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History of, and trends in, the commercial landings of finfish from the Hauraki Gulf, 1850−2006

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L.J. Paul

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EXECUTIVE SUMMARY

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This study reviews the total commercial fishery for finfish in the Hauraki Gulf, from about 1850 to the early years of the 21st century. It covers the principal fisheries (trawl, line, and net) for snapper, *Pagrus auratus*, in most detail, but also covers about 40 other species which are taken as bycatch and/or support separate fisheries.

'Hauraki Gulf' is defined as extending from north of Whangarei to north of Tauranga, shoreline to the shelf edge at 250 m, an area of about 16 000 km^2. The oceanography (bathymetry, sea temperatures, and currents) of the Hauraki Gulf are briefly described, as background to the location and seasonality of fisheries.

Historical information was obtained from the text of Annual Reports on Fisheries, augmented by unpublished Marine Department file notes. The online resource 'Papers Past' was searched, and relevant material was extracted from published papers, reports, and books.

Statistical information on fish catches and landings was summarised from Annual Reports on Fisheries (1902−74), and an update by King 1985 (1974−82), which gave landings by port. Data were used from Whangarei, Auckland, Thames, Coromandel, and Whitianga, with information from the out-of-area ports Manukau and Tauranga also considered. Catches by area (based on Fisheries General Statistical Areas) were obtained from Ministry for Primary Industries (formerly Ministry of Fisheries) databases for 1983−2006). Port landings were scaled down by factors estimated to give the proportion of landings, by species, caught within the Hauraki Gulf as defined. Additional values, as necessary, were located in various papers, and in Plenary Report documents. Interpolation was required to cover a few missing years. Published and unpublished surveys of recreational fishing activity and reported recreational catches provided estimates of recreational catches for the four main species (snapper, gurnard, trevally, kahawai).

Accounts of the nineteenth century fishery are anecdotal, but show that snapper was the main species, taken by line and net in inshore areas. Gropers are mentioned, either because they were more common inshore at the time, or were sufficiently popular to encourage fishing trips to the Gulf's islands and offshore reefs.

Steam trawling commenced about 1900, quickly ceased when most of the inner Gulf was closed to this method, was revived in 1915, and continued until 1951 apart from in the World War II years. Long-lining replaced hand-lining in 1912 and continues to the present day, now landing premium-grade export snapper. Danish seining commenced in 1923 and became the dominant method for catching snapper; it declined for economic reasons in the 1950s and after the mid-1970s. Motor trawling began in the Hauraki Gulf only in 1948 and alternated in importance with Danish seining. Vessels built from the late 1960s were capable of both seining and trawling. Purse seiners began fishing in the mid-1970s, initially for skipjack tuna but later, intermittently, for other pelagic species (e.g. trevally, mackerels, kahawai) when skipjack were not available.

With the return of steam trawling in 1915 the Hauraki Gulf became New Zealand's main coastal fishing ground until at least the 1960s. From 1915 to 1945 it contributed 25−35% of total fish landings, and 20% from 1950 to 1970 as coastal grounds elsewhere were developed. From 1975 this dropped to less than 5% as deepwater fisheries expanded, with no such grounds being found in the Hauraki Gulf area.

Significant events occurred in the mid-1980s, centred on the introduction of the Quota Management System in 1986. Landings of many species rose sharply as fishers anticipated establishing a catch history, a new statistical reporting system took several years to become reliable, and there was a move to alternative fisheries as quotas of several species were reduced. The greater variety of species reported post-1983, and the reduction in landings of several species post-1986, is attributed to a combination of these factors.

Landings of species by Hauraki Gulf port are described, 1931−1974, and the overlap with the ports of Manukau and Tauranga examined.

Landings of species from the Hauraki Gulf, 1931−2006, are described by grouping them into four categories, based on their relative abundance in the (most detailed) 1983−2006 data. Snapper are considered the principal species and considered apart. Primary species include four flatfish species, red gurnard, trevally, blue mackerel, three jack mackerel species, and kahawai. Secondary species include skipjack tuna, John dory, tarakihi, rig, barracouta, pilchard, gemfish, school shark, two groper species, leatherjacket, and kingfish. Minor species include grey mullet, porae, red cod, parore, blue cod, red snapper, spiny dogfish, two skate species, two stargazer species, red moki, blue moki, yellow-eyed mullet, blue maomao, two conger eel species, and butterfish. Records of occasional or other even more minor species, available from about 1990, are briefly described.

Landings of species, 1931−2006, are also described in ecological groupings: shallow water, inshore shelf demersal, inshore shelf pelagic, central to outer shelf demersal, and central to outer shelf pelagic.

All species-fisheries are described individually, under the headings: Distribution, Relative Importance in the Hauraki Gulf fishery, Hauraki Gulf catch history, Seasonal trends (when known), Recreational catches (main species), and References (relevant to the Hauraki Gulf). The snapper fishery is described in more detail, with emphasis on the natural and economic factors influencing stock size.

Snapper have remained dominant for over one and a half centuries although the stock size has undoubtedly fallen. Snapper landings have undergone moderate fluctuations, apparently caused both by variable recruitment and by economic factors (price, gear, etc.) within the industry or because of broader events (notably the 1930s Depression and World War II). Landings − under a quota regime − are now relatively low, in historical terms. The size structure of the exploited snapper stock appears to have changed little between the mid-1920s and 2000, but as no early samples were aged it is not known whether there have been changes to the age structure. However, longline catches after 1990 contain relatively few age classes.

The presence of several other important commercial species in the Hauraki Gulf provides a useful buffer against low snapper stock size or changes in availability.

This review highlights the importance of maintaining reliable, comparable statistical records over time, particularly when fisheries undergo either gradual or sudden change, to allow retrospective longitudinal studies of catches and landings.

1 INTRODUCTION

1.1 Background

New Zealand was the last major land mass to be settled by humans, occurring around AD 1230−1280 (Wilmshurst et al. 2010). Consequently, New Zealand has a short and reasonably complete archaeological, historical and contemporary record of human exploitation of marine resources. This is in contrast to most other places where the earliest evidence of human impacts on marine ecosystems is difficult to discern because of climate fluctuations and changes in sea level. The collaborative multi-disciplinary Taking Stock project (ZBD200505), funded by the Ministry of Fisheries (now the Ministry for Primary Industries), has the overall objective of determining the effects of climate variation and human impact on the structure and functioning of New Zealand shelf ecosystems over the timescale of human occupation.

To achieve this overall objective, the project addresses five specific objectives. Specific Objective 2 is relevant to this report. Its aim is to assess and collate existing archaeological, historical and contemporary data (including catch records and stock assessments) on relevant components of the marine ecosystem in order to provide a detailed description of change in the shelf marine ecosystem in two areas of contrasting human occupation over the last 1000 years. In all, 11 separate reports contribute to addressing this specific objective, each focusing on either different faunal groups in one or more regions, or a different time period and associated method of inquiry. For example, the pre-European Māori period is investigated using archaeological approaches and the historical period is investigated using marine environmental history approaches – see Holm et al. (2010).

Two regions, the Hauraki Gulf and the Otago-Catlins shelf, were chosen as case studies of the larger New Zealand wide changes as they were both settled by Māori at about the same time, but have since experienced contrasting trajectories in human population size and marine resource use (Smith 2011). While Māori rapidly explored and settled all the main islands, the Chatham Islands to the east and as far south as the sub-Antarctic Auckland Islands, the main centre of settlement and growth was the northern half of the North Island, including the Hauraki Gulf region, where a more benign climate allowed the cultivation of a greater range of tropically derived crops (King 2003). However by 1769 it is thought that there were only about 6000 Māori in the whole of South Island, including the Otago-Catlins region, (Pool 1991). Europeans also settled in both study areas at about the same time (King 2003), with the population growth trajectory around Hauraki Gulf being more rapid than in Otago-Catlins. Importantly, both the Hauraki Gulf and the Otago-Catlins regions have sufficient prehistoric, historic and modern information describing marine resource use to reliably indicate the pattern and magnitude of human impacts on the marine environment. This report details part of this story; specifically trends in the commercial landings of finfish from the Hauraki Gulf from the beginning of the commercial fishery in 1850 to 2006, the latest year for which commercial landings data were obtained for this study.

1.2 Physiographic setting

The Hauraki Gulf (Figure 1) is one of New Zealand's largest semi-enclosed coastal embayments, being approximated only by Hawke Bay and Tasman Bay. Its long indented coastline includes numerous shallow bays and estuaries, rocky headlands and near-shore reefs, and two series of islands − one close to the south-western shoreline and around the Coromandel Peninsula, and one across the outer Gulf forming a partial barrier. It contains virtually the full range of possible marine habitats. Consequently, many traditional, recreational, and commercial fisheries have evolved in the region.

The warm temperate climate of the Hauraki Gulf region has encouraged human settlement around its shoreline since the earliest years of Maori arrival. Middens contain shell and bone from prehistoric fishing camps, and a large Maori population eventually inhabited the area, centred on the Auckland isthmus where the Waitemata and Manukau Harbours almost meet. Numerous archaeological reports

document the importance of snapper in midden deposits (e.g.; Leach & Davidson 2000, Davidson 2011). European settlement resulted in New Zealand's largest city, Auckland, developing on the same site, with smaller towns at Whangarei and Thames and coastal communities spread around most of the Gulf's margin. Shipping lanes cross the Gulf, and inner Gulf waters are extensively used by yachtsmen, recreational fishers, and beach-goers.

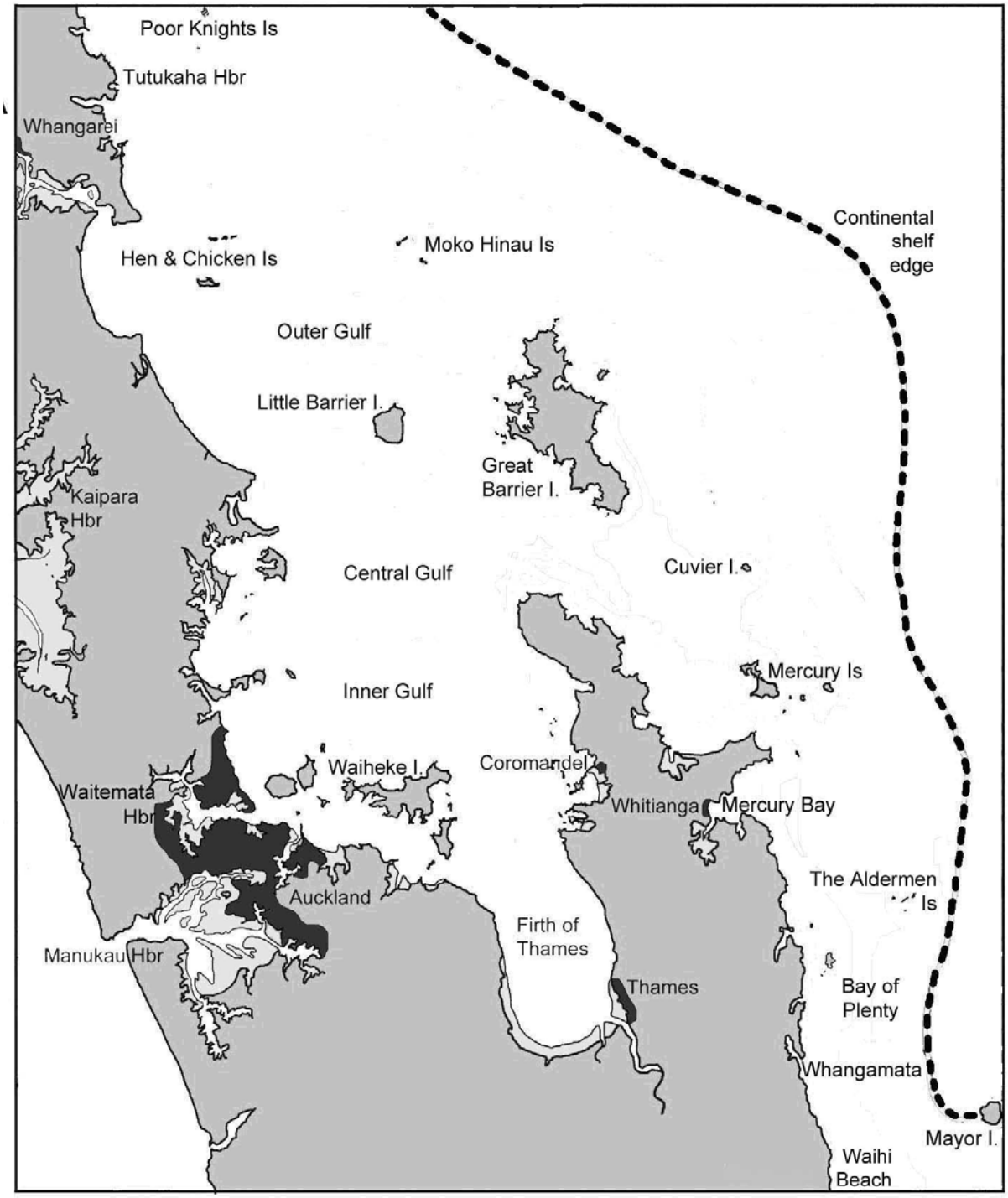

Figure 1: Hauraki Gulf, as defined in this study, extending from Tutukaka Harbour to Waihi Beach. The more usual definition of Hauraki Gulf covers the coastal waters south-west of the outer islands (Hen & Chickens, Mokohinau, and Barrier Islands), but is here extended to include a little of the east Northland coast and the north-western section of the Bay of Plenty, both areas being regularly fished by Hauraki Gulf vessels. Dark shading represents the Hauraki Gulf ports mentioned in the text; Tauranga Harbour, outside the study area but referred to, is just south of Waihi Beach. Pale shading represents extensive areas of intertidal mudflats.

1.3 Previous studies

There is an extensive literature on the geology, geography, climatology, marine biology, and general ecology of the Hauraki Gulf. Dellow (1955) gives a useful general review of the geographic and hydrographic features of the region as they relate to the marine environment. More recent and specific information is contained in a variety of publications. The University of Auckland's Marine Laboratory at Leigh, opened in 1963, has a major focus on coastal and near-shore ecology. Thompson (1981) gives a general but comprehensive account of the fishes, and the books by Doak (1972) and Francis (2001) are based in part on Hauraki Gulf species. The University of Waikato undertakes research with emphasis on coastal morphology, sediments, and benthic ecology. Auckland and Waikato local authorities undertake or commission research on pollution and other management issues. Government departments have carried out broader-scale oceanographic and fisheries studies.

The government-chartered steam trawler 'Doto' fished briefly in the Hauraki Gulf in 1901 during a broader exploratory trawling survey of potential trawling grounds, making (as was anticipated) good catches of snapper. In the mid to late 1920s some research was undertaken on the snapper fishery as a consequence of debate on the impact of 'power fishing' (trawling from 1915, Danish seining from 1923) on the snapper stocks (Hefford 1929). This work was perceptive and is partly incorporated in the present account. A diminished economy during the Depression of the 1930s and the 1939−45 war precluded further research. In the late 1940s the purpose-built research trawler 'Ikatere' commenced work, an early Hauraki Gulf study being on the biology of snapper (Cassie 1956a-c, 1957) and their escapement from trawl nets (Cassie 1955), prompted by a significant decline in Auckland landings in the five years following 1948. In the 1960s work on Hauraki Gulf snapper and their fisheries resumed (Paul 1974, 1976, 1977; Vooren & Coombs 1977) and over subsequent decades, research on this major commercial species greatly expanded (see references in the Snapper Section, 3.7.1, below). Trawl survey data, directed at monitoring juvenile snapper abundance, have been used in fish distribution atlases (Anderson et al. 1998, Hurst et al. 2000), and in a study of demersal fish communities (Kendrick & Francis 2002). In addition to the accounts of the snapper fishery (e.g.; Paul 1977), studies of a few other fisheries based at least partly in the Hauraki Gulf have been published − tarakihi (Vooren 1974), trevally (James 1984) – but most research has been restricted to species biology. There have been some accounts of commercial fisheries in the large Auckland Fisheries Management Area (West Auckland/Northland and North Cape to East Cape) in the grey literature written as official background reports to Fisheries Management Plans or proposals to introduce species into the Quota Management System (QMS). Most of the latter only cover the period subsequent to the changes in the catch and landing reporting procedures that started in 1974 and became more sweeping in the mid-1980s. Many are restricted to the years after 1990, when fisheries statistics re-stabilised. Duncan (1982, 2011) gives a sociological perspective on recent fisheries management regimes in the Hauraki Gulf. As far as can be determined, this is the first general account of the many commercial fisheries centred on the Hauraki Gulf.

1.4 Bathymetry

The Hauraki Gulf is a relatively shallow, semi-enclosed sea on the north-east coast of New Zealand's North Island. The north-eastern continental shelf is quite narrow, but in the Gulf region it broadens considerably, particularly seaward of Great Barrier Island (Figure 2). There are extensive shallow areas, less than 25 m, mainly in the south-western Inner Gulf and Firth of Thames, with the former containing many shallower harbours and estuaries. The remaining Inner Gulf is mainly 25−50 m, while the Outer Gulf seafloor falls steadily from 50 m to 150 m, and then a little more steeply to about 300 m. This fall is steeper and more uniform in the southern region, particularly in the north-western Bay of Plenty; to the north and north-east of the Barrier Islands it is more gradual but develops into a complex of seamounts and canyons. The broad ridge trending north-east from Great Barrier Island drops rapidly from about 300 m into the southernmost extension of the South Fiji Basin. The shelf break is not well defined, but is more distinct in the south. It is shown at about 150 m on New Zealand Oceanographic Institute charts drawn in the 1970s, but Thrasher (1986) places it at 250 m or greater.

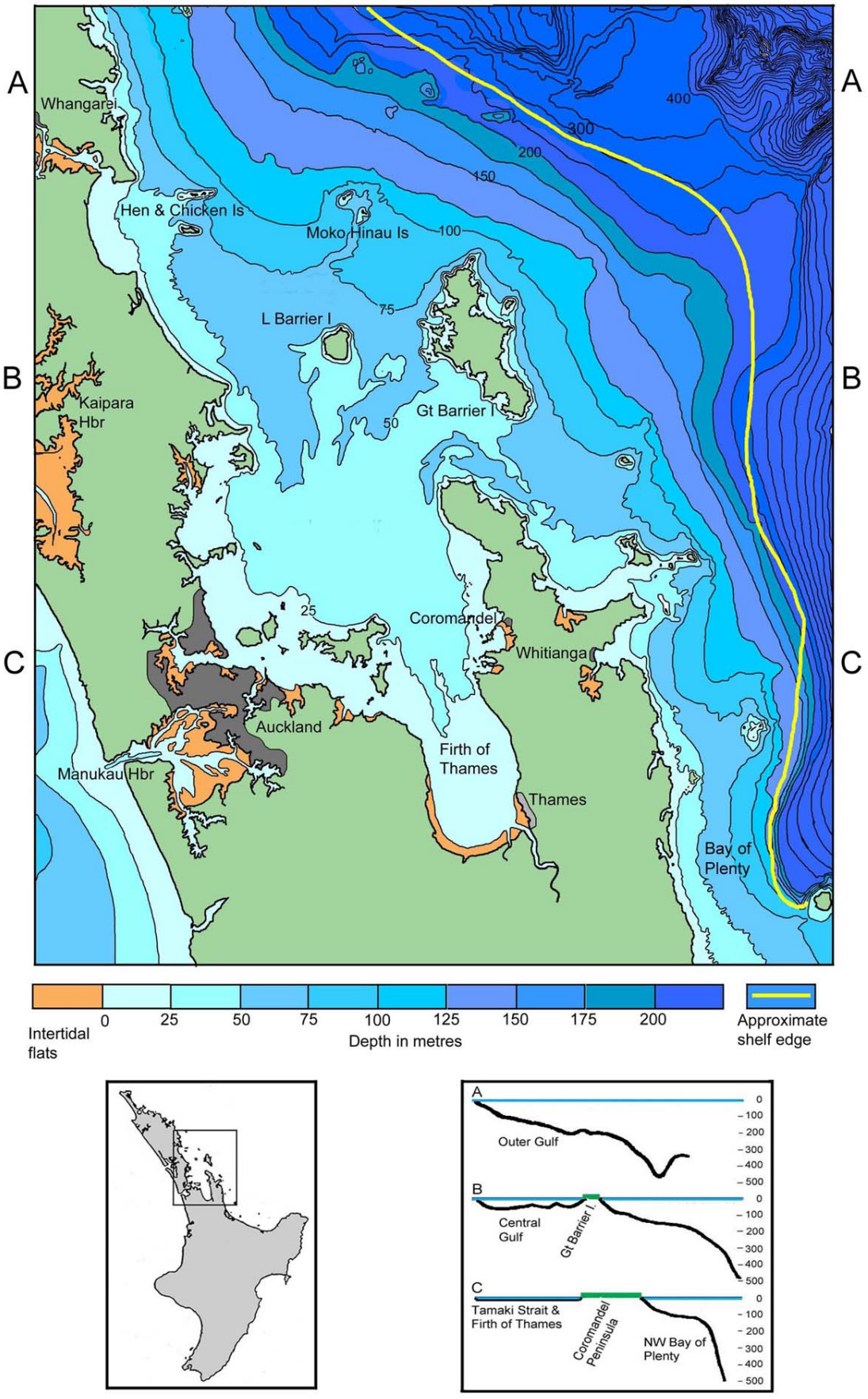

Figure 2: Bathymetry of the Hauraki Gulf, simplified from N.Z. Oceanographic Institute Coastal Series charts. Shelf edge contour taken from Thrasher (1986). Lower right, three depth profiles as indicated.

1.5 Temperature

A brief summary of seasonal changes in Hauraki Gulf water temperatures can be compiled from several studies undertaken in the early to mid-1900s (for references see caption to Figure 3).

Seasons are about one month later than terrestrial seasons, and for convenience summer starts in January, autumn in April, winter in July, and spring in October. Surface temperatures are warmest in one of the summer months, coolest in early to mid-winter (July-August). Seafloor temperatures (for which there is less information) are warmest in summer or autumn, coolest in late winter or early spring. The annual range of surface temperatures is about 12°C in shallow waters, about 7°C in the central Gulf, and about 5°C in the outer Gulf. The annual range of seafloor temperatures is about 8°C in shallow waters, about 7°C in the central Gulf, and 5°C in the outer Gulf. The annual mean temperatures for the entire Gulf in the mid-1960s were about 17°C at the surface, 16°C at the seafloor (Paul 1968); annual variability does occur, and has possibly increased over subsequent decades.

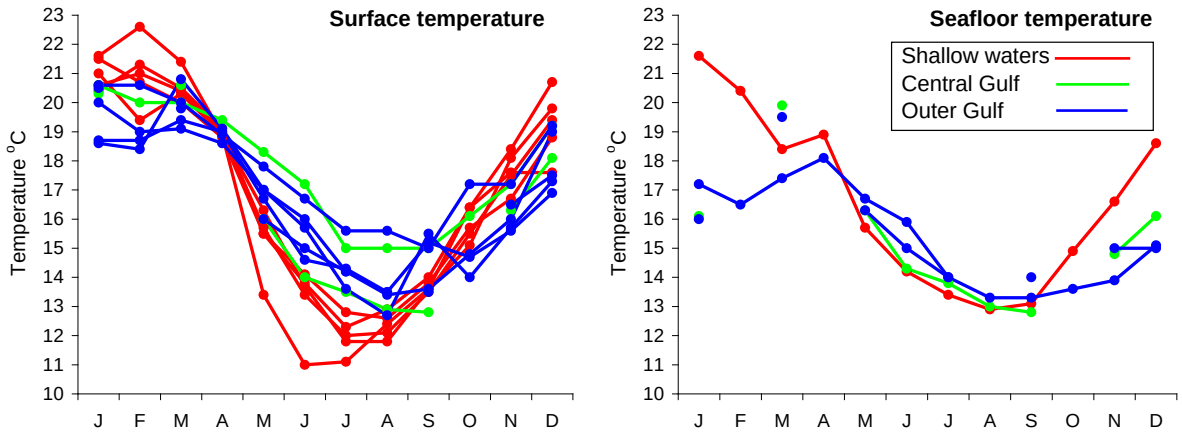

Figure 3: The annual pattern of surface and seafloor water temperatures in the Hauraki Gulf, based on monthly values taken from the following studies: Oliver (1923: 1913–14), Hounsell (1935: 1929–32), Annual Reports on Fisheries (1929–40), Dellow (1955: 1935–38), Skerman (1958: 1934–35), Jillett (1966, 1971: 1964–65), and Paul (1968: 1965–66). Data years as listed. Only Dellow, Hounsell, Jillett, and Paul provide seafloor temperatures. The lines are not identified to separate studies. Mercer (1979) gives seasonal values for 1973−74 (not plotted here).

Other patterns and trends (Figure 3) are most clearly described by season, with some distinction between the three main regions: shallow waters (Firth of Thames and the harbours and bays of the south-west Gulf), the central Gulf, and the outer Gulf (around and beyond the offshore islands). In summer **(**Jan–March), surface temperatures are warmer and more variable in shallow waters (20–23°C) than in the central Gulf (20–21°C) or outer Gulf (19–21°C), presumably responding more rapidly to atmospheric conditions (solar heating, wind, etc.). During summer, seafloor temperatures in shallow waters are only about 1°C lower than surface temperatures. One or more thermoclines occur in the central Gulf, but move downwards and diminish in strength as warming of the water column continues. In autumn (April–June), temperatures fall, most rapidly in shallow waters and at the surface. Thermoclines disappear, and slight inversions may occur (Cassie 1960, Paul 1968). During winter (July–September), surface temperatures reach their minimum, and begin rising in late winter; seafloor temperatures continue falling throughout winter. The water column is either isothermal, or there is a slight inversion. Surface temperatures are coolest inshore, seafloor temperatures are generally similar throughout the Gulf. In spring (October–December), surface temperatures rise steadily to 16–18°, with temperatures below developing thermoclines − appearing first in the inner Gulf − reaching 14–16°. The seasonal surface temperatures recorded in 1965−66 are shown in Figure 4.

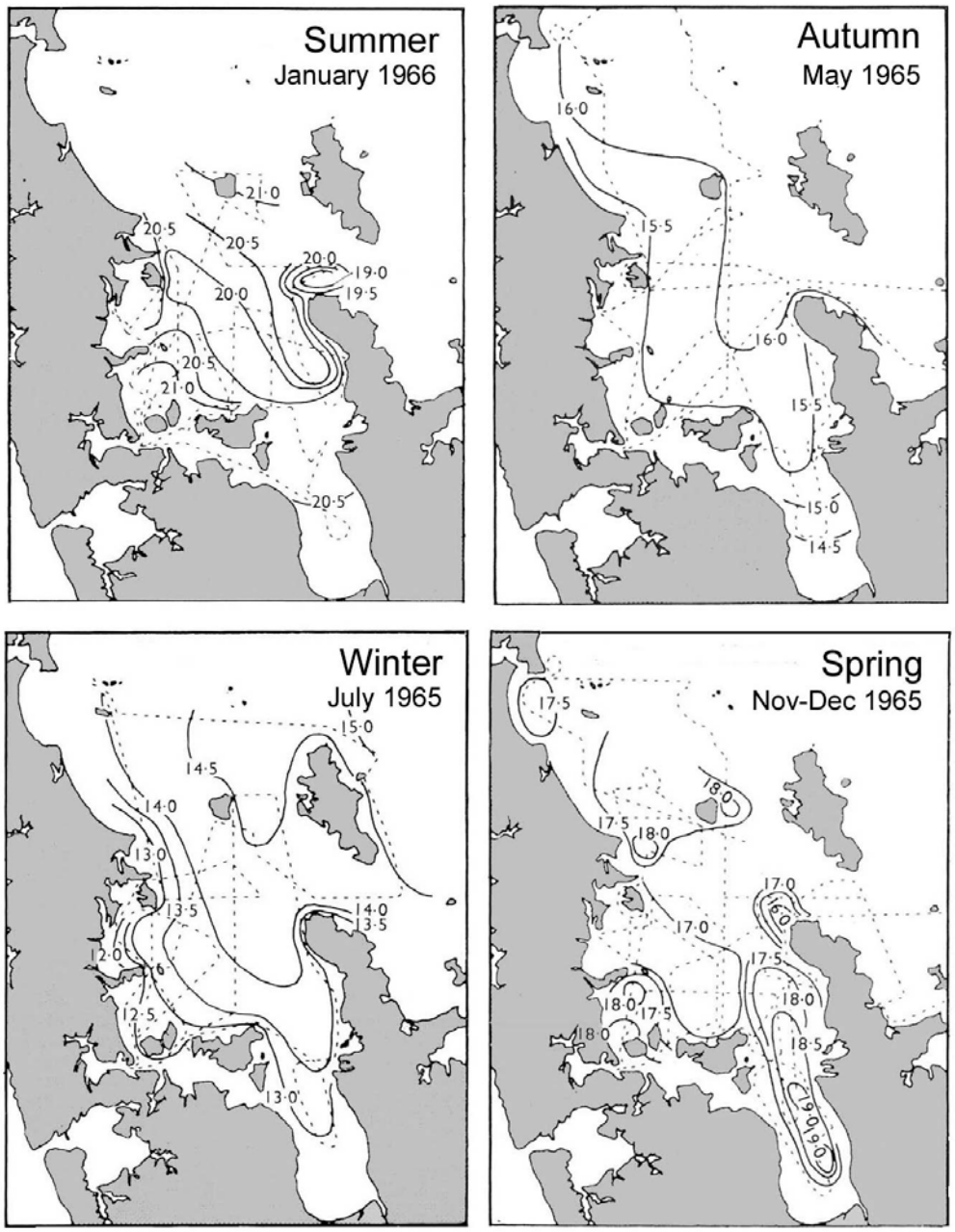

Figure 4: Seasonal surface water temperatures in the Hauraki Gulf, 1965−66. The dashed lines represent the vessel's track, along which surface temperatures were measured at and between bathythermograph casts. Summarised from Paul (1968).

1.6 Currents and circulation

The East Auckland Current flows south-eastwards past the outer Gulf (Harris 1985, Stanton et al. 1997), generally at and beyond the shelf edge. It varies in strength and position seasonally and from year to year, and has a complex influence on the characteristics and movements of water within the Gulf. Nutrient-rich oceanic water periodically enters the Gulf via two, sometimes interrelated, processes. Current-driven upwelling moves water from near the seabed of the upper slope onto the shelf. Wind-driven upwelling results from the surface water being blown offshore and replaced from below by upper slope water. In both cases the Gulf receives cool nutrient-rich water which enhances its biological productivity. A third process delivers warm nutrient-poor surface water to the Gulf;

winds which blow predominantly onshore, usually in summer, move cool oceanic water into the outer and central Gulf, these intrusions sometimes extending as far as the coast. Movement of water within the Gulf, inside the offshore islands, is additionally influenced by tidal flows through Jellicoe, Cradock, and Colville Channels, by seafloor topography − particularly around the many islands, and by wind direction and strength (Black et al. 2000). However, Greig (1990) suggested a net anti-clockwise flow. The numerous recent studies on physical and biological oceanography in the Gulf region emphasise the variability in hydrological conditions, and the relationship between water masses, nutrients, plankton, and the dependent marine ecosystem. Many of these studies are of the north-eastern region extending beyond, particularly northwards of, the Hauraki Gulf (Sharples (1997), Greig & Proctor (1988), Sharples & Greig (1998), Sharples & Nodder (1995, 1996), Stanton et al. (1997), Sharples et al. (1998), Black et al. (2000), Zeldis et al. (1995, 1998, 2004, 2005), Zeldis (2004)).

1.7 Objectives

The objective of this report is to provide a detailed description of trends in landings of commercial fish species in the Hauraki Gulf set within the context of the historical development of commercial fisheries in the wider northern area. As such it helps to address the fisheries history aspects of Objective 2 of the *Taking Stock* Project ZBD200505, which is 'To assess and collate existing archaeological, historical and contemporary data (including catch records and stock assessments) on relevant components of the marine ecosystem to provide a detailed description of change in the shelf marine ecosystem in two areas of contrasting human occupation over last 1000 years'. The history of commercial fishing in the Otago region is provided by MacDiarmid et al. (2012).

2 METHODS

2.1 History of Fisheries

The historical information was assembled from a variety of sources. Commentaries on developing fisheries − as well as statistical data − are included in the Annual Reports on Fisheries, incorporated in the Annual Reports of the Marine Department (1902–1971) and Ministry of Agriculture and Fisheries (1972–74). Much of this was extracted and made more easily available by historians working on the Taking Stock project, who additionally searched early Government files held in National Archives and extracted relevant unpublished material (see MacDiarmid et al. 2012). Early Auckland newspapers accessed via the online source 'Papers Past' (National Library) provided some information on nineteenth century fishing activity, and this was augmented by such published sources as Hutton (1872), Sherrin (1886), Hefford (1929), Martin (1969), Paul (1977), Tichener (1981), Johnson (2004), and articles in the magazines *Commercial Fishing* (Trade Publications, 1962−1990) and *Catch* (Ministry of Agriculture and Fisheries, 1974−1988).

2.2 Sources of catch and landing information

Species

Where possible, this account uses data recorded for individual species. Exceptions occur when related species are difficult to identify (e.g.; jack mackerels, skates), or when there has been no economic or management incentive to distinguish species (e.g.; hapuku and bass = groper; sand flounder and yellowbelly flounder = flounder, and both species may also be grouped with lemon sole as flatfish).

Time series

As is inevitable in a long time series, there have been changes over time in the way catch and/or landing data have been collected, analysed, and published by government agencies. In general there has been an improvement with time, particularly in the number of species recorded separately and not combined as "other species." However, significant problems occurred in the mid to late 1980s when the Quota Management System (QMS) was introduced: catches were recorded by fishing area rather than port of landing (the latter are recorded but not routinely analysed); there are a few years when data are suspect (omissions and duplications) because two recording systems operated; and for one year (fishing year 1988–89) no data are available for these reasons.

Landings data were derived from the following sequence of sources. 1931–73: Annual Reports on Fisheries (Marine Department to 1971, Ministry of Agriculture and Fisheries 1972 and 1973). 1974–82: Ministry of Agriculture and Fisheries, Fisheries Statistics Unit (FSU) data (King 1985). Landings from 1983 onwards were obtained from catch and landing databases as follows. Years 1983–87: Ministry of Fisheries computer extract from Fisheries Statistics Unit database. Years 1990–2006: Ministry of Fisheries computer extracts from all relevant databases. 1988–89: Data unavailable and/or unreliable because of changes to recording systems, values interpolated from adjacent years. From 1983 these data are recorded by Statistical Area of capture (see Figure 5), the Hauraki Gulf region in this study being areas 004–008, plus parts of areas 003 and 009. An estimated 30% of catches from the latter two areas were considered to be from Hauraki Gulf, based on coastline length. About two-thirds of the landings series was reported, or could be extracted from databases, by calendar year. The remainder, based on fishing years with a three-month shift from calendar years, were converted to the latter using the year in which nine months fishing had occurred. The time series of data extracted for this and related studies (e.g. McKenzie & Macdiarmid 2011) ended at 2006.

Monthly data

Annual Reports on Fisheries contain data on monthly landings for the main species at the main ports, 1945–71, and those for Auckland (seven species) and Thames (snapper and flounder) have been used. Monthly data for the main species, by fishing area for the years 1960–70, are tabulated by Ritchie et al. (1975), and data for Fishing Statistical Area 3 (Hauraki Gulf, see Figure 5) are used here. Data recorded in the QMS from 1986, more reliably from 1990, can be analysed by area and month, but require extensive grooming for inaccuracies. Also, because it became possible for fishers to spread their fishing effort more uniformly through the year, rather than fish competitively in the main season, monthly data less clearly define the natural seasonal fluctuations in fish abundance. For these reasons the more recent monthly QMS values have not been used in this study.

Ports

The pre-1983 values were based on the port landings of Whangarei, Auckland, Thames, Coromandel, Whitianga/Mercury Bay, and Whangamata (Figure 5), as recorded in Annual Reports on Fisheries to 1974 (data used from reports to 1973) and King (1985) (for 1974 to 1982 data). Some fish landed into these ports would have been caught outside the Hauraki Gulf, and – from best estimates – the landed values have been adjusted downwards as follows: blue cod (90% of landings estimated to be from the Gulf); John dory, leatherjacket, red gurnard, kingfish, porae (80%); jack mackerels, kahawai, school shark, rig, snapper, trevally, skate, tarakihi, groper (70%); barracouta, gemfish (60%). These are subjective estimates, based on the author's general knowledge of the fisheries; no relevant data exist. For the remaining (minor) species the landed values were accepted as the Gulf catch. Some changes would have occurred over time, but there is no information from which to adjust the above estimates. Some fish caught within the Gulf would have been landed elsewhere, particularly Tauranga, and estimates are incorporated in the percentages above. It is likely to have been small for most species, but perhaps moderate for a few pelagic species in recent decades.

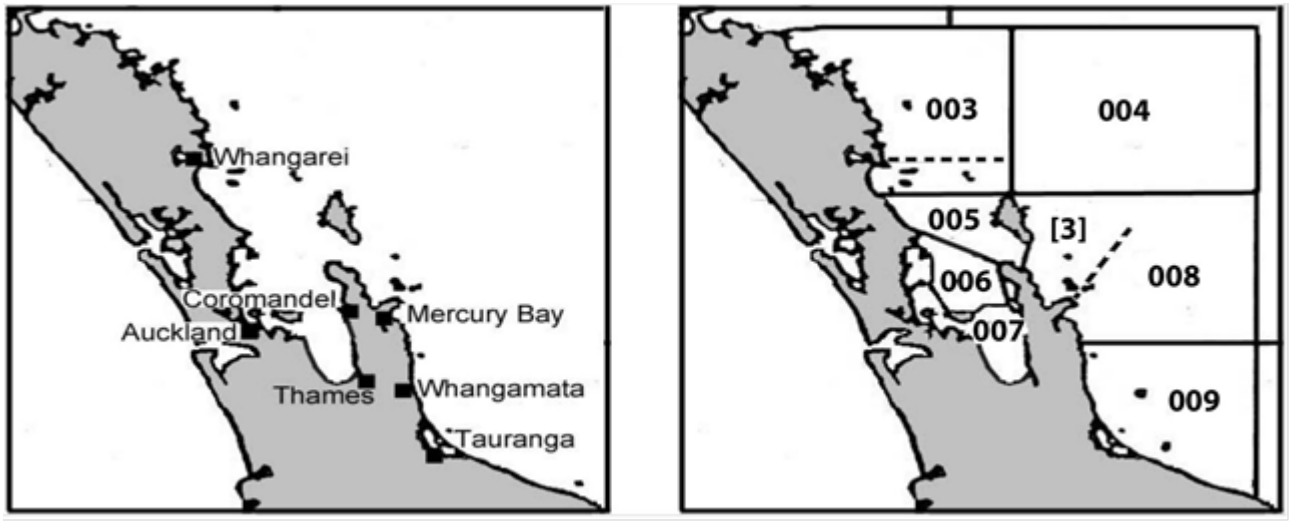

Figure 5: Ports of landing used in this study (left), and General Statistical Areas 003 to 009 (right) used in the extraction of catch by area data from 1983 onwards. These areas replaced the earlier Fishing Catch Areas used by Ritchie et al. (1975) and Paul (1974, 1977). Hauraki Gulf, Area 3 in the earlier series, is shown by square brackets and dashed lines. These earlier studies are thus based on a smaller area defined as the Hauraki Gulf that that used in this account.

Fishing areas

Port landings are available to 1982 (Annual Reports on Fisheries, King 1985), and although catch by area data were collected from at least 1960 they have not been formally published. For the period 1974 to 1982 these data were still requested from fishers, but because of several changes to the recording system and non-compliance by fishers they were considered to be unreliable and were not officially compiled. From 1983 the recorded catch by General Statistical Area (Figure 5) provide more reliable information on regional exploitation. Based on coastline length within the study area 30% of catches from areas 003 and 009 were considered to come from the Gulf, while 100% of catches from areas 004−008 were used.

Catches and landings

From 1983 onwards, deriving landings by area is complex. Estimated catches of the five main species in a fishing event (and fishing effort), and recorded landings of all species from a fishing trip, are recorded separately, sometimes on separate forms. It is necessary to link these in order to obtain catch by area for all species, although approximations are inevitable when several areas are fished during one trip. Sophisticated procedures can be used for single species, but for the suite of species in this study a more straightforward but essentially similar method was employed. All fishing trips which reported a catch in one or more of the designated areas were identified. Estimated catches, and the recorded landed catches from these trips, were extracted from databases. Both were summed by species and calendar year, aggregating catches over the whole fleet to smooth out variations among fishers. The ratio of estimated catches to landed catches was calculated, and then the former were scaled up by the inverse of this ratio. This provided estimated landings for all species by statistical area.

Depth limit

The depth limit adopted for this study is 250 m, which approximates the shelf edge. Before 1983, there was little or no fishing beyond this depth. For catches after this date, species were removed from database extracts if most of their biomass was known to occur below 250 m (from Anderson et al. (1998)). Large vessels provide fishing depths, which allow deeper records to be removed; small vessels are unlikely to work beyond 250 m. Oceanic pelagic species are usually caught in waters beyond the 250 m contour; it

was arbitrarily assumed that 10% were taken above shallower depths. For skipjack, 15% were assumed to be taken inside 250 m, based on West (1991).

Other assumptions and estimation procedures

Where single year values were missing, the mean of adjacent years was used. Where values for two years were missing or incomplete (1988 and 1989) the means of the two preceding and two following years were used. In the 1974–82 data (King 1985) species were dropped when they comprised less than 1% of a port's landing; in most cases the missing values would be small and have been ignored, but for a few species where enough adjacent values are present to show a trend, estimates have been made. In the late 1970s and early 1980s landings of purse-seined pelagic species (jack mackerels, blue mackerel, skipjack, and kingfish) fluctuated inversely between Gulf ports and Tauranga, just south of the defined Hauraki Gulf boundary. It is not known whether Gulf-caught fish were landed at Tauranga, or whether fishing effort shifted to the Bay of Plenty. The latter has been assumed, and no adjustments made. A few instances occurred where species that were unlikely (because of their area and depth distribution) were reported; these were considered erroneous and excluded. As a cross-check, post-1986 Hauraki Gulf landings were compared with an independent, more accurate, data series based on the Fishstock for each species (Ministry of Fisheries 2006); these covered a larger area, in most cases FMA 1 from North Cape to East Cape. Where, in a few instances, Hauraki Gulf values were larger than Fishstock based values, the latter were used.

Foreign catches

Japanese vessels, mainly longliners but occasionally trawlers, fished off northern New Zealand for snapper between 1960 and 1977 (Ministry of Fisheries 2007, p. 841), but their data are poorly recorded. For stock assessment purposes it has been estimated that their catches peaked in 1968 and uniformly rose to and declined from that level (Ministry of Fisheries, 2007). For simplicity and conformity with a complementary study on Hauraki Gulf fisheries (McKenzie & MacDiarmid, 2011) these values are used here. More reliable and/or detailed estimates may later become available. Half of this catch is assumed to have been taken in the Hauraki Gulf region. These foreign snapper catch data are presented separately from the domestic catch data.

Recreational catches

There is an important recreational fishery in the Hauraki Gulf, mainly in the shallow south-western area. Data on estimated catches are scarce and imprecise. Although this study is essentially of the commercial fishery, some comparative information is presented on recreational catches of the major species. Catch estimates for snapper are taken from Gilbert (1994) and Hartill et al. (2007) plus some extrapolation, and for kahawai, red gurnard, and trevally the values for 2005 (Hartill pers. comm. and/or Hartill et al. 2007) were extrapolated back linearly to a very small value in 1942, 1931, and 1955 respectively. They must be interpreted cautiously; surveying recreational fishing activity is difficult, and considerable annual variability results from weather conditions and the abundance and 'catchability' of targeted species.

Discards and underreported catches

Small to moderate quantities of fish have been discarded at sea for a variety of reasons by commercial fishers, varying by species and over time. This has probably declined over time, and particularly since the introduction of the QMS in 1986. Some fish caught has been inadvertently or deliberately underreported in landings data. It has not been possible to quantify the extent of these practices, but the early landings are almost certainly biased low.

'Other' species

A subset of the discards and under-reported or non-reported catches includes non-commercial species (discarded), and very small catches of marginally commercial species (discarded or landed but non-

reported). These are not listed in the landings to 1982. From 1983 the catch by area data included an increasing number of species which belong in this category. The quantities are small, and some are of species unlikely to have been caught in the Hauraki Gulf (probably a consequence of area coding errors). Listings for the years 1990 onwards, when the records seem more reliable, have been used. These species are not included in the main analyses, but are described briefly in a separate section.

Species categories

The species which were at least modestly represented in the commercial landings from 1983 to 2006 are grouped into four categories based on their relative importance in the data for this period (Table 1). This does not represent their true relative abundance in Hauraki Gulf waters; some species are less easily captured by the fishing methods used, and some captured species are discarded at sea because they have little or no commercial value. It also does not represent their relative importance in catches over the entire time period 1931−2006; some species (in particular pelagic species landed in bulk) were not targeted during earlier decades, or were more often discarded, and/or were not reliably recorded. This categorisation is therefore biased by the relative catch of species landed during the second half of the time series, but was chosen because these records are more complete.

Table 1: The four categories of Hauraki Gulf fish used in this account, based on their relative importance in commercial landings from 1983 to 2006, the period when species were most completely and reliably reported in commercial landing statistics.

Principal species

Snapper *Pagrus auratus*

Primary species
Yellowbelly flounder *Rhombosolea leporine*
Sand flounder *Rhombosolea plebeia*
Lemon sole *Pelotretis flavilatus*
New Zealand sole *Peltorhamphus novaezeelandiae*
Red gurnard *Chelidonichthys kumu*
Trevally *Pseudocaranx georgianus*
Blue mackerel *Scomber australasicus*
Yellowtail jack mackerels *Trachurus novaezelandiae*
Greenback jack mackerel *Trachurus declivis*
Slender jack mackerel *Trachurus murphyi*
Kahawai *Arripis trutta*

Secondary species
Skipjack tuna *Katsuwonus pelamis*
John dory *Zeus faber*
Tarakihi *Nemadactylus macropterus*
Rig *Mustelus lenticulatus*
Barracouta *Thyrsites atun*
Pilchard *Sardinops neopilchardus*
Gemfish *Rexea solandri*
School shark *Galeorhinus galeus*
Hapuku (groper) *Polyprion oxygeneios*
Bass groper *Polyprion americanus*
Leatherjacket *Meuschenia scaber*
Kingfish *Seriola lalandi*

Minor species

Grey mullet *Mugil cephalus*
Porae *Nemadactylus douglasi*
Red cod *Pseudophycis bachus*
Parore *Girella tricuspidata*
Blue cod *Parapercis colias*
Red snapper *Centroberyx affinis*
Spiny dogfish *Squalus griffini*
Skates, rough *Zearaja nasuta*
Skate, smooth *Dipturus innominata*
Giant stargazer *Kathetostoma giganteum*
Spotted stargazer *Genyagnus monoptergyius*
Red moki *Cheilodactylus spectabilis*
Blue moki *Latridopsis ciliaris*
Yellow-eyed mullet *Aldrichetta forsteri*
Blue maomao *Scorpis violaceus*
Common conger eel *Conger verreauxi*
Northern conger eel *Conger wilsoni*
Butterfish *Odax pullus*

Sources of further information

In addition to the references listed at the end of this account, references to individual species are given at the end of their section. In most cases these are restricted to the main biological and fisheries studies

relevant to the Hauraki Gulf. When there is limited information from this region, and/or pertinent information is given in other more general accounts, the latter references are included.

Appendices

The appendices include a chronological list of the Acts and Regulations which have influenced the Hauraki Gulf fishery, a similar list of the main Parliamentary Commissions of Enquiry which have been entirely or partially centred on Hauraki Gulf or Auckland issues, a tabulation of landings data from Hauraki Gulf ports 1931–1974, and of the estimated catch of species taken from Hauraki Gulf waters 1931–2006. Also included is a tabulation of snapper size frequencies, taken from Hefford (1929).

3 RESULTS

3.1 Fisheries History

First European contact

Bream Bay, in the north-western Hauraki Gulf, was named by Captain James Cook for an abundance of fish line-caught there on 24 November 1769, called bream or sea bream by his crew. These have been subsequently identified as either snapper or tarakihi, but accepted as "probably snapper" by Beaglehole (1955, p. 210), as the 'Endeavour' "Anchor'd in 14 fathom water a sandy bottom." and its crew immediately caught "between 90 and a hundred Breams ..." An English crew would have been familiar with the sea breams (Sparidae) of Europe. Although the identity of Cook's fish cannot be verified, it would be appropriate for this large bay and its headlands (Bream Head and Bream Tail) to have been named for the dominant species in the fish community, which was a valuable food source for the coastal Maori communities for centuries prior to Cook's visit, and which became the most important species exploited commercially from the late nineteenth Century onwards.

Cook, in fact, was the first European to engage − in a very general sense − in New Zealand's commercial fishery. During his stay in Mercury Bay in November 1769 he wrote "… neither [our] sene nor the Trawl met with any success, but the Natives in some measure made up for this by several baskets or dry'd or ready dress'd fish, altho it was none of the best I order'd it all to be bought up in order to encourage them to trade."

The Nineteenth Century

Commercial fishing in the Hauraki Gulf evolved gradually during the nineteenth century from two activities: the trading of dried marine fish for inland resources between Maori tribes − which quickly extended to supplying the early European settlers with fish, and subsistence fishing by the settlers themselves, some of whom took up fishing as a part-time or full-time occupation. There are very few formal records of this nineteenth century fishery, and its nature and extent can only be inferred from brief accounts in contemporary documents, including Auckland newspapers.

In the early 1850s the Auckland Provincial Government Gazette reported some landings of Hauraki Gulf fish into Auckland from Maori canoes, for example 27 tons during the first six months of 1854, indicating a significant trade, given the city's population. Fish species were not itemised, but it was noted that the canoe landings included oysters (Johnson 2004). A settler's article in '*The New Zealander*' newspaper in 1852 stated "You can buy, for sixpence, as much delicious fish as will serve an ordinary family for two days' dinner. The kinds of fish most commonly brought about here, are the snapper, the mullet, and a fish like our sole in look and taste but rather smaller. Oysters are sixpence a

kit. A kit is a native basket, made of the platted flax of the country; one may contain from four hundred to five hundred oysters." While some fish would have been sold fresh, directly from fishing boats at the wharf, or from hawkers' carts, much of the catch was dried, smoked, or pickled in order to preserve it. In 1857 an advertiser offered: "For Sale, 20 Barrels Fish, Waupuka and Snapper, 20 kits ditto from 60 to 80 lbs each, 2 tons flax, 2 tons Black Fish Oil, in barrels." In 1860 an advertisement offered "Salt fish in Casks. Samuel Cochrane, Brother, & Co. Will sell at their Stores, This Day, 30th instant at 11 o'clock, 6 casks pickled fish, − Cod [hapuku?], Snapper, Mullet, &c.; &c." In 1869 an article describing street scenes in Auckland included notes on several small shops on the wharf near the bottom of Queen St, which included "…'The Young Billingsgate Fish Market,' faced on the opposite side by a Maori establishment of similar character. There is an abundant supply of fish, and […] a wide range of choice. I […] see "schnapper," "mullet," "gar fish," [sic] "tuakie" [tarakihi], "tivally" [trevally], "flounders," […] and an occasional "barracouta." The oysters are supplied in any quantity, and are sold at a shilling a kit. These rock oysters, which, I am told, come from Coromandel, are delicious, and I forthwith go in for a feed."

Small fisheries continued to develop through the 1870s and 1880s, assisted to some degree by government. By 1872 two "fishing stations" were established on the coast just north of Whangarei, drying fish (mostly snapper, with some mullet and hapuku) and receiving a bonus for exporting. One of the companies was supplied by five fishers based at the Hen and Chicken Islands, plus some part-timers. Less is known of the other, but it apparently failed the following year, with its fishers then directly supplying fish to local customers. Mullet was an important species, and mullet canning began at Whangarei in 1870. Canneries were subsequently established at the Bay of Islands and on the Kaipara Harbour, which appear to have remained the main centres through into the early twentieth century although the Hauraki Gulf's harbours would also have been fished. In the absence of refrigeration, canned and cured fish products were popular, and large quantities of salmon, kippers, and sardines were imported from Europe and North America. The 1880s were depression years, following a world economic depression starting in the 1870s. The government passed a number of Acts to encourage local investment and reduce unemployment. Among these was the Fisheries Encouragement Act of 1885, which provided a bonus for the export of locally canned and cured fish, and introduced a system of setting aside suitable coastal areas for the development of "fishing townships" (Sherrin 1886). The latter do not appear to have been taken up, at least in the Hauraki Gulf region, but bonuses paid to the mullet canneries kept several operating until the scheme ended in 1905 (Paulin & Paul 2006). Canned and cured fish remained popular during the late 1800s (Figure 6), allowing supplies to reach inland towns.



Figure 6: Advertisements for fish products in the late 1800s. ***Source: Auckland newspapers, in Papers Past.***

The last three decades of the nineteenth century are notable for the increasing interest shown in fisheries. In 1868 the Colonial Government appointed Commissioners to enquire into the extent and value of fish and fisheries around the New Zealand coastline. Their reports, published as Parliamentary Papers in 1869 and 1870, concluded that although "many varieties" of "wholesome fish" were abundant on every part of the coast, too few people were employed in fishing on a regular basis, and the public demand for fish could not be met because of irregular supplies. It was also recognised that too little was known of the seasonal distribution and habits of most species. There was also confusion over nomenclature, with popular names of European species applied loosely and variably in different regions. The need for a uniform nomenclature was addressed by the catalogue compiled by Hutton (1872), a geologist at the Colonial Museum and Geological Survey Department. In the same booklet Hector, Director of the Colonial Museum, summarised existing knowledge on the main species then being taken for food. This was followed by Sherrin (1886), a 'Handbook of the Fishes of New Zealand,' prepared 'under the directions of the Commissioner of Trade and Customs,' that Department maintaining an interest in fisheries despite the Marine Department (established 1866) gaining responsibility for marine fisheries in 1877 when the Fish Protection Act was passed in that year. Sherrin, an historical journalist with parliamentary connections, described his account as a reprint of Hector's "notes," supplemented by material published in the Transactions of the New Zealand Institute and Parliamentary Papers, together with direct comments from informants. He placed all this within the context of world fisheries developments, and his account conveys the optimism with which fisheries in many countries were regarded at that time. His brief comments on Hauraki Gulf fish and fisheries are summarised here in Table 2.

Table 2: Comments on fish occurring in the Hauraki Gulf (or "northern waters") in Sherrin (1886).

Species	Comments
Snapper	Cites Hector (1872), 'There are few fish better known in the northern parts of New Zealand than the Snapper.'
'Flounder'	They are very abundant at the Thames. As 'Patiki,' … very abundant at the Thames.[1]
Red gurnard	… very abundant during the summer months in the harbours of the North.
Trevally	In Auckland it is sometimes called the yellow-tail … above Kawau and the Barriers they are said to be particularly abundant..
Kahawai	Abundant all round the [New Zealand]coasts, and in the mouths of rivers …
Blue mackerel	In the north of Auckland the Natives make great preparations for fishing tawatawa at the time of new moon during summer, and capture immense numbers. When in season, mackerel are often found between Cape Colville and the Great Barrier, and small shoals have been seen in Auckland Harbour. They are said to be abundant late in the spring about Whangarei … [2]
Jack mackerels	They are seldom caught in the Auckland waters; but are seen at odd times at the end of the Queen Street Wharf. [2]
John dory	They are not plentiful in Auckland … , but they are sometimes caught in the Thames about midsummer, with other fish in the net. They were often obtained by the Auckland Trawling Company [3] …
Tarakihi	[No comment on the Auckland area.]
Rig	No specific Auckland reference, but is undoubtedly included in the comment '… may be found, … at certain seasons, at any Maori settlement by the sea-side, hanging on poles to dry in thousands.'
Barracouta	Found in abundance from Cape Colville to [Great Barrier I.], and around towards Tairua Bay.
Pilchard	They are very abundant in the Auckland waters … and especially so at the Thames …
School shark	Common. [But no reference to Hauraki Gulf.]
Hapuku	The hapuku in the [north] is of two kinds, but whether there are different species has not been determined. [Easily caught at the Hen and Chicken Is.] ... to be found in abundance in the Hauraki Gulf.
Leatherjacket	The leather jacket is not known in the Auckland market, but is common enough outside the harbour, at the Barriers, Whangarei, …
Kingfish	In the Auckland district they are not as plentiful as kahawai or schnapper, but they are to be caught outside if fished for.
Grey mullet	… frequents the tidal rivers, going out to sea in summer and returning in winter in immense numbers. … one of the commonest fish sold in Auckland.
Porae	… found north of Whangarei … and at Auckland.
Red cod	It is by no means a frequent visitor in the northern fish markets.
Parore	… particularly abundant … at Kawau, where it is found in the nets frequently.
Blue cod	They are abundant around the Barrier and Kawau, but are not fished for.
Yelloweye mullet	… very common in Auckland waters.
Blue maomao	[Found, sometimes in abundance, at Moko Hinau Is, the Barrier Is, and Tairua.]
Butterfish	Although not abundant in the North, the butter-fish is found at Kawau, where Sir G. Grey considers there are two varieties.
Turbot	They are sometimes seen in the Auckland market.
Garfish	… the ordinary gar-fish that is so highly appreciated, especially in Auckland and Dunedin.

[1] Although listed as *Rhombosolea monopus* (a synonym of the greenback flounder *R. tapirina*), this is almost certainly a reference to the yellowbelly flounder *R. leporina.*

[2] It is possible that some confusion exists in early accounts of 'mackerel.' Hector (1872) writes: '… it is probable that the Mackerel stated to be so plentiful north of Auckland is also this fish [horse mackerel, *Trachurus* spp.].'

[3] All other references state that trawling did not commence in Hauraki Gulf until 1899; this statement presumably refers to the use of large beach seine or set nets.

Sherrin's compilation includes, without comment, a letter written by a Mr J. McKenzie in 1885 to Sir Julius Vogel, MP, with his observations on fish and fisheries in different parts of the country. McKenzie was commissioned by fishing interests in southern New Zealand, and his views appear to

reflect that. He writes: 'The intense heat of the [Auckland] climate … is against it as a fish-preserving or curing country for other than the most costly processes of preserving, and the dearest kinds of fish, only suitable, as far as price is concerned, for consumption as a delicacy and rarety [sic] by the wealthy.' (This was shortly after successful canning had begun at Whangarei and Kaipara − although McKenzie did record that 'the whole [Kaipara] harbour … seemed to be swarming with the largest and finest mullet in the world.') After fishing in the Firth of Thames and around the Coromandel Peninsula he 'found plenty of firm, delicate fish, the schnapper being the only large fish that could be got in anything like large quantities.' In the western Gulf he 'found schnapper, mullet, kahawai, and bream [tarakihi?] of fine quality.' His conclusion was that 'fish in countless millions frequent the neighbourhood of Great and Little Barrier Isles, and the Firth of Thames.'

At about the same time a lighthouse-keeper in the outer Hauraki Gulf kept records of fish in the vicinity of the Mokohinau Islands (Table 3), but did not comment on any commercial fisheries. He appears to have been one of the more conscientious participants in a project, in part supported by the Marine Department, whereby coastal observers around the country recorded observations of the local fish in an effort to improve what was considered to be a very poor understanding of fish identification, distribution, and life history (Thomson 1891).

Table 3: Fish species recorded at the Mokohinau Islands by Sandager (1888). These records refer to four years of catches or observations made of fish, mostly in depths of 0−25 m, but extending to 110 m. This table includes only those species considered in this paper; some non-commercial species are listed in the original paper, which also includes brief notes on inferred spawning seasons and movements towards or away from the islands.

Species	Abundance	Species	Abundance
Snapper	Common	Gropers[1]	Common
Trevally	Common	Leatherjacket	Common
Jack mackerels	Rare	Kingfish	Common
Kahawai	Common	Porae	Not common
Tarakihi	Rare	Blue cod	Not common
Rig	Not common	Spiny dogfish	Common
Barracouta	Common	Blue maomao	Common
Gemfish	Rare	Butterfish	Not common
School shark	Common		

[1] Two varieties are recognised: fat and large-headed, the maione [moeone, = bass], and small-headed (hapuka) [= hapuku]

In 1889, Auckland newspaper correspondence on the issue of whether fish wholesalers made undue profits, at the expense of fishermen and retailers (fish shops and hawkers), indicates that the standard three-tier structure of a fishing industry had become established. It was not universal, however, and a variety of arrangements, including fishermen selling directly from their boats at the wharf, remained well into the twentieth century (Figure 7).



Figure 7: Fishermen selling fish from their mullet boats near Queen Street, Auckland, in the early 1900s. *Detail from J.D. Richardson photograph, 1902, courtesy of Sir George Grey Special Collections, Auckland Libraries, 4-655.*

Beam trawling was attempted off Dunedin and the Canterbury coast in the 1870s and 1880s, but with limited success; some good catches were made but the industry was not structured to handle intermittent large landings of fish (Johnson 2004). Trawling became a reality in New Zealand in the 1890s with the advent of steam trawlers and refrigeration. The centre of activity was Napier, with some trials elsewhere. Trawling started in the Hauraki Gulf with a single vessel, 'Minnie Casey' (rigged as a beam trawler) in 1899. (A few hauls the previous year by an Auckland tug using a 'dragnet' can only be considered experimental (Johnson 2004).) The 'Minnie Casey' was immediately

successful; in fact, too successful. Commercial fishermen using other methods, and amateur fishermen, were quickly opposed to what was perceived as "the rapid diminution of snapper arising out of the wholesale destruction caused … by trawling" (Hefford 1929). A petition was sent to Parliament, and in 1902 trawling was prohibited in the inner and much of the central Gulf (Figure 8). Closure of the most productive fishing grounds seriously affected the economics of the 'Minnie Casey'; she was detected trawling in a prohibited area and her owners successfully prosecuted. She ceased fishing in 1904, and although restrictions were eased somewhat in 1907 no further trawling took place in the Hauraki Gulf until 1915.

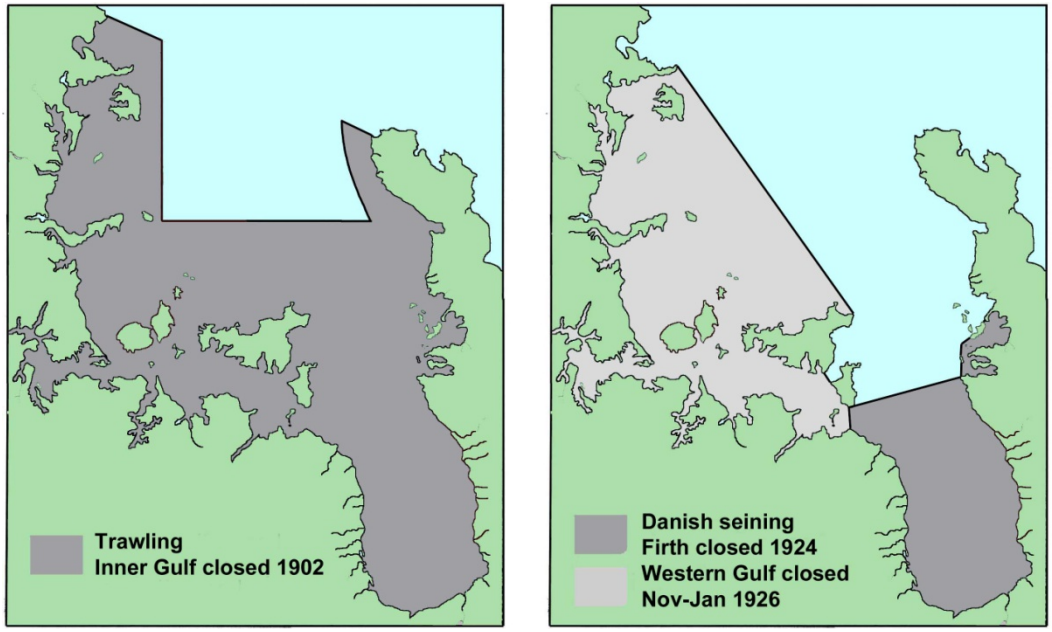

Figure 8: The first closures of parts of the inner Hauraki Gulf to 'power fishing.' Left, most of the inner Gulf was closed to trawling in 1902. Right, the Firth of Thames was closed to Danish seining in 1924, and the western inner Gulf was seasonally closed, 16 November to 31 January, in 1924. Over subsequent decades these lines were adjusted, usually extended seawards, many times. See also Figure 19.

This conflict between amateur (later recreational) and commercial fishermen, and in particular between different groups of the latter − powered versus un-powered or 'traditional', later lines versus nets versus Danish seine (three size categories) versus single and then pair trawlers − came to dominate management of the Hauraki Gulf fishery throughout the twentieth century. Distrust diminished only when the Quota Management System (QMS) reduced competition within the commercial sector in 1986, leaving only the inevitable rivalry between recreational and commercial fishermen.

