

**ASSESSMENT OF  
WESTERN ROCK LOBSTER  
STRATEGIC MANAGEMENT OPTIONS  
(4 volumes)**

**A BIO-ECONOMIC EVALUATION  
OF MANAGEMENT OPTIONS  
FOR THE WEST COAST ROCK LOBSTER FISHERY  
Volume 2**

By Economic Research Associates Pty Ltd

A REPORT PREPARED FOR  
THE DEPARTMENT OF FISHERIES

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**A Report prepared for the Department of Fisheries**

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## **Disclaimer**

The analysis in this report is undertaken at an aggregate industry level to assist in the consideration of alternative management arrangements for the fishery. The results should not be construed as offering investment advice and should not be used or relied on in any way by individuals or business entities to make investment decisions.

## **Preface**

This report finalizes the requirements of the original brief and of the supplementary request for extra modelling work. The additional modelling requested required some new assumptions to be tested.

Whilst the additional modelling added new scenarios, it also changed the substance of some of the results from the modelling work around the original brief. This is because of changed assumptions on certain key variables that needed to be considered and reworked across all scenarios to ensure consistency in the modelling results.

This report includes this additional work and presents the results across scenarios on a consistent basis.

## Executive Summary

### The Task

Economic Research Associates (ERA) was commissioned to evaluate the relative 'socio-economic' benefits of alternative management Scenarios for the Western Rock Lobster Managed Fishery. This study is intended as input into industry's consideration of the future management policy direction for the fishery.

### The Alternative Scenarios

The key variables for defining management scenarios related to the Total Allowable Commercial Catch or TACC (either fixed or variable), number of pots (fixed versus flexible), prices (positive marketing price premiums for extended season and inter (between) and intra (within) seasonal catch stability) and pot design. In all eleven alternative management scenarios were modelled with varying combinations of the key variables.

There were three broad management approaches encompassed in the scenarios modelled. These were:

- Input or effort controlled (ITE) scenarios that include the existing management rules (Scenario 1), a variant of the existing regime in the form of a 20 per cent pot reduction (Scenario 1a), and a modified ITE regime based on pot/fishing days with an extended fishing season that provided scope for greater flexibility around the choice of when to fish (Scenario 2).
- Catch quotas coupled with input controls over pot numbers, but with some modest flexibility in pot design and an extended fishing season. The alternative options under this grouping specified either a fixed TACC (Scenario 3a); or a variable TACC (Scenarios 3b, 3c, and 3d). Key issues for these Scenarios were assumptions around sustainability rules used for the determination of catch quotas, the bases for operating quota in Zones A and B, and various marketing price premium assumptions.
- Catch controlled options based on pure ITQ scenarios, where there was greater freedom over pot numbers, and pot design, including an extended fishing season. The alternative options under this grouping specified either fixed TACC (Scenarios 4a) or variable ITQ (Scenarios 4b, 4c, and 4d). Again key issues for these Scenarios were assumptions around sustainability rules used for the determination of catch quotas, the bases for operating quota in Zones A and B, and various marketing price premium assumptions.

The existing regime (Scenario 1) was used as the base case against which the outcomes for other scenarios were compared and assessed. In making the assessment particular attention was paid to the sustainability of the biomass and the estimated net benefits, although for each scenario a variety of outputs have been estimated.

This approach provided modelling results on a sound and consistent basis across a broad spectrum of possible management options within each of these management approaches.

## The Evaluation Model

The evaluation of the alternative management Scenarios is based on a highly non linear optimization model that integrated the biology of the fishery in each zone with the economics of fishing activity in those zones. The biological component was tested extensively and closely replicates historical data from the West Coast Rock Lobster Fishery on biomass, catch and effort over a ten-year period.

The model runs recursively over a ten-year period to allow the biological cycle that typically characterized the fishery in past data to be played out in full. Hence, the results for each scenario cover a ten-year period for each of the key output variables such as catch, pot lifts, biomass and net economic benefits.

For each management Scenario, these optimization results reflect ten years in long term, steady state, equilibrium. That is, the results are for a ten-year cycle that commences once all the implementation or transition adjustments that occur in response to the adoption of any particular scenario have taken place. This modelling approach ensures that alternatives were assessed and compared on a consistent basis. The optimization is based on maximizing net economic returns or benefits for Zone C and for Zones A and B combined under each of the alternative management regimes. A management regime is captured by specifying a number of constraints, such as a constraint on catch or days fished.

