware of the sociological component of a particular fishery, must not allow this to influence his approach to his research. In addition, a biologist, having proffered his best advice should not be concerned that this advice will be modified almost inevitably in the light of sociological considerations. The economist, drawn from another discipline, cannot work in isolation; he is more intimately involved in sociological considerations.

Schaefer and Revelle (1959) in discussing the question of conflicts among the users of different resources in the same region state, inter alia, "... conflicts among the users of different resources in the same region are numerous and complex. The use of part of the sea for waste disposal may interfere with its use for recreation or commercial and sport fishing."

> "The marine resource, because it is living, is particularly susceptible to change in the condition of its environment. However, unless the 'contamination' exceeds the limits of the natural changes which occur in the aquatic environment, little damage to the living component is likely to take place. But man has already caused serious contamination in many inland waters; his activities are a matter for concern in localised areas in coastal waters and, in the long term, he poses a potential problem in the high seas. This is of relevance in that it adds another (and relatively new) factor to development of the management of the marine resource and one which is created by man himself." (Butcher 1971).

Estuaries and Pollution

The importance of the role of estuaries in the marine complex is completely disproportionate to their area and greater recognition is being accorded the estuarine environment. The proximity of estuaries to the source of sediments and the physical nature of the estuaries themselves make them virtually silt traps and growing damage is being caused to this important segment of the marine environment. The loss of aquatic flora and benthos generally is serious in itself. Silt particles in areas of oil losses present a particular problem in that in providing a nucleus around which oil gathers, the oil sinks to the sea bed and there is a chance of oil entering the marine organisms' food chain before it can be degraded.

A. Dunbavin Butcher

Estuaries have played a historic role in Man's development. Primitive peoples, if they did not settle permanently around the estuaries, visited them regularly. Estuaries provided an ample source of food - fish, shell fish, water fowl and mammals; they were generally sheltered areas and provided a welcome change from the inland; there was usually an ample source of fresh water and for peoples who had developed early forms of transport on water, the estuaries provided a harbour and easy access to the seas.

As Man developed, he built towns around the bays and he constructed harbours, industries developed around the shore lines which greatly simplified transport problems; rail heads were established and many of the great cities of the world were founded on the estuaries, bays and inlets. As a growing number of people found time for leisure the more distant estuaries became favoured recreation areas. This was returning to the early use of the estuaries although in a more sophisticated form.

In many places, agriculture developed inland from the estuaries, close to the domestic markets and close to transport for the export market. With an increasing movement towards agricultural monoculture, new problems developed. Monoculture results in a growing dependence on chemicals, both as fertilisers and for the control of pests. The crops of monoculture provide a particularly suitable habitat for many pests. The problem presented by the use of chemicals in required quantities can be grossly aggravated by the problems arising from misuse.

Waste chemicals, domestic and industrial sewage, silt and many of the other wastes associated with Man's activities find their way to the sea via the estuaries. The estuaries, because of their physical nature, retain more than a proportionate share of the wastes and those wastes which are retained are not diluted as they would be in the ocean. The estuaries present a special problem - an estuary provides a sump in areas in which primary and secondary industry flourish.

Heavy metals as a contaminant of the marine environment have achieved notoriety of late and the estuaries of the subject area have been to the forefront of comment in the media and of study. It is important indeed that this question of the presence of heavy metals in marine organisms be placed in perspective. It is difficult to accept the validity of some of the concern expressed in respect to human health.

Thrower and Eustace (1973) reporting on a survey of heavy metals in Tasmanian oysters in 1972 state "Oysters accumulate certain toxic heavy metals if traces of these are present in the surrounding waters, and sites for commercial leases must be chosen with a full awareness of this possibility. An exploratory survey of oysters from Tasmanian waters has revealed unusual concentrations of cadmium, copper and zinc in some oysters taken from leases close to Hobart and Launceston" and they continue "Indeed, because of the zinc content, not one of our samples would have been acceptable under present Tasmanian food regulations. This is in line with findings on the level of zinc in oysters in other parts of the world.

> "The results demonstrate a fact that is already well recognised - that a certain amount of heavy metals, what may be termed a background level, must be expected in all oysters.
>
> "In view of this, if oysters are to continue to be sold for human consumption, food requirements must take account of their exceptional character." (Tasmanian food regulations for shellfish have been amended since this time).

