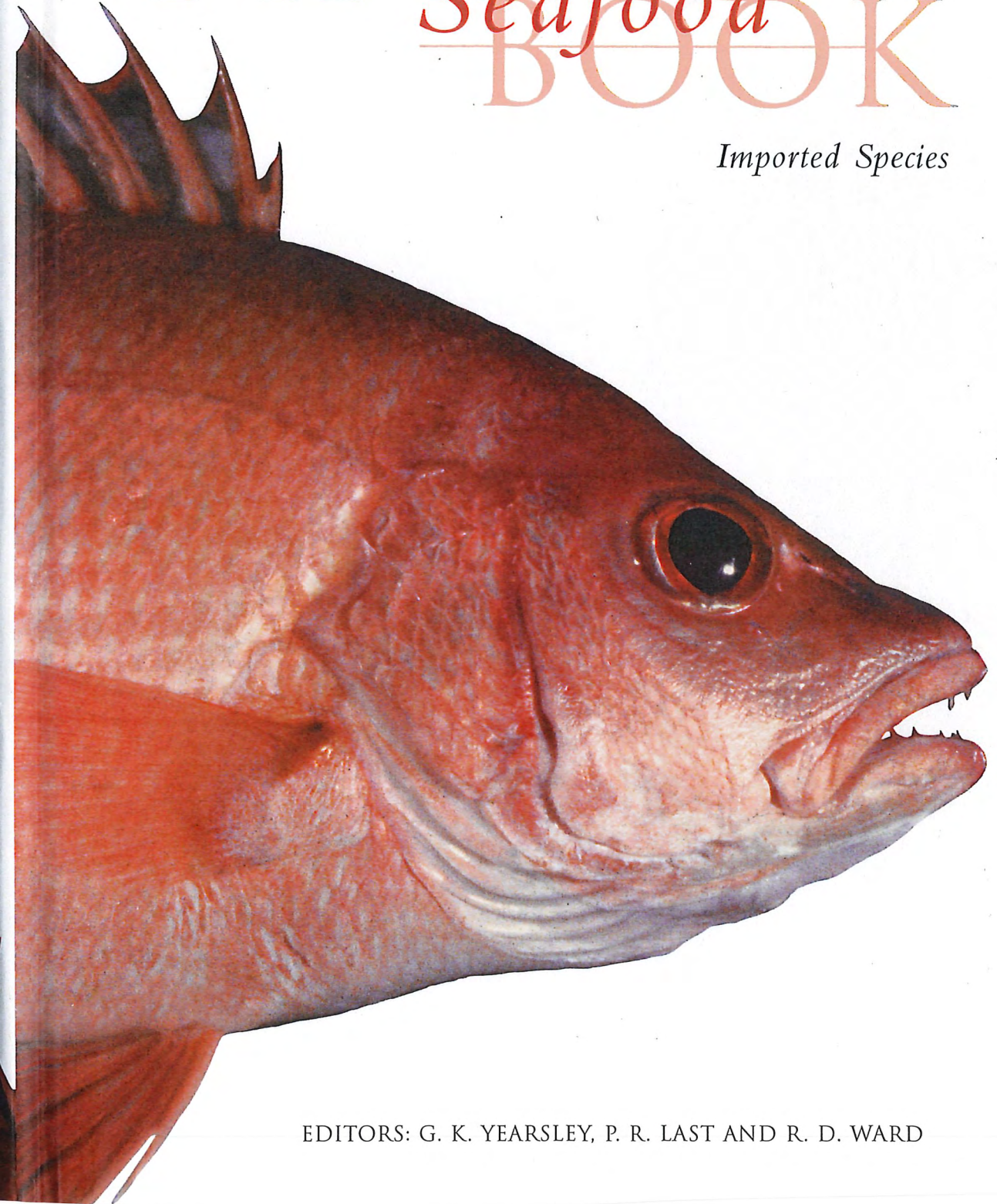


AUSTRALIAN
Seafood
BOOK

Imported Species



EDITORS: G. K. YEARSLEY, P. R. LAST AND R. D. WARD

AUSTRALIAN SEAFOOD HANDBOOK

an identification guide to imported species

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... a selection of imported seafood products
Photo by Thor Carter

Because Australia's non-export seafood production supplies only about half the seafood we eat, Australia is a net importer of seafood—especially from New Zealand, South Africa and South-East Asia. These products constitute a significant competitive factor for pricing and quality against Australian products.

Fisheries Research and Development Corporation, 2000

Foreword

Most Australians would be unaware of the vital role imported seafood plays in ensuring we can enjoy an adequate supply of seafood all year round. Seafood imports will continue to expand to represent sales of more than one billion dollars annually. The publication of this excellent *Australian Seafood Handbook—an Identification Guide to Imported Species* is therefore timely and essential to the orderly development of this significant sector of the commercial fishing industry.

Importers have craved for decades a mechanism that will create a level playing field in trading, and want established guidelines to ensure consistency, stability and accuracy in the naming and identification of imported species. Importers have needed a tool to promote new attitudes and reliable practices in the marketing of seafood from abroad.

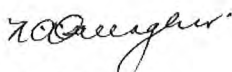
Used in tandem with the Australian Fish Names List, this publication provides the opportunity for importers to develop a new approach to trading—it includes all the material necessary to eradicate confusion and minimise excuses for improper naming of species. This guide will trigger reforms in the seafood industry, which will primarily benefit the consuming public. It is a significant new initiative towards establishing a ‘true to label’ ethic.

The quality of information and the standard of presentation of this handbook will make it a proud possession of every seafood trader in Australia. It will deservedly find its way to the desks of overseas suppliers and will become the mutual reference when products are being labelled for export to Australia. It will be universally embraced for that purpose alone.

This imported species guide, with its sister volume, the *Australia Seafood Handbook—an Identification Guide to Domestic Species*, will represent a unique reference of world class for seafood species identification.

As representative of the Seafood Importers Association of Australasia Limited on Australia’s Fish Names Committee, I commend this guide to seafood traders at all levels of distribution, for their enlightenment and compliance.

I have been involved in the commercial fishing industry domestically and globally since 1948 as marketer, processor, exporter and importer, and therefore I cherished the invitation to write this Foreword. I congratulate the CSIRO Marine Research team who meticulously prepared this guide, and compliment the Fisheries Research and Development Corporation for having the foresight to fund such an essential publication. The roles of Seafood Services Australia Limited and my fellow members of the Fish Names Committee also deserve special acknowledgment.



Noel Gallagher

Seafood Traders of Australasia Pty Ltd, Brisbane

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Introduction




G. K. Yearsley, P. R. Last and R. D. Ward

1

Imported seafood

Australia's seafood selection is second to none. A wonderful variety of more than 800 domestic species is supplemented by an enormous and fascinating offering of imported species and products. The quantity, diversity and origins of seafood imports to Australia have increased dramatically in recent decades, and importers now supply more than 60% of the market in Australia. Prior to the mid-1950s, only a handful of species, such as North Atlantic cod, salmon and herring, were regularly imported. Less than 20 000 tonnes were imported per annum from only a few countries (mainly Norway, Canada, South Africa, New Zealand and the United Kingdom). Today, with efficient international chilled and frozen freight capacities, and diversified Australian markets, the volume of imports has swollen enormously. In 2001, about 140 000 tonnes of more than 225 species were imported from 50 countries. Of the species imported, about 12 were cartilaginous fishes, 165 bony fishes, 18 crustaceans, 25 molluscs and five were other varieties of seafoods. In the last decade alone, the total volume of seafood imported has risen by 50%. The quantity of whole (chilled) imported finfish has grown more than 30% in just the last four years. The total reported value of edible seafood imports exceeded \$870 million in the 2000–2001 financial year (*Australian Fisheries Statistics*, 2002). In addition, but not included in this handbook, is a variety of other imported aquatic species (e.g. bait products, fish feed, petfood, and aquarium fishes).

There are three main reasons for the recent increase in diversity of seafood imported for human consumption:

-  Firstly, Australian fisheries fail to meet local demand for some products. In many such cases, Australian fisheries are just too small. Although Australia's ocean territory is the third largest Exclusive Economic Zone (EEZ) in the world, it is relatively depauperate in terms of seafood biomass compared with many other regions (e.g. New Zealand), ranking fifty-second in terms of production. The food service trade, and fish burger and fish finger manufacturers, require large volumes of white, boned-out fillets, which Australian fisheries cannot supply. Hence, such products are largely imported.
-  Secondly, migrants have begun to source culturally familiar products from their native lands. These largely differ from domestic species and products (e.g. various dried and salted fishes, sauces and pastes, fish balls, and roe) and have introduced more diverse flavours to local markets. This is particularly true of products from South-East Asia. Australians have demonstrated increasing acceptance of the new products on offer, thereby increasing demand.
-  Finally, growth in the number of seafood species imported is related to competition with domestic products from neighbouring countries. Many local species are also caught in fishing grounds adjacent to the Australian EEZ (e.g. the Solomon Islands) and foreign products are imported and sold alongside domestic products. Shipments arrive regularly by air from New Zealand to be sold at many capital city wholesale markets. Such imports are sometimes packaged differently to the local product in an attempt to gain a competitive advantage.

An increase in the number of species has been accompanied by a significant diversification in the source of imports. Asia and the South Pacific, rather than Europe and North America, are now the dominant sources. Together, Thailand and New Zealand provided about 50% of the quantity and value of seafood imports in 1999–2000. Ten years earlier, the same countries provided only 33%. During the same decade, European imports diminished by almost half. South Africa and South America also now supply a significant proportion of seafood imports. A complicating factor in source country statistics is that products may travel to Australia via

two or three other countries. For example, most flyingfish roe imported from Japan is originally sourced from Malaysia or the Philippines.

Over recent decades, the 'commodity type' (e.g. fillets or whole fish) and condition (e.g. frozen, chilled or dried) of imported seafood products have also diversified greatly. Historically, imports were mostly restricted to salted or otherwise preserved products (particularly canned) due to the relatively slow and cumbersome freight services then existing. However, modern freight services allow efficient international transportation of all manner of products.

Commodity types imported include whole fish, trimmed finfishes, headed and gutted finfishes, gilled and gutted finfishes, fillets, mollusc (e.g. bivalve) meat, crustacean tails, crab claws, minced seafood meat, portion-controlled crumbed finfish, sauces, pastes, fish balls, surimi, and roe. Some commodity types that contain seafood are not classified as 'seafood' on import statistics (e.g. Worcestershire sauce contains anchovy but is not considered a seafood import). Products can be chilled, frozen, dried, salted, smoked, pickled, or canned (heated). Chilled and frozen products comprise about 56% of imports, with canned items comprising about 29%, smoked, dried or salted about 2%, and other preparations about 13%. Canned products have a longer shelf life than chilled or frozen products and are therefore popular in international trade.

Many seafood products are imported to cater for specific needs (e.g. important ingredients in unique Asian dishes) while others enter in higher volume for the food service industry. Many (about 65%) of the imported species are also available in Australian waters and the bulk of these are targeted by domestic fishers. Some other imports have closely related forms in Australian seas. For example, hakes (*Merluccius* species) imported from South Africa and South America are closely related to southern hake (*M. australis*), which is caught occasionally off southern Australia.

If recent trends continue, Australia's seafood selection will further increase and diversify. Two worldwide trends will affect future imports: firstly, increased retention and sale of domestic bycatch species, and, secondly, a trend away from wild caught stocks to aquaculture products. Asian imports already have a strong link to freshwater aquaculture products (e.g. freshwater prawn, barramundi, and basa) and the volume of farmed fish on offer will increase.

Seafood names

The naming procedure that applies to domestic seafood species applies equally to imports. A plethora of domestic common names, which has caused confusion for both industry and consumers, is being simplified through the adoption of a unique, national marketing name for each species or group of species. Likewise, seafood imports have attracted a variety of common names, and many species are sold under two or more names in different regions and/or at different times.

Obtaining uniformity of seafood names is perhaps more difficult for imported than domestic species. Different foreign names remain attached to various species from capture or harvest to the final consumer, and identical imports are sometimes sold side-by-side under different names. Increasing diversity of imports has compounded confusion over names, as has inaccurate species identification. By law, imported product—except that from New Zealand—must be displayed with the country of origin or the word 'imported' displayed on the packaging and/or labelling when traded or sold at retail level. Beyond that, however, there is an urgent need for authenticity of labelling, and the adoption of standard marketing names for all species sold in Australia, whether domestic or imported. This will ultimately provide direct and indirect advantages to the entire seafood industry and give confidence to con-

sumers. The entire chain will be protected because trade and retail customers are assured of receiving the authentic product.

To advance this process, domestic and imported seafood marketing names were standardised nationally through a joint industry and government review group, the Fish Names Committee. For more than 20 years this Committee has reviewed all available names of Australia's seafood species. Approved domestic and imported names form the authoritative 'Australian Fish Names List'. Details of the role of the Fish Names Committee, the latest fish names list, and the process by which a marketing name can be approved or changed, are available from Seafood Services Australia Ltd (see Appendix A).

Seafood import statistics also suffer from inadequate nomenclatural protocols. Statistics collected by the Australian Government use international customs tariff codes that have a strong Northern Hemisphere bias, and little relevance to Australia. The categories are very broad or, where they are specific, generally relate to species that are rarely, if ever, imported. For example, a code exists for 'coalfish' or 'coley' (*Pollachius virens*), which is very rarely imported to Australia, but major imports such as Nile perch (*Lates niloticus*) and blue grenadier (*Macruronus novaezelandiae*) are combined under an 'other' code. The customs codes are also insufficient with respect to quarantine issues. They fail to differentiate between gilled and gutted fish, and whole fish, which have different quarantine implications.

The Australian Quarantine and Inspection Service records all species for which an import permit has been requested, but there is little or no correlation between this list and the customs codes. It is therefore difficult to determine species names and origins without detailed advice from seafood importers. The use of standard marketing names would simplify the process for Australian Government staff.

The problem of identifying finfish fillets or other processed seafood has been largely overcome by forensic techniques. For seafood imports this is very important as whole fish are imported only in relatively small volumes. Regulatory and policing authorities can use these methods to detect substitution or misrepresentation, which will increase consumer confidence in names used by vendors. Forensics depend on genetic variation between species, and only a small piece of fillet or invertebrate muscle is needed for identification. Protein fingerprinting was chosen to identify species here because it is simple to use and can be employed outside the laboratory. More refined DNA analysis will be required to identify many value-added products, sauces and pastes, particularly where more than one seafood species is included.

Aim of this handbook

The aim of this imported species volume is to provide an affordable, easy-to-use guide to all major seafood species imported to Australia, including their many product forms, and to link each species to its approved, national marketing name. In the course of this research, many previously unrecorded imports were discovered in markets, and it is likely that the contents included are incomplete. Therefore, this first edition will need to be expanded and refined significantly in the future. Although much of the handbook's content is original, published literature and anecdotal information from specialists and importers were often relied on for product type, country of origin, size, depth range and distributional data. Contradictions and omissions were noted in the literature and better data are needed for many species. Consequently, we encourage comments and new information from industry representatives, and readers who have a good knowledge of particular imported species. Please use the contact details given on the reverse title page. Future editions may be combined with the domestic species volume, and may become available on CD-ROM or on the internet.

How to use this handbook

G. K. Yearsley, P. R. Last and R. D. Ward

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2

Introduction

This reference is a companion volume to the *Australian Seafood Handbook—an Identification Guide to Domestic Species* (Yearsley *et al.*, 1999), and is designed to help readers identify Australia's main imported seafood species, whether whole, in fillet form, shelled or otherwise. Together the two handbooks provide information required to identify most seafood sold in Australia. Externally visible identifying features are provided for most species. In addition, a simple genetic technique called 'protein fingerprinting' is used to further distinguish each species. This information is detailed in a separate chapter. We have minimised the use of technical terms but do so occasionally to avoid the repetitive use of long explanations. An illustrated glossary is provided to acquaint the reader with these terms. Related literature and references cited in the text are listed in two sections: (A) seafood, and (B) protein fingerprinting.

The use of names

Use of this handbook requires an understanding of common, marketing and scientific names. While a particular species may have a number of common names, it has only one approved marketing name in Australia and only one valid scientific name internationally. For example, one popular import (herring) has numerous common names depending on where it is from and/or how it has been processed. These include Atlantic herring, herring, kipper, digby, mattie and sild. However, it has only one approved marketing name in Australia (herring), and only one valid scientific name internationally (*Clupea harengus*).

Common and marketing names

Many hundreds of common names have been used locally for Australia's 225 or so imported seafood species. To minimise confusion, commercial species should be sold only under their approved marketing name, highlighted as blue headings at the top of each page in the seafood entries (Chapters 4–8).

There are two main types of marketing names—unique and group names. A 'unique' marketing name covers only one species, whereas 'group' marketing names cover two or more species (sometimes entire groups of related species known as 'families'). Some group marketing names, which are also known as 'core' marketing names, are used as a default marketing name for a number of similar species, some of which also have a unique marketing name. The prawns provide examples of each marketing name type. 'Black tiger prawn' is a unique marketing name that applies to only one species of prawn. 'Banana prawn', however, is a group marketing name that applies to two very similar species. 'Prawn' is an even broader group marketing name that can be used for all members of the infraorder Caridea and the superfamily Penaeoidea. As such, 'prawn' is also a core marketing name, a default group for all prawn species, including those with unique marketing names. Hence any prawn, irrespective of whether or not it has a unique marketing name, can be marketed simply as 'prawn'. However, vendors usually prefer to distinguish between species by using the correct unique name when one exists. In this handbook, group marketing names are identified by the letter 'G' at the bottom, inner margin of each page where applicable. For group marketing names of domestic species that are also imported, only the scientific names of the imported species are listed in the seafood treatments. Hence, there are occasions (e.g. pearl perch) where the letter 'G' signifies a group marketing name but the scientific name of only one species is listed at the top of the page. In such cases, all relevant scientific names are listed in the domestic species volume.

Invalid marketing names for a species are listed herein as 'minor names'. These include names from an important source country or countries and/or names that have been applied to

imported product of the species in Australia. The following country abbreviations apply:

Argentina—AR	Germany—DE	New Zealand—NZ
Australia—AU	Hong Kong—HK	the Philippines—PH
Brazil—BR	India—IN	Thailand—TH
Cambodia—KH	Indonesia—ID	United Kingdom—UK
Canada—CA	Japan—JP	United States of America—US
Chile—CL	Malaysia—MY	Vietnam—VN
China—CN	Mexico—MX	South Africa—ZA
Denmark—DK	Myanmar—MM	

If a country abbreviation is not given, the name/s is/are widely used. Generally, the ‘minor names’ listed for Australia include old or erroneous marketing names rather than all other common names used locally for the species. However, other frequently used common names are included for some of the individual species covered by group marketing names. Some valid names have been selected for historical reasons. For example, blue cod (*Parapercis colias*) is unrelated to the true codfishes (families Gadidae, Moridae, etc.). However, the name is entrenched in New Zealand and has been adopted in Australia.

The following imported seafood names are not featured in this handbook: ‘Indian dogshark’ (*Scoliodon laticaudus*), ‘coley’ (*Pollachius virens*), ‘haddock’ (*Melanogrammus aeglefinus*), ‘Pacific cod’ (*Gadus macrocephalus*), ‘Arrowtooth flounder’ (*Atheresthes* species), ‘Dover sole’ (*Solea solea*), ‘Greenland turbot’ (*Reinhardtius hippoglossoides*), ‘Chub mackerel’ (*Scomber japonicus*), ‘Atlantic ocean perch’ (*Sebastes marinus*, *S. mentella* and *S. viviparus*), and ‘baby clam’ (*Meretrix* species). In most cases this reflects a decrease in importance to Australian markets. However, the names are still valid and should be used if required.

Occasionally, different species are marketed erroneously under the same name. The previous name of one species (or group of species) may be the approved marketing name of another. For example, ‘North Sea whiting’ (*Merlangius merlangus*) has been sold under the approved marketing name of ‘whiting’ (species of the family Sillaginidae). Extremely confusing scenarios have eventuated for ‘seaperch’, ‘seabream’ and ‘trevally’, with several unrelated species, both domestic and imported, sold under these names.

In some cases, a group marketing name is the same as an individual species’ common name. For example, ‘hapuku’, which is the marketing name of two types of temperate ocean-basses (*Polyprion* species), is also the most frequently used common name of one of these (*P. oxygeneios*).

Scientific names and classification

Classification is a means of cataloguing organisms in a hierarchical manner resembling a family tree. At the top of the tree are major groups called kingdoms. At the bottom of the tree, each species is given a unique species name.

Each kingdom is divided into smaller groups called phyla (singular phylum). Similarly, each phylum is divided into classes, classes into orders, orders into families, families into genera and genera into species. Each rank or level in this hierarchy is called a taxon (plural taxa). For example, here are the taxonomic groupings into which the Nile perch is classified:

Kingdom: Animalia (animals)

Phylum: Chordata (chordates)

Class: Osteichthyes (bony fishes)
 Order: Perciformes (perch-like fishes)
 Family: Centropomidae (giant perches)
 Genus: *Lates*
 Species: *niloticus*

The term 'group' is used in this book to refer to taxonomic levels above a species. Sometimes, those studying classification (taxonomists) subdivide such groups. For example, an order may be subdivided into a number of infraorders, or one family may be subdivided into a number of tribes or subfamilies. Sometimes groups are aggregated. For example, a number of families may be combined to produce a superfamily. Certain rules and conventions apply to the endings of the names of higher-level group taxa. For example, order names end in '-iformes', family names in '-idae' and subfamily names in '-inae'.

The combination of the genus (plural genera) and species (plural species) parts constitute the full 'species name'. While a species has only one species name, a genus may contain any number of closely related species. To continue with the example of Nile perch (*Lates niloticus*), there are numerous other members of the genus in Africa and Asia. One, *Lates calcarifer* (barramundi), occurs in Australian waters.

Species names are italicised with only the first letter of the genus in upper case. The species part of the name should not be capitalised. The genus name precedes the species part of the name but may be abbreviated to its initial letter if no ambiguity results. For example, once Nile perch has been introduced as '*Lates niloticus*' it may be referred to as '*L. niloticus*'. If a species has not yet been scientifically described, it is referred to by its genus followed by the abbreviation 'sp.' Groups of species are sometimes referred to by 'spp'.







The author of a species (the person who described it) and the date it was described follows the scientific species name. For species in this handbook, such details are listed in Appendix B. Parentheses around the author and date indicate that the species is no longer classified in its original genus. A later worker, or the same worker in a later publication, transferred the species to another genus.

Order of presentation of groups and species

Biological identification guides can be ordered in several different ways. To someone familiar with the names, an alphabetical arrangement by common or scientific name is easy to use. However, comparisons are difficult because similar species (members of the same family) are not necessarily placed near each other. To enable comparisons to be made, guides often order species scientifically (systematically), following an internationally recognised order based on our knowledge of their evolutionary lineage. Obviously, while this is useful to biologists, it can be extremely confusing for the lay-person.

This handbook uses a combination of alphabetic and systematic methods, making it user-friendly to the non-specialist while still allowing comparisons of closely related species. Broad group categories (cartilaginous fishes, bony fishes, crustaceans, molluscs and miscellaneous seafood) are separated by chapter. Within chapters, families and family groups (two or more closely related families) are ordered alphabetically by common name. Within families, individual species or species groups are again ordered alphabetically this time by their marketing name.

Information for a particular species or family can be found in a number of ways:

-  your species can be found using a visual inspection of each finfish or shellfish image;
-  if you know the general group to which the species belongs but are unsure of its correct name, you can quickly scan the contents pages (family and family-group common names are listed)—the abbreviated family name is given with its component groups in brackets;
-  if you know the correct family or family-group common name, scanning the contents will be unnecessary—the target group can be found alphabetically in the relevant chapter and each chapter is colour-coded to assist navigation through the guide;
-  once in the correct group, your species can be found from an alphabetic search of marketing names within the section;
-  you can search the index of common and marketing names (marketing names in bold text), or the index of scientific names (family and other higher-level taxa names, only included when specifically mentioned in the text, are in capitals)—in both indexes, numbers in bold refer to the page where that species or group is featured, numbers prefixed with 'P' refer to the relevant protein fingerprint figure;
-  you can also check Appendix B, which lists all families systematically and provides cross-referenced page numbers. Group marketing names are highlighted in bold text and ordered alphabetically by scientific name. Component species are indented and also ordered alphabetically. Only those species mentioned in the text are included.

The protein fingerprinting chapter is arranged in the same way as the main identification chapters—alphabetically by family (or family-group) common name. Page numbers for information on the protein fingerprints are listed on the feature page for each species where applicable (usually in the fillet box for fishes and at the end of the 'Remarks' section for invertebrates and miscellaneous seafood).

Seafood treatments

Chapters 4–8 form the basis of this handbook. Most species with an approved imported seafood marketing name are included. Other species, currently imported at low levels or covered by a group marketing name, may warrant inclusion in future editions. Abbreviated coloured headings at the foot of the page are used to flag sections of similar species, genera or families. The groups treated in each section are listed sequentially on the contents pages. The commonly used Australian name is sometimes different from its international name (e.g. 'mackerels' is used rather than 'tunas'). Similarly, family-group names are selected based on local use and to minimise confusion. For example, members of the family Lutjanidae are known as 'snappers' and 'tropical snappers'. However, as 'snapper' can be confused with one of Australia's premium temperate fishes (*Pagrus auratus*), 'tropical snapper' is used as both a collective group marketing name and the section name.

Unique marketing names are treated on a single page. Group marketing names cover one or two pages; the first (or only) treats the group as a whole, showing and naming a representative species. Where the fillet picture is of a different species, its species name is provided in the fillet box. If two pages are used, the second contains specific information (common name, distribution, distinguishing features, size and, where applicable, marketing name) on three individual species. The species pictured on the first page is repeated on the second.

Various other aspects of each species and group of species are discussed under the headings below.

Identifying features

The main features (characters) by which a species or group of species can be most easily identified are listed and highlighted on each figure as corresponding numbers to show each feature's location. The number may be located near, rather than on, a particular feature to make it visible. Internal features, and others that cannot be seen on the photograph, are identified by a number within a circle. Features that separate closely related species are listed first. Usually, each number refers to the same character on each species within a family or group of families but this is not possible with larger groups. Character traits are not necessarily provided for every species in the group.

Comparisons

Comparisons are made with closely related species (those in the same genus and family and sometimes those in closely related families), firstly with domestic species and then with other similar imported fishes. In special cases, species with a similar marketing name are also compared (e.g. 'southern blue whiting' is compared with 'whiting') or when group-names could be confusing.

Product

Only a small proportion of seafood imported to Australia is whole. Usually, products include only the edible part of a fish making species identification difficult. For example, fillet identification is far more difficult than whole finfish identification, as many useful features such as fin shape and mouth position are missing. However, other features can be used to identify a fillet to a genus and sometimes to species. Commonly imported products are listed here, along with diagnostic features and a brief description. For most finfishes, a photograph of the outer (external), skinned fillet is included.

Very small finfish species, such as Asian whitebait, are marketed whole so a fillet photograph is not included. Similarly, large fishes, such as tunas, are marketed as cutlets or steaks rather than fillets. In such cases, a cutlet or steak photograph is usually provided. The identifying features used here are discussed under the heading 'Characteristics of fillets' below. Additional information is provided in the domestic species handbook.

Apart from informal comments in the 'Remarks' section, edible qualities are not discussed. All the seafood consumed in Australia is esteemed by at least some ethnic groups or palates and most species are generally highly regarded. However, preference for seafood types varies greatly within the community. Future editions of the domestic and imported species handbooks may contain taste comparisons and technical information describing changes that occur during cooking.

Size

Weights are expressed for whole fishes in kilograms (kg) or grams (g). Multiply the kilogram value by 2.2 for an approximate conversion to pounds. Lengths for sharks, bony fishes and some invertebrates are expressed as total length, unless stated otherwise. Total widths are provided for some invertebrates (e.g. crabs). All length and width measurements are expressed in centimetres (cm).

Maximum sizes and weights recorded in the literature are often unreliable. Reported weights are sometimes based on 'guesstimates'. Pounds have sometimes been confused with metric units inflating the maximum weight of species. Lengths, which are based on either standard, fork or total lengths, are rarely specified resulting in quoted sizes often being smaller than the true size of the species. Often length only or weight only data have been recorded from out-sized specimens. Consequently, reported maxima for the two types of measurement rarely correspond, leading to gross over- or understatement of either size measure. Also, maximum sizes of seafood species rarely reflect the normal size marketed.

We have evaluated the size of species, making use of the literature, anecdotes and museum specimens, to provide a provisional review of international maximum and common sizes for each species. 'Commonly imported' sizes reflect the size of fishes imported or the size of fishes from which imported products were obtained. For many species, size data remain inadequate; the authors would like to receive any new data to refine further these statistics.

Habitat

This section includes information on the species' environment in the region from where it is imported. Its general habitat—whether it lives mainly in freshwater, estuaries, near the coast or offshore—is further qualified by its preferred habitat (whether it lives on the continental shelf, continental slope, or is pelagic or bottom-dwelling, *etc.*). The depth at which the species is found is provided when available and where relevant.

Distribution

The worldwide distribution of each species (or group of species) is shown on a map. Dark blue shading is used for marine distribution while light blue shading shows freshwater and estuarine distribution.

Fisbery

This section summarises how and where commercial fisheries for the species occur, particularly fisheries in the regions from where the species is imported. The source countries of Australian imports and the species imported (for group entries) are listed.

Remarks

This informal section may include such items as details of any Australian fishery for the species in question or other species marketed under the same name, a discussion of old or anomalous marketing and scientific names, and some common interest issues such as migrating behaviour, flesh taste and texture, and anecdotal information.

Characteristics of fillets

The edible qualities of different types of seafood can be assessed in a number of ways. Features of the flesh, such as general appearance, moisture level, flavour, texture, colour and shelf life, have all been used as measures of quality. Similarly, these features, along with many others, can be used to identify the fillets of fish groups and, in some cases, species.

Fishes as a group come in all shapes and sizes, which remains apparent in the form of their fillets. Their overall shape and muscle structure, extent of fat deposits, connective tissue colour, and the presence or absence of remnant processing features such as scale pockets,

lateral line, swimbladder, belly flap, sensory pores, and pin bones can be used to assist species identification.

This handbook includes pictures and summary descriptions of fillets for most species, and a glossary section defining and illustrating the key features (Figs 3.8–3.12). The use of fillets as an identification tool will be treated comprehensively in more technical supplementary publications. In this handbook, we have attempted simply to demonstrate some of the variability that exists among fish fillets (domestic and imported), giving examples where necessary.

Fillet shape

The most obvious feature of a fillet is its basic appearance. Short, deep-bodied fishes, such as dories, usually produce short, strongly tapering fillets (Fig. 3.9A). Long, slender fishes, such as eels, usually produce long fillets with little taper (Fig. 3.9G). There is a variety of intermediate forms between these extremes (Figs 3.9B–F). These forms are generally consistent within species and may enable discrimination between close relatives. Larger fishes are often marketed as cutlets (Fig. 3.8C) and rays as flaps (Fig. 3.8D).

Other aspects of shape, such as thickness, are important in characterising fillets. The fillets of round-bodied fishes, such as tunas, are usually thick with a convex outer (external) surface. These contrast strongly with pronounced laterally compressed (e.g. dories) or depressed (e.g. flounders) fishes, both of which produce almost flat fillets.

Filleters may vary slightly in the way they cut a carcass, but the lower anterior angle of the fillet is nonetheless surprisingly consistent within a species. This angle may vary from almost a right angle (oreo dories) to obtuse angles exceeding 135° (flatheads). Removal of the belly flap can dramatically change the appearance of the fillet. Some species are marketed with or without the belly flap, depending on the flap's thickness and the ease of separating rib bones.

Similarly, the presence or absence of remnants of the swimbladder, its position and type can be useful in discriminating not only groups but also members of groups. For example, among domestic redfishes, the swallowtail (*Centroberyx lineatus*) has a thick swimbladder that penetrates as a conical tube into the tail (well beyond the origin of the anal fin). Other redfishes (*Centroberyx* species) have a more delicate swimbladder that lies within the main body cavity. The swimbladder remnants are often trimmed from fillets but the conical remnant is usually present in swallowtail fillets.

Another structure, a remnant of the caudal peduncle, may be present, although its absence can be due to the method of filleting.

Outer features

A key identifying feature on the outer (external) surface of a fillet is the skin. This may be removed, depending on its thickness, revealing other characters such as muscle band structure and features of the integument underlying the skin. The evidence of scale pockets, and their size and ability or inability to remain intact after scaling, are important characters. Scales and pockets may be deeply embedded (e.g. lings, *Genypterus* species), indistinct (e.g. leather-jackets, family Monacanthidae) or totally absent (e.g. catfishes, family Ariidae). When absent, the skin is sometimes covered in minute sensory pores. Similarly, the position and clarity of the lateral line can assist in the identification of some groups, such as the trevallies (family Carangidae), whose lateral-line scales may be enlarged to form scutes. In the tunas (tribes Sardini and Thunnini), fleshy keels are present on the caudal peduncle that remain evident on carcasses. Sharks are covered in small spiny scales known as denticles.

Skinned fillets may have traces of integument remaining that reflect the colour of the skin and its connective tissue (Fig. 3.9D). The most common tones are translucent, white, pink, and silver, but the integument colour of the upper and lower halves of the fish may differ. Similarly the sliminess of the external membrane can vary from almost dry to very slimy.

The arrangement of W-shaped, vertical muscle bands (myomeres, Fig. 3.8A), and the number and form of exposed, outer pin bones in fillets are useful in distinguishing species. Each myomere is separated from the next by a partition of the membranous skeleton known as a 'myoseptum' (Fig. 3.8A). Upper and lower muscle masses of the body are separated by a 'horizontal septum' (Fig. 3.8A), referred to in the tissue descriptions as HS, appearing as a midline (corresponding to the midpoint of the 'W'). When present, the outer pin bones are either exposed or embedded slightly in the anterior part of this septum (Fig. 3.11A).

The muscles above the horizontal septum form the 'epaxial mass', those below, the 'hypaxial mass' (Fig. 3.8A). Myosepta appear either 'V' or 'W' shaped in each mass. The relative heights of these masses, the lengths of the outer arms of the 'V's and 'W's in each mass, the position of the horizontal septum, and the number of epaxial myomeres, are very useful in identifying species. Similarly, the position of a line drawn through the posterior angle of the 'V's in each mass in relation to the horizontal septum varies greatly in fishes. In many perch-like fishes, the epaxial line (referred to in the tissue descriptions as EL), which runs parallel to the dorsal profile of the fillet, is convex in shape (Fig. 3.9A). Alternatively, it may converge with the HS towards the tail end (Fig. 3.9B,F) or can be almost parallel (Fig. 3.9G). The orientation of the hypaxial line (HL) can vary similarly.

In most fishes, the myosepta are distinct, but in some species (Fig. 3.9E) they can be difficult to see, the myomeres either being strongly connected or the myosepta covered with fat.

The horizontal septum may also be concealed by another type of muscle, the red or dark muscle band. The colour of this band has been used as an index of fillet age and handling since capture. Reddish muscle is characteristic of finfish that were recently caught and/or properly handled whereas a brownish band with gaping flesh (Fig. 3.12C) usually indicates the opposite. The width and strength of this band also varies greatly even between related species. In prolonged swimmers, such as tunas and trevallies, it is continuous, broad and very thick (Fig. 3.9D), whereas in non-migratory fishes, such as the wrasses, it is barely detectable (Fig. 3.9B). Thin red muscle bands often appear as 1–3 discontinuous bands that may taper towards the caudal region (Fig. 3.8A). In garfishes the red muscle band is uniform in width and continuous (Fig. 3.11D).

Inner features

The inner surface of a fillet, which is the part closer to the backbone, is equally useful for identifying fish species. As the muscle fibres are cut when filleting, the flesh colour is clearer than on the outer surface. Fresh fishes vary considerably in this character (Fig. 3.10A–J), but it is reasonably consistent within a species. However, old or poorly handled fillets tend to become yellowish or brownish, and this must be considered when assessing colour. Some groups are distinctive—for example, the reddish flesh of most tunas, the orange flesh of salmonids (family Salmonidae), the green flesh of batfish (*Platax* species), and the bluish-white flesh of the grass whiting (*Haletta* species). Others, such as the garfishes (family Hemiramphidae) and some whittings (family Sillaginidae), have almost translucent flesh with greyish 'veins'. Colour reproduction in this handbook is as accurate as possible but some slight variations can occur.

Similarly, the membrane of the gut cavity wall (the peritoneum) and the myosepta can vary from transparent to silver, white or black (Fig. 3.8A,B). Other useful characters include fat deposits (Fig. 3.8A), the muscle flakiness, and the remnants of radial muscles (associated with the dorsal and anal fins and arranged vertically). In some fishes, such as dories, these usually remain even on trimmed fillets. Other fishes such as trevallies may have pockets or pits in the flesh formed by outgrowths of the backbone (Fig. 3.12B). Macroparasites are rarely present in the flesh; the most evident are tapeworms and these are often restricted to specific fish hosts.

Analogous to the outer pin bones are the various rib and intermuscular bones of the inner surface (Fig. 3.12B). Some of these inner pin bones, particularly the ribs, are often removed by filleting; when present, they are useful for distinguishing groups and species. In some fishes (e.g. garfishes) pins not associated with the ribs extend well along the fillet and cannot easily be removed from the fillet. Their size and number are important characters.

Protein fingerprinting

Chapter 9 presents protein fingerprint information on about 175 imported species. The principles of the technique are outlined, together with a recommended strategy for checking identification using these methods. Technical details are briefly presented. The main body of the chapter shows a stylised protein fingerprint of each species, together with common variants when present; the accompanying text highlights the salient identifying features of the imported members of each group, especially with respect to species separation. Additional details on domestic species are in the domestic species handbook.

Appendix A: Fish Names Committee

Appendix A lists the contact details of the secretary of the Fish Names Committee. The secretary can provide information on the Committee and the process the Committee follows to amend or add a marketing name. These processes have changed slightly since the publication of the domestic species handbook.

Appendix B: Table of species

The table in Appendix B includes all the marketing names and species names mentioned in the text. One column heading requires further explanation (the others are discussed in various sections above):

CAAB

Each species (including those covered by a group marketing name) and each group marketing name has been assigned a numeric code based on a system known as 'Codes for Australian Aquatic Biota' (CAAB). These codes are used widely to link data on Australian fisheries and on marine biota generally. The coding system was recently upgraded from six to eight digits (Yearsley *et al.*, 1997). At the time the domestic species handbook was published, codes for invertebrate groups were in a transition phase and were therefore prefixed with '00'. All two-digit prefixes have now been assigned and the new invertebrate codes are included here for imported species. More information and a full list of codes are available on the internet at www.marine.csiro.au/caab.

Glossary

G. K. Yearsley and P. R. Last

3

abdomen: the part of the body containing the digestive and reproductive organs—in crustaceans it consists of several segments (Fig. 3.5)

adductor muscle: in bivalve molluscs, a muscle that joins and closes the valves

adipose fin: a small fleshy fin, without fin rays, usually situated behind the dorsal or anal fins in some finfishes (Fig. 3.3)

adrostral ridge: in prawns, a ridge that runs alongside the rostrum, sometimes nearly reaching the posterior margin of the carapace

allozyme: alternative enzyme forms encoded by different forms or alleles of a gene

anal fin: the unpaired fin on the underside of the body behind the anus in finfishes (Fig. 3.3)

antenna (pl. antennae): the more lateral of the segmented, paired appendages on the head of crustaceans, usually long and whip-like (Fig. 3.5) but sometimes short, broad and flattened

antennule: the more medial (central) of the segmented, paired appendages on the head of crustaceans (Fig. 3.5), usually shorter than the antennae

anterior: the front or head end (Fig. 3.3)

anus: external opening of the digestive system (Fig. 3.3)

aperture: the entrance or opening to the internal cavity of a single-shelled mollusc (Fig. 3.6A)

AR: Argentina

arm: the sucker-bearing appendages surrounding the mouth of cephalopods (Fig. 3.7)

AU: Australia

axillary scale: an enlarged scale-like projection at the axil of the pectoral or pelvic fins of some finfishes

bar: a broad, more or less vertical, line of a different colour to the main (or adjacent) body colour; see also *stripe*

barbel: a slender, fleshy, tentacle-like sensory structure on the head of some finfishes (Fig. 3.3)

barrel: the main body section of a finfish without the guts, gills, head, fins or tail

basal: the region of a projection (often a fin) nearest the body

belly flap: post-filleting remnant of the muscle of the abdominal region or belly of a fish (Fig. 3.8B)

benthic: living on the sea floor

benthopelagic: free-swimming near the sea floor

bill: a usually long and thin anterior extension of one or both of a fish's jaws

bilobed: having two lobes

bivalve: a mollusc with two external shells (valves), for example an oyster or a mussel

blotch: an irregularly shaped area that differs in colour to the surrounding area; see also *spot*

body length: in crustaceans, the distance from the anterior margin of the carapace (near the eyes) to the end of the extended tail fan; for finfishes, see *total length*

bony fish: any finfish with a skeleton made of bone rather than cartilage

BR: Brazil

breast: in finfishes, the ventral surface of the body below the pectoral fins (Fig. 3.3)

bycatch: the component of the catch excluding the targeted species; includes byproduct and discards

byproduct: the component of the catch that is caught incidentally, but retained and sold

CA: Canada

canine tooth: an enlarged, conical tooth (for holding prey)

carapace: the hard, external shell of crustaceans that covers the 'body' (i.e. the head and thorax but not the abdomen) (Fig. 3.5)

carapace length: in crustaceans, the distance from the anterior margin (near the eyes) to the posterior margin of the carapace

cartilage: a skeletal material consisting of a matrix of white or translucent, soft, chondrin

cartilaginous: made of cartilage

cartilaginous fish: any finfish with a skeleton made of cartilage rather than bone

caudal fin: a fish's tail fin (Fig. 3.3)

caudal peduncle: the posterior part of a fish's body from the posterior end of the anal-fin base to the base of the caudal fin (Fig. 3.3)

cephalopod: a mollusc such as a squid or an octopus that has eight or ten sucker-bearing appendages originating from the head, and an internal shell

cervical groove: in prawns, a groove that runs obliquely across the carapace from the ventral anterior third, posteriorly and towards the dorsal midline (Fig. 3.5)

cheek: in finfishes, the fleshy area in front of the preoperculum

chilled: maintained at a temperature between -1°C and $+4^{\circ}\text{C}$

CL: Chile

claspers: in cartilaginous fishes, paired cylindrical extensions of the pelvic fins of males used in mating

cloaca: a common opening for digestive, urinary and reproductive tracts in many finfishes (Fig. 3.3)

CN: China

compressed: flattened laterally, from side to side

concave: arched, curved inwards (opposite of convex)

conical teeth: teeth shaped like a cone

continental shelf: the shelf-like part of the ocean floor beside continents and extending from the coast to a depth of about 200 m; the area at about 200 m is called the shelf break

continental slope: the sloping, often steep, part of the ocean floor bordering the continental shelf and extending to a depth of about 2 000 m; divided into the upper slope (200–700 m), mid-slope (700–1 500 m) and lower slope (below 1 500 m)

convex: arched, curved outward (opposite of concave)

corselet: a band of specialised scales encircling the pectoral region of the body

crustacean: an invertebrate animal with a hard segmented outer shell (e.g. prawns, crabs, rock-lobsters)

ctenoid scale: a scale with a spiny hind margin

cusp: a projection on a tooth

cutlet: in finfishes, a section of fillet, including the backbone, removed by cutting approximately at right angles to the backbone; in crustaceans, a portion of flesh removed from the tail

cuttlebone: calcified, surfboard-shaped internal shell of cuttlefishes

cycloid scale: a smooth-edged scale without spines along its hind margin

DE: Germany

deciduous: easily shed or rubbed off, usually referring to scales

demersal: living on or near the bottom of the ocean

depressed: flattened from top to bottom

disc: the combined head, trunk and enlarged pectoral fins of some sharks and rays with depressed bodies (Fig. 3.2)

DK: Denmark

dorsal: the upper surface of the body (or head) (Fig. 3.3)

dorsal fin: the unpaired fin or fins along the upper surface of the back or tail of finfishes; in bony fishes often divided into an anterior spinous portion and a posterior soft-rayed portion, which may be separate fins (Fig. 3.3)

EEZ: Exclusive Economic Zone, the Australian EEZ is the oceanic area controlled by and surrounding Australia; it extends 200 nautical miles from the coast and includes ocean around island territories

epaxial line: in a fish fillet, an imaginary line drawn through the posterior angle of the 'V' formed by the myomeres in the upper (epaxial) muscle mass (Fig. 3.8A)

filament: a thread-like process or appendage

fillet: a slice of flesh removed from the carcass of a finfish by cuts made parallel to the backbone

fin: in cephalopods, membranous extensions of the body that assist in locomotion, steering and stabilisation (Fig. 3.7)

fin element: each spine or ray in a fish's fin

fin ray: see *ray*

fin spine: see *spine*

finlet: a small fin-like structure behind the anal and/or dorsal fins of some finfishes (Fig. 3.3)

fish: any aquatic vertebrate and invertebrate excluding mammals and amphibians

flagellum (pl. flagella): segmented, usually whip-like terminal section of an antenna or antennule in crustaceans

foot: the large muscular mass on which single-shelled molluscs move (Fig. 3.6A)

fork length: the length of a fish from the tip of the snout to the fork of the caudal fin

forked: a common shape of a fish's caudal fin, one with a deeply concave or excavated hind margin

free rear tip: posterior tip of a fin closest to the fin's posterior point of attachment (Fig. 3.1)

fresh: refers to product that has not been frozen, cooked or preserved by any process other than chilling

frond: in some plants, a leaf-like expansion formed from by the union of stem and foliage

frozen: refers to product that is changed into a solid state as a result of reduction in temperature and that is held at a temperature of -18°C or colder at its thermal centre (i.e. the last point in the product at which a change in temperature occurs)

funnel: in cephalopods, a tube on the ventral side through which water is expelled to produce locomotion (Fig. 3.7B)

funnel groove: in cephalopods, a depression that holds the anterior portion of the funnel (Fig. 3.7B)

fusiform: spindle-shaped, tapering to both ends

gastropod: a mollusc with one external shell (e.g. an abalone); sometimes called a univalve

genus (pl. genera): a natural grouping of closely related species

gill arch: a cartilaginous or bony arch supporting the gills and gill rakers of finfishes (Fig. 3.4); the gill arch closest to the interior surface of the operculum is the 'first gill arch'

- gill membrane:** the skin on each side of the head that encloses the gill chamber during respiration
- gill rakers:** the peg-like structures along the front edge of the gill arches in finfishes (Fig. 3.4)
- gill slit:** a long, narrow gill opening in sharks and rays (Fig. 3.1)
- groove:** well-defined furrow
- head length:** in finfishes, the distance from the anterior tip of the upper jaw to the posterior margin of the operculum
- hepatic ridge:** in prawns, a ridge that runs posteriorly near the anterior ventral margin of the carapace, sometimes beginning close to the anterior margin (Fig. 3.5)
- hinge:** where two valves of a bivalve mollusc are joined, on the dorsal margin (Fig. 3.6B)
- HK:** Hong Kong
- holdfast:** in some algae (e.g. some seaweeds), an organ for attaching to the substrate
- horizontal septum:** line of connective tissue running centrally along the length of a fish fillet and separating the muscle into the upper (epaxial) and lower (hypaxial) masses (Fig. 3.8A)
- hypaxial line:** in a fish fillet, an imaginary line drawn through the posterior angle of the 'V' formed by the myomeres in the lower (hypaxial) muscle mass (Fig. 3.8A)
- ID:** Indonesia
- IN:** India
- incisor tooth:** a cutting tooth with a flat chisel-shaped tip
- insertion:** the posterior point of attachment of a fish's fin
- integument:** tissue between the skin and underlying muscle mass—remnants may be present on skinned fish fillets (Fig. 3.11A)
- ischial spine:** in prawns, a spine projecting from the third segment (counting from the body) of a leg
- isthmus:** the fleshy area on the undersurface of the head between the gill openings
- JP:** Japan
- keel:** a fleshy or bony ridge (Fig. 3.3)
- KH:** Cambodia
- lateral:** refers to the sides
- lateral line:** a line or row of pored scales or sensory organs along the side of a fish (Fig. 3.3)
- lip:** in abalones, the outer edge of the foot
- lobe:** a usually rounded outgrowth
- lunate:** shaped like a crescent moon, usually referring to a fish's caudal fin
- mandible:** the lower jaw (Fig. 3.3)
- mantle:** the muscular integument surrounding the internal organs of molluscs; in cephalopods it is greatly strengthened (Fig. 3.7)
- mantle length:** in squids and cuttlefishes, the distance from the dorsal anterior margin of the mantle to its most posterior point
- maxilla:** in finfishes, a paired bone forming the lateral margin of the upper jaw (Fig. 3.3); in crustaceans, some of the paired mouthparts
- melanophores:** black pigment cells in skin or internal membranes (Fig. 3.12B)
- membrane:** the thin layer of tissue covering part of an animal or connecting the fin elements in finfishes
- mid-lateral scales:** a central row of scales along the side of a fish

MM: Myanmar

molar tooth: a blunt and rounded grinding tooth

mollusc: an animal belonging to the phylum Mollusca (e.g. scallops, clams and octopuses); molluscs have soft bodies and hard shells

morphology: the physical form and structure of an animal

multicuspid: having two or more cusps (on a tooth)

MX: Mexico

MY: Malaysia

myomeres: segmentally arranged blocks of muscle in the bodies of finfishes (Fig. 3.8A)

myoseptum: line of connective tissue separating the bundles of muscle or myomeres (Fig. 3.8A)

nape: in finfishes, the region of the head above and behind the eyes, before the dorsal fin (Fig. 3.3)

nostril: external opening of the nasal organs, usually pore-like in finfishes (Fig. 3.3)

NZ: New Zealand

ocellus (pl. ocelli): an eye-like spot with marginal ring

opercular spine: a spine on the posterior margin of the operculum in finfishes (Fig. 3.3)

operculum: in finfishes, the bony flap covering the gills (Fig. 3.3); in single-shelled molluscs, a hard, plate-like structure that partly or completely closes the aperture when retracted into the shell (Fig. 3.6A)

origin: of a fish's fin, the most anterior point of a fin base

pectoral fins: paired fins just behind or just below the gill opening of finfishes (Fig. 3.3)

pelagic: free-swimming in the open ocean

pelvic fins: paired fins on the underside of the body between a fish's mouth and anus (Fig. 3.3)

pelvic scute: a scute located just anterior to the pelvic fin

pen: cartilaginous, feather-shaped internal shell of squids

peritoneum: membranous lining of the internal belly flap or body cavity housing the internal organs (Fig. 3.8B)

PH: the Philippines

pin bones: rows of thin, usually exposed bones along or near the horizontal septum of the outer (Fig. 3.11A) and inner (Fig. 3.12B) surfaces of a fish fillet; portions of ribs contained within the fillet are frequently referred to as 'pin bones'

plankton: small animals and plants that float or drift with ocean currents

pore: a small opening or pit

posterior: the hind or tail end (Fig. 3.3)

precaudal pit: in sharks, a transverse or longitudinal notch on the dorsal or ventral surface just in front of the caudal fin (Fig. 3.1)

preopercular notch: a notch located on the posterior margin of the preoperculum

preopercular spine: a spine on the posterior margin of the preoperculum in finfishes (Fig. 3.3)

preoperculum: the main bone forming the anterior part of the operculum in finfishes (Fig. 3.3)

protein fingerprint: the pattern of bands seen after a tissue sample is subjected to gel electrophoresis and the gel stained with a protein-specific stain

protrusible: a condition of the jaws in which the mouth projects forward, downward or upward as a tube when the mouth is opened

- ray:** a flexible, often branched and segmented structure that supports a fish's fin (Fig. 3.3)
- red muscle:** relatively dark muscle evident as a flattened wedge extending outwards over the horizontal septum on the outer surface of a fish (Fig. 3.8A)
- rostral spine:** a spine on the rostrum of a crustacean (Fig. 3.5), sometimes referred to as a rostral 'tooth'
- rostrum:** a forward-projecting, thick extension on the carapace of a crustacean (Fig. 3.5)
- rounded:** usually referring to a fish's fin shape, one with an evenly convex margin
- run:** electrophoresis procedure whereby proteins are separated in a gel medium on the basis of their size and electrical charge; in a fast run the proteins move further and become more widely separated from one another than in a slow run
- scale:** a small membranous or horny modification of the skin of many finfishes
- scale pockets:** remnant structures on a fish's skin after scaling—provide evidence of the size and shape of scales
- scute:** a bony plate or enlarged, ridged scale (Fig. 3.3)
- seafood:** any fish or other aquatic plant or animal intended for human consumption
- seamount:** a mountain or hill on the seabed
- shelf:** see *continental shelf*
- shelf break:** see *continental shelf*
- shellfish:** aquatic molluscs and crustaceans
- shoulder:** the upper side of a fish just behind the head and usually above the pectoral fin (Fig. 3.3)
- skin fold:** an area where skin is bent over upon itself, forming a fleshy ridge
- skin nodules:** wart-like structures beneath the skin of some finfishes (Fig. 3.11C)
- slope:** see *continental slope*
- snout:** the part of the upper head in front of the eyes of finfishes (Fig. 3.3)
- soft ray:** see *ray*
- species:** a group of actually or potentially interbreeding animal or plant populations that are reproductively isolated from other such groups
- spicule:** minute, plate-like, calcareous structure that provides support
- spine:** a sharp projecting point; in finfishes, a firm, undivided and unsegmented fin support (Fig. 3.3)
- spinous:** spine-like or bearing or composed of spines
- spiracle:** a respiratory opening behind the eye in sharks and rays (Figs 3.1, 3.2)
- spire:** the pointed or raised part of a single-shelled mollusc, opposite the aperture (Fig. 3.6A)
- spot:** a regularly shaped or rounded marking (usually small) that differs in colour from the adjacent area; see also *blotch*
- standard length:** in finfishes, the distance from the snout tip to the last caudal vertebra
- stinging spine:** the large, serrated, sword-like bony structure on the tail of some rays (Fig. 3.2), sometimes abbreviated to 'sting'
- stripe:** a more or less horizontal line or marking of a different colour to the main (or adjacent) colour; see also *bar*
- suborbital:** area below the eye
- sucker:** suction-cup structure on the arms and tentacles of cephalopods

surimi: a Japanese term meaning finfish paste, and used to describe imitation seafood products manufactured from extruded finfish flesh

swimbladder: a sac (usually gas-filled) in the body cavity beneath the backbone of many finfishes—developed as part of the alimentary canal for buoyancy compensation (Fig. 3.8B)

tail fan: the terminal section of most crustaceans' bodies, consisting of a central telson and two flattened appendages either side (Fig. 3.5)

telson: the central unit of a crustacean's tail fan

tentacle: in some cephalopods, one of two long, sucker-bearing arms originating near the mouth

TH: Thailand

thorn: a sharp tooth-like structure on the skin of a skate or ray (Fig. 3.2)

total length: of finfishes, the greatest distance from the tip of the snout to the end of the tail

truncate: with a straight margin, terminating abruptly; usually refers to fin shape

trunk: that part of a fish (other than the fins) between the head and the tail

tube foot: external muscular extension of the water vascular system of echinoderms, usually occurring in rows

UK: United Kingdom

univalve: see *gastropod*

US: United States of America

valve: each shell of a mollusc (Fig. 3.6)

ventral: refers to the lower surface or underside of the body (or head) (Fig. 3.3)

ventral fins: see *pelvic fins*

VN: Vietnam

vomer: in fishes, a bone forming the front part of the roof of the mouth in the nasal region, frequently toothed

ZA: South Africa

Figure 3.1—Structural features of a generalised shark (lateral view).

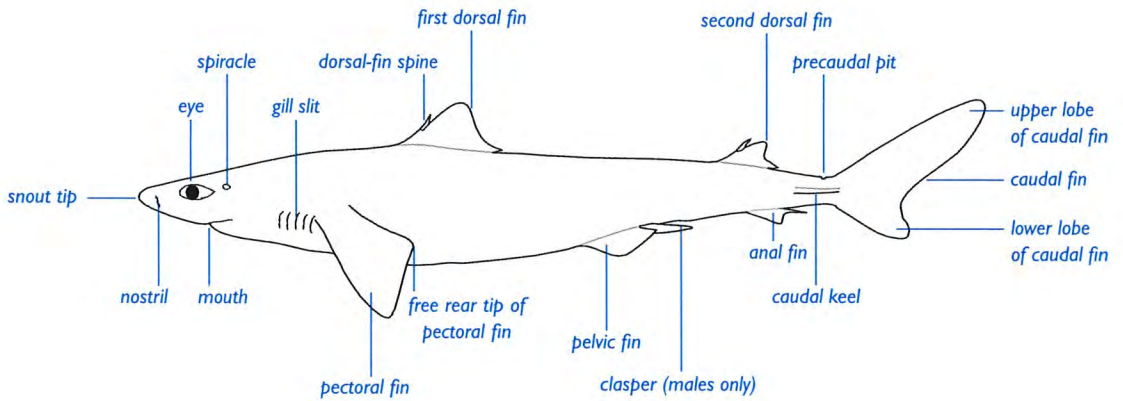


Figure 3.2—Structural features of a generalised ray (dorsal view).

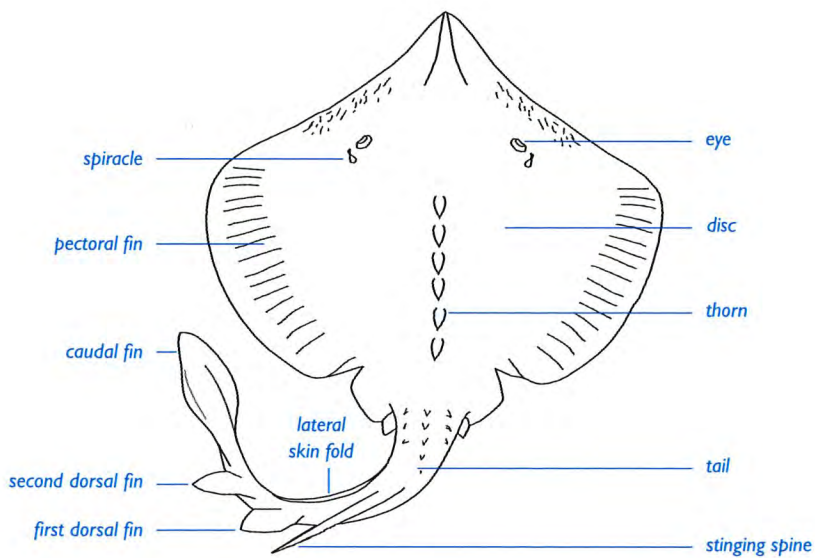


Figure 3.3—Structural features of a generalised bony fish.

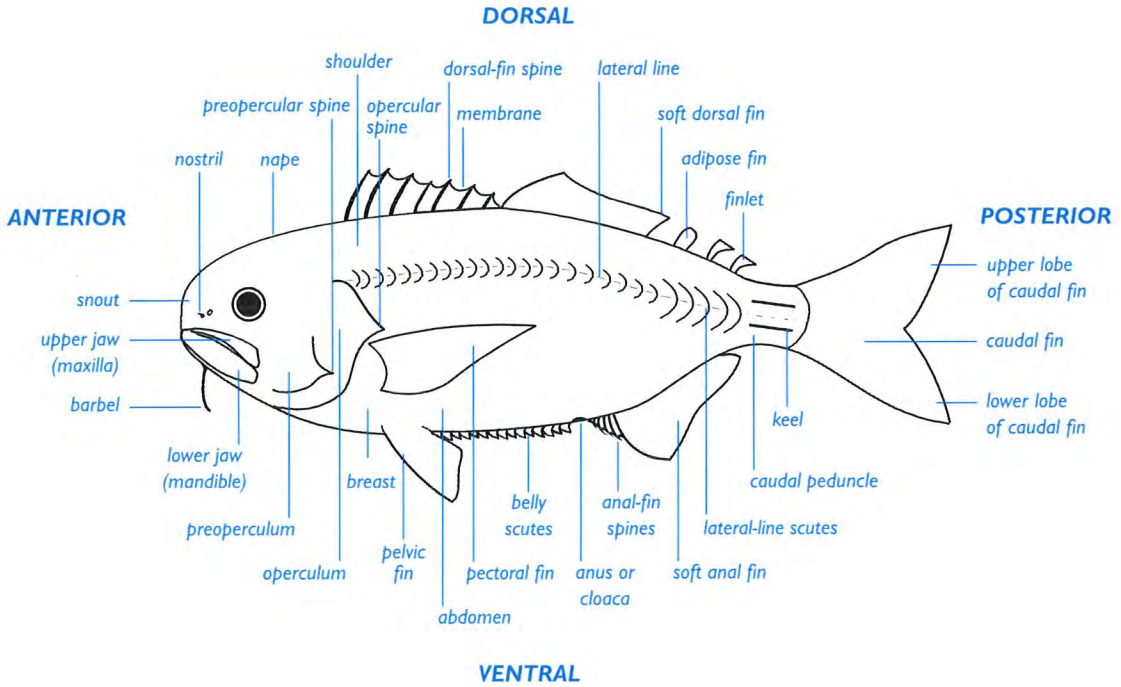


Figure 3.4—Structural features of a generalised bony fish outer gill-arch.

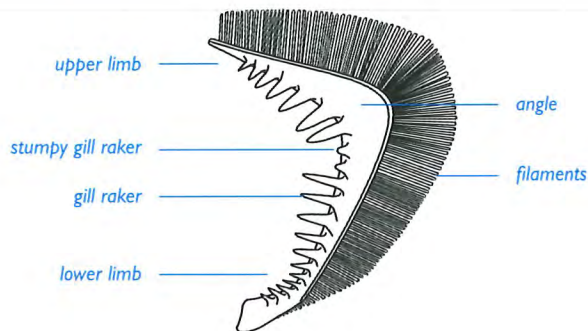


Figure 3.5—Structural features of a generalised crustacean.

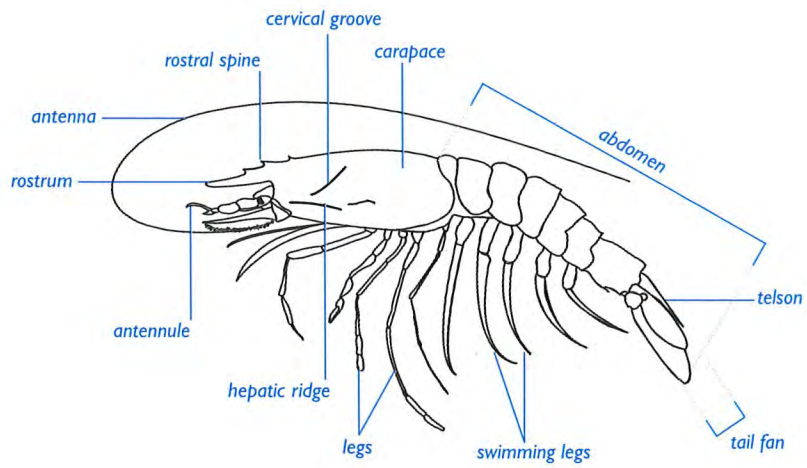


Figure 3.6—Structural features of a generalised (A) single-shelled mollusc; and (B) bivalve mollusc.

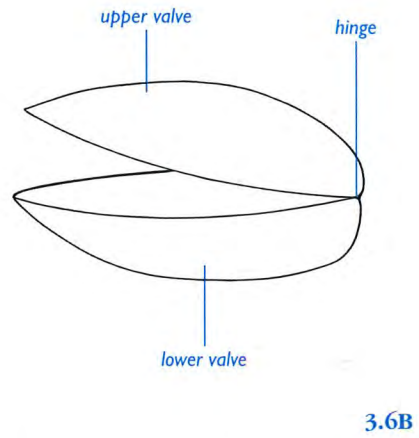
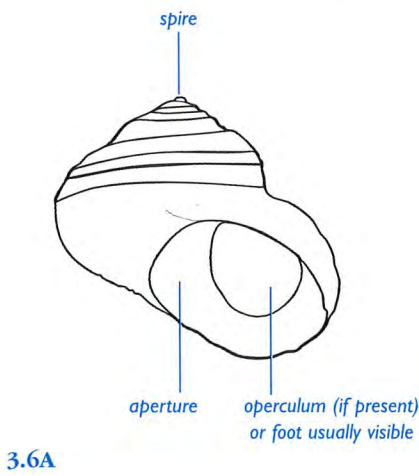


Figure 3.7—Structural features of a generalised cephalopod. (A) dorsal view; and (B) ventral surface showing funnel groove.

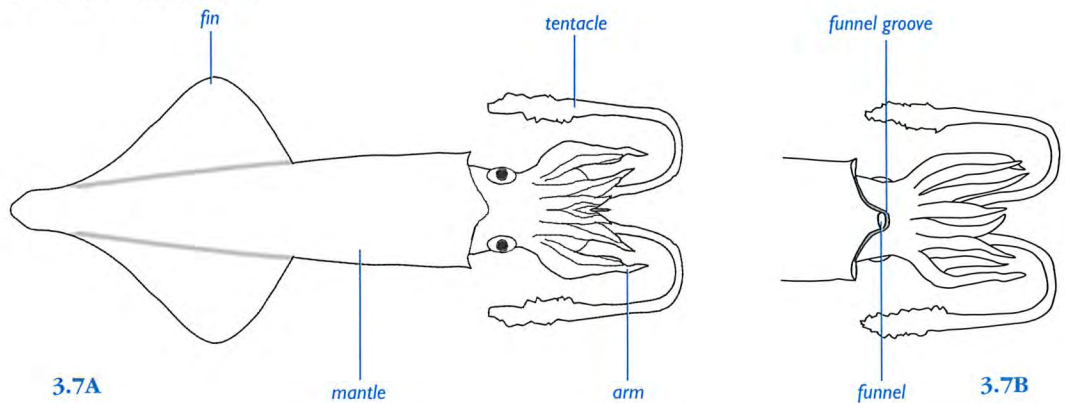


Figure 3.8—Fillet definitions: (A) outer fillet—cardinal fish (*Epigonus telescopus*); (B) inner fillet—cardinal fish (*E. telescopus*); (C) cutlet—yellowfin tuna (*Thunnus albacares*); (D) ray flap—skate (*Raja* sp.).

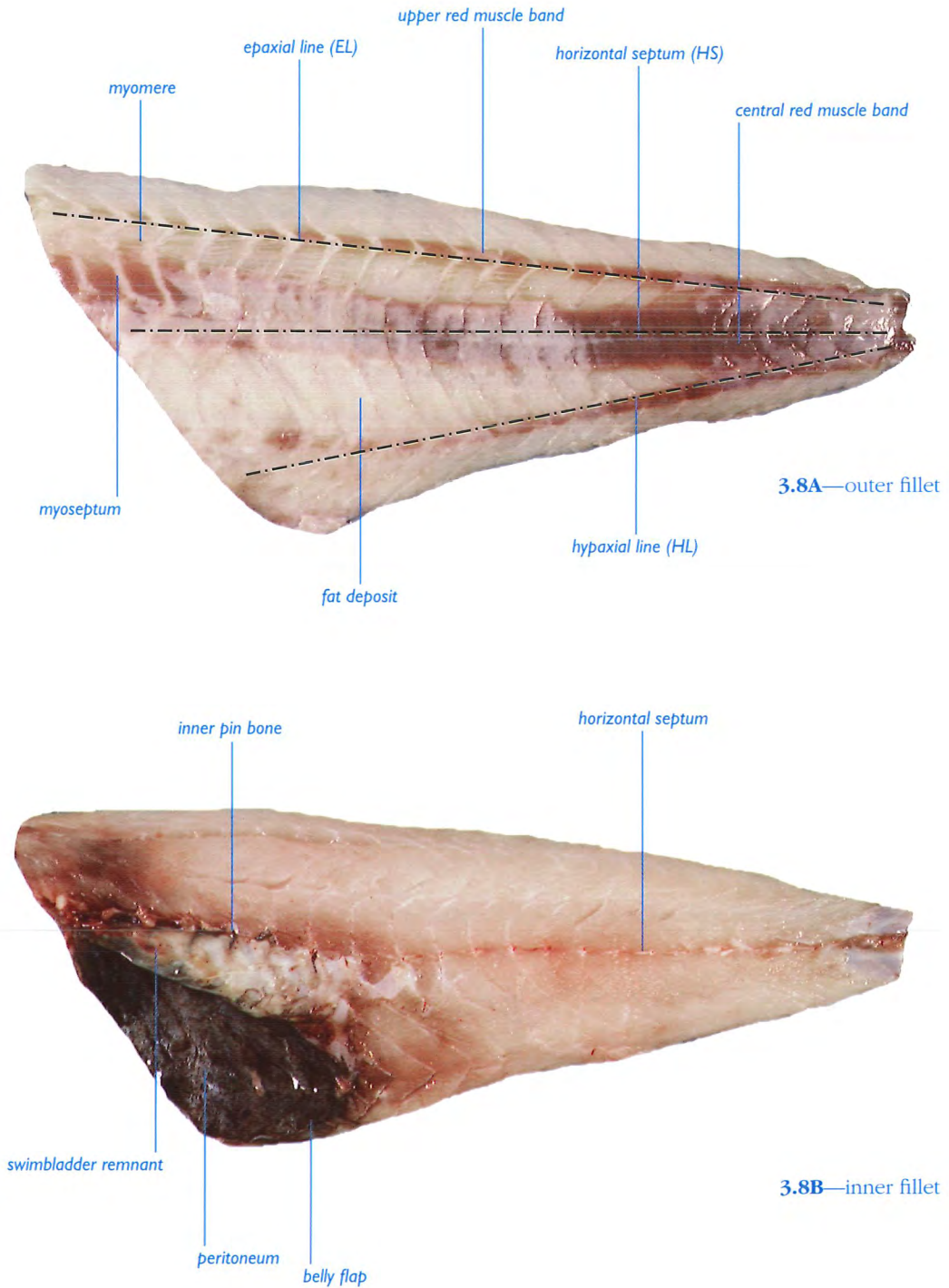
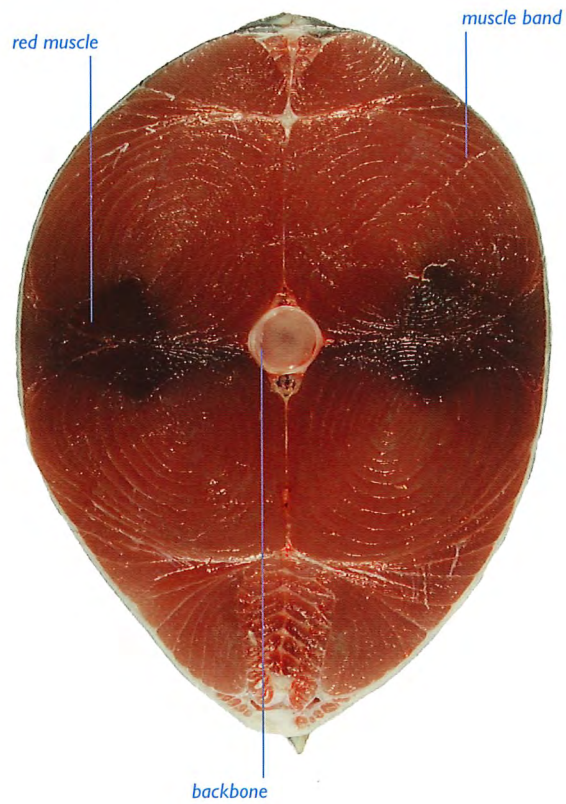
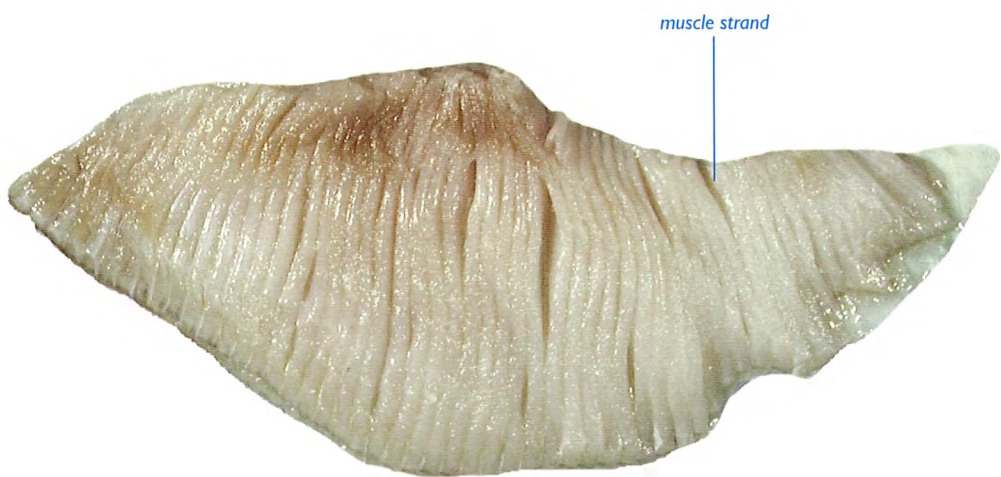


Figure 3.8—Fillet definitions, continued.



3.8C—cutlet



3.8D—ray flap

Figure 3.9—Fillet shapes: (A) deep bodied, short—John dory (*Zeus faber*); (B) deep, elongate, evenly tapering—baldchin groper (*Choerodon rubescens*); (C) elongate, deep, abruptly tapering—redspot emperor (*Lethrinus lentjan*); (D) bottle-shaped—blue-spotted trevally (*Caranx bucculentus*); (E) moderately deep, elongate, gentle taper—mullet (*Mugil argentea*); (F) slender, pronounced taper—tiger flathead (*Neoplatycephalus richardsoni*); (G) long, slender, barely tapering—longfin eel (*Anguilla reinhardtii*).

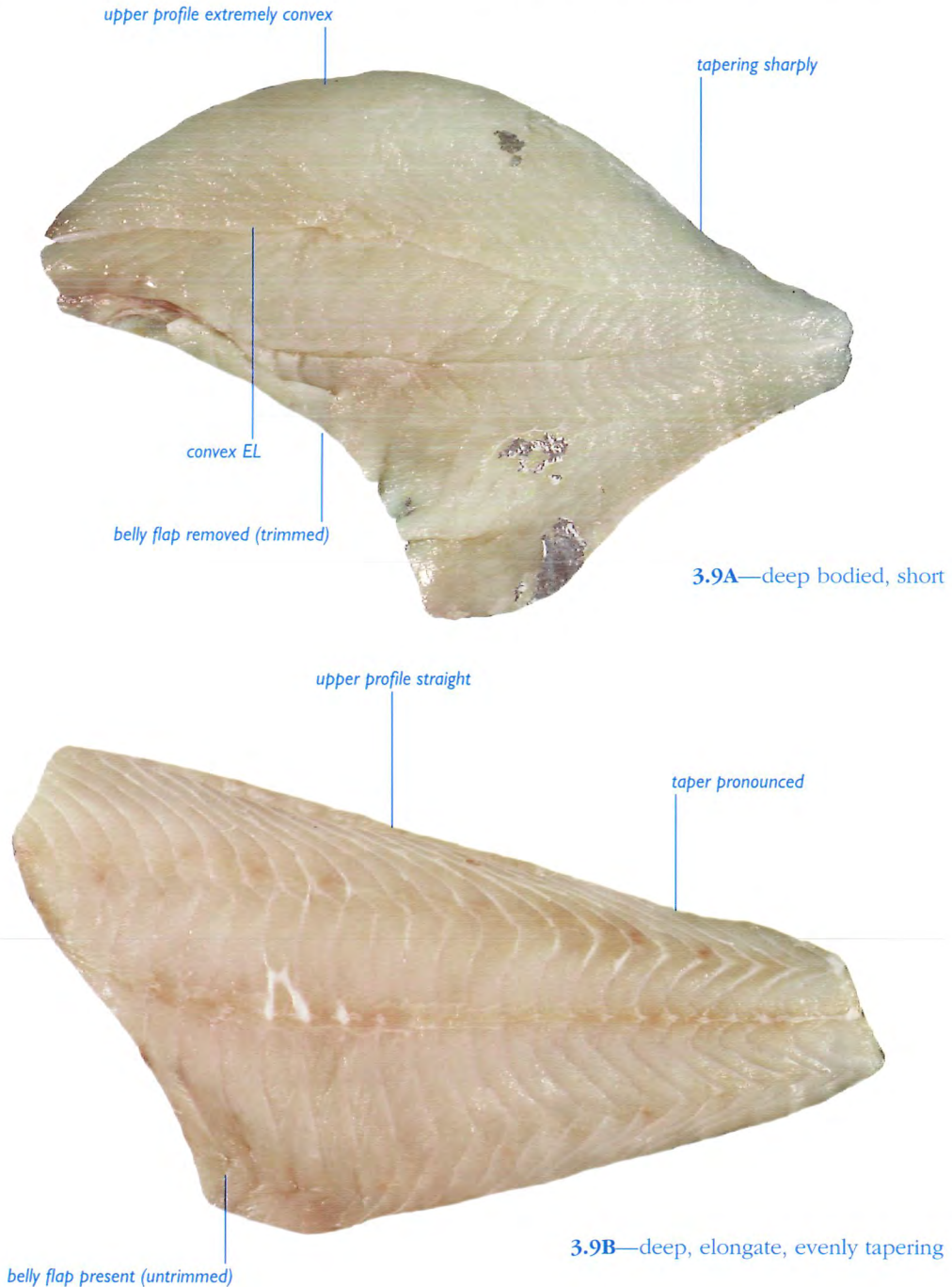
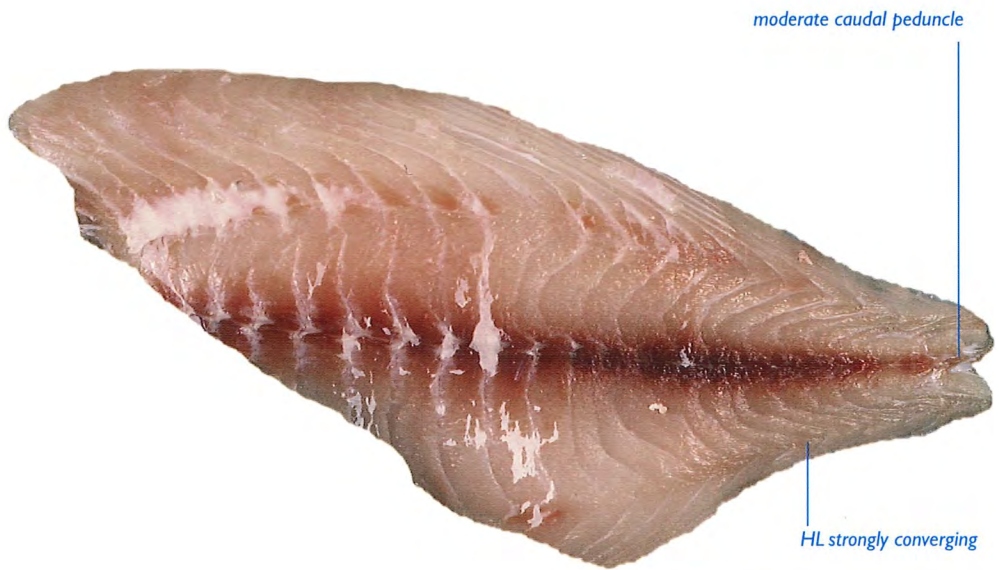


Figure 3.9—Fillet shapes, continued



3.9C—elongate, deep, abruptly tapering



3.9D—bottle-shaped

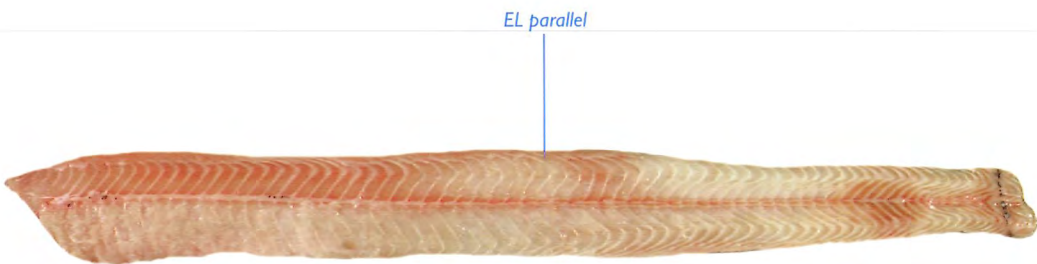
Figure 3.9—Fillet shapes, continued



3.9E—moderately deep, elongate, gentle taper



3.9F—slender, pronounced taper



3.9G—long, slender, barely tapering

Figure 3.10—Fillet colours: (A) milky white—rudderfish (*Centrolophus niger*); (B) pearly white—orange roughy (*Hoplostethus atlanticus*); (C) off-white yellowish—Ray's bream (*Brama brama*); (D) off-white greyish—garfish (*Hyporhamphus quoyi*); (E) bluish-white—grass whiting (*Haletta semifasciata*); (F) pale pinkish—honeycomb rockcod (*Epinephelus quoyanus*); (G) reddish-brown—yellowfin tuna (*Thunnus albacares*); (H) brown—Australian salmon (*Arripis truttaceus*); (I) orange—Atlantic salmon (*Salmo salar*); (J) green—batfish (*Platax batavianus*).

