CLAM SURVEY QUICK GUIDE

For detailed method instructions and information about clams check out the full manual. Always review the full manual before you go out if you haven't done a survey in a while.

CLAM SURVEY EQUIPMENT CHECK-LIST

- ☐ Pitchforks
- ☐ 2 x 50m tape measures
- ☐ Clam sacks
- ☐ Buckets
- ☐ Blank Data sheets
- ☐ Pens, pencils, permanent markers
- ☐ Flagging Tape
- ☐ Camera
- ☐ GPS
- ☐ Field notebook w/ field paper
- ☐ Calipers
- ☐ Digitals scales (spare batteries)
- ☐ Random number table or random # generator

STEP 1 – SELECT CLAM BEACH

Chose the site based on your groups needs or goals. Sites may include loxiwe or areas for community or commercial use. Clam beaches usually have a shallow to moderate slope, broken and/or empty shells on the beach, sand and shell-hash. Always arrive 1 hour before low-tide.

STEP 2 – ESTABLISH GRID AND PLACE X-Y REFERENCE LINES

Chose a place to start (point of commencement (POC)) for the X-Y axis and record the lat-longs. Decide on the X and Y axis lengths and direction. Usually this is 30m by 30m, but it depends on the beach. Estimate of the size of the beach in m2 (length x width).

STEP 3 – GENERATE X-Y COORDINATES AND MARK QUADRATS 1 TO 30

Use a random # table or random # generator to establish X and Y coordinates for quadrats. Mark out the quadrats with stakes or empty clam sacks.

STEP 4(A) – ONE CREW MEMBER COLLECTS AND RECORDS SITE INFORMATION

Fill out site description, location, reason for surveying, beach particle and plants and wildlife. Sketch a map including the X-Y reference lines, upper, middle and lower intertidal zones. Write down all the other basic information: date, time, weather, crew members, tide levels, etc.

STEP 4 (B) – REMAINING CREW MEMBERS DIG QUADRATS AND COLLECT CLAMS

Each quadrat should be 1m x 1m x 0.2m (deep). Sort and collect all clams from that quadrat and store in a vexar sack. Make sure all clam sacks are labelled with the quadrat number.

STEP 5 – PROCESS CLAMS, RECORD ID, MEASUREMENTS, WEIGHT AND COMMENTS

Identify, measure and weigh every clam from each quadrat. One person identifies and measures while the other records the information. Pick a sheltered, flat spot above the high-tide level to do this work.

IMPORTANT LINKS

Marine Weather – Government of Canada - https://weather.gc.ca/marine/index_e.html

Tide Levels – Fisheries and Oceans Canada - http://www.tides.gc.ca/eng/find/region/1

VHF MARINE CHANNELS

Distress, Safety and Calling – Channel **16** or Transmitting Frequency 156.800

Continuous Marine Broadcast (English) – Channel **21** or Transmitting Frequency 161.650

Clam Monitoring Manual

HA-MA-YAS
STEWARDSHIP

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Campbell River, BC V9W 2E4
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TABLE OF CONTENTS

HOW TO USE THIS MANUAL

This manual outlines the steps to do survey for intertidal clams. The document shows you how to start your survey and work through the datasheet step by step. In the appendix there is information about the importance of eelgrass and more detailed descriptions of how to find and identify eelgrass. The appendix has an equipment list and a sample datasheet.

Examples of historic cultivated clam gardens found in the Broughton Archipelago of Coastal BC.

WHY MONITOR CLAMS?

Monitoring clam beds let you know how the clam beds are doing in that area. A typical clam survey is done by digging small plots or **quadrats** on a beach and collecting data such as the number, size, weight and species of clams within each quadrat. Depending on how the data is analyzed, this type of survey can provide information on clam populations:

- Abundance and Biomass – The total number of clams or **abundance** can be estimated for a beach. Collecting the weight of each clam can be used to calculate an estimate of the total weight of clams or **biomass** for a given beach. Calculating the average abundance or average biomass for each quadrat can be used to compare clam populations between different beaches.

- Length, weight and age – These measurements show the status or health of a clam population based on how much of the population is a certain size. These measurements also show about how many **legal** or **sublegal** sized clams there are on a beach.

- Clam growth – The growth for an individual clam is based on the distance between **annuli** (growth rings) on the shell. **Length-at-annulus** data can be used to estimate growth rates of individual clams, when it is collected from several clams can be used to estimate the growth rate for the whole population.

