ISSN 1175-1584

MINISTRY OF FISHERIES
Te Tautiaki i nga tini a Tangaroa

Seasonal fishing patterns in the commercial fishery for groper in New Zealand, with notes on reproduction and apparent migration in *Polyprion oxygeneios* and *P. americanus*: results of a questionnaire sent to commercial fishers

L. J. Paul

New Zealand Fisheries Assessment Report 2005/62
December 2005

Seasonal fishing patterns in the commercial fishery for groper in New Zealand, with notes on reproduction and apparent migration in *Polyprion oxygeneios* and *P. americanus*: results of a questionnaire sent to commercial fishers

L. J. Paul

NIWA
Private Bag 14901
Wellington

New Zealand Fisheries Assessment Report 2005/62
December 2005

Published by Ministry of Fisheries
Wellington
2005

ISSN 1175-1584

Citation:
Paul, L.J. (2005).
Seasonal fishing patterns in the commercial fishery for groper in New Zealand, with notes on reproduction and apparent migration in *Polyprion oxygeneios* and *P. americanus*: results of a questionnaire sent to commercial fishers.
New Zealand Fisheries Assessment Report 2005/62. 38 p.

This series continues the informal
New Zealand Fisheries Assessment Research Document series
which ceased at the end of 1999.

EXECUTIVE SUMMARY

Paul, L.J. (2005). Seasonal fishing patterns in the commercial fishery for groper in New Zealand, with notes on reproduction and apparent migration in *Polyprion oxygeneios* and *P. americanus*: results of a questionnaire sent to commercial fishers.

***New Zealand Fisheries Assessment Report 2005/62.* 38 p.**

This report forms part of Ministry of Fisheries project HPB2002/01, directed at determining the status of groper Fishstocks. Objective 3 is addressed here: To survey groper fishers for information on their seasonal fishing activity and their knowledge of spawning seasons. Its purpose is to clarify whether regional differences in seasonal landings resulted from fish migrations or different fishing patterns.

A questionnaire was distributed to about 90 groper fishers throughout New Zealand, identified (through SeaFIC) as having landed moderate quantities in 2003–04. Only 16 were returned; the reason for this low response is unknown. Good information was obtained, and this is augmented by information already held by NIWA covering the 1960s, 1970s, and 1980s, when fishers were asked similar questions and their responses recorded.

Most respondents had a fishing pattern of moving from ground to ground, "resting" each for periods of a week to a year before returning. Most agreed on three points: (1) Large hapuku are removed first, possibly because they are locally dominant. Large fish tend to be more quickly fished down, probably because of lower numbers. (2) In some regions there has also been a slow decline, over decades, in the average size of hapuku. (3) In Cook Strait, there may be little or no decline in catch rate during the peak May-July season, possibly the consequence of migratory fish passing through.

Equal numbers of fishers (a) fished throughout the year to supply the market, (b) fished for groper when not engaged in another fishery, and (c) fished when groper were seasonally most abundant. Many responses implied that the QMS had altered their pattern of fishing; most considered it had benefited the fish, but disadvantaged small scale line fishing activity.

Along the east coast of both islands, the main season was earliest in the south (January to April), becoming progressively later northwards, moving from summer through autumn (Canterbury and Cook Strait) to winter (northern New Zealand), a shift of about six months. The west coast season was less clearly defined, but appeared more uniform.

Information on the spawning season of hapuku was often unclear, but a consistent response was the estimate of a 3 month progression from "ripening" to "running ripe". There is a weak and inconsistent trend for the reproductive season to be at least one month earlier in the south (May-June) than from Cook Strait northwards (July to September). Many fishers inferred a northward movement of hapuku associated with spawning, at least along the east coast of the South Island and into Cook Strait, and a "disappearance" of fish, or a movement and/or dispersal into deep water as the roes became ripe. Bass spawning was less well understood, and two different seasons (winter, and spring-summer) were nominated. Small juveniles of both species were reported from many regions, but often localised.

Three conclusions can be drawn. (1) Despite fishers shifting to alternative fisheries, the different hapuku seasons in different regions do reasonably reflect local fish abundance. (2) There is recognition of a northward pre-spawning movement of hapuku along at least the South Island, and the spawning season is earlier in the south than the north. Although not confirming the hypothesis that extensive migrations occur, these results do not discredit it, and support the concept of a single stock. (3) Groper line fishing is episodic, and intertwined with similar fisheries for bluenose, ling, and probably school shark; it alternates with lobster and tuna fisheries; and many fishers now have more limited access to quota or Annual Catch Entitlement. There are significant and probably insurmountable difficulties in monitoring this fishery by CPUE indices of either targeted catches, or the groper bycatch in the associated fisheries.

1. INTRODUCTION

The New Zealand gropers and their fishery have been studied from time to time since the early 1960s. The fishery is based on two species, the hapuku (*Polyprion oxygeneios*) and the bass or wreckfish (*P. americanus*, formerly *P. moeone*)[1]. They are distinct and easily distinguishable species. Commercial fishers know them as hapuku or groper, and bass. However, they are combined in most reported catch and landings data, which makes it difficult to describe and understand the fishery. The two species are known to have different depth distributions, probably have different regional distributions, and are likely to have different life history characteristics. Studies on the "groper fishery" have always been hampered by this data grouping (Paul 2002a), and it seems unlikely that stock abundance can be monitored by trends in CPUE indices (Paul 2002c).

There are some patterns in the landings data which suggest that hapuku – the dominant species in most regional fisheries – undertake extensive migrations, likely to be linked to reproductive behaviour (Paul 2002b). Tagging studies support but do not confirm the concept of considerable movements (Johnston 1983, Beentjes & Francis 1999). There are few other relevant studies. Roberts (1989) described the reproductive mode of *Polyprion*, but did not describe the seasonal reproductive cycle. Peres (2000) and Peres & Klippel (2003) gave an account of the biology and fishery for *Polyprion americanus* off southern Brazil, including an inference that this species migrates a considerable distance to spawn.

At present, New Zealand groper (the two species combined) are managed as eight Fishstocks, each with a TACC based mainly on historical catch levels that appeared to be sustainable. This regional subdivision of quota was intended to prevent localised overfishing (i.e., the total TACC being caught in one small area), although it was suspected that hapuku and bass each comprised only a single New Zealand stock. However, the Quota Management System (QMS) has evolved to begin managing the individual Fishstocks of many species as unit fisheries. It is desirable that more information be obtained on the extent of movement of hapuku and bass between their nominal Fishstocks, so that management decisions can be coordinated.

Tagging is expensive and time-consuming, and the susceptibility of *Polyprion* spp. to pressure changes has largely limited past studies to tagging juvenile fish in relatively shallow water. The main requirement now is to obtain information on the deeper dwelling adults. As one step in this process, a questionnaire was devised which queried commercial fishers in all the main groper fishing regions on their seasonal fishing patterns, their observations or inferences of groper movements, and their knowledge of the seasonal changes in the reproductive state of both species. Emphasis was placed on clarifying why fishing occurred seasonally; was it dependent on the seasonal abundance or availability of fish, or the result of fishers switching between seasonal fisheries for quite different species?

2. METHODS

The questionnaire was made as simple and straightforward as possible. Most questions led to a multi-choice answer panel with tick-boxes. A few required a very brief written response, and a couple invited a longer written response. All questions were followed by a space for optional additional notes, and the final question asked "Do you have any comments on groper fishing issues not mentioned in this questionnaire?"

Accompanying the questionnaire was a series of illustrated notes, keyed to the questions, which gave background information on each, and the reason they were asked. Care was taken, however, to avoid providing the fishers with "obvious answers". Both documents were checked for clarity and relevance

[1] The grouping by Roberts (1986) of the Australasian bass *P. moeone* with the widespread wreckfish *P. americanus*, however, is still uncertain; some genetic characters do separate them (Ball et al. 2000).

with representatives of the fishing industry familiar with groper fishing and with acquiring such information, and their advice was incorporated. They were then sent, with a covering explanatory

letter, to about 90 commercial fishers who had owned or leased moderate to large amounts of groper (HPB) quota (in the form of Annual Catch Entitlement (ACE)) in the 2003–04 fishing year. A short article describing this project was published in the magazine *Seafood New Zealand*, inviting fishers previously involved in the fishery, or who for some reason had not participated in 2003–04, to take part.

The following points were made in the documents mailed out:

- The questionnaire has been kept simple, requiring minimal writing. Additional comments are optional, but will certainly be used.
- Responses can be anonymous. Names, and comments that might identify fishers, will not be incorporated in the subsequent report.
- Confidential or commercially sensitive information is not being requested.
- It is most important that you identify your fishing method, and your (general) fishing area.
- NIWA has no "hidden agenda" in asking these questions, and is not aware of any information that might require further restricting the fishery. Recent studies show that it appears to be stable. This may mean that it is in good shape, or alternatively the most appropriate information is not yet being monitored. The questionnaire seeks only to clarify this.
- The main issues are, for hapuku and bass separately: (1) What controls the timing of your seasonal groper fishing? (2) Do you have any comments on groper migration? Can you supply any information on the spawning season of each species?

Illustrations of a hapuku and bass were included in the notes, as a reminder of the differences between them.

Replies to the questionnaire were augmented by unpublished notes and information on the groper fishery already held by NIWA, from the early 1960s, and from the mid 1970s to the mid 1980s. These were collected during more general enquiries, and only those parts which happened to answer the new questions have been used.

This report follows the structure of the questionnaire and accompanying notes. The latter are presented as **Background**. The **Question** follows, in most cases worded as in the questionnaire. **Replies** are tabulated, and then followed by any additional **Comments** that the respondents made. Their original wording is retained as much as possible, but some editing for clarification is indicated by square brackets. A few comments were applicable to more than one question, and they have been repeated in whole or part as appropriate. The 1960 to 1980s comments follow those in the questionnaire, identified by open (o) cf. closed (•) bullet points. Where appropriate, replies and comments are arranged by region. **Summary of information** reviews the preceding sections.

3. RESULTS

3.1 Regional fisheries covered

Background

This survey is centred on regional differences in seasonal fishing, observed reproductive condition, etc., so it was essential to determine where each respondent fished. The notes made it clear that it was not necessary to provide precise fishing ground locations. General fishing regions were necessary, or the standard fishing statistical areas. Fishstock boundaries were inappropriate because several subdivided natural regions (Cook Strait) or were too large (HPB 1), and a map was included which defined the regions used in recent studies of the fishery, and also showed statistical areas (Figure 1).

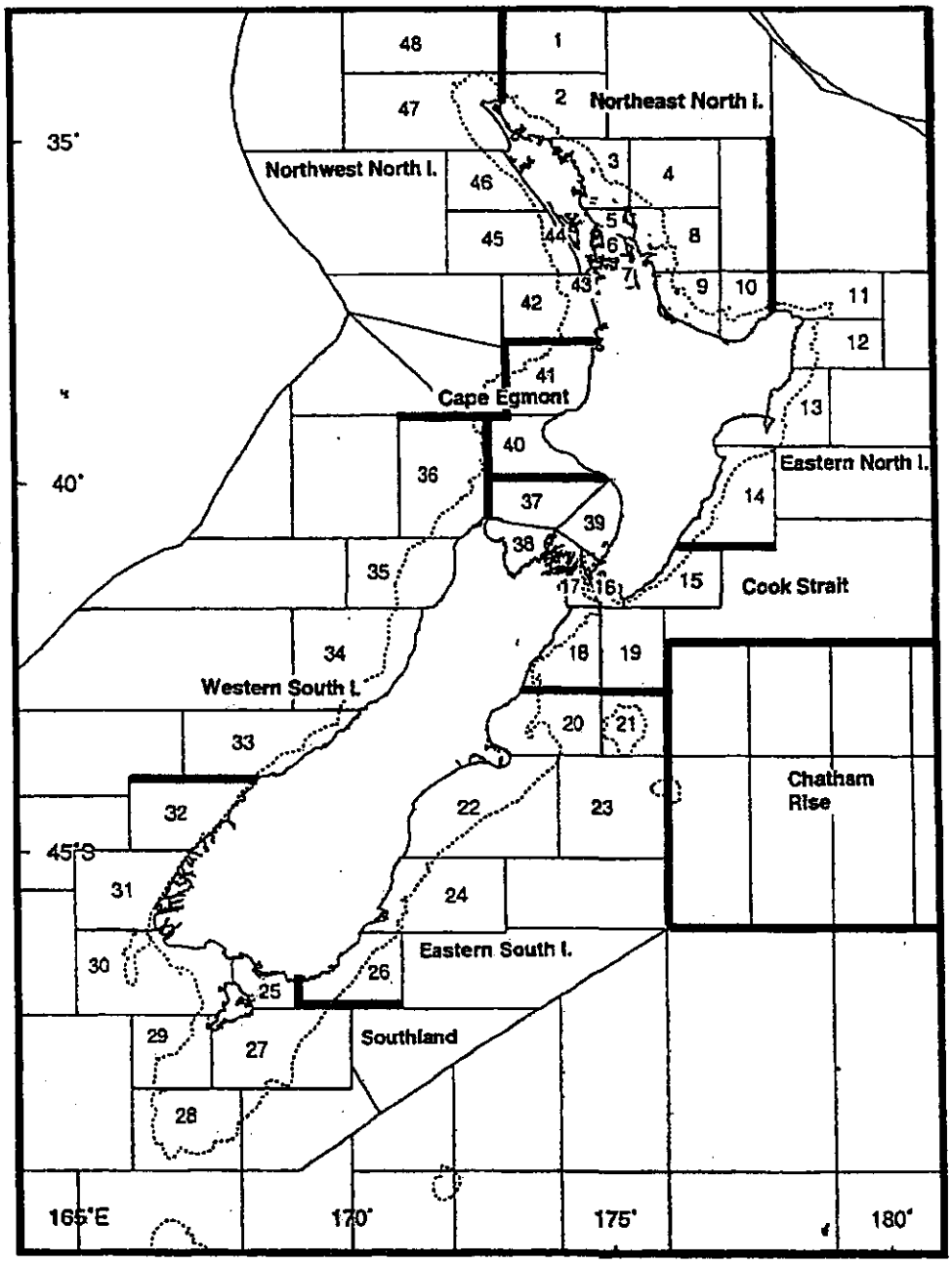


Figure 1: Regions used in recent studies of the groper fishery, and fishing statistical areas, and to be used to define the areas where questionnaire respondents fished.

