PART II: FINFISH
II-A: CHARACTERISTICS

The term "fish" is applied to many aquatic animals which often have very little in common with one another. Over 20,000 species of fish are known to man. There are probably more fish than all the other vertebrate species combined. Fish are also the most important animals which inhabit the waters. Historically, fish have been sought by man for food and sport for at least 7,000 years.

In general, fish are cold-blooded animals having a cartilage (sharks, sturgeons) or bony backbone and rudimentary limbs represented by fins. They breathe by means of gills, swim with fins and tails, and float by controlling air in the swim bladder. Feeding on a variety of substances ranging from microorganisms, plankton, algae to fish, they normally swallow their food without chewing. Their skin is usually covered with scales or other plates. They may reproduce by spawning or by giving birth to living young. The mortality rates are high, which provides an ecological balance in the waters.

Each species of fish lives in a manner and environment suited to its particular biological requirements. An individual species may select specific times and locations for pursuing food or for reproduction. Thus, they may migrate to avoid extreme seasonal temperature changes, or may stay most of the time on the ocean floor. Migration can also be an involuntary action of the young or larvae carried by ocean currents.

Some fish prefer salt water conditions, others could not survive except in fresh waters, yet, some live where salt and fresh waters meet (brackish water). Some fish are born in fresh water, become mature in salt water, and have to return to streams to spawn. These are anadromous fish, and salmon, smelt, shad, striped bass and sturgeon are examples. On the other hand, catadromous fish live in fresh water but enter salt water to spawn. Eels are catadromous fish.
II-B. FISHING GEAR

Fish are caught by many methods. They vary according to the regions, the economics, and the specific species sought. The major tools utilized to catch fish might be categorized as follows:

A. Spears, harpoons and guns

B. Lines
   1. Artificial lure or bait with or without hooks
   2. Longlines
   3. Drift lines
   4. Troll (trawl) lines

C. Traps
   1. Pots and baskets
   2. Pound nets
   3. Gill nets
   4. Entangling nets

D. Nets
   1. Scoop nets
   2. Dip (lift) nets
   3. Dragging or trawl nets
      a. Otter trawls
      b. Bottom trawls
      c. Mid-water trawls
      d. Stern trawlers
      e. Side trawlers
      f. Two-boat trawlers
      g. One-boat trawlers
   4. Purse seines (surrounding nets)
      a. Two-boat purse seines
      b. One-boat purse seines
   5. Drive-in nets
   6. Stow nets

E. Dredges

F. Pump fishing
II-C. IMPORTANT MID-ATLANTIC FINFISH

Menhaden

One of the most abundant fishes found along the Atlantic coast ranging from Maine to Florida, menhaden (*Brevortia tyrannus*), is a herring-like fish. It is called by a variety of names, such as moss-bunker, bunker, porgy, fatback, and shad.

Menhaden travel in large schools along the Atlantic and Gulf of Mexico coasts (Gulf menhaden) and can be spotted from the air. They are generally caught in purse seines. Two purse boats carrying a purse seine (about 1,200 feet long and 60 deep deep) circle a school of fish. The trapped menhaden are then pumped into the hold of the carrier vessel. This is a highly efficient way of catching and harvests nearly 2 billion pounds of fish annually. In Virginia alone, 500 million pounds were caught in 1977.

Being rather oily, menhaden are not usually consumed directly by man in the U.S., but are processed into oil, meal, and soluble protein. The oil is used in paints, soaps, cosmetics, lubricants, and tanning oils. In Europe, it is also made into margarine for human consumption. The meal and soluble proteins are excellent food supplements in feed for cattle, swine, poultry, and mink.

Although menhaden is not considered edible in the U.S., its gigantic production volume makes it economically important. In addition, people in some African countries do use them for food, and the value of the fish may indeed improve as the demand for protein increases in the world. Other than its feed and industrial usage, menhaden is also popular for bait in crab pot fishing. The meal can also be used for fertilizer.

Croaker

Croaker (*Micropogon undulatus*) acquires its name because it makes a drumming croak during spawning season, and when being touched or pursued.
It is, therefore, sometimes called "drum". The upper half of its body becomes golden in color during spawning season, giving it the name "golden croaker". Croakers run from 1-4 pounds on the Atlantic Coast and slightly smaller in the Gulf of Mexico. At maturity (3-4 years), it can be 1½ feet long.

Though distributed along the Atlantic coast from Massachusetts to the Gulf of Mexico, the greatest croaker production is centered in the Chesapeake Bay and Mississippi River delta. It is caught from March through October in the Chesapeake Bay by pound nets and otter trawls. In 1977, 8.6 million pounds of croaker were landed in Virginia.

Flounder

Flounder, an important year-round food fish, are members of a large family of flat fish which includes winter flounder (or blackback, 
Pseudopleuronectes americanus), summer flounder (fluke, Paralichthys dentatus), starry flounder, yellowtail flounder, and a wide variety of soles and dabs. All flatfish have their two eyes on the same side of the body. Fluke is left eyed; both of its eyes are on its colored, left-hand side, and it lies on the bottom on its white, right-hand side. Contrarily, winter flounder is a right-eyed species of the family.

Summer flounder have been found from Maine to Texas, but are most abundant from Cape Cod to North Carolina. During May through September they stay in the shallower areas, while in the winter season they move offshore in the deeper continental shelf. They grow rather rapidly. In one year, a female can be 11 inches in length, and in two years 15 inches, and approximately 1 pound by weight. On the other hand, winter flounder are smaller. The average length for a 2 year old is about 8 inches. They are primarily inshore fish, commonly living in estuaries and coastal ocean areas from the Chesapeake Bay north to the Gulf of St. Lawrence. Favoring cool water, they migrate to areas of greater depth in the summer. For sport fishermen, they become a "winter" flounder.

Commercially, flounders are caught mainly by otter trawls. They can also be found in pound nets and seines. The 1977 landing in Virginia was 4.5 million pounds.
Gray Sea Trout

From southern Florida to Massachusetts, the sea trout (*Cynoscion regalis*) migrates in spring and summer when young. As they get older (over 4 years), they do not move further southward than Cape Hatteras. Gray sea trout are also known as weakfish and squeteagues. Being a member of the drum family, they also make drumming noises like croakers.

A gray sea trout can grow 7 inches in 5 months. Its length varies from 12 to 14 inches for a 4 year old, one pound fish, and up to 30 or more inches for older fish weighing 10 pounds or more. Otter trawls account for most of the commercial catch. Gill nets, pound nets, haul seines, and floating traps are also used. It is one of the prime recreational fishes. The 1977 commercial landing of gray sea trout in Virginia was approximately 4.3 million pounds.

