Survey Report:

Seafloor Habitat & Biological Characterization Assessment of the SEA-US Fiber Optic Cable Route Offshore Hermosa Beach, California by Remotely Operated Vehicle (ROV)

February 2016

Prepared for:

ICF International
630 K Street, Suite 400
Sacramento, CA 95818

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APPLIED marine SCIENCES

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1.0 Executive Summary

On October 14-15, 2015, scientists from Applied Marine Sciences, Inc. (AMS) conducted a remotely operated vehicle (ROV) survey of approximately 6.6 nautical miles (12.2 kilometers) of the proposed SEA-US fiber optic cable route. The portion of the proposed cable route surveyed was located between the proposed offshore terminus of the Hermosa Beach, CA landing borepipe in 62 feet (ft.) (19 meters [m]) water depth out to 520 ft. (158.5 m) water depth (Figure 1). To facilitate field operations, subsequent laboratory analysis, and data presentation, the cable route was divided into four segments (labeled A through D), which roughly corresponded to anticipated differences in habitat types and water depths that might result in different biological communities or differences in dominant taxa as a result of habitat conditions. These survey segments were developed based on information from the geophysical seafloor mapping. Both color digital video and still images were collected of all substrate habitats observed and associated biota.

The predominant seafloor habitat along the proposed SEA-US cable route between 140 and 520 ft. (43-158.5 m) water depth consisted of fine silt and clay soft-substrate with consistent evidence of bioturbation. The seafloor habitat in the shallower water depths of the proposed route (62-140 ft. (19-43 m) consisted of coarse to fine sand, with the sand becoming finer as the water depth increased. In water depths less than 100 ft. (30.5 m) the sand sediment was formed into noticeable sand waves and ripples.

A total of 12 isolated low relief rocks or pieces of debris/trash were observed along survey Segments B, C and D and one small cluster of 5-6 small low relief rocks were observed in survey Segment B. No hard-substrate habitat was observed in survey Segment A. Additionally, no high relief or extensive hard-substrate habitat areas were observed within the proposed cable route corridor.

The mapping of seafloor habitats observed during the biological reconnaissance survey closely matched and corroborated the geophysical seafloor mapping along the cable route. All potential hard-substrate targets identified in the geophysical survey mapping located within or immediately adjacent to the proposed cable burial corridor were surveyed. All of these targets, except one target in survey Segment A, contained hard-substrate habitat that predominantly consisted of isolated low relief rocks or debris/trash. Nearly half of the hard substrate targets identified in the geophysical survey were debris or trash. No hard-substrate habitat was observed at the target identified in the geophysical mapping in survey Segment A.

The epibenthic invertebrate, algae, and fish species observed along the proposed SEA-US cable route are representative of hard-substrate and soft-substrate areas of Southern California and specifically the area offshore Hermosa Beach, California (MBC, 2001, AMS 2015a). The epifauna observed in the soft-substrate segments of the surveyed cable route right-of-way was dominated by multiple species of sea pens and sea whips*;* brittle stars (Ophiurida); the splendid diopatra, *Diopatra splendidissima; the* sea cucumber, *Parastichopus californicus*; and sea urchins, including the pink urchin, *Strongylocentrotus fragilis* and the white urchin, *Lytechinus pictus*.

Other invertebrate epibenthic taxa observed inhabiting or associating with the soft-substrate habitats along the proposed cable route include red and brown algae attached to worm tubes (water depths <100 ft. [30.5 m]); the brown shrimp, *Farfantepenaeus californiensis*; the mantis shrimp, *Hemisquilla californiensis;* the yellow crab, *Cancer anthonyi*; unidentified hermit crabs, *Paguristes* sp.; occasional marine snails, Gastropoda; the California sea slug, *Pleurobranchaea californica*; several species of octopuses including the red octopus, *Octopus rubescens*, the deep water octopus, *O. californicus*, and the two-spot octopus, *Octopus bimaculoides*; several species of sea stars including *Astropecten armatus* and

Luidia foliolata; the moonglow anemone, *Anthopleura artemesia*; and the San Diego scallop, *Leopecten diegensis*.

The most abundant fish species observed associating with areas of soft-substrate habitat along the cable route included longspine and shortspine combfish, *Zaniolepsis latipinnis* and *Z. frenata*; Pacific and speckled sanddab, *Citharichthys sordidus* and C. *stigmaeus*; blackbelly eelpout, *Lycodes pacificus*; California lizardfish, *Synodus lucioceps*; and assorted flatfish including starry flounder, *Platichthys stellatus*; C-O sole, *Pleuronichthys coenosus*; Hornyhead turbot, *Pleuronichthys verticalis*; Dover sole, *Microstomus pacificus*; and fantail sole, *Xystreurys liolepis*. Poachers, Agonidae and pink seaperch, *Zalembius rosaceus were also observed*. Additionally, several species of rockfish were observed along the soft-substrate areas of the cable route including calico, *Sebastes dalli;* flag, *S. rubrivinctus*; halfbanded, *S. semicinctus*; and honeycomb, *S. umbrosus*. Baitfish, Atherinidae, were observed in the water column in water depths < 75 ft. (23 m) and a small school of Pacific bonito, S*arda chiliensis*, were observed along survey Segment D. The Longnose skate, *Raja rhina*, and Pacific angel shark, *Squatina californica*, were also observed.

Detrital specimens of surfgrass, *Phyllospadix*; giant kelp, *Macrocystis pyrifera*; and acid weed, *Desmarestia lingulata*, were observed drifting along the seafloor throughout survey Segments A and B, in water depths < 345 ft. (102 m). Drift acid weed continued to be observed in survey Segment C to a water depth of 375 ft. (114 m). However, no attached surfgrass, bull kelp, or giant kelp plants or beds were observed along the cable right-of-way.

Marine taxa observed consistently associating with hard-substrate habitats along the cable route, both natural and artificial, regardless of water depth included white plumose anemones, *Metridium farcimen*, and a low colonizing turf complex comprising hydroids, tunicates, and bryozoans. Additional epifaunal taxa observed at hard-substrate habitats included the cup coral *Paracyathus stearnsi*; a soft gorgonian coral, *Eugorgia* sp.; encrusting sponges; serpulid worms; the box crab, *Platymera gaudichandii*; the sheep crab, *Loxorhynchus grandis*; the yellow crab, *Cancer anthonyi*; and the bat star, *Asterina miniata*.

Fish species observed associating with hard-substrate areas along the cable route were dominated by rockfish with halfbanded, *S. semicinctus*; vermillion, *S. miniatus*; and brown rockfish, *S. auriculatus*, being the most frequently observed. Other rockfish observed included gopher, *S. carnatus*; copper, *S. caurinus*; calico, *S. dallii*; rosy, *S. rosaceus*; flag, *S. rubrivinctus*; and honeycomb, *S. umbrosus*. Other species observed included California scorpionfish, *Scorpaena guttata*, and pink seaperch, *Zalembius rosaceus*.

The filamentous bacteria, *Beggiatoa* sp., was observed in a small isolated pocket along the seafloor in survey Segment A (sub-section A-3). *Beggiatoa* normally occurs as a white mat overlying sulfur-rich sediments in marine and freshwater environments and oxidizes hydrogen sulfide to elemental sulfur. It is often observed on the seafloor surface in association with oil and gas seeps that are rich in hydrogen sulfide gas, at deep ocean hydrothermal vents, and at locations that contain high levels of organic pollution.

Comparing survey observations and data from the current survey with those previously collected in the area (MBC, 2001) indicate that no substantial changes in either marine habitat or associated biota appear to have occurred over the past fifteen years within the nearshore waters of Hermosa Beach. Additionally, no invertebrate or fish species of special significance or concern to either California or Federal agencies were observed.

2.0 Project Background

MC Global BP4 has proposed to install and operate up to four submarine cable systems connecting the United States to countries of the western Pacific Rim such as Southeast Asia, China, Australia, and Japan. The US landfall for all four-cable systems would be located in Hermosa Beach, California in the County of Los Angeles. The proposed Project would be implemented in four phases consisting of one phase for each of the four cable systems.

Phase 1 of the Project, The Southeast Asia to United Sates (SEA-US) cable system would connect Hawaii, Guam, the Philippines, and Indonesia to the United States using one of two landing sites developed for the Project in Hermosa Beach and located west of 25th Street between Hermosa Avenue and Palm Drive. Figure 1 illustrates the location of the landfall and the proposed subsea cable route to a depth of approximately 600 ft. (200 meters) water depth.

The proposed subsea cable route will transit an area of the seafloor immediately north of the Tyco Networks (US) Inc. TGN Fiber Optic Cable System cable (MBC 2001) (Figure 1).

As part of the SEA-US cable project environmental review and permitting process, the California Coastal Commission requested that a marine habitat and biota survey of the seafloor along the nearshore portions of the proposed cable route be conducted. The primary objective of the habitat and biological survey was to obtain sufficient visual data (color video and still images) to characterize the existing macrobenthic and epibenthic community structure inhabiting both soft and hard-substrate located in the vicinity of the proposed cable route corridor. Prior to initiation of the marine biological and seafloor habitat survey, a geophysical survey and mapping of the seafloor offshore Hermosa Beach, California was conducted to determine the optimum cable routing. It was along this proposed cable route that the marine biological and seafloor habitat photographic survey was conducted (AMS 2015a). This survey report presents the results and conclusions from a remotely operated vehicle (ROV) based photographic survey of approximately 6.6 nautical miles (12.2 kilometers) of the nearshore portion of the cable route.

3.0 Survey Methodologies

AMS conducted the seafloor habitat and marine biology survey on October 14-15, 2015 using a remotely operated vehicle (ROV). Applied Marine Sciences' marine biologists, Jay A. Johnson, James Elliott, and Rebecca DeGabriel were the onboard observers during the survey and conducted all of the post survey data analysis. To facilitate field operations, subsequent laboratory analysis, and data presentation, the cable route was divided into four survey Segments (labeled A through D), which roughly corresponded to anticipated differences in habitat types and water depths that might result in different biological communities or differences in dominant taxa as a result of habitat conditions. Figure 1 illustrates the location of these four survey Segments. The following sections detail the equipment and methodologies employed during the survey.

3.1 Field Survey Protocols

3.1.1 Surface Support Vessel & ROV

The surveyed Segments of the SEA-US fiber-optic cable route are presented in Figure 1. The ROV survey was conducted from the 77-ft support vessel M/V Danny-C. A Hydrosub-10 ROV, owned and operated by Aqueos, Inc. (Oxnard, CA) was used to conduct the survey and was equipped with:

- Color digital video camera,
- Mesotech-1000 Color scanning sonar to assist in locating hard-substrate features,
- BW video for low light conditions, and
- Lasers for providing photographic scales and ensuring consistently sized photoquadrats.

The color video camera was used to obtain continuous video coverage of each of the four cable survey Segments surveyed and to obtain in-situ still images at select survey route points. To aid in quantifying the area within a still image, as well as for providing a means of measurement on still images and video, two lasers were mounted under the cameras on the pan/tilt unit to which the cameras were mounted. Initially, the pan/tilt unit was mounted such that the point of convergence of the two lasers placed the ROV a set distance from the substrate and allowed the photographing of a 0.25-meter squared viewing area (photoquadrat). The distance between the laser points, when the ROV was stationary on the seafloor, was 7 cm.

The digital video feed from the ROV was recorded onto DVD's using a JVC DVD recorder. Superimposed on each video were the ROV heading, water depth, survey date, and time stamp in hours, minutes, and seconds. Stop-frame still images from the video transmission were stored on a separate DVD recorder.

Scientific field crews maintained a dive observations and information log that tracked time, navigation fixes, water depth, times when photos were taken, habitat type, and additional noteworthy observations. Dive transects were conducted at ROV speeds ranging between 0.3-0.5 knots. In hard-substrate areas and when taking still photos, the ROV was operated at much slower speeds.

3.1.2 Surface Vessel and ROV Navigation

Navigation and positioning of the surface support ship and ROV was performed by personnel from Fugro Pelagos, Inc. (Fugro), employing Differential Global Positioning Satellite (DGPS) systems for both support ship and ROV navigation. The configuration of Fugro's Positioning System for acoustic tracking of an ROV along a pre-determined cable route is based on a powerful menu-driven navigation software system that allowed the integration of input data collected from a number of navigation sensors combined with pre-plotted data that allows for "real time tracking" of the support vessel and ROV as detailed below.

Vessel Positioning: Positioning of the vessel was accomplished through the utilization of the above DGPS positioning system and integrated navigation software. Real-time corrections are transmitted via a dedicated communications satellite transponder to the vessel.

The corrections themselves are pseudo-range corrections and range-rate corrections for every satellite in view. The GPS base stations that collectively comprise the Fugro Wide Area Differential (WAD) network are located throughout the world. These base stations make real-time differential observations of the GPS satellite constellation in their view. The differential data were further enhanced by correcting for ionospheric and tropospheric distortions. The enhanced data were then uplinked to a dedicated communication satellite transponder where they were simultaneously transmitted to the vessel. This method of transmitting WAD requires no local base station, has no radio range or line-of-sight considerations, and produces a position accuracy on the order ±1 meter RMS, or better.

