Bay of Bengal Large Marine Ecosystem Project

Rapid Fisheries Assessment by Market Survey (RFAMS) Manual for the use of the RFAMS survey in the BOBLME region

BOBLME-2014-Ecology-24
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Rapid Fisheries Assessment by Market Survey (RFAMS)

Manual for the use of the RFAMS survey in the BOBLME region

Project title: Implementing rapid assessment protocols for assessing catch composition from small scale fisheries in the Bay of Bengal.
Written and prepared by W. White

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1. RFAMS Methodology
Methodology for data collection

The initial information recorded is the fish market (or landing site/port), data recorder (person or group), date and time of survey (e.g. 7:00–9:00 am). The total estimated weight of the landings was classified into one of five categories, i.e. <100 kg, 100–500 kg, 500 kg to 1 tonne, 1–10 tonnes and > 10 tonnes. Where possible, a total estimated weight was also provided calculated by summing the estimated weights in each of the taxonomic categories (see below). Where possible, the fleet size was recorded by determining the approximate number of boats in each of six categories based on boat size (note GT=gross tonnes): <5 GT, 5–10 GT, 10–30 GT, >30 GT, small with outboards and small without outboards.

Catch composition categories

Catch composition was broken down into 6 major taxonomic groupings:

- Cephalopods (squids, octopus)
- Other molluscs (bivalves, gastropods)
- Crustaceans (prawns, crayfish, crabs)
- Other (marine mammals, turtles, algae)
- Elasmobranchs (sharks, rays)
- Teleosts (bony fish).

For each of these major groupings, their percentage contribution to the landings (calculated from estimated weights of each of the taxonomic categories for all groups) and an estimate of the number of species observed was recorded.

Within each of the major taxonomic groupings, catch information was recorded on a family-level basis (e.g. Octopodidae, Penaeidae), except in a few cases where broader categories
were used due to difficulties in accurate family-level identification during rapid surveys (e.g. squids, algae).

<table>
<thead>
<tr>
<th>Octopodidae (octopus)</th>
<th># Biome</th>
<th>Method</th>
<th>%</th>
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<tbody>
<tr>
<td>Sepiidae (cuttlefish)</td>
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<tr>
<td>Squids</td>
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<tr>
<td>Nautilidae (nautilus)</td>
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</table>

In the case of elasmobranchs, catch information was collected at a species level in most instances due to the detailed knowledge of these groups by the developers of this survey method. These species refer to common Indonesian species and will vary between regions.

The most important information is the family level information, and only if time allows would information be collected at the species-level.

<table>
<thead>
<tr>
<th>Hexanchidae</th>
<th># Biome</th>
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<td>Hexanchus griseus</td>
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<td>S. hemipinnis</td>
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<td>S. montalba</td>
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<td>Centrophorus spp</td>
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<td>Chitoscyllium punctatum</td>
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<td>Aloiidae</td>
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<td>Isurus oxyrinchus</td>
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<td>Mustelus of manazo</td>
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<td>M. widodoi</td>
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In the case of the most abundant or most diverse teleost families, catch data was also recorded for the major genera or species groups, i.e. Carangidae (Caranx/Carangoides,
Decapterus, Scomberoides, other carangids), Scombridae (Thunnus/Euthynnus, Katsuwonus/Sarda, Scomberomorus/Acanthocybium, other scombrids). The predetermined taxonomic categories provided in the data sheets are based on surveys undertaken in Indonesia prior to this study as well as general knowledge of the fish groups exploited in the tropical Asian region. Blank spaces are also provided for other families encountered which are not listed.

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<thead>
<tr>
<th>Family</th>
<th>#</th>
<th>Biome</th>
<th>Method</th>
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<td>Engraulidae</td>
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<tr>
<td>Carangidae</td>
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<tr>
<td>Caranx/Carangoides</td>
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<td>Decapterus</td>
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<td>Scomberoides</td>
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<tr>
<td>other</td>
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<tr>
<td>Scombridae</td>
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<td>Thunnus/Euthynnus</td>
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<td>Katsuwonus/Sarda</td>
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<tr>
<td>Other scombrids</td>
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<tr>
<td>Scomberomorus/Acanthocybium</td>
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</table>
**Acquisition of catch data**

For each taxonomic category in each species grouping the following data was collected:

- index of abundance, the major bathome being fished, the major fishing method responsible for the catches, and estimated weight (kg).

### Index of abundance (IA)

For each taxonomic category, an index of abundance (0-11) was recorded based on a log scale:

- 0 = 0
- 1 = 1
- 2 = 2-3
- 3 = 4-9
- 4 = 10-27
- 5 = 28-81
- 6 = 82-250
- 7 = 250-750
- 8 = 750-2000
- 9 = 2000-6000
- 10 = 6000-20,000
- 11 = >20,000 individuals

A log scale index was used as it provides a good indication of abundance and is simple to record which is important in fish markets where large numbers of some fish are landed.

