A KEY TO FAMILIES OF NEW ZEALAND BONY FISHES

C.D. Paulin  Illustrations by J.H. Atkinson

National Museum of New Zealand
Miscellaneous Series Number 9
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INTRODUCTION

This publication is intended as an identification guide to the 165* families of bony fishes occurring within the New Zealand Exclusive Economic Zone (Fig. 2). It is based on an unpublished checklist of fishes in the collections of the National Museum of New Zealand (NMNZ), but deals only with teleosts (bony fishes) and does not include elasmobranchs (sharks and rays) or agnathids (hagfishes and lampreys).

The key includes all New Zealand families of marine teleost fishes, as well as families that are predominantly freshwater but have at least one representative, or juvenile stages, found in the sea or estuaries (e.g. Retropinnidae — smelts; Galaxiidae — kokopu; Salmonidae — trout and salmon; Electrotridae — sleepers). Four families of introduced fishes are restricted entirely to freshwater and are not included in the key (Ictaluridae — North American catfish; Cyprinidae — carp; Poeciliidae — live bearers; Percidae — freshwater perch).

The format of the key is similar to the Guide to the coastal marine fishes of California prepared by D. J. Miller and R. N. Lea (1972) and is based largely on external features such as the shape, proportions, colour, and numbers of the fins, rays, spines, lateral line pores and scales (Fig. 1). Internal characters have been avoided except for gill rakers and teeth which can be examined without dissection.

The key works on the principle of choosing one of two (or occasionally three) alternatives within “couplets”. Only one of the alternatives should describe accurately the characters of the fish in question, and at the end of the selected line there is either the name of a family or the number of another couplet to which the reader should proceed. In some instances the key ends with a pair of closely related families which cannot be separated without specialist knowledge. The organs or structures referred to in the key are identified in Figure 1, and all technical terms are explained in the Glossary. The main diagnostic features of every family are shown in at least one illustrated example, but a few families with differing juvenile and adult forms, or with species of widely differing morphology often recognised as subfamilies, occur twice in the key and are illustrated accordingly. The key is “artificial” in the sense that it uses characters which are not necessarily indicative of taxonomic or phylogenetic order.

The drawings used to illustrate the key were prepared from photographs of specimens in the National Museum of New Zealand. Where photographs were not available, illustrations were prepared directly from specimens or from literature.

ACKNOWLEDGMENTS

We would like to thank our colleagues at the National Museum who have helped in the production of this guide: Warwick Wilson and Mark Strange for photographic work; Rick Webber for Figures 3, 4, 5, and 8; Graham Hardy, Andrew Stewart and Sue Pennial for checking the key, and Patrick Brownsey and Alan Baker for editing the manuscript.

Thanks also to Clive Roberts (Victoria University, Wellington) for Figure 133 and Peter McMillan (Fisheries Research Division) for Figure 168.

LITERATURE CITED


* Since the preparation of this key one additional family, Caristiidae: mane fishes, has been collected in New Zealand waters.
FIGURE 1: FISH STRUCTURE
GLOSSARY

abdominal pelvic fins: paired fins situated near the anus, below or behind the posterior third of the pectoral fin.
abyssal: depths greater than 2500m.
adipose fin: small lobe-like fatty fin on the median line of the body.
agnatha: fishes lacking true jaws.
anal fin: unpaired fin between the anus and the tail.
axillary process: scale-like sheets of tissue arising from the base of a fin, usually the pelvic fin.
barbel: fleshy tentacle, usually on head.
bathypelagic: open water in depths of 1000–2500m.
benthic: in direct association with the bottom.
benthopelagic: on or near the bottom, but also ranging to midwater.
branchial: concerning gills.
branchiostegals: bony or cartilaginous supports of the ventral gill membranes below the gill cover.
caudal: concerning the tail.
caudal peduncle: posterior portion of the body from the anal fin to the end of the vertebral column.
cavernous: with bony ridges bordering mucous channels.
compressed: flattened from side to side.
confluent: merging into one structure with little or no apparent break.
dorsal fin: unpaired fin with rays and/or spines on the median line of the back.
elasmobranchs: cartilaginous fishes (sharks and rays).
epipelagic: open waters in depths of 0–200m.
finlet: small fin-like structures following the main dorsal and anal fins in some fishes.
gill raker: bony tooth-like structures on the anterior edges of gill arches for straining out food.
humeral spine: a large poisonous spine situated immediately behind the operculum and above the pectoral fin.
illicium: slender fishing lure on the head of angler fishes.
isthmus: the narrow extension of the body below the head between the gill chambers (the lower ‘throat’).
keel: flesh or bony ridge, usually on the caudal peduncle.
lateral line: a series of modified scales with pore-like openings to a sensory canal along the side of a fish.
maxilla: bone of the upper jaw.
mesopelagic: open water in depths of 200–1000m.
operculum: bony flap covering gills in teleost fishes, composed of opercle, preopercle, subopercle, and interopercle bones.
pectoral girdle: bony supporting system for the pectoral fin.
pelagic: open waters.
pelvic fins: paired fins on the ventral surface of the body, sometimes called ventral fins.
pelvic girdle: bony supporting system for the pelvic fins.
photophore: specialised light producing organ, well-defined and usually with a lens and reflector.
ray: a fin support that is branched, segmented, seldom sharp, usually flexible.
scute: shield-like plate or scale; enlarged scale.
spine: a fin support that is not branched or segmented, usually stiff and sharp, occasionally flexible.
striae: striations, fine lines.
suborbital-stay: a posterior extension of the third suborbital bone across the cheek to the preoperculum.
teeth — canine-like: large conical teeth (resembling eye teeth of a dog).
— incisoriform: chisel-shaped for cutting.
— molariform: rounded for grinding.
— parrot-like: fused into a beak.
— villiform: slender and crowded in bands.
teleost: higher fishes with true bone. Teleosts are by far the most abundant and diversified group of vertebrates.
terminal jaws: at anterior end of head.
thoracic pelvic fins: paired fins situated below the anterior third of the pectoral fins; sometimes on the throat (jugular).
truncated: cut off, appearing shortened.
KEY TO MAIN GROUPS OF NEW ZEALAND FISHES

