R E P O R T

ON

THE SYMPOSIUM ON CONSERVATION OF NATURE REEF AND LAGOONS

NOUMEA, NEW CALEDONIA, 5th - 14th AUGUST 1971

BY

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ON THE SOUTH PACIFIC COMMISSION/INTERNATIONAL UNION FOR CONSERVATION OF NATURE & NATURAL RESOURCES SYMPOSIUM ON CONSERVATION OF NATURE - REEF & LAGOONS HELD AT NOUMEA, NEW CALEDONIA, 5th - 14th AUGUST, 1971

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INTRODUCTION

Conservation of nature in the Pacific has been the concern of practically all Pacific Science Congresses at their quinquennial meetings since their inception. However, never before has a meeting been called that would be devoted to conservation problems of a single region of that vast area and that would include an overall programme attempting to cure the ills and promote a better future. The idea of the present Symposium originated some years ago at an informal meeting between Docteur G. Loison, Programme Director (Health) of the S.P.C. and Dr H. Coolidge, lately Director of the Pacific Science Foundation and currently President of I.U.C.N. An international meeting on problems of nature conservation in the Pacific sponsored by the I.U.C.N. was held at Koror, Palau, N.W. Pacific in 1968 preparatory to the present Symposium.

The present report enumerates the participants from the South Pacific territories, the international and other organisations present; summarises the accounts of nature conservation problems of the region given by the territorial representatives, and discusses the main topics of the Symposium, viz. (i). general objectives of conservation and of an ecological assessment of Pacific islands and (ii) problems of conservation and planning for their solution. Suggestions for appropriate legislation, a discussion of the role played by the international organisations, and an account of the general discussion and recommendations follow. A brief discussion of the main results that may be of interest to the New Zealand Government, will conclude this report.

PARTICIPANTS

The attendance to the Symposium was by invitation. Some of the sessions had a large attendance of guests, mainly of interested public from Noumea.

The list of participants (Appendix I) calls for some comment. Firstly, only nine of 19 territories and countries in the South Pacific Commission region were represented. Among the notable absentees were the Gilbert and Ellice Colony, Nauru, New Hebrides, Wallis & Futuna and Western Samoa. There were no official observers from the United Kingdom and U.S.A. The small number of representatives of the peoples living in the region were more than compensated by twelve representatives of the international organisations and 23 representatives of other organisations in Canada (1), Fiji (1), France (12), New Zealand (1) and U.S.A. (8).

CONSERVATION PROBLEMS OF THE TERRITORIES IN THE S.P.C. REGION

Reports on conservation problems of the territories were given by the territorial representatives on 4th and 5th August, 1971, before the official opening of the conference on Monday, 9th August, 1971. The meeting was opened by Mr Alan Harris, Programme Director (Economic). Professeur F. Doumenge was elected interim chairman and Doctors R. Clutter, Hawaii and M. Batisse, U.N.E.S.C.O., Paris, were elected rapporteurs.

The outline of nature conservation problems given below is far from complete because, as already stated, over a half of the territories affiliated to the S.P.C. sent no representatives, nor reports.

American Samoa

Swerdloff (1) reported a serious degradation of the reef and lagoon environment, particularly round Pagopago Bay and the Manu'a group. During the last 20 years organic pollution has changed Pagopago Bay into a turbid, silty receptacle. This is aggravated by oil pollution and heavy siltation, particularly after heavy rainstorms owing to denudation of steep hillsides.

Dredging and blasting activities in at least twenty sites and dumping on inorganic rubbish ranging from tin cans to automobiles have aggravated the situation. Extensive pollution and reef destruction have led to the death of most corals while in the Manu'a Islands dredging and blasting of reefs together with dynamiting for fish have destroyed considerable reef areas.

The establishment of an Environmental Quality Commission in April, 1971 was the first step towards restoring and preserving the territory's natural environment.

No information was provided on nature conservation problems on land.

British Solomon Islands Protectorate

The 11,000 square miles of the Solomon Islands consist of volcanic islands and uplifted reefs. The soils are of low fertility, but with a coastal population and no fertilizers being used there were in the past few, if any, conservation problems. At present copra (55%) and timber (39%) make the bulk of the exports but further projected economic development will require stepping up of logging and the developing of mining. The main nature conservation problems are: 1. Erosion, partly arising from shifting agriculture on steep slopes resulting in landslides; 2. The considerable stepping up of logging in the future will lead to further erosion. Although there is a policy of replanting forests this will be done with selected tree species in a 25-year cycle. Tractor logging is likely to cause considerable disruption and associated soil erosion that will considerably affect the countryside; 3. The proposed mining (deposits of bauxite) and prospecting for copper and nickel will eventually lead to strip mining, tailings, etc. that may have the same disastrous effects as the nickel mining in New Caledonia. Some good agriculture land has mineral deposits and their exploitation will mean shifting agriculture (and people) to less productive land; 4. In some of the islands there already exists a high density of people in certain areas and urban growth problems are increasing in Honiara; 5. The Crown-of-Thorn Starfish (Acanthaster planci) has been found round the island of Malaita

and is likely to become a serious problem.

Cook Islands

The overpopulated southern islands and the less populated but poorer northern Cook Islands have a total area of 93 square miles and are inhabited by some 21,000 people with about ⅔ of the population classed as earning no income.

According to Hambuechen (3.) the main conservation problems are: 1. The practically uncontrolled application of insecticides. To quote one example: between 1963 and 1971 31,528 lbs of D.D.T. were imported to control citrus, tomato and banana pests. The acreage of citrus is barely 535 acres and several other kinds of insecticides were also used. This indiscriminate use of some of the most potent insecticides resulted in: (a) An alarming destruction of fish in streams and lagoons; (b) An apparent effect on predators of Acanthaster planci and (c) Some still unassessed effect on human health. 2. Population problems connected with the progressing urbanization in Rarotonga and some centres of the Southern Cooks and overpopulation in some of the Northern Cooks (e.g. Pukapuka). 3. Marine environment problems, such as the spread of Acanthaster planci, reduction of pearl shells and blasting and poisoning of reefs.

Fiji

There was no report on conservation problems of the Fiji Islands except a detailed review of a soil survey in a valley in the main island. It seems to be a forerunner of a land capability classification that may lead to a more efficient and conservative use of the natural resources.

French Polynesia

The main nature conservation problems of the numerous islands of that vast area were described by M. R. Millaud, Professeur F. Doumenge and Moreau et al. (4.).

Firstly, there are longstanding problems of those islands that have either been mined (Makatea) or subject to liberations of ungulates (sheep and goats) leading to a complete or nearly complete destruction of the vegetation; a reserve will be established in the latter to implement and study the course of regeneration. The market gardens on slopes round Papeete are

another case of almost complete depletion with recurring erosion, though so far there was no major contamination of the lagoon by insecticides. Fires have also been a depleting factor on areas abandoned by producers. The urbanisation, particularly of Papeete, where at present half of the population lives, has created major problems of pollution to the effect that it is being felt up to 20 km from Papeete and new scientific laboratories had to be built at a distance of 60 km. A recent study in the Tahiti lagoon has shown that fish, particularly after heavy rains are affected by Escherichia coli bacteria. Finally, the neglect of introducing a recommended scheme for the control of the sand fly pest is now leading to the introduction of a much more elaborate and expensive fly control scheme.

Guam

This westernmost territory of the United States of America has a land area of approximately 210 square miles and a population of about 96,000 inhabitants. The relatively dense population, an economic boom bringing new industries, the presence of some 19,000 U.S. military personnel and a prosperous and increasing tourism lead, according to Natarajan (5.) and Professeur F. Doumenge, to a variety of pollution and nature conservation problems. Among them are pollution associated with urban development, including air pollution from an asphalt plant and solid waste (including large numbers of cars abandoned everywhere). Forest denudation and erosion have occurred and reefs and nearshore waters have been affected near the centres of population. The hotels are increasing in numbers and the areas round each of them present local pollution problems; also tourists collecting souvenirs on beaches and reefs have at times been particularly destructive.

To combat the existing and increasing pollution there are now two Commissions: the Water Pollution Control Commission and the Air Pollution Commission. It is expected that both Commissions are to combine and expand their activities. As all the major conservation problems have already been identified and as there is a growing awareness of improving the quality of the environment it is likely that Guam's resources will be better preserved from pollution in the future.

New Caledonia

The important conservation problems of New Caledonia related to vegetation were described by Parrat (6. and 7.) and also by Professeur F. Doumenge and Dr R. Heim. Pre-European agriculture has altered the vegetation comparatively little. The present, large-scale destruction of the vegetation and of the land is due to the following major factors: (1) Frequent bush-fires during the dry season have played a major role in the gradual development of the niaouli savannah and snake bush at the expense of dense primary forest; (2) Agriculture, mainly stock-farming, has contributed relatively little to deforestation in comparison to logging operations in the early part of this century which reduced the forest to a mere 10% of the land area; (3) Finally, mining of nickel and cobalt is the greatest potential threat to New Caledonia. Its impact on the land is so great that it has to be seen to be believed. The damage occurs in two stages - during surveys and later during the mining operations. It is estimated that some 300,000 ha will be affected by survey operations and at least 10% of the territory, including some 30,000 ha of primeval forest, will suffer directly from the harmful effect of mining, severe erosion and dust pollution of the rivers and of the air. Further effects of strip mining are: mechanical damage to waterways, siltation of some unique fringing marine environments and severe pollution from organic and chemical sources.

Under the increasing pressure from various organisations (Société d'Ornithologie, Association pour la Sauvegarde de la Nature Néo-Calédonienne) the climate of opinion is changing and the Administration is working in two main ways to preserve the environment. Firstly, administratively by protecting all sites of special ecological value, either by an irrevocable ban of any changes in the soil and vegetation or by a ban for a certain period of time. Secondly, by rehabilitating the biological complex through afforestation of soils destroyed by mining. In the latter way the Administration is assisted by the Nickel Company. The task is very difficult as plant species have to be found that will grow on mining spoil and

this and other aspects of conservation require a great deal of further research.

