SUSTAINABLE MANAGEMENT

of the

CHATHAM RISE

ORANGE ROUGHY FISHERY

Office of the
PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT
Te Kaitiaki Taiao a Te Whare Pāremata

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PREFACE

This report details the findings of an investigation into the Crown's management of the Chatham Rise Orange Roughy Fishery. There is no doubt the fishery is at risk and that more courageous decisions are required if collapse is to be avoided. Legislative action is now necessary to remedy the decision which has been taken for the 1992/93 fishing year.

The Minister of Fisheries' determinations of Total Allowable Commercial Catches must be made in accordance with the law. This report indicates changes are needed to Fisheries legislation and administrative procedures in order to assist the Minister.

Sustainable management of the fishery will be achieved only if necessary information on stock assessments can support the advice on quota allocations and if cooperation exists between the industry and the Government's scientific advisers.

The Total Allowable Catch/Total Allowable Commercial Catch decision to be made for the 1993/94 fishing year must ensure that the orange roughy stock can rebuild to a level which enables sustainable management of the fishery.

Helen R. Hughes

Helen R Hughes
Parliamentary Commissioner for the Environment

GLOSSARY

B_o	Virgin (unfished) biomass of a fish stock.
CAY	Current Annual Yield. The amount of fish that can be taken in any one year with the population staying much the same at the end of the year. CAY would vary from year to year.
ITQ	Individual transferable quota.
MAF	Ministry of Agriculture and Fisheries.
MAY	Maximum Average Yield. The recognition that fish populations fluctuate in size from year to year. In order to get the best yield from a fishery it is necessary to alter the catch each year. The maximum average yield is how fisheries scientists generally interpret MSY.
MCY	Maximum Constant Yield. The yield of fish that could be taken each year if the catch was constant each year, i.e. the lowest CAY. Refer to Appendix 3 for relationship of CAY, MCY and MAY.
MSY	Maximum Sustainable Yield. Discussed in Section 3.2.
ORH 3B	The Chatham Rise Orange Roughy Fishery, comprising the South-East (Chatham Rise), the SE (Strathallan), the SE (Otago/Southland) and the Sub-Antarctic Areas combined. (Refer to Figure 1.)
Stochastic process	Any process in which there is a random variable.
TAC	Total Allowable Catch (defined in the Fisheries Act 1983 as "... the amount of fish, aquatic life, or seaweed that will produce from [a] fishery the maximum sustainable yield, as qualified by any relevant economic or environmental factors, fishing patterns, the interdependence of stocks of fish, and any generally recommended sub-regional or regional or global standards").
TACC	Total Allowable Commercial Catch ("in relation to a fishery subject to a quota management system under Part IIA of the Act, the total allowable commercial catch for that fishery specified pursuant to [section 28]".

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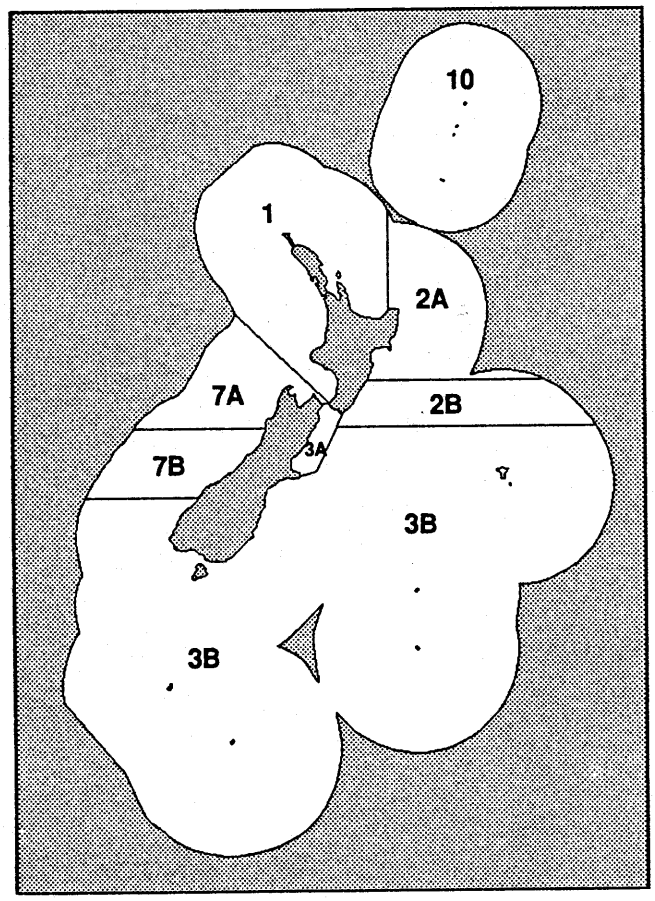
FIGURE 1

Orange roughy quota management areas



Auckland (East), Auckland (West), Central (Egmont) combined	ORH 1
Central (Gisborne)	ORH 2A
Central (Wairarapa)	ORH 2B
Central/Challenger/ South-East (Cook Strait/Kaikoura)	ORH 3A
Challenger (North)	ORH 7A
Challenger (South)	ORH 7B
South-East (Strathallan), South-East (Chatham Rise), South-East (Otago)/Southland, and Sub-Antarctic combined	ORH 3B
Kermadec	ORH 10

Source: Ministry of Agriculture and Fisheries.

1 INTRODUCTION

1.1 Purpose of investigation

The purpose of the investigation is to ascertain whether decisions of the Minister of Fisheries, in relation to the Chatham Rise Orange Roughy Fishery (ORH 3B), are in accordance with the Fisheries Act 1983.

The focus for the investigation was the decision of the Minister of Fisheries not to reduce the Total Allowable Commercial Catch (TACC) for ORH 3B for the 1991/92 fishing year. In order to place this decision in context, decisions on setting or reducing the TACC for other years were examined.

1.2 Authority for investigation

The Environment Act 1986 (Section 16(1)(c)) mandates the Parliamentary Commissioner for the Environment to investigate "any matter in respect of which, in the Commissioner's opinion, the environment may be or has been adversely affected, whether through natural causes or as a result of the acts or omissions of any person or body, to an extent which the Commissioner considers warrants investigation. The Commissioner is to advise, where necessary, the appropriate public authority and any other person or body the Commissioner thinks appropriate of the preventive measures or remedial action which the Commissioner considers should be taken." The results of the investigation are to be reported to the House of Representatives.

1.3 Terms of Reference

The Terms of Reference for the investigation were to:

1 Set out the current state of knowledge about the Chatham Rise Orange Roughy Fishery, identifying uncertainties and differences in interpretation of findings by the Ministry of Agriculture and Fisheries and the fishing industry, and to identify the risk to sustainability of the resource.

2 Summarise the legislative framework for setting TACCs, and the matters the Minister must consider (Fisheries Act 1983).

3 Outline the Minister of Fisheries' decision on TACCs for the 1991/92 year.

4 Assess the Minister's decision in terms of the Fisheries Act 1983.

5 Comment on the consequent risk to the sustainability of the Chatham Rise Orange Roughy Fishery.

6 Assess the adequacy of the Fisheries Act 1983 in achieving sustainable management of the Chatham Rise Orange Roughy Fishery.

7 Make, if appropriate, recommendations for changes to the procedures followed, and to the legislation.

1.4 Background to investigation

A joint report on *Marine Fisheries Management* (Controller and Auditor-General and Parliamentary Commissioner for the Environment, 1990) concluded that exceeding the total allowable catch by whatever means threatens the integrity of the system and the sustainability of the stock.

On 31 January 1991, Greenpeace New Zealand Inc. wrote to the Commissioner about the management of New Zealand orange roughy fisheries. They expressed concern about sustainable harvesting of orange roughy, the practice of "saturation" fishing of spawning grounds, the Minister of Fisheries' performance in setting high Total Allowable Catches (TACs) in the absence of basic but critical biological information, the Minister's advisers' interpretation and application of the Fisheries Act 1983 and the legality of the Minister's phased reduction decisions.

The Commissioner's preliminary investigation of the complaint (completed February 1992) concluded that an explanation should be sought from the Minister of Fisheries for his decision not to reduce the TACC for ORH 3B for 1991/92. Following receipt of the Minister's explanation dated 23 April 1992 (Appendix 1), the investigation was continued.

In anticipation of the TAC/TACC setting process for the 1992/93 fishing year, the Commissioner notified the Minister on 27 August 1992 of the preliminary findings of this Report. The correspondence is attached as Appendix 2.

1.5 Methodology

The investigation has relied, in part, on information obtained during the 1990 joint report on *Marine Fisheries Management*, carried out by the Controller and Auditor-General and the Parliamentary Commissioner for the Environment, and on an investigation by staff. In addition, the Commissioner sought a legal opinion on a number of questions relating to the TAC/TACC setting process and the Minister of Fisheries' decision on the 1991/92 TACC for the Chatham Rise Orange Roughy Fishery. This opinion comprises Section 3.2.

During the course of the investigation, the Commissioner commented on Government reviews of fisheries legislation and fisheries research. Neither review

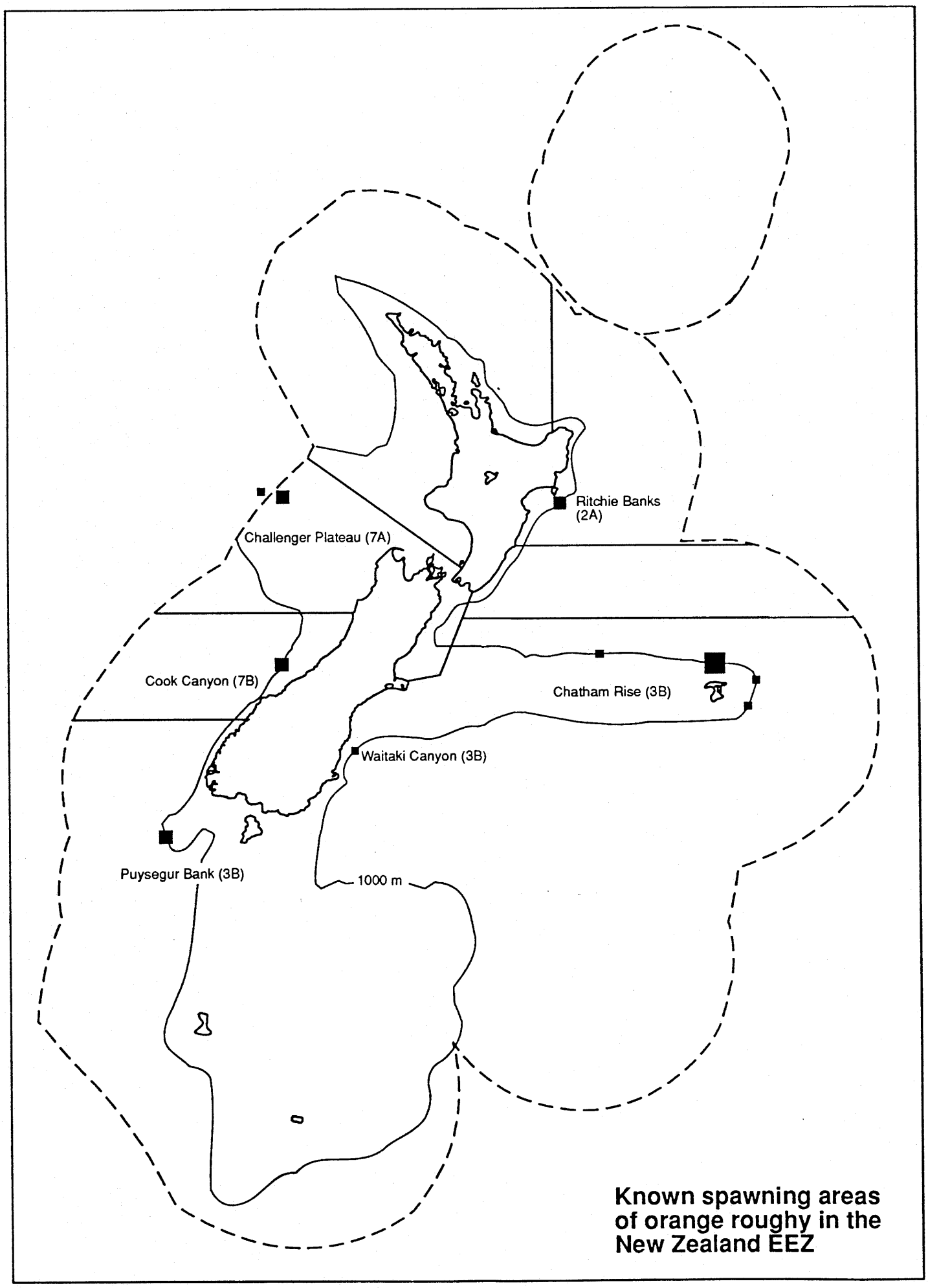
affects the conclusions of this report, although relevant advice was submitted to the Minister of Fisheries and the Minister of Research, Science and Technology respectively.

1.6 Process for setting TAC/TACC

Since 1989, fisheries scientists, industry people, Maori and conservationists have reviewed the TACs in a formal Plenary Session process facilitated by MAF Fisheries (Research) in April/May each year. Groups are established for each of the stocks which are being assessed for the following fishing year. The information from the Plenary Session is then used by a working group, comprising MAF Policy (Fisheries) and MAF Fisheries (Research) staff, to develop a position paper on TACCs for quota management species for the coming fishing season. This Position Paper is sent out by the Minister to interested parties inviting them to provide comments on the proposed TACCs.