Bluefish

Being a voracious and compulsive eater, the bluefish (*Pomatomus saltatrix*) has acquired names like "snapper" and "chopper". They will feed until sated, then regurgitate and feed again. In the U.S., bluefish appear along the Atlantic and Gulf Coasts from Maine to Texas. As a pelagic fish, bluefish is not unique to these areas. In fact, they are found worldwide in temperate, continental shelf waters.

Bluefish arrive in Virginia waters by late April or early May when the surface waters reach 59°F. Generally, the larger adults are caught in deeper water. However, the warmer waters of the Chesapeake Bay seem to attract them during the spring. In their inshore-offshore migration, great numbers of mature bluefish leave the Bay in early summer to spawn on the outer shelf. By late summer, these fish return to the Bay in large schools.

Bluefish become mature in 2 years and reach 3 pounds in 3 years. In 10 years, they may grow to an average weight of 15 pounds. They mainly feed on other fishes and invertebrates and are one of the most popular game fish. The average commercial landing of bluefish in Virginia is approximately 3 million pounds annually, and is mostly caught by using gill nets, pound nets and hand seines.
Spot

The spot (*Leiostomus xanthurus*) can be found in the Chesapeake Bay and its tributaries in early spring. They utilize the rivers as nursery areas until October when they leave the Bay. The spot caught during this time are generally of poor quality. But, by August through October, they have fattened up and started to move southward in the Bay. This is when they are considered to be in prime condition and are sold as "Norfolk Spot".

The bulk of the commercial spot catch in Virginia is made by haul seines and pound nets. The production fluctuates from year to year. In 1977, almost 2 million pounds were harvested. The record high was 8 million pounds in 1945, and the lowest was 400,000 pounds in 1935.

Black Sea Bass

Usually an inhabitant of Atlantic coastal and offshore waters from Cape Cod to northern Florida, the black sea bass (*Centropristis striata*) migrates inshore to spawn or forage in the spring. The black sea bass begins life as a female and transforms into a male at 2 to 5 years of age. Therefore, most fish larger than 11 inches and older than 5 years are males. They can reach a maximum size of about 24 inches and weigh over 9 pounds at an age of 9 years.

Black sea bass spend most of their life-time in deep offshore waters, and are usually caught commercially with trawls. In the mid-Atlantic area, unbaited wooden traps are also used. Because of the great pressure difference, it is not uncommon to find the internal organs protruding from the mouth of a sea bass in a fish market.

American Shad

When the spawning migration starts, the American shad (*Alosa sapidissima*) come in great schools from the ocean into the Chesapeake Bay and its fresh water estuaries. This may occur in early February and continue until May or June in the northern section of the Bay. After spawning, they return to the ocean and can be found as far north as Nova Scotia and south to Florida.

The egg sac or the shad roe, is a popular delicacy and enjoys good market value. On the other hand, the fish has numerous fine bones in
the body, a fact which seems to intimidate some gourmet eaters. Fishermen refer to the male shad as "buck"; to the female with roe as "roe shad". On the market, the roe are generally sold by the pair.

In the past, haul seines, gill nets, and pound nets were used for shad fishing. Today, more shad are caught by stake and drift gill nets. The 1977 landing was 1.5 million pounds in Virginia.

The charts following illustrate characteristics of various finfish, along with some applicable consumer information on each.
### II-D: FINFISH SPECIES CHART
(Courtesy of the Pillsbury Company)

<table>
<thead>
<tr>
<th>Species</th>
<th>Other Names &amp; Types</th>
<th>Where Caught</th>
<th>Fat or Lean</th>
<th>Market Forms</th>
<th>Favorite Ways to Serve</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fresh, frozen.</td>
<td>Deep-fried catfish</td>
</tr>
<tr>
<td>Ocean Catfish</td>
<td>Wolf Fish</td>
<td>Iceland, Germany, England, Denmark, Norway.</td>
<td>Lean</td>
<td>Fillets, breaded portions.</td>
<td>with hush puppies.</td>
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<td></td>
<td>Frozen.</td>
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<td></td>
<td>Fresh, frozen, salted, smoked (tails).</td>
<td>Sticks or portions served with zesty mustard.</td>
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<td></td>
<td></td>
<td>Breaded and precooked sticks and portions.</td>
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<tr>
<td>Species</td>
<td>Other Names &amp; Types</td>
<td>Where Caught</td>
<td>Fat or Lean</td>
<td>Market Forms</td>
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**Croaker**

**Flounder**
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<th>Species</th>
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<td></td>
<td>Fresh, frozen, smoked, canned.</td>
<td>Steaks in herb sauce.</td>
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<td></td>
<td>Breaded portions.</td>
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<td></td>
<td>Fresh, frozen.</td>
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<td></td>
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<td></td>
<td></td>
<td>Fresh, frozen.</td>
<td>Baked whole with herb stuffing.</td>
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</tbody>
</table>

*Mackerel*
<table>
<thead>
<tr>
<th>Species</th>
<th>Other Names &amp; Types</th>
<th>Where Caught</th>
<th>Fat or Lean</th>
<th>Market Forms</th>
<th>Favorite Ways to Serve</th>
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<td>Baked.</td>
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<td></td>
<td>Seafood casserole.</td>
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<td>Spanish</td>
<td></td>
<td>South Atlantic, Gulf.</td>
<td>Fat</td>
<td>Whole, drawn, fillets.</td>
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<td></td>
<td></td>
<td>Fresh, frozen.</td>
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<tr>
<td>King</td>
<td>Cero, Kingfish,</td>
<td>South Atlantic, Gulf.</td>
<td>Fat</td>
<td>Drawn, steaks, fillets.</td>
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<td></td>
<td>Fresh, frozen.</td>
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<tr>
<td>Mullet</td>
<td>Striped, White,</td>
<td>Atlantic (Florida to North Carolina), Gulf (Florida to Texas).</td>
<td>Fat</td>
<td>Round, fillets.</td>
<td>Baked, with herb-seasoned stuffing.</td>
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<tr>
<td></td>
<td>Jumping, Silver.</td>
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<td></td>
<td>Fresh, frozen, smoked, salted.</td>
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<td>Mullet dip.</td>
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<td></td>
<td>Fresh, frozen.</td>
<td>Baked in white wine sauce.</td>
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<td>Breaded fillets and portions.</td>
<td>Perch Cumaudine.</td>
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<td>Species</td>
<td>Other Names &amp; Types</td>
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<tr>
<td>Black Sea Bass</td>
<td>Sea Bass</td>
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<tr>
<td>Black &amp; white</td>
<td></td>
<td>Pacific Coast</td>
<td>Lean</td>
<td>Steaks, fillets.</td>
<td>Baked and stuffed.</td>
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<td></td>
<td></td>
<td></td>
<td>Fresh, frozen.</td>
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<tr>
<td>Sea Trout</td>
<td></td>
<td></td>
<td>Lean</td>
<td>Whole, drawn, fillets.</td>
<td>Pan-fried.</td>
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<tr>
<td>Gray</td>
<td>Weakfish, Squeteagles.</td>
<td>Middle and South America</td>
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<td>Spotted</td>
<td>Speckled Trout.</td>
<td>Middle and South Atlantic Gulf.</td>
<td>Lean</td>
<td>Whole drawn, fillets,</td>
<td>Sauteed with lemon and butter.</td>
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<td></td>
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<td></td>
<td>Fresh, frozen.</td>
<td>Trout Amandine.</td>
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### Sea Trout (continued)