Niue

A brief account of nature conservation problems of this raised atoll of coralline limestone (295 sq. km. and about 5,300 inhabitants) has been given by Yaldwyn (8.). The destruction of the primeval forest started a long time ago with the shifting cultivation of taro in pre-European times but has been accelerated by recent logging. The loss of soil fertility due to fire and shifting agriculture produces increasing barren, fern ("desert") areas. Finally, the drastic reduction of forest habitat, plentiful firearms and inadequate protection regulations resulted in a considerable decline of various bird species and of the flying fox (Pteropus spp.).

On the positive side, Niue Island is almost unique by: (1). The existance of an ancient and important conservation measure by having about 1,000 ha of virgin forest totally protected by Tapu; (2). A new and reasonably comprehensive nature conservation legislation mooted and already introduced to the Niue Assembly; (3). Finally, the New Zealand Government, with the support of prominent Niuean conservationists has recently examined the question of education in nature conservation in the schools of Niue and has decided to produce short texts for use in the Niue schools in the near future.

Territory of Papua - New Guinea

The largest territory of the region (186,000 sq. miles of land with another 40,000 sq. miles of reef and lagoon) with just over 2,000,000 people is according to Graham (9.) still largely undeveloped. Over half of the population live in the upland valleys of the central ranges and the remainder occupies inland coastal areas. Practically the whole population are agriculturalists but, owing to centuries-old practices and the use of small plots and drainage systems, there is no danger of serious erosion. The tree crops of the commercial agriculture have also a conservative effect on soil characteristics. Marine resources appear to be adequate.

Logging and afforestation and mining activities appear to be the main conservation problems of the future that will accompany the development of Papua-New Guinea.

At present only 0.5% of the territory is subject to forestry activities and the Forestry Department is carrying out significant afforestation projects aimed at upgrading timber resources in critical areas. However, the development of tropical woodchip-paper pulp complexes will need the virtual denudation of 10,000 acres p. a. units and is likely to become a major conservation problem.

Mining, now carried out at Bougainville, is likely to become, as also pointed out by Professeur Doumenge, a problem as in the Solomons and as it already is in New Caledonia. The tailings from a large open cast copper mine on Bougainville are being dumped in the Java River and this is likely to have serious effect on freshwater fisheries. As more mining operations are envisaged it is not unlikely that other rivers and even parts of the reef may become biological deserts.

Some other land conservation problems were briefly touched upon (Gare 10.). Thus paradise birds seem to have been able to withstand poaching while a $1,000,000 annual export of crocodile skins, mostly caught by natives, brought a serious decline of that animal. Also, it is intended to farm deer, though neither the species nor its effect on the New Guinea forest is known.

Tokelau Islands

The conservation problems of this New Zealand territory of three atolls (Fakaofo, Nukunonu and Atafu with a total area of 1,059 ha or 3.8 sq. mile and a total population of 1,750 people, who are New Zealand citizens) were outlined by Wodzicki (11.).

(i) The reef and lagoon resources appear to be limited and intensive pelagic fishing by South Korean boats may present a serious threat to one of the mainstays of the Tokelau way of life;

(ii) Marine turtles and their eggs, once an important commodity in the Tokelau diet, are being taken at every opportunity and their population has greatly declined;

(iii) The taking of marine birds and their eggs was once invested into the fono toeaina. Now every owner of land can harvest them and the numbers of birds are gradually declining;

(iv) The Tokelaus are one of the very few territories left in the Pacific with the Polynesian rat (Rattus exulans) as the only rodent present. However, the Polynesian rat or kimoa takes a large part of the coconut harvest and indirectly contributes to the mosquito population and previously had assisted the spread of filariasis. A comprehensive rat control scheme is at present in operation;

(v) The Rhinoceros beetle (Oryctes rhinoceros) introduced to Nukunonu atoll through an unpardonable neglect of elementary quarantine has created havoc to copra production and there is serious danger of its spreading to the two other atolls;

(vi) The wide administrative policy of the New Zealand authorities has fortunately preserved, almost unspoiled, the unique atoll culture of the Tokelauans.

The following steps are highly desired to preserve the ecosystem of the Tokelaus:

(a) The restoration of the powers of the fono toeaina in controlling wildlife;

(b) A co-ordination of efforts in the preservation and management of marine turtles carried out in Samoa and other territories;

(c) Introduction by the New Zealand Department of Education of the already agreed education in nature conservation in the Tokelaus, based on suitable texts;

(d) Continuation of the present policy by the New Zealand Government aiming at the preservation of Homo sapiens in the Tokelaus and of its unique culture.

Trust Territory of the Pacific Islands

This territory consists of the Marianas to the north, the Carolines in the south and the Marshall Islands in the east and includes a total of some 2,000 high and low islands in the Western Pacific, inhabited by Micronesians. According to Owen (12.) the conservation problems vary from one part of the territory to another and the most important issues are: (1) Soil erosion following forest destruction or some agricultural practices, and bush-fires that are still frequent on high islands such as Ponape and Palau; (2) The continued use of explosives on reefs; (3) Fish poisoning, which at times is leading to an ecological desert. The taking of certain fish species and of shellfish, such as mangrove crabs, spiny lobsters and tridesma clams (for both food and shells) for commercial sale and export should be also mentioned; (4) The fast disappearance of archaeological sites of great historical and scientific value; (5) The precarious status of the dugong, several rare bird species and of the marine turtles. Although the dugong's downward trend seems to have been arrested, poaching is still taking place as is indiscriminate shooting of birds. The two species of marine turtles lack sanctuaries; and finally (6) The raising standard of life brings increased pollution in the lagoons. The expanding agriculture for Asian markets is likely to increase the use of insecticides with their accompanying problems. An even greater danger to the environment in the not too distant future may be the mining of bauxite and phosphate deposits, including mining of underwater mineral deposits.

On the positive side of conservation of nature in the U.S. Trust Territory it should be mentioned that there are sanitary, plant and animal quarantine laws and a large number of other regulations that should assist in the solution of conservation problems; and there is already an Acting Chief Conservationist. Also a beginning has been made to return to old, Micronesian, native conservation methods, particularly with the preservation of marine turtles, not unlike the native conservation methods on Niue Island. However, some of these laws require to be re-written and there is at present very little of enforcement of the existing regulations. Perhaps the most important step towards conservation in the Trust

Territories would be to include conservation into the school syllabus.

CONSERVATION PROBLEMS OF THE PACIFIC ISLANDS AND WAYS OF THEIR SOLUTION

The official opening of the Symposium took place on Monday, 9th August 1971, and began with the addresses by Mr J. de Young, Acting Secretary-General, S.P.C., Dr Harold Coolidge, President of the I.U.C.N., and Monsieur H. Levallois, Secrétaire-Général de la Nouvelle Calédonie.

Following the official opening, Professeur François Bourlière, Paris, was appointed General Chairman, Sir Maurice Yonge, General Vice-Chairman, Messrs Alan Harris, S.P.C., and Mr Frank Nicholls, I.U.C.N., Co-Directors, and Sir Hugh Elliott, I.U.C.N., General Rapporteur. Two speakers, Dr Raymond Dassman, I.U.C.N., Morges and Professeur F. Doumenge, Université de Monpellier, France, introduced the general objectives of conservation.

The programme of the technical discussions carried out between 9th and 13th August 1971, together with the names of the chairmen of the Sections and of the discussion leaders are found in Appendix II.

The full proceedings of the Noumea Symposium are to be edited by Sir Hugh Elliott, the General Rapporteur and will eventually be published. It would therefore be superflous to give here a full summary of the papers and discussions on Sections II - V and the following notes include a brief mention of new salient points on nature conservation in the region as they appeared in the papers presented and discussions held, particularly those relevant to the recommendations discussed below. However, an exception was made with regard to matters that may pertain to New Zealand policy on conservation in the future or matters that are directly related to New Zealand territories in the Pacific.

Section II. General Ecological Assessment of Pacific Islands

Professeur Bourlière in introducing the subject thought the following broad classification to be adequate for the purpose of this and later discussions: (1) Very old, large islands like New Zealand or New Caledonia, in fact mini-continents, which have up to 85% of indigenous phanerogams, 60% of Coleoptera and usually 60-75% of the other groups of biota being endemic. Long isolation of these islands resulted in an explosive evolution of certain groups. Finally, the ecosystems of these mini-continents usually have many empty ecological niches and, as the ecosystem is often fragile, filling these niches may sometimes be disastrous; (2) The high or volcanic islands may be of considerable size. The older ones especially have a relatively rich flora and fauna from colonization. Most of them were colonized by man very early; (3) Atolls may be very old (e.g. Aldabra) but most are young with very simple ecosystems. They are built of coral or coral rubble and nutrients are mostly brought by colonially nesting birds. As there is usually no soil, there cannot be proper agriculture on most of the atolls. The reefs are the most important part of the atoll ecosystem. They are by their nature fragile and react adversely to external pressures such as poisons, blasting or pollution.

Salvat (13.) while agreeing with Bourlière's broad classification, pointed out that historically all atolls have been subjected to periods of emergence and sub-mergence during the recent glacial and inter-glacial periods; and considerable ecological changes in the atolls have taken place including the total disappearance of the lagoon. Salvat also pointed out that atolls are not static features but are in a state of a dynamic equilibrium. Being almost perfect ecosystems they have a very great scientific value. However, in addition it has been shown recently that atoll lagoons have also economic value : natural resources can be developed here and exploited, and even more important is the fact that they have a great potential for aquaculture (discussed in Section IV, 12). Tourism and related activities are also likely to develop on low islands and are bound to bring about the degeneration of the environment. Salvat concluded with a plea for protecting at least some of the odd

400 atolls in the world for the purposes stated above.

A considerable discussion on the vulnerability of island ecosystems and their capacity for recovery followed. Professor F. Doumenge pointed out the existence of a balance with the natural environment achieved by the Polynesians and Micronesians and the practices of Melanesians used in their cultivation of taro and yams: these steep slopes such as on the Col de Pirogues although abandoned a century ago, still defy erosion. M. R. Millaud described lowered/reduced productivity and irreversible damage in the Tuamotu Islands with the use of fire over a period of 50 years. Finally, K. Wodzicki briefly described how the New Zealand Government has preserved the ecosystems in the three atolls of the Tokelau Islands and entered a plea for future preservation of not only these three admirable atolls but also of the unique culture and way of life of the Tokelau people.