Comments received are incorporated into a final briefing paper for the Minister setting out, in summary form, the views expressed by interested parties and MAF Policy (Fisheries) advice. The briefing paper makes recommendations on TACCs for each quota management species. Sometimes these recommendations can be in the form of options, as was the case for the ORH 3B fishery in both 1991 and 1992. This briefing paper is given to the Minister of Fisheries who accepts, rejects or varies the recommendations. The Minister of Fisheries then makes decisions on the TACCs for the fishing season which, for most commercial species, commences on 1 October.

FIGURE 2



Source: Ministry of Agriculture and Fisheries.

2 THE CHATHAM RISE ORANGE ROUGHY FISHERY

2.1 Description

Orange roughy *(Hoplostethus atlanticus)* are widespread in most temperate oceans, from the North Atlantic to South Africa and Australasia, at depths between 700 and 1,500 metres. The Chatham Rise Orange Roughy Fishery was discovered by Soviet trawlers in 1977 and commercial fishing started about 1979. The Puysegur Bank aggregations were discovered as recently as the 1990/91 fishing season. The Chatham Rise Orange Roughy Fishery currently accounts for about 70% of New Zealand's total orange roughy fishery.

Around New Zealand, spawning populations have been found on parts of the Challenger Plateau (off the Taranaki coast), on the Ritchie Bank (off the Mahia Peninsula), on the Chatham Rise (off Christchurch), offshore from Timaru, off South Westland in the Cook Canyon and in the region of the Puysegur Bank (the Willwatch Plateau) (refer Figure 2). These appear to be separate stocks because spawning occurs nearly simultaneously in all six areas.

Orange roughy is a major export earner. In 1990 orange roughy earned New Zealand $145 million, mainly on the United States market. It accounted for 19% of seafood exports by value in 1990, and the industry provides employment in the fishing and processing sectors.

2.2 Orange roughy research

Orange roughy are difficult fish to study because of the depths at which they live. Attempts to capture them in a sufficiently healthy state for tagging or holding in captivity have so far been unsuccessful. Research information for stock assessment is gained from a time series of stratified random trawl surveys and acoustic surveys which indicate distribution and abundance, monitoring of the commercial catch (landing records), and scientific observers on commercial fishing vessels.

A combination of factors makes orange roughy susceptible to overfishing. Orange roughy spawn only once a year. On the Chatham Rise, fish gather to spawn over about 20 days during July, then disperse. Another important factor is the low fecundity (fertility) of the species (Pankhurst & Conroy 1987). This is two orders of magnitude lower than that of other species on which major New Zealand fisheries are based.

Studies of orange roughy otoliths (ear bones) indicate that growth rates are exceptionally slow (Mace et al. 1990). Scientists have estimated age at maturity as 20 years, although recent work (Fenton et al. 1991) indicates that maturity is considerably later - at about 32 years. Orange roughy may live up to 150 years. Indications are that the natural mortality rate is low (only about 5% of a population would die off in any one year) and spawning success may be highly variable.

A significant reduction in genetic diversity has been observed in three orange roughy spawning stocks over the period 1982 to 1988 (Annala 1992). This suggests that the fishing activity on these spawning stocks has substantially reduced population size. Loss of genetic diversity can adversely affect a population's ability to survive disease and climatic changes.

Research on a fish species seeks to produce an estimate of the total mass of fish present. This is the absolute biomass. If this cannot be determined, an estimate of relative biomass is needed. The yield potential of a fishery is determined by the biomass and rate of production. Because of the difficulties of assessing virgin (unfished) biomass and biomass at the beginning of each fishing year, scientists also rely on estimates of relative biomass calculated from trawl survey data. In the case of the orange roughy fishery, trawl data has been gathered in the period from 1984 to 1990.

Information for stock assessment purposes is dependent on the effort put into research. In the years leading up to the declaration of the quota management system research was focused on stock assessment. Each year's study of the fishery gives scientists more basis for confidence in the assumptions made about the fishery. If information is not obtained, there is no scientific basis for recommending the TACs. There must be a consistent research effort to improve the information base and gain a time sequence of data. Gaps in the scientific record occurred when research trawl surveys were not carried out in 1983 and 1991 due to budgetary constraints. MAF Fisheries' two vessels were unsuitable for deepwater research and chartering commercial vessels was unsatisfactory. The purchase of the *Tangaroa* in 1990 has greatly improved MAF's ability to carry out deepwater research. This essential research is expensive and MAF Fisheries (Research) spent approximately $3 million (29%) of its annual research budget on the orange roughy fishery alone in the 1991/92 year.

2.3 Management history

Orange roughy has been commercially fished since 1977. Fishing on the Chatham Rise during 1979 and 1980 was unregulated.

A quota for orange roughy was first set in 1981 under the Fisheries (General) Regulations 1950 Amendment No. 35. The initial TAC for ORH 3B was 23,000

tonnes. However it was not until 1986 that the current quota management system was introduced. Table 1 shows reported catches and TACs since 1978.

The reported catch of 32,605 tonnes for the 1982/83 fishing season was well above the TAC of 23,000 tonnes. MAF Fisheries estimated that actual catch in fact exceeded reported catch by around 30%. (As a result of various measures, including improved fishing techniques, MAF Fisheries estimate the overrun is now about 15% of reported catch.)

On the basis of 1982 trawl survey results from a survey box embracing the main spawning ground (Robertson et al, 1984), the TAC for 1983/84 was increased to 30,000 tonnes.

By 1986 trawl surveys of the same area showed a downward trend in the orange roughy population on the Chatham Rise.

The results of surveys in July 1986 and the previous two years led scientists to the view that the population was decreasing much more rapidly than previously estimated. Analyses suggested that the 1982 estimate of initial or virgin biomass was too high, leading to an over-estimate of the maximum sustainable yield (MSY) and hence the TAC/TACC. (It was thought that the 1982 trawl survey inadvertently sampled all or part of the same population more than once by surveying in an easterly direction while the orange roughy population was migrating eastwards after spawning.) The Minister of Fisheries had already gazetted the 38,065 tonnes TAC/TACC for 1986/87, but he agreed to reduce it by 4,000 tonnes.

In 1987, it was recommended that the TAC be reduced to 17,430 tonnes. MAF Fisheries discussed the options with the fishing industry and put a proposal to the Minister which included a quota-swap arrangement. The industry agreed to give up 12,000 tonnes of orange roughy on the Chatham Rise for the 1987/88 season (giving an available quota of 22,000 tonnes), in exchange for an equivalent amount from the Challenger Plateau spread over two years. There was no reduction of the TAC/TACC for the following season, the actual TAC being 38,300 tonnes.

Studies in 1988 showed the growth of orange roughy was much slower than previously thought and that productivity was exceptionally low. Scientists calculated that the rate of exploitation had reduced the Chatham Rise fishery to about 19% of the virgin (unfished) biomass. Fisheries managers worldwide regard 20% of virgin biomass as the minimum safe level for commercially exploited stocks.

New information on age and growth, in early 1989, indicated that a revised estimate of 6,500 tonnes for maximum constant yield (MCY) and 8,000 tonnes for current annual yield (CAY) should be made for the fishery. This suggested that the TAC/TACC should be reduced by about 75%.

In May 1989, MAF Fisheries (Policy) recommended to the Minister a *phased reduction* in orange roughy TAC/TACC for the Chatham Rise. This recognised the uncertainty associated with estimating maximum yields, the likely impact on the fishing industry of a sudden large decrease in TAC/TACC, and the likely buffering effect of younger age groups of fish.

In August 1989, as part of the fishing industry Accord, the Minister of Fisheries and fishing industry representatives agreed that 5,000 tonnes represented the best available estimate of TAC/TACC reductions required in the Chatham Rise quota management area in the next four years. Cabinet decided in October 1989 that the TAC/TACC should be reduced by 4,000 tonnes in the current fishing year (Controller and Auditor-General and the Parliamentary Commissioner for the Environment 1990, Appendix 2). Cabinet noted the intent of the Accord to implement further annual 5,000 tonne reductions on 1 October 1990, 1991 and 1992. The reduction of quota for the 1989/90 fishing year was provided for in the Fisheries Amendment Act 1990 (Section 28OB(5)). However, it was not clear whether the Fisheries Act 1983 permitted a phased reduction strategy.

The TAC was reduced during the 1989/90 season from 38,300 tonnes to 32,787 tonnes via cancellation of Crown quota and quota reduction of 4,000 tonnes.

In 1990, with new data and refined analysis, MAF's stock assessment indicated that a reduction of only 5,000 tonnes per year would result in considerable risk of fishery collapse. For the 1990/91 fishing year, the TAC/TACC was reduced by 9,000 tonnes to 23,787 tonnes. (Refer Regulation 1990/287, date of notification in *Gazette*: 27 September 1990.)

Significant new factors were taken into account in the stock assessment for the 1991/92 season, including the results of a further random trawl survey. Assumptions were refined and risks and options for different catch reduction scenarios examined. According to MAF scientists (Francis & Robertson 1991), the additional survey data "substantially increased the precision" of their estimate of the original population. It was larger than previously assumed; nevertheless they advised that a TAC/TACC reduction of only 5,000 tonnes in the coming season would mean a 54% risk of collapse of the fishery in the next five years. They calculated a maximum constant yield (MCY) of between 7,000 and 8,000 tonnes and, consequently, suggested that more drastic cutbacks were required.

In the briefing paper to the Minister in 1991, MAF clearly stated that there was a need for a substantial reduction in TACC because the stock was below the level that could sustain the MSY and was very unlikely to sustain current catch levels. The policy advice was that a catch of 8,000 tonnes was estimated to be the level that would prevent further stock decline. However, in the recommendations to the Minister, a number of options for reducing the TACC for the ORH 3B quota management area were given, ranging from 8,000 tonnes to 14,787 tonnes to 19,000 tonnes or to 18,787 tonnes. These recommendations were presented in a

confusing manner and were subsequently replaced with a recommendation for no TACC reduction, with agreement from the fishing industry to catch 5,000 tonnes south of 46°S and take part in a research cruise in 1992.

The Minister decided not to reduce the TAC/TACC of 23,787 tonnes for 1991/92 fishing season. He did, however, obtain fishing industry agreement to catch 5,000 tonnes of the TACC south of 46° S, and to limit their catch in the spawning area defined by the MAF survey box on the Chatham Rise to the lesser of 9,000 tonnes or the reported catch from the survey box in the 1990/91 fishing year (4,850 tonnes). This meant that no more than 18,787 tonnes was to be taken.

Table 1 Annual reported catches and TACs of orange roughy from ORH 3B

Fishing year	Reported catch (tonnes)	TAC (tonnes)
Before 78/79	negligible	-
79/80	11,800	-
80/81	31,100	-
81/82	28,200	23,000
82/83*	32,605	23,000
83/84*	32,535	30,000
84/85	29,340	30,000
85/86	30,075	29,865**
86/87	30,689	38,065
87/88	24,214	38,065
88/89	32,785	38,300
89/90	31,669	32,787
90/91	21,540	23,787
91/92	23,365 (provisional)	23,787
92/93 -	21,300	

Sources: Robertson & Mace (1988). Fisheries Statistics Unit, quota monitoring system data, and subsequent updates. Francis, R I C C et al. 1992.

* Catches for 1982/83 and 1983/84 are 15-month totals to accommodate the change-over from an April-March fishing year to an October-September fishing year. The TAC for the interim season, March to September 1983, was 16,125 tonnes.

** Figures subsequent to Quota Appeal Authority decisions. This refers to all these figures from 1985/86 to 1990/91 inclusive.

The analysis provided at the May 1992 Fishery Assessment Plenary (Annala, 1992) showed a slightly more optimistic picture of the Chatham Rise orange roughy population. Estimates indicated the mid-season biomass for the 1990/91 year was 16.7% of virgin (1978) biomass, rather than 10.6% as estimated earlier. The biomass in 1978 (before fishing started) is now estimated to be 461,000 tonnes rather than 383,000 tonnes. Changes have been made to the assessment procedures, most importantly, to introduce stochastic recruitment into the stock reduction analysis.

Scientists still advised that the biomass was too low to support the MSY. As a result of modelling work, they calculated that the 1992/93 TACC for the Chatham Rise area should be no more than 6,100 tonnes to give a more than even chance of increasing biomass. Reducing the catch to 3,300 tonnes would promote rebuilding of the stock and eventually achieve the MSY.

Scientists advised there was not yet sufficient data on the Puysegur Bank fishery to determine how long a catch of 5,000 tonnes was safely sustainable.

The Minister set the 1992/93 TACC for ORH 3B at 21,300 tonnes (refer Regulation 1992/252, date of notification in *Gazette:* 3 September 1992). In return the industry agreed to the closure of the main Chatham Rise spawning grounds, a catch limit of 14,000 tonnes from the balance of the Chatham Rise and a limit of 5,000 tonnes from the Puysegur Bank area. Limiting catches in certain areas was expected to encourage exploration for concentrations of orange roughy elsewhere.

3 THE STATUTORY BASIS FOR DETERMINING THE TOTAL ALLOWABLE COMMERCIAL CATCH

3.1 Part IIA of the Fisheries Act 1983

The current quota management system is established under Part IIA of the Fisheries Act 1983. Part IIA was inserted by the 1986 Amendment Act.

