APPENDIX C

Terrestrial and Marine Biological Resource Information

C.1 RESOURCE AGENCY COORDINATION

The ICF terrestrial biological team also coordinated with relevant resource agencies to discuss sensitive biological resources expected within the terrestrial BSA. A summary of agency communications and site visits is provided below:

California State Parks: July 25, 2019, met with the Environmental Scientist, Stephanie Little, to discuss Project design and potential biological concerns regarding the Project. Ms. Little expressed the importance of considering the western snowy plover. This species has been evaluated in the Biological Resources section and direct and indirect impacts are avoided.

Consultation Outcomes:

- Project was designed to use HDD construction technique to go under the beach with potential snowy plover habitat
- Pre-construction surveys associated with **MM BIO-7: Conduct Pre-Construction Nesting Bird Surveys and Implement Avoidance Measures** on the cable landing site would include surveys for western snowy plover

USFWS: November 19, 2019, site visit with South Coast Division's Biologist, Dou-Shuan Yang. Mr. Yang stated that USFWS would consider Meadow Creek to be habitat for California red-legged frog based on known occurrence information for Meadow Creek Lagoon downstream and occurrences upstream of Meadow Creek. Mr. Yang agreed that direct impacts could be avoided by HDD installation method by going under the creek and implementing avoidance and minimization measures in the vicinity of Meadow Creek. He suggested that the Applicant have a frac-out contingency plan in place. Mr. Yang agreed that Meadow Creek in the BSA does not provide suitable habitat for tidewater goby. Mr. Yang suggested that the Applicant contact State Parks to determine the current status of western snowy plovers and California least terns at Grover Beach. He stated that Oceano Dunes Recreation Area conducts annual surveys of the beach and could provide a current status of the species. He suggested that an appropriate buffer be maintained between proposed work and known nests and established wintering areas.

Consultation Outcomes:

- Consider Meadow Creek to be habitat for California red-legged frog
- Avoided direct impacts by using HDD installation method when going under the Meadow Creek and implementing avoidance and minimization measures in the vicinity of Meadow Creek

- Draft a Frac-Out Contingency Plan as a mitigation measure. A mitigation measure (**MM BIO-6: Prepare and Implement an Inadvertent Return Contingency Plan**) has been identified
- Not expect tidewater goby in Meadow Creek since there is no suitable habitat
- Contact California State Parks to their current data on western snowy plovers and California least terns being at the Grover Beach
- Contact Oceano Dunes Recreation Area for their annual surveys for western snowy plovers and California least terns in the Project area
- Include a mitigation measure to maintain an appropriate buffer between proposed work and known nests and established wintering areas. **MM BIO-7: Conduct Pre-Construction Nesting Bird Surveys and Implement Avoidance Measures** includes a requirement for establishing setback buffers.

CDFW: September 3, 2019, and November 21, 2019, telephone conversations with the Biologist, Brandon Sanderson, about potential resource concerns at Grover Beach. Mr. Sanderson stated that he had no major concerns about the work being proposed as it relates to state-listed species, in particular the California least tern (the only state-listed species potentially affected), because the nearest nesting records are considerably further south from Grover Beach. He said that CDFW would consider all sensitive wildlife species concerns when reviewing the CEQA document but, given coordination with State Parks for the bird species and no impacts on dune habitat, there should be no concerns for California least tern.

Mr. Sanderson recommended a notification for an LSAA to CDFW in the Fresno Office for boring activities under Meadow Creek. He stated that the notification should include a description of the bore, minimization measures to reduce the potential for a frac-out, and a frac-out contingency plan. CDFW does have concerns with tidewater goby because the goby is a sensitive wildlife species that occurs in streams and lagoons under CDFW's jurisdiction; these concerns could be addressed in the LSAA. ICF responded that a notification would be submitted to CDFW (Fresno Office) that would include a description of the bore, minimization measures to reduce the potential for a frac-out, and a frac-out plan. Mr. Sanderson agreed with that approach.

Consultation Outcomes:

- Survey for least-tern (only state-listed species potentially affected) in the Pre-Construction Surveys even CDFW staff expects them to be further south from Grover Beach
- Submit documents to the CDFW (Fresno Office) including a description of the bore, minimization measures to reduce the potential for a frac-out, and a frac-out plan
- Confirmed that CDFW was not expecting tidewater goby to be impacted by the Project because no streams and lagoons would be impacted since HDD construction techniques would be used. If needed these would be address in the CDFW's LSAA.

California Department of Parks and Recreation: January 14, 2020, telephone conversation with the Oceano Dunes District's Senior Environmental Scientist, Ronnie Glick about the Project happened. ICF biologist Angela Alcala asked Mr. Glick whether data were available for the 2019 breeding season on documented western snowy plover and California least tern nests in the vicinity of Grover Beach. Mr. Glick emailed Ms. Alcala a copy of the 2019 nesting report that included monitoring efforts on Grover Beach.

Consultation Outcomes:

- Incorporate the most recent 2019 breeding season data in the MND for western snowy plover and California least tern

Table C-1. Special-Status Wildlife Species with Potential to Occur in the Terrestrial Biological Study Area

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Invertebrates			
Vernal pool fairy shrimp *Branchinecta lynchi*	FT/–	Occurs in the Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County. Inhabits vernal pools and is found in sandstone rock outcrop pools.	None—No suitable habitat is present in the BSA. Surrounding areas are developed.
Monarch butterfly *Danaus plexippus*	–/– Wintering sites protected	Coastal conifer forests or eucalyptus groves protected from wind, with water and nectar sources nearby for wintering sites. Breeds in milkweed.	None—No suitable wintering habitat is present in the BSA. Closest known wintering site is 0.35 mile north along Meadow Creek, adjacent to the North Beach Campground (CDFW 2019c).
Amphibians			
California red-legged frog *Rana draytonii*	FT/SSC	Found in still waters in ponds, marshes, and stream pools near woodlands, coastal scrub, and streams with dense vegetative cover. Most common in lowlands and foothills from sea level to 5,000 feet.	Moderate—Known to occur downstream in Meadow Creek Lagoon. Protocol surveys in 2005 within Meadow Creek through the BSA did not locate the species. The species is known to occur in Arroyo Grande Creek (CDFW 2019c) and in the lower portions of Meadow Creek Lagoon (Terra-Verde 2012). Suitable dispersal and foraging habitat is present within Meadow Creek in the BSA. The species is unlikely to breed in the BSA due to lack of sufficient ponding to support juvenile metamorphosis.
Reptiles			
Northern California legless lizard *Anniella pulchra*	–/SSC	Occurs along the Coast, Transverse, and Peninsular ranges from Contra Costa County to San Diego County with spotty occurrences in the San	High—Potential habitat is present in annual brome grassland and arroyo willow thicket near the cable landing site. Historical CNDDB occurrence for the

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
		Joaquin Valley. Found in habitats with loose soil for burrowing or thick duff or leaf litter; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas.	species overlaps within the BSA (CDFW 2019c).
Western pond turtle *Emys marmorata*	–/SSC	Occurs throughout California west of the Sierra-Cascade crest. Occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests.	Moderate—Pond turtles are known to occupy Meadow Creek Lagoon downstream from the BSA (Terra-Verde 2012). The lack of permanent water within Meadow Creek in the BSA limits pond turtle use of the BSA.
Blainville's horned lizard *Phrynosoma blainvillii*	–/SSC	Occurs in the Sierra Nevada foothills and along central and southern California coasts. Uses a variety of habitats, from brushlands to coniferous forests, including annual grassland. Requires open areas of sandy soils and low vegetation for sunning. Harvester ants are the primary food source.	Moderate—Potential habitat is present in annual brome grassland and arroyo willow thicket near the cable landing site.
Two-striped garter snake *Thamnophis hammondii*	–/SSC	Highly aquatic species that is associated with permanent or semi-permanent water sources, often in rocky areas. Associated with a variety of vegetation types, including oak woodland, willow riparian, coastal sage scrub, scrub oak, chaparral, and brushland.	Moderate—Suitable habitat is present along Meadow Creek and within adjacent riparian and annual grassland habitat in the BSA. No CNDDB occurrences within 5 miles of the BSA (CDFW 2019c).

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Birds			
Western burrowing owl *Athene cunicularia*	–/SSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Rare along south coast. Associated with level, open, dry, heavily grazed or low-stature grassland with available burrows.	None—Annual grassland in the BSA is patchy and surrounded by developed areas, and is not likely to support burrowing owl. No CNDDB occurrences within 5 miles of the BSA (CDFW 2019c).
Western snowy plover *Charadrius nivosus*	FT/SSC	Nests above high tide line on coastal beaches and dunes, near river mouths, and along edges of lagoons and estuaries.	None to Very Low—No suitable habitat within the BSA. Species is known to nest within beach habitat 1.7 miles south of the BSA in the vicinity of the Arroyo Grande Creek outfall (CDPR 2019). Surveys conducted at Grover Beach have not detected the species during breeding season (CDPR 2019).
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FT/SE	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub-jays are abundant.	None—Arroyo willow thickets within the BSA are exposed and adjacent to a roadway and would not provide suitable nesting habitat for the cuckoo. The current range of the species does not include San Luis Obispo County.
White-tailed kite *Elanus leucurus*	–/SFP	Lowland areas west of Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border. Nests in low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands or agricultural fields for foraging.	Moderate—Arroyo willow thickets within and adjacent to the BSA provide suitable nesting substrate for kites. The species is known to nest in the vicinity of Meadow Creek Lagoon, approximately 1.4 miles south of the BSA (Terra-Verde 2012).

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Peregrine falcon *Falco peregrinus*	–/SFP	Found in a variety of habitat types; typically nests on cliff ledges	None—Could forage in or near the BSA, but no suitable nesting habitat is present within 0.5 mile of the BSA.
California black rail *Laterallus jamaicensis coturniculus*	–/ST	Found in brackish and freshwater emergent marshes, typically in high wetland zone near the upper limit of flooding.	None—No suitable habitat is present within the BSA. Potential marsh habitat is present more than 400 feet south of the BSA. Closest CNDDB occurrence is 6.7 miles south of the BSA within freshwater marsh habitat at Oso Flaco Lake (CDFW 2019c).
California least tern *Sternula antillarum browni*	FE/SE	Beaches, mudflats, and sand dunes, usually near shallow estuaries and lagoons with access to the open ocean; nests typically established in barren to sparsely vegetated areas with sandy or gravelly substrates.	None to Very Low—No suitable habitat within the BSA. Species is known to nest within beach habitat 4.3 miles south of the BSA in a seasonally protected area (CDPR 2019). Surveys conducted at Grover Beach have not detected the species during the breeding season (CDPR 2019). There is potential for wintering birds to be present in dune habitat adjacent to the BSA.
Least Bell's vireo *Vireo bellii pusillus*	FE/SE	In coastal southern California, breeding occurs from Santa Barbara County south. Nests in willow riparian forest supporting a dense, shrubby understory.	None—No known nesting occurrences within 5 miles of the BSA (CDFW 2019c), and the species was not observed during 2012 surveys conducted in the nearby Meadow Creek Lagoon (Terra-Verde 2012). Riparian habitat in the BSA is located adjacent to an existing roadway and is not expected to provide suitable habitat for vireos.

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Mammals			
Townsend's big-eared bat *Corynorhinus townsendii*	–/SSC	Roosts in caves, tunnels, mines, crevices, hollow trees, and buildings; usually near water.	None—No suitable roost habitat or substrate is present in the BSA.
American badger *Taxidea taxus*	–/SSC	Woodland, shrub, and grassland habitat types with friable soils for burrowing; preys on small mammals, reptiles, insects, and birds; scavenges for carrion.	None—Grassland habitat in the BSA is patchy and surrounded by developed areas. No suitable denning habitat is present.
Fish			
Tidewater goby *Eucyclogobius newberryi*	FE/SSC	Coastal lagoons, estuaries, and lower reaches of major stream drainages, often in brackish water.	None—No suitable lagoon or estuary habitat is present in the portion of Meadow Creek that crosses the BSA. However, species is known to occur in the Arroyo Grande Creek estuary 1.5 miles south and in the lower reaches of Pismo Creek 0.75 mile north of the BSA (CDFW 2019c). Tidewater goby was observed at the flap gates between Arroyo Grande estuary and Meadow Creek Lagoon during surveys conducted in 2012 (Terra-Verde 2012).
South-central California coast steelhead *Oncorhynchus mykiss*	FT/–	Requires cold, clean water and gravel for spawning and rearing, with cover for water velocity protection and predator refuge.	None—Meadow Creek in the BSA does not provide suitable habitat for steelhead. The closest known occurrences of steelhead are from Arroyo Grande Creek 1.6 miles south (CDFW 2019c).

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area

Terms
BSA = terrestrial biological study area
CNDDB = California Natural Diversity Database
[a] Status:
C = candidate for listing under California Endangered Species Act (CESA)
FE = listed as endangered under Federal Endangered Species Act (FESA)
FT = listed as threatened under FESA
SE = listed as endangered under CESA
SFP = state fully protected
SSC = state species of special concern
ST = listed as threatened under CESA

Table C-2. Special-Status Plant Species with Potential to Occur in the Terrestrial Biological Study Area

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]
Agrostis hooveri *Hoover's bent grass*	–/–/1B.2	Closed–cone coniferous forest, chaparral, cismontane woodland, valley and foothill grassland; usually within a sandy microhabitat; at 15–2,000 ft (6–610 m).	Apr–Jul	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.
Arenaria paludicola *Marsh sandwort*	FE/CE/1B.1	Marshes and swamps (fresh or brackish water); within sandy openings; at 5–560 ft (3–170 m).	May–Aug	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Calochortus obispoensis *San Luis mariposa lily*	–/–/1B.2	Chaparral, coastal scrub, grassland; often in serpentine grassland; at 160–2,395 ft (50–730 m).	May–Jul	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.
Calochortus simulans *La Panza mariposa lily*	–/–/1B.3	Chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland; within a sandy microhabitat often consisting of granite soils and sometimes serpentinite soils; at 1,065–3,775 ft (325–1,150 m).	Apr–Jun	None—Not observed during appropriately-timed surveys. Annual brome grassland contains low-quality habitat.
Castilleja densiflora var. obispoensis *San Luis Obispo owl's–clover*	–/–/1B.2	Meadows and seeps, valley and foothill grassland; sometimes serpentinite soils; at 30–1,410 ft (10–430 m).	Mar–May	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.

Table C-2. Continued

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]
Centromadia parryi subsp. congdonii *Congdon's tarplant*	–/–/1B.1	Annual grassland, on lower slopes, flats, and swales; sometimes on alkaline or saline soils; at 0–755 ft (0–230 m).	May–Oct (Nov)	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.
Cirsium fontinale var. obispoense *San Luis Obispo fountain thistle*	FE/CE/1B.2	Seeps and stream banks in chaparral, valley and foothill grassland, and oak woodlands; on serpentine substrates; at 110–1,265 ft (35–385 m).	Feb–Jul (Aug–Sep)	None—Not observed during appropriately-timed surveys. Banks of Meadow Creek in BSA provide low-quality habitat.
Cirsium scariosum var. loncholepis *La Graciosa thistle*	FE/CT/1B.1	Cismontane woodland, coastal dunes, coastal scrub, marshes and swamps (brackish), valley and foothill grassland; within a mesic, sandy microhabitat; at 10–720 ft (4–220 m).	May–Aug	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland and hardstem bulrush marsh.
Cladium californicum *California sawgrass*	–/–/2B.2	Meadows and seeps, marshes and swamps alkaline or freshwater; at 195–5,250 ft (60–1,600 m).	Jun–Sep	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Dudleya blochmaniae subsp. blochmaniae *Blochman's dudleya*	–/–/1B.1	Coastal bluff scrub, chaparral, coastal scrub, valley and foothill grassland; within rocky, often clay or serpentinite soils; at 15–1,475 ft (5–450 m).	Apr–Jun	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.

Table C-2. Continued

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]
Layia jonesii *Jones' layia*	–/–/1B.2	Clay soils and serpentine outcrops in chaparral and grasslands; at 15–1,310 ft (5–400 m).	Mar–May	None—Not observed during appropriately-timed surveys. Annual brome grassland contains low-quality habitat.
Nasturtium gambelii *Gambel's water cress*	FE/CT/1B.1	Marshes and swamps (fresh or brackish water); at 15–1,085 ft (5–330 m).	Apr–Oct	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Symphyotrichum defoliatum *San Bernardino aster*	–/–/1B.2	Cismontane woodland, coastal scrub, lower montane coniferous forest, meadows and seeps, marshes and swamps, valley and foothill grassland (vernally mesic); within wetland microhabitat, including ditches, streams, springs, seeps, and topographic depressions; at 5–6,695 ft (2–2,040 m).	Jul–Nov (Dec)	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Trifolium hydrophilum *Saline clover*	–/–/1B.2	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools; at 0–985 ft (0–300 m).	Apr–Jun	None—Not observed during appropriately-timed surveys. Hardstem bulrush marsh contains low-quality habitat.
Tropidocarpum capparideum *Caper–fruited tropidocarpum*	–/–/1B.1	Valley and foothill grassland (alkaline hills); at 0–1,495 ft (1–455 m).	Mar–Apr	None—Not observed during appropriately-timed surveys. Annual brome grassland contains low-quality habitat.

Table C-2. Continued

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]

Terms:
ft = feet
m = meters

[a] Legal Status explanations

Federal

FE = listed as endangered under the federal Endangered Species Act (FESA)
FT = listed as threatened under FESA
– = no listing status

State

SE = listed as endangered under the California Endangered Species Act (CESA)
ST = listed as threatened under CESA
CR = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation
– = no listing status

California Rare Plant Rank (CRPR)

1A = presumed extirpated in California and either rare or extinct elsewhere
1B = rare, threatened, or endangered in California and elsewhere
2B = rare, threatened, or endangered in California but more common elsewhere
3 = more information is needed
4 = watch list: plant of limited distribution
.1 = seriously endangered in California (more than 80% of occurrences threatened / high degree and immediacy of threat)
.2 = moderately threatened in California (20–80% occurrences threatened/moderate degree and immediacy of threat)
.3 = not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known)

[b] Potential to Occur in BSA explanations:

None: Floristic surveys were appropriately timed to coincide with the blooming/identifiable period of the special-status plant species known to occur in the project region.

[c] Source

California Native Diversity Database (CDFW 2019b)

Table C-3. Plant Species Observed on the Grover Beach Subsea Cables Project

Scientific Name	Common Name
Achillea millefolium	Common yarrow
Acacia sp.	Acacia
Acmispon glaber	Deer weed
Albizia julibrissin	Persian silk tassel
Amsinckia menziesii	Common fiddleneck
Avena barbata	Common oats
Avena fatua	Slender wild oats
Baccharis pilularis	Coyote brush
Bromus diandrus	Ripgut brome
Bromus hordeaceus	Soft chess
Bromus madritensis	Foxtail chess
Capsella bursa-pastoris	Shepard's purse
Carduus pycnocephalus	Italian thistle
Carpobrotus chilensis	Sea fig
Carpobrotus edulis	Ice plant
Ceanothus thyrsiflorus var. *griseus*	Carmel ceanothus
Chenopodium album	Lamb's quarters
Cistanthe grandiflora	Rock purslane
Cortaderia jubata	Jubata grass
Crassula ovata	Pygmy weed
Cymbalaria muralis	Kenilworth Ivy
Cynodon dactylon	Bermuda grass
Dimorphotheca fruticose	Trailing African daisy
Ehrharta erecta	Panic veldt grass
Erigeron canadensis	Horse weed
Erodium botrys	Stork's bill
Erodium cicutarium	Coastal heron's bill
Eucalyptus globulus	Blue gum eucalyptus
Festuca bromoides	Brome fescue
Festuca myuros	Rattail sixweeks grass
Festuca perennis	Rye grass
Hedera helix	English Ivy
Helianthus annuus	Hairy-leaved sunflower
Helminthotheca echioides	Bristly ox-tongue
Heliotropium curassavicum	Seaside heliotrope
Hesperocyparis macrocarpa	Monterey cypress
Heteranthemis viscidihirta	Sand chrysanthemum
Heterotheca grandiflora	Telegraph weed
Hirschfeldia incana	Mustard
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley

Table C-3. Continued

Scientific Name	Common Name
Hordeum murinum ssp. *leporinum*	Hare barley
Hypochaeris glabra	Smooth cat's-ear
Lactuca serriola	Prickly lettuce
Lagerstroemia indica	Crape myrtle
Lepidium nitidum	Shining pepper grass
Lotus corniculatus	Bird's foot trefoil
Lysimachia arvensis	Scarlet pimpernel
Malva parviflora	Cheeseweed
Matricaria discoidea	Pineapple weed
Medicago polymorpha	Bur clover
Melilotus indicus	Annual sweet clover
Myoporum laetum	Myoporum
Nandina domestica	Sacred bamboo
Oxalis pes-caprae	Bermuda buttercup
Phoenix dactylifera	Date palm
Plantago coronopus	Cut-leaf plantain
Plantago lanceolata	English plantain
Poa annua	Annual blue grass
Potentilla anserina ssp. *pacifica*	Pacific silverweed
Poa secunda var. *secunda*	One-sided blue grass
Polygonum aviculare	Prostrate knotweed
Pinus radiata	Monterey pine
Quercus agrifolia	Coast live oak
Raphanus sativus	Wild radish
Rubus armeniacus	Himalayan blackberry
Rubus ursinus	California blackberry
Salix lasiolepis	Arroyo willow
Salvia longistyla	Mexican sage
Schoenoplectus acutus var. *occidentalis*	Hardstem bulrush
Senecio vulgaris	Common groundsel
Sonchus asper	Sow thistle
Sonchus oleraceus	Common sow thistle
Tribulus terrestris	Puncture vine
Toxicodendron diversilobum	Poison oak
Urtica urens	Dwarf nettle
Washingtonia filifera	California fan palm
Vicia sativa ssp. *Savita*	Narrow-leaved vetch

Table C-4. Special-Status Marine Species and Their Potential to Occur in the Marine Biological Study Area

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Marine Mammals			
Baird's beaked whale *Berardius bairdii*	P	Deep offshore waters in the north Pacific; common along steep underwater geologic structures (e.g., submarine canyons, seamounts, and continental slopes).	Not expected—Sightings in deeper waters than the MSA, mainly along the OCS edges or in deep submarine canyons where they forage. National Marine Fisheries Service records indicate that fewer than a dozen individuals have been washed up along the West Coast.
Blainville's beaked whale *Mesoplodon densirostris*	P	Mainly over the OCS and into open ocean waters; tropical to temperate waters worldwide; groups have been regularly observed off Oahu, Hawaii, and in the Bahamas in waters from 1,640 to 3,280 feet.	Not expected—Unlikely to occur in the MSA.
Blue whale *Balaenoptera musculus*	FE, FD, P	Worldwide, often near the edges of physical features where krill tend to concentrate. These whales begin to migrate south during November.	High—Relatively common farther offshore (56–230 miles from shore) but less common in the MSA.
Bottlenose dolphin *Tursiops truncatus*	P	Worldwide in temperate and tropical waters; both coastal and offshore populations; most common dolphins in the Southern California Bight.	Low-moderate— Bottlenose dolphins were observed offshore of Pismo Beach in recent years, which suggests that this species is becoming increasingly more common in central California as water temperatures warm.
Bryde's whale *Balaenoptera edeni*	P	Highly productive tropical, subtropical, and warm temperate waters worldwide; more common farther from shore.	Not expected—Unlikely to occur in the MSA.
California sea lion *Zalophus californianus*	P	Eastern north Pacific in coastal waters; commonly observed throughout the California coast.	High—Commonly observed.
Common dolphin–long-beaked *Delphinus capensis*	P	Shallow, warmer temperate waters relatively close to shore; most abundant cetacean from Baja California northward to central California; maximum northward extent is Point Arena.	Low—Numbers begin to decrease northward from the central California coast.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Common dolphin–short-beaked *Delphinus delphis*	P	More pelagic than the long-beaked common dolphin; can be found up to 300 nautical miles from shore; majority of populations are observed off California coast, especially in warm water months.	Moderate—Generally found offshore of the MSA.
Cuvier's beaked whale *Ziphius cavirostris*	P	Temperate, tropical, and subtropical waters; associated with deep pelagic waters (usually deeper than 3,280 feet) of the OCS and slope, and near underwater geologic features; seasonality and migration patterns unknown.	Not expected—Generally occur in the deeper waters west of the MSA.
Dall's porpoise *Phocoenoides dalli*	P	Throughout north Pacific, mainly in pelagic waters deeper than 590 feet but can be found both offshore and inshore.	Not expected-low—Most frequently observed offshore in deeper waters.
Dwarf sperm whale *Kogia simus*	P	Continental slope and open ocean; prefer warm tropical, subtropical, and temperate waters worldwide.	Not expected—Records are rare; it is unknown whether low numbers are a consequence of cryptic behavior or if they are not regular inhabitants of offshore California waters.
False killer whale *Pseudorca crassidens*	P	Continental slope and into open ocean waters of tropical and warm temperate waters worldwide.	Not expected—Prefer warmer and deeper waters than those within the MSA.
Fin whale *Balaenoptera physalus*	FE, FD, P	Deep, offshore waters of all major oceans; less common in the tropics.	Moderate—Relatively common in California waters from March to October but prefer deep water farther offshore.
Ginkgo-toothed whale *Mesoplodon ginkgodens*	P	Mainly over the OCS and into open ocean; warm waters of the Pacific and Indian Oceans.	Not expected—Not documented in the MSA.
Gray whale (Eastern Pacific DPS) *Eschrichtus robustus*	FD, P	Predominantly in nearshore coastal waters of the north Pacific from the Gulf of Alaska to Baja Peninsula; can be as close as a few hundred yards offshore but more common 3–12 miles offshore.	Moderate—Pass the MSA during late fall–winter in southward migration and during late winter–early summer in northward migration.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Guadalupe (southern) fur seal *Arctocephalus townsendi*	CT, FT, FD	Tropical waters of southern California and Mexico; breeds in rocky coastal habitats and caves mainly along the eastern coast of Guadalupe Island, approximately 124 miles west of Baja California; small population on San Miguel Island in the Channel Islands.	Not expected—Unlikely to occur north of Point Conception and the Southern California Bight.
Harbor porpoise *Phocoena phocoena*	P	Continental slope to oceanic waters, mainly in northern temperate, subarctic coastal, and offshore waters; common in bays, estuaries, harbors, and fjords less than 656 feet deep.	Low— Can occur in the MSA between 0 and 200 meters depth, but no observations reported in the MSA.
Harbor seal *Phoca vitulina*	P	From British Columbia to Baja California, most commonly observed pinniped along California coastline; favors nearshore coastal waters for foraging and beaches, offshore rocks on sand and mudflats in estuaries and bays for resting.	High—Common along the California coast. Harbor seals favor nearshore coastal waters.
Hubb's beaked whale *Mesoplodon carlhubbsi*	P	Endemic to north Pacific; species is not well known but is assumed to occur mainly over the OCS and into open ocean waters.	Not expected—May occur in waters off central and northern California, but species is very rare.
Humpback whale *Megaptera novaeangeliae*	FE, FD, P	All major oceans; central California population migrates from winter calving and mating areas off Mexico to summer and fall feeding areas off coastal California. Humpback whales occur from late April to early December.	Moderate—Frequently observed migrating along California coast April–November, typically 12–55 miles offshore; more common inshore near the submarine Monterey canyon.
Killer whale *Orcinus orca*	FE, FD, P	All oceans; most abundant in colder waters but also occur in temperate water; presence and occurrence common but unpredictable in coastal California.	Low—Most common in April, May, and June as they feed on northbound migrating gray whales; generally observed in deeper waters offshore of the MSA.
Long-snouted spinner dolphin *Stenella longirostris*	FD, P	Found in all tropical and subtropical oceans; OCS to open ocean waters, but most commonly in the deep ocean where they track prey.	Not expected—Unlikely to be present because species prefers warmer waters.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Minke whale *Balaenoptera acutorostrata*	P	Distributed worldwide and can be in coastal/inshore and over the OCS in temperate (preferred), boreal, or polar waters.	Low—Minke whale observed throughout California coast, but sightings are rare.
North Pacific right whale *Eubalaena japonica*	FE, FD, P	North Pacific Ocean; seasonally migratory; colder waters for feeding, migrating to warmer waters for breeding and calving; may move far out to sea during feeding seasons but give birth in coastal areas.	Not expected—Unlikely to be present in the MSA because they are very rare.
Northern elephant seal *Mirounga angustirostris*	P	Alaska to Mexico; sighted regularly over OCS, shelf-break, and slope habitats; also present in deep ocean habitats seaward of the 6,561-foot isobath; rookeries located north of the MSA.	Low-moderate—Widely distributed along North America's west coast but spend about 9 months at sea.
Northern fur seal *Callorhinus ursinus*	FD, P	Spend 300 or more days per year foraging in open ocean of north Pacific; use rocky beaches for reproduction; usually ashore in California only when debilitated; however, a few individuals observed on Año Nuevo Island.	Low—Usually 11–17 miles from shore in California; however, have been observed within 3 miles of Point Pinos north of the MSA.
Northern right whale dolphin *Lissodelphis borealis*	P	Endemic to deep, cold temperate waters in north Pacific; occur over the OCS and slope where waters are less than 66°F (18°C).	Not expected—Very rare in California waters.
Pacific white-sided dolphin *Lagenorhynchus obliquidens*	P	Temperate waters of north Pacific from the OCS to deep ocean.	Low—Likely to occur throughout California but typically do not occur nearshore.
Perrin's beaked whale *Mesoplodon perrini*	P	Believed to occupy continental shelves and open ocean waters but not well documented.	Not expected—Known from fewer than half a dozen strandings between San Diego and Monterey, but species' complete distribution is unknown.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Pygmy sperm whale *Kogia breviceps*	P	Continental slope and open ocean in tropical, subtropical, and temperate Pacific waters, mostly offshore of Peru; strandings have been documented off Mexico and once each in New Zealand and Monterey Bay.	Not expected—Overall, the species is rare and would occur south of the MSA.
Risso's dolphin *Grampus griseus*	P	All major oceans, generally in waters deeper than 3,280 feet and seaward of the OCS and slopes.	Low—Generally occur in deeper waters offshore of the MSA.
Rough-toothed dolphin *Steno bredanensis*	P	All tropical and subtropical oceans; OCS to open ocean waters; prefer depths of tropical and warmer temperate waters.	Not expected—Unlikely to occur in the relatively cold waters of the MSA.
Sei whale *Balaenoptera borealis*	FE, FD, P	Worldwide cosmopolitan distribution in subtropical, temperate, and subpolar waters; usually observed in deeper waters of oceanic areas far from coastline.	Not expected—Uncommon in California waters, especially in the Project vicinity, because they primarily occupy the open ocean.
Short-finned pilot whale *Globicephala macrorhynchus*	P	Warmer tropical and temperate waters, commonly along the coast close to the OCS; forage in areas with high densities of squid.	Not expected—Generally found in deeper, warmer waters than those in the MSA.
Southern sea otter *Enhydra lutris nereis*	FT, P	Top carnivore and keystone species in nearshore waters of California from San Mateo County south to Santa Barbara County; frequent inhabitant in kelp forests.	Moderate— Southern sea otters occupy the nearshore waters of California from San Mateo County south to Santa Barbara County. The primary populations reside between Monterey Bay and Cayucas in San Luis Obispo County. The waters offshore of Grover Beach are within the southern end of their range, and sea otters are frequently observed.
Sperm whale *Physeter macrocephalus*	FE, FD, P	Open ocean far from land and uncommon in waters less than 984 feet deep; live at surface of the ocean but dive deep to catch giant squid.	Low—Present in offshore California year-round, peaking in abundance in late spring and late summer; but rarely seen because they occupy deep water far offshore.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Spotted dolphin *Stenella attenuata*	FD, P	Typically, far away from coast in tropical and subtropical waters worldwide but can occupy waters over the OCS; spend majority of day in waters 295–984 feet deep, diving to depth at night to search for prey.	Not expected—Eastern Pacific population typically is observed far from the coast and is depleted in numbers.
Stejneger's beaked whale *Mesoplodon stejnegeri*	P	Found in cold temperate and subarctic waters of the north Pacific, occupying deep, offshore waters	Not expected—Generally found in deep, offshore waters on or beyond the OCS.
Steller (northern) sea lion *Eumetopias jubatus*	FE, FD, P	Distributed around the coasts along the north Pacific rim; common in coastal waters and onshore for resting; critical habitat extends approximately 1,000 meters seaward and landward of any Steller sea lion rookery in Washington, Oregon, and California. Any aquatic foraging habitat within the species geographic range.	Moderate—Documented as relatively common in the coastal waters of central California.
Striped dolphin *Stenella coeruleoalba*	P	Continental shelf to open ocean waters worldwide, often in areas of upwelling and around convergence zones; prefer highly productive tropical to warm temperate waters.	Not expected—Unlikely to occur in cold waters of the MSA. Observations typically are far offshore.
Marine Turtles			
Green sea turtle *Chelonia mydas*	FE, P	Distributed globally; oceanic beaches (for nesting), convergence zones in the open ocean and benthic feeding grounds in coastal areas.	Not expected—In eastern Pacific, sightings from Baja California to southern Alaska, but most commonly from San Diego south.
Leatherback sea turtle *Dermochelys coriacea*	FE, P	Distributed globally; regularly seen off West Coast in pelagic waters, with greatest densities found in central California. Critical habitat encompassing the MSA extends from the shore to a depth of 9,845 feet (3,000 meters) from Point Arena to Point Arguello.	Low—Most commonly seen between July and October, when surface water temperature warms to 59–61°F (15–16 °C) and large jellyfish, their primary prey, are seasonally abundant.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Loggerhead sea turtle *Caretta caretta*	FT, P	Temperate and tropical regions of Atlantic, Pacific, and Indian Oceans; use the terrestrial zone, the oceanic zone, and the neritic or nearshore coastal area.	Low—Most recorded U.S. sightings are of juveniles off the California coast, but occasional sightings have been reported along the Washington and Oregon coasts.
Olive ridley sea turtle *Lepidochelys olivacea*	FT	Mainly pelagic in tropical/temperate regions of Pacific, South Atlantic, and Indian Oceans but has been known to inhabit coastal areas, including bays and estuaries.	Not expected—In the eastern Pacific, their range extends from southern California to northern Chile.
Sharks and Fish			
Basking shark *Cetorhinus maximus*	CSC, P	Movements and migrations poorly understood; usually sighted from British Columbia to Baja California in winter and spring.	Not expected—Populations severely depleted by commercial fisheries of the 1950s, and they have never fully recovered due to slow growth and low fecundity.
Green sturgeon (southern DPS) *Acipenser medirostris*	FT, CSC	Marine and estuarine environments, Sacramento River; San Francisco Bay-Delta, Humboldt Bay, offshore waters to 360 feet from Monterey Bay to the U.S.-Canada border.	Low—Species may forage in or near the MSA, but species distribution in ocean waters is essentially unknown.
Steelhead (South-Central California Coast Steelhead DPS) *Oncorhynchus mykiss*	FT, CSC, P	Occur along entire Pacific Coast. Anadromous individuals can spend up to 7 years in fresh water prior to smoltification and then spend up to 3 years in salt water to first spawning. Individuals that spend entire life in fresh water are called rainbow trout. Critical habitat includes essentially all major rivers and all coastal stretches of all rivers and creeks throughout California. Near the BSA, this includes Pismo Creek (approximately 0.7 mile north) and Arroyo Grande Creek (approximately 1.5 miles north).	Moderate—Spawning locations include coastal rivers flowing into the ocean between Point San Luis and Mussel Point. Adults may occur in coastal waters near confluences with freshwater streams and rivers.
White shark *Carcharodon carcharias*	CSC, P	Coastal and offshore waters along the OCS and islands. Important habitat in vicinity of Monterey Bay and Greater Farallones National Marine Sanctuaries.	Moderate-high—Present in coastal waters throughout California. Occurrences in waters offshore of Grover Beach have been increasing in recent years.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Gastropods			
Black abalone *Haliotis cracherodii*	FE, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Range extends from Point Arena, California to Bahia Tortugas and Isla Guadalupe, Mexico. Critical habitat occurs in MSA.	Low—Point Arena is northernmost point of distribution along the California coast; rare north of San Francisco; populations in south-central California have been in decline in recent years.
Green abalone *Haliotis fulgens*	FSC, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Not expected—Mainly distributed from Point Conception to Bahia Magdalena in Baja California.
Pink abalone *Haliotis corrugate*	FSC, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Not expected—Mainly distributed from Point Conception to Bahia Magdalena in Baja California.
White abalone *Haliotis sorenseni*	FE, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Not expected—Mainly distributed from Point Conception to Bahia Magdalena in Baja California.