Replies

Northeast North I.	3
Eastern North I.	1
Cook Strait	3
Eastern South I.	6
Southland	4
Western South I.	4
Cape Egmont	3
Northwest North I.	2

Note: The responses from some fishers covered more than one region.

Fisher's comment

- [Movement between areas:] From April to November I work in Cook Strait charter-fishing, targeting groper. From December to the end of March I fish commercially for groper on the west coast of the South Island.

Summary of information

All areas – apart from the more lightly fished Chatham Rise, HPB 4 – were represented in the responses, although two regions provided only one or two replies. The earlier notes held by NIWA give a more comprehensive coverage, but are difficult to quantify as above.

3.2 Fishing methods

Background

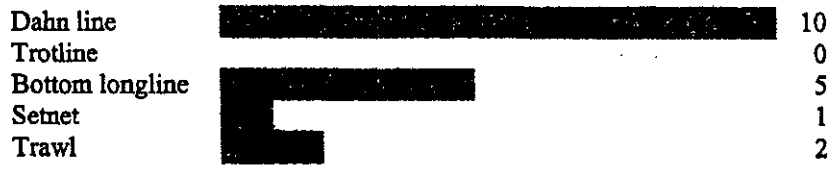
It was also necessary to know the fishing method used by the respondents. Most were likely to be line fishers, and we asked for clarification of any difference between "dropline" and "trotline"; our recent studies had combined these methods, contrasting them with longlines. Our notes stated: Although groper are caught by many methods, our study is centred on line fishing, plus the Kaikoura setnet fishery. The two most relevant line methods are "Dahn line" and "trotline". In previous studies we have combined these and called them "droplines", although we know there are differences. We have considered Dahn lines to be single vertical lines, and trotlines to be sets of vertical lines linked via a horizontal backbone line; essentially they are fished vertically, over or near rough ground. They can be contrasted with "bottom longlines", fished horizontally on or very close to the seafloor and on more open ground. It is our understanding that groper are not targeted with bottom longlines, although they may often be caught on this gear.

We also hoped to get replies from set-netters. We had little recent information on this fishery.

Question

Please tick one or more of the following fishing methods.

Replies



Note: In NIWA analyses, dahn lines and trotlines (reported on CELRs) are combined as "droplines". In the questionnaire responses, no respondent chose the trotline option as a primary method.

Fishers' comments

Comment 1 (in response to: If you line-fish for groper, do you have any comment on our combination of Dahn line and trotline gear as "droplines"?)

Northern North Island

- [Not on your combination of types, but] dahn lines are an easy way to target small areas.
- As more and more fishers entered the fishery [...] we found we needed to handle more hooks and as a result we started to trotline. [...] 12 hook drops on flat ground to 24 hook drops on rough ground.

Cook Strait

- I have used both over the years. A trotline is only a series of dahn lines on a backbone. There is no real difference.
- [They are] totally different methods for targeting groper. Dahn lining is a very target-oriented method, whereas trotlining is spread over a larger area.

Comment 2 (in response to: Do you have any comment on hook type and size?)
Northern North Island

- I prefer medium-sized hooks, 14-0 to 16-0.

Northwest North Island

- I am using 14/0 tuna circle hooks.

East coast North Island

- Started out using J hooks and experimented with short shank, went to long shank Mustad 6318 but later discovered that circle hooks were far better at holding the fish, as they usually ended up hooking the side of the mouth and not ripping out.

Cook Strait

- I have always used Mustad 8318 10-0 and 9-0 hooks. I have tried others but always return to Mustad as they fish well and are easy to handle.

East coast South Island

- Smaller size hooks fished best, but had to use 8-0 mostly to stop straightening out. Used 7-0 Mustad Kirbys up to 10-0. Mustad Straightshanks [are] three times as strong.

Southland

- [I use] 14/0. The bigger the size the less chance of catching small bycatch.

Comment 3 (in response to: If you setnet for groper, are your nets distinctly different, in the way they are constructed and set, from the nets used for other fish species? Mesh size, length/height, depth set?) No comment from the single respondent.

Summary of information

The few responses confirmed our decision to combine Dahn lines and trotlines as droplines. The main difference is in size, trotlines being sets of several Dahn lines. There is some difference in deployment, Dahn lines being used to target fish on small pinnacles and rock faces, trotlines being spread over a larger area of rough seafloor. Comments on hooks suggested that moderate to large hooks were preferred, for strength and the avoidance of small bycatch species.

3.3 Fishery stability

Background

We were interested in fishers' opinions on the state of groper stocks in their regions, and in the often-described procedure of "resting" their grounds, and location of new grounds. We asked: Is your fishery stable? Our previous studies have concentrated on target groper fisheries. We have not been able to detect any decline in catch rate, but this may be a result of fishers progressively finding new grounds as the old ones are worked out. Our present opinion is that the main (larger) fisheries are now stable, while the smaller and more recently developed groper fisheries have gone through a sequence of discovery, "fishing-down", and then further discovery of new areas (usually pinnacles and banks). We do not know whether all fished-down grounds eventually recover. We suspect they do, with the small grounds (reefs?) taking longer than large grounds (large reefs, canyons, etc.). Following introduction of the QMS in 1986–87, there has been no decline in total New Zealand landings, beyond that caused by the TACC and buyback (Figure 2). The difference between landings and TACC results from high regional TACCs in two offshore Fishstocks (Chatham Rise and Campbell Plateau) but low reported catches. Landings from coastal Fishstocks are close to their TACCs.

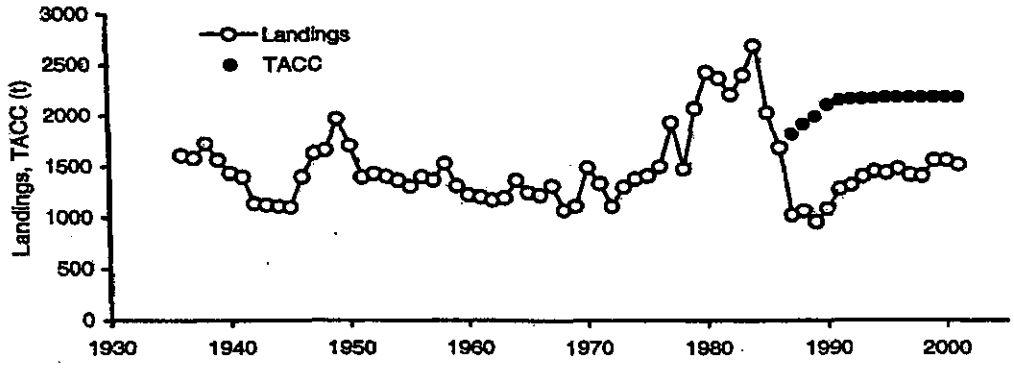


Figure 2: Total New Zealand groper landings, 1936–2001.

Questions and Replies

Both are incorporated in the following two tables.

Hapuku responses to fishing

	No. respondents who agree with statement
The catch (**numbers** of fish) from a ground is fairly stable from year to year	7
The catch (**numbers** of fish) declines with fishing, but recovers within months if the ground is rested	9
After the catch (**numbers** of fish) declines, it takes more than a year to recover	3
After the catch (**numbers** of fish) declines, there is little or no sign of recovery	1
The catch (average **size** or weight of fish) from a ground is fairly stable from year to year	7
The catch (average **size** or weight of fish) declines with fishing, but recovers within months if the ground is rested	6
After the catch (average **size** or weight of fish) declines, it takes more than a year to recover	3
After the catch (average **size** or weight of fish) declines, there is little or no sign of recovery	2

Bass responses to fishing

	No. respondents who agree with statement
The catch (**numbers** of fish) from a ground is fairly stable from year to year	3
The catch (**numbers** of fish) declines with fishing, but recovers within months if the ground is rested	3
After the catch (**numbers** of fish) declines, it takes more than a year to recover	1
After the catch (**numbers** of fish) declines, there is little or no sign of recovery	1
The catch (average **size** or weight of fish) from a ground is fairly stable from year to year	3
The catch (average **size** or weight of fish) declines with fishing, but recovers within months if the ground is rested	2
After the catch (average **size** or weight of fish) declines, it takes more than a year to recover	
After the catch (average **size** or weight of fish) declines, there is little or no sign of recovery	1

Notes: *1. There is a distinction between **numbers** and **size or weight**.*
2. Respondents could check more than one option.

Fishers' comments

In particular, on whether hapuku and bass differ in their response to fishing.

Northern North Island

- ["Fishing down", as either numbers or size] depends on the amount of effort on [individual] grounds. [Recovery may take months if the same ground is regularly fished.]
- We don't fish one area hard, rather we move every week to "farm" areas to conserve catches.

Northwest North Island

- [I have not been in this fishery long, but] feel that if I had enough quota to target groper I could do very well, as there appear to be good numbers where I am fishing [for bluenose]. I am quite often forced to move so as to not catch too much!

Cook Strait

- Our practice has always been to fish an area, then spell it for 3–4 weeks before fishing it again.
  - When very large [hapuku] are present, they do not stand up well to fishing pressure.
  - [1970s, Cook Strait banks], these areas can be fished day after day [during May-July] without any decline in the catches.
  - [In the Kaikoura line fishery] bass are caught all year round in small pockets, which are easily fished out and then left to recover for 9–12 months before being fished again.

East coast South Island

- At the start of the season a full range of fish [hapuku] sizes is available, but as the season progresses the fish become smaller in size.
- [During more than] 35 years of fishing hapuku, the size [of fish] has generally got smaller.

Southern South Island

- [After fishing a ground, numbers recover within days to a week, while the average size or weight of fish remains the same.]
- I don't target-[fish groper], as most of the places or patches I fish have been over-fished.

West coast South Island

- The term "fished down" can be confusing. A virgin [ground] produces a large tonnage when fished as the fish size is often very large, especially with bass. [...] Once the ground has been fished down the numbers of fish can often increase, but the smaller fish do not give such a good weight [giving] the impression of a declining fishery, when in fact [it] is still producing the numbers. This is especially [true of hapuku], where the school fish caught each year during the spawning season are often a very uniform size, 7–15 kg.
- Bass seem to fish down [more easily] and seem to be slower growing than [hapuku], and as such seem to need [longer] spells on the areas fished.
  - Bass caught [during the mid-late 1970s] have been getting much smaller, but in better condition. The numbers [...] are also starting to decline, but fishers seem to [work] the same spots continuously and the fish are not spelled. [... Fishers claim] the decline in fish numbers is caused by foreign fishing pressure [2% of fish taken have a Japanese hook in them] ... but the constant fishing of old familiar grounds must contribute to this.

Summary of information

Most responses described a fishing pattern of moving from ground to ground, and "resting" each for a period before returning. This resting period varied between one week and a year, depending – as one fisher noted – on how heavily it had been fished, and presumably on the size of the ground. There are too few responses to generalise by area, time period, or species, but the following points are consistent with what is already known or suspected. (1) Large hapuku are removed first, possibly because they are dominant in a population of mixed sizes. If only large fish are present, they are more quickly fished down, probably because of smaller numbers. (2) In addition to short-term effects, in some regions there has been a longer-term (over several decades) decline in the average size of hapuku. (3) In Cook Strait, there may be little or no decline in catches made during the peak May-July season, possibly the consequence of migratory fish passing through this region. (4) There was little comment on bass, apart from notes on a decline in fish size during the 1970s, attributed both to the presence of foreign line fishers at that time, and to domestic fishers continuing to fish only known grounds.

