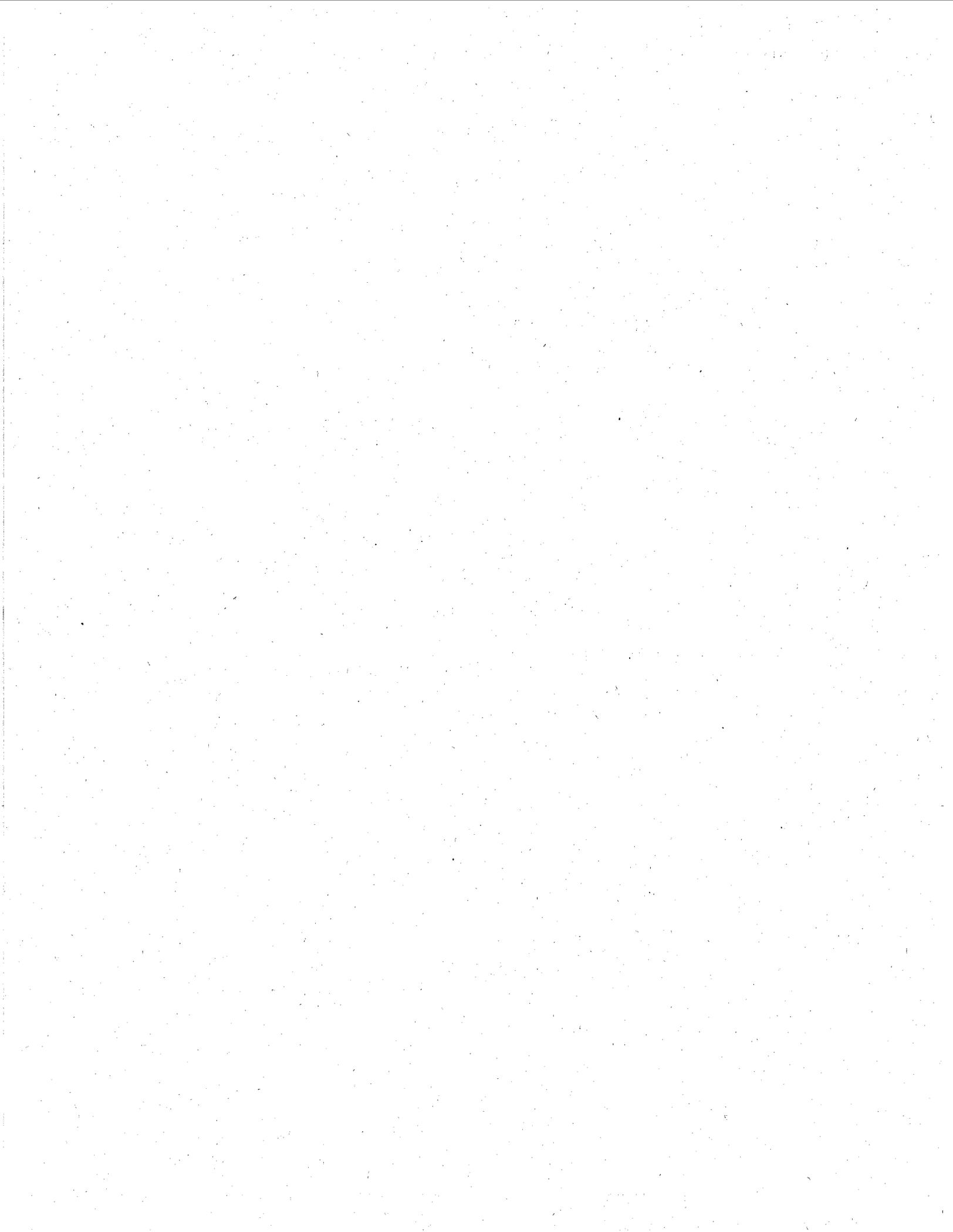


Observer Program Manual
For Sampling Of
Central Bering Sea Pollock Fisheries

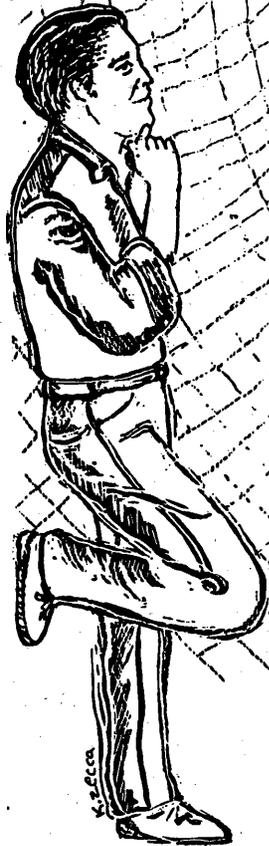
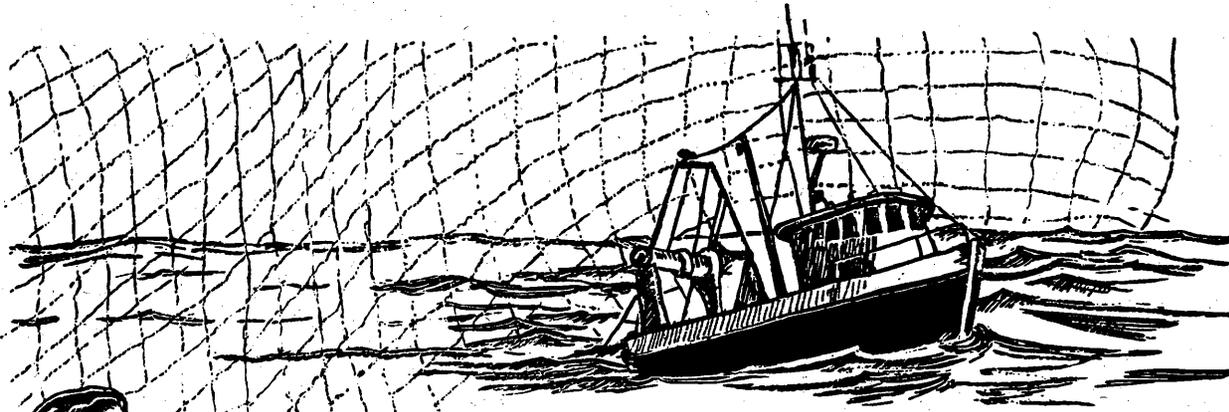
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Prepared by

**Alaska Fisheries Science Center
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115-0070**



Central Bering Sea Observer Manual Preface



This manual has been prepared to assist you in your duties as an observer aboard fishing vessels operating in the Central Bering Sea pollock fishery. In addition to training sessions, this manual should adequately prepare you for your observer experience. It must be remembered however, that conditions can change and that no set of instructions can ever be complete. It is therefore the responsibility of the observer to evaluate each situation on the vessel before deciding on a course of action. Study the manual carefully, refer to it often and consider ways in which it may be improved as a guide for future observers.

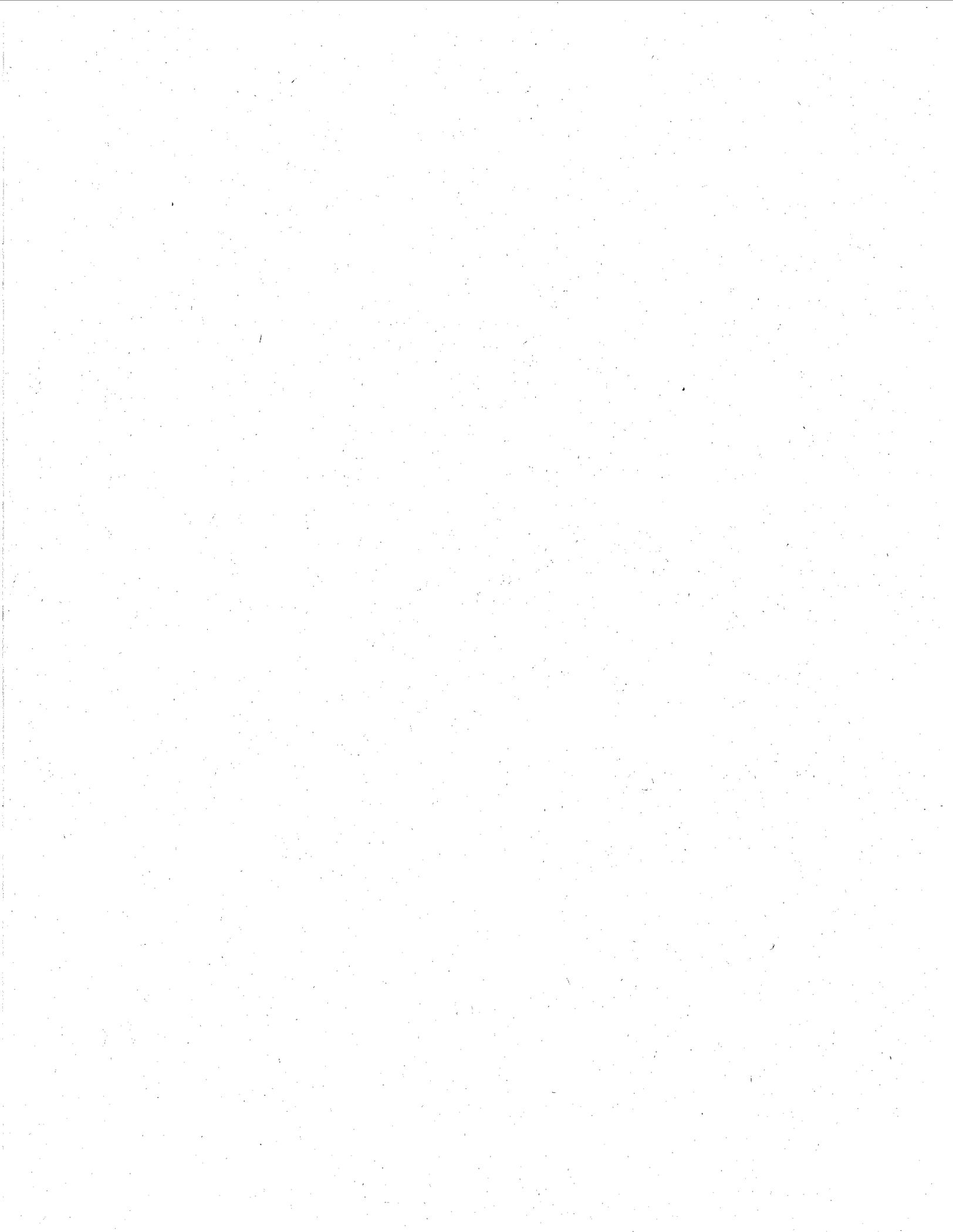


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ROLE OF THE OBSERVER IN THE CENTRAL BERING SEA POLLOCK FISHERY

The international area of the Bering Sea has an important fishery resource. In order to maintain the resource, biological information must be collected from the region. Biological observers will be placed on board vessels fishing in this area to collect the information needed to assess the resource.

The primary objectives of the observers are to record fishing effort, obtain daily catch rates, determine species composition of the catches, determine the incidental takes of salmon and marine mammals, and to gather data on pollock sizes and ages. The estimates of catch rates obtained by the observers may be compared with data reported by vessels to enable scientists to estimate total daily landings of pollock.

Data collected by observers will be used in helping to assess the status of the pollock stock, estimating the bycatch rates of species other than pollock, and investigating population interrelationships.

Data obtained by the observers on catch size and species composition will give fishery scientists an idea of the catch per unit effort of pollock, an important factor in determining the status of the stock. Length frequencies and otolith collections are also vital in determining the condition of the fishery resource, and hence, of determining how much is available to be caught without causing fishery deterioration. Mathematical models used to assess the pollock population are dependent upon a measure of the current age composition of the commercial catch. Without these data and models, the ability of fishery scientists to determine the condition of the pollock stock would be diminished.

Data obtained by observers should be useful in studying particular fisheries questions, such as the stock relationships between pollock caught in the Central Bering Sea and those caught in the Eastern or Western Bering Sea. In addition to planned uses, there are many other uses of data which are not always anticipated.

Because scientists depend on the data obtained by observers in order to assess the impact of fisheries upon the stocks, the necessity for accuracy in data collections, accurate determinations of species, and complete fulfillment of the sampling plan cannot be over stressed. Data forms must be carefully completed and checked. Sample forms in this manual serve as guidelines.

This manual, along with the training sessions, should adequately prepare you for an observer trip. Because of the variations in fish handling by different ships, observers may be confronted with sampling problems not fully covered in the training sessions. You will need to adapt the sampling methods covered in this manual and in your training to the situation experienced aboard your ship.

Observer Duties and Priorities

Primarily, the observer's duties and priorities consist of collecting catch information, determining catch weight estimates, sampling for species composition of the catch, and collecting biological data on pollock. A list of the observer's main duties is given below.

1. Record daily fishing effort and catch weight information. This manual contains instructions describing methods of obtaining these estimates and how your estimates of catch should be used.
2. Record species, and numbers and other biological information of incidentally caught marine mammals and salmon.
3. Determine the species composition of the catch according to instructions in this manual.
4. Obtain biological data and samples from pollock as directed. This may include length frequencies, sexes, otoliths for determining age, stomach content samples, or other information as requested.
5. Prepare a final report for the vessel which includes all information that is pertinent.

Confidentiality of Observer Data

Fishermen are concerned that information you are collecting can be obtained by anyone who may be interested in finding out where they caught fish. If this is brought up to you, reassure them that the information you are collecting is handled under strict rules of confidentiality and that you (the observer) are bound by the confidentiality rules as well. If you are asked by vessel personnel about another vessel you were on, explain that just as you can't talk about this vessel after you get off it, so you can't tell them about a previously observed vessel.

Observers must know that all data collected are the property of their government. No observer can retain or copy any data or reports following their return unless granted express permission from their government.

Standards of Observer Conduct

Observers are expected to conduct themselves in a manner which will reflect favorably upon the observer program. This means acting in an honest, professional manner in all situations. Observers should try to abide by these basic standards of conduct:

1. Observers must diligently perform their assigned duties.
2. Observers must accurately record their sampling data, write reports, and report honestly on the fishing activities of their observed vessel.
3. Observers must keep all collected data and observations made on board the vessel confidential.
4. Observers must refrain from engaging in any activities that would reflect negatively on their image as professional scientists, on other observers, or on the observer program as a whole.

Special Caution on Deportment

1. When conflicts or sampling problems occur which affect your attempts to get unbiased samples of the catch (pre-sorting of fish for example), you can usually work it out by talking with the crewmen, factory foreman or fishing master. If this doesn't help, talk to the captain and ask him to help you but don't be demanding in your attitude. Present a case which shows you have thought about both sides. Listen and consider their objections. Negotiate compromises as long as they don't interfere with your ability to get good data. If talking fails, try to get the best data possible anyway, and make notes on the problems to discuss when you return home.
2. Maintain a friendly but professional demeanor to vessel personnel. Your behavior should be governed by remembering that you are highly visible. Before acting in any given situation, be mindful of the sensitivity of your position. Tactful, mature handling of

problems is expected. Remember, you are on the job 24 hours per day.

3. Observers should never accept gifts as this may appear to compromise your impartiality. You may not accept payment for any work you perform for the vessel during your employment as an observer.
4. As an observer you should abide by the rules and regulations relating to conduct on your host vessel. Do not accept or transport any item violating laws relating to endangered or protected species.
5. Once you are aboard your sampling ship, avoid making visits to other vessels. Sometimes other ships, tenders, or catcher boats may tie up to your vessel. Consider going aboard only if your transfer there and back can be made under safe conditions and if your work performance is not affected. Do not make social visits to other vessels if they are not tied up to your vessel. Do not stay away from your vessel overnight.

*** Most Important ***

Consider *safety first* in everything you do!

TRAINING, EQUIPMENT, AND FIRST DAYS ABOARD

The Training Period

Training will consist of learning how to identify the species of fish expected to be found in the Central Bering Sea pollock fishery, explanations of the sampling procedures, and information on safety and living conditions at sea. The following outline lists some of the activities covered during the training period. The outline is not necessarily complete and the items are not necessarily given in the order that they will be presented.

Observer Training Topics

- Observer sampling duties - emphasis on terminology, visual orientation and safety on board.
- Seasickness, medical advice, living accommodations, clothing and other items to bring.
- Hardships, deportment, and conduct.
- Duties: objectives and priorities, workload.
- Species Identification: a general review of identification terminology of various Bering Sea species.
- General instructions on data forms.
- Obtaining haul information: Haul Summary Form.
- Estimation of catch size - by the observer and by the ship.
- Catch Composition Sampling: determining a sample weight.
- Data entry on Species Composition Form.
- Methods for unbiased sampling.
- Classroom practice of sampling methods and data entry.
- Classroom practice of haul weight estimation.
- Collecting biological information from salmon in samples: weights and lengths, sex, and scale sampling.
- Collecting data on tagged fish.
- Length frequency sampling, Length Frequency Form.
- Otolith and scale sampling, Biological Sample Form.
- Fish dissection and otolith removal: lab practice.
- Discussion on hypothermia, medical emergencies at sea, fire control and sea survival.
- Recording information on marine mammals as incidental take.
- Species identification of salmonids and lab practice review
- Species identification exam.
- Gear issue: familiarization and care of equipment, gear check-out and calibration of scales.
- Final Exam.



- Observer's logbook entries, methods of documentation.
- Preparation for first day aboard.

Observer Clothing and Equipment

Observers will be supplied with the equipment necessary for the collection of biological data at sea. The observer is responsible for the transport and return of the sampling gear issued. The observer must make an effort not to lose and to prevent theft of the gear issued to him.

Observers will provide their own personal clothing, warm work clothes for wearing under rain gear, toilet articles including a towel, and other items of a personal nature. The vessel upon which the observer is to be stationed will be expected to provide adequate quarters and meals. It is expected that the vessel captain will allow the observer an adequate and safe space in which to carry out the sampling duties.