Additional input data including vessel's heading information from the gyrocompass were logged at every fix mark. Position fix marks were generated from the computer system at 150 meter intervals along the pre-plotted fiber-optic cable route, whenever a photo was taken, and whenever the surveying marine

biologist requested a position fix be made, such as at the start of a hard-substrate habitat area along the route.

Vessel Heading: A survey grade digital Gyrocompass was used to provide vessel heading and allow for the accurate position of offsets for the acoustic tracking system hydrophone and bearings to the ROV.

Subsurface Bearing and Distance: Subsurface acoustic positioning of the ROV was accomplished using an Ocean Research Equipment (ORE) Trackpoint II Ultra Short Baseline system. The system determines relative range and bearing from the surface vessel to a mini transponder attached to the ROV therein providing accurate subsurface positioning data. The system comprises of a control and display unit (CDU), a hydrophone, and an acoustic beacon mounted on the ROV.

Range and bearing information is output to the surface positioning system for further transformation to a real-time position. The Ultra-Short Baseline system derives its name from three sensors located on the hydrophone transmitting and receiving acoustic signals. The three sensors form an ultra-short baseline between themselves that receive acoustic signals. The returning acoustic signal from the transponder arrives at each sensor at a different time. This time phase difference comparison is processed by the central processing unit to derive a direction and distance to the transmitting beacon on the RO

System Software: The FUGRO positioning system utilizes a PC based navigation system, Hypack, that has the capability of interfacing DGPS positions of latitude and longitude and converting them to the appropriate coordinates as necessary. In addition to data acquisition of positioning data, the software interfaces with external instruments such as echo sounders, Ultra-Short Baseline acoustic systems, side-scan sonar, and geophysical equipment for annotation of records. One of the system's strengths is its ability to import CAD generated maps and digital charts and have them depicted on several graphics display monitors that can be stationed throughout the vessel.

The graphic monitor displays a scaled depiction of the vessel orientation to the survey lines and/or subsurface targets, and range and bearing from the vessel or ROV to the target. The surveyor can control the scaling of the graphics to assist the vessel helmsman in fine-tuning the vessel's position. The software is configured to allow the operator to select operating coordinate system and zone, pre-plotted data file, output logging file, logging file interval, and vessel offsets from the GPS antenna to the Trackpoint hydrophone pole. Once these selections are input, the software interrogates data output from the differentially corrected GPS satellite positioning system, the vessel heading from a precision gyroscope, and the ROV bearing and distance (relative to the vessel) from the ORE Trackpoint II, to provide the visual and logging output displays.

3.2 Data Analysis

3.2.1 Video and Still Image Analysis

Laboratory evaluation of the video and still images were conducted in separate phases. Still images were initially reviewed to compile a master species list of observed biota and to establish a photographic reference list for subsequent video and still image analysis. Still and video images were quantitatively analyzed using similar protocols using personal computers equipped with DVD video and still image viewing software.

Soft and mixed substrate habitat: Prior to the field survey, the proposed cable route was divided into four survey Segments, designated A through D. These survey Segments were selected based on the habitat types (soft, mixed and, hard-substrate) preliminarily identified in a geophysical seafloor mapping

survey of the cable route conducted a month prior to this survey, oceanographic knowledge of the region, and water depth. Figure 1 illustrates the location of the four survey Segments along the nearshore portion of the proposed cable route. The laboratory analysis of soft-substrate consisted of analyzing the video footage of the four survey Segments in 1,969 ft. (600-meter) subsections for habitat composition and observable biota. All organisms were identified to the lowest taxon practicable and enumerated. If within a survey Segment the habitat changed, each different habitat type was analyzed separately.

Still images of soft and mixed-substrate habitat areas were individually characterized by water depth and substrate type and all observable biota on each still image identified to the lowest taxon practicable and enumerated. Each of the four pre-selected survey Segments ranged in length from 2 to 4.5 Km.

Hard-substrate habitat: Because so little hard-substrate habitat was observed along the nearshore portion of the surveyed SEA-US cable route and what was observed were small isolated rocks or trash/debris, no quantitative photoquadrats were collected. Both the video and still images of hard-substrate habitat and associated biota were analyzed using the same protocols as employed for the soft and mixed substrate habitats described above with the exception that only those still images or video footage that contained hard-substrate habitat were included in the video analysis.

3.2.2 Taxonomic Notes

The marine biologists and taxonomists engaged in the identification of marine invertebrate and vertebrate species observed in video and still images taken by the ROV during this survey have attempted to identify all observed biota to the lowest taxon possible. However, many marine invertebrates are very difficult to identify to genus or species without specimens that can be directly examined. Use of photos collected by other researchers does not always ensure an accurate identification and in many cases can proliferate misidentification.

For example, a total of four different white sea pens and sea whips were observed along the SEA-US cable route beginning with survey Segment A, sub-section A-5 through Segment D. Although each of the four sea pens exhibited apparent different morphological characteristics, without actual specimens, it was very difficult to accurately identify any of them to genus or species. Because of the possibility of taxonomically misidentifying these organisms, for the purposes of this survey, we have assigned them the identifying designation as Subselliflorae Sp. A through D. In addition, we have linked to each of the higher taxonomic identifications the genus and species names used to identify these organisms in past underwater ROV, manned submersible, and diver surveys. Although we may believe these are the most accurate identifications possible, they may also be incorrect. In an effort to avoid continuing misidentification, but to enable comparison of studies and surveys, we have used the closest taxonomic identification possible for uncertain species and then included the genus or genus-species name used in past surveys.

4.0 Survey Results & Discussion

The proposed route of the SEA-US fiber optic cable through the nearshore coastal waters offshore Hermosa Beach, California encounters marine communities that vary both by habitat type, water depth, and ecological conditions. The surveyed Segments of the proposed cable route corridor transits between 62 ft. (19 m) and 520 ft. (158.5 m) water depth. It consisted primarily of soft-substrate habitat with occasional occurrences of low relief rocks and trash/debris. The majority of hard-substrate habitat identified in the geophysical seafloor mapping survey was trash and debris.

Post plots of the habitats and substrate composition observed along the surveyed cable route corridor (Figures 2-6) revealed that soft-substrate was the predominant type of habitat observed. This ranged from coarse sand to fine silt and clay. Additionally, approximately 16 small low relief rocks or pieces of debris/trash were observed along the route with three each occurring in survey Segments C and D and 10 in survey Segment B. Within survey Segment B, five small rocks were clustered together with two additional rocks being isolated by themselves, as was the case for the rocks observed in survey Segments C and D. Of the total hard-substrate features observed along the surveyed cable route corridor, half were trash or debris. No hard-substrate features were observed in survey Segment A. Each of the observed rocks was less than a few feet in length and width and rose less than one foot off the seafloor. In addition to the natural hard-substrate observed, there were numerous observations of trash and debris including wine and beer bottles, plastic buckets, an abandoned anchor, chain and winch, an abandoned metal equipment box or frame, and pieces of sheet metal and pipe. Appendix B contains a summary table of all video recordings, and Appendix C contains copies of all video recordings and still images.

The following sections present detailed information on the seafloor habitat and associated biota encountered within each of the four surveyed segments. Figure 1 illustrates the location of the proposed cable route transiting offshore Southern California and location of each survey Segment along the surveyed cable route. Appendix A contains species lists of all plant, invertebrate and fish species observed during the entire survey.

4.1 Soft-substrate Habitat

4.1.1 Cable Survey Segment A (62-235 ft. [19-72 m])

This initial surveyed segment of the SEA-US cable route transits from the bore pipe located in approximately 62 ft. (19 m) water depth perpendicular to the shoreline out to 235 ft. (73 m) water depth (Figure 2). The seafloor along this survey Segment of the cable route appeared to be predominantly composed of coarse to fine sand with patches of shell hash. The sand got finer in composition with increasing water depth. Between 140-235 ft. (43-72 m) the sediment changed to a finer sand-silt-clay composition with minor evidence of bioturbation. Within survey Segment A, five slightly different habitats were present with observable differences in sediment composition, physical conditions, including exposure to wave energy and light penetration, and associated macrobenthic biota. Each of these five habitats and associated biota are described below.

Cable Survey Segment A-1 (62-75 ft. [19-23 m])

Ten alga and invertebrate taxa and six fish taxa were observed in video records from survey Segment A-1 (Table 4.1). The seafloor sediment was characterized as coarse sand with pronounced wave ripples (Figure 7) and shell hash in the ripple troughs. The invertebrate macrobenthic community included the splendid diopatra, *Diopatra splendidissima;* hermit crabs, Paguroidea*;* white sea pens; the sea star *Luidia foliolata*; and the Kellet's Whelk, *Kelletia kellettii*. Assorted algae were observed drifting along the seafloor including surfgrass, *Phyllospadix* spp.; acid weed, *Desmarestia lingulata*; giant kelp; *Macrocystis pyrifera* (Figure 7), and Turkish towel, *Chondracanthus exasperatus*. Unidentified red and brown algae were observed attached to splendid diopatra tubes. The invertebrate community was dominated by splendid diopatra, *D. splendidissima* with hundreds of tubes per square meter, often with attached red and brown algae.

Six fish taxa were observed in video records from survey Segments A-1 (Table 4.1). Observed fish species included Atherinidae (baitfish), Pacific sanddab, *Citharichthys sordidus;* California lizardfish, *Synodus lucioceps*; combfish (*Zaniolepsis* spp.*),* rockfish, *Sebastes* spp.*;* and unidentified Perciformes (roundfish).

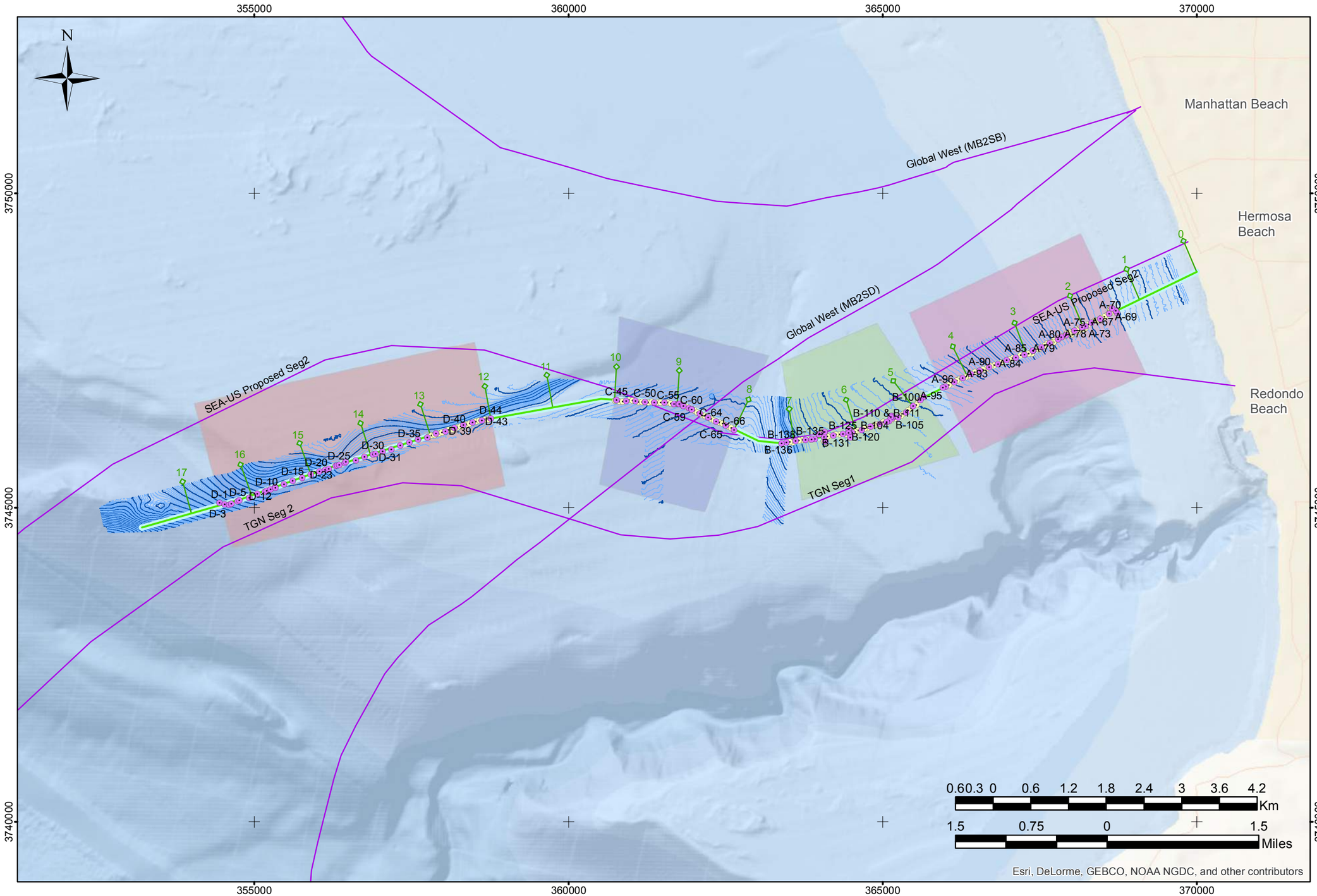
Table 4.1: Soft-Substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment A, Sub-section A-1.

