

REPORT ON UNDER-FISHING OF GREY MULLET (*Mugil cephalus*) IN QUOTA MANAGEMENT AREA 1

Over the last three years of the Quota Management System the TAC for grey mullet in QMA 1 has been under-caught (36.6% 1986/87; 20.2% 1987/88; 16.7% 1988/89).

It is possible that the under-catch is all or in part due to a decline in abundance of grey mullet and hence a reduction in its 'availability' to the commercial sector, if this is true then the current actual TAC for QMA 1 (970.2 t) is presently not biologically sustainable.

Alternatively, the consistent under-catch of the TAC in QMA 1 may be due to non-biological factors, that is, low market values and/or uneconomic fragmentation of available quota.

This report is an assessment firstly of catching and processing sector factors that could account for the under-catch of grey mullet in QMA 1, secondly of CPUE information for a key time series period in the grey mullet catch history.

Introduction

Grey mullet stocks occur primarily around northern areas of North Island, although the species occurs as far south as the Otago Peninsula. Commercial catches of grey mullet are taken mostly in the Auckland Fishery Management Area (QMA 1 [99.6%]).

Within QMA 1, the harbours, estuaries and rivers are the main commercial areas for grey mullet, principally; the Lower Waikato river, Manukau Harbour, Kaipara Harbour, Rangaunu Harbour, Bay of Islands, Whangarei Harbour, Hauraki Gulf and Firth of Thames.

Results from limited tagging studies undertaken in the Manukau Harbour and Lower Waikato River indicate that mullet are not localised and move between other west coast harbours and the coast. It is likely there is a reasonable degree of stock diffusion within QMA 1.

Grey mullet populations undergo spawning related migration and aggregation during spring and early summer, commercial catching peaks also correspond to these times.

Grey mullet is primarily a target fishery and is taken mostly by passive-net fishing methods. Grey mullet fishing operations are generally small scale, most grey mullet fishers are owner-operators and fish from small trailerable dory boats.

Netting practices and mesh restrictions for grey mullet limit the by-catch of other species. Similarly the species does not constitute a major by-catch component of other fisheries. Grey mullet may be considered a 'discrete' fishery.

Methods

A breakdown of grey mullet catch, relative to six quota-holding size categories (<1,000; 1,000-4,999; 5,000-9,999; 10,000-19,999; >20,000 kg) was extracted from the QMS for the 1988/89 fishing year. The quota-holding categories chosen were intended to represent a range of financial commitment to the fishery.

Unfortunately, historical quota-holding details are not retained in the QMS data system. In order to ascertain the actual quota available to individual fishers during the 1988/89 fishing year it was necessary to extract details of grey mullet quota transactions for the 1989/89 fishing year. Due to complex or ambiguous transactions some quota-holdings were too difficult to ascertain, these were excluded from the analysis and lumped into an 'untraceable' category.

Due to the effect of late returns, the actual catch of grey mullet in QMA 1 reported for the 1988/89 fishing year increased from 791.6 tonnes in February 1990 to 802.3 tonnes in April 1990. As a result, the under catch of grey mullet in QMA 1 is not as large as previously calculated but still marked (16.7%). In addition, QAA decisions since February 1990 have increased the actual TAC of QMA 1 from 963.4 to 970.2 tonnes.

A random group of fishers from each of the quota-holding categories were interviewed by phone as to their perception of the 'catchability' and 'marketability' of grey mullet. Care was taken not to 'lead' the interviewees, fishers were asked if they had any problems catching their quota and selling their catch, the responses they gave were volunteered. In addition, the top 5 Licensed Fish Receiver processors of grey mullet were also canvassed by phone.

Catch Per Unit Effort data for grey mullet fishers from Manukau Harbour and the Lower Waikato River and annual grey mullet catch levels from the Auckland Fishery Management Area, was obtained from a MAF Fisheries north report on the effects of commercial fishing in the Manukau Harbour ('Effects of Commercial Fishing on the Fisheries of the Manukau Harbour and Lower Waikato River' MAFFish North, March 1989). Graphically presented are mean CPUE (kg/100 M net) with 95% confidence intervals. For each year, two CPUE means are presented, one weighted by CATCH the other weighted by EFFORT.