The 'Minnie Casey' is believed to have been the first motor-powered fishing vessel to have caught fish in the Gulf (Titchener 1981). Until then, the fishing fleet had comprised 'rowing-boats' and 'sailing-boats' (the terms used in early Annual Fisheries Reports). 'Sailing-boats' are not defined, but there would have been two broad categories: (1) small yachts (Figure 9), including the fast, shallow-draught mullet-boats or 'mulleties' developed in the 1860s specifically for bringing mullet catches to market from the harbour channels of the south-western Gulf and the west coast's Manukau and Kaipara harbours (they subsequently became a class of racing yacht); and conversely (2) larger, keeled racing yachts which were sold second-hand into the fishing industry. Ketches and small schooners were undoubtedly also used. At least one trading scow, the 'Ida,' was seasonally used for fishing; in summer it was sailed by its Maori owners to the Mokohinau Islands to fish for hapuku, which were dried in the rigging and brought back to the Auckland markets (Titchener 1981).

Although no formal records exist, the late nineteenth century fishery in the Hauraki Gulf would have been largely restricted to the sheltered waters close to the ports of Auckland, Thames, Coromandel, and Whangarei. Fishing vessels would generally have been small, with some larger sailing vessels capable of working further off the coast, but probably in the vicinity of the Gulf islands rather than in open waters. Fishing gear would have been hand-lines, set-nets, beach seines and perhaps other forms of nets. The main species landed, from anecdotal accounts, would have been snapper, gurnard, kahawai, mullet, and flatfish. Gropers were undoubtedly more common than at near-shore reefs, and appear to have been moderately important in the fishery and certainly popular with consumers.



Figure 9: Mullet boats in Auckland Harbour about the turn of the century. Although built for mullet fishing in shallow waters, they were also used in the inshore line and net fishery for snapper. *By courtesy of Auckland Institute and Museum, reproduced from Paul (1977).*

Although catches would have been modest by later standards, in 1895 it is recorded that about 4000 cwt (200 t) of fish were exported from the Auckland region, although it is not clear whether rock oysters − which were being harvested in some quantity at the time − were included, or whether this was for one or three years (AJHR 1895 H-21). In 1895, also, a Regulation under the Fisheries Conservation Act 1895 proscribed the minimum size (as weight or size) for 20 fish species.

The Twentieth Century

The turn of the century is a logical point from which to start a more detailed account of the many Hauraki Gulf fisheries which developed over the next 100 years. The government had become increasingly interested in the potential of a fishing industry, both encouraging it − with funded exploratory trawling surveys in 1901 and 1907, and export subsidies − and bringing it under some control, with Acts, Regulations, and some monitoring of its activities. The latter, however, was initially limited to the registration of vessels in 1904. Fishermen were also required to supply details of landed fish, but this was either complied with to a very limited extent, or the records have not survived. Opportunistic reporting by Fisheries Inspectors of fishing activity in the main regions is included in Annual Reports, and/or on files held in National Archives. The main species landed at the main ports (where Inspectors were stationed) are listed, but not quantified. Total landings of fish by

port are provided from 1916, but landings by species are not generally available until 1931 (Figure 10).

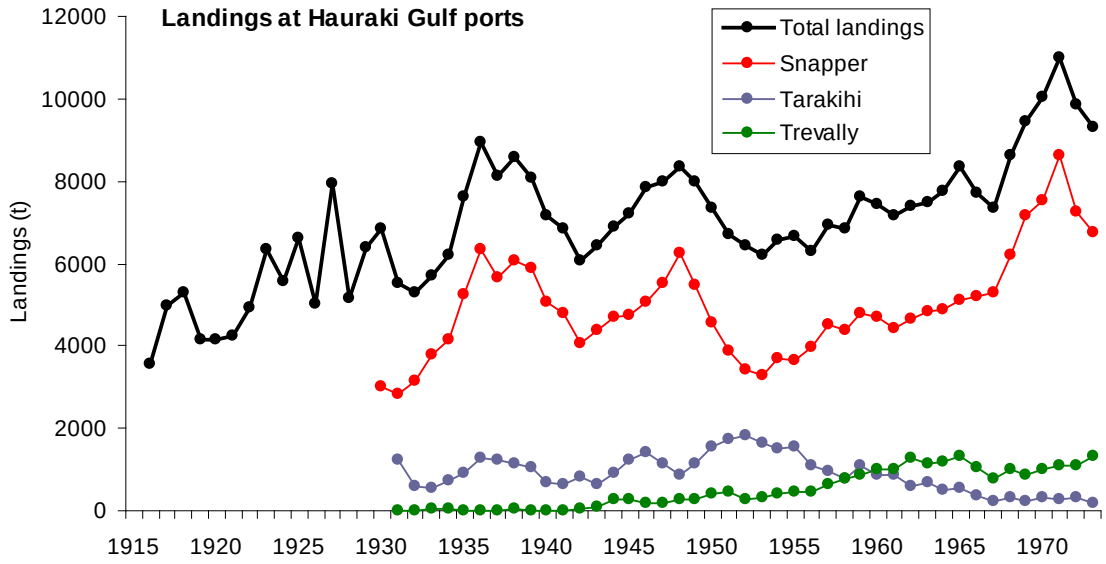

Figure 10: Fish landings at the main Hauraki Gulf ports of Auckland, Thames, Coromandel, and Whangarei combined, representing catches made in the Hauraki Gulf and from further afield. Total landings (1916−73), and landings (1931−73) of the three main species: snapper, tarakihi, and trevally. Subsequent data are not readily available by port. Note: these are port landings; the earliest records would represent predominantly Hauraki Gulf catches, the later records would incorporate relatively more catches taken from further afield. Landings by port are briefly discussed later in this account, but most of this study is based on data sets modified to represent only catches from Hauraki Gulf, i.e.; the catches are lower. Source: Annual Reports on Fisheries, values in cwt converted to tonnes. The earliest recorded value for total landings (1915) is omitted because it appears anomalous and may include rock oysters.

In addition, commercial trawling commenced about 1900 and became a dominant method in many New Zealand regions, although in the Hauraki Gulf it ceased between 1904 and 1915. Refrigeration, developed in the last two decades of the nineteenth century for the meat export trade, was a technological advance of great value to the fishing industry. Although shore-based, it provided a ready supply of ice for use at sea, and for the transportation of fish from ports to inland centres of population.

From about 1900 ‘oil engines’ became available for marine use and were installed in small fishing craft, converting them from sail-boats which were dependent on weather conditions to motor launches with reliable propulsion and able to travel further afield.

Fishing vessels continued to land their catches at the main Auckland wharves along the city waterfront until the early 1930s, with the larger seiners and trawlers progressively moving from Queen St Wharf (Figure 11) to less busy wharves to the west. In the early 1930s the fishing fleet relocated to the Viaduct Basin, developed as a Lighter Basin but under-utilised, where they were closer to the newer fish markets which had been built there.

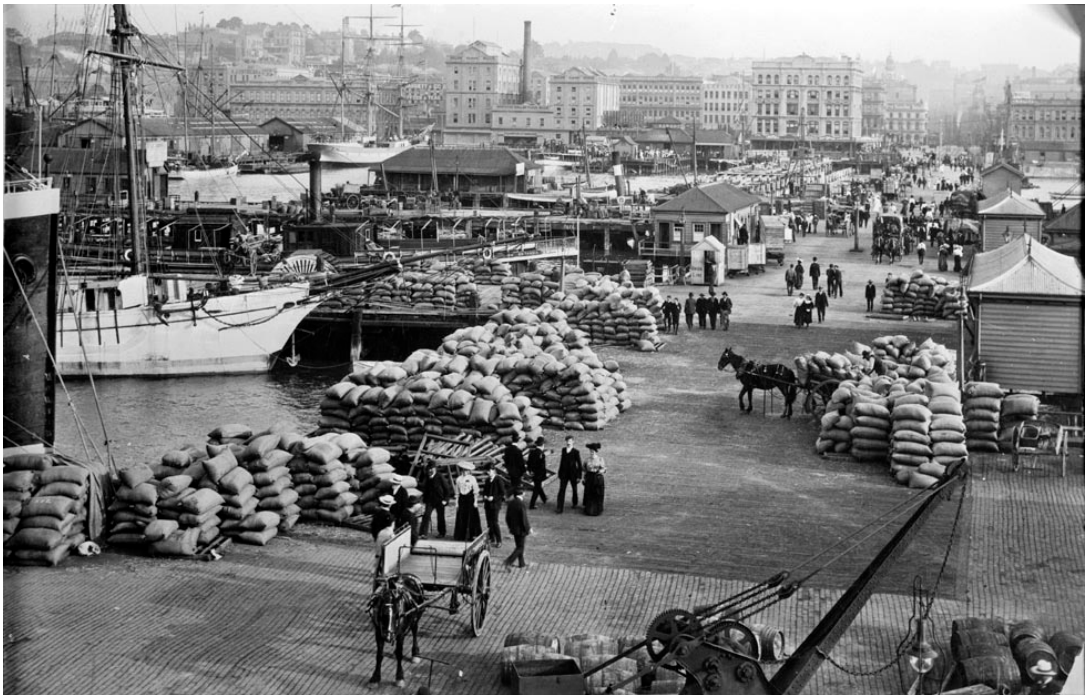

Figure 11: General commercial activity on Queen Street Wharf at the turn of the century, circa 1907. As maritime trade increased most fishing vessels moved to wharves a little further west. ***J.D. Richardson photograph, courtesy Sir George Grey Special Collections, Auckland Libraries, 4-2519.***

The following account deals first with historical changes in the fishing fleet which worked the Hauraki Gulf. It then describes the commercial fish landings, grouped as the principal species (snapper), the primary species, secondary species, and minor species. An account of the fishery for each species is then given in more detail. Finally, the principal (snapper) fishery is discussed within the context of the many Hauraki Gulf fisheries which have evolved over one and a half centuries.

The Fishing Fleet

No single data set of vessel numbers and fishing methods covers the entire period, and there are also inconsistencies within data sets that limit the interpretations that can be made. For example, full- and part-time vessels (defined by monetary catch value) are listed separately only between 1927 and 1950. Part-time vessels can be listed in more than one method category. Similarly, any vessel which changed methods during the year − within and outside this period − will be listed twice. However, several changes over the course of the twentieth century have been sufficiently large to throw some light on the recorded trends in fish landings.

Prior to 1915, one small steam trawler worked from 1899 to 1904, but the main fleet comprised line and net vessels. From 1904 to 1915 there were 250−450 registered vessels at Hauraki Gulf ports (Figure 12), and (on average) 90% were licensed to fish. However, unpublished reports by Fisheries Inspectors (on file at National Archives) suggest that less than half these were actually fishing in any one year. Line-fishing, mainly for snapper, was initially carried out with hand-lines, and was successful enough to create an over-supply of fish during the spring schooling and spawning season; periodically from 1904 fish merchants placed limits on the landings they would accept (unpublished Fisheries Inspectors reports, and Johnson 2004). (This industry-imposed restriction on seasonal landings in fact continued through much of the twentieth century.) The more efficient long-line fishing method was introduced about 1912 and quickly adopted (Hefford 1929), although some hand-lining undoubtedly continued.

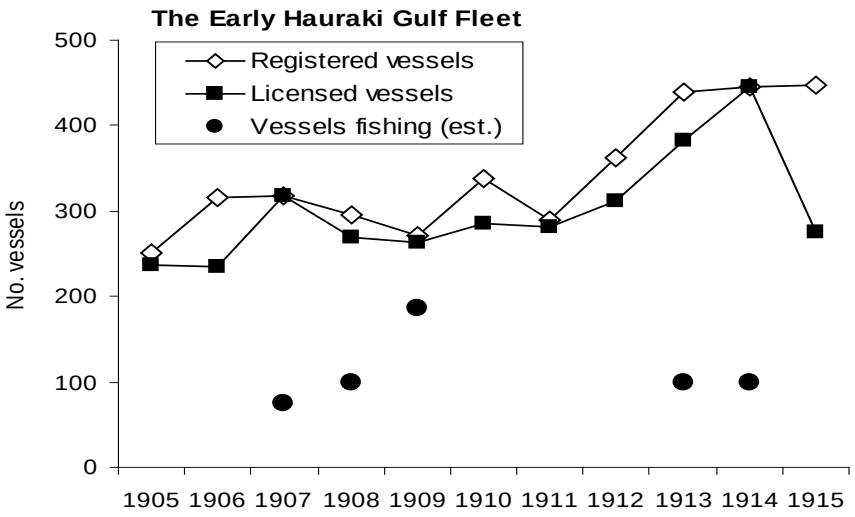

Figure 12: The early line-fishing fleet in the Hauraki Gulf, 1905−1915, based on information tabulated by Fisheries Inspectors at Auckland and Thames (National Archives, Marine Department files). Not all registered fishing vessels had a licence to fish, and some Inspectors' estimates suggest that fewer than half were actually fishing. Subsequent listings in Annual Reports on Fisheries of 'vessels engaged in the fishing industry' are presumably of licensed vessels, although this is not stated.

From 1915 onwards, there are published records of vessel numbers by fishing method in the Annual Reports on Fisheries. They extend to 1971 in Marine Department Reports, and continue to 1974 in Ministry of Agriculture Reports (Figure 13). From 1974 to 1982 there is no listing of vessel by port in King (1985), but a listing of catch (all species) by method by port allows a general comparison with a similar tabulation for 1944−59 in the Marine Department Reports (Figure 14). For several years after the Quota Management System (QMS) was introduced (1986) the data on vessel registration and ownership cannot be directly matched with previous records because of changes to the way they were recorded. From 1990 an electronic database of vessels was maintained as part of the Quota Management System (QMS). However, the QMS also altered fishing strategies, again compromising comparability. For this present account there seemed little value in adding these more recent records to the time series of vessel numbers which were previously a proxy measure of fishing activity and effort.

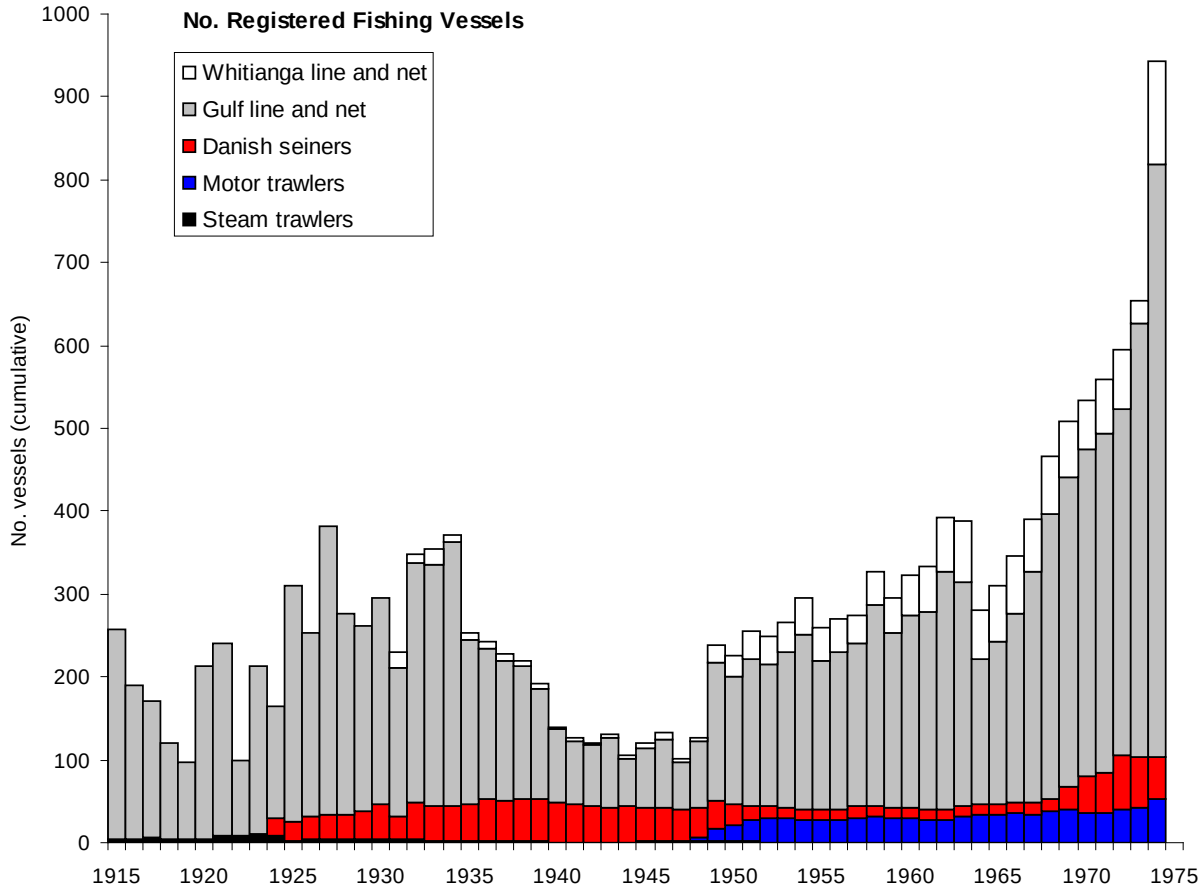

Figure 13: Composition of the fishing fleet based at Auckland, Thames, Coromandel, and Whitianga. Whitianga is shown separately because this small port lies outside the Hauraki Gulf as normally defined. Source: Marine Department, then Ministry of Agriculture & Fisheries, Annual Reports on Fisheries.

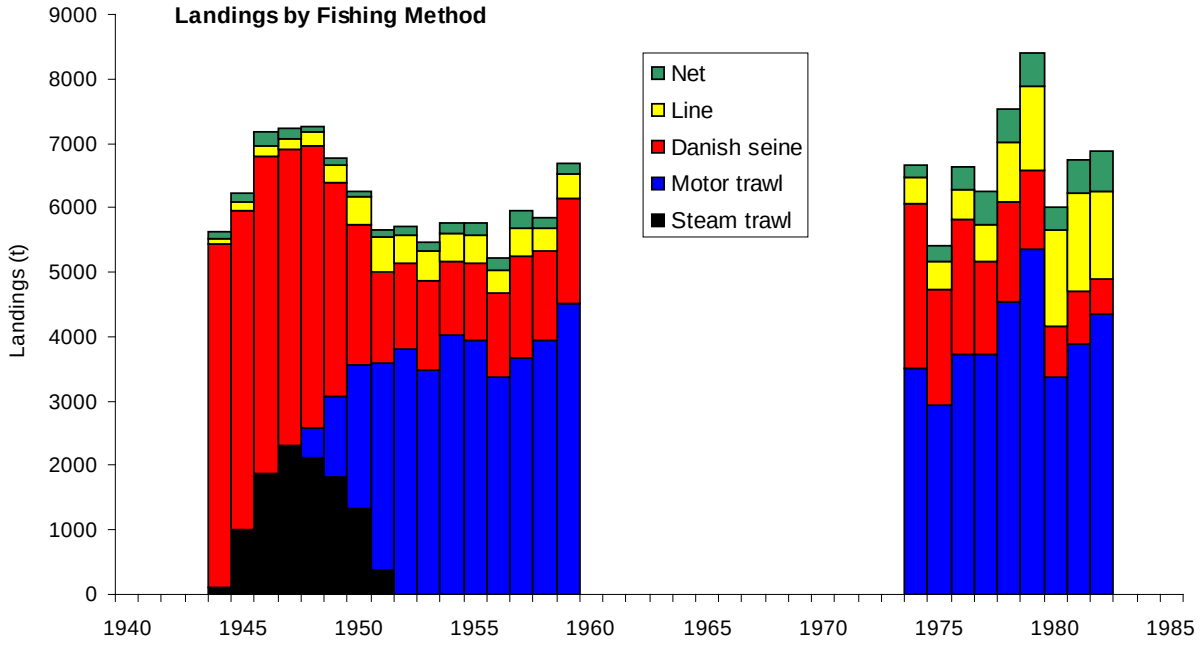

Figure 14: Total fish landings at Auckland by fishing method for 1944–59 (Marine Department Annual Reports on Fisheries) and 1973–82 (King 1985). 'Net' landings are mainly from setnets, but the category includes beach seines, box or teichi net, ring net, and other small nets. 'Line' landings are mainly from longlines, but the category includes handlines and trolled lines.

Although it is useful to know how the size and composition of the fleet has altered over time, the number of licensed fishing vessels is only a crude measure of fishing effort. The 'power' of each method improves as technology develops, and each vessel within a method fishes for a different length of time, and with differing effectiveness, each year. In particular, there is a large distinction between full- and part-time fishermen or vessels, and this information is only available for a little over two decades (Figure 15).

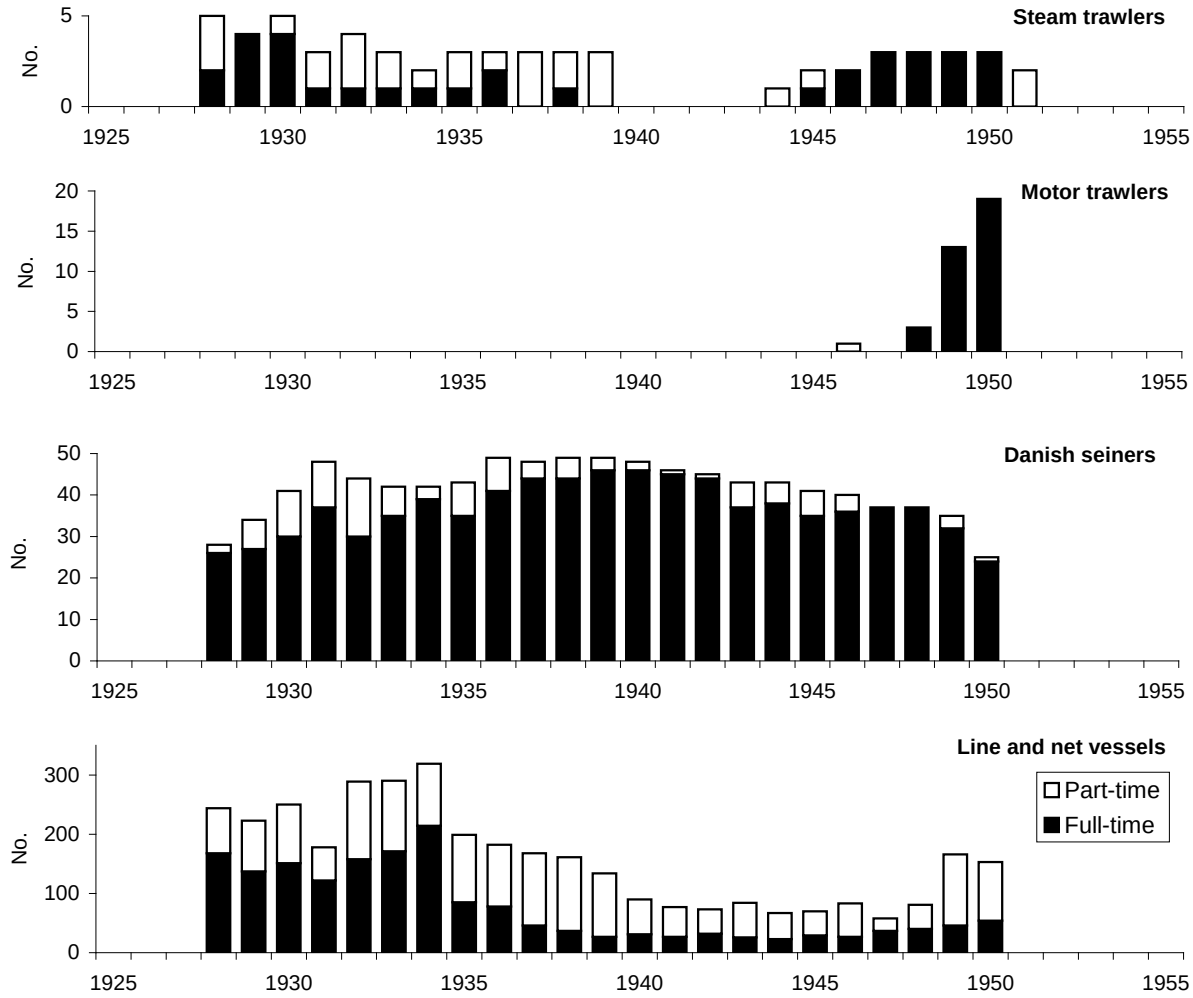

Figure 15: Registered vessel numbers at Hauraki Gulf ports by method, full-time and part-time, 1928 to 1950 (steam trawlers to 1951), the only period for which this part- and full-time information is available. Source: Marine Department Annual Reports on Fisheries.

From 1915 onwards, the fishing fleet is most easily described by method, but some very broad generalisations can first be made on fleet size and composition (see Figure 13). These are most apparent in the numbers of line and net vessels, but changes in the Danish seiners and trawler fleet would have had a greater impact on catches.

- There was a decline from 1914 to 1919 when fishermen enlisted in the armed forces.
- Following a post-war recovery, there was a decline during the early years of the 1930s Depression, a brief recovery and then a decline into the very low period of the Second World War.
- There was another steady post-war recovery, and then from 1965 to 1975 a rapid increase which can be attributed to de-licensing the fishing industry in 1964.

- The relative numbers of vessels by method (see Figure 13) and landings by method (Figure 14) have changed considerably over time.

The following account of the fishing methods is presented in the sequence in which they occurred in the Hauraki Gulf fishery, rather than by their relative importance over the whole period in question.

Line and net vessels

At the turn of the twentieth century there were probably about 200 line and net vessels, of which perhaps half were actively fishing (see Figure 12). Long-lining largely replaced hand-lining in 1912 (Hefford 1929). Line vessels increased to about 400 in 1914, then declined to less than 100 in 1919, probably as young men joined the armed forces (suggested in the Fisheries Report for 1915−16). From 1920 to 1927 numbers fluctuated upwards to about 350. There was a drop in the early 1930s generally attributed to the Depression, followed by a steady decline during the late 1930s, the latter mainly in the number of full-time vessels (see Figure 15), and of rowing boats (Figures 16, 17). A few sail-boats were listed up to 1934. Numbers rose sharply again after their lowest level during World War II, then from 1949 to 1962 increased slowly but steadily. The drop in 1963 and 1964, followed by a steep rise, is a consequence of de-licensing following the 1962 Parliamentary (Scott) enquiry into the fishing industry. Because licences were difficult to obtain they remained held after active fishing ceased, in case they were required in the future; when they became available upon application (1963) non-active licences were let lapse, and then a rush of new fishermen joined the unrestricted fishery. Many of the latter would have been part-time fishermen.

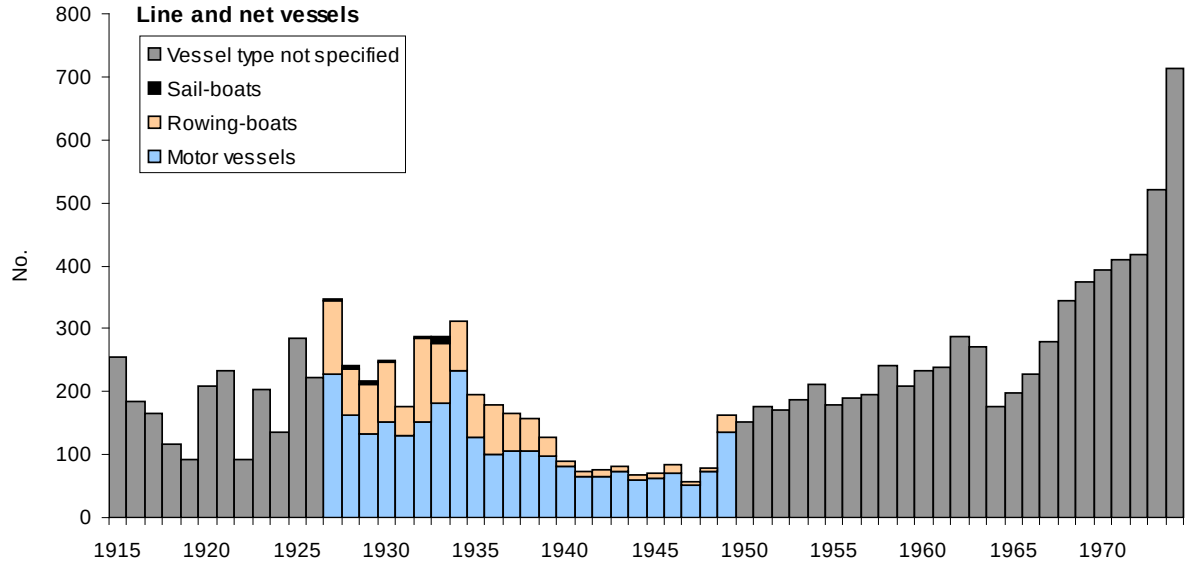

Figure 16: Numbers of line and net vessels, 1915−74. Numbers by category (sail, row, motor) for 1927−49.



Figure 17: Line and net vessels moored at the old Nelson Street wharf, Auckland, in the early 1920s. Some of these vessels remained in the fishery for decades. *By courtesy of Sanford Ltd, reproduced from Paul (1977).*

There are no published post-1974 data, but the increase in numbers almost certainly continued. In 1978 landings from line vessels show a moderate increase (see Figure 14), probably resulting from a demand for higher-quality snapper to be exported whole, principally to Japan. In the mid-1980s two major management decisions were taken which reduced the number of line and net vessels. In 1983 part-time fishermen were excluded from the (New Zealand) industry, because of their perceived potential to increase their landings and further damage an already overfished resource. In 1986 the QMS was introduced; it immediately removed fishermen who did not have a qualifying catch history from two of three years in the early 1980s, and over subsequent years many fishermen sold their quota to companies and either retired or leased back quota when required. As a consequence of (a) de-licensing, (b) part-time removals, and (c) the QMS regime, vessel numbers from the 1970s onwards are unlikely to be comparable with earlier data.

Steam trawlers

The steam trawler 'Minnie Casey' which began fishing in 1899 was laid up in 1904 and subsequently scrapped (Tichener 1981). Four trawlers began working in 1915, their numbers increasing to a maximum of eight from 1921 to 1924, and then declining to between two and five in the late 1920s and 30s. Their initial grounds were in the outer Hauraki Gulf, but they soon worked further afield: to the Bay of Plenty for snapper, gurnard, and tarakihi, and to the East Cape region for tarakihi. Some trips were also made to west Northland, mainly off Ninety Mile Beach. They became less economic during the Depression years when demand for large catches declined, and those remaining in the fleet often worked only for part of the year. The three vessels working in 1939 (built originally as minesweepers) were transferred to the Navy immediately World War II broke out (Tichener 1981). Two trawlers resumed fishing in 1945 (one part-, one full-time), two were operating in 1946, and three were registered from 1947 to 1950; two worked part time in 1951, and they were laid up at the end of that year. They made good catches, but had high running and maintenance costs, and manning problems. Their contribution to the catch into Auckland (see Figure 14) shows the rise and fall in their post-war activity. A typical steam trawler is illustrated in Figure 18.

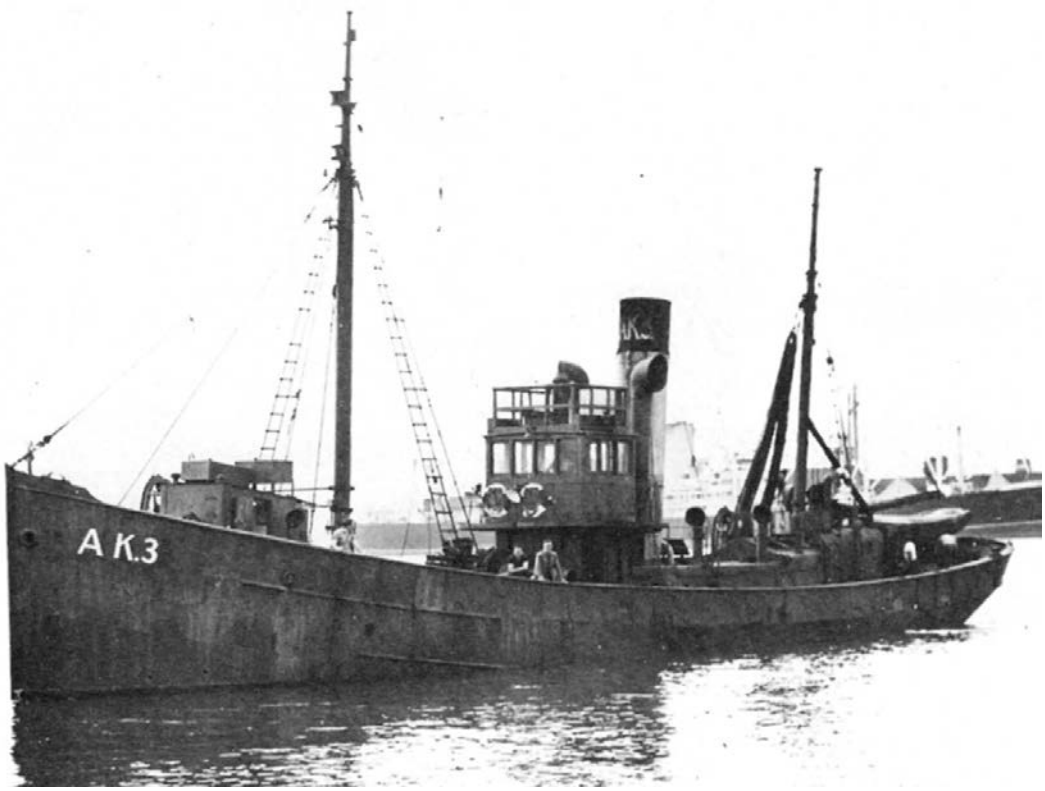

Figure 18: *Thomas Currell,* a steam trawler which began fishing in the early 1920s, was used by the Navy for minesweeping during World War II, then returned to fishing post-war. *By courtesy of Sanford Ltd, reproduced from Paul (1977).*

Danish seiners

The Danish seining method started in the Hauraki Gulf in late 1923. Its success in catching snapper, particularly during the spring schooling season, led to its rapid adoption by the smaller steam trawlers which were becoming less economic. For a short time they could work in inshore waters previously closed to them. It was also adopted by some of the larger line-fishing vessels. During its first season more snapper were taken by this method than the markets could handle (Hefford 1929). Closure of the Firth of Thames to Danish seining in January 1924 did not deter the uptake of this method; 22 seiners were working by the end of 1924, and over 30 by the end of the decade. However, there was increasing opposition to this very powerful fishing method by the traditional line and net fishermen, who claimed it was depleting snapper stocks. In 1929 most of the inner and central Gulf was closed to Danish seiners over 50 ft (15 m) in length, and over the following decades there were various amendments which slightly redefined the areas and seasons of closure to different sizes of vessel (engine horsepower replaced length in 1950); Figure 19 illustrates the closed areas as at 1971.

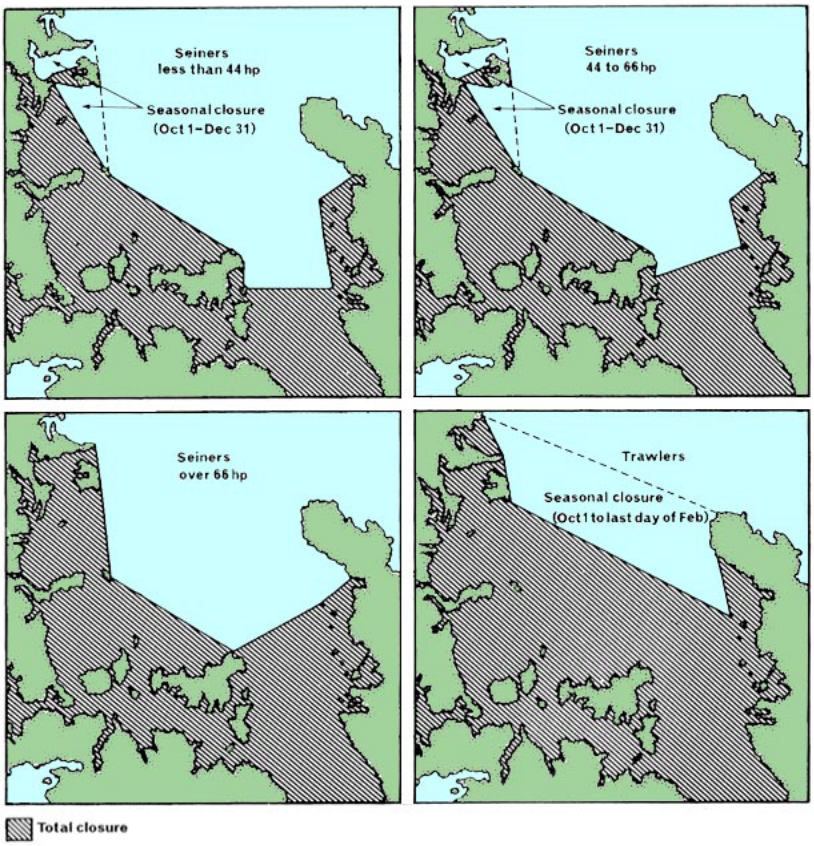

Figure 19: Areas of the Hauraki Gulf closed seasonally or permanently to different sizes of Danish seiners (as defined by engine horsepower), and seasonally to trawlers, as of 1971. *From Paul (1977).*

Danish seiners worked mainly within the Hauraki Gulf, generally − as dictated by regulation − on somewhat shallower grounds than trawlers. From the 1930s onwards somewhat larger purpose-built seiners (Figure 20) replaced some of the older converted launches, and the fleet reached its maximum size of over 40 in the late 1930s and early 40s.

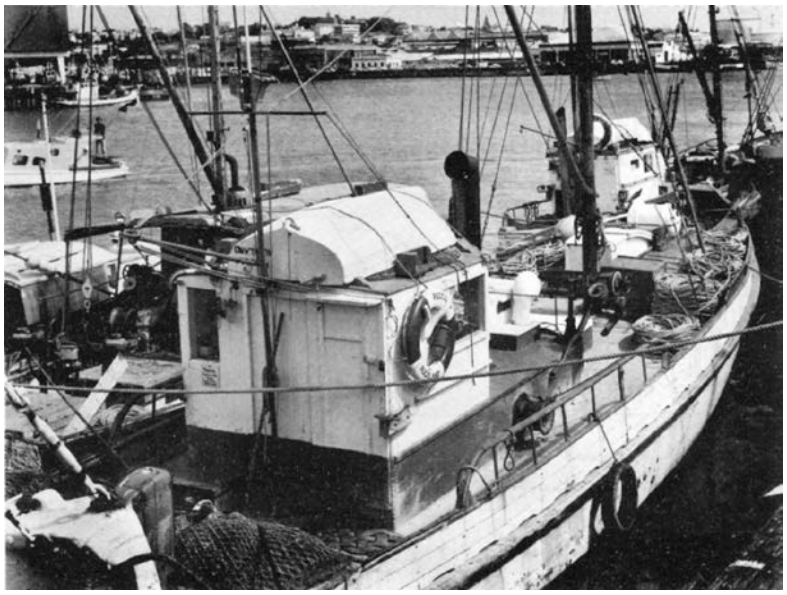

Figure 20: *Podgora*, built in 1934 and still fishing in the 1970s, is typical of the Danish seiners which worked the Hauraki Gulf during these decades. *From Paul (1977).*

The larger vessels worked East Northland and the Bay of Plenty grounds in addition to the Gulf. The gear remained essentially the same, although synthetics replaced natural fibre ropes and nets, and the length of warp (number of rope coils) increased. Most Danish seiners worked full time (see Figure 15). In the late 1940s Danish seining became marginally economic for a number of reasons (Paul 1977), and many vessels converted to trawling or returned to long-lining. However, in 1968 a few vessels experimented with a larger and higher-opening net, and their success during the snapper schooling season led most of the fleet to adopt it during subsequent years. Danish seine increased sharply in the late 1960s and early 70s (Figure 21), but from the mid-1970s declined again. During the 1970s several new vessels were built (Figure 22), generally larger and capable of both seining and trawling, and sometimes also lining. They worked whichever method was most appropriate for the time of year and location of snapper schools; seining was permitted closer inshore, and this method was chosen when the schooling snapper moved inside the 'trawling line' to spawn.

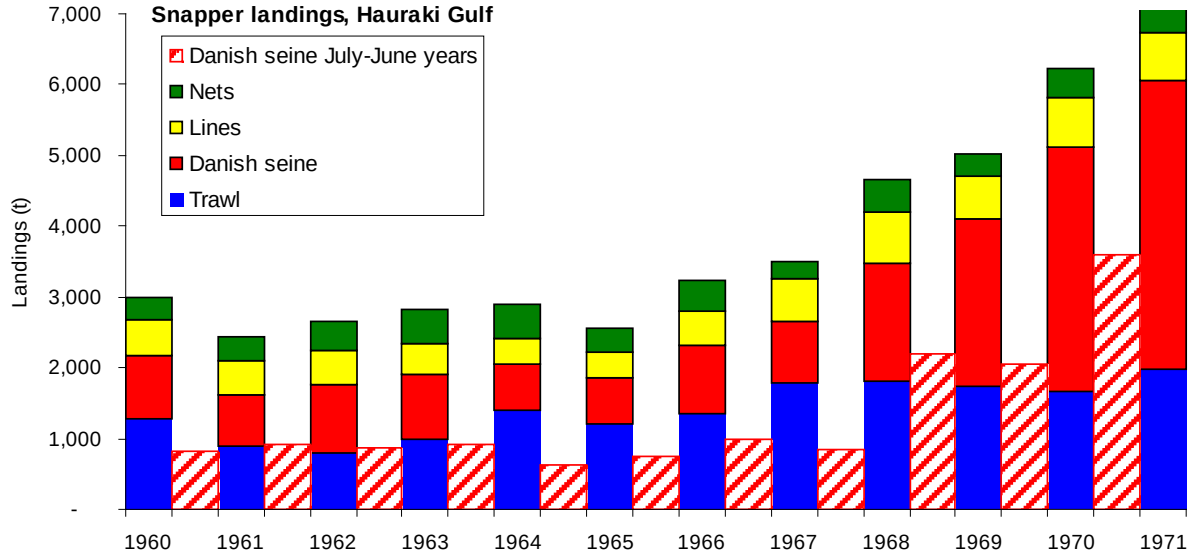

Figure 21: Snapper landings from the Hauraki Gulf, Fishing Catch Area 3, by method, calendar years 1960–71. Danish seine landings are also plotted for July-June years, 1960–61 to 1970–71, to more clearly illustrate the sudden increase in spring-summer 1968–69 when a larger net was first used. These data from Paul (1977) partly fill the gap in Figure 14, but are not directly comparable, they are for snapper only (not all fish), and are by area, not the port of Auckland.



Figure 22: *Eskdale*, a 17 m steel vessel typical of the trawler-seiners built in the late 1960s and 1970s. *From Paul (1977).*

From the mid-1970s, data on the Hauraki Gulf fleet composition by method are not available, but the number of multiple-method vessels would in fact make the information of limited value in understanding changes in fishing effort.

Motor trawlers

Although motor trawlers had operated in other areas of New Zealand for many decades ('oil-engined' trawlers are listed in the Annual Report on Fisheries for 1915) they were not used in the Hauraki Gulf until 1948. Presumably the combination of other methods (steam trawl, Danish seine, line, and net) had maintained an adequate supply of fish. However, in the late 1940s both steam trawling and Danish seining were becoming less economic, and many Danish seiners were converted to small stern trawlers. The combined number of seiners and trawlers remained fairly constant at 40−50 until 1968 (see Figure 13), as the same vessels either changed or alternated methods. After that the number of trawlers increased slightly until 1974, but less dramatically than the number of seiners, which were making good catches of snapper with their larger nets. Numbers are not recorded for subsequent years, but the tonnage of snapper landed into Auckland by trawler through the 1970s (see Figure 14) suggests that there was little change during this time. Figure 23 illustrates a typical motor trawler of the post-war years.

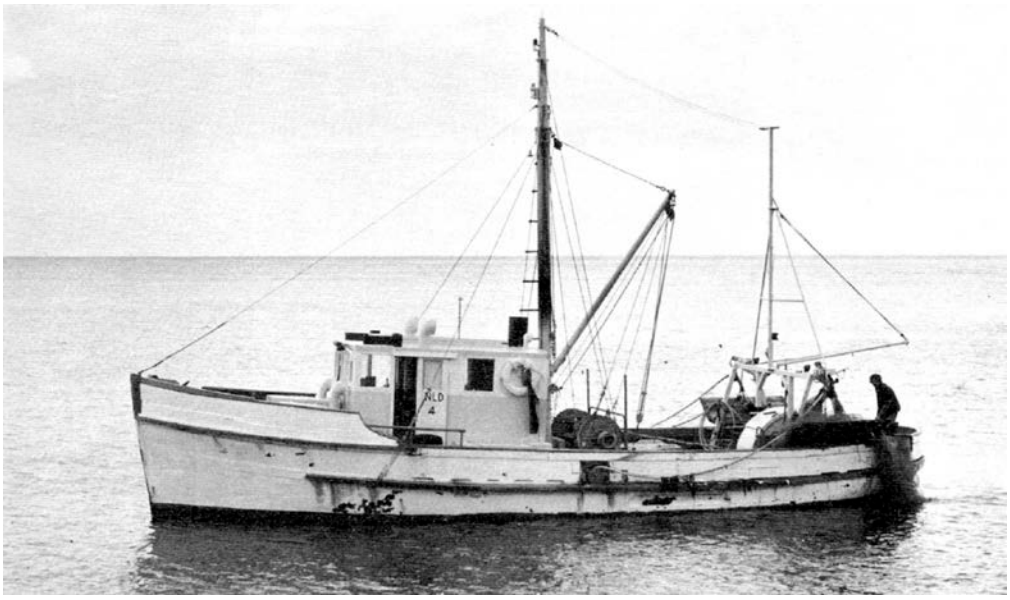

Figure 23: *Viking*, a motor trawler typical of those which worked post-war, initially alongside the steam trawlers but soon replacing them. *From Paul (1977).*

Purse seiners

Because of changes to the statistical recording system during the 1970s and 1980s there is little recorded information on purse seine vessel numbers by port. However, port registrations would have limited relevance as purse seiners fished over a wide area and often landed into other ports. They commenced working in the mid-1970s, the first being chartered American vessels fishing for skipjack tuna, soon joined by New Zealand vessels (Figure 24) which also fished for jack mackerels, blue mackerel, kahawai, and trevally during the remainder of the year or when market demand and prices made it economic.

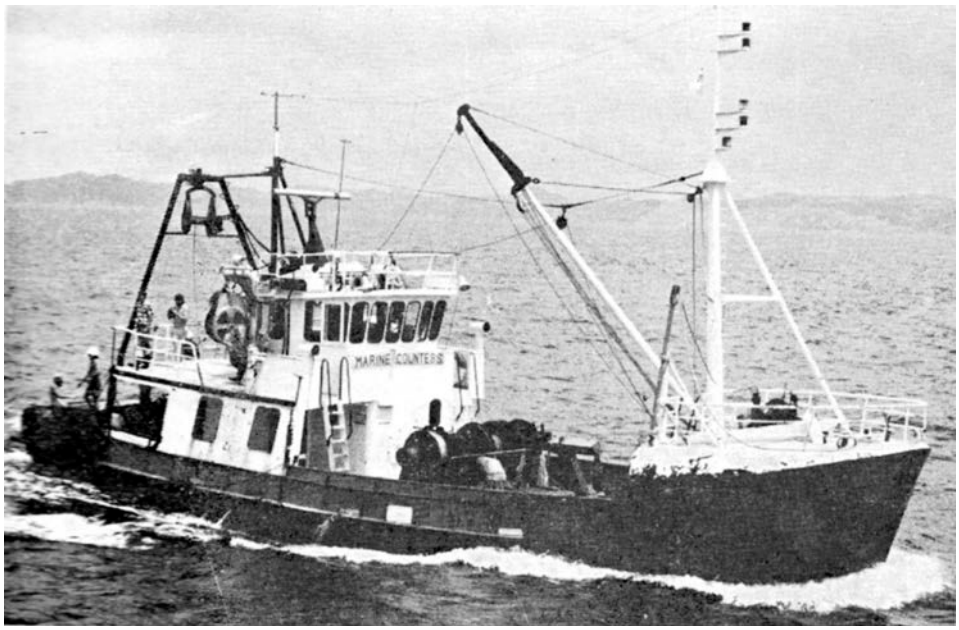

Figure 24: *Marine Countess*, one of the smaller New Zealand purse seiners which began working in the 1970s. *From Catch, November 1976.*

3.2 The relative importance of the Hauraki Gulf in New Zealand fisheries

In the 1890s New Zealand's "major fishery" appeared to be around the southern South Island, centred on the coastal zone from Otago Peninsula to Stewart Island; Auckland was in second place (Johnson 2004). As the Otago region was generally prosperous and progressive there is no reason to doubt this, although little quantitative information is available. "Auckland," at that time, would have included the ports of Auckland, Thames, and Coromandel, with minor contributions from Manukau Harbour, Mercury Bay, and Whangarei.

The first reasonably reliable New Zealand fish landing values are for the fishing year April 1916 to March 1917, plotted in Figure 25 and subsequent figures as 1916. Only total values are available − and from accompanying comments in the Annual Reports on Fisheries it is clear that these are not always reliable − but it is possible to compare regional totals. Hauraki Gulf landings equalled those from Otago and Southland in 1916 and slowly increased, while the latter remained more or less constant. The only other region to show an increase over this period was Cook Strait.

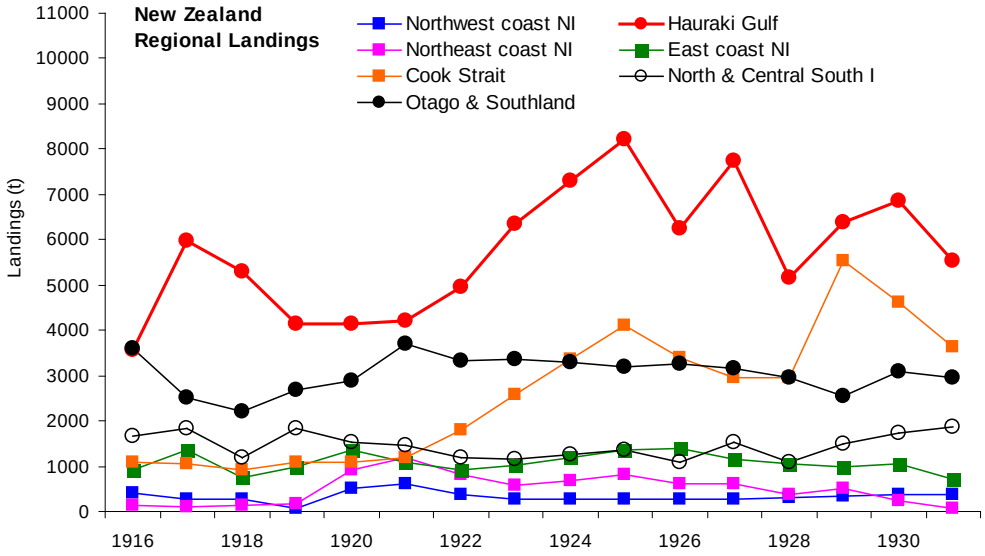

Figure 25: Trends in New Zealand total marine fish landings, by region, 1916–31, based on port landings. The values pre-date the establishment of a formal statistical reporting system (in 1931) and are not considered accurate, but the inter-regional differences are probably reliable. Source: Annual Reports on Fisheries.

Hauraki Gulf and New Zealand total landings increased slowly from 1916 until the early 1970s. Total landings then increased very rapidly as new offshore fisheries were discovered, while Gulf landings declined a little, possibly as a consequence of some fishing effort moving offshore elsewhere around New Zealand (Figure 26). Total landings dropped in 1978 when offshore fisheries management changed following declaration of an Exclusive Economic Zone, then recovered rapidly to a maximum of 400 000−500 000 t in the 1990s. Landings from the Hauraki Gulf appear to increase sharply in 1983 and remain at a higher level, but this marks the change from port-of-landing data to catch-area data, with associated changes in reporting and statistical recording systems, and may well be an artefact.

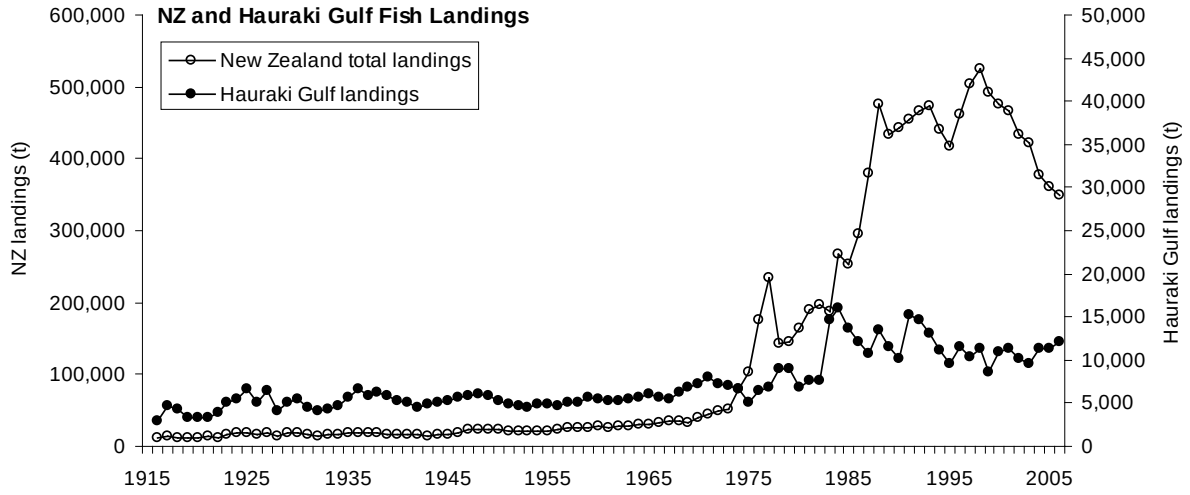

Figure 26: Annual total landings of fish for New Zealand (domestic and foreign vessels), and for the Hauraki Gulf area (as defined in the text), 1916−2006. Note that the two series are plotted at different scales. (The earliest listed landings by species are for 1915 (April 1915 to March 1916), but they are given in 'tons,' not cwt as in subsequent years, and do not seem reliable.) Source: Annual Reports on Fisheries 1916−74, King (1985) for 1974−82, unpublished landings data for 1983−2006 (see text).

The relative importance of the Hauraki Gulf to New Zealand's fisheries is more clearly revealed by percentage values (Figure 27). From 1916 to about 1940 landings from the Gulf were 25−35% of the country's total landings. The percentage then steadily declined during the 1940s to reach a new level of about 20% through the 1950s and 1960s. The actual landings did not decline, but fluctuated between 5000 t and 7000 t (higher when port landings are not adjusted for out-of-area catches, Figure 28); the downward trend in percentages resulting from fisheries landings in other regions of New Zealand rising relatively more rapidly. When new offshore fisheries developed in the early 1970s, there was a small decline in landings from the Gulf, and the percentage fell steeply to 2−5% of New Zealand's total. Few offshore fisheries developed in the Hauraki Gulf region.

From the 1970s onwards a combination of factors make it difficult, and probably impossible, to quantify the relative importance of the Hauraki Gulf to the country's inshore fisheries. Larger vessels ranged further afield from their home ports, moved between inshore and offshore fisheries, and their catches and landings were recorded in a sequence of recording systems with gaps and overlaps.

In summary, Hauraki Gulf fisheries had equalled southern New Zealand fisheries in importance by 1916, possibly earlier, probably as a consequence of the four steam trawlers commencing operations in 1915. They increased in size and relative importance over succeeding decades, providing over one-third of total New Zealand fisheries landings until 1945, the Gulf being the most important inshore fishing region until at least the 1960s. In subsequent decades landings from the Gulf remained stable, although the region probably lost its dominance.

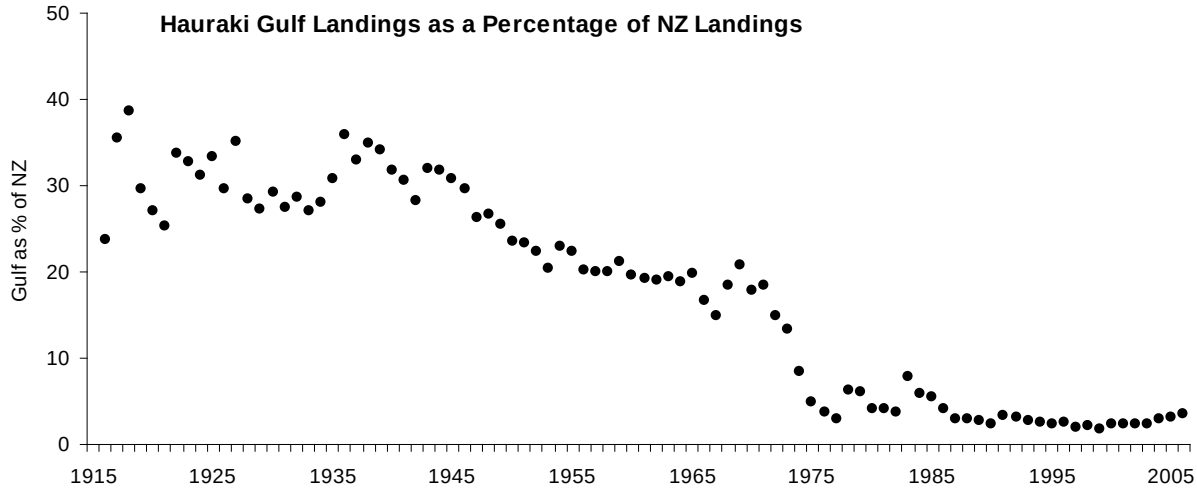

Figure 27: Annual landings of fish from the Hauraki Gulf area (as defined in the text), as a percentage of total New Zealand fish landings. Source, as in previous Figure.

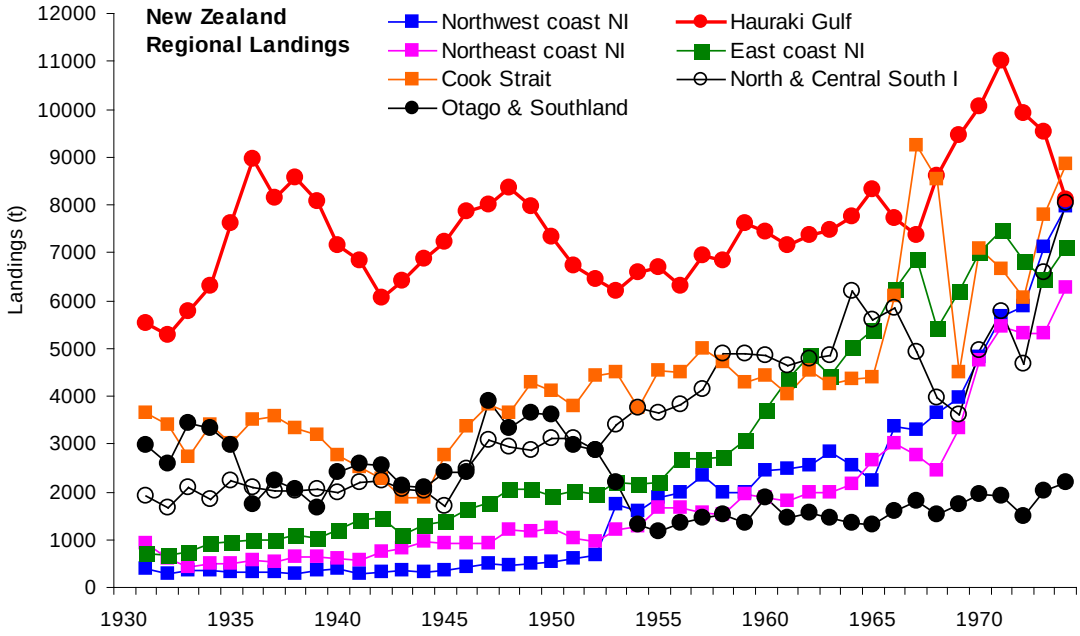

Figure 28: Trends in New Zealand total marine fish landings, by region, 1931−74, based on port landings and not fishing area. A proportion of 'Hauraki Gulf' landings are from outside the Hauraki Gulf area as defined in the text. Source: Annual Reports on Fisheries.

3.3 Landings at Hauraki Gulf ports

Although fish landings into Hauraki Gulf ports include some fish catches made outside the Gulf, they do describe some of the broader within-region differences in Gulf fisheries. There are five nominal ports within the Hauraki Gulf as defined in this study: Whangarei, Auckland, Thames, Coromandel, and Mercury Bay. They are nominal in the sense that although they are the main 'ports' of the Gulf, they incorporate landings at many individual 'landing places' along the adjacent coastline. 'Auckland,' for example, is a combination of all fish landings made at localities along the western and southern coastline of the inner Gulf, to the northern limit of the Firth of Thames, although the greatest

proportion would have been across the wharves in Waitemata Harbour, Auckland. 'Thames' represents all landing places around the Firth of Thames coast. Reliable data are not available by port after 1982.

Auckland

Landings are dominated by snapper (Figure 29). Tarakihi were second in importance until 1960, being replaced by trevally as their decline (from 1953) continued. The tarakihi peak corresponds with a decline in snapper, and partly represents a movement by trawlers away from the Hauraki Gulf to the Bay of Plenty and East Cape tarakihi grounds. The only other demersal species of significance were flounder, which declined from the 1940s onwards, and red gurnard, which increased after the mid-1940s. Pelagic species were only landed in any quantity from the late 1970s, initially mackerels and kahawai, then (skipjack) tuna.

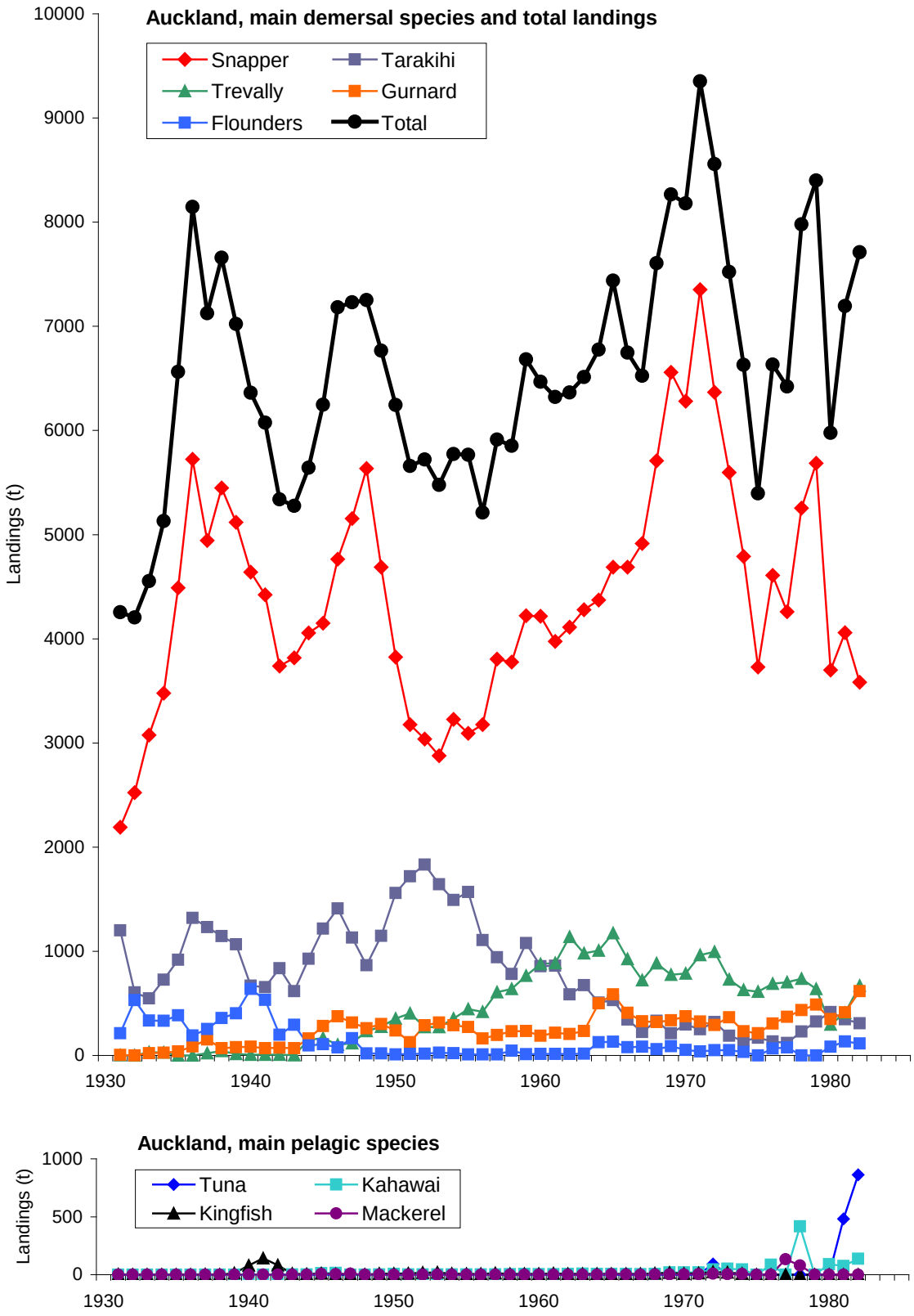

Figure 29: Trends in marine fish landings into the port of Auckland, 1931–82, caught from the Hauraki Gulf and adjacent regions, i.e.; a wider region than the 'Hauraki Gulf' defined in the text. The main demersal and pelagic species are plotted separately; 'total' includes all species of both groups. Sources: Annual Reports on Fisheries, King (1985).