Jaws absent, mouth a sucking disc; gill openings seven pairs of small pores

*Agatha (hagfish and lampreys)

Jaws present, gill openings 5–7

*Chondrichthyes (elasmobranchs: sharks and rays)

Jaws present, gill openings single

Osteichthyes (teleosts: bony fishes)

*Classes Agatha and Chondrichthyes are not treated further in this paper.

KEY TO THE FAMILIES OF NEW ZEALAND TELEOST FISHES

1. Both eyes on same side of head (flat fishes) ........................................ SECTION A (p. 6)
   One eye on each side of head ........................................................................ 2

2. Pelvic fins absent ______________________________________________________ 3
   Pelvic fins present ....................................................................................... 3

3. Pelvic fins abdominal .................................................................................. 4
   Pelvic fins thoracic ..................................................................................... 6

4. One dorsal fin present ................................................................................ 5
   Two dorsal fins present ............................................................................... 5

5. First dorsal fin with rays, the second adipose (no rays) ......................... SECTION D (p. 12)
   Both dorsal fins with rays, spinous and/or soft ........................................... SECTION E (p. 14)

6. Pelvic fins strongly modified forming a cone or sucking disc on belly SECTION F (p. 14)
   Pelvic fins with rays and membranes, or barbel-like, or club-like ............... 7

7. Pelvic fins with 1 spine and 5 soft rays ..................................................... SECTION G (p. 16)
   Pelvic fins with less than 5 rays (spine may be present) ............................. SECTION H (p. 24)
   Pelvic fins with 5 or more rays (spine may be present) ............................. SECTION I (p. 26)
SECTION A
Flat fishes with both eyes on same side of head

1. Eyes on left side of fish (Fig.3) ........................................ Bothidae: left-eyed flounders
   Eyes on right side of fish

2. Margin of preoperculum free (Fig.4) .................................. Pleuronectidae: right-eyed flounders
   Margin of preoperculum covered by skin (Fig.5) .................. Soleidae: true soles

SECTION B
Pelvic fins absent

1. Distance from tip of lower jaw to base of tail less than 4 times body depth .......... 2
   Distance from tip of lower jaw to base of tail more than 5 times body depth ........ 14

2. Upper jaw flattened, sword-like (Fig.6) .................................. Xiphiidae: sword fishes
   Upper jaw not as above

3. Caudal fin reduced or absent (Fig.7) .................................... Molidae: sun fishes
   Caudal fin present

4. Dorsal fin with spines in anterior portion (Fig.8) ........................... Balistidae: leatherjackets
   Dorsal fin wholly of soft rays

5. Teeth confluent into one or two plates in each jaw
   Teeth separate, numerous

6. Teeth confluent into one plate in each jaw (Fig.9) ........................ Diodontidae: porcupine fishes
   Teeth confluent into two plates in each jaw (Fig.10) .............. Tetraodontidae: puffers

7. Body encased in bony interlocking plates (Fig.11) ...................... Ostraciidae: boxfishes
   Body not encased in bony plates

8. First ray of dorsal fin reduced to a fleshy knob or lure on head
   (lure may be well forward of remainder of dorsal fin) ................. suborder Ceratioidei
   No lure on head (Fig.12) ........................................ Cetomimidae: flabby whale fishes

9. (Female specimens only)
   More than 11 dorsal rays (Fig.13) ..................................... Melanocetidae: humpback angler fishes
   Less than 11 dorsal rays

10. 2-3 caruncles (fleshy nobs) on back (Fig.14) .............................. Ceratiidae: sea devils
    No caruncles on back

11. Body slender, lure very long (Fig.15) ................................... Gigantactinidae: slender angler fishes
    Body short, lure usually short

12. Dermal spines present (Fig.16) ........................................ Himantolophiidae: prickly angler fishes
    Skin naked

13. 4-5 branchiostegals; 2-4 dorsal rays (Fig.17) .......................... Linophrynidae: black angler fishes
    6 branchiostegals; 5-8 dorsal rays (Fig.18) .......................... Oneirodidae: smooth angler fishes
14. Caudal rays continuous with dorsal and/or anal fins, not forming a distinct caudal fin; or tip of tail without rays; tail not prehensile ........................................... 15
Caudal rays forming a distinct caudal fin (sometimes joined to dorsal and anal fins, but always distinct); or tail prehensile .............................................. 26

