MarineGEO

THE TENNENBAUM
MARINE OBSERVATORIES NETWORK

Ocean Bitemap:
Summary and Protocols

2016-04-04

Summary

Ocean Bitemap is a global effort to map predation rates and associated predator community data in nearshore marine habitats. Predation is a strong structuring force in ecological communities and yet we have little quantitative understanding of how the strength of predation varies among habitats and regions globally. By deploying simple predation assays and recording data on associated fish communities (the most common predators in coastal waters), we aspire to assemble a large, open-source data set that provides a broad picture of how predation varies in space (and time) and is related to characteristics of fish communities.

This project is designed to be easily deployed and maintained, with minimal infrastructure. We estimate it will require 2-4 people approximately 20 hours over 4-6 days to accomplish the protocol in full. A complete set of materials will cost between $90-250 depending on what you already have in stock, including all Squidpop items and a seine net. If you have access to a GoPro camera with waterproof housing, we encourage using video to identify which fish feed from the Squidpops, although this is not required.

Additional benefits of this (ideally) long-term project and method are that (1) the full complement of data can be collected on site and immediately uploaded as part of a larger global data set, providing near real time results freely available to all participants, (2) Data can be added through time, steadily increasing the value of the data set, (3) the protocol is simple and quick enough to allow university and even high school classes to contribute valuable, original data.

Background

The structure and functioning of ecosystems are largely dictated by the types and productivity of plants that populate them. These characteristics are in turn set by the supply of resources and the intensity of consumption by animals, commonly called bottom-up and top-down forcing, respectively. Bottom-up control is relatively well understood because vegetation can be mapped easily, and remote sensing has yielded a detailed picture of the distribution and biomass of primary producers.

The geography of top-down control is much less well understood. While large-scale distributions of consumers reflect bottom-up forcing (e.g. temperature, productivity, plant defenses, and so on), their mobility, diverse diets, and behavior have precluded a detailed global picture of top-down control equivalent to that available for primary production. Characterizing this variation in consumer pressure is important because top-down control by predators tends to have stronger impacts and penetrates farther through the food web than does bottom-up control by resources. Yet top predators are declining globally, with often profound but poorly documented implications for ecosystem structure and functioning.

In short, there is a need for a systematic exploration of how feeding by predators varies through space and time. Mapping top-down control would be advanced by standardized methods that can be compared rigorously across ecosystem types and

taxa. One promising approach involves exposing standardized prey in different places and times to compare the rate of loss to predators. Such experiments have been used widely by marine ecologists, generally using living prey to estimate vulnerability of the species among habitats. But at larger geographic scales, such methods can be difficult because prey species differ among regions, prey are unavailable in some areas, and working with live prey poses logistical constraints. For many purposes, a standardized food type is desirable.

Here we present a simple assay for measuring the relative feeding intensity of generalist predators in aquatic systems (for further details see the published paper[1]) and a method for sampling the associated fish communities. The assay and sampling method were designed with equal emphasis on simplicity, economy, and scientific rigor to ensure that it will be accessible to a wide range of users, including students and citizen scientists. Thus, these techniques will facilitate the collection of locally and globally relevant scientific data at low cost.

Goal

Develop the first global, quantitative map of top-down predation pressure based on standardized measurements of predation and fish community structure.

This will be accomplished by a collaborative, coordinated project, conducted in paired seagrass and unvegetated habitats, to obtain quantitative, standardized estimates of:

(1) predation pressure: overall feeding rate of the predator community;
(2) fish community metrics (species composition, abundance, size distribution, biomass, and richness);
(3) a first pass at variation among habitats (vegetated vs unvegetated).