Thames

Thames landings show a fluctuating decline from 1931 to the early 1980s (Figure 30), probably as a consequence of some fishers opting to land their catch into Auckland where fish processing and wholesaling was becoming centralised. Thames is also a shallow water port, less accessible to larger vessels. Snapper was the main species, occasionally equalled by flounder. As at Auckland, trevally became more important from the late 1950s. Pioke (rig) increased from the mid-1970s, probably with the rise in monofilament gillnetting. Red gurnard landings were small but steady; they declined after 1970 but their absence from 1975 is an artefact of the data (they are not listed as a separate species).

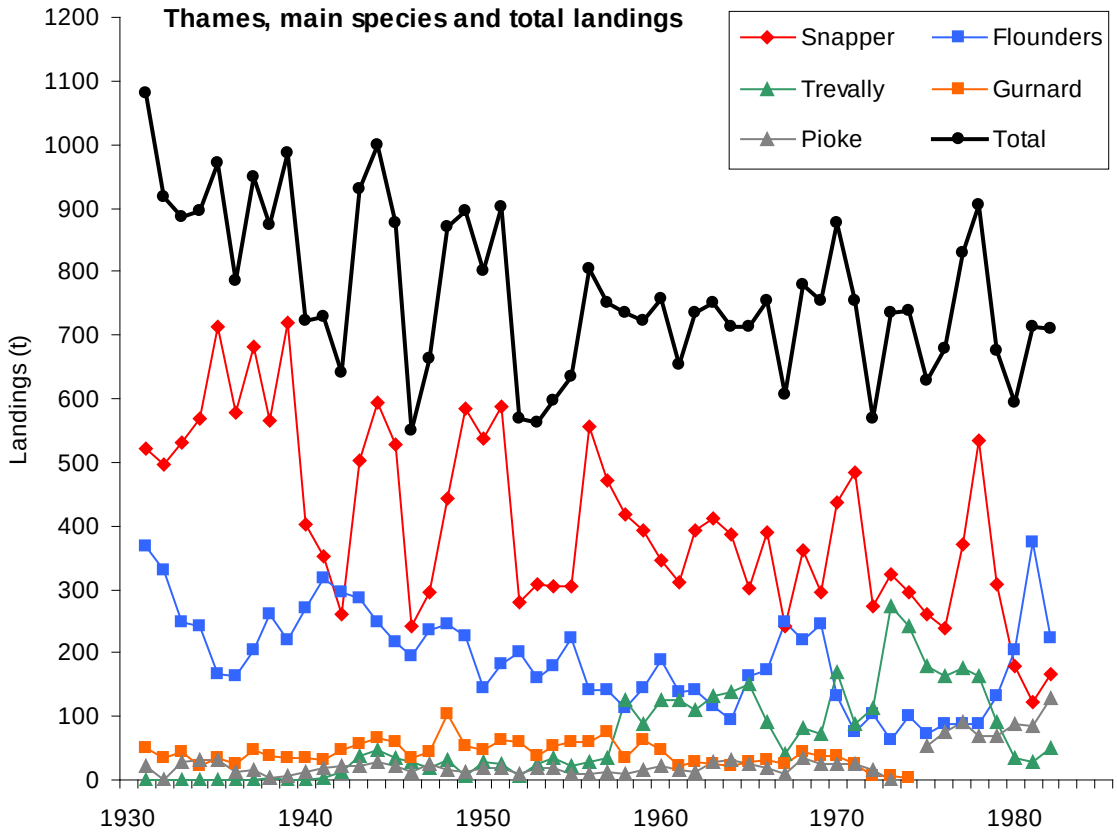

Figure 30: Trends in marine fish landings into Thames (1931–82) caught mainly from the Hauraki Gulf. 'Total' includes all species. Sources: Annual Reports on Fisheries, King (1985).

Coromandel

Landings were very small until about 1960 (Figure 31). Snapper was always the main species, and almost completely accounted for the very large increase in the late 1960s when Danish seiners began working out of the port.

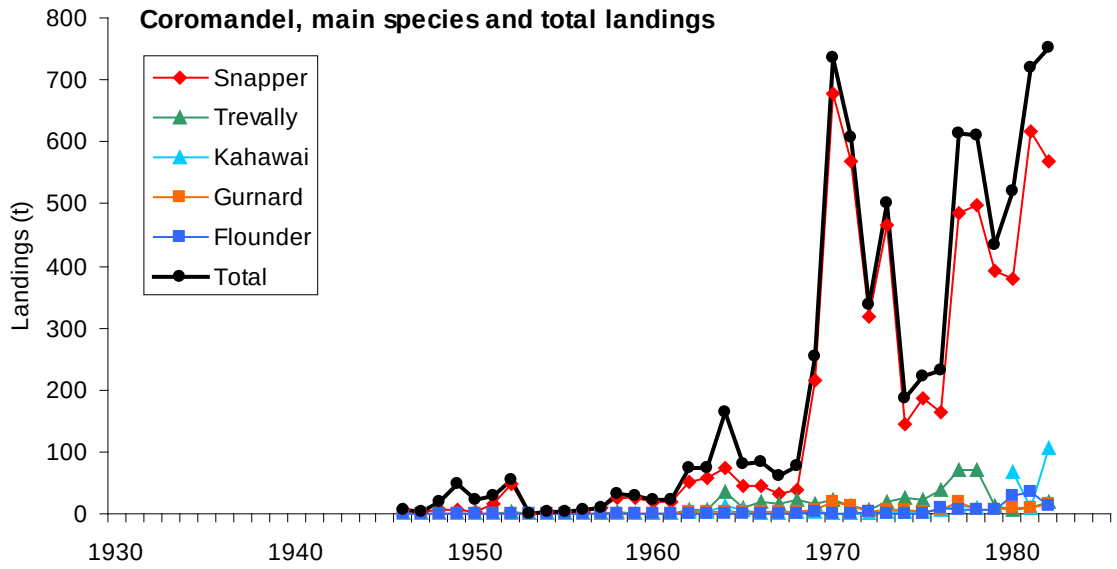

Figure 31: Trends in marine fish landings into Coromandel (1946–82), caught mainly from the Hauraki Gulf. Prior to 1946 Coromandel was included with Auckland. 'Total' includes all species. Sources: Annual Reports on Fisheries, King (1985).

Whangarei

The main species has always been snapper (Figure 32), increasing after 1970 with the arrival of Danish seiners. From the late 1970s there was an increase in gurnard, trevally, and a variety of minor species for which individual values are not available. The small 'non-snapper' peak in the mid-1940s results from higher than usual landings of kahawai and 'mixed' species.

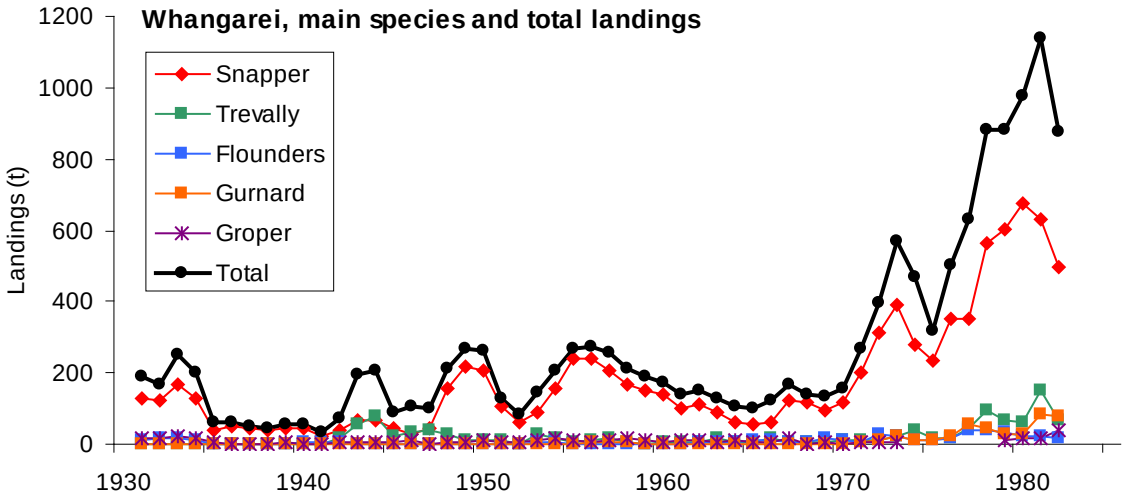

Figure 32: Trends in marine fish landings into Whangarei, 1931–82, caught from the Hauraki Gulf and adjacent regions. 'Total' includes all species. Sources: Annual Reports on Fisheries, King (1985).

Mercury Bay

Landings from the Mercury Bay region (Figure 33), centred on the small port of Whitianga, were predominantly snapper until 1970, taken by line and net vessels. Trawlers and Danish seiners then landed into the port, and the greater variety of fish in their catches accounts for the significant

increase in total landings. It is possible that purse seiners also landed catches in the late 1970s, but no records are available.

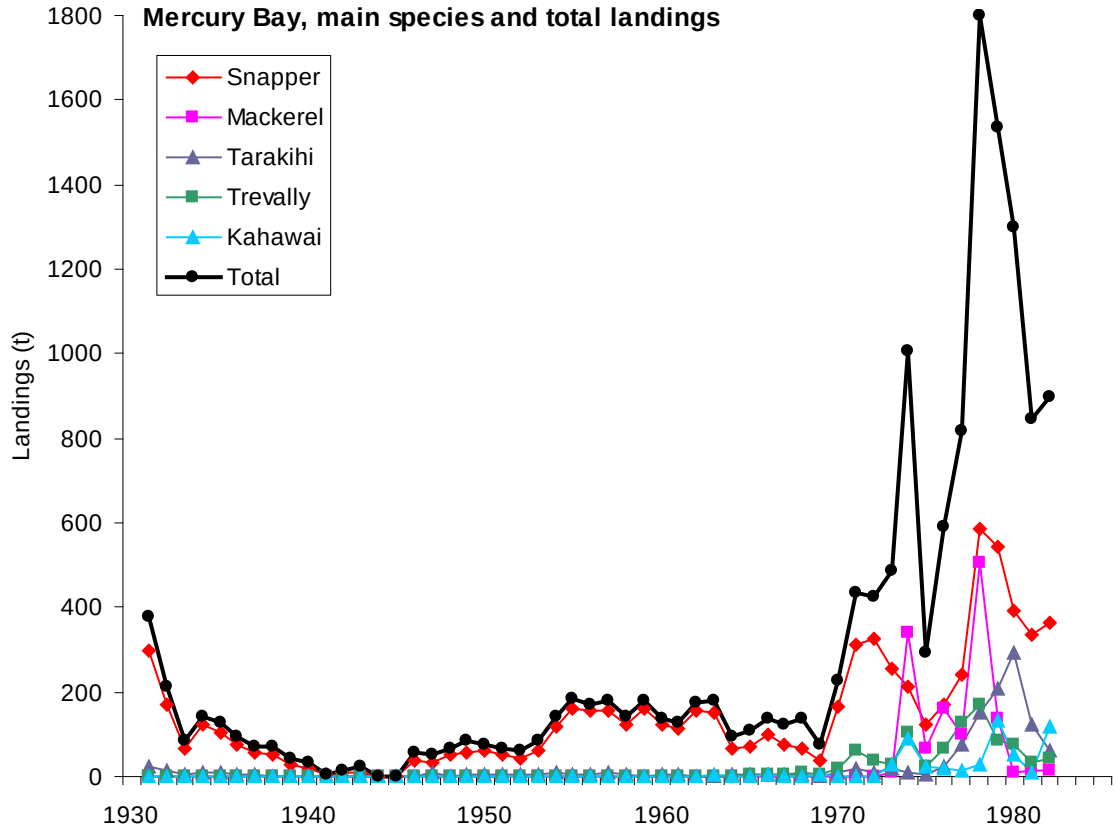

Figure 33: Trends in marine fish landings into Mercury Bay, 1931–82, caught from the Hauraki Gulf and adjacent regions. 'Total' includes all species. Sources: Annual Reports on Fisheries, King (1985).

Manukau

Manukau, a harbour and port on the western side of the Auckland isthmus, is indirectly linked to the Hauraki Gulf fishery by the movement of fishing vessels between the east and west coasts, and by some probable misreporting of catch by port of landing. Setnet fishers have worked Manukau (and Kaipara) Harbours as well as Gulf harbours and the Firth of Thames, and some almost certainly recorded their landings as 'Auckland.' Small catches of snapper, flounder, and grey mullet (incorporated in Auckland landings until 1944) were recorded from Manukau up to the early 1950s (Figure 34). Trawlers registered at Auckland had worked west coast grounds, mainly off Ninety Mile Beach, from about 1920, but were required by regulation to land their catch in Auckland. In 1952 this requirement was waived and Auckland trawlers fished more often further south on the west coast and began landing into Manukau, although they remained registered at Auckland. As a consequence there was a sudden increase in reported Manukau landings, mainly of snapper. A problem in interpreting landings, although relatively minor and more likely to have occurred in the 1950s and 1960s, is that some vessels reportedly fished both the Hauraki Gulf and the west coast, and their whole landing would be reported as either Auckland or Manukau. Increased snapper landings in the mid-1970s came from pair trawling which began in 1972–73, with Auckland vessels more often working directly out of Manukau. From the mid-1970s snapper landings into Manukau fell, particularly that proportion made by pair trawlers. The west coast snapper stock (which was also fished by Japanese trawlers and longline vessels from the 1960s to 1977) was probably over-exploited. There was also a shift towards targeting trevally, and at the end of the decade some of the larger trawlers moved out of the area to fish for hoki and other deepwater species. The difference between total landings and snapper landings into Manukau reflect these trends.

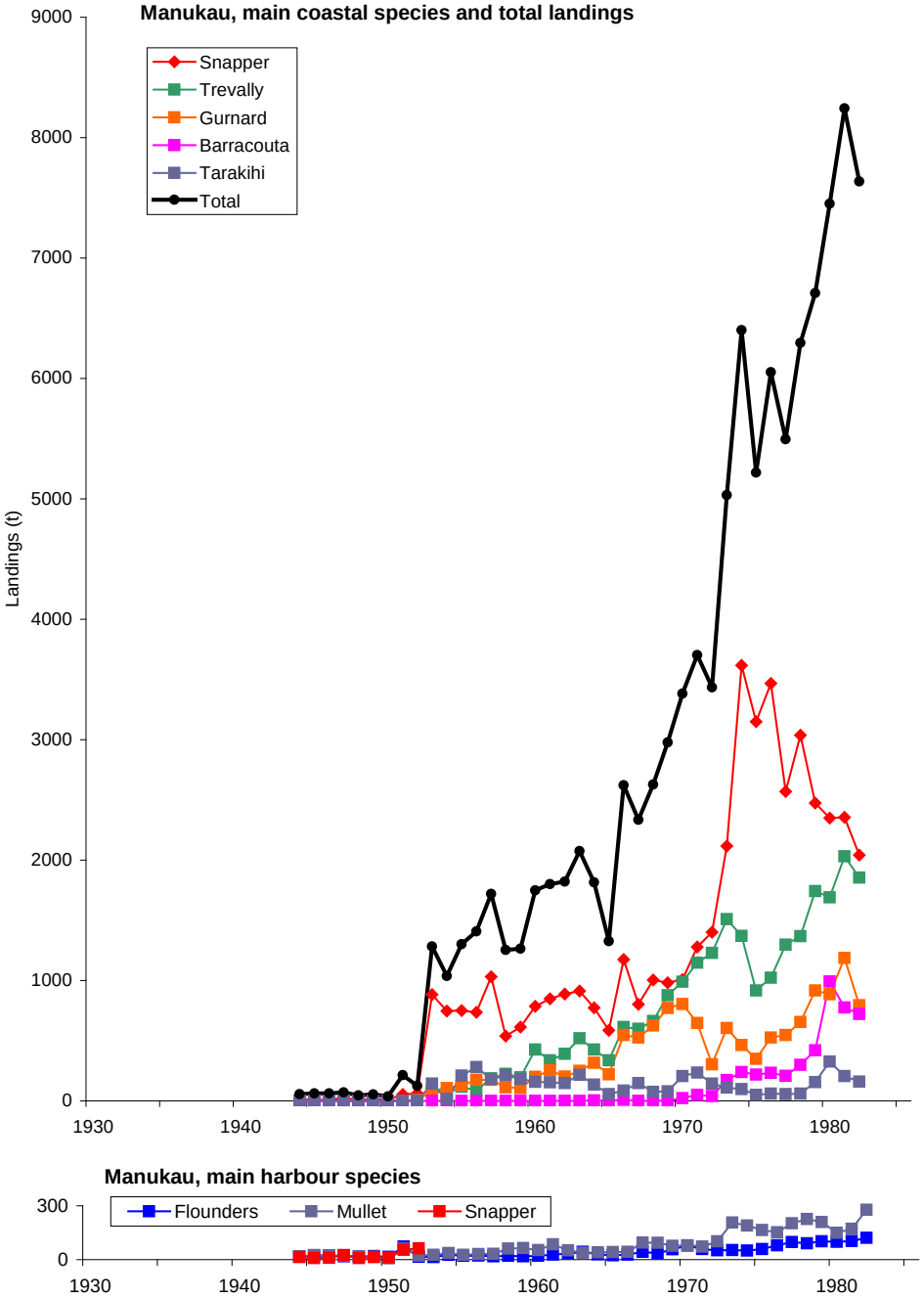

Figure 34: Trends in marine fish landings into the port of Manukau, 1944–82, caught from the northwest coast of the North Island, not the Hauraki Gulf. The main demersal and pelagic species are plotted separately; 'total' includes all species of both groups. Later data are not readily accessible. Sources: Annual Reports on Fisheries, King (1985).

Tauranga

Tauranga is another port outside the Hauraki Gulf (as defined in this account) where catches from at least the southern region of the study area would have been landed. This is most likely to have occurred during the later decades of the twentieth century, but it is not possible to quantify this from the data sets most readily available. (Pre-QMS data are archived in a variety of formats, and QMS

data are difficult to categorise by port of landing.) Snapper have always been important, and a modest proportion seems likely to have been trawled from the western Bay of Plenty (i.e. the south-eastern 'Hauraki Gulf') (Figure 35). Tarakihi, most important during the 1950s and 1960s, would have been trawled from the deeper (shelf-edge) waters of the Bay of Plenty and the East Cape region. A small to moderate proportion was caught in the western Bay. Trevally became important from about 1970, taken by both trawl and purse seine, mostly from the central Bay. Purse seining for skipjack tuna started in the mid-1970s and became more important in the late 1970s and early 80s, the season extending from November to May. The catch would have been taken mainly from waters above the shelf edge, from the central Bay north-westwards to the outer Hauraki Gulf. In winter months the smaller purse seiners fished for kahawai, jack mackerels, and blue mackerels, in shelf waters. Yellowtail kingfish were a small bycatch in the trawl and purse seine fisheries, caught across the Bay and up into the outer Hauraki Gulf.

The movement of fishing fleets between Hauraki Gulf and the west coast, with landings into Auckland and/or Manukau, and the overlap of Hauraki Gulf and Bay of Plenty fisheries, with some landings into Tauranga, demonstrate that "Hauraki Gulf" catches are difficult to define. However, these problems are taken into account in the estimates of Gulf port landings, 1931−82, which were actually made within the Gulf, and how much Gulf fish was landed elsewhere (see **Methods**). By necessity, of course, they are approximations.

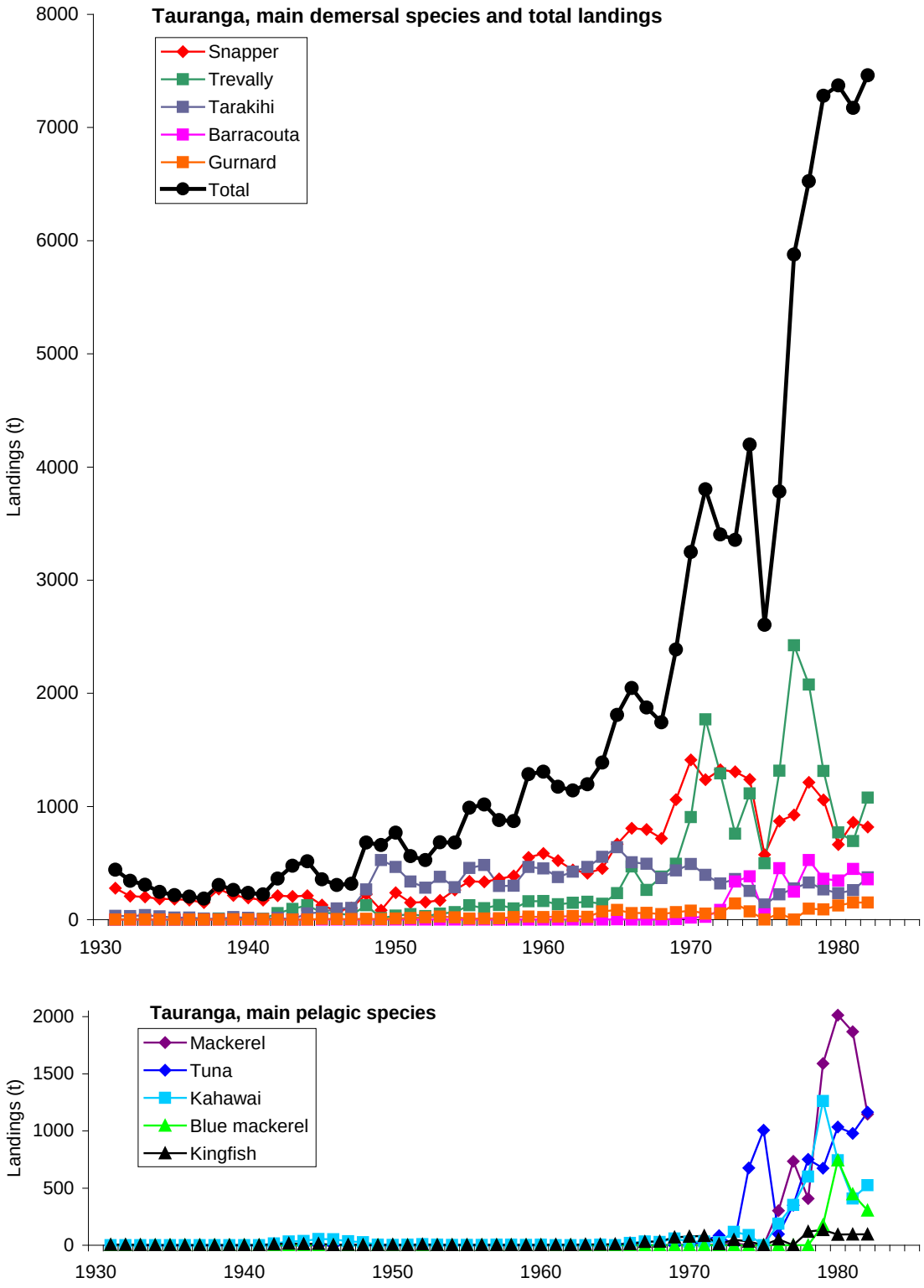

Figure 35: Trends in marine fish landings into the port of Tauranga, 1944–82, caught mainly from the Bay of Plenty, not the Hauraki Gulf. The main demersal and pelagic species are plotted separately. 'Total' in the Demersal panel includes all species of both groups, plus less abundant species not shown in either. Later comparable data are not readily accessible. Sources: Annual Reports on Fisheries, King (1985).

3.4 Trends in the Landings: Species composition

Species composition pre-1931

As noted elsewhere, landing values were not recorded by species until 1931, but from 1915 onwards there was a listing of 'Principal kinds of fish caught' by port in the Annual Reports on Fisheries. The summed listings for Auckland, Thames, and Whangarei (Coromandel is included with Auckland) are shown in Figure 36. Although only showing which species were listed most frequently, it provides some information on the species composition of the commercial landings. Most of the landings would have been caught in the Hauraki Gulf, but steam trawlers were operating during this period and making trips to the Bay of Plenty, mainly for snapper, gurnard, and tarakihi. Yellowbelly flounder and grey mullet would have been netted from the Coromandel area, the Firth of Thames mudflats, and the shallow bays and harbours from the southwest Gulf up to Whangarei. Hapuku ranks relatively high, and was presumably lined from the Gulf's rocky mainland and island coasts and reefs. Fewer comments can be made on the less frequently listed species, but the presence of blue cod at Whangarei is logical, given the predominance of rocky shorelines in the area, whereas the absence of kingfish there is surprising. Garfish are listed more often than would be expected from subsequent landed values. In general, the main species are those taken in inshore fisheries, with a moderate contribution from those taken further offshore in the Gulf (and the Bay of Plenty).

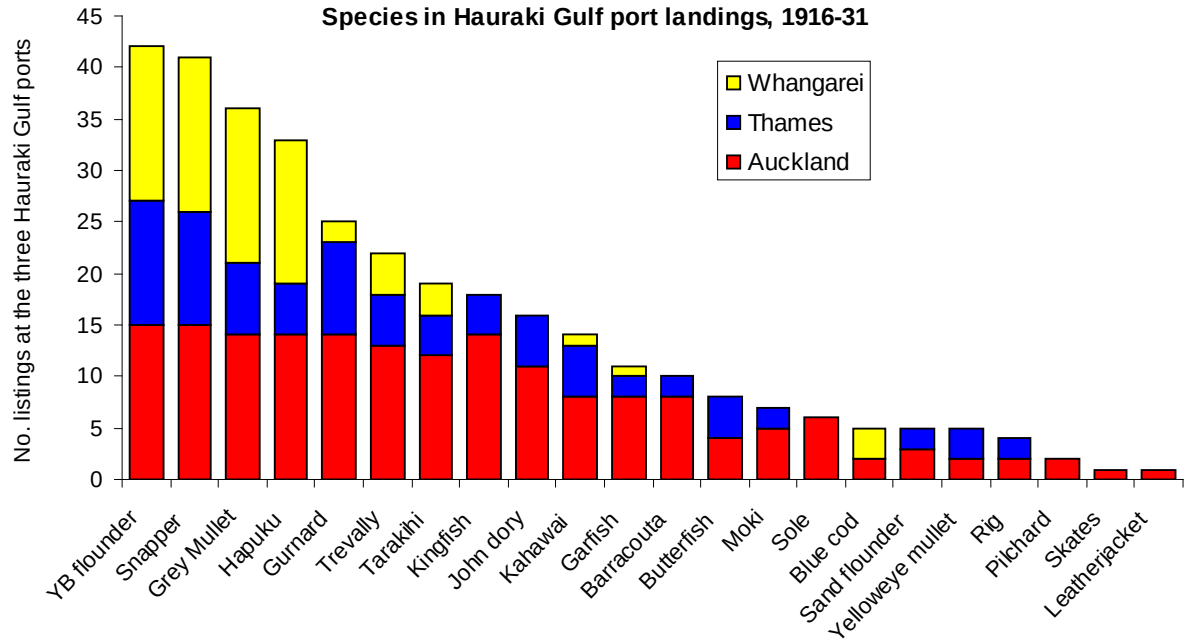

Figure 36: Fish species listed as being the principal kinds landed at Hauraki Gulf ports, although not necessarily caught in the Gulf. Listings (number of times recorded in the table of landings) for the years 1916–31 are summed, subdivided by port, but are not weighted by the total reported landings for each port. Some interpretation of the reported names has been made: 'flounder' would be mainly yellowbelly flounder, with some sand flounder, although the latter was sometimes listed separately (and correctly) as 'dab'; 'mullet' is assumed to be grey mullet, and 'herring' yellow-eyed mullet; 'groper' would be mainly hapuku; 'dogfish' would be rig, and 'sardine' pilchard. The Reports sometimes listed species in what was probably their sequence of relative importance, but sometimes they obviously did not, and this potential source of information has not been used.

Species composition from 1931

From this section onwards, unless otherwise defined, 'Hauraki Gulf' values are of fish estimated to have been commercially caught within the Hauraki Gulf area as defined earlier. For the main species they are lower than the sum of port landings because the latter include fish caught elsewhere.

From 1931 onwards the reported landings of most main species are quantified, with additional species progressively added over time (in most cases, because of removal from the 'mixed species' value). There is a major discontinuity in the mid-1980s (1983−86), caused partly by revisions to the statistical reporting system. Records allowed analysis of species caught by fishing area, rather than by landings into ports. This greatly increased the number of species recorded (Figure 37). Although a listing as 'mixed species' was previously available, it seems likely that small quantities of some commercial species were not recorded, as were even moderate quantities of non-commercial species caught but not landed. The statistics change in 1983 from 'species landed' to 'species caught,' which give more comprehensive and realistic values. However, the mid-1980s discontinuity also reflects two real changes in fishing behaviour and consequently in the pattern of landings. First, anticipating the imposition of quotas, fishers worked harder to establish a catch history, and following introduction of the QMS in 1986 they diversified into alternate fisheries to compensate for lost quota of traditional species. Second, but also in part a consequence of restructuring in the industry following the QMS, there was a move towards bulk fishing of mainly pelagic species.

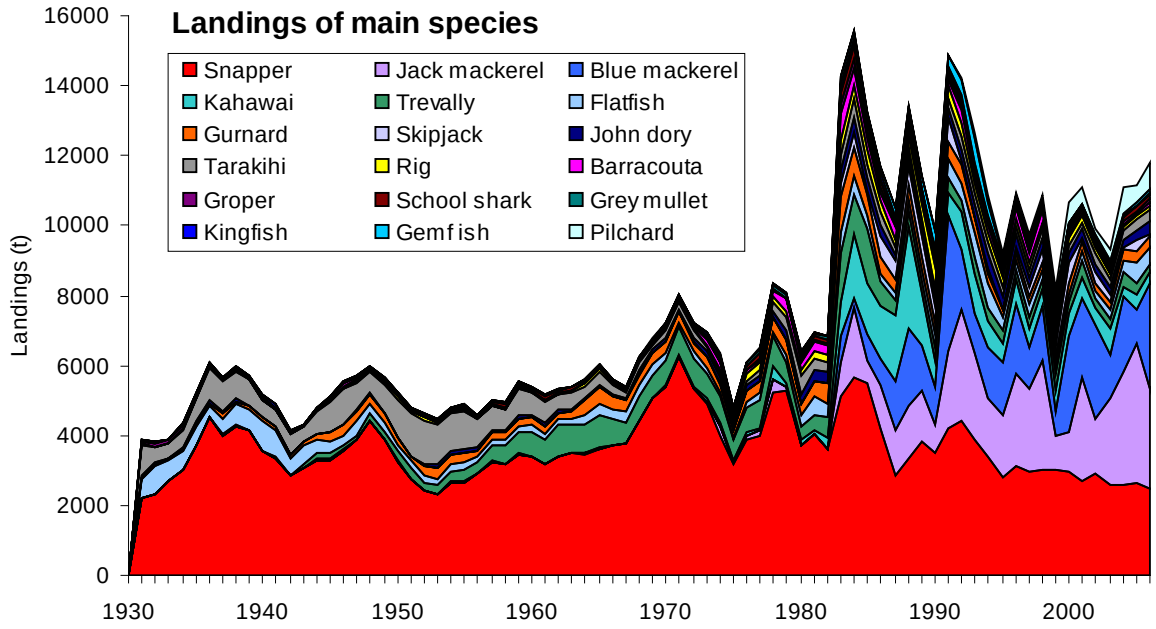

Figure 37: Reported landings of fish from the Hauraki Gulf, 1931 to 2006, by species (main species only). Values to 1982 are based on port landings, adjusted for area (see text), values from 1983 are based on reported area of capture. Because a large number of species fall into the "main" category at different times this total presentation becomes complex, particularly after the mid 1980s. In subsequent sections smaller groupings of species are described.

Thus, grouping species into 'categories of abundance' in this section, from most to least common using the post-1983 data, properly describes the fishery only from this date. The earlier decades are added to this time series to give a longer sequence, but a categorisation based on either the earlier decades, or the entire time series, would inevitably be somewhat different.

3.5 Trends in Landings: Categories of abundance

Grouping by categories (Figure 38, and see Table 1) allow some broad generalisations. Snapper landings at a little over 2000 t to 6000 t dominated total landings until the mid-1980s, but then declined for reasons described in Section 3.7.1, but were usually in the range of 4000−5000 t. Landings of the species grouped as 'primary' increased slowly to about 1980, then rose rapidly to fluctuate through the 1980s, 1990s and early 2000s. Landings of 'secondary' species rose − and sometimes fell − more slowly over time. 'Minor' species (plus species not identified) made up a very small proportion of the total landings.

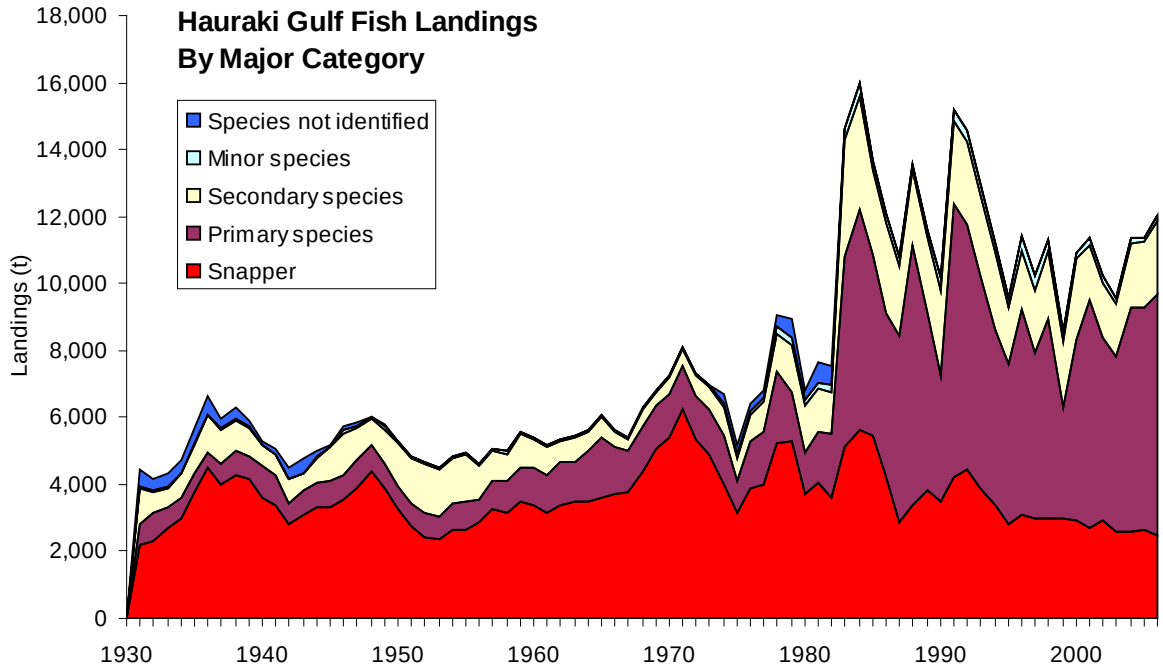

Figure 38: Reported landings of fish from the Hauraki Gulf, 1931 to 2006, by category.

The sudden increase in landings in 1983 marks the transition from the use of port of landing data to fishing area data. This change in statistical reporting has inevitably introduced a discontinuity into the total series. The new reporting forms may have been filled in differently by fishers and/or fishing companies, and analysed differently by fisheries managers. However, other factors have also contributed to the change at this time. The snapper fishery was given a catch quota in 1977, and in 1983 it was declared a Controlled Fishery (with restricted entry). There was consequently considerable incentive for fishers to shift their effort to other species during the 1980s. In the early 1980s it also became clear that a new management regime would be introduced for New Zealand's inshore fishery (quotas had been established progressively for deepwater species from 1978), and the value of recording a catch history for a range of species undoubtedly encouraged fishermen to target a wider range of species and record their landings more thoroughly.

Principal Species

Snapper. See Section 3.7

Primary Species

The move towards greater landings of 'new' species is shown clearly in a breakdown of the 'primary' species category (Figure 39). Flatfish (mainly flounder) were initially dominant but declining, with red gurnard and trevally gradually increasing. Most of the red gurnard and some of the trevally would have been taken as bycatch in the snapper fishery; the rest would have been caught in separate fisheries, usually in different areas with different methods. The early 1980s show a shift to mostly pelagic species. Jack mackerels, blue mackerel, and kahawai were dominant, with the large fluctuations probably driven by market requirements and the movement of moderately large purse seine vessels between the Hauraki Gulf and Bay of Plenty and between different target species.

The distinction between 'primary' and 'secondary' species is somewhat tenuous, as it is based on a period following a marked change in the total fishery. These two categories should be regarded as two components of the set of relatively important species taken either in association with the snapper fishery, or in separate fisheries which operated separately from the snapper fishery.

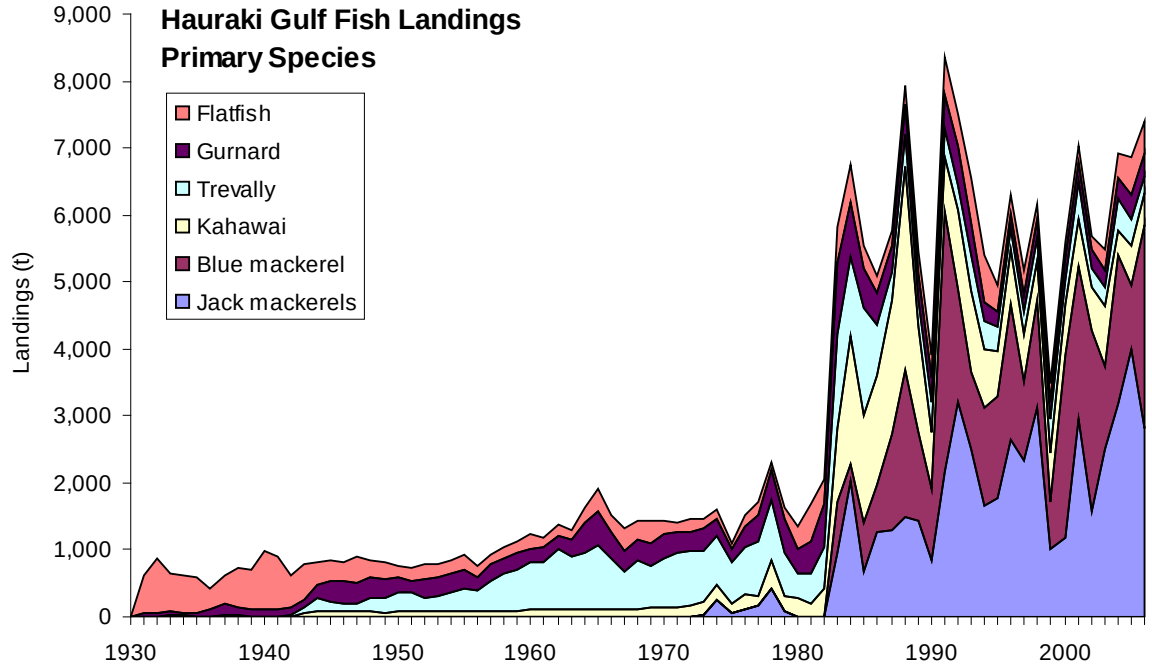

Figure 39: Reported landings of fish from the Hauraki Gulf, 1931 to 2006, in the primary species category.

Secondary Species

These are to some extent comparable to the 'primary species,' their main difference being that they were landed in relatively lower quantity than were the primary species after 1983 (Figure 40). As with the primary, some are directly associated with the snapper fishery, while others comprise separate fisheries. Almost all show considerable changes over time, usually with a different pattern. John dory increased steadily from about 1955 onwards. Tarakihi landings decreased significantly to about 1970, then remained relatively constant; this trend essentially accounted for the overall decline between 1950 and 1970. Barracouta increased slowly to 1980, was constant to 2000, and then declined. Gemfish were taken in most abundance between 1985 and 1995. Pilchard landings increased most rapidly from about 2000. Overall, this category showed the same sudden increase from 1983, resulting from an increase in reported landings of species previously caught (possibly a consequence of more reliable recording), but also from the development of a variety of new fisheries such as those for

skipjack tuna, gemfish, and anchovy. The increase also results from more species being individually identified in the landings and thus added to this category, rather than being grouped as 'Other' (see Minor Species below).

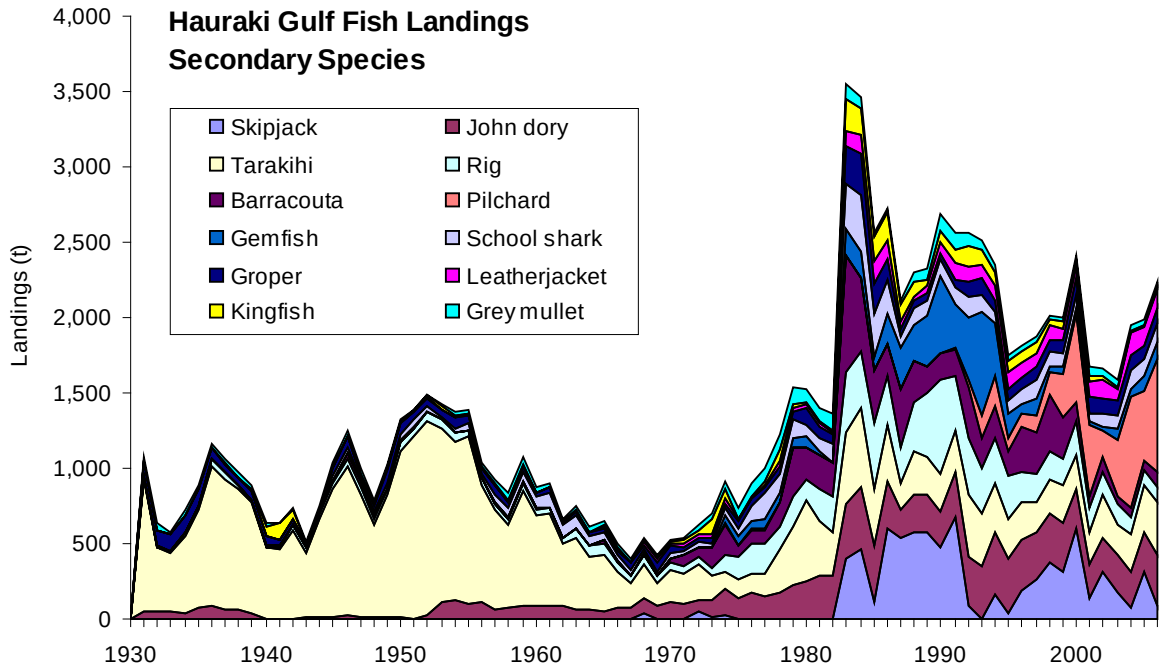

Figure 40: Reported landings of fish from the Hauraki Gulf, 1931 to 2006, in the secondary species category.

Minor Species

This is a difficult group to define. Prior to the QMS (1986), the number of 'minor' species reported in port landings was quite low. This presumably resulted from many being grouped as 'other', or not recorded at all. From 1983, immediately prior to and post-QMS, the catch by area data included a much higher number of minor species. Fishers were required to report them, and they are retained in the database. The difference between the time periods is largely an artefact resulting from the use of two data sets. Thus, Figure 41 must be considered in conjunction with Figure 42. However, the variety of species recorded after 1983 probably also reflects a more diverse by-catch in the new fisheries which developed from the late 1970s onwards, although there was a significant decline after 2000 which is not easily explained. It is also possible that there was some misreporting of species, or misinterpretation of species codes by fishermen or database administrators, both of which are hard to detect. Some of these minor species have different periods of apparent abundance, which appear real rather than recording artefacts. For example, porae were reported from the late 1970s onwards, skates from 1985 onwards, and red cod from 1990 to 2000. This reflects both changes in the abundance of a species in the Hauraki Gulf (e.g.; red cod), and changes in market acceptability (e.g.; skates).

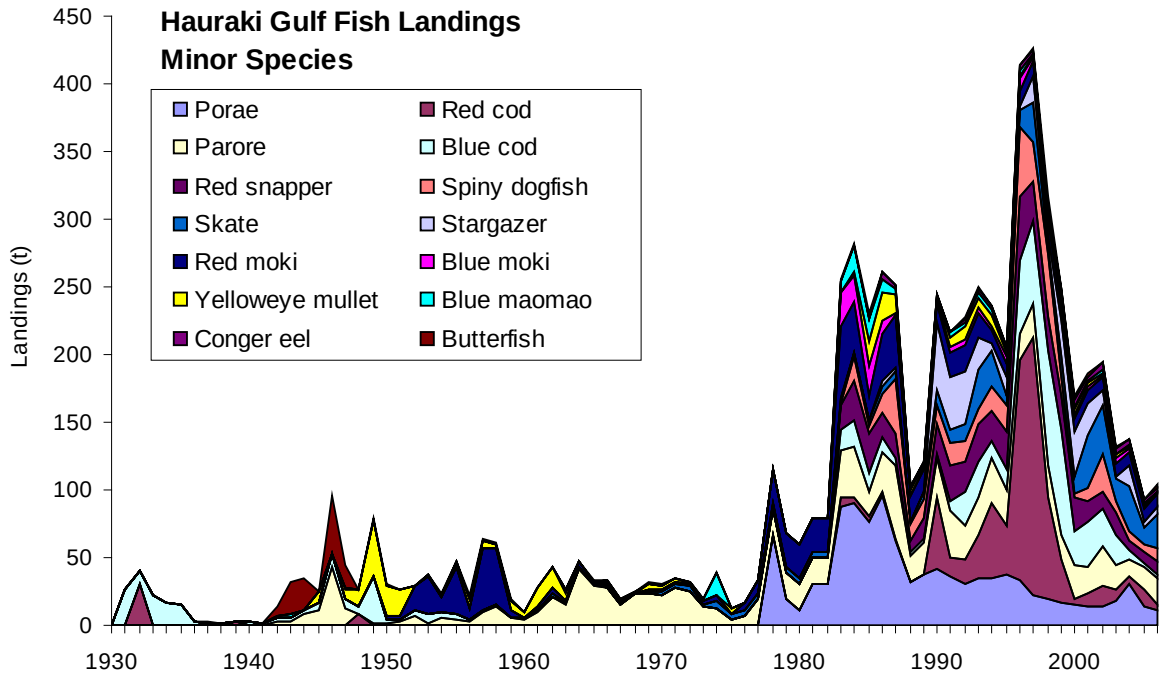

Figure 41: Reported landings of fish from the Hauraki Gulf, 1931 to 2006, in the minor species category.

Landings of 'Other Species'

Early landing records include a value for species not listed individually ('mixed rounds', 'mixed flatfish', and 'kinds not specified') (Figure 42). This initially comprised 5−10% of the total, declining − as species were progressively added to the identified list − to 1% or less from 1945 until the final Fisheries Report for 1974. It is possible, however, that very small catches, particularly of species unmarketable at the time, were simply ignored. From 1974 (there is a one-year overlap) to 1982 the data in King (1985) place many species back in the 'mixed' and 'other' categories. From 1983 onwards the QMS landing extracts incorporate all species listed by fishers. The inclusion of some species only in the latter data set inevitably means that their catch histories are incomplete. Most of the species affected would be in the Minor category (above).

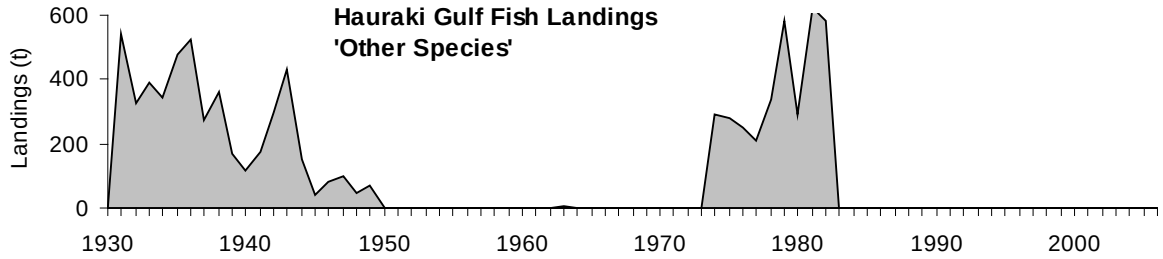

Figure 42: Reported landings of fish from the Hauraki Gulf, 1931 to 2006, not identified to species. The values are recorded as 'mixed species,' 'mixed rounds,' or 'mixed flatfish'. The negligible to zero values between 1951 and 1972 are as listed for these years and probably reflect under- or non-reporting. The zero values from 1983 result from the requirement for fishers to identify all species caught, there are thus no 'Other species' values.

From 1990, when landing records of the least common species (previously grouped as 'Other' or omitted) were judged to be reasonably reliable, it is possible to comment on their presence in Hauraki Gulf fisheries . It is convenient to consider them in three groups, based on the mean annual tonnage landed.

More than 10 t: Koheru, *Decapterus koheru*. Inner and central shelf, taken by setnet, purse seine, and trawl; an unknown quantity would also be reported as mackerel or jack mackerel. **Porcupine fish**, *Allomycterus jaculiferous*. Shelf, taken by trawling, no commercial value. **Silver warehou**, *Seriolella punctata*. Shelf edge and beyond, taken by trawl. **Frostfish**, *Lepidopus caudatus*. Shelf edge and beyond, taken by trawl. **Albacore**, *Thunnus alalunga*. Outer shelf and beyond, pelagic, taken by trolling, midwater longline, purse seine.

From 5 to 10 t: Garfish, *Hyporhamphus ihi*. Shallow water, taken by dragnet. **Stingrays**, *Dasyatis* spp. Inner to central shelf, taken by setnetting and trawling, little or no commercial value. **Eagle ray**, *Myliobatis tenuicaudatus*. Inner shelf, taken by setnetting and trawling, little or no commercial value. **Sea perch**, *Helicolenus* spp. Inner to outer shelf and beyond, taken by trawling and lining. **Hammerhead shark**, *Sphyrna zygaena*. Juveniles on inner shelf, particularly Firth of Thames, taken by setnetting and lining. **Blue shark**, *Prionace glauca*. Shelf and beyond, pelagic, taken by all methods. **Ghost shark**, *Hydrolagus novaezelandiae*. Beyond shelf edge, taken by trawling. **Spotted gurnard**, *Pterygotrigla andertoni*. Shelf edge and beyond, taken by trawling. **Mirror dory**, *Zenopsis nebulosus*. Shelf edge and beyond, taken by trawling.

Less than 5 t: In an approximate sequence from shallow to deep and/or pelagic waters: **Silver drummer**, *Kyphosus sydneyanus*; **Anchovy**, *Engraulis australis*; **Hagfish**, *Eptatretus cirrhatus*; **Witch flounder**, *Arnoglossus scapha*; **Giant boarfish**, *Paristiopterus labiosus*; **Pink maomao**, *Caprodon longimanus*; **Trumpeter**, *Latris lineata*; **Ling**, *Genypterus blacodes*; **Bluenose**, *Hyperoglyphe antarctica*; **Thresher shark**, *Alopias caudatus*; **Mako shark**, *Isurus oxyrinchus*; **Broadbill swordfish**, *Xiphias gladius*; **Ray's bream**, *Brama* spp. Some of these have a commercial value, others do not.

3.6 Trends in Landings: Landings by habitat or ecological grouping

A different, perhaps more logical and informative approach to displaying landings data is to subdivide by habitat or area, commencing at the shore and progressing seawards. Where appropriate these can be separated into demersal and pelagic groups. This grouping and species allocation, as used by Paul (2000), is followed in the account below. Of course, species are not naturally distributed in such convenient groupings; considerable overlap occurs, and the depth boundaries chosen are necessarily generalised. Similarly, many species can be both demersal and pelagic. Species are placed in the habitat category where they most commonly occur, or are most commonly caught. The series commences with the shallow zone (where a subdivision into demersal and pelagic is not necessary), includes the inshore shelf, and the central to outer shelf. The final group − offshore and deepwater − is not considered here, as there is little demersal trawling beyond the shelf edge of the Hauraki Gulf, and the offshore pelagic fisheries (mainly tuna) have been relatively limited and can be included within the fisheries of the outer shelf.

Shallow water species

Only a few species are caught commercially in the shallow waters (estuaries, harbours, and bays) of the Hauraki Gulf (Figure 43). Flounders are the main target species, mainly yellowbelly flounder but sand flounder are taken − mostly seasonally − in some areas. Grey mullet are targeted in the south-western harbours. Yellow eyed mullet are a small bycatch, but sometimes targeted for sale to the zoo and public aquaria as food for marine mammals and birds. Parore are generally a bycatch, mostly used as unnamed fillets in fast-food outlets. Garfish (not shown) are reported in small quantities, generally less than 5 t, in some years.

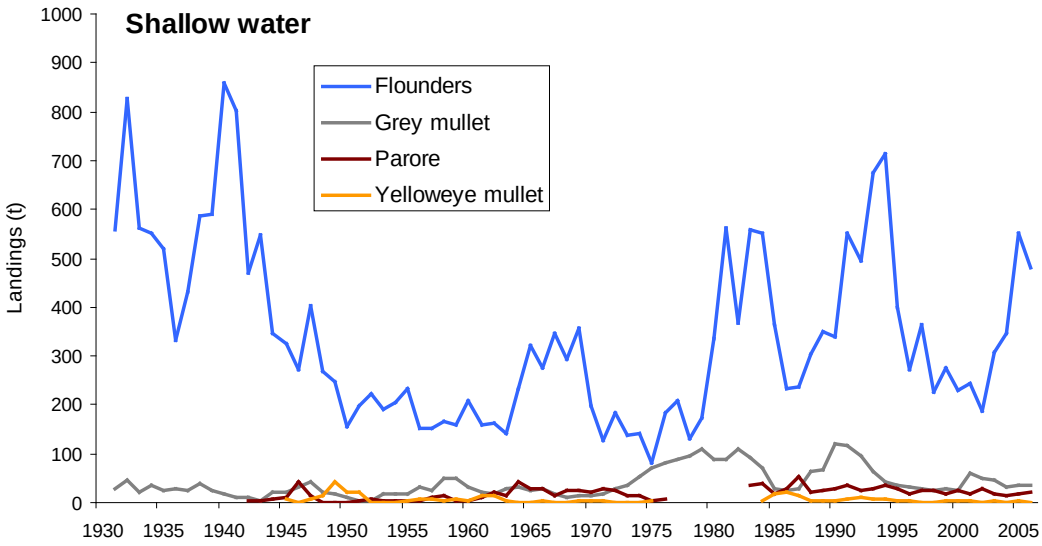

Figure 43: Reported landings of the main species caught commercially in shallow waters of the Hauraki Gulf, 1931−2006. The category 'flounders' includes all flatfish species during some of the period, but the dominant species is yellowbelly flounder, taken by setnet in estuaries, harbours, and shallow bays.

Inshore shelf species, demersal

These are the main fisheries of the Hauraki Gulf, extending over grounds from a short distance out from the coast to about 100 m depth, although the fish species themselves occur both shallower and deeper than this. The dominant species is snapper (Figure 44), with landings that fluctuated considerably through the twentieth century before being restricted as a Controlled Fishery in 1983 and coming within the QMS in 1986. The controlled landings approximate the lowest levels reported during the earlier decades. The other main species, notably red gurnard, John dory, rig and school shark, generally increase over time before becoming constrained by the QMS. Moderate landings of leatherjacket were reported from the mid-1980s; they would have been caught in earlier years, with a proportion discarded at sea and an increasing proportion landed under 'other species.' All these show a mid-1980s peak. This is believed to represent increased fishing and reporting to establish catch histories prior to the allocation of quota within the QMS, together with a change in catch and landing reporting systems in 1983. Although fishing area and port of landing had always been recorded, the most accessible data changed from 'port' to 'area,' and the assumptions necessarily made for each set almost certainly introduced some anomalies. Porae, listed from the late 1970s, was undoubtedly caught and landed earlier but not recorded separately. Among the other species reported as landed in small quantities were blue cod, blue moki, red moki, stargazers, and conger eel.

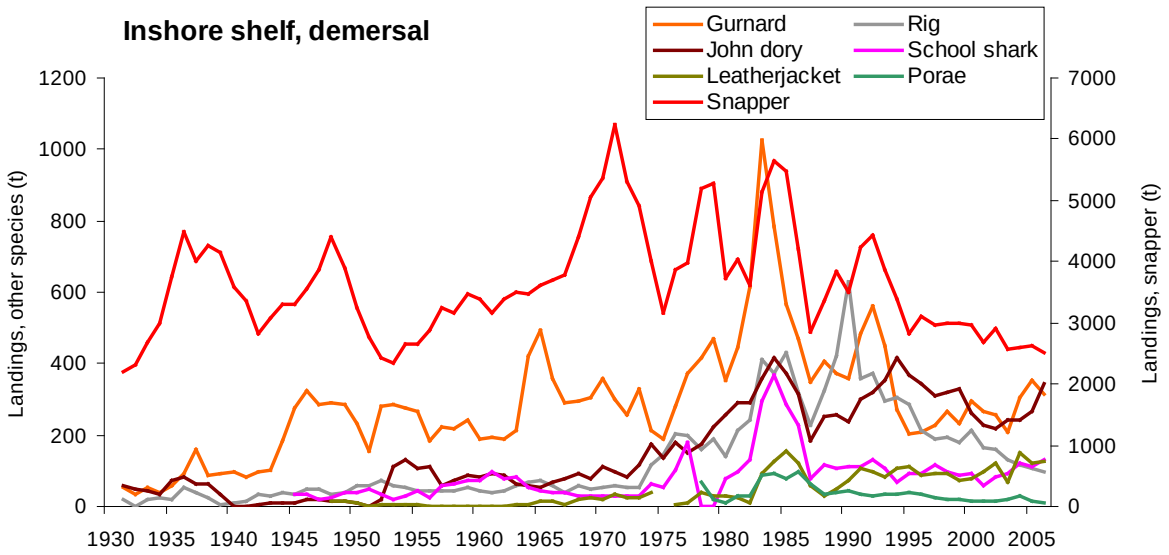

Figure 44: Reported landings of the main demersal species caught commercially over the inner shelf of the Hauraki Gulf, 1931–2006. Note: The dominant species, snapper, is plotted at a different scale to the other species.

Inshore shelf species, pelagic

The slow increase in trevally landings reflects the gradual acceptance of this species as a food fish; the early landings were largely used for bait (Figure 45). The mid-1980s peak represents an increase in purse seining, a move by fishers to establish a catch history prior to introduction of the QMS, and a change in data recording that may have introduced anomalies. Kahawai increased for similar reasons, plus increased marketability (as canned product) for the species. A pilchard fishery developed in the northern Gulf during the 1990s. Yellowtail kingfish landings rose with increased purse seining, but declined as a consequence of catch and fish size restrictions. Blue maomao (not shown) have sometimes been reported, probably taken as a purse seine bycatch.

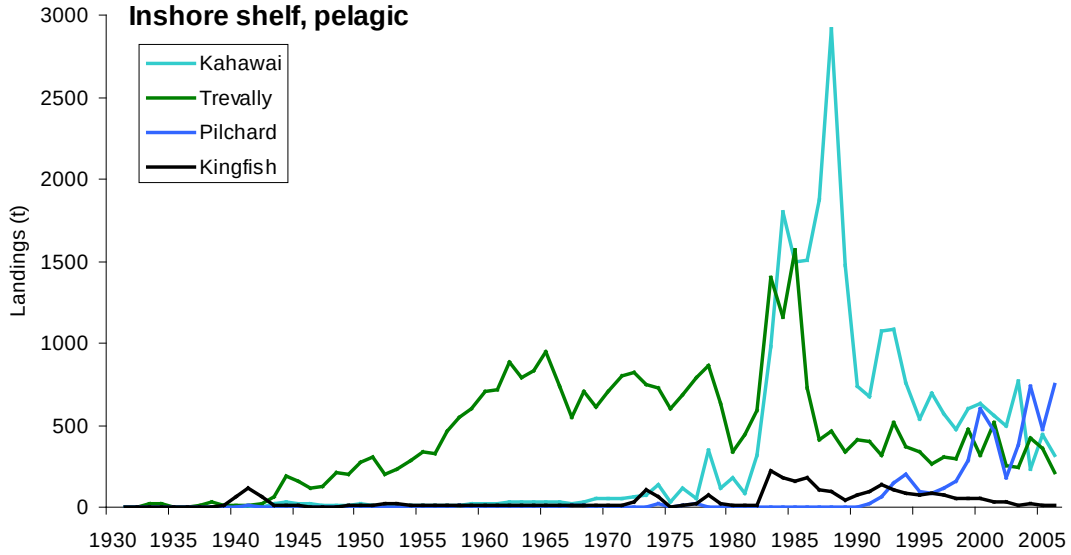

Figure 45: Reported landings of the main pelagic species caught commercially over the inner shelf of the Hauraki Gulf, 1931−2006.

Central to outer shelf fisheries, demersal

This zone extends from about 100 m out to the shelf edge at about 250 m. Until the late 1970s the main species in this grouping was tarakihi (Figure 46). Although a generalised adjustment was made for catches taken outside the Hauraki Gulf (see Sources of information) variations which are known to have occurred over time cannot be quantified. The peak landings through the 1950s, for example, will include a significant proportion caught in the Bay of Plenty and at East Cape by Auckland-based trawlers. Heavy fishing on this stock began in the late 1940s, and catch and CPUE declined as the population of this long-lived species was slowly fished down (Vooren 1974). From about 1970 the landings of several other species from this zone increased, initially barracouta and then gemfish, although the latter fell rapidly after 1995 after over-exploitation. Small quantities of rough and smooth skates were landed, and briefly some red cod. Landings of groper, line-caught on the outer shelf and in deeper water, and sometimes trawled, continued throughout the whole period. Some groper, particularly from about 1980, would have come from vessels which fished more widely along the shelf edge of the north-east Gulf and east Northland. Bluenose (not shown), sometimes grouped with groper in early records and sometimes listed as ‘bonita,’ would have been a bycatch in the groper line fishery, usually in deeper waters. The northern spiny dogfish (not shown) would have always been a small trawl and line bycatch and generally discarded until the most recent decades.

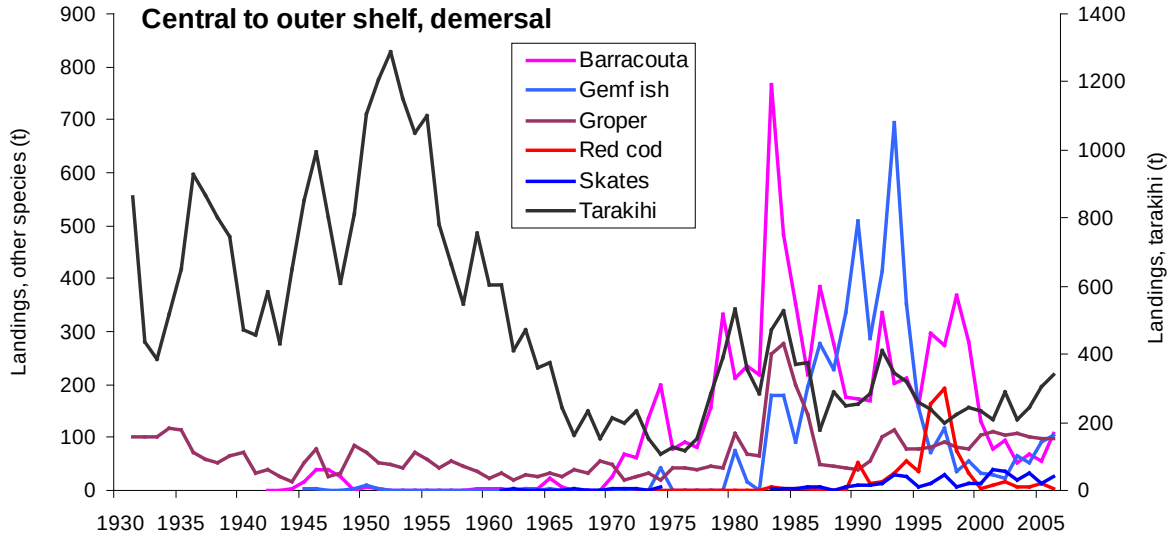

Figure 46: Reported landings of the main demersal species caught commercially over the outer shelf of the Hauraki Gulf, 1931–2006. Note: The dominant species, tarakihi, is plotted at a different scale to the other species.

Central to outer shelf fisheries, pelagic

Mackerels are the main species taken in the zone (Figure 47), mainly by purse seiners. The Hauraki Gulf is not a discrete fishery, the grounds for these species extending from east Northland into the Bay of Plenty. Jack mackerels, *Trachurus* spp. would have been trawl-caught in earlier decades but discarded at sea because of low commercial demand. Although mixed schools occur, the catch was predominantly *T. novaezelandiae*, with small quantities of the larger and deeper water *T. declivis*, and from the early 1990s some *T. murphyi*. Blue mackerel would have been an insignificant trawl bycatch, and landed only after the advent of purse seining. The large variations in mackerel landings at least partly reflect fluctuations in market demand.