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<th>Species</th>
<th>Other Names &amp; Types</th>
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<th>Fat or Lean</th>
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<th>Favorite Ways to Serve</th>
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<tr>
<td>White Sea Trout</td>
<td>Sand Trout</td>
<td>Gulf</td>
<td>Lean</td>
<td>Whole, fillets.</td>
<td>Fresh frozen.</td>
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</table>

#### Shad

- **Buck, Roe, White Shad.**
  - Coastal rivers from Maine to Florida, Washington to California.

<table>
<thead>
<tr>
<th>Shad</th>
<th>Coastal rivers</th>
<th>Fat</th>
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**Albacore**

**Tuna**

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<tr>
<th>Species</th>
<th>Other Names &amp; Types</th>
<th>Where Caught</th>
<th>Fat or Lean</th>
<th>Market Forms</th>
<th>Favorite Ways to Serve</th>
</tr>
</thead>
<tbody>
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<td>Albacore</td>
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<td>Pacific Coast,</td>
<td>Fat</td>
<td>Canned</td>
<td>Tuna salad.</td>
</tr>
<tr>
<td>Yellowfin</td>
<td></td>
<td>Pacific Coast,</td>
<td>Fat</td>
<td>Canned</td>
<td>Scalloped casserole.</td>
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<tr>
<td>Skipjack</td>
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<td>Southern waters</td>
<td>Fat</td>
<td>Canned</td>
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<tr>
<td>Blue Fin</td>
<td></td>
<td>Atlantic and Pacific coast</td>
<td>Fat</td>
<td>Canned</td>
<td></td>
</tr>
<tr>
<td>Little</td>
<td></td>
<td>Atlantic and world-wide</td>
<td>Fat</td>
<td>Drawn</td>
<td>Marinated and grilled.</td>
</tr>
<tr>
<td>Species</td>
<td>Other Names &amp; Types</td>
<td>Where Caught</td>
<td>Fat or Lean</td>
<td>Market Forms</td>
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II-E: MARKET FORMS OF FRESH AND FROZEN FISH

Fresh and frozen fish are marketed in various forms or cuts. Knowing these forms and their special uses helps in choosing which kind to buy. The following are known market forms:

Whole
Fish as they come from the water. Before cooking, the fish must be scaled and eviscerated -- usually the head, tail, and fins are removed. The fish may then be cooked, filleted, or cut into steaks or chunks.

Drawn
Whole fish with insides removed. Generally scaled before cooking, and usually the head, tail, and fins removed. Ask your dealer to do this.
Dressed

Fish with scales and entrails removed; usually the head, tail, and fins are also removed. The fish may then be cooked, filleted, or cut into steaks or chunks. Small dressed fish are called pandressed and are ready to cook as purchased.

Fillets

Fillets are the sides of the fish cut length-wise away from the backbone. They are ready to cook as purchased. A fillet cut from one side of a fish is called a single fillet. This is the type most generally available on the market. The fillets may or may not include the skin. Only two fillets can be cut from one fish.

The two sides of the fish cut length-wise away from the backbone and held together by the uncut flesh and skin of the belly are called butterfly fillets.
Steaks

Steaks are cross section slices from large dressed fish cut 5/8 to 1 inch thick. A cross section of the backbone is the only bone in a steak. They are ready to cook as purchased.

Chunks

Chunks are pieces of the cross sections from large dressed fish. A cross section of the backbone is the only bone in a chunk. They are ready to cook as purchased.

Raw Breaded Fish Portions

Portions are cut from frozen fish blocks, coated with a batter, breaded, packaged, and frozen. Raw breaded fish portions weigh more than 1 1/2 ounces, are at least 3/8 inch thick, and must contain not less than 75 percent fish. They are ready to cook as purchased.

Fried Fish Portions and Sticks

In the 1950's, an entirely new line of frozen food products entered the consumer market and was tremendously successful. Today's homemaker has a selection of food in easy-to-prepare forms that were unknown 20 years ago. Frozen convenience seafoods have become popular throughout the nation, with breaded fish portions and sticks leading the field.

As an example of how frozen fish portions and sticks have caught on in the United States, statistics compiled by the Bureau of Commercial Fisheries show that, since the mid '50s, the combined production of fish portions and sticks rose to over 270 million pounds in 1968. This figure
continues to grow as additional drive-ins, restaurants, schools, institutions, and homemakers are introduced to these convenience seafoods.

Fish portions and sticks are generally made of cod, haddock, or pollock and come in frozen, raw, or partially-cooked forms. Fish portions can be obtained either breaded or unbreaded. They come in a variety of sizes and shapes, carefully defined by FDA standards of identity. The cut pieces are dipped into a batter and coated with breading. Most fish sticks and some portions are then partially cooked. Partially-cooked fish portions and sticks take only minutes to prepare. Uncooked portions and sticks take slightly longer. For best results, follow the directions on the package for cooking time and temperature.

Fish portions range in size from 1 1/2 to more than 5 ounces and come in square, round, and rectangular shapes. Generally speaking, one 8 or 10 ounce package of fish portions will serve two. Raw breaded fish portions are at least 3/8 inch thick and contain not less than 75 percent fish. Partially cooked fish portions are at least 3/8 inch thick and contain not less than 65 percent fish.