Terms:
BSA = terrestrial biological study area
DPS = distinct population segment
MSA = marine biological study area
OCS = Outer Continental Shelf

[a] Status Codes:

Federal: U.S. Fish and Wildlife Service, National Marine Fisheries Service

FC = candidate to become a proposed species
FDL = delisted
FE = listed as “endangered” (in danger of extinction) under the federal Endangered Species Act (FESA)
FSC = former federal species of concern. U.S. Fish and Wildlife Service no longer lists species of concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. National Marine Fisheries Service still lists species of concern.
FT = listed as threatened (likely to become endangered within the foreseeable future) under FESA

State: California Department of Fish and Wildlife

CE = listed as endangered under the California Endangered Species Act (CESA)
CSC = species of special concern

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]

CT = listed as threatened under CESA

RC = species of regional concern; CDFW regulates harvest levels within reserves

National Oceanographic and Atmospheric Administration; Marine Mammal Protection Act

FD = depleted population

P = federally protected

[b] Potential for Occurrence Rankings:

Not expected: Suitable foraging or spawning habitat is not known to be present or is rare, and species has not been or is rarely documented.

Low: Suitable foraging or spawning habitat is present, but species has not been documented to be present or, if present, is uncommon and infrequent.

Moderate: Suitable foraging or spawning habitat is present and species is somewhat common or common for part of the year.

High: Suitable foraging or spawning habitat is present, and species is common throughout the year or in substantial numbers.

Source: AMS 2019

Marine Aquatic Habitats and Biological Resources Offshore Grover Beach, California

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Table of Contents

1 Introduction

The purpose of this scientific review is to 1) present a broad overview of the marine intertidal and subtidal habitats and associated biota observed offshore of coastal Central California based on scientific literature and past field surveys, and 2) to characterize the seafloor habitats and associated macrobenthic communities that are expected to be present along the Bay to Bay Express (BtoBE) cable route, located offshore of Grover Beach, California, based on the geophysical hyrdroacoustic survey data and interpreted seafloor habitats along the proposed cable route. For the purposes of this review, the analysis of seafloor habitats and associated marine taxa covers the water depth range of 0 – 184 m (0 – 600 ft). For fish and marine mammals, the analysis extends out to 1,800 m (5,904 feet) water depth.

Figure 1 provides an illustration of the study area around Grover Beach, California, a graphical presentation of coastal bathymetry and topography, as well as nearby Marine Protected Areas.

2 Previous Scientific Surveys of Subtidal Habitats in Central and Southern California

Beginning in 1999, numerous visual and photographic surveys of fiber optic cable routes in Southern and Central California coastal waters have been conducted using remotely operated vehicles (ROVs). These include:

- Tyco Global West fiber optic cable project, San Diego, Manhattan Beach, Santa Barbara, and Morro Bay (SAIC 2000);
- Tycom fiber optic cable project, Hermosa Beach (MBC 2001);
- SEA-US 1 fiber optic cable project, Hermosa Beach (AMS 2016);
- MCI/WorldCom fiber optic cable project, Montana del Oro/Morro Bay (SAIC-SLO 1999);
- AT&T US/China fiber optic cable project, Morro Bay and Point Arena (SAIC 1999);
- AT&T AAG S-5 fiber optic cable project, Montana del Oro/Morro Bay (AMS 2008);
- Monterey Bay Aquarium Research Institute (MBARI) MARS fiber optic cable project, Monterey Bay (MBARI 2004).

In addition to the above listed surveys that primarily employed ROVs, others employed scientific SCUBA divers to assess the shallower water segments of cable route and landfall locations, marine terminal subsea infrastructure and subsea pipelines, and marine areas of special concern. These include:

- Pacific Crossing and Pan American Crossing fiber optic cable landing, Grover Beach (AMS 1999b);
- The Chevron Pipeline Company Estero Bay Marine Terminal infrastructure prior to abandonment (AMS 1999a; Chambers 1998);
- Tycom fiber optic cable project, Hermosa Beach (MBC 2001); and
- Diver surveys of nearshore rocky reefs in Santa Monica Bay (Occidental 2008).

Finally, the effects of physical disturbance to subtidal hard substrate habitats and associated marine biota, and the recovery of those marine communities following the disturbance, have been extensively studied in conjunction with offshore oil and gas exploration and production operations in the Pacific Outer Continental Shelf. The results of these scientific investigations have been summarized in:

- A Survey of Prominent Anchor Scars and the Level of Disturbance to Hard-Substrate Communities in the Point Arguello Region (Hardin *et al.* 1993);
- Recolonization of Deep-Water Hard Substrate Communities: Potential Impacts from Oil and Gas Development (Lissner *et al.* 199, Brewer et. al 1991).

These studies collectively provide insight into the types of subtidal habitat observed along the California coast in water depths ranging from 0 to 100 fathoms (180 meters).

3 Pelagic Open Water Habitat and Associated Biological Communities

The pelagic zone supports a number of planktonic organisms (phytoplankton, zooplankton, and ichthyoplankton) that float with the currents, as well as nektonic organisms, such as fishes, sharks, and marine mammals that move freely against local and oceanic currents.

3.1 Plankton

Phytoplankton, the primary producers at the base of the marine pelagic food web, are consumed by many species of zooplankton. In turn, zooplankton support a variety of species including small schooling fish (e.g., sardines, herring) and baleen whales (Mysticeti). In the marine environment, phytoplankton tend to be nutrient limited, explaining why they are found at higher densities near coastlines where nutrient inputs from terrestrial point and non-point sources help promote their growth (Fischer 2014). The abundance and composition of phytoplankton along the west coast of California is influenced by the upwelling system and tends to be dominated by diatoms year-round (Du *et al.* 2016). Winds blowing from the north create a current running north to south along the shore that promotes upwelling as well as mixing of plankton over large spatial scales. Relaxation of upwelling and stratification of the water column promotes the growth of phytoplankton that may be considered harmful, such as dinoflagellates and various species of the *Pseudonitzschia* genus (Du *et al.* 2016).

Organisms that complete their entire life cycle as planktonic forms are called holoplankton and include phytoplankton such as diatoms and zooplankton such as *Acartia tonsa*. Holoplankton have short generation times (hours to weeks), have the capability to reproduce continually (i.e. are not dependent on a certain season), and are not restricted to specific geographic zones. Plankton that only spend part of their life cycle as planktonic forms, including as eggs or larvae, are called meroplankton. Meroplankton make up a small fraction of the total number of planktonic organisms in seawater, have shorter spawning seasons, are restricted to a narrow region of the coast, and have a much greater likelihood of impacts on their populations from mortality due to entrainment. As a result, studies in California typically assess effects on meroplanktonic species as proposed by the U.S. EPA (EPA 1977). Important meroplankton include fish larvae and eggs (ichthyoplankton) as well as invertebrate larvae of lobsters, crabs, octopus and squid.

3.2 Fish

Pelagic fish communities tend to be similar throughout the coastal waters of Central California, characterized by small schooling species such as Pacific sardine (*Sardinops sagax*) and Northern anchovy (*Engraulis mordax*), schooling predators such as Bluefin tuna (*Thunnus thynnus*) and thresher shark (*Alopias vulpinus*), swordfish (*Xiphias gladius*), and large solitary predators such as Mako (*Isurus*

oxyrinchu) and Leopard (*Triakis semifasciata*) sharks (CDFW 2018). Other common fish species that inhabit the open water environment include Chinook salmon (*Oncorhynchus tshawytscha),* market squid (*Doryteuthis opalescens*), smelt (*Spirinchus stark*), Jack and Pacific mackerel (*Trachurus symmetricus and T. symmetricus*), Opah (*Lampris spp.),* and assorted perches *(Embiotocidae)* More information on fish species inhabiting the open waters of Central California is provided in Section 5 (Fish Communities) below.

3.3 Marine Mammals & Sea Turtles

3.3.1 Marine Mammals

More than 12 species of marine mammals are reported as regular or periodic inhabitants of the coastal waters of California and anticipated to occupy the waters offshore Grover Beach. These include eight species of cetaceans (whales, dolphins, and porpoises) and three species of pinnipeds (seals and sea lions), and the Southern sea otter, a member of the weasel family (Table 5-1) (Carretta *et al.* 2013; Leatherwood and Reeves 1983; Reeves *et al.* 1992). Marine mammals commonly observed in the waters offshore Grover Beach, in less then 200 meters of water depth, include California sea lions (*Zalophus californianus*), Stellar sea lions (*Eumetopias jubatus*), Pacific harbor seals (*Phoca vitulina*), gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*, fin whales (*Balaenoptera physalus*), and occasionally, killer whales (*Orcinus orca*) (NOAA 2018a). In addition, Pacific white sided dolphins (*Lagenorhynchus obliquidens),* common dolphins *(Delphinus delphis),* and bottlenose dolphins *(Tursiops truncates*). Finally, the Southern sea otter *(Enhydra lutris nereis)* is increasing in numbers in the nearshore waters offshore Grover Beach, which is at the southern end of its current range in Central California.

All of these animals are protected under the Marine Mammal Protection Act (MMPA). Three of the species of cetaceans are federally listed as endangered, while one species of pinnipeds is listed as threatened under the Federal Endangered Species Act (FESA).

3.3.2 Sea Turtles

Physical and oceanographic forces drive patterns of primary and secondary productivity in the coastal waters off California (Wingfeld *et al*. 2011). Five species of marine sea turtles are known to inhabit these waters, or seasonally migrate to the area to forage during times of high productivity. These include Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Leatherback (*Dermochelys coriacea*), Pacific Hawksbill (*Eretmochelys imbricata*), and Olive Ridley (*Lepidochelys olivacea*) sea turtles (California Herps 2018). The Loggerhead, Pacific Hawskbill and Olive Ridley sea turtles are only known to occur in Southern California south of Point Conception, although one sighting of an Olive Ridley near Tomales Bay was reported in 2002 (California Herps 2018).

Of these five species, only the Green and Leatherback sea turtles have been reported occurring in the waters of north Central and southern Northern California (California Herps 2018). Leatherback turtles observed in this region are found to nest in the western Pacific and migrate to the California coast in the summer and early fall to forage on abundant jellyfish that bloom as a result of coastal upwelling (Benson *et al.* 2006). East Pacific green sea turtles originate from nesting beaches in Mexico, and many are long-term residents of San Diego Bay (NOAA SWFSC 2014). They feed on eelgrass and associated biota including algae and invertebrates. While most commonly found in warmer waters off Mexico and southern California, green sea turtles are occasionally observed along Central and northern California during anomalously warm years, with far rarer observations as far north as Canada's Vancouver Island (California Herps 2018).

Given the lack of eelgrass habitat in the nearshore coastal waters adjacent to Grover Beach (Sherman & DeBruyckere 2018), the potential for occurrence of Green sea turtles in this area is low. Leatherback sea turtles typically forage farther offshore than the area of focus, and no nesting of this species occurs north of Mexico (Benson *et al* 2006). Therefore, the potential for occurrence of Leatherback sea turtles in the nearshore coastal waters adjacent to Grover Beach is also low.

The Leatherback, Green, and Pacific Hawksbill sea turtles are Federally listed as endangered throughout their ranges and the Olive Ridley and Loggerhead sea turtles are Federally listed as Threatened. Critical habitat for the Leatherback sea turtle has been established from Point Arena in Northern California south to Point Arguello, in Southern California (NOAA 2018b).

4 Subtidal Habitats and Associated Macrobenthic Biological Communities

Subtidal habitats are typically characterized as either soft or hard substrate. Depending on water depth, currents, wave energy, and other physical conditions, the soft substrate can range from coarse sands, (typically observed in high energy and/or shallow water environments) to fine muds (low energy/deeper water environments). Hard substrate can be divided into natural (rocky outcrop) or artificial (concrete, pilings, steel, etc.) substrate, and further characterized by elevation or rise above the seafloor. While some reports characterize elevation rise only as "low" or "high", the typical descriptors used for categorizing elevation of hard substrate above the seafloor are:

- Mixed-bottom – a combination of coarse sand, gravel, cobble, and small boulders;
- Low-relief – exposed bedrock and rocky outcropping rising approximately < 0.3 m (<1 ft.) from the seafloor;
- Moderate-relief – exposed rocky outcroppings that typically rise approximately 0.3-1.0 m (1-3 ft.) from the seafloor;
- High-relief – exposed rocky outcropping that typically rise >1.0 m (>3 ft.) from the seafloor.

Many of the deep-water, hard substrate biological assessments featured in this report have documented an increase in species diversity and abundance with increasing elevation above the seafloor. These studies have demonstrated that water depth, current speed, rate of sedimentation, and elevation off the seafloor are all key factors in determining the composition of biota inhabiting a specific hard substrate habitat (Battelle 1991; Hardin 1994; Lissner & Shoakes 1986).

Additionally, with increasing water depth and the reduction of wave energy at the seafloor, the sediment composition shifts from coarse sands with low organic content near the beach to fine muds with increasing organic content as you transit farther offshore into deeper water depths. This shift in sediment composition and energy also results in changes to the marine biota inhabiting the soft substrate habitat.

Contained within the Appendices of this report are four tables providing taxonomic listings of invertebrate and fish species observed during the above listed fiber optic cable route reconnaissance surveys employing ROVs, and shallower water depth surveys employing SCUBA, in Southern and Central California with particular emphasis on studies conducted near Grover Beach, CA. Appendix A-1 is a master taxonomic list of invertebrate organisms that identifies each taxon's association with either hard or soft substrate habitat. Appendix A-2 provides a breakout of invertebrate taxa by water depth range. Appendix A-3 is a master taxonomic list of all fish and shark species observed in these surveys by

habitat and Appendix A-4 is a breakout of the fish species by water depth range. When reviewing the data within the appendeces, it should be noted that hard bottom habitat was not always present within specific depth ranges along some of the proposed fiber optic cable routes. As a result, no associated species were reported as occurring within those water depth ranges for hard bottom habitat. This merely indicates that there was no suitable habitat present at that water depth range to be characterized and does not indicate that certain species would not occur in that location, if suitable habitat were present.

4.1 Habitats and Associated Biota Observed in the 0-30.5 Meter (0-100 ft.) Water Depth Range.

Most fiber optic cables begin their offshore routing at the point at which the cable exits an existing pipeline/outfall or horizontal bore hole. This typically occurs in 12-25 m (39-82 ft.) water depth and preferably in soft substrate such as sand or sandy silt. Although hard substrate does occur at these shallower water depths, cable routes are routinely selected to avoid them, especially at the very shallowest water depths. As a result, most of the fiber optic cable route reconnaissance surveys reviewed for this paper begin at water depths greater than 25 meters (82 ft.). Survey work on shallow water reefs in Southern and Central California have been conducted by Occidental College, Chambers, and AMS, which can be used to inform our understanding of species presence at water depths less than 30 meters (98 ft.) (Occidental 2008, Chambers 1998, AMS 1999a, SAIC 2010). Because scientists conducted these surveys using SCUBA equipment, the taxonomic lists generated are more extensive than typically generated from ROV surveys. Appendices A-1 through A-4 include a more detailed listing of marine invertebrate and fish taxa observed on shallow water reefs observed during these SCUBA conducted surveys in the Southern and Central California. The following discussion of deep-water biota focuses primarily on observations made during the cable route surveys in Central California. The shallow water data provided by the Occidental (2008), Chambers (1998), and AMS (1999a) reports has been included to provide reference information on hard and soft substrate communities in water depths shallower than fiber optic cable route characterizations typically assess.

4.1.1 Soft Substrate

Soft substrate habitat types commonly observed between 0-30 m (0-98 ft.) water depth include coarse sands in the surf zone shifting to finer sands and muds (silts and clays) at deeper water depths (Figures 2 and 3).

The most common invertebrate taxa observed include the ornate tube worm (*Diopatra ornata*), cancer crabs *(Cancer sp.),* slender crabs *(Cancer gracilis),* masking crab *(Loxorhynchus crispatus),* octopus *(Octopus rubescens and O. bimaculatus/bimaculoides)*), white sea pens (*Stylatula elongata*), sea cucumbers (*Parastichopus californicus*), sunflower stars (*Pycnopodia helianthoides*), occasional polychaete tube worms, *Pachycerianthus* anemones, spiny sand stars (*Astropecten armatus*), short-spined seastars (*Pisaster brevispinus*), sand stars (*Luidia foliolata*), sea pansy (*Renilla kollikeri*), swimming crabs (*Portunus xantusii*), an occasional hermit crab, Kellet's whelk (*Kelletia kellettii*), Nassa mud snails (*Nassarius sp*.), and sand dollars (*Dendraster excentricus*).

The bat star (*Asterina miniata*) and red sea star (*Mediaster aequalis*) are occasionally observed in soft substrate when the soft substrate habitat is in close proximity to exposed hard substrate. In the coarser sand habitats, the invertebrate community is typically dominated by ornate tubeworms (*D. ornata*) and sand dollars (*D. excentricus*), when they are present in colonies occupying fairly narrow bands. In deeper waters, where the sediments shift to finer muds, brittle stars (*Ophiura spp*.) start to occur in larger numbers.

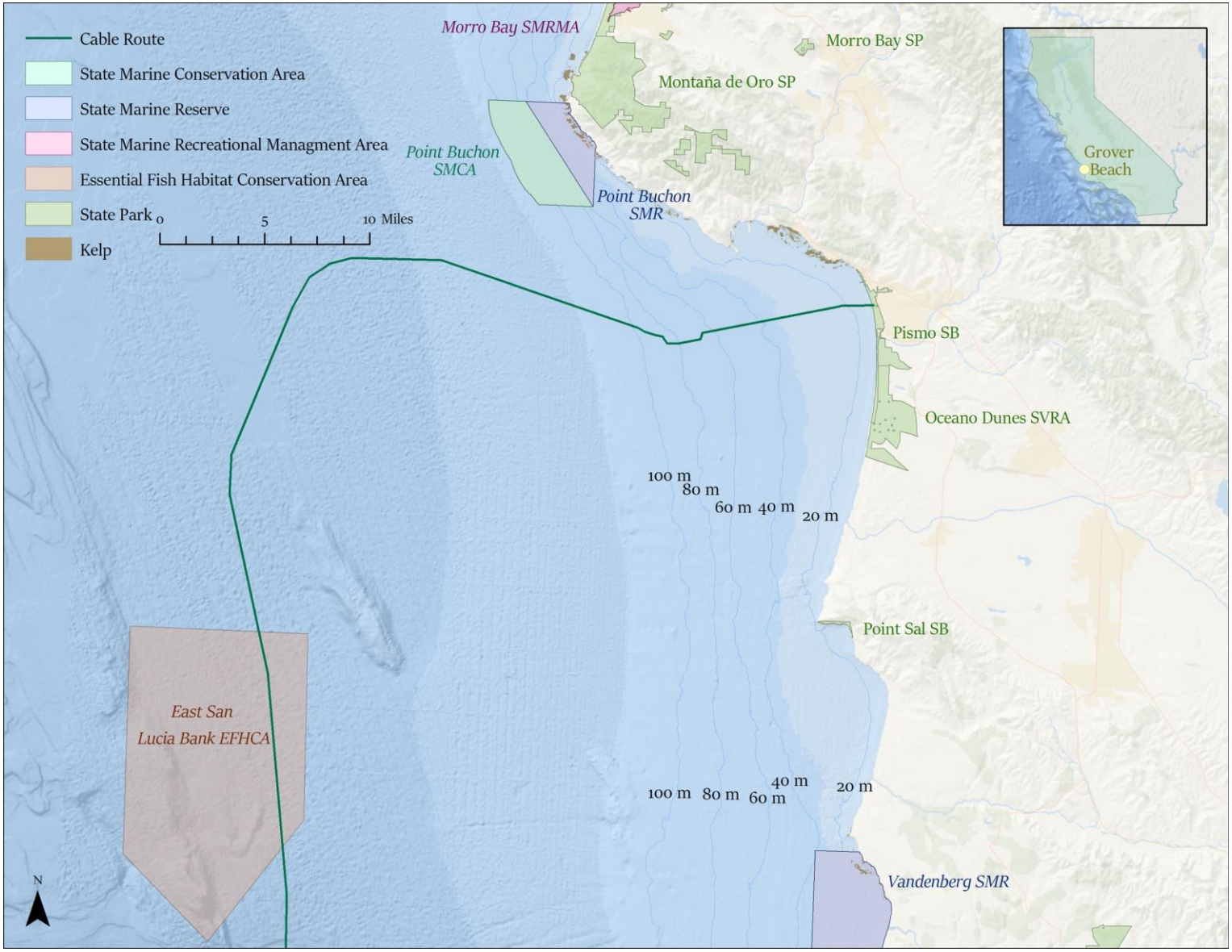

Figure 1: Marine Study Area Offshore Grover Beach California.

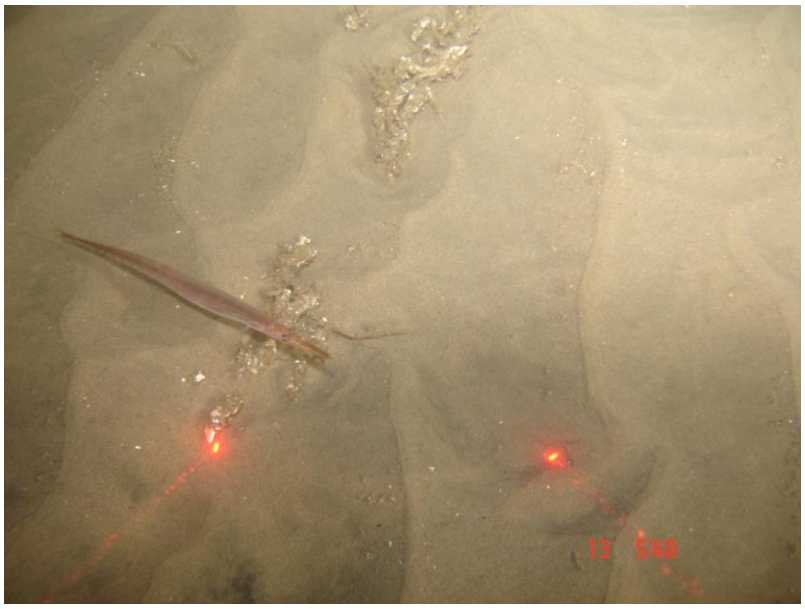

Figure 2: Coarser soft sand substrate in <30 m of water depth offshore Central California. Ornate tube worms (*D. ornata*) and a tubesnout (*Aulorhynchus flavidus*) along the AAG-S5 cable route.

Figure 3: Coarse sand substrate in <30 m water depth offshore Sothern California. Drift kelp, ornate tube worms (*D. ornata*) along the SEA-US cable route.

When hard substrate is nearby to the surveyed location, various species of drift algae are also commonly observed along the seafloor in soft bottom habitat. Observed species include giant kelp (*Macrocystis pyrifera*), feather boa kelp (*Egregia meanzinii*), acid kelp (*Desmarestia ligulata*), and surf grass (*Phyllospadix spp.)*. Populations of very small red and brown algae have also been reported to occur attached to worm tubes (MBC 2001, AMS 2016).

4.1.2 Hard Substrate

Hard substrate habitat types typically observed between 0-30.5 m (0-100 ft.) water depths include mixed-bottom (a combination of coarse sand, cobble, and small rocks < 0.3 m (1 ft.) in height above the seafloor), low-relief, substrate consisting primarily of exposed bedrock and small boulders, and occasionally high-relief substrate with rocks greater than 1 meter (3.3 ft.) above the seafloor (Figure 4).

The biological community inhabiting these hard substrate habitats is typically dominated by a dense mat of turf species (turf) including a mixture of small hydroids, bryozoans, tunicates, and sponges, multiple species of red and brown algae, the white-plumed anemone (*Metridium farcimen =giganteum*) and the strawberry anemone (*Corynactis californica*). Other species that may also be present at some locations include surf grass (*Phyllospadix sp.)* in the very shallow water depths of this zone, sea anemones (*Actinaria unident.*), swimming anemones (*Stomphia coccinea*), squid (*Loligo sp*.), crab (*Cancer sp*.), masking crab (*L. crispatus*), bat stars (*Asterina miniata*), red sea stars (*M. aequalis),* giant-spined sea stars (*Pisaster giganteus*), other *Pisaster* sea stars, brittle stars (*Ophiura spp*.) and occasionally sea hares (*Aplysia californica*). The presence and occurrence of red and brown algae, as well as the density of solitary corals such as orange cup coral (*Balanophyllia elegans*) and brown cup corals (*Paracyathus stearnsi*), appears to be highly influenced by the level of natural turbidity and periodic burial of exposed hard substrate (AMS 1999a, 1999b, Chambers 1998).

4.2 Habitats and Associated Biota Observed in the 30.5-100 Meter (100-329 ft.) Water Depth Range.

4.2.1 Soft Substrate

Soft substrate habitats in the 30.5-100 m (100-329 ft.) water depth range, where bottom currents or wave energy continue to wash the seafloor, include scattered mixed-bottom, coarse sand, and fine muds. The coarser sand substrates are normally only seen at the shallower water depths of this water depth range. The finer mud substrate is frequently pockmarked with burrow holes (Figures 5 and 6).

The soft substrate macrofauna is typically dominated by several species of sea pens (*Ptilosarcus gurneyi, Stylatula elongata, Acanthoptilum spp., Subselliflorae spp., Virgularia spp.)*, sea slugs (*Pleurobranchea californica*), and sand stars (*L. foliolata*). Also, frequently observed are crabs (*Cancer sp*.), red sea stars (*M. aequalis*), multi-armed sea stars (*Rathbunaster californica*), *Cerianthidae* anemones, swimming anemones (*Stomphia coccinea*), and ornate tubeworms *(D. ornata*). In coarser sediments, brittle stars (*Ophiuroids*) and sunflower stars (*Pycnopodia helianthoides*) predominate. One notable difference between surveys conducted in Central California and Southern California is the presence of the sea cucumber *P. californicus*. It is observed more frequently in Southern California than farther north, at all water depths.

4.2.1 Hard Substrate

Hard substrate habitat types observed in the 30.5-100 m (100-328 ft.) water depth range include mixed-bottom at shallower depths as well as low, moderate, and high-relief bottom towards the deeper end of this water depth range.

The hard substrate community appears to be dominated by turf, encrusting and foliose bryozoans, assorted encrusting sponges, and the white-plumed anemone *M. farcimen* (=*giganteum*) (Figure 6). Also, commonly occurring are brown cup corals (*P. stearnsii*), assorted crabs (*Cancer spp*.), shrimps, red sea stars (*M. aequalis*), swimming anemones (*S. coccinea*), and brittle stars (*Ophiuroids*). Additionally, soft gorgonian corals including *Lophogorgia chiliensis* and *Eugorgia rubens* are occasionally observed.

Figure 4: Mixed bottom, low relief, hard substrate habitat in <30 m of water depth offshore Central California along the SEA-US cable route.

4.3 Habitats and Associated Biota Observed in the 91-200 Meter (300-656 ft.) Water Depth Range.

4.3.1 Soft Substrate

The soft substrate observed in the 91-200 m (300-656 ft.) water depth range is exclusively comprised of fine mud (Figures 7 and 8). The macrobenthic community in this water depth range is characterized by sea pens (*S. elongata, Virgularia spp.*), sand stars (*L. foliolata*), crabs (*Cancer spp*.), and assorted shrimp. Other commonly or frequently occurring taxa include several species of sea anemones (e.g. *Urticina* spp.), multi-armed sea star (*R. californica*), the red sea star (*M. aequalis*), brittle stars (*Amphiodia sp*. and Ophiuroidea), pink sea urchin (*Allocentrotus fragilis*), free-living polychaetes (*Chloeia pinnata*), sea cucumber (*P. californicus*), and sea slugs (*P. californica*).

