# Management of Small Docks and Piers

# Environmental Impacts and Issues

# Forward—

This and the other related sections of the following workbook—along with the complementary PowerPoint presentations—were funded through the National Oceanic and Atmospheric Administration’s (NOAA) National Centers for Coastal Ocean Science (NCCOS) and the Office of Ocean and Coastal Resource Management (OCRM). Steve Bliven of Bliven & Sternack prepared the text and slides under contract to those offices. All those concerned would like to thank the reviewers who offered valuable comments on drafts of this document.

# Introduction—

Private docks have been implicated in a number of environmental impacts. Some of these have received scientific investigation and some remain anecdotal. In an attempt to clarify what is known about environmental impacts from docks, NOAA’s National Centers for Coastal Ocean Science convened a workshop in January of 2003. This session brought together scientists and a group of coastal managers from across the country to discuss the environmental impacts of small docks. The results of that workshop may be found in Kelty and Bliven (2003).

The workshop identified four general impacts:

Impacts to vegetation

Impacts from contaminants related to docks

Impacts from associated boating use

Impacts to sediments and substrate

Impacts to wildlife habitat were discussed as part of the topics above, as this is a significant cross-cutting issue.

# Impacts to Vegetation from Small Docks—

Marsh plants and submerged aquatic vegetation (SAV) are ecologically critical as a source of food and nursery habitat for fish, shellfish, amphibians, reptiles, birds and mammals that live in coastal waters or the adjacent marsh and uplands (Weigert *et al.,* 1981; Teal, 1962, 1969; Weinstein, 1996). Vegetated areas also stabilize shoreline and bottom sediments against erosion (Kearney *et al.,* 1983; Teal, 1986) and take up contaminants and excess nutrients from the water and sediments (Vernberg, 1996).

Impacts to plant health and productivity from docks generally occur in one of the following ways:

Short-term construction impacts,

Chronic impacts from shading,

Chronic impacts from storage of floats and boats and associated foot traffic, and

Impacts from boat use (covered later in this module as a separate topic).

## *Short-Term Construction Impacts—*

Activities during construction can destroy plants either above the tide line (*e.g.,* marsh grasses such as *Spartina* or *Distichlis*) or below (*e.g.*, sea grasses such as *Zostera* or *Halodule*) by pulling them from the substrate or destroying their root systems. TPeer Reviewed PublicationsFrom MMS Environmental Studies1999 – 2003Aaron, T., D.K. Mellinger, and A. Martinez. 2002. Passive three-dimensional tracking of sperm whales using two towed arrays during the 2001 SWAMP cruise. The Journal of the Acoustical Society of America. November 2002, 112(5):2399.Abookire, A. A.; Piatt, J. F., and Norcross, B. L. Juvenile groundfish habitat in Kachemak Bay, Alaska, during late summer. Alaska Fishery Research Bulletin 8. 2001:45-56.Ambrose, R.F., Lee, S.F., and S. Bergquist. 2002. Sediment disposal site rocky intertidal monitoring studies:  Santa Monica to Malibu Coastline. Report to the State of California Department of Transportation District 7. (With Addendum: Data and Field Notes.)Amstrup, S.C.; Weston-York, G.; McDonald, T.L.; Nielson, R.; Simac, K. 2003. Detecting denning polar bears with Forward Looking Infra-red Imagery (FLIR). USGS Science Center. BioScience March 4, 2003.Ata, A., Kerr, R.G., Moya, C.E., and R.S. Jacobs.(in press). Identification of anti-inflammatory diterpenes from the marine gorgonian Pseudopterogorgia elisabethae. Tetrahedron Beckenbach, E.H., Washburn, L., Salazar, D., and B. Emery. 2000. Observations of Propagating Eddies in the Santa Barbara Channel. EOS Trans.Amer. Geophys.Union 81 (48): Fall Meet. Suppl. Becker. P.R.; Krahn, M. M.; Mackey, A.; Demiralp, R.; Schantz, M. M.; Epstein, M.; Donais, M. K.; Porter, B.; Muir, C. G., and Wise, S. A. Concentrations of Polychorinated Biphenyls (PCBs), Chlorinated Pesticides, and Heavy Metals and Other Elements in Tissues of Beluga Whales (Delphinapterus Leucas) From Cook Inlet, Alaska. Marine Fisheries Review. 2000 (62):81-98.Boles, J.R., J.F. Clark, I. Leifer, and L. Washburn. 2001. Temporal variation in natural methane seep rate due to tides, Coal Oil Point area, California. J. Geophys. Res. 106(C11):27077-27086.Byrnes, M.R., R.M. Hammer, T.D. Thibaut (in press). Potential physical and biological effects of sand mining off New Jersey. Journal of Coastal Research, Special Issue.Byrnes, M.R., R.M. Hammer, T.D. Thibaut (in press). Potential physical and biological effects of sand mining off Alabama. Journal of Coastal Research, Special Issue.Candela, J., J. Sheinbaum, J. Ochoa, A. Bedan and R. Leben. 2002. The potential vorticity flux through the Yucatan Channel and the Loop Current in the Gulf of Mexico. Geophys. Res. Lett. 29:16-1 to 16-4.Chen, C-S., and D-P. Wang, 2000. Data assimilation model study of wind effects in the Santa Barbara Channel, J.Geophys. Res., 105 (C9):22,003-22,013Christopher, S. J.; Vander Pol, S. S.; Pugh, R. S.; Day, R. D., and Becker, P. R. 2002. Determination of mercury in the eggs of common murres (Uria aalge) for the seabird tissue archival and monitoring project. The Royal Society of Chemistry 2002. 2002:17Clark, J.F., L. Washburn, J.S. Hornafius, and B.P. Luyendyk. 2000. Dissolved hydrocarbon flux from natural marine seeps to the southern California Bight. J of Geophys Res-Oceans 105 (C5):11509-11522.Continental Shelf Associates. 2002. Survey of Invertebrate and Algal Communities on Oil and Gas Platforms in Southern California. Final Report in Press. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region. 102 pp.+ 5 appendices.Davis, R. W., J.G. Ortega-Ortiz, C.A. he peat beds underlying salt marshes can be compacted through the improper use of heavy equipment leading to ponding of saline waters and a resultant loss or changing of marsh vegetation. Although these impacts are seemingly evident, limited research appears to have been done on the long-term effect of these activities.