3.10A—milky white



3.10B—pearly white



3.10C—off-white yellowish



3.10D—off-white greyish



3.10E—bluish-white



3.10F—pale pinkish



3.10G—reddish-brown



3.10H—brown



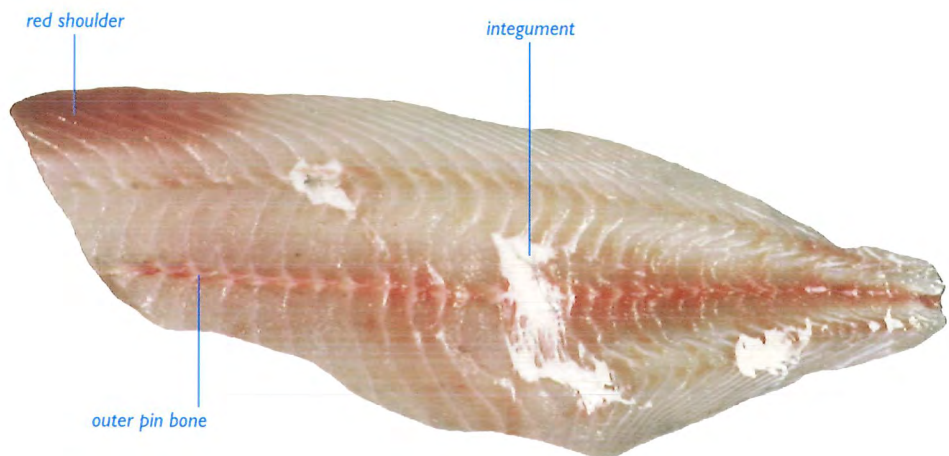
3.10I—orange



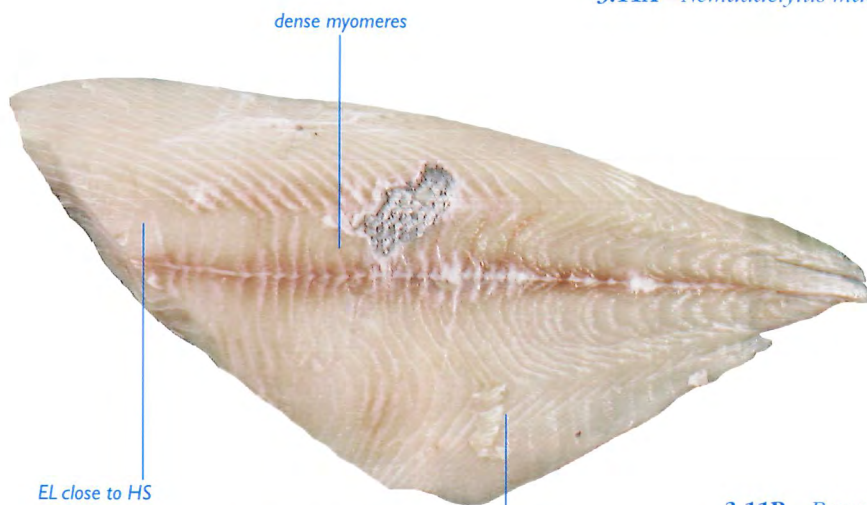
3.10J—green



Figure 3.11—Other features, outer fillet: (A) morwong (*Nemadactylus macropterus*); (B) Ray's bream (*Brama brama*); (C) rudderfish (*Centrolophus niger*); (D) garfish (*Hyporbambus quoyi*); (E) rock flat-head (*Platycephalus laevigatus*); (F) greeneye dogfish (*Squalus* sp.).



3.11A—*Nemadactylus macropterus*

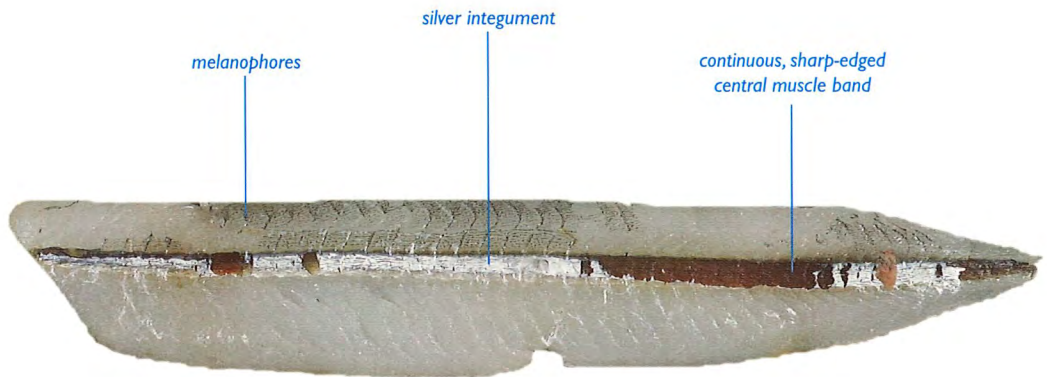


3.11B—*Brama brama*



3.11C—*Centrolophus niger*

Figure 3.11—Other features, outer fillet, continued



3.11D—*Hyporbambus quoyi*

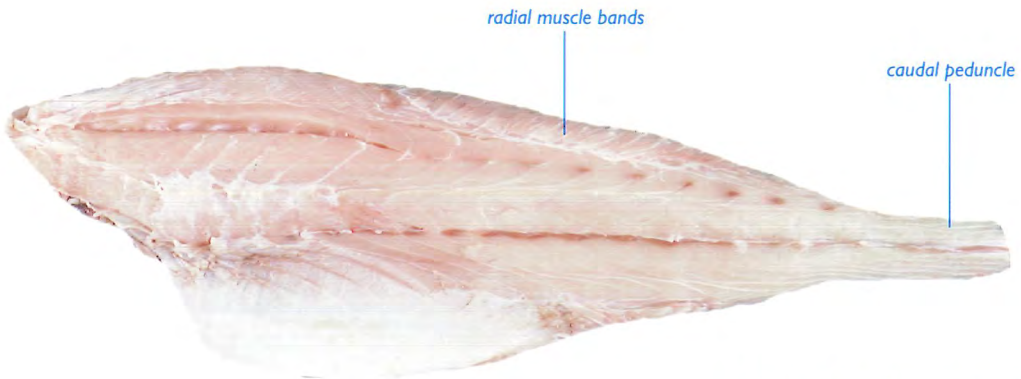


3.11E—*Platycephalus laevigatus*

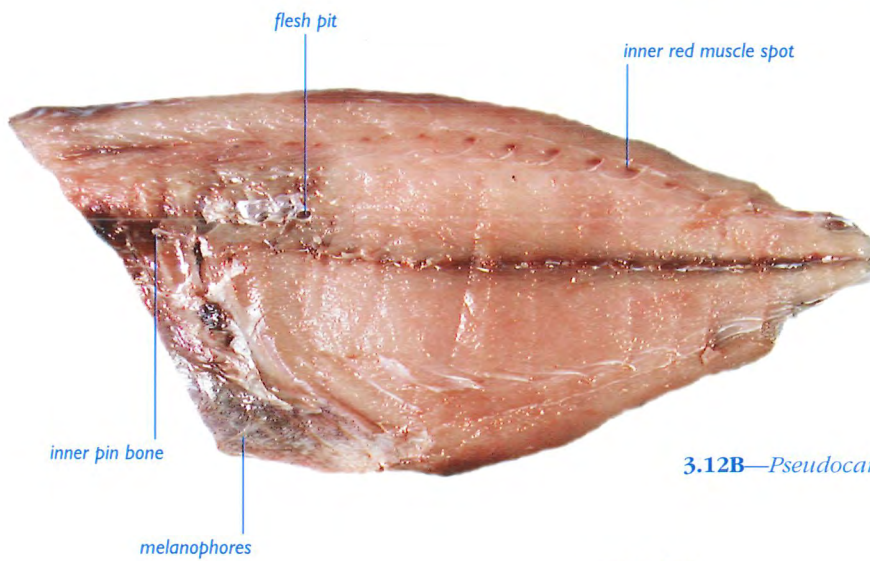


3.11F—*Squalus* sp.

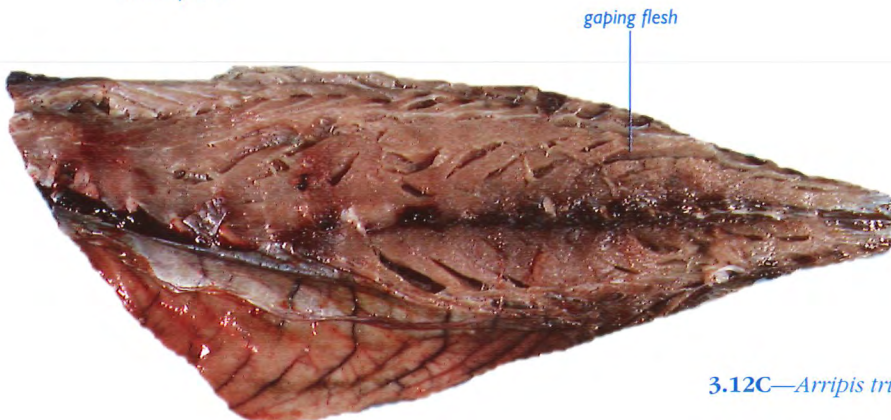
Figure 3.12—Other features, inner fillet: (A) black jewfish (*Protonibea diacanthus*); (B) silver trevally (*Pseudocaranx dentex*); (C) Australian salmon (*Arripis truttaceus*).



3.12A—*Protonibea diacanthus*



3.12B—*Pseudocaranx dentex*



3.12C—*Arripis truttaceus*

Cartilaginous fishes

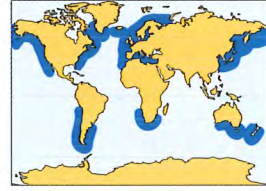
P. R. Last and G. K. Yearsley

4

White-spotted dogfish

Squalus acanthias

Minor names: piked dogfish, spotted spiny dogfish, white-spotted spurdog (AU), spikey dog, spiny dogfish (NZ)



Identifying features: ① bluish-grey with scattered white spots; ② hard spines preceding dorsal fins; ③ snout long and rather pointed; ④ rear inner edge of pectoral fin angular (not long and pointed); ⑤ teeth similar in shape in both jaws ⑥ no anal fin; ⑦ dorsal fin distinctly behind rear tip of pectoral fin.

Comparisons: Distinguished from other closely related grey dogfishes (*Squalus* species) by a bluish body and sparse covering of white spots (otherwise greyish and lacking white spots). Endeavour dogfishes (*Centrophorus* species) are similar in appearance but the inner edge of their pectoral fin is extended to form a pointed flap and they have a lobe on the upper portion of the caudal fin.

Product: Fillets, and headed and gutted carcasses (chilled and frozen). All grey dogfishes have long, skinless, slightly tapering, yellowish-white fillets. Imported fillets larger than domestic product.

Size: To 125 cm and about 7 kg (commonly imported at 70–100 cm and 2–4 kg).

Habitat: Marine; mainly demersal on the continental shelf but occasionally on the slope to depths of 700 m. Venturing inshore, off beaches and in bays over soft-bottoms, during breeding season.

Fishery: Extremely abundant in cool temperate parts of both hemispheres. Imported mainly from New Zealand where there is some target trawl fishing but most is taken as byproduct in other trawl fisheries, in gillnets and by longlines.

Remarks: Small incidental catches using inshore gillnets and Danish seines. Sometimes considered a nuisance to fishers, often tangling gear or dominating trawl bycatch. Probably the only dogfish species currently imported to Australia, although roughskin dogfishes (*Deania* species) may occasionally be imported as 'snow fillets'.

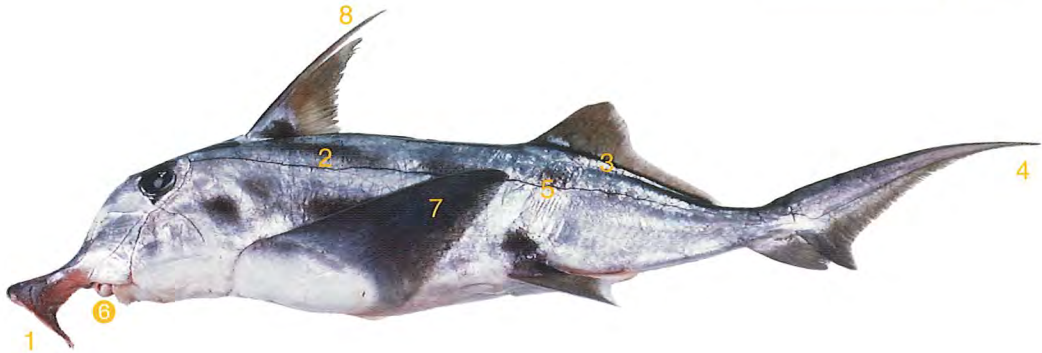
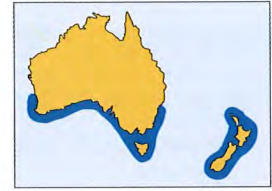


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Elephantfish

Callorhynchus milii

Minor names: elephant-shark, white fillets, whitefish (AU)



Identifying features: ① snout modified to form hoe-shaped structure; ② uniformly silvery with a few dark blotches; ③ second dorsal fin with relatively short base; ④ caudal fin long, pointed and arched upward; ⑤ skin smooth; ⑥ teeth beak-like; ⑦ pectoral fins paddle-like; ⑧ first dorsal fin much taller than second and preceded by strong spine.

Comparisons: Combination of smooth silvery skin, strong dorsal-fin spine, and hoe-shaped snout distinguishes this fish from other fishes consumed in Australasia. Close relatives, the ghostsharks (family Chimaeridae, p. 38), have a longer second dorsal-fin base, a filamentous tail, and lack a strange fleshy snout.

Product: Fillets (chilled and frozen). Flesh vivid white, firm, boneless, without red muscle. Silvery white integument usually residual on outside of fillet. Typically deeper than ghostshark fillets. Imported fillet slightly smaller than domestic product.

Size: To about 120 cm and 10 kg (commonly imported at 60–90 cm and about 1.5–6 kg).

Habitat: Marine; bottom dwelling on sandy and muddy substrates of the continental shelf in depths to 200 m. Migrates inshore between winter and summer to breed.

Fishery: Imported from New Zealand. Caught mainly in the breeding season by trawls and gillnets.

Remarks: Also taken domestically by local fishers off southern Australia. A second species, the Patagonian elephantfish (*C. callorhynchus*), is occasionally imported as frozen fillets from South America.

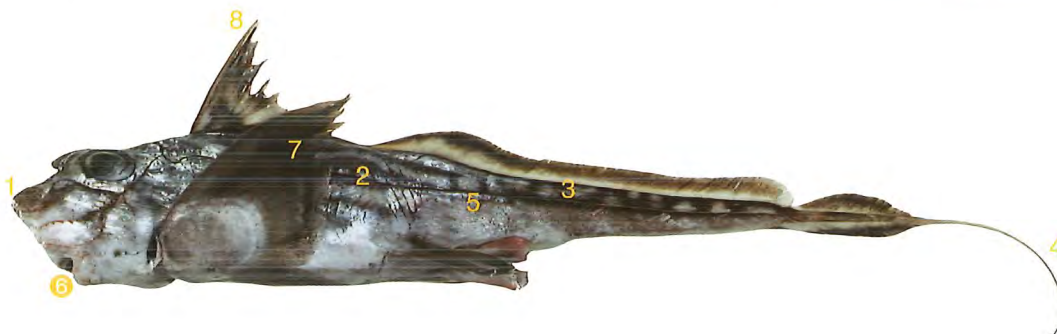


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Ghostshark

Hydrolagus novaezealandiae

Minor names: pearl fillets, white fillets (AU), dark ghostshark (NZ), chimaera



Identifying features: ① snout rounded; ② dark with pale spots and lines; ③ second dorsal fin with very long base; ④ tip of tail extended into long filament; ⑤ skin smooth; ⑥ teeth beak-like; ⑦ pectoral fins paddle-like; ⑧ first dorsal fin much taller than second and preceded by strong spine.

Comparisons: Distinguished from a related import, the elephantfish (family Callorhynchidae, p. 37), in having a rounded snout (rather than one modified to form a fleshy, hoe-like structure), a much longer second dorsal-fin base, and an eel-like tail ending in a rubbery filament (rather than a shark-like caudal fin). A dark body overlain with silvery white spots and stripes distinguishes it from domestic ghostsharks, which are usually plain silvery or blackish.

Product: Headed and gutted (frozen), and as fillets (frozen and chilled). Similar in appearance to domestic ghostsharks. Fillets very pale but more slender than those of the elephantfish.

Size: To at least 100 cm (without tail filament) and about 3 kg (commonly imported at about 50–80 cm and 1–2 kg).

Habitat: Marine; wide-ranging, bottom-dwelling over soft substrates of the upper continental slope between depths of 200–500 m.

Fishery: Caught commonly by demersal trawlers off the south island of New Zealand.

Remarks: Other ghostsharks may also be imported from New Zealand. Similar species are taken by trawl and dropline off temperate Australia. Ghostsharks were formerly sold in local regional markets as ‘white fillets’ or occasionally ‘pearl fillets’.



Trimmed. Protein fingerprint p. 178.

Gummy shark

Mustelus lenticulatus

Minor names: gummy, smooth hound (AU), pioke, rig (NZ)



Identifying features: ① second dorsal fin only slightly smaller than first; ② teeth in both jaws flattened; ③ greyish with tiny white spots; ④ small lobe on outer edge at top of caudal fin; ⑤ first dorsal-fin origin more or less above pectoral-fin rear tip; ⑥ no furrow (precaudal pit) at base of upper caudal-fin lobe; ⑦ no barbel in front of nostril; ⑧ no dorsal-fin spines.

Comparisons: Resembles the larger whaler sharks (family Carcharhinidae, pp 41–42) in body shape (but lacks a distinctive furrow at the base of the upper lobe of the caudal fin) and the similar-sized dogfishes (but lacks fin spines). The teeth of the gummy shark (flattened to form crushing plates) and the presence of many small white spots on the back makes them readily distinguishable from other imported sharks.

Product: Whole (chilled), headed and gutted (frozen) and as fillets (chilled and frozen). Fillets long, slender, tapering slightly, yellowish-white. Very similar in appearance to domestic gummy shark fillets.

Size: To 150 cm and 19 kg (commonly imported at 80–120 cm and 2–8 kg).

Habitat: Marine; demersal around the continental shelf, inshore to depths of about 200 m.

Fishery: Small to moderate resource taken mainly by gillnets and trawls in New Zealand's spring and summer.

Remarks: Rig (*M. lenticulatus*) is the dominant imported gummy shark but other *Mustelus* species are occasionally sourced from South America. The New Zealand species was initially considered to be the same species as the domestic gummy shark (*M. antarcticus*), but is now recognised as separate. The two species are very similar and are sold under the same marketing name. Supplements the fish-and-chip trade. Also sold in New Zealand as 'lemon fish'.

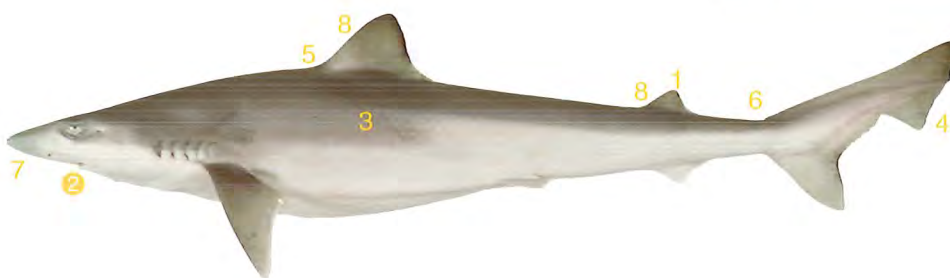


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School shark

Galeorhinus galeus

Minor name: snapper shark (AU)



Identifying features: ① second dorsal fin much smaller than first; ② teeth triangular with lateral cusps, similar shape in both jaws; ③ plain coloured; ④ large lobe on outer edge at top of caudal fin; ⑤ first dorsal-fin origin above or just behind pectoral-fin rear tip; ⑥ no furrow (precaudal pit) at base of upper caudal-fin lobe; ⑦ no barbel in front of nostril; ⑧ no dorsal-fin spines.

Comparisons: Very similar in general appearance to the whaler sharks (family Carcharhinidae, pp 41–42) but lacks a precaudal pit and has a much more distinctive lobe at the top of the caudal fin. Compared to gummy sharks (*Mustelus* species, p. 39), the second dorsal fin is much smaller, the teeth are sharp (rather than forming crushing plates), and the skin lacks white spots.

Product: Headed and gutted, as fillets, and separate belly flaps (frozen). Fillet skinned, deeper than gummy shark fillets.

Size: To 180 cm and 33 kg (adults exceeding 140 cm and 15 kg in New Zealand, but imported at about 70–80 cm).

Habitat: Marine; demersal and midwater over the continental shelf and upper slope from inshore to depths of at least 600 m. Young sharks use inshore bays and estuaries as nursery areas.

Fishery: Imported from New Zealand since the 1950s. It is caught by gillnets or longlines, or as trawl byproduct. Also sourced from South Africa.

Remarks: Wide-ranging shark found mainly in temperate regions. Capable of long migrations with some fish tagged off New Zealand recaptured off Australia. Basis of a small but important fishery off Australia and usually sold by fish-and-chip shops as 'flake'. Also known in the Northern Hemisphere as 'soupfin shark' (California) and 'tope' (United Kingdom).

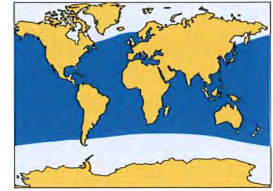


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Blacktip shark (page 1 of 2)

Carcharhinus, Loxodon & Rhizoprionodon species

Minor names: tropical shark, whaler shark (AU), whitefish



Carcharhinus dussumieri

Identifying features: ① second dorsal fin much smaller than first; ② furrow (precaudal pit) at base of upper and lower caudal-fin lobes; ③ no dorsal-fin spines; ④ first dorsal-fin origin usually over or at rear of pectoral fin; ⑤ pectoral fins short or of medium length; ⑥ lobe at tip of caudal fin very small; ⑦ body usually greyish.

Comparisons: A mixed group of tropical sharks sold as 'blacktip shark' all have a streamlined body shape, relatively small second dorsal and anal fins, and long upper caudal-fin lobe. They are difficult to identify particularly after being finned. Unlike the related hound sharks (family Triakidae, pp 39–40), they have crosswise furrows (precaudal pits) at the origin of both upper and lower lobes of the caudal fin.

Product: Fillets (frozen) and fins (frozen and canned). Occasionally marketed as frozen trunks. Fillets usually moderately elongate, off-white brownish. Included species regionally dependent and impossible to identify without using genetic techniques.

Size: To at least 360 cm and 350 kg (commonly imported at about 100 cm or less).

Habitat: Marine; mainly pelagic over the continental shelf, frequently off reefs and inshore in bays and estuaries, but several species occur in the open ocean.

Fishery: Caught using a variety of gear including gillnets, longlines, handlines and trawls. Targeted for their fins as well as taken opportunistically as byproduct. Imported from various Asian countries, and sometimes labelled as 'whitefish'.

Remarks: Whalers are the most commercially important tropical sharks. All are edible and many are marketed in varying quantities throughout the Indo-Pacific. Sometimes eaten raw. One of the two main domestic species, the spot-tail shark (*C. sorrah*), is also taken in quantity throughout Asia. Its fins and flesh are both commercially valuable. A related species, Indian dogshark (*Scoliodon laticaudus*), is occasionally imported from South-East Asia. Some South African product labelled as 'whaler shark' may be school shark (*Galeorhinus galeus*, p. 40).



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Blacktip shark (page 2 of 2)

Carcharhinus, Loxodon & Rhizoprionodon species

Carcharhinus dussumieri



Remarks: Commonly called ‘whitecheek shark’, this species is widely distributed in the Indo–West Pacific from the Persian Gulf east to Queensland and north to southern Japan. Prefers inshore areas near the bottom and also extends to depths of about 170 m. Distinguished by a black spot on the second dorsal fin, a triangular, moderately high first dorsal fin, and a broadly parabolic or wedge-shaped snout. Imported from South-East Asia in various forms, although considered an inferior foodfish in some countries. To at least 90 cm (commonly imported at 75–85 cm).

Carcharhinus sorrah



Remarks: Commonly called ‘spot-tail shark’, this species occurs in the Indo–West Pacific from south-east Africa to the Solomon Islands, including northern Australia. It is common inshore but also extends to depths of 140 m on the continental shelf. As its common name implies, it can be identified by the presence of a black spot on the lower lobe of the caudal fin. The pectoral and second dorsal fins also have black tips. Imported from South-East Asia in various forms, possibly including as fins. To at least 160 cm (commonly imported at less than 120 cm).

Rhizoprionodon acutus



Remarks: Commonly called ‘milk shark’, this species is widely distributed on continental shelves from the western Pacific through the Indian Ocean and to the eastern Atlantic. It is extremely abundant, often close inshore but also to depths of 200 m. Occurs both at the surface and near the bottom. Differs from the *Carcharhinus* species above in having the second dorsal-fin origin behind the middle of the anal-fin base, and in lacking black tips on the fins. The fins are sometimes used in sharkfin soup. Imported from South-East Asia in various forms, including dry salted flesh. To about 100 cm (commonly imported at 75–95 cm).

Bony fishes

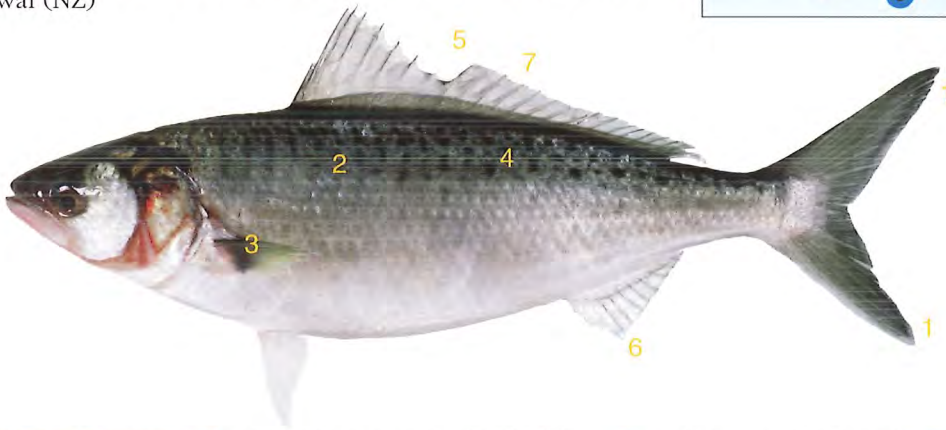
G. K. Yearsley, P. R. Last and D. C. Gledhill

5

Australian salmon

Arripis trutta

Minor names: bay trout, black back, cocky salmon (AU), kahawai (NZ)



Identifying features: ① no black tips on caudal-fin lobes; ② scales smooth to touch; ③ pectoral fin distinctly yellowish with black blotch at its base; ④ upper surface with darker green and golden spots and/or vertical bars (sometimes faint); ⑤ single continuous dorsal fin with a notch after last fin spine; ⑥ anal fin with 3 spines, much shorter-based than dorsal fin; ⑦ dorsal fin with 9 spines, 15–19 soft rays.

Comparisons: Very similar to the western Australian salmon (*A. truttaceus*), but has more rakers on the first gill arch (33–40 versus 25–31). Also similar to the Australian herring (*A. georgianus*) but has more soft dorsal-fin rays (15–19 versus 13–14). Another unrelated domestic species, tailor (*Pomatomus saltatrix*, family Pomatomidae), has 2 separate dorsal fins (rather than 1) and lacks spots. The vaguely similar mullets (family Mugilidae), which are occasionally imported, also have 2 dorsal fins.

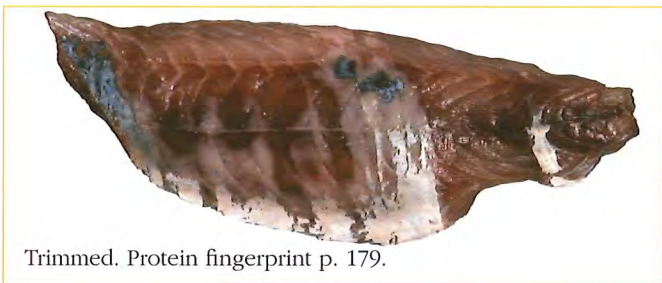
Product: Whole (frozen), mainly for rocklobster bait. Occasionally also as fillets, and headed and gutted (frozen). Processed (including canned) and smoked product also imported for human consumption. Fillet moderately deep, tapering slightly, pale pinkish to brownish.

Size: To at least 60 cm and 3 kg (commonly imported at 40–50 cm and more than 0.9 kg).

Habitat: Marine; coastal pelagic, often congregating in huge shoals inshore. Occasionally venturing into rivers and estuaries.

Fishery: Imported from New Zealand where caught principally by purse seine, but also by gillnets and trawls. Highly regarded sportfish being a strong fighter despite its moderate size.

Remarks: An increasingly important commercial species in New Zealand, although traditionally regarded as baitfish or petfood. Can yield a high-quality fillet if bled and chilled immediately after capture. The high oil content reduces shelf life, and frozen imports are therefore rarely used for human consumption. Sometimes labelled as 'kahawai', its New Zealand name.

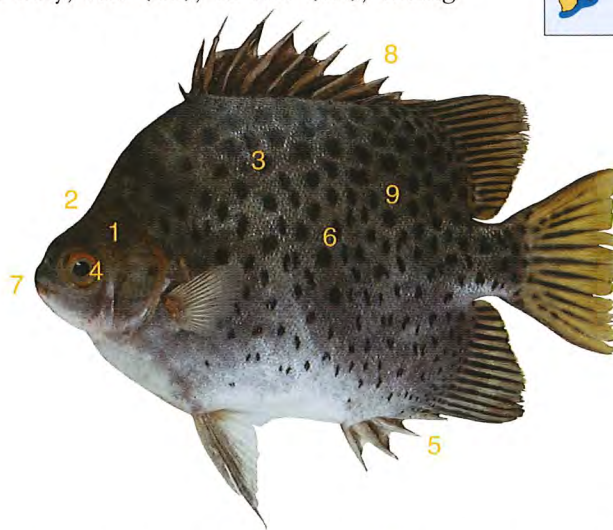


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Butterfish

Scatophagus species

Minor names: John dory, scat (AU), cá nau (VN), ketangkentang (ID), scatty



Scatophagus argus

Identifying features: ① head usually longer than tall; ② dorsal head profile concave; ③ body with dark spots or bars; ④ eye at level of pectoral-fin base or slightly above; ⑤ anal fin with 4 spines; ⑥ body deep and strongly compressed; ⑦ mouth small, at tip of snout, not extendible; ⑧ single dorsal fin, deeply notched, spinous portion distinct; ⑨ minute scales covering body, head and vertical fins.

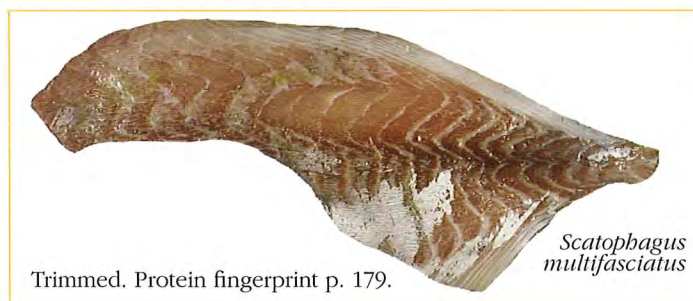
Comparisons: Distinguished by a deep body, small head and concave dorsal head profile. Resemble batfishes (family Ehippidae), but have more anal-fin spines (4 versus 3) and a more elongated head. Also similar to sicklefish (*Drepane punctata*), which is occasionally caught and sold in Australia, but the pectoral fin is less elongated (typically elongated and sickle-shaped in sicklefish), the eye is level with or only slightly above the pectoral-fin base (versus well above), the mouth is much less extendible, and the anal fin has 4 spines (versus 3).

Product: Whole (frozen). Fillets usually skinned, bottle-shaped when belly flap intact, and with a very convex upper profile.

Size: To about 40 cm and 1.6 kg (commonly imported at 15–25 cm and up to 0.5 kg).

Habitat: Marine; shallow coastal bays and estuaries, occasionally entering freshwater.

Fishery: Caught mostly in seine nets, gillnets and traps, and occasionally by handlines. Imported from South-East Asia.



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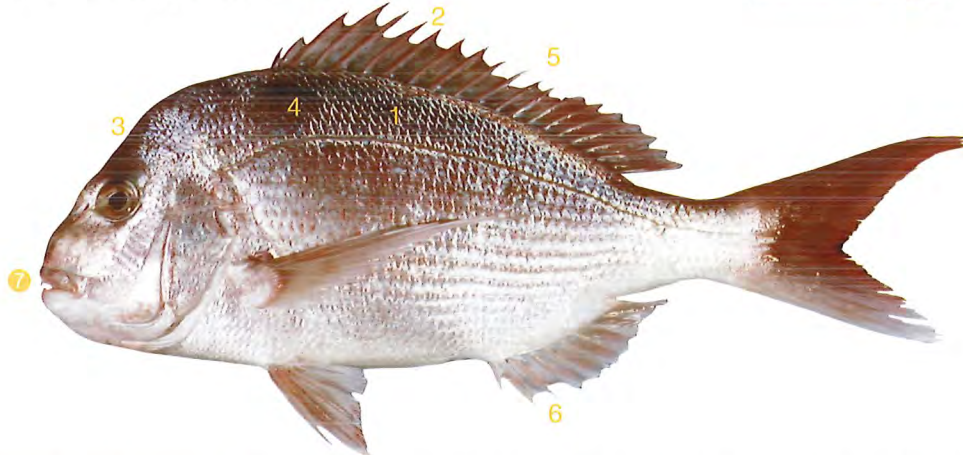
Scatophagus multifasciatus

Remarks: Four species are known, with at least three occurring locally. Favoured in some areas for their sweet flesh but considered of poor taste elsewhere. Usually sold fresh in Asian markets. Popular as aquarium fishes, they require careful handling due to their venomous spines.

Snapper

Pagrus auratus

Minor names: cockney, pink snapper, red bream, squire (AU), school snapper (NZ), schnapper



Identifying features: ① upper body pale silvery pink to reddish, usually with bluish spots (more prominent in young); ② dorsal-fin spines not greatly elongated; ③ forehead with prominent hump in some adults; ④ 8–12 vertical rows of scales between front of dorsal fin and lateral line; ⑤ dorsal fin with 12 spines, 9–10 soft rays; ⑥ second and third anal-fin spines enlarged; ⑦ enlarged canines at front and smaller rounded or flattened molar teeth along back of jaws.

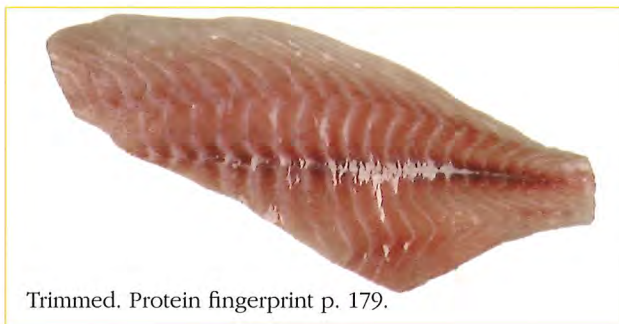
Comparisons: Young distinguished from other domestic commercial breams by body shape and pinkish coloration with blue spots. Otherwise, similar to the frypan bream (*Argyrops spinifer*) but differs in having a less rounded body and shorter dorsal-fin spines (leading spines about equal to pectoral-fin length in frypan bream). Similar to the more tropical seabreams (*Gymnocranius* and *Monotaxis* species) but snapper differs in having a more prominent forehead and having 12 spines (versus 10) in the dorsal fin.

Product: Whole, and headed and gutted (chilled and frozen), and as fillets (chilled and frozen). Fillet pale pink, rather deep and convex anteriorly.

Size: To at least 130 cm and 19.5 kg (imported at 0.5–5 kg; very common at 1–1.5 kg and less than 60 cm). In New Zealand mostly landed at 30–80 cm and about 0.5–8 kg.

Habitat: Marine; coastal and continental shelf to about 200 m. Juveniles mostly inshore.

Fishery: Fished throughout its range using various gear types including Danish seines, trawls, longlines, handlines and gillnets. Imported from New Zealand.



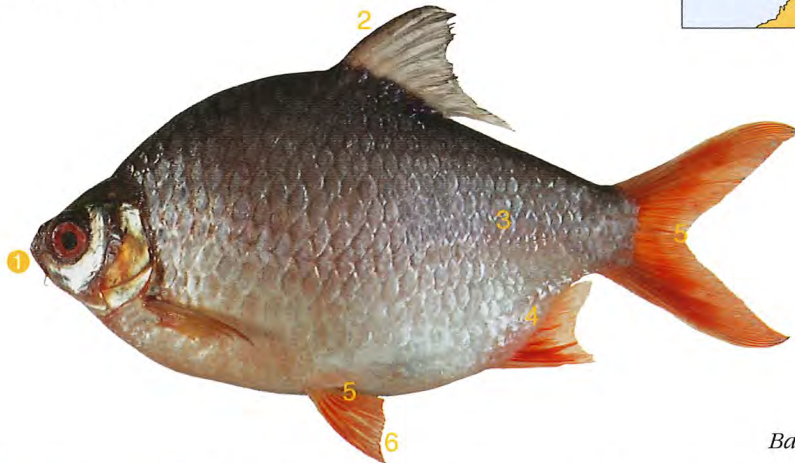
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Remarks: Domestic aquaculture provides a small quantity of juveniles to local markets. True snappers (family Lutjanidae) are unrelated. Another excellent although unrelated foodfish, blue sweep (*Scorpius violaceus*), is imported in small quantities from New Zealand where it is known as 'blue maomao'.

Barb

Barbonymus species

Minor name: tinfoil



Barbonymus altus

Identifying features: ① skin of lower lip clearly separated from lower jaw by shallow groove; ② dorsal-fin spine serrated; ③ 26–36 lateral-line scales; ④ anal-fin base about 90% of head length; ⑤ axillary scale at base of pelvic fin; ⑥ pelvic fin near middle of body.

Comparisons: Barbs belong to the family Cyprinidae (carps). Domestic commercial examples include European carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*), both of which have a long-based dorsal fin compared with that found in barbs. The major import, redbtail barb (*B. altus*), is distinguished from other barbs by red pelvic, anal and caudal fins (without darker submarginal stripes on each caudal-fin lobe) and 31–33 lateral-line scales.

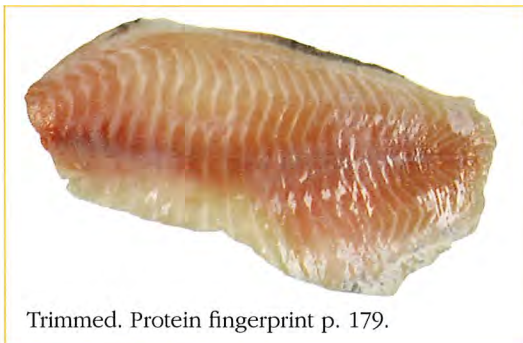
Product: Whole (frozen). Fillet of redbtail barb very deep, short, tapering sharply, pale pinkish. Belly cavity large and belly flap usually evident on fillet. Resembles fillets of domestic goldfish but more convex above.

Size: To at least 35 cm (commonly imported at 18–28 cm).

Habitat: Freshwater; inhabit midwater to bottom depths in rivers, streams, ditches, floodplains and sometimes reservoirs.

Fishery: Caught with seines, gillnets and traps in many parts of South-East Asia. Imported product mainly comes from farms in Vietnam where barbs are cultured in floating cages.

Remarks: The family Cyprinidae, with more than 2 000 species, is the largest family of freshwater fishes. Several species are imported to Australia and sold under names such as 'dace', 'tench' and 'carp'. Product forms include frozen, canned, pickled, dried and as fish paste. Some imports are probably hybrids, making identification difficult. Further marketing names will be required as the types of species imported becomes clearer. Until recently, barbs were classified in the genus *Barbodes*. Some are referred to as 'tinfoil barb' particularly in the aquarium trade.

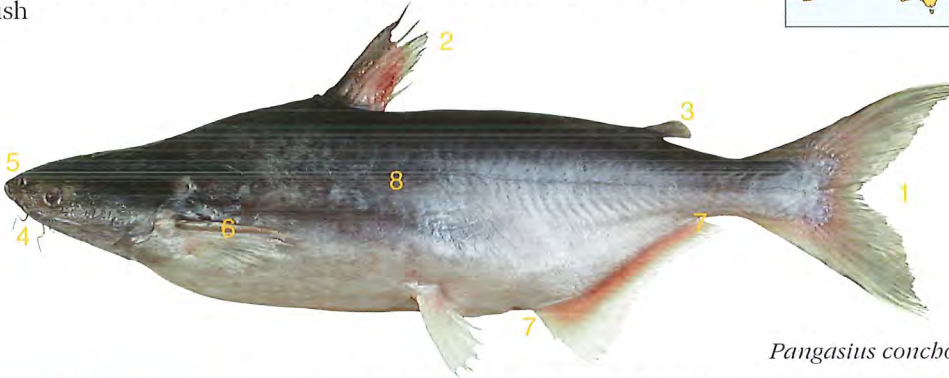


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Basa

Family Pangasiidae

Minor names: cá tra (VN), freshwater fillet, Pacific dory, shark catfish



Pangasius conchophilus

Identifying features: ① caudal fin forked; ② dorsal fin with 1–2 spines, 5–7 soft rays; ③ small adipose fin present; ④ usually 1 pair of barbels on both the upper and lower jaws (occasionally absent in large individuals); ⑤ no nasal barbels; ⑥ pectoral fin on side of body; ⑦ anal-fin origin near midpoint of body and fin ending well short of caudal fin; ⑧ body compressed.

Comparisons: Differ from domestic sea catfishes (*Arius* species) in lacking a flap of skin almost covering the rear nostril, and in having a relatively longer anal-fin base. The dominant import, *Pangasius hypophthalmus* (which has the common name ‘basa’), is unique in having small gill rakers interspersed with larger ones, and 8 or 9 pelvic-fin rays. Import restrictions apply to two large species: the Mekong giant catfish (*P. gigas*) has the mouth located at the snout tip, 8 (occasionally 9) pelvic-fin rays, and minute or absent gill rakers, and the giant catfish (*P. sanitwongsei*) has a wider mouth (more than 17% of standard length) than all other members of the genus.

Product: Whole, trimmed (i.e. fins removed), as fillets and cutlets (frozen), and as fillets (dried). Fillets generally moderately elongate, tapering slightly, pale pinkish; outside with continuous pronounced central red muscle band and distinct myomeres. Fillet colour varies from yellowish white to pink depending on species and environment.

Size: To about 300 cm and 300 kg (commonly imported at up to 45 cm).

Habitat: Freshwater; mainly benthopelagic in rivers and lakes. However, one species commonly inhabits estuaries and two species are marine.

Fishery: Widespread, with wild-caught fish commonly taken by gillnets. Some species important to aquaculture. Sourced from Vietnam and elsewhere in South-East Asia. Sea catfishes are also imported occasionally.

Remarks: The main species farmed are basa (*P. hypophthalmus*, Vietnam, Thailand and Myanmar), Indonesian basa (*P. djambal*, Indonesia), royal basa (*P. bocourti*, p. 49, Cambodia and Vietnam), and yellowtail basa (*P. pangasius*, India). About 90% of Australian imports are basa, *P. hypophthalmus*. Populations of some species have been depleted in the wild.



Trimmed. Protein fingerprint p. 179.

Royal basa

Pangasius bocourti

Minor names: Mekong catfish, freshwater fillet, Pacific dory, shark catfish



Identifying features: ① caudal fin forked; ② dorsal fin with 1–2 spines, 5–7 soft rays; ③ small adipose fin present; ④ 1 pair of barbels on both the upper and lower jaws; ⑤ 36–46 gill rakers on first gill arch; ⑥ pelvic fin with 6 soft rays; ⑦ snout blunt, rounded; ⑧ mouth width less than 10% standard length.

Comparisons: Only two other *Pangasius* species have more than 35 gill rakers: longthread basa (*P. macronema*, 36–45 gill rakers) and basa (*P. hypophthalmus*, 29–38). In royal basa the gill rakers are elongate, whereas in longthread basa they are relatively short and in basa small gill rakers are interspersed with larger ones. Also, longthread basa has a uniquely narrow head and mouth, and basa has 8 or 9 pelvic-fin rays (rather than 6).

Product: Whole, trimmed (i.e. fins removed), as fillets and cutlets (frozen), and as fillets (dried). Fillet moderately elongate, tapering slightly, off-white yellowish; outside with continuous pronounced central red muscle band and distinct myomeres.

Size: To about 130 cm and 50 kg (commonly imported at up to 45 cm).

Habitat: Freshwater; mainly benthopelagic in rivers of the Mekong basin. Known to migrate upstream at the onset of the flood season.

Fishery: Wild-caught fish taken by gillnets, seines, trawls and hook-and-line. However, mostly farmed in wooden cages. Imported from Vietnam.

Remarks: Although considered the premium member of the group due to its whitish flesh, and superior texture and flavour, the quantity of royal basa produced is relatively small compared with other farmed *Pangasius* species such as basa (*P. hypophthalmus*).



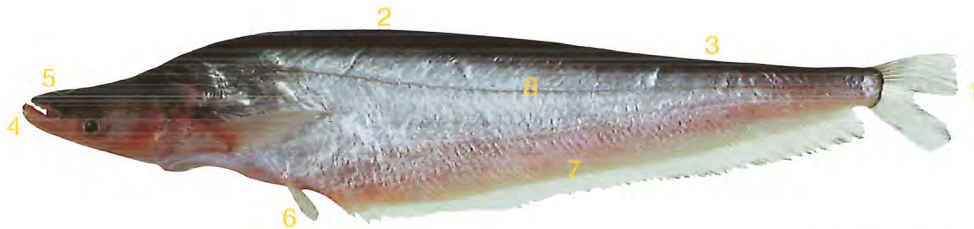
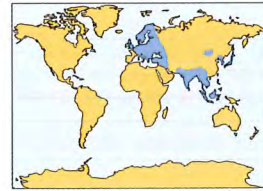
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and/or taste of *Pangasius* flesh are caused by variables including quality and types of feed used, carotenoids present in feed, algae and phytoplankton existing naturally in the stream where the cage is located, and fish age. Almost all broodstock for aquaculture purposes is supplied by Cambodia.

Sheatfish

Family Siluridae

Minor names: ompok fish (VN), wels catfish



Kryptopterus apogon

Identifying features: ① caudal fin usually forked or truncated (rarely rounded or pointed); ② dorsal fin reduced or absent (when present lacking spines and usually with fewer than 7 rays); ③ no adipose fin; ④ 1–2 pairs of barbels on lower jaw; ⑤ no nasal barbels; ⑥ pelvic fins small or absent; ⑦ anal-fin base very long, more than half body length; ⑧ body usually compressed.

Comparisons: Readily differentiated from fishes marketed domestically as ‘catfish’ (*Arius* species) by lacking an adipose fin and having a long-based anal fin (with 41–110 rays). Unlike the domestic cobbler (*Cnidoglanis macrocephalus*) and freshwater catfish (*Tandanus* species), sheatfishes rarely have a pointed tail and their dorsal fin (when present) lacks a spine. Differ from other imported catfishes (basa, p. 48, royal basa, p. 49 and snake catfish, p. 51) in having a much longer anal-fin base combined with a relatively shorter, spineless dorsal fin. Differ from the similarly shaped knifefishes (family Notopteridae, p. 96) by the presence of barbels around the mouth and the absence of pre-anal ventral scutes.

Product: Whole and trimmed (frozen and dried). Fillet of cardinal sheatfish (*Kryptopterus apogon*) distinctly two toned, yellowish above, off-white greyish below, with narrow, well-defined, central red muscle band on outside; moderately elongate, tapering gently.

Size: To about 500 cm and 330 kg (commonly imported at up to 35 cm but size and weight varies greatly with species and market requirements).

Habitat: Freshwater; benthopelagic, occasionally entering brackish water.

Fishery: Mainly cultured. Wild fish caught predominantly by traps, gillnets and lines. Some species targeted as gamefish. Imported from Vietnam and possibly from elsewhere within their range.



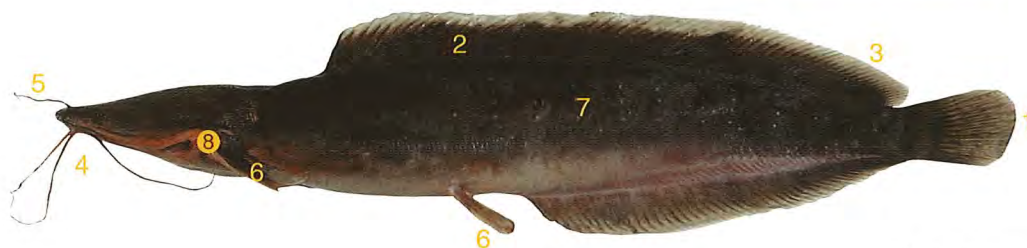
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Remarks: Highly fecund with species spawning up to half a million eggs. The largest sheatfish, wels catfish (*Silurus glanis*), which is a sought after gamefish, is reputed to ambush ducks and eat them whole. Some species popular in the aquarium trade.

Snake catfish

Family Clariidae

Minor names: airbreathing catfish, labyrinth catfish



Clarias batrachus

Identifying features: ① caudal fin rounded; ② dorsal fin spineless, base very long (sometimes extending to caudal fin); ③ adipose fin usually absent (present in a few species with a shorter dorsal-fin base); ④ usually 3 pairs of long barbels around the mouth (1 side pair and 2 pairs on the chin); ⑤ 1 pair of nasal barbels; ⑥ pectoral and pelvic fins small or absent; ⑦ body elongate, cylindrical; ⑧ accessory respiratory organ arising from the gill arches (usually present).

Comparisons: Unique among all catfishes marketed in Australia (families Siluridae, Pangasiidae, Ariidae and Plotosidae) in having a rounded caudal fin (rather than forked or pointed), a very long-based dorsal fin without spines (otherwise much shorter based and often with a hard spine or adipose fin), usually 4 pairs of long barbels (rather than 1–3), and an air-breathing organ associated with the gill arches. Bagrid catfishes (family Bagridae), such as Asian redbtail catfish (*Mystus nemurus*), are occasionally imported; they have a strong dorsal-fin spine, forked caudal fin, smooth skin, usually a very prominent adipose fin, nasal barbels, and a short-based anal fin.

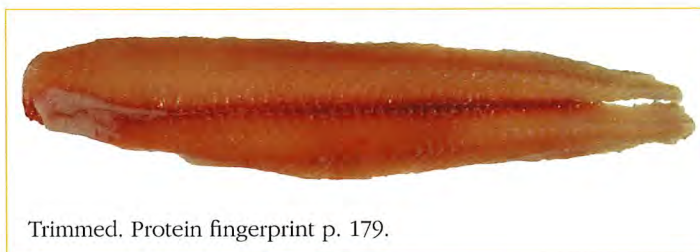
Product: Whole, trimmed (i.e. fins removed) and as cutlets (frozen). Fillet of walking catfish (*Clarias batrachus*) moderately long, slender, tapering slightly, deep pinkish or reddish brown; outside with narrow central red muscle band and sometimes with fat deposits.

Size: To at least 100 cm and 45 kg (commonly imported at 30–40 cm).

Habitat: Freshwater; mainly above the bottom in lakes. Capable of travelling over land using their fins as 'legs' to reach streams where they breed.

Fishery: Caught predominantly by traps, gillnets and lines. Also cultured. Imported mainly from Vietnam.

Remarks: Edible qualities greatly affected by diet and environment, with some wild fish having a 'muddy' taste. Farmed fish, some of which are hybrids, are generally of higher quality. Commonly sold fresh and frozen, and in South-East Asia often live (in baskets). Popular smoked in some regions. An accessory respiratory organ located near the gills enables them to breath air so they can tolerate stagnant water or move over dry land. Can bury into mud during droughts where they lie dormant for extended periods.

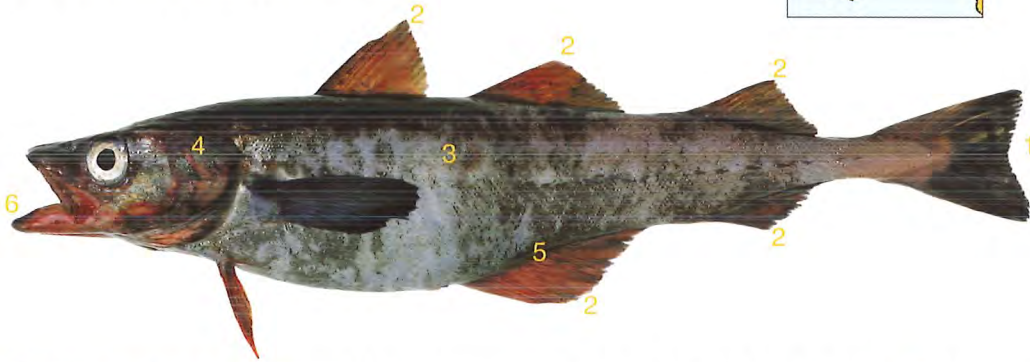
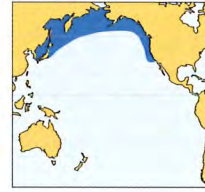


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Alaskan pollock

Theragra chalcogramma

Minor name: walleye pollock (CA)



Identifying features: ① caudal fin separate from other fins, slightly forked; ② 3 separate dorsal fins and 2 anal fins; ③ body pale greenish or brownish with darker mottling; ④ lateral-line pores present on head; ⑤ length of base of first anal fin less than half distance from snout to anus; ⑥ lower jaw projecting further forward than snout.

Comparisons: Belongs to a major commercial group, the codfishes (family Gadidae), whose members occur mainly in the Northern Hemisphere. Their general appearance is distinctive and many of the species have 3 dorsal fins and 2 anal fins. A relative, the southern blue whiting (*Micromesistius australis*, p. 57), which is caught off southern New Zealand and imported to Australia, has a proportionally longer first anal-fin base.

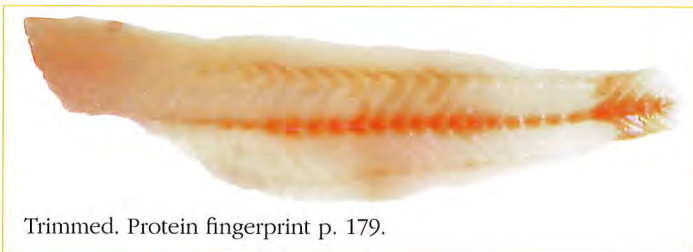
Product: Gilled and gutted (frozen), as fillets (frozen, dried and salted), surimi, and roe. Main imports are laminated blocks of skinless, defatted fillets, which are used for the manufacture of fish fingers and various surimi products. Some skinless fillets are imported for the fish-and-chip trade. Fillet moderately deep, somewhat elongate, tapering gently, margins straight, off-white yellowish; outside with central red muscle band. Fillet superficially similar in appearance to that of the red gurnard (*Chelidonichthys kumu*, p. 88).

Size: To at least 90 cm and more than 14 kg (commonly imported at up to 60 cm and 1.6 kg).

Habitat: Marine; mainly demersal on the continental shelf and upper slope in depths of 30–400 m. Migrates into open water at night.

Fishery: One of the world's largest demersal fish resources with an annual catch frequently exceeding three million tonnes. Caught from multiple stocks across the temperate and sub-Arctic Northern Hemisphere using Danish seines, trawls, longlines, gillnets and dragnets. Largest catches come from the eastern Bering Sea. Imported from China and Canada.

Remarks: Sold under a variety of misleading names locally, including 'hake', 'bream' and 'barramundi'. Once used mainly for animal feed because of its small average landed size and soft flesh. Has become increasingly more important for human consumption in Australia. A common ingredient in seafood sticks, flakes, salad and extender.

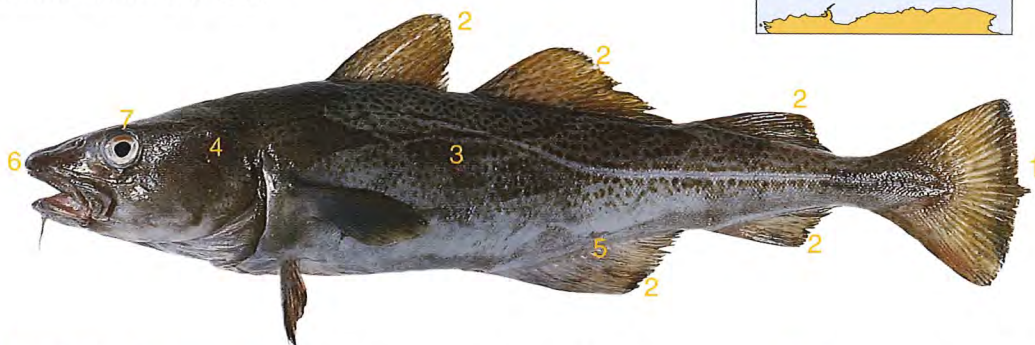


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Atlantic cod

Gadus morhua

Minor name: cod (UK)



Identifying features: ① caudal fin separate from other fins, truncate; ② 3 separate dorsal fins and 2 anal fins; ③ body colour variable, pale greenish, greyish or brownish and usually mottled; ④ lateral-line pores present on head; ⑤ base of first anal fin less than half distance from snout to anus; ⑥ snout projecting further forward than lower jaw; ⑦ head relatively narrow (interorbit less than quarter of head length).

Comparisons: Similar to the Alaskan pollock (*Theragra chalcogramma*, p. 52), in general appearance but its lower jaw does not protrude forward of the snout and it has a relatively smaller chin barbel. Also similar to haddock (*Melanogrammus aeglefinus*), which is occasionally imported, but lacks a dark blotch above the pectoral fin (blotch present in haddock). Another minor import, the Pacific cod (*Gadus macrocephalus*), has a relatively longer head. The North Sea whiting (*Merlangius merlangus*, p. 56) also has 3 dorsal fins and 2 anal fins but differs from these species in having the first anal-fin base visibly much longer than the second anal-fin base (rather than about equal). No domestic species has 3 separate dorsal fins and 2 anal fins.

Product: Fillets (frozen, salted, dried and smoked), trunks (salted and dried) and as cod liver oil. Fillet moderately deep, somewhat elongate, tapering gently, margins straight, off-white yellowish or pinkish; outside with distinct central red muscle band.

Size: Once to 200 cm and 90 kg. Now nearer 45 kg but varies by region (adults averaging about 120 cm and 11 kg).

Habitat: Marine; demersal and pelagic on the continental shelf and upper slope in depths of 1–600 m. Mainly caught offshore in 150–200 m. Aggregates above the bottom during the day.

Fishery: Major commercial fish of the Northern Hemisphere historically referred to as ‘beef of the sea’. Once accounted for almost a third of the world’s demersal finfish catch. Fished in cool temperate and subArctic seas mainly using otter and pelagic trawls but also taken by various other trawls, gillnets and lines. Aquaculture research is progressing. Imported from Europe.



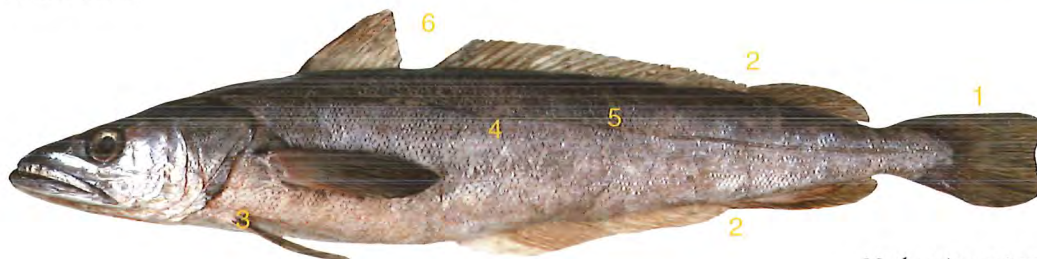
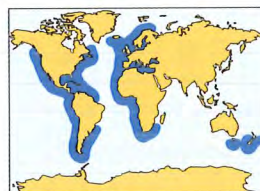
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Remarks: Capable of long migrations, its ecology, biology and habitat vary across the Northern Hemisphere. Diminishing importance as an import in Australia. A relative, coley or saithe (*Pollachius virens*), is imported in small quantities canned.

Hake

Merluccius species

Minor names: southern hake (AU), English hake (NZ), Argentine hake, cape hake, Chilean hake, merluza, North Pacific hake



Merluccius capensis

Identifying features: ① caudal fin separate from other fins; ② second dorsal and anal fins deeply indented (or notched); ③ pelvic-fin base beneath or slightly before pectoral-fin base; ④ body pale greyish to white; ⑤ scales easily removed; ⑥ first dorsal fin separated slightly from second dorsal fin.

Comparisons: Seven species are imported: southern hake (*M. australis*), cape hake (*M. capensis*), Chilean hake (*M. gayi*), Argentine hake (*M. hubbsi*), European hake (*M. merluccius*), deepwater cape hake (*M. paradoxus*) and North Pacific hake (*M. productus*). A characteristic body shape, and deep notches in the dorsal and anal fins, distinguish them from all other cod-like fishes marketed in Australia. Sometimes confused, particularly as trunks, with hapuku (*Polyprion* spp) but hake are less heavily built, have a much longer anal fin, and lack thick, dorsal-fin spines. An imported relative, southern blue whiting (*Micromesistius australis*, p. 57, family Gadidae), is similar but has 3 separate dorsal fins and 2 anal fins.

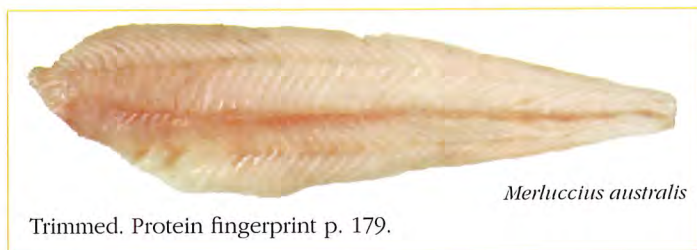
Product: Headed and gutted (frozen), as fillets (frozen, chilled and smoked), crumbed fillets (frozen), processing blocks (frozen), and as surimi. Mainly imported as frozen fillets (skin-on or skin-off). Fillet of southern hake long, slightly tapering, white to yellowish-white; outside with pale central red muscle band.

Size: To 126 cm and at least 14 kg (commonly imported at 40–100 cm and 1–9 kg).

Habitat: Marine; some species demersal on the continental slope to depths of 1 000 m, others shallower on the shelf and upper slope.

Fishery: Targeted in the North Pacific and across temperate parts of the Southern Hemisphere (but not domestically) mostly by trawls. Imported mainly from Namibia, South Africa, Argentina, Chile, New Zealand and the US. Product sourced from South Africa is mostly cape hake.

Remarks: Hake fillets are among the most important fish product imported to Australia. Skin-on fillets are used to produce 'smoked cod'. Processing blocks are used to produce fish fingers, oven fry portions, fish burgers and the like. Hake are rarely caught in quantity in Australian waters but more than 10 000 tonnes are landed annually in New Zealand. Their moist flesh has good eating qualities, with a delicate structure.

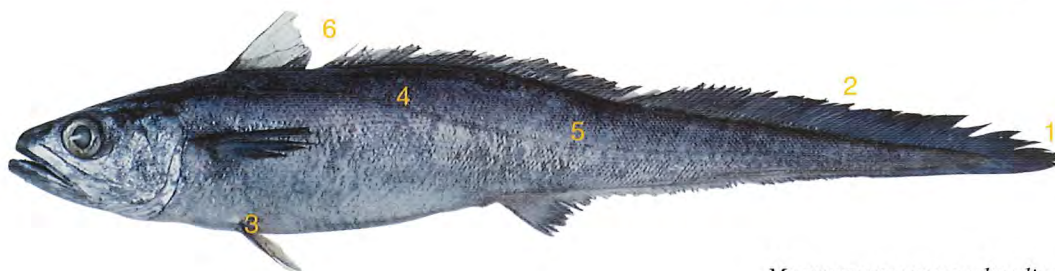
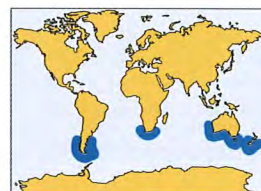


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Hoki

Macruronus species

Minor names: blue hake, New Zealand hoki, New Zealand whiptail, whiptail (AU)



Macruronus novaezelandiae

Identifying features: ① no separate caudal fin; ② hind dorsal-fin rays much longer than anal-fin rays; ③ pelvic-fin base beneath or slightly behind pectoral-fin base; ④ body silvery blue; ⑤ scales easily removed; ⑥ first dorsal fin separated slightly from second dorsal fin.

Comparisons: A genus of grenadier hakes (family Macruronidae). These important commercial fishes are confined to the Southern Hemisphere and should not be confused with their widely distributed relatives, the hakes (family Merlucciidae). They differ from other imported cod-like fishes in having an eel-like tail without a defined caudal fin. Another, less important grenadier hake, the silver grenadier (*Lyconus* sp.), has long fang-like canines at the tip of the upper jaw that overhang the lower jaw when the mouth is closed (rather than short, concealed canines).

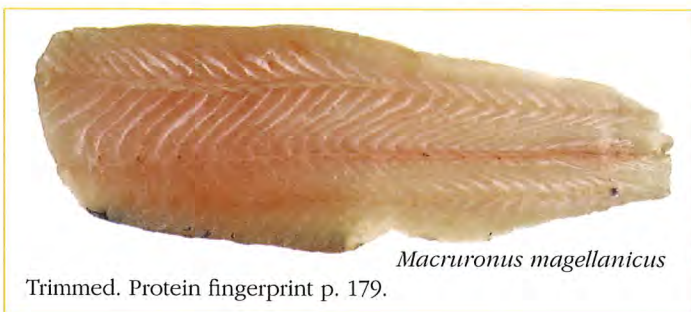
Product: Headed and gutted (frozen), as fillets (frozen, chilled and smoked), and as surimi. The moist, delicate, pale pink to white fillets are more elongate (when untrimmed) than those of most other imported cods. Fillet forms include skin on, skin off and deep skinned. Compared with fillets from New Zealand, fillets from South America are usually roughly cut and include part of the black gut lining (the peritoneum).

Size: Possibly to 130 cm and more than 6 kg (commonly imported at less than 100 cm and under 3.5 kg).

Habitat: Marine; demersal on the outer continental shelf and upper slope, mainly in depths of 150–600 m. Juveniles may occur inshore, occasionally in coastal bays.

Fishery: Hoki are fished widely off southern Australia, New Zealand and Patagonia. They aggregate in large schools where they are caught by midwater and bottom trawls.

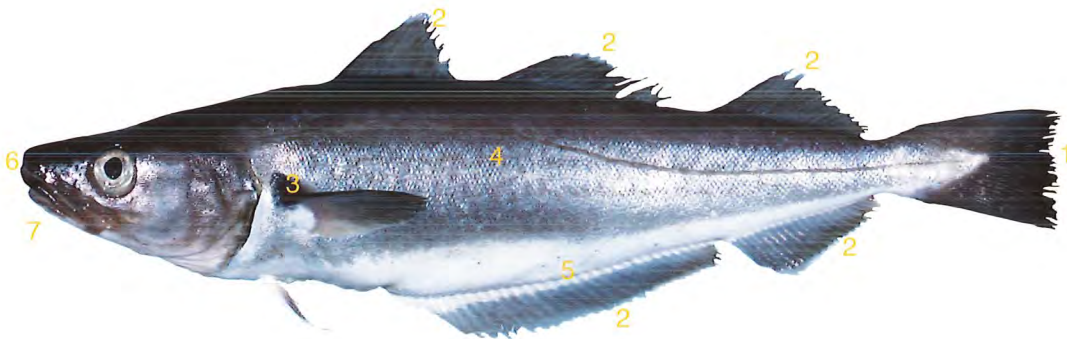
Remarks: Two species are imported. The blue grenadier (*M. novaezelandiae*), an important domestic species, is imported from New Zealand. It can be marketed either as 'blue grenadier' or under the group name 'hoki'. Smaller quantities of the Patagonian grenadier (*M. magellanicus*) are brought in as frozen fillets. The soft flesh has a rather short shelf life and should be eaten very soon after being thawed.



North Sea whiting

Merlangius merlangus

Minor names: Shetland whiting, whiting



Identifying features: ① caudal fin truncate; ② 3 narrowly separated dorsal fins and 2 anal fins; ③ black spot above pectoral fin; ④ body colour mainly sandy to greenish blue on back with silvery white sides and belly; ⑤ length of base of first anal fin much more than half distance from snout to anus; ⑥ snout poking further forward than lower jaw; ⑦ chin barbel very small or absent.

Comparisons: A black spot above the base of the pectoral fin distinguishes this species from other imported codfishes. The southern blue whiting (*Micromesistius australis*, p. 57) also has 3 dorsal fins and 2 anal fins with the first anal-fin base much longer than the second. However, the North Sea whiting has a relatively shorter first anal fin, more closely spaced dorsal fins, and a less pronounced lower jaw than its relative. The bases of the first anal fin of other imported codfishes with 3 dorsal fins are proportionally much shorter (about equal to the base length of the second anal fin).

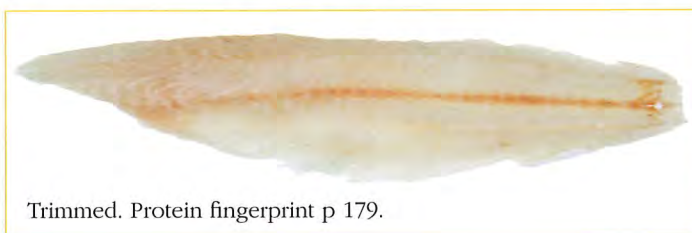
Product: Fillets, often skin-on (frozen). Fillet moderately deep, somewhat elongate, tapering gently, off-white yellowish or slightly pinkish.

Size: To 70 cm and 3 kg (commonly imported at 30–40 cm).

Habitat: Marine; demersal and pelagic on the continental shelf in depths of 10–200 m. Mainly caught inshore in 30–100 m.

Fishery: Valuable and historically important commercial fish of the eastern Atlantic and Mediterranean Sea. Caught mainly by demersal trawls and longlines, also smaller quantities by purse seines and handlines. Imported from the United Kingdom and elsewhere in Europe.

Most imports to Australia have their source in the Shetland Islands and are a diminishing item.



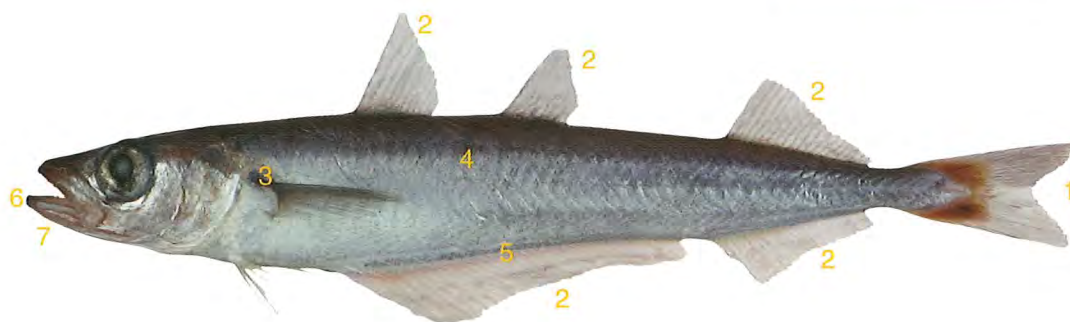
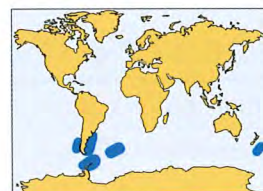
Trimmed. Protein fingerprint p 179.

Remarks: Less migratory than some of its relatives. The flesh is very sweet but soft. Usually cooked with the skin on.

Southern blue whiting

Micromesistius australis

Minor names: none



Identifying features: ① caudal fin forked; ② 3 widely separated dorsal fins and 2 anal fins; ③ no black spot above pectoral fin; ④ mainly uniform bluish on back with silvery white sides and belly; ⑤ length of base of first anal fin longer than distance from snout to anus; ⑥ lower jaw poking slightly further forward of snout; ⑦ no chin barbel.

Comparisons: Not to be confused with the commercially important domestic whittings (family Sillaginidae), which have a similar body shape. Australian whittings are true perches rather than codfishes and have 2 dorsal fins (rather than 3) and a single anal fin (rather than 2). Of the imported codfishes, the southern blue whiting has more widely spaced dorsal fins, a slightly protruding lower jaw (rather than a protruding snout), and lacks the dark pectoral spot of its closest imported relative, the North Sea whiting (*Merlangius merlangus*, p. 56).

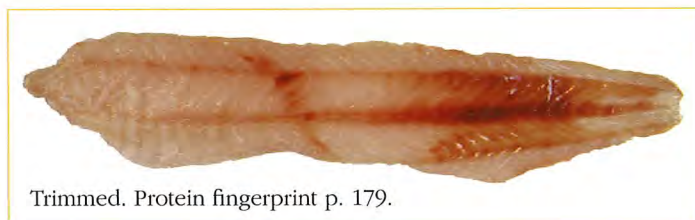
Product: Fillets (chilled and frozen), headed and gutted (frozen), and as surimi. Fillet relatively narrow and elongate, tapering slightly, off-white yellowish; outside with distinct central red muscle band.

Size: To 60 cm and 1.6 kg (commonly imported at 35–55 cm and 0.3–1.2 kg). Reports to lengths of 90 cm have not been validated.

Habitat: Marine; subAntarctic, demersal and pelagic on the continental shelf and upper slope in depths of 70–800 m. New Zealand populations occur deeper (common in about 500 m) than those from South America (about 200 m).

Fishery: Caught mainly by large deepwater trawlers using demersal and pelagic trawl gear. Annual landings can exceed 100 000 tonnes. Imported from New Zealand, Argentina and Chile.