Zones A and B were combined in the optimization because all of the fleet accesses the Zone B biological stock for the first part of the fishing season, but only some of the fleet accesses the Zone A biological stock in the Abrolhos Islands for the second part of the fishing season. Among other things, this approach avoided the difficulty of splitting the fixed costs between the respective zones for fishers with Zone A authorizations that can fish in Zone B until mid-March. In the circumstances, producing combined Zone A/B results for net economic benefits was seen as the most plausible approach. Whilst this was necessary for the modelling, it should not be taken as advocating a change to the existing boundaries in the northern region of the fishery. In analysing the alternative management Scenarios, we were also asked to take account of any marketing benefits (in the form of price gains) that might arise under the alternative Scenarios. The results, therefore, incorporate efficiency gains as well as price gains associated with moving to any of the possible alternative Scenarios specified.

The focus of the modelling is the assessment of the relative net economic benefits associated with the various scenarios modeled. Some variables affect the absolute level of estimated net benefit but have little or no impact on the relative net benefits across scenarios. General cost increases and exchange rate variations are in this category. The model does not factor in general price rises/cost increases or exchange rate variations. Where cost increases affect some scenarios but not others they have been specifically accounted for. The major one in this category is the additional fishery management costs under the TACC scenarios.

## Data Used

Extensive research work on the existing regime has resulted in a comprehensive body of data on stocks, effort and catch going back several years. These data have been used in the model building and testing.

In the case of the alternative Scenarios, there was no such body of data, so some original data collection was necessary on many matters. This was collected through discussions with fishers and processors on how behaviour and prices might change under the alternative Scenarios; as well as from observable developments in other jurisdictions (e.g. South Australia and New Zealand) where management regimes similar to the alternative Scenarios had been adopted.

## **Modelling Results**

The modelling was undertaken in accordance with the Tender requirements.

The results allow consideration of the relative gains (measured as net economic benefits) from moving from the current to the specified alternative management regimes. Although gains in net economic benefits is the logical starting point for assessment, the analysis produces comparison data on many important variables, including annual catch by zone, annual pot lifts by zone, breeder biomass index by zone and biomass of mature, recruits and breeders by zone.

The original brief did not ask us to model the implementation or transition phase for each of the alternatives. Hence the estimated net economic benefits do not include any such costs that might be associated with the implementation of these alternatives.

While these costs can be significant, they were ignored when considering the alternative scenarios.

The comparative results show that:

- All the alternatives produce net benefit outcomes greater than the existing regime (Scenario 1);
- The net benefit gains were higher under TACC based Scenarios (Scenarios 3 and 4 options); and
- The net benefit gains were greatest under the ITQ regimes (Scenario 4 options).

