Hakai Nearshore Marine Ecology Beach Seining Survey Methods

2018 Hakai Institute B Millard
Martin, M Bresch, M Hessing-Lewis

Document produced by the Hakai Institute Please share, acknowledging production and authorship

Background Information

This protocol applies to the near-shore fish component of the larger MarineGEO project at the Hakai Institute on Calvert Island.

Study Objectives

1) Use beach seining to carry out a long term monitoring program of nearshore fish communities on the central coast
2) Evaluate the detection probabilities of key fish species to determine the effectiveness of beach seine sampling
3) Gather information on fish species diversity, size distribution and relative abundance across spatial and temporal scales that can be used for future studies and publications
4) Catalogue species diversity of the Calvert island near-shore beach communities
5) Collect fish and invertebrate by-catch specimens for a food web analysis of central coast near-shore communities
6) Sample a variety of near-shore habitat types, from seagrass beds to sandy bottomed ecosystems in order to build occupancy models for key species such as sand lance, herring, ling cod and rockfish.
7) In combination the above data will constitute a baseline, or benchmark against which to measure future changes and should enable comparison between the relatively pristine ecosystems of the BC central coast and more developed systems along the rest of the coast.

Summary of Activities

During each sampling event, we will aim to conduct repeated seine samples (2 sets per site) at each site during daily low tides, once a month throughout the summer. We will sample during the low low-tide of the day during the lowest tides of the month. As a general rule, we will only seine tides of 1.2m or less although many sites require much lower tides to seine successfully. Within each seine replicate, we will count the total number of each individual species except in cases where there are large numbers of certain species, in which case an estimate can be done after a subset is kept for measuring. We will measure the fork length (for species with a forked tail) or total length (for species without a forked tail) of a random subsample of individuals (N=20) for each species. All fish sampled using the seine net will be released with the exception of 10-20 specimens that will be kept for stable isotope and gut content analysis (see specimen collection permit and protocol). Also, during each site visit physical parameters, including pH, temperature and salinity will be collected using an YSI and a secchi depth will be recorded.

Core Seining Sites

After investigating possible seining sites around HBI, six core sites were identified for the study: three inner shore sites in Kwakshua Channel and three outer coast sites in Choked Pass. Core sites were chosen for their proximity to the Hakai institute, success of exploratory seining, diversity of habitat types, as well as presence of sand lance. These focal sites will be sampled once a month during a set of suitable low tides ($\leq$ 1.2 meters in height) that align with scheduled shifts.

	Site	Net Size
Inner Shores	1) Pruth Bay (PBA)	11m
	2) Pruth Pocket (PPO)	11m
	3) Hakai Dock (HDO)	11m
Outer Shore	1) Sand Spit (SSP)	22m
	2) Wolf Beach (WFB)	22m
	3) Choked Pocket (CHP)	11m

Choosing replicate sites
We will conduct two beach seine replicates per beach. Replicates should be placed along the beach to capture any heterogeneity in subtidal habitat (as defined by substrate type, dominant vegetation, or geographic features such as a rocky headland). They should be set to avoid rocky areas and heavy vegetation (ie: kelp) that might hinder the effectiveness of seining. It is also important to consider wind direction and current to ensure the net is fully expanded when set. Replicates should be offset and adjacent to each other and should aim to capture a representative sample of the beach. The larger (22 m) net is used on large beaches (such as Wolf Beach) while the smaller (11 m) net will be used on small "pocket" beaches. Note: We set in the same locations each time we visit the core sites.

Field Protocol

Seine Deployment
Setting the net will follow these steps:

1) The boat comes ashore and the supplies needed for processing the fish sampled are prepared (buckets filled with water, etc).
2) With one person driving the boat, a second person on the boat feeds the net out to a third person standing on the beach in the water at waist height holding one bridle end (this person will act as the anchor by holding the bridle in position).
3) The boat will then drive perpendicular from shore outwards, and once the net is straightened out, the boat will begin to curve towards shore, giving the net a horseshoe shape parallel to shore.
4) As the boat approaches shore and reaches water shallow enough to wade in, the person deploying the net from the boat will exit the boat with the second bridle end.
5) Both people then simultaneously pull each end of the net onto shore, coming towards each other, as the net gets closer to shore. Special care needs to be taken to ensure that the lead line stays against the beach so that no fish are able to escape out the bottom. This is accomplished by pulling tightly on the float line while allowing the lead line to be slack as the net is brought ashore. As the net comes close to shore the lead line needs to be pulled flush with the float line so that the fish are not dragged onto the beach below the net. The lead line should scoop underneath the leading edge of the float line so the net is essentially folded in half and the fish are contained within it.
6) Once the net is onshore, the float line can be pulled back to reveal the fish inside. A quick observation of species is done to assess numbers and to identify any sensitive species such as

herring (*See Subsampling Procedure*). Fish can then be pulled from the net and placed in holding buckets.

7) All invertebrate by-catch should be identified and counted or estimated. Any invertebrate sample collections should be made at this time.
8) Once the net has been cleared of all fish needed for sampling, it can be pulled into the water where it should be towed out by the boat to "clean it" of any detritus or by-catch left in the net. It is then flaked back on board to get ready for the next set.
9) The second beach seine replicate should be set immediately following the first. Do not process the fish from rep 1 first, as we sample without replacement.

Data Recording

Time of set (start and end time) along with the net size and seine success (see *Seining Success)* are all recorded on the front of each data sheet. Physical characterization of each Core beach has been done (e.g. slope, aspect, length, dominant veg etc.) but these may be re-done in future for comparison.

Seine Success

For each replicate, success of the set will be assessed. This will take into consideration current, the positioning of the net and its components (is the net drifting, is the lead line against the beach bottom the whole time), substrate (rocks that might obstruct the path of the net and require lifting of the lead line) and general valuation of whether or not the net caught a representative sample.

Class	Description
1	A good quality seine set; no rocks obstructing the path, lead line stays against the beach bottom, no fish are lost from the net, no significant current displacing the net – data are of good quality.
2	A questionable quality seine set; net partially fouled or poorly set – data may still be useful.
3	A poor seine set; net completely fouled or deployed improperly – data is highly questionable.

Subsampling Procedure

When there are large numbers of a single species caught in the net, a sub-sample of that species can be retained for counting and measurements. The subsample can be collected by random scoop of a bucket or dip net. The entire net can then be scanned quickly for species diversity. This prevents overcrowding in holding buckets and long processing times that can cause mortality in the fish being held. The sub-sample is removed, and an estimate of those remaining in the net is made (individual estimates for each observer which are then averaged). If there are two age classes of a species present then a separate estimate will be made for each e.g. adult shiner perch vs. juvenile shiner perch.

Fish not being sampled are released immediately by dragging the net back into the water. Some species, such as juvenile salmon or Pacific herring, are particularly sensitive to being caught in the net and have a higher chance of catch related mortality. It is important that the crew be aware of susceptible species and mindful of fish that appear to be stressed. These fish need to be identified and processed quickly. If the entire sample is comprised of particularly sensitive species, (e.g. herring) a quick subsample can be collected, an estimate can be taken of the entire catch, and the majority of the fish can be released. Even when sensitive species are not present, holding buckets must be monitored regularly during processing. This is especially true for large catches or on hot days. When fish start to swim or orient abnormally in the holding buckets, new seawater should be added immediately, holding buckets can be split or a

subsample of the bucket can be taken. Reducing catch mortality should always be one of the top priorities of sampling and can be accomplished by following the above procedures.

Protocol for large catch of Similar Species/Class

Some large seine samples contain several species or classes that are difficult to distinguish from one another. These difficult to distinguish fish include some of the flatfishes and certain age classes within a species. In order to gain estimates of these species or classes in an efficient manner the group will be subsampled and the species/class ratios used to extrapolate to the larger group of similar fishes. Preferable to identifying and counting a very large sample (200+), subsampling will both increase efficiency and reduce mortalities by limiting the time that the fish are out of water.

When a group of similar fish are caught a subsample of roughly 100 will be taken at random by scooping with a net or bucket. An estimate of the entire seine sample of fish will be made. The subsampled fish will then be identified and counted. Protocol will otherwise take place as normal separate from the subsample. Later, during data entry, calculated species ratios will be used to get an estimate for each species/class. Estimates will be presented in the dataset as the total number of a species/class in a seine sample.