Suggested Sampling Equipment:

The following are lists of the clothing and equipment necessary to perform 60 - 90 days of sampling.

Observer sampling manual	scale envelopes
pencils and pens	otolith containers
eraser	alcohol for preserving otoliths
calculator	plastic bags
sampling baskets	clipboard
rope for hanging scale and securing baskets	plastic sheets for recording data
cleaning powder for baskets and equipment	data forms
lubricating oil for scales	binder for holding data forms
50 kg scale	forceps
5 kg scale	knife
2 kg scale	scalpel
large hooks for hanging scales	whet stone
fish gaff	rain pants and jacket
measuring tape, 30 meter or 50 meter	rubber gloves
measuring tape, 2 meter	rubber boots
sponges for cleaning equipment	lifevest and hard hat
	Immersion suit

Personal Items Supplied by Observer

The following is a recommended list of personal clothing. The amount and type of heavy clothing depends on personal preference. Weather in the Bering Sea is generally cold and storms are common.

Work clothes--minimum number and type

Shirts, wool - 2 (1 light, 1 heavy)

Shirts, cotton - 2

Shirts, cotton sweat - 1

T-shirts - 3

Trousers, wool work - 1

Trousers, cotton - 2

Wool knit cap

Slippers or sandals

Handkerchiefs, large - 3

Underwear, long-thermal - 2 pairs

Underwear - 5 pairs

Socks, wool work - 2 pairs

Socks, cotton - 5 pairs

Jacket, medium wool or synthetic - 1

Other items or articles

Towel, medium cotton - 2

Pillowcase - 1

Toilet articles

Duffel bag - sturdy, medium size, old or inexpensive - 1

Small day pack or knapsack - 1

If corrective lenses are used for eyesight -
a spare pair

Optional/Recommended Items

Felt/wool boot insoles (not liners) - 2 pair

Needle and thread, safety pins, and duct
tape for repairs

Camera and film

Watch and alarm clock

Medication for seasickness

Athlete's foot cream

Vitamins

Hand cream

Books and magazines

Water bottle - to keep drinking water in
your cabin

Vessel Data Forms for 3 months:

Haul Summary Form 20

Species Composition Form 150

Species Description Forms 20

Length Frequency Form 45

Biological Sample Form 30

Gear Diagrams 3

Preparation and Care of Sampling Equipment

Protect your gear from loss overboard and from theft. Do not leave gear items such as baskets and scales on the weather deck unless there is no alternative and they are well secured. Stow all sampling gear when you are finished using it and inform the skipper and crew not to borrow or use your equipment without your permission.

Keep all paper products and small, loose equipment (pencils, pens, thumb tacks, scissors, counters, etc.) protected from moisture throughout your trip.

Most important: Every day before use, weighing scales must be checked over. Keep them cleaned and oiled. Adjusting screws must be kept coated with grease. The scales have steel springs inside which will rust - oil must be squirted up inside the scales.

Tape measures, calipers, and thumb counters must also be cleaned (and oiled if necessary) each day when used. (Be careful to keep oil away from plastic data forms, since pencil marks tend to wipe off a slick surface).

Calibrate your scales when you get them. Then prepare a known weight by selecting items which may be easily assembled later. (i.e. a basket, wheels, and books). List the items weighed and their total weight. This known weight may then be used later to check your scale adjustment or to check the accuracy of shipboard scales.

Prior to using your baskets or other containers for weighing, weigh the empty containers so you will know how much to subtract from each weight figure to reflect the weight of the contents only.

Accurate weights are sometimes hard to obtain when the ship is rolling. When possible, secure the top of the scale directly to a fixed structure, such as a ceiling brace. If the top of the scale has to be attached to the ceiling by a length of rope, use three ropes attached to widely separated points on the ceiling to minimize the swing of the scale. Keeping the length of the ropes to the basket short also helps. Scales located close to the center of the ship tend to swing less. If a shipboard scale is available for your use, you should use it, but check it for accuracy first.

Arrival Aboard Ship

Observers must be aware that fishing schedules are often changed by weather, mishap, break-down or fishing success and these events often change observer schedules.

Vessel conditions vary widely depending on the ship type and size, company and skipper's policies, and the fishing success. "Conditions" include cleanliness and upkeep, safety, comfort of quarters, quality of food, general attitude, and good personnel management. Observers

must be flexible as only a few generalities on what to expect can be made. Personal quarters are usually small. The most personal luggage one should ever carry on is a duffle bag.

Your work on board your fishing vessel will be very different than the work of the rest of the crew. In order for you to be able to do your job with the fewest problems, there are some guidelines which have been developed from experience. Show respect to others and it will be returned to you. One way to accomplish this is to make a conscious effort to remain clean and neat. Clean up after yourself and help where you can, as you will need their help in return. Do your best to maintain a good attitude. Adaptable observers with a good attitude are apt to receive more consideration than those who criticize and make demands.

Illness and Accidents Aboard

Seasickness often hampers observers at the beginning of a cruise, but give it time - most of the effects of seasickness disappear after a few days. Indigestible stomach contents, unpleasant fumes or cooking smells, and anticipatory fear will trigger seasickness. The symptoms are nausea, headache, drowsiness, and depression. This is normal, it is just difficult to live with. Remember, no one ever dies of seasickness, but weakness and dehydration can be dangerous. You must make yourself drink water or some non-acidic juice, not coffee, tea or alcohol, and try to eat some mild food such as rice or bread to keep up your strength. Take some seasickness medication along even if you don't plan on using it.

These actions may help you overcome seasickness and adapt to your vessel:

- Try not to think about seasickness, put it out of your mind, force yourself to think of other things.
- Practice releasing the tension in your muscles; as soon as you begin to feel apprehensive try and relax.
- Avoid unpleasant smells (especially tobacco, damp clothing, and vomit). Stay away from the galley
- Below deck: lie down, keep your eyes closed.
- In the saloon: fix your eyes on a freely suspended object.
- Seek out cool, fresh air and take calm, deep breaths.
- Where possible, keep away from enclosed spaces, go out on deck.

- Reduce the amplitude of the motion stimuli: keep amidships or astern, avoid the forward end of the ship.
- Try not to sit and let yourself be rocked passively back and forth with the motion of the boat.
- When standing, avoid leaning against anything, stand erect and make active compensatory movements to keep your balance.
- Try to move your head as little as possible.
- Focus on the horizon; watch the swell and anticipate the movement of the waves
- Participate in the normal duties on board.
- At all events see a job through to the end, do not give up on it.

Determine that you will persevere through the mental and physical discomfort due to seasickness, do not dwell on fear. It is simply a matter of adjustment. If severe discomfort persists for more than five days let the captain know. He may not be able to help you, but he will be aware of your condition in case your health gets much worse.

Safety Aboard Vessels

Fishing vessels have many potentially dangerous areas. The observer must always be alert and should take care to avoid injury. The following points must be adhered to while on the vessel:

1. The first day aboard, note where the lifeboats, life preservers, and other safety devices are kept. Memorize the exit route from your cabin, the factory, the galley, and other locations where you spend a lot of time.
2. During your first talk with the captain, ask him to explain to you what to do in the event of a major emergency such as a fire aboard the ship, a serious collision with another vessel, or other conditions which might require abandoning the ship.
3. Be cautious whenever wading through fish since fish spines can penetrate rubber boots and cause painful wounds to the feet.
4. Clothing with loose strings or tabs should be avoided, as they might become caught in the equipment or conveyor belts.
5. Don't run aboard ships, particularly up stairwells. Slipping, tripping, and falling are the most common sources of observer injury. These accidents often happen when an observer is in a

hurry. Specifically, watch out for slick spots where the deck is wet and oily or frozen, step carefully over the half-foot coaming rising from the bottom of metal latch doors and passageways, and look out for low overheads in vessel stairwells and watertight doors.

6. The observer should not stay outside on the aft deck during rough seas. Fishermen are often swept forward on the deck by waves rolling up the stern ramp. When the observer is outside, he should remain in full view of another person at all times.
7. Cables which break under strain frequently kill sailors. Whenever a cable is subjected to tension, stand in a place where a backlash would not hit you. If your sampling station is on deck, do not work while a trawl is being set or retrieved. Instead, interrupt your work to go to a safe place during the process. When nets are being hoisted off the deck, stand well clear. Heavy nets will fall when the suspending cables part.
8. When working near the exit chutes in the factory floor, where bycatch and factory offal wash out, the observer should be extremely cautious not to slip and fall in the wash of bilge water.
9. Observers are cautioned not to pry loose any fish caught in the spaces of conveyor belts or other machinery, since this may result in getting a finger or hand mangled in the machinery.
10. Factory processing areas are crowded with machinery, electrical lines, and conveyor belts. It is often difficult to get to the area where an observer needs to sample because of the maze of equipment. Climbing over, under and around heading, filleting, and skinning machines on oily and wet floors is extremely hazardous. Observers must watch carefully where they step and where they grab for handholds.
11. Treat all minor cuts, especially those on hands, with antiseptic to avoid infection from fish slime. Poisoning from fish slime is called cellulitis and is a form of staph infection. Should a staph infection be left untreated and allowed to develop, your lymphatic system becomes involved and the threat to your health becomes much more serious than simply a pair of inoperative hands. Wash hands thoroughly after sampling in a solution of very hot water and an antiseptic such as iodine. Disinfectants such as chlorine bleach or alcohol tend to remove your skin's

natural chemicals and prolonged use may make you even more vulnerable to fish poisoning.

12. Take extra precautions against infection when handling dead marine mammals. As these animals have similar biological systems to our own, organisms which infect them can infect us. "Seal finger" is a fungal infection of the hands which can easily be contracted.
13. Ask ship personnel which water sources are safe to drink. Some ships have lines containing water for washing and not drinking.

Safety in At-Sea Transfers

Some observers will board and disembark their vessel at dock, but a transfer at sea may be necessary for many observers. Transfers between vessels are potentially hazardous, especially in rough weather. The observer must assume responsibility for deciding whether or not to transfer based upon his own evaluation of the transfer conditions.

There are general guidelines for allowable safety limits during transfers. Conditions such as method of transfer and vessel size, swells versus waves, current and impending weather, good visibility and distance to cross affect the decision as to whether or not to transfer. Observers must use their best judgement. Be cautious--not foolish. Do not be forced into transferring against your better judgement by an anxious or impatient captain. Whenever possible be preceded or accompanied by a crewman. Always go with an experienced crewman if you are transferring in a small boat or raft. Never transfer via a small boat if you can't see your destination. If boarding a small skiff or inflatable boat, see that the engine has been started and warmed up, and that there are oars stowed as a backup. As general guidelines, do not transfer at dusk, in darkness, in heavy fog, or in any other low visibility conditions. Transfers involving a small boat or raft should never be carried out at night. Observers should not transfer when the sea state is two meters or more. Points to remember when transferring:

1. Observers should wear life vests at all times on skiffs or other small-sized vessels and while transferring.

2. Observers will not encumber themselves with baggage when transferring vessels. Balance is important. Both hands must be free during transfers.
3. All baggage will be secured with lines and transferred via rope lines or cargo nets. Observer baskets have been lost overboard because they were thrown between ships without lines attached.
4. Given a choice between using a Jacob's rope ladder or a gangway to board a ship, in most cases use the Jacob's ladder since the use of a rigid gangway in rough seas can be extremely hazardous to the observer and to the transfer boat.
5. If a cargo net, transfer basket, or cage is used to transfer observer or baggage, make sure that a line is attached to the conveyance from both vessels for greater control and to reduce swinging. The observer should maintain a crouched (knees bent) position as opposed to sitting or standing with straightened legs, to avoid back injury. Be sure to wear your life vest when using this mode of transfer. Keep your arms, particularly elbows and fingers, inside the conveyance when transferring.

First Days On Board

As quickly as possible, the observer should adapt to the new surroundings, meet people, and make preparations for work. Soon after boarding you should have a meeting with the captain. Cooperation from the captain, mates and crew is essential in order to obtain the unbiased samples the observer needs for his work. It is important at this meeting to set the tone for a friendly but business-like working relationship. If the captain is receptive, take this opportunity to mention the following points:

1. Tell the captain that you want to see the ship's fishing logs regularly.
2. Ask to be informed, in advance, of changes in the fishing schedule so that you may adjust your schedule accordingly.
3. Ask to be notified if any marine mammals are found in the catches; request that all dead mammals be held for your

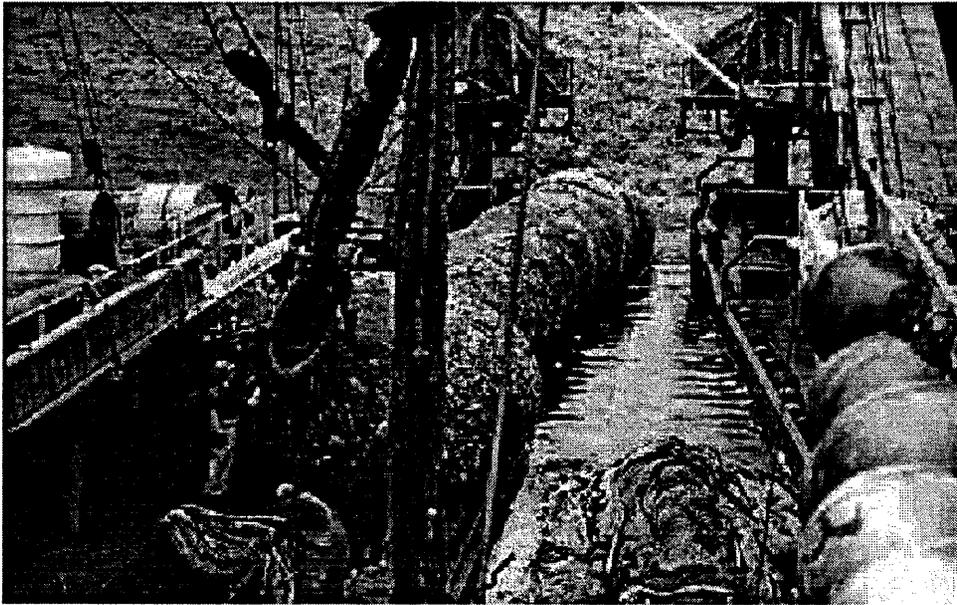
examination. Marine mammal sampling instructions are on page 77.

4. After having done your own survey of safety equipment and instructions ask the captain additional questions. Ask about the location and operation of special emergency equipment, what are the procedures in case of an emergency such as fire, where is the radio and how does it operate, what are the working channels of nearby vessels, are there any hazards that you should be aware of?

During the first few days aboard your ship familiarize yourself with life on board. Prepare to begin your work by noting the following:

1. When the deck is inactive, perhaps on the way to the fishing grounds, make measurements which will aid you in estimating codend dimensions. Then watch the net retrieval and handling. Decide when and where you will need to take additional measurements and which crewmen to ask for help.
2. Watch how and where the codends are opened and how thick and fast the fish are dumped. Look to see if the crew does any sorting on deck and whether different hauls are mixed in the tanks.
3. Notice where the catch is sorted by species and size and what is the destination of fish on each line of conveyer belts. What products are being made?
4. Consider the location of your sampling station. Remember, you have to be present at, or ahead of, any sorting area. If at all possible, avoid having to haul containers of fish long distances or up or down stairs. You need a place where you can gather your samples, have a few containers of fish around you and a place to hang your scale. Adequate lighting will be necessary and you will need to locate the nearest hose for cleaning yourself and your area.
5. Try collecting one or more containers of fish. Familiarize yourself with the species being caught, and start writing species descriptions. Practice sexing the pollock and taking otoliths.
6. Work out routines for sorting, weighing, and counting fish.

7. Get started with the most obvious methods for making catch weight estimations and determining sample weights. Then after your work is underway, consider variations or other methods which may improve your sampling.



Large catch of pollock on deck

OBSERVER OBJECTIVES AND GENERAL INSTRUCTIONS

The main work objectives of observers are to make independent estimates of catch weight, determine the species composition of the catch, collect biological data on pollock and salmon, and record any incidental take of marine mammals.

Since ship design and procedures vary from ship to ship, it will be the responsibility of the observer to select the best sampling methods to obtain the needed data. In the following sections, the methods of sampling will be outlined. To use any of the prescribed sampling methods, the observer will be relied upon to devise and apply good, statistically sound, fish collection techniques.

When conducting biological sampling, the most important thing to remember is to take random, unbiased samples such that your data will be representative, not of any particular catch but of the vessel's catches over time. Random samples are necessary in all data collections. Accuracy is important in all aspects of the work, including: the actual sampling, recording the data on plastic data sheets, and transferring the data from the plastic data sheets to the final paper copy. The need for random, unbiased sampling and accuracy cannot be stressed too much.

Sampling Duties for Observers

Every Haul:

1. Obtain or compute haul data on fishing location, depth, effort, and total catch weight (Haul Summary Form).
2. Estimate haul weight (Haul Summary Form) from as many hauls as possible. Estimates should be made of some hauls that were not sampled as well as of sampled hauls.

Sampled Hauls:

3. Sample for species composition of catch (Species Composition Form).
4. Identify to species, count and weigh *all the salmon* in your sample if possible, or take a random sub-sample (Species Composition Form).
5. Determine sex and take fork length measurements of all salmon in your sample (Length Frequency Form). When many salmon

appear in your sample, take a random sub-sample, such as every third fish. A sub-sample should be of at least 20 fish.

6. Collect scales from salmon in your samples for species confirmation and age determination (Biological Sample Form). Instructions for sampling are on page 71.
7. Check all salmon for missing adipose fins or other fin clips or marks. If you collect a tag be sure to record all pertinent data as requested in the "Tagged Fish" section on page 74 of this manual.

