P.O. Box 958
Wheatland, CA 95692
Telephone 530-633-4858
Fax 530-633-0365
www.CaliforniaShipstoReefs.org

BASELINE STUDY DESCRIPTION AND PROTOCOL

1. Project Description: These studies would provide large amounts of data that have not been generated in previous man-made habitat studies. In the past, studies were completed on several man-made habitats, commencing from the date of their creation for some period of time thereafter. The missing data regards the sites prior to the man-made reefing events and the impact on nearby natural reefs.

2. Background and Problem Statement: Studies of marine life have been and are taking place in California's coastal waters all of the time. Man-made reefs have been placed in coastal ocean waters to create, improve or enhance habitat all over the world for thousands of years. Never, to our knowledge, has a comprehensive study been made of the area of a man-made reef for a significant period before placement, immediately after placement, and then ongoing into the future as the reef grows, matures and then ages.

The fisheries in California near-coastal waters are in distress, as are those who fish and those who make their livings from processing fish and logistically supporting those who fish. Placement of man-made reefs as habitat, dive tourism attractions, or both has been shown to benefit the ports, and to allow those who have historically fished to diversify into the dive charter business as a sustainable source of income. Man-made reefs have also been shown to benefit fish, invertebrate and sessile organisms, however quantifying these benefits has been difficult because no comprehensive studies have been done **far in advance of the reef placement** for comparison with the post reefing studies.

We propose to take this omitted step on the sites where we seek to sink vessels as man-made reefs.

3. Project Goals and Objectives: In these studies, we propose to evaluate potential reefing sites for as many as two years, and in some cases more, prior to a reefing event so that natural, baseline data can be accumulated over a period of seasons and years to enhance scientific accuracy. At the same time, we propose to accumulate data on one or more natural, nearby rocky reef structures, thereby accumulating the same baseline data for that site. These two sets of data can be studied statistically by any number of researchers. Once the reefing event has occurred, this study will continue to accumulate data for a number of years, possibly decades, thus making it possible to evaluate the impact of the man-made reef, not only on its own site, but also on the surrounding natural reefs. Ultimately it should be possible to determine the effect of man-made reefs on their local eco-systems with scientific accuracy.

Completing such a study on a single new man-made reefing site will generate many opportunities for biologists to complete any number of studies on that site. However, scientifically, the results cannot be considered convincing due to any unknown vagaries within that particular small eco-system. For that reason we propose to complete at least three, and probably many more, exact replicates of this study on widely separated sites along the California coastline; potentially including the Central Coast, Santa Monica Bay and the Southern Coast.

Plan of Work

Scope

It is anticipated that these studies will be completed over a period of years, will be double comparative studies and will be replicated. It would be the intention to study pre-identified sink sites for up to two years prior to the sinking of any ship, and for many years following a sinking event, possibly in perpetuity. As to the double comparative nature of each study; first, comparisons will be made of the sink sites to nearby, representative natural reef structures. Second, comparisons will be made between pre-sink conditions and post-sink conditions at both sites. Finally, it is intended that this study protocol will be established on three sink locations throughout the scope of the CSTR operation to provide adequate replication for scientific accuracy.

The ultimate scope of these studies will be determined by the availability of resources, including funding, personnel and time.

Site Selection Protocols

Site selection is basically non-random in that each study will be conducted at a proposed sink site that is chosen not by non-random means but instead by a set of criteria including natural characteristics and socio-economic considerations. The layout of quadrats and transect lines will then be completed by a judgmental selection method.

The sink site will be a large area of primarily featureless ocean bottom. Within this large area, a study site will be randomly chosen and outfitted with two sets of quadrat/transect assemblies. The two assemblies will be connected by a meter-graduated line for the purpose of facilitating turbidity studies and to assist the divers when attempting to locate one assembly from the other.

The overall control site will be a natural reef area chosen judgmentally for proximity to the sink site and for being representative of other such natural reefs in the area. Within the overall site a study area will be randomly chosen and outfitted with two sets of quadrat/transect assemblies as above.

A quadrat/transect assembly will consist of three 50 meter transect lines (nylon rope) each of which culminates with a one meter quadrat (PVC pipe). The three will be continuously connected and randomly laid out and affixed to the substratum (stainless steel screw anchors). The previously mentioned connector line will consist of a 50 meter line with marker flags attached at one meter intervals. At the sink site this entire assembly is to be laid out haphazardly on the substrate. On the control site it is again to be laid out in a haphazard manner but with an eye to covering varying relief characteristics (reef walls, plateaus, etc.).

The control site quadrat/transect assembly will not move throughout the study period and will, therefore, require maintenance and replacement of parts from time to time. The quadrat/transect assembly placed at the sink site will be removed just prior to the reefing event and will be replaced by a similar set of quadrats and transects permanently affixed to the ship. It is important to plan transects and quadrats on the ship in such a manner as to represent as many types of characteristics as possible (open areas, areas comprised of many small spaces, vertical and horizontal areas, etc.).

Benthos Description

Features of the benthos can have a significant impact on the flora and fauna in the area. It is important to understand the dynamics of the benthic conditions including, sediment depths and changes to those depths; bottom current activity as evidenced by ripple lines etc; and general substrate relief. Data regarding the benthos is long term so notes are taken less frequently.

The sessile flora and fauna are not of interest in these studies but are reported in the biological description.

