The Management of Antarctic Whaling Resources

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The magnitude of the potential net economic yield which might be taken from the Antarctic whale stocks — of the order of half the total potential gross value of some $160 million — is contrasted with the failure to attain rational use of the resource.

There is at present little or no economic return from Antarctic whaling because the stocks have been depleted by excessive catches. After they have been rebuilt there is still likely to be little economic return because of competition for the limited quota between countries or expeditions.

It is suggested that the potential net economic yield can only be obtained by some form of international ownership. Licence fees for the right to take a share of the catch could be substantial, and provide an income which could be used in many ways, research, paid to member governments, etc. To set up such an international authority might require an initial loan to buy out those at present whaling; this loan could be repaid out of the licence fees even before the stocks had rebuilt to their optimum level.

Introduction

It is well-known that the history of whaling, and especially of Antarctic whaling, represents one of the outstanding failures to make proper use of a common-property natural resource of the high seas. The scientific facts about the resources have been reported on by special committees set up by the International Whaling Commission and are contained in the reports of these committees published in the annual reports of the Commission (see especially the Final Report of the Committee of Three Scientists in the 14th Annual Report of IWC, 1964).

When intensive Antarctic whaling started less than fifty years ago, the waters around the Antarctic contained some half a million whales; about 150,000 blue whales (the biggest whales, growing up to 100 tons), perhaps 300,000 fin whales and substantial numbers of sei and hump-back whales. If the exploitation of these stocks had been properly managed, by first reducing each stock to the level (probably rather less than half the unexploited abundance) at which its net rate of increase (the "sustainable yield") was highest, and there-

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after maintaining it at this optimum* level by cropping precisely this sustainable yield each year, the annual harvest which could be taken indefinitely is estimated as 6,000 blue whales, 20,000 fin whales, plus some humpback and sei whales (CHAPMAN, 1964), *i.e.* more than 16,000 Blue Whale Units, calculated as 1 blue whale = 2 fin whales = 2½ humpback whales = 6 sei whales. In fact, by concentrating on each species in turn, annual catches of rarely more than 15,000 BWU (*i.e.* less than the possible maximum combined sustainable yield) have depleted each stock to a level where only an extremely small catch is possible.

Economic Returns

The contrast between what has occurred and what was possible is even greater when considering the net economic return from whaling operations, taking into account both the value of the catch, and the cost of harvesting it. With optimum management, around 10–12% of the stock should be harvested each year; in the late fifties and earlier sixties, about one third of the stock was being taken each year. The percentage taken is closely proportional to the intensity of the catching (*e.g.* number of catchers times number of days each is operating) and hence roughly to the cost of capture, so that the actual cost of catching the 16,000 BWU from properly managed stocks could be only a third of the cost of taking 15,000 BWU from the depleted stocks. The actual catching operations are only a part of the total costs of pelagic whaling, and it does not follow that under proper management the total costs could be reduced to the same extent as the actual costs of capture. Because of the effects of weather and other causes there are very great fluctuations in day to day catches of whales. At low catch-rates the factory ship may be working at far less than its full capacity, while at high catch-rates catching may have to be suspended for a time while the factory ship processes the whales that have been caught, though these "stop-catch" days are very rare now. Efficient operations therefore depend on the correct balance between the potential catch-rate (abundance of the stock and number of catchers) and the processing capacity of the factory ship so as to keep the overall loss of efficiency, of catchers during the periods of good catches, and of the factory ships during periods of poor catches, to a minimum. At the high stock abundance that will occur under proper management it is probable that the number of catchers per expedition will be less than at present, and that the actual catching operations will form a smaller proportion of the total cost than at present. However, the factory ships will be able to operate at fuller capacity and therefore greater efficiency than at present so that clearly the overall costs in taking the sustainable yield from a properly managed stock will be substantially less than in further depleting an overfished stock. These costs may be more than the third calculated

* For fish stocks it is questionable whether to take the "maximum sustainable yield" is the best policy, since a sustainable catch only very slightly less than the maximum could be taken at appreciably less cost; for whales the reduction in cost in taking the sustainable yield from a stock rather greater than that giving the maximum yield may not be much greater than the reduction of yield. The difference between the stock giving the greatest physical yield, and the rather bigger one giving the greatest net economic yield (value to catch less cost of catching) may not be very great, and for the present argument will be ignored.

from the percentage of the stock taken, but for the sake of illustration it is probably not unreasonable to assume that the costs would be as little as a half.