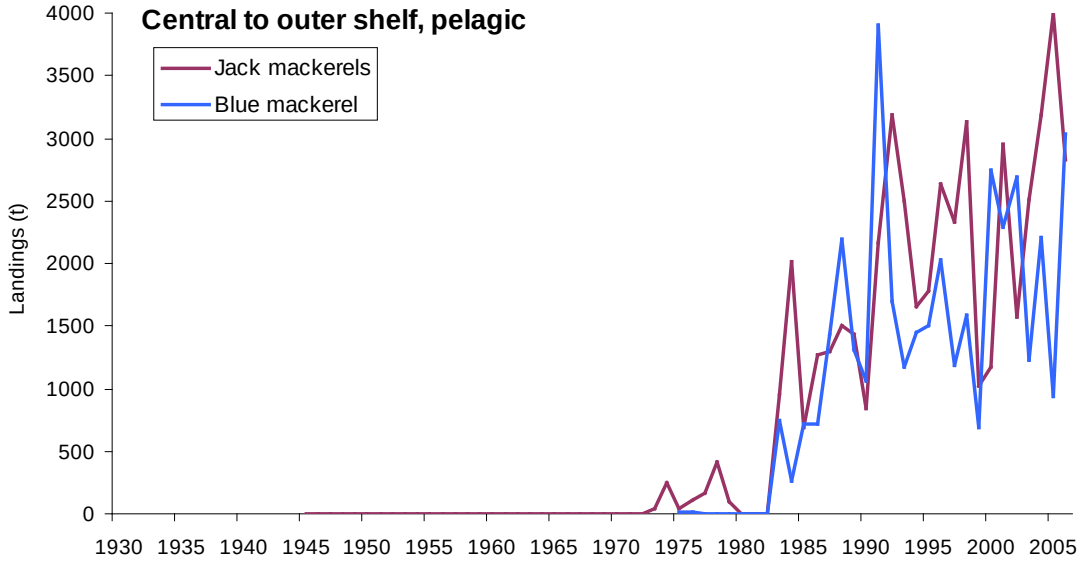

Figure 47: Reported landings of the main pelagic species caught commercially over the outer shelf of the Hauraki Gulf, 1931–2006.

3.7 Species Accounts: The Principal (Snapper) and Primary Species

Snapper

Pagrus auratus



Distribution

Widely distributed around northern and central New Zealand, 0−200 m but most common in 10−100 m, particularly north of East Cape and Cape Egmont. The dominant demersal species in most large embayments, and abundant in the Hauraki Gulf. There are extensive nursery grounds around the shallow inner Gulf, except for the Firth of Thames.

Relative importance of the Hauraki Gulf fishery

Hauraki Gulf contributed about 60% of total snapper landings until 1950, when fisheries in other regions, notably the North Island's west coast, began to develop (Figure 48). It may have been higher, if Gulf-caught snapper were greater than 70% of Gulf port landings. It declined to 30−40% in the 1970s, the period of rapid expansion in inshore fisheries elsewhere, rising a little to 40−50% when the QMS restricted landings in all regions after 1986.

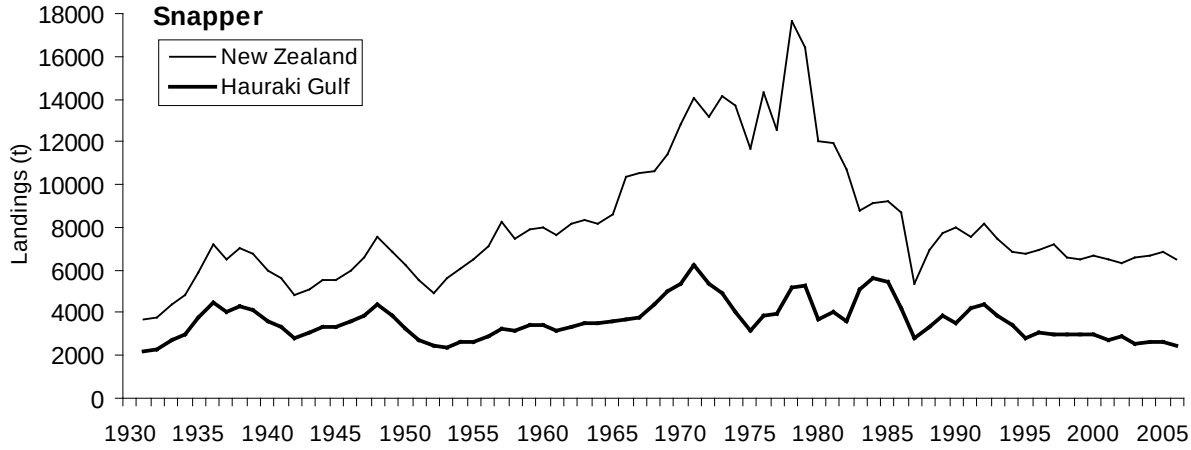

Figure 48: Commercial landings of snapper from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings of snapper. Domestic landings only.

Hauraki Gulf catch history

Snapper landings rose during the 1930s as steam trawlers continued working and the fleet of Danish seiners expanded (Figure 49). There was a drop during the World War II years, when steam trawlers were requisitioned by the Navy, areas of the Hauraki Gulf were closed to fishing for defence purposes (e.g.; because of German (1940) and New Zealand-laid (1942−43) minefields), men joined the Armed Forces, and wartime shortages hindered vessel repair and replacement of gear. The post-war recovery, when steam trawlers returned to fishing, ended in 1948 and landings fell by almost 50% in the following five years. A steady recovery was then followed by large fluctuations in the 1970s and 1980s. The rise subsequent to QMS introduction in 1986 was partly due to successful appeals against restrictive ITQs (individual transferable quotas), but led to a further decline when the TACC (total

allowable commercial catch) for the north-eastern snapper stock was reduced in two stages from 1992 onwards.

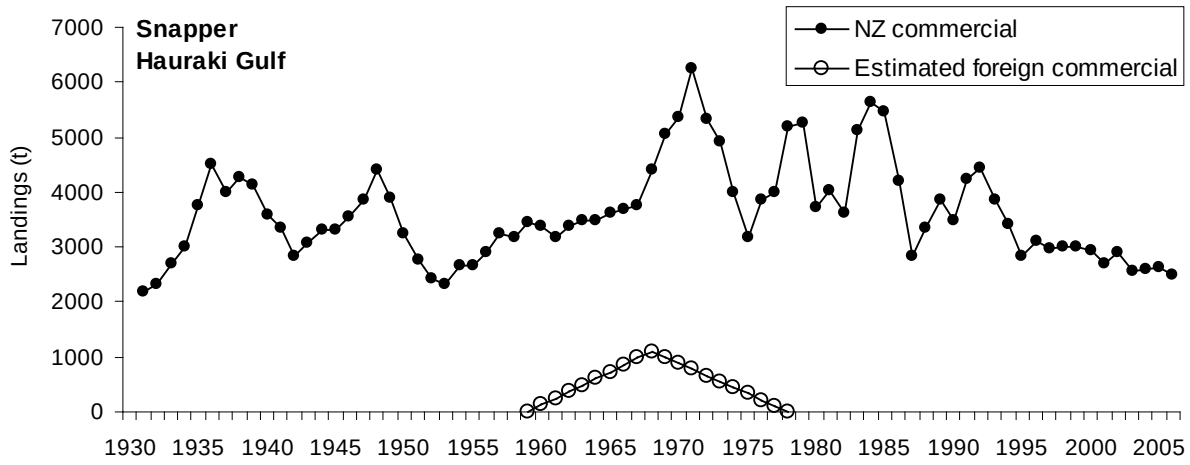

Figure 49: Commercial landings of snapper from the Hauraki Gulf region, 1931−2006, and estimated catches by foreign (Japanese) vessels, 1960−1977.

Seasonal trend

Snapper catches in the Hauraki Gulf have always been seasonal, usually peaking in November during the spring spawning season (Figures 50, 51). The seasonal spring-summer peak became much more pronounced in 1968−69 and following years when Danish seiners adopted a larger and higher-opening net (Paul 1974). However, earlier seasonality was stronger than is illustrated. No comparable data are available for the years prior to 1945, when Danish seiners − which are able to exploit the schooling snapper most effectively − were relatively more important in the fleet. However, Hefford (1929) tabulates some limited data from steam trawlers in the 1920s showing that catches in November, December, and January were two to three times higher than in other months. Post-war, trawlers and Danish seiners were placed on peak-season limits by the markets and processors which were unable to handle large quantities of fish until a more viable export market developed, most notably of whole snapper to Japan.

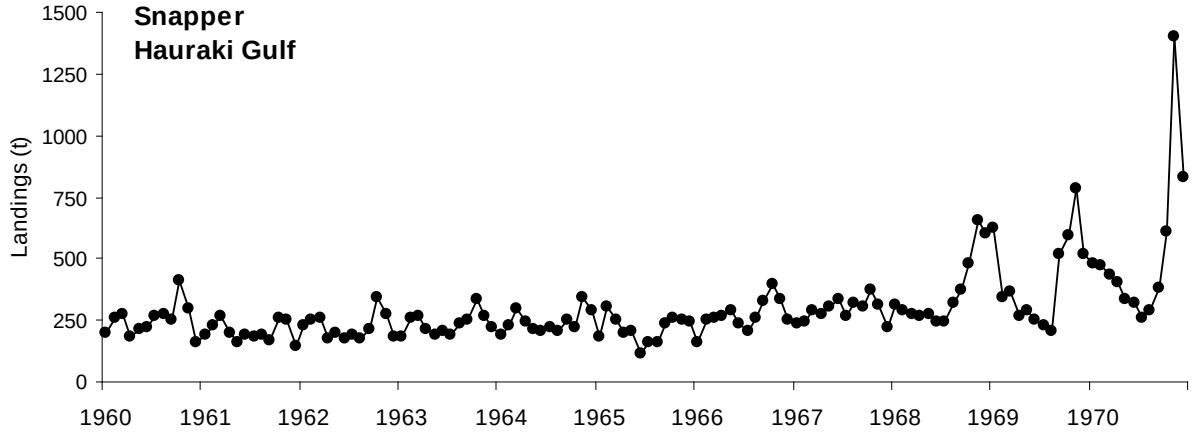

Figure 50: Monthly commercial landings of snapper from the Hauraki Gulf, Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975).

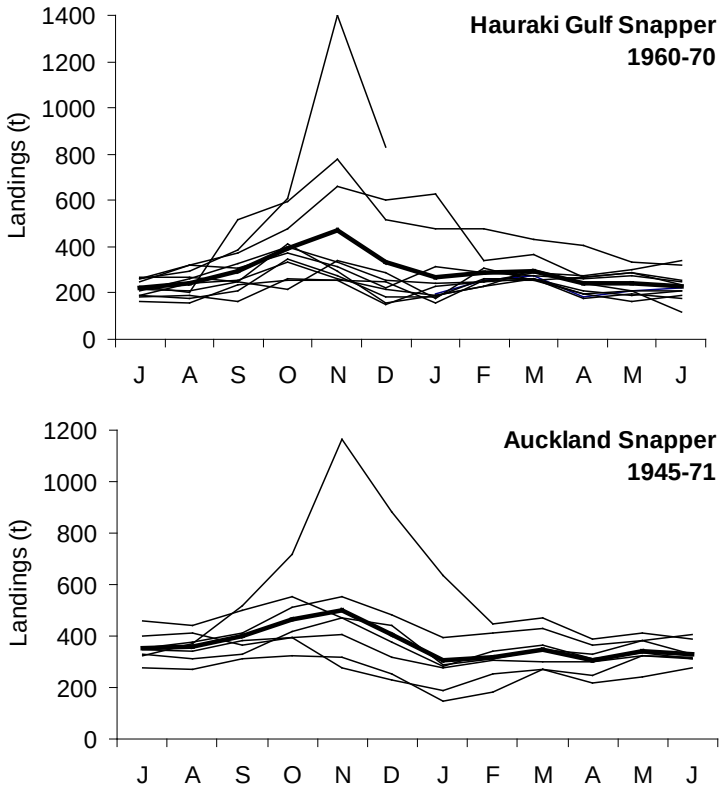

Figure 51: Seasonal (monthly) trends in the commercial landings of snapper. *Top panel,* landings from the Hauraki Gulf as defined by Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975). Annual values, and 11-year mean (heavy line). *Bottom panel*, landings into Auckland, 1945−71, from Annual Reports on Fisheries. Four-year means, and 27-year mean (heavy line). Both data sets presented as July−June years, to avoid subdividing the main fishing season. The higher November peaks represent the latest years in each series.

Recreational catches

Although the recreational fishery does not form part of this account, it is relevant to note that snapper are an important species in the Hauraki Gulf (Figure 52). Catches are difficult to estimate and have varied with methodology, but a 2004–05 survey (aerial vessel counts and boat ramp interviews) gave an estimate of at least 2400 t for SNA 1 (East Northland, Hauraki Gulf, Bay of Plenty), approximately 50% of commercial landings for this area (Hartill et al. 2007a,b). Almost 60% of the recreational catch came from the Hauraki Gulf as usually defined; a higher percentage would have come from the larger area defined in the present study. For conformity with other data and the time span of this study these data are used in Figure 52, but it is noted that a later (2011−12) survey gave a higher estimate – the recreational catch being 80% of the commercial catch in SNA1 (Hartill et al. 2013, Ministry for Primary Industries 2013).

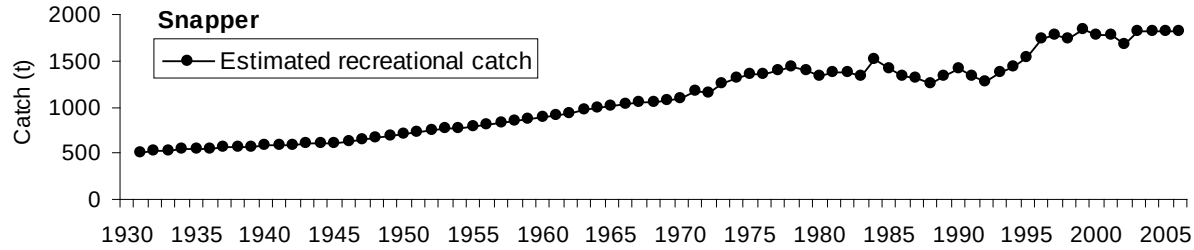

Figure 52: Estimated catch of snapper from the Hauraki Gulf by recreational fishers, 1931−2006.

Landing trends, year-classes, and temperatures

A.E.Hefford, appointed Marine Department Fisheries Expert in 1926, Chief Inspector of Fisheries in 1927, was quickly involved in Hauraki Gulf fishery disputes. His 1929 informative account of the snapper fishery laments the absence of landing statistics, from which the proper state of the fishery could be better assessed. The introduction of steam trawling in 1915 and Danish seining in 1923 had created considerable tension between the fishermen using traditional lining and netting, and the proponents of these new 'power' methods. There were frequent claims that these methods were taking too many fish, and destroying juveniles by trawling on nursery grounds. Hefford (1929) believed that "all methods of fishing … have in varying degrees contributed towards the depletion", and stressed that regulations should not only geographically separate the different fishing methods − as had been done up to that date − but protect the snapper spawning grounds known to exist in the south-western Gulf.

Landing fluctuations during the 1930s and 1940s appeared to be linked to social and economic factors (e.g.; the Depression, and World War II), and no research was undertaken. The significant decline between 1948 and 1953 revived the 1920s concerns over sustainability, and studies were begun using the 20 m research trawler R.V. *Ikatere*, recently released from wartime duties. The work was centred on mesh selectivity of trawl nets, still suspected of destroying too many juvenile fish (Cassie 1955), but included some early work on spawning and life history (Cassie 1956a-c, 1957). The trawl mesh study showed that it would be advantageous to use a larger mesh, but as landings recovered apparently of their own accord, even as steam trawlers were retired, no action was taken.

Research directed at snapper in the Hauraki Gulf fishery resumed in the 1960s. The large seasonal catches made in 1968 and subsequent years attracted attention, and a sample taken from one Danish seine catch in 1969 showed the fish to have a restricted size distribution and to be dominated by a single (1962) year-class (Paul 1970), spawned in a particularly warm spring-summer. A larger age-frequency sample taken in 1970 showed modest agreement between year-class strength and spawning season temperature (Paul 1976, Fig. 35), using Auckland air temperatures as a proxy for inshore seawater temperatures. A similar agreement was also found for snapper in the East Cape region (Paul & Tarring 1980). An exploration of the relationship between the historical time series of snapper landings into Auckland and a lagged temperature series also suggested that temperatures, or some related environmental condition, influenced year-class strength and subsequent recruitment into the exploited stock (Paul 1982). A simplified version of that relationship is shown here in Figure 53. Lagged temperatures broadly correlated with the post-war decline, a recovery, and then a drop again in the 1970s. Francis (1993) and Francis et al. (1995) were subsequently able to quantify a very strong correlation between year-class strength, as measured by 1+ juveniles caught in trawl surveys, and February to June sea surface temperatures. This suggests that the first few months of life are critical in determining the strength of a year-class, but monthly temperature sequences are strongly inter-correlated and the precise determinant of year-class strength is unknown. However, Francis et al. (1995) point out that the relationship is sufficiently robust to allow recruitment prediction three to five years in advance.

Two other data sets support the concept of Hauraki Gulf snapper having variable recruitment. Snapper length frequencies summed annually from 1948 to 1971 (Figure 54) show sequences of years where the modal size of fish slowly increases, possibly reflecting the movement of strong year-classes through the population. A later (1989−90 to 2008−09) sequence of annual age composition shows a pattern of strong and weak year-classes moving through the exploited stock (Figure 55).

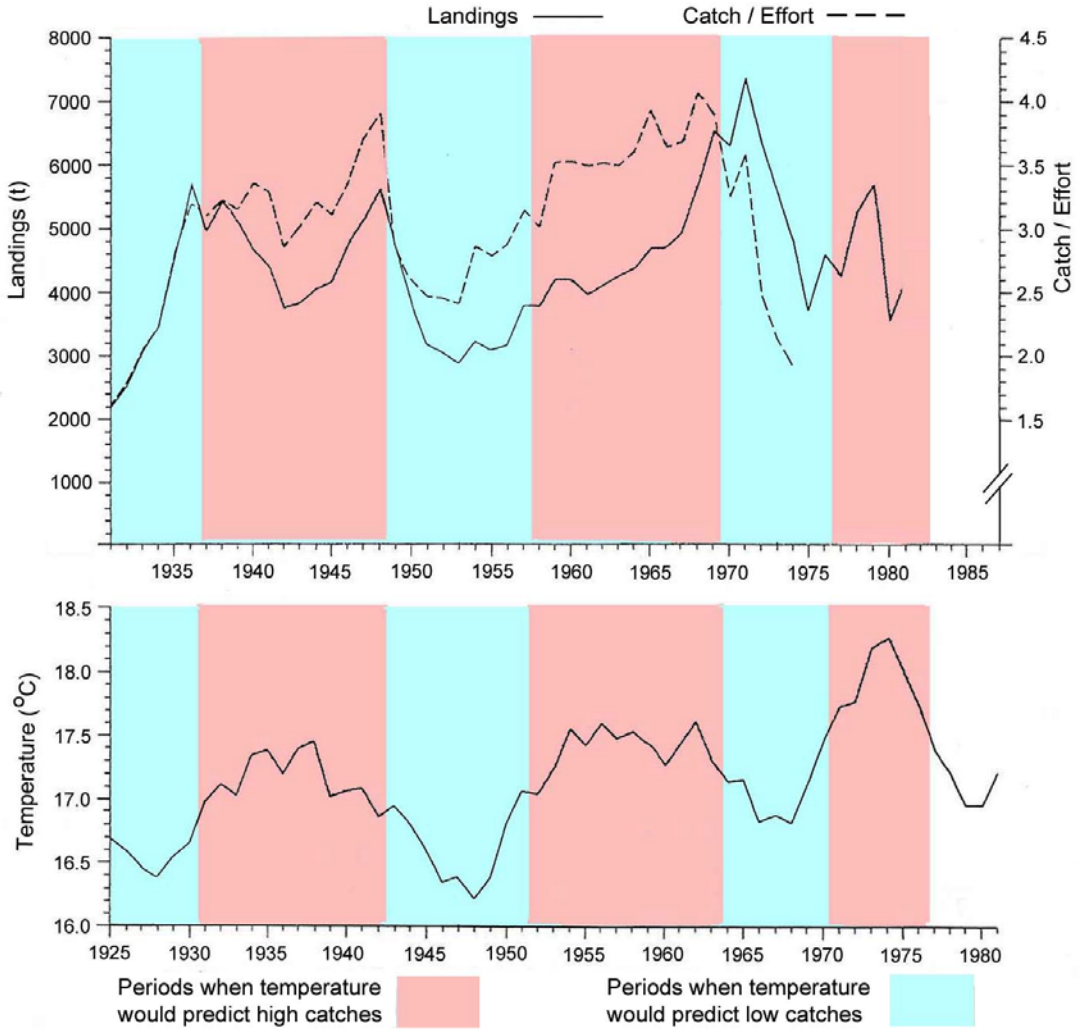

Figure 53: Relationship between snapper landings at Auckland, catch per effort, and spawning season temperatures in the Hauraki Gulf during the mid-twentieth century. Upper panel: landings and catch per effort. Effort was calculated as vessel-units, standardised (after determination of mean catch per vessel by fishing method) as line-and-net vessels; it is necessarily an approximation, and suitable only for showing general trends. Comparable vessel data are not available from 1974 onwards. Lower panel: Auckland air temperatures for Nov-Dec, as proxy for Hauraki Gulf spring water temperatures in the main snapper spawning season (water temperatures are not available for most of this period, but more recent series are closely correlated with air temperatures). Temperatures are plotted as five-year running means, shifted six years forward to correspond with the time to full recruitment of year-classes into the fishery. The first temperature value, therefore, is the mean for Nov-Dec from 1921 to 1925, and is matched against the landing for 1931 when 5−10 year old fish would be in the catch. The coloured banding marks warm and cool periods. *Based on Graph 1 in Paul (1982).*

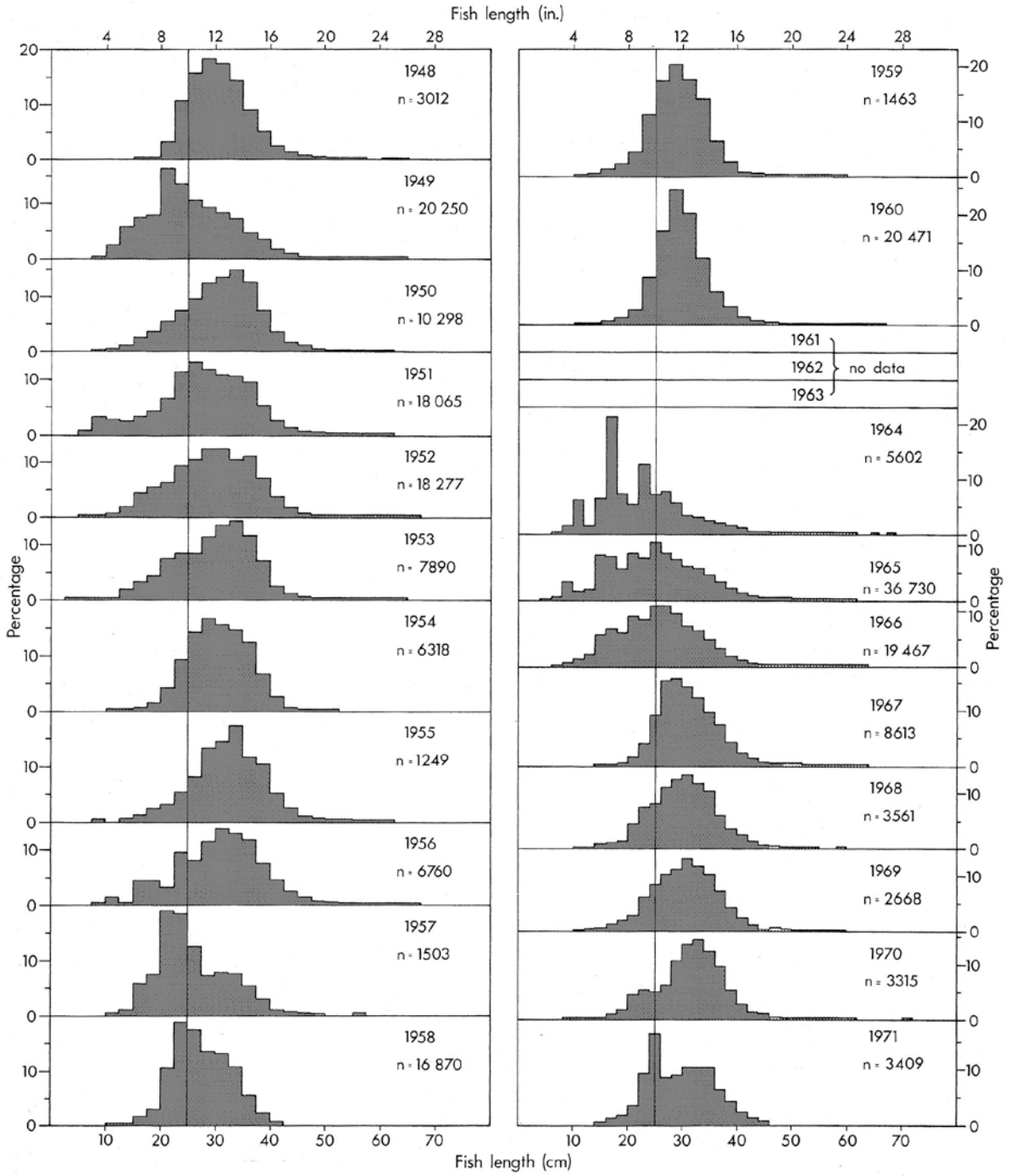

Figure 54: Annual length frequency distributions of trawl-caught snapper from the inner Hauraki Gulf, 1948−71, R.V. *Ikatere*. Data are summed from a variety of projects, and the areas fished are not directly comparable from year to year. The vertical line is generalised at 25 cm, the legal size limit of snapper for most of the twentieth century. *From Paul (1976) figure 28.*

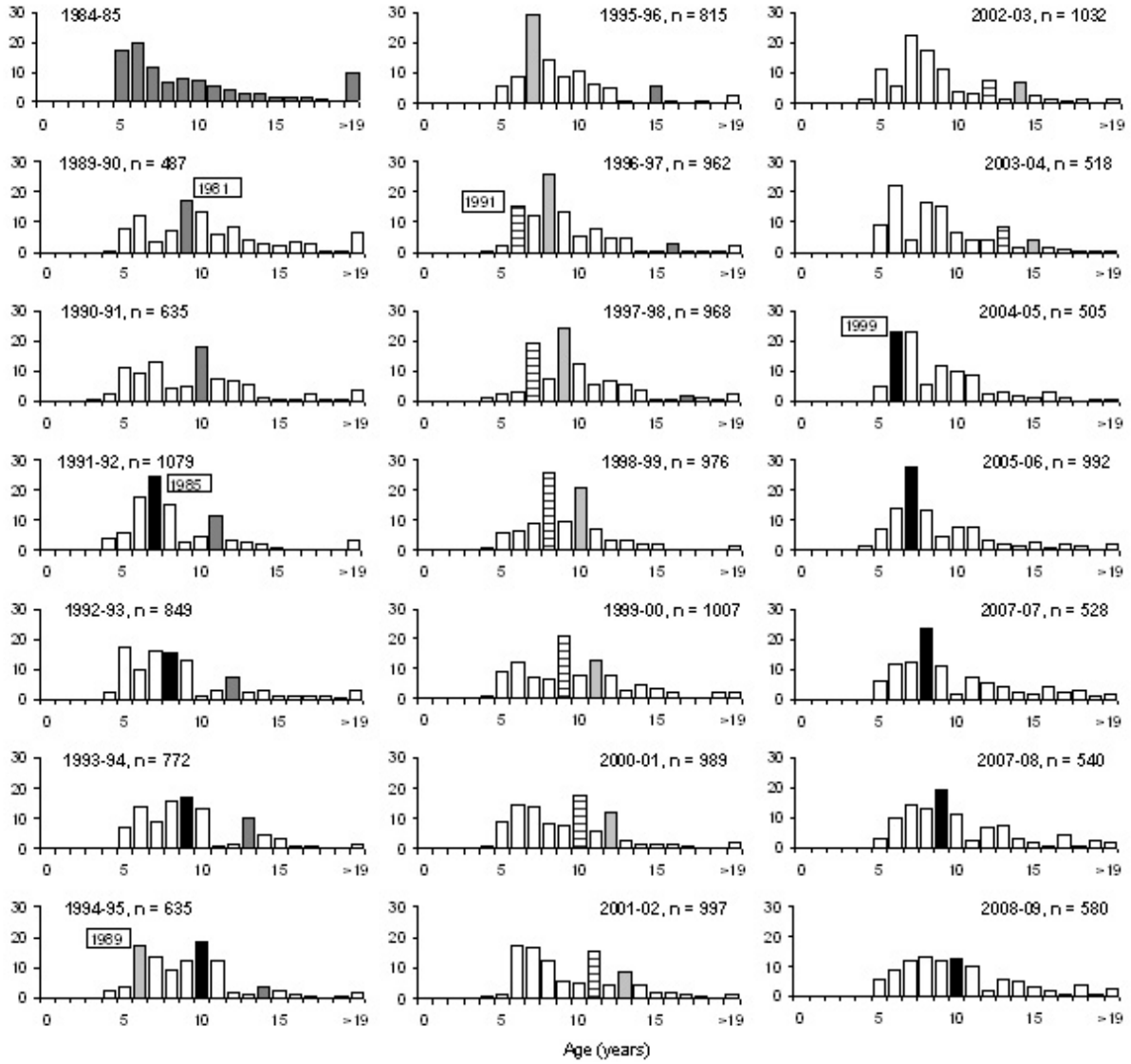

Figure 55: Age distribution of Hauraki Gulf snapper caught commercially by longline, 1984−85 and 1989−90 to 2008−09. Based on shed sampling of commercial landings, as reported by Davies & Walsh (1995), Davies et al. (1993, 1999), and Walsh et al. (1995–2011) – see "For further information" below. The 1984–85 sample is derived from age-length key and length frequency samples, subsequent years from random age sampling. Some prominent year-classes are identified by shading, and are labelled at their first strong appearance.

Most recent stock assessments on snapper have incorporated Hauraki Gulf fish within the larger SNA 1 (North Cape to East Cape) stock, or combine Hauraki Gulf with Bay of Plenty. However, an earlier descriptive account of the Hauraki Gulf fishery alone was made by Paul (1974, 1977). The rather limited length and age frequency data suggested that the rise in catches from the late 1960s to 6000 t in 1971 resulted from a strong 1962 year-class entering the exploited stock, adding to an accumulation of strong mid-1950s year-classes. The 1972 drop in catch and CPUE was predicted to continue, and the catch did decline to 2750 t in 1975. After a moderate recovery it was reduced to about 3100 t by the QMS, and then 2500 t or less from the mid-1990s onwards.

In summary, the twentieth century snapper fishery has been influenced by a number of economic and social factors, and is based on a stock that undergoes some degree of recruitment variability, although this is buffered by the relatively large number of age groups in the population.

Changes in the size distribution of snapper over time

The commercial fishery for snapper in the Hauraki Gulf has existed for almost a century, starting with the commissioning of trawlers in 1915 and intensifying with the development of Danish seining in 1923. (Earlier unrecorded catches by line and setnet would have been small to modest.) It would be reasonable to assume that at least the age structure of the population, and probably the size structure, has been altered over that time. Unfortunately, there are very few comparable data on size distributions, and age structures have only been recorded systematically from the 1990s (see Figure 55).

Snapper were first measured in 1926−27 during the investigation of the fishery by Hefford (1929). As well as measuring large samples caught during experimental Danish seining, he recorded the size frequency of snapper catches taken commercially by trawl, Danish seine, longline and setnet, over two spring-summer periods, presumably measured in fish sheds. The size frequency of these catches by trawl, Danish seine, and longline can reasonably be compared with shed-sampling data obtained in the 1990s and early 2000s by the same methods, although there are some provisos on interpretation.

The two features of size distribution considered here are the modal size, and the proportion of "large" fish, defined as those 40 cm in length or greater.

Trawl

In 1926−27 there were two length frequency modes: 30 and 33 cm (Figure 56. As shown above (Landings, year-classes, and temperatures), at about this size modal lengths can be influenced by the presence of strong and weak year classes. The NIWA samples from the early 1990s have smaller modes, at 28 to 30 cm. If the comparison is valid, there has been a small decrease in the modal size over about 70 years. There are two potential complications. Although much of the inner Gulf was closed to trawling by the mid-1920s, these vessels were still able to work in the central Gulf, closed to trawling by 1990. The size of trawlers also differed. In the mid-1920s the trawlers were mainly large steam-powered vessels, 83 to 125 ft in length (Hefford 1929), while in the 1990s they were smaller, 60 to 70 ft diesel-powered vessels. The latter may have hauled smaller nets, but perhaps faster, and the relative "fishing power" of the two sets of trawlers is unknown.

The proportion of snapper 40 cm and larger is generally similar between the two time periods (Table 4), at 13−21% by number and 28−45% by weight.

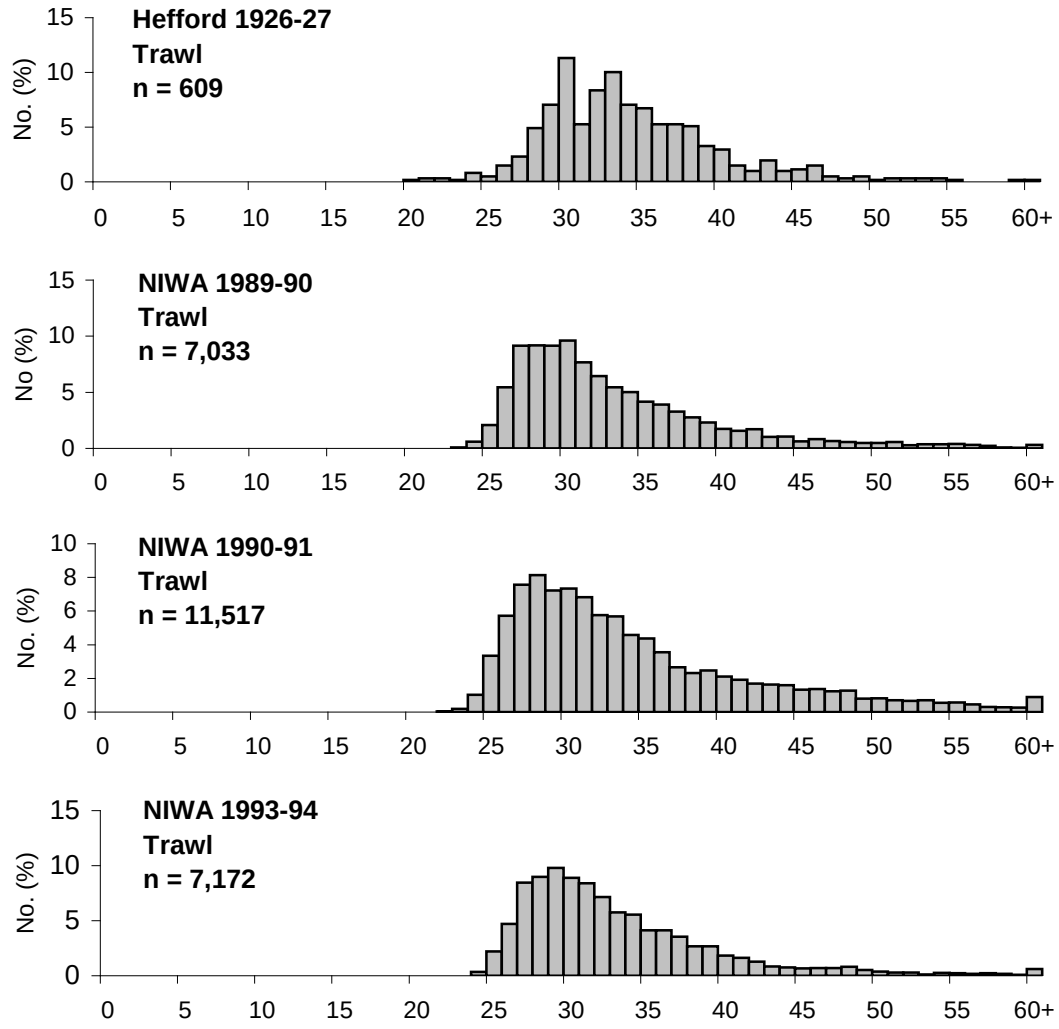

Figure 56 Size frequencies of snapper taken by commercial trawl, 1926−27 and early 1990s. Sources: Hefford (1929), Davies & Walsh (1995).

Table 4: Percentages of snapper 40 cm and greater in length in the samples of snapper 25 cm and greater, in 1926−27 and in the early 1990s. Tabulated as percentage by number, and as percentage by weight, using the length-weight conversion in Paul (1976, table 9).

Fishing method	Sampling date	Numerical %	% by weight	Reference or data source
Single bottom trawl				
	1926−27	15	28	Hefford (1929)
	1989−90	14	32	Davies & Walsh (1995)
	1990−91	21	45	Davies & Walsh (1995)
	1993−94	13	28	Davies & Walsh (1995)
Danish seine	1927−27	9	20	Hefford (1929)
	1992−92	31	52	Davies & Walsh (1995)
	1993−94	14	29	Davies & Walsh (1995)
	1995−96	10	22	Walsh et al. (1997)

Danish seine

In 1926–27 the mode was at 30 cm. In the more recent samples (1970–71 and early 1990s) the mode was at this length or greater (Figure 57). The "fishing power" of Danish seiners almost certainly increased during the twentieth century, particularly with the introduction of larger nets in 1968, but the fishing grounds remained essentially the same. Of the three fishing methods from which size frequency data are available, it probably provides the most comparable sets.

The proportion of snapper 40 cm and larger is 9% by number and 20% by weight in 1926–27, and greater than this (10–31% by number, 22–52% by weight) in the later time periods (Table 4).

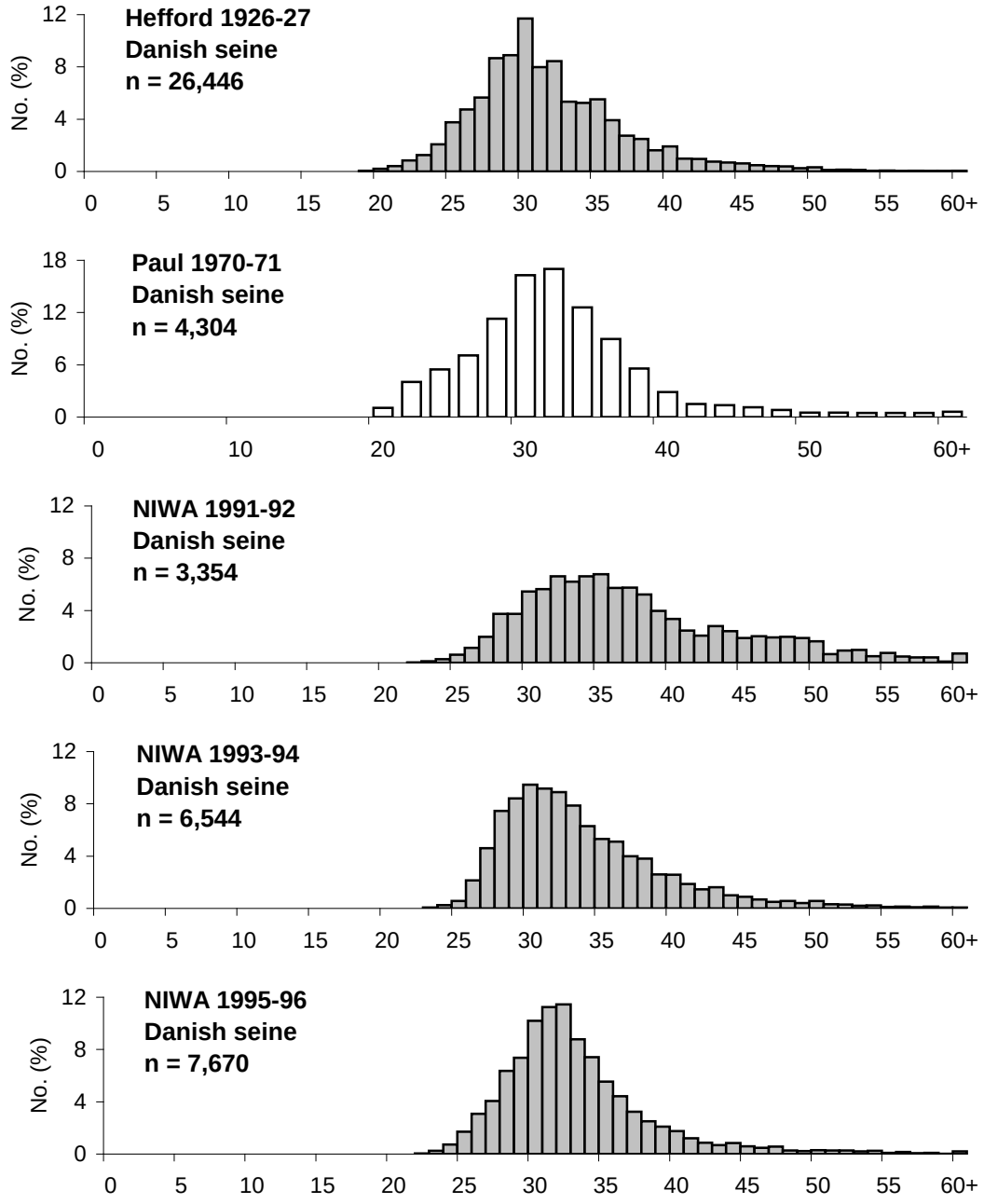

Figure 57: Size frequencies of snapper taken by commercial Danish seine, 1926–27, 1970–71, and early 1990s. Sources: Hefford (1929), Paul (1976), Davies & Walsh (1995), Walsh et al. (1997).

Longline

The longline data sets contain the largest fish. In 1926−27 the mode was at 35−36 cm. In the NIWA samples from the 1990s and 2000s (which are very similar, and represented in Figure 58 by three 3-year compilations) the mode is distinctly smaller, at 30−31 cm. It is possible that this reduction is the result of selectivity by smaller hooks, driven by a preference for smaller, uniformly-sized "iki-jime" fish for the export market over recent decades.

A tail of larger fish remains in the size distribution. In 1926−27 the proportion of snapper 40 cm and larger is 27% by number and 42% by weight (Figure 59). From 1992 to the early 2000s the proportion by number is lower at an average of 21%, but the proportion by weight is similar at an average of 41% − suggesting a relatively higher number of fish in the largest size groups.

The first two years in the recent series, 1990 and 1991, are omitted from these calculations because the samples were taken only in summer, whereas the remainder were taken in both spring and summer, or throughout the year. Davies et al. (1993) observed that the fish caught in summer were larger than those in spring, possibly as a consequence of spawning movements and distribution. This, in fact, underlines the difficulty in making reliable comparisons between samples caught not only by different methods, but at different times of the year.

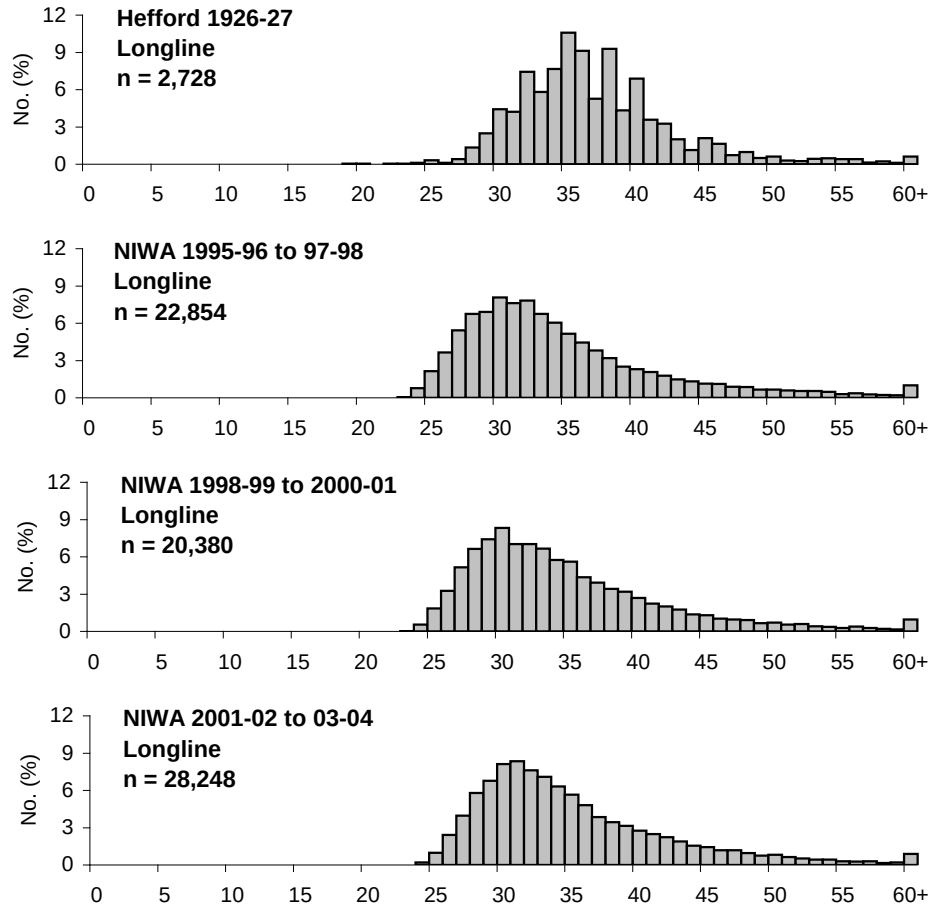

Figure 58: Size frequencies of snapper taken by commercial trawl, 1926−27 and early 1990s. Sources: Hefford (1929), Walsh et al. (2011) and NIWA unpublished data summaries.

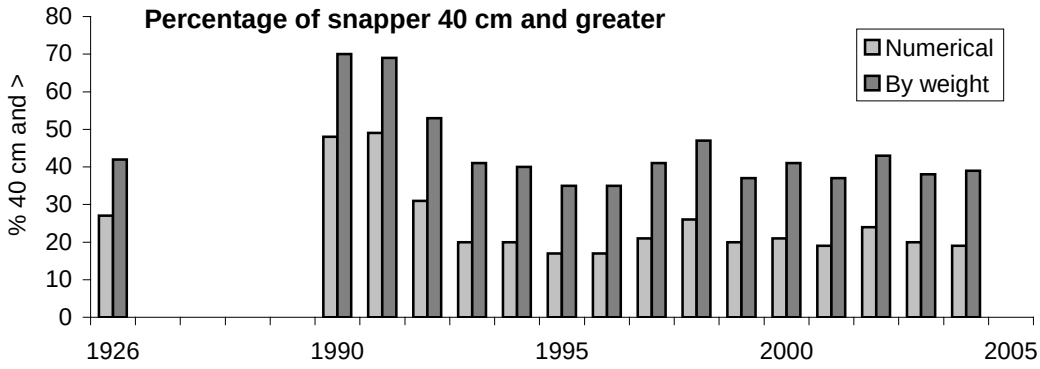

Figure 59: Percentages by number and weight of snapper 40 cm and larger, taken by commercial longline and shed-sampled, 1926-27 (Hefford 1929) and 1989−90 to 2003−04 (Walsh et al. 2011 and references listed therein, and NIWA unpublished data).

In summary, there is no clear indication that there has been a loss of large snapper from the Hauraki Gulf commercial fisheries between the mid-1920s and the 1990s. However, the evidence is inconclusive. There may have been a decrease in the dominant modal size in the population, but this is difficult to verify because of changes within each fishing gear type over time which could alter selectivity. The Danish seine data suggest that the population size structure has not been permanently altered, but this is a cautious conclusion because the fishing method does not take fish from rough seafloor where the largest fish (50 cm and greater) are relatively more common. It is, in fact. possible that these fish declined in relative numbers. Longlines are worked closer to rough ground and are more likely to sample the largest fish more adequately, but they have varied over time in line structure, hook size (hence selectivity), and probably the localities worked. Their catches must also be compared cautiously. Adding to the uncertainty, it has been shown (see Figures 54 and 55) that moderate changes in modal size occur over short sequences of years as a consequence of strong year classes moving through the population. A comparison of two short periods of time is inadequate; a time series is desirable.

No information is available on long-term changes in age structure. And although it appears that there has been no or minimal long-term change in size structure, and in particular the proportion of fish 40 cm in length and larger, it cannot be inferred that the age structure has remained stable. Snapper have a variable growth rate, which slows during times of high population density (Walsh et al. 2011), including periods when particularly strong year classes are present (author's unpublished observations). The growth rate of snapper along the north-east coast (SNA 1 stock) has decreased between 1990 and 2010, which is attributed by Walsh et al. (2011) to a stock rebuild following a reduction in commercial quotas. It seems quite feasible that as fishing pressure in the Hauraki Gulf increased during the twentieth century and population density reduced, growth rate increased and maintained a size structure which included large but increasingly younger fish.

For further information

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Flatfishes



Yellowbelly flounder *Rhombosolea leporina*



Sand flounder *Rhombosolea plebeia*



Lemon sole *Pelotretis flavilatus*



New Zealand sole *Peltorhamphus novaezeelandiae*

Distribution

The four main species have somewhat different distributions. The yellowbelly flounder is widely distributed around New Zealand, but most common north of East Cape and Cape Egmont, in 0−50 m. It is the most common species in the Hauraki Gulf, occurring in the shallow waters, including harbours, around the entire Gulf including the Firth of Thames. The sand flounder is also widely distributed but is more common in southern waters, 0−75 m; in the Hauraki Gulf it is locally and seasonally present, usually in slightly deeper waters than the yellowbelly. The lemon sole is widely distributed and occurs over a greater depth range, 20−500 m but most common to 200 m; it occurs in these depths in Hauraki Gulf but is not particularly abundant. The New Zealand sole is present around New Zealand but much more common around the South Island, 0−100 m; it is uncommon in Hauraki Gulf. Two small species which have no value to commercial or recreational fishers also occur: speckled sole *Peltorhamphus latus* (often mistaken for juvenile *P. novaezeelandiae*), and witch *Arnoglossus scapha*.

Relative importance of the Hauraki Gulf fishery

Hauraki Gulf was a moderately important area for flatfishes in the early 1930s (and probably earlier), but much less so in subsequent decades, particularly from the mid-1970s onwards (Figure 60), probably as the introduction of monofilament setnets encouraged small fisheries for flatfish in other regions.

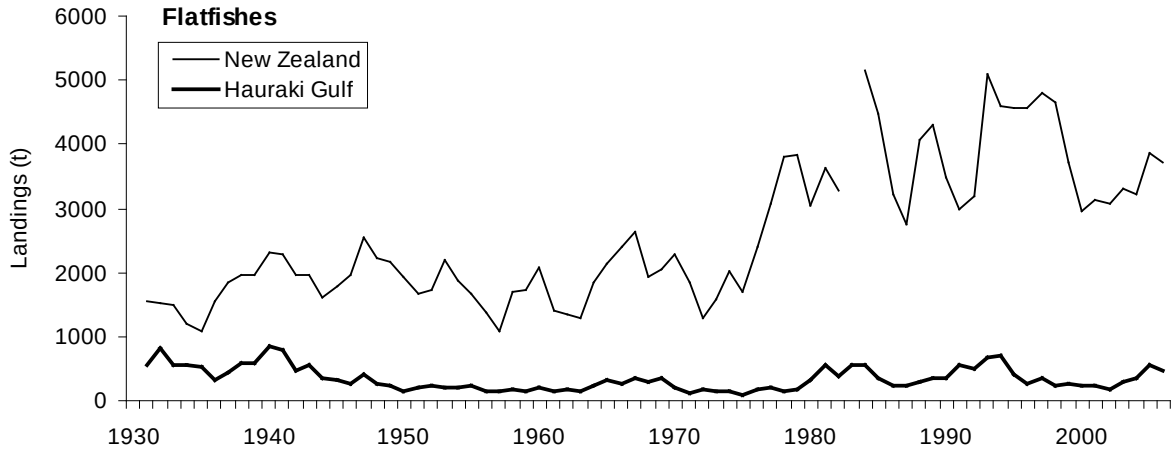

Figure 60: Landings of flatfishes from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Hauraki Gulf landings declined during the 1930s and 40s, then underwent major fluctuations from the 1960s and a generally upward trend from the 1980s (Figure 61). It can only be speculated that the fluctuations result from year-class variability and changes in market demand.

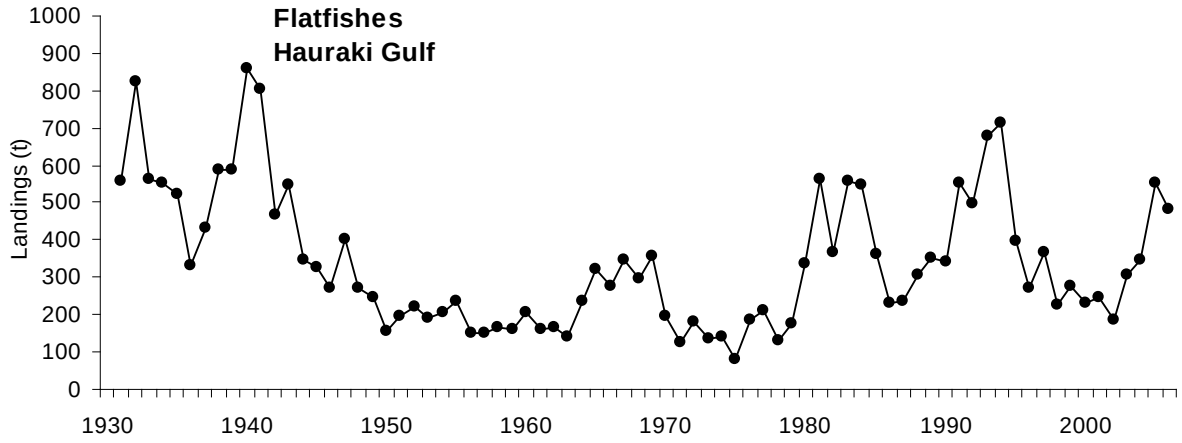

Figure 61: Landings of flatfishes from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There is a strong seasonal pattern to Hauraki Gulf landings, which are highest in summer, usually peaking in January (Figures 62 and 63). This seasonality is only sometimes apparent in the Auckland flatfish landings (Figure 63, right), and is driven primarily by landings into Thames (Figure 64). Most Thames landings come from the setnet fishery on the extensive tidal mudflats around the southern Firth of Thames, where the main target fishery is for yellowbelly flounder. Auckland landings (Figure 63, right panel) have a variable summer component of yellowbelly flounder from harbour setnet fisheries, but also include sand flounder and lemon sole taken by trawl and to a lesser extent Danish seine throughout the year from deeper parts of the Gulf.

The Thames flatfish setnet fishery, on the Thames mudflats, alternates with seasonal fisheries for snapper in the deeper Firth (Figures 64, 65), which generally peak in September and February-March. The same fishers use either a different style of setnet when targeting snapper, or longlines. The relationship between these two fisheries is complex. Some anecdotal information suggested that

flounder were the primary species for many of these fishers, and that after a good flounder season less effort was directed at snapper (Paul 1977). There is little evidence for this in Thames landings (Figure 65), presumably because of other factors: not all fishers followed this pattern; the snapper fishery was variable, often with two seasonal peaks; and market demand for each species affected prices, and often resulted in industry-set 'landing quotas' at the peak of each season.

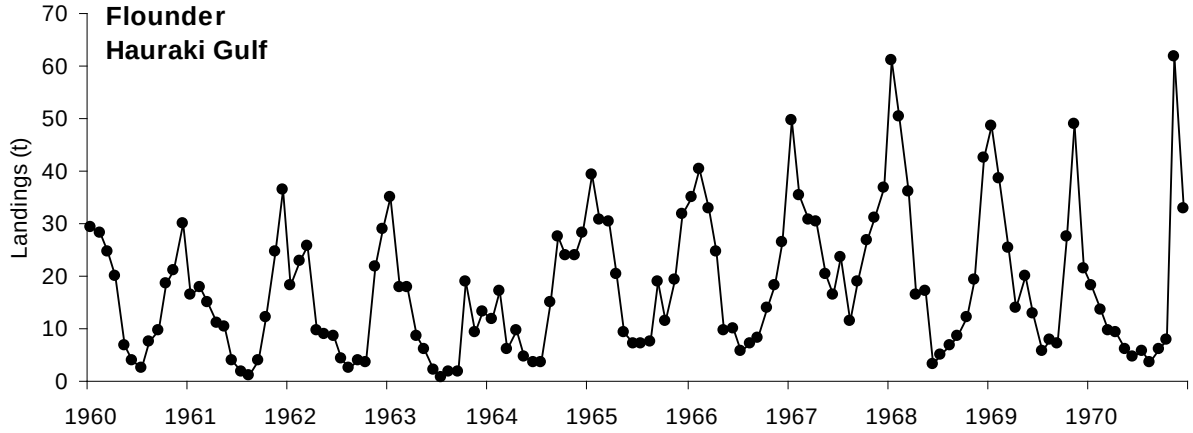

Figure 62: Monthly commercial landings of flounder from the Hauraki Gulf, Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975).

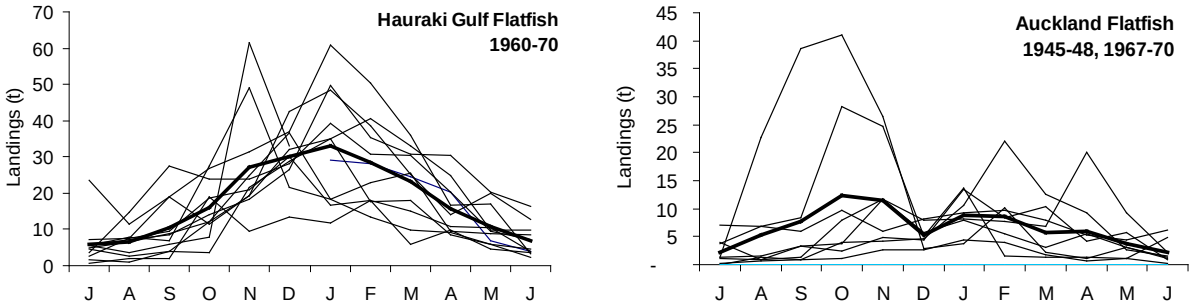

Figure 63: Seasonal (monthly) trends in the commercial landings of flounder. Left, landings from the Hauraki Gulf as defined by Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975), re-plotted from Figure 62. Annual values, and 11-year mean (heavy line). Right, landings into Auckland, 1945−71, from Annual Reports on Fisheries. Annual values, and 8-year mean (heavy line). Both data sets presented as July−June years, to avoid subdividing the main fishing season.

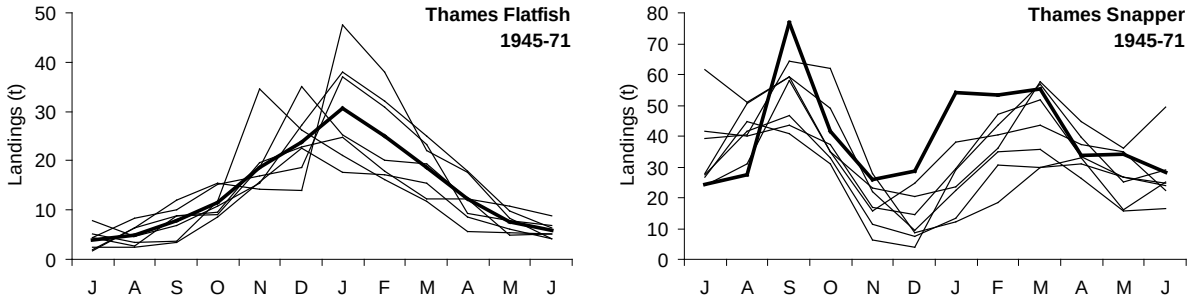

Figure 64: Seasonal (monthly) trends in the commercial landings of flounder and snapper at Thames, 1945−71, from Annual Reports on Fisheries. Four-year means, and 27-year mean (heavy line). Both data sets presented as July−June years, to avoid subdividing the main fishing seasons.

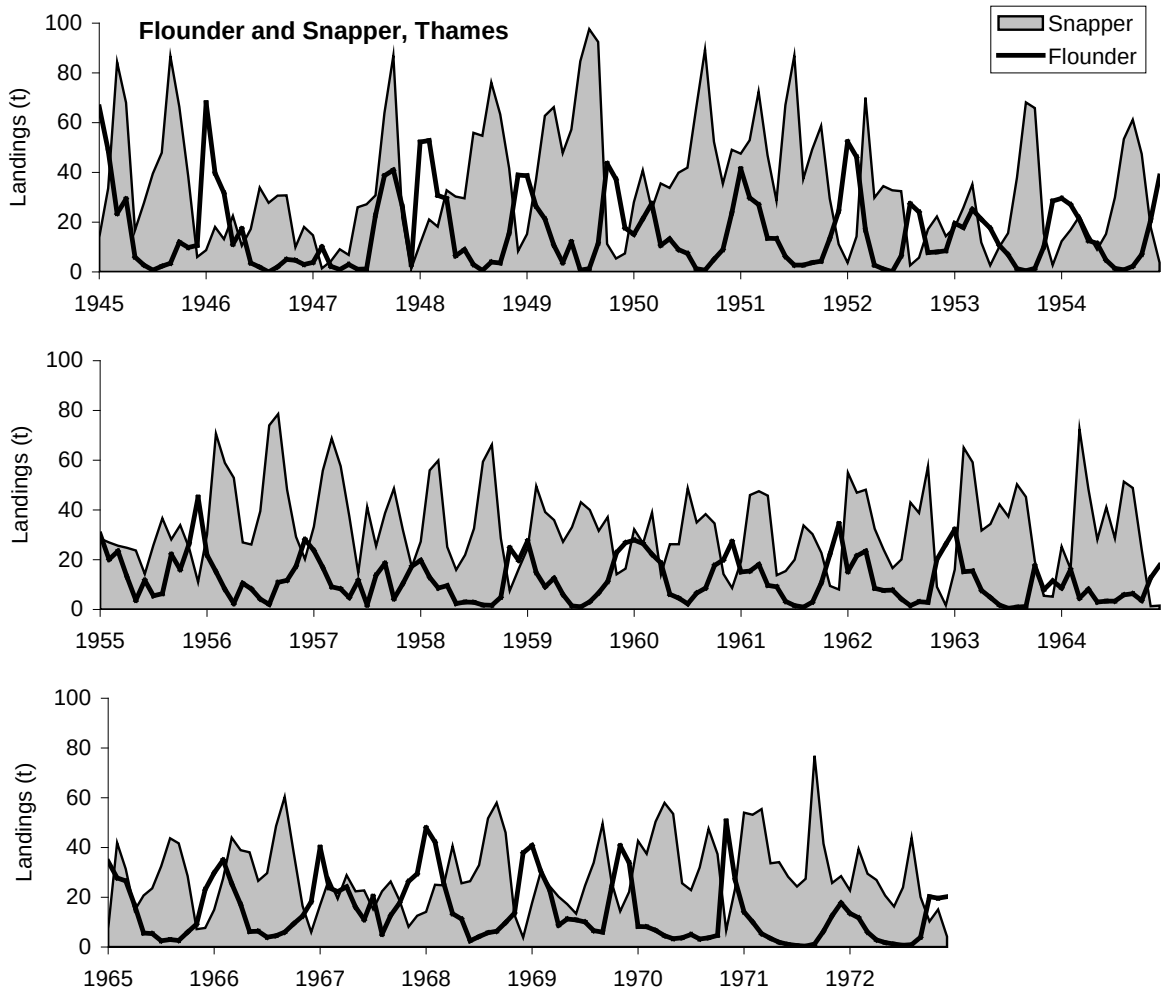

Figure 65: Seasonal (monthly) trends in the commercial landings of flounder and snapper at Thames, 1945−72, Source: Annual Reports on Fisheries, but 1972 data are from an informally printed MAF leaflet).

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Red gurnard

Chelidonichthys kumu



Distribution

Widely distributed around New Zealand, 10−200 m. Widespread and common in Hauraki Gulf, mainly on open seafloor to 100 m.

Relative importance of Hauraki Gulf fishery

Gurnard landings from the Hauraki Gulf are not an important component of the New Zealand fishery (Figure 66). They increased only slowly from the 1930s through the 1960s while landings elsewhere steadily expanded.