The total amount of individual transferable quota (ITQ) available depends on the determination of TAC and TACC. TACC is defined as TAC less any allowance for Maori, traditional, recreational, and other non-commercial interests in the fishery, and less any amount determined under the Territorial Sea and Exclusive Economic Zone Act 1977 for foreign fishers.

Currently there are no allowances in either category for orange roughy in ORH 3B, so TAC and TACC are, in effect, the same.

Section 28B provides for any species of fish, in any specified quota management area, to be made subject to the quota management system.

Section 28C empowers the Minister of Fisheries to specify, by notice in the *Gazette,* the TACC for each species of fish subject to the quota management system in the specified quota management area.

The Minister may, but is not directed to, specify separate TACCs for separate stocks of the same fish species within the one quota management area.

Section 28D specifies the matters relevant to determining or varying any TACC and provides for consultation, while section 28OB allows a TACC to be varied by *Gazette* prior to commencement of the fishing year.

Sections 28OF to 28OO provide for compensation for reductions in quota over a transitional period.

Concern was expressed to the Commissioner that MAF's interpretation and application of the Fisheries Act 1983 was not adhering to the aims and principles of the management and conservation of fisheries. There were a number of legal issues relating to the Minister of Fisheries' ability to set a TACC that required some clarification. A legal opinion was sought from Dr Graham Taylor and follows as Section 3.2.

3.2

OPINION FOR PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT

ON:

**CHATHAM RISE ORANGE ROUGHY FISHERY:
DEFINITION AND APPLICATION OF
"TOTAL ALLOWABLE COMMERCIAL CATCH"**

INTRODUCTION

1. I have been asked for my opinion as to the meanings of "total allowable catch" and "total allowable commercial catch" as defined in s2 of the Fisheries Act 1983 and their application to the Minister of Fisheries' decision not to reduce the tonnages of catch for the Chatham Rise Orange Roughy Fishery (ORH3B) for the 1991–92 fishing year.

2. I understand that the Commissioner is considering making a formal report on the Minister's decision.

3. As an incidental aspect of my instructions, I have been told of a proposal by an environmental group to apply for judicial review of the Minister's decision. I am asked for my view on the likelihood of success of that application, if made.

4. There is only one High Court judgment (Sealord Products Ltd v Moyle, McGechan J, HC Wellington CP 182/87, 22 May 1987) touching on the meaning or application of the definitions on which my opinion is sought and that assists more by implication than by direct determination. The question of definition is therefore primarily one of bare statutory interpretation. The question of application starts from statutory interpretation, and is dominated by it, but has a substantial element of practicability given the nature of the exercise in determining the proper catch based on inconclusive material and the open-textured character of the matters which must be taken into account.

5. I have considered all the material sent me with my instructions, the Fisheries Act 1983 and all amendments, the Territorial Sea and Exclusive Economic Zone Act 1977, and the Law of the Sea convention, the limited knowledge of the nature of commercial fishing I have built up from previous matters, and my reading of case law and legislative material.

6. The opinion is divided into the following parts which seem to present a logical development of issues:

(i) the general meaning of maximum sustainable yield,

(ii) the practical effect of that definition,

(iii) the effect of the context of the Act on the definition,

(iv) the relationship of maximum sustainable yield and total allowable catch,

(v) the elements which modify maximum sustainable yield or total allowable catch and their meaning,

(vi) the effect of Quota Appeal Authority decisions,

(vii) the Minister's statutory duty,

(viii) the effect of relative lack of information,

(ix) the effect of the 1989 accord,

(x) the validity of the Minister's decision,

(xi) the implications for 1992–93, and

(xii) the likelihood of success of litigation.

THE GENERAL MEANING OF MAXIMUM SUSTAINABLE YIELD (MSY)

7. MSY appears only in the definition of total allowable catch (TAC) in s2 of the Act, thus:

> "with respect to the yield from a fishery, means the amount of fish, aquatic life or seaweed that will produce from that fishery the maximum sustainable yield, as qualified by any relevant economic or environmental factors, fishing patterns, the interdependency of stocks of fish, and any generally recommended sub–regional or regional or global standards."

Given "fishery" is defined in s2 as the stock of one or more species of fish etc, the definition of TAC and, with it MSY, will depend on the context. Here the context is one fish (orange roughy) in one part of one management area (Chatham Rise is in the Southern Fishery Management Area). Hence, MSY refers to the MSY of orange roughy in the Chatham Rise. This point is crucial, for it is only indirectly that other orange roughy fisheries, eg the Puyseger or "Willwatch" fishery, become relevant.

There is power under s28C(3)(a) to set separate TACCs for different parts of the one quota management area. There is no such express power in s280B to do so when varying TACC. The effect of this will be considered later.

8. Crown Counsel, Shonagh Kenderdine, in her opinion of 14 August 1987, correctly noted that in the absence of statutory definition or relevant case law, the definition of MSY is the dictionary definition. The Ministry of Agriculture and Fisheries Office Solicitor adopted this in his opinion on 5 May 1989. One should also add, "as affected by the statutory context". The dictionary definition is the subject of this section of the opinion.

9. "Yield" is simply "the quantity of a product resulting from exploitation of natural resources" (Websters Third international Dictionary, definition b). Both "maximum" and "sustainable" are adjectives of equal status modifying "yield". Thus, "maximum" ("the value of a continuously changing varying quantity at the point at which it ceases to increase and begins to decrease" (Shorter Oxford English Dictionary, definition 2, a mathematical

definition which is considered to be the most apt) does not take an absolute meaning, but is the sustainable maximum. Conversely, of the range of yields which are "sustainable" ("able to be kept up, especially, without interruption, diminution or flagging" – Webster's Third International Dictionary, definition 3a), it is the highest point of the range which is to be chosen. "Sustainable" of its nature refers to a period of time and that period of time has necessarily to be determined before a "maximum" can be identified.

10. Natural resources (see the definition of "yield") are either renewable or non–renewable. If the latter then, subject to any scientific consideration, such as a rate of extraction below which water will permeate a natural gas reservoir, a decision is made as to how long the resource is sought to be available and a rate of exploitation is fixed to meet that time. The definition of sustainable involves a constant rate – a "horizontal line" not one tilting up or down. With a renewable resource the situation is more complex because:

(a) there is no necessarily finite period for exploitation, and

(b) the rate of renewal is dependent on external factors over which there may be limited or no control, and so will almost certainly vary.

11. There is a question whether a finite date can be set for exploitation of a renewable resource. That depends legally on the statutory context, and will be addressed near the end of this opinion.

12. Because rates of renewal vary, an appreciation must be made of long term patterns. A "blip" will not matter unless it becomes so extended as to cast doubt on the assumed long term pattern. Thus, the maximum sustainable yield does not have to be revised for every blip.

13. In my opinion, it follows that the equivalence of MSY to maximum constant yield (MCY) by the Ministry is correct, as is the taking of MSY as being, "in the long term". "MCY" was defined in Ministry copies to the Minister on the present subject (and as dealt with in other papers) as

"the maximum constant catch that is extracted to be sustainable, with an acceptable level of risk, at all probable levels of biomass". What is long is considered later as are the implications for the short term of determining MSY based on the long term.

PRACTICAL EFFECT

14. Orange roughy, as I understand renew at a rate of 2.5% per annum. Thus, if the reference size of the orange roughy fishery ORH3B is 100,000 tonnes, the prima facie MSY is 2,500 tonnes a year. If 5,000 tonnes are taken in one year, the fishery the following year is 97,500 tonnes giving a MSY, if this is taken as the base year, of 2,440 tonnes. If 5,000 tonnes are again taken, the next year's fishery is 94,940 tonnes giving a MSY based on that year of 2,380 tonnes, and so on.

15. Obviously, the true rate of renewal is not so simple and is affected by food supply, climate, other stresses, and so on, but the inevitable practical point seems to be that MSY at the reference point cannot be maintained if catch is greater than the renewal rate multiplied by the size of the fishery at the reference point. The consequence is that a TAC greater than the years renewal is permissible only if the MSY is to be based on a fishery size smaller than the present. That in turn would appear to be internally contradictory. Relating to the example in paragraph 14, the MSY is necessarily that based on the reference size, ie 2,500 tonnes. 5,000 tonnes may be able to continue to be taken for a number of years, but in time it will be able to be maintained only by greater effort (cpue). Maintaining a yield only by greater effort is not "sustainable". It involves "flagging" (refer to the definition of "sustainable"). Is TAC above the renewal rate possible because renewal rises with less competition for food? What is the reference point for determining MSY?

16. The scientific answer to the first question raised is beyond my competence, but the practical effect in legal terms can be stated. If the renewal rate increases to 5% where the size of the fishery is 80,000 tonnes, the indicated MSY is 4,000 tonnes. This is higher than the 2.5%

rate in a fishery of 100,000 tonnes and so it would maximise sustainable yield to fish "down" until a 80,000 tonnes fishery size is reached. Any TAC greater than 4,000 tonnes is not sustainable in the long term (whatever long means). In raw and crude terms MSY = the maximum value of F x R where F equals the fishery size and R equals the renewal rate. This in turn answers the second question, because the reference point is F where MSY is greatest. I understand that the maximum renewal quantity for orange roughy is reached at 33% of virgin stock. The actual relationship is plainly much more complex, but in practical terms MSY cannot be greater than the maximum renewal quantity as dictated by, no doubt, a host of other complex factors.

THE CONTEXT OF DEFINITIONS

17. The quota management system, to which this opinion relates is established by Part IIA of the Act. This Part was inserted by the 1986 Amendment Act. No help as to the context and purpose of Part IIA is gained from the long title to the 1986 Act – "An Act to amend the Fisheries Act 1983". The long title to the 1983 Act is, however helpful – "An Act to consolidate and reform the law relating to the conservation and management of fisheries...." (emphasis added). Other parts of the Act are:

I Fishery Management Plans

II Fisheries Authority

III Controlled Fisheries

IIIA Taiapure – Local Fisheries

IV Fishing Vessels and Methods of Fishing

V Freshwater Fisheries (repealed)

VI Appointment and Powers of Fishery Officers

VII Miscellaneous Provisions

Parts IIA and IV were inserted and substituted respectively by the 1986 Act. Section 28B(2) provides that an area cannot be under both Part IIA and Part III at the same time, but Parts I and III can apply simultaneously to the one area. There is no Part dealing with "General Principles" applicable to the Act as a whole. Because of that and the later insertion of Part IIA it cannot be said that there is a unified "vision" found in the Act making Parts I, IIA and III interdependent. One is therefore to look at Part IIA in isolation first.

18. There is no purpose or object indicated expressly in Part IIA, in contrast to Parts I and III. Purpose can be gleaned, however, from the general thrust of the provisions.

19. Section 28B and BA provide for declaring species af fish and rock lobster to be subject to quota fishing. The declaration defines a quota management area within which quota fishing is to take place (S28B(3)) which shall so far as possible be the same for different species or classes of fish (s28B(4)). Thus the quota management areas can broadly be said not to be fish–oriented but fisher–oriented.

20. Section 28C to D provide for determining total allowable commercial catch (TACC). TACC is determined by reference to matters contained in s28D. TACC may (but not must) be defined specifying "separately defined parts of any quota management area" or methods of or periods for taking fish (s28C(3) (a) and (b)). Thus TACC is fish–oriented and related through s28C(3)(b) to Part I. In setting a TACC, 28D provides that the Minister has the TAC and allows for:

"(i) Maori, traditional, recreational, and other non–commercial interests in the fishery; and

(ii) Any amount determined under section 12 of the Territorial Sea and Exclusive Economic Zone Act 1977 as the allowable catch for foreign fishing craft."

In reducing a TACC the Minister shall "have regard to":

"(i) Whether or not the imposition of other controls under this Act on the taking of fish would be sufficient to maintain the fish stock at a level where the current total allowable commercial catch would be sustained; and

(ii) Whether or not a reduction in the level of fishing could be achieved by the Crown's retaining or obtaining the right to take fish under any appropriate quota and not making those rights available for commercial fishing."

Again there is a relation to Part I in s28D(1)(b)(i).

21. Sections 28E to OA relate to the determination and allocation of individual quota within the TACC, including provision for appeals to the Quota Appeal Authority. The quotas are fully tradeable property rights. The TACC determines, directly or indirectly, the quantum of these individual rights.

22. Sections 28OB to OE relate to varying the TACC. Section 28OB contains the general power to vary (subs (1)) which is to be exercised having regard to s28D criteria but mainly relates to variations following decisions by the Quota Appeal Authority on individual quotas, but subs (3) requires any TACC to be made before the first day of the first fishing year to which it relates, and subs (5) prohibits making further reductions in ORH3B and certain other orange roughy fisheries in excess of 4,000 tonnes in respect of the 1989–90 fishing year. Where TACC is reduced, the Ministry first cancels any Crown quota (s28OD(1)) down to the new TACC. If there is no or insufficient Crown quota, individual transferable quotas (ITQs) are reduced proportionately to reach the new TACC (s28OD(3)). Section 28OE provides the procedure for increasing TACC and the consequences for ITQs. No compensation is payable for a reduced ITQ except pursuant to the transitional period from fishing years 1989–90 to 1993–94 (s28OD(7)). The transitional compensation provisions are ss28OF to OO.