It is not practicable to give a direct estimate of the total costs of whaling operations, especially as it would be necessary to combine figures from the state-run enterprises of the USSR with those from the private companies of other countries, and those from the fully amortised Norwegian fleets with those from recently constructed fleets. An estimate which is probably reasonably close can be obtained by assuming that in say 1960 the value of the catch was equal to the cost of operations. The precise value of a Blue Whale Unit naturally depends on the size and species of the whales concerned, as well as on the price of the main products – oil, meat and meat meal – but, considering that oil is about half to a third of the total value and that 1 BWU produces 120 barrels (= 20 tons) which (at say $ 2,000 per ton) is worth $ 4,000, a round figure of $ 10,000 per BWU is probably reasonable to take as a basis for illustrating the order of quantities involved. The estimate of the value of the 1960 catches of about 15,000 BWU is therefore $ 150 million, which will also be taken as the cost of harvesting them. Under proper management 16,000 BWU could have been taken, at half the cost, *i.e.* a value of $ 160 million at a cost of $ 75 million, giving a net annual return of $ 85 million. Clearly Antarctic whaling could be an extremely profitable operation, as well as providing a substantial sustained supply of food. Three questions arise; why did the failure to maintain the stocks of whales occur; what can be done now to rebuild them and manage them better in the future; and, of special importance not only to the whale stocks, but to the management of all similar resources, how could similar disasters be prevented from occurring in the future?

Problems of Management

The reason for the original overfishing of the whale stocks is basically that the whales are, like other living resources of the high seas, common-property. As was pointed out by fishery biologists more than a quarter of a century ago (*e.g.* GRAHAM, 1943), and demonstrated later with greater precision by detailed economic analysis (*e.g.* GORDON, 1954; SCOTT, 1955), if entry into a fishery is unlimited it cannot continue to be profitable. When stocks are abundant whaling is potentially very profitable, so that new countries have a strong incentive to start whaling, and countries already whaling have an incentive to increase their activities. The value of the catch by these extra expeditions is greater than their costs, even though their contribution to the industry as a whole may even be to decrease the value of the total catch as well as to increase the total costs.

To prevent the depletion of the stocks there was set up in 1946 the International Whaling Commission, to which the main whaling countries belong and which, among other things, is responsible for setting an annual quota for the total Antarctic pelagic catch of baleen whales. The IWC had the power to ensure maintenance of the stocks at their optimum level, by setting the quota correctly both as regards the overall total, and the division between species, although it could do nothing directly to control the costs. (In later years an agreement was reached outside the Commission as to how the total quota

should be divided between countries. This enabled each country to plan its operations more rationally, and hence helped to reduce costs). In fact, the quota has always been set too high, and the discrepancy between the actual quota and the desirable quota (*i.e.* the quota that would bring or maintain the stocks at their optimum level) can be considered in three stages. Until about 1955, it was not clear, beyond all reasonable doubt, that the existing quota was permitting depletion of the stocks, at least of fin whales, and it was not unreasonable to set the quota fairly high; from 1955 to about 1963 (when the report of the Special Committee of Three Scientists was delivered to the Commission) it was clear that the stocks were being depleted, but not so clear what precisely should be done. In particular, the choice between a large quota for the coming season, with declining stocks and soon very low catches, and a moderate quota which could be maintained indefinitely, was not put clearly before the Commission. Thus the short term wishes of the whaling industries to take as many whales as possible in the coming season were followed. Then, since 1963, the depleted state of the stocks and the steps needed to build them up again, have been well known, but the necessary steps implied such a drastic reduction in the quota that they were not acceptable to the immediate short term interests of the whaling industries. Thus the conflict between the long term objectives of greatest annual yield maintained indefinitely and the short term objective of as big a catch as possible next season is now becoming increasingly acute.

