RACE AFSC
Shellfish Assessment Program
Survey Scientific Operations Plan/Manual

2017 Crab Sampling Protocols for the Eastern Bering Sea Shelf & Northern Bering Sea Surveys

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Version 05242017

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INTRODUCTION

The annual eastern Bering Sea (EBS) trawl survey, conducted by the Alaska Fisheries Science Center, is a basic and essential part of NOAA Fisheries continuing program to determine the status of king, Tanner, snow, and hair crab populations of the region. The primary goal of this program is to study the population dynamics of these economically important species and to make this information available on a short-term basis to the fishing industry and to the agencies responsible for managing these fisheries.

The basic objective of the crab survey is to obtain estimates of the total number of crabs in the region surveyed. It is also necessary to determine the sex and size composition of the populations estimated, as well as other pertinent biological parameters in order to provide useful information for assessment models and management of the fisheries (e.g. setting catch quotas, size limits, etc.), and to improve management techniques.

CRAB SAMPLING PROTOCOL OVERVIEW

The objective of the Crab Sampling Protocol is to describe the steps required to obtain valid data of king, Tanner, snow, and hair crab populations during the eastern Bering Sea trawl survey.

Three major aspects are:

1. Understanding how to select an adequate sample of crabs from the trawl catch.

2. Understanding the data parameters.

3. Understanding how to enter data into the Fieldbook tablets, and then into the database.

The crab data is to be entered directly into the Fieldbook tablets via the crab application program: CruiseCrab. For detailed instructions, see the Crab Data Entry Application User Guide (separate document).

If there is a failure of the tablets or crab app, use the Crab Data Forms for recording crab data on deck. Data from paper forms should be entered into the tablet application as soon as the issue is resolved.

When sub-sampling of the trawl catch is required, every effort should be made to select the crabs randomly for size, so that length or width frequencies obtained will represent the size-frequency of crabs in the catch. If this is not done carefully, serious errors in the estimates of abundance of size groups in the catch could occur.

Detailed Sampling Procedure

1) Sort catch: remove all crab from the entire trawl catch so that they can be adequately sampled.

2) Sort crab by species and sex: Sort crabs from catch into baskets by species. Red and blue king crabs, Tanner and snow crabs, hybrid *Chionoecetes*, and hair crab are to be sorted further by sex and processed for measurements and biological data.

3) Determine Sampling & Subsampling: If at all possible, every crab should be processed (i.e., sorted, sexed, weighed and measured, etc.). However, if there are more crabs than can be processed between stations, a subsample will have to be taken. When sub-sampling is necessary, it is important to make sure that the crabs sampled represent the crabs actually caught in the net.

Determination = NO subsampling – continue to: 5) Record Total crab weight
Determination = YES subsampling – continue to: 4) Species and sex subsampling

4) Species and sex subsampling: In most trawl catches, only one of the species has been caught in large enough numbers to warrant subsampling. Typically, the remaining species caught can all be processed. At times, large catches of one species are predominantly one sex. When the species has been sorted by sex, only subsample the sex which occurs in too large of numbers to be realistically processed. If, however, the catch is so large that it is not practical to sort by sex, calculate the same sampling factor for both sexes.

Exception: Different size groups of the same species and sex can be sub-sampled separately. Example: if you have a big catch of predominantly small crab with a few large male crab mixed in (i.e. pre-recruit or legal/large size), select a minimum size as a dividing line (e.g. the lower size limit of pre-recruit crab), and sort out all of those crab larger than that minimum size. Measure all of the larger crabs if possible. Enter the two groups separately into the data entry application (tablet), using the appropriate sample descriptor (i.e. small male crab, large male crab). In other words, if necessary, adjust your sub-sampling procedure to maximize the number of legal/large male crab measured while adequately covering the smaller crab.

Be sure your subsample is LARGE enough to adequately sample both sexes!

Weight subsampling: In some areas, exceptionally large crab catches (often *Chionoecetes opilio* and juvenile red king crab) are encountered. The goal of weight subsampling is to obtain a random subsample of any target species or sex. Several methods are usable, depending upon the specific situation. For these examples, we assume that all crabs have been removed from the bin and the sorting table, sorted by species, and placed in baskets randomly. It is sometimes not feasible to sort by sex when you have a big catch. If you have many baskets of similar sized crabs (separate or mixed sexes), first estimate the number of crabs in each basket and decide how many baskets you need to sample. Then use one of the following methods:

A. Method: "Some-off-the-top": Take a similar number of crabs off the top of each basket and place into an empty basket. The new baskets will become the 'Sampled' baskets, and the original baskets the 'Non-sampled' baskets.

B. Method: "Alternate basket": If you decide to sample n baskets from N total baskets, divide N by n to obtain a sample number S. E.g., you need 4 baskets out of 20, the sampled number is 20/4 or

5. If S is not a whole number, round it off. As the baskets are weighed, set aside 1 out of every S (5) baskets, starting with the first one.

Weight subsampling Exception #1 - use of Secondary Sampling Factor

When the catch has to be subsampled by weight, sometimes one sex will be far more abundant than the other, e.g. many more females than males. When that happens, the abundant sex will have to be subsampled a second time. It is important to take a large enough subsample to adequately sample both sexes in the catch.

The Crab App will calculate sampling factor (click on blue clipboard to run a Catch Summary Report). The example listed below shows how to subsample a second time & how to calculate the sampling factor:

Subsample & Sampling Factor Example:

The catch is 1000 lbs. of *C. opilio* all between 45 and 55 mm in carapace width. The original subsample is 60 lbs. After sorting by sex, the females are sub-sampled further for one out of every three crab.

The sampling factors by sex are:

Males - Initial (and in this case, final) Sampling Factor:

Sampled weight: 60
Non-sampled weight: 940
Male Sampling Factor: 16.66667

Females - Initial Sampling Factor:

Sampled weight: 60
Non-sampled weight: 940
Female Sampling Factor: 16.66667

Secondary Sampling Factor:

Sampled weight: 20
Non-sampled weight: 40
Female Sampling factor: 3

Final Female Sampling Factor: 50.0000 (product of initial and secondary)

Weight subsampling Exception #2 – large catches of mixed species and sex

Occasionally, there are very large catches of two or more species with both sexes. If there isn't enough time to sort through every basket, weigh some baskets as non-sampled unsorted (mix). These will be entered into the tablet as "Mix, <spp name> Mix", i.e. "Mix, Chionoecetes Mix".

Set aside baskets to be sorted, the number will depend on the total number and the size of the crabs (they may be further subsampled later). Make sure there are enough so that an accurate proportion of each species in the non-sorted (mix) baskets can be determined. Weigh, record and toss the rest. Sort the remaining baskets by species and sex as usual and determine if additional subsampling is required. Record the weights of the sorted crabs, these will be entered into the tablet as "Add Child Sample" of the "Mix, <spp name> Mix".

5) Record total crab weight: Weigh baskets of crab by species and sex to the 0.01 kilogram, write values down on the Commercial Crab Species Catch Form and enter them into the Crab CATCH >Select Haul>Add Sample section of tablet data entry application. When subsampling by weight, record the weights of the discarded crab (non-sub) and the sampled (sub) crab.

6) Measure every crab:

Measure carapace length of king crabs and hair crab to the nearest 0.1 mm

Measure carapace width of *Chionoecetes* spp.to the nearest 0.1 mm
Tablet: Select "Crab Specimen", select current haul number, choose species and "Enter Specimen Data". Choose shell condition and lock. Use Bluetooth adapted calipers to measure every crab, data will be populated into the tablet.

There may be times when it is not possible to get an exact carapace measurement. Therefore, get the best measurement either by: Measuring a similar sized whole crab; or Measuring as much of the carapace as possible and estimating the whole carapace, i.e., measure ½ and double it.

7) Record Crab Biological Data:
A. Shell condition: for each crab sampled, shell condition class is assessed and assigned to one of five classes according to pre-specified criteria (0=premolt or molting, 1=soft and pliable, 2=new hardshell, firm and clean, 3=oldshell slightly worn, 4=oldshell worn, 5=very oldshell). See Tools: Shell Condition for more details.