15. Anus on throat (Fig. 19) .................................................................. Carapidae: pearl fishes
Anus abdominal .................................................................................. 16

16. Pectoral fins absent ........................................................................ 17
Pectoral fins present ........................................................................ 18

17. Coastal reef fishes; jaws not slender and elongate (Fig. 20) .......... Muraenidae: morays
Deep sea fishes; jaws slender and elongate (Fig. 21) . Nettastomatidae: duckbill eels

18. Mouth enormous; gill openings closer to anus than snout (Fig. 22) .................................................. Eurypharyngidae: gulpers
Mouth small; gill openings closer to snout than anus ............................................. 19

19. Jaws elongate, straight, needle-like (Fig. 23) ................................ Serrivomidae: sawtooth eels
Jaws elongate, curved, needle-like (Fig. 24) ........................................... Nemichthyidae: snipe eels
Jaws not needle-like ........................................................................... 20

20. Head with a series of parallel striations (Fig. 25) ... Derichthyidae: long-necked eels
Head lacking parallel striations .............................................................. 21

21. Tip of tail without rays (Fig. 26) ...................................................... Ophichthidae: snake eels
Tip of tail with rays ............................................................................. 22

22. Branchial apertures (gill opening) confluent ventrally or only slightly separated (Fig. 27) ........ Synaphobranchidae: cut-throat eels
Branchial apertures well separated ........................................................ 23

23. Mouth terminal, slit-like (Fig. 28) ................................................... Simenchelyidae: parasitic eels
Mouth not terminal, with jaws ................................................................. 24

24. Origin of dorsal fin more than head length from tip of pectoral fin (Fig. 29) ................................................................. Anguillidae: freshwater eels
(Fig. 30) ......................................................................................... Ophichthidae: snake eels
Origin of dorsal fin above pectoral fin ................................................... 25

25. Anterior nostril tubular (Fig. 31) ...................................................... Congridae: conger eels
Anterior nostril not tubular (Fig. 32) ...................................................... Zoarcidae: eelpouts

26. Body encased in bony plates (Figs 33 a, b) Syngnathidae: seahorses and pipefishes
Body not encased in bony plates .............................................................. 27

27. Dorsal fin origin above operculum; mouth not protractile (Fig. 34) ...................................................... Ophidiidae: lings
Dorsal fin origin above snout; mouth protractile ........................................... 28

28. Caudal fin lobes uneven, upper lobe enlarged; no anal fin (Fig. 35) ...................................................... Trachipteridae: deal fishes
Caudal fin lobes evenly forked or rounded; anal fin present (Fig. 36) .... Lophotidae: crest fishes
SECTION C

Pelvic fins abdominal; one dorsal fin present

1. Anal fin base long, merged with remains of caudal fin .............................................. 2
   Anal fin not merged with caudal fin ................................................................. 3

2. Dorsal fin with 9–13 soft rays (Fig.37) ................................................................. Halosauridae: halosaurs
   Dorsal fin with 6–40 spines, no soft rays (Fig.38) .......... Notacanthidae: spiny eels

3. Dorsal fin attached about mid body ................................................................. 4
   Dorsal fin attached posteriorly, closer to tail than head .................................... 9

4. Photophores present ......................................................................................... 5
   Photophores absent ............................................................................................ 7

5. Dorsal fin base long, more than half body length (Fig.39) ............................. Idiachthyidae: black dragon fishes
   Dorsal fin base short, less than half body length .............................................. 6

6. Secretary shoulder organ present beneath skin, with an external tube slightly below lateral line (Fig.40) .................. Scarsiiidae: luminescent slickheads
   Shoulder organ absent (Fig.41) ........................................... Gonostomatidae: light fishes
   (Fig.72) ................................................ Photichthyidae: lighthouse fishes

7. Jaws terminal, or lower jaw slightly longer ................................................... 8
   Snout overhanging lower jaw (Fig.42) ........................................... Engraulididae: anchovies

8. Body brilliantly coloured; steel blue above, silver below, with crimson tinge and white spots, fins crimson; depth of body less than twice the length (Fig.43) ............ Lampridae: opah
   Body not coloured as above; depth of body 3–4 times length (Fig.44) ............... Clupeidae: sardines and sprats

9. Photophores present ......................................................................................... 10
   Photophores absent ............................................................................................ 12

10. Jaws shorter than head; photophores on body .......................................... 11
    Jaws longer than head; photophores on head only (Fig.45) ............................ Malacosteidae: loose jaws

11. Scales present (Fig.46) .................................................................................. 13
    Scales absent (Fig.47) .................................................................................. 14
    Stomiidae: scaly dragon fishes
    Melanostomiidae: scaleless black dragon fishes

12. Dorsal and anal fins followed by 5–7 finlets (Fig.48) ............................ Scomberesocidae: sauries
    No finlet following dorsal fin ...................................................................... 13