Cable Route Segment: A-1	**Water Depth:** 62-75 feet (19-23 meters)	
Habitat/Substrate: (SS) Coarse sand with pronounced wave ripples.		
Species	**Common Name**	**Community Composition**
Angiosperm		
Phyllospadix spp. drift	Surfgrass drift	Present
Algae, Phaeophyta		
Desmarestia lingulata drift	Acid weed, drift	Present
Phaeophyta, unident.	Brown algae, unident. Attached to worm tubes)	Abundant
Macrocystis pyrifera drift	Giant kelp, drift	Present
Algae, Rhodophyta		
Chondracanthus exasperatus	Turkish towel red alga	Present
Rhodophyta, unident.	Red algae, unident. (Attached to worm tubes)	Abundant
Annelids		
Diopatra splendidissima	Splendid diopatra	Abundant
Arthropods		
Paguristes sp.	Hermit crab	Present
Cnidarians		
Subselliflorae sp. B *(Stylatula elongata?)*	White sea pen	Common
Echinoderms		
Luidia foliolata	Sand Star	Common
Mollusks		
Kelletia kellettii	Kellet's whelk (shell)	Present
Vertebrates		
Atherinidae, unident.	Baitfish school	Common
Citharichthys sordidus	Pacific sanddab	Present
Sebastes spp.	Unidentified rockfish	Present
Synodus lucioceps	California lizardfish	Present
Zaniolepis spp.	Combfish	Present
Perciformes, unident.	Unidentified round fish (juv.)	Common

Cable Survey Segment A-2 (75-100 ft. [23-30.5 m])

This sub-section of survey Segment A (Figure 2) was very similar to sub-section A-1 in sediment composition and associated biota (Table 4.2). It differed slightly by having occasional small areas of mixed-substrate, which consisted of coarse to medium sand with occasional very small rocks/cobble. There was also one small area that lacked any evidence of sand ripples.

Within this sub-section of survey Segment A, there were 12 alga and invertebrate taxa and three fish taxa observed in the video records. The invertebrate macrobenthic community included most of the same taxa observed in sub-section A-1 with the absence of drift surfgrass, *Phyllospadix spp*.; and hermit crabs, Paguroidea; although the latter were most likely present in higher abundance than observed in the ROV video recordings as they are often quite small. The additional taxa observed in this sub-section were the spiny sea star, *Astropecten armatus*; the California sea cucumber, *Parastichopus californicus*; and the San Diego scallop, *Leopecten diegensis*. The San Diego scallop was observed at the very end of this sub-section in water depths beginning at 100 ft. (30.5 m). The splendid diopatra, *D. splendidissima*, with attached unidentified red and brown algae remained the most abundant taxa observed



Legend

- ROV Photo Location with Fix Number
- ROV Location with Fix Number
- Kilometer Post
- SEA-US Cable 100m Buffer
- SEA-US Proposed Cable Route
- Telecom Cable

Bathymetric Contours

- Major Contours, Interval = 5 Meters
- Minor Contours, Interval = 1 Meter

Survey Segments

- Segment A
- Segment B
- Segment C
- Segment D

Grid Coordinate: UTM North Zone 11 Meter
1 cm = 600 m

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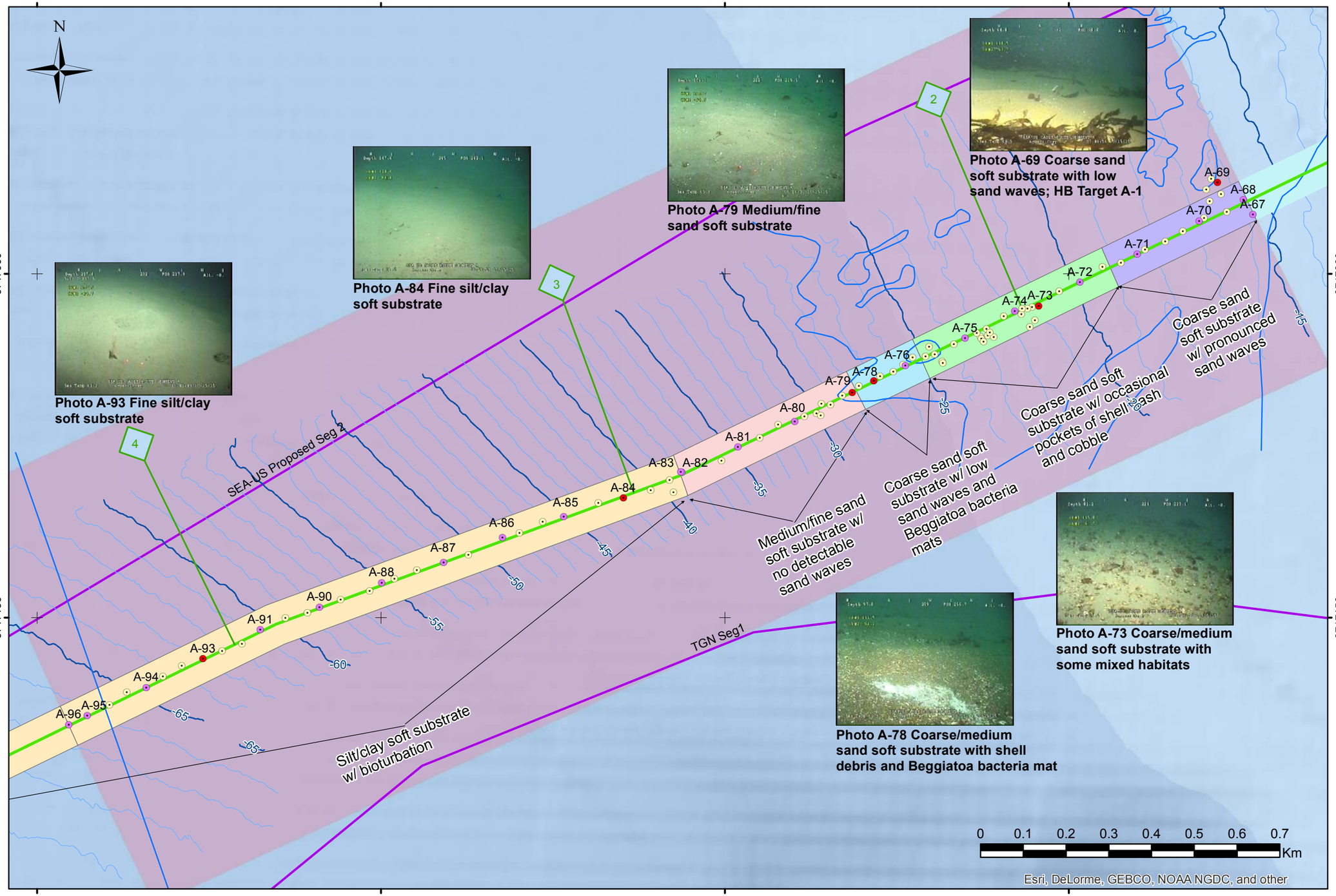
PROPOSED CABLE ROUTE BIOLOGICAL ROV SURVEY

Offshore Hermosa Beach, CA

Figure 1



Legend

- ROV Photo Location with Fix Number
- ROV Photo Location with Fix Number (Picture Provided on Map)
- ROV Location with Fix Number
- Kilometer Post
- SEA-US Cable 100m Buffer
- SEA-US Proposed Cable Route
- Telecom Cable

Bathymetric Contours

- Major Contours, Interval = 5 Meters
- Minor Contours, Interval = 1 Meter

Survey Segment

- Segment A

Grid Coordinate: UTM North Zone 11 Meter
SCALE: 1 cm = 90 m

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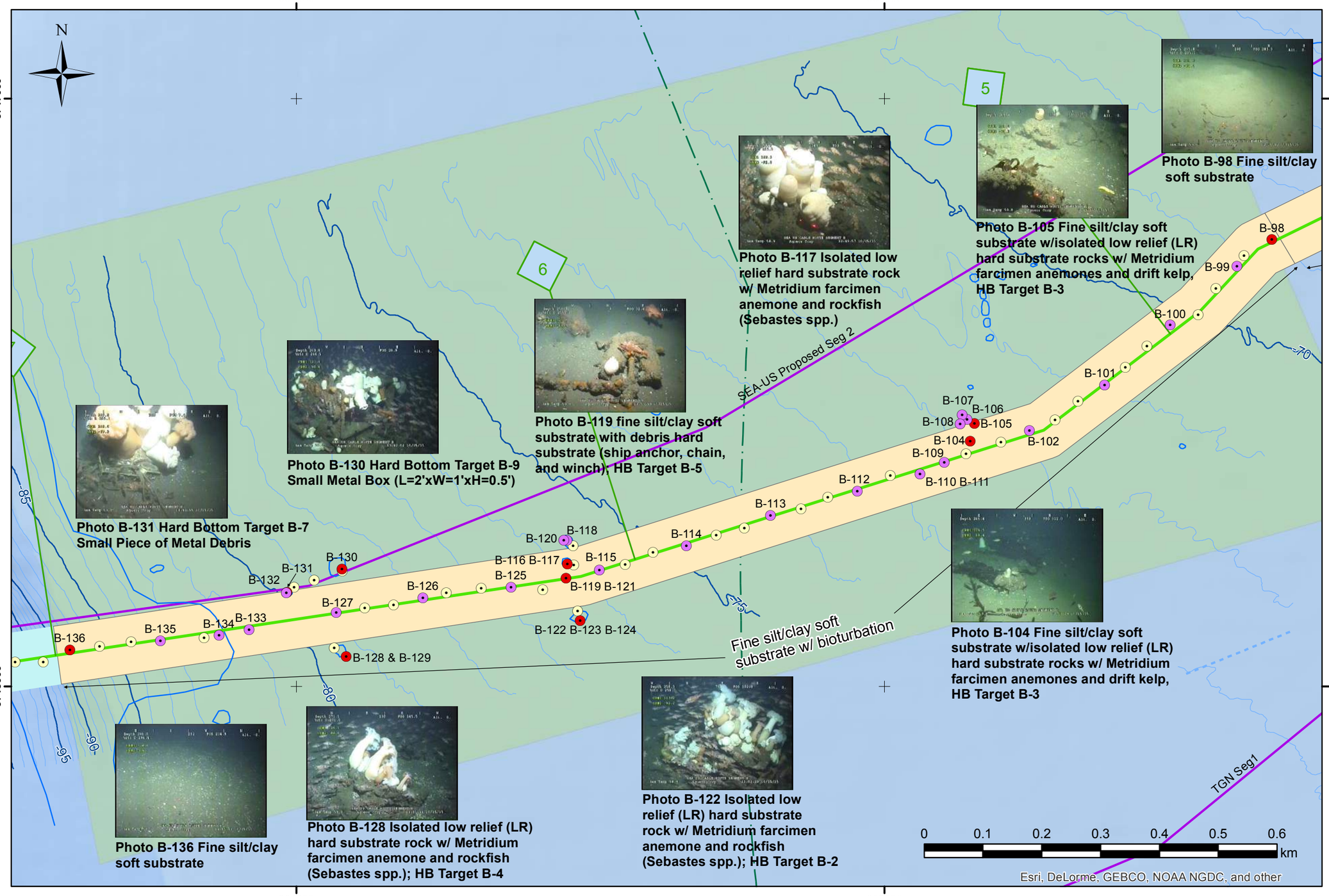
SEGMENT A

PROPOSED CABLE ROUTE BIOLOGICAL ROV SURVEY

Offshore Hermosa Beach, CA

Figure 2



Legend

- ROV Photo Location with Fix Number
- ROV Photo Location with Fix Number (Picture Provided on Map)
- ROV Location with Fix Number
- Kilometer Post
- SEA-US Cable 100m Buffer
- SEA-US Proposed Cable Route
- Telecom Cable
- 3 Nautical Mile Limit