Remarks: Individually quick frozen (IQF) fillets imported for retail use. Also produced as frozen block and for fish meal. The flesh deteriorates quickly and retains its edible quality longer when produced into fish blocks. South American product may have parasite cysts in the flesh. The related blue whiting (*Micromesistius poutassou*) from the Northern Hemisphere is not imported to Australia.



Trimmed. Protein fingerprint p. 179.

Southern rock cod

Pseudophycis bachus

Minor name: red cod



Identifying features: ① caudal fin separate from other fins; ② middle rays of anal fin not appreciably shorter than those adjacent; ③ pelvic fins thread-like and placed well forward of the pectoral fins; ④ skin reddish, silvery pink or brownish; ⑤ body elongate and soft; ⑥ barbel at tip of lower jaw.

Comparisons: Typical morid cod with a long body, soft flesh, large head and mouth, a chin barbel, long dorsal and anal fins, and a small caudal fin. Differs from other imported codfishes in being reddish, brownish or pinkish (rather than silvery, greyish or white) and lacks a deep notch in the anal fin. New Zealand specimens have a dark spot above the pectoral-fin base (spot located at the fin base in Australian populations).

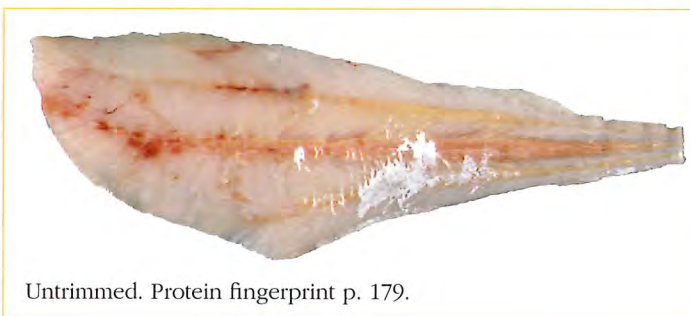
Product: Whole, and headed and gutted (frozen), as fillets (frozen, chilled and smoked). Fillet of moderate length, rather deep anteriorly, tapering rapidly, yellowish-white; outside with pale central red muscle band. Processed product indistinguishable from Australian bearded rock cod (*P. barbata*).

Size: To 80 cm and about 6 kg (commonly imported at 40–60 cm and 0.8–3.0 kg). Domestic fish smaller in size than those from New Zealand.

Habitat: Marine; coastal to mid-continental shelf to depths of 700 m but mainly between depths of 100–300 m. Australian populations occur more inshore in shallower depths (mainly less than 60 m).

Fishery: Imported solely from New Zealand where 'red cod' is caught in moderate quantities by trawls, gillnets, lines and beach seines.

Remarks: New Zealand and Australian populations may represent separate species. The position of the dark spot at or near the pectoral-fin base varies. In Australian specimens the spot is wholly embedded within the base whereas in New Zealand specimens it partly extends above the base. Now caught only in small quantities domestically, along with other species of this genus. Less highly regarded here than in New Zealand. Flesh soft, delicate and flaky, with a short shelf life.

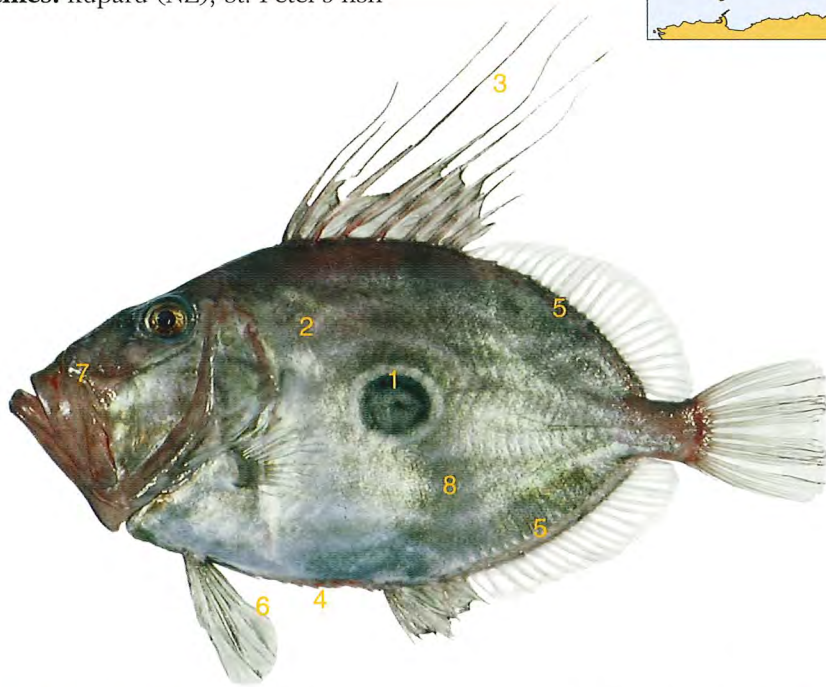
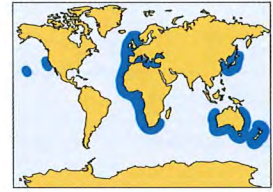


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John dory

Zeus faber

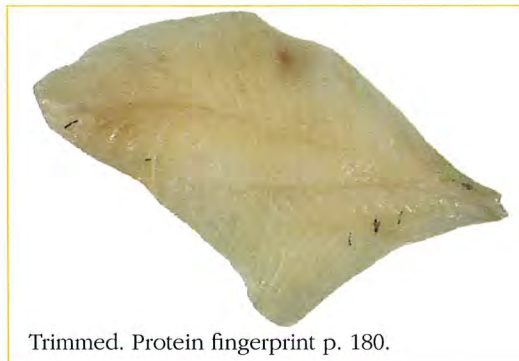
Minor names: kuparu (NZ), St. Peter's fish



Identifying features: ① greenish to silver, with prominent dark spot on side; ② scales tiny, skin smooth to touch; ③ dorsal-fin spine membranes extending well beyond spines; ④ single row of spiny-edged scutes along belly; ⑤ scutes at bases of dorsal and anal fins; ⑥ pelvic fins not concealable in groove; ⑦ head large, jaw upright; ⑧ body almost oval, very compressed.

Comparisons: Dories (family Zeidae) are differentiated from the oreos (family Oreosomatidae, pp 112–113) in generally having smoother, paler skin and a relatively smaller eye. A single prominent spot on the flank, along with a long filamentous dorsal fin, differentiates John dory from other dories, such as king dory (*Cyttus traversi*, p. 60).

Product: Usually whole (chilled) but also headed and gutted, and as fillets (chilled and frozen). Fillets very deep, short, tapering sharply, extremely convex above, yellowish-white with greenish tinge. Very rarely skinned and easily identifiable by prominent spot on skin.



Trimmed. Protein fingerprint p. 180.

Size: To 75 cm and 3.5 kg (commonly imported at 30–40 cm and 0.5–1.3 kg).

Habitat: Marine; demersal over a variety of bottom types and habitats in depths of 20–150 m.

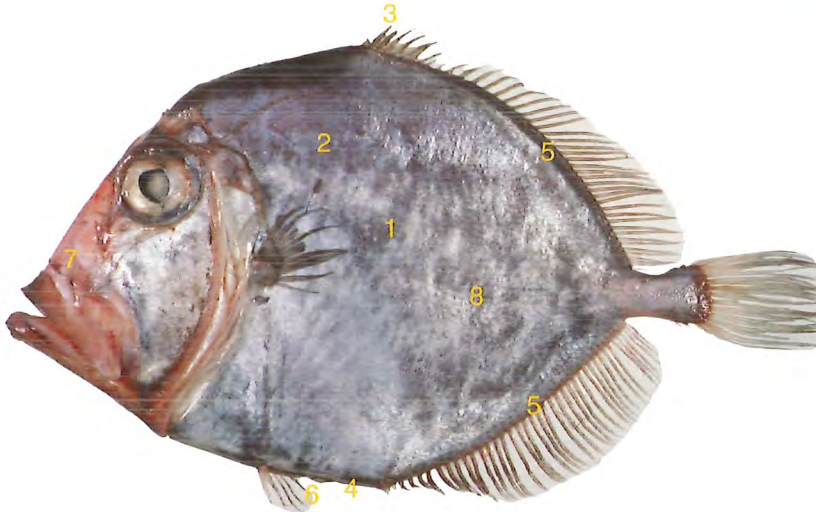
Fishery: Caught mostly by trawls off Korea and Japan, and in the eastern Atlantic and western Indian Oceans. Also trawled off New Zealand, from where it is usually imported.

Remarks: Esteemed internationally as a food-fish. Also taken by local trawlers and anglers.

King dory

Cyttus traversi

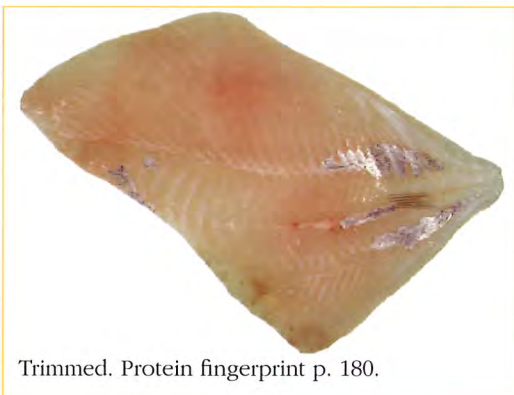
Minor names: horsehead, lookdown dory, McCulloch's dory (AU), lookdown dory (NZ)



Identifying features: ① silver, with no large, dark spot on side; ② scales small, skin rough to touch; ③ dorsal-fin spines short (shorter than longest soft rays); ④ slightly enlarged scales on belly resembling a zip; ⑤ no bony spines at bases of dorsal and anal fins; ⑥ pelvic fins concealable in a groove; ⑦ head large, jaw directed somewhat vertically; ⑧ body almost round, very compressed.

Comparisons: Sometimes caught with the mirror dory (*Zenopsis nebulosus*, p. 61) but differs in having scales and a different dorsal-fin configuration. It is similar to the domestic silver dory (*C. australis*) but is silver (rather than pinkish), deeper and heavier bodied, and has a much shorter first dorsal fin. Differentiated from the related oreos (family Oreosomatidae, pp 112–113) by having generally smoother, paler skin and a relatively smaller eye.

Product: Fillets, skin-off (frozen). Fillet very deep, short, tapering sharply, extremely convex above, yellowish white. Very similar in appearance to other skinned dory and oreo fillets but can be easily separated by protein fingerprinting. Less rubbery than oreo fillets.



Trimmed. Protein fingerprint p. 180.

Size: To 65 cm and 6 kg (commonly imported at 40–55 cm and about 1.5–3.2 kg).

Habitat: Marine; demersal in depths of 100–900 m, but commonly on the upper continental slope in 400–700 m.

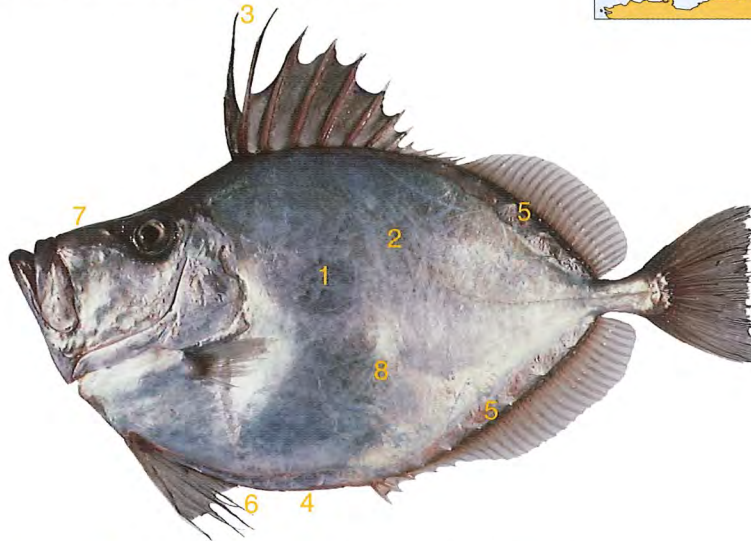
Fishery: Caught by trawls off South Africa and New Zealand. Imported product is from New Zealand.

Remarks: Due to their unusual appearance, some species of dories were initially discarded as deepwater trawling developed in New Zealand.

Mirror dory

Zenopsis nebulosus

Minor names: deepsea dory, mirror perch (AU)

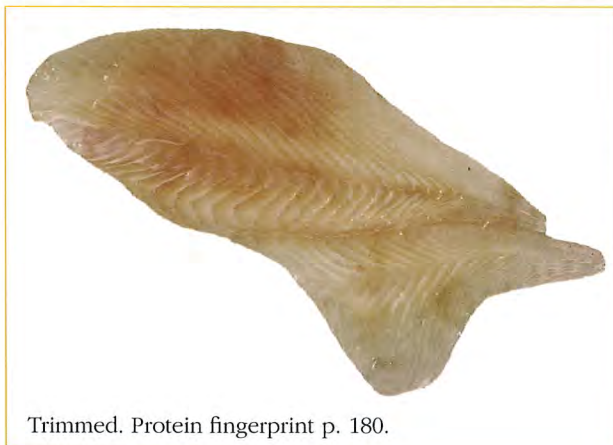


Identifying features: ① silver, with faint, dark spot on side; ② no scales, except on lateral line; ③ dorsal-fin spine membranes extending only slightly beyond spines; ④ single row of spiny-edged scutes along belly; ⑤ greatly enlarged plates at bases of dorsal and anal fins; ⑥ pelvic fins not concealable in a groove; ⑦ head large, jaw almost upright; ⑧ body almost oval, very compressed.

Comparisons: Most similar to John dory (*Zeus faber*, p. 59) but differs in having a fainter spot on the flank and larger bony plates at the bases of the vertical fins. Mirror dory is sometimes confused with the domestic silver dory (*Cyttus australis*) but the skin lacks scales and is smooth (rather than having scales and rough to touch).

Product: Fillets, skin-off (chilled and frozen). Fillet very deep, tapering sharply, extremely convex above, pale pinkish.

Size: To 70 cm and nearly 3 kg (commonly imported at 40–50 cm and 0.7–1.2 kg).



Trimmed. Protein fingerprint p. 180.

Habitat: Marine; demersal on the upper continental slope in depths of about 200–1 000 m but rarely deeper than 600 m.

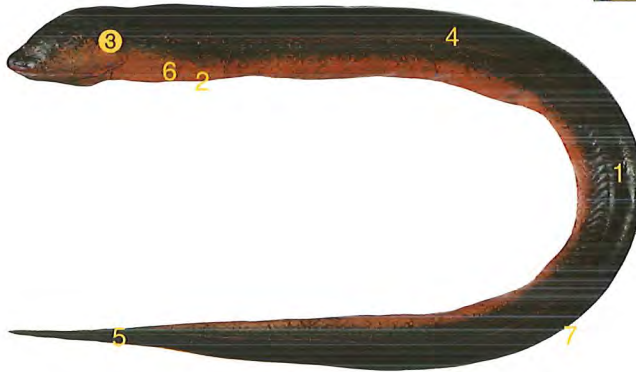
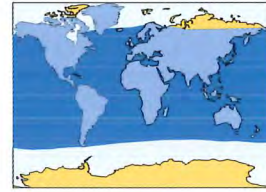
Fishery: Trawled throughout much of its range, and imported from New Zealand.

Remarks: More common off the north of New Zealand than the south. Exhibits excellent eating qualities with similarity to John dory. Tends to be lower priced than John dory. Imports sometimes mislabelled as 'silver dory'.

Eel (page 1 of 2)

Orders Anguilliformes & Synbranchiformes

Minor names: bat sin (HK), longfin eel (NZ), unagi (JP)



Monopterus albus

Identifying features: ① body usually very long and tubular, sometimes with tail compressed; ② pelvic fins absent; ③ gill rakers usually absent; ④ scales usually absent or tiny and embedded; ⑤ dorsal and anal fins often continuous with caudal fin (if present); ⑥ gill openings usually narrow; ⑦ dorsal fin long based.

Comparisons: Two orders containing fishes that have very elongate bodies (often lacking scales) and that lack pelvic fins. Other fins are variously developed. Vaguely similar to cobbler (*Cnidogobius macrocephalus*), pink ling (*Genypterus blacodes*, p. 98) and tusk (*Dannevigia tusca*) but lack barbels or barbel-like pelvic fins originating from the head.

Product: Predominantly freshwater eels imported as fillets, often smoked or chilled but also grilled (broiled) and frozen. Also whole (frozen) and canned. Other species whole and as trunks (frozen and dried).

Size: The dominant international commercial species, Japanese eel (*Anguilla japonica*), reaches 150 cm and 12 kg (commonly imported to 100 cm and 3.5 kg). Other eels reach more than 200 cm and 20 kg but are rarely marketed at such sizes.

Habitat: Freshwater, estuarine and marine; bottom-dwelling, often sheltering among rocks and in crevices. Major commercial species spend most of their lives in freshwater, only entering the ocean to breed. Swamp eels restricted to freshwater, very common in rice paddies.

Fishery: Farmed to meet increasing demand. Species usually caught in fyke nets as young eels as they enter rivers, and then on-grown in freshwater. Imported eels include Japanese eel from Taiwan, European eel (*A. anguilla*) from Europe, New Zealand longfin eel (*A. dieffenbachii*) from New Zealand, and swamp eel (*Monopterus albus*) from Vietnam.

Remarks: Widely considered a delicacy and, in some countries, eels are among the highest-priced fishes available. Some species (e.g. moray eels, *Gymnothorax* species) are sold live in Asia. Some Australian eels have unique marketing names (e.g. longfin eel, *Anguilla reinhardtii*). In Japan, eel backbones are roasted and salted, and then sold as snack food.

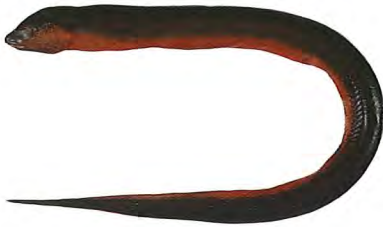


Trimmed. Protein fingerprint p. 180.

Eel (page 2 of 2)

Orders Anguilliformes & Synbranchiformes

Monopterus albus



Remarks: Commonly called 'swamp eel', this species occurs widely in South-East Asia from India to China and Japan, and south to Indonesia. It lives in swamps, muddy ponds, canals and ricefields, and can survive long periods without water when buried in mud. It has no scales, pectoral fins or pelvic fins, and the dorsal and anal fins are joined to the caudal fin and reduced to a skin fold. Imported from Vietnam and elsewhere in South-East Asia whole and as partial trunks (frozen). To at least 100 cm (commonly imported at 60–80 cm).

Anguilla australis



Remarks: Marketed as 'shortfin eel' in Australia, this migratory species breeds in subtropical seas but spends most of its life in the rivers of southeastern Australia, New Zealand and other Pacific Islands. Prefers still water habitats such as coastal swamps, lagoons, farm dams and river backeddies. Its back is uniform olive green in colour and the dorsal fin is relatively short, originating almost over the anus. Imported from New Zealand. To 110 cm and 6.8 kg (commonly imported to 50 cm and up to 0.5 kg).

Macrognathus siamensis

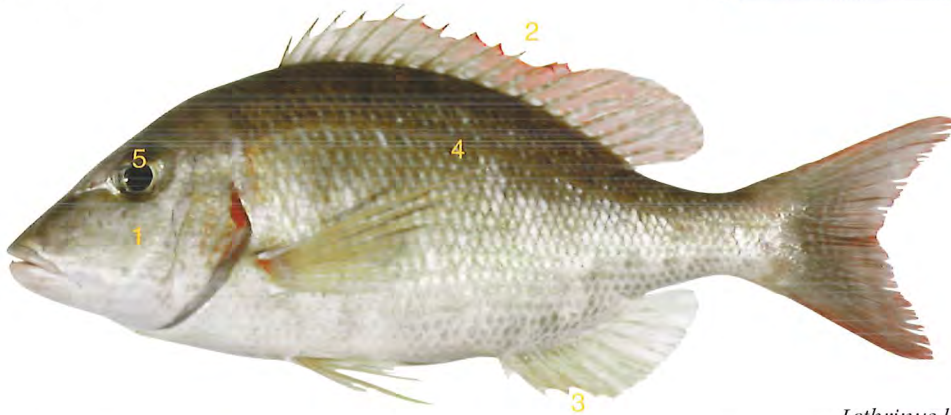
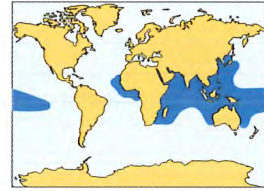


Remarks: Commonly called 'peacock eel', this spiny eel is found in slow-moving or still waters of mainland South-East Asia. It frequently buries in silt or sand with only its head protruding. Distinguished by the presence of a series of 3–6 large conspicuous ocelli along the base of the soft dorsal fin. Imported whole (frozen and dried) mainly from Vietnam. Also common in the Asian aquarium trade. To about 30 cm and 0.1 kg (commonly imported at 12–19 cm and up to about 30 g).

Emperor

Lethrinus species

Minor names: sweetlip emperor (AU), hè mom dai (VN), lentjan (ID)



Lethrinus lentjan

Identifying features: ① cheek scaleless; ② 1 continuous dorsal fin with 10 spines, 9 soft rays; ③ anal fin with 3 spines, 8–9 (usually 8) soft rays; ④ body moderate to deep and compressed slightly; ⑤ eye near top of head.

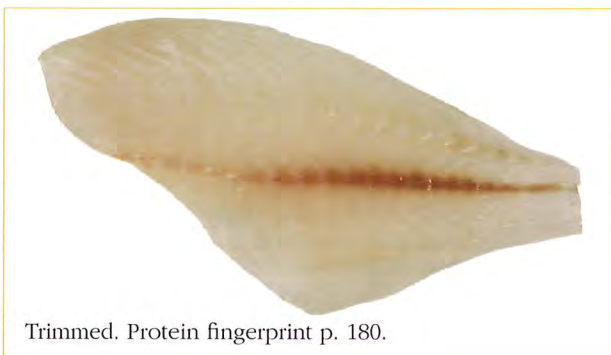
Comparisons: Distinguished from the related seabreams (*Gymnocranius* species, p. 65) by the lack of scales on the cheek (scales present in seabreams) and by usually having only 8 soft anal-fin rays (9–10 in seabreams). Tropical snappers (*Lutjanus* species, pp 136–140) are similar in appearance but have cheek scales.

Product: Fillets, skin-off (frozen). Typical fillet deep, rather elongate, tapering rapidly near caudal peduncle, convex anteriorly, yellowish-white; outside with intermediate central red muscle band. Emperor fillets similar to tropical snapper fillets but generally more yellowish than pinkish.

Size: To about 100 cm and at least 10 kg (commonly imported at 30–50 cm and 0.5–2.0 kg)

Habitat: Marine; broadly distributed over the continental shelf, from inshore seagrass beds, and coral reefs and lagoons, to depths of 220 m.

Fishery: Most of the 30 or so emperors are valuable foodfishes in the Indo–Pacific region, being caught by traps, trawls, handlines, beach seines and vertical longlines. The major imports are spangled emperor (*L. nebulosus*, p. 66), smalltooth emperor (*L. microdon*), and redspot emperor (*L. lentjan*) from Indonesia, Myanmar and Vietnam.



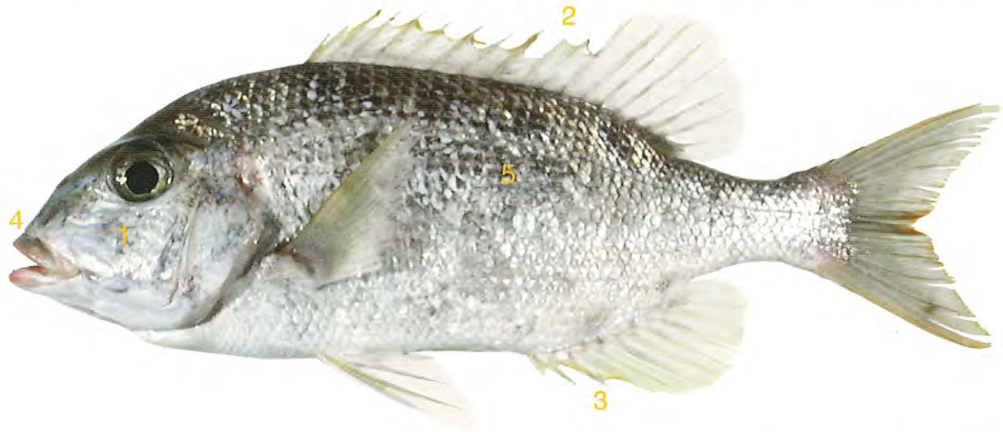
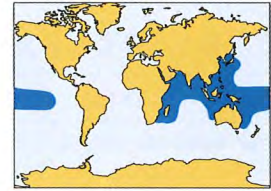
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Remarks: In South-East Asia, often marketed fresh or live and sometimes dry salted. The flesh is firm, sweet and mildly flavoured. Implicated in ciguatera outbreaks in some regions of South-East Asia and the South Pacific. Six species have unique marketing names in Australia. Sometimes called 'pigface' because of their long snout.

Seabream

Gymnocranius species

Minor names: pearl snapper, white snapper (AU), kapas-kapas laut (ID)



Gymnocranius grandoculis

Identifying features: ① cheek with at least 3 rows of scales; ② 1 continuous dorsal fin with 10 spines, 10 soft rays; ③ anal fin with 3 spines, 9–10 soft rays; ④ snout relatively short and angular; ⑤ body moderate to deep, and compressed slightly.

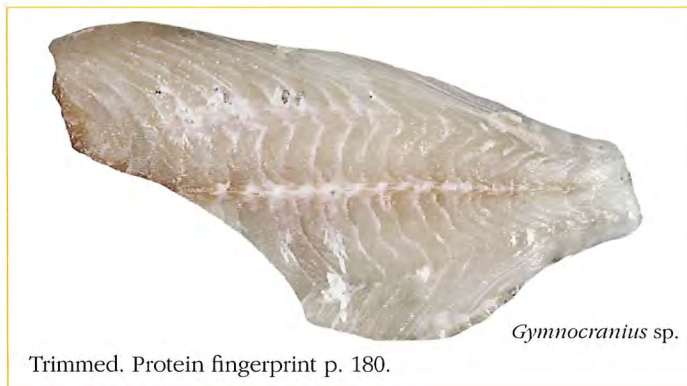
Comparisons: Similar to breams (such as snapper, p. 46, and the red sea bream, *Pagrus major*) but the distance from the eye to the mouth is usually larger in seabreams. Closely related to other emperors (pp 64 and 66) but have 10 soft dorsal-fin rays (9 in other emperors) and cheek scales are present (absent in other emperors). Both seabreams and emperors have fewer soft dorsal-fin rays than tropical snappers (*Lutjanus* species, pp 136–140).

Product: Fillets, usually skin-off (frozen). Fillet of some species moderately deep, rather elongate, upper profile almost straight, yellowish white; outside without red muscle band.

Size: To 80 cm and at least 5 kg (commonly imported at 30–55 cm and 0.8–2.4 kg).

Habitat: Marine; offshore continental shelf near coral and rocky reefs, mainly in depths of 10–100 m.

Fishery: Usually caught in small numbers but locally important and high-priced in some regions. Mostly taken by traps, handlines or trawls. Grey seabream (*G. griseus*), fork-tail seabream (*G. elongatus*) and probably blue-lined seabream (*G. grandoculis*) are imported from Indonesia and elsewhere in South-East Asia. Other unidentified species may also be imported.



Trimmed. Protein fingerprint p. 180.

Gymnocranius sp.

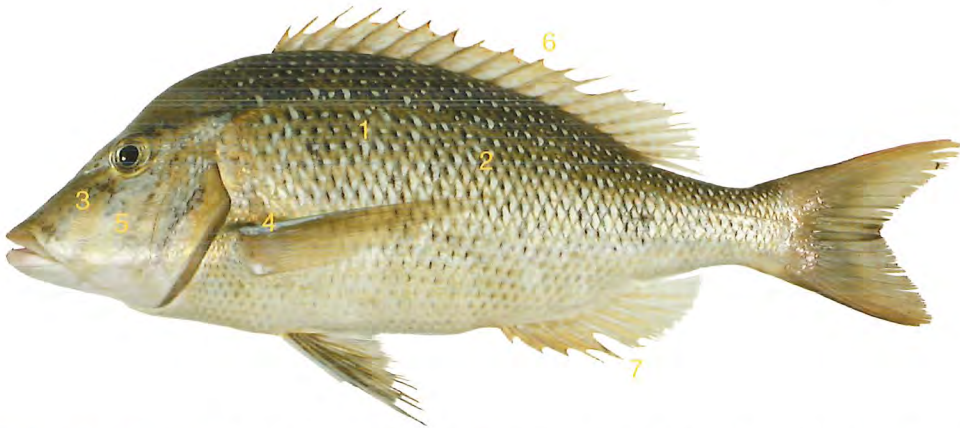
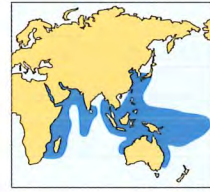
Other unidentified species may also be imported.

Remarks: Also caught off northern Australia, and frequently sold in local markets.

Spangled emperor

Lethrinus nebulosus

Minor names: emperor snapper, greater spangled emperor, nor-west snapper, yellow sweetlip (AU), lencam (ID)



Identifying features: ① body relatively deep; ② sides yellowish in colour, with bluish scales forming horizontal lines (often pale); ③ bluish lines extending from eye to mouth; ④ upper ray of pectoral fin partly blue; ⑤ cheek scaleless; ⑥ 1 continuous dorsal fin with 10 spines, 9 soft rays; ⑦ anal fin with 3 spines, 8 soft rays.

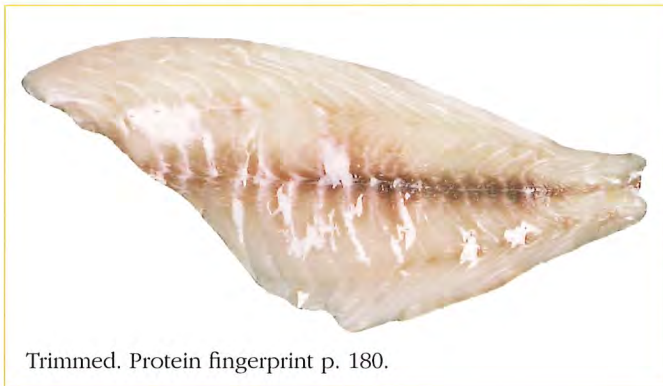
Comparisons: Distinctive among emperors in having bluish lines extending from the eye to the mouth, and distinguished from most species in having the upper ray of the pectoral fin partly blue. The grass emperor (*L. laticaudis*), which occurs widely in South-East Asia, often has a partly blue upper pectoral-fin ray but lacks bluish markings on the sides and the blue lines extending forward of the eye fall well short of the mouth.

Product: Fillets (frozen). Fillet moderately deep, rather elongate, upper profile convex, yellowish white; outside with pronounced continuous red muscle band.

Size: To 93 cm and 10 kg (commonly imported at 30–60 cm and 0.8–4.0 kg).

Habitat: Marine; inshore continental shelf, from seagrass, coral reef and lagoonal habitats, to depths of 85 m.

Fishery: Caught by traps, trawls, handlines, seines and gillnets. Sourced from Asia (mainly Indonesia, Myanmar and Vietnam).



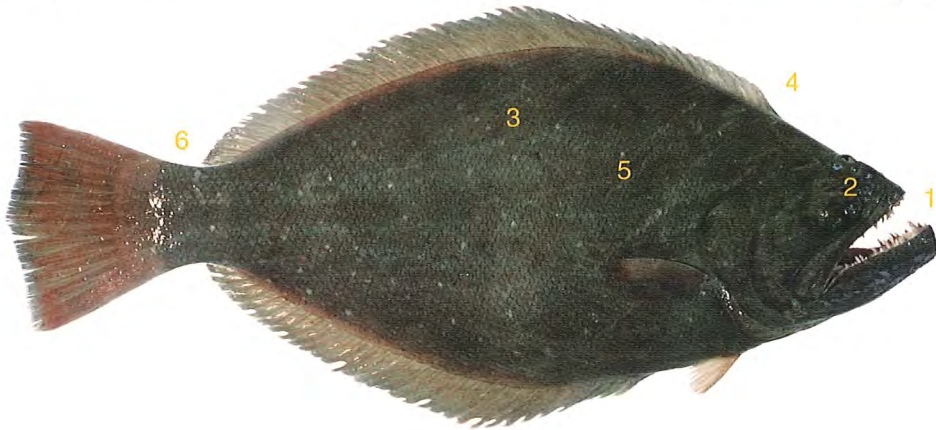
Trimmed. Protein fingerprint p. 180.

Remarks: A widely available and very popular foodfish that is often traded live in Asia. It is mostly marketed fresh. Specimens from some parts of the Indian Ocean are reported to taste and smell of copper or iodine. A second species, lesser spangled emperor (*Lethrinus* sp.), is also marketed as 'spangled emperor' in Australia.

Australian halibut

Psettodes erumei

Minor names: Queensland halibut (AU), Indian halibut, Indian spiny turbot



Identifying features: ① mouth large, with long, sharp teeth; ② eyes located mainly on left side of body (often also on right); ③ upper surface dark brown with 4 broad bands (often faint); ④ dorsal fin commencing well behind snout tip (behind level of eyes); ⑤ body extremely depressed; ⑥ caudal fin separated from dorsal and anal fins.

Comparisons: Distinctive flatfish with a greatly enlarged mouth, large teeth and relatively short dorsal fin (commencing well behind snout tip). These characters distinguish it from other domestic and imported flatfishes.

Product: Whole, gutted (frozen). The deep, rather elongate fillets are pale pinkish with distinct myomeres, and with an intermediate continuous red muscle band on the outside.

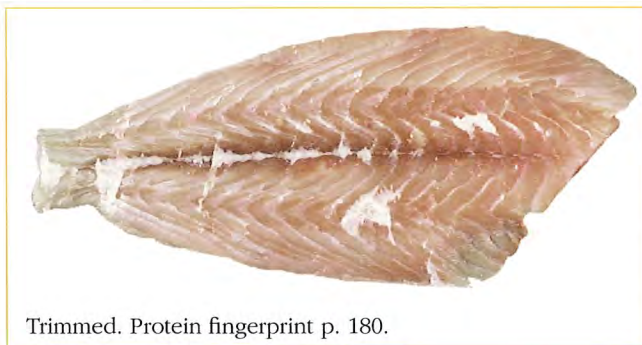
Size: To 64 cm and 3.2 kg (commonly imported at 20–40 cm).

Habitat: Marine; demersal inshore on the inner continental shelf on sand and mud bottoms to depths of 100 m. Rarely entering creeks and estuaries.

Fishery: Small volumes caught mostly by trawlers. Imported from Asia (commonly Vietnam).

Remarks: Very popular in Chinese cuisine and highly sought-after. In Asia, often grilled or smoked and also processed into fish flour. Some large Northern Hemisphere members of a related family (Pleuronectidae) are known internationally as ‘halibut’, and may occasionally be

imported to Australia. These include Atlantic halibut (*Hippoglossus hippoglossus*), Greenland turbot or Greenland halibut (*Reinhardtius hippoglossoides*) and Pacific halibut (*H. stenolepis*). Other flounders (mostly families Pleuronectidae and Bothidae) are sourced from Asia—e.g. arrowtooth flounder (*Atheresthes* species) from Japan, and dried product from Japan and China.

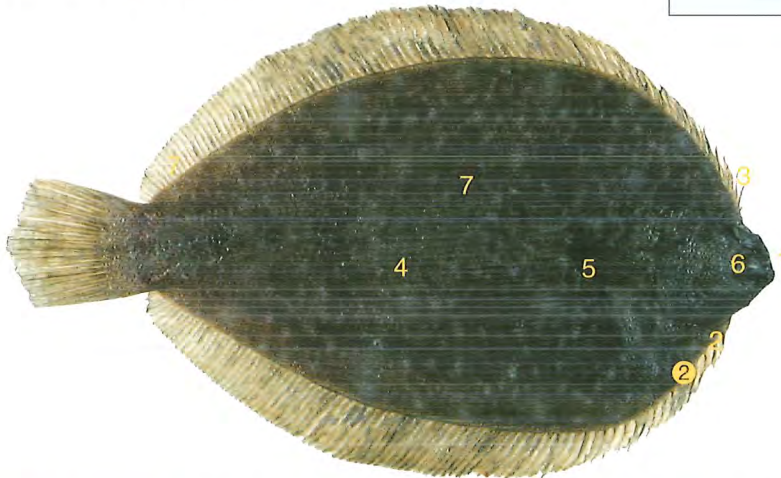
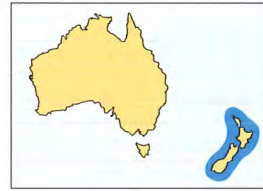


Trimmed. Protein fingerprint p. 180.

Lemon sole

Pelotretis flavilatus

Minor name: New Zealand lemon sole



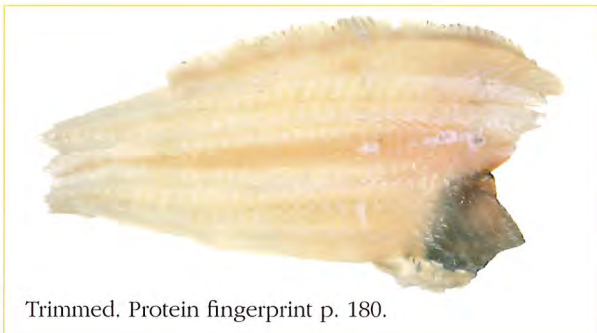
Identifying features: ① snout not hooked; ② 2 distinct pelvic fins; ③ dorsal fin commencing above eye; ④ skin rough to the touch; ⑤ no distinctly elongated rays on upper-side pectoral fin; ⑥ eyes located on right side of body; ⑦ body extremely depressed.

Comparisons: A righteysed flounder (family Pleuronectidae) distinguished from true soles (family Soleidae) in lacking a covering of skin over the operculum (concealing the preopercular margin). Unlike most of the true soles in domestic marketplaces, the caudal fin of lemon sole is separate (compared with united with the dorsal and anal fins). Resembles the New Zealand sole (*Peltorbamphus novaezeelandiae*, p. 70) but lacks both a hooked snout (obviously hooked and hiding the mouth in New Zealand sole) and an elongated first ray of the upper pectoral fin (present in New Zealand sole). Both these species have rough skin, whereas the skin of most other flounders is smooth. The lemon sole of the northeastern Atlantic (*Microstomus kitt*) is also a righteysed flounder and not a true sole.

Product: Whole, gutted and as fillets (chilled and frozen). Fillet deep, rather elongate, upper profile convex, off-white yellowish; outside without red muscle.

Size: To 50 cm and 1.6 kg (commonly imported at 25–35 cm).

Habitat: Marine; prefers sand and mud bottoms of the continental shelf to depths of about 100 m. Small juveniles are found in sheltered areas and mature adults gather to spawn in shallow water.



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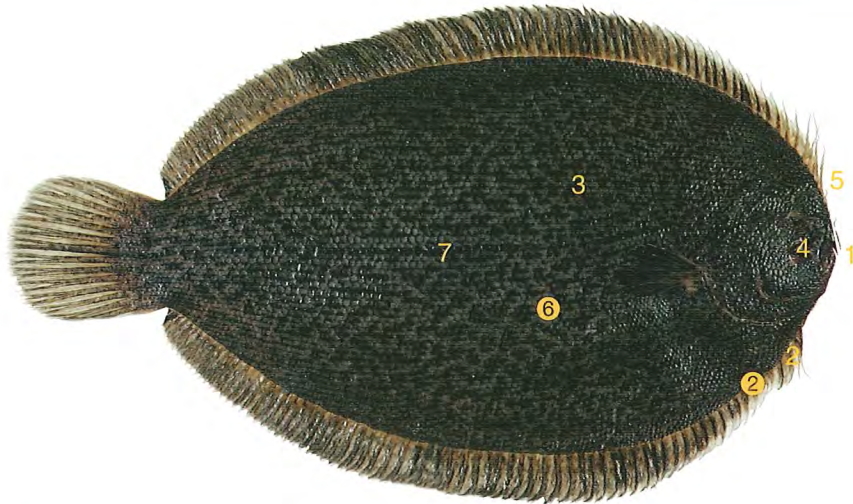
Fishery: Trawled around New Zealand, with the largest catches from the South Island.

Remarks: Considered a splendid foodfish. Its marketing name may change to 'New Zealand lemon sole'. As with many flatfishes, the flesh from the upper surface (the right side) is darker than the flesh from the lower surface.

New Zealand brill

Colistium guntheri

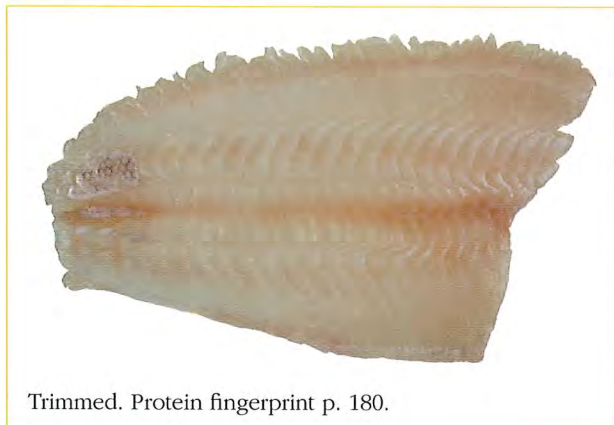
Minor name: brill (NZ)



Identifying features: ① hooked snout not extending below lower end of lower jaw; ② 2 distinct pelvic fins, that on the upper side with 9 or more rays; ③ upper surface with fine black mottling, often somewhat arranged in longitudinal lines; ④ eyes located on right side of body; ⑤ dorsal fin commencing well forward of eye, near snout tip; ⑥ lower (left) side whitish, with darker speckles or blotches; ⑦ body extremely depressed.

Comparisons: Very similar to New Zealand turbot (*C. nudipinnis*, p. 71) but has a relatively short, hooked snout and at least 9 (rather than 7) pelvic-fin rays on the upper side. These species are unrelated to the European brill (*Scophthalmus rhombus*) and turbot (*Psetta maxima*). New Zealand brill is similar to Australia's bay flounders (*Ammotretis* species) but has more anal-fin rays (about 70 in *C. guntheri* versus 47–59 in *Ammotretis* species).

Product: Whole gutted and as fillets (frozen). Fillet deep, upper profile slightly convex, off-white yellowish, sometimes distinctly apricot-coloured; outside with very feeble, discontinuous central red muscle band.



Trimmed. Protein fingerprint p. 180.

Size: To nearly 90 cm and 8 kg (commonly imported at 25–40 cm and 0.35–0.8 kg).

Habitat: Marine; inner continental shelf on sand and mud bottoms to depths of at least 100 m.

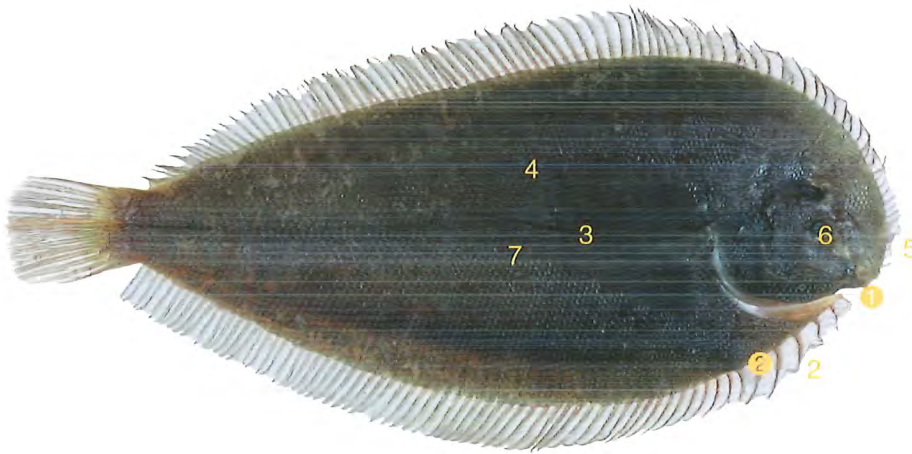
Fishery: Caught in small volumes by coastal trawlers off New Zealand, mainly around the South Island. Occasionally taken in gillnets.

Remarks: In New Zealand, demand for brill generally outstrips supply, and it is rarely exported to Australia.

New Zealand sole

Peltorhamphus novaezeelandiae

Minor name: common sole (NZ)



Identifying features: ① mouth hidden by hooked snout; ② 2 distinct pelvic fins; ③ upper-side pectoral fin with elongated first ray; ④ skin rough to the touch; ⑤ dorsal fin commencing well forward of eye; ⑥ eyes located on right side of body; ⑦ body extremely depressed.

Comparisons: Like the lemon sole (*Pelotretis flavilatus*, p. 68), the New Zealand sole is actually a righteyed flounder (family Pleuronectidae). It is easily identified by having the mouth hidden by a hooked snout (when viewed from above) and an elongate first ray on the pectoral fin of the upper (right) side.

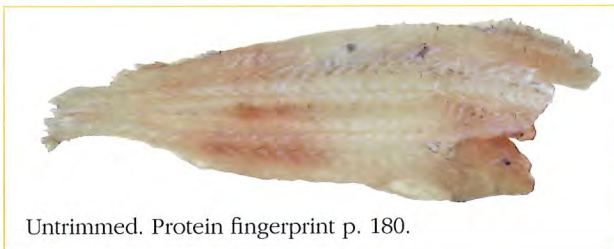
Product: Gutted (frozen), whole (frozen and chilled) and occasionally as fillets (frozen). Fillet moderately deep, rather elongate, upper profile convex, off-white yellowish, upper (right) fillet with greenish tinge.

Size: To nearly 70 cm and 3.4 kg (commonly imported at 30–40 cm).

Habitat: Marine; typically on sandy or muddy bottoms in estuaries, harbours and coastal bays. Also further offshore to depths exceeding 100 m.

Fishery: Taken largely by inshore trawlers, with the most important fishing grounds off Otago, the Canterbury Bight and the west coast of New Zealand's South Island. One of the most commercially important flatfishes in New Zealand and imported to Australia.

Remarks: Largest and most abundant off southern New Zealand. Regarded as a very fine eating fish. The flesh is whitish and has a delicate texture. In Australia, the marketing name 'sole' refers to members of the families Cynoglossidae and Soleidae (p. 74). When swimming fast, particularly when startled, New Zealand soles raise their upper-side pectoral fin and use it as a rudder.

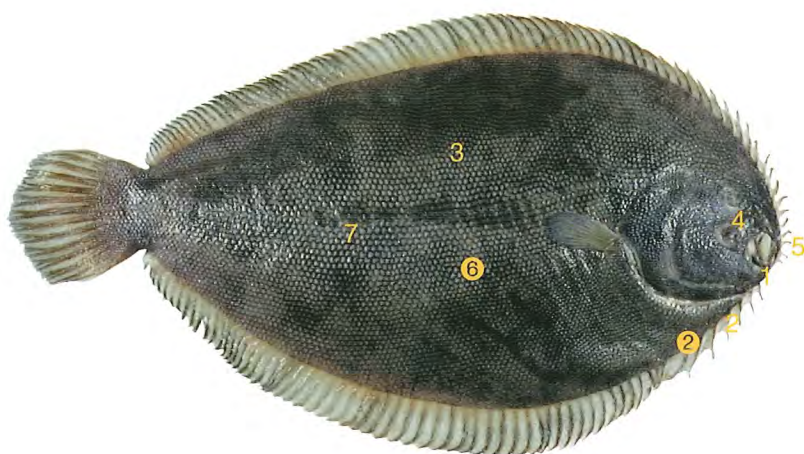


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New Zealand turbot

Colistium nudipinnis

Minor name: turbot (NZ)



Identifying features: ① hooked snout extending below lower end of lower jaw; ② 2 distinct pelvic fins, that on the upper side with 7 rays; ③ upper surface with irregular pale and dark blotches; ④ eyes located on right side of body; ⑤ dorsal fin commencing well forward of eye, near snout tip; ⑥ lower (left) side whitish, with darker speckles or blotches; ⑦ body extremely depressed.

Comparisons: Very similar to New Zealand brill (*C. guntheri*, p. 69) but has a relatively large, hooked snout and 7 (rather than 9 or more) pelvic-fin rays on the upper side. Also superficially similar to Australia's bay flounders (*Ammotretis* species) but rarely has as few anal-fin rays (about 58 in New Zealand turbot versus 47–59). Unrelated to the European turbot (*Psetta maxima*).

Product: Whole gutted and as fillets (frozen). Fillet deep, upper profile slightly convex, off-white yellowish, sometimes distinctly apricot-coloured; outside with very feeble, discontinuous central red muscle band. Fillet photograph not available.

Size: To at least 90 cm and 12 kg (commonly imported at 25–45 cm and 0.4–1.2 kg).

Habitat: Marine; inner continental shelf on sand and mud bottoms to depths of about 100 m.

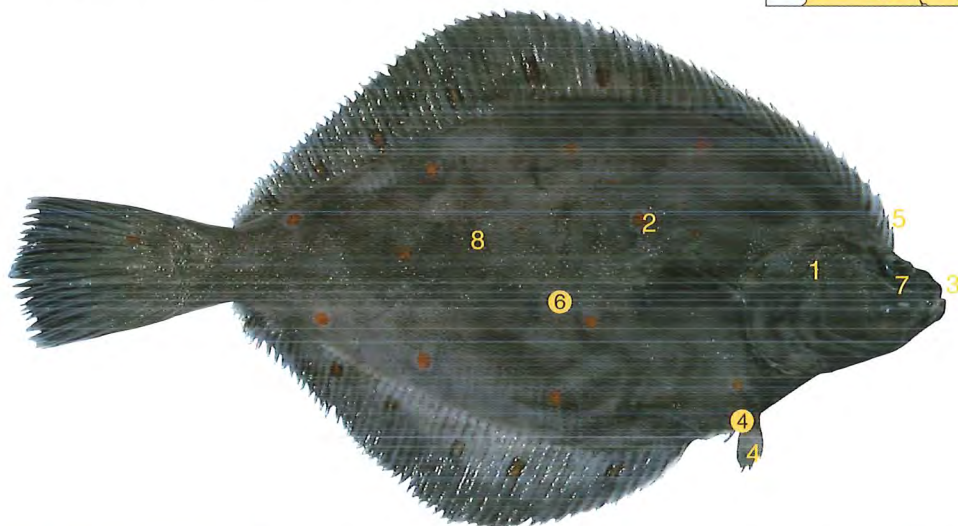
Fishery: Caught in small volumes by coastal trawlers off New Zealand, mainly on the west coast of the South Island. Often taken along with New Zealand brill, New Zealand sole (*Pelotorbamphus novaezeelandiae*) and lemon sole (*Pelotretis flavilatus*). Occasionally taken in gillnets. Suitability for aquaculture is being assessed.

Remarks: The largest of New Zealand's shallow-water flounders, this very popular foodfish is also a target of recreational fishers. Rarely available for export from New Zealand.

Plaice

Pleuronectes platessa

Minor names: Scholle (DE), rødspætte (DK)



Identifying features: ① row of 4–7 bony knobs between eyes and lateral-line; ② numerous irregularly distributed reddish spots on right side of body; ③ snout not hooked; ④ 2 distinct pelvic fins; ⑤ dorsal fin commencing above eye; ⑥ lower (left) side white; ⑦ eyes located on right side of body; ⑧ body extremely depressed.

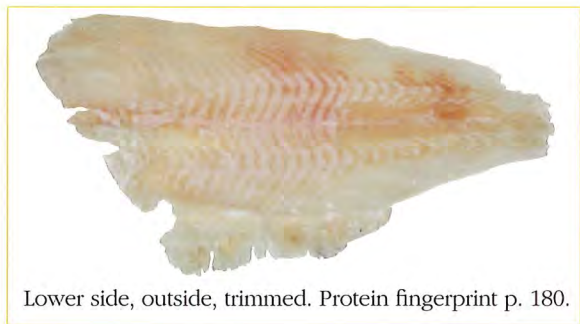
Comparisons: Readily differentiated from other righteyed flatfishes by the presence of bony knobs behind the eyes and reddish spots on the upper surface. New Zealand's black flounder (*Rhombosolea retiaria*) sometimes also has red spots but its dorsal fin commences forward of the eye (compared with above the eye in plaice).

Product: Fillets (frozen); small fish whole gutted (frozen). Fillet deep, rather elongate, upper profile slightly convex, white to off-white yellowish, upper-side fillet with greenish tinge, numerous grey veins in flesh; outside without red muscle band.

Size: To 100 cm and 7 kg (commonly imported at less than 50 cm and about 2–3 kg).

Habitat: Marine; demersal on sand or mixed bottoms of the continental shelf, from close inshore to depths of 200 m (but usually less than 50 m).

Fishery: The most commercially important flatfish in Europe. It is very heavily fished by Danish seines, trawls and gillnets. Large catches are taken from the North Sea, where a protected area has been established along the coasts of Holland, Germany and Denmark to help sustain the fishery. Also farmed. Imported from Europe.



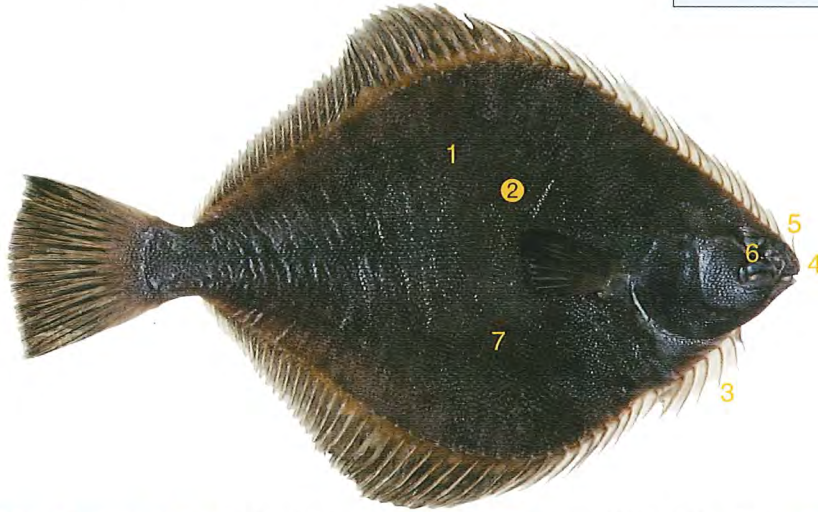
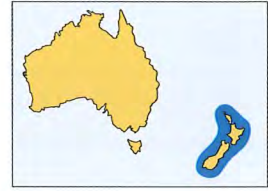
Lower side, outside, trimmed. Protein fingerprint p. 180.

Remarks: Halibut (*Hippoglossus hippoglossus*) and turbot (*Psetta maxima*), are also fished in European waters and may be imported to Australia.

Sand flounder

Rhombosolea plebeia

Minor names: New Zealand flounder (AU), dab (NZ)



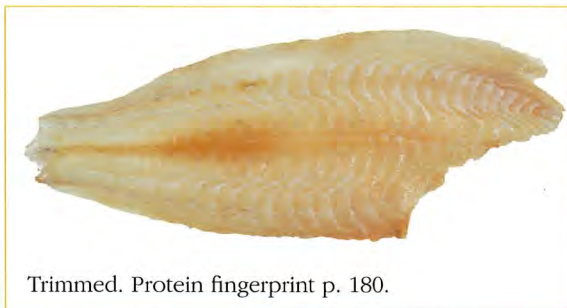
Identifying features: ① body diamond shaped; ② lower (left) side white; ③ 1 pelvic fin; ④ snout not hooked; ⑤ dorsal fin commencing well forward of eye; ⑥ eyes located on right side of body; ⑦ body extremely depressed.

Comparisons: *Rhombosolea* species are distinct from most other commercial righteysed flounders in having only 1 pelvic fin. Unlike New Zealand brill (*Colistium guntheri*, p. 69), New Zealand turbot (*C. nudipinnis*, p. 71) and New Zealand sole (*Peltorbamphus novaezeelandiae*, p. 70), none of these species has a hooked snout. Sand flounder differs from yellowbelly flounder (*R. leporina*, p. 75) in having a diamond-shaped body and whitish undersurface (versus an oval body and a yellowish undersurface), and from greenback flounder (*R. tapirina*) in lacking an extended fleshy process on the snout.

Product: Whole gutted (chilled and frozen), headed and gutted (frozen), and occasionally as fillets (frozen). Fillet deep, rather elongate, upper profile convex, off-white to yellowish; outside without red muscle band. The fillets of *Rhombosolea* species are very similar in appearance to one another.

Size: To 45 cm and 1.2 kg (commonly imported at 25–35 cm and less than 0.5 kg).

Habitat: Marine and estuarine; sand, mud and gravel bottoms in inshore waters to depths of 50 m and occasionally deeper. Congregate in shallow, sandy areas to breed.



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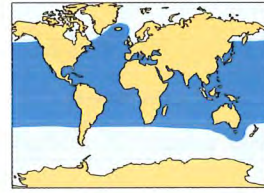
Fishery: Although the fisheries (trawls and gillnets) are relatively small and localised, sand flounder is commonly imported to Australia, particularly Sydney.

Remarks: The whitish, moist flesh is popular both in New Zealand and locally. Usually cooked whole, skin on. A related species, greenback flounder, is caught off Australia and is also popular. Sand flounder has aquaculture potential.

Sole

Families Cynoglossidae & Soleidae

Minor names: tonguesole (AU), cá lười trâu (VN), tonguefish



Paraplagusia bilineata

Identifying features: ① margin of preoperculum concealed by thick skin; ② eyes located on left or right side; ③ mouth small, with short teeth; ④ dorsal fin commencing at eye-level or further forward; ⑤ body extremely depressed; ⑥ caudal fin mostly joined to dorsal and anal fins.

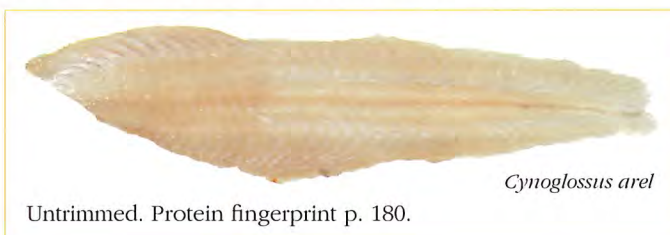
Comparisons: Includes the lefteyed tonguesoles (family Cynoglossidae) and righteyed soles (family Soleidae). These fishes differ from the flounders (families Bothidae and Pleuronectidae) and Australian halibut (*Psettodes erumei*, p. 67) in having the operculum overlain with thick skin (preopercular margin concealed), and the anal, caudal and dorsal fins mostly joined (lacking a separate tail). Dover sole (*Solea solea*) of European waters (which is sometimes imported), lemon sole (*Pelotretis flavilatus*, p. 68) and New Zealand sole (*Peltorbamphus novaezeelandiae*, p. 70) all have a separate caudal fin.

Product: Whole, sometimes gutted (frozen and dry salted). Occasionally as fillets (frozen). Fillet of largescale tonguesole (*Cynoglossus arel*) moderately slender, elongate, upper profile slightly convex, off-white yellowish; outside without red muscle band.

Size: To 60 cm and 3 kg (commonly imported at 18–30 cm).

Habitat: Marine, estuarine and freshwater; bottom-dwelling, mostly on sand or mud bottoms, from the coast to depths of nearly 2 000 m on the continental slope. A few species prefer freshwater.

Fishery: Taken widely using a variety of gear, including otter and beam trawls, seines, and fixed nets. Imports are mostly whole tonguesoles from Asia but fillets of true soles from the Northern Hemisphere are occasionally available.



Cynoglossus arel

Remarks: Highly esteemed foodfishes, some of which are also caught locally. Flesh varies between species. Tonguesoles are usually sold fresh in South-East Asia, where steaming is commonly recommended as the best cooking method.

Yellowbelly flounder

Rhombosolea leporina

Minor names: New Zealand flounder (AU), flounder (NZ)



Identifying features: ① body oval; ② lower (left) side yellowish, often with a few dark spots; ③ 1 pelvic fin; ④ snout pointed but not hooked; ⑤ dorsal fin commencing well forward of eye; ⑥ eyes located on right side of body; ⑦ body extremely depressed.

Comparisons: Apart from close relatives (other *Rhombosolea* species), yellowbelly flounder is distinguished from most commercial righteyed flounders in having only 1 pelvic fin. Sometimes confused with sand flounder (*R. plebeia*, p. 73) but has an oval (rather than diamond-shaped) body with a yellowish (rather than white) undersurface. Lacks the red spots of black flounder (*R. retiaria*) and the hooked snouts of New Zealand brill (*Colistium guntheri*, p. 69), New Zealand turbot (*C. nudipinnis*, p. 71) and New Zealand sole (*Peltorbamphus novaezeelandiae*, p. 70).

Product: Whole gutted (chilled and frozen), headed and gutted (frozen), and occasionally as fillets (frozen). Fillet deep, rather elongate, upper profile convex, off-white to yellowish; outside with weak red muscle band. The fillets of *Rhombosolea* species are very similar in appearance to one another.

Size: To 50 cm and 1.7 kg (commonly imported at 25–40 cm and less than 0.5 kg).

Habitat: Marine and estuarine; soft bottoms in inshore waters, including estuaries and harbours, to depths of about 50 m.



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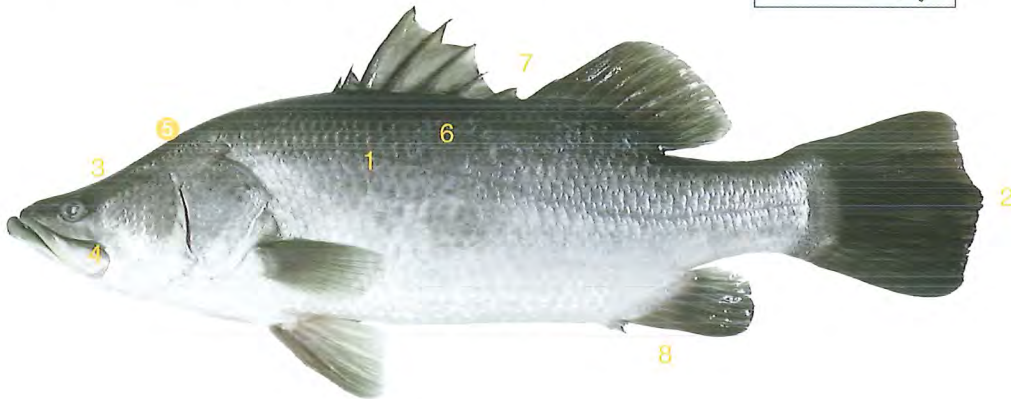
Fishery: Small fisheries, mostly caught by gillnets in the north of New Zealand and by both gillnets and trawls in the south. Commonly imported fresh and frozen to Australia, but in small volumes.

Remarks: Large females, thick enough to be filleted, are favoured by recreational fishers. Possible aquaculture potential.

Barramundi

Lates calcarifer

Minor names: barra, giant perch, silver barramundi (AU)



Identifying features: ① lateral line with 52–61 scales; ② caudal fin rounded; ③ forehead straight or slightly concave; ④ jaw extending to end of eye or well beyond; ⑤ young with prominent white stripe on forehead; ⑥ greyish green to golden brown above; ⑦ dorsal fins almost separate, with 8–9 spines, 10–11 soft rays; ⑧ anal fin with 3 spines, 7–8 soft rays.

Comparisons: Belongs to the giant perch family (Centropomidae), which are similar in general appearance to the freshwater basses (family Percichthyidae) and freshwater tiger perches (family Terapontidae). However, unlike commercial members of these groups, it has a tall, angular first dorsal fin that is almost separate from the second. A smaller marine relative, the sand bass (*Psammoperca waigiensis*), is dull reddish brown above and has a shorter mouth (falling short of hind margin of the eye). The closely related Nile perch (*Lates niloticus*, p. 77) has more lateral-line scales (60–80 versus 52–61).

Product: Headed and gutted (chilled), gilled and gutted, scaled, and as fillets (frozen). Fillet moderately deep, short, tapering gently, convex above, pinkish-grey, generally paler below; outside with continuous, central red muscle band; similar in appearance to Nile perch fillets.

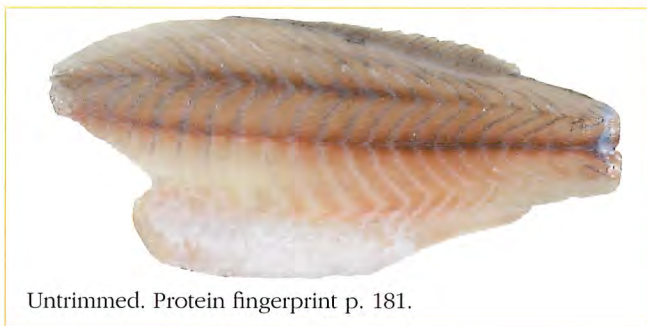
Size: To at least 150 cm and 60 kg (commonly imported at 40–60 cm).

Habitat: Freshwater and inshore; migrating downstream into lower estuaries and marine bays to breed.

Fishery: Wildfish caught mostly by gillnets. Expanding aquaculture industries in Thailand and

Indonesia produce young fish that are marketed at about 0.4–0.6 kg. Imports are sourced mainly from Indonesia, Myanmar, Taiwan, Thailand, India and Vietnam.

Remarks: Also farmed locally. Among the most commercially important freshwater fishes of Asia. Populations differ in size and biology, and two or more species probably exist across its range.



Untrimmed. Protein fingerprint p. 181.

Nile perch

Lates niloticus

Minor names: Lake Victoria perch, Victoria perch



Identifying features: ① lateral line with 60–80 scales; ② caudal fin rounded; ③ forehead straight or slightly concave; ④ jaw extending to end of eye to well beyond; ⑤ young with prominent white stripe on forehead; ⑥ greyish-blue above; ⑦ dorsal fins almost separate, 7–8 spines, 10–14 soft rays; ⑧ anal fin with 3 spines, 7–8 soft rays.

Comparisons: Largest member of the giant perch family (Centropomidae). It very closely resembles the barramundi (*Lates calcarifer*, p. 76) but has smaller scales (60–80 in the lateral line versus 52–61).

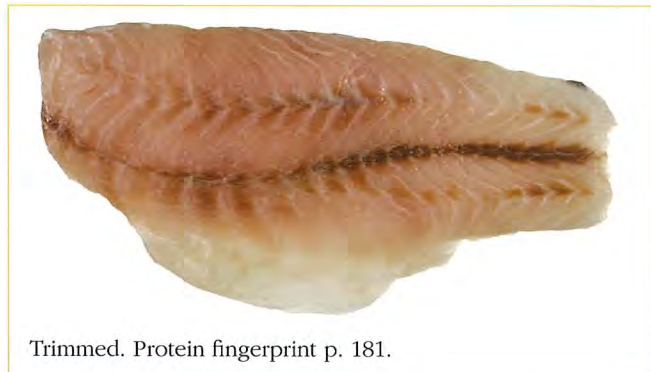
Product: Fillets (frozen). Fillet moderately deep, short, tapering gently, convex above, pinkish-grey, generally paler below; outside with continuous central red muscle band; very similar in appearance to barramundi fillets.

Size: To at least 200 cm and at least 164 kg (commonly imported at about 60 cm).

Habitat: Freshwater; demersal in rivers, reservoirs, canals, lakes and sometimes estuaries.

Fishery: Caught mainly by gillnets and set lines. Smaller quantities taken with spears using lights to highlight their reddish glowing eyes. Caught commercially in Lake Victoria, and imported from Tanzania, Kenya and Uganda. Exceptional aquaculture species.

Remarks: Most important foodfish in parts of Africa. The discovery of mummified specimens along the upper Nile suggests that they were also highly esteemed by the ancient Egyptians. Widely introduced to lakes and waterways across most of northern Africa. Reports of Nile



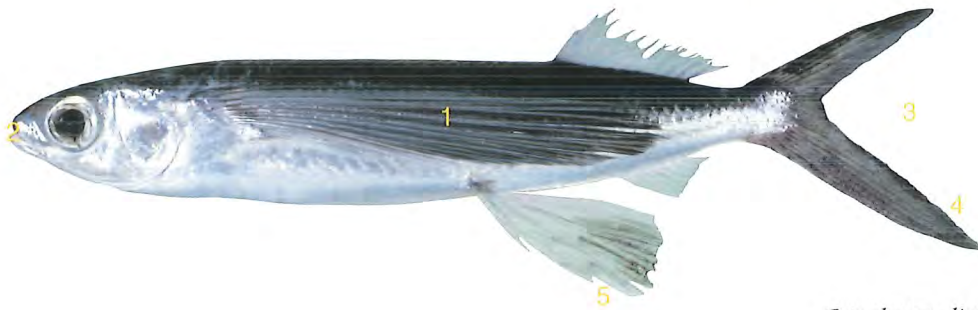
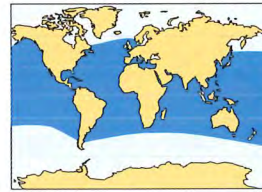
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perch aquaculture outside Africa (e.g. in South-East Asia) are unconfirmed. Voracious predator considered responsible for elimination of freshwater species in some areas where it has been introduced. Other relatives, such as Tanganyika lates (*L. angustifrons*), bigeye lates (*L. mariae*) and sleek lates (*L. stappersii*), are also harvested from East African lakes and may occasionally be imported to Australia.

Flyingfish

Family Exocoetidae

Minor names: none



Cypselurus oligolepis

Identifying features: ① long, wing-like pectoral fins; ② jaws about equal in length, snout not extended into a bill; ③ caudal fin deeply forked; ④ lower lobe of caudal fin longer than upper lobe; ⑤ pelvic fins often greatly enlarged.

Comparisons: Apart from their greatly enlarged pectoral and pelvic fins, flyingfishes most closely resemble mullets (family Mugilidae) in general appearance. The closely related garfishes (family Hemiramphidae) have a much shorter pectoral fin and their lower jaw is variably elongated to form a long pointed bill. The median unpaired fins (anal and dorsal fins) of both garfishes and flyingfishes are located near the tail.

Product: Occasionally headed and gutted (frozen) and roe (frozen and salted). Also marketed in Asia fresh, dry salted, and converted into fermented fish paste.

Size: To 46 cm (commonly imported at about 15–25 cm).

Habitat: Marine; pelagic near the surface, widespread in the open ocean in schools, rarely found near the coast. Well adapted to glide over the sea surface using their wing-like fins. All species are capable of travelling short distances out of water to avoid predators.

Fishery: Imported from Japan, although some Japanese product originally sourced from Malaysia, Taiwan, Indonesia and the Philippines. Caught in the Indo–Malay region in quantities of about 25 000–65 000 tonnes per annum by purse seines, gillnets and traps.

Remarks: Imports of flyingfish roe have increased over recent years. It partly replaces caviar (sturgeon roe), which, with the exception of farmed product, was recently banned from import.



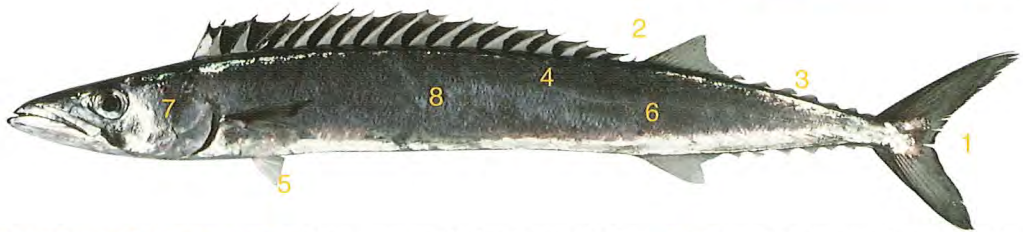
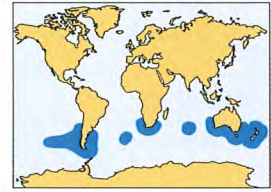
Roe.

Lumpfish (*Cyclopterus lumpus*, family Cyclopteridae) roe is also imported to Australia. Flyingfish roe may be a constituent of some imported bottled fish pastes used in curries. Many of the 50 or so known flyingfish species occur off Australia but these are rarely harvested by domestic fishers. They are nonetheless esteemed as food, with characteristics similar to garfishes. The related needlefishes, such as *Strongylura* species (family Belonidae), are also imported in small volumes, usually whole dried.

Barracouta

Thyrsites atun

Minor names: couta, snoek



Identifying features: ① tail ending in forked caudal fin; ② dorsal fin long, divided into 2 separate parts; ③ 5–7 dorsal finlets; ④ 1 long lateral line, curved below end of spiny part of dorsal fin; ⑤ pelvic fins small (but distinct); ⑥ body very long, compressed slightly; ⑦ head; ⑧ sides silvery blue, skin smooth.

Comparisons: Resembles the domestic and imported commercial gemfish (*Rexea solandri*, p. 80) but has more finlets following both the dorsal and anal fins (5–7 versus 2), and a single lateral line (rather than 2). It is more elongate than other commercial members of the gemfish family (Gempylidae) and has a forked caudal fin (absent in imported ribbonfish). Should not be confused with the more tropical barracudas (family Sphyraenidae), which have rounder bodies and 2 short, well-separated dorsal fins.

Product: Headed and gutted (frozen), and as fillets (frozen and smoked). Elsewhere, smoked and used to make fish cakes. Fillet rather slender, elongate, upper profile almost straight, tapering slightly, off-white to yellowish; outside with feeble, continuous red muscle band.

Size: To about 140 cm and more than 6 kg (commonly imported at about 50–100 cm and 1.5–2.5 kg).

Habitat: Marine; benthopelagic on the continental shelf, occasionally down the slope to 550 m (to 350 m in New Zealand). Adults migratory, often forming dense schools inshore near the surface. Juveniles often occur inshore seasonally in sheltered bays.

Fishery: Imported from New Zealand where it is caught almost exclusively by trawling. Smaller catches by trolling, handlining and netting elsewhere across the Southern Hemisphere. Small tonnage of smoked fillets imported from South Africa.

Remarks: Also caught domestically. Once used widely in fish-and-chip trade, now largely replaced with other species. Develops a spongy texture and milky appearance when handled poorly. The flesh, which is reasonably moist and has a medium oil content, tends to become paler with cooking. White strands in the flesh of some individuals are parasitic worms. Although harmless, these can accentuate marketing problems.

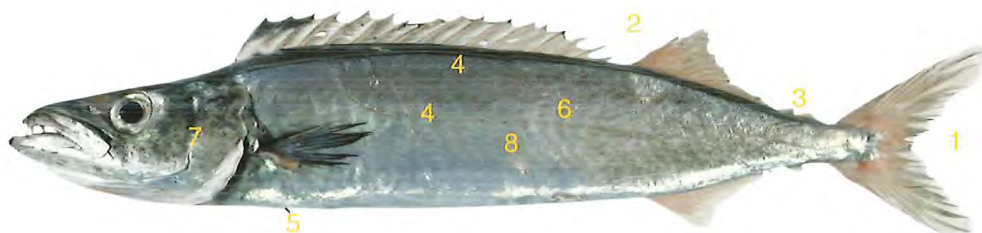
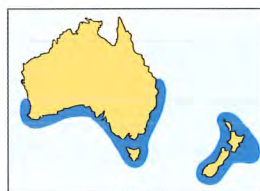


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Gemfish

Rexea solandri

Minor names: hake, king couta (AU), kingfish, silver kingfish, southern kingfish (NZ), silver gemfish



Identifying features: ① tail ending in forked caudal fin; ② dorsal fin long, divided into 2 separate parts; ③ 2 dorsal finlets; ④ 2 separate lateral lines; ⑤ pelvic fins barely visible; ⑥ body moderately long, compressed slightly; ⑦ head large; ⑧ sides silvery, skin smooth.

Comparisons: Resembles the barracouta (*Thyrsites atun*, p. 79) but has fewer finlets following both the dorsal and anal fins (2 versus 5–7), and 2 lateral lines (upper running directly beneath the dorsal fin with the lower arching downwards below the anterior third of the spinous part of the dorsal fin). Sometimes caught with the less important longfin gemfish (*R. antefurcata*) from which it can be distinguished by the form of their lateral lines. The upper lateral line of the longfin gemfish finishes near the rear of the second dorsal fin (rather than forward of the middle of the fin), and the lower lateral line is straight above the anal fin (rather than wavy). The caudal fin of ribbonfishes (family Trichiuridae) is either very small or absent.

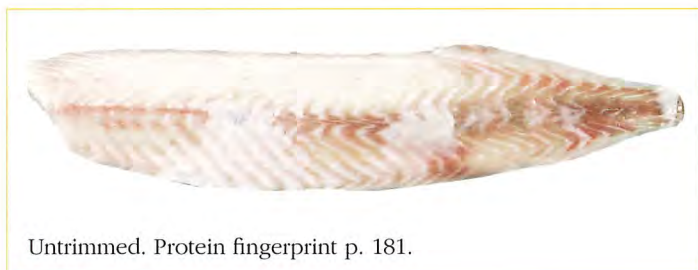
Product: Fillets (chilled and frozen), and headed and gutted (frozen). Fillet rather slender, elongate, upper profile almost straight, tapering slightly, pale pinkish; outside with intermediate, continuous red muscle band (more pronounced posteriorly).

Size: To 120 cm and 15 kg (commonly imported at 60–90 cm and up to 2.0–5.0 kg).

Habitat: Marine; benthopelagic, in midwater or near the bottom of the outer continental shelf and upper slope in about 100–700 m depth (most often in 150–500 m). Occasionally occurs near the surface in summer months.

Fishery: Caught almost exclusively by trawling. Imported from New Zealand.

Remarks: Formerly one of Australia's main trawl fishes. The name 'gemfish' is based on the family name 'Gempylidae'. A related species, escolar (*Lepidocybium flavobrunneum*), is imported in small quantities as frozen fillets from Taiwan. Escolar has prominent keels on the caudal peduncle and a wavy lateral line, and the flesh is much more oily and white in colour.