23. Sections 28P to Z (other than s28V) relate to dealings in ITQs.

24. Sections 28V and ZA to ZG relate to rights and liabilities of fishers in exercising their quota rights. Section 28V allows a fisher to carry forward up to 10% of its ITQ not caught and is not penalised for catching up to 10% over quota. These overs and unders are debited or credited to the next year's catch. The Minister can allow greater quantities to be debited or credited (subs (2)). This emphasises that "blips" are not to result in changes to quota, but to ensure that in the shortish term the TACC is not exceeded. While it is expressly provided that a credit can be carried forward only one year (subs (7)), that is not expressed for debits (subs (5)). It is considered that the wording of subs (1):

> "Subject to the provisions of this section and the requirements of this Act relating to fishing permits, any holder of an individual transferable quota may in any fishing year take in total not more than 10 percent more fish than is specified in that quota, or such greater amount as may be permitted under subsection (2) of this section."

coupled with the automatic reduction of quota for the next year (subs (5)) means that over a 2 year period a fisher cannot, without penalty, exceed its ITQ. The penalty is to pay to the Crown the deemed value of the excess fish (s28ZD) ie confiscation of the fruits of over-fishing. The purpose of ensuring this is inferred to be not to affect adversely the MSY.

25. Fish subject to quota management cannot be taken for sale otherwise than pursuant to quota (s28ZA). This too serves to ensure that MSY is not adversely affected. This is also the purpose of s28ZB prohibiting returning to the sea fish of legal size (with some exceptions) without the presence and authorisation of a fishery officer or scientist.

26. The provisions on the quota management system are all tied back through the calculation of TACC to the MSY and are aimed at ensuring that the fishery is sustained at a level that will enable the MSY to be attained. This defines the purpose of the Part.

27. The purpose of the Part can be enlarged upon by a comparison with Parts I and III. A fishery management plan, under Part I which can co–exist with a Part IIA quota management system (s4) is to:

"conserve, enhance, protect, allocate, and manage the fishery resources within New Zealand fisheries waters having regard to the need for:

(a) Planning, managing, controlling, and implementing such measures as may be necessary to achieve those purposes:

(b) Promoting and developing commercial and recreational fishing:

(c) Providing for optimum yields from any fishery and maintaining the quality of the yield without detrimentally affecting the fishery habitat and environment."

A controlled fishery under Part III, which cannot co–exist with a quota fishing system, but can co–exist with a fishery management plan, may be declared "for the purpose of the management or conservation of the fishery... or the economic stability of the fishing industry" (s30(1)). Thus a controlled fishery will exist relevantly where either:

(a) the s4 purposes exist or;

(b) the fishery needs to be conserved and that cannot be done through a quota management system.

I infer from the detailed licensing regime in a controlled fishery that a controlled fishery is appropriate where a fishery is in danger of collapse. Conversely, a quota management system is for a situation where some control on taking fish is appropriate but there is no danger to the fishery. The purpose of Part IIA may therefore be fleshed out to include maintaining a fishery in a comfortably sound long–term commercial state.

28. The power to set different TACCs for different parts of a quota management area fits this pattern. It is quite clear that different TACCs can be so set – s28C(3)(a). That power is linked back into s28C(1) by the

introductory words to subs (3) and accordingly can be varied under s28OB. It is understood that the Ministry of Agriculture and Fisheries does not believe that this can be done. If that is so, then in my opinion the Ministry is wrong. Where there are separate stocks of fish at different places within a quota management area, as distinct from interdependent stocks which may be viewed as a single entity, the appropriate catch has to be considered both individually for each stock and collectively for all stocks. Individually, because each separate stock will have its own MSY. Collectively because relative sizes of stock and the effects of environment etc on each stock may make it practicable to achieve total MSY by fishing one stock lightly and another heavily. The key is how best to achieve total MSY (cf paras 33–35).

29. Where separate TACCs have been set for separate stocks within a quota management area originally the generally phrased provisions in s280B will allow them to be varied separately. Where there have not been such separate TACCs, separate TACCs can be introduced under s280B because there is an incidental power to allow this and in any event s28C(3) is implied in s280B. Section 280B(1) speaks of a power to "vary any" TACC declared under s28C. "Vary" is an open textured word of great flexibility, but that does not enable a new TACC to be established under the rubric of "vary". Subsection (2) brings in the matters specified in s28D as mandatory factors, and s28D(1) makes a cross-reference to s280B. One of the matters in s28D is the TAC which in turn is defined by reference to attaining the MSY.

30. The interlinking of ss28D and 0B with MSY together with the purpose of Part IIA (see paragraphs 26 and 27) is such, it is considered, as to allow the breaking of a single TACC into TACCs for separate stocks and vice versa. This is considered to be either an incidental power under s280B(1) or an interpretation "to make the Act work" Northland Mill Vendors Association Inc v Northern Milk Ltd [1988] 1 NZLR 530(CA).

31. One may now look more particularly at the definition of TAC viewed against the context and purpose of Part IIA. First, the MSY cannot be set at a level which will endanger the fishery, leading to it having to be brought under Part III. Secondly, the factors stated in the definition of

TAC following "maximum sustainable yield" are relevant in so far as they are relevant to the given TAC, ie "economic and environmental factors" and "standards "are not general but particular. If a variation in them will not affect the TAC, they are not relevant. Thirdly, the economic factors look to equipment and employment in the fishing industry only in so far as a fixing of TAC at a given level will result in removing resources from the industry or part of it so that MSY cannot in fact he met, in other words, MSY and the quota management system is fish not fisher–oriented. Its primary focus is the maintenance of fish stocks at the level for MSY.

RELATIONSHIP OF TAC AND MSY

32. There is apparent disagreement between the Crown Law Office and the Ministry's Office Solicitor on whether the words following "maximum sustainable yield" in the definition of TAC modify MSY or TAC. This is a difficult question but after consideration a clear result arises. Grammatically, they modify TAC. This reading is also in keeping with the concept of TAC and the words which precede "maximum sustainable yield" in the definition.

33. The grammatical analysis of the definition of TAC follows. "Total allowable catch, [*the comma opens a parenthesis*] with respect to the yield a fishery, [*the comma closes the parenthesis*] means [*what follows is the meaning*] the amount of fish... [*irrelevant words separated by commas to show they are distinct*] that [*adjectival clause modifying "amount of fish" begins*] will produce from that fishery the maximum sustainable yield, as [*comma opens parenthesis in the form of a further adjectival clause – "as" is a relative pronoun meaning "which" (this is the only compatible meaning of "as" and relates grammatically to the last preceding substantive, which is "the amount of fish"...) there is an argument that "as" introduces an adjectival clause which modifies the previous adjectival clause, in which case all that follows "means" is the definition and is necessarily separate from "total allowable catch", however, since maximum sustainable yield refers to the long term future, it does not make sense to modify the long term by reference to economic factors, fishing patterns etc which will vary*

unpredictably in the future] qualified by any relevant [*ie relevant to the last preceding substantive "maximum sustainable yield" of the fishery concerned*] economic or environmental factors, [*comma separates concepts*] fishing patterns [*ie "relevant" (word elided, courts would imply it anyway)*]... [*further concepts, each with "relevant" implied*]". This analysis is supported by inference from the Sealord judgment at p 7 where (albeit without reasoning) McGechan J refers economic and environmental factors to TAC.

34. TAC is a statistical derivation from MSY. The relevant factors listed in the definition are identified and evaluated and a series of figures for TAC derived depending on weightings and assessments of those relevant factors. If the MSY is, say, 23,787 tonnes, the TAC is what will produce that given, for example, a particular fishing pattern. A different TAC may be derived from a different fishing pattern.

35. Both MSY and TAC are terms of art not science because both are uncertain and arguable (the former because it extends judgments into the future, the latter because there are different ways of fishing and different influences which may be brought to bear to reach an appropriate TAC). The listed factors include both aspects outside the control of fishers, eg environmental factors, factors within the control of fishers, eg fishing patterns, and factors which can be influenced by Government, eg economic factors, or by both Government and fishers, eg fishing patterns. I am advised that the Fisheries scientists regard MSY as the most predictable element in the whole scheme, so that interpreting the listed factors to modify TAC rather than MSY also "makes the Act work".

36. The other point of effective disagreement between the Crown Law Office and the Ministry's Solicitor is the meaning of "qualified". Mrs Kenderdine said it meant "reduced" or "limited". Mr Fergusson, by allowing catches in excess of MSY must have thought it meant "increased or reduced" or "added to or limited by" in a word "altered". Mrs Kenderdine is right again. "Qualified" is defined in the Shorter Oxford English Dictionary as "limited, modified, or restricted in some respect". All the synonyms involve taking away from, not adding to, something. Had Parliament

wished to allow for "adding to", it would have used a word such as "altered" or "modified" as in the s2 definition of "optimum". In any event, a TAC which results in exceeding the objective MSY means that it cannot be maintained and so the listed factors must give rise to lower TAC to ensure that MSY is not exceeded.

THE MEANING OF THE MODIFYING FACTORS

37. The comments that I can make as a lawyer not a fisheries scientist, are limited. "Economic" can include the economics of fishers (which would seem likely to tend to push TAC up) and export receipts (which would seem likely to keep TAC at a minimum safety level below MSY). The desire to expand current exports to offset lower exports of another product may well be too remote to be relevant. Fishing patterns may well include fishing in the spawning season, and this may tie into fishers' economics where the fish are too dispersed at any other time. Interdependence of stocks of fish would seem to include what Mrs Kenderdine covered in her opinion, as well as a situation where two separate stocks of the same species spawn in the same place – as seems arguable in respect of ORH3B.

QUOTA APPEAL AUTHORITY DECISIONS

38. The Quota Appeal Authority ("QAA") has jurisdiction only in relation to the initial setting of ITQs. Section 28H gives a right of appeal only as to decisions on provisional maximum and guaranteed minimum quota under s28G. That section in turn refers back to ss28B through ss28E and F. By s28J the effect of a QAA decision to allow an appeal is that the maximum held on appeal is a proportionate amount of the whole of the TACC, even though the minimum held is a specific amount and takes the total allocation of guaranteed minimum quota over the TACC. What happens then is that the Minister seeks the surrender of quota under s28L so as to bring the total of guaranteed minimum quota under the TACC. If he fails in this, he varies the TACC set under s28D to equal the total of guaranteed minimum quota. This will in general put the catch in excess of MSY.

39. That will apply until a further varied TACC is set. Whether there will be a duty to vary the TACC to reduce it so that MSY is not exceeded is discussed in paragraphs 45–46 below.

THE MINISTER'S STATUTORY DUTY

40. Here the conduct is a decision not to lower TACC. Since ss28D(1) and 28OB(2) require the Minister to have regard to the same matters in fixing the original TACC, both setting and varying can be considered together.

41. There is an ambiguity in the matters to which the Minister must have regard which are set out in s28D. The relevant parts of s28D(i) are:

"When setting... or varying... a TAC... the Minister shall:

(a) After having regard to the TAC... allow for:

(i) Maori... and non–commercial interests in the fishery; and

(ii) ...the allowable catch for foreign fishing craft.

(b) When considering any reduction in a TACC, have regard to:

(i) Whether or not... other controls ...would be sufficient to maintain the stock at a level where the current Tacc could be sustained; and

(ii) Whether or not a reduction in the level of fishing could be achieved by the Crown's ...not making those [ie, its current or acquired] rights available for commercial fishing.

(c) ..."

"Have regard to" normally means take into consideration as a factor. The matters to be had regard to are normally ones which are not conclusive in a "yes/no" sense. That is the way "have regard to" appears to be used in (b) and (c). In (a), if that is the meaning of "have regard to", a Minister could say "TAC based on MSY is 10,000 tonnes, but in my view the nation is best served by fishing the fishery to extinction over 10 years and so I fix the TACC at 30,000 tonnes." That is considered to be contrary to the purpose of Part IIA and to the concept of sustainable fishing found in s28D(1)(b)(i). In Sealord, McGechan J seems to have read "having regard to" as mandatory, ie "taking", but again there is no reasoning. That purpose and concept would be achieved by reading "having regard to" in para (a) as "taking". That fits with "allow for" in the same paragraph. "Allow for" here propounds an arithmetical subtraction.

42. This, then, is the ambiguity. Which meaning does "having regard to" have in s28D(1)(a)? If it is "take into account", then the Minister has, as his Office Solicitor advised, a genuine discretion in fixing TACC which need not have any direct relationship with MSY. The Minister can lawfully take the fishery to the brink of collapse and beyond. If the meaning of "having regard to" is "take", then the linkage of TACC to TAC and MSY is clear and direct:

TAC = catch to achieve MSY.
TACC = TAC – (a)(i) – (a)(ii).

The Ministry accepts 'having regard to" as mandatory, but nevertheless the point should be clarified.

43. It is considered that there is a genuine ambiguity here which should be resolved urgently. It is considered that "take" is the meaning for para (a) which fits the purpose of Part IIA and the concept of sustainability which is found in it. If that is right then "have regard to" in paras (b) and (c) can be given the same meaning in the following way. The "whether or not" matters in (b) and (c) are conditions precedent to reducing TACC. If, in para (b) other control methods or Crown quota can take the amount of fish caught down to its new level, then there can be no reducing TACC. If those actions cannot take the amount of fish down sufficiently then the degree of shortfall defines the reduction in TACC to be made.

44. If I am right on the meaning of "having regard to" in s28D(1) then the Minister's statutory duty is to

(a) consider the opinions of his Ministry's experts,

(b) consider the opinions of outside experts,

(c) consider the ideas of those whom he must consult, on what is the MSY, and then

(d) derive the TAC and TACC from it.