B. Clutch assessment: Visually inspect the egg clutches of all female crab to determine how recently the clutch was extruded.
i. egg color (0=no eggs, 2=purple, 3=brown, 4=orange, 5=purple-brown, 6=pink);
ii. egg condition (0=no eggs, 1=uneyed, 2=eyed, 3=dead, 4=empty egg cases);
iii. clutch size (0=immature, 1=mature, no eggs, 2=trace to1/8, 3=1/4, 4=1/2, 5=3/4, 6=full). See Tools: Clutch Assessment for more details.

C. Female reproductive potential of *Paralithodes camtschaticus* crab: Not done in 2017.

D. Chela height – *C. bairdi*: See special project: Tanner crab chela height measurements for details.

E. Chela height – *C. opilio*: Measure the right chela of males with both chelae intact and record carapace width and chela height to 0.1 mm along with vessel, cruise, haul and date on the Crab Data Forms provided.

Three separate tally sheets per boat are provided to keep track of the number of measurements made, one for **Southeastern Bering Sea (rows A-K, Z),** for **Northeastern Bering Seas (rows L-V)** and for **Northern Bering Sea collections (rows R – FF).** Note that there is overlap with Northeastern Bering Sea and Northern Bering Sea rows – please refer to station maps (Reference: Station Maps). The tally sheets are located in the Kodiak Lab binder. To ensure that all sizes are being accounted, **for each haul, measure 5 crab from each of the 4 size categories 1) 20-39 mm CW, 2) 40 – 59 mm CW 3) 60-99 mm CW and 3) 100-119 mm CW for a total of 20 crab.** It is likely that all sizes will not be caught in each haul; therefore, each of the 4 larger size categories above are further broken into 10 mm size bins. For each location, the goal is to sample a minimum of 20 crab per size bin, per boat.

Enter the data in tablet. Lock on "Chela height" in Biometrics (clipboard icon) before collecting data.

See Tools: Chela height for measuring details and Tools: Snow crab size frequencies and chela heights for frequency scatter plots

	Minimum sampling goal per boat per location		
Size bins CW mm	Southeastern Bering Sea	Northeastern Bering Sea	Northern Bering Sea
20-29 mm	0	0	20
30-39	0	0	20
40-49	20	20	20
50-59	20	20	20
60-69	20	20	20
70-79	20	20	20
80-89	20	20	0
90-99	20	20	0
100-109	20	20	0
110-119	20	20	0

F. Individual crab weight: Individual weight (±2.0 grams) and carapace length or width data will be collected from red king crab (*Paralithodes camtschaticus*) [odd years], blue king crab (*P. platypus*) [every year], Tanner crab (*Chionoecetes bairdi*) [even years] and snow crab (*C. opilio*) [odd years].

In 2017 collect the following information:

1. *Paralithodes camtschaticus:* weight and carapace length
2. *P. platypus:* weight and carapace length
3. *Chionoecetes opilio:* weight and carapace width

Individual crab weight procedure: Collect data from whole, live crab for these measurements; no crab regenerating or missing limbs, and from entire size ranges throughout the distribution of each species. Crab weight is recorded to ±2.0 g from individual whole crab collected at each station: collect data on 5 crab per haul / per each of the following categories:

1. Male opilio
2. Ovigerous female opilio
3. Non-ovigerous female opilio
4. Male red king crab,
5. Ovigerous female red king crab,
6. Non-ovigerous female red king crab.
7. All blue king crab encountered that are: whole, live crab without regenerating limbs

G. Disease observations: When presence of a disease or parasite is encountered, record in the crab data entry program (Crab Specimen – Blue clipboard icon). See Tools: Diseases and Parasites for more details.

H. Hybrids: The method for identifying hybrids relies on a series of visual morphometric differences between *C. bairdi* and *C. opilio* (see Reference: hybrids). C. hybrids exhibit a range of characteristics between the two and are often best recognized by a combination of characteristics:

1) Carapace:
    a. Shape: *C. bairdi* is triangular whereas *C. opilio* is more round.
    b. Scalloping: *C. bairdi* has scallops on edge of carapace whereas *C. opilio* does not.
    c. Pterygostomian spines: *C. bairdi* has spines whereas *C. opilio* is more smooth.
2) Epistome shape: *C. bairdi* has "M" whereas *C. opilio* is even.
3) Eye color: *C. bairdi* is red whereas *C. opilio* is green/grey.
4) Rostrum:
    a. Lateral view: *C. bairdi* is angled upward whereas *C. opilio* is flat.
    b. Top-down view: *C. bairdi* has deep "v" notch whereas *C. opilio* is more shallow.

It is best to start with carapace shape (1a), then look at epistome shape (2), then look at eye color (3), and finally look at rostrum lateral view (4a). The remaining characteristics are more difficult to use and are mainly for backup if necessary but should not be used as primary characteristics.

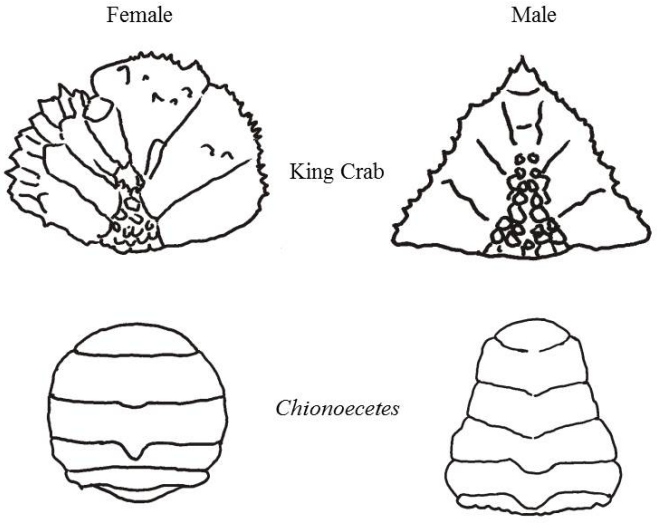
Note that using maturity codes and clutch sizes is NOT an adequate metric for identifying a hybrid. Although hybrids do tend to have lower fecundity, non-hybrids can have partial clutches so clutch size should not be considered.

I. Special Projects: See full and one-pager protocols in the Kodiak data binder or on the laptops.
List of 2017 Special Projects:
1) Live female snow crab collection – ADFG
2) Live Tanner and snow crab collection – Ryer
3) Annual / Biennual preserved ovigerous snow crab – Newby
4) Shell structure: frozen snow crab legs – Foy
5) Bitter Crab: blood in collection plates – Jensen
6) Tanner Chela & CW: measurements of Tanner chela heights – Foy
7) Snow Chela & CW: measurement of snow chela heights – SAP
8) Crab weight: weight measurements – SAP

TOOLS

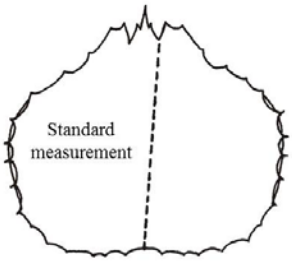
Crab Sex Determination

The shape of the abdominal flap distinguishes sexes. In king crabs and *Chionoecetes* spp. the female shape is round; the male shape is triangular (king) or a truncated triangle (*Chionoecetes*).

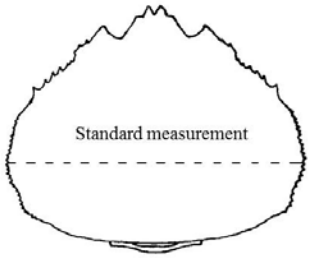


Carapace Measurement

Carapace **length** is the standard measurement for king crabs and hair crab. Carapace **width** is the standard measurement for *Chionoecetes* spp.



Length: Enter carapace length measurement to nearest 0.1 mm



Width: Enter carapace width measurement to nearest 0.1 mm, excluding spines for *Chionoecetes* spp.

Shell condition Codes:

0 - Premolt or molting: In premolt king crab and *Chionoecetes* spp. the membranes between the leg segments tend to swell and turn pink. The "dactyl test" is definitive for identifying premolt crab. Break 1/2 inch off the end of a dactyl (pointed outermost segment of a walking leg). If a well formed underlying dactyl tip is present then the crab is premolt.

1 – Soft and pliable shell.