Experimental design

	Deployments					
	Time Point 1		Time Point 2		Time Point 3	
Unvegetated	Squidpops x 25	Seine x 1	Squidpops x 25	Seine x 1	Squidpops x 25	Seine x 1
Seagrass	Squidpops x 25	Seine x 1	Squidpops x 25	Seine x 1	Squidpops x 25	Seine x 1
Total per deployment	Squidpops = 50	Seine = 2	Squidpops = 50	Seine = 2	Squidpops = 50	Seine = 2

Total Squidpops = 3 deployments, 150 stakes
Total Seines = 6

[1] Duffy JE, Ziegler SL, Campbell JE, Bippus PM, Lefcheck JS (2015) Squidpops: A Simple Tool to Crowdsource a Global Map of Marine Predation Intensity. PLoS ONE 10(11): e0142994. doi:10.1371/journal.pone.0142994

Timing

In order to rigorously quantify how predation pressure varies through space and in association with fish community structure, we will conduct the standardized predation assay (Squidpops) and fish sampling (seine haul) *in tandem at no fewer than three time points* in each of the two habitats (seagrass, unvegetated) over a period of less than 3 weeks (ideally on successive days). This will reduce variation among days in fish visitation, weather, etc. and increase confidence that the averaged data from predation assays and sampling events are representative of the site and season. Fish seines should be conducted immediately before deployment of Squidpops no further than 100 meters from Squidpops in the same habitat type the Squidpops were deployed in (seagrass, unvegetated).

Target Habitats

These protocols are meant to be accomplished with a paired design, in one seagrass and one unvegetated habitat, for a total of six Squidpop/seines over the course of the experiment (seagrass × 3, unvegetated × 3). The habitats should be geographically paired, ideally no more than 500 meters apart, and the three sampling times should be as close together as possible. The three time samples are considered replicates and should sample the same seagrass/unvegetated pair of sites. In other words, you will sample the same locales three times.

Permitting

Be sure you have all the proper permits in place to sample fish at your chosen sites.

Website

Information about Ocean Bitemap including data, resources, template data forms, and contact information can be found at: http://bitemap.wordpress.com/

Bitemap Squidpop Protocol

Overview:

The basic assay involves attaching standardized pieces of animal food to a plastic stake ("Squidpop"), deploying the stake in a shallow water habitat, retrieving the stake after 24 hours, and scoring whether the food is still present or absent. We use food that should be readily available throughout the world and is easy to work with. The simulated animal prey is a piece of dried squid mantle tissue. Dried whole squid is available in many Asian grocery stores as well as online; it is important to get the type of squid in which the squid's mantle (main part of body) remains whole, resembling a flattened sheet (see materials appendix for sources).

Dried squid, with discs removed from the mantle tissue using a cork borer.

Materials Needed:

ITEM	*QUANTITY*
dried squid mantle (about 1.3 cm diameter circle)	25 per deployment
auger hole punch or cork borer (1.3 cm diameter)	1
green fiberglass garden stakes (~50cm)	25 per deployment
fine monofilament fishing line (2-10 lb. or similar)	~5 cm per stake
electrical tape	1 roll
sewing needle	1
scissors	1 pair
data sheets and pencils	several
GPS unit (optional)	1
GoPro camera (optional)	1

Getting Prepared:

1) Use auger punch to make 25 round pieces of dried squid mantle, 1.3 cm diameter (OR cut 1 x 1 cm squares).

2) Pierce the squid with a needle threaded with a thin monofilament line. Wrap the line around the piece of squid and then tie a knot to the lead line to secure the squid to the line.

3) Cut the line approximately 5 cm from the piece of squid. Affix line to the stake with tightly wrapped electrical tape. Wrap the free end of the line to the rod leaving approximately 1 cm in length for the tether (see photo below).

Note: keep the squid as dry as possible until deployment. The dried squid can become oily or slimy when immersed and may foul the water. We recommend keeping the squidpops in the refrigerator until deployment.

Assembled squidpops ready for deployment.

Deploying Squidpops:

4) Deploy the array of squidpops at roughly the same depth in the same type of habitat. This may involve a linear or other arrangement according to the site conditions. The Squidpop rods should be stuck firmly and deeply into the sediment to prevent dislodgement by waves, drifting algae, energetic predators, etc., and spaced approximately 1-2 meters apart. Take care to deploy the rods in such a way that they can be easily relocated after 24 hours.

