A Review of the Past and Present Management of Gill Netting in Tasmania with Particular Reference to the Bastard Trumpeter, *Latridopsis forsteri*.

by

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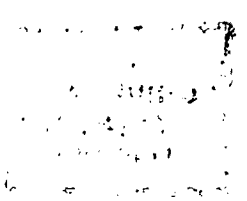

This thesis contains no material which has been accepted for the award of any other degree or diploma in any other university, and to the best of my knowledge contains no copy or paraphrase of material previously published or written by another person, except when due reference is made in the text.

David Harries,
University of Tasmania,
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To all those little bastards

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ABSTRACT

Regulatory development of the inshore fishery in Tasmania is documented and compared with that of mainland Australian States, and the appropriateness of Tasmania's past and present management of the fishery is examined using information on one fish in particular, the bastard trumpeter (Latridopsis forsteri).

Tasmania, with Western Australia, has lagged behind the other Australian States in meaningful regulation of inshore netting. The need for regulation first became apparent in Tasmania in the late 1870s and early 1880s, and limited control measures (minimum net mesh sizes and minimum fish sizes) were introduced in the 1880s and 1890s, primarily to protect juvenile stocks. The regulations have changed little since that time. Prior to 1925, the sea fishery was administered jointly with the more prominent inland fishery, and its management suffered accordingly. A separate sea fisheries authority was established in 1925, but its main responsibility was licensing and enforcement, and it was not until the mid 1970s that it gained true independence and the resources necessary for the development of sound management strategies. In the meantime, the inshore scale fishery of Tasmania had been eclipsed by the deep-sea, crayfish, and abalone fisheries.

Anecdotal accounts in the early literature indicate that a decline in the inshore scale fishery in Tasmania in the late 1870s and early 1880s was associated with depletion of localised fishing grounds. Historical records reveal that another significant decline in the catch of bastard trumpeter occurred between 1910 and 1918. From 1930 to 1939, the catch fluctuated considerably, probably being maintained by more intensive fishing of the inshore waters. Since 1944/45 there has been a general and continuing decline in the catch. Present day commercial catches of bastard trumpeter are taken mainly in summer in the eastern and south eastern coastal waters of the State. They are rarely above 150 kg and usually below 50 kg. Non-commercial gill

netting (by amateurs and crayfishermen seeking bait) appears to have increased markedly since the 1960s, and probably takes as many fish as commercial netting.

Declines in the commercial catch of bastard trumpeter are related to gill netting effort, past and present regulation of gill netting, and the biology of this species. Changes to the present netting regulations in Tasmania are recommended in this light.

CONTENTS

CHAPTER ONE

INTRODUCTION

A gill net is a curtain of mesh material, weighted at the bottom and attached to floats at the top, set in a straight line or a curve to entangle or snare fish which swim into it. These nets, known colloquially as "graballs", were introduced into Tasmania soon after European settlement in 1803 and gill netting remained as the predominant method by which scale fish were taken in Tasmanian waters for over a century. Although they are still in common use, little has been written on the subject of inshore gill netting in Tasmania.

It has been admitted by fisheries managers in recent years that levels of inshore gill netting may, in some areas, be higher than desirable, but that without accurate information it is difficult to mount an effective argument for constraint (Harrison 1982). A netting survey in the Derwent estuary (Dix 1974) has been the only published study on gill netting undertaken by fisheries authorities in Tasmania to date.

Information on the biology of inshore scale fishes captured by the gill net is also scant, though Walker (1972a, 1972b) studied the biology of one inshore species, the southern rock cod (Pseudophycis barbatus), Last (1975) investigated the taxonomy and ecology of Tasmanian leatherjackets (Family Monacanthidae), and Last (1983) also conducted a study of the ecology and zoogeography of Tasmanian

estuaries. Almost no research has been conducted on the biology of the many other inshore scale fishes of Tasmania and the general observations on these fishes noted by Johnston late last century remain, in most cases, the only recorded information on them (Johnston 1882, 1890). Without biological knowledge of the species concerned, it is difficult to determine the impact that gill netting has had, and is having, on the inshore fishery of Tasmania.

The bastard trumpeter (Latridopsis forsteri) is of particular interest in any study of gill netting in Tasmanian inshore waters as this fish is reputed to be the primary target of Tasmanian non-commercial gill netters (Edgar et al. 1982) and is the commercial species most frequently recorded as captured (although not in the greatest quantities) in the nets of commercial fishermen (Tasmania, Parliament 1982). This fish is reported to take bait only rarely and is landed almost exclusively with the gill net (Johnston 1882; Last et al. 1983). A study of the bastard trumpeter, therefore, could have important implications for Tasmania's inshore fishery management.

This thesis, then, has two broad aims. The first is to examine the literature on past and present inshore netting in Tasmania in order to establish the way in which the management of the inshore scale fishery has developed to date. The second is to uncover information relating to the past and present catch of one inshore fish species, the bastard trumpeter, to discuss its biology and to investigate whether inshore fisheries management has been appropriate with respect to this species.

Finally, it is appropriate here to discuss the nomenclature pertaining to fishing nets. In Tasmania, the term "gill net" is a general one used to describe any mesh net set on the bottom. Two types of gill nets are in use, the "graball" and the "mullet net", the latter having a smaller mesh size. Because the former is more commonly used (Dix 1974), the term "gill net" is frequently used interchangeably with "graball". Elsewhere in Australia, gill nets have various other names. In Victoria, for instance, nets used in this way are called "mesh nets", and the term gill net is used only when referring to nets used in inland waters. In other States, gill nets are often called "sunk nets" or "set nets". The term gill net is also used throughout Australia to describe the large mesh nets used in deeper waters to capture, mainly, shark. In this study, unless otherwise stated, gill nets are taken to be inshore mesh nets.

CHAPTER TWO

PAST MANAGEMENT OF THE INSHORE SCALE FISHERY IN TASMANIA

2.1 Introduction

The adage that your sins eventually catch up and overtake you has application to the management of fisheries or any other renewable resource. The style and appropriateness of yesterday's management system leaves its indelible imprint on the fisheries of today. A review of the way in which Tasmania's inshore scale fishery has been managed to date, and the means by which regulatory control of this fishery has been determined provide the background for discussion of present management of this fishery with particular reference to bastard trumpeter.

The historical regulation of gill nets is of particular interest and is the prime focus of the following section. However, regulatory evolution is largely a function of administrative development and a review of the administration of Tasmania's sea fisheries is incorporated into the following historical survey. Historical information on the inshore scale fisheries of Tasmania is scant: the main sources of information used in the following analysis are the Parliamentary Journals, the Hobart Town Gazette and the Tasmanian Government Gazette.

2.2 Past Management of Tasmania's Inshore Scale Fishery.

In the first half of the nineteenth century whaling and sealing constituted the most significant fishing industries in Tasmania (Tasmania, Parliament 1984). Oyster dredging began in the late 1850s and soon became a lucrative industry. In 1861 Tasmania became the first country in the Southern Hemisphere to succeed in establishing breeding stocks of exotic freshwater salmon and trout, and an authority, the "Salmon Commissioners", was set up in 1867 to administer this new fishery. Over the next three and a half decades, numerous Acts were passed to protect salmon and trout stocks and further encourage development of the inland fishery, and by 1895, the inland fisheries had become self-financing.

While legislation was introduced in 1868 to protect oysters from overfishing, the sea fisheries of the colony, in general, attracted little attention from the authorities prior to the 1880s. An Act (34^{O}VICT.No.24) enacted by Parliament in 1870, prohibiting the sale or purchase of flounder under a length of nine inches, was the only legislation passed in Tasmania prior to 1884 which related to the protection of the colony's inshore scale fisheries.

Concern over apparent declines in the abundance of a number of Tasmania's commercially important marine fish species surfaced in the late 1870s. Kingfish (Rexea solandri), the principal fish exported from Tasmania at the time, were sometimes caught in such vast numbers

that they were "sold in great quantities for manure" (Tasmania, Parliament 1882, p.viii). However, the catch of kingfish was subject to considerable fluctuation and the number of this fish exported from Tasmania fell dramatically between 1875 and 1881.

Another important commercial fish, the striped trumpeter (Latris lineata), considered to be the best eating fish from Tasmanian waters, had become relatively scarce by the 1880s. The decline in the populations of this species was generally ascribed to "overfishing" (Tasmania, Parliament 1884).

Bastard trumpeter (Latridopsis forsteri) was, by the 1880s, another commercially important species for which catches appeared to be declining due to overfishing. Some colonists considered the extent of gill netting to be the main cause of the decline; some blamed other fishing techniques, particularly beach seining (Johnston 1882).

A Royal Commission was established in 1882 to investigate claims that fish catches were declining and to determine whether any of Tasmania's fishes were in need of protection. Bastard trumpeter ("silver trumpeter" or "silver bellies") were identified as the fish most frequently caught in gill nets set in the kelp beds of the east coast, and a general comment was made that greed rather than sense prevailed amongst fishermen and that this greed would "play the devil with the silver bellies and make them scarce" (Tasmania, Parliament 1882, p.82). Others argued that with the oceans so vast it was ridiculous to "talk of their destroying all the fish in the sea". One witness

commented that

> **I do believe that if all the inhabitants of the island tried to kill all the fish, they could not begin to do it.**

Those who rejected the notion that overfishing with the gill net was the cause of the decline in the catch of bastard trumpeter and other fish species argued vehemently that the culprit behind the decline was the beach seine net. Fishermen fed these nets, sometimes called "hauling nets", over the stern of a small boat as it moved in a semicircular path, starting and finishing at the shore. It was then pulled onto the shore by hand. Loads of fish drawn up onto beaches in these nets were sorted on the sand. Any fish too small for sale were left stranded on the beach.

The Royal Commission accepted that juvenile stocks were not adequately protected, and that beach seining, as practised, was a "barbarous" method of fishing and the most likely cause of observed declines in fish catches over the preceding years. The Commissioners recommended that fisheries legislation based on that already in force in New South Wales and Victoria be introduced in Tasmania. In particular, they recommended that New South Wales and Victorian regulations applying to the use of the beach seine net be adopted by Tasmania (see Sections 3.2 & 3.3), that the practice of setting minimum size limits for some species in order to protect juvenile fish also be adopted, and that power be vested in the Governor to declare exhausted fishing grounds closed to fishing to allow fish stocks in such areas to recover. The

report of the Royal Commission strongly recommended that the administration of the sea fisheries and the inland fisheries be vested in one board working under the Governor-in-Council and that a "skilled" Inspector of Fisheries be appointed.

The Tasmanian Government responded in part to the Royal Commission's recommendations by introducing the Fisheries Inspection Act of 1884 (48^{O}VICT.No.23) which empowered the Governor-in-Council to appoint a Superintendent and Inspector of Fisheries. The Act also introduced regulations to control the fishing of southen rock lobster (Jasus novaehollandiae), commonly called "crayfish", and silver bream (Acanthopagrus butcheri) by setting seasons and size limits for these species. Although the remainder of the Royal Commission's recommendations were not adopted at this time, provisions to further regulate fishing were incorporated into the Act.

W. Saville-Kent was engaged as the Superintendent and Inspector of Fisheries. Conflict between the Salmon Commissioners and Saville-Kent led to his resignation in 1887 three years later (Tasmania, Parliament 1888-1889a). This could account for the fact that no additional regulations pertaining to fisheries were gazetted in Tasmania between 1884 and 1889 despite the fact that many of the recommendations made by the 1882 Royal Commission had not been acted upon. Following the resignation of Saville-Kent as Superintendent and Inspector of Fisheries, the Salmon Commissioners were replaced by a Fisheries Board of twenty three honorary Fisheries Commissioners. This Board took over the responsibility of both the inland and sea fisheries, with the

exception of the oyster fishery which was left as the responsibility of the Inspector of Fisheries , Saville-Kent, who was retained on a part-time basis and spent only two months of each year in Tasmania carrying out this official duty.

Arguments between amateur and professional net fishermen, and between amateur anglers and gill netters led, in 1888, to an official inquiry into netting in the Derwent River. The report of the Fisheries Board of Inquiry (Tasmania, Parliament 1888-1889b) recommended that the mesh of nets be restricted to a minimum of one and three quarter inches from knot to knot and that beach seining and gill netting be prohibited in parts of the Derwent estuary. Rather than rely solely on the often conflicting claims made by fishermen, the Board of Inquiry called on Sir Thomas Brady of the Irish Fisheries Department (who, it would appear, happened to be in Tasmania at the time) to assist, and asked of this gentleman a series of questions on the need for and type of regulation required. Sir Thomas not only returned written replies to all of the Board's questions, but took the liberty of submitting Reports on the fisheries of Tasmania to both the Fisheries Board (Tasmania, Parliament 1888-1889b) and Parliament (Tasmania, Parliament 1888-1889c). Furthermore, he presented the Fisheries Board with the draft of a Fisheries Bill which was quickly placed before the legislature.

Describing the sea fisheries of Tasmania, in his Report submitted to the Fisheries Board, as "primitive" and "desultory", Brady considered that they were not worked with energy and that in order to effect

improvement, the "old fashioned and most injurious" nets should give way to more modern fishing techniques. He saw most Tasmanian sea fishermen as marine Luddites positively opposed to the introduction of more efficient fishing techniques. His report concluded with a warning to Parliament that the fisheries of the colony would not develop without "judicious expenditure of money" and that such moneys should be met by the public, rather than "wait for that which seldom, if ever, occurs - the employment of private enterprise"

In answer to specific questions asked by the Board of Inquiry, Brady suggested that all nets, those of both amateur and professional fishermen, should be registered and licensed. On the question of the regulation of the use of nets, he suggested that the mesh of nets be limited to a minimum of one and three quarter inches "in places where molts congregate", but dismissed the notion of specific regulation of netting in the spawning grounds of sea fishes as the location of these were not likely to be known. Brady was of the opinion that it would be impractical to expect fishermen to sort the catch from seine nets while still in the water and advised against introducing such regulations. He suggested instead the regulation of mesh sizes of seine nets, thereby ensuring that "little mischief would be done". With respect to regulation of the graball, he answered simply that "in some places the use of the graball would be injurious, while in others it might not be so".

The Fisheries Bill which Sir Thomas Brady presented to the Fisheries Board was submitted to Parliament in 1888 and became Tasmania's first

Fisheries Act (53°VICT.No.11) in the following year. The Fisheries Regulations of 1890 incorporated many of Brady's suggestions as well as those made by the Royal Commission of 1882. Minimum sizes at which fish could be taken were introduced for a small number of species, and in the case of bastard trumpeter this minimum length was set at twelve inches. How these minimum lengths were determined is uncertain, although it is probable that advice was sought from members of the Royal Society of Tasmania, particularly R.M. Johnston, who had studied many of the colony's fishes in some detail (Johnston 1882, 1890). Mesh sizes of nets were regulated, a minimum mesh size of two and a quarter inches for graballs (gill nets) being enforced. No restrictions on the lengths of nets were imposed until 1893 when a new regulation limited the length of graballs used in Tasmanian coastal waters to 80 fathoms (240 yards) and a depth of fifteen feet. Restrictions on the lengths of graballs were rescinded when the Fisheries Regulations of 1905 were gazetted.

Administration and management of the sea fisheries in Tasmania were severely criticised in the Report of a Select Committee into the Deep-Sea Fisheries of Tasmania (Tasmania, Parliament 1913). It was unreasonable, the Committee argued, to expect honorary Fisheries Commissioners, most of whom were appointed on the basis of their interest in freshwater angling and who had no connection with fishing on a commercial basis, to have the skills necessary to manage properly the sea fisheries of the State. Furthermore, lack of funds had "severely handicapped" any work on management and development in this area. The Select Committee Report strongly recommended that a new

Government Department be set up to administer the sea fisheries "as were established in the other States".

Declining fish catches and escalating fish prices forced the Government to establish a second Royal Commission on Tasmania's Fisheries (Tasmania, Parliament 1916-1917). A major recommendation made by the Royal Commissioner, Professor T. T. Flynn, was the establishment of a separate sea fisheries Department under the charge of a Chief Inspector.

Although conceding that "sea fisheries is not an easy subject to handle" and "more important than is generally understood" (Tasmania, Parliament 1920-1921, p.8), the Fisheries Commissioners defended their role in managing the resource, claiming that they had "always been ready and willing to assist its development by framing regulations for its protection" while hesitating "to indulge in expenditure unless assured that reasonably good results would accrue". Continued criticism of the Fisheries Commissioners and management of the sea fisheries finally led to the introduction of the Fisheries Act of 1925, which separated the administration of inland and sea fisheries in Tasmania. A Sea Fisheries Board, consisting of five appointees and chaired by the Commissioner of Police (ex officio), was set up to administer the latter. A major change introduced by the passing of this Act related to the regulation of commercial fishing vessels. Although the Fisheries Act of 1889 had introduced compulsory licensing of fishing boats, the Fisheries Commissioners were never given the authority to enforce payment of licence fees. This anomaly was

resolved with the creation of the Sea Fisheries Board.

The Government immediately came under attack for failing to give representation to the Royal Society of Tasmania on this new Board. In a letter to the Attorney General, the chairman of the Royal Society, Mr L. Rodway, berated the Government on this point, arguing that without such representation the Board would not have the scientific and general knowledge of Tasmanian fisheries necessary for proper management and made the comment that

In most countries in the world today, there is a great awakening as regards the application of science to industry

(Tasmania, Attorney General's Department 1928).

The charter of the Sea Fisheries Board was broadly, in the words of the Board, "to prohibit the doing of things tending to be detrimental to the sea fishing industry" (Tasmania, Sea Fisheries Board 1930, p.4). Apart from the further closure of certain bays and estuaries to netting (in almost all cases for the protection of trout stocks), the only change with respect of gill netting introduced by the Fisheries Regulations of 1926 was an increase in the minimum size at which bastard trumpeter could be taken from twelve to thirteen inches. The reason for this increase in the minimum size at which bastard trumpeter could be taken is not known.

Under the Sea Fisheries Regulations of 1933, restrictions on mesh

sizes of graballs were adjusted to increase the minimum mesh size from two inches to three inches. The change was somewhat technical however, as the regulations defined for the first time a "mullet net" with a minimum mesh size of two inches, the previous minimum mesh size for graballs. As no limits were prescribed for the lengths of these nets, the new regulations had no real effect on netting activity.

In the late 1930s, Danish seining trials were undertaken for the first time in Tasmanian waters by the trawler "Nelson". This fishing technique was similar to that of beach seining but on a far grander scale. Large nets with a central pocket or bunt were fed from the stern of a trawler as it moved in a circular path and then winched aboard. A number of commercial fishermen petitioned Mr F. X. Heerey, a member of the House of Assembly, over their objections to the employment of this fishing technique in the inshore fishing grounds, particularly those of the Derwent estuary and the D'Entrecasteaux Channel (see Figure 7.1), urging him to press for an Inquiry into the matter so that their grievances could be "ventilated". The Sea Fisheries Board were directed to hold an official investigation into the complaints and a Fisheries Inquiry was duly set up in 1940 (Tasmania, Attorney General's Department 1940).

The Board of Inquiry quickly established that little trawling had been carried out in the Derwent Estuary and D'Entrecasteaux Channel areas and that which had been carried out was unlikely to have fished out these areas, as alleged by the petitioning fishermen. The question then became one of what was likely to have been the true cause of any

declines in fish catches in these, and other, fishing grounds as noted by the commercial fishermen. A number of possible causes were put forward by different parties, including an invasion of jellyfish and a great increase in seal populations in Tasmanian waters. However, competition between licensed and unlicensed fishermen appeared to be the most common alternative put forward by the professional fishing sector. Many commercial fishermen were of the opinion that nets used by amateurs frequently breached the regulations and that amateur fishermen were known to have sold fish to Hobart retailers on a number of occasions. One commercial fisherman gave evidence that

> **The only other complaint that I have other than the shortage of fish is that unlicensed fishermen have nets and pots [crayfish pots]. They have more than one pot and more than one net. I am not aiming at a man doing half an hours fishing.**
>
> (Tasmania, Attorney General's Department 1940; p.39-40.)

The commercial fishermens' case against what they saw as too liberal regulation of amateur fishing activities was perhaps best summed up by George Bridge, lesee of the old Hobart Fish Market and a professional fishermen of many years experience. He submitted that

> **As to the protection of fish, now that there is a five day week, I am of the opinion that a new method should be fixed and the gear of all concerned, including farmers and weekenders, yachtsmen, and anyone using the gear. Although a vessel such as the "Storm Bay", worth two thousand pounds, may be very**

> **efficient, on arriving at say St Patrick's Head, may find a man there with a boat of negligible value (worth at the most twenty to thirty five pounds) operating as many pots and nets as he** [the skipper of the Storm Bay] **is using. I think all nets and other fishing equipment should be licensed, and not necessarily the boat.**
>
> (Tasmania, Attorney General's Department 1940; p.77.)

Edwin Percy Andrewartha, Secretary of the Sea Fisheries Board, put forward the views of the Board on the question of licensing of nets. The Board, he stated, had considered these matters and were of the opinion that "the policing of such a regulation would cause much trouble and expense" and that 95% of the costs of licensing would fall on the commercial fishing sector who were already burdened with boat registration and commercial licence fees. With regard to any proposal to introduce licensing for amateur nets or a ban on the use of nets by amateur fishermen, Andrewartha held strong convictions and gave his opinion in no uncertain terms:

> **The provision for payment of licences is restricted to those who make fishing their livelihood. The fish in the sea are the property of the people.**
>
> (Tasmania, Attorney General's Department 1940; p.147.)

In its Report to Parliament (never released), the Board of Inquiry advised that the original claims that Danish seining had affected fish numbers of the inshore grounds were without substance, but suggested

that legislation be introduced to prohibit future trawling and Danish seining operations within two miles of the coast. The Board of Inquiry also recommended that, owing to the growing numbers of weekend fishermen, nets used by those other than licensed fishermen should be licensed and tagged.

Whether this Board of Inquiry Report acted as a catalyst for change in the administration of the sea fisheries, or whether the timing was coincidental, is not known. However, in 1941 the Government abolished the Sea Fisheries Board and in its place set up a Fisheries Division within the Department of Agriculture, which took on a licensing role, while a Sea Fisheries Advisory Board was established to take over the responsibility of regulation and enforcement. Fisheries Regulations, however, remained almost completely unaltered during this administrative restructuring. Not until 1949 were regulations prohibiting trawling and Danish seining within the inshore waters gazetted, and recommendations on licensing of amateurs nets were never taken up.

The creation of the Sea Fisheries Advisory Board occurred at a time when Tasmanian fishermen were just beginning to branch out into deep-sea fishing, and thereafter inshore scale fisheries were steadily displaced in relative importance. As the commercial importance of southern rock lobster and scallops increased, inshore scale fisheries took a further demotion within the ranks of the sea fisheries of the State. The decline in the relative importance of the inshore scale fishery was apparently matched by a decline in managerial interest and

later Inquiries and Reports on the sea fisheries of the State generally glossed over the question of this fishery.

The minimum size at which bastard trumpeter could be taken was reduced in 1950 from thirteen inches to the pre-1926 size limit of twelve inches. Again, the reason for this change is not known. At the same time, the minimum mesh size for graballs was increased from three inches to four inches. The Sea Fisheries Regulations of 1962, gazetted under the Fisheries Act of 1959, retained this minimum mesh size for graballs but increased the minimum mesh size for mullet nets from two inches to two and one quarter inches. In 1966 the Sea Fisheries Regulations were amended and for the first time in Tasmania, regulations applying to the use of graball and mullet nets varied for commercial and non-commercial fishermen. For both mullet nets and graballs, the maximum length for non-commercial users was set at seventy five yards. The regulations also limited non-commercial fishermen to no more than one beach seine and two graballs at the one time. For reasons now unknown, no limit was set on the number of mullet nets which amateurs could use.

These changes to the regulations coincided with developments of new net materials. Up to the 1950s, gill nets were almost all made of 9 to 15 ply cotton, tanned with wattle bark to increase their life. Nets made of kuralon, a synthetic cotton look-alike material, came on the market during the late 1950s. Around 1960, "multimonofilament" nylon nets were first imported into Tasmania, and this was followed a couple of years later by the introduction of monofilament nets which

remain as the basic fishing net in use today (Guard, personal communication).

Upon the metrification of net specifications in 1974, the Government took the opportunity to introduce further changes to the regulations applying to the use of nets by non-commercial fishermen. The maximum length of graballs which could be used by amateurs was reduced from seventy five yards (68.6 m) to fifty metres. The minimum mesh size for these nets remained almost the same in converting from four inches (101.6 mm) to 100 mm and a maximum mesh of 130 mm was introduced. For mullet nets, the conversion from imperial to metric units involved a reduction in the minimum mesh size from two and three quarter inches (69.85 mm) to 60 mm and an upper limit on the permissible mesh size of these nets was set at 70 mm. In making these conversions to the regulations, an apparent oversight left no length limit set for mullet nets used by amateurs and this was not corrected until 1984 when the maximum was set at fifty metres.

A study commissioned by the Government into the sea fishing industry in Tasmania (O'Kelly 1976) recommended further administrative changes in the area of sea fisheries, advising that a separate statutory agency with overall responsibility of these fisheries be established. The Fisheries Development Authority was set up in the following year. Under this Authority, management of Tasmania's fisheries took on a new dimension. Biological research was fostered with the construction of a marine laboratory and research was initiated in many areas of sea fisheries. The Authority was short lived, however, and in 1984 a

Report on the Fisheries Development Authority (Tasmania, Parliament 1984) recommended that a separate Department of Sea Fisheries be established. In February 1985, the Fisheries Development Authority was replaced by the Sea Fisheries Department.

Regulations governing the use of graball and mullet nets in Tasmania today place no restrictions on the number or lengths of nets used by commercial fishermen and do not require amateurs' nets to be registered or amateur netters to be licensed. Only one small Aquatic Reserve, approximately 50 ha in area and located in the Derwent Estuary adjacent to the Marine Laboratories, has been declared in Tasmania to date. Netting in this Reserve is prohibited between sunset and sunrise but is permitted during daylight hours.