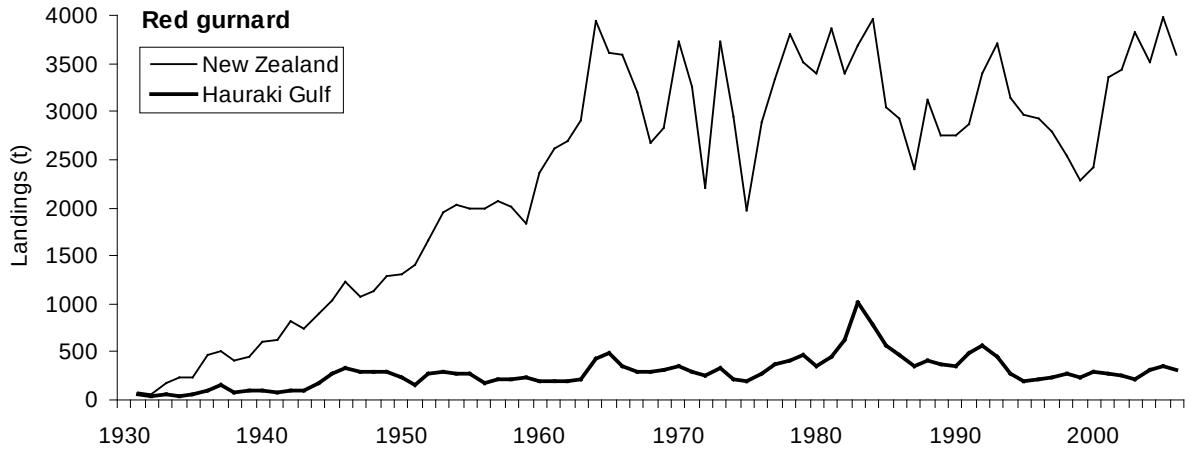

Figure 66: Landings of red gurnard from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Gurnard landings fluctuated upwards from the 1930s (Figure 67). The 1983 peak marks a transition in reporting systems, and also a period when fishers increased their reported landings to establish a catch history prior to the anticipated introduction of quotas. Gurnard are taken mainly by single trawl and long-line.

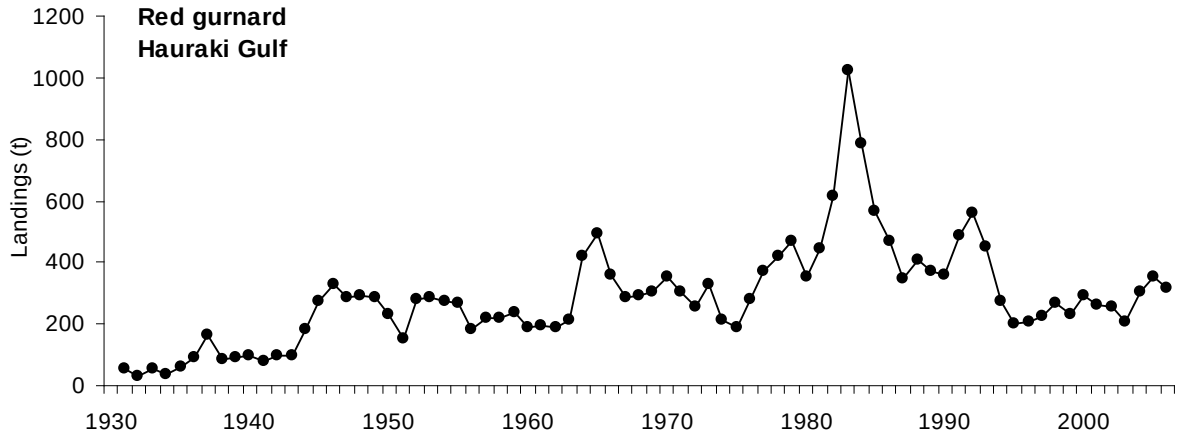

Figure 67: Commercial landings of red gurnard from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There is a moderate and somewhat erratic seasonal pattern in landings (Figure 68). They are usually highest in late winter and spring, with a broad peak from August to October (Figure 69). This pattern appears clearer in the Hauraki Gulf landings for 1960−70 (left) than in the Auckland landings for 1945−71 (right), but the latter lines are from four year means rather than single years. This peak is a little earlier than the seasonal peak for snapper, and probably represents a shift towards targeting snapper from October onwards. The spawning season for gurnard and snapper is essentially similar, but some targeting of pre-spawning aggregations of gurnard may occur.

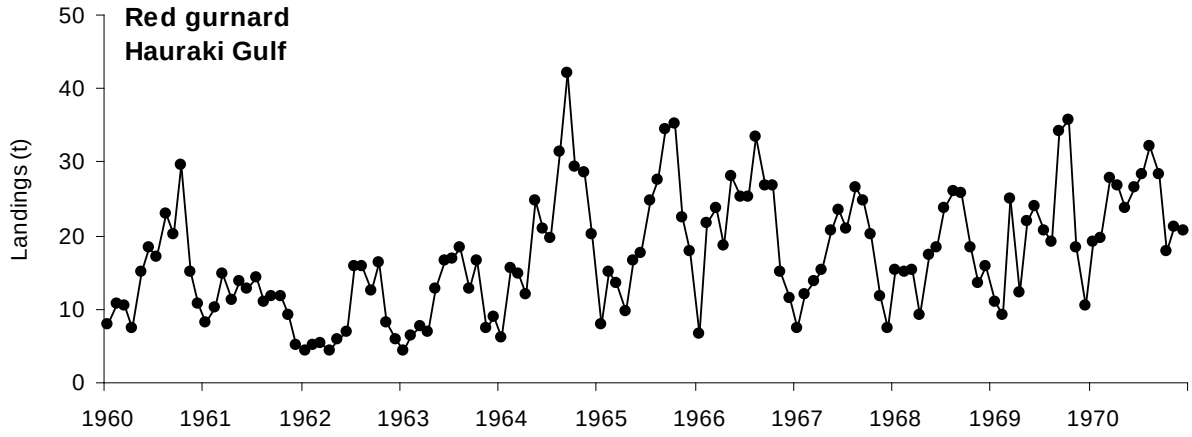

Figure 68: Monthly commercial landings of red gurnard from the Hauraki Gulf, Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975).

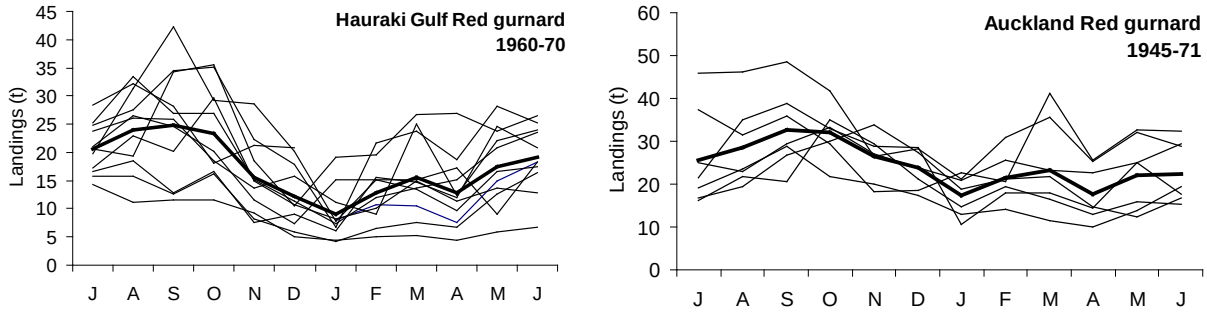

Figure 69: Seasonal (monthly) trends in the commercial landings of red gurnard. Left, landings from the Hauraki Gulf as defined by Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975). Annual values, and 11-year mean (heavy line). Right, landings into Auckland, 1945−71, from Annual Reports on Fisheries. Four-year means, and 27-year mean (heavy line). Both data sets presented as July−June years, to avoid subdividing the main fishing season.

Recreational catches

Although the recreational fishery does not form part of this account, red gurnard are a moderately common species in the catch, and have been provisionally estimated at 10 t about 1930, rising to 25 t at the end of the century (Figure 70).

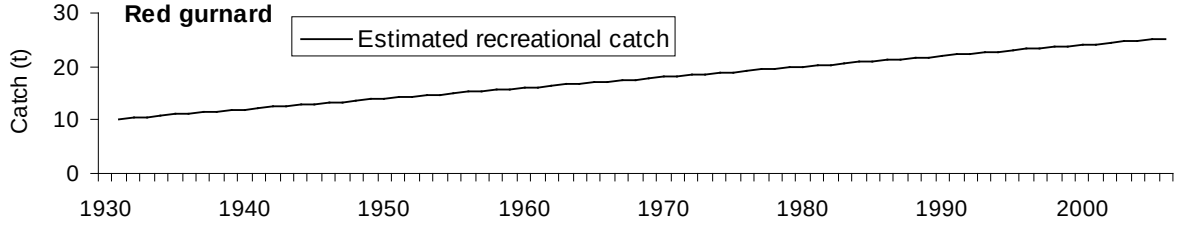

Figure 70: Estimated catch of red gurnard from the Hauraki Gulf by recreational fishers, 1931−2006. Source: extrapolated from B. Hartill pers. comm., based on survey by Hartill et al. (2007b).

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Trevally

Pseudocaranx dentex



Distribution

Common around the North Island, less common around the northern South Island, 0−150m. Common throughout Hauraki Gulf, mainly in open waters out to 100 m. Occur in a wide variety of habitats: shallow harbours, sandy seafloor, surface waters. Often form dense midwater to surface feeding schools.

Relative importance of Hauraki Gulf fishery

From 1940 to the early 1950s a moderate proportion of the total trevally catch was taken from the Hauraki Gulf (Figure 71). Landings from other regions then increased more rapidly, and the Hauraki Gulf contributed only a small proportion of the total.

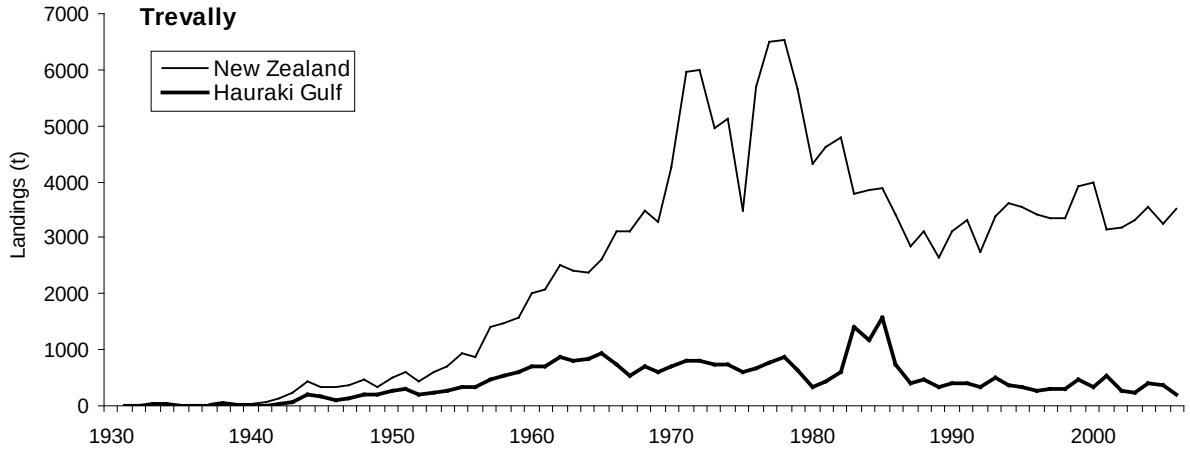

Figure 71: Landings of trevally from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Trevally was not a particularly valuable commercial species until the 1950s (Figure 72), and was either not targeted, was discarded, or used as bait. Landings then rose rapidly until the mid-1960s, before slowly declining. This decline is at least partly due to more profitable trevally fishing grounds being found elsewhere, mainly along Auckland's west coast and in the Bay of Plenty. The 1983 peak marks a transition in reporting systems, and also a period when fishers increased their reported landings to establish a catch history prior to the anticipated introduction of quotas.

Trevally is taken by pair trawl, single trawl, purse seine, and setnet.

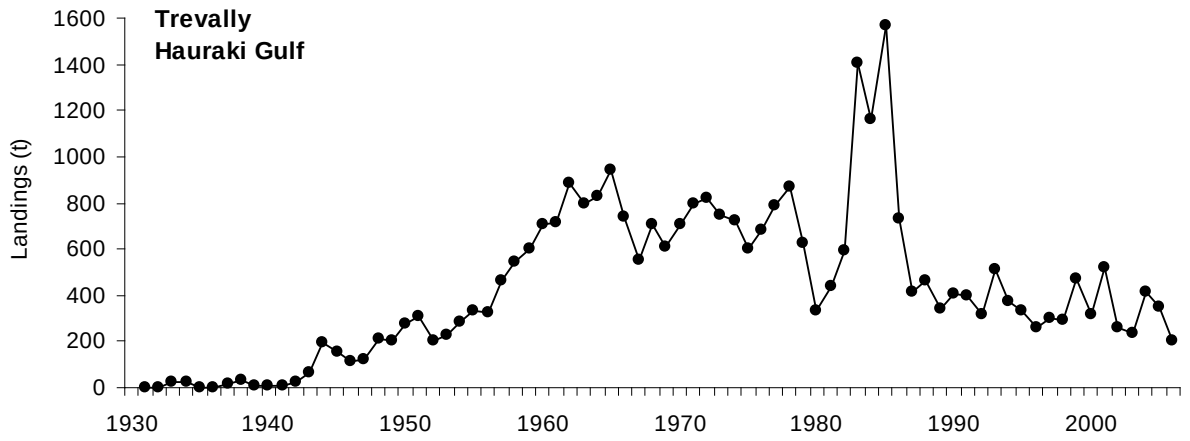

Figure 72: Landings of trevally from the Hauraki Gulf region, 1931−2006.

Seasonal trend

In the early to mid-1960s there was no strong seasonal pattern, although highest landings were usually made in summer (Figure 73). A clear seasonal pattern then developed, with a strong peak during summer, Jan-Mar (Figures 73, 74), a little later than the peak for snapper (see Figures 50, 51). This pattern presumably represents increased targeting for trevally after the main snapper season.

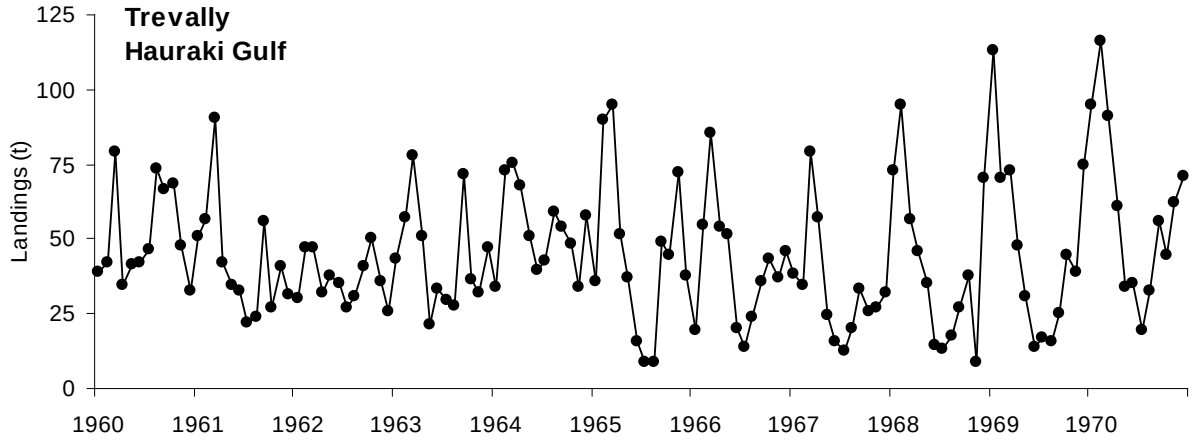

Figure 73: Monthly commercial landings of trevally from the Hauraki Gulf, Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975).

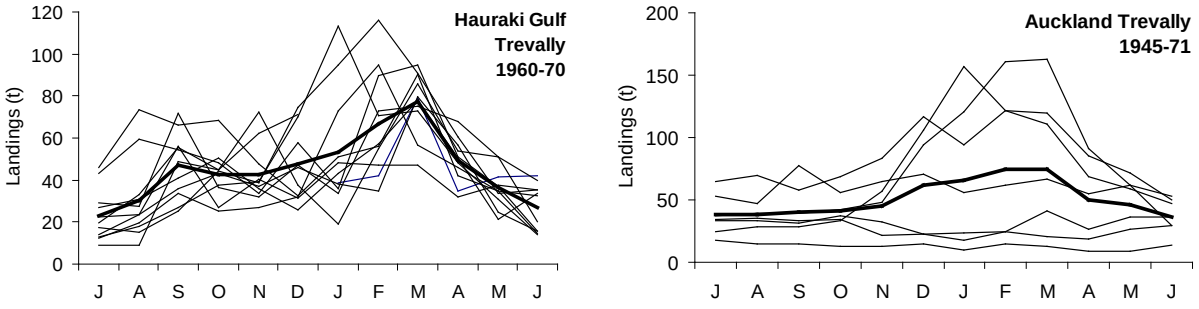

Figure 74: Seasonal (monthly) trends in the commercial landings of trevally. Left, landings from the Hauraki Gulf as defined by Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975). Annual values, and 11-year mean (heavy line). Right, landings into Auckland, 1945−71, from Annual Reports on Fisheries. Four-year means, and 27-year mean (heavy line). Both data sets presented as July−June years, to avoid subdividing the main fishing season.

Recreational catch

The recreational catch is poorly known, but estimated to have increased from low numbers in the 1950s to about 40 t at the end of the century (Figure 75), a moderate quantity relative to the commercial landings.

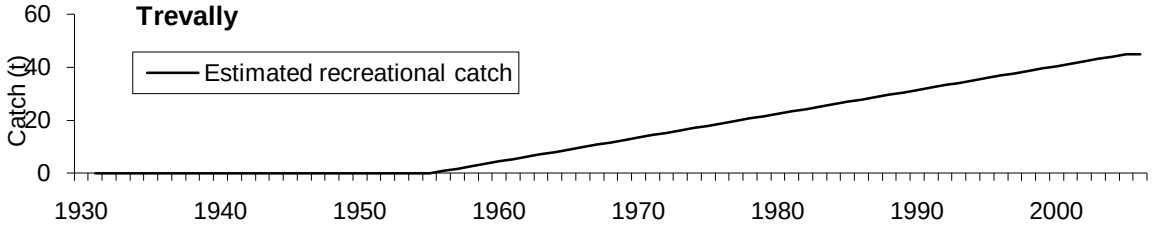

Figure 75: Estimated catch of trevally from the Hauraki Gulf by recreational fishers, 1931−2006. Source: extrapolated from B. Hartill pers. comm., based on survey by Hartill et al. (2007b).

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Kahawai

Arripis trutta



Distribution

Widely distributed around New Zealand, apart from the southern South Island, in the depth range 0−150 m. Common in Hauraki Gulf. Occur in a wide variety of habitats: shallow harbours, sandy seafloor, surface waters. Often form dense midwater to surface feeding schools.

Relative importance of Hauraki Gulf fishery

Hauraki Gulf was a moderately important area for kahawai only in the 1980s (Figure 76).

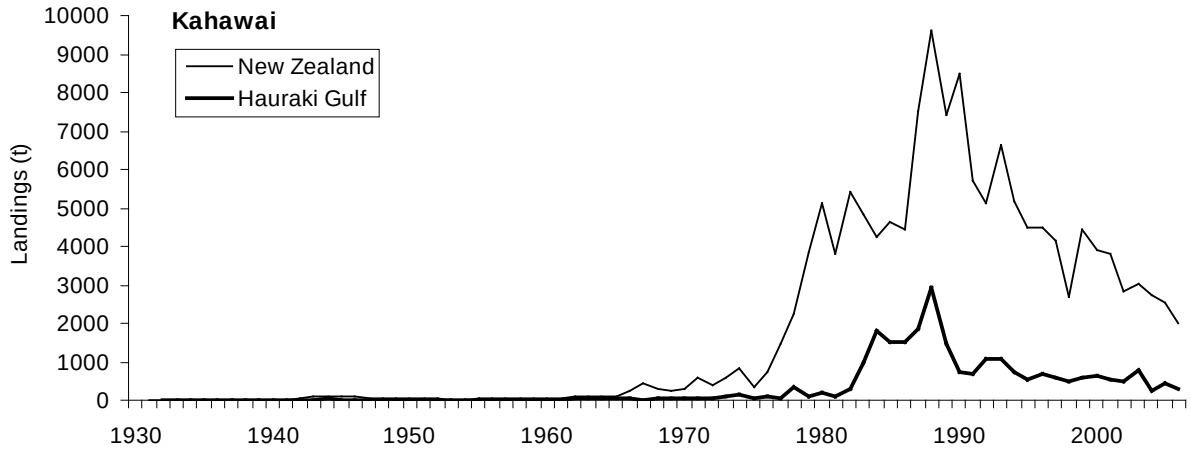

Figure 76: Commercial landings of kahawai from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Very small landings were recorded from the 1930s up to 1980 (Figure 77), although somewhat larger quantities would have been caught and discarded, used as bait, and/or included in 'other' or 'mixed species' in landing records. The peak landings from the mid to late 1980s probably represent catches taken in the central Gulf and north-western Bay of Plenty by purse seiners, during the cooler months when they were not targeting skipjack tuna. Recorded landings by other methods would have increased under the reporting requirements of the QMS (although kahawai itself did not enter the QMS until 2004), and greater commercial acceptance of the species would have encouraged landings. From 1988 a limit was placed on commercial catches by purse seine.

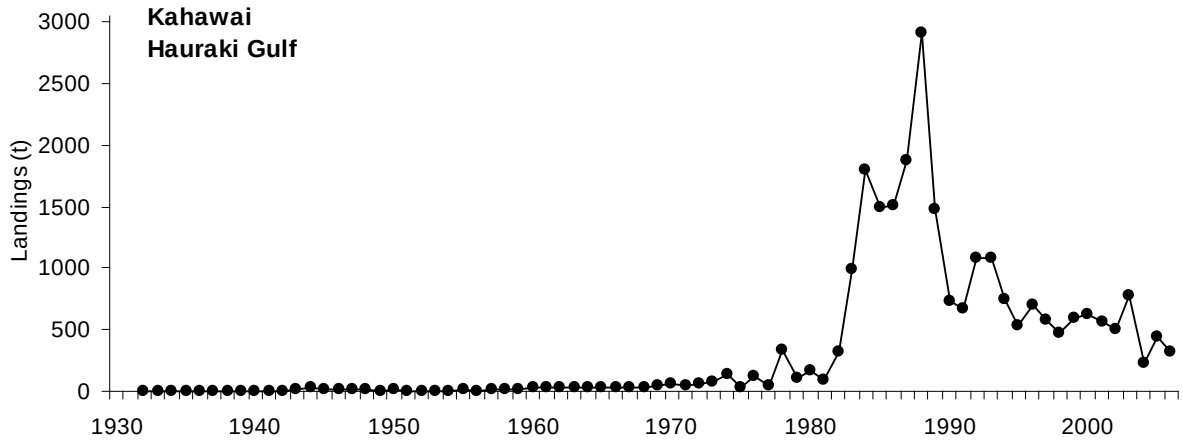

Figure 77: Commercial landings of kahawai from the Hauraki Gulf region, 1931−2006.

Seasonal trend

Data on seasonal landings are not readily available. A detailed analysis would be necessary to determine any true seasonality. Purse seine catches are mainly taken from June to November, but generally only to fill export orders and are thus likely to be erratic. Catches by other methods are mainly bycatch, and dependent on the targeting of other species.

Recreational catches

Kahawai are important in the Gulf's recreational fishery. Catch estimates are very approximate (Figure 78), but have probably risen to over 100 t, one quarter or more of commercial landings.

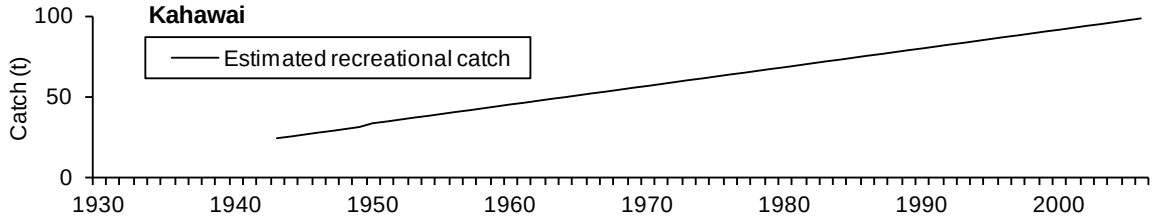

Figure 78: Estimated catch of kahawai from the Hauraki Gulf by recreational fishers, 1931−2006. Source: extrapolated from Hartill et al. (2007a,b).

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Blue mackerel

Scomber australasicus



Distribution

Widespread but only locally common around northern and central New Zealand, 0−150 m. Common in the Hauraki Gulf, usually in midwater to surface schools.

Relative importance of Hauraki Gulf fishery

For a few years in the late 1980s the Hauraki Gulf contributed up to half the total landings (Figure 79), but the trend then remained flat, though annual landings were variable, while landings from other areas, probably mainly the Bay of Plenty, had an upwards trend.

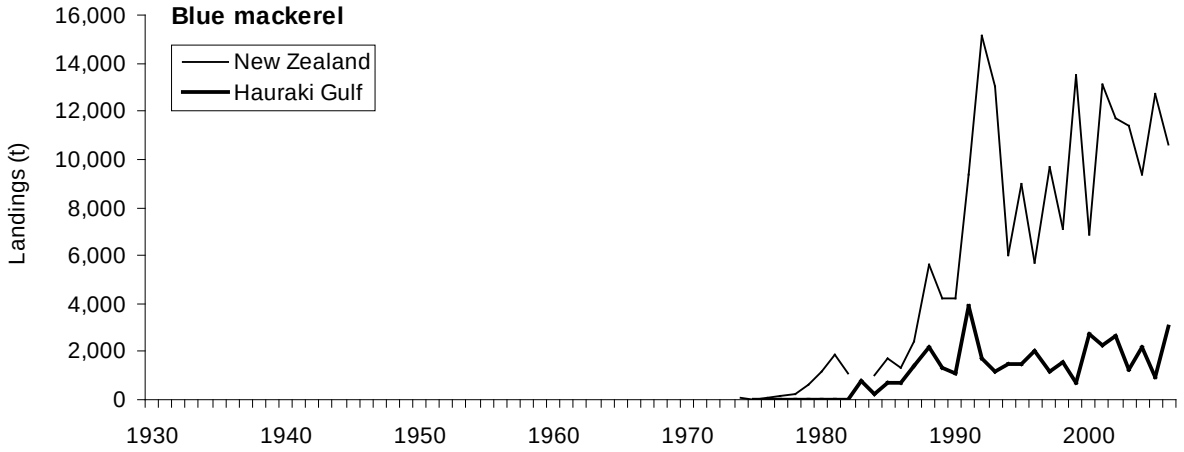

Figure 79: Landings of blue mackerel from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Very small catches were made from the mid-1970s to the early 1980s (Figure 80), undoubtedly as a bycatch, and the species was probably caught in small quantities but unrecorded prior to this. Landings, presumably by purse seine then increased rapidly, to fluctuate widely between 700 t and almost 4000 t from 1990 onwards. These fluctuations result from movements of the seiner fleet between Hauraki Gulf and Bay of Plenty fishing; aerial sighting records show the annual availability of blue mackerel on different fishing grounds to be highly variable. There have also been changes in the market demand for the species.

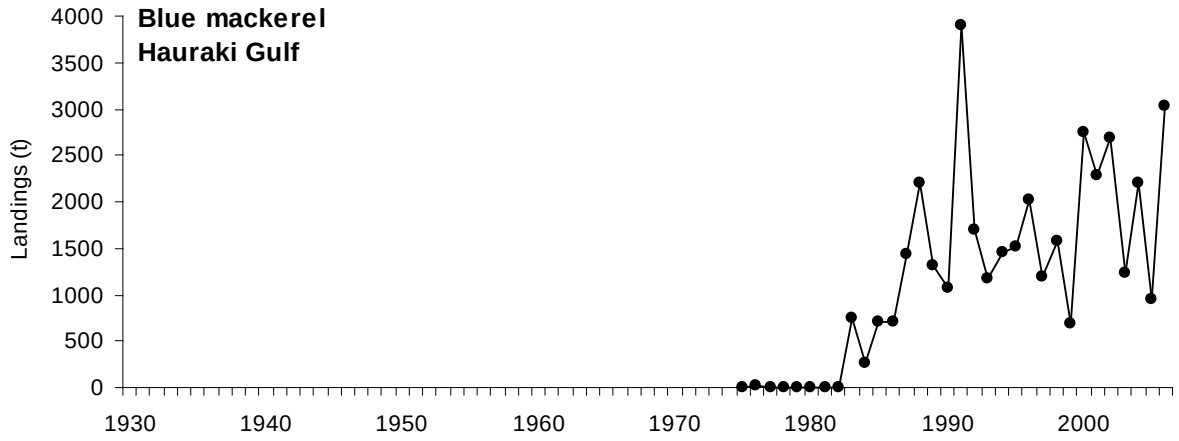

Figure 80: Landings of blue mackerel from the Hauraki Gulf region, 1931−2006.

Seasonal trend

Data on seasonal landings are not readily available. A detailed analysis would be necessary to determine any true seasonality. Purse seine catches are mainly taken from June to November, after the tuna season, and generally only to fill export orders and are thus likely to be erratic. Catches by other methods are mainly bycatch, and dependent on the targeting of other species.

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Yellowtail jack mackerel
Trachurus novaezelandiae



Greenback jack mackerel
Trachurus declivis



Slender jack mackerel *Trachurus murphyi*

Distribution

These three species have slightly different but overlapping distributions. *Trachurus novaezelandiae* is common in inshore coastal waters around the North Island and the northern half of the South Island, in 0−150 m. *T. declivis* is common in slightly deeper coastal waters around New Zealand and on the Chatham Rise, 0−300 m. *T. murphyi* reached New Zealand in the 1980s, being most common in southern and central waters and more variably present in northern waters. It was present in the region during the 1990s and small quantities were taken commercially, but it has subsequently declined. *T. novaezelandiae* is abundant in most of Hauraki Gulf, and *T. declivis* occurs in the outer waters of the Gulf. All three are midwater to surface dwellers.

Relative importance of Hauraki Gulf fishery

Hauraki Gulf is of minor importance in the jack mackerel fishery (Figure 81).

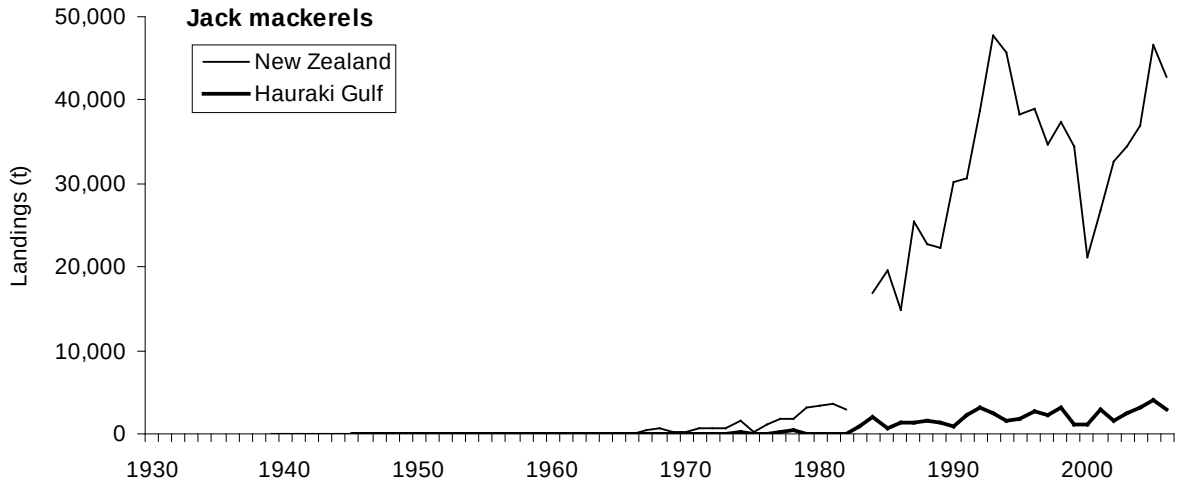

Figure 81: Landings of jack mackerels from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Jack mackerels are abundant in the Hauraki Gulf, but until the 1980s were only taken as a small to moderate bycatch in trawl and some setnet fisheries. With the advent of purse seining they became a target species (Figure 82), together with other shelf pelagic species, during the cooler months of the year when tuna were not available. The main north-eastern fishing grounds, however, are in the Bay of Plenty and on the east Northland coast.

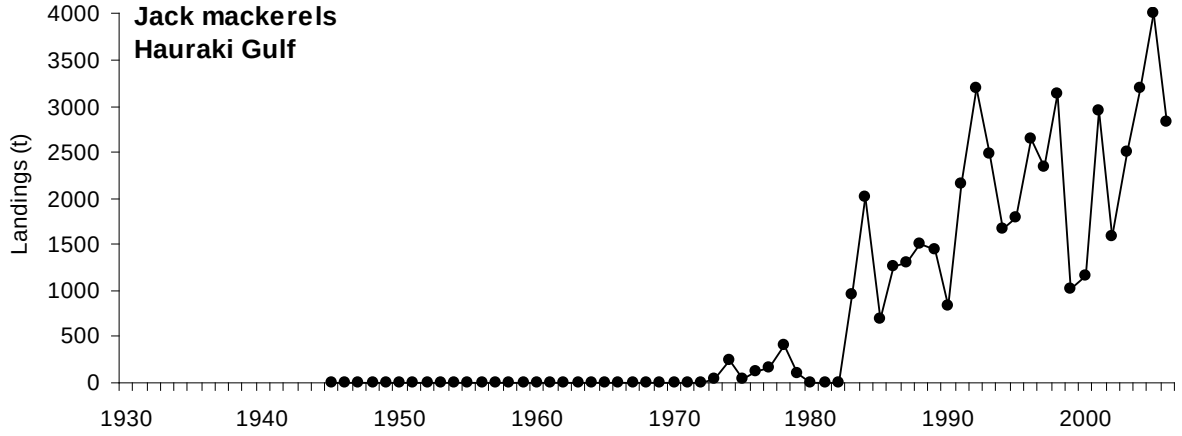

Figure 82: Landings of jack mackerels from the Hauraki Gulf region, 1931−2006.

Seasonal trend

Data on seasonal landings are not readily available. A detailed analysis would be necessary to determine any true seasonality. Purse seine catches are mainly taken from June to November, but generally only to fill export orders and are thus likely to be erratic. Catches by other methods are mainly bycatch, and dependent on the targeting of other species.

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3.8 Species accounts: The Secondary Species

Skipjack tuna

Katsuwonus pelamis



Distribution

Occurs around the North Island in summer and autumn, having migrated from tropical and subtropical waters. Pelagic, 0−250 m over greater depths, usually at or near the surface. Seasonally present in the outer Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

Only a small proportion of the New Zealand catch is taken in outer Hauraki Gulf waters (Figure 83), usually above the shelf edge from south-east of Great Barrier Island to north of the Poor Knights Islands.

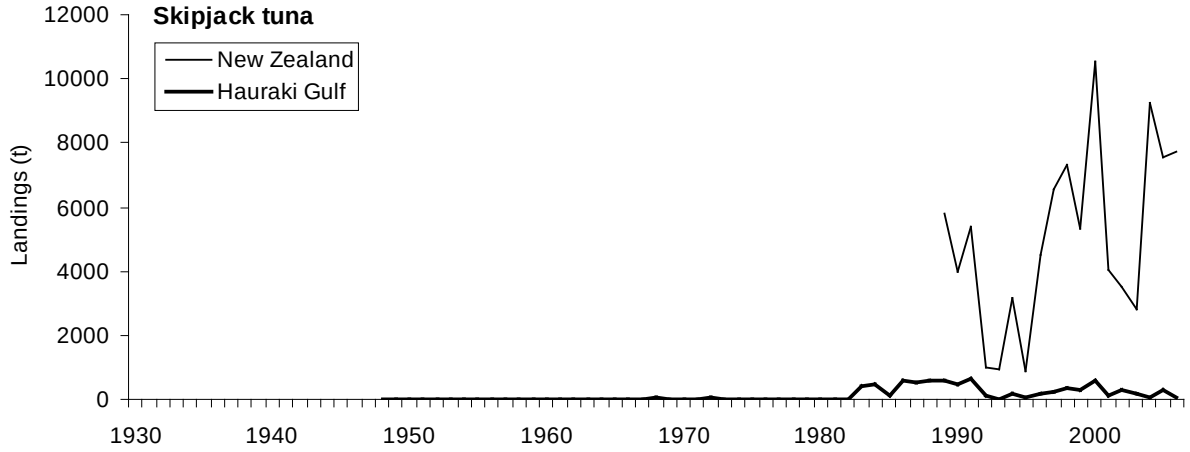

Figure 83: Landings of skipjack tuna from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

After very minor landings from the late 1940s, reported catches from the Gulf increased from the early 1980s but have been highly variable (Figure 84). There were catches made in the outer Gulf from the mid-1970s, but catch by area data are not readily available. A high proportion of catches were made by foreign licensed or chartered American purse seiners, which ranged widely and rapidly in the search for schools. In some years there was considerable fishing activity in the outer Gulf, in others there was little or none.

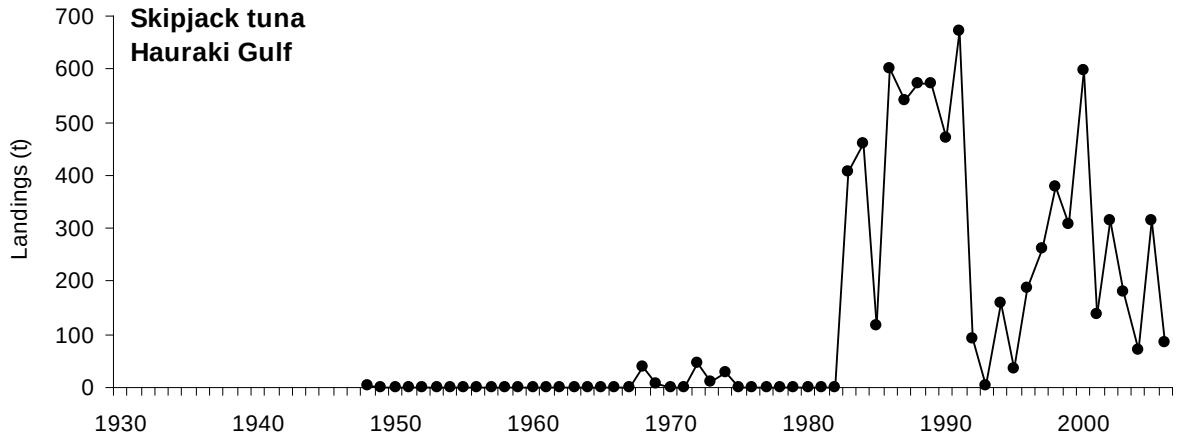

Figure 84: Landings of skipjack tuna from the Hauraki Gulf region, 1931−2006.

Seasonal trend

The main season is from November to May or June.

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John dory

Zeus faber



Distribution

Widespread around the North Island, less common around the northern South Island, 0−300 m. Common in the inner and central Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

In the 1930s and early 1940s the Hauraki Gulf contributed most of the total New Zealand landings (Figure 85). This proportion declined to one third or one half as catches increased elsewhere. John dory are mainly taken as a trawl bycatch of snapper and trevally in the Bay of Plenty and off Auckland's west coast. The Hauraki Gulf remained an important ground, and in recent decades there has been some targeting of John dory by trawl and Danish seine, the two main fishing methods by which it is caught.

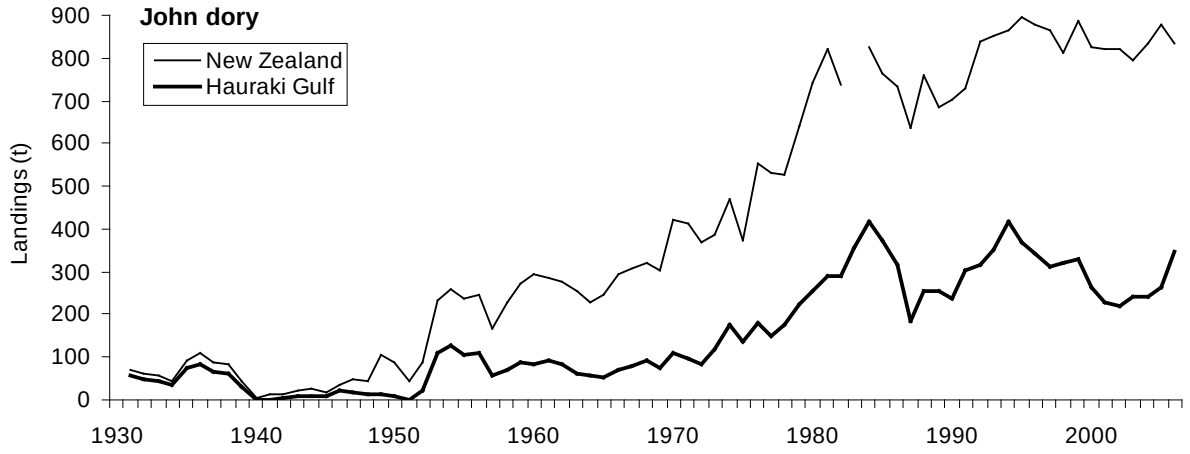

Figure 85: Landings of John dory from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

John dory landings increased steadily during the 1970s and early 1980s (Figure 86). The drop in the late 1980s coincided with the introduction of a quota somewhat lower than previous landings, and with a change in catch recording systems. Subsequent landings from the Gulf have trended both up and down, but remain well below and are not constrained by the quota for the larger north-east area.

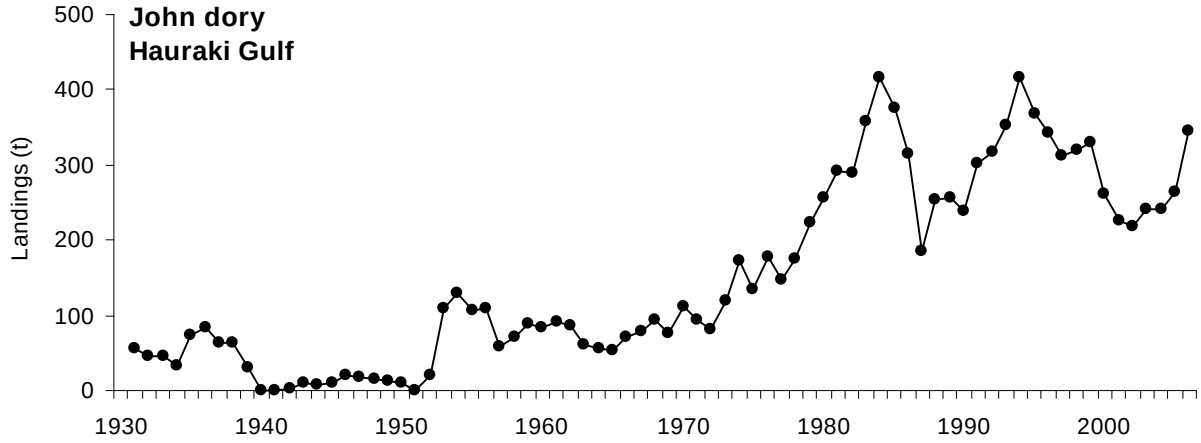

Figure 86: Landings of John dory from the Hauraki Gulf region, 1931−2006.

Seasonal trend

The peak season for landings is January to March (Figure 87). This is closer to the peak season for trevally than for snapper, but John dory is taken as a bycatch with both, as well as being targeted itself. It may be influenced by the December to April spawning period, which is a few months later than that for snapper.

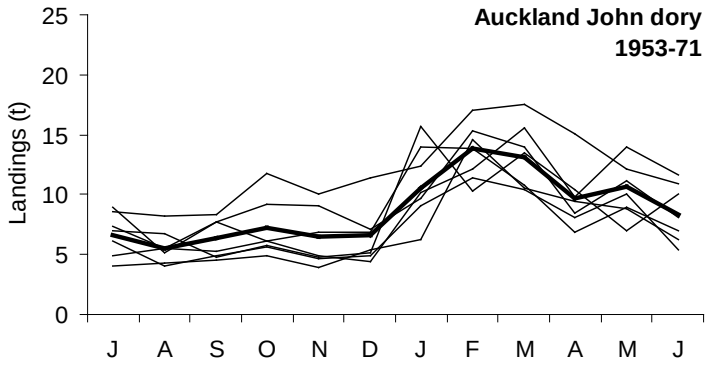

Figure 87: Seasonal (monthly) trends in the commercial landings of John dory. Landings into Auckland, 1953−71, from Annual Reports on Fisheries. Three-year means, and 19-year mean (heavy line). Presented as July−June years, to avoid subdividing the main fishing season.

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Tarakihi



Nemadactylus macropterus

Distribution

Widespread around New Zealand, 5−500 m but mainly 50−150 m. Moderately common in the outer Hauraki Gulf, 100−250 m, essentially near the shelf edge, with juveniles in shallower water at reefs and islands.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf was a moderately important fishing ground for tarakihi until the early 1950s (Figure 88).

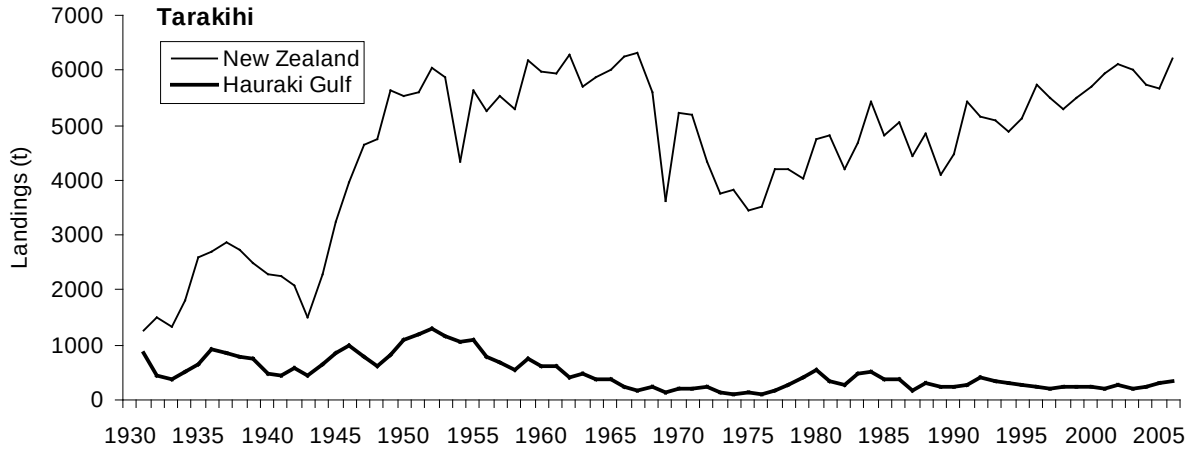

Figure 88: Landings of tarakihi from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

After a drop in landings during World War II resulting from requisitioning of the steam trawlers by the Navy, and minefields closing several outer Gulf fishing grounds, there was a recovery in the late 1940s and early 1950s as normal conditions returned (Figure 89). A combination of factors then contributed to the steady decline from 1300 t to about 100 t in the mid-1970s. The steam trawlers were retired for economic reasons in the early 1950s; these were the vessels most able to work the outer Gulf grounds, and make the longer trips to tarakihi grounds in the Bay of Plenty and around East Cape. (Although the landings presented here are nominally from the Gulf, it is inevitable that they include some catches made on these other grounds during the years that trawlers made relatively more trips to them.) There was a return to snapper fishing, after several years of lean catches around 1950, in particular by the motor trawlers which would otherwise have spent more time targeting tarakihi. From 1953 many of the larger trawlers moved to the port of Manukau for at least part of the year, fishing for snapper and later trevally along the Auckland/Northland west coast. Finally, there is a strong probability that the tarakihi stock in the outer Gulf and Bay of Plenty was being overfished. The increase in landings in the late 1970s can only be speculated on, but it may result from increased trawling in outer Gulf waters targeting barracouta and gemfish (see appropriate sections of this report). After 1986 landings were stabilised by the QMS.

Tarakihi were caught almost entirely by single trawlers. There was often a relationship between fishing for snapper and for tarakihi. Snapper were targeted on the inner to central shelf during the day, particularly in localities where the water was cloudy − green with phytoplankton. Where it was clearer, trawling was either limited to dawn and dusk, or at least the best catches were taken then. At night, fishing moved to the clear water of the outer shelf, where tarakihi was the target species.

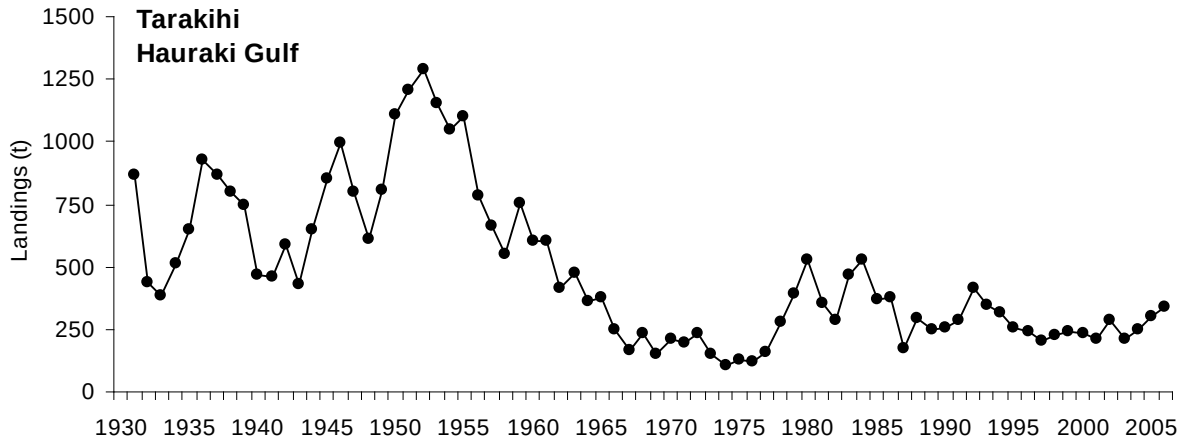

Figure 89: Landings of tarakihi from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There was an irregular seasonality in catches, with moderate peaks about September and March-April (Figures 90, 91). These are, in general terms, the low seasons for snapper, although the summer-autumn peak coincides with the tarakihi's spawning season.

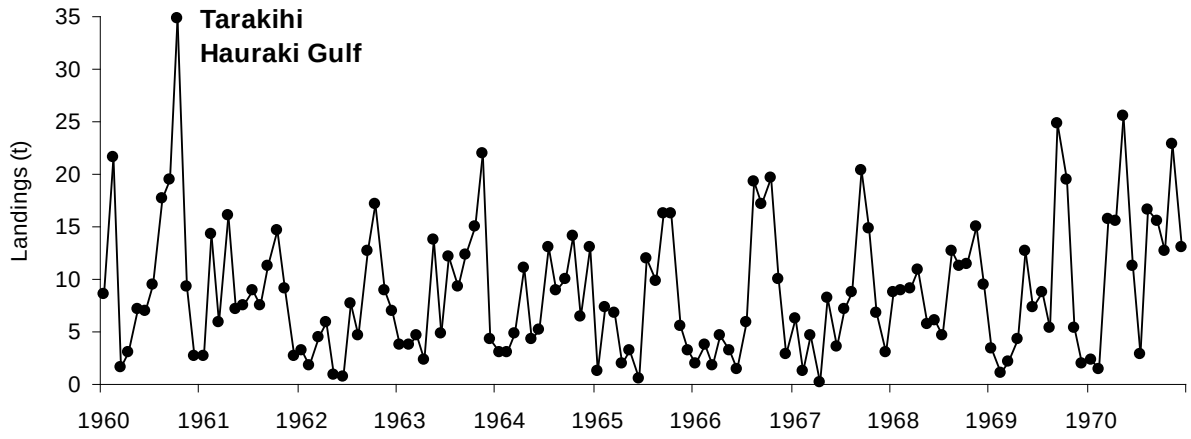

Figure 90: Monthly commercial landings of tarakihi from the Hauraki Gulf, Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975).

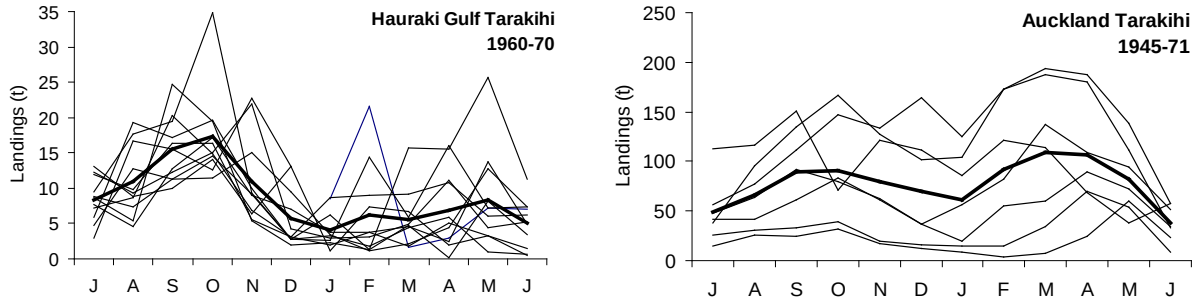

Figure 91: Seasonal (monthly) trends in the commercial landings of tarakihi. Left, landings from the Hauraki Gulf as defined by Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975). Annual values, and 11-year mean (heavy line). Right, landings into Auckland, 1945−71, from Annual Reports on Fisheries. Four-year means, and 27-year mean (heavy line). Both data sets presented as July−June years, to avoid subdividing the main fishing season.

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Rig

Mustelus lenticulatus



Distribution

Widespread around New Zealand, 0−400 m. Common in the Hauraki Gulf, mainly in 5−100 m.

Relative importance of Hauraki Gulf fishery

Only a small proportion of the New Zealand catch is taken in the Hauraki Gulf (Figure 92).

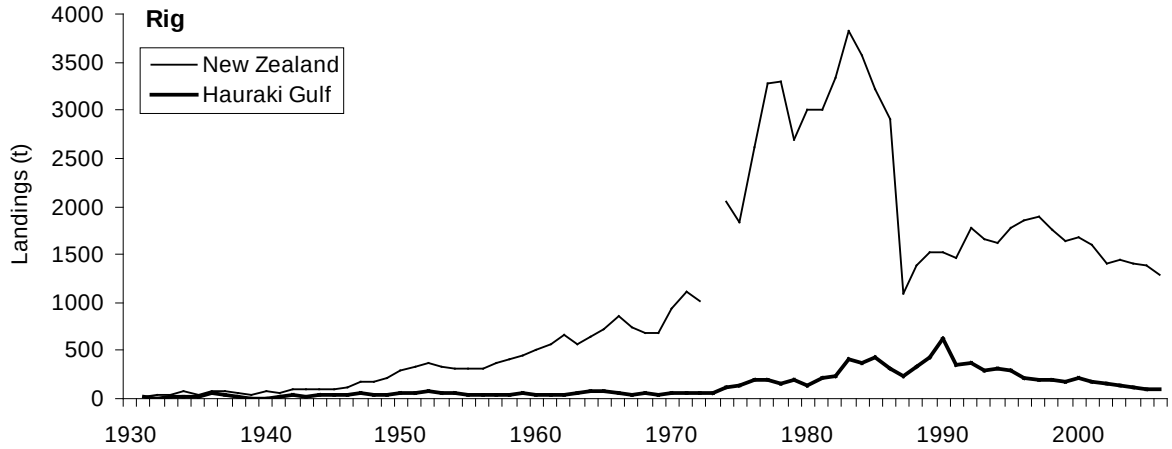

Figure 92: Landings of rig from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Hauraki Gulf landings were relatively stable and low until the mid-1970s (Figure 93). They increased somewhat erratically up to 1990, partly in response to an increase in the extent and efficiency of setnet fishing, and then declined steeply. This pattern reflects the general pattern of landings from most areas around the north-east and north-west coasts of the North Island. Although catch per effort has stabilised at this lower level, it seems likely that some regional northern rig fisheries have been overfished.

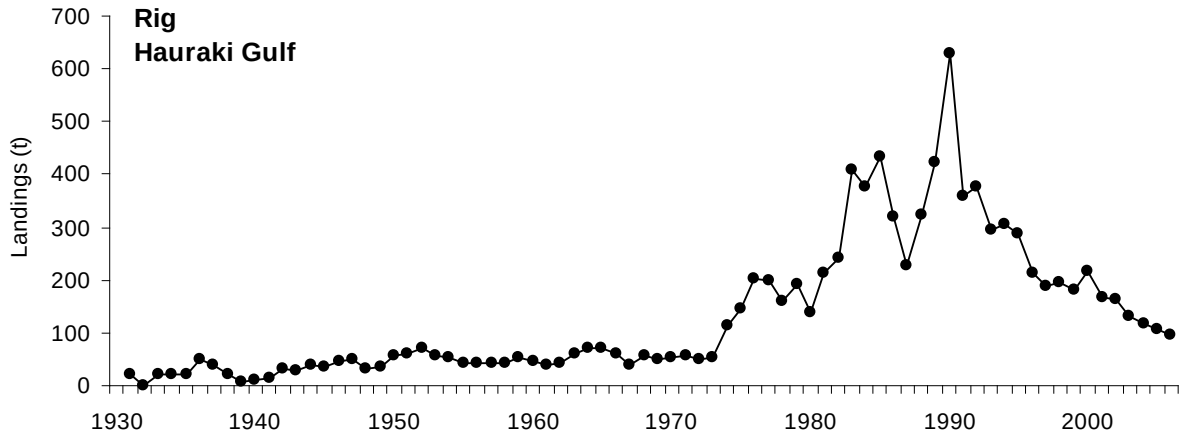

Figure 93: Landings of rig from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There is a strong seasonal trend in landings, with a peak in October (Figures 94, 95), which coincides with an inshore movement of both sexes in spring, the females to give birth in harbours and shallow bays and then subsequently mate with the males. There may be an element of post-spawning feeding in inshore waters before returning to deeper water in autumn and winter. The fishery is thus based on full-term females, spawned females taken before or just after mating, and mature males.

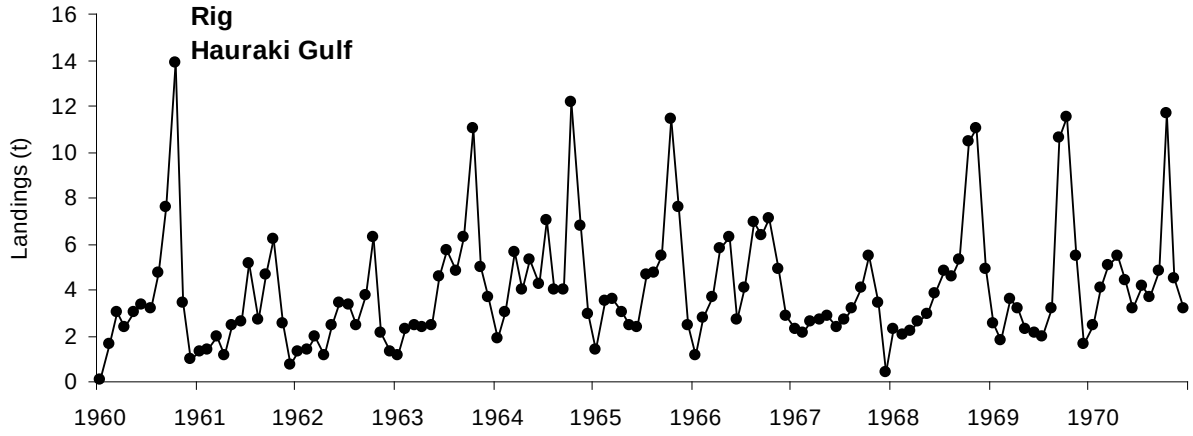

Figure 94: Monthly commercial landings of rig from the Hauraki Gulf, Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975).

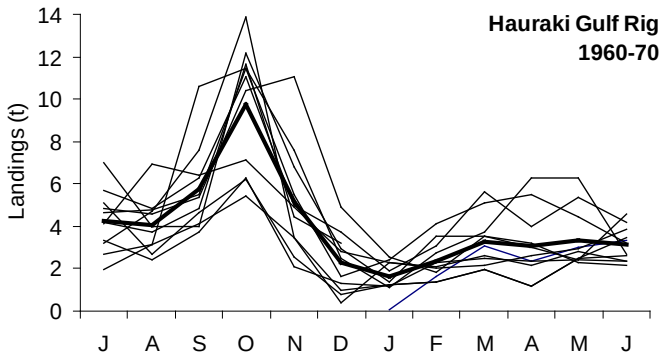

Figure 95: Seasonal (monthly) trends in the commercial landings of rig. Left, landings from the Hauraki Gulf as defined by Fishing Catch Area 3, 1960−1970. Data from Ritchie et al. (1975). Annual values, and 11-year mean (heavy line). Presented as July−June years, to avoid subdividing the main fishing season.

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Barracouta



Thyrsites atun

Distribution

Widespread around New Zealand, 0−400 m. Common in the outer Hauraki Gulf, mainly beyond 50 m; juveniles occur in the Firth of Thames.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery (Figure 96).

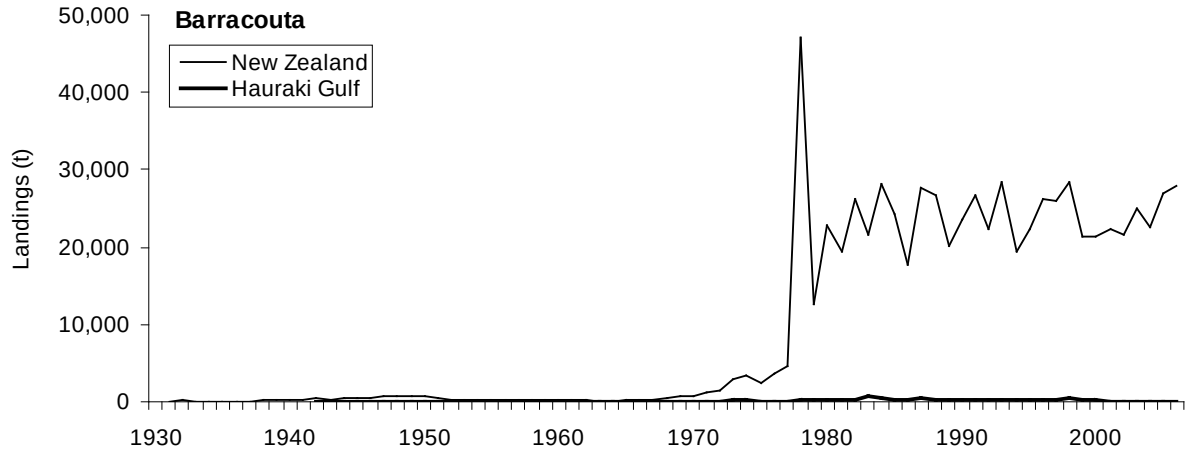

Figure 96: Landings of barracouta from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Minimal landings were reported until 1970 (Figure 97). An unknown − but probably modest − quantity would have been caught, most likely in the outer Gulf fishery for tarakihi, and discarded at sea. The landings from 1970 onwards reflect the acceptance of barracouta as a commercial product and landed in large quantities in other regions. From 1980 some of the barracouta would have been taken as a bycatch of gemfish (see the gemfish section of this report), and the decline from the late 1990s may reflect the decline in that fishery.

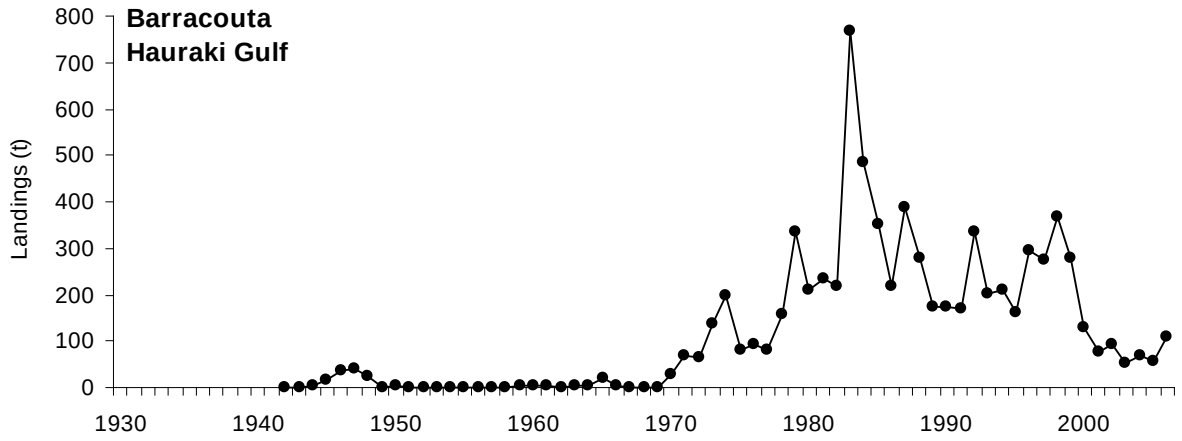

Figure 97: Landings of barracouta from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no available data on seasonal trends.

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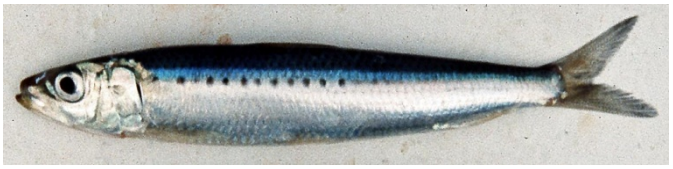
Pilchard

Sardinops neopilchardus



Distribution

Locally common around northern and central New Zealand, over depths out to 200 m. Common in the central and inner Hauraki Gulf. Pelagic.

Relative importance of Hauraki Gulf fishery

From 1990 the Hauraki Gulf provided half or more of the New Zealand pilchard landings (Figure 98). Pilchards were brought into the QMS in 2002.