Note: If using a GoPro to help identify fishes consuming the squid bait, deploy it underwater in such a way that you are able to capture several of the squidpops in the frame. This is not necessary but can be helpful determining what fish species actually consumed the bait. See additional protocols appendix II for more detailed instructions.

5) Record the time of deployment, GPS coordinates (if possible), ambient weather conditions (sunny, partly cloudy, rainy, etc.), water temperature (from temperature probe or closest accurate station), and estimate wind speed.

Note: If not using GPS, be sure to note your relation to land features that will help you find the Squidpops later and identify your approximate GPS coordinates on Google Earth.

Observing And Recording Data:

6) *One hour* after deployment: Examine the Squidpops *in situ* and record how many stakes have lost the squid bait. Make sure all 25 squidpops are still in place, and be sure to note how many (if any) stakes have gone missing. Avoid disturbing or removing the stakes, which will be collected the following day. Bait loss is recorded

as 'all or nothing', that is, to be counted as missing the entire disk of bait must be removed. There are no 'partial' counts.

Note: leave all stakes deployed after one hour in place, regardless of whether the squid has been eaten or not. This will keep the number of stakes on-site constant and prevents confusion when collecting after 24 hours.

7) *24 hours* after deployment: Recover the stakes as close to 24 hours after deployment as possible. Score in the same way as the one-hour observations. When you record the data make sure you clearly indicate that the number you wrote down is the number gone.

Note: At 24 hours, record whether bait is missing from each of the 25 Squidpops, including those you already accounted for at 1 hour. This is to capture cumulative loss of bait. For example, if 5 pieces were gone at 1 hour, and an additional 10 were gone at 24 hours, you would record 15 pieces of bait missing after 24 hours.

Bitemap Seine Protocol

Overview:

The fish community in the area where squidpops are deployed will be characterized using a standard seine haul protocol. The Nearshore Seining Survey is based on one developed for a long-term research study on dynamics of fishes and invertebrates at the Smithsonian Environmental Research Center (SERC) on the central Chesapeake Bay. For Bitemap, the standard seine haul provides a method that allows rigorous comparisons of nearshore fish communities across sites, provided the sites are sufficiently shallow (< ~1.5 m) and free of structure to allow a seine to be pulled through. While it may vary among study sites, it is typically easiest to accomplish seines of this type at low tide.

Materials:

ITEM	***QUANTITY***
seine net with 0.635cm (1/4 in) stretch mesh, 10m mouth width	1
bins and buckets	several
metric rulers	1 per person
metric tape measure	1
small aquarium dip nets	1 per person
transect markers (PVC pole, flag, tape, etc.)	4
weighted float or pole marker	1
data sheet and pencils	several
digital camera	1
crab tongs (optional)	several
GPS unit (optional)	1

Getting Prepared:

1) Gather all the necessary supplies listed above.

2) Once in field, partially fill your large and small bins with water and place these on beach where the seine will come in. Fill in data on data sheet including time, date, location, etc.

   Note: Do not walk through the water anywhere near the transect you are about to sample. This will disturb the fishes prematurely and alter your capture efficiency.

3) Set your transect markers near the water line 10 meters apart from each other in front of the area where you intend to seine. These will provide guides allowing the seiners to maintain a direct line to the shore with 10 meters between them.

   Note: If your site does not abut shoreline, you will have to modify the protocol to standardize the length of your seine haul. We recommend pulling the net no less than 20 m across your site. You will then have to sample the captured fish community from a boat, stable platform, or any other method that allows you to access all the fish in your net while minimizing stress on the animals.

