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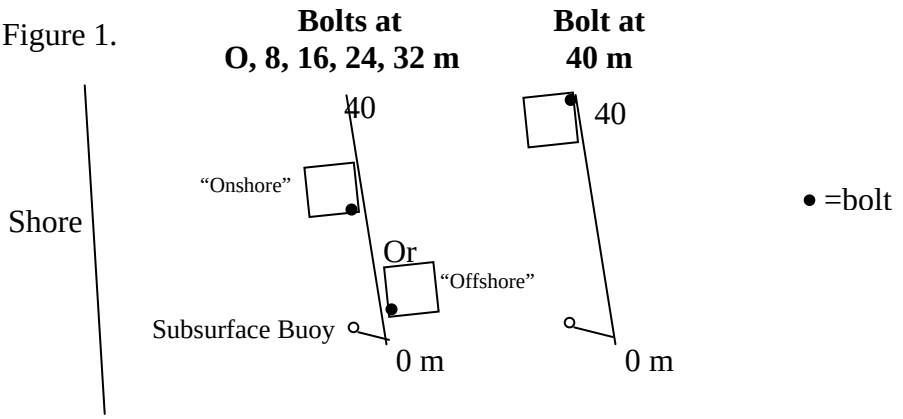
General site descriptions and GPS coordinates are detailed in files "Site Description.xls". The permanent transects at each of the four sites are sampled every six weeks (eight times a year) to monitor the kelp forest community. Each site has 3 permanent 40 meter (m) transects marked with either subsurface buoys on parking bumpers or tygon tubing on yellow rebar stakes. Each transect has six permanent markers (eyebolts or rebar stakes) placed at distances of 0, 8, 16, 24, 32, and 40 meters along each transect. Hereafter, the permanent markers (bolts or rebar) will be referred to as bolts. Most transects run parallel to shore from west to east, generally at headings of 80° or 90°. Before sampling is begun, a surveyor's transect tape is attached to the 0 m bolt, swum through the eyes of 8, 16, 24, 32,and 40 m bolts of the transect, pulled taut, and attached to the 40 m bolt. Sampling is then begun. See the LTE diver protocols for more information on how these sites are surveyed and how kelp is cleared.

Quadrat Sampling

The purpose of quadrat sampling is to determine the abundance of small cryptic and/or abundant common invertebrates and algae. At each of the six permanent bolts along each transect a diver places a three-sided 1 square meter PVC frame on the bottom such that the transect tape forms the fourth side of the PVC frame. The diver then records the number of all target species within the $1m^2$ area. This area is defined by a PVC frame and a transect tape. Substrate beneath understory algae is searched. Epiphytic target species ARE counted (i.e. *Styela* growing on *Cystoseira*). However, neither the substrate nor the organisms attached to it are removed to facilitate sampling of organisms hidden from view.

Quadrats are oriented along the transect in the following manner: at the 8 m, 24 m and 40 m bolts the PVC frame is placed on the onshore side of the transect, at the 0 m 16 m and 32 m bolts the frame is placed on the offshore side of the transect. The PVC frame is positioned such that the bolt is located in the corner closest to the 0 m end of the transect for all distances except the 40 m bolt; at the 40 m bolt, the frame is positioned in the corner furthest from the 0 m end of the transect (Figure 1). Thus the 0 m quadrat samples the 1 m^2 area between 0 m and 1 m on the offshore side of the transect, while the 40 m quadrat samples the 1 m^2 area between 39 m and 40 m onshore of the transect.

Figure 1.