Several speakers reported on the capacity of atolls and other small islands to recover from natural and man-made changes. W. Hambuechen briefly described the remarkable recovery of the Suvarrov Atoll, North Cook Islands after the 1943 hurricane. Professeur Doumenge and Dr J. Bardach reported recoveries in the Tuamotu archipelago and Bermuda respectively and Dr John Yaldwyn described the regeneration on Macauley Island, Kermadecs following the removal of goats; and Professor Geo. Knox drawing on his Department's and the Ecology Division, D.S.I.R. work on the sub-antarctic islands of New Zealand gave evidence of the importance of quantitative studies over a period of years for the assessment of the importance of hoofed animals on island ecosystems.

Finally, Sir Maurice Yonge (14.) made a plea for long-term research on island ecosystems. If we had already acquired sufficient knowledge we might have been able to predict the present population explosion of the crown-of-thorn starfish. Sir Maurice was supported by Dr J. S. Bardach who demanded that national and international agencies should further quantitative studies of recovery of island systems after man-made or natural perturbations under various ecological conditions.

Section III. Problems of Conservation and Planning for their Solution

The problem of soil conservation is according to Dr D.M. Whitt (15.) an universal problem transcending national boundaries. Professeur J. Avias and M. N. Latham (16.) described the consequences of mining and the subsequent deterioration of soils in New Caledonia and the almost insurmountable problems associated with restoration. M. P. Cocherau (17.) mentioned the pollution due to the use of insecticides to control the cattle tick (Boophilus microplus) now being replaced by biological control and Mr W. Hambuechen, Rarotonga (3.) reiterated some of his previous remarks regarding pollution due to the use of hydrocarbons and other insecticides in the Southern Cooks. However, from further statements by M. Corbasson and M. P. Leca on New Caledonia and by Dr J.R.D.Wall on Renall Island, British Solomon Islands it appears that mining is already the greatest danger to soils in these islands leading as exemplified by Nauru to a "lunar landscape". From statements by representatives of other territories it is likely that mining will spread to other islands (18).

Dr D.A.N. Cromer gave an account of the two main factors affecting forests in the tropical Pacific - destruction by, for example, forest fires and problems of conservation of natural forests. Attention was drawn to the fact that on most islands the original forest represented the climax vegetation. Also the dangers inherent even in controlled exploitation were stressed, as this often leads to a devastation of the forest, to a forest poorer in tree species or to a "weed forest". Attention was also drawn to the effect of logging on regeneration, often leading to a rapid growth of thickets of forest weeds. There is an urgent need for studies of the ecology and sylviculture of tropical rain forests. Finally attention was drawn to the impact of Japan's growing timber requirements (an estimated 103,000,000 cubic feet of timber and chips were required in 1970, half of which had to be imported) on the tropical forests of the whole region, as on New Zealand native forests.

The critical position of forestry in New Caledonia resulting from the impact of the mining industry was ably described by Parrat (7.). An analysis was given of the main causes of forest degradation, followed by a succinct description of its effects on the soil, freshwater, vegetation, fauna and the lagoon and the reef. Finally, the administrative and technical measures taken by the Administration were described and their effect in protecting the environment briefly assessed.

The forestry problems of French Polynesia were, according to M. R. Millaud, vastly different of those in the Eastern South Pacific: there were few timber species in that part of the Pacific, leading to the problem of introducing suitable tree species. These were needed for re-forestation, particularly of areas depleted by market growers. These re-aforestated areas were not to be interfered with until mature.

The problem of grassland and bushfires was introduced by Mr E. Hugh, and Messieurs H. Button (19.) and M. Nozieres gave an account of the occurrence and effect of fires in New Caledonia. It was noted that the techniques of controlled burning used in Australia and California were not known nor applied in the region. Also, the Symposium was informed that in New Caledonia the Centre Technique Forestier Tropical has a policy of establishing reservations of up to 10% of certain areas of primary forest, beauty spots, springs, etc.; and that there is industry-assisted research into techniques of artificial aforestation of mined-over areas; and finally that the post-fire association known as the niaouli (Melaleuca leucodendron) savannah, a secondary type of vegetation, is well adapted to the environment and maintains an appropriate biological balance.

It was, however, also found that both in New Caledonia and in most of the territories (including Niue Island), fire, sometimes an essential management tool, was commonly used without discretion with the result that in many places regeneration of forests has been prevented and more often than not the existing primary forest further depleted.

It was agreed that legal provisions existing in many territories are difficult to enforce and that with increased numbers of smokers, campers and tourists more fires are being started than in the past. It was generally agreed that an education campaign is urgently needed throughout the whole region.

Freshwater problems were ably introduced by Dr J. Bardach and a comprehensive paper on environmental sanitation problems on atolls and near-atolls was given by Chan (20.). This ingenious plan (that conceivably could have an application in the Tokelau atolls) for an environment where the sun, sea and sand are the only natural resources aims at recycling from garbage to food. As the result, fuel, animal feed, fertilizer and even food can be produced at a very low cost without causing pollution.

Other contributors to the discussion gave many examples in which water quality is deteriorating with accelerated pollution of various kinds and of the problems of water supply in many regions. The necessity for research, the establishment of adequate legal frame-work for water quantity and for the enforcement of regulations was stressed.

The discussion on marine habitats and conservation of the reefs and lagoons was led by Dr B. Salvat (13.) and several speakers stressed the importance of that environment for so many territories where (as in the Cook Islands, the Tokelau and Niue Islands) such a large percent of the population depends on marine resources. Among the problems mentioned by the contributors were: the physical aspects and the recovery power of coral reefs, pollution by chemicals or wastes, the conservation of fisheries resources, the Crown of Thorns Starfish problem, fish poisoning, mangroves and other problems.

Eude (21.) and Hambuechen reported adverse consequences on the reef by exploitation and removal of sand in New Caledonia and in the Southern Cook Islands. Dr G. Loison and Dr J. Yaldwyn drew attention to the destructive exploitation of phosphate deposits on Makatea, Ocean and Nauru Islands and the planned

exploitation of Renall Island, British Solomon Islands, without any attempt to restore or replace humus and soil with ships returning empty. The physical aspects of the coral reefs according to Dr B. Salvat include the dredging of channels in the reefs, the use of explosives and the plundering of reefs, chiefly for molluscs for tourists - all activities that are detrimental to the reef as part of the ecosystem. Any siting and planning of hotel developments should always be based on ecological studies and should include in their costing an adequate provision for the protection of the neighbouring reefs. Finally, F. Doumenge thought that coral reefs seem to have an admirable power of recovery, even from very violent catastrophies such as cyclones, flood, red tide, etc. However, them seem to be much less impervious to quite limited physical modifications, such as enlargement of reef passes, deposition of sediments, disposal of waste water, etc.

Several speakers reported on the effects of chemicals and wastes on coral reefs. M.J.-J. Eude (21.) and M. Bourret advocated more education of the public in New Caledonia and multidisciplinary research into the movements of water in the lagoons, and Mr N. Siren reported pollution from hotels and from ships affecting reefs of some islands of U.S. Trust Territory.

With regard to the conservation of fisheries resources Bourret thought that sedentary species, such as crustacea, were overfished in the vicinity of Noumea. Dr R. Clutter considered that the standing stocks of reef fish and other edible animals were high as long as the stocks were unexploited but do not readily support intensive fishing. Hence reef fisheries management requires a study of both productivity and ecology. Long-term research as advocated by Sir Maurice Yonge is essential.

As expected the Crown-of-Thorn Starfish infestation dating from the early 1960's was the subject of a considerable discussion. Dr J. Randall (22.) gave a review of the Acanthaster planci infestations and of its possible causes (natural fluctuation,

man-induced or other causes as reported by Mr W. Hambuechen from Manihiki, Southern Cook Islands). D. Garner reported on the distribution of the Crown-of-Thorn Starfish on Malaita, British Solomon Islands, and Dr R. E. Johannes agreed that more research is needed but urged control of the pest wherever practicable.

Dr G. Loison referred to the paper by R. Bagnis (23.) on the appearance of ciguaterra in disturbed coral reefs and mentioned that fish poisoning or ichthyosarcotoxism affects some 10% of the human population of the region and urged the continuation of research into this problem as well as of the bacteriological pollution of lagoons that occurs around hotels and of associated problems.

Dr R. E. Johannes brought up the problem of mangroves and their ecology. The mangroves are a very difficult environment to work but recent research in Florida has provided evidence that a great variety of juvenile forms of fishes and of other marine forms find their important nursery areas; in addition mangroves contain communities rich in species as yet little studied (oysters, crabs, bait fish) and protect the seashore from erosion. They could be potential sites for aquaculture.

With regard to other problems concerning reefs and lagoons the following contributions should be briefly mentioned: a fine contribution on coral reefs and pollution tabled by Dr R.E. Johannes (24.); the proposed international studies of the properties of reef and lagoon environments by the use of co-ordinated remote sensing, including infra-red and imaging recorders mentioned by Miss E. Pruitt and Professeur F. Doumenge; and finally an appeal by Dr F. Serène, U.N.E.S.C.O. for an improvement in international co-operation between biologists working on coral reef problems.

F. G. Nicholls in introducing the discussion on air pollution in the region stated that surprisingly and against expectation there were localized problems such as those arising from the nickel mining and processing ventures, as well as those generated by urbanisation in certain areas leading to large

numbers of motor vehicles concentrated in one area. He thought that problems arising from the release of radioactive materials were not worth discussing at this Symposium.

An interesting contribution was made by Docteur Brunel who stated that, although no proper, long-term survey has been carried out in New Caledonia, there was a significant increase in cases of emphysema, lung cancer and other chest diseases being treated at the Noumea Hospital. Also the number of allergies has increased, although nickel dust is not considered to be allergygenetic. Other speakers reported the awareness of the general public as well as the fact that the Nickel Company has already spent $6.5 million in efforts to arrest the amount of dust and has proposed to spend another $17 million by 1973. A speaker facetiously remarked that the strike of the personnel of the Nickel Company may have been specially organised to prevent the members of the Symposium from seeing the predicament of some inhabitants of Noumea from the smoke nuisance. Mr N. Siren, U.S. Trust Territory, reminded the meeting of the pollution in some of the Marshall Islands following the Bikini atoll atomic explosions, and wondered whether this may occur again.