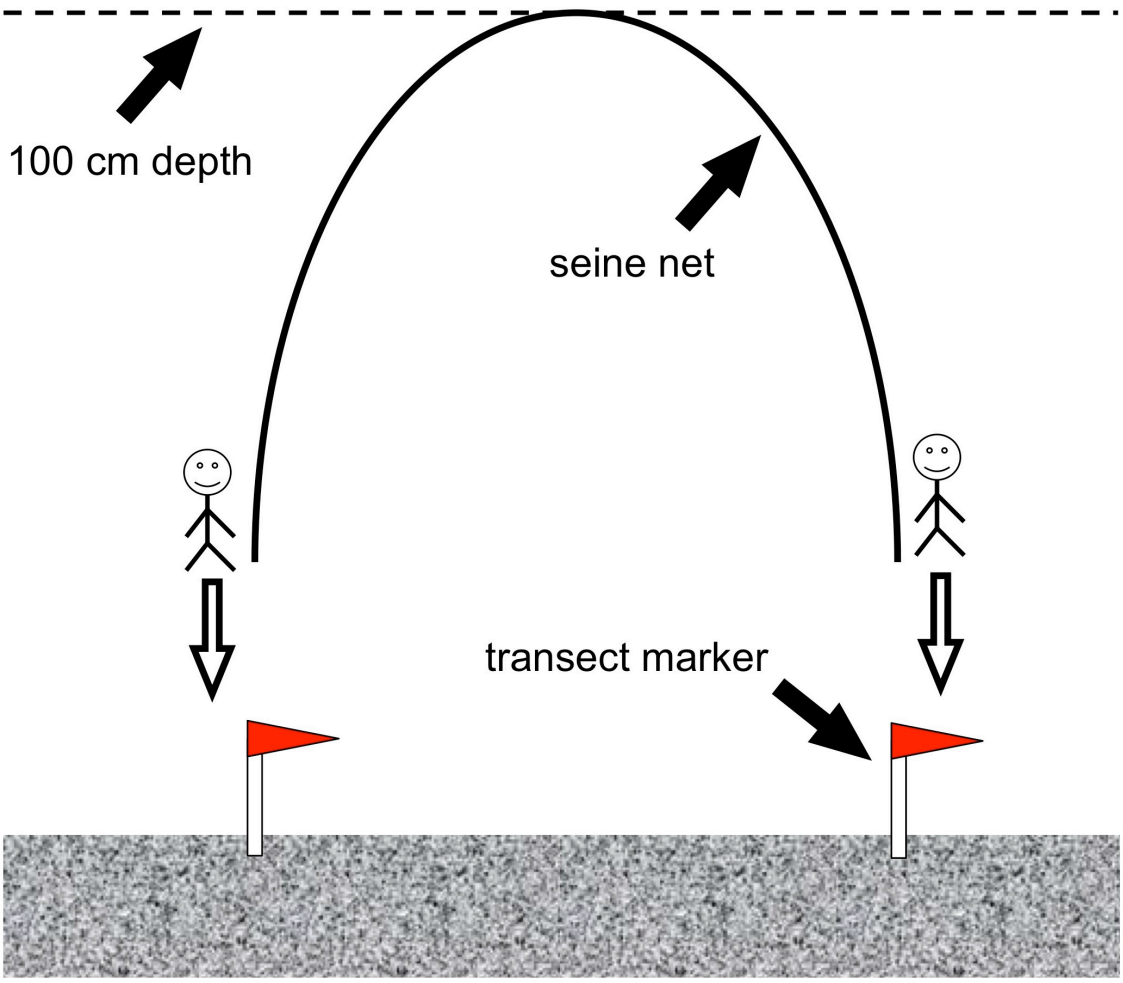
Seining:

4) With the seine net rolled up, walk it well outside the margins of the transect to a depth of 100 cm, carrying a weighted float or pole marker. Once at this depth, approach the transect border. One person should stop offshore of the closest corner of the transect (keeping a hold of one end of the net), while the other person continues to walk parallel to shore toward the point offshore of the other transect marker. While walking, the net should be unrolled between the two people. At this stage, the two seiners are in position to start, with the seine pulled out parallel to shore, 10 m apart, in 100 cm of water. Use the transect markers on shore as guides to maintain a 10 meter distance between you as you begin.