13. Lateral line consisting of up to 20 vertical mucous tubes (Fig.49) .............. Rondelettiidae: red-mouth whale fishes
    Lateral line not as above .............................................................................. 14

14. No scales on head .......................................................................................... 15
    Scales on head ............................................................................................... 17

15. Caudal fin forked; body flabby ..................................................................... 16
    Caudal fin rounded; body firm (Fig.50) ......................................................... Galaxiidae: kokopu

16. Secretary shoulder organ present beneath skin, with an external tube slightly below lateral line (Fig.40) .......... Scarsiiidae: luminescent slickheads
    Shoulder organ absent (Fig.51) ................................................... Alepocephalidae: slickheads

17. Tip of pectorals extended beyond base of pelvics (Fig.52) ................. Exocoetidae: flying fishes
    Tip of pectorals not reaching base of pelvics ............................................ 18

18. Jaws not elongated to form a ‘beak’ (Fig.53) ........................................... Gonorynchidae: sand eels
    Snout, or one or both jaws, elongated, pointed or tubular ........................ 19
19. Snout or both jaws greatly elongated ................................................. 20
   Lower jaw projecting beyond upper (Fig.54) ........................................... Exocoetidae (Hemirhamphinae): halfbeaks

20. Snout greatly elongated, tubular (Fig.55) ..........Fistulariidae: cornet fishes
   Both jaws elongated, beak-like (Fig.56) .................................................. Belonidae: needle fishes

SECTION D

Pelvic fins abdominal; two dorsal fins, one with rays, one adipose

1. Photophores absent .............................................................................. 2
   Photophores present on body or under head ............................................ 14

2. Eye minute; either pectoral or pelvic fin greatly elongated (Fig.57) .......... 2
   Eye normal; pectoral or pelvic fin not elongated ........................................ 3
   Bathypteroidae: tripod fishes

3. Dorsal fin base longer than head length .............................................. 4
   Dorsal fin base shorter than head length .................................................. 5

4. Teeth extremely large, fang-like; body dark metallic blue (Fig.58) .......... 4
   Teeth not as above; body brightly coloured (Fig.59) ................................ 7
   Alepisauridae: lancet fishes
   Aulopiidae: Sergeant Baker

5. Eye bulbous, projecting upwards (Fig.60) ........................................... 6
   Eyes not projecting upwards ................................................................. 7
   Opisthoproctidae: spook fishes

6. Dorsal fin origin opposite or posterior to pelvic fin origin ....................... 9
   Dorsal fin origin in advance of pelvic fin origin ...................................... 10

7. Dorsal fin above anal fin (Fig.61) ....................................................... 8
   Dorsal fin anterior to anal fin .................................................................. 9
   Retropinnidae: smelts

8. Upper jaw extending rearward past eye for a distance at least twice the length of the eye (Fig.62) ...................................................... Synodontidae: lizard fishes
   Upper jaw not extending rearward past eye ............................................ 11

9. First dorsal fin situated about midpoint of body (Fig.63) ....................... 10
   First dorsal fin situated behind midpoint of body (Fig.64) ...................... 11
   Scopelosauridae: silversides
   Prototroctidae: grayling

10. Axillary process present at base of pelvic fin (Fig.65) ........................... 11

7. Axillary process at base of pelvic fin ................................................... 12
   No axillary process at base of pelvic fin .............................................. 13

11. Maxillary reaching beyond anterior edge of eye .................................... 13
   Maxillary falling well short of eye, or barely reaching anterior edge .......... 14

12. Teeth large, fang-like; no scales on body (Fig.66) .................................. 14
   Teeth small; scales present on body (Fig.67) ........................................ 15
   Evermannellidae: sabre-tooth fishes
   Chlorophthalmidae: cucumber fishes

13. Branchiostegals 5; scales persistent; jaws falling short of eye (Fig.68) ...... 15
   Branchiostegals 2-4; scales easily rubbed off; jaws barely reaching eye (Fig.69) 15
   Argentiniiidae: argentines
   Bathylagididae: deep-sea smelts

14. Photophores in a duct between lower jaw and pelvic fins (Fig.70) .......... 15
   Photophores on side of body or head ..................................................... 16
   Paralepididae: barracudinas
15. Photophores under eyes only; small, bright white spot on side of eye (Fig.71) .................Scopelarchidae: pearleys
Photophores on body ......................................................... 16
16. Photophores not arranged in parallel rows ................................................. 17
Photophores in parallel rows .................................................... 18
17. Upper jaw teeth extending outside lower jaw when mouth is closed; photophores generally present on branchiostegal membrane
(Fig.41) ............................................................................Gonostomatidae: light fishes
(Fig.72) ...............................................................................Photichthyidae: lighthouse fishes
Upper jaw teeth contained within mouth; no photophores on branchiostegal membranes (Fig.73) .............Mycotrophidae: lantern fishes
18. Teeth fang-like .............................................................................. 19
Teeth not fang-like (Fig.74) ..........................................................Sternoptychidae: hatchet fishes
(Fig.75) ..............................................................................Neoscopecelidae
19. Barbel present (Fig.76) .......................................................................Astronesthidae: snaggletooths
Barbel absent (Fig.77) ..................................................................Chauliodontidae: viperfishes