### Bathome (‘habitat type’)

For each taxonomic category, the major bathome (depth-related habitat) the catches were caught from was recorded from predetermined categories:

- 1 = freshwater
- 2 = estuarine
- 3 = coastal
- 4 = coral reef
- 5 = shelf demersal
- 6 = slope demersal
- 7 = inshore pelagic
- 8 = oceanic
- 9 = aquaculture
- 10 = beach
For example, tuna caught by pelagic longlines would have a bathome of 8 (oceanic) and fishing method of 6 (longline).

**Method (gear):** For each taxonomic category, the major method (gear) responsible for the catches was recorded from predetermined categories:

- 1 = cast net
- 2 = diver/spear
- 3 = dredge
- 4 = gillnet
- 5 = handline
- 6 = longline
- 7 = traps
- 8 = purse seine
- 9 = tidal trap
- 10 = trawl
- 12 = beach seine
- 13 = bagan (light trap)
- 14 = hand
- 15 = trammel net
- 16 = hand net
- 17 = dynamite

If there was multiple bathomes or fishing methods for a particular taxonomic category, only the major bathome and fishing gear was recorded.

**Estimated weight:** For each taxonomic category, an estimated weight (kg) was also recorded. Estimated weight was determined using known container weights (e.g. Styrofoam boxes, cane baskets, etc) in most cases, thus provide reasonable estimates of biomass being landed. This is one of the more difficult components to cover when different fish groups are being landed over long periods or are in different areas within the fish market.
2. Examples of the use of RFAMS in Indonesian fish landing sites and markets
Recording catch composition

Kedonganan fish market/landing site in Bali

In this market area at Kedonganan, most landings are in Styrofoam boxes of 2-3 sizes. An approximate weight is determined for each box and then used as a rough indicator of the weight of each container seen. In this market, the attached image would represent 3 of over 200-300 boxes, many with mixed groups. Recorders should practice between themselves on one survey day to get more standardised weights.

In the above example the information recorded is:

- the 3 boxes are all recorded as ‘Squid’
- 3 species present
• Full boxes approximately 10 kg, and since not all boxes full estimated weight was
  \[8+7+8 = 23 \text{ kg}\]

• Index of abundance (IA) = 6 (81-250 individuals)

• Bathome: Inshore pelagic = 7

• Method: Handline = 5
Other examples of catches: when in containers of known weight (or standardised in first survey)

Penaeidae: $5 \times 10 = 50$ kg; IA = 8

Bivalves: $1 \times 40 = 40$ kg; IA = 7

Mixed (containers about 10 kg when full)
Caesionidae (10 kg; IA = 5)
Acanthuridae (15 kg; IA = 4)
Chaetodontidae (1 kg; IA = 3)
Labridae (4 kg; IA = 4)

(right box) 20 kg capacity, ½ full=10 kg
Lutjanidae (10 kg; IA = 5)
Other examples of catches: when not in containers, e.g. on floor of market.

Alopiidae (~180 kg; IA = 4)

Dasyatidae (~150 kg; IA = 3)

Scombridae (~15 kg; IA = 2)

For larger specimens, e.g. sharks – length vs. weight relationships can be helpful to estimate weight of a shark to help recorders standardise their weight recordings.
Other examples of catches: very mixed species containers.

1. Cilacap, Central Java – trammel net catches can be very large (above pictured about 10% of the landings on that day!
   - Estimate weight of one drum (can usually be obtained when fishers weigh their catch): in this case ~100 kg
   - Thus ~600 kg in this image.
   - Catches often contain over 10 families of teleosts and 1 or 2 ray families thus too much to sort through
   - As a surrogate, sort through a known proportion, e.g. one drum, and then scale up to account for the other drums – i.e. subsample.

2. Muara Angke, Jakarta – mixed landings all enter site in a short period of time.
   - Need to cover all landings as well as watching out for new landings
   - Need suitable number of people; dependent on size and activity of site
3. Important considerations when doing RFAMS
Number of people doing the survey

Every landing site/market is unique, sometimes very small and sometimes extremely large. Thus, the number of people required to complete the survey will vary and thus pilot investigation of sites to be surveyed is recommended. Some landing sites have several different landing locations with the catches often congregating around weighing stations. At least one person needed on those sites.

Transhipment

Some landing sites have large quantities of fish brought into the site from other locations by road. In these instances, they will still be recorded in RFAMS but are not part of the real daily landing of that site. This is difficult to account for using this method and so at the least, notes about what particular catches are brought into the site may be useful. For example, at Pelabuhanratu (West Java in Indonesia), bigeyes (Priacanthidae) are brought into the landing site and market by truck from the northern Central Javan coast in large numbers.

Period of time to undertake survey

This varies greatly from site to site. Some landing sites operate for 1-3 hours after which all catch has been sold and nothing is left to record. Other landing sites have different fishery types unloading at various times in the day, sometimes very routinely. For example, at Cilacap in Central Java, although landings start at 8 am, trammel net catches mostly get landed in the afternoon and prawns from these may not be visible to record until the early evening. Thus, although the method of data collection is rapid, it may still require a site to be surveyed over a long period of the day.
Recording data for common families of fish

For some groups, e.g. Scombridae (tuna’s) and Lutjanidae (snappers), they are observed at many occasions during a survey and thus the data sheet will not have sufficient space to constantly record.