Frozen fried fish sticks are 3 to 4 inches long and weigh up to 1 1/2 ounces. They are at least 3/8 inch thick and contain at least 60 percent fish. An 8-ounce package will usually serve two persons.

Frozen fried battered fish portions come in 2-ounce and 3-ounce portions. They must contain at least 50 percent fish and not more than 50 percent batter. Fried breaded fish come in 2-ounce, 3-ounce, and 4-ounce portions and contain at least 65 percent fish.
Buying Fresh Fish

The following chart is a general guide for buying fresh fish.

**FRESH FISH BUYING GUIDE**

<table>
<thead>
<tr>
<th>General Appearance:</th>
<th>Fresh</th>
<th>Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>(lustre and bleaching)</td>
<td>Bright, with metallic lustre.</td>
<td>Bloom completely gone.</td>
</tr>
<tr>
<td></td>
<td>Very little, if any, bleaching.</td>
<td>Color faded or bleached.</td>
</tr>
</tbody>
</table>

| Eyes                  | Bright, translucent, usually full but in some cases may be slightly sunken and somewhat dull. | Dull and sunken. May be cloudy, pink, white or opaque. |

<table>
<thead>
<tr>
<th>Gills a. Color</th>
<th>Bright red to slightly pinkish red.</th>
<th>Brownish red to brown or gray. Frequently covered with thick, bacterial mucus.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Odor</td>
<td>Fresh odor characteristic of species to faint sour odor.</td>
<td>Medium to strong sour odor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Odor a. Poke End</th>
<th>Fresh to very faint sour odor.</th>
<th>Medium to strong sour odor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. At Neck when deheading</td>
<td>No odor to very slight odor.</td>
<td>Sour or putrid</td>
</tr>
</tbody>
</table>

II-31
<table>
<thead>
<tr>
<th></th>
<th>Fresh</th>
<th>Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistency of Fish</td>
<td>Firm and elastic to the touch.</td>
<td>Generally soft and flabby, separating from bones.</td>
</tr>
<tr>
<td></td>
<td>Occasionally may be slightly soft.</td>
<td></td>
</tr>
<tr>
<td>Belly Cavity</td>
<td>Flesh adheres firmly to rib bones.</td>
<td>Rib bones free or almost free from flesh.</td>
</tr>
<tr>
<td>Vent</td>
<td>Normal in shape and color.</td>
<td>Protruding and may be discolored.</td>
</tr>
</tbody>
</table>

Buying Frozen Fish

Frozen fish must be handled properly if it is to reach the consumer in good condition. It will not deteriorate while it is deep frozen, but changes in temperature during transporting or handling may result in deterioration of quality.

A check on the following points will help assure that the product has been correctly handled.

A. Flesh should be solidly frozen when received.
B. The flesh should have a firm, glossy appearance with no evidence of drying-out, i.e. no white spots, papery corners or edges, dark spots, discoloration, or fading of red or pink flesh.
C. If wrapped, cut fish shows signs of frost inside the transparent wrap, either the fish has been stored for a long time or the contents have thawed and refrozen.
D. Check carefully to see that the container is intact, with no torn or crushed edges.
E. Avoid packages which have been stacked above the load line or frost line of the store's display freezer.
F. Avoid packages with "drip" or ice on the package, an indication that the contents have thawed and refrozen.
G. Check cello-wrap packages for discoloration.

H. If you purchase products of questionable quality inadvertently, return them to the store at once.

Inspection, Standards, and Grade Marks

Frozen fish portions and sticks lend themselves to the advantages of inspection and grading. However, not all these products on the market are inspected and graded. Inspected products may be labeled "Packed Under Federal Inspection", either as a mark or statement. Fish portions and sticks may also bear "U.S. Grade" marks. See Part II-E for a discussion of the standards connected with these inspections and grades.

Portions and sticks are graded on a number of factors that affect the quality of the products. The standards are set by the National Marine Fisheries Service, taking into account consumer needs and industry capabilities. In the frozen state, the portions and sticks are checked for condition of package, ease of separation, broken or damaged pieces, and uniformity of weight and size. Cooked samples are checked for color, texture coating, defects, blemishes, flavor, and odor.
II-G: HOW MUCH TO BUY

The amount of fish to buy per serving varies with the recipe to be used, the size of the serving, and the amount of bone in the fish. Count about 3 ounces of cooked, boneless fish as a serving, a little less for small children and a little more for adolescent boys and men. The following table can help you decide how much fish, purchased fresh, frozen, or canned, to buy:

FINFISH SERVING GUIDE

<table>
<thead>
<tr>
<th>Form</th>
<th>Amt. per person</th>
<th>Amt. for 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole</td>
<td>3/4 pound</td>
<td>90 pounds</td>
</tr>
<tr>
<td>Dressed or pan-dressed</td>
<td>1/2 pound</td>
<td>45 pounds</td>
</tr>
<tr>
<td>Fillets or steaks</td>
<td>1/3 pound</td>
<td>30 pounds</td>
</tr>
<tr>
<td>Portions</td>
<td>1/3 pound</td>
<td>30 pounds</td>
</tr>
<tr>
<td>Sticks</td>
<td>1/4 pound</td>
<td>25 pounds</td>
</tr>
<tr>
<td>Canned</td>
<td>1/6 pound</td>
<td>15 pounds</td>
</tr>
</tbody>
</table>
II-H: NOW THAT YOU'VE CAUGHT THAT FISH...
WHAT ARE YOU GOING TO DO WITH IT?

Illustrations courtesy Texas A&M University Sea Grant Program

Preparations

Preparations for any fishing trip, short or long, should include a few necessary items that will help the fisherman keep the fish he catches as fresh tasting as the day they were caught -- whether they are eaten a day, a week, a month, or six months later. At a minimum, these items include a knife, an ice chest, and plenty of crushed ice. In addition, scaling or skimming tools and even packaging materials may come in handy. Having this equipment on hand, knowing the parts of the fish (Figure II-1) and following the simple procedures described here, a fish can be easily and quickly prepared for cooking or freezing.

Figure II-1.

Remember that the way a fish is handled, from the time it is pulled from the water until it appears on the dinner table, is important in
preserving good taste and high quality. Ideally, a fish should be removed from the hook or net and gilled, gutted, and iced as soon as possible.

Do's and Don'ts of Fish Handling

Here are some do's and don'ts of fish handling that can affect its taste and storage life. By keeping these suggestions in mind, the fisherman can keep the fresh-caught quality that makes the eating as good as the fishing.