Every Day:

8. Take length measurements of at least 200 randomly selected pollock per day (Length Frequency Form).
9. The otolith collection must be a subset of the length frequency collection. Try to collect 20 pairs of otoliths per day, but no more than that. Follow directions on page 68 of this manual (Biological Sample Form).

Other special projects - if assigned any other special project, such as pollock maturity, stomach sampling, or parasite studies, conduct work according to instructions given.

10. Maintain a daily log of your sampling record and all calculations of density, total catch weight, and sample size. Comment on your observations, problems, and sampling methodology.

Upon Occurrence:

11. From any marine mammal caught incidentally record identifying characteristics and its condition. If the animal is dead, try to determine sex, measure the length, and collect one or both of the upper canine teeth.

Per Vessel:

12. Complete a report on the vessel in your logbook. Include an evaluation of the method and accuracy of the vessel's catch weight estimations from your perspective.

General Instructions for Data Forms

In gathering the necessary data, observers must occasionally be inventive to overcome sampling problems, but once the data are ready to be transferred from the plastic data sampling forms to the paper forms, all creativity must cease. Certain data columns must always be filled in and they must be filled in a certain way, with leading zeros in some places but not others, zeros filled in behind printed decimal points, and decimal points added by observers in other cases. Refer to the specific directions and examples for each form. If you do need to make a comment on the data, place the comment on a portion of the form which is not keypunched.

The forms should be neat - all the numbers should be precisely printed so that they are legible. Sloppy forms multiply the number of data entry mistakes and sometimes require guesswork to interpret. Use a sharpened pencil, not a pen, to fill out all forms so that erasures can be neat if changes have to be made.

Much of the Haul Summary Form can be filled out from the ship's fishing logs. Observers should take care to record the correct information and avoid making copying errors. The vessel position data is needed for all of the data, so if these are missing, other data cannot be used.

Cruise Numbers And Vessel Codes

You will be assigned a number which will identify you and your set of data for your vessel. The number which identifies you is the "cruise number" and the number which identifies your vessel is the "vessel code". If you are sampling in December and over the new year transition, you will be assigned a new cruise number for the new year's data. Start a new page for each set of forms and start their numbering again from page one as of January 1st (0000 hours GMT, between December 31 and January 1).

Page Numbering

On the top of each form is a phrase "page ___ of ___." This helps to keep the forms in order and alerts anyone working with the data forms if a page is missing. Each set of forms, for each cruise, should have pages numbered separately and consecutively. Record the page number every time you begin a new side of each form and fill in the total number after the cruise is complete. For example, if you filled

out 58 Species Composition Forms, then the first sheet will be "page 1 of 58" and the last sheet will be "page 58 of 58."

The Rounding Rule:

≥ 5 is rounded up, < 5 is rounded down.

Example: rounded to two decimal places: $.52499 = .52$

(When rounding, look only at the first digit to the right of the place you are rounding off at. In the example above, since we are rounding off at the hundredth's, we would only look at the "4" and thus leave the "2" as it is. We would not look at the "9" and change the "4" to a "5" and continue to round the "2" to a "3" thus getting an answer of ".53".)

HAUL SUMMARY FORM

The observer's objective is to determine and record the best information available on fishing effort and catch. Catch per unit of effort, the type of nets used, and where in location and depth the nets are deployed are the basic pieces of information needed to monitor the harvest of pollock in the Central Bering Sea. The haul summary information constitutes the basis of all the rest of the data gathered by an observer aboard a vessel. If this form is not complete and correct, the rest of the data collected will be useless. The collection of haul summary information is the top priority for an observer. All subsequent sampling data for a vessel is tied to the Haul Summary Form by the dates and haul numbers. Be certain your haul and date correlations are correct on this and all other forms.

Haul Summary Form Instructions

This form summarizes fishing effort and total catch by haul for trawlers. Obtain the data for this form from the ship's logs, from vessel personnel, and from direct observation. Vessel logbook information may need to be adjusted if it is not correct. Check carefully to see that no errors are made in copying the data to the forms and that the data are reasonable. Points to note:

1. At the top of the form, record your name and nationality and the name and nationality of the vessel you are observing. Also circle the appropriate nationality code for yourself and your vessel:
Codes: 1 - Republic of Korea
2 - Japan
3 - Peoples Republic of China
4 - Poland
5 - Commonwealth of Independent States
2. If there were no hauls retrieved on a day (due to traveling, bad weather, mechanical breakdowns, etc.) record "0" in the haul number column, and record the GMT noon position. Comment on the reason there was no fishing. All days at sea must be accounted for with either fishing information or a noon position entry.
3. Record all of the hauls made while you are aboard. **Do not** make the mistake of recording only the sampled hauls. Place an "X" in the column to the left of the date to indicate which hauls you sampled for species composition.

OBSERVER NAME
EXAMPLE

PAGE 2 OF

HAUL SUMMARY FORM

OBSERVER NATION
1 2 3 4 5

VESSEL NATION
1 2 3 4 5

CRUISE #	VESSEL CODE					YEAR			
	1	2	3	4	5				
1	2	3	4	5	6	7	8	9	10

HAUL SAMPLED	DATE		HAUL #	GEAR TYPE	GEAR PERFORMANCE	FISHING POSITION			FISHING TIMES IN GMT		FISHING DURATION IN MINUTES	AVERAGE FISHING DEPTH	AVG. SPEED KNOTS	OBSERVER TOTAL CATCH ESTIMATE (MT)	VESSEL TOTAL CATCH ESTIMATE (MT)	SEA SURFACE TEMP. (C)	FISHING DEPTH TEMP. (C)	VESSEL LATITUDE
	MONTH	DAY				1/	LONGITUDE	NETS AT DEPTH	BEGIN RETRIEVAL									
	11	12				13	14	15	16	17								
X	08	14	171	1	1	20-23	17946	0625	1137	38-40	202	3.2	42.50	40.00	58-59	60-63	64	
X	08	14	172	1	1	25-29	17930	1410	2100	41-43	215	3.2	38.25	40.00	58-59	60-63	64	
X	08	15	173	1	1	25-29	17925	0575	1105	38-40	250	3.0	28.60	25.00	58-59	60-63	64	
X	08	16	174	1	1	25-29	17710	2230	0500	390	240	3.1	16.00	16.00	58-59	60-63	64	
X	08	16	175	1	2	25-29	17725	0830	1145	195	230	3.1	0.00	0.00	58-59	60-63	64	
X	08	16	176	1	1	25-29	17730	1510	2330	500	230	3.1	32.30	25.00	58-59	60-63	64	
	08	17	0						No fishing, rough seas						6.2			7
X	08	18	177	1	1	25-29	17710	0530	1245	435	215	3.0	46.10	45.00	58-59	60-63	64	
X	08	18	178	1	1	25-29	17735	1420	2050	390	220	3.2	48.44	45.00	58-59	60-63	64	

4. Record haul numbers in numerical sequence and in ascending order. A given haul number should be used only once - there can be no duplicates. Make sure that the haul numbers do not exceed 3 digits. If the haul number recorded in the fishing log is 1657, for example, then drop the first digit and record the haul number as 657. This will enable you to compare your data more easily with the ship's logs.

Every haul is recorded unless there was a gear malfunction resulting in a zero catch. If a zero catch is not due to a gear malfunction then the haul must be recorded. A haul number must be assigned to every haul. If you reach number 999, the next haul should be "1", not "0." Haul number "0" means a non-fishing day as explained in number 2 above.

5. Record the code for gear type based on the style of the trawl net. Leave this column blank temporarily if the gear doesn't fit the categories given below.

Codes: 1 - pelagic trawl
 2 - bottom trawl
 3 - pair trawl

6. Record the gear performance code:

Codes: 1 - no problem
 2 - gear twisted resulting in reduced or no catch
 3 - net ripped
 4 - any other problem which results in reduced or no catch; write a note of explanation in an area not used for recording data

7. Each haul must have a position. For every haul the location recorded should be the *haul retrieval position* - the location of the ship when a particular haul begins to be retrieved, or, when the winches begin bringing in the cable. All latitudes are assumed to be North; record the codes for "east" or "west" longitude as follows:

Codes: 1 = east
 2 = west

Check the latitude and longitudes you record on this form to make sure that they are reasonable - for example, 58° 63'N does not exist. Double check positions that indicate large movements

if you have not been aware of any. Plot a few positions on a chart yourself to verify that they correspond to where you believe yourself to be.

8. The time system used on this and all other forms should be Greenwich Mean Time (GMT) and dates. Times must be recorded according to the 24-hour system (2:00 in the afternoon = 1400).
9. A haul is assigned to a day according to the time the vessel begins to retrieve the net from the fishing level ("begin retrieval" time), which is not necessarily the same day the net was set or the day that you sample. Thus, hauls retrieved before 0000 hours GMT are attributed to the previous day, and hauls retrieved on or after 0000 hours GMT are assigned to the next day. Midnight should be recorded as "0000" hours, not "2400" hours.
10. The time when net retrieval begins is recorded under "Begin retrieval". "Nets at depth" is the time that the net first reaches the fishing level after the winches stop paying out cable.
11. Double check haul times to see if they are reasonable. An overlap in haul times for two hauls made by the same vessel is an obvious error.
12. Record the "nets at depth/begin retrieval" times as well as the "fishing duration" (in minutes). In most cases the duration will be the difference between "nets at depth" and "begin retrieval". If the **actual** fishing duration is substantially different than the duration which would be obtained by calculation from the "nets at depth/begin retrieval" times, record only the duration and "begin retrieval" time. This may occur if the net is raised and lowered several times during the haul. In this case, minutes duration would be more accurate than "nets at depth/begin retrieval" times. Note the reason for the unusual entry at the top of the form.
13. The average fishing depth is assumed to be in meters. Record depths only to the nearest whole number, no decimal values.
14. Record the average trawl speed to tenths of a knot.
15. Observer's estimate of total catch: this is an estimate made by the observer from independently derived or verified information.

The observer should make independent estimates of as many of the hauls as possible. Instructions and information on making estimates of haul weight follow. Record the weight estimate in metric tons to two decimal places.

16. Vessel's estimate of total catch: An estimate made by a vessel manager of the round weight of all species caught in the haul. A vessel estimate should be recorded for every haul made while the observer is on board. It is recorded in metric tons and must be made to two decimal places.
17. Record the sea surface temperature to one decimal place.
18. Record the temperature at fishing depth (if available) to one decimal place.
19. Use the following codes for sea state (Beaufort Scale). Note that the wave height should be the height of surface waves. It should not include the height of the underlying swell.
 - 0 - calm, glass-like surface, wave height 0 meters.
 - 1 - calm, rippled surface, wave height 0-0.1 m.
 - 2 - smooth wavelet, wave height 0.1-0.5 m.
 - 3 - slight waves, wave height 0.5-1.25 m.
 - 4 - moderate waves, wave height 1.25-2.5 m.
 - 5 - rough seas, wave height 2.5-4.0 m.
 - 6 - very rough, wave height 4-6 m.
 - 7 - high seas, wave height 6-9 m.
 - 8 - very high, wave height 9-14 m.
 - 9 - phenomenal, sea height greater than 14 meters.
20. Leading zeros should be recorded in the date and time columns only, as needed. Leave one blank line after each day's entries. Any notes, or comments (other than notes for non-fishing days) should be placed in a part of the form that is not for recording data.

Checking the Haul Summary Form: The correct haul/date correlation, retrieval position, duration, and total catch weight are the necessary items--without this information the observer's sampling data cannot be used. The observer must check these items for accuracy:

- Check the "Begin Retrieval" time of the last tow of each day. The tow cannot span midnight and be the last tow.

- Check to see that no two haul times overlap.
- Check any change in degrees of latitude and longitude. Unless the minutes of latitude indicate the position is close to the next degree, changes of degree would mean long distances traveled or a recording error.
- Look at each whole page of the Haul Summary Form for blank spaces where data may be missing.

Vessel Fishing Logs

A captain may keep several types of records or logs. He may keep fuel and fishing logs for himself or for his company. Your job is to obtain the best information on the fishing catch and effort from these ship's logs, from vessel personnel, and by direct observation, and accurately record the information on your Haul Summary Form. *All of the tows made while you are aboard must be recorded on your Haul Summary Form whether you sampled them or not.*

The captain may wish to use the observer's sampling data as a basis for his own logbook entries. Observers may provide the vessel's officers with copies of their sampling data obtained from that vessel.

Total Catch Weight Estimations

Total catch weight is the fresh weight of all species caught in a haul whether utilized or not. Make an independent estimate of as many hauls as possible, whether sampled or not sampled. If there are 3 - 5 catches per day, the observer should be able to make a catch estimate for nearly all hauls. Also record the vessel estimate for each haul made while you are aboard.

When total catch weight is used for composition sample data, the observer is to use the observer estimate. Observer estimates are preferred over vessel estimates because the observer makes actual measurements to determine catch weight. The captain may only make a visual estimate or approximate individual catches from the production information of a whole day. If no observer estimate was made for a sampled haul, then the observer can use the vessel estimate of total catch as a basis for sample data if needed.

Observer Total Catch Estimates

The observer estimate must be an independent, unbiased, measured estimate of catch weight. Each component of the estimate must be obtained by the observer. Your estimates of total catch are an important part of the reason you are observing on that vessel, so you should do your best to get good data. Do not record any visual estimates as an "Observer Estimate", because you probably learned how to make visual estimates from the captain, and you are there to make independent observations. Document measurements and calculations for each haul in your logbook and record your estimates of catch weight on the Haul Summary Form for every haul you estimate.

Make volume estimates from the live tank, fish bin, or the codend. The volumes are converted to weight estimates using a volume to weight ratio (density value) obtained during composition sampling. Estimates are also needed from non-sampled hauls. You can use an average density for the day for hauls not sampled for composition.

A volume estimate from a fish bin is preferred over a codend volume because a solid sided container is usually an easier, more regular shape to measure than the expandable tube of a codend. However, codend volumes are more commonly used for observer estimates because the tanks may not be accessible for measurements, may have seawater in them, or they may not hold the entire catch at one time.

Methods for Observer Estimates of Codends

As scientists, observers must have data to verify their estimations. Never record estimates made by just looking at and guessing the weight of the codend. Codend measurements must be taken to determine volume of fish (m^3), and that volume is multiplied by weight-per-volume (mt/m^3 , density) to derive an estimate of the catch weight.

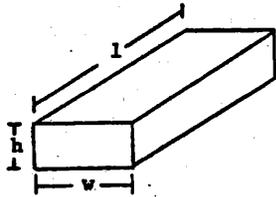
The first step in the estimation of the volume of fish in the codend is to decide which geometric shape a particular codend most closely resembles: a rectangular solid, a cylinder, an ellipsoidal solid, a semi-ellipsoidal solid, or perhaps a combination of two of these shapes. Determine the needed dimensions for volume calculation of the chosen solid. Then measure the codend of fish. Make use of pre-measured dimensions to gauge the net size more quickly. For example, with permission, you could measure and mark structures on deck, such as support posts to sight to for height. Measure the deck

width, height to your shoulder, and lengths of the deck covered by most nets.

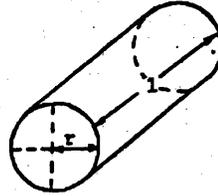
On some vessels full codends will be emptied a portion at a time while the remainder hangs off the stern ramp, still in the water. It is necessary for the observer to measure the volume of fish in several net sections to determine the volume per section and then to count the number of full sections and add them together. This can be done instead of treating the whole codend as a single unit. The codend has reinforcing cables, or "expansion straps", around it and "riblines", which are often made of chain, running its length. These limit extreme bulges and allow the amount of fish between each strap to be added as a consistent unit of weight. Count the number of full sections taking into account that the last section often contains a bit more fish, and the first section contains fish which are not compressed. Also, like any mesh bag, when the net is very full, the mesh will expand and bulge and there will be more tonnage per section. Because each net holds a different amount of fish you must make and record measurements every time you estimate a codend. Calculate the volume in cubic meters using the appropriate formula, then multiply the volume by the density, obtained as explained below, to obtain the metric tonnage of the catches.

The deck crew will often want to empty the net as quickly as possible. They may be reluctant to allow an observer time to make the needed measurements. Prepare for this possibility by making sure the captain is aware of your needs, and by being ready to get your measurements as quickly as possible. Be ready to step on deck as soon as the winch cables go slack and know which measurements you need to take. Having one of the deck crew help you regularly will help everyone. The two of you will soon learn to work quickly as a team; measuring will be easier for you and you will finish faster so that the crew can get on with their work. On a net of fifty tons or more, single handed measurements might take ten minutes. With help you should be able to make your measurements much faster. If the deck crew are reluctant to help you, explain your plan to the captain and ask his cooperation.

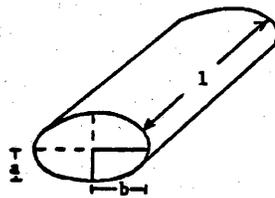
Common Codend Shapes and Formulas for Calculating Volume



Rectangular solid
Volume = height x width x length
 $V = hwl$

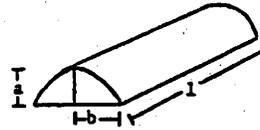


Cylinder
Volume = $\pi \times \text{radius}^2 \times \text{length}$
 $V = \pi r^2 l$

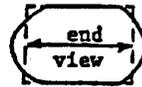
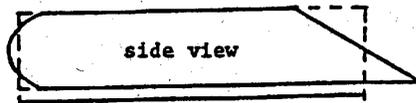


Ellipsoidal solid
Volume = $\pi \times \text{short radius} \times \text{long radius} \times \text{length}$
 $V = \pi abl$

($\pi=3.1416$)



Semi-ellipsoidal solid
Volume = $\frac{1}{2} \pi abl$
 $V = \frac{1}{2} \pi abl$

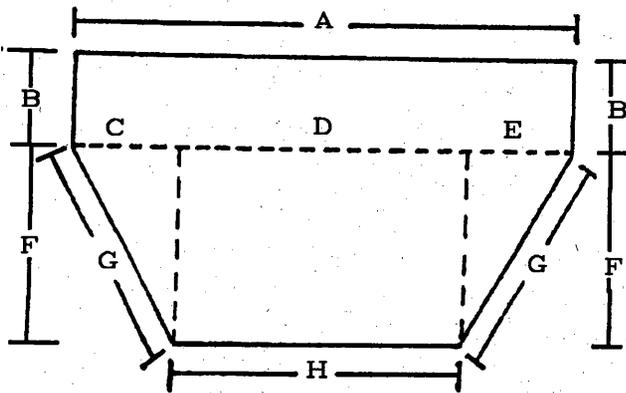


(Allowances can be made for irregular shapes or partially filled portions of the net by the way in which the measurements are taken.)