Unfortunately, whaling operations are carried out by large enterprises whose wishes tend to have strong representation in the various national delegations to the IWC, so that the short term considerations often have large, and perhaps undue, weight. In fact, the conflict between long and short term interests can, and has been, exaggerated; any enterprise of this kind needs to look more than one year ahead. If action had been taken to reduce the quota (and to allocate it between species, so as to give better protection to the most seriously depleted stocks) at any time up to about 1960 the recovery of the stocks would have been quick enough for such action to be economically attractive when considering quite a short period, say 10 years.

Because of the long life, and especially the low reproductive rate, of whales, the superiority of rational management in terms of total catch may not become apparent for some time. Thus despite declining stocks, the actual catches of fin whales were maintained at about 25,000 animals, that is, above the maximum sustainable yield, until 1962. Since then catches have dropped rapidly to 2,300 animals in the 1965 season, and in each year the catch, including other baleen whales, was substantially less than the quota, even though the latter had been progressively reduced. The extra catches taken up to 1962, above the desirable level (*i.e.* greater than the catches necessary to allow the stocks to be restored or maintained at the level giving the maximum sustainable yield), will be progressively balanced by the greater catches which would have come, under proper management, from 1962 onwards. Summed over the period, the catches under proper management would have exceeded those actually taken, or which could under present (1966) conditions be taken in the future, by perhaps 1970 or 1975, depending on when proper management came into force. Although the value in 1955 of a blue whale unit caught in 1955 is probably greater than the discounted value of a BWU caught in 1965 (though because of the increased value of by-products, such as meat extract, the actual value of a BWU in 1965

is probably appreciably greater than that of a BWU in 1955), which would tend to make the unregulated whaling more attractive, this difference in value is more than balanced by the much less effort and costs, and progressively greater stock abundance and rate of capture, occurring under proper management. Therefore, the total net economic yield to the industry, summed over the years, which would have been possible under proper management, would have exceeded that actually obtained earlier than the time when the total physical yields are equal, *i.e.* perhaps by 1965 or 1970.

These dates were not in the unrealistically distant future at the time when the problem of managing the whale stocks first became acute; in particular they are within the useful working life of the ships then employed. So, in the late 50's to early 60's, a policy of proper management (an immediate reduction of catches so as to be able to maintain them at a reasonable level indefinitely) should have been economically attractive, and there should have been no real clash between the shorter term interests of those presently engaged in whaling, and the longer term interests.

By 1966 though, the whale stocks have been so far depleted that even with complete cessation of catching it would take a very long time to rebuild to their optimum level – 15 years for fin whales and 50 years for blue whales – and these periods are outside the normal period of reckoning for a commercial organization. Also it is not at all clear that ultimately the potential benefits will accrue to those at present engaged in whaling. Looking ahead for a short time, perhaps four or five years, it is virtually certain that no country, other than those at present engaged, is going to enter Antarctic whaling: the profit is too small, the future too uncertain, and the capital cost too great. Such benefit that may be obtainable from proper management can, therefore, be shared among the present whaling countries. In perhaps twenty years' time, assuming proper management in the intervening period, whaling will be much more attractive, and all whaling countries, not only new entrants, will have had to face the capital costs of new equipment, so that it is most unlikely that the present whaling countries could restrict the benefits to themselves.