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Quad Species List

SP_CODE	GENUS	SPECIES	SIZE	COMMON_NAME
AMS	Asterina	miniata	small (<25mm)	Bat Star
ANAR	Anthopleura	artemisia	.	Moonglow Anemone
ANSP	Anthopleura	spp.	.	Aggregating anemone
BAEL	Balanophyllia	elegans	.	Orange Cup Coral
BLD	Blade Unidentified	.	.	.
CHOV	Chaceia	ovoidea	.	Wart Necked Piddock
COCA	Conus	californicus	.	Califonia Conus
CUMI	Cucumaria	miniata	.	.
CUSA	Cucumaria	salma	.	.
CYJ	Cystoseira	osmundaceae	juvenile (<5cm diam)	.
CYSP	Cypraea	spadicea	.	Chestnut Cowry
DIOR	Diopatra	ornata	.	Ornate Tube Worm
DIS	Dermasterias	imbricata	small (<25mm)	Leather Star
EAJ	Eisenia	arborea	(<5 cm stipe length)	.
EGJ	Egregia	menziesii	juvenile (<1m height)	Feather Boa Kelp
EUQU	Eupentacta	quinquesemita	.	.
LA	Lytechinus	anamesus	.	White Urchin
LFJ	Laminaria	farlowii	juvenile (<15cm bld width)	.
LIGS	Lithopoma	spp.	small (<25mm)	Wavey Turbin Snail
MIID	Mitra	idae	.	Ida's Mitre
MPJ	Macrocystis	pyrifera	juvenile (<1m height)	Kelp
NONO	Norrisia	norrisi	.	Norris's Topsnail
OKS	Orthasterias	koehleri	small (<25mm)	Rainbow Star
OPES	Ophioplocus	esmarki	.	Brittle Star
OPSP	Ophiothrix	spiculata	.	Brittle Star
PACA	Parapholas	californica	.	Scaleside Piddock
PAFI	Pachycerianthus	fimbratus	.	Tube Dwelling Anemone
PAST	Paracyathus	stearnsi	.	Brown Cup Coral
PBS	Pisaster	brevispinus	small (<25mm)	Short Spined Sea Star
PGS	Pisaster	giganteus	small (<25mm)	Giant Sea Star
PHS	Pycnopodia	helianthoides	small (<25mm)	Sun Star
POPL	Polyclinum	planum	.	Elephant Ear Tunicate
POS	Pisaster	ochraceus	small (<25mm)	Ochre's Sea Star
PTJ	Pterygophora	californica	juvenile (<20 cm stipe length)	.
PTTR	Pteropurpura	trialata	.	Festive Murex
SABW	Sabellid Worm	.	.	Sabellid or Spirobid Worm
SFL	Strongylocentrotus	franciscanus	large (>25mm)	Red Urchin
SFS	Strongylocentrotus	franciscanus	small (<25mm)	Red Urchin
SKE	Small Kelletia	.	.	Kellet's Welk
SPL	Strongylocentrotus	purpuratus	large (>25mm)	Purple Urchin
SPS	Strongylocentrotus	purpuratus	small (<25mm)	Purple Urchin
STMO	Stylela	montereyensis	.	Stalked Tunicate
TEAU	Tethya	aurantia	.	Orange Puffball Sponge
TESP	Tegula	spp.	.	Black Turbin Snail
URLO	Urticina	lofotensis	.	Rose Spotted Anemone
URPI	Urticina	piscivora	.	Fish Eating Anemone

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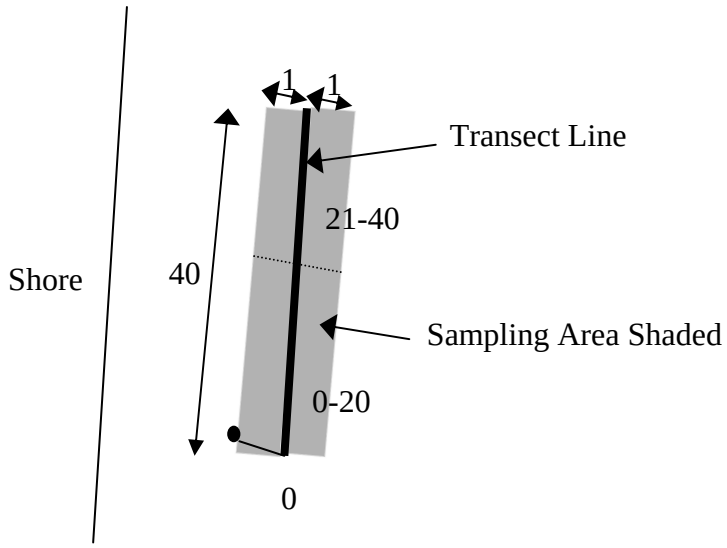
Benthic "Cryptic" Fish Sampling

The purpose of Benthic Fish sampling is to determine the abundance of common small or cryptic fish that can be counted in a 1m wide area on each side of the 40m transect. Benthic Fish sampling is performed by a diver slowly swimming the length of the 40m transect twice, once each on the onshore and offshore sides of the transect tape. As the diver swims, he/she holds a 1m long bar perpendicular to the transect tape and records the size and abundance of all targeted species encountered in the 40 x 2 m area. The total area sampled is 80 m^2 (Figure 2). To facilitate sampling, the abundance of each target species is recorded in each of four subsections: 0-20 m Onshore, 21-40 m onshore, 0-20 m offshore, and 21-40 m offshore. The substrate beneath understory algae is searched for target species as are the undersides of ledges and crevices. No substrate or organisms are removed to expose targeted species hidden from view. This is a permanent list of target species unlike the general fish transect. Size is recorded as Total Length to the nearest cm. as determined by the observer.

Figure 2. Benthic fish sampling area for permanent transects years 2002-present.



