Non-Native Species on Offshore Oil Platforms in Santa Barbara Channel

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The methods for the surveys and the experiments were extracted from the manuscript "Viola and Page et al, Anthropogenic Disturbance Facilitates a Non-Native Species on Offshore Oil Platforms, Journal of Applied Ecology".

Study sites

We conducted this study on offshore oil and gas production platforms "B" and "Gina" in the eastern Santa Barbara Channel, California. Platform B (34º19' N, 119º37' W), installed in 1968, is located ~9 km offshore in a water depth ~58 m and platform Gina (34º07' N, 119º16' W), installed in 1981, is ~6 km offshore in a depth of ~30 m. The two platforms differ in size (platform footprint at the seafloor: B: 48 x 40 m, Gina: 28 x 20 m), but share a general sub-surface structure of vertical, oblique, and horizontal cylindrical steel support members that include the legs, and vertical conductor pipes enclosing additional pipes through which oil and gas flows.

The support members and conductor pipes of offshore platforms in the Santa Barbara Channel are typically covered intertidally and subtidally by a community of sessile and semi-mobile suspension feeding epifaunal invertebrates, including mussels (*Mytilus californianus, M. galloprovincialis*), barnacles (e.g. *Megabalanus californicus*), rock scallops (*Crassodoma gigantea*), and anemones (*Corynactis californica, Metridium senile*) (Page et al. 2010). Macroalgae are relatively sparse and restricted to shallow depths on the periphery of the structure. Herbivorous grazers, such as urchins and snails, are also rare.

Disturbance and depth effects on *Watersipora* abundance

To experimentally examine the effect of disturbance and water depth on the establishment of *Watersipora*, we removed the epibenthic community from 0.41 x 0.62 m (0.25 m^2) rectangular experimental plots at three depths (12, 18, and 24 m) on the north sides of the conductor pipes that run east – west across Platform B in August 2014. Divers manually removed epifaunal organisms to expose the bare metal surface in each treatment plot using hammers and chisels. At each depth, four disturbed plots alternated with four undisturbed control plots on adjacent conductor pipes, resulting in 12 disturbed and 12 control plots total. A maintenance cleaning prior to the onset of our experiment removed the epifaunal community from the structure to a depth of 9 m, which prevented a comparison of disturbed to control plots at shallower depths.

After removing epifauna in the disturbed plots, all plots were photographed using a Canon EOS 6D digital camera with a 14 mm wide-angle lens and two strobes mounted on a 0.41 x 0.62 m quadrat frame (Page et al. 2008). The plots were re-photographed approximately every two months from August 2014 until November 2015 to evaluate temporal patterns in *Watersipora* abundance following disturbance. From the photographs, we identified and estimated the percent cover of sessile and semi-mobile epifauna (e.g. anemones, barnacles, bivalves) occupying the visible layer in each plot using the BisQue online image analysis system (http://bioimage.ucsb.edu/, Rahimi et al. 2014). A grid of 100 uniformly spaced points was superimposed onto each digital image and contacts under each point were scored manually, automatically recorded in XML files, and exported for analysis. We also recorded cover of non-living substrata (e.g., bare steel), when present.

Spatial and temporal patterns in the abundance of *Watersipora* larvae

We measured monthly recruitment of *Watersipora* onto settlement plates to assess temporal and depth-related variability in abundance of *Watersipora* larvae. Settlement plates consisting of a 225 cm^2 unglazed ceramic tile attached to a 16 x 30 cm PVC frame were suspended on ropes in between the conductor pipes of disturbed and control plots on Platform B (n = 4 plates per depth). From August 2014 through November 2015, settlement plates were removed approximately monthly (25 to 37 days) and replaced with plates that had been pressure-washed and air-dried to remove epifauna. Retrieved plates were returned to the laboratory where *Watersipora* colonies and other attached organisms were identified and counted. Counts of *Watersipora* on the plates were standardized to number of recruits per 30 days to adjust for variations among deployment periods. The effects of depth and time on the density of *Watersipora* recruits were evaluated using a generalized linear model with a Poisson error distribution (O'Hara and Kotze 2010), with depth and time as fixed factors. On finding a significant interaction between depth and time ($p < 0.001$), the effects of depth at each time, and time for each depth, were evaluated.

Disturbance and depth effects on *Watersipora* colony dynamics

To investigate the effect of the existing epifaunal community on *Watersipora* recruitment and growth, we quantified the number and sizes of *Watersipora* colonies in the images of the disturbed and control plots over time. Colony size was quantified by manually tracing the perimeter of each colony (defined as a continuous area of *Watersipora)* using the area measurement tool in Adobe Acrobat X. Colony area was calculated based on the known area of the quadrat frame in the photos.

Maintenance cleaning and *Watersipora* abundance

To explore the effect of large-scale anthropogenic disturbance on the establishment of *Watersipora*, we sampled conductor pipes and legs of Platform Gina before (September 2013) and after (August 2014, January & July 2015) a cleaning event. In Spring 2014, epifauna attached to the conductor pipes, but not the legs, were removed by platform operators to a depth of ~15 m. The high-pressure discharge "blasters" used in these cleaning operations remove hard and soft epifauna, leaving only the basal plates of barnacles and cemented portions of encrusting bivalves. To evaluate changes in abundance and distribution of *Watersipora* and other space-holding invertebrates over time, we measured invertebrate cover in 0.25 m^2 plots at two depths on the uncleaned legs and the cleaned conductor pipes using the methods described above.

References:

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