The likelihood of new entrants to the industry makes the long term economic future of Antarctic whaling under the present convention look poor, even if the IWC is successful in setting the desirable quota to restore the stocks and to maintain them at their optimum level. If the stocks were restored to their optimum level whaling would be potentially very attractive, $ 130 million worth of whales need cost only $ 75 million to catch. Many countries would be prepared to enter whaling so long as these conditions lasted, and this would mean both that the share of the profits to each country would be less, and that the actual total profits would tend to disappear. At present whaling is reasonably efficient (within the limits set by the condition of the resource) because shares of the overall quota set by the Commission are, by agreement outside the Commission, allocated to countries who can each then plan their operations to take their share in the most efficient manner. The agreement on the division of the quota in force up to the 1965/66 season would have become invalid if new countries had entered whaling, and it seems that any system of allocation of quota would break down if new entries from outside the system are possible. But without allocation of quota each country and expedition would have to exert a wasteful amount of effort to ensure their share of the total quota. This wasteful scramble for the quota means that the costs of catching would

tend to rise towards the $ 160 million value of the catch, resulting in no net profit; the economic disadvantages of a single quota system are well known on theoretical grounds and have been experienced in several fisheries, *e.g.* the Pacific halibut (CRUTCHFIELD and ZELLNER, 1963).

International Ownership

The present arrangements for the management of Antarctic whaling appear to have several shortcomings: first, it is difficult, or impossible, for the potential $ 85 million per year net profit actually to be attained, and second, and partly as a consequence, there is little economic attractiveness for those at present engaged in Antarctic whaling to accept the drastic reduction of catch necessary for the most rapid restoration of the stocks to their optimum condition.

Both arise to a large extent because, as already mentioned, whales are a common-property resource; all countries feel entitled to a share of the net yield, and their struggles to get a share reduce, or even eliminate, the total net yield available; while the present whaling countries, having no ownership of the resource, cannot be sure that any benefits of action they take now will accrue to them. A solution may therefore lie in removing the whales partly or wholly from the field of common ownership. Thus, some body or organization might own or have rights of exploitation and management over the whales, and in particular should have the right to the large potential net profits. For any marine resource the possible bodies include the coastal state or an association of such states, an association of the countries at present engaged in exploiting the resource, or a broadly based international body, such as the United Nations, or one of its specialized agencies. (A specific recommendation for a new specialized UN agency for managing marine resources, was put forward by the Committee on Natural Resources Conservation and Development to the White House Conference on International Cooperation; and a similar recommendation for a UN agency to manage whale resources has been put forward by IUCN). For whales, the first is inapplicable, while the second does not deal with the problem of countries at present not whaling but which might do so when whaling became highly profitable. Therefore, although the idea of UN ownership or management represents a very different approach from that taken in establishing the present Whaling Commission, or most fisheries commissions, its possibilities are worth examining.

Two questions have to be solved: how will the catch (or the right to catch) be shared, and how will the net profit be shared? These are two distinct problems, although some other proposals for internationalizing marine resources (see *e.g.* CHRISTY and SCOTT, 1966) do not seem to distinguish them. To make the best use of the resource it is desirable that the catch be taken most efficiently, *e.g.* by the country which can take the catch with the least costs, and that it be used most effectively, *e.g.* by the country which sets the highest price on the products. The net profit, once it is in the hands of the managing body, can be shared in any way thought desirable, *e.g.* to the most needy countries, to those which have given up whaling, etc., provided always that the sharing is such that it is more attractive for a country to remain within the scheme than to attempt to get the short term profits of engaging in whaling outside the scheme.

Efficiency is best judged by how much a country is prepared to pay for the right to catch a certain quota; the lower the costs or the higher the value of the product, the greater the value of the right to a share of the catch. The efficiency of the operations will therefore be maintained if the managing body charges a substantial fee for the right to take a certain quota, issuing this licence to the country which is prepared to pay the highest fee. At present costs and prices, the 16,000 BWU which can be taken from the stocks at their optimum would be worth $ 160 million and cost $ 75 million to catch, so that the right to catch 1,000 BWU would be on the average worth slightly over $ 5 million. An efficient operator may be prepared to pay $ 5·2 million for the right to catch 1,000 BWU, but a less efficient only $ 4·8 million. Licences need not necessarily be issued to the highest bidder, and other factors might be taken into account; in particular, it might be desirable that no one country or group of countries should take more than a certain share (perhaps a half) of the total catch. Continuing whaling operations involving much equipment cannot be planned on the basis of a single season, so that licences would have to be issued for a period, for perhaps 5 years, with an option of extension to 10 years, at the same licence fee. Only about a tenth of the total quota would then become open for auction each year. Also a whaling expedition can only efficiently handle a certain number of whales in a season so that a licence to take only, say, 300 BWU would be worth little, because the overheads would not be covered, while as much as 3,000 BWU could not be processed by a single expedition. The regulatory body might therefore determine what was the best economic unit quota for one expedition and issue licences in these units, say 1,500 BWU. Then if the available quota in one year (*i.e.* the difference between the catch it is desired to take to maintain the stock at its optimum level, and the catch for which licences have been issued previously) was 2,000 BWU, then a licence to take 1,500 BWU would be issued to the highest eligible bidder, and the remaining 500 BWU held over to the next year.