But TAC, let alone TACC, cannot exceed MSY for the reasons stated much earlier in this opinion.

45. Although there is no duty to set TACCs for each fishing year (s280B(3) indicates that TACCs may be set for more than one year), there may be a duty to vary TACCs for any given year. Since the purpose of Part IIA (see paragraph 26 above) is to maintain a fishery at the level to provide MSY, there is considered to be a duty to vary TACCs when the evidence is that the present TACCs will not achieve MSY. This is so whether a TACC is above or below that for MSY. Equally, this will be so where the evidence shows that MSY will be better achieved by splitting a TACC or consolidating several TACCs into one.

46. The evidence may be such as to be clear on the point, or it may be ambiguous. The clearer the evidence, the more likely it is that there is a particular duty to vary TACCs.

47. It can be seen now why it has been necessary to take the stage-by-stage analysis that has been undertaken. The exact point of argument has to be put in context and given a firm statutory content. It should also be said that the conclusion in paragraph 44 was not reached and then the reasoning fitted in. Rather, I started out with no idea where I would end on the point of argument when it was reached.

RELATIVE LACK OF INFORMATION

48. In a situation of full knowledge, the size of a fishing stock and many of the other factors relevant to determining MSY would be known. But even then, like economics, there would still be room to argue about what changes in particular factors mean and what their consequences may be. Here there is very incomplete knowledge, and what there is is usually based on extrapolation from limited observations, the limits of which might not even be precisely known. This does not alter the Minister's legal duty. It does not convert an exercise of judgment of probable fact into a discretion. What it does do is make that finding of probable fact more difficult and contentious. It means that the preference for one interpretation of the knowledge of a factor over another can seldom be said to be wrong or unlawful.

49. In these circumstances, the purpose of Part IIA and the context of determining MSY, TAC and TACC become crucial. The purpose is to maximise sustainable yield, sustainability being constant yield over a long term. Sustainable yield cannot be maximised if yield exceeds renewal, other than by occasional "blips". MSY must therefore be set conservatively and increased gradually if that is indicated as knowledge grows, rather than be set liberally and reduced gradually if that is indicated as knowledge grows. The former may take time to maximise sustainable yield. The latter can never maximise sustainable yield unless the first, liberal MSY is objectively correct.

50. This does not mean that the most conservative interpretations of factors and MSY must be accepted. That would be to downgrade "maximum". Rather, probabilities of correctness must be assessed and a conservative choice made among them.

THE 1989 ACCORD

51. The 1989 accord is enbodied partly in ss28OB to OO, and partly in some other oral or written accord which I have not seen. Different considerations apply to each.

52. Sections 28OB to OO permit reductions of quota with payment of compensation if this is done in any of the five fishing years 1989–90 to 1993–94. It is to be expected that Government would take the amount of compensation it would have to pay into consideration and seek to avoid reducing TACC until 1994–95. Generally, the fiscal effect of exercise of power and the financial position of the decisionmaker, are relevant factors – Waters v Public Transport Corporation (1991) 163 CLR 513 (HCA) unless the relevant factors are enumerated exclusively. The situation is different where there is an entitlement – Wahrlich v Bate [1990] 3(NZLR)97. I am not aware of a case close to the present, but it is noted that compensation does not require separate appropriation – s2800. If the setting of TACC to achieve MSY is the dominant purpose of Part IIA, as I consider it to be, then the Minister's statutory duty cannot be deflected by financial considerations: to revert to the preceding section, to do so would be to prevent MSY being achieved.

53. The non–legislative accord involves, I understand from the material, an expectation that TACC would be reduced by no more than 5,000 tonnes a year up to 1993–94. In so far as this means that the Minister thinks he should rule out a greater reduction, it is an unlawful fettering of his power. In so far as it means that the Minister does not independently determine MSY and arrive at his actions from there, the Minister goes against the statutory purpose, fails to ask himself the right question, and acts unlawfully. All that this non–legislative accord can lawfully do is to require the Minister to give the industry a fair hearing on whether the TACC should be reduced by more.

VALIDITY OF THE MINISTER'S DECISION

54. If the interpretations of MSY, TAC and TACC advanced in this opinion are correct, there appear to be several errors in the Minister's 1991–92 decision. First, the advice that he had a discretion in fixing TACC was wrong. In so far as his decision was made applying that advice, it was unlawful. Secondly, the advice that he could move from an over–MSY take down to MSY in stages over time was wrong. In so far as he acted on that advice his decision was unlawful. Thirdly, the advice was that 8,000

tonnes was the maximum that could be taken yet still leave the fishery with a better than even chance of surviving, MSY was substantially lower. In so far as the Minister accepted that view but fixed a TACC starting from a higher figure than 8,000 tonnes, the decision was unlawful. Fourthly, if the Minister determined that TAC/MSY was over 23,787 tonnes as he must have to fix a TACC of that amount, there was nothing that I have read to support that. There may have been something before him which I have not seen which would support that determination, but, if not, the determination was unreasonable and the resulting TACC unlawful.

IMPLICATIONS FOR THE FUTURE

55. The TACC must obviously be set in the correct way. This requires consideration of the three questions left unanswered to this point: What is long term? What is the correct fish stock on which MSY should be based? Over what period should stock move to that level?

56. Prima facie, "sustainable" means indefinitely and precludes a "fish to extinction" approach even over a long period. However, conditions for renewal change and at present they cannot be predicted. Taking the information I have read, that orange roughy live 80 years and are recruited from juvenile (not-takable) to adult (takable) stages after 20 years, it would seem that sustaining over 5 generations (100 years) would provide sufficient probability of indefinite sustainability to give a working time frame. Because environmental and other changes over 100 years cannot be predicted, an assumption would seem necessary to arrive at a working MSY, namely, that conditions remain the same. Climate change affecting breeding patterns and levels, new predation, etc, would warrant a new MSY and TACC.

57. Prima facie and in theory, the virgin fish stock provides the MSY. If it is true that a lower stock increases renewal rate, then a lower stock figure provides the MSY if virgin F x R is less than (a particular lower F)xR.

58. The other consequence for the future is that TACC will need to be lowered substantially, as it must be lower than a yield based on current fish stock to allow natural increase and increasing yield until MSY is reached, ie. more fish must enter the catchable stock each year than are caught. How much lower depends on how far below stock level to provide MSY current stock is, and the period over which the increase is to take place. The Act gives no indication of what that period should be. It assumes that a correct or close to correct TACC is fixed initially. There would seem, therefore, to be a substantial width of discretion and it would be very difficult to say that a rebuilding period of even, say, 50 years, was unreasonable. Obviously, the smaller the planned excess of fish entering the catchable stock over those caught, the greater the chance that there will in fact be a deficit. Since deficit is forbidden by the Act, TACC must be set with a comfortable safety margin to be sure there is an excess. There may be scientific opinion which would shed light on this.

59. The preceding paragraphs of this section related to the 1991–92 decision. At the time of revision of this opinion, the TACC for 1992–93 had been set, though it may be varied under s280B before 1 October 1992. On the material I have read relating to the 1992–93 TACC, both decisions are (based on the interpretation proposed here) clearly unlawful.

60. The TACC, for 1992–93 is fixed for the whole of the fishing year. However, with other limits such as those used in relation to Banks Peninsula By–Catches may within limits be used to ameliorate the situation of an excessive TACC. What those limits are cannot be determined in the abstract. In any event, should the TACC be held to be unlawful in litigation, there would be an urgent need for an amendment to the Act to allow a new TACC to be determined for the remainder of the year. The possibility of legislation authorising a change of TACC in mid year is another possibility.

LITIGATION

61. The initial hurdle for the environmental group which may seek judicial review is standing. Environmental groups have standing in planning and related matters because of particular, wide provisions granting them

standing. At common law an "intellectual or emotional" interest (which is what environmental groups have in an issue such as this) does not confer standing – Australian Conservation Inc v Commonwealth (1980) 146(CLR)493. Recently, Tipping J in O'Neill v Otago Area Health Board (HC – Dunedin, CP50/91, 10 April 1992) suggested that any person with an honest interest in an issue would have standing, but his full formulation contained an internal inconsistency and ACF does not appear to have been cited to him. It must therefore be regarded as doubtful whether the group would have standing.

62. In summary, the group would have an uphill fight to succeed.

CONCLUSION

63. The fish are caught for most of 1991–92 and a TACC declared for 1992–93. In my opinion, the most effective strategy is to seek a declaration on the meaning of TACC, TAC, MSY and the related aspects of statutory interpretation.

GDS Taylor
Wellington
28 October 1992

3.3 Significant issues

Taylor has identified a number of areas where there remains a difference of opinion with MAF legal advisers.

Relationship of TAC to MSY

In paras. 36 and 44 of his Opinion, Taylor states that TAC may not exceed the MSY for the fishery.

The focus for the Opinion is a fishery which has been subject to overfishing, and which is now in deficit. In such a situation TAC should not be set at a level in excess of the MSY. If it is, the purpose of Part IIA, i.e. maintenance of the stock at a level for MSY, will not be achieved.

Taylor notes at para. 45 that in the opposite situation, where TAC/TACC is below the level that would produce the MSY from the fishery, there is also a duty to vary the TACC, and it may be that in a virgin fishery, where the stock is above that for the MSY, the TAC could well exceed the MSY.

As Taylor says at para. 49, TAC should be estimated conservatively and increased gradually if further research confirms that the yield policy is moving the stock to a level which will produce the MSY.

Caution needs to be exercised because it is by no means certain that the orange roughy fishery will be closest to achieving the MSY at about 33% of virgin biomass.

Where a fish stock is at or below the level which will produce the MSY, TAC - let alone TACC - may not exceed the MSY for the rebuilt stock.

Legality of phased reductions

Phased reductions to TACCs could move the stock towards the level at which the MSY could be achieved over time. The Minister of Fisheries has been advised by his officials that the definition of TAC, as the amount of fish which will produce the MSY from the fishery, allows him to do this.

Phased reductions were introduced under the 1989 Accord. The Minister agreed with the fishing industry that he would reduce the ORH 3B TACC by no more than 5,000 tonnes a year up to 1993/94. In fact, only the first reduction of 4,000 tonnes was implemented.

Taylor's view is that an agreement such as the 1989 Accord is unlawful to the extent that it can (and did) preclude the Minister from making reductions of more than 5,000 tonnes per year, if, on the basis of scientific advice, greater reductions were called for.

In another scenario the Minister might initiate a programme of reductions over a number of years, taking into account the scientific advice as to the state of the fishery stock, advice on rebuilding periods, and qualifying factors, including economic factors. Provided the programme of reductions means that the TAC is not set above the sustainable yield from the current biomass, that it allows a greater than even chance of rebuilding, and that the Minister adjusts the programme in light of scientific advice, there is no objection.

Phased reductions which are consistent with scientific advice and which effectively move the stock to the state at which the MSY can, in time, be achieved, do appear to be permitted.

However, if the intention is to limit the possible size of reductions, which would have the advantage of producing greater certainty for the industry, Taylor's view is that the current Act does not allow for this. Changes to the legislation would be needed if the Minister wishes to use the latter type of phased reduction.

Compensation for quota holders

Taylor addresses this issue at para. 52 and refers to sections 28OB to 28OO, which were inserted by the 1990 Amendment.

Taylor concludes that fiscal considerations are not relevant to the TACC decision where the legislation has provided for compensation. Compensation liability should not have been a factor which prevented the Minister from reducing the TAC/TACC for the 1991/92 fishing year.

From the legislation it is not possible to predict what level of TACC reduction, leading to a quota reduction, would have rendered the Crown liable to pay compensation. However, it appears that current levels of TACC reductions do render the Crown liable to compensate quota holders.

4 MANAGEMENT OF THE CHATHAM RISE ORANGE ROUGHY FISHERY

4.1 The fishery assessment plenaries

During April and May each year MAF Fisheries (Research) convenes Fishery Assessment Plenary sessions to critically review the stock assessment information. This is a workshop approach involving MAF scientists, representatives from the Fishing Industry Board, Maori and conservation interests working as Groups on the various fish stocks.

The Terms of Reference for the Groups, as set out in the 1992 Report (Annala, 1992), are to calculate MSY for fish stocks in terms of CAY or MCY and estimate the possible long-term yield, to estimate possible errors and uncertainties, and to consider the effects of applying alternative management strategies.

The Groups also provide information on relevant factors used to define the TAC and on s.28D matters (i.e. Maori and non-commercial interests), and consider whether measures other than a TACC reduction could be used to maintain the fishery.

The result of the work is provided to MAF Policy (Fisheries) to give a basis for the advice given to the Minister of Fisheries. This information is also provided to user groups and is discussed during the consultation process.

The intention is to reach an agreed position or at least, if this is not possible, to put the information on the table, ensure an open discussion of available data and produce a public report which gives an information basis for the final TACC decision by the Minister.

This workshop approach has a great deal to recommend it, particularly if all parties can agree. Presumably this removes the need for parties to express their views separately to the Minister.

In 1991, however, agreement was not reached in the Assessment Working Group on Orange Roughy, and the Fishing Industry Board presented an alternative viewpoint on the status of the Chatham Rise Orange Roughy Fishery (Patchell and Birdsall, 1991).

4.2 Information and advice provided to the Minister

Since 1987 MAF scientists have advised the Fishery Assessment Plenaries and the Minister of Fisheries that a reduction in TACC for quota management area ORH

3B is needed if the MSY is to be achieved (refer Table 2). The fishing industry has challenged their interpretations of the data.