Do's:

.. Do gut, gill, and ice a fish as soon as possible.

.. Do wash the gutted fish in lake water, creek water, saltwater, or tap water to remove as much slime, mud, and blood as possible before icing.

.. Do wrap fish in damp paper or a damp cloth and store in a shady, well ventilated area if ice is not available. This will keep the flesh moist and cool.

.. Do allow for proper bleeding by either removing the head or cutting the tail and positioning the fish in the ice chest so the blood can drain out. Blood remaining in the tissue can speed up the rancidity that develops in fish in frozen storage.

.. Do ice fish generously before transporting it home. Pack the belly cavity with ice and provide adequate ice between fish and the sides of the ice chest. Make a "false bottom" in the ice chest so your fish will not be floating in bloody, melted ice water when you get home.

Don'ts

.. Don't let a fish flop around in the bottom of a boat or on a pier. This will bruise the flesh and speed up biochemical changes (rigor mortis) that may produce an undesirable taste.

.. Don't keep fish on a crowded stringer and/or in shallow, muddy, warm water.

.. Don't leave the gills and guts in a fish for very long after the fish has died.
Most marinas, fishing piers, state parks, etc., have facilities for cleaning fish, and unless you have adequate space at home, it is probably best to make use of these facilities.

The methods of cleaning a fish are as varied as the individual fisherman. Basically, the cleaning process involves gilling and gutting, scaling or skinning, and filleting -- not necessarily in that order. Depending on the final use intended for the fish, only one or two of these procedures might be necessary.

Gilling and Gutting

The gills and guts of a fish should be removed as soon as possible since they contain the highest concentration of bacteria that may cause rapid spoilage. The guts also can cause an off-taste in the flesh because of the enzymes in the fish's intestines. After the fish has died, these enzymes digest the walls of the intestinal tract, creating what is commonly known as "belly burn". This is particularly true in a fish that was feeding when caught.

One good way to gill and gut a fish is:

. Cut into the area under the chin that joins the bottom of the two gill openings; then cut the belly cavity open back to the anal fin (Figure II-2).

Carefully avoid cutting the intestinal tract. If the intestinal contents are spilled onto the flesh of the fish, wash thoroughly.

. Remove any visible body fat, as it will turn rancid in storage.
The kidneys (the dark red mass along the backbone) and inner abdominal lining (either black or a silvery color) should be brushed out under running water (Figures II-3, II-4).

Scaling and Fin Removal

Scaling only (skin left on) is suited for small fish that are hard to skin, or for fish that are to be baked, barbecued or pan dressed.

Scaling is done with a commercial scaler, the back of a knife blade, a tablespoon or the edge of a soft drink can. Use a scraping motion against the grain of the scales, starting at the tail and working toward the head. Fins should be removed by cutting into the flesh (about 3/4 inch) along each side of the fin (Figure II-5).
Pull the fin away from the tail and toward the head with either skinning pliers or household pliers. This is also a good time to dehead the fish if it is to be done. A fish prepared this way is "pan dressed". Fins left on a fish can puncture packaging material and cause freezer burn (dehydration).

Skinning

A large portion of the fat found in fish is located directly under the skin. Removing this layer of fat by skinning the fish will reduce the chances of rancidity developing while the fish is frozen. A fish can be skinned without first being scaled, and skinning is almost always part of preparing a fish like catfish, which has no scales.

To skin a scaleless fish, cut the skin only (not the flesh) along the top of the fish and around each of the dorsal and anal fins. Peel the skin away from the flesh with skinning pliers, household pliers, or your fingers -- if using your fingers, extra grip can be added by dipping them in table salt.
Catfish can be skinned by cutting the skin around the head or by gripping the skin on top of the bone-like knot directly under the pectoral (side) fin and pulling it toward the tail (Figure II-6).

![Figure II-6](image)

The fish can be held by hand for skinning, but it is usually easier to hang it from a tree limb or to hook its lower jaw on a spike mounted on a skinning board. Skinning pliers are recommended for skinning catfish.

Filleting

Filleting is an easy way to clean a fish and produce a boneless portion of meat -- which saves freezing time and space. Fish can be filleted with head, skin, and scales still on and sometimes without removing the guts, although, as mentioned earlier, it is advisable to remove the guts as soon as possible. Filleting can be done with a conventional filleting knife (long, narrow, flexible blade) or a household electric knife.

The filleting process is as follows:

... Starting at the pectoral fin just behind the head, cut into the flesh at a 45° angle toward the head until you hit the backbone.
. . . Turn the knife and follow the backbone all the way to the tail, staying as close to the backbone as possible without cutting it (Figure II-7). Some resistance will be noticed as several rib bones must be cut.

![Figure II-7](image)

. . . Do not cut through the flesh at the tail as this makes it difficult to remove the skin on the fillet.

. . . Lay the fillet back from the fish so it is lying on the cutting board with the flesh side up (Figure II-8).

![Figure II-8](image)
Starting at the tail where the skin is still attached, run the knife between the flesh and the skin back toward the head-end of the fillet (Figure II-9). By keeping the fillet flat and running the knife close to the skin, little meat is wasted.

![Figure II-9](image)

The rib bones may be removed for a completely bone-free fillet. In larger fish, a dark strip of meat can be seen running down the center of the fillet on the skin side. If possible, remove this dark meat.

*Always clean the cutting board and utensils with soap and water before and after use.* A solution of household bleach (one tablespoon bleach per gallon of water) should be used as disinfectant in addition to soap and water. The bleach solution will help eliminate the unpleasant smells associated with cleaning fish.

Your fish is now ready for cooking or storage. See Part V-C for information on home freezing.
PART III: SPECIAL SPECIES OF MARINE FOOD PRODUCTS
III-A: FINFISH: SARDINES, SALMON, CANNED TUNA, EEL, AND ANCHOVY

Sardines, salmon, and tuna are given special attention here because they are among the most widely eaten varieties of fish. Eels and anchovies are considered separately because they are a much overlooked source of excellent seafood.

Sardines

Characteristics: Maine sardines are the immature young of the Atlantic herring. They have elongated bodies and are greenish blue with a silvery cast on the sides and belly. The herring has a deeply forked tail and has a single dorsal fin directly over the small ventral fin. Scales of herring are large and loosely attached. Herring reach about four inches in length by the end of the year.