Results

PROCESSING SECTOR

Based on interviews with grey mullet processors the following synopsis of the grey mullet market was compiled:

Grey mullet is a relatively low value species, on the domestic market the product averages between \$2.00 and \$2.50 a kilogram. On the export market the average value for grey mullet is between \$1.00 to \$1.50 a kilogram.

Domestically, grey mullet is sold whole fresh or frozen for bait.

Processors that process in excess of 20 tonnes of grey mullet per annum process approximately 70% of the annual grey mullet catch from QMA 1. Discussions with a representative group of these processors indicated that the market is at supply/demand equilibrium. They claim to occasionally advise fishers supplying them to 'hold off' catching mullet because of seasonal catch gluts, however, such gluts are usually only a few days in duration. The main processors also claim that some of the smaller receivers pay too much for mullet, as a result, price expectations within the fishing sector are higher than the bulk of the market is capable of paying.

It would appear that all mullet caught can be sold, but there is competition for the market dollar. Market competition would likely be highest between the smaller quota-holders (< 10 tonnes) because these fishers tend to fish more opportunistically, most larger operators have established secure outlets because they can offer regular supply.

CATCHING SECTOR

A breakdown of 'traceable' grey mullet holdings against catch in QMA 1 is given in Figure 1 and Table 1.

An interpretation of the grey mullet quota-holding categories is as follows:

Holdings of less than 1 tonne of quota do not constitute a serious involvement in the fishery.

Holdings between 1 and 5 tonnes are financially viable but mullet would represent only a small part of annual income.

Holdings between 5 and 10 tonnes would constitute a significant but minor source of annual income.

Holdings between 10 and 20 tonnes would constitute major sources of annual income.

Holdings in excess of 20 tonnes would warrant full time commitment to the fishery.

From Figure 1 it is apparent that under-fishing occurred consistently over all quota-holding categories less than 20 tonnes. Under-fishing by grey mullet fishers holding quota less than 20 tonnes was likely close to 26% in the 1988/89 fishing year. Based on the latest (April 1990) holding figures quota-holdings of less than 20 tonnes account for 67% of the TAC in QMA 1 (Table 2).

A break down of fishers by quota-holding category catching in excess of 95% of their holding, i.e. the number of fishers who were 'constrained' by their quota, is given in Table 3.

The results of phone interviews with fishers from each quota-holding category are presented in Table 2, fishers from a range of grey mullet fishing areas are represented in each category.

Catch and Effort information from the Manukau Harbour and Lower Waikato River (Figures 2 & 3) show a marked decline in CPUE occurred between the late 70s and early 80s with an inflection point corresponding to 1979. Comparing this trend to annual catch totals from the AFMA over the same period (Figure 4) indicates over-exploitation occurred when annual exploitation rose to approximately 700 tonnes. However, it is not known how representative fishing effort in the Manukau Harbour and Lower Waikato River, which are traditionally important grey mullet fishing areas, were of relative fishing effort over the AFMA, the indicated level of over-exploitation (700 tonnes) is therefore likely to be conservative, and it is not possible to calculate MCY from this data. It may be inferred from this analysis however, that annual yields in excess of 900 tonnes per annum represent considerable 'risk' to the fishery. After 1981 catch annual grey mullet catch levels rose and remained in excess of 900 tonnes until 1985. CPUE levels in the Manukau Harbour and Lower Waikato river during this period remained low but static.

Discussion

Two factors appear to explain the under-fishing of grey mullet in QMA 1 during the 1988/89 these are lack of availability of mullet and low market value. These two factors are not independent, for economic reasons fishers are encouraged to fish outside periods of peak abundance where the effects of reduced overall abundance are more likely to affect catch rates.