5) Once in position, drop or secure the transect marker (weighted float or pole) at the beginning starting point of the seine haul. This will allow you to measure the distance from the shore to the start of the transect later.

6) Haul that seine! Both people holding the seine should walk towards their shore markers, staying parallel with each other, 10 m apart, and perpendicular to shore. Keep the poles of the seine net upright or pointed towards shore, not slanting back behind you.

   Note: If the net gets snagged on a log, have a person walk outside of the seine net to the point where the net is snagged. Lift the net minimally off of the bottom to un-snag it. Remove the debris from the transect if possible and continue seining.



7) Once the two seine pullers have reached the shore and pulled the first couple of feet of net in, lay the poles down on the beach and begin to pull the net in.

Note: It is very important to keep the seine's sinker line (the bottom part of the seine), on the bottom. As you're pulling it in, it is natural to want to lift the line as you pull—but do not lift the seine off the bottom as fish will escape. Keeping the sinker line on the bottom, pull the top (float) and sinker lines in together. This should be done evenly from both sides.

8) Once the sinker line is completely on shore you have formed a 'netted pouch' with the seine. Lift up on the sinker line and the float (or top) line at the same time from the ends of the net (if available, have people stationed through out the middle to make sure the net doesn't drop into the water).

9) Shake fish carefully down the net until you have the whole pile of fish in a single pocket of net. Usually it is easiest for the two seiners to do this by moving toward the

center of the seine. Holding the net together (to prevent escape), bring the net out of the water, and transfer the fish into the large bin of water including those individuals that have become entangled in the net.

10) Sort the fish from the large bin into the smaller bins/buckets by species. Keep larger fish separate to prevent predation or injury while in captivity. It is important to minimize the time spent holding and handling the fish, which stresses them. To maximize efficiency, some people should start measuring while others finish sorting.

11) Begin measuring the fishes, starting with the most delicate. Measurement should be of the fish's *total* length, from snout to tip of tail. Measure 25 individuals of each species collected, then simply count the rest of that species. For example, if you collected 45 of a particular species, you would measure the lengths of the first 25, then simply note that you caught 20 more individuals of that species. Big animals (larger than 10cm along widest axis) other than bony fishes should be measured using the standard for that type of animal: carapace width for crabs, or length and width of the body for animals like horseshoe crabs, turtles, rays, etc.

Note: For ease of processing and to avoid confusion, try to focus on a single species at a time. One person should serve as 'recorder' and write down fish ID, length, and count measured by the fish 'handlers'.

12) Continue this process until all fish have been measured or counted. When you finish a bucket or bin, pour the water out of the bin through a net to make sure that you haven't missed any fish.

13) Once all animals have been measured, counted, and released, clean up your site.

Bitemap Data Protocol

Recording the data completely, legibly, neatly, and in an organized format is critical to the success of the science and should be done as soon as possible after completing the field work, while everything is fresh in your memory, as described in the next section. Record the data onto the standard template forms provided by MarineGEO (one for squidpop data, and one for fish data). Be sure to record on both forms your full name, not initials (you are the data recorder), your email address (so that we know how to reach you quickly if any questions arise), names of others who participated in the work, date and time of data collection, GPS coordinates of the site, any methodological irregularities (we discovered a hole in the seine, etc.), and any other information you feel might be useful to know in interpreting the data.

If at any time you have questions about how to record or transmit data, please contact Bitemap HQ at: MarineGeo@si.edu

Data Sheets:

Data sheets can be obtained from the appendix of this document, and also online at http://bitemap.wordpress.com/resources/. Be sure to fill out all fields completely. Feel free to take additional notes on the data sheets to make your data as clear and interpretable as possible.

Data Upload:

In order to standardize the collection of data as much as possible, please use the following specific guidelines for submitting all data associated with Ocean Bitemap.