2.3 Summary

The need for regulation of inshore netting activity in Tasmania first became apparent in the late 1870s and early 1880s. Beach seining appeared to warrant closest scrutiny and subsequent legislation introduced was primarily levelled at reducing the impact of these nets, although inshore gill netting also came under regulatory control.

The intention of early control measures was clearly to protect juvenile stocks, and the stipulation of minimum mesh sizes and minimum lengths at which fish could be taken were the two primary methods

chosen to achieve this aim. With very little information upon which to base decisions as to appropriate minimum mesh of nets and minimum sizes at which fish should be taken, early fisheries authorities looked to a number of sources for advice. The opinions of Sir Thomas Brady, of the Irish Sea Fisheries Department, appear to have been particularly heavily relied upon. It is highly probable that similar regulatory measures introduced by other Australian States were borrowed. It is also likely that advice on appropriate minimum lengths of fish was sought from the Royal Society of Tasmania.

Once initial regulatory measures had been formulated and gazetted at the turn of the century, few alterations were made thereafter. The number of areas closed to netting increased, but these were aimed primarily at protection of introduced freshwater species. In the case of graballs, a minimum mesh of 2 1/4 inches was considered to be appropriate and incorporated into the Fisheries Regulations of 1890. This was not altered until 1933 when the minimum mesh of these nets was increased to 3 inches. However, the simultaneous introduction of the mullet net with a minimum mesh set at 2 1/4 inches, the previous minimum of the graball, rendered this change somewhat technical. While the mimimum mesh of the graball was again adjusted upward in 1950 to 4 inches and , upon metrification in 1974, to 10 cm (3.94 inches), the minimum mesh set for the mullet net changed little and remains today at 6 cm (2.36 inches).

The successful establishment of the inland exotic fishery in Tasmania appears to have, in part, been to the detriment of the development and

management of the State's marine scale fisheries. Successive Tasmanian Governments were slow to act on recommendations in the area of sea fisheries and administrative changes were implemented only after considerable coercion was applied. Up until the mid 1920s, sea fisheries were administered jointly with the inland fishery, sea fisheries taking a highly subordinate position within this dual management. On separation of the two administrations in 1925, the functions of the newly established sea fisheries authority were confined to those of licensing and enforcement. Not until half a decade later did sea fisheries in Tasmania gain true independence and the resoures necessary for the development of sound management strategies. In the interim, the expansion of the crayfish industry, and the development of deep-sea and abalone fisheries have meant that little attention is now focused on the inshore scale fishery.

Having described the evolution of regulation and management of the inshore scale fishery in Tasmania, it is now useful to compare this with a brief examination of inshore regulatory development in the mainland Australian States.

CHAPTER THREE

PAST AND PRESENT REGULATION OF THE INSHORE FISHERY IN AUSTRALIA

3.1 Introduction

Despite differences between the inshore fisheries of each of the Australian States and Territories (in terms of species fished, the size of proximate human populations, etc.), these inshore fisheries are characterised by broad similarities. Knowledge of problems encountered in the management of inshore scale fisheries elsewhere in Australia and mechanisms employed by managers to resolve these management problems provide insight into the apparent appropriateness of past management of the Tasmanian inshore fishery and future problems which may be encountered in the management of the inshore scale fishery in this State.

Published information on the evolution of regulation of the inshore scale fisheries of the mainland States is, in most cases, unavailable. Parlaimentary Journals of each of the States and the Northern Territory were used to determine the early development of management. Present and more recent developments in regard to the inshore scale fisheries were uncovered by consulting publications in which statutory rules and regulations are gazetted and through personal communication with officers of fisheries divisions in each State. In the cases of Western Australia and South Australia, a number of publications on past and recent changes in the inshore management are available.

3.2 Victoria.

Victoria was the first Australian colony to introduce legislation specifically designed to protect its marine fisheries from over-exploitation, and Victoria's Fisheries Act of 1863 (27^{O}VICT.No.206) became the model upon which the other colonies based their fisheries-related legislation. As the early fishery in Victoria concentrated almost entirely on the inshore waters for the whole of the nineteenth century, this first Fisheries Act was devoted totally to the control of fishing in the inshore areas (Winstanley 1985). Limitations on the lengths and on the sizes of meshes of hauling nets and seining nets, a total prohibition on the use of stake nets or fixed nets within one mile of the shore or any river mouth, and a total netting ban within two of the colony's major estuaries (Saltwater estuary and the Yarra Yarra-Plenty-Werribee estuary) were the major ways in which the Act regulated the use of nets in Victorian waters.

The initial Act was replaced by the Fisheries Act of 1873 (37^{O}VICT.No.473) which introduced further measures to protect fish stocks, including greater controls on netting and the setting of minimum sizes at which fish could be taken for a number of fish species. In order to ensure that undersized fish caught in beach seines were released unharmed, it became illegal, under this Act, to draw any net onto the land before emptying the net of its catch.

Amendments to the 1873 Fisheries Act were passed by the Victorian Parliament between 1878 and 1912 and consolidated under the Fisheries Act of 1915 (6^{O}GEO.V No.2654). The major changes in the legislation brought about by this new Act were the addition of several areas to those already declared closed to netting and the introduction of seasonal closures for a number of fish species. However, regulations applying to netting in Victorian waters remained, in the main, unaltered by this and subsequent legislation until the late 1950s.

Major changes to the Victorian Fisheries Regulations were introduced between 1958 and 1967, and it was during this period that the present total prohibition on the use of gill nets (mesh nets) by amateur fisherman was enforced. It was during this period that multifilament and monofilament nylon nets were introduced (see Section 2.2). Since the passing of the 1968 Fisheries Act controls on fishing in Victoria have been tightened further and under the Fisheries Regulations of 1981 not all commercial fishermen were licensed to use mesh nets. For those commercial fishermen licensed to use mesh nets their use was subject to conditions which limited the areas in which they could be set, the times of the year during which they are permitted, and the mesh sizes and net lengths which could be used. Regulations applying to the use of mesh nets varied from one locality to the next. In order to allow amateur anglers access to popular fishing areas, commercial netting [illegible]

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Against charges that present Victorian fisheries regulations are

unneccesarily harsh, Winstanley (1985) has argued that the degree of regulation of both amateur and commercial fishing in the inshore waters of Victoria is not substantially different from that of most other Australian States. Furthermore, Winstanley argues that if the resource is to be managed to maximize the benefit to both user groups, increased regulation is inevitable. A hint that increased regulation may come sooner than later came with the suggestion that the Victorian Angling Licence, presently employed to regulate amateur inland fisheries, be extented to a more general angling licence to cover both freshwater and seafishing by amateurs (Anonymous 1984). The idea appears to have been, temporarily at least, shelved.

3.3 New South Wales

As in the case of most Australian States, the early fishing effort in New South Wales focused almost exclusively on the estuarine and inshore waters of the colony (Stead 1910). These fishing grounds continued to supply New South Wales with the major component of its total fish catch until deep-sea fishing methods were introduced in the early 1930s (Pownall 1979). The effects of overfishing of the colony's inshore waters first became apparent toward the middle of the nineteenth century and the Fisheries Act of 1865 (28^{O}VICT. No.10) was introduced in order to regulate net fishing activity. Limits on the mesh sizes and total lengths of hauling and seining nets and a total prohibition on the use of fixed or staked nets (permanent nets) within one mile of the N.S.W. coast, or within one mile of the mouth of any river, were the major protective measures employed under the Act.

Regulation of gill netting, however, was not introduced at this time.

In the years following the introduction of this first Fisheries Act, further reductions in the catches of fish in the inshore areas led to the establishment of a Royal Commission into the fisheries of New South Wales. The findings of the Royal Commission, released in 1880, were immediately acted upon by the Government of N.S.W. and the Fisheries Act of 1881 (44^{O}VICT. No.26) was introduced, in the words of the Act, to

> **check the wanton or unnecessary destruction of immature fish and prevent the disturbance of nurseries and breeding grounds during certain months.**

These aims were pursued through the closure of gazetted waters for the winter months (April to September) and by the imposition of minimum specified sizes at which fish could be taken for a number of species. The use of nets was further regulated by declaration of areas in which netting was totally prohibited and by further regulation of net specification. Under the regulations of the Act, the use of gill nets with a mesh less than four inches (101.6 mm) or with a total length greater than three hundred yards (274.3 m) was outlawed in the territorial waters of the colony. As well as requiring all boats and persons engaged in fishing on a commercial basis to be licensed, the Act required all nets used in a commercial capacity to be licensed.

Increased regulation of the use of nets in N.S.W. was introduced under the Sunk Nets Act of 1892 (55^{O}VICT.No.15), which placed a total ban on

the use of "sunk nets" (i.e. nets hauled or drawn along the bottom) in three major bays of N.S.W. (Port Jackson, Botany Bay and Broken Bay). Total and partial closures to all forms of netting were extended under the Net Fishing (Port Hacking) Act of 1901, the Fisheries Act of 1902, and the Fisheries Amendment Act of 1910.

Regulations currently governing the use of nets in N.S.W. have been introduced under the Fisheries Act of 1935 (20^{O}GEO.V No.58) and its subsequent amendments. Regulation 23(2A), gazetted in 1935, covering the use of gill nets by commercial fishermen, limited the total lengths of such nets to a maximum of 725 m and the meshes to a minimum of 80 mm. The period for which commercial fishermen could set these nets was restricted to a maximum of three hours and all nets were to be tagged to clearly indicate the net's licence number.

The rules applying to the use of nets by amateur fishermen in the waters of N.S.W. were not radically different from those applying to commercial fishermen until 1950. In that year, the addition of Regulation 139(1) to the Fisheries Regulations decreed that

> **...no person, other than a licensed fisherman, shall take, or attempt to take, fish by any means of any net in any waters within the territorial limits of New South Wales.**

Following the introduction of this regulation, the use of gill nets in N.S.W. was restricted to commercial fishermen only. The commercial

use of gill nets was subject to limits on length and mesh and was prohibited in a large number of declared waters.

A search of the literature did not uncover the reason(s) for which a total ban on the use of gill nets by amateurs was enforced in 1950. However, officers of the Sea Fisheries Division (N.S.W.) believe that the total ban was introduced simply because gill netting was considered to fall into the realm of commercial fishing and thought not to constitute a bona fide recreational fishing activity (Brinsley, personal communication). Controls on the use of gill nets by commercial fishermen, introduced at the time the 1935 Fisheries Act was passed, are thought to have been enforced for stock conservation purposes (Ellison, personal communication). The more recent restrictions on commercial gill netting through further closures of waters, on the other hand, have been implemented in order to facilitate a sharing of the resource between recreational anglers and commercial net-fishermen (Henry, personal communication). Almost all of the State's estuaries are now closed to commercial fishing during weekends and on public holidays (Ruello and Henry 1977).

3.4 Queensland

The first Fisheries Act of Queensland (51^{O}VICT.No.6 of 1887) mirrored, to a large extent, legislation introduced by Victoria and New South Wales in the preceding two decades. The Queensland Act contained similar clauses to those incorporated in the Victorian and New South

Wales Acts, providing for the closure of waters to netting, the setting of minimum sizes for various species of fish, and the imposition of maximum lengths and minimum mesh sizes of nets used in Queensland waters. With respect to the use of gill nets by non-commercial fishermen, however, the Queensland legislation differed markedly from its Victorian and New South Wales counterparts. The 1887 Act introduced controls over the use of nets by amateur fishermen under Section 13, which read

> **It is unlawful for any person -**
>
> **(a) To engage in taking fish for sale; or**
>
> **(b) To have in his possession (unless he is a maker of or dealer in such nets) or to use any net for the taking of fish;**
>
> **unless he has obtained from the Minister a licence for that purpose.**

The use of gill nets by amateur fishermen in Queensland waters has been totally prohibited, therefore, since the passing of this legislation ninety nine years ago. The Act exempted the use of cast nets, scoop nets and small bait nets.

The reasons behind the introduction of the rigid regulation of gill netting by amateurs in Queensland at this comparatively early date are not clear. The species most commonly captured by gill net in the estuaries and inshore waters of that State is the catadromous giant perch (Lates calcarifer) and it has been recorded that populations of this fish in Queensland waters declined from early over-exploitation (Roughley 1951). Whether the intention of the 1887 Act was to protect

this species from further overexploitation, or to protect the interests of commercial fishermen from the amateur is not known.

Commercial gill netting in Queensland continues to be conducted on a relatively large scale, although it is controlled through permanent and seasonal closures, a total prohibition on the taking of certain species, and is subject to limits on lengths and mesh sizes of nets used. The giant perch continues to be the major species targeted by commercial gill netting in Queensland, although other species such as blue tailed mullet (Valamugil seheli) and threadfin (Polydactylus sheridani) are commonly taken in commercial quantities by this fishing method. Under present regulations (Fisheries Regulations of 1977), the restrictions on the use of gill nets by commercial fishermen vary between management regions. The minimum mesh size is generally set at 50 mm while the maximum length of the net varies from 100 m to 800 m.

3.5 South Australia

The sea fisheries of South Australia were first regulated under the Fisheries Act of 1878 (42^{O}VICT.No.2). No restrictions on the use of nets in South Australian waters were enforced, however, until the Act was amended in 1889. With this amendment, the size of the meshes of nets were controlled and netting was prohibited within 100 yards of any jetty. In 1893, the Fisheries Act was again amended to allow provisions for the closure of declared waters to netting.

The 1878 Act was repealed and replaced by the Fisheries Act of 1904 (4^{O}EDWD.VII No.864) which introduced licences for commercial fishermen. The new Act also took action to further protect fish stocks by imposing specified minimum sizes (weights) at which a number of species could be taken. Amateurs were restriced by the Act to using only one gill net at a time in the mouth of the Murray River and the waters of the Coorong (see Figure 3.1).

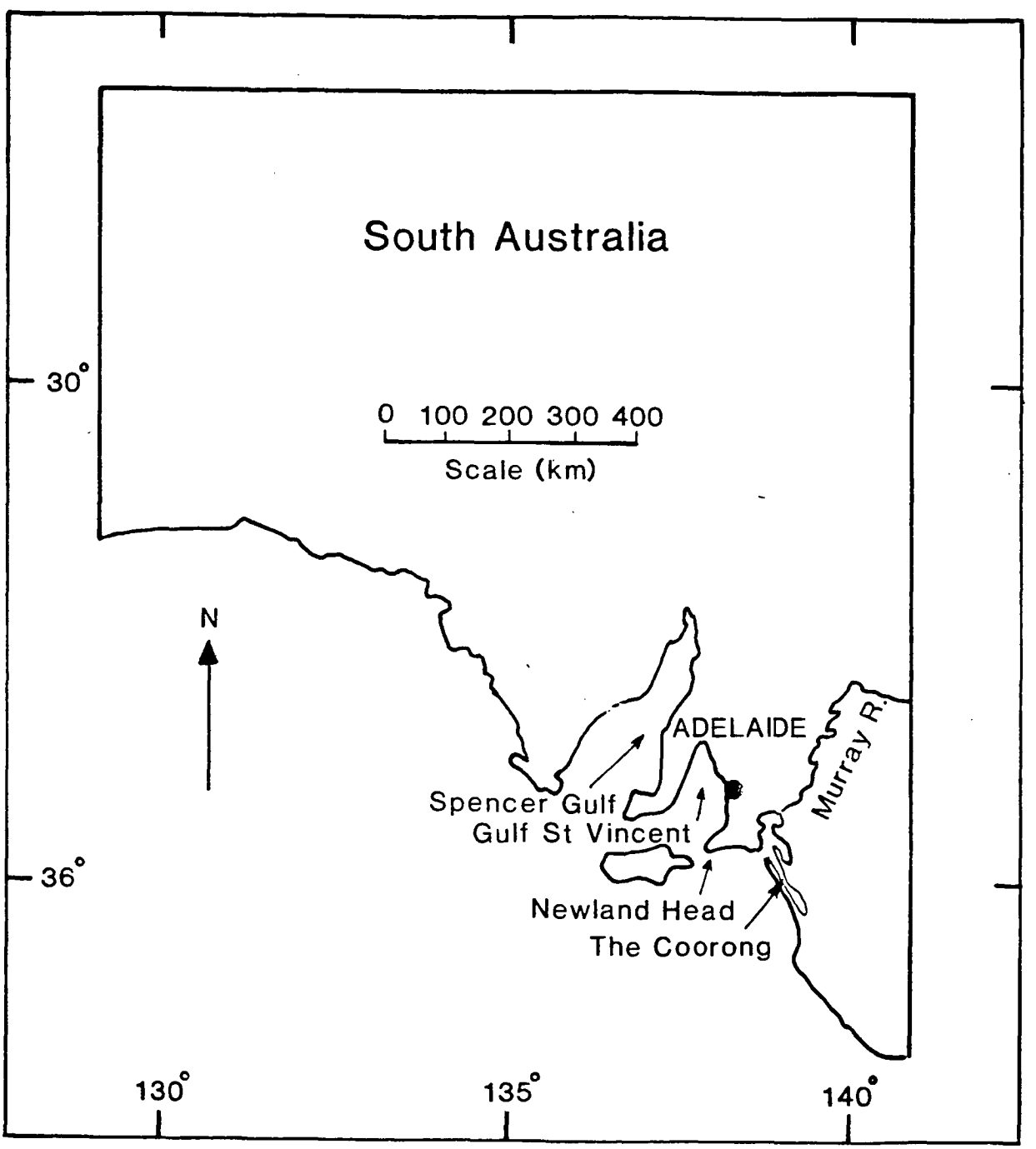
Over the course of the next seventy years, only minor changes were made to the netting regulations, consisting, in the main, of the extension of netting closures. The 1971-1975 Fisheries Act provided for the declaration of Aquatic Reserves. Under Section 47(2)b of the Act it became unlawful to drag or draw any net out of the water into a boat or onto the land to such a distance to prevent undersize fish from escaping alive. Seasonal closures to netting were introduced in a small number of areas in order to protect the fishing rights of amateur anglers from netting. The regulations distinguished for the first time between two separate groups of commercial fishermen: fishermen who engaged in fishing as their sole means of living, and fishermen who operated on a seasonal basis only. Class A commercial fishing licences were issued to the former, while the latter operated with Class B licences. Apart from these changes, no significant alteration to the regulations governing the use of gill nets were introduced.

The changes in regulations applying to netting in South Australian waters after 1975, and the events surrounding these changes, have been

Figure 3.1

Map of South Australia showing location

of place names mentioned in text.



well documented (Anonymous 1982; Jones 1982, 1986; MacDonald 1986). A report on South Australia's fisheries commissioned by the State Government in 1976 recommended that fishing effort be reduced in some of the State's fisheries (Copes 1976). In the following year, growing concern amongst some sectors that the fishing effort was placing too great a pressure on fish stocks led to the announcement of a freeze on the number of commercial fishing licences while the situation was scrutinised by the South Australian Government. The results of a study on South Australia's marine scale fishery (Jones 1979), which examined changes in catch compositon and studied the biology of the commercially important fish species in Spencer Gulf (Figure 3.1), were released two years after the freeze on commercial licences was announced. The study revealed that net fishing effort had increased substantially over the previous decade and that this increase in fishing effort had resulted, in some areas, in reduced catch rates and a significant lowering of the average size of captured fish of some species. The report thus vindicated the Government's action in freezing the number of licences, and recommended that the activities of both recreational and commercial fishermen be restrained, that further netting closures be introduced, and that mesh sizes be increased in the area studied while being closely examined in other areas.

In the year following the release of this report, the South Australian Government set up a Joint Select Consultative Committee to consider ways by which fishing pressure could be reduced. The recommendations of this committee were quickly put into practice, and in that same

year (1980) greater restrictions on the use of nets by both recreational and commercial fishermen were incorporated into the fisheries regulations. For Class A commercial fishermen, the regulations were tightened to limit the total length of net which could be used at any one time to a maximum of 600 m, while the mesh size of the net was limited to a minimum of 70 mm. Fishermen operating under a Class B licence could, after 1980, no longer use a gill net, and were restricted to a maximum of 450 m of hauling net with a minimum mesh size of 70 mm. In the case of recreational fishermen, the maximum length of gill net which could be used was set at 75 m, the minimum mesh size to 50 mm, and the maximum depth of the nets to 50 meshes (i.e. 3.75 m). All gill nets, whether used by professional or by amateur fishermen, required licensing and fitting with a tag to indicate the licence number.

As well as these changes to the regulations, the Government also announced that no further Class A licences were to be issued, and that after July 1981, Class B licence holders would lose all entitlements to use nets of any description in Spencer Gulf and Gulf St. Vincent (see Figure 3.1). Another group using gill nets in South Australian waters were the rock lobster fishermen (the minimum mesh size allowed for gill nets used by this sector was 150 mm) and after July 1983 no further permits for these nets were issued.

The regulations applying to the use of gill nets by amateurs were again altered in December 1985. From that date forward, recreational fishermen using gill nets in the waters west of Newland Head (Figure

3.1) were limited to one net only and this net could not be left unattended and could be set from the waters edge only (i.e. there was to be no gap between the shore and the net). In waters east of Newland Head, recreational fishermen were also restricted to using only one net at a time and were not permitted to leave this net unattended for longer than twelve hours. All nets used in South Australian waters by recreational fishermen were required to be licensed. When applying for renewal of the licence each year, recreational fishermen had to present their net for inspection.

In August 1986, approximately two hundred commercial net licences and approximately twelve thousand recreational licences were registered (Jones, personal communication). Present Government policy to reduce these numbers further is to be achieved through stringent licensing regulations. Only recreational nets for which proof of licensing during the previous twelve months can be established will be relicenced.

As well as the above changes to the netting regulations in South Australia, the South Australian Government increased the total area of the State's Aquatic Reserves threefold between 1980 and 1986. By August 1986, twelve Aquatic Reserves had been declared, while total netting bans were in force in another forty inshore areas.

3.6 Northern Territory

South Australian legislation and regulations applied to the sea

fisheries of the the Northern Territory until the early part of the twentieth century. Legislation specific to Northern Territory was introduced in 1911 but did not limit the use of gill nets until the 1950s. Under the Fisheries Ordinance 1952-1959 the use of gill nets by amateurs was totally prohibited and the use of a sunk gill nets (i.e. set upon the bottom) was totally prohibited within two nautical miles of the coast. The total ban on gill netting by amateurs may have been introduced for reasons similar to those which led to the early prohibition of gill netting in Queensland. The Baramundi (Lates calcarifer) is the fish which is captured most frequently in gill nets in river estuaries and the inshore waters of the Northern Teritory (Grey and Griffin 1979) and the susceptibility of this fish to netting may have led to the total prohibition of amateur gill netting and a ban on the use of sunk nets (i.e. gill nets set on the bottom) within two nautical miles of the coast by commercial fishermen .

Regulations applying to the use of gill nets in the Northern Territory have remained largely unchanged since the 1952-1959 Act. Current regulations (Fisheries Regulations of 1984) under the Fisheries Act (N.T.) of 1982 require all gill nets to be licensed and tagged with the licence number. The 1982 Act also made provision for the declaration of Marine Reserves. Two such reserves have been declared to date. Netting closures have been extended under the present regulations and under the Aboriginal Land Rights Act (AUS.) and the Aboriginal Land and Sea Act (N.T.) which have totally closed fishing to non-Aboriginal people in waters adjoining Aboriginal lands.

3.7 Western Australia.

As in the case of South Australia, restrictions on the use of gill nets in Western Australian waters were not imposed to any significant extent until recent years. Western Australian fisheries regulations, as they apply to gill netting in the inshore areas, are currently being revised, amidst conflict between amateur and professional fishermen.

The evolution of legislation administering the inshore fisheries of Western Australia have been documented by Lenanton (1979,1984). The Government of Western Australia first introduced legislation aimed at protecting inshore fish stocks in 1889 (53^{O}VICT.No.4). Under this first Fisheries Act, all nets used in the catching of fish for sale and all beach seine nets were required to be licensed. Protection of fish stocks was further advanced in 1905 with the introduction of Aquatic Reserves, the imposition of legal specifications for nets, and the provision for the declaration of netting closures. In that same year, minimum sizes at which a number of fish species could be taken were enforced. No major changes to netting regulations were introduced until 1940 when the earlier requirement for the licensing of commercially used nets and all beach seine nets was extended to all nets used by both amateurs and professionals.

According to Lenanton (1979), the records of the Fisheries Department between 1932 and 1948 reveal that commercial fishermen constantly complained during that period that amateur netting was disruptive to

the operations of commercial fishermen and that the sale of fish by unlicensed fishermen was so prevalent that it was causing hardship for members of the commercial fishing industry. Intensive lobbying by professional fishermen failed to have the regulations altered to prohibit netting by any but licensed commercial fishermen as the Department of Fisheries held fast to its belief that netting represented an historical right that should not be denied to the common person.

The conflict was partially resolved in 1949 when Regulation 3A of the Fisheries Regulations was amended to introduced licensing for amateur net fishermen and to impose a maximum length of fifty yards on the nets used by amateurs. All persons catching fish intended for sale were to be licensed as commercial fishermen.

In the following year the regulations were again altered in order to give amateurs greater freedom in the offshore waters and the permissible length of nets which amateurs could use within three miles of the high water mark was increased to sixty six yards (minimum mesh size of two and a quarter inches) and, outside this three mile limit, to one hundred and thirty two yards (minimum mesh size of two inches). These regulations remained in force until 1963.

The maximum length of nets which could be used by either professional or amateur fishermen in the inshore area was set at one hundred yards in 1963. Professional fishermen continued to assert that the extent of recreational netting was injurious to the commercial sector.

Lenanton (1979) stated that the Minister of Fisheries was, at that time, in favour of a total prohibition on amateur netting. The Department of Fisheries was of a different opinion and considered that insufficient evidence existed to show that amateur netting did, in fact, adversely affect commercial fishing operations, and once again adopted the attitude that as a traditional right, amateur netting should not be totally banned in Western Australia.

