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FINAL REPORT TO THE FISHERIES RESEARCH AND DEVELOPMENT CORPORATION

THE AUSTRALIAN BLUE-EYE FISHERY

FRDC Grant 90/12

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FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Department of Primary Industry and Fisheries
TASMANIA

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CHAPTER 1

Introduction

1.1 THE FISHERY

In the 1940's incidental catches of blue-eye or deepsea trevalla (*Hyperoglyphe antarctica*) were landed from research and commercial vessels operating shark longlines over the edge of the continental shelf break (120-180 m) off the coast of Tasmania. During the 1950's the potential for a fishery was explored by several developmental fishing surveys conducted by the Tasmanian Government and the CSIRO. The success of these surveys led to the development of a commercial line fishery off the east coast of Tasmania in the early 1960's.

Following this early success commercial fisheries developed off the southern New South Wales coast and off south-eastern Tasmania. During the 1970's the commercial fishery spread to northern New South Wales. In the 1980's there was a rapid expansion into new areas with fisheries developing off southern and south western Tasmania, King Island, eastern and western Victoria, South Australia, the Cascade Plateau and the extensive seamount system off eastern Australia. Much of this development followed government sponsored exploratory fishing surveys. The discovery of new grounds was also assisted by the experience of fishers from the trawl and shark fisheries.

Line fishing has been the major method used to catch blue-eye throughout the history of the fishery. A variety of line fishing gears have been used, with droplines being the most popular. Shark nets have been used to target blue-eye since the mid 1970's. This method of fishing has been prohibited off Tasmania and New South Wales and only persists off eastern Victoria. In 1989-90 target fishing with semi-pelagic trawl nets was conducted off Tasmania.

Landings from the fishery have increased steadily from almost 50 tonnes in the late 1960's to around 700 tonnes in 1990. The line fishery remains the major catching sector of the fishery accounting for 85% of landings, the remainder is landed as a by-catch from demersal trawling.

1.2 CURRENT ISSUES

Blue-eye taken as a by-catch by trawling was not a significant component of total blue-eye landings until the 1980's when a demersal trawl fishery developed off south-eastern Australia. During the latter half of the 1980's the trawl fishery grew vigorously as a result of speculation in the deep-water fishery for orange roughy (*Hoplostethus atlanticus*) (Hilborn and Walters 1992). The development of this fishery lagged behind the development of a similar fishery in New Zealand. As a consequence experienced skippers from New Zealand were sought for the Australian fishery.

By the late 1980's the South East Trawl fishery was significantly overcapitalised and operators were interested in finding alternative fisheries to maintain their returns. In New Zealand, a midwater trawl fishery had developed targeting alfonsino and blue-eye. Operators looked to developing a similar fishery in Australia, building on the improvements in vessels, fishing gear and experience.

Apart from the midwater trawl fishery one of the few demersal fisheries with potential for expansion was that for blue grenadier. This fishery is the major source of blue-eye by-catches from the trawl fishery.

The potential impact of both these developments on the established blue-eye fishery caused concern to fishers in the line fishery and to fisheries managers. The main concerns were the potential impact on the resource of increased catches and the impact on markets and returns.

Formal consultations between the line and trawl fishing sectors, State fisheries scientists and managers were held under the aegis of the Commonwealth's South East Trawl Management Advisory Committee (SETMAC) to resolve the issue. It was concluded from these meetings that research was required and that until more information was available, fishing should be maintained at the *status quo*. The need for research was readily apparent given the paucity of information relevant to the management of the fishery. The need for holding the fishery at its present level was prudent given the uncertainty about the ability of the resource to sustain current or increased catches.

To maintain the *status quo* the Commonwealth Government imposed a trip limit of 500 kg of blue-eye on South East Trawl (SET) operators in October 1990. This was followed by the imposition of a Total Allowable Catch (TAC) on both the trawl and line fishing sectors in January 1992. The aim of the trip limit was to discourage target trawling for blue-eye whilst permitting by-catches.

1.3 CURRENT RESEARCH

We see the principal biological questions of this fishery as being concerned with the current status of the fishery (whether the stock is under-, fully- or over-exploited) and the likely response of the yield of the stock to increased catches by trawl fishing gear. To address the immediate research needs of the fishery, the Tasmanian Division of Sea Fisheries (DSF) drafted a research program with the following objectives:

- describe the present fishery for blue-eye, including:
  - collation of historic catch and effort data
  - collation of historic biological data
  - introduction of a new catch and effort logbook to the Tasmanian line fishery
- evaluate differences in the vulnerability of the population to exploitation by either line fishing or midwater trawling
- collect basic biological data on:
  - catch composition, age, growth, mortality and reproductive biology
  - movement by tagging
- assess the impact of different gears on the fishery, individually and in combination

The first of these objectives aims to gain an understanding of the present fishery and establish a data base of historic data (such as catch, catch rates and fish size) from which indicators of the status of the fishery could be derived. The other objectives are to examine the productivity of the stock and the effects of the different fishing gears on yield. The program is not aimed at making an assessment of stock size as that type of study could not be achieved in the short term without considerable uncertainty over the outcome and an unrealistic budget.

The research program was submitted to the Fishing Industry Research and Development Council (FIRDC) for funding in 1990. The proposal was considered by FIRDC and initial funding was provided to describe the fishery and collate historic information. It is the results of this program that are the subject of this report.

In the following year the remainder of the research proposal was submitted to FRDC. The proposal was collaborative with the Victorian Department of Conservation and Environment. The research program was accepted by FRDC and funds provided for a three year investigation commencing in late 1991.

1.4 OBJECTIVES OF THE STUDY

In this study we have set out to outline the history of the Australian blue-eye fishery, and describe the current fishery. This includes a description of the types of fishers involved, gears used, the grounds, marketing and the influence of management. We have collected data pertinent to the history of the fishery from established source (such as State and

Commonwealth data bases of fishing logbook returns) and more unusual sources (anecdotal information from fishers and private logbooks).

During the course of the study we found that there were fishers who by keeping their own records over the years had built up significant time series of catch and catch rates for many grounds. Information was also available on factors effecting catch rates, the size of fish on various grounds and the change in size of fish over the years. This data is of great value in understanding the status of the fishery and has been collated and documented by this project as an aid for future researchers.

In writing this report we wished to make a useful and accessible reference for fishers, fisheries managers and researchers. We have written this account with the fishing industry foremost in mind and for the sake of completeness we have included a summary of available information on the biology of the species as well as reporting our findings.

CHAPTER 2

Methodology

2.1 DATA COLLECTION

Interviews were conducted with 136 line fishers and 18 Danish seine and otter board trawl fishers from more than 40 ports around south-eastern Australia (Figure 2.1). Topics discussed during the interviews are listed in Table 2.1.

Table 2.1 Topics discussed during the interviews with fishers.

Topics	With regard to....
General	Skipper, boat size, crew number. Opinion on change in catch rates, size of fish.
Fishing History	Years active in the fishery. Annual/seasonal changes in fishing operation. Time spent at sea involved in blue-eye or other fishing.
Description of line fishing gear	Number, length and type of lines. Hook type and number of hooks per line. Use of swivels, weights and buoys. Description of snood and type of bait. Storage of lines and hooks on board.
Description of fishing operation	Number of shots and/or lines per day and setting method. Setting and retrieval pattern during the day. Depth range of fishing. Use of electronic gear in deciding line placement.
Characteristics of catch	By-catch of other species. Changes in abundance of blue-eye on main grounds over time. Changes in size of blue-eye on main grounds over time. Average annual, daily or weekly blue-eye catch.
Grounds and types of trips	Range of grounds worked and main locations. Description of main ground (distance off-shore, bottom type and depth). Average number of days per trip and number of trips per month to all grounds or main ground(s). Factors affecting the timing of trips (e.g. weather, diurnal feeding patterns, season, moon and tide).
Catch handling and sales	Storage and processing on board. Market location and form blue-eye sold in (fresh, frozen, whole or processed). Average price and price range over time.

The most interviews per port were provided by past and present fishers on the east coast of Tasmania and south coast of New South Wales which are historically important areas for blue-

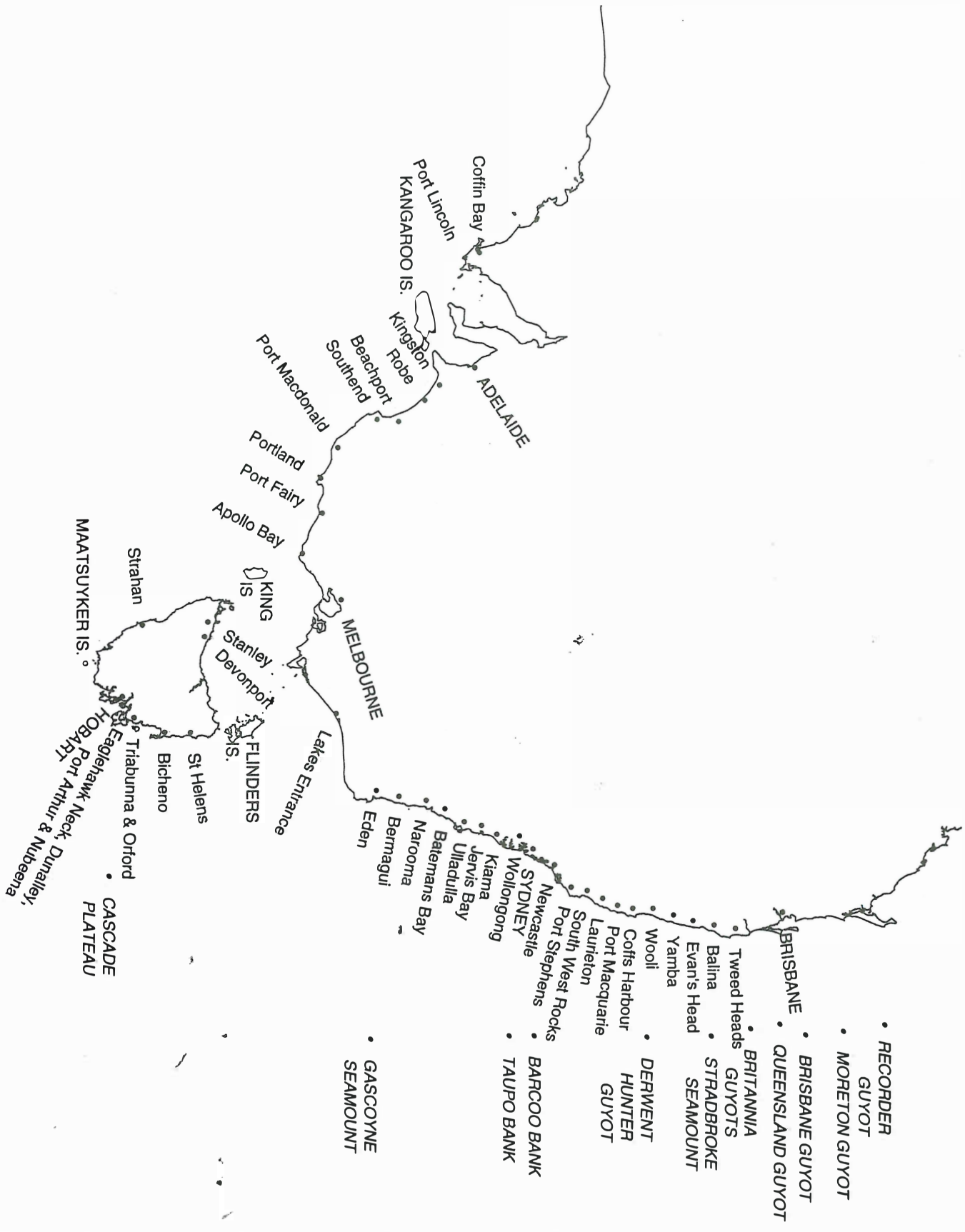

Figure 2.1 Principal ports and fishing locations off south eastern Australia

eye fishing. In New South Wales and Tasmania the average number of interviews per area was 17-18 and in South Australia and Victoria this average was 9-10.

2.2 FISHING ZONE AND HOME PORT DESCRIPTION

For ease of reporting we have divided the area of the Australian blue-eye fishery into 13 zones. The zones are defined by the accessibility of grounds from local ports as well as by State boundaries (Figure 2.2).

Interviewed fishers were assigned to a maximum of two zones according to their level of activity on associated grounds. In situations where boats worked just as frequently in more than one zone (particularly in Tasmania) the zone closest to port of residence was selected. If the second zone was in another State (e.g.. Eden boats working in eastern Victoria) fishers' data was collated by port of origin.

Where 'home port' changed over time fishers were included in no more than two zones over different periods. It was usually appropriate to include fishers operating in the Cascade, Seamount, and King Island zones in an additional zone.

The home ports of fishers assigned to the various zones is given in Table 2.2. The main ports in the zones are also indicated.

Table 2.2 The major fishing ports and other ports used by blue-eye fishers in the fishing zones.

Zone	Main ports	Other ports
Seamount		Eden, Coffs Harbour, Tweed Heads, Southport, Ulladulla, Sydney, Nelsons Bay, Brisbane, Evan's Head, Ballina, Yamba, Wooli, Moowooloobar.
Coffs Harbour	Port Macquarie, Coffs Harbour	Tweed Heads, Nelson Bay, Southwest Rocks, Foster, Laurieton, Evan's Head, Ballina, Wooli.
Sydney	Ulladulla, Kiama, Sydney	Batemans Bay, Greenwell Point, Jervis Bay, Nowra, Wollongong. Fishers from these ports are also likely to work in the Eden zone.
Eden	Eden, Bermagui	Narooma, Merimbula.
Everade	Lakes Entrance	
Freycinet	Bicheno, St Helens	Triabunna, Orford, Hobart.
Storm Bay	Dunalley, Port Arthur	Eaglehawk Neck, Nubeena, Channel area, Hobart, Triabunna.
Cascade	Hobart, Devonport	
Strahan	Hobart, Strahan	Nubeena.
King Island	Portland, Port Fairy	Apollo Bay, Beachport, Hobart, Tamar River, Stanley, Smithton.
Portland	Portland	Port Fairy, Apollo Bay.
Beachport	Beachport, Southend	Port MacDonnell, Blackfellows Caves, Kingston, Robe.
Lincoln	Port Lincoln	Coffin Bay.

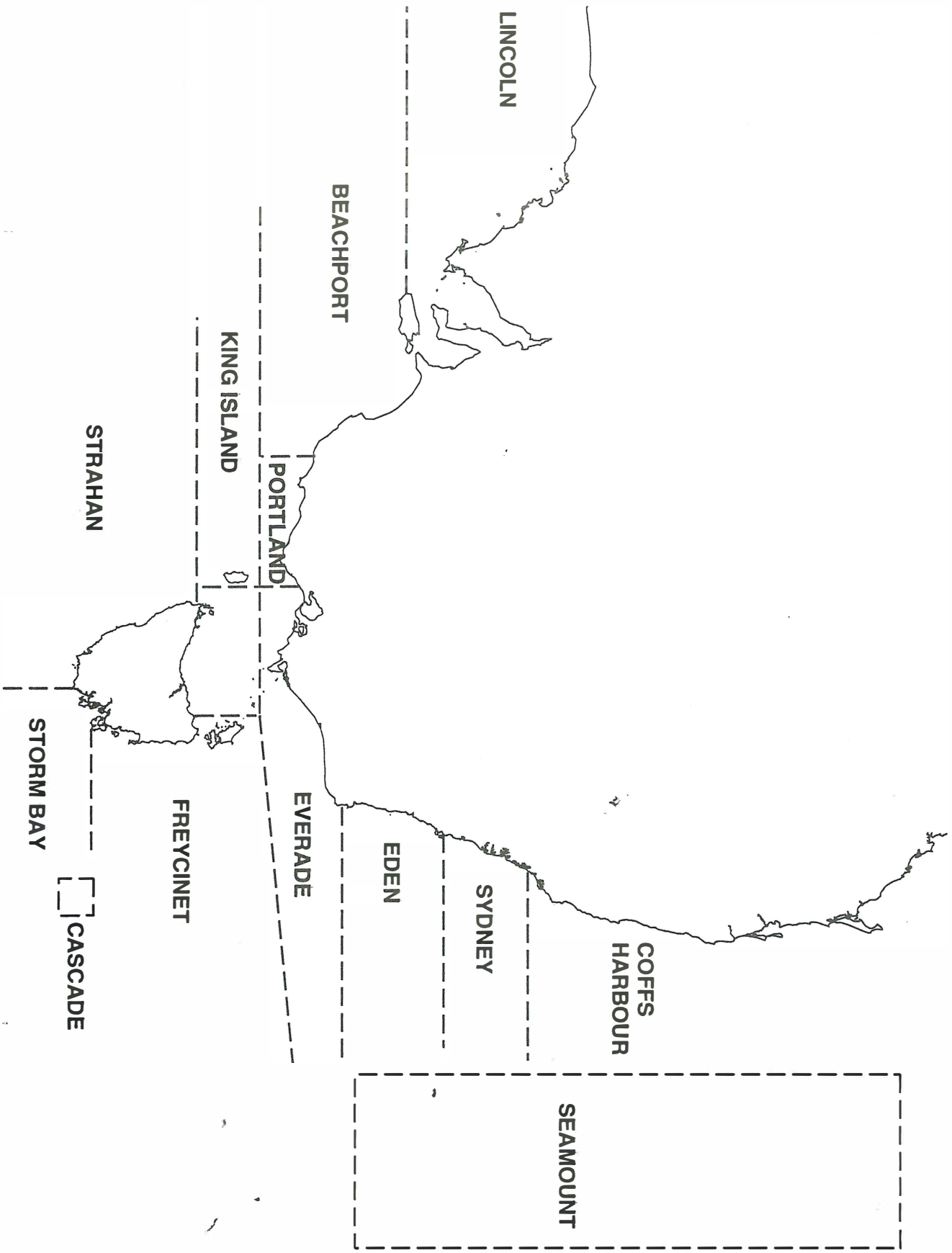

Figure 2.2 Zones used to group fishing grounds and home ports around south eastern Australia

Table 2.3 shows the number of fishers interviewed and the number still active in the fishery by zone. The spread of the earliest year of direct experience in the blue-eye fishery and the relative proportion of owner/operators in the fleet is also recorded.

Table 2.3 Number of interviews, length of fishers experience and type of boat ownership by zone.

Zone	Number interviewed	Earliest experience	Number continuing	Owner/operators %
Seamount	19	1979-88	15	89
Coffs Harbour	14	1973/74-90	13	100
Sydney	17	1964-88	7	93
Eden	24	1964-87	9	70
Everade	7	1971-88	4	100
Freycinet	25	1964-89	17	88
Storm Bay	19	1964-85	3	53
Cascade	3	1984-85	1	100
Strahan	15	1981-89	9	100
King Island	11	1980-89	8	100
Portland	11	1982-88	7	75
Beachport	17	1979-90	11	94
Lincoln	4	1987-90	3	75

2.3 DATA AVAILABILITY AND STORAGE

The primary sources of historic catch and effort information were the State catch returns and the private daily logs provided by line fishers from each State. Blue eye fishing occurs almost exclusively in water under Commonwealth jurisdiction, however, the Commonwealth have not required the provision of fishing returns as a condition of licensing. Rather the States have collected this data where possible on State fishing returns. The provision of this information to the States has been voluntary and as a consequence the catch data are not complete. Records of catches of blue-eye taken as a by-catch to other fisheries exist on the Southern Shark and South East Trawl databases.

The quality of data collected by the State fishing logbooks varies. South Australia is able to provide daily line fishing effort for each target species recorded on the fishing logs. New South Wales and Tasmania rely on monthly logbooks which provide information that is unsuitable for calculating effort but adequate for estimating catches by boat. Information on effort and catch per unit effort was available from a voluntary daily log book which was in operation in Tasmania in the early 1980's (Wilson 1981a, Williams 1986). Information from Victorian logbooks was not available to this study.

The various sources of catch information were amalgamated into a central data bank for use by this and future studies. The database, BEDLAM (Blue Eye Data; Landings, Anecdotal,

Market), comprises a single datafile of anecdotal/personal logbook data and individual files for summaries of Tasmanian, New South Wales and South Australian logbook information.

Anecdotal information in the form of trip details recorded in personal logbooks were provided by 37 fishers with the information covering the period from 1970 to the present. This data comprises nearly 5,000 records on the database, with each record representing the fishing and catch details for one fishing trip. The data recorded include details about the boat and the number of crew, the area and depths fished, the fishing method, the number of lines and hooks per line used, the weight of fish caught and landed, the buyer and the price paid per kilo. Catch per unit effort (CPUE) indices (weight caught per 100 hooks and number caught per 100 hooks) are also recorded.