2 – New hardshell, firm and clean: firm to hard, clean, brick red to yellow brown on topside (green-colored crabs are sometimes encountered in certain areas of Bristol Bay).

3 – Oldshell slightly worn: hard, topside usually yellowish-brown; thoracic sternum and underside of legs yellow with numerous scratches; pterygostomial and branchial spines worn and polished; dactyli on meri and metabranchial region rounded; epifauna (barnacles and leech cases) usually present but not always.

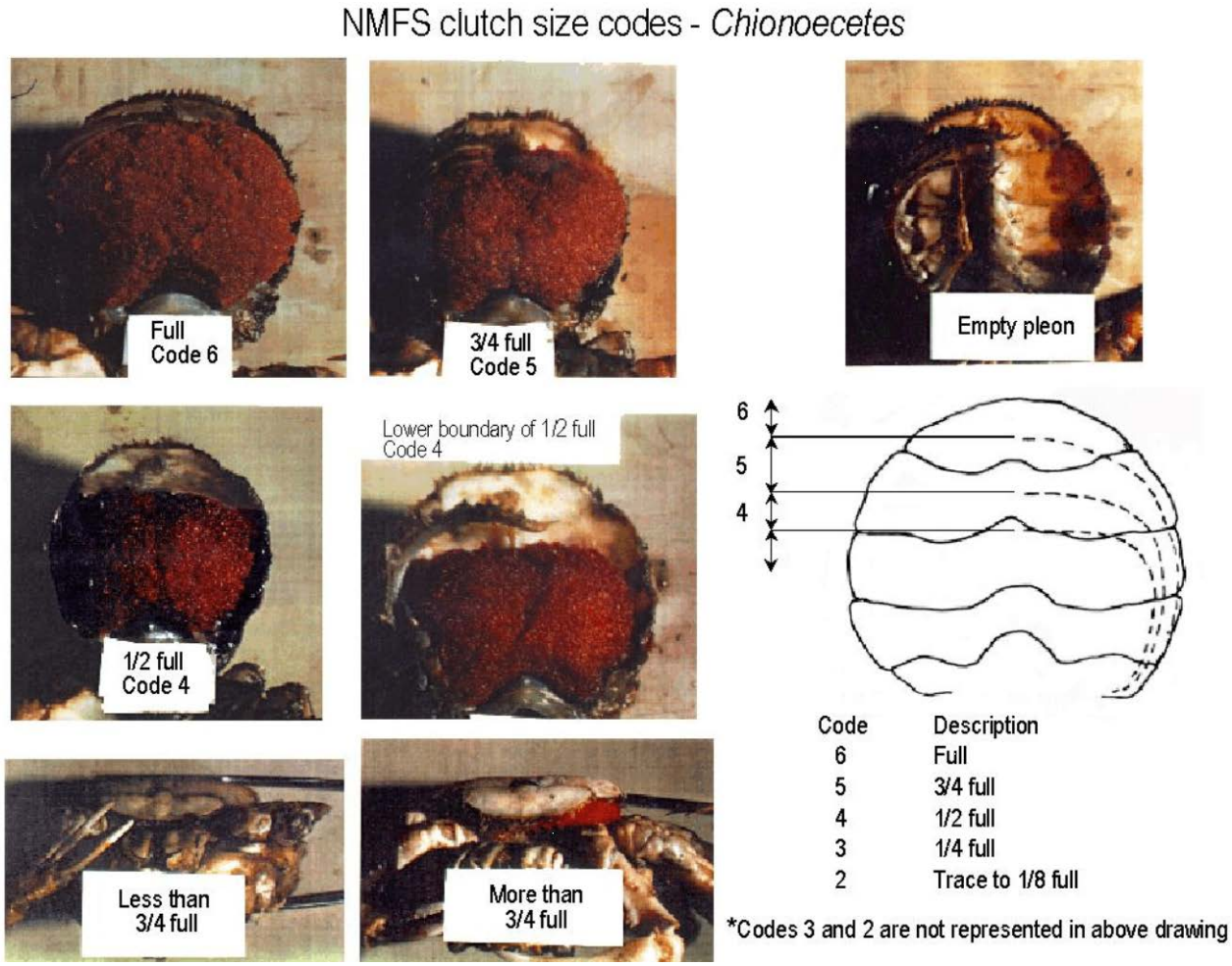
4 – Oldshell worn: hard, topside yellowish-brown to dark brown; thoracic sternum and undersides of legs data yellow with scratches and dark stains; pterygostomial and branchial spines rounded with tips sometimes worn off; dactyl very worn, sometimes flattened on tips; spines on meri and metabranchial region worn smooth, sometimes completely gone; epifauna usually present.

5 – Very oldshell: conditions observed in shell condition 4 much advanced; large epifauna almost completely covers crab; carapace is worn through in metabranchial regions, pterygostomial branchial spines, or on meri; dactyli flattened, sometimes worn through, mouth parts and eyes sometimes nearly immobilized by barnacles.

Clutch Assessment Codes:

Egg Color	Egg Condition	Clutch Size
0 = No eggs	0 = No eggs	0 = Immature
2 = Purple	1 = Uneyed eggs	1 = Mature, no eggs
3 = Brown	2 = Eyed eggs*	2 = Trace to 1/8 full
4 = Orange	3 = Dead eggs	3 = 1/4 full
5 = Purple-brown	4 = Empty egg cases**	4 = 1/2 full
6 = Pink		5 = 3/4 full
		6 = Full

*small black spots within the egg are visible
** filamentous material (not just clean hairs) attached to pleopods of the abdomen (crab has hatched out eggs but has not molted). Crabs with empty egg cases are almost always shell condition 3 or 4. Eyed eggs take precedence over empty egg cases.



Left pleopods removed in all specimens. Top left four images: levels of fullness. Bottom left: as a rule of thumb, pleon can be completely closed if egg mass is less than ¾ full.

Immature female Chionoecetes crab, abdominal flap is flat and covers 2/3 – 3/4 of ventral surface

Mature female Chionoecetes crab, flap covers most of ventral surface, convex in shape

Clutch Coding Combinations:
All the possible coding combinations of the three fields relating to reproductive condition of the female are listed below. The first digit refers to color, the second to egg condition and the third to clutch size. It is expected that all crab will fit into one of these categories (use Notes in the crab data entry application to describe code combinations that do not fit the categories below):

0 0 0 — Immature.
***Chionoecetes* spp.:** The abdominal flap is flat, not convex as in mature crab.

King crabs: setae on the pleopods are golden and clean.

0 0 1 — Mature female without eggs.
Chionoecetes spp. Adult body form (convex abdomen), with setae on the pleopods clean.

King Crabs If a female red king crab >= 75 mm CL with clean pleopods is captured, very carefully inspect the pleopods for any sign of empty egg cases. If empty egg cases are present, code as 041 (mature female with empty egg cases). If no egg cases are present, inspect for the presence of a mature ovary through the abdominal wall. If detected, code as 001. If unable to detect of if you are uncertain, dissect the female and inspect the body cavity directly. If a mature ovary is present, code as 001. If an immature (i.e., flaccid) ovary is present, code as 000. See laminated sheets for visual examples or consult the Lithodid Field Techniques Guide. If a female red king crab <75 mm CL with clean pleopods is captured, she would be normally coded as 000. Nonetheless, still apply good biological judgment and inspect for presence of a mature ovary through the abdominal wall. The difference with respect to these <75mm CL barren crab is that direct inspection of the ovary via dissection is not required.