SECTION E
Pelvic fins abdominal; two fins on back, both with rays
1. Scales absent; skin smooth ..................Chondrichthyes: elephant fish, ghost sharks
Scales present (may be reduced to coarse sandpaper-like asperities) ................................................. 2
2. Snout tubular and elongated (Fig.78) ..................Macrorhamphosidae: snipe fishes
Snout not tubular or elongated ............................................................................................................ 3
3. Lower jaw projecting; teeth large, canine-like (Fig.79) .............Sphyraenidae: barracudas
Jaws about equal; teeth small or absent ......................................................................................... 4
4. Distinct silver band along side of body; eye large, about 2/5 length of head (Fig.80)
..................................................................................Atherinidae: hardheads
No distinct silver band on side of body; eye small, about 1/4 length of head (Fig.81)
.................................................................Mugilidae: mullets

SECTION F
Pelvic fins thoracic, strongly modified into a cone or sucking disc
1. Pelvic fins united into a cone; 2 dorsal fins (Fig.82) .....................Gobiidae: gobies
Pelvic fins forming a sucking disc; 1 dorsal fin (Fig.83) Gobiesocidae: cling fishes
### SECTION G
Pelvic fins thoracic, with 1 spine and 5 soft rays

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Key</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gill openings small, behind, above or below pectorals</td>
<td>Ogcocephalidae: bat fishes</td>
<td>2</td>
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<tr>
<td></td>
<td>Gill openings in front of pectoral fins</td>
<td>Chaunacidae: sea toads</td>
<td>4</td>
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<tr>
<td>2.</td>
<td>Mouth large</td>
<td>Antennariidae: frogfishes</td>
<td>3</td>
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<td></td>
<td>Mouth small; head and body flattened (Fig.84)</td>
<td>Cepolidae: bandfishes</td>
<td>5</td>
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<tr>
<td>3.</td>
<td>Spinous dorsal fin reduced to single illicium or ‘lure’ (Fig.85)</td>
<td>Echeneididae: remoras</td>
<td>6</td>
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<tr>
<td></td>
<td>Spinous dorsal fin reduced to 3 spines (Fig.86)</td>
<td>Diretmidae: discfishes</td>
<td>7</td>
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<tr>
<td>4.</td>
<td>Body eel-like; dorsal and anal fins connected to caudal fin (Fig.87)</td>
<td>Zeidae: dories</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Body not eel-like; dorsal and anal fins free from caudal fin</td>
<td>Scombridae: tunas</td>
<td>9</td>
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<tr>
<td>5.</td>
<td>First dorsal fin modified into a sucking disc on top of head (Fig.88)</td>
<td>Gempylidae: snake mackerels</td>
<td>10</td>
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<tr>
<td></td>
<td>First dorsal fin not modified into a disc</td>
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<tr>
<td>6.</td>
<td>Lateral line absent (Fig.89)</td>
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<td></td>
<td>Lateral line present</td>
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<td>14</td>
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<td>7.</td>
<td>Body laterally compressed, ovate; bony shields or thorns along bases of dorsal and anal fins (Fig.90)</td>
<td></td>
<td>12</td>
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<tr>
<td></td>
<td>Body compressed or elongate; no bony shields or thorns at bases of vertical fins</td>
<td></td>
<td>13</td>
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<tr>
<td>8.</td>
<td>Dorsal fin followed by 2 or more finlets</td>
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<td></td>
<td>Dorsal fin followed by 1 finlet, or finlets absent</td>
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<tr>
<td>9.</td>
<td>Keels present on caudal peduncle; or pelvics enlarged and folded into a deep groove on the midline of the belly (Fig.91)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Keels absent on caudal peduncle; or path of lateral line tortuous and wavy (Fig.92)</td>
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<td>10.</td>
<td>Dorsal fin with soft rays only</td>
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<td></td>
<td>Dorsal fin with spines and soft rays, or with spines only</td>
<td></td>
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<td>11.</td>
<td>Eyes on top of head</td>
<td></td>
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<td></td>
<td>Eyes lateral</td>
<td></td>
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<tr>
<td>12.</td>
<td>Large humeral spine at upper limit of gill cover; lips not fringed</td>
<td>Uranoscopidae</td>
<td>11</td>
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<td></td>
<td>(Fig.93)</td>
<td>Pleuroscopinae: stargazers</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>(Fig.94)</td>
<td>Leptoscopidae: stargazers</td>
<td>12</td>
</tr>
<tr>
<td>13.</td>
<td>Caudal fin deeply forked (Fig.96)</td>
<td>Coryphaenidae: dolphin fishes</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Caudal fin not deeply forked (Fig.97)</td>
<td>Percophidae: opalfishes</td>
<td></td>
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</tbody>
</table>
14. Dorsal and anal fins with spines only (Fig.98) ........................................... *Luvaridae: louvars*
Dorsal fin with both spines and soft rays ........................................... 15
15. Dorsal fin with 3 or fewer spines ....................................................... 16
Dorsal fin with 4 or more spines ....................................................... 20
16. Dorsal and anal fins high, flexible, entirely depressible into a sheath of enlarged scales along base of fin; or dorsal profile of head notably arched or rounded (Fig.99) ................................................................. *Bramidae: pomfrets*
Fins not as above; dorsal profile of head flat or only slightly rounded .... 17
17. Body laterally compressed (Fig.100) .............................................. *Centrolophidae: raftfishes*
Body not laterally compressed ....................................................... 18
18. Strong spine on preoperculum (Fig.101) ......................................... *Callionymidae: dragonets*
Strong spine on operculum (Fig.102) .............................................. *Bovichthyidae: thornfishes*
No spines on preoperculum or operculum ........................................ 19
19. Dorsal fin continuous (Fig.103) ...................................................... *Mugiloididae: sandperches*
Dorsal fin divided into two (Fig.104) .............................................. *Nototheniidae: icecods*