Summary details of the various forms of State logbook information from New South Wales, Tasmania and South Australia have been recorded on the database. Information from New South Wales is in the form of total monthly catches per vessel. Included are the main area fished and the number of days fished. The data is available from 1982 to the present. Tasmanian information from 1980 to the present is in the form of total catch by month, vessel and block. The South Australian information covers the period 1983 to 1991 and summarises catch, effort and CPUE by area and gear for each financial year.

CHAPTER 3

Fisheries Biology Of Blue-Eye

3.1 DISTRIBUTION

Blue-eye (*Hyperoglyphe antarctica*) are wide spread in the temperate waters of the southern hemisphere. The species has been recorded off southern Australia, New Zealand, South Africa, and Tristan da Cunha (Haedrich 1967, McDowall 1982). The adult fish are bathypelagic/demersal and are predominantly found over rocky bottom in depths of 200-900 m (Webb 1979, Jones 1988). The distribution of larval and juvenile fish is unknown, however, it is believed that juveniles have a pelagic habit.

In Australia, adult blue-eye are restricted to a narrow band along the edge of the continental shelf, at depths between 100-1100 m, from Coffs Harbour, around Tasmania and across the Great Australian Bight to south-western Western Australia. Blue-eye also occur on the seamounts off south-east Tasmania to Southeast Queensland in the Australian Fishing Zone (AFZ) and adjacent international waters.

3.2 BASIC BIOLOGY

Two morphs of blue-eye have been noted in the Australian fishery, with the major apparent difference being eye colour and the proportion of eye diameter to body size. A recent investigation of this phenomenon has indicated that the morphs do not represent separate species (Bolch *et al.* 1993) but rather mark a transition from the juvenile to the adult phase. Coincidental to that investigation, a new species, the ocean blue-eye (*Schedophilus labrynthicus*), has recently been reported from drop-line catches off northern New South Wales (*ibid.*).

The minimum size of blue-eye caught on lines is rarely less than 50 cm (1.5-2 kg) and juvenile fish less than 47 cm (2 years) are possibly surface dwelling in schools (Horn 1988). There is some anecdotal evidence of the presence of juveniles on the surface, found sheltering under floating debris. Recruitment to the line fishery usually takes place when blue-eye larger than 47 cm and over 2 years of age adopt a demersal/bathypelagic habit on the continental slope, often over rough reef and associated with steep slopes.

Blue-eye at this stage feed predominantly on a pelagic tunicate *Pyrosoma atlanticum* as well as on squid, fish and crustaceans (Webb 1979, Jones 1985). The tunicate undergoes a diurnal vertical migration in the water column, moving towards the surface at night and generally returning to the bottom during daylight hours (Jones 1988). Although blue-eye are caught predominantly during the day, there is no reason to suppose that feeding necessarily ceases after dusk as some blue-eye are also caught at night.

The rate of growth is relatively slow during the adult stage although growth in juveniles is rapid (Horn 1988, Webb 1979). The largest recorded blue-eye in Australia was captured on the Cascade Plateau weighing 37 kg (107 cm fork length) (Williams 1989). According to the New Zealand growth curve, at 100 cm length, blue-eye may be 12-15 years old.

Estimates of the size at first spawning vary from 50 cm (Jones 1988) to 61-62 cm with an average weight 4.5 kg and estimated age 6-7 years old (Webb 1979). Dropline fishers claim to recognise roe maturity in blue-eye at 5-6 kg. No estimates of fecundity are available.

The breeding season has not been clearly defined and spring-summer or autumn-winter breeding has been indicated by researchers and fishers in different areas. Reports that blue-eye migrate into shallower depths at various times are presumably associated with breeding or feeding on macroplankton (Horn and Massey in prep, Jones 1988, Winstanley 1979).

3.3 PREVIOUS FISHERIES ASSESSMENT WORK

Few Australian studies of the blue-eye fishery have been conducted and those that have are mainly concerned with developing the fishery rather than assessing the resource. The exception to this has been work conducted by the Tasmanian Fisheries Development Authority (TFDA) during the late 1970's.

Webb (1979) and Dix (1979) indicated that in just two years, between 1968-1970, the average weight of blue-eye caught on the Tasmanian east coast declined from 7-8 kg to 4-5 kg. Nevertheless, it was expected that the fishery would expand in other areas around Tasmania. At this time a maximum sustainable yield of blue-eye in Tasmanian waters was arbitrarily estimated at 300 tonnes (Dix, 1979). The actual blue-eye catch in 1980-81 of 172 tonnes was still well below this figure. Later estimates by Dix (1982) suggested that a 450 tonne annual catch should be sustainable. This conclusion was based almost solely on information from

monthly fishing returns, several fishing surveys and only limited biological data (Williams 1989).

3.4 THE FISHERY

The commercial blue-eye fishery began in the early 1960's following several government sponsored developmental fishing programs. The fishery first developed on grounds off the east coast of Tasmania. This was followed by the development of new grounds off the southern New South Wales coast and off south-eastern Tasmania. In the 1970's further grounds were established off northern New South Wales. Figure 3.1 presents total reported catches for the fishery since 1970 (Williams, 1994). The 1980's were characterised by expansion into new grounds around the coast and offshore. From the established fisheries in Tasmania and New South Wales grounds were developed off southern and south western Tasmania, around King Island, the Cascade Plateau and the extensive seamount system off eastern Australia. With the assistance of government development programs new fisheries were started off eastern and western Victoria and South Australia. As the fishery has been steadily expanding into new areas, annual landings have also increased.

Methods used to catch blue-eye on lines have varied according to the nature of the grounds and the fishing experience of operators. Early on, fishers experimented with different gear configurations, at times merely fixing hooks to the buoyline of their shark longlining gear. During the 1960's in the Sydney and Freycinet zones, a stage between traditional longlining and droplining sometimes produced 'hybrid' designs known as the set bottom line and buoyed bottom line (Figure 3.2).

Since the early 1970's the dominant fishing method in nearly all areas has been droplining. Droplining is defined as a vertical line supported by one or more top buoys with a buoyed dan flag or floating buoyline basket on the surface. Baited hooks on snoods are attached at intervals to the mainline above the bottom weight. The line between the top buoy and the hooks is referred to as the buoyline. The vertical position of the line may be assisted by a deepwater pressure buoy set above the hooks. There are two versions of droplines, the fixed dropline where snoods are permanently attached to the mainline and the more common clip dropline which uses individual 'safety pin' or shark clips for each snood (or hook where no snood is used).

A variation of droplining is the single handline or multiple hydraulic reels which remain attached on board the fishing boat. These are currently only used in the Eden and Sydney zones although the original 'dropline gear' developed in the 1950's was strictly a wire handline according to the definitions used in this report. Handlines and handline reels are similar to droplines but often use fewer hooks. Buoyancy is not required although bottom sinkers are still necessary (Figure 3.2).

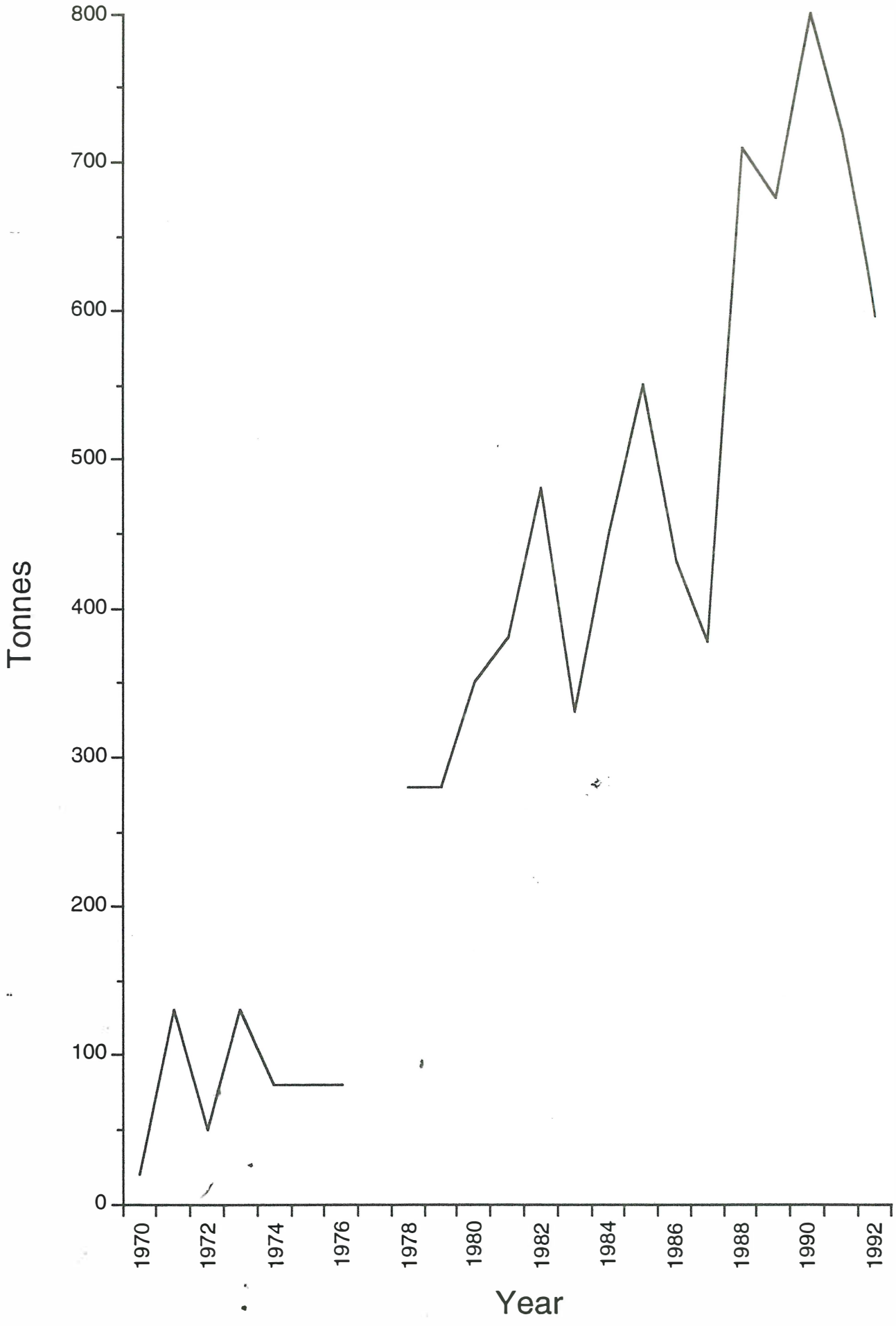

Figure 3.1 Total reported catches for the Australian blue-eye fishery from 1970 to 1992.

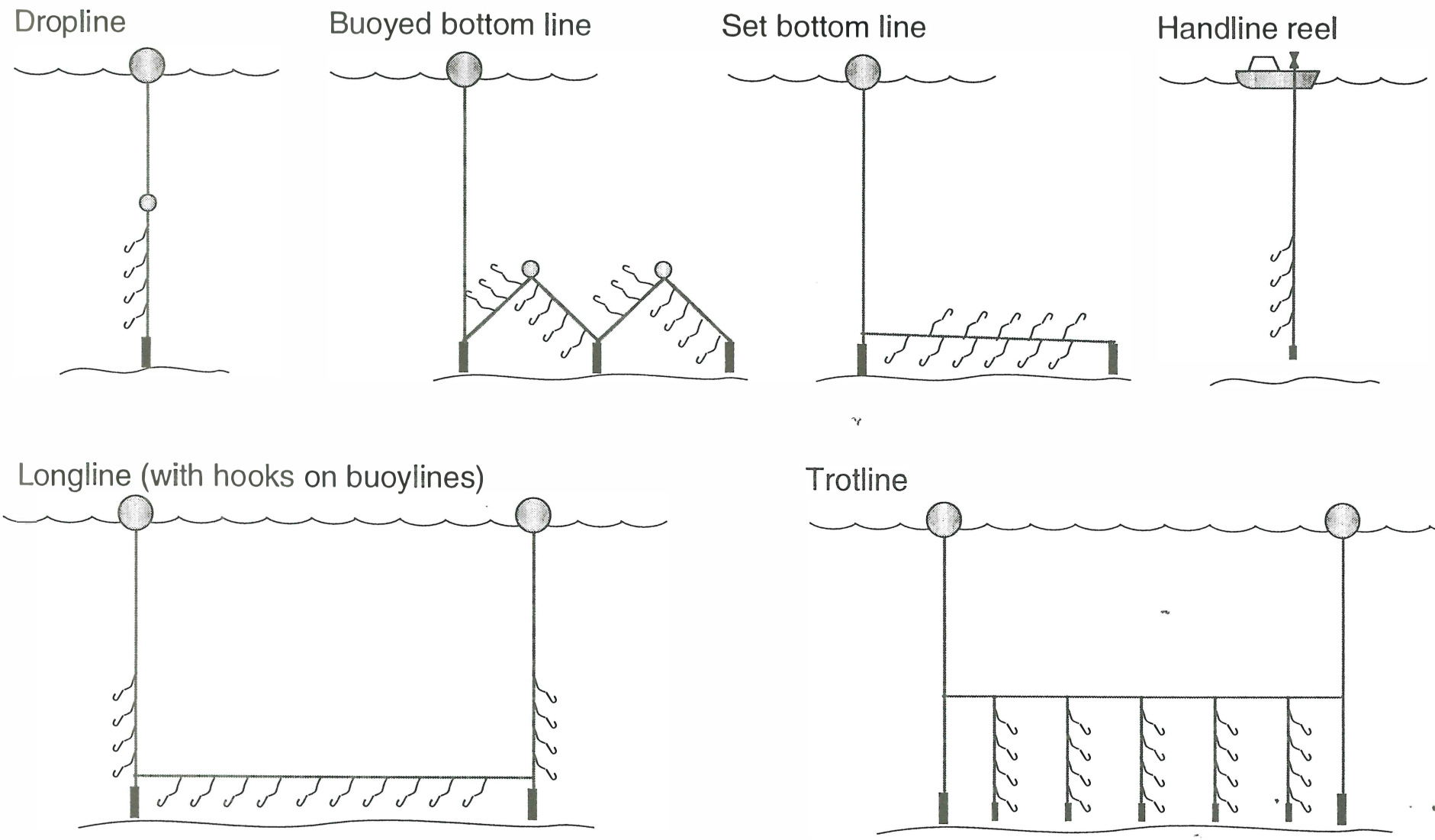

Figure 3.2 Typical gear configurations used in the line fishery.

Trotlining is mainly favoured in the recently developed fishery from Port Lincoln. The basic trotline is a longline or mainline, suspended above the bottom with vertical droppers or branch lines regularly spaced along its length to which baited snoods are attached. The two main weighted buoylines at each end are supplemented by additional buoys and weights on each of the droppers (Figure 3.2).

Droplines are commonly employed during the day although it is quite usual to work trotlines overnight. Trotlines have been worked in this manner for example around Tasmania. Trotlines are generally limited to grounds where areas of flat or undulating bottom are available. The relative merits of droplining or trotlining were outlined by Cowper and Downey (1957). More recent research conducted in South Australia, Tasmania and Victoria to investigate blue-eye fishing used trotlining, longlining as well as droplining gear (Jones 1985, Winstanley and Smith 1982).

Shark nets have also been used to target blue-eye although this method of fishing has been prohibited off Tasmania and New South Wales and only persists off eastern Victoria. Target fishing for blue-eye with trawl gear is very recent with the first semi-pelagic trawl nets being used off Tasmania in late 1989.

3.5 BY-CATCHES OF THE BLUE-EYE FISHERY

The by-catch species taken most commonly by the line fishery are spurdog and greeneye dogfish (*Squalus spp.*), ling (*Genypterus blacodes*), gemfish (*Rexea solandri*), ocean perch (*Helicolenus percoides*), hapuka (*Polyprion oxygeneios*) and bass groper (*Polyprion moene*). It is believed that the last two species have not always been correctly separated in the past although this is now changing as markets are becoming more discerning. It is also possible that the generic term 'hapuka' has been applied to blue-eye. Less wide spread by-catch species include endeavour dogfish (*Centrophorus scalpratus*), redfish (*Centroberyx affinis*) and blue grenadier (*Macruronus novaezelandiae).*

On Tasmanian blue-eye grounds other common by-catch species include school shark (*Galeorhinus australis*), gummy shark (*Mustelus antarcticus*), deep sea cod (*Mora moro*) and cardinal fish (*Epigonus sp.*). Off New South Wales, ribbon fish (*Lepidopus caudatus*) oil fish (*Lepidocybium flavobrunneum*), marlin (*Mackaira spp.*) or alfonsino (*Beryx splendens*) are also taken as by-catch. The draughtboard shark (*Cephaloscyllium laticeps*) is taken as by-catch predominantly in the Sydney zone. Barcod (*Epinephalus septemfasciatus*) is recorded as a by-catch species in the Coffs Harbour and Seamount zones.

Minor catches of ghost shark (*Chimera spp.*), various deepwater sharks, imperador (*Beryx decadactylus*), red hussar (*Lutjanus amabilis*), spotted catshark (*Asymbolus analis*), platypus shark (*Deania spp.*) and Montague mullet (*Chloropthalmus nigripinnis*) are occasionally

encountered off New South Wales, and spotted trevalla (*Seriolella punctata*) has been observed from the grounds off Beachport.

A by-catch is generally rare in the Seamount zone, and fewer dogfish are taken on the southern mounts than the northern mounts. On the Cascade Plateau, few dogfish and only one orange roughy have been caught on lines.

3.6 BLUE-EYE AS A BY-CATCH OF OTHER FISHERIES

The trawl fishery

In Australia blue-eye are commonly taken as a by-catch of the gemfish fishery off New South Wales and the summer blue grenadier fishery off Tasmania. The rate of blue-eye by-catch from the gemfish fishery appears to vary during the season with peak catches being taken in the early stages of the winter run. Occasional by-catches of blue-eye may be taken in the orange roughy fishery, typically as a result of catches made when setting or retrieving the net.

Target trawl fisheries for pelagic or semi-pelagic fisheries have not yet developed in Australia. However there is already keen interest in the potential of these resources. As these fisheries are developed it is likely that they will involve by-catches of blue-eye. In New Zealand blue-eye is a significant component of the alfonsino trawl fishery (Horn and Massey, 1989) with the ratio of alfonsino to blue-eye varying from around 3:1 to 1:1. It is now acknowledged that the two species and their management are tightly linked (Annala 1991). Although alfonsino often dominates the catches, it may be more correct to refer to the mixed alfonsino and blue-eye trawl fishery as neither species can usually be targeted exclusively (McKoy 1988).

Shark gillnet and hook fisheries

The records of blue-eye by-catch from shark fishing with gillnets and hooks are incomplete. However, it would appear that the quantity of blue-eye taken by shark gillnets and longlines is insignificant. Given the relative depth ranges of the school and gummy shark fisheries and the blue-eye fishery there would seem to be little room for overlap and thus little chance of by-catches being made.

CHAPTER 4

Catch, Effort and Catch per Unit Effort

With the exception of the fishery off South Australia, there has been no comprehensive fishing logbook program for the blue-eye hook fishery in Australia. The blue-eye fishery occurs almost exclusively in areas under Commonwealth jurisdiction, however there has been no mandatory fishing logbook program for the fishery. Government sources of fishery statistics have depended on the voluntary collection of information from blue-eye fishers through State fishing logbook programs. As a consequence, the official sources of catch and effort information are fragmented, incomplete and not easily comparable between the different sources.

The official statistics have been significantly augmented by the contribution of fisher's personal logbook information. These data provide valuable information on catches, catch rates and fishing areas and in many cases cover a longer time period than the State logbook information. This information has been critical to examining catch rates prior to 1980 in all areas. In addition to catch and effort data, changes in fishing practices and fishing power have been examined using anecdotal information collected during interviews.

In this chapter the available data has been used to provide an overview of catch and catch rates over the history of the commercial fishery. Behavioural factors influencing catch rates are discussed as are factors affecting the completeness of the data.

4.1 CATCH

Completeness of the data

There is a large and unquantifiable potential for non-reporting of blue-eye fishing from State logbook programs. A number of fishers are known to have not volunteered information as a

'matter of principle' and other fishers may not have provided information for all of their fishing. In addition, the way in which catch weights have been determined is not recorded. In many cases landed weights refer to partial weights from fish that have been gutted and/or headed.

Incidental mortality

Reported catches do not represent an estimate of the mortality caused by fishing as there is a unknown quantity of fish lost from the fishing gear and taken by scavengers. The problems caused by large marine animals damaging the lines and preying on the catch occurs in all fishing zones although some areas experience more serious losses than in others. Shark and gemfish are responsible for tangling and biting off lines as well as the fish from the lines. This is particularly common in the Sydney, Coffs Harbour and Seamount zones. Of the sharks the most common species interfering with fishing are the mako, thresher and blue sharks.