The areas of disagreement can be summarised under the following headings:

Representativeness of the survey box

The fishing industry has argued that the survey box identified by MAF scientists in 1982 is not representative of the Chatham Rise Orange Roughy Fishery. New aggregations and new stocks have been discovered; for example, the Puysegur Bank population during the 1990/91 fishing season.

MAF scientists point out that the hypothesis is not that all orange roughy spawn in the survey box but rather that the same proportion of the stock is continuing to spawn there each year, and that the survey box provides information on what is happening to the total fish stock at current TACC levels.

MAF scientists agree it is too early to say what are the implications of the discovery of aggregations of spawning orange roughy in other places.

However, scientists and fishers appear to agree that catch rates in the survey box are declining. MAF scientists consider this to be the result of fishing at current levels.

The "fishing down" phase

Age and growth surveys indicate that orange roughy mature slowly and probably do not enter the spawning population (and therefore are not likely to be caught) until at least 20 years of age. The fishing industry argues that new stock entering the fishery provide a buffering effect which has not yet been exhausted.

MAF scientists advise that the effect of younger age groups has been taken into account in assessments.

It appears the benefits of fishing a virgin population have already been exploited. Because fishing took place without much knowledge, the level for MSY (i.e. 33% of virgin biomass) was exceeded. The danger now is that the effects of over-fishing the stock will not be apparent for many years. There is a risk that the Puysegur Bank stock, and others which may be discovered, will be dealt with in the same way.

Catch levels not consistent with a "collapse" situation

Table 2 shows that high catches are still being taken from the Chatham Rise. However MAF scientists point out that this is consistent with fishing a spawning population and that fishers are having to take their catch earlier and from new

positions to maintain catch rates. It may take a relatively long time to reach a 'collapse' situation when fishing a spawning population. The risk is that the collapse will be sudden and may be irreversible. Scientists are also concerned that they have little information on the effect that fishing a spawning population has on renewal rates.

The result of the continued challenges to the scientific advice has put the fishery at risk. Scientists have estimated the chances of fishery collapse given a recommended quota reduction (see Table 2).

Scientists point out that significant gaps remain in our knowledge of orange roughy. In their 1991/92 advice to the Minister of Fisheries, policy advisers appear to suggest that uncertainties in the assessment mean that the Minister can use discretion as to the reliance that can be placed on the scientific advice on the MSY, and in setting the TAC and TACC.

Taylor points out that incomplete knowledge "does not convert an exercise of judgement of probable fact into a discretion". He says probabilities of correctness must be assessed and a conservative choice made among them. In the end, the MSY must be assessed on the best available scientific advice and the TAC and TACC derived from this.

It is appropriate in my view for the Minister to rely on his scientific advisors in MAF Fisheries (Research) for stock assessments.

Table 2: **The Orange Roughy Fishery (ORH 3B) 1986/87 to 1992/93: Scientific assessment, Ministerial decisions, and catch estimates** (all figures in tonnes)
Bold line indicates drop of population below 20% of estimated virgin biomass; fishery in serious decline.

Fishing Year	MAF SCIENTIFIC ASSESSMENT			MINISTERIAL DECISIONS		Est.Actual Catch [2]
	Est. B_o [3]	Fishery Collapse Risk [4]	Est. MSY tonnes [1]	TAC tonnes [5]	Change to TAC	
1978	100%					
1981/82				23,000		28,200 [6]
1984/85				30,000		29,340 [6]
1986/87				38,065	Agreed to reduce by 4000 t.	39,896
1987/88		TAC needs to be reduced by 50% to avoid collapse		38,065	No change to TAC. Quota swap agreed. 12,000 t, from Chatham Rise transferred to Challenger Plateau over 2 yrs.	31,478
1988/89	19%	Minimum safe level of B_o is 20%	15,300	38,300		42,621
1989/90		TAC needs to be reduced by 75% to avoid collapse	9,750	32,787	Cancellation of Crown quota. Quota reduction = 4000 t.	41,170
1990/91	16.7%	Reduction of 9000 t. = 19% risk	11,250	23,787	Reduction of 9000 t.	25,848
1991/92	15.0%	Reduction of 5000 t. = 54% risk in the next 5 years.	8,700	23,787	No change to TAC. 18,787 t. from Chatham Rise 5,000 t. from Puysegur Bank	28,038
1992/93	13.5%	Reduction of 5000 t. = 32% risk in the next 10 years. Considered TAC should be limited to 6,100 t.	5000-8000	21,300	14000 t. limit on Chatham Rise 5000 t. limit on Puysegur Bank Closure of main spawning ground	-

Notes to Table 2

1 **MSY - Maximum Sustainable Yield.** Calculation made on the basis that MCY = two-thirds MSY.

2 Total Reported catch plus estimated percentage of overrun (30% for 84/85, 86/87-89/90; 20% for 90/91-91/92; 15% for 92/93).

3 **B_0 = estimated virgin biomass.** The percentage of B_0 should remain between 20% and 80% for a healthy fishery. ***Levels below 20% are an indication the catches must be sharply reduced to allow the fish population to recover.*** Data from Fishery Assessment Meeting 1988, p.110, Francis et al. 1992, p.21 (previous estimate was 10.6% B_0); Francis and Robertson 1991, p.16; and Francis et al. 1992. p.17.

4 **Fishery "collapse" = recruited biomass less than TAC.** Catches continue to decline (e.g. MCY cannot be sustained). Data from Report from Fishing Assessment Plenary 1990, pp. 114-116; Francis and Robertson 1991, Table 9, p.15 (at this stage **scientists also noted that current catch levels were only being sustained by discovery and exploitation of new areas);** and Francis et al. 1992, p.21.

5 **TAC - Total Allowable Catch.** TACC - Total Allowable Commercial Catch and is derived from TAC after making allowance for any Maori, recreational and international harvest. In this fishery there is only the commercial catch so TAC = TACC. Data source for 1986/87 to 1990/91: Francis et al. 1992 Table 1, p.3 (these are post-appeal not gazetted values); for 1991/92 no gazetted change; for 1992/93 gazette notice SR 1992/252 set a new TAC/TACC for ORH 3B.

6 Reported catch.

4.3 Reasons for the 1991/92 TAC/TACC decision

The Minister stated in his April 1992 letter to the Commissioner (Appendix 2) that the significant economic implications and adjustment costs to the fishing industry of a large reduction in the TACC were an important consideration in his decision not to reduce the TACC.

Economic factors may be used to qualify the TAC, but not to the extent that the TAC and TACC exceed the MSY. Economic implications for the industry cannot justify a TAC or TACC which exceeds MSY where the stock is below the level at which the MSY can be achieved.

It is unclear whether, as Taylor points out, the Minister accepted that the MSY for the current stock level was 8,700 tonnes. However no reasons other than the implications for the fishing industry have been put forward to explain a TAC/TACC of 23,787 tonnes for that year. Taylor concludes that the Minister's decision was unreasonable and the resulting TACC unlawful.

The concerns expressed by Greenpeace NZ Inc to the Commissioner have been found to be justified. The Minister's decision to maintain the TAC/TACC for the 1991/92 fishing year in the face of advice that the MSY was less than one-third of the current TAC/TACC is open to criticism. The decision raises concerns for the long term sustainability of the fishery.

5 CONCLUSIONS AND RECOMMENDATIONS

The focus of this investigation is the Crown's long-term management of the Orange Roughy Fishery in quota management area ORH 3B.

I find that successive Ministers have failed to respond appropriately as new scientific information on the state of the fishery has emerged.

The available evidence suggests the present catch rates for orange roughy from the Chatham Rise are not ecologically sustainable and, if continued, will no longer be economically sustainable. In addition, the genetic diversity of the population is at risk, which would further reduce sustainability.

Ministerial decisions on TACCs are crucial to the sustainability of the ORH 3B Orange Roughy Fishery. There are a number of possible scenarios for management of the fishery:

- An industry worth $145 million a year for the next four to five years, then no industry for the next twenty years. After this, the industry could only be resurrected if a viable spawning population remains.

- An immediate reduction in quota with compensation paid until 1994. This would result in a long-term smaller scale orange roughy fishery employing less capital and fewer people, but with a higher likelihood of long-term commercial sustainability.

- A phased reduction with compensation ceasing from 1 October 1994. This would mean more risk to the fishery but more time for the industry to move resources to other fisheries.

Having decided what the policy for sustainable management of a fishery will be, then the intent of that policy needs to be made quite clear in legislation. The present legal arguments then become irrelevant if the legislation is appropriately amended.

TO THE MINISTER OF FISHERIES

Ministerial decisions

According to one legal opinion, the basis for decision making provided by Part IIA of the Fisheries Act 1983 has not been applied. This is one reason why an important fishery is not being maintained on a sustainable basis.

The decisions on TAC/TACC for the Chatham Rise Orange Roughy Fishery in 1991/92 and 1992/93 were unlawful.

Recommendation

1 That legislative action is required to remedy the situation where an unlawful decision was made to set the TACC for quota management area ORH 3B at 21,300 tonnes for the 1992/93 fishing year.

Interpretation of TAC/TACC, MSY

The situation which leads to different legal interpretations of how the Minister may determine the TAC must be resolved.

Recommendation

2 That either a declaration is obtained from the High Court on the meaning of TACC, TAC, MSY and the related aspects of statutory interpretation,

and/or (preferably)

a working group is established to ensure present ambiguities are not carried forward into new fisheries legislation.

Determination of TAC/TACC

Changes to the fisheries legislation are needed to clarify the process and make explicit the requirement to derive the TAC/TACC from the MSY, and ensure that the MSY is not exceeded.

The Fisheries Act 1983 becomes an ineffective measure for achieving sustainable management of commercial fisheries if a Minister may disregard the TAC and its link with MSY in setting TACCs. Any scientific uncertainty over the MSY does not

give the Minister discretion to ignore the TAC. The reasons for the Minister's decisions should always be made public.

TAC is defined in the Fisheries Act 1983 as being qualified by any relevant economic or environmental factors, fishing patterns, the interdependence of stocks of fish and any generally recommended standards.

In setting the TACC for quota management area ORH 3B, the Fisheries Act 1983 requires that an assessment be based on the best scientific advice as to the MSY from the fishery. From this, the TAC, and thence the TACC, are to be derived.

In deriving the TAC, the effect of the relevant qualifying factors must be to modify the TAC by *reducing* the amount of fish which may be taken from the fishery.

Recommendation

3 That an amendment to the Fisheries Act 1983 is needed to :

(a) clarify that the TAC is the basis for the TACC; the TAC is not merely a matter for consideration in deriving the TACC and may not exceed the MSY;

(b) ensure that the Minister discloses the reasons for decisions on the TACCs.

Fishery Assessment Plenary

The Working Groups set up as part of the Fishery Assessment Plenary sessions are an excellent way to help resolve differences between the stakeholders. The Minister of Fisheries is to be commended for establishing a consultative process which attempts to identify and if possible reconcile the views of commercial and non-commercial interests within the context of section 28D(2) of the Fisheries Act 1983. There is however a need to ensure that the MSY is set on the basis of the best assessment of the scientific information. Where agreement on interpretation of the scientific data cannot be reached, there is a case for Working Groups to be heard by an independent technical panel. The panel, after hearing all the evidence, would estimate the MSY for the fishery.

Recommendation

4 That an independent panel be appointed to hear the evidence and advise on the MSY for the fishery where the annual Fishery Assessment Plenary is unable to obtain agreement.

Phased reductions

The Fisheries Act 1983 does not provide for phased reductions where there is overfishing. Therefore merely reducing the TACC so as to give the fishery an improved chance of recovery is not in accordance with the purpose of Part IIA. The purpose of the quota management system is to maintain commercial fisheries at the level which will produce the (rebuilt stock) MSY. However, phased reductions which take account of scientific advice and which effectively move the stock to a level which will produce the MSY do appear to be lawful.

The phased reductions agreed to in the 1989 Accord would have lessened the risk to both the industry and the fishery if continued.

Recommendation

5 That provision be made in future legislation for phased reductions where initial stock assessments for new fisheries have been set too high.

Separation of stock

The issue is how best to achieve the MSY for the quota management area. The identification of separate stocks of orange roughy on the Chatham Rise and the Puysegur Bank within quota management area ORH 3B means the MSY should be assessed for each stock and separate TACs and TACCs set for each. This would lead to better management of each population and help ensure that fishing levels will not jeopardise the MSY.

The Fisheries Act 1983 does appear to allow the Minister to specify separate TACCs for separately defined parts of an existing quota management area in order to achieve the MSY for the whole area. However this would create difficult legal and administrative problems associated with existing property rights and any attempt to split them.

Recommendations

6 That Quota Management Area ORH 3B be reviewed and a separate Quota Management Area established for the Puysegur Bank Fishery.

7 That the problems relating to setting separate TACs and TACCs for each stock are resolved in future legislation.

Fisheries research

Management of fisheries within a quota system based on an assessment of MSY requires extensive information. Management systems based on research findings will only be as good as the information provided. This is largely dependent on retention of a deepwater research vessel. Research funding needs to reflect the needs of the TAC/TACC system.

Exploitation of orange roughy fisheries should not continue at current levels so long as major gaps in knowledge about biomass and rates of aging remain, and agreement cannot be reached as to the MSY.

Recommendation

8 That sufficient funding for research to eliminate gaps in scientific knowledge is ensured so that the quota management system has an adequate information basis for decision making.