Definition: What is a sardine? The word sardine is not the name of just one species of fish but rather a collective name that represents a variety of tiny, soft-boned fish. The name sardine probably comes from the fact that similar, tiny fish called French sardines were first found and caught in great abundance around the island of Sardinia in the Mediterranean. Caught and enjoyed by Atlantic coastal Indians long before the first white settlers arrived, these tasty little fish are still being caught in the same coves and inlets used by the Indians of long ago.

Uses of Sardines: Sardines are a valuable source of high protein needed for building and repairing body tissues. They contain iron needed for healthy, red blood. Sardines provide useful amounts of thiamine, niacin, and riboflavin. Maine sardines are packed in various
types of oil as well as mustard and tomato sauces. Packed in flat 4-
ounce cans, they are ready to eat at the zip of a can opener, pull tab,
or key.

Salmon

Species of Salmon:

Pink (Oncorhynchus gorbuscha) is the smallest, weighing an
average of four pounds. It has a good red flesh and a delicate
flavor. It may be sold fresh or canned. Fresh pink salmon is
abundant during July, August, and September.

Sockeye (O. nerka) is the next largest, weighing approximately
seven pounds. The flesh is deep red and is usually not available
fresh.

Coho (O. kisutch) is generally classified as the next largest,
weighing approximately nine pounds. The flesh is medium red. May
be purchased fresh, frozen and canned. Fresh Coho is abundant from
July to November.

King (O. tshawytscha) is the largest of all the salmon. It is
accepted as the best eating of the salmon and usually commands the
highest prices. It is obtainable fresh in the early spring or
summer, and the year round in smoked or frozen form.

Canned Tuna

There are four kinds of tuna canned commercially in the United
States. They include Albacore, Yellowfin, Skipjack, and Bluefin. The
most prized tuna are the Albacore, which have a very light color and
firm texture. By law, canned Albacore tuna is the only one that can be
commercially labeled as "white tuna". The second most popular species
is the Yellowfin, which has the same firm texture as Albacore but is
slightly darker in color. In the grocery store, canned tuna labeled as
"light" will contain Yellowfin. As the supplies of these favored species
have dwindled, canners have begun to use the Skipjack tuna as well.
This species is smaller, darker, and somewhat stronger flavored than the
other two. The fourth type is called Bluefin tuna, and actually refers
to several species of tuna which are grouped under this collective name.
Bluefin tuna are similar to Skipjack in color and flavor, but can be
much larger (some weigh over 1,000 pounds). The tuna caught in the mid-Atlantic region are usually those from the Bluefin family. Canned tuna is prepared in the following forms:

A. *Solid or solid pack* consist of loins to which no free pieces are added. A piece may be added if necessary to fill a can.

B. *Chunk, chunks, chunk style* consist of a mixture of pieces of tuna in which the original muscle structure is retained. The pieces may vary in size but not less than 50 percent (by weight) shall be retained on a ½ inch-mesh screen.

C. *Flake or flakes* consist of a mixture of pieces of tuna in which more than 50 percent of the weight of the pressed contents of the container will pass through a ½ inch-mesh screen, but in which the muscular structure of the flesh is retained.

D. *Grated* consists of a mixture of particles of tuna that have been reduced to uniform size, that will pass through a ½ inch-mesh screen, and in which the particles are discrete and do not comprise a paste.

Any of the above forms of canned tuna may be smoked.

All canned tuna falls within one of the following color designations:

A. White - limited to the Albacore.

B. Light - includes any tuna not darker than Munsell value 5.3.

C. Dark - includes all tuna darker than Munsell value 5.3.

D. Blended - applied only to a mixture of tuna flakes of which not less than 20 percent by weight meet the color standard for either white tuna or light tuna and the remainder fall within the color standard for dark tuna.

Canned tuna is packed in one of the following optional media.

A. any edible vegetable oil

B. olive oil (When solid pack tuna is packed in olive oil, the designation "Tonno" may also appear.)

C. water
Canned tuna may be seasoned or flavored with one or more of the following:

A. salt
B. purified monosodium glutamate
C. hydrolyzed protein
D. spices, spice oils or spice extracts
E. vegetable broth (not to exceed 5 percent of the volume capacity of the container). The broth can be made from beans, cabbage, carrots, celery, garlic, onions, parsley, peas, potatoes, green bell peppers, red bell peppers, spinach, and tomatoes.
F. garlic

Eels

Eels are snake-like fish found in estuarine waters as well as the fresh waters of major rivers and tributaries. The American eel (*Anguilla rostrata*) averages 7 to 8 pounds and 36 inches in length, and is found in abundance from Greenland to the Gulf of Mexico. Eels are caught in V-shaped weirs in streams.

Eels traditionally have not been a part of the seafood diets of Americans. However, Europeans have long considered them a delicacy. They are sold fresh, smoked, pickled, and canned.

*American Eel*

**Preparation:** Live eels must be killed, cleaned and cooked. One method used in killing eels and also removing the slime layer is to
sprinkle them with salt and add just enough water to cover them. Let them soak in this solution for two to three hours before removing and then wash them thoroughly with clean water. Soak them again, but this time for a half hour only and in fresh cold water. Following this soaking, scrub them with a steel brush to remove the last traces of salt and slime. Following this procedure the eels should be skinned and gutted. The best method of skinning the eel is to drive a nail through the eel's head into a wooden post or board. Using a sharp knife, cut through the skin three inches behind the head all the way around. Care should be exercised to avoid the gall bladder which is located behind the head. Fold the skin back and peel it off with pliers.

The next step is the gutting process. Insert a knife into the vent and cut along the belly line toward the head, stopping at the gills. Cut toward the tail two inches past the vent. Remove the kidneys and, if possible, pull out the large vein along the backbone. Wash the gut cavity, making sure to remove all traces of blood.

**Freezing:** Eels can be frozen, however, they do not keep well in home freezers due to their high fat content. If you do attempt to freeze eels, package them well. This will protect other foods in the freezer against off odors and flavors which could develop in eels stored inadequately or stored for too long a period.

**Cooking Eels:**

A. Fried - Cut cleaned meat in three-inch lengths. Roll in crumbs, dip in slightly beaten egg diluted with two tablespoons of water, roll again in crumbs. Fry in deep fat at 375°F for three to five minutes.

B. Baked - 2 pounds of eel in two inch lengths
   1/4 cup olive oil
   1 clove garlic, coarsely chopped
   a pinch of thyme leaves
   juice of 1/2 lemon

Sprinkle blended salt and pepper over pieces of eel.
Heat the olive oil in a baking dish. Add garlic and thyme.
Place the eel in this hot mixture, squeeze a little lemon
juice over it, and bake in a moderate oven (375°F) for 25 to 30 minutes.