In these instances, it is recommended to use either a blank sheet of paper or a predetermined ‘abundant families’ temporary data sheet should be used to allow data to be recorded throughout the survey time and then accumulated into a single recording afterwards.

For example, on one occasion the recorder may collect the following information:

- Lutjanidae: 10 kg (IA=5); 20 kg (IA=5); 15 kg (IA=4)…..etc
  - these can be more easily recorded as 10(5), 20(5), 15(4), etc
  - following survey, the can be summed together. The IA can be determined roughly by taking the midpoint of the log-scale range and summing together to see what range they fall into. E.g. 5 = 28-80 (midpoint = 54) so in this example it would be 54+54+17 = 125 = IA of 6.
4. The RFAMS data sheets
<table>
<thead>
<tr>
<th>Market code</th>
<th>Recorders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Time</td>
</tr>
<tr>
<td>Estimated Tonnage</td>
<td>Fleet size</td>
</tr>
<tr>
<td>&lt;100 kg</td>
<td>1-10 t</td>
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<tr>
<td>100-500</td>
<td>&gt;10 t</td>
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<tr>
<td>600-1 t</td>
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<tr>
<td>Total landings tonnage</td>
<td>No.</td>
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<tr>
<td></td>
<td>No.</td>
</tr>
</tbody>
</table>

### Habitat (% wt)
1. freshwater
2. estuarine
3. coastal
4. coral reef
5. shelf demersal
6. slope demersal
7. inshore pelagic
8. oceanic
9. aquaculture

### Fishing methods (% wt)
1. cast net
2. diver / spear
3. dredge
4. gillnet
5. handline
6. longline
7. pots / traps
8. purse seine
9. tidal trap
10. trawl (demersal)
11. trawl (mid-water)
12. beach seine
13. began (light trap)
14. other (a)
15. other (b)

### Cephalopods (%)

<table>
<thead>
<tr>
<th>Cephalopod Family</th>
<th>Bathym. Method</th>
<th>Wt</th>
<th>Squids</th>
<th>Bathym. Method</th>
<th>Wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otophodidae (squid)</td>
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<tr>
<td>Sepiidae (cuttlefish)</td>
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### Other molluscs (%)

<table>
<thead>
<tr>
<th>Mollusc Group</th>
<th>Bathym. Method</th>
<th>Wt</th>
<th>Bivalves - mix, small</th>
<th></th>
<th>Nautilidae (nautil)</th>
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### Crustaceans (%)

<table>
<thead>
<tr>
<th>Crustacean Family</th>
<th>Bathym. Method</th>
<th>Wt</th>
<th>Raninidae (crab)</th>
<th>Bathym. Method</th>
<th>Wt</th>
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<tbody>
<tr>
<td>Penaeidae (shrimp)</td>
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<tr>
<td>Pandalidae (shrimp)</td>
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<tr>
<td>Portunidae (swimmer crab)</td>
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### Other (%)

<table>
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<th>81-250</th>
<th>9</th>
<th>2000-6000</th>
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<td>Bathone</td>
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<td>Wt</td>
<td>Hexanchidae</td>
<td>Rhincobatidae</td>
<td>Rhinidae</td>
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<td>Squalidae</td>
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<td><em>Squalus</em></td>
<td><em>Rhincobatus</em></td>
<td><em>Rhinobatos</em></td>
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<td><em>S. mokarran</em></td>
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<td><em>S. mokarrani</em></td>
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<td><em>Galeocerda</em></td>
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<td><em>C. longimanus</em></td>
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<td><em>C. melanopterus</em></td>
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5. Guide and keys to the marine faunal categories used in RFAMS
Crustaceans
(cray, crabs, prawns, shrimps)

Main groups recorded in RFAMS

**Palaemonidae** (palaemon shrimps)

**Penaeidae** (penaeid shrimps, prawns)

**Palinuridae** (spiny lobsters)

**Scyllaridae** (slipper lobsters)

**Stomatopods** (mantis shrimp, killer prawns)

**Portunidae** (swimming crabs, mud crabs)

**Raninidae** (spanner crabs)
Molluscs

Main groups recorded in RFAMS

Cephalopods (squid, octopus, cuttlefish, nautilus)

- Nautilidae (nautilus)
- Sepiidae (cuttlefishes)
- Squids (all squids combined)
- Octopodidae (benthic octopuses)

Other molluscs

- Typical bivalves (e.g. cockles, clams, mussels, oysters)
- Typical gastropods (e.g. limpets, abalone, turban shells, periwinkles, cowries)
- Volutidae (volutes, baler shell)
Other organisms
Main groups recorded in RFAMS

