NORTHEAST FISHERIES OBSERVER PROGRAM BIOLOGICAL SAMPLING MANUAL 2010

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INTRODUCTION

The Northeast Fisheries Observer Program (NEFOP) collects, maintains and distributes data for scientific and management purposes in the northwest Atlantic Ocean. The Program is a component of the Northeast Fisheries Science Center (NEFSC) of the National Marine Fisheries Service (NMFS). For the year of 2009, NEFOP trained and deployed approximately 80 observers and provided coverage on a variety of fisheries averaging to about 8000 days at sea.

This guide is intended to serve as a general at-sea biological sampling reference for NEFSC fisheries observers. It contains summaries and tables designed to enable observers to quickly determine the correct biological sampling protocols and methods while at sea. While this manual provides identification criteria for selected species that have proved troublesome in the past, observers should mainly rely on the field guides issued in training for species identification.

Biological sampling is one of the most important functions of a fisheries observer. Information and samples collected by observers are often unobtainable by any other method. These data are used in scientific studies and can influence management regulations. It is therefore very important that observers have a thorough understanding of biological sampling principles and practices. Prior to deployment, especially in a new fishery, observers should review all biological sampling protocols and resolve any uncertainty with their supervisor or NEFOP staff.

In addition to this manual, the NEFSC Fisheries Observer Program Manual provides a detailed description of each data field collected. The NEFSC Fisheries Observer Program Training Manual is a textbook for observer trainees as well as a reference for experienced observers containing in-depth instruction on procedures and protocols relating to biological data collection as well as other aspects of the job, such as safety at sea.

This manual represents a revision of the biological sampling protocols described in the 1996 NEFSC Observer Program Manual. All figures contained in this version are from the 1996 edition unless otherwise noted. For documentation of other changes see Documentation of changes made to the NEFSC Biological Sampling Protocols, 2010.

OBSERVERS AT WORK

Observer measuring flounder.

Observer sorting through catch.

Observer doing safety check.

Observer weighing catch.

Cover photos (left to right): Observer weighing monkfish. An observer meauring skate. An Observer sorting catch. All photos from NEFSC Observer Program photo files.

BIOLOGICAL SAMPLING PROTOCOLS: overview

Definitions

Observed Haul: A haul for which the observer collects weights for all species both kept and discarded. Collection of discard information includes everything brought up in the gear; plants, vertebrate and invertebrate animals, rocks and debris.

Sampled Haul: A haul for which the observer collects detailed biological information, such as length measurements and age structures, from certain species or portion of the catch.

Summary

Biological sampling involves collecting data on the species caught in order to aid in determining the effect of fishing effort on catch size and species distribution. These data are also useful in establishing length-weight relationships, aging, migration patterns, food habits, and other valuable biological information.

Biological sampling consists of the collection of the following information from both the kept and discarded catch:

- Actual weights
- Length frequencies
- Age structures
- Tissue and/or other samples, which may include specialty sampling requests

Biological sampling should generally occur after or during every or every other observed haul, as the instructions for each fishery specify. Sampling after every other observed haul is requested in order to allow adequate time to **thoroughly** sample hauls.

BIOLOGICAL SAMPLING: overview

BIOLOGICAL SAMPLING: overview

The tables and summaries included in this manual are designed to give the observer enough information to make decisions about which species to sample, and in what priority, on a per haul basis.

- Tables 1a-h. Length Frequency and Age Structure Sampling Priorities are organized by fishery (excluding the pelagic fisheries) and area, with species listed alphabetically. Each list includes fish, shellfish and squid species most likely to be encountered in the fishery, and gives a priority rating (1 = high, 2 = medium, 3 = low) to guide in choosing the order in which to sample species on a per haul basis.

- Table 2. Fish and Shellfish Sampling Requirements by Species for Domestic Fisheries lists the number of lengths, and the type and number of age structures to collect for each fish, shellfish and squid species which may be sampled from the non-pelagic fisheries.

- Table 3. Pelagic Species Sampling Requirements for Domestic Fisheries summarizes the sampling priorities and protocols for pelagic species.

- The Sea Turtle and Sea Bird Biological Sampling Protocols section summarizes the sampling priorities and protocols for incidentally taken sea turtles and sea birds.

These tables are guidelines, and not absolute instructions. Every fishery, every trip, and every haul may be different. Thus, sampling procedures must be adapted by the observer to each unique situation.

Generally, only those species listed in Tables 2 & 3 should have length measurements and, where applicable, age samples collected, as these species are considered the commercially important (marketable) species taken by the specific gear in the designated area. However, significant quantities (catches) of targeted species or bycatch of commercially important species which may not be listed in these tables may also be sampled. In general, the observer should attempt to obtain a large variety of kept and discard samples of the requested size (see Tables 2 and 3) from species in the same haul or statistical area. Sampling larger numbers of animals than requested produces

data of little additional value.

When deployed in a pelagic fishery (*i.e.* pelagic drift gillnet, pelagic pair trawl, pelagic longline, etc.), the sampling priorities for pelagic species should be followed, as outlined in Table 3. This table should also be consulted regardless of the fishery, whenever pelagic species are caught.

Specialty sampling requests should also be accommodated whenever time and circumstances permit.

INCIDENTAL TAKE SAMPLING PRIORITIES FOR ALL FISHERIES

Marine mammals and **sea turtles** are high sampling priority species. However, additional work-up beyond minimum requirements, should occur only after the sampling of priority species listed in Tables 1a-h and/or Table 3 (*i.e.* cod, pollock, tunas, etc...) is completed. Once these data are collected, and if time permits, additional sampling should occur as outlined in the Marine Mammal Sampling Protocols and the Sea Turtle Sampling Protocols sections of this manual.

Incidentally taken dead **sea birds** are also high sampling priority species and should be identified, photographed, and checked for the presence of bands (tags). If present, the band number must be recorded. The band should be removed if possible. Once these data are collected, and if time permits, additional sampling should occur as outlined in the Sea Bird Sampling Protocols section of this manual. Any incidentally taken birds which are still alive need only be identified, recorded, checked for the presence of bands, photographed, and released as soon as possible.

BIOLOGICAL SAMPLING: overview

GILLNET AND BEACH SEINE SAMPLING PRIORITIES

GILLNET

Limited fish sampling trips:

- A protected species haul watch is conducted during **every** haul.
- Kept catch weights will be recorded after each haul.
- Discarded catch is NOT recorded or sampled, except for animals that are recorded on an Individual Animal Log or incidental takes of marine mammals, sea turtles, or sea birds.
- Biological sampling of the **kept catch** should occur for the last haul of the trip (day trips) during the steam back to port or the last haul of the day (multi-day trips).

Complete fish sampling trips:

- **Every** haul is observed, *i.e.* complete catch information for both kept and discarded species is recorded.
- No protected species haul watches are conducted.
- The kept and discarded catch of all hauls should be biologically sampled, with **priority given to the discarded species**.

BEACH SEINE

- If gear is hauled onto the beach **all** hauls will be observed; kept and discarded catch should be biologically sampled with **priority given to the discarded species**.
- If gear is "fished-over" (a dory is used to check the gear while it is in the water), the observer will record and biologically sample the **kept catch** only.
- In **both** situations the observer will conduct a marine mammal, sea turtle, and debris haul watch.

If it is not possible to biologically sample a particular haul according to these instructions, the reason(s) should be noted in the comments section of the corresponding Haul Log.

Table 1a. Length frequency and age structure sampling priorities in gillnet and beach seine fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Gulf of Maine (Statistical areas 511 - 515)				
Alewife	1	1	-	-
Bass, Striped	2	2	-	-
Bluefish	3	3	-	3
Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1
Dogfish, Spiny	2	2	-	-
Flounder, Am. Plaice	2	2	2	2
Flounder, Winter	1	1	1	1
Flounder, Witch	1	1	2	3
Flounder, Yellowtail	2	2	2	2
Haddock	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Halibut, Atlantic	1	1	1	1
Herring, Blueback	1	1	-	-
Mackerel, Atlantic	3	3	3	3
Monkfish	1	1	1	1
Pollock	1	1	1	1
Redfish	2	2	2	2
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	-	3	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Wolffish	1	1	1	1
George's Bank (Stat areas 522, 525, 526, 561, 562)				
Bluefish	3	3	-	3
Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1
Dogfish, Spiny	2	2	-	-
Flounder, Am. Plaice	2	2	2	1
Flounder, Witch	2	2	2	2
Haddock	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Halibut, Atlantic	1	1	1	1
Monkfish	1	1	1	1
Pollock	1	1	1	1
Redfish	2	2	2	2
Skate, Barndoor	3	3	-	-
Skate, Little	2	2	-	-
Skate, Rosette	3	3	-	-
Skate, Smooth	2	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Wolffish	1	1	1	1

GILLNET AND BEACH SEINE SAMPLING PRIORITIES

Table 1a. (Con't) Length frequency and age structure sampling priorities in gillnet and beach seine fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Cape Cod (Statistical area 521)				
Alewife	1	1	-	-
Bass, Striped	3	3	-	-
Bluefish	3	3	-	3
Cod, Atlantic	1	1	1	1
Cusk	3	3	3	3
Flounder, Winter	2	2	2	2
Haddock	2	2	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Blueback, Atlantic	1	1	-	-
Mackerel, Atlantic	3	3	3	3
Monkfish	1	1	1	1
Pollock	1	1	1	1
Redfish	2	2	2	2
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	-	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Tautog	3	3	-	-
Wolffish	1	1	1	1
Southern New England (Statistical areas 537-539)				
Alewife	1	1	-	-
Bass, Striped	3	3	-	-
Bluefish	3	3	-	3
Cod, Atlantic	2	2	2	2
Dogfish, Spiny	2	2	-	-
Flounder, Winter	3	3	3	3
Herring, Blueback	1	1	-	-
Mackerel, Atlantic	3	3	3	3
Monkfish	1	1	1	1
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Clearnose	3	3	-	-
Skate, Little	2	2	-	-
Skate, Rosette	3	3	-	-
Skate, Smooth	2	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Tautog	3	3	-	-

Species	Length Frequencies		Age Structures		Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard		Kept	Discard	Kept	Discard
Mid-Atlantic (Stat areas 201, 393, 401, 611-616, 621, 622, 625, 626, 631, 632, 635, 636, 700-702, 707, 708)									
Alewife	1	1	-	-	Herring, Blueback	1	1	-	-
Bass, Striped	1	1	-	-	Lobster, American	2	1	-	-
Bonito	3	3	-	-	Mackerel, Atlantic	2	2	2	2
Bluefish	1	1	-	1	Mackerel, Spanish	2	2	-	-
Croaker, Atlantic	2	2	-	-	Menhaden, Atlantic	2	2	-	-
Dogfish, Spiny	1	1	-	-	Monkfish	1	1	1	1
Drum, Black	3	3	-	-	Scup	2	2	2	2
Drum, Red	2	2	-	-	Sea Bass, Black	2	2	2	2
Flounder Sand Dab	3	2	3	3	Shad, American	1	1	-	-
Flounder, Summer	1	1	1	1	Spot	3	3	-	-
Flounder, Winter	1	1	1	1	Sturgeon, Atlantic	1	1	-	-
Flounder, Yellowtail	1	1	1	1	Tautog	3	3	-	-
Herring, Atlantic	2	2	-	-	Weakfish	1	1	-	-

GILLNET AND BEACH SEINE SAMPLING PRIORITIES

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

- **At a minimum 75% of the hauls** should be observed, *i.e.* complete catch information for both kept and discarded species is recorded. The number of hauls observed will be affected by trip and tow duration.
- Collection of length frequencies and age structures should occur **at least** after every other observed haul.
- If catches are light and time permits, the observer should sample every haul.
- Otter trawl fishery: obtain actual weights for as many species as possible.
- Shrimp trawl fishery: obtain actual weights for all discarded species.

If it is not possible to biologically sample a particular haul according to protocol, the reason(s) should be noted in the comments section of the corresponding Haul Log.

Table 1b. Length frequency and age structure sampling priorities in the otter trawl fisheries.

Species	Length Frequencies		Age Structures		Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard		Kept	Discard	Kept	Discard
Gulf of Maine (Statistical areas 511-515)					**George's Bank (Statistical areas 522, 525, 526, 561, 562)**				
Alewife	1	1	-	-	Bluefish	3	3	-	3
Bluefish	3	3	-	3	Butterfish	2	2	2	2
Cod, Atlantic	1	1	1	1	Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1	Cusk	1	1	1	1
Dogfish, Spiny	2	2	-	-	Dogfish, Spiny	2	2	-	-
Flounder, Am. Plaice	1	1	1	1	Flounder, Am. Plaice	2	2	2	2
Flounder, Winter	1	1	1	1	Flounder, Sand Dab	2	2	2	2
Flounder, Witch	1	1	1	2	Flounder, Summer	2	2	2	2
Flounder, Yellowtail	1	1	1	1	Flounder, Winter	1	1	1	1

Haddock	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Halibut, Atlantic	1	1	1	1
Herring, Atlantic	2	2	-	-
Herring, Blueback	1	1	-	-
Monkfish	1	1	1	1
Pollock	1	1	1	1
Redfish	2	2	2	2
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	-	3	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Wolffish	1	1	1	1

Flounder, Witch	2	2	2	2
Flounder, Yellowtail	1	1	2	2
Haddock	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Halibut, Atlantic	1	1	1	1
Herring, Atlantic	2	2	-	-
Lobster, American	1	1	-	-
Monkfish	1	1	1	1
Ocean Pout	2	2	-	-
Pollock	1	1	1	1
Redfish	2	2	2	2
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	-	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Squid, Atl. Long-fin	3	3	-	-
Squid, Short-fin	3	3	-	-
Wolffish	1	1	1	1

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

Table 1b. (Con't) Length frequency and age structure sampling priorities in the otter trawl fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Cape Cod (Statistical area 521)				
Alewife	1	1	-	-
Bass, Striped	2	2	2	2
Bluefish	3	3	-	3
Butterfish	3	3	3	3
Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1
Flounder, Am. Plaice	3	3	3	3
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	1	1	1	1
Flounder, Winter	1	1	1	1
Flounder, Witch	2	2	2	2
Flounder, Yellowtail	1	1	1	1
Haddock	2	2	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Herring, Atlantic	2	2	-	-
Herring, Blueback	1	1	-	-

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Southern New England offshore (Statistical area 537)				
Alewife	1	1	-	-
Bass, Striped	2	2	2	2
Bluefish	3	3	-	3
Bonito	3	3	-	-
Butterfish	1	1	1	1
Cod, Atlantic	2	2	2	2
Dogfish, Spiny	2	2	-	-
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	1	1	1	1
Flounder, Winter	1	1	1	1
Flounder, Yellowtail	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	2	2	-	-
Herring, Atlantic	2	2	-	-
Herring, Blueback	1	1	-	-
Mackerel, Atlantic	2	2	2	2
Monkfish	1	1	1	1
Ocean Pout	2	2	-	-

Mackerel, Atlantic	3	3	3	3
Monkfish	1	1	1	1
Pollock	1	1	1	1
Redfish	2	2	2	2
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	2	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Squid, Atl. Long-fin	2	2	-	-
Squid, Short-fin	2	2	-	-
Tautog	3	3	-	-
Wolfish	1	1	1	1