Dr G. Baines, mentioned the possibility of a pollution drift of pesticides from continental to island areas and advocated long-term studies. There was also some support for the establishment of monitoring stations to provide base level figures against which the future rate of wide-ranging pollution could be checked. Finally, the subject of legislation to prevent air pollution was also discussed.

The problems of <u>conservation of endangered species</u> and of <u>introduction and re-introduction of exotic plants and animals</u> were discussed jointly under the chairmanship of Dr Harold Coolidge. This was an unfortunate ruling made apparently because the agenda had become crowded. As result of this ruling some papers dealing with aspects particular to one country were admitted but others, for instance the writer's comprehensive paper on problems of invasions and liberation of exotic species in the <u>whole</u> region were refused presentation.

The Chairman gave an account of his travels throughout the Pacific and of his efforts to encourage the administrations of various territories to send representatives to this Symposium. Not much time has been left on our hands with regard to rare or vanishing species. Professor George Knox supported the Chairman's statement regarding endangered species and proceeded to give his paper on the problems of introduced mammals on some Pacific Islands with special reference to New Zealand region (mainly from Sub-Antarctic Islands). An account was given of New Zealand experience in the elimination of mammalian herbivores from certain islands where man has affected the environment for a long time. He concluded by suggesting some general principles in management of introduced mammals on these islands(25.).

Beginning with problems of rare and vanishing species J.M. Veillon (26.) gave an account of the originality and richness of the flora of New Caledonia and described its vulnerability when facing forest fires and the impact of mining. The recent establishment of the "Association pour la Sauvegarde de la Nature Neo-Caledonienne" may become a turning point in saving at least a part of this vegetation from total destruction.

K. Wodzicki (27.) discussing vanishing plant and animal species in the area of the South Pacific Commission jurisdiction distinguished two facets: the problem of rare and often unique animals and the problem of proper management of plant and animal communities in the area. With regard to the first problem five bird species from Fiji are already extinct and 21 species of birds from New Caledonia, Western Samoa, Fiji, Micronesia and the Tuamotu archipelago are either threatened with extinction or being reduced in their distribution to few localities. The second problem of preservation of original plant and animal communities is becoming acute because of over-population, firearms and some other causes. The preservation of original plant communities is difficult because so few examples of primeval plant communities still exist. The Tapu Forest on Niue Island is one of the very few surviving primitive areas, still well preserved because of an old Polynesian custom.

A survey of the present distribution and the status of both categories of animals and of the existing primeval plant communities is the most urgent recommendation.

The second paper by K. Wodzicki (28.) (not presented because of the Chairman's ruling) discussed invasions and introductions of plants and animals on two levels. The continuing invasion of weeds into territories of the area requires continuous vigilance and ecological surveys and the possibility of further introductions of harmful plants (e.g. marijauna) is to be brought to the attention of all territorial administrations. Several examples of invading animals ranging from arthropods to mammals were given and it was recommended that (i) any future liberation of exotic animals into the islands of the region should be preceded by an ecological investigation, and (ii) every effort should be made to prevent the entry of rodents into islands (e.g. Tokelau Is.) that are still free of them for economic and health reasons.

Several speakers supported the above recommendations, particularly with regard to the conservation of marine turtles. Dr Pillay, F.A.O. mentioned a report that is being prepared on marine turtles conservation with the view of their proper management in the future as part of natural resources of the Pacific islands to be shortly presented. Mr B.F. Weilbacher, Mariana Islands, made a strong plea for proper consultation with the indigenous people to ascertain their hopes and aspirations in connection with their environment, and to take full advantage of their knowledge and skills in the use and conservation of the native species of animals. In the further lively discussion dealing with a wide range of introduced plants and animals in almost every island group a widespread evidence of the adverse effects of introduced animals on the island ecosystems was mentioned. The mongoose, cane toad, Indian myna, Tillapia and Lantana were examples quoted. Prevention of introductions of any new species by tight controls was strongly recommended.

Dr R. Shutler, Canada, commented on his working paper (29.) on the irreplaceability of archaeological, historical, paleontological and geological sites. He presented a five-

point programme which included a continuing survey, formulation and correlation of policies to conserve, an inventory of sites with high, scenic, educational or monumental value and co-ordination by a local agency of all archaeological activities. M.L. Chevalier, Noumea (30) agreed with the above statement regarding archaeological sites, recounted his experiences in New Caledonia and emphasised the great value of these sites as part of a country's natural resources. He also described the procedures that have been adopted for the preservation and exploration of archaeological sites, and the regulations preventing the export of artifacts. Several apeakers discussed the problems of patrolling and enforcing protection of artifacts and sites and Mr P. Tauiliili, American Samoa, described the activities of an historical commission in American Samoa and expressed satisfaction that not only some historical sites but also legends concerned with such sites have been preserved. Mr de Young, S.P.C. thought that the First Pacific Festival of Arts to be held in Fiji in 1972 may promote interest in the monuments of the past. Dr G. Loison, S.P.C. quoted cases of illicit export of valuable artifacts from New Caledonia despite existing regulations.

Mr Alan Harris, S.P.C. identified both the positive and negative aspects of tourism. Other speakers reiterated statements made in the reports from the territories regarding the negative side of tourism: the diversion of labour from food production to construction of hotels and airports, the often considerable destruction of the environment, and physical, psychological and cultural pollution. It was also stated by Mr T. Simika, Kingdom of Tonga, that the acceptance of tourism is often a dire necessity because of the economic situation of various territories. On the other hand there is some promise that a part of the revenue from tourism could be used to improve the destruction caused and protect island beauty.

Dr Yaldwyn, Niue, mentioned the terrible junk often accompanying tourist presence and Dr K. Wodzicki emphasised the particular impact of tourist on the culture of atolls where,

according to anthropologists working in the Tokelau Islands, no more than one or two Europeans can be tolerated: a ban on visitors by the New Zealand Administration since New Zealand took over those islands has helped to preserve that remarkable culture almost intact. Other speakers discussed means of screening tourists to eliminate undesirables, setting aside villages where villagers are willing to accept tourists and providing valid crafts rather than tourist "junk" as souvenirs.

Mr Alan Harris, S.P.C. introduced the discussion on special resources use schemes under three headings: aquaculture, rural development and conservation of resources. Dr T. Pryor's paper (31.) was introduced by Dr J. Bardach who stated that aquaculture is on the cards because of the human population pressure. It has the advantage of using the most abundant asset of the region - solar energy. A further advantage is that aquaculture can be coupled with other activities and practices. There can be two kinds of aquaculture - subsistance or semi-subsistance and on commercial scale. While attention was drawn to the existence of aquaculture in China thousands of years ago, a note of caution was sounded about the large amount of research required, particularly on waste recycling and on the most economical size of operations. In discussing rural development and conservation of resources concern was expressed about progressing urbanization which is tending to upset the social heritage and may specially affect the close family ties of Pacific people. Mr G. Chan described the policy and experience in Taiwan which appears very successful and deserves study. The Taiwan rural development policy is aimed at an orderly transition from the rural to an urban industrial way of life and work. It also provides a very efficient use and conservation of the existing resources. Other speakers agreed that the achievements of Taiwan are relevant to problems of many islands of the Pacific and deserve further study.

The veteran expert on national parks and reserves, Dr J.-P. Harroy, I.U.C.N., Bruxelles (32.) described certain experiences in other parts of the world that could be of value and relevance to the South Pacific. In addition to national

parks and reserves marine parks have to be considered. During an extensive discussion a major difference became apparent between the interpretation of the "parcs" by the French people as exemplified by M. J. Parrat, New Caledonia, and the English and international ideas and definitions of "National Parks" by Dr J.-P. Harroy and several other speakers. Professeur F. Doumenge, Monpellier, reported on the marine parks of Japan and gave his ideas on this subject. Dr J. Randall, Hawaii, mentioned a National Marine Park to be established in the entire Street of Georgia in British Columbia(33). According to Mr N.C. Gare, Papua, New Guinea, a new national park may be established in New Britain and he stated that local people support is the main point for the establishment of a new national park. Other representatives from territories agreed and Dr O. V. Natarajan, Guam, while supporting the idea of reserves stated that the size of most Pacific Islands precludes the establishment of national parks; however, he supported the idea of marine parks. Dr D.A.N. Cromer, Australia, tabled a paper on conservation of Norfolk Island. In all interventions it was emphasized: (1) Time is of greatest essence because the demand for land for all purposes increases, the availability and cost of the sites may soon preclude the establishment of any new national parks and reserves; (2) As land in many Pacific islands is already scarce, more attention should be paid to the special potential of marine parks.

Section IV. Suggestions of Appropriate Legislation concerning Conservation

In introducing the discussion on land and water policies Sir Maurice Yonge like most of the discutants had little new to say or had to repeat observations and arguments already used or stated in previous discussions. In conclusion it was noted that the need was expressed by all contributors for fuller precise information on soils, water and associated resources of the Pacific islands.

The brief session on legislation was introduced by Mr F. G. Nicholls, I.U.C.N., Dr H. Coolidge, I.U.C.N., was concerned with the looseness of existing quarantine regulations, Sir Hugh Elliott, I.U.C.N., considered most of the existing

present legislation outdated and many concepts brought in without consultation with scientists and other experts and Mr E. Max Nicholson considered that the principle "no-one has the right to destroy or injure the common environment" should be asserted. Dr J.-P. Harroy, I.U.C.N. and Dr K. Wodzicki, New Zealand, advocated the enlisting of public understanding and support as essential to the success of all conservation legislation and considered important to have a cadre of independent environmental officers, without other duties, responsible for the winning of public support as well as other tasks.