**Algae** (all types of seaweeds)

**Cnidaria** (jellyfishes)

**Cheloniidae** (sea turtles)

**Delphinidae** (true dolphins)
Chondrichthyans
(sharks, rays, chimaeras)

Key to the main families in the area

1 pair of gill openings

- **Snout short**
  - Chimaeridae

- **Snout very long**
  - Rhinorhinaidae

5-7 pairs of gill openings

- Gill openings on side of head
  - Chlamydoselachidae
  - Hexanchidae

- Gill openings on ventral surface of head
  - Anal fin present
    - A to 2A
    - **B** to 3B
    - C to 7B
Snout greatly elongate, blade-like, with numerous, sharp, lateral teeth and a pair of long barbels

Pristiophoridae

Body strongly depressed; pectoral fins very large and broad

Body not strongly depressed; pectoral fins small to moderate in size

Squatinidae

Denticles not extremely large; 1st dorsal fin closer to pectoral fins

Denticles extremely large; 1st dorsal fin origin over pelvic-fin bases

Echinorhinidae

No strong keel on caudal peduncle; a terminal lobe on caudal fin; spines present or absent

Strong keel on caudal peduncle; no terminal lobe on caudal fin; strong dorsal spines present

Squalidae
**Chondrichthyes**

**A** from 2A

- Upper teeth without lateral cusplets; if present, dorsal-fin spines often more even in height
- Upper teeth with strong lateral cusplets; 2nd dorsal-fin spine much longer than 1st

**Etmopteridae**

Dorsal-fin spines absent or very short

**Centrophoridae**

Dorsal-fin spines prominent

**Sonnioidae**

- Head quite broad and somewhat flattened
- Head narrow, rounded to conical

**Dalatiidae**

**B** from 1B

- Body yellow with numerous spots; strong ridges on sides
- Caudal fin nearly as long or longer than body

**Stegostomatidae**

**Alopiidae**

- Body bluish grey without spots; no ridges on sides
- Caudal fin much less than half body length

**A** to 4A
Mouth very broad, terminal; caudal fin forked; massive

Whole of mouth in front of eyes

Body strongly depressed anteriorly; skin flaps present along sides of head

Body not depressed; no skin flaps on side of head

Orectolobidae

Anal fin low, barely separable from caudal fin

Anal fin angular, tall, distinct from caudal fin

Ginglymostomatidae

Hemiscylliidae

Mouth partly below or behind eyes

Dorsal-fin spines present

Heterodontidae

A from 1B

A to 5A
**Scyliorhinidae**

- Head with broad, lateral expansions, hammer-shaped

- Upper part of snout not greatly elongate; jaws not protrusible

**Sphyrnidae**

- Upper part of snout greatly elongate; jaws highly protrusible

**Mitsukurinidae**

- Mouth not huge and subterminal

**Megachasmidae**

- Mouth huge and at front of head

- 1st dorsal-fin origin in well in front of pelvic-fin origin

**Scyliorhinidae**

- Caudal fin lunate, upper and lower lobes of similar length

**Lamnidae**

- 1st dorsal-fin origin well behind pelvic-fin origin

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**Chondrichthyans**
A from 5A

- Eyes very large; gill slits very large, extending onto dorsal surface of head
- Pseudocarchariidae

Eyelid capable of closing over eye (nictitating)

- Eyes smaller; gill slits not extending onto dorsal surface
- Odontaspididae

Spiracles absent (except in tiger shark *Galeocerdo cuvier*)

- Precaudal pits present at origin of caudal fin
- Carcharhinidae

Small, but distinct spiracles present

- Precaudal pits absent
- Hemigaleidae

Teeth small, numerous (>100 rows)

- Pseudotriakidae

Teeth larger, much less than 100 rows

A to 7A
Labial furrows at corners of mouth relatively long; ventral caudal lobe short but distinct

**Triakidae**

Labial furrows at corners of mouth short or absent; ventral caudal lobe barely evident

**Proscylliidae**

A
from 6B

Snout not saw-like

2 prominent dorsal fins present; origin of 1st dorsal fin closer to pelvic fins than tip of tail

**Pristidae**

B
from 1C

Snout greatly elongated, blade-like with numerous sharp lateral teeth

Body hard to touch, rough  Body soft to the touch, slimy

A
to 8A

Mouth broadly arched; 1st dorsal fin larger than 2nd

Mouth almost straight; dorsal fins similar in size larger than 2nd

B
to 8B

0-2 dorsal fins; when 2 dorsal fins present, origin of 1st closer to tip of tail than pelvic fins
A
from 7A
Snout triangular, pointed
Snout broadly rounded, not pointed

Rhinidae

Caudal fin without a distinct lower lobe
Caudal fin with a distinct lower lobe

Rhynchobatidae

Rhinobatidae

B
from 7B
6 pairs of gill openings

Hexatrygonidae

B
from 9A
Head elevated and laterally demarked from disc; eyes lateral on head

A
to 9A

B
to 9B
5 pairs of gill openings
Head not elevated, not clearly separable from disc; eyes dorsolateral on head
A pair of paddle-like flaps at front of head