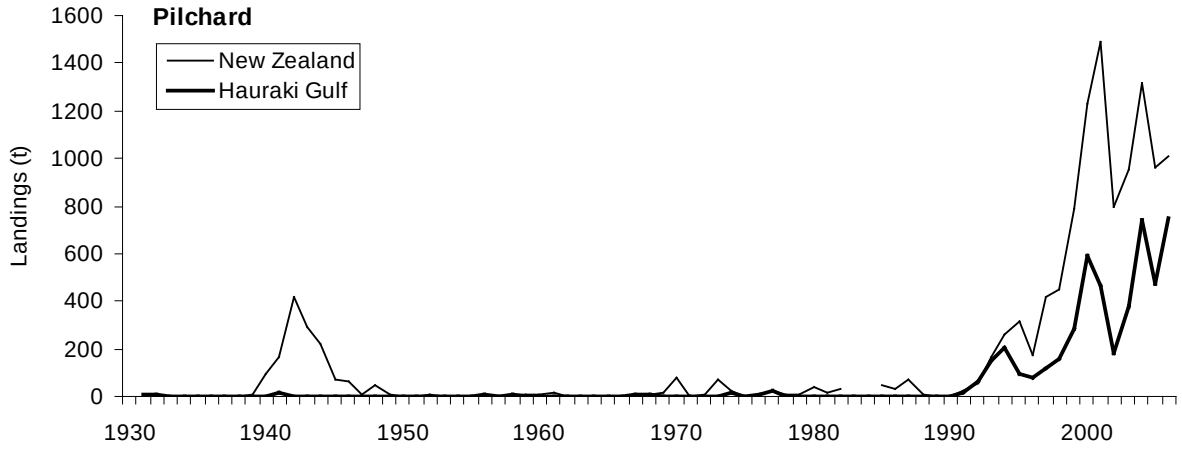


Figure 98: Landings of pilchard from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Very small landings were reported prior to 1990 (Figure 99), the majority probably used for bait. Landings then steeply but erratically increased, initially taken by lampara nets, later by small purse seines. Only a small number of vessels were involved, most based at Whangarei and fishing the northernmost Gulf and east Northland waters to the north. The fluctuations represent small changes to the fleet's size, and commercial demand for pilchards, again mostly packed for use as bait.

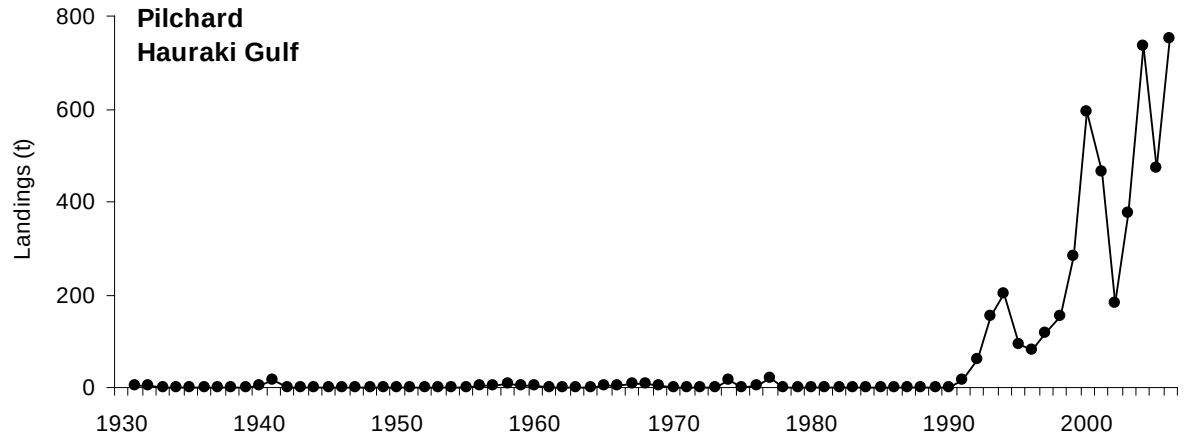


Figure 99: Landings of pilchard from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no available data on seasonal trends, but purse seine fishing is probably more effective in the calmer and warmer months.

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Gemfish

Rexea solandri



Distribution

Widespread around New Zealand, 50−600 m. Moderately common in the Hauraki Gulf, at or beyond the shelf edge.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is relatively unimportant in the context of the total New Zealand fishery (Figure 100).

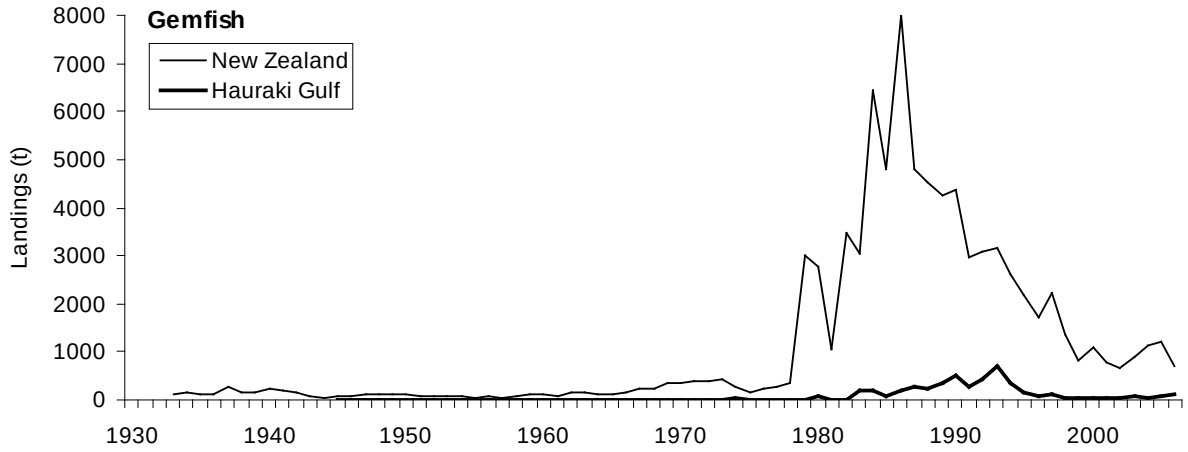

Figure 100: Landings of gemfish from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Active fishing for gemfish along the north-east coast increased steadily from 1980 (Figure 101). In the outer Hauraki Gulf the grounds were just beyond the shelf edge from Great Barrier Island south to the Bay of Plenty, and north-east of Whangarei. After reaching a peak in the mid-1990s catches declined as a consequence of overfishing, and a significant reduction in the TAC resulted in much lower landings.

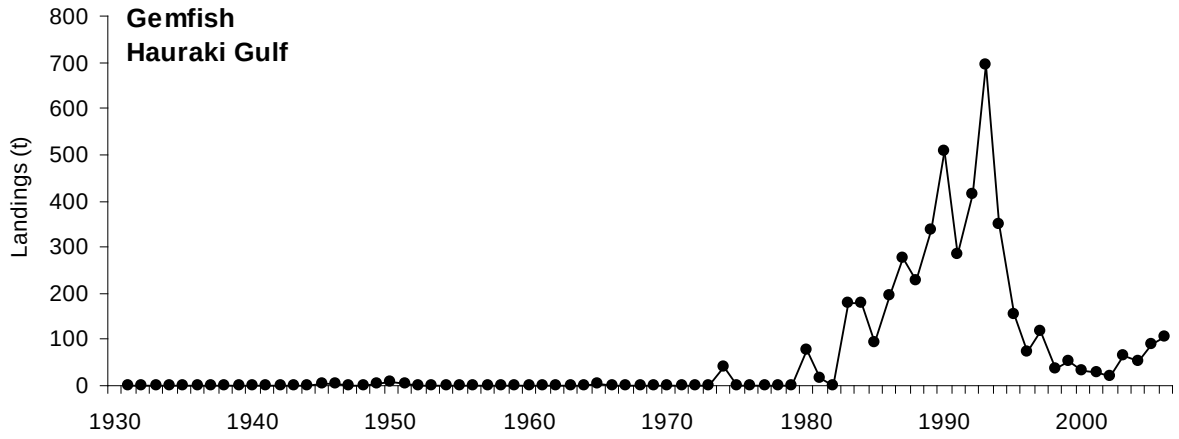

Figure 101: Landings of gemfish from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on seasonal trends in Hauraki Gulf landings.

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School shark



Galeorhinus australis

Distribution

Widespread around New Zealand, 0−800 m, semi-pelagic over the shelf and beyond. Moderately common in the Hauraki Gulf, with a nursery area in the Firth of Thames and probably other shallow embayments.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is relatively unimportant in the context of the total New Zealand fishery (Figure 102).

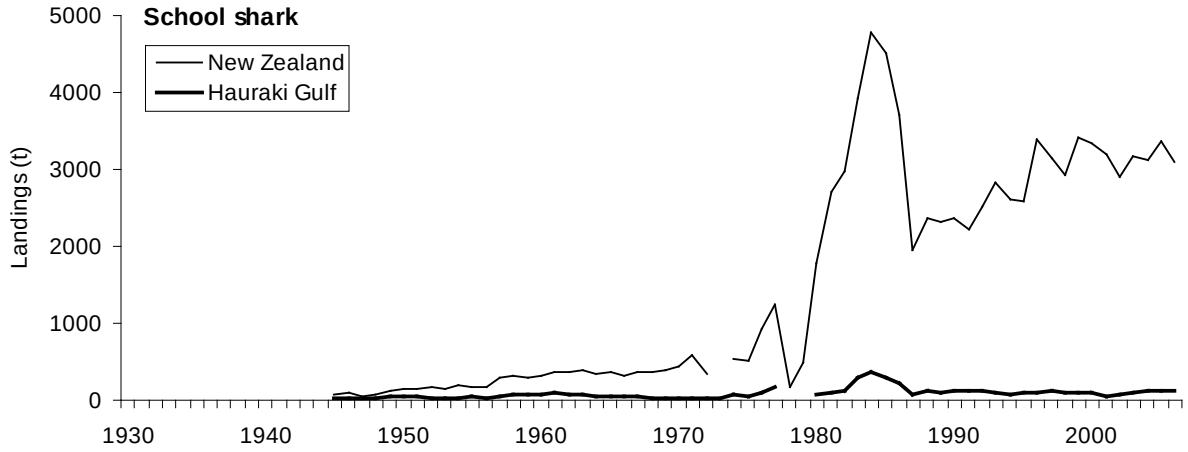

Figure 102: Landings of school shark from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

The early catch history is not known, school shark being included within the category "other species" until 1945 (Figure 103). Reported landings then fluctuated around 50 t until the mid-1970s. The increase to 370 t in 1984 could partly be attributed to the change in recording systems (and therefore the proportion of landings assigned to the Hauraki Gulf). However, as it mirrors the pattern for the rest of New Zealand (Figure 102) it is more likely a real increase in catches, and perhaps the proportion of those catches reported as landings, in anticipation of the QMS and the need perceived by fishers to establish a catch history. The QMS introduced quotas which significantly reduced landings in most regions from 1986 onwards. The Hauraki Gulf component of SCH 1 landings dropped and then fluctuated around 100 t.

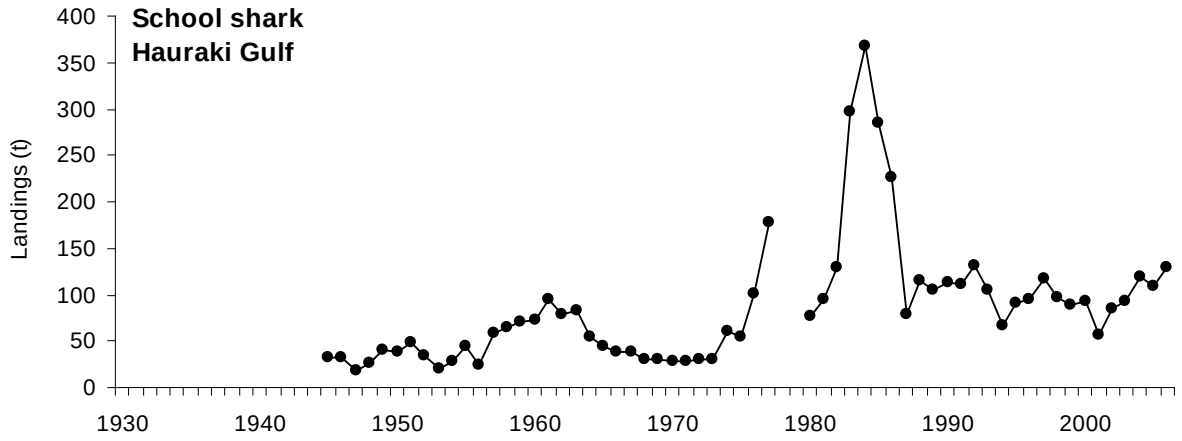

Figure 103: Landings of school shark from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on seasonal trends in Hauraki Gulf data. Some school shark are targeted, mainly between September and February when females move inshore to pup, while others are taken as bycatch in several fisheries throughout the year.

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Groper



Hapuku *Polyprion oxygeneios* (right)
Bass *Polyprion americanus*

Distribution

The two species have slightly different but overlapping distributions. The hapuku is widely distributed around New Zealand, 50−600 m, mainly near reefs, pinnacles and trenches but also over open seafloor. The bass is also widely distributed around New Zealand but is relatively more common from about Cook Strait northwards, 50−900 m. Bass tend to be more restricted to rough areas of seafloor. Both species are present in the outer Hauraki Gulf, but their relative abundance is unknown.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery (Figure 104).

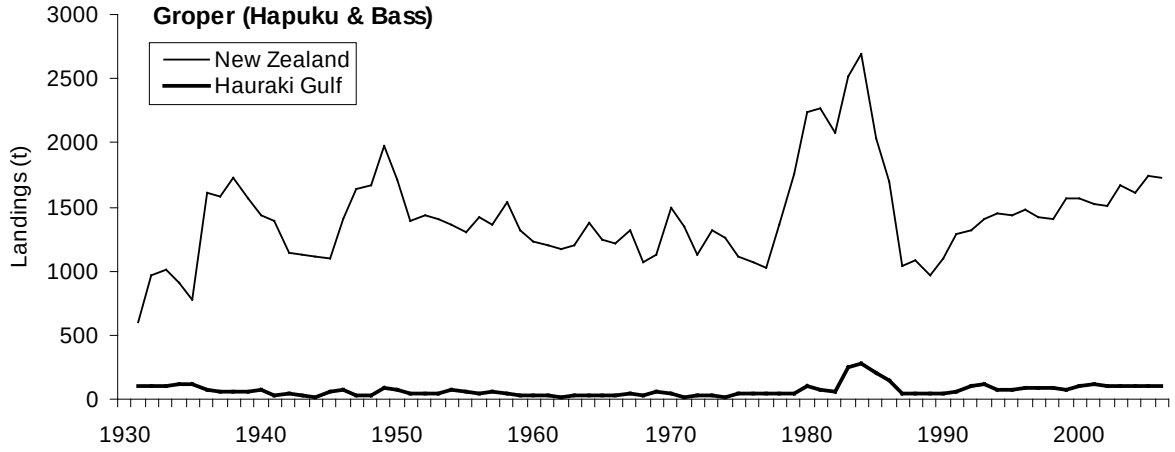


Figure 104: Landings of groper from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

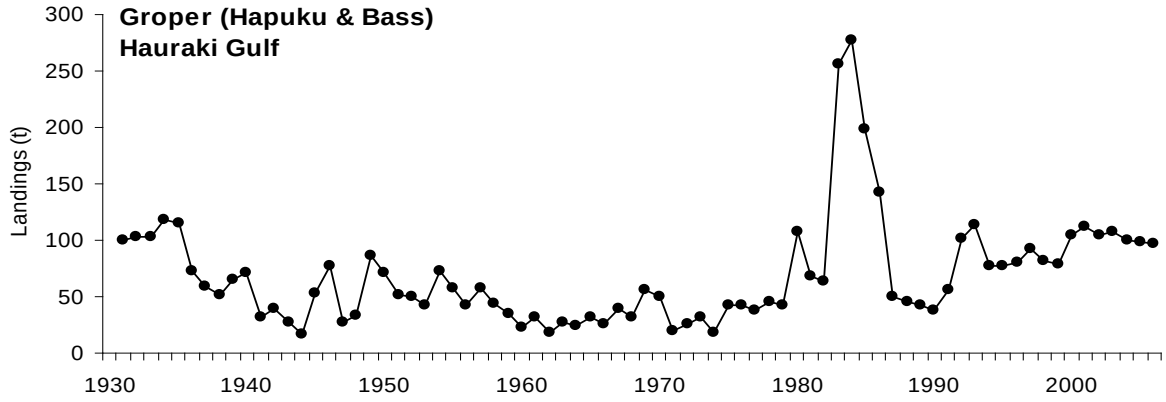


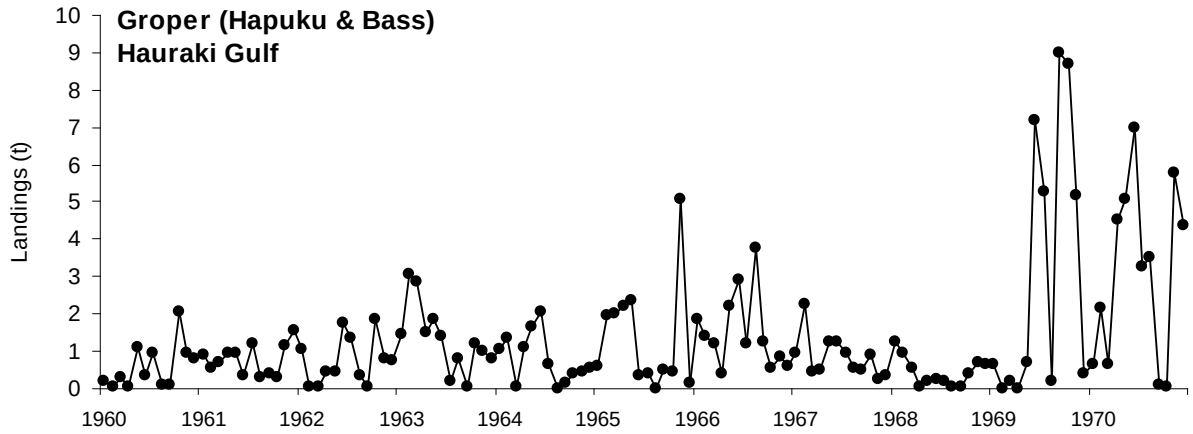
Figure 105: Landings of groper from the Hauraki Gulf region, 1931−2006.

Hauraki Gulf catch history

Landings from the Hauraki Gulf have generally fluctuated between 20 and 120 t since the 1930s (Figure 105), with a much larger spike in the mid-1980s. This coincides with a change in catch recording systems, and immediately precedes introduction of the QMS − when fishers realised they had to completely record catches, and perhaps increase fishing, in order to establish a catch history.

Seasonal trend

A rather erratic pattern of monthly landings (Figure 106) shows no real seasonality.



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Leatherjacket



Meuschenia scaber

Distribution

Widespread around the North Island, northern South Island, and along the Canterbury coast, 0−150 m. Common in the inshore and central Hauraki Gulf; demersal, near rough ground and also over open seafloor.

Relative importance of Hauraki Gulf fishery

There was little market demand for leatherjacket until the 1970s, although it would have been a bycatch in many fisheries and discarded. Landings from the Hauraki Gulf increased in the 1980s (Figure 107), a little later than elsewhere, and afterwards remained relatively constant at a modest proportion of total New Zealand landings, not undergoing the very large fluctuations of the latter in the late 1990s and early 2000s.

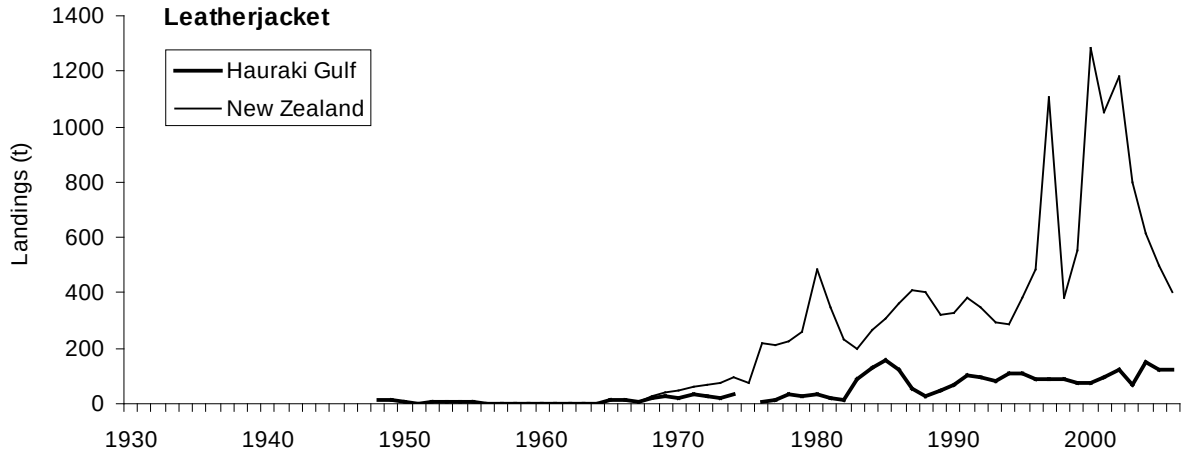

Figure 107: Landings of leatherjacket from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Landings were minor until about 1970 (Figure 108), although quantities would have been taken as bycatch, particularly in the trawl fishery for snapper, and with limited market value discarded at sea or landed under the category of "other species". The spike in landings in the mid-1980s, as for other species, reflects a change in recording systems and the need of fishers to record a catch history prior to quota allocations. More generally, landings fluctuated upwards.

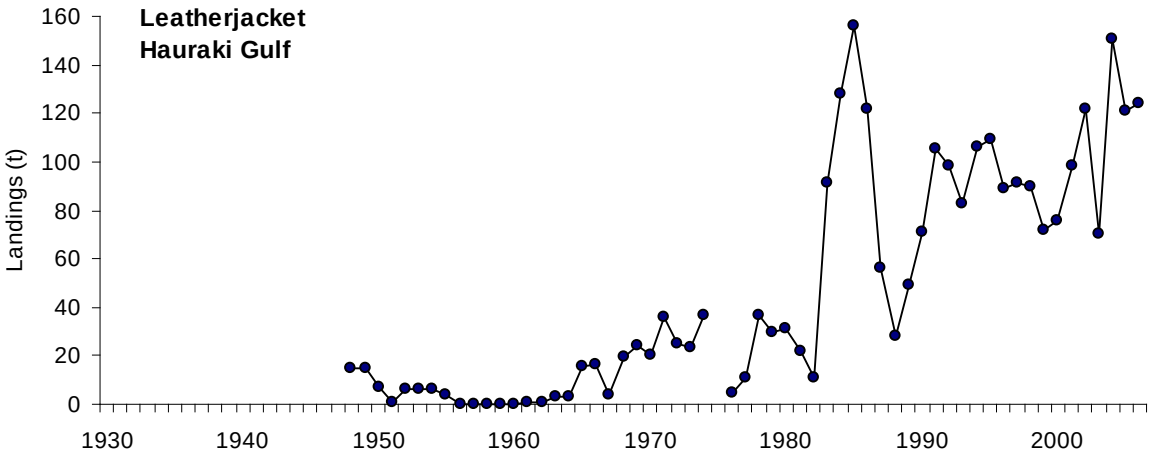

Figure 108: Landings of leatherjacket from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on seasonal trends in landings in Hauraki Gulf data, but these would simply reflect the seasonal patterns in the fisheries where they were taken as bycatch.

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Kingfish

Seriola lalandi



Distribution

Common around northern New Zealand, seasonally present around central regions, 0−200m. Pelagic, often near reefs. Moderately common in the Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf has contributed a moderate proportion of the total New Zealand landings (Figure 109).

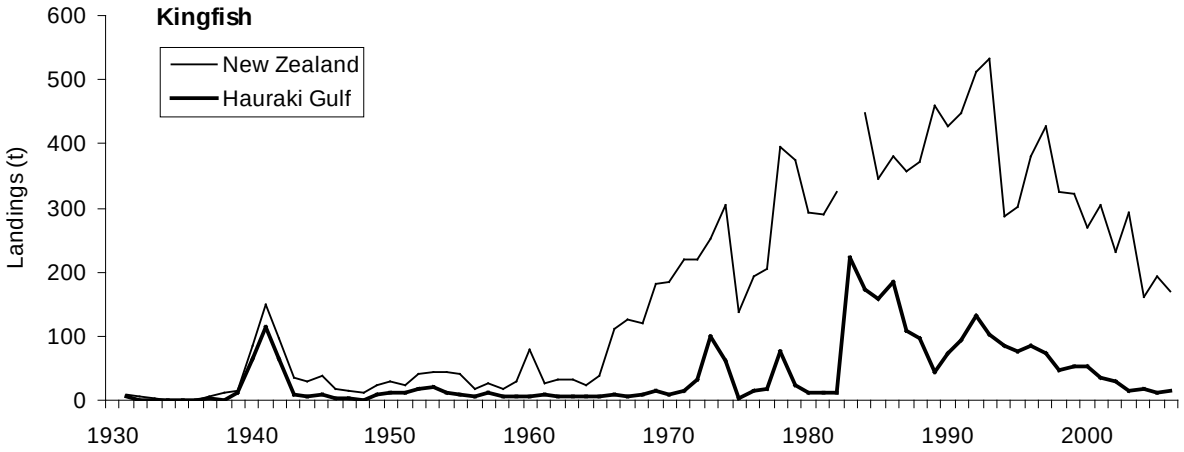

Figure 109: Landings of kingfish from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

The fluctuations since the mid-1980s (Figure 110) result from several interacting factors. The 1983 peak marks a change in recording systems and the change from proportion-of-port-landings to catch and landing by area; consequently, the apparent increase may in part be an artefact. As with other species, however, it also represents an increase in reported catches made by fishers establishing a catch history prior to the introduction of the QMS. Although not introduced into the QMS until 2003, targeted catches (by pole, troll, longline, and setnet) from the late 1980s were restricted to holders of special permits, while bycatches in a variety of other fisheries continued. In 1993 a minimum size limit was introduced, with trawler bycatches exempt until 2000. In combination, these measures probably explain the decline in Hauraki Gulf landings.

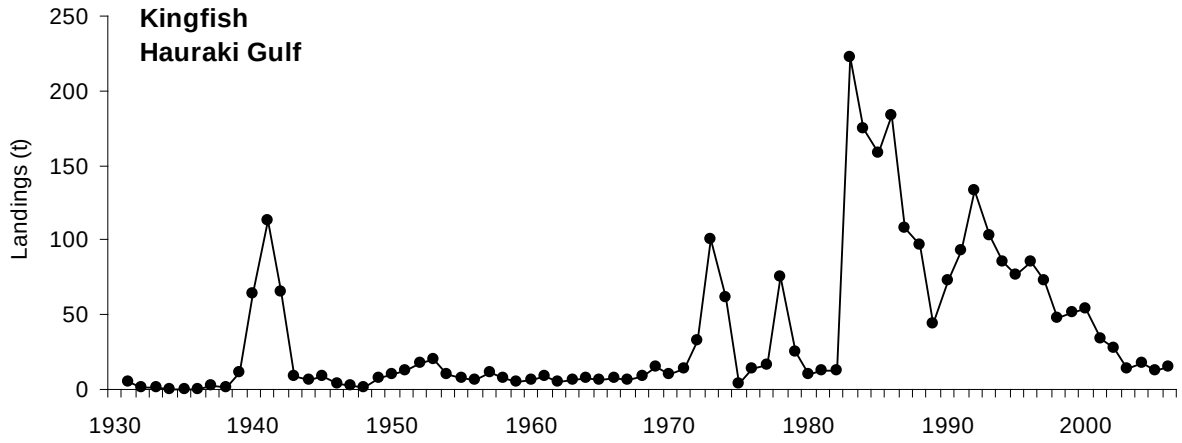

Figure 110: Landings of kingfish from the Hauraki Gulf region, 1931−2006.

Seasonal trend

No extensive data on Hauraki Gulf seasonal landings are readily available. Walsh et al. (2003) report that landings are higher in summer and autumn (when fishing activity in general is higher), but the difference is small, and at least in part attributable to the target fisheries in which kingfish are a bycatch.

Recreational catches

A species much sought after by recreational fishers. Recreational catches are difficult to quantify because they are taken infrequently in areas of the outer Gulf fished by launches not fully covered by boat ramp surveys, appear to vary annually, and include a high proportion of sub-legal size fish returned to the water. The retained catch is estimated to at least equal the commercial landings and may be several times greater (Ministry for Primary Industries 2013).

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3.9 Species Accounts: The Minor Species

Grey mullet

Mugil cephalus



Distribution

Locally common around the northern North Island, in bays, harbours, and the lower reaches of rivers; less common off open coasts. Pelagic, 0−10 m. Common in these habitats in the Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

Although grey mullet were taken in the inshore fishery in the nineteenth century and are listed in the earliest records, the Hauraki Gulf has not been particularly important in the context of the total fishery for grey mullet (Figure 111).

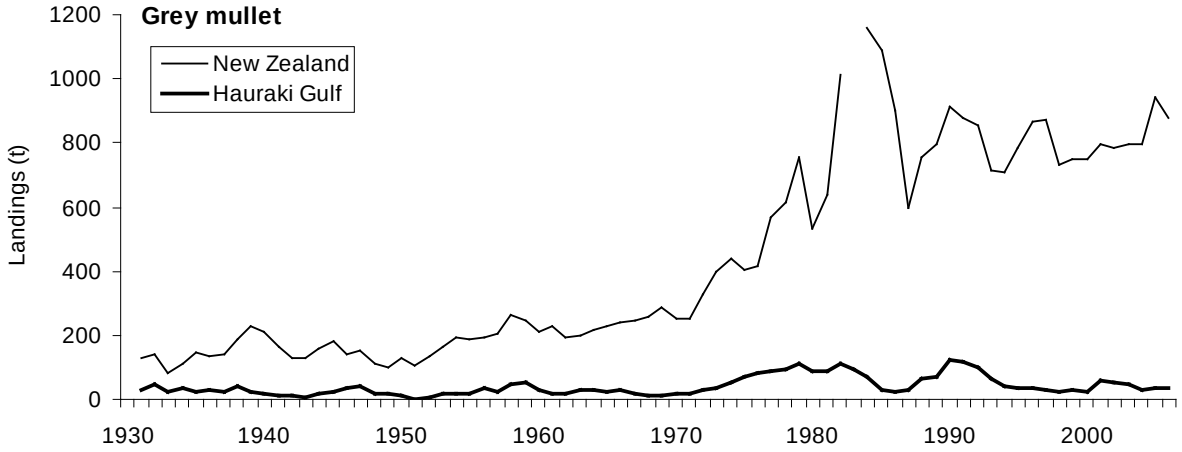

Figure 111: Landings of grey mullet from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

From 1931 to 1970 landings fluctuated from near zero to about 50 t (Figure 112), probably with moderate under-reporting because of direct sales from fishers to retail shops and customers. The fluctuations may be a consequence of there being relatively few fishers in the fishery, with arrivals and departures having a large impact on landings, in addition to natural variability in stock size. The reasons for the subsequent rise to peaks around 1980 and 1990 are unknown. Most studies have been on the larger fisheries in the west coast harbours, and there is increasing evidence that each harbour fishery has different characteristics. The difference between natural stock abundance on the east and west coasts is likely to be equally as great, as is the difference in effort by the fishers on each coast.

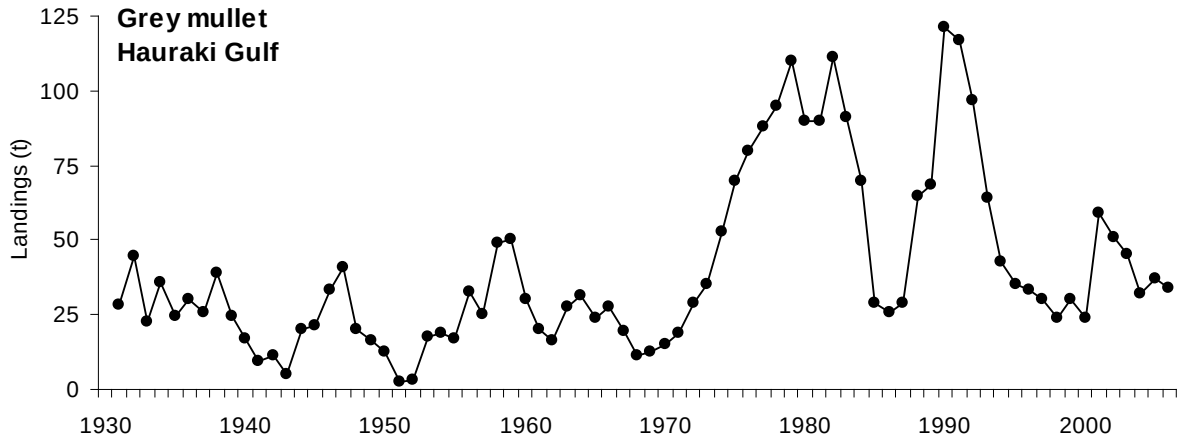

Figure 112: Landings of grey mullet from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on seasonal trends in Hauraki Gulf landings.

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Porae

Nemadactylus douglasii



Distribution

Restricted to the northeast coast of the North Island, North Cape to East Cape, 0−200 m. Present but not common in the central and inner Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf has contributed a moderate proportion of the total New Zealand landings (Figure 113).

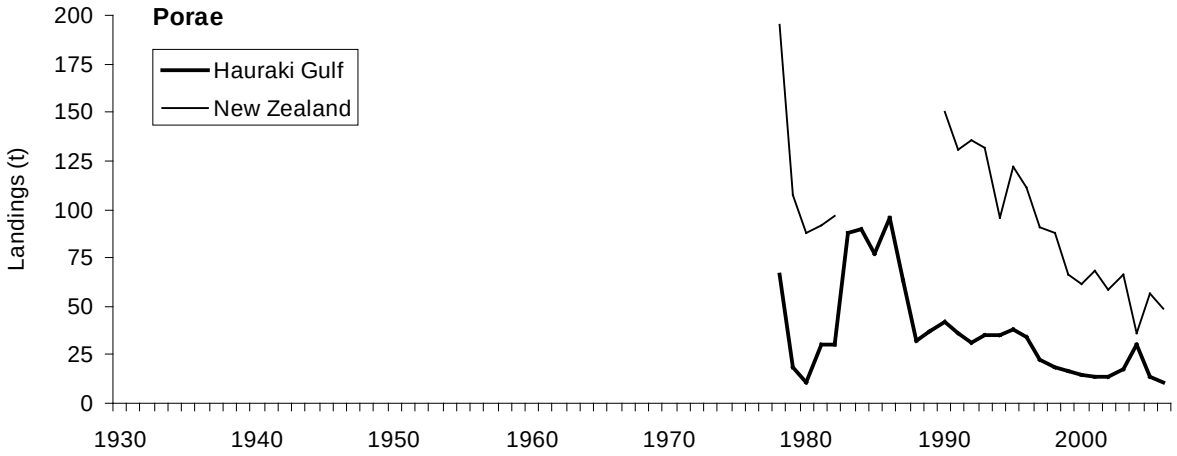

Figure 113: Landings of porae from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Porae are taken as a minor bycatch in trawl fisheries for snapper and trevally, and to a lesser extent in snapper line and probably setnet fisheries. They have almost certainly been caught and landed since the early years of trawling in the Gulf, but included within the "mixed" category of reported species. Recorded landings show a decline following a peak in the late 1980s (Figure 114), but there is no known reason for this.

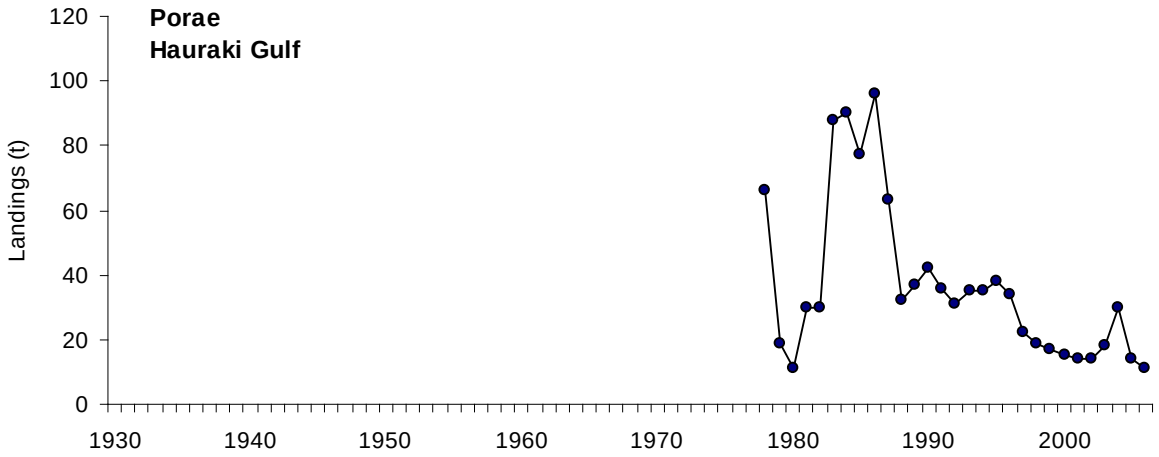

Figure 114: Landings of porae from the Hauraki Gulf region, 1931−2006.

Seasonal trend

No reliable data are available for the Hauraki Gulf, but any seasonal trend will simply follow the pattern of the target fisheries in which porae occurs as bycatch.

For further information

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Red cod



Pseudophycis bachus

Distribution

Widespread around New Zealand, more common in central and southern regions, 5−600 m. Uncommon in the Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery for red cod, which is largely restricted to the South Island. The comparative data sets are not plotted, as the New Zealand total reaches 18 000 t while Hauraki Gulf landings only briefly reached 190 t.

Hauraki Gulf catch history

The virtual absence of recorded red cod landings until 1990 (Figure 115) is considered real, although minor quantities would have been included within "other species". At about this date red cod began appearing in trawl survey catches, and small quantities would have been taken as bycatch in several commercial fisheries, perhaps mainly in the trawl fishery for snapper. The reason for its appearance in slightly greater numbers in northern waters during these years is unclear, but may result from two life history features that have been observed in red cod in more southern waters: a short life span and high recruitment variability, which together result in large fluctuations in abundance.

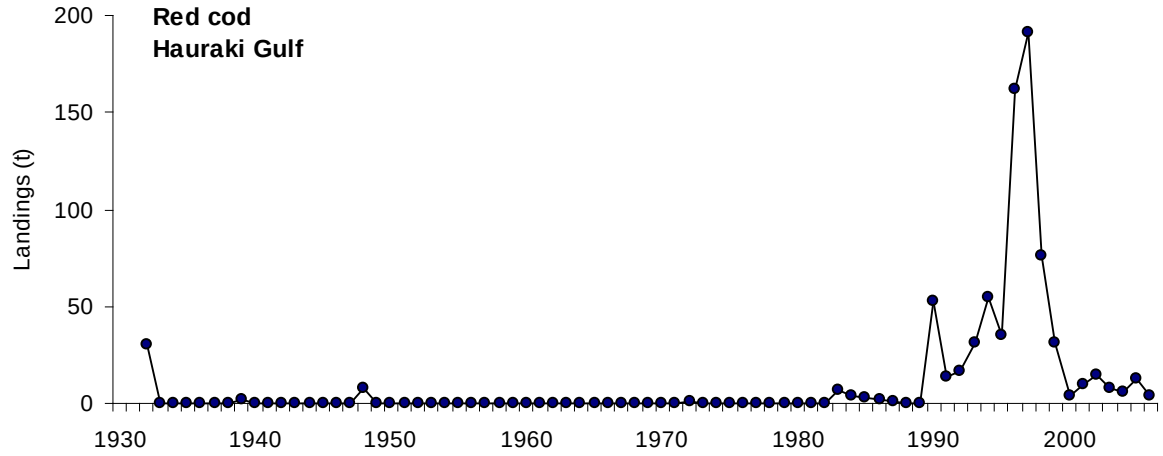

Figure 115: Landings of red cod from the Hauraki Gulf region, 1931−2006.

Seasonal trend

Any seasonal trend will simply follow the pattern of the target fisheries in which red cod occurs as bycatch.

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Parore



Girella tricuspidata

Distribution

North Island, but only common in northern harbours, 0−50 m but usually less than 10 m. Common in some inshore areas of the Hauraki Gulf, mostly in the harbours and estuaries of the southwestern coastline.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is moderately important in the context of the total New Zealand fishery (Figure 116), and was the major fishing ground for the species from the 1940s to the late 1960s. It is a minor species and for various reasons the landing records are incomplete.

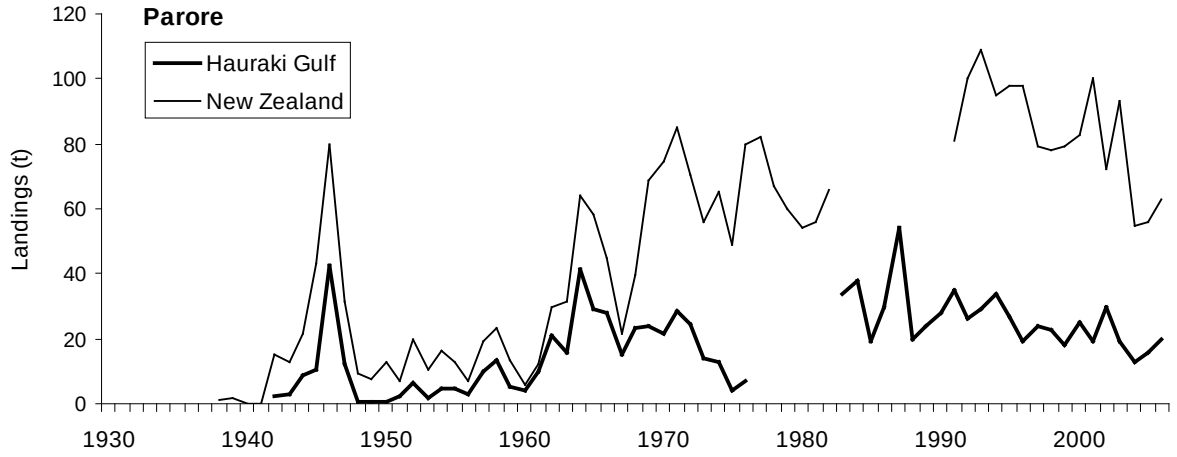


Figure 116: Landings of parore from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

The recorded landings are an unreliable measure of catch, as for many decades parore was not a popular commercial species and was discarded when caught in shallow setnet fisheries for flatfish, grey mullet, and trevally. Small quantities would have been included among the "other species" listing, and an unknown quantity is reputed to have been supplied informally to small retail outlets for sale under various names, or used in the fish and chip trade. However, recorded landings increased during the 1950s and 1960s (Figure 117), probably declined in the 1970s although the data from the mid-1970s to the mid-1980s are considered unreliable. Landings declined slowly after 1990, but the reason is unknown. Parore may have been coded unreliably with porae (POR).

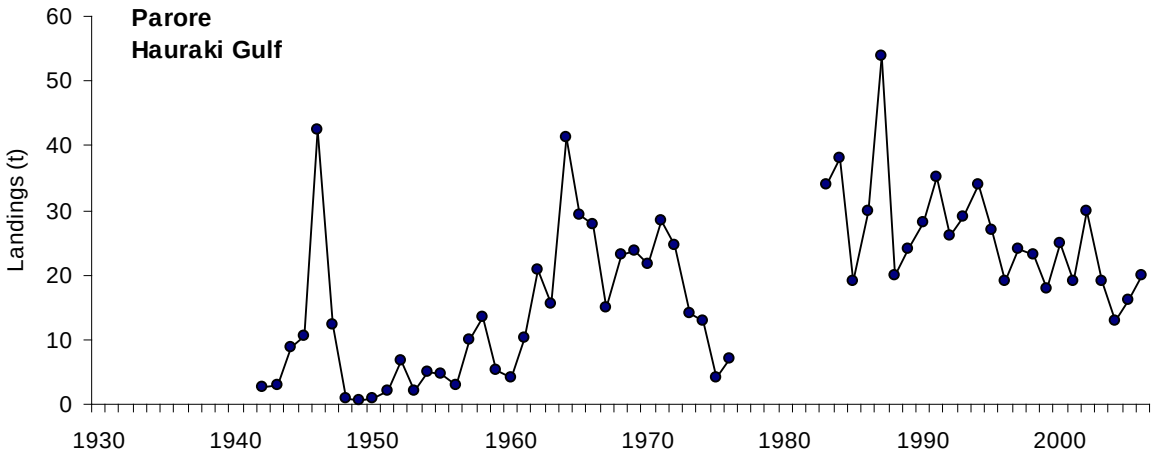


Figure 117: Landings of parore from the Hauraki Gulf region, 1931−2006.

Seasonal trend

No reliable data are available for Hauraki Gulf landings, but they will largely follow the pattern of the target fisheries in which parore occurs as bycatch.

For further information

Clarke, F.E. (1899). Notes on parore (the mangrove fish). *Transactions and Proceedings of the New Zealand Institute 31*: 96–101.

Morrison, M.A. (1990). Ontogenetic shifts in the ecology of the parore, *Girella tricuspidata*. Unpublished MSc thesis, University of Auckland. 66 p.

Blue cod



Parapercis colias

Distribution

Widespread around New Zealand but more common in central and southern regions, 0−200 m. Moderately common in many parts of the Hauraki Gulf, usually on rough seafloor.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery for blue cod, which is mainly caught around the South Island. The comparative data sets are not plotted, as the New Zealand total reaches 2500 t while Hauraki Gulf landings only briefly reached 85 t.

Hauraki Gulf catch history

A minor species from the 1930s through the 1950s, when landings almost cease (Figure 118). Data from the 1970s and early 1980s are unreliable (blue cod were probably landed but included within "mixed species"), but fluctuating landings were derived from the catch by area data from 1983 onwards. The reason for the peak in late 1990s landings is unknown.

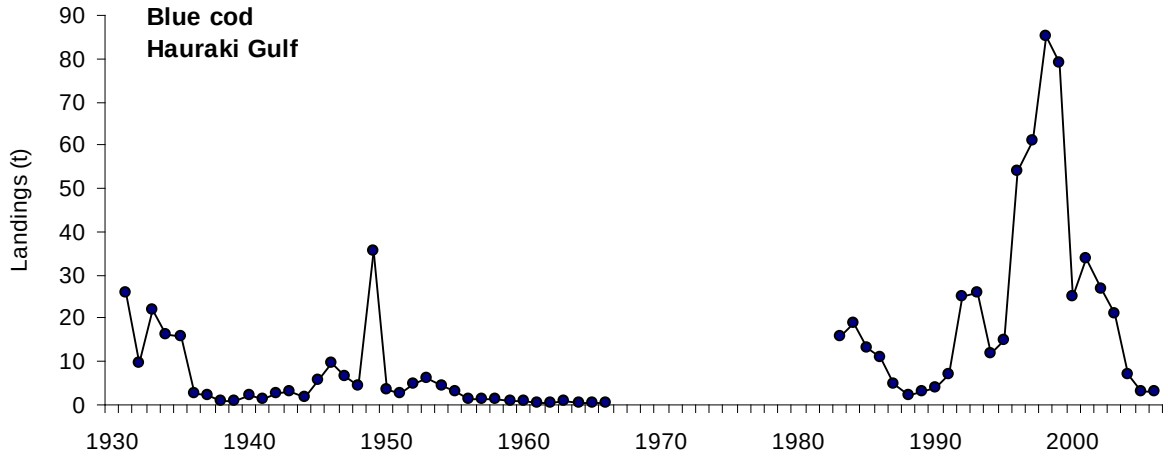


Figure 118: Landings of blue cod from the Hauraki Gulf region, 1931−2006.

Seasonal trend

No reliable data are available, but any trend will largely follow the pattern of the target fisheries in which blue cod occurs as bycatch

For further information

McGregor, G.A. (1988). Blue cod. New Zealand Fisheries Assessment Research Document 1988/41. 11 p. (Unpublished document held by NIWA library, Wellington.)

Mutch, P.G. (1983). Factors influencing the density and distribution of the blue cod (*Parapercis colias*). (Unpublished M.Sc. thesis held in University of Auckland library, Auckland.)

Rapson, A.M. (1956). Biology of the blue cod (*Parapercis colias* Foster) of New Zealand (Unpublished Ph.D. thesis held in Victoria University library, Wellington.)

3.9.6 Red snapper



Centroberyx affinis

Distribution

Mainly northern North Island, 10−500 m. Present but apparently uncommon in some central and outer areas of the Hauraki Gulf, usually associated with reefs.

Relative importance of Hauraki Gulf fishery

Landing records of this species are unreliable, with the possibility that some sparid snapper − reddish in colour − have inadvertently been interpreted and recorded as "red snapper." The Hauraki Gulf appears to have contributed a modest amount to the total landings (Figure 119).

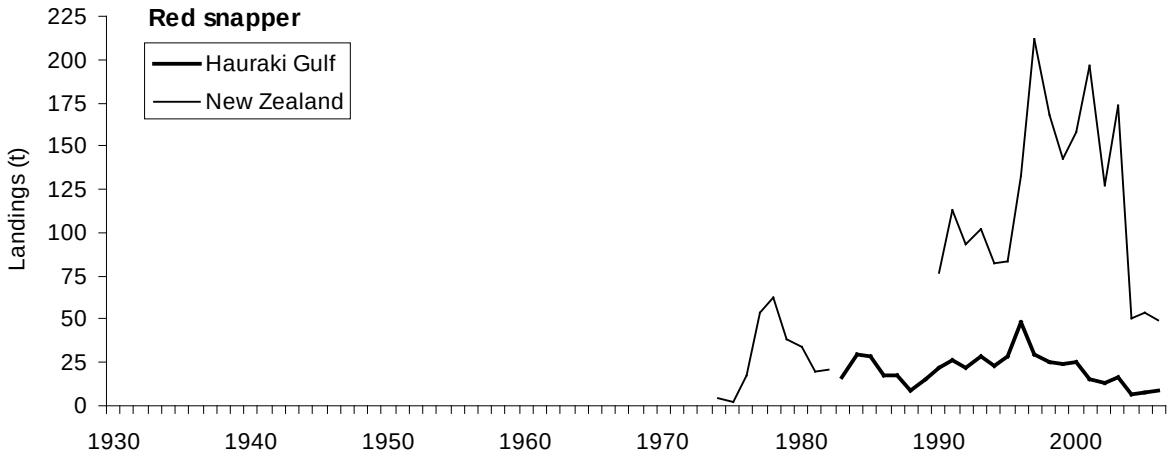


Figure 119: Landings of red snapper (as reported) from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Hauraki Gulf catch history

Recorded only in the catch by area data from 1983 (Figure 120), but undoubtedly caught prior to this and included within "mixed species". In the Hauraki Gulf red snapper are generally taken as bycatch in the setnet fisheries for snapper and trevally, particularly when the gear is set near reefs.

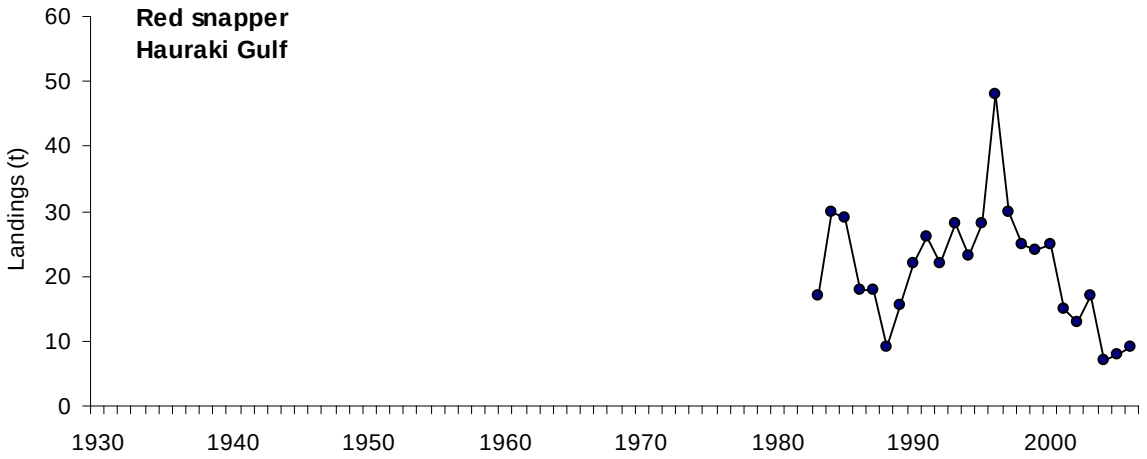


Figure 120: Landings of red snapper from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data for Hauraki Gulf landings, but seasonal trends would follow those of the target fisheries in which red snapper occurs as bycatch.

For further information

Ayling, T.; Cox, G.J. (1984). Collins guide to the sea fishes of New Zealand. Collins, Auckland. 343 p.

Francis, M. (2001). Coastal fishes of New Zealand. An identification guide. Reed Books, Auckland. 103 p.

Kalish, J.M. (1995). Application of the bomb radiocarbon chronometer to the validation of redfish *Centroberyx affinis* age. *Canadian Journal of Fisheries and Aquatic Sciences 52(7)*: 1399–1405.

Paul, L.J. (1992). Age and growth studies of New Zealand marine fishes, 1921–90: a review and bibliography. *Australian Journal of Marine and Freshwater Research 43(5)*: 879–912.

Paul, L. (2000). New Zealand fishes. Identification, natural history and fisheries. Reed Books, Auckland. 253 p.

Thompson, S. (1981). Fish of the Marine Reserve. A guide to the identification and biology of common coastal fish of north-eastern New Zealand. Leigh Laboratory, University of Auckland. 364 p.

Spiny dogfish



Squalus griffini

Distribution

Widespread around northern and central New Zealand, 100−500 m. Present in the outer Hauraki Gulf, usually at or beyond the shelf edge. The more common spiny dogfish *Squalus acanthias* is not present on the north-east coast.

Relative importance of Hauraki Gulf fishery

It is not possible to determine this, as the two commercial species of spiny dogfish are not distinguished in landings data. The Hauraki Gulf, however, provides a trivial component of the combined landings of both species, which has reached over 11 000 t.

Hauraki Gulf catch history

Undoubtedly caught since line vessels and trawlers began working near the shelf edge of the outer Gulf, but initially discarded as of no commercial value, and then recorded within the "other species" category when spiny dogfish acquired some limited value. Mostly taken as a bycatch with tarakihi, barracouta, and gemfish, its catch history (Figure 121) reflects these fisheries.

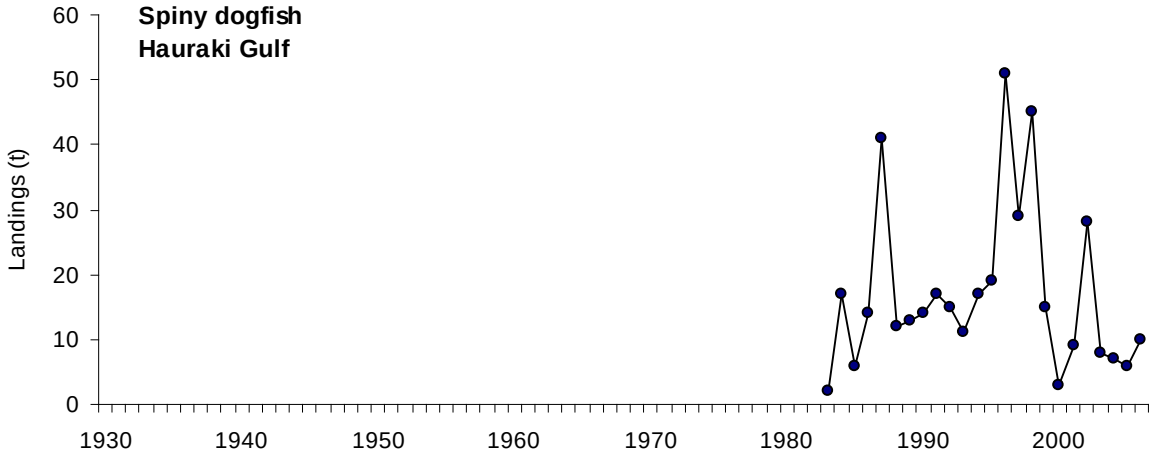


Figure 121: Landings of spiny dogfish from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data for Hauraki Gulf landings, but seasonal trends would follow those of the target fisheries in which spiny dogfish occurs as bycatch.

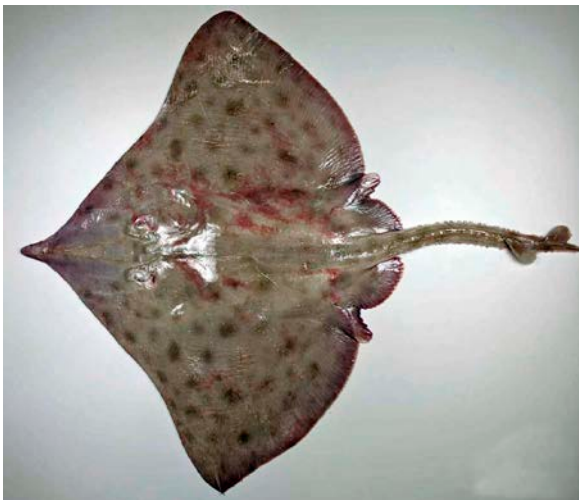
For further information

Duffy, C.A.J..; Last, P.R. (2006). Redescription of the northern spiny dogfish *Squalus griffini* Phillipps, 1931 from New Zealand. Pp. 91−100 *In:* Last, P.R.; White, W.T.; Pogonowski, J.J. (Eds.), Descriptions of new dogfishes of the genus *Squalus* (Squaloidea: Squalidae). *CSIRO Marine and Atmospheric Research Paper No. 014*. CSIRO, Hobart.

Skates



Rough skate *Zearaja nasuta*



Smooth skate *Dipturus innominatus*

Distribution

Both species are widely distributed around New Zealand, mainly deeper than 20 m. The rough skate is relatively more common, occurring over the shelf and on the continental slope down to 600 m. The smooth skate occurs on the central and outer shelf and on the slope to 800 m. Both species are present in the Hauraki Gulf, the rough skate being much more common.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery for skates, which are mainly caught around the South Island. The comparative data sets are not plotted, as the New Zealand total reaches over 3000 t while Hauraki Gulf landings have only reached 30−40 t.

Hauraki Gulf catch history

Undoubtedly caught since trawlers began working the central and outer Gulf, but initially discarded as of no commercial value, and then recorded within the "other species" category when skates acquired some limited value. Taken as a bycatch in several trawl fisheries on the outer shelf and beyond, sometimes by longline, their catch history (Figure 122) reflects these fisheries.

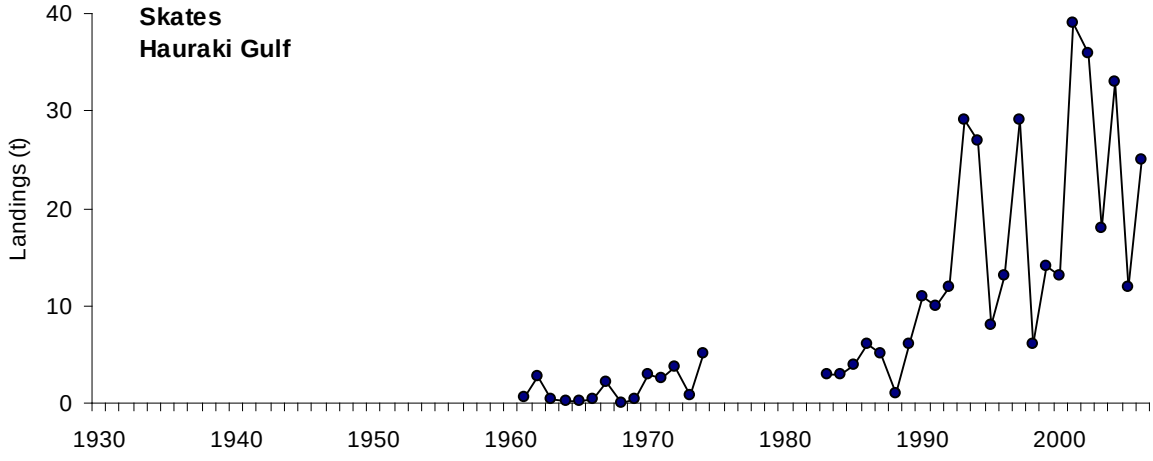


Figure 122: Landings of skates from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data for Hauraki Gulf landings, but seasonal trends would follow those of the target fisheries in which skates occur as bycatch.

For further information

Francis, M.P. (1997). A summary of biology and commercial landings, and a stock assessment of rough and smooth skates (*Raja nasuta* and *R. innominata*). New Zealand Fisheries Assessment Research Document 1997/5 27 p. (Unpublished document held by NIWA library, Wellington.)

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Francis, M.P.; Ó Maolagáin, C.; Stevens, D. (2001b). Age, growth, maturity, and mortality of rough and smooth skates (*Dipturus nasutus* and *D. innominatus*). *New Zealand Fisheries Assessment Report 2001/17*. 21 p.

Francis, M.P.; Ó Maolagáin, C.; Stevens, D. (2004). Revised growth, longevity and natural mortality of smooth skate (*Dipturus innominatus*). Final Research Report for Ministry of Fisheries Project MOF2003/01H. (Unpublished report held by Ministry for Primary Industries, Wellington.)

Garrick, J.A.F.; Paul, L.J. (1974). The taxonomy of New Zealand skates (Suborder Rajoidea), with descriptions of three new species. *Journal of the Royal Society of New Zealand 4(3)*: 345−377.

Stargazers



Spotted stargazer *Genyagnus monopterygius*



Giant stargazer *Kathetostoma giganteum*

Distribution

The spotted stargazer is present around northern and central New Zealand, 0−200 m. The giant stargazer is widely distributed around New Zealand, 100−900 m. The spotted stargazer is present in the Hauraki Gulf but is not common; the giant stargazer occurs in the outer Gulf.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery for stargazers, which are mainly caught around the South Island. The comparative data sets are not plotted, as the New Zealand total reaches over 4000 t while Hauraki Gulf landings have only briefly reached 50 t.

Hauraki Gulf catch history

Both species have undoubtedly been caught in small quantities since commercial fishing began, initially by setnet and then more frequently by trawl. Recorded within the "other species" category in port landings, and recorded in variable quantities in area landings (Figure 123). A bycatch in several, mainly trawl, fisheries.

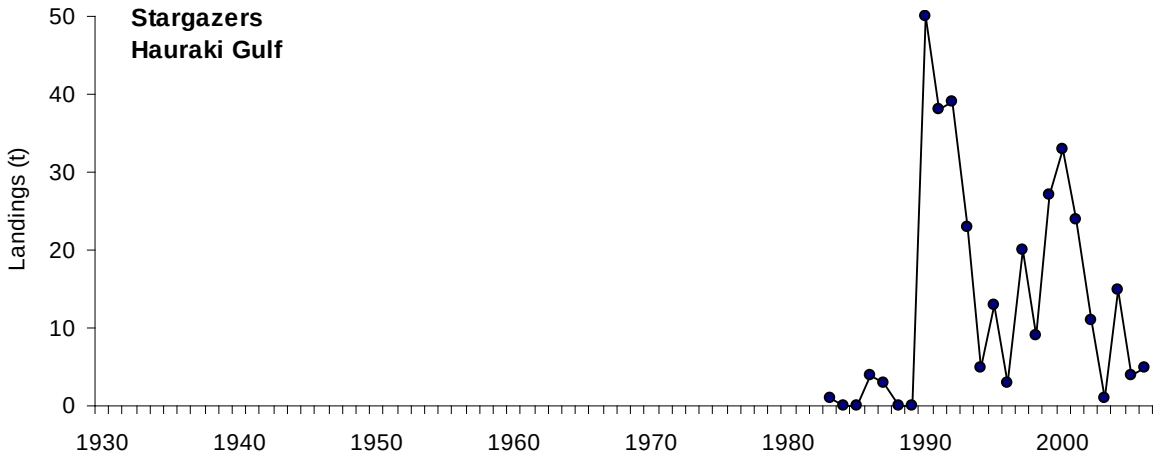

Figure 123: Landings of stargazers from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on Hauraki Gulf landings, but seasonal trends would follow those of the target fisheries in which stargazers occur as bycatch.

For further information

McGregor, G.A. (1988). Stargazer. New Zealand Fisheries Assessment Research Document 88/43. 5 p. MAFFish, N.Z. Ministry of Agriculture and Fisheries. (Unpublished report, held in NIWA library, Wellington.)

Red moki

Cheilodactylus spectabilis



Distribution

Distributed around the North Island but more common in the north, and restricted to rocky coasts and reefs, 0−50 m. Present on the rocky coast and around the islands of the outer Gulf.