Observer Estimates by Bin Volume

On some ships, it may be possible to estimate the catch size by the volume of fish in a holding tank or deck bin. Tank or bin volume is preferred over codend volume because the shape doesn't change. Some factors which make it difficult or impossible to use this method are that the tanks may be enclosed such that the depth of fish cannot be determined; the tank may hold fish and an indeterminate amount of water; the tank may be too difficult a shape to measure; or tows may be mixed by dumping them in together.

Determine which bin or bins are used to hold unsorted fish. Measure the fish bin to obtain the volume in cubic meters. If the fish bin is shaped like a rectangle or square, it is relatively easy to calculate the volume. Simply multiply the floor area (length x width) by the height of fish. However, many fish bins are irregularly shaped, in which case the floor area of the bin must be considered in separate sections which can be easily measured. The example below shows how one fish bin was separated into shapes easily calculated or measured to obtain floor area.



Useful Formulas You May Need

Area of a circle = πr^2

Circumference = $2\pi r$ ($\pi = 3.1416$)

Area of a square or rectangle
= length x width

Area of a triangle = $1/2$ base x height

For bin floors with a conical shaped depression:

Volume of a right angle cone = $1/3 \pi r^2 h$

The height of fish in the bin is the third dimension needed to determine volume. If the bin is constructed with boards of equal width, measure the width and use the height of each board to estimate the height of fish in the bin. If this method can't be used, ask if you can use some paint to make height gauges at a few different places on the inside of the bin. To determine an average height of fish, it is best to measure the height of fish at four or more points around the inside of a bin. Be aware of overhead structures which may reduce the volume capacity of a bin when it is filled above a certain point. Height gauges painted on the sides of the tank might also be read from the trawl deck. The area of the fish bin (constant) multiplied by the height of fish from that haul (variable) equals the volume. Volume multiplied by density equals the catch weight.

Density Sampling

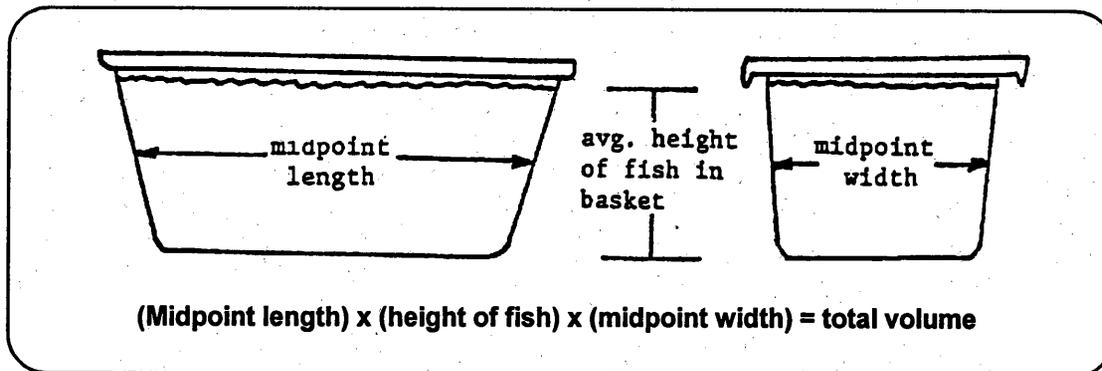
Codend or bin volume (in cubic meters) is multiplied by a weight per cubic meter ratio, (termed "density") to obtain a catch weight estimate for that haul. Density is the ratio of mass, or weight, to volume. One cubic meter of fresh water by definition weighs one metric ton. Its density then is $1 \text{ mt} \div 1 \text{ m}^3$, or 1.00 mt/m^3 . The density of seawater is 1.026 mt/m^3 . The density of fish in a bin, (their weight per cubic

meter of volume) should be close to 1.00 (densities commonly range from .87 - .98). Even though the fish in a codend can be very tightly compacted, observers should not try to compensate for this and must make their own density estimates by sampling for density as explained below.

Density is variable and should be derived from random samples for each sampled haul. Average density values for the day should be calculated and used for catch weight estimates of unsampled hauls. Measure the volume of fish in any simply-shaped container that holds 500 kg or less (half a cubic meter). If a sample basket is used, it should be of at least 50 kilogram capacity. A minimum of four to five baskets or 200 kilograms of fish would then be used to calculate density.

First determine the volume of fish in the sample. When taking a four or five basket sample, fill all the baskets to the same level. (Unless you want to measure and record the depth of fish in each basket and calculate and sum the volumes.) A one centimeter difference in the height of fish in the basket, for a given weight, can change the resultant density value by several percent. This in turn, changes the volume to weight conversion of a codend by several tons!

If the container sides are sloped slightly use the midpoint width and length measurements. Remember that the midpoint is half the distance from the bottom to the level *of fish* in the container, not necessarily to the top of the container. To calculate the volume of the container, use the following equation:



Examine the way fish are laying in your container and make sure that it is similar to the way that fish are packed in the fish bin or codend. For instance, if you have very large fish in your basket, they may not be lying flat on top of each other as they would in a large fish bin. The

density of the fish in the basket will be less than the density of fish in the bin because there are more spaces or air pockets between the fish in the basket. It *is* appropriate to *arrange or settle* the fish into the container to minimize the spaces between fish. However, *do not compact or smash* the fish in an attempt to duplicate the force in the codend. Your resulting density value would be too subjective. A better solution would be to find a larger container or have one built.

After the volume of the sample is calculated, sum its total weight. Then simply divide the total sample weight by the total volume to obtain the density value for that haul. If you are not confident in your sample technique, examine your work. Remember it is important to take a random sample of the catch and to fill your container(s) consistently to the same level. Using the volume of the fish in the codend or fish bin and the density of your sample fish, you can calculate a total catch weight estimate. Remember:

$$\text{Volume of fish (m}^3\text{)} \times \text{density (mt/m}^3\text{)} = \text{weight of fish (mt)}$$

Vessel Estimates of Total Catch Weight

Vessel estimates are usually recorded in the vessel's fishing log. The captain or other officer on watch will usually make a deck estimate by looking at the codend of the net and counting the number of sections full of fish. The codend has reinforcing cables or "expansion straps" around the circumference at regular intervals. The amount of fish between each strap may be counted as a consistent unit of weight but this is not always true.

Their visual estimates of the catch are not always accurate. Large catches may be overestimated and small ones underestimated. Ask how the officers make their estimates. Are all species and is discard being included? Do not rely on the vessel estimate as a measure of how good your observer estimates are. If there are large differences, simply check your measurements and calculations. Record your investigation and findings in your logbook. Continue to make and record your independent estimates.

Never argue with the captain about haul weight estimations. His estimated weights in his logbook do not have to equal or even approximate yours. The important thing to remember is that making your independent estimates of catch weight is a top priority in your work. Do your best to make an accurate volume and density

assessment. Make diagrams of the volumes used. Document each calculation in your logbook.

RANDOM SAMPLE TABLE

To avoid bias regarding which hauls were selected to be sampled, the hauls to sample for species composition have been predetermined by using a random numbers table. Use it to determine which hauls will be sampled during a fishing trip. Using the table is not an option, it is a requirement for your work.

Observers on catcher/processors and motherships will also have a break table to use if needed. Instructions for using both tables follow, the random sample tables will be discussed first, followed by the break table and how to integrate both tables. Be sure you have a complete understanding of both tables before you are deployed.

The Random Sample Table is made up of rows of numbers in **bold-faced** type alternating with rows in normal-faced type. The bold-faced rows indicate the number of consecutive hauls you sample. The normal-faced rows are the number of consecutive hauls you do not sample unless you can exceed the upcoming hauls to be sampled. During training you will be instructed how to determine your starting point on the table. From that point move vertically down through the table, sampling or not sampling the number of hauls as indicated. If you reach the bottom of a column continue at the top of the next column. If you reach the end of the table (Z,Z) continue on at the top of the table (A,A).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	2	3	2	4	4	2	3	2	4	3	4	2	4	2	4	3	2	3	4	3	4	4	2	3	2	4
	1	2	1	2	1	2	1	1	1	1	2	1	1	1	1	2	2	1	2	1	2	2	1	1	1	1
B	4	3	4	4	3	2	3	2	3	3	2	3	2	2	3	2	3	2	4	3	2	4	2	2	3	2
	2	2	2	2	2	1	2	1	1	2	2	2	1	2	2	1	1	2	1	1	1	2	2	2	1	2
C	2	4	3	2	4	3	3	2	3	4	3	3	2	4	2	3	2	2	4	3						
	1	1	2	2	1	2	2	1	2	1	2	1	2	1	1	1	2	1	2	2	1	1	1	1	1	1
D	4	4	3	4	4	4	3	4	4	4	4	3	4	3	3	2	4	2	2	2	2	3	3	2	3	3
	1	2	1	1	1	2	1	2	1	2	2	1	1	2	2	2	2	1	2	2	2	2	1	2	2	1
E	3	3	3	2	2	3	4	2	4	2	4	3	3	3	2	4	2	2	3	4	2	2	4	2	4	4
	2	2	1	1	1	2	2	2	2	1	1	2	1	2	1	2	2	1	2	2	2	1	1	1	2	2
F	4	4	4	4	4	3	3	2	3	2	2	2	3	2	2	2	2	4	2	3	4	4	4	4	3	2
	2	2	2	1	1	1	2	1	2	2	2	2	2	2	2	1	2	2	1	2	2	2	1	2	1	2

It takes most observers a couple of days to set up their sampling station, observe the operation, and get comfortable with their sampling duties. So, you do not need to use the Random Sample Table on your

first day or two of sampling. Begin using the table as soon as your sampling methodology is established.

If you find that this sampling schedule is too rigorous, consider and try the following recommendations:

1. If your vessel is a catcher/processor or mothership, use the break table each day or on some days as needed.
2. Reduce the sampling time by reducing the sample size of one or more hauls in the series. Sampling a catch on a c/p vessel should usually take two to three hours. If you are spending more than three hours per sample you will not be able to stick to the table when four or more hauls per day are being landed. If you were sampling entire catches, try cutting back to a smaller sample size so that all designated hauls in the series can be sampled. It is more important to have good sample collection technique, smaller samples and stick to the random sample table than to sample the whole catch and sample fewer hauls.
3. Plan ahead. It is important that you look ahead at your schedule and plan to make best use of your rest time. For example, if the table dictates that you have a four on, one off, four on schedule, get more rest *before* this series and plan on getting paperwork, chores, and meals done in between samples so you have as large a block of rest time in between the sets of four sampling hauls as possible.

If you were to basket sample from the first part of one haul and sample the last part of the next haul (assuming presorting is not a problem), you get a larger break between hauls while still avoiding stratification *over time*. This is not as good as sampling from all parts of *each* haul but is acceptable.

4. If you get caught in an unworkable situation you can, if necessary, skip one of the hauls in the series to be sampled but then complete the *remainder* of the sample series, counting the unsampled haul as part of the block. As in the example of a four on, one off, four on series, if the observer needs to rest for two hauls, the observer should sample four hauls, rest for two, and sample *three* hauls to complete the series.

If you find yourself on a vessel that makes few hauls/day or you don't need as much rest as your sampling scheme allows you, you should sample additional hauls as long as designated hauls are given priority. In your logbook entries record when you sample additional hauls and which hauls they were.

If you go to another vessel during your trip, continue from where you left off in the table. On a new boat you may need to watch a haul or two to adapt to a new routine. Then resume using the table. If you were in the middle of a sampling block continue with that block. If you have just finished a sampling block, or if you are in the middle of a non-sampling block, then go to next sampling block as you begin work on your next vessel.

Example: Suppose you begin following the table with haul 6 and your starting point on the table is column N row C. You leave vessel A after haul 10 and board vessel B. The first haul to come on board after your arrival is number 56 and you stay on board for 5 hauls. Using the manual example table you would sample 2 hauls, not sample 1 haul, sample 3 hauls, not sample 2 hauls, sample 3 hauls, etc. Your activity for all hauls landed while you were on board would look like this:

Vessel A		Vessel B	
3/21	Haul 6, On - Sampled	3/26	Haul 56, On - Sampled
	Haul 7, On - Sampled		Haul 57, Off - Not sampled
3/22	Haul 8, Off - Not sampled		Haul 58, Off - Not sampled
	Haul 9, On - Sampled	3/27	Haul 59, On - Sampled
	Haul 10, On - Not sampled, cut hand		Haul 60, On - Sampled
			Haul 61, On - Sampled

Now that you have an understanding of the Random Sample Tables let's move on to the break table. The break table can be used by observers on catcher/processors or motherships. It was designed to give observers a block of time off each day, in response to the difficulty observers were having on motherships and when there are many hauls or deliveries per day.

For many observers however, following the directions above to reduce sample size, plan ahead, and occasionally to not sample an "on" haul will satisfy their needs. Also, if the vessel does not fish for a certain part of each day, usually at night, or makes one long tow at night, the observer should consider that their break and disregard the break table.

If the vessel *averages* less than four hauls per day, the observer should disregard the break table but still follow the random sample table.

The break table may just be used occasionally, when needed. In this case, track each day on the break table, whether the break time is used or not. For example, if no break is taken for two days, just record the dates on two lines and use the time on the third line for a break on the third day.

The break table is made up of three columns of cells. Each cell consists of a space for the date and gives a break starting-time for each day. As with sampling data, a day is from 0000 to 2359 ALT. Beginning at the top of the table enter the date of the first day you use the Random Sample Table and check to see when you could begin your six-hour break. Work down the first column, filling in the date of each day, whether or not a break is taken, and taking six-hour breaks when needed (only one per day) using the scheduled time for that date. When you finish the first column, start at the top of the second column and so on.

DATE ____ 0400	DATE ____ 0800	DATE ____ 1600
DATE ____ 1300	DATE ____ 0100	DATE ____ 0900
DATE ____ 0400	DATE ____ 0700	DATE ____ 0400
DATE ____ 1800	DATE ____ 1300	DATE ____ 1300
DATE ____ 1500	DATE ____ 1600	DATE ____ 0500

Although neither the break nor the random sample table is particularly difficult to follow, when you put the two together things can get a little confusing until you focus on the haul retrieval time. If a break is to be taken and it is to start one minute *after* the retrieval time of a haul to be sampled, sample the haul. If a break starting time occurs one minute *before* the haul retrieval time of a haul to be sampled, don't sample, take your break. At the completion of the break period you should re-enter the random sampling table. If you are in the middle of sampling when your break starts, finish that sample first, then begin your six-hour break. **Hauls that were retrieved during an observer's six hour break continue to be counted against the random sample table.**

In summary:

1. Each day that you need to take a break, start the break after sampling is completed on hauls whose retrieval time is before the break time indicated on the break table for that day.
2. Break for six hours.
3. Sample the next "on" haul whose retrieval time is after the six hour break.

All observers are required to make a Sampling Record in your observer logbook. In your table list the haul number of each haul made, whether it was an "on" or "off" haul (that is, to be or not to be sampled) according to which column and row in the Random Sample Table, whether you were on break and whether you did or did not sample it and the start and end times of your samples. Finally, when an "on" haul is not sampled, we need to know the reason. In your final report we would like to have a written commentary on your difficulties, if any, with using this sampling scheme.

Haul No.	RST On/Off	Col/Row	Break On/Off	Sample Y or N	Sample Time Start	Sample Time End	Reason for "On" haul not sampled
34	on	H/C		Y	1630	1825	
35	on	H/C		Y	2005	2200	
36	on	H/C	on	N			Break
37	off		on	N			
38	on	H/D	on	N			Break continued
39	on	H/D		Y	0715	0930	

Commonly Asked Questions:

1) I am supposed to sample 4 hauls in a row. The third haul comes up at 1450, and I am scheduled to begin a break at 1500. Do I sample that haul? Yes, sample the third haul in that block and then take your 6-hour break. When you finish your break you will re-enter the random sampling table. To re-enter, check the fishing

schedule against the random sample table to see when the next "on" haul will be retrieved.

2) A haul is retrieved at 0945 and my break starts at 1000. According to the instructions I should sample this haul, but they don't begin processing until after the fish have set for four hours. Do I sample this haul? Yes. While you are waiting for them to begin processing you can do paperwork, laundry, eat, etc. After you complete your sampling you may begin your 6-hour break if needed or skip the break for that day.

3) Can I skip breaks and only take them on a few days when I need to? Yes. On the table though, record the date of each day whether or not a break was taken. Note: you cannot accumulate break time by skipping a day and taking a longer break or more than one break on a following day.

4) Can I sample more hauls than those indicated on the random sample table? Yes! please do! Just make sure that if you sample some "off" hauls you can do this *in addition to* the "on" hauls. *Do not switch* sampling "off" hauls for "on" hauls to make your schedule more agreeable.

5) My break is over and the haul currently being processed is an "on" haul and is about half processed. Can I sample from the remaining portion? Yes you may, if the crew does not normally presort the catch. However, this is not the best sampling because not all the catch is available. The remaining portion could be biased.