Front margin of snout with a deep central notch

No flaps at front of head

Front margin of snout without a central notch

Pelvic fin divided into 2 distinct lobes

Pelvic fin not divided into 2 lobes

Caudal fin present

No caudal fin

Mobulidae

Rhinopteridae

Myliobatidae
A
from 8A

Tail very thin and filamentous

Snout soft with thin and flexible rostral cartilage

Anacanthobatidae

Tail thicker, not filamentous

Snout firm with stiff rostral cartilage

Arhynchobatidae

Rajidae

No dorsal fins; strong stinging spine present

Plesiobatidae

B
from 9B

0 or 1 dorsal fins; no stinging spines

Narkidae
Disc very broad; tail short and thin

A from 9C

Disc not laterally expanded; tail longer

Gymnuridae

Dasyatidae

Chondrichthyes

Gymnuridae

Dasyatidae
Teleosts (bony fishes)

Key to the main families in the area

- Body encased in bony plates
  - Snout tubular
    - Body extremely compressed, blade-like
      - Centriscidae
    - Body not extremely compressed
      - Syngnathidae
  - Snout not tubular
    - 2 separate dorsal fins
      - Peristethiidae
    - A single dorsal fin
      - Ostraciidae
- Body not encased in bony plates
  - Elongate bill-like or beak-like jaws
    - A to 2A
  - Jaws not bill-like or beak-like
    - Body strongly flattened; eyes on one side of head
      - B to 2B
    - Body not strongly flattened; an eye on each side of head
      - C to 3B
A
from 1A

Only lower jaw greatly elongate

Hemiramphidae

Belonidae

Both jaws greatly elongate

Xiphiidae

Istiophoridae

Only upper jaw greatly elongate

1 keel on each side of caudal peduncle; bill flat in cross-section

2 keels on each side of caudal peduncle; bill round in cross-section

B
from 1B

Teeth very large, very distinct

Psettodidae

Soleidae

Eyes on right side of body

Margin of preopercle not free, embedded in skin

Eyes on left side of body

Margin of preopercle free and distinct

Eyes on right side of body

Pleuronectidae

Teeth small, usually not

A
to 3A
Teleosts

A from 2A

Pectoral fins absent

Lateral line present below lower eye

Cynoglossidae

Pectoral fins present

Lateral line present below lower eye

Paralichthyidae

No lateral line below lower eye

Bothidae

Tail very elongate, ribbon-like or eel-like with no distinct (except in some Trachipteridae) caudal fin

1 long dorsal fin or 2 dorsal fins

1 short dorsal fin; snout gelatinous

Ateleopodidae

1 short dorsal fin; snout gelatinous

4 pairs of barbels on head; no scales

2 dorsal fins: 1st short, tall; 2nd long, low

Plotosidae

often 1 barbel on chin; large scales present

Macouridae

Dorsal fin not as above

Tail not ribbon-like or eel-like; caudal fin distinct

A to 4A

B to 6A
External gill opening a large bony operculum

Anal fin distinct

Skin covered with bony, raised tubercles

Pelvic fins absent or consisting of 1 or 2 separate rays

Body very elongate, with dark bands

Pelvic fins present

Body elongate, orange to reddish

External gill opening a small, fleshy opening

Anal fin absent or reduced to short spinules

Skin smooth, without scales

Trachipteridae

Ophidiidae

Genus Xiphasia

Bleniidae

Cepolidae
Very small scales present on body

A
from 4A

No scales on body

No pectoral fins

Posterior nostril high on head, above or before eye

Anguillidae

Posterior nostril low on head, in upper lip or mouth

Muraenidae

Ophichthidae

Congridae

Muraenidae

No enlarged teeth at tip of jaws or vomer

Pectoral fins present

Lips not well developed

Lips well developed

Enlarged teeth at tip of jaws and on midline of vomer

Muraenidae

Teleosts
Exocoetidae

Dactylopteridae

Echeneidae

Fistulariidae

Molidae

A
from 3B

Pectoral fins greatly enlarged, wing-like

2 dorsal fins and 2 free dorsal-spines anteriorly

1st dorsal fin modified into a sucking disc on top of head

Snout tubular, flute-like

1 short dorsal fin

Caudal fin truncate and rudder-like; body very deep

Snout not flute-like

1 short dorsal fin with a small ray-less adipose fin posteriorly

Caudal fin not rudder like; body not very deep

1 long dorsal fin or 2 separate dorsal fins

A to 7A
B to 9A
C to 9B
A from 6A

Body covered in many sharp spines

Caudal fin truncate or rounded; belly inflatable

Body without sharp spines

Caudal fin shallowly forked; lateral line extends onto caudal fin

Caudal fin deeply forked; lateral line not on caudal fin

Body bright red

Body mostly silvery

Dorsal fin located above middle of body; teeth not fang-like

Dorsal fin located set far back on body; teeth fang-like

A to 8A

Diodontidae

Tetraodontidae

Pempheridae

Berycidae

Chirocentridae
No scutes on belly

Scutes present on midline of belly in front of pelvic fins

Anal fin very long

Upper jaw extends well past eye

Pristigasteridae

Upper jaw not extending past eye

Engraulidae

Clupeidae

Anal fin relatively short

Dorsal fin with a long posterior filament

Megalopidae

A from 7A

No scutes on belly

Mouth inferior

Albulidae

Mouth terminal

No filament on dorsal fin

Mouth large, extends past eye

Elopidae

Mouth small, not extending past eye

Chanidae
Barbels present around mouth

Ariidae

Paralepididae

Myctophidae

Snout elongate

Light organs present on body

Myctophidae

Synodontidae

Upper jaw not extending to end of eye

Upper jaw extending well past eye

Teleosts

Pelvic fins absent (also absent in adults of *Parastromateus* in Carangidae) or if present, reduced to a short bony rudiment or with a single enlarged spine