Scup	1	1	1	1
Sea Bass, Black	1	1	1	1
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Clearnose	3	3	-	-
Skate, Rosette	3	3	-	-
Skate, Little	2	2	-	-
Skate, Smooth	3	3	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Squid, Atl. Long-fin	1	1	-	-
Squid, Short-fin	2	2	-	-
Tautog	3	3	-	-

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

Table 1b. (Con't) Length frequency and age structure sampling priorities in the otter trawl fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Mid-Atlantic offshore (Statistical areas 616, 622, 623, 626, 627, 632, 636)				
Alewife	1	1	-	-
Bluefish	3	3	-	3
Butterfish	2	2	2	2
Dogfish, Spiny	2	2	-	-
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	2	2	-	-
Herring, Atlantic	1	1	-	-
Herring, Blueback	1	1	-	-
Lobster, American	2	2	-	-
Monkfish	1	1	1	1
Scallop, Sea	3	3	3	3
Scup	1	1	1	1
Sea Bass, Black	1	1	1	1
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Mid-Atlantic inshore (Statistical areas 538, 539, 611-615, 621, 625, 631, 635)				
Alewife	1	1	-	-
Bass, Striped	1	1	-	-
Bluefish	1	1	-	1
Butterfish	2	2	2	2
Croaker, Atlantic	3	3	-	-
Dogfish, Spiny	1	1	-	-
Drum, Black	3	3	-	-
Drum, Red	3	3	-	-
Flounder Sand Dab	1	1	1	1
Flounder, Summer	1	1	1	1
Flounder, Winter	1	1	1	1
Flounder, Yellowtail	1	1	1	1
Herring, Atlantic	2	2	-	-
Herring, Blueback	1	1	-	-
Lobster, American	2	1	-	-
Mackerel, Atlantic	2	2	2	2
Mackerel, Spanish	3	3	-	-

Skate, Clearnose	2	2	-	-
Skate, Little	2	2	-	-
Skate, Rosette	2	2	-	-
Skate, Smooth	3	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	3	3	-	-
Squid, Atl. Long-fin	1	1	-	-
Squid, Short-fin	1	1	-	-
Weakfish	3	3	-	-

Menhaden, Atlantic	3	3	-	-
Monkfish	1	1	1	1
Ocean Pout	2	2	-	-
Scup	2	2	2	2
Sea Bass, Black	1	1	1	1
Shad, American	1	1	-	-
Skate, Clearnose	2	2	-	-
Skate, Little	2	2	-	-
Spot	3	3	-	-
Squid, Atl. Long-fin	1	1	-	-
Squid, Short-fin	1	1	-	-
Tautog	3	3	-	-
Weakfish	1	1	-	-

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

OTTER and SHRIMP TRAWL SAMPLING PRIORITIES

Table 1c. Length frequency and age structure sampling priorities in the shrimp trawl fishery**.

Species	Length Frequencies		Age Structures		Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard		Kept	Discard	Kept	Discard
Massachusetts, New Hampshire and Maine									
Alewife	1	1	-	-	Monkfish	1	1	1	1
Cod, Atlantic	*	1	*	1	Ocean Pout	*	1	*	1
Flounder, Am. Plaice	*	1	*	1	Pollock	*	1	*	1
Flounder, Sand Dab	*	2	*	2	Redfish	*	1	*	1
Flounder, Winter	*	1	*	1	Shad, American	1	1	-	-
Flounder, Witch	*	1	*	1	Skate, Barndoor	-	2	-	-
Flounder, Yellowtail	*	1	*	1	Skate, Little	2	2	-	-
Haddock	*	1	*	1	Skate, Smooth	-	3	-	-
Hake, Red	*	3	*	-	Skate, Thorny	-	2	-	-
Hake, Silver	*	2	*	-	Skate, Winter	2	2	-	-
Hake, White	*	2	*	2	Wolffish	1	1	2	2
Herring, Atlantic	2	2	-	-					
Herring, Blueback	1	1	-	-					
Lobster, American	2	1	-	-					

* As of 1 January 1994, regulations mandate the use of a Nordmore Grate in all Shrimp Trawl gear which reduces finfish bycatch. Since none of these species may currently be kept, measurement of **all** discards should occur when time permits.

** All weight measurements for discarded species should be actual in this fishery.

The following two shrimp species, which are not contained in *Atlantic Coast Fishes* (Peterson, 1986) issued to observers in training, may be encountered in the shrimp trawl fishery.

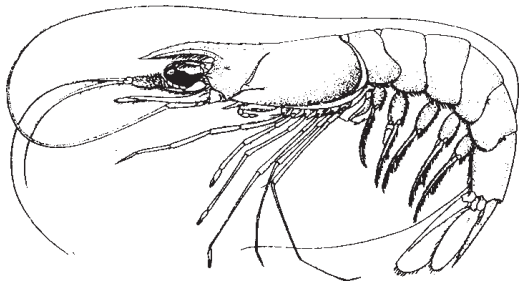


Figure 1. Royal red shrimp *Pleoticus robustus*

- color variable from mostly opaque white to salmon, pink and red
- eyes large with scale-like dorsal projection
- carapace and abdominal segments covered with short hairs; abdominal segments 3-6 have mid-dorsal ridge ending in small spine or tooth
- rostrum medium long, reaching to about the end of antennular peduncle; with ridge and 10-12 spines extending onto carapace
- antennular flagella both long but unequal in length
- carapace length to 42 mm males, 61.5 mm females; total length to 173 mm males, 219 mm females
- benthic, occurring on silty bottoms of upper continental slope 180-730 m, usually below 250 and above 500 m, water temp. 5-15 °C
- commonly encountered from 35° N (Cape Hatteras) south, occasionally extend to 43° N (Scotian Shelf)

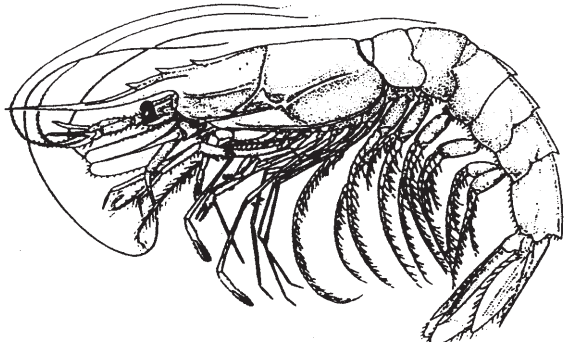


Figure 2. Scarlet shrimp *Plesioenaeus edwardsianus*

- color is a brilliant crimson red; gold setae fringes
- several lateral ridges on carapace, one with single anterior spine
- long, sharply pointed rostrum equal to at least half the carapace length; 3 dorsal spines
- upper antennular flagellum very short, other flagellum very long, up to 3 times total body length
- abdominal segments 3-6 with dorsal ridge, forming short spine at the end of each segment
- a very large species, carapace length to 55 mm males, 104 mm females; total length to 193 mm males, 334 mm females
- benthic, inhabiting muddy bottoms of continental slope, mostly 400-900 m, water temp. 4-8 °C
- encountered from 47° N (Gulf of St. Lawrence) to Gulf of Mexico

SCALLOP TRAWL and SCALLOP DREDGE FISHERY SAMPLING PRIORITIES

Scallop Trawl Fishery

- **Every haul** should be observed, *i.e.* complete catch information for both kept and discarded species is recorded, during on-watch periods.
- Collection of length frequencies should occur at least after **every other observed haul**.
- At minimum, **half** of the hauls should be observed and **one quarter** of the hauls should be biological sampled during a trip.
- At approximately the midpoint of the trip, the observer should switch watches in order to ensure collection of data most representative of the entire trip.

SCALLOP SHELL HEIGHT FREQUENCIES

- A random sample of at least 100 scallops should be collected and measured **from each disposition** (*i.e.* kept and discarded).
- Collect shell height frequencies from **only one net** per haul.
- Sample alternate nets (*i.e.* port and starboard) each time biological sampling of scallops is conducted.
- Generally, scallop shell height frequency sampling should be the first priority for all hauls, with finfish sampling being second priority.
- For **at least** one haul per watch, finfish sampling should be first priority.

FINFISH SAMPLING

- Collect finfish length frequencies and age structures as a first priority for at least one haul per watch, and on additional hauls, as time permits.
- If a haul has an exceptionally large amount of finfish bycatch, finfish sampling should become first priority for that haul.
- Collect finfish length frequencies and age structures from **both nets** per haul.
- When sampling finfish, refer to Otter and Shrimp Trawl Sampling Priorities (pages 8-15) for priority status for length frequencies and age structures per stat area.

Scallop Dredge Fishery

- **Every haul** should be observed, *i.e*. complete catch information for both kept and discarded species is recorded, during on-watch periods.
- Collection of length frequencies should occur at least after **every other observed haul**.
- At minimum, **half** of the hauls should be observed and **one quarter** of the hauls should be biological sampled during a trip.
- At approximately the midpoint of the trip, the observer should switch watches in order to ensure collection of data most representative of the entire trip.

SCALLOP SHELL HEIGHT FREQUENCIES

- A random sample of at least 100 scallops should be collected and measured **from each disposition** (*i.e.* kept and discarded).
- Collect shell height frequencies from **only one dredge** per haul.
- Sample alternate dredges (*i.e.* port and starboard) each time biological sampling of scallops is conducted.
- Generally, scallop shell height frequency sampling should be the first priority for all hauls, with finfish sampling being second priority.
- For **at least** one haul per watch, finfish sampling should be first priority.

FINFISH SAMPLING

- Collect finfish length frequencies and age structures as a first priority for at least one haul per watch, and on additional hauls, as time permits.
- If a haul has an exceptionally large amount of finfish bycatch, finfish sampling should become first priority for that haul.
- Collect finfish length frequencies and age structures from **both dredges** per haul.

SCALLOP TRAWL and SCALLOP DREDGE FISHERY SAMPLING PRIORITIES

SCALLOP TRAWL and SCALLOP DREDGE FISHERY SAMPLING PRIORITIES

Both Scallop Trawl and Scallop Dredge Fishery

VOLUMETRIC MEASURES OF SCALLOP MEATS

- **On the first haul of each watch only**, the volume of meats corresponding to the length frequency sample from the **kept** portion of the catch (whole scallops) should be measured.
- The volume of this sample must represent the meats of **all kept and measured** animals.
- The weight of the sample for which the volumetric measurement was collected, should be obtained.

If it is not possible to biologically sample a particular haul in the manner outlined above, the alternate sampling method followed should be recorded in the comments section of the corresponding Haul Log.

Table 1d. Length frequency and age structure sampling priorities in the scallop trawl and scallop dredge fishery.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Cod, Atlantic	2	2	2	2
Flounder, NK	3	3	2	2
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	2	2	1	1
Flounder, Winter	1	1	1	1
Flounder, Yellowtail	1	1	1	1
Monkfish	2	2	1	1
Scallop, Sea	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, nk	3	3	-	-

**Skate, nk = single skate species

**Flounder, nk = single flounder species

TWIN TRAWL FISHERY SAMPLING PRIORITIES

- **At a minimum 75% of the hauls** should be observed, *i.e.* complete catch information for both kept and discarded species is recorded. The number of hauls observed will be affected by trip and tow duration.
- Collection of length frequencies should occur at least after **every other observed haul**.
- If catches are light and time permits, the observer should sample every haul.
- Collect finfish length frequencies and age structures from **both nets** per haul.
- Obtain actual weights for as many species as possible.
- For length frequency and age structure sampling guidelines per stat area refer to Otter and Shrimp Trawl Sampling Priorities (pages 8-15) for priority status.

If it is not possible to biologically sample a particular haul according to protocol, the reason(s) should be noted in the comments section of the corresponding Haul Log.

LOBSTER, CRAB and FISH POT FISHERY SAMPLING PRIORITIES

- **Every haul** should be **both** observed, *i.e.* complete catch information for both kept and discarded species is recorded, and biologically sampled.
- Conduct sampling for **each pot**, when possible.
- Lobster pot fishery: **every individual lobster** caught should be biologically sampled when possible.

If it is not possible to biologically sample a particular haul according to protocol, the reason(s) should be noted in the comments section of the corresponding Haul Log.

CRAB CATCH ESTIMATION AND SUB-SAMPLING

Following are some suggested methods to collect **crab counts and weights** in the lobster, crab and fish pot fishery. These suggested methods are listed in order of preference. While the observer may choose to use a method other than those listed below, or make another judgement on what to sample due to time or other constraints, any sub-sampling or catch estimation method used must be recorded in the comments section of the corresponding Haul Log or Crustacean Sample Log. These methods may be applied to both the kept and discarded catch.

Crab sampling of the species listed in Table 1e should occur **following lobster sampling**, as time/conditions permit. However, when the captain targets crabs with (a) particular trawl(s), crab sampling becomes equal in priority to lobster sampling.

Per Trawl Methods

1 The crew sorts all crabs to be kept into totes to be weighed (total kept weight) by the observer. The crew sorts crabs to be discarded into totes to be weighed (total discard weight) by the observer. The observer randomly fills a tote, each, from both the kept and discarded catch to be sampled.

2 The crew places crabs into the hold while randomly selecting some to fill a tote for the observer to weigh and sample.

The observer, using a clicker, counts the number of crabs placed in the hold. The total number of crabs caught (which includes those in the subsample tote) are divided by the number of crabs in the subsample tote. The quotient is multiplied by the weight of the tote to yield an estimated total kept weight. The observer also samples the crabs in the tote. Follow these procedures for weight determination and length frequency sampling of discards.

Example: 300 crabs are placed in the hold, and 50 crabs are counted in the tote. The actual sample weight of the tote is 100 lbs:
[(300 + 50) ÷ 50] * 100 = 700 lbs total kept catch

3 The crew places crabs into the hold while randomly selecting some to fill a tote for the observer to sample. The observer estimates the pounds of crabs placed in the hold. This estimated weight is added to the actual tote weight (sample weight) to yield an estimated total kept weight. The observer also samples the crabs in the tote. Follow these procedures for weight estimation and length frequency sampling of discards.

Per Day Methods

1 Following one haul selected randomly each day (this haul should not routinely be the last haul of the day), the crew places all of the kept crabs into totes to be weighed and sampled by the observer. Follow these procedures for weight determination and biological sampling of discards. For the remaining hauls of each day, the observer estimates the kept and discarded crab catch weights, but does not conduct any sampling.

2 Follow the methods of number 2 or 3, above, for one haul per day.

Table 1e. Length frequency and age structure sampling priorities in the lobster, crab and fish pot fishery.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Gulf of Maine (Statistical area 515)				
Crab, Jonah	2	2	-	-
Crab, Red	2	2	-	-
Crab, Rock	2	2	-	-
Cusk	1	1	2	2
Hagfish	1	1	-	-
Lobster, American	1	1	-	-
Wolffish	1	1	1	1

NOTE: When crabs are the target of (a) particular trawl(s), the crab priority will be the same as lobster.

BOTTOM LONGLINE FISHERY SAMPLING PRIORITIES

- **Every haul** should be observed, *i.e.* complete catch information for both kept and discarded species is recorded.
- Collection of length frequencies and age structures should occur **at least** during/after every other observed haul.
- If catches are light and time permits, the observer should sample every haul.
- If commercially important bycatch is caught in significant quantities, yet the species are not listed in Table 1f, refer to Table 2. Fish and Shellfish Sampling Requirements By Species For Domestic Fisheries.