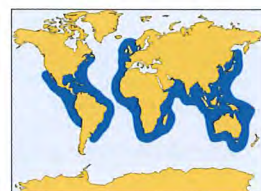


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Ribbonfish

Trichiurus lepturus

Minor names: Australian hairtail (AU), cutlassfish, largehead hairtail



Identifying features: ① tail ending in a point; ② dorsal fin very long, extending along most of body; ③ no dorsal finlets; ④ 1 lateral line, situated close to ventral surface for most of its length; ⑤ no pelvic fins; ⑥ body very long, strongly compressed; ⑦ head small; ⑧ sides silvery blue, skin smooth and easily removed.

Comparisons: Imported ribbonfishes (family Trichiuridae) can be distinguished from their commercial domestic relatives in having the tail terminating in a point rather than forming a definite caudal fin. The barracouta (*Thyrsites atun*, p. 79), and gemfish (*Rexea solandri*, p. 80), both have a well-developed, forked caudal fin. Another small-scale commercial trichiurid (*Lepidopus caudatus*) is also marketed locally as ‘ribbonfish’. It has a very elongate, compressed body but unlike *Trichiurus* has a small, forked caudal fin.

Product: Whole (chilled and frozen). Suitable for sashimi when fresh. Fillet very long, slender, barely tapering, off-white yellowish; outside without red muscle band.

Size: To 120 cm and 2 kg (commonly imported at 50–100 cm and up to 1.0 kg).

Habitat: Marine; benthopelagic, commonly in midwater or near the bottom of the outer continental shelf and upper slope in depths of 1–350 m. Mostly schooling, shallower and at the surface at night.

Fishery: The most important commercial gemfish or ribbonfish, with an annual catch sometimes exceeding one million tonnes. Caught almost exclusively offshore by trawling but through more varied methods inshore, including trolling, bag-netting, gillnetting, longlining, and seining. Imported from India and Indonesia.

Remarks: Also taken in small quantities as bycatch by trawlers off eastern Australia. In South-East Asia, ribbonfish is sold fresh in markets as well as processed into fish balls. In some regions, the silvery deposit in the skin (guanine) is used to make pearl buttons. Another ribbonfish, savalani hairtail (*Lepturacanthus savala*), has also reportedly been imported to Australia from Asia.

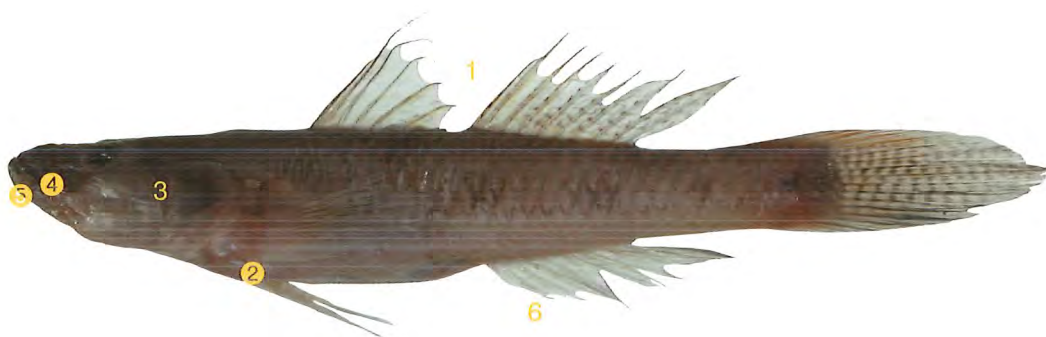


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Golden goby

Glossogobius species

Minor names: sand goby (AU)



Glossogobius aureus

Identifying features: ① 2 separate dorsal fins, the first with 6 (sometimes 7) weak spines, the second with 1 weak spine, 7–12 soft rays; ② pelvic fins joined together; ③ head large; ④ tongue bilobed; ⑤ lower jaw with more than 1 row of teeth; ⑥ anal fin with 1 spine, 6–10 soft rays.

Comparisons: Distinguished from marbled gobies (*Oxyeleotris* species, p. 83) in having joined pelvic fins (2 separate pelvic fins in marbled gobies) and a bilobed tongue (otherwise not bilobed). Less elongate and with shorter-based dorsal and anal fins than the the mudskippers (*Pseudapocryptes* species, p. 84), the other gobies included here.

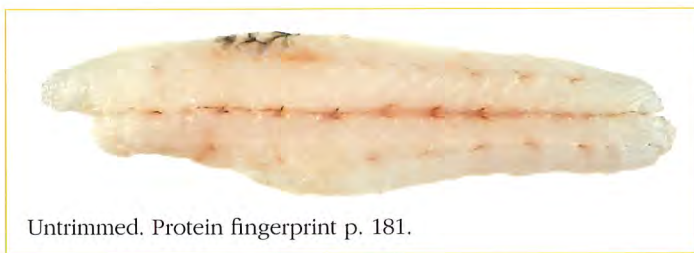
Product: Whole (frozen), sometimes individually wrapped in plastic. Fillet of golden tank goby (*G. aureus*) slender, elongate, tapering slightly, off-white pale yellowish; outside without red muscle band. Inside with grey veins following myomeres. Rarely filleted.

Size: To at least 30 cm and 300 g (commonly imported at 19–28 cm and 60–240 g).

Habitat: Estuarine and freshwater; mostly in brackish water but some species extend upstream to freshwater. Also occur in canals, ditches and ponds. A few enter the marine domain. Prefer soft bottoms but also occur on gravel and rock.

Fishery: Caught by seines, trawls, setnets, traps and castnets in many parts of South-East Asia. Sourced from various countries.

Remarks: About 40 *Glossogobius* species (most small-sized) occur in the tropical Indo-Pacific and the primary species are not well defined. Sometimes marketed as 'sand goby', a name that is applied to a wide variety of goby-like fishes. Popular in Filipino cuisine but not considered commercial in some other countries. For example, golden gobies are rarely seen in Malaysian markets. Some species are used in the aquarium trade.

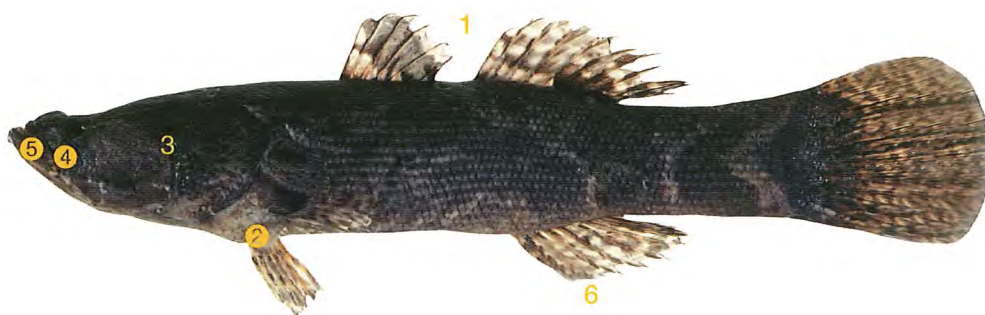


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Marbled goby

Oxyeleotris species

Minor names: goby fish, marbled sleeper goby (AU), cá bong tuong (VN), trey damrey (KH)



Oxyeleotris marmorata

Identifying features: ① 2 separate dorsal fins, the first with 6 spines, the second with 1 spine, usually 9–12 soft rays; ② pelvic fins separate; ③ head large; ④ tongue not bilobed; ⑤ lower jaw with more than 1 row of teeth; ⑥ anal fin with 1 weak spine, usually 8–12 soft rays.

Comparisons: Despite their marketing name, marbled gobies belong to the gudgeon family, Eleotridae. Best distinguished from true gobies by their separate pelvic fins (rather than joined). Compared with the domestic sleepy cod (*O. lineolatus*) and giant gudgeon (*O. selbeimi*), the dominant import, the marbled goby (*O. marmorata*), has 80–90 mid-lateral scales (versus 62–70). Sleepy cod is a type of marbled goby rather than a cod.

Product: Whole (frozen), fish sometimes individually wrapped in plastic. Fillet of the marbled goby moderately deep, rather elongate, tapering rapidly, off-white yellowish or brownish; outside with feeble, diffuse central red muscle band.

Size: To 66 cm (commonly imported at 20–30 cm and 0.2–0.3 kg).

Habitat: Freshwater; found in freshwater and brackish waters in rivers, swamps, dams and canals. Occupy a wide range of bottom types, and sometimes associated with dense aquatic vegetation.

Fishery: Dominated by cage-cultured marbled goby (*O. marmorata*). Otherwise taken as byproduct by seines, trawls and gillnets. Imported from various countries in South-East Asia, including Vietnam and Cambodia.

Remarks: Perhaps the largest of the goby-like fishes, the dominant member of this group, *O. marmorata*, is highly esteemed throughout much of South-East Asia. It is often steamed and commonly displayed live in restaurants. In some regions, it is considered to be particularly nutritious to men. Locally, sleepy cod is supporting a developing aquaculture industry, particularly in Queensland.



Trimmed. Protein fingerprint p. 181.

Mudskipper

Pseudapocryptes species

Minor name: baby eel



Pseudapocryptes elongatus

Identifying features: ① 2 separate dorsal fins, the first with 5 spines and the second very long, with 1 spine, 28–32 soft rays; ② pelvic fins joined together; ③ head small; ④ body elongate; ⑤ lower jaw with only 1 row of teeth; ⑥ anal fin long, with 1 spine, 26–30 soft rays.

Comparisons: Two species, both have a distinctive elongate body and long-based dorsal and anal fins. Elongate mudskipper (*P. elongatus*), the dominant commercial species, is more elongate than the Borneo mudskipper (*P. borneensis*); body depth less than 14% of standard length in elongate mudskipper versus more than 14% of standard length. Most other similarly shaped gobies have either a much taller first dorsal fin or have only 1 dorsal fin.

Product: Whole (frozen). Fillet of elongate mudskipper long, very slender, barely tapering, off-white yellowish or brownish; outside with feeble, diffuse central red muscle band. Muscle structure simple, with only one muscle band above and below midline. Rarely, if ever, filleted.

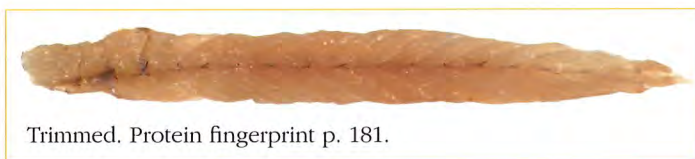
Size: To 20 cm (commonly imported at 15–17 cm and about 20 g).

Habitat: Live in mudflats of estuaries and the tidal zone of rivers, often in deep burrows.

Fishery: Taken by seines, trawls, castnets and tidal gillnets. Common in some regional markets (e.g. the Mekong delta, Vietnam). Imported from Vietnam.

Remarks: The goby family (Gobiidae) numbers about 1 900 species and has more marine species than any other fish family. The more estuarine mudskippers can survive extended periods out of water, and some even climb trees. Sometimes marketed in Australia under the confusing name, 'baby eel'. Elongate mudskipper is also sometimes referred to by an incorrect scientific name, *P. lanceolatus*. These amphibious 'air-breathers' are reportedly good eating,

particularly when salted and dried. However, they are not considered commercial across their range and are rarely seen in the markets of some countries.

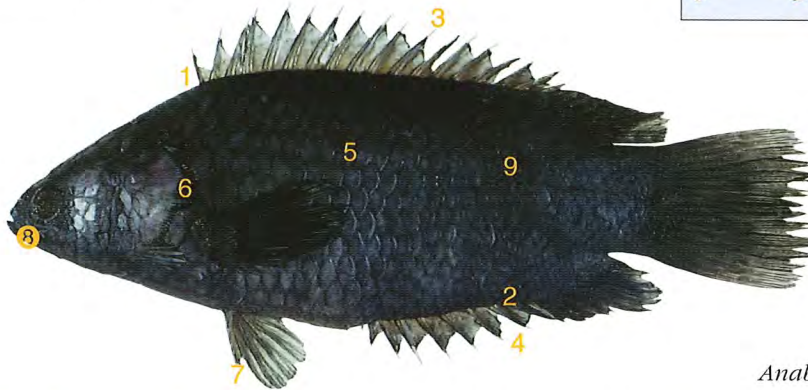


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Climbing perch

Anabas species

Minor name: climbing gourami



Anabas testudineus

Identifying features: ① dorsal-fin origin forward of pectoral fin; ② anal-fin base long, but shorter than dorsal-fin base; ③ dorsal fin with 16–20 spines, 7–10 soft rays; ④ anal fin with 9–11 spines, 8–12 soft rays; ⑤ body compressed or subcylindrical, roughly oblong or oval; ⑥ posterior edge of operculum heavily serrated; ⑦ pelvic fin without long filament; ⑧ jaws with fixed conical teeth; ⑨ lateral line interrupted below dorsal fin.

Comparisons: Climbing perches can be differentiated from gouramis (families Belontiidae, Helostomatidae and Osphronemidae, p. 86) by the combination of characters listed above. Tilapias (*Oreochromis*, *Sarotherodon* and *Tilapia* species, p. 128) also have an interrupted lateral line but they are deeper bodied and their anal-fin base is relatively much shorter.

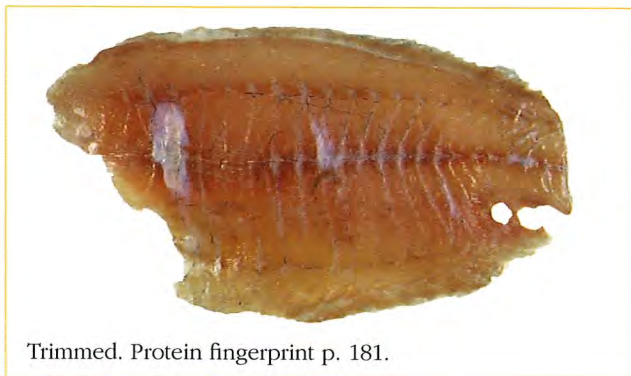
Product: Whole, trimmed (frozen, dried). Also pickled, and as fish paste and fish sauce. Fillet of climbing perch (*A. testudineus*) very deep, short, tapering slightly, upper profile convex, brownish; outside without red muscle band.

Size: To at least 26 cm (commonly imported at 9–14 cm).

Habitat: Freshwater (rarely brackish); demersal, generally in slow-moving streams or even stagnant water, often with dense aquatic vegetation.

Fishery: Caught by seines, gillnets and entangling nets hung on the dry borders of canals and rice paddies, but mostly produced by aquaculture. Imported from South-East Asia.

Remarks: The climbing perch (*A. testudineus*) is the most commercially important of a few



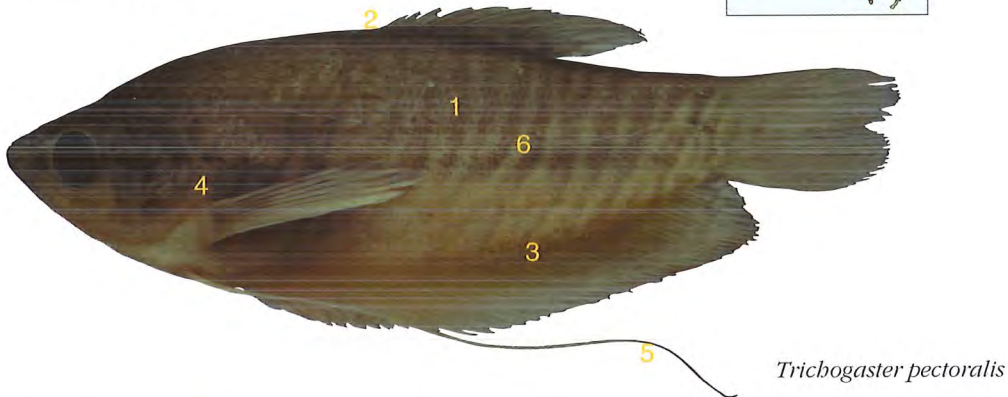
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Asian *Anabas* species. Other family members are harvested commercially in Africa, many for the aquarium trade. These fishes possess an accessory breathing organ in the gill chamber and are able to tolerate stagnant water and even spend a number of days out of water. They bury in mud when water is scarce, and even 'walk' some distance over land. Reportedly occasionally found alive in trees.

Gourami

Families Belontiidae, Helostomatidae & Osphronemidae

Minor names: fighting fish, giant gourami, kissing gourami



Trichogaster pectoralis

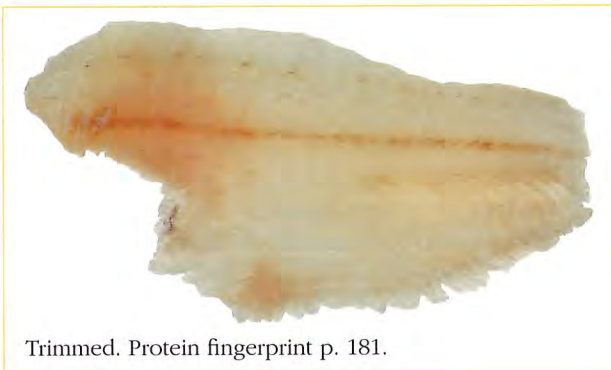
Identifying features: ① body compressed, roughly oblong or oval; ② dorsal-fin origin over or, more usually, well behind pectoral fin; ③ anal-fin base long, usually longer than dorsal-fin base; ④ posterior edge of operculum not serrated; ⑤ pelvic fin often with long filament; ⑥ lateral line variable but often complete.

Comparisons: The kissing gourami (family Helostomatidae) lacks both teeth and a filamentous pelvic fin. Giant gouramis (family Osphronemidae) have teeth and a complete and continuous lateral line. Gouramis (family Belontiidae) have teeth, a vestigial or absent lateral line and, usually, a filamentous pelvic ray. The closely related climbing perches (*Anabas* species, p. 85) have their dorsal-fin origin forward of the pectoral fin (rather than over or well behind) and a heavily serrated posterior edge of the operculum. Tilapias (*Oreochromis*, *Sarotherodon* and *Tilapia* species, p. 128) have a relatively much shorter anal-fin base.

Product: Trimmed (i.e. fins removed), and gilled and gutted (frozen, dried). Also pickled, and used in fish paste and fish sauce. Fillet of snakeskin gourami (*Trichogaster pectoralis*) deep, reasonably short, tapering rapidly, off-white yellowish with green tinge; outside without red muscle band; inside with distinct elongated pocket in flesh, extending about half length of fillet from posterior margin.

Size: To about 80 cm (commonly imported at 15–25 cm).

Habitat: Freshwater; prefer slow moving or stagnant water, often sheltering among dense aquatic vegetation.



Trimmed. Protein fingerprint p. 181.

Fishery: Caught mainly by seines, castnets and gillnets, with some aquaculture production. Giant gouramis also taken with baited hooks. The snakeskin gourami is probably the dominant import, mostly from South-East Asia.

Remarks: Often consumed dry salted. Occasionally, aquarium specimens have escaped into some northern Australian waterways. Can live in poorly oxygenated waters.

Sweetlip bream

Family Haemulidae (except *Pomadasys* species)

Minor names: painted sweetlip, spotted sweetlip, sweetlip emperor (AU), gaji (ID), kaci (MY), pla khang ta pao (TH)

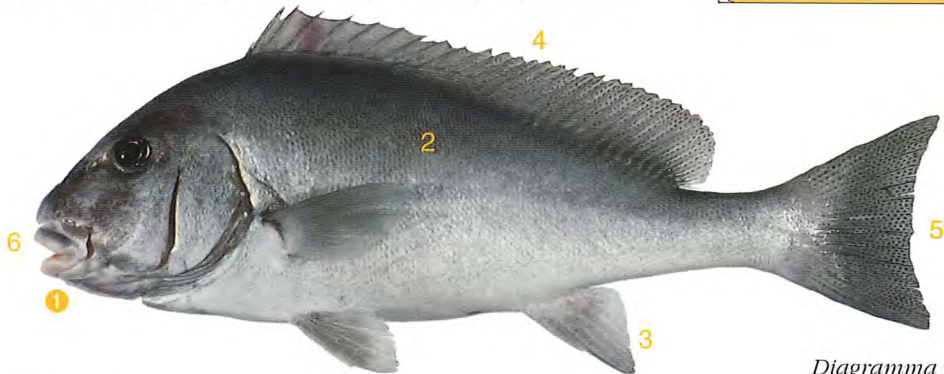
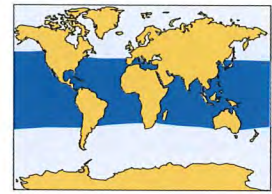


Diagramma pictum

Identifying features: ① undersurface of lower jaw with 3 pores on each side; ② sides vividly coloured or patterned (occasionally silver all over); ③ anal fin with 3 spines (the second long and thick), 6–8 soft rays; ④ dorsal fin continuous, with 8–14 spines, 13–26 soft rays; ⑤ tail more-or-less truncate (not forked); ⑥ thick, fleshy lips.

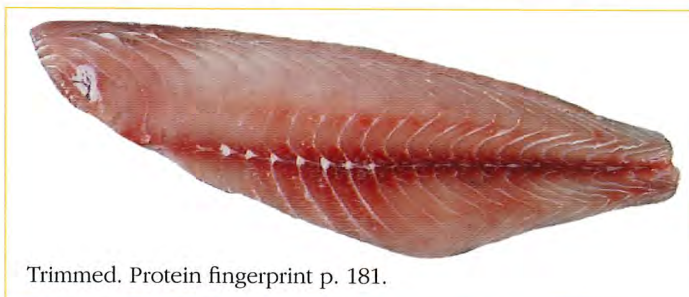
Comparisons: Similar to grunter breams (*Pomadasys* species), which are also imported, but with 3 pores on the undersurface of the lower jaw (rather than a pore on each side separated by a groove). Most are brightly coloured with distinctive spots and/or stripes. Painted sweetlip (*Plectorhinchus picus*) has 3 broad black bars across the head and back when small, and numerous small, black spots on the upper half of the body when large. Painted sweetlip bream (*Diagramma pictum*) is unusually drab (uniformly silvery grey) when adult. Breams (family Sparidae) have forked tails, grunters (family Terapontidae) have a notched dorsal fin, and tropical snappers (*Lutjanus* species) have thinner lips, distinguishing them from sweetlip breams.

Product: Primarily frozen fillets, occasionally whole (gutted). Fillet of painted sweetlip bream moderately deep, rather elongate, tapering rapidly near peduncle, convex above, yellowish-white; outside with continuous, intermediate central red muscle band.

Size: To 100 cm and about 12 kg (commonly imported at less than 60 cm and 3 kg).

Habitat: Marine; demersal, from inshore bays and estuaries to broken rubble bottoms on off-shore reefs. Some species inhabit caves.

Fishery: Widespread commercial importance, often taken in traps. Dominant imports are painted sweetlip from Indonesia and painted sweetlip bream from Thailand. Other species, along with the closely related grunter breams, are also sourced from Asia.



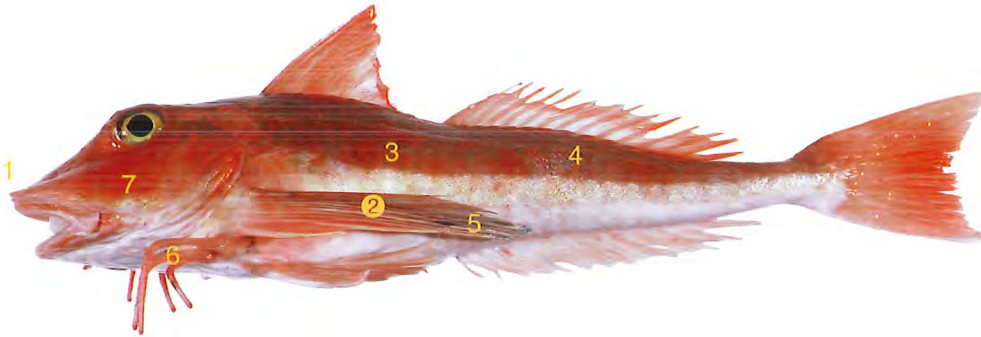
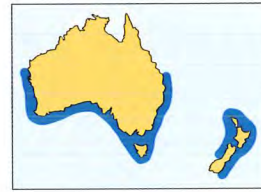
Trimmed. Protein fingerprint p. 181.

Remarks: Fifteen or so species occur locally. Of five subspecies of painted sweetlip bream only one, *D. pictum labiosum*, occurs in Australia. Sometimes traded live in Asia but usually marketed fresh. The flesh tends to be coarse. Often used in curries. Known internationally as 'grunts'.

Red gurnard

Chelidonichthys kumu

Minor names: flying gurnard, kumu gurnard, kumukumu, latchet (AU), gurnard (NZ)



Identifying features: ① no long spines at snout tip; ② upper surface of pectoral fin with blue edge and numerous blue spots centrally; ③ body scales small with smooth edges; ④ lateral line scales slightly larger than those adjacent; ⑤ upper pectoral fin greatly enlarged, almost wing-like; ⑥ lower pectoral fin with 3 finger-like rays; ⑦ head covered in a bony casing without scales.

Comparisons: Similar in general appearance to the domestic latchet (*Pterygotrigla polyommata*) in having small, smooth-edged scales and a very large pectoral fin, but lacks long spines on the snout tip and has vivid blue spots on the mid upper surface of the pectoral fin (rather than yellow spots or blue and yellow lines).

Product: Fillets (frozen and chilled), and headed and gutted (chilled). Fillet rather slender, tapering gently, yellowish-white to pink; outside with pronounced, continuous, central red muscle band; often with skin on.

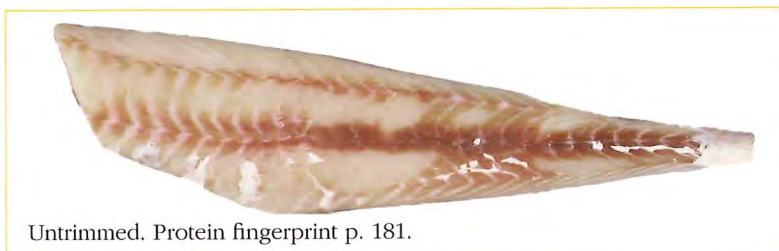
Size: To at least 53 cm and about 2 kg (imported size commonly imported at 30–50 cm).

Habitat: Marine; demersal on soft bottoms, mainly on the inner continental shelf to 100 m depth (possibly deeper in New Zealand to 180 m). Often in shallow water in large bays and estuaries.

Fishery: Imported catch taken by demersal trawlers near the New Zealand coast. A significant component of the New Zealand catch is exported to Australia.

Remarks: Largest of the gurnards, with firm high-quality flesh. Also taken in small quantities

in the South East Fishery by domestic trawlers and Danish seiners. More than one red gurnard species may occur across the Australasian region and further research is required.

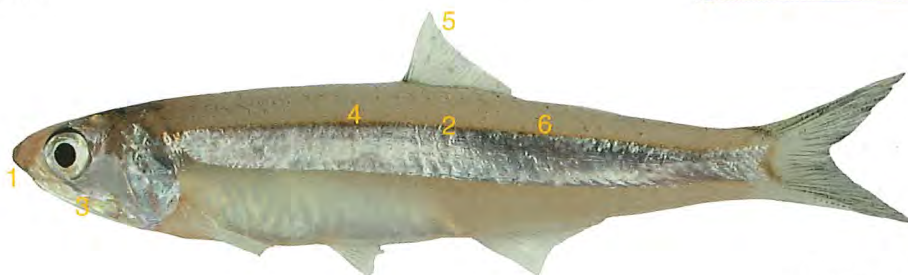
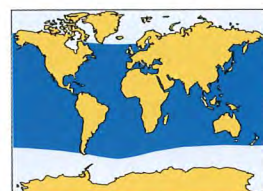


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Anchovy

Family Engraulidae

Minor names: bilis (ID), cá com (VN), dilis (PH), pla bai pai (TH), bilis



Stolephorus indicus

Identifying features: ① lower jaw underslung; ② sides often silver, no black spots; ③ angle of jaws situated behind eye, usually well behind; ④ body usually compressed; ⑤ 1 small dorsal fin, usually near midpoint of body; ⑥ scales usually large and easily removed.

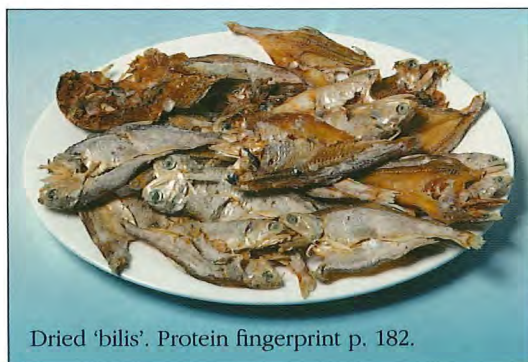
Comparisons: Anchovies are distinctive herring-like fishes that have a long, thin, underslung jaw that extends back behind the eye. Other herring-like fishes have a deep lower jaw that articulates under, or only slightly behind, the eye level. The Australian anchovy (*Engraulis australis*) of temperate waters has a broad silver stripe along the sides and lacks a serrated ridge on the belly.

Product: Whole (dried, dry salted and pickled), and headed and gutted (frozen). Also canned, and contained in various sauces, pastes and fish balls. Fillet of Australian anchovy moderately elongate, barely tapering, brownish-white; outside with pronounced, continuous red muscle band. Rarely filleted due to small size.

Size: To about 40 cm (commonly imported at 5–9 cm).

Habitat: Marine; typically form schools in coastal regions, with a few species entering brackish water or freshwater. Individuals of one species have been found 900 km upstream in New Guinea.

Fishery: Support extensive fisheries via purse seines, beach seines and various shallow-water nets and traps. Catches in some regions fluctuate wildly and have generally declined in recent years. Imports, mainly from South-East Asia, include rat-tail anchovies (*Coilia* species), thryssas (*Thryssa* species), hairfin anchovies (*Setipinna* species) and various other related fishes (e.g. *Stolephorus* species).



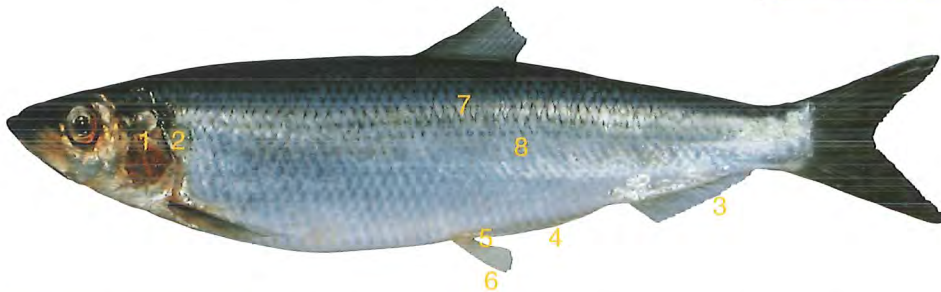
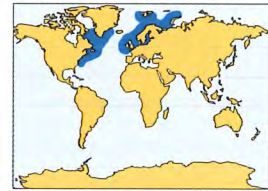
Dried 'bilis'. Protein fingerprint p. 182.

Remarks: The common Australian anchovy should be marketed as 'Australian anchovy'. Although dominated by anchovies, imported dried 'bilis' often contains other species such as ponyfishes (family Leiognathidae) and red mullets (family Mullidae). Anchovies are popular in many parts of Asia and are prepared for eating in numerous ways including raw, dried, fried, as a filling for buns and sandwiches, and boiled (to make stock). Some second-grade anchovies are fermented for six months to make a base for fish sauce.

Herring

Clupea harengus

Minor names: Atlantic herring, herring, kipper



Identifying features: ① operculum smooth (lacking obvious bony lines radiating downwards); ② hind margin of gill opening evenly rounded (without fleshy outgrowths); ③ all anal-fin rays of similar size; ④ enlarged scales present on belly (not forming a strong keel); ⑤ pelvic-fin insertion behind origin of dorsal fin; ⑥ pelvic-fin elements 9 (rarely 8 or 10); ⑦ no dark spots along sides; ⑧ body moderately deep.

Comparisons: Closely resembles the pilchards (*Sardina* and *Sardinops* species, p. 91) and other sardines (Clupeinae, p. 92). Differs from pilchards, including the European pilchard (*Sardina pilchardus*), in having belly scales that do not form a pronounced keel, the last 2 anal-fin rays not longer than those before them, and in lacking radiating lines on the operculum. Can be distinguished from many sardines in not having fleshy outgrowths along the rear margin of the gill opening (present in *Sardinella*) and in having anal-fin rays all of similar size (rather than last 2 elongated). A domestic species, the sandy sprat (*Hyperlophus vittatus*), is similar but has a more forward-positioned pelvic fin and more pronounced belly scales.

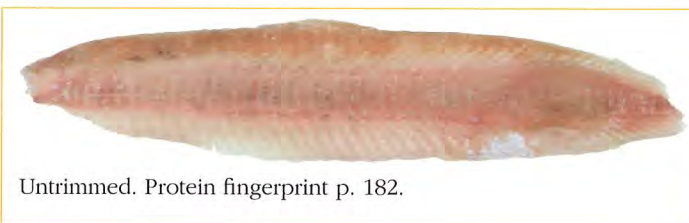
Product: Whole, as fillets and gilled and gutted (frozen), and smoked. Also canned (small individuals) and as rollmops. Fillet moderately deep, barely tapering, pale reddish-brown; outside with very pronounced, continuous red muscle band.

Size: To 40 cm and 1 kg (commonly imported at 20–25 cm and 60–120 g).

Habitat: Marine; coastal pelagic to depths of 200 m, schooling in large numbers near surface.

Fishery: A historically important component of North Atlantic pelagic fisheries. Caught by trawls, seines and gillnets. Stocks collapsed from overfishing but are apparently starting to recover due to the implementation of stock protection measures. Imported from Europe (e.g. the United Kingdom and the Netherlands). Other members of the family are also imported, for example, shad (*Tenulosa* species) whole frozen from China.

Remarks: Also imported for rocklobster bait. Very similar to Pacific herring, *C. pallasii*, which forms the basis of an important fishery in the north Pacific. The two species, which occur together in the Arctic Sea, are difficult to differentiate and considered by some to be the same species. The high oil content of herring makes it suitable for preparations including pickling, smoking, canning and salting.

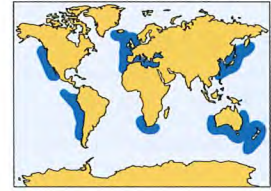


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Pilchard

Sardina & *Sardinops* species

Minor name: sardine



Sardinops neopilchardus

Identifying features: ① operculum with distinct, bony lines radiating downwards; ② hind margin of gill opening evenly rounded (no fleshy outgrowths); ③ last 2 anal-fin rays longest; ④ belly midline scales forming serrated ridge; ⑤ narrow silver stripe along side edged below with dark blue spots; ⑥ upper and lower jaws extend forward equally; ⑦ large, easily removed scales; ⑧ body almost oval in cross-section; ⑨ no serrated ridge along shoulder midline.

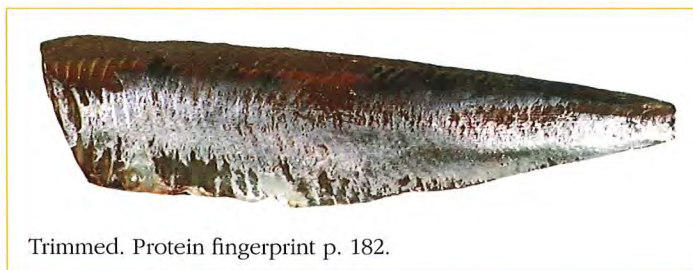
Comparisons: Distinguishable from herring (*Clupea harengus*, p. 90) and other sardines (*Clupeinae*, p. 92) in having distinct radiating bony lines on the operculum and a row of widely spaced, dark spots along the sides. Compared with *Sardinops* species, the European pilchard (*Sardina pilchardus*) has a shorter jaw (not reaching mid-eye level) and the gill rakers located at the bend of the outer gill arch are not exceptionally shorter than those above and below (lower gill rakers shortened at angle of outer arch in *Sardinops* species).

Product: Whole and as butterfly fillets (frozen and sometimes crumbed), and canned (frequently with other products such as tomato and chilli). Otherwise processed as petfood, bait, or as feedfish for farmed southern bluefin tuna (*Thunnus maccoyii*, p. 103). Fillet of pilchard (*Sardinops neopilchardus*) moderately deep, barely tapering, reddish-brown; outside with very pronounced, continuous red muscle band.

Size: To about 28 cm and more than 100 g (commonly imported at 18–20 cm).

Habitat: Marine; pelagic, commonly schooling offshore over the continental shelf to the edge of the slope, occasionally nearing the coast.

Fishery: Caught by purse seines, beach seines, lamparas, gillnets, trap nets and occasionally by bottom trawls. Imported largely from Portugal, the US, New Zealand and Japan. South American pilchard (*Sardinops sagax*), which forms the basis of a million-tonne fishery off Chile and Peru, could be imported in a variety of processed forms.



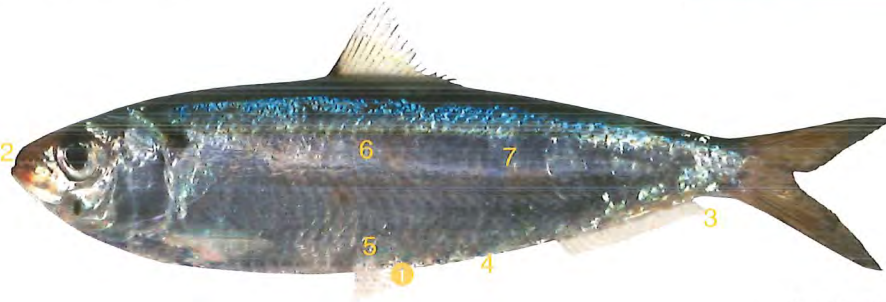
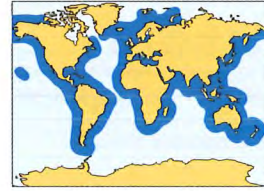
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Remarks: Studies have failed to determine unambiguously the correct scientific name of the domestic *Sardinops* species, and it is referred to as *S. neopilchardus*, *S. sagax* and *S. sagax ocellatus*. Juveniles of the European pilchard are sold in Australia as 'sardine'.

Sardine

Subfamily Clupeinae

Minor names: Spanish sardine (US), Indian oil sardine, oil sardine, round sardinella



Sardinella gibbosa

Identifying features: ① pelvic scute with dorsally pointing arms, not W-shaped; ② upper jaw rounded when viewed from the front; ③ last 2 anal-fin rays sometimes extended; ④ belly midline scales forming serrated ridge; ⑤ pelvic-fin insertion often just behind origin of dorsal fin; ⑥ often deep-bodied and strongly compressed; ⑦ lateral line absent.

Comparisons: This subfamily includes imports such as herring (*Clupea harengus*, p. 90) and pilchards (*Sardina* and *Sardinops* species, p. 91). However, many other sardine imports (e.g. *Sardinella* species) have 2 fleshy outgrowths along the rear edge of the gill opening (lacking in herring and pilchards). A group of commercially important Indo-Pacific sardines (*Herklotsichthys* species) have these fleshy outgrowths but do not have their last 2 anal-fin rays enlarged.

Product: Whole (frozen and dried), as fillets (frozen), and canned (frequently with other ingredients). Rarely filleted due to their small size.

Size: To 40 cm and about 1 kg (common size and weight varies greatly with species).

Habitat: Marine; pelagic, mostly forming schools near the coast. Some species, mainly as juveniles, enter lagoons, estuaries and the lower reaches of rivers.

Fishery: Trapped, netted and seined, of varying importance to fisheries throughout their range. Imported mainly from Portugal and Thailand but also from elsewhere in Europe and South-East Asia. European canned imports are likely to be a mix of Spanish sardine (*Sardinella aurita*) and European pilchard (*Sardina pilchardus*). Members of some other groups are also imported as 'sardine' for local sale.



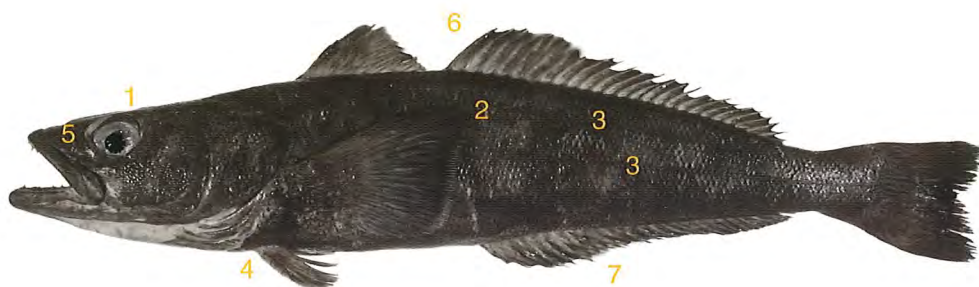
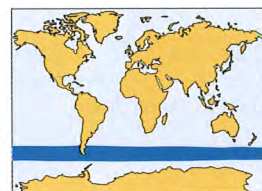
Canned. Protein fingerprint p. 182.

Remarks: Important foodfishes throughout most of their range although some species avoided due to their numerous small bones. Their high oil content makes sardines suitable for a number of processing methods including drying, canning and smoking. Also processed into fish crackers or fish balls, or eaten raw. A local species, scaly mackerel (*Sardinella lemuru*), is caught commercially off Western Australia. Adult *Sardina pilchardus* are usually referred to as 'pilchard' and juveniles as 'sardine'. 'Sardines' canned in Norway are often sprats, *Sprattus sprattus*.

Patagonian toothfish

Dissostichus eleginoides

Minor names: Australian sea bass, sea bass, toothfish (AU), Antarctic cod



Identifying features: ① top of head with several small, narrow scaleless patches; ② sides brownish-grey with faint darker blotches; ③ 2 separate lateral lines; ④ pelvic-fin base forward of pectoral-fin base; ⑤ single nostril on each side of head; ⑥ dorsal fin with 8–11 spines, 26–31 soft rays; ⑦ anal fin with 26–31 soft rays.

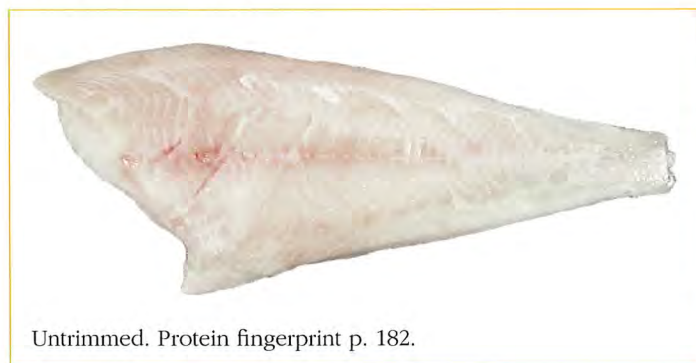
Comparisons: Large, elongate, round-bodied toothfish (family Nototheniidae) that is distinct from all other Australian commercial fishes in a combination of the characters above. It is distinguished from another smaller locally sold icefish, the mackerel icefish (*Champsocephalus gunnari*), in having scales (scales present only on the lateral line in mackerel icefish) and in lacking bands on the body (irregular dark bands otherwise present).

Product: Fillets and cutlets (frozen). Fillet moderately deep, elongate, upper profile almost straight, tapering slightly, milky white; outside with feeble, diffuse red muscle band.

Size: To 215 cm and 100 kg (commonly imported at more than 40 cm and more than 1 kg).

Habitat: Marine; pelagic in both midwater and near the bottom of canyons in depths of 70–1 500 m.

Fishery: Caught by demersal trawlers and longliners off South America, South Georgia, and the Falkland Islands, and along the ridges and seamounts near various subAntarctic islands. Imported as cutlets from Singapore and from elsewhere as fillets. Imports have decreased recently due to high prices.



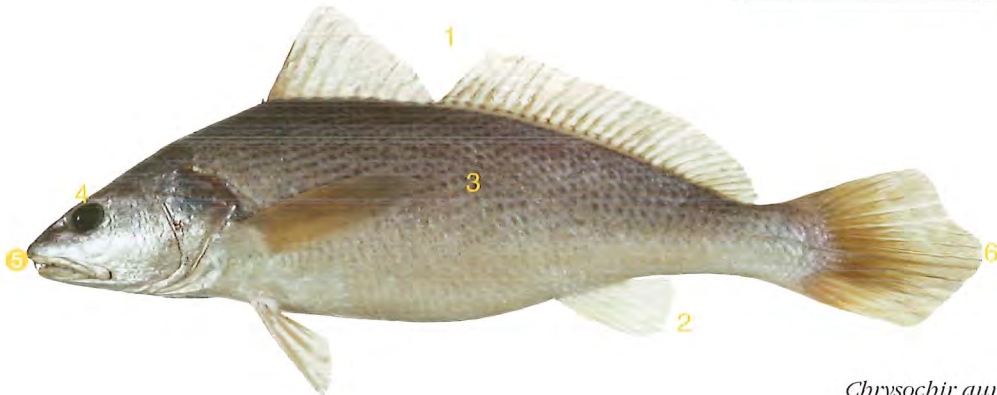
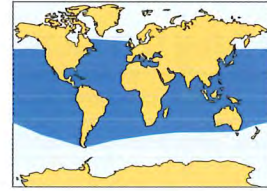
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Remarks: Also caught in Australian subAntarctic waters. Toothfishes are the major fish resource exploited in the Southern Ocean and poaching by foreign vessels is an important jurisdictional issue. Highly regarded, premium foodfish both locally and overseas. The related mackerel icefish may also be imported to Australia.

Jewfish (page 1 of 2)

Family Sciaenidae

Minor names: jew (AU), croaker, drum



Chrysochir aureus

Identifying features: ① dorsal fin long, deeply notched, with 6–13 spines in first portion, 1 spine and 20–44 soft rays in second; ② anal fin short, with 1–2 spines, 6–13 soft rays; ③ body moderately elongate, often with silver reflections; ④ eyes near top of head; ⑤ conspicuous sensory pores over snout tip and chin; ⑥ lateral-line scales extending to end of caudal fin.

Comparisons: Distinctive fishes with a moderately elongate body, a long, notched dorsal fin, and a short anal fin. In Australia, jewfishes are sometimes confused with the similarly named West Australian dhufish (*Glaucosoma hebraicum*), which is a type of pearl perch (family Glaucosomatidae). However, pearl perches lack a notch in the dorsal fin and have 3 (rather than 1–2) anal-fin spines.

Product: Whole, and headed and gutted (frozen and dried). Fillet of Reeve's croaker (*Chrysochir aureus*) moderately elongate, tapering gradually, off-white yellowish; outside with very faint evidence of central red muscle band.

Size: To 200 cm and at least 73.5 kg (commonly imported at 20–40 cm and up to 1 kg).

Habitat: Marine, occasionally freshwater; demersal mainly over sand and mud on the continental shelf but some species extend on the upper continental slope to depths of 400 m. Many live inshore with some entering estuaries and freshwater. A few species restricted to freshwater.

Fishery: Widely targeted by traps, trawls, gillnets, seines and hooks; some species farmed. A few small Asian species are sourced from a variety of countries, including Taiwan, Myanmar and Vietnam.

Remarks: More than 270 species worldwide. International names include 'drum' and 'croaker'.



Trimmed. Protein fingerprint p. 182.

Species identification based on external characteristics is often difficult. In South-East Asia, jewfishes are mostly sold fresh but in some regions dry salted product is preferred. Jewfish otoliths (earbones) are very large and, in some regions, used as ornaments or in jewellery.

Jewfish (page 2 of 2)

Family Sciaenidae

Chrysochir aureus



Remarks: Commonly called ‘Reeve’s croaker’, this species occurs in the Indo–West Pacific from the Bay of Bengal east to southern China and Indonesia. It is common in shallow coastal waters. It can be identified by 1 or 2 pairs of canines in the front of the upper jaw, and a carrot-shaped swimbladder with 27–30 pairs of fan-like appendages along the sides. The snout is acutely pointed and projects in front of the upper jaw. Imported whole from Myanmar, Vietnam and elsewhere in South-East Asia. To about 35 cm (commonly imported to 30 cm).

Otolithes ruber



Remarks: Commonly called ‘tigertooth croaker’, this species is widely distributed in the Indo–West Pacific from South Africa east to Queensland and north to southern China. Prefers shallow coastal waters to depths of about 170 m but usually in less than 40 m. Distinguished by the presence of canine teeth at the front of both jaws, and a carrot-shaped swimbladder with 32–36 pairs of fan-like appendages along sides. Occasionally imported whole and dried from South-East Asia. To at least 75 cm (commonly imported to 45 cm).

Larimichthys polyactis

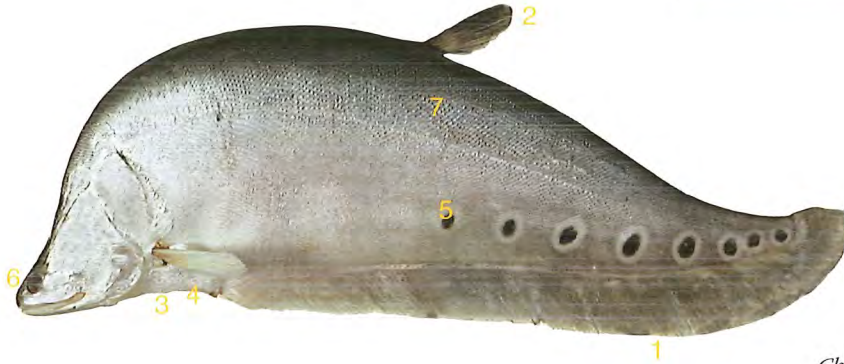
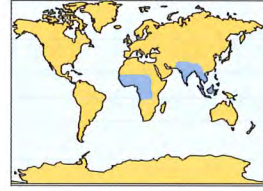


Remarks: Commonly called ‘yellow croaker’, this species occurs in the north-west Pacific Ocean, in the Yellow and East China Seas. It is very common along the coast of China and prefers shallow waters. Differs from the jewfish species above in having an upturned mouth, a large eye, and a yellow belly. Widely exported whole from Asia to Chinese communities almost worldwide (including Australia). Also common in the aquarium trade. To about 45 cm (commonly imported to 20 cm).

Knifefish

Family Notopteridae

Minor name: featherback



Cbitala ornata

Identifying features: ① anal fin long, extending along most of the body and joining the caudal fin; ② dorsal fins small or absent; ③ pelvic fins small or absent; ④ scutes present ventrally; ⑤ body may have numerous small spots, wavy stripes or large ocellated spots above anal fin; ⑥ barbels on nostrils; ⑦ body elongate and compressed.

Comparisons: Superficially similar to rat-tail anchovies (*Coilia* species, p. 89), but lack extended pectoral-fin filaments (5–19 extended filaments in rat-tail anchovies). Differ from domestic freshwater catfish (*Tandanus tandanus*) and cobbler (*Cnidoglanis macrocephalus*), and imported sheatfishes (family Siluridae, p. 50), in lacking barbels directly around the mouth but barbels are present around the nostrils. The reduced or absent dorsal fin and the row of ventral scutes forward of the anal fin are useful diagnostic characters.

Product: Whole and as fish paste (frozen). Fillet of clown featherback (*Cbitala ornata*) moderately elongate, deep, tapering gradually, pinkish but darker, almost greyish, above; outside without central red muscle band.

Size: Up to 150 cm, and at least 7 kg (commonly imported at about 50 cm and 1.25 kg).

Habitat: Freshwater; demersal, may occur in brackish water.

Fishery: Most species are of commercial importance, being utilised both fresh and dried, and in fish paste. Wild caught and farmed. Imported from Vietnam, with clown featherback the dominant whole import.

Remarks: Popular in the aquarium trade where live, large adults are often displayed in public aquaria. The anal fin provides locomotion in both forward and reverse directions by undulating.



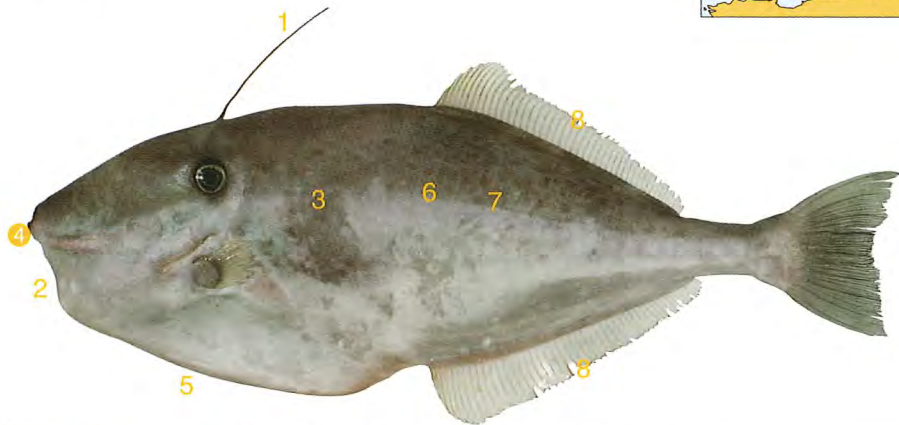
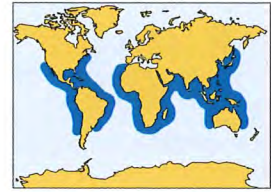
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Some rat-tail anchovies and sheatfishes are from similar regions to knifefishes, and the groups may sometimes be confused. Knifefishes are rather bony, so they need to be prepared using special cooking methods. In Indonesia, used to make fish crackers (kerupuk). Also used in soups and processed into fish balls.

Leatherjacket

Aluterus monoceros

Minor name: unicorn leatherjacket



Identifying features: ① long, thin dorsal spine (second spine usually embedded); ② chin convex, with distinctive hump; ③ skin leathery and rough, lacking normal scales; ④ mouth small, teeth long and flat; ⑤ no pelvic fins; ⑥ body very compressed; ⑦ body pale brown or greyish, often spotted above midline; ⑧ soft dorsal and anal fins pale yellowish to brownish.

Comparisons: Distinguished from domestic and imported leatherjackets by its mostly plain coloration, deep and strongly compressed head, convex snout and humped chin, and single long spine located above the eye. The closely related triggerfishes (family Balistidae), which are of less commercial importance in Australia, can be differentiated from leatherjackets by having 3 (versus 1–2) visible dorsal spines, and their body is covered with hard, plate-like scales.

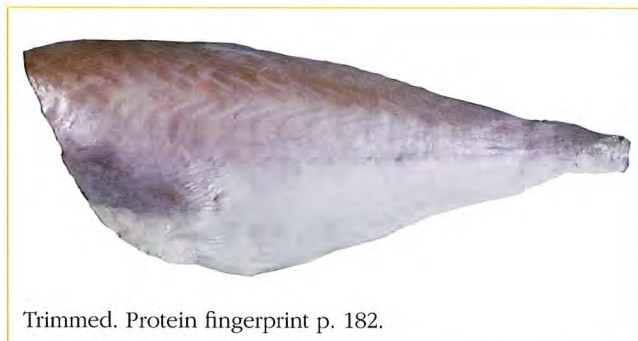
Product: Fillets, skinned (frozen). Moderately deep, rather elongate, upper profile slightly convex, taper pronounced, off-white yellowish; outside without red muscle band.

Size: To 76 cm and 3.2 kg (commonly imported at sizes exceeding 50 cm and 2 kg).

Habitat: Marine; demersal and pelagic in tropical and subtropical oceans, mainly near coral reefs and over soft bottoms with rich invertebrate communities. Also offshore, occurring from the surface to depths of about 100 m.

Fishery: Caught mainly by bottom trawls and occasionally by purse seines and traps. Low to medium importance to fisheries. Imported from Indonesia, Thailand and Vietnam.

Remarks: Juveniles, which have a striking reticulate pattern of pale lines enclosing brown spots and greyish blotches, are distinctly different in colour to adults.



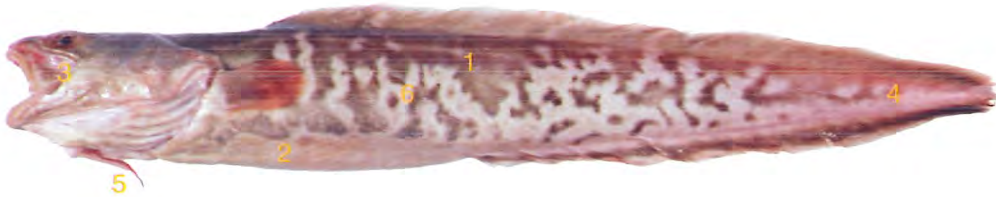
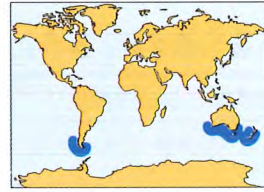
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spots and greyish blotches, are distinctly different in colour to adults. In some regions, the skin is considered poisonous if cooked with the flesh and is therefore removed before cooking. Considered excellent in curries. Other leatherjackets, such as the velvet leatherjacket or creamfish (*Parika scaber*) from New Zealand, are also imported, and many species are caught domestically.

Pink ling

Genypterus blacodes

Minor names: congribadejo (AR), hokorari (NZ), kingclip (ZA), ling



Identifying features: ① skin pinkish or orange, with darker mottling; ② belly and cheek usually pale rather than mottled; ③ upper jaw extending to or just beyond eye; ④ tail eel-like; ⑤ pelvic fins barbel-like, originating below centre of eye; ⑥ body long, rounded.

Comparisons: Related to codfishes, the cusk eels (family Ophidiidae), which include the pink ling, are typically eel-like in form. However, unlike eels they have long gill openings and finger-like pelvic fins under the chin. The colour tones differentiates pink ling from other lings (*Genypterus* species), with the exception of the South African kingclip (*G. capensis*). Genetic techniques are required to separate these species.

Product: Whole, and headed and gutted (frozen), and as fillets (frozen and chilled). Fillet long, rather slender, tapering gradually, pale pinkish to off-white; outside fillet with feeble central red muscle band, usually skinned and with translucent and silvery white integument.

Size: To at least 200 cm and 25 kg (commonly imported at 50–90 cm and 0.6–4.5 kg).

Habitat: Marine; demersal on the continental shelf and upper slope in depths of 20–800 m. Juveniles tend to occur inshore on the continental shelf while adults prefer deeper waters on the continental slope.

Fishery: All lings are of commercial importance, being targeted mostly by trawls, lines and traps. Pink ling is imported from New Zealand and Argentina. Black ling (*G. maculatus*) is occasionally sourced from Chile. Other species, such as kingclip and Chilean ling (*G. chilensis*) may also be imported.

Remarks: At least five lings are currently recognised and all occur in southern latitudes. A group marketing name, 'ling', has been proposed. Further research may show South American stocks of pink ling to be a separate species. Two domestic species, pink ling and rock ling (*G. tigrinus*), are sold locally in quantity.

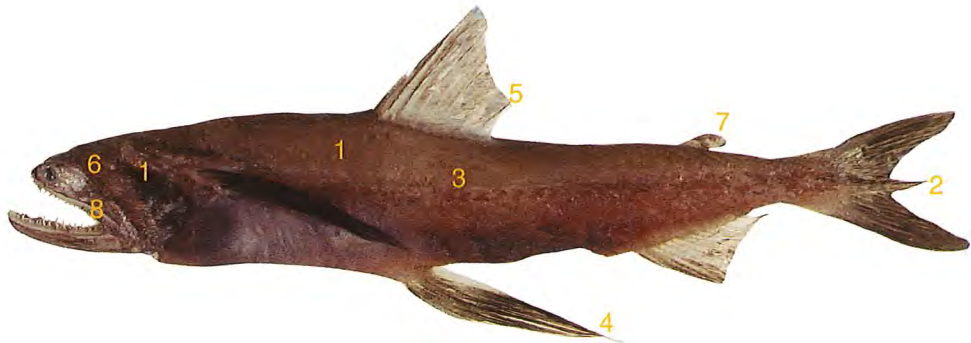


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Bombay duck

Harpadon species

Minor name: lizardfish



Harpadon nebereus

Identifying features: ① head and anterior part of body without scales (except on lateral line); ② lateral-line scales enlarged, extending beyond caudal fin; ③ body elongate, compressed; ④ 9 pelvic-fin rays; ⑤ dorsal fin inserted about middle of body; ⑥ head lizard-like; ⑦ adipose fin present; ⑧ upper jaw extending back far beyond eye.

Comparisons: Closely related to sauries (*Saurida* species) but have greatly enlarged lateral-line scales (not enlarged in sauries) and a compressed (versus cylindrical) body. Lizardfishes (*Synodus* species) are also similar but have 8 rather than 9 pelvic-fin rays. The major commercial species, the Bombay duck (*H. nebereus*), which is sometimes called ‘flabby bummalow’, can be distinguished from other members of the genus in having the pectoral fin reaching beyond the origin of the dorsal fin (versus reaching well short of the dorsal fin).

Product: Whole (frozen and dried). Fillet of Bombay duck (*H. nebereus*) slender, tapering gradually, off-white yellowish; outside without red muscle band.

Size: To at least 75 cm; Bombay duck to only about 45 cm (commonly imported at 20–30 cm).

Habitat: Marine and estuarine; demersal on sandy and muddy bottoms from close inshore to depths of at least 1150 m. Coastal species venture into estuaries.

Fishery: Only the coastal species, Bombay duck, is commonly targeted. Taken by demersal trawlers, particularly around Indonesia and India, and imported from Asia.

Remarks: One species, which is not commercially important, occurs locally. Marketed in a variety of forms across Asia, including fresh whole, dry salted, and smoked. Fresh fillets are often deep fried after coating with flour and egg. Also used extensively as a relish with curry



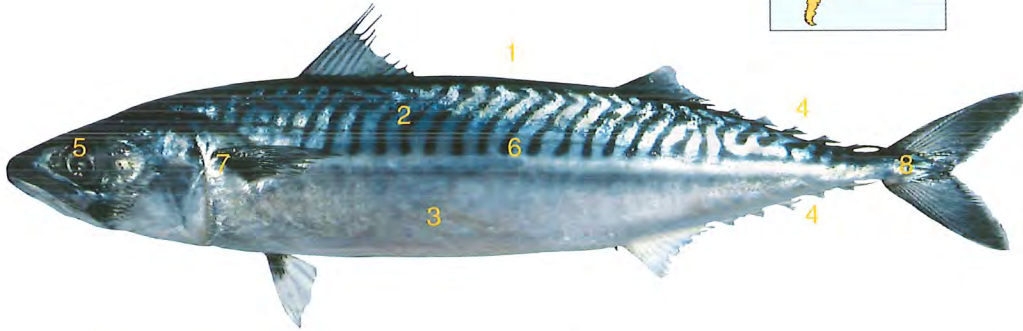
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and commonly added to soup with glass noodles. The term ‘Bombay duck’ sometimes applies only to dried product. Different colour forms of *H. nebereus* occur in South-East Asia and further taxonomic research is required.

Atlantic mackerel

Scomber scombrus

Minor name: mackerel



Identifying features: ① dorsal fins widely separated; ② markings above lateral line oblique or near vertical; ③ lower sides unmarked; ④ 5 finlets behind dorsal and anal fins; ⑤ clear fatty eyelid at front and back of eye; ⑥ body covered in small scales; ⑦ no pronounced scale patch near pectoral-fin base; ⑧ 2 small, fleshy keels on caudal peduncle.

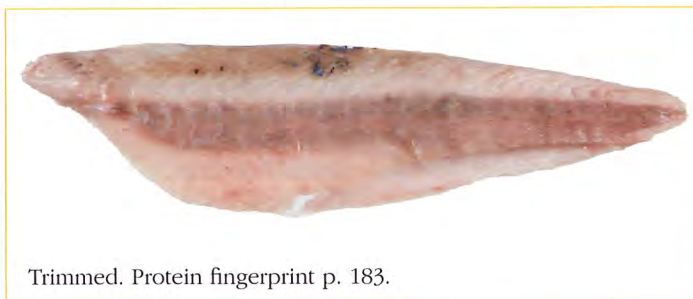
Comparisons: Similar in appearance to the domestic blue mackerel (*S. australasicus*) and the occasionally imported chub mackerel (*S. japonicus*) but the dorsal fins are more widely separated (space between end of first dorsal-fin groove and origin of second dorsal fin about 1.5 times length of groove in Atlantic mackerel versus about equal to or less than length of groove in other species) and there are no marks on the lower sides (versus narrow broken bars or spots on sides). Differs from most other mackerels and tunas by having 2 rather than 3 keels on each side of the caudal peduncle.

Product: Whole and as fillets (frozen), smoked (skin on), gilled and gutted (as butterfly fillets). Canned in various ways (young specimens only) and occasionally as rollmops. Fillet moderately deep, elongate, upper profile slightly convex, tapering posteriorly, pinkish brown; outside with pronounced, continuous red muscle band.

Size: To at least 55 cm (fork length) and more than 3 kg (commonly imported at about 30 cm and 0.75 kg, although smaller when canned).

Habitat: Marine; pelagic, migratory fishes that often school close to the surface but overwinter near the bottom in depths to more than 200 m. School fronts can be 200 m wide and 100 m deep.

Fishery: Very important North Atlantic foodfish that is caught in purse seines, drift and fixed nets, and by trolling. Imported from northern Europe (e.g. Scotland and Norway).



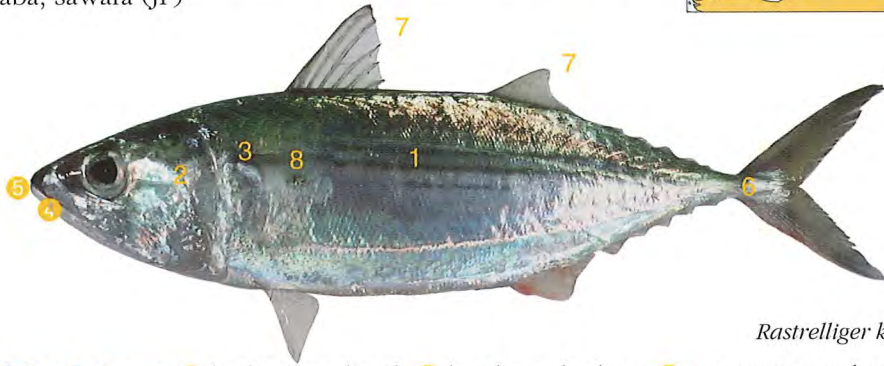
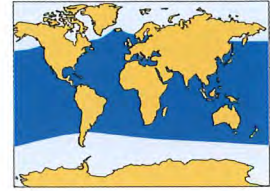
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Remarks: Atlantic mackerel is widely exported from Europe. Excellent eating but the flesh deteriorates quickly due to its high oil content. Smoked and otherwise cured product is very popular overseas. Considered a superior foodfish to its close domestic relative, the blue mackerel.

Mackerel

Tribes Scomberomorini & Scombrini

Minor names: Indian mackerel (MM), insi (TH), kembung (ID), saba, sawara (JP)



Rastrelliger kanagartha

Identifying features: ① body streamlined; ② head mostly short; ③ no pronounced scale patch on sides above and behind base of pectoral fin; ④ no cartilaginous ridges on tongue; ⑤ teeth typically enlarged, compressed, triangular or knife-like; ⑥ caudal peduncle with 2 or 3 fleshy keels on each side; ⑦ 2 dorsal fins (depressible into grooves) followed by 5–12 finlets; ⑧ pectoral fin placed high on body.

Comparisons: Mackerels comprise two major subgroups of the family Scombridae, the tribes Scomberomorini (Spanish mackerels) and Scombrini (true mackerels). These fishes have a streamlined, usually slender body, short fins, finlets on the caudal peduncle, and a thinly forked or moon-shaped caudal fin. They differ from members of the other major subgroups of the family, the tribes Thunnini (tunas) and Sardini (bonitos), by lacking a well-defined scale patch behind the pectoral-fin base. Spanish mackerels differ from the true mackerels in having 3 (rather than 2) keels on the caudal peduncle and 6–10 (rather than 5) dorsal finlets.

Product: Whole, and headed and gutted (frozen), as fillets (frozen or smoked) and canned. Fillets take a variety of shapes but most are relatively elongate compared with many fish fillets.

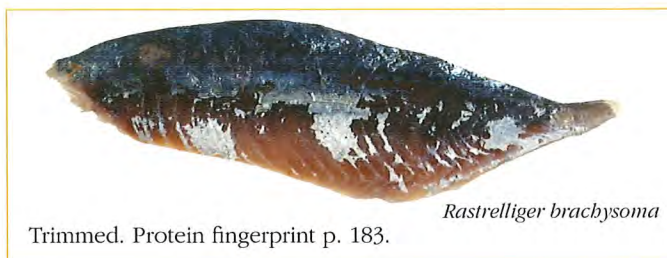
Size: To 210 cm (fork length) and at least 83 kg (commonly imported to 125 cm and 15 kg, although some species much smaller).

Habitat: Marine; pelagic, mainly in surface waters over continental shelves but some venture into the open ocean.

Fishery: Caught virtually worldwide, using a wide variety of gear, including trawls, gillnets, driftnets, fixed nets, purse seines, beach seines, and handlines, and by trolling and dynamiting. Imported widely from Europe, Asia and the South Pacific (including New Zealand).

Remarks: Important and popular seafood components worldwide. Even small species are sought after. For example, several *Rastrelliger* species commonly attain only about 15 cm fork

length but support large fisheries throughout South-East Asia; two of these, Indian mackerel (*R. kanagartha*), and short mackerel (*R. brachysoma*) are imported to Australia. Various species targeted commercially and recreationally by domestic fishers.



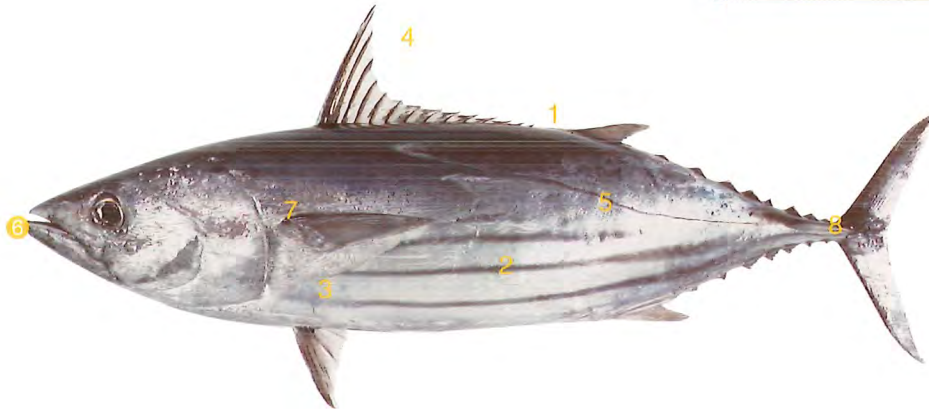
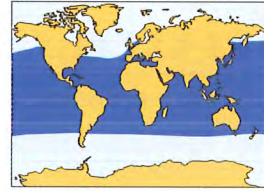
Trimmed. Protein fingerprint p. 183.

Rastrelliger brachysoma

Skipjack tuna

Katsuwonus pelamis

Minor name: bonito



Identifying features: ① 2 dorsal fins, narrowly separated; ② 3–5 stripes below lateral line; ③ no dark spots below pectoral fin; ④ 14–16 spines in first dorsal fin; ⑤ no scales on posterior half of body (except on lateral line); ⑥ upper surface of tongue with 2 longitudinal ridges; ⑦ pronounced, thickened scale patch near pectoral-fin base; ⑧ large fleshy keel on caudal peduncle flanked by 2 smaller keels.

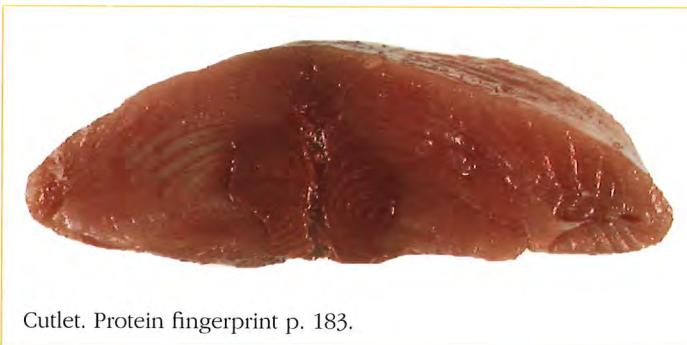
Comparisons: Distinctive tuna characterised by a combination of stripes on the belly and 2 longitudinal ridges on the upper surface of the tongue. Differs from bonitos (*Sarda* species) in having longitudinal ridges on the upper surface of the tongue and no stripes above the lateral line.

Product: Whole (frozen) and canned. Fillet moderately deep, rather short, upper profile slightly convex, reddish-brown, tending toward brown as it ages; outside with broad, pronounced, continuous red muscle band (pronounced on inside).

Size: To at least 110 cm and 34.5 kg (commonly imported to 75 cm and about 10 kg).

Habitat: Marine; pelagic to depths of more than 250 m in all temperate and tropical seas.

Fishery: Among the world's most widely caught and eaten seafood products, skipjack tuna is imported mainly from Indonesia, Japan, New Zealand and the Solomon Islands. Taken using a variety of methods, including seine netting, trolling and pole-and-lining.



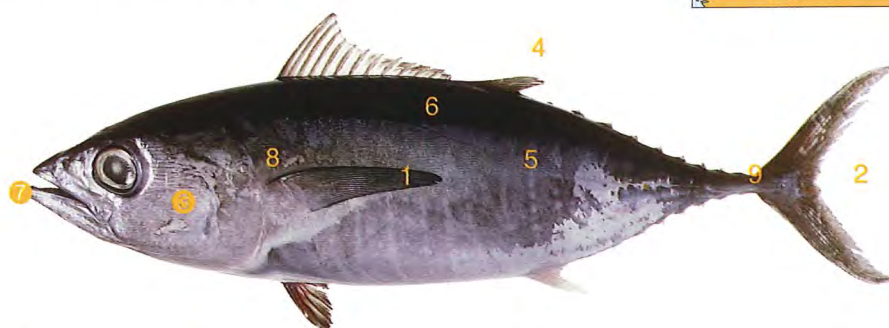
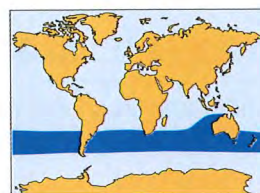
Cutlet. Protein fingerprint p. 183.

Remarks: Primarily canned but increasingly marketed fresh or frozen. Also caught domestically. Reportedly best as food when grilled or baked, particularly when en-papillote to reduce moisture loss. Also very good raw. In Japan, dried and used for katsuobushi (dried bonito flake), a tasty and widely used cooking ingredient and garnish.

Southern bluefin tuna

Thunnus maccoyii

Minor names: bluefin tuna (NZ), tunny



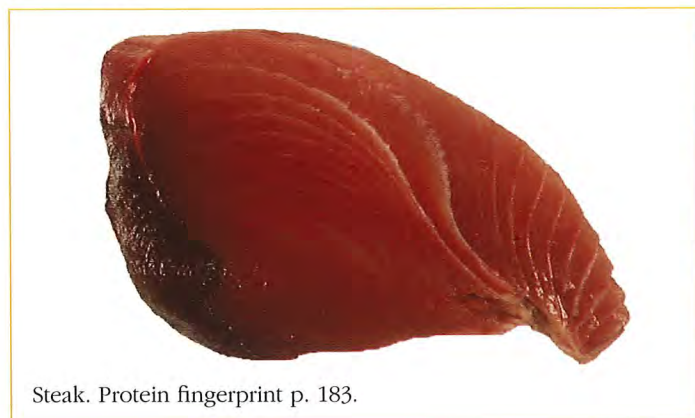
Identifying features: ① pectoral fins short, not reaching posteriorly to origin of second dorsal fin; ② no white outer edge on caudal fin; ③ 31–40 gill rakers on first gill arch; ④ second dorsal fin barely taller than first dorsal fin in adults; ⑤ small scales on posterior half of body; ⑥ upper surface dark blue without dark spots or striped pattern; ⑦ top of tongue with 2 longitudinal ridges; ⑧ pronounced, thickened scale patch near pectoral-fin base; ⑨ large fleshy keel on caudal peduncle flanked by 2 smaller keels.

Comparisons: Locally, very similar in appearance to northern bluefin tuna (*T. thynnus*) but usually has slightly longer pectoral fins as an adult and a yellow rather than dark central caudal keel. Differs from adult bigeye tuna and albacore in having more gill rakers on the first arch (31–40 versus 23–31) and shorter pectoral fins (not reaching second dorsal fin versus reaching or extending well beyond second dorsal fin). Occasionally confused with yellowfin tuna (*Thunnus albacares*, p. 106) but its second dorsal and anal fins are never greatly extended.

Product: Gilled (or headed) and gutted, and whole (chilled). Fillet moderately deep, rather elongate, upper profile convex, somewhat bottle-shaped, pinkish to reddish-brown; outside with pronounced, continuous red muscle band (pronounced on inside).

Size: To 225 cm (fork length) and possibly 200 kg (commonly imported at sizes to 180 cm and 100 kg).

Habitat: Marine; pelagic in the open ocean, mainly in cool temperate waters but spawns in the subtropics.



Steak. Protein fingerprint p. 183.

Fishery: Fished in southern oceans from the southeastern Atlantic, across the Indian Ocean to the South-West Pacific (New Zealand), using longlines, pole-and-line and purse seines. Imported from New Zealand and probably elsewhere in South-East Asia and the Pacific.

Remarks: Smaller individuals grown-out in sea cages locally. Highly regarded for use as sashimi.

Spanish mackerel

Scomberomorus commerson

Minor names: king seer (IN), thu insi (TH), narrow-bar Spanish mackerel



Identifying features: ① dorsal fins narrowly separated; ② dark wavy bars on sides, often faint but most pronounced on lower half; ③ no black blotches on dorsal fins; ④ lateral line wavy posteriorly, descending to below the midline behind second dorsal fin; ⑤ 15–18 spines in first dorsal fin; ⑥ enlarged teeth, triangular or knife-like; ⑦ no pronounced scale patch near pectoral-fin base; ⑧ large fleshy keel on caudal peduncle flanked by 2 smaller keels.