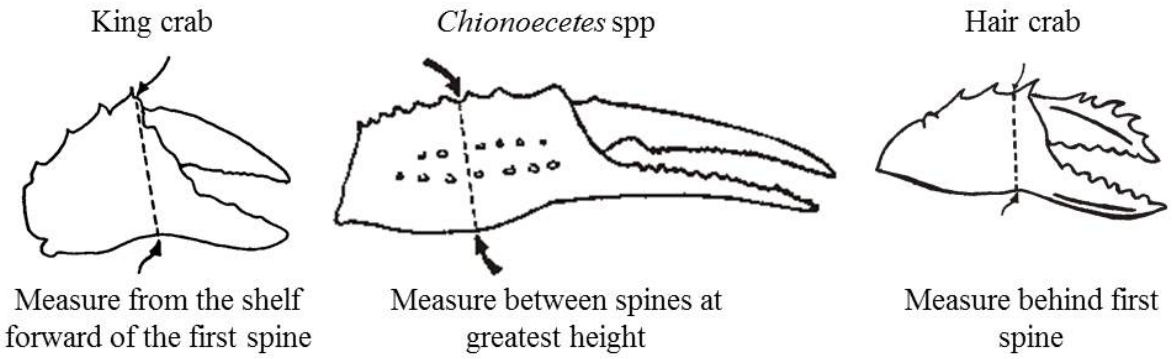
2 **1** 2 thru thru 6 **1** 6 — Crabs with variable numbers of eggs and colors of **uneyed** eggs.

2 **2** 2 thru thru 6 **2** 6 — Crabs with variable numbers of eggs and colors of **eyed** eggs. Dark eye spots can sometimes be difficult to see without close examination.

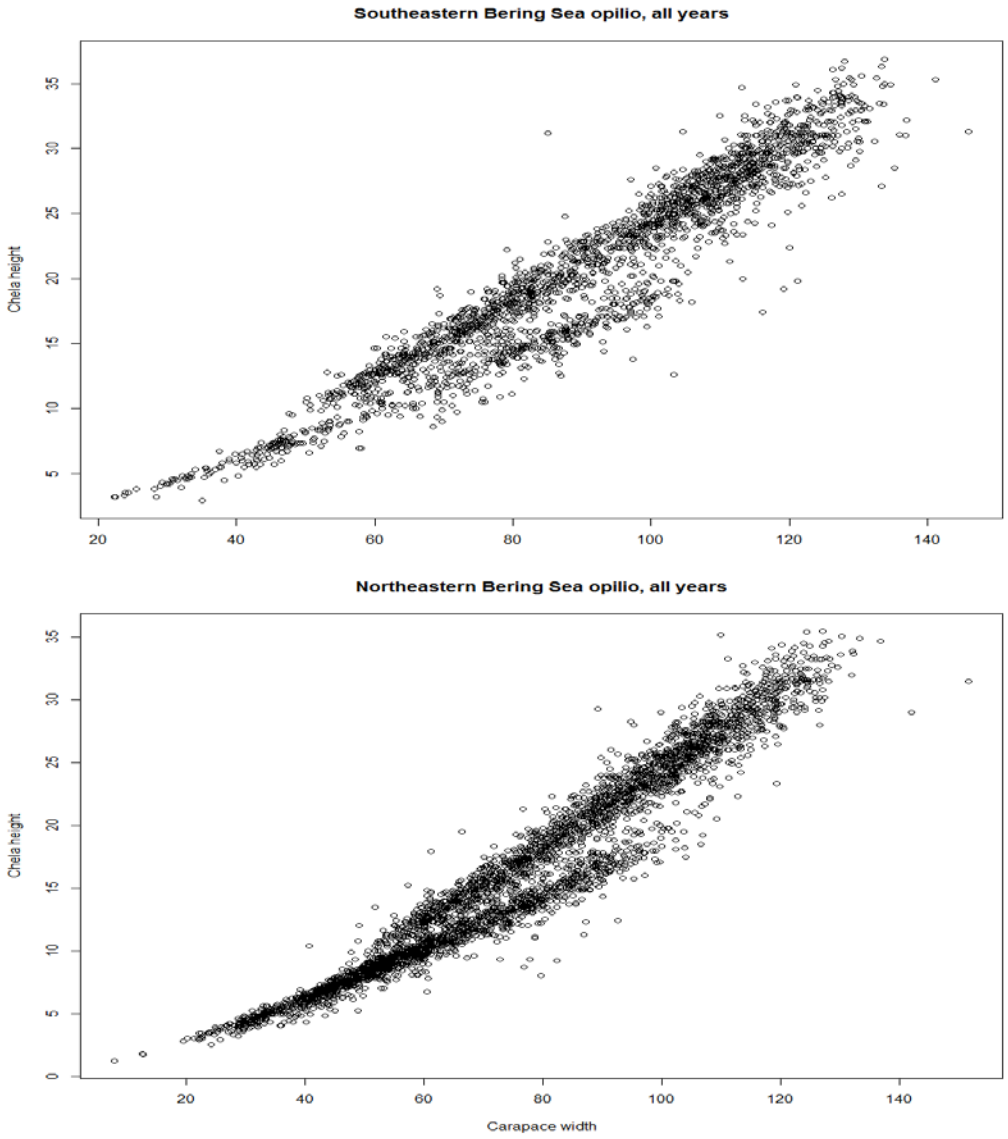
2 **3** 2 thru thru 6 **3** 6 — Crabs with variable numbers of eggs and **dead** eggs. Eggs opaque, may be white or nearly white. This condition is not often encountered.

0 **4** 1 — Mature female with **empty egg cases**. Filamentous material attached to setae on pleopods, usually has dirty appearance. These empty egg cases break off, so even the smallest quantity should be coded this way.

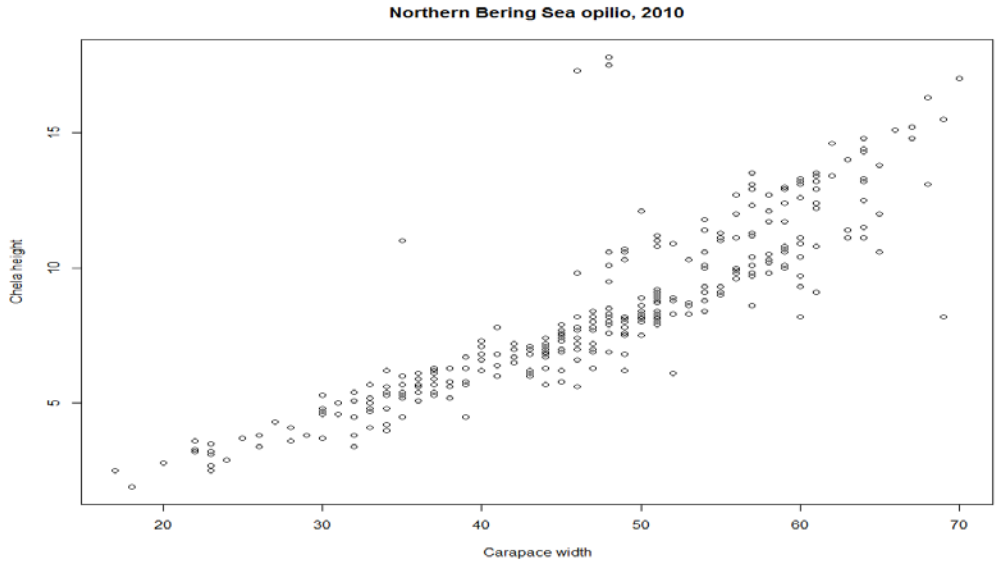
Chela height measurements: Measure right chela to nearest 0.1 mm.



Snow crab size frequencies and chela heights: EBS 2010 - 2016



Snow crab size frequencies and chela heights: NBS 2010



Diseases and Parasites

Parasites and diseases can serve as indicators of stock and ecosystem health and trends and there are a number of diseases/parasites to which crustaceans are susceptible. Below are the diseases and parasites most often encountered on our surveys. Record each disease for any crab displaying symptoms using Biometric button (clipboard icon on tablet). For any disease encountered (or any other pathological condition of note) not on the drop down list of 'visible biometrics', record the disease state in the notes field (select record to edit, then tap on blue button located on the upper right corner of the editing screen.