Results of a single survey will provide information for one clam population in a single year. However, repeated surveys on the same beach each year will provide a long-term data set that can be used to track changes over time. Data from several different beaches can be used to compare differences in abundance or biomass throughout a larger area. The knowledge will help to inform decisions about harvest rates and closures, as well as identify potential impacts (over-harvesting or point-source pollution) affecting a clam beach.

WHAT TYPES OF CLAMS ARE MOST COMMONLY HARVESTED?

Littleneck clams, manila clams and butter clams are the most common species harvested for commercial, recreational an aboriginal harvesting on the west coast of BC are native (Gillespie et al. 1999). Other species commonly harvested by coastal First Nations include horse clams also known as gapers (*Tresus* spp.), razor clams (*Siliqua patula*) and cockles (*Clinocardium* spp.) (Harbo 2011).

BUTTER CLAMS

Native to BC. Maximum size is as large as 130mm. The shells are heavy and thick with side-by side circular ridges. Found in sand, shell hash and gravel within the lower intertidal zone (between high and low tide) and subtidal (below low tide) to depths of 40m.

Pacific Butter Clam (Photo courtesy of Fisheries and Oceans Canada)

LITTLENECK CLAMS

Native to BC, these clams grow to about 75mm. Shells have ridges in rings and ridges that are straight lines starting near the hinge. They are found in mixed gravel, sand and mud in the lower intertidal zone to depths of 10m.

Pacific littleneck clam (Photo courtesy of Fisheries and Oceans Canada)

MANILA CLAMS

Introduced to the waters of BC prior to 1936. The biggest size is about 75mm. . Shells have ridges in rings and ridges that are straight lines starting near the hinge. This clams usually live in the upper half of the intertidal zone in mixed mud, sand and gravel.

Manila Clam (Photo courtesy of Fisheries and Oceans Canada)

FIELD METHODS

WHAT IS "SIMPLE RANDOM SAMPLING"?

Simple random sampling is a tool for estimating clam abundance and biomass. Survey methods outlined in this manual follow the DFO survey protocol as described in Gillespie and Kronlund, 1999. Other sampling methods will not be covered in this manual. A simple random sample is achieved by picking a clam beach, setting a survey area and digging several quadrats at random locations within that area. The number, size and species of each clam removed from the quadrat is then recorded and entered into a spreadsheet. This data can be used to estimate the health of the clam population. The most common analyses are estimating the average abundance or biomass of a beach.

WHAT DO YOU NEED TO COMPLETE A CLAM SURVEY?

- Pitch forks
- 2 x 50m tape measures
- Vernier calipers
- Digital field scale
- Data-sheets, pens, pencils and notepaper, cybertracker if using
- Vexar mesh tubing for making clam sacks
- Buckets
- Digital camera, GPS
- Compass
- Flagging tape

Note – a quick reference list similar to the example in appendix 1 is helpful when preparing for the clam surveys to ensure no equipment is forgotten and all the pertinent field information is recorded.

STEP 1 - SURVEY DESIGN

- **Timing** – Due surveys during a low-tide cycle during the day. Select a tidal station located near your survey area or beach. (http://www.tides.gc.ca/eng/find/region/1).
    - Select a tide cycle where the low tide level is equal to or less than 1.0m above chart datum (usually occurring during the late spring and summer months from April to September).
    - Ideally the closer the low tide level is to chart datum, the better it will be for obtaining those types of clams found in the lower intertidal zone.
- **Site Selection** – Clam beaches are typically selected because it has been harvested before; i.e. commercial, community or family use. Surveyors should do a pre-survey on unfamiliar beaches before choosing them for a full sample. A pre-survey can be done by digging test-holes in areas of the beach likely to hold clams. Usually clam beaches have:
    - A shallow to moderate slope
    - Broken and/or empty shells on the beach
    - Sand and shell-hash.

A typical clam beach located in the Carey Group Islands, Central Coast, BC.