Albatross and mutton birds cause losses by puncturing and sinking 'floaters' (decompressed fish floating free of the fishing gear). This is a common source of losses in the Freycinet, Storm Bay, Portland and Eden zones. Significant losses are also reported from seals and orcas taking fish from lines as they are hauled. Seals may frequent fishing grounds on a seasonal basis, especially in those areas adjacent to south-eastern Tasmania and Beachport. Orcas have been a common hazard for fishers off Tasmania generally (Wilson 1981c) and in the Eden zone. Other whales and dolphins may occasionally be a source of significant losses for fishers in the Seamount zone.

Scavengers may also take fish of the line before they are hauled. Off southern New South Wales an unexplained phenomenon occurs which causes the wasting of the muscle of the blue-eye, leaving a brown slime inside the carcass. Other scavengers, such as mantis shrimp, will clean fish and baits from lines if soak times are excessive.

Variation in catches by zone

Annual landings for each zone are given in Figure 4.1. It is assumed that whilst reported landings in each zone may be incomplete, they may be used as an index of catches taken within a zone. It is apparent from Figure 4.1 that catch trends are not uniform over the area of the whole fishery. The coastal fishery off New South Wales shows a steady but slight increase in the Coffs Harbour and Eden zones, whilst blue-eye catches from the Sydney zone shows a steady and marked decline. Since 1987, more blue-eye have been caught in the Seamount zone than on the New South Wales shelf. Indeed much of the recent increase in blue-eye landings for the Australian fishery can be attributed to the catches made from this zone. Catch trends for the zones off the east coast of Tasmania are not as even as those for New South Wales. They are marked by large fluctuations and sporadic peaks in catches.

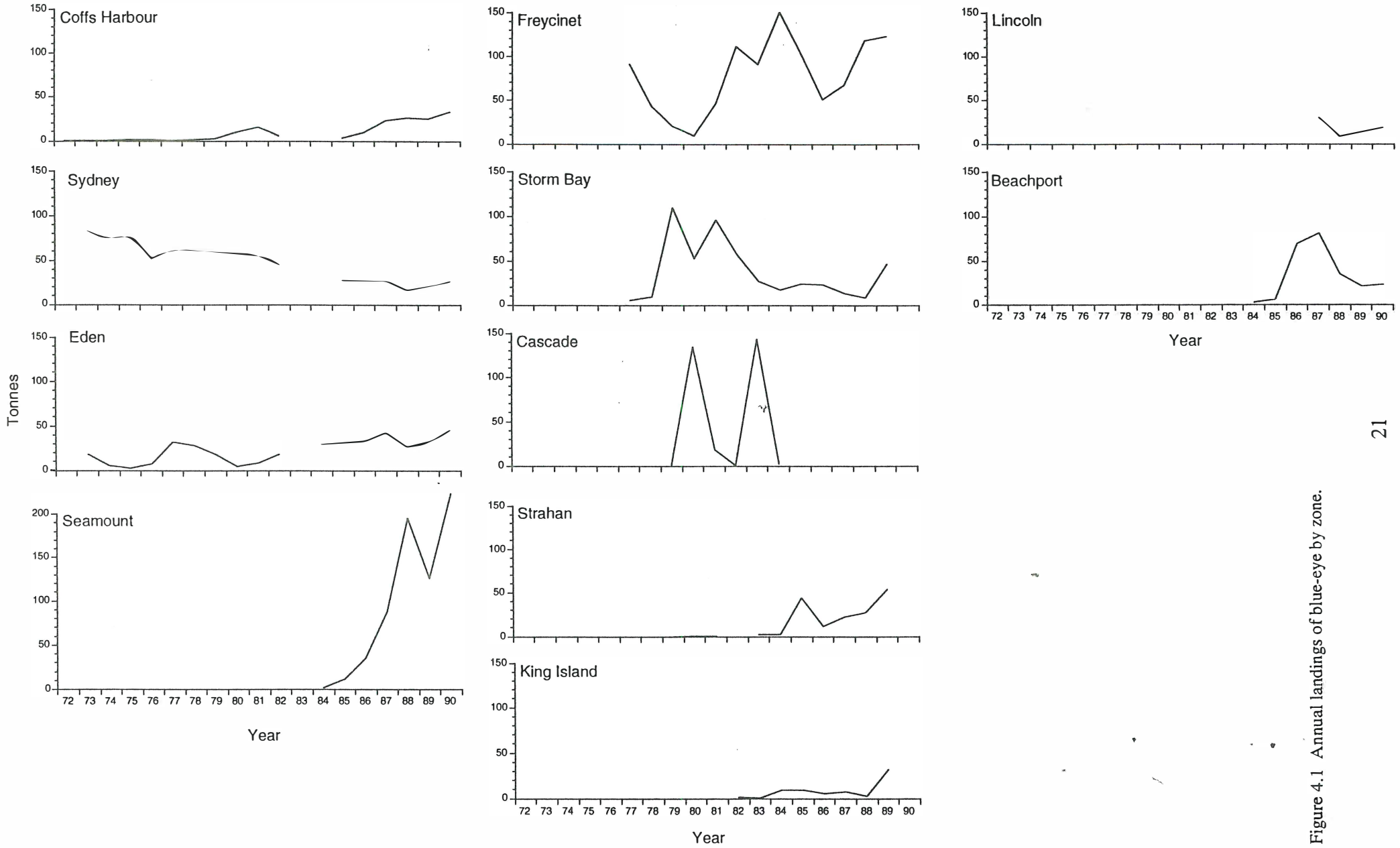

Figure 4.1 Annual landings of blue-eye by zone.

With regard to total reported blue-eye landings, the recent increase in production is initially attributable to the expansion of the fishery into offshore areas in the 1980's followed by a rapid decline in offshore production and an increase in production from inshore grounds in the 1990's (Figure 4.2). In the established zones, production appears to have declined significantly in the Sydney and Storm bay zones, and increased slightly in the Coffs Harbour, Eden and Freycinet zones. Whilst catches in the Cascade zone have been significant they have not proved sustainable.

Catch per boat by zone

The average annual catch per boat for each zone fished during the 1980's was derived from the interviews and is given in Table 4.1.

Table 4.1. Average annual catch per boat by zone

Zone	Annual catch per boat (tonnes)
Seamount	100-200
Coffs Harbour	<10
Sydney	<10
Everade	<10
Freycinet	10-20
Storm Bay	20-30
Cascade	100-200
Strahan	10-20
Portland	<10
Beachport	10-20
Lincoln	50

The offshore zones generally support higher catches per boat (100-200 tonnes per annum) a reflection of the larger boat sizes required to operate in these zones and the higher catch rates that occur. As grounds become closer to the major ports so the annual average catch declines, possibly as a function of the higher fishing pressure and the smaller vessels being used.

4.2 EFFORT

Estimates of total effort for the fishery were not available at the time of this study. A subsequent project has been conducted to examine catch and effort in more detail and that work is currently being reported. Preliminary results of the study are available in Baelde (1994) although that report is restricted to an analysis of data available from the South East (Trawl) Fishery logbook and Tasmanian fishing returns. Effort for the Tasmanian data was estimated in terms of the number of monthly returns in each year on which a catch of blue-eye was recorded. The result is a crude estimate in terms of the annual total of boat months spent in the blue-eye fishery.

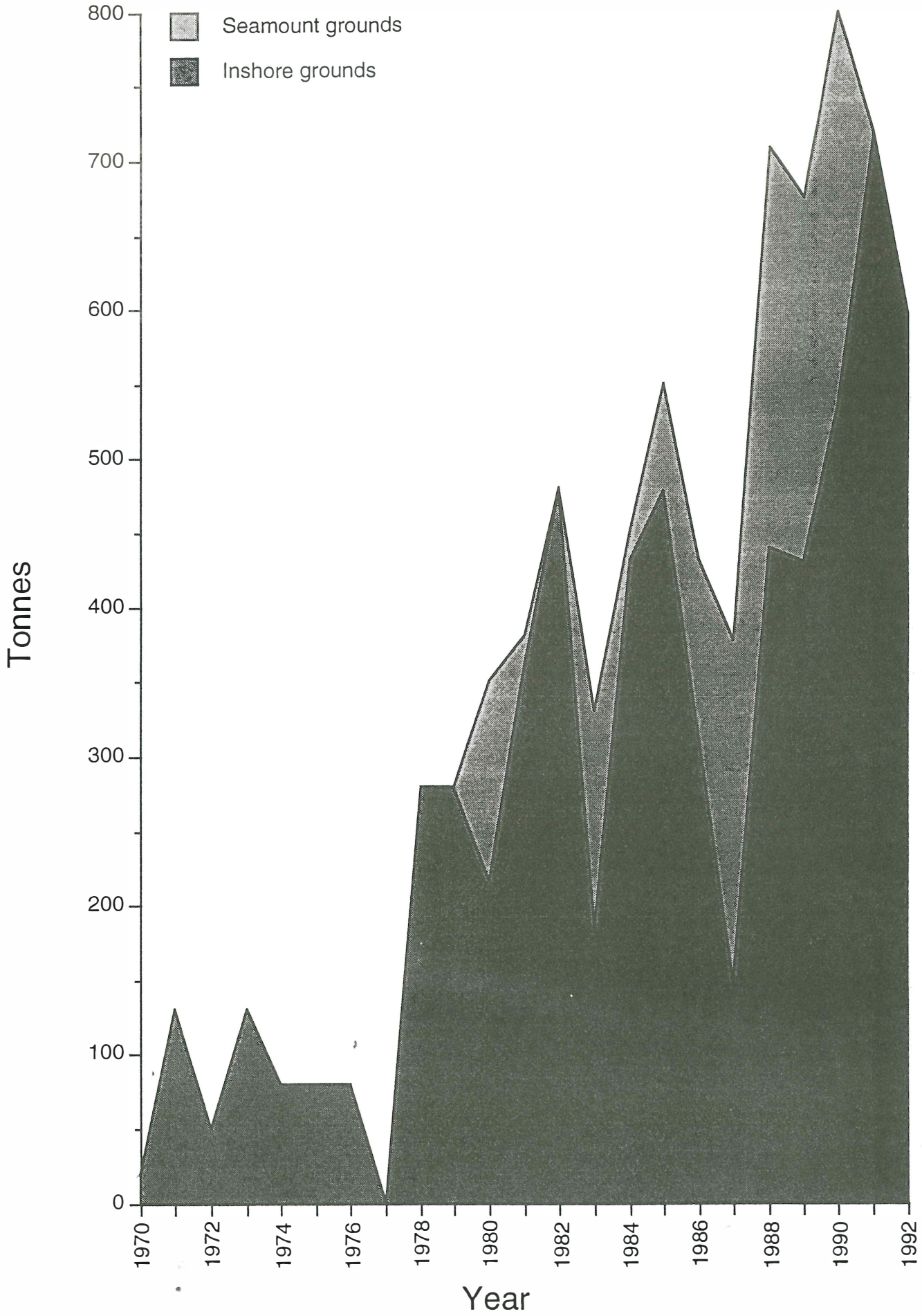

Figure 4.2 Annual landings from the blue-eye fishery from inshore grounds and offshore seamounts.

Baelde (1994) found that from 1980, effort in the Tasmanian fleet increased from about 20 boat months to 60 boat months in the early 1990's, the level of effort then stabilised.

Whilst this type of analysis gives nominal effort in terms of the number of boats involved in the fishery and the lengths of their fishing seasons, the levels of real effort may be quite different. Whilst this analysis indicates a three-fold increase in effort since 1980, changes in fishing efficiency made during that time will significantly increase the real effort being exerted. Important factors which will have influenced the efficiency of line fishing operation through this period include:

- increasing use of electronic equipment (accurate sounders, radar, GPS and plotter);
- skills and experience of the skipper and crew;
- changes in fishing grounds;
- changes in fishing techniques;
- new gear configurations;
- changes in vessel design and construction;
- environmental factors, such as current and tidal conditions.

The interviews provided estimates of the number of fishers involved in each zone since 1975. This information is presented in Figure 4.3 together with estimates of the average annual landing per boat. This is a crude and rather patchy estimator of effort but does demonstrate that in some areas of the fishery such as the Coffs Harbour and Eden zones, the fishery is subject to high participation rates and low returns, whilst in the offshore areas such as the Seamount and Cascade zones there are low participation rates but higher returns. This is a reflection of the accessibility of areas to fishers and the difference in vessels needed to participate in the different areas.

4.3 CATCH RATES FROM CATCH AND EFFORT DATA

Calculation of catch rates

As we have indicated above, estimates of total effort were not available to this study. In the absence of this information we have estimated catch rates from data recorded in fishers logbooks and where possible catch rates have been derived as the catch in kilograms or number of fish for every 100 hooks fished. Catch rates were estimated for each day or trip depending on how information was recorded in the logs. Catch weight were recorded for each day or for the trip, fishing effort was measured in terms of the number of hooks used and this was determined from either the number of lines set during the trip or the number of lines set on each day. Catch rates were then calculated as the catch per unit of fishing effort (CPUE). Annual averages of CPUE by zone were then derived from these data.

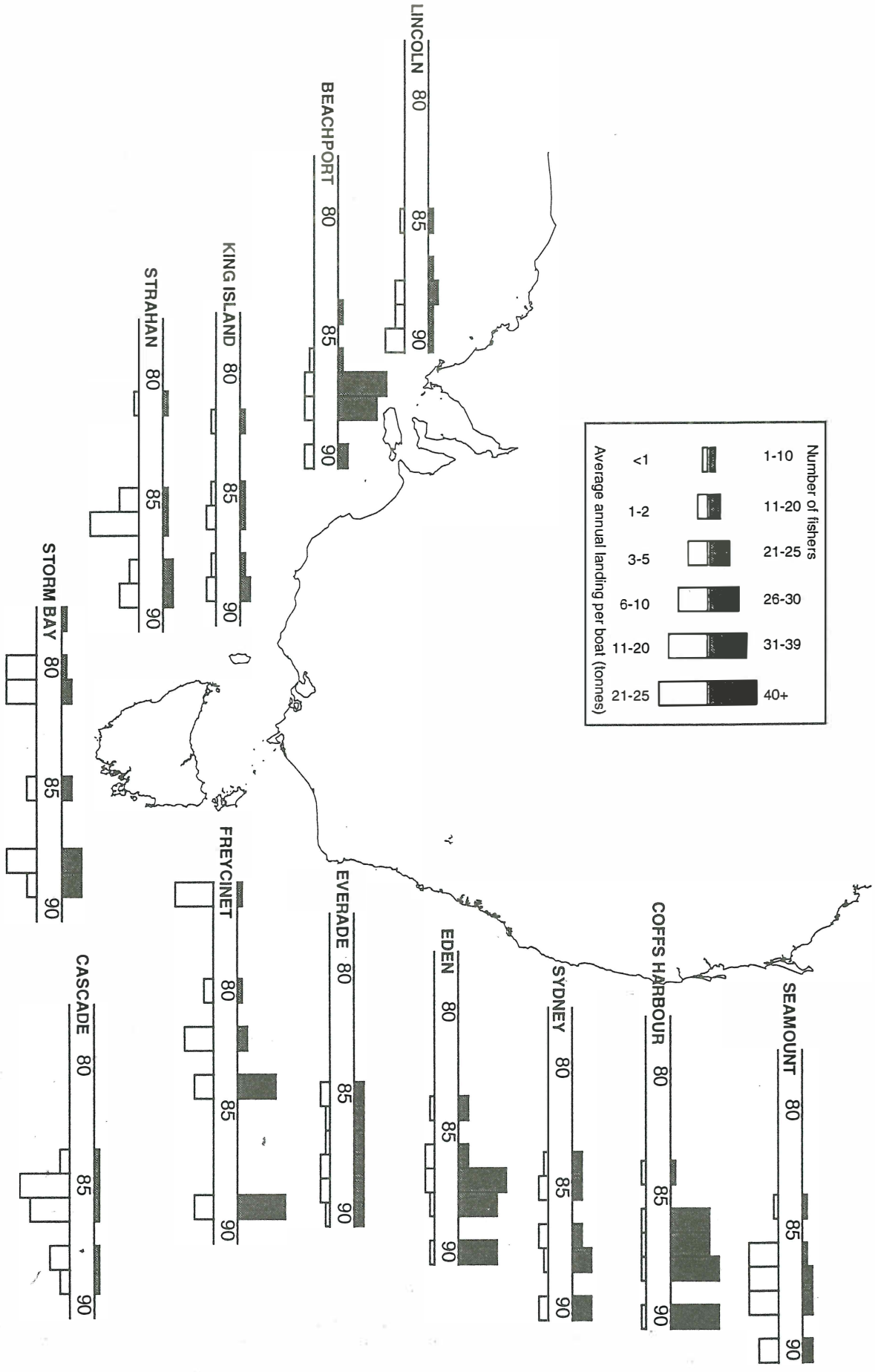

Figure 4.3 The number of fishers involved in the blue-eye line fishery and the avearage annual landing per boat by zone and year.

Catch rate by zone

Catch rates as average annual CPUE for each zone are given in Figure 4.4. For several of the zones the fishery has a relatively short history and so the time series of data is short. Coffs Harbour, Sydney, Eden, Freycinet and Storm Bay have longer time series and demonstrate some strong trends. For Coffs Harbour and Sydney, CPUE is relatively stable at a low rate. Eden and Freycinet both show initial high CPUE which quickly decline to lower levels. For Freycinet these lower levels are then maintained. Storm Bay shows a highly variable average annual CPUE with no clear trend appartent. A summary of the trends are given in Table 4.2.

Table 4.2. Trends in CPUE (kg/100 hooks) by zone for periods indicated.

Zone	Period	Range in kg/100 hook lifts	Trend
Seamount	1988-91	10 - 99	increasing
Sydney	1976-90	30 - 130	stable
Eden	1971-91	42 - 142	declining
Freycinet	1970-91	20 - 135	declining-stable
Storm Bay	1971-90	5 - 160	fluctuating
Cascade	1985-90	160 - 260	declining
Strahan	1987-91	3 - 7	stable
Portland	1988-91	20 - 64	fluctuating
Beachport	1984-91	2 - 28	fluctuating
Lincoln	1988-91	10 - 41	increasing

The catch rates derived here are not able to correct for any changes in efficieny that will have been achieved by the fleet over the past twenty years. During this period there have been several technological advances available to the fleet and no legislative inefficiencies (input controls) have been imposed. Improvements in fishing efficiency would lead to higher catches for the same unit of effort. In terms of the trends seen above then long periods of stable CPUE indicate periods of decline in real catch rates, with improvements in fishing efficiency maintaining or increasing total catches. Similarly periods of decline indicate that real CPUE is declining more steeply.

4.4 CHANGE IN SIZE COMPOSITION OF CATCHES

Significant declines in the average size of fish caught have been noted by Webb (1979) for the Storm Bay zone in the late 1960's. Such changes indicate either changes in the population caused by removals (e.g. the average size of fish in the population declines as the larger fish are removed) or it may indicate changes in the selectivity of gear (e.g. fishers are able to select the size of fish targetted). To gain more infomation on this phenomenon, the interviews included questions relating to the size composition of catches.

