List of Potential Biofouling Organisms for the Ventura Shellfish Enterprise Project[1]

Biofouling Organism	Habitat		Propagule Dispersal	Potential to Occur
Seaweed	Gametophyte	Sporophyte	Spores	Potential to Occur
Undaria pinnatifida Wakame	Found in temperate coastal waters in low intertidal and subtidal areas.	Sporophyte attaches to hard structures, including natural and man-made structures; known to attach to rocky reefs, mudstones, cobbles, or even shells of bivalves.	Low dispersal ability. Motile spores travel short distances, as little as 0.2m to < 10m unless sporophyte is adrift.	*Undaria* was first discovered in Ventura Harbor in 2008 and was established at Anacapa Island in 2016. Although its natural spore distribution is limited, its efficient hitchhiker thereby spreading its spores and establishing itself in more remote areas. **Moderate** potential to occur on mussel socks due to vessel transport from colonized areas.
Sargassum horneri Devil weed	Occurs in the intertidal zone down to depths of 100 feet.	Sporophyte attaches to hard structures, including natural and man-made structures; extensive natural dispersal capabilities via drifting fragments; may disrupt aquaculture activities.	Capable of self-fertilization. Young plants grow from embryos released from the reproductive structures. Can spread by attaching to vessel hulls or drifting. Due to its short planktonic stage, ship fouling is the likeliest mode of transportation and dispersal.	This species was first reported in California in 2003 and discovered in Ventura Harbor in 2003. The species has extensive natural dispersal capabilities via drifting fragments. **Moderate** potential to occur on mussel socks due to vessel transport from colonized areas.

Biofouling Organism	Habitat	Propagule Dispersal	Potential to Occur
Caulerpa taxifolia Killer seaweed	Found on rocky, sandy and muddy bottoms in shallow lagoons, or at deeper depths.	Arises from horizontal stems (stolons). Invasive strain is asexual and reproduces through fragmentation. Can grow from small fragments transported by boat anchors and fishing gear.	This species was first discovered in 2000 in lagoons in Carlsbad and Huntington Beach and was officially eradicated in 2006. No other infestations of the cold water strain have been located. **Low** potential to occur. Although sandy bottoms are present, this species is currently expected to be absent from the area. *Caulerpa* surveys are usually required pre-construction of projects in federal waters.
Invertebrates			
Tunicates			
Diplosoma listerianum Colonial sea squirt	Subtidal marine environments. Attach to a variety of surfaces including rocks, shells, other marine animals, seaweeds, buoys, lines, woody debris, vessel hulls, etc.	Reproduces asexually by budding or sexually by releasing sperm and eggs into the water, where they unite to form swimming larvae.	*D. listerianum* can foul cultured shellfish and aquaculture equipment, and outcompete other colonial tunicates and benthic invertebrates for space. **Moderate** potential to occur on mussel socks, buoys, and long lines due to vessel transport from colonized areas.

Biofouling Organism	Habitat	Propagule Dispersal	Potential to Occur
Ciona spp. (*C. intestinalis*, *& C. savignyi*) Solitary sea squirts	Low intertidal to subtidal areas. Found attached to a variety of surfaces including rocks, woody debris, and vessel hulls in marinas.	Reproduces sexually by releasing sperm and eggs into the water, where they unite to form swimming larvae.	*Ciona* spp. can foul cultured shellfish and aquaculture equipment, and outcompete other colonial tunicates and benthic invertebrates for space. **Moderate** potential to occur on mussel socks, buoys, and long lines due to vessel transport from colonized areas.
Bryozoans			
Watersipora subtorquata Encrusting Bryozoan	Lower intertidal and subtidal areas; found on variety of natural and man-made surfaces, including rocks, shells, vegetation, woody debris, marine mammals, pier pilings, vessel hulls, etc.	Reproduces sexually by releasing sperm and eggs in the water where they unite and form swimming larvae; larvae settle onto hard surfaces, mature and bud into a colony.	This species was first reported in California in 2003 and discovered in Ventura Harbor in 2003. **Moderate** potential to occur on mussel socks, buoys, and long lines due to vessel transport from colonized areas.
Tube Worms			
Filograna implexa Lacy tube worm	Subtidal and low intertidal areas; encrusts hard surfaces including rocks, shells, marine animals, vessel hulls, piers, etc.	Reproduces asexually by budding or sexually by releasing sperm and eggs into the water, where they unite to form swimming larvae; spreads by attaching to vessel hulls.	This species is found worldwide, including California. **Moderate** potential to occur on mussel socks due to vessel transport from colonized areas.

Biofouling Organism	Habitat	Propagule Dispersal	Potential to Occur
Spirorbis spp. Spiral tube worm	Lower intertidal and shallow subtidal areas. Attaches to vessel hulls, rocks, pier pilings, shells of other animals, etc.	Reproduce sexually by releasing sperm and eggs into the water, where they unite to form swimming larvae; spreads by attaching to surfaces in marinas.	This species is found worldwide, including California. **Moderate** potential to occur on mussel socks due to vessel transport from colonized areas.
Hydroides spp. (*H. elegans & H. gracilis*) Tube worms	Subtidal and low intertidal areas. Attaches to hard natural and man-made surfaces, including woody debris, shells of other animals, oyster reefs, rocky reefs, pier pilings, vessel hulls, intake lines, canals, etc.	Reproduce sexually by releasing sperm and eggs into the water, where they unite to form swimming larvae; spreads by attaching to surfaces.	This species is found worldwide, including all along the California coast. In southern California, this species was first found in 1931 in Los Angeles-Long Beach Harbors. **Moderate** potential to occur on mussel socks due to vessel transport from colonized areas.
Amphipods			
Laticorophium baconi Mud tube amphipod	Marine intertidal areas, including hard substrates and unstructured bottoms. The species builds U-shaped tubes in shallow subtidal muddy substrates and on hard surfaces. It spreads by attaching to vessel hulls in marinas.	Its reproduction is unstudied; however, the species has separate sexes, brooded embryos, and direct development.	This species is a native along the California coast, including Ventura Harbor area. **High** potential to occur on mussel socks, buoys, and long lines due to vessel transport from colonized areas.

Notes: [1] Identification of invasive and fouling organisms available through University of California Cooperative Extension, California Aquatic Invasive Species Program. Accessed November 2019. https://ucanr.edu/sites/CalAIS/Seaweeds_and_Hull_Fouling_Species/?uid=10&ds=781