STEP 2 - SURVEY LAYOUT

GRID PLACEMENT

- X and Y reference lines should be placed on the beach such that a representative area of clam habitat is covered by the grid. The reference grid is used to guide the placement of quadrats.
- The X reference line is typically laid out parallel to the long axis of the beach; the Y axis is laid out perpendicular to the long axis of the beach.
- For most small beaches, the reference lines are 30m long, but shape and size of the beach will dictate the length.
- Designate one end of the reference line to be 0; if you face seaward, the left end of the reference line will be the 0m mark or point of commencement (POC); the other end will be the a the distance mark you have chosen (i.e. 30m mark for a 30 x 30 grid).

Place the X and Y reference lines so that a representative area of clam habitat is covered by the grid.

- Determine and record the direction of each reference line using a compass. *If using an electronic data-form on the cybertracker, enter the compass bearings into the header form.*

Take a photograph looking down each reference line and record the direction and length of each line.

RECORD ENVIRONMENTAL INFORMATION

- Briefly describe each intertidal zone (upper, middle and lower) in terms of slope, beach material and plant types. Draw a site map to show the reference lines relative to the intertidal zones and shoreline. Also record the:
- Comments on other plants and animals; i.e. other types of shellfish, barnacles, kelp, etc.
- Weather – current weather and/or the weather for the past 24 hour period if relevant.
- Other important information – signs of recent harvest, any litter or other material showing human use of the beach.

Recording environmental information of the selected clam beach.

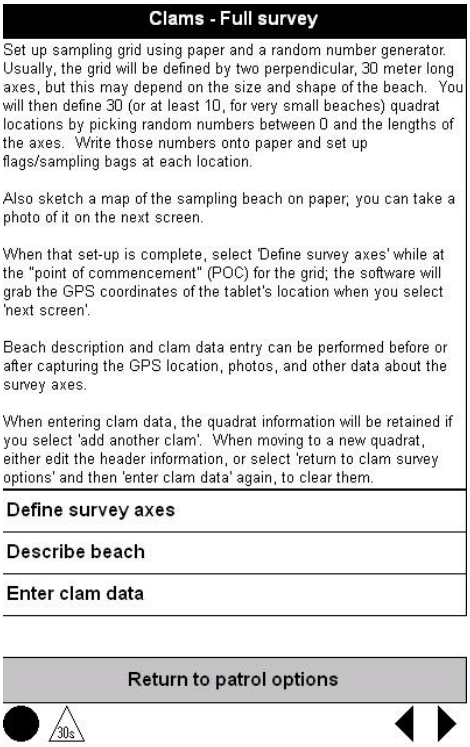
- As per the DFO clam manual, the recommended sampling rate for small beaches less than 5 hectares in size is 30 quadrats per hectare with a minimum of 10 quadrats per hectare. A quadrat is a rectangle 1m2 in area and 0.2m in depth.
- The total population of quadrats, N, is equal to the number of square meters available in the grid you established when you first arrived on site. For example, if you have placed a 30m x 30m grid on the beach, your survey area is 900m2; this gives you an N value of 900 quadrats to choose from.
- Your sample size, n, is the sub-set of quadrats randomly selected from the survey area that you will dig up. Quadrats are numbered sequentially 1, 2, 3,…, n.
- The quadrat locations are determined by randomly selecting coordinates from the X and y reference lines. Numbers can be chosen by way of a random number table or a random number generator downloaded to a mobile device.
- Example: If you've decided to have 10 quadrats (n=10) in your 900m2 survey grid, you would randomly choose 10 numbers between 0 and 30 from the X-axis to obtain your X-coordinates Then you would randomly select 10 numbers between 0 and 30 to obtain your Y-coordinates. Pair the two sets of numbers to make n=10 pairs of coordinates for quadrats.

Quadrat Number (i.e. 1 – *n*)	X values	Y values
1	*10*	*6*
2	*18*	*12*
3	*9*	*17*
4	*27*	*18*
5	*13*	*29*
6	*4*	*28*
7	*8*	*20*
8	*11*	*11*
9	*22*	*8*
10	*25*	*14*