Competition on the local market for maximised economic return exists and encourages fishers to regulate fishing effort to avoid market over-supply. It would appear that some grey mullet fishers have a higher economic expectation from the fishery than the main market can sustain this may result in limiting effort in the fishery especially by smaller quota-holders who have other economic interests. Larger quota-holders have greater economic commitment and 'dedication' to the fishery and have established secure outlets.

Lack of mullet abundance was noted by just over half the fishers interviewed who held quotas less than 20 tonnes. It was consistent from the phone interviews that fishers who were not able or prepared to move around and fish a range of areas cited abundance problems and tended to under-fish their quota. Most of the fishers that did well in respect to their quota, notably the larger holders, were mobile, and fished a range of different localities. From this evidence we must accept that lack of abundance was a contributing factor to the 1988/89 grey mullet under-catch, although the degree of contribution cannot be determined.

Evidence that the actual TAC for Grey mullet in QMA 1 is not sustainable:

Catch Per Unit Effort information from two important grey mullet fishing areas within QMA 1 indicated that mullet abundance fell markedly when annual catch reached 700 tonnes.

The estimated MCY for grey mullet in QMA 1 is 825 tonnes.

From 1982 to 1985 the grey mullet stocks of QMA 1 were subject to annual exploitation levels higher than 900 tonnes, which, relative to two independent estimates of sustainable yield is excessive.

The TAC for grey mullet has been significantly under-caught for the last three years, and lack of abundance was found to be a contributing factor.

The conclusion is that the current actual TAC for grey mullet in QMA 1 (970 tonnes) is unrealistic in biological terms.

At present current annual exploitation of grey mullet are well below the actual TAC. However, 70% of quota-holders holding in excess of 20 tonnes (Table 3) were constrained (caught in excess of 95% of their holding) by their quota in 1988/89. This would indicate that the fishery was capable of fuller exploitation of the TAC should economic incentives encourage increased fishing effort. It will be necessary to control the exploitation of grey mullet by management measures we cannot rely in the long term on economic constraints to do this.

There are three explanations why abundance problems are evident in the grey mullet fishery at the present time, even though annual exploitation levels are currently below the MCY (825 tonnes). Firstly, the MCY estimate is possibly too high. Secondly, the stocks are still 'stressed' due to prolonged over-exploitation. Thirdly the fishery is targeted toward sub-optimal yield-per-recruit.

This third explanation is supported by age/growth and maturity data from the Manukau Report, which suggests that the present minimum mesh size for grey mullet is too selective of the smaller younger females. Net selectivity data collected for the Manukau report indicates better yield-per-recruit selection may be obtained from a mesh size of 90 mm. **This data has yet to be fully-analyzed.**

If yield-per-recruit can be optimised by an increase in minimum mesh size for grey mullet this will firstly allow better stock recovery and secondly constrain the fishery within the bounds of the estimated MCY. The implementation of a reduction in the TAC at the present may if pending analysis supports an increase in mesh size is desirable.

^{be unnecessary}
It is recommended that a Fisheries Assessment Research Document be produced that presents an analysis of Yield-Per-Recruit for the grey mullet fishery. Until the results of this FARD are assessed it is recommended that the TAC for grey mullet in QMA 1 remains unchanged.

Table 1 Grey mullet catch and holdings from QMA 1 during the 1988/89 fishing year.

Holding Category (kg)	No of Fishers Catching Quota	caught (kg)	held (kg)	% of Total Holdings Caught	%of TAC (963.4 tonnes)
< 1,000	29	5282	13100	40.32%	1.36%
1,000-4,999	33	51554	87300	59.05%	9.06%
5,000-9,999	27	143862	194200	74.08%	20.16%
10,000-19,999	18	189637	232900	81.42%	24.17%
>=20,000	10	311895	311500	100.13%	32.33%
'Untraceable'	30	100071	124400	80.44%	12.91%
TOTAL (TAC as of)	147	802301	963400 (09/02/89)	83.28%	100.00%

Table 2 Interview results from fishers who fished grey mullet quota during the 1988/89 fishing year.