3.4 Annual trends in landings

Background

An observation which raised the possibility that groper, presumably hapuku, had a north–south migration was the difference in some years between "northern" and "southern" reported landings (Figure 3). From 1960 to 1985 (at least) they moved in opposing directions, i.e., when northern landings increased, southern landings decreased; see 1966, 1970, 1975, 1980. Landings in the Cook Strait region are closer to the southern trend. Some variability in landings must inevitably result from the development and/or decline of commercial groper fishing in different regions. In addition, this north–south pattern of landings has several possible explanations. (1) Fish migration. If hapuku have a seasonal north–south movement, perhaps related to spawning, and part of the population does not immediately return, in some years groper would become more abundant and easily caught in the north, and in other years would be more abundant in the south. (2) Separate populations. Northern and southern hapuku (perhaps also bass) populations may fluctuate independently in size. (3) Fisher movement. (a) The main groper fishers (in terms of high catches) may periodically shift between northern and southern grounds. (b) There may be some systematic difference in the way northern and southern fishers shift between alternative fisheries, such lobster potting, or tuna trolling and lining.

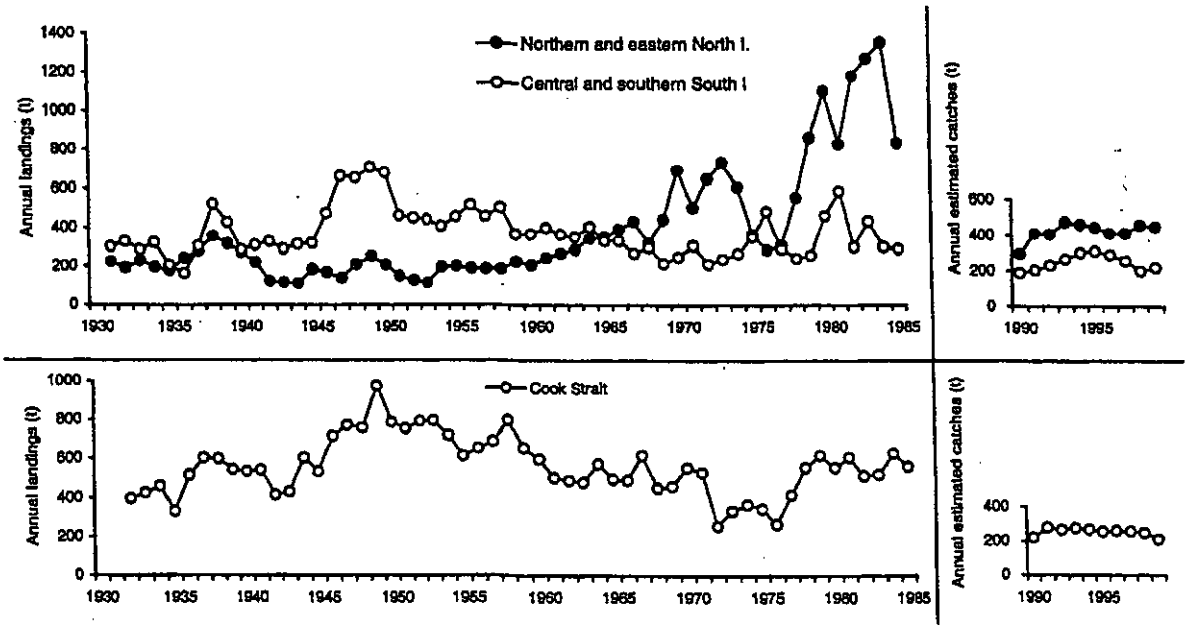


Figure 3: Northern, southern, and Cook Strait annual landings of groper, 1931 to 1985, and fishing years 1998–90 to 1998–99.

Notes: Reliable landing values by port are available only up to 1985. The recording system changed when the QMS was introduced in 1986, and values from 1986 to 1989 are incomplete. From 1990 onwards 'estimated-catch' by area can be obtained (estimated catches are 70–90% of landings). "Northern and eastern North I." is the total of port landings from Mangonui to Napier, or (from 1990) catches from statistical areas 1–15 + 47–48. "Central and southern South I." is the total of port landings from Lyttelton to Greymouth, or (from 1990) catches from areas 20–35. "Cook Strait" is the total of ports between Castlepoint, Kaikoura, Paremata, and Nelson, or (from 1990) catches from areas 16–17 + 37–39.

Questions

Do you have any comments on this pattern of landings? Is there some explanation other than north–south fish migration (such as north–south vessel movement)? Note: you may prefer to include your response to this in your answer to the following question, on monthly catch patterns.

Replies

Northern North Island

- Hapuku [do] seem to move around more.
- [I] feel tuna fisheries, both trolling and surface lining, would have a big impact on when [catching effort] takes place.
- The [...] decline in [northern] catches in 1975–76 is a direct result of three [important] vessels moving from the east coast of the North Island to the west coast of the South Island for the albacore season in February-May. [...] The continued increase in [groper] catches on the [northeast] coast [results from low albacore prices, and the moratorium on fishing licences – when the Ministry stopped issuing inshore permits but issued permits for vessels to fish outside 12 miles. By 1981–82 the vessels line fishing between Napier and Tauranga went from 2 to about 15 in a very short time. Another reason for the [steep rise] in the groper catch north of Auckland is that the vessels landing into Auckland sold all their catch, including bluenose, as groper and this was recorded on the CLRs.

Cook Strait

- Tagging [... carried out by] Alex Johnston in the late 1970s indicated that in some months [hapuku] did not move very far from where they were tagged and released. However, there was a movement northwards during May and June. Hapuku tagged off Cape Campbell were recaptured shortly afterwards in Cook Strait. In 1981–82 I fished the Mernoo Bank and in April the hapuku were large fish [full of roe]. About mid April these fish disappeared and in early May the same type of fish began to appear along the coast from Clarence to Cape Campbell, then further north in Cook Strait. A fish tagged at Cape Campbell was caught four days later at Fisherman's Rock, Cook Strait, and another was recaptured off Terawhiti. This suggests some sort of migration. Since heavier fishing started on the Chatham Rise in the late 1980s [hapuku] catches at Clarence and Cape Campbell have declined somewhat, to such a state that we rarely fish these regions now. However, Cook Strait catches remain stable.
- I don't know whether [hapuku] move from north to south or vice versa. But I do know [from the results of a tagging study] that [hapuku] in Cook Strait migrate in two year cycles. I also know that groper will return to exactly the same place on their return, while they are still immature.

East coast South Island

- [The] number of line vessel declined from the 1970s onwards, from about 30 to 1.

Southland

- I don't know anything about migration but they do move somewhere.

Summary of information

No relevant information was provided, apart from an acknowledgment that participation in other fisheries was a factor, and agreement that some migration or movement did occur.

3.5 Seasonal trends in landings

Background

To investigate this issue further, we compared monthly catches from the same large regions of New Zealand (northern, southern, and Cook Strait, based on statistical fishing areas) from 1990 to 1999 (Figures 4 and 5).

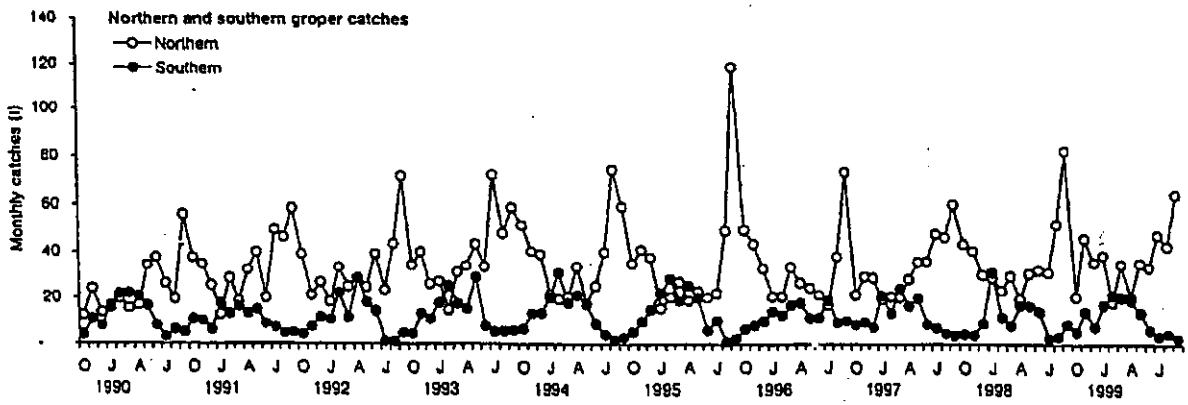


Figure 4: Northern and southern monthly landings of groper, October 1989 to August 1999. The northern region is from Ninety Mile Beach to Castlepoint, or statistical areas 47, 48, and 1–15; the southern region is from north Canterbury Bight southwards around the southern South I. and up to north Westland, or areas 20–35.

Figure 4 shows "northern" (north-eastern North I.) and "southern" (central and southern South I.) groper catches (species combined). The labels are for October, January, April, and July. The northern and southern peaks are almost the reverse of each other. Northern catches peak between July and October, when southern catches are low. Southern catches peak between January and April. Another feature is that when the seasonal cycle is weak or unusual in the north, e.g., in 1996 and 1997, it is also weak in the south.

Cook Strait and Kaikoura catches show a different pattern (Figure 5).

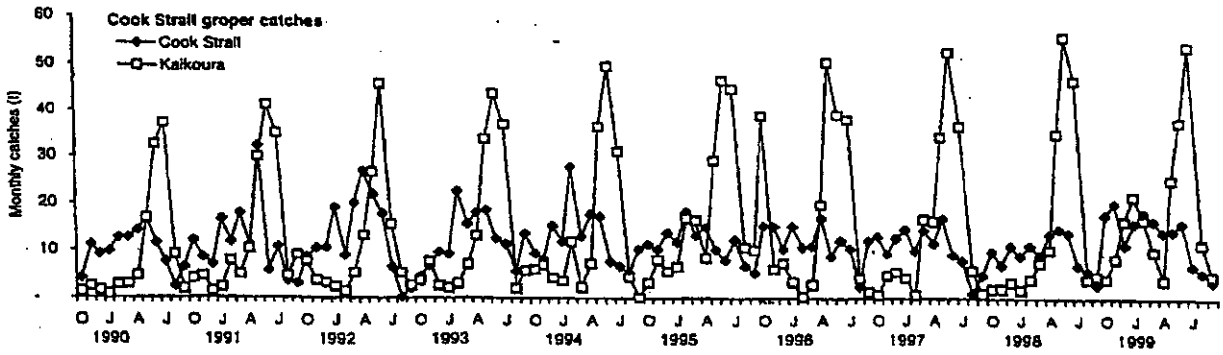


Figure 5: Cook Strait (areas 16–17 + 37–39) and Kaikoura (area 18) monthly landings of groper, October 1989 to August 1999.

Cook Strait line catches are similar to those from the southern South I., peaking between January and April, sometimes very slightly later. (As elsewhere, the peaks are weak in 1996 and 1997.) The Kaikoura setnet catch, however, peaks from May to July. As with the annual landings data, it is possible to interpret this as some evidence for north–south migration, with the fish moving in some complex way through Cook Strait. There are, however, two other issues to consider.

1. This information is available for the combination "groper", not for hapuku and bass separately. This combination limits interpretation of the two trends; it is possible that the two species have different seasonal patterns of abundance or availability.
2. It is possible that other fisheries, such as those for rock lobster and tuna, perhaps scallops and oysters, determine the timing of the groper fishery. That is, fishers may fish for groper in the off-season for their main fisheries, and the timing of these may differ between regions. In this instance, landings records can be used to compare the relationship between groper and rock lobster seasons in the northern and southern regions.

Northern region

First, the northern region (Figure 6), as defined above. The catches of rock lobster and groper are superimposed.

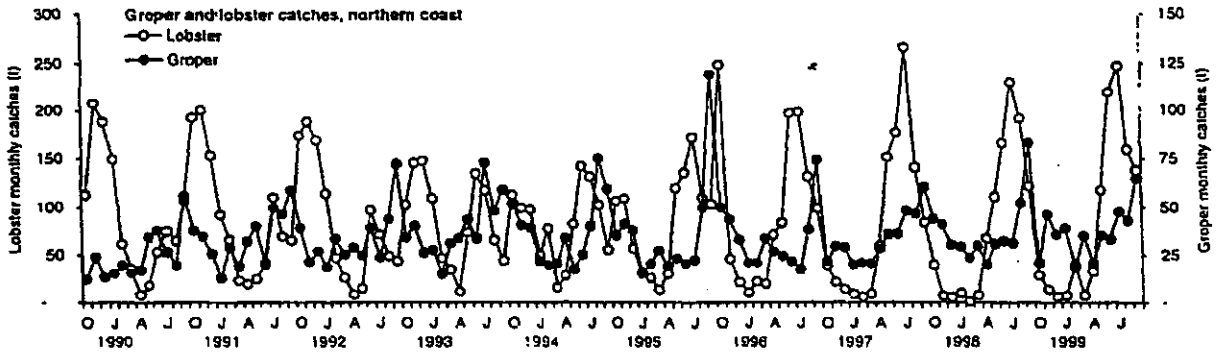


Figure 6: Northern region monthly landings of groper and rock lobster, October 1989 to August 1999.

In the early 1990s the groper season (or period of highest catches) was a month or two earlier than the lobster season. In the mid 1990s the seasons for both fisheries coincided. In the late 1990s the groper season was slightly later than the lobster season. The lobster fishing season was the one that shifted during the 1990s, moving from spring back into winter, October–December back to June–July. This is believed to be market-driven, e.g., by the timing of better prices, and possibly also by a change in emphasis between fishing for males (in winter) and for females (in spring) (NIWA, unpublished information). The timing of the groper fishery (winter and early spring) did not change, and there is no apparent alternation between the main seasons for lobster and groper.

