

this in turn carries us to Key E (p. 7) because it has three separate, well developed dorsal fins.

Since there are 3 dorsal fins and 2 anal fins, section 1 of Key E sends us to the key to the cod and silver hake families (p. 173). Turning to the first section of the latter we find that our fish fits the first alternative (3 dorsal fins and 2 anals),

which refers it to section 2. And here the black lateral line and the dark blotch on each shoulder name it a haddock.

Any other Gulf of Maine species is to be named in the same way, starting with Key A, section 1, and following through the appropriate alternatives as they refer it from section to section.

KEY TO GULF OF MAINE FISHES

Key A

1. Mouth soft, with no firm jaws; no pectoral fins; form eel-like..... 2
Mouth has firm jaws; pectoral fins are present even if the form is eel-like..... 3
2. Two separate fins on the back; no barbels on the snout..... Lamprey, p. 12
Only one fin on the back; with barbels on the snout..... Hag, p. 10
3. Five gill openings on each side..... 4
Only one gill opening on each side..... 5
4. General form cylindrical in all Gulf of Maine species; the forward edges of the pectoral fins are not attached to the sides of the head forward, past the gill openings; the gill openings are not confined to the lower surface; the upper margin of each orbit is free from the eyeball, as a free eyelid..... Sharks, key, p. 16
General form very flat, dislike; the forward edges of the pectoral fins are attached to the sides of the head forward past all of the gill openings; the gill openings are confined to the lower surface; the upper margin of each orbit is not free from the eyeball (no free eyelid)..... Skates and Rays, key, p. 57
5. The bones of the head are fused in a tubular snout, with the mouth at its lip..... refer to Key B, p. 6
No tubular snout..... 6
6. One or both jaws are prolonged as a bony sword or bill..... refer to Key C, p. 6
Neither jaw is greatly prolonged..... 7
7. Body abruptly square-cut, close behind the very high dorsal and anal fins..... refer to Sunfishes, key, p. 529
Body with distinct tail part..... 8
8. There is a sucking plate or disc, either on the top of the head or on the chest..... 9
There is no sucking disc or plate..... 11
9. The sucking plate is on the top of the head..... refer to Remora family, key, p. 485
The sucking disc is on the chest..... 10
10. General form is like a tadpole; the anal fin originates about as far back as the tips of the pectorals, refer to Sea snail family, key, p. 464
General form is not like a tadpole, but is high arched, with longitudinal ridges; the anal fin originates far behind the tips of the pectorals..... refer to Lumpfish family, key, p. 459
11. Tail like a shark, i. e., with the upper lobe much longer than the lower..... Sturgeons, key, p. 81
Tail with the upper and lower lobes of equal lengths, or nearly so..... 12
12. No clear separation between the anal and the caudal fins, which together form one continuous fin (the anal portion may be either long or short)..... refer to Key D, p. 6
Anal and caudal fins are separated by a deep notch, or by a space..... 13
13. Sides of body and head, or both, with luminescent spots or patches, easily seen if not damaged, refer to Luminescent fishes, key, p. 141
No luminescent organs..... 14
14. There is a fleshy ("adipose") fin, with neither rays nor spines, either in front of the rayed dorsal fin, or behind it..... 15
There is no fleshy ("adipose") fin, but both the dorsals (if there are two) are supported by rays or by spines that can be felt, if not seen..... 18
15. The adipose fin is on the nape of the neck, in front of the dorsal fin..... Tilefish, p. 426
The adipose fin is behind the dorsal fin..... 16
16. The dorsal fin extends nearly the entire length of the body..... Lancetfish, p. 161
The dorsal fin is short, standing about midway of the body..... 17
17. Tail deeply forked..... refer to Smelts and Argentine Key, p. 133
Tail nearly square or only slightly forked..... refer to Salmon key, p. 120
18. The head is fringed with fleshy tags or flaps..... 19
The head is not fringed with fleshy tags or flaps..... 22
19. The pectorals are armlike..... 20
The pectorals are not armlike..... 21