Bathymetric Contours

- Major Contours, Interval = 5 Meters
- Minor Contours, Interval = 1 Meter

Survey Segment

- Segment B

Grid Coordinate: UTM North Zone 11 Meter
SCALE: 1 cm = 65 m

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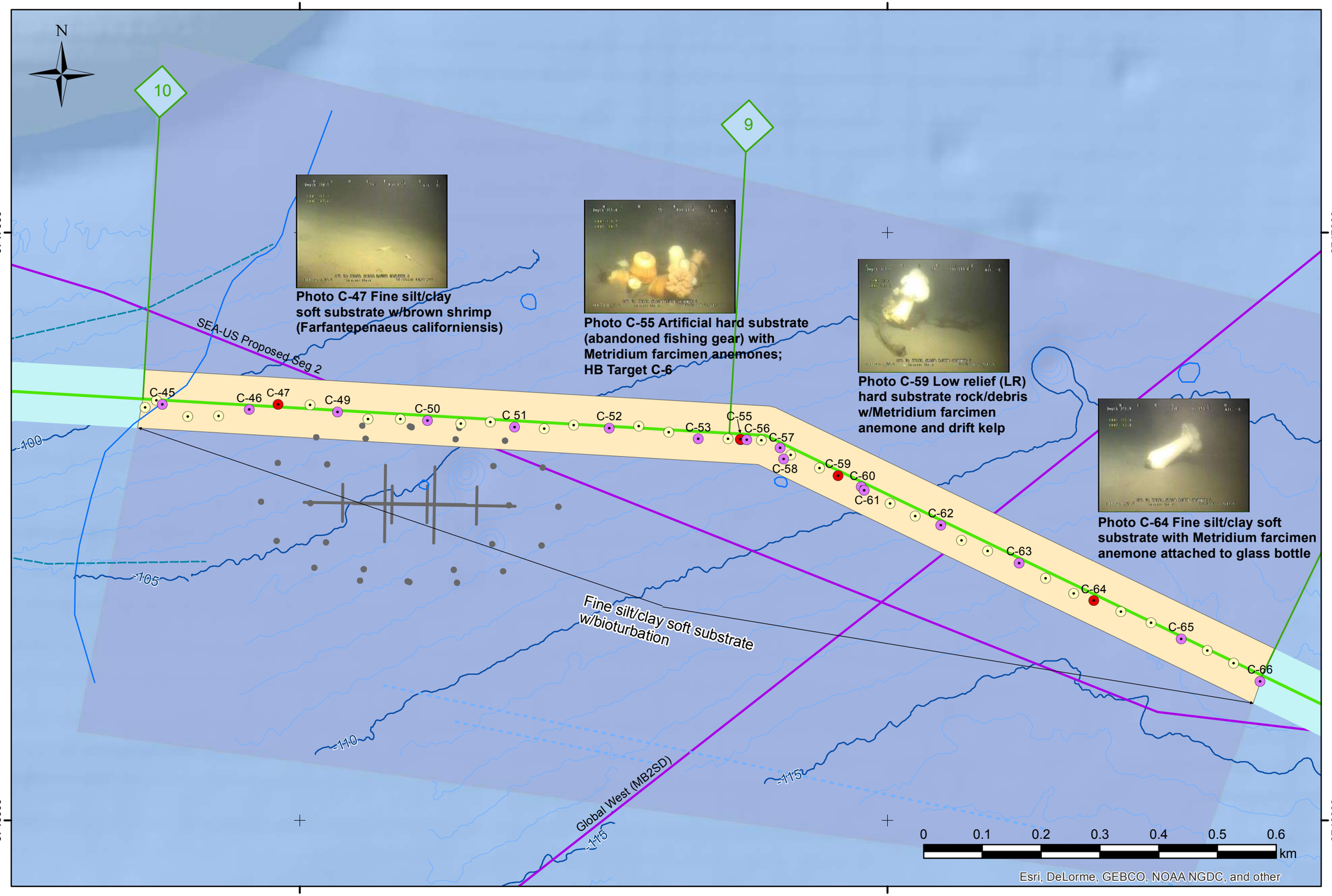
SEGMENT B

PROPOSED CABLE ROUTE BIOLOGICAL ROV SURVEY

Offshore Hermosa Beach, CA

Figure 3



Legend

- ROV Photo Location with Fix Number
- ROV Photo Location with Fix Number (Picutre Provided on Map)
- ROV Location with Fix Number
- Kilometer Post
- SEA-US Cable 100m Buffer
- SEA-US Proposed Cable Route
- Telecom Cable
- Ship Wreck
- Scar
- INS Cable - As-Found

Bathymetric Contours

- Major Contours, Interval = 5 Meters
- Minor Contours, Interval = 1 Meter

Survey Segment

- Segment C

Grid Coordinate: UTM North Zone 11 Meter
SCALE: 1 cm = 65 m

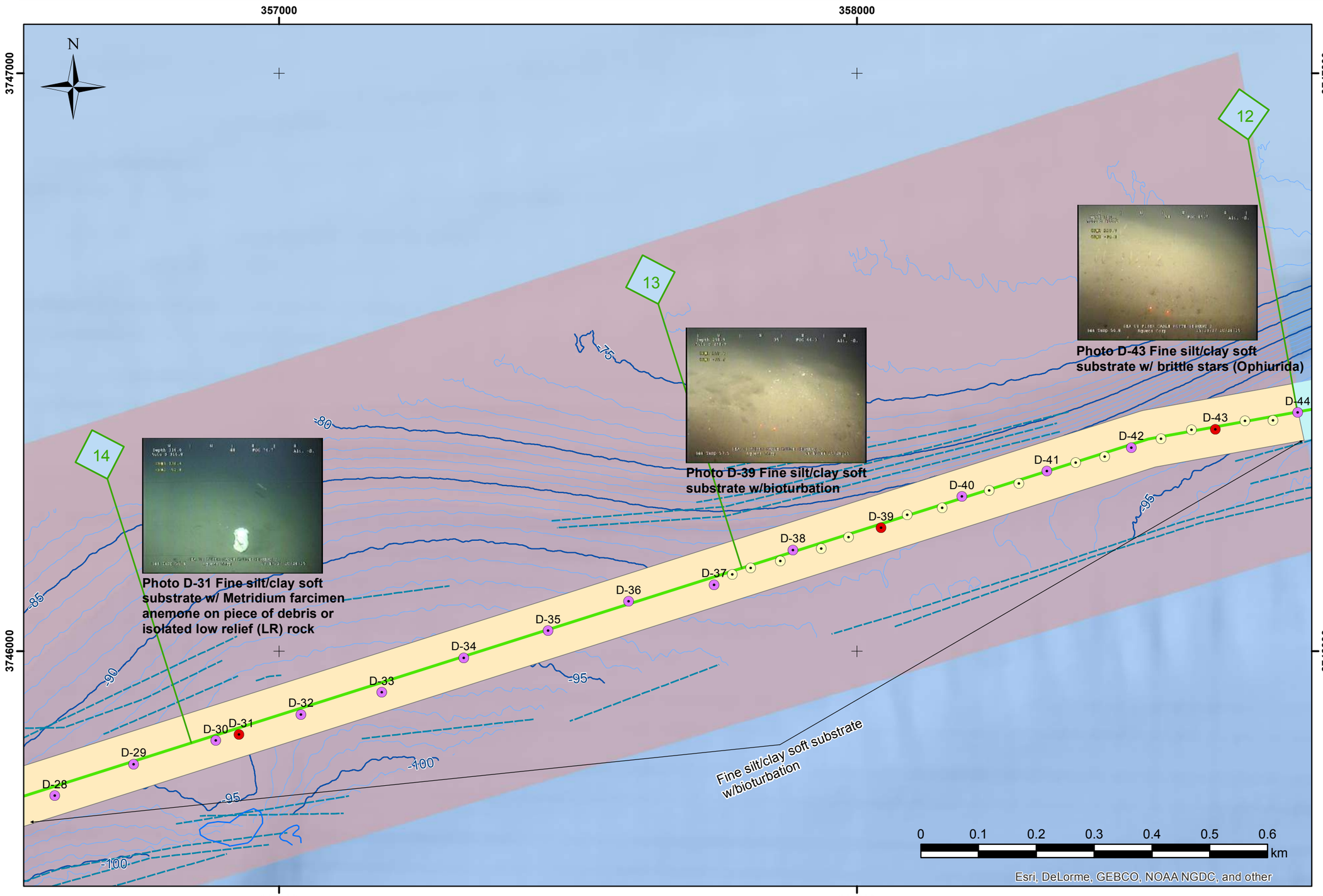
APPLIED marine SCIENCES

SEGMENT C

PROPOSED CABLE ROUTE BIOLOGICAL ROV SURVEY

Offshore Hermosa Beach, CA

Figure 4



Legend

- ROV Photo Location with Fix Number
- ROV Location with Fix Number
- Kilometer Post
- SEA-US Cable 100m Buffer
- SEA-US Proposed Cable Route
- Telecom Cable
- Scar

Bathymetric Contours

- Major Contours, Interval = 5 Meters
- Minor Contours, Interval = 1 Meter

Survey Segment

- Segment D

Grid Coordinate: UTM North Zone 11 Meter
SCALE: 1 cm = 65 m

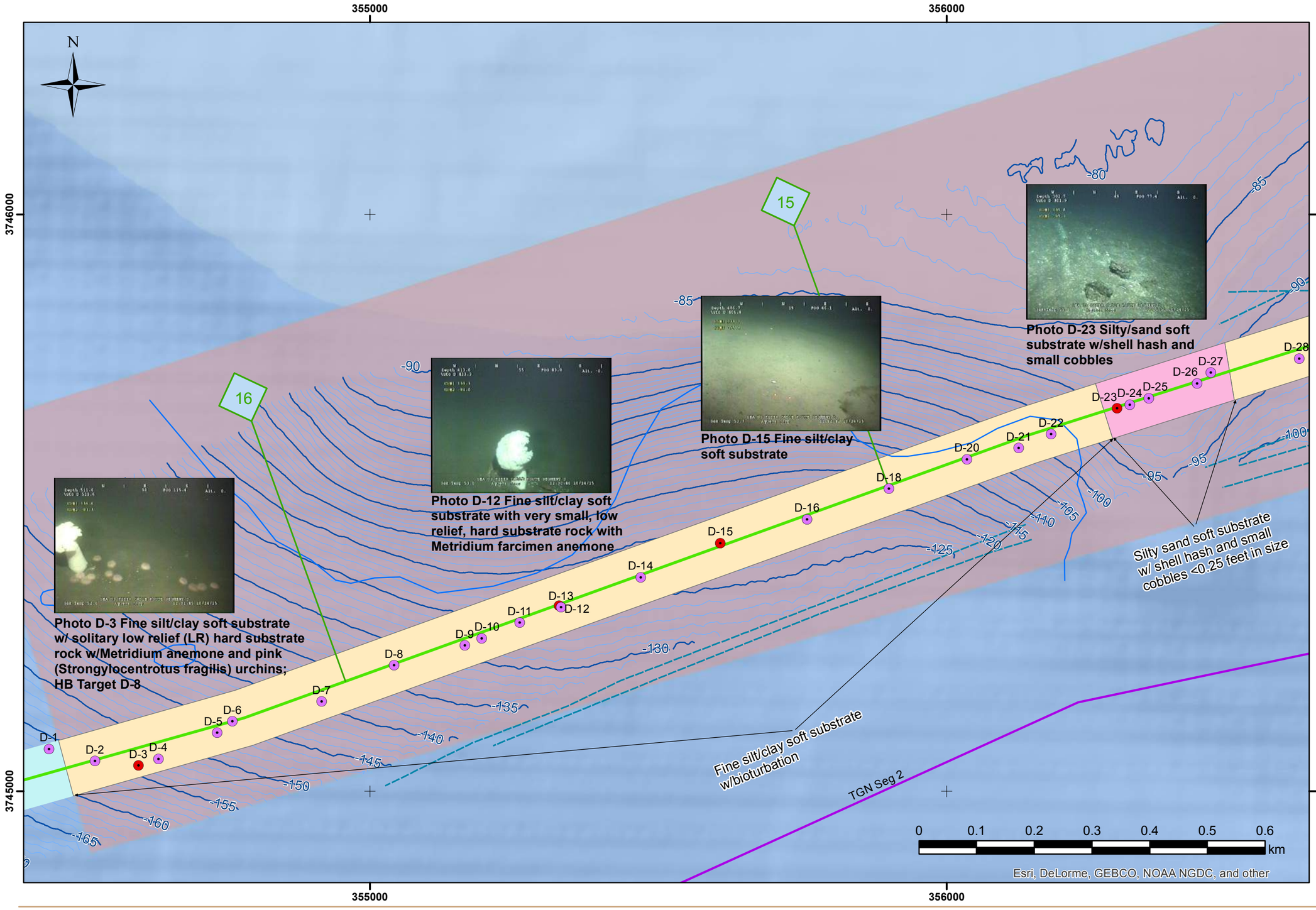
APPLIED marine SCIENCES

SEGMENT D-1

PROPOSED CABLE ROUTE BIOLOGICAL ROV SURVEY

Offshore Hermosa Beach, CA

Figure 5



Legend

- ROV Photo Location with Fix Number
- ROV Photo Location with Fix Number (Picutre Provided on Map)
- ROV Location with Fix Number
- Kilometer Post
- SEA-US Cable 100m Buffer
- SEA-US Proposed Cable Route
- Telecom Cable
- Scar

Bathymetric Contours

- Major Contours, Interval = 5 Meters
- Minor Contours, Interval = 1 Meter

Survey Segment

- Segment D

Grid Coordinate: UTM North Zone 11 Meter
SCALE: 1 cm = 65 m

APPLIED marine SCIENCES

SEGMENT D-2

PROPOSED CABLE ROUTE BIOLOGICAL ROV SURVEY

Offshore Hermosa Beach, CA

Figure 6

Observed fish species in sub-section A-2 *(Table A-2)* included California halibut, *Paralichthys californicus*; combfish, *Zaniolepis* spp.*;* and rockfish, *Sebastes* spp.

Table 4.2: Soft-substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment A, Sub-section A-2.