SQUIDPOPS:

To upload your data for all Squidpop deployments, go to: http://bitemap.wordpress.com/data/. Here you will enter the data from your squidpop field data sheets into a Google Form, which ensures standard format and minimizes errors. Be sure to answer all required questions.

ALL OTHER DATA:

Transfer your data from your field data sheets to the excel spreadsheet provided at http://bitemap.wordpress.com/resources for all data collected during the experiment. Review the metadata tab of the excel spreadsheets thoroughly in order to meet all guidelines. Data that does not conform to the data standard will not be accepted and you will be asked to resubmit.

Please send completed spreadsheets to: MarineGEO@si.edu
with associated subject line indicated in the protocol.

Data Sharing Policy

We envision that data from the ongoing Bitemap project will eventually be open and available to all on the web in near real-time after some level of basic quality control/quality assurance. For the inauguration of the Bitemap project in summer 2016, we envision that data from all sites will be made available to all participants (but not yet the general public) and that the lead participant from each site will be eligible (assuming continued involvement in MS preparation) to be a co-author on the manuscript that emerges from the research. After the MS is accepted we will make all data public on the website and we envision that subsequent additions of data to the project will also be available to the public.

APPENDIX I: SOURCING MATERIALS

Below find a list of links for sourcing materials used for Ocean Bitemap activities.

Squidpops/Bait Bags

Squid: http://www.amazon.com/Hang-Marine-Products-Dried-Squid/dp/B00HN18KA6/ref=sr_1_14?ie=UTF8&qid=1439399988&sr=8-14&keywords=dried+squid

Fishing line: http://www.amazon.com/Stren-Original-330-Yard-Spool-Pound/dp/B001H32I7M/ref=sr_1_1?ie=UTF8&qid=1422284845&sr=8-

Electrical Tape: http://www.amazon.com/EL7566-AW-Synthetic-Rubber-Premium-Electrical/dp/B000TPEHMS/ref=sr_1_1?s=electronics&ie=UTF8&qid=1422453815&sr=1-1&keywords=electric+tape

Cork Borer: http://www.amazon.com/American-Educational-Piece-Nickel-Borer/dp/B005QDWU18/ref=sr_1_1?ie=UTF8&qid=1404146522&sr=8-1&keywords=cork+borers

Fiberglass Stakes: http://www.amazon.com/EcoStake-Stakes-Garden-Tomato-Training/dp/B00YNU1BDS/ref=sr_1_3?ie=UTF8&qid=1454247202&sr=8-3&keywords=fiberglass+plant+stake

Plastic Canvas Mesh: http://www.amazon.com/Bulk-Buy-Plastic-12-Pack-33900-20/dp/B00KHAYGJO/ref=sr_1_4?ie=UTF8&qid=1459524431&sr=8-4&keywords=plastic+mesh

Zip Ties: http://www.amazon.com/1000-Black-Plastic-Cable-Fasten/dp/B0094DE1WM/ref=sr_1_7?s=electronics&ie=UTF8&qid=1459524815&sr=1-7&keywords=zip+ties

APPENDIX II: ADDITIONAL RECOMMENDED PROTOCOLS

While not required for participation in Ocean Bitemap, if at all possible we encourage you to record predatory fish communities directly, as well as other characteristics of the environment to allow a more robust analysis and predictions about conditions influencing predation.

Bitemap Site Characterization Protocol

Overview:

The physical environment is a primary driver of marine community characteristics. Here we present a method for measuring several metrics that are known to have strong influence on animal and plant communities in coastal habitats. While collecting data on all the metrics is ideal, we welcome data collected on any of the metrics listed below according to the protocol.

Materials:

ITEM	*QUANTITY*
temperature probe	1
salinity probe/refractometer	1
GPS unit	1

Getting Prepared:

1) Gather all your supplies. If calibration is required for your temperature and/or salinity probe be sure that it has been done.

2) For each place that you take an individual measurement, you will also take a GPS point, either directly from a GPS unit (preferred), or by orienting yourself to landmarks and determining the GPS points on Google Earth (or similar).