The conflict between amateur and professional fishermen continued, but no further changes to the legislation were introduced until 1975. Allegations by commercial fishermen that the quantity of fish taken by amateur gill net fishermen was in excess of their requirements, that amateur net fishermen were regularly in the habit of selling their surplus fish, and that the nets employed by amateur fishermen frequently infringed the regulations, finally led the Government to modify slightly the regulations applying to the use of nets by amateurs. In 1975, the length of net which amateurs could use was reduced from one hundred yards to sixty metres.

The closure of netting in 62 areas and the partial closure to netting in another 6 areas together with the regulations described above constitute the restrictions on the use of gill nets by amateur and professional fishermen in Western Australia today. Regulation of the inshore fishery in Western Australia is currently the most liberal of all the mainland States and is similar to that of Tasmania. The extensive Western Australian coastline, coupled with the relatively small population of that State, have limited the need for more rigid

regulation. However, most of Western Australia's population is located in the south western corner of the State, especially in the capital city, Perth, and netting is totallly prohibited in most inshore waters within a 100 km radius of that city.

The regulations applying to amateur and professional net fishermen in Western Australia will be under constant review over the coming years as further studies on the extent of amateur gill netting and on the effect of netting in general will be conducted to monitor the need for reassessment of netting regulations.

3.8 Summary and discussion

In each of the Australian States, the inshore fishing grounds supplied the major share of the fish catch for the first century of European settlement. Regulation of fishing activity in these waters appears, in each case, to have been introduced only after declining fish catches signalled a need for control. New South Wales and Victoria were the first States to enact comprehensive fisheries related legislation and were followed in due course by the less populated and more peripheral colonies. All States had introduced some form of regulatory control by the turn of the century.

Regulation of inshore netting by both amateur and professional fishermen was subsequently increased in Victoria and New South Wales over the next century. Increasing pressure on the resource and

mounting conflict between user groups resulted in the declaration of further netting closures and more rigid licensing, and, by the 1960s, netting by amateur fishermen had been totally prohibited in both of these States. The introduction of monofilament nylon nets at this time may have been an influential factor in the decision to introduce such prohibitions.

Development of regulatory control of inshore waters in Queensland was atypical in that gill netting by amateur fishermen was totally banned late last century. Early recognition of the susceptibility of fish species targeted by gill netting in Queensland waters may account for this action being taken. The Northern Territory, which shares many inshore species with Queensland, also introduced a total prohibition of inshore gill netting by amateur and commercial fishermen by the 1950s.

South Australia and Western Australia, the two southern mainland Australian States with low populations and comparatively long coastlines, have been much slower than Victoria and N.S.W. to increase regulatory control of fishing activity in the inshore grounds and, up until recently, regulations governing the use of inshore gill netting in both of these States had remained largely unaltered from that introduced late in the nineteenth century. Over the past decade, however, significant changes have been made to the regulation of gill netting in both of these States. In South Australia, inshore netting by amateur fishermen, although not totally prohibited, is highly controlled and the extent of inshore netting by professional fishermen

has been significantly curtailed. Regulation of inshore netting in Western Australia is presently the most liberal of the mainland States and,in many respects, is similar to present regulation existing in Tasmania. However, the exceptionally long Western Australian coastline and highly centralised population of that State render the positions of Western Australia and Tasmania quite different. These features, together with a high level of netting regulation in areas close to populated areas, ensure that fishing pressure is low in the majority of Western Australia's inshore waters.

When compared to regulation in the mainland States, past development and present control of the inshore scale fishery in Tasmania appears to have followed most closely that of Western Australia, regulation governing the use of nets in these two States being the most liberal in Australia. Exploitation of the inshore resource in Western Australia is being closely monitored and changes made over the past decade have been based on study of fishing pressure. While the size and distribution of the Western Australian population have permitted the retention of lenient regulation, Tasmania's far smaller coastline and highly decentralised population render the appropriateness of its liberal regulation more questionable.

This study, now turns its attention to investigating the impact of this past and present liberal regulation of inshore netting in Tasmania by focusing on the trends in the catch and on the biology of one important fish species commonly captured by inshore gill netting, the bastard trumpeter (Latridopsis forsteri).

CHAPTER FOUR

THE PAST CATCH OF BASTARD TRUMPETER

4.1 Introduction

An analysis of the impact of gill netting on populations of bastard trumpeter requires an examination of the catch and the catch effort associated with the species, and the way in which these parameters have altered over time. Unfortunately, early records of fish catches in Tasmanian waters are very limited and fragmented as the collection of fishing returns for statistical purposes was not introduced until the mid 1940s. Even with this development, statistical information on fish species such as bastard trumpeter, which did not constitute a significant portion of the total fish catch at this time, contained many inherent inaccuracies and ommissions. Even though there are many problems associated with the catch records, it is nevertheless of value to assemble the information which does exist. The information can then be examined in order to see if any trends emerge concerning the effects of past management regimes on the populations of this species.

4.2 Historical catch records

4.2.1 1882 to 1923

Information collected from this period was obtained from the annual

Tasmanian Government publication, "Statistics of Tasmania", from the papers and reports of the Tasmanian Parliament, and from Departmental files (Archives of Tasmania). The last two of these sources were, for the most part, anecdotal in nature and provided useful information on the perceptions of the fishery during the period.

From the early 1880s onward, successive Tasmanian Governments frequently came under pressure to make available funds for the collection of accurate records of fish catches (Tasmania, Parliament 1882, 1883, 1889a, 1889b). Such information, it was argued, was necessary if the colony's fisheries were to be properly managed. Tasmanian Governments of the day, however, proved reluctant to invest moneys in the development of the colony's sea fisheries, holding to the view that resource management and development costs should be met by the industry involved. No moneys were made available for the collection of fishing returns until sixty years later.

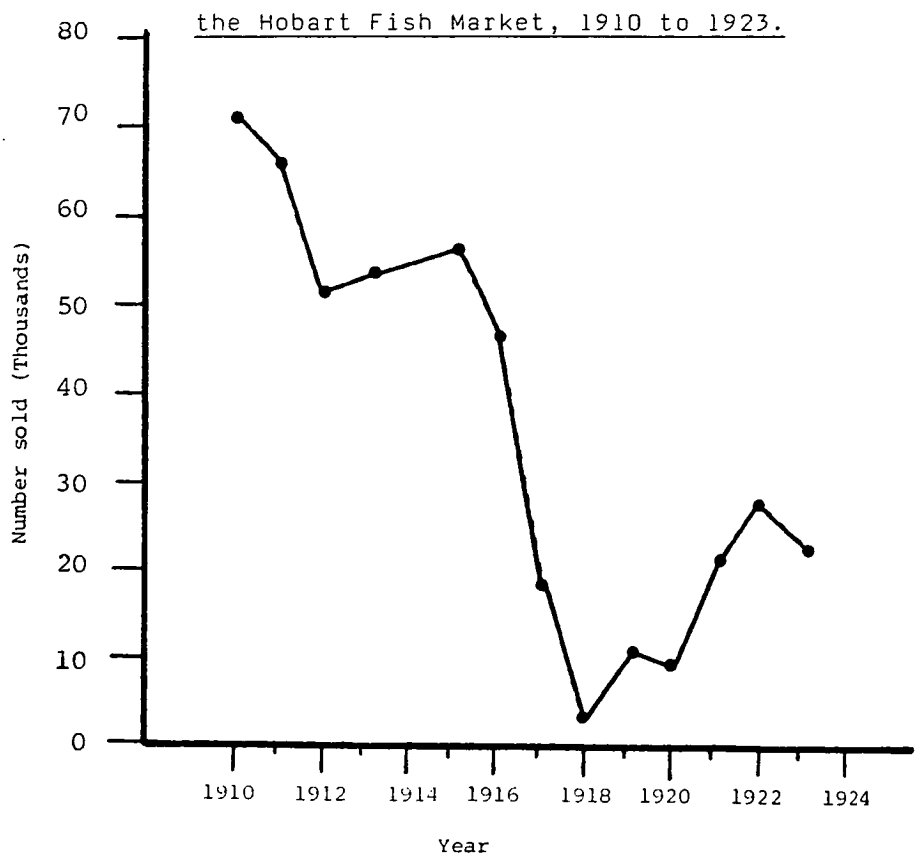
The Fisheries Commissioners therefore had only very crude information on the trends of annual fish catches in Tasmania, these being the records of fish sold at the Hobart Fish Market. These records were known to be subject to a number of errors when used as an index of the number of fish caught. Firstly, Victorian fishing vessels operating in Tasmanian waters returned with their catches to their home ports. Secondly, not all Tasmanian commercial fishermen operated from Hobart: in 1882, 37% of the colony's fishing fleet was based elsewhere in Tasmania (Tasmania, Parliament 1882). Thirdly, not all fish sold in Hobart passed through the Market: although the Hobart Municipal

Regulations required all persons selling fish to do so through the Market, it was widely appreciated that this was "more honoured in the breach than in the observance" (Tasmania, Parliament 1913, p.2). And, finally, records based on the fish sold at the Market gave no account of the numbers caught by non-commercial fishermen. In all, therefore, these records represented a considerable underestimate of the actual catch. Nevertheless, the Commissioners considered that by comparing these returns from year to year "a fair idea of the relative trend of the supply of fish and their wholesale prices" could be obtained (Tasmania, Parliament 1918-1919, p.5).

The numbers of bastard trumpeter sold through the Hobart Fish Market each year for the period 1910 to 1923 are shown in Figure 4.1. There

Figure 4.1

Numbers of bastard trumpeter sold at the Hobart Fish Market, 1910 to 1923.



was a considerable decline in the sales of this fish between 1910 and 1918, particularly after 1915, and sales improved only marginally thereafter. The number sold in the poorest year (1918) was approximately four thousand, while the number sold at the beginning of the period (1910) was in the vicinity of seventy one thousand. In the partial recovery from 1919 to 1923, the number of bastard trumpeter sold in the best year (1922) was approximately twenty eight thousand, forty percent of the number sold in 1910. Bastard trumpeter comprised between 1.2% (1918) and 8.2% (1917) of the total fish sales (by numbers).

The pattern in the sale of bastard trumpeter between 1910 and 1923, as shown in Figure 4.1, was similar to the pattern exhibited in the total sales of all fish over this period. The reduction in the numbers of fish caught occurred at a time when "boats of an improved class and in larger numbers" were engaged in the local fishing industry (Tasmania, Parliament 1916-1917, p.5). Together, these facts led the Fisheries Commissioners to the belief that the general decline in fish sales represented "a depletion of fish in our waters of a serious character due to causes unknown" (Tasmania, Parliament 1917, p.4) and that "the most prolific grounds had ceased to yield the usual harvest" (Tasmania, Parliament 1920-1921, p.8).

As a result of the declining annual catch of fish over this period, the price of fish sold through the Hobart Fish Market rose steadily, becoming so high that the Fisheries Commissioners expressed concern in their annual report over "the inordinate price of fish now obtaining,

except in the case of the poorer qualities, which has rendered this article of food almost a luxury" (Tasmania 1916-1917, p.4). Parrot fish, once "despised as food" (Tasmania, Parliament 1919-1920, p.6), appeared amongst the fish for sale at the Hobart Fish Market for the first time in 1916. The rising price of fish, and the associated problems for the fishing industry and the community, became the subject of the second Royal Commission into the Tasmanian fisheries in 1916.

Of interest to this study is the fact that the price increase of bastard trumpeter during this period outstripped the price increases of all other fish. In 1910, bastard trumpeter fetched between eight and ten shillings per dozen and were the fifth most expensive fish to the consumer (striped trumpeter were the most expensive). By 1923, the price of bastard trumpeter had risen to between fifteen and thirty shillings per dozen, making it, together with striped trumpeter, the most expensive fish to purchase at the Hobart Fish Market.

Deep-sea fisheries were not developed to any significant extent at this time, and the decline in fish catches , as suggested by the records of fish sales, was most likely due to a partial exhaustion of localised, inshore fishing grounds.

4.2.2 1924 to 1940

Under the Fisheries Act of 1925, the administration of inland and sea fisheries in Tasmania was separated and the Sea Fisheries Board was

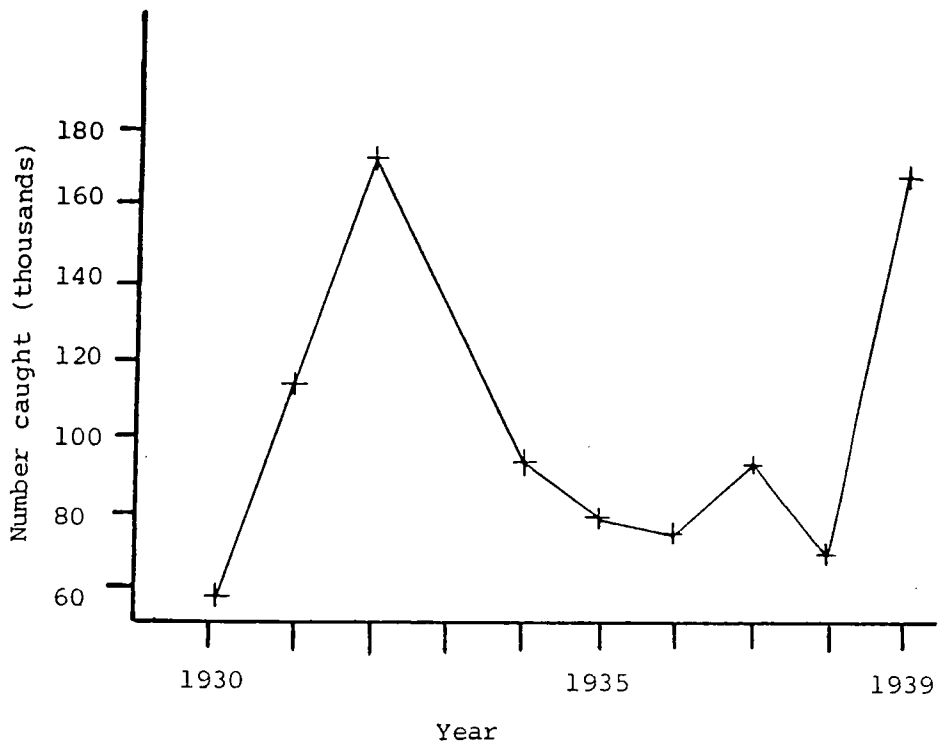
established. This new authority failed to continue the practice of its predecessor in providing Parliament with annual reports of its activities. The Board did, however, independently publish three reports, the first, in 1930, covering the years 1926 to 1929. Later reports were published in 1933, for the years 1931 and 1932, and 1940, for the period 1934 to 1939 (Tasmania, Sea Fisheries Board 1930, 1933, 1940).

By the 1930s, the Hobart Fish Market had ceased to operate and the Board members had to find alternative sources of information on fish catches. An attempt was made to employ local policemen to collect fish catch statistics from the fishermen. However, no laws existed to compel fishermen to provide such information and the Board recognised that obtaining reliable information was difficult "due to disinclination on the part of many fishermen to keep accurate records of fish captured for market" (Tasmania, Sea Fisheries Board 1933, p.15). Nevertheless, the Board considered that the figures it had obtained came from "various sources" and could be regarded, for statistical purposes, as being "reasonably accurate". The Secretary of the Board, Mr E. P. Andrewartha, described the figures as being "substantially correct" (Tasmania, Attorney General's Department 1940).

The numbers of bastard trumpeter captured for sale each year between 1930 and 1939, as given by the three reports, are shown in Figure 4.2. The numbers caught each year were significantly higher than the numbers recorded as sold through the Hobart Fish Market between 1910

Figure 4.2

Numbers of bastard trumpeter caught for sale, 1931 to 1939.



and 1923 (Figure 4.1) as the sales through the Hobart Fish Market represented a substantial underestimate of the total number of fish caught. For most of the period, the annual catch of bastard trumpeter ranged between 60 thousand to 80 thousand, while the number caught in 1932 and 1939 was approximately double this figure. Bastard trumpeter comprised 21% of the total fish catch (by number) in 1932, but generally constituted approximately 6% of the total catch.

The species recorded as captured for sale during 1931 to 1939 did not differ from the species recorded as sold through the Hobart Fish

Market between 1910 and 1923, indicating that fishing methods employed during the two periods were basically the same, and the high catches recorded in the later period cannot, therefore, be explained by changes in fishing method. By the 1930s, however, new fishing were being exploited and this may explain the high catches made during the that period. Gill netting was carried out in almost all of Tasmania's inshore waters, including those of the west coast (Tasmania, Sea Fisheries Board 1930), during the 1930s and the extension of fishing into these more distant bays would have allowed the supply of fish to be maintained. In giving evidence to an Inquiry into Tasmania's fisheries, the Secretary of the Sea Fisheries Board gave his opinion on trends in the fish catch over the previous years:

> **Although the fishermen taking scale fish made a record catch in 1939 compared with previous years, this I think has been the outcome of intensive fishing in the home and middle grounds.**
>
> (Tasmania, Attorney General's Department 1940; p.147)

It is of interest to note that almost all fishermen who gave evidence at this Inquiry were of the expressed opinion that fish were once again becoming scarce.

4.2.3 1941 to 1962

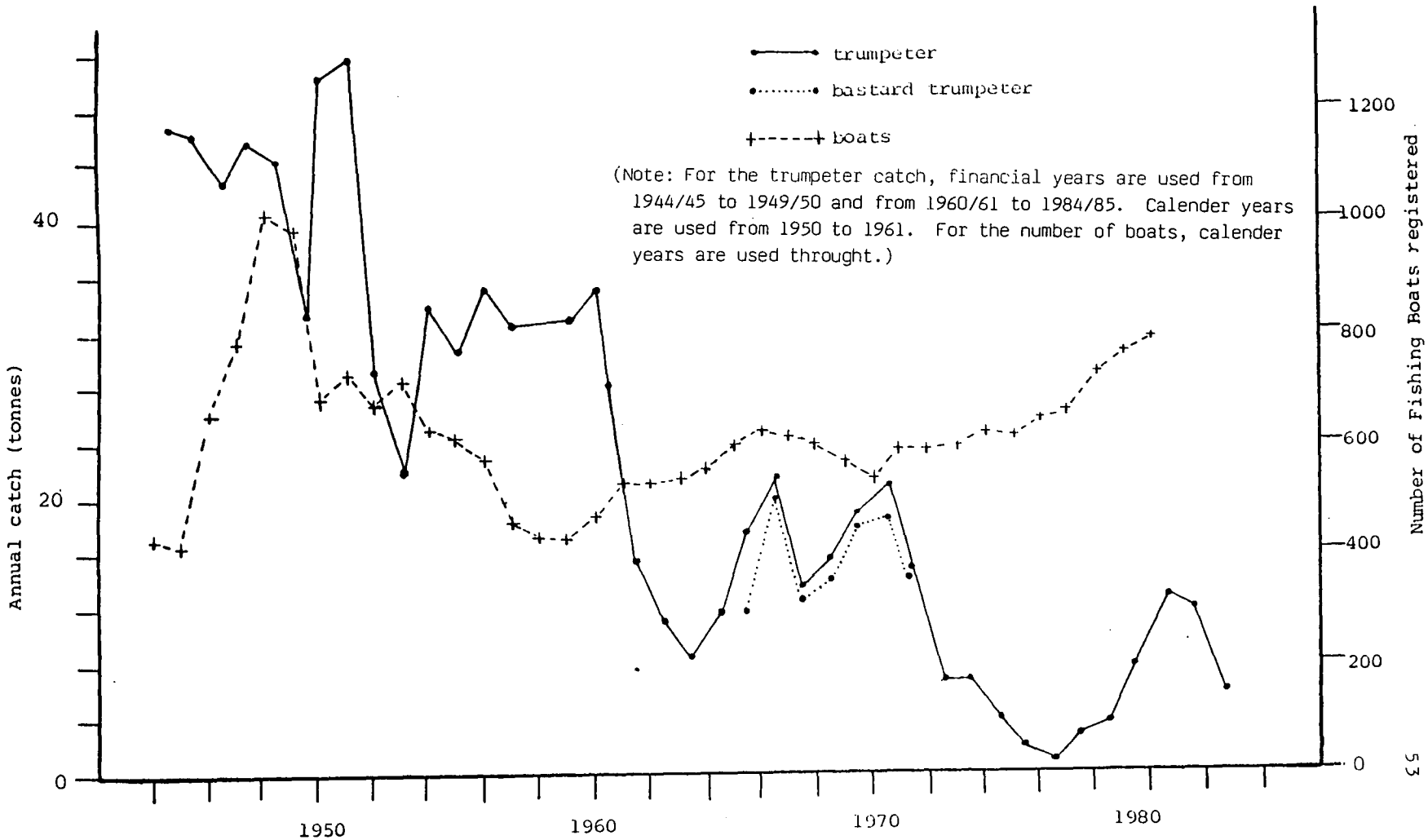
In 1941 the Sea Fisheries Board became defunct and a Sea Fisheries Division, under the umbrella of the Department of Agriculture, was established. The Sea Fisheries Advisory Board was set up to

administer the new Sea Fisheries Division. Changes to the regulations made at the time of this administrative change made it obligatory for commercial fishermen operating in Tasmanian waters to provide the Sea Fisheries Division with figures on their monthly catch. This allowed the authorities to make relatively accurate estimates of the total monthly catch of each species, particularly for those commercially important species, such as snoek (Thyrsites atun), which were the sole target of a specific fishing method. For species of lesser economic importance, especially those which comprised only part of a catch, it is probable that the records are less accurate, as many fishermen probably omitted such catches from their returns. However, the extent to which the records underestimate the catch of fish of lower commercial importance, such as bastard trumpeter, cannot be estimated.

Publication of fish catch statistics based on information obtained from fishing returns was delayed for a number of years, allowing fishermen time to become acquainted with the completion of the returns. The first figures published in the Annual Reports of the Department of Agriculture were those for 1944/45. The annual total (live) weight of "trumpeter" caught in Tasmanian waters, as given in the Annual Reports, for the period 1944/45 to 1961 are shown in Figure 4.3 together with the catch for later periods (see section 4.2.4) and the numbers of fishing boats registered in Tasmania each year. A major shortcoming of the data obtained from the Annual Reports is that no distinction was made between two species which shared the common name "trumpeter": catches of striped trumpeter (Latris lineata) and

Figure 4.3

Estimated (live) weight of trumpeter captured and number of fishing boats registered in Tasmania 1944/45 tO 1983/84



bastard trumpeter (Latridopsis forsteri) were lumped together. However, in the literature striped trumpeter have consistently been regarded as the scarcer of the two species, and it is probable that the greater part of the "trumpeter" catch during the period 1944/45 to 1961 comprised bastard trumpeter.

Annual catches of trumpeter recorded from 1944/45 to 1948/49 remained level at approximately 45 tonnes per annum. In 1949/50, the catch fell to 30 tonnes, or 67% of the average annual catch of the preceding years. The catch increased in 1950 and 1951 to a peak of 52 tonnes, but fell to 22 tonnes in 1953. Over the remaining eight years to 1961/62, the annual catch of trumpeter fluctuated between 23 and 35 tonnes.

4.2.4 1963 to 1984:

A new system of collecting catch statistics was introduced in June of 1963, following the Commonwealth-State Fisheries Conference of the previous year. A uniform methodology was adopted by all the Australian States and Territories in order to obtain more consistent and comprehensive information on fish catches. Commercial fishermen were obliged to complete monthly returns, giving the total catch weight of each fish species landed, the area in which they were caught, and the numbers of men and vessels involved in the catch. This data was collected and directed to the Australian Bureau of Statistics (A.B.S.) in Canberra where it was "mechanically prepared". The summarised results for each State were then published in the

Bureau's respective "Year Book".

The information collected in this way was not directly comparable with the information on annual catches previously published by the Department of Agriculture. For instance, fish caught in Tasmanian waters but landed at mainland ports were no longer included in the Tasmanian catch statistics. Although it is unlikely that mainland boats were engaged in gill netting in Tasmanian inshore waters to any great extent, there would have been some lowering of the recorded catch for certain Tasmanian species.

As for the information previously published by the Tasmanian Department of Agriculture, the data on fish catches given by the Australian Bureau of Statistics did not separate the two "trumpeter" species. However, the Department of Agriculture continued to publish figures on fish catches and in its Annual Reports for the years 1966/67 to 1971/72 gave the annual catch of bastard trumpeter and striped trumpeter separately. Although the total "trumpeter" catch (i.e. the sum of the bastard trumpeter and the striped trumpeter catches) given in the Annual Reports of the Department of Agriculture did not correspond exactly with the "trumpeter" catch as given by the Australian Bureau of Statistics in the Tasmanian Year Books, the Department's figures allowed the proportion of the catch from the A.B.S. data attributable to each species to be calculated for the six year period 1966/67 to 1971/72, and these have been plotted seperately in Figure 4.3.

The total recorded catch of "trumpeter" fell steadily from 1966/67 to 1976/77. As bastard trumpeter constituted the major component of the "trumpeter" catch throughout the period 1966/67 to 1971/72, the annual catch of bastard trumpeter must also have fallen significantly over this period. The bastard trumpeter catch of 1976/77 was, at most, 2% of the bastard trumpeter catch for the year 1966/67. The annual "trumpeter" catch increased from 1 tonne in 1976/77 to 13 tonnes in 1981/82, the latter figure representing 25% of the peak catch (51.9 tonnes) in 1951. The annual catch declined in the final years and was 6 tonnes in 1983/84, representing 11% of the 1951 catch.