If it is not possible to biological sample on a particular haul, the reason(s) should be noted in the comments section of the corresponding Haul Log.

For biological sampling priorities in the pelagic longline fishery see Table 3. Pelagic Species Length Frequency Sampling Requirements for Domestic Fisheries.

Table 1f. Length frequency and age structure sampling priorities in the bottom longline fishery.

Gulf of Maine (Statistical areas 464, 465, 467, 511-515) and Georges Bank (Statistical areas 521, 522, 525, 526, 541-543, 561, 562)

Species	Length Frequencies		Age Structures		Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard		Kept	Discard	Kept	Discard
Cod, Atlantic	1	1	3	2	Skate, Thorny	-	1	-	-
Cusk	1	1	-	-	Hake, White	1	1	1	1
Haddock	1	1	3	2	Monkfish	1	1	1	1
Hake, Red	2	2	-	-	Pollock	1	1	3	2
Hake, Silver	2	2	-	-	Wolffish	1	1	1	1
Halibut, Atlantic	1	1	1	1	Skate, nk	2	2	-	-
Skate, Barndoor	-	1	-	-					

**Skate, nk = single skate species

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Southern New England (Statistical areas 533, 534, 537-539)				
Cod, Atlantic	1	1	3	2
Flounder, Summer	1	1	1	1
Hake, Red	2	2	-	-
Monkfish	1	1	1	1
Skate, Barndoor	-	1	-	-
Skate, nk	2	2	-	-
Skate, nk	2	2	-	-
Tilefish	1	1	1	1

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Mid-Atlantic (Statistical areas 611-616, 621-629, 631-639)				
Flounder, Summer	1	1	1	1
Hake, Red	2	2	-	-
Monkfish	1	1	1	1
Tilefish	1	1	1	1
Skate, nk	2	2	-	-

**Skate, nk = single skate species

BOTTOM LONGLINE FISHERY SAMPLING PRIORITIES

MID-WATER OTTER TRAWL, PURSE SEINE and PAIR TRAWL SAMPLING PRIORITIES

- **Every haul** should be observed, *i.e.* complete catch information for both kept and discarded species is recorded.
- Collection of length frequencies and age structures should occur after every observed haul.
- Collect 10 baskets of fish, obtain actual weights and calculate percent composition's for both the kept and discard species on every haul.

PAIR TRAWL

- If only one of the two vessels has an observer onboard, the observer should be recording the catch for both vessels (Disposition 110 should be used for the part of the catch that is pumped/transferred to other vessel).
- If both vessels have an observer onboard, the observer onboard the vessel where the catch is pumped onto should be observing and recording all of the catch. The observer onboard the other vessel should comment that "catch was loaded onto the other vessel" and leave the species section BLANK.
- If catch is dumped before coming onboard, the haul should be marked as unboserved and all visually observed discards should be noted in the species section of the haul log. Be sure to **clearly** document the situation in the comments section.

If it is not possible to biologically sample a particular haul according to protocol, the reason(s) should be noted in the coments section of the corresponding Haul Log.

Table 1g. Length frequency and age structure sampling priorities in the mid-water otter trawl, purse seine and pair trawl fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Gulf of Maine (Statistical areas 511-515)				
Alewife	1	1	-	-
Bluefish	3	3	-	3
Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1
Dogfish, Spiny	2	2	-	-
Flounder, Am. Plaice	1	1	1	1

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
George's Bank (Statistical areas 522, 525, 526, 561, 562)				
Bluefish	3	3	-	3
Butterfish	3	3	3	3
Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1
Dogfish, Spiny	2	2	-	-
Flounder, Am. Plaice	2	2	2	2
Flounder, Sand Dab	2	2	2	2

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Gulf of Maine (Statistical areas 511-515) cont.....				
Flounder, Winter	1	1	1	1
Flounder, Witch	1	1	2	2
Flounder, Yellowtail	1	1	2	2
Haddock	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	2	2	-	-
Hake, White	2	2	1	1
Herring, Atlantic	1	1	-	-
Herring, Blueback	1	1	-	-
Monkfish	1	1	1	1
Pollock	1	1	1	1
Redfish	2	2	2	2
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	-	3	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Wolffish	1	1	2	2

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Georges Bank (Stat areas 522, 525, 526, 561, 562) cont.....				
Flounder, Summer	2	2	2	2
Flounder, Winter	1	1	1	1
Flounder, Witch	2	2	2	2
Flounder, Yellowtail	1	1	2	2
Haddock	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	2	2	-	-
Hake, White	2	2	1	1
Herring, Atlantic	1	1	-	-
Lobster, American	2	2	-	-
Monkfish	1	1	1	1
Ocean Pout	2	2	-	-
Pollock	1	1	1	1
Redfish	2	2	2	2
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	-	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Squid, Atl. Long-fin	3	3	-	-
Squid, Short-fin	3	3	-	-
Wolffish	1	1	2	2

MID-WATER OTTER TRAWL, PURSE SEINE and PAIR TRAWL SAMPLING PRIORITIES

MID-WATER OTTER TRAWL, PURSE SEINE and PAIR TRAWL SAMPLING PRIORITIES

Table 1g. (Con't) Length frequency and age structure sampling priorities in the mid-water otter trawl, purse seine and pair trawl fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Cape Cod (Statistical area 521)				
Alewife	1	1	-	-
Bluefish	3	3	-	3
Butterfish	3	3	3	3
Cod, Atlantic	1	1	1	1
Cusk	1	1	1	1
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	1	1	1	1
Flounder, Winter	1	1	1	1
Flounder, Yellowtail	1	1	1	1
Haddock	2	2	1	1
Hake, Red	3	3	-	-
Hake, Silver	3	3	-	-
Hake, White	1	1	1	1
Herring, Atlantic	1	1	-	-
Herring, Blueback	1	1	-	-
Mackerel, Atlantic	1	1	3	3
Monkfish	1	1	1	1

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Southern New England offshore (Statistical area 537)				
Alewife	1	1	-	-
Bluefish	3	3	-	3
Bonito	3	3	-	-
Butterfish	3	3	3	3
Cod, Atlantic	2	2	2	2
Dogfish, Spiny	2	2	-	-
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	1	1	1	1
Flounder, Winter	1	1	1	1
Flounder, Yellowtail	1	1	2	2
Hake, Red	3	3	-	-
Hake, Silver	2	2	-	-
Herring, Atlantic	1	1	-	-
Herring, Blueback	1	1	-	-
Mackerel, Atlantic	1	1	2	2
Monkfish	1	1	1	1
Ocean Pout	3	3	-	-

Pollock	1	1	1	1
Redfish	2	2	2	2
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Little	2	2	-	-
Skate, Smooth	2	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Squid, Atl. Long-fin	2	2	-	-
Squid, Short-fin	2	2	-	-
Tautog	3	3	-	-
Wolffish	1	1	2	2

Scup	1	1	1	1
Sea Bass, Black	1	1	1	1
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, Clearnose	3	3	-	-
Skate, Rosette	3	3	-	-
Skate, Little	2	2	-	-
Skate, Smooth	3	3	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	2	2	-	-
Squid, Atl. Long-fin	1	1	-	-
Squid, Short-fin	2	2	-	-
Tautog	3	3	-	-

MID-WATER OTTER TRAWL, PURSE SEINE and PAIR TRAWL SAMPLING PRIORITIES

MID-WATER OTTER TRAWL, PURSE SEINE and PAIR TRAWL SAMPLING PRIORITIES

Table 1g. (Con't) Length frequency and age structure sampling priorities in the mid-water otter trawl purse seine and pair trawl fisheries.

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Mid-Atlantic offshore (Statistical areas 616, 622, 623, 626, 627, 632, 636)				
Alewife	1	1	-	-
Bluefish	3	3	-	3
Butterfish	3	3	3	3
Dogfish, Spiny	2	2	-	-
Flounder, Sand Dab	2	2	2	2
Flounder, Summer	1	1	1	1
Hake, Red	3	3	-	-
Hake, Silver	2	2	-	-
Herring, Atlantic	1	1	-	-
Herring, Blueback	1	1	-	-
Mackerel, Atlantic	1	1	2	2
Monkfish	1	1	1	1
Scallop, Sea	3	3	3	3
Scup	1	1	1	1
Sea Bass, Black	1	1	1	1
Shad, American	1	1	-	-
Skate, Barndoor	-	2	-	-

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Mid-Atlantic inshore (Statistical areas 538, 539, 611-615, 621, 625, 631, 635)				
Alewife	1	1	-	-
Bass, Striped	1	1	-	-
Bluefish	1	1	-	1
Croaker, Atlantic	3	3	-	-
Dogfish, Spiny	1	1	-	-
Drum, Black	3	3	-	-
Drum, Red	3	3	-	-
Flounder Sand Dab	1	1	1	1
Flounder, Summer	1	1	1	1
Flounder, Winter	1	1	1	1
Flounder, Yellowtail	1	1	1	1
Herring, Atlantic	1	1	-	-
Herring, Blueback	1	1	-	-
Lobster, American	2	1	-	-
Mackerel, Atlantic	1	1	2	2
Mackerel, Spanish	3	3	-	-
Menhaden, Atlantic	3	3	-	-

Skate, Clearnose	2	2	-	-
Skate, Little	2	2	-	-
Skate, Rosette	2	2	-	-
Skate, Smooth	3	2	-	-
Skate, Thorny	-	2	-	-
Skate, Winter	3	3	-	-
Squid, Atl. Long-fin	1	1	-	-
Squid, Short-fin	2	2	-	-
Weakfish	3	3	-	-

Monkfish	1	1	1	1
Scup	2	2	2	2
Sea Bass, Black	1	1	1	1
Shad, American	1	1	-	-
Skate, Clearnose	2	2	-	-
Skate, Little	2	2	-	-
Spot	3	3	-	-
Tautog	3	3	-	-
Weakfish	1	1	-	-

MID-WATER OTTER TRAWL, PURSE SEINE and PAIR TRAWL SAMPLING PRIORITIES

CLAM/QUAHOG FISHERY SAMPLING PRIORITIES

- **Every haul** should be observed, *i.e.* complete catch information for both kept and discarded species is recorded, during on-watch periods.
- Collection of length frequencies should occur at least after **every other observed haul**.
- At minimum, **half** of the hauls should be observed and **one quarter** of the hauls should be biological sampled during a trip.

CLAM/QUAHOG SHELL HEIGHT FREQUENCIES

- A random sample of at least 30 clams/quahogs should be collected and measured **from each disposition** (*i.e.* kept and discarded).
- Generally, clam/quahog shell height frequency sampling should be the first priority for all hauls, with finfish sampling being second priority.
- For **at least** one haul per watch, finfish sampling should be first priority.

FINFISH SAMPLING

- Collect finfish length frequencies and age structures as a first priority for at least one haul per watch, and on additional hauls, as time permits.
- If a haul has an exceptionally large amount of finfish bycatch, finfish sampling should become first priority for that haul.

Table 1h. Length frequency and age structures sampling for the clam/quahog fisheries

Species	Length Frequencies		Age Structures	
	Kept	Discard	Kept	Discard
Clam, Surf	1	1	-	-
Flounder, nk	3	3	2	2
Flounder, Summer	2	2	1	1
Flounder, Yellowtail	2	2	1	1
Monkfish	2	2	1	1
Quahog, Ocean	1	1	-	-
Scallop, Sea	1	1	-	-
Skate, Barndoor	-	2	-	-
Skate, nk	3	3	-	-

**Skate, nk = single skate species
**Flounder, nk = single flounder species

CLAM/QUAHOG FISHERY SAMPLING PRIORITIES

TABLE 2. FISH & SHELLFISH SAMPLING REQUIREMENTS BY SPECIES PER STATISTICAL AREA
(For Kept and Discard Separately)

SPECIES NAME	LENGTH TARGET	LENGTH TYPE	SEXING NECESSARY?	SCALE TARGET	OTOLITH TARGET
Alewife	100	FL	-	-	-
Bass, Striped	100	FL	-	-	-
Bluefish	100	FL	-	25	-
Butterfish	100	FL	-	-	20****
Cod, Atlantic	100	FL	-	-	20
Clams, Surf	30*	S	-	-	-
Crabs	200	C	YES	-	-
Croaker, Atlantic	50	TL	-	-	-
Cusk	100	TL	-	-	20
Dogfish, Spiny	200	TL	YES	-	-
Drum, Black	50	FL	-	-	-
Drum, Red	50	FL	-	-	-
Flounder, Am. Plaice	100	TL	-	-	20
Flounder, Sand Dab	100	TL	-	-	20
Flounder, Summer	100	TL	-	25	-
Flounder, Winter	100	TL	-	-	20
Flounder, Witch	100	TL	-	-	20
Flounder, Yellowtail	100	TL	YES	20	-
Haddock, Large (>56 cm)	100	FL	-	-	20
Haddock, Scrod (48-56 cm)	50	FL	-	-	20
Haddock, Small (<48 cm)	50	FL	-	-	20
Hagfish	100	TL	-	-	-
Hake, Red	100	TL	-	-	-
Hake, Silver	100	FL	-	-	-
Hake, White	100	TL	-	-	20

Halibut, Atlantic	100	TL	-		20
Herring, Atlantic	50	FL	-	-	-
Herring, Blueback	100	FL	-	-	-
Lobster, American	200	C	YES	-	-
Mackerel, Atlantic	100	FL	-	-	20****
Mackerel, Spanish	100	FL	-	-	-
Menhaden	50	FL	-	-	-
Monkfish (40 cm and over)	100	O	-	-	15 (vertebrae)
Monkfish (under 40 cm)	100	O	-	-	10 (vertebrae)
Ocean Pout	100	TL	-	-	-
Pollock	100	FL	-	-	20
Quahog, Ocean	30*	S	-	-	-
Redfish	100	FL	YES	-	20
Scallop, Sea	100	S	-	-	-
Scup	100	FL	-	25	-
Sea Bass, Black	100	TL	-	25	-
Shad, American	100	FL	-	-	-
Spot	100	FL	-	-	-
Skate, nk **	100	TL	-	-	-
Squid, Atlantic Long-fin	100	ML	-	-	-
Squid, Short-fin	100	ML	-	-	-
Tautog	100	TL	-	-	-
Tilefish	100	FL	-	-	20***
Weakfish	100	FL	-	-	-
Wolfish	100	TL	-	-	20

NOTE: For animals that require to be sexed: Animals are not to be separated by sex before sampling, rather, sex should be obtained as length sampling is occurring.

* If size distribution is variable, length target is 50.
** See Tables 1a-h for listing of priority species.
*** Bottom Longline fishery only.
**** Heads may be collected in lieu of otoliths.