Peakall and Lovett (1972) in a paper entitled "Mercury: Its Occurrence and Effects in the Ecosystem" commenting on a figure depicting the overall global cycling of mercury state "A look at Figure 1 suggests that man's activities are unlikely to affect the concentration in the oceans since the amount in the oceans is four orders

of magnitude greater than man's annual usage," and they had stated earlier "Approximately half of the mercury used was recycled in 1967; there are reports that the situation has improved since then."

There is a substantial literature being produced on heavy metals in the marine environment with emphasis on mercury. A particularly apposite paper was presented by Jernelov (1972) in the Twentieth Nobel Symposium - "The Changing Chemistry of the Oceans." Jernelöv's paper was entitled "Mercury - A Case Study of Marine Pollution" and one of the three ecological hazards arising from mercury contamination of the environment which he stresses is "That tidal areas and estuaries might be favourable for high methylation rates, which could mean that the organisms there also 'naturally' contain high concentration of mercury, but also that they are specially sensitive to further contamination."

The situation thus reported in summary is:

(i) An exploratory survey of oysters from Tasmanian estuarine waters has revealed unusual concentrations of cadmium, copper and zinc in some oysters;

(ii) It is already well recognised, that a background level of heavy metals must be expected in all oysters (and in many other marine organisms);

(iii) Man's activities are unlikely to affect the concentration of mercury in the oceans, and

(iv) The organisms with a 'naturally' high concentration of mercury in estuaries are specially sensitive to further contamination.

Because of Man's historic proclivity to base himself on estuaries and inlets and the established fact that he has always made substantial use of shell fish, it would be reasonable to assume that man has always been subjected to the effects of the ingestion of heavy metals. (Man has also traditionally utilised "sharks" (Elasmobranchs) as food and this is a group of animals from the open seas with a currently 'notorious' level of mercury).

The overall historic heavy metal situation is one in which there is little evidence of adverse effects on human health; equally, there have been circumstances in which the effects on health have ranged from minor disturbances to human disasters but these have generally been confined to identifiable localised situations.

There is obvious need to protect Man in certain situations but it would appear that a single standard, a single accepted level of contamination, is completely unsatisfactory. It is recognised that there are inherent administrative problems in flexibility, but there is need for a rational approach to regulation and restraint if the optimum and legitimate use of a resource is not to be inhibited and if undesirable economic and social effects are to be avoided.

Exotic Organisms

There is another area of management which demands comment and this is the deliberate introduction of living organisms into the aquatic environment. This is by no means a new activity on the part of man, but it is one receiving renewed attention.

Again, the decision maker must be involved and if he is not empowered to do so, then existing legislation is inadequate. The same principles as apply to management of the utilisation of the resource, and to the use of the aquatic environment as the site for the disposal of waste are relevant here.

Carpenter (1971) said "Democratic political processes seek the proper trade-off between the common good and individual liberty." Final judgement must have over-riding concern for the needs and good of the community.

The introduction of living organisms is a biological interference with the environment, but it should be recognised that man has willy-nilly, transported organisms across the oceans and certain species of marine organisms are ubiquitous.

The outstanding example is the mussel (*Mytilus planulatus*) and as marine studies expand, more exotic species are being identified in the subject area of the symposium.

The full significance of the sudden spread of the European carp (*Cyprinus carpio*) in streams feeding into the northern periphery of these seas is yet to be established. Streams in the two major water sheds of south-eastern Australia are being subjected to gross environmental change and portion of at least one estuary (the Gippsland Lakes) has been invaded. This development arose from defiance of the decision makers. There is substantial evidence that the form (variety) of European carp involved is a recent, illegal introduction. There was no concern for the community.

Any proposal to introduce exotic species should be the subject of environmental study and assessment.

Coastal Streams

The effect of the withholding of fresh water is yet to receive adequate attention and this also should be the subject of environmental assessment. The first and obvious effect of the damming of coastal streams will be on the estuaries and two estuaries and their catchments on the Victorian coast are the subject of current environmental studies and a study of a further estuary and its catchment is being planned.

The discharge from the rivers is progressively diminishing. Resource use in general in the past has been a unilateral action and this must, in fact, pre-empt the use, and possibly the welfare of other resources. This approach is no longer acceptable and it is this which has the major influence in the development of the concept of environmental study and assessment and its application.

What is the influence of damming rivers on the marine environment and resource?