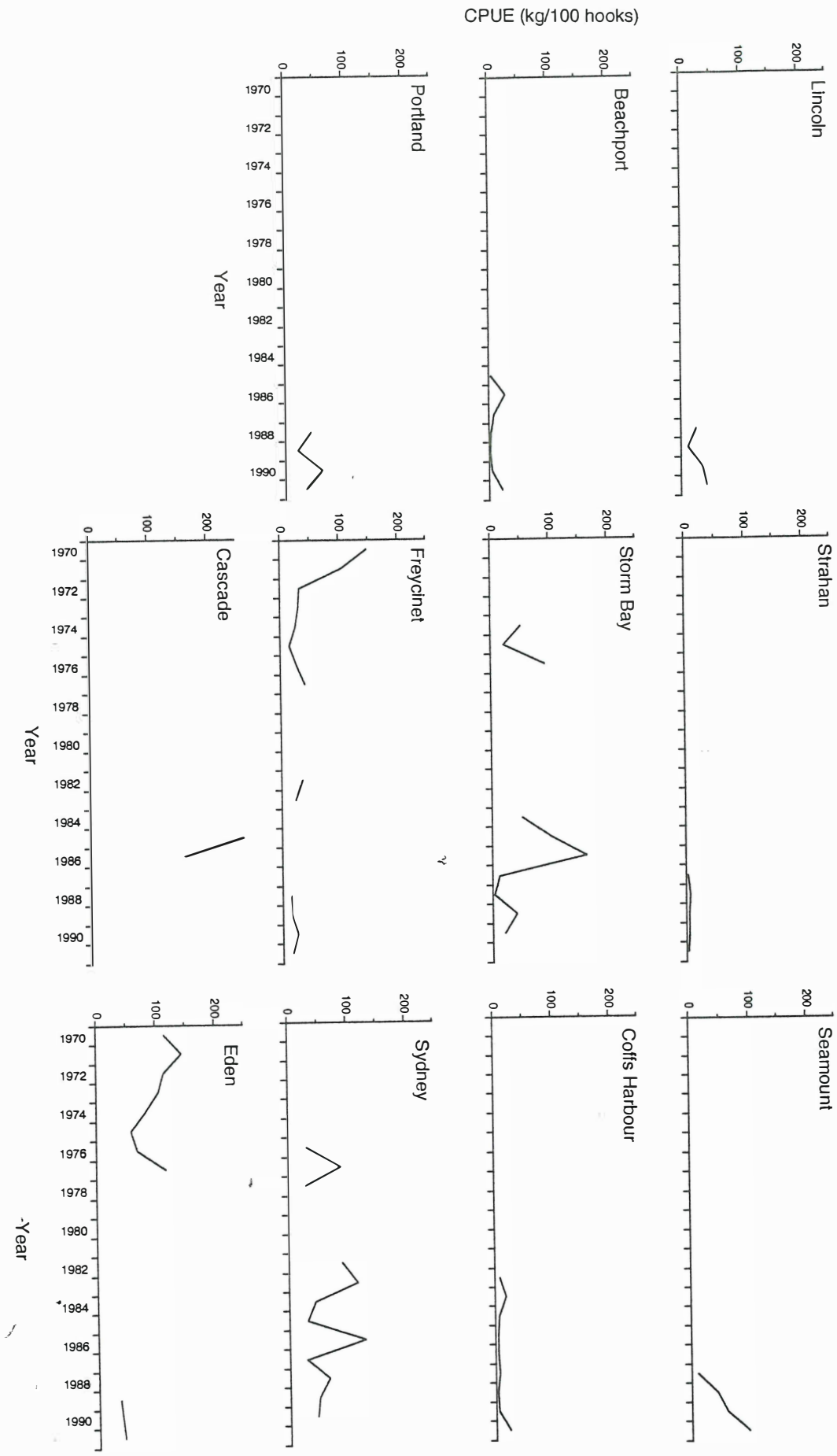

Figure 4.4 Average catch rates (kgs/100 hooks) by year and zone.

From the interviews several issues emerged which confounds the problem of changes in size composition. Fishers pointed to changes in size associated with the initial exploitation of new or fallowed grounds, fishing depth, season, breeding migrations and the difference in behaviour and vulnerability of sub-adults.

Large fish (around 30 kg) were associated with new or rested grounds. After a short time from the commencement of fishing, catches of large fish declined and fishers generally belived that this indicated that the larger fish were residents on particular grounds. The average landed weight per day falls rapidly on new grounds due to a decline in both the size and number of blue-eye. It was observed by fishers that this process may take only six months to be first noticed.

Generally fishers indicated that the smaller schooling sub-adults occurred in shallower waters compared to the more dispersed adults. However, it was observed that during breeding seasons larger blue-eye are often found in shallower depths than normal (around 325-360 m, minimum 240 m). A significant proportion of fishers in all zones (with the exception of Coffs Harbour) noted a decline in the size of blue-eye landed from the main grounds in each zone. In most cases, there has been some reduction in the maximum size also.

Table 4.3 The average and maximum weights of blue-eye landed from each of the zones and the number of fishers interviewed who noted a change (decline) in mean weight and maximum size.

Zone	Time period	Median weight (kg)	Respondents noting change (%)	Maximum size (kg)	Respondents noting change (%)
Seamount	1990-91	7	20	30	5
	1987-88	8		28	
Coffs Harbour	1991	4.5 (9)	7	(20)	0
Sydney	1990-91	2 (5)	40	(29)	30
	1960's-70's	8 (24)		(35)	
Eden	1990-91	6	40	20	24
	1980's	5		20	
	1970's	6.5		25	
Everade	1991	7	30	15	15
	1985	6		25	
	1976	15.8		-	
Freycinet	1990-91	4	65	15	26
	1980's	5		14	
	1960's-1970's	13.5		28.5	
Storm Bay	1980's-1991	5.5	70	13	20
	1960's-1970's	10.5		19	
Cascade	1990-91	10		35	
	1984-85	15-20	68	45-50	100
Strahan *	1991	6	42	8	17
	1980's	12		18	
King Island	1990-91	5	50	12	33
	1980's	8		21	
Portland	1990-91	3	40	11	20
	1980's	5		24.5	
Beachport	1991	4	30	14	20
	1980's	10		-	

4.5 OTHER FACTORS AFFECTING CATCH RATES

Seasonal variation in catches

Seasonality as reflected in the particpation rates of fishermen in various zones is shown in Figure 4.5. Anecdotal advice on seasonal abundance of fish on the grounds showed a wide variation over the area of the fishery. In the Sydney and Coffs Harbour zones, fishers associated higher blue-eye abundances with the timing of gemfish pre- and post-spawning runs (April-May and September-November respectively). Lower catch rates were seen in summer and this was thought to be a result of the fish dispersing and migrating either south or into deeper water to avoid warmer currents.

South Australian fishers generally preferred the Beachport zone during autumn and winter when blue-eye appeared to congregate and larger fish were generally caught (average weights of 8 kg in winter and 3 kg in summer).

In the Freycinet zone blue-eye were most abundant on the main grounds in late autumn,winter and early summer, with mid to late summer being the period in which abundance was lowest. In contrast, the Strahan zone fishers found highest abundances in the period from November to June and associated this with breeding 'availability'. Victorian fishers also found the greatest abundance of blue-eye corresponding with spring and summer although currents at this time of year hampered fishing with droplines. The general belief was that blue-eye may migrate into cooler latitudes during summer and move north in the winter.

Breeding

Breeding was most often recognised by fishers as occurring in the colder months, from late summer through autumn till early spring. The broadest 'breeding' season was described by Coffs Harbour zone fishers who had noted fish in spawning condition from November to August. Half of those interviewed claimed that the best fishing time was connected to pre- and post-spawning. Another 17% found better catches of blue-eye outside this time (August - November). Only 8% concluded that their was no seasonality in blue-eye catches.

The most consistent time of blue-eye spawning was reported by Sydney zone operators and 57% concluded that the best catches between March and July were related to the aggregation of roed fish.

Behavioural changes

Fishers observed that after several consecutive days of fishing on a ground the catch rate may decline rapidly, a response often described as 'hook shy' behaviour. It was believed that this was due to a change in the vulnerability of fish rather than a decline in abundance.

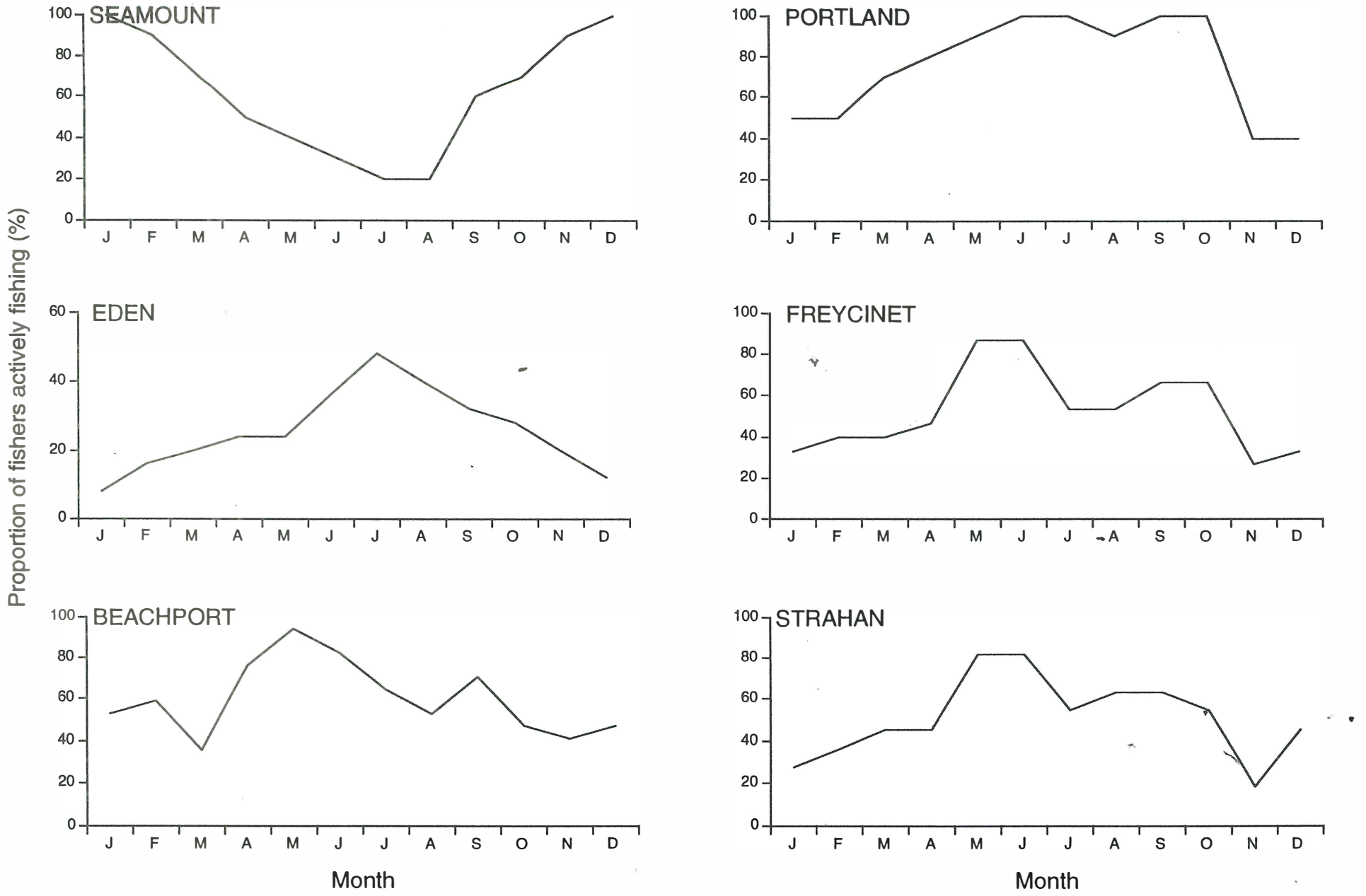

Figure 4.5 Participation rates of fishers in the blue-eye fishery by month and zone.

CHAPTER 5

The Development Of The Blue-Eye Fishery To 1980

The blue-eye line fishery has operated off the continental shelf adjacent to Tasmania, New South Wales and eastern Victoria since the mid 1960's, and off western Victoria and South Australia since the 1970's and 1980's. Initial fisheries development work undertaken by CSIR and Tasmanian government research vessels concentrated on the east coast of Tasmania from the late 1940's to the mid 1950's .

In the Portland and Beachport zones trawlers provided the main source of information about promising areas for blue-eye in the late 1970's. Shark longlining made some contribution to identifying potential grounds off the King Island and Sydney zones (even as far back as the mid 1950's) and also assisted fishers in the Beachport, Strahan, Storm Bay and Portland zones.

5.1 DISCOVERY AND DEVELOPMENTAL FISHING PRIOR TO 1970

In December 1949, the Tasmanian FRV *Liawenee* caught several blue-eye (average weight 8 kg) on shark longlines in 450 m off Flinders Island (Anon 1951a). By 1951, Tasmanian and Victorian shark fishers were reporting further landings of blue-eye, particularly off south-eastern and eastern Tasmania. Investigations followed to determine the potential for a deepsea fishery off the east coast of Tasmania (Anon 1951b).

Wire gear on reels developed by the CSIR's FRV *Derwent Hunter* in 1954 proved more successful than longlines for targeting blue-eye. During trials with the new gear, Cowper and Downey (1957) found that the optimal areas for blue-eye fishing were on the steepest, shelving parts of the slope, mainly in 360-540 m and associated with hard, rough bottom. The average weight of blue-eye caught was 6-7 kg.

Considerable variation in catch rate was noticed with small changes in depth and this 'patchy' distribution was attributed to the complexity of the bottom environment. For this reason, an echo sounder was essential to locate grounds and depths suitable for blue-eye. Development of the fishery in Tasmania and New South Wales was delayed until the 1960's when sounders were first installed on fishing vessels.

The research conducted by the CSIR and Tasmanian Department of Agriculture & Fisheries during the 1950's correctly predicted that blue-eye fishing would develop into a viable industry off the east coast of Tasmania. Major fishing ports at the time within close proximity of potential blue-eye grounds were Eden (New South Wales), Port Fairy (Victoria) and Triabunna (Tasmania) (Anon 1951a). However fishers from other Tasmanian ports including Bicheno, Dunalley and Eaglehawk Neck were soon to show a commercial interest in blue-eye as well.

The blue-eye target line fishery began in Tasmania from 1961-2 with several 10-12 m boats working short bottom set lines (Figure 3.2) between St Patrick's Head and the Nuggets on the east coast (324-720 m depths). Within a few years dropline gear was being used, and by 1964 fishing for blue-eye with hydraulic reels, similar to the original research gear, was a common option for diversification in the rock lobster, couta and shark fisheries in the Storm Bay zone. The main period of blue-eye fishing was August - November while the rock lobster and shark fisheries were closed during breeding seasons.

During the mid 1960's, line and Danish seine fishers in the Eden zone, adapted the ideas from FRV *Derwent Hunter* and earlier FRV *Endeavour* cruise reports to design dropline gear and choose grounds respectively. Initially, it was the Eden fishers who investigated the eastern Bass Strait for blue-eye and became familiar with grounds off eastern Victoria before Lakes Entrance line boats. School shark fishers from western Victorian ports were still taking an accidental blue-eye by-catch in the late 1960's. There was no demand for blue-eye at the markets and so it was used as shark bait.

In New South Wales, Woolongong fishers were catching blue-eye incidentally in shark longline operations on the shelf edge. By 1966, New South Wales ports such as Kiama were also involved in blue-eye fishing and the grounds extended from Eden to Sydney.

The main ground off Sydney in 360-720 m depths was discovered after examination of hydrographic charts and FRV *Derwent Hunter* reports. Initially, the wire 'dropline' used was based on the design from FRV *Derwent Hunter*.. In the mid 1960's, the maximum sized blue-eye caught in New South Wales was 22.5 kg and the average size from the Sydney ground was 6-7 kg (Gorman 1967a).

At the same time, the average size of blue-eye caught in Tasmania was more than 9 kg on grounds between Tasman and Maria Islands in 450-720 m depths. Best catches were taken

from depths greater than 540 m and the maximum size was 17 kg (Anon 1951b). Blue-eye in excess of 90 cm total length were not uncommon during sampling off the east Tasmania coast in 1967 (Dix 1979).

By 1966-67, Tasmanian blue-eye fishing grounds extended from Eddystone Point to Tasman Island and Pedra Branca on the edge of the shelf. Fishers tended to travel to grounds closest to their respective home ports and to use sail power where possible.

Droplines were adopted quickly in both the Sydney and Freycinet zones while handlines and droplines were both important in the Eden and Storm Bay zones before the 1970's. Although some use of hydraulic reels and longlines continued in the Sydney and Freycinet zones, trotlines and handlines were generally superseded by droplines. By 1970, clip droplines were the most common gear type with an average of 6 droplines being deployed by those operators interviewed in New South Wales and Tasmania.

Until the 1970's, dropliners from New South Wales used an average of 425-500 hooks per day while Tasmanian line fishers averaged around 540-670 hooks in a day's fishing, depending on the gear type and zone.

In Tasmania during the 1960's and 1970's the most popular bait species were barracouta (90%) and Australian salmon (7%) (Webb 1979). These were later replaced by squid which became readily available from trawlers in the 1980's.

5.2 DEVELOPMENT OF THE COMMERCIAL FISHERY -THE 1970'S

Research by the Tasmanian Fisheries Development Authority (TFDA) indicated that in just two years, between 1968-1970, the average weight of blue-eye caught on the Tasmanian east coast declined from 7-8 kg to 4-5 kg. This latter weight was also the estimated size at first spawning (Webb 1979).

Exploratory dropline fishing off Victoria was undertaken in 1973-74 in an effort to provide options for diversification for shark fishermen. The surveys indicated a greater potential blue-eye resource off Portland. Involvement in blue-eye fishing was slow to start with in eastern Victoria compared with Port Fairy or Portland in western Victoria. It was more common for shark and rock lobster fishers in these ports to have used droplining as an auxiliary, off-season activity since the 1970's than their counterparts in eastern Victoria (Winstanley pers. comm.).

Later research (1978-80) in the Portland zone investigated blue-eye catch rates on trotlines and longlines. The average of 2.3 blue-eye/100 hooks lifts on trotlines compared poorly with dropline catches and it was concluded that longlining was less appropriate for targeting blue-eye (Winstanley and Smith 1982).

During the 1970's, droplines remained the dominant gear in New South Wales although a few trotlines were introduced in the Sydney zone. This zone shows the most gear experimentation amongst interviewed fishers and 39% had used or were using trotlines, handlines or hydraulic reels by the 1980's. In the Freycinet and Storm Bay zones, droplining had already become the most important method. A limited amount of exploratory blue-eye fishing in the Strahan zone used longlines in the 1970's.

Blue-eye grounds in the Coffs Harbour zone were first identified by dropliners in the mid-1970's and the fishery became incorporated into the diversified line and trap operations. In the mid to late 1970's, New South Wales Danish seiners on the south coast also diversified into droplining for blue-eye. In areas where the drop-off from the shelf edge is nearly vertical, canyons or points were targeted with droplines in around 270 m depths. The main depth was 430 m on the 1 km wide blue-eye grounds from Tathra (New South Wales) to Cape Everade (Victoria).

5.3 THE INTRODUCTION OF MESH NETS

In 1976-77 a 21 m Lakes Entrance vessel targeted blue-eye with meshnets on grounds off the east coast of Tasmania. Tasmanian dropline fishers voiced concern at this operation citing the danger of 'ghost fishing' from lost nets and over-exploitation of blue-eye stocks as the main issues. The main size range of netted fish (4.5-13.5 kg) overlapped the size range of fish caught on droplines (Anon 1977).

A Tasmanian vessel also worked mesh nets for blue-eye in the Storm Bay zone for a brief period and other local boats expressed interest in gill netting. Nets were considered a more efficient method than droplines (Anon 1977) with good reason - the Victorian mesh net boat landed over 30% of the total 1977 blue-eye catch from the Tasmanian east coast (Dix 1979).

Operational difficulties for both droplines and gill nets included catch predation by seabirds, seals, orcas or sharks, as well as gear loss and fouling from shark attack or strong current. However, poorer quality product was usually landed from nets which were often set overnight (Gresik 1966).

In 1978, netting was banned from Commonwealth waters deeper than 200 m between Tasman Island and Eddystone Point to conserve the blue-eye stock (Sinclair 1978, Dix 1979). During the same decade, conflict over mesh netting with Eden fishers resulted in a further ban being placed on the method in waters off New South Wales.

The meshnet vessel then concentrated operations off eastern Victoria until 1981. Trips were also made to Queensland, northern New South Wales, Lord Howe Island and King Island. A substantial proportion of the blue-eye handled by Melbourne Fish Market (MFM) was supplied by this one vessel, particularly during 1976-78.

CHAPTER 6

The Fishery From 1980 To The Present

6.1 EXPANSION INTO NEW AREAS

The 1980s were a period of expansion into new areas including the Lincoln, Beachport, Portland, King Island, Seamount and Cascade zones. The only areas of the fishery not investigated first by a government line fishing survey were in the Coffs Harbour and the Seamount zones. This second zone was first developed by tuna and reef fishers during the 1980's. In the same decade, FRV Challenger (DSF) discovered commercial quantities of blue-eye on the Cascade Plateau and this area was soon being fished by Tasmanian fishing vessels (Anon 1985).

Trawl surveys by Japanese and Norwegian vessels (1988-90) investigated the eastern seamounts (with the exception of the Gascoyne Seamount) and the Cascade Plateau. Blue-eye were caught on the Derwent Hunter, Taupo and Brittania Seamounts as well as on the Cascade Plateau, although further trawling for any fish species was not recommended. Detailed line fishing surveys were conducted on the west coast of Tasmania (Wilson 1981b, 1982a, 1982b), in Victoria (Winstanley 1979, Winstanley and Smith 1982) and South Australia (Jones 1985, 1988).

During this period the number of lines carried by fishers did not change, however, the total number of hooks set per day increased in all of the established zones (Coffs Harbour, Sydney, Eden, Portland, Freycinet, Storm Bay and Strahan zones). The maximum number of hooks set per day was reported in the Cascade zone (up to 5,000) and the lowest average number remained off Coffs Harbour. The higher number of hooks set was accounted for by more frequent setting of lines and/or a greater number of hooks being attached to lines.