Pelvic fins present, not reduced to a bony rudiment
A from 9A

1 long dorsal fin

Caudal fin deeply forked

Stromateidae

Caudal fin truncate to slightly forked

Monodactylidae

2 dorsal fins; 1st dorsal spine robust

Pelvic fin consists of 1 enlarged spine

Triacanthidae

Body with scales

Pelvic fin absent or reduced to a bony rudiment

Balistidae

Skin rough, without scales

Monacanthidae

Skin rough, without scales
A
from 9B

1. Pectoral-fin not leg-like; no ‘fishing pole’ (illicium) present on head
   - Antennariidae

2. Snout long and trumpet-like with a small barbel on chin; body elongate and depressed
   - Aulostomidae

3. Head not bony with rostral projections and lower 3 pectoral-fin rays not free
   - Triglidae

4. Head not strongly depressed
   - Platycephalidae

5. Body not oval with bright red fins
   - Lamprididae

6. Pectoral-fin lobe elongate and leg-like; 1st dorsal spine modified into a ‘fishing pole’ (illicium)
   - 12A
Head broad and depressed, with a stout preopercular spine; no scales on body

Dorsal and anal fins not both sail-like, or if so then bony plates present on caudal peduncle

A ventral keel of large scutes on belly; no mucous canals on head

Two dorsal fins separated by a distinct space

A

from 11A

Usually no strong preopercular spine (if present then head not depressed; usually scales on body

1st dorsal and anal fins long, high and sail-like; no bony plates on caudal peduncle

No ventral keel of large scutes on belly; no mucous canals on head

Only 1 dorsal fin or 2 fins separated by only a very narrow space

Head with a strong bony ridge below eye extending across cheek to preopercle; head usually with numerous spines

Head without a strong bony ridge below eye; usually none or few spines on head

B

to 13A

C

to 14A

Dorsal and anal fins both sail-like, or if so then bony plates present on caudal peduncle

A ventral keel of large scutes on belly; head with numerous mucous canals

To 15A

Callionymidae

Veliferidae

Trachichthyidae
### Mullidae
- A pair of long barbels at tip of chin
- Lower pectoral-fin rays filamentous and separate from fin

### Polynemidae
- Head broad and flattened above; no silvery band running along lateral midline of body
- Mouth not large; teeth not large

### Sphyraenidae
- Head narrow, not flattened; a distinct silvery band running along lateral midline of body
- Mouth very large with many large, sharp teeth

### Atherinidae
- A pair of long barbels not present on chin
- Lower pectoral-fin rays not filamentous

### Mugilidae
<table>
<thead>
<tr>
<th></th>
<th>A from 12B</th>
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<tbody>
<tr>
<td></td>
<td>Dorsal fin spines greatly elongate; body usually with vertical, mostly reddish bars</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dorsal fin spines not greatly elongate; body usually without vertical reddish bars</td>
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<tr>
<td></td>
<td>Skin at gill openings connected to each other or connected to isthmus only narrowly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skin at gill openings broadly connected to isthmus</td>
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<td></td>
<td>3rd infraorbital bone not inclined ventrally</td>
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<td></td>
<td>3rd infraorbital bone inclined ventrally</td>
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<td></td>
<td>Longest dorsal spines shorter than body depth</td>
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<td></td>
<td>Longest dorsal spines equal to body depth</td>
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</tbody>
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- **Pteroidae**
- **Synanceiidae**
- **Sebastidae**
- **Scorpaenidae**
- **Neosebastidae**
A pair of long barbels not present on chin

Eyes on top of head; cleithral spine present on upper opercle

A

from 12C

Uranoscopidae

Caudal peduncle without enlarged bony plates or spines

Caudal peduncle with 1–10 bony plates or a folding forward pointing spine on each side

Acanthuridae

Zanclidae

1 long dorsal fin, greatly elevated anteriorly

Scales very small

Snout protruding

Scales moderately large

Snout not protruding

Chaetodontidae

genus Heniochus

A
to 16A

2 dorsal fins or a single long dorsal fin not greatly elevated anteriorly

B
to 16B
Enlarged scutes present on caudal peduncle

A from 15A

Caudal fin deeply forked to very lunate; scales very large

Bramidae

Mouth small; colour not pinkish

Caudal fin not deeply forked or lunate; scales moderately large or small

Ephippidae

Mouth large; pinkish in colour

Sparidae
genus *Argyrops*

Enlarged scutes present on caudal peduncle

B from 15B

Carangidae

No enlarged scutes present on caudal peduncle
Pelvic fin with 2 strong spines with 3 soft rays inbetween; a sharp forward-pointing spine at front of dorsal fin