LENGTH TYPE CODES:
TL= Total Length
FL = Fork Length
NL =Natural Length
O = Lower jaw to tip of tail, with jaw pushed down
S = Shell, width or height
C = Carapace, width or length
ML = Mantle Length

TABLE 2. FISH & SHELLFISH SAMPLING REQUIREMENTS BY SPECIES PER STATISTICAL AREA

LENGTH MEASUREMENT ILLUSTRATIONS

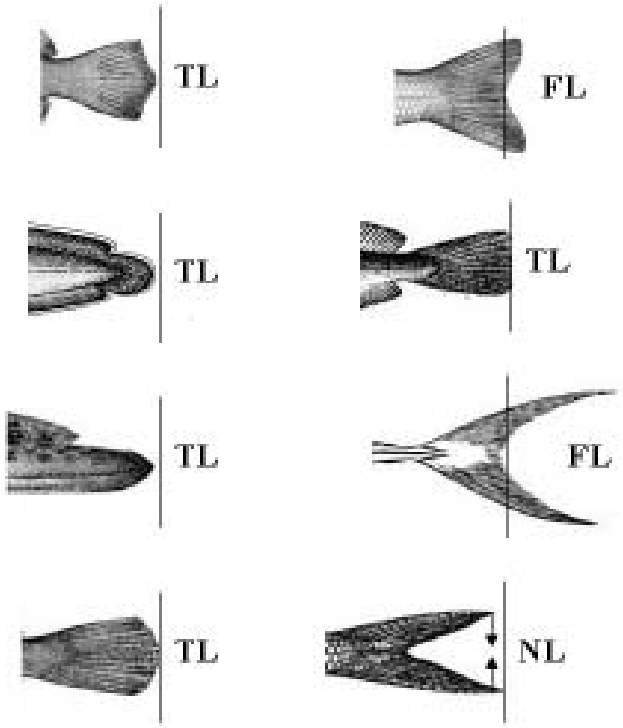


Figure 3. Length types illustrated on different fish tails.

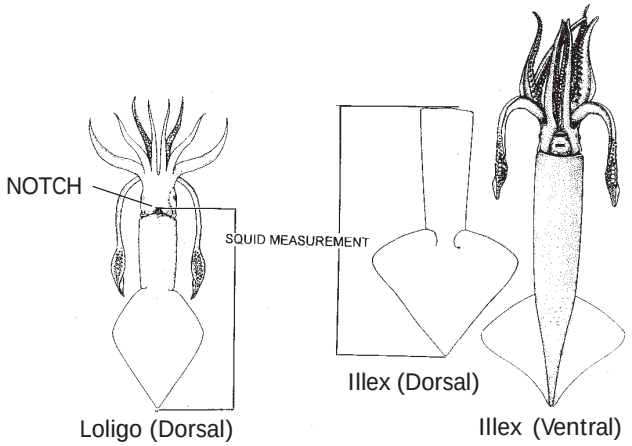


Figure 4. Squid mantle length illustrations.

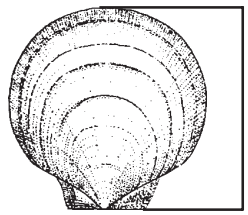


Figure 5. Scallop shell height illustration.

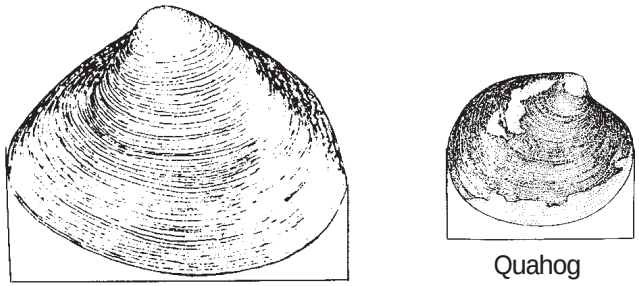


Figure 6. Clam shell width illustrations.

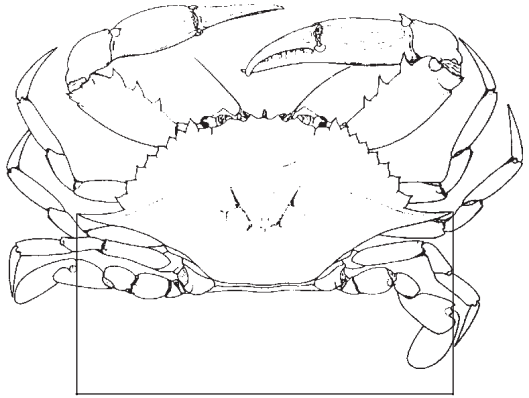


Figure 7. Crab carapace width illustration.

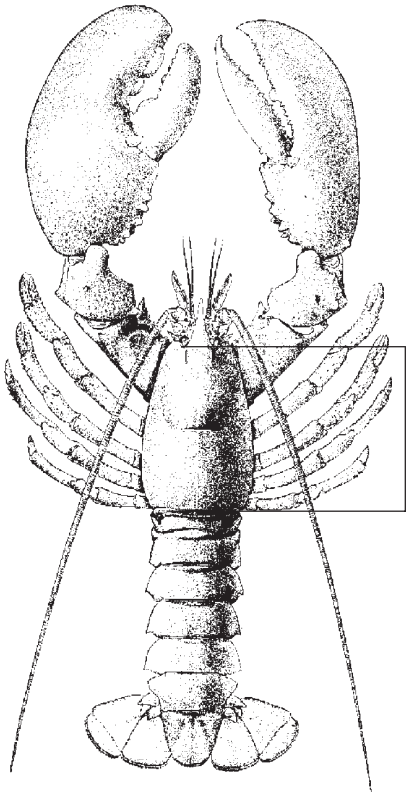


Figure 8. Lobster carapace length illustration.

LENGTH MEASUREMENT ILLUSTRATIONS

OTOLITHS

Figure 9. Examples of otoliths from a variety of fish.

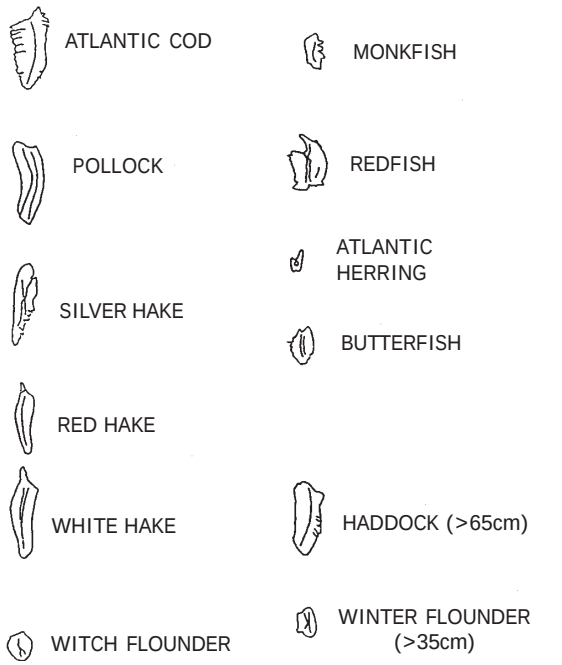


Figure 10. Illustration of a method of dissecting a fish skull to remove otoliths.

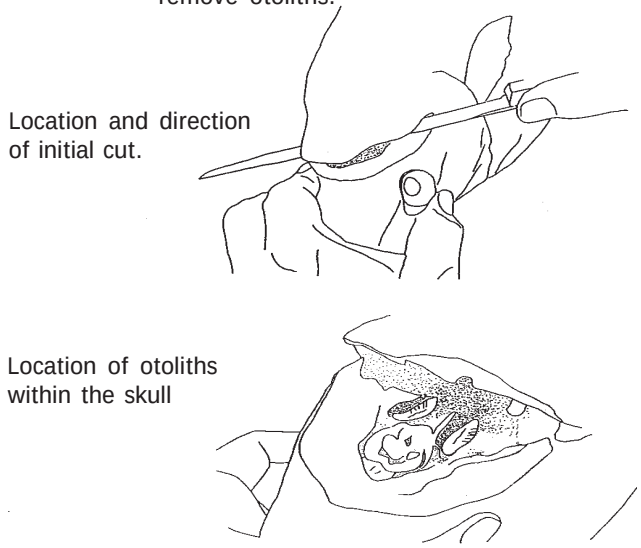


Figure 11. Location of otoliths on ventral side of fish.

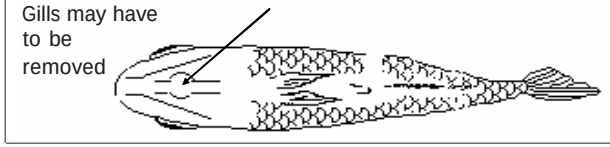
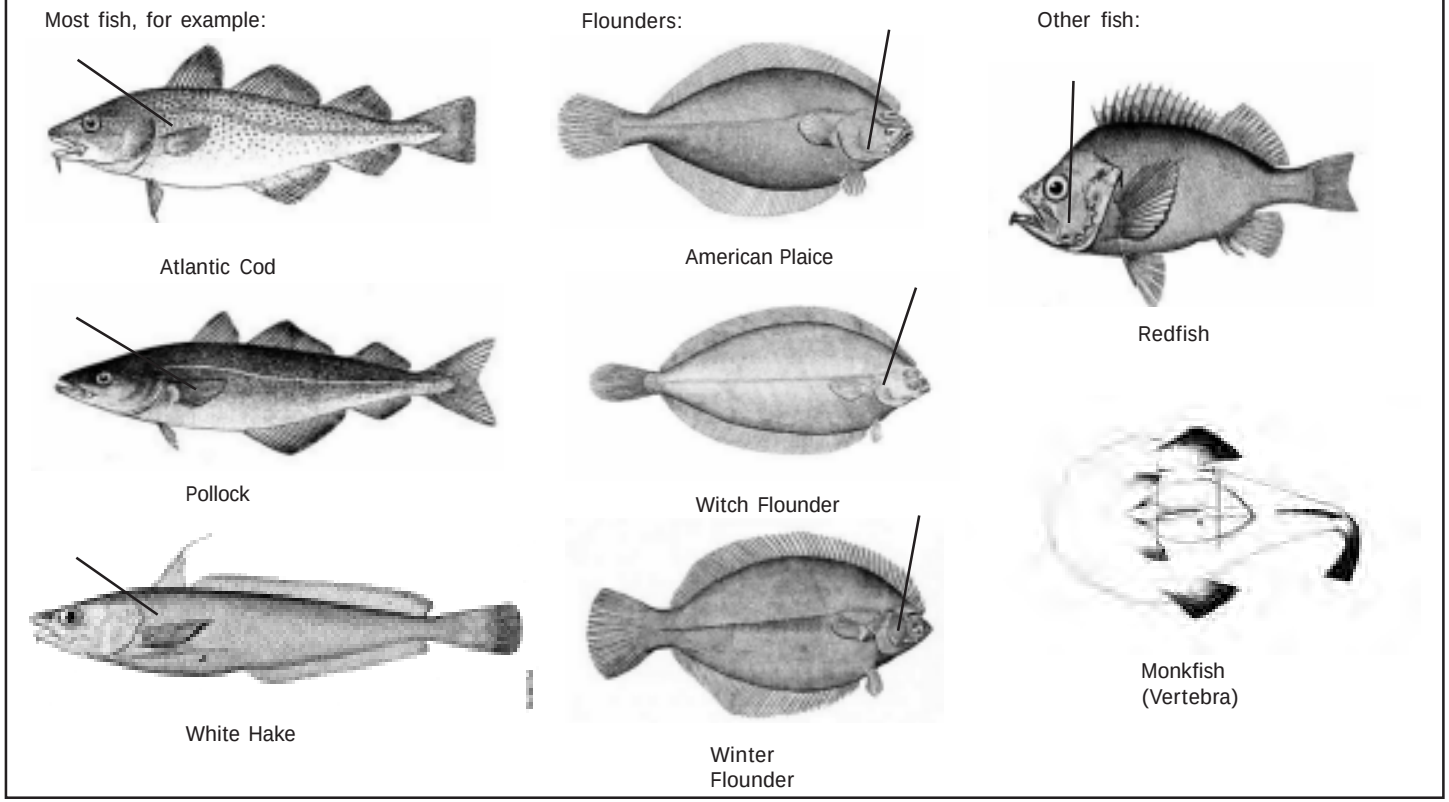


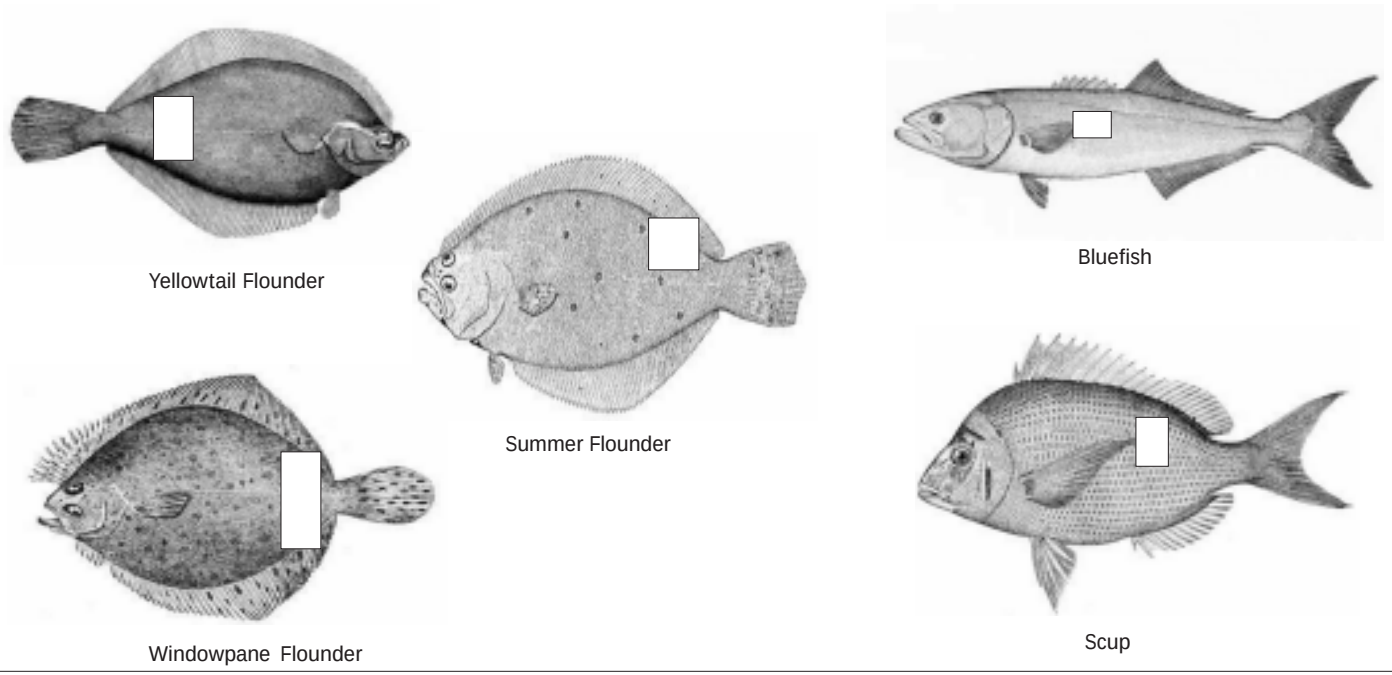
Figure 12. Location and angle of the necessary cut to remove otoliths/vertebrae from various fish.



AGE STRUCTURE SAMPLE COLLECTION

SCALES

Figure 13. Location from which to collect scales from various fish.



General considerations for age structure sample collection:

Otoliths: Exercise care when cutting the fish to remove the otoliths so as not to shatter them. Shattered otoliths are of little value.