4.3.2 Hard Substrate

Hard substrate habitat types observed in the 91-200 m (328-656 ft.) water depth range are the same as those present in the 30.5-91 meter (100-300 feet) water depth range. The macrobenthic taxa are similar with turf, cup corals, and the white-plumed anemone being the most often observed. Also, commonly observed are giant basket stars (*Gorgonocephalus eucnemis*), brittle stars (Ophiuroidea), various species of crabs (*Cancer spp*.) and the red sea stars (*M. aequalis*). At some locations, crinoids (e.g. *F. serratissima*) are also commonly observed.

Figure 5: Soft substrate habitat in 30.5-100 m (100-328 ft.) water depth offshore Southern California along the SEA-US Cable Route. Left Photo-shell hash and drift algae. Right photo- *Acanthoptilum spp*. sea pens.

Figure 6: Natural and artificail hard substrate habitat in 30.5-100 m (100-328 ft.) water depth offshore Southern (Left photo) and Central California (right photo). Left photo-debris with attached turf species, *Metridium farcmens* anemone, crab, and rockfish along the SEA-US Cable Route. Right photo- low shelf with turf, cup corals (*Balanophyllia elegans*), sponges, and bryozoans along the AAG-S5 Cable Route.

Figure7: Fine silt and clay soft substrate in100-185 m water depth offshore Southern California. Pink urchins (*Strongylocentrotus fragilis*) along the SEA-US Cable Route.

Figure 8: Fine silt and clay soft substrate in 100-183 m water depth offshore Central California. Spiny sand star (*Astropecten spp*.) and brittle stars along the AAG-S5 Cable Route.

It is at these water depths that deep-water corals have occasionally been reported along fiber optic cable routes. Based on whether current speeds, sedimentation rates, and the occurrence of hig-relief features are favorable, branching hard and soft corals have been reported including the branching white coral *Lophelia sp*. and the California hydrocoral *Stylaster californicus* (= *Allopora californica)*. Note that Cairns (1983) synonymized *A. californica* to *S. californicus*. Because of widespread and historic use and immediate name recognition of "*Allopora*" by most marine scientists, this discussion uses the original name (*Allopora*) to avoid confusion. *Allopora* can also occur in shallower water depths when conditions are favorable, although frequently in a very small, stunted form (Occidental 2008).

5 Fish Communities

The distribution of fish species offshore California is influenced by various combinations of water depth, substrate type, temperature, and ocean currents (Love and Yoklavich 2006). Fish communities along the Central California coast have not been extensively researched and most data are based on commercial and recreational landing data. This data, combined with data from ROV reconnaissance surveys along fiber optic cable routes is the primary basis for describing fish communities in this paper. Although many marine resources, including fishes, are typically distributed by water depth and habitat type, the following description of fish communities is divided by substrate type. A master list of fish species observed during several fiber optic cable and scientific diver surveys near Grover Beach, CA is presented in Appendix A-3. Appendix A-4 presents fish species observed during these surveys by water depth range.

5.1 Hard Substrate

Similar to macroinvertebrate communities discussed above, fish communities in Central California are also highly variable depending on both abiotic and biotic parameters including the presence of reef structure (Pondella *et al.* 2011). Common fish species observed inhabiting or associating with hard substrate habitat, including both mixed bottom, low relief, and high-relief, include Sculpins (Cottidae), Bull sculpin (*Enophrys taurina*), coraline sculpin (*Artedius corallines*), black eyed goby (*Coryphopterus nicholsi*), giant kelpfish (*Heterostichus rostratus*), Rainbow seaperch (*Hypsurus caryi*), White seaperch (*Platchthys stellatus*), Pile perch (*Rhacochilus vacca*), Pink surfperch (*Zalembius rosaceus*), Kelp bass *(Paralabrax clathratus),* Painted greenling *(Oxylebius pictus),* Lingcod *(Ophiodon elongates),* and Senorita (*Oxyjulis california*) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000).

The most common fish assemblages observed occurring on deeper water hard substrate outcroppings are assorted juvenile and adult rockfish including Brown (*Sebastes auriculatus*), Gopher (*S. carnatus*), Copper (*S. caurinus*), Green striped (*S. elongates),* Quillback (*S. maliger),* Rosy (*S. rosaceus),* Half banded (S. *semicinctus*), Olive (*S. serrinoides),* and Tree fish (*S. serriceps)* rockfish (AMS 2008, AMS 1998, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000). Fish species typically observed associated with hard substrate do not appear to be restricted by water depth, at least to 200 m (656 ft.), as illustrated in Appendix A-4. If any water depth delineation occurs in Southern or Central California waters it appears to occur between water depths <30.5 m (100 ft.) and >30.5 m (100 ft.)(Appendix A-4)

Other schooling fish species that have been observed or collected close to hard bottom substrate areas include Poachers (Agonidae), Blue rockfish (*S. mystinus*), schooling baitfish (Atherindae), and speckled sanddabs (*Citharichthys stigmaeus*) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000). These same species are expected to occur in the vicinity of hard bottom features along the Grover Beach Fiber Optic Cable Project's offshore cable routes. For additional species that have been documented over hard substrates in south Central California see Appendix A-3.

5.2 Soft Substrate

Soft bottom habitat is the most widespread benthic habitat on the California shelf (Dugan *et al*. 2015, Allen 2006; Allen *et al.* 2011). Demersal fishes occupying this habitat are relatively sedentary compared to pelagic fish species and respond more readily to changes in the benthic environment. Fishes found in soft-bottom habitats in south Central California are typified by flatfishes, such as Sanddabs, including speckled (*Citharichthys stigmaeus*) and Pacific (*C. sordidus*), Dover sole (*Microstomus pacificus*), English sole (*Pleuronectes vetulas*), assorted soles (Pleuronectidae), California halibut (*Paralichthys californicus*), Poachers (Agonidae), Tubesnout (*Aulorhynchus flavidus*), spotted cuskeels (*Chilara taylori*), Longspine combfish (*Zaniolepsis latispinnus*), black eyed gobys (*C. nicholsi*), Pacific hagfish (*Eptatretus stouti*), Spotted ratfish (*Hydrolagus colliei*), California tonguefish (*Symphurus atricauda*), Pacific electric ray (*Torpedo californica*), Banded guitarfish (*Zapteryx exasperate*) and Eelpouts (*Lycodes* spp) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000). Larger predators include Big skate (*Raja binoculata*), Longnose skate (R. *shina*), Pacific angel shark (*Squatina californica*), Swell shark (*Cephaloscyllium ventriosum*) and Great white shark (*Carcharodon carcharias).* As discussed above for fish species associated with hard substrate habitat, water depths <200 m (656 ft.) does not appear to be a big delineator for soft substrate associating fish (Appendix A-4).

Pelagic species that are common in waters offshore Grover Beach include Northern anchovy (*Engraulis mordax*), White croaker (*Genyonfemus lineatus*), and both juvenile and adult rockfish including Olive rockfish (*S. serrinoides/flavidus*) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000) (Appendix A-3 and A-4).

5.3 Magnuson-Stevens Act Managed Fish Species

In accordance with the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act (MSA), Essential Fish Habitat (EFH) is defined as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Central California coincides with areas designated as EFH in all four Fishery Management Plans (FMPs): the Pacific Coast Groundfish FMP (PFMC 2016b), the Coastal Pelagic Species FMP (PFMC 2018a), Pacific Coast Salmon FMP (PFMC 2016a), and the Highly Migratory Species FMP (PFMC 2018b).

Most of the 85-groundfish species managed under the Pacific Groundfish FMP are found at various stages in their life histories in diverse habitats throughout the Central California. Some species are broadly dispersed during specific life stages, especially those with pelagic eggs and larvae, while other species may have limited distributions (i.e. adult rockfishes in nearshore habitats) with strong affinities to a particular location or substrate type. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" such as seamounts, offshore banks, canyons are designated Habitat Areas of Particular Concern (HAPC) for groundfish managed species. Figure 9 illustrates the locations of NMFS designated HAPCs along the California coast and specifically those occurring along the proposed BtoBE fiber optic cable route.

Fish species managed under the Pacific Groundfish FMP, known to inhabit the coastal waters of Central California, that have been observed during reviewed seafloor habitat and biological community surveys offshore Grover Beach, Montana Del Orro, and Estero Bay, include four flatfishes, 33 rockfishes (*Sebastes* spp.), the California scorpionfish, two different Thornyheads (*Sebastolobus* spp.), and five different roundfishes (Cabezon, Kelp greenling, Lingcod, Pacific cod, and Sablefish). There are also four different elasmobranchs (Big skate, Leopard shark, Longnose skate, and Spiny dogfish) managed under this plan that are known or expected to occur offshore Grover Beach (Table 4-1, Appendix A-3 and A-4).

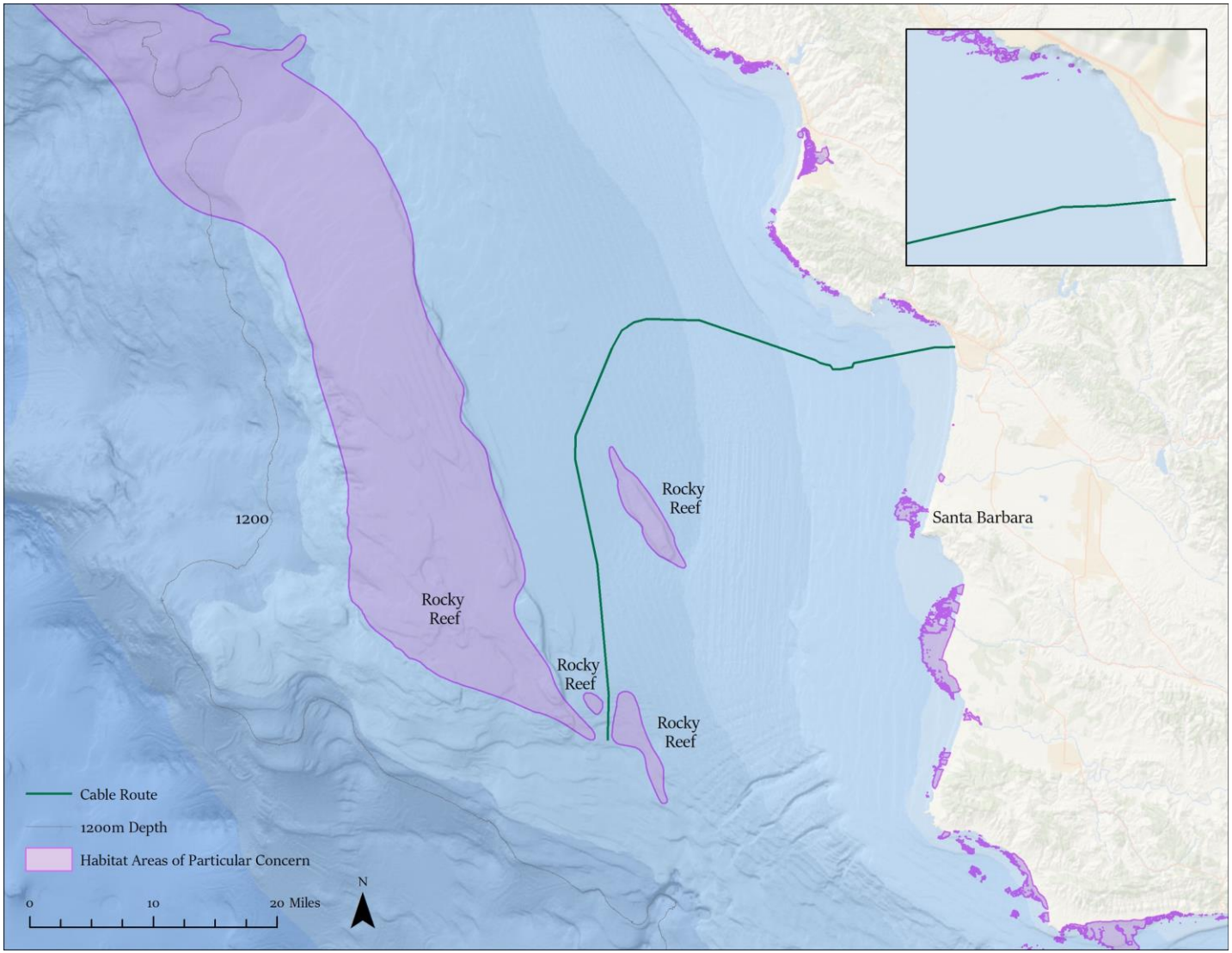

Figure 9: Habitat Areas of Special Concern (HAPC) Offshore Grover Beach in Central California.

Coastal Pelagic fish species live in the water column, not near the sea floor, and are usually found from the surface to >1,000 m (3,281 ft.) water depth (PFMC 2018a). There are 6 stocks of coastal pelagic fish species managed under the CPS FMP, including Jack mackerel (*Traxchurus symmetricus*), Pacific chub mackerel (*Scomber japonicas*), Pacific sardine (*Sardinops sagax*), market squid (*Doryteuthis opalescens*), Northern anchovy (*E. mordax)* and krill or euphausiids (*Euphausia* spp., *Thysanoessa* spp., *Nyctiphanes simplex, and Nematocelis difficilis*). Additionally, Jacksmelt (*Atherinopsis californiensis*) and Pacific herring (*Clupea pallasii*) are considered ecosystem components of the fishery and are also monitored. All of these species, with the exception of Pacific herring and Northern anchovy, are commonly observed and harvested in the coastal waters offshore Grover Beach (Table 4-1 and 4-2).

The Pacific Coast Salmon FMP (2016a) outlines spatially explicit EFH for chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), and Puget Sound pink (*Oncorhynchus* gorbuscha) salmon. While inland spawning habitat is considered to be the most essential to these species (all areas designated as HAPC for salmon are inland), all three are still present in marine coastal waters. The marine EFH for all three species extends from the inland extreme high tide line out to the 200-mile Exclusive Economic Zone offshore of the states of Washington, Oregon, and California north of Point Conception. Grover Beach is therefore located near the southern boundary of this EFH. Chinook are more commonly found off the coast of California, but Coho and Puget Sound pink, while uncommon, can also be present (Table 4-1 and 4-2).

EFH for Highly Migratory Species includes all marine waters from the shoreline to 200 nautical miles (370 km) offshore. There are three species of shark managed under the Highly Migratory Species FMP; Blue shark (*Prionace glauca*), Common thresher shark (*Alopias vulpinus*), and Shortfin mako shark (*Isurus oxyrinchus*). In addition, there are five species of tunas managed under this plan including Bigeye tuna (*T. obesus*), North Pacific albacore (*Thunnus alalunga*), Pacific bluefin tuna (*T. orientalis*), Yellowfin tuna (*T. albacares*), and Skipjack tuna (*Katsuwonus pelamis*) (Table 4-1 and 4-2). Striped marlin (*Kajikia audax*) is the only species of billfish managed under the Highly Migratory Species management plan. Broadbill swordfish (*Xiphias gladius*) is the only species of swordfish and dorado/mahi mahi (*Coryphaena hippurus*) is the only species of dolphin fish managed under this plan. All of these species are known to occur in the nearshore and offshore waters adjacent to Grover Beach. The common thresher shark, North Pacific albacore, and Swordfish are also known to be present (Table 4-1 and 4-2).

5.4 Commercial and Recreational Fishing

The coastal waters of Central California are extensively used for both commercial and recreational fishing. Although more than 80 fish species or groups were commercially landed at Morro Bay and Port San Luis between 2013 and 2017, 15 of them accounted for 94% of the landings based on tonnage (Table 4-2). Those taxa that account individually for more than 0.7% of the total landings between 2013 and 2017 include Market squid (*Doryteuthis opalescens)*, Dungeness Crab (*Metacarcinus magister)*, Sablefish (*Anoplopoma fimbria)*, Hagfish (Myxini), Ocean pink shrimp (*Pandalus jordani*), Dover sole (*M. pacificus)*, Shortspine thornyhead (*Sebastolobus alascanus)*, *Longspine thornyhead (S. altivelis)*, Petrale sole (*E. jordani)*, Lingcod (*O. elongates)*, assorted Rockfish including Bank (*S. rufus)*, Brown (*S. auriculatus*), Gopher (*S. carnatus)*, and Chinook salmon (*Onchorynchus tshawytscha*). Commercial fishing methods employed include trolling, trawling, and trapping.

Recreational fishing, conducted from rocky shores, sandy beaches, docks, private boats, and commercial party boats, landed approximately 100 fish taxa between 2013 and 2017 (Table 4-3). However, 19 of these taxa accounted for more than 91% of the landings in tonnage or in individual numbers of fish landed. The dominant fish taxa caught by recreational fisherman include Lingcod (*O. elongates*),

assorted species of rockfish including Blue, Vermillion, Yellowtail, Gopher, Copper, Brown, Black, Olive, Boccacio, Kelp, and Canary (*S. mystinus, S. miniatus, S. flavidus, S. caratus, S. caurinus, S. auriculatus, S. malanops, S. serranoides, S. paucispinis, S. astrovirens, S. pinniger*, respectively)), Cabezon (*Scorpaenichthys marmoratus*), Barred surfperch (*Amphistichus argenteus*), Dungeness crab (M. magister), California Halibut (*P. californicus)*, Jacksmelt (*A. californiensis*), Pacific chub mackerel (*Trachurus symmetricus*), and Pacific sanddab (*C. sordidus*), (Table 4-3).

6 Species of Special Concern

Inhabiting California's coastal subtidal region are several species of special concern, which includes species protected under the Federal Endangered Species Act (FESA); the California Endangered Species Act (CESA); the Marine Mammal Protection Act (MMPA); the California Fish and Game Code; the National Oceanic and Atmospheric Administration (NOAA) species of concern lists; the U.S. Fish and Wildlife Service; the California Department of Fish and Wildlife (CDFW); or State or Federal agencies, such as the California Coastal Commission (CCC) that designate species as having a scientific, recreational, ecological, or commercial importance. Table 5-1 provides a listing of all species of special concern that have any potential to be present offshore Grover Beach. Under FESA, CESA, and the MMPA, the marine mammals and sea turtles discussed in Section 6 (Marine Mammals & Sea Turtles) are all considered species of special concern. There are FESA/CESA protected and MSA managed fish species that are considered species of special concern and are similarly discussed in Section 5 (Fish Communities) above. Finally, there are marine birds that are FESA, CESA, or protected under the Federal Migratory Bird Act, that are not part of this study which is focused on marine aquatic resources.

TABLE 4-1
MAGNUSON-STEVENS ACT MANAGED FISH AND INVERTEBRATE SPECIES

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage[1]	Occurrence in Proximity to Grover Beach Site[2]
Coastal Pelagic	Jack mackerel	*Trachurus symmetricus*	E, L, J, A	Common
	Jacksmelt	*Atherinopsis californiensis*	E, L, J, A	Present
	Krill or Euphausiids	*Euphausia pacifica, Thysanoessa spinifera, Nyctiphanes simplex, Nematocelis difficilis, T. gregaria, E. recurva, E. gibboides, E. eximia*	E, L, J, A	Present
	Market squid	*Doryteuthis opalescens*	E, L, J, A	Common
	Northern anchovy	*Engraulis mordax*	E, L, J, A	Present
	Pacific herring	*Clupea pallasii pallasii*	E, L, J, A	Uncommon
	Pacific (chub) mackerel	*Scomber japonicus*	E, L, J, A	Common
	Pacific sardine	*Sardinops sagax*	E, L, J, A	Present
Pacific Groundfish	Cabezon	*Scorpaenichthys marmoratus*	E, L, J, A	Common
(Dashed lines separate	Kelp greenling	*Hexagrammos decagrammus*	E, L, J, A	Present
Roundfish,	Lingcod	*Ophiodon elongatus*	E, L, J, A	Common
Rockfish,	Pacific Cod	*Gadus macrocephalus*	E, L, J, A	Present
Elasmobranchs,	Pacific Whiting (Hake)	*Merluccius productus*	E, L, J, A	Uncommon
and Flatfish,	Sablefish	*Anoplopoma fimbria*	E, L, J, A	Common
respectively)	Aurora rockfish	*Sebastes aurora*	E, L, J, A	Uncommon
	Bank rockfish	*Sebastes rufus*	E, L, J, A	Present
	Black rockfish	*Sebastes melanops*	E, L, J, A	Common
	Black-and-yellow rockfish	*Sebastes chrysomelas*	E, L, J, A	Present
	Blackgill rockfish	*Sebastes melanostomus*	E, L, J, A	Present
	Blue rockfish	*Sebastes melanostomus*	E, L, J, A	Common
	Bocaccio rockfish	*Sebastes paucispinis*	E, L, J, A	Common
	Bronze spotted rockfish	*Sebastes gilli*	E, L, J, A	Uncommon

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage[1]	Occurrence in Proximity to Grover Beach Site[2]
	Brown rockfish	*Sebastes auriculatus*	E, L, J, A	Common
	Calico rockfish	*Sebastes dalli*	E, L, J, A	Uncommon
	California scorpionfish	*Scorpaena gutatta*	E, L, J, A	Present
	Canary rockfish	*Sebastes pinniger*	E, I, J, A	Present
	Chameleon rockfish	*Sebastes phillipsi*	E, L, J, A	Present
	Chillipepper rockfish	*Sebastes goodei*	E, L, J, A	Present
	China rockfish	*Sebastes nebulosus*	E, L, J, A	Present
	Copper rockfish	*Sebastes caurinus*	E, L, J, A	Common
	Cowcod	*Sebastes levis*	E, L, J, A	Uncommon
	Darkblotched rockfish	*Sebastes crameri*	E, L, J, A	Uncommon
	Deacon rockfish	*Sebastes diaconus*		Absent
	Dusky rockfish	*Sebastes ciliatus*		Absent
	Dwarf-red rockfish	*Sebastes rufinanus*		Absent
	Flag rockfish	*Sebastes rubrivinctus*	E, L, J, A	Uncommon
	Freckled rockfish	*Sebastes lentiginosus*	E, L, J, A	Absent
	Gopher rockfish	*Sebastes carnatus*	E, L, J, A	Common
	Grass rockfish	*Sebastes rastrelliger*	E, L, J, A	Present
	Greenblotched rockfish	*Sebastes rosenblatti*	E, L, J, A	Uncommon
	Greenspotted rockfish	*Sebastes chlorostictus*	E, L, J, A	Present
	Greenstriped rockfish	*Sebastes elongatus*	E, L, J, A	Uncommon
	Harlequin rockfish	*Sebastes variegatus*		Absent
	Halfbanded rockfish	*Sebastes semicinctus*	E, L, J, A	Uncommon
	Honeycomb rockfish	*Sebastes umbrosus*	E, L, J, A	Present
	Kelp rockfish	*Sebastes atrovirens*	E, L, J, A	Common
	Longspine thornyhead	*Sebastolobus altivelis*	E, L, J, A	Common
	Mexican rockfish	*Sebastes macdonaldi*	E, L, J, A	Uncommon
	Olive rockfish	*Sebastes serranoides*	E, L, J, A	Common
	Pacific ocean perch	*Sebastes alutus*	E, L, J, A	Uncommon
	Pink rockfish	*Sebastes eos*	E, L, J, A	Uncommon
	Pinkrose rockfish	*Sebastes simulator*		Absent
	Quillback rockfish	*Sebastes maliger*	E, L, J, A	Uncommon
	Redbanded rockfish	*Sebastes babcocki*	E, L, J, A	Uncommon
	Redstripe rockfish	*Sebastes proriger*		Absent
	Rosethorn rockfish	*Sebastes helvomaculatus*	E, L, J, A	Uncommon
	Rosy rockfish	*Sebastes rosaceus*	E, L, J, A	Present
	Rougheye rockfish	*Sebastes aleutianus*	E, L, J, A	Uncommon
	Sharpchin rockfish	*Sebastes zacentrus*	E, L, J, A	Uncommon
	Shortbelly rockfish	*Sebastes jordani*	E, L, J, A	Uncommon
	Shortraker rockfish	*Sebastes borealis*	E, L, J, A	Uncommon
	Shortspine thornyhead	*Sebastolobus alascanus*	E, L, J, A	Common
	Silvergray rockfish	*Sebastes brevispinis*	E, L, J, A	Uncommon
	Speckled rockfish	*Sebastes ovalis*	E, L, J, A	Present
	Splitnose rockfish	*Sebastes diploproa*	E, L, J, A	Uncommon
	Squarespot rockfish	*Sebastes hopkinsi*	E, L, J, A	Uncommon
	Sunset rockfish	*Sebastes crocotulus*	E, L, J, A	Common
	Starry rockfish	*Sebastes constellatus*	E, L, J, A	Present
	Stripetail rockfish	*Sebastes saxicola*	E, L, J, A	Uncommon
	Swordspine rockfish	*Sebastes ensifer*	E, L, J, A	Uncommon
	Tiger rockfish	*Sebastes nigrocinctus*	E, L, J, A	Uncommon
	Treefish rockfish	*Sebastes serriceps*	E, L, J, A	Present
	Vermillion rockfish	*Sebastes miniatus*	E, L, J, A	Common
	Widow rockfish	*Sebastes entomelas*	E, L, J, A	Present
	Yelloweye rockfish	*Sebastes ruberrimus*	E, L, J, A	Uncommon
	Yellowmouth rockfish	*Sebastes reedi*		Absent
	Yellowtail rockfish	*Sebastes flavidus*	E, L, J, A	Common
	Big skate	*Raja binoculata*	E, L, J, A	Uncommon
	Leopard shark	*Triakis semifasciata*	E, L, J, A	Present
	Longnose skate	*Raja rhina*	E, L, J, A	Present
	Spiny dogfish	*Squalus suckleyi*	E, L, J, A	Present
	Arrowtooth flounder (turbot)	*Atheresthes stomias*	E, L, J, A	Uncommon
	Butter sole	*Isopsetta isolepis*	E, L, J, A	Uncommon
	Curlfin sole	*Pleuronichthys decurrens*	E, L, J, A	Uncommon
	Dover sole	*Microstomus pacificus*	E, L, J, A	Present
	English sole	*Parophrys vetulus*	E, L, J, A	Uncommon

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage[1]	Occurrence in Proximity to Grover Beach Site[2]
	Flathead sole	*Hippoglossoides elassodon*		Absent
	Pacific sanddab	*Citharichthys sordidus*	E, L, J, A	Common
	Petrale sole	*Eopsetta jordani*	E, L, J, A	Present
	Rex sole	*Glyptocephalus zachirus*	E, L, J, A	Uncommon
	Rock sole	*Lepidopsetta bilineata*	E, L, J, A	Uncommon
	Sand sole	*Psettichthys melanostictus*	E, L, J, A	Present
	Starry flounder	*Platichthys stellatus*	E, L, J, A	Present
Salmon	Chinook Salmon	*Oncorhynchus tshawytscha*	A	Present
	Coho Salmon	*Oncorhynchus kisutch*	A	Uncommon
	Pink Salmon	*Oncorhynchus gorbuscha*	A	Uncommon
Highly Migratory	Bigeye tuna	*Thunnus obesus*	A	Uncommon
	Blue Shark	*Prionace glauca*	A	Uncommon
	Common thresher shark	*Alopias vulpinus*	A	Present
	Dorado (mahi mahi, dolphinfish)	*Coryphaena hippurus*	A	Uncommon
	North Pacific Albacore	*Thunnus alalunga*	A	Present
	Pacific bluefin tuna	*Thunnis orientalis*	A	Uncommon
	Shortfin mako (bonito) shark	*Isurus oxyrinchus*	A	Uncommon
	Skipjack tuna	*Katsuwonus pelamis*	A	Uncommon
	Swordfish	*Xiphias gladius*	A	Present
	Striped marlin	*Tetrapturus audax*	A	Uncommon
	Yellowfin tuna	*Thunnus albacares*	A	Uncommon
All FMPs	Mesopelagic fishes	Families: *Myctophidae, Bathyalgidae, Paralepididae, and Gonostomatidae*		Absent
	Pacific sand lance	*Ammodytes hexapterus*	E, L, J, A	Uncommon
	Pacific saury	*Cololabis saira*	A	Uncommon
	Pelagic squids	Families: *Cranchiidae, Gonatidae, Histioteuthidae, Octopoteuhidae, Ommastrephidae* except Humboldt squid (*Dosidicus gigas*), *Onychoteuthidae, and Thysanoteuthidae*	E, L, J, A	Present
	Round Herring	*Etrumeus teres*		Absent
	Silversides	*Atherinopsidae*	E, L, J, A	Uncommon
	Smelts	*Osmeridae*	E, L, J, A	Present
	Thread herring	*Opisthonema libertate, Opisthonema medirastre*		Absent

[1]**E** = Egg, **L** = Larvae, **J** = Juvenile, **A** = Adult

[2]**Common** = Species that comprise the top 90% of commercial and/or recreational landings in thousands of pounds between 2013-2018.

Present = Species that comprise 9% of commercial and/or recreational landings in thousands of pounds between 2013-2018
Uncommon = Species that comprise the bottom 1% of commercial and/or recreational landings in thousands of pounds between 2013-2018

Absent = Not found within project area

Notes: Species not listed in landings data were assigned categories based on the factors of distribution, range, and life history.