6) Suppose a break is just over but the next haul retrieved is an "off" haul, resulting in a longer break than I need. Should I stick to the random sample table and not sample? Yes, you could, resulting in a longer break than the six hours scheduled. Or, look ahead at your table and fishing schedule. If sampling an "off" haul is not going to put you in a bind, causing you to miss upcoming hauls to be sampled, please sample! We need you to sample as many hauls as possible.

SPECIES COMPOSITION OF THE CATCH

In order to study the biology of Central Bering Sea pollock, scientists need to know how much pollock is being caught, what species are caught in association with the pollock (bycatch), and in what relative quantities. Observer species composition data is used for long term stock assessment. The observer should strive for data that is representative of the catch over time by collecting random, unbiased samples of unsorted catch.

Definitions of Sampling Terms

Species composition sample - an observer sample of a trawl catch in which the observer identifies, counts and weighs species and determines the total weight of the sample.

Sample weight - the weight of catch which was sorted and sampled by the observer.

Whole haul sample - Bycatch is sorted from the entire catch by the observer. The sample weight equals the total catch weight as recorded on the Haul Summary Form. The predominant species is sub-sampled.

Partial haul sample - Bycatch is sorted, counted and weighed from a portion of the catch which is less than the whole haul. The sample weight is determined by bin volume. The predominant species is sub-sampled.

Weighed sample - The entire sample is actually weighed, no weight estimates. When using a weighed sample to determine the composition of all species, the sample weight minimum is 300 kg. The maximum is equal to the total catch weight. Because of the amount of work involved, a weighed sample size is usually smaller than sample sizes obtained using other methods.

Bycatch - any species in the catch other than pollock.

Predominant species - the species which is the most abundant in the catch - not necessarily the pollock.

Pre-sorting - removal of any catch before the point where the observer samples.

Sub-sample - A weighed sample of the predominant species taken when whole or partial haul sampling. ***Or***, it may be a portion of any larger sample, set aside for more specific data collection. Example: sub-sample for salmon scale collection or a sub-sample for length frequencies.

Species Composition Form Instructions

The Species Composition Form is for recording detailed data for each haul sampled. The observer must be careful when deciding how to sample each haul because he must be able to record an accurate sample weight. All organisms in the sample must be accounted for.

1. *Record your name and nationality and the name and nationality of your vessel.* Use the same nationality codes from the Haul Summary Form.
2. *Record the date, and haul number.* Remember that the date recorded on the Species Composition Form must be the same as the date on the Haul Summary Form. The date should be the GMT day the trawl began to be hauled in, which is not necessarily the date you sampled it.
3. *Indicate the sampling type for each sample, using:*
Codes: 1 - whole haul sample
 2 - partial haul sample
 3 - weighed sample
4. *Record each species in your samples by its scientific name and the corresponding code from the Species Code List in this section.* Every entry on the composition form must be coded from the existing species code list. If you positively identify a species which is not on the list, record and code it under the family, order, or as an "unidentified fish" and write the species name in parenthesis. (Refer to the Species Identification text on page 53) Fill out species description forms to confirm or assist with your identifications. Use the description format on page 55.

An appropriate species code can be assigned after you return. If you find a species which you cannot identify, try to preserve it and bring it back with you when your observer trip is finished. (Refer to "How To Collect Fish" on page 57)

5. *You cannot record any species more than once.* Each species may only be listed once for each haul.
6. *Salmon should be listed separately by species whenever possible.*

Sub-sampling: If large quantities of one of the salmon species are seen, it is permissible to take a random sub-sample of all the

salmon in the sample. Record the sub-sample by species. Then either count or weigh all the remaining salmon and apply an average weight (from your sub-sample) to get the weight or number, and record these as "salmon unidentified".

Make sure that no individual is recorded twice on the forms. None of the sub-sample should be reported in the larger group of unidentified individuals.

7. *Every number must have a weight and every weight must have a number.* All weights should have a well-defined decimal point as the decimal point itself will be keypunched and must be present even if the weights are not carried to a tenth or a hundredth of a kilogram (see the examples of the form). Write in a zero after the decimal point if you do not carry the weights to a tenth or a hundredth of a kilogram. Do not record any weight to more than two decimal places. If the weight of a species in your sample is much less than .01 kg, do not include the species on this form.
8. For occurrences of decomposed fish (species code 26) and/or miscellaneous items (code 27) in your samples, record the total weight of all items, not a weight by species or by individual item, and record the number of items.

Miscellaneous items are garbage, debris, fishing gear, wood, seaweed and other such items that may occur in your samples. Decomposed or waste fish are those obviously in a state of decomposition as evidenced by a breakdown of skin and muscle. Decomposing fish must be distinguished from damaged but fresh fish. Damaged fresh fish are not distinguished from undamaged fresh fish of the same species in your sample data.

9. *Indicate the sample weight for each species in the sample using a well-defined decimal point and trailing zero.* If you whole-haul sampled for the species composition, the sample weight is the same as the observer's total catch estimate. The sample weight can equal but never exceed the observer's total catch weight.
10. *Record in the space at the top of the form, any pertinent data or information that is not otherwise entered on the form. For example:*

Remember:

Avg. wt. = wt. ÷ number

Not the reverse!

If more individuals of a species were counted than could be weighed, record the number and weight of the individuals which you were able to weigh, then calculate the average weight. For example, if you were only able to weigh 500 pollock but you counted 2000, you could determine the average weight of the 500 and multiply the average weight by 2000 to obtain the total weight of 2000.

On the top lines, you can also note any unusual occurrence or situation and describe it more fully in your logbook.

11. *Complete the keypunch check (line 999 at the top of each form) by adding all of the figures in the number column and enter the sum on line 999, columns 23 - 28. Similarly, add the weights of all species in the sample and enter them on line 999, columns 29 - 37.*

Species Composition Sampling

Determination of the species composition of the catch is one of the high priority duties of an observer. When random sampling, the relative amounts of species in the sample will not necessarily reflect their proportion in the haul. However, from many samples taken within an area, a reflection of the relative species proportions over time should be apparent. Never "hand-pick" a "representative" sample based on your visual estimate of the composition. Composition samples must be collected such that every fish or organism in the catch has an equal opportunity of being in the observer's sample.

There are three different sampling methods you can use. These methods are **whole haul sampling**, **partial haul sampling** and **weighed sampling**. The method you choose is dependent on:

- the diversity and size of the catch;
- the layout of the trawl deck and sorting area and the methods used for handling the catch;
- your time and energy.

It is up to you to decide which sampling method provides the most accurate information in your situation, for any sampled haul. You may change sampling methods between hauls, as needed.

Whole-haul sampling means that the entire unsorted catch passes by you at one point, and you are able to see and remove all bycatch organisms for counting and weighing later. **Partial haul sampling** is

a variation of this method in which the observer samples a large portion of the catch and sorts it for bycatch. In a pure pollock fishery, catches will normally be whole or partial haul sampled, which allows for a larger sample. The danger is that accuracy may suffer. **Weighed sampling** is a method in which all organisms in the sample are weighed and are usually individually counted as well. Although it is an accurate method, is not as useful for large catches of pollock.

Sampling Rules



1. *You must sample unsorted catch.* For each sample, you must be present on deck as the net is emptied to make sure that the crew does not pre-sort the catch. If this is occurring, explain the problem to the captain and ask for his cooperation. Then inform the deck boss when you are going to sample. If pre-sorting continues in small amounts, ask that the pre-sorted fish be given to you to identify, count and weigh. If lots of catch is removed on deck, consider moving your sampling station up to get your sample prior to the deck sorting. This insures your sample will include all individuals caught in the haul.
2. *Strive to collect unbiased samples from throughout the catch.* Believe in scientific sampling and in the accuracy of it over a long period of time. After many samples, the level of occurrence will closely approximate the true value. Remember, your data will be combined with all other observer data from the Central Bering Sea pollock fishery.
3. *Allocate your time appropriately.* Maximize your sample size according to the amount of time you can afford for a haul. Keep in mind your schedule according to the Random Sampling Table. Remember the scope of your duties and your priorities.
4. *You cannot leave out any component of the catch.* You cannot sample for some species and not others.
5. *The weight of catch sorted by the observer is the "sample weight".* You must be present to sort, or directly supervise the sorting, of **all** of every sample. If you see or suspect that the sorting of your sample is not completely thorough, reduce your sample size and/or change your sampling situation until you can be sure that you are getting all the bycatch. Reduce your sample size if the fish passing by you are too deep, moving too quickly, or you cannot closely watch those assisting you to sort.

6. If you whole and/or partial haul sample for all species, a sub-sample must also be taken for the one or two predominant species.
7. *You cannot have two sample weights for any one species or species group.* For example, if you whole haul sample for salmon, you cannot have salmon in your weighed sample.
8. The sample is sorted according to species, and the weight and number of individuals for each group is recorded. It is best to count and weigh all of a species sorted from your sample weight, but if you cannot, you must at least count them all and weigh some of them or vice versa. *You cannot estimate both the number and the weight of any species.*

Whole-Haul Sampling - Criteria:

- for composition sampling, hauls must be fairly pure, as seen in the pollock fishery. Consider that 1% bycatch in a 50 mt haul is 500 kg or about *thirteen* 40 kg baskets of bycatch.
- you are able to collect all of the whole haul sampled species from the catch.
- the flow of fish is such that you are able to see everything in the haul; either the flow of fish is slow and controlled or the flow of fish is shallow.
- On a processing vessel, sorting the catch does not usually take more time than you can afford.

When whole-haul sampling, the sample weight is the same as the Observer's Total Catch weight from the Haul Summary Form, converted to kilograms.

When whole-haul sampling, the entire *unsorted* catch must pass by you at one point and you must be able to see and pull out all bycatch for counting and weighing later. The observer cannot weigh the whole catch but does *sort through all of it*. The observer must be present **at all times** to sort or supervise the sorting of bycatch when whole haul sampling. If processing is slow or the catch is very large, the observer may have to change to partial haul sampling if sorting the entire catch will take too much time.

Ideally, the fish flow passing by the observer would be slow and shallow to allow for the complete sorting of catch by the observer alone, but this is not always possible. If you are sorting out bycatch along with the crew, make sure the crew knows that you are sampling

(not just helping) and that you need the bycatch set aside for you. Avoid having crew simply count bycatch for you and then rely on their counts multiplied by an average weight. It is too easy for the crew to lose count, and you can't supervise what's going on in their minds. You must have direct *visual* supervision of anyone helping you to gather sampling data.

Bycatch species sorted out of the entire catch must then be counted and weighed. Record the total number and weight of each species group on the Species Composition Form. Then collect a random sub-sample of the pollock and count and weigh them. ***Take a minimum of 80 kg of fish for a single species sub-sample.*** This sub-sample is recorded as a "Weighed Sample" (code 3 under "sample Type").

The sample and sub-sample method above may be expanded for when two species dominate the catch. For example, some hauls may have a majority of pollock and jellyfish with very little other bycatch. In this case, sort the other bycatch from the entire haul and identify, count and weigh them. Also take a random sub-sample of just pollock and jellyfish together - as they occur. This sub-sample for two species must be larger. ***A subsample for two predominant species must weigh a minimum of 200 kg.*** If more than two species are prevalent in the catch, change to the Weighed Sampling method to sample for composition (see text on page 49).

Partial Haul Sampling - Criteria:

- sorting bycatch or prohibited species from the whole haul would be too much to handle or take too long because the catch is large and/or because the processing rate is slow, but you are still able to sample a large portion of the haul.
- the catches are still very pure
- you are the first person or near the first person who sorts the catch
- the flow of fish is such that you are able to see everything in the portion of the haul that you are sampling
- **you are able to get an accurate sample weight** (this will be discussed later in this section - read it carefully)

Whole haul sampling may not be possible when hauls contain a large amount of bycatch, have a very long processing time, or are very large. Sampling only a portion of the haul is an alternative. The sampling procedure is the same as when whole-haul sampling, but bycatch is collected from only a portion of the haul and your sample weight is less than the total catch weight.

Visual estimates such as "about 1/2 or 1/4 of the catch" are not allowed. Also remember, fish tend to settle into layers by shape or species in a bin, so you must try to sample different parts of the bin or hold. Individuals from all parts of the catch should have an equal opportunity of being sampled.

Refer to "Observer's Total Catch Estimates" page 26, for instructions on measuring the amount of fish in a bin.

For this method, sample weight is estimated by determining the volume of fish sampled from a bin. If the whole bin is sorted, the initial height of fish in the bin is multiplied by the bin area to determine the volume. Then multiply that volume by the density, to determine the sample weight. *When you use a partial haul sample method you must report (log) all sample size calculations.*

With large bins of fish you may sample in several periods. This is done by measuring the difference in the height of fish in the bin at the beginning of each sampling period and again at the end of the sampling period. Sum the difference in the height measurements. Multiply the sum by the area to determine the volume sampled.

$$\text{Height (m)} \times \text{floor area (m}^2\text{)} \times \text{density (kg/m}^3\text{)} = \text{sample size (kg)}$$

You cannot use this method if:

- you have not measured or verified the floor area of the bin,
- you cannot see into the bin to determine an accurate depth of fish,
- there is standing water in the bin sufficient to float the fish, or
- unknown amounts of additional fish are added to the bin during your sampling period.

On some boats the observer may have to work on the trawl deck. If the fish are dumped onto the deck for sorting, the observer might partition off a section of the catch on deck with a board or shovel, and sort, count and/or weigh all the catch in the section. On some boats the fish are dumped into compartments on either side of the trawl deck and the observer can collect his samples from these deck bins. The observer should measure the size of deck bins to determine sample size.

If small containers are used to collect fish on deck for a sample, be very careful to avoid bias in filling the containers. The best way to fill small containers is to "catch" the fish as they are flowing from one place to another by inserting the container into the flow or *diverting* the flow of fish into the container.

Once the sample has been taken, sort, count and weigh all the bycatch. The bycatch is recorded as sample type 2 - partial haul sampled. Also take at least an 80 kg sub-sample of pollock (as described above for whole haul sampling). Record this subsample as sample type 3.

Weighed Sampling - Criteria:

- you cannot whole or partial haul sample,
- all organisms in the sample are actually weighed and are usually all counted. Your sample weight is not an estimate

A weighed sample is an unbiased, random selection of organisms which are all weighed. A variety of containers may be used to collect and weigh the sampled catch: baskets, brail nets, deck bins, garbage cans, totes or hoppers. Weighed sample sizes may range from a minimum of 300 kg to a maximum of the total catch weight.

Some biases to avoid when collecting samples of catch:

1. The heterogeneity of the catch in the net - i.e., some species tend to be found at the head end of the net while other species tend to concentrate at the bottom of the codend. Therefore, samples should be taken from different parts of the trawl.
2. As the fish are dumped into a bin, or as they pass onto a conveyor belt, the physics of fish flow may cause fish to separate by size. Sampling should compensate for this.
3. Note the locations where species sorting or size selection by crew members or by machines takes place - samples must be taken before such sorting takes place.

Since observers must avoid unconscious selection for certain sizes or certain species when obtaining samples, various methods have been used to obtain samples. On some ships it may be possible to get samples directly from the codend as it is emptied. The observer should get assistance from a crewman on the deck to hold a container into the flow of fish as they fall from the net through the deck hatch.

Another good method is to hold the container where unsorted fish are falling from the holding tank to a conveyor belt, or from one conveyor belt to another. A third technique is to find or design a diverter board for the conveyor belt. This is a board hinged into the side of the conveyor belt trough capable of blocking the fish flow along the conveyor belt. This allows the catch to spill off the conveyor belt into

a container. Sometimes the boards of a fish bin can be raised, allowing fish to spill out from a lower layer of fish into a container, but this could be a size selective method.

On factory trawlers it commonly takes several hours for all of the fish to be emptied from the bins to the factory and sometimes you do not have many containers available and/or the sampling space is limited. Therefore it is recommended that you collect only two or three containers at a time and do this at intervals during the haul processing. This allows you to gather your samples effectively from different parts of the catch.

With organisms such as jellyfish it might be easiest to weigh them all together and divide the total species weight by their average weight to obtain an estimate of their number. ***At least thirty to fifty organisms must be sub-sampled for average weight.*** However, in a Weighed Sample, the weight of a species group may only be obtained by actually weighing.

Mixing of Hauls

A special sampling problem exists when hauls are being mixed and you must sample after mixing occurs. If this happens, there are at least four possible courses of action:

1. Assess whether it would be *possible* to keep hauls separate. Make a plan as to what would work for both you and the factory operation and then speak to the captain about it. If several bins simultaneously empty onto the conveyor belt from which you are sampling, ask the factory manager if he could arrange for only one bin at a time to be emptied while you are sampling.
2. If the fish from two different hauls are thoroughly mixed in the bin before you start sampling, take a larger sample (double the normal size if possible) from the combined hauls and divide the sample data proportionally by haul weight and record the data as two separate samples. Adjust the species weights as necessary to preserve their actual average weight. Haul by haul information is a convenient and necessary way of dividing up the data, but if the hauls are from the same area, vessel and time period, it is not critical that the fish are attributed to the exact haul in which they were caught.

3. You may observe layering of fish after the mixing of hauls. You possibly could see the difference in new fish versus old fish in freshness and in state of rigor mortis. Noticing this difference can allow you to sample either or both hauls and obtain discrete data.
4. If you are already sampling and a new catch is dumped on top of the one you are working on, finish your sample before any mixing can occur.