	Grey Mullet Quota Holding Category (kgs)				
	<1,000	1,000-4,999	5,000-9,999	10,000-19,999	>20,000
Number of Fishers Interviewed	10	7	11	14	4
Stated abundance has declined	5	4	5	7	
Claimed mullet were available and not constrained by lack of mullet	2		3	6	4
Claimed current low price deterred them from fishing	4	3	3	1	
Did not fish during part of year due to personal reasons			3		
Areas Interviewees Fish	3,5,6,7	3,4,5,6	1,2,3,4,5,6,7,8	1,2,3,4,6,7	1,2,3,7,8
Number of Holders (1990)	50	53	36	21	10
Quota Held kgs (1990)	16200	115100	237000	280900	321000
% TAC of QMA 1 Held	1.67%	11.86%	24.43%	28.95%	33.09%

1. Waikato River
2. Manukau Harbour
3. Kaipara Harbour
4. Rangaunu Harbour
5. Bay of Islands
6. Whangarei Harbour
7. Hauraki Gulf
8. Kawhia/Aotea/ Raglan

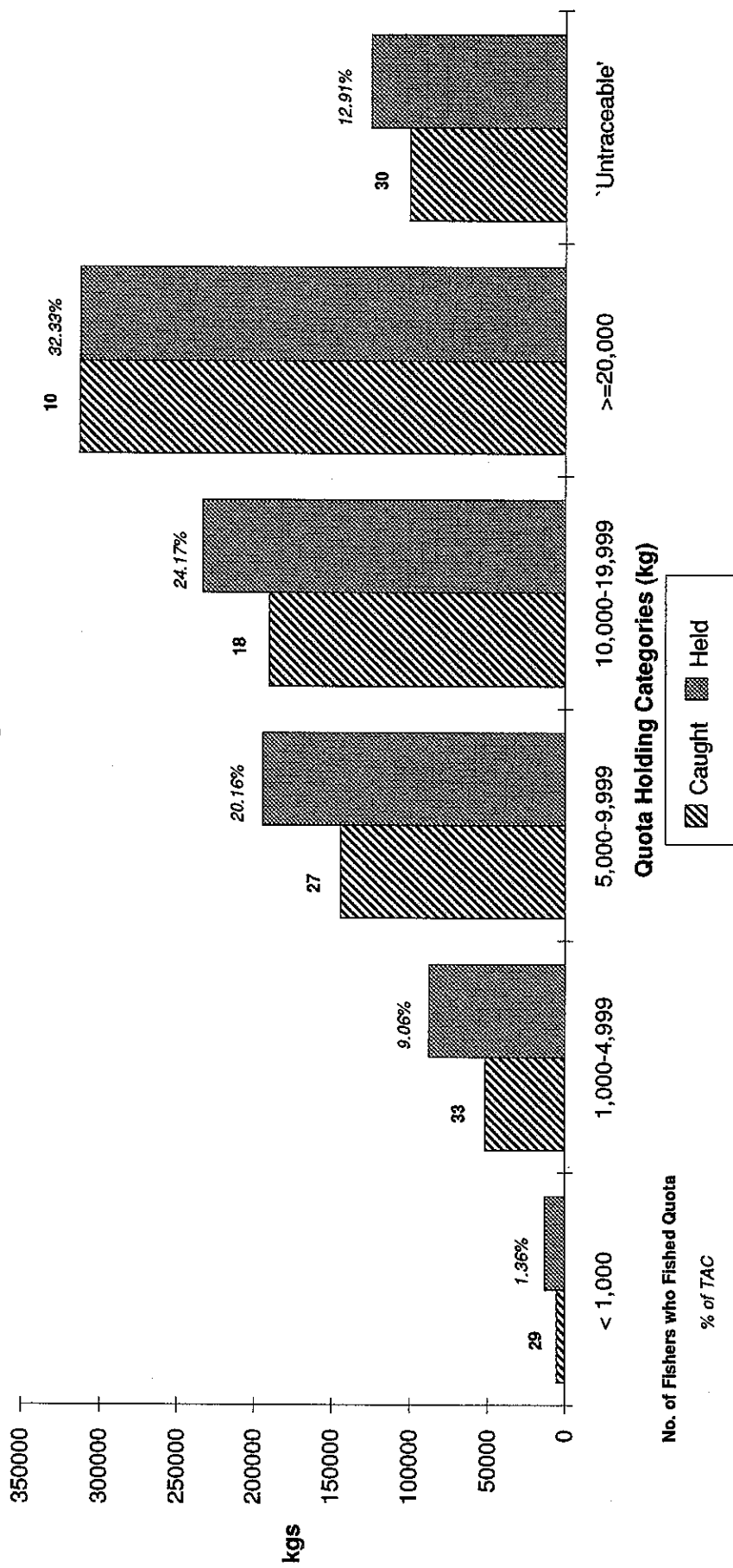
Table 3 Numbers of Fishers 'Constrained' by Quota holding