Storm Bay (The 'Thirty Mile Patch')

A second influx of boats into the Storm Bay zone occurred in late 1970's and early 1980's when a dozen or so planing hull boats commenced droplining day trips for blue-eye, concentrating on an area known as the 'Thirty Mile Patch'. During this period the bulk of the catch was no longer taken from the Freycinet zone but was landed from the Storm Bay zone.

The ten year lull in fishing effort in Storm Bay was apparently enough for the blue-eye stocks to recover from earlier fishing pressure in the 1960's. High catch rates were experienced in the Storm Bay zone during 1979, but catch rates soon declined (Webb 1979). The peak time for activity on the 'Thirty Mile Patch' lasted until 1983..

Although blue-eye catch rates had already started to decline by 1982 (Figure 4.4), consistently good catches were reported over the whole year rather than the usual six month season experienced by fishers in other new areas. By 1985 only a few regular droplines were left on the 'Thirty Mile Patch'. Most of the 'scooter' boats had already headed north to once again concentrate on grounds in the Freycinet zone. Few line fishers have worked the 'Thirty Mile Patch' since 1989-90.

Strahan and King Island

A line fishing survey of the Strahan and King Island zones was conducted by the Tasmanian Fisheries Development Authority (TFDA) over two periods in 1981-82. The catch rate in the Strahan zone averaged 15.6 blue-eye/100 hooks on droplines and 6.4 blue-eye/100 hooks on trotlines. The catch rates were even higher on grounds west of King Island with 17.7 blue-eye/100 hooks on droplines and 12.1 blue-eye/100 hooks on trotlines. In summary, longlines were found to be inefficient, trotlines were preferable for night fishing and droplines proved effective in targeting blue-eye 'patches' during daylight hours. Weather conditions were recognised as a limiting factor for commercial fishing in these areas (Wilson 1981b, 1982a, 1982b).

The King Island zone is a particularly remote area which is still worked fairly infrequently by Tasmanian fishers, mainly restricted to summer months as the weather allows. These operators are either local to the island or the northwest coast of Tasmania (e.g. Stanley), or come from other Tasmanian ports. The King Island grounds are also fished for blue-eye by a number of fishers from the Portland zone with an occasional visitor from the Beachport zone. The recent peak (1989) in both the number of fishers and total blue-eye catches from waters adjacent to the island are indicative of the ongoing interest, particularly from Portland.

South Australia

Longline shark fishers in South Australia had been aware of blue-eye as a by-catch at least since the mid-1960's. However, hapuka and bass groper were generally more abundant as by-catch and there was little recognition of the blue-eye as a marketable species.

Survey dropline work was conducted by the South Australian government in 1983-84. The study indicated comparatively low catch rates (5.4 fish/100 hook lifts) in comparison with western Tasmania (Jones 1985). Target blue-eye fishing commenced with droplines and longlines from Beachport and out of Port Lincoln with droplines and trotlines around 1984-85.

Cascade Plateau

The Cascade Plateau is situated approximately 100?? km off south-eastern Tasmania. Japanese tuna longliners too blue-eye in the area as a by-catch during the 1980's. In March 1985 the Tasmanian Sea Fisheries Division sent the FRV *Challenger* to undertake exploratory dropline fishing. This was quickly followed by commercial fishing activity in the area.

Several operators fished the Cascade Plateau with droplines as weather allowed. Within a few months the size of blue-eye had fallen from 80 blue-eye per tonne to 120 blue-eye per tonne, catch rates also decined. A catch of at least two tonnes was regarded as the minimum required to fund a trip (Anon, 1985). The area is worked intermittently by a few fishers with fishing occurring mainly during summer (January to March).

The Seamounts

The mounts are of volcanic origin, often composed of granite domes or plateaux with pinnacles and ravines. As oceanographic features in the Pacific basin, they have long been recognised by tuna fishers for providing areas of fish aggregation associated with local upwellings (Yamanaka 1986).

A chain of seamounts (or guyots) off the coast of New South Wales and south-eastern Queensland may be divided into a northern and southern sector. The main areas to the north are the Derwent Hunter mount about 450 km north-east of Port Stephens, and the Brittania and Queensland Seamounts (200-300 km east and south-east of Brisbane). To the south lie the Taupo and Barcoo Seamounts, roughly 450 km east of Newcastle, and the Gascoyne Seamount 700 km offshore from Merimbula outside the AFZ.

Some droplining has also been attempted on the South Recorder, Moreton, Frazer and Stradbroke Seamounts with less success, as well as off Lord Howe Island, Balls Pyramid and Middleton Reef. Fishers vary in their ideas about the relationship between blue-eye caught on the Seamounts and on the New South Wales shelf. Many regard the stock as continuous, either

from dispersion at the larval or juvenile stage or as a result of adult migration to breed on the shelf. Some consider the blue-eye on seamounts to be residential.

Droplining is the only method used on the Seamounts. Earliest recorded catches of blue-eye are from the Gascoyne Seamount in 1979 although the Seamount zone fishery did not begin in earnest until the mid 1980's. Only about half the interviewed operators had previous droplining experience on the New South Wales coast. More operators work on northern than southern mounts and only a handful work in both areas. The largest number of operators worked on the Brittania and Queensland Seamounts (1988-89).

Since then there has been a noticeable decline in success which has been partly blamed on interannual changes in currents. In 1990, the apparent annual catch per boat dropped to half the rate in previous years.

6.2 TRAWLING FOR BLUE-EYE

The trawl fishery in south-eastern Australia expanded rapidly over the last two decades. This was facilitated by numerous imrpovements in fishing gear and navigational and fish finding equipment (such as radar, SATNAV, colour sounders, sonar, and in recent times by the introduction of Global Positioning Systems (GPS) and plotters). The introdction in the earlt 1980's of bobbin rollers on the ground line of trawl nets was a major improvement in fishing technology which allowed rougher bottom to be explored by trawlers. This gear enabled trawlers to work between canyons, although the canyons themselyes were usually avoided.

More recently there has been increasing interest in midwater gear, this has been prompted by increasing effort on traditional grounds and the decline of several of the principal demesal trawl species. Blue-eye is a well known species as part of market fish trawling on the edge of the continental shelf and upper slope. By-catch of blue-eye is also possible on the orange roughy grounds (south and east Tasmania, south-western Victoria).

New South Wales

Since steam trawlers started working off the New South Wales coast around 1910 there has always been a small, occasional by-catch of blue-eye from trawl operations. As these boats were only able to work depths less than 360 m, the catch of blue-eye was limited. Traditional south coast trawl grounds were 36 km wide from Bermagui to Gabo Island and Danish seining was virtually restricted to depths less than 160 m on the continental shelf.

Conversion from Danish seine to board trawling started in the mid-1960's (Gorman 1967b). Board trawling was quickly recognised as a more efficient method utilising a larger net and being less labour intensiye than seine trawling. However, otter board trawling also meant travelling further, day trips were no longer always sufficient to cover operational costs. There

was some initial reluctance to transfer methods because of concerns for the environment and fishing sustainability.

Nevertheless, with growing competition for catches, Eden and Ulladulla fishers swung in favour of otter trawling before the end of the 1970's. Bigger boats (20-25 m) were built as part of the move to board trawlers, large enough to accommodate tuna fishing in summer if necessary. Fishers with the smaller seine trawlers (approximately 15 m) found it more difficult to make a living without diversification, which often included droplining for blue-eye.

In the late 1970's radar was also becoming generally available along with better paper sounders which allowed clearer bottom definition on rough grounds. Since the late 1970's incidental blue-eye catches have increased, mostly while targeting ling, gemfish and blue grenadier on the edge of the shelf.

When spawning gemfish were targeted (1970's-1990) between eastern Victoria and northern New South Wales, some correlation in the availability of blue-eye and gemfish was noticed. The late autumn migration up the coast was pre-empted by good catches of blue-eye as well as mirror dory and ling. Often 60-70 boxes of blue-eye were caught in the first few days of targeting the gemfish run out of any port. This by-catch dropped to a few blue-eye as the gemfish season progressed.

During 1983-84, for example, boats commonly caught 2-5 boxes of blue-eye per shot for gemfish. The best reported catch on a Bermagui boat in the 1980's was 12 boxes of blue-eye in one shot. Overall, Bermagui trawlers have taken only minor catches of blue-eye. According to New South Wales fishing returns (1984-91), the blue-eye catch in demersal trawl nets was approximately 43 tonnes with a yearly average of 5.4 tonnes.

Interest in midwater trawling has some history in New South Wales. In November - December 1987, midwater gear was used off New South Wales coast. taking only a small catch of blue-eye. The New South Wales government subsequently banned further midwater trawling because of fears by local trawlers that traditional trawl species might be jeopardised by this highly efficient method.

Since the Seamount zone dropline fishery developed off New South Wales during the 1980's, Australian trawlers have also worked on the Gascoyne Seamount where some blue-eye have been landed while fishing for orange roughy.

Tasmania

The line fishery for blue-eye has been prominent in Tasmania for years. In comparison, it was still nearly all virgin trawl ground prior to 1989. Since then, trawling has become easier with the new gear and the grounds which were opened up for orange roughy fishing. Previously,

only some of these areas were worked by a handful of local trawlers. Trawl catches recorded on Tasmanian fishing returns (1979-85) total 24.5 tonnes and average 3.5 tonnes per year. Only a few boats travelled from Lakes Entrance, Portland and Melbourne. The unpredictable weather in the Bass Strait had limited effort from interstate.

The largest blue-eye catches are most often landed from grounds south of Tasman Island where a number of demersal trawlers have worked since 1985. On occasion, it is possible to catch over 5 tonnes of blue-eye per shot mixed with the other species.

Since 1989, more trawlers have worked off the east coast of Tasmania, particularly during summer. The trawled blue-eye from this area are an average weight of 5 kg and maximum weight of 15-20 kg. This is larger than the average droplined blue-eye from eastern Tasmania (4 kg) but no different from the maximum sized blue-eye caught on lines. Trawlers also work off north-eastern Tasmania (Eddystone Point to Babel Island). Grounds further north are accessible to vessels from the Lakes Entrance and Eden zones.

In general, few Tasmanian trawlers or line boats from any State work the west coast. During winter, some trawlers regularly work between Strahan and Sandy Cape on the west coast where blue grenadier spawn. The expected blue-eye by-catch is between a few fish and 500 kg/shot. Some blue-eye by-catch is taken most frequently while targeting grenadier, considered by some as the species with the biggest trawl potential in Tasmania.

Very little market fish trawling (150-550 m) takes place between Strahan and Maatsuyker Island on the south coast because of limited survey work in the area, difficult weather and distance from port and markets. However, trawler fishers regard this area as holding potential blue-eye, grenadier and warehou stocks. There is also significant interest in conducting investigations for a blue-eye/alfonsino fishery on these grounds, as they are very similar to grounds in New Zealand where such a fishery occurs.

Blue-eye is not a significant by-catch of orange roughy fishing. Although blue-eye is not caught on all orange roughy peaks, reasonable catches have been reported from south of Maatsuyker Island in about 1100 m depths. In regard to other potential midwater trawl species, cardinal fish has been found in Tasmania but as yet, no alfonsino. 1989 was the peak year for orange roughy catches off the east and south coasts of Tasmania. Since that season the number of trawlers working out of Tasmania has continued to expand with approximately 20, 50 and 56 boats in 1989, 1990 and 1991 respectively. In recent years, more than 20 South East Trawl vessels have been based permanently in the State.

Outside the orange roughy season, some of these trawlers fish for market fish on the shelf edge (shallower than 540 m) at different times where blue-eye are taken as a by-catch to grenadier, ling, mirror dory and gemfish.

Victoria

Trawling started off Portland in 1977 with 15 vessels operating in what is now the SET fishing zone. The early 1980's was a period of expansion with boats generally working in depths of 360 m, mainly targeting gemfish and blue grenadier. Occasional deeper shots near canyons sometimes yielded up to 12 boxes of blue-eye. Blue-eye may have been sold as 'mixed fish' from trawler catches and it is unlikely that the full quantity of blue-eye was recorded in SET log books or State fishing returns.

Over time, a few fishers learnt to target the rough ledges for blue-eye using demersal trawl nets, particularly in November when blue-eye appeared to congregate in particular areas. The trawl time was up to four hours per shot, and over a 7-8 year period the average blue-eye weight was observed to decline by 1-1.5 kg. Since then, the quantity of both blue-eye and hapuka has noticeably declined on Portland trawl grounds. Nevertheless, working in 400-450 m Portland trawlers can still catch 2-3 kg blue-eye on flat ledges whereas the dropliners who target the deeper drop-offs (around 540 m) land blue-eye in the 5-40 kg size range.

In 1989 several Portland fishers bought midwater gear from New Zealand to use on orange roughy (later found to be unsuitable). Instead, using the New Zealand gear in October 1990, up to three tonnes of blue-eye was landed mixed with a few alfonsino followed shortly by a clean seven tonne shot of 4-6 kg blue-eye. This event led to a 500 kg trip limit on blue-eye which was in force until 1992. No clean shots of alfonsino were taken off Portland during the short trial period with this midwater gear.

The small midwater nets were towed in semi-pelagic mode at least 3-4 m off the bottom. The gear can be used to precisely target fish schools although the initial scattering effect enables some fish to escape around the net mouth. Midwater nets are built for lightness and have large meshes to reduce drag and outpace faster swimming fish. Although demersal nets may also be used in a semi-pelagic fashion, as for orange roughy, the increased drag limits the towing speed and efficiency.

The perceived benefits of a midwater trawl fishery in Portland are to allow trawlers to work all year round out of home port, alternating between midwater trawling in winter and orange roughy fishing in summer. Trawlers with a limited orange roughy history and consequently small quota allocation have to look at alternative fisheries to remain viable. Midwater trawling is one such alternative. However, there availability of new resources from midwater fishing has yet to demonstrated.

In 1982-83, demersal trawlers working from Lakes Entrance caught 500 kg to one tonne blue-eye per trip while targeting gemfish in the April-August season from Gabo Island to Cape Everade. This extensive trawl ground stretches 180 km with a depth range of 370-450 m.

Blue-eye was caught mainly during morning shots in 430-450 m depths. Since that time, blue-eye have rarely been found in this area. This apparent depletion may be attributable to the activity of local mesh net boats working deeper waters (360-450 m) from 1984-85 to target ling and blue-eye.

From information gathered from the Lakes Entrance Fishermen's Co-operative, the total trawl catch from 1985-90 (taken from the local trawl grounds) was 39.5 tonnes, averaging 6.6 tonnes/year and 1.1 tonnes/year/boat.

CHAPTER 7

Management Of Blue-Eye And Related Fisheries

7.1 DIVERSIFIED FISHING OPERATIONS IN SOUTHEASTERN AUSTRALIA

The main fisheries in south-eastern Australian are abalone, rock lobster, trawl/Danish seine, fish trap and line (including tuna, kingfish, snapper, striped trumpeter and barracouta), shark longline and meshnets, and scallop. Line fishing for blue-eye is a common thread which connects all of these fisheries. The seasonality of droplining effort is often determined by activity within other fisheries as well as the availability of blue-eye on the grounds. There is a tendency for blue-eye dropline fishers to diversify their operations according to licensing requirements, boat size and market opportunity. In this way, the management and success of alternative fisheries may have implications for blue-eye fishing effort from year to year

Pattern of diversification in blue-eye fishing

The pattern of diversification varies between States and the relative importance of the different fisheries has fluctuated over time (Figure 7.1). The main fisheries in which dropline fishers are involved are shark and rock lobster in South Australia, Tasmania and Victoria, and tuna, rock lobster and other trap and line fisheries in New South Wales. The wide choice of alternatives in New South Wales during the 1960's to 1970's has been greatly reduced in recent years. In Tasmania scallop dredging is presently unavailable. Danish seine trawling has been replaced by board trawling in New South Wales.

Although Figure 7.1 includes most of the interviewed blue-eye fishers it is not intended to show the degree to which individuals are involved in each fishery. Few fishers can claim to be occupied exclusively in the blue-eye fishery. However, at times when they turn to blue-eye

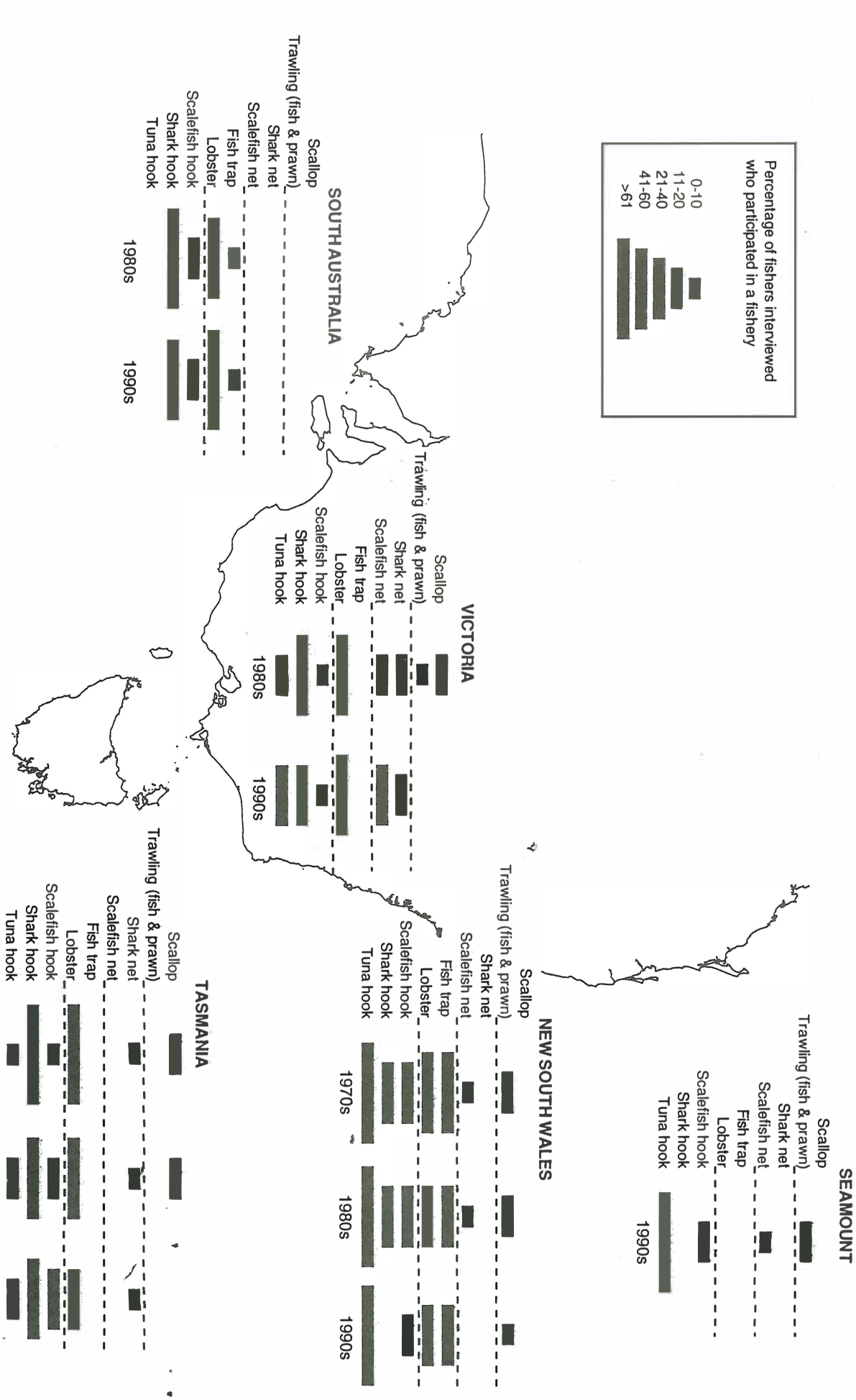

Figure 7.1 Participation rates of fishers in different fisheries by decade and state. Bars indicate the percentage of those interviewed who indicated that they participated in the corresponding fishery..

fishing it may be the mainstay of their operations whether it be for periods of several months or virtually for the whole year.

7.2 MOBILITY BETWEEN ZONES IN WHICH FISHERS OPERATE

The mobility of fishers varies between and within individual States. A small number of Tasmanian fishers have worked at least occasionally in every zone outside Tasmania. From the interviews, over half the blue-eye fishers off King Island are from the Portland zone and a fifth are from the Beachport zone. Approximately a third of the operators in the Everade zone also work in the Freycinet zone and a similar proportion of operators from the Portland zone have included the Beachport zone in their range of blue-eye grounds.

Few South Australian fishers work on King Island grounds and even less travel to the Great Australian Bight for blue-eye fishing. Port Lincoln fishers restrict their blue-eye fishing to areas west and south of their home port, except for trips to Kangaroo Island. Approximately half the blue-eye fishers from southern South Australia also work off Beachport. Fishers from the Eden zone commonly work in the Everade zone and many operators from the Sydney and Coffs Harbour zones now work in the Seamount zone.