Sources: CDFW Final California Commercial Landings Table 14MB, 2013 – 2018; PSMFC RecFIN Recreational Landings for Santa Cruz, Monterey, and San Luis Obispo Counties (Central California Region), 2013 – 2018; www.fishbase.org

Table 4-2: Morro Bay, CA Annual Commercial Landings in Thousand Pounds: CDFW 2013 – 2017

Common Name	Genus Species	2017	2016	2015	2014	2013	Mean	% Total Catch
Squid, market	*Doryteuthis opalescens*	2,297.0	1,413	1,260	4,322	4,266	2,2	47.58%
Crab, Dungeness	*Metacarcinus magister*	687.5	870.8	672.9	735.1	534.2	700.1	12.29%
Sablefish	*Anoplopoma fimbria*	361.5	551.0	519.7	726.4	722.1	576.1	10.11%
Hagfishes	*Myxini*	663.9	635.1	500.6	440.9	517.1	551.5	9.68%
Shrimp, ocean (pink)	*Pandalus jordani*	195.8	718.1	0.0	0.0	0.0	456.9	3.21%
Sole, Dover	*Microstomus pacificus*	11.5	92.8	143.2	159.0	240.9	129.5	2.27%
Thornyhead, shortspine	*Sebastolobus alascanus*	54.5	90.5	123.0	115.0	174.4	111.5	1.96%
Sole, petrale	*Eopsetta jordani*	53.6	108.4	78.3	91.3	81.8	82.7	1.45%
Lingcod	*Ophiodon elongatus*	43.4	46.1	61.8	62.4	36.6	50.1	0.88%
Thornyhead, longspine	*Sebastolobus altivelis*	8.4	24.7	24.2	43.5	108.6	41.9	0.74%
Rockfish, gopher	*Sebastes carnatus*	42.9	39.5	46.0	40.9	40.3	41.9	0.74%
Crab, rock unspecified	*NA*	18.7	32.0	74.4	13.5	70.6	41.8	0.73%
Rockfish, bank	*Sebastes rufus*	12.9	29.3	32.4	58.4	65.4	39.7	0.70%
Rockfish, brown	*Sebastes auriculatus*	27.6	33.8	42.3	43.1	48.9	39.1	0.69%
Salmon, Chinook	*Oncorhynchus tshawytscha*	27.7	29.0	36.2	18.7	68.6	36.1	0.63%
Cabezon	*Scorpaenichthys marmoratus*	24.8	36.8	39.6	34.5	31.8	33.5	0.59%
Crab, red rock	*Cancer productus*	37.7	37.4	22.8	28.5	7.1	26.7	0.47%
Rockfish, chillipepper	*Sebastes goodei*	3.1	58.6	36.2	22.0	11.6	26.3	0.46%
Grenadier	*Macrouridae*	7.3	20.0	15.9	31.3	51.3	25.2	0.44%
Swordfish	*Xiphias gladius*	45.9	27.2	16.3	8.7	12.7	22.2	0.39%
Prawn, spot	*Pandalus platyceros*	18.9	21.2	22.7	15.4	21.4	19.9	0.35%
Rockfish, vermilion	*Sebastes miniatus*	16.9	16.1	20.2	18.2	18.0	17.9	0.31%
Rockfish, blackgill	*Sebastes melanostomus*	12.5	12.5	5.6	13.6	42.1	17.2	0.30%
Rockfish, black and yellow	*Sebastes chrysomelas*	18.6	15.5	17.5	15.6	15.9	16.6	0.29%
Halibut, California	*Paralichthys californicus*	21.0	18.5	14.2	7.3	12.1	14.6	0.26%
Crab, brown rock	*Cancer pagurus*	17.7	42.5	1.2	1.1	0.0	15.6	0.22%
Rockfish, grass	*Sebastes rastrelliger*	9.9	7.9	15.1	9.9	11.7	10.9	0.19%
Surfperch, barred	*Amphistichus argenteus*	5.8	13.2	22.7	7.3	5.5	10.9	0.19%
Skate, longnose	*Raja rhina*	0.3	0.4	2.9	2.9	34.9	8.3	0.15%
Rockfish, bocaccio	*Sebastes paucispinis*	4.5	19.0	8.6	3.2	2.3	7.5	0.13%
Seabass, white	*Atractoscion nobilis*	7.1	4.4	4.9	11.3	1.8	5.9	0.10%
Opah	*Lampris*	16.2	4.9	2.5	2.3	3.4	5.8	0.10%
Shark, thresher	*Alopias vulpinus*	6.7	2.9	13.0	2.1	1.5	5.3	0.09%
Tuna, albacore	*Thunnus alalunga*	3.5	2.3	3.0	4.9	11.2	5.0	0.09%
Sole, sand	*Psettichthys melanostictus*	0.4	0.3	9.3	5.2	7.0	4.4	0.08%
Greenling, kelp	*Hexagrammos decagrammus*	2.8	3.7	5.3	4.9	4.9	4.3	0.08%

Data source: CDFW Final California Commercial Landings, Table 14MB: 2013 - 2017. Species shown account for 99% of mean annual commercial landings in pounds in the Morro Bay area. Fished species comprising the remaining 1% include: Rockfish, treefish; Rockfish, blue; Sardine, Pacific; Crab, yellow rock; Rockfish, copper; Shark, shortfin mako; Tuna, bluefin; Rockfish, splitnose; Whiting, Pacific; Sole, English; Rockfish, black; Anchovy, northern; Surfperch, unspecified; Rockfish, aurora; Whelk, Kellet's; Prawn, ridgeback; Sanddab, Pacific; Mackerel, Pacific; Sheephead, California; Flounder, starry; Sea urchin, red; Bonito, Pacific; Rockfish, kelp; Rockfish, yellowtail; Sea cucumber, warty; Shark, Pacific angel; Shark, unspecified; Shark, sevengill; Shark, soupfin; Surfperch, calico; Barracuda, California; Sole, rex; Sole, unspecified; Skate, unspecified; Rockfish, widow; Louvar; Rockfish, group shelf; Crab, spider; Tuna, skipjack; Sea cucumber, giant red; Lobster, California

spiny; Skate, big; Rockfish, China; Rockfish, group red; Rockfish, olive; Rockfish, canary; Rockfish, darkblotched; Yellowtail; Rockfish, cowcod; Rockfish, redbanded; Lizardfish, California; Jacksmelt, Octopus unspecified; Turbot; Sole, fantail; Rockfish, group slope; Rockfish, starry; Tuna, yellowfin; Whitefish, ocean; Ray, bat; Sole, rock; Rockfish, unspecified; Shark, spiny dogfish; Shark, leopard; Crab, tanner; Smelt, night; Prickleback, monkeyface (eel); Croaker, white; Shark, swell; Flounder, unspecified; Splittail; Snail, sea; Squid, jumbo; Sole, curlfin; Rockfish, Mexican; Surfperch, shiner; Rockfish, bronzespotted; Scorpionfish, California; Mackerel, unspecified; Halfmoon; Ray, unspecified; Surfperch, pile; Skate, California; Guitarfish, shovelnose; Rockfish, speckled; Surfperch, redtail; Smelt, surf; Rockfish, yelloweye; Rockfish, quillback; Stingray; Pomfret, Pacific; Shark, blue; Shad, American; Rockfish, rosy; Shrimp, bay; Surfperch, rubberlip; Rockfish, greenspotted; Butterfish (Pacific pompano); Seabass, striped; Mackerel, jack; Turbot, curlfin; Ray, Pacific electric; Rockfish, flag; Rockfish, Pacific ocean perch; Rockfish, group bolina; Thornyheads; Shark, brown smoothhound; Ratfish, spotted; Rockfish, greenstriped; Crab, box; Rockfish, shortbelly; Shark, sixgill; Sunfish, ocean; Sanddab; Skate, thornback; Fish, unspecified; Flounder, arrowtooth; Rockfish, greenblotched; Kelpfishes; Rockfish, rougheye; Surfperch, silver; Rockfish, stripetail; Surfperch, black; Crab, spider/sheep claws; Rockfish, pink; Rockfish, shortraker; Sole, slender.

Table 4-3: Central California Annual Recreational Fish & Invertebrate Landings: RecFin 2013 - 2018

Fish Species		Recreational Landings (metric tons)							
Common Name	**Genus Species**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Total Catch**
Lingcod	*Ophiodon elongatus*	41.0	164.0	184.6	216.2	215.2	150.1	161.9	23.57%
Rockfish, vermilion	*Sebastes miniatus*	63.7	121.2	79.2	79.6	55.9	41.1	73.5	10.70%
Surfperch, barred	*Amphistichus argenteus*	0.4	83.8	103.4	128.4	64.0	47.5	71.2	10.37%
Rockfish, blue	*Sebastes mystinus*	26.5	81.9	83.1	91.0	74.5	48.6	67.6	9.84%
Rockfish, yellowtail	*Sebastes flavidus*	15.0	26.4	18.0	49.7	35.7	36.1	30.2	4.39%
Rockfish, gopher	*Sebastes carnatus*	8.2	27.0	41.4	34.9	36.2	22.5	28.4	4.13%
Rockfish, copper	*Sebastes caurinus*	17.0	54.5	30.2	24.1	18.6	12.9	26.2	3.82%
Rockfish, brown	*Sebastes auriculatus*	9.9	23.7	18.8	21.5	41.5	33.1	24.7	3.60%
Rockfish, black	*Sebastes melanops*	1.9	4.2	16.0	18.5	24.4	54.7	20.0	2.90%
Rockfish Genus	*Sebastes*	0.0	0.0	0.0	6.1	13.7	76.6	16.1	2.34%
Sanddab, Pacific	*Citharichthys sordidus*	4.3	9.8	11.1	12.0	36.5	7.5	13.5	1.97%
Rockfish, olive	*Sebastes serranoides*	6.7	14.1	21.1	21.9	10.8	3.5	13.0	1.89%
Cabezon	*Scorpaenichthys marmoratus*	1.6	9.4	16.4	18.2	18.0	11.9	12.6	1.83%
Rockfish, bocaccio	*Sebastes paucispinis*	10.6	39.9	8.6	6.8	5.1	4.3	12.6	1.83%
Mackerel, Pacific (Chub)	*Trachurus symmetricus*	0.3	1.6	7.6	47.9	8.5	2.4	11.4	1.66%
Halibut, California	*Paralichthys californicus*	7.6	6.7	6.4	6.7	23.1	16.9	11.2	1.63%
Smelt, Jacksmelt	*Atherinopsis californiensis*	1.6	11.8	6.8	17.0	9.1	11.8	9.7	1.41%
Crab, dungeness	*Metacarcinus magister*						39.9	39.9	0.97%
Rockfish, kelp	*Sebastes atrovirens*	1.1	7.3	6.6	6.6	8.0	8.7	6.4	0.93%
Rockfish, canary	*Sebastes pinniger*	8.5	26.6	0.5	0.4	0.7	0.5	6.2	0.90%
Seaperch, striped	*Embiotoca lateralis*	0.0	8.0	4.6	6.1	5.2	5.8	5.0	0.72%
Rockfish, black and yellow	*Sebastes chrysomelas*	1.1	8.2	3.5	6.8	5.5	3.9	4.8	0.70%
Bass, striped	*Morone saxatilis*	0.2	3.3	8.4	12.5	0.0	2.3	4.4	0.65%
Rockfish, starry	*Sebastes constellatus*	3.8	7.7	3.0	3.5	2.3	2.8	3.9	0.56%
Rockfish, grass	*Sebastes rastrelliger*	0.3	3.5	2.7	4.4	5.3	4.7	3.5	0.51%
Bonito, Pacific	*Sarda lineolata*		0.2	1.3	18.1	0.5		5.0	0.49%
Greenling, kelp	*Hexagrammos decagrammus*	0.2	4.7	2.1	5.0	3.2	2.8	3.0	0.44%
Surfperch, calico	*Amphistichus koelzi*	0.1	1.8	3.4	5.3	2.5	4.6	3.0	0.43%
Mackerel, Jack	*Trachurus symmetricus*	0.2	8.9	1.1	5.0	2.1	0.3	2.9	0.43%
Seabass, white	*Atractoscion nobilis*	0.6	2.0	0.8	1.7	9.1	0.2	2.4	0.35%
Croaker, white	*Genyonemus lineatus*	0.6	2.5	0.8	1.9	3.5	3.3	2.1	0.31%
Surfperch, walleye	*Hyperprosopon argenteum*	0.3	2.1	1.3	1.2	2.1	3.0	1.7	0.24%
Rockfish, China	*Sebastes nebulosus*	0.6	1.6	2.1	2.2	1.9	1.2	1.6	0.23%
Rockfish, widow	*Sebastes entomelas*	2.6	1.9	0.4	1.3	2.1	1.1	1.6	0.23%
Surfperch, silver	*Hyperprosopon ellipticum*	0.0	1.9	2.2	3.3	0.7	1.2	1.5	0.23%

Fish Species		Recreational Landings (metric tons)							
Common Name	**Genus Species**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Total Catch**
Squid Class	*Cephalopoda*					0.0	8.0	4.0	0.19%
Common Name	**Genus Species**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Total Catch**
Surfperch, black	*Embiotoca jacksoni*	0.0	2.2	1.5	1.6	1.3	0.4	1.2	0.17%
Rockfish, treefish	*Sebastes serriceps*	0.5	1.5	1.2	1.7	1.5	0.6	1.2	0.17%
Rockfish, greenspotted	*Sebastes chlorostictus*	1.8	4.2	0.1	0.1	0.2	0.6	1.2	0.17%
Skate, big	*Beringraja binoculata*			0.0	0.0	0.0	6.4	1.6	0.16%
Anchovy, northern	*Engraulis mordax*	0.7	2.1	0.0	0.4	1.9	0.3	0.9	0.13%
Rockfish, rosy	*Sebastes rosaceus*	1.3	1.7	0.7	0.6	0.6	0.5	0.9	0.13%
Eel, monkeyface prickleback	*Cebidichthys violaceus*	0.0	0.8	0.6	1.3	1.0	1.3	0.8	0.12%
Perch, pile	*Rhacochilus vacca*	0.3	1.6	0.5	0.5	1.2	0.5	0.8	0.11%
Sardine, Pacific	*Citharichthys sordidus*	0.1	0.1	0.4	0.6	2.3	0.9	0.7	0.11%
Ray, bat	*Myliobatis californica*	0.0	1.2	1.4	0.4	1.2	0.1	0.7	0.11%
Shark, spiny dogfish	*Squalus acanthias*	1.5	1.3	0.0	0.3	0.5	0.3	0.7	0.10%
Surfperch Family	*Embiotocidae*	0.0	0.0	0.0	0.1	1.6	2.3	0.7	0.09%

Data Source: PSMFC RecFIN, Central California (San Luis Obispo, Monterey, and Santa Cruz Counties) 2013 – 2018. Species shown account for 99% of mean annual recreational landings in metric tons in the Santa Cruz – San Luis Obispo region. Fished species comprising the remaining 1% include: Unidentified Fish; Flounder, starry; Crab, red rock; Lizardfish, California; California Sheephead; Shark, unidentified; Rockfish, flag; Guitarfish, shovelnose; Perch, shiner; Skate And Ray Order; Sole, rock; Shark, leopard; Seaperch, rubberlip; Eel, wolf; Whitefish, ocean; Seaperch, white; Seaperch, rainbow; Greenling, rock; Rockfish, speckled; Sole, sand; Halfmoon; Sole, petrale; Sculpin, Pacific staghorn; Opaleye; Sablefish; Rockfish, yelloweye; Blacksmith; Rockfish, quillback; Barracuda, Pacific; Surfperch, redtail; Smelt, Topsmelt; Seaperch, sharpnose; Rockfish, squarespot; Sculpin Family; Shark, soupfin; Rockfish, greenstriped; Rockfish, chilipepper; Bass, kelp; Rockfish, calico; Lizardfish, California; Herring, Pacific; Thornback; Cowcod; Flatfish Order; Silverside Family; Rockfish, tiger; Rockfish, stripetail; Kelpfish, giant; Shark, gray smoothhound; Shark, brown smoothhound; Triggerfish, finescale; Surfperch, spotfin; Eulachon; Pompano, Pacific (Butterfish); Rockfish, bank; Sanddab Genus; Sanddab, speckled; Greenling, painted; Rockfish, greenblotched; Senorita; Sanddab, longfin; Skate, Longnose; Turbot, diamond; Sole, curlfin.

The following discussion is primarily focused on marine invertebrates and algae that inhabit the coastal subtidal waters of south central and northern Southern California out to approximately 1,200 m (3,937 ft.) water depth. The sub-sections below discuss specific species of concern inhabiting subtidal soft and hard substrate habitats offshore Grover Beach that may be at greater risk to fiber optic cable installations than other marine biota.

6.2 FESA/CESA Protected Invertebrate Species

6.2.1 Soft Substrate Species

Sand dollars (*D. excentricus*) are considered by some California agencies as a species of special concern. They form dense beds in the shallow subtidal zone of open sandy beaches in water depths between 4 (13 ft.) and 12 m (39 ft.), typically just offshore of the wave zone (Merrill & Hobson 1970). As would be expected, they move locations frequently and are easily subject to physical disturbance. Most cable landings go beneath the seafloor at water depths ranging between 10 (33 ft.) and 25 m (82 ft.) water depth, connecting with the horizontal bore hole or pipeline of the onshore segment of the cable. As such, it is unlikely that sand dollar beds would be affected by fiber-optic cable installations.

6.2.2 Hard Substrate (Sessile) Invertebrate Species

In general, hard substrate habitat occurrence offshore California, when compared to the extent of soft substrate habitat, is relatively limited. As indicated in the discussion above, the occurrence of high-relief hard substrate typically results in the presence of species that may be considered more susceptible to impacts from mechanical disturbance, such as cable installation. The most susceptible species to these

types of impacts are usually large (e.g., more than 0.3 m (1 ft.) in height), slow growing (a few to several centimeters per year), and relatively delicate/brittle or soft/friable in body form (e.g. branching corals and erect sponges, respectively). (Lissner *et al*. 1991; Hardin *et al*. 1994). For example, large erect sponges (*Demospongiae*) in a variety of colors are slow growing, and similar to the California hydrocoral, *Stylaster californica*, require several years to achieve sizes of 30 cm (11.8 in.) or more (e.g., Lissner *et al.* 1991; Hardin *et al.* 1994, SAIC-SLO 1999). These species are of special concern due to their natural history characteristics. Following natural or human-related disturbance, recolonization and recovery can take years due to their limited dispersal abilities and slow growth.

6.2.3 White Abalone *(Haliotis sorenseni);* Green Abalone (*Haliotis fulgens*); Pink Abalone (*Haliotis corrugate)*

Abalones are large marine herbivorous gastropods that live in rocky ocean waters. White abalone typically occurs at depths of 24-30 m (80-100 ft) in low and high-relief rock or boulder habitats interspersed with sand channels (NOAA 2015b). White Abalone is listed as endangered under FESA and occurs only in coastal waters south of Point Conception. Green abalone is listed as a species of concern. This species resides in shallow water on open, exposed coastal areas in the low intertidal to at least 9 m (30 ft) water depth and in some locations as deep as 18 m (60 ft). Like the white abalone, green abalone only occurs south of Point Conception. Pink abalone is also listed as a species of concern. This species occupies sheltered waters at depths between 6 - 36 m (20 - 118 ft). Pink abalone also only occurs south of Point Conception.

6.2.4 Black Abalone (*Haliotis cracherodii*)

The black abalone is found inhabiting rocky intertidal and very shallow subtidal habitats. It is listed as endangered under FESA. Black abalone reaches maturity at about 3 years old and Southern California populations primarily eat giant kelp and feather boa kelp (NOAA 2015a). During low tides, these marine gastropods can typically be found wedged into crevices of intertidal and shallow subtidal rocks. Black abalone ranges from Point Arena, California to Bahia Tortugas and Isla Guadalupe, Mexico (NOAA 2015a). However, black abalone populations have experienced significant declines in abundance and have gone locally extinct in most locations south of San Simeon, California, along the Central California coast (Bell 2013). Prior to these declines, scientists estimated the abundance of black abalone at >3 million (NOAA 2015a). The primary factors leading to the declines are overfishing and withering syndrome, which struck black abalone at the northern Channel Islands in 1985 (NOAA 2015a). The disease appears to be more prevalent in locations where water temperatures are relatively warmer. Populations observed at Santa Cruz, California and northward along the California coast appear to be doing better than those areas in south Central and southern California (Bell 2013). Die-offs also seem to occur in habitats where water temperatures are elevated by thermal discharge from power plants. As population densities decrease, the increasing distance among potentially spawning males and females has also led to reproductive failure.

6.2.5 Red Abalone (*Haliotis rufescens*)

Most commonly found in Northern California, red abalone (*Haliotis rufescens*) inhabit intertidal and shallow subtidal rocky substrate between Bahia Tartugas, Baja California to Oregon. While red abalone predominantly inhabits rocky hard substrate, it is known to move across sand or gravel regions between isolated rocky substrate features. Red abalone inhabits water depths ranging between the intertidal zone to approximately 180 m (590 ft), but are most common between 6 and 40 m (20 and 131 ft) water depth (CDFG 2001).

Red abalone is a broadcast spawner that aggregates in clusters for reproduction. Young abalone, including post larva and juveniles, forage on bacteria, diatoms and single celled algae. Adult abalone forage on brown algae, and when food is scarce, feed on benthic diatom films.

Mortality of red abalone is typically due to predators, anthropogenic impacts, environmental conditions and disease (CDFG 2005). Although neither currently protected under Federal or State endangered species regulations, nor identified as a species of special concern, red abalone is a major recreational fishery in Northern California and recent declines in abundance and the recent closure of the fishery elevates this species to a status of special concern by the State of California.

All species of abalone were part of a commercial and recreational fishery offshore California until 1997 when the CDFW closed the commercial fishery due to crashing abalone populations. A red abalone recreational fishery was left open north of San Francisco, however this was reduced in size with an indefinite closure of the Fort Ross area after a high mortality event as a result of a harmful algal bloom (The Press Democrat 2014). The CDFW closed the red abalone recreational fishery at the end of 2017. The CDFW cite low stock abundances, starving abalone, and high mortalities as reason for the closure and is developing the Red Abalone Fisheries Management Plan that will identify what conditions need to be met for reopening the fishery (CDFW 2018).

6.3 Deep-Sea Corals

Deep-sea or cold-water corals are a diverse group of organisms with thousands of species found worldwide. Many of these corals provide habitats for a myriad of marine species. Deep-sea corals occur primarily on hard bottom substrate on the continental shelf and slope, offshore canyons, and on oceanic island slopes and seamounts. Deep-sea corals are HAPC for groundfish and other managed fish species under the MSA.

Deep-sea coral ecosystems are typically long lived, slow growing, and fragile, which makes them especially vulnerable to physical disturbances and damage. Along the west coast of North America, 101 species of corals have been identified, consisting of 18 species of stony corals, 7 species of black corals, 36 species of gorgonian or soft corals, 8 species of true soft corals, 27 species of pannatulaceans or sea pens, and 5 species of stylastid corals (Lumsden *et al.* 2007). Many of these species and taxa are designated as "structure-forming," meaning they are known to provide vertical structure above the seafloor that can be utilized by other invertebrates or fish (NOAA 2010; Whitmire & Clarke 2007).

The most common stony corals observed offshore California are the solitary cup corals (e.g., *Balanophyllia elegans*, *Paracyathus stearsii*) and branching corals (e.g., *Lophelia pertusa*, *Oculina profunda*, *Madrepora oculata*, *Dendrophyllia oldroydae*, *Astrangia haimei*, *Labyrinthocyathus quaylei* and *Coenocyathus bowersi*). Black corals, which are represented by only seven species, are considered vary abundant along the Pacific coast, with *Antipathes sp*. and *Bathypathes sp*. exhibiting coast wide distributions, while the other five species appear to be limited to seamounts (Whitmire & Clarke 2007). Gorgonians are the most populous group of corals off the Pacific coast. *Eugorgia rubens* (purple gorgonian) and *Adelogorgia phyllostera* (orange gorgonian) are commonly observed in the nearshore coastal waters, whereas *Paragorgia arborea* (bubblegum coral), although found in high abundance region-wide, inhabits water depths greater than 200 meters. Gorgonian and black corals have branching tree-like forms and can occur singly or form thickets. These three-dimensional features and vertical structures provide habitat for numerous fish and invertebrate species and enhance the biological diversity of many deep-sea ecosystems.

Included with deep-sea corals are sea pens (order Pennatulacea), which occur over soft-bottom substrates and are the most abundant coral taxon in the region. Some sea pens are quite mobile and can move from one location to another. *Stylatula sp*., *Anthoptilum grandiflorum* and *Umbellula sp*. are the most common taxa, all of which are found coast wide. Although groves of pennatulaceans have been shown to support

higher densities of some fish species over adjacent areas, they are not considered to be structure forming (Brodeur 2001).

Lace corals or stylasterid corals have been observed colonizing moderate to high-relief rocky habitats from the intertidal zone down to shelf water depths. Only five species from three genera are known to occur along the Pacific west coast with *A. californica* being the only species known to occur in California.

A. californicus has a calcareous skeleton and forms upright pink to dark blue branching colonies. This species is characterized by very slow growth (e.g. 5 to 10 years to reach sexual maturity, possibly more than 20 years to grow to a height of 30 cm) (Thompson, *et al*. 1993; Gotshall 1994). *Allopora* has no planktonic larval stage and fertilization between adult colonies more than 10 meters apart is rare.

In recent years, NOAA has developed an increased interest in these ecosystems and especially the potential for impacts from bottom contact fishing activities (NOAA 2014a). Deep-sea coral are being evaluated for designation as EFH within the Pacific Coast Groundfish FMP, and likely will be designated once the 5-year review is complete.

Unfortunately, there is limited information concerning known occurrences of deep-sea coral offshore Southern California. This is in part due to the difficulty and expense of locating and surveying deep-sea hard substrate habitat. Much of what the scientific community knows about their presence is as a direct result of manned submersible and ROV surveys of fiber optic cable routes or oil and gas exploration sites.

Christmas tree coral (*Antipathes dendrochristos*), a species of black coral that occurs in the Southern California Bight, has been documented around Piggy Bank and on Hidden Reef north of Santa Catalina Island; there are also a few documented occurrences around San Nicolas Island (Huff *et al.* 2013). Huff *et al.* (2013) mapped ocean currents, primary productivity (chlorophyll), and temperature against known locations of Christmas tree coral to develop a predictive model for the SCB. These environmental correlates predict bands of low occurrence, interspersed with isolated pockets of high occurrence, in the project area. Specific locations of coral within these bands and pockets depend on the availability of hard bottom substrate. Guinotte & Davies (2014) developed a habitat suitability model for multiple species of deep-sea coral for the U.S. West Coast. They reported bands of suitable habitat associated with specific bathometric features in the project area. Both studies show suitable deep-sea coral habitat in places that would be crossed by the proposed cable routes. Specific locations where the proposed cable routes may encounter deep-sea coral are the following:

- Bottom slopes south of the Channel Islands and around Piggy Bank;
- High-relief bottom between Santa Barbara Island and the Channel Islands;
- High-relief bottom between San Nicolas Island and the Channel Islands.

6.4 Kelp and Sea Grasses (Submerged Aquatic Vegetation)

The giant brown kelp (*Macrocystis pyrifera*) forms large dense forests in the nearshore waters of Southern California and some locations in Central California, as well as throughout the Channel Islands where clear water allows them to grow in depths exceeding 30 m (100 ft.). The more dominant "forest" forming algae in Central California is bull kelp (*Nereocystis luetkeana*). Bull kelp is an annual that releases spores in the spring that grow throughout the year and then die (Springer *et. al* 2007). Kelp forests are home to many marine animals and act as spawning and nursery grounds for many invertebrates and fish. *Macrocystis* and *Nereocystis* anchor themselves to the seafloor by attaching their holdfasts to small boulder-sized rocks or rocky outcroppings. Both *Macrocystis* and *Nereocystis* beds occur throughout Central California and are known to be present offshore Grover Beach. Extensive bull kelp

beds occur north of Grover Beach, north of the Pismo Beach Pier. Some isolated bull kelp plants may be present in sporadic gravel/cobble beds offshore Grover Beach.

Surfgrass (*Phylospadix*) is a flowering marine plant in the family *Zosteraceae* and can be found throughout coastal California where suitable habitat occurs. It is most commonly observed attached to rocks in middle to low intertidal zones, but where conditions are favorable, it can occur to depths of 15 m. The closest known occurrence of surfgrass is at Shell Beach, 3 miles north of Grover Beach, where extensive intertidal and shallow subtidal rock shelf outcropping occur.

7 Potential Effects of Fiber Optic Cable Installation and Operation on Intertidal and Subtidal Marine Communities

The installation, maintenance, and ultimate abandonment/removal of a subsea fiber optic cable located in the coastal waters of California can be expected to result in disturbances to the communities that the cable traverses. These impacts would likely vary, not only with respect to the route and substrate type, but also according to installation methods which will depend on water depth and substrate type. In shallow water soft-sediment areas, divers or ROVs are typically used to bury the cable using a water jet to create a channel into which the cable is laid. Typically, the cable channel is allowed to self-bury. In deeper soft-bottom areas, a cable installation plow is employed to dig a 1 m (3.3 ft) deep trench in the seafloor, place the cable into the trench, and then refill the trench with the excavated sediment.

In the event a proposed cable route contains hard substrate features, the final routing of the cable will avoid, to the maximum extent feasible, moderate- and high-relief outcrops, especially in high energy environments in water depths less than 33 m (100 ft). If placement along mixed bottom or low- to moderate-relief habitat is unavoidable, the cable is typically laid onto the seafloor and either a ROV or divers are used to properly position the cable around isolated exposed outcrops or high relief features and to locate the cable so that minimum contact with more sensitive hard bottom habitat occurs.

In addition to direct physical disturbance of marine habitats by cable placement or burial during installation, other potential effects include:

- Short term and isolated, increased water turbidity during cable burial in soft seafloor sediments with a cable plow or by ROV or diver trenching activities,
- Potential release of drilling fluids during the boring of the fiber optic cable landfall conduits,
- Underwater noise from marine construction work vessels and cable laying activities, and
- Accidental release of hydrocarbon containing fuel oils and lubricants by work vessels engaged in cable installation and landfall conduit horizontal directional drilling (HDD) activities.

Numerous fiber optic cables have been installed in the coastal waters of California, Oregon and Washington over the past several decades (SAIC-SLO 1999, SAIC 1999, AMS 1999b, SAIC 2000, MBC 2001, MBARI 2004, AMS 2008, AMS 2016). Within California, landfalls have occurred in Southern California (San Diego, Hermosa Beach, Manhattan Beach, Los Angeles, and Santa Barbara), Central California (Montana de Oro, Grover Beach, Estero Bay, and Moss Landing), and Northern California (Manchester Beach). CEQA and NEPA documents prepared for these projects discuss in detail the potential impacts to marine biota from the installation, operation and removal/abandonment of fiber optic cables. Mitigation measures outlined in these documents can be assessed for their efficacy in preventing or minimizing the potential effects to marine resources. Additionally, pre- and post-cable lay ROV surveys have been performed that provide information on the longevity and severity of potential effects to marine habitats and biota. Finally, the effects of cable installation and operation on marine soft and hard

substrate habitats and associated biological communities have been assessed in a number of diverse locations including the Olympic Coast National Marine Sanctuary, Washington (NOAA 2018b), Monterey Bay, California (Kogan *et. al* 2006, Kunz *et. al* 2015), coastal waters in Australia (Sherwood *et. al* 2016), and multiple other locations worldwide (Kraus and Carter 2018).

Potential effects will undoubtedly vary between each project depending on project specifics, route, location along the coast, and technical approach for installation. The following discussion provides a brief synopsis of potential marine effects to marine biological resources from fiber optic cable installation and operation, and outlines operational actions that can be employed to prevent significant impact to marine ecosystems.

7.1 Soft-bottom Habitat & Associate Biota

Effects to soft-sediment biota during cable installation, operation, or abandonment can be expected to be short-term and therefore temporary (Kraus and Carter 2018, Antrim *et al*. 2018, Kunhz *et. al* 2015, Kogan *et. al* 2006). The use of a cable plow to create a furrow along the seafloor into which the fiber optic cable is placed and buried can be expected to result in a temporary disturbance of benthic infauna (animals living in the sediments of the seafloor) and epifauna (animals living on the surface of the seafloor). It is estimated that the actual area of disturbance is less than 8 meters (26 ft.) wide with the most severe effects being limited to the 1 m (3.3 ft) wide trench made by the plow (Kraus and Carter 2018). Many motile epifaunal invertebrates and fish can be expected to avoid the plow and return to the area shortly after the plow has left and the trench has been refilled. Any benthic infauna inhabiting the upper sediment layers disturbed by the plow are assumed to be smothered and killed. This loss, however, will occur in a small area of the seafloor relative to the surrounding area. The infaunal community inhabiting the adjacent, undisturbed sediments will be expected to rapidly start recolonizing the affected area. Recolonization will occur both by migration from adjoining, undisturbed seafloor areas and by natural recruitment (Kunhz *et. al* 2015, Kraus and Carter 2018, Antrim 2018, Kogan *et. al* 2006).

Studies of the ATOC/Pioneer seamount cable (Kogan *et. al* 2006), the PAC fiber optic cable in the Olympic Coast National Marine Sanctuary (Antrim *et. al* 2018), the MARS fiber optic cable in the Monterey Bay National Marine Sanctuary (Kunhz *et. al*. 2015), and other submarine cables worldwide (Kraus and Carter 2018) found that recolonization of soft sediment communities was fairly rapid, beginning within weeks of the disturbance, but full recovery of the community could take up to a couple of years. Key factors in the recovery of seafloor sediments was water depth, sediment composition, level of energy present, and whether the location was depositional or erosional in nature. Studies that specifically investigated benthic infaunal and epifaunal communities along the cable routes found no significant differences in community composition between studied sites adjacent to the installed cables and comparison sites several 100 meters distant from the cables (Kogan *et. al* 2006, Kunhz *et. al*. 2015, Antrim *et. al* 2018). A similar study on a high voltage direct current power cable installation offshore Australia concluded that the ecological effects of the cable installation on soft substrate epibiota were transient and minor (Sherwood *et. al* 2016).

These findings are similar to findings from studies of offshore sand mining operations in the Gulf of Mexico and in the Atlantic Ocean where large areas of sand are removed for shoreline restoration. These studies have shown that recovery of the benthic infaunal and epifaunal community to comparable pre-disturbance conditions typically occurs within a couple years following the disturbance (Hammer *et al.* 1993; Van Dolah *et al*. 1992). The key factors influencing the speed of recovery in these studies were (1) when the impact occurred relative to seasonal periods of spawning and recruitment, and (2) the proximity of undisturbed sediment to the disturbed/impacted area.