Relative importance of Hauraki Gulf fishery

Only a short recorded catch history of red moki in New Zealand is available, although catches have been made since the rise in setnetting activity in the 1970s. King (1985) records 29 t in 1978, and between 6 t and 18 t until 1982. Catches through the 1980s are assumed to have been small, generally less than 100 t. However, there may have been some recording of this species as "moki," and assigned to blue moki. From the very limited data, Hauraki Gulf appears to have contributed one-third to one-half of total landings (Figure 124). In 1993 a regulatory ban was placed on the targeted fishing for and sale of red moki (and 18 other northern reef species) in the Auckland Fishery Management Area (which includes the Hauraki Gulf). Reported landings ceased, but it is not clear whether very minor bycatches were discarded at sea.

Hauraki Gulf catch history

Catches of perhaps 50 t were made in the late 1970s and early 1980s (Figure 124). Reef setnetting was then discouraged, and banned in 1993.

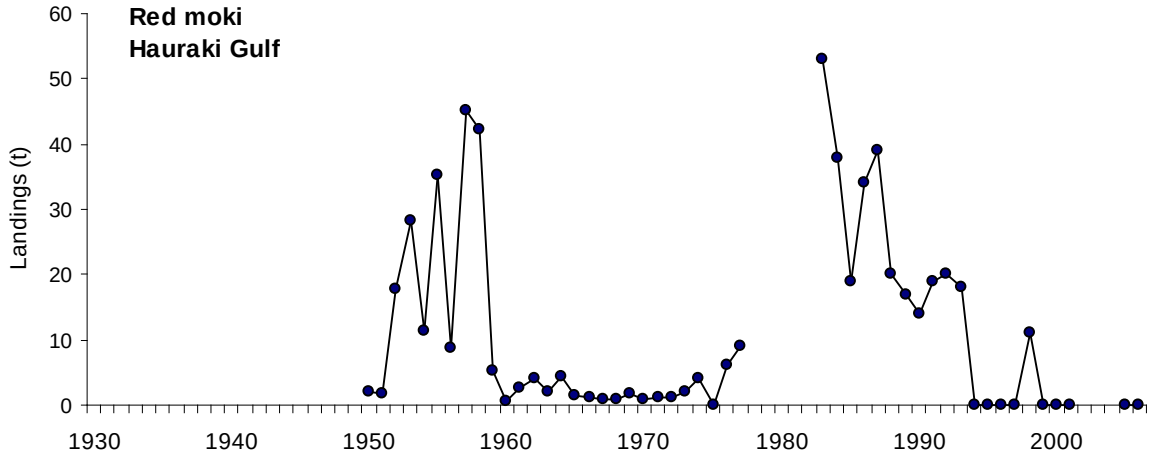

Figure 124: Landings of red moki from the Hauraki Gulf region, 1931−2006.

Seasonal trend

Although higher catches were made from March to May, this was undoubtedly dependent on targeted fishing for one or a group of other species.

For further information

Ayling, T.; Cox, G.J. (1984). Collins guide to the sea fishes of New Zealand. Collins, Auckland. 343 p.

Cole, R.G. (1994). Abundance, size structure, and diver-oriented behaviour of three large benthic carnivorous fishes in a marine reserve in northeastern New Zealand. *Biological Conservation 70(2)*: 93–99.

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Francis, M. (2001). Coastal fishes of New Zealand. An identification guide. Reed Books, Auckland. 103 p. + pls.

Leum, L.L.; Choat, J.H. (1980). Density and distribution patterns of the temperate marine fish *Cheilodactylus spectabilis* (Cheilodactylidae) in a reef environment. *Marine Biology 57(4)*: 327–337.

McCormick, M.I. (1998). Ontogeny of diet shifts by a microcarnivorous fish, *Cheilodactylus spectabilis*: relationship between feeding mechanics, microhabitat selection and growth. *Marine Biology 132(1)*: 9–20.

McCormick, M.I. (1989a). Spatio-temporal patterns in the abundance and population structure of a large temperate reef fish. *Marine Ecology Progress Series 53(3)*: 215–225.

McCormick, M.I. (1989b). Reproductive ecology of the temperate reef fish *Cheilodactylus spectabilis* (Pisces: Cheilodactylidae). *Marine Ecology Progress Series 55(2–3)*: 113–120.

McCormick, M.I.; Choat, J.H. (1987). Estimating total abundance of a large temperate-reef fish using visual strip-transects. *Marine Biology 96(4)*: 469–478.

Paul, L.J. (1992). Age and growth studies of New Zealand marine fishes, 1921–90: a review and bibliography. *Australian Journal of Marine and Freshwater Research 43(5)*: 879–912.

Blue moki

Latridopsis ciliaris



Distribution

Distributed around New Zealand, but much more common along the eastern coasts of both islands, 0−200 m, Present but not common in the Hauraki Gulf, mainly occurring around the islands of the outer Gulf.

Relative importance of Hauraki Gulf fishery

The Hauraki Gulf is unimportant in the context of the total New Zealand fishery for blue moki, which are mainly caught from East Cape southwards. The comparative data sets are not plotted, as the New Zealand total reaches over 1000 t while Hauraki Gulf landings have nominally reached 45 t (Figure 125) but have probably been half or less of that.

Hauraki Gulf catch history

Reported landings into Auckland briefly reached 45 t in the 1950s. These were considered to have come largely, if not entirely, from the East Cape grounds worked intensively for tarakihi at this time, and are not included in Figure 125. Small landings were probably included within the "Other" category in the 1960s and 70s. The 1983 listing reflects the change to the catch by area database, and eperhaps fishers reporting more accurately to establish a catch history prior to the introduction of quotas. Subsequently, landings have generally been in the range 1−4 t, taken by trawl and setnet.

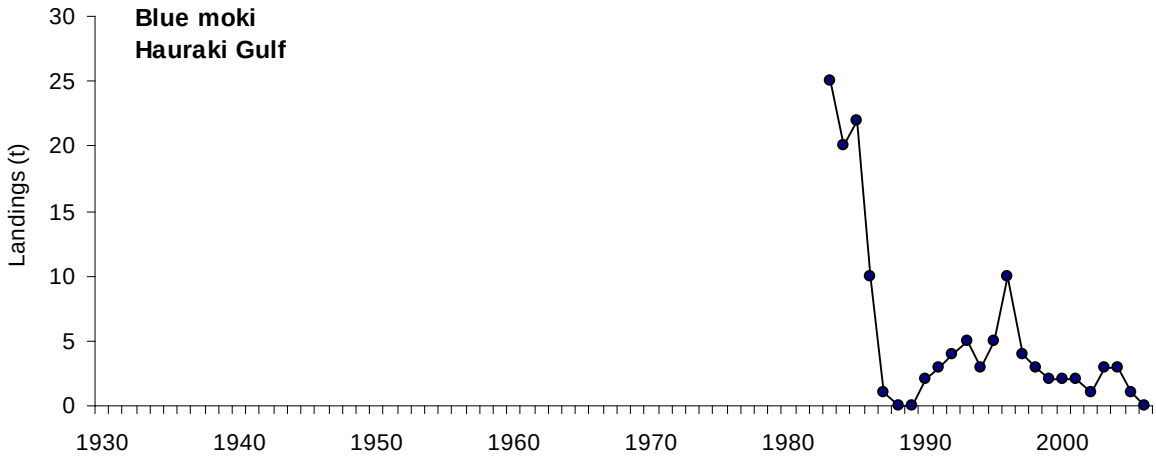

Figure 125: Landings of blue moki from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on Hauraki Gulf landings, but seasonal trends would follow those of the target fisheries in which blue moki occur as bycatch.

For further information

Francis, M.P. (1979). A biological basis for the management of New Zealand moki (*Latridopsis ciliaris*) and smoothhound (*Mustelus lenticulatus*) fisheries. (Unpublished MSc thesis, University of Canterbury, Christchurch, New Zealand.)

Francis, M.P. (1981a). Spawning migration of moki (*Latridopsis ciliaris*) off eastern New Zealand. *New Zealand Journal of Marine and Freshwater Research 15*: 267–273.

Francis, M.P. (1981b). Age and growth of moki, *Latridopsis ciliaris* (Teleostei: Latridae). *New Zealand Journal of Marine and Freshwater Research 15*: 47–49.

Horn, P. (1988). Blue moki. New Zealand Fisheries Assessment Research Document 1988/10. 11 p. (Unpublished document held by NIWA library, Wellington.)

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Manning, M.J.; Stevenson, M.L.; Dick, C.M. (2010). The length and age composition of the commercial catch of blue moki (*Latridopsis ciliaris*) in MOK 1 during the 2004/05 and 2005/06 fishing years including total and fishing mortality estimates. *New Zealand Fisheries Assessment Report 2010/34.* 65 p.

Yellow-eyed mullet



Aldrichetta forsteri

Distribution

Present around most of New Zealand, more common in the north and in sheltered bays, harbours, and estuaries, 0−50 m. Common in shallow waters of the Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

Reporting of yellow-eyed mullet catches was almost certainly unreliable until the introduction of the QMS in 1986. Landings from the few target fisheries around New Zealand would have been reported, but in other fisheries the species would have been an unsaleable bycatch and discarded, or landed within the categories "mixed species" and "bait." It is also possible that some (yellow-eyed) "mullet" landed values have been attributed to grey mullet (see the grey mullet section of this report). Yellow-eyed mullet will also have been landed under its alternative (but incorrect) names of herring or sprat. At times the Hauraki Gulf appears to have contributed a moderate proportion of total landings (Figure 126).

Hauraki Gulf catch history

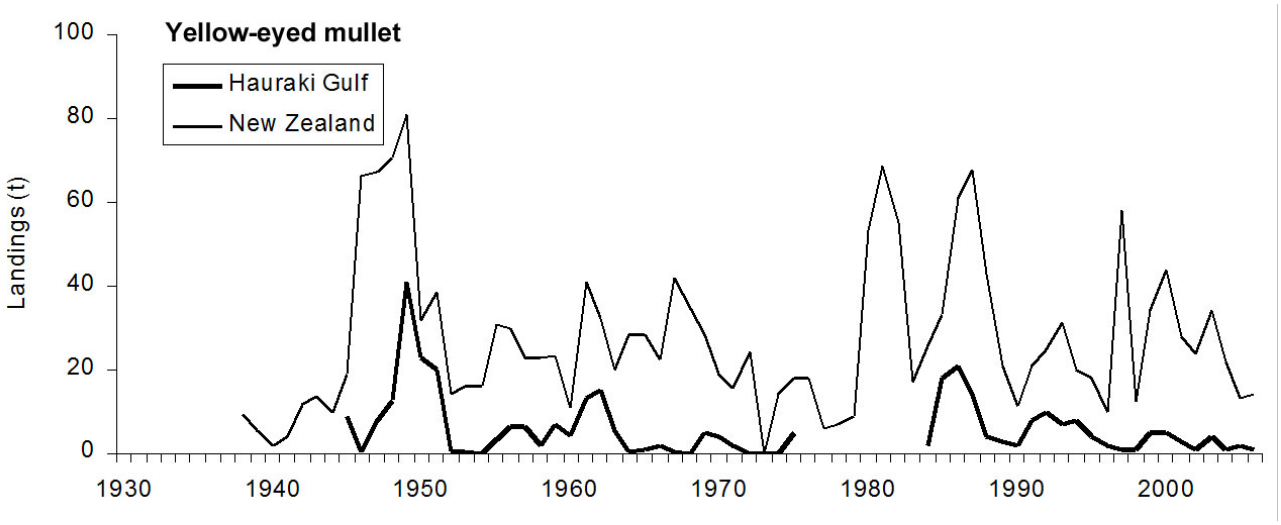

Figure 126: Landings of yellow-eyed mullet from the Hauraki Gulf region, 1931−2006, compared with the total New Zealand landings.

Reported landings have been highly variable (Figure 127), probably − in addition to the issues mentioned above − reflecting the activities of the relatively few fishers landing this species.

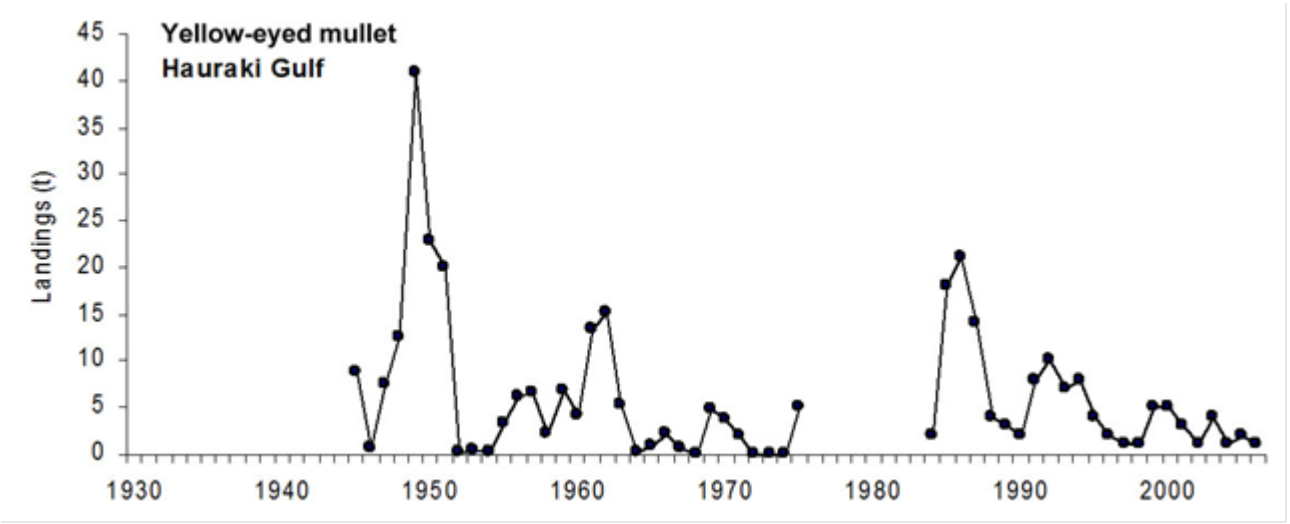

Figure 127: Landings of yellow-eyed mullet from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on Hauraki Gulf landings.

For further information

Manikiam, J.S. (1963). Studies on the yellow-eye mullet. Unpublished thesis submitted to the Victoria University of Wellington for the degree of Master of Science.

Taylor, P.R.; Paul, L.J. (1998). A summary of biology, commercial landings, and stock assessment of yellow-eyed mullet, *Aldrichetta forsteri* (Cuvier and Valenciennes, 1836) *(Mugiloidei: Mugilidae*). New Zealand Fisheries Assessment Research Document 1998/17. 34 p. (Unpublished document held by Ministry for Primary Industries, Wellington.)

Blue maomao

Scorpis violaceus



Distribution

Distributed around the North Island, much more abundant along the northeast coast, almost always found near rocky headlands and offshore reefs and islands, 0−40 m. Present in these habitats in the outer Gulf.

Relative importance of Hauraki Gulf fishery

Unknown, because of the unreliability of recorded landings, but from the general information available a moderate proportion of total landings are taken from the Hauraki Gulf.

Hauraki Gulf catch history

Reported landings have generally been less than 5 t, with a peak in the 1970s and 1980s when blue maomao were taken as bycatch when purse seiners worked relatively close to reefs and headlands (Figure 128).

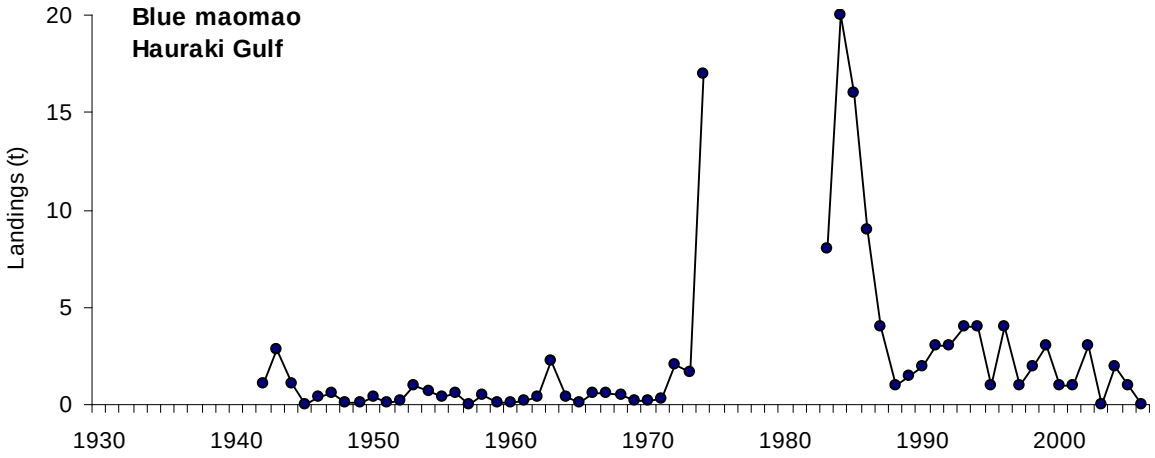

Figure 128: Landings of blue maomao from the Hauraki Gulf region, 1931−2006.

Seasonal trend

There are no readily available data on Hauraki Gulf landings, but seasonal trends would follow those of the target fisheries in which blue maomao occur as bycatch.

For further information

Francis, M. (2001). Coastal fishes of New Zealand. An identification guide. Reed Books, Auckland. 103 p.

Smith, P.J.; Wood, B.A.; Benson, P.G. (1979). Electrophoretic and meristic separation of blue maomao and sweep. *New Zealand Journal of Marine and Freshwater Research 13(4)*: 549–551.

Conger eel



Common, or southern conger *Conger verreauxi*
Northern conger *Conger wilsoni*

Distribution

Widespread around New Zealand, 0−200 m, usually at or close to reefs and rough seafloor. The much less common northern conger *C. wilsoni* occurs around the northern half of the North Island. Both are present in appropriate habitats in the Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

Unknown, because of the unreliability of recorded landings. The reported total catch, commencing in 1938, reached only 20 t in 1980 but no later data are available, probably because landings from all marine eel species, including the deepwater eels then being caught in quantity are combined. An unknown amount of conger eel is probably discarded because of its limited commercial value, particularly in early years.

Hauraki Gulf catch history

Conger eel landings as recorded by port (to 1983) are negligible, but subsequent catches reported by area are in the range 1−4 t (Figure 129). Earlier catches would probably have been similar, and certainly more than reported landings.

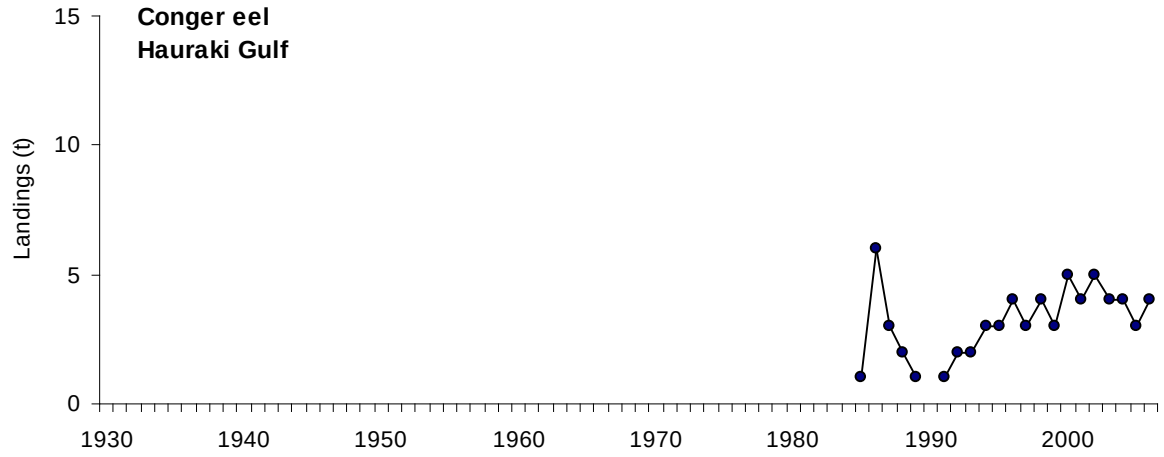

Figure 129: Landings of conger eels from the Hauraki Gulf region, 1931−2006.

Seasonal trend

No reliable data are available.

For further information

Francis, M. (2001). Coastal fishes of New Zealand. An identification guide. Reed Books, Auckland. 103 p.

Butterfish



Odax pullus

Distribution

Widely distributed around New Zealand, 0−40 m, but more abundant from Cook Strait southwards; restricted to rocky shores and reefs with seaweed beds. Present in the Hauraki Gulf.

Relative importance of Hauraki Gulf fishery

Apart from a few years in the 1940s, landings have generally been less than 5 t, a minor component of the New Zealand fishery which averages about 100 t and has reached 200 t.

Hauraki Gulf catch history

Reported landings show a peak of landings in the mid-1940s into the ports of Auckland and Whangarei (Figure 130). Although possibly a reporting error, landings of butterfish are not implausible. The climate was relatively cool during the 1940s, which would have favoured this typically more southern species. Butterfish are present in the Hauraki Gulf, taken as bycatch in shallow setnet fisheries; however, targeted butterfish netting differs from other setnetting, and one or more fishers might have adopted this method during the war years when some areas of the Gulf were closed and landings of other species declined.

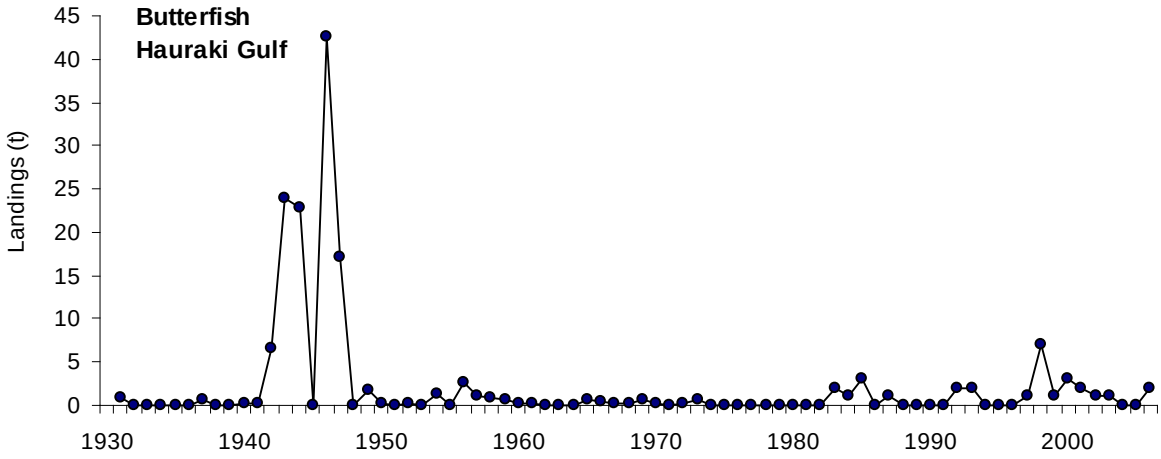

Figure 130: Landings of butterfish from the Hauraki Gulf region, 1931−2006.

Seasonal trend

No information is available.

For further information

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4 DISCUSSION

It is inevitable that over the course of eighty years changes were made to the way fisheries statistics were collected and published. However, it is unfortunate that the changes made in the mid-1980s did not make better provision for 'linking' the time series before and after that date. They coincided with − but did not directly result from − significant changes in the fisheries themselves, notably the move from a relatively free-access regime to a quota system, and a transfer of some effort from inshore demersal species to deeper water and pelagic species. This makes it difficult to determine which changes in landing patterns at that time reflect real events, and which simply result from changes in data recording. Nevertheless, it has been possible to use the entire data series to describe in broad terms the various fisheries that have developed in the Hauraki Gulf region.

Although landings by species were not recorded until 1931, it is reasonable to infer that snapper has always been the primary commercial catch. It was the most frequently mentioned species in anecdotal accounts from the nineteenth century. The first trawler which worked briefly about 1900 would have landed moderate quantities of snapper; its fishing success led to its downfall when, following complaints by line and net fishers the inner Gulf was closed by regulation to trawling in 1902. The trawler fleet which began working in 1915, although required to fish further afield in the Gulf and the Bay of Plenty, would also have once again increased snapper landings. Pre-1931 snapper landings can only be estimated from incomplete data on 'total fish' landings at Gulf ports, but could have been as high as 3000 t from 1915 to 1920, rising to 4000 t in the 1920s. Although catch by area is not available, it seems probable that a moderate proportion of this came from the central and outer Gulf, and from the north-western section of the Bay of Plenty which is grouped with the Hauraki Gulf in this account. Snapper remained the primary species taken in Gulf fisheries in subsequent decades because of its dominance in the fish community, its widespread distribution in most soft- and hard-bottom habitats from shallow water out to at least mid-shelf, and by its schooling behaviour in spring and summer which allowed it to be caught quite easily by setnet, line, Danish seine, and trawl. It is omnivorous (Godfriaux 1969, Colman 1972), which presumably allows it to alter its diet and continue to do well when environmental conditions affect the abundance of some of its prey items.

Snapper are moderately long lived, capable of reaching at least 60 years (Paul 1986), although most fish in the exploited population in the Hauraki Gulf are in the age range 10−30 years. Year class strength (and hence recruitment) is variable, controlled by a temperature-related factor in the marine environment. However, this variability is not extreme, and the moderate number of age groups in the commercial catch buffers the impact of strong and weak year classes on the fishery. Nevertheless, there have been a few sequences of warm and cool years which, in conjunction with other factors (World War II, fishing method and gear changes), diminished or raised snapper landings for some years after the lag from spawning to recruitment. At these times there was almost certainly some shift of fishing effort between targeted snapper and one or more alternate species, although this cannot be quantified.

Flatfish, mainly yellowbelly flounder, were an important species in the nineteenth and early twentieth centuries. They were initially been taken by the same fishers who worked lines and nets for snapper, but over time were caught almost exclusively by those inshore setnet fishers who remained with launches and dinghies (when others either found work on the large steam trawlers, converted their larger launches to Danish seiners, and eventually built new motor trawlers). Many of these fishers would have worked only part-time. Landings of flatfish declined from the mid-1940s for several reasons. Other species became more popular with consumers, the main Danish seining ground for flatfish − the 'Dab Patch' − was closed seasonally in 1934 and fully in 1946, and many part-time fishers were excluded from the fishing industry in 1983. However, a relationship between snapper and flounder fishing remained in the Firth of Thames, with seasonal alternation of target species.

Tarakihi were an important alternate species to snapper until about 1960. They were of particular value in the late 1940s and 1950s, when steam trawlers returned to the fleet and fished too heavily on snapper during a period of low natural recruitment.

Gurnard were a modest but useful bycatch in the snapper trawl fishery from the late 1940s, and a bycatch or alternate target species in the longline fishery in the 1980s and 1990s. John dory became a modest trawl and Danish seine bycatch from about 1970. Trevally landings increased after about 1950, partly as a consequence of reduced trawl bycatch discarding at sea, and partly as a result of targeted single and pair trawling, and purse seining, when its market value increased.

The rise in landings of these alternate or bycatch species occurred when snapper landings had peaked and were beginning a fluctuating decline. To some extent they buffered the economic effects of this decline, but by about 1980 it was clear that the snapper fishery − in common with many other coastal fisheries around the country − was being over-exploited under the open-access management regime. A Hauraki Gulf snapper catch quota was imposed, limited entry introduced, and then in 1986 the fishery came under the jurisdiction of New Zealand's Quota Management System. This reduced the effective quota still further (the Hauraki Gulf did not have its own quota, but came within a larger management area, SNA1).

From the 1980s through subsequent decades New Zealand's marine fisheries underwent major changes, with a significant shift towards deepwater trawling, and − for a few years − deepwater longlining. There was also a major development of pelagic fisheries, from oceanic tunas taken over the outer shelf and beyond, to mid-and inner shelf fisheries for mackerels and kahawai. Management regimes were changed to keep up with developments, and the mid-1980s change in the reporting of catches and landings make interpretation of some events difficult, as has been repeatedly noted in this account. In the Hauraki Gulf region covered by this study no deepwater grounds were discovered and exploited. However, there were several pelagic species that began to be intensively fished by purse seiners, usually on a seasonal basis: skipjack tuna over or near the shelf edge, and mackerels (blue mackerel, two jack mackerels) over the central shelf. New Zealand's main pilchard fishery developed over the inner Gulf shelf in the 1990s.

This diversification was additional to an ongoing snapper fishery. Snapper continued to be caught by trawling, Danish seine, longline, and setnet, as they had been for a century or more. Catches and landings of snapper − constrained by the QMS − are lower than the peak years of the 1970s and early 1980s, and lower than the earlier peaks of the late 1930s and late 1940s, but are more sustainable and are believed to be allowing the stock to rebuild, while still allowing a popular recreational fishery to expand. Snapper has proved to be a resilient species, and its fishery has undergone only a few moderate declines over the past century. It is almost certain to remain the dominant fish in the Hauraki Gulf ecosystem, and in the several fisheries that depend upon it.

4.1 Conclusions

Many Hauraki Gulf fisheries, over the past century or longer, have been associated in some way with the snapper fishery, either directly as some form of bycatch, or indirectly − as alternate species to be targeted either seasonally or during periods when the snapper stock size decreased as a consequence of low recruitment or over-exploitation. The present level of commercial landings, constrained by the QMS, is well below that of some historically high periods. The desirable rebuilding of the stock, and the retention of relatively higher numbers of old, or at least large, fish within it, now seems to be achievable. However, the rise in recreational catches − although not well quantified − is becoming significant. The development in the mid-1980s of alternate commercial fisheries, primarily for pelagic species, took only a limited amount of fishing effort away from the snapper fishery.

5 MANAGEMENT IMPLICATIONS

For well over a century, the Hauraki Gulf fishery has been dominated by snapper, with some support from a few other species usually taken as bycatch but sometimes alternately targeted. Although the exploited snapper stock comprises a moderate number of year-classes it is inevitable that the older fish are now relatively less abundant. There is moderate variability in recruitment, driven by an environmental variable linked to temperature. Although single strong or weak year-classes have a limited impact on stock size, there have been times in the past, and there may be in the future, when a sequence of warm or cool years has had a clear impact on snapper stock size. Some monitoring of year-classes, together with a better understanding of the linked environmental variables, is considered desirable.

This study was hampered by the large changes in statistical catch and landing systems in the mid-1980s, which unfortunately coincided with major changes in the fisheries themselves. There are consequently several years of unreliable data. It is recommended that future changes in data recording are done in such a way that a continuous time series of comparable information can be maintained. Studies such as this, looking at long-term changes in both single and mixed fisheries, are very dependent on reliable data.

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8 APPENDICES

8.1 Appendix 1 Fisheries Acts and Regulations

Fisheries Acts and Regulations relevant to Hauraki Gulf fisheries, 1877−1999

This compilation is based on several secondary sources[1], most of which were incomplete, and several of which were ambiguous or contradictory. A formal and comprehensive account of the legislation which applies directly or indirectly to Hauraki Gulf fisheries is not yet available. Within the Hauraki Gulf region a variety of interrelated and discrete fisheries developed from the late nineteenth century onwards, prompting increasingly complex government legislation to prevent or recover from perceived overfishing. Conversely, at times there was legislation to encourage and financially assist the fishing industry. This account is intended only as a general guide to the way in which the region's commercial fisheries have been governed. It is incomplete, particularly concerning the changes to closed areas for different categories of trawlers and Danish seiners, 1920s to 1970s, and changes to the Quota Management System from 1986 onwards. Where appropriate information could be located the entries are annotated.

In broad terms, there have been five stages in the management of New Zealand's inshore fisheries:
(1) Essentially unregulated, to 1884 (in some respects to 1908).
(2) Open-access (registration), area, gear and method restriction, 1908 to 1937−40.
(3) Limited-entry, area, gear and method restriction, 1940 to 1962.
(4) Regulated open-access, area, gear and method restriction, 1963 to 1986.
(5) Property-right (individual quotas), area, gear and method restriction, 1986 to present.
(Deepwater fisheries − which developed in only in the early 1970s − had property rights from 1978.)

Notes:
An Act is a law passed by Parliament, and usually deal with principles rather than detail.
Regulations are laws made by the Governor-General, Ministers of the Crown, and certain other bodies under powers conferred by an Act of Parliament. Regulations usually deal with matters of detail or administration.
Notices, issued within the authority of a regulation, concern matters which require urgent action, or which may be subject to frequent change.
In a few cases, other categories of management activity which are relevant to Hauraki Gulf fishing are listed here; e.g. wartime restrictions, non-parliamentary committees, etc.; are included within this list. See also Appendix 2.

1877
Fish Protection Act 1877
Establishes the principles for regulating New Zealand's fisheries, such as closed areas and seasons, gear restrictions, the imposition of penalties for infringements, and the general concept of registration or licensing. The Marine Department (officially established in this year by consolidating existing marine agencies formed during the 1860s) was given responsibility for fisheries.

[1] Including E.R. Martin 1969, Marine Department centennial history, 1866−1966; T. Nightingale 1992, White collars and gumboots; a history of the Ministry of Agriculture and Fisheries, 1892−1992; Johnson, D. 2004, Hooked, the story of the New Zealand fishing industry; Annual Reports on Fisheries, Marine Department/ Ministry of Agriculture and Fisheries; New Zealand Ministry for Primary Industries website, history of fishing page, accessed September 2012; various papers and reports on the QMS; articles in Catch magazine, New Zealand Ministry of Agriculture and Fisheries; search of Marine Department files in National Archives by Taking Stock project historians.

1878
Fisheries Dynamite Act 1878
Prohibited dynamiting fish in the sea and fresh water. New Zealand's jurisdiction for this offence stated to be one league (about 3 miles) from the coast.

1878
Regulations under the Fish Protection Act 1877:
Defines mesh size for garfish nets and set-nets. Defines minimum size for flounders and soles.

1884
Fisheries Conservation Act 1884
Consolidates previous legislation and introduces more specific regulations on minimum sizes, closed seasons, and fishing methods.

1885
Fisheries Encouragement Act. 1885
Provides for the establishment of fishing towns and villages, and promotes (via a financial bonus) the export of canned and cured fish.

1886
Fish Auction Act 1886
Allows fishermen and their agents to sell fresh fish at any hour of the day or night, without requiring an auctioneer's or trader's licence.

1887
Fisheries Conservation Amendment Act
[Information not located]

1888
Regulations under the Fisheries Conservation Act 1884 and the Fisheries Conservation Amendment Act 1887:
Defines mesh size for general seine nets (2 inches), garfish nets and herring [yellow-eyed mullet] nets (1 inch). Defines minimum weight or size (length) for 21 fish species.

1893
Regulations under the Fisheries Conservation Act 1884:
Redefines (decreases) minimum size of kahawai.

1894
Sea-fisheries Act 1894
Consolidates previous enactments, and gives the Marine Department authority to license fishing boats (delayed until 1908).

1895
Regulations under the Fisheries Conservation Act 1884:
Confirms minimum fish sizes in previous regulations.

1897
Regulations under the Sea-fisheries Act 1894.
Confirms previous regulations, but increases mesh size of herring net ($1^1/_2$ inches).

1902
Regulations under the Sea-fisheries Act 1894:
Trawling prohibited in the inner Hauraki Gulf.

1903
Regulations under the Sea-fisheries Act 1894:
Size limit revised for sand flounder, and closed season (Oct−May) for this species in Auckland waters.
Trawl net mesh size defined, 5 inches in main net, 4 inches in cod-end, measured diagonally.

1903
Sea-fisheries Amendment Act 1903.
Fishing vessels to be licensed. Commercial landing returns required to be made by fishermen, and quantities of processed (cured) fish recorded by processors. (However, this provision was not gazetted and came (partially) into force only in 1931. Penalties imposed for destroying edible fish.

1904
Regulations under the Sea-fisheries Act 1894:
Increases mesh size of general seine nets to 4 inches, and more closely defines trawl mesh measurement procedure.

1906
Regulations under the Sea-fisheries Act 1894:
Defines an area of the inner and central Hauraki Gulf closed to trawling.
Confirms previous regulations, and modifies mesh size of various nets. General seine nets, $2^1/_4$ inches; flounder net 4 inches; mullet net $3^1/_4$ inches; garfish net 1 inch; herring net $1^1/_4$ inches; trawl net $4^1/_4$ and then $4^1/_2$ inches in main net, 4 inches in cod-end.

1907
Regulations under the Sea-fisheries Act 1894:
Revise the area of Hauraki Gulf closed to trawling (opening an area north of Kawau Island).
Trawling prohibited within three miles of coast in much of the Bay of Plenty (Whangamata to Opotiki).
Closed season (Dec-Feb) for grey mullet, apart from inner Firth of Thames.

1908
Fisheries Act 1908
Consolidates previous legislation, establishes administrative framework that survives in broad form until 1983, and more formally claims jurisdiction over a Territorial Sea to 3 miles offshore.

1914
Regulations under the Fisheries Act 1908:
Defines the term long-line, cf. hand-line, and limits the time of setting to 2 hours.

1915
Regulations under the Fisheries Act 1908:
Defines the minimum size of snapper as 12 oz. [approx. 25 cm FL]

1915
Auckland City Markets and Empowering Act 1915
Empowers Auckland City Council to enter and at least partially control (through inspection of fish) the fishing industry. Stimulated competition with private interests (mainly Sanford Ltd), leading to the reintroduction of steam trawlers. The Council's financial losses resulted in the sale of its fishing interests in 1923.

1916
Regulations under the Fisheries Act 1908:
Defines the cod-end mesh trawls as not less than $3^3/_4$ inches (for nine months from 1 November).

1917
Regulations under the Fisheries Act 1908:
Bream Bay (Whangarei) waters, to 3 miles from shore, closed to trawling.
Harbours at Kawai Island and Great Barrier Island closed to trawling.

1919
Regulations under the Fisheries Act 1908:
Trawling prohibition (1907) removed from inner Bay of Plenty, then reinstated a few months later.
Revises slightly the area of Hauraki Gulf closed to trawling.

1919
Fishing Industry Promotion Act 1919
Provides loans to the fishing industry for fishing vessels, fishing gear, and cool storage facilities. Operated 1920−24, by Marine Department and then State Advances Corporation, the loans continuing for a few years after that.

1919
The Aliens Restriction (Amendment) Act 1919
Included a restriction on aliens owning or skippering vessels over a certain size. Rivalries within the fishing industry prompted the Marine Department into investigating whether the Danish seiners owned or skippered by Dalmations (technically aliens) were exempt. They were, and the issue was dropped.

1920
Regulations under the Fisheries Act 1908:
Revises slightly the area of Hauraki Gulf closed to trawling.

1921
Regulations under the Fisheries Act 1908.
Trawling prohibition extended slightly seawards outside Tauranga Harbour, Bay of Plenty. [Outside area of present study.]

1924
Regulations under the Fisheries Act 1908.
Danish seining (initially defined as purse-seining) prohibited within the Firth of Thames.
Prohibits carrying or using a Danish seine on a vessel engaged in trawling.

1926
Regulations under the Fisheries Act 1908:
Redefines areas closed seasonally and permanently to trawlers and Danish seiners in the Hauraki Gulf.

1927
Regulations under the Fisheries Act 1908:
Redefines area closed to Danish seining in the Coromandel area.

1928
Regulations under the Fisheries Act 1908:
Trawling and Danish seining prohibited within Mercury Bay.
Danish seine cod-end mesh defined as $4^1/_2$ inches.

1929
Redefines areas closed seasonally and permanently to trawlers and Danish seiners in the Hauraki Gulf.

1931
Regulations under the Fisheries Act 1908:
Clarification of the definition of Danish seining and trawling.

1932
Regulations under the Fisheries Act 1908 revoked, and then essentially reinstated in consolidated form.

1934
Regulations under the Fisheries Act 1908:
Trawling and Danish seining prohibited in Tutukaka Harbour (on northern limit of study area).
Trawling and Danish seining prohibited in Whangamata Harbour, Bay of Plenty.
Danish seining prohibited in the outer Firth of Thames, Aug-Sep, the sand flounder spawning season.
Danish seining prohibited in Great Barrier Island harbours (Fitzroy and Abercrombie).

1935
Regulations under the Fisheries Act 1908:
Redefinition of Hauraki Gulf areas closed seasonally or permanently to trawlers and Danish seiners.
Trawling and Danish seining prohibited in Kennedy Bay (Coromandel Peninsula).
Minimum size of hapuku redefined (2 feet TL).
Set-nets (e.g. for flounder) prohibited from extending more than half-way across a channel or stream.
Danish seining prohibited in Tryphaena Harbour, Great Barrier Island.
Minimum mesh size for flounder set-nets defined as $4^{3}/_{4}$ inches, and maximum length as 80 fathoms.

1936
Industrial Efficiency Act 1936
After investigation by the Sea Fisheries Investigation Committee (1937), the fishing industry was brought under this Act. Increased bureaucratic control resulted; involving collaboration between Marine Department and Department of Trade and Commerce. Vessel registration replaced by licensing, commencing 1937 and completed 1940. All full-time and seasonal registered fishers were licensed, as well as wholesalers, retailers, canners, and exporters. Casual and intermittent fishers were excluded from the industry.

1937
Regulations under the Fisheries Act 1908:
Defining 'herring' and 'sardine' and the size of garfish nets.

1938
Regulations under the Fisheries Act 1908:
Prohibiting trawling and Danish seining in further areas of the Bay of Plenty.
Prohibiting large (over 40 ft) Danish seine vessels from fishing in vicinity of Whangamata Harbour.

1939
Regulations under the Fisheries Act 1908:
Prohibiting Danish seining in further areas of the Bay of Plenty.
Amending the minimum size limits for certain fish species.
Consolidating the Sea-fisheries Regulations 1939.

1940
Regulations under the Fisheries Act 1908:
Defining areas of the Hauraki Gulf prohibited to different sizes of Danish seiners, classified by horsepower.

1940–45

Under wartime conditions, a variety of regulations and proclamations were issued which requisitioned steam trawlers and large Danish seiners for naval duties, closed some inshore grounds in sensitive military areas, and allocated a proportion of fish supplies to the armed forces.

1945
Regulations under the Fisheries Act 1908:
Limitation on size of seine or drag nets in Whangarei and Coromandel regions.

1945
Fisheries Amendment Act
Wholesale and retail sectors of the industry delicensed. Restrictive licensing of the catching sector (fishing vessels) under the Sea Fisheries Licensing Authority, replacing dual control by the Marine Department and Bureau of Industry. Licensed fishing vessels could only land their catches into specific ports, as defined in their license.

1947
Regulations under the Fisheries Act 1908:
Whangarei Harbour waters closed to Danish seining.

1950
Fisheries (General) Regulations.
A comprehensive consolidation and some revision of existing regulations.

1952
Auckland-registered vessels allowed to land catches into Manukau as well as Auckland (Waitemata). (The restriction on landing into the port of registration was removed for all ports in 1964, following the 1962 Commission of Enquiry.).

1963
Fisheries Amendment Act 1963
Deal with aspects of registration and permits, arising from recommendations of 1962 Parliamentary Select Committee (W.J. Scott Report). Restrictive licensing abolished as from January 1964, returning to a licensing regime. Home port landing restriction removed.

1965
Territorial Sea and Fishing Zone Act 1965
New Zealand's jurisdiction over fishing extended from 3 to 12 miles, empowering the government to regulate foreign vessels working within the 12 mile zone. This included Japanese longliners working the outer Hauraki Gulf and adjacent waters, although by negotiation with Japan the withdrawal was phased in over five years, ending 1970.

1965
Supplementary Loans and Mortgage Guarantee Scheme. This government scheme first provided finance to independent fishermen to purchase new fishing vessels, and in 1968 was extended to cover engines, gear, and (mortgage) re-financing. With other financial incentive and tax schemes it continued through the 1970s.

1977
Fisheries Amendment Act 1977
The Ministry of Agriculture is given the authority to declare Controlled Fisheries, with the return of a Fisheries Licensing Authority. This regime is subsequently (1983) applied to the Hauraki Gulf fishery for snapper, and indirectly for associated species in the area.

1977

The Territorial Sea and Fishing Zone Act 1977
The Territorial Sea is extended from 3 to 12 miles, and a 200 mile EEZ is established. An indirect result in following years is the removal of some fishing pressure from inshore grounds such as the Hauraki Gulf.

1977
A catch quota is imposed on the Hauraki Gulf snapper fishery, with various closed areas and gear restrictions. The quota applies to a smaller region (Whangarei to Cape Colville) than the Hauraki Gulf region discussed in this paper.

1978-80
Hauraki Gulf Snapper Advisory Committee. Comprised Fishing Industry Board, Ministry of Agriculture & Fisheries, and all fishing industry sectors. Discussed options for managing Hauraki Gulf fisheries, without reaching consensus. Various modifications to regulations were enacted during this time, but a Controlled Fishery − discussed by the Committee − was not favoured.

1980
Hauraki Gulf moratorium on new fishing permits, and permits retained only for full-time or significantly active part-time fishermen. Quota retained in modified form, and new method and area restrictions added. Intention to create a Controlled Fishery announced.

1982
New Zealand-wide moratorium enforced on new permits issued for inshore fisheries, to relieve pressure on stressed stocks. (Did not apply to the Hauraki Gulf as usually defined, already under moratorium.)

1982
The Hauraki Gulf snapper fishery was declared a Controlled Fishery, taking effect from March 1983. There was restricted entry, a catch limit, and a continuation or modification of regulations on methods, areas, seasons, etc.

1983
Fisheries Act 1983
Introduced the concept of a Quota Management System (QMS). Allowed development of regional Fisheries Management Plans. Part-time commercial fishers (defined by a minimum monetary value of landings) were removed from the industry. This was done partly for administrative convenience, and partly because it was held that these fishers had the greatest potential to increase their fishing effort and impact already-stressed fisheries. (This had less effect in the Hauraki Gulf as usually defined, where restricted licensing had already removed many part-timers.)

1984
Moratorium on new government lending for inshore fishery projects.

1986
Fisheries Amendment Act 1986
Establishes the detail of the Quota Management System, Total Allowable Catches (TACs, later TACCs) and ITQs, applying from 1 October. In the Hauraki Gulf the QMS replaced the Controlled Fishery regime.

1990
Fisheries Amendment Act 1990
Changes the basis of ITQ from a fixed tonnage to a proportion of the TAC (now TACC, Total Allowable Commercial Catch), which can be adjusted annually to ensure sustainability. This removes the requirement of the government to purchase excess quota in order to retire it.

1996

Fisheries Act 1996

Introduces Annual Catch Entitlements (ACE), a harvesting right, as distinct from ITQs, which are ownership rights. Recognises a broader ecosystem approach to management, and gives fishery stakeholders (fishing industry and other user groups) more participation in decisions.

1998

Fisheries Amendment Act 1998

Attempts to simplify the growing complexity of the QMS.

1999

The Fisheries Amendment Act 1999

Devolves some non-core government fisheries services to quota-owning companies, in a further attempt to simplify the QMS.

2001

Administrative components of the QMS (permits, quota trading, catch and landing reporting, etc.) are devolved to a non-government agency, FishServe, which functions within government guidelines.

8.2 Appendix 2 Commissions of Enquiry

Commissions of Enquiry relevant to Hauraki Gulf fisheries, published as Parliamentary Papers[2]

Notes: The pagination of these may vary, as several were issued in different forms: consolidated Appendices, individual Annual Reports, and sectional or individual reports reprinted separately. Where listed, the authors are the sole or main commissioners, or chairmen of committees. Annotations indicate their relevance to Hauraki Gulf fisheries. The arrangement is chronological.

Anon. 1880. Report of the Colonial Industries Commission. Appendix to the Journal of the House of Representatives of N.Z. H.–22.
Stated that the fishing industry was not flourishing, and required better transport (rail) facilities to distribute fish landings.

Anon. 1885: Papers relating to the development of colonial industries. I. Fisheries. Appendix to the Journal of the House of Representatives of N.Z. H.–15. 9 p.
General notes and correspondence by several writers on the New Zealand's marine fish and fisheries as known at this date, with brief notes on the Auckland area.

Anon. 1891: Correspondence relative to proposed limit of size of flounders to be taken. Appendix to the Journal of the House of Representatives of N.Z. H.–10. 18 p.
Passing reference to Thames flounder.

Hector, J. 1897: [Report on the] protection of mullet. Appendix to the Journal of the House of Representatives of N.Z. H.–17. 24 p.
Deals mainly with mullet in west coast harbours, but briefly mentions development of early fishing in the wider Auckland area.

Ayson, L.F. 1901: Report on experimental trawling [by the "Doto", 1901]. Appendix to the Journal of the House of Representatives of N.Z. H.–15A. 17 p.
Brief mention of experimental trawling in the Hauraki Gulf.

Ayson, L.F. 1913: Reports on the fisheries of New Zealand, with recommendations for their organisation and administration. Appendix to the Journal of the House of Representatives of N.Z. H.–15B. 25 p.
Generalised report, but includes a brief mention of Hauraki Gulf fishing and Auckland fish markets.

Prince, E.E. 1914: Preliminary Report on the Fisheries of New Zealand. Appendix to the Journal of the House of Representatives of N.Z. H.–15C. 34 p.
Generalised and optimistic report on the potential for New Zealand's marine and freshwater fisheries, but with few references to the Auckland region.

Cutten, E.C. 1919: Fisheries Commission (Report of Commissioners). Appendix to the Journal of the House of Representatives of N.Z. H.–28. 6 p.
Dealt entirely with fisheries in the Auckland region, in particular with restricted areas for trawlers, trawl mesh size, industry-imposed limits on fish landings, and the price of fish to the public.

Hefford, A.E. 1929: Report on the fisheries of the Hauraki Gulf, with special reference to the snapper fishery and to the effects of "power" fishing (trawling and Danish-seining). Fisheries, Appendix 1.

[2] Appendices of the Journal of the House of Representatives.

pp. 30−71. In Marine Department Annual Report for 1928−29. Appendix to the Journal of the House of Representatives of N.Z. H.–15.
Reviews the Auckland snapper fishery to this date, the need for closed areas, and the requirement for better statistical data on catches.

Thorn, T. 1939: Report of the [1937−38] Sea Fisheries Investigation Committee. Appendix to the Journal of the House of Representatives of N.Z. H.–44A. 128 p.
A general enquiry into New Zealand's fisheries, but with particular reference to Auckland. Included coverage of the production and distribution of fisheries products, the licensing of fishermen, and difficulties in the export trade.

Lake, H.R. 1956: Report of Caucus Fisheries Committee 1956. Appendix to the Journal of the House of Representatives of N.Z. H.–15A. 12 p.
A general review of the country's fisheries. Endorsed the existing conservation policy, on the assumption that inshore fisheries were close to fully exploited. Exporting (discouraged by the 1937−38 Committee) still not favoured. Recommended that government play a more significant role in organising the industry, principally be facilitating liaison between groups with divergent views. A Fishing Industry Advisory Council established.

Scott, W.J. 1962: [Report of the] Fishing Industry Committee 1962. Appendix to the Journal of the House of Representatives of N.Z. I.–19. 87 p.
A major review of the New Zealand fishing industry. Restrictive licensing replaced by registration and fishing permits, essentially returning the industry in 1963 to an open-access regime. Single (home) port landing to be abolished. The Fishing Industry Advisory Council to be replaced by a more autonomous and proactive Fishing Industry Board. The review had two major outcomes: encouragement to expand fisheries by acquiring larger vessels to work offshore grounds; and an expansion of fishing effort on many inshore grounds, leading to overfishing and more or less directly to the introduction two decades later of the Quota Management System.

Anon. 1968: Agreement on fisheries between New Zealand and Japan, with related documents. Appendix to the Journal of the House of Representatives of N.Z. A.–18. 12 p.
A negotiated agreement to phase out the activity of Japanese fishing vessels in New Zealand's territorial waters, including the longliners working in the Hauraki Gulf region.

Dick, A.D. 1972: [Report of the] Fishing Industry Committee 1970−72. 4. (a) Roadside Sales of Fish. (b) Industry Representation on the Fishing Industry Board. (c) Other Subjects. Appendix to the Journal of the House of Representatives of N.Z. I.–14. 97 p.
A general review of several aspects of the New Zealand fishing industry, with some relevance to the Auckland region.

8.3 Appendix 3 Reported commercial landings 1931–82

Reported commercial landings of finfish at the Hauraki Gulf ports of Whangarei, Auckland, Thames, Coromandel, and Mercury Bay/Whitianga, 1931−82.

Introductory Notes

Data to 1973 taken from Annual Reports on Fisheries, reprinted from Annual Reports of the Marine Department (to 1971) and the Department of Agriculture & Fisheries (1972, 1973). The original data are in cwt, converted here to tonnes (t).

Data from 1974 taken from King (1985). The original data are rounded to the nearest tonne. In a few cases where a 1974 value is not given in King (1985), the value in the 1974 Annual Report on Fisheries was used.

The port landing data in King (1985) include only those species that in a year comprise at least 1% of the total landings for that port. Consequently minor species are either not listed at all, or are listed for only those years where they were at least 1% of the total. To complete the sequences and avoid the impression that there were zero landings, these gaps have been filled, either by using the mean of the five previous years (1969−73), or the mean of an incomplete 1974−82 series, or a combination of these if this seemed more appropriate. They can only be considered 'best estimates,' and as with the recorded values of minor species, which for a variety of reasons are not well reported, are more likely to be biased low than high. Higher landings in any year are likely to have come within the 1% or greater category.

The 1931−73 data, converted from cwt, are listed to 0.1 of a tonne in order to quantify the landings of minor species. The 1974−82 data are of necessity listed as whole tonnes, except where missing values less that 1 tonne had to be estimated.

For uniformity, the same sequence of species is used for each port, even when there were zero landings. It follows the species sequence in the text.

Other procedures used to complete and standardise these data are given in the main text, under Methods.

Appendix 3: Reported landings (t) of commercial fish species at Whangarei, 1931−82. Page 1 of 3. For details see the Introductory Notes to this Appendix.

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1931	129.0	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0
1932	123.4	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1933	164.9	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1934	128.0	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1935	41.7	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1936	51.8	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1937	43.3	2.0	0.1	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1938	36.4	0.2	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	42.0	1.8	0.2	0.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1940	44.3	4.2	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	24.0	3.9	0.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	41.1	4.9	0.1	15.6	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1943	65.5	1.8	0.0	56.3	12.5	0.0	0.0	0.0	0.1	0.0	0.1	0.1
1944	68.3	1.0	0.1	78.8	33.2	0.0	0.0	0.0	0.0	0.1	0.4	0.1
1945	43.6	0.4	0.0	19.7	7.7	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1946	29.8	0.8	0.0	34.3	3.5	0.0	0.0	0.0	0.0	0.4	0.0	0.0
1947	47.2	2.2	0.0	37.2	1.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0
1948	155.4	2.1	0.1	30.5	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0
1949	215.7	2.2	0.9	9.6	0.4	0.0	0.0	0.0	0.0	3.0	1.3	0.0
1950	205.7	2.3	2.7	12.4	0.1	0.0	0.0	0.0	0.0	15.0	5.3	0.0
1951	103.8	1.4	0.8	8.6	0.0	0.0	0.0	0.0	0.0	0.5	1.1	0.0
1952	61.4	1.9	0.1	2.7	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.0
1953	88.4	3.1	1.6	28.5	1.2	0.0	0.0	0.0	0.0	0.0	2.7	0.0
1954	154.6	4.6	2.0	16.9	0.6	0.0	0.0	0.0	0.0	0.5	0.9	0.0
1955	237.9	0.3	0.5	5.7	0.1	0.0	0.0	0.0	0.0	0.4	0.2	0.1
1956	238.9	0.7	3.3	13.2	0.1	0.0	0.0	0.0	0.5	2.7	0.6	0.0
1957	209.1	0.6	4.6	17.0	0.2	0.0	0.0	0.0	0.0	0.9	0.4	0.0
1958	170.1	1.6	3.6	6.1	0.5	0.0	0.0	0.0	0.0	0.6	0.1	0.0
1959	148.3	1.2	1.6	2.2	1.4	0.0	0.0	0.0	0.0	0.5	0.2	0.0
1960	137.4	0.7	0.9	7.2	0.9	0.0	0.0	0.0	0.0	0.1	0.4	0.0
1961	99.8	2.6	0.6	6.7	0.4	0.0	0.0	0.6	0.0	0.2	0.4	0.0
1962	111.6	4.6	0.4	5.9	1.0	0.0	0.0	0.0	0.0	0.8	0.4	0.1
1963	87.3	6.1	0.1	14.7	0.6	0.0	0.0	0.0	0.0	0.4	0.2	0.0
1964	61.4	8.2	0.2	4.0	1.9	0.0	0.0	0.0	0.0	0.1	0.3	0.0
1965	58.3	11.6	0.0	6.3	0.3	0.0	0.0	0.0	0.0	0.1	0.4	0.0
1966	63.4	10.6	0.4	15.6	2.5	0.0	0.2	0.0	0.0	1.4	1.9	0.0
1967	123.8	7.6	1.3	6.1	0.5	0.0	0.0	0.0	0.5	4.3	0.7	0.0
1968	116.5	7.3	0.9	7.2	0.3	0.0	0.0	0.0	0.8	0.8	1.1	0.0
1969	94.6	15.6	2.1	6.4	0.4	0.0	0.0	0.0	1.5	1.7	1.9	0.0
1970	116.9	9.9	1.7	9.7	0.1	0.0	0.0	0.0	1.3	1.3	1.2	0.1
1971	200.5	7.7	3.6	13.4	0.4	0.0	0.1	0.0	3.3	9.3	0.5	8.6
1972	311.7	26.9	12.5	13.8	0.5	0.0	0.0	0.0	4.3	6.0	0.9	0.1
1973	388.5	21.0	19.9	20.0	0.9	0.0	43.1	0.3	10.8	8.3	2.1	18.0
1974	277.0	9.0	13.0	41.0	5.0	0.0	4.0	0.1	7.0	6.0	4.9	29.0
1975	234.0	11.0	9.0	15.0	0.4	0.0	8.0	0.1	5.0	8.0	16.0	8.0
1976	353.0	19.0	23.0	18.0	0.4	0.0	8.0	0.1	15.0	9.0	12.0	11.0
1977	350.0	37.0	55.0	45.0	0.4	0.0	8.0	0.1	17.0	27.0	16.0	21.0
1978	565.0	37.0	44.0	97.0	0.4	0.0	8.0	0.1	28.0	23.0	16.0	16.0
1979	603.0	35.0	28.0	66.0	0.4	0.0	8.0	0.1	27.0	27.0	11.0	16.0
1980	676.0	20.0	29.0	61.0	0.4	0.0	8.0	0.1	43.0	48.0	16.0	11.0
1981	628.0	21.0	85.0	150.0	0.4	0.0	8.0	0.1	51.0	36.0	26.0	16.0
1982	495.0	18.0	80.0	67.0	11.0	0.0	8.0	0.1	30.0	35.0	16.0	15.0

Appendix 3: Reported landings (t) of commercial fish species at Whangarei, 1931−82. Page 2 of 3. For details see the Introductory Notes to this Appendix.

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1931	0.0	0.0	0.0	14.7	0.0	1.8	15.7	0.0	0.0	0.0	10.9	0.0
1932	0.0	0.0	0.0	14.2	0.0	0.0	10.7	0.0	0.0	0.0	0.0	0.0
1933	0.0	0.0	0.0	19.6	0.0	0.0	14.7	0.0	0.0	0.0	14.5	0.0
1934	0.0	0.0	0.0	16.3	0.0	0.0	15.2	0.0	0.0	0.0	10.2	0.0
1935	0.0	0.0	0.0	5.3	0.0	0.0	7.8	0.0	0.0	0.0	0.5	0.0
1936	0.0	0.0	0.0	1.2	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0
1937	0.0	0.0	0.0	0.6	0.0	0.0	2.4	0.0	0.0	0.0	0.1	0.0
1938	0.0	0.0	0.0	2.5	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	3.9	0.0	0.1	5.2	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	2.3	0.0	0.1	4.8	0.0	0.0	0.0	0.1	0.0
1941	0.0	0.0	0.0	1.4	0.0	0.1	2.5	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	4.3	0.0	0.2	4.7	0.0	0.3	2.5	0.0	0.0
1943	0.0	0.0	0.0	3.3	0.0	1.9	0.6	0.0	0.0	2.4	0.3	0.0
1944	0.0	0.0	0.0	4.8	0.0	4.0	2.0	0.0	0.0	8.3	0.1	0.0
1945	0.0	0.0	4.6	8.1	0.0	0.5	0.7	0.0	0.0	3.5	0.1	0.0
1946	0.0	0.0	13.3	10.4	0.0	1.0	3.0	0.0	0.0	6.5	0.1	0.0
1947	0.0	0.0	3.3	2.4	0.0	0.0	0.6	0.0	0.0	2.6	0.1	0.0
1948	0.0	0.1	7.2	6.6	0.0	0.1	0.9	0.0	5.2	0.0	0.3	0.0
1949	0.0	0.0	14.9	8.0	0.0	0.2	0.6	0.0	0.0	0.0	0.1	0.0
1950	0.0	0.0	6.0	12.3	0.0	0.8	1.1	0.0	0.0	0.0	0.3	0.0
1951	0.0	0.0	5.9	3.8	0.0	0.8	0.2	0.0	0.0	0.2	0.6	0.0
1952	0.0	0.0	8.2	4.3	0.0	2.2	0.5	0.0	0.0	0.8	0.7	0.0
1953	0.0	0.0	0.5	9.6	0.0	2.4	3.3	0.0	0.0	0.3	0.9	0.0
1954	0.0	0.0	2.0	19.5	0.0	2.0	3.1	0.0	0.0	0.6	1.1	0.0
1955	0.0	0.0	12.0	8.4	0.0	1.0	2.4	0.0	0.0	1.1	0.3	0.0
1956	0.0	0.0	4.1	4.7	0.0	0.4	4.0	0.0	0.0	0.7	0.1	0.0
1957	0.0	0.0	12.9	10.1	0.0	0.7	1.8	0.0	0.0	0.2	0.0	0.0
1958	0.0	0.0	8.9	16.8	0.0	0.4	3.0	0.0	0.0	0.0	0.1	0.0
1959	0.0	0.0	5.7	12.6	0.0	0.0	13.7	0.0	0.0	0.1	0.1	0.0
1960	0.0	0.0	6.9	7.8	0.0	0.1	12.0	0.0	0.0	0.1	0.0	0.0
1961	0.0	0.0	7.9	12.3	0.0	0.1	4.7	0.0	0.0	3.2	0.1	0.0
1962	0.0	0.0	7.6	9.0	0.0	0.0	2.1	0.0	0.0	7.7	0.0	0.0
1963	0.0	0.0	5.7	6.5	0.0	0.2	2.6	0.0	0.0	4.5	0.1	0.0
1964	0.0	0.0	4.7	10.4	0.0	0.1	2.9	0.0	0.0	12.3	0.0	0.0
1965	0.0	0.0	6.2	7.0	0.0	0.0	1.8	0.0	0.0	7.8	0.0	0.0
1966	0.0	0.0	5.1	6.5	0.0	0.1	5.3	0.0	0.0	6.8	0.0	0.0
1967	0.0	0.0	2.4	14.4	0.1	0.1	2.3	0.0	0.0	1.3	0.1	0.0
1968	0.0	0.0	0.5	2.2	0.0	0.1	1.2	0.0	0.0	2.6	0.0	0.0
1969	0.0	0.0	1.3	2.8	0.5	0.1	2.3	0.0	0.0	4.0	0.1	0.0
1970	0.0	0.0	1.9	1.4	0.7	0.2	0.9	0.0	0.0	6.4	0.0	0.0
1971	0.0	0.0	3.4	3.9	0.1	0.3	1.3	0.0	0.0	10.0	0.0	0.0
1972	0.0	0.0	4.0	3.6	0.3	1.5	2.8	0.0	0.0	6.5	0.0	0.0
1973	0.0	0.0	0.9	4.2	0.1	27.1	1.4	0.0	0.0	4.4	0.0	0.0
1974	0.0	26.0	2.1	20.0	2.0	34.0	1.0	10.0	0.0	6.0	0.0	0.0
1975	0.0	5.0	8.0	20.0	11.0	13.0	2.0	0.0	0.0	7.0	0.0	0.0
1976	0.0	5.0	8.0	20.0	5.0	13.0	2.0	0.0	0.0	7.0	0.0	0.0
1977	0.0	5.0	44.0	20.0	11.0	13.0	2.0	0.0	0.0	7.0	0.0	0.0
1978	0.0	5.0	17.0	20.0	15.0	13.0	9.0	16.0	0.0	7.0	0.0	0.0
1979	0.0	5.0	17.0	10.0	11.0	13.0	2.0	19.0	0.0	7.0	0.0	0.0
1980	0.0	5.0	10.0	15.0	15.0	13.0	2.0	11.0	0.0	7.0	0.0	0.0
1981	0.0	5.0	21.0	17.0	22.0	13.0	2.0	17.0	0.0	7.0	0.0	0.0
1982	0.0	5.0	19.0	38.0	11.0	13.0	2.0	14.0	0.0	7.0	0.0	0.0

Appendix 3: Reported landings (t) of commercial fish species at Whangarei, 1931−82. Page 3 of 3. For details see the Introductory Notes to this Appendix.