20. Lowermost rays of pectoral fin detached and thread-like or barbel-like (Fig.105) ................................................................. *Triglidae: gurnards*
Lowermost rays of pectoral fin not detached from fin ........................................... 21
21. Suborbital-stay present ................................................................. 22
Suborbital-stay absent ................................................................. 26
22. Anal spines absent ................................................................. 23
Anal spines present ................................................................. 25
23. Head and body flattened; a row of spiny scutes of each side of body (Fig.106) ................................................................. *Hoplichthyidae: flatheads*
Head and body not greatly flattened; spiny scutes absent ........................................... 24
24. Body without scales except for lateral line (Fig.107) ....................... *Cottidae: sculpins*
Body with 50–90 vertical scale rows (Fig.104) ................................. *Nototheniidae: icecods*
25. Body scaled; snout normal (Fig.108) ............................................. *Scorpaenidae: scorpionfishes*
Body without scales, or with coarse granular scales; snout elongated (Fig.109) ................................................................. *Congiopodidae: pigfishes*
26. Scales absent ................................................................. 27
    Scales present ................................................................ 28
27. Belly not distensible; gill rakers present (Fig. 110) ..........Grammistidae: soapfishes
     Belly distensible; gill rakers absent (Fig. 111) .............Chiasmodontidae: swallowers
28. Throat with 2 long barbels just behind chin (Fig. 112) .......Mullidae: goatfishes
     Chin without barbels ...................................................... 29
29. Anal spines 1-2 (very weak in some families and may appear as rays) ...................................... 30
     Anal spines 3-4 .............................................................. 36
30. All anal spines connected to soft-rayed portion by membranes ............................................... 31
     1-2 anal spines isolated from soft-rayed portion; tail crescent-shaped ..................................... 36
31. Caudal peduncle with 2 keels on each side (Fig. 113) ...Tetragonuridae: squaretails
     Caudal peduncle without keels, or with a single keel on each side ........................................... 32
32. Lateral line terminating below dorsal fin, not extending onto caudal area (Fig. 114) ............... Pomacentridae: damselfishes
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33. Dorsal fin continuous (Fig. 115) ................................. Branchiostegidae: tilefishes
     Dorsal fin in 2 portions which may or may not be separated .................................................. 34
34. Caudal peduncle about same length as base of dorsal fins (Fig. 116) ....................................... Apogonidae: cardinalfishes
     Caudal peduncle much shorter than base of dorsal fins ............................................................. 35
35. Dorsal fins separated (Fig. 117) ....................................... Eleginidae: sleepers
     Dorsal fins not separated (Fig. 118) ............................... Mugilidae: sandperches
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     Anal spines connected to soft-rayed portion of anal fin ............................................................. 37
37. Body yellow or silver, with 4 or 5 vertical black bands (Fig. 120) ........................................ Chaetodontidae: butterfly fishes
     Body not coloured as above ........................................................................................................... 38
38. Sheath of scales extending onto spinous dorsal fin (Fig. 121) .................................................. Kyphosidae: drummers
     No sheath of scales as above (scales may extend onto base of fin and form a shallow groove) . 39
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<td>39.</td>
<td>Maxillary mostly hidden when mouth is closed</td>
<td>Labridae: wrasses</td>
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<td>Maxillary fully exposed, or only slightly covered by edge of bone above when mouth is closed</td>
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<td>Anterior teeth canine-like (Fig.122)</td>
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<td>41.</td>
<td>Side teeth molariform (Fig.123)</td>
<td>Sparidae: snappers</td>
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<tr>
<td></td>
<td>Side teeth not molariform</td>
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<td>42.</td>
<td>Snout usually elongated; either, head encased in exposed rough bones, or caudal peduncle with 1 or more lateral spines</td>
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<td></td>
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<td>Caudal peduncle with spines (Fig.124)</td>
<td>Acanthuridae: surgeonfishes</td>
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<td></td>
<td>Caudal peduncle lacking spines; head encased in exposed rough bones (Figs 125 a,b)</td>
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<td>Pentacerotidae: boarfishes</td>
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<td>44.</td>
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<td></td>
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<td></td>
<td>Anal fin base shorter than soft dorsal</td>
<td></td>
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<tr>
<td>45.</td>
<td>Teeth incisorform or parrot-like</td>
<td></td>
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<td></td>
<td>Teeth not incisorform or parrot-like</td>
<td></td>
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<tr>
<td>46.</td>
<td>Teeth incisorform (Fig.126)</td>
<td>Kyphosidae (Girellinae): drummers</td>
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<td></td>
<td>Teeth fused, parrot-like (Fig.127)</td>
<td>Scaridae: parrotfishes</td>
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<td>47.</td>
<td>Lower pectoral rays elongate; caudal fin deeply forked or rounded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower pectoral rays not usually elongate; caudal fin rounded or lunate</td>
<td></td>
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<td>Dorsal spines 10, each with a tuft of short filaments (Fig.128)</td>
<td>Cirrhitidae: hawkfishes</td>
</tr>
<tr>
<td></td>
<td>Dorsal spines 14–23, no filaments (Fig.129)</td>
<td>Cheilodactyliidae: morwongs</td>
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Mouth not protractile ......................................... 51