Data To Collect From Salmon

The following information should be collected from the salmon which occur in your samples:

1. *Species identification* - the five species which may be encountered are king, chum, sockeye, pink, or coho.
2. *Number of salmon* - determine numbers by species and sex.
3. *Weight* - record the individual weights if scale samples are to be taken; if scale samples are not taken of all fish, obtain the total weight by species for those fish whose scales were not sampled.
4. *Sex* - determine the sex of each salmon; only vigorous live salmon that have minimal scale loss should not be sexed, but recorded as "unknown" sex. When the observer is not sure of the sex of a salmon or does not have enough time to sex it, the sex should also be recorded as "unknown."
5. *Length* - the fork length of each salmon found in the sample is recorded to the nearest half centimeter on the Length Frequency Form, (see "Length Frequencies" in a following section). Length measurements are grouped by species and by sex, and are recorded in ascending order.
6. *Scale samples* - the purpose of taking scale samples is primarily for confirming the observer's identification of the salmon, therefore, observers should take scale samples of the first 20 salmon of each species identified during the deployment period (regardless of the number of vessels the observer was on). The scale samples and data forms will also be used for determining the ages of the salmon. Follow the collecting instructions for "Salmon Scale Sampling" on page 71. Record the specimen data

on the Biological Sample Form. Do not collect scales from salmon that are not part of your sample unless they were tagged salmon.

7. Check for *missing adipose fin*, fins that are clipped, brands, and tags. Salmon with these types of marks may also have been tagged with a coded wire in the snout. Follow the directions in the section on "Tagged Fish," page 74.

Sub-sampling salmon - The observer should seldom have to sub-sample salmon. If time does not allow the observer to gather all of the above information from each fish, numbers and weights by species should be collected from your random sample. If this does not help, reduce your sample size. Then take a random sub-sample for sexed lengths (and watch for tags). Take scale samples from each species identified, as needed.

Species Identification

All organisms which occur in your samples should be identified to the most specific taxonomic level of which you can be confident. All organisms in your samples must be recorded with a species name and code from the provided list. Pollock will constitute the greatest part of the catch in the Central Bering Sea fishery.

Pictures and descriptions of the expected species will be given to you to help you make your identifications. If you have a salmon for example, but you are unsure of the species, record and code it as "Oncorhynchus sp." rather than "unidentified fish." Better yet, record it as "Oncorhynchus sp. A," fill out a species description form, and collect a scale sample. (For species other than salmonids, you may need to bring back the whole fish. See text on collecting fish, page 57.) All similar but unknown salmon can be labeled "Oncorhynchus sp. A." If a different salmon also could not be identified, it would be recorded as "Oncorhynchus sp. B."

If you have in your sample a shark that is not Lamna ditropis, you will have to code it "unidentified fish (shark A)" as there is no code for unidentified shark on the present list. Again, fill out a species description form for identification later. If you knew that it was a sleeper shark, Somniosus pacificus, it would still have to be coded as "unidentified fish (species name)" until a new code is assigned at a later date. Your species identification would still need to be confirmed with a description form of that specimen. See page 55 .

Remember: on the Species Composition Form, a species code may only be listed once for each haul.

To verify identifications, each observer should fill out species description forms for the first sighting of any fish or invertebrate which occurs in the samples. You do not need to fill out a description form for pollock. These forms can be kept with your data so that anyone who uses your data will know exactly what species you have included on the Species Composition Form. It is important to fill out these forms if your ship catches a species not included in the code list.

Species Code List

Code	Scientific Name	American Name
01	unidentified fish	
02	unidentified invertebrate	
03	unidentified bird	
04	<u>Vampyromorpha</u> sp.	pelagic octopus
05	Scyphozoa	unidentified jellyfish
06	Decapoda	unidentified squid
07	<u>Gonatopsis borealis</u>	boreopacific gonate squid
08	<u>Gonatopsis makko</u>	mako gonate squid
09	<u>Lamna ditropis</u>	salmon shark
10	Petromyzontidae	unidentified lamprey
11	<u>Lampetra tridentata</u>	Pacific lamprey
12	Myctophidae	lanternfish
13	<u>Aptocyclus ventricosus</u>	smooth lumpsucker
14	<u>Sebastes</u> sp.	unidentified rockfish
15	<u>Sebastes aleutianus</u>	roughey rockfish
16	<u>Oncorhynchus</u> , sp.	unidentified salmon
17	<u>Oncorhynchus tshawytscha</u>	chinook salmon
18	<u>Oncorhynchus keta</u>	chum salmon
19	<u>Oncorhynchus gorbuscha</u>	pink salmon
20	<u>Oncorhynchus nerka</u>	sockeye salmon
21	<u>Oncorhynchus kisutch</u>	coho salmon
22	<u>Zaprora silenus</u>	prowfish
23	<u>Icosteus aenigmaticus</u>	ragfish
24	<u>Caristius macropus</u>	manefish
25	<u>Alepisaurus ferox</u>	longnose lancetfish
26	<u>Clupea harengus pallasii</u>	herring
27	<u>Hippoglossoides elassodon</u>	flathead sole
28	<u>Atheresthes stomias</u>	arrowtooth flounder
29	<u>Gadus macrocephalus</u>	Pacific cod
30	<u>Theragra chalcogramma</u>	walleye pollock
31	decomposed fish	
32	miscellaneous, unidentified (seaweed, garbage, etc.)	

If you have a fish in your sample or samples which is not on this list, write down the scientific name on your forms and leave the species code columns blank. A code will be assigned to the species after you return.

Species Description Form

Species Name: _____
Date of Capture: _____
Haul or Delivery Number: _____
Position of Capture (Lat. & Long.): _____
Depth of Capture: _____
Length: _____
Weight: _____

Did you bring back a specimen? Yes No

(Note: If this animal represents a range or depth extension or a record in size, bring it back for species verification.)

This form is to be filled out for the first sighting of all fish and invertebrates keyed out to species. For fish, include counts of all fin rays, standard body measurements, (fork length, head length, snout length, and caudal peduncle length) and any other pertinent measurements.

Examine the fish and record the following characters: (Note: There is variability in fish of the same species, and even between counts on different sides of the same fish. Therefore, counts on both sides might help.)

Dorsal fin spines: _____
Dorsal fin rays: _____
Anal fin rays: _____
Anal fin spines: _____
Pectoral fin rays: _____
Pelvic fin spines: _____
Pelvic fin rays: _____
Gill rakers--lower arm: _____
Gill rakers--upper arm: _____
Gill rakers total: _____

List below, the features that led you to decide on this species name. Be detailed in your description, and on the back of this form, make a sketch showing the main features.

If you are not absolutely sure of your identification, bring a specimen back or take a photograph of it.

Draw Specimen on Reverse Side

How to Collect Fish

You may be asked to collect specimens of various fish, or you may need to bring home a fish which you can't identify. Keep in mind that a large frozen specimen or a specimen collection becomes a piece of luggage, so limit the size to what you can handle. Freeze the fish quickly after deciding to collect it. Lay the fish flat and straight to freeze it. Make an identifying label and put it with (in) the fish before freezing. Fill out a Specimen Collection Form and keep that with your paperwork. When the fish is frozen, glaze and reglaze it with water two or three times. When you prepare to leave your ship, pad and package it well. While in transit do your best to keep it frozen.

Specimen Collection Form

Collector: _____ Cruise No.: _____ Vessel Code: _____

Date: _____ Vessel Name: _____

Haul No.: _____ Lat. & Long.: _____

Depth: _____ (meters) Water Temp.: _____ (degrees C.)

Collector's Identification: _____

Length: _____ (cm) Weight: _____ (kg)

Notes on in vivo coloration, unusual scale patterns or spines:

Sketch if necessary:

Identification confirmed by: _____

Date: _____

Common Name: _____

Scientific Name: _____

Comments: _____

LENGTH FREQUENCY MEASUREMENTS

The Length Frequency Form is used for recording the lengths of randomly selected pollock from your samples, and the lengths of all salmon in your samples. **Caution: On this form record only lengths which you actually measured, do not record estimated lengths.**

1. Record your name and nationality and the name and nationality of your ship, as on the Haul Summary Form and the Species Composition Form.
2. Record the date. This should be the same date as on the Haul Summary Form for the haul number. Start each day's measurements on a new side of the two sided form. Use both sides of the page.
3. Record the scientific name and the associated species code from the same code list as used for the Species Composition Form.
4. Record the haul number in columns 17-19. All length frequency data must have a haul number assigned to it.
5. Record lengths of pollock or salmon by sex. If no sex is determined or the immaturity of the species makes sex identification impossible, use code "3" for unknown.
Codes: 1 - male
2 - female
3 - unknown sex
6. The size group is the length measurement to the nearest five millimeters. Lengths from 0-5 mm are rounded down to 0, and lengths from 5-10 mm are rounded down to 5. For example, if the fork length of a fish is 426 mm, it would be recorded as 425 mm on the form. Another fish measuring 453 mm would be recorded as 450 mm.

Record sequential data horizontally across the form. List lengths from the smallest to the largest within a species/haul/sex designation. Record the size groupings in the shaded columns labeled "Length."

7. The frequency is the number of fish observed in each size group. Include a size group only if there is a frequency of one or more. The frequency is recorded in the columns labeled "Number."

8. Start a new row each time there is a change in sex, haul number, or species; or when there are more than seven sizes in a group.
9. In the "Sum Of Row" columns 21-24, simply add all of the numbers in the row (size group and frequencies together) and enter the sum. Be sure to check your work by adding it again to verify your sum.
10. Note that more than one species can be recorded per page as long as each species is identified by name and code. Skip a line between species.
11. Note that more than one haul can be recorded per sheet as long as the hauls all ended on the date written at the top of the page. Start each day's measurements on a new side and use both sides of the form.
12. Leading zeros should appear in the month and day only (columns 11 and 13 only, as needed). No leading zeros should be written in species code, haul number, size, or frequency columns.

Length Frequencies of Salmon

All observers should take length frequencies of all salmon found in each sample except when there are too many salmon to sex, weigh and measure in a reasonable length of time. For sub-sample guidelines, refer to "Data To Collect From Salmon" on page 51. A sub-sample should be a random sample as found in the catch. Do not select a single salmon species for subsampling.

Length frequencies are recorded by species and by sex. Do not use the species code for "unidentified salmon." Cut open salmon to determine the sex unless it is vigorous and has minimal (less than 10%) scale loss. For help, see "Sexing Fish" on page 67.

Length Frequency Sampling Method

The length and age data from observer samples will be used to determine the relative abundance of each year-class of pollock. Length frequency data provide information on abundance of fish of each size category while otoliths (ear bones) are read to determine the corresponding age.

All observers are asked to take length frequencies. The fish to be measured may be collected during or after sampling, or from an unsampled haul, as long as they are randomly gathered. You should try to take length frequencies of at least 200 fish every day. The day's length measurements may all be taken during **one** sample period or lengths may be taken from **several** sample periods to ensure that measurements are representative. It is important, however, that no sample is selected on the basis of size.

Length frequencies are taken from fish which are collected in a random, non-size selective manner during your species composition sampling. If you wanted to sample 200 fish for length frequencies and the sample you set aside only has 192 fish, don't collect another eight fish. It is too easy to bias your sample by "picking" them out in an inappropriate manner.

Determine the sex of all the pollock you have set aside for length measurements. Instructions on sex determination follow on page 67. Separate the fish into containers according to sex. If you are unable to determine the sex of some fish (usually the small ones), separate them into a third group to measure. Their lengths will also need to be recorded and sex code "3" (unknown) recorded.

Next, set up a measuring board, and record the haul number, date, and species name. Observers must keep length frequency data for each tow and each species separate. Record data from different hauls on different length measuring strips.

Take one of the containers of sexed fish. Note whether the fish are male, female or of unknown sex. Position each fish on the measuring strip with jaws closed, snout against the end, dorsal surface away from you, and the fish body flat and straight. Spread the caudal fin with your hand to see the tips of the caudal rays at the fork or midpoint of the fin's posterior margin. Fork length measurements should always be taken, even if the tails are ragged and the exact location of the fork has to be estimated.

With a pencil, place a stroke or punch a hole on the strip in the space where the fork or midpoint of the tail is. If the fork of the tail lies on a line, reposition the fish and check it again. If it is still on the line, record the length in the smaller (shorter), adjacent length space. After recording a measurement on the strip, some fish may be set aside for otolith and/or scale sampling. Refer to "Collecting Otoliths" or "Salmon Scale Sampling" in the following section.

When starting to measure another container of sexed fish, verify their sex and make sure you are recording their lengths on the appropriate part of the strip. At the end of sampling, the number of pencil strokes/hole punches per sex, per length spacing will give the size group's frequency by sex.

BIOLOGICAL SAMPLING

The Biological Sample Form is used for recording specimen information concerning individual fish. It will most often be used in recording the sex, length, and weight of fish from which you have collected scales, otoliths, or other biological structures. It is also used to record pollock maturity. It is the record of associated data which must accompany scales of salmon caught incidentally as well as the otolith collections of pollock which you may have.

1. Record your name and your vessel's name. Circle the appropriate nationality code for each. Enter the date. Start each day's measurements on a new side.
2. Leading zeros should appear in the month and day only (columns 11 and 13) as needed.
3. Record species name, species code, haul number, and sex code for each fish. Use the same species and sex codes as on the Species Composition and Length Frequency forms.
4. Record the specimen type that is being collected:

Codes: 1 -- otoliths
2 -- scales
3 -- other structure

5. Record the sampling system that was used: (you will be told which sampling system to use before you go to your ship)

1--stratified random--This is the most common system for collecting otoliths in the U.S. Observer Program. The fish are obtained from your length frequency samples and a tally sheet is used to ensure that structures are obtained from no more than 5 fish per 5 mm size and sex group.

2--systematic--In this system, although the fish may be from your length frequency sample, no stratification is made by size and sex. Instead, you may be instructed to take structures from every eighth, tenth, fifteenth (or other) fish. Salmon scale samples are taken from all the salmon in your composition sample. Code these samples as systematic.

BIOLOGICAL SAMPLE FORM

PAGE 1 OF

OBSERVER NATION OBSERVER NAME Example

1 2 3 4 5

VESSEL NAME

1 2 3 4 5

CRUISE #	VESSEL CODE	YEAR	MONTH	DAY
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

SPECIES NAME	SPECIES CODE		HAUL NUMBER	SEX CODE	SPECIMEN NUMBER	SPECIMEN TYPE	SAMPLING SYSTEM	LENGTH	WEIGHT (kg)	MATURITY CODE	REMARKS
	15-16	17-19									
<i>O. tshewytscha</i>	17	174	1	1	21	2	26	27-30	31-34	35	
		176	1	2	2	2		830	6.31		
			2	3	3	1		700	4.30		
			2	4	4	1		520	2.10		
			2	5	5	1		565	2.90		
			2	6	6	1		675	2.90		
<i>O. tshewytscha</i>	17	176	2	2	21	2	26	27-30	31-34	35	
			2	3	3	2		680	3.62		
<i>T. chalcogramma</i>	30	176	1	1	21	1	26	27-30	31-34	35	
			1	2	2	1		320	.80	2	
			1	3	3	1		400	.95	2	
			1	4	4	1		420	.96	3	
			1	5	5	1		330	.80	2	
			1	6	6	1		350	.86	2	
			2	7	7	1		345	.91	2	
			2	8	8	1		350	.94	1	
			2	9	9	1		330	.80	2	
			2	10	10	1		435	.96	2	
			2	11	11	1		345	.92	2	
			2	12	12	1		380	.88	3	
<i>T. chalcogramma</i>	30	176	2	1	21	1	26	27-30	31-34	35	
			2	2	2	1		340	.82	2	

6. The specimen number is the identifying number on the vial, envelope, or other container with the specimen. There should not be any duplicate specimen numbers within a species. Maintain a separate numbering sequence for each species, starting with "1." The specimen numbers should be listed in sequence.

7. It is best if the specimen data are grouped by sex on the form. See the example form.

All salmon species can have consecutive specimen numbers, but they should be kept separate from the pollock specimen numbers. See the example form.

8. Record the length of the fish to the appropriate 5 mm group.

9. The weight is to be filled out to two decimal places. Add trailing zeros where necessary.

10. If you are requested to record maturity stage, record this in column 35. An appropriate maturity scale for the pollock is included at the end of this section on page 73.

11. The space to the right of maturity stage is for the age readers to complete. These spaces should be left blank unless you note something extraordinary about an individual fish, then you may write your comments small enough to allow the age readers to record their remarks also, if necessary.

12. Data from several hauls can be recorded on each page. If more than one haul is recorded per page, the hauls must occur on the same date on the Haul Summary Form. Begin a new side only when all lines are filled, or when you are starting a new day.

13. If you board another ship before completing a collection, you can continue with the same sequence of specimen numbers, but keep separate sets of Biological Sample Forms for the different vessels.

14. If, for some reason, some preservative other than ethyl alcohol was used (such as rubbing alcohol) for preserving otoliths, note the preservative at the top of the first page of each set of the Biological Sample Form.

How to Sex Fish

Pollock:

You should be able to determine the sex of pollock easily with a little practice. In determining sex, it is generally easiest to start with large, mature fish and work down in size to small, immature specimens. Thoroughly dissect a few pollock and identify the various internal structures so that you know what you are looking for.

The gonads of pollock are found directly above the vent near the top of the visceral cavity. An easy way to find the gonads (with a little practice) is to slit the stomach open near the vent, but do not cut through the vent. Then use your thumb to scoop the viscera out of the visceral cavity. With a little practice, the gonads can be exposed for examination on the back of your thumb.

The ovaries are paired bags or sacs which are typically pink or orange in color and slightly translucent. When immature the sacs may be clear but they can be distinguished from testes or other organs by shape and position. When the ovaries are mature they tend to be bright orange. They will often nearly fill the posterior end of the visceral cavity and you should be able to see the eggs inside the ovaries. The ovary sac may or may not have black and white blotches on it.

The testes look very different from the ovaries. They are always opaque. They are in the same location as the ovaries but when immature, they will only be a thin filament with a tiny ruffled edge that is attached to the vent. In this stage, the testes are very small and must be looked for carefully. As an immature male pollock begins to develop, the lower side of the filament can be seen to have very small and fine convolutions. When immature, the testes will be dark pink due to the ample blood supply. Then, their color turns near white tinted with pink as milt develops. As the fish matures, the lower edge of the testes fills with milt and the convolutions will be thick, opaque and white, filling the inside of the fish.