Scales: Do your best to remove mucus, debris and epidermis from the fish before collecting scales. Only scales collected from the proper locations can be used for aging.

Figure 14. Age structure envelope.

- Every envelope must have a liner.
- Sample envelopes containing age structures from the same species and disposition codes should be grouped together. Each group of envelopes should contain a header envelope. All of the required information should be filled out on the header envelope and each envelope following the header should only contain the length of the species sampled.

Disposition: Record appropriate kept or discarded fish disposition **code** in the space provided. The code must match the fish disposition code as recorded on accompanying length frequency log.

AGE STRUCTURE SAMPLE COLLECTION

TABLE 3. PELAGIC FISH SAMPLING REQUIREMENTS BY SPECIES

SPECIES NAME	SAMPLE PRIORITY CODE	TARGET SAMPLE SIZE (per haul)	LENGTH TYPE(S) (#1, #2)	LENGTH CODE	SEXING NECESSARY?	AGE STRUCTURE TYPE(S) TO COLLECT
Swordfish	1	100	LJFL, CK	C	Yes	-
Tuna, Bluefin	1	all caught	FL, PFL	S	Yes	-
Bonito	2	50	FL, PFL	S	Yes	-
Marlin, Sailfish, Spearfish, NK	2	50	LJFL, PFL	C	No	-
Shark, NK	2	100	FL, TL	S	Yes	Vertebral Centra
Tuna, Albacore	2	100	FL, PFL	S	Yes	-
Tuna, Bigeye	2	100	FL, PFL	S	Yes	-
Tuna, Blackfin	2	all caught	FL, PFL	S	Yes	-
Tuna, Yellowfin	2	all caught	FL, PFL	S	Yes	-
Dolphinfish (Mahi Mahi)	3	20	FL	S	No	-
Escolar	3	20	FL	S	No	-
Louvar	3	20	LJFL	S	No	-
Mackerel, NK	3	20	FL	S	No	-
Oilfish	3	20	FL	S	No	-
Opah	3	20	TL	S	No	-
Ray, NK	3	20	TL, DW	S	Yes	-
Sturgeon, NK	3	all caught	FL	S	No	-
Tuna, Little (False Albacore)	3	50	FL, PFL	S	Yes	-
Tuna, Skipjack	3	50	FL, PFL	S	Yes	-
Wahoo	3	20	FL	S	No	-

SAMPLE PRIORITY CODES
1 = HIGH
2 = MEDIUM
3 = LOW

LENGTH CODES
S = STRAIGHT
C = CURVED

LENGTH TYPE CODES	
FL = Fork Length	TL = Total Length
PFL = Pectoral Fin to Fork Length	CK = Cleithrum to Keel Length
LJFL = Lower Jaw to Fork Length	DW = Disk Width

Length measurement and age sample parts illustrations for pelagic fish. Shaded areas indicate TAG RECAPTURE

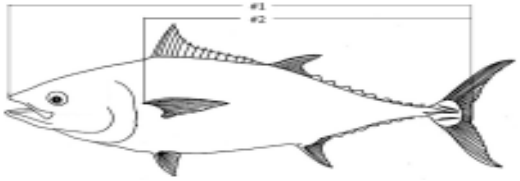


Figure 15.
TUNA measurements in order of importance:
#1: Tip of upper jaw to fork (straight); #2: Anterior pectoral fin to fork (straight).

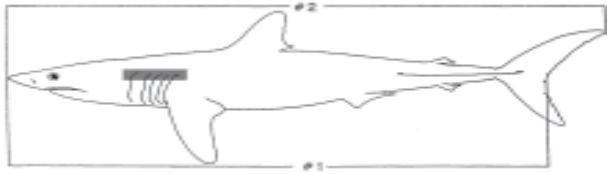


Figure 16.
SHARK measurements in order of importance:
#1: Tip snout to fork (straight); #2: Tip of snout to tip of upper caudal lobe (straight).

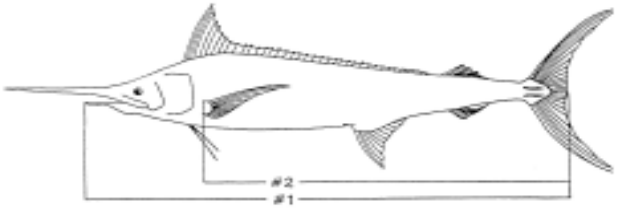


Figure 17.
BILLFISH measurements in order of importance:
#1: Tip of lower jaw to fork (curved); #2: Anterior pectoral fin to fork (curved).

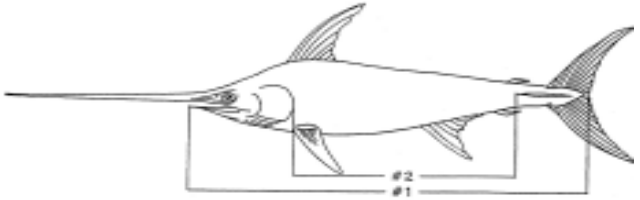


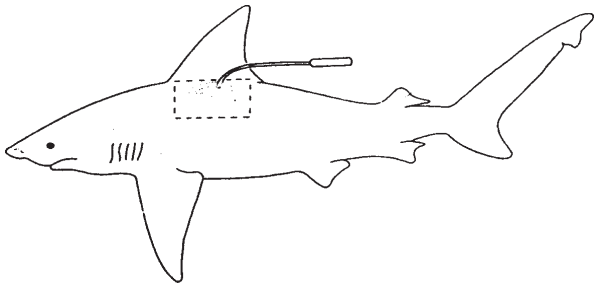
Figure 18.
SWORDFISH measurements in order of importance:
#1: Tip of lower jaw to fork (curved); #2: Cleithrum to the anterior origin of the caudal keel (curved).

TABLE 3. PELAGIC FISH SAMPLING REQUIREMENTS BY SPECIES

SHARK/FISH TAG RECAPTURE

Shark and Fish Tag Recapture

- See Table 2 and Table 3 for samples and length measurement descriptions to collect from tag recapture animals (excluding pelagic species).
- **All** tag recaptures should be recorded on the Individual Animal Log and fully sampled if possible (*i.e.* weather permitting and without interfering with the processing of a kept fish).
- Information to record:
  - Tag #
  - Species
  - Tag program name, address and/or phone number
  - Comments regarding the animal condition at the tag location



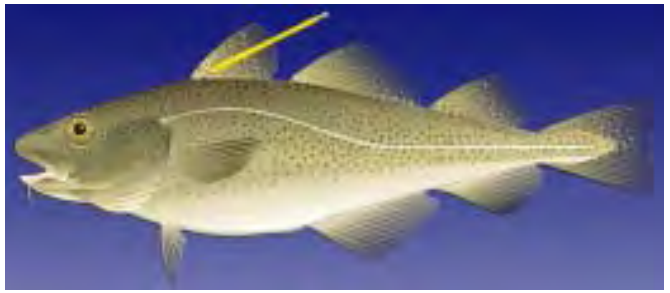


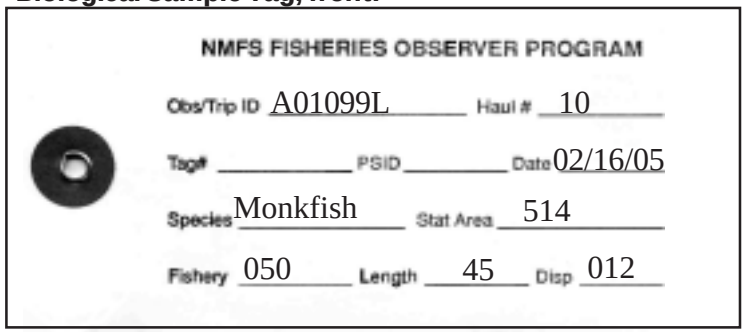
Figure 19. Examples of tagging locations for sharks/fish.

BIOLOGICAL SAMPLE TAG

General instructions for filling out biological sample tags:

- The purpose of biological sample tags is to provide a sturdy label for biological samples collected *(i.e.* vertebrae, finclip, head), excluding otolith and scale age structures.
- Each sample should be bagged separately, unless otherwise instructed, and have its own tag.
- If several samples from one animal are collected, or numerous vertebrae from one haul are obtained, each separately bagged sample may be placed in a larger bag for ease in transporting and tracking samples. The larger bag should be tagged as well and all of the appropriate samples indicated.
- A permanent marker should be used to complete the tag.
- If an entire marine mammal is retained, a biological sample tag should be completed and attached to the animal's lower jaw or caudal peduncle in addition to the yellow carcass tag.
- If an entire turtle is retained, a biological sample tag should be completed and attached to the animal's flipper, in addition to tagging the rear flipper with one Inconel tag.
- All protected species samples must be double bagged and double tagged.

Biological Sample Tag, front.



Biological Sample Tag, back.

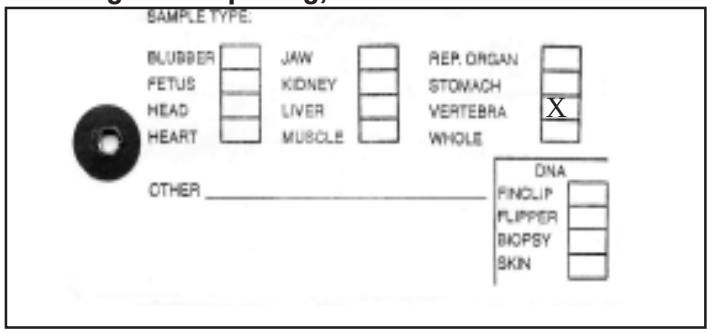


Figure 20. Biological Tag illustration

STURGEON SAMPLING

Genetic Sample Collection Instructions

1 Photograph **(ALL STURGEON)** - photos should consist of fish in profile, the underside of the head, post-dorsal fin scutes (dorsal view) and post-anal scutes (ventral view). Include something in the photos for scale.

2 Biosample **(ATLANTIC STURGEON ONLY)** - cut the tip of the dorsal fin off to about the size of a dime from each fish and place in vial. Each vial should only consist of a DNA sample from one fish. Label each vial with the following:

TRIPID
SEQUENCE NUMBER
HAUL NUMBER

Wipe your knife clean between samples with a clean cloth or paper towel to avoid cross contamination. Store samples at room temperature and send in with your trip. Be sure to put parafilm around each cap to prevent leaking.

3 PIT Tags **(ALL STURGEON)** - scan the entire sturgeon for PIT tags using the same scanner that was issued to you for turtle PIT tag scanning (you may not have been issued one). If present, record the PIT tag number in the tag number field on the Individual Animal Log. In comments, record whether or not a sturgeon was scanned regardless of the presence or absence of a PIT tag.

4 Individual Animal Log Instructions **(ALL STURGEON)** - obtain a measured fork length and actual weight. PROVIDE ID CHARACTERISTICS IN THE COMMENT SECTION. If a DNA sample was taken, BIOSAMP (Y/N) should be checked as 1 (Yes). Record the presence or absence of tags (including PIT tags), tag number (if present), and tagging program name and contact information.

NOTE: In 1994, sturgeon were stocked in the Hudson River, New York. These fish were marked by removing their left pelvic fin. Today these fish would be near 6 feet in length. Should you come across a large sturgeon that is missing its left pelvic, in addition to the above protocols, please photograph the missing fin and comment on the Individual Animal Log.

STURGEON ID

ATLANTIC STURGEON *Acipenser oxyrhynchus*

Key characteristics:

- snout v-shaped from underside view
- barbel length > 1/2 width of mouth
- width inside lips < 55% of bony interorbital width
- 2 rows post-dorsal plates
- 2 rows post-anal plates

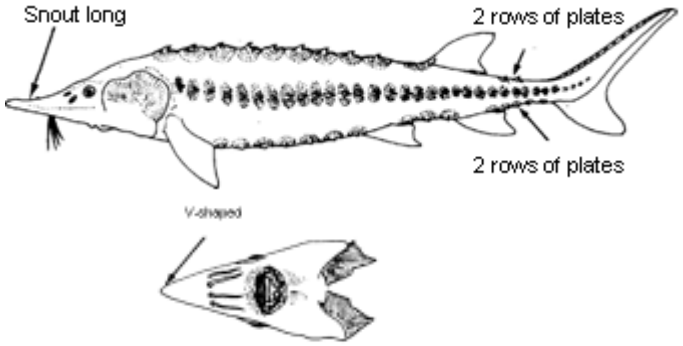


Figure 21. Atlantic sturgeon. Source: *FAO Species Identification Sheets for fishery purposes. Western Central Atlantic (fishing area 31). Vol. 1*, UNFAO.

STURGEON ID

SHORTNOSE STURGEON *Acipenser brevirostrum*

Key characteristics:

- snout u-shaped from underside view
- barbel length < 1/2 width of mouth
- width of inside lips > 62% of bony interorbital width
- post-dorsal plates usually absent
- post-anal plates, when present, in 1 row

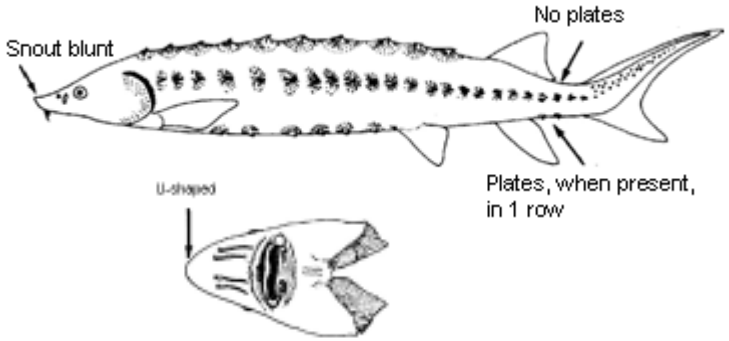


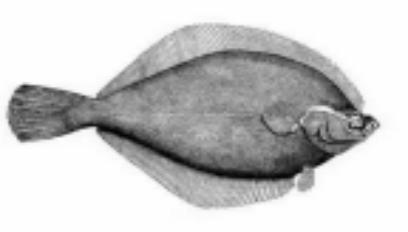
Figure 22. Shortnose Sturgeon. Source: *FAO Species Identification Sheets for fishery purposes. Western Central Atlantic (fishing area 31). Vol. 1*, UNFAO.

SEX DETERMINATION: groundfish

YELLOWTAIL FLOUNDER *Pleuronectes ferrugineus*

Female: The anterior edge of the ovary is rounded, and extends back toward the caudal fin, forming a balloon or sac-like structure. In mature fish the ovary extends back to a minimum of one half of the body cavity. Depending on maturity stage, the ovaries will appear light pink (immature) to bright orange (ripe) in color.

Male: The testis is tapered at the anterior edge. It is triangular in shape, and does not extend as far back as the ovary. It extends back toward the caudal fin about twice the distance of the width of the front edge. In mature fish the testis will not extend back any further than the pectoral fins. Depending on maturity stage, the testis will appear clear and transparent (immature) to opaque and white (ripe) in color.



REDFISH *Sebastes* sp.

Redfish are live-bearers, so the stage of maturity for females and males are offset. Females will ripen in the winter, when males rest.

Female: The ovaries are paired and sac-like, or balloon-like in shape. After the eggs are fertilized, the eyes of the larvae can been seen as black dots. Redfish eggs are green in color.