Section V. The Role of International Organizations

Dr D.A.N. Cromer, Australia, presided and representatives of W.H.O., U.N.E.S.C.O., F.A.O., I.B.P. and I.U.C.N., outlined the scope of these organizations and their relevance to the South Pacific. Dr M. Batisse, U.N.E.S.C.O., Paris, summed up the attitude of his organization in the following 4 points: (i) A good deal of research is needed to utilise the natural resources by properly conserving them. The programme "Man and Biosphere" should help to achieve this. The participation by many Pacific islands would be possible through the UNESCO-member countries with which they are associated; (ii) The separation of necessary development from the required conservation is the practical issue of greatest importance to mankind. This very complicated problem will be discussed at the Stockholm Environmental Conference in 1972; (iii) Social and cultural problems have been greatly neglected while occidental culture has in many ways overwhelmed the world and (iv) Education is the only means by which people can be prepared to reconcile problems of expansion with the needs for conservation.
Dr Raymond Dassman, I.U.C.N., outlined a substantial programme for the South Pacific Commission, including training courses and seminars on environmental problems of the Pacific, environmental surveys and the establishment of environmental officers with the Commission. Dr G. Loison pointedly stated that at every Annual Conference of the S.P.C. there is a request for the appointment of a new specialist. To avoid a considerable delay in the initiation of work on nature conservation and related problems, the territorial representatives

would be well advised in pressing their Governments and Administrations for more funds for that purpose.

Introducing the discussion on conservation of certain Pacific islands as "islands for science" Mr E. Max Nicholson, I.B.P. , outlined the long way towards the achievement of the objective of securing these islands for research. Elliott(34.) summarized the background of this proposal and also gave briefly the reasons for each nomination of an island. The list of islands includes so far 39 islands, of which only 19 are in the ambit of the South Pacific Commission. Finally, it may be noted that only three islands are within the New Zealand region: (i) The Suvarov Atoll, Northern Cook Islands, (ii) Antipodes Islands and (iii) Adams Island in the Auckland Islands group. The two latter are under the protection of the N.Z. Lands & Survey Department and an intensive programme of research is being carried out by the D.S.I.R. and the University of Canterbury. Finally, Nicholls (35.) presented the third draft of a "Convention on Conservation of Certain Islands for Science". He expressed the hope that this convention will be finally accepted at the Stockholm Meeting on Environment in 1972 and be ready for ratification. In the discussion possible choices of further islands were mentioned in French Polynesia, Fiji and New Caledonia. Professeur F. Doumenge, Monpellier, referred to the important, little known, pre-war Japanese marine research on Palau and suggested that one of the most important, basic objectives in the "islands for science" project was to establish and make available a complete and up to date bibliography of all scientific studies which had or were still being conducted in Pacific islands.

Section VI. Conservation Education

Reference to the key role of education in conservation was made at the discussion of practically every major topic of this Symposium. In view of the interest in this matter shown by the territorial representatives and shared by a number of other delegates and at the initiative of Miss Martha Henderson and the writer, an informal meeting of all territorial representatives and a few others was held. The New Zealand

approach to conservation education in the Tokelaus and Niue, primarily by the preparation of short textbooks for teachers was briefly reported. Following these discussions a memorandum on conservation education was prepared. Upon further discussion it was accepted and signed by fourteen island representatives and eight other participants interested in this important problem. The following extract summarized the scope of the discussions and recommendations:

> "Many different facets of the environmental situation have been presented: preparation and enforcement of laws; co-operation of the general public with existing and potential laws; exchanges between scientists; and, finally, exchanges between the scientific community and the public.
>
> This all points to a need for communication. Communication of data between scientists, communication of information between countries and communication of scientific ecological principles to the public. One of the major objectives of this conference should be the communication of the importance of environmental protection to the Pacific Islander. Paths for this communication must be developed now.
>
> We have seen two fine examples of video-communication in the films shown at this meeting. We have maintained audio-communication between people who, in general, understand the problems and agree upon the solutions. Now we face a much more difficult task, that of communicating these concerns and problems, along with their solutions, to the general public. This is the duty of education.
>
> Environmental law enforcement has been stated as a problem. Enforcement is less necessary where education is successful. Administrative and legislative inaction is another problem. Laws and edicts for environmental protection will come forth more rapidly with education.
>
> We have talked about the need for education. We now must develop the idea of environmental education into concrete and definite programmes. These programmes must be aimed at all levels and ages. Primary, secondary, college, technical programmes on agriculture or fisheries and community programmes, must be tailored to the

specific environmental problems of each island group. A recommendation this conference must make is to perpetuate itself and its ideas by encouraging the development of environmental education throughout the islands."

The above recommendation was presented to the meeting by Professor Geo. Knox and was well received, particularly by territorial representatives. In the lively discussion that followed, Miss Martha Henderson, Washington, said that African programmes that have been already successful there should be consulted, Dr G. Baines, Suva (36) offered the assistance of the University of the South Pacific, Dr K. Wodzicki pointed out that in most territories the human population has doubled but the natural resources remained the same or even diminished; and this notion, new to most islanders, can be brought over to them only by education; an encouraging fact was that for instance Niuean political leaders were behind the conservation education scheme. Finally, Dr G. Loison aptly observed that with such an extension of educational activities as suggested in the resolution, we may be short of money and suitable teachers.

RECOMMENDATIONS

On the last afternoon of the Symposium of 14th August 1971, the last meeting chaired by Professeur Francois Bourliere, the General Chairman, listened to and briefly discussed a total of 19 draft resolutions. The final wording of the resolutions was left to Mr Frank G. Nicholls, Deputy Director-General, I.U.C.N., Nineteen draft resolutions were adopted by the meeting but eventually twenty-one resolutions were sent to the delegates. The list of the final resolutions follows while their full text is attached in Appendix III.

No. 1. Ecological Principles in Development Planning;
2. Environmental Protection Agencies;
3. Human Populations;
4. Environmental Education;
5. Conservation of Islands for Science;
6. Conservation of Plants and Animals;
7. Control of Introduced Species;

8. Marine Parks and Reserves;
9. Studies on Lagoon and Reef Ecology;
10. International Co-ordination of Coral Reef Research;
11. Extractive Activities and Environmental Disturbance;
12. Utilization of Coastal Marine Resources;
13. Mangroves;
14. Use of Explosives and Poisons;
15. Regulation of Fish Net Sizes;
16. Fish Poisoning;
17. Pesticides and Toxic Materials;
18. Pollution of Waters;
19. Conservation of Ground Water Resources;
20. Aquaculture;
21. Proposals for Environmental Activities of South Pacific Commission.

I would like to make the following brief comments with regard to the above resolutions. Firstly, as one would expect with so many resolutions and so little time left for any re-drafting or amendments by the participants, there is some repetition and redundancy; also, some of the resolutions reflect more the feelings of those drafting them than hard facts and little action following the acceptance of such resolutions is expected. Secondly, there is a considerable divergence between the number of resolutions presented and passed by the last meeting and the final text (Appendix III); the wording, at least in some of the resolutions in their final text differs substantially from the text presented to the final meeting. Finally, we may gain some perspective in the road ahead of us if the 21 resolutions are divided into the following five major groups: i. General (resolutions 1 and 3); Conservation (5, 6, 7, 8, 12, 15 and 19); iii. Research (9, 10, 12, 13, 16 and 20); iv. Problems of explosives, pollution, etc. (11, 14, 17 and 18) and new activities (2 and 21).

The first group of resolutions belongs to those general ones, referred to above. Although the demography of the region was not discussed at the Symposium, a resolution on population was inserted, perhaps it is now fashionable to have such a resolution at any conference.

In the second group of 7 resolutions on conservation two resolutions (on conservation of plants and animals and control of introduced species) are general and are applicable to the whole region. Unfortunately, in the first resolution, an important recommendationof having a survey of the distribution and the present status of rare or vanishing species (see pp.18-19) is missing - obviously one cannot preserve a species without the knowledge of its present status! Similarly, in the second resolution important recommendations arising from the papers presented and the discussion are also missing. Two other resolutions (on islands for science and on marine parks and reserves) are naturally very important though of local character, while the last two resolutions (on fish net sizes and conservation of ground water resources) are of considerable practical importance.

It is unfortunate that no resolution was drafted nor passed on the conservation of historical, archaeological, paleontological and geological sites in the area. This serious omission of the Drafting Committee is important because as the discussion on this subject has shown (p.22) the existing sites are fast disappearing from all over the area.

The six resolutions on research, though varying in urgency and scope are all of great theoretical and practical importance. It should, however, be realised that all these major research projects are not in the purview of any of the constituent territories. Obviously, they should be the responsibility of the large marine laboratories, such as the Marine Laboratory on Cocos Island, Hawaii, or its French counterpart at Papeetee, financed by international organisations.

The four resolutions of the next group, viz. exploitation of natural resources on land and in the sea and the destruction of Pacific islands habitats by explosives, poisons, pollution and pesticides, are all of extreme urgency because of the fragility of the environment and often also because of the irreversibility of some of these destructive processes. All these resolutions should be brought to the attention of

governments and administrations as soon as possible for study and action.

Finally, the last group of three resolutions dealing with action resulting from the present Symposium falls into two parts: a proposal for environmental activities of the South Pacific Commission and other bodies, and the proposal on environmental education.

A note of caution was sounded during the previous discussions on this new involvement of the S.P.C. The suggested programme of environmental action by the Commission is certainly ambitious and appears to be on a very large scale; and apart from the money required, it may not be easy to find a specialist who would efficiently attend to such a diversified programme for the whole region.

Finally, the writer considers the last resolution - on environmental education one of the highlights and a tangible result of the Symposium. The response of all territorial representatives during the discussion of this proposal at the Symposium was very encouraging. If the South Pacific Commission could help in the implementation of this proposal, it would be, without doubt, a very sound investment for the future of Nature Conservation.

DISCUSSION

To briefly recapitulate the environmental problems as outlined to the Symposium by the territorial representatives present, we will follow the excellent summary given by Professor F. Doumenge: there are three main categories of environmental problems that face us in our region, viz. demographic problems, problems arising from the exploitation of natural resources, and problems arising from social changes in the area. The demographic problems reported from so many territories are obvious and need little comment. They lead to shortage or over-exploitation of resources on one side and urbanisation on the other. The consequences of the exploitation of natural resource in the territories are of considerable magnitude and are often irreversible. Mining on Makatea, French

Polynesia, New Caledonia, Nauru, Ocean Island or Bougainville present terrifying examples. Other examples of results of exploitation are the erosion problems in New Caledonia or parts of the Solomon Islands and the depletion of forests by fires and of the reefs by explosives and poisoning; and last but not least, the extensive use of pesticides following expansion of agriculture, as exemplified by the problems found in the Southern Cook Islands and elsewhere. Finally, the effect of social changes as shown by urbanization and industrialization cannot be overemphasised, with car and factory problems. Ten years ago there were four cities in the whole area, now there are many large urban centres together with new ports which have brought both urban and sea pollution. A decade ago there were practically no hotels, now there are about one hundred, each with its own pollution problem, and tourists exporting large quantities of shells and even destroying coral. While the importance of most of these new developments should be realised, only a common policy of all territories in the region can preserve the essential parts of the environment for future generations.