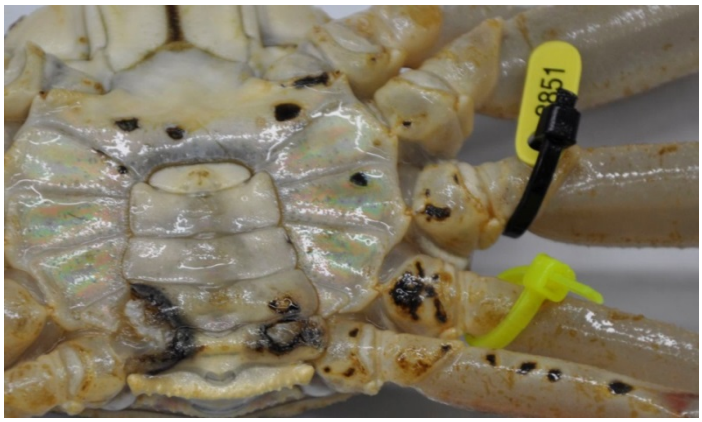
1. **Black Mat Syndrome**. Caused by a fungal parasite that proliferates on the exoskeleton, invading the shell and eventually the internal tissues. The exoskeleton of infected hosts suffer varying degrees of coverage by a dense hard tarry black encrustation. Reported in *C. bairdi*, *C. opilio*, and *C. tanneri.* Enter percentage coverage for the three regions: dorsal body surface, ventral body surface, and surface of legs.

C. bairdi with heavy black mat on carapace (100%) and light covering on legs (~5%). (Photo by Hank Pennington)

2. **Bitter Crab Disease**. Caused by a parasitic dinoflagellate and found in 40+ species of decapods. In the north Pacific, in *Chionoecetes bairdi, C. opilio, C. angulatus, C. tanneri, Hyas coarctatus, H. lyratus,* and *Lithodes couesi*, and red and blue king crabs in Russia. As infection progresses, the hemolymph turns white, causing the exoskeletons of *Chionoecetes* spp. and *Hyas* spp. to appear pink, peach, or white, especially where the shell is thin (joints).

Ventral view of an infected *Chionoecetes* spp. (above) and otherwise healthy crab (below).

3. **Shell Disease**, sometimes also known as 'torch'. Caused by invasion of any of a number of species of chitinoclastic (chitin-degrading) bacteria. Frequently at injury sites, appears as brown or black lesions/ulcers of varying severity that eventually penetrate the shell, leading to internal tissue damage and septicemia. Reported in red, blue, and golden king crabs and Tanner crabs, but likely occurs in all marine crustaceans. When referred to as 'torch', potentially large sections of carapace are discolored (as if a blow torch was applied) and lesions may be present. Enter percentage coverage for the three regions: dorsal body surface, ventral body surface, and surface of legs.

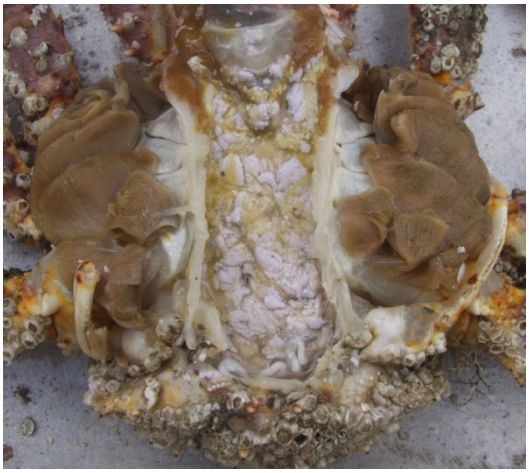


Dorsal view of snow crab with lesions caused by chitinoclastic bacteria. Note green/pink sheen on shells that may indicate earliest stages of bacterial infection.

4. **Parasitic rhizocephalan barnacle**. Red, blue, golden and scarlet king crabs are known to be hosts. The parasite is usually nonlethal, but renders the host sterile. On both male and female hosts, the parasite produces a large reproductive body (the externa) that contains ova and larvae and that is attached to the underside of the crab's abdominal flap; the host tends the mass as if it were a host egg mass. After loss of the externa, a scar is visible on the ventral surface of the abdomen.

Parasitic barnacle externae. Left externa on *Lithodes couesi* (photo from NOAA/Tom Shirley). Right, externa on golden king crab. Abdomen was hyperextended for the photo and has ruptured, exposing hepatopancreas (photo courtesy of Dave Somerton).

5. **Cottage cheese disease**. Caused by a microsporidian infection of host muscle. Found in red, blue and golden king crabs. Characterized by presence of cottage cheese-like material in the abdominal cavity. Condition can be recognized externally by whitish discoloration of abdominal tissues as seen through the shell on the underside of the abdomen. Probably fatal, as the heart becomes infected.

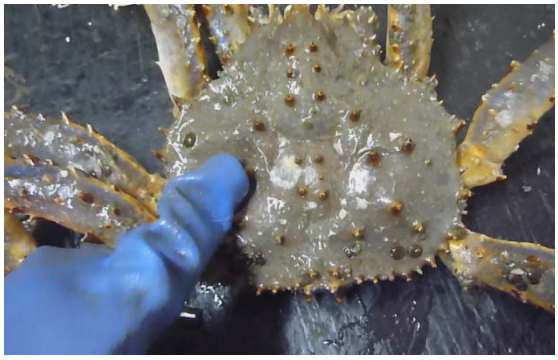
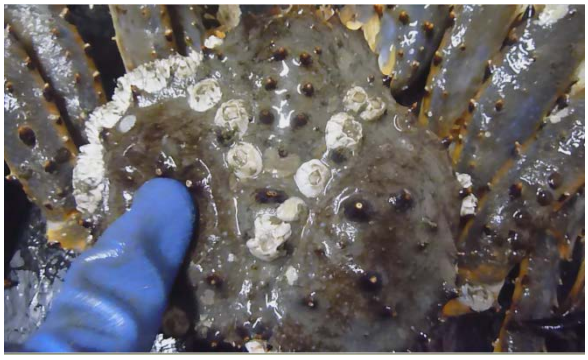


King crab with cottage cheese disease (photo courtesy of ADF&G).

6. **Pepper spot syndrome**. Distinguished from black mat by the presence of numerous round, granular, peppercorn spots. Causative agent and effect on host unknown. Enter percentage coverage for the three regions: dorsal body surface, ventral body surface, and surface of legs.

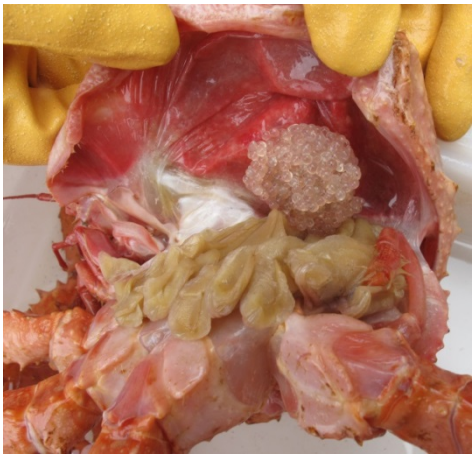
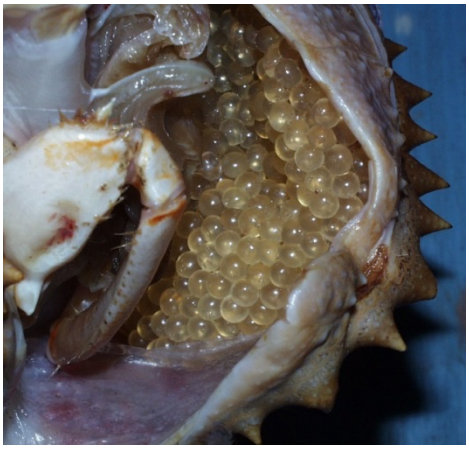
Chionoecetes tanneri with Pepper Spot Syndrome on legs and 20% of ventral body surface.

7. **Leatherback**. Cause and effect on host unknown. Documented in blue and golden king crabs. The carapace has a soft, leathery texture, but the crab is not newly molted. Crab may be old shell with barnacles.

Leatherback blue king crabs (photo courtesy of ADF&G)

8. **Snailfish**. Some species of snailfish place their eggs in the gill chambers of king crabs. Effect on the host is uncertain, but gills are crowded and often have necrotic areas.