Benthic Fish Species List

Code	Species	
AHOL	*Alloclinus holderi*	Island kelpfish
CLIN	*Gibbonsia spp.*	Crevice kelpfish
CNIC	*Coryphopterus nicholsii* (now *Rhinogobius n.*)	Blackeye goby
COTT	*Cottid spp.*	Sculpin
CSTI	*Citharichthys stigmaeus*	pacific sanddab
LDAL	*Lythrypnus dalli*	bluebanded goby
LHIR	*Leiocottus hirundo*	Lavender sculpin
NBLA	*Neoclinus blanchardi*	Sarcastic fringehead
OPIC	*Oxylebius pictus*	Painted greenling

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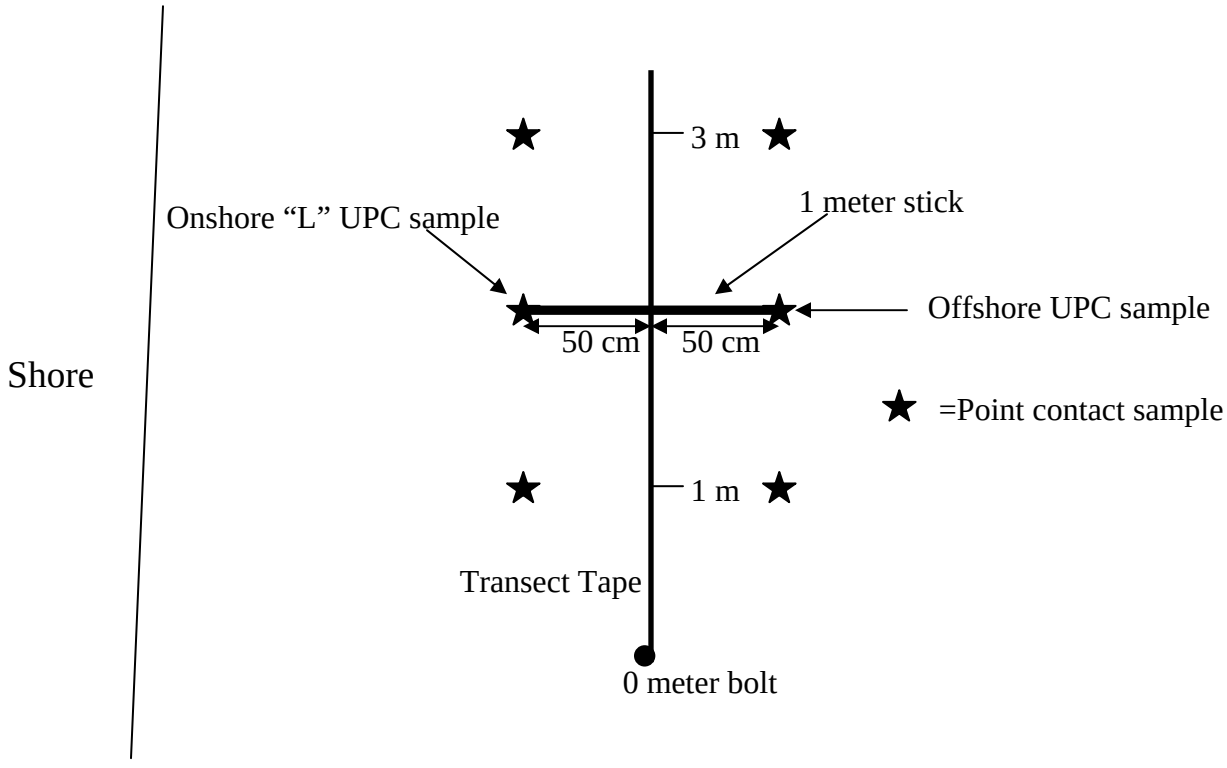
UPC (Uniform Point Contact) Sampling

General UPC Methods

The purpose of the Uniform Point Contact sampling is to determine the percentage cover of algae and sessile invertebrates along a 40m transect. A diver swims along the transect, centering a meter stick perpendicular to the transect tape at 1m intervals along the transect and records the species that intersect an imaginary vertical line (or point) positioned at each end of the meter stick (n= 80 points per transect) (Figure 3). Species are recorded from top-down as they are encountered. Species are recorded from left to right on the datasheet in such a way that primary space holders occupy the left side of the "SP_CODE" column. Epiphytic species are not counted, but species growing on Diopatra are. Additionally, the substrate type under each point is noted and if the substrate is sand, a depth is measured to the nearest cm. Mobile organisms are not counted and thus moved when possible and necessary. All adult kelp holdfasts are counted. No blades of the following species are counted: *Macrocystis*, *Pterygophera*, *Eisenia* and *Laminaria*. Adult *Cystoseira* blades ARE counted.

Figure 3. Diagram of Uniform Point Contact points for meters 1-3.