Southern region

However, the southern fishery shows a very different relationship between the two fisheries (Figure 7). Again, the catches of rock lobster and groper are superimposed.

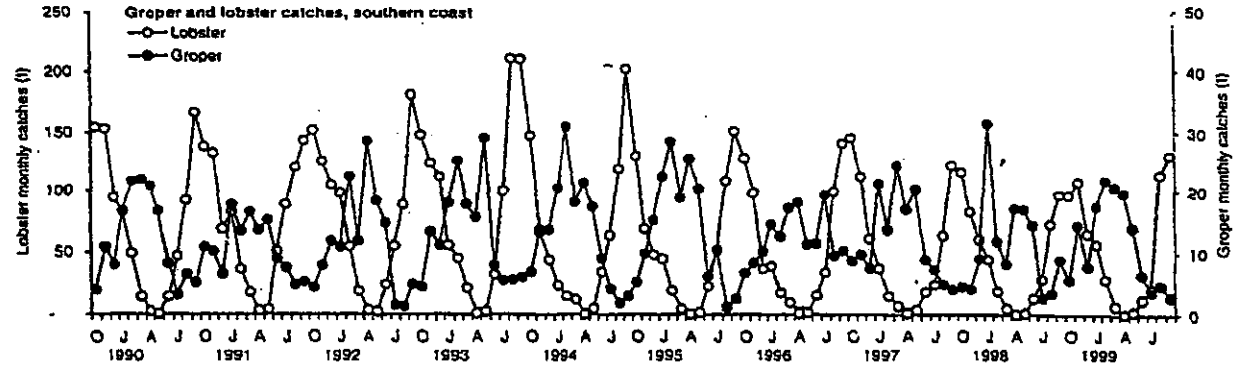


Figure 7: Southern region monthly landings of groper and rock lobster, October 1989 to August 1999.

Here the two fisheries do alternate, very strongly. The rock lobster fishery, which is assumed to be the main fishery for most fishers, peaks from September to November. The groper fishery usually peaks in the lobster low season, January to May. Here, perhaps, the timing of the groper fishing season is driven by the lobster season, with fishers changing to groper fishing after their lobster fishing stops?

North to south trend

Finally, we examined seasonal patterns in groper catches in smaller coastal regions around New Zealand, subdivisions of the "Northern" and "Southern" regions (Figure 8).

Because the data (monthly catches, in tonnes) are averaged from 10 years (the fishing years 1989–90 to 1998–99) the seasonal peaks in each of these regional graphs are less distinct than those for individual years (in the graphs above). However, the results do show regional differences in the timing of peak monthly catches.

Issues requiring clarification include:

- Do these regional graphs, unfortunately only for "groper" (both species combined), reveal north–south fish migration?
- Or do they result from different seasonal patterns of fishing in each region?
- Increased availability of ACE in August–September, at the end of the fishing year, might be driving this peak in the north. But if so, why does it this pattern not occur in the south?

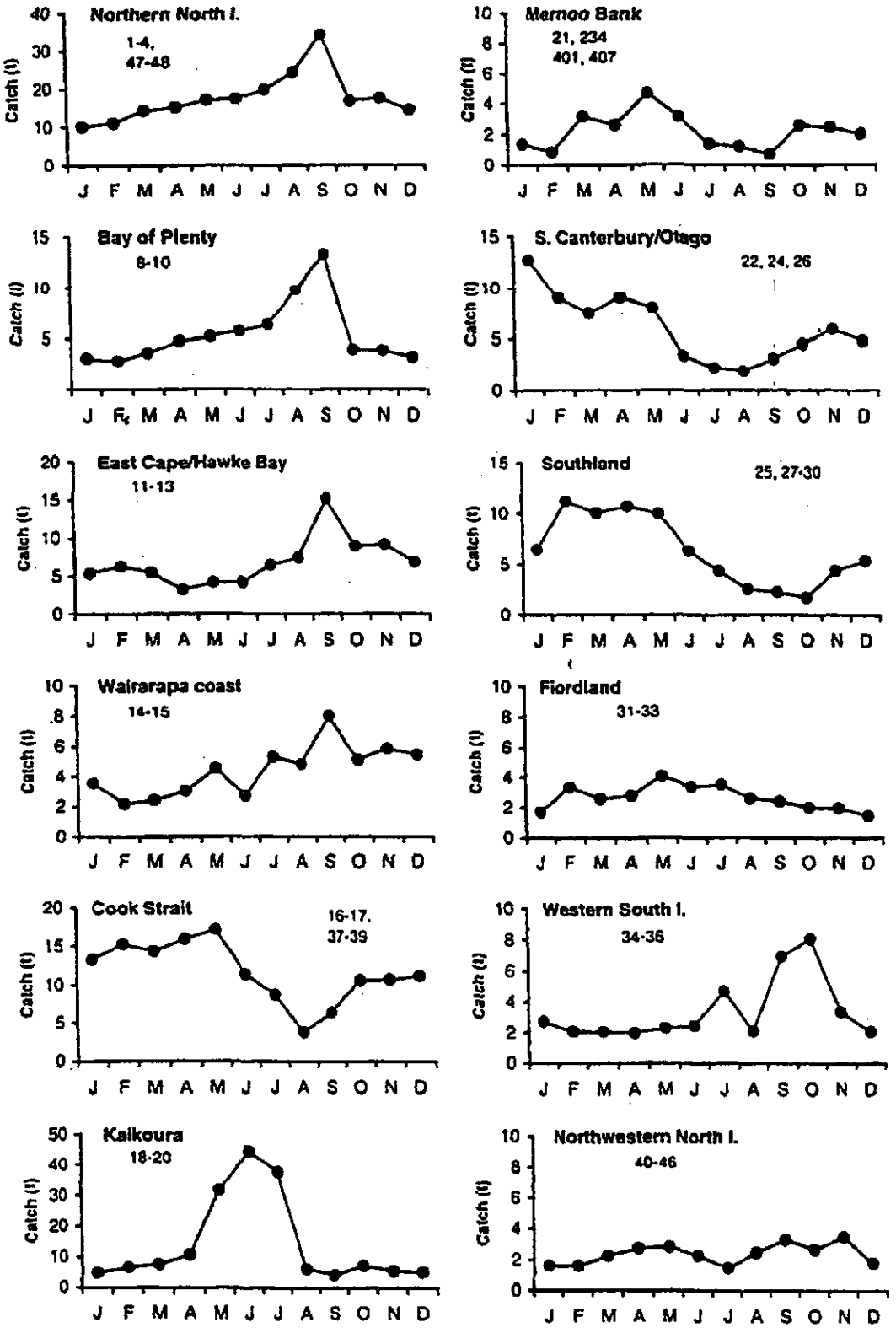


Figure 8: Regional monthly landings of groper and rock lobster, fishing years 1989–90 to 1998–99 combined.

Notes:

1. The listed numbers are the statistical fishing areas making up each region.

2. "Western South I.", statistical areas 34–36, has a pattern of landings which differs from the regions further south (Fiordland, Southland). The general and larger "Southern" region used in the previous accounts and graphs will therefore have to be redefined when additional, more localised information becomes available. For example, "Southern" will probably exclude the western South Island.

Questions and Replies

A. In your main fishing area, what months do you go target fishing for "groper", i.e., for either or both species? (For the species separately, see C below.) (In these and all similar presentations, each line represents a fisher, and a shaded cell marks the response.)

Northern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Cook Strait

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

East coast South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Southern South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

West coast South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

B. Within this period, do you have a "main season" of highest catches?

Northern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Northwestern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Cook Strait

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

East coast South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Southern South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

West coast South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

C. In your main fishing area, are there different "main seasons" for hapuku and bass?

Hapuku

Northern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Northwestern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Eastern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Cook Strait

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

East coast South Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Southland

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Bass

Northern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

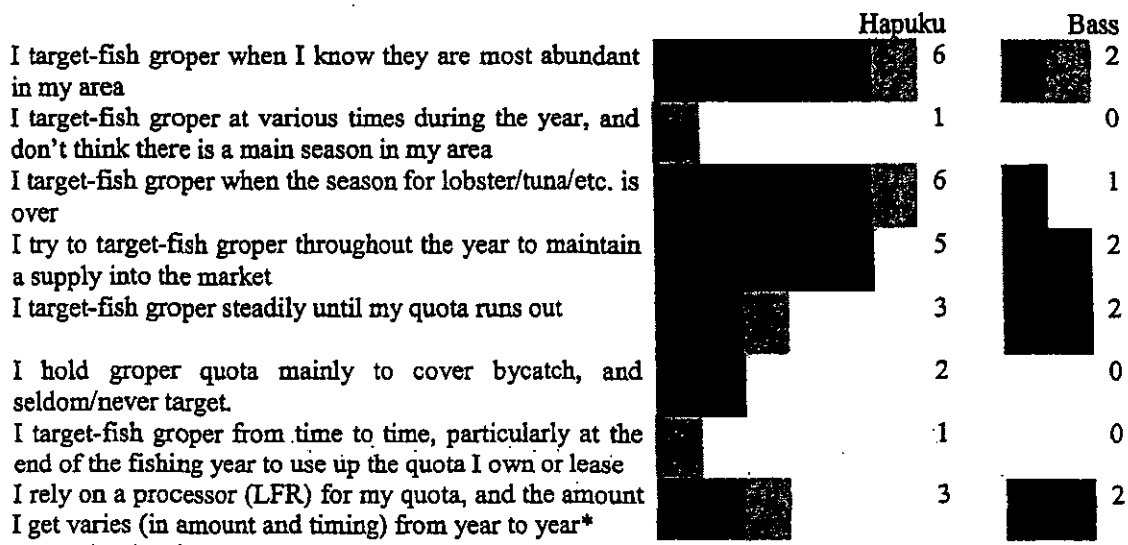
Eastern North Island

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Cook Strait

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

D. *In your main fishing area*, what determines the timing of your targeted groper fishing? Please indicate your main and secondary reasons. (Main reason, dark shading; secondary reason, light shading.)



* See also Section 11.6, (below) for more detail on the effect of the QMS on groper fishing.

Fishers' comments: main fishing season

General

- Any two months of the year – but usually associated with spawning – seem to provide [a good] fisher with about half the annual catch.

Northern North Island

- The main season [in HPB 1 & 2] for us is August–September.
- We fish [both] these species all year round. [We run out of quota] in HPB 8 and 2 [first], so more time is spent in HPB 1 where the greatest [quota] holdings are available.
- The northern region is later [than East Cape and northwest North Island], April to July for hapuku and August to October for bass.
  - About six boats fish hapuku during the winter months, May–October.
  - [Outer Hauraki Gulf] Best months for fishing are October–December and May–July. Hapuku come into 20 m in November.

Northwest North Island

- [Although] I target bluenose and only catch groper as bycatch, I have noticed this year that in the last two months [October–November] bass catch rates have increased dramatically in the places I target bluenose.
- Hapuku can be caught in good numbers from August to December, mainly on mud bottoms to 280 m. Bass [are mostly taken] from 300 to 600 m, mostly on hard bottoms.

Cape Egmont region

- [Offshore from Wanganui], work all year round, better [catches] start at end of November, reaching a peak of females in March–April and males in May–June.

East coast North Island

- Main [fishing] season for [hapuku] is the spawning season, June–August. [...] Outside the main [season, the spawning period] we caught a mix of the three species [hapuku, bass, bluenose], and in July the ling [began] to spawn, so we put lines down to 500 m for ling, at the same time as we put lines at 150–200 m for groper.
- As we had three species, hapuku, bass, and bluenose, all spawning at different times of the year, and we were able to use the same gear, we were not pressuring one species all the time. Some trips we would have an even mix of the species, but when we found the spawning [locations] we would end up with two-thirds of the spawning species and one-third of the others.
  - May is the first month when serious line fishing is undertaken for groper, [mostly in shallow water for relatively small fish. [...] July is the most reliable month of the year for groper fishing [...]. After this consistent fishing goes off with the apparent movement of groper out into deeper water. Fishing from then on becomes irregular.

Cook Strait

- During autumn and early winter I catch adult [hapuku] which are starting to school up for the coming spawning season. In November and December I catch adult [hapuku] which are spent, hungry, and generally in only average to poor condition.
  - Best months May–July; [where the seafloor is] mostly rocky pinnacles, but [on the] mud in winter.
  - Best fishing from February to July. August and September [are] poor because fish are in spent condition.
  - During April [hapuku] are first caught at the southern end of Cook Strait, [this being the start of] the peak season; [they appear first] in deep water (350–400 m), then move shallower.
  - [Kaikoura, mid 1970s] The season is from April to July inclusive. The usual method is to alternate the days between lobstering and groper line-fishing.
  - [Kaikoura, late 1970s] Setnet fishers [...] net for hapuku in 100–150 m on a bank [a short distance] south of the Kaikoura Peninsula. [The fishing ground is a narrow band 2–3 km long.] A concentration of [hapuku] occurs [here] in June and July, nearly all the fish [being] in ripe condition. [... for the rest of the year] the setnetters follow runs of moki, tarakihi, and warehou [and groper, bass, and bluenose are caught in small numbers].