Comparisons: Most similar to the other *Scomberomorus* species (e.g. Indo-Pacific king mackerel, *S. guttatus*) but differs in having a distinct dip in the lateral line below the second dorsal fin and dark wavy bars on the sides (most pronounced on lower half), and in lacking a black blotch on the dorsal fin. Differs from the tunas by lacking a pronounced scale patch near the pectoral-fin base. A related, widely distributed species, the wahoo (*Acanthocybium solandri*), has bars on the sides but is more slender-bodied with a longer snout and the lateral line bends below the first dorsal fin (rather than with a distinct dip below the second dorsal fin).

Product: Fillets and cutlets (frozen), headed and gutted (chilled), and canned. Fillet moderately deep, elongate, and gradually tapering, with a slightly convex upper profile and off-white to yellowish. Fillets of the different species are difficult to differentiate except via genetic techniques.

Size: To at least 200 cm (fork length) and 50 kg (commonly imported at 55–125 cm and about 2–15 kg).

Habitat: Marine; pelagic near the surface along continental margins and near islands.

Fishery: Taken throughout its range using trawls, troll-lines, handlines, gillnets and beach seines. Imported gilled and gutted from Fiji, as fillets from a number of Asian countries, including India, Myanmar and Thailand, and as canned product from the Philippines. Other *Scomberomorus* species (e.g. *S. guttatus* and *S. niphonius*) are imported and mostly labelled as 'Spanish mackerel'.

Remarks: The most sought-after commercial mackerel in Australia, where it is mainly sold fresh. Also sought-after throughout South-East Asia, where it is sold fresh or dry salted. The flesh is firm and versatile.



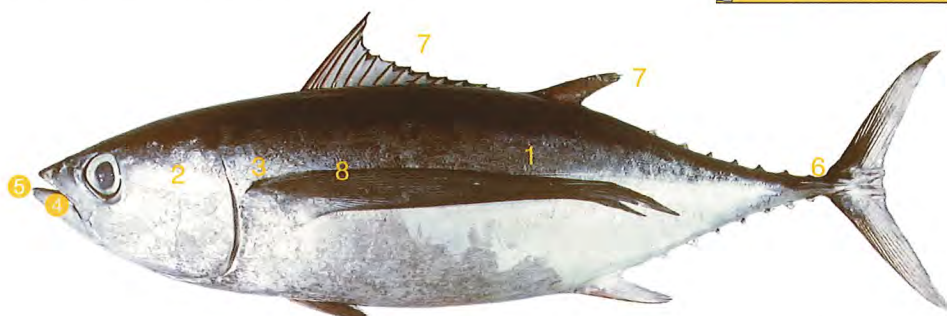
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Popular cooking methods include grilling, frying and baking. Also sometimes eaten raw. The name 'Spanish mackerel' is also widely applied to *Scomber japonicus*, a relative of Atlantic mackerel (*S. scombrus*, p. 100).

Tuna

Tribes Sardini & Thunnini

Minor names: howalla (IN), kihada (JP)



Thunnus alalunga

Identifying features: ① body streamlined, usually fusiform; ② head rather large; ③ pronounced, raised scale patch on sides above and behind pectoral-fin base; ④ cartilaginous ridges on tongue of many species; ⑤ teeth relatively small, not compressed, conical; ⑥ caudal peduncle with 3 fleshy keels on each side; ⑦ 2 dorsal fins (depressible into grooves) followed by 5–12 finlets; ⑧ pectoral fins placed high on body.

Comparisons: Tunas comprise two major subgroups of the family Scombridae, the tribes Thunnini (tunas) and Sardini (bonitos). These fishes have a streamlined, usually fusiform body, short fins, finlets on the caudal peduncle, and a thin, almost moon-shaped caudal fin. They differ from members of the other major subgroups of the family, the tribes Scomberomorini (Spanish mackerels) and Scombrini (true mackerels), by having a well-defined scale patch behind the head. True tunas have 2 longitudinal ridges on the tongue that are lacking in bonitos.

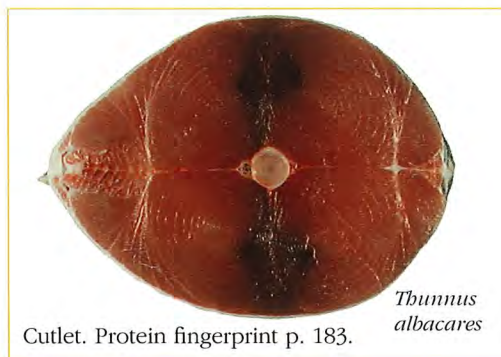
Product: Whole, headed and gutted, and as fillets and steaks (frozen and chilled); and as loins (frozen). Also vacuum packed and possibly in modified atmosphere packaging. Whole fillets are rarely seen in the marketplace due to their large size. Lesser grade species canned.

Size: To at least 225 cm (fork length) and 200 kg (common size varies depending on the species).

Habitat: Marine; pelagic, mainly in schools near the surface and in midwater over continental shelves and in the open ocean. Some species enter coastal waters seasonally.

Fishery: Support very important fisheries worldwide in warm temperate and tropical seas.

Capture gear includes trawls, gillnets, driftnets, fixed nets, purse seines, beach seines, handlines, longlines, pole-and-line, troll-lines and dynamite. Sourced from Asia (north to Japan) and the South Pacific. Some sashimi-grade tuna is imported from New Zealand.



Cutlet. Protein fingerprint p. 183.

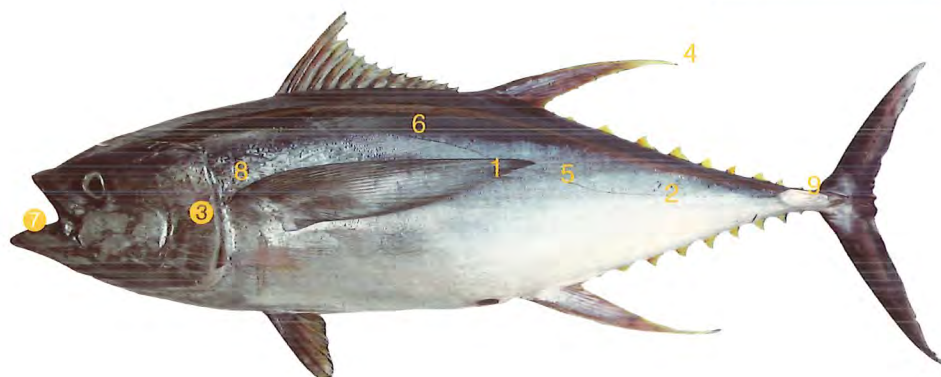
Thunnus albacares

Remarks: Highly sought-after foodfishes, particularly for sashimi and canning. Also caught domestically. While whole (chilled or frozen) tuna imports have decreased significantly in recent years, more than 21 500 tonnes of canned tuna were imported in 2000–2001.

Yellowfin tuna

Thunnus albacares

Minor names: albacora (PH), cá bò vang (VN)



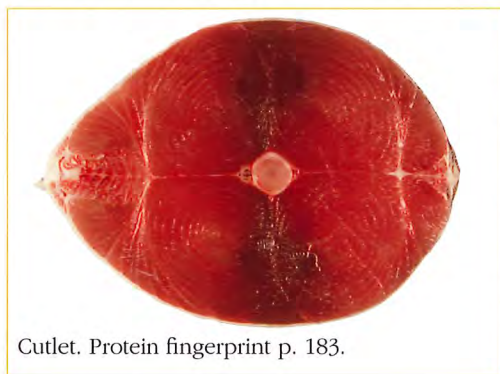
Identifying features: ① moderate to long pectoral fins, sometimes reaching just beyond origin of second dorsal fin; ② tail not excessively slender behind anal fin; ③ 26–34 gill rakers on first gill arch; ④ second dorsal fin greatly extended in adults; ⑤ small scales on posterior half of body; ⑥ upper surface dark blue without dark spots or striped pattern; ⑦ top of tongue with 2 longitudinal ridges; ⑧ pronounced, thickened scale patch near pectoral-fin base; ⑨ large fleshy keel on caudal peduncle flanked by 2 smaller keels.

Comparisons: Larger specimens (greater than 120 cm fork length) have greatly elongated second dorsal and anal fins. Smaller specimens separated from the similar longtail tuna (*Thunnus tonggol*) in having more gill rakers on the first arch (usually 27 or more versus usually 26 or less) and a heavier body beyond the anus.

Product: Whole, headed and gutted (chilled and frozen); and as fillets, steaks and loins (frozen). Also processed (canned and smoked). Fillet moderately deep, rather short, upper profile convex, bottle-shaped, reddish; outside with pronounced, continuous red muscle band (evident on inside).

Size: To 208 cm (fork length) and at least 176 kg (commonly imported at 50–190 cm and 4–100 kg).

Habitat: Marine; pelagic in the open ocean, mainly in warm temperate and tropical waters.



Outlet. Protein fingerprint p. 183.

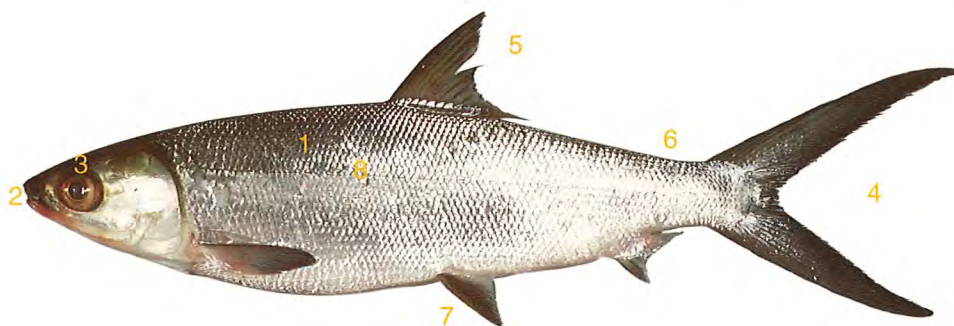
Fishery: Extremely valuable commercial species, widely caught using longlines (for fresh and frozen markets) and purse seines (for fish destined for the can). Imported from numerous countries in South-East Asia (e.g. Vietnam, Thailand and Indonesia) and the South Pacific (e.g. New Zealand and the Solomon Islands).

Remarks: Highly prized as sashimi. Also caught locally for domestic consumption and export. A spectacularly coloured animal when live, aptly named 'ahi' (or fire) by the Hawaiians.

Milkfish

Chanos chanos

Minor name: salmon herring (AU)



Identifying features: ① body silvery; ② mouth very small; ③ eye covered with gelatinous membrane; ④ very large, deeply forked caudal fin; ⑤ single, short-based dorsal fin; ⑥ no adipose fin on dorsal surface of caudal peduncle; ⑦ pelvic fins located well behind pectoral fins; ⑧ lateral line present on body.

Comparisons: Differs from the distantly related herrings (clupeoids), which it superficially resembles, in having a much larger caudal fin, a continuous lateral line (generally absent in herrings), and in lacking scutes on the belly. Very similar to bonefish (*Albula vulpes*), but has a relatively larger eye and shorter snout (distance from eye to snout tip less than length of eye, versus about twice eye length in bonefish). Superficially similar to some catfishes (but lacks barbels), and to threadfin salmons (but has only 1 dorsal fin rather than 2).

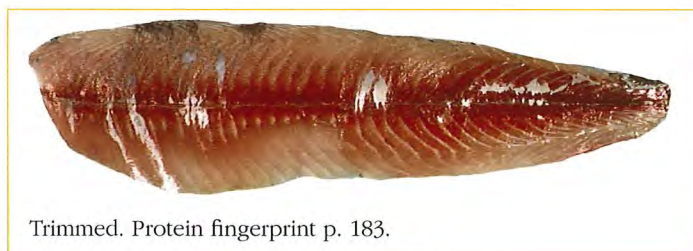
Product: Whole (frozen). Fillet moderately elongate, barely tapering, translucent grey; outside with a broad, well-defined, continuous red muscle band.

Size: To in excess of 120 cm and 18 kg (commonly imported at 45–70 cm and up to 6 kg).

Habitat: Marine; pelagic, mainly in the open sea. Adults migrate inshore to estuaries, bays or freshwater to spawn.

Fishery: Farmed extensively in South-East Asia and now one of the world's most important aquaculture species. Sourced from Taiwan, Myanmar and the Philippines, and potentially from elsewhere in Asia.

Remarks: Well suited to aquaculture due to high growth and energy conversion rates. The flesh, which is very popular in some parts of South-East Asia, is at its best when recently harvested. Available fresh, smoked and frozen in many parts of South-East Asia. Smoked milkfish are given as gifts in Indonesia.



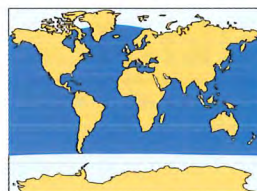
Trimmed. Protein fingerprint p. 183.

Mainly used in Japan for long-line bait. The skin is also highly regarded as food in some regions. Increasing domestic demand may see this species become more valuable over time, and aquaculture research is continuing.

Moonfish

Lampris guttatus

Minor name: opah

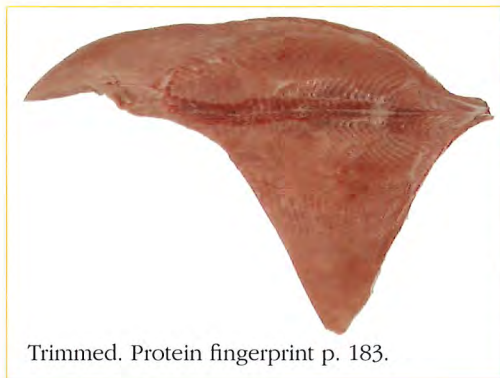


Identifying features: ① body very compressed, and oval to almost round when viewed from side; ② body silvery blue and covered with large silvery spots; ③ fins bright red; ④ dorsal fin long-based, with front portion relatively taller; ⑤ pectoral fin high on body, capable of moving up and down (rather than forward and backward); ⑥ scales minute.

Comparisons: The striking appearance of moonfishes makes them unique within fishes. Compared with the less common southern moonfish (*L. immaculatus*), spotted moonfish (*L. guttatus*) has a rounder body and is covered with silver spots.

Product: Fillets, steaks and trunks (chilled). Readily identified by distinctive skin colour, orange flesh and large size. Fillet very deep, short, V-shaped; profile tapering sharply below, convex above, orange; outside with narrow, pronounced, continuous, central red muscle band.

Size: Reported to attain more than 180 cm and 270 kg (commonly landed at 80–150 cm and 20–50 kg). Import size variable.



Trimmed. Protein fingerprint p. 183.

Habitat: Marine; solitary, pelagic vagrant in upper water masses of the open ocean from about 100–500 m depth; rarely venture inshore.

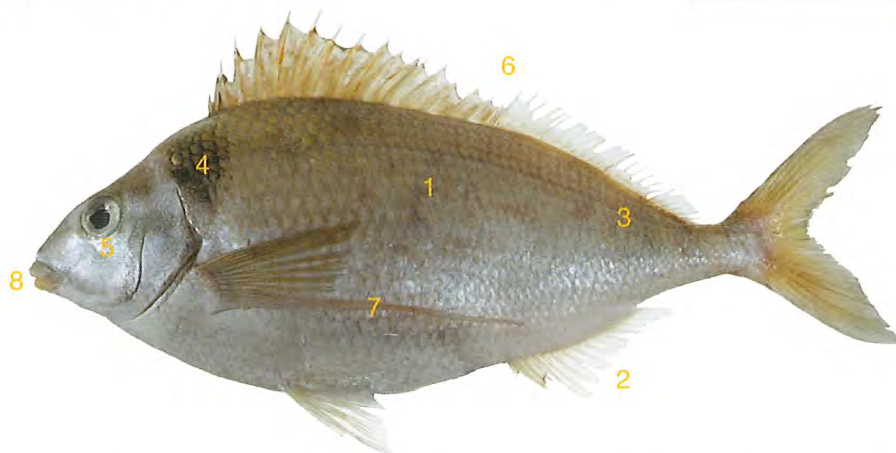
Fishery: Widely caught as longline fishery byproduct and by pelagic trawlers. Imported from New Zealand and potentially elsewhere.

Remarks: Spotted moonfish has four distinct areas of flesh across the fillet, each with a unique colour and texture. Highly regarded as table-fishes, their supply to the market is irregular. May be grilled, baked or used for sashimi.

Morwong

Nemadactylus macropterus

Minor names: butterfish, jackass morwong, king morwong (AU), terakihi (NZ)



Identifying features: ① sides uniform silvery grey above, and whitish below; ② anal fin with 3 spines, 14–15 soft; ③ 59–60 lateral-line scales; ④ prominent dark band across nape; ⑤ no yellow or blue lines around eyes; ⑥ dorsal fin with 17–18 spines, 25–28 soft rays; ⑦ 1 pectoral-fin ray very much longer than those above, and detached; ⑧ lips thick, rubbery.

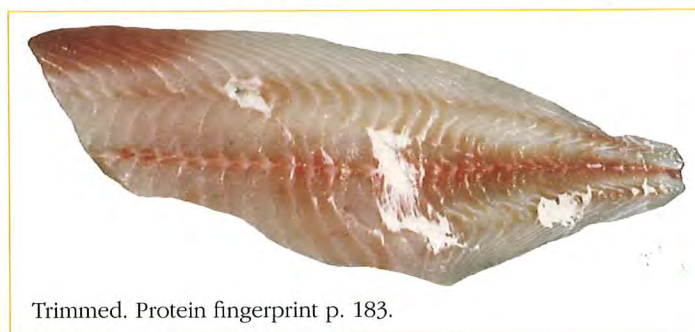
Comparisons: Resembles the domestic grey morwong (*N. douglasii*) but is greyish white (rather than bluish), and has a dark saddle on the nape and fewer soft anal-fin rays (15 or less versus 16–17). The blue morwong (*N. valenciennes*) has a more pronounced colour pattern of blue and yellow lines. Compared with the similar king morwong (*N. sp.*), *N. macropterus* lacks an additional dark band on the outer upper half of the pectoral fin and has more anal-fin rays (14–15 versus 12).

Product: Whole, headed and gutted, and as fillets (frozen and chilled). Fillet moderately deep, rather elongate, convex above, off-white to pinkish; outside with feeble, continuous central red muscle band.

Size: To 70 cm and 4.5 kg (commonly imported at 40–60 cm and 0.9–3 kg).

Habitat: Marine; demersal on the continental shelf and upper slope, mainly in depths of about 100–250 m as adults.

Fishery: Imported from New Zealand where it is caught mainly by trawls or deep-set gillnets.



Trimmed. Protein fingerprint p. 183.

Remarks: Important domestic species. King morwong is landed in Sydney by vessels fishing seamounts east of Australia and may also be imported in small quantities from New Zealand. Morwong is a commercially important and well-regarded eating fish with firm, white, mildly flavoured flesh.

Asian whitebait

Family Salangidae

Minor names: Chinese nannata, icefish, noodlefish, silverfish



Neosalanx brevirostris

Identifying features: ① dorsal fin short-based and somewhat posteriorly located (partially over anal fin); ② adipose fin present; ③ body scaleless, except for 1 row above the anal-fin base in adult males; ④ body small, elongate and transparent or translucent; ⑤ head depressed.

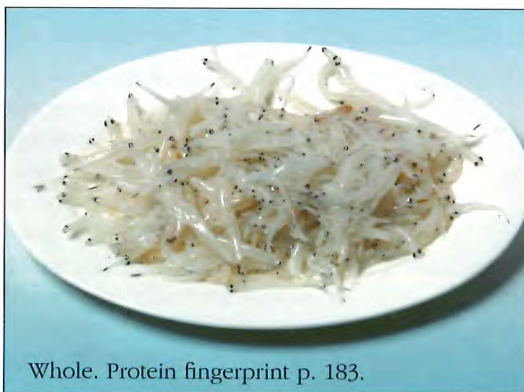
Comparisons: Differ from Tasmanian whitebait (*Lovettia seali*) in having the dorsal-fin origin closer to the anal-fin origin than to the pelvic-fin origin (versus closer to the pelvic-fin origin in *Lovettia*), and the body is usually more elongate. Also similar to native trout fry (*Galaxias maculatus*, p. 121), which occurs domestically and is imported from New Zealand, but has an adipose fin (lacking in native trout). Sandy sprat (*Hyperlophus vittatus*) is sometimes sold locally as 'whitebait', but Asian whitebait lacks scales (except for a single row in adult males) and there is no silver stripe along the midline.

Product: Whole (block frozen). Frozen blocks are commonly 500 g. Too small to fillet.

Size: To at least 23 cm and 16 g (commonly imported at 3–8 cm and up to 1.2 g).

Habitat: Marine, estuarine and freshwater; inhabit coastal seas, rivers, lakes and dams, favouring river mouths. Some species restricted to freshwater.

Fishery: Large quantities are caught each year, mainly with fixed nets in coastal regions where they are known to spawn. Also farmed. Japanese noodlefish (*Salangichthys microdon*), short-snout noodlefish (*Neosalanx brevirostris*) and Chinese noodlefish (*Protosalanx chinensis*) are among the most important species commercially. Imported from China and potentially from elsewhere in the region.



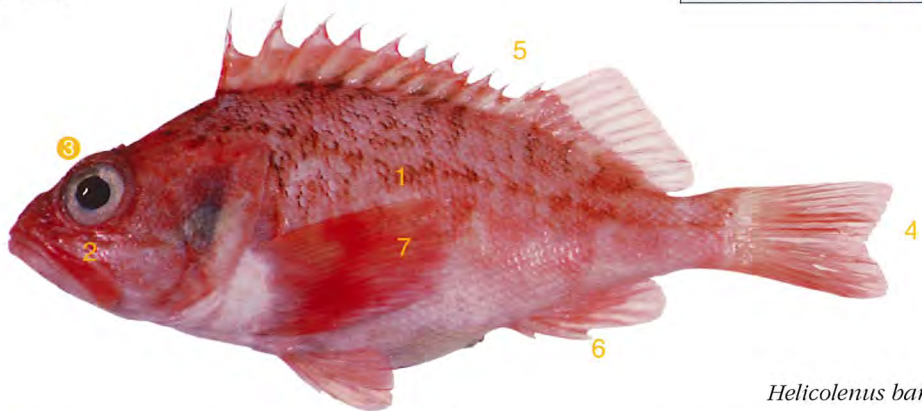
Whole. Protein fingerprint p. 183.

Remarks: Known as shirauwo (whitefish) in Japan but the English name 'noodlefish' (from the Russian 'lapsha-ryba') is gaining in international popularity. Also sometimes called 'icefish' but unrelated to Southern Ocean icefishes, such as Patagonian toothfish (*Dissostichus eleginoides*, p. 93) and mackerel icefish (*Champscephalus gunnari*). A one-year lifecycle is common for these small, predatory fishes. Young of many marine representatives leave freshwater to mature, returning to spawn over a one or two month period and then slowly die.

Ocean perch

Helicolenus barathri & *H. percoides*

Minor names: coral perch (AU), sea perch, scorpionfish, scarpee (NZ)



Helicolenus barathri

Identifying features: ① body reddish with greenish, brownish or reddish flecks or bands; ② smooth bony ridge on cheek beneath eye; ③ no scales between eyes; ④ caudal fin truncate or forked slightly; ⑤ dorsal fin with 12 strong spines, 11–14 soft rays, last spine distinctly shorter than first soft ray; ⑥ anal fin with 3 strong spines, 5 soft rays; ⑦ pectoral fins large.

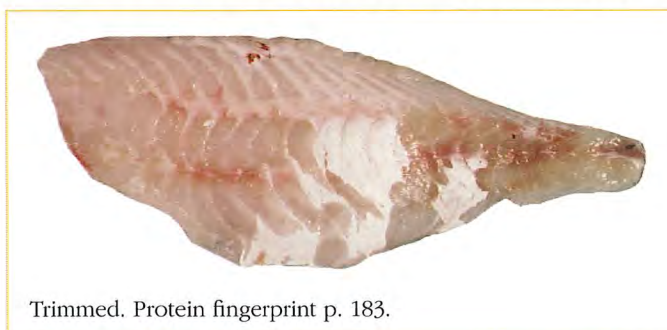
Comparisons: Two species imported. The reef ocean perch (*H. percoides*) has more pronounced banding on the body and fewer soft dorsal-fin rays (mostly 11–12 versus mostly 13–14) than the ocean perch (*H. barathri*). Sometimes confused with other domestic scorpionfishes. The deepwater scorpionfishes (*Trachyscorpia* species) have only 9 soft anal-fin rays (rather than 11 or more) and scale pockets exist between the eyes (rather than scaleless).

Product: Whole (chilled) and fillets (frozen). Fillet of ocean perch (*H. barathri*) moderately deep, short, with a pronounced taper, slightly convex above, yellowish-white; outside with feeble, discontinuous central red muscle band.

Size: To 47 cm and 1.8 kg, although reportedly smaller in New Zealand (commonly imported at 25–35 cm and up to 0.8 kg).

Habitat: Marine; demersal on the continental shelf and slope from close inshore to depths of about 600 m.

Fishery: Reef ocean perch (or 'scarpee') is taken by trawlers inshore on the continental shelf while ocean perch (known as 'sea perch' in New Zealand) is caught by trawlers and by line in depths of 200–600 m. Imported from New Zealand, with the deeper water form dominant.



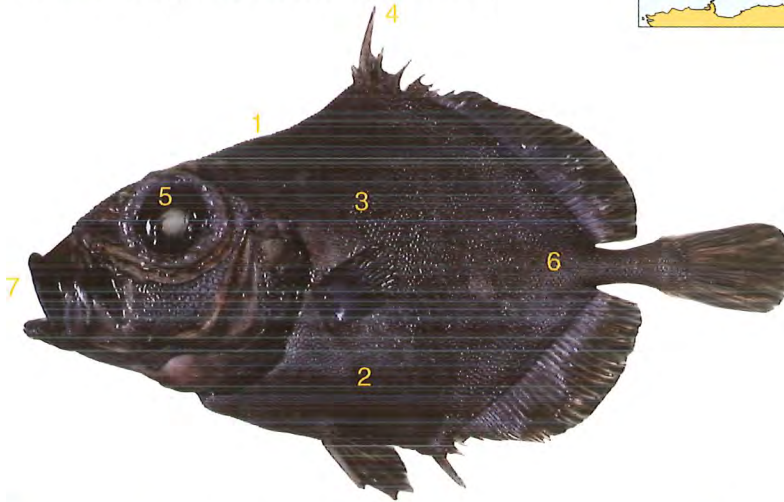
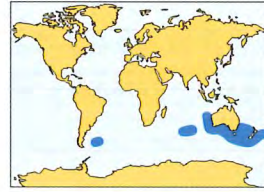
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Remarks: Atlantic ocean perch (*Sebastes* species) also imported occasionally. Domestic ocean perches taken by trawlers in the South-East. Although the same scientific names are currently used for New Zealand and Australian species, the taxonomy is confused and additional species may occur. Flesh is well suited to a variety of cooking methods.

Black oreo

Alloctytus niger

Minor names: black dory, black oreo, black oreodory



Identifying features: ① predorsal profile straight or slightly concave; ② short row of protuberances on the skin on each side of belly (usually present as scars in large adults); ③ skin rough, scales very difficult to dislodge; ④ second dorsal-fin spine much thicker and taller than first; ⑤ eye very large; ⑥ dark, stumpy body, with a small caudal fin and narrow caudal peduncle; ⑦ mouth can be extended well forward to form a tube.

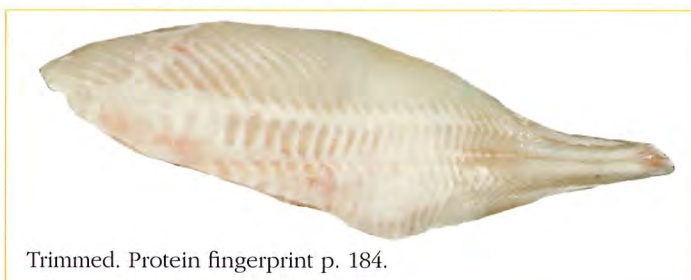
Comparisons: The rough skin and vaguely rhomboidal-shaped body easily distinguish it from another import, the smooth oreo (*Pseudocyttus maculatus*, p. 113), which has smooth skin and an oval-shaped body. Differs from the spikey oreo (*Neocyttus rhomboidealis*), which is also occasionally imported, by having protuberances on the belly and from the warty oreo (*A. verrucosus*) in having a larger pelvic fin and in lacking 2 rows of bony 'plates' on the belly (0–1 rows of protuberances instead).

Product: Whole, headed and gutted, and as skin-off fillets (frozen). Fillet moderately deep, bottle-shaped, tapering sharply, very convex above, yellowish-white; outside without central red muscle band.

Size: To 49 cm and almost 2 kg (commonly imported at 25–35 cm and 0.4–1.0 kg).

Habitat: Marine; demersal on the continental slope in depths of 600–1 200 m, often on hard bottoms and over seamounts. Possibly occurs slightly shallower off New Zealand than Australia.

Fishery: Imported from New Zealand, where oreos are targeted in a deepwater trawl fishery.



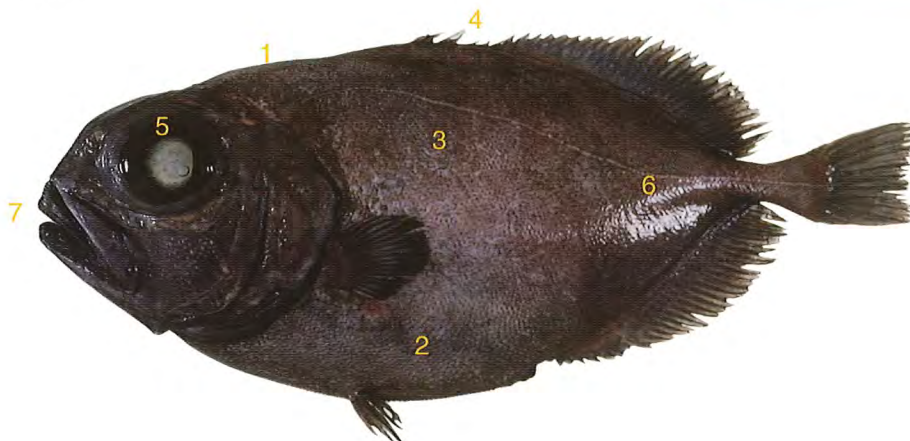
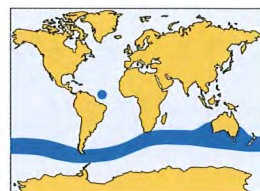
Trimmed. Protein fingerprint p. 184.

Remarks: A new marketing name, 'black oreodory', has been proposed. Although caught extensively in New Zealand waters, it is rarely exported from there to Australia. A domestic species, the warty oreo, is also sold as 'black oreo'.

Smooth oreo

Pseudocyttus maculatus

Minor names: smooth dory, smooth oreo, smooth oreodory, spotted oreo



Identifying features: ① predorsal profile almost straight behind eye; ② no bony 'plates' or protuberances on sides; ③ skin smooth, scales rub off easily; ④ second spine of dorsal fin small and only slightly shorter than first; ⑤ eye very large; ⑥ dark, oval body with a small caudal fin and narrow caudal peduncle; ⑦ mouth can be extended forward.

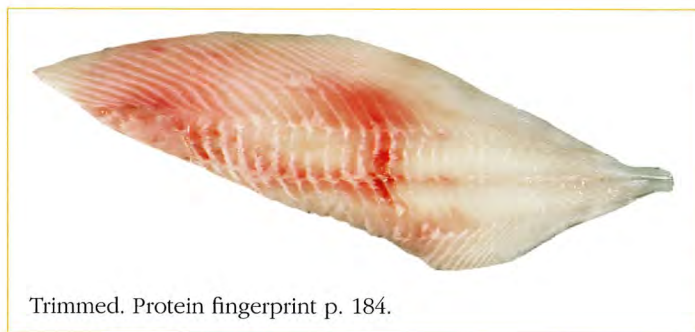
Comparisons: Compared to dories and other oreos the smooth oreo has smooth skin, a short second dorsal-fin spine, no bony 'plates' or protuberances on belly, and an oval-shaped body. Small specimens have dark roundish or oval spots on the sides, which are absent from the other major commercial oreos and dories.

Product: Skin-off fillets (frozen, sometimes chilled). Fillet moderately deep, bottle-shaped, tapering sharply, very convex above, white; outside without central red muscle band.

Size: To 68 cm and at least 4.5 kg (commonly imported at 35–45 cm and 1–2 kg).

Habitat: Marine; demersal on the mid-continental slope in depths of 650–1 500 m, mostly over deep underwater pinnacles.

Fishery: Targeted mainly by trawlers off New Zealand (mainly east of the South Island) in one of the deepest fisheries outside Australia (800–1 200 m). Also taken off South Africa but imported from New Zealand.



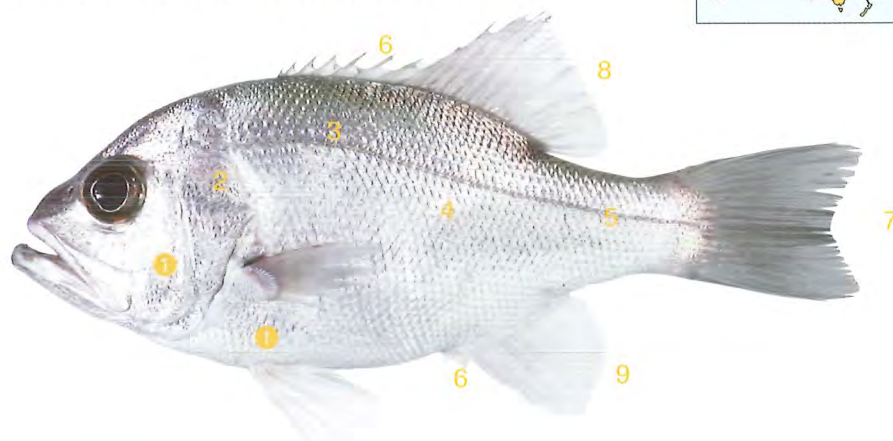
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Remarks: Also trawled domestically. The tasty fillets are well-suited to a variety of cooking methods and styles. Often marketed in New Zealand as 'deepsea dory'. A new Australian marketing name, 'smooth oreodory', has been proposed. Apparently slow growing and long lived (to at least 80 years).

Pearl perch

Glaucosoma buergeri

Minor names: northern pearl perch (AU), aobadai (JP)



Identifying features: ① gill rakers and body cavity membrane black; ② no flattened, bony plate at top of operculum; ③ silvery grey with about 10 thin stripes that often fade with age; ④ body deep and slightly compressed; ⑤ lateral line almost straight and extending onto tail; ⑥ dorsal and anal-fin spines gradually increasing in size; ⑦ hind margin of caudal fin square or slightly emarginate; ⑧ dorsal fin with 8 spines, 11 soft rays; ⑨ anal fin with 3 spines, 9 soft rays.

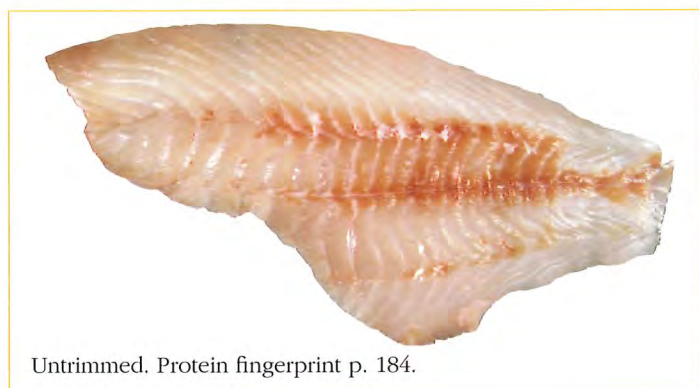
Comparisons: Most similar to the other three pearl perches, including the West Australian dhufish (*G. bebraicum*), but can be distinguished in having black gill rakers and body cavity membrane, and in lacking a flattened, bony plate at the top of the operculum. Pearl perches differ from members of other Australian warm temperate and tropical perch-like fishes in the combination of characters listed above.

Product: Fillets (frozen). Fillet deep, short, tapering prominently, convex above, yellowish-white; outside with feeble, continuous, central red muscle band.

Size: To at least 45 cm and 2.5 kg (commonly imported at less than 40 cm).

Habitat: Marine; demersal near reefs or rough bottom over the continental shelf.

Fishery: Although usually caught by bottom trawling and lining, best catches are reportedly taken in midwater at night. Imported from Vietnam and possibly elsewhere in South-East Asia.



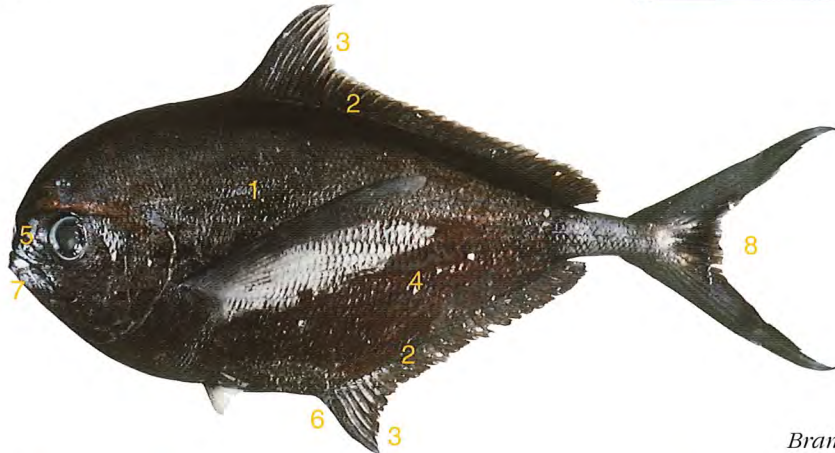
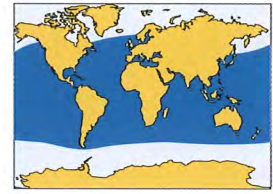
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Remarks: Also taken in northwestern Australia. The highly esteemed West Australian dhufish is arguably the premium member of the group but all pearl perches are considered superior table-fishes, with white flesh and excellent flavour and texture.

Ray's bream

Family Bramidae

Minor names: bigscale pomfret, flathead pomfret, golden pomfret (AU)



Brama brama

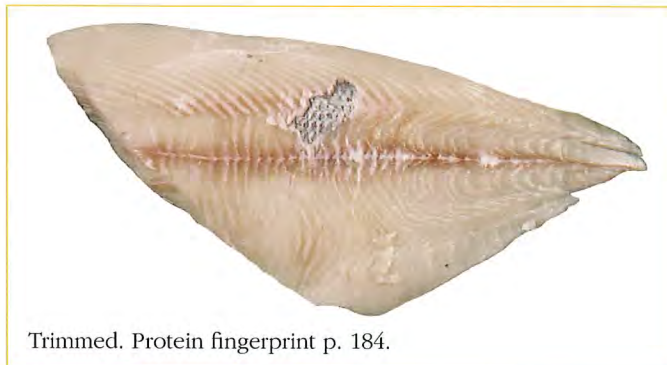
Identifying features: ① sides usually silvery or silvery brown; ② dorsal and anal fins covered in scales and fixed in position; ③ leading fin-rays more flexible, elongated; ④ body scales vary greatly in shape and size; ⑤ snout short; ⑥ no anal-fin spines; ⑦ lower jaw strong; ⑧ caudal fin strongly forked or lunate.

Comparisons: Distinctive perch-like fishes with each of the species recognisable by slightly different body shapes. Their body is deeper and more compressed than that of tunas and other pelagic fishes with which they are caught. They are readily identified from inshore perches by their rather upright, long-based, scaly dorsal and anal fins that lack hard spines. Some trevallias (family Centrolophidae) have these features but their bodies are soft and flabby rather than firm.

Product: Whole and barrels (chilled). Fillet of Ray's bream (*Brama brama*) moderately deep, rather elongate, tapering sharply, slightly convex above, yellowish-white; outside with continuous, feeble central red muscle band.

Size: To at least 110 cm (fork length) and about 45 kg (commonly imported at 35–60 cm and less than 2 kg).

Habitat: Marine; pelagic in all oceans but particularly abundant in the temperate and tropical regions of the Indo-Pacific. The largest species are most commonly caught in cool seas. Imported from New Zealand.



Trimmed. Protein fingerprint p. 184.

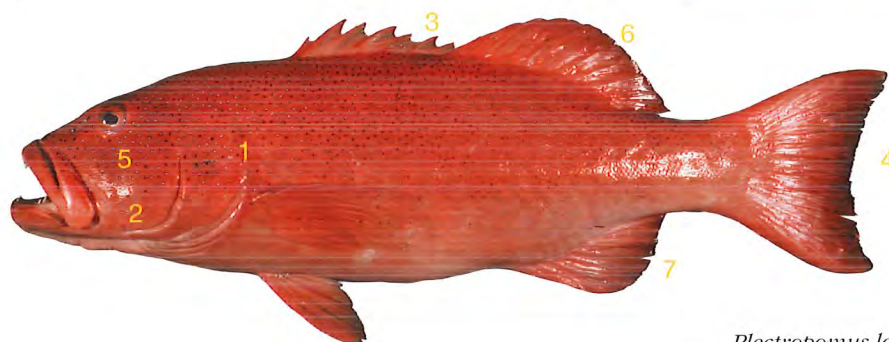
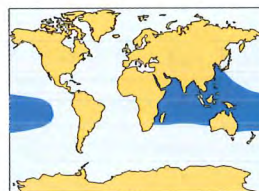
Fishery: Landed mainly as byproduct of longline, purse seine, pelagic trawl and troll fisheries for tunas. Underutilised, and expansion likely in the Pacific.

Remarks: Small catches by domestic vessels are marketed locally. Excellent foodfishes with *B. brama* perhaps the most commonly imported species.

Coral trout

Plectropomus & *Variola* species

Minor names: cá mu cham (VN), kerapu merah (MY), lapu-lapu (PH)



Plectropomus leopardus

Identifying features: ① operculum mildly angular posteriorly, with 3 spines; ② large, forward-pointing spines on lower margin of preoperculum; ③ dorsal fin continuous with spinous part distinct; ④ caudal fin lunate to square (not rounded or forked); ⑤ mouth and head large; ⑥ dorsal fin with 7–9 strong spines, 10–15 soft rays; ⑦ anal fin with 3 strong spines, 8 soft rays.

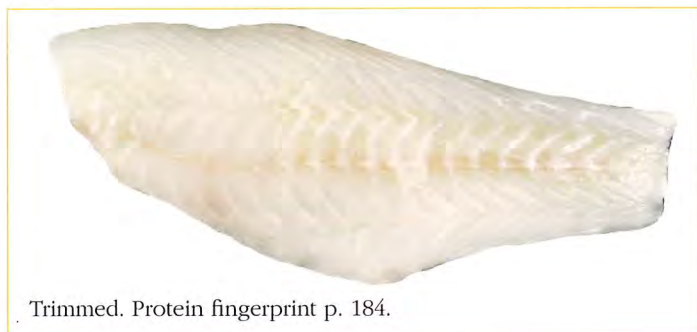
Comparisons: Differ from rockcods (*Epinephelus* species, p. 118) in having either fewer dorsal-fin spines (7–8 in the *Plectropomus* species versus 10–11), or having a more convex caudal-fin margin with greatly elongated soft rays near the end of the dorsal and anal fins (as in *Variola* species). The smaller coral cods (*Cephalopholis* species) have a rounded caudal fin and more dorsal-fin spines (9) than all species other than the coronation trouts (*Variola* species).

Product: Whole, fillets, and gilled and gutted (frozen). Fillet of leopard coral trout (*P. leopardus*) moderately deep, rather elongate, tapering gradually, slightly convex above, white; outside with feeble, discontinuous, central red muscle band.

Size: To about 120 cm and possibly 21 kg (commonly imported at 40–80 cm and 0.8–9.0 kg).

Habitat: Marine; demersal, mainly in shallow to mid-depth coralline and tropical reef habitats over the continental shelf to depths of about 100 m.

Fishery: Caught using lines, traps, spears and some trawls. Imported mainly from South-East Asia (e.g. Indonesia and Myanmar) and also from the South Pacific (Fiji). Commonly traded live overseas. *Plectropomus* species are more commonly imported than *Variola* species, with leopard coral trout perhaps the most important species.



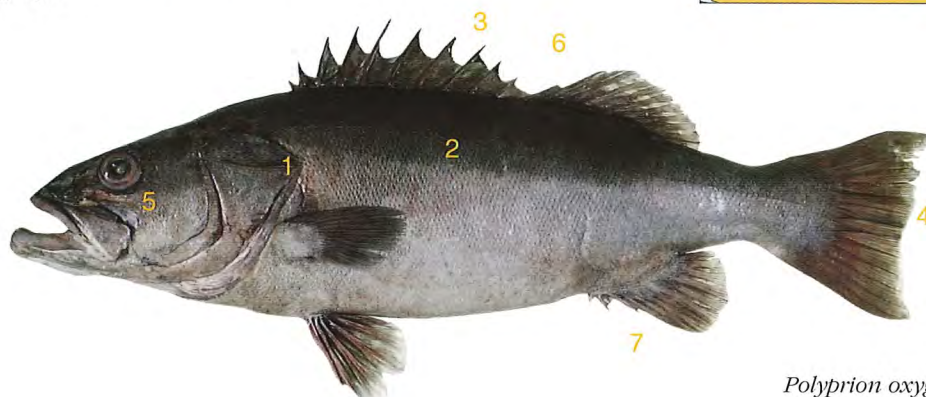
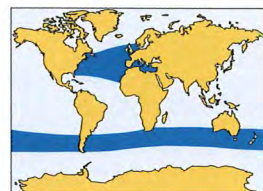
Trimmed. Protein fingerprint p. 184.

Remarks: Also caught locally and very highly regarded. Reportedly imported from New Zealand but as coral trouts do not occur in New Zealand waters, these imports were presumably sourced from the Pacific Islands. Premium table-fishes with white flesh and excellent flavour and texture.

Hapuku

Polyprion americanus & *P. oxygeneios*

Minor names: hapuka, New Zealand groper (AU), bass (NZ), bass groper



Polyprion oxygeneios

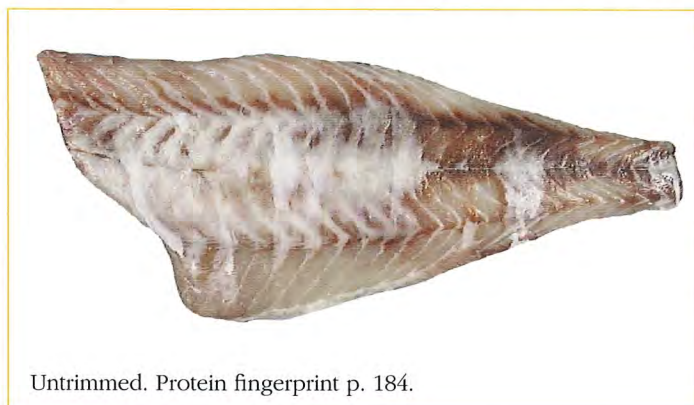
Identifying features: ① operculum broadly angular posteriorly, with obvious ridge ending in strong spine; ② greyish-blue, sometimes with an obvious demarcation between the dark upper surface and the paler ventral surface; ③ dorsal fin continuous with spinous part distinct; ④ caudal fin truncate; ⑤ mouth and head large; ⑥ dorsal fin with 11–12 strong spines, 12–13 soft rays; ⑦ anal fin with 3 strong spines, 8–10 soft rays.

Comparisons: Temperate fishes that can be distinguished from their distant relatives, the rockcods, by having a plain-coloured body, smaller pectoral fins, a more truncate caudal fin, and in having a prominent horizontal ridge on the operculum that ends in a spine. The true rockcods (e.g. *Epinephelus* species, p. 118) have bright or more complex colour patterns. The hapuku (*P. oxygeneios*) differs from the heavier-bodied bass groper (*P. americanus*) in having a pale ventral surface rather than a uniform dark coloration.

Product: Whole, headed and gutted, as fillets, and heads (chilled and frozen). Fillet of *P. oxygeneios* moderately deep, somewhat elongate, tapering gently, weakly convex above, brownish-white; outside with pronounced, broad, continuous central red muscle band.

Size: To 180 cm and 70 kg (commonly imported at 80–100 cm and 7–15 kg).

Habitat: Marine; mainly demersal from deep coastal reefs and canyons of the continental slope to 450 m depth. Large adults may live beneath flotsam in the open ocean.



Untrimmed. Protein fingerprint p. 184.

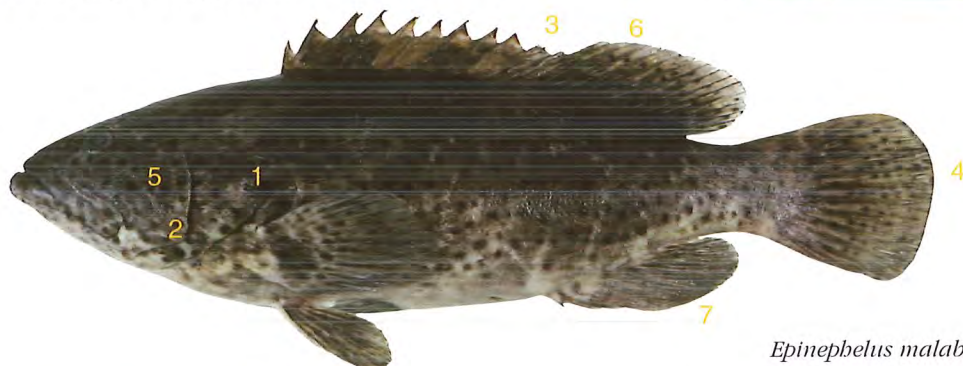
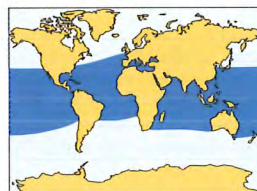
Fishery: Important commercial finfishes in New Zealand, mostly targeted by coastal dropliners. Also taken by gill-nets, and increasingly further offshore. Bulk fillets sourced from New Zealand.

Remarks: Separate marketing names may be applied to the two species included here, hapuku and bass groper. Both also caught domestically. The flesh is firm and flavoursome.

Rockcod

Epinephelus species

Minor names: Malabar cod (AU), kyauk-nga (MM), kerapu (MY), cá song (VN), grouper



Epinephelus malabaricus

Identifying features: ① operculum angular posteriorly, with 3 spines; ② no large, forward-pointing spines on lower margin of preoperculum; ③ dorsal fin continuous with spinous part distinct; ④ caudal fin lunate to rounded (not forked); ⑤ mouth and head large; ⑥ dorsal fin with 10–11 strong spines, 13–18 soft rays; ⑦ anal fin with 3 strong spines, 7–10 soft rays.

Comparisons: Essentially similar to each other in shape, but usually differ subtly in colour. Differ from related fishes marketed as ‘coral trout’ (*Plectropomus* and *Variola*, p. 116) in having 10–11 dorsal-fin spines (versus 7–8 in the *Plectropomus* species), and a less convex caudal-fin margin without the hind soft rays of the dorsal and anal fins greatly elongated (as in *Variola*). Sometimes simply referred to as ‘cod’ but are unrelated to true cods (Gadiformes).

Product: Gilled and gutted, and as fillets (frozen). Fillet of comet rockcod (*E. morrhuia*) moderately deep, rather elongate, tapering prominently, distinctly convex above, yellowish-white to pinkish. Outside with intermediate, continuous, central red muscle band.

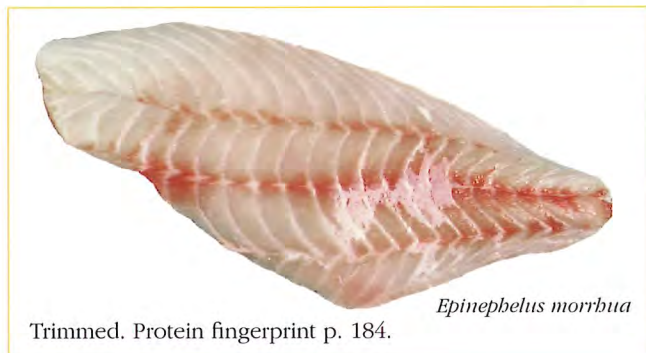
Size: To about 300 cm and 400 kg (commonly imported at more than 30 cm and more than 0.5 kg).

Habitat: Marine; demersal in coralline and rocky reef habitats over the continental shelf and upper slope to depths of about 400 m.

Fishery: Among the most important and high-priced commercial fishes in tropical regions. Caught mainly using lines, nets, traps, spears and trawls. Some species, such as Malabar rockcod (*E. malabaricus*), are farmed. Imported widely from Namibia, South-East Asia (e.g.

India, Myanmar and Singapore) and the South Pacific (e.g. Fiji, Papua New Guinea, and the Solomon Islands).

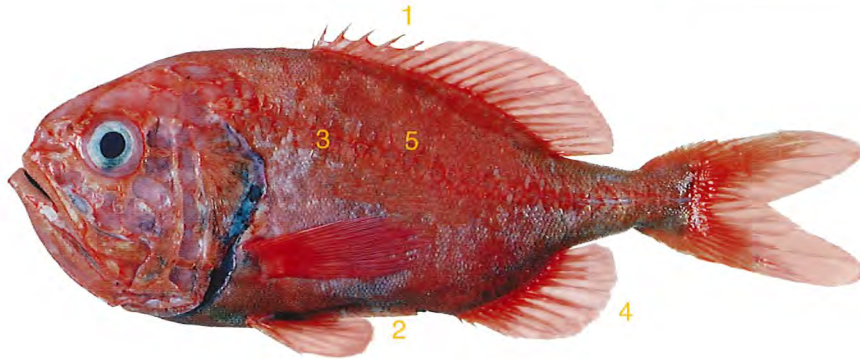
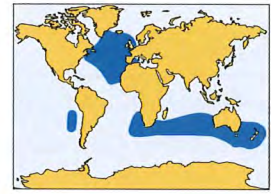
Remarks: A new group marketing name, ‘grouper’, has been proposed. The domestic fishery includes small quantities of other species such as redflushed rockcod (*Aethaloperca rogaa*) and whitelined rockcod (*Anyperodon leucogrammicus*). Flesh firm.



Orange roughy

Hoplostethus atlanticus

Minor names: deepsea perch, sea perch



Identifying features: ① dorsal fin with 6 spines (last longest), 15–18 soft rays; ② 19–25 weak scutes along belly; ③ body compressed; ④ anal fin with 3 spines, 10–11 soft rays; ⑤ body bright red (fading to orange after death).

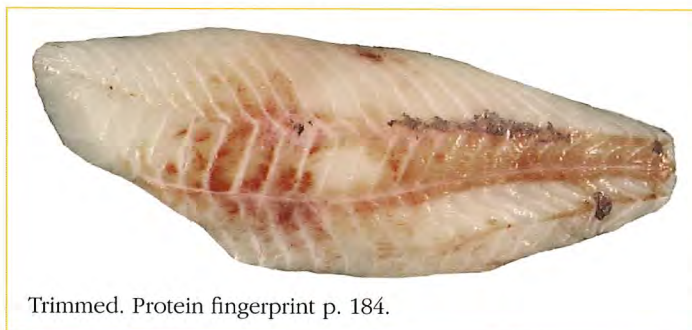
Comparisons: Similar to a lesser domestic species, the Darwin's roughy (*Gephyroberyx darwini*), but has 19–25 weak scutes along the belly (versus 10–12 strong scutes) and has only 6 dorsal-fin spines (versus 8–9). Distinguishable from other roughies, which have fewer, stronger scutes. Roughies are dissimilar to other fish groups (domestic and imported) and can be differentiated by their large bony head and obvious scutes on the belly.

Product: Whole, headed and gutted (frozen), and as fillets (frozen and chilled). Fillet deep, rather elongate, tapering sharply, slightly convex above, milky white; outside with feeble, continuous central red muscle band.

Size: To at least 60 cm and 3.5 kg (commonly imported at 35–45 cm and 0.8–1.5 kg).

Habitat: Marine; demersal, schooling over seamounts and along the mid-continental slope in depths of 500–1 400 m (more commonly in 750–1 050 m).

Fishery: Caught by demersal trawlers in deep waters off New Zealand, Namibia and in the North Atlantic. Stocks have been depleted in a number of fishing grounds, with some concerns about the sustainability of those located in international waters, where there is little or no control of fishing effort. Imported from New Zealand.



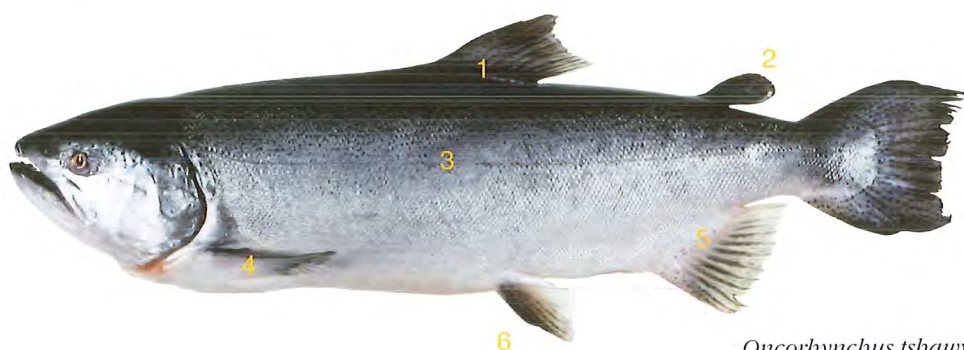
Trimmed. Protein fingerprint p. 184.

Remarks: A popular fish that is the basis of lucrative exports from Australia and New Zealand, with the biggest market being the US. Orange roughy is deep skinned prior to utilisation to remove the largely indigestible fatty layer. Locally, the skin and carcass have a range of commercial uses.

Salmon

Oncorhynchus & *Salmo* species (except *O. mykiss* & *S. trutta*)

Minor names: king salmon (NZ), Atlantic salmon, chinook salmon, king salmon, Pacific salmon, quinnat salmon



Oncorhynchus tshawytscha

Identifying features: ① dorsal fin short-based and centrally located (well forward of anal fin); ② adipose fin present; ③ scales small (more than 110 along lateral line); ④ pectoral fins placed low on side; ⑤ anal-fin base short; ⑥ pelvic fins well behind pectoral fins.

Comparisons: Two similar species constitute most of the salmon imports. The anal-fin base of the chinook salmon (*O. tshawytscha*) is longer than the longest anal-fin ray, whereas in the Atlantic salmon (*S. salar*) the anal-fin base is shorter than the longest anal-fin ray. The same character also separates chinook salmon from the local rainbow (*O. mykiss*) and brown (*S. trutta*) trouts. Atlantic salmon differs from the rainbow and brown trouts in having a shorter jaw (reaching to beneath eye rather than beyond the eye).

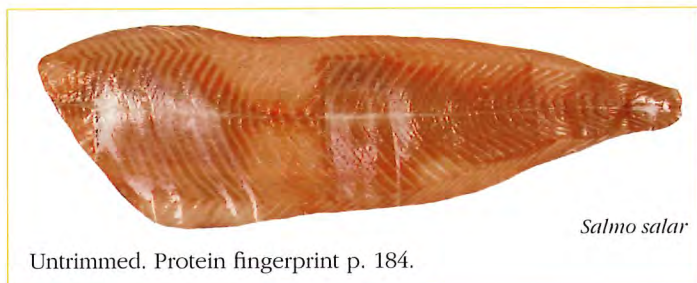
Product: Fillets and steaks (frozen and chilled) and headed (or gilled) and gutted (chilled and frozen). Also commonly imported canned as well as cold and hot smoked. Fillet of Atlantic salmon deep, elongate, slightly tapering, reddish-orange; outside with pronounced, continuous red muscle band.

Size: To 150 cm and at least 60 kg (commonly imported at 65–90 cm and 3.5–10 kg).

Habitat: Sea-going natives of streams, rivers and lakes. Introduced virtually worldwide for recreational and commercial fishing and aquaculture.

Fishery: Basis of very important commercial and recreational fisheries in numerous countries. Commercial production almost exclusively farmed in ponds and sea cages. Chinook salmon imported from New Zealand, with canned and smoked product from the Northern Hemisphere.

Remarks: Atlantic salmon also supports an important domestic aquaculture industry in Tasmania. Use of the names 'salmon' and 'trout' is somewhat arbitrary, although salmonids that are predominantly freshwater are usually called 'trout'. *Salmo* and *Oncorhynchus* species were originally from Atlantic and Pacific Ocean drainages respectively.



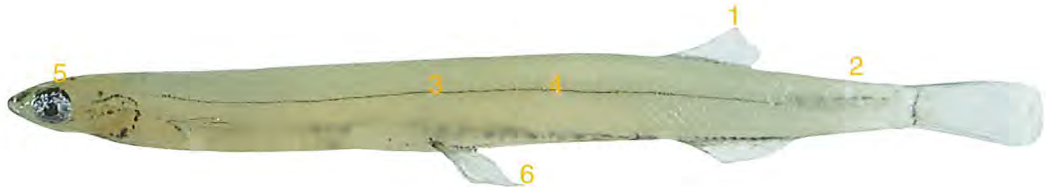
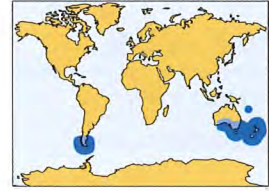
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Salmo salar

Whitebait

Galaxias species

Minor names: galaxias, jollytail, native trout (AU), inanga, kokopu (NZ)



Galaxias maculatus

Identifying features: ① dorsal fin short-based and somewhat posteriorly located (partially over anal fin); ② adipose fin absent; ③ scaleless; ④ body small, elongate, and largely translucent; ⑤ head not depressed; ⑥ pelvic fins located well behind pectoral fins.

Comparisons: Fry resemble adults of the native Tasmanian whitebait (*Lovettia sealii*), but differ in having the dorsal fin situated above the anal fin (rather than well forward of it) and in lacking an adipose fin. Also similar to imported Asian whitebait (family Salangidae, p. 110) but lack an adipose fin and the head is not as angular or depressed. Product sold as 'whitebait' in Europe are young members of the family Clupeidae.

Product: Whole (block frozen). Canned product may sometimes be available. Too small to fillet.

Size: Adults to 20 cm, but whitebait (the juveniles) commonly imported at 4.5–5 cm, with more than 2 000 individuals per kg.

Habitat: Sea-going; young commonly hatch in freshwater and are then carried downstream to the sea, where they live and grow before migrating back up rivers and streams in late winter and early spring. Prefer areas with overhead cover and waterside vegetation. The dominant commercial species, native trout (*G. maculatus*), which is called 'inanga' in New Zealand, prefers habitats in the lower catchments of streams and rivers.

Fishery: Taken in freshwater habitats with a variety of nets in a strictly controlled New Zealand fishery. Although catches consist primarily of three *Galaxias* species, imported product is almost exclusively native trout (inanga) from New Zealand.

Remarks: Despite the New Zealand fishery being tightly controlled, a general decline has been noted in some regions, reportedly due to overfishing and habitat degradation. A Tasmanian fishery, which was dominated by Tasmanian whitebait, was closed in 1974. Whitebait are eaten whole, without removing the head or intestines, and have a delicate flavour. Other information is provided for protein fingerprints (p. 184).

Blue cod

Parapercis colias

Minor names: none



Identifying features: ① continuous dorsal fin, with 5–6 (usually 5) short spines, usually 20 soft rays; ② head not depressed, pointed; ③ mouth at tip of snout; ④ anal fin with 17–18 soft rays; ⑤ body cylindrical; ⑥ pelvic fins inserted forward of pectoral fins.

Comparisons: Despite its marketing name this robust species is not a cod, but belongs to the sandperch family, Pinguipedidae. Differs from the related South American flathead (*Percophis brasiliensis*, p. 123) in having a continuous dorsal fin (versus 2 separate dorsal fins), a mouth at the snout tip (versus projecting lower jaw) and fewer anal fin rays (17–18 versus 38–42).

Product: Whole (frozen), headed and gutted (chilled), and as fillets (frozen, chilled and smoked). Fillet moderately elongate, tapering gradually, upper profile slightly convex, pale pinkish; outside without red muscle band.

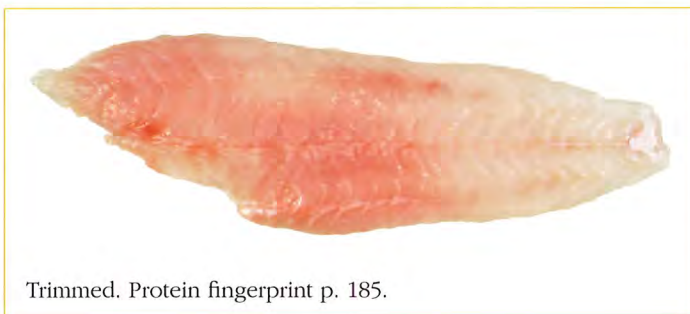
Size: To 65 cm and more than 5 kg (commonly imported at 30–40 cm and 1–3 kg).

Habitat: Marine; from shallow coastal waters to depths of at least 150 m, usually in association with reefs.

Fishery: Endemic to New Zealand, this popular fish supports both recreational and commercial fisheries. Caught by pots and handlines, mainly in rocky areas around the Chatham Islands and the southern South Island. Historically imported to Australia in large volumes, but is less common now.

Remarks: About 25 sandperch species occur in Australian waters but none is of commercial value. New Zealand's blue cod is the largest member of the family worldwide and probably

the most commercially important. A high-quality foodfish with small-flaked, pinkish-white flesh with a delicate flavour. Excellent smoked and historically imported to Australia for smoking. The common name 'blue cod' is well-entrenched in New Zealand and has been marketed in Australia.



Trimmed. Protein fingerprint p. 185.

South American flathead

Percophis brasiliensis

Minor names: pez palo (AR), tira-vira (BR), Brazilian flathead, duckbill



Identifying features: ① 2 dorsal fins, first with 8–10 spines and second with 30–33 soft rays; ② head depressed; ③ lower jaw projecting beyond upper; ④ anal fin with 1 weak spine, 38–42 soft rays; ⑤ body extremely elongate, depressed anteriorly, cylindrical posteriorly; ⑥ pelvic fins inserted in advance of pectoral fins.

Comparisons: A member of the duckbill family (Percophidae), the South American flathead's depressed head has earned it the common name 'flathead'. However, it differs from the unrelated Australian flatheads (family Platycephalidae) in having the pelvic fins in advance of the pectoral fins, and in lacking bony ridges and spines on the head. Stargazer (*Kathbetostoma giganteum*) is occasionally imported from New Zealand (and often sold as 'flathead') but has a large cube-like head with the eyes on top, and an upwardly directed mouth. South American flathead differs from New Zealand's blue cod (*Paraperca colias*, p. 122) in having 2 separate dorsal fins (rather than 1 continuous fin), a depressed head, and more anal-fin rays (38–42 versus 17–18).

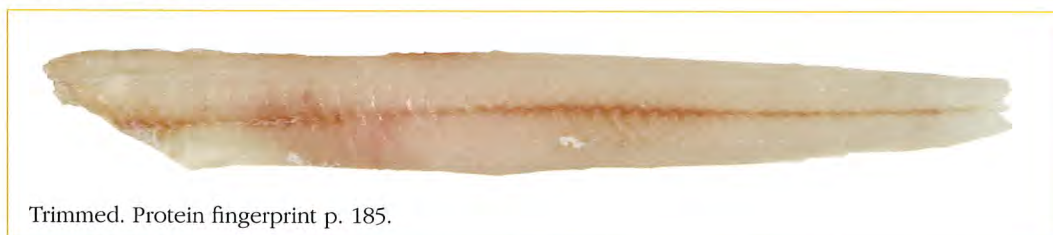
Product: Mostly fillets (frozen) but also available whole (headed and gutted, frozen). Fillet long, slender, tapering slightly, off-white yellowish; outside fillet with discontinuous, feeble central red muscle band, usually skinned and with silvery white integument.

Size: To about 70 cm and possibly 4 kg (commonly imported at 25–60 cm).

Habitat: Marine; demersal on sandy bottoms of the continental shelf to depths of about 50 m.

Fishery: Caught by coastal bottom trawlers. Imported from Argentina and Chile.

Remarks: A number of duckbill species occur domestically but most are small and of little commercial value. The South American flathead has firm, white flesh that makes it popular as a foodfish in many countries. It is imported for the supermarket trade but is not widely available in Australia.

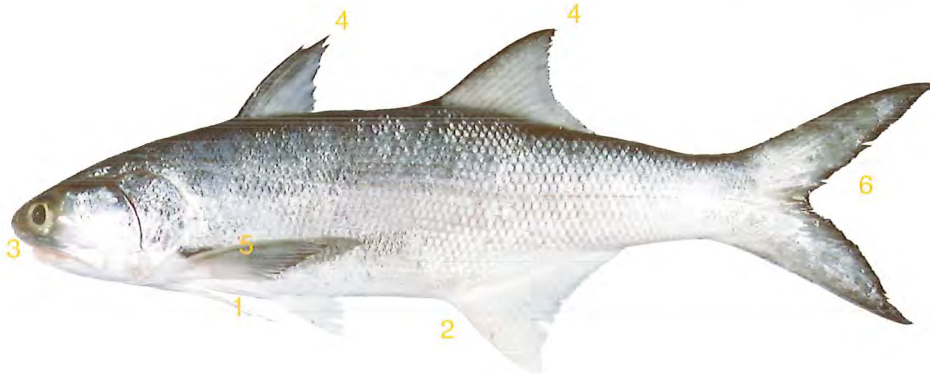


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Blue threadfin

Eleutheronema tetradactylum

Minor names: blue salmon, threadfin (AU), kesumbag (ID)



Identifying features: ① 4 filaments at bottom of each pectoral fin, longest barely extending beyond pectoral fin; ② anal fin with 3 spines, 13–17 soft rays; ③ mouth behind tip of snout; ④ 2 widely separated dorsal fins; ⑤ pectoral fins inserted very low on body; ⑥ caudal fin deeply forked.

Comparisons: Most similar to the East Asian fourfinger threadfin (*E. rbadinum*), which also has 4 pectoral filaments, but blue threadfin has a yellow pectoral fin (rather than black). Rarely, can have 3 pectoral filaments, which is characteristic of threefinger threadfin (*E. tri-dactylum*, southern Indonesia to Gulf of Thailand). Not to be confused with the similarly named but unrelated threadfin breams (family Nemipteridae, p. 125), which have 1, long-based dorsal fin rather than 2 widely separated, short-based dorsal fins. Threadfin salmons are also unrelated to true salmons.

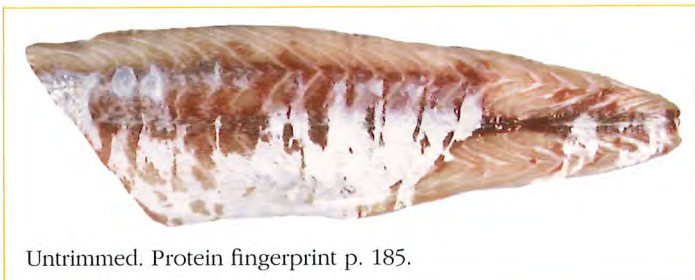
Product: Frozen fillets. Fillet moderately deep, elongate, gently tapering to deep caudal peduncle, pale pinkish; outside with broad, pronounced, broken central red muscle band.

Size: Reported outside Australia to 160 cm and more than 20 kg (commonly imported at up to 90 cm).

Habitat: Marine; coastal, benthopelagic in tropical regions and mostly inshore. Habitats include estuaries, muddy rivers and occasionally freshwater.

Fishery: Caught by a variety of methods including longlining, beach seining, trapping and bottom trawling. Imported from Indonesia and possibly from elsewhere in Asia.

Remarks: Preparation methods in Asia are varied and include fried, boiled, steamed, roasted, dried and pickled fish. Pectoral-fin filaments are used as feelers as they move across the bottom to locate food. Populations can have distinct breeding grounds. Thought to breed off southern Papua New Guinea in August, with adults ascending rivers in winter.

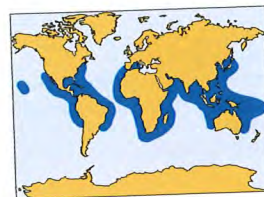


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Threadfin

Family Polynemidae

Minor names: Burnett's salmon, king salmon, threadfin salmon (AU), bastard mullet (ZA), tasselfish



Polydactylus macrochir

Identifying features: ① 2 dorsal fins, widely separated; ② pectoral fin divided in two, upper normal, lower with 3–16 free, filamentous rays; ③ mouth large, behind tip of snout; ④ clear layer of fatty tissue over eye; ⑤ caudal fin very large, deeply forked.

Comparisons: Threadfins can be separated from the unrelated true salmons (family Salmonidae p. 120) in having 2 widely separated dorsal fins, filamentous extensions on the pectoral fins and a deeply forked caudal fin. The king threadfin (*Polydactylus macrochir* or, until recently, *P. sheridani*) has 5 (occasionally 4) filaments at the bottom of each pectoral fin (longest extending to or slightly past anal-fin origin), and the anal fin has 3 spines and 9–11 soft rays.

Product: Fillets, usually skinned (frozen), and whole (dried). Fillet of king threadfin moderately deep, elongate, tapering slightly to a deep caudal peduncle, pale pinkish; outside with broad, intermediate, diffuse central red muscle band.

Size: To 185 cm and at least 30 kg (commonly imported at 50–90 cm and up to 6 kg).

Habitat: Marine; coastal, benthopelagic in muddy bays, and also entering estuaries and rivers.

Fishery: Capture gear includes nets, traps, longlines, beach seines and bottom trawls. Various species are sourced from Asia (e.g. Taiwan) and from Namibia.

Remarks: Widely utilised throughout their range; in some regions outside Australia, king threadfin is second in commercial importance only to barramundi (*Lates calcarifer*, p. 76). Imports are often incorrectly identified and labelled as 'king threadfin'.



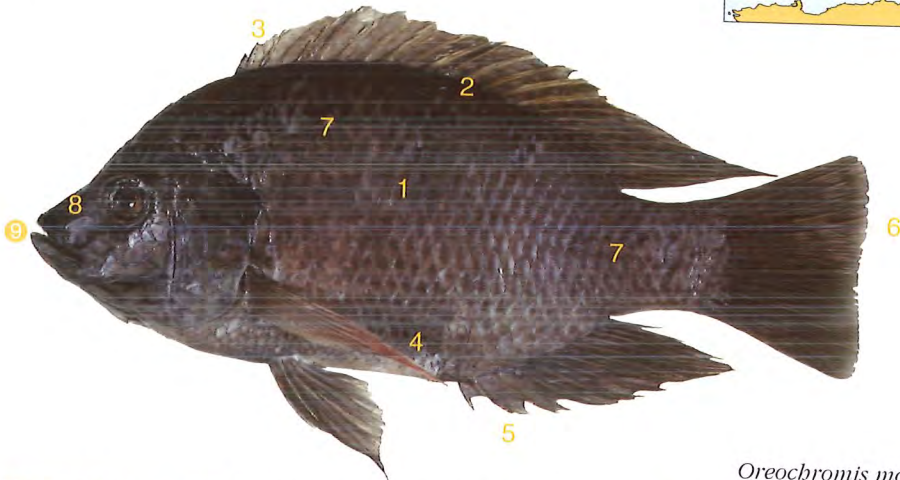
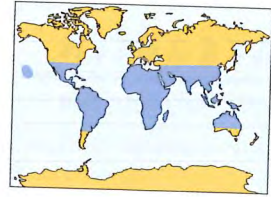
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occurs only off northern Australia and southern New Guinea. Product from Africa and as far north as Taiwan represents other threadfin species. Skinned fillets are difficult to identify visually but are readily separated using genetic techniques.

Tilapia

Oreochromis, Sarotherodon & Tilapia species

Minor name: mouthbrooder



Oreochromis mossambicus

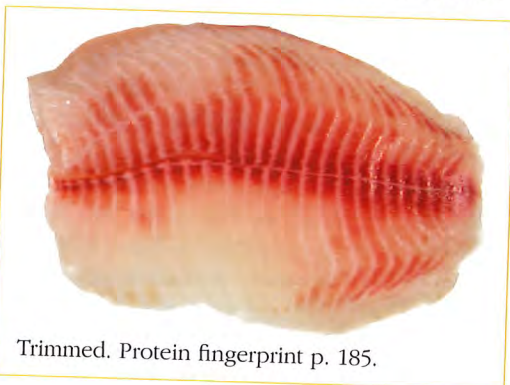
Identifying features: ① body deep, somewhat compressed; ② dorsal fin long-based; ③ front of fin heavily spined; ④ belly scales distinctly smaller than flank scales; ⑤ anal fin with 3–6 spines; ⑥ tail truncate; ⑦ lateral line in 2 parts (sometimes indistinct), anterior (upper) part curved and following dorsal profile, posterior (lower) part straight; ⑧ single nostril on each side; ⑨ teeth with notched crowns.

Comparisons: The combination of characters above makes tilapias distinct from all other commercial fishes. As young, they also usually possess a black spot ringed with yellow (the 'tilapia mark') at the junction of the spinous and soft ray portions of the dorsal fin. Some are superficially similar to black bream (*Acanthopagrus butcheri*), but differ in having a truncate (rather than forked) tail and an interrupted (rather than continuous) lateral line.

Product: Whole (frozen and chilled), and gilled and gutted, headed and gutted, and as fillets (frozen). Fillets typically extremely deep, short, minimal taper, upper profile convex, off-white yellowish; outside with continuous, pronounced red muscle band.