Processing Fish

Any fish that are to be processed will be placed into 5 gallon buckets of seawater taken from the sampling site. Small aquarium nets can be used to aid in the transfer of fish from the beach seine to holding buckets. All fish in the buckets will be counted and a subsample of no more than 20 of each species will be measured. To ensure an unbiased subsample, the aquarium nets will be used to 'blindly' select fish from the holding buckets. Counts of individuals per species are cumulative for each replicate, but the measurements are cumulative for each site (ie: *if there are 20 sandlance in the first replicate*, they only need to be counted in the second replicate; they do not to be measured). Fish will be identified to species. When observers cannot identify to species, the individual fish can be photographed and/or kept as a voucher specimen. Once fish are measured and/or tallied, they can be placed into a release bucket containing seawater, which can be periodically emptied back at the sampling site.

Bycatch

All non-fish species within each seine set will also be identified and enumerated. These include jellies, nudibranchs, caridean shrimp, crabs etc. An average size can also be recorded for each species.

Specimen Collections

In the Field:

Specimens will be collected according to the species-specific plan laid out in the regionally based sample collection protocol (see *Specimen collection Protocol below*). They will be placed in labeled Ziploc or whirlpak bags and immediately put in ice and seawater to keep them cold and limit digestion of stomach contents. Specimens of the same species from a site can be bagged together with the exception of specimens for genetic analysis (herring) that should be placed in individual whirlpak bags. If there are obvious size class bins in the specimens collected (from a random sub-sample of the seine net contents) these can be placed in separate specimen bags and labeled accordingly.

In the lab:

Once back at the institute, properly labeled samples (with printed rite in rain label) for stable isotopes and stomach content analysis will be placed in the freezer for storage. Genetics samples (herring) will be processed according to the written protocol (see *Specimen collection protocol)* and then frozen.

Data
After data has been entered, it will be checked by another crewmember for accuracy. Data entry will occur on the same day as sampling.

Fish ID
If species id is not possible in the field, (e.g. larval specimens that are very small) a representative sample can be collected and kept as a voucher specimen for identification back in the laboratory. If collection is not possible, specimens can be photographed and pictures can be sent to experts for assistance in identification.

Collection Procedures for Stable Isotope, Stomach Contents and Genetic Analysis

Handling fish in the field

Specimens will be collected according to the species-specific plan laid out in the regionally based sample collection protocol (see below). They will be placed in labeled Ziploc or whirlpak bags and immediately put in an ice & seawater slurry to keep them cold and limit digestion of stomach contents.

Specimens of the same species from a site can be bagged together with the exception of specimens for genetic analysis (herring) that should be placed in individual whirlpak bags. If there are obvious size class bins in the specimens collected (from a random sub-sample of the seine net contents) these can be placed in separate specimen bags and labeled accordingly.

In the lab

Once back at the institute, properly labeled samples for stable isotopes and stomach content analysis will be placed in the freezer for storage. Genetics samples (herring) will be processed according to the written protocol below.

Labeling Specimen Collections

The project identifier is FABS (Fish Assemblage Beach Surveys). This will be on every label followed by a four-digit sample number unique for each sample collected: e.g. FABS0001. Every time we collect a sample this number will be updated chronologically, regardless of location or species. All of this information will be included in the metadata linked to the sample number. We keep a running tally of FABS ID labels printed out on write in the rain paper in the lab which can be removed and placed in bags while simultaneously updating the electronic spreadsheet on the drive.

To differentiate between individual fish collected and processed for genetics the project identifier and sample number will be followed by a processing sample id consisting of a letter and up to two digits e.g. G01. These sample ids will be consecutive for each fish collected for genetics from a single site but not throughout the season. Therefore a herring collected for genetics could be FABS0004G01 and the next herring from the same site/date would be FABS0004G02, but for a subsequent site the herring samples would be labeled FABS0005G01…02 etc.