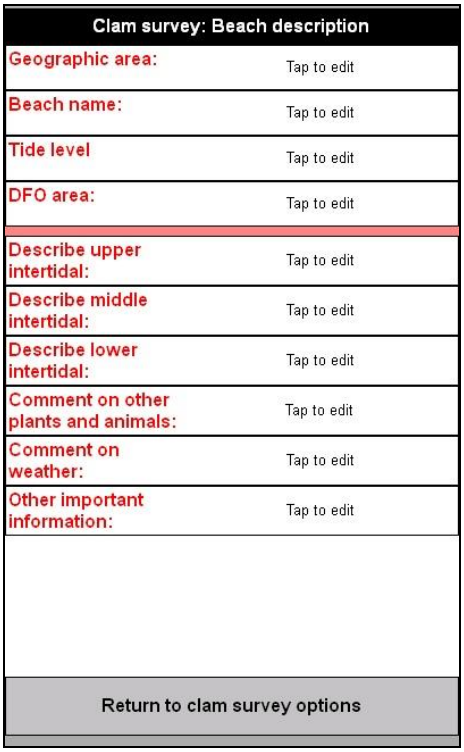
- Place a numbered clam sack at the corresponding quadrat based on the coordinate location. For example, Quadrat 1 would be located at (10, 6) or 10m down the X reference line and 6m down the Y reference line, and so on.

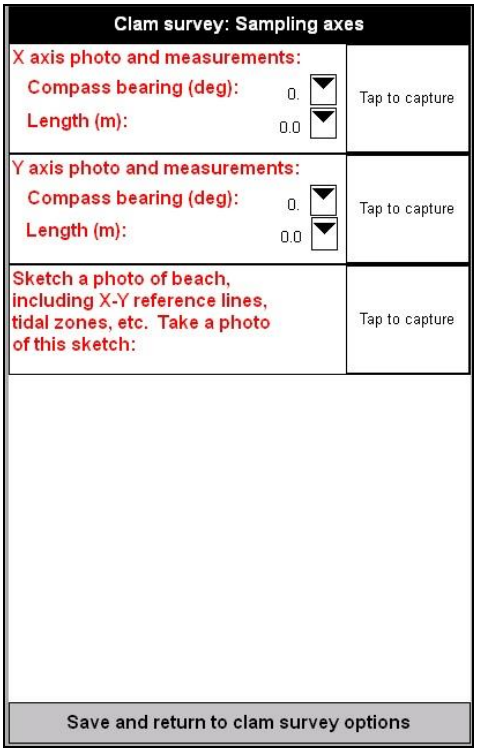
CYBERTRACKER SCREENS

Introduction Screen



Beach Description





STEP 3 - SAMPLE COLLECTION

DIGGING

- Mark out a 1.0m by 1.0m square at each quadrat location. Dig down to a depth 0.2m at each quadrat location using a pitchfork and/or rake.
- Carefully overturn the beach material (substrate) for the whole square, while gently hand-sifting the sediment in order to pick out clams of all sizes and species.
- Most d-handled pitchforks are about 1.0m long and the tine length is about 0.2m. Mark out your quadrat using the length of the pitchfork as a reference and dig only as deep as the tine length. If you use this approach each time you dig a quadrat, your digging effort will remain the same for all surveys.

Sorting and collecting clams from a quadrat.

COLLECTION AND STORAGE

- Clams of all sizes and species should be removed from the hole and placed in the right numbered clam sack.
- Beaches that produce a lot of clam may require two or more sacks to be used to hold the clams from a single quadrat; ensure that all extra bags are labeled with same quadrat # so they are all counted for the right square.

STEP 4 - DATA COLLECTION

Pick a flat location on the beach above the high-tide mark to process clams and record the clam data. For each clam write down the quadrat number where it was found, species, size and weight into a data form. This work can start while quadrats are still being dug in order to reduce the time spent on the beach. You can split into two groups for this.

Lawn chairs and/or portable picnic tables can make the work easier.

Selecting a sheltered and flat area to measure and record clam data as well as using lawn chairs makes the job easier.

HEADER INFORMATION

Header information such as **date, tide level, etc.** should be recorded in the spots at the top of each data sheet (See Appendix 2 for an example of a blank data sheet including header information) or into a header form provided on a tablet or cybertracker to record data.

Header information should include:

- Date – date that the work was done
- Sampling crew - first and last initials of the work crew members
- Geographic location – a general description of the area; i.e. Broughton Archipelago, Johnstone Strait.