Size: To at least 70 cm and 3.6 kg (commonly imported at 22–30 cm and about 0.4–0.8 kg).

Habitat: Freshwater; benthopelagic, some species can tolerate a wide range of salinities and may enter brackish coastal waters to move between river systems.



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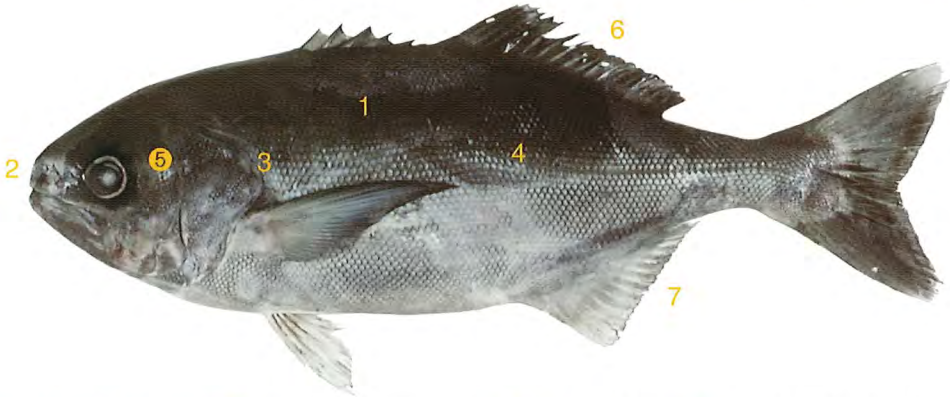
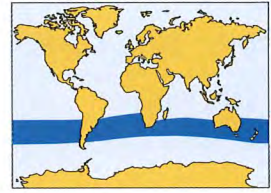
Fishery: Among the most widely aquacultured fishes. Commonly farmed species in South-East Asia are the Nile (*O. niloticus*), Mozambique (*O. mossambicus*) and the Zanzibar (*O. urolepis*) tilapias. Imported mainly from Indonesia, Myanmar, Taiwan and Vietnam.

Remarks: Mostly farmed in ponds or floating cages, and often sold live to restaurants and sometimes processed into sashimi. Farmed fishes are often hybrids, making species delineation difficult without genetic techniques. Some feral populations exist in Australia.

Blue-eye trevalla

Hyperoglyphe antarctica

Minor names: blue-eye, blue-eye cod, deepsea trevalla (AU), bluenose (NZ)



Identifying features: ① silvery or bluish-grey; ② snout blunt; ③ no dark blotch above pectoral-fin base; ④ body firm, deep, compressed slightly; ⑤ head with numerous small pores; ⑥ dorsal fin with 7–9 spines, 18–21 soft rays; ⑦ anal fin with 3 spines, 13–16 rays.

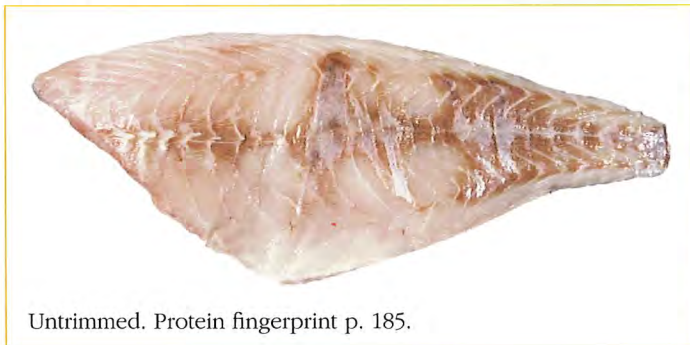
Comparisons: Colour similar to the warehou species (e.g. *Seriotelella brama*, p. 130) but lacks a dark blotch behind the head. A second domestic species, the ocean blue-eye (*Schedophilus labyrinthica*), has more dorsal-fin rays (26–29 in the ocean blue-eye versus 18–21 in the blue-eye trevalla) and a shorter upper jaw (barely reaching to below anterior of eye versus reaching to level of mid-eye or beyond).

Product: Headed and gutted, and as fillets (chilled and frozen); sometimes whole, heads and wings (chilled). Fillet moderately deep, rather elongate, upper profile slightly convex, taper pronounced, off-white to yellowish; outside with intermediate, continuous red muscle band.

Size: To 140 cm (about 130 cm in New Zealand) and 50 kg (commonly imported at 55–90 cm and 2–10 kg).

Habitat: Marine; adults benthopelagic usually over rough bottom and seamounts on the outer continental shelf and upper slope in depths of 200–600 m. Young more midwater, often to the surface.

Fishery: Caught mainly by longlines and also as trawl byproduct. Imported from New Zealand.



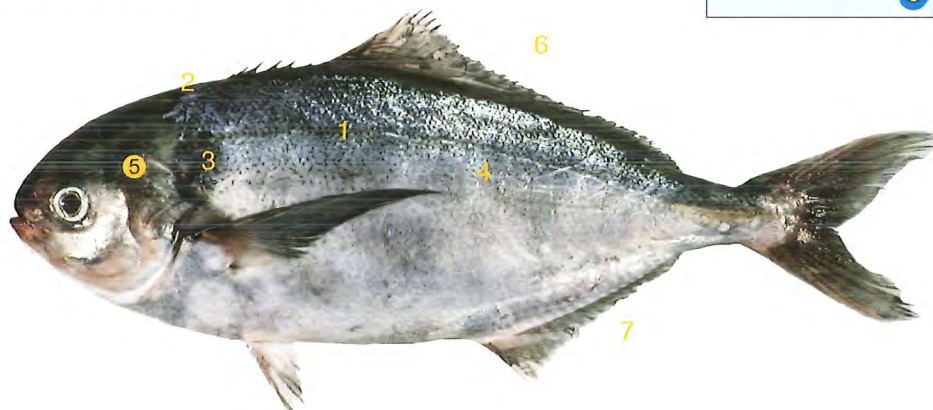
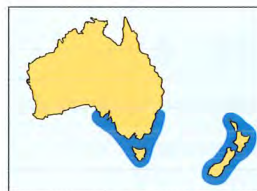
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Remarks: Also targeted domestically. Other historical New Zealand names include 'stoneye', 'bonita', 'bream' and 'Griffin's silverfish'. Also sometimes called 'blue-eye cod' in Australia, but this species is unrelated to cods and to blue cod (*Paraperchis colias*, p. 122). Very highly regarded foodfish with moist and succulent flesh.

Blue warehou

Seriolella brama

Minor names: snotty trevalla, trevally (AU)



Identifying features: ① silvery blue without spots; ② scaled area on midline before dorsal fin shorter than lower jaw; ③ dark blotch above pectoral-fin base; ④ body firm, deep and quite compressed; ⑤ head with numerous small pores; ⑥ dorsal fin with 7–9 spines, 25–29 soft rays; ⑦ anal fin with 3 spines, 19–23 soft rays.

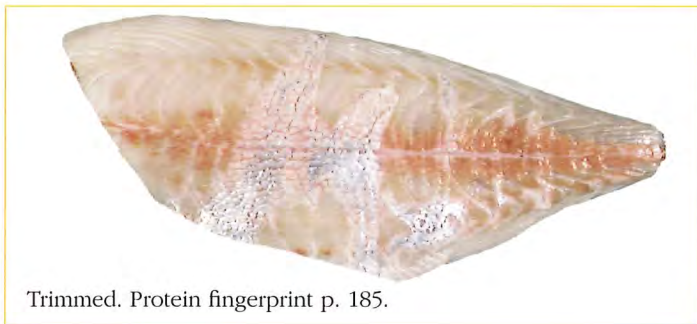
Comparisons: Domestic species as well as imported, it resembles the local white warehou (*S. caerulea*) in body shape but is more bluish (rather than whitish to grey) and has a dark blotch above the pectoral-fin base (otherwise lacking). The more slender silver warehou (*S. punctata*), another domestic commercial species, has a blotch at the pectoral-fin base but has more soft dorsal-fin rays (35–39 versus 25–29) and small, dark spots on the body.

Product: Headed and gutted (frozen), and as fillets (chilled and frozen). Fillet moderately deep, rather elongate, upper profile slightly convex, taper pronounced, off-white to yellowish; outside with pronounced, continuous red muscle band.

Size: To at least 80 cm (70 cm in New Zealand) and possibly 7 kg (commonly imported at 35–55 cm and 1–3 kg).

Habitat: Marine; adults mostly live near the bottom on the continental shelf to depths of 200 m. Juveniles occur over the shallow shelf, and the early juveniles are pelagic, seeking refuge among the stinging tentacles of jellyfish.

Fishery: Imported from New Zealand where it is taken mainly by gillnets, sometimes by trawls and occasionally by purse seines. The New Zealand fishery has increased considerably since the 1970s as new regional fisheries developed.



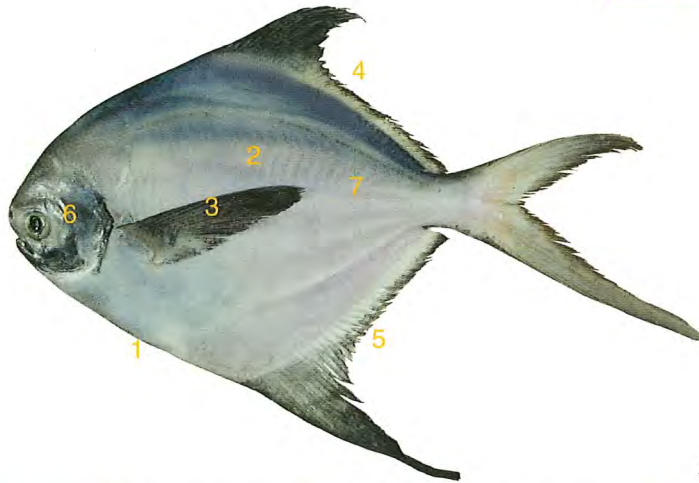
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Remarks: Also caught locally. The silver (sometimes called 'spotted') and white warehou species are also imported from New Zealand in small quantities. Warehou flesh becomes soft if handled poorly but otherwise makes excellent eating.

Silver pomfret

Pampus species (except *P. chinensis*)

Minor names: pomfret (AU), bak-chong (CN), nga-mote-phyu (MM)



Pampus argenteus

Identifying features: ① no pelvic fins; ② very deep and compressed; ③ pectoral fins large, extending to about level of middle of anal-fin base; ④ long-based dorsal fin, with 7–11 spines, 34–41 soft rays; ⑤ long-based anal fin, with 5–8 spines, 34–39 soft rays; ⑥ head and mouth small; ⑦ body silvery white.

Comparisons: Belong to the family Stromateidae (butterfishes). The main import, silver pomfret (*P. argenteus*), has rudimentary gill rakers and a deeply forked caudal fin with the lower lobe longer than the upper. The related trevallias (family Centrolophidae) are usually more elongate and possess pelvic fins (lacking in silver pomfrets). Black pomfret (*Parastromateus niger*, p. 132), more closely allied to the trevallias than the trevallias, is distinguishable by its darker coloration and the presence of scutes on the lateral line.

Product: Whole and cutlets (frozen). Fillet of silver pomfret deep, short, tapering slightly posteriorly, upper profile convex, off-white yellowish; outside without red muscle band.

Size: To about 60 cm (commonly imported at 15–25 cm).

Habitat: Marine; prefer soft bottoms and sometimes enter estuaries. Usually found inshore but also extend down to depths of about 110 m on the continental shelf.



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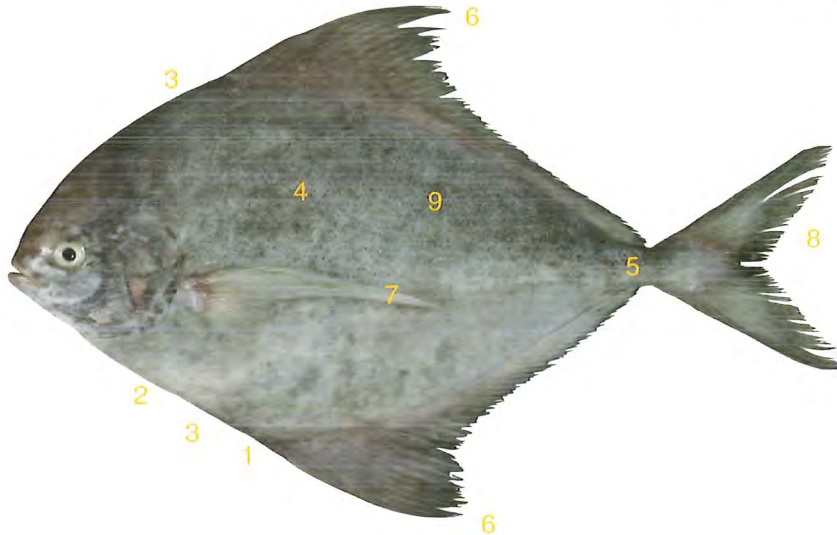
Fishery: Targeted widely in South-East Asia, usually by bottom trawls or gillnets, and sometimes purse seines. Source countries include Myanmar and China.

Remarks: The marketing name 'white pomfret' is reserved for *P. chinensis*. Considered a delicacy in South-East Asia, and among the highest-priced foodfishes in some regions. The anal and caudal fins are particularly highly esteemed, especially when fried.

Black pomfret

Parastromateus niger

Minor names: bawal hitam (ID), sin-ngamoke (MM)



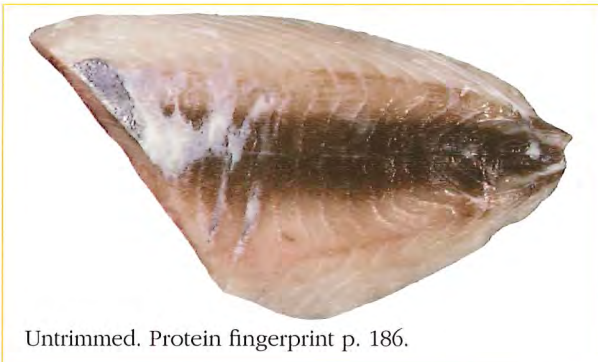
Identifying features: ① no detached anal-fin spines; ② no pelvic fins in adults; ③ symmetry of dorsal and ventral profiles almost identical; ④ body very deep, compressed; ⑤ weak scute-like scales confined to caudal peduncle; ⑥ dorsal and anal fins tallest anteriorly; ⑦ pectoral fins very elongated and scythe-like; ⑧ deeply forked caudal fin with short, slender caudal peduncle; ⑨ body brownish-grey.

Comparisons: Unusual member of the trevally family. Closely resembles the unrelated silver pomfrets (*Pampus* species, p. 131) but has large spiny scales (scutes) on the caudal peduncle typical of most trevallies, and a dark body (rather than silvery white).

Product: Whole (frozen). Fillet deep, profile convex above and below, reddish-brown; outside with broad, continuous, very pronounced central red muscle band.

Size: To at least 55 cm and 2.6 kg (commonly imported at 20–35 cm and 0.2–0.8 kg).

Habitat: Marine; surface dwelling pelagic of tropical seas, commonly occurring inshore and often in very shallow water. Generally closer to the bottom during the day. Occurs in depths to 40 m, often over muddy bottoms.



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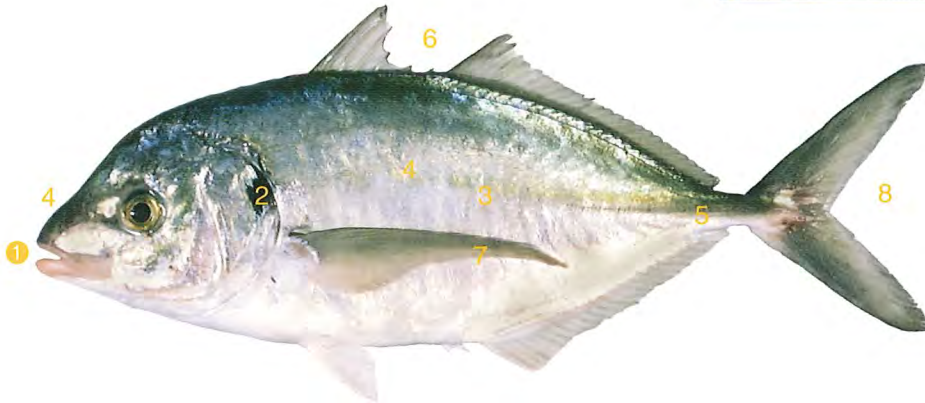
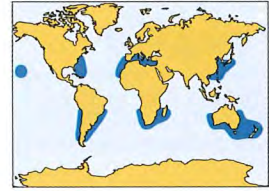
Fishery: Caught mostly with gillnets but also with seines and trawls. Imported from various countries in South-East Asia, including Indonesia and Myanmar.

Remarks: Taken as bycatch in northern Australian coastal net fisheries. In Asia, often sold along with silver pomfrets and sometimes available dry salted. Considered excellent eating, and sometimes consumed raw.

Silver trevally

Pseudocaranx dentex

Minor name: trevally



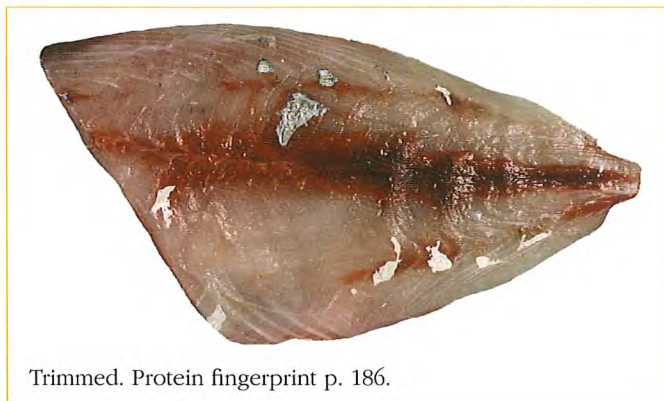
Identifying features: ① teeth in both jaws in single row (occasionally additional row in front of upper jaw); ② black spot on operculum edge above pectoral-fin base; ③ sides often with yellowish stripe, but lacking spots or bands; ④ body moderately elongate with relatively pointed head; ⑤ 34–46 scute-like scales at end of lateral line; ⑥ dorsal fins well separated, first with 8 spines; ⑦ pectoral fins very elongated and scythe-like; ⑧ deeply forked caudal fin on a short, slender caudal peduncle.

Comparisons: Similar in appearance to some other main domestic commercial trevallies (*Caranx* and *Carangoides* species) but usually has blunt conical teeth in upper jaw confined to a single row (rather than being in multiple rows).

Product: Whole, headed and gutted, and as fillets (chilled and frozen). Fillet deep, short, tapering to narrow peduncle, strongly convex above, pale reddish-brown; outside with broad, continuous, very pronounced central red muscle band.

Size: To about 94 cm (70 cm in New Zealand) and at least 10 kg (commonly imported at 35–50 cm and 0.4–2 kg).

Habitat: Marine; occupy a variety of habitats from shallow harbours to surface waters across the continental shelf. Also found near the bottom to depths of 200 m.



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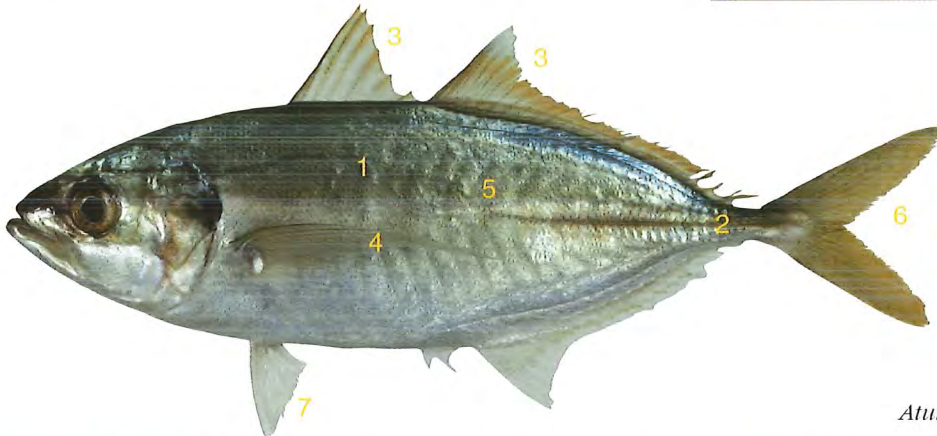
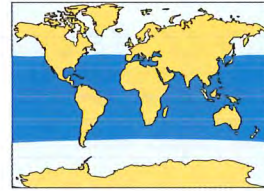
Fishery: Commercially important in trawl, purse seine and gillnet fisheries around New Zealand's North Island, from where they are exported. Elsewhere caught mainly with demersal trawls.

Remarks: Also caught domestically, along with the smaller, less common skipjack trevally (*P. wrighti*). Although silver trevally has a short shelf life, it is regarded as a good foodfish.

Trevally

Subfamily Caranginae

Minor names: Indian mackerel (AU), cá trac (VN), jack



Atule mate

Identifying features: ① body usually silvery, deep and compressed; ② enlarged, scute-like scales at end of lateral line; ③ usually with 2 dorsal fins, the first with 5–8 spines; ④ pectoral fins mostly elongated, scythe-like; ⑤ body covered in small cycloid scales; ⑥ deeply forked caudal fin on a short, slender peduncle; ⑦ pelvic fins small, base beneath pectoral-fin base.

Comparisons: Of the trevallies (family Carangidae), only members of the diverse subfamily Caranginae may be marketed as ‘trevally’. Other trevally subfamilies, the amberjacks (Seriolinae), queenfishes (Scomberoidinae), and darts (Trachinotinae), differ in appearance and do not have a row of enlarged scutes along the lateral line.

Product: Whole, headed and gutted, and as fillets (chilled and frozen). Fillets tend to be rather deep, with pinkish or whitish flesh, and a pronounced central red muscle band on outer fillet.

Size: To at least 170 cm and exceeding 60 kg (commonly imported at 30–100 cm and 0.3–15 kg, although some smaller species are imported from Asia).

Habitat: Marine; pelagic, mainly over the tropical continental shelf but some venture further offshore. Most occur in large schools.

Fishery: Widely caught by trawls, purse seines, nets, traps and lines. One species, silver trevally (*Pseudocaranx dentex*, p. 133), imported from New Zealand and several from Asia.

Remarks: Trevallies are among the most important groups of commercial fishes in the world.



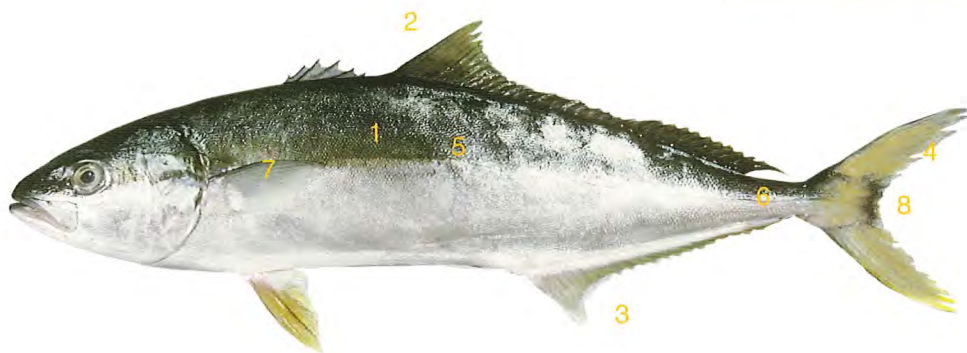
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Thirteen domestic species have separate marketing names. Some of these are also imported. One Vietnamese import is whole frozen yellowtail scad (*Atule mate*), which is sold in cane baskets and often labelled as ‘steamed trevally’. It is also sometimes confusingly labelled as ‘Indian mackerel’. Flesh quality varies between species.

Yellowtail kingfish

Seriola lalandi

Minor names: kingfish (AU), yellowtail (NZ)



Identifying features: ① back bluish-green with a yellowish stripe through midline; ② dorsal fin with 6–7 spines, 30–37 soft rays; ③ anal fin with 19–21 soft rays; ④ caudal fin yellowish; ⑤ body elongate and robust; ⑥ no scute-like scales on lateral line; ⑦ pectoral fins rather short; ⑧ forked caudal fin with short caudal peduncle.

Comparisons: Members of the genus *Seriola* are distinctive within the trevallies. Yellowtail kingfish resembles related fishes sold domestically as ‘samson fish’ (*S. dumerili* and *S. hippos*) but has a more slender head and body, and a yellowish (rather than olive or greyish) tail. Also has more soft dorsal-fin rays (30–37 versus 22–25) and soft anal-fin rays (19–21 versus 16–17 rays) than *S. hippos*.

Product: Whole (chilled), and headed and gutted (chilled and frozen). Fillet moderately deep, rather elongate, tapering gently, weakly convex above, reddish-brown; outside with continuous, pronounced central red muscle band.

Size: To about 190 cm (slightly smaller in New Zealand) and 70 kg (commonly imported at 70–110 cm and up to 18 kg).

Habitat: Marine; pelagic, solitary or in small schools mainly near the coast and around offshore islands and reefs in temperate water. Usually near the surface to depths of 50 m.

Fishery: Imported from New Zealand. Caught mainly as a byproduct of trawling, purse seining and gillnetting but historically taken with box-nets off northern New Zealand. Also targeted

elsewhere by hook-and-line, and trawls. A close relative is successfully aquacultured in Japan, and aquaculture trials of yellowtail kingfish are progressing in New Zealand.

Remarks: Targeted and farmed locally. Also prized by recreational fishers. Popular and highly regarded as sashimi, and also excellent smoked.

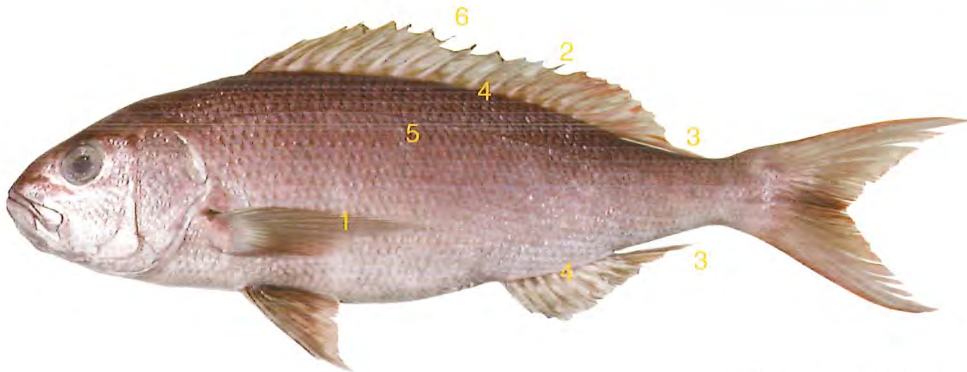
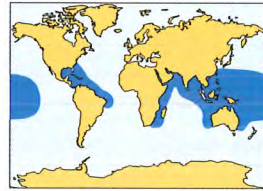


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King snapper (page 1 of 2)

Pristipomoides species

Minor names: rosy jobfish (AU), pla kapong (TH), jobfish



Pristipomoides filamentosus

Identifying features: ① pectoral fins longer than snout; ② dorsal fin not deeply notched between spinous and soft portions; ③ last soft ray of dorsal and anal fins longer than those preceding; ④ dorsal-fin and anal-fin bases without a covering of scales; ⑤ body elongate and slightly compressed; ⑥ dorsal fin with 10 spines, 11–12 soft rays.

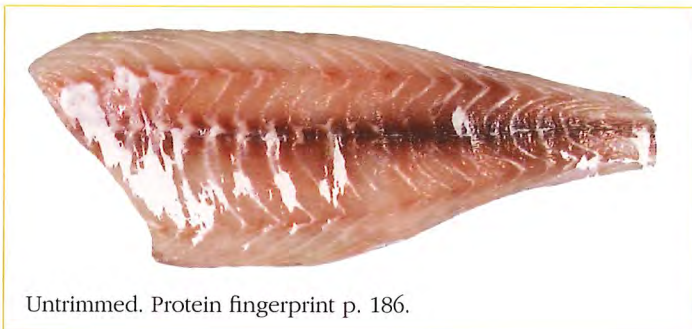
Comparisons: Several species differing from the ruby snappers (*Etelis* species) in lacking a deep notch in the dorsal fin, and from the green jobfish (*Aprion virescens*) in the length of the pectoral fin (longer than snout length in king snappers and about equal to the snout length in green jobfish). Tropical snappers (*Lutjanus* species, pp 139–140) belong to the same family but are deeper bodied and have a covering of scales on the soft dorsal and anal fins.

Product: Fillets (frozen). Fillet of rosy snapper (*P. filamentosus*) moderately deep, rather elongate, tapering gently, upper profile slightly convex, pale pinkish; outside with pronounced, continuous central red muscle band. King snapper fillets are generally more elongate than those of tropical snappers (*Lutjanus* species).

Size: To 90 cm and at least 6 kg (commonly imported at less than 60 cm and 2.2 kg).

Habitat: Marine; usually over rocky bottoms or near coral reefs on the continental shelf and upper continental slope in depths of 20–550 m.

Fishery: Taken mainly by bottom-set longlines and deep handlines but also with traps and trawls. Imported from Singapore, Vietnam, Fiji, Papua New Guinea and the Solomon Islands.



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Remarks: Important foodfishes, particularly throughout the Indo–West Pacific, where larger individuals are sometimes preferred. Often eaten raw or marinated in lime juice and coconut cream. The related ruby snappers and green jobfish are widespread in the region and beyond, and are also imported.

King snapper (page 2 of 2)

Pristipomoides species

Pristipomoides filamentosus



Remarks: Commonly called by its specific marketing name 'rosy snapper', this species prefers rocky bottoms of the Indo-Pacific (from east Africa to Hawaii, and from Japan to Australia) in depths of 90–360 m. Imported from Vietnam and elsewhere in Asia. Also caught locally. Best distinguished by its body colour, small scales (60–65 in lateral line) and the lack of stripes on the sides. To about 90 cm and 6.5 kg.

Pristipomoides multidentis



Remarks: Commonly called by its marketing name 'goldband snapper' (which it shares with *P. typus*), this species is widespread in the Indo-Pacific from the Red Sea to Samoa, and from Japan to Australia. It prefers rocky bottoms of the continental shelf in depths of 40–200 m. Imported from Asia and the South Pacific and also caught locally. Best distinguished by its large scales (48–52 in lateral line), yellow stripes on the sides, and yellow bars on the top of the head. To 90 cm and at least 6 kg.

Pristipomoides zonatus

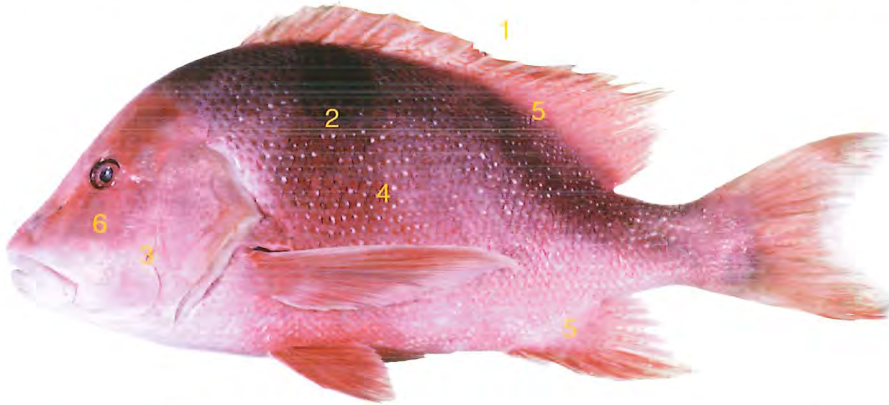


Remarks: Commonly called 'oblique-band snapper', this striking species is widespread in the Indo-Pacific from east Africa (south of Madagascar) to Hawaii, and from Japan to New Caledonia. Also recently recorded from eastern Australia, it prefers rocky bottoms in depths of 70–300 m. Imported from Asia and the South Pacific. Best distinguished by the pink or red colour with 4 oblique orange or yellow bars on its sides. To about 50 cm.

Red emperor

Lutjanus sebae

Minor names: government bream, seaperch (AU), gajah (ID), pla kapong-deang (TH)



Identifying features: ① dorsal fin with 11 spines, 16 (rarely 15) soft rays; ② body red, pink or white with 1 broad darker bar along the head and 2 across the body (often faint in large adults); ③ very pronounced preopercular notch; ④ body very deep, compressed; ⑤ dorsal-fin and anal-fin bases, especially soft portions, with covering of scales; ⑥ scales on cheek.

Comparisons: Distinct among tropical snappers (*Lutjanus* species) in having 3 broad dark bars on the head and body (may be faint in adults), 15–16 soft dorsal-fin rays, a very pronounced preopercular notch and a very deep body. Compared with true emperors (*Lethrinus* species, p. 64), red emperor has more dorsal-fin rays (15–16 versus 9–10) and scales on the cheek (absent in the emperors).

Product: Fillets (usually skinned, frozen), occasionally dressed (frozen). Fillet deep, rather elongate, tapering sharply, upper profile strongly convex, yellowish-white to pinkish; outside with pronounced continuous central red muscle band.

Size: To at least 100 cm and 22 kg (commonly imported at less than 60 cm and 3.5 kg).

Habitat: Marine; often associated with coral or rocky reefs or nearby sand or gravel patches but also extending to depths of about 100 m on soft bottoms.

Fishery: Important foodfish throughout its range, being caught by handlines, traps, gillnets and trawls. Imported from South-East Asia (mainly Indonesia, Myanmar, Thailand and Vietnam).



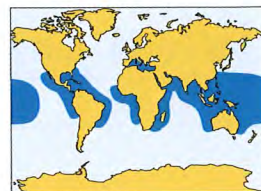
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Remarks: Considered excellent eating. Internationally, usually marketed fresh or frozen, but also dry salted in many parts of Asia. One explanation for the common name 'government bream' for juvenile red emperor is that the red bars on the body give the impression that the fish is entangled in red tape.

Tropical snapper (page 1 of 2)

Lutjanus species

Minor names: seaperch, white snapper (AU), cá hong (VN), ikan merah (ID), ngapahni (MM), pla kapong (TH)



Lutjanus johnii

Identifying features: ① dorsal-fin and anal-fin bases, especially soft portions, with covering of scales; ② small to large fishes, body usually deep and compressed; ③ dorsal fin with 10–12 spines, 11–16 soft rays; ④ lateral-line scales 42–51; ⑤ mouth medium, protrusible; ⑥ notch present on lower margin of preoperculum, variable in development.

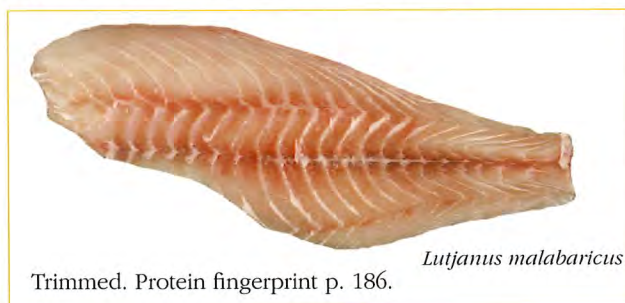
Comparisons: A major group of the family Lutjanidae (tropical snappers) that are distinctively deep bodied with scales on the dorsal- and anal-fin bases. Members of other tropical snapper genera are more slender and lack scaly fin bases. Similar to emperors and seabreams (family Lethrinidae) but have more soft dorsal-fin rays (11–16 versus 9–10).

Product: Fillets (frozen), occasionally dressed (frozen). Fillet of saddletail snapper (*L. malabaricus*) moderately deep, rather elongate, tapering sharply, upper profile strongly convex, yellowish-white or pinkish-white; outside with pronounced, continuous central red muscle band. Tropical snapper fillets generally less elongate than those of king snappers (*Pristipomoides* species, pp 136–137), ruby snappers (*Etelis* species) and green jobfish (*Aprion virescens*). Mostly pinkish-white compared with the more yellowish-white fillets of the emperors.

Size: To 130 cm and about 25 kg (commonly imported at less than 60 cm and 4 kg).

Habitat: Marine, rarely estuarine or freshwater; generally occur near the bottom over shallow (less than 40 m) coral reefs. Some species occur on trawl grounds of the upper continental slope (deeper than 200 m).

Fishery: Taken by trawls, gillnets, lines, traps and spears. Imported from Asia (e.g. Indonesia, Myanmar, Thailand, Vietnam and Taiwan) and west Africa (Namibia).



Trimmed. Protein fingerprint p. 186.

Lutjanus malabaricus

Remarks: In the domestic species handbook, this group was known as 'seaperches'. Since then, the marketing name has changed to 'tropical snapper'. Outside Australia, usually marketed fresh (or frozen), but also dry salted. Certain species are used in Indian cuisine to prepare fish-head curry, a high-priced delicacy. Some species also traded live.

Tropical snapper (page 2 of 2)

Lutjanus species

Lutjanus bitaeniatus



Remarks: Commonly called ‘Indonesian snapper’, this species occurs on offshore reefs of Indonesia and northwestern Australia in depths of 40–70 m. It is reportedly imported from Indonesia as frozen fillets, often mislabelled as the larger ‘Malabar snapper’, a name usually applied to *L. malabaricus*. Best distinguished by its colour—upper sides uniformly red or pink (although juveniles have a central black stripe on each side) and lacking spots, stripes, or a dark saddle on the upper caudal peduncle. To at least 30 cm and 0.6 kg.

Lutjanus malabaricus



Remarks: Commonly called by its marketing name ‘saddletail snapper’, or less commonly as ‘Malabar snapper’, this species is widely distributed from the Persian Gulf to Fiji, and from Japan to Australia. It occurs on coastal and offshore reefs, and over soft bottoms, to depths of 100 m. Imported as frozen fillets from a number of Asian nations (e.g. Indonesia, Thailand and Myanmar). Best distinguished by its uniformly reddish or pinkish colour and a dark saddle on the upper caudal peduncle. Its mouth is relatively larger than that of the similar crimson snapper (*L. erythropterus*). To 100 cm and nearly 14 kg.

Lutjanus sanguineus

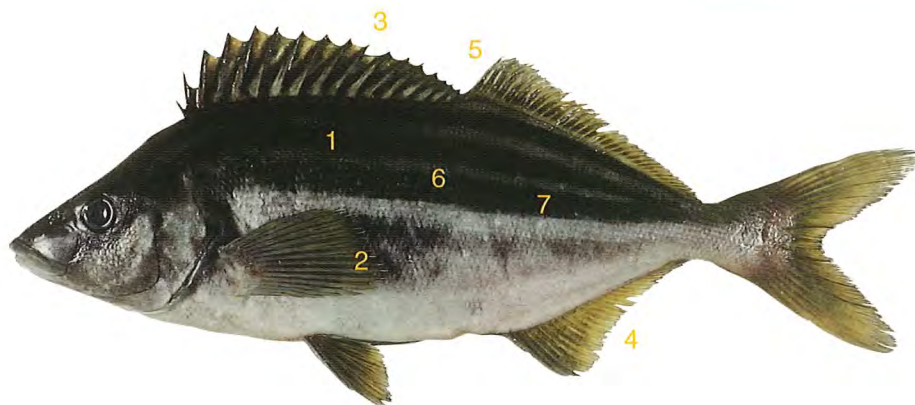
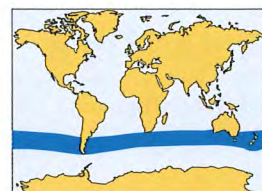


Remarks: Commonly called ‘humphhead snapper’, this species occurs on coral and rocky reefs of the western and northern Indian oceans to depths of 100 m. It is occasionally imported from India as frozen fillets. Also reportedly sourced from Myanmar but its distribution east of India is uncertain. Best distinguished by its colour—upper sides red with darker lines along scale rows—and its steeply sloped snout. To 130 cm and about 25 kg.

Striped trumpeter

Latris lineata

Minor names: kohikohi (NZ), trumpeter



Identifying features: ① 3 broad, dark stripes on upper sides; ② pectoral fins rounded, middle rays longest; ③ dorsal fin with 17–18 spines, 34–36 soft rays; ④ anal fin with 3 spines, 31–32 soft rays; ⑤ distinct notch between spinous and soft-ray sections of dorsal fin; ⑥ body elongate and compressed; ⑦ body scales small and numerous.

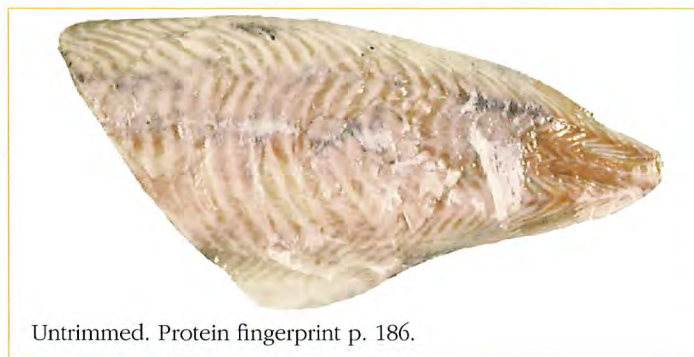
Comparisons: Distinguished from other domestic commercial trumpeters (*Latridopsis* species) in having 3 broad, dark stripes on the upper sides and rounded pectoral fins. Morwongs (family Cheilodactylidae, p. 109) are similar but have much larger pectoral fins (usually with the central rays greatly elongated) and fewer soft anal-fin rays (8–19 versus 31–32).

Product: Whole, and headed and gutted (chilled). Fillet moderately deep, rather elongate, almost bottle-shaped, off-white to yellowish; outside with feeble continuous central red muscle band.

Size: To 120 cm (100 cm in New Zealand) and at least 25 kg (commonly imported at 50–80 cm and to about 6 kg).

Habitat: Marine; adults prefer rocky reefs in depths to at least 250 m. Juveniles occur closer inshore.

Fishery: Imported from New Zealand, where a small catch (mostly byproduct) is taken by gill-nets inshore and by linefishing offshore. Mainly caught off central and southern New Zealand. Although individuals are capable of large migrations, populations seem to be localised and are quickly fished down.



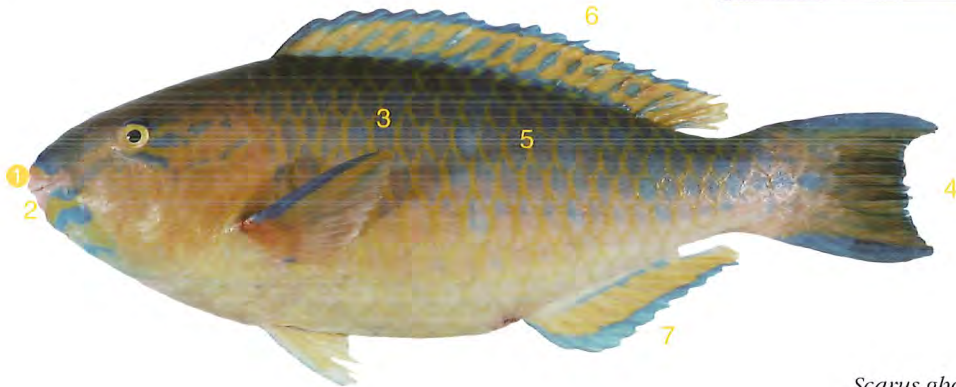
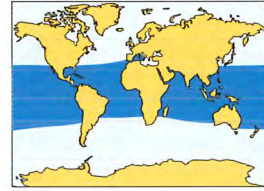
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Remarks: Subject to aquaculture trials domestically. A highly esteemed foodfish that is popular with anglers.

Parrotfish

Family Scaridae

Minor names: ikan kakatua (ID), cá mo (VN)



Scarus ghobban

Identifying features: ① plate-like teeth in front of jaws joined to form beak-like cutting edges; ② mouth very small; ③ usually extremely colourful; ④ caudal fin truncated or lunate (rarely rounded); ⑤ scales large and cycloid; ⑥ dorsal fin usually with 9 spines, 10 soft rays; ⑦ anal fin usually with 3 spines, 9 soft rays.

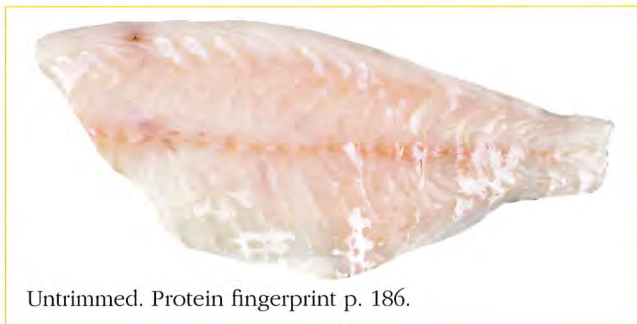
Comparisons: Have a distinctive appearance with a rounded or bump-headed snout and small mouth. Variable in colour with adult males and females usually quite different from each other but the fin-ray counts are totally uniform within the group. The jaws cannot be protruded forward and the plate-like teeth are joined to form a structure resembling a parrot's beak. True wrasses (family Labridae), which have sometimes been incorrectly called 'parrotfish', have conical or peg-like teeth that are separate and that do not form a cutting edge.

Product: Fillets (frozen). Fillet of bluebarred parrotfish (*Scarus ghobban*) deep, rather elongate, upper profile slightly convex, taper pronounced, pale pinkish; outside with feeble, diffuse central red muscle band.

Size: To 130 cm and 68 kg (commonly imported at 30–50 cm and 0.4–2.5 kg).

Habitat: Marine; demersal in shallow tropical seas, mainly in coral reef habitats.

Fishery: Several species fished widely throughout their range, including domestically; taken by traps, nets and spears. Some—e.g. bluebarred parrotfish and bridled parrotfish (*S. frenatus*)—are common in the live fish trade in South-East Asia. The dominant imports include two coral reef species, Indian Ocean steephead parrotfish (*Chlorurus strongylocephalus*, often incorrectly called 'Scarus gibbus') and daisy parrotfish (*C. sordidus*), that are imported mostly from Indonesia and Vietnam.



Untrimmed. Protein fingerprint p. 186.

Remarks: Well-regarded foodfishes although discarded in some areas. Rarely distinguished by species in Asian markets. The firm, white flesh is reportedly best steamed. The related wrasses are also imported from South-East Asia.

Crustaceans

G. K. Yearsley and P. R. Last

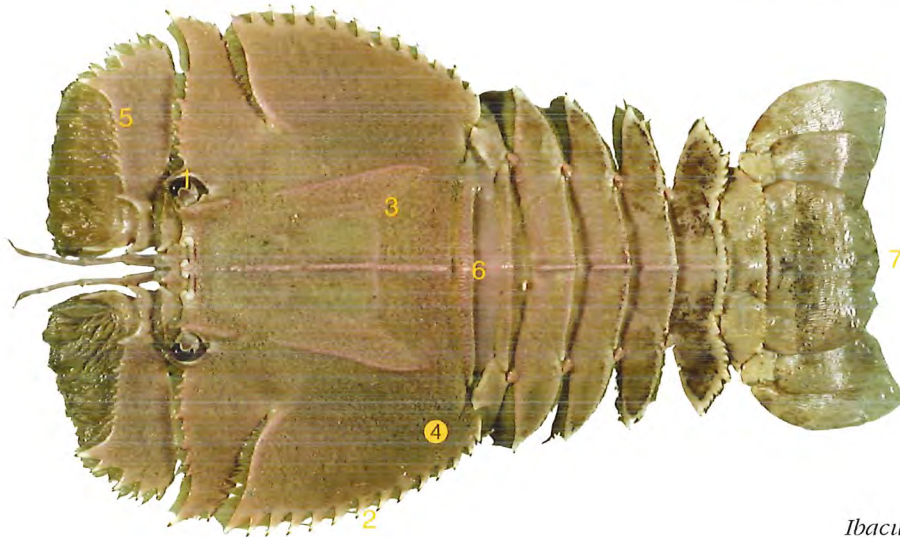
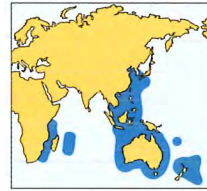
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Balmain bug

Ibacus species

Minor names: shovelnose lobster, slipper lobster (AU), kong kradan deng (TH)



Ibacus pubescens

Identifying features: ① eyes closer to body midline than to carapace margin; ② carapace with prominent marginal spines; ③ carapace broader than long; ④ legs all of similar size and shape; ⑤ short, broad and flattened antennae; ⑥ body strongly depressed; ⑦ telson broadly convex.

Comparisons: In Balmain bugs, the eyes are closer to the body midline than to the carapace margin whereas in Moreton Bay bugs (*Thenus* species, p. 145) they are at the carapace margin, and in slipper lobsters (*Scyllarides* species) they are closer to the carapace margin than to the midline.

Product: Tails (frozen).

Size: To almost 9 cm in carapace length (more than 25 cm total length) and nearly 0.4 kg (commonly imported at much smaller sizes and occasionally minute).

Habitat: Marine; prefer soft bottoms on the continental shelf and upper slope in depths of about 40–750 m.

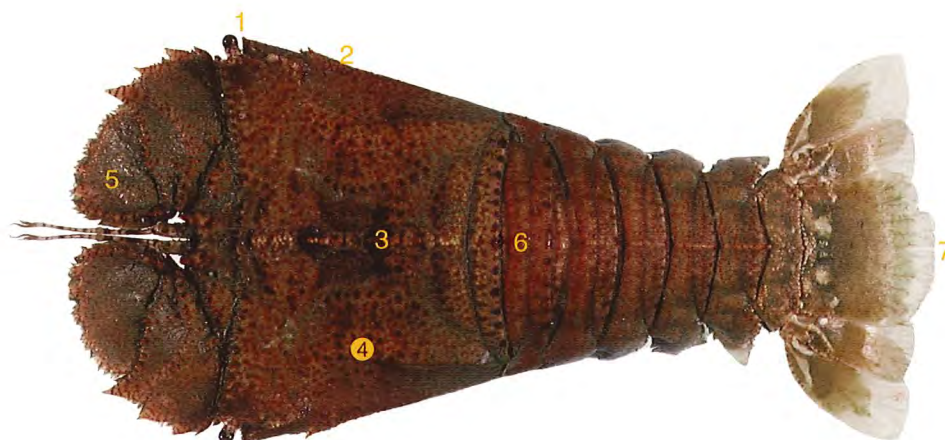
Fishery: Widespread trawl fishery; often taken as byproduct of more valuable fisheries (e.g. for prawns), and regularly seen in markets of Japan, Korea, Taiwan and the Philippines. One species taken by longlines off Japan. Various species occasionally imported from Asian countries such as Indonesia and Vietnam.

Remarks: Commonly caught and marketed domestically. Imports sometimes mislabelled as 'slipper lobster'. The group marketing name 'bug' (*Ibacus* and *Thenus* species) is available if product has not been identified to genus. Other information is provided for protein fingerprints (p. 187).

Moreton Bay bug

Thenus species

Minor names: baylobster, shovelnose lobster, slipper lobster (AU), kong kradan (TH), udang pasir (ID)



Thenus orientalis

Identifying features: ① eyes at carapace margin; ② most of carapace margin without prominent spines; ③ carapace broader than long; ④ legs all of similar size and shape; ⑤ short, broad and flattened antennae; ⑥ body strongly depressed; ⑦ telson broadly convex.

Comparisons: The position of the eyes (at the carapace margin) separates these species from the similar Balmain bugs (*Ibacus* species, p. 144) and slipper lobsters (*Scyllarides* species).

Product: Whole and as tails (frozen).

Size: To 10 cm in carapace length and more than 0.5 kg (commonly imported at much smaller sizes).

Habitat: Marine; prefer soft substrates on the continental shelf in depths of about 10–70 m, and occasionally to 100 m.

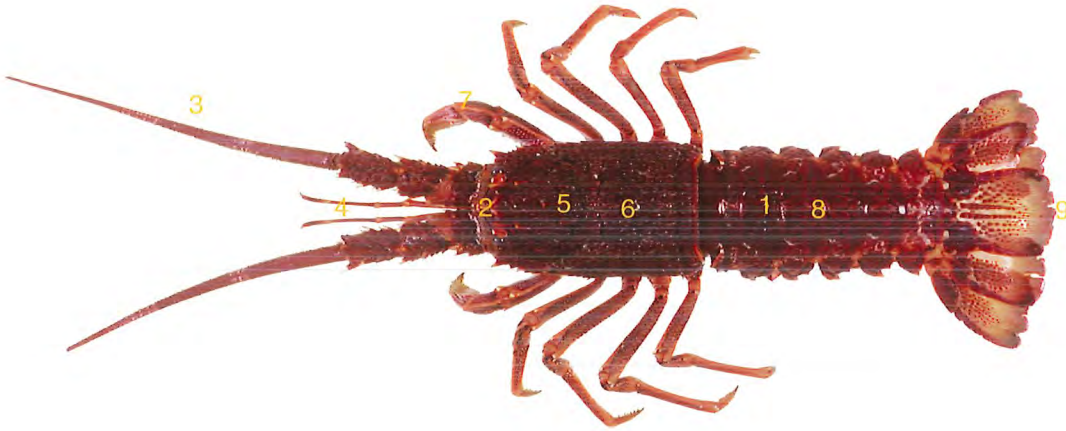
Fishery: Widely caught but rarely targeted; usually taken as trawl byproduct. Indonesia, Thailand and other Asian countries supply Australian markets.

Remarks: Moreton Bay bugs account for most imported bugs but they are often mislabelled as 'slipper lobster', even when sold alongside locally caught 'Moreton Bay bug'. The marketing name 'slipper lobster' is reserved for *Scyllarides* species in Australia. Although the scientific name '*Thenus orientalis*' has been widely used, a number of species are now recognised throughout the Indo-Pacific region. The group marketing name 'bug' (*Ibacus* and *Thenus* species) is also available. Other information is provided for protein fingerprints (p. 187).

Southern rocklobster

Jasus edwardsii

Minor names: cray, crayfish (AU), red rocklobster, red spiny-lobster (NZ)



Identifying features: ① abdominal segments sculptured; ② minute rostrum (central spine) flanked by 2 prominent spines between eyes; ③ antennae a little flexible, very long; ④ antennules with very short flagella; ⑤ fresh body colour variable, often red or orange; ⑥ carapace much longer than broad; ⑦ first pair of legs slightly more robust than those following (much larger in large males); ⑧ body slightly depressed; ⑨ telson broad, usually convex.

Comparisons: Distinguished from other domestically caught rocklobsters by the sculptured abdominal segments, flexible antennae and short antennule flagella.

Product: Whole cooked and tails (chilled and frozen). Rocklobster tails can usually be identified to species.

Size: To 23 cm in carapace length (54 cm in body length) and 5.4 kg (commonly imported at 9–11 cm in carapace length, 26–28 cm in body length and 0.5–0.75 kg).

Habitat: Marine; most common in depths of 5–100 m but also extending to 275 m on the continental slope. Usually associated with reefs but sometimes aggregate on clear ground.

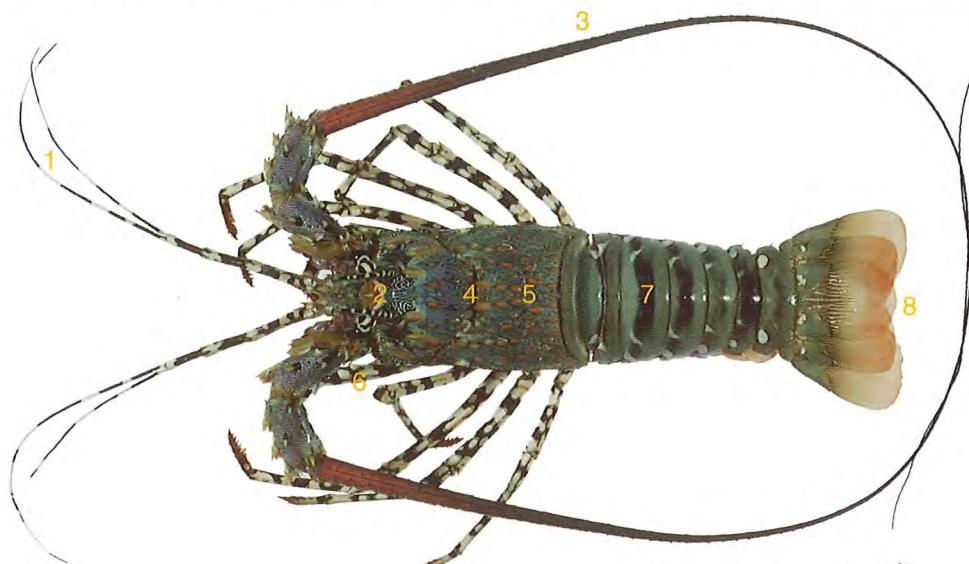
Fishery: Imported in small volumes from New Zealand, where it supports a valuable pot fishery.

Remarks: Also supports a valuable fishery off southern Australia. Australia's eastern rocklobster (*J. verreauxi*) also occurs off northern New Zealand, where it has been reported to exceed 15 kg in weight. However, the fishery there is small (contributing less than 5% of commercial rocklobster landings) and eastern rocklobster is rarely, if ever, imported to Australia. Other information is provided for protein fingerprints (p. 187).

Tropical rocklobster

Panulirus species (except *P. cygnus*)

Minor names: ornate rocklobster, painted cray (AU), langosta (CL), langosta (MX), udang barong (IN), spiny-lobster



Panulirus ornatus

Identifying features: ① antennules with very long, whip-like, forked flagella; ② 2 prominent spines between (or over) eyes; ③ antennae somewhat flexible and usually extremely long; ④ fresh body colour variable, often bright and ornately patterned; ⑤ carapace much longer than broad; ⑥ first pair of legs often slightly more robust than those following; ⑦ body slightly depressed; ⑧ telson broad, usually convex.

Comparisons: The domestic western rocklobster, *P. cygnus*, can be distinguished from the tropical rocklobsters by the following combination of characters: abdominal segments with both a straight-edged, hairy transverse groove (each groove joins with a groove on the side piece of each segment) and a hairy area, an antennular plate with 2 large spines, and no ornate pattern. The flagella of tropical rocklobsters are much longer than those of all other domestic rocklobsters.

Product: Whole cooked and as tails (chilled and frozen) from the Americas, and uncooked as tails (frozen) from South-East Asia and various Pacific islands. Tails usually contain enough identifying features to determine the species.

Size: To 60 cm in body length (commonly imported at 15–25 cm in body length).

Habitat: Marine; cryptic, often in shallow water on rocky bottoms and reefs but some species extend well offshore to depths exceeding 140 m. A few species prefer soft bottoms.

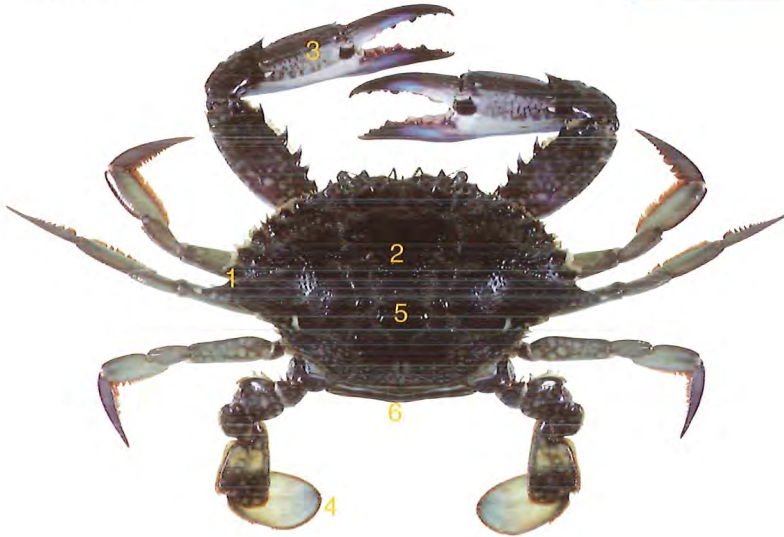
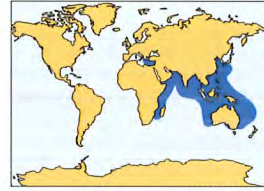
Fishery: Widely fished using such gear as hands or spears (diving), trammel nets, trawl nets and traps. Source countries include US, Cuba, Mexico, Papua New Guinea and India.

Remarks: Also caught domestically. Many tropical rocklobsters live deep in crevices, only emerging to forage after dark. Other information is provided for protein fingerprints (p. 187).

Blue swimmer crab

Portunus pelagicus

Minor names: blue crab, blue manna crab, sand crab (AU), pu ma (TH), flower crab



Identifying features: ① each side of carapace with 9 sharp spines, the last long and projecting laterally; ② dorsal surface colour variable—generally mottled blue in males and mottled brown in females; ③ first pair of legs much longer than second and with prominent, slender claws; ④ tips of posterior pair of legs broadly flattened (disc-shaped); ⑤ carapace broader than long; ⑥ abdomen short and tucked under carapace.

Comparisons: The presence of 9 spines on each side of the carapace, the last very prominent, distinguishes this species from most other domestic commercial swimmer crabs (family Portunidae). The related blue crab (*Callinectes sapidus*), is exported widely from the east coast of the US, and has been confused with blue swimmer crab in some seafood guides. The two are similar in appearance but the blue swimmer crab has a triangular-shaped abdomen in males (versus T-shaped in the blue crab) and in females the last abdominal segment (before the short, pointed telson) is more-or-less straight-edged (versus gently rounded).

Product: Whole (frozen), crab meat (canned and frozen) and crab crackers.

Size: Reaches almost 22 cm in carapace width and more than 1 kg.

Habitat: Marine; prefers sandy and muddy substrates in coastal regions to depths of 65 m. Sometimes in seagrass or algal beds, or near reefs or mangroves.

Fishery: Taken in many countries and exported widely, often canned. Capture methods include a variety of trapping, netting, trawling and entangling devices. Also farmed. Australian imports mostly sourced from Vietnam, Indonesia, Thailand and Myanmar.

Remarks: Recent work on Australian populations suggests that more than one Indo-Pacific species is currently lumped under the name '*P. pelagicus*'. Other swimmer crabs—three-spotted crab (*P. sanguinolentus*), gazami (*P. trituberculatus*) and coral crab (*Charybdis feriata*)—are also imported in small quantities frozen or canned. Product labelled as 'blue swimmer crab' from New Zealand is probably sand crab, *Ovalipes catharus*. Crab crackers are imported from China and perhaps elsewhere. Other information is provided for protein fingerprints (p. 187).

Snow crab

Chionoecetes species

Minor names: zuwai crab (JP), tanner crab, queen crab



Chionoecetes bairdi

Identifying features: ① cleft (split) rostrum, forming 2 adjoining spines; ② carapace widest in back and narrowing toward front; ③ first pair of legs shorter than second and with prominent, slender claws; ④ tips of posterior pair of legs not broadly flattened like a disc; ⑤ carapace width about equal to length; ⑥ abdomen short and tucked under carapace.

Comparisons: Members of the spider crab family (Majidae), which are characterised by having a pointed, cleft rostrum (appearing as 2 spines if deeply cleft), a body that narrows in the front, and the last pair of walking legs not modified for swimming. Some king crabs (family Lithodidae) have a similarly shaped carapace but the last pair of walking legs is greatly reduced and hidden. The five species of snow crabs can be distinguished by minor variations in carapace morphology.

Product: Claws (frozen); sometimes legs (frozen), or canned meat. Also crumbed meat (frozen), which is mixed with Alaskan pollock (*Theragra chalcogramma*, p. 52).

Size: To nearly 16 cm carapace width (commonly imported at 6–13 cm in carapace width; claw length commonly 5–6 cm).

Habitat: Marine; widely distributed from intertidal areas to the abyssal plain in 3 000 m. Preferred bottom types are mud or fine sand.

Fishery: Support extensive fisheries in high latitudes of the Northern Hemisphere, and are of major commercial importance. However, some areas were closed to fishing in recent years due to low crab abundance. Mostly taken in traps, in depths to about 1 000 m. The primary commercial species is snow crab (*C. opilio*). Claws imported from Japan and possibly more from elsewhere.

Remarks: First targeted in the 1960s. The Australian snow crab (*Chaceon bicolor*) belongs to a different family (Geryonidae). To prevent confusion with the true snow crabs, *C. bicolor* is now known as 'crystal crab'; it is taken commercially off Western Australia and is increasingly important in domestic markets. Other information is provided for protein fingerprints (p. 187).

Banana prawn

Fenneropenaeus merguensis

Minor names: white banana prawn (AU), udang putih (ID), white shrimp



Identifying features: ① antennae reddish brown; ② body translucent grey or yellow, speckled with small, dark spots; ③ hepatic ridge absent; ④ lower margin of rostrum with 3–5 spines; ⑤ telson pointed, without spines; ⑥ antennule flagella shorter than carapace; ⑦ second pair of legs not differing dramatically in size from first pair; ⑧ body compressed.

Comparisons: Very similar to a second domestic banana prawn, redleg banana prawn (*F. indicus*), but has reddish brown antennae rather than yellowish. Two other similar species with reddish brown antennae, redtail prawn (*F. penicillatus*) and false white prawn (*F. silasi*), are much rarer in Asian seafood markets and probably not imported. Distinguished from other non-banded commercial prawns by having 3–5 lower rostral spines and lacking spines on the telson.

Product: Tails with and without shell (frozen), sometimes cooked.

Size: To 25 cm body length (about 6.3 cm carapace length) and 75 g (commonly imported at 13–15 cm body length).

Habitat: Marine; in turbid waters on sand and mud bottoms from close inshore to depths of 55 m. Juveniles are often found among mangroves, and sometimes enter rivers.

Fishery: Very important commercial species in the Indo–West Pacific, and imported from Indonesia, Thailand, Papua New Guinea and Myanmar. Caught by trawls, pocket nets, beach seines, castnets and a variety of other gear. Also farmed, mainly in Indonesia, Thailand and Malaysia.

Remarks: Often referred to as '*Penaeus merguensis*'. Other banana prawns, such as redleg banana prawn, are also likely imported. Banana prawn is also farmed in northern Australia. Other information is provided for protein fingerprints (p. 187).

Black tiger prawn

Penaeus monodon

Minor names: leader prawn, tiger prawn (AU), giant tiger prawn, sea tiger



Identifying features: ① base colour with bands of dark brown, black or blue and cream; ② antennae uniform brown or red; ③ upper margin of rostrum with 6–8 spines and lower margin with 2–3 spines; ④ adrostral ridge extending back to about the level of first rostral spine; ⑤ telson pointed, without spines; ⑥ antennule flagella shorter than carapace; ⑦ second pair of legs not differing dramatically in size from first pair; ⑧ body compressed.

Comparisons: A distinctive banded prawn, distinguishable from other banded commercial species (domestic tiger prawns) by the following combination of characters: non-banded antennae, 6–8 upper and 2–3 lower rostral spines and an adrostral ridge extending to about level of first rostral spine.

Product: Wide variety including cooked and green whole (frozen and chilled), cooked and peeled, and peeled and undeveined (frozen).

Size: To 35 cm in body length and exceeding 150 g (commonly imported at much smaller sizes).

Habitat: Marine and estuarine; juveniles occupy shallow estuarine waters among seagrass beds and mangroves, and occasionally enter rivers. Adults are marine in depths to 30 m and sometimes extending offshore to 150 m. Sand and mud bottoms are preferred.

Fishery: A widely valued fisheries target, it is the most dominant single prawn species from wild harvests. India and Indonesia together account for the vast majority of the catch. Taken by trawls, gillnets, seines, traps and a variety of other gear. Also widely farmed, with the largest production from Thailand. Imported mainly from Thailand, Indonesia, Papua New Guinea, India, Myanmar and Vietnam.

Remarks: Reportedly the most common prawn imported to Australia. Some small imported prawns are incorrectly labelled as 'black tiger prawn'. The Andaman Sea is famous for very large black tiger prawns. Also domestically farmed and occasionally wild caught. Other information is provided for protein fingerprints (p. 187).

Freshwater prawn

Macrobrachium rosenbergii

Minor names: cherabin, scampi (AU), giant freshwater prawn, giant river prawn



Identifying features: ① second pair of legs much larger than the first and with prominent claws; ② third pair of legs without claws; ③ lower margin of rostrum with spines; ④ antennule flagella just shorter than length of carapace; ⑤ telson pointed, with 2 pairs of spines; ⑥ body compressed.

Comparisons: Easily distinguishable from other prawns and lobsters in having the second pair of legs enlarged and bearing prominent claws, while the third pair of legs lack claws. Sometimes confused with domestic freshwater crayfishes (*Cherax* species) and scampi (family Nephropidae) but have the second pair of legs enlarged (rather than the first) and a pointed (rather than broadly convex) telson.

Product: Whole (frozen).

Size: To 34 cm in body length (commonly imported at 10–20 cm body length).

Habitat: Estuarine, freshwater and marine; found mainly in estuaries (often among seagrass or algae) and rivers.

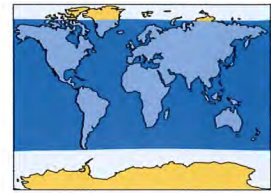
Fishery: Widely cultivated throughout South-East Asia in freshwater. Also caught in the wild using a wide variety of gear, including bamboo barriers, traps, gillnets, castnets, and hook-and-line. Catches more plentiful after heavy rains. Imported from Myanmar, Vietnam, Thailand and elsewhere in Asia.

Remarks: Usually sold fresh and sometimes live in South-East Asia. Imports are often erroneously labelled as 'scampi'. Small-scale farming occurs in Western Australia, but Australian specimens differ in rostral extension and perhaps protein fingerprints (p. 187), and possibly represent a different species. Other lower-priced freshwater prawns (*Macrobrachium* species) also occur in Asian markets.

Prawn

Infraorder Caridea & superfamily Penaeoidea

Minor name: shrimp



Litopenaeus stylirostris

Identifying features: ① rostrum well developed; ② abdomen longer than carapace and compressed; ③ telson pointed; ④ antennae very long (when not broken), thin and roughly cylindrical in cross-section.

Comparisons: Prawns (referred to as 'shrimps' in many countries) differ from related seafood species (bugs, lobsters, scampi and crayfishes) in having long, thin antennae, a well-developed rostrum, a pointed telson, and a compressed abdomen.

Product: Whole (frozen and dried), cooked and peeled (frozen and canned), shrimp cakes (frozen), shrimps in brine (bottled), crackers, and paste. Canned prawns often with other ingredients (e.g. minced prawns with spices).

Size: To at least 35 cm body length and 180 g (common size varies but usually 8–18 cm body length).

Habitat: Marine, estuarine and freshwater; from freshwater ponds and rivers to deep ocean waters in depths exceeding 700 m. Soft bottoms (sand and mud) are preferred.

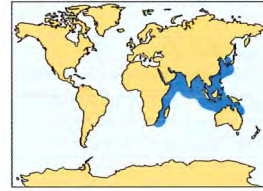
Fishery: Dozens of species caught extensively by trawls, seines, gillnets, traps and artisanal gear. Large-scale pond culture of prawns occurs in numerous countries and is an expanding industry worldwide. Australia imports about 10 species either whole or as tails, mostly from South-East Asia. Imports include paste shrimps (*Acetes* species), usually used in the manufacture of shrimp paste or shrimp powder, fine shrimp (*Metapenaeus elegans*) from Vietnam, whiteleg prawn (*Litopenaeus vannamei*) from Thailand, and paradise prawns (*L. stylirostris*), which are farmed in the South Pacific. Prawns are also reportedly imported from New Zealand but such product probably originates elsewhere.

Remarks: Popular food-species the world over, prawns are highly sought-after and generally high-priced. Prepared for consumption in various ways and sometimes eaten raw. Despite declining catches of some species in some areas, an explosive increase in prawn farming in many countries enables supply to an eager market. Other information is provided for protein fingerprints (p. 187).

Tiger prawn

Penaeus semisulcatus

Minor names: flower prawn, grooved tiger prawn (AU), udang windu (ID), green tiger prawn, sea tiger



Identifying features: ① adrostral ridge long, extending posteriorly beyond first rostral spine; ② antennae banded; ③ light brown or pink (sometimes greenish), with many dark brown or red bands; ④ lower margin of rostrum with 3 spines; ⑤ antennule flagella shorter than carapace; ⑥ second pair of legs not differing dramatically in size from first pair; ⑦ telson pointed; ⑧ body compressed.

Comparisons: Grooved tiger prawn (*P. semisulcatus*) is very similar to the Australian endemic brown tiger prawn (*P. esculentus*) but the adrostral ridge extends beyond the first rostral spine in grooved tiger prawn (versus reaching or falling short in brown tiger prawn). A third species marketed as 'tiger prawn' in Australia, kuruma prawn (*Marsupenaeus japonicus*), has non-banded antennae (antennae banded in both grooved and brown tiger prawns). The black tiger prawn (*Penaeus monodon*) also has non-banded antennae but its adrostral ridge extends only to the first rostral spine.

Product: Whole and tails, with and without shell (frozen); sometimes cooked.

Size: Reaches 30 cm in body length (commonly imported at 13–18 cm body length).

Habitat: Marine; from close inshore to depths of about 130 m but usually less than 60 m. Prefers sand or mud bottoms, and high salinities. Primarily nocturnal, and often buried in the substrate during the day.

Fishery: Mainly taken in offshore trawls and common in Asian markets, particularly in Thailand and Indonesia. The most dominant prawn species in the Philippines' offshore fisheries. Also taken near the coast in some areas. Imported from Indonesia and India.

Remarks: Also targeted (at night) in northern Australia. Other information is provided for protein fingerprints (p. 187).

Molluscs

G. K. Yearsley and P. R. Last —

7

Paua

Haliotis iris

Minor names: blackfoot paua, common paua (NZ)



Identifying features: ① foot black, meat colour dark grey throughout; ② outer shell surface rough, sometimes with prominent outward-radiating grooves; ③ exposed shell colour pale grey; ④ spiral ridges on outer surface fine; ⑤ single ear-shaped shell, with low spire and broad aperture occupying most of the underside.

Comparisons: A species of abalone (family Haliotidae) with a black foot. These distinctive gastropod (single shell) molluscs have an ear-shaped shell with a low spire and a broad aperture occupying most of the underside. Fifty-six species have been documented worldwide, differentiated by size, foot-lip colour, and shell characteristics (colour, shape and grooving patterns).

Product: Meat only (usually canned). Canned product is bleached (particularly for the Asian market) to remove the dark coloration of the foot.

Size: Reported to 20 cm in length (maximum shell diameter) and commonly imported at 12.5–14 cm.

Habitat: Marine; from intertidal zone to depths of 20 m, mainly on coastal rocks and rocky reefs. Most abundant in depths of less than 5 m.

Fishery: Collected by hand by free diving (snorkelling), mostly around New Zealand's South Island and southern North Island. Farmed paua is increasingly common.

Remarks: Four domestic species have separate marketing names, and any member of the family Haliotidae can be marketed simply as 'abalone'. DNA tests are available to differentiate the main Australian species from paua. The internal paua shell is a striking iridescent array of blue, green, purple and pink, and is keenly sought after for the production of buttons, jewellery and decorative inlays for carvings. Also used in the production of abalone pearls.

Cockle

Anadara granosa

Minor names: so huyet (VN), blood cockle, granular ark



Identifying features: ① valves sculptured, with 15–20 stout, outward-radiating ribs that bear nodules; ② valves roughly egg-shaped; ③ external colour yellowish-brown over a white base; ④ internal valve colour white, often tinged with yellow toward the concavity; ⑤ reddish tissues and reddish liquid in shell.

Comparisons: Bivalve molluscs have 2 valves joined at a hinge. Granular ark (*A. granosa*) is a very commonly consumed cockle, separated from most similar species by the number and form of the radial ribs (15–20, often 18, compared with about 26 in the local Sydney cockle, *A. trapezia*). The outer shells of other domestic species marketed as ‘cockle’ (*Kateleysia* species) have numerous concentric rings rather than radiating ribs. Another domestic bivalve, pipi (*Donax deltoides*), has smooth, wedge-shaped valves.

Product: Whole (frozen). Some species canned.

Size: To 9 cm in length (maximum diameter) and commonly imported at about 3.5–5 cm.

Habitat: Marine; coastal, preferring muddy bottoms in bays and estuaries, and mangroves.

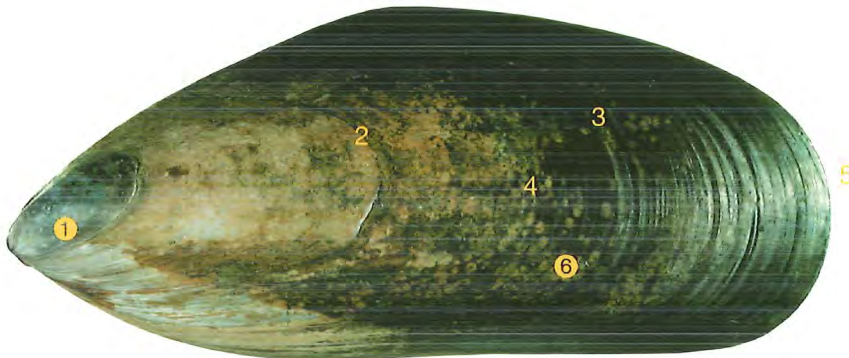
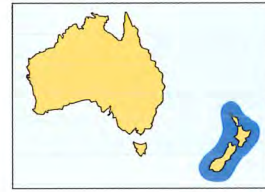
Fishery: Widely collected and cultivated in many areas of the Indo–Pacific. Granular ark is imported from Vietnam and possibly elsewhere in Asia. Other similar imported bivalves include canned ‘baby clam’ (possibly *Meretrix* species) from Thailand and China, and frozen oriental cyclina (*Cyclina sinensis*) from Korea. Clams also imported from New Zealand.

Remarks: *Anadara* species are widely termed ‘blood cockles’ due to the reddish liquid released on opening the valves and the reddish tinge to the tissues. Numerous cockles (families Arcidae and Veneridae) are harvested in Asia and a few species are probably imported, with granular ark the most dominant. Species identification of canned product is virtually impossible without genetic techniques such as DNA tests. Additional marketing names may be required for both imported and domestic species as this seafood component increases in popularity. Other information is provided for protein fingerprints (p. 188).