3) Haphazardly choose three spots within your site for taking temperature/salinity measurements. They should all be in the subtidal zone (if possible), and at least 10m apart from each other.

Note: Be sure to consult tide predictions for your area so you can ensure that you are sampling in the subtidal zone.

Temperature/Salinity:

4) Take GPS point (if using GPS on site).

5) Take temperature/salinity measurement according to manufacturers specifications for your particular probe. Measurements should be made at least 20cm below the water's surface.

6) Record data on your data sheet.

7) Repeat at each of the haphazardly selection spots within your site

Note: These measurements should be taken at the time of all Squidpop and seine deployments/recoveries. We recommend taking the measurements before *deploying Squidpops and* after *conducting seine activities to minimize disturbance that might impact the other observations. You will do this protocols at both vegetated and unvegetated sites.*

Bitemap Video Protocol

Overview:

To characterize the fish communities and identify common predators, it is possible to use small GoPro cameras in place of, or in tandem with beach seines. Here we present two video methodologies for using GoPros to this end. This first is a protocol to be used specifically with Squidpops to identify and size predators, the second is a general fish observation protocol to use for characterizing the fish community. Keep in mind that these protocols are designed to be done in relatively clear-water conditions where visibility is *at least* 3 meters.

Materials:

ITEM	***QUANTITY***
GoPro Camera affixed to PVC Stake	1
Scale Bar (large enough to be seen by camera, metric units)	1
Prepared Squidpops (for Squidpop observations)	25
Bait Bag (for fish community observations)[squid, plastic mesh, zip ties, post or dowel]	1

Getting Prepared:

1) Attach GoPro to PVC stake at least 0.5m in length (or long enough to clear seagrass canopy if deploying in seagrass habitat).

2) Set GoPro to medium angle setting (to prevent distortion of fish at edges of frame). Make sure all time and date settings on your GoPro are correct.

3) Make bait bag to attract fish (if not deploying with Squidpops). This can be done by cutting up dried squid (see resources list for products) into chunks (~3cm square, use at least one whole squid) and placing into plastic mesh canvas (see resources). Close the mesh like a pouch around the squid pieces and close with zip ties. This is then affixed to the end of a rod or dowel with a similar length to your GoPro PVC stake.

GoPro Video Monitoring:

4) Deploy Squidpops (Squidpop Protocol) or push rod/dowel with bait bag attached into substrate in approximately 1m of water so the bait bag is at approximately 30cm above the substrate, or clear of any seagrass canopy.

5) Push the PVC stake with GoPro into the sediment so that the field of view captures at least one Squidpop (or the bait bag), but preferably multiples at the beginning of your deployment.

6) Begin recording. Note the time on your data sheet

7) Hold your scale bar in the same plane as the Squidpop closest to the GoPro in clear view of the camera for at least 10 seconds. This will allow you to set the scale for measuring fish predators later.

8) Finish deploying Squidpops and let soak for one hour, or leave bait bag in place and return in one hour.

9) Retrieve the camera after you return for your one hour bait count. Note the time. Remove bait bag as necessary.

GoPro Video Analysis:

10) Watch a one hour segment of the video beginning from the moment you removed the scale bar.

11) Using the scale bar as a guide, track the size and identity (to lowest taxonomic resolution possible) of the fish(es) responsible for removing the bait.

Note: A simple, cost-effective way to measure distances in video is to use the scale bar from the beginning of the video to make a grid on a piece of clear plastic that you can then tape over your computer monitor. Remember that lengths measured are only accurate when the fish is in the same plane as the original location of the scale bar, therefore you will only be estimated fish lengths when fish strike at squidpops or interact with bait bags, putting them in roughly the same plane.

Video Analysis Rules - Squidpops

12) Track the strikes, or number of bites taken by all fish (identified to lowest taxonomic level and length measured) that approach and interact with the bait, whether they visibly remove bait or not.