- Name of the beach being sampled – a local name or label only used for that beach; if one is not already used for that site, it can be made-up.
- Tide level – the time of and height of low-tide as well as the station it was recorded at; i.e. 0.6m @ 08:15am – Port Neville
- Statistical area and sub-area – DFO Fisheries Management Areas for the Pacific Region: http://www.pac.dfo-mpo.gc.ca/fm-gp/maps-cartes/areas-secteurs/index-eng.html
- Sample Type - **Simple Random Sample** is used in this manual
- Sample Tech – **fork/not screened** is used in this manual

CLAM DATA

Write down species, size, weight and any special notes. ***See an example of a pre-made data-form is in Appendix 2*.**

- Species – enter the species code into the species column. Codes are:

  B = Butter clams

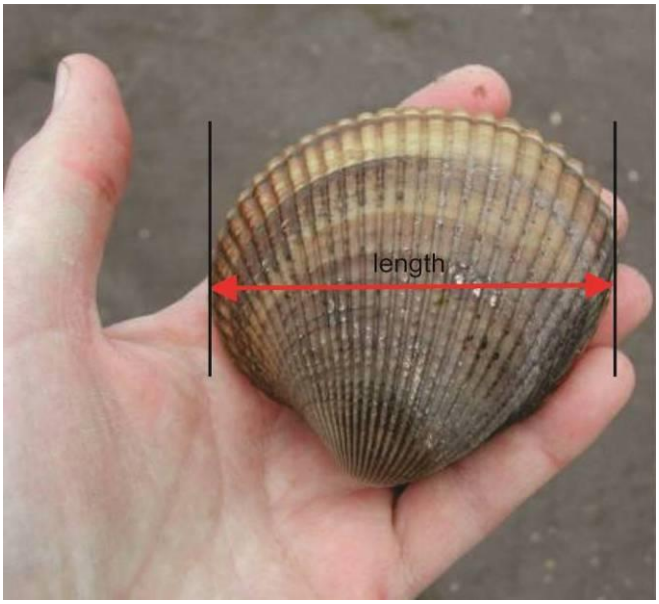
  BN = Macoma (bent-nose)

  C = Cockle spp.

  HC = Horse Clam

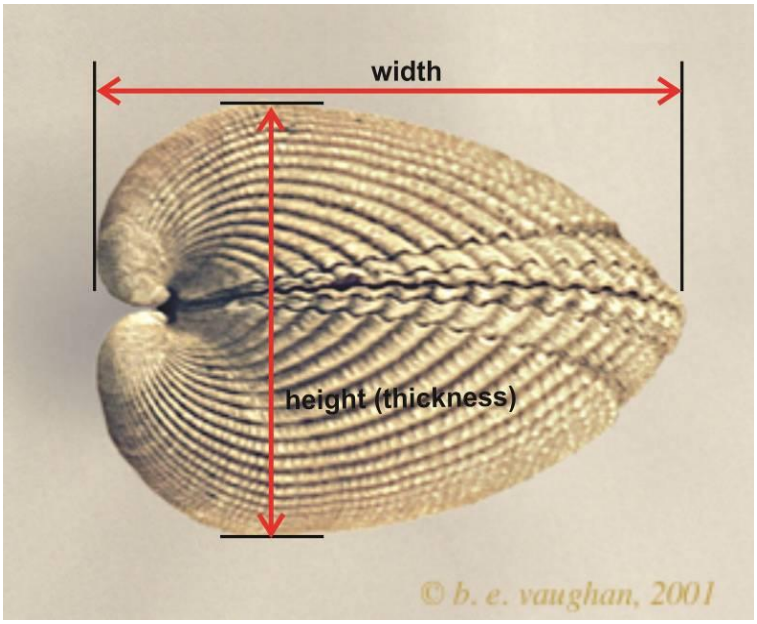
  LN = Little Neck

- Length – measure the length of the clam and record it in mm into the table.
- Width and Height (thickness) – Width and height (or thickness) of the clam and record the measurements in mm into the table.
- Weight – weigh the clam on a digital scale. Remove any excess water or dirt from the clam prior to placing on scale. Record the weight in grams to the nearest single decimal place in the table.
- Comments - Other things note should be written down. For example: healed injuries, shell damage, bad smell, etc.



The length measurement of a cockle (*Clinocardium* spp.)

Obtaining length measurements using calipers.



Width and height (thickness) measurements for a cockle (*Clinocardium* spp.)

Obtaining a thickness measurement using calipers.

CYBERTRACKER SCREEN

INFORMATION SOURCES

FIELD GUIDES

"Whelks to Whales – Coastal marine life of the Pacific Northwest" – Rick M. Harbo – Newly rev. and expanded 2nd ed.