Key A—Continued

20. Body very broad and flat; mouth enormous..... Goosefish, p. 532
 Body deep and flattened sidewise; mouth small..... Sargassum fish, p. 541
21. The first (spiny) dorsal fin is longer than the second (soft-rayed dorsal); neither dorsal fin is fleshy.... Sea raven, p. 454
 The first (spiny) dorsal fin is much shorter than the second (soft-rayed dorsal); both of the dorsals are thick and fleshy..... Toadfish, p. 518
22. Fishes which lie flat on the one side, with both of their eyes on the other side; the upper side is dark, the lower side normally is pale..... refer to Flatfish tribe key, p. 248
 Fishes which do not lie flat on one side..... 23
23. Two or more separate and well-developed dorsal fins, each with continuous membrane..... refer to Key E, p. 7
 Only one well-developed dorsal fin with continuous membrane (this, however, may be preceded by isolated spines or rays)..... 24
24. Top of snout with several barbels or beards..... Rockling (cod family in part), p. 234
 No barbels or beards on the top of the snout..... 25
25. Jaws with very large canine tusks..... refer to Wolfishes key, p. 503
 No large canine tusks in either jaw..... 26
26. Dorsal fin soft-rayed throughout its length, except that it may be preceded by a few separate spines.
 refer to Key F, p. 8
 At least the forward one-third of the dorsal fin is with stiff sharp rays or spines..... refer to Key G, p. 9

Key B

Fishes with tubular snouts (from No. 5, p. 5).

1. Head is horselike; rear portion of trunk is slender, prehensile; no caudal fin..... Sea horse, p. 315
 Head is not horselike; rear part of trunk is not prehensile; there is a caudal fin..... 2
2. Body and head (measured from tip of snout) are only about 4 times as long as deep; the dorsal fin has a long, strong, saw-edged spine..... Snipefish, p. 301
 Body and head (measured from tip of snout) are at least 25 times as long as deep; the dorsal fin does not have a large spine..... 3
3. The snout is not longer than the dorsal fin; the anal fin is very small; no ventral fins; the caudal fin is rounded..... Pipefishes, key, p. 312
 The snout is more than 6 times as long as the dorsal fin; the anal fin is about as large as the dorsal; ventral fins are present though small; the caudal fin is forked..... Trumpetfish, p. 316

Key C

Fishes with bills or swords (from No. 6, p. 5)

1. Both of the jaws are elongated..... 4
 Only one of the jaws is elongated..... 2
2. Upper jaw elongated, as a sword..... 3
 Lower jaw elongated..... Halfbeak, p. 169
3. The sword is flattened dorso-ventrally, and is sharp-edged; the first dorsal fin is shorter than the sword forward of the eyes; no ventral fins..... Swordfish, p. 351
 The sword is round-edged; the first dorsal fin is nearly twice as long as the sword..... refer to Spearfishes or Marlins and Sailfish, ¹²p. 358
4. The caudal fin is well developed..... 5
 No caudal fin; the tip of the tail is whip-like..... Snipe eel, p. 159
5. There are several finlets behind the dorsal and anal fins..... Needlefish, p. 170
 No finlets behind the dorsal and anal fins..... refer to Billfishes or Silver gars, key, p. 167

Key D

Bony fishes with snouts of ordinary form; with only one gill opening on each side, and with the anal fin continuous with the caudal fin around the tip of the tail (from No. 12, p. 5).

1. Only one dorsal fin..... 2
 Two separate dorsal fins, the first much bigger than the second, but shorter..... 7
2. Body band-shaped, the tail tapering to a whip-like tip..... Cutlassfish, p. 350
 Body thick, eel-like; the vertical fins continuous around the tip of the tail in a broad band..... 3
3. The dorsal fin is spiny from end to end..... 4
 The dorsal fin is soft-rayed, at least for almost all its length..... 5

¹² The sailfish would also come under this heading should one ever be taken in the Gulf of Maine. The distinctions between it and the spearfishes are given on page 358.