13) If a fish leaves the frame it is considered 'gone', and you will still count every fish that enters the frame after, even if it looks identical to a fish you think you've already seen and counted. (for example, if a 10cm long parrot fish enters the frame, strikes twice at the bait then leaves the frame, and then 15 seconds later a 10cm long parrot fish enters the frame, strikes once and removes the bait, you would record both occurrences as separate events. See data sheet metadata for more information).

14) Keep track of the identity of all other fishes that enter the camera's field of view during the one hour viewing period. In other words, if you see a species you haven't seen before, note it on your datasheet (abundance and measurement are not needed).

Video Analysis Rules - Bait Bag

15) Identify and measure all fish that approach and interact (touch) the bait bag.

16) If a fish leaves the frame it is considered 'gone', and you will still count every fish that enters the frame after, even if it looks identical to a fish you think you've already seen and counted. (for example, if a 10cm long parrot fish enters the frame, interacts with the bait bag, then leaves the frame, and then 15 seconds later a 10cm long parrot fish enters the frame and interacts with the bait bag, you would record both occurrences as separate events. See data sheet metadata for more information).

Data Submission

17) Submit the results of your video analysis to MarineGEO@si.edu using spreadsheets provided with the email subject line: *BITEMAP GOPRO DATA [your site name]*

APPENDIX III: DATA SHEETS

OCEAN BITEMAP SQUIDPOP DATA SHEET

Site ID:	GPS:	Habitat type:

Date Deployed:	Date Collected:	Number Deployed:	Number Recovered:

Time Deployed:	Time Collected:	Notes:	Depth:
Data Collector:	Data Collector:		
Weather:	Weather:		

Detachment 1 hr:	Notes:

Detachment 24 hrs:	Notes:

OCEAN BITEMAP

Site ID:	GPS:	Habitat type:

Date Deployed:	Date Collected:	Number Deployed:	Number Recovered:

Time Deployed:	Time Collected:	Notes:	Depth:
Data Collector:	Data Collector:		
Weather:	Weather:		

Detachment 1 hr:	Notes:

Detachment 24 hrs:	Notes:

OCEAN BITEMAP

OCEAN BITEMAP SEINE DATA SHEET

Site Name
Latitude (decimal)
Longitude (decimal)
Date (yyymmdd)
Time (24hr, hhmm)
Distance Of Haul (m)

(circle one)
Seagrass/Unvegetated

Depth (m)

Data Collector
Contact Email
List Of Participants

Genus species	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19	L20	L21	L22	L23	L24	L25	Abundance

Notes

OCEAN BITEMAP SITE CHARACTERIZATION DATA SHEET

Site Name				(circle one)
Latitude (decimal)		Date (yyyymmdd)		Seagrass/Unvegetated
Longitude (decimal)		Time (24hr, hhmm)		

	TEMP (C)	SAL (PPT)	Notes
Point 1			
Point 2			
Point 3			

Site Name				(circle one)
Latitude (decimal)		Date (yyyymmdd)		Seagrass/Unvegetated
Longitude (decimal)		Time (24hr, hhmm)		

	TEMP (C)	SAL (PPT)	Notes
Point 1			
Point 2			
Point 3			

Site Name				(circle one)
Latitude (decimal)		Date (yyyymmdd)		Seagrass/Unvegetated
Longitude (decimal)		Time (24hr, hhmm)		

	TEMP (C)	SAL (PPT)	Notes
Point 1			
Point 2			
Point 3			

Site Name				(circle one)
Latitude (decimal)		Date (yyyymmdd)		Seagrass/Unvegetated
Longitude (decimal)		Time (24hr, hhmm)		

	TEMP (C)	SAL (PPT)	Notes
Point 1			
Point 2			
Point 3			

Site Name				(circle one)
Latitude (decimal)		Date (yyyymmdd)		Seagrass/Unvegetated
Longitude (decimal)		Time (24hr, hhmm)		

	TEMP (C)	SAL (PPT)	Notes
Point 1			
Point 2			
Point 3			

Data Collector ______________________

Contact Email ______________________