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(Fig.134) ..........................................................Percichthyidae: basses
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Opercular flaps not meeting below isthmus, not entirely covering branchiostegal rays ........................................................................ 53

53. Anal fin base shorter than soft dorsal (Fig.136) ...........Arripidae: kahawai
Anal fin base about equal to soft dorsal (Fig.137) .............Latrididae: trumpeters
Anal fin base longer than soft dorsal (Fig.138) .................Pempheridae: bullseyes

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SECTION H

Pelvic fins thoracic, will less than 5 rays

1. Upper jaw prolonged into a spear (Fig.139) ..................Istiophoridae: billfishes
Upper jaw not prolonged into a spear ........................................ 2

2. Pelvic fins filamentous; body compressed laterally, eel-like (Fig.140)
..................................................Regalecidae: eelfishes
Pelvic fins filamentous; body not eel-like (Fig.141) ..........Morididae: morid cods
(Fig.142) ..................................................Bregmacerotidae: codlets
Pelvic fins not filamentous ................................................. 3

3. Dorsal fin entirely of spines, or spines and soft rays ............4
Dorsal fin entirely of soft rays ................................................. 12

4. Dorsal fin spines not in line but alternating side to side (Fig.143)
..................................................Monocentrididae: pineapple fishes
Dorsal fin spines in line .................................................. 5

5. Dorsal fin with more spines than rays ................................................................. 6
Dorsal fin with less spines than rays ................................................. 8

6. Dorsal fin 1 ........................................................................ 15
Dorsal fins 2 ........................................................................ 7
Dorsal fins 3 (Fig.144) ..................................................Tripterygiidae: triplefins

7. Teeth fang-like; pectoral rays branched (Fig.92) ....Gempylidae: snake mackerels
Teeth conical; pectoral rays unbranched (Fig.145) ..............Clinidae: weed fishes
8. Pectoral fins enlarged, reaching beyond anal fin (Fig.146) .......................................................... Dactylopteriidae: flying gurnards
	Pectorals not enlarged .......................................................... .......................................................... 9
9. Body partly or entirely lacking scales; anal spines absent .......................................................... 10
	Body scaled; anal fin with spines .......................................................... 11
10. Dorsal fins separated; preoperculum with spines (Fig.147) ................. Cottidae: sculpins
	Dorsal fin continuous; preoperculum without spines
	(Fig.148) .................................................................................. Psychrolutidae: toadfishes
	(Fig.149) .................................................................................. Cottunculidae: toadfishes
11. Gill membranes free from isthmus (Fig.145) ........................................ Clinidae: weed fishes
	Gill membranes joined to isthmus (Fig.150) ...................................... Blenniidae: blennies
12. Gill membranes joined to isthmus; fins club-like (Fig.32) ............... Zoarcidae: eel pouts
	Gill membranes free from isthmus .......................................................... 13
13. Pelvic fin rays normal (Fig.151) ........................................ Limnichthyidae: tommyfishes
	Pelvic fin rays modified to small scale or spine; tail fin forked (Fig.152) .......................................................... 14
	Pelvic fin rays barbel-like; tail fin rounded (if present) .......................................................... 14
14. Pelvic fins attached under shoulder girdle; the 2 rays united by a membrane (Fig.153) ........................................ Bythitidae: cusk eels
	Pelvic fins attached under eyes or chin; the 2 rays joined only at base of fin (Fig.155) ........................................................................ Aphyonidae
	Ophidiidae: lings
15. Anal spines 3 (Fig.156) ...................................................... Odacidae: butterfishes
	Anal spines more than 3 (Fig.157) ................................................... Acanthocliniidae: rockfishes

SECTION I
Pelvic fins thoracic, with 5 or more rays not modified to form a cone or sucking disc
1. Body ovate, laterally compressed .......................................................... 2
	Body elongate, much longer than deep, not laterally compressed .......... 8
2. Spines absent from fins .................................................................. 3
	Strong spines in fins .................................................................. 5
3. Body brilliantly coloured, steel blue above, silver below with crimson tinge, numerous white spots and bright crimson fins (Fig.158) ........................................ Lampridae: opah
	Body not coloured as above .......................................................... 4
4. Teeth small or absent (Fig.159) ...................................................... Veliferidae: velifers
	Teeth fang-like (Fig.160) ............................................................... Anoplogastridae: fangtooth
5. Caudal fin forked ........................................................................... 6
	Caudal fin rounded or truncated .......................................................... 7
6. Pelvic fin with 1 spine and 7–13 soft rays; head not cavernous (Fig.161) .......................................................... Berycidae: alonsinos
	Pelvic fin with 1 spine and 6 soft rays; head cavernous (Fig.162) .......................................................... Trachichthyidae: roughies
7. Anal fin spines present (Fig. 90) .............................................. Zeidae: dorries (Fig. 163)  
    Anal fin spines absent (Fig. 89) ........................................... Oreosomatidae: oreos (Fig. 164)  
    Macruridae: disc fishes