A number of Tasmanian fishers operate extensively in several zones within the State, either alternatively during the same period or consecutively in a number of zones. More fishers in New South Wales than in other States have transferred their home port, though usually remaining within New South Wales.

7.3 MANAGEMENT STRATEGIES FOR THE BLUE-EYE LINE FISHERY

Prior to the introduction of the *Fisheries Management Act 1991* access to blue-eye line fishing only required a Commonwealth Master Fisher's Licence and boat registration for Commonwealth waters (from 3 to 200 nautical miles). A freeze was placed on further issue of licences in 1985 (Meany 1992) and there has also been bans on the issue of new State fishing licences in all of the States adjacent to the fishery. Apart from 'restricting' access to the fishery to all Commonwealth licence holders, there are few restrictions on sectors other than the trawl sector. This is likely to change over the next few years.

As a result of conflict between the trawl and line sectors in the early 1990's, a trip-limit for blue-eye was imposed on trawlers to discourage targetting of the species particularly by mid-water trawlers. The trip limit was set at 500 kg to allow legitimate by-catches to be landed. The trip limit was replaced in 1992 with a Total Allowable Catch (TAC) for the trawl sector of 125 t. The TAC was set at a level slightly higher than the historic highest catches of the trawl sector.

As the new Act is implemented under the auspices of the new federal body, the Australian Fishing Management Authority (AFMA), all previously 'open' fisheries, such as blue-eye line fishing, will require operators to hold a specific fishing permit. If a management plan is developed at some future date, this will create five year statutory fishing rights with appropriate conditions (Meany 1992). Already, there are repercussions on the blue-eye line fishery from the implementation of Offshore Constitutional Settlements (OCS)s between several State and the Commonwealth Governments during the 1980's.

New South Wales has had a scalefish OCS since January 1991 to the 4,000 m depth contour and management of trap and line fisheries is currently being assessed by the New South Wales Office of Fisheries. The blue-eye shelf fishery falls under the ambit of the Pot Line And Trap Management Advisory Committee (PLATMAC) which also includes species such as lobster, snapper and kingfish. Although blue-eye fishing is not considered a major component, the register of interest in blue-eye had received about 90 responses by June 1991.

In 1988, a meeting was held to discuss Commonwealth management of the Seamount fishery. Registration of interest and fishing histories were collected, mainly from New South Wales and Queensland fishers. No further arrangements have been made to date.

As an open fishery, the blue-eye line fishery, has long functioned as a "sink fishery" at times of increased competition within managed fisheries such as mesh nets, rock lobsters, abalone, southern bluefin tuna and scallops. This pattern is already being disrupted as New South Wales, Tasmania and South Australia increase the number of restricted fisheries to include pot, line, trap, beach seine and trawling in State waters. Changes in the management of the shark fishery are also likely to have an impact on the blue-eye fishery.

7.4 MANAGEMENT OF ASSOCIATED FISHERIES

Southern Shark Fishery (SSF)

The longline fishery for shark was established off Victoria by 1927. The fishery rapidly expanded in Victoria followed by South Australia and Tasmania during the early 1940's. By the mid 1940's effort was moving offshore as nearshore stocks became depleted (Tilzey 1989) resulting in the first blue-eye by-catches on commercial longlines.

A second period of expansion occurred when the shark net fishery developed off Lakes Entrance around 1965 (Tilzey 1989). Even at this stage it was recognised that a potential fishery might also exist for blue-eye and striped trumpeter (*Latris lineata*), although less than 5% of the catch was listed as 'bony fish' which included these two species (Gresik 1966). The method was seen as a step forward for the shark industry and it was recommended that gill nets be encouraged outside the 12 mile State limit. Except in areas of strong current, mesh nets proved to be more efficient than shark longlines.

A small shark fishery also operated in the Eden and Sydney zones from the 1960's to the mid 1980's. In some Eden and Sydney zone ports shark longlining was the main fill-in fishery during winter and longlines were also set for blue-eye in 200-500 m depths. A minor blue-eye by-catch was landed during the 1960's from both shark and snapper longlining operations. At this stage blue-eye was hardly recognised on the New South Wales market, so few attempt were made to target blue-eye. With the apparent decline in shark abundance from the late 1970's, effort has subsequently been transferred to blue-eye fishing.

In 1972 the Victorian government lowered mercury limits in seafood and unacceptably high levels in school shark led to a ban on sale of school and gummy shark over 104 cm in length (Tilzey 1989). This restriction had a major impact on Tasmanian and Victorian longline fishers who were forced to diversify their fishing operations. The nature of fishing operations in Tasmania and Victoria was fundamentally affected by this new government regulation.

The Tasmanian Fisheries Development Authority and the Victorian Fisheries and Wildlife Department responded by conducting exploratory and experimental survey work on other potential fisheries. A variety of options was trialed including board trawling, Danish seining, squid jigging, giant crab trapping as well as line fishing for blue-eye. Later research compared trotlining, longlining and droplining methods (Winstanley and Smith 1982) although work on meshnetting for blue-eye remains unpublished.

Many Victorian fishers simply transferred effort from school or snapper shark (*Galeorhinus gales*) to gummy shark (*Mustelus antarcticus*). Gummy shark are caught more readily with nets than on hooks, and thus both species have been targeted with gillnets since the mid 1960's, particularly in the Everade zone where the grounds are most favourable. Mesh nets are also used to target fish species and the priority of diversified Victorian blue-eye fishers varies between shark longlining, fish netting and rock lobster fishing.

The meshnet fishers in the Everade zone concentrate on shark, warehou (*Seriolella brama*) and ling as target species and land minor catches of blue-eye. Nets worked in depths of 240-620 m have caught blue-eye with noticeably larger fish landed from deeper water. The size of fish ranged from 3-20 kg during the 1970's-80's. The interviewed Everade zone fishers include 25% who target blue-eye with mesh nets or trotlines, usually in combination with droplines.

Rock lobster fishing

Fishing for rock lobster (*Jasus edwardsii*) with pots has been an important fishery in Tasmanian and Victorian State waters since the 1920's (Winstanley 1973) and in South Australia since the 1930's. During closed rock lobster seasons in Victoria, larger vessels have tended to go longlining for shark. Smaller boats in Tasmania or Victoria, which have traditionally targeted barracouta (*Thyrsites atun*) and blue-eye in the rock lobster off season,

may now also concentrate on striped trumpeter and other scalefish such as ling (*Genypterus blacodes*).

Many who have in the past earned most of their living from rock lobster and/or shark are also part-time or occasional blue-eye fishers (Figure 7.1). In Tasmania, the rock lobster Offshore Constitutional Settlement makes explicit reference to the right offishermen to use dropline equipment. The rock lobster fishery is also relatively important in New South Wales and blue-eye is often the fill-in fishery during the off-season. The rock lobster fishery remains unregulated in New South Wales except for minimum size restrictions, but the situation is soon to be reviewed by a new management committee.

Line and trap fisheries

A number of species and methods are included in this category which is particularly important in New South Wales and receives some attention from blue-eye fishers in South Australia and Tasmania. In contrast with other areas, line fishers in the Coffs Harbour zone often target hapuka, bass groper, barcod and large-eyed Job-fish (*Etelis coruscans*) on droplines rather than blue-eye which is usually a by-catch species. At times, blue-eye is also targeted specifically. In a few instances where the numbers of bass groper have been observed to decline, blue-eye has become a more important alternative target species.

Elsewhere in New South Wales target line fishing concentrates on gemfish (particularly during the winter spawning run), and dogshark, hapuka, bass groper and ling as well as kingfish (*Seriola lalandi*), snapper (*Chrysophrys auratus*) and morwong (*Nemadactylus macropterus*) throughout the year. Several of these species are also caught in traps. There have also been a few, largely unsuccessful attempts to trap blue-eye. Blue-eye line fishing may be an alternative fishery during winter when fish traps are used less regularly.

Exploratory fishing to develop a trotline fishery for cardinal fish off New South Wales has been underway intermittently since 1990. The small catches have contained a relatively significant blue-eye by-catch.

Dogshark, hapuka and bass groper are also targeted by blue-eye fishers in South Australia. These species are caught most readily over soft bottom at the base of drop-offs or canyons using either longlines, droplines or trotlines. Dogshark are prized for the squalene oil content of the liver, rich in vitamin A. A relatively large number of hapuka have been landed in recent years by blue-eye fishers in Port Lincoln.

Tuna line and pole fisheries

Tuna fishing was dominated by southern bluefin tuna (*Thunnus maccoyii*) from the 1950's until the early 1980's when severe restrictions were imposed to reduce excessive catches and to counter changes in the catch size composition.

The domestic tuna longline fishery around south-eastern Australia has received much attention recently and since 1990 it has been a limited entry fishery in New South Wales and Queensland. Tuna species caught on longlines include southern bluefin tuna, skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*) and albacore (*Thunnus alalunga*). Some blue-eye fishers have also expressed an interest in the possibility of developing a troll fishery for albacore in New South Wales, Tasmania and eastern Victoria.

In New South Wales, a large proportion of blue-eye fishers have always been active in tuna fishing (Figure 7.1) although the main methods have changed from poling in the 1960's and 1970's to longlining in the mid-1980's. The Seamount fishery for blue-eye off northern New South Wales and south-eastern Queensland started as an offshoot from tuna longlining activities. These line fishers are still the main participants in the offshore fishery and most continue their involvement in tuna fishing.

Scallop dredging

Scallop dredging was based in eastern Tasmania from 1945 until the 1960's when Victoria also developed a fishery in Port Phillip Bay (1963) and eastern Bass Strait (1969). Limited entry was introduced to Victorian in 1971 and to Tasmania in 1985 to curb rapid expansion. Limits on the open season, allowable gear and catch were imposed soon after.

The Commonwealth fishery in the Bass Strait encouraged over-capitalisation during the early to late 1980's. Special licence conditions have been required for scallop fishing in Tasmanian, Victorian and Bass Strait waters since 1986 when an OCS agreement was signed by the State and Commonwealth Governments. The number of Tasmanian operators has been returned to 1985 levels on the basis of time of involvement in the fishery rather than a catch level cut-off point. The current number of licensed vessels in Victoria is probably only necessary to harvest scallops in peak years.

Due to major fluctuations in scallop recruitment and the boom and bust nature of the fishery, the core scallop fleet has often been involved part-time in the fishery. Traditionally, Tasmanian rock lobster fishing boats diversified into scallops during winter. Blue-eye fishing has become a more likely alternative for fishers since the recent dramatic decline in scallops (Zacharin 1989, Gwyther 1989).

Other fisheries

Minor components of diversification within the blue-eye fishery include abalone and mussel diving, Danish seining, demersal prawn and fish trawling and charter work. Blue-eye fishers from Sydney zones ports include some who are mainly concerned with prawn and fish trawling. In the future it is possible that new management arrangements for trawling in State waters may encourage interest in droplining for blue-eye as an alternative fishery. In recent years, charter and survey work have become necessary additions to fishing diversification for a few operators

CHAPTER 8

Dropline Gear Design And Operation

Despite variation between individuals, blue-eye fishers in a particular zone may share distinct characteristics in terms of the types of vessels and fish finding equipment used, the design of the gear and the way in which it is used.

The following account is a summary of detailed information collected from interviews and held by the Tasmanian Marine Reseources Division. Most emphasis is put on describing droplining operations and gear, reference to trotlines and handlines are made where appropriate.

8.1 BOAT TYPE AND CREW NUMBER

A description of the hull types comprising the fleets by zone, and the average sizes and range of sizes is given in Table 8.1. Blue-eye fishing is a small boat industry in the Eden, Sydney and Everade zones. The size of the most common displacement hull boats range from 9.1-19.6 m LOA (average 14.7 m). The less common planing hull boats vary between 6.3-16.1 m LOA (average 10.6 m). Some of the advantages of a planing hull are improved manoeuvrability on the grounds and speed of travel between port and grounds for a day's fishing to maintain catch quality. Disadvantages include increased fuel cost and less stability heading into bad weather.

The greatest proportion of planing hull boats occurred in the Storm Bay zone, particularly during the peak of activity on the Thirty Mile Patch. The number of planing hull vessels used in blue-eye fishing also increased from the late 1970's in the Sydney zone. A comparatively large number of planing hull boats work grounds in the Coffs Harbour zone. No known planing hull boats operate in the King Island, Strahan or Cascade zones and few work in the Seamount or Victorian zones.

The fishery in the Strahan zone requires large, displacement hull boats up to 25.0 m LOA (average 18.6 m) due to the weather conditions, lack of shelter and distance of grounds from where the average boat length is 25.4 m LOA, ranging up to 32.0 m.

Table 8.1 The segregation of fleets by zone between displacement and planing hulls, and the average length and size range.

Hull type (m)	Zone	% of fleet	Average length (m)	Size range
Displacement	Seamount	85	17.2	11.5-23.5
	Coffs Harbour	56	13.4	11.5-19.8
	Sydney	63.3	13.1	9.3-19.1
	Eden	67.6	12.7	9.1-19.6
	Everade	91.7	16.2	11.5-19.6
	Freycinet	83.3	10.5	5.6-27.3
	Storm Bay	50	16.0	10.6-21.0
	Cascade	100	25.4	19.1-32.0
	Strahan	100	18.6	12.1-25.0
	King Island	100	17.4	14.1-25.0
	Portland	87.5	14.0	10.8-18.0
	Beachport	60	13.7	10.9-17.0
	Lincoln	100	17.4	12.1-22.8
Planing	Coffs Harbour	44	9.3	7.0-13.0
	Sydney	36.7	10.8	6.6-16.1
	Eden	32.4	11.9	6.3-16.1
	Everade	8.3	7.9	-
	Freycinet	16.7	10.5	10.0-10.9
	Storm Bay	50	12.4	10.6-15.2
	Portland	12.5	11.7	9.6-13.8
	Beachport	40	13.1	9.4-15.6
	Seamount	15	15.4	14.5-16.0

The range in the number of crew carried on the majority of boats by zone is given in Table 8.2. Most operators carry at least one and usually no more than three crew members. Some New South Wales fishers also work solo. An adequate crew number is determined by several factors. Extra crew may be required for baiting the lines between shots, handling and preparing the catch (e.g. heading and gutting at sea for Sydney Fish Market) and retrieving floaters.

Table 8.2 The number of crew in addition to the skipper for the majority of boats by zone.

Zone	Number of crew
Seamount	2-3
Coffs Harbour	0-1
Eden	0-1
Freycinet	1-2
Storm Bay	1-2
Cascade	3
Strahan	1-3
King Island	1-2
Beachport	1-2
Lincoln	2-3

8.2 COLOUR AND PAPER SOUNDERS

As paper sounders became more readily available by the mid to late 1960's, blue-eye fishing became more efficient. Colour sounders were first available in the 1970's and since then many fishers have converted to a colour sounder which provide a digital readout of bottom depth. However, a more powerful colour sounder than a usual 50 kHz (2 kW) model does not necessarily improve fishing success.

More than 50% of the interviewed fishers in the Eden, Coffs Harbour, Seamount, Freycinet, Strahan, Cascade, South Australian and Victorian zones use colour sounders. Around 20-30% of these fishers originally used paper sounders except in the Coffs Harbour zone where almost every colour sounder now in use has replaced a paper sounder.

Some fishers have noted increased efficiency of their operations with upgrading to a colour sounder and others have not noted any advantage. In fact, some claim that a colour sounder is only preferable because the paper has become too expensive to replace. Fishers who prefer a paper sounder are able to distinguish hard bottom and feed or fish marks on it more reliably than on a colour sounder, especially in calm weather. It is also possible to mark paper and keep for later reference. The highest proportion of fishers who still use paper sounders were interviewed in the Freycinet, Storm Bay and Eden zones.

Other fishers use both a colour and paper sounder together, particularly in the Seamount, Coffs Harbour, Sydney, Eden and Everade zones. The paper sounder may give better bottom definition and colour is used for general survey to indicate thermoclines, fish and feed. Sonar is occasionally used instead of, or in addition to, a sounder.

8.3 GPS AND PLOTTER

The latest development in navigational equipment, a GPS and plotter was first used to assist blue-eye fishing in the late 1980's. Now, most of those interviewed either own or intend to install a GPS to work in the Seamount, Cascade, Lincoln, Portland, Coffs Harbour, Strahan and Beachport zones.

Between 10-15% of fishers in the Coffs Harbour, Eden and Seamount zones either think that GPS is too expensive to consider or unnecessary for small boat, local fishing operations. Nevertheless, the following reasons have been cited in support of installing a GPS as soon as possible:

- GPS allow greater total number of lines to be worked per day,
- GPS means fewer lines can be worked without decreasing catch,
- GPS has improved fishing success and accuracy in locating known grounds and holding position on the most productive spot,

- GPS has improved efficiency and decreased costs by dramatically reducing searching time.

The accuracy and speed of locating and maintaining a known position is the major advantage of the new technology. It is found to reduce the time spent at sea and increase the catch rate of an otherwise more 'hit and miss' operation.

There may be inherent disadvantages of increasing efficiency as increased fishing pressure is also exerted but it is too soon and difficult to measure either the impact on fishing effort or success.

8.4 RADAR, SATNAV AND OTHER NAVIGATIONAL AIDS

Fishers have used radar marks to identify fishing grounds since the 1970's. However, previously if weather allowed, grounds were located and position maintained by reading the sounder and using landmarks on familiar grounds. This was the only means of orienting vessels before radar was available.

Both radar and SATNAV have been superseded where GPS has been adopted. Nonetheless, most of those interviewed still rely to some extent on radar to set lines and locate previously fished grounds especially in the Coffs Harbour, Eden and Strahan zones. Even a ship's compass may still be used and an autopilot may also be necessary.

Relatively few interviewed line fishers use SATNAV facilities except in the Seamount, Portland and Beachport zones.

8.5 OTHER ELECTRONIC CUES FOR SETTING LINES

A large proportion of interviewed fishers set lines according to the bottom type and depth in the Coffs Harbour, Eden, Everade, Freycinet, Strahan, Portland and Lincoln. Fish or feed marks are more important in the Seamount, Freycinet, Storm Bay, Cascade and Beachport zones.

Fishers in New South Wales, probably because of their background in tuna fishing, have experimented with temperature probes and identifying water bodies on the sounder to indicate the likely position of blue-eye. A surface temperature of less than 18°C is used as a cue to set lines. It is believed that larger quantities of big fish are found in cold water masses.

8.6 GEAR DESIGN

Hook number and spacing

The average number of hooks per dropline ranges from 130 in the Cascade zone to 33 in the Coffs Harbour zone. Tasmanian fishers generally use more hooks per line than in any other

states. Droplines in the Seamount and Everade zones will often carry more than 70 hooks. In the remaining zones, around 60 hooks per dropline are used. However, the widest range in the number of hooks which may be used is found in the Seamount, Beachport and Everade zones. An increase in the maximum number of hooks per line has come over time in the Sydney, Seamount, Freycinet, Cascade, Beachport and Everade zones.

Fishers from Coffs Harbour, Sydney, Eden, Seamount, Everade, Portland and Cascade zones tend to space hooks regularly on each line. The greatest variability in hook spacing on one line occurs in Tasmanian zones where up to 25% of interviewed fishers may cluster or spread hooks according to the time of day, expected fish depth and other factors. However, the average distance between hooks is fairly consistent in all areas, ranging between 80 cm (Cascade, Portland) to 160 cm (Eden, Sydney). Overall, fishers from New South Wales set hooks further apart than fishers from the other states. Clip gear is necessary where the distance between hooks is varied and fixed droplines may be advantageous where a set distance is preferred.

A number of operators in all zones sometimes leave a 'tail' of line and attach hooks some distance above the weight to target blue-eye more effectively. The height above the bottom where fish are likely to be caught varies according to water body movement and the distribution of the feed which attracts blue-eye. Blue-eye are generally assumed to congregate some distance off the bottom. The variability of conditions means that fish are often caught all along the line with no particular pattern.

The preferred length of line before the first hook off the bottom was a minimum of 30 m and no more than 54 m. At night, some fishers were reported to have caught blue-eye by setting 90 m of hooks starting 90 m up line. However, others have found no difference in the distribution of blue-eye in the water column, night or day.

Hook type and size

The main hook types were initially long shank shark hooks in the Everade, Eden, Coffs Harbour and Tasmanian zones. Short or long shank shark hooks were used in the Sydney zone and tuna circle hooks in the Seamount, Beachport and Lincoln zones. Double hooks were used in Cascade zone.

Changes in hook type favoured long shank shark hooks in the 1970's. Tuna circle hooks, which are now the most popular, became available in the 1980's. There has been a range of popular hook sizes according to type of hook or area of operation. Shark hooks are usually (9/0-13/0) and tuna, offset or suicide circle hooks are generally (12/0-16/0).