	Spiny Dogfish	Skates	Stargazers	Red moki	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea perch	Garfish	Mixed species
1931	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
1932	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
1933	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.6
1934	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.3
1935	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9
1936	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
1937	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	50.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5	0.0	0.0	6.2
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	1.1
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.2
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	2.4
1949	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	9.4
1950	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.6	0.1
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.1	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1963	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.8	0.6
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.4
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
1971	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
1972	0.0	1.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
1974	0.0	0.3	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.1	0.1	0.0
1975	0.0	0.3	0.0	0.0	0.0	5.0	0.1	0.0	0.0	5.0	0.1	8.0
1976	0.0	0.3	0.0	0.0	0.0	0.2	0.1	0.0	0.0	15.0	0.1	14.0
1977	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	22.0
1978	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	47.0
1979	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	44.0
1980	0.0	0.3	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.1	39.0
1981	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	63.0
1982	0.0	0.3	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.1	46.0

Appendix 3: Reported landings (t) of commercial fish species at Auckland, 1931−82. Page 1 of 3. For details see the Introductory Notes to this Appendix.

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1931	2,189.7	213.4	5.1	2.6	0.5	0.0	0.0	0.0	62.0	1,201.6	5.3	0.0
1932	2,522.7	531.0	0.0	0.0	0.0	0.0	0.0	0.0	49.7	606.2	0.0	0.0
1933	3,075.6	335.6	21.0	30.5	0.0	0.0	0.0	0.0	46.3	546.9	0.0	0.0
1934	3,476.5	332.8	25.7	29.4	0.0	0.0	0.0	0.0	30.7	726.1	0.0	0.0
1935	4,489.6	384.1	38.9	0.0	0.0	0.0	0.0	0.0	87.5	919.5	0.0	0.0
1936	5,723.2	190.2	86.1	0.0	0.0	0.0	0.0	0.0	104.7	1,319.1	61.4	0.0
1937	4,942.8	252.4	153.8	20.4	0.1	0.0	0.0	0.0	80.0	1,231.4	42.3	0.1
1938	5,448.6	359.9	68.7	42.7	0.3	0.0	0.0	0.0	77.9	1,144.6	29.3	0.0
1939	5,119.0	403.8	79.4	14.2	0.2	0.0	0.0	0.0	39.6	1,065.9	3.4	0.0
1940	4,640.4	638.2	83.3	7.3	0.4	0.0	0.0	0.0	0.5	669.8	1.8	0.0
1941	4,421.2	533.0	69.9	8.0	0.2	0.0	0.0	0.0	0.4	654.4	1.0	0.0
1942	3,739.2	199.0	73.5	6.5	4.3	0.0	0.0	0.0	3.7	836.7	26.2	0.9
1943	3,817.9	295.5	69.1	1.8	1.5	0.0	0.0	0.0	11.9	616.1	19.0	0.0
1944	4,056.2	95.4	162.9	148.1	1.7	0.0	0.0	0.0	10.3	929.1	27.0	3.7
1945	4,150.8	107.4	283.0	167.5	13.4	0.0	7.3	0.0	11.6	1,217.5	31.0	24.9
1946	4,764.8	75.9	374.4	102.4	15.1	0.0	3.4	0.0	25.8	1,411.7	52.4	63.3
1947	5,154.9	165.7	314.9	116.5	0.3	0.0	8.0	0.0	22.9	1,132.1	44.1	66.4
1948	5,634.5	20.3	261.1	235.3	0.1	0.0	0.0	2.0	18.3	865.2	26.7	43.6
1949	4,687.1	19.6	302.2	274.2	1.5	0.0	0.0	0.0	15.1	1,148.3	36.5	0.0
1950	3,824.9	9.1	238.1	353.9	5.7	0.0	0.0	0.0	12.1	1,558.6	57.4	8.4
1951	3,176.0	13.5	126.4	403.2	1.5	0.0	0.0	0.0	0.5	1,718.7	63.8	3.3
1952	3,038.7	16.9	288.7	271.5	1.2	0.0	0.2	0.0	25.8	1,833.0	89.3	2.0
1953	2,877.8	25.9	315.5	272.0	2.6	0.0	0.0	0.0	136.8	1,643.2	60.0	0.4
1954	3,226.3	22.3	288.3	354.9	1.9	0.0	0.0	0.0	161.0	1,492.8	55.1	0.8
1955	3,092.5	9.4	273.1	445.7	1.3	0.0	0.0	0.0	132.7	1,568.4	51.1	0.0
1956	3,177.4	9.6	162.1	419.2	1.3	0.0	0.0	0.0	136.1	1,108.5	50.0	0.0
1957	3,805.6	9.7	196.7	606.8	2.4	0.0	0.0	0.0	73.9	943.0	46.5	0.0
1958	3,776.6	52.2	231.7	639.6	3.5	0.0	0.0	0.0	88.3	781.3	49.1	0.8
1959	4,222.2	14.6	233.5	764.9	5.4	0.0	0.0	0.0	111.4	1,077.6	63.4	6.9
1960	4,216.5	18.8	187.9	877.9	4.7	0.0	0.0	0.0	105.1	856.1	43.5	4.7
1961	3,976.1	17.9	216.8	887.6	3.4	0.0	0.0	0.0	114.4	861.3	42.7	7.6
1962	4,111.2	15.4	205.5	1,137.8	7.4	0.0	0.0	0.0	107.0	586.7	44.8	2.1
1963	4,278.3	17.2	235.6	980.3	8.9	0.0	0.1	0.1	75.6	674.1	55.4	5.0
1964	4,371.6	132.2	500.6	1,006.7	6.9	0.0	0.4	0.0	71.2	506.3	67.1	6.9
1965	4,686.8	143.8	584.8	1,175.5	5.8	0.0	4.7	0.0	65.3	531.0	71.9	35.8
1966	4,688.5	89.0	408.9	926.2	7.3	0.0	2.6	0.0	87.4	345.5	62.8	8.7
1967	4,913.9	87.2	328.3	721.4	3.7	0.0	0.8	0.2	95.6	225.4	44.7	0.3
1968	5,710.0	63.6	321.4	885.0	5.6	0.0	2.9	0.0	114.5	331.3	45.8	2.1
1969	6,559.1	90.7	336.6	775.4	18.5	0.0	3.1	0.1	92.0	213.6	41.3	0.9
1970	6,281.2	55.1	376.1	785.7	18.9	0.0	2.9	0.1	125.4	295.7	47.9	44.7
1971	7,352.9	40.9	325.2	963.3	19.2	0.0	3.3	0.9	101.2	251.9	53.8	104.1
1972	6,368.0	50.9	292.3	995.8	44.9	0.0	8.8	91.5	88.0	321.4	54.2	97.3
1973	5,597.3	52.0	366.7	729.2	52.5	0.0	4.9	7.5	123.1	190.1	52.2	205.4
1974	4,791.0	34.0	231.0	628.0	46.0	0.0	6.0	2.0	192.0	139.0	134.4	243.0
1975	3,728.0	57.0	213.0	613.0	142.0	0.0	75.0	0.0	153.0	169.0	155.0	125.0
1976	4,610.0	68.0	305.0	689.0	86.0	0.0	75.0	0.0	193.0	134.0	199.0	143.0
1977	4,260.0	76.0	370.0	703.0	142.0	0.0	133.0	0.0	151.0	119.0	190.0	117.0
1978	5,254.0	57.0	436.0	737.0	417.0	0.0	80.0	0.0	167.0	230.0	152.0	241.0
1979	5,686.0	57.0	488.0	638.0	142.0	0.0	75.0	0.0	193.0	325.0	192.0	382.0
1980	3,699.0	84.0	349.0	297.0	91.0	0.0	75.0	0.0	216.0	416.0	87.0	238.0
1981	4,060.0	134.0	414.0	410.0	75.0	0.0	75.0	482.0	265.0	347.0	154.0	359.0
1982	3,583.0	114.0	618.0	670.0	137.0	0.0	75.0	863.0	294.0	309.0	205.0	326.0

Appendix 3: Reported landings (t) of commercial fish species at Auckland, 1931−82. Page 2 of 3. For details see the Introductory Notes to this Appendix.

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1931	4.6	0.0	0.0	99.6	0.0	2.4	32.8	0.0	0.0	0.0	5.7	0.0
1932	4.0	0.0	0.0	115.5	0.0	1.1	67.4	0.0	0.0	0.0	5.3	0.0
1933	1.6	0.0	0.0	119.8	0.0	0.4	21.4	0.0	0.0	0.0	7.2	0.0
1934	0.3	0.0	0.0	146.9	0.0	0.1	49.0	0.0	0.0	0.0	3.1	0.0
1935	0.0	0.0	0.0	149.5	0.0	0.0	35.0	0.0	0.0	0.0	10.9	0.0
1936	0.0	0.0	0.0	97.3	0.0	0.0	49.4	0.0	0.0	0.0	1.4	0.0
1937	0.0	0.4	0.0	81.3	0.0	2.1	43.1	0.0	0.0	0.0	1.2	0.0
1938	0.0	0.0	0.0	65.4	0.0	0.5	60.1	0.0	0.0	0.1	0.4	0.0
1939	0.0	0.0	0.0	80.0	0.0	12.5	36.3	0.0	0.0	0.0	0.7	0.0
1940	3.4	0.6	0.0	87.6	0.0	79.5	25.2	0.0	0.2	0.0	1.6	0.0
1941	15.2	0.7	0.0	44.4	0.0	140.9	15.0	0.0	0.1	0.0	1.1	0.0
1942	0.0	0.3	0.0	49.7	0.0	80.7	14.0	0.0	0.1	0.0	2.2	0.0
1943	0.0	0.1	0.0	30.0	0.0	9.3	8.3	0.0	0.0	0.3	1.7	0.0
1944	0.0	0.0	0.0	19.9	0.0	4.3	17.9	0.0	0.0	0.5	1.8	0.0
1945	0.0	6.2	42.2	67.6	0.0	11.0	20.4	0.0	0.0	7.1	5.8	0.0
1946	0.0	4.9	31.6	92.2	0.0	3.9	30.1	0.0	0.0	10.5	4.9	0.0
1947	0.0	0.3	20.3	29.2	0.0	3.0	40.1	0.0	0.0	2.6	4.3	0.0
1948	0.0	0.4	28.6	37.4	14.7	0.7	19.0	0.0	2.6	0.1	2.6	0.0
1949	0.0	3.7	38.2	99.8	14.6	7.8	16.0	0.0	0.0	0.2	34.1	0.0
1950	0.0	15.1	46.6	82.8	7.4	8.6	9.9	0.0	0.0	0.2	1.6	0.0
1951	0.0	4.6	62.6	62.8	0.7	11.3	1.9	0.0	0.0	1.0	1.3	0.0
1952	0.0	0.9	39.8	59.9	6.1	18.2	2.6	0.0	0.0	0.3	2.3	0.0
1953	0.0	1.1	26.1	40.0	6.6	19.6	13.7	0.0	0.0	0.7	2.2	0.0
1954	0.0	1.3	37.3	78.1	6.5	8.9	15.6	0.0	0.0	2.8	1.5	0.0
1955	0.0	0.4	49.9	67.8	4.1	7.2	14.2	0.0	0.0	1.5	0.9	0.0
1956	4.2	0.4	30.1	49.7	0.4	6.6	28.7	0.0	0.0	1.9	0.2	0.0
1957	2.4	0.2	69.0	60.8	0.3	12.4	23.0	0.0	0.0	5.9	0.6	0.0
1958	8.3	0.6	80.4	38.4	0.1	7.3	45.6	0.0	0.0	3.4	0.5	0.0
1959	3.0	1.1	92.9	28.6	0.4	6.0	36.1	0.0	0.0	2.1	0.2	0.0
1960	2.9	0.8	92.1	21.3	0.0	6.8	17.1	0.0	0.0	2.1	0.5	0.0
1961	0.0	1.2	120.1	26.3	0.9	10.8	13.9	0.0	0.0	4.9	0.2	0.0
1962	0.0	0.3	96.6	11.7	0.6	5.7	10.7	0.0	0.0	2.6	0.1	0.0
1963	0.0	3.3	103.7	25.3	2.8	6.5	22.9	0.0	0.0	3.2	0.0	0.0
1964	0.4	0.5	40.3	17.1	2.9	6.8	27.1	0.0	0.4	4.3	0.0	0.0
1965	2.4	4.1	47.7	28.3	15.4	7.4	21.5	0.0	0.2	2.0	0.2	0.0
1966	3.2	0.5	42.1	22.9	16.3	7.3	20.3	0.0	0.0	5.1	0.1	0.0
1967	7.6	0.0	38.4	16.9	4.0	6.9	16.6	0.0	0.0	8.3	0.0	0.0
1968	7.8	0.0	32.0	34.2	19.8	9.8	9.4	0.0	0.1	9.6	0.1	0.0
1969	3.0	0.0	25.5	68.2	0.0	16.5	9.3	0.0	0.2	5.2	0.2	0.0
1970	0.7	0.0	28.1	64.0	17.9	9.3	9.9	0.0	0.2	7.4	0.1	0.0
1971	1.3	0.0	30.2	19.7	29.7	13.5	17.0	0.0	0.0	16.8	0.3	0.0
1972	0.0	0.0	30.1	29.2	19.8	24.0	22.9	0.0	0.4	12.4	0.1	0.0
1973	0.0	2.1	22.4	35.4	18.6	18.5	32.7	0.0	0.4	5.1	0.1	0.0
1974	1.0	8.0	57.8	16.0	31.0	9.0	48.0	0.0	0.2	3.0	0.1	0.0
1975	1.0	42.0	75.0	40.0	17.0	16.0	82.0	0.0	0.2	9.0	0.1	0.0
1976	1.0	42.0	75.0	40.0	17.0	16.0	82.0	0.0	0.2	9.0	0.1	0.0
1977	1.0	42.0	70.0	40.0	17.0	16.0	88.0	0.0	0.2	9.0	0.1	0.0
1978	1.0	42.0	75.0	40.0	17.0	16.0	82.0	0.0	0.2	9.0	0.1	0.0
1979	1.0	42.0	75.0	40.0	17.0	16.0	82.0	0.0	0.2	9.0	0.1	0.0
1980	1.0	76.0	79.0	146.0	17.0	16.0	82.0	0.0	0.2	9.0	0.1	0.0
1981	1.0	42.0	75.0	40.0	17.0	16.0	82.0	0.0	0.2	9.0	0.1	0.0
1982	1.0	42.0	75.0	40.0	17.0	16.0	111.0	0.0	0.2	9.0	0.1	0.0

Appendix 3: Reported landings (t) of commercial fish species at Auckland, 1931−82. Page 3 of 3. For details see the Introductory Notes to this Appendix.

	Spiny dogfish	Skates	Stargazers	Red moki	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea perch	Garfish	Mixed species
1931	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	429.5
1932	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	301.3
1933	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	348.7
1934	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	310.5
1935	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	449.1
1936	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	514.3
1937	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	272.8
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	359.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	165.6
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	116.6
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	169.6
1942	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	6.7	0.0	0.0	293.5
1943	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	22.8	0.0	0.0	369.2
1944	0.0	0.0	0.0	0.0	0.2	0.0	1.0	0.0	22.3	0.0	0.9	140.1
1945	0.0	0.0	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0	4.7	39.5
1946	0.0	0.0	0.0	0.0	0.4	0.6	0.4	0.0	37.8	0.0	1.5	74.8
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	15.8	0.0	0.9	83.1
1948	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.6	38.8
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.3	0.0	2.7	62.3
1950	0.0	0.0	0.0	0.0	2.0	0.3	0.3	0.0	0.0	0.0	1.2	0.8
1951	0.0	0.0	0.0	0.0	1.6	1.4	0.1	0.0	0.1	0.0	3.0	0.3
1952	0.0	0.0	0.0	0.0	17.6	0.3	0.2	0.0	0.0	0.0	5.6	0.0
1953	0.0	0.0	0.0	0.0	28.1	0.4	0.9	0.0	0.0	0.0	4.4	0.0
1954	0.0	0.0	0.0	0.0	11.2	0.2	0.1	0.0	0.3	0.0	5.6	0.7
1955	0.0	0.0	0.0	0.0	35.2	3.3	0.3	0.0	0.0	0.0	7.1	1.6
1956	0.0	0.0	0.0	0.0	8.6	6.1	0.6	0.0	2.7	0.0	6.2	1.7
1957	0.0	0.0	0.0	0.0	44.9	6.5	0.0	0.0	1.2	0.0	1.1	0.5
1958	0.0	0.0	0.0	0.0	42.2	0.0	0.4	0.0	0.9	0.0	0.5	0.0
1959	0.0	0.0	0.0	0.0	5.3	4.0	0.1	0.0	0.7	0.0	2.4	0.1
1960	0.0	0.2	0.0	0.0	0.6	3.8	0.0	0.0	0.3	0.0	3.5	0.1
1961	0.0	0.5	0.0	0.0	2.5	10.4	0.2	0.0	0.0	0.0	1.2	0.0
1962	0.0	1.7	0.0	0.0	3.9	10.4	0.4	0.0	0.0	0.0	2.1	0.0
1963	0.0	0.4	0.0	0.0	1.3	4.7	2.2	0.0	0.0	0.0	0.2	3.5
1964	0.0	0.1	0.0	0.0	4.4	0.3	0.2	0.0	0.0	0.0	0.9	1.0
1965	0.0	0.1	0.0	0.0	1.2	0.6	0.1	0.0	0.4	0.0	0.1	0.6
1966	0.0	0.3	0.0	0.0	0.6	2.1	0.2	0.0	0.0	0.4	0.0	0.1
1967	0.0	2.1	0.0	0.0	0.2	0.6	0.6	0.0	0.0	0.0	0.9	0.1
1968	0.0	0.0	0.0	0.0	0.4	0.0	0.3	0.0	0.0	0.0	0.0	0.2
1969	0.0	0.3	0.0	0.0	0.1	4.7	0.1	0.0	0.0	0.0	0.1	1.2
1970	0.0	2.9	0.0	0.0	0.4	3.7	0.1	0.0	0.0	0.0	0.8	0.3
1971	0.0	2.5	0.0	0.0	0.5	2.0	0.2	0.0	0.0	0.0	1.4	0.1
1972	0.0	2.3	0.0	0.0	0.3	0.0	1.8	0.0	0.1	0.2	1.3	0.0
1973	0.0	0.6	0.0	0.0	1.4	0.0	1.5	0.0	0.0	0.0	1.0	1.7
1974	0.0	2.0	0.0	0.0	2.0	2.0	1.0	0.0	0.0	0.0	0.9	3.0
1975	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	241.0
1976	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	205.0
1977	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	145.0
1978	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	265.0
1979	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	495.0
1980	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	198.0
1981	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	494.0
1982	0.0	2.0	0.0	0.0	0.5	2.0	0.7	0.0	0.0	0.0	0.9	480.0

Appendix 3: Reported landings (t) of commercial fish species at Thames, 1931−82. Page 1 of 3. For details see the Introductory Notes to this Appendix.

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1931	521	367.2	51.0	0.0	0.1	0.0	0.0	0.0	7.7	0.0	22.8	0.0
1932	495	331.0	33.5	0.0	1.4	0.0	0.0	0.0	8.5	0.7	0.0	0.0
1933	530	247.4	43.9	0.1	0.0	0.0	0.0	0.0	9.9	0.0	29.3	0.0
1934	567	242.3	22.8	0.0	0.0	0.0	0.0	0.0	11.1	0.4	32.8	0.0
1935	714	167.9	33.5	0.0	0.0	0.0	0.0	0.0	4.2	0.7	30.7	0.0
1936	577	163.4	26.4	0.0	0.0	0.0	0.0	0.0	0.3	0.0	11.6	0.0
1937	681	203.1	48.5	0.2	1.0	0.0	0.0	0.0	0.1	0.1	14.2	0.0
1938	565	262.0	37.7	4.3	0.0	0.0	0.0	0.0	0.2	0.0	3.0	0.0
1939	719	220.0	35.7	0.1	0.2	0.0	0.0	0.0	0.0	0.0	6.7	0.0
1940	401	271.0	35.7	0.3	0.4	0.0	0.0	0.0	0.0	0.0	11.0	0.0
1941	353	317.4	32.6	2.6	1.6	0.0	0.0	0.0	0.1	0.0	17.4	0.0
1942	260	294.0	47.4	11.5	1.2	0.0	0.0	0.0	0.0	0.0	20.5	0.0
1943	503	284.7	55.6	39.2	10.7	0.0	0.0	0.0	0.0	0.1	21.3	0.0
1944	594	249.0	66.7	48.6	6.7	0.0	0.0	0.0	0.0	0.0	28.7	0.0
1945	529	218.2	59.5	33.8	11.1	0.0	0.0	0.0	0.0	0.0	20.5	0.0
1946	242	194.9	33.4	26.9	5.4	0.0	0.0	0.0	0.0	0.0	12.8	0.0
1947	294	235.9	44.8	19.9	10.2	0.0	0.0	0.0	0.0	0.1	24.0	0.0
1948	444	246.3	104.5	30.5	21.3	0.0	0.0	0.0	0.0	0.0	14.2	0.0
1949	585	225.2	51.9	6.7	8.6	0.0	0.0	0.0	0.0	0.0	13.6	0.0
1950	537	144.0	46.8	27.2	18.0	0.0	0.0	0.0	0.0	0.5	18.4	0.0
1951	588	182.9	63.8	25.1	7.9	0.0	0.0	0.0	0.0	0.6	19.5	0.0
1952	280	202.0	58.7	5.8	8.7	0.0	0.0	0.0	0.0	0.1	10.8	0.0
1953	309	161.0	39.0	26.1	4.1	0.0	0.0	0.0	0.0	0.0	20.4	0.0
1954	305	177.7	52.8	33.8	6.0	0.0	0.0	0.0	0.0	0.0	18.7	0.0
1955	304	224.1	59.7	23.0	10.5	0.0	0.0	0.0	0.0	0.1	10.1	0.0
1956	555	140.7	60.3	27.7	7.5	0.0	0.0	0.0	0.0	0.0	10.5	0.0
1957	471	140.7	74.3	33.8	12.1	0.0	0.0	0.0	0.0	0.0	13.9	0.0
1958	417	112.1	35.8	126.6	17.8	0.0	0.0	0.0	0.0	0.1	10.5	0.0
1959	392	143.3	62.7	86.6	17.5	0.0	0.0	0.0	0.0	0.0	14.4	0.0
1960	344	188.3	47.5	125.9	25.0	0.0	0.0	0.0	0.0	0.0	20.6	0.0
1961	312	138.5	22.7	126.6	28.4	0.0	0.4	0.0	0.0	0.0	14.6	0.0
1962	393	142.3	27.7	109.5	38.1	0.0	0.7	0.0	0.0	0.0	14.0	0.0
1963	412	116.7	23.8	131.9	24.5	0.0	1.1	0.0	0.0	0.0	29.5	0.0
1964	388	93.4	23.0	139.3	20.0	0.0	1.0	0.0	0.0	0.0	30.0	0.0
1965	301	163.0	27.1	152.3	32.6	0.0	0.5	0.0	0.6	0.0	26.5	0.0
1966	389	174.3	30.4	90.8	36.6	0.0	1.1	0.0	0.1	0.1	17.8	0.0
1967	241	249.5	24.2	41.0	27.8	0.0	0.5	0.0	0.6	0.1	10.6	0.0
1968	362	220.7	43.7	80.2	28.9	0.0	0.2	0.0	0.7	0.0	33.5	0.0
1969	294	246.9	38.1	71.8	41.1	0.0	0.1	0.0	0.2	0.2	25.6	0.0
1970	437	131.3	39.0	168.4	61.2	0.0	1.2	0.0	1.6	0.0	24.1	0.0
1971	483	75.0	25.7	89.2	48.4	0.0	0.9	0.0	2.2	0.2	25.0	0.0
1972	273	102.7	6.4	113.3	41.8	0.0	0.1	0.0	0.5	0.1	15.4	0.0
1973	323	62.9	6.6	273.2	25.5	0.0	0.5	0.0	1.0	0.1	26.2	0.0
1974	294	100.0	4.0	241.0	42.0	0.0	2.0	0.0	1.0	0.0	32.9	0.0
1975	260	71.0	23.0	180.0	27.0	0.0	0.5	0.0	1.0	0.1	52.0	0.0
1976	239	87.0	23.0	164.0	54.0	0.0	0.5	0.0	1.0	0.1	76.0	0.0
1977	370	88.0	23.0	177.0	49.0	0.0	0.5	0.0	1.0	0.1	92.0	0.0
1978	534	87.0	23.0	164.0	37.0	0.0	0.5	0.0	1.0	0.1	69.0	0.0
1979	308	133.0	23.0	91.0	28.0	0.0	0.5	0.0	1.0	0.1	70.0	0.0
1980	178	203.0	23.0	35.0	37.0	0.0	0.5	0.0	1.0	0.1	89.0	0.0
1981	124	373.0	23.0	27.0	30.0	0.0	0.5	0.0	1.0	0.1	85.0	0.0
1982	165	223.0	23.0	50.0	77.0	0.0	0.5	0.0	1.0	0.1	128.0	0.0

Appendix 3: Reported landings (t) of commercial fish species at Thames, 1931−82. Page 2 of 3. For details see the Introductory Notes to this Appendix.

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1931	0.0	0.0	0.0	0.0	0.0	0.3	2.4	0.0	0.0	0.0	0.0	0.0
1932	0.0	0.0	0.0	0.3	0.0	0.3	2.0	0.0	30.4	0.0	0.1	0.0
1933	0.0	0.0	0.0	0.2	0.0	0.5	5.2	0.0	0.0	0.0	0.0	0.0
1934	0.0	0.0	0.0	0.3	0.0	0.0	1.2	0.0	0.0	0.0	0.2	0.0
1935	0.0	0.0	0.0	0.4	0.0	0.0	1.1	0.0	0.0	0.0	0.2	0.0
1936	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
1937	0.0	0.0	0.0	0.1	0.0	0.2	0.4	0.0	0.0	0.0	0.1	0.0
1938	0.0	0.0	0.0	0.0	0.0	0.1	1.3	0.0	0.1	0.0	0.0	0.0
1939	0.0	0.2	0.0	0.0	0.0	0.0	1.3	0.0	2.3	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.1	0.0	0.1	1.2	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.1	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0
1945	0.0	0.0	0.0	0.5	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.1	0.2	0.1	0.0	0.2	0.1	0.0	0.0	25.6	0.1	0.0
1947	0.0	0.0	0.9	0.2	0.0	0.1	0.1	0.0	0.0	7.1	0.1	0.0
1948	0.0	0.9	0.7	0.5	0.0	0.5	0.0	0.0	0.1	0.8	0.3	0.0
1949	0.0	0.0	1.6	0.0	0.0	1.2	0.0	0.0	0.0	0.4	0.1	0.0
1950	0.0	0.0	0.3	0.1	0.0	1.8	1.2	0.0	0.0	0.7	0.4	0.0
1951	0.0	0.0	1.3	0.0	0.0	1.3	0.3	0.0	0.0	0.9	0.1	0.0
1952	0.0	0.0	0.8	0.0	0.0	0.4	0.3	0.0	0.0	2.0	0.1	0.0
1953	0.0	0.0	1.0	0.0	0.0	0.2	0.2	0.0	0.0	0.4	0.4	0.0
1954	0.0	0.0	0.5	0.0	0.0	0.3	0.0	0.0	0.0	1.2	0.0	0.0
1955	0.0	0.0	0.5	0.1	0.0	0.0	0.1	0.0	0.0	1.3	0.0	0.0
1956	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
1957	0.0	0.0	2.0	0.0	0.0	0.1	0.4	0.0	0.0	3.4	0.0	0.0
1958	0.0	0.0	2.8	0.0	0.0	0.1	0.1	0.0	0.0	9.6	0.0	0.0
1959	0.0	0.0	2.3	0.0	0.0	0.1	0.0	0.0	0.0	2.7	0.1	0.0
1960	0.0	0.0	4.4	0.0	0.0	0.1	0.3	0.0	0.0	1.3	0.0	0.0
1961	0.0	0.0	7.2	0.0	0.0	0.1	1.1	0.0	0.0	1.9	0.0	0.0
1962	0.0	0.0	3.6	0.0	0.0	0.1	2.1	0.0	0.0	5.2	0.0	0.0
1963	0.0	0.0	5.4	0.0	0.0	0.1	1.5	0.0	0.0	3.0	0.0	0.0
1964	0.0	0.0	7.8	0.0	0.0	0.1	0.9	0.0	0.0	9.8	0.0	0.0
1965	0.0	0.0	6.9	0.0	0.0	0.2	0.0	0.0	0.0	3.8	0.0	0.0
1966	0.0	0.0	5.2	0.0	0.0	1.3	0.1	0.0	0.0	4.9	0.4	0.0
1967	0.0	0.0	11.3	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
1968	0.0	0.0	6.5	0.0	0.0	0.2	0.2	0.0	0.0	1.2	0.0	0.0
1969	0.0	0.0	10.7	0.0	23.6	0.7	0.5	0.0	0.0	2.2	0.0	0.0
1970	0.0	0.0	7.0	0.1	0.0	0.6	4.1	0.0	0.0	1.5	0.0	0.0
1971	0.0	0.0	3.0	0.0	0.0	0.4	0.5	0.0	0.0	0.2	0.0	0.0
1972	0.0	0.0	7.3	0.0	0.0	1.1	3.0	0.0	0.0	2.7	0.0	0.0
1973	0.0	0.0	11.2	0.0	0.1	0.5	1.1	0.0	0.0	3.3	0.0	0.0
1974	0.0	0.0	14.1	0.0	5.0	0.6	2.0	0.0	0.0	3.0	0.0	0.0
1975	0.0	0.0	12.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0
1976	0.0	0.0	27.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0
1977	0.0	0.0	20.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0
1978	0.0	0.0	18.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0
1979	0.0	0.0	18.0	0.0	5.0	0.6	8.0	0.0	0.0	2.0	0.0	0.0
1980	0.0	0.0	7.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0
1981	0.0	0.0	18.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0
1982	0.0	0.0	25.0	0.0	5.0	0.6	2.0	0.0	0.0	2.0	0.0	0.0

Appendix 3: Reported landings (t) of commercial fish species at Thames, 1931−82. Page 3 of 3. For details see the Introductory Notes to this Appendix.

	Spiny dogfish	Skates	Stargazers	Red moki	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea perch	Garfish	Mixed species
1931	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	109.6
1932	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8
1933	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	17.8
1934	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7
1935	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.4
1936	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	5.7
1937	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.6
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.1
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
1946	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.0	8.1
1947	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.6	0.0	0.0	18.6
1948	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	4.8
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.3	0.0	0.0	0.1
1951	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.1
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.1	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	0.1	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0
1961	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1
1962	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.3
1969	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1974	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	26.0
1976	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	30.0
1977	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	34.0
1978	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	15.0
1979	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	38.0
1980	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	44.0
1981	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	55.0
1982	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	41.0

Appendix 3: Reported landings (t) of commercial fish species at Coromandel, 1946−82. Page 1 of 3. For details see the Introductory Notes to this Appendix.

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1946	7.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	1.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	5.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	6.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	4.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1951	17.6	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
1952	48.0	0.1	0.3	2.8	0.5	0.0	0.0	0.0	0.0	0.0	0.7	0.0
1953	1.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	4.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	10.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	27.2	0.1	0.6	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	26.2	0.2	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	20.2	0.1	0.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0
1961	19.7	0.1	0.3	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	51.5	1.1	2.1	7.1	2.2	0.0	0.0	0.0	0.0	0.0	1.1	0.0
1963	58.7	1.2	4.1	5.0	2.9	0.0	0.0	0.0	0.0	0.0	0.6	0.0
1964	74.0	0.1	3.1	35.3	12.2	0.0	0.0	0.0	0.0	0.0	1.3	0.0
1965	46.2	0.7	2.7	10.8	5.6	0.0	0.0	0.0	0.0	0.0	1.3	0.0
1966	46.3	1.3	1.8	20.4	0.9	0.0	0.0	0.0	0.0	0.1	1.0	0.0
1967	33.7	1.1	1.8	16.7	1.0	0.0	0.0	0.0	0.0	1.1	1.8	0.0
1968	38.7	1.6	1.9	23.3	2.6	0.0	0.0	0.0	0.4	0.0	1.1	0.0
1969	214.1	2.2	7.0	17.1	2.9	0.0	0.0	0.0	1.3	0.0	0.8	0.0
1970	676.9	1.0	20.3	23.7	0.6	0.0	0.0	0.0	4.6	0.0	1.6	0.0
1971	568.4	1.4	12.4	13.1	0.4	0.0	0.0	0.0	4.6	0.2	2.8	0.0
1972	317.5	1.6	4.0	6.3	0.5	0.0	0.0	0.0	2.8	0.2	2.0	0.0
1973	464.8	1.4	5.5	17.8	3.6	0.0	0.0	0.0	2.5	0.3	1.4	0.0
1974	145.0	0.0	6.0	26.0	3.0	0.0	0.0	0.0	3.0	0.1	4.0	0.0
1975	185.0	0.0	3.0	22.0	3.0	0.0	0.0	0.0	3.0	0.1	4.0	0.0
1976	164.0	10.0	7.0	37.0	7.0	0.0	0.0	0.0	3.0	0.1	4.0	0.0
1977	485.0	8.0	20.0	71.0	13.0	0.0	0.0	0.0	6.0	0.1	4.0	0.0
1978	498.0	8.0	7.0	70.0	10.0	0.0	0.0	0.0	6.0	0.1	6.0	0.0
1979	393.0	6.0	8.0	14.0	27.0	0.0	0.0	0.0	6.0	0.1	4.0	0.0
1980	380.0	28.0	10.0	8.0	68.0	0.0	0.0	0.0	9.0	0.1	4.0	0.0
1981	616.0	35.0	11.0	9.0	9.0	0.0	0.0	0.0	13.0	0.1	13.0	0.0
1982	568.0	14.0	17.0	20.0	105.0	0.0	0.0	0.0	10.0	0.1	4.0	0.0

Appendix 3: Reported landings (t) of commercial fish species at Coromandel, 1946−82. Page 2 of 3. For details see the Introductory Notes to this Appendix.

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1946	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.0
1952	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.1	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1955	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
1957	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.1	0.2	0.0	0.2	0.0	0.0	0.0	0.5	0.0	0.0
1959	0.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.4	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0
1961	0.0	0.0	0.3	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.0	0.0
1962	0.0	0.0	2.3	0.0	0.0	0.4	1.3	0.0	0.0	1.3	0.0	0.0
1963	0.0	0.0	1.4	0.2	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0
1964	0.0	0.0	24.0	0.1	0.0	1.3	0.2	0.0	0.0	11.3	0.1	0.0
1965	0.0	0.0	0.4	0.0	0.0	0.2	0.3	0.0	0.0	10.4	0.1	0.0
1966	0.0	0.0	1.6	0.0	0.0	0.6	2.1	0.0	0.0	5.9	0.1	0.0
1967	0.0	0.0	0.4	0.2	0.0	0.5	0.5	0.0	0.0	1.9	0.2	0.0
1968	0.0	0.0	1.7	0.0	0.0	0.4	0.3	0.0	0.0	4.1	0.1	0.0
1969	0.0	0.0	0.5	0.0	0.0	1.5	0.4	0.0	0.0	6.5	0.0	0.0
1970	0.0	0.0	0.2	0.0	0.0	2.1	0.1	0.0	0.0	5.5	0.0	0.0
1971	0.0	0.0	0.2	0.0	0.0	1.5	0.0	0.0	0.0	1.3	0.0	0.0
1972	0.0	0.0	0.2	0.0	0.0	1.0	0.1	0.0	0.0	1.9	0.0	0.0
1973	0.0	0.0	2.1	0.2	0.0	0.5	0.0	0.0	0.0	1.2	0.0	0.0
1974	0.0	0.0	2.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0
1975	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1976	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1977	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1978	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1979	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1980	0.0	0.0	1.0	8.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1981	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0
1982	0.0	0.0	1.0	1.0	0.0	1.0	0.1	0.0	0.0	3.0	0.0	0.0

Appendix 3: Reported landings (t) of commercial fish species at Coromandel, 1946−82. Page 3 of 3. For details see the Introductory Notes to this Appendix.

	Spiny dogfish	Skates	Stargazers	Red moki	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea perch	Garfish	Mixed species
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0	0.0	0.0	0.1
1949	0.0	0.0	0.0	0.0	0.0	40.5	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	17.5	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.6	0.0	0.0	0.1	4.4	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.5	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0
1970	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.6	0.0	0.0	0.1
1974	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0
1975	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	5.0
1976	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	3.0
1977	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	10.0
1978	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	12.0
1979	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	8.0
1980	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	8.0
1981	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	14.0
1982	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	18.0

Appendix 3: Reported landings (t) of commercial fish species at Mercury Bay/Whitianga, 1931−82. Page 1 of 3. For details see the Introductory Notes to this Appendix.

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1931	299.3	2.1	9.3	0.0	0.0	0.0	0.0	0.0	0.0	25.1	0.0	0.0
1932	168.6	2.2	7.4	0.0	0.0	0.0	0.0	0.0	0.0	13.3	0.0	0.1
1933	66.4	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
1934	121.5	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0
1935	103.1	0.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	9.4	0.0	0.0
1936	75.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.2
1937	58.0	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0
1938	54.3	1.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.2
1939	30.1	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
1940	19.5	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
1941	2.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	7.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1943	10.9	2.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	38.9	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.6	1.2	0.0
1947	30.9	0.3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	7.3	2.4	0.0
1948	49.8	0.3	0.1	0.0	0.3	0.0	0.0	0.0	0.0	1.4	5.8	0.0
1949	57.5	0.3	0.2	0.3	0.3	0.0	0.0	0.0	0.0	5.6	1.6	0.1
1950	62.2	0.4	0.0	0.3	0.1	0.0	0.0	0.0	0.0	3.6	1.0	0.0
1951	51.6	0.2	0.0	0.2	0.1	0.0	0.0	0.0	0.0	3.1	0.4	0.0
1952	40.7	0.4	0.3	1.9	0.1	0.0	0.0	0.0	0.0	4.3	0.8	0.0
1953	60.9	0.5	0.1	0.1	0.2	0.0	0.0	0.0	0.0	4.9	0.2	0.0
1954	118.4	0.7	0.3	0.4	0.6	0.0	0.0	0.0	0.0	8.5	0.0	0.0
1955	161.1	1.0	1.0	1.2	0.7	0.0	0.0	0.0	0.0	7.0	0.0	0.0
1956	155.5	0.7	1.4	1.3	0.5	0.0	0.0	0.0	0.0	3.6	0.0	0.0
1957	154.0	0.5	1.3	0.3	0.6	0.0	0.0	0.0	0.0	7.8	0.0	0.0
1958	123.2	0.6	1.5	0.3	0.8	0.0	0.0	0.0	0.0	3.6	0.0	0.0
1959	161.7	0.9	2.1	0.5	1.6	0.0	0.0	0.0	0.0	2.0	0.0	0.0
1960	121.7	0.3	1.6	0.6	2.2	0.0	0.0	0.0	0.0	3.2	0.0	0.0
1961	113.7	0.4	1.5	1.1	1.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
1962	158.0	0.6	1.1	1.7	1.1	0.0	0.1	0.0	0.0	1.4	0.1	0.0
1963	153.4	0.6	1.0	2.2	2.5	0.0	0.1	1.2	0.0	2.3	0.2	0.0
1964	68.3	0.2	2.1	1.4	1.0	0.0	0.1	0.1	0.0	6.4	0.4	0.0
1965	70.4	1.2	2.9	5.4	1.6	0.0	0.1	0.1	0.3	6.0	1.1	0.1
1966	97.6	1.3	7.5	4.2	4.7	0.0	0.0	0.0	0.1	3.8	0.3	0.2
1967	77.2	0.7	4.8	3.6	0.8	0.0	0.0	0.2	0.2	4.4	0.2	0.0
1968	67.4	1.0	1.3	8.5	0.8	0.0	0.0	38.3	0.2	3.3	0.3	0.0
1969	37.0	0.8	0.1	3.7	6.7	0.0	0.0	5.9	0.0	1.2	0.1	0.0
1970	165.9	0.2	7.9	19.6	0.2	0.0	0.0	0.0	5.9	9.4	0.0	0.5
1971	312.3	0.3	10.5	60.0	0.1	0.0	0.0	0.1	7.3	21.2	0.3	0.0
1972	326.3	0.5	6.5	39.9	0.3	0.0	0.0	3.8	5.9	7.6	0.1	7.8
1973	255.7	0.1	14.3	30.7	30.0	0.0	10.0	13.1	10.4	20.2	1.9	6.4
1974	212.0	0.0	12.0	102.0	92.0	2.0	338.0	56.0	14.0	9.0	1.4	61.0
1975	125.0	0.0	9.0	24.0	22.0	8.0	65.0	5.0	7.0	6.0	8.0	70.0
1976	168.0	0.0	14.0	67.0	18.0	13.0	160.0	0.0	12.0	24.0	8.0	70.0
1977	240.0	0.0	18.0	128.0	13.0	0.0	97.0	0.0	11.0	75.0	8.0	70.0
1978	587.0	0.0	35.0	168.0	26.0	0.0	506.0	0.0	25.0	150.0	8.0	22.0
1979	545.0	0.0	64.0	87.0	131.0	0.0	139.0	0.0	53.0	209.0	8.0	174.0
1980	394.0	0.0	53.0	76.0	54.0	0.0	200.0	0.0	51.0	294.0	23.0	102.0
1981	336.0	0.0	49.0	34.0	10.0	0.0	200.0	0.0	35.0	125.0	26.0	30.0
1982	362.0	0.0	55.0	42.0	117.0	0.0	200.0	16.0	28.0	61.0	11.0	24.0

Appendix 3: Reported landings (t) of commercial fish species at Mercury Bay/Whitianga, 1931−82. Page 2 of 3. For details see the Introductory Notes to this Appendix.

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1931	0.0	0.0	0.0	28.8	0.0	1.2	0.4	0.0	0.0	0.0	9.2	0.0
1932	0.0	0.0	0.0	16.2	0.0	0.4	0.5	0.0	0.0	0.0	4.1	0.0
1933	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
1934	0.0	0.0	0.0	4.5	0.0	0.0	0.2	0.0	0.0	0.0	3.0	0.0
1935	0.0	0.0	0.0	9.9	0.0	0.0	0.2	0.0	0.0	0.0	4.2	0.0
1936	0.0	0.0	0.0	5.2	0.0	0.0	0.4	0.0	0.0	0.0	1.2	0.0
1937	0.0	0.0	0.0	3.4	0.0	0.6	1.3	0.0	0.0	0.0	0.8	0.0
1938	0.0	0.0	0.0	5.8	0.0	0.6	3.5	0.0	0.0	0.0	0.7	0.0
1939	0.0	0.0	0.0	8.8	0.0	0.9	1.5	0.0	0.0	0.0	0.3	0.0
1940	0.0	0.0	0.0	10.8	0.0	0.4	0.0	0.0	0.0	0.0	0.6	0.0
1941	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
1942	0.0	0.0	0.0	2.5	0.0	0.1	0.2	0.0	0.0	0.0	0.6	0.0
1943	0.0	0.0	0.0	5.3	0.0	0.3	0.2	0.0	0.0	0.0	0.9	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	1.2	7.5	0.0	0.3	0.0	0.0	0.0	0.1	4.5	0.0
1947	0.0	0.0	2.0	6.8	0.0	0.2	0.0	0.0	0.0	0.0	2.0	0.0
1948	0.0	0.0	0.6	4.2	0.0	0.1	0.0	0.0	0.0	0.0	1.3	0.0
1949	0.0	0.0	2.3	15.0	0.0	1.0	0.0	0.0	0.0	0.0	1.2	0.0
1950	0.0	0.0	0.5	6.5	0.0	2.0	0.0	0.0	0.0	0.0	1.3	0.0
1951	0.0	0.0	0.4	6.6	0.0	1.8	0.0	0.0	0.0	0.0	0.7	0.0
1952	0.0	0.0	0.3	6.8	0.0	1.2	0.1	0.0	0.0	2.7	1.6	0.0
1953	0.0	0.0	0.2	10.9	0.0	2.8	0.2	0.0	0.0	0.7	2.5	0.0
1954	0.0	0.0	0.6	7.0	0.0	1.6	0.3	0.0	0.0	0.3	2.0	0.0
1955	0.0	0.0	0.5	6.7	0.0	1.4	0.1	0.0	0.0	0.8	1.9	0.0
1956	0.0	0.0	0.5	5.9	0.0	1.1	0.0	0.0	0.0	0.0	0.1	0.0
1957	0.0	0.0	0.4	10.4	0.0	1.0	0.0	0.0	0.0	0.6	0.7	0.0
1958	0.0	0.0	0.4	7.8	0.0	0.9	0.0	0.0	0.0	0.1	0.8	0.0
1959	0.0	0.0	0.2	9.4	0.0	0.9	0.4	0.0	0.0	0.3	0.7	0.0
1960	0.0	0.0	0.0	4.4	0.0	0.3	0.8	0.0	0.0	0.8	0.4	0.0
1961	0.0	0.0	0.2	6.5	0.0	0.4	0.2	0.0	0.0	0.1	0.2	0.0
1962	0.0	0.0	1.5	5.3	0.0	0.5	0.0	0.0	0.0	4.1	0.5	0.0
1963	0.0	0.0	0.9	7.8	0.0	0.6	0.4	0.0	0.0	4.3	0.7	0.0
1964	0.0	0.0	0.5	7.9	0.0	0.6	0.3	0.0	0.0	3.5	0.6	0.0
1965	0.0	0.0	2.4	9.1	0.1	0.3	0.0	0.0	0.0	5.4	0.3	0.0
1966	0.0	0.1	1.5	8.4	0.1	0.5	0.0	0.0	0.0	5.2	0.0	0.0
1967	0.0	0.0	3.2	24.4	0.1	0.4	0.1	0.0	0.0	3.5	0.3	0.0
1968	0.0	0.0	1.5	8.7	0.0	0.5	0.0	0.0	0.0	5.8	0.1	0.0
1969	0.0	0.0	4.2	8.0	0.0	0.5	0.1	0.0	0.0	6.0	0.1	0.0
1970	0.0	0.0	3.5	6.2	2.0	0.6	0.0	0.0	0.0	1.0	0.1	0.0
1971	0.0	0.0	4.4	5.6	6.1	1.6	0.0	0.0	0.0	0.1	0.2	0.0
1972	0.0	0.0	2.1	3.1	5.1	12.8	0.0	0.0	0.0	1.2	0.1	0.0
1973	0.4	0.1	0.8	4.6	4.6	78.8	0.0	0.0	0.0	0.2	0.0	0.0
1974	17.0	34.0	0.6	3.0	4.0	34.0	1.0	0.0	0.0	2.0	0.1	0.0
1975	0.0	28.0	6.0	20.0	15.0	30.0	0.0	0.0	0.0	4.0	0.1	0.0
1976	6.0	0.0	48.0	20.0	15.0	18.0	0.0	0.0	0.0	7.0	0.1	0.0
1977	20.0	28.0	119.0	11.0	15.0	21.0	0.0	0.0	0.0	5.0	0.1	0.0
1978	4.0	28.0	45.0	23.0	22.0	95.0	0.0	50.0	0.0	5.0	0.1	0.0
1979	4.0	28.0	45.0	20.0	19.0	31.0	0.0	13.0	0.0	5.0	0.1	0.0
1980	0.0	51.0	13.0	85.0	16.0	13.0	0.0	13.0	0.0	5.0	0.1	0.0
1981	0.0	28.0	20.0	47.0	15.0	15.0	0.0	13.0	0.0	5.0	0.1	0.0
1982	0.0	28.0	65.0	20.0	15.0	16.0	0.0	16.0	0.0	5.0	0.1	0.0

Appendix 3: Reported landings (t) of commercial fish species at Mercury Bay/Whitianga, 1931−82. Page 3 of 3. For details see the Introductory Notes to this Appendix.

	Spiny dogfish	Skates	Stargazers	Red moki	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea perch	Garfish	Mixed species
1931	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.1
1932	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1933	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
1934	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1935	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1936	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
1937	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
1938	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.2
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.2
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	1.2
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5
1953	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	1.1	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1956	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1957	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.5	0.1
1965	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.4	1.7
1966	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.8
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0
1968	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.2	0.0	0.1	0.2
1970	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	5.5	0.0
1971	0.0	0.0	0.0	0.0	0.8	0.0	0.1	0.0	0.0	0.0	3.2	0.0
1972	0.0	0.0	0.0	0.0	0.9	0.0	0.1	0.0	0.1	0.0	0.5	0.1
1973	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	2.3	0.6
1974	0.0	0.0	0.0	0.0	1.0	0.0	15.0	0.0	0.1	0.0	2.0	0.0
1975	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.1	0.0	2.0	13.0
1976	0.0	0.0	0.0	0.0	6.0	0.0	0.1	0.0	0.1	0.0	2.0	28.0
1977	0.0	0.0	0.0	0.0	9.0	0.0	0.1	0.0	0.1	0.0	2.0	53.0
1978	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.1	0.0	2.0	91.0
1979	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.1	0.0	2.0	84.0
1980	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.1	0.0	2.0	73.0
1981	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.1	0.0	2.0	78.0
1982	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.1	0.0	2.0	63.0

8.4 Appendix 4 Landings 1931–2006

Landings (t) of commercial fish species from the extended Hauraki Gulf region defined in this study (see text), 1931−2006.

Data to 1982 are based on landings at Hauraki Gulf ports, either total landings or a proportion of landings (see text, Methods). Data from 1982 are based on reported area of capture. The sequences of species follows that in the text, and Appendix 3.

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1931	2,197	557	52	2	0	0	0	0	56	864	20	0
1932	2,317	826	33	0	1	0	0	0	47	434	0	0
1933	2,686	561	52	21	0	0	0	0	45	387	21	0
1934	3,005	552	39	21	0	0	0	0	33	515	23	0
1935	3,744	521	59	0	0	0	0	0	73	651	22	0
1936	4,499	334	90	0	0	0	0	0	84	928	51	0
1937	4,007	431	162	16	1	0	0	0	64	866	40	0
1938	4,273	586	85	34	0	0	0	0	62	802	23	0
1939	4,137	589	92	11	0	0	0	0	32	746	7	0
1940	3,574	860	95	6	1	0	0	0	0	470	9	0
1941	3,360	803	82	9	1	0	0	0	0	458	13	0
1942	2,834	469	97	23	4	0	0	0	3	586	33	1
1943	3,079	549	100	68	17	0	0	0	10	431	28	0
1944	3,303	345	184	193	29	0	0	0	8	650	39	2
1945	3,306	326	274	155	22	0	5	0	9	852	36	15
1946	3,563	272	326	116	18	0	2	0	21	993	47	38
1947	3,873	404	288	121	9	0	6	0	18	801	49	40
1948	4,405	269	293	207	15	0	0	2	15	611	33	26
1949	3,886	247	284	204	8	0	0	0	12	810	37	0
1950	3,244	156	230	276	17	0	0	0	10	1,104	58	5
1951	2,756	198	153	306	7	0	0	0	0	1,206	60	2
1952	2,428	221	278	199	7	0	0	0	21	1,286	71	1
1953	2,337	191	285	229	6	0	0	0	109	1,154	58	0
1954	2,664	205	275	284	6	0	0	0	129	1,051	52	0
1955	2,658	235	267	333	9	0	0	0	106	1,103	43	0
1956	2,892	152	182	323	7	0	0	0	109	780	43	0
1957	3,255	151	221	460	11	0	0	0	59	666	42	0
1958	3,160	166	218	544	16	0	0	0	71	550	42	0
1959	3,465	160	240	598	18	0	0	0	89	756	55	4
1960	3,388	208	191	708	23	0	0	0	84	602	45	3
1961	3,165	159	194	715	24	0	0	1	91	605	40	5
1962	3,378	164	189	883	35	0	0	0	86	412	42	1
1963	3,492	142	212	794	28	0	1	1	61	474	60	3
1964	3,474	234	423	831	29	0	1	0	57	359	69	4
1965	3,614	320	494	945	32	0	4	0	53	376	71	22
1966	3,700	276	359	740	36	0	3	0	70	246	59	5
1967	3,773	346	288	552	24	0	1	0	78	165	41	0
1968	4,406	294	295	703	27	0	2	38	93	235	57	1
1969	5,039	356	307	612	49	0	2	6	76	152	49	1

	Snapper	Flatfish	Gurnard	Trevally	Kahawai	Blue mackerel	Jack mackerels	Tunas	John dory	Tarakihi	Rig	Barracouta
1970	5,375	198	356	705	57	0	3	0	111	214	52	27
1971	6,242	125	302	797	48	0	3	1	95	198	58	68
1972	5,318	183	257	818	62	0	6	48	81	235	51	63
1973	4,920	137	330	750	79	0	41	11	118	153	55	138
1974	4,003	143	213	727	132	0	245	29	174	108	114	200
1975	3,172	82	187	598	36	8	46	0	134	128	145	80
1976	3,874	184	279	683	116	13	112	0	178	117	201	92
1977	3,994	209	370	787	53	0	161	0	148	155	197	83
1978	5,207	132	418	865	343	0	410	0	176	282	159	158
1979	5,275	174	470	627	111	0	97	0	223	393	191	334
1980	3,729	335	353	334	175	0	0	0	255	531	139	211
1981	4,035	563	447	441	87	0	0	0	291	356	213	233
1982	3,621	369	616	594	313	0	0	0	290	284	241	219
1983	5,129	559	1,024	1,404	984	748	958	407	357	470	409	766
1984	5,640	550	785	1,158	1,805	261	2,020	461	415	528	375	483
1985	5,472	363	568	1,567	1,494	715	684	119	375	372	432	351
1986	4,200	233	469	727	1,506	713	1,265	614	315	375	321	217
1987	2,851	235	346	412	1,878	1,431	1,293	558	186	176	229	386
1988	3,358	306	407	459	2,911	2,192	1,499	580	253	292	324	279
1989	3,843	349	371	338	1,472	1,312	1,440	580	256	251	423	176
1990	3,490	340	358	407	738	1,063	839	477	239	254	629	172
1991	4,225	552	485	402	673	3,899	2,160	672	302	283	359	169
1992	4,422	495	559	319	1,077	1,691	3,193	99	317	411	375	337
1993	3,858	676	448	515	1,080	1,166	2,491	23	352	347	295	201
1994	3,400	715	273	371	753	1,454	1,660	199	417	320	307	212
1995	2,822	399	201	333	534	1,509	1,781	79	369	257	287	161
1996	3,107	273	209	263	694	2,028	2,640	215	343	240	212	296
1997	2,977	365	227	302	572	1,185	2,331	300	312	200	187	274
1998	2,993	226	265	294	476	1,583	3,129	428	319	223	195	369
1999	2,990	276	231	472	600	691	1,016	359	331	244	181	280
2000	2,951	231	295	319	627	2,746	1,170	618	262	231	215	129
2001	2,693	245	264	520	559	2,292	2,952	154	227	209	166	77
2002	2,907	186	257	256	497	2,692	1,579	327	219	287	162	93
2003	2,567	306	208	238	771	1,230	2,510	188	242	210	132	53
2004	2,605	346	304	418	234	2,206	3,188	76	240	245	116	68
2005	2,638	552	351	353	439	942	4,004	319	264	303	105	57
2006	2,500	481	316	206	313	3,039	2,825	89	345	341	97	108

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey Mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1931	5	0	0	100	0	5	28	0	0	0	23	0
1932	4	0	0	102	0	1	44	0	30	0	9	0
1933	2	0	0	103	0	1	23	0	0	0	20	0
1934	0	0	0	118	0	0	36	0	0	0	15	0
1935	0	0	0	116	0	0	24	0	0	0	14	0
1936	0	0	0	73	0	0	30	0	0	0	2	0
1937	0	0	0	60	0	2	26	0	0	0	2	0
1938	0	0	0	52	0	1	39	0	0	0	1	0
1939	0	0	0	65	0	11	24	0	2	0	1	0
1940	3	0	0	71	0	64	17	0	0	0	2	0
1941	15	0	0	33	0	113	10	0	0	0	1	0
1942	0	0	0	40	0	65	11	0	0	3	2	0
1943	0	0	0	27	0	9	5	0	0	3	3	0
1944	0	0	0	17	0	7	20	0	0	9	2	0
1945	0	4	33	53	0	9	21	0	0	11	5	0
1946	0	3	32	77	0	4	33	0	0	43	9	0
1947	0	0	18	27	0	3	41	0	0	12	6	0
1948	0	1	26	34	12	1	20	0	8	1	4	0
1949	0	2	40	86	12	8	17	0	0	1	32	0
1950	0	9	37	71	6	11	12	0	0	1	3	0
1951	0	3	49	51	1	12	2	0	0	2	2	0
1952	0	1	34	50	5	18	3	0	0	7	4	0
1953	0	1	19	42	5	20	17	0	0	2	5	0
1954	0	1	28	73	5	10	19	0	0	5	4	0
1955	0	0	44	58	3	8	17	0	0	5	3	0
1956	4	0	25	42	0	6	33	0	0	3	1	0
1957	2	0	59	57	0	11	25	0	0	10	1	0
1958	8	0	65	44	0	7	49	0	0	14	1	0
1959	3	1	71	35	0	6	50	0	0	5	1	0
1960	3	0	73	23	0	6	30	0	0	4	1	0
1961	0	1	95	32	1	9	20	0	0	10	0	0
1962	0	0	78	18	0	5	16	0	0	21	0	0
1963	0	2	82	28	2	6	27	0	0	16	1	0
1964	0	0	54	25	2	7	31	0	0	41	1	0
1965	2	2	45	31	12	6	24	0	0	29	1	0
1966	3	0	39	26	13	8	28	0	0	28	1	0
1967	8	0	39	39	3	6	19	0	0	15	0	0
1968	8	0	30	32	16	9	11	0	0	23	0	0
1969	3	0	29	55	19	15	12	0	0	24	0	0

	Pilchard	Gemfish	School shark	Gropers	Leatherjacket	Kingfish	Grey Mullet	Porae	Red cod	Parore	Blue cod	Red snapper
1970	1	0	28	50	16	10	15	0	0	22	0	0
1971	1	0	29	20	29	14	19	0	0	28	0	0
1972	0	0	31	25	20	32	29	0	1	25	0	0
1973	0	1	29	31	19	100	35	0	0	14	0	0
1974	17	41	61	19	30	62	53	0	0	13	0	0
1975	0	0	55	43	0	4	70	0	0	4	0	0
1976	6	0	102	43	4	14	80	0	0	7	0	0
1977	20	0	179	38	9	17	88	0	0	0	0	0
1978	0	0	0	46	30	76	95	53	0	0	0	0
1979	0	0	0	43	24	25	110	15	0	0	0	0
1980	0	76	78	108	25	10	90	9	0	0	0	0
1981	0	17	95	68	18	12	90	24	0	0	0	0
1982	0	0	130	64	9	13	111	24	0	0	0	0
1983	0	180	297	256	91	222	91	88	7	34	16	17
1984	0	180	367	278	128	174	70	90	4	38	19	30
1985	0	92	285	198	156	158	29	77	3	19	13	29
1986	0	195	227	143	122	184	26	96	2	30	11	18
1987	0	277	79	50	56	108	29	63	1	54	5	18
1988	0	229	116	46	89	96	65	59	6	37	7	21
1989	0	336	105	43	89	44	68	59	6	37	7	21
1990	1	508	113	38	71	73	121	42	8	28	4	22
1991	16	286	112	56	105	93	117	36	14	35	7	26
1992	60	413	133	101	98	133	97	31	17	26	10	22
1993	152	693	109	113	83	103	64	35	31	29	12	28
1994	201	351	68	78	106	85	43	35	55	34	12	23
1995	94	156	93	77	109	77	35	38	35	27	13	28
1996	80	73	96	81	89	85	33	34	28	19	11	48
1997	119	116	135	92	91	73	30	22	42	24	13	30
1998	154	36	101	82	90	48	24	19	22	23	16	25
1999	282	54	92	79	72	52	30	17	10	18	12	24
2000	595	31	94	104	76	54	24	15	3	25	14	25
2001	465	29	57	112	98	34	59	14	5	19	15	15
2002	181	22	84	105	122	28	51	14	6	30	12	13
2003	375	66	92	107	70	14	45	18	8	19	11	17
2004	737	52	119	100	151	18	32	30	6	13	7	7
2005	473	91	110	98	121	12	37	14	13	16	3	8
2006	750	105	130	97	124	15	34	11	4	20	3	9

	Spiny dogfish	Skates	Stargazers	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea Perch	Garfish
1931	0	0	0	0	0	0	0	1	0	0
1932	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	1	0	0
1938	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	3
1940	0	0	0	0	0	0	0	0	0	5
1941	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	1	0	7	0	0
1943	0	0	0	0	0	3	0	24	0	0
1944	0	0	0	0	0	1	0	23	0	1
1945	0	0	0	0	9	0	0	0	0	5
1946	0	0	0	0	1	0	0	43	0	1
1947	0	0	0	0	8	1	0	17	0	1
1948	0	0	0	0	13	0	0	0	0	1
1949	0	0	0	0	41	0	0	2	0	3
1950	0	0	0	2	23	0	0	0	0	2
1951	0	0	0	2	20	0	0	0	0	3
1952	0	0	0	18	0	0	0	0	0	6
1953	0	0	0	28	0	1	0	0	0	5
1954	0	0	0	11	0	1	0	1	0	6
1955	0	0	0	35	3	0	0	0	0	7
1956	0	0	0	9	6	1	0	3	0	6
1957	0	0	0	45	7	0	0	1	0	1
1958	0	0	0	42	2	1	0	1	0	0
1959	0	0	0	5	7	0	0	1	0	2
1960	0	0	0	1	4	0	0	0	0	3
1961	0	0	0	3	13	0	0	0	0	1
1962	0	2	0	4	15	0	0	0	0	2
1963	0	0	0	2	5	2	0	0	0	0
1964	0	0	0	4	0	0	0	0	0	1
1965	0	0	0	1	1	0	0	1	0	1
1966	0	0	0	1	2	1	0	0	0	0
1967	0	1	0	1	1	1	0	0	0	2
1968	0	0	0	1	0	0	0	0	0	1
1969	0	0	0	2	5	0	0	1	0	0

	Spiny dogfish	Skates	Stargazers	Blue moki	Yellow-eyed mullet	Blue maomao	Conger eel	Butterfish	Sea Perch	Garfish
1970	0	2	0	1	4	0	0	0	0	6
1971	0	2	0	1	2	0	0	0	0	5
1972	0	3	0	1	0	2	0	0	0	2
1973	0	1	0	2	0	2	0	1	0	3
1974	0	4	0	4	0	17	0	0	0	0
1975	0	0	0	0	5	0	0	0	0	0
1976	0	0	0	6	0	0	0	0	0	0
1977	0	0	0	9	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	2	3	1	53	0	8	0	2	4	9
1984	17	3	0	38	2	20	0	1	1	10
1985	6	4	0	19	18	16	1	3	1	4
1986	14	6	4	34	21	9	6	0	1	9
1987	41	5	3	39	14	4	3	1	2	15
1988	22	8	6	27	11	5	3	0	2	9
1989	22	8	6	27	11	5	3	0	2	9
1990	14	11	9	14	2	2	0	0	1	4
1991	17	10	8	19	8	3	1	0	3	8
1992	15	12	18	20	10	3	2	2	3	6
1993	11	29	19	18	7	4	2	2	6	4
1994	23	27	5	0	8	4	3	0	6	11
1995	26	8	13	0	4	1	3	0	6	5
1996	52	13	3	0	2	4	4	0	7	3
1997	30	29	20	0	1	1	3	1	9	20
1998	45	6	9	11	1	2	4	7	5	7
1999	15	14	27	0	5	3	3	1	5	5
2000	4	13	33	0	5	1	5	3	5	5
2001	12	39	24	0	3	1	4	2	8	3
2002	40	36	11	0	1	3	5	1	9	3
2003	20	18	1	0	4	0	4	1	5	2
2004	13	33	15	0	1	2	4	0	5	6
2005	6	12	4	0	2	1	3	0	5	8
2006	12	25	5	0	1	0	4	2	6	4

8.5 Appendix 5 Size distribution 1926–27

Size distribution of commercially-landed snapper, 1926−27, by fishing method.

From Hefford (1929, table VII), recorded here because of its historical value.

	Fishing method			
Length (cm)	Trawl	Danish seine	Longline	Setnet
18 and under	0	0	0	0
19	0	11	1	0
20	1	52	1	0
21	2	107	0	0
22	2	226	1	0
23	1	333	1	1
24	5	551	3	4
25	3	993	9	1
26	9	1,253	3	0
27	14	1,498	11	3
28	30	2,295	37	6
29	43	2,356	68	48
30	69	3,097	121	98
31	32	2,109	115	119
32	51	2,230	203	152
33	61	1,414	159	172
34	43	1,387	209	159
35	41	1,462	289	118
36	32	1,038	249	95
37	32	723	144	34
38	31	655	253	33
39	20	430	118	37
40	18	508	188	19
41	9	257	98	7
42	6	253	89	10
43	12	199	55	6
44	6	179	31	10
45	7	164	57	7
46	9	127	45	2
47	3	106	20	3
48	2	104	27	2
49	3	64	14	1
50	1	87	17	1
51	2	32	8	1
52	2	35	7	1
53	2	29	12	2
54	2	13	13	0
55	1	20	11	0
56	0	9	11	0
57	0	12	4	0
58	0	9	6	0
59	1	4	3	0
60 and over	1	15	17	0
Totals	609	26,446	2,728	1,152