Male: There are greater than two fat bodies present which are sac-like, segmented or lumpy. These may look like the testes, but the testes are paired, consist of smooth tissue and are firmer than the fat bodies. The coloration is light tan when resting and off-white when developing and ripe. Males over 20 cm also have an external copulatory organ, which is located near the vent. If the organ is not seen, it will be necessary to cut open the fish to verify the sex.

SEX DETERMINATION: sharks / tunas

SHARKS Elasmobranchii

ADULT CLASPERS MALE | JUVENILE CLASPERS MALE | CLASPERS ABSENT FEMALE

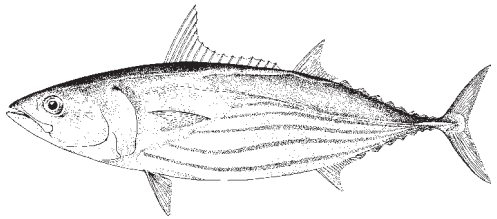
Figure 23. Sex determination in sharks. Top figure: location of the pelvic fins. Bottom figures: ventral view of the pelvic fins, and location (or absence) of the claspers.

TUNAS *Euthynnus, Thunnus* sp.

See sex determination of **swordfish** section (next page).

Female: Same characteristics as swordfish ovaries.

Male: The testes are usually elongated and uniform in shape throughout. They are flatter and thinner when compared to the swordfish testes. Generally, there is more fatty or connective tissue associated with the tuna testes than with the swordfish testes.



SEX DETERMINATION: swordfish

SWORDFISH *Xiphias gladius*

Female:

The most prominent characteristics of female swordfish gonads are:

- oval shape (cigar or sausage shaped)
- rough (striated) external appearance
- in a cross section, the presence of a lumen (opening) near the center

Color: variable, ranges from gray (indicating immature egg production) to orange (indicating near spawning)

Generally, swordfish and tuna over 250 pounds are female.

Figure 24. Cross section (left) and whole (right) views of female swordfish gonads. Courtesy of U.S. National Marine Fisheries Service, Southeast Fisheries Science Center.

SEX DETERMINATION: swordfish

Male:

The most prominent characteristics of male swordfish gonads are:

- triangular in shape (cross section), solid
- thin, elongated, and slightly compressed (smooth and flat)
- a raised center ridge

Color: white to pink

Figure 25. Cross section (left) and whole (right) views of male swordfish gonads. Courtesy of U.S. National Marine Fisheries Service, Southeast Fisheries Science Center.

SEX DETERMINATION: crustaceans

AMERICAN LOBSTER *Homarus americanus*

Female: The first pair of swimmerets are thin and filament-like.

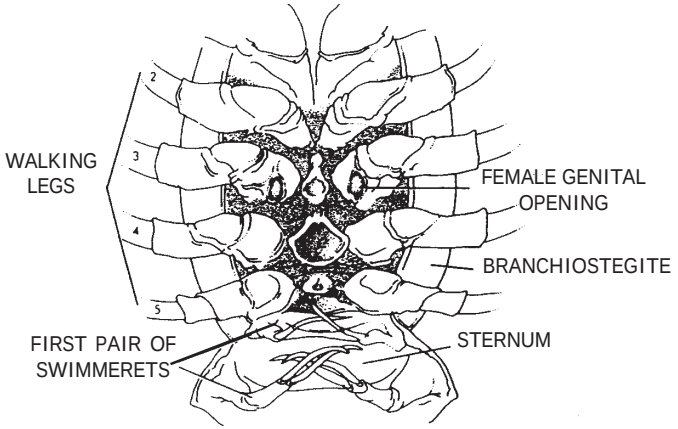


Figure 26. Ventral view of **female lobster**. Note the relatively large genital opening on the third pair of walking legs.

Male: The first pair of swimmerets are thick in shape and firm in texture.

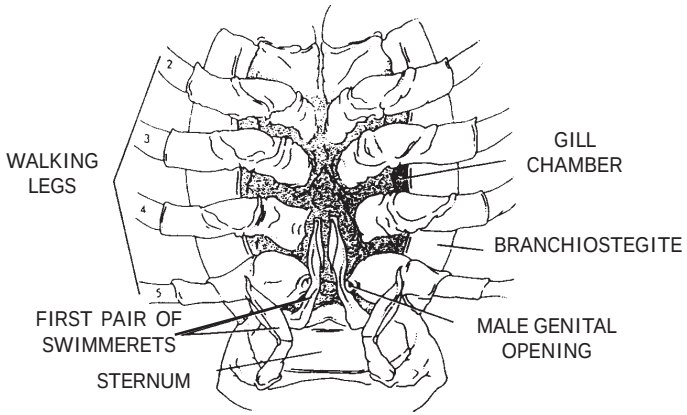
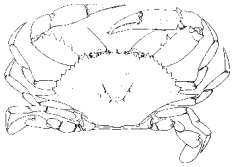


Figure 27. Ventral view of **male lobster**. Note the small genital opening on the fifth pair of walking legs.

SEX DETERMINATION: crustaceans

CRABS Brachyura



Female: The abdomen is "U" shaped.

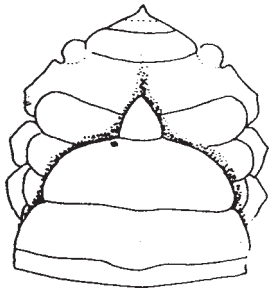


Figure 28. Ventral view of **female crab** abdomen.

Male: The abdomen is "V" shaped.

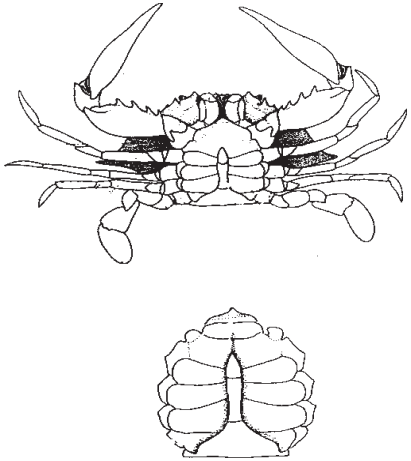


Figure 29. Ventral views of **male crab** abdomen.

PRECAUTIONS WHEN HANDLING MARINE MAMMALS:

Marine mammals can carry microbes which may cause illness in humans and other animals.

Safety measures to prevent illness and infections

- Use common sense!
- Wear gloves and other protective gear when handling animal and specimens.
- Wash hands and areas of contact thoroughly after contact.
- Clean/wash gear thoroughly after each use.
- Report any animal bite, scratch, or other significant exposure to marine animal blood, saliva, or excretions.
- Tell your physician that you work with marine animals

MARINE MAMMAL SAMPLE PRIORITIES:

Minimum sampling requirements should always be collected. Whole animals should be collected whenever possible. If whole animal cannot be retained, collect head/jaw.

Sample priorities after collection of above tissue when additional sampling is feasible should be:

stomach	fetus
blubber	kidney
muscle	heart
liver	

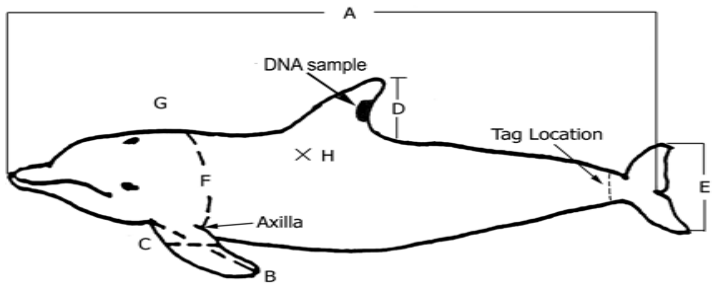
MARINE MAMMAL MINIMUM SAMPLING PROTOCOLS

MINIMUM REQUIREMENTS

Live animals: Photograph and return to the water.

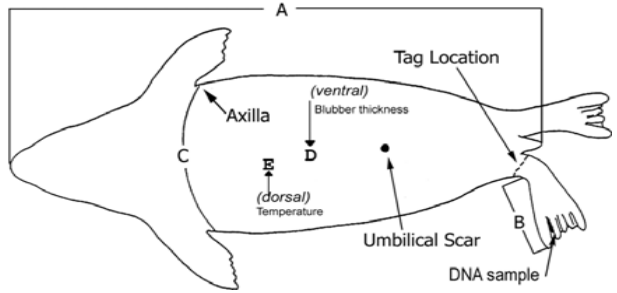
Dead animals:
1. DNA sample
2. Tag
3. Identify, noting immediate observable characteristics
4. Photograph
5. Body Measurements:
   7 for cetaceans (bottlenose = 11), 4 for pinnipeds
6. Body Temperature
7. Sex Determination
8. Describe any new and/or healed wounds

Figure 30. Marine mammal carcass tag



A. Total Length: snout tip to fluke notch
B. Flipper Length
C. Flipper Width, maximum
D. Height of Dorsal Fin
E. Fluke Width, from tips of flukes
F. Girth at Axilla (circumference)
G. Blubber Thickness
H. Body Temperature

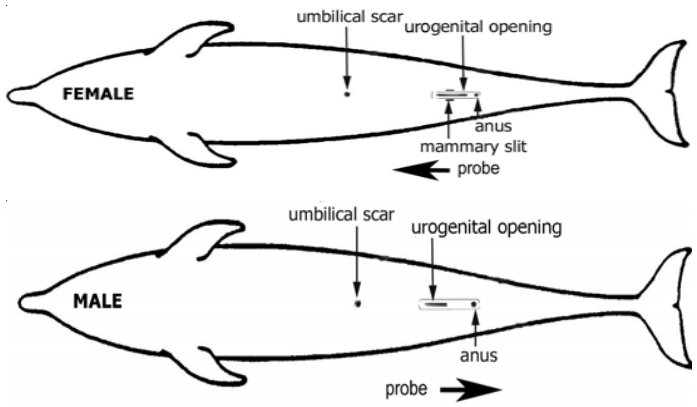
Figure 31. Cetacean body measurements (straight line).



A. Total Length - snout to tip of tail
B. Rear Flipper Length
C. Girth at Axilla (circumferance)
D. Blubber Thickness (ventral)
E. Body Temperature (dorsal)

Figure 32. Pinniped body measurements (straight line).

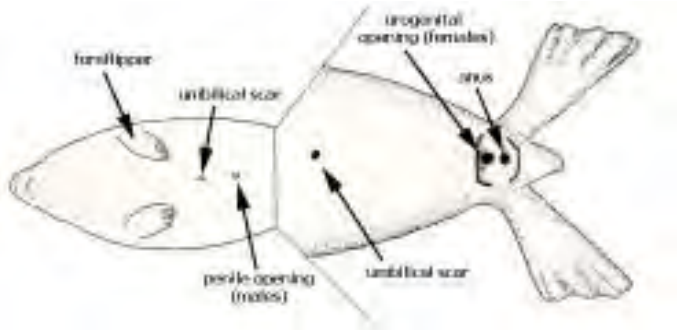
MARINE MAMMAL MINIMUM SAMPLING: sex determination



Dead Cetaceans:
Probe the urogenital opening: female = direction of the opening will be forward; males = direction of the opening will be toward the back (fluke).

Live Cetaceans:
Presence of mammary slits on both sides of the urogenital = females; lack of mammary slits is not indicative of males, as females may be immature and not yet show mammary slits. Females - urogenital opening close to anus (almost one opening); Male - urogenital opening separated from anal opening (two distinct openings).

Figure 33. External sex characteristics of cetaceans.



Pinnipeds (live or dead):
Examine the urogenital opening by stretching the rear flippers taut and very wide apart at the base of the tail, looking inside the outer opening: females = two distinct inner openings (anal opening and vaginal opening); males = only an anal opening.

Penile opening in males is along the ventral midline between the umbilical scar and the anus. Mammary teats (two) are posterior to the umbilical scar in females. However, it is often very difficult, to locate either the penile opening or the teats on a pinniped.

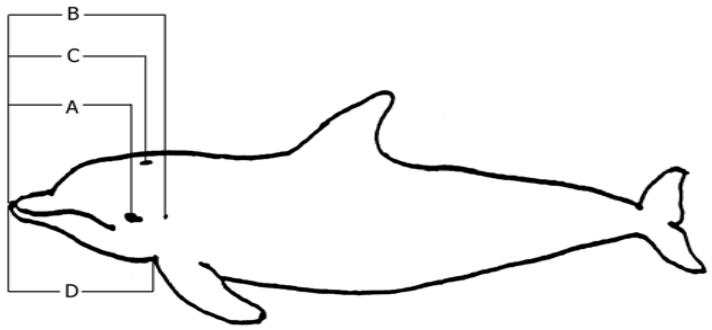
Figure 34. External sex characteristics of pinnipeds.

MARINE MAMMAL ADDITIONAL SAMPLING PROTOCOLS

Marine Mammal Additional Sampling Protocols

Below are additional marine mammal **measurements** for **Bottlenose dolphins only (Figure 36). Photographs** of the profile of the **dorsal fin** from **both sides** should be taken Figure 35). Be sure to fill out separate tags for each sample collected (Figure 37).

Figure 35. Profile of Bottlenose dolphin dorsal fin from both sides.



A. Snout to Center of Eye
B. Snout to Ear
C. Snout to Center of Blowhole
D. Snout to Flipper Anterior Insertion

Figure 36. Additional measurements (straight line) for Bottlenose dolphins.

Figure 37. Properly filled out white Tyvek sample tag.

MARINE MAMMAL ADDITIONAL SAMPLING: internal anatomy

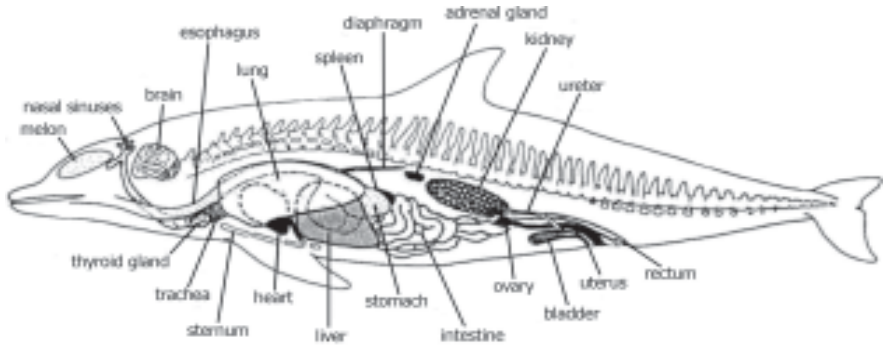


Figure 38. Internal anatomy of cetaceans.

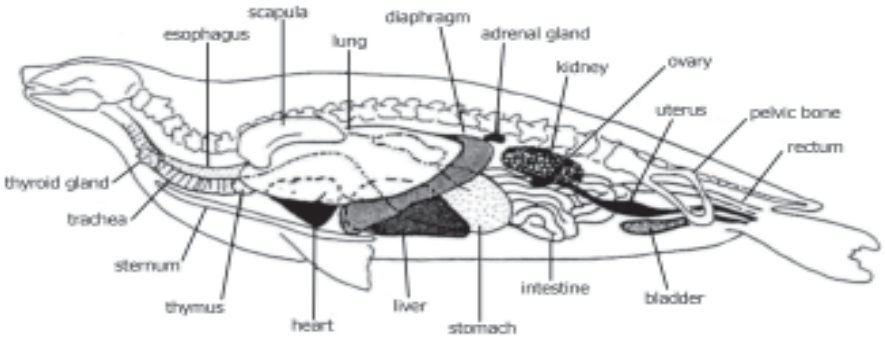


Figure 39. Internal anatomy of pinnipeds.