UPC Species List

SP_CODE	GENUS	SPECIES	SIZE
AB	Abietinaria	spp.	.
AL	Astrangia	lajollaensis	.
ANAR	Anthopleura	artemisia	.
ANPI	Antropora	pinctus	
ANSO	Anthopleura	sola	.
ANSP	Anthopleura	spp.	.
AR	Archidistoma	spp.	.
AS	Aglaophenia	spp.	.
ATM	Amphipod tube mat	.	.
AU	Acrosorium	uncinatum	.
B	Bedrock	.	.
BA	Barnacle	spp.	.
BAEL	Balanophyllia	elegans	.
BCAL	Bugula	californica	.
BF	Botryoglossum	farlowianum	.
BL	Boulder Large	.	.
BM	Boulder Medium	.	.
BN	Bugula	neritina	.
BO	Bossiella	orbigiana	.
BR	Blady red	spp.	.
BRA	Branching Red Algae	spp.	.
BS	Boulder Small	.	.
C	Cobble	.	.
CAL	Calliarthron	cheilosporioid	.
CC	Chondracanthus	corymbifera	.
CF	Callophyllis	flabellulata	.
CG	Cladophora	graminea	.
CH	Cystoseira	osmundaceae	Holdfast
CHOV	Chaceia	ovoidea	.
CHPR	Chelyosoma	productum	.
CILU	Cirriformia	luxuriosa	.
CL	Clavelina	spp.	
CO	Corallina	officinalis	.
COF	Codium	fragile	.
CP	Colpomenia	spp.	.
CRGI	Crassadoma	gigantea	.
CROC	Crisia	occidentalis	.
CUPI	Cucumaria	piperata	.
CUSA	Cucumaria	salma	.
CY	Corynactis	californica	.
CZ	Chondracanthus	spinosa	.
DC	Diaperoecia	californica	.
DIOR	Diopatra	ornata	.
DL	Desmarestia	ligulata	.
DOFE	Dodecaceria	fewkesi	.
DP	Dictyota	spp.	.

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SP_CODE	GENUS	SPECIES	SIZE
DU	Dictyopteris	undulata	.
EA	Eizenia	arborea	(>5 cm stipe length)
EAH	Eizenia	arborea	holdfast
EAJ	Eizenia	arborea	(<5 cm stipe length)
EB	Erect Bryozoan	spp.	.
EC	Encrusting coralline	spp.	.
ECB	Encrusting Bryozoan	spp.	.
EH	Egregia	menziesii	Holdfast
ER	Encrusting red algae	spp.	.
ES	Encrusting sponge	spp.	.
EUCL	Euherdmania	claviformis	.
EUQU	Eupentacta	quinquesemita	.
FB	Filamentous brown	spp.	.
FR	Filamentous red	spp.	.
GR	Gelidium	robustum	.
GS	Gracilaria	spp.	.
HART	Hiatella	arctica	.
HC	Hymenamphiastra	cyanocrypta	.
HIP	Hippodplosia	Insculpta	.
IR	Iridaea	spp.	
LI	Lithothrix	spp.	.
LINU	Lissothuria	nutriens	.
LNUT	Leucilla	nuttingi	.
LOCH	Lophogorgia	chilensis	.
LS	Laurencia	spp.	.
LX	Laurencia	spectabilis	.
MC	Mytilus	californianus	.
MH	Macrocystis	pyrifera	holdfast
MT	Membranipora	tuberculata	.
MUCA	Muricea	californica	.
NA	Nienburgia	andersoniana	.
NEO	Neoagardhiella	baileyi	.
OBSP	Obelia	spp.	
OPES	Ophioplocus	esmarki	.
PA	Phragmatopoma	californica	.
PACA	Parapholas	californica	.
PAFI	Pachycerianthus	fimbratus	.
PAST	Paracyathis	stearnsi	.
PH	Pterygophora	californica	Holdfast
PHSE	Phycodrys	setchellii	.
PHSP	Phyllactis	spp.	.
PHTO	Phyllospadix	torreyi	.
PL	Prionitis	lanceolata	.
PLAB	Phidolopora	labiata	.
PLUM	Plumularia	spp.	.
POLA	Polyneura	latissima	
PRUB	Pachythyone	rubra	.
PU	Pholad Unidentified	.	.
PYST	Pychnoclavella	stanleyi	.
R	Rhodymenia	californica	.
RAT	Red Algal Turf	spp.	.

SP_CODE	GENUS	SPECIES	SIZE
REKO	Renilla	koellikeri	.
RP	Rhodymenia	pacifica	.
S	Sand	.	.
SABW	Sabellid worm	.	.
SAFU	Sarcodiotheca	furcata	
SAGA	Sarcodiotheca	gaudichaudii	
SAMU	Sargassum	muticum	.
SC	Spheciospongia	confoederata	.
SCCA	Scinaia	confusa	.
SE	Serpulorbis	squamiger	.
SELO	Scytosiphon	lomentaria	.
SH	Shell debris	.	.
SS	Shallow Sand	.	.
ST	Salmacina	tribranchiata	.
STIN	Stenogramme	interrupta	.
STMO	Stylela	montereyensis	.
TALE	Taonia	spp.	.
TC	Thalamoporella	californica	.
TEAU	Tethya	aurantia	.
UAB	Unidentified Arborescent Bryozoan	spp.	.
UBB	Unidentified brown blade	spp.	.
UEC	Unidentified erect coralline	spp.	.
UIH	Unidentified hydroid	spp.	.
UM	Unidentifiable tube mat	spp.	.
UNAN	Unidentified anemone	spp.	.
URLO	Urticina	lofotensis	.
UT	Unidentified compound tunicate	.	.
UV	Ulva	spp.	.
WK	Weeksia	spp.	.
ZOMA	Zostera	marina	.