Green mussel

Perna canaliculus

Minor names: greenlip mussel, mussel (AU), greenshell mussel (NZ)



Identifying features: ① no anterior adductor muscle (near pointed end of valves); ② external colour bright green (sometimes with yellow, red or brown streaks), dark green or bluish-black; ③ valve surfaces smooth or with numerous concentric fine lines; ④ valves wedge-shaped, about the same size and much longer than high; ⑤ posterior ventral margin (opposite hinge) almost rounded; ⑥ internal surface slightly iridescent.

Comparisons: Easily distinguished from the domestic blue mussel (*Mytilus edulis*) by the green shell and the lack of an anterior adductor muscle. Some green mussels from intertidal areas are bluish black in colour (and may therefore be confused with the domestic species) but these animals are not imported. Imported mussels are farmed, and are usually bright green. A related South-East Asian species, *P. viridis*, is sometimes called 'green mussel'; its shell is dull green and brown.

Product: Whole or in half shell (frozen and chilled). Also as mussel meat (pickled, smoked or frozen) and in a variety of other forms such as freeze-dried powder. Green mussels are commonly included in 'marinara mix'.

Size: To at least 23 cm in length (commonly imported at 10–15 cm).

Habitat: Marine; from intertidal areas to depths of 50 m. Attach to rocks, jetty pylons and even sandy bottoms by use of byssal threads, usually in groups.

Fishery: Supports a major aquaculture industry in New Zealand and is a very common import. Green mussels are farmed on buoyed longlines set in designated areas in productive, high-quality coastal waters. Different mussel species are imported from South-East Asia.

Remarks: The edible portion of males is creamy white in colour while that of females is pale orange or apricot-coloured. Generally more abundant off the north of New Zealand than off the south, with Marlborough Sounds the main farming area. A similar species occurs off South America and Africa, and another in Asia. The latter may be imported, along with other mussels, canned (often smoked) or as frozen meat. Other than New Zealand, mussel imports are mainly from China and South Korea. Other information is provided for protein fingerprints (p. 188).

Baby octopus

Octopus aegina & *O. sp. A*

Minor names: none



Octopus sp. A

Identifying features: ① lateral arms longer and more robust than dorsal arms (dorsal arms shortest); ② mantle and arms not covered with iridescent blue rings or lines; ③ small species, maximum mantle length 9 cm (total length 30 cm, weight less than about 100 g) and commonly much smaller; ④ base colour creamish-brown with short black longitudinal bar through each eye, or mantle with pattern of cream to green spots and a pale longitudinal stripe along dorsal midline; ⑤ 8 arms and no tentacles; ⑥ no fins on head.

Comparisons: Marbled octopus (*O. aegina*) has a distinct pale longitudinal stripe over a pattern of cream to green spots on the dorsal mantle, whereas eye-bar ocellate octopus (*O. sp. A*) has a base colour of cream-brown, a short black longitudinal bar through each eye, and bluish ocelli (false eye spots) on the web. Differ from other octopuses by their colour, small size and relative arm lengths. Squids have 8 arms and 2 tentacles.

Product: Whole and whole cleaned (frozen and dried).

Size: To 9 cm in mantle length (30 cm total length) and about 100 g (commonly imported to 6 cm in mantle length).

Habitat: Marine; occupy mud and sand bottoms in coastal waters from intertidal areas to depths of 60 m but usually less than 40 m. Marbled octopus often in muddy waters.

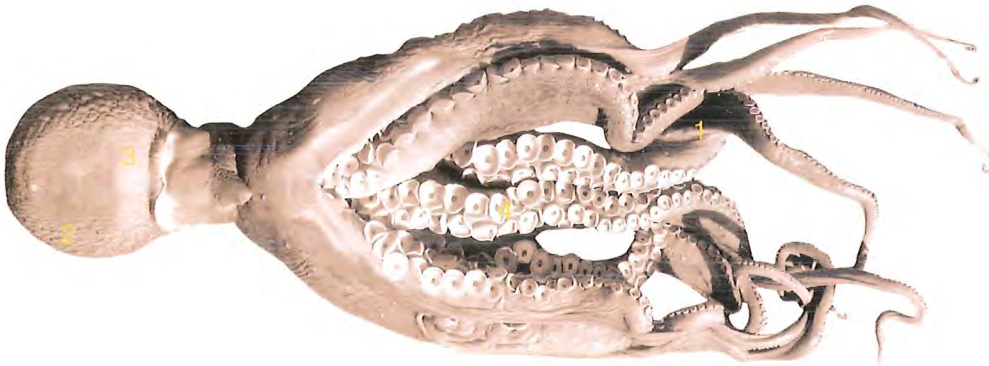
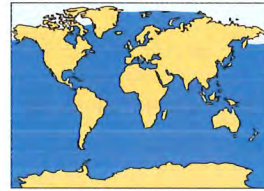
Fishery: Taken by trawls, particularly in the Gulf of Thailand and the South China Sea. Mostly imported from Thailand, Vietnam and India but also elsewhere in South-East Asia.

Remarks: These two species account for the vast majority of baby octopus sold internationally. However, octopus taxonomy is confused and other species may be involved. In international trade, marbled octopus is often incorrectly referred to as '*O. dollfus*', and eye-bar ocellate octopus incorrectly as '*O. membranaceus*'. Eye-bar ocellate octopus occurs off northern Australia but is rarely harvested domestically. Other information is provided for protein fingerprints (p. 188).

Octopus

Family Octopodidae

Minor names: tako (JP), pla muk yak (TH)



Enteroctopus dofleini

Identifying features: ① 8 arms and no tentacles; ② no fins on head; ③ mantle variable in shape, usually ovate or pear-shaped; ④ suckers (1 or 2 rows on each arm) without small teeth-like spines and hooks.

Comparisons: Octopuses and squids are cephalopod molluscs, having either no shell or an internal shell, and a circle of arms surrounding a well-developed head. Octopuses usually have 8 arms whereas squids have 8 arms plus 2 longer tentacles. Unlike squids, octopuses lack both an internal shell and teeth or hooks on their suckers. The North Pacific giant octopus (*Enteroctopus dofleini*) is gigantic (to a total length in excess of 300 cm and 50 kg in weight); it has warty skin on the mantle and its ventral arms are shortest.

Product: Whole cleaned, mostly head-on and gutted, or as arms only (frozen). Occasionally dried or pickled. Imported octopus is often cooked in its country of origin.

Size: To at least 300 cm in total length and 50 kg (commonly imported at less than 2 kg).

Habitat: Marine; bottom-dwelling from intertidal areas to abyssal depths exceeding 5 000 m. Occupy a wide range of bottom types, including rocky and coral reefs, sand, mud and sea-grass beds.

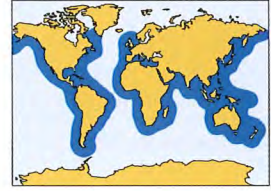
Fishery: Octopuses contribute to local fisheries in dozens of countries. Taken by hand or spears in the shallows and, in deeper water, by trawls, lures, pots, and spears. Other than baby octopus (*O. aegina* and *O. sp. A*, p. 159), the dominant octopuses imported to Australia are the common octopus (*O. vulgaris*) from South Africa and Spain, and the North Pacific giant octopus from Japan. Octopuses are also imported from New Zealand, with Maori octopus (*Pinnoctopus cordiformis*) the dominant New Zealand species.

Remarks: The family Octopodidae includes many commercial species. Some family members are attractively decorated with bright lines and spots, and some are highly venomous. One species superbly mimics the appearance and behaviour of other animals (e.g. flounders, stingrays and sea snakes), possibly to deceive predators or lure prey. Other information is provided for protein fingerprints (p. 188).

Oyster

Family Ostreidae

Minor name: Pacific oyster



Crassostrea gigas

Identifying features: ① shape very variable from round to oval to triangular or trapezoidal; ② valves of variable (often uneven) relative size and shape; ③ valve margins usually at least partly irregular; ④ usually higher (measured from hinge to opposite margin) than long.

Comparisons: Oysters are distinguishable from other bivalve molluscs, such as the green mussel (*Perna canaliculus*, p. 158), by the shape and sculpturing of the valves and the methods by which they attach to the substrate. Four domestic species or groups have separate marketing names and one of these, Pacific oyster (*Crassostrea gigas*) is also a major oyster import. It has a chalky outer surface and black mantle edges.

Product: Meat (chilled, frozen, smoked and dried) and half shell (chilled and frozen). Also oyster sauce.

Size: Varies enormously but those imported usually have a maximum diameter of 8–15 cm. The Pacific oyster reportedly grows to 45 cm in maximum diameter but is rarely observed larger than 15 cm.

Habitat: Estuarine and marine; coastal, usually attached to hard substrates, including rocks, shells and dead coral. However, some are more mobile and occur on soft bottoms. Rare deeper than 50 m.

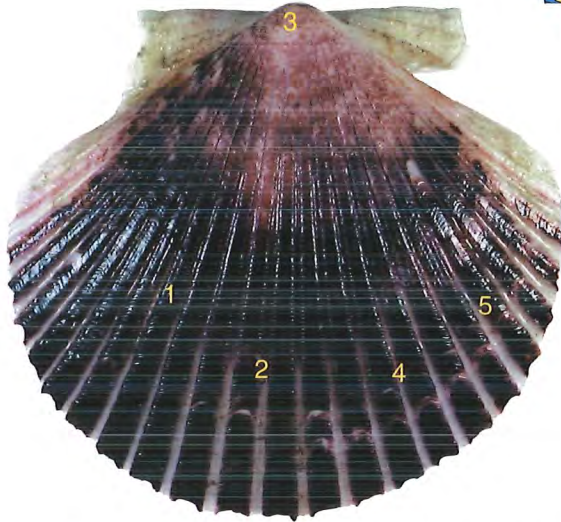
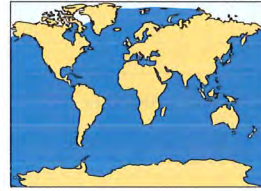
Fishery: Intensively cultured in many regions and also collected by hand from the wild. The dominant import is Pacific oyster from New Zealand. South-East Asian imports predominantly farmed.

Remarks: A versatile seafood immensely popular the world over. Domestic product almost exclusively farmed. The edible qualities vary greatly from species to species, and within species depending on growing location. Other information is provided for protein fingerprints (p. 188).

Scallop

Family Pectinidae

Minor names: none



Argopecten purpuratus

Identifying features: ① valves the same or slightly unequal size and ovate, oval or almost round in shape; ② valves flat, convex, or occasionally concave; ③ hinge line straight with equal- or unequal-sized ‘wings’ on each side of dorsal midpoint; ④ outer valve surfaces with varying number of radiating ribs, or smooth and polished; ⑤ valve colour variable, usually a shade of brown or pink, with darker markings.

Comparisons: Saucer scallops (*Amusium* species) are distinguished from other groups by their smooth, polished and flat shells. Scallop identification usually relies on the size and shape of the ‘wings’, the number of radiating ribs on the outer surface, and the shape of the valves.

Product: Various species imported from Thailand, Japan and elsewhere in Asia, mostly as frozen, roe-off, adductor muscle. Some product (e.g. some Japanese and Thai imports) are roe-on. The South American bay scallop (*Argopecten purpuratus*) is imported frozen from Peru roe-on, on the half shell. Muscle ‘meat’ is hard to identify without genetic fingerprinting. However, saucer scallops have a thin muscle with a large diameter, whereas most other scallops (domestic and imported) are thicker with a smaller diameter.

Size: To at least 22 cm length (commonly imported at 7–11 cm length).

Habitat: Marine and estuarine; benthic, mostly in shallow water on the continental shelf but some species extend to depths of at least 1 500 m. Occupy a range of bottom types, including sand, rubble, mud and firm substrates.

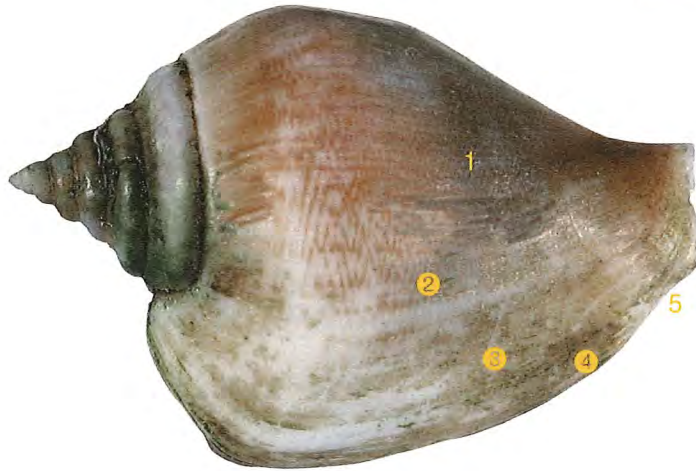
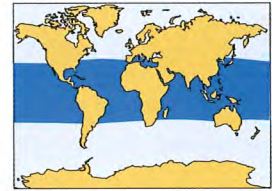
Fishery: Many scallop species are harvested, mostly trawled or dredged but increasingly farmed. For example, the South American bay scallop has traditionally been fished in coastal waters but farming of this species increased almost exponentially during the 1990s. Imports come from Asia (e.g. farmed yesso scallop, *Patinopecten yessoensis*, from Japan), New Zealand (New Zealand scallop, *Pecten novaezelandiae*), and South America.

Remarks: *Amusium* species should be labelled as ‘saucer scallop’ but are also known as ‘moon scallops’. Unique marketing names may be required for some other imported species. Other information is provided for protein fingerprints (p. 188).

Conch

Family Strombidae

Minor name: queen conch



Strombus canarium

Identifying features: ① single thick, solid shell of variable shape; ② operculum thick, horny and claw-like; ③ aperture elongated; ④ outer lip usually thickened and flaring in adults; ⑤ distinct notch along anterior margin of outer lip.

Comparisons: Distinguished from other gastropods (single-shelled molluscs) by the combination of characters above. The 'stromboid notch' on the anterior margin of the outer lip is characteristic of the family, but poorly developed in dog conch (*Strombus canarium*). Domestic periwinkles (families Littorinidae, Neritidae, Trochidae and Turbinidae) rarely have an elongated aperture. Trochus (*Trochus* species) have a conical shell and bailer shells (sub-family Zidoninae) lack an operculum.

Product: Whole and meat (frozen). Also canned.

Size: To 43 cm maximum shell length (commonly imported at 6–18 cm).

Habitat: Marine; prefer shallow water on sand, mud or rubble bottoms. Often on reef flats and occasionally among seagrasses.

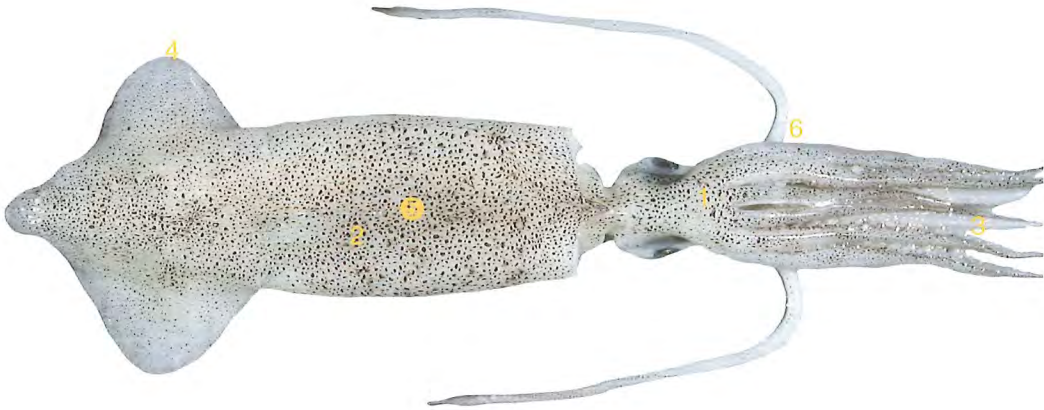
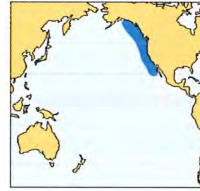
Fishery: Widely harvested by hand (wading or diving), and very common in Asian seafood markets. Dog conch, one of the major commercial species, is imported frozen to Australia. Other species, such as the central west Atlantic queen conch (*S. gigas*), have been heavily exploited and are now threatened. Trade in queen conch, which is imported canned to Australia from the US, is limited by an international convention. Aquaculture research is continuing overseas. Other imported gastropods include Japanese ivory whelk (*Babylonia japonica*) and trochus (*T. niloticus*), both from South-East Asia, and bailer shells from Fiji.

Remarks: Conchs occur off northern Australia but are rarely harvested domestically. They are widely used in the commercial shell trade. In the Philippines, dog conch shells are used as sinkers on fishing nets. Conchs are generally very active and can 'leap' along the bottom using their narrow foot and strong operculum. Other information is provided for protein fingerprints (p. 188).

Californian squid

Loligo opalescens

Minor name: market squid (US)



Identifying features: ① head and arms compact, arms short; ② mantle slender; ③ arm suckers with about 30 blunt teeth; ④ fins of medium length, rhomboidal; ⑤ a translucent, feather-like 'pen' running underneath the back; ⑥ 8 arms and 2 tentacles.

Comparisons: Squids, like octopuses, are cephalopod molluscs. Commercial species can be distinguished from octopuses by the presence of 2 long tentacles, fins and an internal shell (the 'pen'). Californian squid belongs to the family Loliginidae (loligo squid, p. 168), as do calamaris (*Sepioteuthis* species). It is best distinguished by having a compact head and short arms, a slender mantle, and 30 or so blunt teeth on each arm sucker.

Product: Whole (block frozen and canned).

Size: To almost 31 cm total length and exceeding 85 g (commonly imported at 15–20 cm total length).

Habitat: Marine; pelagic in continental shelf waters from the surface to depths of 200 m. Aggregate to spawn in nearshore waters.

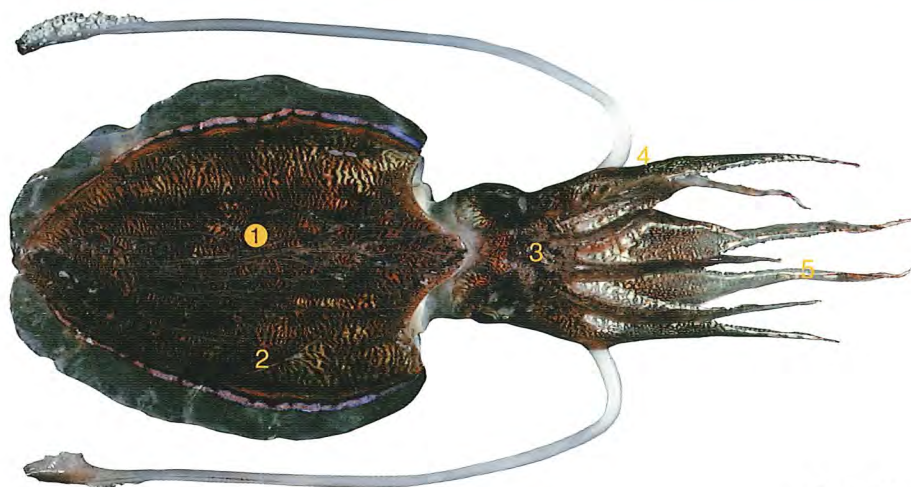
Fishery: Taken predominantly by purse seines. As in many squid fisheries, lights are used to attract spawning aggregations of Californian squid to the surface. Exported widely from the US (mainly to China in recent years), mostly block frozen. Some canned Californian squid is imported to Australia via other countries, such as Greece.

Remarks: During the early to mid-1990s, this species was California's number one fishery in terms of both catch and value. Major markets prefer animals with a mantle length of 11–13 cm. Other information is provided for protein fingerprints (p. 189).

Cuttlefish

Sepia species

Minor name: baby cuttlefish



Sepia pharaonis

Identifying features: ① calcified internal shell ('cuttlebone') along the back; ② body oval, with narrow fins around edges; ③ head relatively large; ④ 8 short arms and 2 long tentacles; ⑤ arm suckers with short teeth.

Comparisons: Cuttlefishes, like squids and octopuses, are cephalopod molluscs. They are readily distinguished from other cephalopods by the internal 'cuttlebone' and generally oval body, and from each other mainly by the shape of the cuttlebone, body coloration, and extent and shape of the mantle.

Product: Whole (cleaned, frozen and dried), 'steaks' and 'cuttle crackers'. Also shredded.

Size: To more than 50 cm in mantle length and at least 5 kg (commonly imported at 4–20 cm in mantle length).

Habitat: Marine and estuarine; primarily bottom dwelling on inshore continental shelves but occasionally on upper slopes to depths of about 600 m. Inhabit a large variety of bottom types.

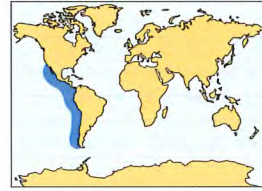
Fishery: Taken largely as trawl byproduct but also targeted using a variety of nets as well as jigs and lures. Lights are often used to attract cuttlefishes to jigs and lures. Imported mainly from South-East Asia.

Remarks: The Australian catch is insignificant in world terms. Highly regarded as foodfish but also widely used as bait. Some very small, imported whole product is labelled as 'baby cuttlefish'. In South-East Asia, cuttlefish are often dry salted, or dried and sweetened to make popular crunchy snacks. Also sometimes eaten raw. In Malaysia, preserved cuttlefish is mixed with water convolvulus (water spinach) and sold on the streets by hawkers. The taxonomy of cuttlefishes is confused and the exact composition of imports is uncertain. Cannibalism among cuttlefishes appears rather common. Other information is provided for protein fingerprints (p. 189).

Giant squid

Dosidicus gigas

Minor name: jumbo flying squid



Identifying features: ① tips of arms tapering to a thin point with numerous minute, closely set suckers; ② mantle very large, robust, thick-walled; ③ fins broad and rhomboidal, width 49–65% mantle length; ④ a translucent, feather-like ‘pen’ running underneath the back; ⑤ 8 arms and 2 tentacles; ⑥ suckers with teeth.

Comparisons: Along with illex squid (*Illex* species, p. 167), New Zealand arrow squid (*Nototodarus sloanii*, p. 169) and the domestic Gould’s squid (*N. gouldi*), giant squid belongs to the family Ommastrephidae. It is the largest member of the family and differs from other relatives in having elongated arms that taper to a thin point. Each arm has up to 200 pairs of suckers compared with up to only 35 pairs in close relatives. The name ‘giant squid’ is also popularly applied to the largest of all squids (*Architeuthis* species), which can reach 20 m in total length but have no commercial value.

Product: Tube pieces and arms (frozen).

Size: To about 400 cm total length, at least 1.2 m mantle length and 50 kg (commonly imported at 25–80 cm in mantle length and 0.5–3 kg).

Habitat: Marine; pelagic over water deeper than 200 m, from the surface to depths of 1 200 m. Adults migrate through the water column daily, spending daylight hours in deep, dark waters before ascending to depths less than 200 m overnight. Occasionally seen close inshore during feeding migrations.

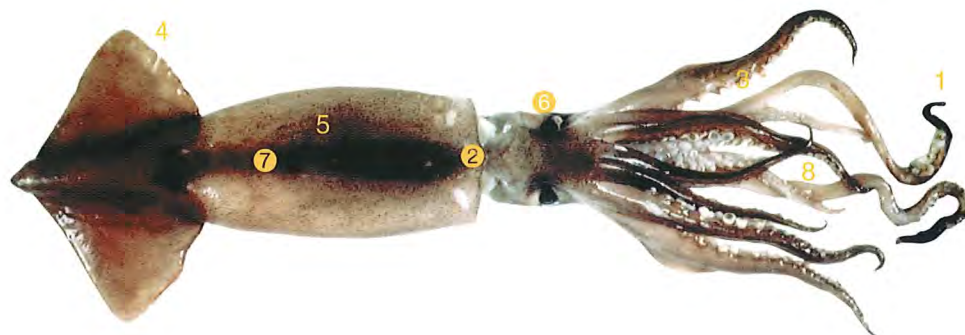
Fishery: Exploratory fishing began off South America in the 1970s and the fishery expanded dramatically during the 1990s. Mexico and Peru caught the largest volumes in recent years. Automatic and hand jigging methods are used, as well as gear such as drift nets, purse seines and handlines. Imported irregularly from South America.

Remarks: Individuals grow extremely rapidly and live for only one year. They are active predators, pursuing prey such as copepods, prawns, crabs, fish and other squids. Reportedly with good flavour and texture, and used mainly by restaurants.

Illex squid

Illex species

Minor names: calamar (AR), Argentine shortfin squid



Illex argentinus

Identifying features: ① end of tentacle with 8 longitudinal rows of small suckers; ② funnel groove smooth, without ridges or pockets; ③ arms with 2 rows of suckers; ④ fins short, rhomboidal; ⑤ torpedo-shaped body; ⑥ no transparent membrane over eyes; ⑦ a translucent, feather-like ‘pen’ running underneath the back; ⑧ 8 arms and 2 long tentacles.

Comparisons: Similar to some other domestic and imported squids but distinguished by the presence of 8 longitudinal rows of small suckers on the end of the tentacles and a smooth funnel groove. The funnel grooves of closely related commercially important species have internal or side pockets. *Illex* squid also lack the thinly pointed arm tips of the giant squid (*Dosidicus gigas*, p. 166).

Product: A variety of forms, including whole and tubes (frozen), and rings (frozen, often battered or crumbed).

Size: To at least 37 cm in mantle length (commonly imported at up to 25 cm in mantle length).

Habitat: Marine; pelagic or near the bottom from the surface to depths of about 1 000 m. More common over continental slopes than the shelves. Distribution within the water column varies between species and seasons.

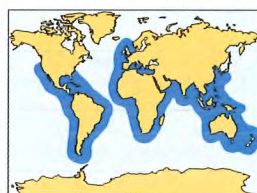
Fishery: The fishery for Argentine shortfin squid (*I. argentinus*) off Patagonia is one of the largest and commercially most important cephalopod fisheries in the world, with Argentina accessing the greatest volumes. Total annual catch has exceeded 330 000 tonnes. Local fishers are also joined by foreign vessels (e.g. the distant fishing fleets of Taiwan, Japan and Spain). Other *Illex* species also support significant fisheries. Taken by jigs and trawls, and usually processed on board. Most imported product is Argentine shortfin squid from South America, often imported from Asia after value adding. North Atlantic *Illex* species are also imported.

Remarks: The flesh of the northern shortfin squid (*I. illecebrosus*), although considered of high quality, has a high water content and deteriorates easily. Argentine shortfin squid has a lower water content but its taste is not favoured in some markets. The lifespan of these species is one to two years.

Loligo squid

Family Loliginidae

Minor name: inshore squid



Photololigo cf edulis

Identifying features: ① transparent membrane over eyes; ② suckers on arms always in 2 rows; ③ a translucent, feather-like ‘pen’ running underneath the back; ④ 8 arms and 2 tentacles; ⑤ suckers with teeth.

Comparisons: Loligo squids have a transparent membrane over the eye and 2 rows of suckers on each arm. This family includes the calamaris (*Sepioteuthis* species), which can be distinguished by their very long fins (90% or more of mantle length compared with less than 75% of mantle length in other loligo squids). Californian squid (*Loligo opalescens*, p. 164) is also a loliginid. Cuttlefishes (*Sepia* species, p. 165) possess a prominent calcified internal shell (the cuttlebone) compared with loligo squids’ translucent, feather-like ‘pen’.

Product: Whole (cleaned, frozen and dried). Also as ‘squid rings’ and tubes (frozen).

Size: To 90 cm in mantle length (commonly imported at 15–25 cm in mantle length).

Habitat: Marine; demersal or semipelagic on continental shelf and upper slope areas to depths of about 400 m. Many species are coastal, with some restricted to extremely shallow waters. Typically aggregate near the bottom during the day and disperse into the water column at night.

Fishery: Often trawled but also taken by purse seines, castnets, dipnets, tunnel nets and jigs. In many jig fisheries, lights are used to attract squids to the surface at night. Mostly imported from South-East Asia, and most dried product imported to Australia belongs to the genus *Photololigo* (e.g. Indian squid, *P. duvaucelii*).

Remarks: A number of loligo squids are taken domestically. Confusion exists in the taxonomy of this group and further work is required to accurately identify imported and domestic product. Highly valued for human consumption and very popular in Australia. Other information is provided for protein fingerprints (p. 189).

New Zealand arrow squid

Nototodarus sloanii

Minor names: calamari (AU), arrow squid (NZ)



Identifying features: ① more than 60 pairs of suckers on the first (outer) right arm; ② dorsal surface of mantle smooth, light brownish-pink with a blue or purple stripe; ③ large arm suckers with 11–13 similar-sized, flattened conical teeth; ④ fins short, rhomboidal; ⑤ torpedo-shaped body; ⑥ no transparent membrane over eyes; ⑦ a translucent, feather-like ‘pen’ running underneath the back; ⑧ 8 arms and 2 long tentacles.

Comparisons: A member of the family Ommastrephidae, and characterised by having short, rhomboidal fins, a torpedo-shaped body and no transparent membrane over the eyes. Very similar to Australia’s prized Gould’s squid (*N. gouldi*) but with more than 60 pairs of suckers on the first (outer) right arm compared with fewer than 51 suckers in Gould’s squid. Many other commercial squids have much longer fins.

Product: Usually processed and often crumbed as ‘squid rings’ or, incorrectly, ‘calamari rings’ (frozen). Also whole, tubes and arms (frozen).

Size: To 42 cm in mantle length and 1.4 kg (commonly imported at 20–25 cm in mantle length).

Habitat: Marine; pelagic in continental shelf and slope waters, usually in depths of less than 200 m but sometimes taken to about 500 m.

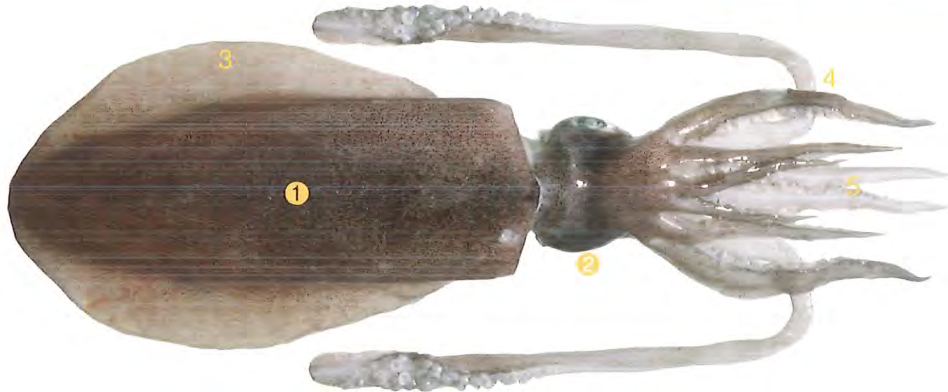
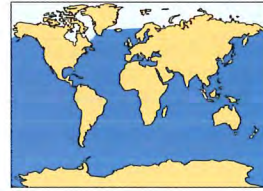
Fishery: Mostly trawled off New Zealand’s South Island, but sometimes jigged. Since the late 1960s, New Zealand’s lucrative squid stocks have been targeted by foreign vessels, including Japanese, Taiwanese and Korean.

Remarks: New Zealand arrow squid and Gould’s squid both occur in New Zealand waters but the former dominates the fishery and imports to Australia. Although the two species are very similar, imported product is usually trawl caught and therefore of lower quality than jigged product.

Squid

Order Teuthoidea

Minor names: none



Sepioteuthis lessoniana

Identifying features: ① a translucent, feather-like ‘pen’ running underneath the back; ② with or without a transparent membrane over the eyes; ③ fin length variable, often less than half mantle length; ④ 8 arms and 2 tentacles; ⑤ suckers with teeth.

Comparisons: Members of the order Teuthoidea have 8 arms, 2 tentacles and an internal cartilage ‘pen’ running underneath the back. The closely related cuttlefishes (*Sepia* species, p. 165) have an internal calcified ‘cuttlebone’. Numerous characters—many technical, and challenging even for experts—are used to distinguish squid species from one another. Some of the simpler ones are mantle shape, shape and extent of fins, number and arrangement of suckers, and number and shape of teeth-like sucker spines and hooks.

Product: Wide variety of forms, including whole (cleaned, and dried or frozen), tubes (frozen), rings (frozen, frequently battered or crumbed), pickled, smoked and canned. Some canned product includes other ingredients (e.g. ‘fried squid in soya bean sauce’). Also squid ‘chips’.

Size: To 90 cm in mantle length.

Habitat: Marine and estuarine; mostly pelagic over continental shelves and upper slopes, but travel freely through the water column.

Fishery: Widely caught by trawls, purse seines, castnets, dipnets, tunnel nets and jigs. Imported from numerous countries in South-East Asia as well as New Zealand, South America and the US.

Remarks: A number of domestic and imported species may be sold under separate marketing names. Some South American product imported to Australia is value added in Asia (e.g. crumbed or battered in Malaysia). Dried smoked strips of squid, a Japanese snack food, are imported from South-East Asia. Some ‘squid rings’ sold in Australia are actually surimi-based products that contain only a little squid. These imitation products are much softer than authentic squid rings. Other information is provided for protein fingerprints (p. 189).

Miscellaneous seafoods

G. K. Yearsley and P. R. Last

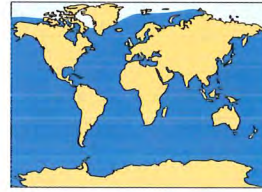
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8

Jellyfish

Class Schyphozoa

Minor names: ubur-ubur (MY), mang ka proon hang (TH)



Aurelia aurita

Identifying features: ① tentacles sometimes present around bell margin; ② oral arms usually present under centre of bell; ③ distinct hemispherical-shaped bell containing gelatinous material; ④ radially symmetrical.

Comparisons: Distinct as whole or processed products. The oral arms of 'edible jellyfish' (*Rhopilema esculenta*) are covered with filamentous and large fusiform appendages.

Product: Semi-dried after dry salting, often using a mixture of table salt and alum.

Size: To 100 cm bell width and exceeding 50 kg, although most harvested species reach only 50 cm (commonly imported to 30 cm).

Habitat: Marine and estuarine; coastal and offshore surface waters, mostly in depths to 40 m.

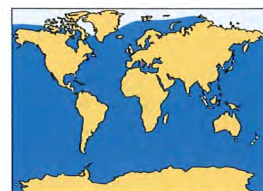
Fishery: Aggregations targeted mostly in Asia by seines, trawls, driftnets, gillnets, and dipnets. 'Edible jellyfish' is the most commercially important species. Imported mainly from China.

Remarks: Small fisheries exist off Australia, particularly for jelly blubber, *Catostylus mosaicus*. Jellyfish fisheries display considerable seasonal fluctuations. The worldwide catch exceeded 520 000 tonnes in 1997, with over 400 000 tonnes taken by China, and most of the remainder taken elsewhere in Asia. For some species, the bell and oral arms are utilised while for others only the bell, which usually fetches a higher price than the oral arms, is processed. Considered a delicacy in many parts of Asia, the rubbery texture is valued by the Chinese. Also used for medicinal purposes. The processed products are not suitable for the protein fingerprint test used here.

Beche-de-mer

Families Holothuriidae & Stichopodidae

Minor names: hai-sum (CN), sea cucumber, trepang



Holothuria scabra

Identifying features: ① tapering, semi-cylindrical body; ② circle of retractile tentacles around mouth; ③ body wall usually covered with small or minute spicules, giving surface a rough feel.

Comparisons: Easily distinguishable from close relatives such as sea urchins by their tapering, semi-cylindrical body. Species identification is often difficult, requiring specimen dissection and specialist knowledge of the calcareous skeleton that encircles the pharynx and of the calcareous spicules.

Product: Whole (frozen and some fresh), but mostly dried. Product from US usually sliced ready to use.

Size: To about 70 cm in length and more than 8 kg (commonly imported at 25–40 cm in length and up to 2 kg live weight).

Habitat: Marine and estuarine; benthic, from brackish inshore waters to depths exceeding 2 000 m. Most common on inshore reefs and in lagoons where they are found on sand or mud or in coral or rock crevices.

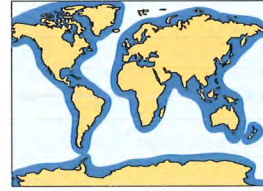
Fishery: Mostly harvested by hand, by wading on reefs at low tide, or by free-diving from the shore or small boats. A dozen or so species are commercially important in Asia and a few are imported. Most imports are from China (various species) and the US (Californian sea cucumber, *Parastichopus californicus*). Also imported from elsewhere in South-East Asia and the South Pacific.

Remarks: Also harvested domestically, with most local product exported. A preferred seafood delicacy in oriental markets, and some species considered to have high medicinal value. Generally high priced, and served mainly on special occasions. In South-East Asia, beche-de-mer is sometimes added to vegetable soups and stews. Most international trade of beche-de-mer is in the dried form. The processed products are not suitable for the protein fingerprint test used here.

Nori

Porphyra species

Minor name: hoshi-nori



Porphyra yezoensis

Identifying features: ① dark purple or brownish red when alive; ② frond blades very thin and membranous, and spear-shaped or broadly oval; ③ holdfast constructed from several filaments.

Comparisons: Red algae (Rhodophytes) such as *Porphyra* species can usually be recognised by their reddish, brownish or purplish coloration. There are some 4 500 species of red algae worldwide and identification often requires microscopic examination of cell arrangement and reproductive structures. Other seaweeds used for similar purposes (*Monostroma*, *Enteromorpha* and *Ulva* species) belong to a different group (Chlorophytes) and are usually green in colour.

Product: Dried sheets.

Size: To 100 cm in length (commonly imported at up to 35 cm).

Habitat: Marine and estuarine; attached to rocks or other plants in intertidal and subtidal areas. Highly seasonal in appearance and growth.

Fishery: Cultivated extensively in muddy bays in Japan, China, and Korea where it is harvested in winter. The main mariculture species is *P. yezoensis*. Imported dried from Japan.

Remarks: *Porphyra* species produce 'hoshi-nori' whereas nori made from green algae is called 'aonori'. Nori is used extensively as sushi wrap, and is also cut and sprinkled on various dishes. It contains substantial amounts of protein, vitamins and minerals. In Ireland and Wales, *Porphyra* species are prepared as a pinkish jelly by heating with minimal water and beating with a fork. Other imported seaweeds that may require separate marketing names include kombu (which is a type of kelp) and wakame (a soft seaweed added to miso soup and other dishes). The processed product is not suitable for the protein fingerprint test used here.

Protein fingerprinting

R. D. Ward, R. K. Daley, and G. K. Yearsley

9

Introduction

Two fillets on a slab may look very similar, but how can you tell if they are from the same species, or from the species claimed? Colour, shape and muscle structure give important clues, but are often not enough to provide a firm identification. Genetic testing provides a way, because the genes of different species have changed over evolutionary time and are never identical.

There are many methods of genetic testing. These vary in their accuracy and in the time, labour and equipment required. The technique used here is inexpensive and simple. Results can be achieved in less than one hour and the equipment is portable. The procedure, known as protein electrophoresis, has been used previously for fish identification (e.g. Shaklee and Keenan, 1986; Daley *et al.*, 1997) and was used in the domestic species handbook (Yearsley *et al.*, 1999).

How protein fingerprinting works

Proteins are large molecules and are essential components of all living cells. They regulate chemical reactions in the cell, and provide components for membranes. Some carry essential substances through an organism (e.g. haemoglobin in our blood carries oxygen to cells) and others act as hormones (chemical messengers). There are thousands of different proteins and each one is 'built' from instructions carried in the DNA. Slight differences in these instructions in a gene can lead to small changes in either the size or electric charge of a particular protein molecule, even though the protein will still carry out its usual functions. Two similar proteins, which have different sizes or a different electric charge, move at different speeds when an electric current is applied to them. They can therefore be separated. This is the principle behind protein electrophoresis—difference in protein movement in an electric field indicates a difference in protein structure, which in turn indicates a genetic difference.

A sample of muscle tissue from a fish or invertebrate may contain thousands of proteins, but most will be present in only very small amounts. Because protein electrophoresis detects only the most abundant proteins, the protein patterns ('fingerprints') are normally quite simple. They usually differ between species, which makes identification of samples possible.

This method applies only to the identification of fresh or frozen material—any dried, canned or cooked product requires DNA tests. Protein fingerprints are therefore not available for the dried or smoked tissues from jellyfish or beche-de-mer. DNA tests may also be needed if problems arise with protein fingerprinting for species identification, or if the results need legal confirmation.

Checking an identification

If a fillet is claimed to be from species X, but the claim needs to be tested, that fillet's protein fingerprint can be determined and compared with the figure given for species X here. If there are obvious major differences, it's unlikely to be species X. However, slight differences can occur between electrophoretic tests run on different days, and a better procedure is to run a sample from a known specimen of species X beside the fillet to be tested. The protein fingerprints can be compared with one another and with the figure of species X given here. If the protein fingerprint of the fillet differs from that of species X, but is similar to that of another species, Y, the fillet sample should be run beside known samples of both species X and Y.

Reading protein fingerprint figures

The protein fingerprint of each species is compared with a 'standard' protein fingerprint—a mixture of chicken albumen and a crude protein extract from redfish (*Centroberyx affinis*). The standard gives seven well-defined bands: P5 is the fastest (the chicken albumen band), followed by P4, P3, P2 and P1—all located above the point of application of the protein mix at the origin (O); P0 is on or close to O; P-1 migrates below O.

Protein fingerprint descriptions in the text are approximate. For example, a band stated to be 'at P1.3', is about a third of the way between P1 and P2. These relative mobilities can vary a little, but not significantly. Faint staining bands not recorded in the diagrams may be seen; these sometimes occur in some individuals of a species but not others. They are disregarded here. The positions of bands migrating close to or below O can vary significantly, and are not generally used for diagnostic purposes.

Sometimes one or more bands vary among individuals of the same species. This usually reflects genetic variation (also called polymorphism) for that protein, and could result in mis-identification. Where possible, at least eight individuals of each species were examined to determine the extent of such variation. Common patterns are included in the figures but others may occur. Such undescribed variants will be very similar to the described patterns (usually differing by only a single band) and will usually still be identifiable. Some very closely related species have identical protein fingerprints. Supplementary allozyme tests (as in Daley *et al.*, 1997) or DNA tests are then needed for accurate identification.

In the figures—diagrammatic representations of the gels—groups (dogfishes, ghostsharks, *etc.*) are ordered alphabetically and species within groups by scientific name. In most cases where an imported species also occurs locally, the protein fingerprint shown is of domestic samples. Fingerprints of some domestic-only species are given for comparative purposes. Figures are labelled above by marketing name, with scientific names provided in the caption. The marketing name is given a suffix (1, 2, 3, *etc.*) where it covers more than one species. Common variants are further suffixed in the marketing name by the letters A, B or C. Common names, marked with a cross (†), are used for species that lack a marketing name.

Technical details

Protein separation used Titan III cellulose acetate gel plates, from Helena Laboratories. Equipment needs are a power pack, electrophoresis chamber, and an inexpensive microcentrifuge.

To test a sample, a small piece of white muscle was homogenised in a few drops of water in a 1.5 mL microcentrifuge tube. Fish tissue was taken from the 'shoulder'. Tissues tested in invertebrates were: crustaceans—abdominal muscle; sea snails—foot muscle; bivalves—adductor muscle; squids—mantle. The mixture was centrifuged at about 10 000g at room temperature for three minutes, and the supernatant used for electrophoresis.

Up to twelve samples can be electrophoresed simultaneously on a single 76 x 76 mm plate using the Helena Super-Z12 system. Lanes 1 and 12 were left empty (outside samples can run unevenly), the standard protein mix (see above) was placed in lanes 2 and 11, and the test samples in lanes 3 to 10. A tris glycine buffer system was used (0.02 M tris, 0.192 M glycine; Hebert and Beaton, 1993) for 25 minutes at 200 V at room temperature. The plates were then stained with a protein stain, Coomassie Blue (0.2% Coomassie Blue in a mixture of 6 parts water to 4 parts methanol to 1 part glacial acetic acid) for 5 to 15 minutes. Unbound stain was removed by washing in a destaining solution (the stain solution without Coomassie Blue). Gels were then digitally photographed and dried for future reference.

Sharks

Dogfishes (Fig. 9.1)

Two species examined, both in the domestic species handbook. The domestic/imported white-spotted dogfish (*Squalus acanthias*) and the domestic spikey dogfish (*S. megalops*) are clearly separable and both show variation, which is documented in the domestic species handbook.

Ghostsharks (Fig. 9.1)

Four species examined, one not in the domestic species handbook. The imported-only ghostshark-2 (*Hydrolagus novaezealandiae*) presented two types, possibly different species. The major band of Type A (two of three specimens) is at P1, that of Type B (one specimen) at P2; both can be readily distinguished from the two domestic species (*H. lemures* and *H. ogilbyi*), which have the major band at P1.6. The domestic/imported elephantfish (*Callorhynchus milii*) has two strong bands at or near P-1. Additional comments are provided in the domestic species handbook.

Hound sharks (Fig. 9.1)

Two species examined, one not in the domestic species handbook. The imported-only gummy shark-2 (*Mustelus lenticulatus*) can be distinguished from the domestic gummy shark-1 (*M. antarcticus*) by a double band in the P1–P2 range (versus single) and by differences in the cathodal region.

Whaler sharks (Fig. 9.1)

Five species examined, all in the domestic species handbook. The domestic/imported species, blacktip shark-1 (*Carcharhinus dussumieri*), bronze whaler shark-1 (*C. obscurus*), blacktip shark-2 (*C. sorrah*) and blacktip shark-4 (*Rhizoprionodon acutus*), are separable from each other and from the domestic-only blacktip shark-3 (*C. tilstoni*). Additional comments are provided in the domestic species handbook.

Bony fishes

Australian salmon (Fig. 9.2)

Two species examined, both in the domestic species handbook. The domestic/imported Australian salmon-1 (*Arripis trutta*) and the domestic-only Australian salmon-2 (*A. truttaceus*) have the same patterns. Additional comments are provided in the domestic species handbook.

Batfishes (Fig. 9.2)

Three domestic/imported species examined, all in the domestic species handbook. These species, butterfish-1 (*Scatophagus argus*), butterfish-2 (*S. multifasciatus*) and butterfish-3 (*S. sp.*), have similar but separable patterns. Additional comments are provided in the domestic species handbook.

Breams (Fig. 9.2)

One domestic/imported species examined, also in the domestic species handbook. The snapper (*Pagrus auratus*) is distinguished from other domestic breams by a major band at P1 and no bands between P1 and P2.

Carp (Fig. 9.2)

Two species examined, one not in the domestic species handbook. The imported-only barb-1 (*Barbonymus altus*) is similar to the related domestic/imported European carp (*Cyprinus carpio*), but its major band is just below rather than just above P2. Comments on other domestic carps are in the domestic species handbook.

Catfishes (Fig. 9.2)

Seven species examined, five not in the domestic species handbook. The imported-only sheatfish (*Kryptopterus apogon*) shows a distinctive triplet of bands at and below P3, with lower bands weak or absent. The imported-only royal basa (*Pangasius bocourti*) has an identical fingerprint to a second imported-only basa, basa-2 (*P. hypothalamus*); both are characterised by a pair of major bands at about P2.3 and P2.4. A third imported basa, basa-1 (*P. conchophilus*), is characterised by major bands at P2.3 and at P3. The imported-only snake catfish-1 (*Clarias batrachus*) has a major band at about P2.4 with minor bands at P2.2 and P1.7. Comments on the domestic-only species catfish-1 (*Arius thalassinus*) and freshwater catfish (*Tandanus tandanus*) are provided in the domestic species handbook.

Cods (Fig. 9.3)

Twelve species examined, nine not in the domestic species handbook. The imported-only Alaskan pollock (*Theragra chalcogramma*) has four more-or-less equally spaced bands from just above the origin to about P3.6. The imported-only Atlantic cod (*Gadus morhua*) shows three major bands at about P1.6, P1.8 and P2.4. The two hoki species, the imported-only hoki-1 (*Macruronus magellanicus*) and the domestic/imported blue grenadier (*M. novaezelandiae*), show very similar patterns with major bands at P1.8 and P2.5; the apparent lack of a strong band in the P0.5 region in our specimens of *M. magellanicus* might reflect specimen degrada-

Bony fishes (cont.)

tion rather than true absence. Five species of hakes (*Merluccius*) were examined; all can be discriminated. The domestic/imported *M. australis* has a major (sometimes weak) band at P1; the other species (all imported-only) have strong bands at P1.7 (*M. merluccius*), P1.2 (*M. capensis*), P0.9 (*M. gayi*), P0.7 (*M. paradoxus*). In *M. capensis*, the P1.2 band was present as a single band in four of seven specimens (Type A) and as a pair of closely-coupled bands in three specimens (Type B). *M. gayi* showed three variants: Type A (three of eight specimens) with a minor band at P2.6; Type B (two specimens) with a major band at P0.6; Type C (three specimens) lacking the P2.6 minor band and with a minor rather than major band at P0.6. The imported-only North Sea whiting (*Merlangius merlangus*) is characterised by a pair of bands flanking P2 and southern blue whiting (*Micromesistius australis*) by major bands at P0.5, P1.6 and P2.5. The imported/domestic southern rock cod (*Pseudophycis bachus*) has an identical protein pattern to the domestic southern rock cod (*P. barbata*).

Dories (Fig. 9.4)

Four species examined, all in the domestic species handbook. The domestic/imported John dory (*Zeus faber*), king dory (*Cyttus traversi*) and mirror dory (*Zenopsis nebulosus*), and the domestic-only silver dory (*Cyttus australis*), all have a band at P1 and a weak band at P3 (sometimes this band may be too weak to be apparent), but the species can be distinguished. Additional comments are provided in the domestic species handbook.

Eels (Fig. 9.4)

Four species examined, two not in the domestic species handbook. The imported eel-2 (*Monopterus albus*) can be readily separated from other eels by a triplet of bands just below P2. The imported-only eel-1 (*Macrogathus siamensis*) is somewhat similar to the domestic/imported *Anguilla* species but can be separated by a major band at or just below P1 rather than just above P1. Additional comments on the *Anguilla* species are provided in the domestic species handbook.

Emperors (Fig. 9.4)

Five domestic/imported species examined, all in the domestic species handbook. Redspot emperor (*Lethrinus lentjan*), seabream-1 (*Gymnocranius grandoculis*), seabream-2 (*G. elongatus*), seabream-3 (*G. sp.*) and spangled emperor (*L. nebulosus*) are all particularly similar, sharing a major band at P1.2 and a band at P0.5. *G. grandoculis* and *G. sp.* cannot be separated. Additional comments are provided in the domestic species handbook.

Flatfishes (Fig. 9.5)

Ten species examined, seven not in the domestic species handbook. All flatfishes except the *Rhombosolea* species could be readily distinguished. The imported-only sand flounder (*R. plebeia*) has a very similar pattern to the domestic/imported greenback flounder (*R. tapirina*), with a pair of major bands at about P2 and P2.4; the imported-only yellowbelly flounder (*R. leporina*) can be distinguished by a triplet of bands at and below P2. The imported-only New Zealand brill (*Colistium guntheri*) has a pair of major bands flanking P2 and other major bands at P1.4 and P0.5. Two types of the imported-only lemon sole (*Pelotretis flavilatus*) were observed: Type A has a double band at P0.6/P0.8 (two of four specimens) and Type B has a

Bony fishes (cont.)

single band at P0.8 (two specimens). The imported-only New Zealand sole (*Peltorbamphus novaezeelandiae*) has major bands at P2 and P2.8. The imported-only sole-1 (*Cynoglossus arel*) has a major band at P2.4 and a minor band at P1.5. The imported-only plaice (*Pleuronectes platessa*) has three major bands at P1.8, P2.1 and P3; variation for minor bands in the region of P1 could not be well-resolved. Additional comments, including on the domestic/imported Australian halibut (*Psettodes erumei*) and sole-2 (*Paraplagusia bilineata*) are provided in the domestic species handbook.

Freshwater perches (Fig. 9.5)

Two species examined, one not in the domestic species handbook. Substitutions of the imported-only Nile perch (*Lates niloticus*) for the domestic/imported barramundi (*L. calcarifer*) have occurred; these two species can be readily distinguished as the fastest major band in *L. niloticus* is at P2.5 compared with P3 in the *L. calcarifer*. Additional comments are provided in the domestic species handbook.

Gemfishes (Fig. 9.6)

Five species examined, one not in domestic species handbook. All can be distinguished. An escolar-1 fillet (*Lepidocybium flavobrunneum*, Type B) imported from Taiwan had a band at P0.6 rather than the P0.3 of the domestic product (Type A). More than one species of *Lepidocybium* may occur in the region. The mostly-imported ribbonfish-1 (*Trichiurus lepturus*), which was not profiled in the domestic species handbook, has a triplet of bands between P2 and P2.5, although in one of two specimens the central band was weak. Additional comments on the domestic/imported species are provided in the domestic species handbook.

Gobies (Fig. 9.6)

Three imported-only species examined. Golden goby (*Glossogobius aureus*) and marbled goby (*Oxyeleotris marmorata*), are indistinguishable despite being in separate families; both have major bands at P0.5, P1.5 and P2.5 and no clear minor bands. Major bands at these positions also characterise the mudskipper (*Pseudapocryptes elongatus*), which also has bands at P1.8 and P2.

Gouramis (Fig. 9.6)

Two imported-only species examined. Major bands at P0.5, P1.5 and P2.5 characterise the gourami (*Trichogaster pectoralis*). The climbing perch (*Anabas testudineus*) is characterised by a major band at P1.8 and minor bands at P1 and P2.

Grunter breams (Fig. 9.6)

One domestic/imported species examined, also in the domestic species handbook. The sweetlip bream (*Diagramma pictum*) has a close-coupled pair of bands at P2 and a band at P0.3. Comments on other grunter breams are provided in the domestic species handbook.

Gurnards (Fig. 9.6)

Two species examined, both in the domestic species handbook. They share a common band

Bony fishes (cont.)

at about P1.5, which is strong in the domestic/imported red gurnard (*Cbelidonicbthys kumu*) and weak in the domestic latchet (*Pterygotrigla polyommata*). Comments on other species are provided in the domestic species handbook.

Herrings (Fig. 9.7)

Five species examined, three not in the domestic species handbook. All species readily distinguishable. The imported-only herring (*Clupea barengus*) has major bands at just below the origin, at P1.2, and at P1.8. An imported shad, *Tenualosa* sp., has two major bands, one just below the origin, one at P1.6, plus a close-coupled band pair just below P1. The two pilchards, the domestic pilchard-1 (*Sardinops neopilchardus*) and the imported-only sardine-1 (*Sardina pilchardus*), are characterised by the major bands being between the origin and P-1; in *Sardinops neopilchardus* as a close-coupled pair at P-0.7 and P-1, in *Sardina pilchardus* as a less closely-coupled pair at P-0.3 and P-1. Additional comments, including on the Australian anchovy (*Engraulis australis*), are provided in the domestic species handbook.

Icefishes (Fig. 9.7)

One domestic/imported species examined, also in the domestic species handbook. The Patagonian toothfish (*Dissostichus eleginoides*) is characterised by strong bands at P1.9 and P0.8, together with weaker fast moving bands at P2.9 and P3.9.

Jewfishes (Fig. 9.7)

Three species examined, none of which are in the domestic species handbook. The imported-only jewfish-1 (*Chrysochir aureus*) has major bands at P0.1, P1.9, and P2.5, and a close-coupled pair of minor bands just above P3. The imported-only jewfish-2 (*Larimichthys polyactis*) is distinguished by major bands at or close to P2, P3 and P4, and by bands below P2 being weak or absent. The domestic/imported jewfish-3 (*Otolithes ruber*) has major bands at about P0.7 and P1.8. Comments on other species are provided in the domestic species handbook.

Knifefishes (Fig. 9.7)

One species examined, not in the domestic species handbook. The imported-only knifefish (*Cbitala ornata*) has a single major band at about P2.3.

Leatherjackets (Fig. 9.7)

Two domestic/imported species examined, both in the domestic species handbook. Leatherjacket-1 (*Aluterus monoceros*) and velvet leatherjacket (*Parika scaber*) are easily separable by bands in the P1–P2 region. *Parika scaber* shows variation: four specimens were Type A, four were Type B. Comments on other species are provided in the domestic species handbook.

Lings (Fig. 9.7)

One species examined, also in the domestic species handbook. The domestic/imported pink ling (*Genypterus blacodes*) is compared with other domestic lings in the domestic species handbook.

Bony fishes (cont.)

Lizardfishes (Fig. 9.7)

One imported-only species examined. The Bombay duck (*Harpadon nebereus*) specimens were in poor condition; only minor bands were seen, at P2 and P3.7.

Mackerels & tunas (Fig. 9.8)

Seven species examined, one not in the domestic species handbook. The imported-only Atlantic mackerel (*Scomber scombrus*) can be distinguished from the domestic blue mackerel (*Scomber australasicus*) by a major band at P0.5 rather than a minor band, and by differences in bands below the origin. Comments on other species are provided in the domestic species handbook.

Milkfishes (Fig. 9.8)

One domestic/imported species examined, also in the domestic species handbook. Milkfish (*Chanos chanos*) is characterised by a major band at P0.7 and a pair of bands at P0.2 and P0.4.

Moonfishes (Fig. 9.8)

One domestic/imported species examined, also in the domestic species handbook. The moonfish-1 (*Lampris guttatus*) has a very similar pattern to the domestic moonfish (*L. immaculatus*), which is figured in the domestic species handbook. The weak bands migrating just above P1 appear less readily detectable in *L. guttatus* than in *L. immaculatus*. The two major bands depicted just above and at O sometimes fail to separate.

Morwongs (Fig. 9.9)

Two species examined, both in the domestic species handbook. The domestic/imported morwong-1 (*Nemadactylus macropterus*) has an identical protein fingerprint to the domestic morwong-2 (*N. sp.*), but both can be distinguished from other morwongs by having a band at P3. Comments on other species are provided in the domestic species handbook.

Noodlefishes (Fig. 9.9)

One imported-only species examined. The Asian whitebait-1 (*Neosalanx brevirostris*) is identifiable by a triplet of bands at P2.4, P2.7 and P3, and by a band at P1.8.

Ocean perches (Fig. 9.9)

Two domestic/imported species examined, both in the domestic species handbook. Ocean perch-1 (*Helicolenus barathri*) and ocean perch-2 (*H. percooides*) have identical protein fingerprints. These species are distinguishable from other domestic ocean perches by the presence of a major band at P1.5. Comments on other species are provided in the domestic species handbook.

Bony fishes (cont.)

Oreos (Fig. 9.9)

Three species examined, all in the domestic species handbook. The domestic/imported black oreo-1 (*Allocyttus niger*), domestic black oreo-2 (*A. verrucosus*) and domestic/imported smooth oreo (*Pseudocyttus maculatus*) are all distinguishable. *A. niger* and *A. verrucosus* lack bands in the P2.5 region, and can be separated from each other by the presence of a major band at P0.5 in *A. niger* (otherwise absent). *P. maculatus* has a pair of equally staining tightly coupled bands at P2.5. Additional comments are provided in the domestic species handbook.

Pearl perches (Fig. 9.9)

Four species examined, all in the domestic species handbook. The domestic/imported pearl perch-1 (*Glaucosoma buergeri*) is distinguishable from the other three (domestic-only) pearl perches. It is similar to pearl perch-2 (*G. magnificum*) but has a strong band below P-1 (otherwise absent). Additional comments are provided in the domestic species handbook.

Pomfrets (Fig. 9.10)

Three species examined, all in the domestic species handbook. While they possess bands in common, they can all be distinguished. Ray's bream-1 (*Brama brama*) has a major band at P1 while the other two species have a major band at P0.3. The latter two (domestic) species can be distinguished by Ray's bream-2 (*Taractichthys longipinnis*) having a minor band at P1.3 while Ray's bream-3 (*Xenobrama microlepis*) has a minor band at P1. One of the three *T. longipinnis* examined showed an extra band at P0.4 (not figured).

Rockcods (Fig. 9.10)

Ten species examined, two not in the domestic species handbook. The latter two species are both domestic/imported coral trouts (*Variola albimarginata* and *V. louti*). Protein fingerprints of these two species, which are also known as coronation trouts, are identical to one another, with a pair of major bands flanking P2 (the faster the more intense) and a minor band at P0.5. This pattern is somewhat similar but distinguishable from the pattern shown by three species of domestic/imported coral trouts of the genus *Plectropomus*. These have a pair of major bands at and just below P2 (this pair sometimes fails to separate giving an apparently single broad band) and minor bands at P1 and P0.5. Comments on other species are provided in the domestic species handbook.

Roughies (Fig. 9.11)

One domestic/imported species examined, also in domestic species handbook. Orange roughy (*Hoplostethus atlanticus*) differs from domestic relatives in the presence of bands just above and just below P2. About half of all *H. atlanticus* also have a band at P2 (Type A) that the other half lack (Type B). The P1 band sometimes separates into a weak band at P1 and a strong band at P0.9. Comments on other species are provided in the domestic species handbook.

Salmons (Fig. 9.11)

Six species examined, one not in domestic species handbook. The three samples of imported-

Bony fishes (cont.)

only chinook salmon (*Oncorhynchus tshawytscha*) gave weak and diffuse bands in the P1 to P2 region, suggesting that they were in a poor state of preservation. It was therefore difficult to distinguish between *O. tshawytscha* and the other salmon and trouts, trout-1 (*O. mykiss*), Atlantic salmon (*Salmo salar*) and trout-2 (*S. trutta*). Whitebait-1 (*Galaxias maculatus*) from New Zealand (Type C) can be distinguished from the Australian samples of the same species (Types A and B) by having a band just above P2, and by a major band at P1.6 rather than P1.7. Further work is required on juveniles and adults of these fishes to confirm identifications. The domestic whitebait-2 (*Lovettia seali*) is distinguished from *G. maculatus* by having its major band at P2 rather than below P2. Comments on other species are as in the domestic species handbook.

Sandperches (Fig. 9.11)

Two imported-only species examined. The blue cod (*Parapercis colias*) is characterised by a pair of major bands at P1.1 and P1.6, and by a major band close to P-1. The South American flathead (*Percophis brasiliensis*), not a flathead at all but rather a sandperch related to the blue cod, has a major band at about P1.9 and minor bands at P1.6 and P0.8.

Snakeheads (Fig. 9.12)

One imported-only species examined. The snakehead-1 (*Channa striata*) is characterised by major bands at P0.5 and P2. Of seven individuals examined, one (from Vietnam) only appeared to have the slower of the two close-coupled bands near P2.5.

Threadfin breams (Fig. 9.12)

Three domestic/imported species examined, all in the domestic species handbook. Threadfin bream-1 (*Nemipterus furcosus*) and threadfin bream-2 (*N. peronii*) have a major band at P1.2 whereas threadfin bream-3 (*Scolopsis teaniopterus*) has a major band at P1.5. Comments on other species are provided in the domestic species handbook.

Threadfin salmon (Fig. 9.12)

Two domestic/imported species examined, both in the domestic species handbook. Blue threadfin (*Eleutheronema tetradactylum*) is easily separated from king threadfin (*Polydactylus macrochir*) by the presence of a major band at P1.5 and the absence of a major band at P2.

Tilapias (Fig. 9.12)

One imported species examined. The tilapia (*Oreochromis mossambicus*) is characterised by a major band at P1.8 and a pair of minor bands at P0.5 and P1. The latter two bands were of about equal intensity in two individuals; in two further samples the P0.5 band was markedly more intense. The identification of tilapia specimens is confused by the presence of hybrids.

Trevallas (Fig. 9.12–9.13)

Six species examined, one not in the domestic species handbook. The domestic/imported blue-eye trevalla-1 (*Hyperoglyphe antarctica*) and the domestic blue-eye trevalla-2 (*Schedo-*

Bony fishes (cont.)

pbilus labyrinthica) are identical (but can be distinguished by an allozyme test). White warehou (*Seriolella caerulea*) is very similar to the two blue-eye trevallias but the band in the P0.5 region is faint or absent. The mostly domestic silver warehou (*S. punctata*) has a slightly slower band in the P1 region than the two blue-eye trevallias whereas in the domestic/imported blue warehou (*S. brama*) the band is slightly faster. Two forms of the imported-only silver pomfret (*Pampus argenteus*) were seen: one (Type A, four of eight specimens) with three bands in the P1.5 to P2 region, one (Type B, four specimens) with a single major band at P2. Bands in the P1 to P-1 region were weak. The taxonomy of *Pampus* species is confused and the observed differences may reflect separate species. Comments on other species are provided in the domestic species handbook.

Trevallies (Fig. 9.13)

Seven species examined, two not in the domestic species handbook. The mostly imported trevally-1 (*Atule mate*) has a major band at P1, and a pair of major bands between the origin and P-1. The mostly domestic black trevally (*Caranx lugubris*) has a pair of major bands at P1 and P1.3, similar to other trevallies of the genus *Caranx* (see domestic species handbook). The domestic samson fish-1 (*Seriola dumerili*) and the domestic/imported yellowtail kingfish (*S. lalandi*) are very similar to each other. Comments on other species are provided in the domestic species handbook.

Tropical snappers (Fig. 9.14)

Seven species examined, one not in the domestic species handbook. The domestic red bass (*Lutjanus bohar*), is distinguished from other domestic/imported tropical snappers (*L. sebae*, *L. erythropterus*, and *L. malabaricus*) by having two major bands at P1.6 and P0.5, with additional well-defined bands at P2.6 and P1. Note that crimson snapper, *L. erythropterus*, sometimes has a minor band at P1, not shown in the figure. Rosy snapper (*Pristipomoides filamentosus*) has three Types: Type A—major bands at P1.1 and P0.9; Type B—no P1.1 band, major band at P0.9; Type C—major band at P1.1, no P0.9 band. These three Types are all separable from the closely related goldband snappers, *P. multidens* and *P. typus*. Additional comments are provided in the domestic species handbook.

Trumpeters (Fig. 9.14)

One domestic/imported species examined, also in the domestic species handbook. The striped trumpeter (*Latris lineata*) has a pair of major bands at P1.3 and P0.6. Comments on another species are provided in the domestic species handbook.

Wrasses (Fig. 9.14)

One domestic/imported species examined, also in the domestic species handbook. The parrotfish-1 (*Scarus ghobban*) can be distinguished from most other commercial wrasses by a major band just above P1. Comments on other species are provided in the domestic species handbook.

Crustaceans

Bugs & rocklobsters (Fig. 9.15)

Nine species examined, all in the domestic species handbook. All except Balmain bug-2 (*Ibacus peronii*) and western rocklobster (*Panulirus cygnus*) are potentially imported. Balmain bug-1 (*I. novemdentatus*) and Balmain bug-2 are characterised by a major band at P2.4. Balmain bug-3 (*I. pubescens*), Moreton Bay bug-1 (*Thenus indicus*) and Moreton Bay bug-2 (*T. orientalis*) have a major band at about P2.1. Note that the Balmain bug-3 (*Ibacus pubescens*) was referred to by its old scientific name (*I. ciliatus*) in the domestic species handbook protein fingerprint chapter. The four rocklobster species examined, southern rocklobster (*Jasus edwardsii*), eastern rocklobster (*J. verreauxi*), *P. cygnus*, and tropical rocklobster-1 (*P. ornatus*) can be separated from one another on the basis of bands in the P2–P3 region. Additional comments are provided in the domestic species handbook.

Crabs (Fig. 9.15)

Five species examined, one not in the domestic species handbook. All are potentially imported. The imported-only snow crab-1 (*Chionoecetes* sp.) is characterised by a major band at P3.6. Coral crab (*Charybdis feriata*) and blue swimmer crab (*Portunus pelagicus*) can be distinguished from other crabs by a minor band at P0.5. *P. pelagicus* showed three Types: Type A, Type B (similar to *C. feriata*) and Type C. Crab-1 (*P. sanguinolentus*) shows very similar variation (Types A and B) to *P. pelagicus* (but lacks the P0.5 band). Crabs with a major band at P1.4 are *P. pelagicus* or *P. sanguinolentus*. Sand crab-1 (*Ovalipes australiensis*) has a major band at about P1.8. Additional comments are provided in the domestic species handbook.

Prawns (Fig. 9.16)

Five species with protein fingerprints shown, one not in the domestic species handbook. Some other species of imported-only prawns were examined, but band resolution was poor and they are not shown. One such species is the imported-only paradise prawn (*Litopenaeus stylirostris*), whose major bands appeared similar to the black tiger prawn (*Penaeus monodon*). The protein fingerprint shown of the freshwater prawn-1 (*Macrobrachium rosenbergii*) is from domestic samples; there was a suggestion that the major band in imported samples is at about P2.4 rather than P2.3, but this would need confirmation (or refutation) from analysis of specimens in better condition than those currently available to us. The imported-only prawn-1 (*Metapenaeus elegans*) was similar to other, domestic, *Metapenaeus* species such as the bay shrimp and endeavour prawns (see domestic species handbook), with a major band at P2.7. The imported samples of tiger prawn-1 (*Penaeus semisulcatus*) showed variation in minor bands in the P1 region (Types A, B and C) that was not described in the domestic species handbook. Note that, as described in the domestic species handbook, the P2.2 and P2.3 pair of bands common to several prawn species sometimes appears as a single band.

Molluscs

Clams (Fig. 9.17)

Three species examined, two not in the domestic species handbook. Protein bands tend to be weak in molluscs and we do not recommend our protein fingerprinting technique for clam identification. The mostly imported cockle-1 (*Anadara granosa*) has minor bands at about P2.5 and P5. Seven of eight specimens of the imported-only cockle-2 (*Cyclina sinensis*) had a major band at about P2.3 (Type A); this was less pronounced in the eighth specimen but was accompanied by a minor band at P2.6 (Type B). Bands in this species between P1 and P2 tend to be ill-defined and variable. Additional comments are provided in the domestic species handbook.

Mussels (Fig. 9.17)

Two species examined, one not in the domestic species handbook. Protein bands tend to be weak in molluscs. The imported-only green mussel (*Perna canaliculus*) is similar to the domestic mussel (*Mytilus edulis*) but has fewer bands below the origin.

Octopuses (Fig. 9.17)

Two species examined, one not in the domestic species handbook. Protein bands tend to be weak in molluscs and we do not recommend our protein fingerprinting technique for octopus identification. The imported-only baby octopus-1 (*Octopus* sp.) was similar to the domestic octopus-1 (*Octopus australis*), with a minor band at about P4. Additional comments are provided in the domestic species handbook.

Oysters (Fig. 9.17)

One domestic/imported species examined, also in the domestic species handbook. Protein bands tend to be weak in molluscs. Pacific oyster (*Crassostrea gigas*) shows variation among individuals in the P2–P2.5 region (Types A, B and C). Additional comments are provided in the domestic species handbook.

Scallops (Fig. 9.18)

Three species examined, one not in the domestic species handbook. Protein bands tend to be weak in molluscs. The imported-only South American bay scallop, scallop-1 (*Argopecten purpuratus*), stained weakly but showed three forms in the P2 region: Type A (band at P1.8, one of six specimens), Type B (bands at P1.8 and P2.2, two specimens), and Type C (band at P2.2, three specimens). This species differs from the domestic/imported saucer scallops (*Amusium balloti* and *A. pleuronectes*) by having weak bands at about P3 and about P3.8. Comments on other species are provided in the domestic species handbook.

Sea snails (Fig. 9.18)

Two species examined, one not in the domestic species handbook. Both gave weak and rather indistinct bands and we do not recommend our protein fingerprinting technique for sea snails. The imported-only conch-1 (*Strombus canarium*) has bands at about P1 and P2 whereas the domestic/imported trochus (*Trochus niloticus*) has only one band, a weak one at about P4.6. Comments on other species are provided in the domestic species handbook.

Molluscs (cont.)

Squids (Fig. 9.18)

Six species examined, one not in the domestic species handbook. Protein bands tend to be weak in molluscs. The imported-only Californian squid (*Loligo opalescens*) had a single major band at P1.1, very similar to the domestic/imported squid-1 and squid-2 of the genus *Photololigo*. The domestic Gould's squid (*Nototodarus gouldi*) has a major band at P2.5; the domestic/imported cuttlefish-1 (*Sepia pharaonis*) has a major band at P2.3; the mostly domestic northern calamari (*Sepioteuthis lessoniana*) has a major band at P1.5 and occasionally at P1.8. Additional comments are provided in the domestic species handbook.

Sharks and bony fishes

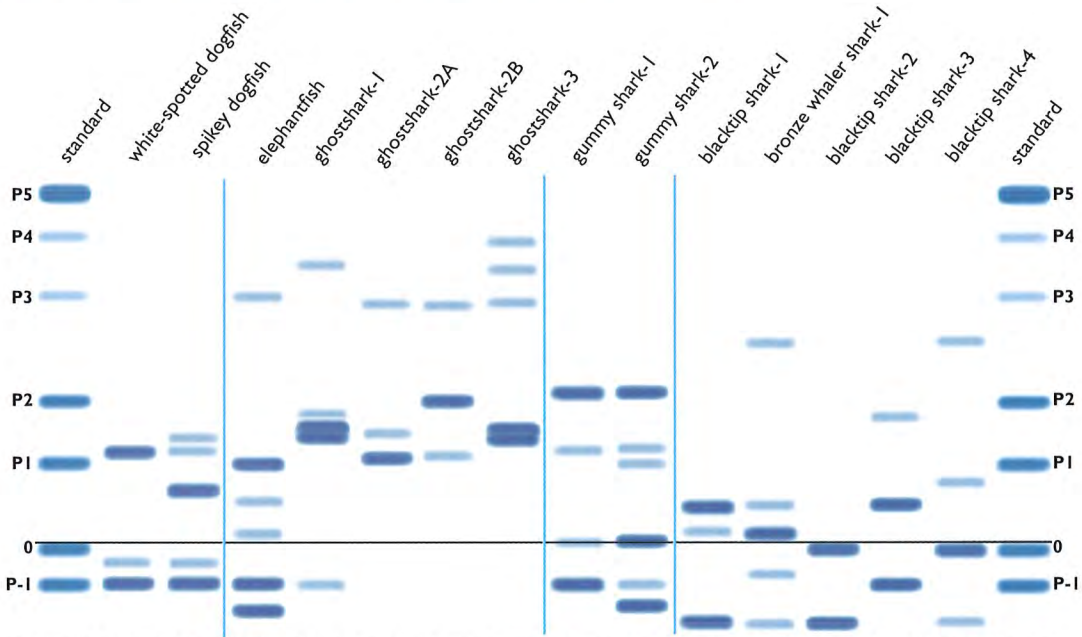


Figure 9.1—Protein fingerprints of dogfishes, ghostsharks, hound sharks and whaler sharks. White-spotted dogfish (*Squalus acanthias*), spiky dogfish (*S. megalops*), elephantfish (*Callorhynchus milii*), ghostshark-1 (*Hydrolagus leuroides*), ghostshark-2 (*H. novaezealandiae*), ghostshark-3 (*H. ogilbyi*), gummy shark-1 (*Mustelus antarcticus*), gummy shark-2 (*M. lenticulatus*), blacktip shark-1 (*Carcharhinus dussumieri*), bronze whaler shark-1 (*C. obscurus*), blacktip shark-2 (*C. sorrah*), blacktip shark-3 (*C. tilstoni*), blacktip shark-4 (*Rhizoprionodon acutus*).

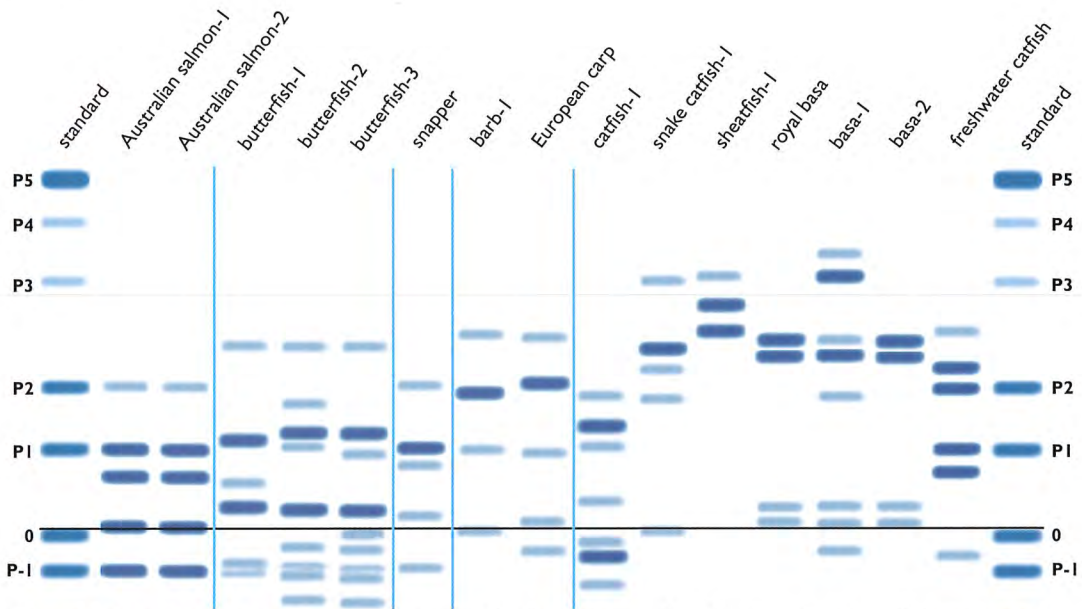


Figure 9.2—Protein fingerprints of Australian salmon, batfishes, breams, carps and catfishes. Australian salmon-1 (*Arripis trutta*), Australian salmon-2 (*A. truttaceus*), butterfish-1 (*Scatophagus argus*), butterfish-2 (*S. multifasciatus*), butterfish-3 (*S. sp.*), snapper (*Pagrus auratus*), barb-1 (*Barbonymus altus*), European carp (*Cyprinus carpio*), catfish-1 (*Arius thalassinus*), snake catfish-1 (*Clarias batrachus*), sheatfish-1 (*Kryptopterus apogon*), royal basa (*Pangasius bocourti*), basa-1 (*P. conchophilus*), basa-2 (*P. hypophthalmus*), freshwater catfish (*Tandanus tandanus*).