Key D—Continued

4. Mouth large and strongly oblique; there are no ventral fins..... Wrymouth, p. 500
 Mouth small and horizontal; with small ventral fins..... Rock eel, p. 492
5. There are no ventral fins..... refer to Eel family key, p. 150
 With small but distinct ventral fins, situated forward of the pectorals..... 6
6. The ventrals are situated behind the gill openings and are of ordinary form.... refer to Eelpout family, key, p. 509
 The ventrals are situated on the chin, well in front of the gill openings and are reduced to forked, barbel-like structures..... Cusk eel, p. 517
7. The ventral fins are situated below the points of origin of the pectorals; the skin is conspicuously scaly.
 refer to Grenadier family, key, p. 243
 The ventral fins are situated far back, behind the tips of the pectorals; the skin is soft, without scales.
 Chimaera, p. 79

Key E

Bony fishes of ordinary form, with 2 or 3 well-developed dorsal fins and with the anal fin and the rearmost dorsal separated from the caudal fin. (from No. 23, p. 6).

1. Three dorsal fins and 2 anal fins..... refer to Cod family, key (in part), p. 173
 Only 2 dorsal fins and 1 anal fin..... 2
2. With one or more small finlets between the second dorsal and anal fins and the caudal fin..... 3
 No finlets between the second dorsal and anal fins and the caudal fin..... 4
3. With more than 3 dorsal finlets and 3 anal finlets..... refer to Mackerel family, key, p. 317
 With only 2 dorsal finlets and 2 anal finlets..... Escolar, p. 349
 With only 1 dorsal finlet and 1 anal finlet..... Mackerel scad (Pompano family, in part), p. 374
4. Head very broad; top and sides of head bony, with sharp spines or horns..... 5
 Head not noticeably broad; sides of head have no spines or horns..... 7
5. First (lower) few rays of the pectoral fins are not separate from the remainder of the fin; the mouth is very large
 refer to Sculpin family, key, p. 440
 First (lower) few rays of the pectoral fins are separate from the remainder of the fin; the mouth is not very large..... 6
6. Each of the first (lower) 2 or 3 rays of the pectoral fins have the form of a separate feeler; outline of tip of snout is concave; the first few spines of the first dorsal fin are not separate from the remainder of the fin.
 refer to Sea robin and Armored sea robin, key, p. 467
 First (lower) few rays of the pectorals do not have the form of feelers, but are connected, one with the next, by membrane, as a separate fin; outline of tip of snout convex; the first few spines of the first dorsal are separate.
 Flying gurnard, p. 472
7. First spine of first dorsal fin is very much stouter than the other spines, and can be locked erect by the second spine; no ventral fins; skin of the sides is very hard..... Triggerfish, p. 520
 First dorsal spine is not much stouter than the others and cannot be locked erect by the second spine; ventral fins are well-developed; skin of the sides is soft..... 8
8. The space between the two dorsal fins is nearly as long as the first dorsal fin, or longer; the ventral fins are situated behind the middle of the pectorals..... 9
 There is little or no free space between the two dorsal fins; the ventrals are in front of the middle of the pectorals.... 11
9. Jaws long; teeth large and strong; anal with one spine..... Barracuda, p. 306
 Jaws short; teeth weak..... 10
10. Anal fin is about as long as head (snout to gill openings) and has one weak spine refer to Silverside family key, p. 302
 Anal fin is only about half as long as head and has three stiff spines (only two spines in very young specimens).
 Mullet, p. 305
11. Caudal peduncle is extremely slender; the caudal fin is deeply forked..... Pompano family (in part) key, p. 371
 Caudal peduncle is at least moderately deep and thick; the caudal fin is only moderately forked, at most..... 12
12. First dorsal fin is much lower than second dorsal..... 13
 First dorsal fin is as high as the second dorsal fin, or higher..... 14
13. Anal fin is nearly as long as second dorsal fin..... Bluefish, p. 383
 Anal fin is only about one half as long as second dorsal fin..... Rudderfish (Pompano family in part), p. 373
14. Body very thin through, flat sided, nearly two-thirds as deep as it is long to base of caudal fin; the back and also the ventral edge of the body are armed with bony plates; there is a finlet of three short spines in front of the anal fin..... John Dory, p. 297
 Body stout, not more than one-third as deep as it is long; the sides are rounded; the back and lower surface are not armed with bony plates; there is no finlet in front of the anal fin..... 15