Salmon:

The gonads of salmon are thin, clear filaments which are found along the top of the visceral cavity just below the backbone. Salmon gonads, unlike other fish, will be found near the anterior (head) end of the visceral cavity.

Sexing salmon is relatively easy. Even very young females produce eggs. To sex the fish find the clear tissue of the gonad and look for the presence or absence of the relatively large, round, orange eggs. If eggs are present then the fish is a female. If eggs are absent then the fish is a male.

Collecting Otoliths

Many observers will be asked to collect otoliths (ear bones) or other structures from pollock. Each observer will be instructed individually on what to collect and how to collect it. These are general instructions on how to collect otoliths from pollock.

Random Stratified Otolith Sampling

Otoliths, or fish ear bones, are collected from a stratified sample of the catch for determining age. These are read in a similar manner as tree rings to determine age. The fish from which you take age structures are a sub-sample of those in your length frequency sample. A "random stratified" sample is a sub-sample, chosen according to length, taken from the randomly selected length frequency sample of fish.

A maximum of five pairs of otoliths per sex for each 5 mm length group are to be taken for this type of collection (5 males and 5 females of each size group). Do not be concerned if after completing your collection you do not have a complete set of five pairs of otoliths per sex for each length group that you observed. It is expected that you will have only one or two samples from fish whose lengths are at the extremes of the size range you see. The object of this collection is not to complete the 5/size/sex categories on the tally sheet or to fill all the containers. The object is to obtain age structures from most of the commonly observed length groups in the length frequency collection so that age and length information can be used to evaluate the status of the fish populations.

Systematic Otolith Sampling

If you are requested to collect otoliths using this method, you will be instructed on which fish to collect. The otolith collection will also be a sub-sample of your length-frequency sample. The description of this method can be found in the instructions for filling out the Biological Sample Form.

Recording Collection Information

Otoliths are always collected while taking length-frequency measurements by sex from pollock. After taking the length measurement, if the fish is of a size and sex needed, weigh the fish with a scale. Record weight, sex, and length along with the container number in which the otoliths are placed. The otolith containers are to be filled in numerical order and the sexes should be grouped. A running tally of your otolith collection helps you keep track of what sizes and sex of fish are needed for your collection. A cumulative (running) tally should be maintained for all samples.

Running Tally								
mm	M	F	mm	M	F	mm	M	F
250			355			460		
255			360			465		
260			365			470		
265			370			475		
270			375			480		
275			380		1	485		
280			385			490		
285			390			495		
290			395			500		
295			400	1		505		
300			405			510		
305			410			515		
310			415			520		
315			420	1		25		
320	1		425			30		
325			430			35		
330	1	1	435		1	40		
335			440			45		
340		1	445			50		
345	1	1	450			55		
350	1	1	455			60		

You will be instructed on the total number of pairs of pollock otoliths to collect. It is best to spread the collection out by limiting the number of fish sampled each day. The collection should be made over the duration of your sampling time on one boat, not in one or two days.

It is very important to identify the otoliths being collected carefully. A mistake in the numbering sequence or procedure used to relate the

otoliths to associated biological data can make a collection useless. If you have collected less than 50 otoliths from pollock and you must disembark your vessel and move to a new vessel, you should dump the otoliths which you have already collected and start over on the new ship.

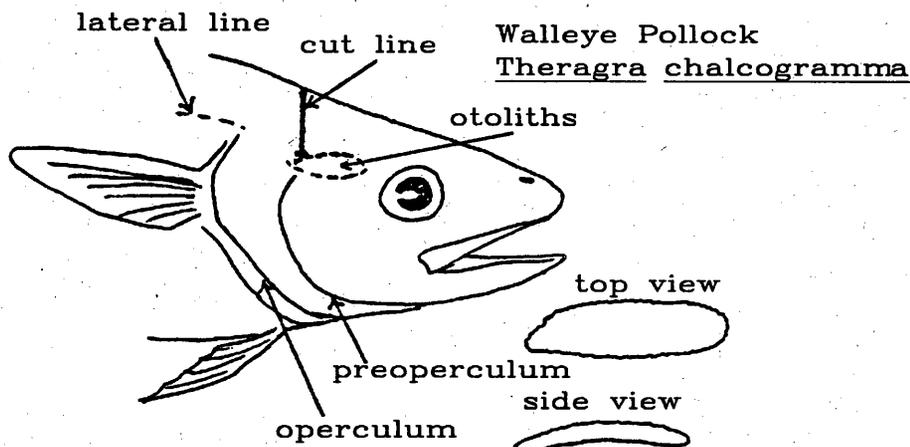
Otolith Removal

The largest pair of otoliths are located ventrally and to either side of the brain tissue, about one eye diameter behind the eye in most fishes. Refer to the diagram later in this section. There are three common methods of cutting into a fish's head to remove the pair of otoliths. The easiest method to use in locating and removing otoliths is to make a vertical cut down through the top of the head to the location of the otolith pocket. This point is located by this simple technique: On the side of the fish's head, if you were to make a hypothetical extension of the lateral line and of the curve of the preopercular bone, determine the point at which these two lines would meet. Cut down to that point.

Grasp the fish firmly by putting thumb and forefinger into the eye sockets. Use even pressure on the knife as you cut through the bone of the head. Pay attention to the amount of pressure you are required to apply to make this cut. As soon as the cutting gets easier, ease pressure on the knife or you will slice through the otoliths. Stop cutting, put the knife down and break the head open. If you have cut

to the correct point, the otolith cavities (one on each side of the brain) will break open and expose the white, calcareous otoliths. They are then easily picked out with forceps and should be wiped clean before storage.

Location of Pollock Otoliths



Approximate location of the otoliths (sagittal) and the cut for the removal of otoliths from pollock.

Another method is to make a horizontal cut, in an anterior to posterior direction which cuts off the top of the head. This can be done to expose the otolith cavity. This cavity can also be reached by going into the back of the mouth with a pair of forceps or scalpel and piercing up through the roof of the mouth.

Remove the pair of otoliths from each fish. Clean the otoliths by rubbing them between your fingers in water, or on a wet sponge or cloth, to remove slime and tissue, and place them in the container. Place one set of two otoliths in each container. If you use vials with caps, fill the vial half full with a solution of 50% ethyl alcohol and 50% water and cap it. At the end of the measuring period, you should have a complete record of species name, haul number, otolith number, and all corresponding sex, length, and weight data.

Salmon Scale Sampling

For salmon the scale is the preferred structure for determining age. Scale samples should be taken from the first 20 of each species of salmon present in your samples. Do not collect scales from salmon that are not part of your samples unless they are tagged salmon.

As there is a high chance of obtaining regenerated scales from salmon, try to take samples from both sides of the fish to increase the chance of getting fully formed scales. A minimum of five good scales from each fish must be collected. Place salmon scale samples in small paper envelopes. Try to smear or spread out the scales inside the envelope so that they will not clump together. Then, record the following information on the outside of the envelope: date, haul number, species scientific name, sex, length, weight and scale zone. You can make envelopes with paper and tape or glue.

SPECIES	<i>O. tshawytscha</i>	SPECIMEN NO.	4
HAUL/BET	176	DATE	08/16/97
FORK LENGTH	565	SEX	Female
WT.	2.90	MISSING ADIPOSE? Y or N	(N)
SCALE ZONE	A	CRUISE/	
		VESSEL CODE	

Directions for collecting scales:

1. Rinse the fish off and/or lightly wipe the area to be sampled with a wet sponge, paper towel, or cloth. This is to minimize contamination of the sample with scales of other fish and to remove slime which can cause scales to rot.
2. Examine the fish and select zone A, B, or other. *Record the zone on the envelope.* "A" is the preferred zone, "B" is next in preference. Refer to the figure on the next page (Location of Preferred Scale Sampling Zones"). When there are no scales

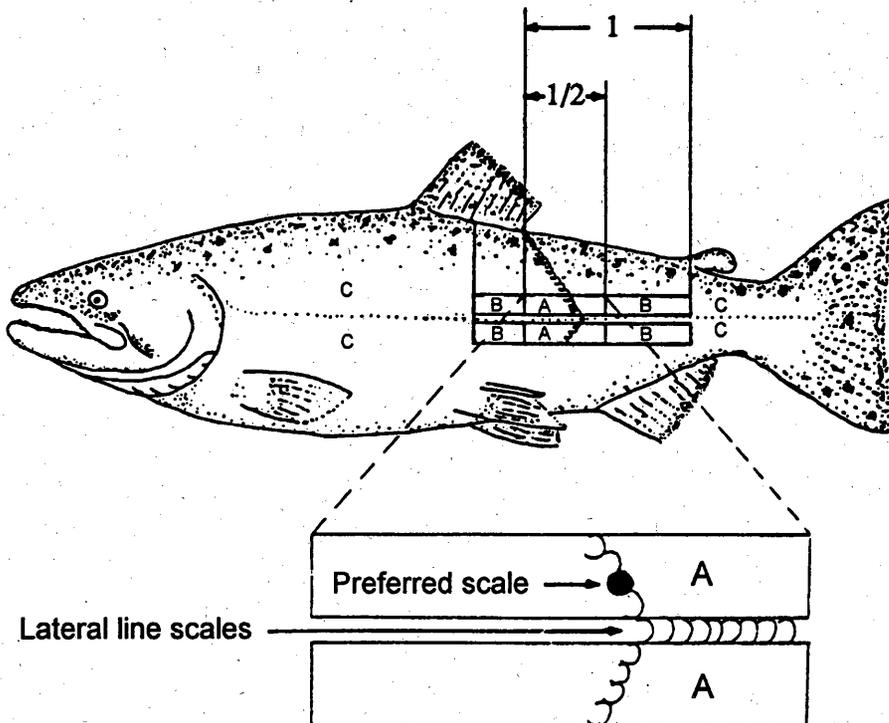
available in either zones A or B (on either side of the fish) then another area may be used.

3. Pluck salmon scales out with forceps so as to minimize the amount of accompanying mucus.
4. Wipe off, inside the envelope, 15 to 20 scales that adhere to the forceps. Collect a minimum of five scales. Ensure that samples are clearly labeled and all pertinent information is recorded.
5. Remove excess scales from the instrument before sampling the next fish.

It is recognized that strict adherence to the methods will sometimes be impossible or impractical. Keep a record of the deviations from instructions so that the effect can be evaluated.

LOCATION OF PREFERRED SCALE SAMPLING ZONES

(Do not take lateral line scales)



Follow the diagonal scale row from the posterior insertion of the dorsal fin to the lateral line of either side. On the second scale row up from the lateral line (on the diagonal) are the preferred scales.

Pollock Maturity Description

Males

Gonad Code	Condition	Description
1	Immature	Testes thread-like, contained within a transparent membrane.
2	Developing	Testes uniformly ribbon-like. Surface of testes appears smooth and uniformly textured.
3	Mature	Testes large and highly convoluted; sperm cannot be extruded. Body wall incision causes gonads to be expelled from opening.
4	Spawning	Testes milk freely or extrude sperm when compressed.
5	Spent	Testes large - but flaccid, watery and bloodshot.

Females

Gonad Code	Condition	Description
1	Immature	Ovaries small, transparent and tapered.
2	Developing	Ovaries tapered, forming two distinct lobes having well developed red blood vessels. Ovaries may be partially granular (some distinct ova).
3	Mature	Ova distinctly visible but cannot be extruded when ovaries are compressed. Ovaries are two large, distinct lobes. Body wall incision causes gonads to be expelled from opening.
4	Spawning	Ova extruded when gonads are compressed or ova are loose in ovaries.
5	Spent	Ovaries are large but flaccid and watery. Ovaries may contain remnants of disintegrated ova and associated structures.

Tagged Fish

Collecting and returning tags is an important way to help fishery research. If you should find a tagged fish while you are sampling, or if a crew member brings you a tagged fish, return the tag, along with all pertinent information, with your data at the end of your cruise. Tags from cod, pollock, and other fish will then be forwarded to the appropriate tagging agency. Pertinent information should normally include:

1. Tag or tag serial number.
2. Scale and/or otoliths for age determination.
3. Fish length (in mm if possible).
4. Fish weight (in gm if possible).
5. Sex and maturity of gonads (immature, mature, spawning).
6. General appearance (poor body condition, good body condition).
7. Condition of tagging wound (healthy healed tissue, open wound, etc.).
8. Time and date of capture (GMT).
9. Capture location (latitude and longitude).
10. Capture depth.

Tags are usually located on the dorsal surface of the fish, or on the gill cover. Tags can be of the anchor, spaghetti, or modified disk variety. Some fish may be tagged twice.

Some agencies tag salmon by inserting a coded wire into the snout of fingerling salmon. These wire-tagged salmon are marked by clipping their adipose fins. If you find a salmon missing an adipose fin, check to see whether it is missing any other fins, collect a scale sample, record the important data, and in addition, weigh the gonads. Remove the snout by cutting well *behind the eye*, place the snout in salt, and seal it in a plastic bag. After a few days, drain off any accumulated liquid and re-salt the snout. Repeat the draining and re-salting as needed.

TAGGED FISH INFORMATION FORM

Cruise No.: _____ Vessel Code: _____ Observer Name _____

Ship Name: _____

Permit Number: _____

Captain (or reward recipient's) Name: _____

Address: _____

Species: _____

Tag Prefix (often a two letter code) and Serial No.: _____

Tagging Agency (circle one): Seattle Auke Bay Nanaimo Shimizu IPHC Other _____

Time and Date of Capture: _____

Capture Location (lat. & long.): _____

Sex and Maturity of Gonads (immature, mature, spawning): _____

Length (fork length in cm): _____

Affix the tag or
vial here (with tape):

Weight (total wt. in kg): _____

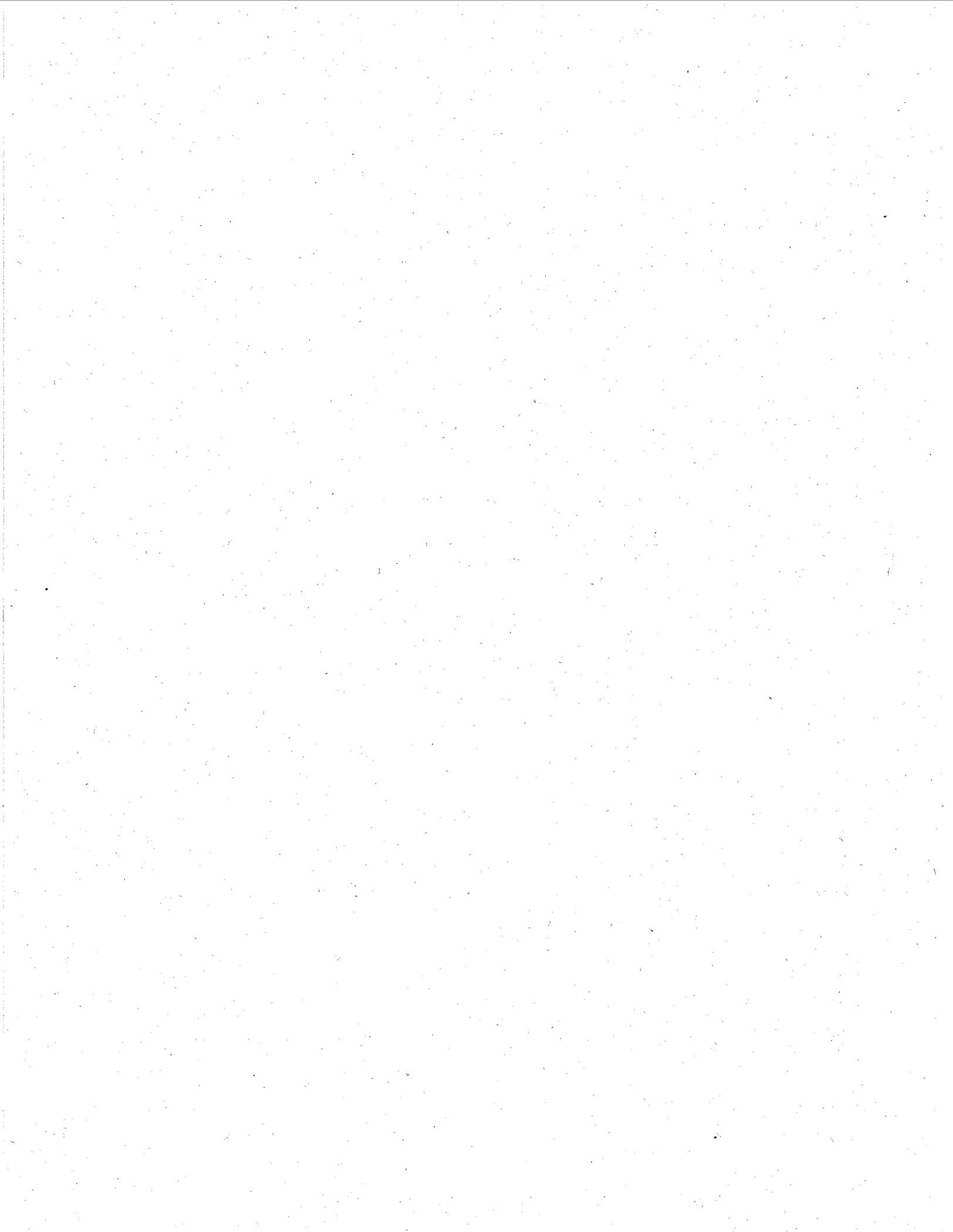
Capture Depth (fathoms): _____

Vessel/Gear Type: _____

General Appearance (poor body condition, good body condition):

Condition of Tagging Wound (healthy healed tissue, open wound):

Other Comments:

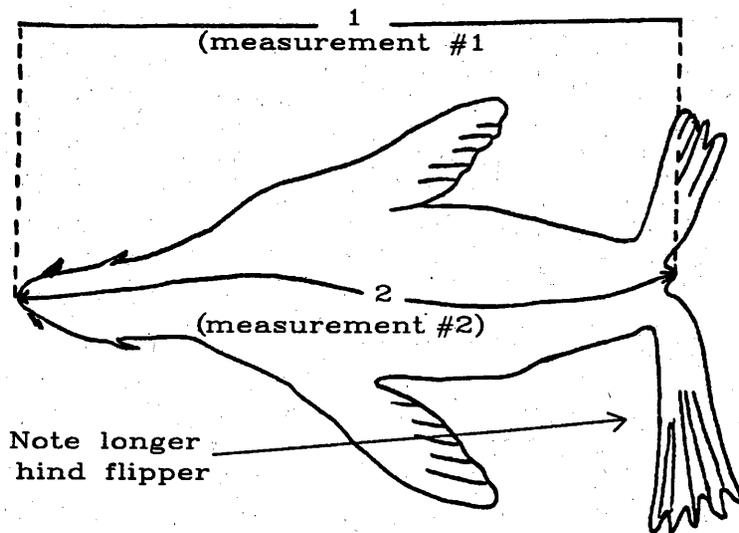


MARINE MAMMAL INCIDENTAL CATCH DATA

Observers should record any incidental catch of marine mammals. While watching the retrieval and dumping of sample hauls for presorting, you will also observe whether or not a marine mammal was in the catch. Marine mammals, such as sea lions, tend to congregate around codends being brought in.