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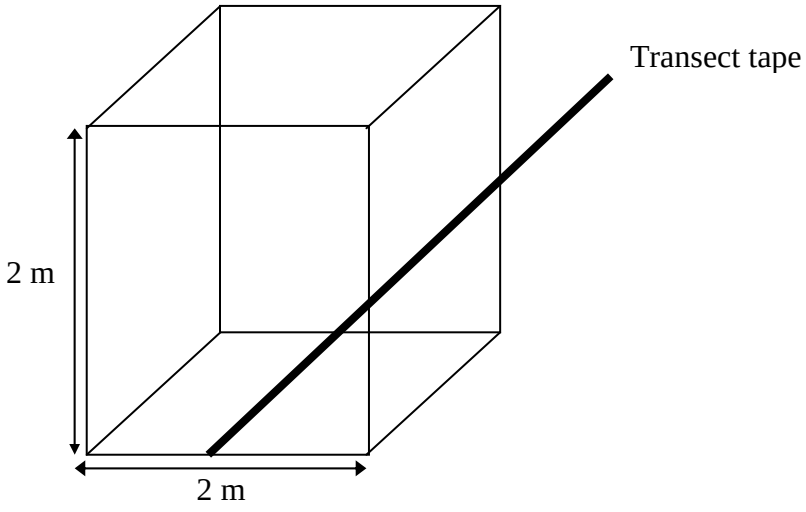
Fish Overview:

The purpose of fish sampling is to determine the abundance, size, and species composition of reef fish on each transect. The observer always notes horizontal visibility for the transect using the meter tape as a guide. Fish species are recorded using four letter species codes where the code generally represents the first letter of the genus followed by the first three letters of the species name. For example, kelp bass, *Paralabrax clathratus* = PCLA.

Fish Sampling

- The observer locates the transect start and clip a meter tape in to the 0 bolt.
- The diver swims along an average heading given on the transect maps.
- An observer swims the length of the 40m transect, approximately 1m above the substrate, recording the abundance and size of all fish individuals encountered within a predefined imaginary "cube". The "cube" extends 1m on either side of the transect tape (2m across) and 2m up from the substrate (2m high) (Fig. 1).
- The diver samples by scanning ahead frequently to record any transient species that pass through the "cube" while also searching beneath understory algae.
- All fish except those species counted on the cryptic swath are counted so the list of species for this sample can grow as new ones are encountered
- Care is taken by the diver to count only fish that enter the "cube". Some fish species (e.g. seniorita, *Oxyjulis californica* and kelp bass, *Paralabrax clathratus*) are attracted to divers and will follow the diver, re-entering the sampling "cube" several times. Therefore, fish that enter the sampling "cube" from behind the observer are not counted.
- A total area of 80 m^2 is sampled.
- Size intervals are printed on the edges of slates to help divers estimate length to the nearest centimeter
- Multiple fish are recorded as # of fish (size of fish) e.g. 6(15) which allows a range of sizes to be given for a school of fish e.g. 30(10-16). The range is then averaged during data entry.

Figure 4. Fish sampling "cube"