Category	No Fishers	No fish Catch <95%	No. Overfishing	% Constraint
<1000	29	16	6	44.83%
1000-4999	33	20	5	39.39%
5000-9999	27	17	6	37.04%
10000-19999	18	13	4	27.78%
>20,000	10	3	4	70.00%

Untraceable 30

TOTAL 147

Figure 1
Catch and Holdings of Grey Mullet from QMA 1
1988/89 Fishing Year



No. of Fishers who Fished Quota
 % of TAC

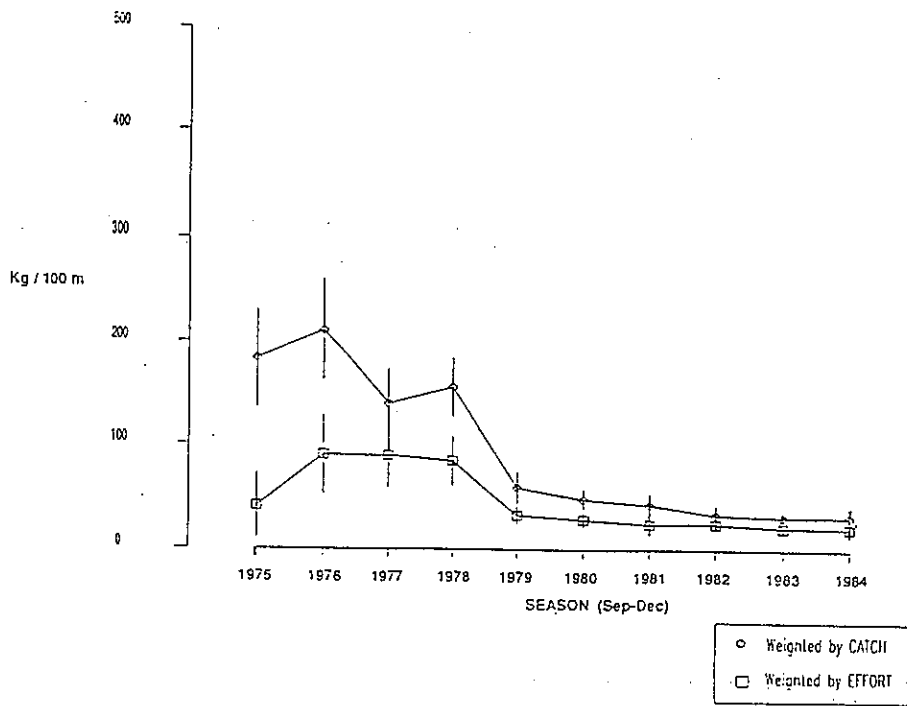


FIGURE 2 Grey mullet mean annual CPUE weighted by catch and effort from the Manukau Harbour, 1975-1985