East coast South Island

- Consistent catches [occur] Jan–Jun, then most hapuku move into deeper water (depending on conditions) and don't come back until Sep, when all big fish are skinny.
- In the 1960s when [hapuku] were spread over the open bottom areas we used to follow them from the Rakaia River area (April) to off Le Bons Bay (June-July) as they moved north. They were bigger breeding fish with roe. We used to hear Kaikoura fishermen talking on the radio when they [knew we were catching them, saying it wouldn't be long before they were there also. I am not sure whether the Mernoo Bank enters the equation somewhere because we [fished there June–September and] made good catches in August and September. Small groper come back inshore at the end of October.
- I have had very good catches of [hapuku] in December at the same [localities] as my Mar-Apr fishing, though I am usually fishing for other species during this period.
- My understanding of migration in this area, 022, is that the [hapuku] move from south to north. Catches [at Timaru and south] generally show up before our season in March, April and May. [I have heard that NIWA] believe hapuku migrate up the east coast of the South Island and travel through Cook Strait, and the fishing pattern here would endorse that.
- [South Island in general] The season is generally January to May for catching groper in [numbers].

Southern South Island

- The [hapuku] in our area usually come back around just before Christmas, but are usually all over the place, so we wait until they move on to rocks or gather up before putting too much effort into them. Then a week or two before the shortest day [i.e., early June] they disappear (depending on the seas and weather we have had) to spawn.
- Hapuku seem to be better during the summer months in Southland. I'm not sure whether it's because of the warmer temperatures, or the food supplies, i.e., squid or "whitebait".
- Hapuku appear to move into shallow water during summer months, then sometimes disappear (into deeper water?) during winter.
- [Moeraki], The [hapuku] start to run in November and continue until March.
- [From Bluff], actual groper fishing is only done between January and May, on slack tide [...] i.e., after the lobster pots have been worked, or there is spare time at the end of a trip.

West coast South Island

- [Our main season for bass] in the deep Hokitika Trench was February-March.

Fishers' comments: relationship with other fisheries

Northern North Island

- Our season [for both groper species??] is 2 to 3 weeks, from August. It differs in some years.
- Here the groper season may be driven by the lobster season, but I also think the groper are bass, and you are catching the spawning season.
- [Bay of Plenty. We] could fish all year round, but the boat is used by [another skipper] for tuna fishing in February-March, and [at other times] is used for lobstering as well.
- About 20 boats are working from Whangarei on lobster and hapuku fishing. About six boats fish hapuku during the winter months, May-October. Their catches comprise lobster 50% and hapuku 50%.
- [From Houhora ...] Some 12 boats are working lobster at present, but are shortly to change to hapuku. [...] Due to a poor lobster season [they] are moving to hapuku earlier than usual.
- [From Whangaroa ...] The lobstermen have had a very poor season and most have changed over to hapuku. There are about 12 boats working the Three Kings Is. now, [whereas] last year [...] was the only boat there. [From Opua ... [fisher X] has not worked hapuku for five years ... because lobster were more profitable.
- [Bay of Plenty] [vessel] also works tuna and lobster in the season. Could fish all year as the fish are [present]; weather is better in November so bigger catches are landed.
- [Seasonal pattern for Bay of Plenty vessels, 1970s, two fishers]: (a) March to June, rest of year lobstering. (b) April to June, rest of year lobstering.

Eastern North Island

- Will abandon hapuku fishing on reports that lobster are available in quantity.

Cook Strait

- We generally fish for lobster from the end of June to November, then fish for [hapuku] and shark during the rest of the year. We generally fish for [hapuku] during neap tides, then change to longline for shark during spring tides. This "spells" the groper grounds and allows them to recover rapidly. Migration may be some sort of [response] to the feed cycle. In May, birds such as Cape pigeons and albatrosses appear in numbers. Humpback whales also appear, and it was at this time [that] jack mackerel used to enter Port Underwood and Tory Channel. I have seen large shoals of mackerel off Cape Campbell in May, and as they pass [hapuku] lines set in front of them the buoys begin to bob as groper – following along under the mackerel – take the baited hooks. Sometimes barracouta would have the same [relationship as the mackerel].
- [We trawl, so don't] target groper, but take it as a bycatch when targeting tarakihi. [We catch most from September to January.]
- Groper fishing is mostly carried out in the off-season for lobster, as a fill-in fishery.
  - [Late 1970s], Most of the vessels involved in groper fishing spend their year as follows: June–July groper fishing, July–January lobster fishing, January–April tuna fishing [but varies], April–May gillnetting for butterfish.

East coast South Island

- We used to fish for hapuku in the off-season for lobster, but now with the short lobster season we catch [hapuku] any time the price is right. [Also], in 1963 and 1964 we fished the Mernoo Bank because of a bad lobster season.

Southern South Island

- While the groper are around we target them. But we are also fishing for blue cod at the same time, so if things are not suitable (e.g., tides, weather) we just concentrate on blue cod.

West coast South Island

  - [Some vessels working lobsters in the Fiords take some groper by line, mainly dependent on breaks in the lobster season.]
  - [Some line vessels fish throughout the year, but for ling and bluenose in addition to groper, while others fish only] when bass are running, being engaged in trawling the rest of the year. [The] line boats will also stop lining and concentrate on tuna when they are running.

Difference in timing for the two species

General

- [I suggest] what the graph [of north–south differences in monthly landings shows] is that the South Island fishery peak is based on bass where the spawning season is in February–March and the North Island peak is based on hapuku where the July peak is the height of the spawning season, especially Cape Runaway to Gisborne.

Northern North Island

- The northern region is later [than East Cape and northwest North Island], April to July for hapuku and August to October for bass.

Cook Strait

- My peak season for hapuku is November, December and January which is after they have spawned. My bass peak season is in May and June when they are primed to spawn. This happens in completely different areas to where the [hapuku] are.

Summary of information

Main season: hapuku

Some generalisation is possible, although the information provided contains apparent contradictions resulting from different patterns of fishing activity. For the main species, hapuku, equal numbers of fishers (a) fished throughout the year to supply the market, (b) fished for hapuku when not engaged in

another fishery, and (c) fished when hapuku were seasonally most abundant. The most consistent pattern emerged from the nominated main season for hapuku (section C above), together with the associated notes. Along the east coast of both islands, the main season was earliest in the south, becoming progressively later northwards, moving from summer through autumn to winter, a shift of about six months. The southernmost (Southland) season occurred from November to May, centred on January to April. Off the Canterbury coast the season was March to May or June. In the Kaikoura setnet fishery the season was described as April to July, which agrees with the recorded data from the 1990s showing a regular peak in June-July. Several fishers commented that the fish "appeared" progressively later from south to north, and interpreted it as movement. Around Cook Strait the season was generally described as April to July, with the earliest appearance in the south. Along the eastern and northeastern North Island the season is later, June to September, from some accounts peaking in July, but possibly extending later. One fisher commented that the North Cape fishery peaked later than that at East Cape. There was less information on the hapuku season along the west coast of both islands, but it appeared to be more uniform than the east coast, with most reports centring the season at December to April. It is thus either later than the northeastern season, or (alternatively) earlier than the southern season.

Main season: bass

The few responses on the bass fishing season did not reveal a clear pattern. There were apparent contradictions, possibly because in most areas bass are a secondary species to hapuku (and to more important alternative fisheries).

Alternative fisheries

As expected, there is some alternation between fisheries for groper and fisheries for other species. About half the respondents – most of whom were important groper fishers – reported this, and the proportion would presumably be higher among all groper fishers. The main alternative fishery was lobster potting, again as expected, but there was involvement in a variety of others. Perhaps the most striking feature of this alternation is its variability. Some fishers appeared to alternate between groper and lobster on a reasonably regular basis, but others moved between fisheries more irregularly, or at least earlier or later than usual, depending upon relative catch rates, prices, and (in recent years) on available quota. Some fishers alternated between two fisheries (e.g., groper and lobster) on a daily basis, and others combined two fisheries on the same trip (e.g., groper lining and lobster potting, or groper lining and setnetting for inshore fish species).

3.6 The quota management system (QMS) and fishing patterns

Background

The quota management system (QMS) has undoubtedly influenced the way the groper fishery operates. Recent studies by NIWA have separated the catch and landings records into "pre-QMS" (to 1986) and "post-QMS" (1990 onwards). It is generally accepted that there has been progressive acquisition of quota by companies, and therefore probably more control by LFRs on when during the fishing year the quota is leased out (and thus caught). Most regional TACCs are now fully caught, and this must be a major constraint on fishing. The QMS is complex, in particular the changes introduced during the 1990s, and it is difficult to ask specific questions. But if you have some views on how the QMS has changed the groper fishery, **especially its seasonal patterns of fishing effort and landings,** your comments will be appreciated. Issues are likely to include: quota ownership, quota price, quota leasing, the use of quota to cover bycatch rather than targeted catch, ACE, deemed values, (etc.).

Replies and fishers' comments

Northern North Island

- QMS has lessened effort due to cost of lease or purchase of quota. Compared with returns, margins are very small these days. [However,] there may be increased effort in the next couple of years due to very slow tuna fishing.

- We fish [both] these species all year round. [We run out of quota] in HPB 8 and 2 [first], so more time is spent in HPB 1 where the greatest [quota] holdings are available. I think that fish stocks are generally in better shape since the implementing of ITQs, [but] quite the opposite could be said for fishermen.
- The northern North Island [and down to Hawke Bay fisheries] are almost certainly being driven by the availability of HPB quota from the LFRs. HPB 1 quota is in short supply, and the deemed value is so high that they do not release it early in the year. Another [complication] is that [many] fishers in the two northern areas are targeting bluenose in midwater, and only target groper as the sheds force the issue towards the end of the fishing year. The quota system is very good for sustainability, but [...] useless for maximising the sustainable yield.

Northwest North Island

- [The quota or TACC given to Fishstocks 7 and 8 may be low, relative to stock size] because of limited fishing activity during the years when the fishery was first assessed.

Cook Strait

- I have no problem getting sufficient quota to lease at a reasonable price [...] We do [also] catch shark and lobster, and I am not sure that if we fished [hapuku] fulltime (a) the resource could stand it, and (b) whether we could lease enough ACE to keep us going. This year we have arranged to lease [...] t of HPB ACE in addition to our own [...] t, and these amounts have been fairly stable for a number of years now.
- The QMS has shifted a lot of the (traditionally) line-caught groper to the trawl fishery, as a bycatch species. The bigger companies have collected up a lot of the quota from inshore lining operations and shifted that quota to their larger trawlers.
- [From a trawl skipper's perspective:] We don't usually target groper, we catch them [in the Egmont region] along with tarakihi and John dory. The problem for us is access to quota to enable us to target tarakihi and John dory and all the other species once we have caught our HPB quota. We have big Deemed Value bills, so it ends up being unprofitable targeting TAR and JDO and all the rest because we also catch HPB. We end up leaving the area where the fishing is usually pretty good (though when you [add in] the Deemed Value bill from the equation it's not so good). [In other words,] our catch of HPB is lower than it would be if we could cover the HPB quota and stay fishing in these areas – maybe by catch trade-offs or cheaper Deemed Value bills.

East coast South Island

- The QMS has destroyed the one-man boats, and nobody gives a damn. All we wanted to do was go fishing. Up the paperwork. Groper were never under threat.
- In HPB3 most of the quota has been bought by fishermen and investors (I guess) who are located in groper-abundant areas such as Kaikoura, which seem to have 2 or 3 times more groper on their grounds than on our Dunedin areas. [Consequently,] they are able to pay higher prices for purchase or lease of quota – quite simple really! We all have the same market opportunities if we try, so the price paid for product to fishers is similar but catch efficiency is the main difference.
- [Re the QMS,] I understand you can no longer target without quota, and you can no longer cover or swap species to cover over-catch of groper, which is good because I'm sure groper was targeted (an easy killing in school situations) and swapped for uncaught quota, e.g., elephantfish, etc.

Southern South Island

- [General:] We are a third generation fishing family, and we are fishing the same grounds for groper [that] our grandfather and father have used and worked. Over the years you will have a strange year, when you know the groper are there but for some reason won't feed, or when the tides are right to have a go at the groper the weather is against us so [you] miss out. You do have the odd bad year, but on the whole we feel the groper have improved and are not on a decline. [As to the QMS:] we feel it has been good for the industry [in terms of] fish stocks, but as far as the follow-on effects of quota price-leasing, and everything that goes with it, we wonder what the hell we are doing half the time, trying to make a living. [For example,] when you look back, the years when the catch history was taken were the worst years for that fishery, meaning now that you have to go and lease quota.
- The QMS seems to work okay, but if they increase the quota it will only increase the lease price; then, as for other species, it would make it impossible for the smaller fisher to obtain [quota].

[Additionally,] if the Ministry doesn't restrict the fishery somehow it will have everyone fishing for groper, [and] that will see the end of the groper industry. I target hapuku all year round. I have many different areas or patches which I try to nurse along and conserve, and never clean out or take the last fish. I believe that if many more fishers start to target groper they will clean them out. There is far too much greed in the New Zealand fishing industry, and with the very high lease prices for the main species [fishers are tempted to] look for alternatives such as groper.