If a marine mammal is caught in the net, describe identifying characteristics of the animal in your logbook. Don't forget to record the date, haul number and vessel position. Is it dead or alive? If alive, is it in poor condition or will it probably survive? Describe any injuries. If the animal is dead, also try to determine its sex, measure its length, and collect one or both upper canine teeth of pinnipeds.

Length Measurements of Seals and Sea Lions



Upper half of the diagram is a Stellar Sea Lion, the lower half a Northern Fur Seal.

Standard Length (measurement #1) is the straight-line distance from the snout to the tip of the tail flesh on the unskinned body, belly up, ideally with the head and vertebral column on a straight line. If rigor mortis has set in, then this measurement probably cannot be taken and measurement #2 should be taken.

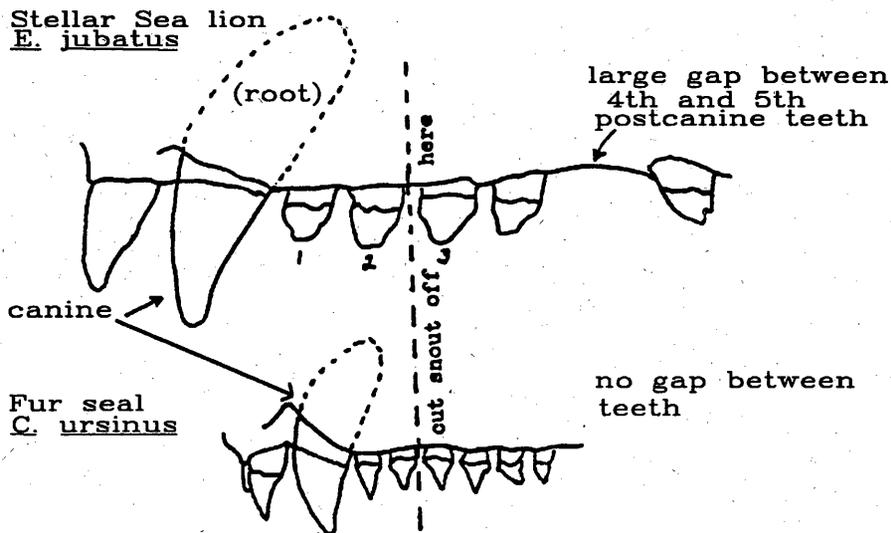
Curvilinear Length (measurement #2) is taken when the seal cannot be stretched belly up, as when rigor mortis sets in, or is too heavy to

be moved. It is the shortest surface distance from the tip of the tail flesh along the back, belly, or side. Record the type of measurement taken. Seals and Sea Lions are usually measured with a flexible tape.

Collection of Sea Lion and Fur Seal Teeth

The procedure in collecting a tooth from a seal or a sea lion is as follows:

1. Skin and cut off the snout, taking care not to damage the root of the canine tooth.
2. To insure that the entire canine root is collected, the snout should be cut off between the 2nd and 3rd post canine teeth (see figure).
3. **Methods of preservation:**
 - a. It is probably easiest to triple-bag the specimen and either freeze or salt the snout to preserve it until it can be brought back from sea. Marine mammal scientists will extract the teeth for study.



Outline of sea lion and fur seal teeth.

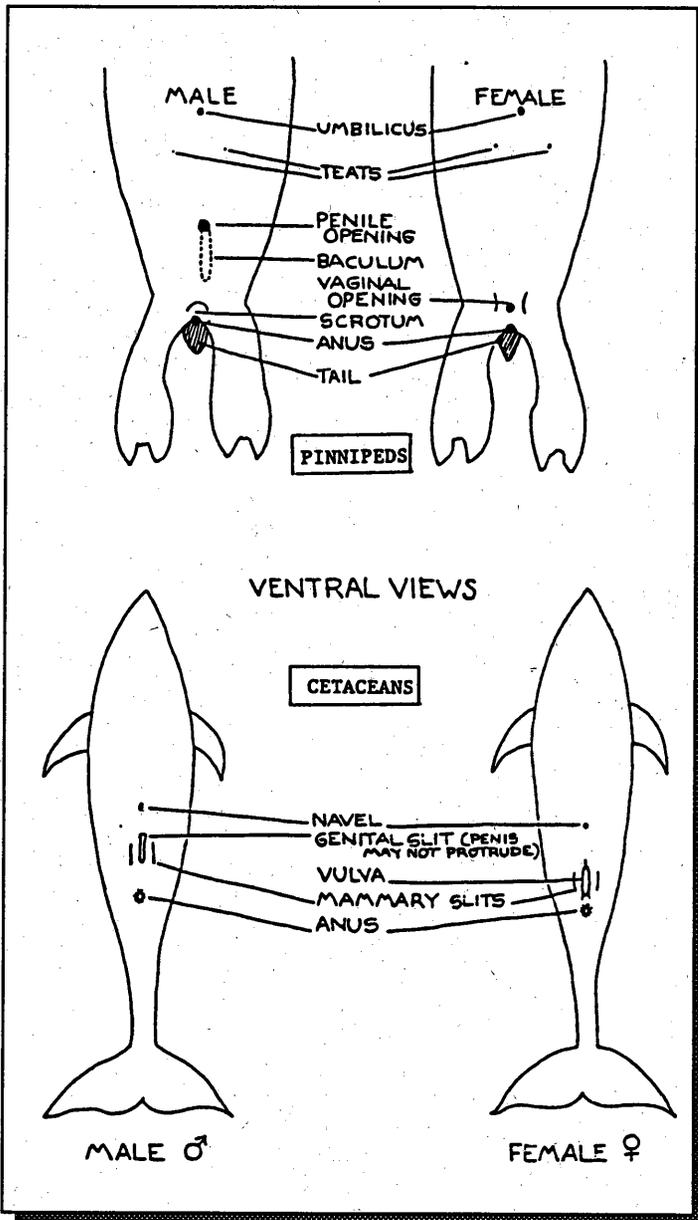
- b. Alternatively, you may be able to arrange to boil the snout (suggest: outside, on a hot plate, in a non-food pot) until no more flesh remains on the jaws. The jaws can then be stored dry until

they're turned in and the teeth will be safely extracted by the Marine Mammal Lab for study.

c. Or, boil the snout until the tooth can be easily pulled and removed. **Do not** forcibly twist the tooth when removing; twisting will break the tooth.

4. **Do not** preserve the snout in formaldehyde.

Sexing Pinnipeds and Cetaceans



In cetaceans, the distance between the anus and the genitals is greater in males.

Otherwise, the sexes appear similar because males have external teats, and females have enlarged clitori.

If possible, take a photograph or make a drawing.

LOGBOOK, CHECKING DATA, AND FINAL REPORT

Logbook Entries

Observers should try to keep a record book for notes and data not included on the forms. Record in this book your catch volume measurements and calculations and density sampling data. Include in the book anything that you may later want to include or summarize in a final report, anything unusual that occurs on the cruise, or anything else that you feel may be of interest. Appropriate entries include:

Why you chose your sampling method,
any changes in sampling procedure,
sampling problems,
calculation of codend or bin dimensions and densities and any
other calculations for total catch weight.

Descriptions of how catch estimates were obtained should be recorded here.

Short comments on hauls sampled can go in the lines at the top of the Species Composition Form, but additional explanations on anything unusual, such as a high percentage of jellyfish in a tow, or comments on hauls not sampled, can be entered in the logbook.

Note details on factory processing, or observations on the biology of pollock.

You cannot always rely on your memory of details of events, so it is important that they be written down as soon as possible. If you write a report upon your return, your original notes will be very helpful to you. Any events that are recorded should be in chronological order. Please record your name, vessel name and dates aboard your vessel on the first page inside the logbook.

Checking Your Work While at Sea

When you return from sea you will give all your data to fisheries scientists who will analyze it. They will be studying the biology of pollock and trying to learn more about the quantity of pollock in the Central Bering Sea. The scientists must be able to trust that your data are complete and correct because they may not have the opportunity to discuss your methods with you. There are many things you can do while at sea to make sure that your data are complete and correct.

1. *Check your forms on a regular basis* while you are at sea. Your manual should be your constant companion while you are doing paperwork. Do not assume that you remember everything that was taught in your training class. Consult your manual and be sure that you are right. Constant checking of your work will insure that the data you bring back with you will be useful.
2. *Use a logbook.* In it you will want to keep notes, records, calculations, diagrams, etc. Then you will have all the information you need to write a good final report. On the cover or first page of your logbook write your name, your ship's name, observer cruise number, and the dates you were aboard your ship.
3. *Have all forms completed* when you come back from sea. These are the Haul Summary Form, Species Composition Form, Length Frequency Form and Biological Sample Form.

Other items you may bring back:

- Gear diagrams
- Species Identification forms
- And, if applicable:
 - Salmon scale samples
 - Otolith collections
 - Specimen collection forms
 - Tagged fish forms with fish tags
 - Salmon snouts
 - Sea lion or seal teeth
 - Other biological specimens

Check all of your data forms carefully. If you make one correction be sure to think about what other data might be affected by the change, and carry the correction through to the end. Any change you make on a form may cause changes on other forms, so you must think through all the changes you make.

You should try to check your forms at least once per week. When you do check your data only look at a few pages at a time. This will insure that you maintain your concentration and that you will notice any errors you have made. There is a list at the end of this section of common mistakes observers make when filling out forms. You should read this section and become familiar with the common errors so that you can avoid making them. If you have questions, consult the manual to find the answers. If the manual does not help you, try to contact your lead observer, if you have one.

Remember that if you were on more than one ship that the data from each will need to be kept separate. Do not mix the data together; number the pages in sequence for each vessel - NOT for your entire trip. In addition, changing over to a new year requires new page numbering even if you remain on the same vessel.

Items to Check on All Forms:

- Your name and ship's name must be written on at least the first page of each type of form for each ship.
- Make sure the pages are numbered properly with no skipped numbers and no duplicate numbers. If you have a page with data on one side and blank on the other, the blank page may have a page number or not at your discretion.
- Every page must have a cruise number and a vessel code.
- Every time there is a decimal point printed on the page there should be two decimal places written in behind it. On the composition form you can record one or two decimal places for species weights at your discretion.
- Be sure that your handwriting is clear and legible. Your data will be studied by people who may not be able to ask you what you have written.

You can help the people who will use your data if you make notes on your forms. Notes should be made any time you have something that is unusual or that might need an explanation. There is space on the top, bottom, and edges of the forms to make notes. Remember not to record notes in data recording areas. The notes you record will enable the people who work with your data to understand what your data means without the need to talk to you. Notes may cover any topic, such as sub-samples, long fishing times, missing data that you could not obtain, and other items.

Haul Summary Form Check:

The Haul Summary Forms are often the ones with the most problems. Look them over carefully. Question anything that seems incorrect with the ship's officers while at sea. Check the Haul Summary Form for:

- An entry for every day, whether fishing or not. For non-fishing days at sea, make a note after the noon position giving the reason why the ship did not fish.
- Haul numbers must be in consecutive order. Record haul number "0" for all non-fishing days.
- There can be no duplicate haul numbers.

- There can be no missing data in a line, except possibly haul speed or observer estimate of total catch.
- There can be no decimals except those printed on the page. The exception is the average speed where you may write in a decimal. Record depths as whole numbers.
- You must record positions for all hauls and non-fishing days.
- Check that there are no large changes in positions within small amounts of travel time.
- There can be no recorded minutes in positions or times larger than 59.
- There can be no overlapping "nets at depth" and "begin retrieval" times.
- Retrieval times of 0000 GMT are attributed to the next day.
- A vessel estimate should be recorded for every haul. Record observer estimates when made.

Species Composition Form:

Be sure that there are:

- The correct dates from the Haul Summary Form for the haul numbers sampled.
- Species names which match your species codes.
- No duplicate species codes.
- Weights for every number of fish and a number of fish for every weight listed.
- At least one decimal place behind a distinct decimal point for every weight.
- Sample and species weights are in kg.
- Necessary calculations and sub-sample data recorded at the bottom of the page.
- Data recording check sums at the column tops.

Length Frequency Form:

On this form there must be:

- The correct date from the Haul Summary Form for the haul numbers recorded.
- Matching species codes to species names.
- Species name, species code, sex and haul number for every line of data.
- No species with a greater total number listed than is on the Species Composition Form in whole haul sampled data.
- No decimal places.
- "Sum of Row" filled out for each line.
- Lengths recorded in ascending order. No lengths with a frequency of zero.

- Lengths must end in "0" or "5."
- Sex codes recorded for every species, on every line.

Biological Sample Form:

Check each page for:

- Weights and lengths that are in relation to each other.
- All specimens have a species name, species code, haul number, sex code, a specimen number, a sex, specimen type, sampling system, length, and a weight.
- Each species must be grouped separately on the page.
- No duplicate specimen numbers for the same species.
- Lengths must also be recorded on the Length Frequency Form.

Cross Checking:

A very important part of checking your data is cross checking one form to other forms that have the same data. Make sure that no hauls are listed on different days on the different forms. The haul date must always be the day when the net was brought on board the ship, not necessarily on the day when you did the work.

If you have salmon in your samples you will need to match the weight data on the Biological Sample Form to the weights on the Species Composition Form.

The lengths on your Biological Sample Form should match lengths on your Length Frequency Form for the same species in the same haul. All of the lengths on the Biological Sample Form must be present on the Length Frequency Form.

If you took otoliths be sure that the haul numbers for the otolith collection correspond to the hauls from which you recorded lengths on your Length Frequency Form.

The Most Common Mistakes on Data Forms

Haul Summary Form:

1. Latitude, longitude, or nets at depth/begin retrieval time recorded with greater than 60 minutes.
2. Writing "2400" for midnight instead of "0000".
3. A haul retrieved at 0000 attributed to the previous day.
4. Not recording the GMT noon position under "Haul Position" on non-fishing days.
5. Overlapping haul times, for example recording a "nets at depth" time which is earlier than the "begin retrieval" time for the previous haul.
6. Recording catch weight to other than two decimal places.
7. Large changes in position which would not be possible during the time recorded.
8. Leaving haul number blank on non-fishing days is incorrect; record "0".
9. You should always record positions, do not leave the position columns blank. If you don't have a position for a haul you should look at the fishing log and find the position, or if there is no position recorded, interpolate one from the positions before and after the missing one.

Species Composition Form:

1. Numbers and/or weights don't add up correctly, do check your math.
2. Species code listed without data accompanying it.
3. Species code doesn't match the recorded scientific name.
4. Decimal point not included in every recorded weight.
5. A weight listed without a number.
6. Recording weights to greater than two decimal places.
7. Haul number doesn't match the date as recorded on Haul Summary Form.
8. Whole-haul sample weight doesn't match the Haul Summary Form figure for Observer's Total Catch.
9. Recording a fish species that is not on the species code list. Bring back a specimen for verification if this happens.

Length Frequency Form:

1. Data not recorded in haul number order.
2. Summations incorrect. Check and double-check your math.
3. Reversing the size group and the frequency.
4. Haul numbers and dates don't match the Haul Summary Form.
5. Never record estimated lengths on the Length Frequency Form.

Biological Sample Form:

1. Not writing weights out to two decimal places. Do include trailing zeros.
2. Not grouping sexes together.
3. Not separating the otolith collections taken on different boats. (See "General Instructions for Data Forms" section in your manual.)
4. Duplicate otolith or scale number within one species collection.
5. An otolith or scale number is skipped without any note as to why.

Reports

Reports are a written synopsis of your activities at sea. They should be complete with good detail and be easy to follow. One of the main reasons for writing a report is for the people who use your data. They will be able to understand your methods of data collection without talking to you.

Please answer at least the following questions:

1. Describe in detail how the observer estimate was made. How were densities determined? What was the average density value? If bin measurements were used, did you find any difficulties? If no observer estimates were made, explain why.
2. Evaluate the method and accuracy of catch weight estimates made by vessel personnel. If there were significant differences between your estimate and the vessel estimate, what were the causes?
3. Explain in detail the sampling method(s) you used on this vessel. Describe and make a diagram of your sampling area. Describe how you collected the samples, and if there were any difficulties.
4. Did you obtain sexed length frequencies? Please describe methods used and any difficulties you encountered in sexing fish.
5. Please describe anything that affected your ability to effectively conduct your work.

You can also include information on how the ship fished, what products it made from the fish, and how much the captain and crew helped you.

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