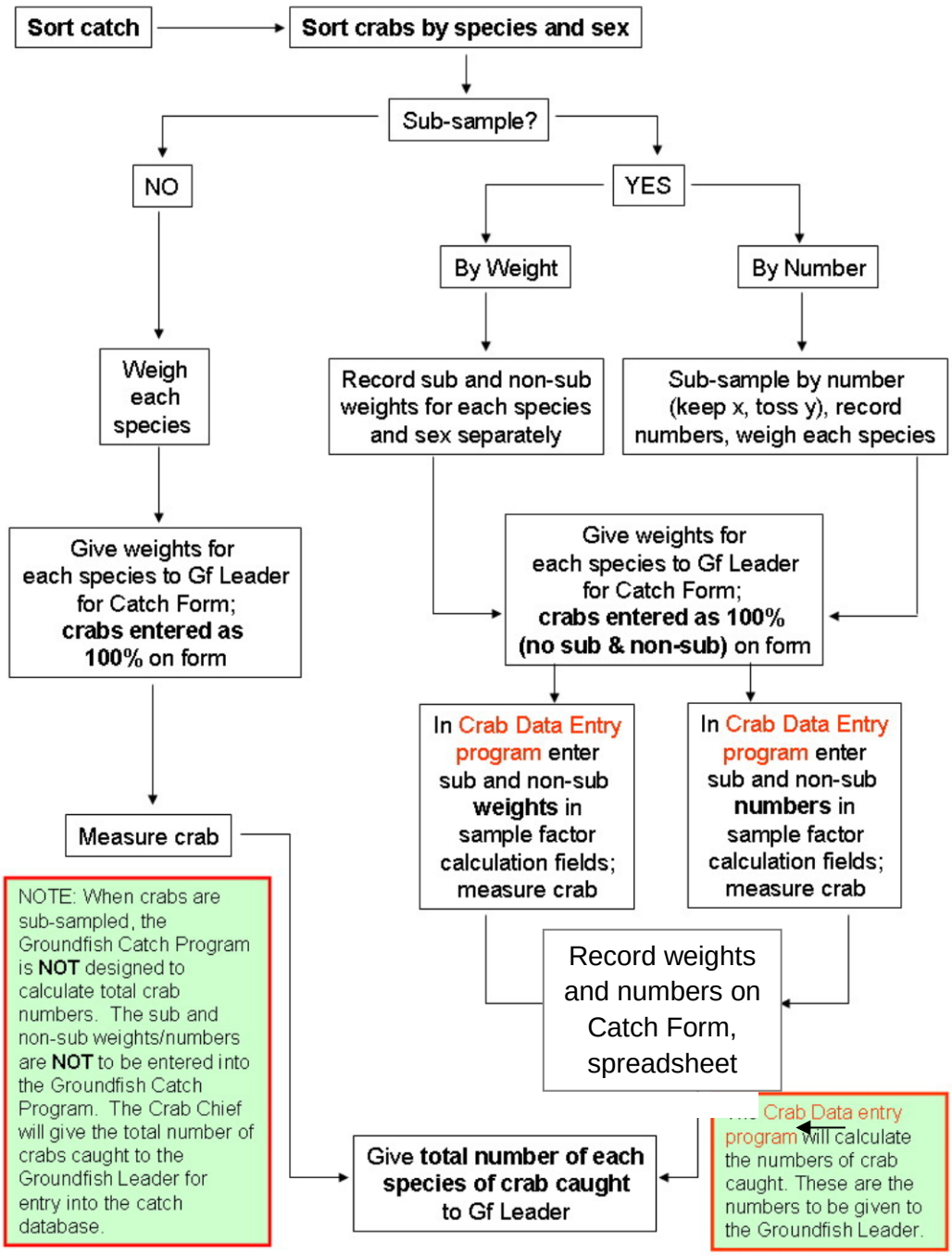



Left, snailfish eggs in gill chamber of *Lithodes couesi*. Right, snailfish eggs in gill chamber of *Lithodes aequispina*.

TRANSFERRING CRAB DATA TO GROUNDFISH ASSESSMENT PROGRAM

The crab team leader is responsible for recording all weights and counts of the commercially important crab species on the Commercial Crab Species Catch Form, and in the CRAB CATCH section of the data entry application. Fill out the Catch Form for every haul; if no crab are caught, note that on the form.

CRAB SAMPLING FLOWCHART



INVERTEBRATE IDENTIFICATION

Mixture sampling (aka "SHAB" -Shells Hermits and Associated Biomass) includes shelled mollusks (including snail eggs and empty shell), and all other species attached to, or living in mollusk shells. There is some flexibility in the taxa one can include with SHAB. For example in some catches tunicates are easily separated out from all other taxa and should not be included in SHAB. In other catches most tunicates are attached to mollusk shells and can be included as SHAB.

The Field Guide to the Benthic Marine Invertebrates of Alaska's Shelf and Upper Slope, written by Roger Clark in 2006, should be used as the primary field identification tool for invertebrates, and the Guide to Alaska Fishes based on D.W. Kessler's previous work should be used for identifying fishes.

SHAB sampling protocol

1. Sort all SHAB into baskets.

2. Randomly select at least one basket for subsample and set aside.

3. Weigh all non-subsample baskets of SHAB and record each basket weight on the On Deck Sampling Form in a section of that form partitioned off "SHAB SUBSAMPLE".

4. Remove and sort all material attached to shells.

5. Sort entire basket to the appropriate taxa.

6. Record name, count and weight of each taxon in the "SHAB" section of the On Deck Sampling Form.

7. Mollusks and hermits are weighed in the shell.

8. Weigh one shell with each hermit.

Identify animals to the lowest level taxon and record it with the appropriate code on the Groundfish Catch Form. Make only one entry per species Code.

DISPOSITION OF THE DATA

At the end of each leg, the crab chiefs on each boat must do the following:

a) Combine data & documents from both boats so it can be returned to Kodiak Lab.
   i) Thumb drive with all digital data from BOTH BOATS! (Access database and all files downloaded from tablet). **Make sure you copy the data files, not the links!**

   ii) Crab Catch Forms, Crab Data Forms, and any written notes or observations

b) Make a copy of the data to give to one of the Seattle groundfish personnel as a back-up.

c) Personnel responsible for bringing data & documents back to Kodiak:
   Leg 1 = Jon Richar
   Leg 2 = Bob Foy or Chris Long
   Leg 3 = Allie Bateman
   Leg 4 = Chris Long or Jen Newby

MISCELLANEOUS INFORMATION

Although the digital calipers are waterproof and designed for outdoor use, please take care to keep them clean. They are set to measure in mm, but check to make sure and if the readout shows "in", press the left button below the readout screen until it reads "mm". If, when the calipers are fully closed, the readout shows anything other than 0.00, press the "origin" button (the right button under the readout screen) until it reads 0.00. The Vernier calipers (if used) should be rinsed and kept clean as well

<u>At the end of each leg:</u>
1. Clean fish scales and gunk off the tablets and headphones

2. Clean the rust and scales from the calipers, rinse them with fresh water, spray them with WD-40 and wipe with a paper towel

3. Leave a note for the next crab team regarding, for example, the location of various gear, data collection issues, status of special collections; survival suits swaps and disposition, problems with equipment, etc. Leg 1 personnel should leave a note with the location of packing materials, boxes, etc. for end of survey personnel.

If for any reason, the survival suits are switched between boats or a 406 PLB (Personal Locator Beacon) is removed or switched, e-mail or call Bob Foy (robert.foy@noaa.gov, 907-481-1711). All 406 PLBs are registered to a suit on a specific vessel. This information will need to be updated if there are any changes.

If there are problems with equipment/computers let someone in Kodiak know ASAP so that arrangements can be made to replace the defective equipment.

Please address any issues with the tablet and crab data entry application to Christie Lang: christie.lang@noaa.gov, 206-526-6715.