Summary of information

Although no responses directly discussed the effect on seasonal fishing patterns, several fishers commented on their difficulty in obtaining quota. In some cases it had been bought up by companies to use as cover for trawl bycatch (although one response suggested this was still insufficient in some areas where groper (almost certainly hapuku) were regularly caught). In another case quota was believed to have moved to an area within a Fishstock where groper could be more efficiently caught. In both cases, economic decisions had replaced traditional activity. By extrapolation, some – probably many – of the small-scale fishers who fished groper as part of their annual fishing cycle have less control over when they can fish, and how much they can land. However, no respondent claimed the QMS to have completely disrupted their fishing, and under a scenario of increasing costs (boat operation, QMS compliance, etc.) it is likely that they would fish as efficiently as possible, and continue to work in the season when groper were most abundant, or at least sufficiently abundant, in comparison with other fisheries, to be targeted.

A variety of more general opinions was expressed on the QMS. Many fishers accepted the principle of QMS, and believed that it had effectively protected groper stocks, though at the expense of the small-scale fishers themselves – through loss of direct "quota" ownership and high compliance costs. There were mixed opinions on quota levels. Some believed their regional Fishstock TACC to be too low, perhaps resulting from an incorrect original assessment. Others thought that TACCs were about right, or at least should not be increased. Several fishers made the point, here and elsewhere in the questionnaire's responses, that they accepted the limitations of groper stocks. Rather than fishing-out small grounds and moving on to new pinnacles and banks, as is sometimes assumed, they rested their known grounds for a period of time before returning to fish them again.

3.7 The seasonal reproductive cycle of groper

Background

It is probable that, at least collectively, fishers know more about the spawning cycle of groper than do scientists. Bringing this information together would help to understand some general features on when and where hapuku and bass spawn. Could this somehow be related to their apparent north–south movement? The male and female roes enlarge greatly as groper approach spawning. However, they probably remain enlarged for some time before spawning, so roe size alone is not a good indicator of ready-to-spawn fish. For this general review, three stages can be defined:

Ripening	Male & Female: roes moderately enlarged
Ripe	Male: some milt will flow if pressure is applied
	Female: some clear (dark) eggs are visible in the paler roe
Running ripe	Male: milt flows easily
	Female: many eggs are clear (dark), and the roe is fragile. In this condition the roes may have little or no commercial value

Questions and Replies

In your region, what months do you observe hapuku and bass with roes in the above condition? Females only. A question on males follows. Each fisher's response is given a separate row.

Hapuku, female

Northern North Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Northwest North Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Eastern North Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Cook Strait

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

East coast South Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Southern South Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Fishers' comments

Northern North Island

- [Northern regions have different spawning times.] East Cape is earlier than North Cape [... the northwest region] is later than North Cape.
  - [East Northland and outer Hauraki Gulf] Best hapuku months are October–November (possibly because of weather?). From February to April [we] find them with roe in, they start disappearing to spawn, coming back about September. [...] July to September, hapuku are [spawning in groups in deeper water]. [Bay of Plenty] bass, hapuku, bluenose appear to spawn February-March.

Northwest North Island

- Hapuku in roe April–May, on the mud in June.

Cape Egmont region

- Lobster boats work in their off-season for hapuku, January to June, their best landings in April-June.

East coast North Island

- Spawning season June-August (local tradition, when there is snow on Mt Hikurangi).
  - May is the first month in the year when any serious line fishing is undertaken for [hapuku]. There are a few fish about and most fishing is done in shallow water, 45–65 m [...] on average the fish are small, 3–5 kg. June is the first month of spawning fish occurring in quantity [...] The start of spawning is patchy, with the roes starting to develop in May, June sees full roes, with the odd groper spawning in 90–130 m. July is the peak month of the year; big spawners comprise [most] of the fish caught, [... they are in full roe and taken in] a depth of 130 m or more. In May-June the [male:female] ratio is about 5:1; in July, the peak season, the female percentage increases but [they are] still outnumbered by males. The females are [on average 40% heavier than the males], so most of the large groper caught are female. [The peak of the spawning season can shift by about one week between years.] Spawning generally occurs from the last week of July to about the second week of August. [...] The bulk of spawning [about two-thirds] occurs within a two-week period. After this, consistent fishing goes off with the apparent movement of fish out into deeper water.

Cook Strait

- [Hapuku] prefer not too muddy a bottom, except in midwinter (July) when they are taken on a thick mud bottom, perhaps connected with spawning.
- When fish spawn at the Brothers Is they are good fish, fat, with thicker bodies. After spawning, fish on [rocky grounds] from the Straits to Kapiti I. are in good condition. Fish on the soft bottom – Island Bay ground, Palliser, Cape Campbell – are not in good condition; they are big fish but battered and thin.
- [In northern Cook Strait] large pre-spawning fish are taken in deep water during July-August. Then these disappear, [their place being taken by] smaller fish. The spawning season is winter, June–July, the average fish being about 8 kg. Fishers think that spawning occurs over the whole area in July, on blue mud.
- There are two distinct populations of [hapuku] in Cook Strait, ["spawn" (mature breeding) and "spring" (mainly immature) fish]. (1) Spawn fish first appear in April–May, in deep water (200–250 m) of the southern Strait. [They have ripening roes.] They disappear in August, [reappearing] in October in a spent condition, close to where they were last seen in a ripe condition. They remain, [distributed over] mud and shingle banks, for about one month, [disappearing again] until [returning in a ripe condition in] the following April. These spawn fish can be caught on both tides. (2) Spring fish appear in August [when spawn fish disappear]; they average 80 cm, are immature, and are [more common] in the northern Strait. They concentrate on rocky [seafloor, (cf. flatter areas)]. In October they disappear when the spawn fish return, [but are present again in the northern Strait, January to March]. Spring fish are only caught on the south-going tide, perhaps indicating that they are travelling in one direction. [There is thus an alternation in apparent abundance of the two populations. In addition, spawn fish appear to be more heavily infested with external copepod parasites.]
- At the end of May ripe [hapuku] appear on the banks [cf. reefs], the males arriving first, and stay until July. There are no [hapuku] on these banks for the rest of the year. These areas can be fished day after day without any decline in the catches. The fish then disappear until October, when they come back into the shallows – spawned-out, skinny, with scarred jaws, bellies and tails, and very hungry. They soon put condition back on. When the fish are on the bank they are ripe, but not running ripe. [... it appears that] the ripe fish move into [deeper water] and barren fish stay on or near the banks. However, the movements of the ripe fish is confusing; when sperm whales were caught in Cook Strait [from deep water] they often contained [hapuku] with ripe roe, before [such hapuku] had appeared on the banks. [Ripe] fish are first caught at the southern approaches to Cook Strait and gradually work north. When they first appear they are in 110–160 m, and when they disappear in about six weeks' time they are in about 350 m. These ripe fish almost always have empty stomachs.
- The fish that were barren were very fat and in superb condition. These barren fish are always found in [parts of Cook Strait] in May–July, as they do not go out into the deeper water with the [ripe] fish.
- [1980s, a long-time fisher] believes all [hapuku] move north through the Straits, never south. [...] The [hapuku] in October–November seem to move in on the southern rocks first, moving north.
- [In the Kaikoura setnet fishery] the run of [hapuku] usually lasts six weeks; they take three weeks to peak and then three weeks to disappear. [...] about 25% of the fish caught are females in roe. [... It is suspected] that these fish are coming from either Chatham Rise or Mernoo Bank, and are the same fish that are caught [between] Banks Peninsula and Cook Strait during the same period.
- [1985 summary of Cook Strait information] [Tagging studies showed that most juveniles were resident. A few returns from larger fish supported] the theory put forward by Cook Strait fishers for many years, that mature "spawn" fish migrate in a northerly direction around Cape Campbell and into Cook Strait, [then move at 200–300 m across the Strait and] move up the Wairarapa coast, constantly going deeper, [to] spawn. [...] It is also suspected that [hapuku] approaching spawning condition that [occur] in areas south of Kaikoura move north to spawn, [and that] mature fish on the Chatham Rise travel to the coast, just south of Kaikoura [and also] move north. [Initially, these migrating fish might not travel] in concentrated schools and are therefore not caught commercially. However, when these fish reach [...] Kaikoura they [become concentrated in the narrow] 200–300 m depth zone [...]. At this stage they become vulnerable to the [setnets] of

Kaikoura fishers. These [hapuku] continue north and become dispersed as the continental shelf widens. On reaching Cape Campbell they [are again concentrated by a shallow underwater extension of the Cape across the shelf] and are fished by the Picton line fishers. [Once again they] disperse until reaching the Brothers Islands. The seabed [from here to] the Wairarapa coast is steep and narrow [for appropriate depths], and the fish are again concentrated in schools; [here] they are vulnerable to [...] line fishers on both sides of the Strait.

East coast South Island

- There used to be a run of 25–35 kg hapuku come through our area [Akaroa] from the south, April–May. Timaru had a similar run a month earlier. These fish were 50:50 male/female, and full of well-formed roe. All fish over about 15 kg left the Akaroa area about this time.
- It was always thought that hapuku spawned in Cook Strait, but I suspect they may not have gone that far north.
  - [In the Timaru area hapuku] are caught May-July all full of very ripe roes, [but] no spawning fish are ever taken. [During this time] they move into deeper water, [and are] not seen again until November, with small roes or as spent fish. In November they are in 70 m, in December they move along the beaches feeding on small sharks. Often these are the smallest hapuku.
  - [At Oamaru] in June-July fish are full of roe; at the end of July they are in deeper water, then they vanish in August, [though some, usually barren, fish] are caught on rocks. The beginning of the season is September–October; [fish are caught] in deeper water, some are scarred, battered, and spent.
  - [Further south at Moeraki, hapuku] are taken on rough bottom through the winter. Fishermen think there is a northward movement, fish are first caught at Moeraki and Oamaru, then outside Timaru.

Summary of information

As anticipated, unfortunately, conflicting information was provided. The tabulated information was reasonably consistent between fishers, but sample sizes by region were small. The additional comments were somewhat variable between fishers, and sometimes also differed from the tabulated information. It is possible that this partly results from the extended period when female roes are large and are interpreted as almost ripe. However, the one consistent feature of the tabulated information is the estimate of a 3 month progression from "ripening" to "running ripe". There is a weak and inconsistent trend in this tabulated information for the reproductive season to be at least one month earlier in the south, May–June, cf. July to September from Cook Strait northwards. The additional comments imply a more uniform spawning season, with running ripe fish – or assumed spawning activity in deeper water – occurring between May and September and mainly in July–August.

A striking feature of most fishers' additional comments was the inclusion of observations or inferences on fish movement or migration in association with spawning. South Island fishers were of the firm opinion that hapuku moved northwards from April to July, based on the progressive appearance of the main "run" of fish on their main grounds, from Otago to Kaikoura. (There is a possible alternative explanation: local fish formed aggregations progressively later, from south to north, perhaps in response to some environmental factor, moving only locally rather than from south to north.) Cook Strait fishers report a northward "appearance" (movement?) of fish in the strait. Some make the assumption that these are the same fish that have moved north past Kaikoura, despite their first appearance in April–May being similar to the timing at Kaikoura (see Figure 8). However, the timing of hapuku "runs" in Cook Strait, based on catch weight or catch rate, is complicated by the widely reported presence of two groups of fish: "spawn fish" (mature adults) and "spring fish" (immature fish caught most commonly in early spring, August to October). Information compiled in 1985 from fishers' observations and theories suggested that mature adults with ripening roes moved north into Cook Strait, then east across the strait narrows and north again along the Wairarapa coast. An alternative explanation for the disappearance of these fish in August and September is that they disperse widely over the flat muddy seafloor. In October and November thin, spent, and scarred adult fish reappear in Cook Strait and along the east coast of the South Island.

Bass, female

Northern North Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Northwest North Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Eastern North Island

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Cook Strait

Ripening roes (roes moderately enlarged)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Ripe roes (some clear (dark) eggs are visible in the paler roe)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Running ripe roes (many eggs are clear (dark), and the roe is fragile)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Fishers' comments

Northern North Island

- [Northeast coast], bass spawn May–June. [Bay of Plenty] bass, hapuku, bluenose appear to spawn February–March.

Eastern North Island

- Bass spawn, from memory, January and February.

West coast South Island

- [From] March to September the bass are barren. Bass are in a ripe condition during January and February although no fish are seen to be actually running ripe, [and relatively few fish are caught during this time]. The bass are spawned out in March, being in very poor condition. They are not caught again in numbers until September; [when they reappear] the ling disappear. [... Fishers claim that bass definitely move about a great deal, as the [hapuku] do in Cook Strait.

Summary of information

The limited information provided on bass spawning is consistent, but contains a significant conflict. Two quite different seasons are listed: one in spring-summer, with spawning centred on February, the other in winter, with spawning in either July-August (Cook Strait, at the same time as hapuku) or September-November (northern North Island). This issue must be left open until more information is obtained.

Fishers comments on male hapuku and bass

Northern North Island

- Male fish for both species tend to appear earlier than females, and disappear sooner after spawning.