The only answer to this situation is to recognise the problems and to know them in order to provide an answer. It may therefore be advisable to obtain first as full picture of the situation prevailing as possible, before taking action. It is hoped that the proceedings of this Symposium, when published, will provide such an account.

In the light of these considerations it was somewhat disappointing to see a lack of good liaison between the territories and the Commission as exemplified by the absence of delegates from nearly half of the territories. In this context the absence of Government representatives from the United Kingdom and Western Samoa should be noted as well as the fact that there was only one delegate from Australia, though this country and the United Kingdom supply a large percentage of finance for the Commission and will no doubt be asked for more money for nature conservation. On the other hand, it

was pleasing to see so many representatives of international organizations. Time and again these representatives stated that most of the international programmes have so far missed the Pacific. Assurances were given that in the future more financial assistance for projects concerning this region would be available. In fact, all the research discussed during the Symposium and considered essential for nature conservation in the region cannot be conducted without international help. Finally, it is to the credit of International Union for Conservation of Nature and Natural Resources that they helped the organization of this Symposium and sent such a contingent of experts, whose knowledge and expertise greatly assisted the work of the Symposium. The only criticism the writer would like to level at the I.U.C.N. was their difficulty in concentrating sometimes on problems that are peculiar to this region. Everyone appreciated the ideas of the I.U.C.N. and I.B.P. people of securing a number of islands for science and of the necessary international legislation, but the time spent on these items prejudiced discussion on some urgent problems affecting most of the Pacific islands. By tacitly admitting that these islands for science may in the future be the only islands left in their natural state, the I.U.C.N. and I.B.P. representatives may have been out of focus with regard to some immediate problems of paramount interest to territorial representatives.

Finally, it remains to mention briefly a few matters arising from the Symposium and its recommendations that either affect New Zealand directly or are of special interest to New Zealand.

In the first group, we have the extension of the S.P.C. activities into environment (resolution No. 3) and the question of environmental education (resolution No. 2). Both, if accepted by the Annual Assembly of the Commission will mean an increase in the annual contribution made by New Zealand to the S.P.C. budget.

With regard to the first matter, the whole evidence presented in the preceding pages of this report seems logically

to support an involvement of the Commission in the ecology and management of the natural resources in this region. I have, however, reservations whether the whole programme as envisaged by the resolution should be accepted at once and I consider that a good deal of thinking will be necessary before the inception of such a new agency of the Commission. It would also be essential to obtain the assistance of some of the international organizations, particularly for the long-term projects referred to in several of the recommendations. With regard to environmental education, it would be difficult for New Zealand to oppose this important recommendation for the following reasons: i. New Zealand has been a pioneer in that direction and New Zealand's example had an effect in having this resolution passed; ii. It should be remembered that this resolution has been passed unanimously by the territorial representatives, one of the very few matters on which everybody agreed, and iii. New Zealand would be able to supply a good deal of know-how and expertise.

The Symposium has also raised a good many questions concerning the territories for which New Zealand is either responsible (Tokelau & Niue Islands) or has a special interest (Western Samoa and Cook Islands). The present report can mention only a few: (i) Research to explore the New Zealand overseas territories and assist in their development. The writer during his stay in Noumea was greatly impressed by the solid research effort of the O.R.S.T.O.M. (Research Organization for the Development of Overseas Territories), the Fondation Polignac, the Museum d'Histoire Naturelle in Paris, all working in New Caledonia and in French Polynesia. Professeur F. Bourliere informed the writer that Frs (old) 2,000,000 have been provided in this year's budget for new buildings and equipment of O.R.S.T.O.M's. laboratories at Noumea. New Zealand's scientific effort in the Pacific territories, except for geologists and pedologists, has been very modest and as far as the writer is aware little has been done to alleviate the problems faced by the Cook Islands referred to in this report. The writer is convinced that the D.S.I.R. and other Government organisations could, even without expansion, assist all the

above territories in their development and preservation of their environment; (ii) Environmental studies could assist development without environmental deterioration of the islands' habitat. An international airport is being built and the building of hotels is also envisaged. Also urbanization though to a much lesser extent than in the other Pacific islands is progressing in the Cooks and perhaps also at Niue. Has any attention been paid to the sanitation and pollution problems that must eventuate and to their effect on reef and lagoon? (iii) Quarantine problems. It is well known that Niue Island has strict quarantine regulations rigidly enforced and the rhinoceros beetle is fortunately still absent from this island. We also know that through laxity (or disregard?) of elementary quarantine regulations, Oryctes rhinoceros became established on Nukunonu atoll much to the detriment of the inhabitants. A review of the quarantine regulations in all N.Z. territories and of their application is an urgent matter in the interest of conservation and the welfare of the islanders; (iv) Niue Island and to a lesser degree the Tokelau Islands have strong surviving Polynesian traditions of nature conservation, and it is possible that something similar could be found in the Cook Islands. It is recommended that every support should be given to maintaining and developing these old traditions. Also from William R. Sykes' studies of the Niuean flora it is known that the primeval forest there contains elements and communities not known anywhere else and the establishment of a reserve of such plant community should be favourably considered.

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34. Elliott, H. Sir Pacific Oceanic Islands recommended for Designation as Islands for Science. WP. 17, 16 pp.

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APPENDIX I

LIST OF PARTICIPANTS

REGIONAL SYMPOSIUM ON CONSERVATION OF NATURE - REEF AND LAGOONS, 5th - 14th AUGUST, 1971

I. TERRITORIAL PARTICIPANTS

1. American Samoa

   Mr Pemerika Tauiliili, Director of Agriculture, Government of American Samoa, Pagopago, American Samoa.

2. British Solomon Islands Protectorate

   Dr J.R.D. Wall, Overseas Development Administration, Agriculture Department, Honiara.

   Mr R. F. Hansell, As above.

3. Cook Islands

   Mr Walter Hambuechen, Department of Agriculture, Rarotonga, Cook Islands.

4. Fiji

   Mr S. Chandra, Department of Agriculture, Koronivia Station, Nausori, Fiji.

5. French Polynesia

   M. R. Millaud, Chef du Service de l'Economic Rurale, Polynesie Francaise, Papeete, Tahiti.

6. Guam

   Dr O.V. Natarajan, Administrator, Guam Water Pollution Control Commission, Agana, Guam.

7. New Caledonia (all participants below were from Noumea)

   M. J. Parrat, Chef du Service des Eaux et Forets

   M. J-J. Eude, Chef du Service de la Marine Marchande

   M. M. Corbasson, Directeur du Centre Technique Forestier Tropical

   M. L. Chevalier, Conservateur du Musee Caledonien

   M. P. Leca, Directeur du Service des Mines

   M. B. Tabuteau, Directeur de l'Office du Tourisme

   M. Nozieres, Chef du Service de l'Agriculture

   M. de Luccio, Association pour la Sauvegarde de la Nature neo-caledonienne

8. Niue

   Dr John C. Yaldwyn, Assistant Director, Dominion Museum, Wellington, New Zealand.

9. Papua New Guinea

Mr G. K. Graham, Deputy Assistant Director, Division of Research & Surveys, Department of Agriculture, Stock & Fisheries, Konedobu.

Mr N.C. Gare, Executive Director, National Parks Board, Boroko.

10. Kingdom of Tonga

Mr T. Simiki, Director of Agriculture, Nuku'alofa.

11. Trust Territory of the Pacific Islands, Saipan, Mariana Islands

Mr Robert P. Owen, Chief Entomologist & Acting Chief Conservationist.

Mr Nachsa Siren, Chief, Environmental Health Division.

Mr B. F. Weilbacher, Chief of Plant Industry.

II. OBSERVERS

1. Dr D.A.N. Cromer, Director-General, Department of National Development, Forestry & Timber Bureau, Yarralumla, A.C.T. Observer for Australia.

2. Dr Bernard Salvat, Directeur-Adjoint, Laboratoire de Biologie Marine & de Malacologie, Ecole Pratique des Hautes Etudes, Paris. Observer for France.

3. Dr Kazimierz Wodzicki, Department of Scientific & Industrial Research, Wellington. Observer for New Zealand.

III. S.P.C. STAFF

1. Mr Alan Harris, Programme Director (Economic)
2. Dr Guy Loison, Programme Director (Health)
3. Mr G. Chan, Public Health Engineer
4. Mr V. Hinds, Fisheries Officer
5. Mr E. I. Hűgh, Agriculturalist
6. M. M. Lambert, Tropical Agriculturalist
7. Mr A. Tubb, South Pacific Islands Fisheries Development Agency.

IV. REPRESENTATIVES OF INTERNATIONAL ORGANIZATIONS

1. Dr M. Batisse, Director, Natural Resources Research Division, S.C.E., U.N.E.S.C.O., Paris.

2. Dr R. Serene, U.N.E.S.C.O., Marine Science Regional Expert for S.-E. Asia, Singapore.

3. Dr T.V.R. Pillay, Chief, Fisheries Resources Division, F.A.O., Rome.

4. M. S. Castrillon, Sanitary Engineer, W.H.O., Suva.

International Union for Conservation of Nature & Natural Resources (I.U.C.N.):

5. Dr Harold J. Coolidge, President, Washington, D.C.

6. Dr Raymond Dassman, Chief Ecologist, Morges, Switzerland.

7. Sir Hugh Elliott, Scientific Consultant, Oxford, England.

8. Mr E. Max Nicholson, one-time Director-General, Nature Conservancy, London.

9. Miss Gina Douglas, Scientific Co-ordinator, London.

10. Sir Maurice Yonge, University of Edinburgh, Scotland.

11. Dr Frank G. Nicholls, Deputy Director-General, Morges, Switzerland.

12. M. Jean-Paul Harroy, President, International Commission on National Parks, I.U.C.N.

V. REPRESENTATIVES OF OTHER ORGANIZATIONS

Canada

1. Dr R. Shutler, Department of Anthropology, University of Victoria, Victoria, British Columbia.

France

1. Professeur F. Doumenge, Institut de Geographie, Faculte de Lettres, Monpellier.

2. Professeur Francois Bourliere, Sorbonne, Paris.

3. Professeur R. Heim, one-time Director du Museum National d'Histoire Naturelle, Paris.

4. Professeur J. Avias, Directeur de l'U.E.R."Ressource naturelles et Amenagement Regional", Universite du Languedoc, Monpellier.