Cable Route Segment: A-2		**Water Depth:** 75-100 feet (23-30.5 meters)
Habitat/Substrate: (SS & MS) Predominantly coarse to medium sand sediment with small to large wave ripples, patches of shell hash, and scattered cobble. Additionally within this survey Segment was a small patch of coarse sand sediment with no evident sand ripples.		
Species	**Common Name**	**Community Composition**
Algae, Phaeophyta		
Desmarestia lingulata drift	Acid weed, drift	Present
Phaeophyta, unident.	Brown algae, unident. (Attached to worm tubes)	Abundant
Macrocystis pyrifera drift	Giant kelp, drift	Present
Algae, Rhodophyta		
Chondracanthus exasperatus	Turkish towel red alga	Present
Rhodophyta, unident.	Red algae, unident. (Attached to worm tubes)	Abundant
Cnidarians		
Subselliflorae sp. B *(Stylatula elongata?)*	White sea pen	Present
Annelids		
Diopatra splendidissima	Splendid diopatra	Abundant
Echinoderms		
Astropecten armatus	Spiny sand star	Present
Luidia foliolata	Sand star	Common
Parastichopus californicus	California sea cucumber	Present
Mollusks		
Kelletia kellettii	Kellet's whelk	Present
Leopecten diegensis[1]	San Diego scallop	Present
Vertebrates		
Paralabrax nebulifer	Barred sand bass	Present
Paralichthys californicus	California halibut	Present
Sebastes spp.	Unidentified rockfish	Present
Zaniolepis spp.	Combfish	Present

[1] Scallops observed occurring at ~100 ft. and deeper.

Cable Survey Segment A-3 (95-100 ft. [29-30.5 m])

This very small sub-section of survey Segment A (Figure 2) was characterized as having medium to coarse sand with low to moderate sand ripples and shell hash, similar to sub-sections A-1 and A-2. What differentiated this sub-section from the other sub-sections and surveyed segments of the SEA-US cable route was the presence of the filamentous bacteria, *Beggiatoa sp*., in small isolated pockets along the seafloor (Figure 8; Table 4.3). *Beggiatoa* normally occurs as a white mat overlying sulfur-rich sediments in marine and freshwater environments and oxidizes hydrogen sulfide to elemental sulfur. It is often observed on the seafloor surface in association with oil and gas seeps that are rich in hydrogen sulfide gas, at deep ocean hydrothermal vents, and at locations that contain high levels of organic pollution (Microbewiki 2016).

In addition to the presence of the *Beggiatoa* mats, splendid diopata tubes, *D. splendidissima*, with attached red and brown algae were abundant along with white sea pens (tentatively identified as *Stylatula elongata*), and San Diego scallops. No fish were observed within this sub-section of survey Segment A.

Table 4.3: Soft-substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment A, Sub-section A-3.

Cable Route Segment: A-3		**Water Depth:** 95-100 feet (29-30.5 meters)
Habitat/Substrate: (SS) Coarse to medium sand with low to moderate sand ripples and shell hash. Presence of white filamentous bacteria (*Beggiatoa sp.)*.		
Species	**Common Name**	**Community Composition**
Proteobacteria		
Beggiatoa sp.	White filamentous bacteria	Dominant
Algae, Phaeophyta		
Phaeophyta, unident.	Brown algae, unident. (Attached to worm tubes)	Abundant
Algae, Rhodophyta		
Rhodophyta, unident.	Red algae, unident. (Attached to worm tubes)	Abundant
Annelids		
Diopatra splendidissima	Splendid diopatra tube	Present
Cnidarians		
Subselliflorae sp. B *(Stylatula elongata?)*	White sea pen	Present
Mollusks		
Leopecten diegensis[1]	San Diego scallop	Present

[1] Scallops observed occurring at ~100 ft. and deeper.

Cable Survey Segment A-4 (100-140 ft. [30.5-43 m])
This sub-section of the survey Segment A (Figure 2) was characterized by fine to medium sand with little to no evident sand ripples, a result of increasing water depth and reduced wave energy. Although the invertebrate and fish taxa inhabiting this sub-section are similar to the previous sub-sections of Survey Segment A, only five-macrobenthic/epibenthic invertebrate taxa and five fish taxa were observed on the video footage.

The invertebrate macrobenthic taxa observed included splendid diopatra tubes, *D. splendidissima*' with attached red and brown algae; white sea pens; the sand star, *Luidia foliolata*; the California sea cucumber, *Parastichopus californicus;* and the San Diego scallop, *L. diegensis*. The presence of red and brown algae attached to splendid diopatra tubes ceased at about 120 ft. (36.6 m). Observed fish species in sub-section A-4 *(Table 4.4)*, Pacific sanddab, *Citharichthys sordidus*; hornyhead turbot, *Pleuronichthys verticalis*; combfish, *Zaniolepsis* spp.*;* rockfish, *Sebastes* spp.*;* and unidentified Perciformes (roundfish).

Cable Survey Segment A-5 (140-235 ft. 43-72 m])
This final sub-section of the survey Segment A (Figure 2) changed in sediment composition from sandy sediments to a finer silt-clay composition. In conjunction with finer seafloor sediments, evidence of bioturbation was readily observable. Within this sub-section, a total of 10 invertebrate taxa were observed and 8 fish taxa (Table 4.5). The invertebrate macrobenthic community was dominated by sea pens (Figure 9) and brittle stars observed as arms extending from the sea floor sediment (Ophiurida). Also commonly observed were a second white sea pen previously identified as either *Acanthoptilum* sp. or *Virgularia* sp., white sea whips, the sand star, *Luidia foliolata;* the California sea cucumber,

californicus; the Carpenter's turrid, *Megasurcula carpenteriana*; the California two-spot octopus, *Octopus bimaculoides*; and the San Diego sea scallop *L. diegensis*. The San Diego sea scallop was only observed at the shallower water depths in this sub-section.

Vertebrate fish species observed included Dover sole, *Microstomus pacificus;* California scorpion fish, *Scorpaena guttata*; California lizardfish, S. *lucioceps*; combfish, *Zaniolepis spp*.; rockfish, *Sebastes spp.;* the longnose skate, *Raja rhina*; and unidentified roundfish and flatfish,

Table 4.4: Soft-substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment A, Sub-section A-4.

Cable Route Segment: A-4	**Water Depth:** 100-140 feet (30.5-43 meters)	
Habitat/Substrate: (SS) Fine to medium sand with little to no sand ripples.		
Species	**Common Name**	**Community Composition**
Algae, Phaeophyta		
Phaeophyta, unident.	Brown Algae, unident. (Attached to worm tubes)	Abundant
Algae, Rhodophyta		
Rhodophyta, unident.	Red Algae, unident. (Attached to worm tubes)	Abundant
Cnidarians		
Subselliflorae sp. B *(Stylatula elongata?)*	White sea pen	Common
Annelids		
Diopatra splendidissima	Splendid diopatra tube	Present
Mollusca		
Leopecten diegensis[1]	San Diego scallop	Present
Echinoderms		
Luidia foliolata	Sand Star	Present
Parastichopus californicus	California sea cucumber	Present
Vertebrates		
Citharichthys stigmaeus.	Speckled sanddab	Present
Pleuronichthys verticalis	Hornyhead turbot	Present
Sebastes spp.	Unidentified rockfish	Present
Zaniolepis spp.	Combfish	Present
Perciformes, unident.	Unidentified Round Fish	Present

[1] Scallops observed occurring at 100 ft. and deeper.

Table 4.5: Soft-substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment A, Sub-section A-5.

Cable Route Segment: A-5	**Water Depth:** 140-235 feet (43-72 meters)	
Habitat/Substrate: (SS) Silt-clay sediment with minor evidence of bioturbation.		
Species	**Common Name**	**Community Composition**
Cnidarians		
Metridium farcimen (=giganteum)	White-plumed anemone	Present
Subselliflorae sp. A (Acanthoptilum sp.?/Virgularia sp.?)	Sea pen	Common
Subselliflorae sp. B *(Stylatula elongata?)*	White sea pen	Abundant

Cable Route Segment: A-5	**Water Depth:** 140-235 feet (43-72 meters)	
Habitat/Substrate: (SS) Silt-clay sediment with minor evidence of bioturbation.		
Species	**Common Name**	**Community Composition**
Subselliflorae sp. C	Sea whip	Common
Echinoderms		
Luidia foliolata	Sand Star	Present
Ophiurida	Brittle star	Abundant
Parastichopus californicus	California sea cucumber	Common
Mollusks		
Leopecten diegensis[1]	San Diego scallop	Present
Megasurcula carpenteriana	Carpenter's turrid	Present
Octopus bimaculoides	California two spot octopus	Present
Vertebrates		
Microstomus pacificus	Dover sole	Present
Raja rhina	Longnose Skate	Present
Scorpaena guttata	California scorpion fish	Present
Sebastes spp.	Unidentified rockfish	Present
Synodus lucioceps	California lizardfish	Present
Zaniolepis spp.	Combfish	Present
Perciformes, unident.	Unidentified round fish	Present
Pleuronectiformes, unident.	Unidentified flatfish	Present

[1] Scallops observed occurring at 100 ft. and deeper.

4.1.2 Cable Survey Segment B (235-345 ft. [72-105 m])

The soft-substrate along survey Segment B of the proposed SEA-US cable route consisted of fine silts and clays with regular evidence of moderate bioturbation of the sediments (Figure 3). A total of 19 invertebrate and 18 fish species were identified from video recordings (Table 4.6). The macrobenthic/epibenthic invertebrate community was dominated by the white sea urchin, *Lytechinus anamesus*; brittle stars (Ophiurida); the California sea cucumber, *P. californicus*; and white sea pens (Subselliflorae sp, B [*Stylatula elongata*?]. Other observed taxa included several species of drift kelp and algae; three additional species of sea pens and sea whips; tubeworms; the yellow cancer crab, *Cancer anthonyi*; the N. Pacific two-eye octopus, *Octopus californicus;* and assorted sea stars including the spiny sea star, *Astropecten armatus*; the sand star, *Luidia* foliolata; and several unidentified sea stars.

The observed fish community was dominated by rockfish, *Sebastes* spp.; unidentified combfish, *Zaniolepsis* spp.; and the longspine combfish, *Z. latipinnus*. In addition to these commonly observed species, assorted flatfish including Pacific sanddab, *Citharichthys sordidus*; Dover sole, *Microstomus pacificus*; California halibut, *Paralichthys californicus*; hornyhead turbot, *Pleuronichthys verticalis*; and fantail sole, *Xystreurys liolepis* were occasionally observed. Assorted roundfish observed along this survey Segment of the proposed cable route included poachers (Agonidae, unident.), California scorpionfish, *Scorpaena guttata*; California lizardfish, *Synodus lucioceps*; and pink seaperch, *Zalembius rosaceus*. Additionally, both a Pacific angel shark, *Squatina californica,* and a longnose skate, *Raja rhina*, were observed.

4.1.3 Cable Survey Segment C (345-375 ft. [105-114])

The soft-substrate along survey Segment C of the proposed SEA-US cable route was identical to route survey Segment B, consisting of fine silts and clays with regular evidence of moderate bioturbation of the sediments (Figure 4). The associated marine community was also similar to that observed in Segment B (Table 4.7) with a few exceptions. Because of the greater distance from shore, increasing depth, and reduced wave energy, less drift kelp and algae were present, fewer sea star species were observed, and the white urchin, *L. anamesus* was absent. Additionally, a second species of sea cucumber, the warty sea cucumber, *P. parvimensis,* was present and the brown shrimp, *Farfantepenaeus californiensis*, (Figure 10) was observed as one of the dominant taxa inhabiting this survey Segment of the cable route. In total, 13 invertebrate and 12 fish species were identified from video recordings (Table 4.7). A fish species observed in survey Segment C, but not further inshore was the blackbelly eelpout, *Lycodes pacificus*.

Table 4.6: Soft-substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment B

Cable Route Segment: B	**Water Depth:** 235-345 feet (72-105 meters)	
Habitat/Substrate: (SS) Fine silt-clay sediment with moderate bioturbation.		
Species	**Common Name**	**Community Composition**
Algae, Phaeophyta		
Desmarestia lingulata drift	Acid weed, drift	Present
Macrocystis pyrifera drift	Giant kelp, drift	Present
Algae, Rhodophyta		
Chondracanthus exasperatus	Turkish towel red alga	Present
Cnidaria		
Metridium farcimen (=giganteum)	White-plumed anemone	Present
Subselliflorae sp. A (Acanthoptilum sp.?/ Virgularia sp.?)	Sea pen	Present
Subselliflorae sp. B (*Stylatula elongata*?)	White sea pen	Common
Subselliflorae sp. C	Sea whip	Present
Subselliflorae sp. D	Sea pen	Present
Annelids		
Sabellid, unident.	Sand tubeworm	Present
Arthropods		
Cancer anthonyi	Yellow crab	Present
Echinoderms		
Asteroidea, unident.	Orange sea star	Present
Astropecten armatus	Spiny sand star	Present
Echinoidea, unident.	Sea urchin	Present
Luidia foliolata	Sand star	Present
Lytechinus anamesus	White urchin[1]	Abundant
Ophiurida, unident.	Brittle star	Abundant
Parastichopus californicus	California sea cucumber	Common
Strongylocentrotus fragilis (=Allocentrotus fragilis)	Pink sea urchin	Present
Mollusks		
Octopus californicus	Deep water octopus	Present
Vetebrates		
Agonidae, unident.	Poacher	Present
Citharichthys sordidus	Pacific sanddab	Present

Cable Route Segment: B	**Water Depth:** 235-345 feet (72-105 meters)	
Habitat/Substrate: (SS) Fine silt-clay sediment with moderate bioturbation.		
Species	**Common Name**	**Community Composition**
Microstomus pacificus	Dover sole	Present
Raja rhina	Longnose skate	Present
Paralichthys californicus	California halibut	Present
Pleuronichthys verticalis	Hornyhead turbot	Present
Scorpaena guttata	California scorpionfish	Present
Sebastes spp.	Unident. rockfish	Common
Sebastes semicinctus	Halfbanded rockfish	Present
Squatina californica	Pacific angel shark	Present
Synodus lucioceps	California lizardfish	Present
Xystreurys liolepis	Fantail sole	Present
Zalembius rosaceus	Pink seaperch	Present
Zaniolepis sp.	Combfish	Common
Zaniolepis latipinnis	Longspine combfish	Present
Zapteryx exasperata	Banded guitarfish	Present
Perciformes, unident.	Unidentified round fish	Present
Pleuronectiformes, unident.	Unidentified flatfish	Present

[1] White urchins observed from 259-345 ft.