Example:

When sampling Wolf Beach on a set date, the first sample collected will be FABS0001 (e.g. we have collected ten sandlance). If we subsequently collect surf smelt the sample id will be FABS0002 etc. For herring genetics collected at the next site the label would read FABS0003_G01.

Genetics Samples

1. Tissue samples should be preserved in 100% non-denatured ethanol as soon as possible after the herring are caught.
2. Each individual herring has its own sampling tube (2ml stand alone tubes with screw cap tops) and an individual label will be placed within the tube with the sample. These labels are pre-printed on rite in the rain paper. You need two copies of each label, one for the tube, and another for the whirlpak which will hold the rest of the fish, post fin clip.
3. Each individual herring must first be measured (FL) and weighed on the analytical balance. A new wax paper weigh sheet will be used for each individual.
4. The ratio of tissue to ethanol should be 1:5 and all tissue MUST be covered in ethanol-an ideal tissue sample size is $2cm^2$ so for small specimens both the dorsal and caudal fin should be collected or a bit of caudal tissue along with the caudal fin. Avoid cutting into the stomach as these will be gone through later for food web study. The fin clip goes in the tube of ethanol.
5. Rinse the scissors with water and wipe with paper towel between sampling different individuals.
6. Once you have removed tissue from the specimen place the body of the fish back in its whirlpak with associated label.
7. Sample tubes should be stored in a refrigerator until they can be shipped to the lab for further processing.
8. Bagged samples should be placed inside one larger bag with the FABS id and frozen as soon as possible.

Voucher Specimen Collections

Voucher specimens can be preserved using formalin in a sample jar once back at the laboratory. After a few weeks the sample solution can be switched to ethanol, and the formalin can be saved and used for other samples.

Sediment Sample Collection and Processing

After a qualitative assessment of the intertidal and subtidal sediment is complete a sediment sample should be collected at each site and brought back to the lab for analysis of bulk mass and grain size distribution.

Sample Collection:

1. Use the sampler to collect a sediment plug along the low tide line. You push the sampler into the sediment up to the marked black line.
2. The sample gets stored in a labeled Ziploc bag. A sediment sample paper insert gets filled out and placed in the bag with the sample
3. Once back at the lab the samples are stored in the fridge until further processing.

Sample Processing: Drying and Sieving

1. The bagged sample is weighed and emptied onto a pre-weighed tin pie plate for drying in the oven. Subtract the empty bag weight from the first mass to get the sediment "wet weight".
2. The sediment sample then gets placed in the oven at 100°C for 24 hrs.
3. Once dried the entire sample should be weighed (Dry weight) and placed on the sieves and shaken for 15 minutes (using the Ro-Tap-RX-29E Test Sieve Shaker) on "coarse" mode. There are 11 size fractions in the sieve stack (8mm, 4mm, 2mm, 1mm, 500μm, 250μm, 125μm, 63μm, 32μm, 20μm and <20μm).
4. Once finished shaking each size fraction should be weighed to the nearest 0.001g.

5. The sediment sample can be disposed of.
6. The sieves can then be cleaned in preparation for the next dried sediment sample.

YSI Protocol

Temperature, salinity and pH measurements will be collected at defined depths at each seining at specified distances from the site. Measurements will be taken alone a transect at a near shore station (A), a 1m depth station (B) a seine-extent station (C) and a distant station (D).

Station transects will fall along the centreline of each seine path. If seine replicates are adjacent to one another a single transect from the centre of the beach, and perpendicular to the beach orientation, will be sufficient.

The near shore station is defined as the point at which the water reaches a depth 0.5 meters. A single reading will be taken at 0.5 meters. The 1m depth station is defined as the location where the water reaches a 1 metre depth. Readings will be taken at depths of 0.5 metres and 1 metre. The seine-extent station is located at the outer-most point that the seine reaches. Readings at this location will be taken at 0.5 metres, 1.0 metre and 3.0 metres. The distant station falls where a 10m depth is reached or 100m from shore, whichever is closer to shore. Readings at this location will be made at 0.5 meters, 1.0 meter, 5.0 metres and 10 metres. If any of these depths cannot be achieved, a bottom measurement will be made and the depth recorded. GPS coordinates we be collected for each station. All data will be manually recorded.