5. Professeur R. Durand, Directeur du Department de Biologie Appliquee, Institut Universitaire de Technologie de Tours, Tours.

Representatives of the Organization des Recherches des Territoires d'Outremer (ORSTOM), Noumea Centre

6. M. H. Botton, Agronome
7. M. Paul Cocherau, Entomologiste
8. M. M. Latham, Pedologue
9. M. M. Michel, Oceanographe
10. M. S. Piems, Hydrologue
11. M. J-M. Veillon, Botaniste
12 & 13. Dr and Madame R. Catala, Aquarium de Noumea.

In addition there were 7 semi-official observers representing primary and secondary industries of New Caledonia.

Fiji

1. Dr Graham Baines, University of the South Pacific, Suva

New Zealand

1. Professor George Knox, University of Canterbury, Christchurch

U.S.A.

1. Dr J.E.Bardach, Director, Hawaii Institute of Marine Biology, Coconut Island, Hawaii
2. Dr R. Clutter, South Pacific Is. Fisheries Development (SPIFDA), Hawaii Institute of Marine Biology, Hawaii
3. Dr R. E. Johannes, University of Georgia, Athens, Georgia
4. Dr John Randall, Bernice P. Bishop Museum, Honolulu, Hawaii
5. Dr D. M. Whitt, Soil Conservation Section, U.S. Department of Agriculture, Washington, D.C.
6. Miss Evelyn L. Pruitt, Navy Office of Naval Research, Arlington, Virginia
7. M-elle Marie-Helene Sachet, Smithsonian Institution, Washington, D.C.
8. Miss Martha Henderson, Pacific Science Board, Washington, D.C.

APPENDIX II

PROGRAMME OF TECHNICAL DISCUSSIONS, SECTIONS II - VI
(including the names of the Sections' Chairmen and Discussion Leaders)

SECTION II - GENERAL ECOLOGICAL ASSESSMENT OF PACIFIC ISLANDS

Chairman : Sir Hugh Elliott, I.U.C.N., Discussion Leader: Dr R. Clutter, Hawaii

SECTION III - PROBLEMS OF CONSERVATION AND PLANNING FOR THEIR SOLUTION

Chairman : Dr Raymond Dassman, I.U.C.N.

1. Conservation of the Soils.
   Discussion Leader: Dr D.M. Whitt, U.S. Dept. Agric.
   (a) Soil Erosion : Mining Activities
   (b) Chemical Pollution : Pesticides
   (c) Bacteriological Pollution
   (d) Other problems

2. Forests. Discussion Leader: Dr D.A.H. Cromer, Australia
   (a) Destruction of Forests : Forest fires
   (b) Conservation of Natural Forests

3. Pasture Fires. Discussion Leader: E. Hugh, FAO/SPC.

4. Freshwater Problems - Pollution of Waterways.
   Discussion Leader: Dr J. Bardach, Hawaii

5. Marine Habitats - Conservation of the Reefs and Lagoons.
   Discussion Leader: Dr Bernard Salvat, Paris

6. Air Pollution. Discussion Leader: Mr F.G. Nicholls, I.U.C.N., Morges.

7. Conservation of Endangered Species and

8. Introduction and Re-introduction of Exotic Plants and Animals. Discussion Leaders: Dr Harold Coolidge, IUCN. and Professor George Knox, New Zealand.

9. Islands for Science. Discussion Leader: Mr E. Max Nicholson, IUCN., London.

10. Conservation of Historical, Archaeological and Palaeontological Sites.
    Discussion Leader: Dr R. Shutler, Canada.

11. The Impact of Tourism. Discussion Leader: Mr Alan Harris, SPC.

12. Special Resources Use Scheme.
    Discussion Leader: Mr Alan Harris, SPC.

13. National Parks and Reserves in Land and Marine Environments.
Discussion Leader: Dr J.- P. Harroy, Bruxelles

SECTION IV - LEGISLATION

Chairman : F. G. Nicholls, IUCN.

14. Land and Water Use Policies.
Discussion Leader: Sir Maurice Yonge, Edinburgh

15. Suggestions of Appropriate Legislation concerning Conservation, etc. Discussion Leader: F.G. Nicholls, IUCN., Morges.

SECTION V - THE ROLE OF INTERNATIONAL ORGANIZATIONS IN SUPPORTING LOCAL ACTION TOWARDS CONSERVATION PURPOSES

Chairman : Dr D.A.N. Cromer, Discussion Leader: Dr M. Batisse, UNESCO., Paris.

SECTION VI - CONSERVATION EDUCATION

Chairman: Professor Geo. Knox

RESOLUTIONS

RESOLUTION NO. 1

Ecological Principles in Development Planning

The Symposium:

Believing that a major reason for the lack of success in many development projects has been the neglect of ecological principles during the conception and planning phases;

Being aware that IUCN in collaboration with development planners and other specialists has prepared a compendium setting out ecological principles with special reference to the problems of development planners;

Being aware that many agencies concerned with development intend to use this compendium to formulate ecological guidelines for the evaluation and elaboration of development projects;

Recommends that the South Pacific Commission and all governments and administrations concerned formulate and adopt such ecological guidelines as the basis for their own development projects.

RESOLUTION NO. 2

Environmental Protection Agencies

The Symposium:

Being convinced of the urgent need to establish appropriate machinery for creation of environmental policy and administering such policy within the various South Pacific territories;

Recommends to all governments concerned that they establish within their structure formal independent organisations or agencies specifically charged with environmental protection operating in close co-operation with those governmental units charged with the exploitation and economic use of natural resources and other agencies affecting the environment.

RESOLUTION NO. 3

Human Populations

The Symposium:

Being aware of the rapid growth of human populations in various Pacific islands with the consequent stress on limited environmental resources;

Being concerned with the serious consequences which will occur if the present upward trend in population continues unchecked;

Recommends to all governments and administrations concerned that high priority be given to family planning and related matters concerning population control and that every endeavour be made to maintain human populations in proper balance with their environment at a high standard of living and with full consideration for the quality of life.

RESOLUTION NO. 4

Environmental Education

The Symposium:

Believing that action to create awareness of the environment and its problems and their solutions throughout all segments of the population is an essential prerequisite to effective environmental action programmes;

Realising the importance of creating effective communication channels and media for this purpose and developing materials and methods for environmental education;

Recommends to the South Pacific Commission and all governments and administrations concerned that the following proposals be implemented:

(1) That a workshop on environmental education for the South Pacific region be convened as soon as possible, and that appropriate action be taken to involve island personnel and senior decision makers in its deliberations;

(2) That, both at this workshop and subsequently, multimedia material be developed in small units suitable for specific audiences (e.g. schools, training colleges and adult education programmes) in particular island environments using as a basis the many existing examples available from international agencies and from courtries involved with the region.

RESOLUTION NO. 5

Conservation of Islands for Science

The Symposium:

Realising that islands, because of isolation, limited size and other environmental characters, tend to develop specialised, and sometimes simple and fragile communities;

Realising the special value to science of islands as locations for the continuing studies of evolution, genetics, population dynamics, interaction between species and many related topics;

Realising that island ecosystems, particularly of small and remote islands, having evolved in isolation, are vulnerable and easily disrupted by disturbances arising from human activities;

Being convinced that it is in the interests of mankind to conserve selected islands as sites for scientific studies, particularly remote and uninhabited islands;

Recommends to all governments concerned that they adhere to the proposed Convention on Conservation of Certain Islands for Science proposed by IUCN and scheduled for discussion at the UN Conference on the Human Environment (Stockholm, June 1972);

And recommends further that early attention be given to the selection of appropriate islands for conservation for this purpose.

RESOLUTION NO. 6

Conservation of Plants and Animals

The Symposium:

Being aware of the special value to mankind of the plants and animals that have evolved in isolation in many island territories;

Realising that increased population pressures, uncontrolled hunting, development projects and unwise land use have already destroyed many of these unique resources;

Realising also that general inventories of the flora and fauna are lacking for many island territories and that existing information on the status of endangered and vulnerable species and communities of plants and animals is often inadequate;

Being concerned to see that representative samples of this plant and animal life are conserved for the benefit of the island peoples and the world at large;

Being concerned also to see that adequate protection is given to endangered and vulnerable species of plants and animals to ensure their survival;

Recommends to all governments and administrations concerned that where necessary inventories of flora and fauna be made and that information on endangered and vulnerable species be made available to appropriate local agencies;

Recommends also that immediate action be taken to conserve areas containing these unique plant and animal resources and particularly to conserve remaining populations of endangered and vulnerable species by the creation of additional reserves and parks of appropriate size and kind;

And recommends further that adequate provision be made for supervising and protecting the resources conserved in such reserves.

RESOLUTION NO. 7

Control of Introduced Species

The Symposium:

Recognising that introduced species, particularly introduced mammals, have disrupted and modified island natural communities with effects that include extinction of local species, modification of vegetation, widespread erosion, and subsequent economic losses;

Emphasising that effective management and control of introduced species must be based on sound ecological knowledge;

Recommends to the South Pacific Commission and all governments and administrations concerned that the following conservation priorities be established:

(1) Vigorous management action to ensure that potentially harmful foreign species are not introduced on to islands;

(2) Control measures to reduce or eliminate undesirable introduced species from actively degrading islands;

(3) Maintenance of existing balances on other islands unless the desirability of alternative action is supported by relevant ecological research and after careful consideration of the probable ecological consequences of such action;

And recommends also that quarantine regulations be revised to ensure that those relating to plant and animal introductions are based on sound ecological principles;

And recommends further that opportunities for training local personnel to undertake such conservation management action be expanded.