Example: Crab Catch Form

COMMERCIAL CRAB SPECIES
CATCH FORM

Vessel_____ Cruise_____ Haul_____

Date_____ Recorder's name_____

Species and sex	KILOGRAMS			COUNTS		
	Subsample weights	Non-subsample weights	Total weight caught	Subsample measured	Non-sub Not measured	Total Caught

Example: Crab Data Form

CRAB DATA FORM

VESSEL ☐☐☐ CRUISE ☐☐☐☐☐☐☐ DATE ____________________

Vessel Name ____

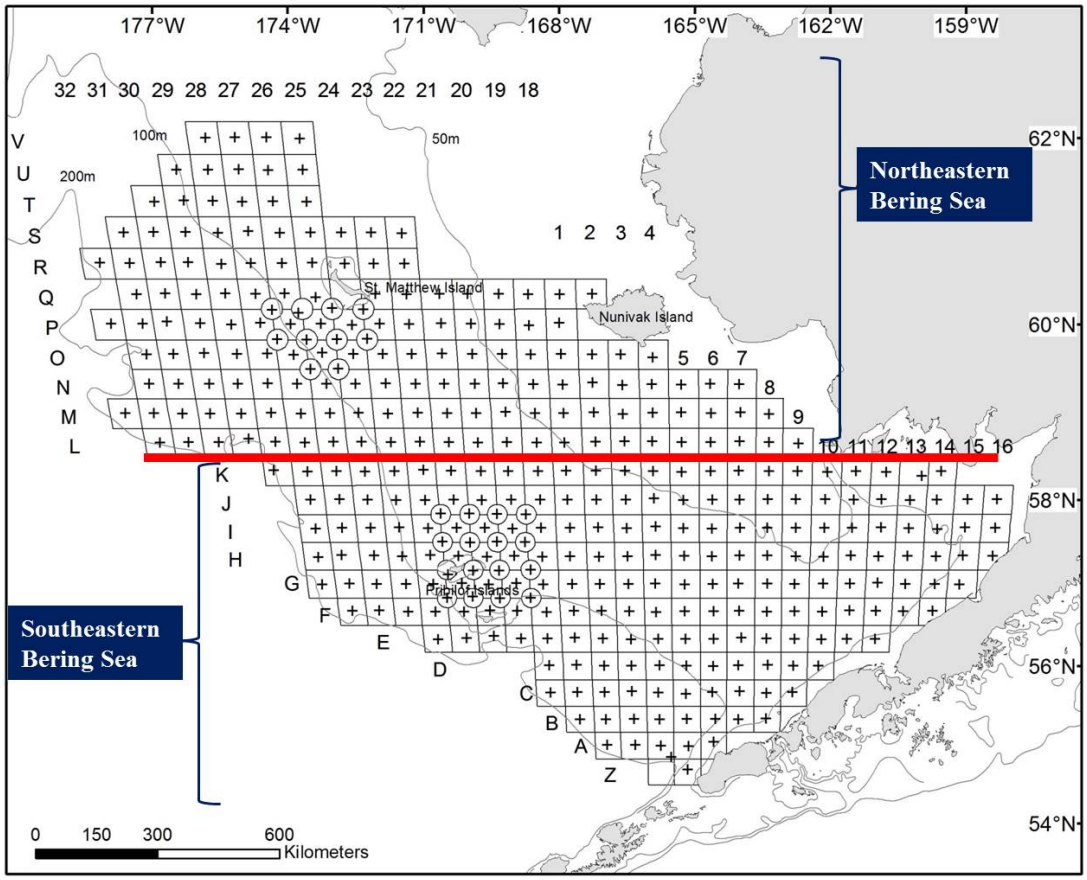
SPECIES	HAUL	SEX M=1;F=2	CARAPACE LENGTH**	CARAPACE WIDTH**	SHELL CONDITION	EGGS			CHELA HEIGHT Nearest 0.1 mm	SPECIAL SAMPLE					WEIGHT (g)
						COLOR	CONDITION	CLUTCH		BLACK MAT DORSAL	VENTRAL	LEGS	BITTER CRAB	OTHER	

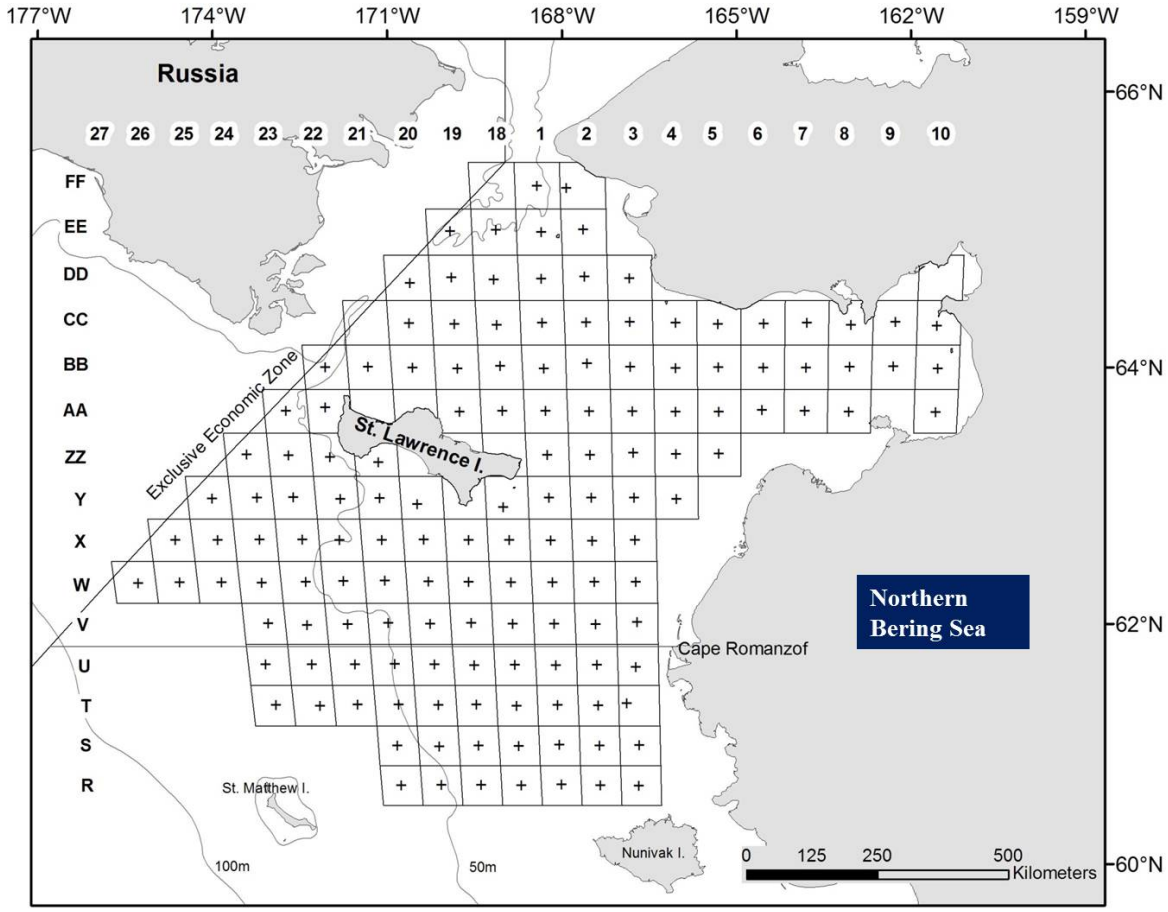
** To the nearest 0.1 mm when collecting chela height and individual weight data

Enter chela ht. and indiv. wt data from this form into the Crab Data spreadsheet for the corresponding vessel