SEA BIRD SAMPLING PROTOCOLS

Live animals:
1 Identify, noting immediate observable characteristics
2 Photograph
3 Check for the presence of bands
4 Release

Dead animals:
1 Identify, noting immediate observable characteristics
2 Photograph
3 Check for the presence of bands
4 Retain whole seabird or feathers*

***NOTE:** For seabirds (fresh dead only) caught in the area between Maine and North Carolina, all attempts should be made to retain whole specimens. However, if unable, 20-30 breast feathers should be collected. Samples should be bagged and labeled with Tyvek tags, filled out as shown in Figure 37.

Figure 40. Example of commonly used bird bands. Photo courtesy of USGS, Patuxent Wildlife Research Center.

Figure 41. Placement of a bird band around the leg. Photo courtesy of John Cassady.

SEA TURTLE SAMPLING PROTOCOLS

SAMPLING REQUIREMENTS (all turtles)

1 Identify, noting immediate observable characteristics
2 Photograph
3 Describe any new and/or healed wounds
4 Body Measurements (3, curvilinear)
5 Identification Criteria (6)
6 Biopsy/tissue (genetic) sample
   Live Animals: Turtle must be > 25 cm notch to tip carapace length
   Dead Animals: Retain animals whole. If not possible then obtain biopsy/tissue sample
7 Tag with inconel tag(s) on rear flipper(s): 1 for dead sea turtles, 2 for live sea turtles > 26 cm notch to tip carapace length
8 Scan for PIT tags on flippers and all soft tissues

Inconel Tag Location: Proximal to the first scale (closest to the body) on the trailing edge of each rear flipper for all turtles except Leatherback. For Leatherback turtles, tag along the trailing edge of the rear flipper approximately 5 cm (~2 inches) out from the base of the tail (they do not have flipper scales). Position the tag so there will be adequate overhang (approx. 1/3 length of tag) after it is attached. See Figures 42 and 43.

Biopsy Location: Posterior trailing edge of the rear flipper and out (away from the body) from the Inconel tag location. **One crescent shape biopsy per rear flipper**. See Figure 42.

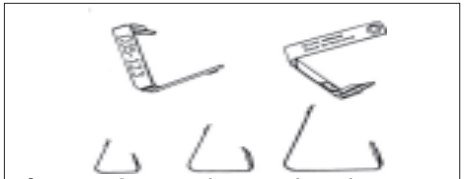


Figure 42. Metal Inconel turtle tags.

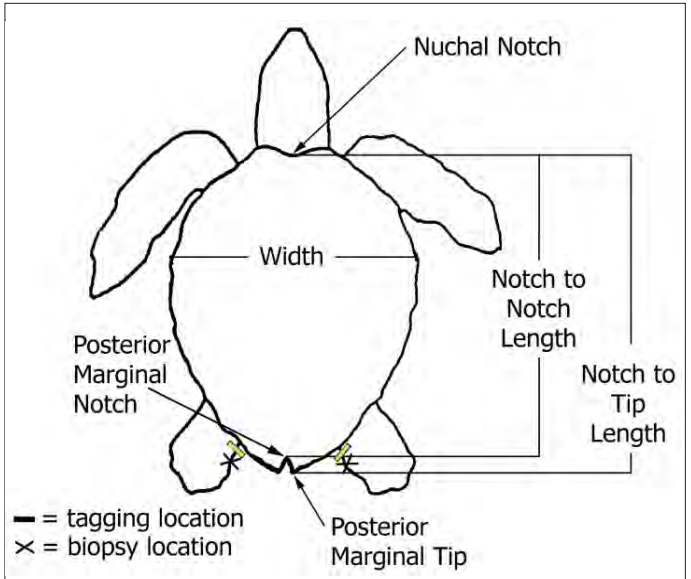


Figure 43. Sea turtle measurements (curvilinear), tagging and biopsy locations.

SEA TURTLE SAMPLING PROTOCOLS: resuscitation

Resuscitation must be attempted on sea turtles that are comatose or inactive, but not dead. **Do not assume that an inactive turtle is dead**. The onset of rigor mortis is often the only definitive indication that a turtle is dead.

RESUSCITATION:

1 Place the turtle right side up (on the bottom shell or plastron).
2 Elevate the hindquarter 6 inches for a period of 4 up to 24 hours.
3 Protect from environmental conditions.
4 Periodically rock the turtle from side to side by holding the outer edge of the carapace and lifting one side about 3 inches.
5 Touch the upper eyelid and pinch the tail (reflex test) periodically to see if there is a response.

Those that revive and become active must be **released over the stern** of the boat when fishing **gear is not in use**, when the **engine gears are in neutral** position, and in areas where they are unlikely to be recaptured or injured by fishing gear or vessels. Sea turtles that fail to respond to the reflex test or fail to move within several hours (up to 24, if possible) should be returned to the water in the same manner.

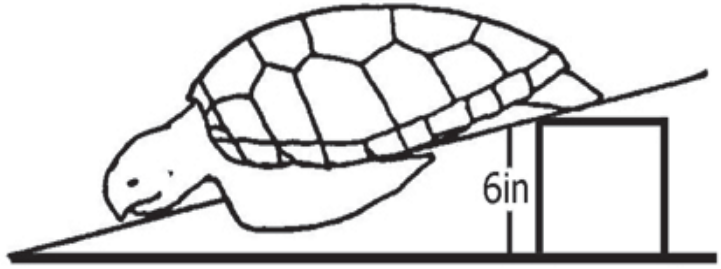
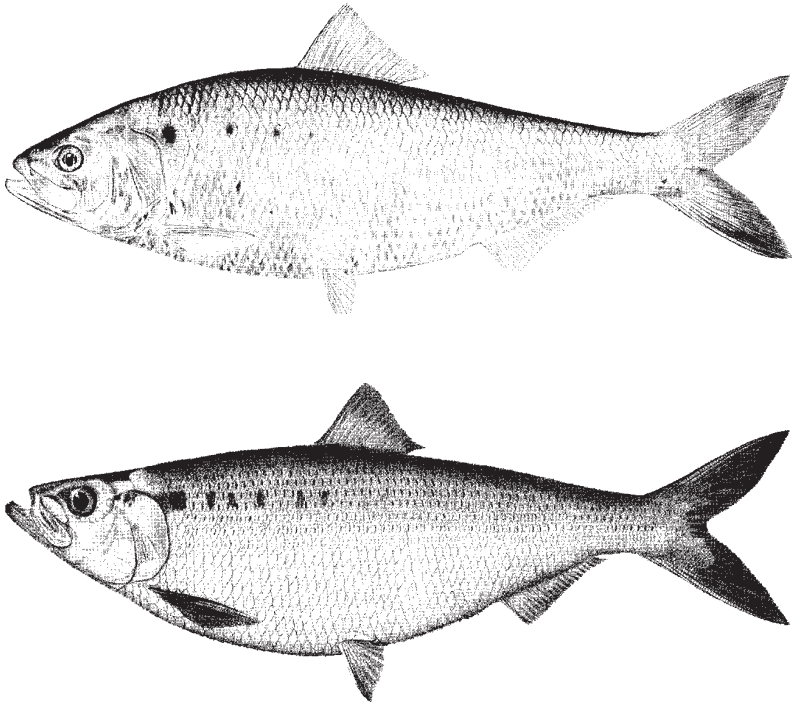


Figure 44. Proper positioning of turtle for resuscitation.

SELECTED SPECIES ID'S: shad

The following selected species identification section contains descriptions of some of the more commonly misidentified Atlantic species. It should be used as a supplement to the field guides distributed in training.



AMERICAN SHAD *Alosa sapidissima*

Key characteristics

- tip of the lower jaw is entirely enclosed within the tip of the upper mouth when closed
- longer mouth than hickory shad
- upper jaw reaches below the rear edge of the eye
- spots are circular shaped

VS.

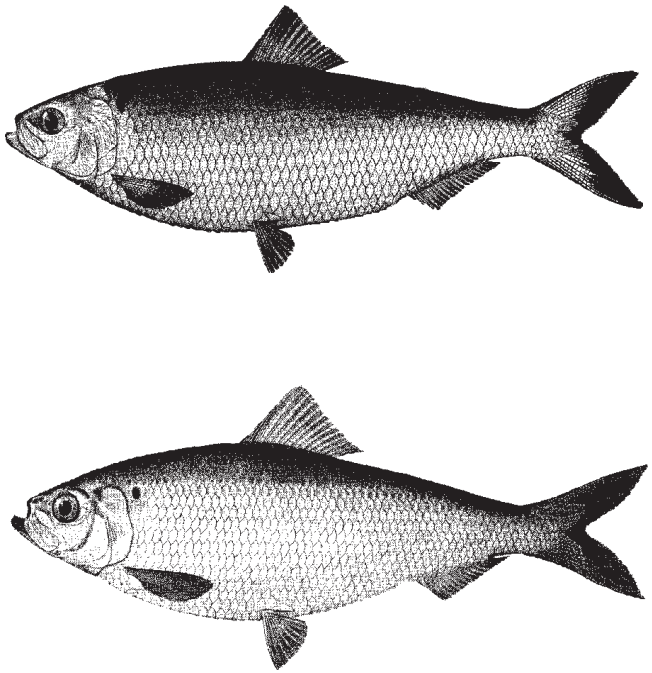
HICKORY SHAD *Alosa mediocris*

Key characteristics

- tip of the lower jaw projects beyond the upper jaw when mouth is closed
- shorter mouth than American shad
- upper jaw reaches the middle of the eye
- spots are oval shaped

Figure 45. American shad (top) and hickory shad (bottom). Source: *Fishes of Chesapeake Bay* by E. O. Murdy et al., published by Smithsonian Institution Press.

SELECTED SPECIES ID'S: herring



BLUEBACK HERRING *Alosa aestivalis*
Key characteristics:

- peritoneum (belly lining) is black or sooty colored
- back is blue-green in color
- eye width = distance between the front of the eye to the tip of the snout
- body shape is slightly more slender than the alewife

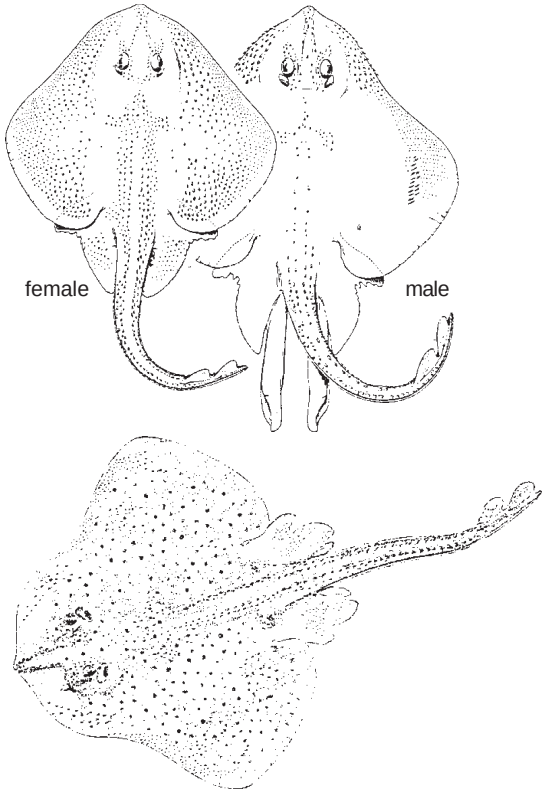
VS.

ALEWIFE *Alosa pseudoharengus*
Key characteristics:

- peritoneum (belly lining) is pale gray or pink
- back is gray-green in color
- eye width > distance between the front of the eye to the tip of the snout
- body shape is slightly deeper than the blueback

Figure 46. Blueback herring (top) and alewife (bottom). Source: *Fishes of Chesapeake Bay* by E. O. Murdy et al., published by Smithsonian Institution Press.

SELECTED SPECIES ID'S: skates



LITTLE SKATE *Leucoraja erinacea*
Key characteristics:

- maximum length 54 cm
- matures at a smaller size than winter skates
- animals 35 cm and over will be sexually mature, males will have large claspers that extend well beyond the posterior edge of the disk, females will have a granular patch on the bottom of the animal, in front of the tail

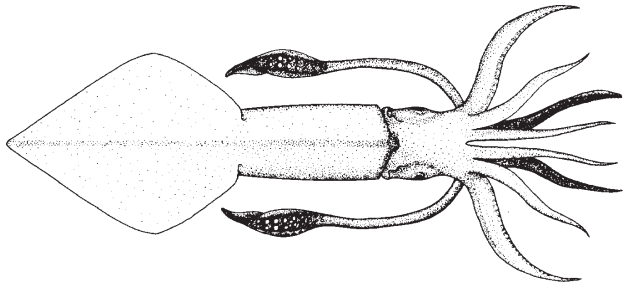
VS.

WINTER SKATE *Leucoraja ocellata*
(Big skate)
Key characteristics:

- maximum length 109 cm
- matures at a larger size than little skates
- animals < 54 cm will be sexually immature, males will have small claspers that rarely extend beyond the posterior edge of the disk, females do not have a granular patch on the bottom of the animal

Figure 47. Little skate (top) and winter skate (bottom). Source: *Fishes of the Gulf of Maine* by H.B. Biegelow & W.C. Schroder, U.S. Fish and Wildlife Service.

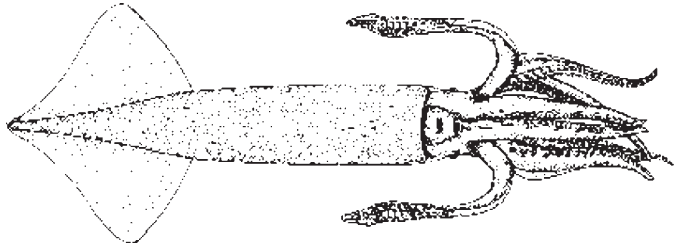
SELECTED SPECIES ID'S: squid



dorsal view

LOLIGO SQUID *Loligo pealei*
(Long-finned squid)
Key characteristics:
- fins elongated, about 1/2 of mantle length
- color: white to purple, occasionally some reddish-brown, darker on dorsal side

VS.