Key E—Continued

15. First dorsal fin soft-rayed; second dorsal fin at least 5 times as long as first dorsal. refer to Cod family key, in part, p. 173
 First dorsal fin noticeably spiny; second dorsal fin as long as first dorsal.....16
16. Second dorsal fin not much longer than the anal fin.....refer to Sea bass family key, in part, p. 389
 Second dorsal fin is about twice as long as the anal fin.....refer to Weakfish family key, p. 417

Key F

- Bony fishes with snouts of ordinary form; symmetrical tails; caudal fin distinct from the anal fin; neither with barbels on the top of the snout nor with canine tusks; and with only one well-developed dorsal fin; the latter is soft-rayed except that it may be preceded by a few short spines or by a series of hair-like rays without connecting membrane and that there may be an isolated spine on the top of the head (from No. 26, p. 6).
1. The rear parts of the dorsal fin and of the anal fin are broken up into series of almost separate finlets (fig. 191)....2
 The rear parts of the dorsal and anal fins are not broken up into series of finlets.....3
2. The forward parts of the dorsal and anal fins are very high and scythe-shaped; the pectorals are very long, reaching back considerably beyond the high part of the dorsal fin; there are no spines in front of the anal fin...Sea bream, p. 361
 The dorsal and anal fins are not very high and slope gradually rearward; the pectorals are small, their tips falling far short of the level of the front of the dorsal fin; the anal fin is preceded by two short stout spines. Leather jacket, p. 380
3. The mouth gapes back far beyond the eye.....refer to Anchovies key, p. 118
 The mouth does not gape back much beyond the rear edges of the eyes, if that far.....4
4. The whole of the anal fin is behind the rear end of the dorsal fin.....refer to Herring Tribe key, p. 85
 Part or all of the anal fin is further forward than the rear end of the dorsal fin.....5
5. There is a spine or a bristle-like rod on the top of the head over the eyes.....6
 There is no spine or bristle-like rod on the head over the eyes, but there may be a few short spines close in front of the dorsal fin.....7
6. The spine on the top of the head is thick and very stiff and has no fleshy tab at its tip; mouth small; body stiff; fin rays slender, not fleshy.....refer to Filefish family, key, p. 521
 The spine on the head is slender and flexible and has a fleshy tab or "bait" at its tip; body soft; mouth very large; fin rays thick and fleshy.....Deep-sea angler, p. 543
7. Form eel-like; snout sharp pointed.....Launce, p. 488
 Form not eel-like; snout blunt.....8
8. Dorsal fin originates on the head, about over the eyes.....Dolphin, p. 360
 Dorsal fin originates far behind the eyes.....9
9. Each ventral fin is represented by a single large stout spine.....refer to Stickleback key, p. 307
 The ventral fins are of ordinary rayed type, or are lacking.....10
10. The upper anterior profile of the head is conspicuously concave.....11
 The upper anterior profile of the head is more or less convex.....12
11. The forward parts of the dorsal fin and of the anal fin are much higher than the rear parts, the first few rays of each being very much longer than the rays farther back.....Lookdown, p. 379
 The dorsal and anal fins are only a little higher in front than rearward, the first few rays not being much longer than the rays farther to the rear.....Moonfish, p. 378
12. The forward rays of the dorsal and anal fins are very long and thread-like.....Thread-fin, p. 381
 The forward rays of the dorsal and anal fins are not very long and thread-like.....13
13. The entire body is armored with several rows of overlapping plates.....Alligator fish, p. 457
 The body is not armored with overlapping plates.....14
14. The skin is rough or prickly.....Refer to Puffers and Porcupine fishes, key, p. 526
 The skin is smooth, though scaly.....15
15. The front part of the dorsal fin is much higher than the rear part.....16
 The front part of the dorsal fin is not much higher than the rear part.....17
16. The ventral fins are large and conspicuous.....Opah, p. 247
 There are no ventral fins.....Refer to Butterfish and Harvest Fish, key, p. 363
17. The tail fin is conspicuously rounded.....18
 The tail fin is more or less deeply forked.....19
18. The dorsal fin runs the whole length of the back from close behind the head to the caudal fin which it joins; there is a barbel on the chin.....Cusk, p. 238
 The dorsal fin occupies only about one-third of the length of the back or less, and stands far to the rear; there is a considerable space between it and the caudal fin; there is no barbel on the chin...Refer to Mummichog key, p. 162