Pelvic fin without rays between 2 strong spines; no forward-pointing spine at front of dorsal fin

Body very deep, disc-shaped, strongly compressed; dorsal profile angular; pinkish red

Body not deep, or if deep then without an angular dorsal profile and not pinkish red

A fringe of cirri above anterior nostril and on tips of dorsal spines; lower pectoral-fin rays thickened with membranes deeply incised

No cirri on nostrils or tips of dorsal spines; lower pectoral-fin rays no deeply incised

Dorsal fin continuous, but with a deep notch between spinous and soft portions

Dorsal fin spinous portion very low, often appearing as a series of short, separate spines

Two dorsal fins clearly separate from each other by a narrow space

Dorsal fin continuous with only a shallow notch or no notch between spinous and soft portions

A from 16A

from 16A

Siganidae

Caproidae

Cirrhitidae

A to 18A

B to 19B

C to 20B

D to 21B
A large and strong spine on preopercle

Caudal fin slightly to deeply forked

No, or only short, preopercular spines

Scales not strongly adherent, easily removed; body silvery to pinkish in colour

Scales strongly adherent; body mostly bright red in colour

Body relatively short; spinous dorsal fin longer than soft portion

Body moderately elongate; spinous and soft dorsal-fin portions subequal in length

Holocentridae

genus *Etelis*

No enlarged flat spines on upper opercle

Lutjanidae

Ambassidae

Acropomatidae

2 or 3 flat spines on upper opercle

Caudal fin not forked
Body very deep, covered in dark spots

Strongly patterned; body cylindrical

Body more elongate

Silvery to dusky; body moderately compressed

Head deeply concave behind eyes; preopercular margin serrated

Latidae

Head not deeply concave; preopercle not serrated

Sciaenidae

Body elongate and cylindrical; dark brown with 2 narrow silvery stripes

Rachycentridae

Body deeper and compressed, without stripes on sides

A
from 18A

Pinguipedidae

Scatophagidae

B
from 17B

A
to 20A
Anal fin with 2 detached spines anteriorly; body firm

**Carangidae**
*genera Scomberoides and Trachinotus*

Anal fin without separate, detached spines anteriorly; body relatively soft

**Centrolophidae**

Caudal fin not deeply forked

No barbel on chin; fins with spines Small barbel present on chin, no spines in fins

**Moridae**

Body with scales Body elongate and without scales

**Gobiidae**

Snout not long or conical; body only moderately elongate Snout long and conical; body elongate

**A**
*to 21A*

Caudal fin deeply forked

**B**
*to 21B*
Preopercle with distinct double-edge; a single small opercular spine

A from 20B

Preopercle not double-edged; 2 or 3 flat opercular spines

Apogonidae

Acropomatidae

B from 20B

No separate spines between dorsal fins

1-3 short, separate spines between dorsal fins

Emmelichthyidae

No detached finlets behind dorsal and anal fins

Detached finlets present behind dorsal and anal fins

Scombridae

Gempylidae

A to 22A

No fang-like teeth at front of jaws; usually with dark spots, bars or stripes

Fang-like teeth at front of jaws; no markings on body
Jaws strong with large fang-like teeth

A
from 20A

Jaws without large, fang-like teeth

Body dark brown

Body silvery

Gempylidae

1st dorsal fin longer than 2nd

Scombrolabracidae

Nomeidae

1st dorsal fin shorter than 2nd

1st dorsal fin lower than 2nd

Carangidae
genus Seriola

1st dorsal fin much taller than 2nd dorsal fin

Mouth small, not angled strongly upwards

Mouth large, angled strongly upwards

Ariommatidae

Lactariidae
Dorsal and anal fins very long; body elongate; head very blunt

Dorsal and anal fins not very long; head not very blunt

A from 17D

Caudal fin deeply forked

Caudal fin not deeply forked

A to 25B

Dorsal and anal fins very long; head not very blunt

Body elongate; head very blunt

Menidae

Body very deep, almost triangular and extremely compressed; anal fin very long and low

Body not very deep and extremely compressed; anal fin not very long

Coryphaenidae

Anal fin long, almost length of dorsal fin

Anal fin short to moderate, shorter than dorsal fin

B to 24A

Body silvery; mouth protrusible; small in size

Leiognathidae

Body dark brown to dusky; mouth not protrusible; medium to large in size

Bramidae
Scales easily removed; mouth protractile, extending downwards

Gerreidae

A from 23B

Anal-fin with 2 spines and 9-16 soft rays; 1 nostril on each side of head

Pomacentridae

Scales adherant; mouth not protracting downwards

Anal-fin with 3 spines and 7-13 soft rays; 2 nostrils on each side of head

usually 10 (up to 15) dorsal-fin spines

Symphysanodontidae

9 dorsal-fin spines

mostly 10-15 dorsal-fin soft rays; 8-13 anal-fin soft rays

Nemipteridae

9 dorsal-fin soft rays; usually 7 anal-fin soft rays

A to 25A
**Lutjanidae**
- genera *Aphareus*, *Aprion*, *Parapristipomoides*, *Pristipomoides*, some *Paracaeio*