Biological Description

It is anticipated that the photographs of the quadrats and video taken along the transects will provide two sets of biological data. The first is an assessment of the sessile life in the area. After the dive is completed, surface personnel will identify the various flora and fauna and counts of individuals of each species present can be made. The second data set is a fish count. Again, the personnel on the surface will perform this function, reviewing the quadrat photographs and video taken along the transects. The goal is to report as accurately as possible a list of species present and the number of individuals present with notes as to juvenile or adult states as well as numbers of males and females where possible.

All photographs and video taken will be downloaded to CD. Two copies will be sent to archive locations in different geographic regions, one copy will be maintained by the Project Team, and as many copies as needed will be supplied to the surface analysis personnel as work copies. Photographers and videographers should have appropriate expertise and certifications if deemed appropriate.

Laboratory Analysis

The purpose of the water column sample is to determine two parameters; first is to establish the existence of any contaminants borne by the currents and the second is to identify and quantify the plankton present. This test will be conducted on regular intervals at both the sink and control sites to identify any changes that may occur over time or seasonally and to determine if any new contaminate source should come into existence (specifically a reefed ship).

The purpose of taking the sediment sample is to determine two parameters; first is to establish the existence of any chemical compounds and the second is to sample the micro-benthic community. It is proposed that samples will be taken semi-annually at each of the proposed sink and control sites, during the baseline studies continuing throughout the ongoing post-sink studies. The pre-sink samples set the baseline and comparison while the post-sink samples allow for comparisons only.

Dive Procedure

Each study is to be completed by three teams of two divers each, divers are pre-trained and utilizing only open circuit equipment. The dive group will proceed to the first dive location; this will be the proposed sink site. One of the divers on the first team will have clipped a marker buoy to his/her

gear. The first team will descend to the bottom taking necessary readings along the way. If visibility is less than 10 feet, abort the dive. Assuming visibility is suitable; this team will complete all Ocean and Benthos Description protocols as well as take laboratory samples when needed. They will also locate the first set of pre-set quadrats and transect lines. Throughout the dive they will keep a look out for any pelagic species passing through, or within sight of, the study area. This team will take still photographs of the first quadrat and then swim the first transect taking video as they go. The field of vision should be set at 16' to encompass 8' on either side of the transect line (or any other approved width), which should capture any pelagics within visual range. When they reach the next quadrat, they will mark it with a floating marker buoy and ascend to the surface.

Team two will descend, when team one surfaces, along the marker buoy line directly to the pre-set quadrats and transect lines. One of the divers will attach the marker buoy to his/her gear. Still photographs will be taken of this second quadrat. Then the team will swim the second transect taking video as they go. The field of vision should be set at 16' to encompass 8' on either side of the transect line (or any other approved width), which should capture any pelagic within visual range. When they reach the next quadrat, they will re-deploy the marker buoy and ascent to the surface.

Team three will enter the water when team two surfaces and follow the marker buoy line to the end of the last quadrat & transect, and one of the divers will attach the marker buoy to his/her gear so it can be returned to the boat. This team will follow the same procedure as the two prior teams.

After completion of the first set of dives, the dive group will relocate to the second dive location; this will be the control site. The control site is anticipated to be considerably shallower than the sink site and it will either be the closest natural reef structure to the sink site and/or it will be representative of other natural reef structures in the vicinity. The procedures outlined for the first location will then be repeated on the second (control) location.

It is anticipated that the depths encountered by the study teams on the sink site may be beyond the sport diving depth limits. Therefore each team will be comprised of willing, highly trained participants (preferably Divemaster or better, but requiring a deep dive certification at minimum) and each dive should have no more than twelve (12) minutes time on the bottom. The second dive site must be chosen within sport diving limits, and being shallower, will provide an opportunity for proper out-gassing of the divers. Further, it is anticipated that the shallower control site will have more fish, however the divers should spend the same amount of time (12 minutes) counting to prevent skew of the data.

Dives must be planned and completed approximately every eight weeks based on ocean conditions that are consistent with safe diving practices. Replicates will be taken for at least one year prior to any sinking event and preferably two or more years with studies continuing for up to ten years or more after a sinking event.

All divers participating in these baseline studies will comply with the California Ships to Reefs Dive Operations Safety Policy. Divers who notice that equipment is damaged or torn loose shall refasten if possible. If equipment needs to be replaced, divers will notify the VP Science so new equipment can be placed. All equipment removed from the bottom will be brought to the surface and disposed of appropriately, or recycled if possible.

Protocol	Parameter	Method	Frequency
Ocean Description	Temperature Measurements at surface -3mt, and bottom	Thermometer 5 -45 Celsius	Bi-Monthly
	Thermocline depth	Depth gage and thermometer	Bi-Monthly
	Current direction & speed	Visual determination with mag Compass and velocity meter	Bi-Monthly
	Surface swell activity	Coast Guard report	Bi-Monthly
	Turbidity (visibility) at both surface -3mt, and bottom	Visual reading with graduated line in mt	Bi-Monthly
Benthos Description	Orientation of ripple lines	Visual reading with mag compass	Bi-Monthly
	Sediment depth (if any)	Manual prove with a graduated mt rod	Semi-Annual
	Description of substrate	Photograph with diver notes	Semi-Annual
Biological Description	Sessile life species list and counts	Photograph of preset quadrat and diver notes	Bi-Monthly
	Fish species list and counts	Diver counts on preset transects and photographs/videos	Bi-Monthly
	Pelagics list and counts	Diver notes (if any) and photographs/videos	Bi-Monthly
Laboratory Analysis	Water Column	1 liter sample at 20 ft off the bottom	Semi-Annual
	Substrate	Sediment sample from area	Semi-Annual