4.3 Catch versus fishing effort: 1944/45 to 1984

Trends in the fish catch alone are not indicative of changes in the abundance of fish and catch records need to be discussed in the light of trends in fishing effort. The number of fishing boats licensed each year to operate in Tasmanian waters is shown with the trumpeter catch in Figure 4.3. The sharp rise in the number of fishing boats operating in Tasmanian waters between 1944 and 1948 has been attributed, in the main, to a stimulation of the snoek ("couta") fishery and initiation of a shark fishery in Tasmania with the onset of the Second World War (Tasmania, Parliament 1982). Boat numbers dropped dramatically after 1949, largely due to the influx of cheap imported frozen fish (Tasmania, Parliament 1982) and then dropped to a low of 429 in 1959. Thereafter, numbers generally increased steadily to present day levels, except for a slight decline in the late 1960s. The general increase in the size of the fishing fleet in later years

has been attributed to increased costs of imported fish and a consequent increased demand for fresh fish, and to developments in the crayfish, abalone and deep-sea fisheries (Tasmania, Parliament 1982).

The trumpeter catch remained stable from 1944/45 to 1948/49, rose in 1951, and thereafter generally declined. At first glance, it is tempting to relate this decline to a reduction in fishing effort. However, caution is needed in interpreting the data and accepting too readily that the reduction in the size of the fishing fleet alone caused the decline in the catch. Firstly, the catch remained high up until 1951, while a major part of the reduction in the size of the fishing fleet occurred between 1948 and 1950. Secondly, the decline in the trumpeter catch occurred during a period in which the reduction in the size of the fishing fleet was temporarily arrested. Conversely, the number of boats declined again between 1954 and 1959, while the annual trumpeter catch stabilised. Thirdly, the reduction in the number of fishing boats occurring between 1948 and 1959 was not mirrored by declines in the annual catch of most fish species. Snoek was the major exception, the decline in the annual catch of this fish matching closely the decline in the number of boats. Shark catches also declined between 1948 to 1960, although to a lesser extent. Finally, the size of the fishing fleet recovered steadily after 1959, while the trumpeter catch fell dramatically between 1960/61 and 1964/65, and again between 1970/71 and 1976/77.

Trends in the numbers of fishing boats do not, therefore, explain the overall decline in the trumpeter catch. This is largely because they

do not reveal trends in gill netting, the fishing method by which trumpeter are taken, and it may be that the catch declined simply because gill netting declined. Historical information on gill netting is scant. A possible means of overcoming this problem would be to examine the trends in the catch of other fish species commercially caught with the gill net. However, only one other fish of commercial importance is taken, predominantly, in this way, warehou (Seriolella brama). Furthermore, catch records for this species are of little value as catches were recorded under the name "trevally" which is shared by other fishes.

It is known, however, that in 1939, 221 fishing boats were engaged in fishing in Tasmania and that approximately 86 of these worked in the scale fisheries (Tasmania, Attorney Generals Department 1940). As deep-sea fishing was not well developed in Tasmania at that time, a large proportion of these boats would have used gill nets. In the same year, bastard trumpeter comprised 9.3% of the total scale fish catch (by numbers). In 1948, the fishing fleet numbered 1005 (Figure 4.3), a five fold increase. However, bastard trumpeter comprised only 0.1% of the scale fish catch for that year, suggesting that the increase in the number of fishing boats was accompanied by a decrease in gill netting effort.

The reduction in the size of the fishing fleet after 1949 was due primarily to a collapse of the snoek and shark fisheries. Gill netting effort may or may not have declined during this period and no information is available to shed further light on this matter.

However, it is known that in 1979/80, when the trumpeter catch had declined to a fraction of that of 1949, gill nets were used by a significant portion of the fishing fleet. Of the 139 fishing boats under 6 m (excluding 96 abalone boats) registered in that year, 116 were recorded as using gill nets (Tasmania, Parliament 1982). Overall, it would appear that the general decline in the trumpeter catch over the period 1944/45 to 1983/84 was not matched by a decline in commercial gill netting effort. Indeed, it would appear that commercial gill netting effort today is comparable and may be even higher than that of 1939, and it is likely that commercial gill netting effort in the intervening years was of a similar magnitude.

4.4 Summary

A decline in the annual catch of bastard trumpeter features as a common thread throughout the catch records. Prior to 1910, no records of the annual fish catch were kept. However, in the late nineteenth century, landings of most fish types, including those of bastard trumpeter, fell to such an extent that fisheries became the subject of a Royal Commission. The report of that Royal Commission took the view that inadequate protection of juvenile stocks and nursery areas had led to the observed falls in the annual catches of many species (Tasmania 1882).

Evidence of a decline in the annual catch of bastard trumpeter, and most other fish types commonly captured, from 1910 to 1918, comes from records of fish sold each year through the Hobart Fish Market. The

price increases of bastard trumpeter relative to those of other fish types suggest that bastard trumpeter became particularly scarce in the fishing grounds of the day.

In the 1930s, there was a change in the nature of the statistics from numbers of fish sold through the Hobart Fish Market to numbers of fish caught for sale in Tasmanian waters. Although the annual catch of bastard trumpeter fluctuated significantly from 1930 to 1939, this period is the only one studied in which no overall decline in the bastard trumpeter catch was recorded. The evidence suggests that the catch was maintained throughout this period by more intensive fishing of the inshore waters.

A general decline in the trumpeter catch, of which bastard trumpeter appears to have consistently comprised the greater portion, occurred over the period 1944/45 to 1983/84. Although information on gill netting effort is scant, the decline in the commercial catch does not appear to have been the result of a decline in commercial gill netting effort over this period.

Before discussion on the likely causes of this general decline in the catch of bastard trumpeter, it is necessary to examine more closely the commercial catch, to look at recent trends in the non-commercial catch, and to examine what is known on the biology of this species.

CHAPTER FIVE

THE PRESENT COMMERCIAL CATCH OF BASTARD TRUMPETER, (1978 - 1982)

5.1 Introduction

Historical records of the bastard trumpeter catch in Tasmania examined in the previous chapters provide information on the size of the annual catch but contain few details of the catch-effort and none on the distribution of the catch. Information of this nature is now contained, however, in the monthly fishing returns completed by commercial fishermen. Apart from the problem of confidentiality, an archival search of these fishing returns would reqire enormous effort. However, the data from fishing returns is placed on computer file and the Tasmanian Fisheries Development Authority (T.F.D.A.), now the Sea Fisheries Department, kindly made available the computer print-outs for the four year period 1978/79 to 1981/82. Information on the bastard trumpeter catch was compiled manually from these files.

Interpretation of the information was tedious and not without its logistical problems. Fish species, fishing methods, and fishing areas were all numerically coded. Furthermore, commercial gill netting represents a relatively minor mode of fishing in Tasmanian waters, being carried out in conjunction with one or more other fishing methods, and the T.F.D.A.'s records lumped together all catches made by minor fishing methods (gill netting, drop lining, seining, trawling, fyke netting, and deep-water gill netting) into the one

category, coded "097" (other methods). It was necessay to be able to distinguish in some way between catches which were made using a gill net (inshore) and those using other minor fishing techniques. The method employed to achieve this was simply to examine the (numerically coded) composition of the catch and to compare it to the data in Table 5.1 (i.e. a key to common Tasmanian fish species and their predominant mode of capture) prepared with the assistance of T.F.D.A. officers. The gill net catches could then be separated from others. Any bastard trumpeter caught by the other minor fishing methods were assumed to be incidental only and excluded for the purposes of this study.

Table 5.1

Minor fishing methods in Tasmania and major species captured by each method.

GILL NET	FYKE NET	TRAWL	DROP LINE	DEEP WATER GILL NET	BEACH SEINE
Yellow-eyed mullet	Eel	Shark	Deep-sea Trevalla	Shark	Australian Salmon
Bastard trumpeter		Snoek	Ling	Trevally	Yellow-eyed mullet
Leather jacket		Morwong			
Parrot fish		Ling			
Snoek		Hake			
Trevally		King Dory			
Southern rock cod		Gurnard perch			
Australian salmon		Tiger flathead			

5.2 Catch Statistics

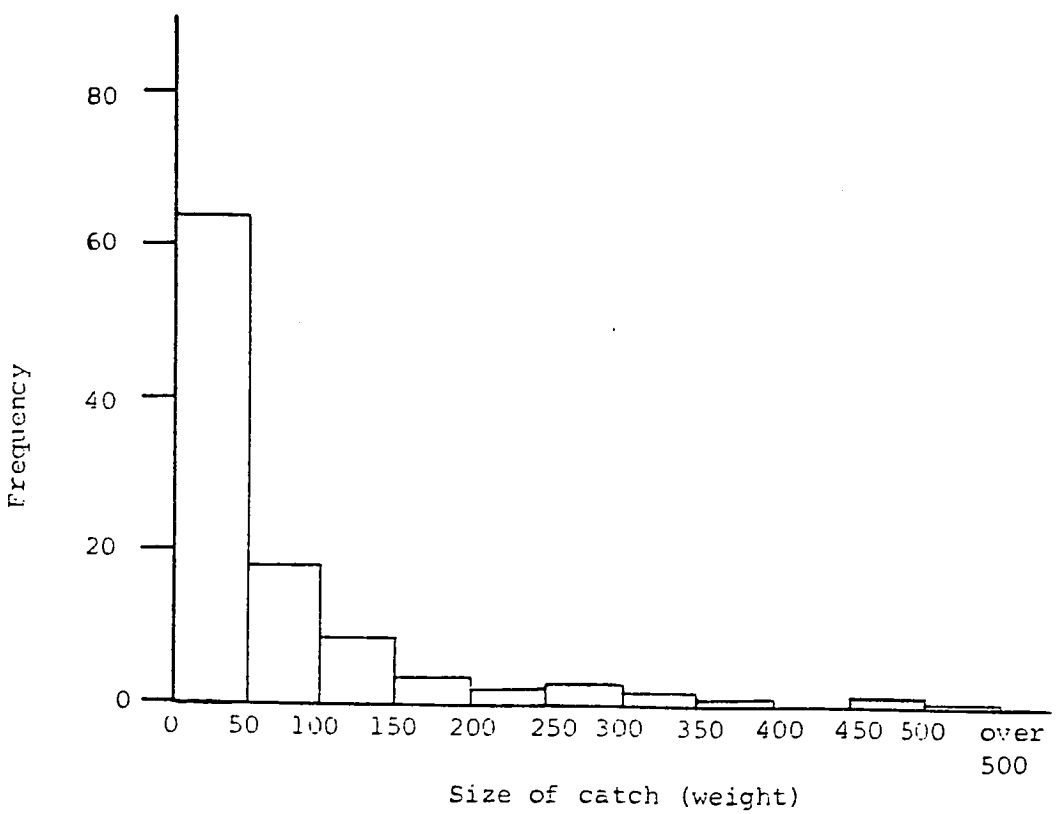
5.2.1 Size of catch

The degree of correspondence between the manually calculated annual bastard trumpeter catch and the annual "trumpeter" catch published by the A.B.S. (see Figure 4.3) was low. The difference between figures from the two sources was greatest for 1978/79, the calculated (bastard trumpeter) catch of 11.5 tonnes being almost three times higher than the "trumpeter" catch (4 tonnes) given by the A.B.S. for that year. The total calculated catch over the four years 1978/79 to 1981/82 was 39.9 tonnes compared with a total trumpeter catch of 29 tonnes as published by the A.B.S. The reason for these discrepancies is that after 1977, the A.B.S. ceased to rely on figures obtained from fishing returns to calculate the annual catch of each species and used instead the weight of fish purchased from fishermen by fish buyers on the assumption that these were likely to be more accurate (Brett, personal communication). Although the T.F.D.A. data underestimates the annual catch, trends on the area, size and seasonality of the bastard trumpeter catch obtained from this data are still likely to be accurate.

The average size of the monthly catch of bastard trumpeter per boat is small. Figure 5.1 gives the frequency of the catch size of the individually recorded boat catches of bastard trumpeter from July 1978 and June 1982. Less than 10% of the monthly boat catches were over 150 kg, and more than 60% were under 50 kg.

Figure 5.1

The size of bastard trumpeter catches, July 1978 to June 1982.

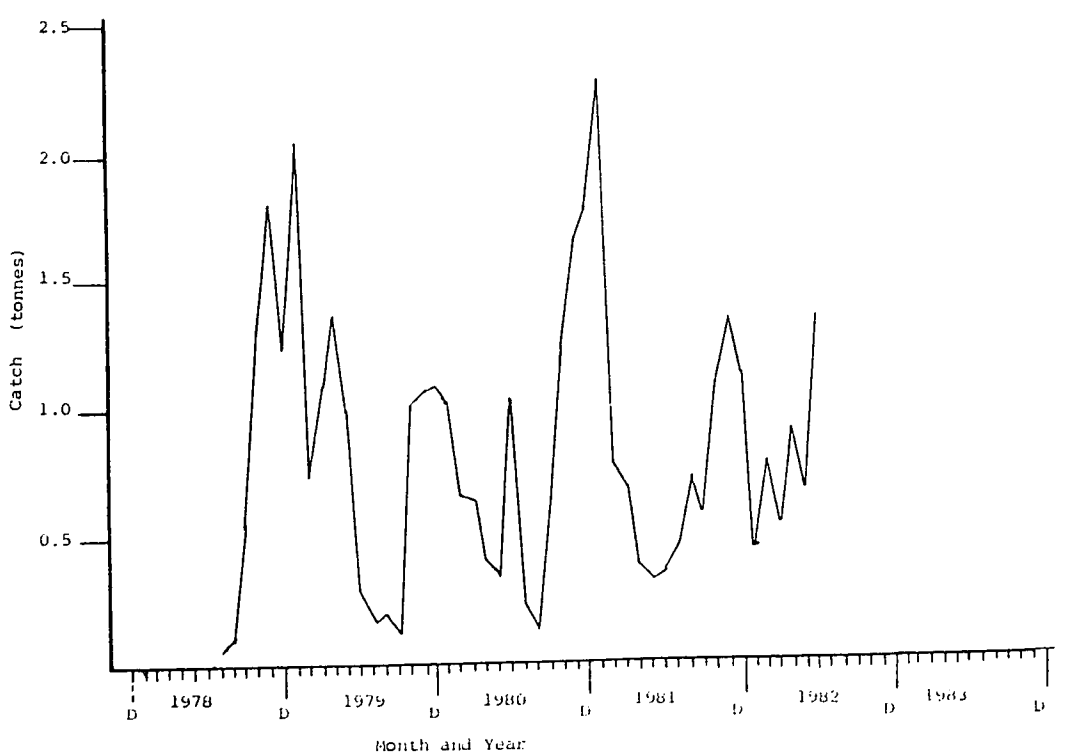


5.2.2 Seasonality of Catch

The monthly catch of bastard trumpeter from July 1978 to June 1982 is shown in Figure 5.2. It is apparent that the catch has a tendency to peak over the summer months and to fall over winter. Two reasons may account for this. Firstly, while there is no closed season for commercial gill netting, poor weather and rougher seas lead to a general curtailment of fishing activity during winter. Secondly, the commercial crayfishing is closed during September and October for male crayfish and over August, September and October for female crayfish. No commercial crayfishing is therefore undertaken during September and October and as commercial gill netting is frequently carried out in conjunction with crayfishing, gill netting activity may also decline during these months.

Figure 5.2.

Monthly catch of bastard trumpeter, July 1978 to June 1982.



5.2.3 Distribution of catch.

For the purposes of fisheries statistics, the waters of Tasmania are divided into fishing "blocks" defined by one degree of latitude and one degree of longitude. Major bays, estuaries and channels are ascribed separate block numbers. Information on the catch of bastard trumpeter from each of these blocks was extracted from the T.F.D.A. records and the average annual catch of bastard trumpeter in each block was calculated for the years 1978/78 to 1981/82. This information is shown in Figure 5.3.

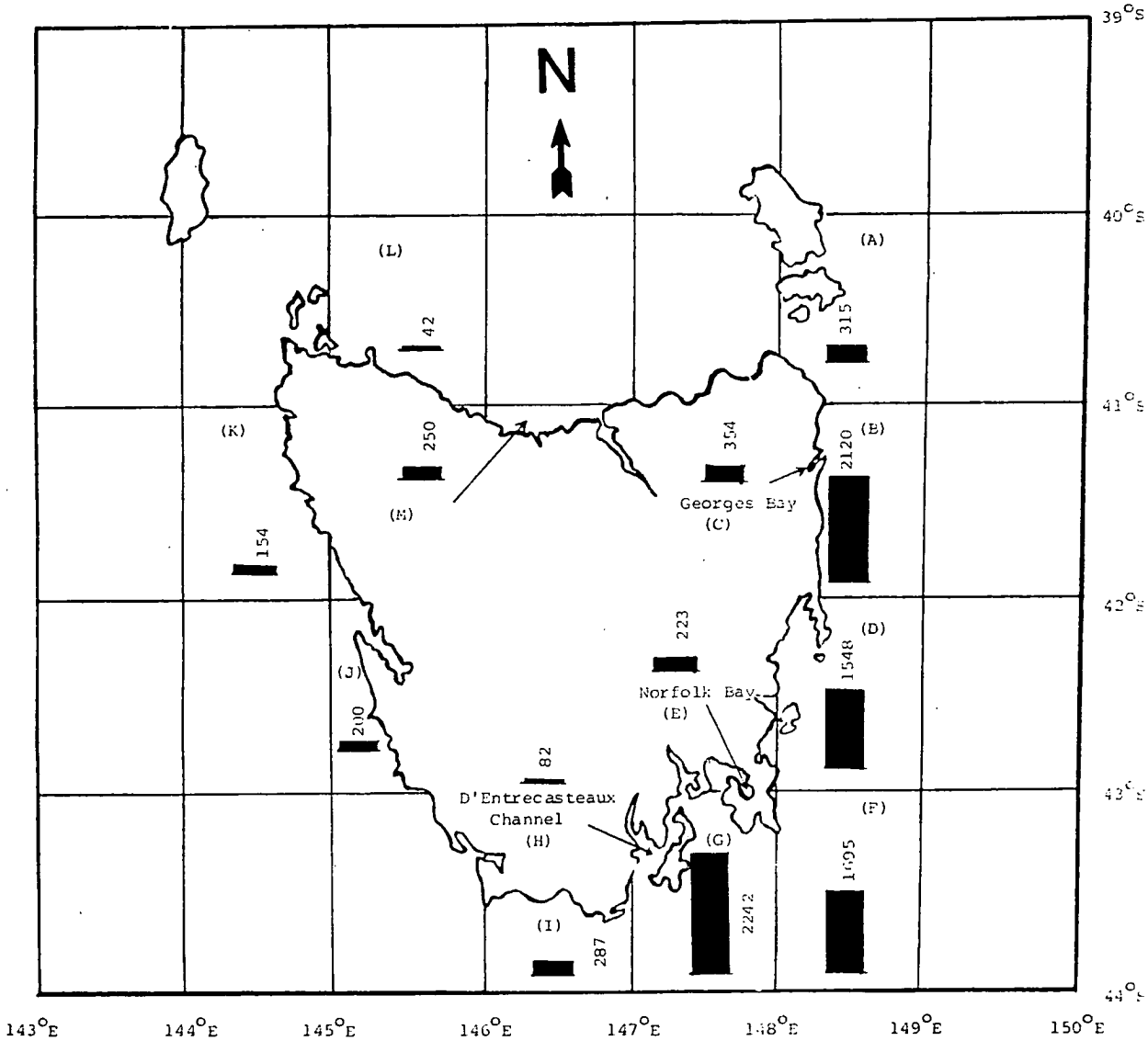
It can be seen from Figure 5.3 that the greatest part of the bastard trumpeter catch in Tasmania is made in the waters of the eastern and south eastern coasts. Catches along the the western and southern coasts are relatively small, possibly due to the lower fishing effort in these areas resulting from adverse weather conditions. The sea bed adjacent to the more sheltered northern coast is sandy, and catches here are also small.

5.2.4 Catch-per-unit-effort

Inshore gill netting in Tasmania is a secondary fishing method only, and fishing returns do not contain information on the effort associated with the gill net catch separate from the effort associated with the primary catch. It was not possible, therefore, to obtain figures on the gill netting effort from the T.F.D.A. print-outs. With no other information available, mean monthly catch per boat is used

Figure 5.3

Average annual catch (kg) of bastard trumpeter in each fishing block, 1978/79 to 1981/82.



here as a crude measure of catch-per-unit-effort.

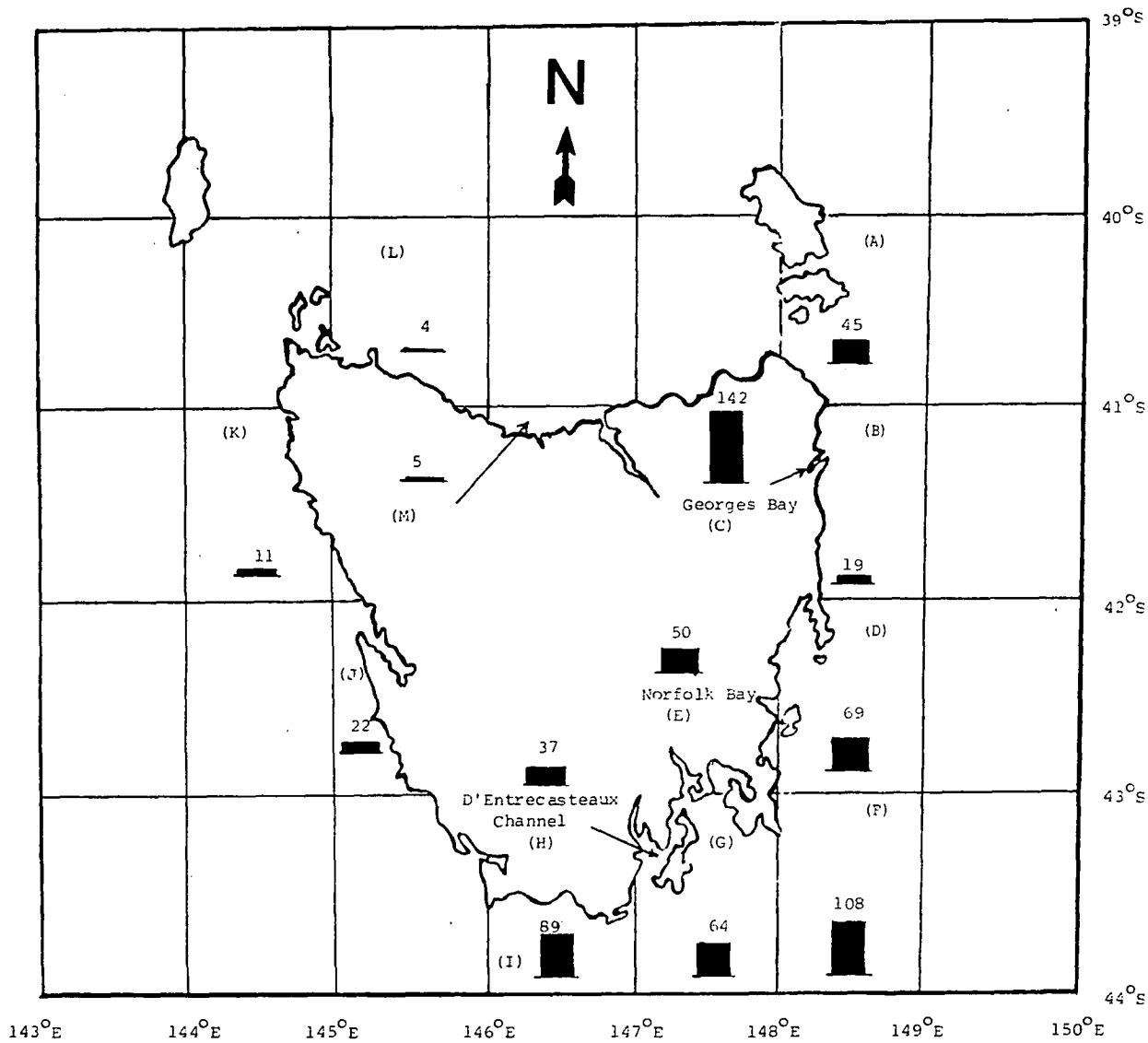
The mean monthly catch per boat was calculated for each "block" over the four year period (Figure 5.4). The eastern and southeastern blocks displayed the highest catch-per-boat, the greatest value being 142 kg in George's Bay (block C). The northern and western blocks showed a low catch-per-boat, but that of the southern block (I) compared favourably with the catch-per-boat of the south eastern blocks (E,F,G,H) and was higher than two of the eastern coastal blocks (B,D). While the average catch from block I was low (287 kg, Figure 5.4), the sizes of the individual catches were high (up to 89 kg).

5.3 Summary

Commercial fishing boats engaged in gill netting activity in Tasmanian waters rarely record a monthly catch of bastard trumpeter over 500 kg and monthly catches per boat of this species are generally of the order of fifty kilograms. Commercial gill netting effort is high in summer and low in winter and the monthly catches follow this same pattern. The greatest catch of this species is made in the coastal waters of the eastern and south eastern regions of Tasmania. Low annual catches recorded in the northern region most probably are linked to the sandy nature of the sea bed in that region, while unfavourable weather conditions are the most likely cause for the low commercial catch of this species recorded in southern and western regional waters. Individual boat catches from the southern region

Figure 5.4

Mean catch per boat of bastard trumpeter in each fishing "block".



are high, although few catches are recorded from these waters.

Discrepancies which exist between T.F.D.A. and A.B.S. estimates of the annual catch of bastard trumpeter suggest that the quantity of this fish landed as reported by fishermen in their fishing returns may be overestimated. Furthermore, the A.B.S. figures themselves may also underestimate, by a small amount, the annual catch of this fish as these do not take into account sales direct to the public or to the smaller dealers.

CHAPTER SIX

THE NON-COMMERCIAL CATCH OF BASTARD TRUMPETER

6.1 Introduction

Gill nets are used in a non-commercial sense in Tasmania by two groups: amateur fishermen and professional rock lobster fishermen (crayfishermen). The former use these nets to take fish for private consumption. The latter may employ gill nets to take fish for sale (i.e. in a commercial capacity), but also use them to obtain bait for "cray pots". Fish caught for bait are defined here as part of the non-commercial catch. Persons using gill nets for non-commercial purposes are not required to license their nets, nor to complete returns of their catches. It is not possible, therefore, to obtain direct information on either the numbers of persons engaged in non-commercial gill netting in Tasmania or the size and composition of the non-commercial catch.