Setting pilings in sea grass beds may have immediate impacts as well as causing long-term changes. The act of installing pilings destroys any vegetation within the footprint of the pilings. The use of “jetting” with high-pressure hoses typically disturbs adjacent vegetation and sediments—depopulating grasses existing there prior to construction. Once areas are depopulated, the presence of pilings may lessen chances for regrowth. Beal, Schmit, and Williams (1999) suggest that changes in seagrass communities in the vicinity of pilings may be caused by the modification of currents, sediment deposition, attraction of bioturbators, and leaching from chemically treated wood.

Shafer and Robinson (2001) tracked the regrowth of the seagrass *Halodule wrightii* beneath docks in St. Andrew Bay, FL. They noted bare areas from 35–78 inches in diameter around pilings, ”even though the age of these docks varied widely” suggesting that regrowth is affected by the presence of pilings. Use of high pressure jetting produced a six- to seven-foot diameter hole around each piling, which was then backfilled to hold the piling in place. The resultant “halo” might remain for 10 years without seagrass regrowth. The authors found that where piles were installed using low-pressure jetting techniques there was, “little or no sand deposition around the pilings and the remaining seagrasses around the pilings looked healthy and had good growth around the piling.”

Dock construction also impacts marsh grass. Sanger and Holland (2002) noted a barren path through the marsh along each side of a newly constructed dock in North Carolina where vegetation had been almost totally destroyed. However, construction did not appreciably alter the original marsh elevations. Resurveying the site 15 months later, the researchers found that *Spartina. alterniflora* had recolonized the area and substantial recovery had occurred.

## *Chronic Impacts from Shading—*

Both marsh grasses and sea grasses have adapted to living in extended periods of sunlight. Therefore, shading can have significant impacts on the health and productivity of these plants. Figure 1 illustrates some of the potential impacts from dock shading. Two thresholds are shown; the minimum amount of light necessary for the plant to reach full growth, and the minimum amount of light for the plant to sustain itself. Below the first threshold, plants are stunted in growth or grow tall and spindly in an attempt to reach sunlight. Below the second threshold, plants die.

**Figure 1.** Light Profile under a dock (From Nightengale and Simenstad 2001. Ron Thom, pers. comm.). The graph illustrates how the shading of an east-west oriented dock affects light levels and vegetation growth below a dock in Washington state. The two horizontal lines indicate the light levels necessary for full, unaffected growth of plants (Minimum light needed for full growth) and the amount of light for plants to live (Minimum light for plant maintenance). Note that much of the area beneath the illustrated dock is below the threshold for plant life. Note also that the shading is somewhat offset to the north due to the declination of the sun.

Amount of Light Required by Vegetation—

Susceptibility to shading varies by species, even those occupying similar habitats. For example, in marsh grasses, densities of *Spartina patens* (Salt Meadow Grass or Salt Hay Grass) and *Distichlis spicata* (Spike Grass or Salt Grass) are more sensitive than *Spartina alterniflora* (Smooth Cordgrass or Saltwater Coordgrass) (Kearney *et al.* 1983).

Light levels necessary for plants to sustain themselves generally range between 12–25 percent of ambient light, depending on the species. Specifically for seagrasses, a National Marine Fisheries Service (NMFS) Technical Memorandum reports that “the light requirements of temperate and tropical seagrasses are very similar” requiring “at least 15 to 25% of the incident light just for maintenance” (Kenworthy and Haunert, 1991). Light requirements are presumably higher to allow full growth but there has been limited research that provides specific percentages.

NMFS’ summary report is supported by studies on individual seagrass species. For example, Shaefer and Robinson (2001) report that light levels of 13–14 percent of mean daily surface irradiance (SI) are necessary for survival of the seagrass *Halodule wrightii*. Shaefer (1999) found that seagrass densities were 40–47 percent less in areas shaded at levels of 16–19 percent SI. Burdick and Short (1999) observed similar trends in the eelgrass, *Zostera marina,* which required light levels of at least 15 percent of surface irradiance for survival and approximately 50–60 percent for healthy beds.

## Direct Impacts of Shading—

As we have already