**Caesionidae**

**Teleosts**

**Teeth in jaws fused to form a parrot-like beak (except in *Calotomus*); lips continuous with facial skin**
Eyes very large; mouth upturned

A
from 25A

12-17 dorsal-fin soft rays

Eyes not very large; mouth not upturned


Serranidae
genera Variola and some anthiines

Nemipteridae
some Pentapodus

B
from 25B

Head not bulbous with very large eyes

Opistognathidae

Head bulbous with very large eyes;

Body with scales

Blenniidae

Body without scales and elongate
Soft portions of anal and dorsal fins broadly rounded and extending beyond base of caudal fin

Soft portions of anal and dorsal fins not extending beyond base of caudal fin

A

Caudal fin rounded

Caudal fin not rounded

A

to 29B

from 26B

Lobotidae

Body not very deep; usually not silvery, if so then also with bright colours

Body very deep; mostly silvery in colour

Drepaenidae

Scales very large, tough and slimy to touch

Scales not very large, tough and slimy

B
to 28A

1–3 dorsal-fin spines

Pseudochromidae

6–16 dorsal-fin spines

C
to 28B

Teleosts
Teeth in jaws fused to form a parrot-like beak (except in *Calotomus*); lips continuous with facial skin

A  
from 27B

Teeth in jaws separate, not forming a parrot-like beak; lips well-developed and not continuous with facial skin

Scaridae

Labridae

B  
from 27C

2nd anal-fin spine not robust; no flap on nostrils

2nd anal-fin spine long and robust; large flap on anterior nostril

Centrogeniidae

Serranidae

Body deep and strongly compressed; no spines on upper opercle

Body mostly moderately elongate and only moderately compressed; 3 spines on upper opercle

A  
from 29A
1 or more strong spines at angle of preopercle

No spines at angle of preopercle

Pomacanthidae

Chaetodontidae

Dorsal fin situated far back on body; lower jaw protruding; dorsal head profile flat

Dorsal fin not far back on body; lower jaw not distinctly protruding; dorsal head profile not flat

Toxotidae

Body not deeper than long, usually not strongly compressed, if so then brightly coloured

Body deeper than long and strongly compressed; silvery to blackish in colour

Scales very large, tough and slimy to touch

Scales not very large, tough and slimy

A from 28B

B from 27A

A to 30A

B to 30B

C to 30C
Teeth in jaws fused to form a parrot-like beak (except in *Calotomus*); lips continuous with facial skin

**A** from 29A

Teeth in jaws separate, not forming a parrot-like beak; lips well-developed and not continuous with facial skin

**B** from 29B

Pectoral fins not greatly elongate

*Ephippidae*

Pectoral fins greatly elongate

*Scaridae*

*Scaridae*

*Labridae*

*Labridae*
Eyes very large; pelvic fins in front of pectoral fins; mouth angled upwards

Eyes not very large; pelvic fins behind pectoral fins; mouth not angled upwards

Priacanthidae

Body relatively elongate; 1 soft spine on upper opercle

1 or 2 anal-fin spines

Malacanthidae

Body moderately deep; no spine on upper opercle

Pomacentridae

3 spines on upper opercle

3 or more anal-fin spines

Serranidae

0-2 (usually 0) spines on upper opercle
Body very deep; mouth small and protrusible

Body moderately elongate; mouth larger, not protrusible

Chaetodontidae

Chin without pores; 2nd anal-fin spine not very strong

Chin with 2 or 6 pores; 2nd anal-fin spine usually very strong

Haemulidae

No strong spine on posterior edge of opercle

Opercle with 2 spines on posterior edge, lower one strong

Terapontidae

Teeth in both jaws in a single row and incisor-like

Teeth usually in more than one row and not incisor-like

Kyphosidae

A from 31A

A to 33A
Cheek area completely naked, without scales (*Lethrinus*).

Cheek with a scaled area.

- **Lethrinidae**
  - 8-10 anal-fin soft rays
  - 10 dorsal-fin spines

- **Nemipteridae**
  - 7 anal-fin soft rays
  - 11-13 dorsal-fin spines

- **Sparidae**
  - Vomer and palatine regions of mouth with teeth

- **Lutjanidae**
  - upper jaw

No teeth on vomer and palatine regions of mouth.

*Teleosts*
Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand are working together through the Bay of Bengal Large Marine Ecosystem (BOBLME) Project to lay the foundations for a coordinated programme of action designed to better the lives of the coastal populations through improved regional management of the Bay of Bengal environment and its fisheries.

The Food and Agriculture Organization (FAO) is the implementing agency for the BOBLME Project.

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For more information, please visit www.boblme.org