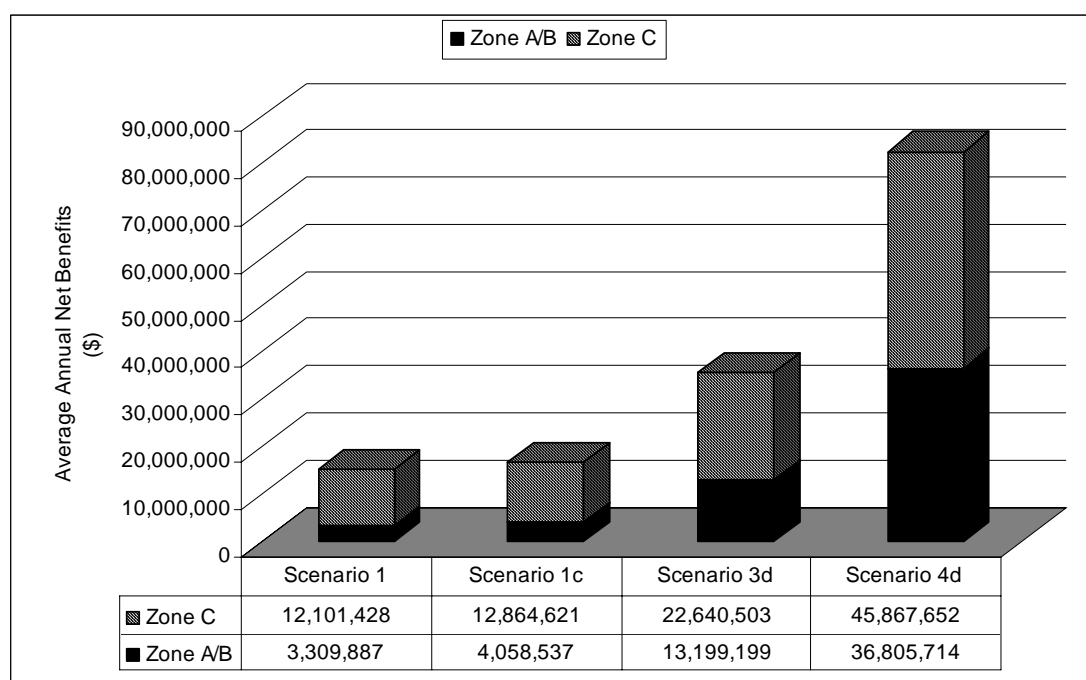
The ITQ Scenario 4 produces significantly higher net benefits. The significant gains associated with Scenario 4 reflect the relaxation of the constraints on pot numbers, pot design and the extended fishing season. They arise from a combination of increased pot efficiencies, fleet rationalization driven by having more pots per boat and increased input (cost) efficiencies which arise as fishers focus on minimizing the cost for a given level of catch.

## **The Comparative Net Economic Benefits**

Based on consultation with the Project Steering Committee, it is suggested that industry focus their attention on the key issues by comparing three options that appeared to be the most 'realistic' alternatives to the existing base case (Scenario 1). These are options that minimise the biological risks posed by changes to the management arrangements for the fishery, and make conservative assumptions about the potential price premiums due to improved marketing.

The three alternative scenarios were a variation of the base case in the form of a 20 per cent pot reduction (Scenario 1a), a variable TACC alternative based on conservative quota determination rules and marketing price premium combined with a constraint over pot numbers and some improvements in pot design (Scenario 3d); and a variable ITQ which was a pure catch quota regime with no constraint over pot numbers and much more efficient pot design (Scenario 4d).

The comparative net economic benefit results for these three alternative compared to the base case are shown below. These are modelling results and should not be seen as predictions but rather as a guide to the extent of the possible net economic benefits.



Whilst the absolute levels of these estimated aggregate net economic benefits are significant, the key consideration from a policy evaluation perspective is the relative level of the net economic benefits between the Scenarios.

The net economic benefit estimates may be conservative, as the actual implementation of alternative management arrangements could induce behavioural changes that may enhance efficiency in ways that we cannot easily identify and /or model at this stage. For instance, while operating more than one quota entitlement on a single fishing boat license might increase efficiency, this possible development has not been modelled. The ITQ regime (Scenarios 4d) results show relatively greater gains from improved efficiency. In an industry where costs associated with lobster fishing activities are largely fixed, this may offer a realistic way for individual fishers to significantly drive down costs per unit of catch in the long run and improve viability in an industry that is increasingly commoditized and is facing declining terms of trade (i.e. costs are rising faster than prices received in this commoditized trade).

The net benefit estimates for these alternative Scenarios were a combination of price differentials and pure efficiency gains. In the case of the three alternatives above, the source of the net gains in net economic benefits over the base case were largely attributable to efficiency gains, even for the variable TACC scenarios 3d and ITQ Scenario 4d, reflecting the conservative marketing price premium assumptions.

## The Sensitivity of Net Economic Benefit Results to Marketing Price Premium Changes

Prices and marketing premiums over those prevailing under the existing regime used in modelling alternative options drew on discussions with the processing sector and reflected the existing state of knowledge about world lobster markets.

From these discussions, we identified three possible sources of extra price gains. They consisted of ‘extended season’ marketing price premiums (for Scenarios 2, 3, and 4), ‘inter-year’ stability marketing price premiums (for certain Scenario 3 and 4 options), and an ‘intra-seasonal’ stability marketing price premiums (under Scenario 4 options). Scenario 1a is simply a variation of the existing regime with the same marketing price premium assumptions as the base case, whilst the variable TACC Scenario (3d) and the variable ITQ Scenario (4d) which generally followed the catch experience of base case catch, factored in conservative assumptions about extra marketing price premiums.