Because the disturbance to benthic infauna during the proposed cable installation offshore Eureka, CA does not involve permanent sediment removal, and the distance between disturbed and undisturbed

sediment will typically be less than 0.5 meters, recovery to pre-disturbance conditions is expected to be relatively rapid, requiring a couple of years or less for full recovery.

Disturbances resulting from laying cable in shallow water areas with coarse sand can be similar to disturbances in deeper areas covered with fine sediments, despite the existence of different types of sediments. Similar levels of disturbance may also result even if different methods of cable burial are employed, such as ROVs or cable plows. In the very nearshore areas, in water depths less than 30.5 m (100 ft), the seafloor and associated biota experience frequent and regular disturbances from wave action. As a result of this high energy, constantly changing environment, the associated biological community has adapted to frequent exposure and burial. The infaunal community is typically limited in species diversity and consists primarily of filter feeders (e.g. tube worms, sand dollars, sand anemones) and detrital feeders (e.g. shrimp and crabs). These taxa also tend to be highly motile and as a result, any effects to the habitat and associated biota can be expected to be undetectable within a few days or months of cable installation.

During cable plowing and trenching activities, temporary spikes in near-seafloor turbidity may occur. Increased turbidity is typically restricted to the water immediately above and adjacent to the seafloor where the plowing or trenching occurs. Depending on water depth, natural wave and current energy, turbidity plumes (i.e. resuspended sediments) generated from the trenching can be expected to resettle to the seafloor quickly. During ROV surveys of cable routes, seafloor sediments are frequently disturbed by the ROV thrusters and generate turbidity plumes similar to those generated by cable plows (AMS 2008, AMS 2016). These turbidity plumes also quickly dissipate within minutes following the disturbance.

Similar to increases in turbidity from cable trenching and plowing activities, HDD boring of conduits can result in turbidity increases through the accidental release of bentonite drilling fluid to the seafloor and nearshore subtidal habitats. Bentonite is a marine clay that is used for lubricating the borehead cutting tool and transporting borehole cuttings back to shore. The HDD boring process typically terminates the landfall conduit installation at water depths between 12-17 m (40 and 55 ft). In general, the offshore termination point along the cable route is selected to occur in soft sediment habitat. Throughout most of California, the seafloor sediments occurring at these water depths are composed of sand with some minor silt and clay components. Coastal seafloor sediments at these water depths are also typically exposed to wind and wave surge, as well as regular resuspension of seafloor sediments, resulting in naturally occurring increased turbidity near the seafloor.

The accidental release of small volumes of bentonite drilling fluid into this environment is not expected to result in any detectable effects on marine biota above that which may be naturally occurring in the area of release, or result in any permanent changes to soft substrate habitat. Any released bentonite clay would be expected to be quickly resuspended by wind- and wave-generated surge present at these shallow water depths and transported with similar sized sediment particles to natural depositional areas along the coast. Any potential increased turbidity resulting from the accidental release of bentonite drilling fluid would be expected to be either non-detectable against existing background turbidity conditions at the release site or to be quickly dissipate similar to any increased turbidity caused by cable trenching or ploughing.

The greatest potential for substantive effects to marine habitats and associated marine biota from the accidental release of bentonite drilling fluids during HDD boring activities is if a large volume of fluid is released. Such a large release could result in the short-term smothering and burial of benthic epifauna and infauna, as well as clogging of fish gills (Robertson-Bryan 2006). It could also cause longer-term increased turbidity in the area of the release. Early detection of any accidental release of bentonite drilling fluid, and the immediate cessation of HDD drilling activities until operational steps can be taken to stop the release of drilling fluid, are key to limiting the potential effects on marine habitats and biological resources. Preparation and implementation of an HDD monitoring plan that details procedures for

preventing the accidental release of drilling fluid during HDD work, as well as operational and release response procedures in case of a drilling fluid release, can prevent the inadvertent discharge of large volumes of bentonite drilling fluid to the marine environment. A key and critical component of an HDD monitoring plan is the inclusion of rhodamine dye into the drilling fluid, paired with continuous monitoring, to detect its presence in the ocean water above the HDD borehole route during active HDD boring activities. Since 2000, bentonite drilling fluid has been detected very infrequently among a total of 28 fiber optic cable landing projects using HDD boring technology that implemented monitoring programs. In two cases where drilling fluid was detected, the boreholes were going through highly fractured sedimentary rock close to the seafloor surface, and were about to exit the seafloor. The early detection of rhodamine dye placed in the drilling fluid as part of the monitoring program, the immediate cessation of HDD boring activities, and in both cases the conversion to fresh water for lubrication, as outlined in the HDD monitoring and response plan, resulted in no continued detectable presence of bentonite on the seafloor or deleterious effects to marine taxa.

The use and operation of marine construction equipment and vessels always poses some risk of an accidental release of hydrocarbon-based products such as fuel oil, diesel fuel, lubricants, hydraulic fluids, etc. Depending on the quantity released, the accidental release of these products into the marine environment has the potential to impact marine habitats and taxa. These impacts could come from oiling, destruction or degradation of habitat, food sources, nursery grounds, or through chronic toxicity.

Vessels operate under strict State and Federal regulatory requirements that include measures to prevent and respond to an unforeseen accidental release of hydrocarbon-based products. These vessel-specific spill prevention and response plans include procedures to prevent, contain, report, recover, and remove any accidentally released hydrocarbon materials onboard the vessel or from the vessel into the ocean. Additionally, project-specific spill prevention and response plans include specific requirements that prevent hydrocarbon products present at work sites and onboard work vessels from reaching coastal waters. Such spill plans will typically prevent stockpiling of hydrocarbon-based products onboard, include onsite recovery and clean-up procedures for equipment and materials, and include training requirements for project personnel. These types of requirements routinely prevent the occurrence of accidental releases as well as minimize the potential exposure to marine ecosystems.

7.2 Hard-substrate Habitat

Impacts from cable installation can potentially be most severe in hard substrate habitat that occur within the cable route. The biota associated with hard substrate habitat is predominantly sessile, slow growing, and susceptible to crushing, dislodgement, and other physical disturbances. High-relief hard substrate areas (> 1 m (3.3 ft) are generally considered to be more sensitive to impacts than low-relief hard bottom habitat (< 1 m) (Lissner *et al*. 1991, Brewer et. al 1991). This is because of their higher species diversity, species abundances, and the potential presence of organisms that are sensitive to physical disturbances such as erect turf species, hard and soft hydrocorals, as well as branching and erect sponges (Lissner *et al*. 1991, Brewer et. al 1991). Mixed-bottom and low-relief hard bottom habitats generally have lower species diversity and abundances due to frequent cycles of burial by sand and higher turbidity near the seafloor. These harsher physical conditions typically result in a more ephemeral biological community that is often dominated by organisms that are more tolerant of high turbidity, sand scouring, or able to grow fast enough to avoid complete burial. Typical taxa observed in recent ROV habitat and macrobenthic taxa surveys for fiber optic cable routes in California include cup corals, gorgonian corals, brittle stars, sea stars, puffball and other similar encrusting sponges, and some species of anemones such as *Stomphia* and *Urticina*.

The predominant species inhabiting moderate- to high-relief hard substrate in water depths <200 m (650

ft) include turf communities (mixtures of small hydroids, bryozoans, tunicates, and sponges), cup corals (*Paracyathus* and *Balanophyllia*), sea stars (*Asterina* and *Henricia*), brittle stars (*Amphipholis*), red algae (at depths to about 30 m), rockfishes (*Sebastes spp.),* lingcod (*O. elongatus*), and painted greenling (*O. pictus*). Additionally, on hard bottom moderate- to high-relief features in water depths >100 meters (300 ft) the feather star or crinoid, *Florometra serratissima,* and the large plumose anemone *Metridium* are frequently observed. All of these taxa are capable of withstanding periodic physical impacts. Other species, such as California hydrocoral (*S. californica*), branching coral (*Lophelia*), colonial anemone (*C. californica*), and large erect sponges are typically more sensitive to physical impact/burial and may require longer time periods to recover. *Metridium* and *Corynactis* are common species on moderate and high-relief substrate, whereas *Stylaster and Lophelia* are only infrequently reported being observed in past cable route surveys.

The potential for post-lay disturbance effects is highly dependent on where the cable is located within a hard substrate area, the type of hard substrate present (i.e. Mixed, low, moderate or high relief) and how securely the cable is installed on the seafloor. Suspensions often result in continued movement of the cable in response to currents and wave action in shallow depths (< 30.5 m [100 ft]), causing abrasion of hard substrate (Kogan *et. al* 2006, Kuhnz *et. al* 2015). Based on observations made during past cable route and post-lay surveys in California coastal waters, the impacts to associated biota from post-lay movement appear to be minimal with careful placement of the cable. During a survey of the AT&T Asia-America Gateway (AAG) S-5 cable near Morro Bay, CA, AMS (2008) reported that they could not detect any noticeable impacts associated with previously laid cables in the area. Several studies have reported the presence of large erect sponges, *M. farcimen* anemones, and other sessile organisms growing on or over exposed cables (SAIC 1999, Kogan *et. al* 2006, Kuhnz *et. al* 2015). An ROV survey of the MCI-ATT fiber optic cable route offshore Montana De Oro reported small-localized movements of a previously installed trans-pacific telephone cable, up to 10 cm (4 in) in width, occurring when the cable was laid over hard substrate habitat in a high wave energy, shallow water depth, location (SAIC-SLO 1999). Similarly, sections of the surface installed ATOC/Pioneer Seamount cable running through soft silt/sandstone offshore Pigeon Point, CA reported deep groves cut into exposed rock from cable strumming in very high energy, shallow water depth (<11 m [35 ft]) (Kogan *et. al* 2006). The installation of a power transmission cable through a glass reef located offshore British Columbia resulted in 100% mortality of glass sponges immediately under the cable and up to 15% within 1.5 meters (4.5 ft) of the cable, because of the method of installation (Dunham *et. al* 2015). No evidence of cable movement was observed, however, once the cable was installed.

Recovery of disturbed hard substrate areas by immigration, asexual propagation or larval recruitment should begin occurring within months of the disturbance. However, some areas take longer to recover fully than others. A study performed in the Pt. Arguello area suggested that the small areas of hard bottom habitat that might be disturbed by cable laying operations could take years to recover fully to pre-disturbance conditions (Hardin et al. 1993). These authors reported estimated mean time for recovery to background densities of 23 years for *Paracyathus stearnsi* and 19 years for *Lophogorgia chilensis* in areas disturbed by dragging anchors during pipe laying operations. Sherwood *et. al* (2016) reported in his assessment of the ecological effects of a power cable installation offshore Australia, that the armored cable running over hard substrate provided a colonizable surface for reef species comparable to species found in surrounding coral reefs within 3.5 years of installation. Dunham *et. al* (2015), reported that the glass sponge reef offshore British Columbia had recovered to approximately 85% natural reef growth and cover when compared to control sites within 2-years of the cable's installation. Finally, during the assessment of the ATOC/Pioneer cable, the surface-laid cable through soft sediment areas of the cable route was noted to provide artificial hard substrate habitat which was quickly colonized by *M. farcimen* and *Urticina spp.* anemones, occasional sponges, and other low relief colonizing taxa (Kogan et. al 2006). In this latter case, species diversity and abundance associated with the cable were actually higher than that of adjacent sediment habitats (Kogan *et. al* 2006). These authors further noted that the presence of the

attached epifaunal community established a microcosm that attracted fish and crab taxa (Kogan *et. al* 2006).

Increased turbidity from cable trenching or ploughing activities, or the accidental release of bentonite drilling fluid, can be expected to pose a greater negative effect on hard bottom habitats compared with soft bottom habitats. As discussed above, marine taxa, such as colonial and branching corals, large erect sponges, anemones, hydrocorals, and in shallower waters, brown, red and green algae, are generally more sensitive to increased turbidity and sediment deposition than solitary cup corals and turf species. Project induced turbidity, sedimentation, and bentonite drilling fluid releases can result in increased burial of low, moderate, and high-relief hard substrate and attached taxa, clogging of fish gills and feeding surfaces, and temporary loss of foraging habitat. These impacts can be expected to be greater for moderate- to high-relief habitat and associated biota because of their greater sensitivity to sedimentation and the greater time it takes to recover from impacts (Hardin *et. al.* 1993). Terminating cable trenching and HDD borehole cable conduits in areas of soft sediment that are away from hard bottom habitat and associated biota, as well as the development and implementation of an HDD Monitoring Plan, can be expected to prevent and minimize potential exposure of hard substrate habitat and biota to accidental bentonite drilling fluid releases and increased turbidity from cable trenching and burial.

Potential exposure of hard substrate habitat and associated marine communities, including fish, marine mammals, and sea turtles to hydrocarbon materials is typically worse than that posed for soft substrate communities because of the time it takes these communities to establish themselves. As for soft substrate communities, the implementation of spill prevention, training, and response procedures can be expected to prevent the occurrence of accidental hydrocarbon releases or limit the volume of released material.

7.3 Fishes

Most of the environmental assessments prepared for underwater fiber optic cables (e.g., CSLC 2000a; CSLC 2000b; CSLC 2005) indicate that temporary displacement of some fishes from the immediate vicinity (e.g. tens of feet) of the cable route would occur during passage of cable installation equipment. The impacts described in these assessments are considered temporary (i.e., hours) and localized (occurring over a very discrete area), and therefore less than significant. Extensive alteration or destruction of habitat or communities lasting more than 1 year is unlikely due to the small size of the cable, the very localized corridor represented by the route, and burial of the cable along most of the inshore route to a depth of 100 fathoms (185 m/600 ft) of the route. Any disturbances to the bottom from installation methods are expected to return to pre-installation conditions in a relatively short amount of time (less than a year) and are typically verified during a post-installation survey.

Fish could be exposed to temporary and isolated increased underwater noise from cable laying activities and from work vessels involved in HDD boring and cable installation activities. Studies in the North Sea assessing cable trenching and ploughing projects for offshore wind farms reported peak underwater noise levels of 178 db re 1 µp at a distance of 1 m (Nedwell et al 2003). Similarly, peak underwater noise levels for cable laying ships has been reported to range between 170-180 db re 1 µp at a distance of 1 m (Hale 2018) and 160-180 db at a distance of 1 m for small work boats (CalTrans 2015), depending on the vessel size and design. Peak nearshore background underwater noise levels have been reported averaging between 128-138 db re 1 µp at a distance of 1 m (Fabre and Wilson 1997). Therefore, the generation of underwater noise by fiber optic cable installation are most likely below established 206 dB acute peak underwater noise levels for fish as well as the SEL cumulative noise levels of 183 dB and 187 dB for fish less than and greater than 2 grams in mass, respectively, and only slightly higher than the 150 dB (rms) level established for behavioral disturbance (CalTrans 2015). Additionally, it can be anticipated that

project generated underwater noise levels would degrade below behavioral effect levels for fish in approximately 32-64 m (95-210 ft), and below background underwater noise levels in 128-160 m (420-840 ft) from the source, based on an assumed drop of 5-6 db per doubling of distance from the noise source (McKenna et.al 2012). Given the low magnitude of underwater noise generated by most cable laying activities relative to established thresholds for acute effects to fish, and the short duration and small distance underwater noise generated by cable laying activities will exceed background conditions, no substantive effects to fish are anticipated.

As discussed above for invertebrate taxa, the accidental release of hydrocarbon-based products has the potential to impact any fish that happen to be present in the area effected by the release. The preparation and implementation of a spill prevention, training, and response procedures plan can be expected to prevent the occurrence of accidental hydrocarbon releases from cable installation and maintenance activities, as well as limit the volume of any released material and therein the potential effects on fish taxa, should it occur.

7.4 Marine Mammals & Sea Turtles

No significant effects to marine mammals are anticipated from cable installation at the landing sites or along the offshore route. Many of the potential impacts such as disruption of migration routes or increased noise during installation are considered temporary, lasting only hours (along the sea route installation) to a few days (at the cable landfall location) in any one location, and are not expected to cause disruptions substantially different from normal ship traffic (e.g., noise) through the area (SAIC 2000).

Ship strikes of whales have become of growing concern for several species, with ship strikes to the highly endangered North Atlantic right whale receiving the most attention off the U.S. east coast (Calambokidis 2011). In 2007, four blue whales off the coast of California were found dead with direct or indirect indications of having been struck by ships. These four were all found in the vicinity of the Santa Barbara Channel and Los Angeles-Long Beach Harbors. Ship strikes during cable installation is highly unlikely since the speed of the ship during cable laying activities is slower (~0.5 to 1.5 knots while plowing) than migrating whales or fast swimming sea lions. The potential for ship strikes to sea turtles is greater than for marine mammals, especially when they surface to breathe. Although some avoidance of a cable lay ship can be anticipated as a result of disturbance and the low level underwater noise generated by cable installation operations, some potential for collision remains. Active avoidance of potential collisions with both marine mammals and sea turtles remains the best approach to preventing negative interactions between cable lay vessels and marine mammals and sea turtles. This can be accomplished through the preparation and implementation of a marine mammal monitoring and avoidance plan during all cable laying operations. These plans typically require that marine mammal observers be present on the cable installation ship, in addition to outlining procedures for ceasing all operations if a marine mammal or sea turtle comes within a prescribed “safety zone” distance of the vessel, in order to halt movement by the vessel and equipment and thereby minimize the risk of a collision.

The long-term presence of the fiber optic cable along the seafloor also would not significantly impede whale migrations since it would be 1) buried along most of the nearshore route, and 2) represent a very low profile (e.g., 1 to several inches) in hard bottom areas as a result of careful installation and post-lay inspection/adjustment. Also, as discussed in CSLC (2000a), cable slack would be stabilized at a level within the range of 2 to 3 percent in areas where the cable cannot be buried to ensure that the cable conforms to the slopes and peaks of the seabed so that it is not suspended substantially (e.g., more than 1 foot) above the bottom. This would prevent the creation of any spans that could potentially entangle

marine mammals (e.g. whales). Of the approximately 2 dozen known commercial fiber optic cable landings in coastal California waters installed since 2000, no known or reported entanglements between whales and fiber optic cables have occurred.

As discussed above for fish, exposure to non-impulsve underwater noise from cable installation activities and work vessels poses some potential for acute and/or sublethal effects to marine mammals and sea turtles. Underwater operations can generate underwater noise levels ranging between 160-180 db. NOAA (2016) established combined peak and cumulative (SEL) underwater sound exposure levels for marine mammals. These cumulative SEL levels from non-impuslive sound sources are199 dB for baleen whales, 198 dB for dolphins and toothed whales201 dB for true seals, , 155 dB for porpoises, and 219 dB for sealions, fur seals, and otters. With the exception of the sound exposure limits for porpoises, all other NOAA established underwater sound thresholds for non-impulsive sound sources are greater than the underwater noise generated by cable installation equipment and vessels. As discussed above for underwear noise effects on fish, assuming a 5-6 dB decrease in noise level for every doubling of the distance from the noise source, underwater noise associated with cable installation should decrease to levels <155 dB in approximately 16-32 m (52-105 ft) from the source.

As presented in Table 8, the only porpoise species expected to occur in the coastal waters offshore Grover Beach is Dahl's porpoise. If present during cable installation activities, the porpoises would need to be closer than 32 m (105 ft) to the cable lay ship or work vessel to be impacted by the underwater noise. Although they can be expected to avoid the immediate area where the underwater noise is generated during cable lay activities, the implementation of a marine mammal monitoring program and the presence of a marine mammal observer onboard the cable installation vessel, can be expected to prevent any exposure of porpoises and other marine mammals and sea turtles to underwater noise levels of sufficient magnitude to result in any deleterious effects.

As discussed above for fish and invertebrate taxa, the accidental release of any hydrocarbon-based product has the potential to impact marine mammals and sea turtles that are present in the area affected by the accidental release. The preparation and implementation of a spill prevention, training, and response procedures plan can be expected to prevent the occurrence of accidental hydrocarbon releases from cable installation and maintenance activities, as well as limit the volume of any released material and therein the potential effects on marine taxa, should it occur.

Little scientific information is known about the effects of anthropogenic underwater noise on marine turtles or at what potential threshold levels acute or behavioral responses may occur (Williams et. al 2015). What apparent information is available concerns impulsive sound sources, such as seismic mapping equipment (ie. air guns) and from dynamite explosions. These studies indicated that marine turtles maybe somewhat resistant to successive dynamite blasts (Erbe 2012) and can detect and exhibit avoidance behavior to 175 dB RMS generating impulsive air gun sounds when several kilometers distant from the source (Weilgart 2012). Consequently, any marine turtles approaching active cable installation activities are expected to avoid project work vessels and if avoidance does not occur and they approach project work vessels, as indicated above, the Marine Wildlife Monitoring and Contingency Program applies to marine turtles and onboard observers will observe them and cease cable installation activities until the marine turtle has transited a safe distance past operations.

TABLE 5-1
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	General Habitat, *Critical Habitat (if established)*	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals					
Baird's Beaked Whale	*Berardius bairdii*	P	Inhabit deep offshore waters in the North Pacific and are common along steep underwater geologic structures, like submarine canyons, seamounts, and continental slopes.	Seasonal-sightings from late spring to early fall Very Rare	Not Expected. Sightings occur in deeper waters than the study area, mainly along continental shelf edges or in deep submarine canyons where they forage. National Marine Fisheries records indicate less than a dozen individuals have been washed up along the west coast of the US.
Blainville's Beaked Whale	*Mesoplodon densirostris*	P	Found mainly over the continental shelf and into open ocean waters. Occupy tropical to temperate waters worldwide. Groups have been regularly observed off Oahu, Hawaii and in the Bahamas in 500-1000 m waters.	Rare	Not Expected. Unlikely to be observed in the study area.
Blue Whale	*Balaenoptera musculus*	FE, FD, P	Blue whales are found worldwide but often occur near the edges of physical features where krill tend to concentrate. These whales begin to migrate south during November.	Seasonal from June through November Common	High. Relatively common offshore the CA coast, in waters 90- 370 km from the shore**.**
Bottlenose Dolphin	*Tursiops truncatus*	P	Found in temperate and tropical waters around the world. These are the most common dolphins in Southern and Central CA, including offshore**.** Have both coastal and offshore populations.	Year-round Uncommon-Occasional	Low-moderate. Bottlenoe dophins have been sited offshore Pismo Beach in recent years suggesting that this species is becoming increasingly more common in Central California as water temperatures warm.
Bryde's Whale	*Balaenoptera edeni*	P	Found in highly productive tropical, subtropical, and warm temperate waters worldwide. More commonly found further from shore.	Rare	Not Expected. Unlikely to be observed in the study area.
California Sea Lion	*Zalophus californianus*	P	Reside in the Eastern North Pacific Ocean in coastal waters. Commonly observed along the west coast of North America from southeast Alaska to the central coast of Mexico	Seasonal Common	High. Commonly observed.
Common Dolphin – Long-beaked	*Delphinus capensis*	P	Found from Baja California northward to central California. Found in shallow, warmer temperate waters typically within 15 nautical miles of the coast and on the continental shelf.	Year-round Uncommon-Occasional	Low. The common dolphin is the most abundant cetacean found in the coastal waters of California, but numbers begin to decrease northward from the central coast, and the maximum northward extent is Point Arena.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Common Dolphin – Short-beaked	*Delphinus delphis*	P	A more pelagic species than the long-beaked common dolphin; can be found up to 300 nm from shore and commonly found near underwater geologic features where upwelling occurs. Majority of populations are observed off California coast, especially in the warm water months.	Year-round Common	Moderate. Generally found offshore of the study area.
Cuvier's Beaked Whale	*Ziphius cavirostris*	P	Found in temperate, tropical, and subtropical waters. Associated with deep pelagic waters (usually greater than 1,000 m deep) of the continental shelf and slope, and near underwater geologic features. Seasonality and migration patterns are unknown.	Sightings in fall and winter Rare	Not Expected. Generally occur in the deeper waters west of the study area.
Dall's Porpoise	*Phocoenoides dalli*	P	Distributed throughout the North Pacific Ocean and along the west coast of the US from the border with Mexico to the Bering Sea. Mainly found in pelagic waters deeper than 180 m, but can be found both offshore and inshore.	Winter and early spring Rare	Not Expected-Low. Most frequently observed offshore in deeper waters.
Dwarf Sperm Whale	*Kogia simus*	P	Dwarf sperm whales live in tropical and temperate waters worldwide and occur over the continental slope and open ocean. Found in the Pacific northwest and California, but more common near Hawaii and the Gulf of Mexico.	Rare	Not Expected. Not likely to be observed within the study area. Records of dwarf sperm whales are rare and it is unknown whether low numbers are a consequence of their cryptic behavior or if they are not regular in habitants of offshore CA waters.
False Killer Whale	*Pseudorca crassidens*	P	Occur over the continental slope and into open ocean waters with depths over 1,000 m of tropical and warm temperate waters worldwide.	Sightings in summer and early fall Rare	Not Expected. Not likely to occur in the study area because they prefer warmer and deeper waters than within the study area.
Fin Whale	*Balaenoptera physalus*	FE, FD, P	Fin Whales occupy the deep, offshore waters of all major oceans, but are less common in the tropics.	Seasonal Common	Moderate. Relatively common in CA waters between March and October, but due to their occurrence farther offshore in deep water, it is not likely they would be seen in the study area.
Ginkgo-toothed Whale	*Mesoplodon ginkgodens*	P	Found mainly over the continental shelf and into open ocean warm waters of the Pacific and Indian Oceans.	Rare	Not Expected. No documented sightings in the study area.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Gray Whale (Eastern Pacific)	*Eschrichtus robustus*	FD, P	Predominantly occur within the nearshore coastal waters of the North Pacific Ocean, from the Gulf of Alaska to the Baja Peninsula.	Seasonal December through May Common	Moderate. Occur in coastal waters during late fall-winter southward migration and again late winter to early summer during their northward migration. Can be as close as a few hundred yards of shore, but more common 3-12 miles offshore.
Guadalupe (Southern) Fur Seal	*Arctocephalus townsendi*	CT, FT, FD	Reside in tropical waters off Southern California and Mexico. Breed in rocky coastal habitats and caves mainly along the eastern coast of Guadalupe Island, approximately 200 Kilometers west of Baja California. There is a small population on San Miguel Island in the Channel Islands.	Very Rare	Not Expected. Unlikely to occur north of Point Conception and the Southern Californian Bight.
Harbor Porpoise	*Phocoena phocoena*	P	Commonly found in bays, estuaries, harbors, and fjords less than 200 m deep in northern temperate and subarctic coastal waters. In California, most common north of Point Conception.	Year-round Uncommon	Low. Can occur in the study area between 0-200 m depth, but no obervations reported in study area.
Harbor Seal	*Phoca vitulina*	P	Found as far north as British Columbia, Canada and as far south as Baja California, Mexico. Most commonly observed pinniped along CA coastline. Use the offshore waters for foraging and beaches for resting. Occur on offshore rocks, on sand and mudflats in estuaries and bays, and on some isolated beaches.	Year-round Common	High. Common throughout the California coast. Harbor seals favor near shore coastal waters.
Hubb's Beaked Whale	*Mesoplodon carlhubbsi*	P	Endemic to the North Pacific Ocean. Species is not well known but assumed to occur mainly over the continental shelf and into open ocean waters.	Very Rare	Not Expected. May occur in waters offshore of central and north California but the species is very rare.
Humpback Whale	*Megaptera novaeangeliae*	FE, FD, P	Found in all major oceans. Central California population of humpback whales migrates from their winter calving and mating areas off Mexico to their summer and fall feeding areas off coastal California. Humpback whales occur from late April to early December.	Seasonal-May through November Common	Moderate. Frequently observed migrating along the CA coast between April and November, up to 90 km offshore.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Killer Whale	*Orcinus orca*	FE, FD, P	Found throughout all oceans. Most abundant in colder waters but can be somewhat abundant in temperate water. Presence and occurrence can be common but unpredictable in coastal California.	Seasonal Uncommon	Low. Most common during April, May, and June as they feed on northbound migrating gray whales. Generally observed in the deeper waters offshore of the study area.
Long-snouted Spinner Dolphin	*Stenella longirostris*	FD, P	Found in all tropical and subtropical oceans. Continental shelf to open ocean waters, but most commonly in the deep ocean where they track prey.	Sightings in summer and early fall Rare	Not expected to occur in the study area because they prefer warmer waters.
Minke Whale	*Balaenoptera acutorostrata*	P	Distributed worldwide and can be in coastal/inshore and over the continental shelf in temperature (preferred), boreal, or polar waters.	Year-round Uncommon	Low. Minke whale sightings have occurred throughout the California coast. While rare, they may be observed within the study area.
North Pacific Right Whale	*Eubalaena japonica*	FE, FD, P	Found in the North Pacific Ocean. Seasonally migratory; inhabit colder waters for feeding, and then migrate to warmer waters for breeding and calving. Although they may move far out to sea during their feeding seasons, right whales give birth in coastal areas.	Very Rare	Not Expected. Unlikely to be present in the study area because fewer than 50 individuals are believed to occupy US waters.
Northern Elephant Seal	*Mirounga angustirostris*	P	Found from Alaska to Mexico. They are sighted regularly over shelf, shelf-break, and slope habitats and they are also present in deep ocean habitats seaward of the 2000 m isobaths. Rookeries are located in the Channel Islands and Ano Nuevo State Park.	Year-round Uncommon	Low-Moderate. Northern elephant seals are widely distributed along the west coast of North America and spend about nine months of the year at sea.
Northern Fur Seal	*Callorhinus ursinus*	FD, P	Spend 300 or more days per year foraging in the open ocean of the North Pacific. Use rocky beaches for reproduction. Usually come ashore in California only when debilitated, however, few individuals observed on Ano Nuevo Island.	Year-round Very Rare	Low. Usually 18-28 km from shore in California, however, they have been observed within 5 km of Point Pinos to the north of the study area.
Northern Right Whale Dolphin	*Lissodelphis borealis*	P	Endemic to deep, cold temperate of the North Pacific Ocean. Also occur over the continental shelf and slope where waters are less than 66°F.	Year-round Rare	Not Expected. Considered very rare within CA waters. Not likely to occur near in the study area.
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	P	Occupy temperate waters of the North Pacific. Found from the continental shelf to the deep ocean.	Year-round Common	Low. Likely to occur throughout the California coastline but typically do not occur nearshore.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Perrin's Beaked Whale	*Mesoplodon perrini*	P	Believed to occupy continental shelves and open ocean waters of the Pacific, but not well documented.	Very Rare	Not Expected. This whale is known from less than half a dozen strandings between San Diego and Monterey. It is highly unlikely that it will be observed within the study area, but the species' complete distribution is unknown.
Pygmy Sperm Whale	*Kogia breviceps*	P	Prefer tropical, subtropical, and temperate waters of the Pacific Ocean and occur over the continental slope and open ocean. They are mostly found offshore of Peru but also occur in the waters near Hawaii and the Pacific Northwest.	Rare	Not Expected. Unlikely to occur in the study area. Strandings have been documented off Mexico, and once in New Zealand and Monterey Bay. Overall the species is rare and would occur south of the study area.
Risso's Dolphin	*Grampus griseus*	P	Distributed throughout all major oceans. Generally found in waters greater than 1,000 m in depth and seaward of the continental shelf and slopes.	Year-round Rare	Low. They generally occur in deeper waters offshore of the study area.
Rough-toothed Dolphin	*Steno bredanensis*	P	Found in all tropical and subtropical oceans. Continental shelf to open ocean waters. Prefer deeper depths of tropical and warmer temperate waters.	Sighting in summer and early fall Rare	Not Expected. Unlikely to occur in the relatively cold waters surrounding the study area.
Sei Whale	*Balaenoptera borealis*	FE, FD, P	Wide distribution in subtropical, temperature, and subpolar waters around the world. Usually observed in deeper waters of oceanic areas far from the coastline.	Seasonal-spring and summer Very Rare	Not Expected. Sei whales are uncommon in CA waters, especially within the project area because they primarily occupy the open ocean.
Short-finned Pilot Whale	*Globicephala macrorhynchus*	P	Found in warmer tropical and temperate waters. Commonly seen along the coast close to the continental shelf. Forage in areas with high densities of squid.	Year-round Very Rare	Not Expected. Generally found in deeper water than that in the study area and in warmer waters.
Sperm Whale	*Physeter macrocephalus*	FE, FD, P	Occur globally in the open ocean far from land and are uncommon in waters less than 300 m deep. Live at the surface of the ocean but dive deeply to catch giant squid.	Most probable late spring and late fall Rare	Not Expected. Sperm whales are present offshore CA year- round, peak in abundance late spring and late summer, but are rarely seen because they occupy deep water far offshore.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Southern Sea Otter	*Enhydra lutris nereis*	FT, P, P	A top carnivore in its coastal range and a keystone species of the nearshore coastal zone. Frequent inhabitor in kelp forests.	Year-round Uncommon	Low-Moderate. Southern sea otters occupy the nearshore waters of California from San Mateo County south to Santa Barbara County. The primary populatons reside in between Monterey Bay and Cayucas in San Luis Obispos County. The waters offshore Grover Beach are within the southern end of their range and Sea otters are frequently observed.
Spotted Dolphin	*Stenella attenuata*	FD, P	Typically found far away from the coast in tropical and subtropical waters worldwide but can also occupy waters over the continental shelf. Spend majority of day in waters 90-300 m deep then dive to depth at night to search for prey.	Sightings in summer and early fall Rare	Not Expected. The eastern Pacific Ocean population is typically observed far from the coast and depleted in numbers of individuals.
Stejneger's Beaked Whale	*Mesoplodon stejnegeri*	P	Found in cold temperate and subarctic waters of the North Pacific Ocean, occupying deep, offshore waters.	Rare	Not Expected. Typically found in deep, offshore waters on or beyond the continental shelf.
Steller (Northern) Sea Lion	*Eumetopias jubatus*	FE, FD, P	Distributed around the coasts along the North Pacific Ocean rim. Common in coastal waters and onshore for resting. A small population breeds on Año Nuevo Island, north of Monterey Bay. *Critical Habitat; A zone that extends approximately 1000m seaward and landward of any Steller sea lion rookery in WA, OR, and CA. Any aquatic foraging habitat within the species geographic range.*	Seasonal Occasional-Common	Moderate. Documented as relatively common in the coastal waters of Central California.
Striped Dolphin	*Stenella coeruleoalba*	P	Distributed along continental shelf to open ocean waters worldwide, often found in areas of upwelling and around convergence zones. Prefer highly productive tropical to warm temperate waters that are oceanic and deep.	Sightings in summer and early fall Rare	Not Expected. Unlikely to occur near the study area. Observations are typically farther offshore.