Cook Strait

- Male groper usually appear with [good] roes a little before the females, and do congregate in certain areas at this time, e.g., outside Cook's Rock. As the females begin to develop roes the males spread out and mix with them. The males seem to become "running ripe" a little before the females.
- Males generally arrive on the grounds before the females and seem to be riper than the females. By the end of June both sexes seem to be in an equal state of readiness for [spawning].

3.8 "Disappearance" of fish before and during spawning

Background

It is frequently stated (see above) that groper, particularly hapuku, disappear from their normal grounds as their spawning season approaches. This question attempted to prompt answers that might provide additional information to the previous answers.

Question

Do hapuku and/or bass "disappear" from your normal fishing area as their roes ripen?

Hapuku

Northern North Island

Yes	No	Don't know	Males	Females	Both sexes
Yes	No	Don't know	Males	Females	Both sexes
Yes	No	Don't know	Males	Females	Both sexes

Cook Strait

Yes	No	Don't know	Males	Females	Both sexes
Yes	No	Don't know	Males	Females	Both sexes

East coast South Island

Yes	No	Don't know	Males	Females	Both sexes
Yes	No	Don't know	Males	Females	Both sexes

Southland

Yes	No	Don't know	Males	Females	Both sexes

Bass

Northern North Island

Yes	No	Don't know	Males	Females	Both sexes
Yes	No	Don't know	Males	Females	Both sexes
Yes	No	Don't know	Males	Females	Both sexes

Cook Strait

Yes	No	Don't know	Males	Females	Both sexes

Fishers' comments, both species

Northern North Island

- Bass seem to move deeper when not in roe.
- o August, the spawning month [for hapuku?] is the best time to catch them, for they gather (mostly females) but in deeper water than the rest of the year.

Cook Strait

- From early July to the end of August we do not see spawn [mature, ripe] fish, only smaller immature fish. At the middle of September the larger fish return and they are in poor condition, and some are chafed under the jaws, etc. They feed very heavily at this time, are easy to catch, and fatten rapidly. Before spawning, [hapuku] are always fat and sleek, but lose condition while spawning. I do not have any theories whether they shift away to spawn or whether they just stop feeding during the spawning process.
- o In September and October there are [few] fish, and it is not worth fishing.

East coast South Island

- It was always thought that hapuku spawned in Cook Strait, but I suspect they may not have gone that far north.

Southern South Island

- A week or two before the shortest day [i.e., early June] the [hapuku] disappear (depending on the seas and weather we have had) to spawn.

West coast South Island

- o Bass are in a ripe condition during January and February although no fish are seen to be actually running ripe, [and relatively few fish are caught during this time]. The bass are spawned out in March, being in very poor condition. They are not caught again in numbers until September; [when they reappear] the ling disappear.

Summary of information

The rather limited information offered here, and in response to earlier questions, does point to either a disappearance or a movement to deeper water of mature, ready to spawn, hapuku. This disappearance occurs earlier in the south (June) than in Cook Strait (July–August) and northern New Zealand (August). Their return to their usual grounds commences in September, but is probably not well documented because the fishers are working in other fisheries. There is little information on bass, but an indication of movement (or dispersal) away from their usual grounds during or after spawning.

3.9 Juvenile hapuku and bass

Background

Very little is known about the juveniles of these two species. Few have been caught, or at least caught and reported to scientists. Most recorded juveniles have been pelagic, caught at or near the surface and often associated with drifting seaweed or other flotsam. Small hapuku have a brownish to blue-grey banded pattern, which at 40–60 cm changes to bright blue above, white below; these fish then settle to the seafloor, where (as "baby blues" or "blue-bottles") they are not uncommonly caught by fishers in some areas. Small bass have an irregularly mottled pattern, usually brown and yellowish brown; this

gradually changes to the overall mid-brown of adult fish, although some adult bass retain some trace of the lighter lines and patches. A sequence of sizes for each species is illustrated in Figure 9.

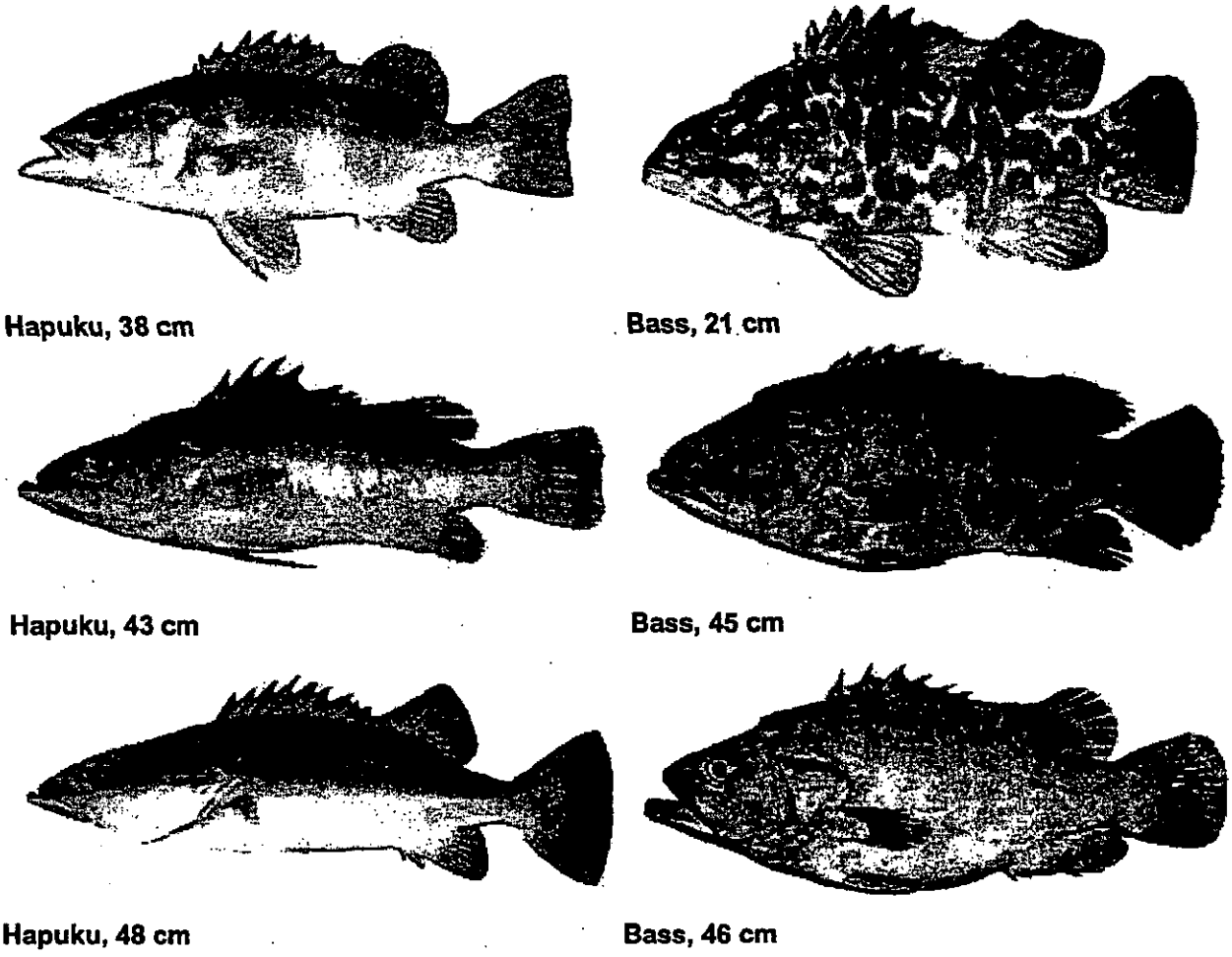


Figure 9: Juvenile hapuku and bass. Photos modified from those published by C.D. Roberts.

Question

We would like to know whether juveniles of the size illustrated above occur in your area. This may help define the location of spawning sites (which will be a considerable distance away, "up-current"), and of nursery areas (if such areas do exist – juveniles may simply be dispersed). Suggestions for comments: species; size; habitat and/or method caught.

Replies and fishers' comments

Northern North Island

- We catch juveniles from November to April in various stages, mostly in [relatively] shallow water with red snapper and king tarakihi.
- The smallest hapuku are usually caught in shallow water – inside 100 m. They are predominantly found in the waters around Great Barrier, Moko Hinau, Poor Knights, and Cape Brett. Small fish are not often caught in more northern and western areas. [However], this may be more of a "pecking order" [issue] where there are more adult fish, than [an indication of] where small fish live.

East coast North Island

- Saw a lot of juvenile bass while surface longlining off Napier this year [2004].

Cook Strait

- Juvenile [hapuku] 30–40 cm in length congregate together in quite large numbers; one place is just outside White Rocks off Queen Charlotte Sound. These fish have always congregated there, even when groper were first fished. The local fishermen do not fish there because the fish are so small. I found a similar place at the Memoo Bank in 1982. We set 1200 hooks for 900 [hapuku], all about 40 cm long. We moved away as we simply could not get enough quantity of larger fish.
- We do have areas in Cook Strait where juveniles congregate in July, August, September, and October. These areas have held these fish since our records began in 1945.
- Where are the very small [hapuku]? I have one in a bottle of formalin from about 20 years ago; you never hear or see any in trawl shots, etc. But they must start somewhere.
  - Small [hapuku], 50 cm, [have been found] in August near Brothers Is.

East coast South Island

- Small hapuku have always been under floating kelp, and were never targeted. [Small] blue groper used to be in large schools along the 20 fathom [35–40 m] line south of Akaroa; not fished by line boats but decimated by trawlers in later years.
- I have very rarely seen groper less than 38 cm. But [I find small] blues on patches of rock never previously fished. They school separately from the main school [of hapuku] but nearby, until they are fished down and then they seem to combine.
- I have seen small blue-coloured [hapuku] move into areas which have previously only really had bigger [hapuku], but after some fishing pressure seem to re-stock with the smaller school [hapuku] normally found out on sand/shelly bottom in large numbers.
  - Small [hapuku], 25–28 cm, are reported off Oamaru in 90 m, on rough bottom.

West coast South Island

- While tuna fishing off Greymouth I have caught juvenile bass on the tuna lures around floating driftwood along the tidal convergences. Again, these were only about 40 cm, spotted and sometimes an unusual colour.

West coast North Island

- [I] have had some bottom longline sets with a lot of small HPB [? possibly bass] which were not much bigger than the pelagic [young bass I have seen elsewhere] and I therefore assume they must have just moved down to the bottom.

Summary of information

Juvenile hapuku and bass are widely reported. The smallest juveniles have been caught in surface waters, in association with drifting material, supporting existing reports. The small blue hapuku appear to be widely distributed, but concentrated in particular – especially relatively shallow – areas. There is no indication that juveniles of either species are more common in the north, or in the south. The relatively long pelagic juvenile life history stage (the duration is unknown but assumed to be more than one year, and possibly three) presumably permits wide dispersal via coastal currents.

3.10 Other information not specifically covered above

Background

Space was provided for fishers to express opinions on any matters they considered relevant to the groper fishery but not specifically covered by a question. Some of their comments here did in fact apply to a topic above, and these have been moved to the appropriate section. Others are grouped under subheadings below.

Question

Do you have any comments on groper fishing issues not mentioned in this questionnaire?

Replies and fishers' comments

1. Geographic and depth distribution of species

Northern North Island

- Catch composition: Three Kings Is, 65% bass, 30% hapuku, 5% bluenose; Whangaroa, 20% bass, 70% hapuku, 10% bluenose. [Landings into Whangarei from northern grounds, 5–10% bluenose, then bass slightly predominating over hapuku.] [Catches on Bay of Plenty grounds, bass 25%, hapuku 10%, bluenose 65%.

West coast North Island

- I feel the QMS does not take into account the effort put in for specific areas. Area 7 covers much of the South Island but also covers areas west of Cape Egmont. I wonder how much effort was put into this northern area when the QMS was introduced. I know there are a few boats coming up from the South Island, but as there has never been much effort out of New Plymouth which is closer, I think there could be a case to say that the area west of Cape Egmont has had very low [fishing] effort. [Fishstock HPB 8] is the same, with little historical effort but a very healthy fishery.
- [In the Viti Canyon, 300–400 m] the main fish taken are large bass.

Cook Strait

- We rarely catch a bass in Cook Strait these days. However, we have caught a few in the Palliser area as bycatch in the ling fishery.
- Hapuku are never taken over 450 m, their best depth being 150–220 m. The best depth for bass is 270–360 m.
- [In the Kaikoura setnet fishery] very few bass are caught. [In the Kaikoura line fishery] bass are caught all year round in small pockets.

East coast South Island

- Bass are deeper than 350 m. Bass were fished in the early 1950s north of Akaroa in 350–550 m. But no [or few] bass have since been landed, because of the low price.

South coast South Island

- Bass and bluenose appear to be in deeper water, 200 m or more, while hapuku are in less than 200 m. During summer there seem to be more school [hapuku] about.