In practice, the actual price levels and marketing price premiums will only be known once the processing sector commences marketing on the basis of whatever management regime is adopted. There will be a degree of uncertainty about the extent to which the price assumptions under each of the alternative Scenarios are reasonable and realizable, particularly as they are dependent on world market developments that are outside the industry’s control.

Efficiency gains across scenarios are generated from within the industry. In this sense, the efficiency gains are relatively more “bankable”.

A comparison between two sets of variable ITQ Scenarios (4c and 4d) with the same management rules and where the only difference was the assumed marketing price premium, shows that the resulting net economic benefits, whilst impacted, were not markedly different. This analysis reaffirmed that a major source of the net benefit gains was in terms of potentially ‘bankable’ improvements in economic efficiency.

## **Employment and Social Impacts**

In the catching sector, boat numbers and pot lifts largely drive employment. There are reduced boat numbers, compared to the current level, under all Scenarios. However, the greatest rationalization in the fleet occurs under Scenario 4 options, where ‘representative’ boat numbers are approximately halved. In practice, the actual boat number outcomes under each of the alternatives Scenarios could be different and will depend on how individual lobster businesses respond to the any changed management regime or rules that may be adopted.

Deckhand employment is driven by pot numbers, pot lifts and regulated minimum crewing levels for boats above a certain size operating deeper waters.

Taking account of both vessel numbers and pot lift changes, the most significant potential employment impacts occur under Scenarios 4 options (the fixed and variable ITQ’s).

However, employment in rock lobster harvesting is not significant in any affected Shires, but is more significant in term of some regional centres. Assessing how the changes in employment might occur across urban and regional centres is virtually impossible as it depends on individual decisions made by boat owners and crew that are not modelled.

The model is a long run equilibrium model and we expect any adjustments to take several years. This is important because growth in the key Mid-West region is generating alternative attractive employment opportunities, which are already putting pressure on the industry to keep crew. Other centres are experiencing population growth through urbanization which is reducing rock lobster significance to them.

## **Fisheries Management Implication Issues**

Several resource sustainability risks are outlined in the report. These risks are greater for the fixed TACC Scenarios 3a and the fixed ITQ Scenario 4a than they are for the existing regime (Scenario 1 or its variant Scenario 1a) during low abundance periods based on the TACC setting rule used in the modelling. However, the more conservative the level at which the fixed TACC/ITQ is set under Scenarios 3a and 4a to mitigate this risk the greater the impact on fleet rationalization.

These sustainability risks under the TACC controlled Scenarios tend to be greater in Zone C, and, although not insignificant in Zone A, this stock has been shown to be quite resilient in the past although the biological reasons are not entirely clear. The modelling results suggest the risk profile in Zone B under these TACC Scenarios does not appear to be material for the TACC setting rules used in the model.

The modelling results also highlight the need for effort reductions (pot numbers and/or fishing days) under the existing regime and the alternative pot/fishing days Scenario at or before the end of the ten-year period to ensure stocks remain sustainable.

The additional fisheries management costs likely under the TACC controlled Scenarios were advised by the Fisheries Department. These extra costs are presumably related to activities designed to minimize these risks and are detailed in the report. The additional management costs were incorporated into the modelling of the TACC/ITQ controlled Scenarios.

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# 1 Background

## 1.1 Introduction

The Western Australian Government requested the Department of Fisheries in conjunction with the Rock Lobster Industry Advisory Committee to review the management arrangements in place for the West Coast Rock Lobster Managed Fishery. In this review, any further efficiency gains from additional changes to the current regulatory regime, including but not limited to the costs and risks of management failure, were to be quantified.

The review is being conducted in an Ecologically Sustainable Development (ESD) framework, so as to enable:

- The Department of Fisheries to continue to pursue excellence in fisheries management, and
- The Government to address the ‘public interest’ test<sup>i</sup> of National Competition Policy (NCP) when considering the future management of West Coast Rock Lobster Managed Fishery.

The review is a three-phased process that is being managed by a joint Department-Industry Steering Committee.

## 1.2 Scope of this Evaluation

The evaluation of the economic efficiency gains and social impacts under alternative fisheries management options covered by this report are input into the first of this three-phased review process. The required tasks were progressed in consultation with this joint Steering Committee<sup>ii</sup>.