"Marine Life of the Pacific Northwest: A photographic encyclopedia" – Andy Lamb and Bernard P. Hanby

GOVERNMENT WEBSITE LINKS

Fisheries and Oceans Canada – Pacific Region BC Sport Fishing Guide – Shellfish Identification http://www.pac.dfo-mpo.gc.ca/fm-gp/rec/species-especes/shellident-identcoquille-eng.html

Fisheries and Oceans Canada – Pacific Region Science and Aquatic Species Research – Intertidal Clams http://www.pac.dfo-mpo.gc.ca/science/species-especes/shellfish-coquillages/clam-palourde/index-eng.html

Fisheries and Oceans Canada – Pacific Clam Species http://www.pac.dfo-mpo.gc.ca/science/species-especes/shellfish-coquillages/clam-palourde/clams-palourdes-eng.html

Fisheries and Oceans Canada – Tides, Currents and Water Levels - http://www.tides.gc.ca/eng/find/region/1

Government of Canada – Environment and Natural Resources – Weather Information – http://weather.gc.ca/canada_e.html

Fisheries and Oceans Canada – Science Branch – Pacific Region – "A Manual for Intertidal Clam Surveys" – By G.E. Gillespie and A.R. Kronlund - http://www.dfo-mpo.gc.ca/Library/234406.pdf

Fisheries and Oceans Canada – Integrated Fisheries Management Plans – Pacific Region – Intertidal Clams January 1, 2013 to December 31, 2015. http://www.pac.dfo-mpo.gc.ca/fm-gp/mplans/2013/intertidal_clam-palourde_intercotidale-sm-2013-15-eng.pdf

First Nations Health Authority – Wellness –Healthy Eating – Traditional Food Facts Sheet - http://www.fnha.ca/Documents/Traditional_Food_Fact_Sheets.pdf

GOVERNMENT CONTACTS

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Jason Dunham - Jason.Dunham@dfo-mpo.gc.ca – 250-756-7214

APPENDIX 1 – SURVEY EQUIPMENT CHECKLIST AND QUICK REFERENCE CARD

CLAM SURVEY EQUIPMENT CHECKLIST:

- ☐ blank 8.5x11" field paper
- ☐ field notebook with field paper
- ☐ clam id or field guide
- ☐ survey methodology book
- ☐ random numbers table, or phone app.
- ☐ map of beaches
- ☐ tide guide
- ☐ pencils and permanent markers
- ☐ 2-3 box cutters or knives
- ☐ GPS with spare batteries
- ☐ Digital scales with spare batteries
- ☐ 1 VHF radio
- ☐ 1 camera and charger
- ☐ 1 hand measuring tape (5m)
- ☐ 2 x 50m measuring tapes
- ☐ 3-4 calipers (measuring)
- ☐ 30 stakes (skewers)
- ☐ 4 rolls flagging tape
- ☐ 300 ft roll of vexar clam bag
- ☐ 30 clam sacks (numbered with pink flag)
- ☐ 4 clam shovels (pitchfork)

FIELD NOTE QUICK REFERENCE CARD:

• **Date**	• **Beach Name and General Location**
• **Crew Initials**	• **Weather**

• **Random numbers** for X and Y (#1-30)	• **Transect Details**
	  ○ POC of transect (Lat. / Long.)
	  ○ X-axis length and direction (30m is best)
	  ○ Y-axis length and direction (30m is best)
	  ○ Estimate the size of the beach in square meters (length x width)

• **Site description**: topography and slope	• **Tides:** tide height, time at low tide, reference station **(Alert Bay)**
• **Site info:** (why was it chosen? Fish farm proximity/log dump/ is it an index site/ common commercial digging) • **History:** evidence of clam gardens, commercial harvest (use pers. comm.), food gathering	

APPENDIX 2 – EXAMPLE OF A FIELD DATA-FORM WITH HEADER INFORMATION

Intertidal Clam Biological Data

Location:_____ Beach:_____Page:_____
Date:_____ Tide Level:_____Stat Area:_____
Samplers:_____ Water Temp:_____Sample Type:_____
Sample Tech: fork/not screened Sub Area:_____

Quadrat	Species	Length (mm)	Width (mm)	Height (mm)	Weight (g)	Comment