West coast South Island

- Off the west coast of the South Island good numbers of ling, bluenose, and bass are caught, with very few [hapuku].
- [Both hapuku and bass are caught.] By 1978 there was a perceived decline in fish numbers, in part attributed to the presence of foreign longliners. Fishing on the different grounds, from Kahurangi Point to off Milford, has been sporadic, and is limited by weather.
- Bass, bluenose, and ling are fished for on the edge of the Hokitika Trench and Cook Canyon in 400–450 m. No [hapuku] are caught because [it is too deep]. However, there are [hapuku grounds elsewhere] in 100–200 m, taken in good numbers when these [shallower] grounds are fished.

2. Fish behaviour

Northern North Island

- Bluenose [are often] the first fish caught [when a new ground is worked], and tend to keep off the bottom. Hapuku are then taken in quantity.
- Bass appear to have fixed areas, while hapuku move around more.

Cook Strait

- Bass do not tend to school as often as [hapuku]. The exception with bass is when they are getting ready to spawn.
- [A decline in Cook Strait hapuku can be attributed to a decline in] the [hapuku's] main source of food in the winter. The steady decline has [...] coincided with the wholesale slaughter of the Cook Strait hoki. Up to and during the 1980s it was common to catch hoki on the top half of dahn lines

while targeting groper. It was also common for groper to spew whole hoki on the surface. Since then the hoki have disappeared from the grounds, and so have the winter groper.

- [Trawl observations:] We have on occasions caught significant quantities in our midwater trawl gear during the hoki season in Cook Strait. On one occasion [in the mid 1990s] we caught [more than one tonne] in one shot; this would have been with the gear 15–30 m off the bottom.

East coast South Island

- Most hapuku caught by trawlers are caught on the full moon when the groper go on to the mud and go hard [down] on the bottom at night. Other than this, hapuku are not silly and have adapted to trawling by mostly staying on the foul [ground].
- The schools shift around, and may be only a few hundred metres away, but you may not find them – at any time of the year.
- In my experience the [hapuku] tend to school in sizes, i.e., of two schools of fish within one mile, sometimes much less, one could be small fish and the other much larger fish.

3. Weather effects on fishing

Northern and eastern North Island

- Weather conditions determine [the seasonal pattern in] in fishing areas more than [fish] abundance. Fishing the north and northwest coast is done in summer months because of weather patterns. The [north]west coast has greater [apparent] abundance [and] higher CPUE than the northern and [north]eastern areas, but weather is unsuitable for at least half of the year. I have fished for more than 20 years and the biggest decline has been in fishermen [rather] than fish.
- Our usual trips were Tauranga to East Cape, or Gisborne to East Cape, depending on whether we had southerly or westerly winds, and we set gear at different depths as we moved between fishing grounds.
- When the weather was rough we fished more inshore, [on or close to the overfished recreational areas], when the weather was fine we took off [to deep water].

Southland

- Weather plays a big part in the fisheries here, as well as strong tides.

West coast South Island

- [Both hapuku and bass are caught. [...] Fishing on the different grounds, from Kahurangi Point to off Milford, has been sporadic, and is limited by weather.

4. Vessel and fishing method changes over time

Cook Strait

- Up until the late 1980s we had a healthy and vibrant [hapuku] fishery in Cook Strait, especially in the winter. Since then this part of the [hapuku] fishery has steadily declined to the point where it is no longer commercially viable during this period. My own view on this steady decline is that there are two issues: [1] The first issue is technology: (a) very accurate navigation systems, (b) echo-sounding and sea mapping, (c) monofilament fishing gear, (d) more pressure on handy fishing grounds from amateur fishers with modern electronics. [2] The second issue concerns the groper's main source of food [... Cook Strait hoki, which have disappeared after heavy fishing].

East coast South Island.

- Before about 1965, 90% of the groper were caught by dahn lines. From then on it changed so that 90% are now caught by trawlers. This trend started when synthetic trawls became available which gave an increase in headline height, and the greater horsepower and bigger boats continued the trend. The decline of the line boats started in the 1970s, with a major drop in boats coinciding with the start of the QMS. In the 1960s, Akaroa had a fleet of about 15 boats, now there is 1 boat. Lyttelton has none. Timaru none. So an area that had at least 30 line boats now has 1.
- Groper [fishing] off Banks Peninsula has changed. Modern gear and technology has enabled trawlers to target groper [hapuku] as they school, and in the last 20 years they have become confined to the rocky offshore areas. Up until the 1970s we used to be able to catch hapuku in abundance just off our lobster gear, but the modern nets and gear used by new trawlers has seen

them [mainly restricted] to the rocky patches offshore. Some of these groper "patches" contain predominately small fish, and others larger fish – [although] when fished hard these down-size. These [groper grounds] are from 11 miles to 30 miles offshore.

- Groper is only a bycatch in our [trawl] operation, and we would land only a few tonnes a year. Groper are certainly not as abundant in the Canterbury Bight trawl fishery as 15 years ago, but you still get lots of school groper in areas of foul ground at different times.

5. Charter fishing vessels

Cook Strait

- [There is] more pressure on handy fishing grounds from amateur fishers with modern electronics.
- From April to November I work in Cook Strait charter-fishing, targeting groper. From December to the end of March I fish commercially for groper on the west coast of the South Island

East coast South Island

- Charter boats are having major effects on [the rocky offshore areas] as they continually hit them when the weather is right, and never leave them alone to [let the fish] build back up. There is little monitoring of these vessels, and some of their landings have to be seen to be believed.
- My biggest concern is charter boats fishing known school areas day after day, skimming fish and not leaving a commercially viable catch. For years, [our] practice has been to fish a rock or area and then leave it alone to recover – the time [for this] dependent on time of year, the amount of fish that were there, etc.

6. The QMS

- The QMS is a totally mismanaged system. They don't care about fish stocks, all they care about is collecting revenue. It has made the rich get very rich, [even those who] are not even involved in the fishing industry. I think the bycatch system needs to be looked at. I know of big offshore trawlers dumping tonnes of groper because of [relative] values and quota holdings. The Deemed Values [system] is nothing but a joke; who is going to record [catches] and pay Deemed Values on fish that's not worth much? The QMS has allowed LFRs and big companies to own and hold quota. In turn, they dictate prices and make it very hard for small fishers to obtain small amounts of quota. It's time the Ministry stopped patting itself on the back and listened to what the fishers had to say. The squid fishery [for example,] is taking away the main food source for all inshore stocks and should be banned.

Summary of information

The main points made are these.

- Bass are relatively more common in the north, and probably also along the western coast, in deeper water than hapuku.
- The quotas originally set [on the basis of historical catches] for Fishstocks, and little changed since then, are too low in some because of low fishing activity at that time.
- The groper line fishery is closely associated with similar fisheries for bluenose and ling.
- Weather, and fish prices, influence fishing activity and target species. Considerable skill is required to recognise and work appropriate tides, and place lines accurately in relation to reefs and rough seafloor.
- Some fishers attribute the decline of groper in some areas to a loss of food; squid (southern South Island), hoki (Cook Strait).
- Other causes put forward to explain perceived declines include foreign line fishing (before this was phased out), electronic navigation aids, and competition from recreational charter vessels (though some commercial fishers also operate in the charter fishery).
- Declines in landings by line vessels is also linked to their loss of quota, through acquisition by companies and re-allocation to trawlers to cover bycatch.

- However, there are mixed opinions as to whether groper stocks have substantially declined. Some fishers maintain, here and elsewhere above, that by rotating their fishing effort through different known grounds, individual areas recover after a relatively short period.
- Trawl captures of groper (hapuku) well above the seafloor (noted here, and anecdotal information from elsewhere) suggest (a) midwater feeding, and (b) an ability of these large fish to migrate.
- In this section and in other responses to the questionnaire, fishers supported the basic concept of the QMS. There was agreement that it was protecting the groper stock. But there was also agreement that it had disadvantaged the fishers themselves, through loss of quota to large fishing companies, and that compliance costs – particularly in terms of paperwork – were high. There also seemed to be some suspicion that even though relatively more quota was now allocated to trawlers, groper (hapuku) were sometimes an unwanted bycatch and discarded.

4. DISCUSSION

Despite the low response to the questionnaire, much useful information was obtained on the groper fishery. Equal numbers of the responding fishers (a) fished throughout the year to supply the market, (b) fished for groper when not engaged in another fishery, or (c) fished when groper were seasonally most abundant. However, despite these different approaches to fishing, it is considered probable that recorded seasonal landings do reflect regional patterns in the abundance of groper, primarily hapuku.

Along the east coast of both islands, the main season was earliest in the south (January to April), becoming progressively later northwards, moving from summer through autumn (Canterbury and Cook Strait) to winter (northern New Zealand), a shift of about six months. The west coast season was less clearly defined, but appeared more uniform. Many responses stated (or it could be inferred) that the QMS had changed their pattern of fishing in some way. Consequently, pre-QMS data (to 1986) must be assessed separately from QMS data.

Fishers were not asked to comment on the success of the QMS, but many did so. They considered it *was operating to the benefit of the fish, but often at cost to fishers, mainly by a loss of control over* their fishing activities as the (sometimes scarce) quota shifted from small operators to larger companies.

The questionnaire was directed at obtaining information on the association (if any) between seasonal catches, the spawning season, and migrations. There was generally a positive response to the suggestion, made in the notes which were sent out with the questionnaire, that hapuku might move considerable distances. A variety of comments either supported this, or suggested variations such as movement away from deep reefs into even deeper water.

Information on the spawning season of hapuku was often unclear, but a consistent response was an estimate of a 3 month progression from "ripening" to "running ripe". There is a weak and inconsistent trend for the reproductive season to be at least one month earlier in the south (May-June) than from Cook Strait northwards (July to September). Many fishers inferred a northward movement of hapuku associated with spawning, at least along the east coast of the South Island and into Cook Strait. Also a "disappearance" of fish, or a movement and/or dispersal into deep water as the roes became ripe. Bass spawning was less well understood, and two different seasons (winter, and spring-summer) were nominated. Small juveniles of both species were reported from many regions, but often localised.

Three conclusions can be drawn. (1) Despite fishers shifting from groper to alternate fisheries, the different hapuku seasons in different regions do reasonably reflect local fish abundance. (2) There is recognition of a northward pre-spawning movement of hapuku along at least the South Island, and the spawning season is earlier in the south than the north. Although not confirming the hypothesis that extensive migrations occur, these results do not discredit it, and support rather than refute the concept of a single stock of hapuku. (3) Groper line fishing is episodic, and intertwined with similar fisheries

for bluenose, ling, and probably school shark; alternates with lobster and tuna fisheries. Post-QMS, it is limited by access to quota or ACE; some fishing patterns have changed, and groper fishing is probably more variable than in pre-QMS years. In combination, these give rise to significant and probably insurmountable difficulties in monitoring the fishery by CPUE indices of either targeted catches, or of groper bycatch in the set of related line fisheries.

5. ACKNOWLEDGMENTS

I thank the fishers who completed this groper fishing questionnaire. In particular, I thank those (and they were in the majority) who contributed additional notes on their fishing activities, and put forward their opinions on the topics under discussion. They were all interesting and useful. I must also thank the fisheries research staff who, over the years and following discussions with commercial fishers, have compiled notes on the groper fishery. The late Alex Johnston deserves special mention for his work on the Cook Strait groper fishery. This study was funded by the Ministry of Fisheries, as part of Project HPB2002/01.

6. REFERENCES

Ball, A.O.; Sedberry, G.R.; Zatcoff, M.S.; Chapman, R.W.; Carlin, J.L. (2000). Population structure of the wreckfish *Polyprion americanus* determined with microsatellite genetic markers. *Marine Biology 137(5–6)*: 1077–1090.

Beentjes, M.P.; Francis, M.P. (1999). Movement of hapuku (*Polyprion oxygeneios*) determined from tagging studies. *New Zealand Journal of Marine and Freshwater Research 33(1)*: 1–12.

Johnston, A.D. (1983). The southern Cook Strait groper fishery. *Fisheries Technical Report No. 159*. 33 p.

Paul, L.J. (2002a). A description of the New Zealand fisheries for the two groper species, hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*). *New Zealand Fisheries Assessment Report 2002/13*. 47 p.

Paul, L.J. (2002b). Can existing data describe the stock structure of the two New Zealand groper species, hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*)? *New Zealand Fisheries Assessment Report 2002/14*. 24 p.

Paul, L.J. (2002c). Can separate CPUE indices be developed for the two groper species, hapuku (*Polyprion oxygeneios*) and bass (*P. americanus*)? *New Zealand Fisheries Assessment Report 2002/15*. 24 p.

Peres, M.B. (2000). Dinâmica populacional e pesca do cherne-poveiro *Polyprion americanus* (Bloch e Schneider, 1801) (Teleostei: Polyprionidae) no sul do Brasil. Ph.D thesis. Fundação Universidade do Rio Grande.

Peres, M.B.; Klippel, S. (2003). Reproductive biology of southwestern Atlantic wreckfish, *Polyprion americanus* (Teleostei: Polyprionidae). *Environmental Biology of Fishes 68(2)*: 163–173.

Roberts, C.D. (1986). Systematics of the percomorph fish genus *Polyprion* Oken 1817. Ph.D thesis, Victoria University of Wellington. 283 p.

Roberts, C.D. (1989). Reproductive mode in the percomorph fish genus *Polyprion* Oken. *Journal of Fish Biology 34(1)*: 1–9.