Once the stocks had built up to the optimum level so that catch rates were high and licences would be worth paying for, the managing body would have a considerable income, in fact only slightly less than the maximum potential net profit from the whale stocks, which at present cost and values is some $ 85 million. This money could be allocated, perhaps equally, in three ways:

(a) to ensure good management of the resource;
(b) shared between individual countries;
(c) to the managing body itself, *i.e.* the UN, if it were a UN agency.

Management in this context would include *direct administration* and *enforcement* (these would not be very high; it would be difficult to operate a completely clandestine whaling expedition and two inspectors on board each factory vessel, *i.e.* not more than about 20 in all, would probably be adequate for policing the licenced expeditions); *research directly related to management* (studies of the state of the stocks, and estimation of the desirable catch each year), and also research into associated scientific and technical problems, such as the interrelationship of whales and other resources, *e.g.* krill, and the possibility of rational exploitation of these resources, and a better knowledge of the whales themselves. For instance, virtually nothing is known of the behaviour of whales, which, besides being the largest animals ever known, also belong to a group possessing, it seems, considerable intelligence.

The share of individual countries could be divided in many ways, giving particular weight to size, population, need for food, interest in past or present whaling, interest in the oceans and fisheries in general, etc. The precise formula would be the subject of negotiation, but clearly any one of a wide range of possible formulae could leave each country better off than it is at present, and with a strong incentive to keep the scheme in being rather than be attracted by the short term profits of whaling outside the scheme (see Appendix).

The attractiveness of the scheme, once the stocks were under proper management, and had reached their optimum level, is obvious, but the urgent problem is to start to build the stocks up. This involves a considerable reduction from even the present (1966/67) level of whaling activity, and therefore some sacrifice, at least in the short term, on the part of those at present engaged in whaling. As has been explained, it does not seem possible to provide an incentive to make this reduction in activity by guaranteeing the present whaling operators a share in the large net yields once the optimum stock levels have been reached. As an alternative, the incentive might be provided by a suitable direct compensation. At present whaling is not very profitable, and it is sure to become less profitable in the near future, so either the need for effective steps to achieve management will be accepted, or effective management will *not* be introduced, and the whale stocks and the industry will have to be drastically reduced even below the low 1966/67 level. Thus the present operators might be willing to give up rights to pelagic whaling for some not too large lump compensation sum. There is no precise data available on what this figure should be, though a rough guide is given by the prices paid by the Japanese to the British and Dutch companies for their expeditions (or in fact for the relevant share of the quota) which has been reported to be of the order of £ 1 million. These were presumably the less efficient expeditions, but since the time of these sales the stocks and potential profit from whaling have declined further. For the sake of illustration, and as a basis for tentative calculation, it is probably true that a figure of $ 5 million as the compensation price per expedition is a conservative upper limit. That is, with 10 expeditions operating in the 1965/66 season, an International Whaling Authority could buy all rights to pelagic whaling for a total of $ 50 million, less than the potential annual net yield from the stocks in the optimum conditions (*i.e.* the likely annual income to the Authority from licence fees).

Land stations must also be considered; possibly their rights could be bought up in a similar way to the pelagic rights, with the land stations having the opportunity in the future to enter the market for a licence to take a quota of whales once stocks have built up. Alternatively, land station catches could be largely outside the scheme, provided that they were under some control. For instance, countries operating land stations might agree to limit catches in the future to not more than the average catch in recent years.