The evaluation requested concentrates only on the fisheries management arrangements applying to the commercial harvest and post harvest of western rock lobster. The recreational management arrangements in this fishery and the inter-sectoral allocation issues were specifically excluded from this evaluation. The later can affect the optimizing outcome from commercial use depending on overall use of the resource between these sectors that optimizes the economic and social benefits to society.

## 1.3 Meeting Statutory Obligations

The Fish Resources Management Act 1994 requires the Department of Fisheries to manage the West Coast Rock Lobster Fishery so as to deliver the optimum long-term mix of economic and social benefits to the State in an ecologically sustainable manner. Hence, the economic and social benefits that flow to the community from ecologically sustainable use of the western rock lobster resource have to be assessed in an integrated manner.

In particular, the Department of Fisheries needed to know which management approach provides:

- the greatest incentives and opportunity for growth in economic return from all sectors of the rock lobster industry to Western Australia; and
- a net ‘socio-economic benefit’ to the Western Australian community by encouraging the maintenance and development of regional communities.

Also, with regard to the related need to comply with the National Competition Policy and the associated competition policy principles agreed between the Commonwealth and all the States, this evaluation is designed to provide guidance as to the extent to

which alternative management arrangements for the West Coast Rock Lobster Managed Fishery satisfy the determined ‘public interest’ test, and contribute to the achievement of ‘non-economic’ government objectives (e.g. conservation of the marine environment, support for regional development and rural employment). This evaluation report is not a formal NCP review of the restrictions under the alternative management options. However, the results of the analysis contained in this report will provide useful input for the Project Steering Committee, and policy makers:

- To evaluate the net ‘socio-economic’ benefits of alternative fisheries management options, including the trade-offs between economic and social outcomes among the management scenarios, and
- To address the ‘public interest’ test of national competition policy when resolving the future direction of management arrangements in this fishery.

## 1.4 The Required Task

The required task called for an objective and soundly based analysis of material costs and benefits associated with three broadly specified management scenarios using an interactive and integrated model. The management scenario that existed at the time of the Tender was taken as the benchmark case against which alternate management scenarios were compared and assessed.

The integrated assessment of the relative advantages and disadvantages of each of the three specified scenarios were in the context of the above objectives for the review. In particular, the evaluation focused on material economic and social costs and benefits in an integrated way, including the following aspects:

- Cost of production, and identification of economic opportunities and consequent changes in wealth distribution patterns that could be realized under alternate management systems;
- Consideration of the costs of fisheries management, including the risk of biological or management failure under each scenario; and
- Potential and likely market developments, or market advantage opportunities, under alternate management scenarios, and, for consistency purposes,
- All alternatives were to be analysed in terms of the long term, steady state once all implementation or transition adjustments had taken place.

After presentation of the modelling results for the alternative management options specified in the original brief, we were subsequently asked to model additional scenarios. The original and additional scenarios, which included a 20 per cent pot reduction option under the existing management, are discussed in Chapter 3.

## 1.5 The Specified Alternative Fisheries Management Scenarios

There are numerous possible combinations of spatial, temporal, biological, input and output controls that could be applied in designing alternative management regimes for the West Coast Rock Lobster Fishery. However, for practical purposes of this evaluation, the Tender brief specified three management scenarios.

The three broadly specified management scenarios that “...needed to be equally assessed side by side” in this evaluation were as follows:

- **The Status Quo of Individually Transferable Effort (Pot) Controls** – i.e. the system based on sustainable commercial utilization of the rock lobster resource by limiting the number of pots that can be fished in each zone, a range of biological controls and a limited season. This was based on the

management rules that existed after the maximum pot entitlement or so-called '150 pot rule' was discontinued but before the pot reductions and other management rule changes that were announced for the 2005/2006 season.

- **An Individually Transferable Effort System (ITE)**– i.e. a management system based on individually transferable quotas on time and effort in each zone, and with the ability to set the Total Allowable Effort and biological controls based on sustainability needs and socio-economic objectives, but with more flexibility for individual operators to choose when they fish and how much gear they use at different times of the year.
- **An Individually Transferable Quota System (ITQ)**– i.e. a management system based on individually transferable catch quotas in each zone, and with the ability to set the Total Allowable Commercial Catch (TACC) and biological controls based on sustainability needs and socio-economic objectives, but with the potential to provide the greatest freedom to operators in terms of when they choose to harvest their share of the catch.