Anchovy

The strong flavored seafood product known as anchovy is made from several different small, fatty, pelagic fishes including herring, sardine, and anchovy families, but most often small fish called sprats (*Clupea sprattus* L.). The fish are cured with a combination of salt and spices and allowed to undergo a complicated maturation process which gives them their characteristic flavor. Anchovies are generally packed in one of two ways; either in bulk barrels or directly into retail cans. Those packed in barrels are later repacked into small containers in the form of skinless, boneless anchovies. 

Barrel anchovies are packed into wooden barrels; about 95 kilogram to each barrel. To these are added a mixture of salt, sugar, spices and a preservative, usually benzoic acid. Whole sprats are mixed thoroughly on special tables with the salt-sugar-spice mixture, then poured into clean barrels with the same mixture in the bottom. Once full, the rest of the salt-sugar-spice mixture is poured over the top. After 1-2 days a brine is formed from the liquid extracted from the fish. At this point, the barrels are tightly sealed and put aside, and the curing process begins. The curing process depends upon the condition of the raw fish and the temperature at which the barrels are held. In some countries, the barrels are kept cold, while in others, such as Spain and North West Africa, the barrels are actually placed in the sun. A ripe anchovy is one with a soft and smooth consistency and one from which the backbone can be easily removed. Generally, one person is responsible for determining when the anchovies are ripe. He does so by continually sampling until they finish curing. Most of these experts sample by biting through the anchovy just behind the head.

When the barrel anchovy is ripe, it is cut into fillets and packed into small rectangular cans. The final product is then covered with a sauce of salt, sugar and spices, and the can is sealed and labeled.

'Direct made' anchovies are packed whole into small rectangular cans, and the same salt-sugar-spice combination is added to the cans.
When all the salt and sugar is dissolved, about two days later, the cans are topped up with brine and sealed. Curing is done at temperatures between 12-15°C and the cans are turned over every two weeks. When the cure is complete, the cans are placed in cold storage and are ready to eat.

As the anchovies ripen, several by-product compounds diffuse out of the fish and into the brine. Since this diffusion of by-products occurs in the retail can of direct made anchovies, they tend to be stronger in flavor. Some of these flavors are left behind in barrel-cured anchovies and are further diluted and masked by packing into cans with new brine and sauce. Another difference to consider is that directly packed anchovies are still whole and have to be filleted by the consumer if so desired. Many anchovy eaters consider it part of the experience and some eat the fish whole.
III-B: ROE

The female gonads of fish develop during the annual spawning cycle to edible proportions in a few species. Roe can be frozen, salted, smoked, canned or fried. For instance, fresh cod roe are available around March in the Northeast, although they can be frozen, refrigerated, or canned to make them available year round. They are also considered a delicacy when smoked. Salmon roe can be as large as 35 percent of the fish's total weight, and are generally smoked. The roe of sturgeon are salt-pickled and sold as the premium priced caviars. Salmon roe are also used for this purpose in some places.

In the mid-Atlantic region, good quality edible roe can be obtained from herring, mullet, rockfish and shad. One of the more common methods of preparation is to remove the egg sacs (or skeins) from the fish whole, wash it carefully, and then simply fry it in a small amount of grease or oil. Roe prepared in this manner are frequently eaten as a breakfast dish.

Fish roe are an excellent source of protein, but tend to be high in both fat and cholesterol. It should be kept in mind that the roe of a few species of marine fish are very poisonous (see Part V-F). So sport fishermen should be very careful about eating the roe from their catch.
III-C: CAVIAR

Caviar is a product made from fish eggs which has been enjoyed as a delicacy for centuries. Although caviar can be made from eggs of many fish, including salmon, mullet, herring, steelhead, rock fish, and shad, the most highly prized is the eggs of sturgeon caught in the Volga River of the Soviet Union. Only sturgeon yield the top grade black caviar which has large, firm grains. Lesser grade caviars range in color from yellow to red to dark grey, and are characterized by smaller grain size and a looser consistency.

Caviar is produced through a special salt pickling procedure in which a controlled process of maturation encourages the development of the characteristic flavor. Commercial production of caviar begins by collecting the roe in special basins where it is washed and mixed with salt (44 grams of salt per kilogram of roe). The salted roe is packed into jars or cans, kept in ice and sawdust, and shipped at temperatures just above freezing.

The U.S.S.R. is the leading producer of caviar, producing about 5,000 tons annually or about 90 percent of the world supply. The Soviet processors utilize four species of sturgeon which abound in the Caspian Sea and process them in a large plant in Astrakhan. Iran, which also borders the Caspian Sea, is the second largest producer, providing only 5 percent of the world supply. Attempts have been made in Western European countries to produce a substitute caviar from the roe of lumpfish (or lumpsucker, *Cyclopterus lumpus*), which has eggs comparable with, but even larger than those of the sturgeon.

Caviar exported to the U.S. is preserved with salt, so the salt content is quite high. It also contains a relatively high fat content (about 15 percent) and has one of the highest cholesterol contents of any fishery product, about 300 milligrams per 100 grams.

Caviar should always be refrigerated. It generally remains acceptable
for about a month. Caviar should never be frozen.

Caviar can be produced at home from the species mentioned above by using the following procedure:

A. Begin with eggs that are less than twenty-four hours old and show no signs of spoilage (particularly an ammonia odor).

B. Gently remove the individual eggs from the egg sacs and place in a bowl, being careful to remove pieces of membrane, blood, and bits of intestine or black skin.

C. For every two cups of cleaned eggs, stir ½ cup of salt with two cups of cold water in a large bowl until the salt is dissolved.

D. Pour the eggs slowly into the salt solution. Gently stir the eggs to allow contact with the brine and allow them to sit 30 minutes.

E. Pour the caviar into a strainer and rinse with cold water.

F. Transfer the finished caviar into a container which can be sealed tightly and store in the refrigerator.

Your homemade caviar should stay acceptable in the refrigerator for several weeks. It should be served chilled by nesting the serving bowl in a larger bowl filled with crushed ice. Caviar is most often served with unsalted crackers or toast spread with sweet butter or sour cream.
III-D: TURTLES

Due to excessive harvesting of nesting females and their eggs, sea turtles are an endangered species and should NOT be harvested.