RESOLUTION NO. 8

Marine Parks and Reserves

The Symposium:

Being concerned that representative examples of marine environments should be conserved for the benefit of the island peoples and the world at large because of their scientific and educational value and to ensure the survival of species;

Recommends to all governments concerned that action be taken to creat a range of underwater reserves and marine parks suitably and effectively protected under appropriate legislation.

RESOLUTION NO. 9

Studies on Lagoon and Reef Ecology

The Symposium:

Being aware of the paucity of ecological data on the structure and functioning of lagoon and reef ecosystems;

Being aware also that studies of these exceptionally complex systems must cover a series of years if reliable data are to be obtained;

Believing that such data are urgently needed if effective conservation and management of these valuable resources are to be carried out;

Recommends to all governments and administrations concerned, and particularly to international agencies and scientific bodies, that urgent action be taken to initiate and finance studies on lagoon and reef ecology, particularly quantitative studies on the recovery of reefs after disturbance, whether natural or man-induced, including studies on niches and sub-systems of reef ecosystems.

RESOLUTION NO. 10

International Coordination of Coral Reef Research

The Symposium:

Believing that closer co-operation is desirable between marine biologists and other scientists working on coral reefs in various countries;

Recommends to the Pacific Science Association that during the 12th Pacific Science Congress (Canberra, August 1971) consideration be given to means of improving international co-operation in this field;

And recommends further that the proposal be examined of establishing an international working group on coral reef research and effective liaison between laboratories working in this field.

RESOLUTION NO. 11

Extractive Activities and Environmental Disturbance

The Symposium:

Being concerned at the extensive ecological disturbance that has been caused in certain Pacific islands by extractive activities, including open cast mining, dredging and timber cutting;

Being concerned particularly at the indiscriminate removal of forest cover by prospectors who use fire to clear land in their search for minerals, by pastoralists who use fire for clearing land and by logging operators using tractors and heavy equipment;

Recommends to the South Pacific Commission and all governments and administrations concerned that agencies wishing to undertake extractive activities involving considerable environmental disturbances such as mining, oil drilling, logging operations or excessive removal or destruction of vegetation, should be required to undertake land restoration, revegetation or reafforestation and the control of resulting pollution of air, water or land and, failing that, to pay the cost of such rehabilitation.

RECOMMENDATION NO. 12

Utilization of Coastal Marine Resources

The Symposium:

Being concerned at the extensive ecological damage that has been caused in certain Pacific islands by utilization of coastal marine resources, including reef materials, and by the development of tourism;

Being concerned particularly at the building of hotels and other developmental activities on beach fronts, at the gathering of sand and coral in large quantities for building and industrial use without thought to the disturbance of beaches, reefs and lagoons, extensive dredging operations, and overharvesting of marine shells and other forms of marine life;

Recommends to the South Pacific Commission and all governments and administrations concerned that relevant ecological studies should be a necessary prelude to approval of any development projects in coastal areas;

And further recommends that appropriate control measures linked to the findings of such surveys should be applied to regulate the building of hotels, the disposal of wastes, the gathering of sand and coral, the collecting and harvesting of marine shells and other forms of marine life as well as other types of exploitation so as to reduce or remove environmental disturbances resulting from such activities.

RESOLUTION NO. 13

Mangroves

The Symposium:

Realising the importance of mangrove communities in protecting the adjacent lagoons, reefs and inshore environments from polluted run-off, especially sewage, providing valuable fisheries resources, protecting the land against marine erosion, providing safe anchorage for ships and boats during typhoons, providing important breeding sites for fishes, birds and marine invertebrates; and having a unique flora and fauna of great scientific interest;

Being concerned that development projects are causing rapid disappearance of these mangrove communities, especially through land reclamation;

Recommends to all governments and administrations concerned:

(1) That unrestricted exploitation and infilling of mangrove areas be stopped immediately;

(2) That guidelines for effective conservation of mangrove areas be established;

(3) That relevant ecological studies should be a necessary prelude to approval of any development projects in mangrove areas; and,

(4) That long-term investigations be initiated to determine the level of economic exploitation which mangrove communities can sustain without undue damage to the ecosystem.

RESOLUTION NO. 14

Use of Explosives and Poisons

The Symposium:

Being aware of the extensive use of explosives and poisons for killing fish and in engineering works within island territories;

Being concerned at the unnecessary damage to habitats including the destruction of reefs, increase in silting and the incidental destruction of virtually all species of organisms within the ecosystem;

Recommends to all governments and administrations concerned that more effective control be exercised on the importation, sale and use of explosives and poisons including the enactment of rigid licensing laws;

And further recommends the total prohibition of the use of explosives and poisons in enclosed waters; ponds, lakes, lagoons and river systems, together with the institution of effective systems of policing this prohibition.

RESOLUTION NO. 15

Regulation of Fish Net Sizes

The Symposium:

Being aware that in many Pacific islands there are no restrictions on the use of small-meshed nets with resulting unwise exploitation of fisheries resources;

Being concerned that such practices result in eventual reduction of catches to below the maximum sustainable yields with consequent loss of protein supplies to the island peoples;

Recommends to all governments and administrations concerned that effective control measures be instituted to prevent the use of nets with meshes below a specified minimum size.

RESOLUTION NO. 16

Fish Poisoning

The Symposium:

Being aware that fish poisoning (ichthyosarcotoxism) presently limits the use of fisheries products on a wide scale in tropical waters of the Pacific and constitutes a serious health hazard;

Recommends to the South Pacific Commission and all governments concerned that additional research into this problem should be undertaken perhaps under the auspices of SPIFDA.

RESOLUTION NO. 17

Pesticides and Toxic Chemicals

The Symposium:

Being concerned at the environmental disturbances being experienced in Pacific island ecosystems, both terrestrial and aquatic, because of unwise and excessive use of pesticides and other toxic chemicals;

Recommends to the South Pacific Commission and all governments and administrations concerned:

(1) That strict controls be instituted on the importation and use of such materials;

(2) That public education programmes be instituted to make all users aware of the need for adequate care in usage and the long-term risks of using certain persistent chemicals;

(3) That consideration be given to the establishing of regional analytical and monitoring services for pesticides and other toxic chemicals;

(4) That more intensive studies be instituted on the rate and manner of accumulation and decomposition of such materials;

(5) That action be taken to initiate studies within the region on biological control and to explore the possibility of establishing a local branch of the International Organisation for Biological Control.

RESOLUTION NO. 18

Pollution of Waters

The Symposium:

Being concerned at the increasing pollution of streams, lagoons and offshore waters of Pacific islands with consequent environmental damage including destruction of many forms of aquatic life;

Being concerned also with the urgent need to maintain uncontaminated water supplies and to conserve and improve the valuable food resources produced in lagoon and reef zones;

Recommends to the South Pacific Commission and all governments and administrations concerned:

(1) That no sewage be discharged into any body of water without appropriate treatment;

(2) That the location of marine outfalls for the final disposal of effluent from treatment plants be settled only after careful ecological, hydrological and engineering studies;

(3) That where conditions are suitable, simple and effective methods relying on settling and anaerobic digestion, or aerobic stabilisation and photosynthesis, such as the use of septic tanks, pipes and stabilisation ponds, be used in lieu of sophisticated, mechanical treatment plants;

(4) That action be taken to initiate research and data collection on relationships between rates of application of organic and inorganic fertilisers and run off from agricultural areas via streams and groundwater into lagoons and reef flats so as to overcome the paucity of knowledge in this subject area and to provide the basis for future planning;

(5) That, on islands relying on underground water for water supply purposes, special precautions be taken to prevent pollution of these supplies by discharge of untreated wastes;

(6) That, in order to ensure the effective operation of anti-pollution measures, effective water quality monitoring programmes be established and maintained;

(7) That adequate measures be taken to prevent water pollution by oil, either from shore or ship installations.

RESOLUTION NO. 19

Conservation of Ground Water Resources

The Symposium:

Being concerned that ground water resources which are the main source of water supply in some islands are endangered by over-extraction, pollution and modification of the natural environment;

Recommends to the South Pacific Commission and all governments and administrations concerned:

(1) That, in such islands, appropriate studies should precede the establishment of additional water development projects to define short and long-term requirements; and

(2) That when a proper balance has been established between available water resources and the requirements of users, care should be taken to prevent any substantial increase in extraction so that water quality is maintained.

RESOLUTION NO. 20

Aquaculture

The Symposium:

Being aware that animal protein supplies in Pacific islands are scarce and are likely to be more scarce in the future:

Believing that aquaculture can supply substantial protein increments;

Considering that aquaculture can be coupled with other food diversification projects and utilise human and agriculture wastes;

Recommends to the South Pacific Commission and to all governments and administrations concerned that action be taken:

(1) to encourage, with appropriate safeguards, aquaculture by itself and in conjunction with other developmental projects to which it can be related;

(2) to initiate aquaculture development research under appropriate auspices, giving particular attention to the economic aspects of aqua-farming;

(3) to co-ordinate, through the S.P.C., information, research and development relating to aquaculture in the South Pacific Region, including the activities of appropriate national, international and private agencies;

(4) to initiate an urgent educational programme for the people of some territories to overcome lack of understanding and extreme prejudice against the potential usefulness of animal and human wastes as fertiliser after proper digestion and oxidation processes.

RESOLUTION NO. 21

Proposals for Environmental Activities of South Pacific Commission

The Symposium:

Believing that international and regional agencies have an important role in planning and co-ordinating environmental action programmes;

Being concerned by the environmental deterioration in the South Pacific region as revealed in the country and other reports submitted during the meeting;

Recommends to the South Pacific Commission and all governments concerned:

(1) that an environmental office be established within SPC to be responsible for liaison with appropriate international agencies and to give advice to territorial administrations on environmental planning and environmental conditions in the region;

(2) that SPC arranges for the carrying out of appropriate environmental surveys as the basis for the development of environmental planning for islands of the region;

(3) that SPC arrange for training courses in ecology and environmental conservations in the first place for those concerned with the administration and management of land, water and other resources of the region;

(4) that SPC conduct within various islands of the region, appropriate seminars on environmental problems and their solutions;

(5) that the South Pacific Commission arrange for a further Symposium on the Conservation of Nature and Natural Resources in three years time to review progress and examine new developments.