A study on gill netting would not, however, be complete without some attempt at addressing the question of present levels of non-commercial netting. Information on recreational fishing and commercial crayfishing is therefore examined in order to gauge the approximate extent of non-commercial gill netting in Tasmania.

6.2 Recreational gill netting

Frequent disputes between recreational and commercial fishermen, in Tasmania and elsewhere, have been the primary reason for the formation of recreational fishing associations. A large part of the campaign strategy of these associations has been to obtain figures on participation levels in recreational fishing with the aim of impressing authorities with the numbers of their (potential) clientele. Survey data of this nature represents a major source of information on recreational fishing and, in Tasmania, the results of one such survey are available: a national survey of recreational fishing in Australia undertaken by the Australian Recreational Fishing Confederation in 1984. Another fisheries survey, which canvassed household consumption of fish and ownership of fishing gear in Tasmania, was conducted by the Australian Bureau of Statistics in 1983. The results of these surveys on recreational fishing are discussed below, together with past trends of recreational netting and commercial crayfishing in Tasmania.

6.2.1 National recreational fishing survey, 1984

P.A. Management Consultants were contracted by the Australian Recreational Fishing Confederation in 1984 to undertake a national study of recreational fishing. As part of the study, a random sample of 2448 persons, including 174 (7.1%) from Tasmania (Hobart), were interviewed and their fishing habits canvassed (Australian Recreational Fishing Confederation 1984a, 1984b). The results of the

study indicated that ownership of boats (yachts, dingies, and motor boats) was higher in Tasmania than in any of the other Australian States (79 boats per 1000 population compared with a national average of 35 per 1000 population) and that 37% of Hobart's population engaged in recreational fishing of some form at least once a year. The only Australian State capital estimated to have a higher percentage of its population engaging in recreational fishing at least once a year was Brisbane (40%).

The high per capita ownership of boats in Tasmania is significant in the light of the findings of an earlier study of recreational fishing in South Australia by Philipson and Rohan (1983), who found that fishing frequency was approximately three times higher for fishermen owning a boat than it was for other fishermen. If this is also the case in Tasmania (given that most boats are used for recreational fishing, see Section 6.2.2), the high per capita ownership of boats would indicate that the total level of recreational fishing in Tasmania is high.

It is unfortunate that the results of the national survey by P.A. Management Consultants are limited somewhat by the small size of the survey sample and, more importantly for the purposes of the present study, by the failure to differentiate between inland and sea fishing.

6.2.2 Australian Bureau of Statistics Survey, 1983

The second survey of recreational fishing in Tasmania discussed here is that conducted by the Australian Bureau of Statistics (A.B.S.) as part of its monthly population survey for October, 1983 (Australian Bureau Of Statistics, Tasmanian Office, 1984). The Tasmanian branch of the A.B.S. was asked by the Tasmanian Fisheries Development Authority to include in this monthly survey a series of questions on fish consumption and fishing activities of persons aged 15 years or more. Two thousand one hundred households were surveyed (approximately 1.8% of Tasmanian occupied households), 17.8% of which were found to own or part-own a boat, and a further 11% were reported as having access to a boat. Fishing was the primary function of the boat in 69% of households owning a boat and 39.9% of recreational fishermen indicated that they fished from a boat. On the question of fish consumption, the survey revealed that 26% of households caught their own fish or were given fish as their main fish supply. This compared with 29% of households which bought fish as their main supply.

The results of the A.B.S. survey were most revealing on ownership of fishing equipment and fishing habits, indicating that 6.6% of household owned "graballs", compared to 4.0% owning craypots and 5.0% owning beach seine nets (households occupied by professional fishermen were excluded from these results). The Bureau also estimated that 14824 persons in Tasmania aged fifteen years or older used graballs at least once a year (unpublished data from the A.B.S. survey). This

estimation included instances where more than one person used a single net and the number of graballs used by recreational fishermen would be somewhat lower than this figure. Approximately one third of persons who used graballs did so at least once a month and approximately 15% used them at least once a fortnight.

6.2.3 Trends in recreational gill netting

Although no statistics are kept on the numbers of recreational nets in use or on the numbers of persons using these nets, trends in the number of non-commercial crayfish pots licensed each year in Tasmania may be an indicator of amateur gill netting trends. There are some obvious similarities in craypot and gill net usage by amateur fishermen, such as the fact that both require the use of a boat and both require one trip to set the net or pot and another to recover it. However, there are also differences between the two and these differences are likely to make any similarity in the trends of amateur gill netting and amateur use of craypots approximate only. In particular, gill nets have been used by non-commercial fishermen in Tasmania since the early days of European settlement and no licence or licence fee has been required, while craypots were introduced in the mid 1950s and non-commercial fishermen have had to pay a licence fee in order to use them.

It is likely that any trends in the numbers of recreational fishermen using gill nets in Tasmania each year will be determined by a number of socio-economic factors, such as the price of petrol and increased

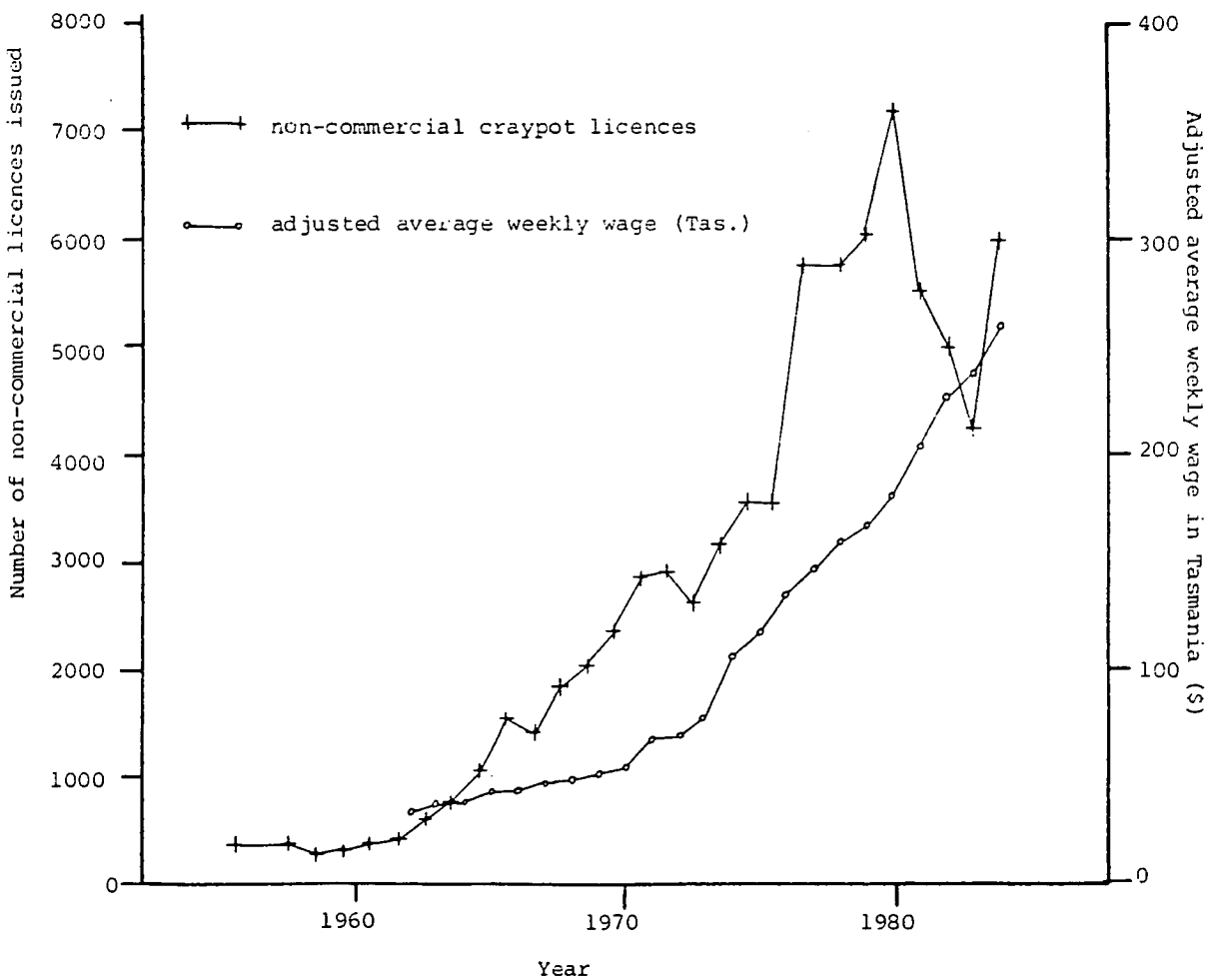
leisure time. It is also likely that the numbers of non-commercial craypot licences issued each year would be influenced in a similar manner by these same factors. Lenanton (1979) showed that the increase in the number of non-commercial fishing nets registered in Western Australia from 1950 to 1977 correlated highly with both the increase in average household surplus income and the increase in the number of motor boats registered each year in Western Australia over the same period.

The number of non-commercial craypot licences issued each year in Tasmania between 1955/56 and 1984 are shown in Figure 6.1 together with trends in the adjusted average weekly wage. The number of licences issued represents the number of craypots used by recreational fishermen, as the non-commercial craypot licence permits the use of one craypot only. The number of non-commercial craypots licenced each year began to increase rapidly after 1961/62, with small declines in 1966/67 and 1975, and a more significant decline between 1981 and 1984. This latter decline in the number of non-commercial craypot licences coincided with annual increases in licence fees from $5 in 1980 to $12.50 in 1981, $13.20 in 1982, and $16 in 1983. In 1984, the licence fee remained at $16 and the number of licences taken out increased.

Non-commercial gill netting would most probably have been higher than that of non-commercial craypotting throughout this period for the simple reason that no licence fee or registration of nets has been required for the former activity. This is borne out by the findings

Figure 6.1

Numbers of non-commercial craypot licences and adjusted average weekly wage in Tasmania, 1955/56 to 1984.



of the Australian Bureau of Statistics survey (Section 6.2.2) in which 6.6% of Tasmanian households were found to own graballs compared to 5% owning craypots. Other reasons why the number of nets used by recreational fishermen is likely to have been consistently higher than the number of non-commercial craypot licences taken out each year is, firstly, that non-commercial fishermen were not restricted in the number of nets each could use up to 1966, and thereafter they were allowed to use two at the one time, and secondly, that there is no closed season for amateur gill netting while there is a closed season for female crayfish from August to November and for male crayfish from September to November.

Despite the differences between non-commercial gill netting and craypotting, it is highly probable that non-commercial gill netting activity in Tasmania has increased in a similar manner but to a lesser extent as did the two parameters shown in Figure 6.1. This increase is more likely to have been steady and sustained, as in the case of changes in average weekly wages, than to have undergone a decline of 1980 to 1983 as displayed by the number of non-commercial craypot licences issued, as this decline appears to be related to licence-fees. It could be reasonably argued, therefore, that amateur gill netting in Tasmania most probably increased steadily and significantly from the early 1960s to the early 1980s.

6.3 Gill netting for crayfish bait

The extent to which professional crayfishermen use nets as a means of obtaining bait for their craypots is difficult to determine. It is known that many crayfishermen will turn to almost anything when seeking to find "bait", including penguins, cormorants, and wallabies (Wolfe, personal communication). While one professional crayfisherman has been reported using cuttlefish, octopus, squid and elephant fish as cray bait (Baker 1982), it is uncertain to what extent the more saleable fish caught in gill nets, such as bastard trumpeter, are also used for this purpose.

Smith and Ferguson (1969), in their economic survey of the Tasmanian crayfishery, found that by far the largest source of bait was imported frozen fish pieces and that crayfishermen generally only turned to other sources of bait if the quantity of frozen bait proved inadequate for the trip or if the fishing boat had no refrigeration system on board. The authors made the comment that netting for bait was avoided where possible, as effort expended in this way meant reduced effort for crayfishing.

However, the crayfishing industry in Tasmania is large in comparison to the scale fishery. In 1974/75, for example, the value of the crayfish catch in Tasmania was $ 8,057,000, or 50% of the total value of the Tasmanian fish catch for the year. The value of the scale fish catch, excluding salmon and snoek, for the same year was $ 329,000, or 4% of the value of the total fish catch (Tasmania, Parliament 1976).

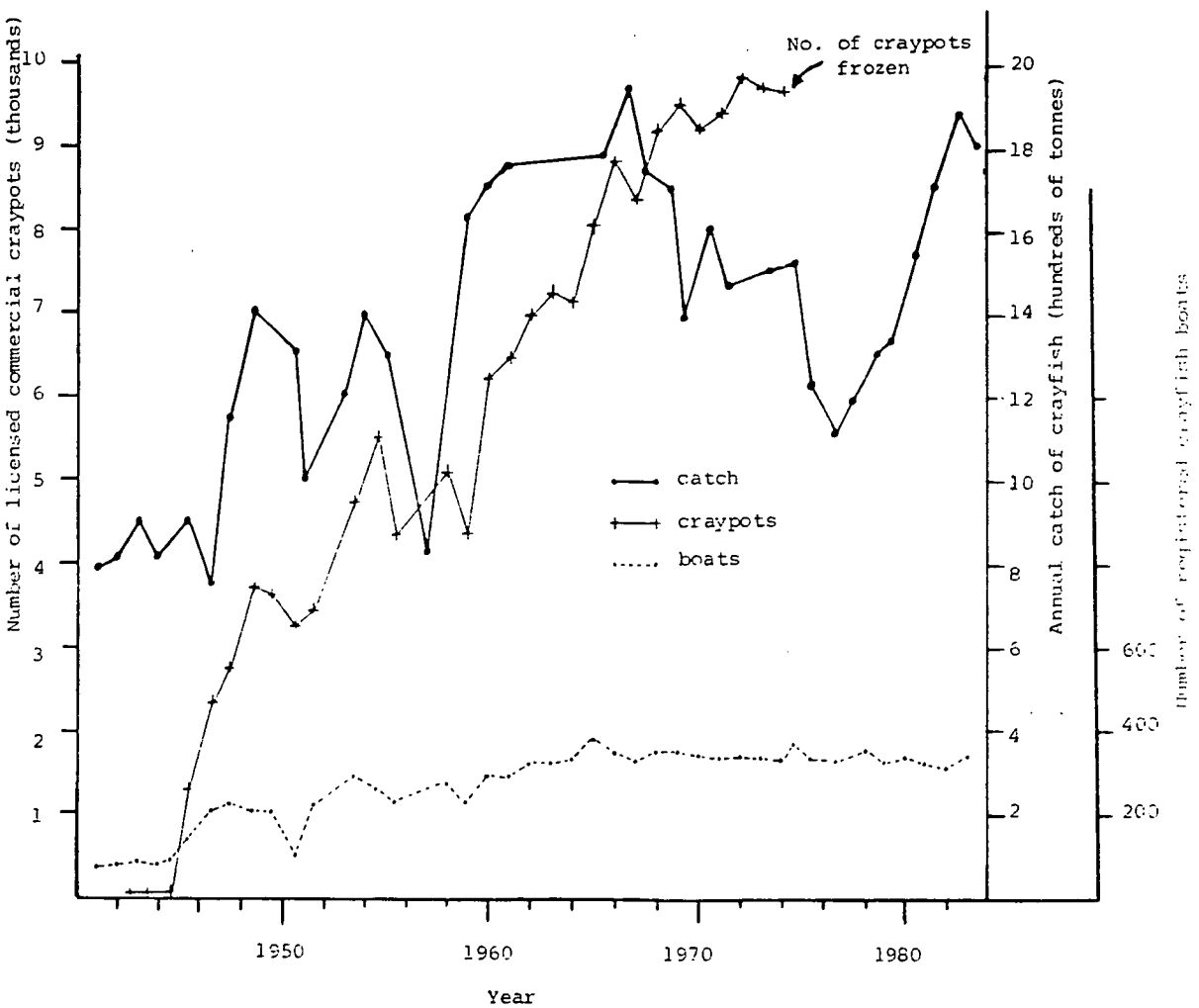
It is likely, therefore, that whatever the extent of gill netting for bait, it is significant in comparison to the extent of gill netting undertaken for the purpose of capturing fish for sale, and could well be higher. Moreover, it would appear that part of the total commercial gill netting activity is undertaken by crayfishermen. Smith and Ferguson (1969) found that scale fish (other than salmon and snoek) accounted for approximately 3% of the total income of crayfishermen. Since crayfish made up approximately half of the total value of the Tasmanian fish catch in that year, this would mean that scale fish captured for market by crayfishermen accounted for approximately 1.5% of the value of the total fish catch. Scale fish made up approximately 4% of the total value of the Tasmanian fish catch in that year and, therefore, crayfishermen accounted for about one third of the commercial scale fish catch (other than snoek or salmon).

Whether or not crayfishermen use certain species of fish captured in their gill nets, such as bastard trumpeter, for bait would likely be dependent on factors such as whether or not the boat is fitted with refrigeration equipment, the ability to sell these fish, and the quantity of each species captured.

Since the crayfishing industry undoubtedly uses significant quantities of gill netted fish for cray bait, it is worth considering how crayfishing effort has changed over the years. In Figure 6.2, the annual catch of crayfish in Tasmania from 1943 to 1983 is shown together with the number of commercial craypots and the number of

Figure 6.2

Numbers of commercial craypots and crayfish boats, and the annual crayfish catch in Tasmania, 1942/43 to 1983.



commercial crayfish boats licensed each year. The annual catch of crayfish is not a good indicator of crayfishing effort as this is more a function of regulations introduced to control the crayfishery and of changes in the abundance of the crayfish. Likewise, the number of registered crayfish boats cannot be used, on its own, as a measure of crayfishing effort.

The best simple indicator of annual commercial crayfishing effort is, with some qualification, the number of commercial craypots licensed each year. Regulations prohibited the use of the craypot in Tasmania until the early 1940s. From 1942/43 to 1946/47, the number of craypot licences taken out increased without a corresponding increase in the total catch of crayfish. The explanation for this is that crayfishermen replaced their older equipment ("cray rings") with craypots during this period. The general increase in the number of craypots licensed each year from 1946/47 to 1972, and particularly after 1959, indicates a substantial increase in crayfishing effort. In 1972, the Government placed a freeze on the number of commercial craypots and the numbers have remained approximately level since that time (though accurate figures are not available). Crayfishing effort is likely to have also stabilised after that time.

From this information, it is possible to deduce that the level of gill netting undertaken for the purpose of obtaining cray bait rose particularly sharply between 1959 and 1972, and most likely remained high, and approximately constant, after 1972.

6.4 Summary and Discussion

Although information on the extent of non-commercial gill netting is sketchy, it would appear that both recreational gill netting and gill netting by commercial crayfishermen as a means of obtaining cray bait have increased markedly since the early 1960s. In the case of recreational gill netting, the increase has most likely continued up to the present time while gill netting by professional crayfishermen seeking bait is likely to have plateaued in 1972. It is probable that the present levels of gill netting by both amateur fishermen and commercial crayfishermen seeking bait are at least as great as the level of commercial gill netting in Tasmania.

With respect to the bastard trumpeter, the non-commercial catch is likely to have followed these same trends. In the case of crayfishermen using gill nets to obtain bait for their craypots, the proportion of bastard trumpeter captured which has been used for bait may have declined relative to the proportion retained for sale on the market as outlets for small quantities of table fish increased in the late 1970s (Baker 1982). However, it is likely that, overall, the quantity of this fish used as crayfish bait increased significantly between 1959 and 1972, and has been approximately stable from 1972.

CHAPTER SEVEN

THE BIOLOGY OF INSHORE POPULATIONS OF BASTARD TRUMPETER.

7.1 Introduction.

Liberal regulation of netting in Tasmania is tied to the fact that bastard trumpeter do not take bait readily and are taken almost exclusively in gill nets. It is appropriate, therefore, that an examination of the inshore netting should include a study of the biology of this particular species.

Bastard trumpeter (Latridopsis forsteri, Castelnau 1872) commonly occur in the inshore waters and deeper reefs of New South Wales, Victoria, South Australia, Tasmania and New Zealand (Stead 1906; Doak 1972; Scott et al. 1974; Last et al. 1984). Only in Tasmania is this fish taken in commercial quantities, although the present commercial fishery is small (see Chapter 4). Until the recent publication of a study on the biology of bastard trumpeter (Harries and Lake 1985), almost no research had been conducted in this species. Studies have, however, been carried out on latrids in New Zealand where they form a substantial fishery. In particular, the work by Francis on the biology (1981a), spawning and migration (1981b), and management (1979) of the closely related Latridopsis ciliaris (blue moki) is of special relevance to investigations of bastard trumpeter biology.

Due to the paucity of information on the biology of bastard trumpeter,

a study was initiated in 1969 by Dr P. S. Lake, then of the Zoology Department of the University of Tasmania, to investigate the age, growth, maturity, colour phase and feeding of the inshore populations of this fish species. Specimens were caught in gill nets between 1969 and 1971. Scales, gonads and stomachs were removed and the weight, sex, colour and length of each specimen was recorded at the time of capture.

Analysis of gonads and stomach contents was undertaken at the University of Tasmania, but further analysis was discontinued when Dr Lake took up a position at Monash University in July 1976. The project had been shelved for a number of years when the author made contact with Dr Lake early in 1983. Analysis of the data was completed by the present author and a co-authored paper on the biology of inshore populations of the bastard trumpeter was subsequently published (Harries and Lake 1985). This chapter is largely a reproduction of that paper.

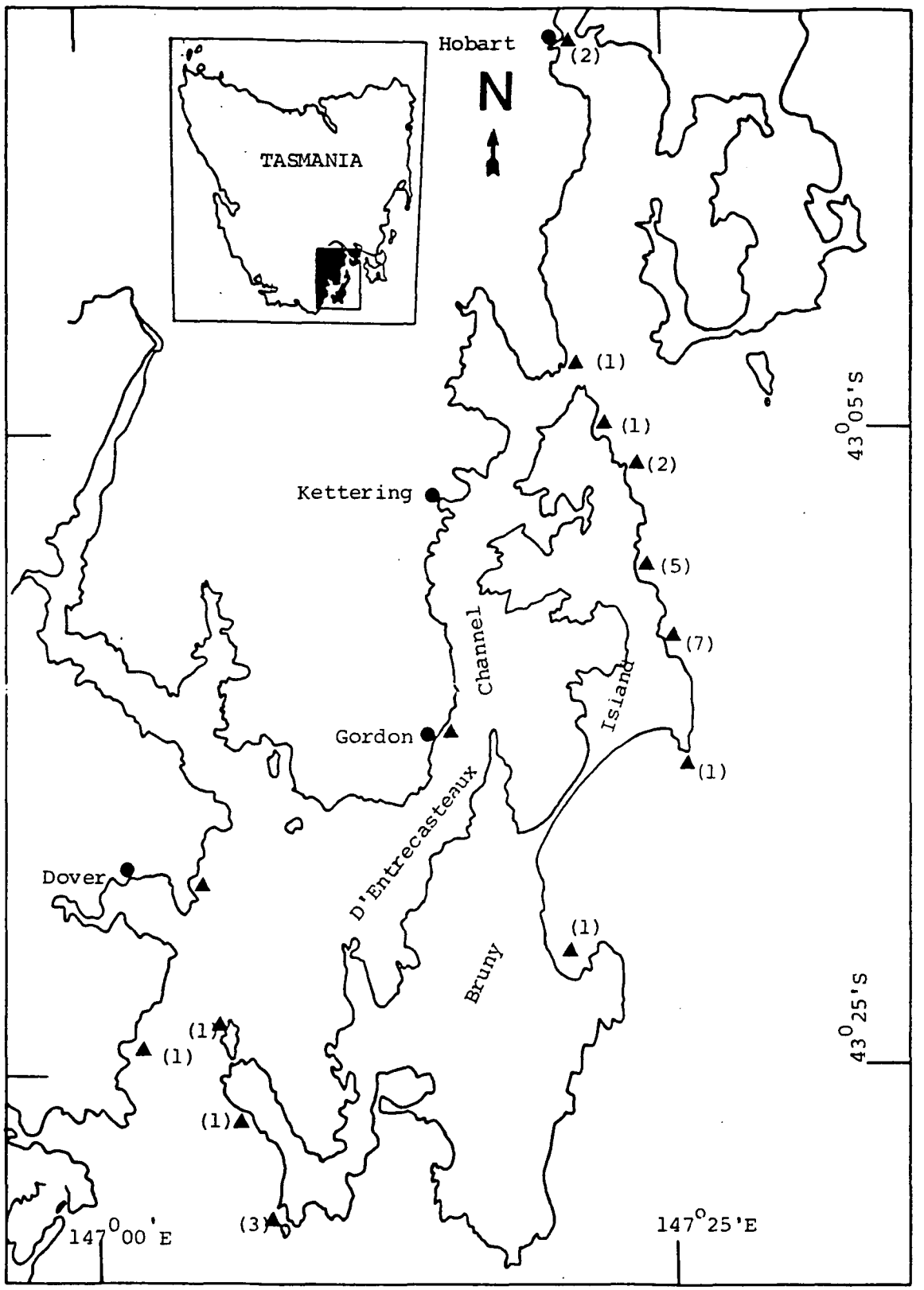
7.2 The Biology of Inshore Populations of Bastard Trumpeter

7.2.1 Research Methods

Four hundred and twelve specimens were caught in gill nets from January 1969 to January 1971. Standard graball nets, with a 4 1/2 inch mesh and 75 yards in length, were set from a 3 m dingy operated from the twelve metre Zoology Department's (University of Tasmania) research vessel "Neotrigonia". Figure 7.1 shows the locality of

Figure 7.1

Location sites visited to catch bastard trumpeter with number of visits to each site in brackets.