9 That the scientific observer programme be extended to achieve full coverage of the orange roughy fishery and improve the accuracy of assessment of overruns, and thus improve the procedure for setting TACCs.

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APPENDICES

1 Letter from Minister of Fisheries dated 23 April 1992
2 Correspondence with the Minister of Fisheries August/September 1992
3 Guide to Biological Reference points for the 1992 Fisheries Assessment Meetings

APPENDIX I

Office of
THE MINISTER OF FISHERIES
Wellington, New Zealand

23 April 1992

Helen R Hughes
Parliamentary Commissioner for the Environment
P O Box 10-241
WELLINGTON

Dear Commissioner

I refer to your letter of 19 March 1992 regarding the management of orange roughy fisheries.

In September 1991 I announced the changes to total allowable commercial catches (TACCs) for the 1991/92 fishing season. One of my decisions was to maintain the Chatham Rise orange roughy (ORH 3B) TACC at 23 787 tonnes. In making this decision I had regard to my legal obligations, the most recent scientific information, and the views expressed by user groups in the consultation process.

As part of the annual TACC review process, the latest stock assessment information was presented and reviewed at the Stock Assessment Working Group and plenary meetings. In the case of ORH 3B, some contention arose between the fishing industry and MAF regarding how appropriate the survey box was in representing the whole fishery. The industry argued that the survey box did not fully represent the total spawning activity of the stock, and therefore the stock assessment gave a conservative estimate of the stock size. The industry supported this view by stating that their catch rates were inconsistent with the conclusions of the stock assessment.

An important consideration in my decision was the significant economic implications and adjustment costs to the industry of a large reduction in the ORH 3B TACC. My decision was contingent upon three commitments from the fishing industry for the 1991/92 fishing year. The first was an undertaking to transfer 5 000 tonnes of fishing effort to a recently discovered fishing ground in the south of the ORH 3B quota management area. Secondly, the industry has agreed to carry out a further research cruise, involving MAF Fisheries scientific staff, in the southern areas of ORH 3B to help determine the size of the new stock and to search for other orange roughy concentrations. Thirdly, the industry agreed to reduce fishing effort on the spawning aggregations of Chatham Rise orange roughy by transferring effort away from the survey box used in the stock assessment.

I have been in contact with the fishing industry to ensure that these commitments are fulfilled. I believe that the measures will spread fishing effort and allow a recovery of the Chatham Rise stock.

Yours sincerely

Hon D L Kidd
Minister of Fisheries

APPENDIX II

FILE COPY

Office of the
PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT
Te Kaitiaki Taiao a Te Whare Pāremata

27 August 1992

File Ref : CZM 6/3

Hon. Doug Kidd
Minister of Fisheries
Office of the Minister of Fisheries
Parliament Buildings
WELLINGTON

Dear Mr Kidd

Re : Investigation into the Crown's Management of the Chatham Rise Orange Roughy Fishery

Further to my letter of 19 March 1992 in which I advised that I was carrying out an investigation into the Crown's management of the Chatham Rise Orange Roughy Fishery, and into the setting of the TAC/TACCs for the 1991/92 fishing season, I confirm that I intend to table my Report in the House early in October 1992. Attached is a copy of the investigation Terms of Reference for your information.

My investigation has, to date, identified a number of serious deficiencies in the approach taken by MAF (Policy) Fisheries in providing advice to you. It is also critical of your decision last year to maintain the TAC/TACC for orange roughy for quota management area ORH 3B at 23,787 tonnes. The Report is however commendatory of the work of fishery scientists, and endeavours to provide advice to improve fisheries management.

The findings at this stage are preliminary because it is my practice to submit the Report to any parties which are the subject of the Report for them to check factual accuracy, and to comment on the findings. The Report will also be peer reviewed before being finalised.

This Report arises out of the December 1990 Joint Report by the Controller and Auditor-General and my Office on Marine Fisheries Management, and further representations to my Office expressing concern about the Crown's management of the Chatham Rise orange roughy fishery. Concerns were expressed that the TACCs set for the fishery were at levels considerably above the maximum sustainable yield, and that the provisions of Part IIA of the Fisheries Act 1983 was being incorrectly interpreted and applied.

5th Floor, 163 The Terrace, PO Box 10-241, Wellington, New Zealand *Telephone: 0-4-471-1669 Fax 0-4-471-0331*

On the basis of my inquiries, and a legal opinion, I have reached the initial conclusion that the concerns are justified.

While it is too late to do anything about the 1991/92 fishing season, I understand that you are soon to announce quota levels for 1992/93. In view of this I consider it appropriate that I bring the following findings and recommendations to your attention at this stage.

1. That there is an ambiguity in section 28D(1)(a) as to whether the requirement to **"have regard to"** the TAC means that the Minister of Fisheries has a discretion when setting a TACC to base his decision on the TAC. In view of the purpose of Part IIA, the Minister of Fisheries does not have a discretion; under the Fisheries Act, the TACC is based on the TAC, which in turn is derived from the MSY.

2. The advice I have received is that even taking into account economic implications and adjustment costs to the fishing industry, TAC and TACC levels cannot exceed the MSY.

3. The Fisheries Act makes no provision for phased reductions. That this is a situation of incomplete knowledge does not make the setting of TACCs into an exercise of discretion. Rather it is a matter of acting on the best available scientific advice as to what the MSY for the stock is, and setting the TACC on that basis.

As I said I would do, a copy of the draft Report, including the legal opinion, will be sent to Mark Edwards in the Ministry of Agriculture and Fisheries (Policy) Fisheries, for comment, next week.

I appreciate the shortness of time between now and the commencement of the 1992/93 fishing season, but urge you to ensure that appropriate procedures are followed for setting the TACC levels for the coming fishing year.

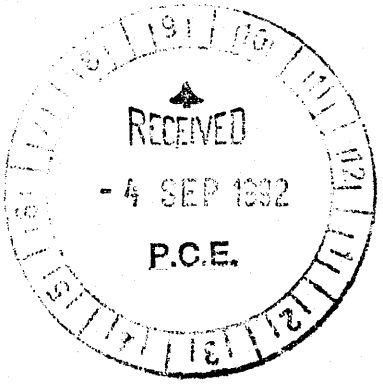
Yours sincerely

Helen R. Hughes

Helen R Hughes
Parliamentary Commissioner for the Environment

Office of
THE MINISTER OF FISHERIES
Wellington, New Zealand

2 September 1992



Helen Hughes
Parliamentary Commissioner for the Environment
P O Box 10-421
WELLINGTON

Dear Helen Hughes

I refer to your letter of 27 August concerning your investigation into the Crown's management of the Chatham Rise orange roughy fishery.

You are correct that decisions on TACC adjustments, including orange roughy, will soon be announced. The new TACCs will appear in the Gazette on 3 September and I do not intend to delay that notice. However, I think you may have less concern for the orange roughy stock in ORH 3B as a result of my recent decisions.

I have carefully considered the conflicting advice I have received on the stock status for ORH 3B. I have made an overall TACC reduction to 21 300 tonnes on the basis that the QMA contains more than one stock of orange roughy and fishing pressure on the more stressed areas can be alleviated by spreading effort. I will take steps to divide the catch taken in ORH 3B into a number of areas.

I will address my concerns about fishing pressure on the Rise by stopping fishing in the "spawning box", the major concentration of fishing on the Rise in the past. I will also restrict the take on the South and East Rise and divert effort to the NW Rise which has supported higher catches in the past.

Exploratory fishing is an important component in the future of orange roughy fishing. In recent years the industry has established fisheries on the Puysegur and off Timaru. The available information suggests these areas have a limited capacity, so I will place constraints on the level of fishing in these areas. However, I want to encourage industry to extend their exploratory fishing into the vast area south of 46^0 S. Hence I will make an allocation of catch for this area.

I have been disturbed during my discussions with affected parties over the uncertainty and conflicting views on the state of the orange roughy resource on the Rise. The industry intends to assist in a considerable improvement in this situation through the use of their consultants. Their documented views should be available for consideration during the working group and plenary process next year. I hope that these consultants will also work with the MAF scientists in determining the facts on which they can agree.

I look forward to receiving your report on the management of the ORH 3B fishery. I will be interested to discuss your interpretation of the information and views on recent decisions for this fishery.

Yours sincerely

Hon D L Kidd
Minister of Fisheries

GUIDE TO BIOLOGICAL REFERENCE POINTS FOR THE 1992 FISHERIES ASSESSMENT MEETINGS

The aim of this document is to define commonly used terms, explain underlying assumptions and describe the biological reference points used in the 1992 Fisheries Assessment Meetings and their associated documents. Methods of estimation appropriate to various circumstances are given for two levels of yield: Maximum Constant Yield (*MCY*) and Current Annual Yield (*CAY*). The relevance of these to the setting of Total Allowable Catches (TACs) is discussed.

Definitions of *MCY* and *CAY*

The Fisheries Act (1983) defines Total Allowable Catch in terms of maximum sustainable yield (*MSY*). The definitions of the biological reference points, *MCY* and *CAY*, derive from two ways of viewing *MSY*: a static interpretation and a dynamic interpretation. The former, associated with *MCY*, is based on the idea of taking the same catch from the fishery year after year. The latter interpretation, from which *CAY* is derived, recognises that fish populations fluctuate in size from year to year (for environmental and biological, as well as fishery, reasons) so that to get the best yield from a fishery it is necessary to alter the catch every year. This leads to the idea of maximum average yield (*MAY*) which is how fisheries scientists generally interpret *MSY* (Ricker 1975).

The definitions are:

> *MCY* - Maximum Constant Yield
> The maximum constant catch that is estimated to be sustainable, with an acceptable level of risk, at all probable future levels of biomass.

and

> *CAY* - Current Annual Yield
> The one-year catch calculated by applying a reference fishing mortality, F_{ref}, to an estimate of the fishable biomass present during the next fishing year. F_{ref} is the level of (instantaneous) fishing mortality that, if applied every year, would, within an acceptable level of risk, maximise the average catch from the fishery.

Note that *MCY* is dependent to a certain extent on the current state of the fish stock. If a stock is fished at the *MCY* level from a virgin state then over the years its biomass will fluctuate over a range of levels depending on environmental conditions, abundance of predators and prey, etc. For stock sizes within this range the *MCY* remains unchanged (though our estimates of it may well be refined). If the current state of the stock is below this range the *MCY* will be lower.

The strategy of applying a constant fishing mortality, F_{ref}, from which the *CAY* is derived each year is an approximation to a strategy which maximises the average yield over time. For the purposes of this document the *MAY* is the long-term average annual catch when the catch each year is the *CAY*. With perfect knowledge it would be possible to do better by varying the fishing mortality from year to year. Without perfect knowledge, adjusting catch levels by a *CAY* strategy as stock size varies is probably the best practical method of maximising average yield. Appropriate values for F_{ref} are discussed below.

What is meant by 'an acceptable level of risk' for *MCY*s and *CAY*s is intentionally left undefined here. For most stocks our level of knowledge is inadequate to allow a meaningful quantitative assessment of risk. However, we have two qualitative sources of information on risk levels: the

experience of fisheries scientists and managers throughout the world, and the results of simulation exercises such as those of Mace (1988a). Information from these sources is incorporated, as much as is possible, in the methods given below for calculating *MCY* and *CAY*.

It is now well known that *MCY* is generally less than *MAY* (see, e.g., Doubleday 1976, Sissenwine 1978, Mace 1988a). This is because *CAY* will be larger than *MCY* in the majority of years. However, when fishable biomass becomes low (through overfishing, poor environmental conditions, or a combination of both), *CAY* will be less than *MCY*. This is true even if the estimates of *CAY* and *MCY* are exact. The following diagram shows the relationships between *CAY*, *MCY* and *MAY*.

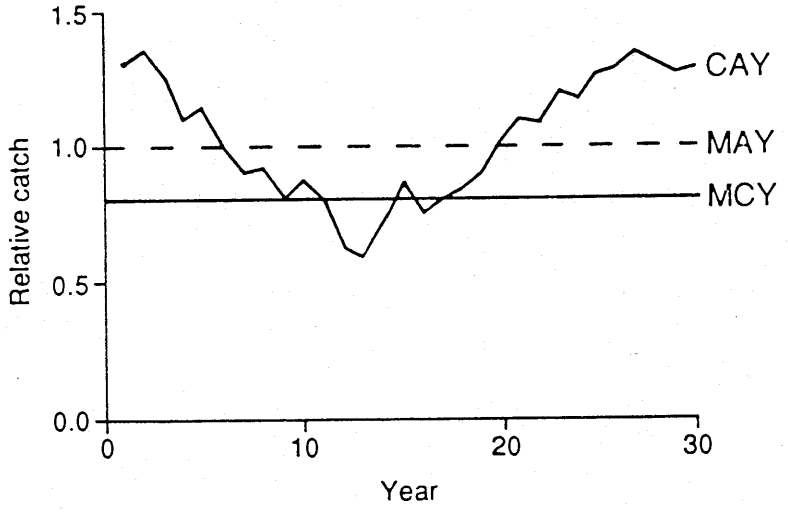


Figure 1. Relationship between *CAY*, *MCY* and *MAY*.