Table 4.7: Soft-substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment C

Cable Route Segment: C	**Water Depth:** 345-375 feet (105-114 meters)	
Habitat/Substrate: (SS) Fine silt-clay sediment with moderate bioturbation. Limited depth change.		
Species	**Common Name**	**Community Composition**
Algae		
Desmarestia lingulata , drift	Acid weed	Present
Annelids		
Sabellid, unident.	Unidentified tube worm	Present
Arthropods		
Brachyura, unident.	Crab, unident.	
Cancer spp.	Cancer Crab	Present
Farfantepenaeus californiensis	Brown shrimp	Common
Cnidarians		
Metridium farcimen (=giganteum)	White-plumed anemone	Present
Subselliflorae sp. A	Sea pen	Present
Subselliflorae sp. B (*Stylatula elongata*?)	White sea pen	Common
Subselliflorae sp. C	Sea whip	Common
Echinoderms		
Astropecten spp.	Spiny or smooth sea star	Present
Luidia foliolata	Sand Star	Present
Parastichopus californicus	California sea cucumber	Present

Cable Route Segment: C	**Water Depth:** 345-375 feet (105-114 meters)	
Habitat/Substrate: (SS) Fine silt-clay sediment with moderate bioturbation. Limited depth change.		
Species	**Common Name**	**Community Composition**
Parastichopus parvimensis	Warty sea cucumber	Present
Mollusks		
Octopus californicus	Deep water octopus	Present
Vetebrates		
Citharichthys sordidus	Pacific sanddab	Present
Lycodes pacificus	Blackbelly eelpout	Present
Microstomus pacificus	Dover sole	Present
Paralichthys californicus	California halibut	Present
Sebastes semicinctus	Halfbanded rockfish	Present
Sebastes spp.	Unidentified rockfish	Present
Synodus lucioceps	California lizardfish	Present
Zaniolepis spp.	Combfish	Common
Zaniolepis frenata	Shortspine combfish	Present
Zaniolepis latipinnis	Longspine combfish	Present
Perciformes, unident.	Unidentified round fish	Present
Pleuronectiformes, unident.	Unidentified flatfish	Present

4.1.4 Cable Survey Segment D (285-520 ft. [87-158.5 m])

Survey Segment D transited between 290 and 520 ft. (87-158.5 m) water depth and consisted predominantly of finer silts and clays with moderate bioturbation, similar to surveySegments B and C. A small area located approximately in the middle of the survey Segment contained coarser sand, shell hash, and small cobbles/rocks that were lying on top of the finer sediments. This survey Segment of the proposed cable route transited over approximately 5 km of seafloor and recorded the highest number of invertebrate taxa observed (Figures 5 and 6). A total of 27 macrobenthic invertebrate taxa and 19 fish species were observed occupying this survey Segment of the surveyed cable route (Table 4.8).

In general, the macrobenthic invertebrate community inhabiting the soft-substrate habitat within this depth range was the same as that observed in survey Segments B and C with a few notable additions and omissions. The invertebrate community was again dominated by sea pens (Figure 11) and sea whips, along with the California sea cucumber, *P. californicus;* brittle stars, Ophiurida (Figure 13); *Luidia foliolata* sea stars; and the pink sea urchin, *Strongylocentrotus fragilis* (Figure 12). This latter species was one of the additions to the invertebrate community within this cable route segment. Additional species observed along this survey Segment not observed in either survey Segments B or C were mantis shrimp, *Hemisquilla californiensis*; the moonglow anemone, *Anthopleura artemesia*; the orange or fleshy sea pen, *Ptilosarcus gurneyi*; the serpulid tube worm, *Protula superba*; the California frog shell snail, *Crossata ventricosa*; the red octopus, *Octopus* rubescens; and the California sea slug, *Pleurobranchaea californica*.

Similar to the shallower water Segments of the proposed cable route, the observed 19 fish species were similar to those observed in survey Segments B and C with the addition of Pacific Argentine (*Argentina sialis*).

The small section of cable route in survey Segment D that exhibited coarser sand sediments, shell hash, and cobbles overlying the more typical finer sediments typical for this water depth appeared to be associated with the terminus of a small canyon area in which coarser sediments from a shallower depth may have slipped down the shallow canyon, depositing coarser sediments and small rocks on the surface of the seafloor (Figure 14). The observation that most of the cobbles/rocks did not appear to have any biological growth attached to them would appear to support this interpretation.

Table 4.8: Soft and Mixed Substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment D

Cable Route Segment: D	**Water Depth:** 285-520 feet (87-158.5 meters)	
Habitat/Substrate: (SS & MS) Predominantly fine silt-clay sediment with moderate bioturbation. Between 300-310 ft. water depth, a segment of coarse silty sand with track marks was observed with occasional small cobbles (< 0.5 ft.) and shell hash. Rocks showed little to no evidence of encrusting biota.		
Species	**Common Name**	**Community Composition**
Arthropods		
Brachyura, unident.	Unidentified crab	Present
Cancer anthonyi	Yellow crab	Present
Cancer spp.	Cancer Crab	Present
Crustacea, unident.	Small unidentified crustaceans	Common
Hemisquilla californiensis	Mantis shrimp	Present
Playtymera gaudichandii	Armed box crab	Present
Cnidarians		
Anthopleura artemesia	Moonglow anemone	Present
Metridium farcimen (=giganteum)	White-plumed anemone[1]	Present
Ptilosarcus gurneyi	Orange or fleshy sea pen	Present
Subselliflorae sp. A (Acanthoptilum sp.?/Virgularia sp.?)	Sea pen	Present
Subselliflorae sp. B (*Stylatula elongate?)*	Sea pen	Common
Subselliflorae sp. C	Sea whip	Present
Subselliflorae sp. D	Sea pen	Present
Annelids		
Protula superba	Serpulid tube worm	Present
Echinoderms		
Asterina miniata	Bat star	Present
Luidia foliolata	Sand Star	Common
Lytechinus pictus	White sea urchin[2]	Abundant
Ophiurida, unident.	Brittle star	Abundant
Parastichopus californicus	Sea cucumber	Common
Pisaster brevispinus	Short-spined sea star	Present
Strongylocentrotus fragilis (=Allocentrotus fragilis)	Pink sea urchin[3]	Dominant
Mollusks		
Crossata ventricosa (=*Bursa californica*)	California frog shell	Present
Octopus californicus	Deep water octopus	Present
Leopecten diegensis	San Diego scallop	Present
Octopus rubescens	Red octopus	Present

Cable Route Segment: D	**Water Depth:** 285-520 feet (87-158.5 meters)	
Habitat/Substrate: (SS & MS) Predominantly fine silt-clay sediment with moderate bioturbation. Between 300-310 ft. water depth, a segment of coarse silty sand with track marks was observed with occasional small cobbles (< 0.5 ft.) and shell hash. Rocks showed little to no evidence of encrusting biota.		
Species	**Common Name**	**Community Composition**
Octopus spp.	Octopus	Present
Pluerobranchaea california	California sea slug	Present
Vetebrates		
Argentina sialis	Pacific Argentine	Present
Citharichthys sordidus	Pacific sanddab	Present
Lycodes pacificus	Blackbelly eelpout	Present
Microstomus pacificus	Dover sole	Present
Paralichthys californicus	California halibut	Present
Platichthys stellatus	Starry flounder	Present
Pleuronichthys coenosus	C-O sole	Present
Raja rhina	Longnose skate	Present
Sarda chiliensis	Pacific bonito	Present
Sebastes dalli	Callico rockfish	Present
Sebastes rubrivinctus	Flag rockfish	Present
Sebastes semicinctus	Halfbanded rockfish	Present
Sebastes spp.	Unidentified rockfish	Common
Squatina californica	Pacific angel shark	Present
Synodus lucioceps	California lizardfish	Present
Zaniolepis spp.	Combfish	Common
Zaniolepis frenata	Shortspine combfish	Present
Zaniolepis latipinnis	Longspine combfish	Present
Perciformes, unident.	Unidentified round fish	Present
Pleuronectiformes, unident.	Unidentified flatfish	Present

[1] Some hard-substrate with *Metridium* attached observed at ~300 ft.

[2] White urchins observed from 409-413 ft.

[3] Pink urchins observed from 488-520 ft.

4.2 Hard-substrate habitat

4.2.1 SEA-US Cable Route Survey Segments B, C, and D

Hard-substrate habitat was observed in three of the four cable route survey segments, including Segments B, C, and D. The cable route corridor along survey Segments C and D each contained three, isolated, low relief (> 1 ft. [0.3 m] elevation) (LR) rocks or pieces of debris to which sessile organisms were observed attached. The cable corridor and the area immediately adjacent to the proposed cable corridor in survey Segment B contained 10 low relief rocks or pieces of debris (Figure 15), with a grouping of 4-5 rocks at HB Target B-3, two more isolated low relief rocks and 3 pieces of trash/debris.

The pieces of debris, which included pieces of scrap steel, plastic buckets, glass bottles (Figure 16), an anchor (Figure 17), anchor chain, anchor winch, abandoned fishing gear (Figure 18), and a metal box all

acted as artificial reefs, providing substrate for invertebrate organisms to attach to and providing habitat for more mobile taxa such as crabs and fish.

Tables 4.9, 4.10, and 4.11 provide detailed taxonomic listings of the invertebrate and fish taxa observed inhabiting the hard-substrate habitats in survey Segments B, C, and D, respectively. Figures 3, 4, 5, and 6 illustrate where these hard-substrate features are located and provide graphic images of many of the features.

With the exception of hard-substrate Target HB-3 (Figure 15) in survey Segment B, all of the hard-substrate features observed along the proposed cable route were isolated rocks or pieces of debris (Figures 16, 17, and 18). Hard-substrate Target HB-3 consisted of a small grouping of approximately 4-5 low relief rocks.

The sessile invertebrate community observed attached to the hard-substrate in all three survey segments was similar with minor shifts in the presence or absence of individual species as a result of changes in physical factors such as water depth. The hard-substrate invertebrate community was dominated by the white plumed anemone, *Metridium farcimen*, and a turf complex consisting of hydroids, tunicates and bryozoans, which are all too small in size to accurately identify from either video or still images. In several instances, the presence of a very small rock or piece of debris that a *Metridium* anemone was attached was not discernable in the video since the solitary *Metridium* anemone completely covered it.

Other invertebrate species observed inhabiting natural rock and artificial debris hard-substrate areas or adjacent areas (within 1 m) along the cable route included the occasional gorgonian coral, *Eugorgia* sp.; a serpulid tube worm; the brown cup coral, *Paracyathus stearnsi*; sponges; several species of crabs including sheep crab, *Loxorhynchus grandis*; armed box crab, *Platymera gaudichandii*; yellow crab, *C. anthonyi*; unidentified cancer crabs; the California N. Pacific two-spot octopus, *O. californicus*; the warty sea cucumber, *P. parvimensis*; the California sea slug, *Pleurobranchaea californica*; and the bat star, *Asterina miniata*.
The fish species observed associating with hard-substrate areas along the cable route were dominated by rockfish with halfbanded, *S. semicinctus*; vermillion, *S. miniatus*; and brown rockfish, *S. auriculatus*, being the most frequently observed. Other rockfish observed included gopher, *S. carnatus*; copper, *S. caurinus*; calico, *S. dallii*; rosy, *S. rosaceus*; flag, *S. rubrivinctus*; and honeycomb, *S. umbrosus*. Other species observed included California scorpionfish, *Scorpaena guttata*, and pink seaperch, *Zalembius rosaceus*.