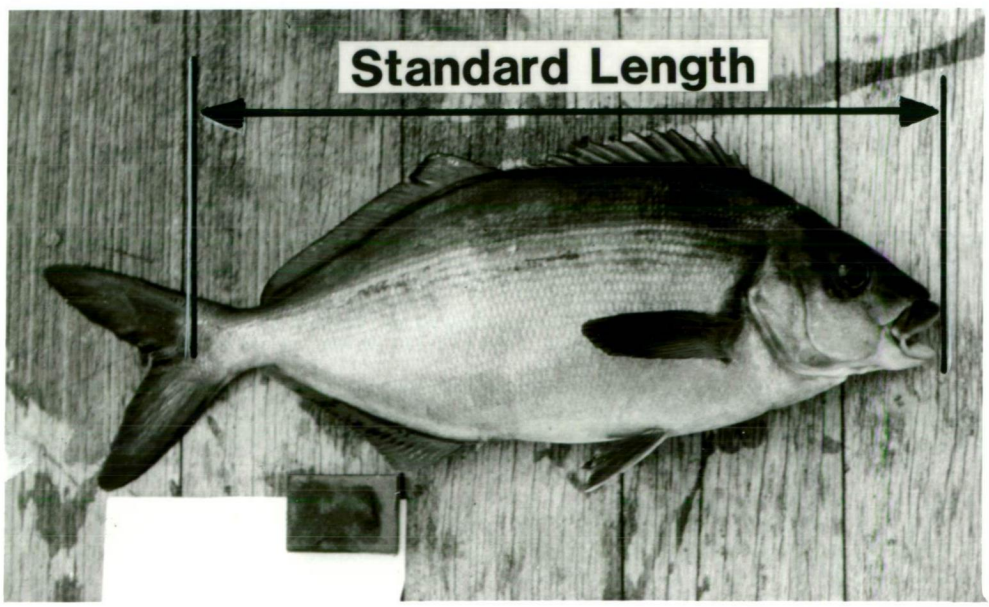
sample sites around Bruny Island and the D'Entrecasteaux Channel, south eastern Tasmania, and the number of visits to each site.

On each sampling occasion, between five and seven nets were used. Two shots were made before dark followed by one in the morning. Nets were set perpendicular to the shore in gutters between clumps of kelp (Macrocystis angustifolia) at about twenty metres from the shore and in depths ranging from three to eight metres for a period of one to one and a half hours.

Fish caught were processed on board the research vessel. The date of capture of each specimen and the sex, weight, colour phase and standard length (Figure 7.2) was recorded. Total lengths ("fork lengths") were not reliable because of tail damage caused by rock

Figure 7.2

Photograph of Latridopsis forsteri showing "standard length".



lobsters to a significant portion of netted fish. Gonads were removed and preserved in Bouin's solution. Stomachs and alimentary canals were removed, tied off with string and stored in 10% formaldehyde in seawater.

Scales were removed from the shoulder and placed in labelled envelopes. Later, in the laboratory, these were cleaned in 2N sodium hydroxide, rinsed in distilled water, dried and mounted on slides using polyvinyl alcohol. To prevent drying and subsequent curling, mounts were covered and sealed with nail varnish. Scales were viewed under a microscope and measurements were taken of the longest scale radius from the estimated mid-point of the nucleus (Figure 7.3a). The distance from the nucleus to each check was also recorded. The age of the fish was determined by counting the number of checks as described by Tesch (1971).

When the age of each fish was plotted against its length, the study population displayed inordinately rapid growth in the first year. This led the authors to hypothesise whether any growth check was added to the scale in the first year. To test this hypothesis, two specimens of the young school fish ("paper fish") were obtained from the Department of Sea Fisheries' marine laboratory and scales from these fish examined. No growth checks were evident on these scales (Figure 7.3b). The ages of the study sample specimens were therefore recalculated as one year older than the number of growth checks observed on the scales. The five smallest specimens in the study sample (standard lengths 15.0 to 16.0 cm) were considerably smaller

Figure 7.3a

Photograph of scale from four year old Latridopsis forsteri showing growth checks used in age calculations. (X 16)

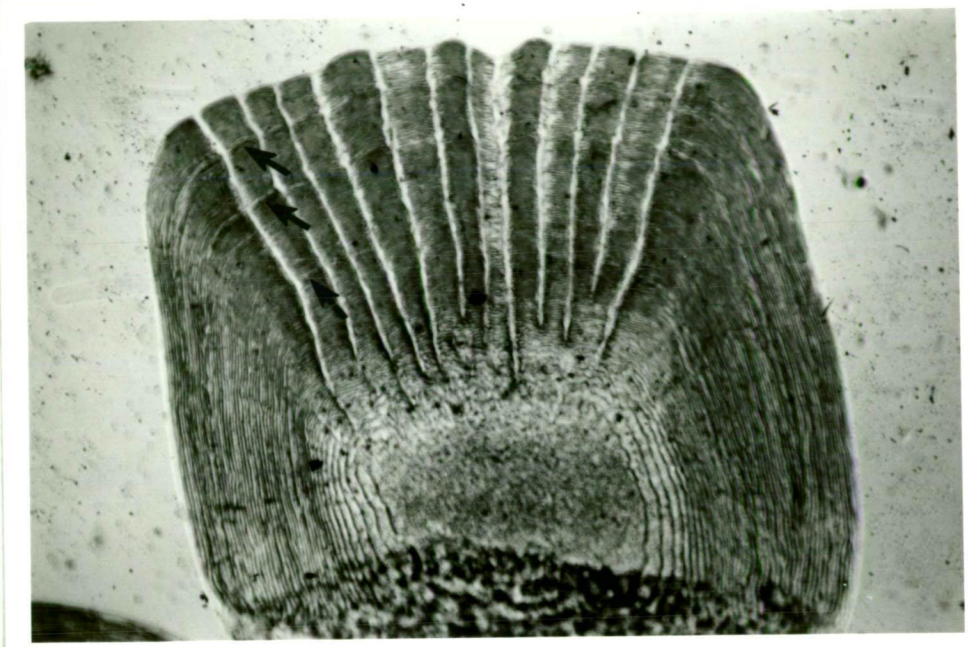


Figure 7.3b

Photograph of scale from "paper fish" (Latridopsis forsteri). (X 45)

than the next largest fish. These were plotted in the one year age class together with the two "paper fish" (standard lengths 15.9 cm and 16.7 cm).

To investigate any sampling bias due to selectivity of the gill nets, the weights of the study sample were compared with catch records of the Australian Spearfishing Championships held in Tasmania in 1973 and 1979.

7.2.2 Results

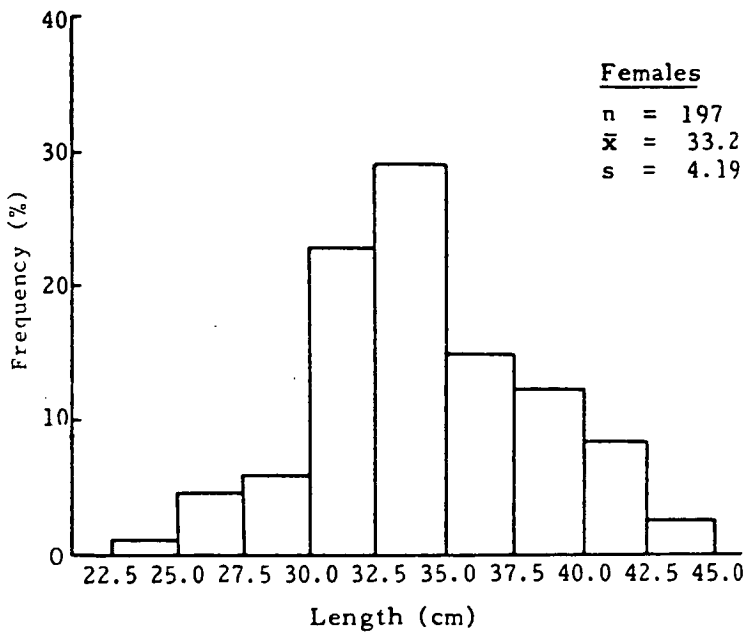
7.2.2.1 Size-age parameters

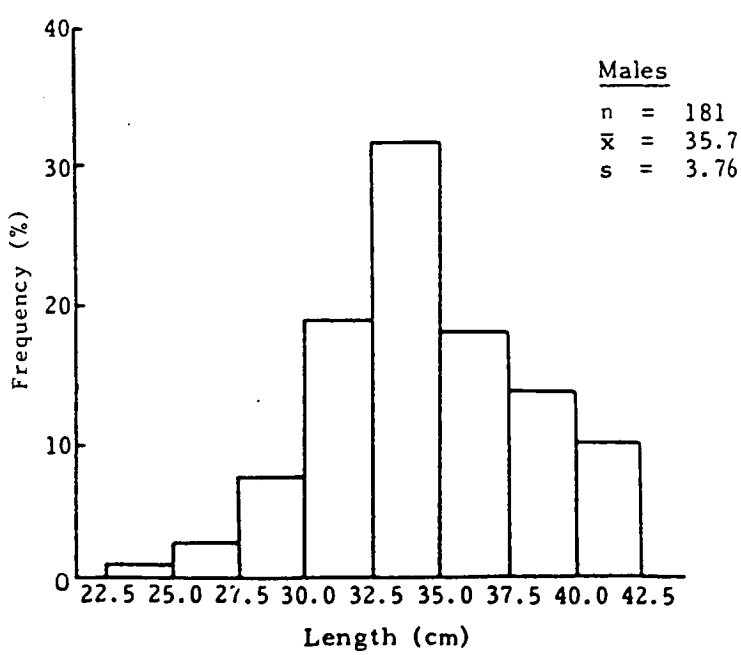
The length-frequency distribution of the total fish collected is given in Figure 7.4. Standard lengths ranged from 15.0 to 43.8 cm. The distributions for both males and females displayed modes at a length class of 32.5 to 35.0 cm.

Nets are well known to be size selective (Pope 1966; Hamley 1975; Trent and Pristas 1977; Grant 1981; Francis 1981a; Jones 1982), retaining medium fish and failing to capture small fish. In order to gain additional insight into whether the sample population was the result of size selective netting, records of bastard trumpeter speared at the Australian Spearfishing Championships were obtained from Dr Graham Edgar, now with the Division of Fisheries and Oceanography (C.S.I.R.O.) in Perth. The weights of the study sample were compared with those of bastard trumpeter speared in two Australian Spearfishing

Figure 7.4

Length-frequency distributions for male and female Latridopsis forsteri.





Championships held in Tasmania (1972, 1979).

Weight-frequency distributions for the study sample and for the three separate spearfishing trials are shown in Figure 7.5. Specimens recorded at the championships represented the largest a diver could spear. Most divers landed only the one specimen and only a minority of divers retained smaller specimens. The spearfishing catch was, therefore, size selective toward fish at the larger end of the spectrum of the inshore population.

The comparable results between the weights of the larger fish in the study sample and of the three spearfishing trials indicate that the study sample was not size selective against larger fish. The mean weight of specimens in the study sample (711.8 g) was comparable with the mean value of weights in each of the spearfishing trials (735 g, 753 g, and 604.8 g). The modal values of weight were also comparable in all cases (850 g, 550 g, 740 g) with that of the study sample (650 g). No assumptions could be made, on the other hand, concerning the presence of bastard trumpeter smaller than 15 cm in the study area.

The age-frequency distribution for the study sample is given in Figure 7.6. A predominance of fish in the study sample were aged from 3 to 5 years (60% of males; 53% females). Eight fish caught had reached five years of age (1.5% males; 4% females). The five fish caught aged less than two years were not sexed. Chi-square tests for heterogeneity indicated that the age classes between the sexes were not significantly different.

Figure 7.5

Comparison of weight-frequency distributions of Latridopsis forsteri between fish of the study sample (A) and fish speared at the Australian Spearfishing Championships held at Bridport in 1973 (B) and Grindstone Bay (C) and Bicheno (D) in 1979.

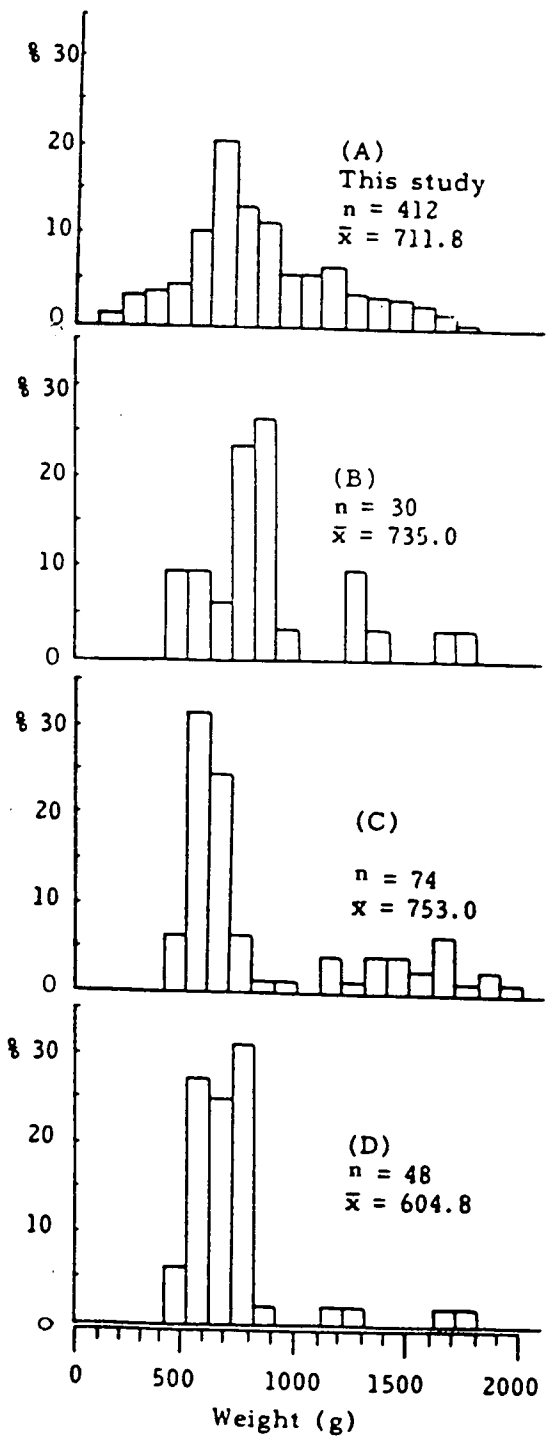
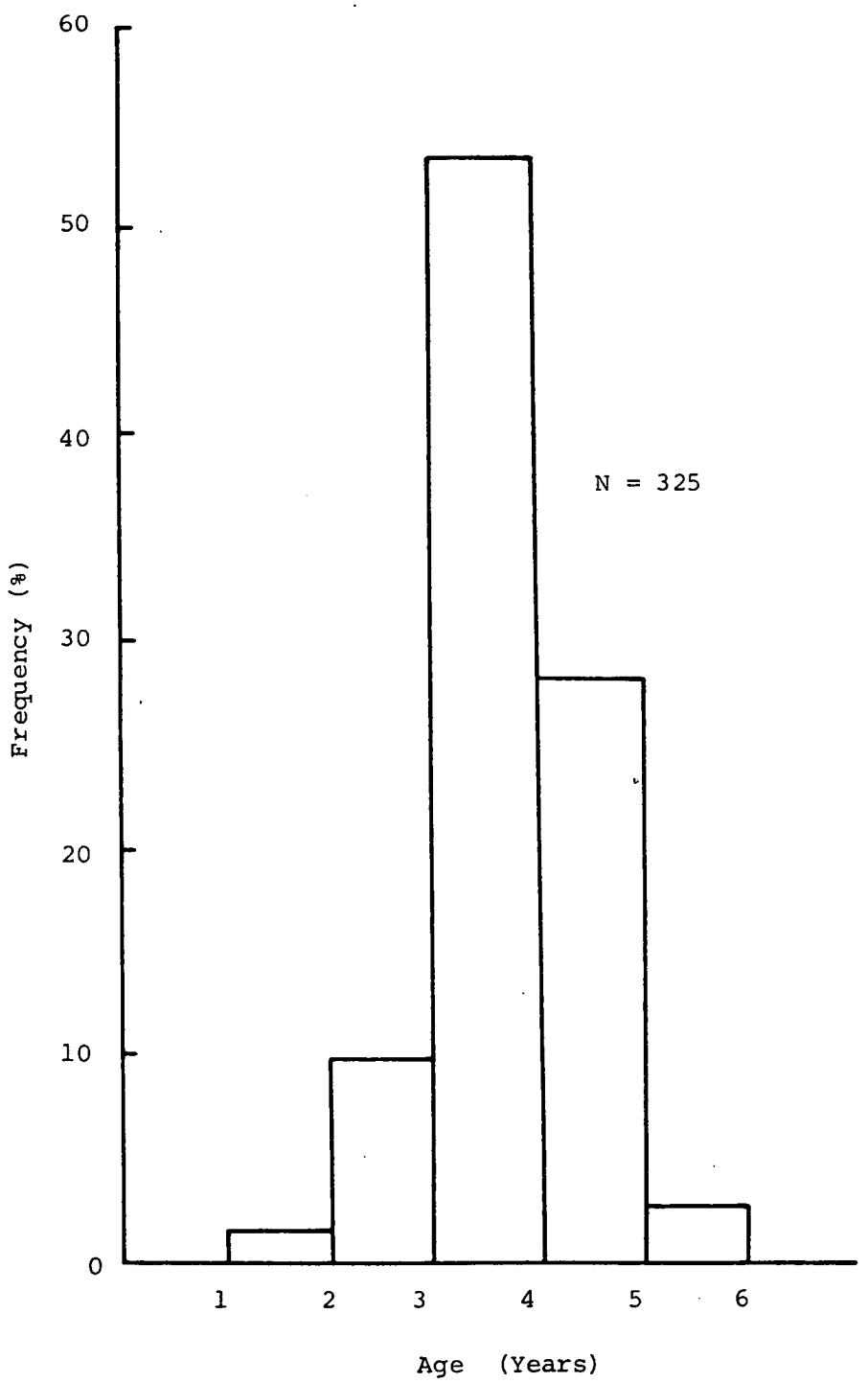


Figure 7.6

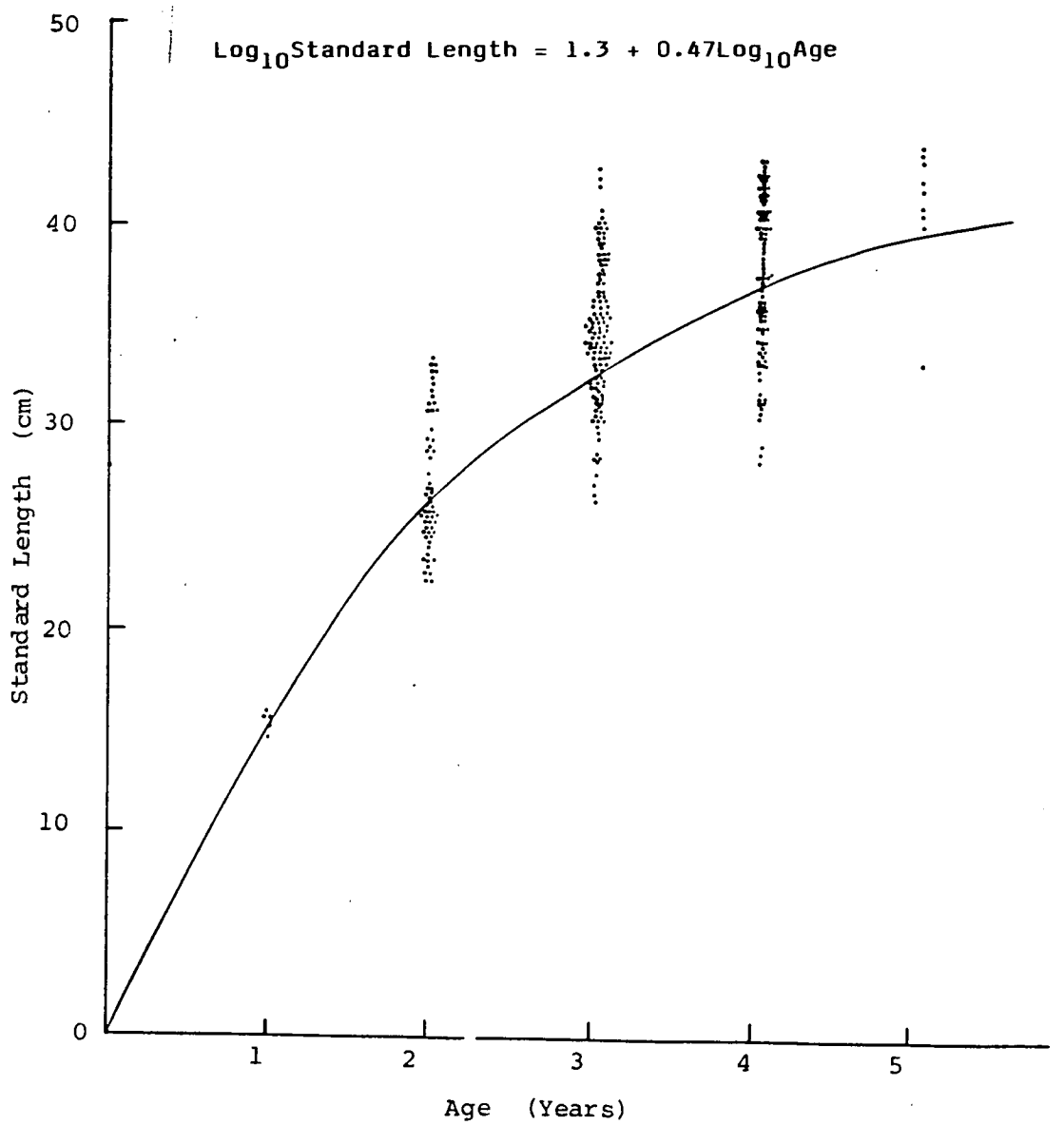
Age-frequency distribution of Latridopsis forsteri in the study sample.



The form of the age-length relationship was determined by a least squares fit to a log-log regression. The resultant curve was plotted as age against length (Figure 7.7) and closely resembled the growth curve for blue moki, Latridopsis ciliaris, obtained by Francis (1981a). There was a great deal of variability of growth as shown by the wide range of lengths present in any age class.

Figure 7.7

Age-length of Latridopsis forsteri in the study sample.



An estimate of terminal standard length was calculated using a "Walford Plot", as described by Tesch (1971). This consisted of calculating the mean length of fish at age t (l_t) and plotting this against the mean age of fish at age t+1 (l_{t+1}). The result was a straight line, indicating that the mean annual increment in growth is a constant fraction of the preceding year's growth increment. On the same graph, the mean length calculated for each age group was plotted against itself (null growth). Both of these straight lines were then extrapolated to find their point of intersection which corresponded to the terminal standard length (Figure 7.8). The estimate of the terminal standard length obtained in this way was 49 cm. The total terminal length, adding an estimated 8 cm for tail length, would then be in the vicinity of 55 to 60 cm. This is consistent with reports of the adult lenght of bastard trumpeter (Doak 1972; Pollard 1980).

A log-log regression was used to determine the weight-length relationship (Figure 7.9). From this graph it was calculated that a standard length of 49 cm corresponds to a weight of approximately 2.1 kg. Last et al. (1983) state that the largest bastard trumpeter captured in Tasmanian waters weighed 3.3 kg, while the largest captured in Australia was recorded as 65 cm in length and weighing 4.3 kg. The "adult" weight of bastard trumpeter was given by Saville-Kent late last century as ranging from 2.3 to 3.2 kg (5 to 7 lbs: Tasmania, Parliament 1885). Johnston (1882) described the bastard trumpeter as reaching a length of about 21 inches (53 cm) and, "rarley exceeding 6 to 7 lbs" (2.8 to 3.2 kg).

Figure 7.8

"Walford Plot" of length at age t (l_t) against length at age t+1 (l_{t+1}). The dotted line represents null growth and the solid line represents the extrapolated observed growth over three age classes. The estimated terminal standard length is where these two lines intersect.