Snood construction

Snoods construction shows considerable variation in the material type, length and strength. The dominant materials are poly plastic, nylon monofilament (mono) or wire. Poly snoods are nearly always 3-4 mm diameter and wire 1-2 mm. The mono used often has 250-350 lb. breaking strength. Some fishers from the Coffs Harbour and Seamount zones have opted not to use any snood, while a few operators from the Sydney and Eden zones found this to be inadvisable. Using a hook to clip with no snood is seen as an advantage because the catch losses due to problems with twisting, chafing or bite-offs are thought to be reduced .

The relative merits of each type of material are variously described by fishers. The advantages of poly are the cost and durability. Fishers from all Tasmanian zones, Beachport and Portland favour poly snoods. Mono is thought to be equally strong, though less detectable in the water. Lincoln zone fishers, and the majority of New South Wales operators prefer this material. Wire snoods are adopted to prevent shark and gemfish from tangling around the mainline and damaging the gear. Snoods longer than 10 cm are either awkward because they twist around the mainline, or beneficial, allowing the bait to move freely and attract fish to the line. Where snood length has been changed over time there is a tendency towards using shorter snoods.

Approximately half the swivels used are incorporated into the snood in New South Wales and Tasmania zones and around a third of the swivels from South Australia and Victoria. Swivels are either connected to the hook or clip, or between the snood and mainline. From the interviews, swivels are often just as likely to be left off hooks or clips when replacing snoods.

The expense of replacing swivels when snoods are lost is somewhat prohibitive if the only perceived benefit is to allow lines to be winched faster without fear of losing too much catch. Rust is another problem which reduces swivel efficiency.

Dropline construction

Line dimensions are variable with the average total length ranging from 574 m in the Sydney zone to 1,100 m in the Seamount zone. The Seamount zone also has the widest range in length of line used. The average mainline is 67.5 m which is similar to the Coffs Harbour zone (61.3 m). As might be expected, the longest mainlines were used in the Cascade, Freycinet and Seamount zones.

Line construction sometimes involves swivels, most commonly between mainline and buoyline except in the Beachport, Strahan and Cascade zones where no swivels were used by interviewed fishers. In the Seamount and Freycinet zones lengths of mainline may also be swivelled together to improve line flexibility.

The materials used in the droplines include poly rope, braided or hardlaid poly, galvanised wire and stainless steel as well as monofilament nylon. Drag and abrasion on the gear, ease of operation and chance of gemfish bite-offs were factors in the choice of material and line diameter.

Virtually all buoylines and many mainlines are poly with an average 6-8 mm diameter. Wire mainlines are an average 2-3 mm (stainless steel) and 3-6 mm (galvanised). Wire mainlines are used where chafing, gemfish or sharks may damage poly or mono gear. Wire has also been rejected on the grounds that it is difficult to handle, becomes kinked and distorted and is hard to unsnag from the bottom. It is suspected by some fishers that mono mainline is preferable because it is less detectable by fish.

Most Seamount zone fishers use wire and there has been a tendency to convert from stainless steel to galvanised mainlines. Problems are encountered with the stainless steel which is more expensive and prone to fracture during use. However, galvanised wire may also need to be discarded after several shots as the line becomes kinked and likely to fail due to fatigue.

The problem of wire mainlines untwisting may be overcome by using plastic coated wire. Some Coffs Harbour zone fishers use plastic or poly covered wire for ease of handling and to allow the clip to spin rather than slip on the mainline. Electrolysis of swages to hold hooks in place on wire mainlines has also been experienced.

Changes in mainline or buoyline lengths over time are minor by comparison with the 30-50% tendency to vary the length of buoyline according to the depth of water. Mainline length may also be changed in response to the height of drop-offs and buoyline length is often increased according to the current strength.

Bait type

A variety of species are used for bait including squid, tuna, pilchards, couta, mullet, mackerel, salmon and octopus. Fishers generally prefer fresh (possibly frozen) bait and quality is an important factor for many operators. Frozen bait is used frequently in the Seamount zone and exclusively in the Cascade zone.

Squid is the most popular bait type in the Eden, Lincoln, Beachport, Strahan, Storm Bay, Freycinet, Everade, Seamount and Cascade zones. Pilchards, octopus and tuna are considered the best bait in the Sydney, Portland and Coffs Harbour zones respectively. Bait is either supplied by trawlers or caught independently by line fishers and so fresh bait type may vary seasonally. Fluorescent beads or 'light sticks' to attract blue-eye to the lines have been trialed occasionally with little apparent success.

Studies indicate that bait loss during the first few hours of soaking longlines determines the catch (Laevastu and Favorite 1988). It is therefore logical for blue-eye fishers to favour tougher bait, such as squid which not only survives the trip to the bottom but may also be retrieved and re-used if necessary. Bait 'cocktails', as suggested by research, have been used by some blue-eye fishers. Bait combinations may consist of reliable tough bait such as dogshark or squid mixed with an 'attractive', oily fish such as mackerel or salmon on the same line.

Use of weights and buoys

The most popular weights are between 25 kg to 40 kg. Some fishers vary the weight according to daily current conditions or the nature of the grounds. Weights less than 10-12 kg allow the current to move gear after reaching the bottom without much damage, usually because it is reasonably flat or the water is shallower. Heavier weights are used to target particular 'spots' or fish in deeper water. The maximum weight used is 70 kg in the Coffs Harbour zone where currents are noticeably stronger than other zones.

The most sought after weight materials are iron, steel or lead. Bricks, concrete, chain, sash weights, cast iron, rocks or sandbags are also used. Weights are not always retrievable. For example, where bricks are used, it is usual to leave them on the bottom. The catch is still able to be landed when the weight snags if the line is designed to break directly above the weight.

One or more inflatable top buoys (72"-100" circumference) are popular in all New South Wales zones, particularly on the Seamount. Smaller (60"-75") inflatable buoys are used most commonly in Tasmania and Victoria and the smallest (40-60") top buoys feature in the Beachport zone. Hard, plastic surface buoys are also important in the New South Wales zones. The larger 12-14" diameter floats are quite common in the Seamount and Sydney zones while 8"-12" ones are used in the Eden zone.

All New South Wales and Tasmania fishers show a preference for 1-3 top buoys with a maximum of eight buoys being occasionally used in the Coffs Harbour zone. Usually fewer buoys are required off South Australia and Victoria. Additional buoys are most often attached in strong current or if the first line is used to test the conditions.

Dan flags are common in all zones. Dans have also been removed when a floating buoyline basket or a second top buoy was introduced. Lights are attached at times for dusk/predawn or night fishing.

More than 60% of fishers use midwater floats, usually attached directly above the top hook. These buoys are generally 6"-8" except in the Eden zone where 4"-6" ones are equally common. In the Seamount and Cascade zones, 8-9" deepwater floats are used exclusively. Many fishers attach midwater buoys as a matter of course while some use them only in slack current when the line may collapse on the bottom if not held vertically by a midwater buoy.

Other fishers will use midwater buoys when strong tide may lay the line flat, over particularly rough bottom, or to support a wire mainline. As the current strengthens, the midwater buoys may be attached further up the buoyline above the hooks.

8.7 OPERATION OF GEAR

Factors affecting the number of lines and hooks set per day

The effective daily fishing effort (usually measured as the number of hooks used) by a dropliner depends on both the number of lines carried aboard the vessel as well as the number of times each line is deployed during the day. It is possible to achieve the same level of fishing effort by using a larger number of lines infrequently, or fewer lines more often. Obviously, changing the number of hooks per line is a further important variable.

The time of day when the lines are set can be as critical as the total number of lines used. Lines may be left in the water for longer during the day and more effort focused on the twilight times at dawn and dusk when peak catch rates are often experienced.

The factors which control the number of lines and/or shots per day are the time it takes to set and haul lines, line soak time, variable environmental conditions, and constants such as boat size and number of crew. The term 'shot' used here infers that either one or more lines have been set on the fishing ground at one time.

Some patterns may be associated with the general fishing practice within each zone. For example, fishers in the Coffs Harbour zone who carry the lowest average number of droplines (4.2 lines) still achieve a better average daily range (8-14 lines) in comparison to fishers from the Sydney zone. This is made possible by setting lines 2 to 4 times per day. In contrast, the Sydney zone fishers consistently set an average of 6.1 droplines only 1 to 2 times thus using the least overall number of droplines per day of any zone (Table 8.3).

Table 8.3 Number of lines set pre day and the average and range in the number of times that lines are reset by zone.

Zone	Lines set per day	times line reset per day	
		Average no. of lines	Range
Seamount	15-28	4-7	1-15
Coffs Harbout	8-14	2-4	1-8
Sydney	1-7	1-2	1-4
Eden	8-35	2-5	1-7
Everade	15-21	2-3	1-5
Freycinet	15-28	2-4	1-6
Storm Bay	15-21	2-4	1-5
Strahan	15-28	3-5	1-8
Cascade	15-21	1-3	1-3
Portland	15-21	3-5	1-7
Beachport	15-28	1-3	1-8

The majority of fishers in the Beachport, Victorian and Tasmanian zones operate either 15 to 28 or 15 to 21 lines per day (Table 8.3). However, there are differences in the number of shots per day and the number of lines carried on board. Fewer lines than the full complement may be set or reset, particularly in the Freycinet, Strahan, Portland and Lakes Entrance zones.

The average number of lines set per day is at a minimum of 15 in the Cascade and Seamount zones. However, fishers in the north of the Seamount zone use an average of 5.3 lines (often set for no more than 40 minutes) and may use up to 50 lines during one fishing day. The strong current may prevent leaving lines in the water for longer than 20 minutes. As a result, the maximum number of sets is found in the northern Seamount zone (up to 15 times). In contrast, fishers in the Cascade zone generally use an average of 8 lines set 1 to 3 times per day.

It should be noted that in the southern areas such as the Storm Bay, Strahan, Cascade, Freycinet and Portland zones, the seasonal variation in day length has a marked effect on the number of lines and sets that can be made.

Soak time

The number of lines used is partly determined by the optimal soak time to allow long enough for best catches without losing fish to vermin (e.g. mantis shrimp) or predators such as sharks. The length of time lines are left in the water before retrieval has increased in some areas (such as the Freycinet zone) as the number of fish has declined. Increasing the soak time of lines may or may not produce a larger catch. Soak times which regularly result in successful fishing vary from a minimum of five minutes (northern Seamount zone) to a maximum of four hours (Sydney zone).

The most common soak times for the first line in the first shot is one to two hours for more than half of those interviewed in the Seamount, Coffs Harbour, Sydney, Beachport and Strahan zones. However, more than 60% of fishers in the Eden zone leave droplines submerged for no more than an hour. In contrast, in the Cascade and Storm Bay zones, more than two hours soak time is nearly always necessary, and just as common as 1-2 hours in the Freycinet zone.

In both Victorian zones, interviewed fishers were equally divided between 1.5 to 3 hours and 30 minutes to an hour soak time. The maximum target soak time when lines are being worked repeatedly are given for each zone in Table 8.4.

At times, more lines are utilised in the first shot when searching for fish or in subsequent shots if fish are difficult to locate. Unless fishing success improves and lines are then hauled and reset more frequently on a particular 'patch', searching for fish may mean fewer shots using the maximum number of lines spread out to cover as much ground as possible (see setting pattern).

An increasing number of blue-eye fishers have now installed a GPS and plotter system to pinpoint previously fished spots sooner by recording the vessel's position accurately. Once a good area is located, fewer lines set more often on discrete patches of fish may improve the day's catch, even using a smaller total number of lines.

Table 8.4 The most common soak times worked by fishers by zone.

Zone	Soak time (hours)
Seamount	2-3
Coffs Harbour	2-4
Sydney	4-5
Eden	1-2.5
Everade	0.1-0.5
Freycinet	3-4
Storm Bay	2-3
Strahan	3-5
Portland	0.5-1
Beachport	3-6

Hook and line setting methods

The number of lines fished per day is also conditional to the rate at which lines can be set and hauled safely. Line haulers have been used to facilitate both line deployment and retrieval, particularly in Tasmania and South Australia. The line hauler may take the strain while clipping hooks on the mainline as it is paid out slowly. Hook setting devices have improved this rate in the past two decades, especially in New South Wales and Victoria. The most common method in these two states is still 'self-setting hooks' which are baited, attached to the mainline and hung from the gunnels until it is time to release the weight overboard, followed quickly by the hooks.

Unfortunately, this is a somewhat dangerous method with the potential for injury and tangles. These difficulties have been overcome by fishers who have adopted hook rails, split PVC tube and rubber edged boards to enclose hooks and hold them securely when not in use. Hook setting rails attached to the gunnels have always been used by most fishers in the Seamount zone.

The speed of setting the buoyline has also been improved noticeably with the use of floating buoyline baskets by some fishers in most zones during the last decade. Prior to this, the buoyline was unwound from reels or paid out from baskets on board. The vessel may be run into the current or around the target spot to hasten the process.

Without adequate care, lines were sometimes cut by the propeller as a consequence of this 'manual' buoyline setting method. Alternatively, floating buoyline baskets may be thrown

overboard after the weight and mainline have reached the bottom so that the buoyline continues to feed out automatically while the fisher moves on to the next spot. If trotlines are used or too many problems with tangles and increased drag are faced, baskets are not considered beneficial (such as in the Lincoln and Coffs Harbour zones). However, in most other situations the floating buoyline baskets assist fishing.

On grounds in the Strahan zone and off Victoria both methods of setting buoylines are now equally popular and manual setting remains the main method in the Beachport, Sydney and Seamount zones.

The most common length of time required to 'shoot' a set of droplines in each zone is:-

1-2 hours	Eden, Sydney (no floating baskets or hook rails), Freycinet, Cascade, Beachport.
1-1.5 hours	Seamount, Storm Bay, Lincoln (trotline).
30 mins-1 hour	Coffs Harbour, Sydney (with floating baskets or hook rails), Everade, Strahan, Portland.

This is significantly longer than the five minutes needed to set a single handline in the Sydney zone. Overall, most fishers take up to one or even two hours to deploy a set of droplines.

Speed of line hauling

Prior to line haulers being installed in the 1960's and early 1970's it was necessary to pull each 5line in by hand. Since line haulers became standard equipment, the problems of line tangles and 'floaters' (fish spinning off the hooks on reaching the surface and becoming easy prey for albatross and mutton birds) still restrict the speed at which line haulers operate. It takes more time to haul a line when fishing in deeper water (e.g. in the Seamount zone), if the line tangles, or if the catch rate is particularly good. The most common haul times per dropline and per set are given for each zone in Table 8.5.

Table 8.5 Haul time and haul with reset for lines and sets of lines by zone.

Zone	Haul time per line (mins)		Haul time per set (hrs)	
	Hauling only	With reset	Hauling only	With reset
Seamount	20-35	60-120		1-2
Coffs Harbour	15-30	20		
Sydney	15-30	40-45	2-3	
Eden	15-20	25-90		2
Everade	10-20	30	1-1.5	
Freycinet	10-20	35	1-3	
Storm Bay		20		
Cascade		20-35		
Strahan		10		
Portland	10-20	30-40	2-3	
Beachport	10-20	30	3-5	
Lincoln			2-5	

Spatial pattern

The spatial pattern in which lines are set varies according to a range of factors, notably the presence of topographical features such as canyons, rough reef, hard bottom or fish marks on the sounder and the strength of the current. Many fishers vary the depth among the first set of lines or spread them further than subsequent shots in order to locate the best 'patches'.

It is interesting that in the Eden, Freycinet and Storm Bay zones where blue-eye fishing has been operating for almost three decades that fishers who have a long involvement in the industry recall days when precision targeting in canyons was unnecessary. Success only required setting lines over hard bottom in the correct depth. When blue-eye schools are not well defined, or as abundance declines either through seasonal changes or local depetion, operators set their gear over a wider area. The limit to the spread of lines within a set is determined by travelling time between lines and the need to have accurate fixes on line positions (either GPS or visual) to avoid gear loss.

Overall, fishers are more likely to concentrate on discrete areas by deploying their droplines in one or more groups in repetitive sets throughout the day. At times when a productive spot has been identified and the current is favourable it may be possible to drop several lines sequentially on a spot before retrieving them down current.

Local current strength and direction may be used to advantage to target likely 'spots', possibly allowing the droplines to catch scattered fish as they pass up and over a 'wall' or across flat bottom. However, it is more usual for lines to be set so that they snag quickly in a position from where the current will lay them against the shelf, increasing the chance of blue-eye capture.

There is a risk that lines will tangle if set too close (less than 10-30 m apart). For this reason, the usual minimum average distance between lines is 36-60 m. Frequently, the minimum distance required to spread a number of droplines is 300-900 m. The maximum distance between lines or groups of lines is often 450 m-1.8 km (or a nautical mile) and less regularly 3.6-5.6 km. The maximum distance which lines may be spread over is 3.6-10.8 km although in general 4-6.5 km is sufficient. The most common average distance between lines or groups of lines is 100-270 m.

Temporal pattern

The length of trips by zone and the travelling time to grounds by zone are given in Table 8.6 and 8.7 respectively. As would be expectedthe longest trips are associated with the most distant grounds (Seamount, Cascade and Freycinet zones), a result of the greater travelling time and the larger holding capacity of the vessels working these grounds.

Table 8.6 Most common trip length and maximum trip length by zone.

Zone	Usual no. of days per trip	Maximum no. of days per trip
Seamount	1-3	14
Coffs Harbour	1-2	
Sydney	1-2	
Eden	1-2	3
Everade	2-3	
Freycinet	1-2	10
Storm Bay	1-2	5
Cascade	3	10
Strahan	5	7
King Island	3-4	7
Portland	1-2	3
Beachport	1-2	5
Lincoln	1-5	

Table 8.7 Travelling times to grounds by zone.

Zone	Travelling time (hours)								
	2	4	6	8	10	15	20	25	40
Seamount				*	*			*	*
Coffs Harbour	*	*	*						
Sydney		*	*	*					
Eden	*	*		*					
Everade			*	*		*			
Freycinet	*		*						*
Storm Bay				*					
Cascade							*		
Strahan								*	
King Island					*	*	*		
Beachport			*		*				

Fishers generally commence operations before or at first daylight. In the last ten years a pre-dawn start has become more common in order to claim a 'spot'. In some instances it was possible to start fishing at any time of day with success in the 1970's, before competition on the grounds became a problem.

In the Seamount zone, fishers may continue working till midnight. However, in all zones it is usual to pull the last lines around dusk, or as fish stop biting either at dusk or by mid-afternoon. In contrast, a large proportion of fishers from the Coffs Harbour and Sydney zones finish by noon rather than at dusk. The usual number of hours worked per day on blue-eye grounds is between 12 and 16 hours.

Some operators work after dark, particularly in the Seamount zone, but more often fishers have not been able to catch blue-eye at night. Where there has been success, night fishing may be preferred because of the freedom from competition on the grounds.

The maximum continuous fishing period (36 hours) is recorded in the Seamount zone, while no more than ten hours may be possible in the Strahan zone. However, the usual maximum is 20 to 24 hours at a stretch. The number of lines used and the maximum distance gear is spread over is likely to be less at night than during daylight hours.

Generally, the lunar cycle in conjunction with tidal and current effects are considered important factors which affect the correct timing of blue-eye fishing. Unfortunately, no consistent pattern was described. At various times blue-eye schools have been fished in shallower depths and on top of pinnacles around full moon, new moon or the dark of the moon. In a few cases, the turn of the tide was also noted as the optimal period for blue-eye fishing.

A tidal phenomenon known as 'dodge tide' occurs about twice a month in South Australian waters. Slack water for 12 to 18 hours allows successful blue-eye fishing to continue throughout the period. In the Beachport zone the worst fishing weather is experienced from midwinter to early spring. Currents are often too strong for blue-eye fishing during late spring or early summer in the Portland zone.

The direction and temperature of seasonal offshore currents on the east coast of Australia are critical to successful blue-eye fishing. The cold south current in winter apparently favours blue-eye aggregation and condition factor while fish become more dispersed during summer when warmer north currents move down the coast. The fishing conditions may be more favourable in the Eden zone than in the Coffs Harbour zone in autumn and winter.

8.8 ENVIRONMENTAL AND OTHER FACTORS

The number of lines set is influenced by various factors such as the prevailing current strength, weather conditions, time of the day, the number of other boats in the vicinity, as well as previous catch rate. The number of lines is also restricted by the availability of suitable bottom in the preferred depths (e.g. the northern Seamount zone).

Current strength is a major factor which limits both the number and soak time of droplines that may be used in a day's fishing without loss of gear. Lines in situ require some current to set up a burley trail, although too much current will either drag droplines under or cause the boat to drift off the spot when handlining. At worst the current may be reversed at some depth below the surface resulting in the lines moving in the opposite direction to the fisher's boat.