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Turtles					
Green Sea Turtle	*Chelonia mydas*	FE, P	Distributed globally. Primarily use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas. *Critical Habitat; waters surrounding Puerto Rico.*	Seasonal Rare	Not Expected. In the eastern Pacific, green turtles have been sighted from Baja California to southern Alaska but most commonly occur from San Diego south.
Leatherback Sea Turtle	*Dermochelys coriacea*	FE, P	Distributed globally. Regularly seen off the western coast of the US in the pelagic with the greatest densities found off central CA. *Critical Habitat; U.S. Virgin Islands and offshore California, Oregon and Washington. In California all coastal waters between the shore and 200 m water depth between Point Arena and Point Sur and out to 3,000 m between Point Arena and Point Arguelo.*	Seasonal Occasional	Low. Leatherback sea turtles are most commonly seen between July and October, when the surface water temperature warms to 15-16° C and large jellyfish, the primary prey of the turtles, are abundant offshore.
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	FT, P	Mainly a "pelagic" sea turtle in tropical/temperate regions of the Pacific, South Atlantic, and Indian Oceans but has been known to inhabit coastal areas, including bays and estuaries.	Seasonal Very Rare	Not Expected. In the eastern Pacific, the range of the Olive Ridley turtle extends from southern California to northern Chile.
Loggerhead Sea Turtle	*Caretta caretta*	FE, P	Distributed throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Occupy three different ecosystems during their lives: the terrestrial zone, the oceanic zone, and the neritic or nearshore coastal area. *Critical Habitat; The Northwest Atlantic DPS critical habitat includes waters throughout the Gulf of Mexico around the Florida panhandle and up the eastern seaboard of the US.*	Seasonal Very Rare	Low. In the U.S., most recorded sightings are of juveniles off the coast of California but occasional sightings are reported along the coasts of Washington and Oregon.

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Sharks and Fish					
Basking Shark	*Cetorhinus maximus*	CSC, P	Usually sighted from British Columbia to Baja California in the winter and spring months. Movements and migrations of species once it leaves coastal areas is poorly understood and largely unknown.	Seasonal Very Rare	Not Expected. Basking shark populations were severely depleted by commercial fisheries of the 1950s, and they have never fully recovered due to slow growth and low fecundity.
Eulachon	*Thaleichthys pacificus*	FT	Found between northern CA and southwest Alaska. Spawning and rearing occurs in estuarine river habitats, then individuals migrate to saltwater where they spend three year before returning to river spawning locations. *Critical Habitat; From Eureka, CA to the boarder with OR coastal stretches of the Mad River, Redwood Creek, and Klamath River that reach the ocean are designated as critical habitat.*	Rare	Not Expeted. Monterey Bay is at the southern limit of this species' distribution, and the population is in decline.
Coho Salmon (Southern OR and Northern CA coasts ESU)	*Oncorhynchus kisutch*	FT, CT, P	Spawn in small streams with gravel substrates, and spend first half of life cycle in streams and small freshwater tributaries. The later half of life cycle is spent foraging in estuarine and marine waters.	Seasonal, Very Rare	Not Expected. -Low. No known suitable spawning rivers in San Luis Obispo County. Salmon swimming ocean waters could occasionally be present.
Longfin smelt	*Spirinchus thaleichthys*	CT	Found along the Pacific coast from Alaska into California. This species uses nearshore waters, estuaries, and freshwater streams throughout its life cycle.	Very Rare	Not Expected. A single longfin smelt collected from the Monterey Bay area was reported by Eschmeyer et al. (1983) but the San Francisco Bay Delta population is considered the southernmost population for this species (Moyle 2002)

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Sharks and fish (continued)					
North American Green sturgeon (Southern Distinct Population Segment, DPS)	*Acipenser medirostris*	FT	Within the marine environment, the Southern DPS occupies coastal bays and estuaries from Monterey Bay to Puget Sound in Washington. Individuals occasionally enter coastal estuaries to forage. *Critical Habitat; All of Monterey Bay, CA and ocean water out to 60 Fathoms depth from Monterey Bay northward to the boarder with Canada.*	Rare	Low. There a very few data on green sturgeon presence in coastal waters. This species may forage in or near the project area but its distribution in ocean waters is essentially unknown.
Steelhead Trout, South-Central California Coast Steelhead DPS	*Onchorhynchus mykiss*	FT, CSC, P	Can be found along the entire Pacific Coast. Anadromous individuals can spend up to 7 years in fresh water prior to smoltification, and then spend up to 3 years in salt water prior to first spawning. Individuals that spend their entire life in fresh water are called rainbow trout. *Critical Habitat; Essentially all major rivers and coastal stretches of all rivers and creeks throughout CA.*	Seasonal Rare to Common	Moderate. Spawn in streams and rivers throughout northern and central CA including coastal rivers flowing into the ocean between Point San Luis and Mussel Point. Adults may occur in coastal waters near streams and rivers.
Tidewater Goby	*Eucycloglobius newberryi*	FE, P	This goby inhabits lagoons formed by streams running into the sea. The lagoons are blocked from the Pacific Ocean by sandbars, admitting salt water only during particular seasons, and so their water is brackish and cool. The tidewater goby prefers salinities of less than 10 parts per thousand (ppt) and is thus more often found in the upper parts of the lagoons, near their inflow.	Seasonal Rare	Not Expected to occur in coastal waters. It is very rare and suitable habitat only occurs in coastal lagoons. Present in several of the coastal lagoons in Central California near Grover Beach.
White sharks	*Carcharodon carcharias*	CSC, P	Coastal and offshore waters along the continental shelf and islands. In California, important white shark habitat is present around Monterey Bay and Greater Farallones national marine sanctuaries. White shark populations are impacted by purposeful and incidental capture by fisheries, marine pollution, and coastal habitat degradation	Year-round Occassional to Common	Moderate to High. Present in coastal waters throughout the State. Occurrence in the waters offshore Grover Beach have been increasing in recent years.

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Gastropods					
Black Abalone	*Haliotis cracherodii*	FE, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Range from Point Arena, CA to Bahia Tortugas and Isla Guadalupe, Mexico. *Critical Habitat; Essentially all CA coast line from Del Mar Landing Ecological Reserve to South of Government Point and again from the Palos Verded/Torrance boarder through the LA harbor. Also all nearshore waters around the Farallon and Ano Nuevo Islands and the San Miguel, Santa Cruz, Anacapa, Santa Barbara, and Santa Catalina Islands.*	Year-round Very Rare	Low. Point Arena is the northern most point of black abalone distribution along the entire California coast; the populations in south Central California have been declining in recent years due to a variety of ecological factors.
Green Abalone	*Haliotis fulgens*	FSC, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Green abalone habitat ranges from Point Conception, CA to Bahia Magdalena, Baja Calfironia Sur, Mexico.	Year-round Very Rare	Not Expected. Green abalone are not known to occur north of Point Conception, CA.
Pink Abalone	*Haliotis corrugate*	FSC, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Distributed from Point Conception to Bahia de Santa Maria in Baja California, Mexico.	Year-round Very Rare	Not Expected. Pink abalones are unlikely to be found north of Point Conception.
White Abalone	*Haliotis sorenseni*	FE, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Range from Point Conception, CA to Punta Abreojos, Baja California, Mexico.	Year-round Very Rare	Not Expected. White abalone numbers are extremely low throughout southern CA. It is highly unlikely given their historic range and depleted numbers that they occur north of the Point Conception.

NOTES:

FESA = Federal Endangered Species Act

MMPA = Marine Mammal Protection Act

CESA = California Endangered Species Act

STATUS CODES:

Federal: National Oceanographic and Atmospheric Administration (NOAA); MMPA

FD = Depleted Population

P = Federally Protected

Federal: U.S. Fish and Wildlife Service (USFWS), NOAA National Marine Fisheries Service (NMFS); FESA

FDL = Delisted

FE = Listed as “endangered” (in danger of extinction) under FESA

FT = Listed as “threatened” (likely to become Endangered within the foreseeable future) under FESA

FC = Candidate to become a proposed species

FSC = Former “federal species of concern”. The USFWS no longer lists Species of Concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. *NMFS still lists “Species of Concern”.

State: California Department of Fish and Game (CDFG); CESA

CE = Listed as “endangered” under the CESA

CT = Listed as “threatened” under the CESA

CSC = CDFW designated “species of special concern”

Potential for Species Occurrence Rankings:

Not Expected - Suitable foraging or spawning habitat is not known to be present or rare, and the species has not been or is rarely documented to occur

Low - Suitable foraging or spawning habitat is present, but the species has either not been documented to be present or if present, the presence is uncommon and infrequent

Moderate - Suitable foraging or spawning habitat is present and the species is somewhat common or common for part of the year

High - Suitable foraging or spawning habitat is present and the species is common throughout the year and/or in substantial numbers

Sources: Allen et al 2010, Allen 2014, Applied Marine Sciences (2015), California Department of Fish and Wildlife (CDFW), Natural Diversity Database. 2018., Dick et. al 2007, Driscoll 2014. Love and Yoklavich 2008, Marine Mammal Commission Marine Mammal Species of Special Concern 2018, Mercury News 2016, Miller and Shanks 2004, NOAA 2011b, NOAA 2014b, NOAA 2017, NOAA 2018a NOAA 2018b, OCS 2015, UC Davis 2017, Whaleopedia 2018,

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9 Appendices

Appendix A: Macrobenthic Invertebrate, Algae, and Fish Taxonomic Lists

Appendix A-1: Master Macrobenthic Invertebrate and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters.

Appendix A-2: Macrobenthic Invertebrates and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters by Depth.

Appendix A-3: Master Fish Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters.

Appendix A-4: Fish Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters by Depth.

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Appendix A-1: Master Macrobenthic Invertebrate and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and Central California Waters.

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
Angiosperm	**Flowering Plant**																	
	Phyllospadix sp.	Surf grass									X							
	Phyllospadix sp.	Drift surf grass			X													
Chlorophyta	**Green Algae**																	
	Ulva spp. drift	Sea lettuce, drift									X							
Phaeophyta	**Brown Algae**																	
	Egregia meanzinii drift	Feather boa kelp drift							X		X	X	X					
	Macrocystis pyrifera drift	Giant kelp, drift	X		X				X		X	X	X					
	Nereocystis californica drift	Bull kelp, drift									X	X	X					
	Phaeophyta, unident.	Unidentified brown algae																
Rhodophyta	**Red Algae**																	
	Callophyllus sp.	Beautiful leaf algae			X						X			X	X			
	Corallina officinalis														X			
	Corallincea Unident., drift	Coralline algae, drift		X	X						X	X	X	X				
	Cumathamnion decipiens													X				
Rhodophyta	*Cryptopleura violacea*														X			
	Gelidium coulteri													X				
	Gracilaria														X			
	Halymena californica													X	X			
	Halymena coccinea													X	X			
	Halymena hollenbergii														X			
	Gymnogongrus														X			

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	platyphyllus																	
	Mazzaella cordata													X	X			
	Mastocarpus papillatus	Turkish towel		X	X				X									
	Opuntiella californica													X				
	Phycodrys setchellii													X	X			
	Polyneura latissima													X				
	Rhodoglossum owensiae													X				
	Rhodymenia sp.	Red membrane algae									X			X	X			
	Rhodophyta, unident.	Red algae unidentified		X	X													
Ochrophyta	*Cystoseira osmundacea*	Chain-bladder kelp							X									
	Desmarestia ligulata	Acid kelp			X				X					X	X			
	Desmarestia ligulata	Acid kelp, drift	X	X	X													
Ochrophyta	*Eisenia arborea*	Southern sea palm							X									
	Laminaria dentigera														X			
	Laminaria farlowii	oarweed							X									
	Laminaria setchellii	Southern stiff striped kelp							X									
	Pterygopgora californica	Pom pom kelp							X									
	Sargassum sp.	wireweed							X									
	Undaria pinnatifida	Wakame							X									
Porifera	**Sponges**																**X**	
	Acarnus erithacus	Red volcano sponge													X			
	Craniella arb	Gray puffball sponge				X	X		X						X			
	Haliclona sp.														X			
	Halichondria panicea	Breadcrumb sponge												X				
	Leucetta losangelensis													X	X			
	Polymastia pachymastia	Aggravated vase sponge									X							
	Rhabdocalyptus sp.	Vase sponge		X														

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	Spheciospongia confoederata	Grey moon sponge									X							
		Sponge, foliose white									X	X						
		Sponge, large white									X							
Porifera		Sponge, white									X	X						
		Sponge, white encrusting									X	X						
		Sponge, white/gray saucer									X	X						
		Sponge, grey									X	X						
		Sponge, orange	X								X							
		Sponge, salmon encrusting									X	X						
		Sponge, tan bulbous									X							
		Sponge, tan globose									X							
		Sponge, unidentified	X											X				
		Sponge, yellow	X								X	X						
	Tethya aurantia	Orange puff ball sponge							X		X	X						
	Toxadocia spp.	White finger sponge							X		X							
Cnidaria	**Hydroids, Sea Anemones, Sea Pens, Corals**																	
	Acanthoptilum sp.	Sea Pen		X	X	X	X					X	X					X
	Actinaria unident.	Sea anemone				X											X	
	Actinostola	Anemone				X												
	Adelogorgia phyllostera	Orange gorgonian		X							X		X					
	Amphianthus	Sea anemone				X												
	Anthopleura artemsia?	Moonglow anemone											X		X			

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Cnidaria	Anthopleura elegantissima	Aggregating anemone							X						X			
	Anthopleura sola	Solitary anemone							X									
	Anthopleura xanthogrammica	Giant green anemone							X									
	Anthozoa unident.	Anthozoan anemone, unidentified			X													
	Aurellia sp.	Moon jelly																
	Balanophyllia elegans	Orange cup coral					X				X			X	X			
	Bossiella													X				
	Caryophillia sp.?	White cup coral				X	X				X							
	Cerianthidae, unident.	Cerianthid anemone										X	X					X
	Corallimorphus sp. 1	Colonial anthizoan																X
	Corynactis californica	Strawberry or club-tipped anemone				X					X			X	X		X	
	Cup coral	Brown or orange cup corals							X									
	Cyathoceras foxi	Cup corals		X														
	Desmophyllum	Cup corals				X												
	Eugorgia rubens	Purple gorgonian		X					X									
Cnidaria	*Eugorgia spp.*	Gorgonian coral, unidentified	X															
	Gorgonocephalus eucnemis	Giant basket star		X		X	X										X	
	Hydrozoa	Corals							X									
	Lophelia sp.	Branching white coral				X					X							
	Lophogorgia chiliensis	Red gorgonian (sea whip)		X		X	X		X		X							
	Metridium farcimen (giganteum)	White-plumed anemone	X	X	X	X	X				X	X	X	X	X		X	

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	Muricea californica	Golden gorgonian							X									
	Muricea fruticoas	Brown gorgonian							X									
	Paracyathus stearnsi	Brown cup coral	X			X	X				X	X		X	X		X	
	Parazoanthus sp.	Parasitic aggregating		X														
	Pachycerianthus sp.	Tube anemone									X	X		X	X			
	Pachycerianthus fimbratus	Tube-dwelling anemone							X									
	Pennatulacea sp.	Sea pen																X
	Plumularia sp.															X		
	Polyorchis pencillatus	Bell medusa							X									
Cnidaria	*Ptilosarcus gurneyi*	Orange or fleshy sea pen		X	X								X					X
	Scytalium sp.	Sea pen			X							X	X					
	Stomphia coccinea	Swimming anemone				X					X		X					
	Stompia spp.	Swimming anemone																X
	Stylaster californicus (formerly Allopora californica)	California hydrocoral				X			X		X							
	Stylatula elongata	White sea pen		X	X							X	X	X		X		X
	Stylatula sp.	Sea pen			X			X				X	X					
	Urticina piscivora	Rose anemone									X	X						
	Urticina sp.	Anemone, unident.											X					
	Virgularia californica	Sea pen											X					
	Virgularia sp	Sea pen			X							X	X					
	Virgularidae unident.	Sea pen										X	X					
	Urticina columbiana	Sand-rose anemone									X	X						
	Urticina lofotensis	White-spotted rose anemone							X						X			
	Urticina mcpeaki	McPeak's urticina							X									

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Cnidaria	*Urticina piscivora*	White-spotted rose anemone Fish-eating anemone									X			X	X			
	Urticina sp.	Sand dwelling anemone											X					
		Plumed hydroid, unident.									X		X					
		Branched hydroid, unident.									X							
Annelida	**Segmented Worms**																	
	Arcidae unident.							X										
	Amphinomidae	Polychaete worm											X					
	Chaetopterus variopedatus	Parchment worm			X									X		X		
	Chloeia pinnata?	Free living polycahete						X					X					
	Cossura	Polychaete						X										
	Dodecaceria fewkesi													X	X			
	Diopatra ornata	Ornate tube worm								X			X	X	X	X		X
		Serpulid worm casing									X							
		Tube Worm, unident.											X					
	Diopatra splendidissima	Splendid diopatra			X													
	Laonice spp.													X				
Annelida	*Lumbrineris*	polychaete						X										
	Maldanidae	polychaete mound worms		X	X			X										
	Mediomastus	Polychaete worm						X										
	Nephtys	Catworm						X										
	Paraprionospio	polychaete						X										
	Pectenaria	Fanworm						X										
	Phyllochaetopterus	Parchment worms		X														
	Pista pacifica															X		

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	Prionospio							X										
	Protula superba	Serpulid tube worm			X													
	Sabellidae unident.	Feather duster worms			X													X
	Serpulidae unident.	Sand tube worm			X													
	Spiophanes							X										
	Tharyx							X										
Mollusca	**Bivalves, Snails, Octopus, Squid, Sea Hares, Nudibranchs**																	
	Anisodoris sp.	Yellow nudibranch									X							
	Aplysia californica	California sea hare							X									
Mollusca	*Astrea gibberosa*	Red turban snail									X							
	Axinopsida							X										
	Bivalve Mollusk	Clam like bivalve																
	Bivalve siphon																	X
	Cadlina leuteomarginata	Yellow-edged cadlina							X									
	Calliostoma annulatum	Purple-ring top snail									X			X				
	Calliostoma tricolor	Three colored top shell													X			
	Calliostoma ligatum	Blue top snail												X	X			
	Cancellaria cooperii	Cooper's nutmeg														X		
	Ceratostoma foliatum	Leafy hornmouth							X					X				
	Chaceia ovoidea	Wart-necked piddock							X									
Mollusca	*Chromadorid sp.*	Chromid sea slug									X							
	Crassedoma giganteum	Rock scallop							X									
	Crossata ventricosa	California frog shell			X													
	Cyclocardia							X										
	Cypraea spadicea	Chestnut cowry							X									
	Cryptochiton stelleri	Gumboot chiton or giant western fiery chiton												X				

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	Dendrodoris sp.	Dendrodorid nudibranch							X									
Mollusca	*Diaulula sandiegensis*	San Diego dorid							X					X				
	Diodora aspera	Rough keyhole limpet													X			
	Dirona albolineata	White-lined dirona							X									
	Doriopsilla albopunctata	White spotted sea goddess												X	X			
	Doris montereyensis	Monterey dorid							X									
	Flabellinopsis iodinea	Spanish shawl nudibranch							X		X			X	X			
	Gastropoda	Marine snail								X								X
	Haliotis corrugata	Pink abalone							X									
	Haliotis fulgens	Green abalone							X									
	Haliotisrufescens	Red abalone							X									
	Kelletia kellettii	Kellet's whelk			X				X					X	X			
	Leopecten diegensis	San Diego scallop		X	X													
	Lithopoma undosum	Turban snail							X									
	Loligo sp. (In water column)	squid									X	X	X					
	Megathura carpenteriana	Carpenter's turid			X													
	Megathura crenulata	Giant keyhole limpet							X									
Mollusca	*Mexichromis porterae*	Porter's chromodorid							X									
	Mitra idae	Ida's miter												X				
	Mitrella	Sea snail						X										
	Nassarius fossatus															X		
	Nassarius sp.	Nassa mud snails								X				X		X		
	Norrisia norrisi	Norris's topsnail							X									
	Nudibranch, dorid white	Sea slug									X							X
	Octopoda	Octopus			X			X						X	X			X

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	Octopus bimaculoides	Two-spot octopus			X				X									
	Octopus californicus	Deep water octopus		X	X													
	Octopus rubescens	Octopus			X								X					
	Olivella biplicata	Purple dwarf olive														X		
	Opistobranchia, *unident.*	Unidentifed opistobranch			X													
	Parapholas californica	Scaleside piddock							X					X	X			
	Parvilucina							X										
	Peltodoris nobilis	Sea lemon							X									
	Polinices altus															X		
	Polinices draconis															X		
Mollusca	*Pleurobranchea californica*	Sea slug	X	X	X			X					X					X
	Rictaxis punctulatus													X				
	Tonicella lineata	Lined chiton												X				
	Tritonia diomedea	Large triton slug		X														
	Trivia calforinicana	Coffee bean trivia												X				
Arthropoda		**Shrimp, Crabs, Isopods**																
	Amphipods							X										
	Barnacle	Unidentified barnacle							X									
	Brachyura, unident.	Unidentified crab	X		X													
	Cancer antennarius	Brown rock crab							X									
	Cancer anthonyi	Yellow crab	X		X													
	Cancer gracilis	Slender crab										X	X					
	Cancer spp.	Crab	X		X			X	X		X	X	X					X
	Cancer productus	Red rock crab		X	X													
	Euphilomedes							X										
	Farfantepenaeus	Brown shrimp			X													

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	californiensis																	
Arthropoda	*Galatheidae*	Squat lobster				X	X											
	Heterocrypta occidentalis	Sandflat elbow crab								X						X		
	Hemisquilla ensigera	Manta shrimp		X	X													
	Hinnites giganteus	Rock scallop									X							
	Isocheles pilosus															X		
	Loxorhynchus crispatus	Masking crab				X	X		X		X					X		
	Loxorhynchus grandis	Sheep crab												X	X			
	Majidae	Masking spider crab	X	X	X													
	Munida quadrispina	Squat lobster									X							
	Paguristes sp.	Hermit crab	X	X						X		X	X	X		X		
	Pandalus danae	Coon stripe shrimp									X							
	Pandalus gurneyi	Coon striped shrimp							X									
	Panulirus interruptus	California spiny lobster							X									
	Pandalus platyceros	California spot prawn																X
	Pandalis jordani ?	Pacific ocean shrimp									X	X	X					
	Pandalid shrimp	Shrimp									X	X	X					
	Paralithodes californiensis	California king crab		X														
	Photis	Amphipod	X	X	X			X										
	Phyllolithodes papillosus	Heart crab												X				
Arthropoda	*Playtymera guadichandii*	Armed box crab																
	Pugettia producta	Northern kelp crap							X							X		
	Pugettia richii	Cryptic kelp crab							X									
	Sicyonia	Prawn						X										

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	Bryozoans																	
Ectoprocta		Bryozoa, pink encrusting									X							
		Bryozoa, tan encrusting									X							
		Bryozoa, tan									X				X			
		Bryozoa, white branching		X							X							
		Bryozoa, orange encrusting		X							X							
		Bryozoa, orange branching			X						X							
		Bryozoans, Unident				X	X				X							
	Membranipora sp.	White encrusting bryozoan on drift kelp										X						
		White ectoproct?																
	Cellaria sp	Stick-figure bryozoan									X							
Echinodermata	**Sea Stars, Brittle Stars**																	
	Allocentrotus fragilis	Pink sea urchin		X	X			X										
	Amphiodia sp.	Brittle star						X					X					
Echinodermata	*Amphipholis* sp.	Brittle star				X		X					X					
	Asterina miniata	Bat star			X	X	X		X	X			X	X	X	X		
	Astometis sertulifera	Fragile rainbow star							X									
	Asteroidea unident.	Sea star			X													X
	Astropecten verrilli and/or A. *armatus*	Spiny sand star		X	X			X	X				X					
	Brisaster	Sea urchin						X										
	Brisingidae	Sea star						X										X
	Brissopsis	Sea urchin																
	Centrostephanus coronatus	Black sea urchin							X									
	Ceramaster patagonicus	Cookie cutter sea star							X		X							
	Crinoidea	Orange crinoid	X															

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	Cucumaria piperata	Salt-and-pepper sea cucumber							X									
	Dendraster excentricus	Sand dollar										X				X		
	Dermasterias imbricata	Leather star							X		X							
	Echinoderm, juvenile unident.	Juvenile sea star									X							
	Echinoderm, unident.	Unidentified sea star			X													
Echinodermata	*Florometra serratissima*	Crinoid					X				X							
	Henricia spp.	Sea star				X	X		X		X							
	Hippasteria sp.	Sea star					X											X
	Holothuroidea sp.	Sea cucumber																X
	Leptosynapta albicans	Translucent sea cucumber														X		
	Linckia columbianus	Fragile star							X									
	Luidia foliolats	Sand star			X													
	Lytechinus anamesus	White urchin			X			X	X									
	Lytechinus pictus	White sea urchin		X	X													
	Mediaster aequalis	Red sea star		X	X	X	X				X							X
	Ophiocantha diplasia	Brittle star				X	X						X					
	Ophionereis sp.	Brittle star				X	X						X					
	Ophiura sp.	Brittle star										X	X					
	Ophiuroids, unident	Brittle star		X	X							X	X					
	Ophioplocus esmarki	Smooth brittle star							X					X				
	Ophiothrix spiculata	Brittle star												X				
	Orthasterias koehleri	Rainbow sea star							X		X			X	X			
	Parastichopus californicus	Sea cucumber	X	X	X				X				X					X
Echinodermata	*Parastichopus leukothele*	Sea cucumber																X
	Parastichopus parvimensis	Purple sea cucumber			X				X									
	Parastichopus sp.	Sea cucumber					X						X					X

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	Peridontaster					X												
	Petalaster (luidia) foliolata	Leafy flat star		X	X			X					X					X
	Pisaster brevispinus	Pink sea star			X	X			X	X	X	X	X	X	X	X		
	Pisaster sp.	Sea star									X	X	X					
	Pisaster giganteus	Giant-spined sea star							X		X			X	X			
	Pisaster ochraceus	Ochre star							X	X				X	X			
	Poraniopsis inflata	Fat yellow sea star		X	X													
	Pteraster sp.	Sea star																X
	Pteraster tesselatus arcuatus	Fat sea star											X					
	Pycnopodia helianthoides	Sunflower star							X				X		X			X
	Rathbunaster californica	Multi-armed sea star				X	X						X					X
	Solaster dawsonii	Morning sun star											X					
	Strongylocentrotus franciscanus	Red sea urchin							X					X	X			
Echinodermata	*Strongylocentrotus purpuratus*	Purple sea urchin							X					X	X			
	Stylasterias forreri	Fish-eating star							X									X
	Tunicates					X	X											
	Archidistoma psammion	Compound ascidian									X							
Urorchordata	*Ascidia paratropa*	Glassy tunicate									X							
	Boltenia villosa	Spiny-headed tunicate									X			X	X			
	Cystodytes sp.	Lobed tunicate									X							
	Polyclinum planum	Elephant ear tunicate									X							
	Styela montereyensis	Stalked tunicate							X		X			X	X			

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Laqueus californianus	Lampshell															X	
Hemichordata	*Balanoglassus sp.*								X									
	Enteropneusia								X									

Appendix A-2: Macrobenthic Invertebrates and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and Central California Waters by Depth.