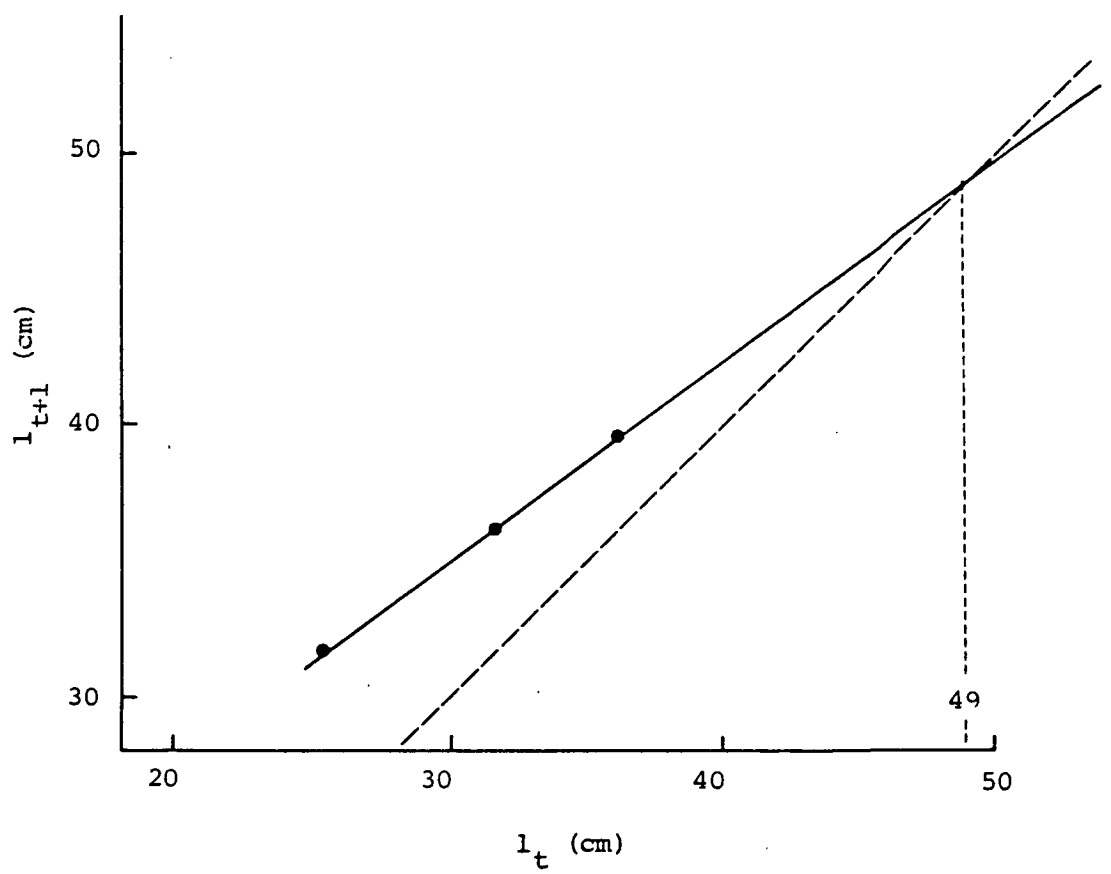
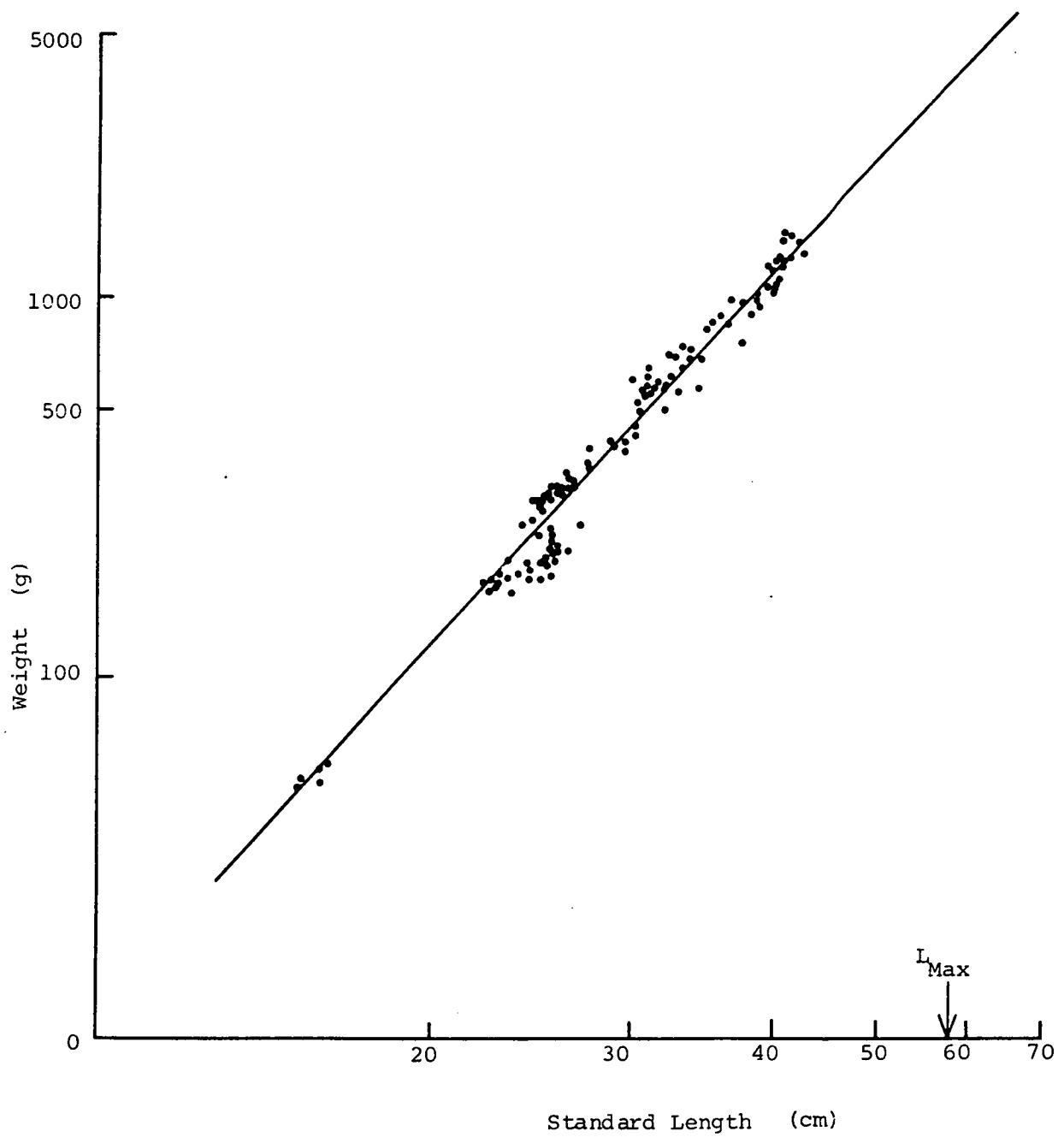


Figure 7.9

Weight-length relationship of Latridopsis forsteri in the study sample.

$$\text{Weight} = 5.7\ \text{Standard Length}^{1.53}$$



7.2.2.2 Back-calculation of lengths

To test the validity of the assumption that the number of checks on a scale was a direct measure of the age of the fish from which the scale was taken, a sample of 71 fish scales was used for back calculations (Tesch 1971). The scale radius-length relationship was determined from the least squares fit of the log-log plot and the mathematical expression for the relationship (Equation 7.1) determined. This equation was then used to fit a curve to the scatter plot of radius against length (Figure 7.10). Scale radius and length were highly correlated (r=0.82, n=246).

$$\log_{10}L = 0.682 \log_{10}R + 1.681 \text{ -------- Equation 7.1}$$

where: L is the standard length (cm), and

R is the scale radius (mm).

As most fish had scales which were either larger or smaller than the average for their particular length, it was necessary to make a correction for scale radius. Equation 7.2 (Tesch 1971) was used to make this adjustment.

$$\bar{S}_n = \bar{S}S_n / S \text{ ---------- Equation 7.2}$$

where: S is the actual scale radius,

S_n is the actual distance to the n^{th} check on the scale,

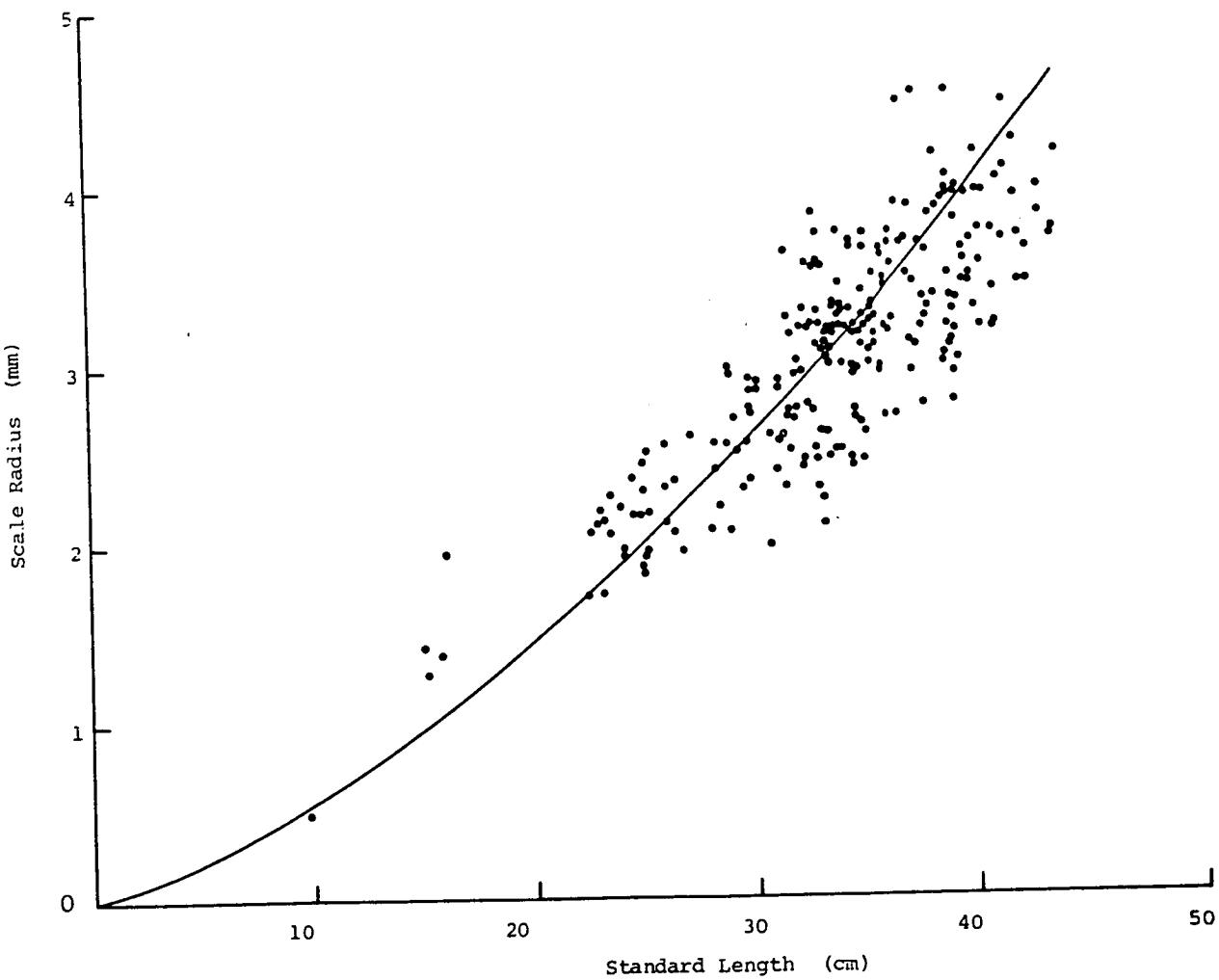
$\bar{S}$ is the average scale radius for fish of observed length, and

$\bar{S}_n$ is the adjusted distance to the n^{th} check.

Figure 7.10

Relationship between scale radius and standard length used in back calculations.

$$\text{Standard Length} = 76.03 \text{ Scale Radius}^{0.682}$$



Having been calculated from Equation 7.2, the adjusted scale radius was inserted into the equation determined for the scale radius-length relationship (Equation 7.1) to calculate the length of the fish at the time of formation of the n^{th} check (the "back calculated" length). Table 7.1 gives the mean back-calculated lengths for the sample of 71 fish. The mean back-calculated lengths were plotted against age. On the same graph, mean standard length was also plotted against age (Figure 7.11). The degree of correspondence between back calculated lengths and actual mean lengths for a given age supports the assumption that only one growth check occurs annually. The number of growth checks on the scale was, therefore, a valid measure of age.

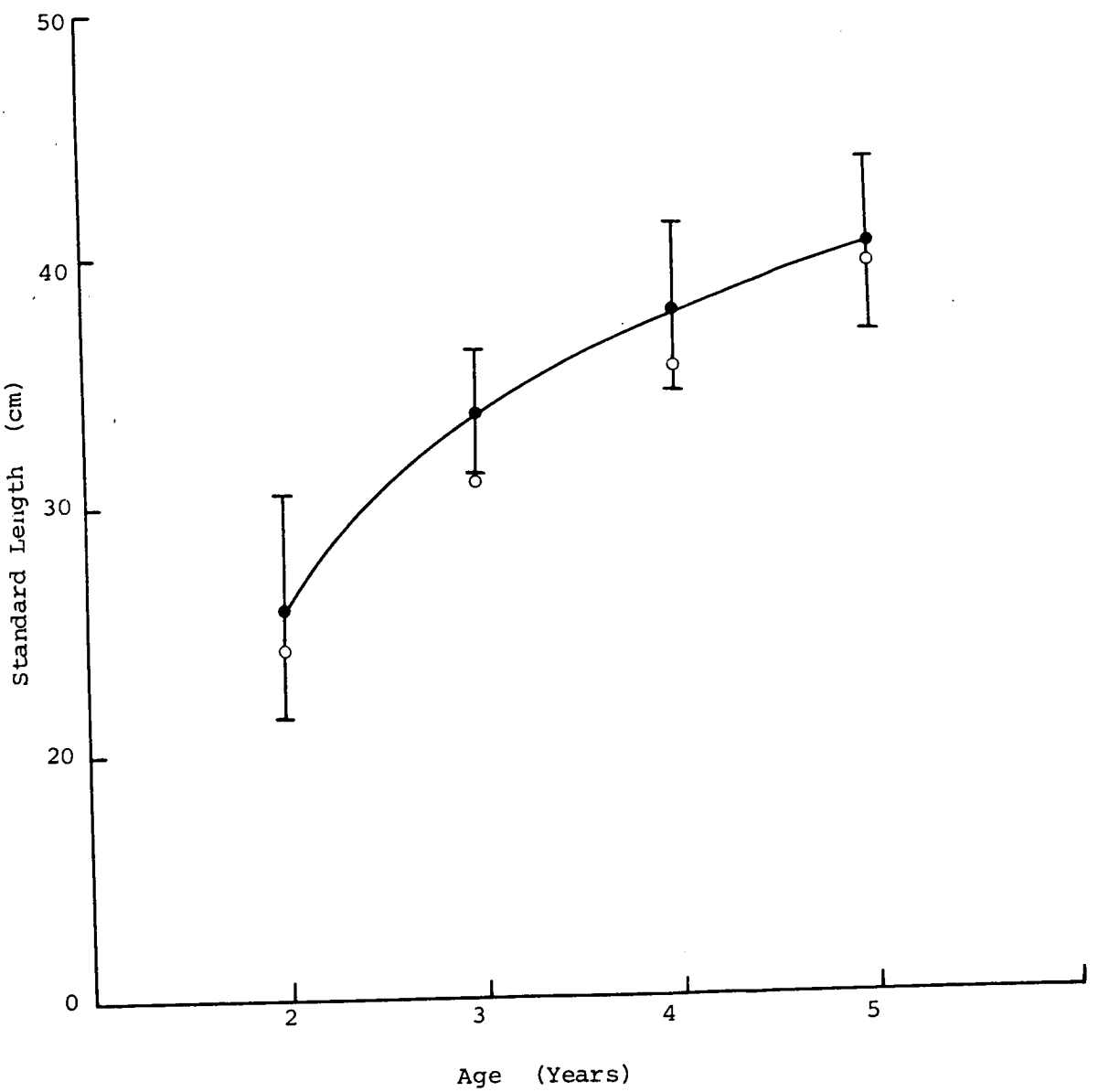
Table 7.1

Mean back calculated lengths for a sub-sample of 71 fish.

Age at capture	No. of fish	Length at age (cm)			
		2	3	4	5
2	10	25.33 σ = 8.35 SE = 3.74			
3	23	24.39 σ = 10.68 SE = 3.08	31.64 σ = 8.92 SE = 2.17		
4	33	23.92 σ = 11.57 SE = 4.15	30.62 σ = 11.20 SE = 3.93	35.99 σ = 9.88 SE = 3.74	
5	5	21.45 σ = 3.74 SE = 2.06	29.76 σ = 3.07 SE = 1.77	36.17 σ = 3.30 SE = 1.77	39.55 σ = 3.07 SE = 1.77
Mean		23.77	30.67	36.17	39.55
Weighted mean		23.89	30.51	36.17	39.55

Figure 7.11

Growth in Latridopsis forsteri in the study sample showing means found in the field populations (•) and means by back calculation (o). (Standard deviation shown)



7.2.2.3 Condition Factor

The condition factor, K, was calculated after Tesch (1971).

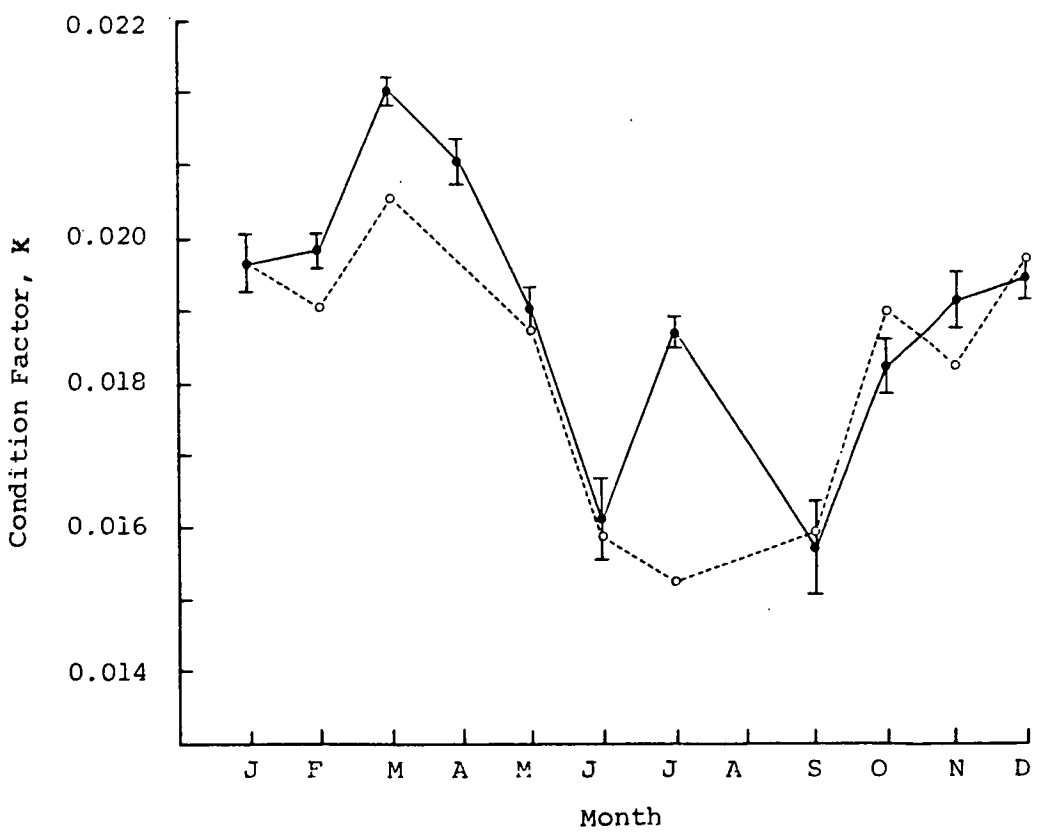
$$K = W/L^3 \quad \text{---------- Equation 7.3}$$

where: W is the weight (g), and L is the standard length (cm).

The mean value of the condition factor was determined for each month for males and females (Figure 7.12). In both cases, condition factors were low over winter and high in summer with a peak between February and April. In the case of females, a sharp mid-winter secondary peak occurred from July to September. No correlation existed between length and condition factor (r=0.004, n=185, females; r=0.003, n=159, males). From the changes in condition factor over the year, it is apparent that bastard trumpeter grow and reach peak condition in summer and autumn.

Figure 7.12

Mean monthly condition factor, K, for male (---) and female (---) Latridopsis forsteri in the study sample. (Standard deviations shown)



7.2.2.4 Age at Maturity

Gonads were inspected visually and classified into one of seven maturity stages as described by Niklosky (1963) and given in Table 7.2. All gonads fell into either the first ("Immature") or the second ("Resting Stage I") stage. From this evidence, it would appear that the entire study population was sexually immature.

The gonadosomatic index (GSI) was calculated for each fish using Equation 7.4.

GSI=(Gonad WeightX100)/(Body Weight-Gonad Weight) ---- Equation 7.4

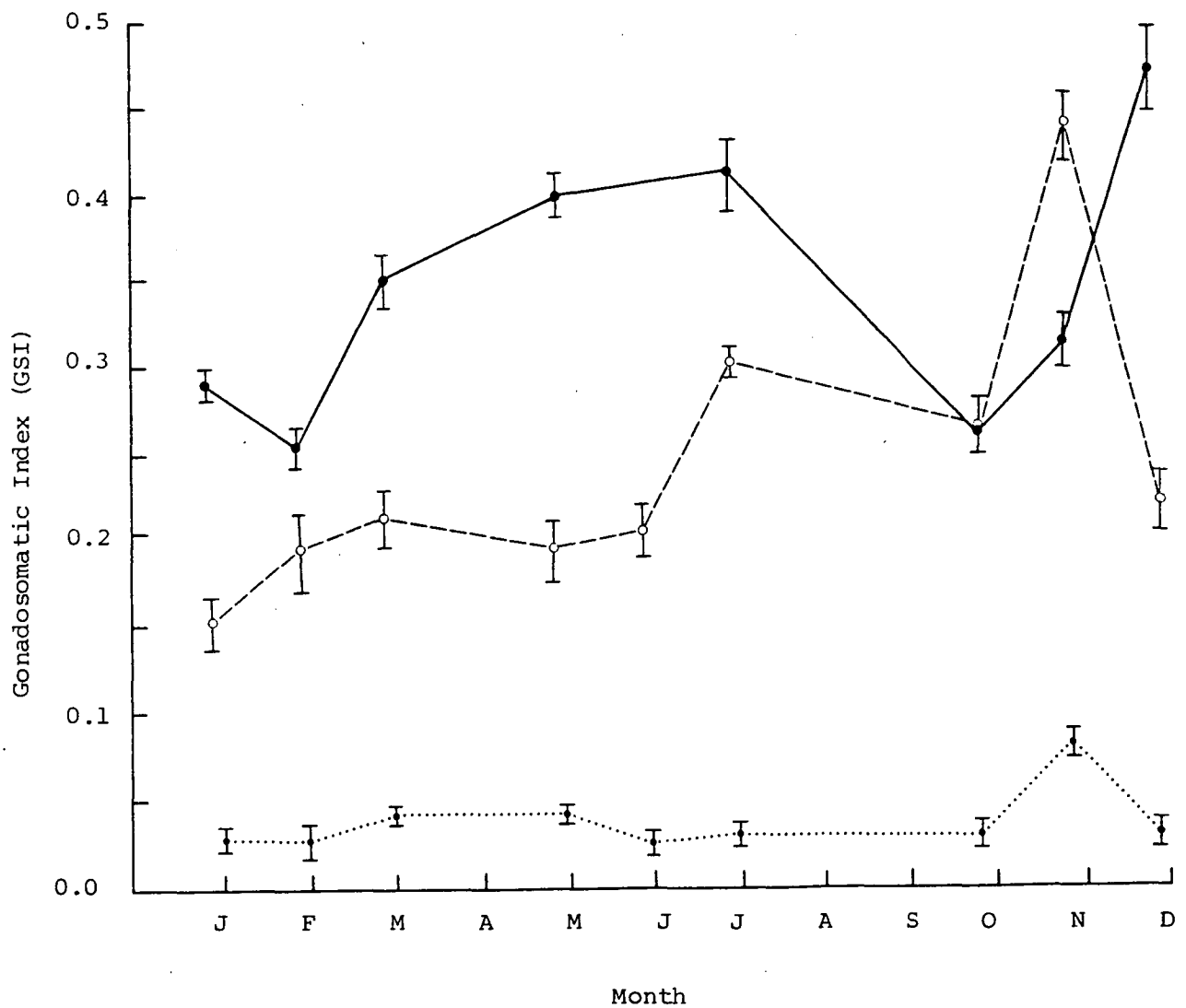
Fish were grouped into three categories: (a) 4 and 5 year old females, (b) 3 year old females, and (c) all males. The mean gonadosomatic index (GSI) for each month for each of these three groups was calculated (Figure 7.13). Males exhibited a small peak in GSI from October to December. Both categories of females displayed a similar pattern with minimum values of GSI occurring between December to February after a sharp peak. Figure 7.13 must be interpreted in the light of the changes in condition factor (Figure 7.12). When the two figures are compared, the two major changes in the GSI, the early summer peak for all fish and the late summer minima for females, become more significant. The changes in GSI in a population of sexually immature fish, as was the study sample, suggests that young immature fish show some signs of maturity and for females these signs become more pronounced with age.

Table 7.2
Generalised classification of gonadal maturity stages in fishes (Nikolsky 1963)

1. Immature gonads of a very small size;
2. Resting Stage I; sexual products have not yet begun to develop; gonads of very small size; eggs not distinguishable to the naked eye;
3. Maturation eggs distinguishable to the naked eye; a very rapid increase in weight of the gonad; testes change in colour from transparent to pale rose;
4. Maturity sexual products ripe; gonads achieved maximum weight; sexual products still not extruded when light pressure is applied;
5. Reproduction sexual products are extruded in response to light pressure on belly; weight of gonad decreases rapidly from the start of spawning to its completion;
6. Spent Condition sexual products have been discharged; genital aperture inflamed; gonads have appearance of deflated sacs; ovaries usually contain a few left-over eggs; testes usually contain residual sperm;
7. Resting Stage II sexual products have been discharged; inflamation around genital aperture subsided; gonads of very small size; eggs not distinguishable to the naked eye;

Figure 7.13

The mean gonadosomatic index for four and five year old females (——), three year old females (----), and all males (·····). (Standard deviations shown)



Ovary weight and body length are highly correlated (r=0.89, n=79, 1969; r=0.95, n=59, 1970; r=0.89, n=51, 1971). A relationship between the two variables was determined from a least squares fit to a log-log regression and the expression used to fit a curve to a scatter plot of ovary weight against length (Figure 7.14). The curve, when compared with the typical fecundity-length relationships (Ricker 1971), and particularly to the fecundity-length curve obtained for Latridopsis ciliaris (Francis 1981a), can be regarded as that of a sample of fish approaching maturity. Latridopsis ciliaris were found to mature at a fork length of 40 cm, which corresponds to the maximum length of fish in the present study.

7.2.2.5 Colour Phase.

Bastard trumpeter display two distinct colour phases (Figures 7.15a & 7.15b), the "silver" form and the "red/brown" form, with a small number of intermediates. The popular name for these two forms are "summer" fish and "winter" fish respectively, indicating the extent to which local fishermen believe the change in colour to be a function of seasonal change. Such a belief is also common amongst authors (Pollard 1980). Johnston (1882) reported that the "silver" variety was captured only in the months of January, February and March while the "red" form was taken all year around.