Environmental assessment, together with advice on the social and economic options, and related to the planning of the development of a region, makes multi-resource planning possible. The successful management of the marine resource is dependent on the effective management of other resources and of the influences on the marine environment, direct and indirect, deriving from the use of those other resources.

CONCLUSION

Management concern may lie with the living renewable resource of the seas or with the largely non-renewable resource; it may lie with the adverse environmental effects of the use of other resources; it may lie with the proposed introduction of exotic living organisms or with the withholding of a natural input such as the reduced discharge from controlled rivers.

There are sociological and economic elements in each of the situations, initially in the proposed use or the proposed action and finally, in the effects of those uses and actions. There are environmental considerations in all of these situations.

There are decisions to be made in each of the situations and the basic concern is with multi-resource planning for the region. The decisions should not be such that

they irreversibly commit the resources and thus pre-empt the right, in due course, of others to exercise their choice and make their decisions.

REFERENCES

Anon, 1803: *Sydney Gazette*, 29 May

Anon, 1960: *Sport Fishing Inst. Bull.*, 104.

Australia Parliament, 1914: Joint Library Committee. *Historical Records of Australia*, Series 1.

Butcher, A. Dunbavin, 1969: Man in the Marine Environment. *Aust. Fish. Newsl.* 28(6), 6-7.

_____, 1971: Fisheries Management - Social Considerations. NATIONAL FISHERIES SEMINAR, 6-10 DECEMBER. Centre for Continuing Education Australia National University, Canberra. 12pp.

Carpenter, R.A., 1971: Expectations of the Decision Maker in Matthews, W.H., in Smith, F.E. and Goldberg, E.D. (eds) MAN'S IMPACT ON TERRESTIAL AND OCEANIC ECOSYSTEMS, 473-476. MIT Press, Cambridge, U.S.A.

C.S.I.R.O. Aust., Division of Fisheries and Oceanography, 1967: Major Australian Marine Fisheries Resources and the Prospects for their Exploitation. *Australian Fisheries Development Conference, 20-22 February* Canberra.

Flinders, M., 1814: A VOYAGE TO TERRA AUSTRALIS, G. and W. Nicol, London.

Gordon, H.S., 1953: An Economic Approach to the Optimum Utilisation of Fishery Resources. *J. Fish. Res. Bd.*, Canada, 10(7), 442-457.

Grant, J.F. and Alexander, K.R., 1973: The Scallop Resources of Bass Strait below latitude 39° 12' S, 1972-73. *Tasm. Fish. Res.*, 7(2), 1-9.

Hainsworth, D.R., 1972: THE SYDNEY TRADERS, Cassell, Melbourne.

Jernelöv, A., 1972: Mercury - A Case Study of Marine Pollution, in Dyrssen, D. and Jagner, D. THE CHANGING CHEMISTRY OF THE OCEANS, 162-188. Wiley, Sydney.

Lockyer, N., 1915: Biological Results of the Fishing Experiments carried on by the F.I.S. "Endeavour" 1909-14 in *Fisheries* vol. III. Commonwealth of Australia, Department of Trade and Customs, Sydney.

McHugh, J.L., 1959: Can We Manage Our Atlantic Coastal Fishery Resources? *Trans. Amer. Fish. Soc.*, 88, 105-110.

Norman, L., 1938: PIONEER SHIPPING OF TASMANIA, J. Walch and Sons, Hobart.

Peakall, D.B. and Lovett, R.J., 1972: Mercury: Its Occurrence and Effects in the Ecosystem. *BioScience*, 22, 20-25.

Rawson, G., ed., 1946: MATTHEW FLINDERS' NARRATIVE OF HIS VOYAGE IN THE SCHOONER FRANCIS: 1798. Golden Cockerel Press, London.

Schaefer, M.B. and Revelle, R., 1959: Marine Resources, in NATURAL RESOURCES. McGraw Hill, New York.

Thrower, S.J. and Eustace, I.J., 1973: Heavy Metals in Tasmanian Oysters in 1972,

Aus. Fisheries, 8-10.

Winstanley, R.H., 1973: Rock Lobster Fishing in Tasmania, 1904-1972. *Tasm. Fish. Res.*, 7(1), 1-23.

Wolfe, D.C., 1972: Squid Fishing and the Tasmanian Potential. *Tasm. Fish. Res.*, 6(2), 26-32.