While eventually the annual income of the Whaling Authority is likely to be more than the total compensation, the optimum stocks would not be reached for many years. Presumably, therefore, the compensation would have to be financed from some long-term loan; if this were to be repaid steadily over a period, say 20 years (*i.e.* including interest, at about $ 5 million per year) then small-scale whaling might be permitted to produce the repayment sums, rather than stop whaling completely until the stocks have recovered to their optimum levels (which would in the long run produce the greatest yield). At present

whaling is not attractive, so that licence fees could not be high; perhaps a total quota of no more than 1,500 BWU which could be split between 3 licences each to take 500 BWU (about the minimum for a single expedition). A catch of 1,500 BWU would be worth about $ 15 million gross, but at the present depleted state of the stocks the cost of taking the catch would be not much less, so that the licences would be not worth much. Within as little as 5 years the stocks would have recovered sufficiently to allow a total quota of perhaps 2,250 BWU, which could be taken with about the same costs as the initial quota of 1,500 BWU. The profit, and potential value of the licence, would then be about $ 22·5 million less $ 15 million, *i.e.* $ 7·5 million. This will be sufficient to finance the loan interest and repayment instalments, and still leave some surplus for distribution.

Discussion

Earlier three questions were raised concerning the past, present and future of the management of whale stocks; the answer to all three lies in changing the common-property status of the resource. If the whale stocks in the Antarctic had appeared in the balance sheets of the whaling companies as part of their capital assets, many of the problems would not have arisen. The answer to the difficulties must therefore lie in removing the resource to some extent from the field of common property. While the scheme for UN investing in exploitation and management rights outlined here will doubtless produce difficulties of its own, these should be soluble, and no other scheme, including the continuation of the International Whaling Commission in its present form, offers as good a chance of obtaining the considerable net yield from the Antarctic whale stocks. It must be emphasized that, fundamentally, the present scheme does not make any greater restriction on the participation in whaling by any country. The biological characteristics of any stock (of whales or fish) set a definite limit on the catch that can be taken, and an unrestricted increase of fishing can only serve to reduce this limit, possibly drastically. The share any country takes of the total catch is governed by the amount it is prepared to pay, and the difference between unrestricted fishing and international management is that in one case the money is spent in the unproductive use of excessive resources of men, money and equipment, and in the other the money goes, as a licence fee, to an authority which can use it in any desired manner.

Although whales present the problems of managing the living resources of the sea in their most acute form and the penalties – in the form of dwindling stocks and catches – of mismanaging whale stocks are more severe than for most fish stocks, and only the tuna fishery is to anything like the same extent an open ocean fishery, far from any coast, similar problems are occurring in important fisheries. For instance, in the North Atlantic cod fisheries, worth perhaps $ 300 million per year, considerably more fishing is done than is necessary to take the present catch, and a reduction in fishing could bring a substantial reduction in costs and probably also a slight increase in total catch. This is generally agreed by all concerned, not only scientists and administrators, and some of the strongest suggestions for some form of restriction of fishing have come from members of the industry. While the two international North Atlantic fishery commissions do have provision for limiting the amount of fishing, it seems that there is likely to be considerable difficulty in actually agreeing on such limitations and particularly in securing the large potential

benefits in reduction of costs. It is probable that some form of international management would help to resolve these difficulties, and certainly the experience of a system of international management of the Antarctic whales stocks would be invaluable for the future management of all living resources of the sea.

Summary

The maximum sustainable yields from the Antarctic whale stocks are about 6,000 blue whales, 20,000 fin whales and several thousand smaller whales per year. The value of these whales, at present prices, is around $ 160 million, and this catch could be taken at a cost of perhaps $ 75 million.