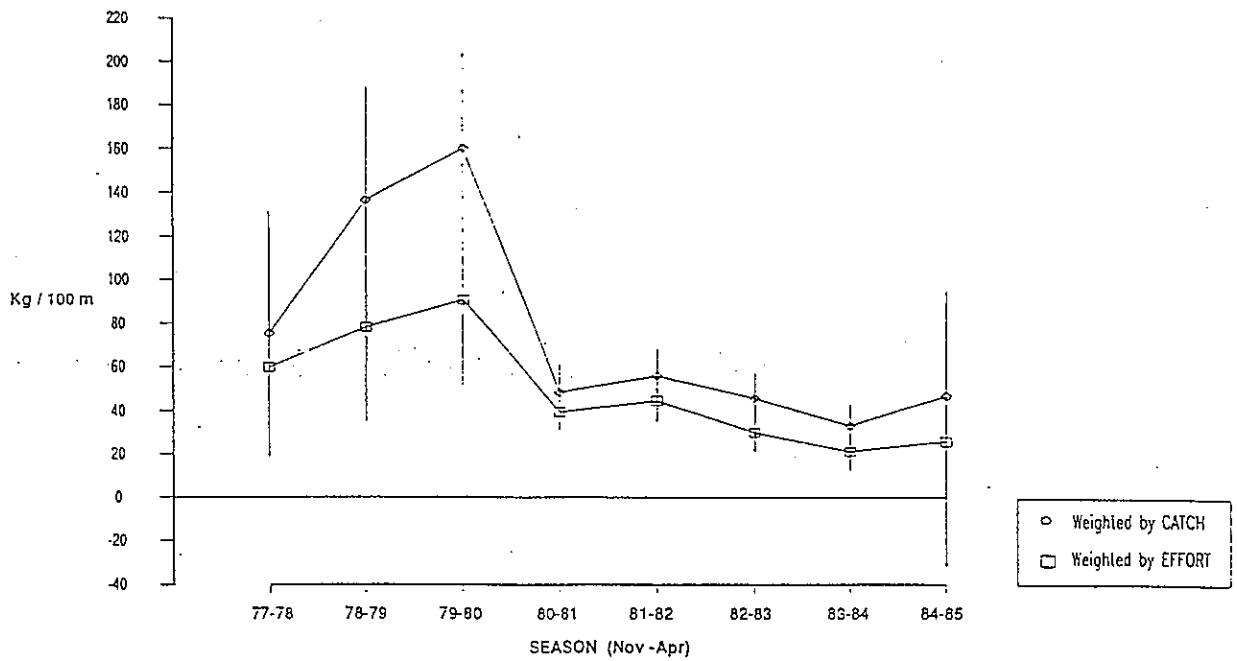


FIGURE 3 Grey mullet mean annual CPUE weighted by catch and effort from the Lower Waikato River, 1975-1985

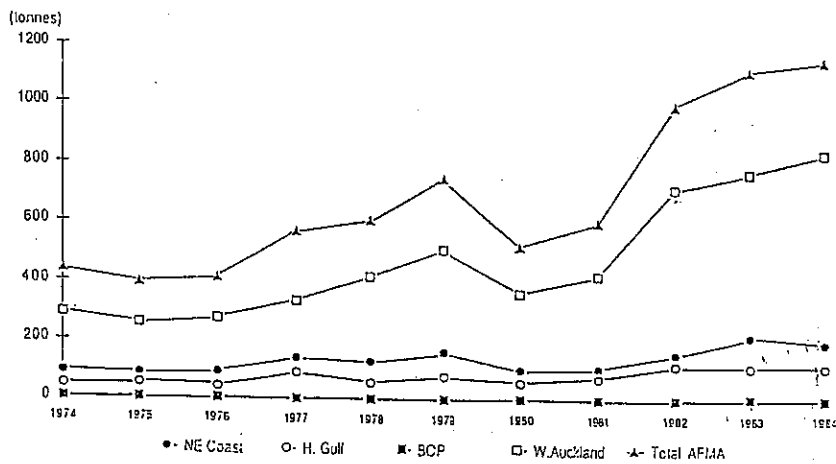


FIGURE 4 Grey mullet landings (tonnes) by fishery zone and total for the Auckland FMA (all methods combined), 1974-1984.