Fish Species List

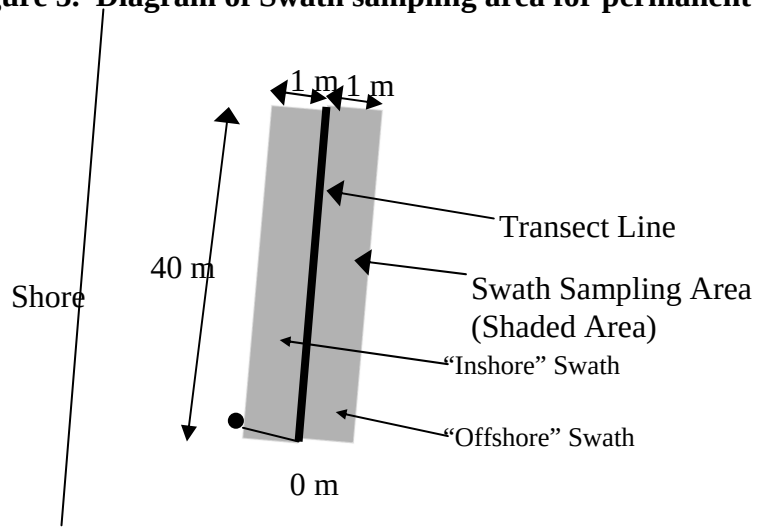
SP_CODE	GENUS	SPECIES	COMMON_NAME
AUFL	Aulorhynchus	flavidus	Tube-Snout
BFRE	Brachyistius	frenatus	Kelp Surfperch
BOTH	Bothid	spp.	Flatfish, unidentified sp.
BRAY	Myliobatis	californica	Bat Ray
CAGG	Cymatogaster	aggregata	Shiner Surfperch
CAPR	Caulolatilus	princeps	Ocean Whitefish
CPUN	Chromis	punctipinnis	Blacksmith
CVEN	Cephaloscyllium	ventriosum	Swell Shark
DVAC	Rhacochilus	vacca	Pile Surfperch
EJAC	Embiotoca	jacksoni	Black Surfperch
ELAT	Embiotoca	lateralis	Striped Surfperch
EMBI	Embiotoca	spp.	Surfperch, unidentified sp.
GMON	Gibbonsia	montereyensis	Crevice Kelpfish
GNIG	Girella	nigricans	Opaleye
HARG	Hyperprosopon	argenteum	Walleye Surfperch
HCAR	Hypsurus	caryi	Rainbow Surfperch
HDEC	Hexagrammos	decagrammus	Kelp Greenling
HROS	Heterostichus	rostratus	Giant Kelpfish
HRUB	Hypsypops	rubicundus	Garibaldi
HSEM	Halichoeres	semicinctus	Rock Wrasse
MCAL	Medialuna	californiensis	Halfmoon
NF	No fish	.	no fish present
OCAL	Oxyjulis	californica	Senorita
OELO	Ophiodon	elongatus	Lingcod
OTRI	Orthonopias	triacis	Snubnosed Sculpin
PCAL	Paralichthys	californicus	California Halibut
PCLA	Paralabrax	clathratus	Kelp Bass
PFUR	Phanerodon	furcatus	White Surfperch
PNEB	Paralabrax	nebulifer	Barred Sandbass
PNOT	Porichthys	notatus	Plainfin Midshipman
PTRY	Platyrhinoidis	triseriata	Thornback Ray
RTOX	Rhacochilus	toxotes	Rubberlip Surfperch
SATR	Sebastes	atrovirens	Kelp Rockfish
SAUR	Sebastes	auriculatus	Brown Rockfish
SCAL	Squatina	californica	Pacific Angel Shark
SCAR	Sebastes	carnatus	Gopher Rockfish
SCAU	Sebastes	caurinus	Copper Rockfish
SCHR	Sebastes	chrysomelas	Black and Yellow Rockfish
SCSP	Sebastes	spp.	
SGIG	Stereolepis	gigas	Giant Sea Bass
SGUT	Scorpaena	guttata	California Scorpionfish
SMAR	Scorpaenichthys	marmoratus	Cabezon
SMYS	Sebastes	mystinus	Blue Rockfish
SPAR	Sphyraena	argentea	Pacific Barracuda
SPAU	Sebastes	paucispinis	Boccacio
SPUL	Semicossyphus	pulcher	California Sheephead
SSER	Sebastes	serranoides	Olive Rockfish
STRE	Sebastes	serriceps	Treefish
SYNG	Syngnathus	spp.	Pipefish, unidentified sp.
TSEM	Triakis	semifasciata	Leopard Shark

SBCLTER Swath Protocol

Swath Sampling

The purpose of Swath sampling is to determine the abundance of common algae and mobile invertebrates that can easily be counted in a 1 m-wide area on each side of a 40m transect. Swath sampling is performed by an observer swimming the length of the 40m transect twice, once each on the onshore and offshore sides of the transect tape. As the observer swims, he/she holds a 1m long bar perpendicular to the transect tape and records the abundance of all targeted species encountered in each 20 x 1 m area. The total area sampled is 80 m^2 (Figure 5). To facilitate sampling, the abundance of each target species is recorded in each of four subsections: 0-20 m Inshore, 21-40 m Inshore, 0-20 m Offshore, and 21-40 m Offshore. The substrate beneath understory algae is searched for target species as are the undersides of ledges and crevices. No substrates or organisms are removed to expose targeted species hidden from view. Adult species are targeted with swath counts and size ranges given on the data sheet reflect this effort.

Figure 5. Diagram of Swath sampling area for permanent transects.