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Protobacteria																		
Beggiatoa spp.	White filamentous bacteria		X															
Angiosperm		X																
Phyllospadix sp.	Surf grass, drift									X	X	X						
Phaeophyta																		
Egregia meanzinii	Feather boa kelp, drift							X		X	X	X						
Macrocystis pyrifera	Giant kelp, drift	X		X				X		X	X	X	X					
Nereocystis californica	Bull kelp, drift									X	X							
Phaeophyta, unident.	Unidentified brown algae	X	X															
Rhodophyta																		
Callophyllus sp.	Beautiful leaf algae													X				
Chondracanthus exasperatus		X		X										X				
Corallina officinalis														X				
Corallincea Unident., drift	Coralline algae, drift													X				
Cumathamnion decipiens																		
Cryptopleura violacea														X				
Mastocarpus papillatus	Turkish towel							X										
	Encrusting coralline algae									X	X	X						
Cystoseira osmundacea	Chain-bladder kelp							X										
Desmarestia ligulata	Acid kelp	X						X						X				
Desmarestia ligulata, drift	Drift acid kelp	X		X	X													
Eisenia arborea	Southern sea palm							X										
Gelidium coulteri														X				
Gracilaria														X				

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Halymena californica														X				
Halymena coccinea														X				
Halymena hollenbergii														X				
Gymnogongrus platyphyllus														X				
Mazzaella cordata														X				
Laminaria dentigera														X				
Laminaria farlowii	oarweed							X										
Laminaria setchellii	Southern stiff striped kelp							X										
Pterygopgora californica	Pom pom kelp							X										
Opuntiella californica														X				
Phycodrys setchellii														X				
Polyneura latissima														X				
Rhodoglossum owensiae														X				
Rhodymenia sp.														X				
Rhodophyta, unident.	Red algae unidentified	X	X															
Sargassum sp.	wireweed							X										
Undaria pinnatifida	wakame							X										
Porifera																		
Acarnus erithacus	Red volcano sponge													X				
Craniella arb	Gray puffball sponge							X						X				
Haliclona sp.														X				
Rhabdocalyptus sp.	Vase sponge			X	X													
Silicea (Porifera*) Sp. A*	Sponge-orange			X														
Silicea (Porifera*) Sp. B*	Sponge- Yellow			X														
Silicea (Porifera*) Sp. C*	Sponge, unident.			X														
Silicea (Porifera*) Sp. D*	Tan globular sponge										X	X	X					
Tethya aurantia	Orange puff ball sponge							X			X	X						

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Toxadocia spp.	White finger sponge							X										
Cnidaria																		
Acanthoptilum sp.	Sea Pen	X	X	X	X						X	X	X					
Actinaria unident.	Sea anemone														X	X	X	
Actinostola	Anemone					X	X											
Adelogorgia phyllostera	Orange gorgonian		X										X					
Amphianthus	Sea anemone					X	X											
Anthopleura artemsia?	Moonglow anemone				X						X			X				
Anthopleura elegantissima	Aggregating anemone							X						X				
Anthopleura sola	Solitary anemone							X										
Anthopleura xanthogrammica	Giant green anemone							X										
Balanophyllia elegans	Orange cup coral						X				X	X	X	X				
Bossiella														X				
Caryophillia sp.	White cup coral					X	X				X							
Cerianthidae, unident.	Cerianthid anemone										X	X				X	X	
Corallimorphus sp. 1	Colonial anthizoan																X	
Corynactis californica	Strawberry or club-tipped anemone					X				X				X	X			
Cyathoceras foxi	Cup corals			X														
Desmophyllum	Cup corals					X	X											
Eugorgia rubens	Purple gorgonian		X					X										
Eugorgia, spp.	Unidentified gorgonian coral				X													
Gorgonocephalus eucnemis	Giant basket star				X		X										X	
Hydrozoa	Corals				X			X										
Lophelia sp.	Branching white coral						X					X						
Lophogorgia chiliensis	Red gorgonian (sea whip)		X			X		X			X							

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Metridium farcimen (=giganteum)	White-plumed anemone		X	X	X	X	X				X	X	X	X	X	X	X	X
Muricea californica	Golden gorgonian							X										
Muricea fruticoas	Brown gorgonian							X										
Paracyathus stearnsi	Brown cup coral			X		X				X	X	X		X		X		
Parazoanthus sp.	Parasitic aggregating		X															
Pachycerianthus sp.	Tube anemone							X		X	X	X	X	X				
Pennatulacea sp.	Sea pen				X													
Plumularia sp.														X				
Polyorchis pencillatus	Bell medusa							X										
Ptilosarcus gurneyi	Orange or fleshy sea pen		X		X						X					X	X	X
Scytalium sp.	Sea pen										X	X	X					
Stomphia coccinea	Swimming anemone						X			X	X					X	X	
Stompia spp.	Swimming anemone															X	X	
Stylaster californicus (formerly Allopora californica)	California hydrocoral					X		X										
Stylatula elongata	White sea pen	X	X	X	X					X	X	X	X	X	X	X	X	X
Stylatula sp.	Sea pen					X				X	X	X	X					
Subselliflorae spp.	Sea whip, unidentified		X	X	X													
Urticina columbiana	Sand-rose anemone									X								
Urticina piscivora	White-spotted rose anemone									X	X			X				
Urticina sp.	Anemone, unident.									X	X	X	X					
Urticina lofotensis	White-spotted rose anemone							X		X				X				
Urticina mcpeaki	McPeak's urticina							X										

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Virgularia agassizii	Sea pen										X	X	X					
Virgularia californica	Sea pen									X	X	X	X					
Virgularia sp	Sea pen		X	X	X					X	X	X	X					
Virgularidae unident.	Sea pen									X	X	X	X					
Amphinomidae	Free living Polychaete												X					
Chaetopterus variopedatus	Parchment worm	X												X				
Chloeia pinnata?	Free living polychaete						X						X					
Cossura	Polychaete					X												
Dodecaceria fewesi														X				
Diopatra ornata	Ornate tube worm	X	X						X	X	X			X		X		
	Tube Worm, unident.									X	X	X	X					
Diopatra splendidissima	Splendid diopatra	X																
Laonice spp.														X				
Lumbrineris	polychaete					X	X											
Maldanidae	polychaete mound worms	X																
Mediomastus	Polychaete worm					X												
Nephtys	Catworm					X												
Paraprionospio	polychaete					X	X											
Pectenaria	Fanworm					X												
Phyllochaetopterus	Parchment worms	X																
Pista pacifica														X				
Prionospio						X												
Protula superba	Serpulid tube worm		X															
Sabellidae unident.	Feather duster worms		X					X										
Spiophanes						X												
Tharyx							X											
	Unknown feathered tube										X							

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
	worm																	
Mollusca																		
Aplysia californica	California sea hare				X			X										
Axinopsida						X												
Bivalve Mollusk	Clam like bivalve										X					X		
Cadlina leuteomarginata	Yellow-edged cadlina							X						X				
Calliostoma annulatum	Purple ring top snail										X			X				
Calliostoma tricolor	Three colored top shell													X				
Calliostoma ligatum	Blue top snail													X				
Cancellaria cooperii	Cooper's nutmeg													X				
Ceratostoma foliatum	Leafy hornmouth							X						X				
Chaceia ovoidea	Wart-necked piddock							X										
Crassedoma giganteum	Rock scallop							X										
Cyclocardia						X												
Cypraea spadicea	Chestnut cowry							X										
Cryptochiton stelleri	Gumboot chiton													X				
Dendrodoris sp.	Dendrodorid nudibranch							X										
Diaulula sandiegensis	San Diego dorid							X						X				
Dirona albolineata	White-lined dirona							X										
Diodora aspera	Rough keyhole limpet													X				
Doris montereyensis	Monterey dorid							X										
Doriopsilla albopunctata	White spotted sea goddess													X				
Flabellinopsis iodinea	Spanish shawl nudibranch							X						X				
Gastropoda	Marine snail								X	X	X					X		
Haliotis corrugata	Pink abalone							X										
Haliotis fulgens	Green abalone							X										
Haliotis rufescens	Red abalone							X										

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Kelletia kellettii	Kellet's whelk	X						X						X				
Leopecten diegensis	San Diego scallop	X	X															
Lithopoma undosum	Turban snail							X										
Loligo sp.	squid									X	X	X	X					
Megathura crenulata	Giant keyhole limpet							X										
Megasurcula carpenteriana	Carpenter's turid		X															
Mexichromis porterae	Porter's chromodorid							X										
Mitra idae	Ida's miter													X				
Mitrella	Sea snail						X											
Nassarius sp.									X					X				
Norrisia norrisi	Norris's topsnail							X										
Nudibranch, dorid white	Sea slug															X		
Octopoda	Octopus				X	X								X		X	X	
Octopus bimaculoides	Two-spot octopus		X	X				X										
Octopus californicus	Deep water octopus			X	X													
Octopus rubescens	Octopus				X					X	X	X	X					
Olivella biplicata	Purple dwarf olive													X				
Parapholas californica	Scaleside piddock							X						X				
Parvilucina						X												
Peltodoris nobilis	Sea lemon							X										
Pleurobranchia californica	Sea slug			X	X		X				X	X	X			X	X	X
Polinices altus														X				
Polinices draconis														X				
Rictaxis punctulatus														X				
Tonicella lineata	Lined chiton													X				
Tritonia diomedea	Large triton slug			X														
Trivia calforinicana	Coffee bean trivia													X				

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Ectoprocta																		
	Bryozoa, orange branching										X							
	Bryozoa, orange encrusting									X	X	X						
	Bryozoa, pink encrusting									X	X	X						
	Bryozoa, unknown			X	X					X	X	X						
Cellaria sp.	Stick-figure bryozoan										X							
Arthropoda																		
Barnacle	Unidentified barnacle							X										
Brachyura, unident.	Crabs, unidentified			X	X													
Cancer antennarius	Brown rock crab							X										
Cancer anthonyi	Yellow crab			X	X													
Cancer gracilis	Slender crab									X	X	X	X					
Cancer productus	Red rock crab	X																
Cancer spp.	Crab			X	X	X				X	X	X	X		X	X	X	X
Euphilomedes						X												
Farbantepentaeus californiensis	Brown shrimp			X														
Galatheidae	Squat lobster					X	X											
Heterocrypta occidentalis	Sandflat elbow crab								X					X				
Hemisquilla ensigera	Manta shrimp		X		X													
Hinnites giganteus	Rock scallop							X			X							
Isocheles pilosus														X				
Loxorhynchus grandis														X				
Loxorhynchus crispatus	Masking crab							X		X				X				
Loxorhynchus grandis	Kelp crab			X														
Majidae, unident.	Masking spider crab			X														
Paguristes sp.	Hermit crab	X							X		X			X				

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Pandalid shrimp	Shrimp										X	X	X					
Pandalis jordani?	Pacific ocean shrimp										X	X	X					
Pandalus gurneyi	Coonstriped shrimp							X										
Pandalus platyceros	California spot prawn		X															
Panulirus interruptus	California spiny lobster							X										
Paralithodes californiensis	California king crab				X													
Photis	Amphipod					X												
Phyllolithodes papillosus	Heart crab													X				
Playtmera gaudichandii	Armed box crab			X	X													
Pugettia producta	Northern kelp crap							X						X				
Pugettia richii	Cryptic kelp crab							X										
Sicyonia	Prawn					X												
Echinodermata																		
Amphiodia urtica	Brittle star										X	X	X					
Amphiodia sp.	Brittle star					X	X				X	X	X					
Amphipholis sp.	Brittle star					X					X	X	X					
Asterina miniata	Bat star				X	X		X	X	X	X	X	X	X				
Asteroidea unident.	Sea star			X											X	X	X	
Astometis sertulifera	Fragile rainbow star							X										
Astropecten verrilli and/or A. armatus	Spiny sand star	X		X		X	X	X			X							
Brisaster	Sea urchin						X											
Brisingidae	Sea star						X										X	
Centrostephanus coronatus	Black sea urchin							X										
Ceramaster patagonicus	Cookie cutter sea star							X										
Crinoidea	Orange crinoid	X																
Cucumaria piperata	Salt-and-pepper sea							X										

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
	cucumber																	
Dendraster ecentricus	Sand dollar										X							
Dermasterias imbricata	Leather star							X			X							
Echinoidea, unident.	Unidentified sea urchin			X														
Ecinoderm, juvenile unident.	Juvenile sea star									X	X							
Florometra serratissima	Crinoid						X											
Henricia spp.	Sea star					X		X										
Hippasteria sp.	Sea star					X												X
Holothuroidea sp.	Sea cucumber		X	X														
Leptosynapta albicans	Translucent sea cucumber													X				
Linckia columbianus	Fragile star							X										
Luidia foliolata	Sand star	X	X	X	X													
Lytechinus anamesus	White urchin		X	X	X	X		X										
Mediaster aequalis	Red sea star		X		X		X			X	X					X	X	X
Ophiocantha diplasia	Brittle star					X												
Ophionereis sp.	Brittle star					X	X				X							
Ophiocantha dispasia	Brittle star										X							
Ophiocanthus sp.	Brittle star										X							
Ophiothrix spiculata	Brittle star													X				
Ophiura sp.	Brittle star									X	X	X	X					
Ophiuroids	Brittle star		X	X	X					X	X	X	X					
Ophioplocus esmarki	Smooth brittle star							X						X				
Orthasterias koehleri	Rainbow sea star							X		X				X				
Parastichopus californicus	Sea cucumber	X	X	X	X			X										X
Parastichopus leukothele	Sea cucumber																	X
Parastichopus parvimensis	Purple sea cucumber			X				X										
Peridontaster							X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Parastichopus sp.	Sea cucumber	X			X	X						X						X
Peridontaster																		
Petalaster (luidia) foliolata	Leafy flat star		X		X					X	X	X	X			X	X	X
Pisaster brevispinus	Pink sea star	X						X	X	X	X			X				
Pisaster sp.	Sea star				X					X	X							
Pisaster giganteus	Giant-spined sea star							X		X	X	X		X				
Pisaster ochraceus	Ochre star							X	X					X				
Poraniopsis inflata	Fat yellow sea star				X													
Pteraster sp.	Sea star															X		
Pycnopodia helianthoides	Sunflower star							X		X		X		X	X	X		
Rathbunaster californica	Multi-armed sea star					X					X	X	X			X	X	X
Solaster dawsonii	Morning sun star										X							
Strongylocentrotus (Allocentrotus) fragilis	Pink sea urchin			X	X		X											
Strongylocentrotus franciscanus	Red sea urchin							X						X				
Strongylocentrotus purpuratus	Purple sea urchin							X						X				
Stylasterias forreri	Fish-eating star							X									X	X
Urorchordata																		
Boltenia villosa	Spiny-headed tunicate													X				
Cystodytes sp.	Lobed tunicate										X							
Polyclinum planum	Elephant ear tunicate										X							
Styela montereyensis	Stalked tunicate							X						X				
Brachiopoda																		
Laqueus californianus	Lampshell																	X

[1] AMS 2016 survey joined into Hermosa Beach columns where species occurring at depth ranges 19-23m, 29-72.5m, 73-114m, and 115m-185m were categorized into 9-30m, 30-85m, 85-100m, and 100-300m ranges, respectively.

Appendix A-3: Master Fish Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and Central California Waters.

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Alloclinus holderi	Island kelpfish						X								
Agonidae unident.	Poacher		X	X					X	X					X
Anisotremus davidsonii	Sargo						X								
Anoplodoma fimbria	Sablefish		X												X
Argentina sialis	Pacific Argentine		X	X											
Artedius corallinus	Coralline sculpin						X					X			
Atherinidae, unident.	Baitfish school			X	X										
Atherinops affinis	Topsmelt						X								
Atherinopsidae	Silverside						X								
Atherinopsis californiensis	Jack smelt						X								
Aulorhynchus flavidus	Tubesnout						X			X	X				
Balistes polylepis	Finescale triggerfish						X								
Brachyistius frenatus	Kelp perch						X								
Caulolatilus princeps	Ocean whitefish						X								
Cephaloscyllium ventriosum	Swell shark						X			X					
Cheilotrema saturnum	Black croaker						X								
Chilara taylori	Spotted cusk-eel									X					
Chilara sp.	Cusk-eel									X					
Chondrichthyes	Cartilaginous fishes														X
Chromis punctipinnis	blacksmith						X								
Clupeiformes	Ray finned fishes														X
Citharichthys sordidus	Pacific sanddab		X	X						X					
Citharichthys stigmaeus	Speckled sanddab			X								X	X	X	
Citharichthys spp	Sanddab			X						X					

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Clinidae	kelpfish						X								
Clinocottus analis	Wooly sculpin						X								
Coryphopterus nicholsi	Black eyed goby											X	X		
Cottidae unident.	Sculpin, cabezon							X	X	X					X
Cymatogaster aggregata	Shiner perch			X			X								
Embiotoca jacksoni	Black perch						X								
Embiotoca lateralis	Striped seaperch						X								
Engraulis mordax	Northern anchovy						X	X	X	X	X				
Enophrys taurina	Bull sculpin								X	X					
Eopsetta exilis	Slender sole					X									
Eptatretus stouti	Pacific hagfish					X				X					
Galeorhinus galeus	Soupfin shark						X								
Gibbonsia elegans	Spotted kelpfish						X								
Gibbonsia sp.	Kelpfish						X					X			
Girella nigricans	Opaleye						X								
Gobiidae	Unidentified goby						X								
Genyonemus lineatus	White croaker									X	X				
Glyptocephalus zachirus	Rex sole					X									X
Gymnothorax mordax	California moray						X								
Halichoeres semicinctus	Rock Wrasse						X								
Hermosilla azurea	Zebra perch						X								
Heterodontus francisci	Horn shark						X								
Heterostichus rostratus	Giant Kelpfish						X	X							
Hexagrammos decagrammus	Kelp greenling						X								
Hydrolagus colliei	Spotted ratfish			X						X					

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Hyperprosopon argenteum	Walleye surfperch						X								
Hypsurus caryi	Rainbow seaperch						X					X			
Hypsypops rubicundus	Garibaldi						X								
Leiocottus hirundo	Lavender sculpin						X								
Lethops connectens	Halfblind goby						X								
Lycodes sp.	Eelpout									X					X
Lycodes cortezanus	Bigfin eelpout					X									X
Lycodopsis pacifica	Blackbelly ellpout		X	X											
Lythrypnus dalli	Bluebanded goby						X								
Medialuna californiensis	halfmoon						X								
Micrometrus minimus	Dwarf surfperch						X								
Microstomus pacificus	Dover sole		X	X		X				X					X
Merluccius productus	North Pacific hake					X									X
Myliobatis californicia	California bat ray			X			X								
Ophiodon elongatus	Lingcod			X		X	X			X		X		X	X
Orthonopias triacis	Snubnose sculpin						X								
Oxyjulis californa	Senorita			X			X					X			
Oxylebius pictus	Painted Greenling						X	X				X	X		
Paralabrax clathratus	Kelp bass						X	X							
Paralabrax neubulifer	Barred sandbass			X			X								
Paralichthys californicus	California halibut			X			X			X					
Phanerodon atripes	Sharpnose seaperch						X								
Phanerodon furcatus	White seaperch						X					X			
Platchthys stellatus	Starry Flounder			X											
Pleuronectes vetulas	English sole									X					X
Pleuronectifores, *unident.*	Flatfish			X											
Pleuronichthys coenosus	C-O sole			X								X			X

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Pleuronichthys ritteri	Spotted turbot			X											
Pleuronichthys verticulus	Hornyhead turbot			X											
Pleuronectidae Sp.	Sole			X						X					
Porichthys notatus	Plainfin midshipman					X									
Rathbunella alleni	Stripefin ronquil						X								
Raja binoculata	Big skate									X					
Raja rhina	Longnose skate			X						X					X
Raja sp.	Skate		X							X					
Rhacochilus toxotes	Rubberlip seaperch						X								
Rhacochilus (Damalichthys) vacca	Pile perch						X					X			
Rhinogobiops nicholsii	Blackeye goby						X								
Sarda chiliensis	Bonito				X		X								
Sardinops sagax	Pacific sardine						X								
Scomber japonicus	Pacific chub mackerel						X								
Scorpaena guttata	California scorpionfish	X		X			X								
Scorpaenichthys marmoratus	Cabezon						X								
Scorpaenodes xyris	Rainbow scorpionfish						X								
Sebastes atrovirens	Kelp rockfish						X								
Sebastes auriculatus	Brown rockfish	X					X					X			
Sebastes cimplex	Brown rockfish						X								
Sebastes carnatus	Gopher rockfish	X					X						X		
Sebastes caurinus	Cooper rockfish	X					X					X			
Sebastes crameri	Darkblotched rockfish														X
Sebastes chrysomelas	Blank-and-yellow rockfish						X								

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Sebastes dallii	Calico rockfish						X								
Sebastes diplopora	Splitnose rockfish														X
Sebastes elongatus	Green stripped rockfish							X							X*
Sebastes jordani	Shirtbelly rockfish														X
Sebastes maliger	Quillback rockfish							X							
Sebastes melanostomus	Blackgill rockfish					X									
Sebastes miniatus	Vermillion rockfish	X					X								
Sebastes mystinus	Blue rockfish						X					X			
Sebastes paucispinus	bocaccio						X								
Sebastes pinniger	Orange rockfish		X	X											
Sebastes rastrelliger	Grass rockfish						X								
Sebastes rosaeeus	Rosy rockfish	X						X							
Sebastes rubrivinctus	Flag rockfish	X	X												
Sebastes saxicola	Stripetail rockfish														X
Sebastes semicinctus	Half banded rockfish	X	X	X				X							
Sebastes serriceps	Tree fish						X	X							
Sebastes serrinoides	Olive rockfish						X	X	X	X					
Sebastes serrinoides/flavidus	Olive/yellowtail rockfish						X								
Sebastes umbrosus	Honeycomb rockfish	X	X				X								
Sebastes spp. (juveniles)	Rockfish (juveniles)	X		X				X	X	X					
Sebastes spp. (adult)	Rockfish (adult)	X		X			X	X		X					X
Sebastolobus alascanus	Shortspine thornyhead					X									
Semicossyphus pulcher	California sheephead						X								
Seriphus politus	Queenfish			X											
Sphyraena argentea	Pacific barracuda						X								
Squalus acanthias	Dogfish shark		X												
Squatina californica	Pacific angel shark			X			X			X					

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Stereolepis gigas	Giant sea bass						X								
Symphurus atricauda	California tonguefish									X					
Synodus luciocepsis	California lizardfish			X											X
Torpedinidae	Torpedo ray														X
Torpedo californica	Pacific electric ray									X					
Trachurus symmetricus	Jack mackerel						X								
Triakis semifasciata	Leopard shark						X								
Urobatis halleri	Round stingray						X								
Xeneretmus leiops	Smootheye poacher					X									
Xenistius californiensis	salema						X								
Xystreurys lioepsis	Fantail sole			X											
Zalembius rosaceus	Pink surfperch		X	X				X							X
Zaniolepi frenata	Shortspine combfish			X											
Zaniolepis latipinnus	Longspine combfish		X	X						X					
Zaniolepi spp.	Combfish			X											
Zapteryx exasperata	Banded guitarfish			X						X					
Zoarcidae unident.	Eelpout														X

Appendix A-4: Fish Taxonomic List of Observed Fish Species in Southern and Central Coastal California Waters by Depth.

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Agonidae unident.	Poacher		X							X	X						X
Alloclinus holderi	Island kelpfish					X											
Anisotremus davidsonii	Sargo					X											
Anoplodoma fimbria	Sablefish		X													X	X
Artedius corallinus	Coralline sculpin					X							X				
Argentina sialis	Pacific Argentine	X	X		X												
Atherinidae, unident.	Baitfish school	X			X												
Atherinops affinis	Topsmelt					X											
Atherinopsidae	Silverside					X											
Atherinopsis californiensis	Jack smelt					X											
Aulorhynchus flavidus	Tubesnout					X			X			X					
Balistes polylepis	Finescale triggerfish					X											
Caulolatilus princeps	Ocean whitefish					X											
Cephaloscyllium ventriosum	Swell shark					X			X								
Cheilotrema saturnum	Black croaker					X											
Chilara taylori	Spotted cusk-eel								X	X	X	X					
Chilara sp	Cusk-eel								X	X	X	X					
Chromis punctipinnis	blacksmith					X											
Citharichthys sordidus	Pacific sanddab	X	X	X	X					X	X	X					

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Citharichthys spp	Sanddab									X	X	X		X	X	X	X
Citharichthys stigmaeus	Speckled sanddab												X				
Clinidae	Kelpfish					X											
Clinocottus analis	Wooly sculpin					X											
Coryphopterus nicholsi	Black eyed goby												X				
Cottidae unident.	Sculpin									X	X	X			X	X	X
Cymatogaster aggregata	Shiner perch	X				X											
Embiotoca jacksoni	Black perch					X											
Embiotoca lateralis	Striped seaperch					X											
Engraulis mordax	Northern anchovy					X			X	X	X	X					
Enophrys taurina	Bull sculpin									X							
Eptatretus stouti	Pacific hagfish									X	X	X					
Galeorhinus galeus	Soupfin shark					X											
Genyonemus lineatus	White croaker									X							
Gibbonsia elegans	Spotted kelpfish					X											
Gibbonsia sp.	Kelpfish					X							X				
Girella nigricans	Opaleye					X											
Glyptocephalus zachirus	Rex sole							X									X
Gobiidae	Unidentified goby					X											
Gymnothorax mordax	California moray					X											
Hydrolagus colliei	Spotted ratfish				X					X							
Halichoeres semicinctus	Rock Wrasse					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Hermosilla azurea	Sebraperch					X											
Heterodontus francisci	Horn shark					X											
Heterostichus rostratus	Giant Kelpfish					X											
Hexagrammos decagrammus	Kelp greenling					X											
Hyperprosopon argenteum	Walleye surfperch					X											
Hypsurus caryi	Rainbow seaperch					X							X				
Hypsypops rubicundus	Garibaldi					X											
Leiocottus hirundo	Lavender sculpin					X											
Lethops connectens	Halfblind goby					X											
Lycodes sp.	Eelpout									X	X	X					X
Lycodes cortezanus	Bigfin eelpout							X									X
Lycodes pacifica	Blackbelly ellpout			X	X												
Lythrypnus dalli	Bluebanded goby					X											
Medialuna californiensis	Halfmoon					X											
Merluccius productus	North Pacific hake			X	X			X									
Micrometrus minimus	Dwarf surfperch					X											
Microstomus pacificus	Dover sole		X	X	X			X		X	X						X
Myliobatis californicia	California bat ray	X				X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Ophiodon elongatus	Lingcod				X	X		X		X			X				X
Orthonopias triacis	Snubnose sculpin					X											
Oxyjulis california	Senorita	X				X							X				
Oxylebius pictus	Painted Greenling					X							X				
Paralabrax clathratus	Kelp bass					X			X	X							
Paralabrax neubulifer	Barred sandbass	X				X											
Paralichthys californicus	California halibut	X		X	X	X				X	X	X					
Phanerodon atripes	Sharpnose seaperch					X											
Phanerodon furcatus	White seaperch					X							X				
Platichthys stellatus	Starry flounder				X												
Pleuronectes vetulas	English sole									X	X						X
Pleuronectidae unident.	Sole									X	X	X					
Pleuronichthys coenosus	C-O sole			X	X								X				
Pleuronichthys ritteri	Spotted turbot	X															
Pleuronichthys verticalis	Horneyhead turbot			X	X												
Porichthys notatus	Plainfin midshipman							X									
Raja binoculata	Big skate									X							
Raja rhina	Longnose skate		X	X	X						X				X	X	X
Raja sp.	Skate				X					X	X				X		
Rathbunella alleni	Stripefin ronquil					X											
Rhacochilus toxotes	Rubberlip seaperch					X											
Rhacochilus (damalichthys) vacca	Pile perch					X							X				
Rhinogobiops nicholsii	Blackeye goby					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Sarda chiliensis SEP	Bonito				X	X											
Sardinops sagax	Pacific sardine					X											
Scomber japonicus	Pacific chub mackerel					X											
Scorpaena guttata	California scorpionfish		X	X		X											
Scorpaenichthys marmoratus	Cabezon					X											
Scorpaenodes xyris	Rainbow scorpionfish					X											
Sebastes atrovirens	Kelp rockfish					X											
Sebastes auriculatus	Brown rockfish			X		X							X				
Sebastes cimplex	Brown rockfish					X											
Sebastes carnatus	Gopher rockfish			X		X							X				
Sebastes caurinus	Cooper rockfish			X		X							X				
Sebastes crameri	Darkblotched rockfish																X
Sebastes chrysomelas	Blank-and-yellow rockfish					X											
Sebastes dallii	Calico rockfish			X	X	X											
Sebastes diplopora	Splitnose rockfish																X
Sebastes elongatus	Green stripped rockfish																X
Sebastes jordani	Shirtbelly rockfish															X	X
Sebastes melanostomus	Blackgill rockfish							X									
Sebastes miniatus	Vermillion rockfish			X		X											
Sebastes mystinus	Blue rockfish					X							X				
Sebastes paucispinus	Bocaccio					X											
Sebastes pinniger	Orange rockfish		X														
Sebastes rastrelliger	Grass rockfish					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Sebastes rosaeeus	Rosy rockfish			X					X	X							
Sebastes rubrivinctus	Flag rockfish		X	X	X												
Sebastes saxicola	Stripetail rockfish																X
Sebastes semicinctus	Half banded rockfish		X	X	X												
Sebastes serriceps	Tree fish					X											
Sebastes serrinoides	Olive rockfish					X				X							
Sebastes serrinoides/ flavidus	Olive/yellowtail rockfish					X											
Sebastes spp. (juveniles)	Rockfish (juveniles)								X	X	X	X		X	X		X
Sebastes spp. (adult)	Rockfish (adult)	X	X	X	X	X			X	X	X	X					
Sebastes umbrosus	Honeycomb rockfish		X	X		X											
Sebastolobus alascanus	Shortspine thornyhead							X									
Semicossyphus pulcher	Califonria sheephead					X											
Seriphus politus	Queenfish	X															
Sphyraena argentea	Pacific barracuda					X											
Squalus acanthias	Dogfish shark				X												
Squatina californica	Pacific angel shark	X		X	X	X				X							
Stereolepis gigas	Giant sea bass					X											
Symphurus atricauda	California tonguefish									X	X						
Synodus luciocepsis	California lizardfish	X	X	X	X										X	X	
Torpedinidae	Torpedo ray														X	X	
Torpedo californica	Pacific electric ray									X							
Trachurus symmetricus	Jack mackerel					X											
Triakis semifasciata	Leopard shark					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Urobatis halleri	Round stingray					X											
Xeneretmus leiops	Smootheye poacher							X									
Xenistius californiensis	Salema					X											
Xystreurys liolepis	Fantail sole			X													
Zalembius rosaceus	Pink surfperch		X	X	X					X	X				X	X	X
Zanioles spp.	Combfish	X	X	X	X												
Zanioleis frenata	Shortspine combfish			X	X												
Zanioleis latipinnis	Longspine combfish		X	X	X						X						
Zapteryx exasperata	Banded guitarfish			X						X							
Zoarcidae unident.	Eelpout																X

[1] AMS 2016 survey joined into Hermosa Beach columns where species occurring at depth ranges 19-23m, 29-72.5m, 73-114m, and 115m-185m were categorized into 9-30m, 30-85m, 85-100m, and 100-300m ranges, respectively.

Marine Aquatic Habitats and Biological Resources Offshore Grover Beach, California:

Addendum 1- BtoBE Cable Route Characterization

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BtoBE Cable Route (Grover Beach, CA Landing)

The proposed routing of the BtoBE fiber optic cable through the nearshore coastal environment of Central California is illustrated in Figures 1.1, 1.5, and 1.8. These Figures also illustrate the proximity of the BtoBE offshore cable route to the PAC 1 Segment 1 (Seg 1), PC 1 Segment S (Seg S), and PC 1 Segment E (Seg E) fiber optic cables. All three of these cables have landings in Grover Beach, California. The habitat along the proposed BtoBE cable route is principally comprised of soft sand and silt/clay substrate with occasional pockets of gravel and cobble. Some mixed and low to high substrate hard bottom occurs to the north of the proposed cable route. Seafloor mapping information from a recently completed geophysical survey of the BtoBE cable route (EGS 2018) was combined with marine biological community data from numerous ROV and diving surveys near the BtoBE cable location to develop the technical descriptions of habitat and associated marine communities along the BtoBE cable route. The discussion of habitat and associated marine biological communities has been broken out by route segments that corresponds with key water depth ranges.

This discussion of the BtoBE cable route is prepared as an Addendum to its parent document entitled *Marine Aquatic Habitats and Biological Resources Offshore Grover Beach, California*. As such it references data tables and other information contained within that document.

BtoBE Cable Route Segment 1 between 16-25 m (52-82 ft) Water Depth

This segment of the BtoBE cable route commences at the bore pipe exit point, located at a water depth of approximately 16.5 m (82 ft), and transits perpendicular to the shoreline, parallel to and immediately northward of the PC 1 Seg E, Seg S and PAC 1 Seg 1cable routes, out to 25 m (82 ft) water depth (Figure 1.1). The seafloor along this segment of the cable route is characterized in the geophysical seafloor mapping survey conducted by EGS Surveys as, “fine to medium sand” (EGS 2018). Within this segment of the seafloor, occasional patches of “coarse sediment” containing “bull kelp (*Nereocystis luetkeana*) meadows over loose silty sand” were also characterized by EGS (Figure 1.1). The proposed BtoBE cable route attempts to avoid all these areas by exiting the cable conduit just offshore of the largest mapped coarse sediment patch identified as potentially supporting bull kelp. (Figure 1.1).