Characteristics

There are seven species of sea turtles found in the tropical and subtropical waters of the world. Only three species have been of commercial value. They are commonly called the green turtle, hawksbill turtle, and loggerhead turtle. The remaining four species are not used due to their scarcity or, in the case of the ridley turtle, small size.

Sea turtles rarely leave the water except to lay their eggs. When first hatched the turtles are only inches long. Once mature the average weight range is 100 pounds (ridleys) to 1,000 pounds (leatherbacks) with a carapace (shell) length of 2 to 7 feet.

Freshwater turtles, terrapins (i.e., edible, more or less aquatic, hardshelled turtle), and tortoises (i.e., terrestrial turtles) are composed of many different species. Some of these species are eaten locally, but only a small percentage of the catch is marketed.
Important Species

Green turtles, hawksbill turtles, and loggerhead turtles are the three sea turtles which have been of commercial importance. In most areas, there is a closed season for taking turtles and their eggs. Some countries have banned the taking of eggs or nesting females at any time. Also, due to dwindling numbers, most sea turtles have been or are now listed as endangered species. Therefore, prior to harvesting any turtles, check with the local extension agent or the Wildlife and Fisheries office.

The following fresh water turtles and terrapins are marketed in the United States: snapping turtle, diamond back terrapin, pond slider, red-bellied turtle, spring softshell, Florida softshell, and the Chinese softshell. Just as the sea turtles are endangered, some freshwater turtles are listed as endangered species at times, or there may be closed seasons in some areas. These limitations should be investigated prior to collecting turtles.

Fishing Methods

For commercial purposes, turtles are usually collected in stationary nets in which they become entangled during the night. The nets are checked early each morning, hopefully before sharks attack and ruin the catch and the nets.

There are basically three methods for harvesting freshwater turtles. The method used is determined by the habits of the turtles.

The first method, employed during hibernation, uses a large hook to probe in areas where turtles may be hibernating. Fishermen and trappers harvest large numbers of snapper during the winter months.

Terrapins are usually taken by the second method. A net is placed around a log, rock, or any object which the fisherman knows is a place where turtles bask in the sun. One end is left open for the turtles to climb onto the object. Then either the turtles overcrowd and push one another into the net, or the fisherman surprises the turtles, causing them to jump into the awaiting net.

The third method also utilizes a net. Seine nets are sometimes used, but the most effective is a baited net, which should be checked
every 12 hours to prevent drowning. Softshell turtles are usually caught in this manner.

Market Forms

Turtles are harvested primarily for their meat which can be purchased and eaten fresh as steaks, or in turtle soup or curry. The meat and soup may also be purchased canned.

Other products obtained largely from sea turtles are turtle oil, which is used in soaps, face creams, and cosmetic lotions, and turtle leather. The leather is produced from the skin of the neck and forequarters and is used for shoes and handbags, replacing alligator and crocodile hides. Turtle shells obtained from the hawksbill, a sea turtle, are used for jewelry and inlaying on such objects as knife handles and toilet accessories.
III-E: SEAWEED

Characteristics

There are two kinds of marine plants: grasses and algae. Stationary or fixed algae, as opposed to grasses and free floating algae, are of commercial importance. Green, brown, red, and blue green algae are the four varieties of fixed (attached) algae. In commercial utilization of algae, considerations should be given to light, temperature, size, life span, supply, and harvesting methods.

Light: Different amounts of light are necessary for each of the four varieties to grow. For this reason, the algae grow at various depths along the coast line: green in shallow water, brown at intermediate depths, and red the deepest (up to 100 fathoms). The depth of growth depends on clarity of water and amount of sun the area is exposed to everyday (latitude).

Temperature: The four algae also require various temperatures. Brown algae is found primarily in cold water and red algae, though found in colder regions, flourishes in tropical waters.

Size: The green and blue green algae are very small and difficult to harvest. The larger red and brown algae are used commercially most often, due to economy of harvesting. Kelp is a term used for the larger brown algae.

Life Span: There are annual, biennial, and perennial seaweeds. The life span of each alga determines how often and intensively the algae may be harvested.
Supply: The supply of seaweed must be located sufficiently close to a processing plant to keep transportation costs within economical limits. The type of seaweed available is determined mainly by latitude and temperature of the waters.

Harvesting Methods: The harvesting methods and frequency of harvest are determined by the size, location, and life span of the seaweed. Other than kelp, most species of algae are hand-harvested by divers or men using rakes with handles 15 to 20 feet long.

Market Forms
Seaweed is the raw material for many different products. It is used in food, fertilizer, and chemicals.

Food: As a food, seaweed is not widely accepted in the Western countries, but is used extensively in the Orient, especially Japan. Seaweed is high in minerals and vitamins and is used in soups, salads, and vegetable dishes. Seaweed is purchased dried, either in sheets or tangles, and may be used in a dry state or restored to a fresh state by soaking. The most popular forms are kombu (kelp), nori, wakame, and hijiki.

Fertilizer: Due to a high content of potassium and trace elements, seaweed is used for fertilizer. Additions are made to the seaweed to produce a complete fertilizer which is widely used.

Chemicals: A wide variety of chemicals may be produced from seaweed; potassium chloride, iodine, organic solvents, and phycocolloids, to name a few. Of these chemicals, phycocolloids are produced most often due to the economical feasibility. There are many kinds of phycocolloids which may be manufactured from seaweed, but agar, algin, and carrageenan are the only ones of commercial value (see marine colloids).
Nutrition

Sea plants are generally high in nutritive value and are among the most nutritious plants available to us. As with all plants, the nutritive content of different species of algae varies from plant to plant; the following information, however, is generally true of edible algae:

Vitamins: Generally marine algae contain good supplies of vitamins E and A. They also are sources of vitamins C, B₁₂, B₁, pantothenic acid, niacin, folic acid, and folinic acid. The vitamin concentrations in marine algae vary with the season of the year.

Minerals: Marine algae contain the minerals found in sea water and some even tend to be good sources of iron and calcium. Iodine concentrations tend to be fairly high.

Protein: Like other marine food products, the protein found in marine algae generally is highly digestible. The proportion of protein in seaweed can account for up to 25 percent of its dry weight.

Carbohydrates: Seaweed compare favorably with oats in carbohydrate (and protein) value. Marine algae contain carbohydrates in the form of polysaccharides. While not biologically available at first eating, the human body can acquire the capability to digest this "gel" after a conditioning period of about one week.

Fats and Oils: Concentrations of fats and oils in sea vegetables range from 1 to 8 percent, and in general, calories and cholesterol content are extremely low.