The International Whaling Commission has authority to set a quota for the total catch. For the past 15–20 years this quota has been set too high, but even when set at the correct level, the IWC cannot prevent a wasteful scramble between the countries for the biggest share of the quota. Lately there has been an agreement between countries on a division of the quota, but this agreement becomes void if further countries enter whaling. If the whale stocks increased to their optimum level other countries would tend to enter whaling. Thus the IWC cannot ensure that the potential economic yield from the Antarctic whales is not wasted.

The economic yield might be obtained if the whale stocks were not common property. It is suggested that they could be managed by some international authority, which could issue licences at a fee equal to the difference between the value of the catch, and the cost of capture. When the stocks have been rebuilt this should provide an annual income of some $ 75 million; some of this could be used to cover all the costs of research including the necessary research, and the rest distributed as desired.

While the stocks are rebuilding some small-scale whaling could still provide an income to the authority. This may be used to repay an initial loan which may be necessary to buy out those at present engaged in Antarctic whaling.

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Appendix

Possible Distribution of Licence Income

As described in the text there is a wide range of possible ways of distributing the gross income of the Whaling Authority which will satisfy the major requirement of making it more attractive to a country to join the Authority than to

remain outside. The following scheme is therefore only one example of how the redistribution could be made to illustrate the order of magnitude of sums involved. These will be based on the possible income from the stocks in their optimum condition, *i.e.* $ 85 million. Until the stocks have built up the income and the various shares will be less.

The first call on the total income will be for the management and associated costs, including the necessary research. The total budget of the International Whaling Commission in 1962/63, a year when there were relatively very high costs concerned with the work of the Committee of Three Scientists, was only $ 50,000, so that the minimum management costs, even adding the expenses of inspectors on each factory ship could be quite low. However, if the Authority is also to finance widespread research on the whales, which is likely to include work on research ships, the costs will be much higher. Thus the Inter-American Tropical Tuna Commission has an annual budget of some half a million dollars, and this is not sufficient to pay for all the desirable research immediately concerned with the tuna fisheries of the eastern tropical Pacific. An annual sum of $ 10 million would not be too much to finance not only research immediately related to the management of the whale stocks (probably carried out by the Authority's own staff), but also any general research into whales and associated subjects (*e.g.* by grants to universities or research institutions).

The distribution to member governments should make the scheme attractive to all, but especially to those countries presently engaged in whaling, and those which are likely to consider catching whales in the future, whether or not they take out a licence. The total distributed (say $ 30 million) could then be allocated in four ways as follows:

(i) $ 5 million to the members of the present International Whaling Commission, on the basis of recent, say 1950–65, catches
(ii) $ 5 million to the licence holders, according to their catches of whales
(iii) $ 10 million to all countries, according to their catches of marine fish (which should give a measure of their potential interest in whaling)
(iv) $ 10 million to all countries, according to their population.

While it is reasonable for the present whaling countries to have some special interest in the future catches, whether or not they continue whaling, it would be unreasonable for this interest to be continued in perpetuity. Perhaps the payments under (i) could continue for 30 years, *i.e.* some 15 years of low payments while the fin whale stocks are building up, followed by 15 years of higher payments (about 60% of the maximum, assuming 20,000 fin whales but no blue whales are taken in that period).

The money to the licence holders, in effect a partial refund of the licence fees, would be conditional on the satisfactory performance of the Authority's requirements, *e.g.* full supply of statistics, biological data, etc. Reductions in the repayments would form a suitable method for dealing with the occasional infraction of the regulations, *e.g.* the killing of undersized whales by careless or inexperienced gunners. Thus the repayments could be at the rate of $ 300 per BWU caught, with a penalty of $ 20,000 (twice the value of a blue whale) for each infraction.

The level of payments to some countries, both whaling and non-whaling, on the basis of these proposals, omitting the possible refund of licence fees, is set out below (in thousands of dollars).

Country	(i) IWC membership	(iii) Fish Catches	(iv) Population	Total
Japan	1,700	1,200	300	3,200
USSR	1,000	800	650	2,450
Australia	170	16	40	226
Peru	-	2,000	30	2,030
Ghana	-	16	20	36

Finally, the remainder, $ 45 million, could be paid into the general United Nations funds.