Whereas EGS identified gravel/cobble beds that potentially support bull kelp beds in the nearshore waters offshore Grover Beach, more recent reviews of aerial images for the area do not reveal any major kelp beds south of the Pismo Beach Pier. Additionally, scientific diver surveys of the PC 1 and PAC 1 cable borehole exit locations, and similar locations located along the shallower subtidal route of these cables which were also previously characterized as supporting kelp beds in the geophysical seafloor mapping surveys conducted for those cables (Figure 1.2), reported that the seafloor habitat within this region was composed of silt, sand and clay substrates with no mixed or hard substrate present (AMS 1998). It is obvious from the current (EGS 2018) and previous geophysical surveys, that the nearshore subtidal region (< 31m, 102 ft.) offshore Grover Beach, California is highly dynamic and constantly changing, with periodic large swells and shifting seafloor sediments. Although some mixed bottom[1] habitat may be present, or exposed for brief periods of time, it may become reburied with sand moved by wave and tidal action. In addition, a thin veneer of sand or sediment may provide reflectivity in the geophysical survey data making it difficult to accurately characterize hard substrate.

The AMS diving survey also observed a persistent nepheloid layer (murky fine sediment-laden water) present within 0.5 meters of the seafloor. Sand ripples averaged 1-2 cm in height and 5-10 cm apart. The

[1] Mixed Hard Bottom is a combination of exposed rock shelf, large cobbles and/or small boulders, intermixed with soft sediment. Soft substrate is typically the dominant habitat type.

survey also reported the presence of terrestrial plant debris that was assumed to have originated from winter storm flow (AMS 1998). Both the plant debris and the nepheloid layer may make it more difficult to accurately characterize the area geophysically. In addition, turbidity is not conducive towards the establishment of kelp (Springer *et. al* 2007). Bull kelp is an annual plant with spores being released in the spring and growth occurring throughout the year before the plant dies (Springer *et. al* 2007). It is conceivable that during a period of oceanographic conditions that an area of suitable mixed habitat might become exposed long enough in the spring to enable some bull kelp plants to establish themselves, only to have the holdfasts buried under moving sand and sediment later in the year, preventing additional plant establishment the following year.

Based on the findings reported in the 1998 AMS report and personal communications with area commercial fishermen (Tognazzini 2019), it is hypothesized that the occurrence of bull kelp south of the Pismo Beach Pier (between the Pismo Beach Pier and Mussel Rock) is very limited. In contrast, the nearshore region of San Luis Obispo Bay, between Port San Luis and the Pismo Beach Pier, contains extensive areas of exposed hard substrate that supports bull kelp beds.

The biological community offshore of Grover Beach that will be impacted by the BtoBE cable route is likely to be similar to the communities associated with the Asia America Gateway (AAG) S-5 (AMS 2008) and MCI/WorldCom fiber optic cable projects offshore Montana del Oro/Morro Bay (SAIC 1999), located approximately 20 miles north of the proposed BtoBE cable route. The epibenthic communities inhabiting the soft substrate in this depth range, included the ornate tube worm *Diopatra ornata (*Figure 1.3*);* cancer crabs *(Cancer sp.);* the slender crab *Cancer gracilis*, the masking crab *Loxorhynchus crispatus*, the octopus *Octopus rubescens*, the squid *Loligo sp.*, the white sea pen *Stylatula elongata*, occasional polychaete tube worms, *Pachycerianthus* anemones, brittle stars, and the sea stars *Petalster* (*Luidia) foliolata* and *Pycnopodia helianthoides*. The sea stars *Asterina miniata* and *Mediaster aequalis*, were observed inhabiting soft sediment habitat adjacent to or in close proximity to exposed hard substrate (Table A-1 and A-3).

The PC and PAC fiber optic cable landfalls and inshore route survey 15-23 m (50-75 ft.) conducted by SCUBA divers reported the occurrence of the ornate tube worm *D. ornata*; gastropods including the mud snail *Nassarius sp.*, the arthropods *Heterocrypta occidentalis* and *Paguristhes sp*., and the sea stars *A. miniata*, *Pisaster ochraceous*, and *P. brevispinus* (AMS 1998).

The predominant taxa inhabiting mixed bottom habitat in the 15-23 m depth range include the red alga *Rhodymenia* sp.; orange encrusting bryozoans; encrusting coralline algae; unknown tan globular and white foliose sponges; the brown cup coral *Paracyathus stearnsi*; assorted sea stars, including *Mediaster aequalis, P. brevispinus, and P. giganteus;* and assorted anemones, including *Urticina columbiana*, *U. piscivora*, *Metridium* sp., and *Stomphia coccinea* (AMS 2008, SAIC 1999*).*

Fish taxa observed at these water depths along included Speckled sanddab *(Citharichthys stigmaeus);* Tubesnout (*Aulorhynchus flavidus) (*Figure 1.3*);* Swell shark (*Cephaloscyllium ventriosum); C*usk eel *(Chilari sp.);* Kelp bass *(Paralabrax clathratus);* and Northern anchovy *(Engraulis mordax).* In addition, squid (*Loligo* sp.) (Figure 1.4) were periodically observed swimming in the water column (Tables A-2 and A-4) (AMS 2008), SAIC 1999).

BtoBE Cable Route Segment 2 Between 25-100 m (82-328 ft) Water Depth

The seafloor habitat along the BtoBE cable route through these water depths was predominantly characterized by the EGS seafloor survey (EGS 2018) as loose silty sand (Figure 1.5). Between 63m (207 ft.) and 81 m (266 ft.) and again at between 88 m (289 ft.) and 97 m (312 ft.) mixed, low, moderate and high relief hard substrate occurs 200-600 m (656-1,969 ft.) to the north of the route (Figure 1.5).

Figure 1.1: BtoBE Cable Route Between 5-25 Meters (16-82 Feet) Water Depth.

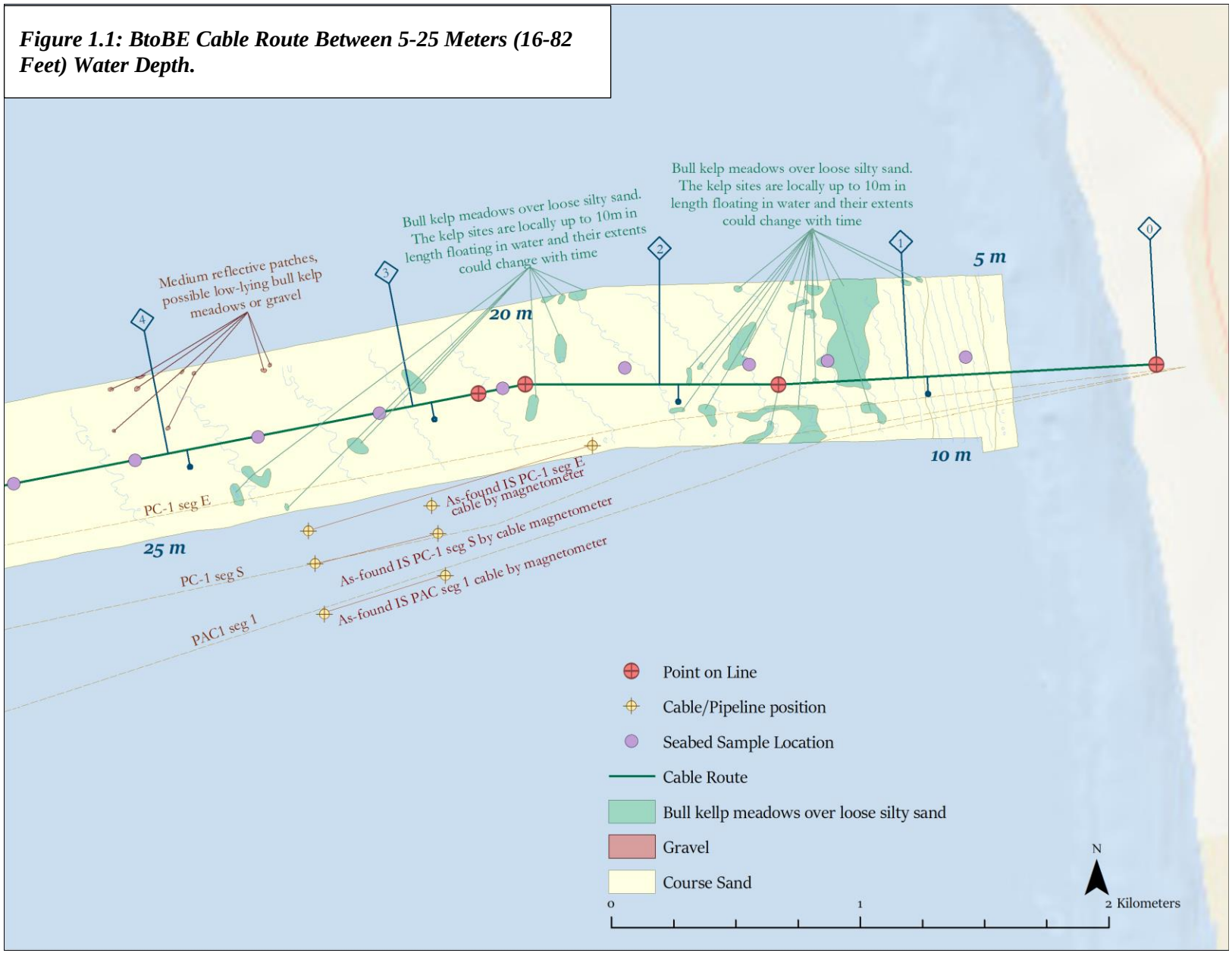


Figure 1.2: BtoBE and the PC-1 (Seg 1) Nearshore Cable Routes Illustrating the Geophysical Seafloor Mapping Characterizations for Both Cable Routes and Scientific Diver Survey Transect Locations on Characterized Hard Substrate Habitat.

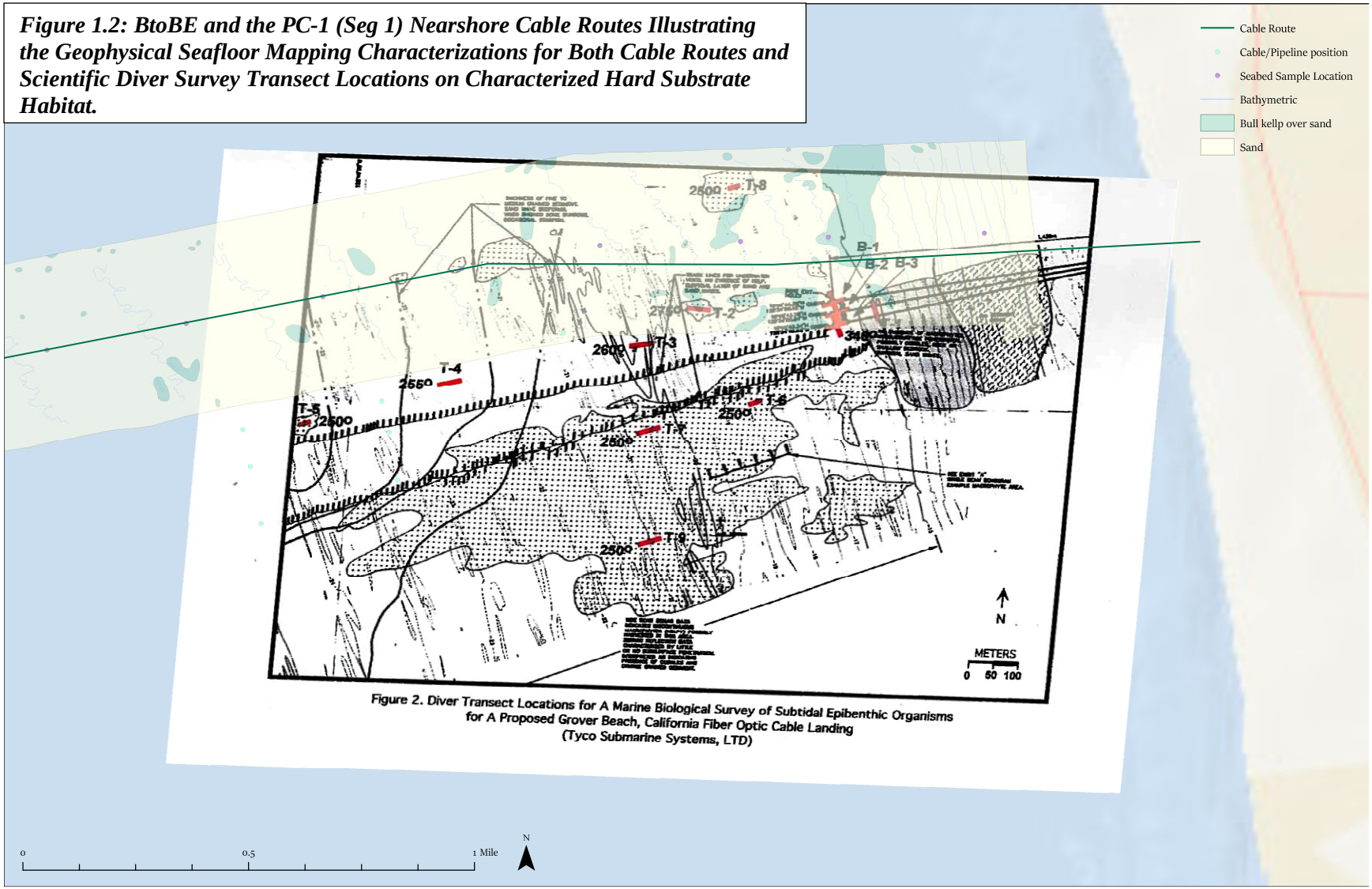


Figure 2. Diver Transect Locations for A Marine Biological Survey of Subtidal Epibenthic Organisms
for A Proposed Grover Beach, California Fiber Optic Cable Landing
(Tyco Submarine Systems, LTD)

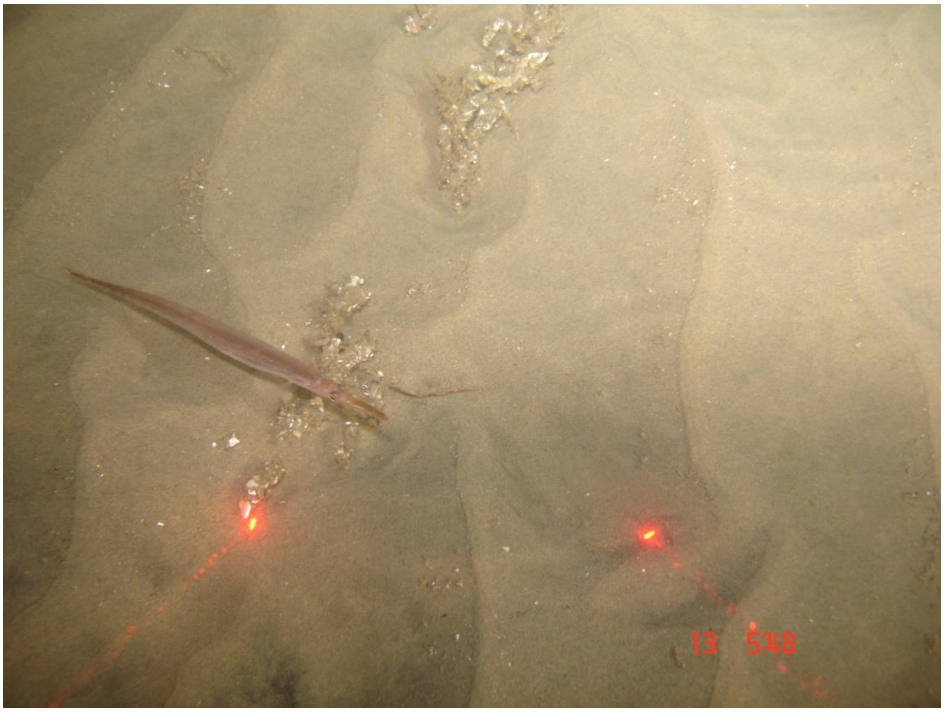


Figure 1.3: Coarse sand substrate with wave induced ripples, ornate tube worms (*Diopatra ornata*) and a Tubesnout (*Aulorhynchus flavidus)* (Source AMS 2008).

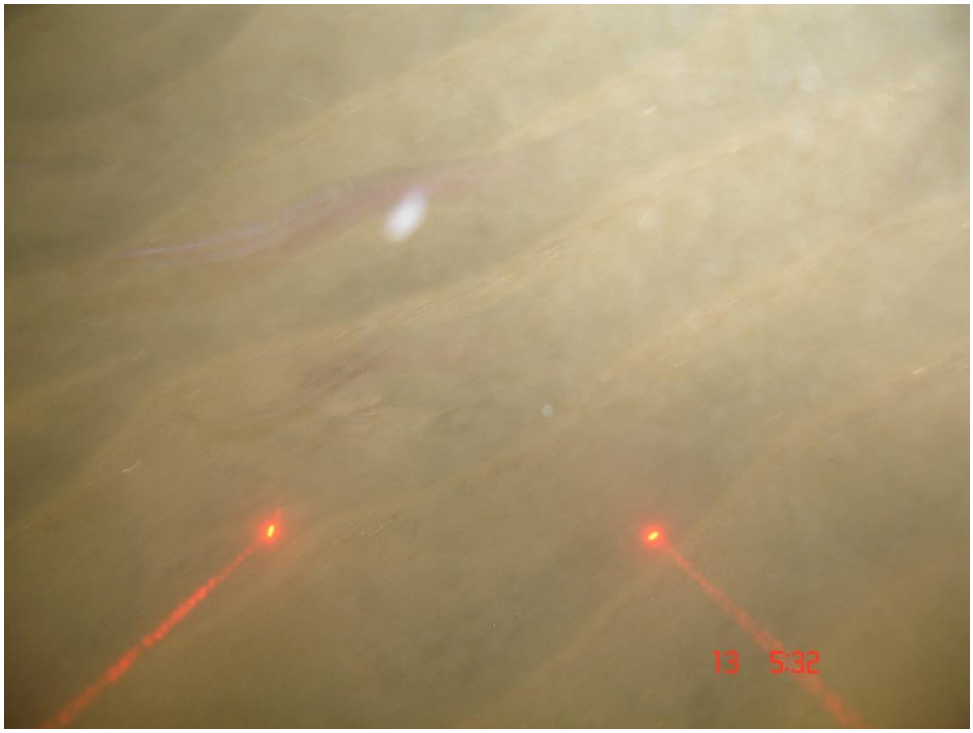
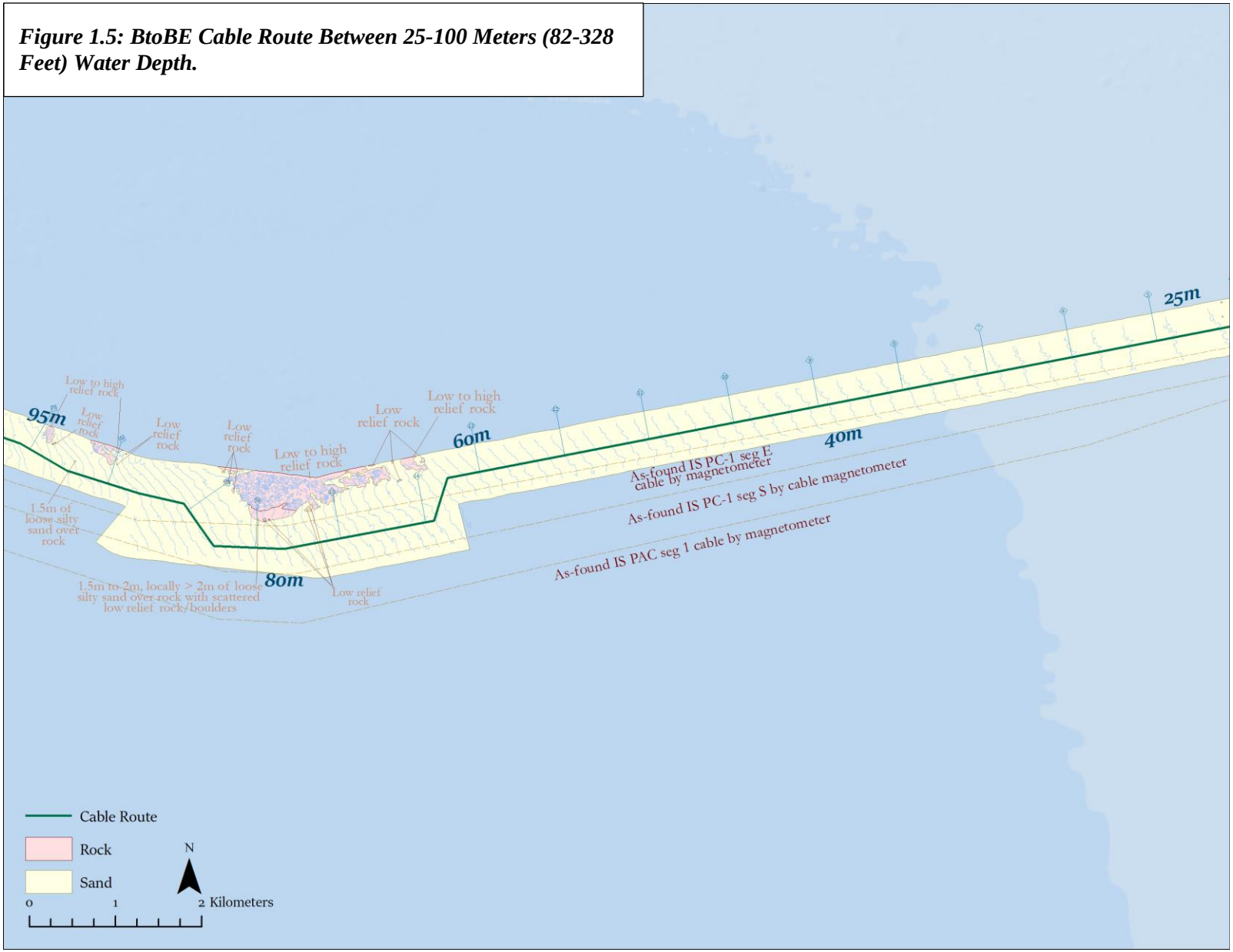


Figure 1.4: Coarse sand substrate with sand ripples and squid (*Loligo sp*.) (Source AMS 2008)

Figure 1.5: BtoBE Cable Route Between 25-100 Meters (82-328 Feet) Water Depth.



Along the AAG S-5 and MCI/WorldCom fiber optic cable routes offshore Montana Del Oro/Morro Bay, California more than 40 algal and invertebrate taxa were observed. At these deeper water depths, the sediment composition shifted to finer silts and clays, compared with the shallower depths where sands predominated (AMS 2008, SAIC 1999). Observed invertebrate biota included sea pens, mostly *S. elongata*, *Acanthoptilum sp*., *Virgularia spp*., *Virgularia californica*, and *Ptilosarcus gurneyi;* brittle stars, including *Ophioneries* sp.; the cerianthid anemones, including *Pachycerianthus sp*. (Figure 1.6); the anemones *Urticina piscivorus Urticina sp*., *Anthopleura artemisia*, and *S. coccinea*; tube worms, cancer crabs including the slender crab *Cancer gracilis*; shrimp such as *Pandalus sp*.; occasional marine snails (Gastropoda); the California sea slug *Pleurobranchia californica*; the hermit crab *Paguristhes sp*.; and several species of sea stars including *P. brevispinus*, *Petalaster (luidia) foliolata, Rathbunaster californica, A. miniata,* the spiny sand star, *A. armatus,* and *Solaster dawsonii (Tables A-1 and A-3).*

Within the shallower water depths of this route segment, dominated by sandier sediments, the ornate tube-worm *D. ornata* and occasional isolated *Dendraster ecentricus* sand dollars were observed. Assorted algae, including *Phyllospadix* spp., surfgrass, the giant kelp *Macrocystis pyrifera*, and the bull kelp *N. californica*, originating from locations closer to shore or upcoast, were also be expected to be present along the seafloor. At this depth, squid such as *Loligo* sp. and the octopus, *O. rubescens*, also frequently inhabit the water column (Table A-2) (AMS 2008, SAIC 1999).

The sea pen *P. gurneyi* and the sea star *P. brevispinus* were observed only at water depths of 48.8 m (160 feet) or less. The most abundant invertebrate organisms were sea pens, including *S. elongata, Acanthoptilum sp*., and *Ptilosarcus gurneyi*, brittle stars (Ophiuroids), especially *Ophioneries* sp., tube worms, and the sea stars *P. brevispinus, A. miniata,* and *R. californica* (AMS 2008, SAIC 1999).

Fish species that occurred along the soft substrate habitats of this water depth range included sanddabs, *Citharichtys sp*., the California halibut *Paralichthys californicus*, the Dover sole *Microstomus pacificus*, the, English sole *Pleuronectes vetulas*, the Tonguefish *Symphurus atricauda*, the Banded guitarfish *Zapteryx exasperata*, the Pacific electric ray *Torpedo californica*, *Raja* spp. Skates, the Pacific angel shark *Squatina californica*, both adult and juvenile Rockfish *Sebastes* spp., the Eelpout *Lycodes* sp., the Cuskeels *Chilara* spp, Poachers (Algonidae), Sculpins (Cotidae), and the Hagfish *Eptatretus stouti*. The dominant and most frequently observed fish taxa were the assorted flatfish, especially the Pacific sanddab *C. sordidus* Cusk-eels, Poachers and Rockfish. Assorted baitfish (Atherinidae), such as the Northern anchovy *Engraulis mordax*, were also commonly observed in the water column (Tables A-2 and A-4) (AMS 2008, SAIC 1999).

As indicated above and illustrated in Figure 1.5, the hard bottom substrate that occurs within this segment of the BtoBE cable route is located more than 200 m (656 ft.) to the north of the proposed cable routing. Based on the EGS (2018) seafloor survey, these hard substrate features begin with mixed bottom and low relief features that progress into moderate and high relief features. Based on survey data collected for similar hard substrate features occurring in similar water depths along the AAG S-5 and MCI/WorldCom fiber optic cable routes (AMS 2008, SAIC 1999), it can be expected that these features will be inhabited by turfs of *Komokoiacea* foraminiferans *(Figure 1.7),* hydroids, encrusting bryozoans, ectoprocts, lumpy tan sponges, the orange puffball sponge *Tethya aurantia*, the brown cup coral *Paracyathus stearnsi*, the orange cup coral *Balanophyllia elegans*, the giant white anemone *Metridium farcimen (=giganteum)*, the red gorgonian coral *Lophogorgia chiliensis*, the orange gorgonian coral *Adelogorgia phyllostera*, the California hydrocoral *Stylaster californicus (=Allopora californica*), the giant keyhole limpet *Megathura crenulate,* cancer crabs, brittle stars (Ophiuroidea), the feather star *Florometra serratissima,* and the sea stars *Pisaster giganteus*, the cookie cutter sea star *Ceramaster patagonicus*, and the bat star *Patiria miniata.* On the sides of the higher relief features, it can be anticipated that the branching white coral *Lophelia sp*. may be present (AMS 2007, SAIC 1999).

Figure 1.6: Fine sandy silt substrate with a cerianthid anemones (*Pachycerianthus sp*.) and brittle stars (Source AMS 2008).

Figure 1.7: Low-relief hard bottom habitat with turf of Komokoiacea foraminifer and and hydroids, globular sponge, the leather star, *Dermasterias imbricata*, orange cup corals (*Balanophyllia elegans*) (Source AMS 2008)

Dominant fish taxa that can be expected to occur include sculpins (Cottidae), and juvenile and adult rockfish including the Olive rockfish *Sebastes serranoides*, the Rosy rockfish *Sebastes rosaceus*, and the Brown rockfish *Sebastes auriculatus* (Table A-2 and A-4) (AMS 2008, SAIC 1999).

BtoBE Cable Route Segment 3 Between 100-183 m (328-600 ft) Water Depth

The seafloor habitat along the BtoBE cable route between 100-183 m (328-600 ft) was predominantly characterized by the EGS seafloor survey (EGS 2018) as loose silty sand (Figure 1.8). Based on previous seafloor surveys of Central California, sediments would be expected to be dominated by fine silts and clays,with a very small percentage of fine sands and in the shallower protion (<200 m) of the segment (AMS 2007, SAIC 1999).

The soft substrate biological community expected to occur along this segment of the BtoBE cable route include the sea pens *Stylatula, sp, Virgularia californica, Virgularia agassizii, Scytallum* sp,, and *Scytallopsis* sp., brittle stars including *Amphiophodia urtica, Amphiopholis* sp,, *Amhiodia* sp., *Ophionereis sp, and Ophiura* sp. (Figure 1.9); the squid *Loligo* sp.; the octopus O. *rubescens*; the California sea slug *Pleurobranchia californica*; several species of anemones including *Urticina sp.* and *Pachycerianthus sp.*; the sea stars *A. (Luidia) foliolata* (Figure 1.10), *Rathbunaster californica, Astropecten sp., and P. foliolata;* polychaete fire worms (Amphinomidae); and occasionally the sea cucumber *Parastichopus sp.* (AMS 2007, SAIC 1999).

Fish taxa expected to occur along this segment of the BtoBE cable route include the pink surfperch *Zalembius rosaceus*, poachers (Algonidae), the hagfish *Eptatretus stouti*, juvenile and adult rockfish (*Sebastes* spp.), the anchovy *E. Mordax*, the tonguefish *S. atricauda*, skates including longnose skate and the big eye skate *Raja binoculata*, flatfish including sanddabs (Citharichtys sp.), sole (Pleuronectidae), eelpouts (*Lycodes* sp.), and cuskeels (*Chilara* sp.) (AMS 2007, SAIC 1999).

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Tognazzini, M. 2018. Mark Tognazzini, Captain F/V *Bonnie Marietta*, Personal Communications.

Figure 1.8: BtoBE Cable Route Between 100-183 Meters (328-600 Feet) Water Depth.

Figure 1.9: Fine soft substrate with *Virgularia sp*. sea pens and brittle stars (Source AMS 2008)

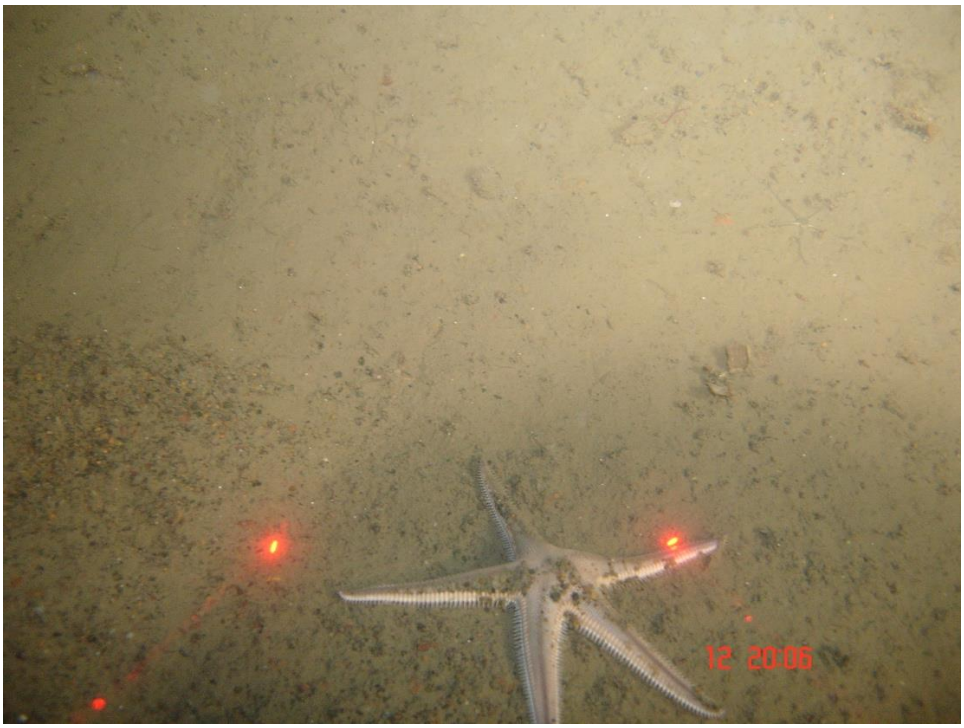

Figure 1.10: Fine silty substrate with fire worms (Amphinomidae) and the sand star *Luidia foliolata* (Source AMS 2008)