Table 4.8: Hard-Substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment B

Cable Route Segment: B	**Water Depth:** 235-345 feet (72-105 meters)	
Habitat/Substrate: (HS) Isolated low relief rocks and isolated debris including a ship anchor, metal frames, metal plate, and bottles.		
Species	***Common Name***	***Community Composition***
Algae		
Desmarestia lingulata, drift	Acid weed	Present
Annelids		
Serpulidae, unident.	Serpulid tube worm	Present
Cnidarians		
Eugorgia sp.	Gorgonian	Present
Metridium farcimen (=giganteum)	White-plumed anemone	Abundant

Cable Route Segment: B	**Water Depth:** 235-345 feet (72-105 meters)	
Habitat/Substrate: (HS) Isolated low relief rocks and isolated debris including a ship anchor, metal frames, metal plate, and bottles.		
Species	***Common Name***	***Community Composition***
Paracyathus stearnsi	Brown cup coral	Present
Subclass Leptothecatae, Order Conica	Hydroid, unident.	Present
Arthropods		
Brachyura, unident.	Crab	Present
Cancer anthonyi	Yellow crab	Present
Loxorhynchus grandis	Sheepcrab	Present
Platymera gaudichandii	Armed box crab	Present
Mollusks		
Octopus californicus	Deep water octopus	Present
Sponges		
Silicea (Porifera) A	Sponge - Orange	Present
Silicea (Porifera) B	Sponge - Yellow	Present
Silicea (Porifera) C	Sponge, unident.?	Present
Turf Complex		
Turf Complex	Includes Hydroids, Tunicates, Bryozoans	Abundant
Vertebrates		
Scorpaena guttata	California scorpionfish	Present
Sebastes auriculatus	Brown rockfish	Common
Sebastes carnatus	Gopher rockfish	Present
Sebastes caurinus	Copper rockfish	Present
Sebastes dallii	Calico rockfish	Present
Sebastes miniatus	Vermilion rockfish	Common
Sebastes rosaceus	Rosy rockfish	Present
Sebastes rubrivinctus	Flag rockfish	Present
Sebastes semicinctus	Halfbanded rockfish	Present
Sebastes spp.	Unident. rockfish	Common
Sebastes umbrosus	Honeycomb rockfish	Present
Zalembius rosaceus	Pink seaperch	Present
Perciformes, unident.	Unidentified round fish	Present

Table 4.10: Hard-Substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment C

Cable Route Segment: C	**Water Depth:** 334-375 feet (102-114 meters)	
Habitat/Substrate: (HS) Isolated low relief rocks or debris including a plastic bate bucket, bottles, and abandoned fishing gear.		
Species	**Common Name**	**Community Composition**
Algae		
Desmarestia lingulata drift	Acid weed	Present
Annelids		

Cable Route Segment: C	**Water Depth:** 334-375 feet (102-114 meters)	
Habitat/Substrate: (HS) Isolated low relief rocks or debris including a plastic bate bucket, bottles, and abandoned fishing gear.		
Species	**Common Name**	**Community Composition**
Serpulid, unident.	Unidentified tube worm	Present
Arthropods		
Brachyura, unident.	Crab, unident.	
Cnidarians		
Metridium farcimen (=giganteum)	White-plumed anemone	Abundant
Echinoderms		
Parastichopus parvimensis	Warty sea cucumber	Present
Mollusks		
Pleurobranchaea californica	California sea slug	Present
Turf Complex		
Turf Complex	Includes Hydroids, Tunicates, Bryozoans	Abundant
Vetebrates		
Sebastes spp.	Unidentified rockfish	Present
Sebastes semicinctus	Halfbanded rockfish	Present
Synodus lucioceps	California lizardfish	Present
Zalembius rosaceus	Pink seaperch	Present
Perciformes, unident.	Unidentified round fish	Present

Table 4.11:Hard-Substrate Habitat and Taxa Observed Along SEA-US Cable Route Survey Segment D

Cable Route Segment: D	**Water Depth:** 290-520 feet (88-158.5 meters)	
Habitat/Substrate: (HS) Isolated low relief rocks and debris.		
Species	**Common Name**	**Community Composition**
Echinoderms		
Asterina miniata	Bat star	Present
Cnidarians		
Metridium farcimen (=giganteum)	White-plumed anemone[1]	Abundant
Mollusks		
Pluerobranchaea california	California sea slug	Present
Turf Complex		
Turf Complex	Includes Hydroids, Tunicates, Bryozoans	Abundant
Vertebrates		
Sebastes dalli	Callico rockfish	Present
Sebastes rubrivinctus	Flag rockfish	Present
Sebastes semicinctus	Halfbanded rockfish	Abundant
Sebastes spp.	Unidentified rockfish	Common
Perciformes, unident.	Unidentified round fish	Present
Pleuronectiformes, unident.	Unidentified flatfish	Present

[1] Some hard-substrate with *Metridium* attached observed at ~300 ft.

Figure 7: Photo A-69 - Survey Segment A: Coarse sand with sand ripples, shell hash and drift kelp

Figure 8: Photo A-77 - Survey Segment A: Medium to coarse sand substrate with *Beggiatoa* sp. bacterial mats, splendid diopatra tubes with attached red and brown algae.

Figure 9: Photo A-92 - Survey Segment A: Soft silt/clay substrate with white sea pens, Subselliflorae sp. A (Acanthoptilum sp.?/ Virgularia sp.?), **and brittle star arms.**

Figure 10: Photo C-48 – Survey Segment C: Fine silt/clay soft-substrate with bioturbation; a brown shrimp and a blackbelly eelpout.

Figure 11: Photo D-9 – Survey Segment D: Fine silt/clay soft-substrate with bioturbation; a fleshy sea pen and brittle star arms.

Figure 12: Photo D-10 – Survey Segment D: Fine silt/clay soft-substrate with pink sea urchins.

Figure 13: Photo D-12 – Survey Segment D: Fine silt/clay soft-substrate with brittle star arms.

Figure 14: Photo D-23 – Survey Segment D: Coarser fine sand and shell hash overlying finer silt/clay sediment with small cobbles at base of shallow canyon.

Figure 15: Photo B-105 - Survey Segment B; HB Target B-3: Fine silt/clay soft substrate with cluster of low relief rocks with while plumose anemones, turf, gorgonian soft coral, drift kelp, sea star, California lizardfish, and rockfish.

Figure 16: Photo C-64 – Survey Segment C: Fine silt/clay soft-substrate with bioturbation; a white plumose anemone attached to a glass bottle.

Figure 17: Photo B-119 - Survey Segment B; HB Target B-5: Fine silt/clay soft substrate with abandoned anchor, anchor chain, anchor winch, with white plumose anemone, cancer crab, and rockfish.

Figure 18: Photo B-131 – Survey Segment B; HB Target B-7: Fine silt/clay soft substrate with isolated abandoned fishing gear with white plumose anemones and rockfish.

4.3 Comparison of Biological Surveys

In September 2000, MBC Applied Environmental Sciences conducted a survey of the seafloor habitat and associated biota offshore Hermosa Beach, California for the TCN fiber optic cable Project (MBC, 2001). The two cables installed for the TCN Cable Project made landfall jut south of the proposed SEA-US cable landings along the Hermosa Beach shore and transited along slightly different routes through the nearshore region of Hermosa Beach (Figure 1). The SEA-US cables follow a somewhat parallel route that is located slightly northward of the TGN cables, but essentially transits similar habitats and water depths.

Differences in survey goals and resulting analytical approaches between the two surveys make direct comparison of reported dominant taxa within the different habitat types difficult. For example, although both studies had the same goal to characterize seafloor habitat and associated marine biota, the MBC study had as a primary focus the "…surveying [of] selected locations along the route of the proposed TyCom Transpacific submarine fiber optic cable to characterize potentially sensitive marine habitat." More specifically, the MBC survey was focused on surveying segments of the proposed cable route that were identified as "…transitional areas from one sediment type to another or to be areas where there is the possibility of hard-substrate." Since MBC scientists determined that "…these transition area are found more frequently in the area off Hermosa Beach from 0-125 meters depth, the focus of the study was an assessment of the epibenthic and macrobenthic communities found at those locations."

This survey focused on "…observing and characterizing the existing biological communities and their associated habitat for both hard and soft bottom substrates along the coastal segment of the proposed cable route" (AMS 2015b). This was accomplished by identifying locations of different seafloor habitat types along the route based on knowledge of Southern California coastal marine communities and habitats and the geophysical seafloor mapping data gathered to select the best routing for the new cable. As a result, the current study focused on identifying the various soft-substrate and hard-bottom habitats occurring along the surveyed cable route and the characterization of marine biota within each varying substrate. This resulted in the delineation of the various encountered seafloor habitats into multiple subcategories as well as gathering species abundance data and occurrence resulting in a better understanding of coastal marine communities in the vicinity of Hermosa Beach, California and the Southern California region.

Finally, differences in taxonomic identification and nomenclature result in slight differences in taxonomic lists and descriptions of dominant taxa and what organisms comprise a specific biological community. Some of these differences are the result of recent updates in taxonomic nomenclature, such as the reassignment of the pink sea urchin *Allocentrotus fragilis* to the genus *Strongylocentrotus* or the renaming of the white plumed anemone *Metridium giganteum* to *Metridium farcimen*. Similarly, as more visual surveys by ROVs are conducted along the coastal waters of California and video, still imaging and lighting systems improve, the observing marine biologist's ability to detect physical differences in individual organisms results in questioning previous taxonomic assignment. In many of the cases, without a physical specimen to be analyzed in a taxonomic lab, an accurate taxonomic name may not be able to be assigned. For example, past surveys have identified white sea pens as belonging to the genera *Stylatula, Acanthoptilum*, and *Virgularia*. Because of the uncertainty in accurate taxonomic identification in the current study, observed white sea pens were assigned to higher taxonomic classification as Subselliflorae Species A, B, C, and D, with what has been previously used for taxonomic identification (i.e. *Stylatula, Acanthoptilum*, and *Virgularia)* assigned to these individuals included in parentheses to indicate that these individuals could be that species, but might not be.

Despite these differences, some comparisons between the two studies can be made as follows.

- No observable changes in either marine habitat or associated biota within the nearshore Hermosa Beach region appear to have occurred over the past fifteen years based on observable species and similarities in reported habitat occurrence within comparable depth and survey Segments of the surveyed cable routes.

- Similar epibenthic and macrobenthic plants, invertebrates, and fishes were observed in both surveys for both soft-substrate and hard-substrate habitats. Slight differences in species lists, primarily for fishes and for hard-substrate areas, can be accounted for by the differences in terrain along the two cable routes (i.e. less low relief and no high relief (>1 m [3. 3 ft.), less hard-substrate habitat along the SEA-US surveyed cable route, more soft-substrate habitat surveyed along the SEA-Us surveyed cable route, as well as improvements in video and still imaging equipment, and different conditions affecting underwater visibility when the two surveys were conducted.

- The soft-substrate habitats along the two surveys' cable routes were largely dominated by the same species of sea pens, sea cucumbers, sea stars, anemones, brittle stars, tube-dwelling polychaetes, octopuses, crabs, and fish taxa. Both invertebrate and fish taxa were observed within the same relative depth ranges and sediment composition.

- Two notable differences between the reported observed species between the two surveys that can not be differentiated solely by survey route locations was the presence of brown shrimp, *Farfantepenaeus californiensis*, and the San Diego scallop, *Leopecten diegensis*, that were observed along the current survey's cable route. Both species are considered widespread throughout Southern California nearshore coastal waters. The absence in the previous survey results is most likely the result of a stronger focus on surveying hard-substrate habitat that resulted in less soft-substrate fauna being observed along the surveyed routes.

- Low-growing turf species and the white plumed anemone *Metridium farcimen* (= *giganteum*) dominated the low relief hard-substrate areas in both surveys. Other commonly occurring or present species included similar sea stars, encrusting sponges, cup corals and gorgonian soft corals. Both surveys reported similar occurrence of red algae in the shallower, photic depths, of each survey route and the occurrence of the white plumed anemone, *Metridium farcimen (=giganteum)* throughout the two survey routes whenever a hard-substrate surface permitted colonization.

5.0 Observations and Conclusions

Based upon the analysis of the digital video and still images collected during the October 14-15, 2015 ROV survey of the nearshore portion of the SEA-US proposed fiber optic cable route offshore Hermosa Beach, California, the following conclusions and general observations can be made:

- The epibenthic invertebrate, algae, and fish species observed along the proposed cable route are representative of low relief hard-substrate and soft-substrate habitat of Southern California (MBC, 2001, AMS 2015a).

- Of the 6.6 nautical miles (12.2 kilometers) of proposed cable route surveyed between 62 and 520 feet (19-158.5 m) during the biological reconnaissance survey, the predominant seafloor habitat was soft-substrate. A total of 12 isolated low relief rocks or pieces of debris/trash were observed along survey Segments B, C and D and one small cluster of 4-5 small low relief rocks in survey

Segment B were observed. No high relief or extensive hard-substrate habitat areas were observed within the proposed cable route corridor.

- Cable route survey segments B, C, and D consisted of fine silt and clay soft substrate with periodic isolated low relief rocks or pieces of debris. Between 140 and 520 ft. (43-58.5-m) water depths these sediments were highly bioturbated.

- Cable route survey Segment A consisted of coarse to medium sand to a depth of 140 ft. (43 m) where it changed to fine sand and silt/clays. No hard substrate habitat was observed along the cable route in survey Segment A.

- The standing sand waves observed along much of the shallower portions of survey Segment A, between the proposed bore pipe terminus in 62 ft. (19m) of water and 100 ft. (43 m) are a major physical feature of the area. Observations of invertebrate taxa associated with these sand waves suggest they exert substantial influence on organism distributions.

- The mapping of seafloor habitats observed during the biological reconnaissance survey closely matches and corroborates the geophysical seafloor mapping along the cable route. All potential hard-substrate targets within or immediately adjacent to the proposed cable burial corridor were surveyed and all except one in survey Segment A contained hard-substrate habitat. Nearly half of these targets were debris or trash.