Key F—Continued

19. The caudal peduncle is slender and has a conspicuous longitudinal keel on either side; the pectoral fins do not reach back as far as the point of origin of the dorsal fin.....Pilotfish, p. 372
The caudal peduncle is deep and has no longitudinal keel; the pectoral fins reach back farther than the point of origin of the dorsal fin.....20
20. There are 6-8 short detached spines, each with a small triangular fin membrane, on the back in front of the dorsal fin.....Barrelfish, p. 369
There are no detached spines on the back in front of the dorsal fin.....21
21. The ventral fins stand far behind the bases of the pectoral fins; the point of origin of the dorsal fin is little if any in advance of the anal fin; the pectoral fins (Gulf of Maine species) are very long, reaching back nearly to the base of the tail fin.....Flying fish, p. 172
The ventral fins stand about under the base of the pectoral fins; the point of origin of the dorsal fin is far in advance of the anal fin; the pectoral fins are small, falling far short of the anal fin.....Black ruff, p. 370

Key G

Fishes as in Key F, except that at least the forward one-third of the single dorsal fin is spiny. There is no adipose fin behind the rayed dorsal nor fleshy flap in front of it (from No. 26, p. 6).

1. The body (tip of snout to base of caudal fin) is at least as deep as it is long.....Boarfish, p. 438
The body is considerably longer than it is deep.....2
2. The rear part of the dorsal fin is soft-rayed.....3
The whole length of the dorsal fin is spiny.....8
3. Sides of head bony, with knobs or spines.....4
No knobs or spines on the sides of the head.....5
4. Sides of head armed with conical spines; the spiny portion of the dorsal fin is at least as long as the soft part; the body is flattened sidewise.....Refer to Rosefish family, key, p. 430
Sides of head with low rounded knobs only; the spiny portion of the dorsal fin is considerably shorter than the soft part; body tadpole-shaped.....Arctic sculpin (Sculpin family in part), p. 453
5. The ventral fins are much larger than the pectorals; the eyes are very large.....Short big-eye, p. 410
The ventral fins are not larger than the pectorals; the eyes are not very large.....6
6. The pectorals are sharply pointed; the body is much flattened sidewise.....Refer to Porgy family, key, p. 411
The pectorals are rounded; the body is not much flattened sidewise.....7
7. The rear (soft) part of the dorsal fin is nearly as long as the front (spiny) part; the anal fin is much higher than long.....Seabass (Seabass family in part), p. 407
The rear (soft) part of the dorsal fin is less than half as long as the spiny (front) part; the anal fin is longer than high.....Refer to Cunner family, key, p. 473
8. The mouth is strongly oblique; there are no ventral fins.....Wrymouth, p. 500
The mouth is not strongly oblique; ventral fins are present (very small in one species).....Refer to Blenny fishes, key, p. 491

THE CYCLOSTOMES. CLASS AGNATHA

The lampreys are the most primitive of the true vertebrates, their skeletons being cartilaginous without any true bone, and their skulls hardly differentiated from the vertebral column which forms a simple notochordal sheath. They have no true jaws, no ribs, no shoulder or pelvic girdles, and no paired fins. They are eel-like in

appearance, but are easily distinguishable from the true eels and, indeed, from most of the true fishes, by their peculiar jawless sucking mouth situated at the tip of the snout, and, further, from all Gulf of Maine eels by lacking pectoral fins.

THE HAGFISHES AND LAMPREYS. FAMILIES MYXINIDAE AND PETROMYZONIDAE

These two groups are easily distinguished, one from the other, by the fact that the hags have several barbels on the chin, that their mouths are not disc- or funnel-like, that they have only one continuous fin fold on the back and around the tail, and that their eyes are not visible exter-

nally, whereas the lampreys have no barbels, their mouths are disc- or funnel-like, their eyes are well developed after the larval stage is past, and they have one or more dorsal fins separate from the caudal fin.