The specifications that were given for the alternative management scenarios are outlined in Chapter 3.

## 1.6 The Approach and Process

The following approach was employed to undertake the required task.

### 1.6.1 Literature Review

An extensive review of the fisheries management and economic literature both here and overseas to identify any published material elsewhere that was relevant to the required tasks of this evaluation.

### 1.6.2 Specifications of the Management Rules

The management rules that were to be incorporated in the model for each of the management scenarios were clarified with the Project Steering Committee. These are shown in Chapter 3.

### 1.6.3 Model Development

The development of a model that was able to identify and quantify the material differences in the benefits and costs of the three management scenarios for the West Coast lobster fishery. This built on related research previously undertaken by Prof Lindner.<sup>iii</sup>

The interactive model needed to be capable of integrating information across the biological, economic and social disciplines. In particular, the cost benefit analysis must consider biological, economic and social issues based on current understanding of the western rock lobster and its environment.

The developed model needed to be an optimising model; one that was robust and simple to use in providing a guide to industry behaviour under alternative management scenarios.

Also, the model needed to be sufficiently interactive to predict the effects, trends and rate of change on key variables such as fleet size, fleet distribution, concentration of ownership, wealth distribution, net value of production, and employment shifts taking into account the sensitivity of regional community to changes within the rock lobster industry.

Whilst third parties provided extensive directly observable data relating to pre-existing management regimes which was used to develop estimates of coefficient value contained in the interactive model, the outcomes in relation to these key variables had to be predicted for the benchmark scenario as well as the alternative scenarios.

For instance, in the case of the benchmark scenario, the way in which lobster fishermen will adapt to the recent removal of the maximum entitlement holding (i.e. the '150 pot rule') and its impact on further fleet rationalization, and on consequent reductions in the fishery's capacity or number of usable pots, can not be observed directly, and needed to be predicted. Likewise, outcomes of the other two scenarios also needed to be predicted because at present they are counterfactual scenarios that have not been implemented in the West Coast Rock Lobster Fishery. The inferential tasks in developing these scenarios should not be under-estimated when considering the results of the model contained later in this report.

The outcomes of the 'bio-economic' optimisation model needed to be linked to the social consequences for West Coast regional fishing communities associated with the lobster fishery. The results from the model needed to be spatially distributed and linked to the social profiles of these regional communities. The UWA Regional Development Unit is carrying out the social profiling tasks under a separate research project.

#### **1.6.4 Data Requirements**

A wide range of data needed to be collated and interpreted so as to estimate values of the large numbers of coefficients in the developed model. For instance, estimates needed to be made, inter alia, of the biological characteristics of the fishery, and changes in catching costs, in catch returns, and in resource rent from the fishery due to reduced boat numbers, more or less intensive pot use, extended fishing season, and altered seasonal catch variations.

Apart from a harvest 'cost of production' survey, there was no provision for original data collection. All aggregate data requirements were generally sourced from the Department of Fisheries or through relevant members of the Steering Committee in the case of lobster market and price information. Also, whilst in South Australia and New Zealand, Prof. Lindner used the opportunity to talk to relevant fisheries policy and industry people regarding experiences in managing lobster fisheries in these jurisdictions.

A 'cost of production' survey of individual lobster fishermen in each of the three commercial fishing zones was undertaken with the co-operation of the Department of Fisheries. Individuals' financial data were sent directly to ERA and matched to their catch and effort return information that they had authorized the Fisheries Department to release to ERA. These individual data, which were obtained in accordance with the requirements of the Privacy Act, were provided to ERA on a strictly confidential basis and were used solely by ERA for aggregate statistical purposes in this report.

#### **1.6.5 Consultative Processes**

Regular meetings were held with the Steering Committee, during the course of this evaluation. These meetings, which are listed in Appendix 1, generally coincided with pre-determined project milestones.

Two Focus Groups of lobster fishermen were formed with assistance of the Department of Fisheries and the Executive Director of the Western Rock Lobster Council. One related to Zone C, whilst the other jointly covered Zones A and B.

















































































































































































































































