- Detrital specimens of surfgrass, *Phyllospadix* spp.; giant kelp, *Macrocystis pyrifera*; and acid weed, *Desmarestia lingulata*, were observed drifting along the seafloor throughout survey Segments A and B in water depths < 345 feet. Drift acid weed continued to be observed in survey Segment C to a water depth of 345 ft. However, no surfgrass, bull kelp, or giant kelp beds were observed along the cable right-of-way.

- The most abundant marine invertebrate taxa observed associating with areas of soft-substrate habitat within the cable route included sea pens, brittle stars, sea cucumbers, tube worms, and urchins. Additional invertebrate species observed included octopuses, shrimp, crabs, snails, hermit crabs, sea scallops, and sea stars. In water depths < 100 ft. (30.5 m), both red and brown algae were observed attached to splendid diopatra worm tubes.

- The most abundant fish species observed associating with areas of soft-substrate habitat along the cable route included longspine and shortspine combfish, Pacific and speckled sanddab, blackbelly eelpouts, California lizardfish, and assorted flatfish (including starry flounder, CO sole, hornyhead turbot, Dover sole, and fantail sole), poachers, pink seaperch, and rockfish (including calico, flag, halfbanded. Baitfish (Atherinidae) were observed in the water column in water depths < 75 ft. (.23 m) and a small school of Pacific bonito were observed along survey Segment D. Longnose skates and Pacific angel sharks were also observed.

- Marine taxa observed consistently associating with hard-substrate habitats along the cable route, both natural and artificial and regardless of water depth, included white plumed anemones and a low colonizing turf complex comprising hydroids, tunicates, and bryozoans. Additional epifaunal taxa observed at hard-substrate habitats included a cup coral, a soft gorgonian coral, encrusting sponges, serpulid worms, crabs, and sea cucumbers.

- The most abundant fish species observed associating with areas of hard-substrate habitat along the cable route included California scorpionfish and numerous species of rockfish including

calico, flag, and halfbanded. The halfbanded rockfish was the most commonly observed rockfish associated with hard-substrate habitat.

- The filamentous bacteria *Beggiatoa sp*. was observed in a small isolated pocket along the seafloor in survey Segment A (sub-section A-3). *Beggiatoa* normally occurs as a white mat overlying sulfur-rich sediments in marine and freshwater environments and oxidizes hydrogen sulfide to elemental sulfur. It is often observed on the seafloor surface in association with oil and gas seeps that are rich in hydrogen sulfide gas, at deep ocean hydrothermal vents, and at locations that contain high levels of organic pollution.

- Comparing survey observations and data from the current survey with those previously collected in the area (MBC, 2001) indicate that no substantial changes in either marine habitat or associated biota appear to have occurred over the past fifteen years within the nearshore waters of Hermosa Beach.

6.0 References & Citation

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7.0 Appendices

Appendix A: Master Taxonomic Lists

Table A-1: Invertebrate and plant taxa observed along SEA's proposed fiber optic cable route offshore Hermosa Beach, California

Phylum	Scientific Name	Common Name	Habitat[1]		
			HS	MS	SS
Bacteria	**Bacteria**				
	Beggiatoa sp.	White bacterial mat			X
Angiosperm	**Flowering Plants**				
	Phyllospadix spp. drift	Surfgrass drift	X	X	X
Algae, Phaeophyta	**Green and Brown Algae**				
	Desmarestia lingulata drift	Acid weed, drift	X	X	X
	Phaeophyta, unident.	Brown algae, unident. (Attached to worm tubes)			X
	Macrocystis pyrifera drift	Giant kelp, drift	X	X	X
Algae, Rhodophyta	**Red Algae**				
	Chondracanthus exasperatus	Turkish towel red alga		X	X
	Rhodophyta, unident.	Red algae, unident. (Attached to worm tubes)			X
Silicea (Porifera)	**Sponges**				
	Silicea (Porifera) A	Sponge - orange	X		
	Silicea (Porifera) B	Sponge - yellow	X		
	Silicea (Porifera) C	Sponge, unident.?	X		
Cnidaria	**Anemones and Sea Pens**				
	Anthopleura artemesia	Moonglow anemone			X
	Anthozoa, unident.	Unidentified anemone			X
	Anthozoa, unident.	Unidentified gray anemone in sand			X
	Eugorgia sp. A	Erect white gorgonian coral	X		
	Metridium farcimen	Giant plumose anemone	X	X	
	Paracyathus stearnsi	Brown cup coral	X		
	Ptilosarcus gurneyi	Fleshy sea pen			X
	Subselliflorae sp. A (Acanthoptilum sp.?/Virgularia sp.?)	Foliose sea pen			X
	Subselliflorae sp. B (*Stylatula elongata*?)	White, thin sea pen			X
	Subselliflorae sp. C	Sea whip			X
	Subselliflorae sp. D	White sea pen, short, thin & erect			X
Annelida	**Segmented Worms**				
	Chaetopterus variopedatus	Parchment tubeworm			X
	Diopatra splendidissima	Splendid diopatra			X
	Protula superba	*Protula* worm tube			X
	Sabellid, unident.	Tubeworm			X
	Serpulid, unident.	Serpulid worm tube	X		
Mollusca	**Bivalves, Snails, Octopus, Squid, Sea Hares, Nudibranchs**				
Mollusca, Bivalvia	**Bivalves**				
	Leopecten diegensis	San Diego scallop			X
Mollusca, Cephalopoda	**Cephalopods**				
	Octopus rubescens [2]	Red octopus			X
	Octopus californicus [2]	N. Pacific big eye octopus			X
	Octopus bimaculoides	Two-spot octopus			X

Phylum	Scientific Name	Common Name	Habitat[1]		
			HS	MS	SS
	Octopus spp.	Octopus, unident.			X
Mollusca, Gastropoda	**Snails and Opistobranchs**				
	Crossata ventricosa (AKA *Bursa californica*)?	California frog shell?			X
	Kellettia kellettii	Kellet's whelk			X
	Megasurcula carpenteriana	Carpenter's turrid			X
	Opistobranchia?	White opistobranch?			X
	Pleurobranchaea californica	California sea slug			X
Arthropoda, Crustacea	**Shrimp, Crabs, Isopods**				
	Cancer anthonyi	Yellow crab	X		X
	Cancer spp.	Cancer crab, unident.	X		X
	Farfantepenaeus californiensis	Brown shrimp			X
	Loxorhynchus grandis	Sheep crab	X	X	X
	Hemisquilla californiensis	Mantis shrimp			X
	Platymera gaudichandii	Armed box crab	X		X
	Crustacea, unident.	Small crustaceans flitting about the bottom			X
	Superfamily Paguroidea	Hermit crabs	X	X	X
Echinodermata	**Sea Stars, Brittle Stars, Sea Cucumbers, Urchins**				
	Asterina miniata	Bat star			X
	Astropecten armatus	Spiny sand star			X
	Astropecten spp.	Sand star, unident.			X
	Luidia foliolata	Sand star			X
	Lytechinus pictus	White sea urchin			X
	Order Ophiurida	Brittle stars			X
	Parastichopus californicus	California or Spiny sea cucumber	X		X
	Parastichopus parvimensis	Warty sea cucumber			X
	Pisaster brevispinus	Pink short-spined sea star?			X
	Strongylocentrotus fragilis (AKA *Allocentrotus fragilis)*	Pink sea urchin			X
	Echinoidea, unident.	Sea urchin, unident.			X
	Asteroidea, unident.	Orange sea star, unident.			X
Turf Complex		Includes hydroids, tunicates, bryozoans			X

1 HS – hard-substrate, MS – mixed-substrate, SS – soft-substrate

2 *Octopus rubescens* and *Octopus californicus* have both been reported occurring in the nearshore waters of Southern California. Although *O. rubescens* appears to be more frequently identified, it is possible that more than one similar looking species is present and being misidentified.

Table A-2: Fish taxa observed along SEA-US proposed fiber optic cable route offshore Hermosa Beach, California

Phylum	Scientific Name	Common Name	Habitat[1]			
			HS	MS	SS	WC
Chordata, Chondrichthyes						
	Squatina californica	Pacific angel shark			X	
Chordata, Osteichthyes						
	Agonidae, unident.	Poacher			X	
	Argentina sialis	Pacific Argentine			X	
	Atheriniidae, unident.	Baitfish school				X
	Citharichthys sordidus	Pacific sanddab			X	
	Citharichthys spp.	Sanddab			X	
	Citharichthys stigmaeus	Speckled sanddab			X	
	Lycodes pacificus	Blackbelly eelpout			X	
	Microstomus pacificus	Dover sole			X	
	Paralabrax nebulifer	Barred sand bass		X		
	Paralichthys californicus	California halibut			X	
	Perciformes, unident.	Fish, unident.			X	
	Platichthys stellatus	Starry flounder			X	
	Pleuronectiformes, unident.	Flatfish, unident.			X	
	Pleuronichthys coenosus	C-O sole			X	
	Pleuronichthys verticalis	Hornyhead turbot			X	
	Scorpaena guttata	California scorpionfish or sculpin	X		X	
	Sebastes dalli	Calico rockfish	X		X	
	Sebastes auriculatus	Brown rockfish	X			
	Sebastes carnatus	Gopher rockfish	X			
	Sebastes caurinus	Copper rockfish	X			
	Sebastes miniatus	Vermillion rockfish	X			
	Sebastes rosaceus	Rosy rockfish	X			
	Sebastes rubrivinctus	Flag rockfish	X		X	
	Sebastes semicinctus	Halfbanded rockfish	X		X	
	Sebastes sp.	Rockfish, unident.			X	
	Sebastes umbrosus	Honeycomb Rockfish	X		X	
	Synodus lucioceps	California lizardfish			X	
	Sarda chiliensis	Pacific bonito				X
	Xystreurys liolepis	Fantail sole			X	
	Zalembius rosaceus	Pink seaperch			X	
	Zaniolepis frenata	Shortspine combfish			X	
	Zaniolepis latipinnis	Longspine combfish			X	
Chordata, Rajiformes						
	Raja rhina	Longnose skate			X	

[1] HS – Hard-substrate, MS – Mixed Substrate, SS – Soft-substrate, WC – Water Column

Appendix B: Digital Still & Video Files

Table B-1: SEA-US Photo and Video Log Summary

Dive #	Survey Segment	Photo #'s	Habitat[1] (HS/SS/MS)	Survey Date	Video Disk	Time	Navigation Fix's
3	A	67-72	SS	10/15/15	A	07:35-08:12	67-72
3	A	73	MS	10/15/15	A	08:12	73
3	A	74	SS	10/15/15	A	08:27	74
3	A	75-78	MS	10/15/15	A	08:47-09:13	75-78
3	A	79-97	SS	10/15/15	A	09:18-10:57	79-97
3	B	98-103	SS	10/15/15	B	11:14-11:47	98-103
3	B	104-108	HS	10/15/15	B	11:58-12:02	104-108
3	B	109-110	SS	10/15/15	B	12:08-12:09	109-110
3	B	111	HS	10/15/15	B	12:11	111
3	B	112-115	SS	10/15/15	B	12:23-12:45	112-115
3	B	116-124	HS-Debris	10/15/15	B	12:49-13:03	116-124
3	B	125-127	SS	10/15/15	B	13:14-13:27	125-127
3	B	128-130	HS	10/15/15	B	13:31-13:42	128-130
3	B	131-134	HS-Debris	10/15/15	B	13:48-13:55	131-134
3	B	135-138	SS	10/15/15	B	13:59-14:15	135-138
2	C	45	HS	10/14/15	C	16:15	45
2	C	46-50	SS	10/14/15	C	16:21-16:34	46-50
2	C	51	HS	10/14/15	C	16:40	51
2	C	52-53	SS	10/14/15	C	16:46-16:51	52-53
2	C	54-55	HS-Debris	10/14/15	C	16:56	54-55
2	C	56	HS	10/14/15	C	16:57	56
2	C	57	SS	10/14/15	C	17:01	57
2	C	58	HS	10/14/15	C	17:02	58
2	C	59	HS-Debris	10/14/15	C	17:07	59
2	C	60	SS	10/14/15	C	17:10	60
2	C	61	HS	10/14/15	C	17:10	61
2	C	62-63	SB	10/14/15	C	17:19-17:25	62-63
2	C	64	HS-Debris	10/14/15	C	17:31	64
2	C	65	SS	10/14/15	C	17:37	65
2	C	66	HS-Debris	10/14/15	C	17:42	66

Dive #	Survey Segment	Photo #'s	Habitat[1] (HS/SS/MS)	Survey Date	Video Disk	Time	Navigation Fix's
1	D	1-2	SS	10/14/15	D	10:58-11:51	1-2
1	D	3	HS	10/14/15	D	12:01	3
1	D	4	SS	10/14/15	D	12:04	4
1	D	5	HS	10/14/15	D	12:08	5
1	D	6-10	SS	10/14/15	D	12:09-12:25	6-10
1	D	11-13	HS	10/14/15	D	12:27-12:31	11-13
1	D	14-20	SS	10/14/15	D	12:37-13:05	14-20
1	D	21	SS/HS	10/14/15	D	13:10	21
1	D	22-30	SS	10/14/15	D	13:12-13:47	22-30
1	D	31	HS	10/14/15	D	13:47	31
1	D	32-44	SS	10/14/15	D	13:52-15:21	32-44

[1]HS – Hard-substrate, MS – Mixed Substrate, SS – Soft-substrate

Appendix C: Video and Still Image CDs