In this example *CAY* represents a constant fraction of the fishable biomass, and so (if it is estimated and applied exactly) it will track the fish population exactly. *MAY* is the average over time of *CAY*. The reason *MCY* is less than *MAY* is that *MCY* must be low enough so that the fraction of the population removed does not constitute an unacceptable risk to the future viability of the population. With an *MCY* strategy, the fraction of a population that is removed by fishing increases with decreasing stock size. With a *CAY* strategy, the fraction removed remains constant. A constant catch strategy at a level equal to the *MAY*, would involve a high risk at low stock sizes.

Relationship Between *MCY*, *CAY*, TAC and Total Allowable Commercial Catch (TACC)

The TAC covers all mortality to a fish stock caused by human activity, whereas the TACC includes only commercial catch. *MCY* and *CAY* are reference points used to evaluate whether the current stock size can support the current TACC. It should not be assumed that the TACC will be equal to either one of these yields. There are both legal and practical reasons for this.

Legally, we are bound by the Fisheries Act (1983). Firstly, 'relevant economic or environmental factors, fishing patterns, the interdependence of stocks' as well as 'Maori, traditional, recreational, and other non-commercial interests' must be taken into account before setting a TACC. Secondly, the fact that the TACC is higher than the *MCY* or *CAY* is not in itself sufficient reason to lower the TACC. When ~~determining or~~ varying any TACC the Minister shall have regard to "(i) whether or not the imposition of other controls . . . on the taking of fish would be sufficient to maintain the fish stock at a level where the current total allowable commercial catch could be sustained; and (ii)

whether or not a reduction in the level of fishing could be achieved by the Crown's retaining or obtaining the right to take fish under any appropriate quota and not making those rights available for commercial fishing."

From a practical point of view it must be acknowledged that the concepts of *MCY* and *CAY* are directly applicable only in idealised management regimes. The *MCY* could be used in a regime where a catch level was to be set for once and for all; our system allows changes to be made if, the level is found to be too low or too high. With a *CAY* strategy the yield would probably change every year. Even if there weren't the above legal impediments to following a *CAY* strategy the fishing industry's desire for stability may be a sufficient reason to make TACC changes only when the need is pressing.

Natural and Fishing Mortality

Before describing how to calculate *MCY* and *CAY* we must discuss natural and fishing mortality, which are used in these calculations. Both types of mortality are expressed as instantaneous rates (thus, over n years a total mortality Z will reduce a population of size B to size Be^{-nZ}, ignoring recruitment and growth). Units for mortalities are 1/year.

Natural mortality

Methods of estimating natural mortality, M, are reviewed by Vetter (1988). When a lack of data rules out more sophisticated methods, M may be estimated by dividing $\log_e 100$ by the maximum age observed in the unexploited (or lightly exploited) population. This method, which assumes that the maximum age is reached by about 1% of each cohort, gives results very similar to the empirical estimates of Hoenig (1983).

Reference Fishing Mortalities

Reference fishing mortalities in widespread use include $F_{0.1}$, F_{msy}, F_{max}, F_{mey}, and M.

The most common reference fishing mortality used in the calculation of *CAY* (and, in some cases, *MCY*) is $F_{0.1}$ (pronounced 'F zero point one'). This is used as a basis for fisheries management decisions throughout the world and is widely believed to produce a high level of yield on a sustainable basis (Mace 1988b). It is estimated from a yield per recruit analysis as the level of fishing mortality at which the slope of the yield-per-recruit curve is 0.1 times the slope at $F = 0$. If an estimate of $F_{0.1}$ is not available an estimate of M may be substituted.

F_{max} is the fishing mortality that produces the maximum yield per recruit. It may be too high as a target fishing mortality because it does not account for recruitment effects (e.g. recruitment declining as stock size is reduced). However, it may be a valid reference point for those fisheries that have histories of sustainable fishing at this level.

F_{msy}, the fishing mortality corresponding to the deterministic *MSY*, is another appropriate reference point. F_{msy} may be estimated from a surplus production model, or a combination of yield per recruit and stock recruitment models.

When economic data are available it may be possible to calculate F_{mey}, the fishing mortality corresponding to the maximum (sustainable) economic yield. F_{mey} is always less than F_{msy}. (NB strategies that maximise the net present value of the catch do not necessarily lead to the *MEY*.)

Every reference fishing mortality corresponds to an equilibrium or long-run average stock biomass. This is the biomass which the stock will tend towards or randomly fluctuate around, when the reference fishing mortality is applied constantly. The fluctuations will be caused primarily by

variable recruitment. It is necessary to examine the equilibrium stock biomass corresponding to any candidate reference fishing mortality. A reference fishing mortality which corresponds to a low stock biomass may be undesirable if the low biomass would lead to an unacceptable risk of stock collapse. For fisheries where this applies a lower reference fishing mortality may be appropriate.

Natural Variability Factor

Fish populations are naturally variable in size because of environmental variability and associated fluctuations in the abundance of predators and food. Computer simulations (e.g. Mace 1988a) have shown that, all other things being equal, the ***MCY*** for a stock is inversely related to the degree of natural variability in its abundance. That is, the higher the natural variability, the lower the ***MCY***.

The natural variability factor, ***c***, provides a way of incorporating the natural variability of a stock's biomass into the calculation of ***MCY***. It is used as a multiplying factor in method 5 below. The greater the variability in the stock, the lower is the value of ***c***. Values for ***c*** should be taken from the table below and are based on the estimated mean natural mortality rate of the stock. It is assumed that because a stock with a higher natural mortality will have fewer age-classes it will also suffer greater fluctuations in biomass. The only stocks for which the table should be deviated from are those where there is evidence that recruitment variability is unusually high or unusually low.

Natural mortality rate ***M***	Natural variability factor ***c***
<0.05	1.0
0.05–0.15	0.9
0.16–0.25	0.8
0.26–0.35	0.7
>0.35	0.6

Methods of Estimating *MCY*

It should be possible to estimate ***MCY*** for most fish stocks (with varying degrees of confidence). For some stocks, only conservative estimates for ***MCY*** will be obtainable (e.g., some applications of Method 4) and this should be stated. For other stocks it may be impossible to estimate ***MCY***. These stocks include situations in which: the fishery is very new; catch or effort data are unreliable; strong upwards or downwards trends in catch are not able to be explained by available data, (e.g., by trawl survey data or by catch per unit effort data).

When catch data are used in estimating ***MCY*** all catches (commercial, illegal, and non-commercial) should be included if possible. If this is not possible and the excluded catch is thought to be a significant quantity, then this should be stated.

The following examples define ***MCY*** in an operational context with respect to the type, quality and quantity of data available. Knowledge about the accuracy or applicability of the data (e.g., reporting anomalies, atypical catches in anticipation of the introduction of the Quota Management System) should play a part in determining which data sets are to be included in the analysis.

As a general rule it is preferable to apply subjective judgments to input data rather than to the calculated ***MCY***s. For example, rather than saying 'with the official catch statistics the ***MCY*** is ***X*** tonnes, but we think this is too high because the catch statistics are wrong' it would be better to say 'we believe (for reasons given) that the official statistics are wrong and the true catches were probably such and such, and the ***MCY*** based on these catches is ***Y*** tonnes'.

Background information on the rationale behind the following calculation methods can be found in Mace (1988a) and other scientific papers listed at the end of this document.

1. New fisheries

$$MCY = 0.25\ F_{0.1}\ B_0$$

where B_0 is an estimate of virgin recruited biomass. If there are insufficient data to conduct a yield per recruit analysis $F_{0.1}$ should be replaced with an estimate of natural mortality (M). Tables 1–3 in Mace (1988b) show that $F_{0.1}$ is usually similar to (or sometimes slightly greater than) M.

It may appear that the estimate of *MCY* for new fisheries is overly conservative, particularly when compared to the common approximation to *MSY* of $0.5MB_0$ (Gulland 1971). However various authors (including Beddington and Cooke 1983; Getz et al. 1987; Mace 1988a) have shown that $0.5MB_0$ often overestimates *MSY*, particularly for a constant catch strategy or when recruitment declines with stock size. Moreover it has often been observed that the development of new fisheries (or the rapid expansion of existing fisheries) occurs when stock size is unusually large, and that catches plummet as the accumulated biomass is fished down.

New fisheries become developed fisheries once F has approximated or exceeded M for several successive years, depending on the lifespan of the species.

2. Developed fisheries with historic estimates of biomass

$$MCY = 0.5F_{0.1}B_{av}$$

where B_{av} is the average historic recruited biomass, and the fishery is believed to have been fully exploited (i.e. fishing mortality has been near the level that would produce *MAY*). This formulation assumes that $F_{0.1}$ approximates the average productivity of a stock.

As in the previous method an estimate of M can be substituted for $F_{0.1}$ if estimates of $F_{0.1}$ are not available.

3. Developed fisheries with adequate data to fit a population model,

$$MCY = \tfrac{2}{3}\ MSY$$

where *MSY* is the deterministic maximum equilibrium yield.

This reference point is slightly more conservative than that adopted by several other stock assessment agencies (e.g. ICES, CAFSAC) that use as a reference point the equilibrium yield corresponding to ⅔ of the fishing effort (fishing mortality) associated with the deterministic equilibrium *MSY*. But it is in line with simulation results from Mace (1988a) showing that *MCY* may be as low as 60% of the deterministic *MSY*.

If the current biomass is less than the level required to sustain a yield of ⅔ *MSY* then

$$MCY = \tfrac{2}{3}\ CSP$$

where *CSP* is the deterministic current surplus production.

Simulation modelling which is currently being carried out may lead to a revision of the ⅔ factor for this method.

4. Catch data and information about fishing effort (and/or fishing mortality), either qualitative or quantitative, without a surplus production model.

$$MCY = cY_{av}$$

where c is the natural variability factor (defined above) and Y_{av} is the average catch over an appropriate period.

If the catch data are from a period when the stock was fully exploited (i.e. fishing mortality near the level that would produce *MAY*), then the method should provide a good estimate of *MCY*. In this case, $Y_{av} = MAY$. If the population was under-exploited the method gives a conservative estimate of *MCY*.

Familiarity with stock demographics and the history of the fishery is necessary for the determination of an appropriate period on which to base estimates of Y_{av}. The period chosen to perform the averaging will depend on the behaviour of the fishing mortality or fishing effort time series, the prevailing management regime, the behaviour of the catch time series, and the lifespan of the species.

The period should be selected so that it contains no systematic changes in fishing mortality (or fishing effort, if this can be assumed to be proportional to fishing mortality). Note that for species such as orange roughy, where relatively static aggregations are fished, fishing mortality cannot be assumed to be proportional to effort. If catches during the period are constrained by a TACC then it is particularly important that the assumption of no systematic change in fishing mortality be adhered to. The existence of a TACC does not necessarily mean that the catch is constrained by it.

The period chosen should also contain no systematic changes in catch. If the period shows a systematic upward (or downward) trend in catches then the *MCY* will be under-estimated (over-estimated). It is desirable that the period be equal to at least half the exploited life span of the fish.

5. Sufficient information for a stochastic population model.

This is the preferred method for estimating *MCY* but it is the method requiring the most information. It is the only method that allows some specification of the risk associated with an *MCY*.

The simulations in Mace (1988a) and Breen (1989) provide examples of the type of calculations necessary for this method. A trial and error procedure can be used to find the maximum constant catch that can be taken for a given level of risk. The level of risk may be expressed as the probability of stock collapse within a specified time period. At the moment MAF Fisheries has no standards as to how stock collapse should be defined for this purpose, what time period to use, and what probability of collapse is acceptable. These will be developed as experience is gained with this method.

Methods of Estimating *CAY*

It is possible to estimate *CAY* only when there is adequate stock biomass data. In some instances relative stock biomass indices (e.g., catch per unit effort data) and relative fishing mortality data (e.g., effort data) may be sufficient. *CAY* calculated by method 1 includes non-commercial catch. If method 2 is used and it is not possible to include a significant non-commercial catch, then this should be stated.

1. Where there is an estimate of current recruited stock biomass, *CAY* may be calculated from the appropriate catch equation. Which form of the catch equation should be used will depend on the way fishing mortality occurs during the year. For many fisheries it will be a reasonable approximation to assume that fishing is spread evenly throughout the year so that the Baranov catch equation is appropriate and *CAY* is given by

$$CAY = \frac{F_{ref}}{F_{ref} + M}(1 - e^{-(F_{ref} + M)})B_{beg}$$

Where B_{beg} is the projected stock biomass at the beginning of the fishing year for which the *CAY* is to be calculated and F_{ref} is the reference fishing mortality described above.

If most of the fishing mortality occurs over a short period each year it may be better to use one of the following equations:

$$CAY = (1 - e^{-F_{ref}})B_{beg}$$

$$CAY = (1 - e^{-F_{ref}})e^{-\frac{M}{2}}B_{beg}$$

$$CAY = (1 - e^{-F_{ref}})e^{-M}B_{beg}$$

where the first equation is used when fishing occurs at the beginning of the fishing year, the second equation when fishing is in the middle of the year, and the third when fishing is at the end of the year.

It is important that the catch equation used to calculate *CAY* and the associated assumptions are the same as those used in any model employed to estimate stock biomass or to carry out yield per recruit analyses. Serious bias may result if this criterion is not adhered to. The assumptions and catch equations given here are by no means the only possibilities.

The risk associated with the use of a particular F_{ref} may be estimated using simulations.

2. Where information is limited but the current (possibly unknown) fishing mortality is thought to be near the optimum, there are various "status quo" methods which may be applied. Details are available in Shepherd (1991), Shepherd (1984) and Pope (1983).

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