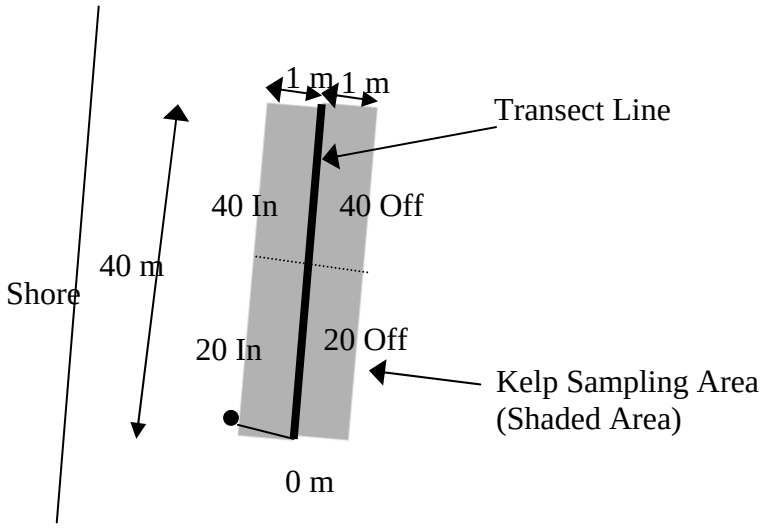
Swath Species List

SP_CODE	GENUS	SPECIES	SIZE	COMMON_NAME
AML	Asterina	miniata	large (>25mm)	Bat Star
APCA	Aplysia	californica	.	Sea Hare
APVA	Aplysia	vaccaria	.	Spotted Sea Hare
CASP	Cancer	spp.	.	Crab
CRGI	Crassadoma	gigantea	.	Giant Scallop
CUKE	Parastichopus	californicus	.	California Cucumber
CYOS	Cystoseira	osmundaceae	(>5cm height)	.
DIL	Dermasterias	imbricata	large (>25mm)	Leather Star
EA	Eisenia	arborea	(>5 cm stipe length)	
EGME	Egregia	menziesii	(>1m height)	Feather Boa Kelp
HACO	Haliotis	corrugata	.	Pink Abalone
HACR	Haliotis	cracherodii	.	Black Abalone
HAKA	Haliotis	kamtschatkana	.	Pinto Abalone
HARU	Haliotis	rufescens	.	Red Abalone
KEKE	Kelletia	kelletii	.	Kellet's Welk
LAFA	Laminaria	farlowii	(>15cm bld width)	.
LIGL	Lithopoma	spp.	large (>25mm)	Wavey Turbin Snail
LOCH	Lophogorgia	chilensis	.	Red Gorgonian
LOGR	Loxorhynchus	grandis	.	Sheep Crab
MECR	Megathura	crenulata	.	Giant Key Hole Limpet
MUCA	Muricea	californica	.	California Golden Gorgonian
MUFR	Muricea	fruticosa	.	brown gorgonian
OCTO	Octopus	spp.	.	.
OKL	Orthasterias	koehleri	large (>25mm)	Rainbow Star
PAIN	Panulirus	interruptus	.	California Spiney Lobster
PAPA	Parastichopus	parvimensis	.	Warty Sea Cucumber
PBL	Pisaster	brevispinus	large (>25mm)	Short Spined Sea Star
PGL	Pisaster	giganteus	large (>25mm)	Giant Sea
PHL	Pycnopodia	helianthoides	large (>25mm)	Sun Star
POL	Pisaster	ochraceus	large (>25mm)	Ochre sea star
PTCA	Pterygophora	californica	(>20 cm stipe length)	.
PUPR	Pugettia	producta	.	Kelp Crab

Kelp Sampling

The purpose of kelp monitoring is to track the abundance and size of all *Macrocystis pyrifera* plants on permanent transects through time. Kelp sampling is performed by an observer swimming the length of the 40 m transect twice, once each on the onshore and offshore sides of the transect tape. The total sampling area is 80 m^2 (Figure 6). As the observer swims, he/she holds a 1m-long bar perpendicular to the transect tape and records data for all *M. pyrifera* encountered in the 1m wide area on both sides of the transect tape. At least half of the holdfast must be within the swath in order to count it. Kelp data is recorded in four subsections for each transect, 0-20 m Inshore, 21-40 m Inshore, 0-20 m Offshore and 21-40 m Offshore. Each plant with any part of its holdfast located within 1 meter of the transect tape is counted. The number of fronds, measured 1 m above the holdfast, is recorded. Sub-adult plants that have a common holdfast are considered one entity.

Figure 6. Kelp sampling area years 2001-present.