8. Anal fin absent (Fig. 165) ....................................................... Trachipteridae: dealfishes  
    Anal fin present ........................................................................ 9

9. Anal fin spines absent ............................................................... Melamphaidae: bigscale fishes (Fig. 166)  
    Anal fin spines 1-2 (Fig. 167) ..................................................... Nomeidae: eyebrow fishes (Fig. 168)

10. Tail pointed; no distinct caudal fin (Fig. 169) ......................... Macrouridae: rattails (Macrurinae): hoki  
    Caudal fin present (may be continuous with dorsal and anal) .... 11

11. Dorsal fin 1 (Fig. 170) ......................................................... Bathysauridae: deep sea lizardfish  
    Dorsal fins 2 ........................................................................ 12
    Dorsal fins 3 (Fig. 171) ........................................................... Gadidae: cods (Fig. 172)
    Moridae: morid cods

12. First dorsal consisting of 1 long ray and many brush-like rays (Fig. 173)  
    First dorsal not as above ................................................................ 13

13. Barbel absent; pelvic fins normal ............................................. 14
    Barbel usually present; outer rays of pelvic fins filamentous (Fig. 174)  
    Moridae: morid cods

14. Caudal fin separate from dorsal and anal fins, body silver .......... 15
    Caudal fin joined to dorsal and anal fins; body dark brown to black (Fig. 175)  
    Melanidae: pelagic cods

15. Teeth canine-like; caudal fin truncated (Fig. 176) .................... Merlucciidae (Merluccinae): hake  
    Teeth small, villiform; caudal fin rounded (Fig. 177) ................... Moridae: morid cods
REFERENCE COLLECTION OF FISHES AT THE NATIONAL MUSEUM

The National Museum of New Zealand maintains a comprehensive collection of fishes caught in the New Zealand region. This collection has been built up from smaller collections established by the Colonial Museum (1865–1907) and the Dominion Museum (1907–1973) and comprises in excess of 15,000 specimen lots, representing approximately 720 species of bony fishes.

The collection is continually expanding, both in numbers of specimens and species, through the efforts of Museum staff, other scientists and donations from local fishermen and members of the public. Such is the limited state of our knowledge about the fishes in the water around New Zealand that new collections continue to produce species new to science and new records for the region.

All fishes in the collection are kept in systematic order so that each is readily available for research or reference by scientists and students, both in New Zealand and overseas. The reference collection provides a wealth of basic data for such studies as the systematics, classification, distribution, ecology and biology of fishes.

Fishermen can make a valuable contribution to this research by forwarding rare or unusual fishes to the Museum. It is important to ensure that fishes arrive in the best possible condition, and the following notes have been prepared as a guide for anyone wishing to help in this way.

COLLECTING FISHES

Fishes can be identified properly only by careful examination of a specimen. Verbal or written descriptions and sketches are often inadequate, especially if the fish belongs to an undescribed species.

After collection specimens should be handled carefully to avoid damage, and must be preserved and labelled clearly before being sent to the Museum. Fish colours fade rapidly after death even in liquid preservation. A colour photograph of the fresh specimen is therefore very useful.

Labels These should be durable and written in waterproof ink or pencil. Never use ball-point pen. Minimum information should include place, depth and date of capture and the collector’s name.

Preservation Freezing is best if the specimen can be transported to the Museum quickly. A frozen fish well wrapped in wet newspaper and sent sealed inside a waterproof plastic bag or container will remain in good condition for up to 24 hours. If freezing is not available then fishes can be preserved in formalin or methylated spirits. Fishes should be preserved in an outstretched position — not crammed into an inadequate container. Large fishes (more than 300mm) should have a small incision made in the side of the body to enable the liquid to penetrate the body cavity. Fishes ‘fixed’ in preservative can be removed after a few days, wrapped in cloth or cotton wool which has been pre-soaked in the preservative, and well sealed in plastic bags or containers before transportation. Care should be taken to ensure that fin spines do not penetrate the plastic bags. Formalin (available from chemists and also used to control foot rot in sheep) should be used 1 part to 10 parts water. Formalin is poisonous and corrosive and must be handled with care. Formalin is used to ‘fix’ fishes before long-term storage in alcohol. Alternatively methylated spirits, diluted 3 parts meths to 1 part water, may be used.

Despatch Once the specimen has been sealed to prevent any leakages it can be sent, preferably in a rigid container, to the Curator, Department of Fishes, National Museum of New Zealand, Buckle Street, Wellington (Phone 859-609).