The proportion of each colour-type caught per month in the study sample is shown in Figure 7.16. The fall in the proportion of the "silver" variety over March to October lends some support to the

Figure 7.14

The relationship between the weight of the ovary (gonad weight) and standard length for female Latridopsis forsteri in the study sample.

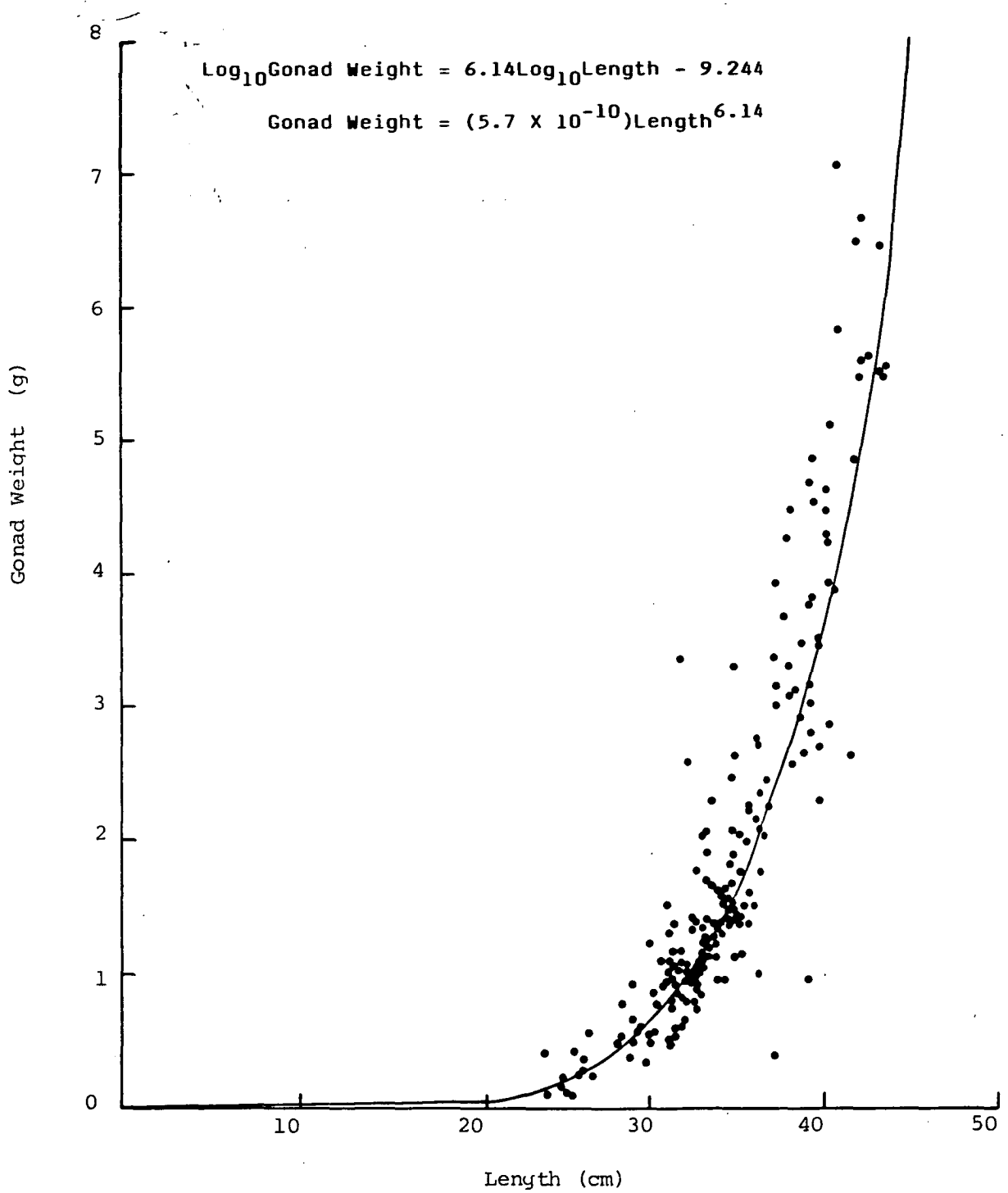


Figure 7.15a

Photograph of the "silver" or "summer" phase of the bastard trumpeter, Latridopsis forsteri.

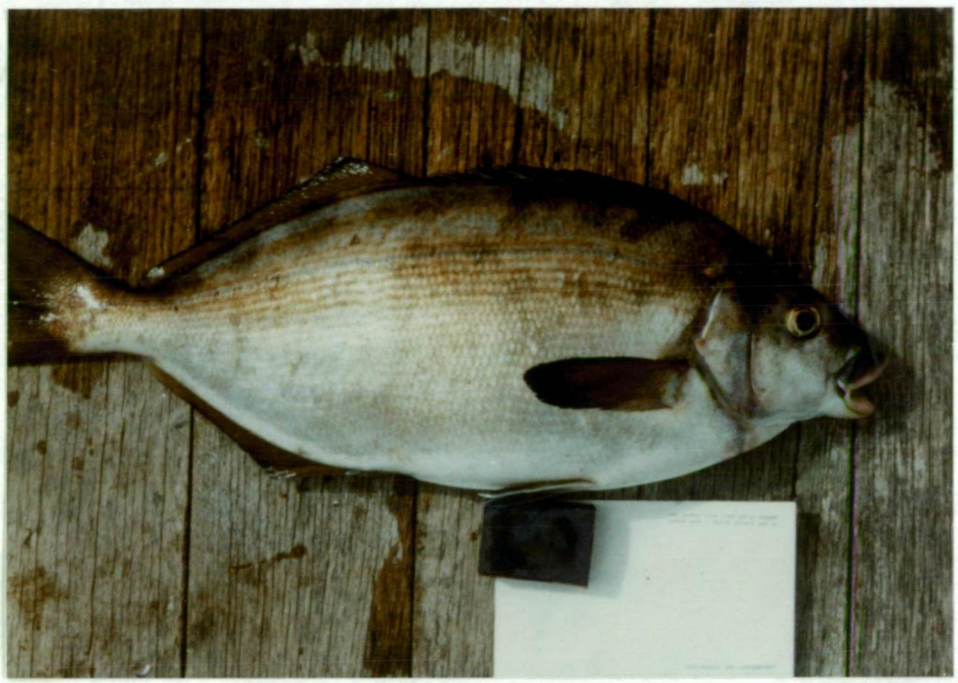
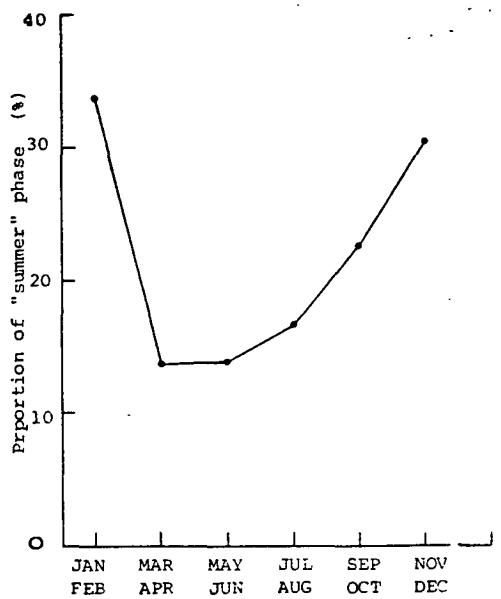


Figure 7.15b

Photograph of the "red/brown" or "winter" phase of the bastard trumpeter, Latridopsis forsteri.

Figure 7.16

The proportion of the fish in each month's catch that were of the"silver" ("summer") colour phase. Months were paired to enable significant numbers to be used.



commonly held hypothesis that colour is a function of seasonality. The "silver" colour phase increased from 13.5% of the monthly catch in March/April to over 30% of the monthly catch in November/February. However, at no time in the study was the "silver" fish, or "summer" fish, the predominant phase captured. This would strongly suggest that, while there was a change in the relative proportion of the two forms over the year, the local terms of "summer" and "winter" fish are misnomers, and factors other than season also appear to play a role in determining colour phase.

A second belief relating to the two forms is that the "silver" phase represents the mature, well conditioned fish while the "red/brown"

phase represents the immature fish (Johnston 1882; Thomson 1977). To test this hypothesis, the fish captured were categorised into seven condition factor classes (class width 0.002). No significant differences were found in forms over the range of condition factors (X^2=15.9, df=6, n=185, P>0.05 for females; X^2=4.22, df=6, n=159, p>0.05 for males). However, significant differences were found to occur between the forms between the age groups (X^2=15.9, df=4, n=296, 0.001<p<0.01). From Table 7.3 it is apparent that the "silver" form shows a trend to be predominant with increasing age.

Table 7.3

The distribution of the two colour phases between age classes. Figures in brackets show percentage of phase type in that age class.

Phase	Age					Total
	1	2	3	4	5	
Brown "winter fish"	5 (2.2%)	19 (10.6%)	141 (66.5%)	50 (22.0%)	2 (0.9%)	227
Silver "summer fish"	0 (0%)	6 (8.7%)	33 (47.9%)	26 (37.7%)	4 (5.8%)	69
TOTAL	5	25	184	76	6	296

X^2 = 15.9, df = 9, 0.001 < P < 0.01

7.2.2.6 Food

The stomach contents of 150 fish were analysed using three methods described by Windell (1971);

(a) occurrence - the number of stomachs in which each food item occurred was recorded and expressed as a percentage of the total number of stomachs examined;

(b) numerical diet composition - the number of individuals of each food item in each stomach examined was counted, and these were summed to give totals for the whole sample. Each item was expressed as a percentage by number of the grand total;

(c) volumetric diet composition - the food volume was measured directly by displacement of water and the total volume occupied by a particular food type was expressed as a percentage of total stomach volume.

The results are shown in Table 7.4. Percentages given were calculated after the detritus component (54.8% volume composition) was excluded. The most important food type of bastard trumpeter comprised Amphipoda, forming 52.1% of the total food volume. This group was found in 96% of the stomachs analysed. Isopods were next in importance and occurred in 62.7% of stomachs examined. The four main food types (amphipods, isopods, brachyurans and macrurans respectively) together made up almost three-quarters of the total stomach volume.

A comparison of the three measures of analysis shows much the same order of importance of component groups in the diet. The very large

Table 7.4

Stomach contents of 150 fish by volume, number of items, and frequency of occurrence, ranked in order of representation in stomach.

Species	Volume of stomach (%)	Total number of items (%)	Frequency of occurrence (%)
Amphipoda	52.07	70.40	96.00
Isopoda	10.09	13.09	62.66
Decapoda-Brachyura	7.06	0.70	18.00
Polychaeta (errantia)	5.44	1.02	28.00
Algae	4.59	-	35.33
Decapoda-Macrura	4.40	3.76	15.33
Pisces	2.89	0.15	6.67
Ostracoda	2.19	6.00	44.00
Echinodermata-Ophiuroidea	2.03	0.40	11.33
Polychaeta (sedentaria)	1.96	0.11	5.33
Echinodermata-Asteroidea	1.80	0.30	14.67
Mollusca-Gastropoda	1.47	1.73	17.33
Tanaidacea	0.92	0.39	15.33
Cumacea	0.69	0.53	12.67
Nebaliacea	0.59	0.38	8.00
Mollusca-Cephalopoda	0.50	0.04	2.00
Coelenterata	0.20	-	2.00
Bryozoa	0.19	-	3.33
Stomatopoda	0.17	0.07	2.67
Porifera	0.14	-	2.00
Mollusca-Bivalvia	0.13	0.23	4.00
Foraminifera	0.04	0.46	4.67
Euphausiacea	0.01	0.01	0.67
Pisces (eggs)	0.01	0.14	0.67

predominance of amphipods in all three measures means that it was difficult to pick up differences between many of the less important groups. This was particularly so for the volumetric and numerical dietry component analysis measures.

Changes in diet with growth were investigated by dividing the 150 fish into three size classes (Table 7.5 and 7.6). The analysis was limited due to the small numbers in both the smallest and largest classes. Further limitations on the results are based on local prey availability between sampling locations and at different times of the year. With these limitations in mind, there still appears to be a detectable trend for reduced importance of amphipods and isopods with increasing age of bastard trumpeter. Two of the largest food items, small fish and sedentary polychaetes, were not found in the stomachs of bastard trumpeter from the smallest length class.

7.2.3 Summary and Conclusions

Inshore populations of bastard trumpeter appear to range in age from one to five years and in standard length from 15 to 44 centimetres. The terminal standard length of the bastard trumpeter was calculated to be in the vicinity of 50 cm, which would make the full terminal length 58 to 60 cm. A finding of importance was that the entire inshore population of bastard trumpeter is an immature stock with the older, larger specimens nearing the lengths of sexually mature adults. The overall picture obtained is that, as these inshore

Table 7.5

Total volume of food items (%) in the stomachs of 148 fish from three length classes.

Length class (cm)	Number of fish	Polychaeta (sed)	Polychaeta (errant)	Isopoda	Amphipoda	Brachyura	Ophiuroidea	Asteroidea	Pisces
20.0-27.9	13	-	1.35	9.00	44.08	1.17	1.66	0.92	1.66
28.0-37.9	105	1.15	4.49	6.04	34.80	5.32	1.04	1.21	1.04
38.0+	30	2.12	3.36	5.81	32.40	2.85	1.84	2.06	1.84

Table 7.6

Total number of items (%) in the stomachs of 148 fish from three length classes.

Length class (cm)	Number of fish	Polychaeta (sed)	Polychaeta (errant)	Isopoda	Amphipoda	Brachyura	Ophiuroidea	Asteroidea	Pisces
20.0-27.9	13	-	0.16	15.42	61.75	0.08	0.13	0.23	-
28.0-37.9	105	1.15	1.36	11.95	71.44	1.05	0.47	0.32	0.14
38.0+	30	0.30	0.91	15.09	69.96	0.38	0.53	0.46	0.08

fish mature at five years or older, they migrate to deeper offshore waters and do not return. Johnston (1882) reported that fishermen were "mostly all of the opinion" that genital organs were undeveloped in both the "silver" and the "red" forms. Johnston himself, however, considered this to be a mistake and that the "silver" form inhabiting reefs 3 to 8 fathoms (5.5 to 14.5 m) deep were found with mature genital organs. He also hypothesised that these mature fish migrated to outer reefs 30 to 70 fathoms (73 to 103 m) deep to spawn in the non-summer months. The results detailed here do not concur with Johnston's observations on the presence of sexually mature specimens in the inshore waters at any time of the year. Rather, it would appear that mature fish occur only in deeper waters.

In his study of the closely related species Latridopsis ciliaris (blue moki), Francis (1981a, 1981b) found that sexually mature fish are recruited to the offshore migratory stock in New Zealand at a fork length of about 40 to 44 cm and at an age of five to six years. These findings support those of the present study on bastard trumpeter, Latridopsis forsteri, that the inshore stock is an immature one.

There is some evidence that a gradual colour change may be associated with the movement of fish from the inshore population to the deeper waters as hypothesised by Johnston (1882), although factors other than maturity are involved with these colour changes.

With regard to the diet of bastard trumpeter, the fish are mainly carnivorous with an amphipod-rich diet. There is evidence that the

importance of amphipods in the diet decreases slightly as the fish grows. Russell (1983) has reported that amphipods are a common component of the diet of coastal rocky reef fish species of New Zealand and that blue moki, Latridopsis ciliaris, has a particularly rich amphipod diet.

CHAPTER EIGHT

SUMMARY AND DISCUSSION

8.1 History

The need for regulation of the inshore scale fishery in Tasmania first surfaced in the late 1870s and early 1880s. However, recognition of the need was not matched by action on the part of Government, and protection of the fishery was slow to develop. A preoccupation with the development of an inland fishery could well account for the apparent lack of interest in the marine scale fishery of the State. A reluctance to commit moneys to the latter, while the former was self-funding, deepened this rift. The early union in the administration of the two fisheries further compounded the bias towards the inland fishery since administrators were selected solely on the basis of their interest in freshwater angling.

Many years passed before the Tasmanian Government conceded to demands to set up a separate body to administer the sea fisheries of the State. The Sea Fisheries Board was established in 1925. However, its function was largely that of a licensing and enforcement agency. Not until the mid 1970s were those responsible for management of the sea fishery given the freedom and resources necessary for the development of research-based management strategies. With regard to the inshore scale fishery, it was unfortunate that these changes came too late.

An eclipsing of the importance of this fishery ensured that the research was directed elsewhere, and the inshore scale fishery has yet to come under the umbrella of a management strategy founded on biological research.

The inshore scale fishery of Tasmania, and the management thereof, shares a common early history with those of the mainland States. In each case, these fisheries bore the thrust of colonial fishing activity and declined in importance before the development of sophisticated fisheries management systems. For the first fifty to one hundred years of European settlement, these fisheries were conducted within the context of an almost complete absence of regulatory control. Increasing fishing activity ultimately forced the hand of the colonial authorities, and the rudiments of fisheries management were introduced in each of the Australian Colonies in the latter half of the nineteenth century.

The onset of regulatory control of the inshore scale fishery in each State, and the rapidity of its development, was determined by a number of factors, paramount of which was population and concomitant fishing level. Victoria and New South Wales, with their greater populations, were the first States to enact comprehensive fisheries-related legislation, and they progressed comparatively rapidly towards more complete regulation. Regulatory mechanisms adopted by these States were few in number and somewhat hierarchical in character. As greater control of the inshore fishery was sought, higher order mechanisms were implemented, while extant lower order mechanisms were extended.

Thus, regulation began with the introduction of netting closures and advanced with the imposition of minimum sizes at which certain fish could be taken. These methods of control were followed by requirements that commercial nets be licensed, and by regulation of nets with respect to mesh sizes. These were followed in turn by restrictions on the lengths of nets and the number of nets which an individual could use at any one time. Licensing of amateurs' nets occurred and, eventually, regulation advanced to a stage where amateur "mesh" nets were completely banned. Restrictions on the total number of commercially licensed nets and declaration of Aquatic Reserves represented the final stages of regulatory development in these two States.

Regulatory development in Western Australia, South Australia and Tasmania tended to follow, but lag, the sequence displayed by Victoria and New South Wales. Their relatively small populations buffered, for a time, the impact of inshore netting. A pervading ethos that fish in the sea were common property and that the use of nets by the common person was a natural right, meant that lenient netting regulations established in the late nineteenth century were retained with few changes in each of these States. In recent years, however, the appropriateness of such regulation has been challenged in Western and South Australia. In both cases, the level of conflict between amateur and professional fishermen served as a signal that excessive pressure was being exerted on the inshore resource, and subsequent studies on the biology of the fishery and of fishing levels indicated that more complete regulation had been delayed for longer than was desirable.

Consequently, significant changes to the regulations have been implemented in both of these States. The question of the appropriateness of present inshore scale fishery management and netting regulation in Tasmania has not, as yet, been adequately addressed.

8.2 Bastard Trumpeter

Commercial catch records of the bastard trumpeter in Tasmanian inshore waters indicate that populations of this fish have exhibited declines from overfishing. Reports of declining catches prior to 1882 and records of a decline in the commercial catch of bastard trumpeter between 1910 and 1918 strongly suggest a depletion of populations of this fish in localised inshore bays and estuaries more proximate to major population centres. Commercial catches of the bastard trumpeter during the 1930s appear to have been sustained at a high level only by exploitation of virgin inshore fishing grounds further afield. A more general and long-term decline in the commercial catch of bastard trumpeter in Tasmania has occurred from the early 1950s to the present, despite a more or less steady level of commercial gill netting activity.

During the latter period, i.e. since the 1950s, non-commercial gill netting activity (by amateurs and crayfishermen seeking bait) has increased significantly. Survey results indicate that the present level of amateur gill netting alone is comparable to that of commercial gill netting.

The total gill netting effort in Tasmanian waters has thus increased significantly in recent times. The increase partially explains the general decline in the commercial catch of bastard trumpeter, as commmercial gill netting competed with non-commercial gill netting for a limited resource. The overall increase in gill netting does not, however, appear to have been sufficient to explain the **magnitude** of the decline in the commercial catch of bastard trumpeter. The lowest recorded commercial catch of 1 tonne in 1976/77 represented a 50 fold decrease from the peak catch in 1952 and a thirty fold reduction from the catch of 1960/61.

The findings of the study on the biology of inshore populations of bastard trumpeter help to explain the magnitude of the long-term decline in the commercial catch. The results suggest that the entire inshore population of this fish is an immature stock with the larger fish approaching the length of sexually mature adults. The overall picture obtained is that these inshore fish mature at five years or older and that as they approach sexual maturity they migrate to deeper offshore waters, never to return. The idea that there are two separate groups of bastard trumpeter, an immature inshore stock and a deeper water mature stock, is not, however, conclusive. There could be a two-way movement of fish in the four to five year age class between the inshore and the offshore populations. Advanced inshore specimens may be recruited into the mature reproducing stock while similar sized fish leave the offshore stock and return to the inshore waters.

The original intention of authorities, in Tasmania and elsewhere, in setting minimum lengths at which fish could be taken was to ensure that fish spawned at least once before they were captured (Roughley 1974; Gulland 1974). In more recent times, the purpose of the minimum length regulation has also been to allow fish to attain maximum growth before being harvested (Tasmania, Tasmanian Fisheries Development Authority 1981). The present minimum legal length at which bastard trumpeter may be taken, set at 12 inches in 1890 and increased only marginally since then to 33 cm (12.9 inches), achieves neither of these objectives, as inshore populations of bastard trumpeter are sexually immature.

The potential dangers of concentrating a fishery solely on the juvenile stock are well known (Ingpen 1969; Gulland 1974; Allen 1975; Cushing 1977; Francis 1979, 1983). A number of fisheries operating in this manner have exhibited declining catches over a long period, and the collapse of the Atlantic herring fishery, which has been attributed to overfishing of the juvenile stocks, was one of the classic fishing industry failures of the past (Cushing 1977). It appears that the inshore gill netting of the bastard trumpeter has focused entirely on the immature stock and it is highly likely that much of the observed decline in the commercial catch of this fish can be attributed to this fact.

8.3 Recommendations

From this discussion, it is possible to identify ways in which gill netting in Tasmania should be changed. Prior to this, however, several specific comments need to be made.

Firstly, this study has concentrated in the main on the graball, as there appears to be a general feeling that the smaller-meshed mullet net is seldom used, that its impact is limited, and that it does not constitute a threat to fish stocks (Dix 1974). As no licensing of nets is required, and biological investigations of the the species involved have been minimal, no data are available to check these assumptions. A prominent importer/distibutor of commercial and amateur fishing equipment in Tasmania estimates that, up until 1980, his firm sold only one mullet net for every ten graballs (to amateur fishermen) (Guard, personal communication). However, since 1980, the proportion of mullet nets sold has doubled. While amateur fishermen, theoretically, use these nets on sandy bottomed areas only, there is no regulation to prevent the use of these nets in areas with rocky bottoms where, from a biological viewpoint, their use is totally inappropriate.

Secondly, a particular weakness in the present regulations governing the use of gill nets is the fact that there is no limit on the period for which these nets may be set. In the study of the biology of bastard trumpeter presented in Chapter Seven, nets were set for one to one and a half hours and a significant portion of the fish captured

had sustained damage to their tails by attacks from predators while held in the net. A smaller portion of fish captured were dead by the time the net was pulled (Mawbey, personal communication). It is highly likely that the proportion of fish killed in the net and the amount of tail damage done will increase proportionally with the length of time for which the net is set. Many shack owners are reported to leave their nets set overnight (Schapp, personal communication). The point here is that it is senseless to regulate that undersized fish must be returned to the water if existing regulations allow fishermen to leave their nets in the water for such long periods that many fish are killed or sustain so much damage that the chances of survival are low.

Finally, this study has focused on the effects of netting of a single species, the bastard trumpeter. Many other fishes are captured in these inshore nets and little is known of their biology. Other species commonly taken in nets include labrids (Pseudolabrus tetricus, P. psittaculus, P. fucicola), leatherjackets (Penicipelta vittiger, Meuschenia freycineti, M. hippocrepis), morwong (Nemadactylus macropterus, Cheilodactylus spectabilis), southern rock cod (Pseudophycis barbata), striped trumpeter (Latris lineata), warehou (Seriolella brama), and Australian salmon (Arripis trutta). The effects of gill netting on these fish are largely unknown and must be considered for any sound management of the inshore gill net fishery.

Following these comments, several recommendations can be made:-

(a) Regulations governing the use of mullet nets should be altered to ban the use of these nets over rocky bottomed areas.

(b) Regulations applying to both graballs and mullet nets should bar the setting of these nets overnight, or for longer than 2 hours.

(c) Further studies of the biology of species captured in gill nets should be undertaken to assess the effects of gill netting on these species and to determine the approriateness of net mesh sizes, and size limits specified for the various species.

(d) In order to facilitate better knowledge on non-commercial gill netting, licences for amateur gill nets should be introduced. Policing of non-commercial gill netting would also benefit from a requirement that non-commercial gill nets be tagged with the holder's licence number as legislated in other Australian States.

(e) The use of gill nets by commercial crayfishermen to capture fish species such as bastard trumpeter for use as crayfish bait should be better controlled with the introduction of maximum net lengths and restrictions on the numbers of nets used for this purpose.

(f) Finally, consideration should be given to the banning of inshore gill netting in Tasmania, pending further biological research on the species taken by this fishing technique. The general lack of biological knowledge of these species is exemplified by the unexpected finding that the entire inshore population of bastard trumpeter, one of the principal targets of gill netting, is an immature one: it is not surprising that catches of this species have fluctuated wildly and generally declined. Given our present ignorance of the biological impact of gill netting, it is difficult to justify the continued use of this fishing technique in Tasmanian inshore waters.

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