Bony fishes (cont.)

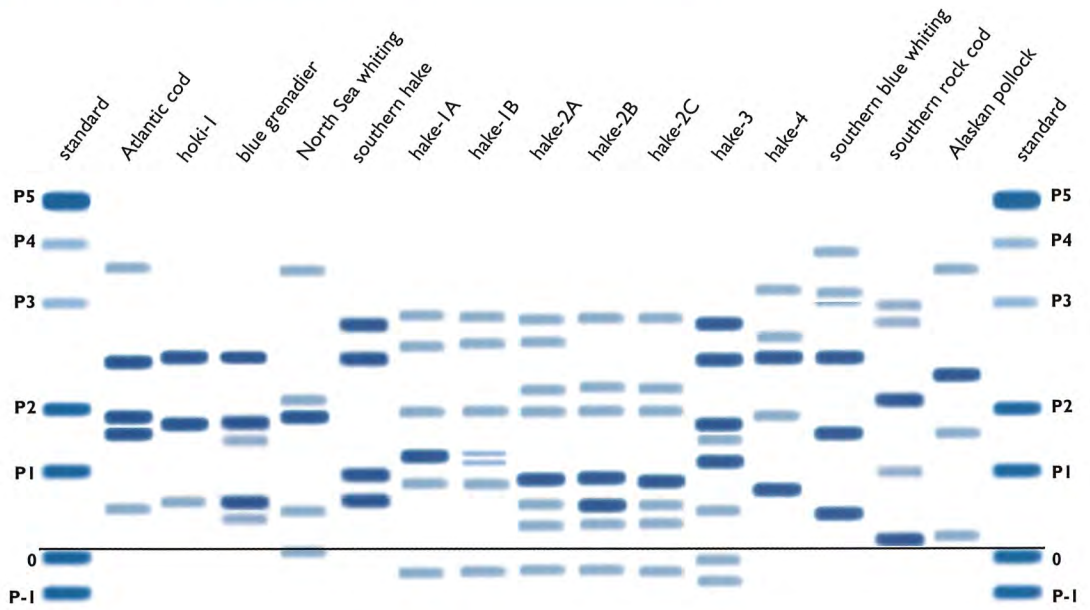


Figure 9.3—Protein fingerprints of cods. Atlantic cod (*Gadus morhua*), hoki-1 (*Macruronus magellanicus*), blue grenadier (*M. novaezelandiae*), North Sea whiting (*Merlangius merlangus*), southern hake (*Merluccius australis*), hake-1 (*M. capensis*), hake-2 (*M. gayi*), hake-3 (*M. merluccius*), hake-4 (*M. paradoxus*), southern blue whiting (*Micromesistius australis*), southern rock cod-1 (*Pseudophycis barbata*), Alaskan pollock (*Theragra chalcogramma*).

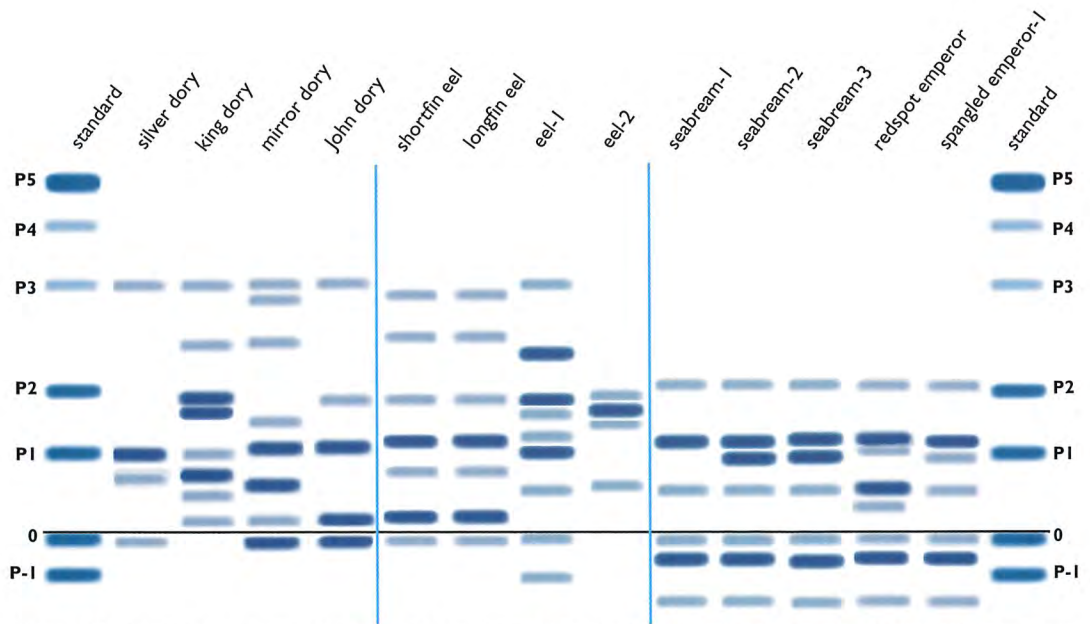


Figure 9.4—Protein fingerprints of dories, eels and emperors. Silver dory (*Cyttus australis*), king dory (*C. traversi*), mirror dory (*Zenopsis nebulosus*), John dory (*Zeus faber*), shortfin eel (*Anguilla australis*), longfin eel (*A. reinhardtii*), eel-1 (*Macroganabus siamensis*), eel-2 (*Monopterus albus*), seabream-1 (*Gymnocranius elongatus*), seabream-2 (*G. grandoculis*), seabream-3 (*G. sp.*), redspot emperor (*L. lentjan*), spangled emperor-1 (*L. nebulosus*).

Bony fishes (cont.)

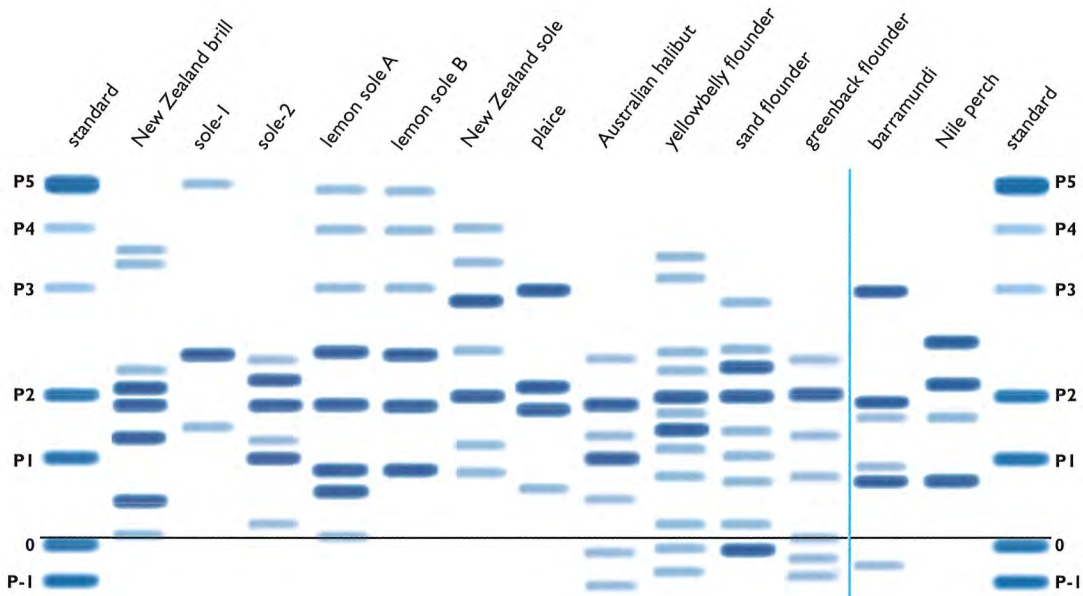


Figure 9.5—Protein fingerprints of flatfishes and freshwater perches. New Zealand brill (*Colistium gunteri*), sole-1 (*Cynoglossus arel*), sole-2 (*Paraplagusia bilineata*), lemon sole (*Pelotretis flavilatus*), New Zealand sole (*Peltorbambus novaezeelandiae*), plaice (*Pleuronectes platessa*), Australian halibut (*Psettodes erumei*), yellowbelly flounder (*Rhombosolea leporina*), sand flounder (*R. plebeia*), greenback flounder (*R. tapirina*), barramundi (*Lates calcarifer*), Nile perch (*L. niloticus*).

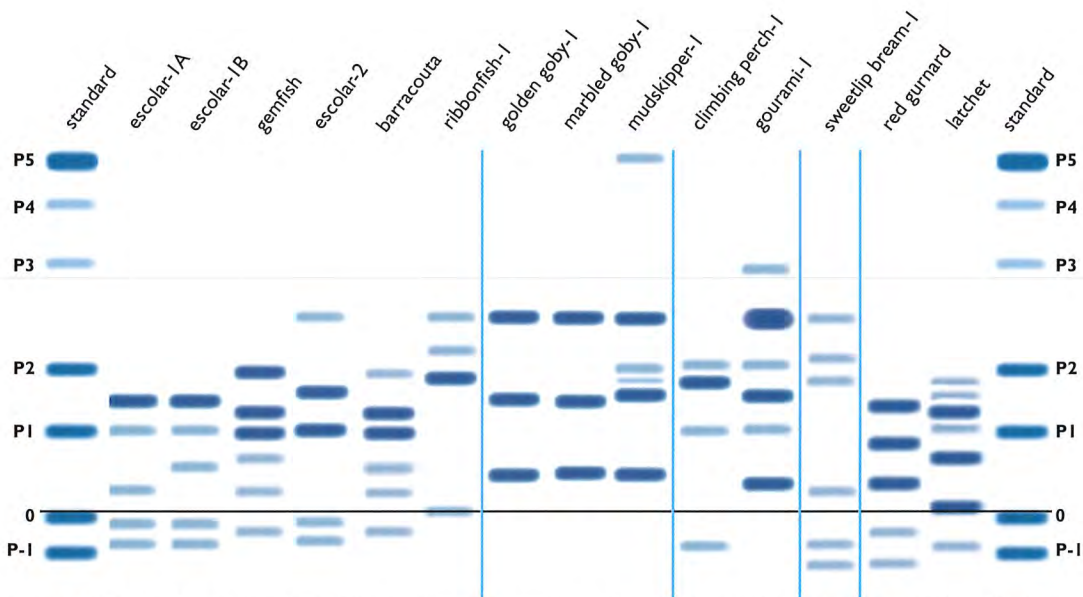


Figure 9.6—Protein fingerprints of gemfishes, gobies, gouramis, grunter breams, and gurnards. Escolar-1 (*Lepidocybium flavobrunneum*), gemfish (*R. solandri*), escolar-2 (*Ruvettus pretiosus*), barracouta (*Thyrsites atun*), ribbonfish-1 (*Trichiurus lepturus*), golden goby-1 (*Glossogobius aureus*), marbled goby-1 (*Oxyeleotris marmorata*), mudskipper-1 (*Pseudapocryptes elongatus*), climbing perch-1 (*Anabas testudineus*), gourami-1 (*Trichogaster pectoralis*), sweetlip bream-1 (*Diagramma pictum*), red gurnard (*Cheilodichthys kumu*), latchet (*Pterygotrigla polyommata*).

Bony fishes (cont.)

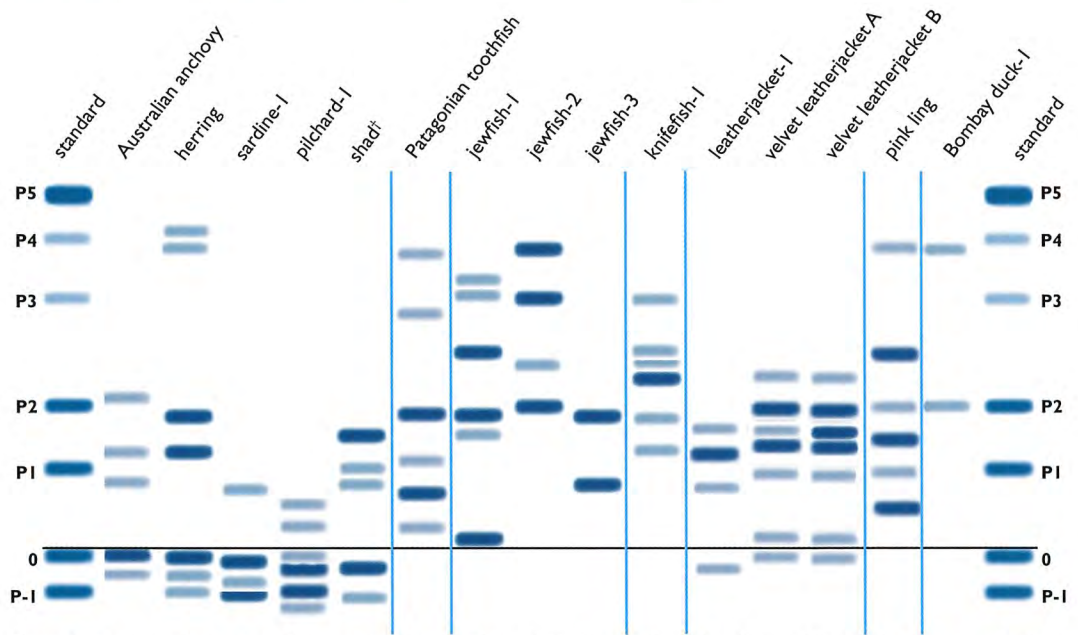


Figure 9.7—Protein fingerprints of herrings, iceshishes, jewfishes, knife-fishes, leatherjackets, lings and lizardfishes. Australian anchovy (*Engraulis australis*), herring (*Clupea barengus*), sardine-1 (*Sardina pilchardus*), pilchard-1 (*Sardinops neopilchardus*), shad† (*Tenualosa* sp.), Patagonian toothfish (*Dissostichus eleginoides*), jewfish-1 (*Chrysochir aureus*), jewfish-2 (*Larimichthys polyactis*), jewfish-3 (*Otolithes ruber*), knife-fish-1 (*Chitala ornata*), leatherjacket-1 (*Aluterus monoceros*), velvet leatherjacket (*Parika scaber*), pink ling (*Genypterus blacodes*), Bombay duck-1 (*Harpadon nebererus*).

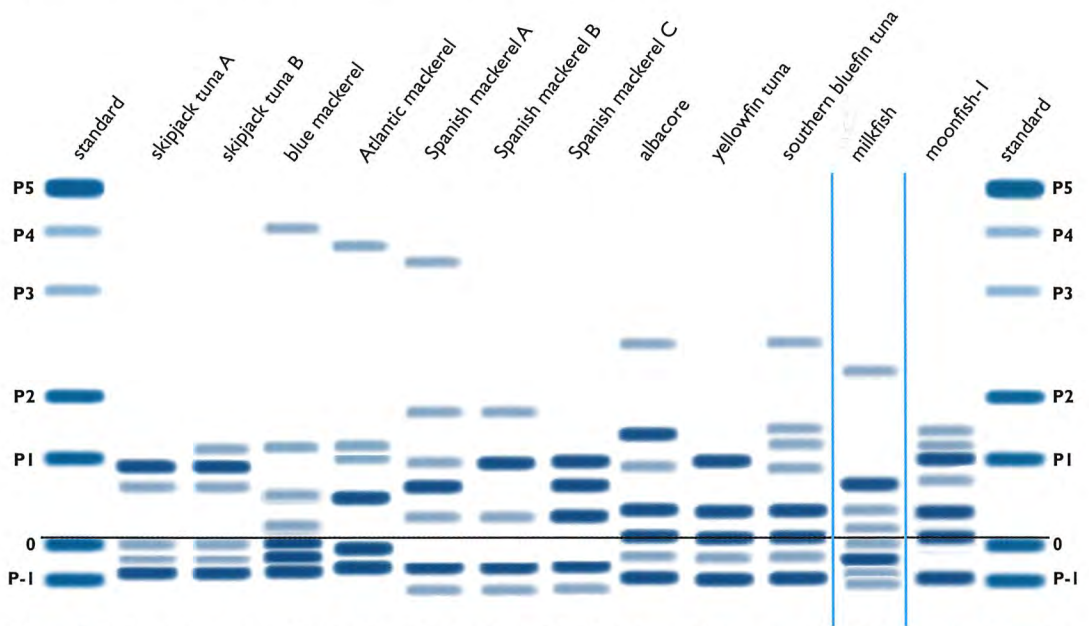


Figure 9.8—Protein fingerprints of mackerels, milkfish and moonfish. Skipjack tuna (*Katsuwonus pelamis*), blue mackerel (*Scomber australasicus*), Atlantic mackerel (*S. scombrus*), Spanish mackerel (*Scomberomorus commerson*), albacore (*Thunnus alalunga*), yellowfin tuna (*T. albacares*), southern bluefin tuna (*T. maccoyii*), milkfish (*Chanos chanos*), moonfish-1 (*Lampris guttatus*).

Bony fishes (cont.)

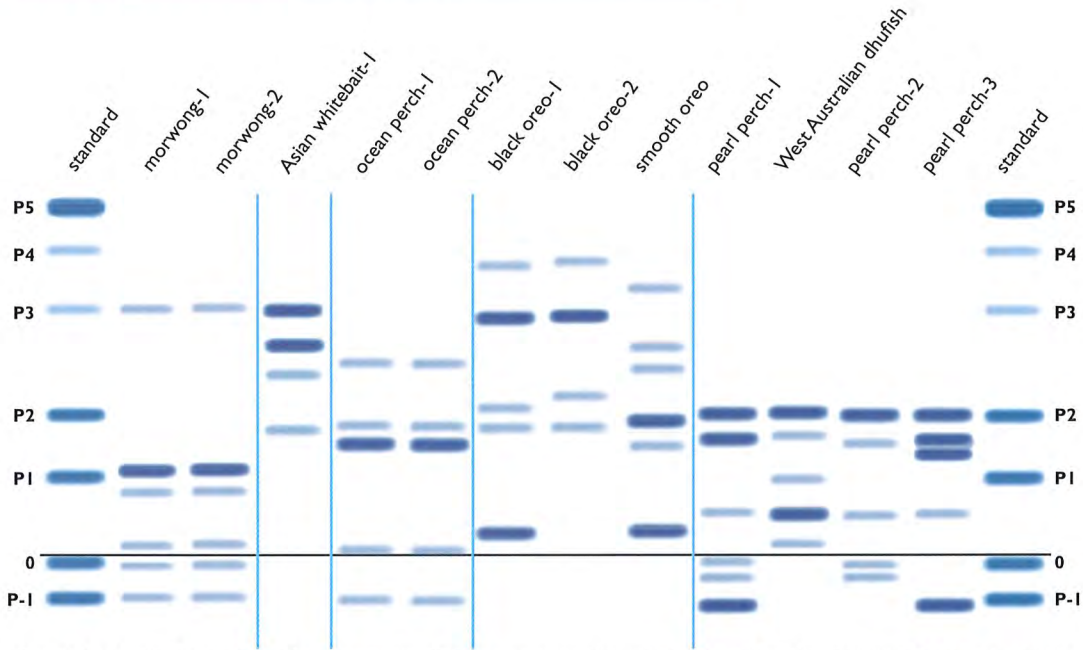


Figure 9.9—Protein fingerprints of morwongs, noodlefishes, ocean perchs, oreos and pearl perchs. Morwong-1 (*N. macropterus*), morwong-2 (*N. sp.*), Asian whitebait-1 (*Neosalanx brevirostris*), ocean perch-1 (*Helicolenus barathri*), ocean perch-2 (*H. percoides*), black oreo-1 (*Alloctytus niger*), black oreo-2 (*A. verrucosus*), smooth oreo (*Pseudocyttus maculatus*), pearl perch-1 (*Glaucosoma buergeri*), West Australian dhufish (*G. hebraicum*), pearl perch-2 (*G. magnificum*), pearl perch-3 (*G. scapulare*).

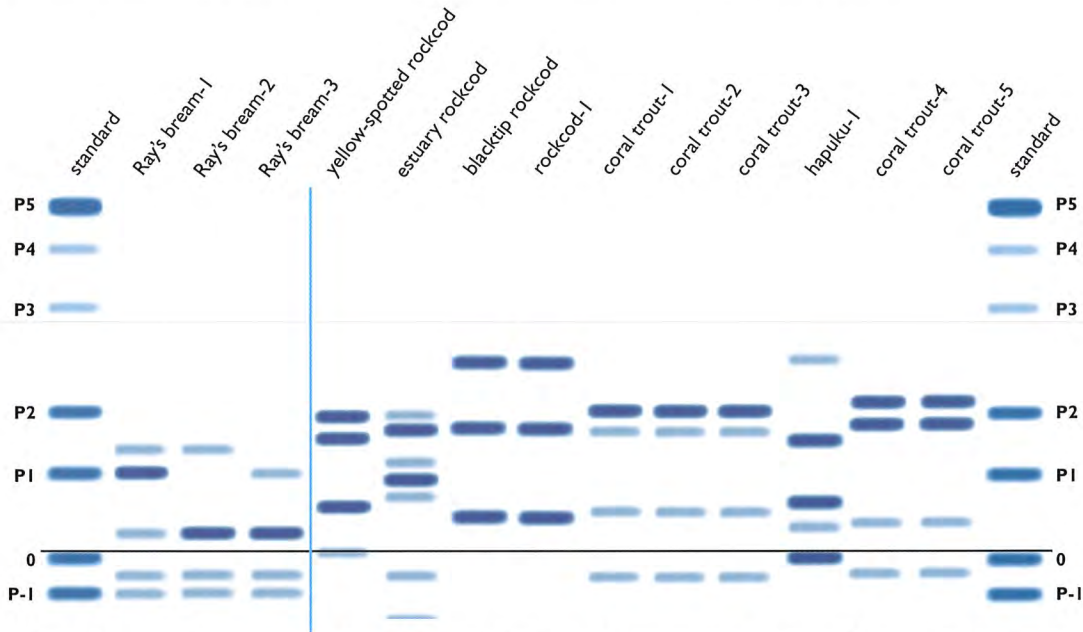


Figure 9.10—Protein fingerprints of pomfrets and rockcods. Ray's bream-1 (*Brama brama*), Ray's bream-2 (*Taractichthys longipinnis*), Ray's bream-3 (*Xenobrama microlepis*), yellow-spotted rockcod (*Epinephelus areolatus*), estuary rockcod (*E. coioides*), blacktip rockcod (*E. fasciatus*), rockcod-1 (*E. morrbua*), coral trout-1 (*Plectropomus areolatus*), coral trout-2 (*P. leopardus*), coral trout-3 (*P. maculatus*), hapuku-1 (*Polyprion oxygeneios*), coral trout-4 (*Variola albigarginata*), coral trout-5 (*V. louti*).

Bony fishes (cont.)

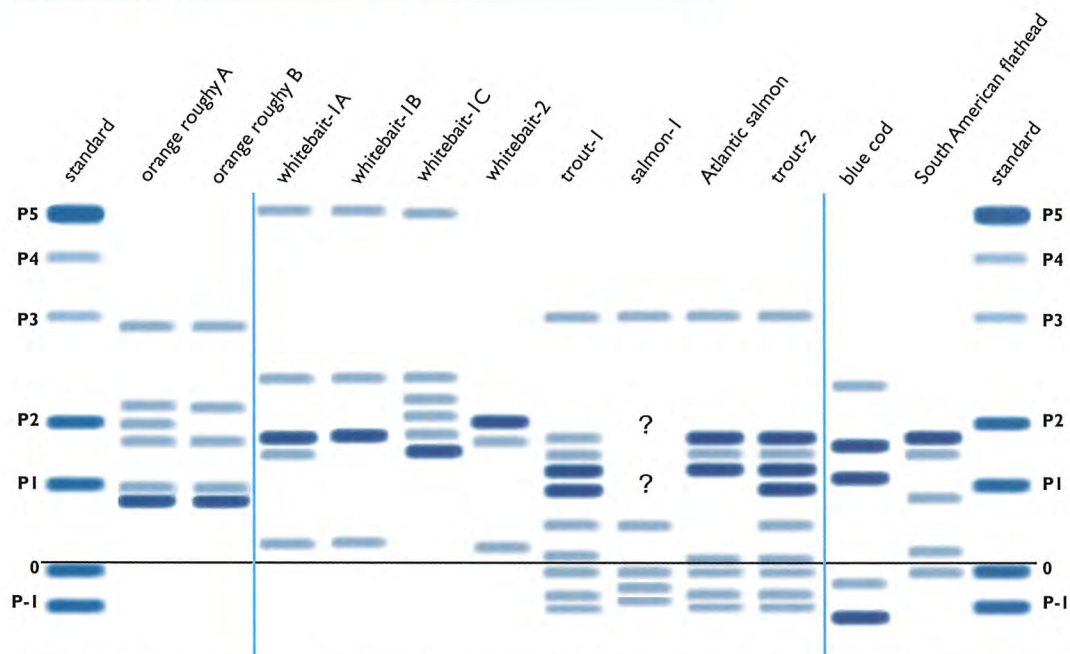


Figure 9.11—Protein fingerprints of roughies, salmon and sandperches. Orange roughy (*Hoplostethus atlanticus*), whitebait-1 (*Galaxias maculatus*), whitebait-2 (*Lovettia sealii*), trout-1 (*Oncorhynchus mykiss*), salmon-1 (*Oncorhynchus tshawytscha*), Atlantic salmon (*Salmo salar*), trout-2 (*S. trutta*), blue cod (*Paraperca colias*), South American flathead (*Percophis brasiliensis*).

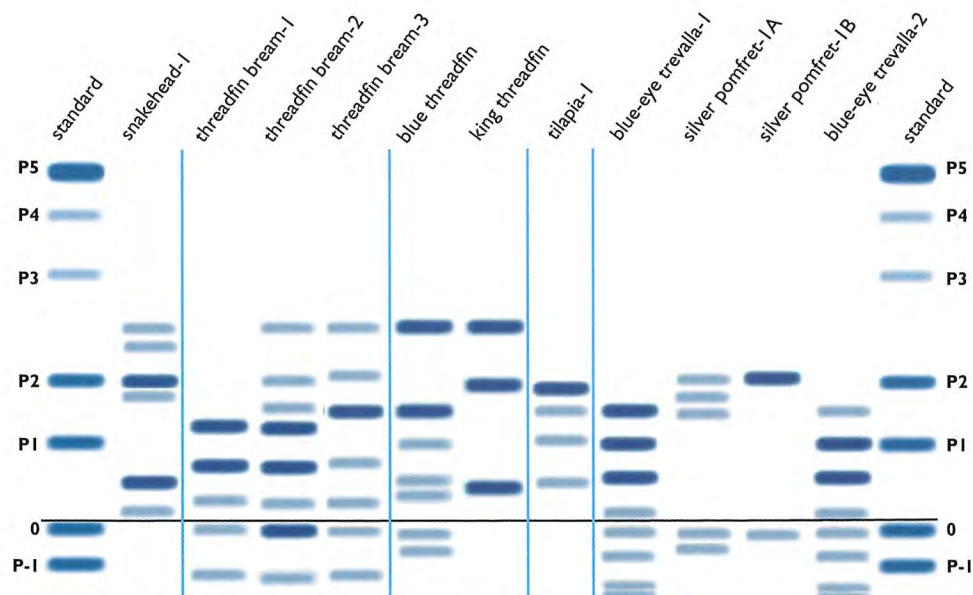


Figure 9.12—Protein fingerprints of snakehead, threadfin breams, threadfin salmon, tilapias and trevallas (part). Snakehead-1 (*Channa striata*), threadfin bream-1 (*Nemipterus furcosus*), threadfin bream-2 (*N. peronii*), threadfin bream-3 (*Scolopsis taeniopterus*), blue threadfin (*Eleuteronema tetradactylum*), king threadfin (*Polydactylus macrochir*), tilapia-1 (*Oreochromis mossambicus*), blue-eye trevalla-1 (*Hyperoglyphe antarctica*), silver pomfret-1 (*Pampus argenteus*), blue-eye trevalla-2 (*Schedopbilus labyrinthica*).

Bony fishes (cont.)

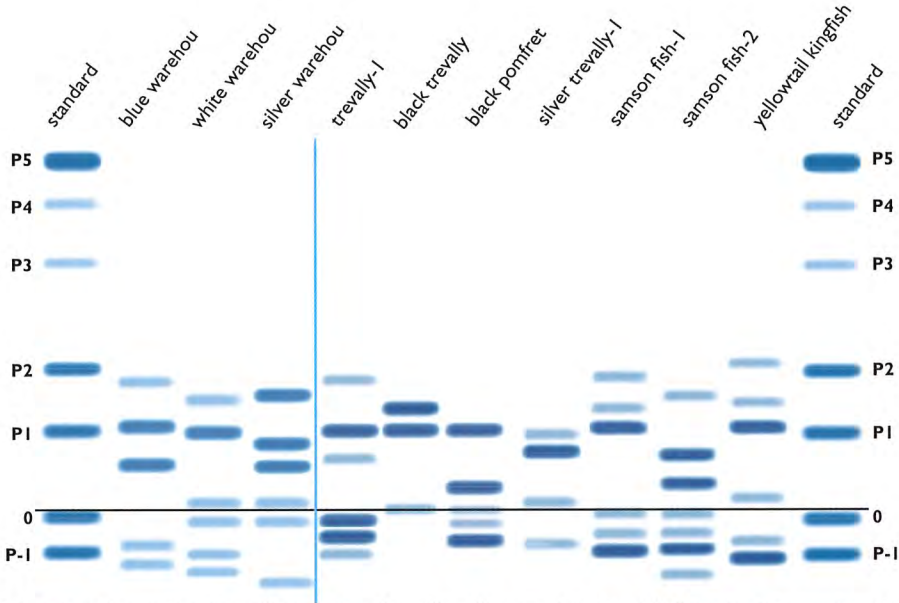


Figure 9.13—Protein fingerprints of trevallids (cont.) and trevallies. Blue warehou (*Seriolella brama*), white warehou (*S. caerulea*), silver warehou (*S. punctata*), trevally-1 (*Atule mate*), black trevally (*Caranx lugubris*), black pomfret (*Parastromateus niger*), silver trevally-1 (*Pseudocaranx dentex*), samson fish-1 (*Seriola dumerilii*), samson fish-2 (*S. bippos*), yellowtail kingfish (*S. lalandi*).

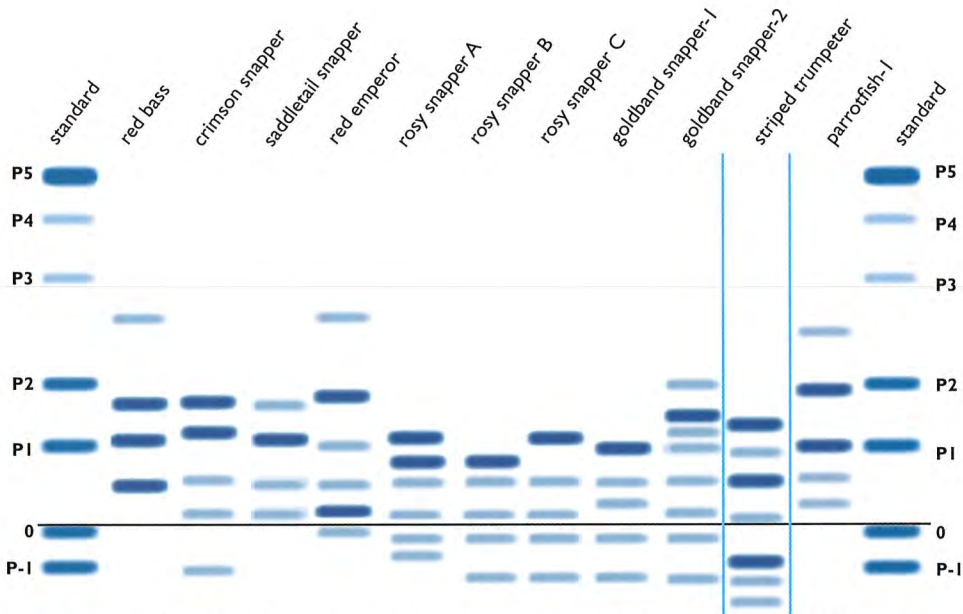


Figure 9.14—Protein fingerprints of tropical snappers, trumpeters and wrasses. Red bass (*Lutjanus bobar*), crimson snapper (*L. erythropterus*), saddletail snapper (*L. malabaricus*), red emperor (*L. sebae*), rosy snapper (*Pristipomoides filamentosus*), goldband snapper-1 (*P. multidentis*), goldband snapper-2 (*P. typus*), striped trumpeter (*Latris lineata*), parrotfish-1 (*Scarus ghobban*).

Crustaceans

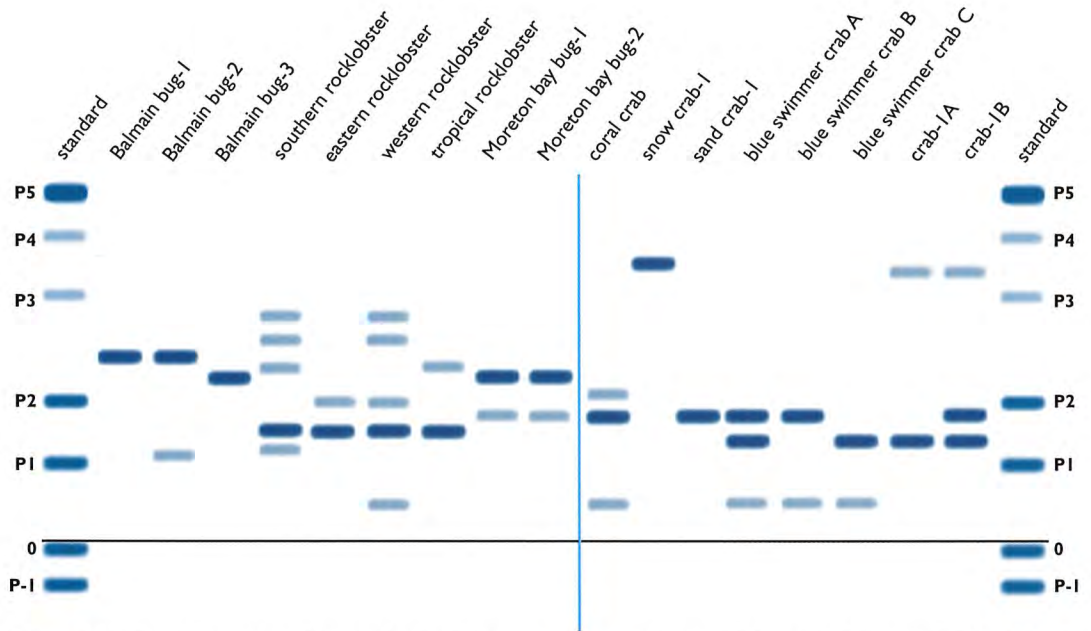


Figure 9.15—Protein fingerprints of bugs and crabs. Balmain bug-1 (*I. novemdentatus*), Balmain bug-2 (*I. peronii*), Balmain bug-3 (*Ibacus pubescens*), southern rocklobster (*Jasus edwardsii*), eastern rocklobster (*J. verreauxi*), western rocklobster (*Panulirus cygnus*), tropical rocklobster-1 (*P. ornatus*), Moreton Bay bug-1 (*Thenus indicus*), Moreton Bay bug-2 (*T. orientalis*), coral crab (*Charybdis feriata*), snow crab-1 (*Chionoecetes* sp.), sand crab-1 (*Ovalipes australiensis*), blue swimmer crab (*Portunus pelagicus*), crab-1 (*P. sanguinolentus*).

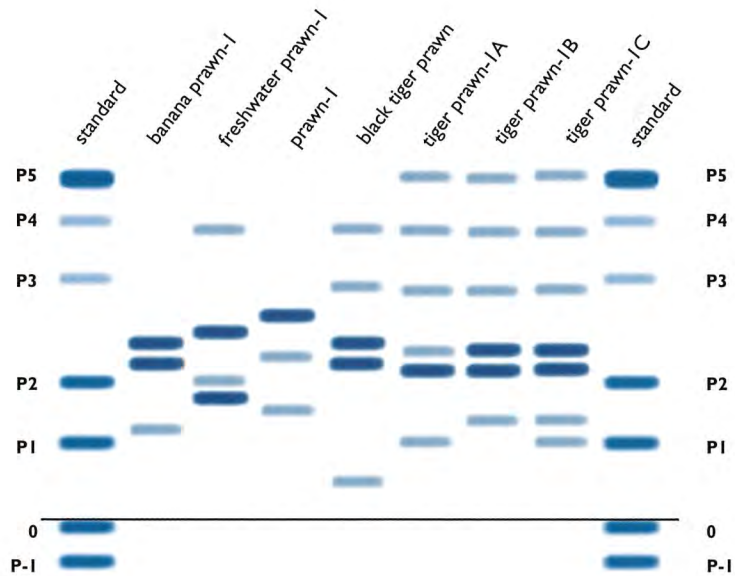


Figure 9.16—Protein fingerprints of prawns. Banana prawn-1 (*Fenneropenaeus merguensis*), freshwater prawn-1 (*Macrobrachium rosenbergii*), prawn-1 (*Metapenaeus elegans*), black tiger prawn (*Penaeus monodon*), tiger prawn-1 (*P. semisulcatus*).

Molluscs

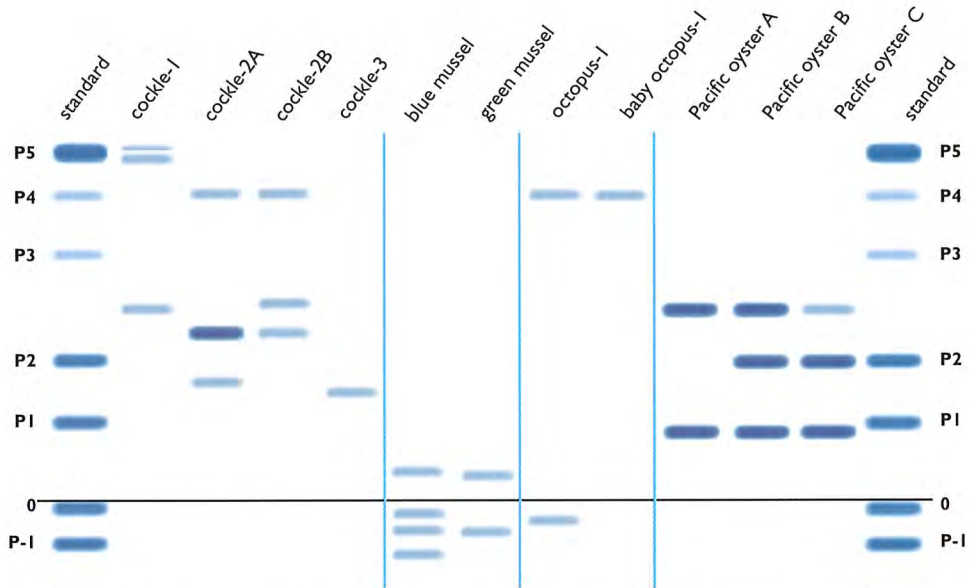


Figure 9.17—Protein fingerprints of clams, mussels, octopuses and oysters. Cockle-1 (*Anadara granosa*), cockle-2 (*Cyclina sinensis*), cockle-3 (*Kateleyia scalarina*), blue mussel (*Mytilus edulis*), green mussel (*Perna canaliculus*), octopus-1 (*Octopus australis*), baby octopus-1 (*O. sp. A*), Pacific oyster (*Crassostrea gigas*).

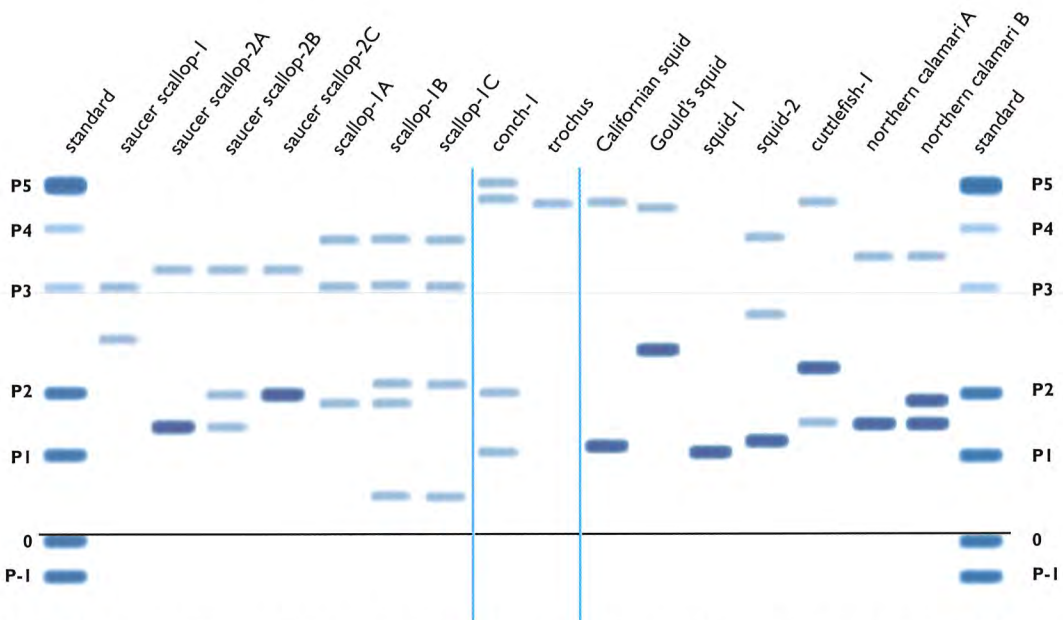


Figure 9.18—Protein fingerprints of scallops, sea snails and squids. Saucer scallop-1 (*Amusium balloti*), saucer scallop-2 (*A. pleuronectes*), scallop-1 (*Argopecten purpuratus*), conch-1 (*Strombus canarium*), trochus (*Trochus niloticus*), Californian squid (*Loligo opalescens*), Gould's squid (*Nototodarus gouldi*), squid-1 (*Photololigo cf chinensis*), squid-2 (*P. cf edulis*), cuttlefish-1 (*Sepia pharaonis*), northern calamari (*S. lessoniana*).

References

A: Seafood (Chapters 4–8)

- ABARE (2002). *Australian Fisheries Statistics 2001*. Commonwealth of Australia, Canberra: 72 pp.
- Abbott, R. T. and Dance, S. P. (1983). *Compendium of Seashells (revised edition)*. E. P. Dutton, Inc., New York, New York: 421 pp.
- Carpenter, K. E. and Niem, V. H. (eds) (1998–2001). *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Pacific, Vols 1–6*. Food and Agriculture Organization of the United Nations, Rome: 4218 pp.
- Department of Primary Industries and Energy (1995). *Marketing Names for Fish and Seafood in Australia*. Commonwealth of Australia, Canberra: 170 pp.
- Frimodt, C. (1995). *Multilingual Illustrated Guide to the World's Commercial Coldwater Fish*. Blackwell Science Ltd, Oxford: 263 pp.
- Frimodt, C. (1995). *Multilingual Illustrated Guide to the World's Commercial Warmwater Fish*. Blackwell Science Ltd, Oxford: 235 pp.
- Food and Agriculture Organization of the United Nations (1980–1999). *FAO Species Catalogue, Vols 1–18. FAO Fisheries Synopsis, 125*.
- Helfman, G. S., Collette, B. B. and Facey, D. E. (1997). *The Diversity of Fishes*. Blackwell Science, Malden: 528 pp.
- Jones, D. S. and Jones, G. J. (1994). *A Field Guide to Crustaceans of Australian Waters*. Reed, Chatswood: 216 pp.
- Kailola, P. J., Williams, M. J., Stewart, P. C., Reichelt, R. E., McNee, A. and Grieve, C. (eds) (1993). *Australian Fisheries Resources*. Bureau of Resource Sciences, Department of Primary Industries and Energy, and the Fisheries Research and Development Corporation, Canberra: 422 pp.
- Kottelat, M., Whitten, A. J., Kartikasari, S. N. and Wirjoatmodjo, S. (1993). *Freshwater Fishes of Western Indonesia and Sulawesi*. Periplus Editions Ltd, Indonesia: 235 pp, 84 plates.
- Lamprell, K. and Healy, J. M. (1998). *Bivalves of Australia, Vol 2*. Backhuys Publishers, Leiden: 288 pp.
- Lamprell, K. and Whitehead, T. (1992). *Bivalves of Australia, Vol 1*. Crawford House Press, Bathurst: 182 pp.
- Last, P. R. and Stevens, J. D. (1994). *Sharks and Rays of Australia*. CSIRO Publications, Melbourne: 513 pp, 84 plates.
- Muus, B. J. and Nielsen, J. G. (1999). *Sea Fish*. Scandinavian Fishing Year Book, Hedehusene: 340 pp.
- Nelson, J. S. (1994). *Fishes of the World*. 3rd edition. John Wiley & Sons, Inc., New York: 620 pp.
- Paul, L. J. (2000). *New Zealand Fishes: Identification, Natural History and Fisheries*. 2nd edition. Reed Publishing (NZ) Ltd, Auckland: 261 pp.
- Pérez Farfante, I. and Kensley, B. (1997). Penaeoid and Sergestoid Shrimps and Prawns of the World: Keys and Diagnoses for the Families and Genera. *Mémoires du Muséum National d'Histoire Naturelle*, 175: 1–233.
- Rainboth, W. J. (1996). *Fishes of the Cambodian Mekong*. FAO, Rome: 277 pp, 27 plates.
- Roberts, T. R. (1989). The Freshwater Fishes of Western Borneo (Kalimantan Barat, Indonesia). *Memoirs of the California Academy of Sciences*, 14: 222 pp.
- South Pacific Commission (1994). *Sea Cucumbers and Beche-de-Mer of the Tropical Pacific—a Handbook for Fishers*. Handbook No. 18, revised edition, South Pacific Commission, Noumea: 51 pp.

- Wadley, V. A. and Dunning, M. C. (1998). *Cephalopods of Commercial Importance in Australian Fisheries*. CSIRO Marine Research, Hobart: 65 pp, 12 plates.
- Williams, A. B. (1988). *Lobsters of the World: an Illustrated Guide. Lobsters of the World in U.S. Trade*. Osprey Books, Huntington, New York: 186 pp.
- Yearsley, G. K., Last, P. R. and Morris, G. B. (1997). Codes for Australian Aquatic Biota (CAAB): an upgraded and expanded species coding system for Australian fisheries databases. *CSIRO Marine Laboratories Report 224: 125 pp.*
- Yearsley, G. K., Last, P. R. and Ward, R. D. (eds) (1999). *Australian Seafood Handbook—an Identification Guide to Domestic Species*. CSIRO Marine Research, Hobart: 469 pp.
- Yearsley, G. K., Onley, A. C. and Brown, F. K. (eds) (2000). *Australian Seafood Users Manual: Making the Most of the World's Best*. The State of Queensland (Department of Primary Industries) and Fisheries Research and Development Corporation, Brisbane: 373 pp.

B: Protein fingerprinting (Chapter 9)

- Daley, R. K., Last, P. R., Yearsley, G. K. and Ward, R. D. (1997). *South East Fishery Quota Species: an Identification Guide*. CSIRO Division of Marine Research, Hobart: 91 pp.
- Hebert, P. D. N. and Beaton, M. J. (1993). *Methodologies for Allozyme Analysis Using Cellulose Acetate Electrophoresis*. Helena Laboratories, Beaumont, Texas: 32 pp.
- Manchenko, G. P. (1994). *Handbook of Detection of Enzymes on Electrophoretic Gels*. CRC Press, Boca Raton: 341 pp.
- Pepperell, J. and Grewe, P. M. (1998). *A Field Guide to the Indo-Pacific Billfishes*. CSIRO Marine Research, Hobart: 16 pp.
- Richardson, B. J., Baverstock, P. R. and Adams, M. (1986). *Allozyme Electrophoresis: a Handbook for Animal Systematics and Population Studies*. Academic Press, North Ryde: 410 pp.
- Shaklee, J. B. and Keenan, C. P. (1986). A practical laboratory guide to the techniques and methodology of electrophoresis and its application to fish fillet identification. *CSIRO Marine Laboratories Report 177: 59 pp.*
- Ward, R. D., Daley, R. K., Andrew, J. and Yearsley, G. K. (1999). Protein Fingerprinting (Chapter 9) in Yearsley, G. K., Last, P. R. and Ward, R. D. (eds) *Australian Seafood Handbook—an Identification Guide to Domestic Species*. CSIRO Marine Research, Hobart.
- Whitmore, D. H. (1990). *Electrophoretic and Isoelectric Focusing Techniques in Fisheries Management*. CRC Press, Boca Raton: 350 pp.

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Appendix A: Fish Names Committee

Details of the role of the Fish Names Committee, and the process by which a marketing name can be approved or changed, can be obtained from the Seafood Services Australia website or from the committee secretary as listed below. The secretary, located within Seafood Services Australia, is the initial point of contact and is responsible for processing applications. The Fish Names Committee includes representatives of the Australian Seafood Industry Council and the Seafood Importers Association of Australasia, as well as other industry nominees. The Fisheries Research and Development Corporation actively supports the Fish Names Committee and its naming processes. CSIRO Marine Research provides taxonomic and nomenclatural advice. The Australian Fisheries Management Forum provides advice from fisheries management and research perspectives.

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Seafood Services Australia
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Hamilton
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Appendix B: Table of species

This table lists systematically all the imported seafood species profiled in the text (i.e. domestic-only species are excluded). Species and groups that *do not occur* in Australian waters (apart from feral populations) are in blue text; species and groups that *are available locally* and also imported are in black text. Group number (No.) and feature-page number (p.) are provided for each marketing name. Group marketing names are in bold text, with the names of component species that are mentioned in the text indented below. Marketing names marked with an asterisk (*) are group marketing names but only one member of the group is known to be imported.

The official list of Australian fish marketing names for both domestic and imported products, as ratified by the Fish Names Committee, is called the 'Australian Fish Names List'. The Fish Names Committee will make changes to the Australian Fish Names List from time to time. The most recent version of the list is available from the Seafood Services Australia website at www.seafoodservices.com.au/fishnames/index.html.

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
CARTILAGINOUS FISHES							
4.3	school shark	<i>Galeorhinus galeus</i>	(Linnaeus, 1758)	37 017008	Triakidae	hound sharks	40
4.3	gummy shark*	<i>Mustelus lentiginos</i>	Phillipps, 1932	37 017750	Triakidae	hound sharks	39
4.4	blacktip shark	<i>Carcharhinus, Loxodon & Rhizoprionodon spp:</i>		37 018901	Carcharhinidae	whaler sharks	41
		<i>Carcharhinus dussumieri</i>	(Valenciennes, 1839)	37 018009			
		<i>Carcharhinus sorrah</i>	(Valenciennes, 1839)	37 018013			
		<i>Rhizoprionodon acutus</i>	(Rüppell, 1837)	37 018006			
4.1	white-spotted dogfish	<i>Squalus acanthias</i>	Linnaeus, 1758	37 020008	Squalidae	dogfishes	36
4.2	ghostshark*	<i>Hydrolagus novaezealandiae</i>	(Fowler, 1911)	37 042750	Chimaeridae	ghostsharks	38
4.2	elephantfish	<i>Callorhynchus milli</i>	(Bory de Saint-Vincent, 1823)	37 043001	Callorhynchidae	ghostsharks	37
BONY FISHES							
5.8	eel	Anguilliformes		37 990025		eels	62
	shortfin eel	<i>Anguilla anguilla</i>	(Linnaeus, 1758)	37 056750	Anguillidae		
		<i>Anguilla australis</i>	Richardson, 1841	37 056001	Anguillidae		63
		<i>Anguilla dieffenbachii</i>	Gray, 1842	37 056751	Anguillidae		
		<i>Anguilla japonica</i>	Temminck & Schlegel, 1846	37 056752	Anguillidae		
5.18	herring	<i>Clupea harengus</i>	Linnaeus, 1758	37 085790	Clupeidae	herrings	90
5.18	sardine	Clupeinae spp:		37 085904	Clupeidae	herrings	92
		<i>Herklotsichthys spp</i>		37 085905			
		<i>Sardinella aurita</i>	Valenciennes, 1847	37 085791			
		<i>Sardinella gibbosa</i>	(Bleeker, 1849)	37 085013			
		<i>Sardinella spp</i>		37 085906			
		<i>Sprattus sprattus</i>	(Linnaeus, 1758)	37 085792			

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.18	pilchard	<i>Sardina & Sardinops</i> spp: <i>Sardina pilchardus</i> <i>Sardinops neopilchardus</i> <i>Sardinops sagax</i>	(Walbaum, 1792) (Steindachner, 1879) (Jenyns, 1842)	37 085903 37 085793 37 085002 37 085794	Clupeidae	herrings	91
5.18	anchovy	Engraulidae spp: <i>Coilia</i> spp <i>Setipinna</i> spp <i>Stolephorus indicus</i> <i>Stolephorus</i> spp <i>Thryssa</i> spp	(van Hasselt, 1823)	37 086000 37 086750 37 086901 37 086006 37 086902 37 086903	Engraulidae	herrings	89
5.21	knifefish	Notopteridae spp: <i>Cbitala ornata</i>	(Gray, 1831)	37 091000 37 091001	Notopteridae	knifefishes	96
5.36	salmon Atlantic salmon	<i>Oncorhynchus & Salmo</i> spp (except <i>O. mykiss</i> & <i>S. trutta</i>): <i>Oncorhynchus tshawytscha</i> <i>Salmo salar</i>	(Walbaum, 1792) Linnaeus, 1758	37 094903 37 094005 37 094001	Salmonidae	salmons	120
5.29	Asian whitebait	Salangidae spp: <i>Neosalangx brevirostris</i> <i>Protosalangx chinensis</i> <i>Salangicthys microdon</i>	(Pellegrin, 1923) (Basilewsky, 1855) (Bleeker, 1860)	37 100750 37 100001 37 100002 37 100003	Salangidae	noodlefishes	110
5.36	whitebait	Galaxias spp: <i>Galaxias maculatus</i>	(Jenyns, 1842)	37 990002 37 102006	Galaxiidae	salmons	121
5.24	Bombay duck	Harpadon spp: <i>Harpadon nehereis</i>	(Hamilton, 1822)	37 119900 37 119750	Harpadontidae	lizardfishes	99
5.26	milkfish	<i>Chanos chanos</i>	(Forsskål, 1775)	37 142001	Chanidae	milkfishes	107
5.4	barb	Barbonymus spp: <i>Barbonymus altus</i>	(Günther, 1868)	37 165750 37 165751	Cyprinidae	carps	47
5.5	sheatfish	Siluridae spp: <i>Kryptopterus apogon</i> <i>Silurus glanis</i>	(Bleeker, 1851) Linnaeus, 1758	37 175750 37 175751 37 175752	Siluridae	catfishes	50

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p-
5.5	basa	Pangasiidae spp:		37 177750	Pangasiidae	catfishes	48
		<i>Pangasius conchophilus</i>	Roberts & Vidthayanon, 1991	37 177752			
		<i>Pangasius djambal</i>	Bleeker, 1846	37 177753			
		<i>Pangasius gigas</i>	(Chevey, 1931)	37 177754			
		<i>Pangasius hypophthalmus</i>	(Sauvage, 1878)	37 177755			
		<i>Pangasius pangasius</i>	(Hamilton, 1822)	37 177756			
		<i>Pangasius santuwongsei</i>	Smith, 1931	37 177757			
5.5	royal basa	<i>Pangasius bocourti</i>	Sauvage, 1880	37 177751	Pangasiidae	catfishes	49
5.5	snake catfish	Clariidae spp:		37 182750	Clariidae	catfishes	51
		<i>Clarias batrachus</i>	(Linnaeus, 1758)	37 182751			
5.6	southern rock cod*	<i>Pseudophycis bachus</i>	(Forster, 1801)	37 224006	Moridae	cods	58
5.6	Atlantic cod	<i>Gadus morhua</i>	Linnaeus, 1758	37 226790	Gadidae	cods	53
5.6	North Sea whiting	<i>Merlangius merlangus</i>	(Linnaeus, 1758)	37 226794	Gadidae	cods	56
5.6	southern blue whiting	<i>Micromesistius australis</i>	Norman, 1937	37 226795	Gadidae	cods	57
5.6	Alaskan pollock	<i>Theragra chalcogramma</i>	(Pallas, 1911)	37 226793	Gadidae	cods	52
5.6	hoki blue grenadier	Macruronus spp:		37 227901	Macruronidae	cods	55
		<i>Macruronus magellanicus</i>	Lönnberg, 1907	37 227750			
		<i>Macruronus novaezelandiae</i>	(Hector, 1871)	37 227001			
5.6	hake southern hake	Merluccius spp:		37 227900	Merlucciidae	cods	54
		<i>Merluccius australis</i>	(Hutton, 1872)	37 227002			
		<i>Merluccius capensis</i>	Castelnau, 1861	37 227790			
		<i>Merluccius gayi</i>	(Guichenot, 1848)	37 227791			
		<i>Merluccius hubbsi</i>	Marini, 1933	37 227792			
		<i>Merluccius merluccius</i>	(Linnaeus, 1758)	37 227793			
		<i>Merluccius paradoxus</i>	Franca, 1960	37 227794			
<i>Merluccius productus</i>	(Ayres, 1855)	37 227795					

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.23	pink ling	<i>Gentypenus blacodes</i>	(Forster, 1801)	37 228002	Ophidiidae	lings	98
5.12	flyingfish	Exocoetidae spp: <i>Cypselurus oligolepis</i>	(Bleeker, 1866)	37 233000 37 233027	Exocoetidae	garfishes	78
5.35	orange roughy	<i>Hoplostethus atlanticus</i>	Collett, 1889	37 255009	Trachichthyidae	roughies	119
5.7	king dory	<i>Cyttus traversi</i>	Hutton, 1872	37 264001	Zeidae	dories	60
5.7	mirror dory	<i>Zenopsis nebulosus</i>	(Temminck & Schlegel, 1845)	37 264003	Zeidae	dories	61
5.7	John dory	<i>Zeus faber</i>	Linnaeus, 1758	37 264004	Zeidae	dories	59
5.31	black orco*	<i>Alloctytus niger</i>	James, Inada & Nakamura, 1988	37 266901	Oreosomatidae	oreos	112
5.31	smooth oreo	<i>Pseudocyttus maculatus</i>	Gilchrist, 1906	37 266003	Oreosomatidae	oreos	113
5.27	moonfish*	<i>Lampris guttatus</i>	(Brünnich, 1788)	37 268900	Lampridae	moonfishes	108
5.38	snakehead	<i>Channa spp:</i> <i>Channa striata</i>	(Bloch, 1793)	37 283750 37 283751	Channidae	snakeheads	124
5.8	eel	Synbranchiformes <i>Monopterus albus</i>	(Zuiew, 1793)	37 990026 37 285001	Synbranchidae	eels	62
5.30	ocean perch	<i>Helicolenus barabtri</i> & <i>H. percoides</i> <i>Helicolenus barabtri</i> <i>Helicolenus percoides</i>	(Hector, 1875) (Richardson, 1842)	37 287901 37 287093 37 287001	Scorpaenidae	ocean perches	111
5.17	red gurnard	<i>Chelidonichthys kumu</i>	(Lesson, 1826)	37 288001	Triglidae	gurnards	88
5.11	barramundi	<i>Lates calcarifer</i>	(Bloch, 1790)	37 310006	Centropomidae	freshwater perches	76
5.11	Nile perch	<i>Lates niloticus</i>	(Linnaeus, 1758)	37 310790	Centropomidae	freshwater perches	77
5.34	rockcod	<i>Epinephelus spp:</i> <i>Epinephelus malabaricus</i> <i>Epinephelus morrbua</i>	(Bloch & Schneider, 1801) (Valenciennes, 1833)	37 311901 37 311150 37 311151	Serranidae	rockcods	118

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.34	coral trout	<i>Plectropomus & Variola spp:</i> <i>Plectropomus leopardus</i>	(Lacépède, 1801)	37 311905 37 311078	Serranidae	rockcods	116
5.34	hapuku	<i>Polyprion americanus & P. oxygeneios</i> <i>Polyprion americanus</i> <i>Polyprion oxygeneios</i>	(Bloch & Schneider, 1801) (Forster, 1801)	37 311902 37 311170 37 311006	Serranidae	rockcods	117
5.32	pearl perch*	<i>Glaucosoma buergeri</i>	Richardson, 1845	37 320901	Glaucosomatidae	pearl perches	114
5.43	trevally	Caranginae spp: <i>Atule mate</i>	(Cuvier, 1833)	37 337913 37 337024	Carangidae	trevallies	134
5.43	black pomfret	<i>Parastromateus niger</i>	(Bloch, 1795)	37 337072	Carangidae	trevallies	132
5.43	silver trevally*	<i>Pseudocaranx dentex</i>	(Bloch & Schneider, 1801)	37 337062	Carangidae	trevallies	133
5.43	yellowtail kingfish	<i>Seriola lalandi</i>	Valenciennes, 1833	37 337006	Carangidae	trevallies	135
5.33	Ray's bream	Bramidae spp: <i>Brama brama</i>	(Bonnaterre, 1788)	37 342901 37 342001	Bramidae	pomfrets	115
5.1	Australian salmon*	<i>Arripis trutta</i>	(Bloch & Schneider, 1801)	37 344002	Arripidae	Australian salmon	44
5.44	red emperor	<i>Lutjanus sebae</i>	(Cuvier, 1829)	37 346004	Lutjanidae	tropical snappers	138
5.44	tropical snapper	Lutjanus spp: <i>Lutjanus bitaeniatus</i> <i>Lutjanus johnii</i> <i>Lutjanus malabaricus</i> <i>Lutjanus sanguineus</i>	(Valenciennes, 1830) (Bloch, 1792) (Bloch & Schneider, 1801) (Cuvier, 1828)	37 346905 37 346025 37 346030 37 346007 37 346750	Lutjanidae	tropical snappers	139
5.44	king snapper rosy snapper goldband snapper	Pristipomoides spp: <i>Pristipomoides filamentosus</i> <i>Pristipomoides multidentis</i> <i>Pristipomoides zonatus</i>	(Valenciennes, 1830) (Day, 1870) (Valenciennes, 1830)	37 346916 37 346032 37 346002 37 346056	Lutjanidae	tropical snappers	136

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.39	threadfin bream	Nemipteridae spp: <i>Nemipterus furcosus</i>	(Valenciennes, 1830)	37 347000 37 347005	Nemipteridae	threadfin breams	125
5.16	sweetlip bream	Haemulidae (except <i>Pomadasys</i> spp): <i>Diagramma pictum</i> <i>Plectorhinchus pictus</i>	(Thunberg, 1792) (Cuvier, 1830)	37 350904 37 350003 37 350023	Haemulidae	grunter breams	87
5.9	seabream	Gymnocranius spp: <i>Gymnocranius elongatus</i> <i>Gymnocranius grandoculis</i> <i>Gymnocranius griseus</i>	Senta, 1973 (Valenciennes, 1830) (Schlegel, 1844)	37 351903 37 351010 37 351005 37 351003	Lethrinidae	emperors	65
5.9	spangled emperor*	<i>Lethrinus nebulosus</i>	(Forsskål, 1775)	37 351008	Lethrinidae	emperors	66
5.9	emperor redspot emperor	<i>Lethrinus</i> spp: <i>Lethrinus lentjan</i> <i>Lethrinus microdon</i>	(Lacépède, 1802) Valenciennes, 1830	37 351902 37 351007 37 351011	Lethrinidae	emperors	64
5.3	snapper	<i>Pagrus auratus</i>	(Bloch & Schneider, 1801)	37 353001	Sparidae	breams	46
5.20	jewfish	Sciaenidae spp: <i>Chrysochir aureus</i> <i>Larimichthys polyactis</i> <i>Otolibtes ruber</i>	(Richardson, 1846) (Bleeker, 1877) (Bloch & Schneider, 1801)	37 354000 37 354750 37 354751 37 354006	Sciaenidae	jewfishes	94
5.2	butterfish	Scatophagus spp: <i>Scatophagus argus</i> <i>Scatophagus multifasciatus</i>	(Linnaeus, 1766) Richardson, 1846	37 363900 37 363002 37 363001	Scatophagidae	batfishes	45
5.41	tilapia	<i>Oreochromis</i>, <i>Sarotherodon</i> & <i>Tilapia</i> spp: <i>Oreochromis mossambicus</i> <i>Oreochromis niloticus</i> <i>Oreochromis urolepis</i>	(Peters, 1852) (Linnaeus, 1758) (Norman, 1922)	37 371900 37 371001 37 371750 37 371751	Cichlidae	tilapias	128
5.28	morwong*	<i>Nemadactylus macropterus</i>	(Bloch & Schneider, 1801)	37 377003	Cheilodactylidae	morwongs	109
5.45	striped trumpeter	<i>Latris lineata</i>	(Schneider, 1801)	37 378001	Latridae	trumpeters	141

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.40	blue threadfin	<i>Eleutheronema tetradactylum</i>	(Shaw, 1804)	37 383004	Polynemidae	threadfin salmon	126
5.40	threadfin king threadfin	Polynemidae spp: <i>Polydactylus macrochir</i>	(Günther, 1876)	37 383000 37 383005	Polynemidae	threadfin salmon	127
5.46	parrotfish	Scaridae spp: <i>Chlorurus sordidus</i> <i>Chlorurus strongylocephalus</i> <i>Scarus frenatus</i> <i>Scarus ghobban</i>	(Forsskål, 1775) (Bleeker, 1854) Lacépède, 1802 Forsskål, 1775	37 386000 37 386030 37 386750 37 386016 37 386001	Scaridae	wrasses	142
5.37	blue cod	<i>Pampercis colias</i>	(Bloch & Schneider, 1801)	37 390790	Pinguipedidae	sandperches	122
5.37	South American flathead	<i>Percopbis brasiliensis</i>	Quoy & Gaimard, 1825	37 393750	Percophidae	sandperches	123
5.19	Patagonian toothfish	<i>Dissostichus eleginoides</i>	Smitt, 1898	37 404792	Nototheniidae	icefishes	93
5.14	golden goby	Glossogobius spp: <i>Glossogobius aureus</i>	Akihito & Meguro, 1975	37 428900 37 428148	Gobiidae	gobies	82
5.14	mudskipper	Pseudapocryptes spp: <i>Pseudapocryptes borneensis</i> <i>Pseudapocryptes elongatus</i>	(Bleeker, 1855) (Cuvier, 1816)	37 428750 37 428751 37 428752	Gobiidae	gobies	84
5.14	marbled goby	Oxyleotris spp: <i>Oxyleotris marmorata</i>	(Bleeker, 1852)	37 429900 37 429750	Eleotridae	gobies	83
5.13	gemfish	<i>Rexea solandri</i>	(Cuvier, 1832)	37 439002	Gempylidae	gemfishes	80
5.13	barracouta	<i>Thyrstites atun</i>	(Euphrasen, 1791)	37 439001	Gempylidae	gemfishes	79
5.13	ribbonfish*	<i>Trichiurus lepturus</i>	Linnaeus, 1758	37 440004	Trichiuridae	gemfishes	81
5.25	skipjack tuna	<i>Katsuwonus pelamis</i>	(Linnaeus, 1758)	37 441003	Scombridae	mackerels	102
5.25	tuna albacore	Sardini & Thunnini spp: <i>Thunnus alalunga</i>	(Bonnaterre, 1758)	37 441912 37 441005	Scombridae	mackerels	105

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.25	Atlantic mackerel	<i>Scomber scombrus</i>	Linnaeus, 1758	37 441790	Scombridae	mackerels	100
5.25	mackerel	Scomberomorini & Scombrini spp:		37 441911	Scombridae	mackerels	101
		<i>Rastrelliger brachysoma</i>	(Bleeker, 1851)	37 441750			
		<i>Rastrelliger kanagurta</i>	(Cuvier, 1816)	37 441012			
5.25	Spanish mackerel	<i>Scomberomorus commerson</i>	(Lacépède, 1800)	37 441007	Scombridae	mackerels	104
5.25	yellowfin tuna	<i>Thunnus albacares</i>	(Bonnaterre, 1788)	37 441002	Scombridae	mackerels	106
5.25	southern bluefin tuna	<i>Thunnus maccoyii</i>	(Castelnau, 1872)	37 441004	Scombridae	mackerels	103
5.42	blue-eye trevalla*	<i>Hyperoglypbe antarctica</i>	(Carmichael, 1818)	37 445001	Centrolophidae	trevallas	129
5.42	blue warehou	<i>Seriolella brama</i>	(Günther, 1860)	37 445005	Centrolophidae	trevallas	130
5.42	silver pomfret	<i>Pampus spp (except P. chinensis):</i>		37 448750	Stromateidae	trevallas	131
		<i>Pampus argenteus</i>	(Euphrasen, 1788)	37 448751			
5.42	white pomfret	<i>Pampus chinensis</i>	(Euphrasen, 1788)	37 448752	Stromateidae	trevallas	131
5.15	climbing perch	<i>Anabas spp:</i>		37 450750	Anabantidae	gouramis	85
		<i>Anabas testudineus</i>	(Bloch, 1792)	37 450751			
5.15	gourami	Belontiidae, Helostomatidae & Osphronemidae spp:		37 990750	Belontiidae, Helostomatidae, etc.	gouramis	86
		<i>Tribogaster pectoralis</i>	(Regan, 1910)	37 451750			
5.8	eel	Synbranchiformes		37 990026		eels	62
		<i>Macroganathus siamensis</i>	(Günther, 1861)	37 455750	Mastacembelidae		
5.10	Australian halibut	<i>Psettodes erumei</i>	(Bloch & Schneider, 1801)	37 457001	Psettodidae	flatfishes	67
5.10	New Zealand brill	<i>Colistium guntheri</i>	(Hutton, 1873)	37 461790	Pleuronectidae	flatfishes	69
5.10	New Zealand turbot	<i>Colistium nudipinnis</i>	(Waite, 1911)	37 461797	Pleuronectidae	flatfishes	71
5.10	lemon sole	<i>Pelotretis flavilatus</i>	Waite, 1911	37 461796	Pleuronectidae	flatfishes	68

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
5.10	plaice	<i>Pleuronectes platessa</i>	Linnaeus, 1758	37 461792	Pleuronectidae	flatfishes	72
5.10	New Zealand sole	<i>Peltorhynchus novaezeelandiae</i>	Günther, 1862	37 461794	Pleuronectidae	flatfishes	70
5.10	yellowbelly flounder	<i>Rhombosolea leporina</i>	Günther, 1862	37 461750	Pleuronectidae	flatfishes	75
5.10	sand flounder	<i>Rhombosolea plebeia</i>	(Richardson, 1843)	37 461751	Pleuronectidae	flatfishes	73
5.10	sole	Cynoglossidae & Soleidae spp:		37 990015	Cynoglossidae & Soleidae	flatfishes	74
		<i>Cynoglossus ariel</i>	(Bloch & Schneider, 1801)	37 463750	Cynoglossidae		
		<i>Paraplagusia bilineata</i>	(Bloch, 1787)	37 463001	Cynoglossidae		
5.22	leatherjacket	<i>Aluterus monoceros</i>	(Linnaeus, 1758)	37 465022	Monacanthidae	leatherjackets	97

CRUSTACEANS

6.3	prawn	Caridea & Penaeoidea spp:		28 710000	Caridea & Penaeoidea	prawns	153
		<i>Acetes</i> spp		28 720903	Sergestidae		
		<i>Litopenaeus stylirostris</i>	(Stimpson, 1874)	28 711077	Penaeidae		
		<i>Litopenaeus vannamei</i>	(Boone, 1931)	28 711079	Penaeidae		
		<i>Metapenaeus elegans</i>	de Man, 1907	28 711078	Penaeidae		
6.3	banana prawn*	<i>Fenneropenaeus merguensis</i>	(de Man, 1888)	28 711050	Penaeidae	prawns	150
6.3	freshwater prawn*	<i>Macrobrachium rosenbergii</i>	(de Man, 1879)	28 756002	Palaemonidae	prawns	152
6.3	tiger prawn*	<i>Penaeus semistulcatus</i>	De Haan, 1844	28 711053	Penaeidae	prawns	154
6.3	black tiger prawn	<i>Penaeus monodon</i>	Fabricius, 1798	28 711051	Penaeidae	prawns	151
6.1	Balmain bug	Ibacus spp:		28 821901	Scyllaridae	bugs	144
		<i>Ibacus pubescens</i>	Holthuis, 1960	28 821002			

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
6.1	southern rocklobster	<i>Jasus edwardsii</i>	(Hutton, 1875)	28 820001	Palinuridae	bugs	146
6.1	tropical rocklobster	Panulirus spp (except <i>P. cygnus</i>): <i>Panulirus ornatus</i>	(Fabricius, 1798)	28 820901 28 820006	Palinuridae	bugs	147
6.1	Moreton Bay bug	Thenus spp: <i>Thenus orientalis</i>	(Lund, 1793)	28 821903 28 821008	Scyllaridae	bugs	145
6.2	snow crab	Cbionoecetes spp: <i>Cbionoecetes bartoli</i> <i>Cbionoecetes opilio</i>	Rathbun, 1924 (Fabricius, 1788)	28 880901 28 880158 28 880157	Majidae	crabs	149
6.2	blue swimmer crab	<i>Portunus pelagicus</i>	(Linnaeus, 1758)	28 911005	Portunidae	crabs	148
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7.1	paua	<i>Haliotis iris</i>	Martyn, 1784	24 038003	Haliotidae	abalones	156
7.7	conch	Strombidae spp: <i>Strombus canarium</i> <i>Strombus gigas</i>	Linnaeus, 1758 Linnaeus, 1758	24 125000 24 125007 24 125008	Strombidae	sea snails	163
7.2	cockle*	<i>Anadara granosa</i>	(Linnaeus, 1758)	23 226011	Arcidae	clams	157
7.3	green mussel	<i>Perna canaliculus</i>	(Gmelin, 1791)	23 220751	Mytilidae	mussels	158
7.6	scallop saucer scallop	Pectinidae spp: <i>Amusium spp</i> <i>Argopecten purpuratus</i> <i>Patinopecten yessoensis</i> <i>Pecten novaezelandiae</i>	(Lamarck, 1819) (Jay, 1857) Reeve, 1853	23 270000 23 270901 23 270054 23 270055 23 270056	Pectinidae	scallops	162
7.5	oyster Pacific oyster	Ostreidae spp: <i>Crassostrea gigas</i>	(Thunberg, 1793)	23 257000 23 257001	Ostreidae	oysters	161

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7.4	baby octopus	<i>Octopus aegina</i> & <i>O. sp. A</i> <i>Octopus aegina</i> <i>Octopus sp. A</i>	Gray, 1849	23 659903 23 659016 23 659039	Octopodidae	octopuses	159
7.4	octopus	Octopodidae spp: <i>Ectopoctopus dofleini</i> <i>Octopus vulgaris</i> <i>Pinnoctopus cordiformis</i>	(Wülker, 1910) Cuvier, 1797 (Quoy & Gaimard, 1832)	23 659000 23 659040 23 659041 23 659003	Octopodidae	octopuses	160
7.8	loligo squid	Loliginidae spp: <i>Photololigo duvaucelii</i> <i>Photololigo cf edulis</i>	(d'Orbigny, 1848) (Hoyle, 1885)	23 617000 23 617003 23 617903	Loliginidae	squids	168
7.8	giant squid	<i>Dosidicus gigas</i>	(d'Orbigny, 1835)	23 636015	Ommastrephidae	squids	166
7.8	illex squid	<i>Illex</i> spp: <i>Illex argentinus</i> <i>Illex illecebrosus</i>	(Castellanos, 1960) (Lesueur, 1821)	23 636901 23 636016 23 636017	Ommastrephidae	squids	167
7.8	Callifornian squid	<i>Loligo opalescens</i>	Berry, 1911	23 617011	Loliginidae	squids	164
7.8	New Zealand arrow squid	<i>Nototodarlis sloanii</i>	(Gray, 1849)	23 636006	Ommastrephidae	squids	169
7.8	cuttlefish	<i>Sepia</i> spp: <i>Sepia pbaraonis</i>	Ehrenberg, 1831	23 607901 23 607008	Sepiidae	squids	165
7.8	squid northern calamari	Teuthoidea spp: <i>Sepioteuthis lessoniana</i>	Lesson, 1830	23 615000 23 617006	Loliginidae	squids	170

No.	Marketing name	Scientific name	Authority	CAAB	Family or other	Group name	p.
MISCELLANEOUS SEAFOODS							
8.1	jellyfish	Schyphozoa spp:		11 120000	Schyphozoa	jellyfishes	172
		<i>Aurelia aurita</i>	(Linnaeus, 1758)	11 133001	Ulmaridae		
		<i>Catostylus mosaicus</i>	(Quoy & Gaimard, 1824)	11 136001	Catostylidae		
		<i>Rhopilema esculenta</i>	Kishinouye, 1891	11 141001	Rhizostomatidae		
8.2	beche-de-mer	Holothuriidae & Stichopodidae spp:		25 415000	Holothuriidae & Stichopodidae	sea cucumbers	173
		<i>Holothuria scabra</i>	Jaeger, 1833	25 416004	Holothuriidae		
		<i>Parastichopus californicus</i>	(Stimpson, 1857)	25 417013	Stichopodidae		
8.3	nori	Porphyra spp:		55 010900	Bangiaceae	seaweeds	174
		<i>Porphyra yezoensis</i>	Ueda, 1932	55 010750			

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