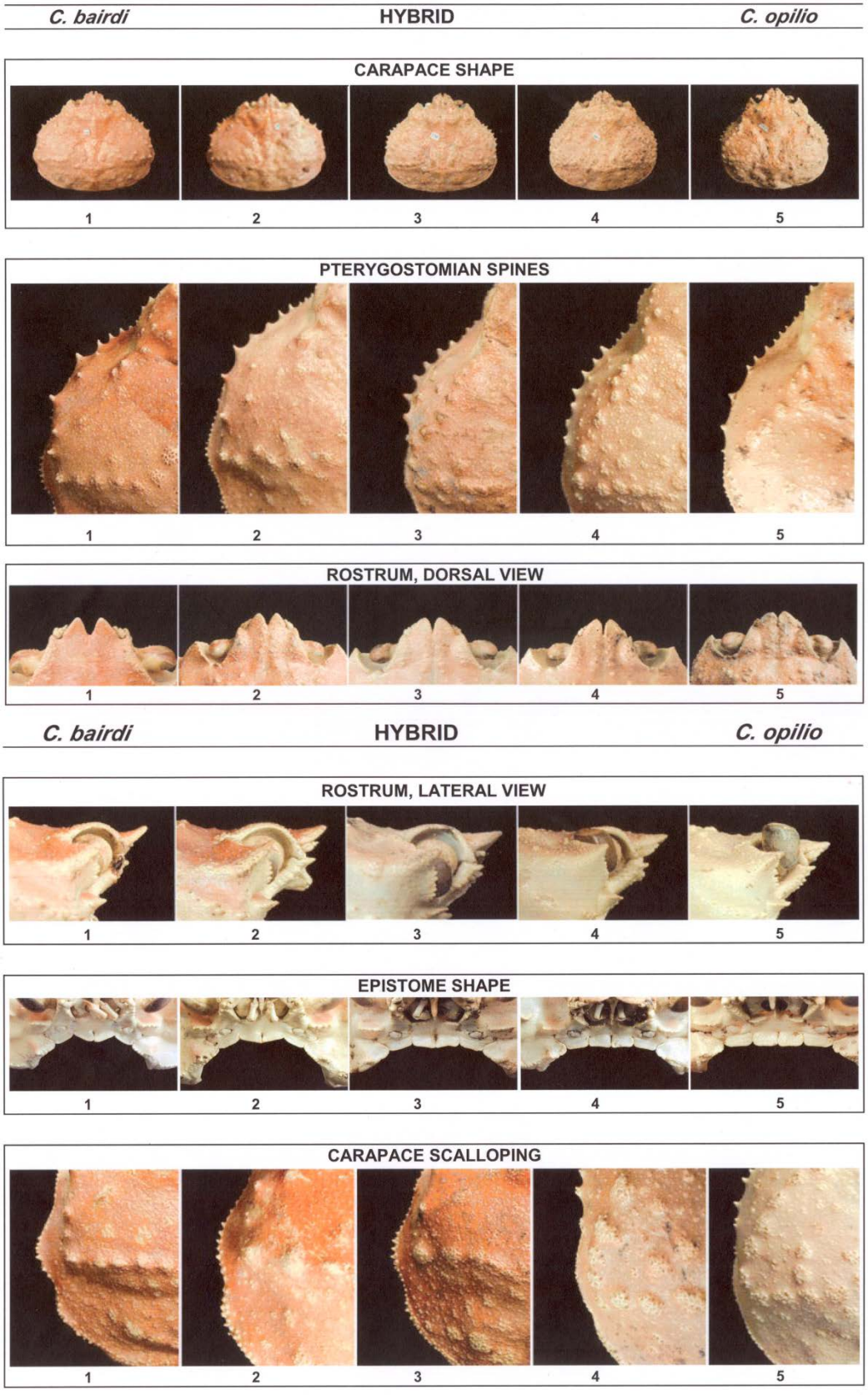
Rev Jan. 2011

Reference: Station Maps

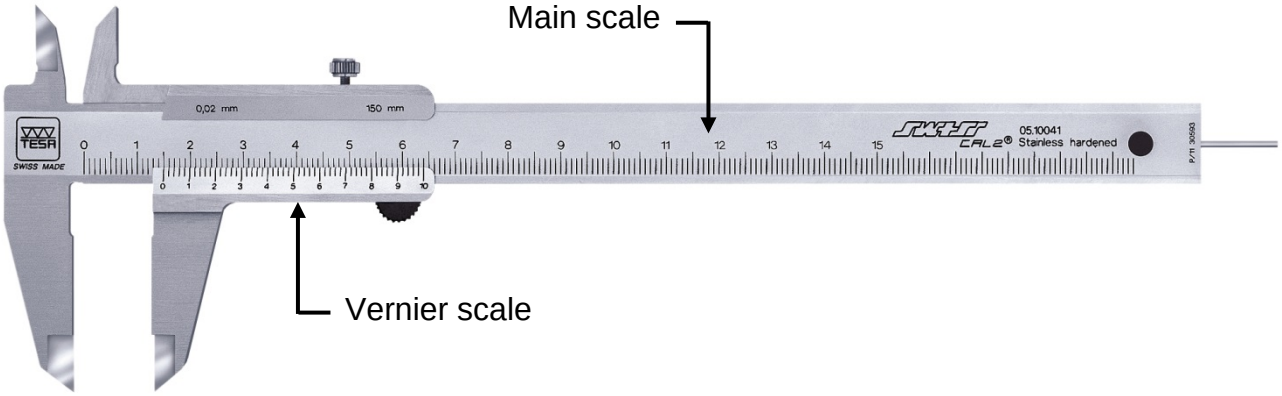




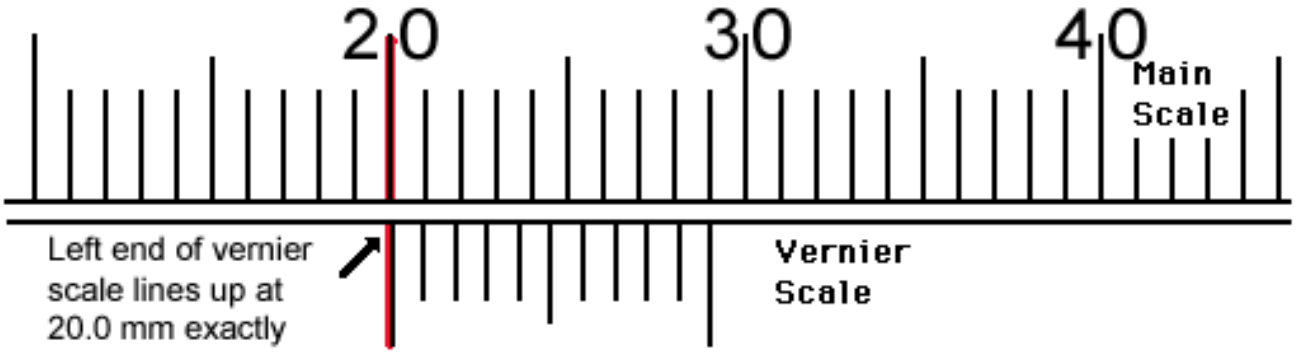
Reference: ***C. bairdi* x *C. opilio* (hybrid) characteristics** (thanks to Dan Urban for this graphic)



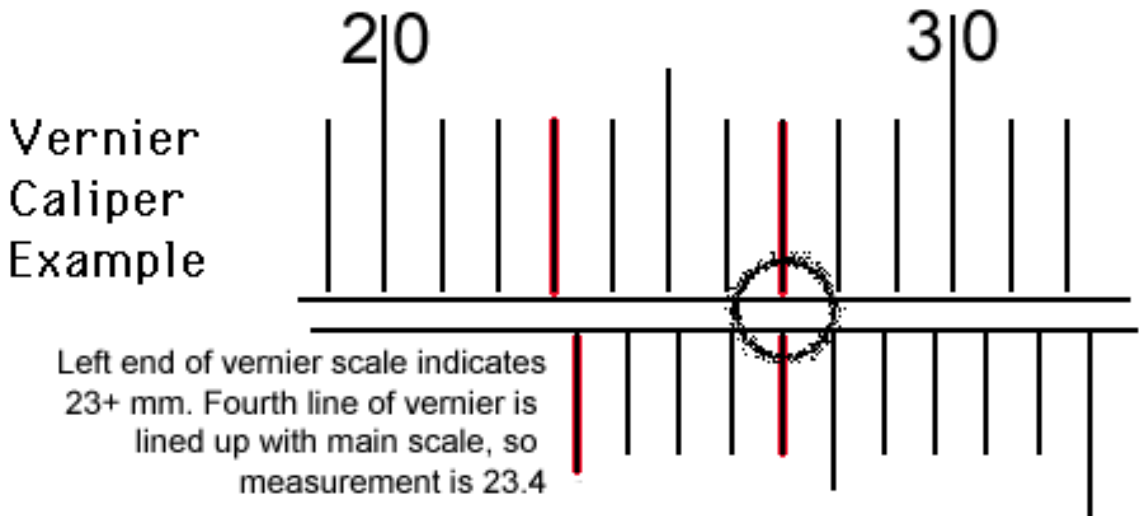
Reference: Reading Vernier Calipers



A.



B.



In example B. above, when recording to the nearest millimeter, the correct measurement is 23 mm, when recording to the nearest tenth the correct measurement is 23.4 mm.