Allometric Sampling

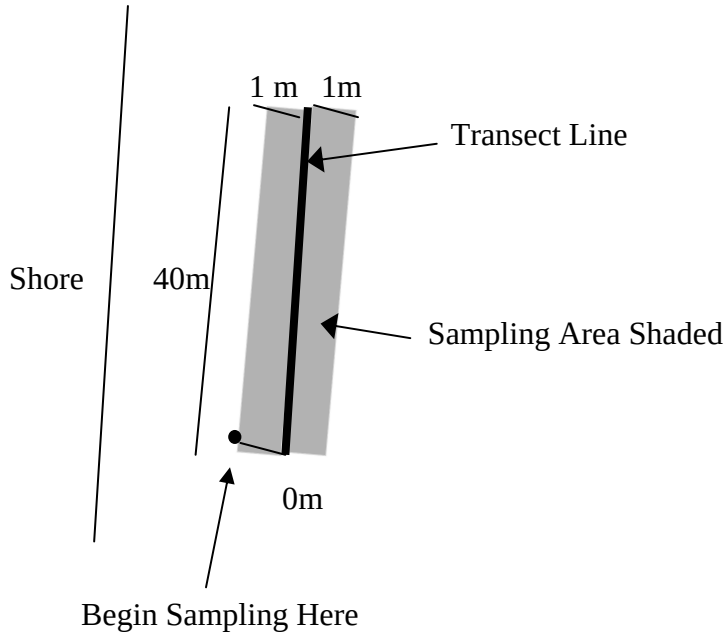
The purpose of allometric sampling is to collect size data for adult *Laminaria farlowii* and *Pterygophora californica* individuals to estimate the biomass of each species over time. Adult individuals are defined as follows and hereafter reference to adults will imply individuals in the following size classes:

Pterygophora: stipe length $\geq$ 20cm, stipe diamter > 0.7cm measured 20cm up the stipe from the holdfast

Laminaria: blade width $\geq$ 15cm

Only individuals falling into these size categories are sampled in this survey. Allometric sampling is conducted by an observer swimming along the length of a 40m transect tape twice, once on the onshore and offshore side. As the observer swims, he/she holds a 1m long bar perpendicular to the transect tape and records the total number of *Pterygophora* blades $\geq$ 30cm and the total length of each *Laminaria* blade $\geq$ 30cm for each ADULT individual encountered. Once a sample size of 30 individuals of each species is reached, sampling is terminated and sampling area is recorded. If less than 30 individuals are present in the 40m x 2m swath, sampling is terminated; i.e. maximum sampling area=80m^2 (Figure 7).

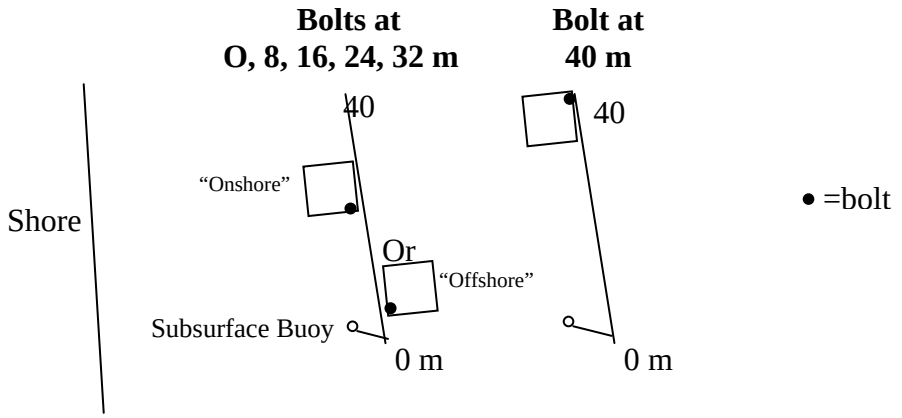
Fig. 7. Allometric Sampling



Detritus Collection

The purpose of detritus collection is to estimate the amount of drift algal biomass available on a given sampling day. Beginning in the winter of 2008 Drift sampling is conducted by the observer performing the quadrat survey. This diver collects any detritus located within the one square meter areas sampled for the quadrat surveys. All drift should be collected including algae on invertebrates i.e. urchins and anemones. Drift falling partially into the sampling area is cut as only the portion falling within the sampling area should be collected. Detritus is collected in 6 quadrats (Fig 8) for each transect. Drift from each quadrat is collected in a separate mesh bag and brought back to the lab to be identified to species and weighed. The bag number for each quadrat is recorded on the Quad datasheet.

Fig 8. Detritus Collection Quadrats



Urchin Count

The purpose of Urchin Count is to collect data that can be used to create a size distribution curve for urchins at the LTE sites. This could eventually lead to a biomass estimate for urchins counted in the Quadrat Survey. Along each transect sampled an observer will measure the maximum test diameter to the closest half centimeter for both *Strongylocentrotus franciscanus* (red) and *Strongylocentrotus purpuratus* (purple). In this survey an observer will attempt to collect size data for 50 purple and 50 red urchins. The observer should evenly space the urchins sampled along the 40 meter transect in areas of high urchin densities like barrens. Sometimes urchins may not be present along the transect, in this case the diver can swim up to 2 meters off the transect to locate nearby urchins to measure.

Fig 9. Urchin Measurement