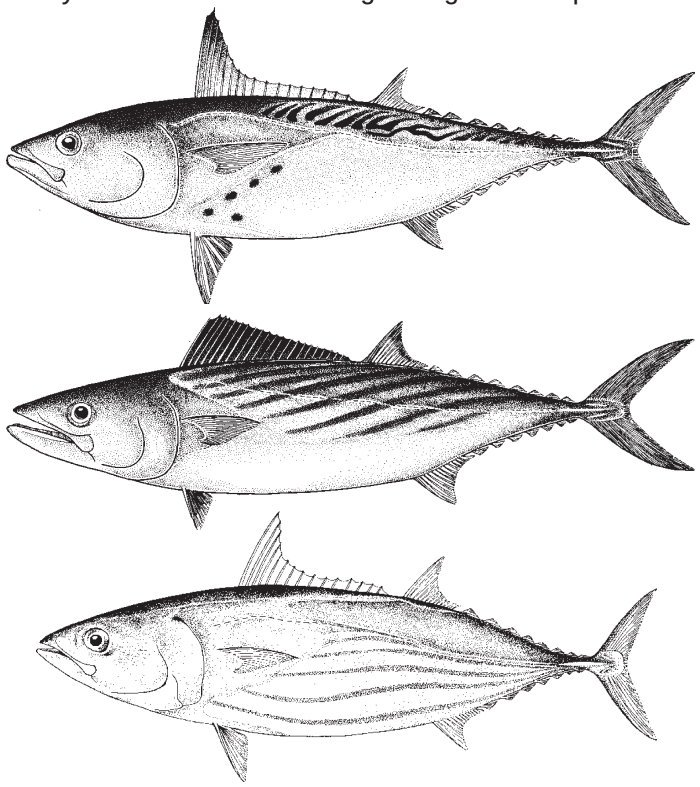
ventral view

ILLEX SQUID *Illex illecebrosus*
(Short-finned or Boreal squid)
Key characteristics:
- fins shortened, about 1/3 of mantle length
- color: reddish-brown, darker on dorsal side

Figure 48. Loligo squid (top) and illex squid (bottom). Source: *FAO Species Identification Sheets for fishery purposes. Western Central Atlantic (fishing area 31). Vol. 6*, UNFAO.

SELECTED SPECIES ID'S: tuna

The key characteristics for distinguishing these 3 species are the body markings.



LITTLE TUNNY* *Euthynnus alletteratus* (False albacore)

- markings: a series of dark, wavy lines above the lateral line
- 4-5 dark spots below pectoral fin

*note that the name 'little tuna' may also be used by fishermen to refer to other Euthynnus species

VS.

ATLANTIC BONITO *Sarda sarda*

- markings: a series of dark, longitudinal stripes on the upper half of the fish

VS.

SKIPJACK TUNA *Euthynnus pelamis*

- markings: a series of dark, longitudinal stripes on the lower half of the fish

Figure 49. Little tunny (top), Atlantic bonito (middle) and skipjack tuna (bottom). Source: *FAO species catalogue. Vol. 2. Scombrids of the World. An annotated and illustrated catalogue of tunas, mackerels, bonitos and related species know to date* by B.B. Collette & C.E. Nauen, UNFAO.

CATCH ESTIMATION GUIDELINES

Accurate weights are extremely important. It will be possible to obtain actual weights in most situations. In rare cases, *i.e.* extremely large catches, rough weather, etc., it may be necessary to estimate the catch or a portion of the catch.

- Dressed vs. Round weights: Get round weights unless they are landing parts of a particular species, for example: monkfish livers, monkfish tails, skate wings, shark fins.
- Kept vs. Discarded catch: The following techniques can be used to estimate weights for both the kept and discarded portions of the catch. Your first priority should be actual weights or accurate estimates on discards. If there is a small amount of discards, ask the crew to throw the discarded fish aside in totes or baskets for you to weigh at the end of the haul. Typically the kept portion of the catch will be sorted into baskets or totes, making it easy to obtain an estimated weight using the basket/tote count method.
- Remember to subtract the weight of the basket or tote, *i.e.* the subsampling unit, from all weight calculations.
- Obtain a catch estimate from the captain if there is no other way of estimating a weight.

A Estimation Based on Basket or Tote Counts

1 The catch is separated into totes by species. For each species:
2 Get an average weight per tote by actually weighing 2 or 3 totes (A).
3 Count the total number of totes; make sure that all of the totes are filled to approximately the same level (B).
4 If the last tote is not full, weight it (C).
5 To calculate the total catch, multiply the number of totes by the average weight of a tote and add the remainder (A x B + C). This is recorded as an estimated weight on the haul log.

Example: Basket Count Method. A conveyor system is used to fill baskets with Atl Long-Fin Squid. The observer weighs 3 baskets at 66, 65, and 68 lbs. The average weight per basket is 66 lbs. As the baskets are being filled, the observer counts 42 full baskets of squid, and there is one basket that is about half full at the end. He weighs the last basket and it is 37 lbs. The total weight for Atl Long-Fin Squid is:
66 lbs (average weight per basket) x 42 (number of full baskets) + 37 lbs (remainder weight) = 2809 lbs

B Estimating Large Catches and Total Species Weights Using Volume to Volume Method

1 Calculate the volume of the catch within the fish bin or hold. Take care that your volume measurements accurately represent the entire catch.**

2 Calculate/determine the volume of the catch within a basket or tote (the subsampling unit) by multiplying the number of subsampling containers by the volume of the subsampling container.

- Volume of a standard fish tote = 2.65 ft^3
- Volume of an orange basket = 1.47 ft^3

3 Calculate the Sample Weight Multiplier by dividing the total catch volume (Step 1) by the total subsample volume (Step 2).

4 Extrapolate the total weight of each of each species from the subsample by multiplying the weight of each individual species by the sample weight multiplier. These are recorded as estimated weights on the haul log.

Example: Volume to Volume Method

1 Fish are dumped into a rectangular fish pen. The observer calculates the volume as:
5.2 ft (length) x 8.7 ft (width) x 1.4 ft (average depth) = 63.34 ft^2 (volume).

2 8 orange baskets were used to collect a subsample of the entire catch. The subsample volume would be:
8 (number of baskets) x 1.47 ft^3 (volume of an orange basket) = 11.76 ft^3 (subsample volume).

3 The sample weight multiplier is calculated as:
63.34 ft^3 (total volume of catch) ÷ 11.76 ft^3 (total subsample volume) = 5.39 (sample weight multiplier).

4 The total subsample consists of 126 lbs Monkfish, 78 lbs Atlantic Cod and 93 lbs Summer Flounder.
126 lbs (Monkfish) x 5.39 (sample weight multiplier) = 679 lbs (estimated total Monkfish weight)
78 lbs (Atlantic Cod) x 5.39 (sample weight multiplier) = 420 lbs (estimated total Cod weight)
93 lbs (Summer Fld) x 5.39 (sample weight multiplier) = 501 lbs (estimated total Summer Fld weight).

** Examples of calculating the volume for odd shaped containers can be found in the NEFOP Observer Program Training Manual.

SUBSAMPLING AND RANDOM SAMPLING GUIDELINES

The keys to accurate subsampling are:

- **A sufficiently sized sample.** Collect as large a sample as possible, but at least 20% of the entire catch amount.

- **A randomly selected sample.** Each fish from the entire catch should have an equal chance of being selected for the subsample. No "favoritism" is given to "exceptional" fish (*i.e.* particularly large or small fish), as it must be equally likely that these, as well as the "typical" members, will be chosen.

Some other basic guidelines:

- Collect subsamples from **at least three different parts of a large pile**. The greater the range of fish sizes, and the greater the diversity in species composition, the greater the number of subsamples to collect, as time and conditions permit.

- Instead of a few, large subsamples, **collect more, smaller subsamples from different areas of a pile** or different times during the crew's sorting procedures.

- Ensure collection of fish from the **bottom, middle, and top layers** of a pile. Scoop a basket to be filled from the top of a mixed pile of fish, down to the deck, and back to the top.

In every subsampling situation, the methods used should be recorded in the Comments section of the corresponding Catch Estimation Worksheet.

Example: Combination of catch estatimation methods. A large otter trawl catch is brought aboard the vessel and dumped on deck into a rectangular holding area. The catch is composed of summer flounder, which are kept, and several species of skates, which are discarded. The crew picks out all the flounder and tosses them into baskets. Several are considered too small and are tossed into a separate basket for the observer. The skates are left in the holding area for the observer.

1 The observer is able to get actual weights on the flounder that are too small to keep by weighing the baskets.

2 The observer gets a count of the number of baskets filled with kept summer flounder and then weighs 3 baskets to get an average weight per basket. He will later multiply the total number of baskets by the average weight for an estimated total weight of summer flounder.

3 The observer measures the holding area with skates in it so he can later calculate the total volume. He takes a random subsample of skates from several different areas in the pile. While doing this he notices there are only 2 barndoor skates in the entire pile, so he removes them and gets an actual weight. Then he speciates the skates in his subsample and weighs them. He will later use the volume to volume method to estimate the total weights for these species.

4 Since there is still time before the next haul, the observer has the opportunity to take biological samples. Since he is in the Mid-Atlantic, he knows that summer flounder are his #1 priority, followed by the barndoor skates and then other skates*. He collects lengths and scale samples from all the discarded summer flounder, as well as several from the kept summer flounder. He obtains lengths on the 2 barndoor skates, and then takes lengths on the other skate species as time permits.

* See Tables 1a-h. Length Frequency & Age Structure Sampling Priorities by Fishery, & Table 2. Fish & Shellfish Sampling Priorities by Species.

SUBSAMPLING AND RANDOM SAMPLING GUIDELINES

SUBSAMPLING GUIDELINES FOR THE SCALLOP FISHERY

Listed below are comprehensive notes on subsampling scenarios which might occur while observering a scallop trip. The standard subsampling method is the Volume to Volume Method. Some general guidelines to keep in mind are:

- Actual weights are the priority, especially for Access Area Scallop trips. Subsampling is used only for large volume catches where estimated weights are expected.
- Kept vs. Discarded catch: The following techniques can be used to estimate weights for both the kept and discarded portions of the catch. However, usually weight estimation will only be necessary for kept species. If the amount of discards is small, ask the crew to throw the discards aside in totes or baskets for you to weigh at the end of the haul.
- Remember to subtract the weight of the basket or tote *(i.e.* the subsampling unit) from all weight calculations.
- Obtain a catch estimate from the captain if there is no other way of estimating a weight.

A **Sampling for a Standard Haul** (*i.e.,* each haul is sorted individually. The haul is dumped on a clean deck and sorted before the next haul back)

-Collect Weights of discarded species.

1 When a haul is dumped on deck, collect (actual) weights for all discarded species during and after the sorting process. You may also use the Tally or Basket Count Methods to obtain accurate estimates of discards. If time becomes an issue, you may choose to collect a subsample of the discard pile and use the Volume to Volume Ratio Method (refer to page 67).

-Determine weight of kept scallops for the haul using the Basket Count Method.

2 Count the number of baskets of kept scallops collected for that haul. This value will be entered in the Number of Bushels field under kept scallops on the Scallop Dredge Haul Log.

3 Obtain an average weight of a basket of kept scallops (calculated once per watch at a minimum). In Open Areas, an average weight will be calculated from three or more full baskets of whole kept scallops (filled by

crew). In Scallop Access Areas, an average weight will consist of the meat weight from 1 full basket of whole scallops (filled and cut by crew). Enter this value in the Average lb/bushel field on the Scallop Haul Log.

4 Multiply the number of kept scallop baskets by the obtained average weight. This product will equal the total weight of kept scallops for that haul, and will be entered as an estimated weight on the Scallop Haul Log.

B **Shoveling only** - Volume to Volume Method (*i.e.,* mixed catch shoveled into baskets. Deck cleared for next haulback)

-Find the Total Catch Volume.

1 Keep an accurate tally of the # of baskets of mixed catch shoveled for the haul. The total basket count will represent the total volume.

-Collect weights of species

2 Collect a random subsample of baskets (ideally ≥ 20% of the total catch volume) as they are filled by the crew.

3 Calculate a sample weight multiplier by dividing the total number of baskets shoveled by the crew by the number of baskets sampled.

4 Extrapolate the total weight of each species from the subsample by multiplying the weight of each individual species by the sample weight multiplier.

5 In Scallop Access Areas, multiply the meat weight from 1 shoveled basket (filled and cut by crew) by the total number of baskets shoveled. This value is recorded on the Catch Estimation Worksheet, but NOT on the Scallop Haul Log.

SUBSAMPLING GUIDELINES FOR THE SCALLOP FISHERY

If larger finfish are not shoveled, collect actual weights while the shoveling is occurring.

Example: Shoveling scenario

1 The crew filled 37 baskets with shoveled catch, which includes scallops, little skates, and scallop shells.

2 The observer removes 5 baskets for sampling.

3 The sample weight multiplier is 37 (total number of baskets) ÷ 5 (number of subsample baskets) = 7.4

4 The total subsample consists of 223 lbs of scallops, 17 lbs of little skates, and 51 lbs of scallop shells. The extrapolated weights are:
223 lbs (scallop) x 7.4 (sample weight multiplier) = 1650 lbs (estimated total round weight of scallops)
17 lbs (little skate) x 7.4 (sample weight multiplier) = 126 lbs (estimated total weight of little skates)
51 lbs (scallop shell) x 7.4 (sample weight multiplier) = 377 lbs (estimated total weight of scallop shells)

5 If the trip occurs in a Scallop Access Area, the observer has the crew cut the scallops from one shoveled basket, and then weighs the meats. If this weight is 5.3, then the estimated total dressed weight of scallops is:
5.3 (meat weight per shoveled basket) x 37 (total number of shoveled baskets) = 196 lbs

C Deckloading - Cumulative Sum Method (i.e., multiple hauls are dumped on top of each other)

1 Obtain a cumulative count of kept scallop baskets over the deckloading period. Obtain a cumulative actual weight of all other species caught during these hauls. If an actual weight is not possible, then an approved estimation method (Tally or Basket Count Method) may be used instead. In Scallop Accesss Areas, cumulative weights on yellowtail flounder MUST be actual weights.

2 If there is a rare species that can be pulled out of the pile after a haul, obtain the actual weight for that species and record it as an actual weight for that particular haul. Be sure to comment on this situation.

3 Divide the weight totals equally among participating hauls (refer back to steps 1-3 under section A to determine the weight of scallops). These will be recorded as estimated weights on the haul log because the exact weight on any given haul is unknown. Show all math on the Catch Estimation Worksheet for the last haul in a deckloading period.

Example: Deckloading scenario

1 Hauls 1, 2, and 3 are deckloaded. At the end of haul 3, the crew sorts through the catch and clears the deck. The observer counts 63 baskets of kept scallops (with an average weight of 67 lbs per basket), weighs 14 lbs of yellowtail flounder, 46 pounds of sponge, and tallies 27 monkfish at 3.5 lbs each (based on an average weight from 4 animals).

2 On haul 2 there was one barndoor skate that the observer removed from the pile and weighed at 7.9 lbs. She records this on her haul log for haul 2 as an actual weight.

3 The total weight of each species over the deckloading period is:

63 (number of baskets of kept scallops) x 67 lbs (average weight per basket) = 4221 lbs of kept scallops
14 lbs of yellowtail flounder
46 lbs of sponge
27 (number of monkfish) x 3.5 lbs (average weight per monkfish) = 95 lbs of monkfish

The total weight of each species is divided by 3 (number of hauls during deckloaded period) and the same estimated weight is recorded on each haul log:

4221 lbs of kept scallops ÷ 3 = 1407 lbs per haul
14 lbs of yellowtail flounder ÷ 3 = 5 lbs per haul
46 lbs of sponge ÷ 3 = 15 lbs per haul
95 lbs of monkfish ÷ 3 = 32 lbs per haul

SUBSAMPLING GUIDELINES FOR THE SCALLOP FISHERY

revised 01/01/10