Weather and current conditions

At times, gear loss or problems due to current, prevent blue-eye fishing and effort is weather dependant, particularly in the Seamount and Cascade zone. Over time operators learn to adjust line materials and gear deployment to overcome potential problems due to current. Some fishers, using either handlines or droplines will check the current and whether fish are biting by

closely observing the first line or set of lines before continuing or moving on to a new location. This may be particularly necessary if lines are set close to dusk prior to continuing to fish after dark.

Conflict with other vessels on the grounds

In the Seamount zone, problems have been caused by the activities of foreign vessels- particularly from Japan and New Zealand- for at least 40% of interviewed Seamount zone fishers. A decline in blue-eye catch rates on the Gascoyne Seamount has been blamed on the uncontrolled and largely unknown level of harvesting of blue-eye and other species by overseas trawlers and longline vessels. However, any decline in the availability of blue-eye on the other seamounts is more likely to be as a result of New South Wales and Queensland dropliners or environmental factors.

Conflict for space on dropline grounds had been experienced, particularly in winter, by 25-30% of fishers working in the Sydney, Storm Bay (during the early 1980's) and Portland zones. Another 7-15% of operators in the Eden, Coffs Harbour and Freycinet zones had similar problems. During the 1980's, some Eden zone fishers were willing to work in more difficult weather conditions than previously as the number of fishers and competition on the grounds increased.

Additional sources of conflict were tuna longlines in the Eden zone, shark nets and freighters in the Beachport zone, and the Lakes Entrance meshnet vessel working in the Eden, Everade, Freycinet and Storm Bay zones during the 1970's.

CHAPTER 9

Marketing

9.1 CATCH PREPARATION FOR MARKET

The bulk of dropline caught blue-eye is sold on the fresh fish market, either whole, headed and gutted, gilled and gutted or gutted only. A small proportion is processed as frozen fillets. Catches are often stored either on deck in boxes or bulk ice chests, or below deck in a fish hold. Freshly caught blue-eye may be bled, gutted, gilled or headed prior to storage or upon arrival in port.

In the Storm Bay, Strahan, Cascade, Everade and Eden zones blue-eye are mainly stored onboard on ice or in refrigerated seawater (RSW). Most boats in the Portland, Beachport, Freycinet and Coffs Harbour zones have an ice-room which they use to maintain the catch quality. In the Sydney zone it is possible that washed fish are left in covered bins on deck during winter and only iced in summer. The Seamount and Lincoln zone fishers often cool blue-eye immediately in an ice slurry before storage on ice.

9.2 EARLY HISTORY OF MARKETING - THE 1960's AND 1970's

In the 1960's, the sale of blue-eye (known as bream trevally) from survey work off Tasmania was received favourably and the local buyers accepted occasional blue-eye on the quality fresh fish market. However, the commercial fishers who subsequently caught the first large quantities of blue-eye on lines still had to work hard overcoming marketing difficulties. Blue-eye was even air freighted to the Melbourne Fish Market in the early 1970's and the Hobart Fish Market was only established later in the decade. The 'Hobart Fish Market' is a loose term which refers here to the main Hobart retailers and the fish punts on Constitution Dock. Unlike New South Wales and Victoria, Tasmania has never had a central fish marketing authority and regional processors continue to be important.

During the 1970's the main regional fish processors on the east coast of Tasmania were SAFCOL, Blue Waters, Dover Fisheries, Boxall, and others in northern centres such as Stanley, Devonport and Flinders Island. In 1972 the price paid for blue-eye in Tasmania was steady but still relatively poor. By 1976 the price showed some improvement which was maintained through to the early 1980's as blue-eye became established as a top quality restaurant fish (Figure 9.1).

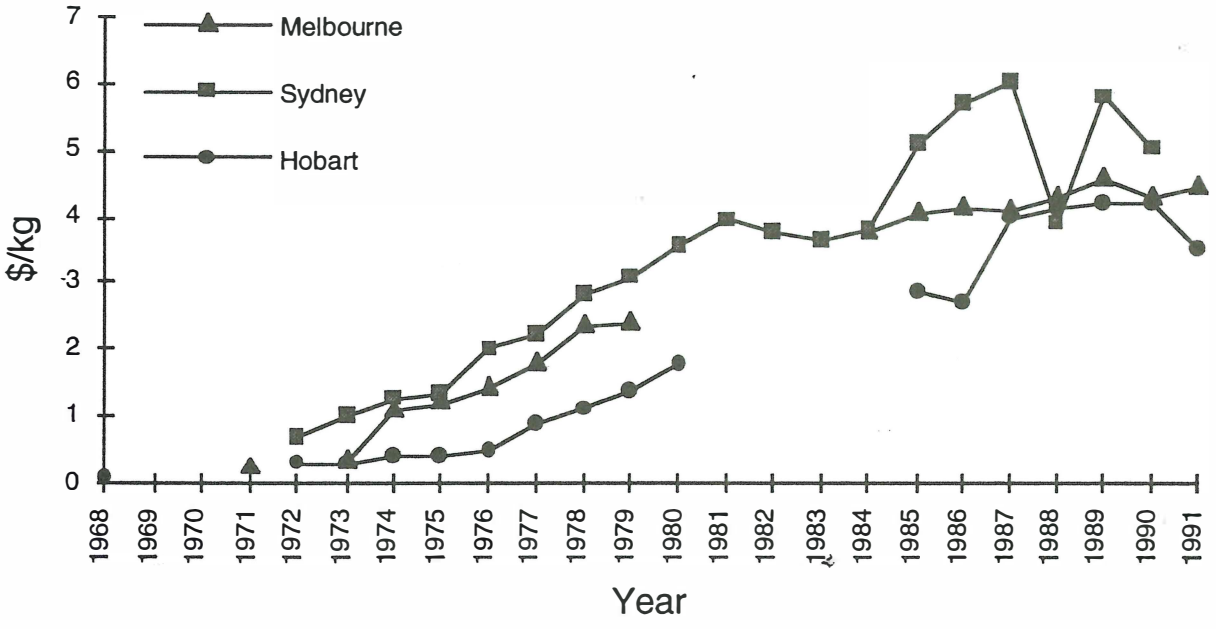

Figure 9.1 Annual averages of price paid (as $/kg) at each market

Markets were also slow to develop in Victoria and South Australia. The lack of a local market for ports distant from metropolitan centres discouraged expansion of the fishery. Initially, blue-eye was virtually unsaleable. The spur dogfish (*Squalus megalops*) dropline by-catch (which was later to become prized) was considered uneconomic to harvest in the 1960's because of the small body size. Heavy metal levels still prohibit the sale of this and some other shark species in Victoria.

However, the Melbourne Fish Market very quickly came to hold its place as the primary market for Eden zone fishers, particularly from the ports of Eden and Bermagui (Table 9.1). In the early days, the market for blue-eye was limited to approximately two days per week. If more than 15-20 boxes were consigned to the Melbourne Fish Market in a day the price could be expected to fall.

Table 9.1 The tonnage of blue-eye consigned to the Sydney and Melbourne Fish Markets from the Eden zone. Data from the Bermagui Co-op, Melboune Fish Market and records. Form of blue-eye (whole/gutted) not specified. Dates according to the Sydney Fish Market financial year (Oct-Sept).

Year	Quantity (tonnes) consigned to- Sydney Fish Market	Melbourne Fish Market
74/75	-	1.1
75/76	3.2	26.6
76/77	28.1	35.7
77/78	19.3	41.9
78/79	21.3	37.4
79/80	1.8	11.3
80/81	2.3	11.8
81/82	5.3	11.3
82/83	0.7	8.0
83/84	0.8	13.1
84/85	0.2	19.9
85/86	0.2	3.5
86/87	3.6	8.2
87/88	4.9	17.6
88/89	3.5	11.8
89/90	3.1	13.5
90/91†	1.9	1.8

† data incomplete.

On the Sydney Fish Market, blue-eye was known as stony-eye bass or deep sea blue bass and sometimes confused with blue warehou (*Seriolella brama*) in the 1960's. Initially the price offered for blue-eye at Sydney Fish Market was unacceptably low for some operators.

The New South Wales State Fisheries became interested in promoting the fishery and it was decided not to use 'deep-sea trevalla' as the marketing name for *Hyperoglyphe antarctica* because of the similarity to trevally, regarded as an inferior quality fish. The term blue-eye was coined in New South Wales and adopted as an appropriate name for the species with a positive sales pitch (Gorman 1967a).

9.3 CURRENT OVERVIEW OF AUSTRALIAN BLUE-EYE MARKETS

Comparative prices for blue-eye on the Sydney, Melbourne and 'Hobart' markets from the late 1960's to the present are given in Figure 9.1. The real value (CPI adjusted) for prices from the early 1980's to the present are given in Figure 9.2. It is apparent from the latter figure that prices on each of the markets are converging from the large differentials seen in the 1980's. It is also apparent that the price of blue-eye has been stable (if not decreasing slightly) in real terms over this period.

Blue eye trevalla is now established as a quality product for which people should expect to pay a reasonable price. Since the early 1980's blue-eye has been recognised as comparable with other quality fish species such as John dory, ling, snapper and sea-run trout. However, since the mid 1980's, fish prices in general have been depressed by the influence of the readily marketable orange roughy on buyers' perceptions as well as the impact of the recession on the

Australian economy. To some degree, less abundant and higher priced fish such as blue-eye have been disadvantaged as a result.

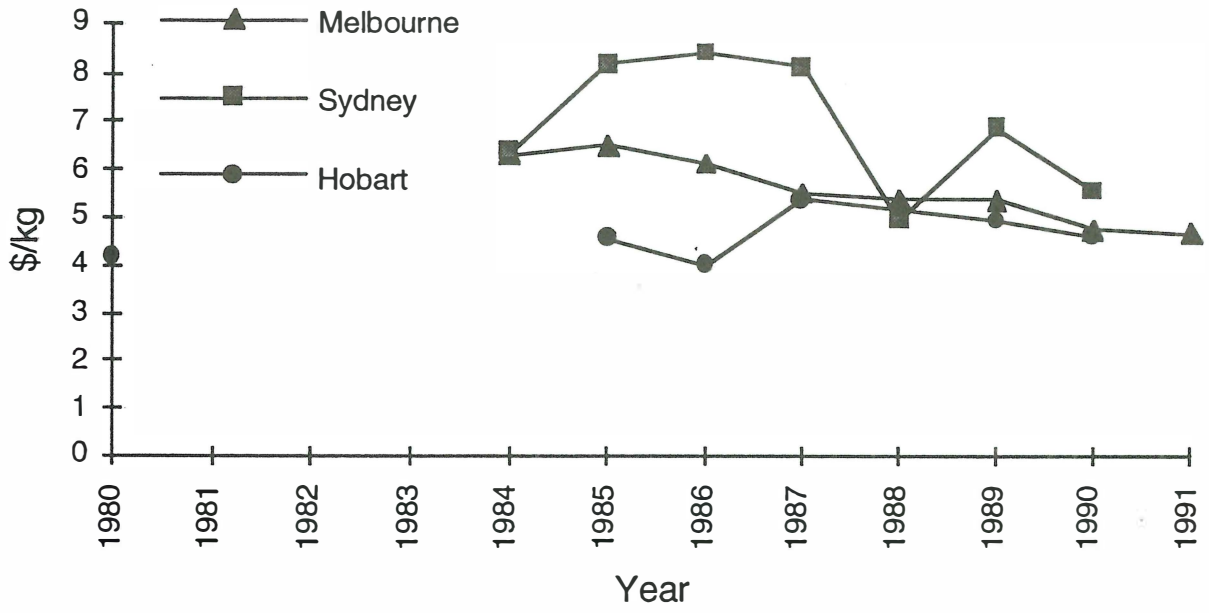

Figure 9.2 Annual average price paid adjusted for changes in the CPI.

The markets are able to handle more blue-eye over late spring and summer with the increased demand for seafood in restaurants over the holiday period. However, as the rock lobster season and tuna seasons have only recently opened in November-December there may be commensurably less interest in droplining than during at least some part of autumn-winter-early spring when fishers from all ports are most often occupied with blue-eye fishing. As a result, despite some increased demand for fish over Easter, there may also be an over-supply of blue-eye on the market at this time because the more stable weather conditions during autumn are particularly favourable to blue-eye fishing.

Dissatisfaction with prices on the market floor due to the presence of blue-eye from too many other dropliners or from trawlers was voiced by fishers from the Coffs Harbour, Sydney, Eden, Freycinet and Portland zones. Any increase in the number of blue-eye fishers in the future is expected to degrade the price received in the markets.

Fishers from the Beachport zone saw no advantage in selling fish to the Adelaide market and quickly sought interstate outlets to receive a satisfactory price. However, New South Wales

operators were unimpressed with the quantity of blue-eye sold in Sydney Fish Market from South Australia. The presence of New Zealand caught trawled fish was a further concern.

There is no dominant market for blue-eye in Australia. However both Sydney Fish Market and Melbourne Fish Market cater for blue-eye sales as well as the conglomerate Hobart fishmarket which includes the Constitution Dock fish punts, Stingrays (Bernies Fish Shop), Abate Bros and Mures. SAFCOL stopped buying blue-eye in 1990. Petuna Seafoods still takes trawl and line caught blue-eye. Other buyers in Tasmania involve private sales, local shops, restaurants, hotels and regional processors.

In Victoria, processors such as Trident and Select Seafoods, Victorian and Flinders Island Co-ops or fish agents are avenues for blue-eye sales outside the Melbourne Fish Market. New South Wales fishers may also utilise Victorian wholesalers as well as the local regional Co-ops in addition to the Melbourne Fish Market or Sydney Fish Market.

9.4 BLUE-EYE SALES IN TASMANIA SINCE 1980

Although it may have taken ten years to educate the public about the merits of blue-eye (or deep-sea trevalla as it is known in Tasmania) the local consumer response since the late 70's has encouraged the continued growth of Tasmanian blue-eye fishing. As a result, the majority of catches are now marketed within the State.

Peak demand in Tasmania were experienced during the early to mid 1980's, associated with catches from the Thirty Mile Patch in the Storm Bay zone and the Cascade Plateau. During this decade, some fishers claim there were noticeable fluctuations in the average price received for blue-eye. However, others explain that the demand was also increasing and it was not too difficult to sell blue-eye on the Hobart Fish Market. Nevertheless, over the same period the number of blue-eye fishers was also increasing, keeping apace with demand.

9.5 MELBOURNE FISH MARKET AND BLUE-EYE SALES SINCE 1980

Line caught blue-eye has been sold at Melbourne Fish Market from all four south-eastern States for the past 20 years, traditionally as whole fish. Over the summer months (November-February) the majority of fish marketed in Melbourne come from Victorian ports as well as from Eden, Bermagui and Beachport . A small amount also originates from Tasmania. The supply continues through winter but the main interstate ports are further up the east coast, as far north as Coffs Harbour.

A reliable supply of blue-eye from the Beachport and Portland zones was made possible by the provision of regular truck transport to the Melbourne metropolitan centre since 1986. Blue-eye landed in Port Lincoln are freighted either whole to Melbourne Fish Market or headed and gutted to Sydney Fish Market. The travel time to each market is 24 and 48 hours respectively

and the costs have been fixed since 1989 at approx. $1.00/ kg. The majority of blue-eye (and hapuka, blue grenadier) from Port Lincoln is sent to Sydney Fish Market where prices are traditionally higher, albeit less stable than Melbourne Fish Market.

In contrast, a number of Eden fishers have always preferred to supply Melbourne Fish Market rather than the Sydney Fish Market because of the convenience of selling whole fish and the reliable price structure. However, prices may decline if more than 100 boxes of blue-eye is sent to Melbourne Fish Market in a day.

9.6 SYDNEY FISH MARKET AND BLUE-EYE SALES SINCE 1980

According to fisher interviews, the Sydney Fish Market may or may not 'reward' fish quality and freshness with higher prices for line caught blue-eye from the shelf than for larger quantities of blue-eye from the Seamount zone which may be about 5 days old. A $5/kg nett price for blue-eye was cited in 1991 as necessary to make blue-eye fishing worthwhile after paying for fuel, ice, bait, crew and market commission. Sydney Fish Market may take up to 300 boxes of blue-eye before the price drops to an unacceptable level ($2-3.00/kg). The Sydney Fish Market price is thus often more influenced by the quantity available than by the quality of individual suppliers' product .

The market is usually 'flooded' when large catches are landed from the Seamount or Lincoln zones. At these times, it may be a better arrangement for Seamount zone fishers to sell directly to interstate buyers for a negotiated price. The security of a set price has been recommended by other fishers who normally sell independently through a Co-op. However, the fluctuations in Sydney Fish Market pricing system still offers the incentive in the chance to earn much higher prices at peak times.

Summer prices for blue-eye previously tended to improve because blue-eye was scarcer and tuna fishers were usually occupied. Since the development of fishing in the Seamount zone this has changed, and any seasonal improvement in price is not necessarily expected. Sometimes a higher price was also paid for the larger fish landed in March-June during breeding season.

The auction system appears to breakdown at times of oversupply when it was suggested that a minimum floor price would be beneficial. However, a minimum floor may give less incentive to maintain quality. Both quality and price control are necessary to provide a fair deal for suppliers and buyers. The Sydney Fish Market is now best for big fish because of the expectation that most fish will be headed and gutted.

Blue-eye heads have been sold in the Sydney Fish Market since the 1970's although the demand was limited until the mid 1980's. The fishers from distant Coffs Harbour zone ports found it impractical to send heads to Sydney Fish Market before the late 1980's. Prior to this, fish were still headed and gutted, though the heads were discarded or sold locally for rock

lobster bait. Ironically, permission was sought to head fish that were otherwise too bulky for a single fish box to accommodate. Only a small quantity of blue-eye roe has been marketed in Sydney Fish Market.

The market for droplining by-catch species such as endeavour dogfish liver and carcass, hapuka and bass groper are still improving and may act as important alternatives when blue-eye is less available or prices are poor. The other species, such as bass groper, may fetch a higher price than blue-eye .

As a footnote, blue-eye is called 'red cod' in retail shops in Queensland where it is not yet a well recognised species.

9.7 OVERSEAS MARKETS FOR BLUE-EYE

Market for blue-eye in Japan

A number of individuals were interested to export fish to Japan or Korea in the 1980's from New South Wales, South Australia, Tasmania and eastern Victoria. In most cases, the necessary risks to establish the market, however potentially favourable, have not been accepted by either the suppliers or the buyers. An initial attempt to export blue-eye fillets to the United States of America (USA) and Europe also proved unsuccessful, partly because the recovery rate was too low (approx. 42-45%).

Only a couple of large operators have found it possible to compete on the overseas market, mainly sending sashimi grade blue-eye to Japan though some whole fish may be sent to the USA in the future. It was suggested that demand in the USA for skinned blue-eye fillets will increase. However, larger quantities of fish would be required to cater for this market than the domestic fresh fish market. For example, 50 tonnes of whole blue-eye would only produce around 22 tonnes of skinless, boneless fillets.

Obstacles to the Japanese market include the demand for a select size range of 4-6 kg fish. Blast freezing might be necessary to offer a sashimi quality product. Alternatively fresh, chilled blue-eye could be air-freighted directly to Japan as a riskier and more expensive option. Even if catches were sold collectively from a port to supply a consistent and reasonable quantity of blue-eye, changes in fishing operations might still be required to cater for an export market given the traditional seasonality of fishing activity and the fluctuations in blue-eye availability over a 12 month period. The incentive to launch such a scheme did not apparently exist at the time of enquiry for this report. A particular disincentive for most Seamount zone fishers to export blue-eye is that the current peak season in Australia (October-March) coincides with the best time for landing a related species in Japan.

However, the option to export sashimi blue-eye was discussed by both dropline and trawl operators as both sectors envisaged that the quantity and quality of the fish they produce is appropriate for this Japanese market. The export market was suggested as a means to reduce competition on the domestic market between line fishers and/or line and trawl sectors. In contrast, as an alternative to pursuing any export market, if cheap blue-eye was no longer imported from New Zealand, Australian consumers might be fully supplied with locally caught fish. Although 25% of gross earnings is lost on expenses to export to Japan it still provides a better option than selling on the domestic market for a limited number of Seamount zone fishers. In 1991 the average price for Australian blue-eye sold to Japan was $10.50 (max $19.00).

Blue-eye imports from New Zealand

The Sydney Fish Market and other Sydney buyers has been importing blue-eye from New Zealand for at least 20 years. Fish processors and agents also import the New Zealand product into Tasmania and Victoria. Generally, the product is supplied as headed and winged (pectorals removed), whole fish, chilled or frozen fillets.

Available records of New Zealand exports show a combined total 177 tonnes live weight of blue-eye, blue grenadier and hapuka was exported to Australia in 1987. Imports of blue-eye from New Zealand in 1988 and January to August 1990 totalled 47 and 81 tonnes live weight respectively. Conversion rates were taken from the South East Trawl (Individual Transferable Quota) Management Plan 1991. Some increase in import levels of blue-eye is apparent.

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